PREFACE

This manual covers the construction, function and servicing procedures of the Honda BF200A and BF225A outboard motors.

Careful observance of these instructions will result in better, safer service work.

Pay attention to these symbols and their meaning:

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

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

Honda Motor Co., Ltd.
Service Publications Office

CONTENTS

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Abbreviations

Abbreviations	
ACG	Alternator
API	American Petroleum Institute
Approx.	Approximately
Assy.	Assembly
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATT	Attachment
BARO	Barometric
BAT	Battery
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
CKP	Crankshaft Position
Comp.	Complete
CYL	Cylinder
DTC	Diagnostic Trouble Code
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EX	Exhaust
F	Front or Forward
GND	Ground
GPS	Global Positioning System
HO2S	Heated Oxygen Sensor
IAB	Intake Air Bypass
IAC	Idle Air Control
IAT	Intake Air Temperature
ID or I.D.	Inside Diameter
IG or IGN	Ignition
IN	Intake
INJ	Injection
L.	Left
KS	Knock Sensor
MAP	Manifold Absolute Pressure
MIL	Malfunction Indicator Light
O.D.	Outside Diameter
OP	Optional Part
PGM-FI	Programmed-fuel Injection
P/N	Part Number
Qty	Quantity
R.	Right
SAE	Society of Automotive Engineers
SCS	Service Check Signal
SOL	Solenoid
STD	Standard
SW	Switch
TDC	Top Dead Center
TP	Throttle Position
VTEC	Variable Valve Timing & Valve Lift Electronic Control

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

INDEX

1. SPECIFICATIONS

DIMENSIONS AND WEIGHTS

Item \ Model	BF200A				
Description code	BAEJ	BAEJ	BAFJ	BAEJ	BAFJ
Type	LD	XD	XCD	XXD	XXCD
Overall length	920 mm (36.2 in)				
Overall width	625 mm (24.6 in)				
Overall height	1,670 mm (65.7 in)	1,800 mm (70.8 in)	1,800 mm (70.8 in)	1,925 mm (75.8 in)	1,925 mm (75.8 in)
Dry weight (*1)	270 kg (595 lbs)	275 kg (606 lbs)	278 kg (613 lbs)	280 kg (617 lbs)	283 kg (624 lbs)
Dry weight (*2)	267 kg (589 lbs)	272 kg (600 lbs)	272 kg (600 lbs)	277 kg (611 lbs)	277 kg (611 lbs)
Operating weight (including oil)	279 kg (615 lbs)	284 kg (626 lbs)	287 kg (633 lbs)	289 kg (637 lbs)	292 kg (644 lbs)

*1: With propeller mounted.
*2: Without propeller mounted.

Item \ Model	BF225A				
Description code	BAGJ	BAGJ	BAHJ	BAGJ	BAHJ
Type	LD	XD	XCD	XXD	XXCD
Overall length	920 mm (36.2 in)				
Overall width	625 mm (24.6 in)				
Overall height	1,670 mm (65.7 in)	1,800 mm (70.8 in)	1,800 mm (70.8 in)	1,925 mm (75.8 in)	1,925 mm (75.8 in)
Dry weight (*1)	270 kg (595 lbs)	275 kg (606 lbs)	278 kg (613 lbs)	280 kg (617 lbs)	283 kg (624 lbs)
Dry weight (*2)	267 kg (589 lbs)	272 kg (600 lbs)	272 kg (600 lbs)	277 kg (611 lbs)	277 kg (611 lbs)
Operating weight (including oil)	279 kg (615 lbs)	284 kg (626 lbs)	287 kg (633 lbs)	289 kg (637 lbs)	292 kg (644 lbs)

*1: With propeller mounted.
*2: Without propeller mounted.

FRAME

Item \ Model	BF200A•BF225A				
Type	LD	XD	XCD	XXD	XXCD
Transom height (*1)	508 mm (20.0 in)	635 mm (25.0 in)		762 mm (30.0 in)	
Tilting angle	68°				
Tilting stage	Stageless				
Trim angle (*1)	–4° to 16°				
Swivel angle	30° right and left				

*1: Transom angle is at 12°.

TYPES OF Honda BF200A/BF225A OUTBOARD MOTORS

It may be necessary to refer to this chart for reference purposes when reading this manual.

Model	BF200A•BF225A				
Type	LD	XD	XCD	XXD	XXCD
Shaft Length type	L	XL	XL	XXL	XXL
Counter Rotation			○		○
Remote control	○	○	○	○	○
Power Trim/Tilt	○	○	○	○	○
Tachometer	(○)	(○)	(○)	(○)	(○)
Trimmeter	(○)	(○)	(○)	(○)	(○)

XL: Extra long, XXL: Extra-extra long
(_): Optional part

The power trim/tilt type motors use an electric/hydraulic power cylinder to trim or tilt the motor.

ENGINE

Item \ Model	BF200A	BF225A
Description code	BEAEJ-SE	BEAGJ-SE
Type	4-stroke, O.H.C., 6-cylinder	
Displacement	3,471 cm³ (211.7 cu in)	
Bore x stroke	89 x 93 mm (3.5 x 3.7 in)	
Rated power *1	147.1 kW (200HP)	165.5 kW (225HP)
Maximum torque	295 N•m (30.1 kgf•m, 217.7 lbf•ft)	
Compression ratio	9.4 : 1	
Fuel consumption ratio	334 g/kW•h (246 g/PS•h)	
Cooling system	Forced water circulation by impeller pump with thermostat	
Ignition system	Full transistorized, battery ignition	
Ignition timing	10° at 650 rpm B.T.D.C.	
Spark plug	IZFR6F11 (NGK), VKJ20RZ-M11 (DENSO)	
Fuel supply system	Programmed fuel injection	
Fuel injection system	Electronic control	
Fuel injection nozzle	Pintle type	
Fuel	Unleaded gasoline with a pump octane rating of 86 or higher	
Fuel pump	Electric and mechanical plunger type	
Lubrication system	Pressure lubrication by trochoid pump	
Lubrication capacity	8.8 ℓ (9.3 US qt, 7.7 Imp qt)	
Starter system	Electric starter	
Stopping system	Primary circuit ground	
Exhaust system	Underwater type	

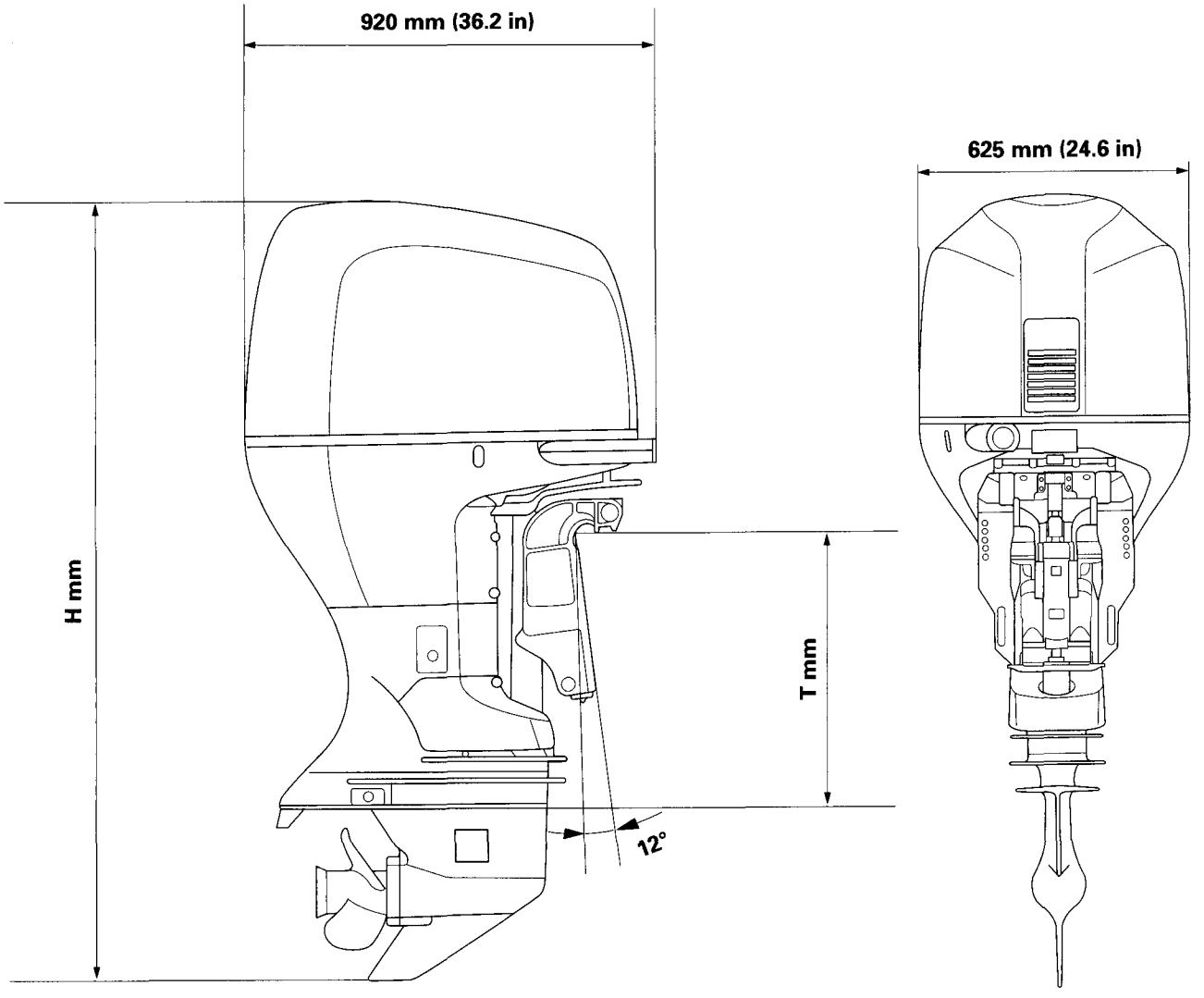
*1: Full throttle range.

LOWER UNIT

Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	0.536 (15/28)
Reduction	Spiral bevel
Gear case oil capacity	1.17 ℓ (1.24 US qt, 1.03 Imp qt)
Propeller rotating direction	Clockwise (viewed from rear): LD, XD and XXD types Counterclockwise (viewed from rear): XCD and XXCD types

2. DIMENSIONAL DRAWING

Transom	H	T
LD type	1,670 mm (65.7 in)	508 mm (20.0 in)
XD type	1,800 mm (70.8 in)	635 mm (25.0 in)
XXD type	1,925 mm (75.8 in)	762 mm (30.0 in)



1. SYMBOLS USED IN THIS MANUAL

As you read this manual, you may find the following symbols with the instructions.

S. TOOL — A special tool is required to perform the procedure.

GREASE — Apply grease

GREASE

(Molybdenum disulfide oil) : Use molybdenum oil solution (mixture of the engine oil and molybdenum grease with the ratio 1 : 1).

OIL — Apply oil

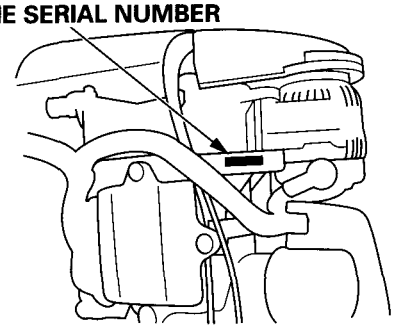
○ x ○ (○) Indicates the diameter, length, and quantity of metric flange bolts used.

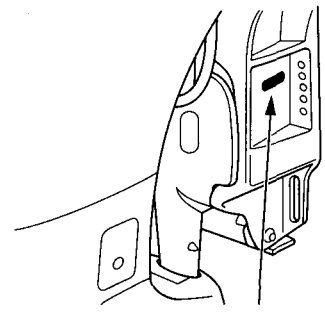
P. Indicates the reference page.

2. SERIAL NUMBER LOCATION

The engine serial number is stamped on the alternator bracket and the product identification number is located on the right stern bracket. Always specify these numbers when inquiring about the engine or when ordering parts in order to obtain the correct parts for the outboard motor being serviced.

ENGINE SERIAL NUMBER





PRODUCT IDENTIFICATION NUMBER

3. MAINTENANCE STANDARDS

• ENGINE

Unit: mm (in)

Part	Item		Standard	Service limit
Engine	Idle speed (in neutral)		650 ± 50 rpm	———
	Trolling speed		650 ± 50 rpm	———
	Cylinder compression		1,373 – 1,569 kPa (14 – 16 kgf/cm², 199 – 228 psi) at 300 rpm	———
Ignition timing	At idle*1		10 ± 2°BTDC at 650 ± 50 rpm	———
Spark plugs	Gap		1.0 – 1.1 (0.039 – 0.043)	———
Valves	Valve clearance	IN	0.20 – 0.24	———
		EX	0.28 – 0.32	———
	Stem O.D.	IN	5.485 – 5.495 (0.2159 – 0.2163)	5.455 (0.2148)
		EX	5.450 – 5.460 (0.2146 – 0.2150)	5.420 (0.2134)
	Guide I.D.	IN/EX	5.515 – 5.530 (0.2171 – 0.2177)	5.55 (0.219)
	Guide extrusion amount	IN	21.20 – 22.20 (0.835 – 0.874)	———
		EX	20.63 – 21.63 (0.812 – 0.852)	———
	Stem-to-guide clearance	IN	0.020 – 0.045 (0.0008 – 0.0018)	0.080 (0.0031)
		EX	0.055 – 0.080 (0.0022 – 0.0031)	0.120 (0.0047)
	Seat width	IN/EX	1.25 – 1.55 (0.049 – 0.061)	2.0 (0.08)
	Seat installation height	IN	46.75 – 47.55 (1.841 – 1.872)	47.80 (1.882)
		EX	46.68 – 47.48 (1.838 – 1.869)	47.73 (1.879)
	Spring free length	IN	50.07 (1.971)	———
		EX	53.48 (2.106)	———
Rocker arms	Rocker arm I.D.	IN	20.012 – 20.030 (0.7879 – 0.7886)	———
		EX	18.012 – 18.030 (0.7091 – 0.7098)	———
	Rocker arm shaft O.D.	IN	19.972 – 19.993 (0.7863 – 0.7871)	———
		EX	17.976 – 17.994 (0.7077 – 0.7084)	———
	Rocker arm-to-rocker arm shaft clearance	IN	0.026 – 0.067 (0.0010 – 0.0026)	0.067 (0.0026)
		EX	0.026 – 0.077 (0.0010 – 0.0030)	0.077 (0.0030)
Pistons	Skirt O.D.		88.975 – 88.985 (3.5029 – 3.5033)	88.965 (3.5026)
	Piston-to-cylinder clearance		0.015 – 0.040 (0.0006 – 0.0016)	0.080 (0.0031)
	Pin bore I.D.		21.960 – 21.963 (0.8645 – 0.8647)	———
	Pin O.D.		21.961 – 21.965 (0.8646 – 0.8648)	———
	Pin-to-pin bore clearance		–0.005 – + 0.002 (–0.0002 – + 0.0001)	———
	Ring groove width	Top/Second	1.220 – 1.230 (0.0480 – 0.0484)	1.25 (0.049)
		Oil	2.805 – 2.825 (0.1104 – 0.1112)	2.85 (0.112)

*1: With the SCS short connector connected to the service check connector.

Unit: mm (in)

Part	Item		Standard	Service limit
Piston rings	Ring side clearance	Top	0.035 – 0.060 (0.0014 – 0.0024)	0.13 (0.005)
		Second	0.030 – 0.055 (0.0012 – 0.0022)	0.13 (0.005)
	Ring end gap	Top	0.20 – 0.35 (0.008 – 0.014)	0.6 (0.024)
		Second	0.40 – 0.55 (0.016 – 0.022)	0.7 (0.028)
		Oil	0.20 – 0.70 (0.008 – 0.028)	0.8 (0.031)
	Ring thickness	Top	1.170 – 1.185 (0.0461 – 0.0467)	———
		Second	1.175 – 1.190 (0.0462 – 0.0469)	———
Cylinder head	Warpage		———	0.05 (0.002)
	Camshaft journal I.D.		43.000 – 43.024 (1.6929 – 1.6939)	———
	Head height		120.95 – 121.05 (4.762 – 4.766)	———
Cylinder block	Cylinder sleeve I.D.		89.00 – 89.015 (3.5039 – 3.5045)	89.065 (3.5065)
	Warpage		0.07 (0.003) Max	0.10 (0.004)
	Gap between upper and lower parts of sleeve I.D.		———	0.05 (0.002)
Connecting rods	Small end I.D.		21.970 – 21.976 (0.8650 – 0.8652)	———
	Small end-to-piston pin clearance		0.005 – 0.015 (0.0002 – 0.0006)	———
	Big end axial clearance		0.15 – 0.35 (0.006 – 0.014)	0.45 (0.018)
	Connecting rod big end oil clearance		0.020 – 0.044 (0.0008 – 0.0017)	———
Crankshaft	Journal O.D.	Main	71.976 – 72.000 (2.8337 – 2.8346)	———
		Pin	54.976 – 55.000 (2.1644 – 2.1654)	———
	Journal roundness (Main/Pin)		0.005 (0.0002) Max	0.01 (0.0004)
	Shaft runout		0.020 (0.0008) Max	0.030 (0.0012)
	Crankshaft main bearing oil clearance		0.020 – 0.044 (0.0008 – 0.0017)	0.050 (0.0020)
	Crankshaft axial clearance		0.10 – 0.35 (0.004 – 0.014)	0.45 (0.018)

Unit: mm (in)

Part	Item			Standard	Service limit
Camshaft	Camshaft axial clearance			0.05 – 0.20 (0.002 – 0.008)	0.2 (0.008)
	Shaft runout			0.03 (0.001) Max	0.04 (0.002)
	Journal O.D.			42.935 – 42.950 (1.6904 – 1.6909)	———
	Cam height	IN	Primary	34.769 – 35.054 (1.3689 – 1.3992)	———
			Mid	36.295 – 36.580 (1.4289 – 1.4402)	———
			Secondary	35.073 – 35.358 (1.3808 – 1.3920)	———
		EX		36.176 – 36.461 (1.4242 – 1.4355)	———
	Shaft oil clearance			0.050 – 0.089 (0.0020 – 0.0035)	0.15 (0.006)
Oil pump	Body I.D.			84.000 – 84.030 (3.3071 – 3.3083)	———
	Inner rotor-to-outer rotor clearance			0.04 – 0.16 (0.002 – 0.006)	0.20 (0.008)
	Outer rotor-to-oil pump body clearance			0.02 – 0.07 (0.001 – 0.003)	0.12 (0.005)
	Outer rotor height			9.480 – 9.500 (0.3732 – 0.3740)	———
	Pump body depth			9.520 – 9.550 (0.3748 – 0.3760)	———
	Outer rotor - to-oil body side clearance			0.14 – 0.19 (0.006 – 0.007)	0.20 (0.008)
Fuel pump/ Fuel line	Discharge volume [with pump operated for 2 sec.]			60 m ℓ (2.0 US oz,z, 2.1 Imp oz) or more	———
	Fuel pressure [kPa (kgf/cm², psi)]			280 – 330 (2.9 – 3.4, 41 – 48)	———
Vapor separator	Float height			28.5 – 33.5 (1.12 – 1.32)	———

Unit: mm (in)

Part	Item		Standard	Service limit
Alternator	Brush length		10.5 (0.41)	9.0 (0.35)
	Brush spring pressure		3.2 N (0.33 kgf, 0.73 lbf)	———
	Rotor coil resistance		2.7 – 3.1 Ω	———
	Slip ring O.D.		14.2 – 14.4 (0.56 – 0.57)	13.8 (0.54)
	Belt tension [N (kgf, lbf)] Measured between the pulleys with belt tension gauge.	Used belt	490 – 590 (50 – 60, 110 – 132)	———
		New belt	880 – 980 (90 – 100, 198 – 220)*1	———
			660 – 740 (67 – 75, 148 – 165)*2	———
	Belt deflection Measured with 98 N (10 kgf, 22 lbf) of force applied to the center of belt between the pulleys.	Used belt	5.4 – 6.3 (0.21 – 0.25)	———
		New belt	3.2 – 3.4 (0.12 – 0.13)*1	———
			4.2 – 4.8 (0.17 – 0.19)*2	———
Starter motor	Brush length		12.3 (0.48)	7.0 (0.28)
	Insulation depth		0.4 – 0.5 (0.016 – 0.020)	0.2 (0.008)
	Commutator O.D.		29.4 (1.16)	28.8 (1.13)
	Commutator runout		———	0.1 (0.004)
CKP sensor	Resistance		1,850 – 2,450 Ω	———
TDC sensor	Resistance		1,850 – 2,450 Ω	

*1: With a new belt installed
*2: After the engine running for five minutes.

• FRAME

Unit: mm (in)

Part	Item	Standard	Service limit
Vertical shaft	Shaft O.D. (at needle bearing)	31.991 – 32.000 (1.2595 – 1.2598)	———
Propeller shaft	Shaft O.D. (at needle bearing)	32.007 – 32.020 (1.2601 – 1.2606)	———

4. TORQUE VALUES

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
• Engine				
Bearing cap bolt (11 x 131 mm)	M11 x 1.5	*1 : 29	3.0	22
Side bolt (10 x 60 mm)	M10 x 1.25	49	5.0	36
Side bolt (10 x 80 mm)	M10 x 1.25	49	5.0	36
Side bolt (10 x 109 mm)	M10 x 1.25	49	5.0	36
Timing belt back cover (TDC sensor) bolt	M5 x 0.8	3.9	0.4	2.9
Cylinder head bolt	M12 x 1.5	*2 : 39.2	4.0	29
Spark plug	M14 x 1.25	18	1.8	13
Valve adjusting nut	M7 x 0.75	20	2.0	14
Connecting rod bolt	M8 x 0.75	*3 : 20	2.0	14
Crankshaft pulley bolt	M16 x 1.5	245	25.0	181
Timing belt tensioner bolt	M10 x 1.25	39	4.0	29
Timing belt idler bolt	M12 x 1.25	83	8.5	61
Timing belt driven pulley bolt	M12 x 1.25	90	9.2	67
Rocker shaft (IN side) bolt	M8 x 1.25	24	2.4	17
Rocker shaft (EX side) bolt	M8 x 1.25	24	2.4	17
Oil pressure switch (High pressure side)	M10 x 1.25	21.6	2.2	16
Oil filter cartridge	M20 x 1.5	21.6	2.2	16
Oil filter holder bolt	M22 x 1.5	49	5.0	36
Oil drain plug bolt	M12 x 1.5	23	2.3	17
Throttle body bolt, nut	M8 x 1.25	21.6	2.2	16
Mount case bolt	M10 x 1.25	44	4.5	33
Mount case bolt	M12 x 1.25	64	6.5	47
Mount case nut	M10 x 1.25 flange nut	44	4.5	33
Ignition coil bolt	M6 x 1.0	12	1.2	9
Flywheel bolt	M12 x 1.0	118	12.0	87
Flywheel boss bolt	M8 x1.25	32	3.2	24
Alternator bolt	M10 x 1.25	44	4.5	33
Alternator nut	M8 nut	26	2.7	20
Starter motor bolt	M10 x 1.25	44	4.5	33
Oil pressure switch (Low pressure side)	PT 1/8	8	0.85	6.1
MAP sensor	M5 x 0.8	3.4	0.35	2.5
IAT sensor	M12 x 1.5	18	1.8	13
ECT sensor	M10 x 1.25	12	1.2	9
HO2S	M18 x 1.5	42	4.3	31
Knock sensor	M12 x 1.25	31	3.2	23

*1: Tighten the crankcase bolts to 29 N•m (3.0 kgf•m, 22 lbf•ft) first, then tighten them an additional 51° (Snag torque [Angle method]).

*2: Tighten the cylinder head bolts to 39.2 N•m (4.0 kgf•m, 29 lbf•ft) first, then tighten them an additional 103° (Snag torque [Angle method]).

*3: Tighten the connection rod bolt to 20 N•m (2.0 kgf•m, 14 lbf•ft) first, then tighten them an additional 90° (Snag torque [Angle method]).

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
• GEAR CASE				
Gear case bolt	M10 x 1.25	37	3.75	27
Gear case self-lock nut	M10 x 1.25	37	3.75	27
Pinion gear nut	M18 x 1.0	182	18.5	134
Gear oil level bolt	M8 x 1.25	3.5	0.35	2.5
Bearing holder	M100 x 2.0	191	19.5	141
Gear oil drain plug bolt	M8 x 1.25	3.4	0.35	25
Impeller housing bolt	M8 x 1.25	20	2.0	14
Propeller castle nut	M18 x 1.5	*1 : 1.0	0.1	0.7
64 mm lock nut	M64 x 1.5	123	12.5	90
Water screen screw	M5 x 0.8	1.0	0.1	0.7
• EXTENSION/MOUNT				
Lower rubber motor mount nut	M14 x 1.5	103	10.5	76
Upper rubber mount nut	M12 x 1.25	83	8.5	61
Extension separator stud bolt	M12 x 1.25	22	2.25	16
Extension separator stud bolt	M10 x 1.25	15	1.5	11
• STERN BRACKET				
Stern bracket nut	M25 x 2.0	34	3.5	25
Stern bracket nut	7/8-14UNF	34	3.5	25
• Others				
Neutral switch nut	M20 x 1.0	2.5	0.25	1.8
Grease fitting	M6 x 1.0	3	0.3	2.2
Starter motor B terminal nut	M8 x 1.25	11	1.1	8.0
Alternator terminal B terminal nut	M6 x 1.0	8	0.85	6.1

*1 If the split pin cannot be set by tightening the 18 mm castle nut to the specified torque, tighten the castle nut additionally until the split pin can be set. Note that the maximum torque of the 18 mm castle nut is 44.1 N•m (4.5 kgf•m, 33 lbf•ft).

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

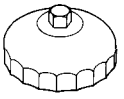
STANDARD TORQUE VALUES

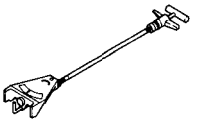
Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
Bolt and nut	5 mm	5.2	0.52	3.8
	6 mm	10	1.0	7
	8 mm	21.5	2.15	15.6
	10 mm	34	3.5	25
	12 mm	54	5.5	40
Flange bolt and nut	6 mm (SH Flange bolt)	9	0.9	6.5
	6 mm	12	1.2	9
	8 mm	26	2.7	20
	10 mm	39	4.0	29
Screw	5 mm	4.2	0.42	3.0
	6 mm	9	0.9	6.5

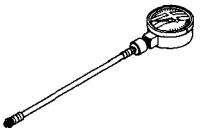
5. SPECIAL TOOLS

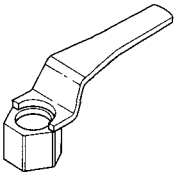
- **Special tool applicable to the parts except gear case**

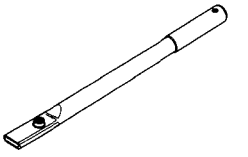
	Tool name	Tool number	Application
1	Oil filter wrench	07912 – 6110001	Oil filter replacement
2	Belt tension gauge	07JGG – 0010101	Alternator belt tension inspection
3	Fuel pressure gauge	07406 – 0040003	Fuel pressure inspection
4	Holder attachment, 50 mm offset	07MAB – PY30100	Crankshaft pulley bolt removal/installation
5	Holder handle	07JAB – 001020B	
6	Lock nut wrench, 56 mm	07LPA – ZV30200	
7	Air supply	07LAJ – PR30102	VTEC system, VTEC valve inspection
8	Air supply adapter M10 x 1.0	070AJ – 0010100	
9	VTEC air adapter	07VAJ – P8A0100	
10	VTEC air stopper	07VAJ – P8A0200	
11	Stem seal driver	07PAD – 0010000	Stem seal replacement
12	Valve spring compressor	07757 – 0010000	Valve keeper removal/installation
13	Valve guide driver, 5.5 mm	07742 – 0010100	Valve guide removal/installation
14	Valve guide reamer	07HAH – PJ70100	Valve guide reaming
15	Cutter holder, 5.5 mm	07781 – 0010101	Valve seat reconditioning (IN/EX)
16	Valve seat cutter 32° 35 mm	07780 – 0012300	Valve seat reconditioning (IN)
17	Valve seat cutter 32° 33 mm	07780 – 0012900	Valve seat reconditioning (EX)
18	Valve seat cutter 45° 35 mm	07780 – 0010400	Valve seat reconditioning (IN)
19	Valve seat cutter 45° 29 mm	07780 – 0010300	Valve seat reconditioning (EX)
20	Valve seat cutter 60° 37.5 mm	07780 – 0014100	Valve seat reconditioning (IN)
21	Valve seat cutter 60° 30 mm	07780 – 0014000	Valve seat reconditioning (EX)
22	Driver	07749 – 0010000	Camshaft oil seal installation
23	Attachment, 52 x 55 mm	07746 – 0010400	
24	Oil pressure gauge set	07506 – 3000001	Cylinder block oil pressure inspection
25	Oil pressure gauge attachment	07406 – 0030000	
26	Driver	07749 – 0010000	Cylinder block left side cover oil seal installation
27	Oil seal driver attachment, 96	07948 – SB00101	
28	Driver	07749 – 0010000	Oil pump crankshaft oil seal installation
29	Attachment, 52 x 55 mm	07746 – 0010400	
30	Driver	07749 – 0010000	*Water pump housing 26 x 42 x 7 mm water seal replacement*
31	Attachment, 42 x 47 mm	07746 – 0010300	
32	Ring gear holder	070PB – ZY30100	Flywheel boss removal/installation, flywheel removal/installation
33	Driver	07749 – 0010000	Mounting case oil seal installation
34	Attachment, 32 x 35 mm	07746 – 0010100	
35	Pilot, 22 mm	07746 – 0041000	
36	Driver	07749 – 0010000	Mounting case shift shaft oil seal installation
37	Attachment, 24 x 26 mm	07746 – 0010700	
38	Pilot, 12 mm	07746 – 0040200	
39	Bearing puller attachment	07931 – 4630100	Lower mount center housing removal
40	Pin wrench, 6 mm	07SPA – ZW10100	Piston rod comp. removal/installation
41	Pin wrench, 4 mm	07SPA – ZW10200	Rod guide comp. removal/installation
42	Pressure gauge kit	07YAJ – 0010410	Power trim/tilt assembly upper chamber blow pressure inspection
43	Hose comp.	07FPJ – 7520100	
44	Oil pressure gauge joint A	07SPJ – ZW10100	
45	Pressure gauge kit	07YAJ – 0010410	Power trim/tilt assembly lower chamber blow pressure inspection
46	Hose comp.	07FPJ – 7520100	
47	Oil pressure gauge joint B	07SPJ – ZW10200	
48	SCS service check connector	070PZ – ZY30100	ECM troubleshooting
49	ECM test harness	070PZ – ZY30200	
50	Float level gauge	07401 – 0010000	Vapor separator float level inspection
51	Driver	07749 – 0010000	Cylinder head 39 x 53 x 8 mm oil seal installation
52	Attachment, 52 x 55 mm	07746 – 0010400	
53	Sensor socket wrench, 22 x 90L	07LAA – PT50101	HO2S removal/installation

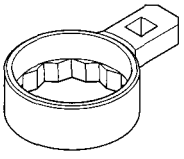
① 

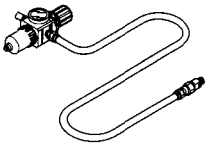
② 

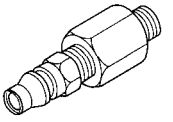
③ 

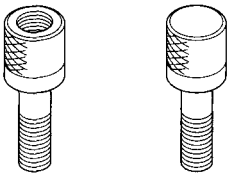
④ 

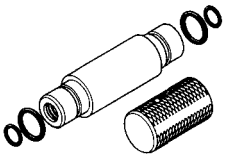
⑤ 

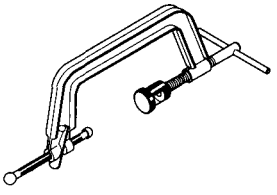
⑥ 

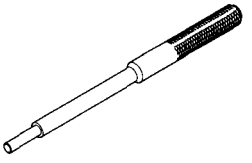
⑦ 

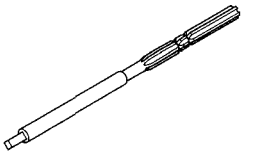
⑧ 

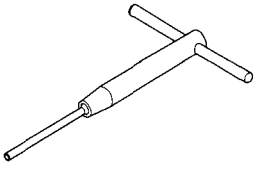
⑨ ⑩ 

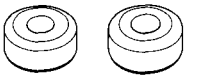
⑪ 

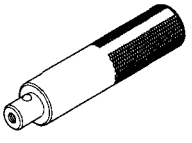
⑫ 

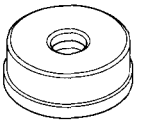
⑬ 

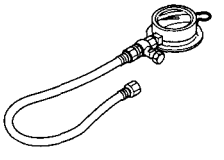
⑭ 

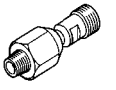
⑮ 

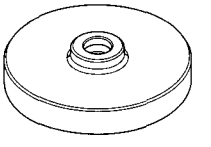
⑯ – ㉑ 

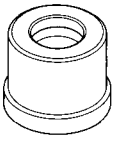
㉒, ㉖, ㉘, ㉙, ㉜, ㉟, ㊶ 

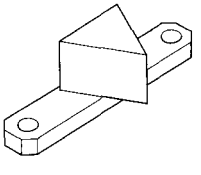
㉓, ㉙, ㊷ 

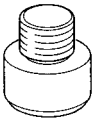
㉔, ㊷, ㊸ 

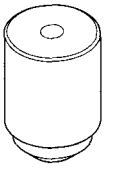
㉕ 

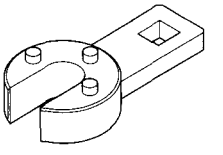
㉗ 

㉛, ㉞, ㉗ 

㉜ 

㉟, ㊳ 

㊴ 

㊵, ㊶ 

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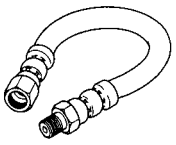

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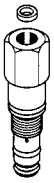

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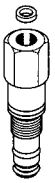

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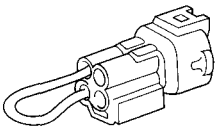

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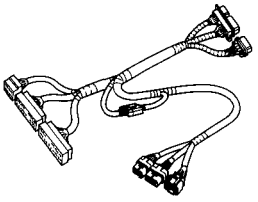

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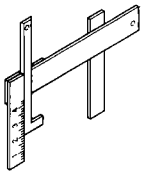

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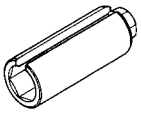
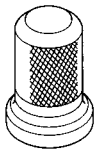


• **Special tool applicable to all types of gear case**

	Tool name	Tool number	Application
1	Oil seal driver, 44.5	07947 – SB00100	Propeller shaft holder 30 x 45 x 7 mm water seal installation
2	Driver handle, 15 x 280L	07949 – 3710001	
3	Oil seal driver attachment, 28 x 35 mm	07945 – 4150200	Propeller shaft holder 32 x 42 x 30 mm needle bearing removal
4	Pilot, 32 x 50 mm	07MAD – PR90200	
5	Taper bearing installer attachment	070PF – ZY30100	Propeller shaft holder 32 x 42 x 30 mm needle bearing installation
6	Attachment, 32 x 42 mm	070PD – ZY30100	
7	Pin type wrench, 110 mm ID	07WAA – S1G0100	Bearing holder assembly disassembly/reassembly
8	Oil seal driver, 65	07JAD – PL90100	Bearing holder bevel gear disassembly
9	Driver handle, 15 x 280L	07949 – 3710001	
10	Attachment, 37 x 40 mm	07746 – 0010200	Forward bevel gear disassembly
11	Pilot, 25 mm	07746 – 0040600	
12	Attachment, 27.2	07747 – 0010300	
13	Driver	07749 – 0010000	Forward bevel gear installation
14	Taper bearing installer attachment	070PF – ZY30100	
15	Oil seal driver, 65	07JAD – PL90100	Bearing holder bevel gear installation
16	Pin type wrench, 110 mm ID	07WAA – S1G0100	Bearing holder assembly disassembly/reassembly
17	Driver	07749 – 0010000	Bearing holder assembly (outer race) disassembly
18	Attachment, 72 x 75 mm	07746 – 0010600	
19	Driver	07749 – 0010000	Bearing holder assembly (outer race) reassembly
20	Taper bearing installer attachment	070PF – ZY30100	
21	Driver	07749 – 0010000	
22	Bearing driver attachment, 44 x 49.5 mm	07945 – 3330300	Taper bearing/bevel gear disassembly/reassembly
23	Pilot, 28 mm	07746 – 0041100	
24	Oil seal driver, 65	07JAD – PL90100	
25	Bearing race puller	070PC – ZY30100	
26	Remover handle	07936 – 3710100	Propeller shaft taper bearing (outer race) removal/installation
27	Remover weight	07741 – 0010201	
28	Taper bearing installer attachment	070PF – ZY30100	
29	Driver handle, 480L	070GD – 0010100	
30	Driver	07749 – 0010000	
31	Bearing driver attachment, 44 x 49.5 mm	07945 – 3330300	Propeller shaft bearing (inner race) disassembly
32	Pilot, 28 mm	07746 – 0041100	
33	Driver	07749 – 0010000	Propeller shaft bearing (inner race) reassembly
34	Oil seal driver, 52 x 55 mm	07NAD – P200100	
35	Puller jaws	07WPC – ZW50100	
36	Bearing race puller	070PC – ZY30100	Propeller shaft reverse bevel gear removal
37	Remover handle	07936 – 3710100	
38	Remover weight	07741 – 0010201	
39	Puller jaws	07WPC – ZW50100	
40	Bearing race puller	070PC – ZY30100	Propeller shaft reverse bevel gear bearing removal
41	Remover handle	07936 – 3710100	
42	Remover weight	07741 – 0010201	
43	Oil seal driver, 65	07JAD – PL90100	Propeller shaft bearing/bevel gear installation
44	Vertical shaft holder	07SPB – ZW10200	Vertical shaft pinion gear nut removal/installation
45	Lock nut wrench, 30/64 mm	07916 – MB00002	Vertical shaft lock nut removal
46	Gauge adapter, 100	070PJ – ZY30100	Vertical shaft pinion gear shim adjustment
47	Puller jaws	07SPC – ZW0010Z	
48	Puller bolt	07SPC – ZW0011Z	Vertical bevel gear backlash inspection
49	Backlash indicator tool	07SPJ – ZW0030Z	
50	Driver handle, 15 x 15 x 280L	07949 – 3710001	
51	Attachment, 37 x 40 mm	07746 – 0010200	Gear case vertical shaft 36 x 46 x 37 mm needle bearing removal
52	Pilot, 32 x 50 mm	07MAD – PR90200	
53	Shaft installer, 15 x 370L	07VMF – KZ30200	
54	Bearing driver attachment, 64 x 72 mm	07946 – SB20000	Gear case vertical shaft 36 x 46 x 37 mm needle bearing installation
55	Attachment, 32 x 42 mm	070PD – ZY30100	
56	Drive shaft B	07964 – MB00200	Propeller shaft taper roller bearing (inner race) installation
57	Oil seal remover	07748 – 0010001	Water pump housing, water seal removal/installation
58	Attachment, 42 x 47 mm	07746 – 0010300	

①, ⑧, ⑮, ㉔, ㉞



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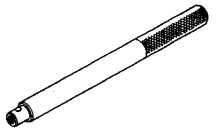

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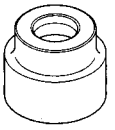

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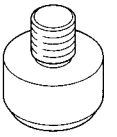

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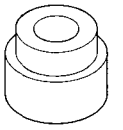

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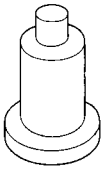

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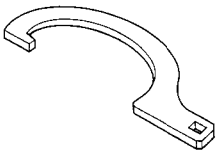

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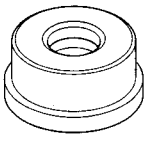

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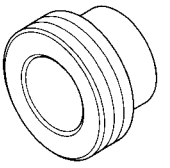

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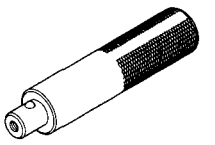

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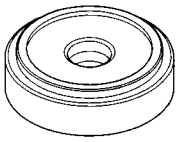

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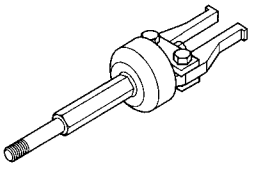

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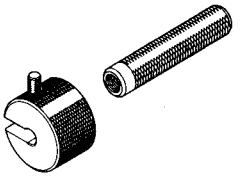

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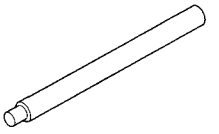

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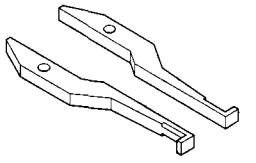

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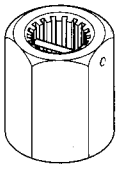

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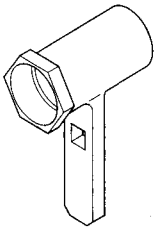

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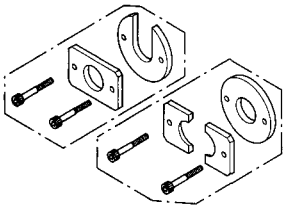

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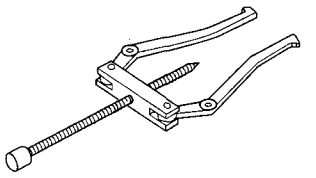

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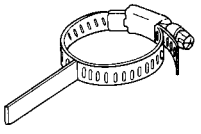

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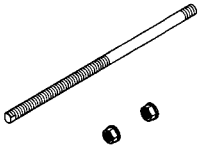

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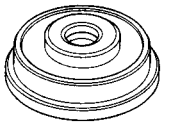

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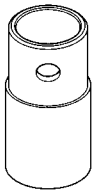

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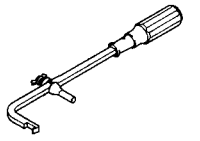
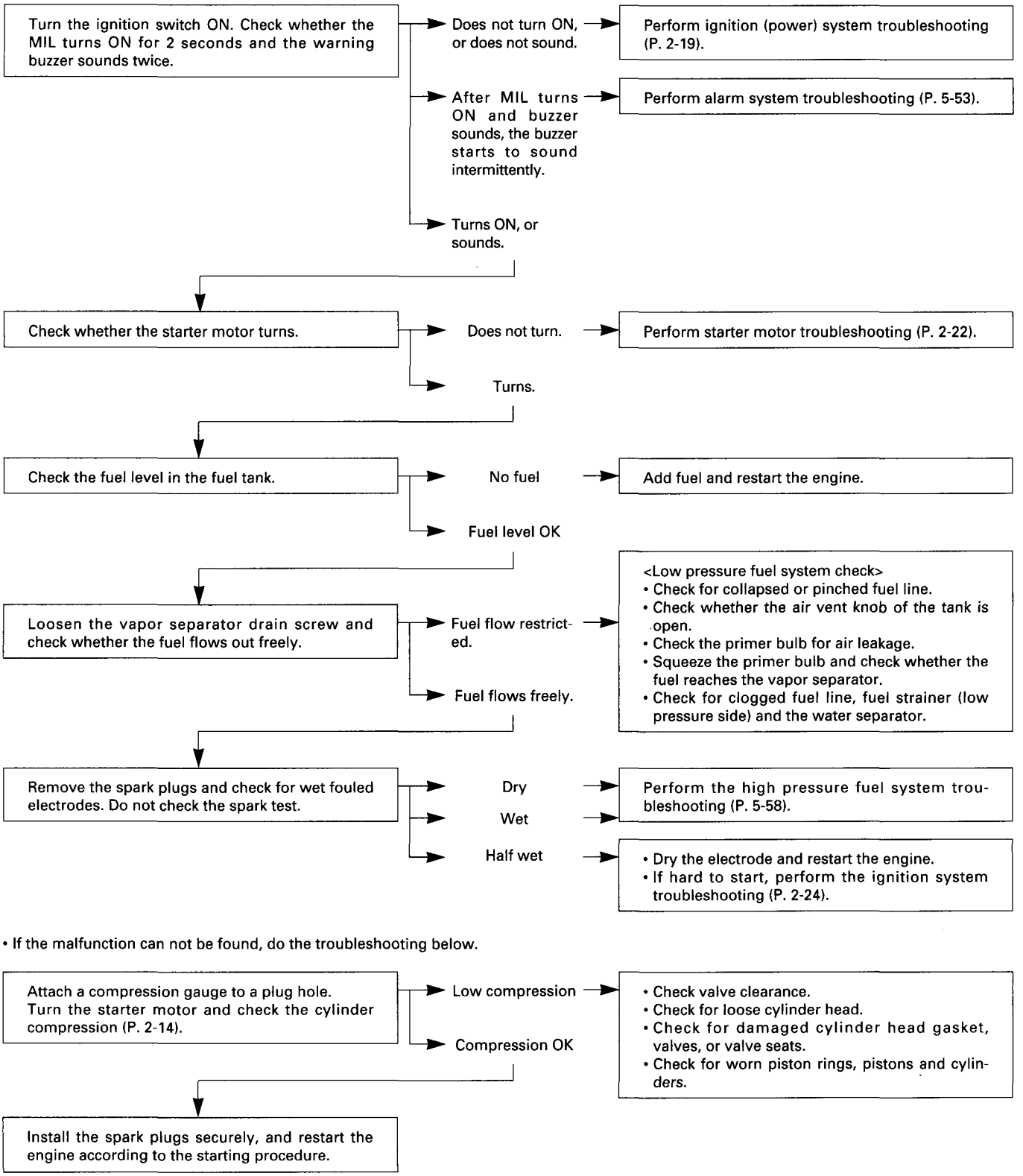


6. TROUBLESHOOTING

- **ENGINE**

a. HARD STARTING

- Use a known-good battery for troubleshooting.



• If the malfunction can not be found, do the troubleshooting below.

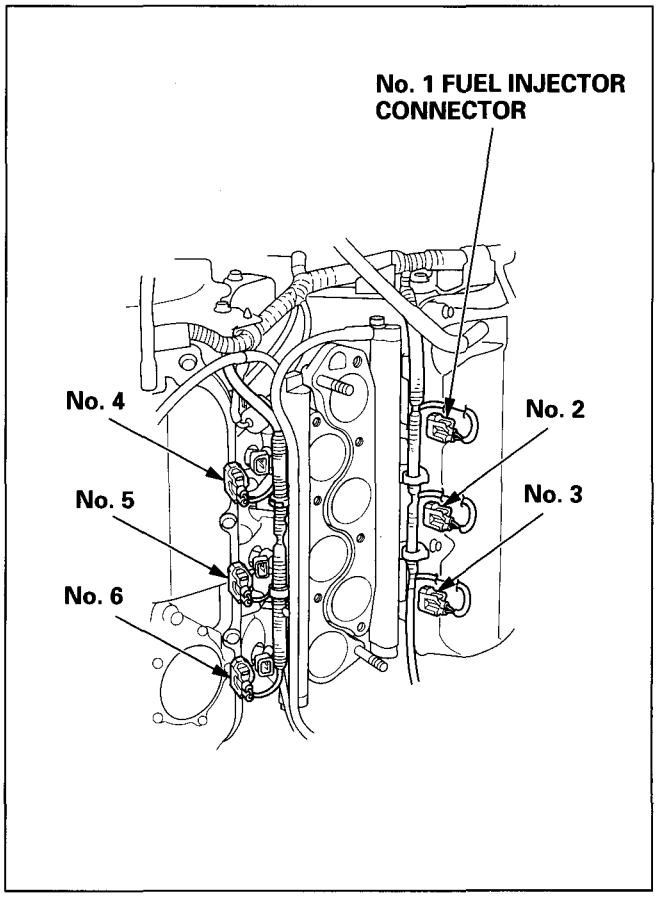
***: When the gasoline overflow is detected, check the vapor separator and fuel line cut solenoid valve (P. 5-72, P. 5-81).**

• CYLINDER COMPRESSION TEST

1) Set the remote control lever in the "N" (Neutral) position.

2) Remove the clip of the emergency stop switch.

3) Remove the engine cover and the intake manifold, and disconnect the fuel injector connectors of each cylinder.



4) Remove the ignition coil, the spark plug cap and the spark plug from each cylinder.

5) Install a compression gauge in the No. 1 plug hole.

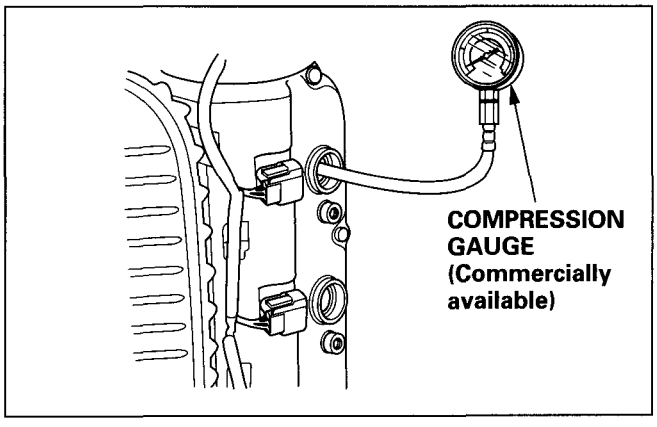
6) Disconnect the remote control cable [throttle side] from the throttle arm.

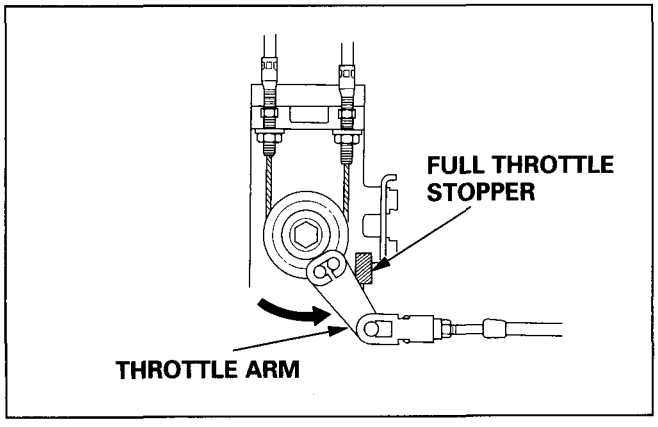
7) Set the throttle in the full throttle position by pulling the throttle arm against the full throttle stopper with hand as shown.

8) Set the ignition switch in the START position and turn the starter motor. Measure the cylinder compression.

Cylinder compression	1,372 – 1,568 kPa (14 – 16 kgf/cm², 199 – 228 psi) at 300 rpm

9) Check the compression on all cylinders.





b. ENGINE DOES NOT RUN SMOOTHLY

- Warning buzzer sounds with a continuous buzzer sound. → Perform the alert system troubleshooting (continuous sound) (P. 5-49).
- Warning buzzer sounds with a short term intermittent buzzer sound. → Perform the alert system troubleshooting (short beep: intermittent sound) (P. 5-55).
- Warning buzzer sounds with a long term intermittent buzzer sound. → Perform the alert system troubleshooting (long beep: intermittent sound) (P. 5-53).

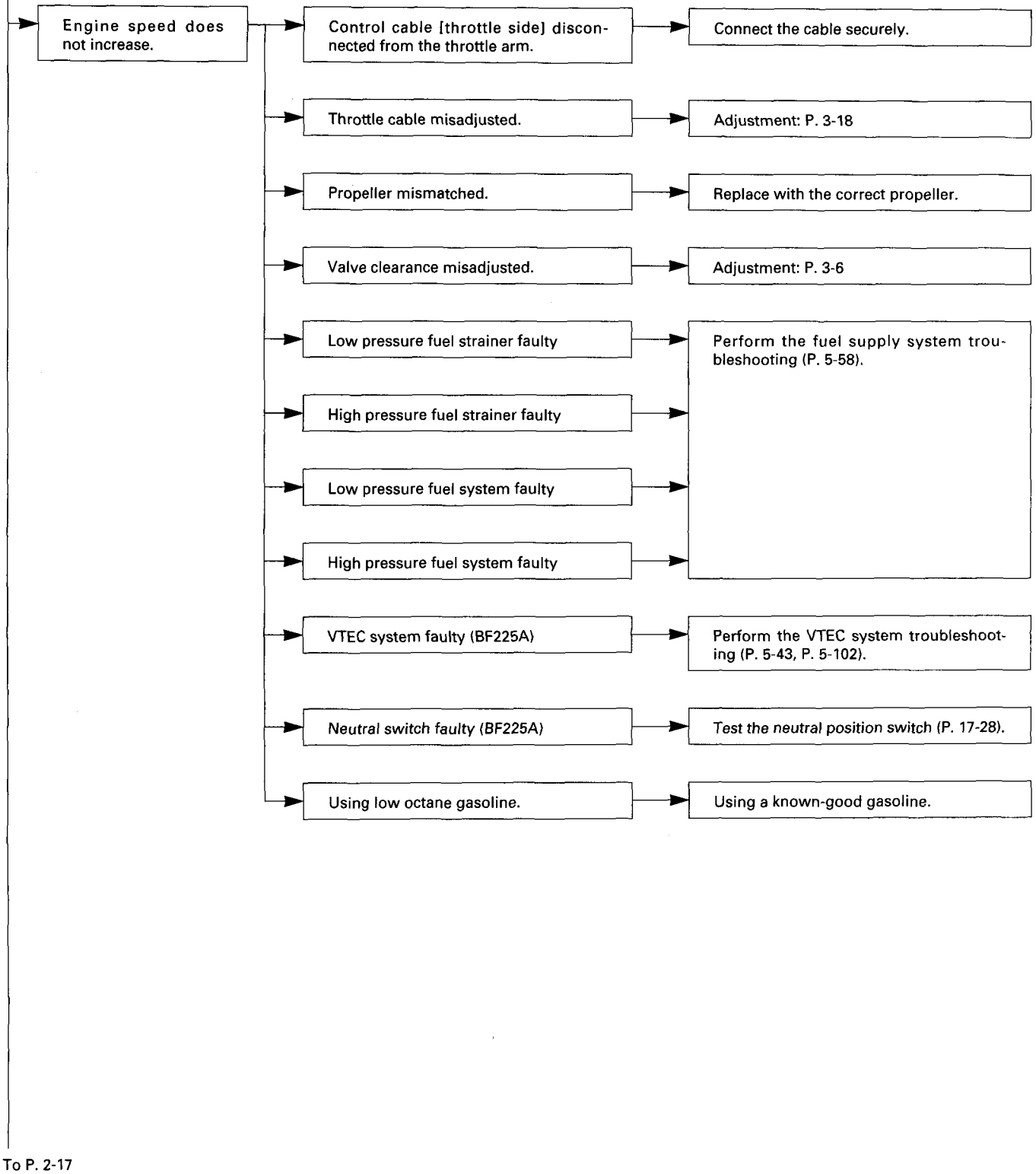
No warning sound from the warning buzzer, but the engine does not run smoothly.

Engine starts, but stalls soon. Idle speed is not stable or stalls.

- Spark plug faulty → Replace or clean (P. 3-5).
- Check whether secondary air is being sucked. →
  - Loose IAC valve or throttle body mounting bolts. Or check the gasket for damage and replace if necessary (P. 5-99).
  - Loose IAT sensor. Or check the O-ring for damage and replace if necessary (P. 5-99).
  - Loose shutter valve cover mounting bolts. Or check the seal ring for damage and replace if necessary (P. 5-112).
  - Loose intake manifold and injector base mounting bolts. Or check the O-ring and gasket for damage and replace if necessary (P. 5-112).
  - Check the fuel injectors and seal rings for damage and replace if necessary (P. 5-72).
  - Check vacuum tubes for damage, replace if necessary.
  - Check vacuum tank for damage, replace if necessary.
- High pressure fuel system faulty → Perform the high pressure fuel system troubleshooting (P. 5-58).
- Low pressure fuel system faulty → Perform the low pressure fuel system troubleshooting (P. 5-58).
- Idle control system faulty → Perform the idle control system troubleshooting (P. 5-44).

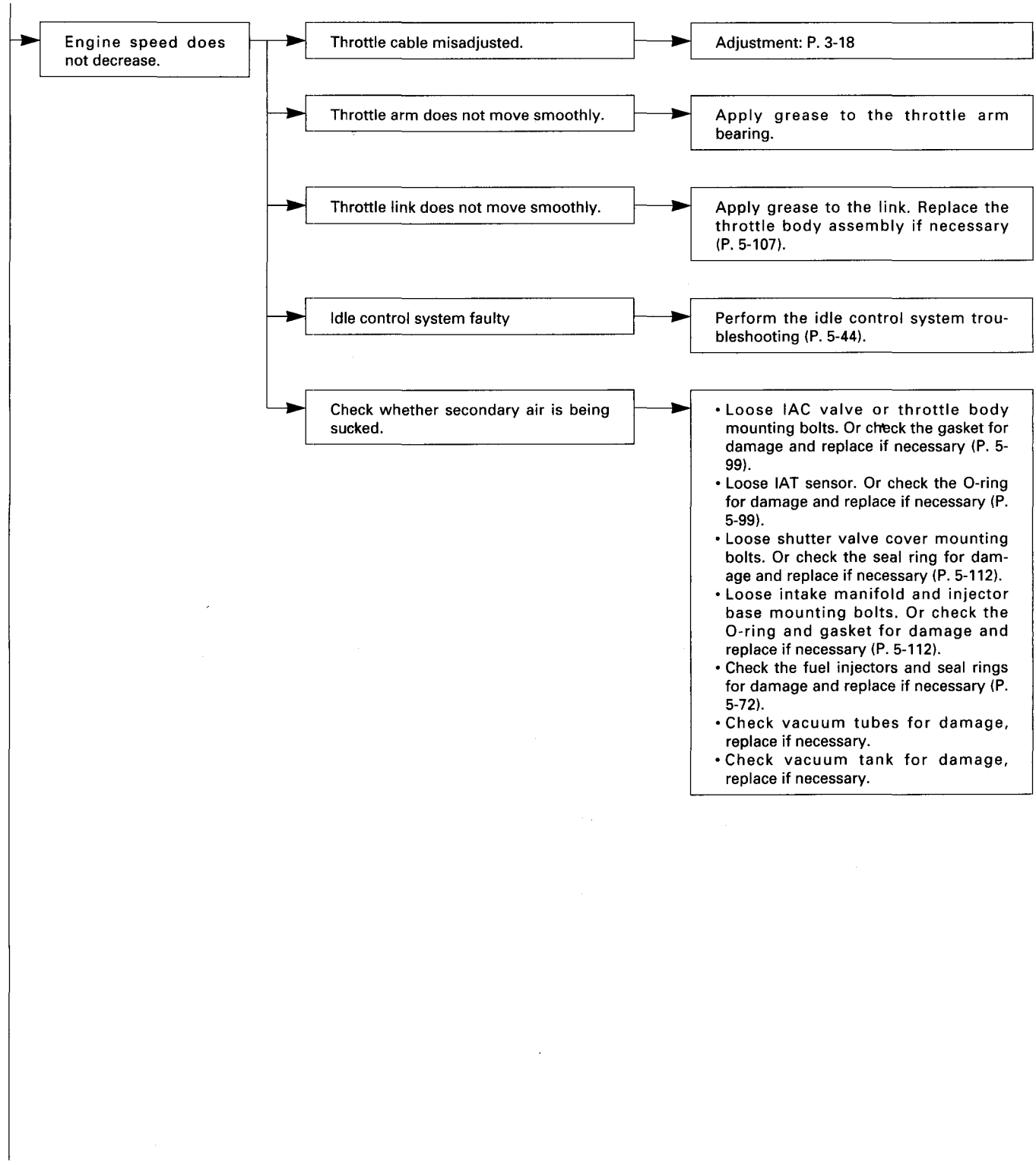
To P. 2-16

From P. 2-15



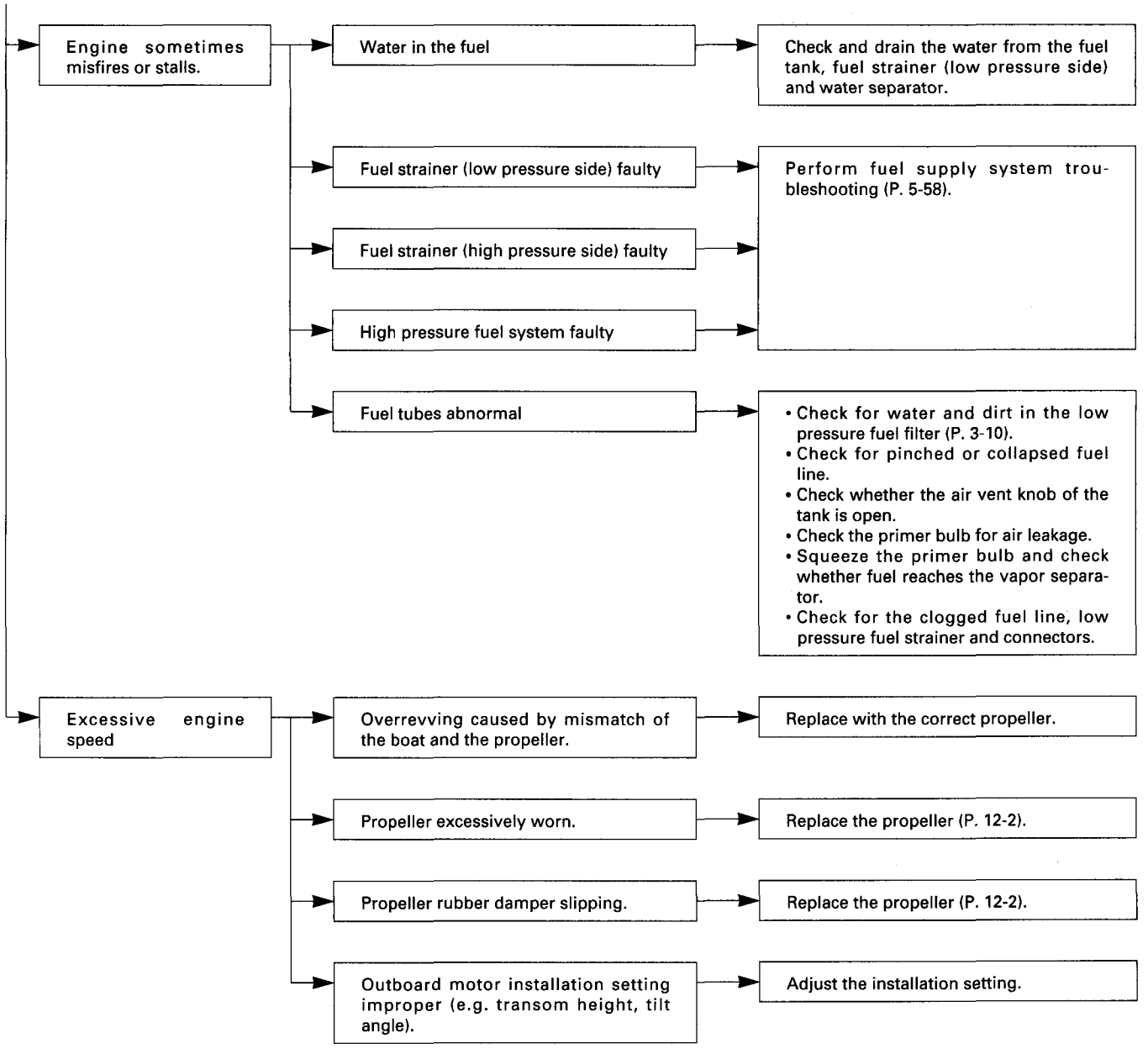
To P. 2-17

From P. 2-16



To P. 2-18

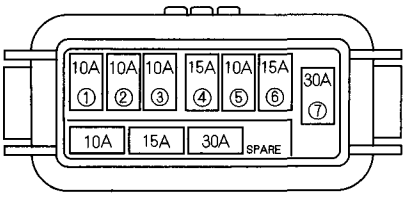
From P. 2-17



***: When fuel overflow is detected, check the vapor separator (P. 5-88).**

c. IGNITION (POWER) SYSTEM

- Turn the ignition switch OFF before checking the ignition system.
- Check for a blown No. 5 (10 A) fuse. If necessary, replace the fuse, and check for a short in the main wire harness (P. 2-21).



Ignition (power) system is faulty (engine does not start).

↓

Turn the ignition switch ON. The MIL should turn ON once for 2 seconds.

→ Turns ON. → Perform the "Hard Starting" troubleshooting (P. 2-13).

↓ Does not turn ON.

When the ignition switch is ON, the warning buzzer sounds twice with an intermittent sound.

→ Intermittent sound → Perform the ECM troubleshooting (MIL does not turn ON). (P. 5-16)

↓ No intermittent sound

Check for a blown No. 3, No. 4 and No. 7 fuses.

→ Blown →
- Replace the blown fuse.
- Check for short in the main wire harness or incorrect load by referring to the fuse load list (P. 2-21).

↓ Not blown

Check the main relay (P. 17-9), and/or perform the main wire harness troubleshooting (P. 5-59)

→ Incorrect →
- Replace the main relay (P. 17-8).
- Replace the main wire harness.

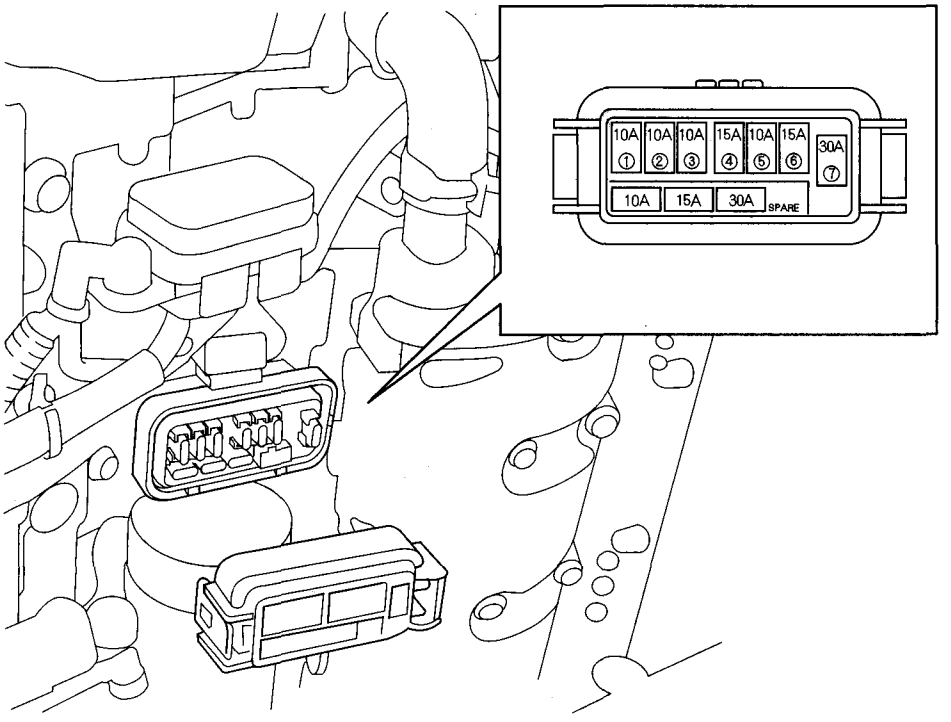
↓ Correct

Perform the ECM troubleshooting (MIL does not turn ON). (P. 5-16)

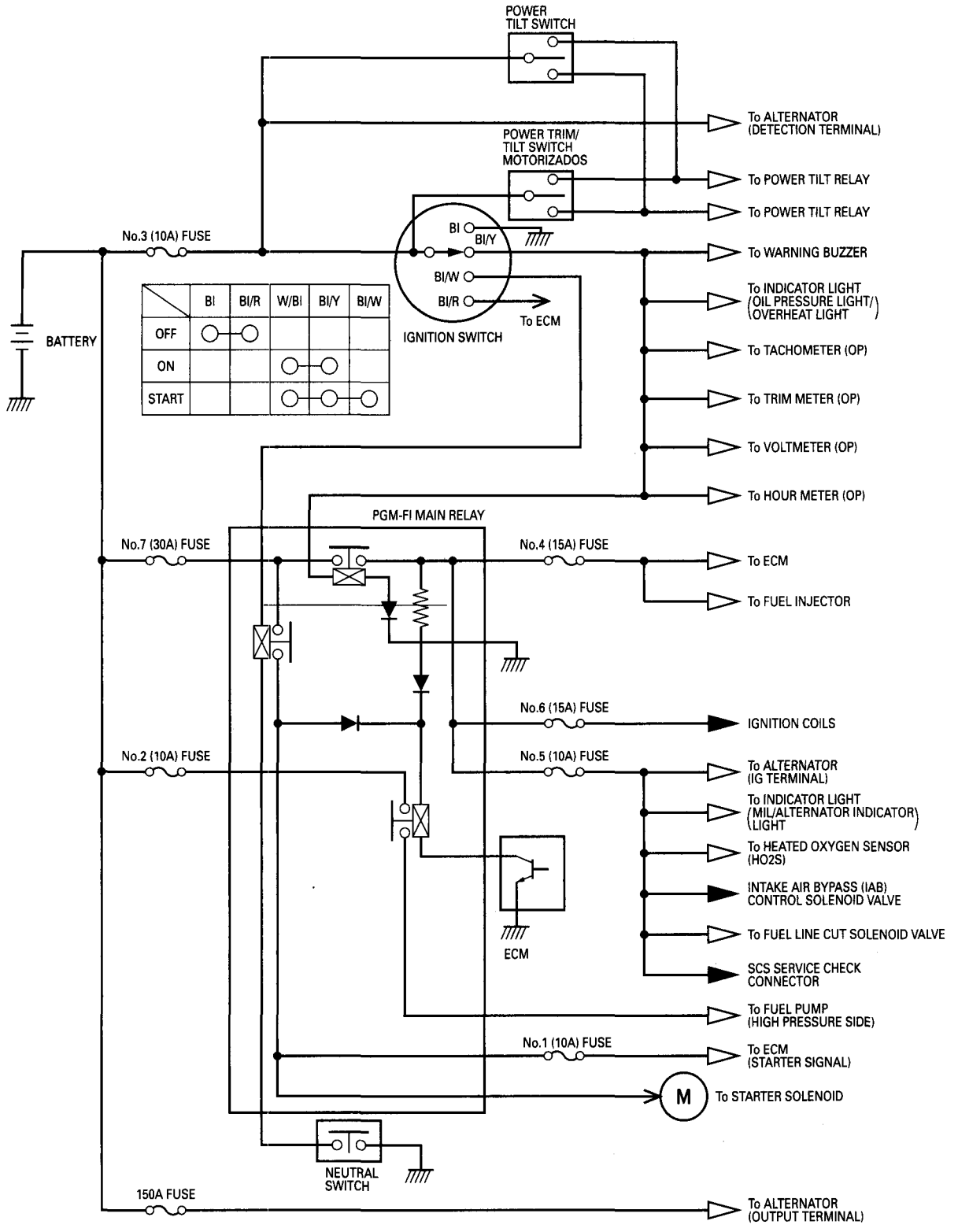
• FUSE to COMPONENTS INDEX

Fuse No.	Amps.	Component(s) or Circuit(s) Protected
1*1	10 A	ECM (STS)
2	10 A	Fuel pump
3	10 A	Alternator (output terminal), Engine oil pressure light, Overheat light, Power tilt relay, PGM-FI main relay, Techometer, Trim meter, Warning buzzer
4*1	15 A	ECM (power supply), Injector
5*1	10 A	Alternator, HO2S (heated oxygen sensor), Fuel line cut-off solenoid valve, Intake air bypass (IAB) control solenoid valve, VTEC solenoid valve, Service check connector
6*1	15 A	Ignition coils
7	30 A	ECM (power supply), Injector
		Alternator, HO2S (heated oxygen sensor), Fuel line cut-off solenoid valve, Intake air bypass (IAB) control solenoid valve, VTEC solenoid valve, Service check connector
		Ignition coils
		Starter motor

*1: Via PGM-FI main relay

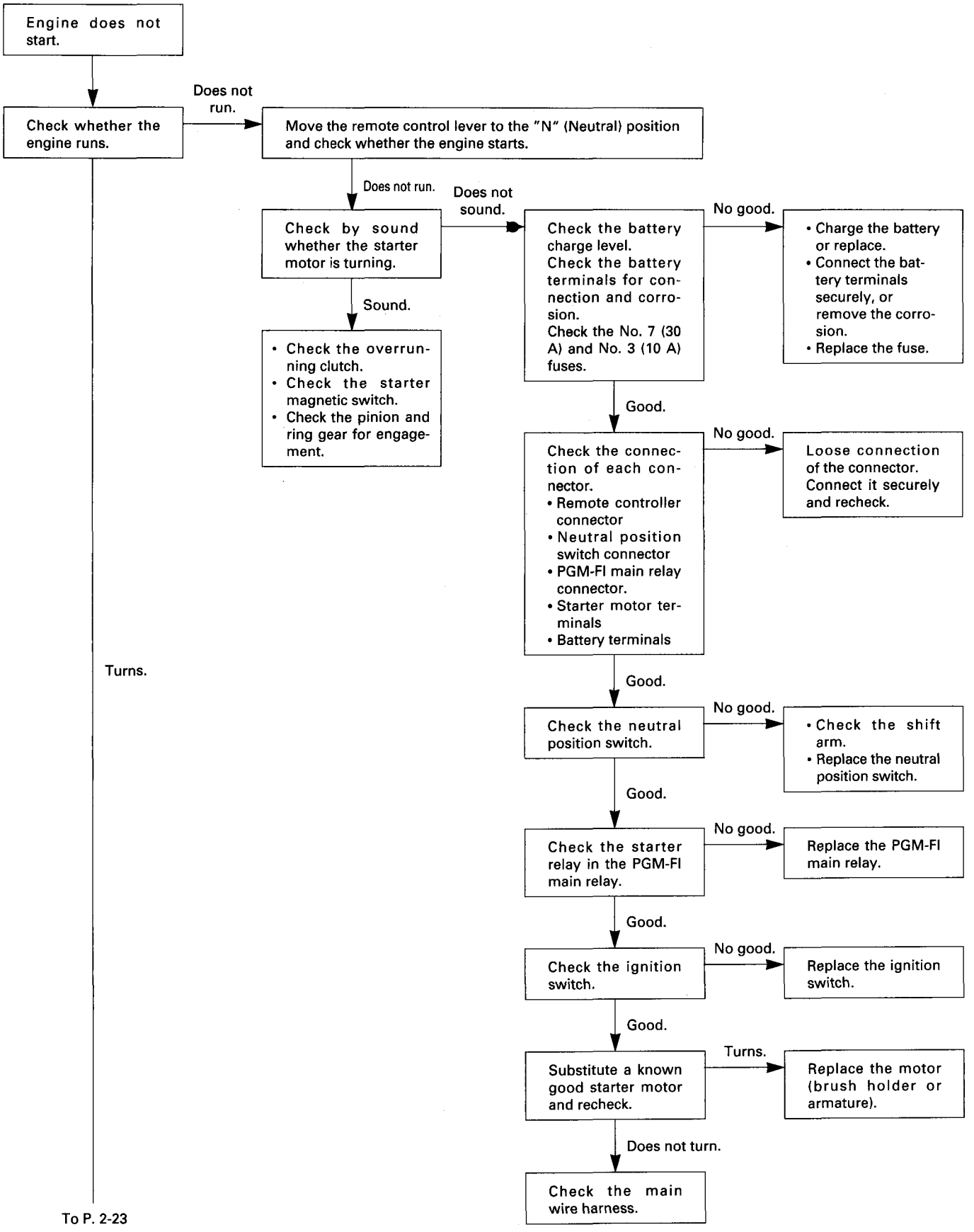


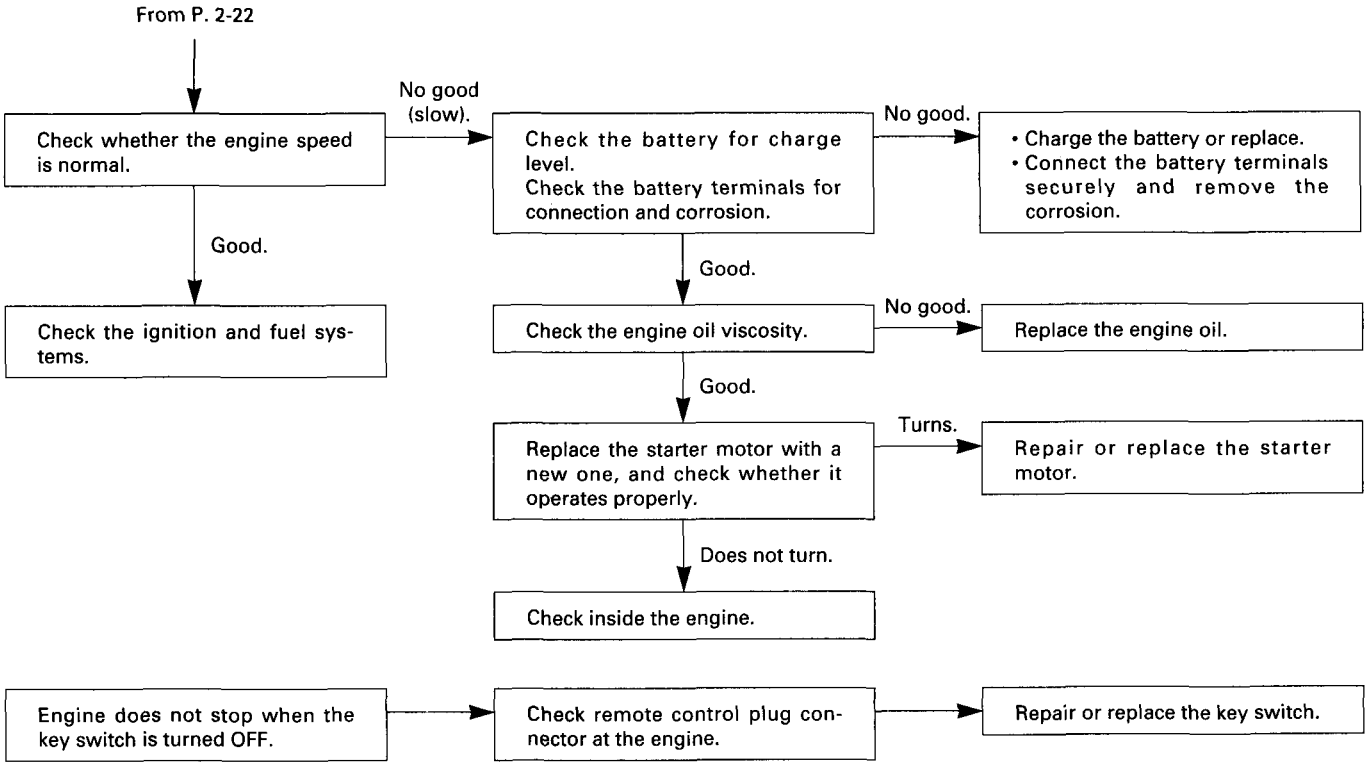
• FUSE LOAD LIST



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

d. STARTER MOTOR





NOTICE: When a problem occurs, disconnect the battery immediately.

e. IGNITION SYSTEM

Troubleshoot the ignition system after the MIL turns ON for 2 seconds and the buzzer sounds twice with ignition switch ON. If the MIL does not turn ON or the buzzer does not sound, troubleshoot the ignition (power) system first (P. 2-19).

Engine hard to start.

Check for a blown No. 6 (15 A) fuse.
- No good. → • An open in the wire between the fuse box and ignition coils. • Replace the No. 6 fuse. • Replace the main wire harness.
- Good.

Is the emergency stop switch clip connected?
- No → Set the clip securely.
- YES

Measure the spark plug gap.
Spark Plug Gap: 1.0 – 1.1 mm (0.03937 – 0.04331 in)
- No good. → Replace the spark plug. • Do not adjust the spark plug gap.
- Good.

Clean the spark plugs, electrode (P. 3-5), and recheck.
- Good. → The system is OK.
- No good.

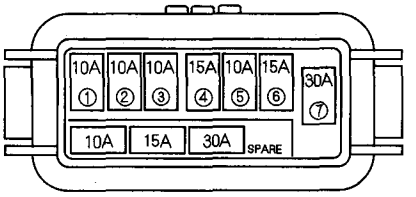
Check again with new spark plugs.
- Good. → Replace the spark plug.
- No good.

Check the connection of the TDC sensor 4P connector.
- No good. → Connect the 4P connector securely and recheck.
- Good.

Check the timing belt driven pulleys.
- No good. → Replace the timming belt driven pulley.
- Good.

To P. 2-25

FUSE BOX



From P. 2-24

1) Turn the ignition switch OFF.
2) Disconnect the ECM 26P, 34P and 12P connectors from the ECM.
3) Connect the test harness.
4) Check for continuity between the B5 terminal and body ground, and the B6 terminal and body ground.

Continuity → A short in the wire between the ECM and the emergency stop switch.
- Replace the main wire harness.
- Replace the remote control cable.

No continuity

1) Disconnect the 3P connector from each ignition coil.
2) Turn the ignition switch ON.
3) Check for voltage between the ignition coil No. 3 terminal and body ground.

No voltage → An open in the wire between the fuse box and the ignition coil.
- Replace the main wire harness.

Voltage

1) Turn the ignition switch OFF.
2) Check for continuity between the ignition coil No. 2 terminal and body ground.

No continuity → Poor ground or an open in the wire between the ignition coil and body ground.
- If the ground is OK, replace the main wire harness.

Continuity

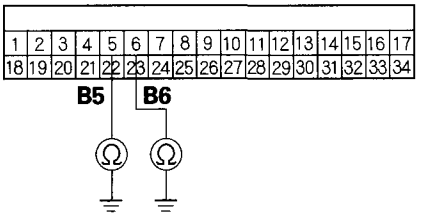
Check for continuity between the test harness connector B7, B8, B16, B24, B32 and B33 terminals and body ground.

Continuity → A short in the wire between the ECM and ignition coil.
- Replace the main wire harness.

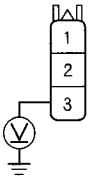
No continuity

To P. 2-26

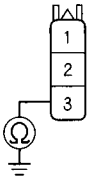
TEST HARNESS CONNECTOR B (34P)



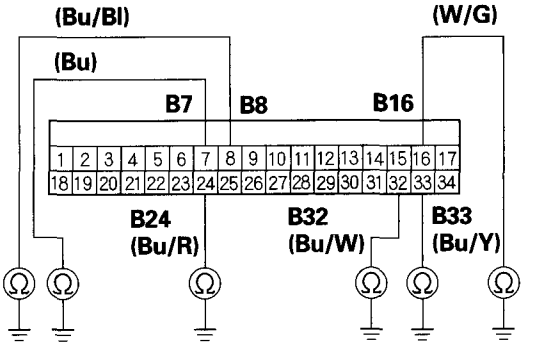
IGNITION COIL 3P CONNECTOR



Viewing the connector from the front side



TEST HARNESS CONNECTOR B (34P)



From P. 2-25

Check for continuity between the test harness connector B7, B8, B16, B24, B32 and B33 terminals and ignition coil 3P connector No. 2 terminal.
- No. 2 (Bu wire) and B7 terminal
- No. 2 (Bu/Bl wire) and B8 terminal
- No. 2 (W/G wire) and B16 terminal
- No. 2 (Bu/R wire) and B24 terminal
- No. 2 (Bu/W wire) and B32 terminal
- No. 2 (Bu/Y wire) and B33 termi-

No continuity → An open in the wire between the ECM and ignition coil.
- Replace the main wire harness.

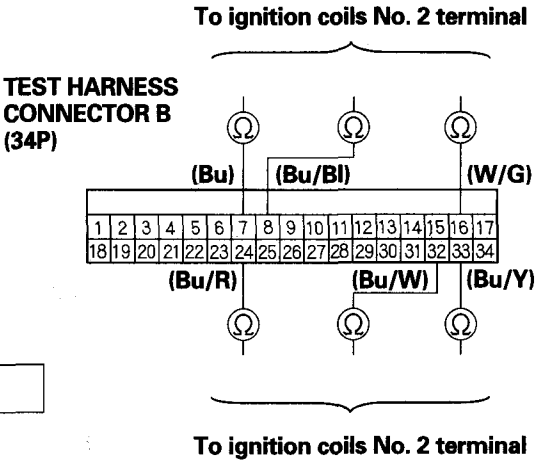
Continuity

Replace the ignition coil and recheck.

The engine can start. → Replace the ignition coil.

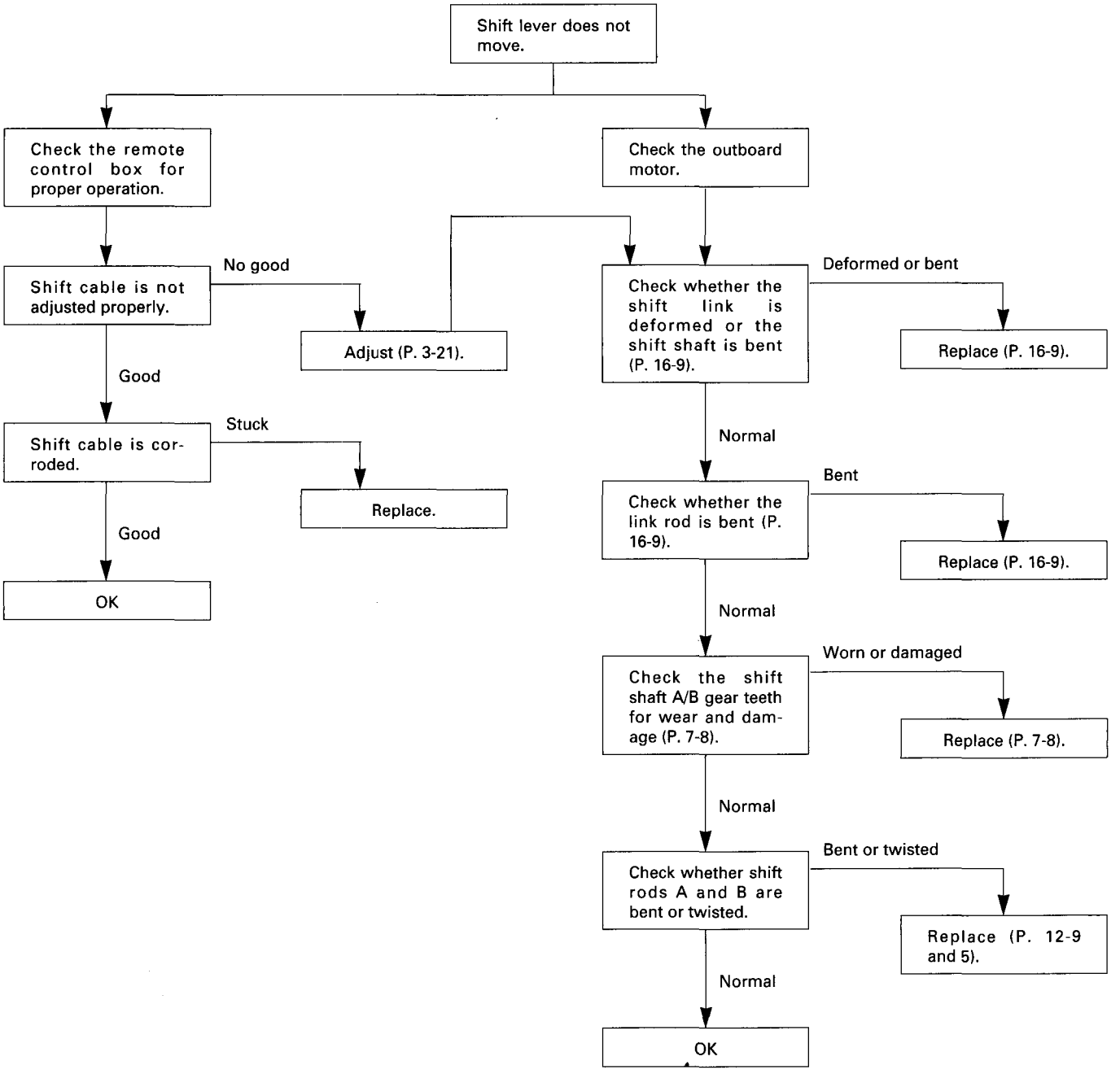
Still no good.

Substitute a known-good ECM and recheck.



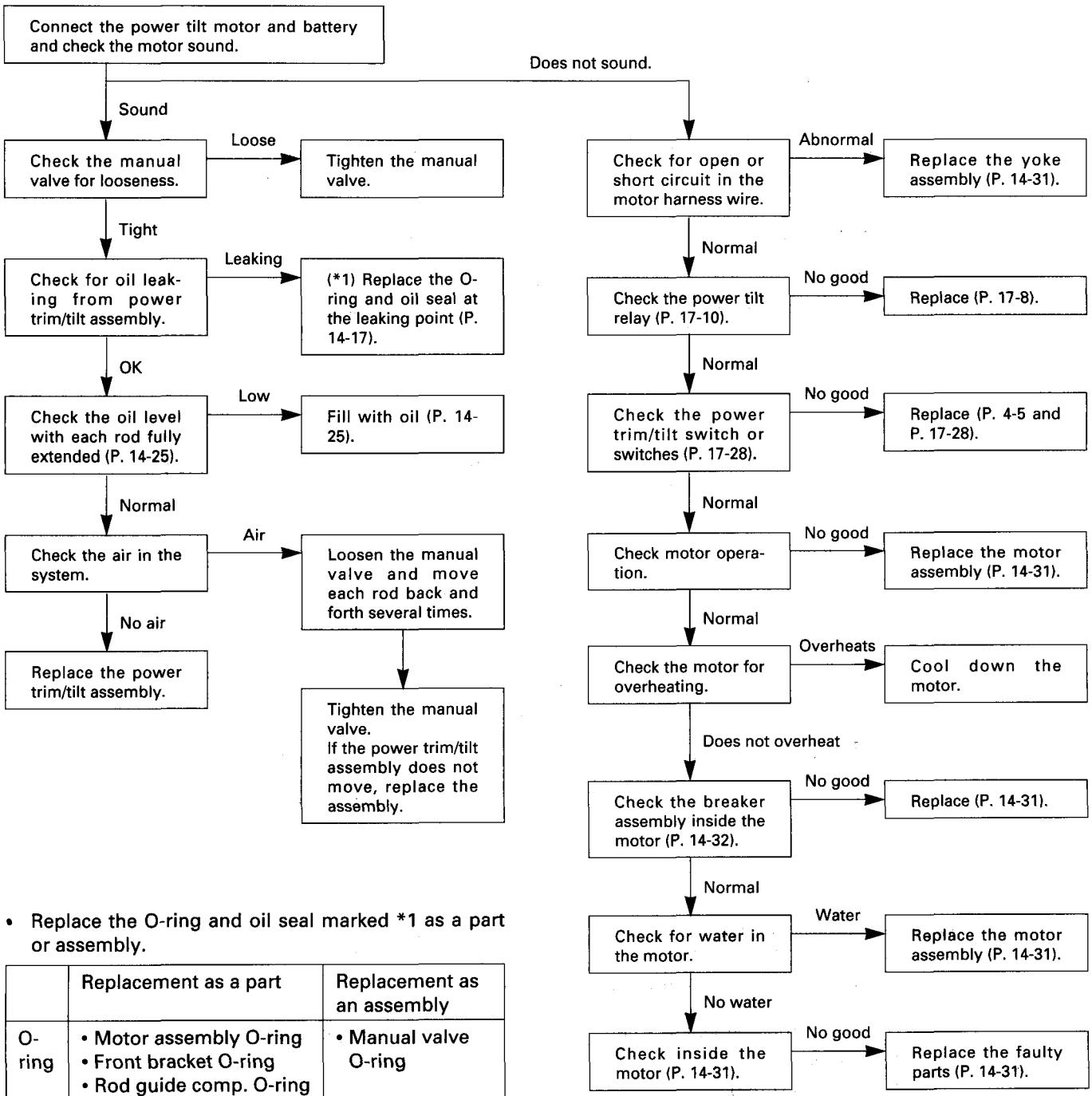
- **FRAME**

a. SHIFT



b. POWER TRIM/TILT ASSEMBLY DOES NOT MOVE

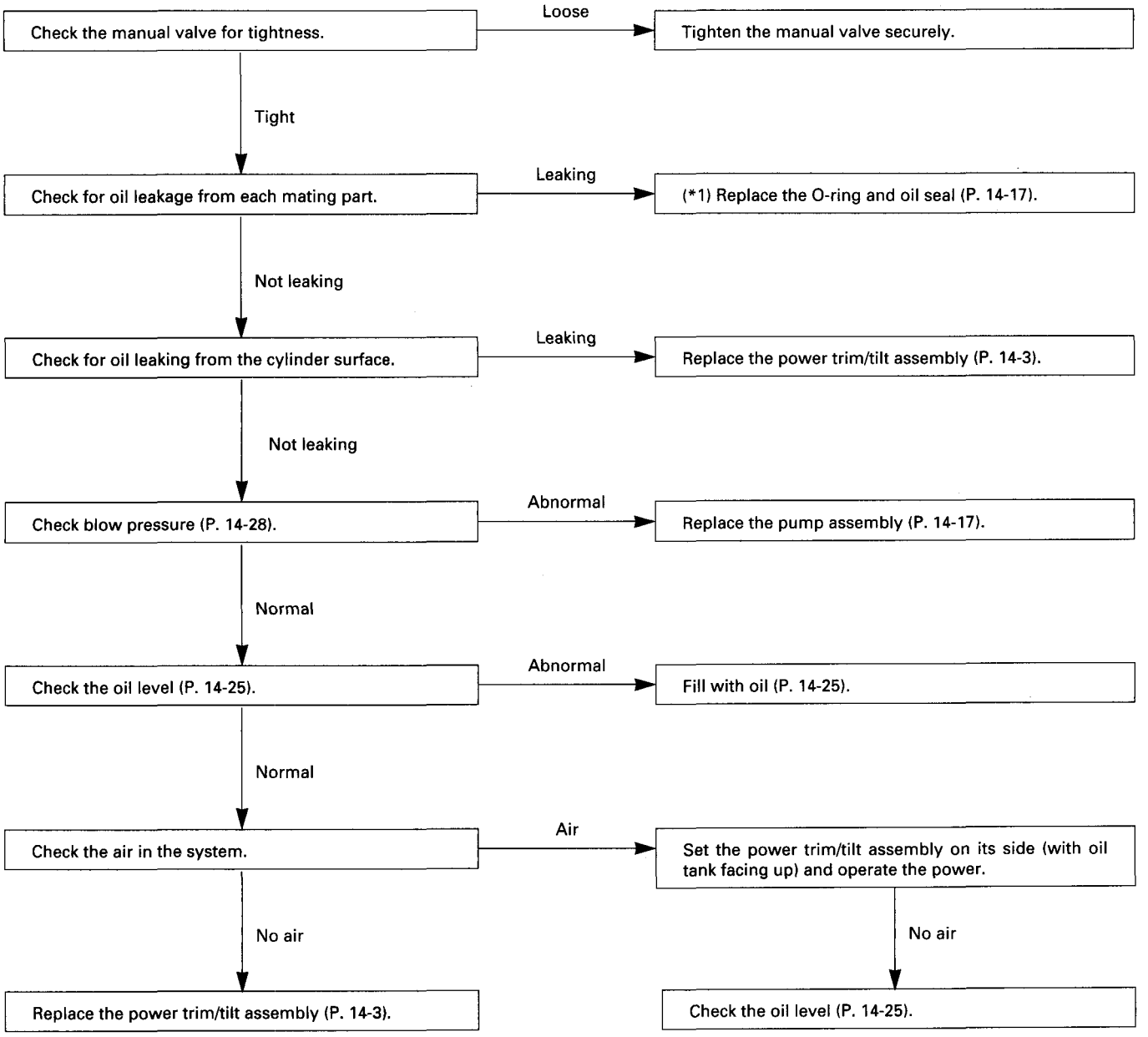
- Use a fully charged 12V battery.



- Replace the O-ring and oil seal marked *1 as a part or assembly.

	Replacement as a part	Replacement as an assembly
O-ring	• Motor assembly O-ring • Front bracket O-ring • Rod guide comp. O-ring • Oil tank, pump assembly O-ring • Piston rod B O-ring/backup ring • Piston rod comp. O-ring • Free piston O-ring/backup ring	• Manual valve O-ring
Oil seal	• Front bracket oil seal • Rod guide comp. oil seal/dust seal	• Piston rod comp. (cylinder cap) oil seal

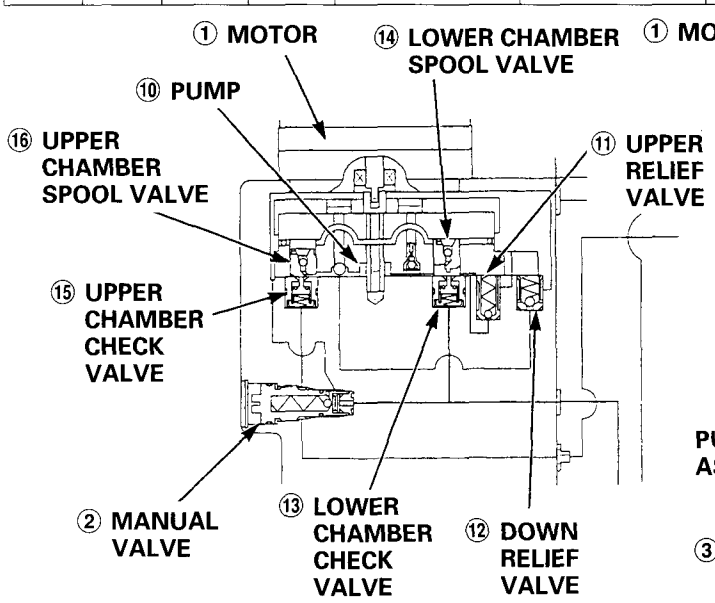
c. POWER TRIM/TILT ASSEMBLY DOES NOT HOLD.

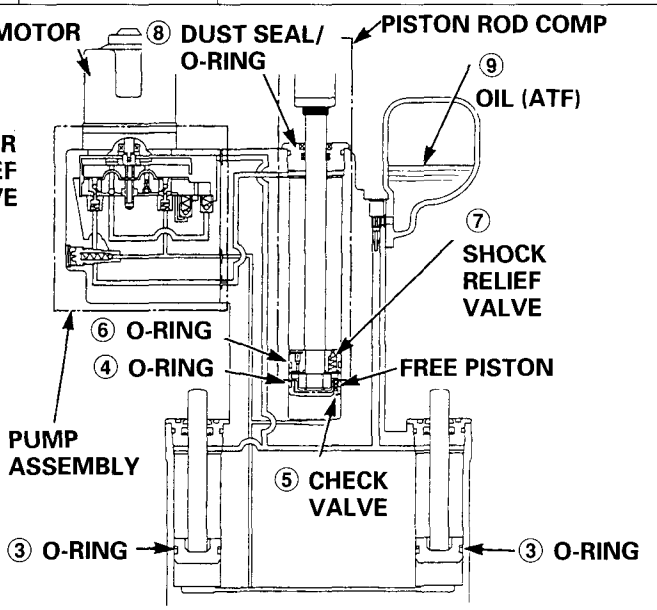


- Replace the O-ring and oil seal marked *1 as a part or assembly.

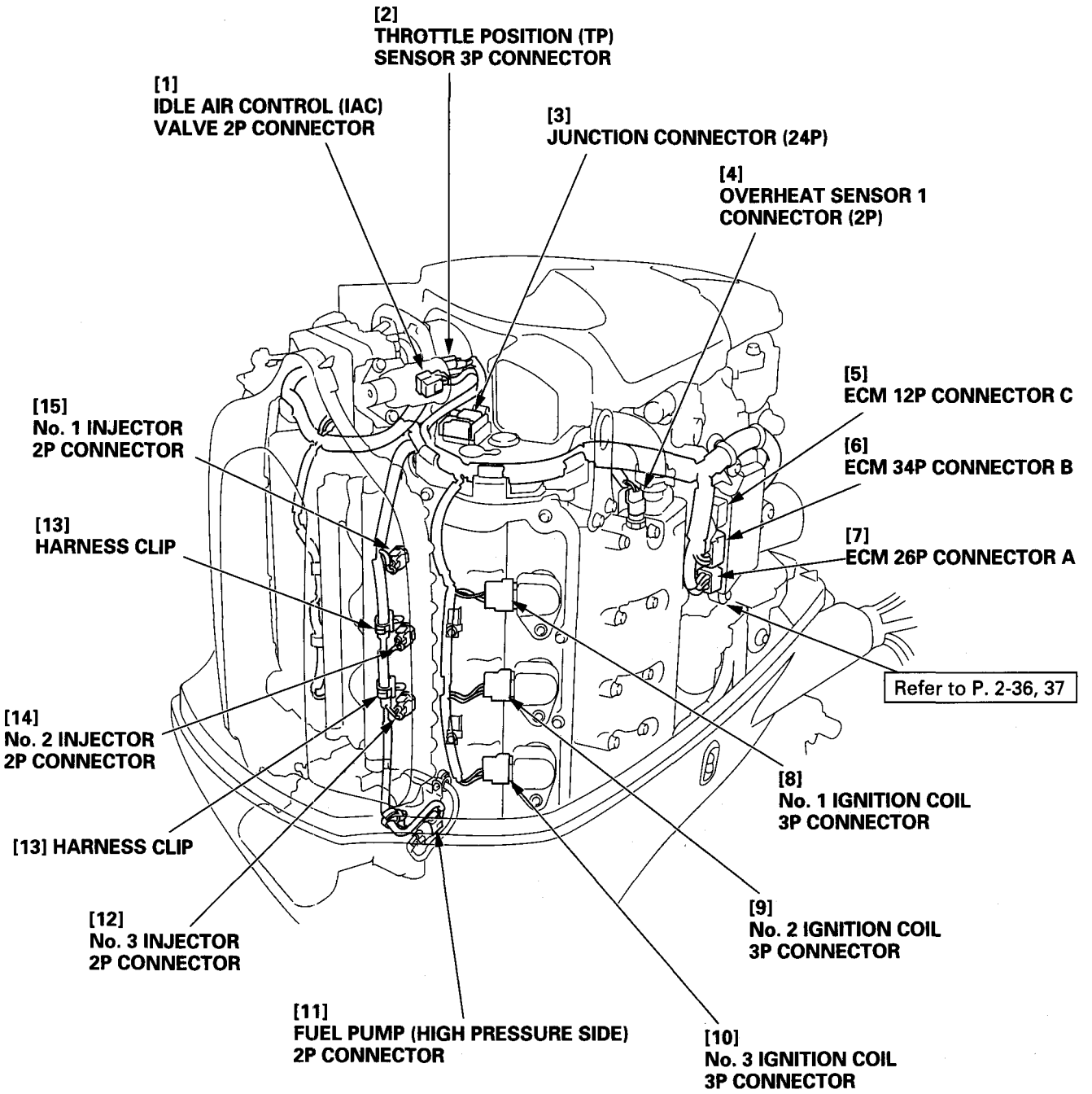
	Replacement as a part	Replacement as an assembly
O-ring	• Motor assembly O-ring • Front bracket O-ring • Rod guide comp. O-ring • Oil tank, pump assembly O-ring • Piston rod B O-ring/backup ring • Piston rod comp. O-ring • Free piston O-ring/backup ring	• Manual valve O-ring
Oil seal	• Front bracket oil seal • Rod guide comp. oil seal/dust seal	• Piston rod comp. (cylinder cap) oil seal

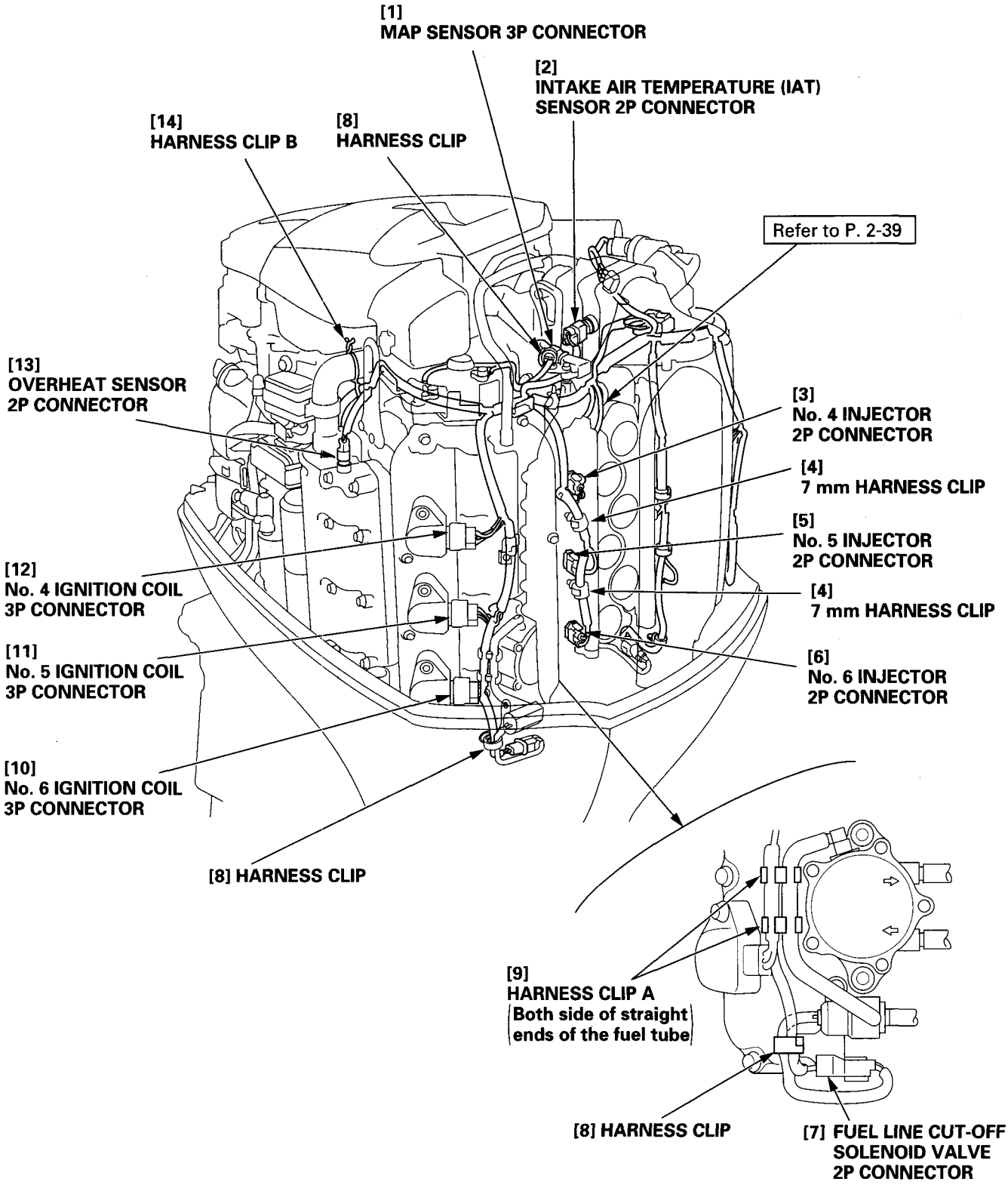
Symptom				Pressure check		Check point	Check/repair method
Does not tilt up.	Does not tilt down.	Does not hold.		Lower chamber blow-off pressure lower than spec. or pressure drops.	Upper chamber blow-off pressure lower than spec. or pressure drops.		
		Lowers.	Extends.				
◎	◎			◎	◎	① Motor	Check according to the motor check procedure.
◎	◎	◎	◎	◎	◎	② Manual valve	Check the manual valve for foreign material and the O-ring surface for damage. Wash or replace the manual valve if necessary.
◎	◎	◎		◎		③ O-ring	Check the O-ring surface for damage or foreign material and replace if necessary.
◎		◎		◎		④ O-ring	
◎		◎		◎		⑤ Check valve	Do not disassemble the free piston as it is the guaranteed part of the assembly. Check the ball seat for damage or foreign material. Wash or replace the free piston if necessary.
	◎		◎		◎	⑥ O-ring	Check the O-ring surface for damage and foreign material. Replace if necessary.
	◎		◎		◎	⑦ Shock relief valve	Do not disassemble the piston rod comp. as it is the guaranteed part of the assembly. Check the ball seat for damage or foreign material. Wash the shock relief valve or replace the piston rod comp. if necessary.
	◎		◎		◎	⑧ Dust seal/O-ring	Do not disassemble the piston rod comp. as it is the guaranteed part of the assembly. Check the O-ring surface for damage or foreign material. Replace the piston rod comp. if necessary.
◎	◎					⑨ Oil	Check the oil level and add the oil if necessary.
◎	◎			◎	◎	⑩ Pump	Do not disassemble the pump assembly as it is the guaranteed part of the assembly. Replace the pump assembly if necessary.
◎				◎		⑪ Upper relief valve	
	◎				◎	⑫ Down relief valve	
○	○	◎		◎		⑬ Lower cham ber check valve	
○	○	○		○		⑭ Lower cham ber spool valve	
○	○		◎		◎	⑮ Upper cham ber check valve	
○	○		○		○	⑯ Upper cham ber spool valve	

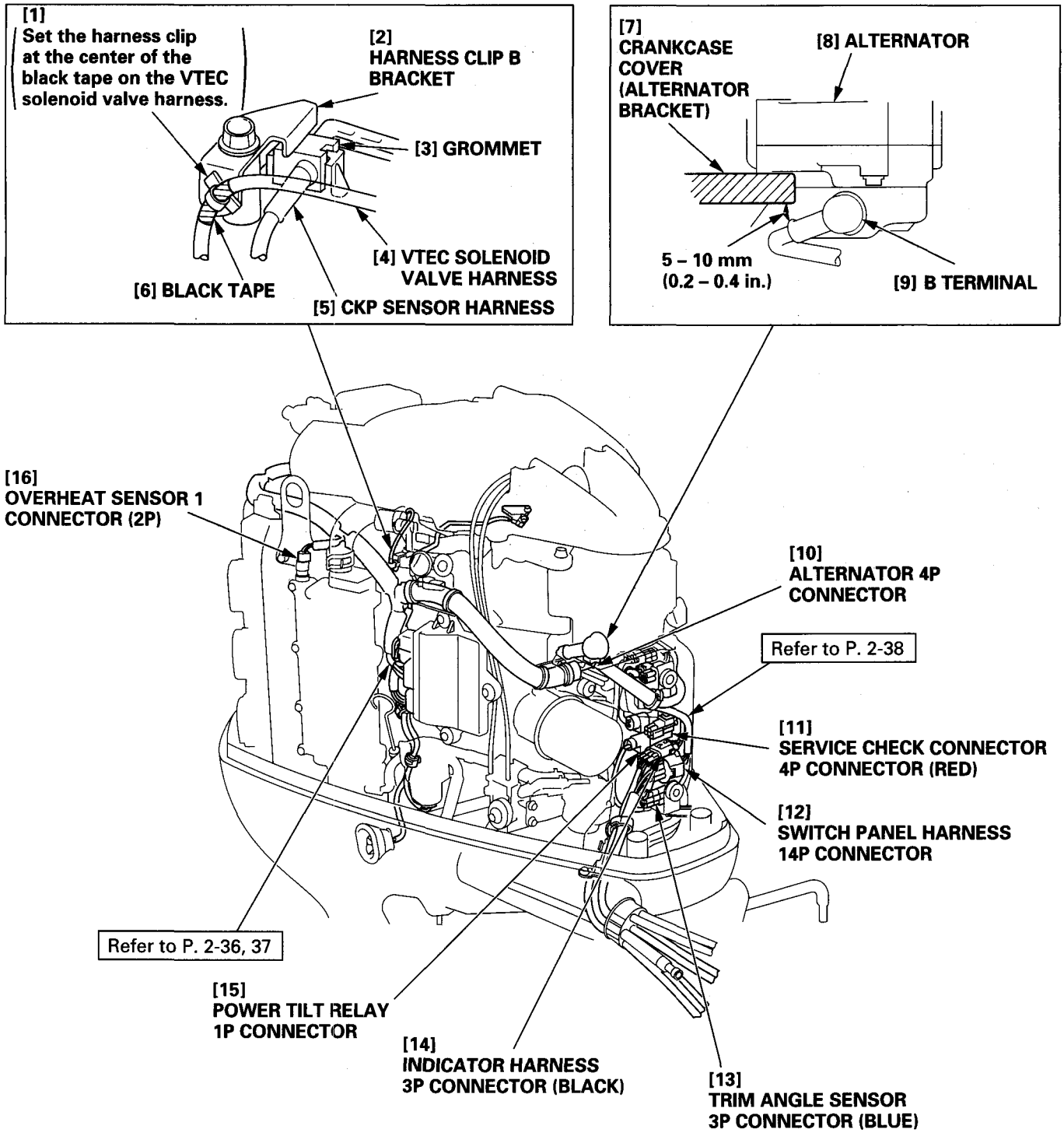


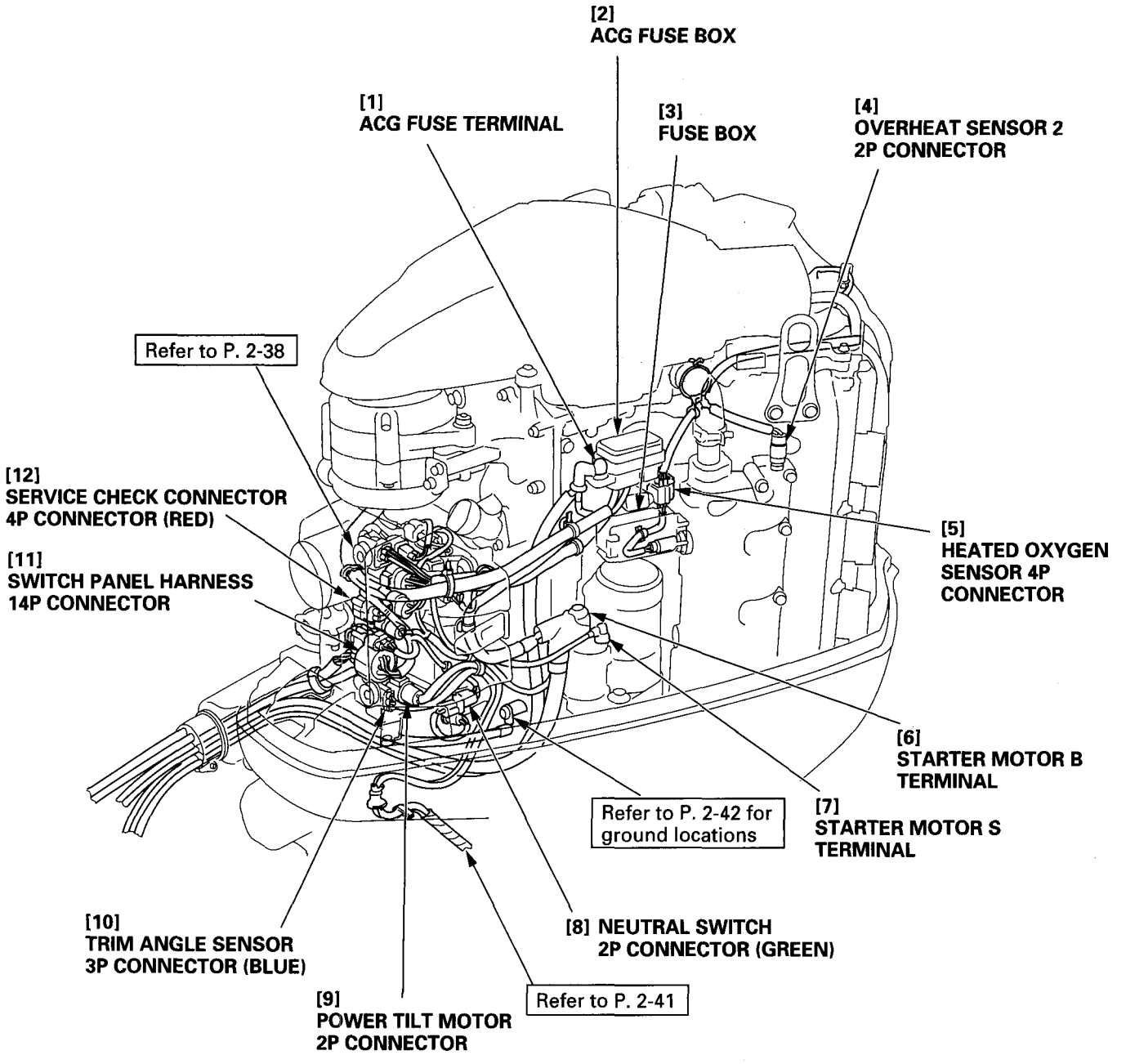


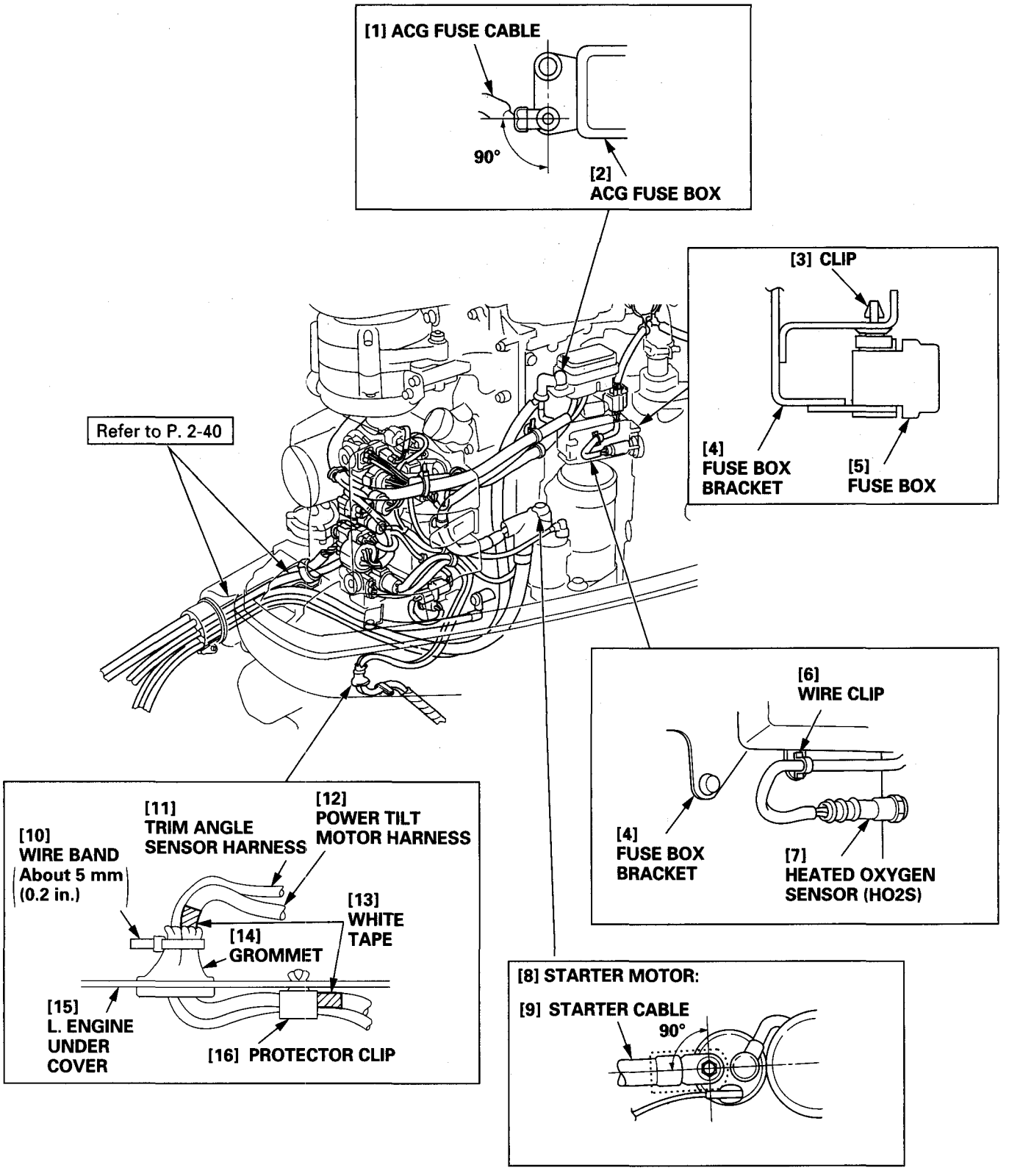
7. CABLE/HARNESS ROUTING

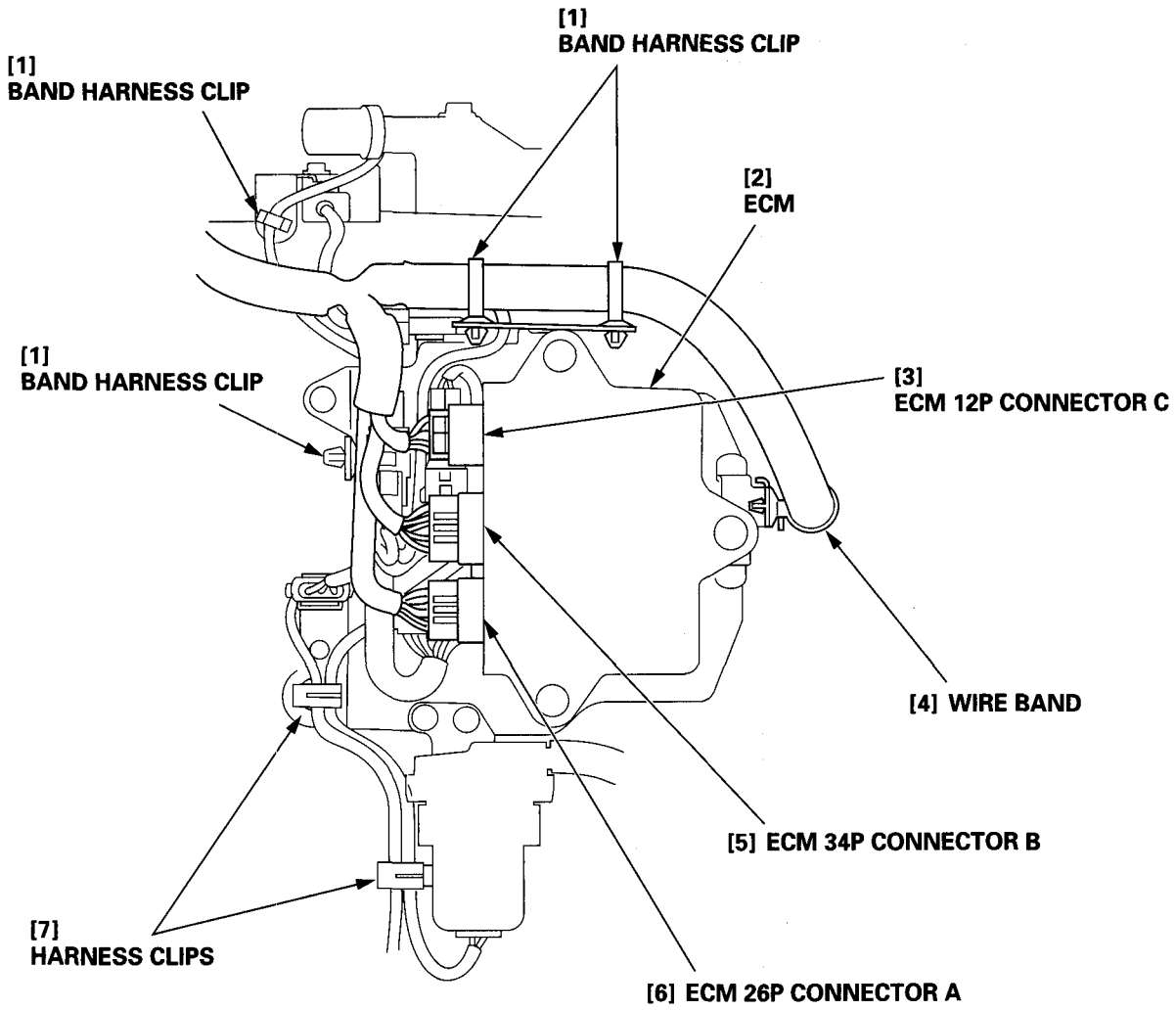


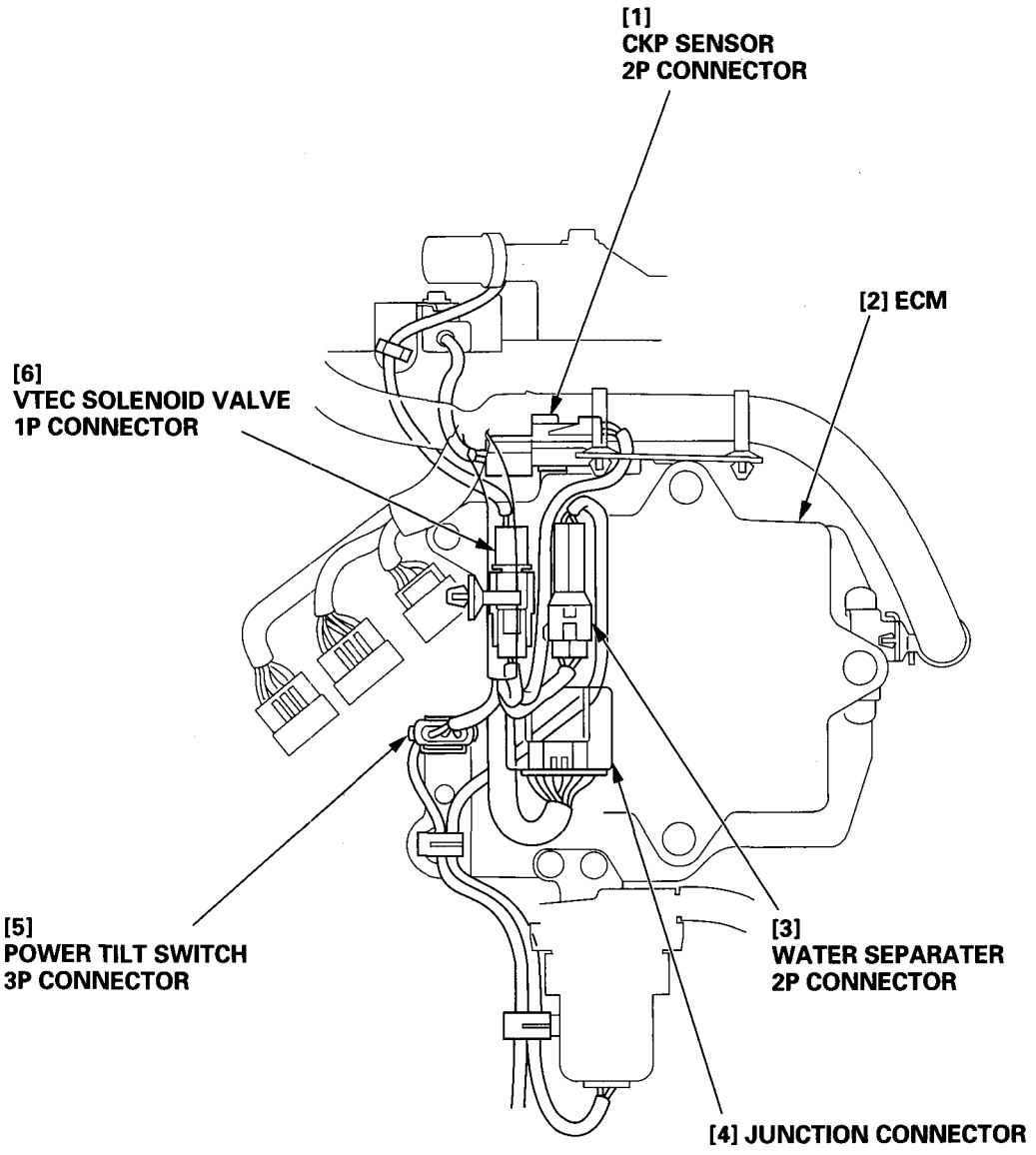

[1]
MAP SENSOR 3P CONNECTOR
[2]
INTAKE AIR TEMPERATURE (IAT)
SENSOR 2P CONNECTOR
[14]
HARNESS CLIP B
[8]
HARNESS CLIP
Refer to P. 2-39
[13]
OVERHEAT SENSOR
2P CONNECTOR
[3]
No. 4 INJECTOR
2P CONNECTOR
[4]
7 mm HARNESS CLIP
[5]
No. 5 INJECTOR
2P CONNECTOR
[12]
No. 4 IGNITION COIL
3P CONNECTOR
[4]
7 mm HARNESS CLIP
[11]
No. 5 IGNITION COIL
3P CONNECTOR
[6]
No. 6 INJECTOR
2P CONNECTOR
[10]
No. 6 IGNITION COIL
3P CONNECTOR
[8] HARNESS CLIP
[9]
HARNESS CLIP A
(Both side of straight ends of the fuel tube)
[8] HARNESS CLIP
[7] FUEL LINE CUT-OFF
SOLENOID VALVE
2P CONNECTOR


[1]
Set the harness clip at the center of the black tape on the VTEC solenoid valve harness.
[2]
HARNESS CLIP B BRACKET
[3] GROMMET
[4] VTEC SOLENOID VALVE HARNESS
[5] CKP SENSOR HARNESS
[6] BLACK TAPE
[7]
CRANKCASE COVER (ALTERNATOR BRACKET)
[8] ALTERNATOR
5 – 10 mm (0.2 – 0.4 in.)
[9] B TERMINAL
[16]
OVERHEAT SENSOR 1 CONNECTOR (2P)
[10]
ALTERNATOR 4P CONNECTOR
Refer to P. 2-38
[11]
SERVICE CHECK CONNECTOR 4P CONNECTOR (RED)
[12]
SWITCH PANEL HARNESS 14P CONNECTOR
Refer to P. 2-36, 37
[15]
POWER TILT RELAY 1P CONNECTOR
[14]
INDICATOR HARNESS 3P CONNECTOR (BLACK)
[13]
TRIM ANGLE SENSOR 3P CONNECTOR (BLUE)

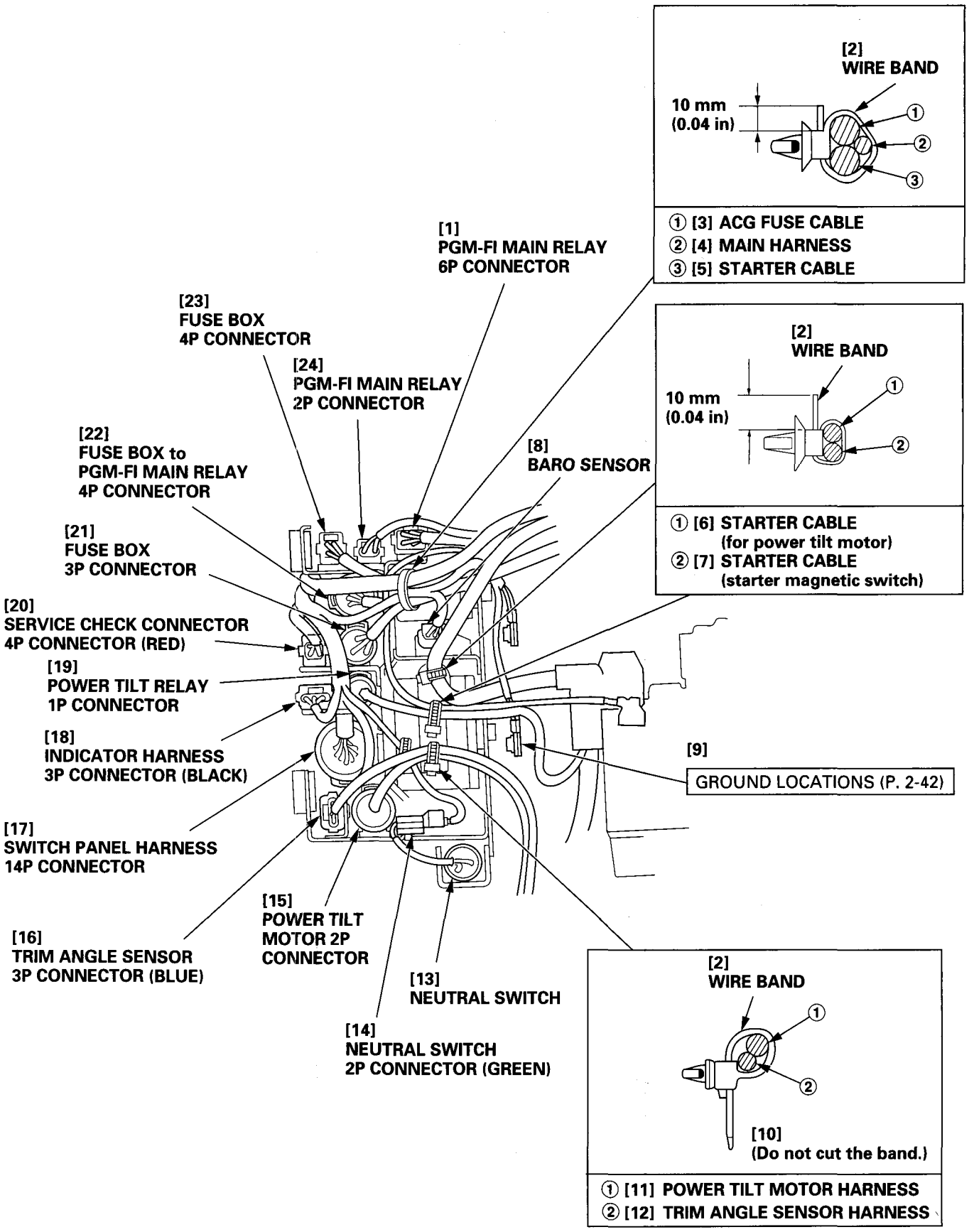

[2]
ACG FUSE BOX
[1]
ACG FUSE TERMINAL
[3]
FUSE BOX
[4]
OVERHEAT SENSOR 2
2P CONNECTOR
Refer to P. 2-38
[12]
SERVICE CHECK CONNECTOR
4P CONNECTOR (RED)
[11]
SWITCH PANEL HARNESS
14P CONNECTOR
[5]
HEATED OXYGEN
SENSOR 4P
CONNECTOR
[6]
STARTER MOTOR B
TERMINAL
Refer to P. 2-42 for
ground locations
[7]
STARTER MOTOR S
TERMINAL
[10]
TRIM ANGLE SENSOR
3P CONNECTOR (BLUE)
[8] NEUTRAL SWITCH
2P CONNECTOR (GREEN)
Refer to P. 2-41
[9]
POWER TILT MOTOR
2P CONNECTOR


[1] ACG FUSE CABLE
90°
[2]
ACG FUSE BOX
[3] CLIP
[4]
FUSE BOX
BRACKET
[5]
FUSE BOX
Refer to P. 2-40
[6]
WIRE CLIP
[4]
FUSE BOX
BRACKET
[7]
HEATED OXYGEN
SENSOR (HO2S)
[10]
WIRE BAND
About 5 mm
(0.2 in.)
[11]
TRIM ANGLE
SENSOR HARNESS
[12]
POWER TILT
MOTOR HARNESS
[13]
WHITE
TAPE
[14]
GROMMET
[15]
L. ENGINE
UNDER
COVER
[16] PROTECTOR CLIP
[8] STARTER MOTOR:
[9] STARTER CABLE
90°

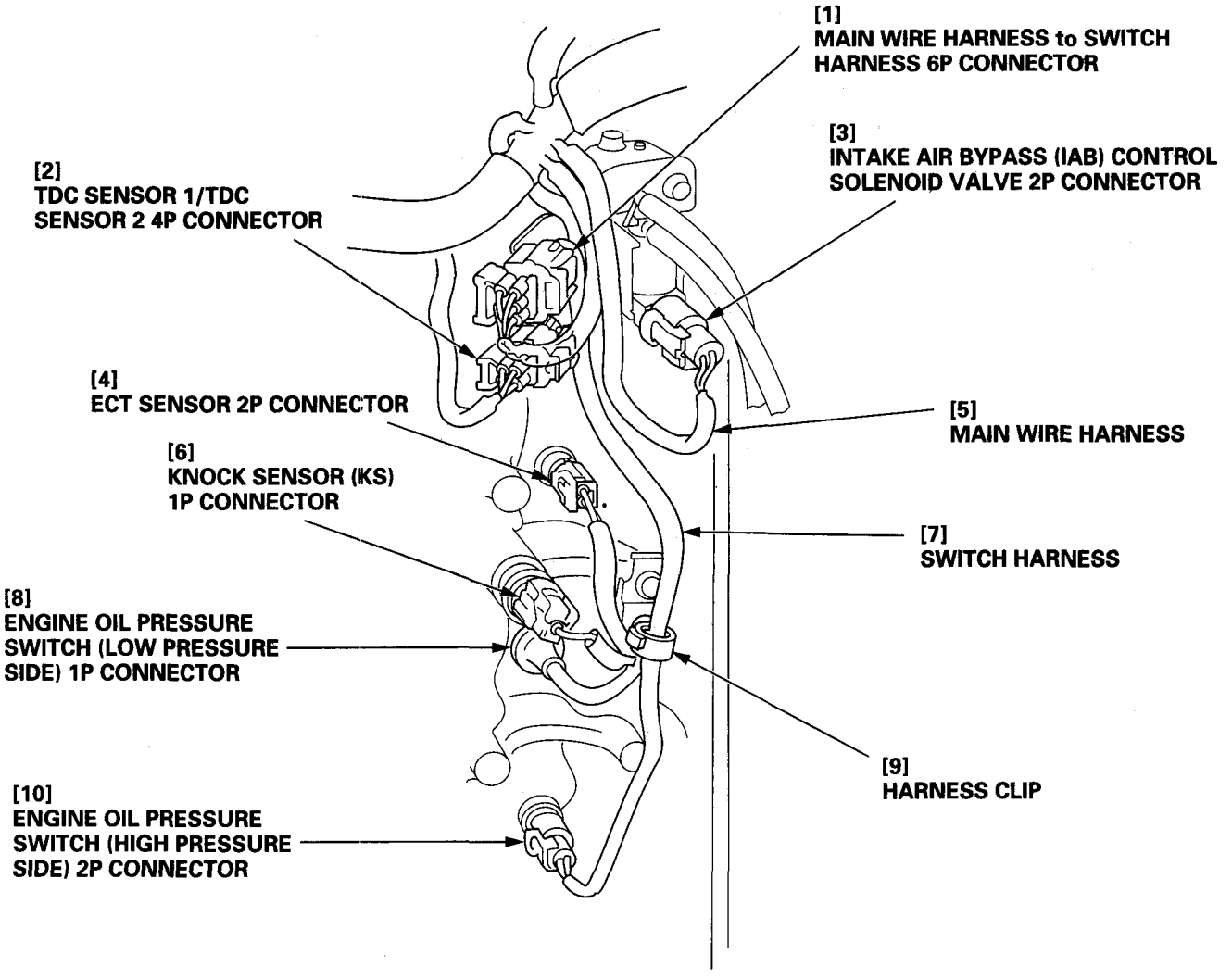

[1]
BAND HARNESS CLIP
[1]
BAND HARNESS CLIP
[2]
ECM
[1]
BAND HARNESS CLIP
[3]
ECM 12P CONNECTOR C
[4] WIRE BAND
[5] ECM 34P CONNECTOR B
[7]
HARNESS CLIPS
[6] ECM 26P CONNECTOR A

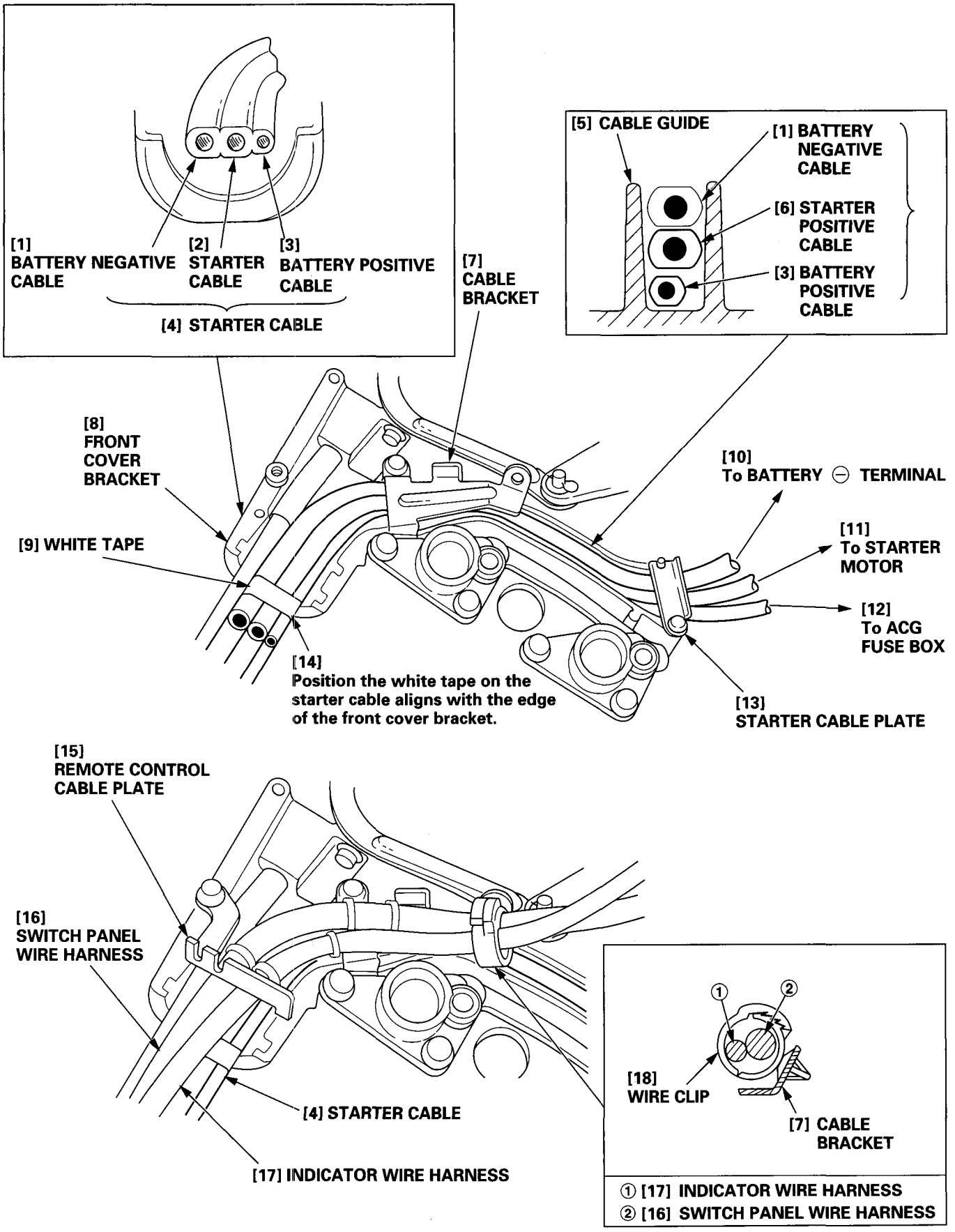

[1]
CKP SENSOR
2P CONNECTOR
[2] ECM
[6]
VTEC SOLENOID VALVE
1P CONNECTOR
[5]
POWER TILT SWITCH
3P CONNECTOR
[3]
WATER SEPARATER
2P CONNECTOR
[4] JUNCTION CONNECTOR

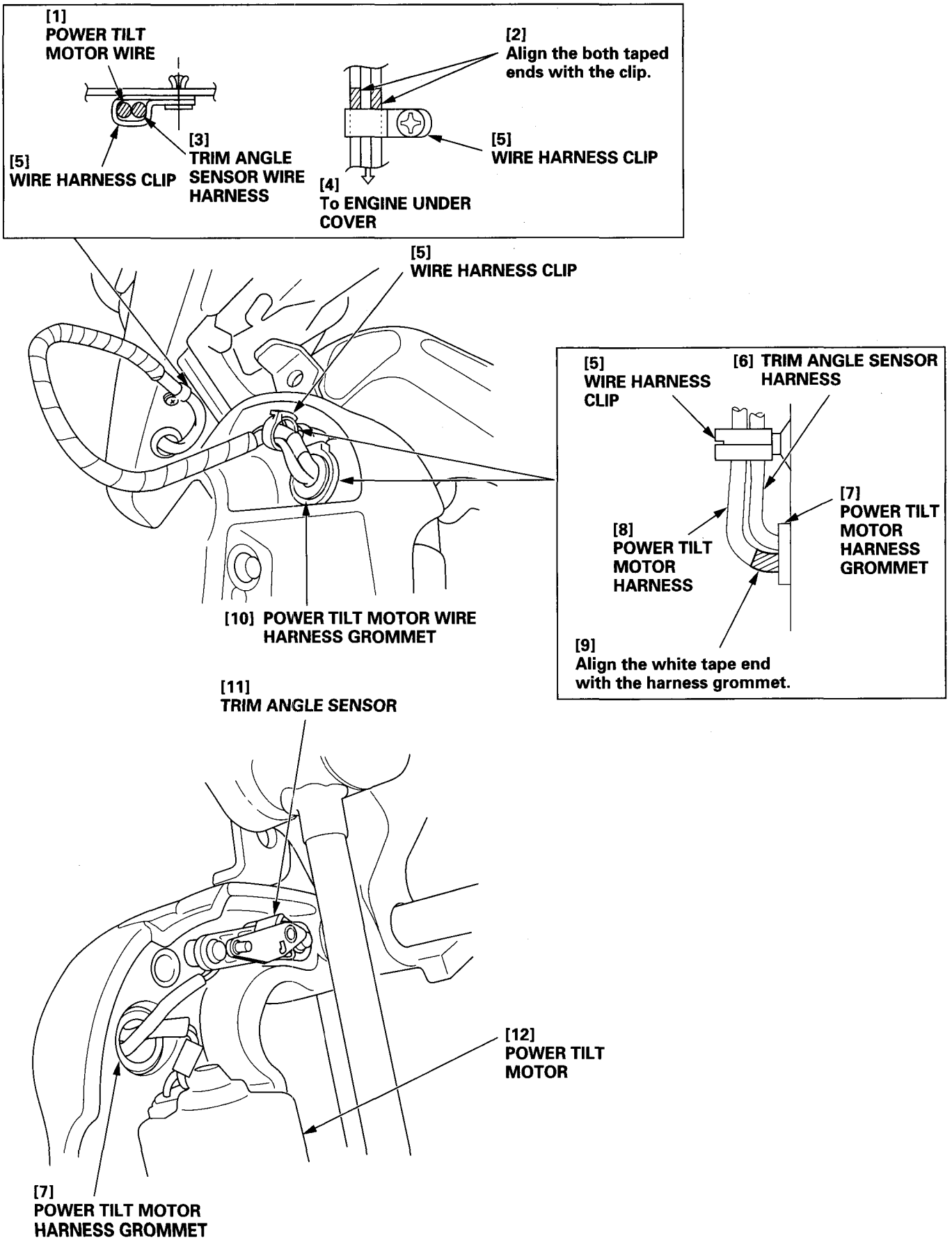
INSIDE OF THE ELECTRIC PARTS COVER



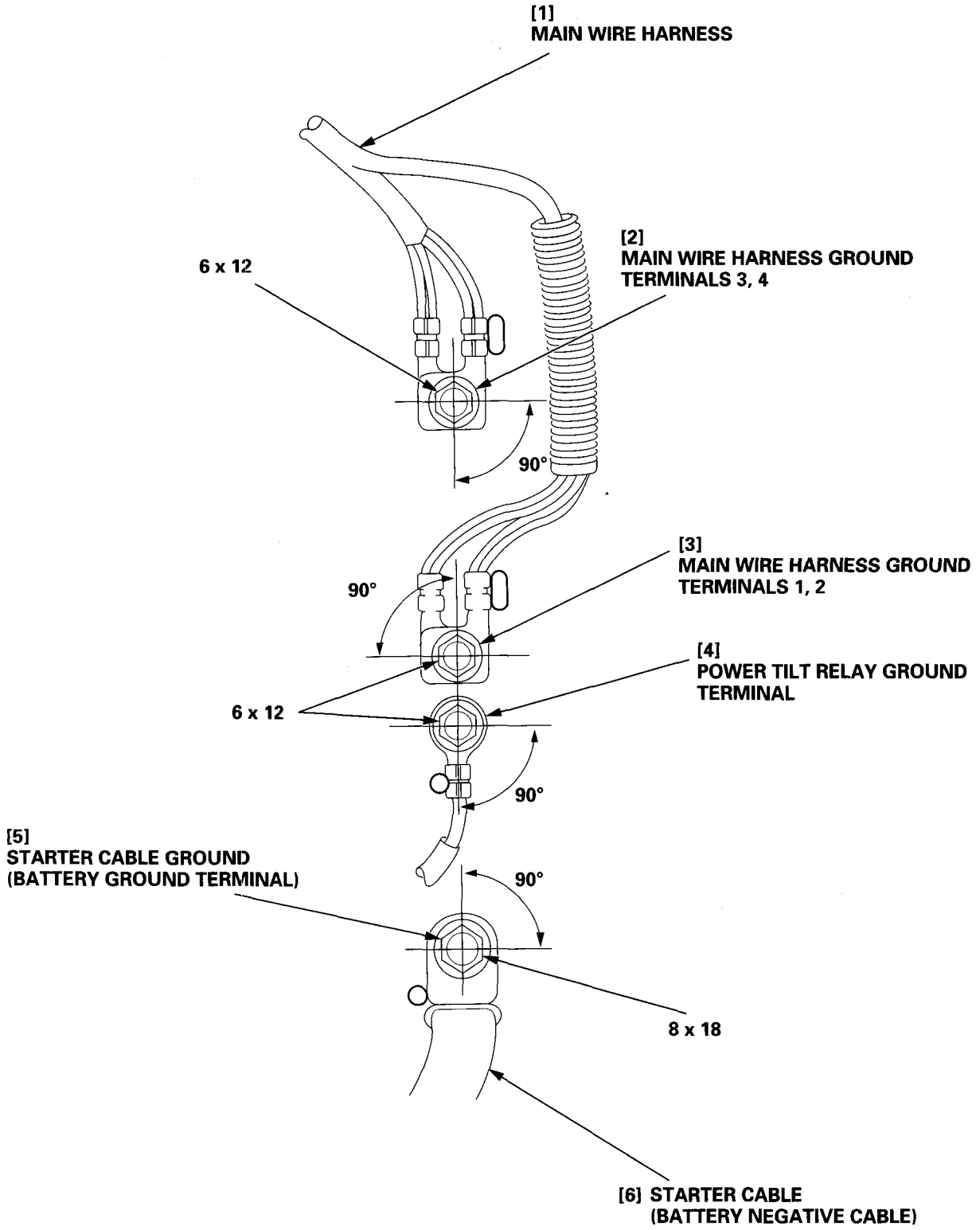
ENGINE V BANK




[1] BATTERY NEGATIVE CABLE
[2] STARTER CABLE
[3] BATTERY POSITIVE CABLE
[4] STARTER CABLE
[5] CABLE GUIDE
[1] BATTERY NEGATIVE CABLE
[6] STARTER POSITIVE CABLE
[3] BATTERY POSITIVE CABLE
[7] CABLE BRACKET
[8] FRONT COVER BRACKET
[9] WHITE TAPE
[10] To BATTERY ⊖ TERMINAL
[11] To STARTER MOTOR
[12] To ACG FUSE BOX
[13] STARTER CABLE PLATE
[14] Position the white tape on the starter cable aligns with the edge of the front cover bracket.
[15] REMOTE CONTROL CABLE PLATE
[16] SWITCH PANEL WIRE HARNESS
[4] STARTER CABLE
[17] INDICATOR WIRE HARNESS
[18] WIRE CLIP
[7] CABLE BRACKET
① [17] INDICATOR WIRE HARNESS
② [16] SWITCH PANEL WIRE HARNESS

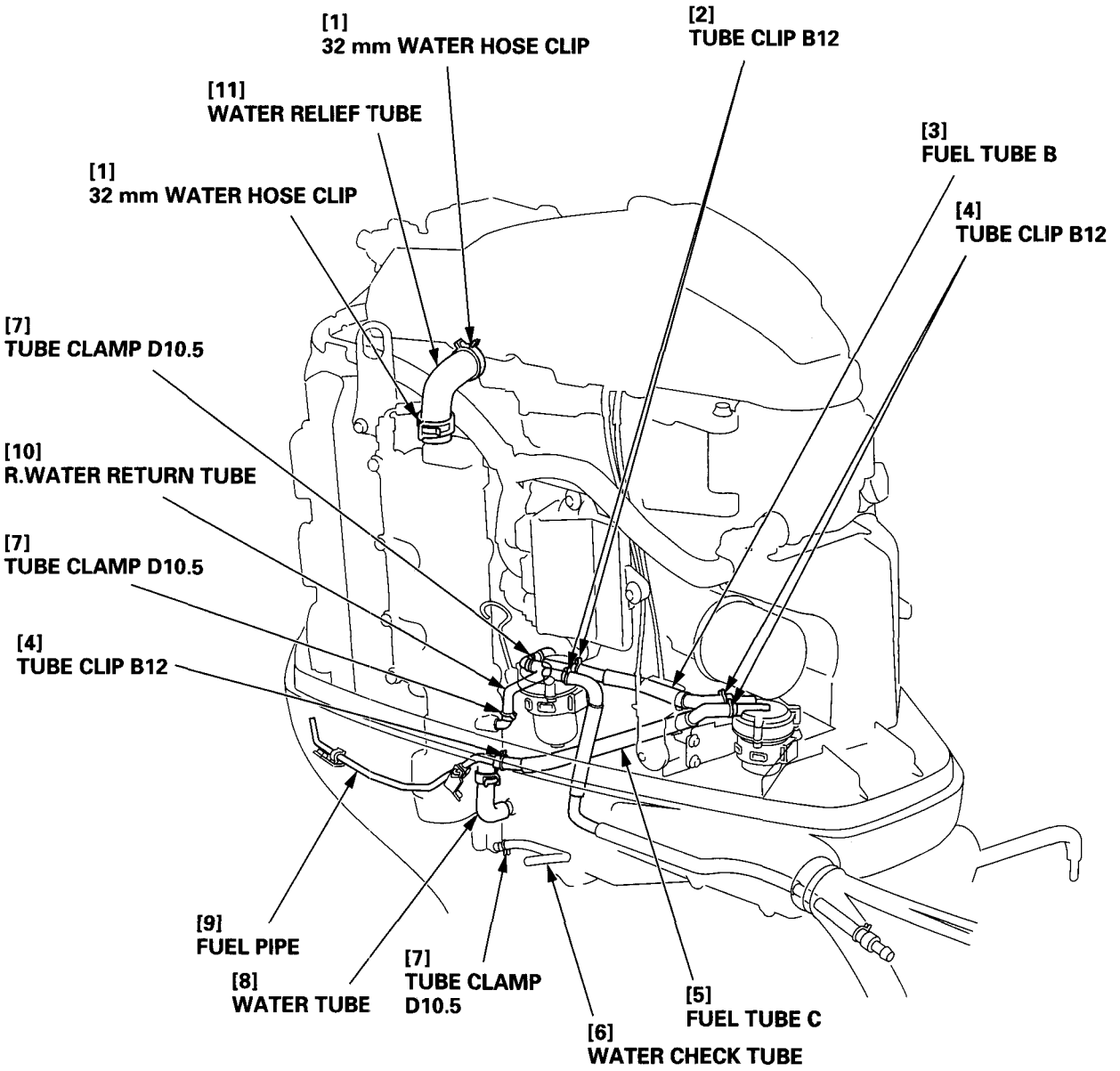

[1]
POWER TILT
MOTOR WIRE
[2]
Align the both taped
ends with the clip.
[3]
TRIM ANGLE
SENSOR WIRE
HARNESS
[5]
WIRE HARNESS CLIP
[4]
To ENGINE UNDER
COVER
[5]
WIRE HARNESS CLIP
[5]
WIRE HARNESS CLIP
[6] TRIM ANGLE SENSOR
HARNESS
[7]
POWER TILT
MOTOR
HARNESS
GROMMET
[8]
POWER TILT
MOTOR
HARNESS
[9]
Align the white tape end
with the harness grommet.
[10] POWER TILT MOTOR WIRE
HARNESS GROMMET
[11]
TRIM ANGLE SENSOR
[12]
POWER TILT
MOTOR
[7]
POWER TILT MOTOR
HARNESS GROMMET

GROUND LOCATION (In the electric parts cover):

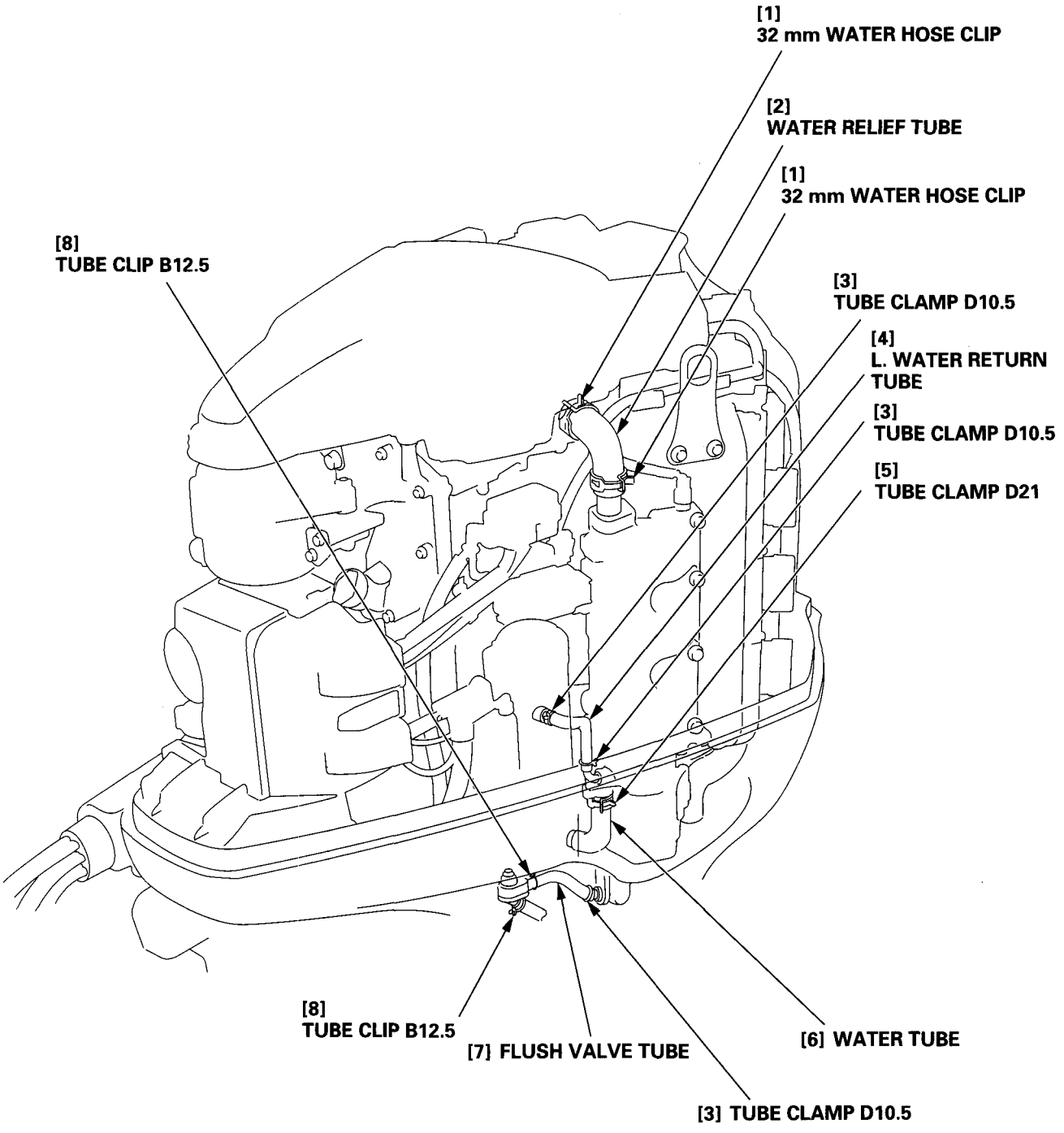


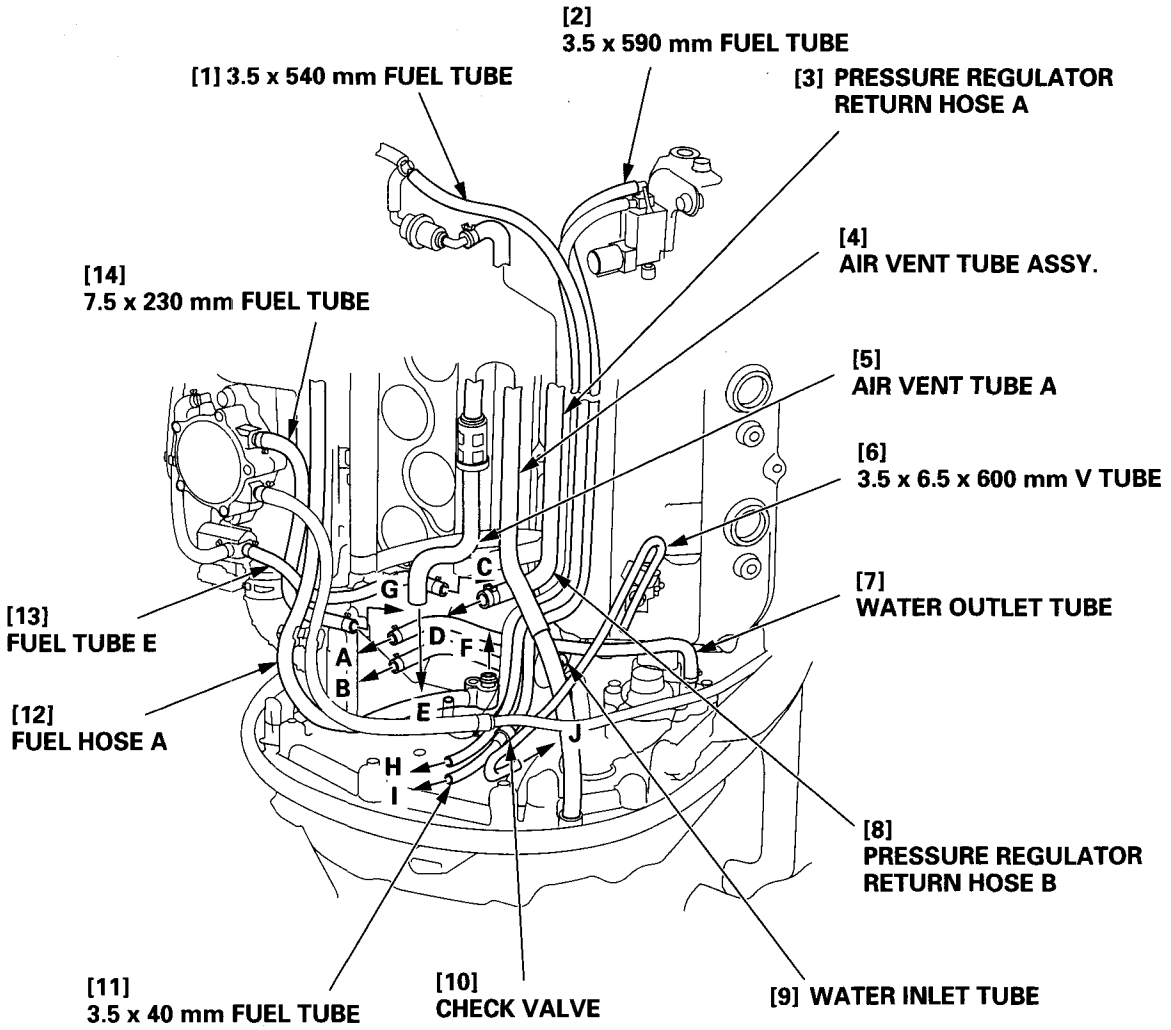
8. TUBE ROUTING

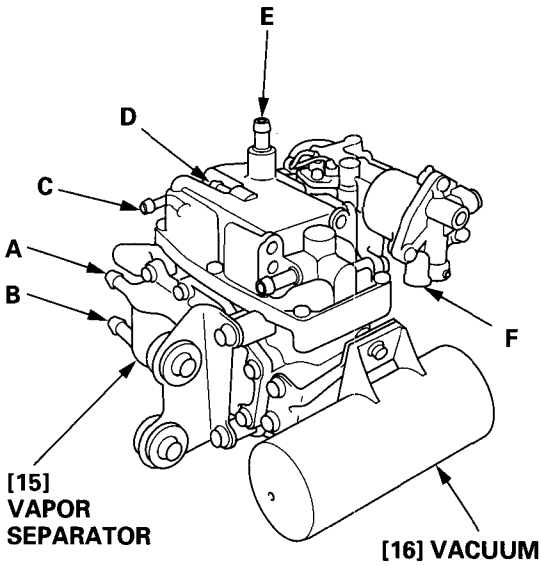
SHOP MANUAL NEWS

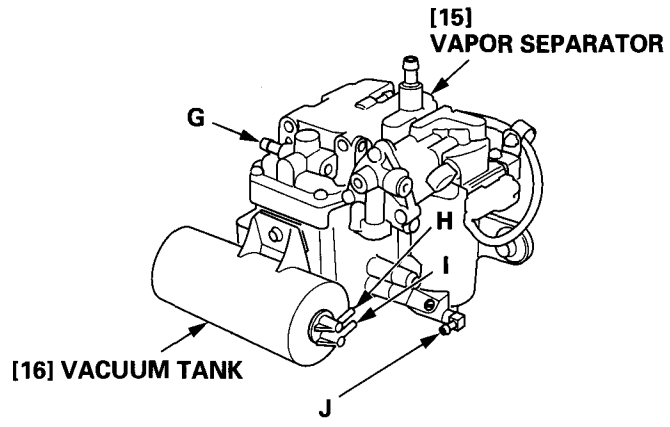


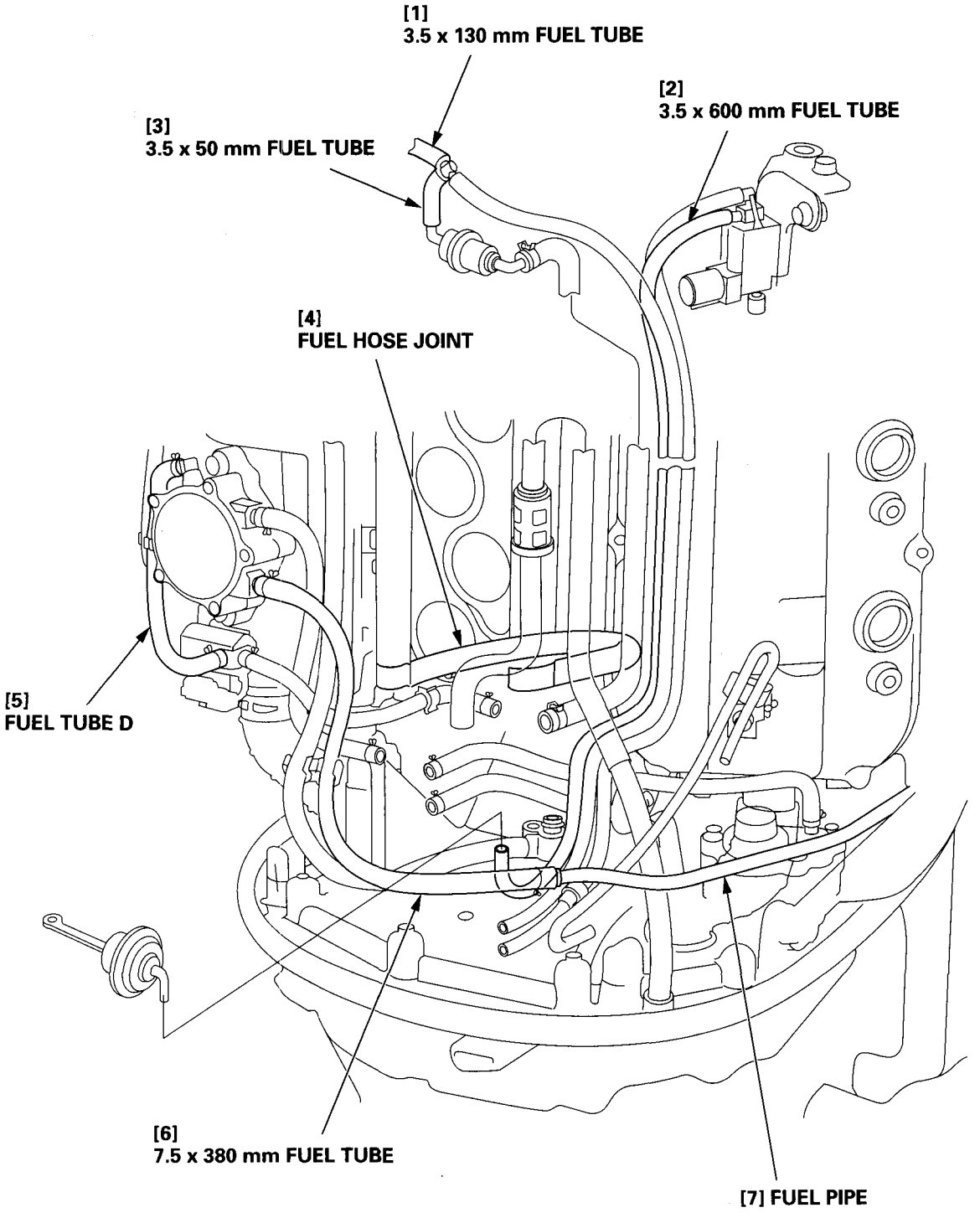
SHOP MANUAL NEWS

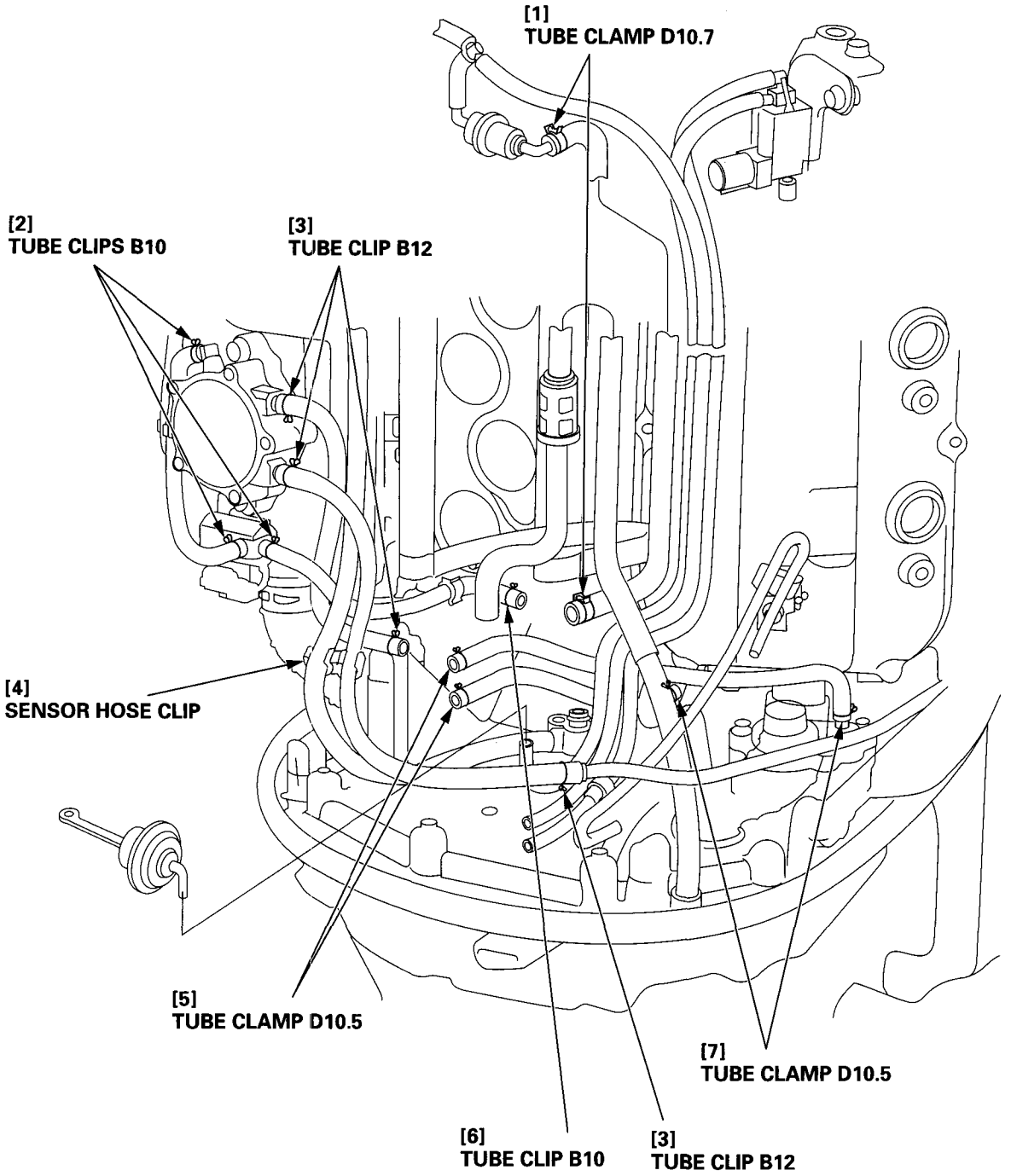


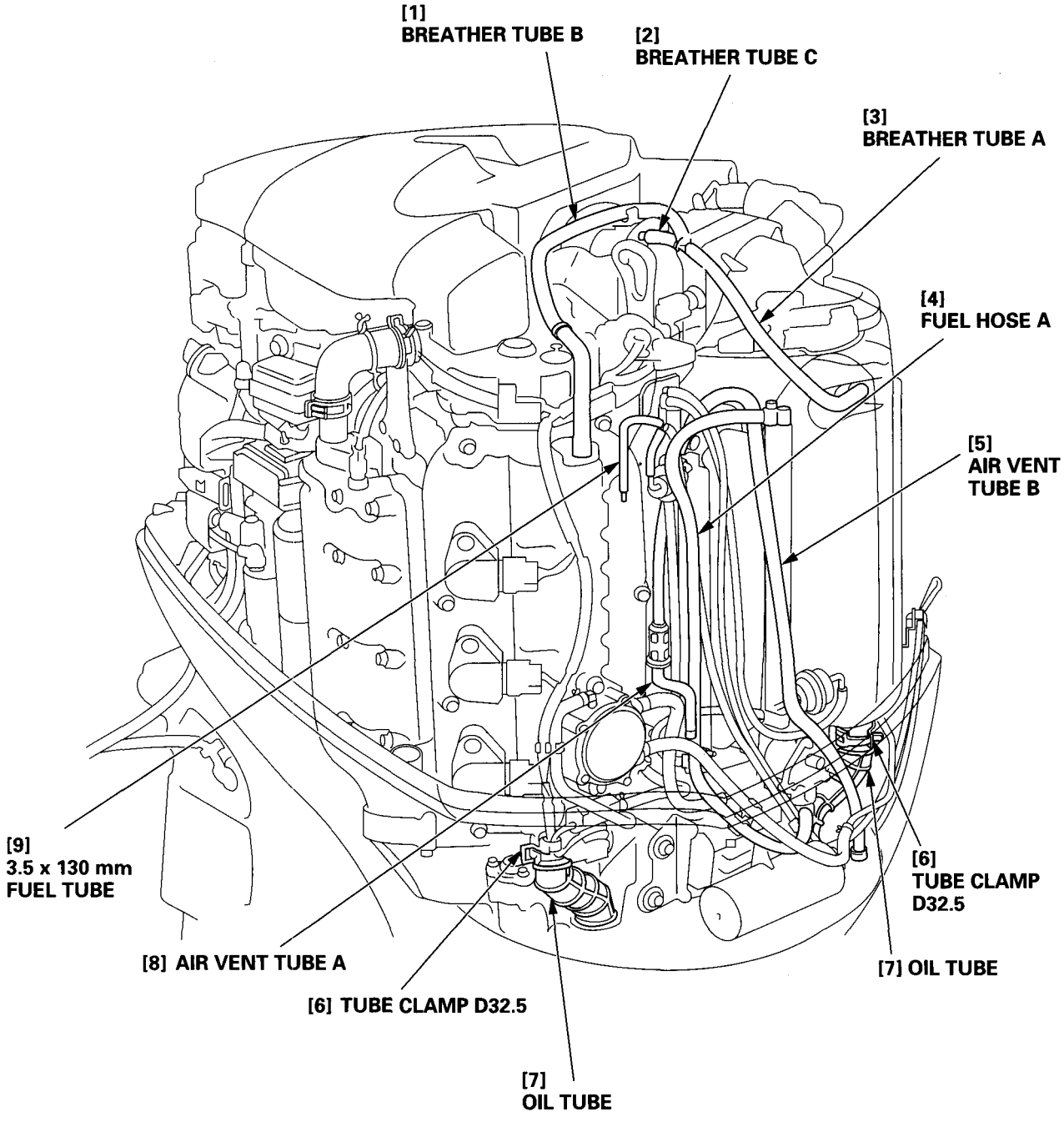

[2]
3.5 x 590 mm FUEL TUBE
[1] 3.5 x 540 mm FUEL TUBE
[3] PRESSURE REGULATOR
RETURN HOSE A
[4]
AIR VENT TUBE ASSY.
[14]
7.5 x 230 mm FUEL TUBE
[5]
AIR VENT TUBE A
[6]
3.5 x 6.5 x 600 mm V TUBE
[7]
WATER OUTLET TUBE
[13]
FUEL TUBE E
[12]
FUEL HOSE A
[8]
PRESSURE REGULATOR
RETURN HOSE B
[11]
3.5 x 40 mm FUEL TUBE
[10]
CHECK VALVE
[9] WATER INLET TUBE
A
B
C
D
E
F
G
H
I
J

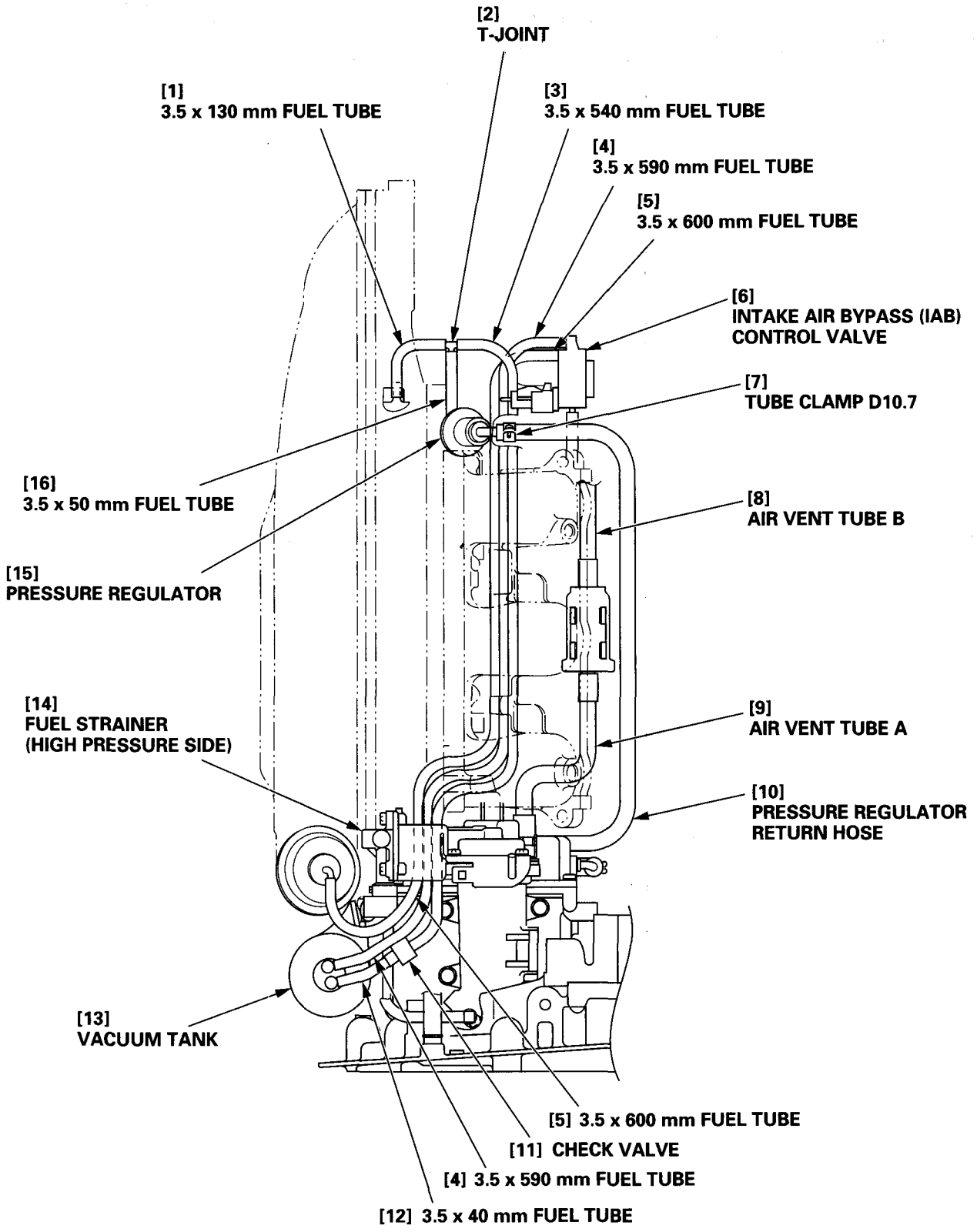

E
D
C
A
B
F
[15]
VAPOR
SEPARATOR
[16] VACUUM TANK


[15]
VAPOR SEPARATOR
G
H
I
[16] VACUUM TANK
J


[1]
3.5 x 130 mm FUEL TUBE
[2]
3.5 x 600 mm FUEL TUBE
[3]
3.5 x 50 mm FUEL TUBE
[4]
FUEL HOSE JOINT
[5]
FUEL TUBE D
[6]
7.5 x 380 mm FUEL TUBE
[7] FUEL PIPE

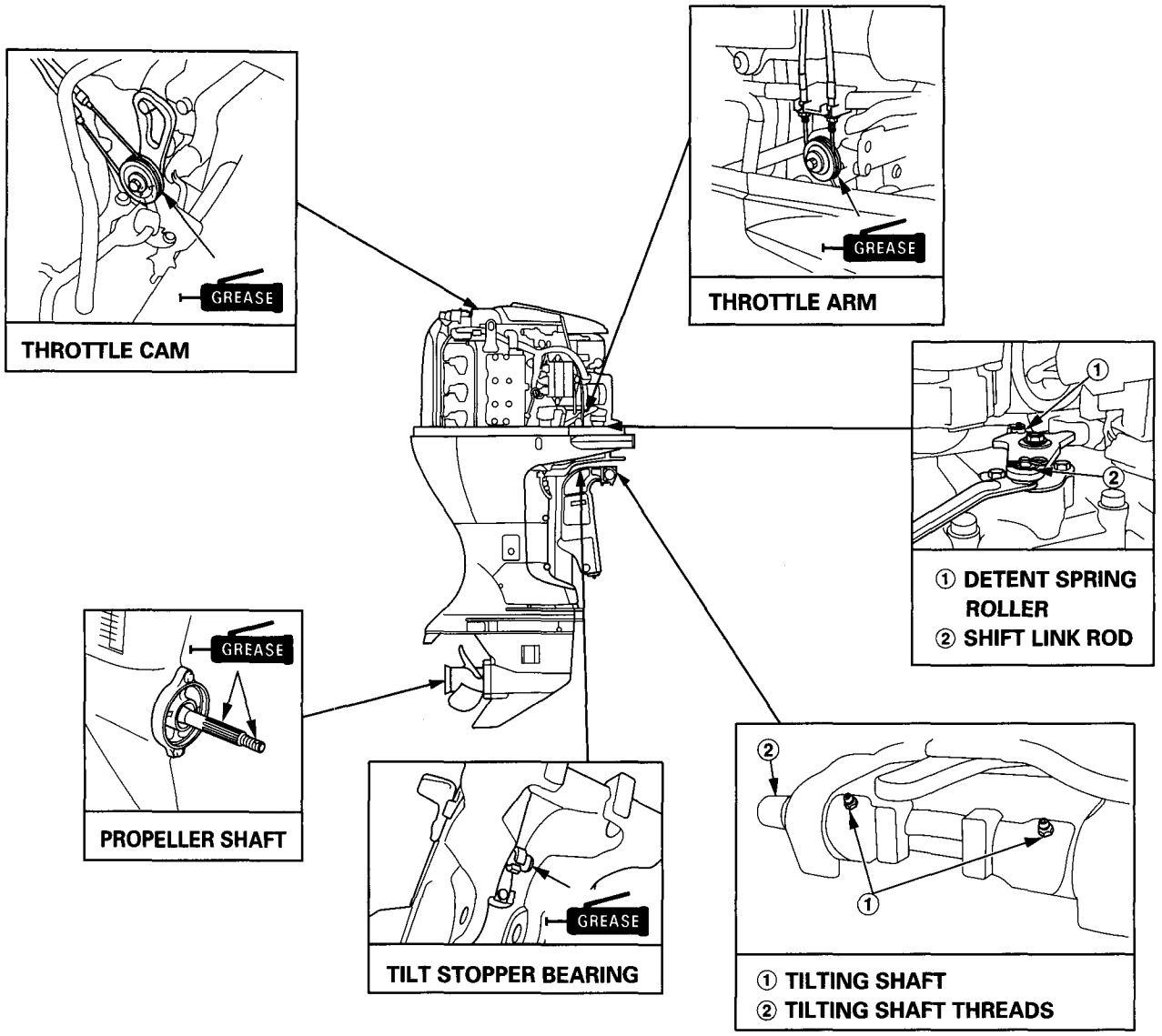

[1]
TUBE CLAMP D10.7
[2]
TUBE CLIPS B10
[3]
TUBE CLIP B12
[4]
SENSOR HOSE CLIP
[5]
TUBE CLAMP D10.5
[6]
TUBE CLIP B10
[3]
TUBE CLIP B12
[7]
TUBE CLAMP D10.5

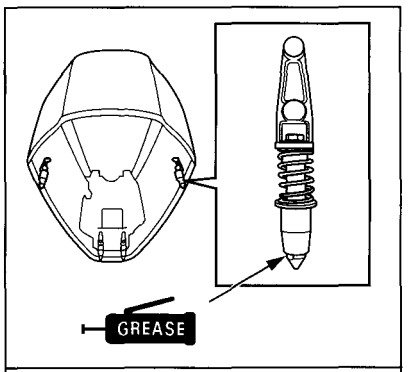

[1]
BREATHER TUBE B
[2]
BREATHER TUBE C
[3]
BREATHER TUBE A
[4]
FUEL HOSE A
[5]
AIR VENT
TUBE B
[9]
3.5 x 130 mm
FUEL TUBE
[8] AIR VENT TUBE A
[6] TUBE CLAMP D32.5
[7]
OIL TUBE
[6]
TUBE CLAMP
D32.5
[7] OIL TUBE


[2]
T-JOINT
[1]
3.5 x 130 mm FUEL TUBE
[3]
3.5 x 540 mm FUEL TUBE
[4]
3.5 x 590 mm FUEL TUBE
[5]
3.5 x 600 mm FUEL TUBE
[6]
INTAKE AIR BYPASS (IAB)
CONTROL VALVE
[7]
TUBE CLAMP D10.7
[16]
3.5 x 50 mm FUEL TUBE
[8]
AIR VENT TUBE B
[15]
PRESSURE REGULATOR
[14]
FUEL STRAINER
(HIGH PRESSURE SIDE)
[9]
AIR VENT TUBE A
[10]
PRESSURE REGULATOR
RETURN HOSE
[13]
VACUUM TANK
[5] 3.5 x 600 mm FUEL TUBE
[11] CHECK VALVE
[4] 3.5 x 590 mm FUEL TUBE
[12] 3.5 x 40 mm FUEL TUBE

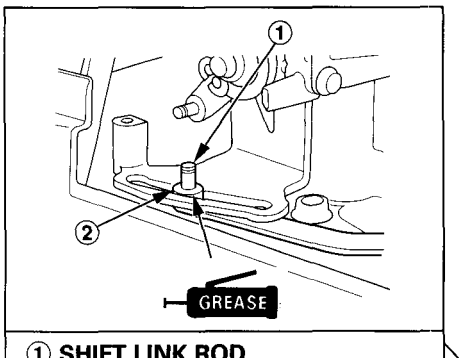
9. LUBRICATION

Apply marine grease to the following parts:

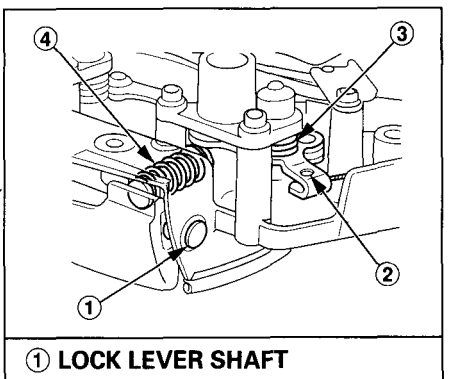




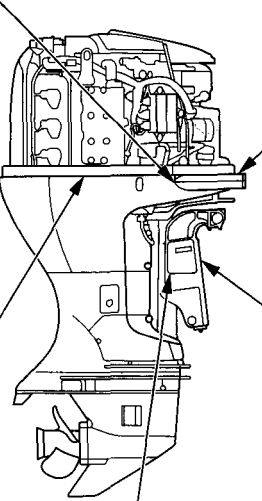
COVER LOCK BOLTS

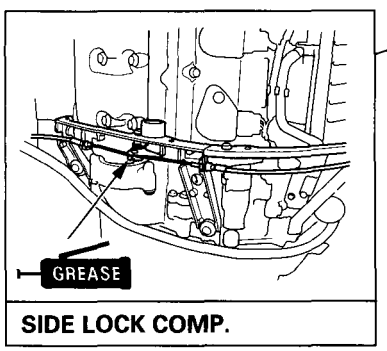


① SHIFT LINK ROD
② SHIFT SLIDER COLLAR

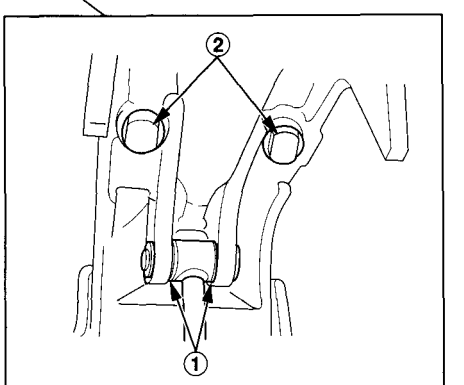


① LOCK LEVER SHAFT
② CABLE END
③ SHAFT OF LOCK ASSEMBLY
④ LOCK COVER SHAFT

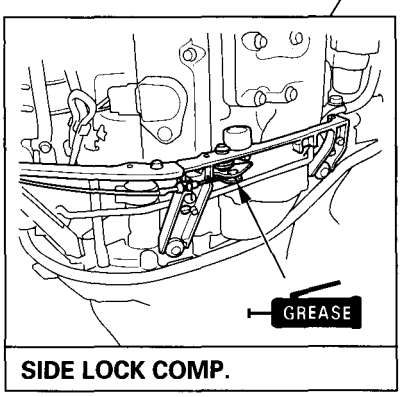




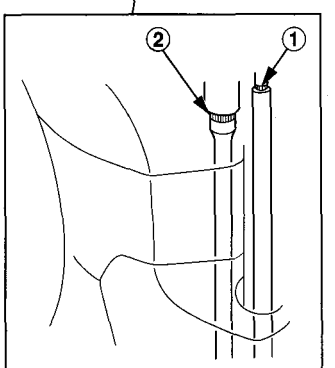
SIDE LOCK COMP.



① UPPER CYLINDER BUSHINGS/PINS
② SLIDING SURFACES OF THRUST RECEIVER



SIDE LOCK COMP.



① SHIFT LOD A
② VERTICAL SHAFT

1. MAINTENANCE SCHEDULE

	REGULAR SERVICE PERIOD(2) Item — Perform at every indicated month or operating hour interval, whichever comes first.		Each use	After use	First month or 20 hrs.	Every 6 months or 100 hrs.	Every year or 200 hrs.	Every 2 years or 400 hrs.
•	Engine oil	Check level	○					
		Change			○	○		
	Gear case oil	Change			○	○		
•	Engine oil filter	Replace					○	
	Timing belt	Check-adjust					○	
	ACG belt	Check-adjust					○	
	Throttle linkage	Check-adjust			○	○		
•	Idling speed	Check-adjust			○	○		
•	Valve clearance	Check-adjust			○		○	
•	Spark plug	Check			○		○	
		Clean			○		○	
		Replace						○
	Propeller and Cotter pin	Check	○					
	Anode metal	Check	○					
	Lubrication	Grease			○ (1)	○ (1)		
•	Water separator	Check	○					
•	Fuel filter	Check				○		
		Replace						○
•	Fuel filter (High pressure type)	Replace						○
	Thermostat	Check					○	
•	Fuel line	Check	○					
		Replace	Every 2 years (If necessary)					
	Battery and cable connection	Check level-tightness	○					
	Bolts and Nuts	Check-tightness			○	○		
•	Crankcase breather tube	Check					○	
	Cooling water passages	Clean		○ (3)				

• Emission related items

NOTICE

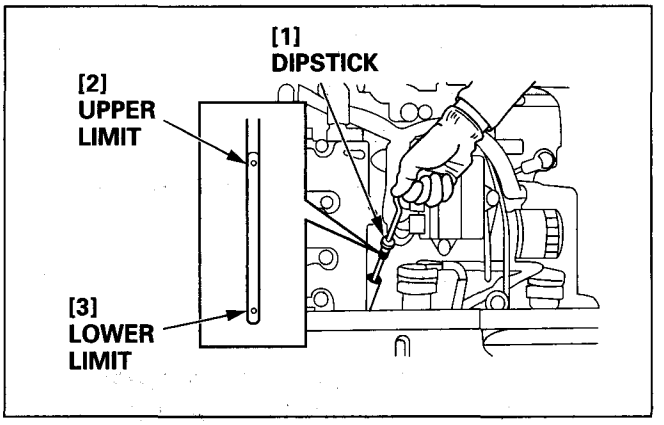
(1) Lubricate more frequently when used in salt water.
(2) For professional commercial use, log hours of operation to determine proper maintenance intervals.
(3) When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.

2. ENGINE OIL

Oil Level Inspection:

Check the engine oil level with the engine stopped and the outboard motor in the vertical position.

1) Remove the engine cover.
2) Remove the dipstick and wipe it clean.
3) Insert the dipstick all the way in, then pull it out and read the oil level.
4) If the oil level is low, remove the oil filler cap, and add the recommended oil (P. 3-3) to reach the upper limit mark on the dipstick.
5) Reinstall the oil filler cap and dipstick.

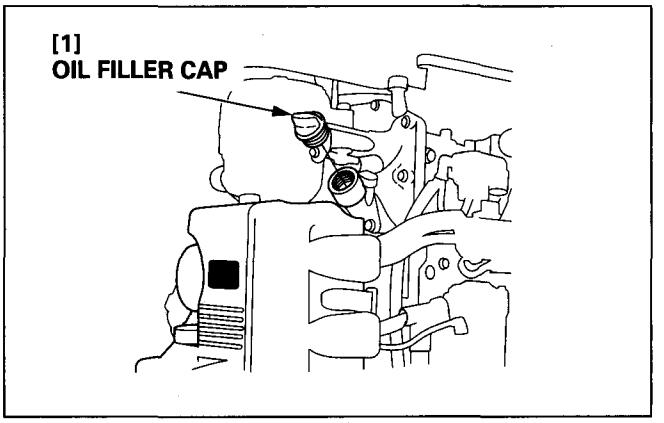


Oil Change:

Drain the used oil while the engine is warm. Warm oil drains quickly and completely.

1) Remove the oil filler cap and the drain plug cover.
2) Place a suitable oil container next to the outboard motor, and remove the oil drain plug.

   Please dispose of used motor oil in a manner that is compatible with the environment. We suggest you take used oil in a sealed container to your local recycling center or service station for reclamation. Do not throw it in the trash, pour it on the ground, or down a drain.

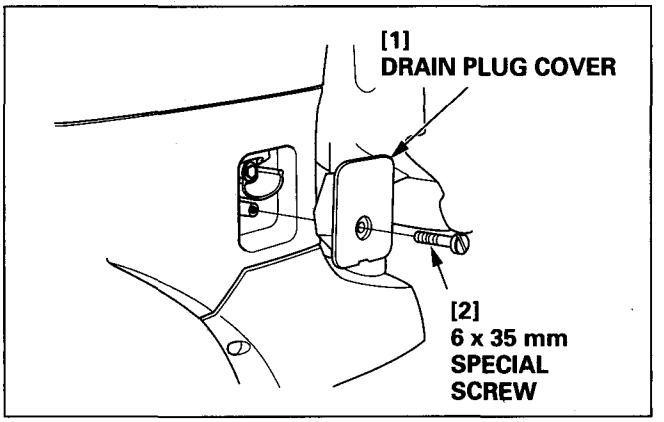


CAUTION:

Used engine oil contains substances that have been identified as carcinogenic.

If repeatedly left in contact with the skin for prolonged periods, it may cause skin cancer.

Wash your hands thoroughly with soap and water as soon as possible after contact with used engine oil.

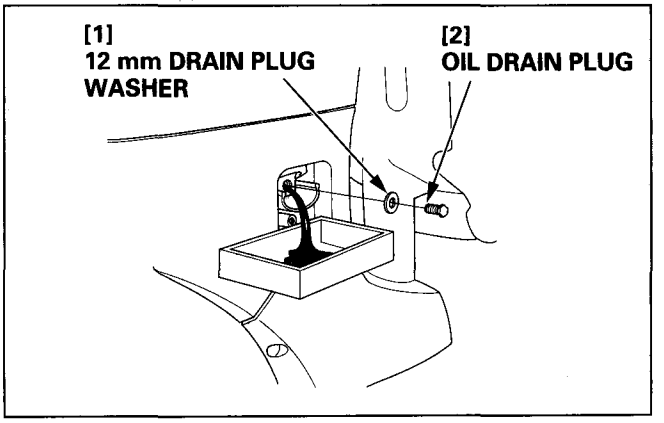


3) Replace the drain plug washer with a new one, and reinstall the oil drain plug. Tighten the oil drain plug to the specified torque value.

   TORQUE: 23 N•m (2.3 kgf•m, 17 lbf•ft)

4) Reinstall the drain plug cover. Tighten the 6 x 35 mm special screw to the specified torque value.

   TORQUE: 6.4 N•m (0.65 kgf•m, 4.7 lbf•ft)



5) Refill with the recommended engine oil to the upper limit mark on the dipstick.

Engine oil capacity	7.6 ℓ (8.0 US qt, 6.7 Imp qt) With oil filter replacement: 7.8 ℓ (8.2 US qt, 6.9 Imp qt)

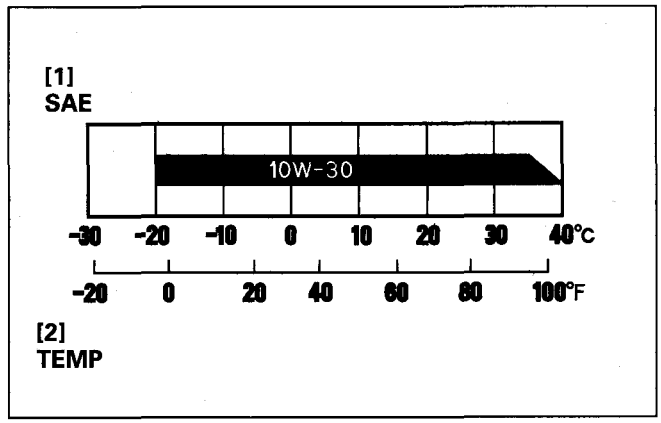
Recommended engine oil	SAE 10W – 30 API Service classification SG/SH/SJ

NOTICE

Using nondetergent oil can shorten the engine's service life, and using 2-stroke oil can damage the engine.

6) Reinstall the oil filler cap and dipstick.

7) Reinstall the engine cover.



3. OIL FILTER

Replacement:

1) Drain the engine oil, then reinstall the oil drain plug and cover, as described in the oil change procedure.

2) Place a shop towel under the oil filter to absorb any spilled oil, then remove the oil filter with an oil filter socket tool (commercially available).

3) Drain the used oil filter into a suitable container for oil disposal (P. 3-2)

4) Clean the filter mounting base, and coat the seal of the new oil filter with clean engine oil.

   • Use only a genuine Honda oil filter or a filter of equivalent quality specified for your model. Using the wrong Honda filter, or a non-Honda filter which is not of equivalent quality, may cause engine damage.

5) Screw on the new oil filter by hand, until the seal contacts the filter mounting base, then use an oil filter socket tool (commercially available) to tighten the filter an additional 7/8 turn.

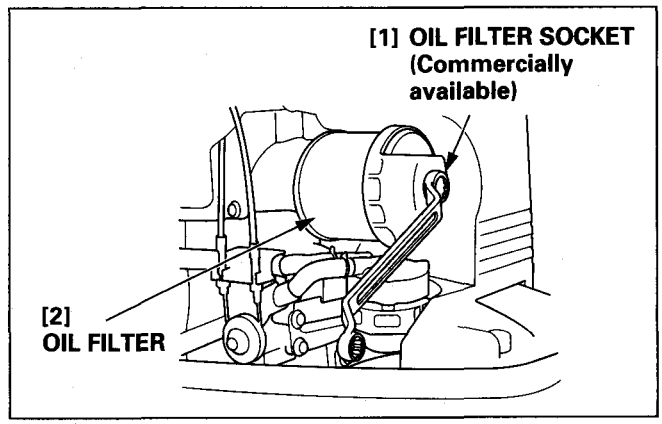
   TORQUE: 22 N•m (2.2 kgf•m, 16 lbf•ft)

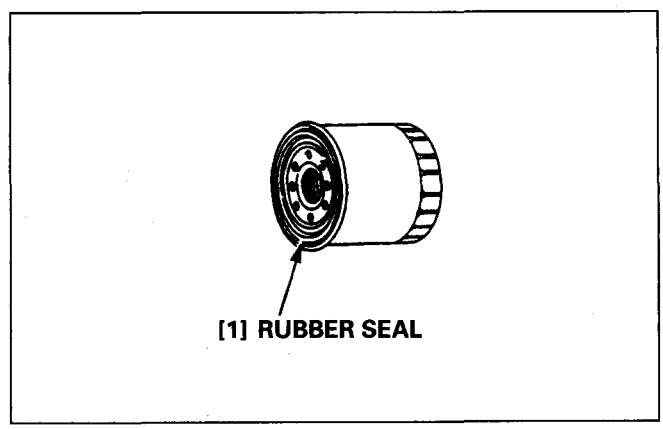
6) Refill the engine oil with the specified amount of the recommended oil, as described in the oil change procedure. Reinstall the oil filler cap and dipstick.

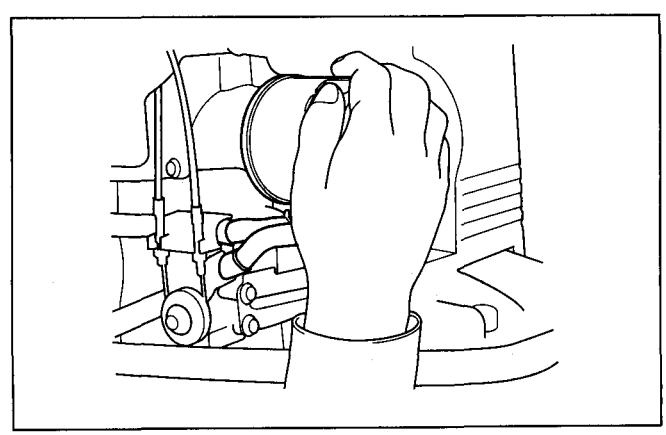
7) Start the engine, and check for leaks.

8) Stop the engine, and check the oil level as described on page 3-2. If necessary, add oil to the upper limit mark on the dipstick.

9) Reinstall the engine cover.







4. GEAR CASE OIL

Inspection:

1) Position the outboard motor vertically.
2) Remove the oil level bolt and check whether the gear case oil flows out of the gear case. If it flows out, be sure to catch the oil in a suitable container.
3) If the oil does not flow out, add oil.

Addition of gear oil:

1) Remove the oil drain bolt, and install the commercially available gear oil pump in the oil drain bolt hole.
2) Remove the oil level bolt, and add gear oil until it flows out of the oil level bolt hole.

Gear oil capacity	1.17 ℓ (1.24 US qt, 1.03 Imp qt)

Recommended gear oil	MARINE SAE 90 Hypoid gear oil API Service Classification (GL-4 or GL-5)

3) After adding gear oil, install the oil drain bolt and oil level bolt securely.

TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)

Replacement:

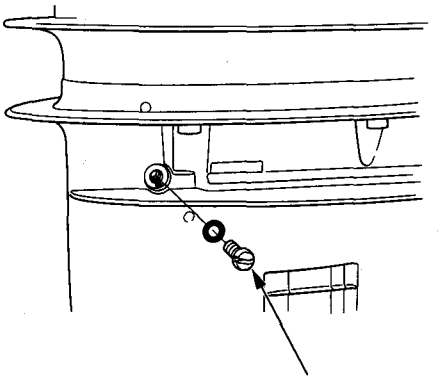
1) Position the outboard motor vertically. Remove the oil level bolt and oil drain bolt, and drain the old oil.
If there is water in the oil, the water will flow out first when the oil drain bolt is removed, or the oil will be a milky color. If water in the gear oil is detected, check the gaskets and water seals for damage, and check the torque on the gear case bolts.
2) Check for metal particles on the magnet end of the oil drain bolt.
3) If there are metal particles on the magnet end of the oil drain bolt, disassemble the gear case assembly and check (P. 12-3).
4) Install the commercially available gear oil pump in the oil drain bolt hole, and add gear oil until it flows out of the oil level bolt hole.

Gear oil capacity	1.17 ℓ (1.24 US qt, 1.03 Imp qt)

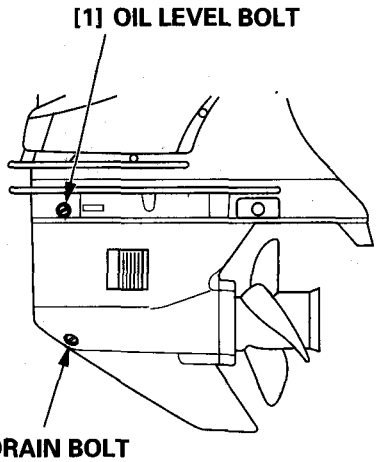
Recommended gear oil	MARINE SAE 90 Hypoid gear oil API Service Classification (GL-4 or GL-5)

5) After adding the gear oil, install the oil drain bolt and oil level bolt securely.

TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)

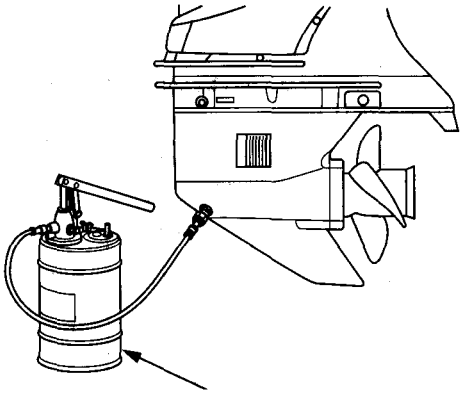


[1] OIL LEVEL BOLT



[1] OIL LEVEL BOLT

[2] OIL DRAIN BOLT



[1] GEAR OIL PUMP (Commercially available)

5. SPARK PLUGS

Inspection/Cleaning:

1) Remove the engine cover, and if necessary, remove the engine under covers (P. 4-1, 5).

2) Disconnect the 3P connector from the ignition coil.

3) Remove the 6 x 25 mm socket bolts and ignition coils by using a hex wrench. Take care not give an impact or drop the ignition coils. Replace the ignition coil if drop it.

4) Clean any dirt from around the spark plug bases.

5) Use a spark plug wrench and remove the spark plugs.

6) Visually inspect the spark plugs. Discard the plugs if the insulators are cracked or chipped.

7) Remove the carbon or other deposits with a plug cleaner (Do not spray the cleaner more than 20 seconds.).

8) *Measure the plug gap with a wire-type feeler gauge.*

Spark plug gap	1.0 – 1.1 mm (0.040 – 0.043 in) Service limit 1.3 mm (0.051 in)

Recommended spark plug	IZFR6F - 11 (NGK) VKJ20RZ - M11 (DENSO)

- If the gap is out of the specifications, replace the plug. Do not adjust the plug gap.

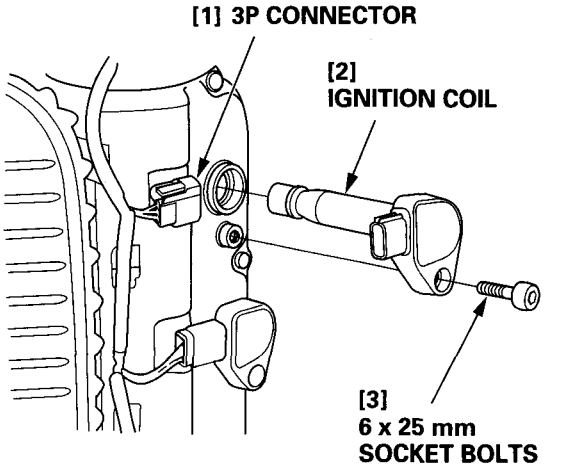
9) Make sure each sealing washer is in good condition. With each spark plug sealing washer attached, thread the spark plugs in by hand to seat the sealing washers and prevent crossthreading.

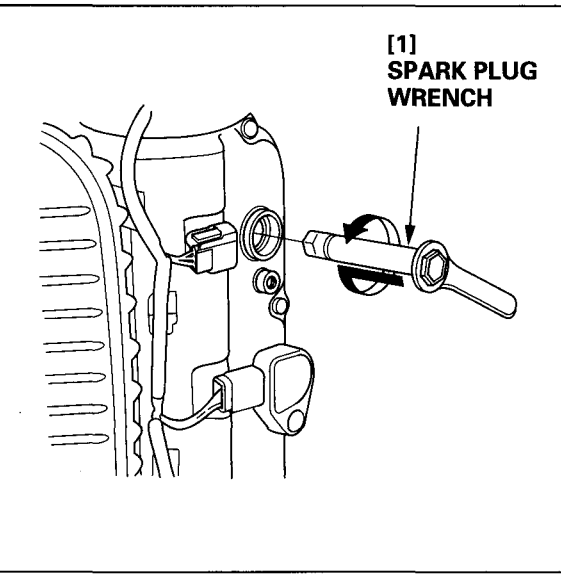
   Then tighten with a plug wrench (an additional 1/2 turn if a new plug) to compress the sealing washer. If you are reusing a plug, tighten 1/8 – 1/4 turn after the plug seats.

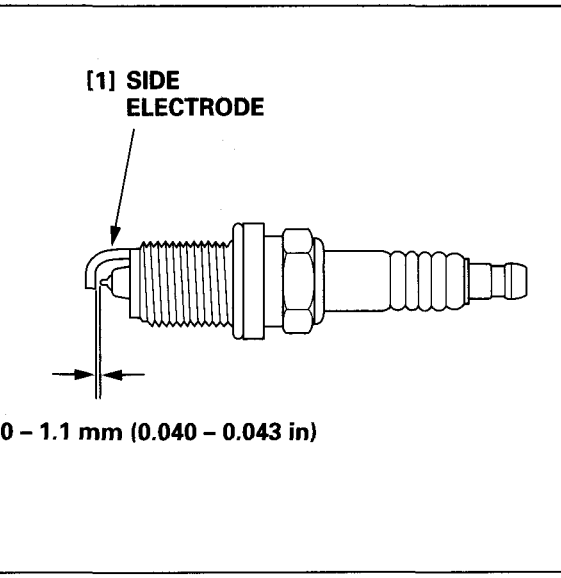
   TORQUE: 18 N•m (1.8 kgf•m, 13 lbf•ft)

NOTICE

A loose spark plugs can become very hot and can damage the engine. Overtightening the spark plugs can damage the threads in the engine.







6. VALVE CLEARANCE

Inspection/Adjustment:

- Valve clearance inspection and adjustment must be performed with the engine cold.

1) Remove the engine cover and the engine under covers (P. 4-1, 5).

2) Remove the silencer case (P. 5-103).

3) Remove the throttle body and intake manifold (P. 5-107, 112).

4) Disconnect the breather tubes A and B and 3.5 x 130 mm fuel tube.

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

- Before disconnecting the fuel tube, be sure to clamp the fuel tube with a fuel tube clip to prevent the gasoline from leaking.

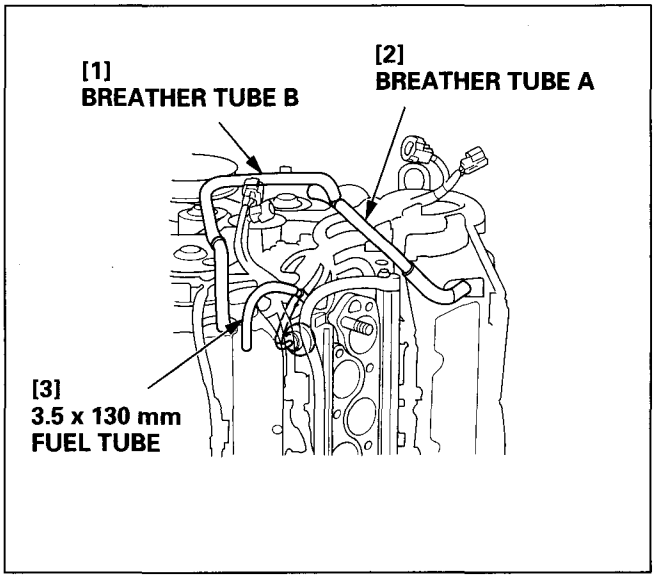
5) Disconnect the 2P connector from the fuel line cut solenoid valve and remove the main wire harness from the clamp.

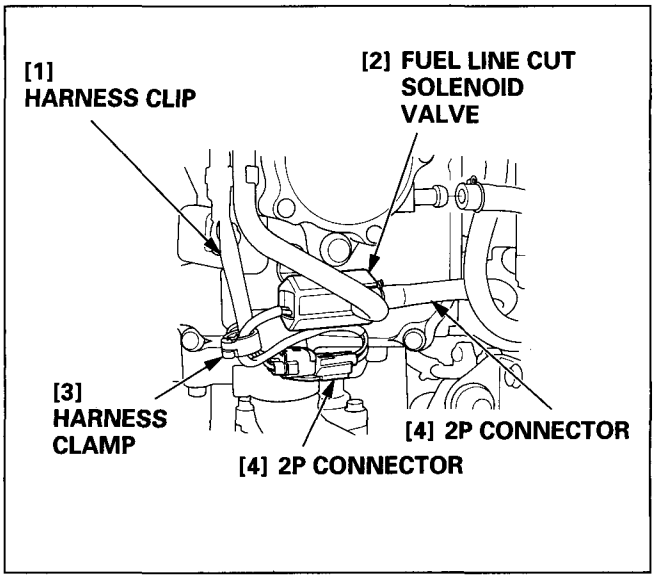
6) Disconnect the 7.5 x 230 mm and 7.5 x 380 mm fuel tubes from the fuel pump (low pressure side).

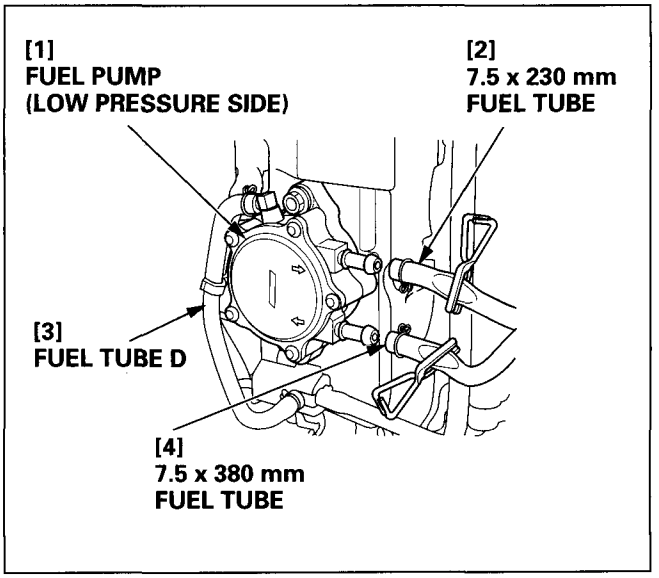
7) Disconnect the fuel tube E from the fuel line cut solenoid valve.

8) Disconnect the 3P connector from the each ignition coil, and remove the main wire harness from the clamp.

9) Remove the ignition coils and spark plugs (P. 3-5).



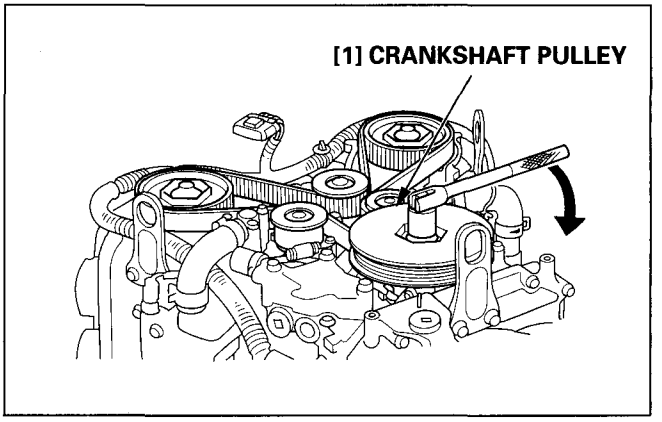


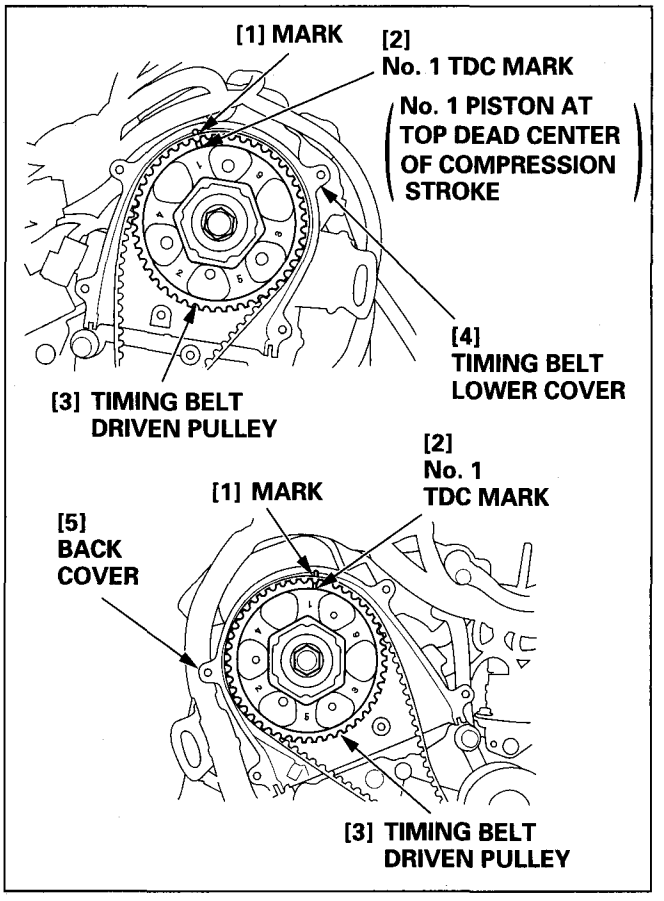


10) Remove 6 x 35 mm cylinder head cover bolts and cylinder head covers (P. 9-2).

11) Remove the timing belt covers (P. 6-15).

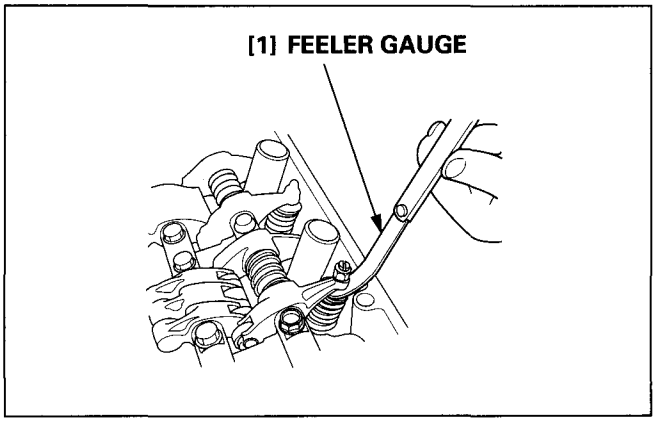
12) Manually turn the crankshaft pulley clockwise, and align the No. 1 TDC (top dead center) marks on the both side of timing belt driven pulleys with the marks on the timing belt back covers.
    - Do not turn the crankshaft pulley counterclockwise.





13) With the engine in the position described in step 8, check the intake and exhaust valve clearance on No. 1 cylinder with a feeler gauge and adjust if necessary.

Valve clearance	IN	0.20 – 0.24 mm
	EX	0.28 – 0.32 mm



14) If adjust is necessary, loosen the valve adjusting lock nut, and adjust the intake and exhaust valve clearance by turning the valve adjusting screw right or left.

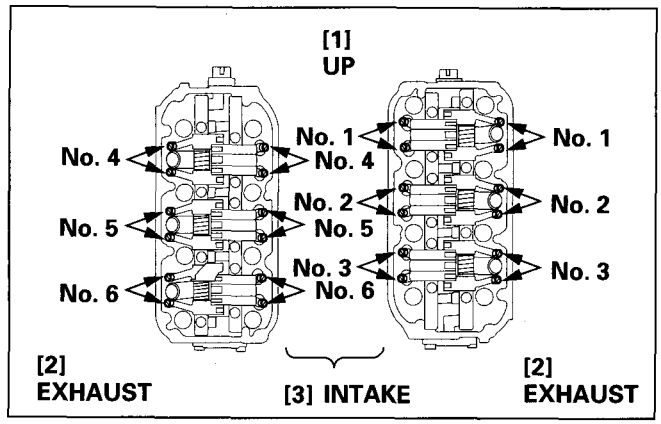
15) After adjustement, secrue the adjusting screw and loosely tighten lock nut.

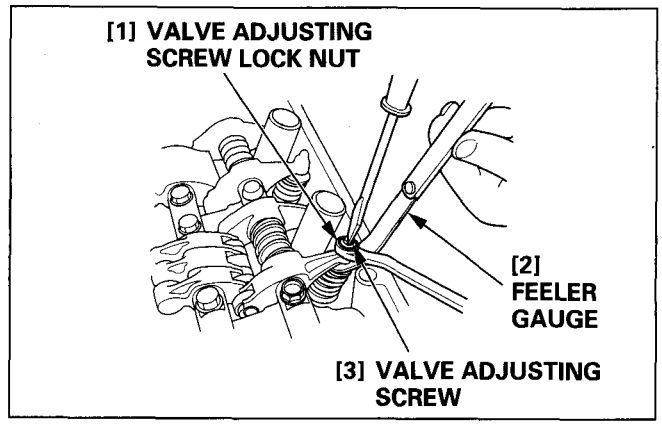
16) Recheck the valve clearances and tighten the valve adjusting lock nut securely.

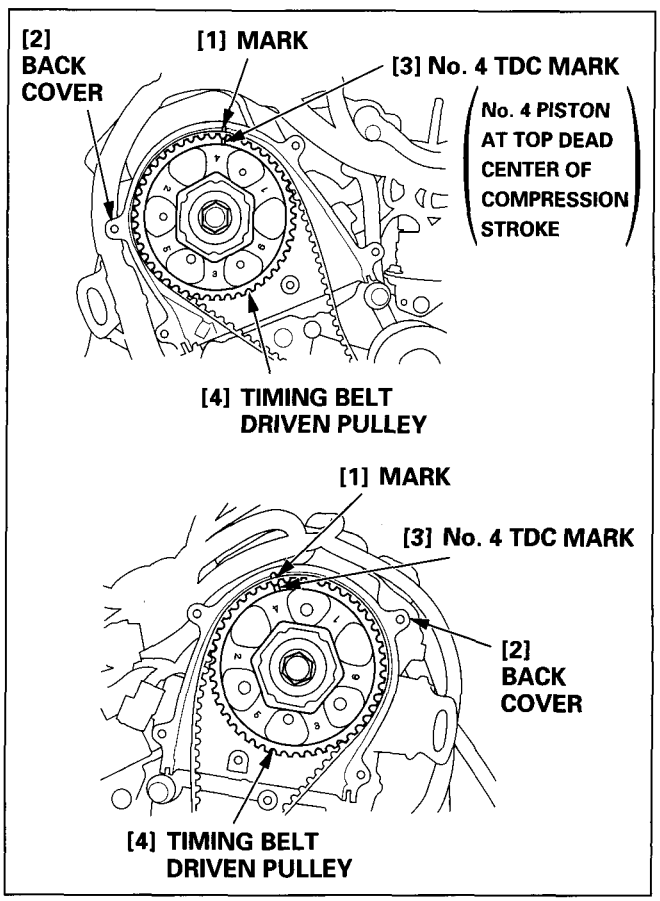
TORQUE: 20 N•m (2.0 kgf•m, 14 lbf•ft)

17) After adjusting the intake and exhaust valve clearance of the No. 1 cylinder, turn the crankshaft pulley clockwise and align the No. 4 TDC marks on the timing belt driven pulleys with the marks on the timing belt back covers.
In this position, No. 4 piston is at TDC of its compression stroke. With the engine in this position, adjust the intake and exhaust valve clearance of the No. 4 cylinder.

18) After adjusting the intake and exhaust valve clearances of the No. 4 cylinder, adjust the intake and exhaust valve clearance of the No. 2, No. 5, No. 3 and No. 6 cylinders in this order in the same procedures from the above steps 8 through 12.







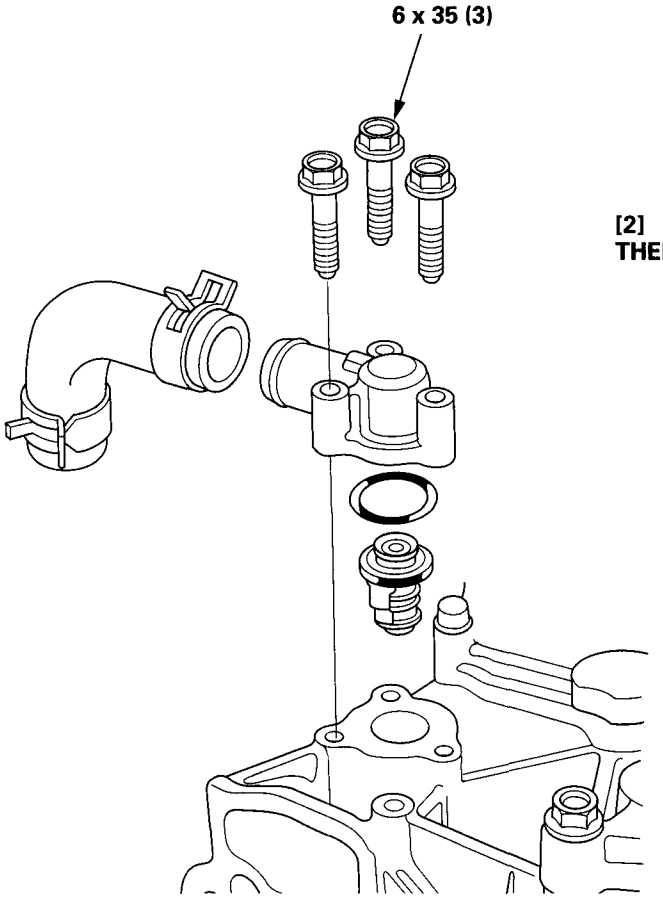
7. THERMOSTAT

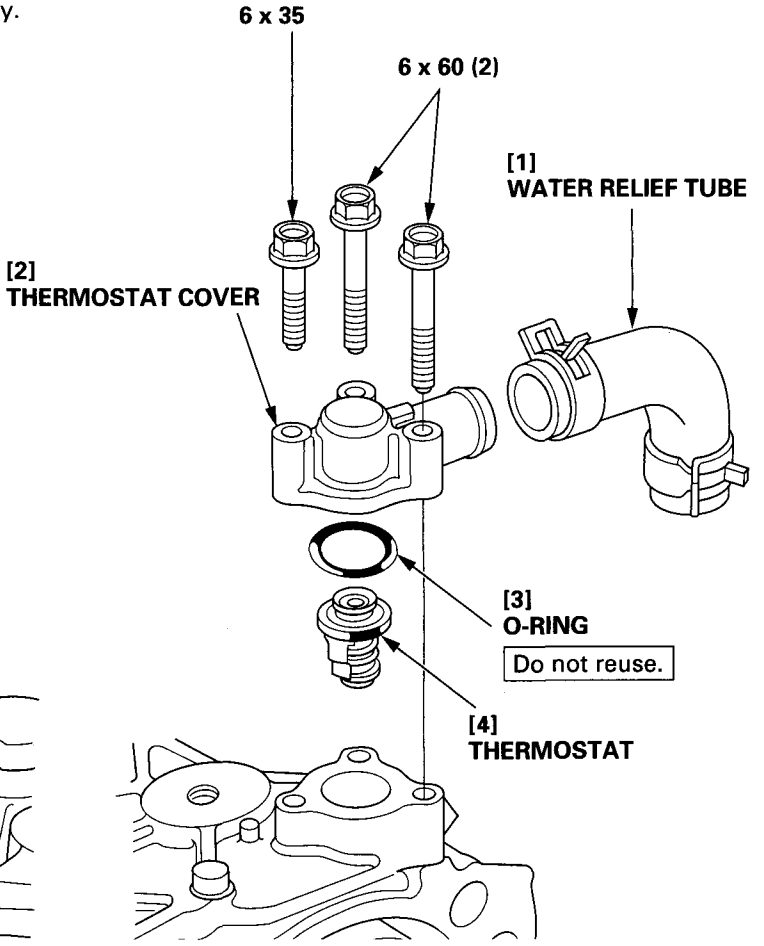
a. Removal/Installation

1) Remove the silencer case (P. 5-103).

2) Remove the 6 x 35 mm and 6 x 60 mm flange bolts and the thermostat from the engine.

3) Replace the O-ring with a new one on disassembly.





b. INSPECTION

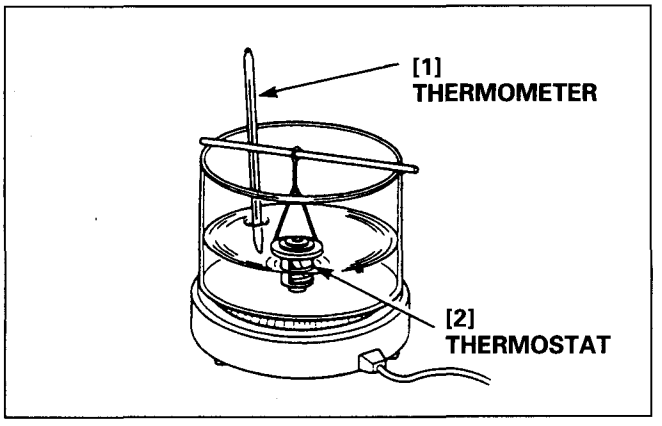
1) Immerse the thermostat in water.

2) Heat the water and observe the operation of the thermostat as the water temperature increases.

3) Measure the water temperature when the thermostat starts opening.

NOTICE

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



4) Measure lift height when fully open.

Start opening	60°C (140°F)
Fully open	70°C (158°F)

Lift height	More than 3.0 mm (0.12 in)

8. FUEL STRAINER (LOW PRESSURE SIDE)/WATER SEPARATER

• FUEL STRAINER (LOW PRESSURE SIDE)

Inspection:

1) Remove the engine cover (P. 4-1).

2) Check the fuel strainer for water accumulation or sediment. If water or sediment is found, remove the fuel strainer as follows.

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

Removal:

1) Clamp the fuel tubes B and C with the hose clips, and disconnect the fuel tubes B and C from the strainer.

2) Remove the fuel strainer with the suspension from the strainer bracket.

3) Remove the fuel strainer from the suspension.

Disassembly/Cleaning:

1) Remove the three 5 x 12 mm pan screws and strainer cup.

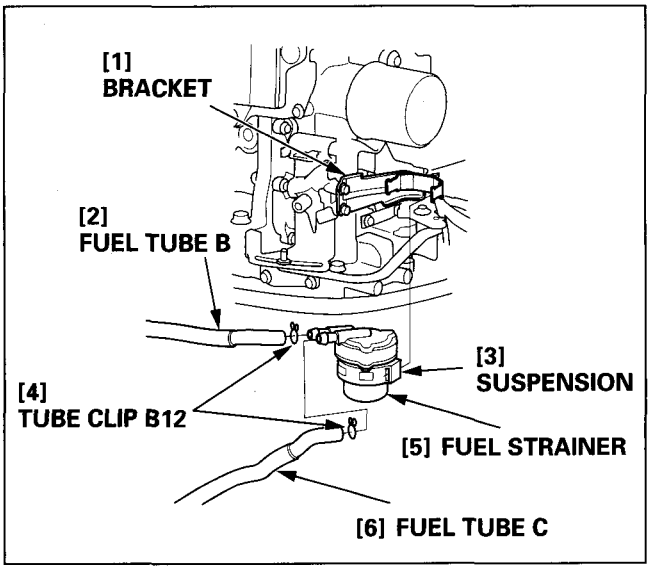
2) Clean the water or sediment in the cup, and if necessary, replace the strainer.

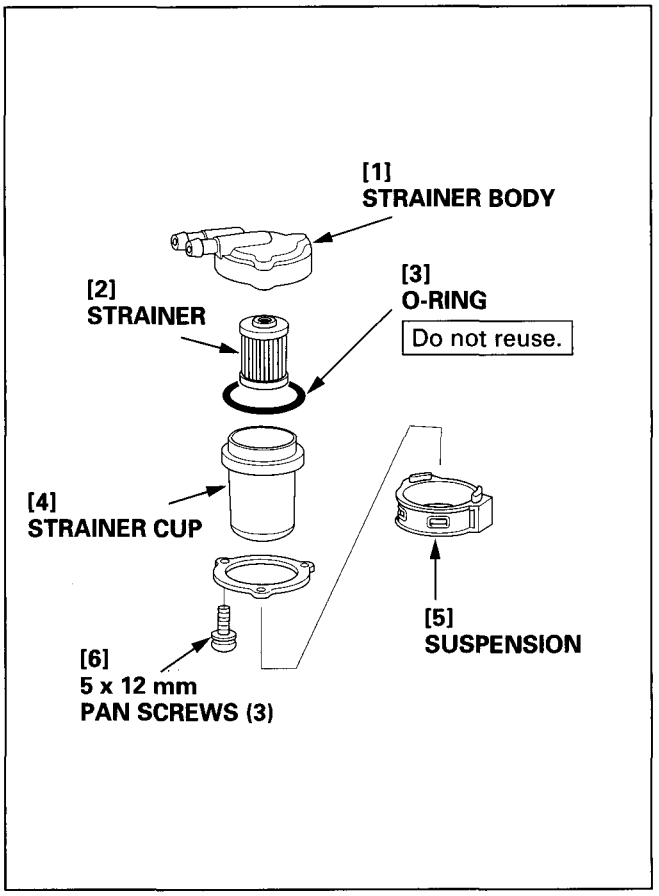
Reassembly:

1) Enter the fuel strainer into the fuel strainer cup.

2) Replace a O-ring and tighten the strainer body with the three 5 x 12 mm pan screws to specified torque.

TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)



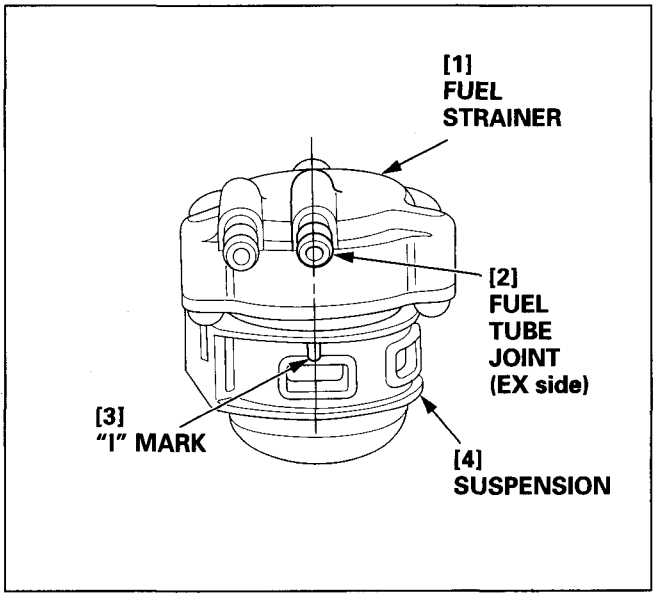


Installation:

1) *Install the suspension to the fuel strainer.*

2) Align the "I" mark on the suspension with the direction of exit side of the fuel tube joint and install the fuel strainer to the bracket.

3) Connect the fuel tubes B and C securely to the fuel strainer.



• WATER SEPARATER with WATER LEVEL SENSOR

Inspection:

1) Remove the engine cover (P. 4-1).

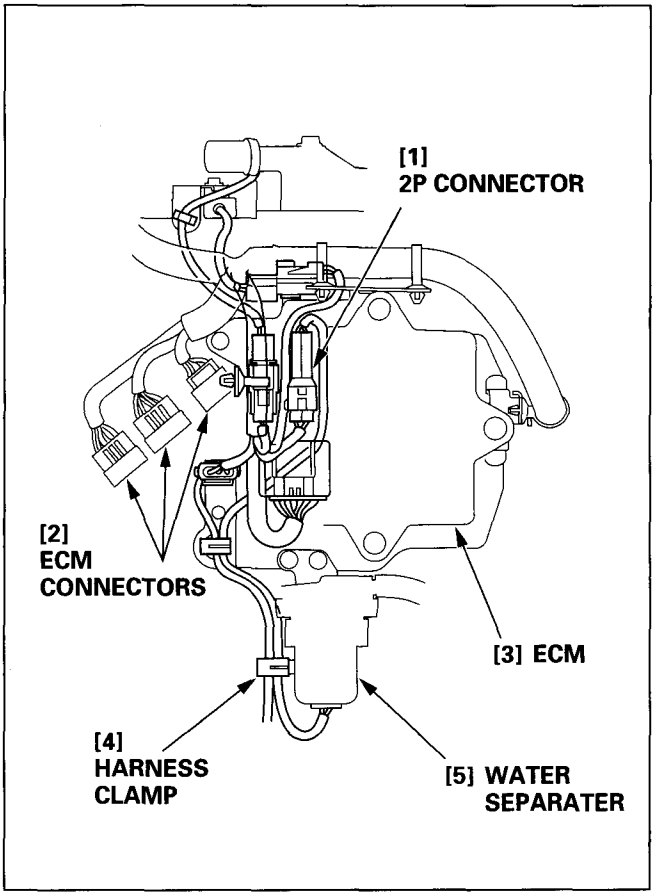
2) Check the water separater for water accumulation or sediment. If water or sediment is found, or the water filled alart buzzer is sound, remove the water separater as follows.

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**



Removal:

1) Turn the ignition switch OFF, and disconnect the battery negative (–) cable, then positive (+) cable.

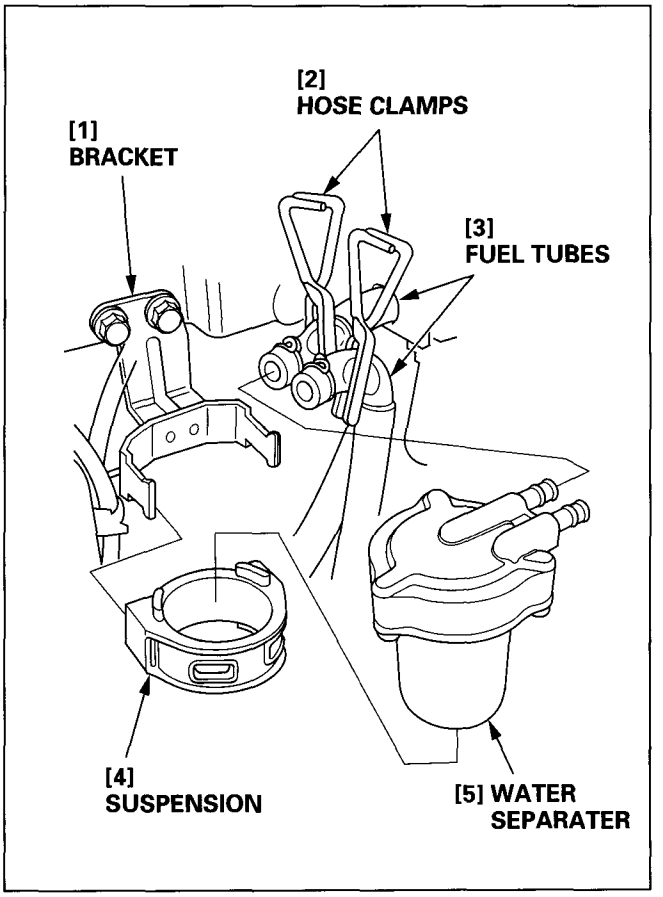
2) Disconnect the all connectors from the ECM.

3) Disconnect the water separater 2P connector and remove the wire harness from the harness clamp.

4) Clamp the fuel tubes and disconnect the fuel tubes from the water separater.

5) Remove the water separater with the suspension from the bracket.

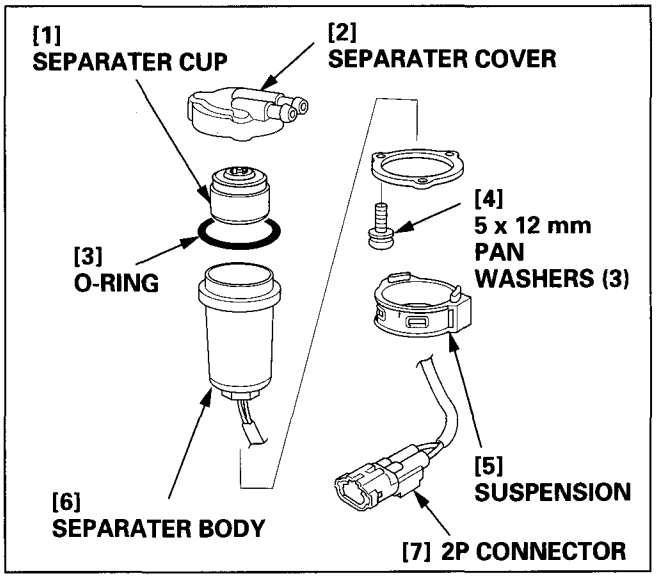
6) Remove the water separater from the suspension.



Disassembly:

1) Remove the three 5 x 12 mm pan screws and the water separater cup from the water separater body.

2) Remove the water accumulation and sediment.

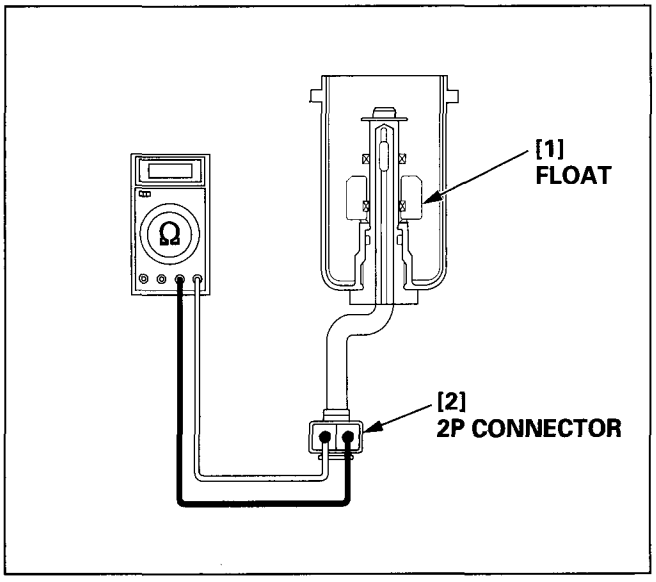


Water Level Sensor Inspection:

1) Check that the float of the water level sensor moves up and down freely; if it doesn't, replace the water separater.

2) Check for continuity between the water level sensor 2P connector terminals in each float position.
   - There should be no continuity when the sensor is level (The float is down).
   - There should be continuity when the sensor is upside down (The float is up).

3) If the water level sensor is faulty, replace the water separater.

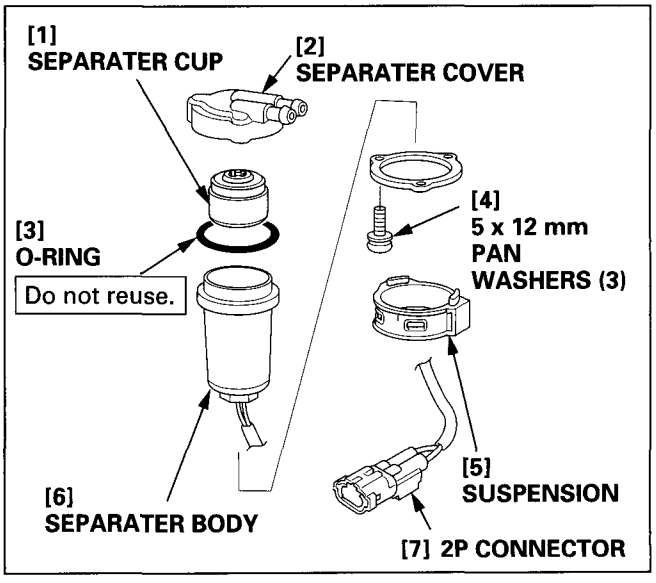


Reassembly:

1) Enter the water separater cup into the separater body.

2) Replace a O-ring and tighten the three 5 x 12 mm pan screws to specified torque.

   TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)

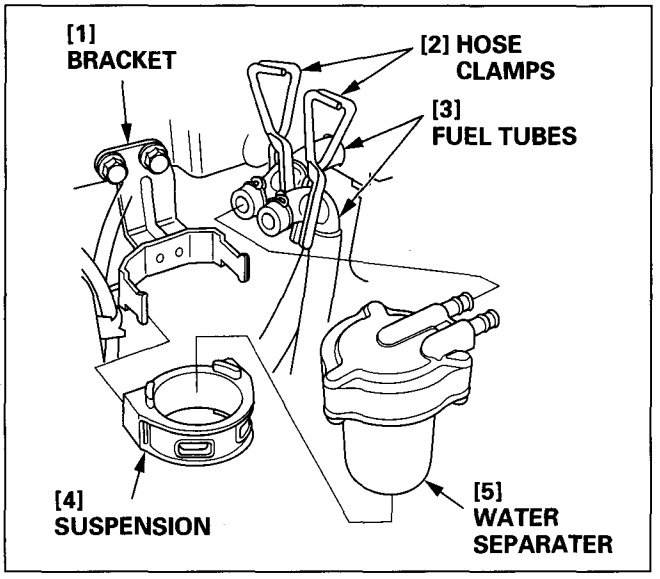


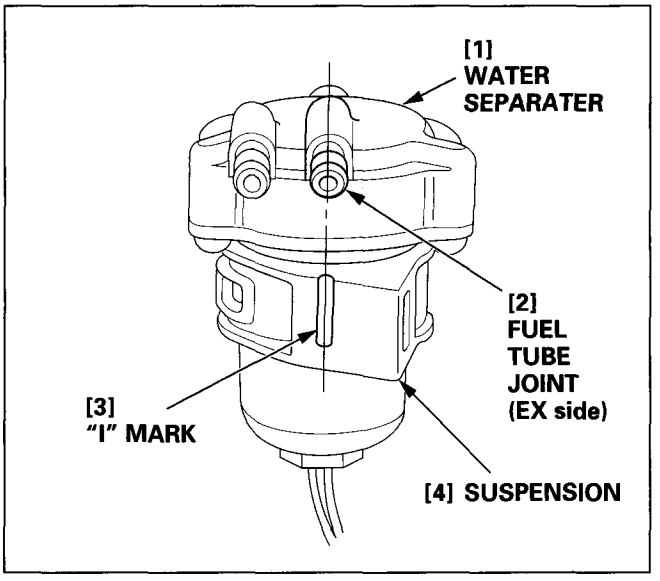
Installation:

1) Install the suspension to the water separater.

2) Align the "I" mark on the suspension with the direction of exit side of the fuel tube joint and install the water separater to the bracket.

3) Connect the fuel tubes to the water separater.

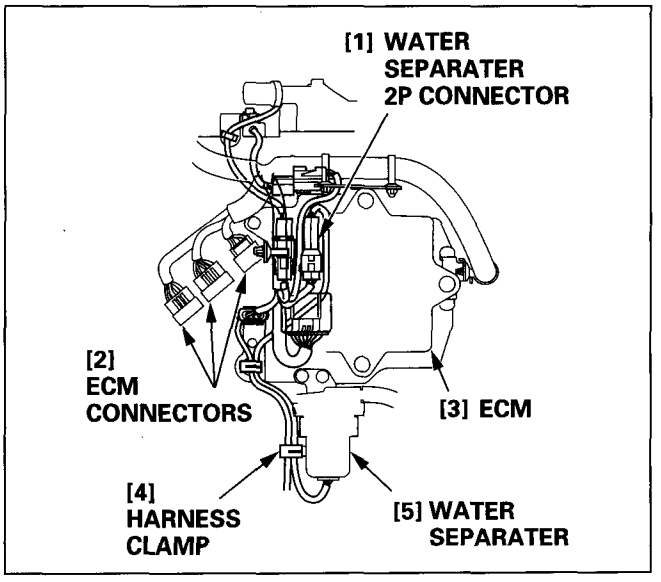




4) Connect the water separater 2P connector and clamp the water separater 2P connector harness with the harness clamp.

5) Connect the ECM connectors securely.

6) After connecting the ECM connectors, connect the battery positive (+) terminal and negative (–) terminal.



9. FUEL STRAINER (HIGH PRESSURE SIDE)

- Disconnect the battery cable from the battery negative (–) terminal before relieving the fuel pressure.
- Replace the sealing washer when the service check bolt is loosened or removed.
- Catch the draining gasoline from the filter to avoid contaminating the engine parts with the gasoline.

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

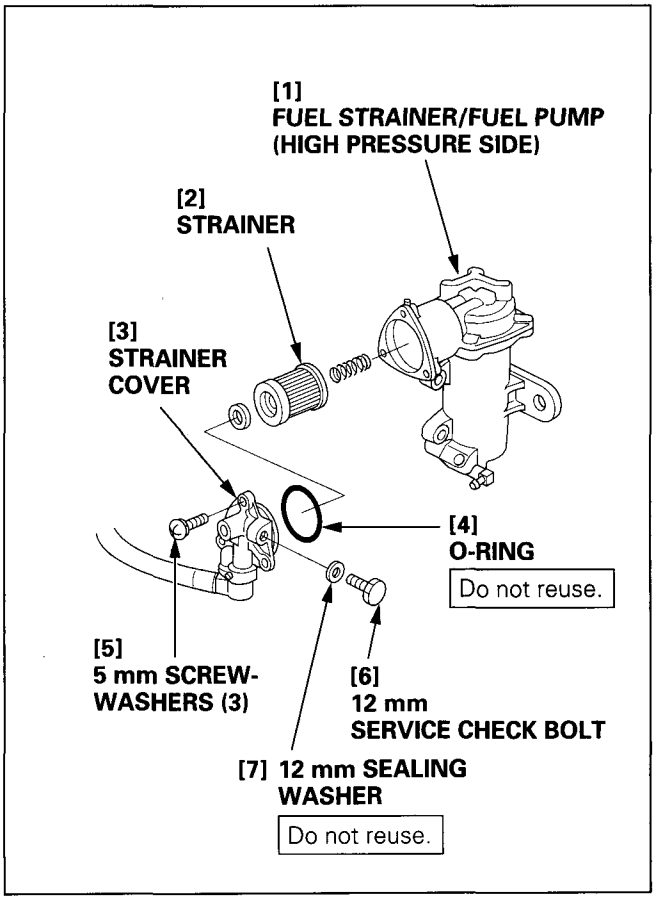
Replace the fuel strainer (high pressure side) at the replacement interval shown or in the following case.

- Regular replacement period of every 2 years or 400 operating hours.
- When the fuel pressure does not reach 280 – 330 kPa (2.9 – 3.4 kgf/cm², 41 – 48 psi) with the pressure regulator vacuum tube connected, be sure that the fuel pump (P. 5-82, 94) and the pressure regulator (P. 5-73) are normal, and replace the fuel strainer (high pressure side).

Replacement:

1) Relieve the fuel pressure following the instruction of "How to relieve fuel pressure" (P. 5-69).
2) Place a rag or a shop towel over the strainer cover.
3) Remove the three 5 mm screw-washers and the strainer cover.
4) Remove the strainer and replace it if necessary.
5) Replace a O-ring.
6) Install a fuel strainer.
7) Install the strainer cover with the 5 mm screw-washers.
8) Replace a sealing washer and tighten the 12 mm service check bolt to specified torque.

   TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)



10. IDLING

Inspection:

Check the following before starting the idling inspeciton.
— Spark plug inspection (P. 3-5)
— MIL must be OFF.

1) Place the outboard motor vertically (with the engine level to the ground), and set the remote control lever in the "N" (Neutral) position.

2) Remove the propeller. Set the outboard motor gear case in a test tank filled with water and start the engine.

3) Remove the engine cover (P. 4-1).

4) Wait until the engine speed stabilizes under no load, and check the idle speed.

Specified idle speed (At neutral)	650 ± 50 rpm

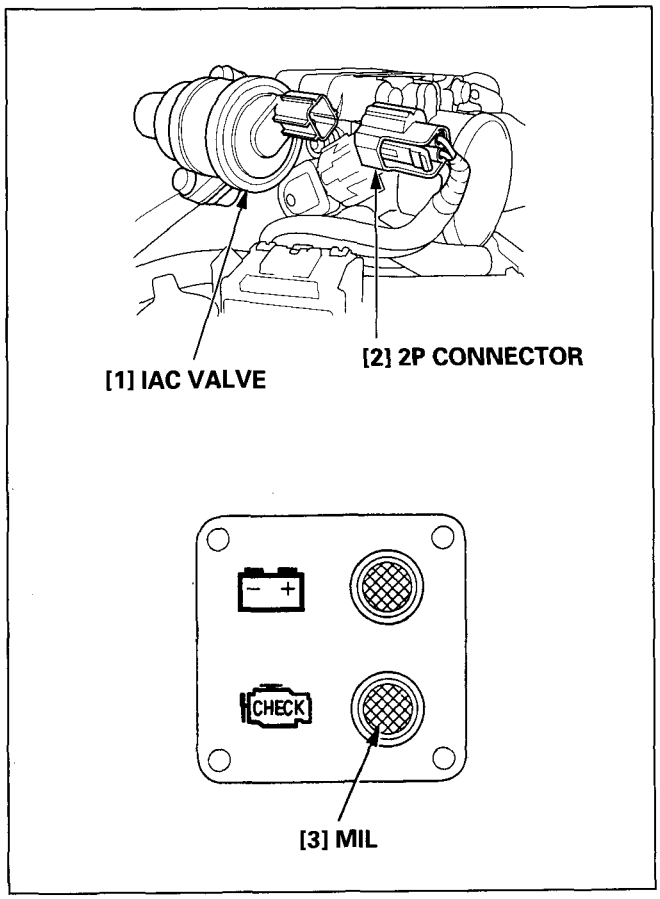
- When the idle speed is out of the specification or when a problem symptom shown on the Idle Control System Troubleshooting Guide (P. 5-44) appears, perform the following adjustment.

Adjustment:

1) Remove the propeller and set the outboard motor gear case in a test tank filled with water. Start the engine.

   TOOL:
   SCS short connector **070PZ – ZY30100**

2) Disconnect the IAC valve 2P connector. Check the MIL should come ON and the warning buzzer should sound (intermittent sound: long beep) this time.



3) Wait until the engine speed stabilizes, then check the idle speed.

4) If the idle speed is outside the specification, adjust by turning the idle adjusting screw in or out.

Idle speed (At neutral)	570 ± 30 rpm

5) After adjustment, stop the engine and apply Nippon Paint Uni-pack 200 or equivalent to the entire surface of the idle adjusting screw head.

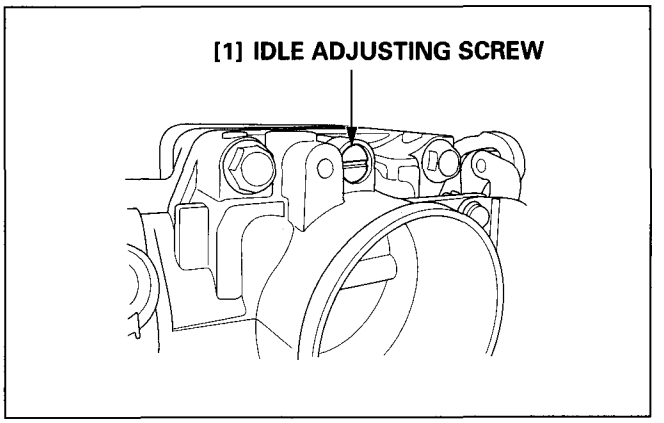
6) Connect the IAC valve 2P connector and connect the SCS short connector (special tool) to the service check connector.

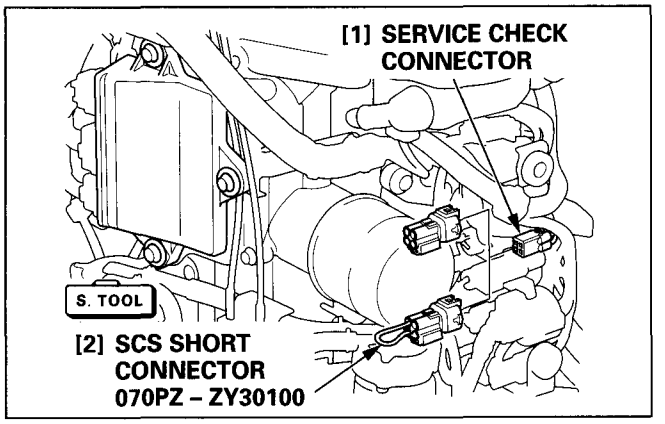
7) Reset the ECM (P. 5-8).

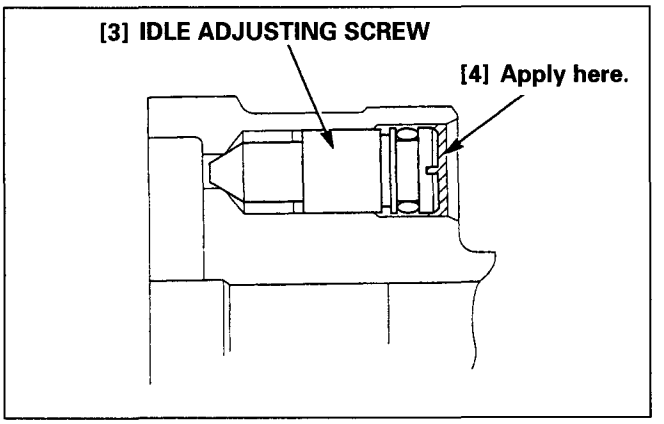
8) Start the engine. Wait until the engine speed stabilizes under no load, and recheck the idle speed.

Specified idle speed (At neutral)	650 ± 50 rpm

9) If the idle speed is outside the specification, inspect and troubleshoot the idle control system (P. 5-44).





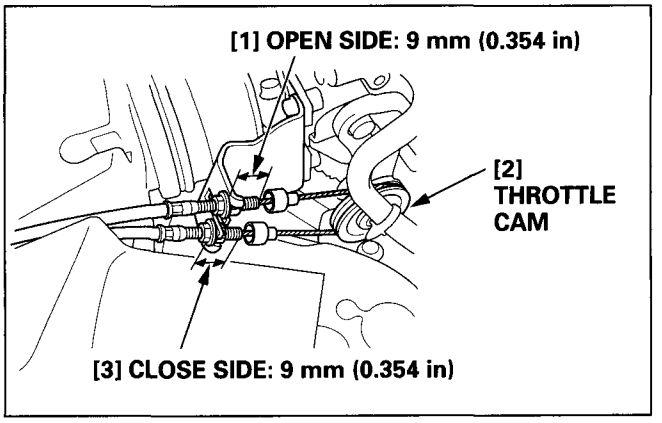


11. THROTTLE CONTROL CABLE/ THROTTLE LINK

Adjustment:

1) Remove the engine cover (P. 4-1).

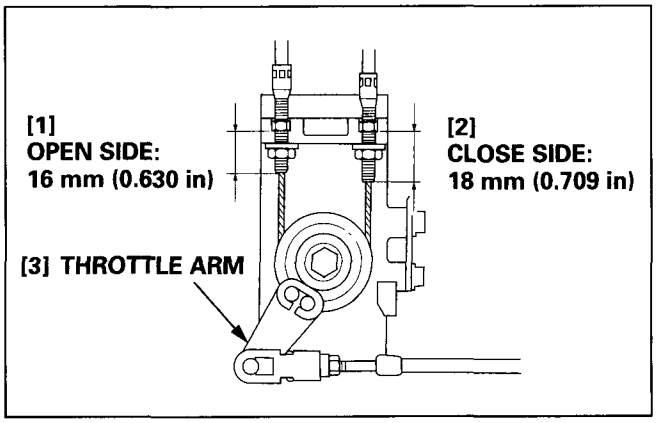
2) Check the throttle cable length of the sections shown at the throttle cam open side and the close side respectively. The cable length at the throttle cam open side and the close side should be 9 mm (0.354 in) from the point shown.



3) If the measurement is above or below the specification, adjust by loosening the adjusting nut at the throttle cam open side or the close side as needed.

4) Measure the throttle cable length from the end of the threaded part to the lock nut end.
Measure at the throttle arm open side and the close side respectively.

Open side	16 mm (0.630 in)
Close side	18 mm (0.709 in)

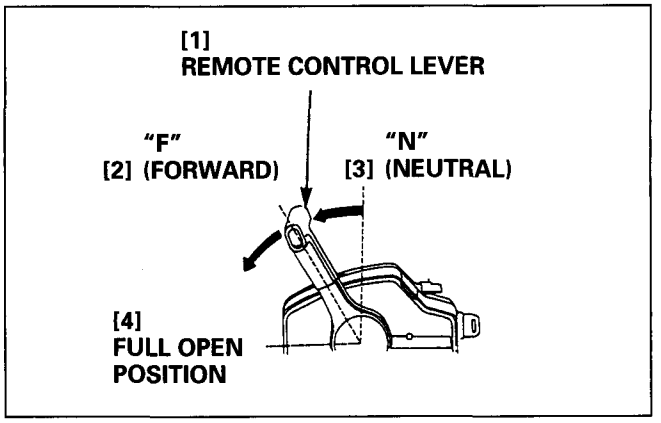


5) If the measurement is above or below the specification, adjust by loosening the adjusting nut at the open side or the close side as needed.

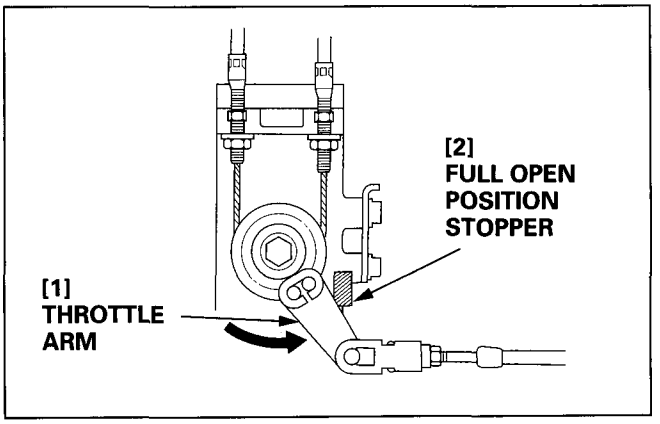
6) Move the remote control lever to the "F" (Forward) full open position.

NOTICE

- If it is hard to move the remote control lever to the "F" (Forward) position with the engine stopped, move the lever while turning the propeller or propeller shaft.
- Do not move the remote control lever with force or damage to the gearshift system can result.



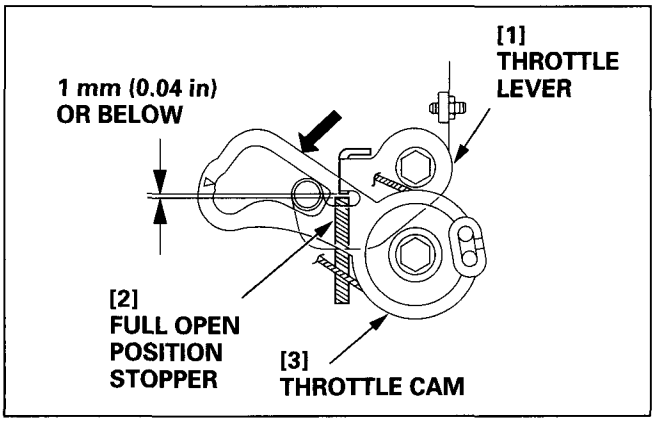
7) Check whether the throttle arm is in contact with the full open position stopper this time. If it is not, adjust as follows.



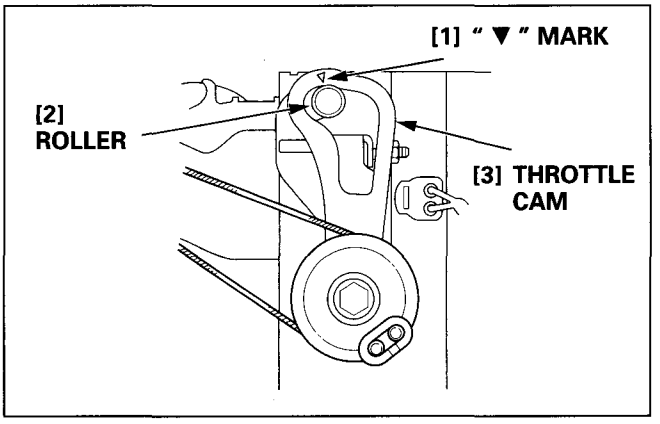
8) Check whether the throttle lever of the throttle body is in the full open position at the state of the step 7.

9) With the throttle arm in contact with the full open position stopper, measure the clearance between the throttle lever of the throttle body assembly and the full open position stopper.
It should be 1 mm (0.04 in) or below.

Adjustment is needed if the clearance is more than 1 mm (0.04 in).

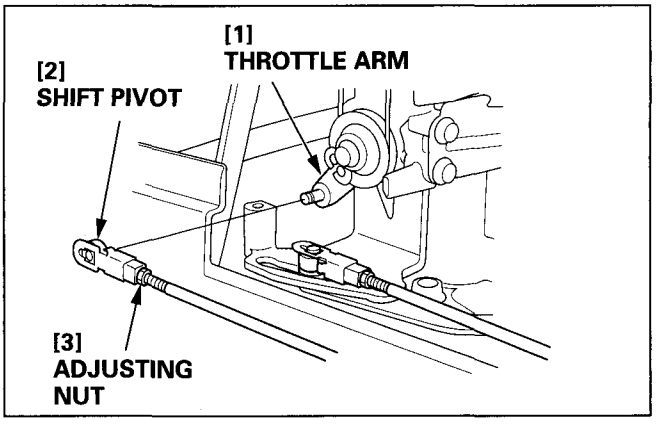


10) When return the remote control lever to the "N" (Neutral) position, check whether the " ▼ " mark on the throttle cam aligns with the center of the throttle cam roller.
If the mark is out of alignment, adjust by turning the adjusting nuts of the throttle cables.

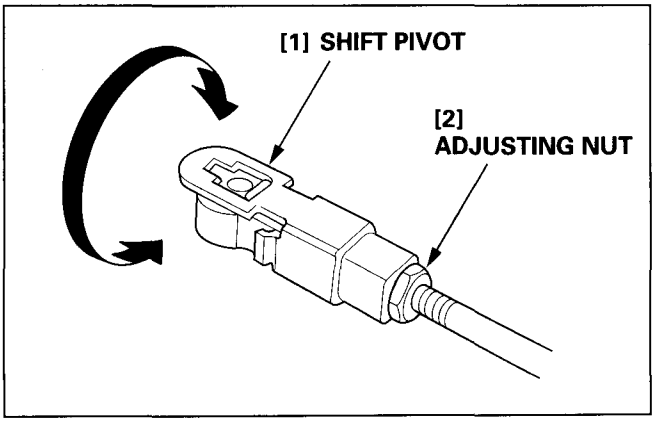


<The case of the throttle arm is not full open>

1) Remove the shift pivot from the throttle arm and loosen the adjusting nut.



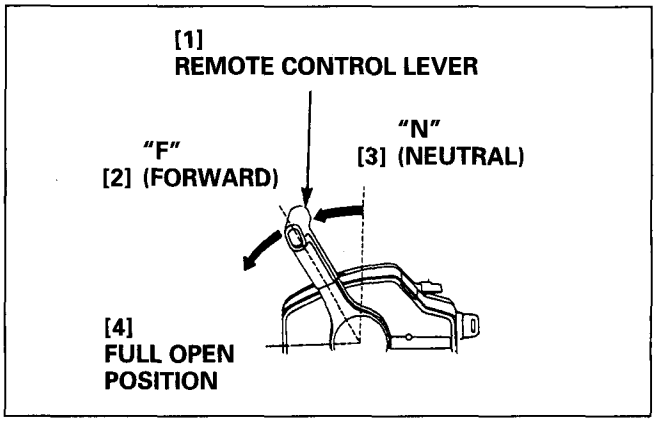
2) Tighten the shift pivot as needed, and install the shift pivot to the throttle arm.



3) Move the remote control lever to the "F" (Forward) full open position.

4) Check whether it is in the state of the step 7 to 10 of the throttle cable adjustment.

5) Move the remote control lever to the "N" (Neutral) position and tighten the adjusting nut.

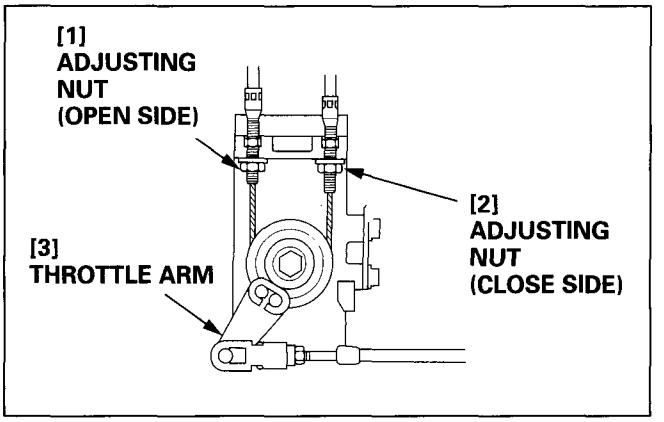


<The case of the throttle cam is not full open>

1) At the throttle arm side, loosen the adjusting nuts of the throttle cables.

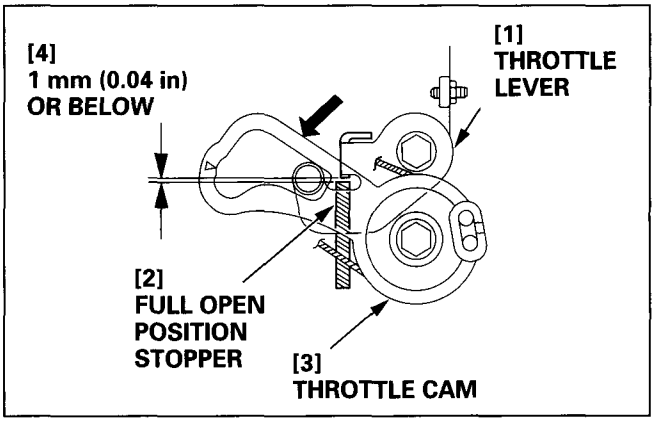
NOTICE

In adjustment, be sure to loosen or tighten the adjusting nuts.



2) Move the remote control lever to the "F" (Forward) full open position.

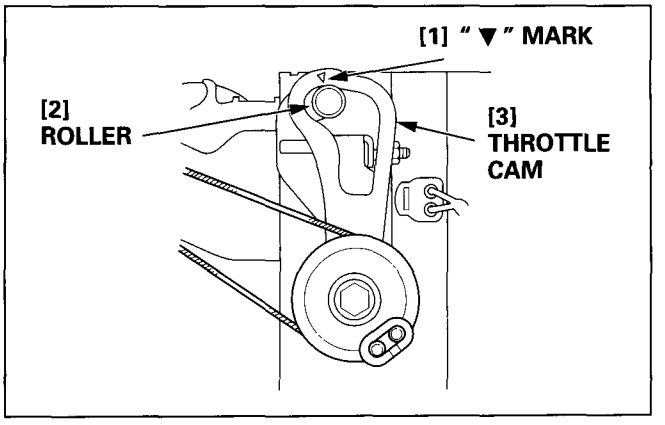
3) Turning the adjusting nut at the open side of the throttle cable in or out, adjust the gap between the throttle lever of the throttle body assembly and the full open position stopper to 1 mm (0.04 in) or below.



4) Move the remote control lever to the "N" (Neutral) position.

5) Check whether the " ▼ " mark on the throttle cam aligns with the center of the throttle cam roller.
If the mark is out of alignment, adjust by turning the adjusting nut at the open side of the throttle cable.

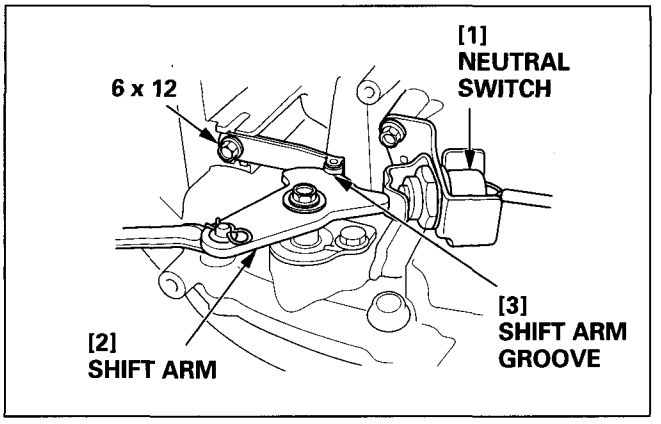
6) After adjustment, tighten the adjusting nuts at the open side and the close side of the throttle cable securely.



12. SHIFT CONTROL CABLE

Inspection/Adjustment:

1) Remove the engine cover (P. 4-1).

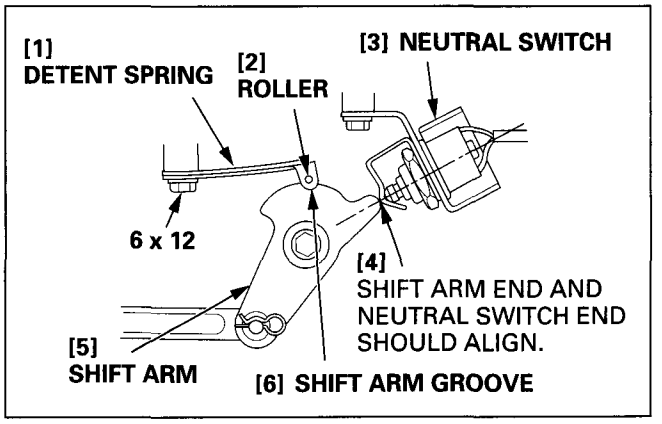


2) Move the remote control lever to the "N" (Neutral) position.

3) Check whether the detent spring roller is in the shift arm groove ["N" (Neutral) position] with the "▼" mark on the shift link bracket in alignment with the "▲" mark on the shift link. (The shift arm end should align with the neutral switch end.)

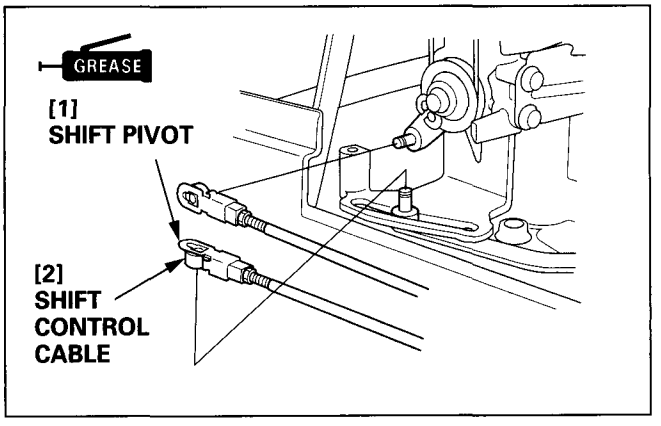
4) If the detent spring roller is not in the shift arm groove, loosen the 6 x 12 mm flange bolt, and move the detent spring right or left to adjust.

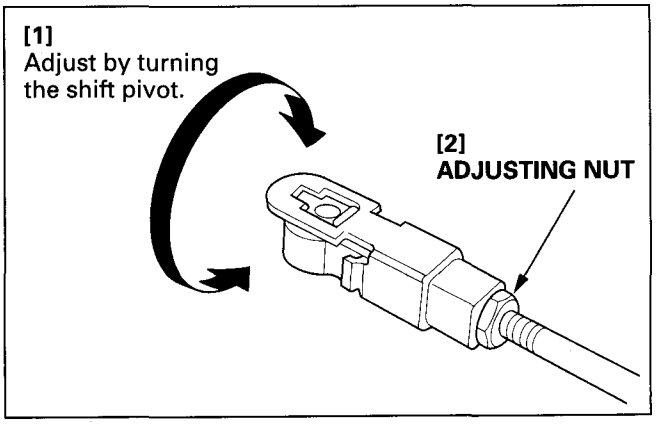
   After adjustment, tighten the 6 x 12 mm flange bolt securely.



5) If the shift arm end should not align with the neutral switch end, remove the shift pivot of the shift control cable, and loosen the locknut and adjust by turning the shift pivot as needed.

6) After adjustment, install the shift pivot to the shift control cable and recheck the shift control.





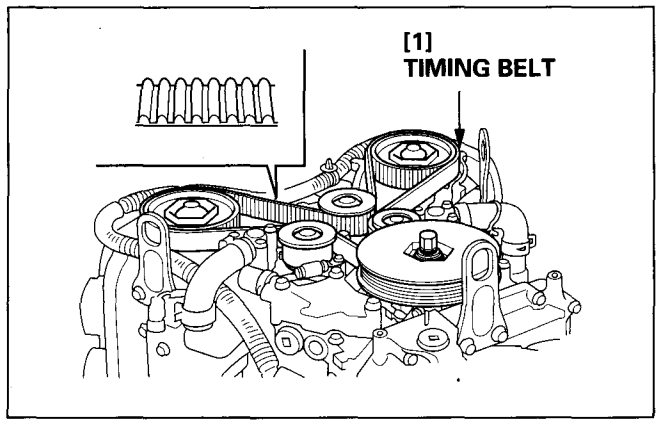
13. TIMING BELT

INSPECTION

1) Remove the engine cover, the silencer case and the timing belt upper cover.

2) Check the timing belt for wear and damage.
Replace the timing belt if it is worn or damaged.

3) Check the timing belt and the related parts for oil and grease.
If contaminated with oil or grease, clean the parts and replace the timing belt.



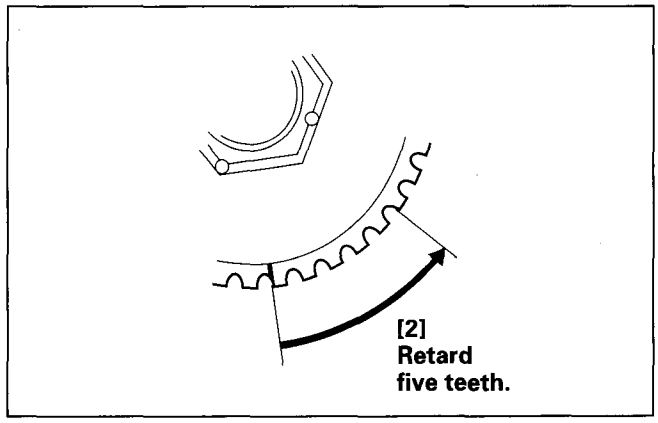
- **Timing Belt Deflection Inspection**

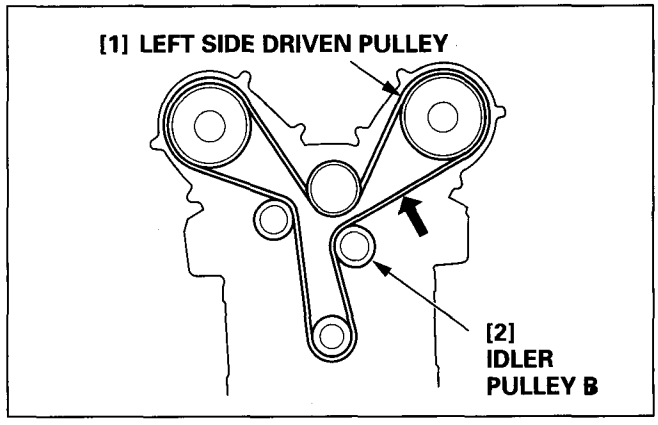
1) Align the timing belt driven pulleys No. 1 TDC marks with the marks of the timing belt back cover (P. 3-7).

2) Slowly turn the crankshaft pulley counterclockwise further by five teeth of timing belt driven pulley gear.

3) Apply a force of 19.6 N (2 kgf, 4.4 lbf), and measure the deflection at the mid point between the left side timing belt driven pulley and the idler pulley B.

Deflection	8.8 – 9.7 mm (0.35 – 0.38 in)

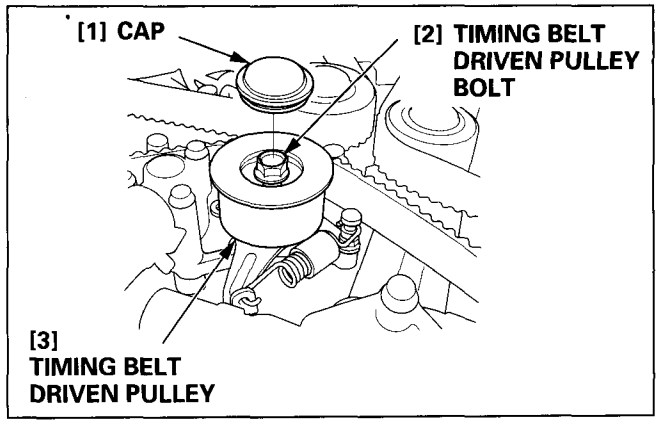




- **Adjustment**

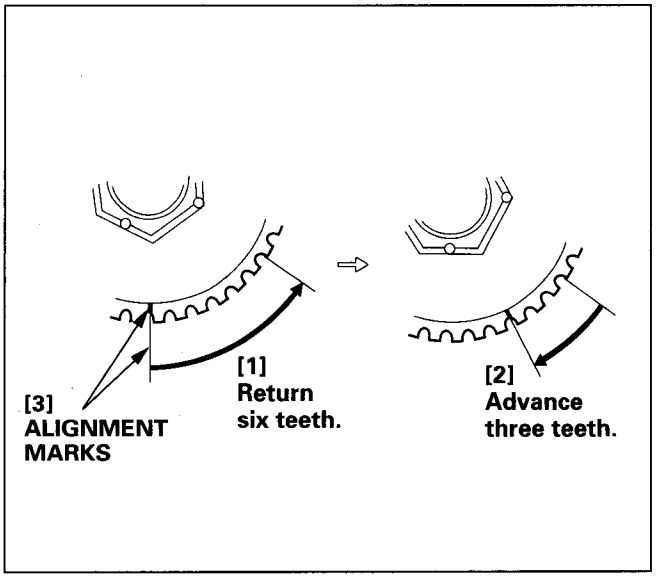
1) Align the timing belt driven pulleys No. 1 TDC marks with the marks of the timing belt back cover (P. 3-7).

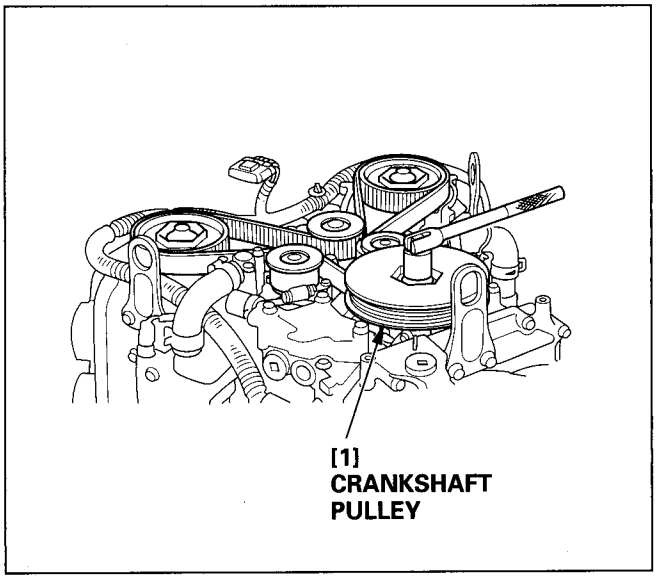
2) Loosen the timing belt tensioner bolt about one or one and half turns.



2) Rotate the crankshaft pulley counterclockwise by six teeth of the timing belt driven pulley gear, then return the crankshaft pulley clockwise by three teeth of the timing belt driven pulley gear.

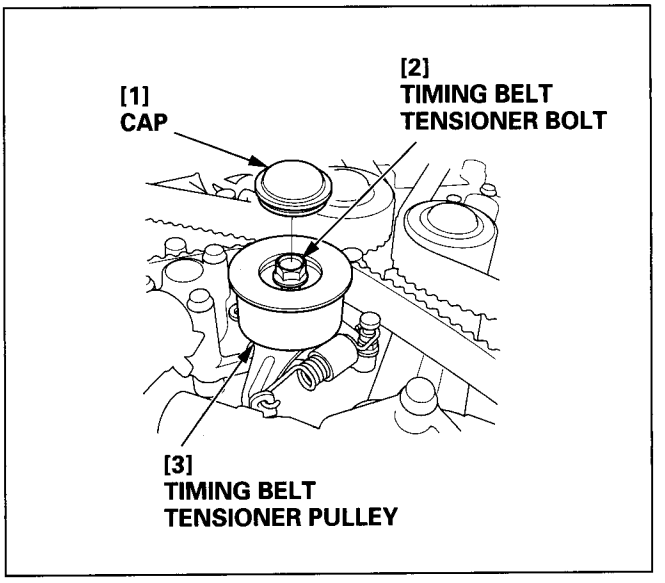
   • If the crankshaft pulley was turned more than three teeth of the timing belt driven pulley gear, turn the crankshaft pulley clockwise to bring the No. 1 piston at its compression stroke, then repeat the belt tension adjustment procedure explained above. Be sure that the spark plugs are installed properly.





3) Tighten the timing belt tensioner bolt to the specified torque.

   TORQUE: 39 N•m (4.0 kgf•m, 29 lbf•ft).



14. ALTERNATOR BELT

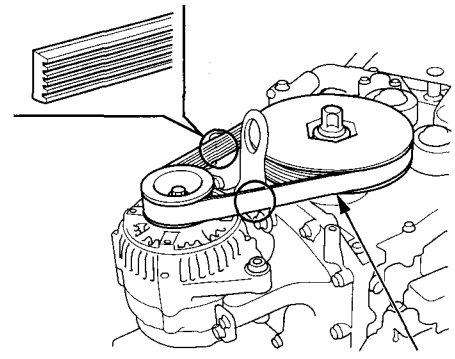
Inspection:

1) Remove the engine cover and the timing belt upper cover (P. 4-1, 6-15).

2) Check the alternator belt for wear and damage. Replace the belt if it is worn or damaged (P. 6-2).

3) Check the alternator belt and the related parts for stain with oil, etc. If stained, clean the stained parts and replace the belt.

4) Check the alternator belt tension or deflection.

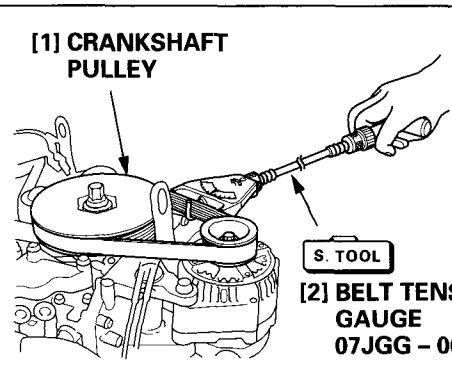


[1] ALTERNATOR BELT

a. Belt tension inspection using belt tension gauge

1) Set the special tool at the center between the alternator belt pulley and the crankshaft pulley, and measure the belt tension.

TOOL:
Belt tension gauge **07JGG – 0010101**



[2] BELT TENSION GAUGE 07JGG – 0010101

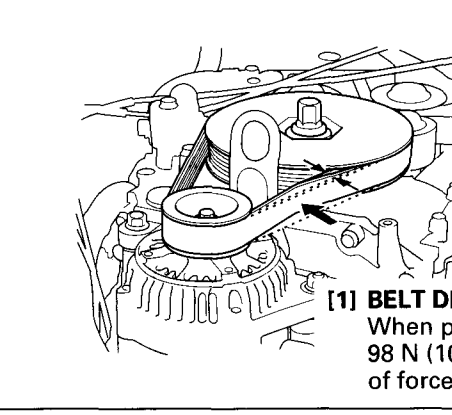
Belt tension	New belt*1	880 – 980 N (90 – 100 kgf, 198 – 220 lbf)
	New belt*2	660 – 740 N (67 – 76 kgf, 148 – 168 lbf)
	Used belt	490 – 590 N (50 – 60 kgf, 110 – 132 lbf)

- When installing a new belt, adjust the belt tension to *1 specification, then run the engine for 5 minutes and readjust the belt tension to *2 specification.

2) If the belt tension is out of the specification, adjust the belt tension.

b. Belt deflection inspection

1) Measure the belt deflection by pushing the alternator belt at the center between the pulleys with 98 N (10 kgf, 22 lbf) of force.



[1] BELT DEFLECTION
When pushed with 98 N (10 kgf, 22 lbf) of force.

Belt deflection	New belt*1	3.2 – 3.4 mm (0.12 – 0.13 in)
	New belt*2	4.2 – 4.8 mm (0.17 – 0.19 in)
	Used belt	5.4 – 6.3 mm (0.21 – 0.25 in)

- When installing a new belt, adjust the belt deflection to *1 specification, then run the engine for 5 minutes and readjust the belt deflection to *2 specification.

2) If the belt deflection is out of the specification, adjust the belt tension.

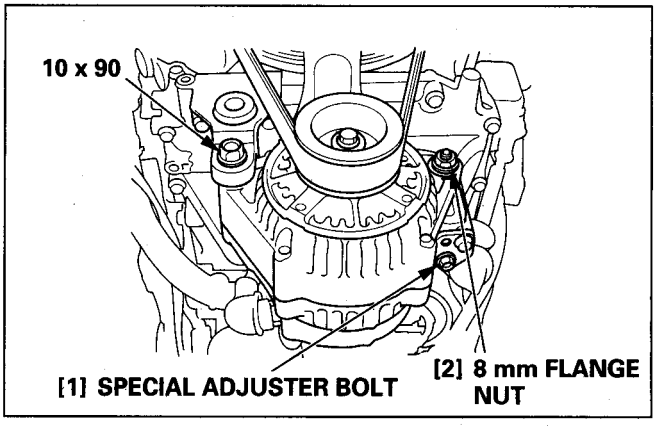
Belt Tension Adjustment:

1) If the belt tension or the belt deflection is out of the specification, loosen the 10 x 90 mm flange bolt and the 8 mm flange nut and adjust the belt tension or deflection by turning the special adjuster bolt right or left.

2) After adjustment, tighten the 8 mm flange nut and the 10 x 90 mm flange bolt in this order to the specified torque.

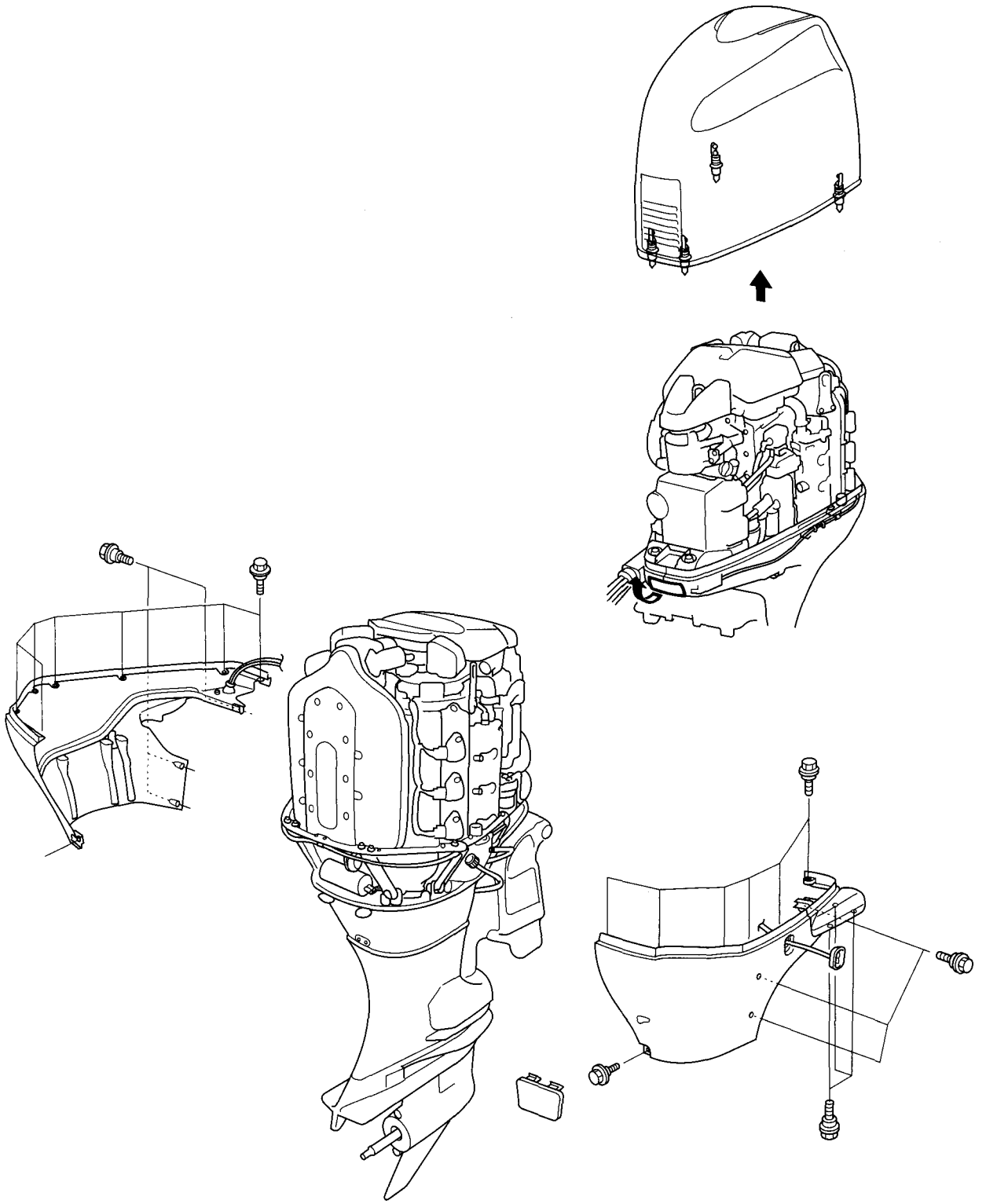
   TORQUE:
   44 N•m (4.5 kgf•m, 33 lbf•ft) (10 x 90 mm flange bolt)
   26 N•m (2.7 kgf•m, 20 lbf•ft) (8 mm flange nut)

3) After tightening the bolt and nut to the specified torque, check the alternator belt tension again.
   If the measurement is still out of the specification, repeat the step 1 and 2 again.



4. ENGINE COVER/COVER LOCK

1. ENGINE COVER
2. FRONT SEPARATE COVER
3. ELECTRIC PARTS COVER
4. LEFT/RIGHT ENGINE UNDER COVER
5. COVER LOCK CABLE/ENGINE COVER BRACKET
6. FRONT LOCK ASSEMBLY/FRONT COVER BRACKET
7. ENGINE COVER BRACKET



1. ENGINE COVER

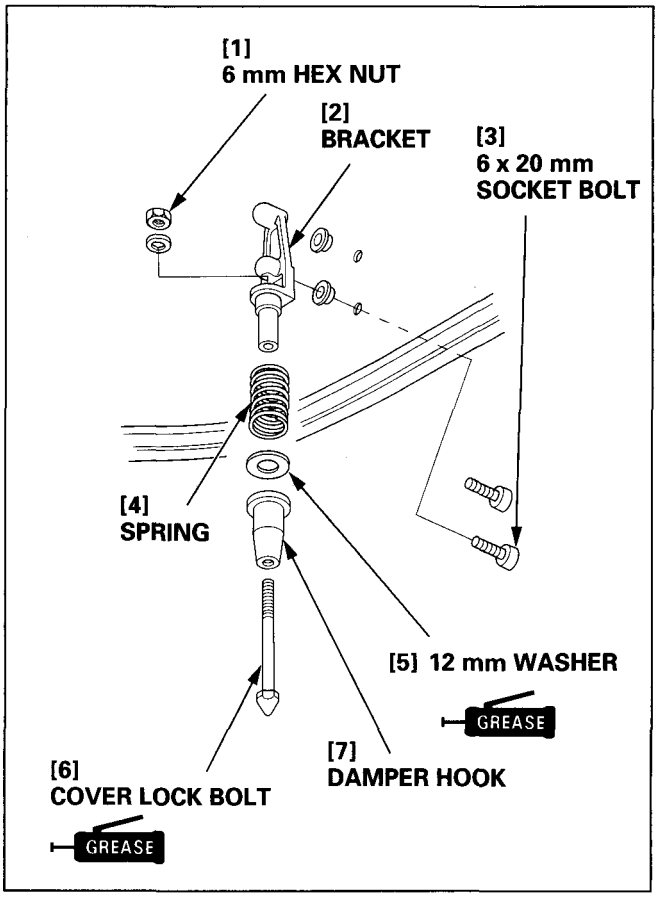
a. DAMPER HOOK DISASSEMBLY/REASSEMBLY

1) Remove the 6 x 20 mm socket bolt and the damper hook.

2) Remove the 6 mm hex nut and disassemble the damper hook.

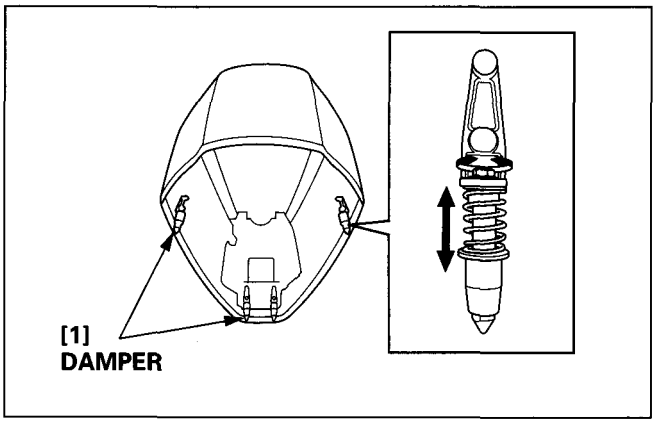
3) Apply marine grease to the threaded and flanged parts of the cover lock bolts.

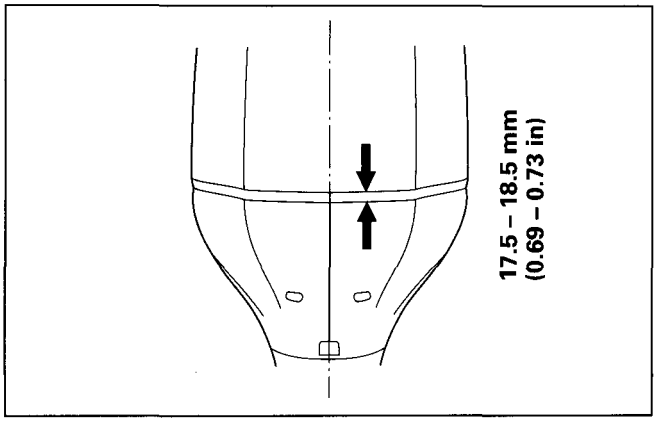
4) After reassembling the damper hook, install the damper hook to the engine cover with the 6 x 20 mm socket bolt.



b. DAMPER HOOK ADJUSTMENT

Adjust height of the damper hook to be 17.5 – 18.5 mm (0.69 – 0.73 in) by tightening the nuts, and adjust an even clearance between the engine cover and the undercover.





2. FRONT SEPARATE COVER

a. REMOVAL

1) Remove the two 6 x 25 mm hex bolts, 6 x 17 mm special bolt and the two 6 x 37 mm special bolts and remove the front separate cover.

b. INSTALLATION

1) Slide the hook of the front separate cover into the engine under cover.

NOTICE

Make sure that the undercase grommet A is positioned in the grooves of the engine under cover and front separate cover.

2) Loosely tighten the ① 6 x 25 mm hex bolt.

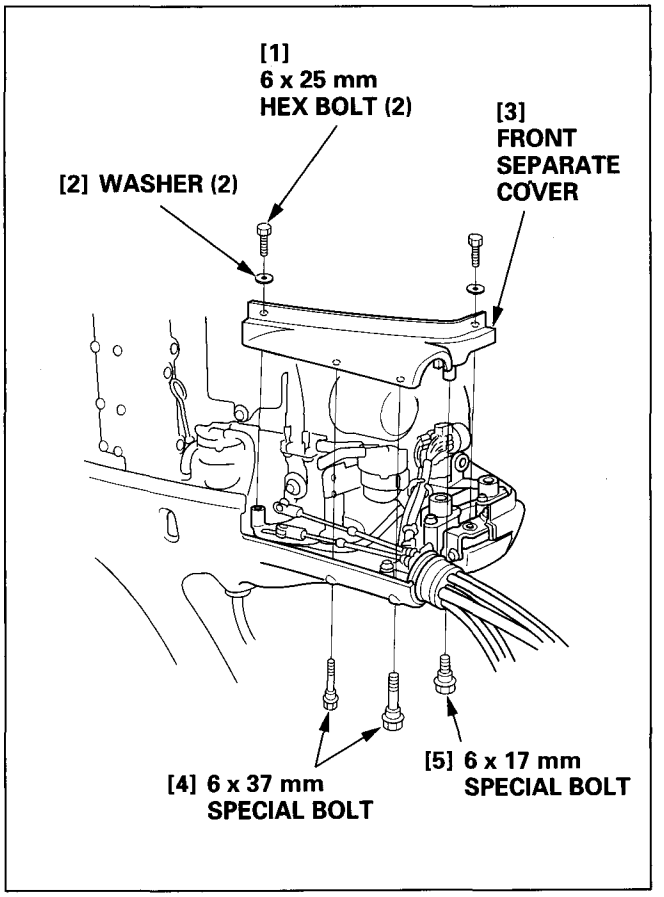
3) Loosely tighten the ② 6 x 17 mm special bolt until the shoulder of the bolt is in the hole of the engine under cover.

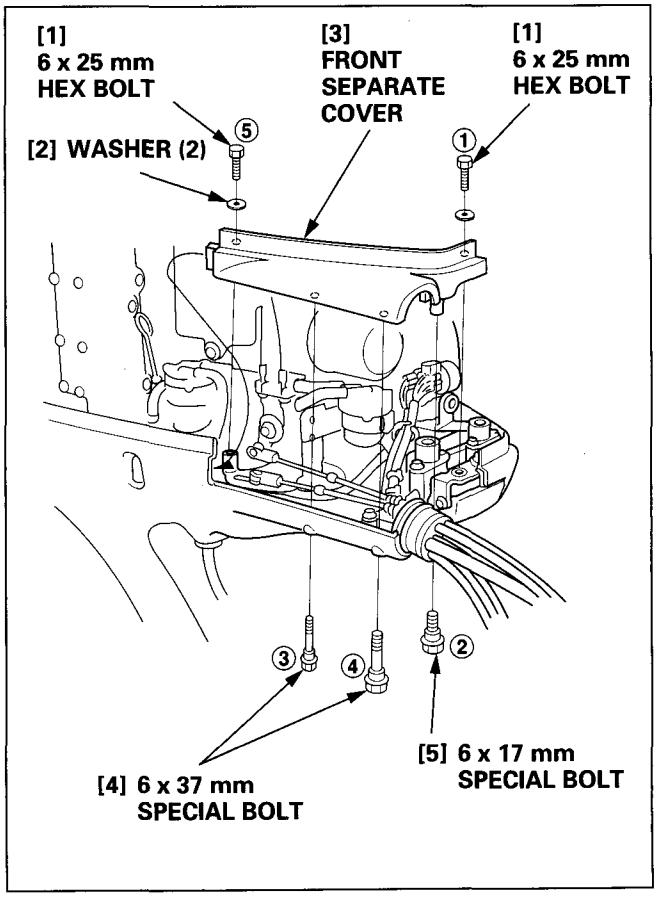
4) Tighten the ③, ④ and ⑤ bolts and washers in the numbered order.

NOTICE

Keep the remote control cable level with the ground.

5) Tighten the ① and ② bolts securely.





3. ELECTRIC PARTS COVER

a. REMOVAL

1) Remove the rubber band from the electric parts cover.

2) Pull the upper section of the electric parts cover toward you lightly, then lift up the lower section of the electric parts cover lightly and pull the cover horizontally. Take care not to break the plastic knobs on the cover.

b. INSTALLATION

1) *Spray the round rubber grommets with silicone spray* so the plastic knobs will easily align and engine with the rubber grommets.

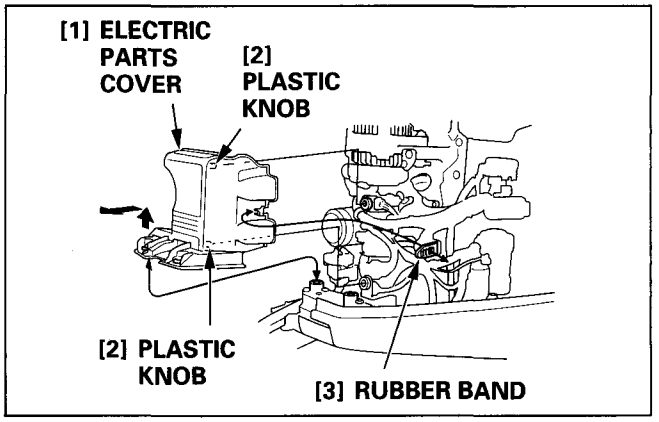
2) Install the electric parts cover and secure with the rubber strap. Make sure the electric parts cover is properly aligned with the engine cover mounting bosses.

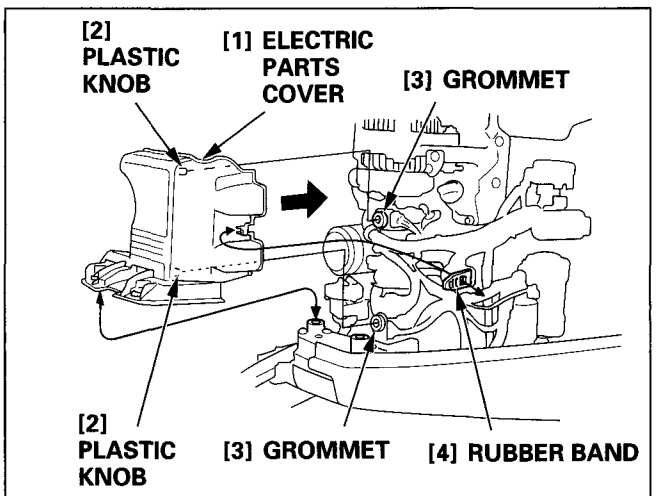
   - Push on the left side of the cover lightly and hang the cover on the hook on the left back.
   - Install the right lower sectin of the electric parts cover into the inner of the engine under cover.

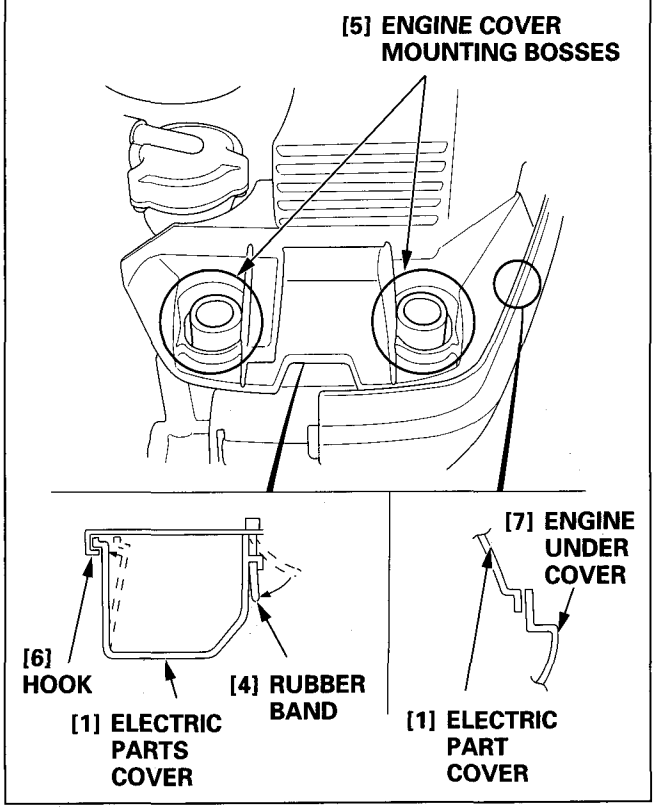
NOTICE

- To install the cover securely, make sure the remote control cable, switch panel wire harness and the indicator wire harness are installed securely.
- If the electric parts cover is pushed hard and the plastic knobs are not aligned with the grommets, the plastic knobs may break.
- The connector cover must be installed correctly to allow the engine cover to insert the engine cover mounting bosses.

3) Install the electric parts cover and secure with the band.



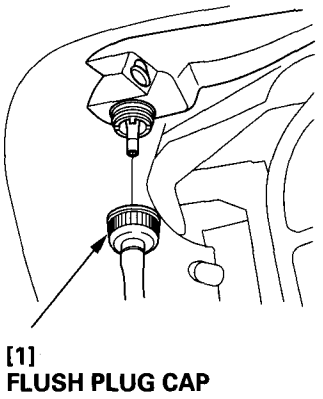




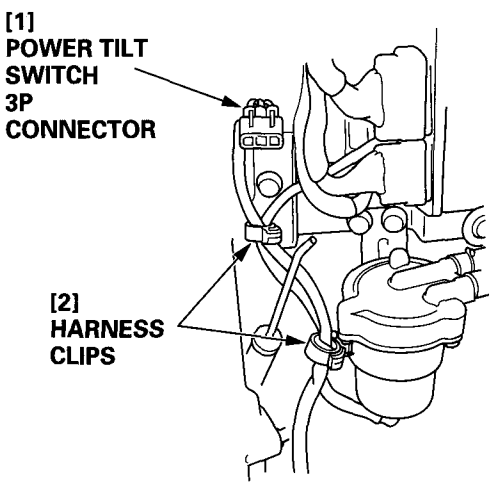
4. LEFT/RIGHT ENGINE UNDER COVER

a. REMOVAL

1) Disconnect the flush plug cap from the right engine under cover.



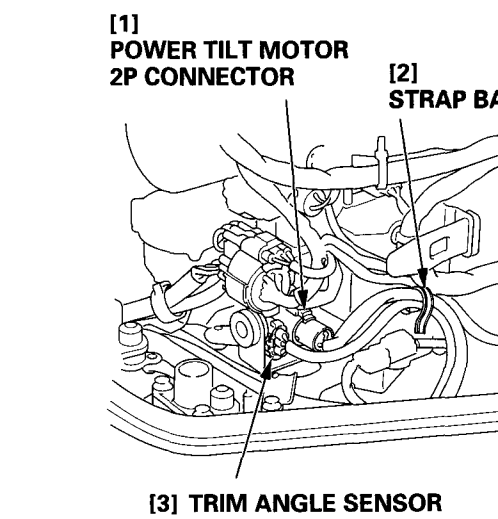
2) Disconnect the power tilt switch 3P connector and remove the harness from the harness clips.



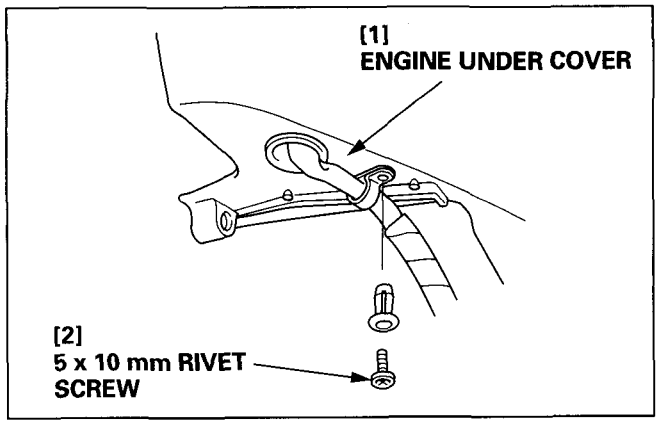
3) Remove the electrical parts cover (P. 4-4).

4) Disconnect the power tilt motor 2P connector and the trim angle sensor 3P connector.

5) Open the strap band and remove the power tilt motor wire harness and the trim angle sensor wire harness.

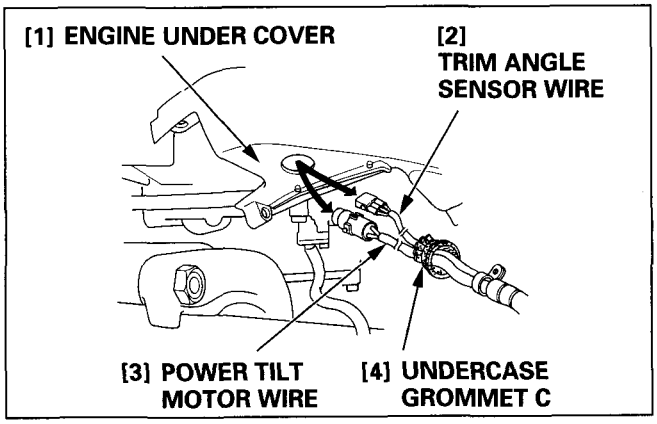


6) Remove the 5 x 10 mm rivet screw from the engine under cover.

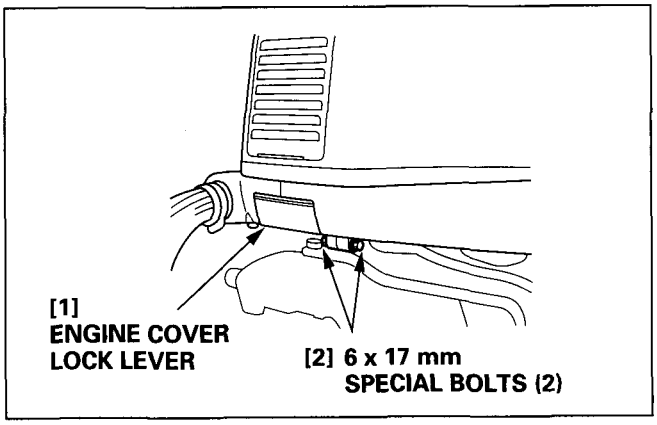


7) Remove the undercase grommet from the engine under cover.

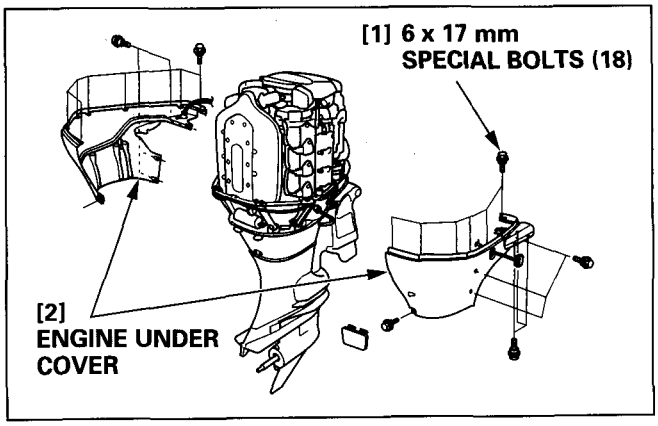
Remove the trim angle sensor wire harness and the power tilt motor wire harness from the hole in the engine under cover.



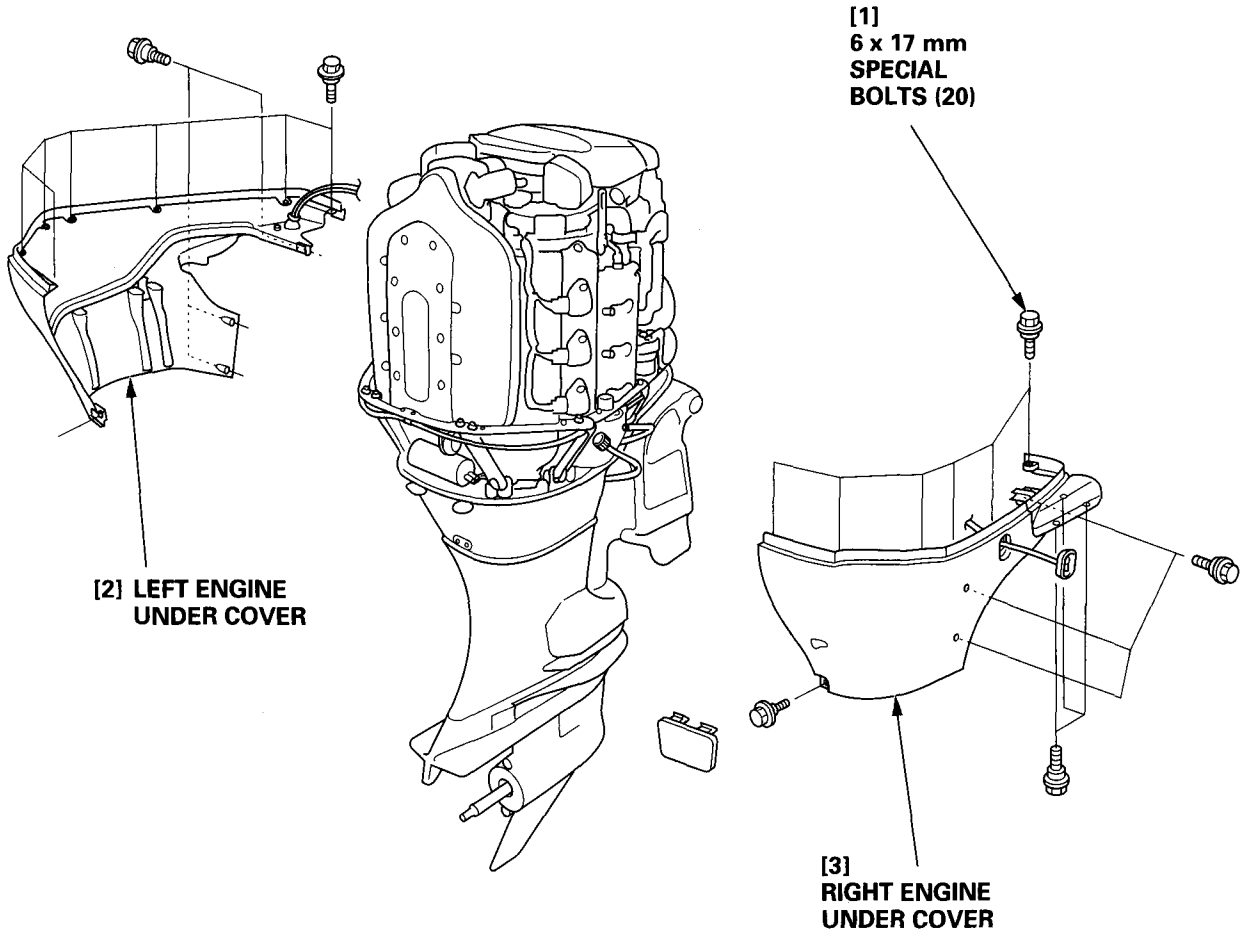
8) Remove the 6 x 17 mm special bolts from under the engine cover lock lever.



9) Remove the 6 x 17 mm special bolts from the left/right engine cover, and remove the left/right engine cover.

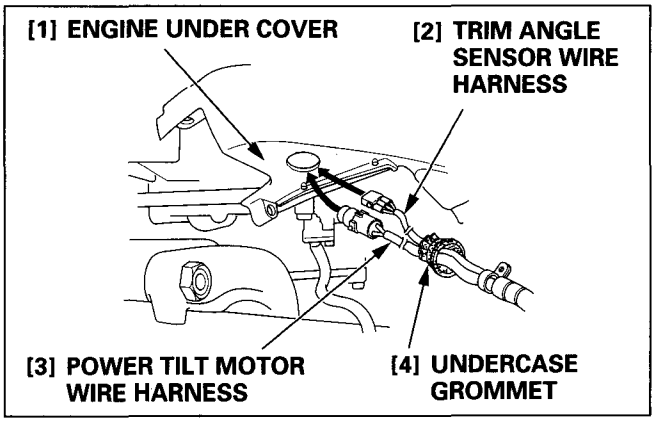


b. EXPLODED VIEW

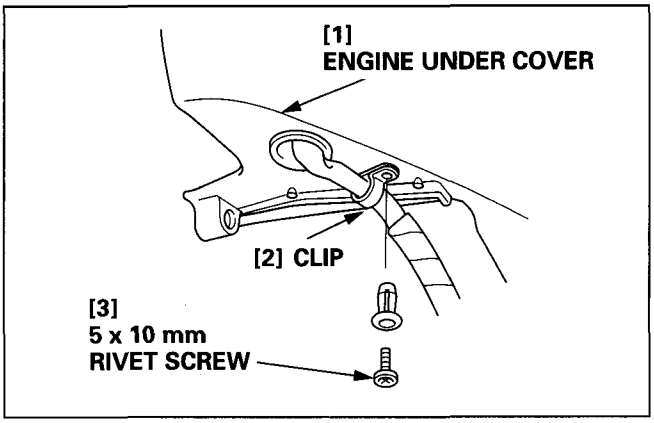


c. INSTALLATION

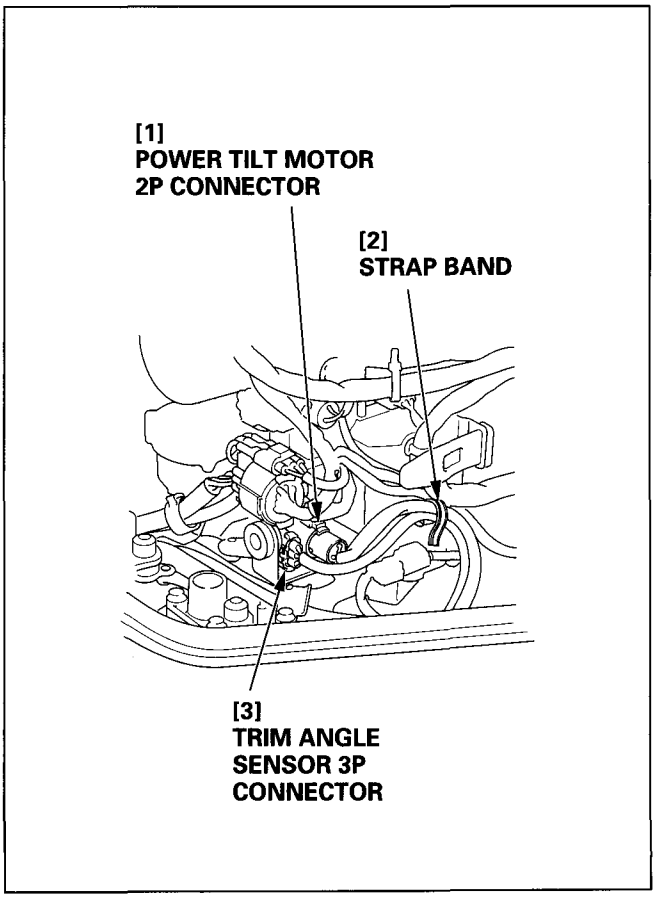
1) Pass the trim angle sensor wire harness and the power tilt motor wire harness through the hole in the engine under cover.
Install the undercase grommet securely to the engine under cover.



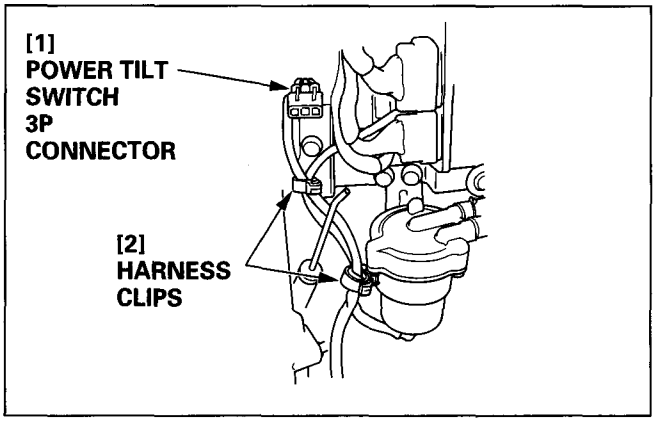
2) Install the wire harness clip to the engine under cover with the 5 x 10 mm rivet screw.



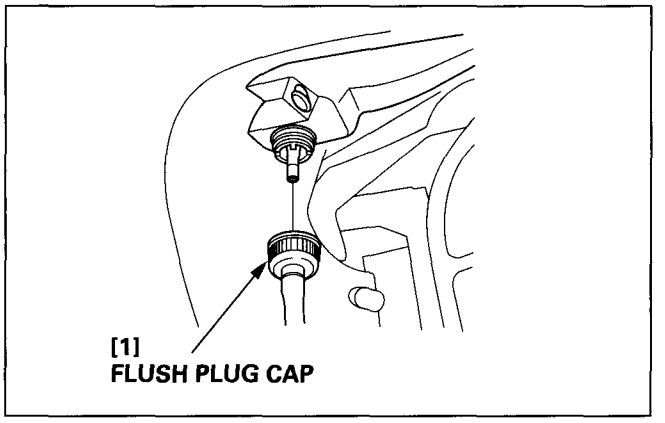
3) Connect the trim angle sensor 3P connector and the power tilt motor 2P connector, and tighten the wire harness with the strap band.



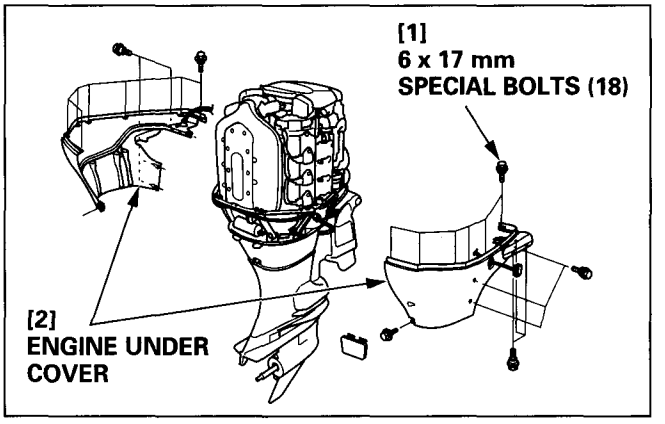
4) Connect the power tilt switch 3P connector and clamp the harness with the harness clips securely.

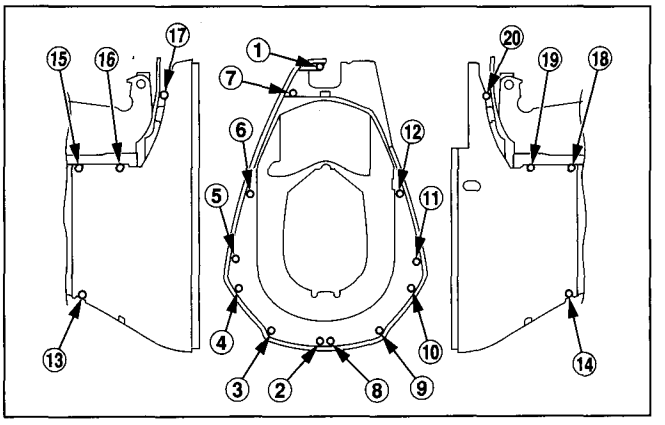


5) Install the flush plug cap.



6) Install the left/right engine under cover with the 6 x 17 mm special bolts.



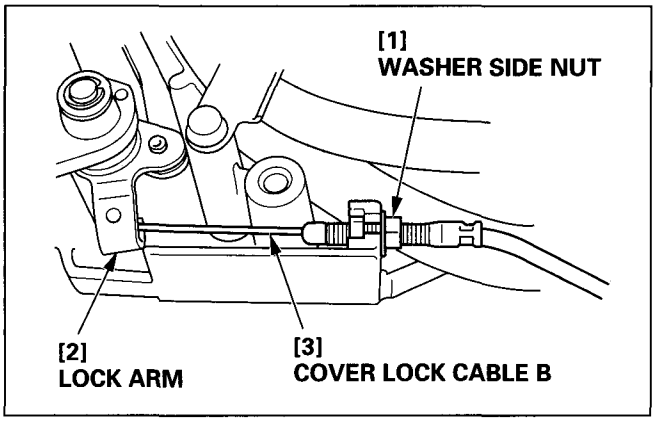


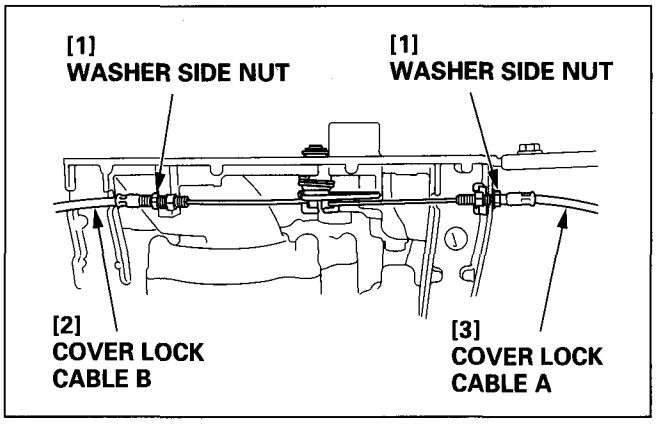
5. COVER LOCK CABLE/ENGINE COVER BRACKET

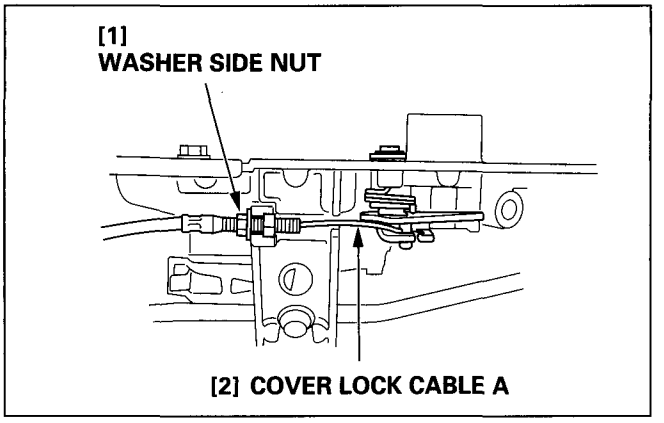
• COVER LOCK CABLE

a. REMOVAL

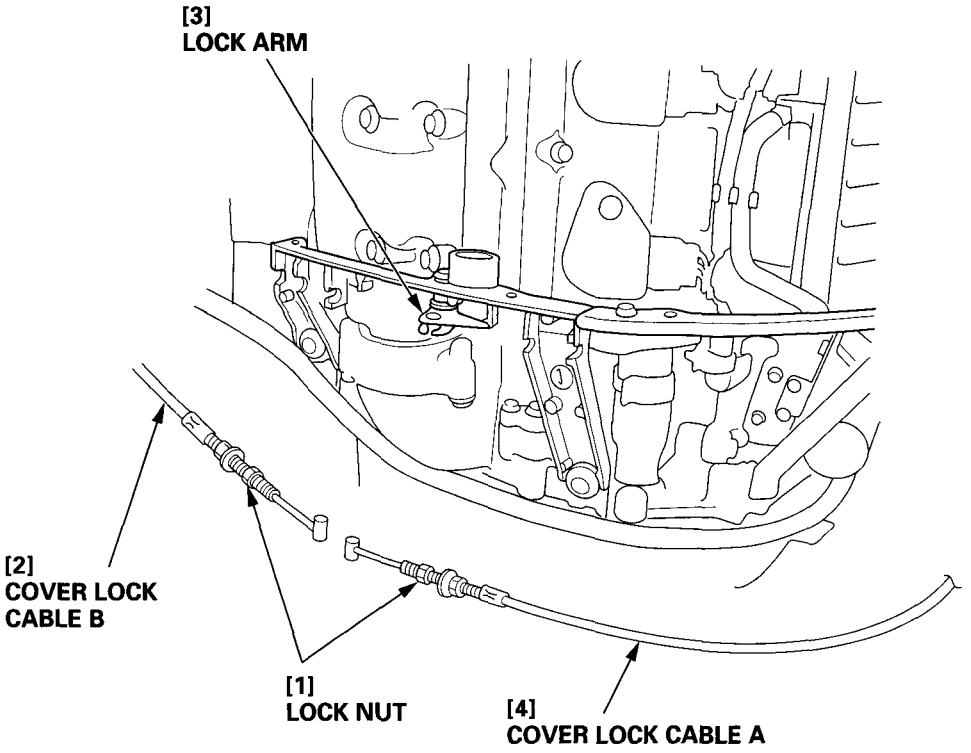
1) Loose the washer side nuts of the cover lock cables, and remove the cover lock cable A and B.

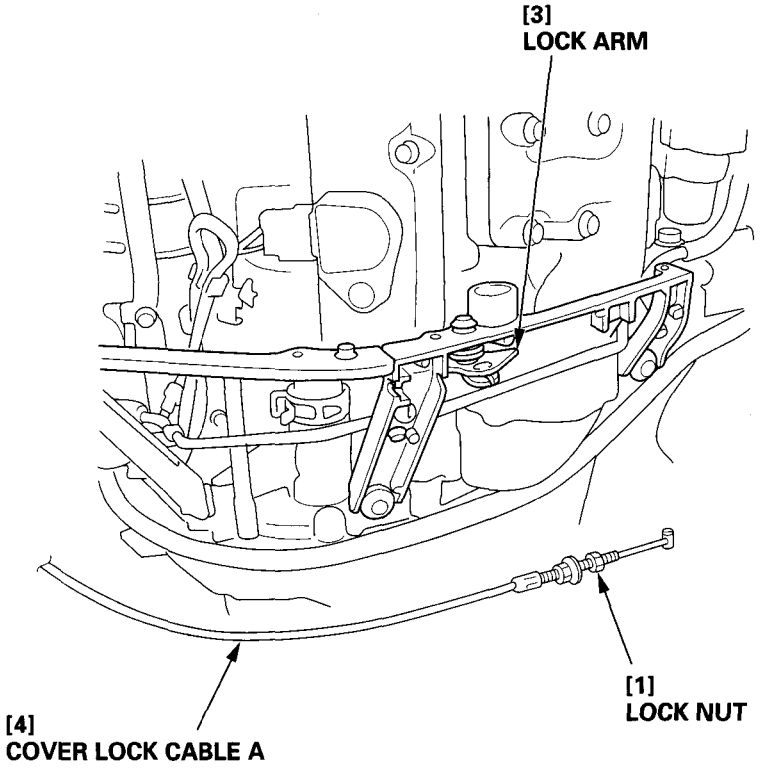






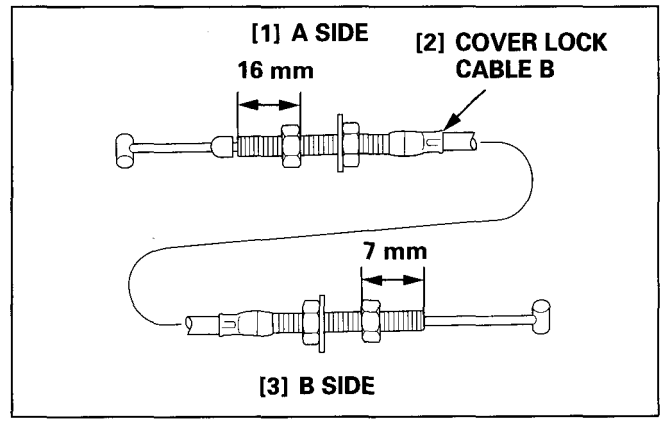
b. EXPLODED VIEW



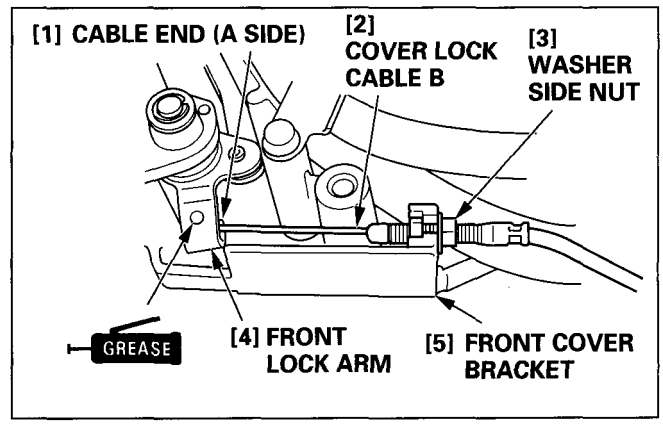


C. INSTALLATION/ADJUSTMENT

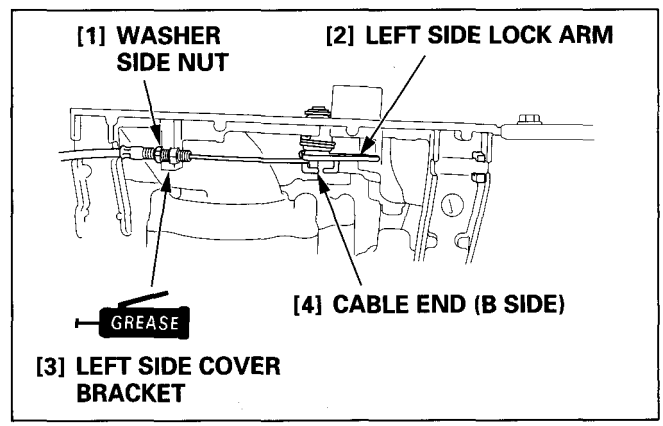
1) Align the adjust nut position of the cover lock cable B (shorter cable) to the measure position as shown.



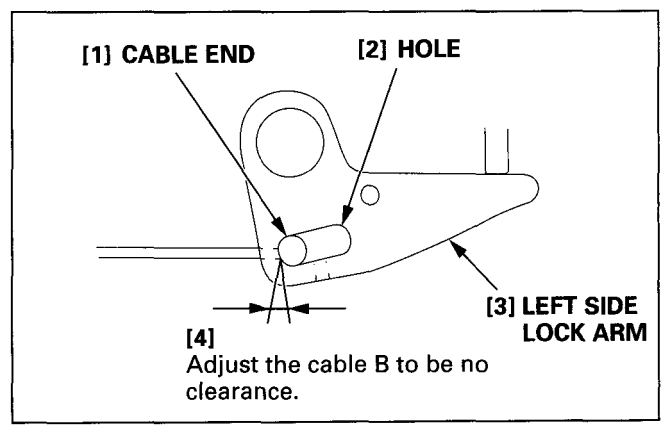
2) Insert the cable end (A side) of the cover lock cable B to the front lock arm.
Install the cover lock cable B so that the cable align with the groove of the front cover bracket, and tighten the washer side nut.



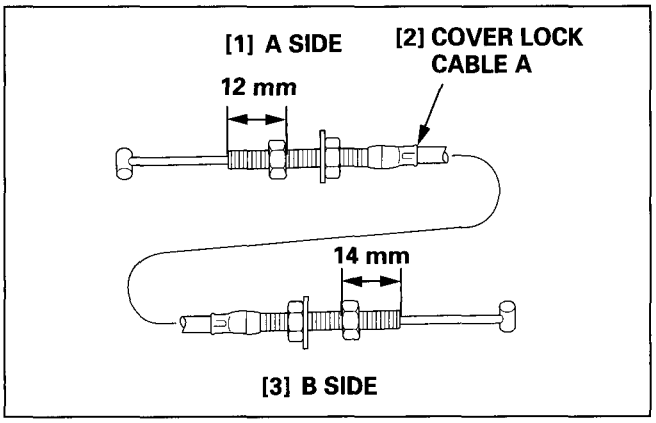
3) Insert the cable end (B side) of the cover lock cable B to the left side lock arm.
Install the cover lock cable B so that the cable align with the groove of the left side cover bracket, and tighten the washer side nut.



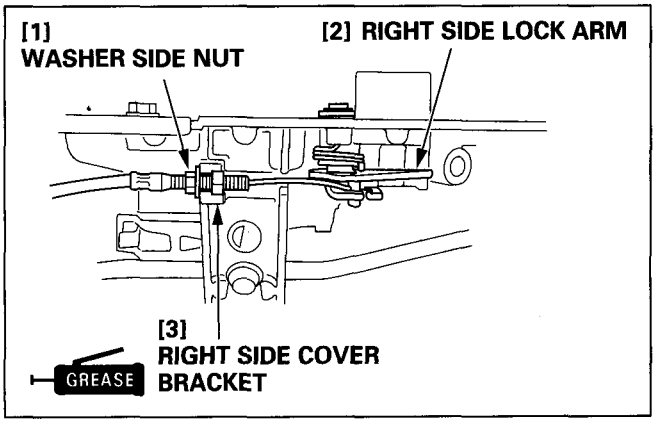
4) Be carefull to be no clearance between the hole of the left side lock arm and the cable end.
Re-adjust if there is clearance.



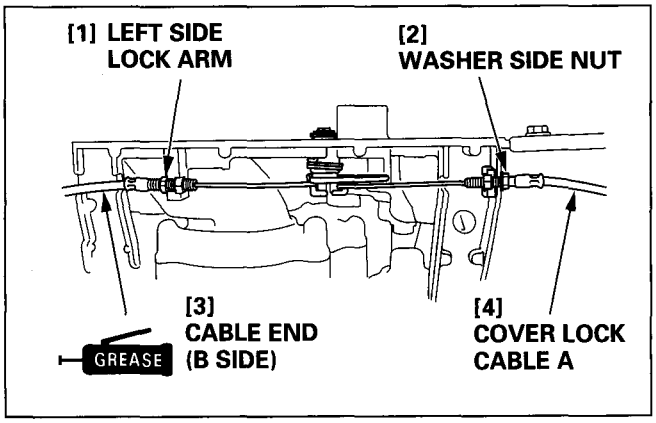
5) Align the adjust nut position of the cover lock cable A (longer cable) to the measure position as shown.



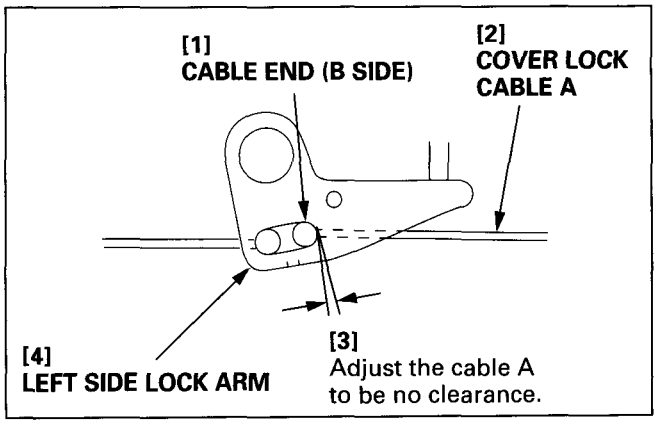
6) Insert the cable end (A side) of the cover lock cable A to the right side lock arm.
Install the cover lock cable A so that the cable align with the groove of the right side cover bracket, and tighten the washer side nut.



7) Insert the cable end (B side) of the cover lock cable A to the left side lock arm.
Tighten the washer side nut.



8) Then, be carefully to be no clearance between the hole of the left side lock arm and the cable end.
Re-adjust in the nut position of the left side cover bracket side if there is a clearance.

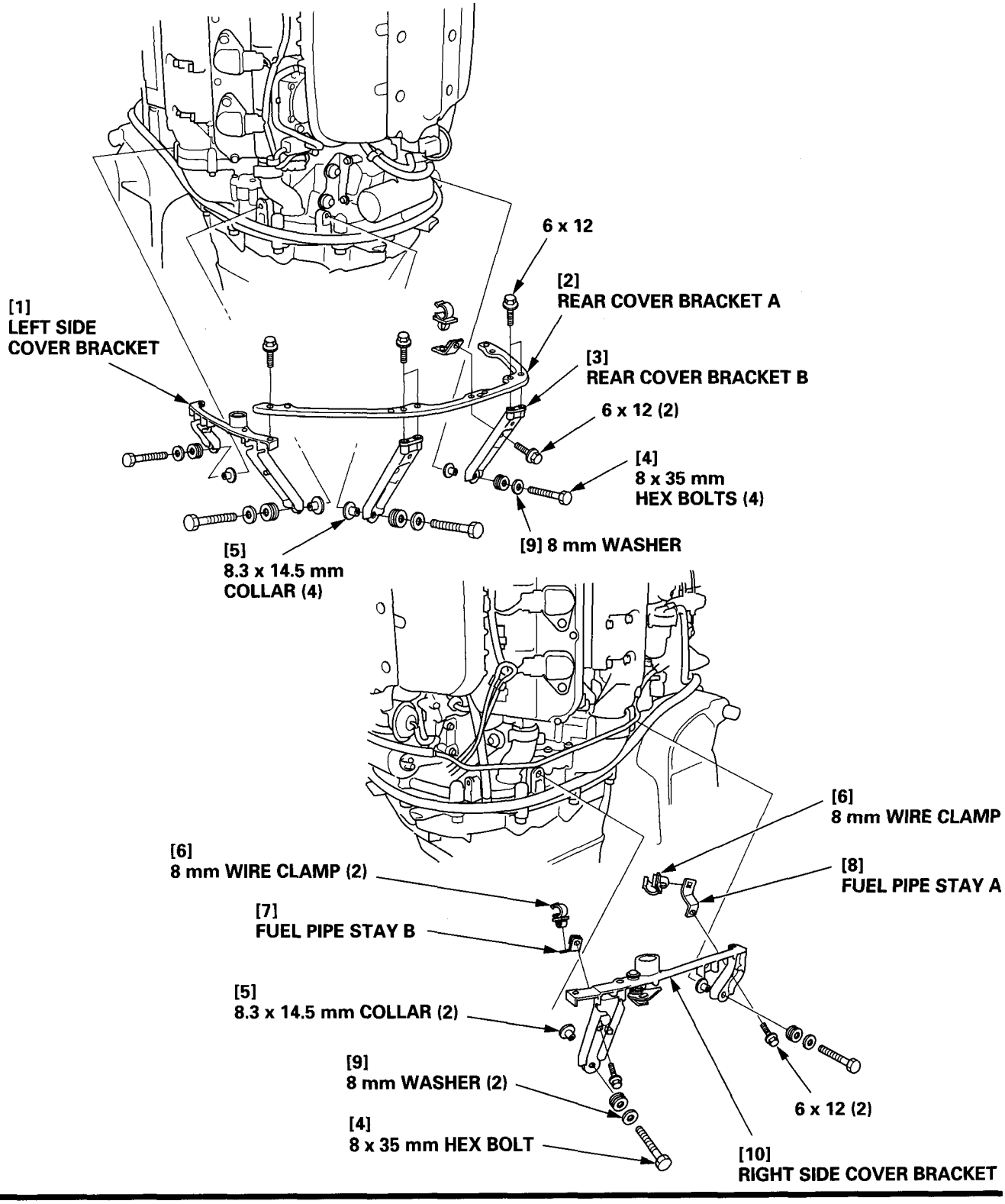


• ENGINE COVER BRACKET

a. Removal/Installation

Loose the washer side nuts of the cover lock cables A and B, and remove the cover lock cables A and B from the each lock arm.

b. EXPLODED VIEW



6. FRONT LOCK ASSEMBLY/FRONT COVER BRACKET

a. REMOVAL

1) Remove the engine cover (P.4–1).

2) Remove the electric parts cover (P.4–4).

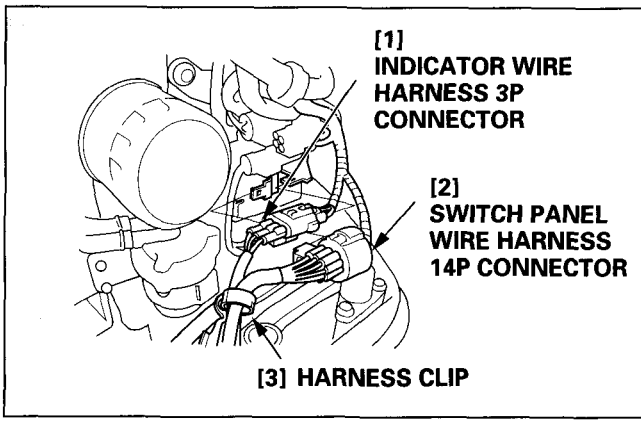
3) Remove the front separate cover (P.4–3).

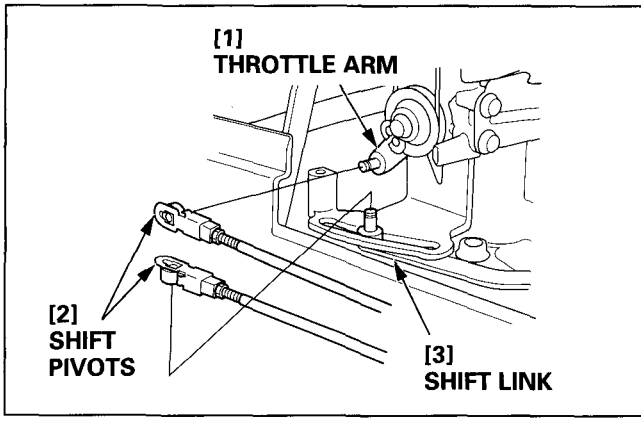
4) Disconnect the indicator wire harness 3P connector and the switch panel wire harness 14P connector.

5) Remove the indicator wire harness and the switch panel wire harness from the wire harness clip.

6) Shift the remote control lever in "N" (neutral) position.

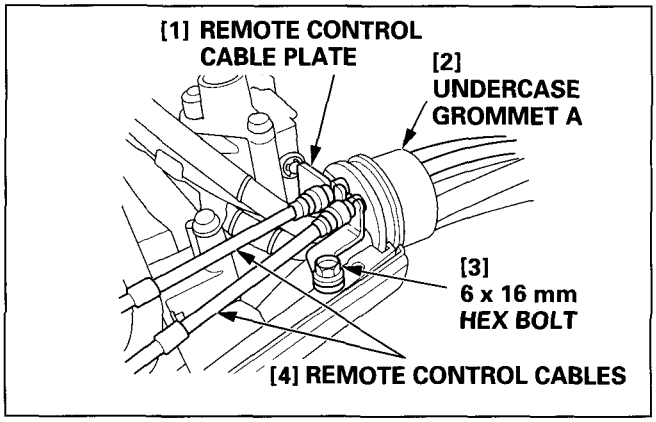
7) Remove the shift pivots from the throttle arm and the shift link.



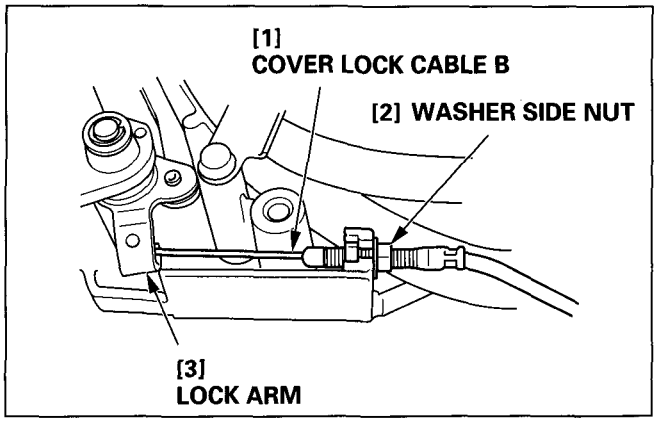


8) Remove the band of the undercase grommet A and the remote control cables.

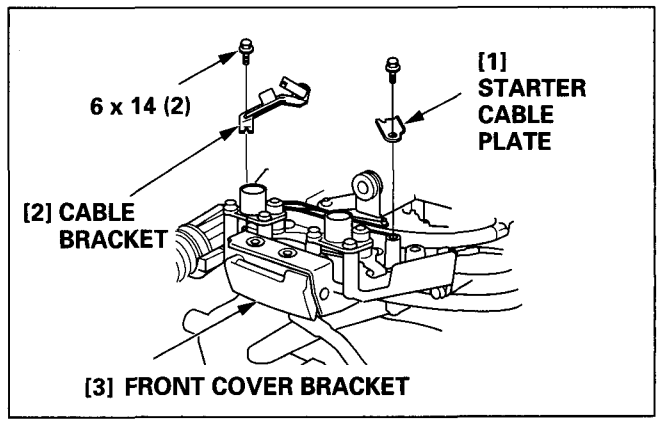
9) Remove the 6 x 16 mm hex bolt and the remote control cable plate.



10) Loosen the washer side nut of the cover lock cable B and remove the cover lock cable from the lock arm of the front lock assembly.



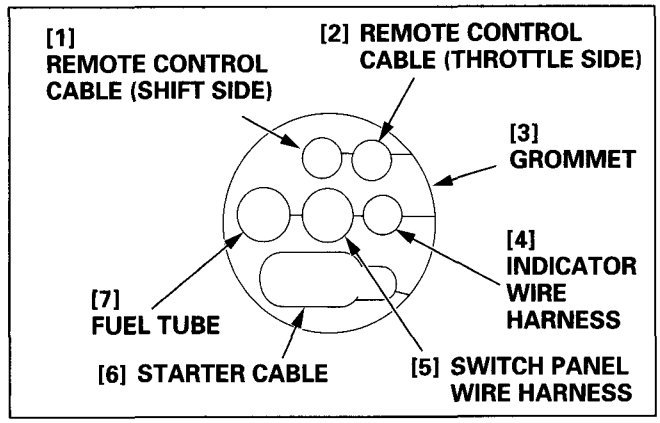
11) Remove the 6 x 14 mm flange bolt and the cable bracket and the starter cable plate.



12) Remove the indicator wire harness, switch panel wire harness, starter cable and the fuel tube.

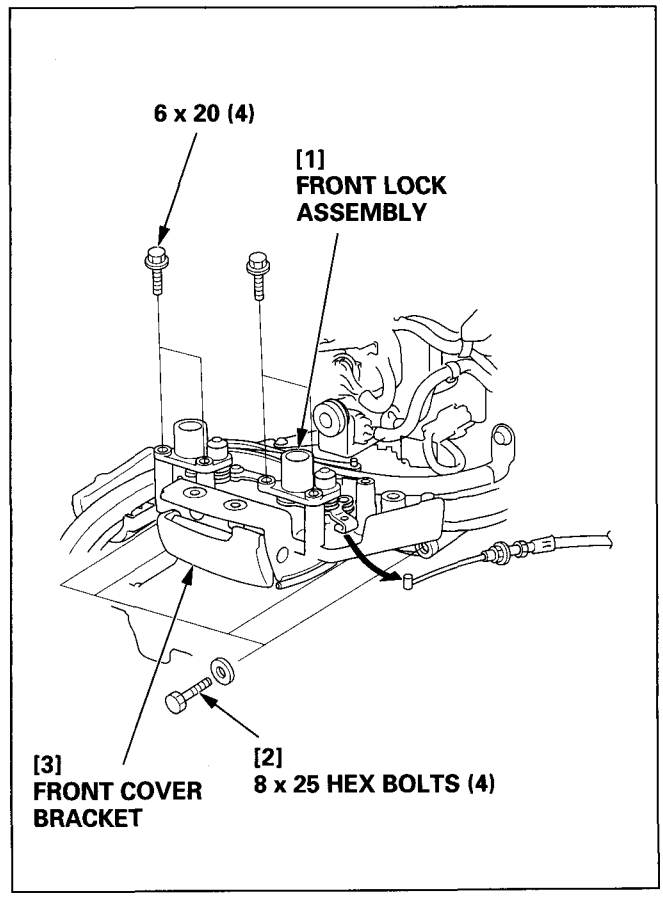
13) Remove the undercase grommet A from the front cover bracket.

14) Be careful not to damage the starter cable by its weight, using a string, hang the starter cable from the engine hunger bracket.

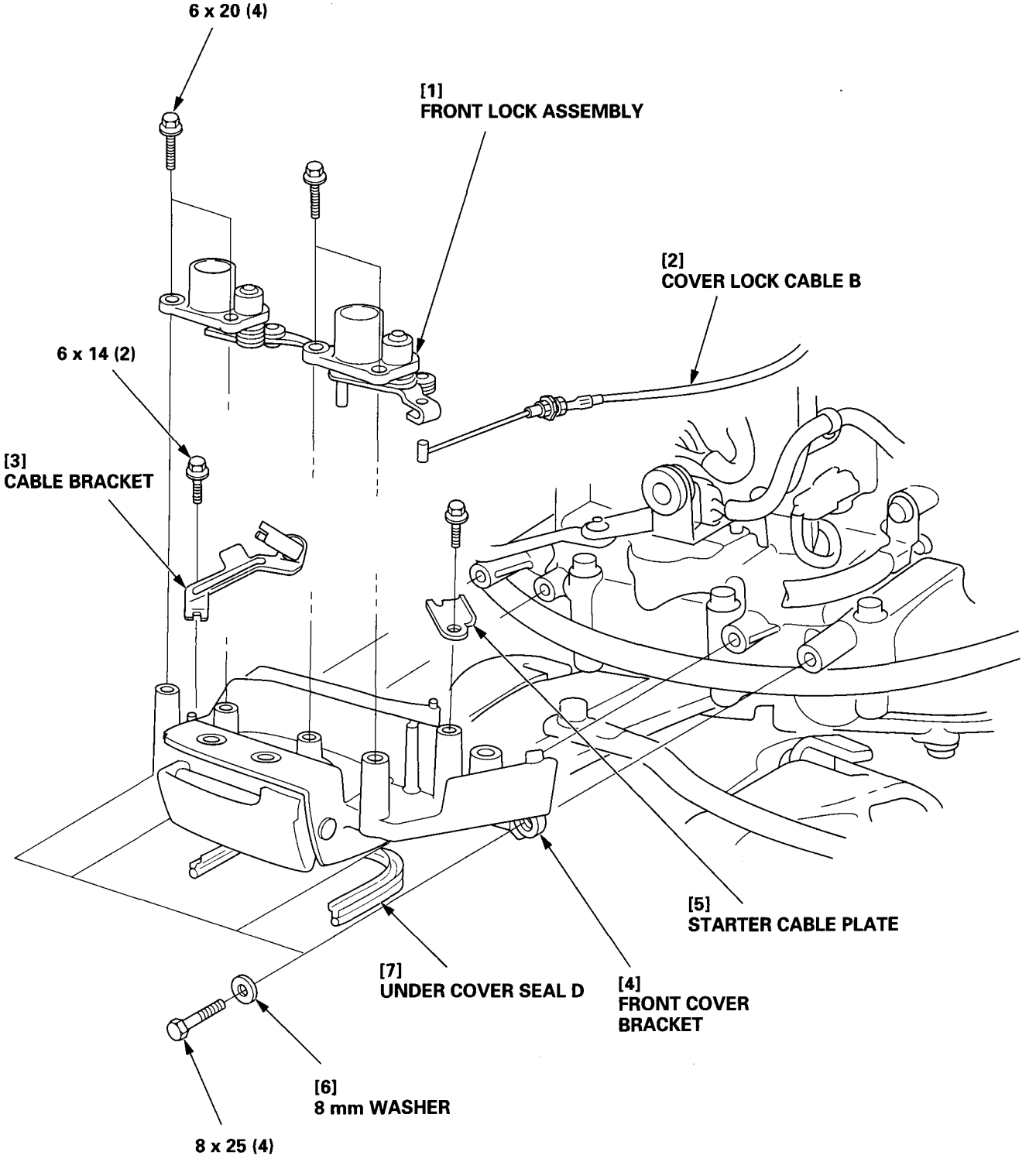


15) Remove the four 8 x 25 mm hex bolts and the front cover bracket.

16) Remove the four 6 x 20 mm flange bolts and the front lock assembly from the front cover bracket.



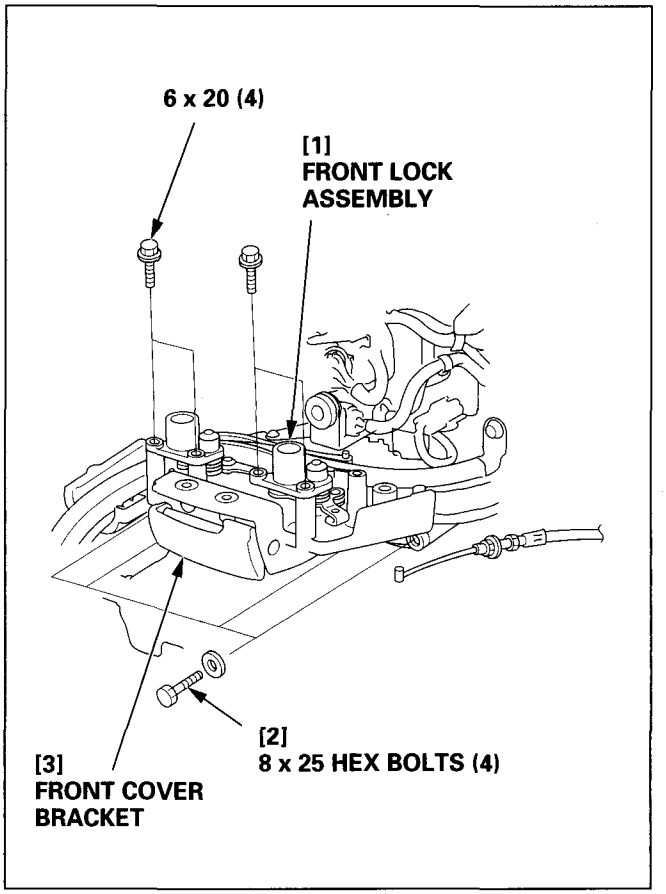
b. EXPLODED VIEW



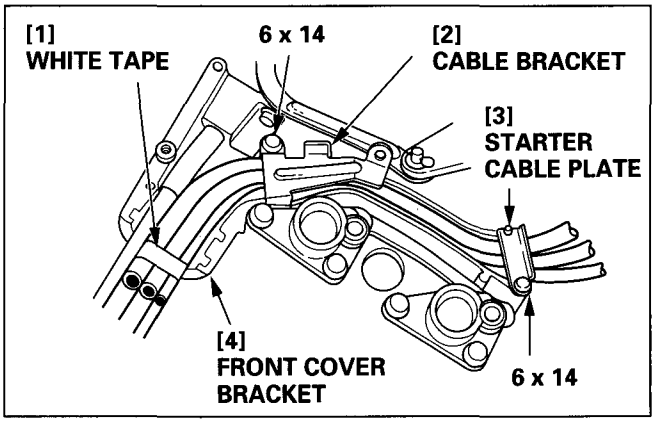
C. INSTALLATION

1) Tighten the front lock assembly to the front bracket cover with the four 6 x 20 mm flange bolts.

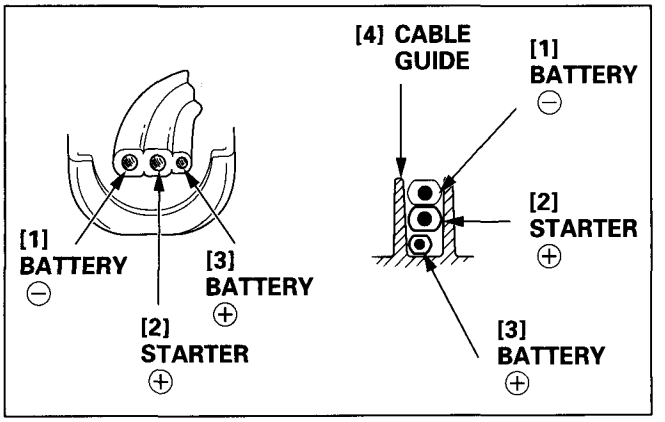
2) Tighten the front cover bracket to the mounting case with the four 8 x 25 mm hex bolts, and install the under cover seal D.



3) Insert the starter cable to the groove of the front cover bracket, and tighten the starter cable plate and the cable bracket with the 6 x 14 mm flange bolt.

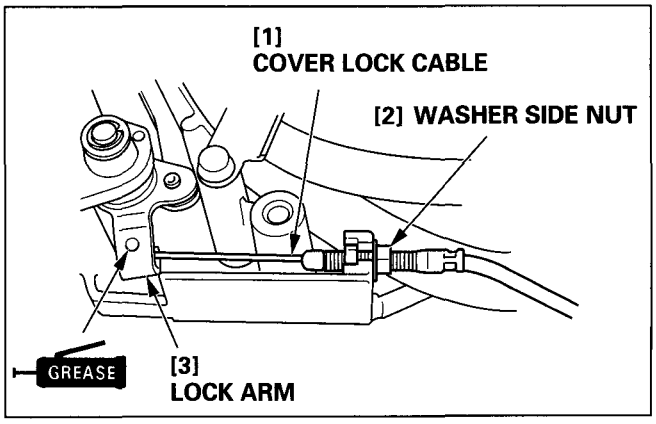


4) Pass the indicator wire harness, switch panel wire harness, starter cable and the fuel tube through the undercase grommet A, and install the grommet A to the front cover bracket (P.17-25).



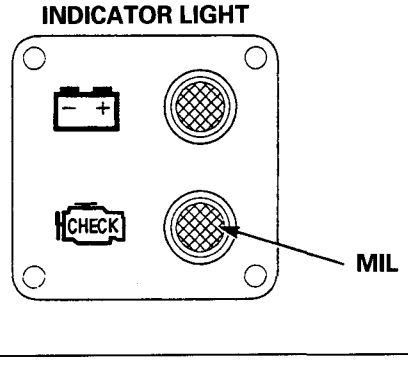
5) Install the cover lock cable B to the front lock arm and tighten the washer side nut.

6) After installing the cover lock cable B, adjust the cover lock cable (P. 4-12).



1. SERVICE PRECAUTIONS

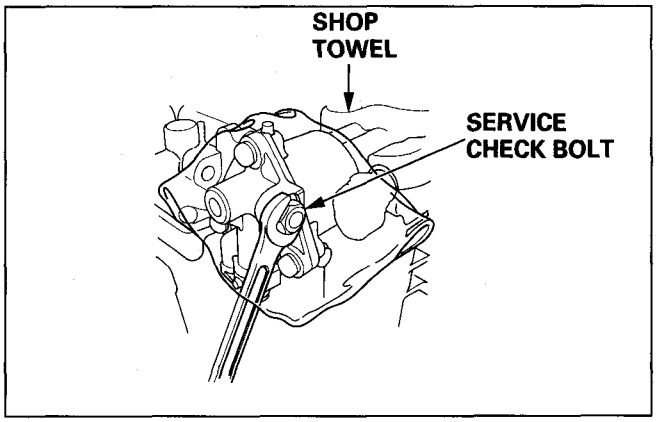
1) **Programmed-fuel injection (PGM-FI) troubleshooting**
   - First, check the MIL of the indicator.
   - Be sure to turn the ignition switch OFF before disconnecting and connecting the ECM connector.
   - After inspection and repair, reset the ECM memory (P. 5-8).

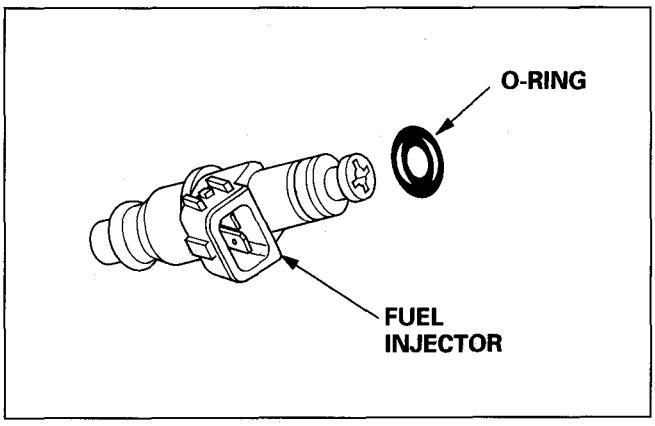


2) **Fuel line removal/installation**
   - Do not smoke while working on the fuel system. Keep open flame or sparks away from the work area.
   - Disconnect the battery cable from the battery negative (–) terminal.
   - Before removing and installing the fuel line, relieve the fuel pressure by loosening the service check bolt, as described in of "How to relieve fuel pressure (P. 5-69)".

   Service check bolt torque: 12 N•m (1.2 kgf•m, 9 lbf•ft)

   - Replace the sealing washers when the fuel pressure is relieved and/or the fuel line is disassembled.



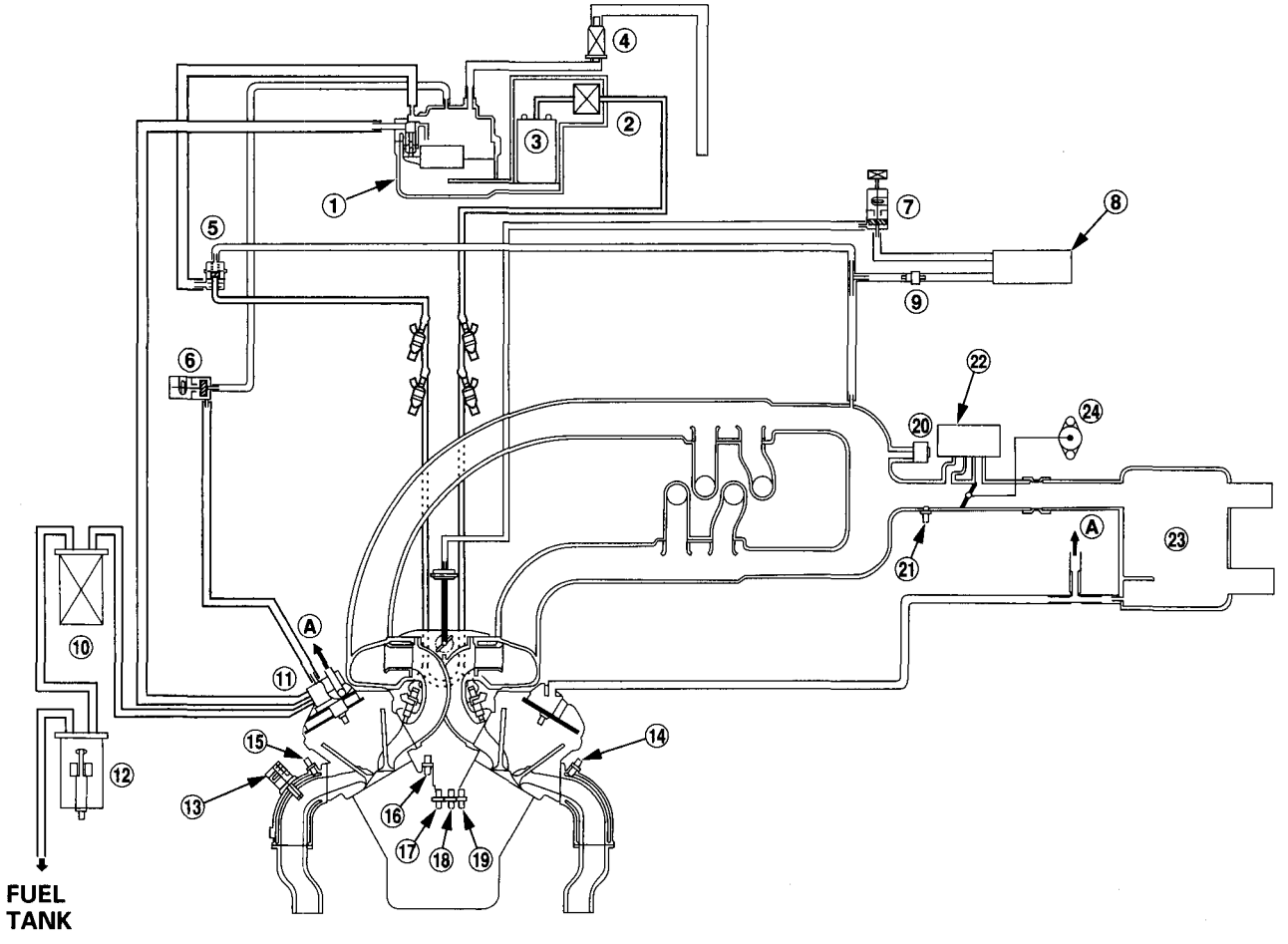


3) **Check after operation:**
   - Check the parts for secure installation and the bolts, screws and other fasteners for secure tightening.
   - Connect the battery cable to the battery negative (–) terminal.

4) **Fuel leak check:**
   - Turn the ignition switch ON (but do not turn the starter) after connecting the fuel lines. The fuel pump unit should operate for approximately 2 seconds and the fuel pressure in the high pressure side fuel line should rise. Repeat this operation 2 or 3 times and check for fuel leakage.

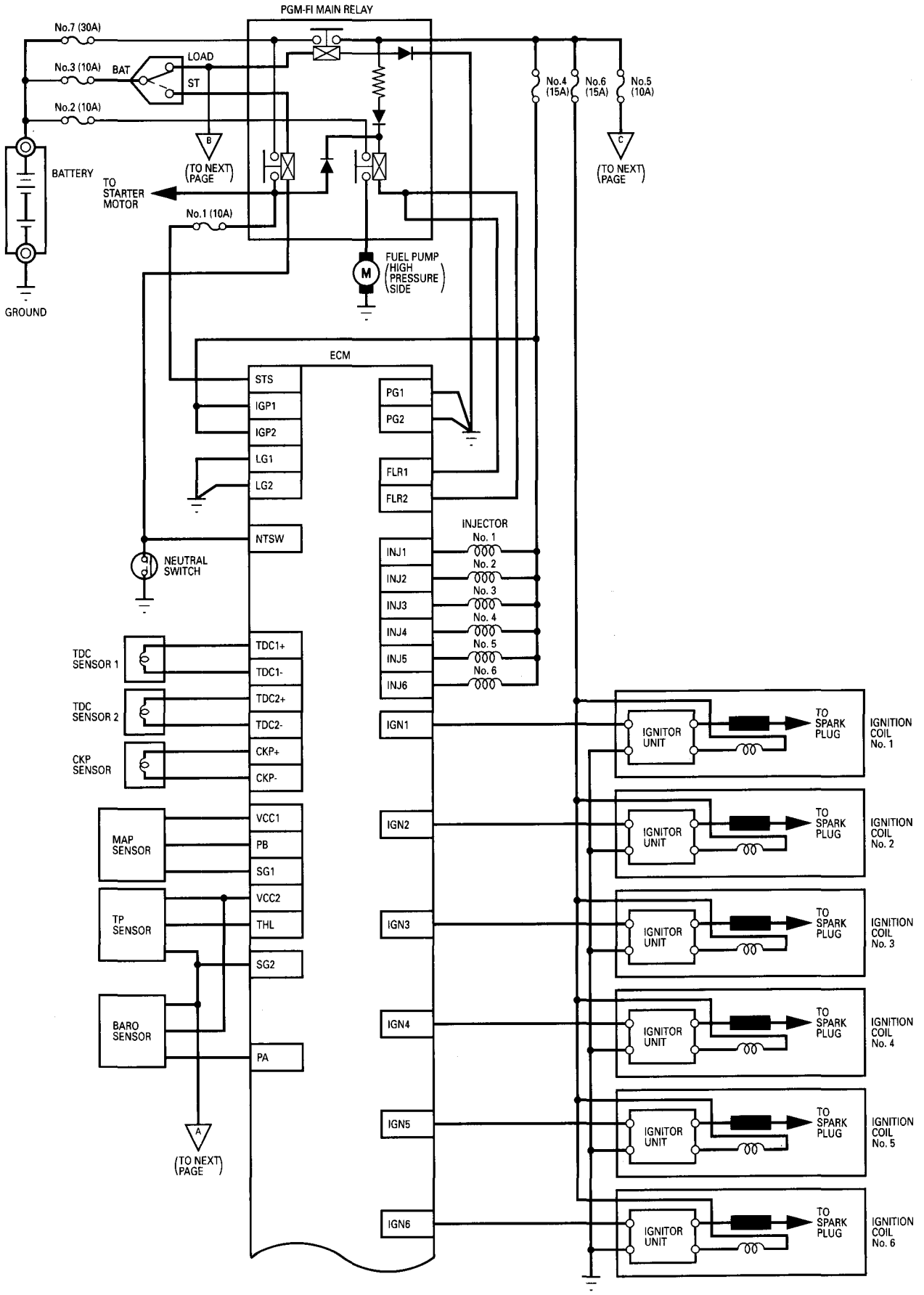
5) **When the boat is equipped with radio equipment:**
   The ECM and its wires are designed to be unaffected by radio waves. However, the ECM can malfunction when it senses an extremely powerful electric wave. Note the following to avoid malfunction of the ECM.
   - Install the antenna and the body of the radio equipment at least 50 cm (20.0 in) away from the ECM, remote control cable A/B and the remote control box.
   - Antenna wire must not be too long compared with the remote control cable A and other cables/wires.
   - Do not mount radio equipment of large output power on the boat. (The maximum output power of the radio equipment should be 10 W when mounted on a boat.)

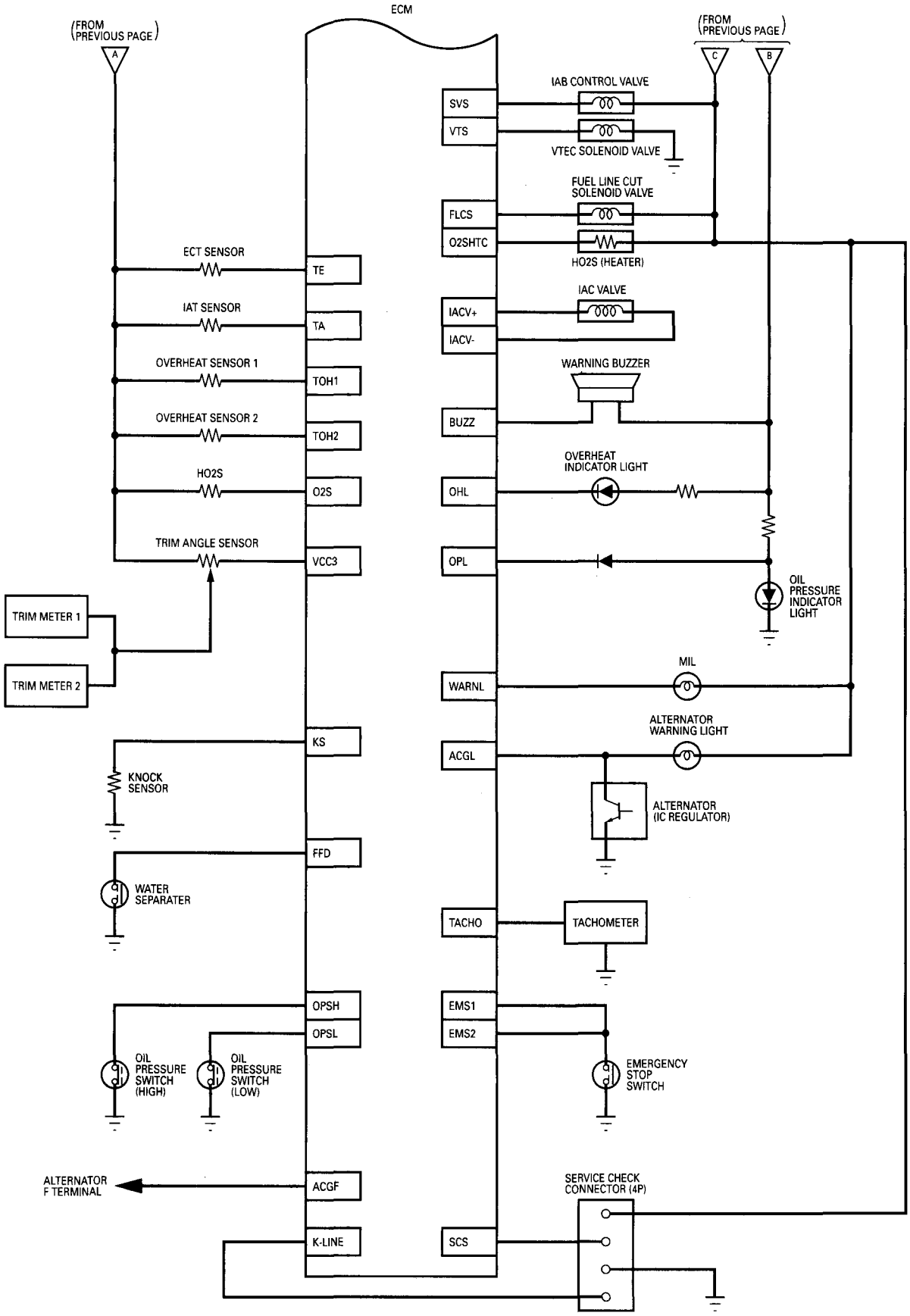
2. VACUUM CONNECTIONS



① Vapor separator
② Fuel strainer (high pressure side)
③ Fuel pump (high pressure side)
④ Vapor chamber
⑤ Pressure regulater
⑥ Fuel line cut solenoid valve
⑦ IAB control valve
⑧ Vacuum tank
⑨ Check valve
⑩ Fuel strainer (low pressure side)
⑪ Fuel pump (low pressure side)
⑫ Water separater (with water level sensor)
⑬ Heated oxygen sensor (H02S)
⑭ Overheat sensor 1
⑮ Overheat sensor 2
⑯ Knock sensor
⑰ Engine temperature sensor
⑱ Oil pressure switch (high pressure side)
⑲ Oil pressure switch (low pressure side)
⑳ MAP sensor
㉑ IAT sensor
㉒ IAC valve
㉓ Silencer case
㉔ TP sensor

3. CIRCUIT DIAGRAM




ECM
(FROM PREVIOUS PAGE)
A
(FROM PREVIOUS PAGE)
C
B
IAB CONTROL VALVE
SVS
VTS
VTEC SOLENOID VALVE
FUEL LINE CUT SOLENOID VALVE
FLCS
O2SHTC
HO2S (HEATER)
ECT SENSOR
TE
IAT SENSOR
TA
IAC VALVE
IACV+
IACV-
OVERHEAT SENSOR 1
TOH1
WARNING BUZZER
BUZZ
OVERHEAT SENSOR 2
TOH2
OVERHEAT INDICATOR LIGHT
HO2S
O2S
OHL
TRIM ANGLE SENSOR
VCC3
OPL
OIL PRESSURE INDICATOR LIGHT
TRIM METER 1
TRIM METER 2
MIL
WARNL
ALTERNATOR WARNING LIGHT
KS
ACGL
KNOCK SENSOR
ALTERNATOR (IC REGULATOR)
FFD
WATER SEPARATER
TACHO
TACHOMETER
OPSH
EMS1
OPSL
EMS2
OIL PRESSURE SWITCH (HIGH)
OIL PRESSURE SWITCH (LOW)
EMERGENCY STOP SWITCH
ALTERNATOR F TERMINAL
ACGF
SERVICE CHECK CONNECTOR (4P)
K-LINE
SCS

4. TROUBLESHOOTING

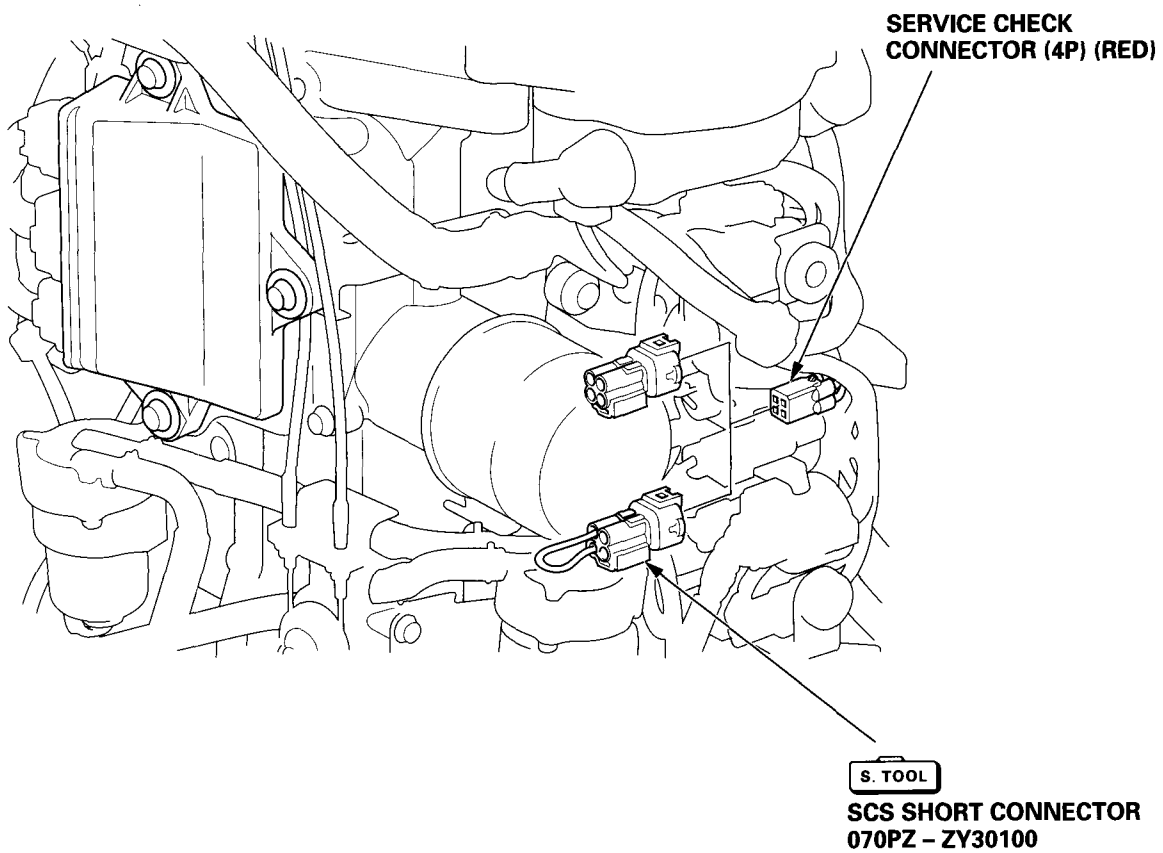
The ECM (Engine Control Module) has the self-diagnosis function which turns the MIL (Malfunction Indicator Lamp) ON when it detects an abnormality with the input/output system. Short-circuit the service check connector when then MIL is ON. The MIL should blink indicating the probable problem part by the number and length of the blinks. When multiple problems occur simultaneously, the MIL can indicate them by blinking separate codes, one after another.
Codes 10 and after are indicated by a series of long and short blinks. The number of long blinks equals the first digit and the number of short blinks equals the second digit. When the overheat sensor (TOH1 or TOH2) is faulty, the overheat light as well as the MIL should blink simultaneously.

If the ECM body is faulty, the MIL turns ON and it stays ON when the service check connector is short-circuited. If the MIL blinks by short-circuiting the service check connector, detect the probable problem part by referring to the Troubleshooting Guide on page 5-14, and troubleshoot following the troubleshooting flow chart.

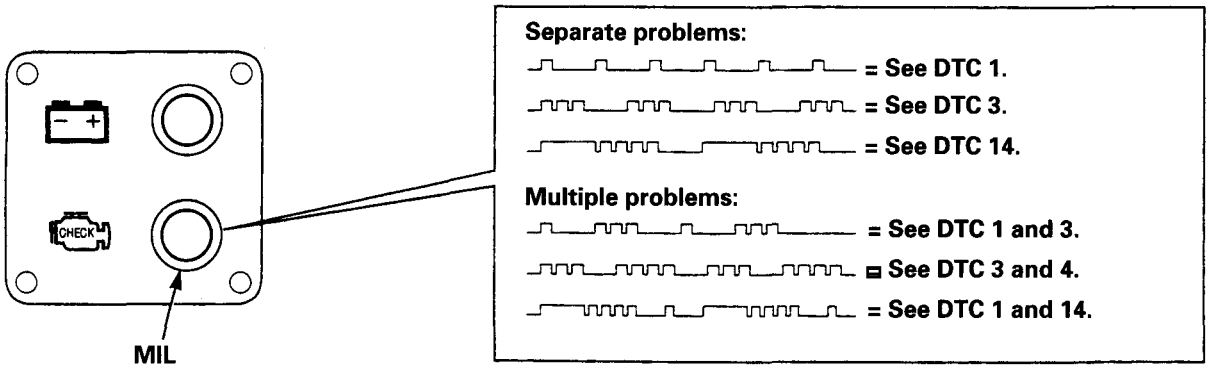
Observe the following instruction when using the troubleshooting flow chart.

I. Lighting and blinking procedure of MIL

1) Allow the MIL to blink.
When the MIL is ON, short-circuit the 4P service check connector (Red connector) located inside the electric parts cover using the special tool (SCS short connector).



2) Check the number of blinks.
Count the number of blinks when the MIL starts blinking. The diagnostic trouble code (DTC) is indicated repeatedly. The number of long blinks equals the first digit and the number of short blinks equals the second digit of the DTC.



II. ECM reset procedure

- Perform the following steps 4 through 6 within 20 seconds to reset the ECM.

1) Turn the ignition switch OFF.

2) Short-circuit the 4P service check connector (red) located inside the electric parts cover using the special tool (SCS connector). (P. 5-6)

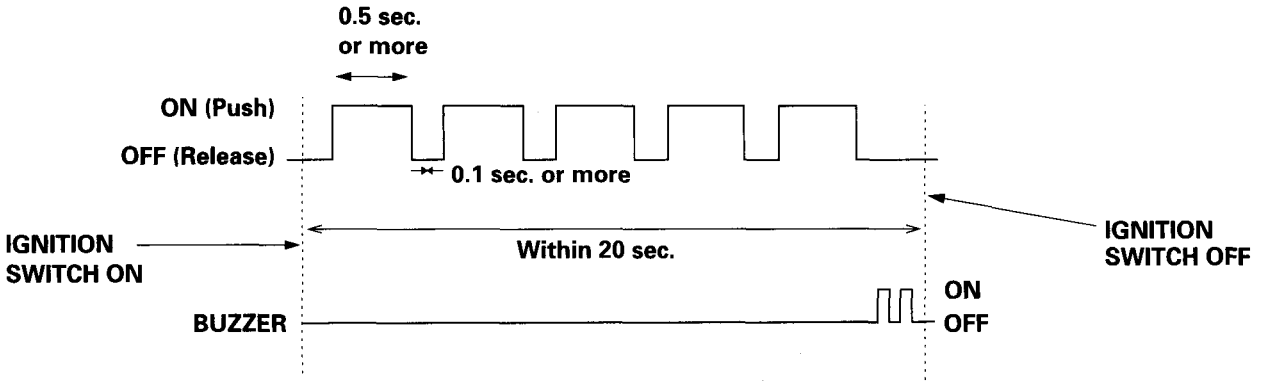
3) Turn the ignition switch ON.

4) With the lanyard clip engaged in the emergency stop switch, press the emergency stop switch for 0.5 seconds or more, then release the switch for 0.1 seconds or more. Repeat this procedure 5 times.

   Proceed immediately to steps 5 and 6. Steps 4 through 6 must be performed within 20 seconds.

5) Be sure that the buzzer sounds twice.
   - The MIL should stay ON.

6) Turn the ignition switch OFF. (ECM reset procedure completes.)



III. Final procedure (After troubleshooting)

1) Disconnect the SCS connector from the service check connector.

   - Note that the MIL stays ON while the SCS connector is connected to the service check connector.

2) Be sure to reset the ECM after troubleshooting.

The MIL can turn ON or blink when the ECM detected poor or loose contact of a connector. If it is hard to identify the problem part by following the troubleshooting flow chart, check the three connectors of the ECM and the connector of the probable problem part and clean or repair the connector(s) if necessary.

If the problem cannot be identified by the above procedure, check by following the troubleshooting flow chart for the intake air system (P. 5-66) and the fuel supply system (P. 5-58).

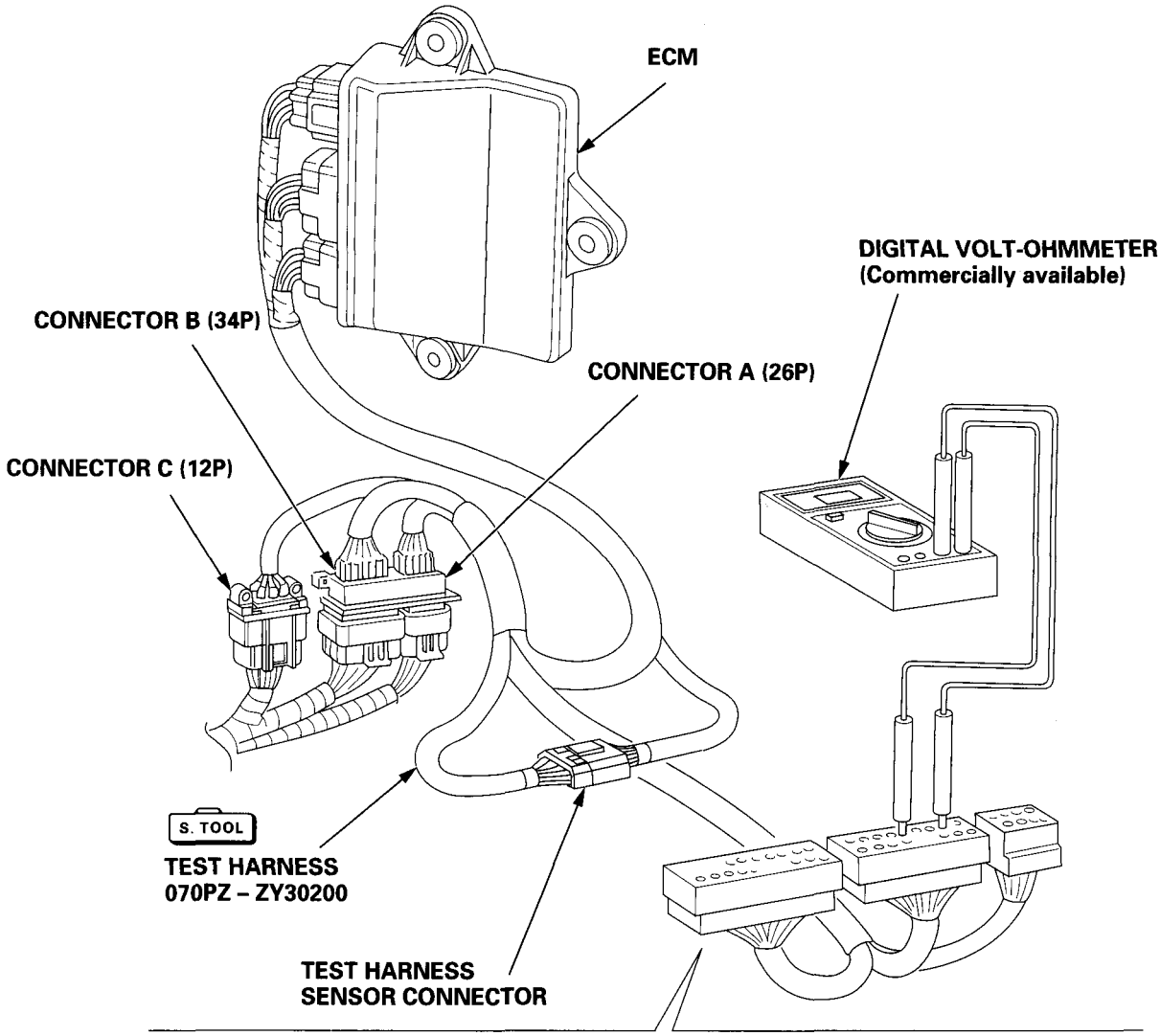
<Troubleshooting precautions>

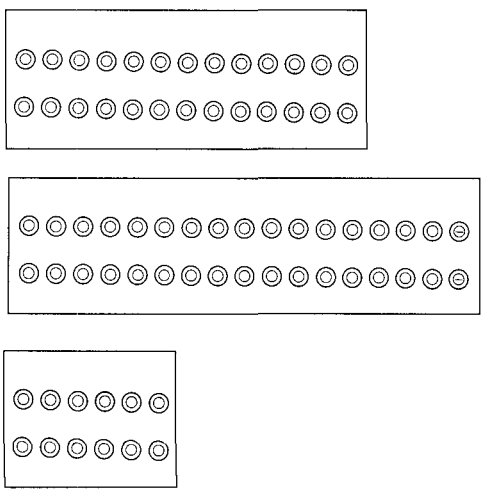
- The MIL goes OFF when the ignition switch is turned OFF, and it does not turn ON again when the ignition switch is ON unless the abnormality is detected again.
  The MIL blinks when the SCS connector is connected to the 4P (red) service check connector and the ignition switch is turned ON, because the memory of the problem is stored in the ECM. Turn the ignition switch ON again and, even though the MIL does not turn ON again, connect the SCS connector to the 4P (red) service check connector to short and check the DTC.

- When the ignition switch is turned ON with the special tool (test harness) disconnected during the inspection per the troubleshooting flow chart, the MIL can turn ON. Be sure to reset the ECM.

Use the test harness (special tool) and a commercially available digital volt-ohmmeter for the inspection per the troubleshooting flow chart.

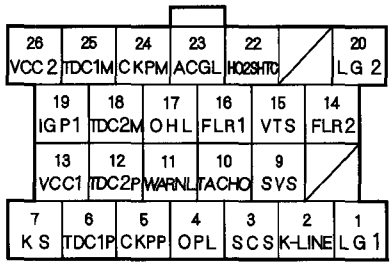
Disconnect the test harness sensor connector if instructed to do so during the inspection.





PROGRAMMED FUEL INJECTION SYSTEM

• ECM TERMINAL ARRANGEMENT

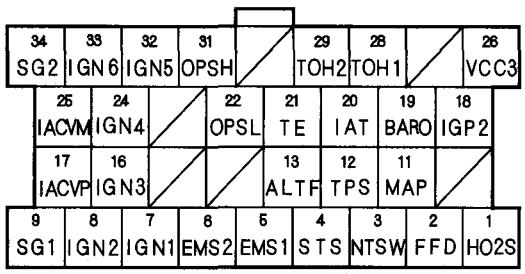


Harness side connector viewed from front side

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

ECM Connector A (26P)

Terminal No.	Wire color	Terminal	Name	Content	Signal
1	G/Bl	LG1	Logic ground 1	Ground for the ECM control circuit.	
2	Bu	K-LINE	ECM check terminal	Sends and receives the Honda PGM tester signal	With ignition switch ON : about 12 V
3	Lg/W	SCS	Service check signal	Detects the service check connertor (4P) signal for DTC code.	With the terminal connected : about 0 V With the terminal disconnected : about 5 V
4	Y	OPL	Oil pressure light	Drives oil pressure light.	With oil pressure light ON : about 0 V With oil pressure light OFF : about 0 V
5	Bu	CKPP	CKP sensor (+) side	Detects CKP sensor.	With the engine running : pulses
6	G	TDC1P	TDC sensor 1 (+) side	Detects TDC sensor.	With the engine running : pulses
7	R/Bu	KS	Knock sensor	Detects KS signal.	With the engine running : pulses
9	Bl	SVS	Intake air bypass control solenoid	Drives IAB solenoid vaive.	With engine at low rpm : about 0 V With engine at high rpm : battery voltage
10	Gr	TACHO	Tachometer	Outputs the eingine running signal	With the engine running : pulses
11	R/Bu	WARNL	MIL (Malfunction indicator lamp)	Drives MIL.	With the MIL turned ON : about 0 V With the MIL turned OFF : battery votage
12	Y	TDC2P	TDC sensor 2 (+) side	Detects TDC sensor.	With the engine running : pulses
13	Br/Y	VCC1	Sensor output voltage 1	Outputs the sensor voltage.	With ignition switch ON : about 5 V With ignition switch OFF : about 0 V
14	Lg/R	FLR2	Fuel pump 2	Drives the fuel pump relay.	2 seconds after ignition switch ON : about 0 V After 2 seconds : battery voltage With the engine running : about 0 V
15	G/Y	VTS	VTEC solenoid valve	Drives VTEC solenoid valve.	With engine at low rpm : about 0 V With enigne at high rpm : battery voltage
16	Lg/R	FLR1	Fuel pump 1	Drives the fuel pump relay.	2 seconds after ignition switch ON : about 0 V After 2 seconds : battery voltage With the engine running : about 0 V
17	R	OHL	Overheat light	Drives overhear light.	With overheat light ON : about 0 V With overheat light OFF : battery voltage
18	Bl	TDC2M	TDC sensor 2 (–) side	Ground for TDC sensor 2.	
19	Y/Bl	IGR1	ECM main power 1	Power source for the ECM control circuit.	With ignition switch ON : battery voltage With ignition switch OFF : about 0 V
20	G/Bl	LG2	Logic ground 2	Ground for ECM control circuit.	
22	W/Bl	HO2S HTC	Heated oxygen sensor	Drives HO2S sensor.	With ignition switch ON : battery voltage With idling : pulses
23	W/Bu	ACGL	Alternator	Detects the alternator regulator signal.	With the alternator warning light ON : about 0 V With the alternator warning light OFF : battery voltage
24	W	CKPM	CKP sensor (–) side	Ground for CKP sensor	
25	R	TDC1M	TDC sensor 1 (–) side	Ground for TDC sensor	
26	Br/W	VCC2	Sensor output voltage 2	Outputs the sensor voltage.	With ignition switch ON : about 5 V With ignition switch OFF : about 0 V



Harness side connector viewed from front side

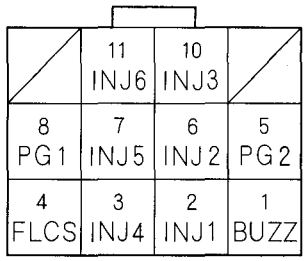
Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

ECM Connector B (34P)

Terminal No.	Wire color	Terminal	Name	Content	Signal
1	Bl/Y	HO2S	Heated oxygen sensor	Detects Air fuel ratio.	With throttle fully opened from idle with fully warmed up engine : above 0.6 V With throttle quickly closed : below 0.4 V
2	Br	FFD	Fuel strainer water level sensor	Detects water level in the fuel strainer.	With water level filled : about 0 V With no water : battery voltage
3	Bl/Bu	NTSW	Neutral switch	Detects neutral switch signal.	With neutral switch ON : about 0 V With neutral switch OFF : battery voltage
4	W	STS	Starter switch	Detects starter motor running.	With starter switch ON : battery voltage With starter switch OFF : about 0 V
5	Bl/R	EMS1	Emergency stop switch 1	Detects Emergency stop switch 1 signal.	With Emergency stop switch ON : about 0 V With Emergency stop switch OFF : battery voltage
6	Bl/R	EMS2	Emergency stop switch 2	Detects Emergency stop switch 2 signal.	With Emergency stop switch ON : about 0 V With Emergency stop switch OFF : battery voltage
7	Bu	IGN1	No. 1 ignition pulse	Outputs No. 1 ignition signal.	With ignition switch ON : about 0 V With engine running : pulses
8	Bu/Bl	IGN2	No. 2 ignition pulse	Outputs No. 2 ignition signal.	With ignition switch ON : about 0 V With enging running : pulses
9	G/R	SG1	Sensor ground 1	Ground for sensor.	
11	W/R	MAP	Manifold absolute pressure sensor	Detects Manifold absolute pressure.	With ignition switch ON : about 3 V At idle : about 1.5 V (depending on engine speed)
12	R/Bl	TPS	Throttle position sensor	Detects Throttle valve position.	With throttle fully opened : about 4.75 V With throttle fully closed : about 0.5 V
13	W/G	ALTF	Alternator FR signal	Detects the alterntor generation level.	With engine running with fully warmed up : about 0 – 5 V (depending on electrical load)
16	W/G	IGN3	No. 3 ignition pulse	Outputs No. 3 ignition signal.	Wtih ignition switch ON : about 0 V With engine running : pulses
17	G/W	IACVP	Idle air control valve (+) side	Drives IAC valve.	With engine running : duty controlled
18	Y/Bl	IGP2	ECM main power 2	Power source for the ECM control circuit.	With ignition switch ON : battery voltage With ignition switch OFF : about 0 V
19	W/Bu	BARO	Barometric pressure sensor	Detects Barometric pressure.	With ignition switch ON : about 3 V
20	R/Y	IAT	Intake air temperature sensor	Detects Intake air temperature.	With ignition switch ON : about 0.1 – 4.8 V (depending on intake air temperature)
21	R/W	TE	Engine temperature sensor	Detects Engine temperature.	With ignition switch ON : about 0.1 – 4.8 V (depending on engine speed)

ECM Connector B (34P)

22	P	OPSL	Low pressure oil pressure switch	Detects oil pressue.	With oil pressure switch ON : about 0 V With oil pressure switch OFF : battery voltage
24	Bu/R	IGN4	No. 4 ignition pulse	Outputs No. 4 ignition signal.	With ignition switch ON : about 0 V With engine running : pulses
25	Bl	IACVM	Idle air control valve (–) side	Drives IAC valve.	With engine running : about 0 V – battery voltage pulses
26	Lg/Bl	VCC3	Sensor output voltage 3	Outputs the sensor voltage.	With ignition switch ON : about 5 V With ignition switch OFF : about 0 V
28	R/Bl	TOH1	Overheat sensor 1	Detects exhaust temperature.	With ignition switch ON : about 0.1 – 4.8 V (depending on exhaust temperature)
29	R	TOH2	Overheat sensor 2	Detects exhaust temperature.	With ignition switch ON : about 0.1 – 4.8 V (depending on exhaust temperature)
31	Y/R	OPSH	High pressure oil pressure switch	Detects oil pressure.	Oil pressure switch ON: about 0 V Oil pressure switch OFF : battery voltage
32	Bu/W	IGN5	No. 5 ignition pulse	Output No. 5 ignition signal.	With ignition switch ON : about 0 V With engine running : pulses
33	Bu/Y	IGN6	No. 6 ignition pulse	Outputs No. 6 ignition signal.	With ignition switch ON : about 0 V With engine running : pulses
34	G/R	SG2	Sensor ground 2	Ground for sensor.	



Harness side connector viewed from front side

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

ECM Connector C (12P)

Terminal No.	Wire color	Terminal	Name	Content	Signal
1	Y/G	BUZZ	Buzzer	Drives warning buzzer.	With buzzer sound : about 0 V With buzzer OFF : battery voltage
2	Br	INJ1	No. 1 fuel injector	Drives No. 1 fuel injector.	With engine running : depending on engine speed
3	Y	INJ4	No. 4 fuel injector	Drives No. 4 fuel injector.	With engine running : depending on engine speed
4	R	FLCS	Fuel line cut solenoid	Drives fuel line cut solenoid.	With ignition switch ON or start the engine when the engine is hot : depending on the engine temperature sensor With ignition switch OFF : battery voltage
5	G	PG2	Power ground 2	Ground for ECM control circuit.	
6	R	INJ2	No.2 fuel injector	Drives No. 2 fuel injector.	With engine running : depending on engine speed
7	Y/R	INJ5	No. 5 fuel injector	Drives No. 5 fuel injector.	With engine running : depending on engine speed
8	G	PG1	Power ground 1	Ground for ECM control circuit.	
10	Bu	INJ3	No. 3 fuel injector	Drives No. 3 fuel injector.	With engine running : depending on engine speed
11	Y/Bu	INJ6	No. 6 fuel injector	Drives No. 6 fuel injector.	With engine running : depending on engine speed

TROUBLESHOOTING GUIDE

No. of blinks of MIL	MIL	Probable problem part	Page
MIL does not come ON or does not blink.		• Open circuit in MIL wire • Blown MIL bulb • Open circuit in ECM ground wire • Faulty ECM	5-16, 20
MIL stays ON.		• Short circuit in service check connector wire • Short circuit in MIL wire • Short circuit in sensor system power supply line • Open circuit in power supply line for ECM • Faulty ECM	5-17
1		• Disconnected oxygen sensor connector • Short or open circuit in oxygen sensor wire • Faulty oxygen sensor • Spark plug misfire	5-26
3		• Disconnected MAP sensor connector • Short or open circuit in MAP sensor wire • Faulty MAP sensor	5-28
4		• Disconnected CKP sensor connector • Short or open circuit in CKP sensor wire • Faulty CKP sensor	5-30
6		• Disconnected ECT sensor connector • Short or open circuit in ECT sensor wire • Faulty ECT sensor	5-31
7		• Disconnected TP sensor connector • Short or open circuit in TP sensor wire • Faulty TP sensor	5-33
8		• Disconnected TDC sensor 1 connector • Short or open circuit in TDC sensor 1 wire • Faulty TDC sensor 1	5-30
10		• Disconnected IAT sensor connector • Short or open circuit in IAT sensor wire • Faulty IAT sensor	5-35
13		• Disconnected BARO sensor connector • Short or open circuit in BARO sensor wire • Faulty BARO sensor	5-37
14		• Disconnected IAC valve connector • Short or open circuit in IAC valve wire • Faulty IAC valve	5-45

No. of blinks of MIL	MIL	Probable problem part	Page
21 (BF225A)		• Disconnected VTEC solenoid valve connector • Short or open circuit in VTEC solenoid valve wire • Faulty VTEC solenoid valve	5-43
23		• Disconnected knock sensor connector • Short or open circuit in knock sensor wire • Faulty knock sensor	5-39
24		• Disconnected overheat sensor 1 connector • Short or open circuit in overheat sensor 1 wire • Faulty overheat sensor 1	5-56
25		• Disconnected overheat sensor 2 connector • Short or open circuit in overheat sensor 2 wire • Faulty overheat sensor 2	5-56
26		• Disconnected oil pressure switch (high pressure side) connector • Short or open circuit in oil pressure switch (high pressure side) wire • Faulty oil pressure switch (high pressure side)	5-96
41		• Disconnected oxygen sensor heater circuit connector • Short or open circuit in oxygen sensor heater circuit wire • Faulty oxygen sensor heater circuit • Spark plug misfire	5-26
58		• Disconnected TDC sensor 2 connector • Short or open circuit in TDC sensor 2 wire • Faulty TDC sensor 2	5-30

No. of blinks of MIL	MIL	Probable problem part	Page
7, 13		Open circuit in sensor output voltage line (brown/white)	5-33 and 37
1, 6, 13, 7, 10, 24, 25		Open circuit in sensor ground line (green/red)	5-26, 31, 37, 33, 35 and 56

a. ECM

• MIL does not come on (MIL does not come on for 2 seconds with the ignition switch ON.)

The MIL should come on for 2 seconds with the ignition switch ON. If the MIL does not come on or blink by short-circuiting with the service check connector, see the SCS line inspection flow chart (P. 5-17).

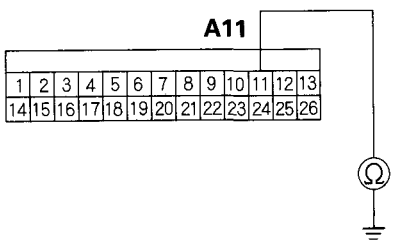
Turn the ignition switch ON. Check whether the warning buzzer sounds twice.

Does the buzzer sound?
- NO → Check the No. 4 (15 A) fuse.
  - Is it normal?
    - NO → • Repair short in the Y/Bl wires between the No.4 (15 A) fuse and ECM, injectors.
    - YES → Check the No. 7 (30 A) fuse (FI).
      - Is it normal?
        - NO → • Repair short in the wires between the PGM-FI main relay and No.4, No.5, No.6 and No.7 fuses. • Repair short in the wire between the main relay and the starter motor.
        - YES → Check the No. 3 (10 A) fuse (R/C).
          - Is it normal?
            - NO → • Repair short in the power supply line.
            - YES → • Repair open in the Y/Bl wires that go to the main relay. • Repair open in the W/R wire between the No.7 (30 A) fuse (FI) and the main relay. • Check the main relay.
- YES → Check whether the alternator indicator light comes on with the ignition switch ON.

Does the light come on?
- NO → Repair open in the Y/Bl wires between the MIL, alternator indicator light and the main relay.
- YES →
  1) Turn the ignition switch OFF.
  2) Connect the test harness between the ECM and the connector.
  3) Attach the test harness A11 terminal to body ground.
  4) Turn the ignition switch ON.

Does the MIL come on?
- NO → • Replace the blown bulb of the MIL. • Repair open in the R/Bu wire between the ECM and the MIL.
- YES → Substitute a known-good ECM and recheck.

TEST HARNESS A (26P)



• MIL comes on but it does not blink by short-circuiting with the service check connector.

- MIL stays on with the service check connector short-circuited.
- When there is an open in the service check wire and a failure occurred, the MIL comes on but it does not blink by short-circuiting the service check connector.

1) Turn the ignition switch ON.
2) Connect the SCS connector to the service check connector.
3) Checck the number of blinks of the MIL.

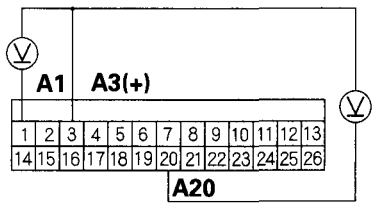
Is the MIL blinking? — YES → Perform each of the inspections according to the Troubleshooting Guide.

NO

1) Disconnect the SCS connector from the service check connector.
2) Check whether the engine starts.

Does the engine start? — YES →
1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors. Note that the test harness sensor connector must be disconnected this time.
3) turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) A3 terminal and the negative (–) A1 and A20 terminals.

TEST HARNESS A (26P)



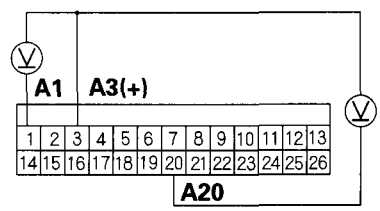
NO

Is there 4.30 – 5.25 V? — NO → Substitute a known-good ECM and recheck.

YES

1) Turn the ignition switch OFF.
2) Connect the test harness sensor connector.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) A3 terminal and the negative (–) A1 and A20 terminals.

TEST HARNESS A (26P)



Is there 4.30 – 5.25 V? — NO → Repair short in the Lg/W wire between the ECM and the service check connector.

YES

A

To P. 5-18

To P. 5-19

From P. 5-17

1) Turn the ignition switch ON.
2) Disconnect the MAP sensor 3P connector, Barometric sensor 3P connector and TP sensor 3P connector each, and check the MIL.

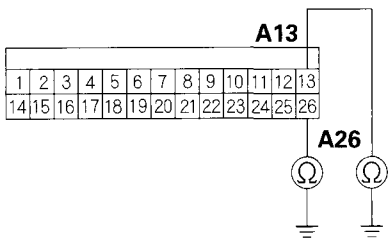
Is the MIL staying on?

NO → Replace the sensor that turns the MIL off.

YES

1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors. Note that the ECM side 26P connector A must be disconnected this time.
3) Check for continuity between the test harness A13 and A26 terminals and boby ground.

TEST HARNESS A (26P)



Is there continuity?

YES →
- Repair short in the Br/Y wire between the ECM and the MAP sensor (A13 terminal).
- Repair short in the Br/W wire between the ECM and the PA sensor, the TP sensor (A26 terminal).

NO

1) Connect the ECM connectors to the ECM.
2) Turn the ignition switch ON.
3) Measure the voltage between the test harness positive (+) A19 and B18 terminals and the negative (–) A1 and A20 terminals.

Is there battery voltage?

NO →
- Repair open in the Y/Bl wire between the ECM and the main relay.
- Check the PGM-FI main relay and the main wire harness (Power supply lines).

YES

Substitute a known-good ECM and recheck.

From P. 5-17

A

1) Connect the SCS connector to the service check connector.
2) Measure the voltage between the text harness positive (+) A3 terminal and the negative (–) A1 and A20 terminals.

Is there 4.30 – 5.25 V?

YES

1) Disconnect the SCS connector from the service check connector.
2) Turn the ignition switch OFF.
3) Check for continuity between the BI wire terminal of the service check connector and the body ground.

Is there continuity?

NO

Repair open in the BI wire between the service check connector and ground.

YES

Repair open in the Lg/W wire between the ECM and the service check connector.

NO

1) Disconnect the SCS connector from the service check connector.
2) Turn the ignition switch OFF.
3) Disconnect the 26P connector from the ECM.
4) Turn the ignition switch ON.
5) Check whether the MIL comes on.

Does the MIL come on?

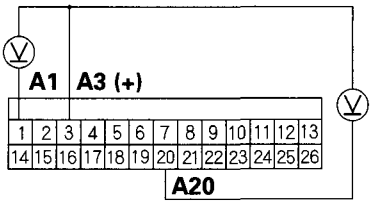
YES

Repair short in the R/Bu wire between the ECM and the MIL.

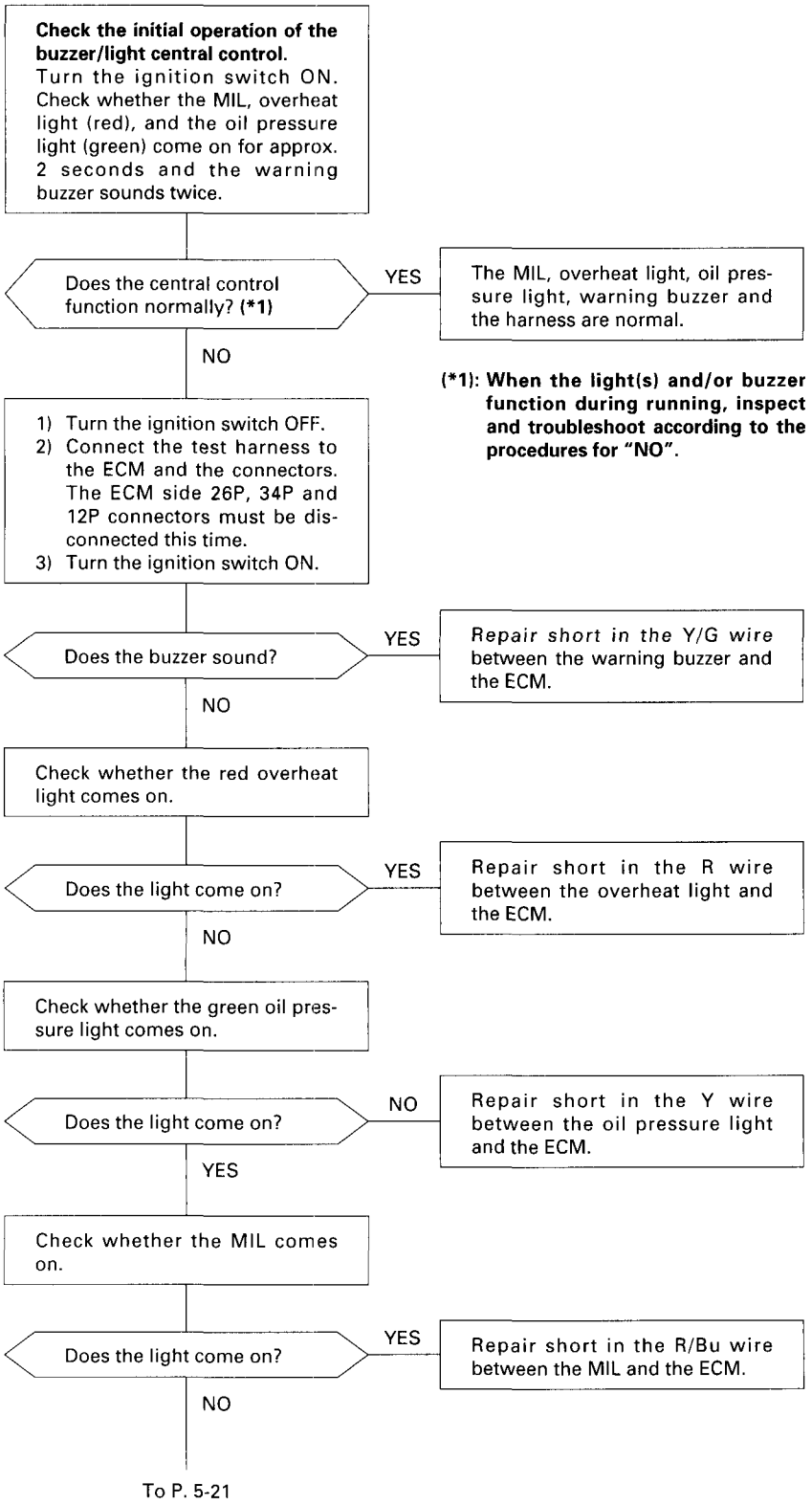
NO

Substitute a known-good ECM and recheck.

TEST HARNESS A (26P)



• Buzzer/light central control (Check on buzzer/light system main harness)



From P. 5-20

1) Attach the test harness C1 terminal to the body ground.
2) Turn the ignition switch ON.

Does the buzzer sound?

NO

- Repair open in the Y/G wire (warning buzzer line).
- Check the warning buzzer.
- Check the remote control system harnesses and the ignition switch.

YES

1) Attach the test harness A17 terminal to the body ground.
2) Turn the ignition switch ON.

Check whether the red overheat light comes on.

NO

- Repair open in the R wire (overheat indicator light line).
- Replace the blown overheat light bulb.
- Check the remote control system harnesses and the ignition switch.

YES

1) Attach the test harness A4 terminal to the body ground.
2) Turn the ignition switch ON.

Check whether the oil pressure light (green) comes ON.

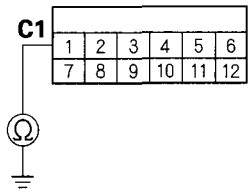
NO

- Repair open in the Y wire (oil pressure indicator light line).
- Replace the blown oil pressure light bulb.
- Check the remote control system harnesses and the ignition switch.

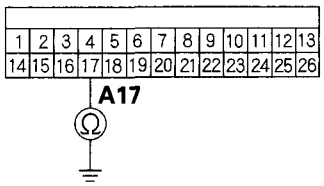
YES

To P. 5-22

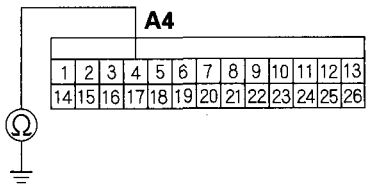
TEST HARNESS C (12P)



TEST HARNESS A (26P)



TEST HARNESS A (26P)



From P. 5-21

1) Attach the test harness A11 terminal to the body ground.
2) Turn the ignition switch ON, check whether the MIL comes on.

Does the light come on?

NO → Perform the troubleshooting flow chart of "MIL does not come on. (MIL does not come on for 2 seconds with the ignition switch ON.)"

YES

1) Disconnect the alternator 4P connector.
2) Check for continuity between the test harness A23 terminal and the body ground.

Is there continuity?

YES → Repair short in the W/Bu wire between the alternator and the ECM.

NO

Check for continuity between the alternator 4P connector W/Bu wire terminal and the test harness A23 terminal.

Is there continuity?

NO → Repair open in the W/Bu wire between the alternator and the ECM.

YES

1) Disconnect the 2P connector from the water level sensor.
2) Check for continuity between the test harness B2 terminal and the body ground.

Is there continuity?

YES → Repair short in the Br wire between the water level sensor and the ECM.

NO

Check for continuity between the test harness B2 terminal and the Br terminal of the harness side water level sensor 2P connector.

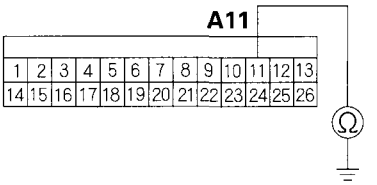
Is there continuity?

NO → Repair open in the Br wire between the water level sensor and the ECM.

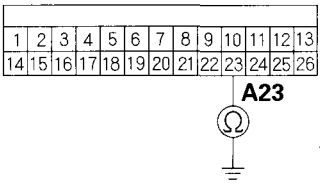
YES

To P. 5-23

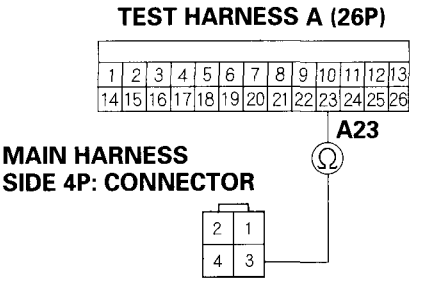
TEST HARNESS A (26P)



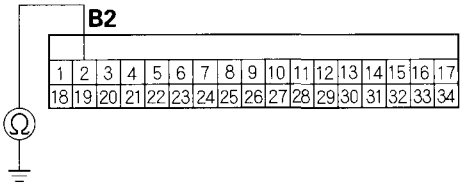
TEST HARNESS A (26P)



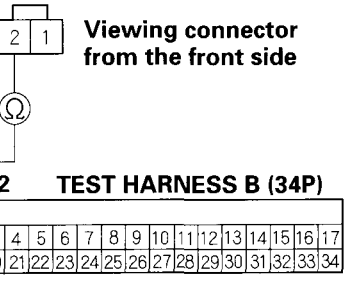
TEST HARNESS A (26P)



TEST HARNESS B (34P)



WATER SEPARATOR 2P CONNECTOR



From P. 5-22

1) Disconnect the silencer case.
2) Disconnect the 6P connector between the main wire harness and the switch wire harness.
3) Check for continuity between the test harness B22 terminal and the body ground.

Is there continuity ?

YES

- Repair short in the main wire harness.
- Repair short in the P wire of the oil pressure switch (Low).

NO

Check for continuity between the test harness B22 terminal and the P wire of the main wire harness side 6P connector.

Is there continuity?

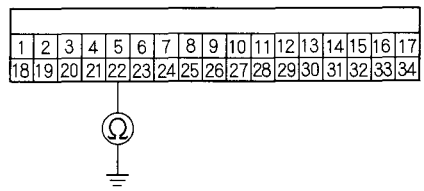
NO

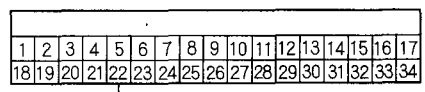
- Repair open in the main wire harness.
- Repair open in the P wire of the oil pressure switch (Low).

YES

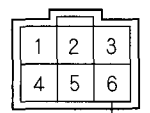
To P. 5-24

TEST HARNESS B (34P)





MAIN WIRE HARNESS SIDE 6P CONNECTOR



Viewing connector from the front side

From P. 5-23

Check for continuity between the test harness B31 terminal and the body ground.

Is there continuity?

YES

- Repair short in the main wire harness.
- Repair short in the Y/R wire (the oil pressure switch (high pressure side) line).

NO

Check for continuity between the test harness B31 terminal and the Y/R wire of the main wire harness side 6P connector.

Is there continuity?

NO

- Repair open in the main wire harness.
- Repair open in the Y/R wire (the oil pressure switch (high pressure side) line).

YES

Check for continuity between the Y/R and G/R wires of the switch wire harness side 6P connector.

Is there continuity?

NO

- Repair open in the switch wire harness.
- Replace the oil pressure switch (high pressure side).
- Loose connection between the oil pressure switch and the ECM.

YES

Check for continuity between the P wire of the switch wire harness 6P connector and the body ground.

Is there continuity?

NO

- Repair open in the switch wire harness.
- Replace the oil pressure switch (low pressure side).
- Loose connection between the oil pressure switch and the ECM.

YES

<Check inside of the V bank>
Check the open or short of the Y/R, G/R and P wires of the switch wire harness.

Is the switch wire harness normal?

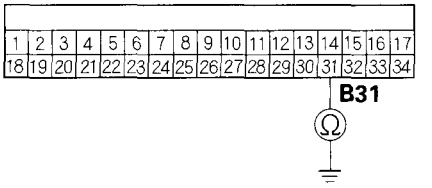
NO

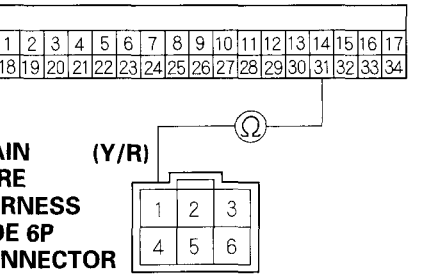
Replace the switch wire harness.

YES

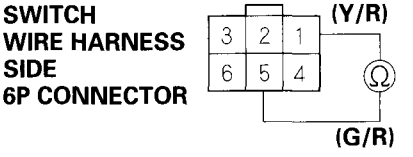
Buzzer/light system is OK. Substitute a known-good ECM and recheck.

TEST HARNESS B (34P)



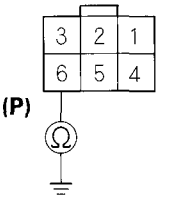


Viewing connector *from the front side*



Viewing connector from the front side

SWITCH WIRE HARNESS SIDE 6P CONNECTOR



Viewing connector from the front side

• Tachometer malfunction

Check the tachometer body and check for open or short in the tachometer power line, remote control cable (remote control box and control panel side) 14P connector, and the meter harness A. If it checked out all right, perform the inspection and troubleshooting according to the following flow chart.

1) Turn the ignition switch OFF.
2) Disconnect the remote control cable 14P connector.
3) Connect the test harness to the ECM and the connectors. Note that the ECM side 26P, 34P and 12P connectors must be disconnected this time.
4) Check for continuity between the test harness A10 terminal and the body ground.

Is there continuity?

YES → Repair short in the Gr wire between the ECM and the outboard motor side 14P connector.

NO

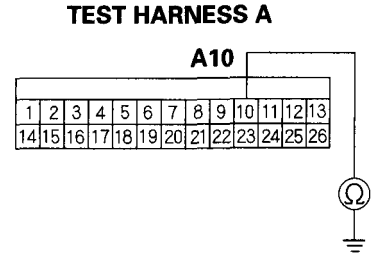
Check fer continuity between the test harness A10 terminal and the No.14 (Gr) terminal of the remote control cable A14P connector.

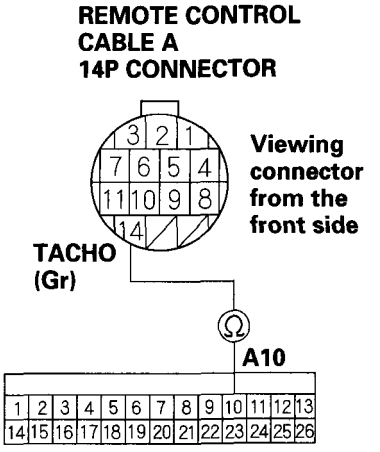
Is there continuity?

NO → Repair open in the Gr wire between the ECM and the outboard motor side 14P connector.

YES

Substitute a known-good ECM and recheck.





b. HEATED OXYGEN SENSOR (HO2S)

- **MIL blinks 1 time with service check connector shorted (P. 5-14).**

1) Reset the ECM. (P.5–8)
2) Start the engine. Hold the engine at 3,000 rpm with no load for 5 minutes.
3) Hold engine at idling with no load for 1 minute in neutral position.
4) Connect the SCS connector to the service check connector (4P).
5) Check the MIL for the number of blinks.

Does the MIL blink 1 time? — NO → Loose connection or open or short in the wire between the ECM and HO2S.

YES

Check the fuel pressure.

Is it OK? — NO → Check the fuel supply system.

YES

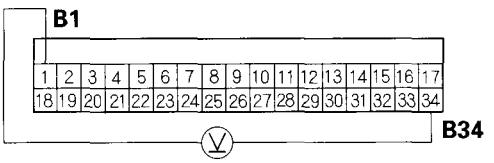
1) Start the engine. Hold the engine at 3,000 rpm with no load for 3 minutes or more.
2) Measure voltage between the test harness B1 and B34 terminals.
3) Open the throttle widely open then release it.

Is the voltage above 0.6 V at wide opened throttle to 4,500 rpm, and below 0.4 V when the throttle is quickly released from 4,500 rpm? — YES → Check the fuel supply system. If OK, substitute a known-good ECM and recheck.

NO

To P. 5-27

TEST HARNESS B (26P)



From P. 5-26

1) Turn the ignition switch OFF.
2) Disconnect the 4P connector from the HO2S.
3) Connect the battery positive (+) and negative (–) terminals to the two W wires of the HO2S.
4) Start the engine. Hold the engine at 3,000 rpm with no load for 3 minutes or more.
5) Measure voltage between the Bl wire terminal and Gr wire terminal.
6) Open the throttle widely open then release it.

Is the voltage above 0.6 V at wide opened throttle to 4,500 rpm, and below 0.4 V when the throttle is quickly released from 4,500 rpm?

NO → Replace the HO2S.

YES

Repair open or short in the wire between the ECM and the HO2S.

c. MAP SENSOR

- **MIL blinks 3 times with service check connector shorted (P. 5-14).**

1) Reset the ECM (P. 5-8).
2) Start the engine and let it idle.
3) Check the MIL for the number of blinks.

Does the MIL blink 3 times?

NO → Loose connection between the ECM and the MAP sensor. Connect securely.

YES

1) Turn the ignition switch OFF.
2) Disconnect the MAP sensor 3P connector.
3) Turn the ignition switch ON.
4) Connect the positive (+) tester lead to the Br/Y terminal of the harness side MAP sensor 3P connector, and the negative (–) tester lead to the body ground. Measure the voltage.

Is there 4.75 – 5.25 V?

YES → Connect the positive (+) tester lead to the Br/Y terminal of the harness side MAP sensor 3P connector, and the negative (–) tester lead to the G/R terminal. Measure the voltage.

NO

Is there 4.75 – 5.25 V?

NO → Repair open in the G/R wire between the ECM and the MAP sensor.

YES

Connect the positive (+) tester lead to the W/R terminal of the harness side MAP sensor 3P connector, and the negative (–) tester lead to the G/R terminal. Measure the voltage.

Is there 4.75 – 5.25 V?

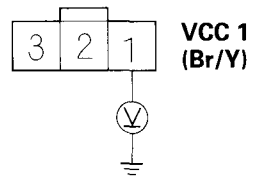
NO →
- Repair open or short in the W/R wire between the ECM and the MAP sensor.
- Substitute a known-good ECM and recheck.

YES

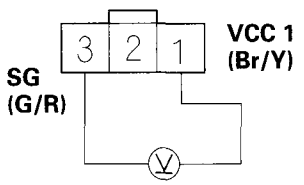
A → To P. 5-29

B → To P. 5-29

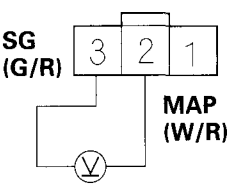
MAP SENSOR 3P CONNECTOR



Viewing connector from the front side



Viewing connector from the front side



Viewing connector from the front side

From P. 5-28 (A)

1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors. Note that the test harness sensor connector must be disconnected this time.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) AB terminal and the negative (–) B9 terminal.

Is there 4.75 – 5.25 V ?

YES → Repair open in the Br/Y wire between the ECM and the MAP sensor.

NO → Substitute a known-good ECM and recheck.

From P. 5-28 (B)

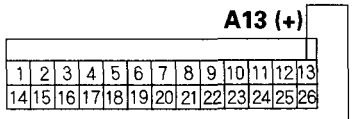
1) Turn the ignition switch OFF.
2) Connect the MAP sensor 3P connector.
3) Connect the test harness to the ECM and the connectors.
4) Turn the ignition switch ON.
5) Measure the voltage between the test harness positive (+) B11 terminal and the negative (–) B9 terminal.

Is there 2.76 – 2.96 V ?

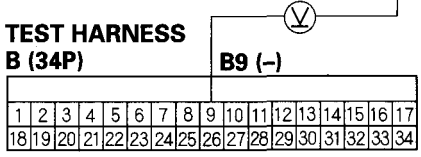
NO → Replace the MAP sensor.

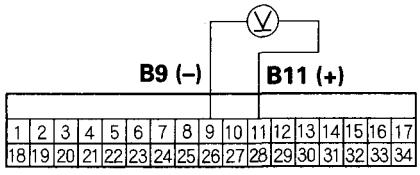
YES → Substitute a known-good ECM and recheck.

TEST HARNESS A (26P)



TEST HARNESS B (34P)





d. TDC SENSOR 1, 2/CKP SENSOR

- **MIL blinks 8, 58, or 4 times with service check connector shorted (P. 5-14).**

1) Reset the ECM.
2) Start the engine.
3) Check the number of blinks of the MIL.

Does the blink either 8 or 58 times?
- NO → Loose connection between the ECM and the TDC1 (8 times)/ TDC2 (58 times) sensor.
- YES ↓

Does the blink 4 times?
- NO → Loose connection between the ECM and the CKP sensor.
- YES ↓

1) Disconnect the TDC sensor 4P connector.
2) Disconnect the CKP sensor 2P connector.
3) Measure the resistance between the appropriate sensor terminals according to the table (*1).

*1

SENSOR	No. of BLINKS	TEST HARNESS	SENSOR
TDC1	8	A6	G
		A25	R
TDC2	58	A12	Y
		A18	Bl
CKP	4	A5	Bu
		A24	W

Is the resistance 2,000 ± 500Ω?
- NO → The TDC (or CKP) sensor is faulty, replace it.
- YES ↓

Check for continuity between the each sensor terminal and body ground.

Is there continuity?
- YES → The TDC (or CKP) sensor is faulty, replace it.
- NO ↓

1) Reconnect the connector.
2) Disconnect the test harness connector form the ECM side and connect the test harness only the harness side.
3) Measure the resistance between the appropriate test harness connector terminals according to the table (*1).

Is the resistance 2,000 ± 500Ω?
- NO → Repair open in the wire between the ECM and the TDC (or CKP) sensor.
- YES ↓

Check for continuity between the appropriate sensor terminals and the body ground according to the table (*1).

Is there continuity?
- YES → Repair short in the wire between the ECM and the TDC (or CKP) sensor.
- NO ↓

Substitute a known-good ECM and recheck.

e. ECT SENSOR

• MIL blinks 6 times with service check connector shorted (P. 5-14).

1) Reset the ECM. (P.5-8)
2) Turn the ignition switch ON.
3) Check the MIL for the number of blinks.

Does the MIL blink 6 times?

NO → Loose connection between the ECM and the ECT sensor.

YES

1) Turn the ignition switch OFF.
2) Disconnect the ECT sensor 2P connector.
3) Measure the resistance between the two terminals of the ECT sensor.

Is there the adequate resistance for the engine temperature? (*1)

NO → Replace the ECT sensor.

YES

1) Turn the ignition switch ON.
2) Connect the positive (+) tester lead to the R/W terminal of the harness side ECT sensor 2P connector and the negative (–) tester lead to the body ground.
Measure the voltage.

Is there 4.30 – 5.25 V?

YES → Connect the positive (+) tester lead to the R/W terminal of the harness side ECT sensor 2P connector, and the negative (–) tester lead to the G/R terminal.
Measure the voltage.

NO

Is there 4.30 – 5.25 V?

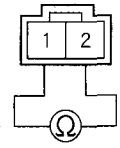
NO → Repair open in the G/R wire between the ECM and the ECT sensor (including the switch wire).

YES

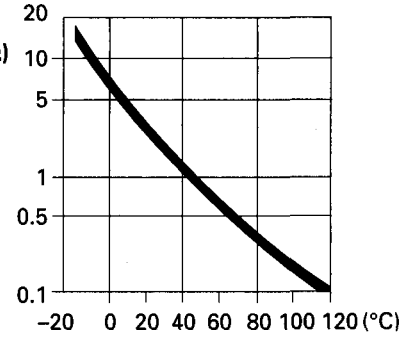
Substitute a known-good ECM and recheck.

To P. 5-32

ECT SENSOR 2P CONNECTOR (ECT sensor side)

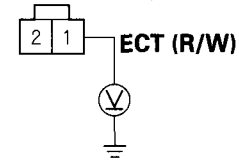


Viewing connector from the front side

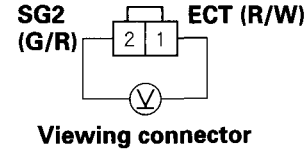


ENGINE TEMPERATURE

ECT SENSOR 2P CONNECTOR (Harness side)



Viewing connector from the front side



Viewing connector from the front side

From P. 5-31

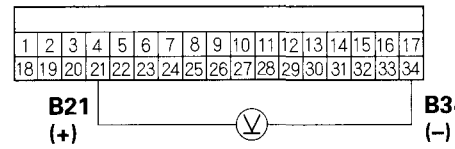
1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors. Note that the test harness sensor connector must be disconnected this time.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) B21 terminal and the negative (–) B34 terminal.

Is there 4.30 – 5.25 V?

YES → Repair open or short in the R/W wire between the ECM and the ECT sensor (including the switch wire harness).

NO → Substitute a known-good ECM and recheck.

TEST HARNESS B (34P)



f. TP SENSOR

• MIL blinks 7 times with service check connector shorted (P. 5-14).

Check that the throttle cable is adjusted properly (P. 3-18) before starting the TP sensor inspection/troubleshooting.

1) Reset the ECM.
2) Start the engine.
3) Check the MIL. For the number of blinks.

Does it blink 7 times?

NO → Loose connection between the ECM and the TP sensor. Connect securely.

YES

1) Turn the ignition switch OFF.
2) Disconnect the TP sensor 3P connector.
3) Turn the ignition switch ON.
4) Connect the positive (+) tester lead to the Br/W terminal of the harness side TP sensor 3P connector, and the negative (–) tester lead to the G/R terminal of the 3P connector. Measure the voltage.

Is there 4.75 – 5.25 V?

NO → Connect the positive (+) tester lead to the Br/W terminal of the harness side TP sensor 3P connector, and the negative (–) tester lead to the body ground. Measure the voltage.

Is there 4.75 – 5.25 V?

YES → Repair open in the G/R wire between the ECM and the TP sensor.

NO → To P. 5-34

YES

1) Turn the ignition switch OFF.
2) Connect the TP sensor 3P connector.
3) Connect the test harness to the ECM and the connectors.
4) Turn the ignition switch ON.
5) Measure the voltage between the test harness positive (+) B12 terminal and the negative (–) B34 terminal with the throttle fully open and fully closed respectively.

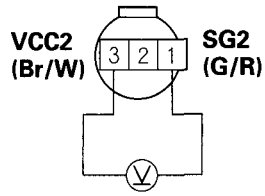
Is there about 10% or 0.5 V when the throtthle is fully closed and about 90% or 4.5 V when the throttle is fully opened.

NO →
- The TP sensor is faulty.
- Repair open or short in the R/Bl wire between the ECM and the TP sensor.

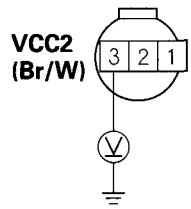
YES

Substitute a known-good ECM and recheck.

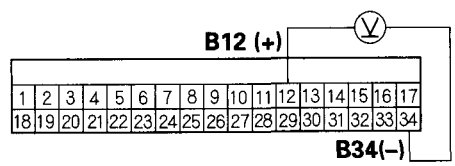
TP SENSOR 3P CONNECTOR

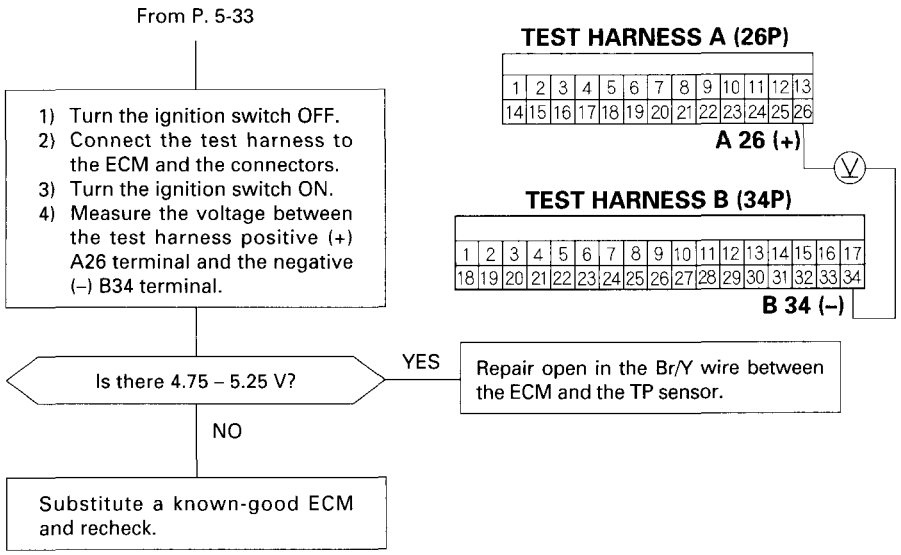


Viewing connector from the front side



TEST HARNESS B (34P)




From P. 5-33
1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) A26 terminal and the negative (–) B34 terminal.
TEST HARNESS A (26P)
1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20 21 22 23 24 25 26
A 26 (+)
TEST HARNESS B (34P)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
B 34 (–)
V
Is there 4.75 – 5.25 V?
YES
Repair open in the Br/Y wire between the ECM and the TP sensor.
NO
Substitute a known-good ECM and recheck.

g. IAT SENSOR

• MIL blinks 10 times with service check connector shorted (P. 5-14).

1) Reset the ECM (P. 5-8).
2) Turn the ignition switch ON.
3) Check the MIL for the number of blinks.

Does the MIL blink 10 times?

NO → Loose connection between the ECM and the IAT sensor.

YES

1) Turn the ignition switch OFF.
2) Disconnect the IAT sensor 2P connector and measure the resistance between the two terminals of the IAT sensor.

Is there adequate resistance? (*1)

NO → Replace the IAT sensor (P. 5-99).

YES

1) Turn the ignition switch ON.
2) Connect the positive (+) tester lead to the R/Y terminal of the harness side IAT sensor 2P connector, and the negative (–) tester lead to the body ground. Measure the voltage.

Is there 4.30 – 5.25 V?

YES → Connect the positive (+) tester lead to the R/Y terminal of the harness side IAT sensor 2P connector and the negative (–) tester lead to the G/R terminal. Measure the voltage.

NO

Is there 4.30 – 5.25 V?

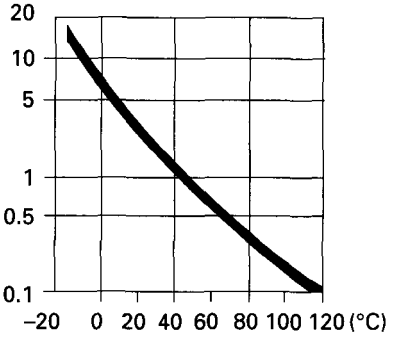
NO → Repair open in the G/R wire between the ECM and the IAT sensor.

YES

Substitute a known-good ECM and recheck.

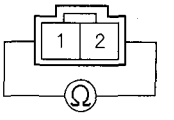
To P. 5-36

*1:



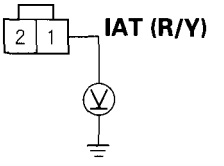
INTAKE AIR TEMPERATURE

IAT SENSOR 2P CONNECTOR
(IAT sensor side)

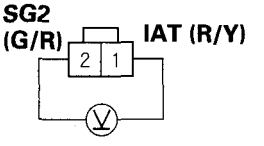


Viewing connector from the front side

IAT SENSOR 2P CONNECTOR
(IAT sensor side)



Viewing connector from the front side



From P. 5-35

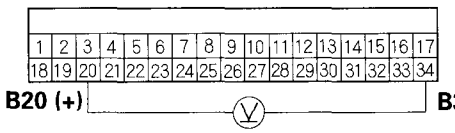
1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors. Note that the test harness sensor connector must be disconnected this time.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) B20 terminal and the negative (–) B34 terminal.

Is there 4.30 – 5.25 V?

YES → Repair open or short in the R/Y wire between the ECM and the IAT sensor.

NO → Substitute a known-good ECM and recheck.

TEST HARNESS B (34P)



h. BAROMETRIC (BARO) SENSOR

- **MIL blinks 13 times with service check connector shorted (P. 5-14).**

1) Reset the ECM (P. 5-8)
2) Start the engine and let it idle.
3) Check the MIL for the number of blinks.

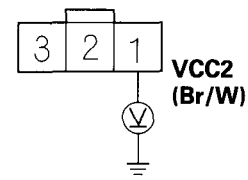
Does the MIL blink 13 times?

NO → Loose connection between the ECM and the BARO sensor.

YES

1) Turn the ignition switch OFF.
2) Disconnect the BARO sensor 3P connector.
3) Turn the ignition switch ON.
4) Connect the positive (+) tester lead to the Br/W terminal of the harness side BARO sensor 3P connector, and the negative (–) tester lead to the body ground. Measure the voltage.

BARO SENSOR 3P CONNECTOR

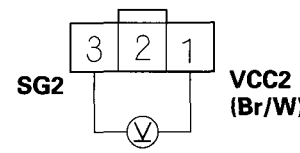


Viewing connector from the front side

Is there 4.75 – 5.25 V?

YES → Connect the positive (+) tester lead to the Br/W terminal of the harness side BARO sensor 2P connector, and the negative (–) tester lead to the G/R terminal. Measure the voltage.

BARO SENSOR 3P CONNECTOR



Viewing connector from the front side

NO

1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors. Note that the test harness sensor connector must be disconnected this time.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) A26 terminal and the negative (–) B34 terminal.

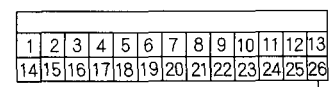
Is there 4.75 – 5.25 V?

NO → Repair open in the G/R wire between the ECM and the BARO sensor.

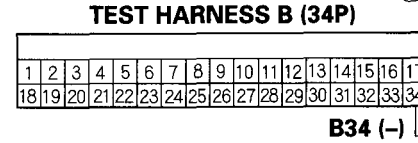
YES

To P. 5-38

TEST HARNESS A (26P)



TEST HARNESS B (34P)



Is there 4.75 – 5.25 V?

YES → Repair open in the Br/W wire between the ECM and the BARO sensor.

NO

Substitute a known-good ECM and recheck.

From P. 5-37

Connect the positive (+) tester lead to the W/Bu terminal of the harness side BARO sensor 3P connector, and the negative (–) tester lead to the G/R terminal. Measure the voltage.

Is there 4.75 – 5.45 V?

NO

- Repair open or short in the W/Bu wire between the ECM and the BARO sensor.
- Substitute a known-good ECM and recheck.

YES

1) Turn the ignition switch OFF.
2) Connect the BARO sensor 3P connector.
3) Connect the test harness to the ECM and the connectors.
4) Turn the ignition switch ON.
5) Measure the voltage between the test harness positive (+) B19 terminal and the negative (–) B34 terminal.

Is there 2.76 – 2.96 V?

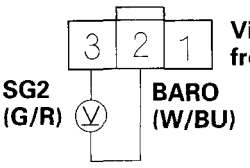
NO

Replace the BARO sensor.

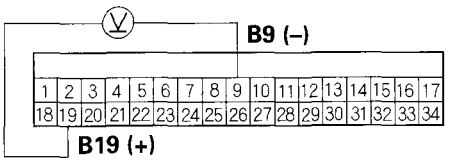
YES

Substitute a known-good ECM and recheck.

BARO SENSOR 3P CONNECTOR



TEST HARNESS B (34P)



i. KNOCK SENSOR

- **MIL blinks 23 times with service check connector shorted (P. 5-14).**

1) Reset the ECM. (P. 5-8)
2) Start the engine. Hold the engine at 3,000 rpm with no load for 5 minutes.
3) Hold the engine at 3,500 rpm for 10 seconds, and warm up the engine temperature at 85°C (185°F).
4) Connect the SCS connector to the service check connector.
5) Check the MIL for the number of blinks.

Does the MIL blink 23 times?
- NO → Loose connection between the ECM and the knock sensor.
- YES ↓

1) Turn the ignition switch OFF.
2) Disconnect the knock sensor 1P connector and check for continuity between the test harness A7 terminal and the body ground.

Is there continuity?
- YES → Repair short in the wire between the ECM and the knock sensor.
- NO ↓

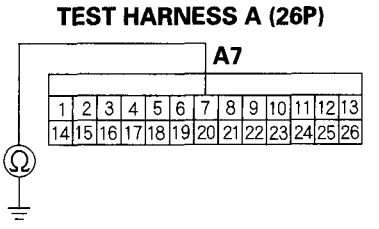
Check for continuity between the test harness A7 terminal and the R/Bu terminal of the knock sensor.

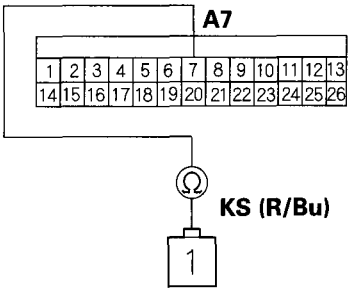
Is there continuity?
- NO → Repair open in the wire between the ECM and the knock sensor.
- YES ↓

Replace a known-good knock sensor and recheck the number of blinks.

Dose the MIL blink 23 times?
- NO → Replace the knock sensor.
- YES ↓

Substitute a known-good ECM and recheck.





j. OIL PRESSURE SWITCH (HIGH PRESSURE SIDE)

- **MIL blinks 26 times with service check connector shorted (P. 5-14).**

1) Reset the ECM (P. 5-8)
2) Turn the ignition switch ON.
3) Check the MIL for the number of blinks.

Does the MIL blink 26 times?

NO → *Loose connection between the* ECM and the oil pressure switch (high pressure side).

YES

1) Disconnect the oil pressure switch (high pressure side).
2) Check for continuity between the two terminals of the oil pressure switch (high pressure side) 2P connector.

Is there continuity?

NO → Replace the oil pressure switch (high pressure side).

YES

Check for continuity between the test harness B31 terminal and Y/R wire terminal of the oil pressure switch (high pressure side) 2P connector.

Is there continuity?

NO → Repair open in the Y/R wire between the ECM and the oil pressure switch (high pressure side).

YES

Check for continuity between the test harness B34 terminal and G/R wire terminal of the oil pressure switch (high pressure side) 2P connector.

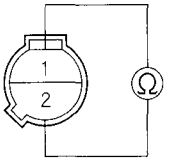
Is there continuity?

NO → Repair open in the G/R wire between the ECM and oil pressure switch (high pressure side).

YES

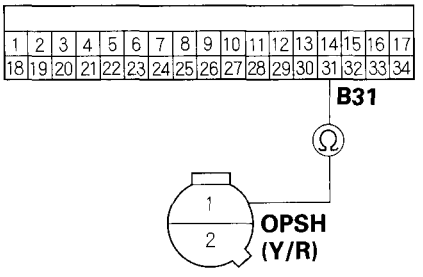
Substitute a known-good ECM and recheck.

OIL PRESSURE SWITCH 2P CONNECTOR



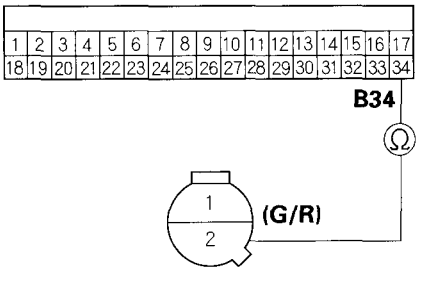
Viewing connector from the front side

TEST HARNESS B (34P)



Viewing connector from the front side

TEST HARNESS B (34P)



k. HEATED OXYGEN SENSOR (HO2S) [HEATER CIRCUIT]

- **MIL blinks 41 times with service check connector shorted (P. 5-14).**

1) Reset the ECM (P. 5-8).
2) Start the engine. Hold the engine at 3,000 rpm with no load for 5 minutes.
3) Connect the SCS connector to the service check connector.
4) Check the MIL for the number of blinks.

Does the MIL blink 41 times?
- NO → Loose connection between the ECM and the HO2S.
- YES →

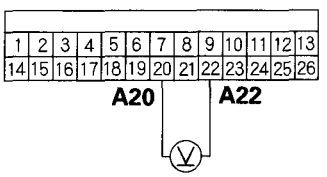
1) Turn the ignition switch OFF, then ON again.
2) Measure the voltage between the test harness A22 and A20 terminals.

Is there battery voltage?
- NO → B → To P. 5-42
- YES →

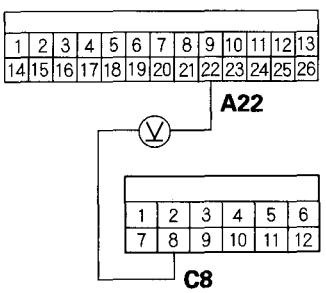
1) Start the engine.
2) Measure the voltage between the test harness A22 and C8 terminals.

Is the voltage below 0.1 V or less?
- NO → Substitute a known-good ECM and recheck.
- YES → A → To P. 5-42

TEST HARNESS A (26P)



TEST HARNESS A (26P)



TEST HARNESS C (12P)

From P. 5-41

A B

1) Turn the ignition switch OFF.
2) Disconnect the HO2 sensor 4P connector.
3) Connect the positive (+) tester lead to the Y/BI terminal of the harness side HO2 sensor 4P connector, and the negative (–) tester lead to the body ground. Measure the voltage.
4) Turn the ignition switch ON.

Is there battery voltage?

NO → Repair open in the Y/BI wire between the HO2S and the MIL main relay.

YES

1) Turn the ignition switch OFF.
2) Measure the resistance between the two W wires of the HO2S.

Is there 10 – 40 Ω

NO → Replace the HO2S.

YES

Check for continuity between the two W wires of the HO2S and the body ground.

Is there continuity?

YES → Replace the HO2S.

NO

1) Disconnect the test harness connector A (26P) from the ECM.
2) Check for continuity between the test harness A22 terminal and W/BI wire terminal of the HO2S 4P connector (main wire harness side).

Is there continuity?

NO → Repair open in the W/BI wire between the ECM and the HO2S.

YES

1) Connect the test harness connector A (26P) to the ECM.
2) Check for continuity between the test harness A22 terminal and the body ground.

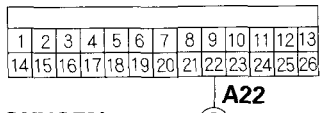
Is there continuity?

YES → Repair short in the W/BI wire between the ECM and the HO2S.

NO

Substitute a known-good ECM and recheck.

TEST HARNESS A (26P)

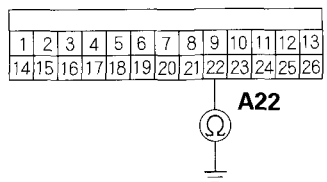


A22

HEATED OXYGEN SENSOR 4P CONNECTOR

HO2S HTC (W/BI)

Viewing connector from the front side



VTEC SYSTEM

a. VTEC system

- **MIL blinks 21 times with service check connector shorted (P. 5-14).**

1) Reset the ECM (P. 5-8)
2) Start the engine.
3) After the engine has warmed-up, disconnect the 2P connector from the neutral switch.
4) Accelerate to an engine speed over 4,500 rpm with the throttle lever. Hold that engine speed for at least 2 seconds.
5) Check the MIL for the number of blinks.

↓

Does the MIL blink 21 times? — NO → Loose connection of the connector.

↓ YES

VTEC SOLENOID VALVE CHECK
1) Turn the ignition switch OFF.
2) Disconnect the 1P connector from the VTEC solenoid valve.
3) Measre resistance between the VTEC solenoid valve and the body ground.

↓

Is there 12 – 18 Ω ? — NO → Replace the VTEC solenoid valve.

↓ YES

1) Connect the test harness to the ECM and the connectors.
2) Note the ECM side of the test harness 26P connector must be disconnected.
3) Check for continuity between the test harness A15 terminal and the harness side of the VTEC solenoid valve 1P connector terminal.

↓

Is there continuity? — NO → Repair open in the wire between the ECM and the VTEC solenoid valve.

↓ YES

Check for continuity between the main wire harness side of the VTEC solenoid valve 1P connector terminal and the body ground.

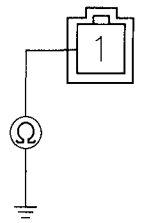
↓

Is there continuity? — YES → Repair short in the wire between the ECM and the VTEC solenoid valve.

↓ NO

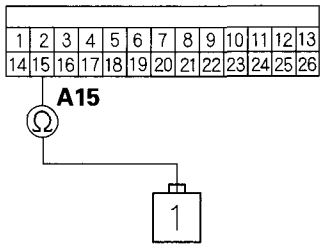
Substitute a known-good ECM and recheck.

VTEC SOLENOID VALVE 1P CONNECTOR



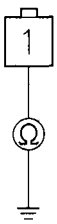
Viewing connector from the front side

TEST HARNESS A (26P)



Viewing connector from the front side

VTEC SOLENOID VALVE 1P CONNECTOR (Harness side)



IDLE CONTROL SYSTEM

• TROUBLESHOOTING GUIDE

When an engine failure of either of the following symptoms occur at the engine start or during idling, inspect the parts in the numbered sequence shown in the table below.

Check part / Page / Symptom		Idle adjusting screw P. 3-16	IAC valve P. 5-99	Neurtal switch P. 17-28	Vacuum pipe P. 5-73 and 77	Alternator F signal P. 5-47
At engine start	Hard to start		2		1	
Poor idling	Engine starts but stalls soon. (Poor fast idle at cold start).	1	2		3	
	Engine speed is higher than the specified idle speed after warming up.	3	2		1	
	Engine speed is higher than the specified trolling speed after warming up.	3	3	1	2	
	Engine speed is lower than the specified idle speed after warming up.	2	1		3	
	Engine speed is lower than the specified trolling speed after warming up.	2	1		3	
	Engine speed is not stable during idling and trolling.	2	1	3	3	
	Engine speed is lower than the specified idle speed with electric load after warming up.					1

When the idle speed is outside the specification and the MIL does not show the DTC 14, inspect in the following procedure.

1) Check the following parts.

- Idle adjusting screw (P. 5-107)
- Neutral switch (P. 17-28)
- Bypass passage, vacuum pipe
- IAC valve for proper installation and O-rings for condition (P. 5-99).

2) If the above parts checked out all right, perform the idle adjustment (P. 3-16).

- If the adjustment cannot be made, replace with a new IAC valve and perform the idle adjustment.
- If the adjustment cannot be made by replacing the IAC valve, replace with a new ECM and perform the idle adjustment.

— Note that the idle speed becomes lower than the specification when the bypass passage is restricted.

— When the vacuum pipe is damaged or disconnected, or there is a leak from the bypass passage, the idle speed becomes higher than the specification.

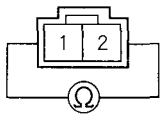
a. IAC VALVE

- **MIL blinks 14 times with service check connector shorted (P. 5-14).**

1) Reset the ECM. (P. 5-8)
2) Start the engine.
3) Check the MIL for the number of blinks.

Does it blink 14 times.
- NO → Is idling lower than 650 rpm?
  - NO → Loose connection between the ECM and the IAC valve.
  - YES
- YES

1) Turn the ignition switch OFF.
2) Disconnect the IAC valve 2P connector and measure the resistance between the two terminals of the IAC valve.



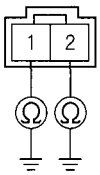
Viewing connector from the front side

Is there 8 – 12 Ω?
- NO → Replace the IAC valve.
- YES

Check for continuity between the IAC valve terminals and the body ground.

Is there continuity?
- YES → Replace the IAC valve.
- NO

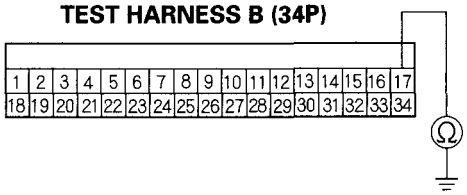
IAC VALVE 2P CONNECTOR (Harness side)



Viewing connector from the front side

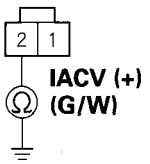
1) Disconnect the ECM connector and connect the test harness only the harness side.
2) Check for continuity between the test harness B17 terminal and the body ground, and the G/W wire of the IAC valve 2P connector and the body ground.

TEST HARNESS B (34P)



Is there continuity?
- YES → Repair short in the G/W wire between the ECM and the IAC valve.
- NO

IAC VALVE 2P CONNECTOR (Harness side)



Viewing connector from the front side

To P. 5-46

From P. 5-45

Check for continuity between the test harness B25 terminal and the body ground, and the BI (+) terminal of the IAC valve 2P connector and the body ground.

Is there continuity?

YES → Repair short in the BI wire between the ECM and the IAC valve.

NO

1) Connect the 2P connector to the IAC valve.
2) Measure the resistance between the test harness B17 and B25 terminals.

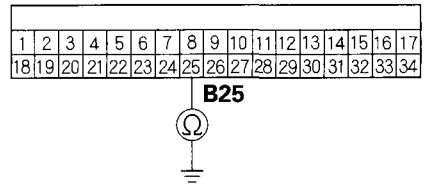
Is there 8 – 12 Ω?

NO → Repair open in the G/W, BI wire between the ECM and the IAC valve.

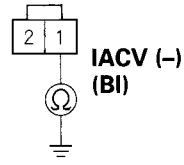
YES

Substitute a known-good ECM and recheck.

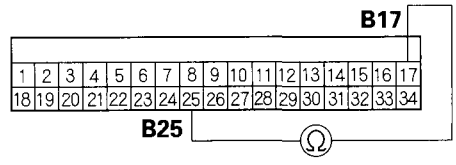
TEST HARNESS B (34P)



IAC VALVE 2P CONNECTOR (Harness side)



Viewing connector from the front side



b. ALTERNATOR FR TERMINAL SIGNAL CHECK

1) Disconnect the alternator 4P connector.
2) Turn the ignition switch ON.
3) Measure the voltage between the B13 and A1 terminals.

Is there 4.30 – 5.25 V?

NO

1) Turn the ignition switch OFF.
2) Disconnect the ECM side connector A of the test harness.
3) Check for continuity between the test harness B13 terminal and the body ground.

Is there continuity?

YES

Repair short in the wire between the ECM and the alternator.

NO

- Replace the alternator.
- Substitute a known-good ECM and recheck.

YES

1) Turn the ignition switch OFF.
2) Connect the alternator 4P connector.
3) Start the engine. Hold the engine at 3,000 rpm with no load for 5 minutes.
4) Measure the voltage between the B13 and A1 terminals.
5) Check for voltage when the power trim is operated.

Is the voltage down?

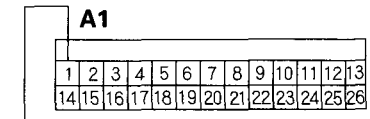
YES

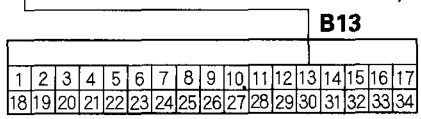
- The alternator FR terminal line is OK.

NO

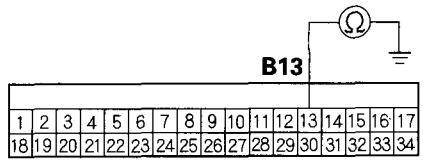
To P. 5-48

TEST HARNESS A (26P)

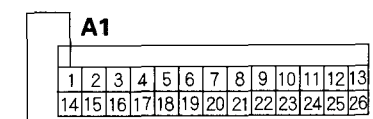


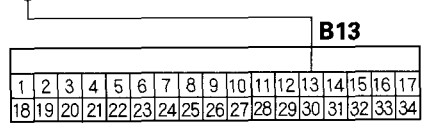


TEST HARNESS B (34P)



TEST HARNESS A (26P)





TEST HARNESS B (34P)

From P. 5-47

1) Turn the ignition switch OFF.
2) Disconnect the ECM side connector A of the test harness.
3) Disconnect the alternator 4P connector.
4) Attach the W/G wire terminal of the alternator 4P connector to the body ground.
5) Check for continuity between the ECM side connector B13 terminal of the test harness and the body ground.

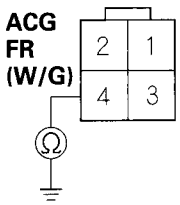
Is there continuity?

NO → Repair open in the wire between the ECM and the alternator.

YES

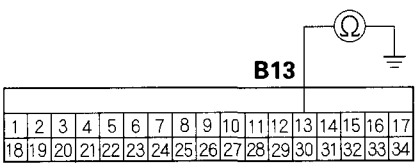
Replace the alternator.

ALTERNATOR 4P CONNECTOR



Viewing connector from the front side

TEST HARNESS B (34P)



a. CONTINUOUS SOUND

There is the continuous sound from the warning buzzer.

*The warning buzzer can sound while the starter motor is running or running at excessively low speed. The system is normal if the warning buzzer stops sounding after the engine starts.

Check the indicator light.

Is the red overheat light ON?

YES

1) Turn the ignition switch OFF.
2) Check the water screen.

Is it clogged?

YES

Remove the dust and foreign material from the water screen.

NO

NO

1) Start the engine.
2) With the engine idling, check whether the cooling water is constantly flowing from the check port.

Is the water flowing out constantly?

NO

- Inside of the water pump is faulty.
- Water tube is clogged or damaged.
- Discharge pump is clogged.

YES

1) Engage the gear for a few minutes and cool the engine down with the engine idling.
2) Check whether the red overheat light goes off and the buzzer stops sounding.

Does the buzzer stop?

YES

Warning buzzer is normal.

NO

Check the thermostat (P. 3-9).

Is the thermostat normal?

NO

Replace the thermostat (P. 3-9).

YES

Perform the overheat sensor troubleshooting (P. 5-56).

Is the overheat sensor normal?

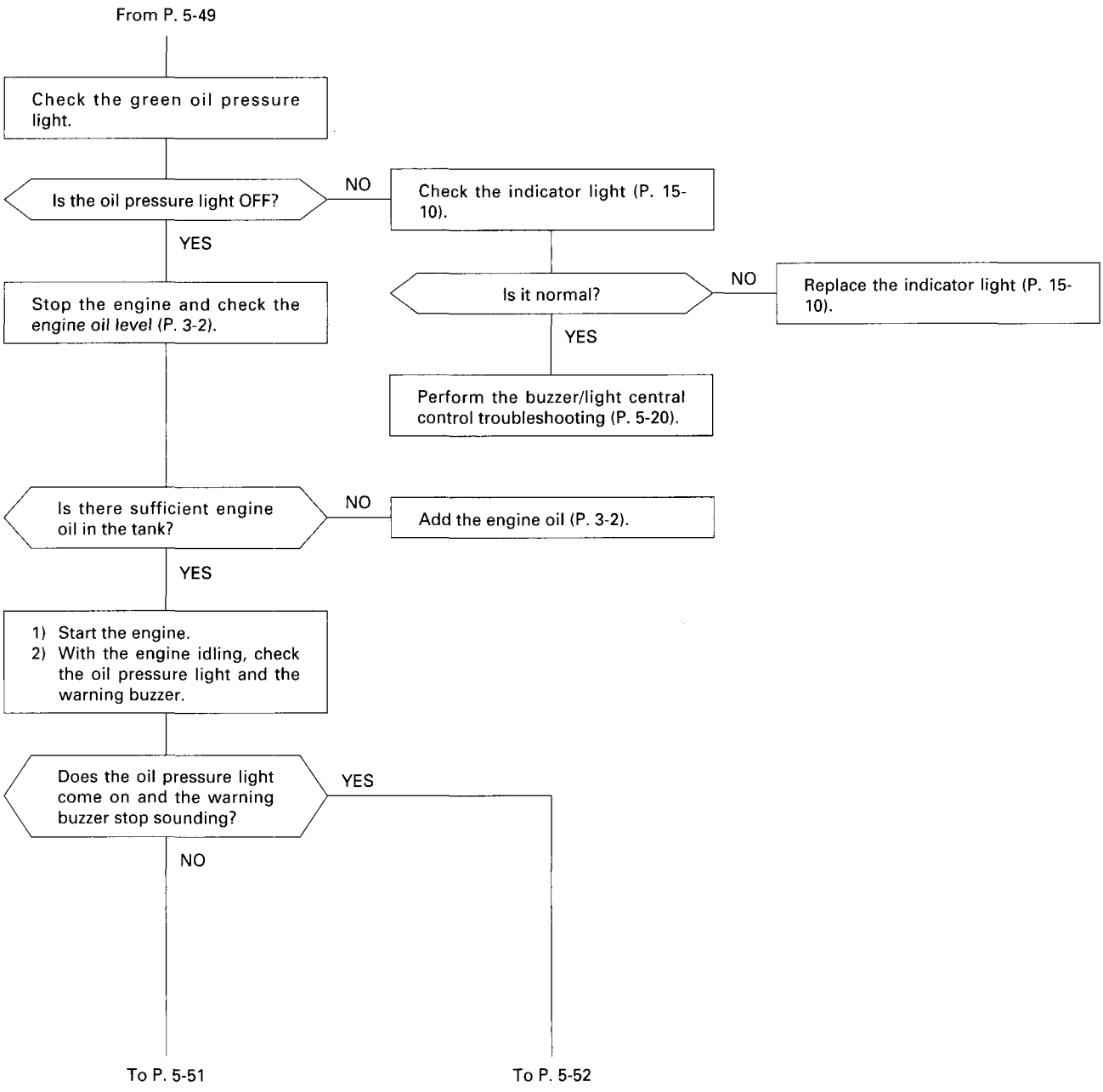
NO

Replace the overheat sensor (P. 5-98).

YES

Perform the buzzer/light central control troubleshooting (P. 5-20).

To P. 5-50


From P. 5-49
Check the green oil pressure light.
Is the oil pressure light OFF?
NO
Check the indicator light (P. 15-10).
YES
Is it normal?
NO
Replace the indicator light (P. 15-10).
YES
Perform the buzzer/light central control troubleshooting (P. 5-20).
Stop the engine and check the engine oil level (P. 3-2).
Is there sufficient engine oil in the tank?
NO
Add the engine oil (P. 3-2).
YES
1) Start the engine.
2) With the engine idling, check the oil pressure light and the warning buzzer.
Does the oil pressure light come on and the warning buzzer stop sounding?
YES
NO
To P. 5-51
To P. 5-52

From P. 5-50

Check the oil pressure switch wire:
1) Disconnect the silencer case.
2) Disconnect the 6P connector between the main wire harness and the switch wire harness.
3) Check whether the oil pressure light comes on and the warning buzzer sounds continuous sound.
(The MIL comes on.)

Does the oil pressure light (green) come on and the warning buzzer sound continuous sound?

NO → Perform the buzzer/light central control troubleshooting (P. 5-20).

YES

1) Connect the 6P connector and reset the ECM in manual.
2) Check the oil pressure.

Is the pressure normal?

NO →
- Oil strainer is clogged.
- Oil pump is faulty.
- Oil passage is clogged.
- Oil filter cartridge is clogged.

YES

Check the oil pressure switch (low pressure side):
1) Remove the intake manifold (P.5-112).
2) Replace the oil pressure switch (low pressure side) and substitute a known-good oil pressure switch (low pressure side).

Does the oil pressure light (green) turn off and the warning buzzer sound?

NO → Replace the oil pressure switch (low pressure side) (P.5-97).

YES

Check inside of the engine, etc.

From P. 5-50

Check the oil pressure light comes on and the warning buzzer doesn't sound when hold the engine at 4,000 rpm or above with no load.

Does the oil pressure light (green) come on and the warning buzzer stop?

YES → The system is OK.

NO

Check the oil pressure switch wire:
1) Remove the silencer case (P. 5-103).
2) Disconnect the 6P connector between the main wire harness and the switch wire harness.
3) Check whether the oil pressure light comes on and the warning buzzer sounds continuous sound.
(MIL comes on.)

Does the oil pressure light (green) come on and the warning buzzer sound continuous sound?

NO → Perform the buzzer/light central control troubleshooting (P. 5-20).

YES

1) Connect the 6P connector and reset the ECM in manual.
2) Check the oil pressure.

Is the pressure normal?

NO →
- Oil strainer is clogged.
- Oil pump is faulty.
- Oil passage is clogged.
- Oil filter cartridge is clogged.

YES

Check the oil pressure switch (high pressure side).
1) Remove the intake manifold (P. 5-112).
2) Replace the oil pressure switch (high pressure side) inside of the V bank and substitute a known-good the oil pressure switch (High).

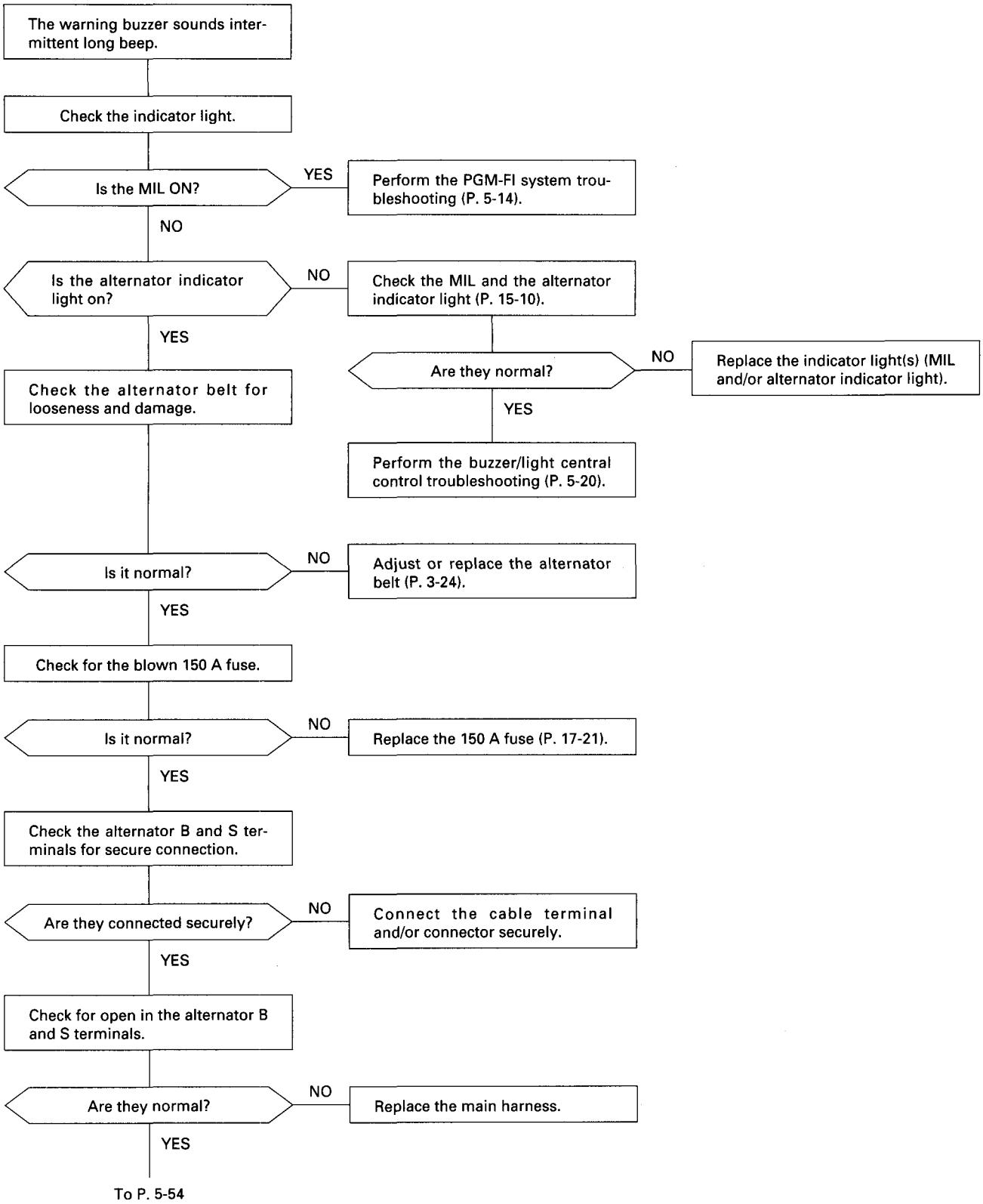
Does the oil pressure light (green) turn off and the warning buzzer sound?

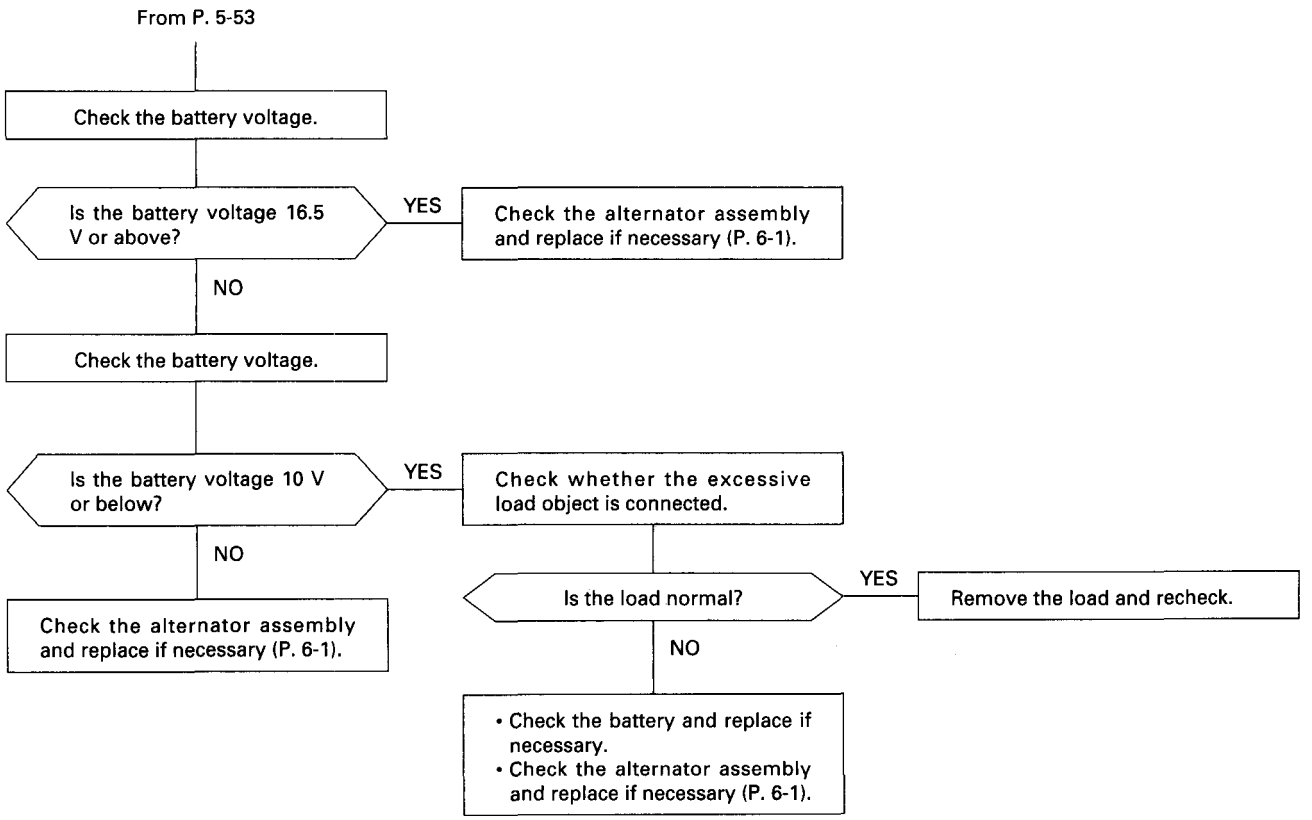
NO → Replace the oil pressure switch (high pressure side) (P. 5-96).

YES

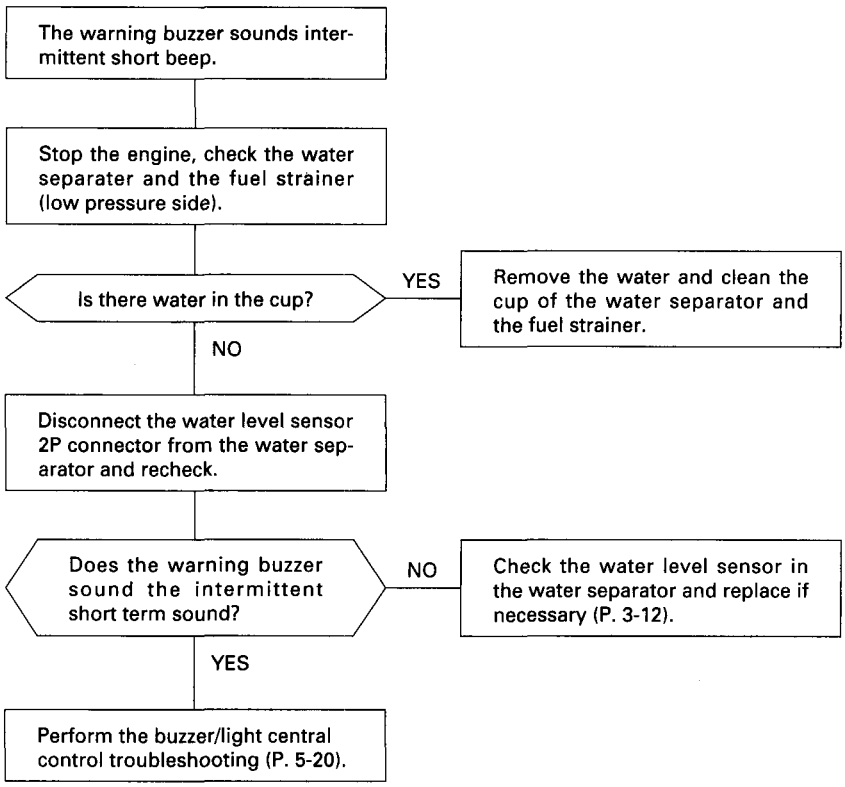
Check inside of the engine, etc.

b. INTERMITTENT SOUND (LONG BEEP)




From P. 5-53
Check the battery voltage.
Is the battery voltage 16.5 V or above?
YES
Check the alternator assembly and replace if necessary (P. 6-1).
NO
Check the battery voltage.
Is the battery voltage 10 V or below?
YES
Check whether the excessive load object is connected.
NO
Is the load normal?
YES
Remove the load and recheck.
NO
Check the alternator assembly and replace if necessary (P. 6-1).
• Check the battery and replace if necessary.
• Check the alternator assembly and replace if necessary (P. 6-1).

c. INTERMITTENT SOUND (SHORT BEEP)



d. OVERHEAT SENSOR 1, 2

- **MIL blinks 24 (TOH1) or 25 (TOH2) times with service check connector shorted (P. 5-14).**

1) Reset the ECM. (P. 5-8)
2) Turn the ignition switch ON.
3) Check the MIL for the number of blinks.

Does the MIL blink 24 [or 25] times? [ ] : TOH2

NO → Loose connection between the ECM and the overheat sensor (TOH1 [or TOH2]). Connect securely.

YES

1) Turn the ignition switch OFF.
2) Disconnect the overheat sensor 2P connector and measure the resistance between the two terminals of the overheat sensor.

Is there the adequate resistance for the exhaust port temperature? (*1)

NO → Replace the overheat sensor (TOH1 [or TOH2]).

YES

1) Turn the ignition switch ON.
2) Connect the positive (+) tester lead to the R/Bl terminal of the harness side overheat sensor 2P connector, and the negative (–) tester lead to the body ground. Measure the voltage.

Is there 4.30 – 5.25 V?

YES → Connect the positive (+) tester lead to the R/B1 terminal of the harness side overheat sensor 2P connector and the negative (–) tester lead to the G/R terminal. Measure the voltage.

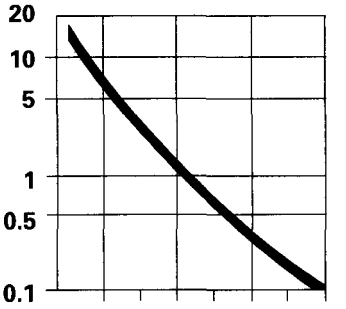
Is there 4.30 – 5.25 V?

NO → Repair open in the G/R wire between the ECM and the overheat sensor.

YES → Substitute a known-good ECM and recheck.

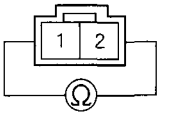
NO → To P. 5-57

*1:
RESISTANCE (kΩ)



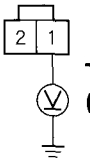
EXHAUST PORT TEMPERATURE

OVERHEAT SENSOR
2P CONNECTOR (Sensor side)



Viewing connector from the front side

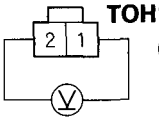
OVERHEAT SENSOR
2P CONNECTOR (Harness side)



TOH1, TOH2
(R/Bl,R)

Viewing connector from the front side

SG2
(G/R)



TOH1, TOH2
(R/Bl,R)

Viewing connector from the front side

From P. 5-56

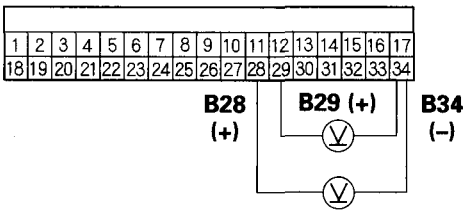
1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors. Note that the test harness sensor connector must be disconnected at this time.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) B28 [or B29] terminals and the negative (–) B34 terminal.

Is there 4.30 – 5.25 V?

YES → Repair open or short in the R/Bl [or R] wire between the ECM and the overheat sensor (TOH1 [or TOH2]).

NO → Substitute a known-good ECM and recheck.

TEST HARNESS B (34P)



FUEL SUPPLY SYSTEM

• TROUBLESHOOTING GUIDE

(Low pressure side)

When the engine has either of the following symptoms at engine start or during idling, inspect the parts in the numbered sequence shown in the table below.

Check part / Page / Symptom		Low pressure fuel pipe P. 3-10 P. 5-70	Water separater P. 3-10	Low pressure fuel pump P. 5-94	Low pressure fuel strainer P. 3-10	Fuel line cut solenoid valve P. 5-64, 71	Vapor separator P. 5-81	PGM-FI main relay P. 5-59
Hard to start		3	1		2		4	1
Poor engine running	Engine starts but stalls soon.	3	1		2		4	
	Idle speed and/or trolling *speed do not stabilize or* engine stalls during idling.		1		2			
	Engine sometimes misfires or tends to stall.	3	1	2	4			
	Engine starts but stalls soon when the engine is hot.					1	2	

If the fuel overflows from the air vent tube of the vaper separater, check the fuel line cut solenoid valve and the vaper separater.

(High pressure side)

When the engine has either of the following symptoms at engine start or during idling, inspect the parts in the numbered sequence shown in the table below.

Check part / Page / Symptom		High pressure fuel pipe P. 5-70, 81	Fuel injector P. 5-63, 72	High pressure fuel pump P. 5-82	Pressure regulator P. 5-73	High pressure fuel strainer P. 3-15	PGM-FI main relay P. 5-59
Hard to start		1	3	2			1
Poor engine running	Engine starts but stalls soon.	1	2		3		
	Idle speed and/or trolling speed do not stabilize or engine stalls during idling.	1	2		3		
	Engine speed does not increase.	1	3	3	2	3	
	Engine sometimes misfires or tends to stall.	1	2	3	3		

a. PGM-FI MAIN RELAY

1) Disconnect the all connectors from the PGM-FI main relay.
2) Connect the positive (+) tester lead to the BI terminal of the main wire harness side 6P connector and the negative (–) tester lead to the body ground. Check for continuity.

Is there continuity?
- NO → Repair open in the BI wire between the PGM-FI main relay and the body ground.
- YES

Connect the positive (+) tester lead to the W/Y terminal of the fuse box side 4P connector and the negative (–) tester lead to the body ground. Measure the voltage.

Is there battery voltage?
- NO → • Replace the No. 7 (30 A) fuse (FI).
  • Repair open or short in the wire between the PGM-FI main relay and the No. 7 (30 A) fuse (FI).
- YES

1) Turn the ignition switch ON.
2) Connect the positive (+) tester lead to the BI/Y terminal of the main wire harness side 6P connector and the negative (–) tester lead to the body ground. Measure the voltage.

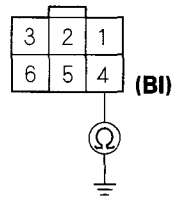
Is there battery voltage?
- NO → • Replace the No. 3 (10 A) fuse (R/C).
  • Repair open or short in the wire between the PGM-FI main relay and the ignition switch.
  • The ignition switch is faulty, and replace it.
- YES

1) Turn the ignition switch OFF.
2) Connect the positive (+) tester lead to the W/BI terminal of the main wire harness side 2P connector and the negative (–) tester lead to the body ground. Measure the voltage.

Is there battery voltage?
- NO → • Replace the No. 2 (10 A) fuse (fuel pump).
  • Repair open or short in the wire between the PGM-FI main relay and the No. 2 (10 A) fuse (fuel pump).
  • Repair short in the wire between the PGM-FI main relay and the No. 2 (10 A) fuse (fuel pump) 2P connector.
- YES

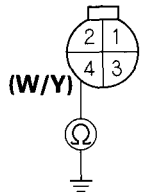
To P. 5-60

PGM-FI MAIN RELAY 6P CONNECTOR (HARNESS SIDE)



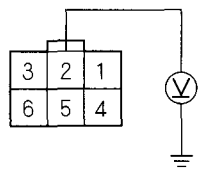
Viewing connector from the front side

PGM-FI MAIN RELAY 4P CONNECTOR (HARNESS SIDE)

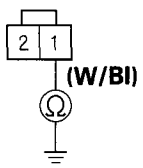


Viewing connector from the front side

PGM-FI MAIN RELAY 6P CONNECTOR (HARNESS SIDE)



PGM-FI MAIN RELAY 2P CONNECTOR (HARNESS SIDE)



Viewing connector from the front side

From P. 5-59

1) Connect the test harness to the ECM and the connectors. Note that the test harness 26P, 34P and 12P connectors must be disconnected this time.
2) Connect the positive (+) tester lead to the W/Bl terminal of the fuse box side 4P connector and the negative (–) tester lead to the test harness A19 and B18 terminals. Check for continuity.

Is there continuity?

NO

- Repair open or short in the wire between the PGM-FI main relay and the ECM.
- Repair short in the wire between the No. 4 (15 A) fuse and fuel injector 2P connectors.

YES

Connect the positive (+) tester lead to the Lg/R terminal of the main harness side 6P connector and the negative (–) tester lead to the test harness A14 and A16 terminals. Check for continuity.

Is there continuity?

NO

Repair open in the wire between the PGM-FI main relay and the ECM (FLR).

YES

Connect the positive (+) tester lead to the W terminal of the main harness side 6P connector and the negative (–) tester lead to the test harness B4 terminal. Check for continuity.

Is there continuity?

NO

- Replace the No. 1 (10 A) fuse (STS).
- Repair open or short in the W wire between the W wire terminal of the main wire harness side 6P connector and the ECM (STS).

YES

1) Reconnect the PGM-FI main relay connectors.
2) Turn the ignition switch ON.
3) Measure the voltage between the test harness positive (+) A19 and B18 terminals and the negative (–) A1 and A20 terminals.

Is there battery voltage?

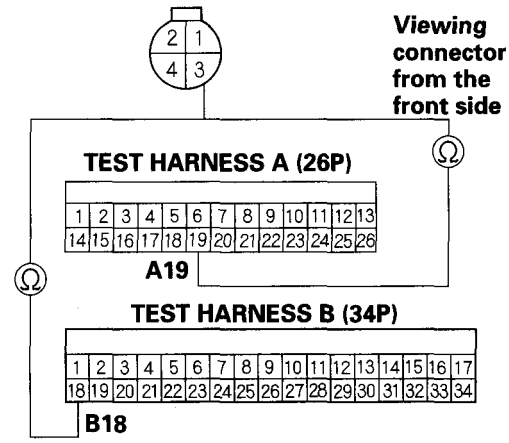
NO

- Repair open in the wire between the ECM and the body ground.
- Poor ground.
- Faulty PGM-FI main relay.

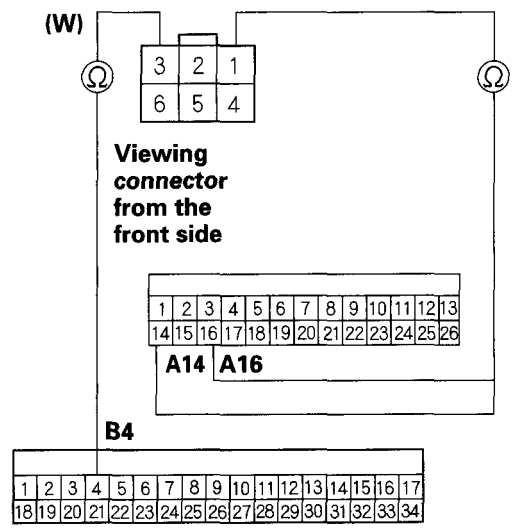
YES

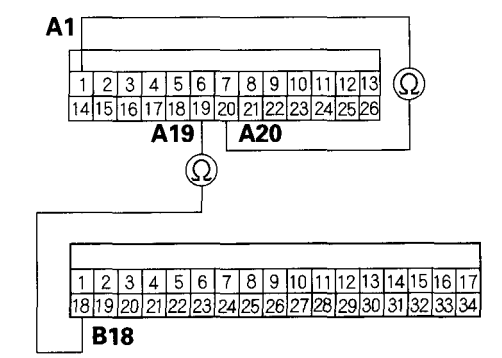
To P. 5-61

PGM-FI MAIN RELAY 4P CONNECTOR



PGM-FI MAIN RELAY 6P CONNECTOR (HARNESS SIDE)





From P. 5-60

Measure the voltage between the test harness C2, C3, C6, C7, C10 and C11 terminals and the body ground.

Is there battery voltage?

NO

- Repair open in the wire between the No. 4 (15 A) fuse and the fuel injector 2P connectors.
- Repair open in the wire between the fuel injector 2P connectors and the ECM 12P connector.
- Faulty fuel injector.

YES

1) Turn the ignition switch OFF.
2) Disconnect the 3P connector from all ignition coils.
3) Turn the ignition switch ON.
4) Measure the voltage between the harness side No. 3 terminal of the ignition coil 3P connectors and the body ground.

Is there battery voltage?

NO

- Replace the No. 6 (15 A) fuse.
- Repair open or short in the wire between the No. 6 (15 A) fuse and the ignition coil 3P connectors.
- Faulty PGM-FI main relay.

YES

Measure the voltage between the test harness A22 terminal and the body ground.

Is there battery voltage?

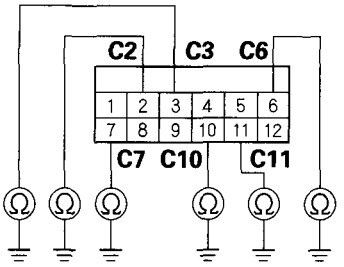
NO

- Replace the No. 5 (10 A) fuse.
- Repair open or short in the wire between the No. 5 (10 A) fuse and the HO2S 4P connector.
- Repair open in the wire between the HO2S 4P connector and the ECM.
- Repair open in the wire between the No.5 (10 A) fuse and the IAB control valve 2P connector.
- Faulty HO2S.
- Repair short in the wire between the No. 5 (10 A) fuse and the alternator 4P connector.
- Repair short in the wire between the No. 5 (10 A) fuse and the indicator wire harness 3P connector.
- Repair short in the wire between the No. 5 (10 A) fuse and the service check connector.
- Repair short in the wire between the No. 5 (10 A) fuse and the fuel line cut solenoid valve 2P connector.
- Faulty PGM-FI main relay

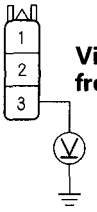
YES

To P. 5-62

TEST HARNESS C (12P)

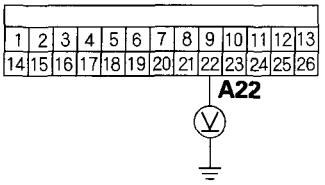


IGNITION COIL 3P CONNECTOR



Viewing connector from the front side

TEST HARNESS A (26P)



From P. 5-61

Measure the voltage between the test harness A9 terminal and the body ground.

Is there battery voltage?

NO

- Repair open in the wire between the No. 5 (10 A) fuse and the bypass control solenoid valve 2P connector.
- Repair open in the wire between the intake air bypass (IAB) control solenoid valve 2P connector and the ECM.
- Replace the intake air bypass (IAB) control solenoid valve.

YES

Measure the voltage between the test harness C4 terminal and the body ground.

Is there battery voltage?

NO

- Repair open in the wire between the No. 5 (10 A) fuse and the fuel line cut solenoid valve 2P connector.
- Repair open in the wire between the fuel line cut solenoid valve 2P connector and the ECM.
- Replace the fuel line cut solenoid valve.

YES

Measure the voltage between the test harness A14 and A16 terminals and the body ground.

Is there battery voltage?

NO

- Repair short in the wire between the PGM-FI main relay and the ECM (FLR).
- Replace the PGM-FI main relay.

YES

1) Turn the ignition switch OFF.
2) Connect the test harness 26P, 34P and 12P connectors to the ECM.
3) Turn the ignition switch ON, then check for battery voltage between the BI/R terminal of the fuel pump 2P connector and the body ground for about two seconds.

Is there battery voltage?

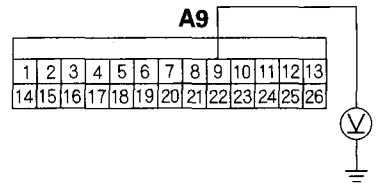
NO

- Repair open in the wire between the fuel pump 2P connector and the main wire harness 2P connector.
- Replace the PGM-FI main relay.

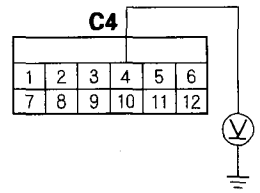
YES

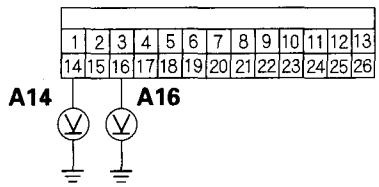
ECM power supply circuit and main wire harness are OK.

TEST HARNESS A (26P)

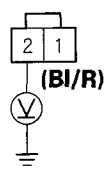


TEST HARNESS C (12P)





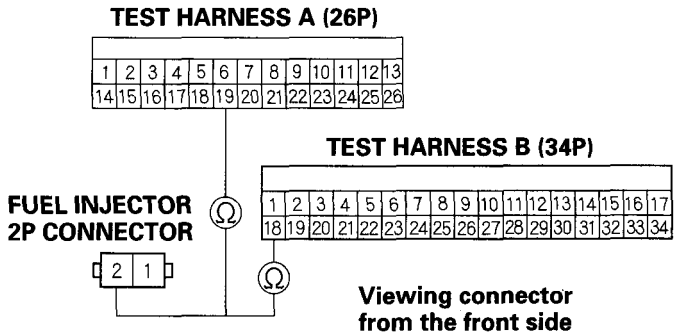
FUEL PUMP 2P CONNECTOR



Viewing connector from the front side

b. FUEL INJECTOR POWER LINE

1) Make sure the ignition switch is OFF.
2) Disconnect the intake manifold. (P. 5-112)
3) Disconnect the 26P, 34P and 12P connectors from the ECM.
4) Connect the test harness between the ECM and the connectors. Do not connect the ECM side 26P, 34P and 12P connector at this time.
5) Check for continuity between the test harness A19 and B18 terminals and the Y/Bl wire of the fuel injector 2P connectors.

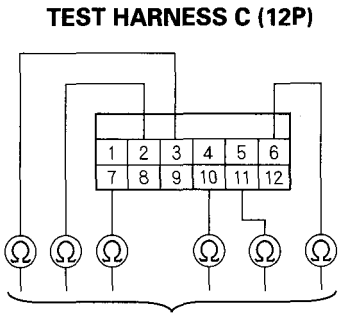


Is there continuity?

NO → Repair open in the Y/Bl wire.
• Replace the main wire harness.

YES

Check for continuity between the terminals of the test harness and the fuel injector 2P connector (harness side).
• The test harness C2 terminal and the Br wire.
• The test harness C6 terminal and the R wire.
• The test harness C10 terminal and the Bu wire.
• The test harness C3 terminal and the Y wire.
• The test harness C7 terminal and the Y/R wire.
• The test harness C11 terminal and the Y/Bu wire.

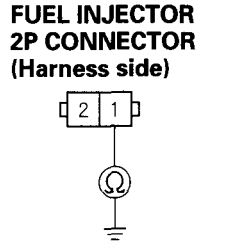


Is there continuity?

NO → Repair open in the wire between the ECM and the fuel injector.
• Replace the main wire harness.

YES

Check for continuity between each fuel injector 2P connector (harness side) and the body ground.
• The Br wire and body ground
• The R wire and body ground
• The Bu wire and body ground
• The Y wire and body ground
• The Y/R wire and body ground
• The Y/Bu wire and body ground

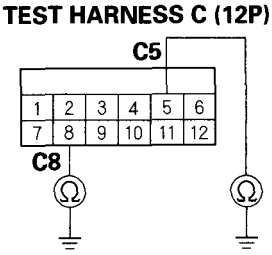


Is there continuity?

YES → Repair short in the wire between the ECM and the fuel injector.
• Replace the main wire harness.

NO

Check for continuity between the test harness C5 and C8 terminals and body ground.



Is there continuity?

NO →
• Repair open in the ECM (ground line) wire.
• Poor ground.
  – Check the ground.
  – Replace the main wire harness.

YES

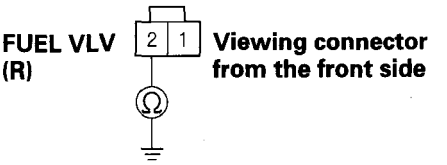
The main wire harness (injector line) is OK.

c. FUEL LINE CUT SOLENOID VALVE

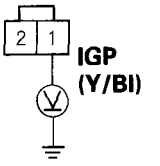
Check for a short in the wire:
1) Turn the ignition switch OFF.
2) Disconnect the 12P connector from the ECM.
3) Check for continuity between the harness side No. 2 terminal of the fuel line cut solenoid valve 2P connector and the body ground.

Is there continuity? — Repair short in the wire between the ECM and the fuel line cut solenoid valve.

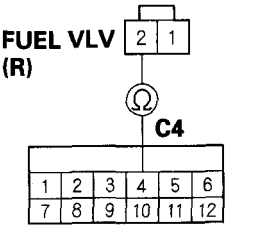
FUEL LINE CUT SOLENOID VALVE 2P CONNECTOR



Check for an open in the wire 1:
1) Turn the ignition switch ON.
2) Check the voltage between the harness side No.1 terminal of the fuel line cut solenoid valve 2P connector and the body ground.



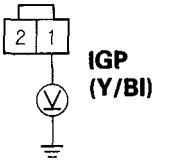
Is there battery voltage? — • Repair open or short in the wire between the fuse box and the fuel line cut solenoid valve.
• A blown No. 5 (10 A) fuse.



TEST HARNESS C (12P)

Check for an open in the wire 2:
1) Turn the ignition switch OFF.
2) Disconnect the 26P, 34P and 12P connectors from the ECM. connect the test harness.
3) Check for continuity between the harness side No. 2 terminal of the fuel line cut solenoid valve 2P connector and the test harness C4 terminal.

Is there continuity? — Repair open in the wire between the ECM and the fuel line cut solenoid valve.



To P. 5-65

From P. 5-64

Check the resistance between the fuel line cut solenoid valve 2P connector terminals.
It should be 43.2 – 52.8 Ω (in 20 – 30°C).

Is the resistance as specified?

NO → Replace the fuel line cut solenoid valve. (P.5-71)

YES

1) Disconnect the fuel tube between the fuel line cut solenoid valve and the vapor separater at the vapor separater side.
2) Send the fuel into the vapor separater with the priming pump.
3) Check the fuel discharge from the fuel tube joint of the fuel line cut solenoid valve.

⚠ WARNING

Gasoline is highly flammable and explosive.
You can be burned or seriously injured when handling fuel.
- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

Is the fuel discharged?

YES → Replace the fuel line cut solenoid valve. (P. 5-71)

NO

1) Reconnect the fuel line cut solenoid valve 2P connector, ECM 26P, 34P and 12P connectors.
2) Send the fuel into the vapor separater with the priming pump.
3) Turn the ignition switch ON.
4) Check the fuel flow out from the fuel tube joint of the fuel line cut solenoid valve.

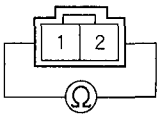
Is the fuel discharged?

NO → Replace the fuel line cut solenoid valve. (P. 5-71)

YES

Substitute a known-good ECM and recheck.

FUEL LINE CUT SOLENOID VALVE 2P CONNECTOR



Viewing connector from the front side

INTAKE AIR SYSTEM

a. INTAKE AIR BYPASS (IAB) CONTROL CIRCUIT

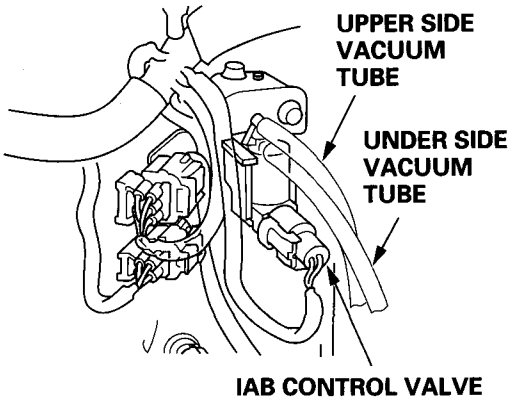
Idling inspection:
1) Start the engine and let it idle.
2) Disconnect the vacuum tube from the intake air bypass (IAB) control diaphragm, connect the hand vacuum pump to the diaphragm and check the vacuum.

Is there vacuum?

NO

Check the vacuum tube 1:
Check the loose connect, damaged, or clogged of the vacuum tube between the intake air bypass control diaphragm and the intake air bypass (IAB) control valve.

YES



Is it normal?

NO

Loose connect, damaged or clogged of the vacuum tube between the IAB control diaphragm and the IAB control valve.

YES

Check the vacuum tube 2:
Disconnect the vacuum tube of the IAB control valve, connect the hand vacuum pump to the vacuum tube and check the vacuum.

Is there vacuum?

NO

- Loose connect, damaged or clogged of the vacuum tube between the IAB control valve and the intake manifold.
- Replace the check valve.
- Replace the vacuum chamber.

YES

Check the bypass control solenoid valve:
1) Disconnect the hand vacuum pump and connect the vacuum tube.
2) Disconnect the vacuum tube of the IAB controlvalve and connect the hand vacuum pump to the IAB control valve.
3) Disconnect the IAB control valve 2P connector.
4) Check the vacuum.

Is there vacuum?

NO

Replace the IAB control valve.

YES

A

To P. 5-67

B

To P. 5-67

From P. 5-66

A

Start the engine and let it idle, then turn the ignition switch OFF.

Is the vacuum opened?

NO

YES

C

To P. 5-68

From P. 5-66

B

Check for a short in the wire:
1) Turn the ignition switch OFF.
2) Disconnect the 26P connector A from the ECM.
3) Check for continuity between the harness side No. 2 terminal of the IAB control valve 2P connector and the body ground.

Is there continuity?

YES

Repair short in the wire between the ECM and the IAB control valve.

NO

Substitute a known-good ECM and recheck.

Check the voltage between the harness side No.1 terminal of the IAB control valve 2P connector and the body ground.

Is there battery voltage?

NO

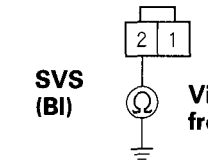
- Repair open or short in the wire between the fuse box and the IAB control valve.
- A blown the No. 5 (10A) fuse

YES

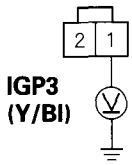
D

To P. 5-68

IAB CONTROL VALVE 2P CONNECTOR



Viewing connector from the front side



Viewing connector from the front side

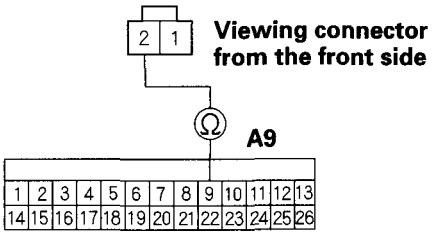
From P. 5-67

C

From P. 5-67

D

IAB CONTROL VALVE 2P CONNECTOR



Check for an open in the wire:
1) Turn the ignition switch OFF.
2) Disconnect the 26P, 34P and 12P connectors from the ECM and connect the test harness.
3) Check for continuity between the harness side No. 2 terminal of the IAB control valve 2P connector and the test harness A9 terminal.

Is there continuity?

NO → Repair open in the wire between the ECM and the IAB control valve.

YES

Substitute a known-good bypass control solenoid valve and recheck.

Is the bypass control solenoid valve normal?

NO → Replace the IAB control valve.
- The resistance between the IAB control valve 2P connector terminals should be 37 – 44 Ω (in 20°C).

YES

Substitute a known-good ECM and recheck.

Check the IAB control diaphragm:
1) Connect the hand vacuum pump to the IAB control diaphragm.
2) Apply a vacuum and check that the chamber volume control valve touches with the stopper.

Is the IAB control valve normal?

NO → Replace the IAB control diaphragm.

YES

The IAB control valve is OK.

5. FUEL LINES

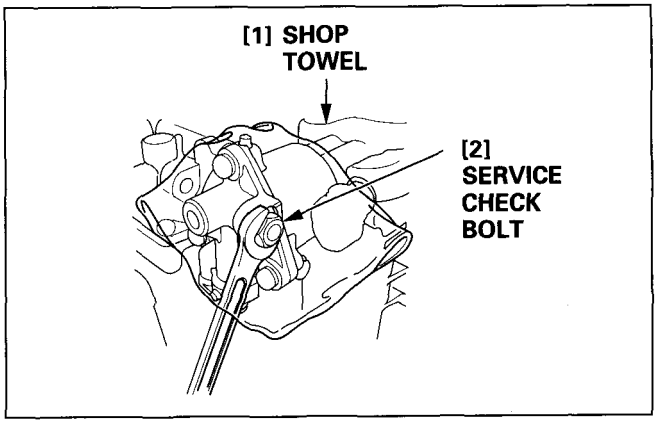
• HOW TO RELIEVE FUEL PRESSURE

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**



- Disconnect the battery cable from the battery negative (–) terminal before relieving the fuel pressure.
- Replace the sealing washer when the service check bolt is loosened or removed.

1) Remove the engine cover.

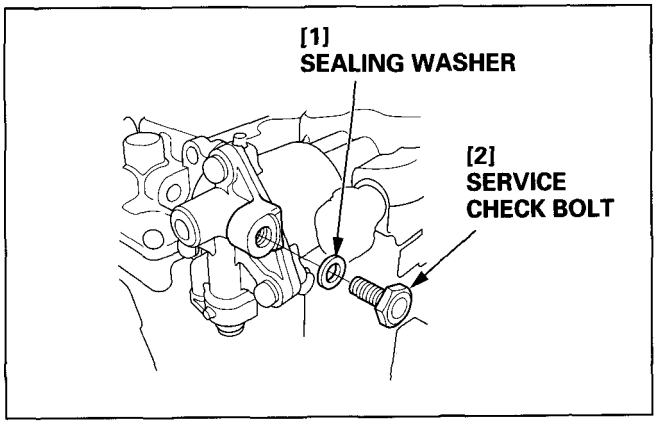
2) Set a wrench on the service check bolt beside of the fuel strainer (high pressure side).

3) Place a shop towel or equivalent material over the service check bolt.

4) Loosen the service check bolt approximately one turn slowly to relieve the fuel pressure.

5) After relieving the fuel pressure, remove the service check bolt and replace the 6 mm sealing washer with a new one. Tighten the service check bolt to the specified torque.

TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

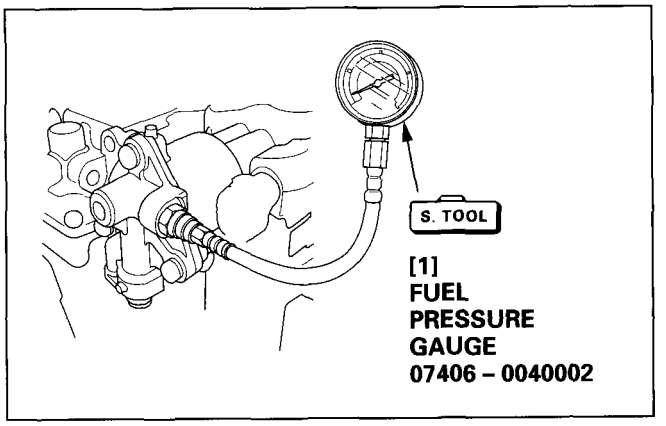


• FUEL PRESSURE MEASUREMENT

1) Relieve the fuel pressure according to "How to relieve fuel pressure" shown above.

2) Remove the service check bolt and set the special tool in the threaded bolt hole.

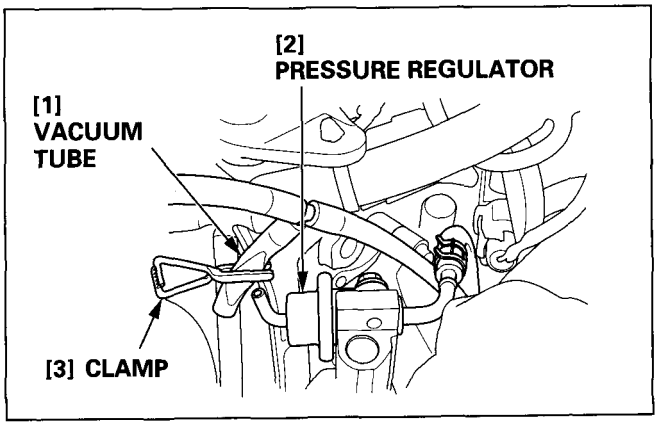
TOOL:
Fuel pressure gauge 07406 – 0040002



3) Disconnect the pressure regulator vacuum tube from the pressure regulator, and clamp the vacuum tube.

4) Remove the propeller. Set the outboard motor gear case in a test tank filled with water. Start the engine and measure the fuel pressure at idling.

Standard fuel pressure [At idle speed of 650 ± 50 rpm]	280 – 330 kpa (2.9 – 3.4 kgf/cm2, 41– 48 psi)



• FUEL LINES

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

INSPECTION:

1) Check the fuel pipe, fuel hose, pressure regulator return hose and the fuel tube for damage, gasoline leakage, rust and other abnormalities.

2) Replace the hose or tube if there is damage, gasoline leakage, rust, etc.

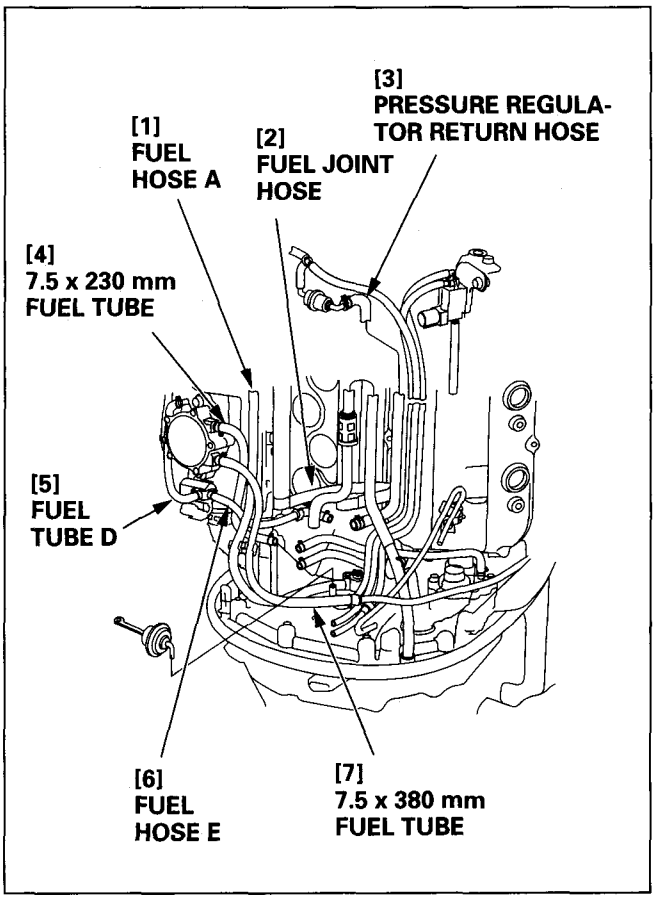
REPLACEMENT:

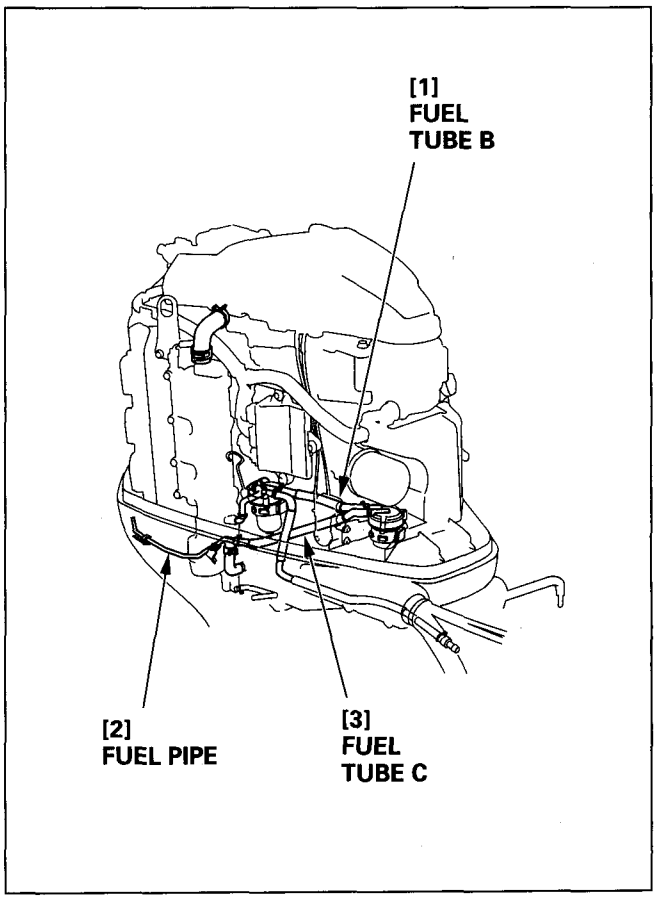
1) Relieve the fuel pressure according to "How to relieve fuel pressure" (P. 5-69).

2) Replace the fuel pipe, lines and tubes if necessary.

NOTICE

When the fuel hose A or the fuel joint hose is necessary to replace, replace the O-ring with a new one and coat it with the engine oil.





• FUEL LINE CUT SOLENOID VALVE

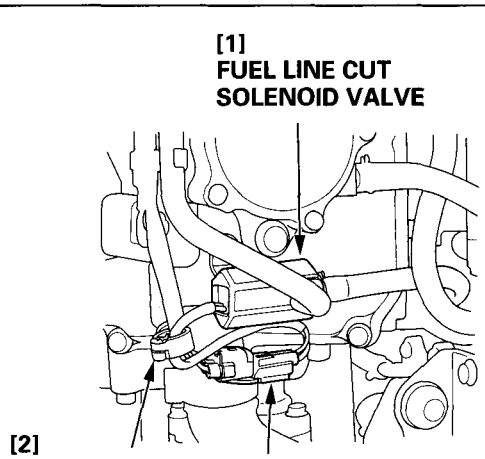
⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

Check for the cracks and other damage in the tubes and replace if necessary.
Check for gasoline leakage after install the fuel tube.



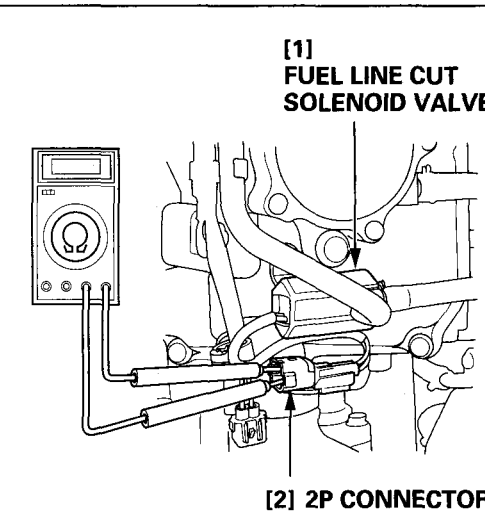
INSPECTION:

1) Disconnect the 2P connector from the fuel line cut solenoid valve and remove the main wire harness from the wire harness clip.

2) Measure the resistance between the fuel line cut solenoid valve terminals.

Resistance	43.2 – 52.8 Ω

3) When the measurement is out of the specification, replace the fuel line cut solenoid valve.

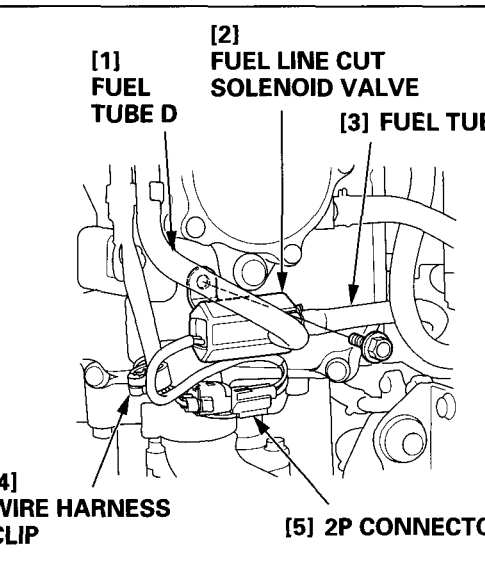


REPLACEMENT:

1) Disconnect the fuel tube D and fuel tube E from the fuel line cut solenoid valve.

2) Slide the fuel line cut solenoid valve to right and remove it from the bracket.

3) After replacement, connect the fuel tubes and 2P connectors securely.



6. FUEL INJECTORS/FUEL PRESSURE REGULATOR

• FUEL INJECTORS

INSPECTION:

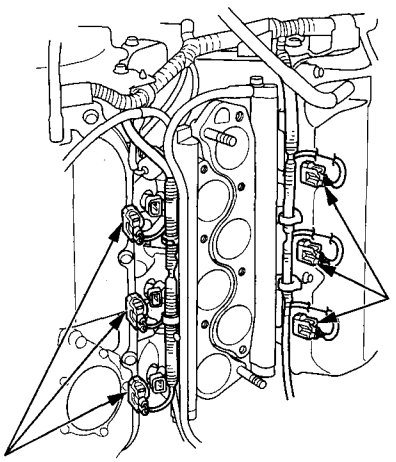
When the engine is hard to start:

1) Disconnect the fuel injector connectors.

2) Measure the resistance between the fuel injector terminals.

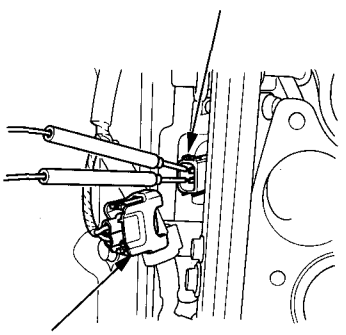
Resistance	11.1 – 12.3 Ω

- When the measurement is out of the specification, replace the fuel injector (P. 5-74).



[1] FUEL INJECTOR 2P CONNECTOR

[1] FUEL INJECTOR 2P CONNECTOR



[1] FUEL INJECTOR

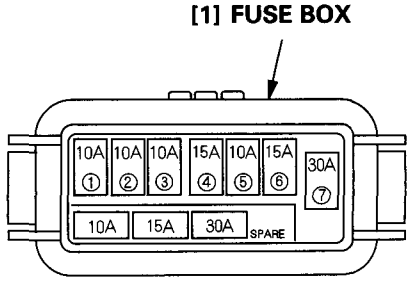
[2] 2P CONNECTOR

- If the fuel injector is normal, check the following parts. If the checks are OK, replace the ECM (P. 17-12).

  — No. 4 (15 A) fuel
  — No. 7 (30 A) fuel
  — PGM-FI main relay.

  — Brown wire between the fuel injector and ECM for *short/open circuit and connection.*

  — Yellow/Black wire between the fuel injector and ECM for open or short circuit.



• PRESSURE REGULATOR

INSPECTION:

Measure the fuel pressure. If the measurement is outside the specification, check the fuel pump (P. 5-82, 94) to be sure it is normal. Then, check the pressure regulator.

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

1) Check that the pressure regulator vacuum tube is not bent, disconnected and damaged.

2) Remove the propeller. Set the gear case in a test tank filled with water and start the engine.

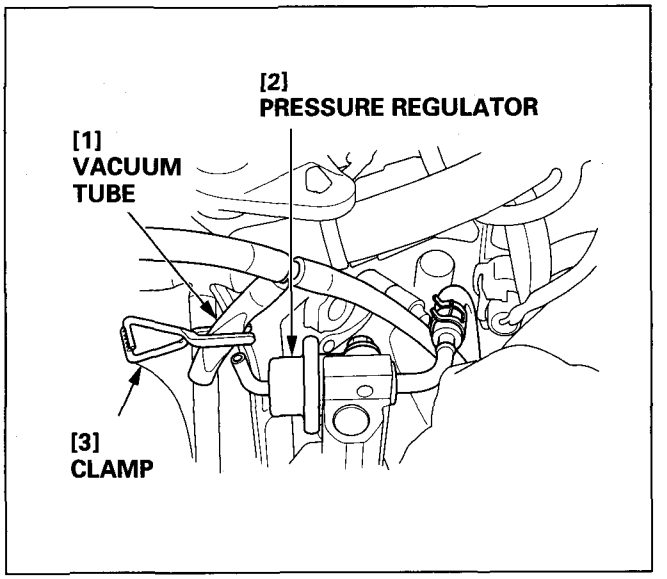
3) With the engine idling, disconnect the vacuum tube from the pressure regulator and clamp the vacuum tube.

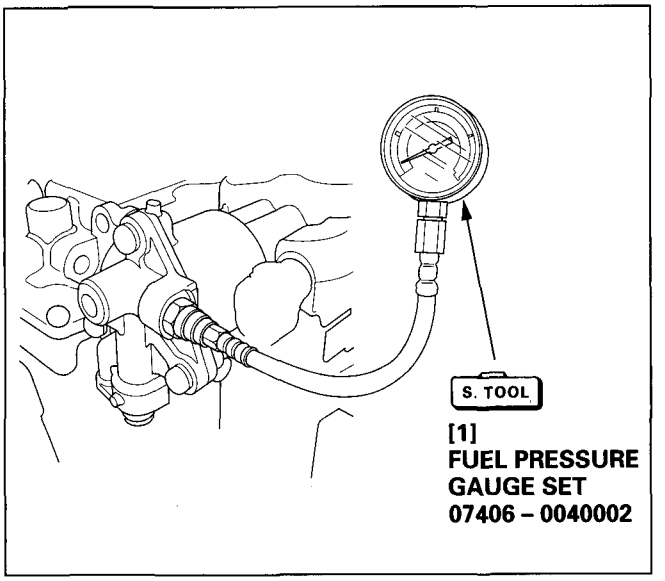
4) Check the fuel pressure. It should be higher than the pressure measured with the vaccum tube connected.

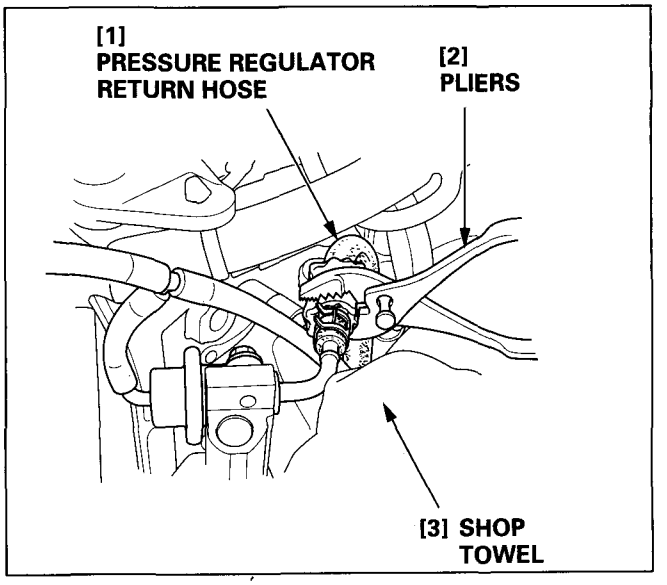
Standard fuel pressure [At idle speed of 650 ± 50 rpm]	280 – 330 kpa (2.9 – 3.4 kgf/cm2, 41– 48 psi)

5) When the fuel pressure does not rise, connect the vacuum tube to the pressure regulator. Pinch the pressure regulator return hose that goes from the pressure regulator to the vapor separator 2 or 3 times lightly, and measure the fuel pressure again. If the measurement is outside the specified standard pressure, replace the pressure regulator.

   - Protect the pressure regulator return hose by winding a shop towel or equivalent around the hose, and lightly pinch the hose with the pliers.







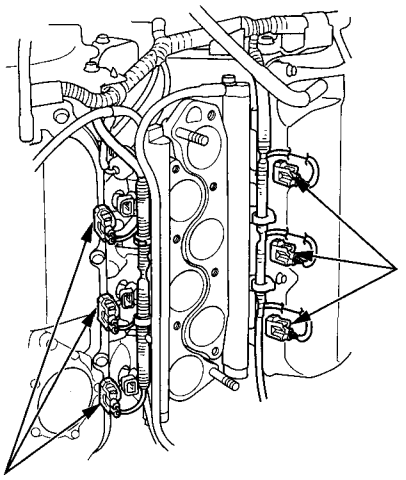
a. REMOVAL

⚠ WARNING

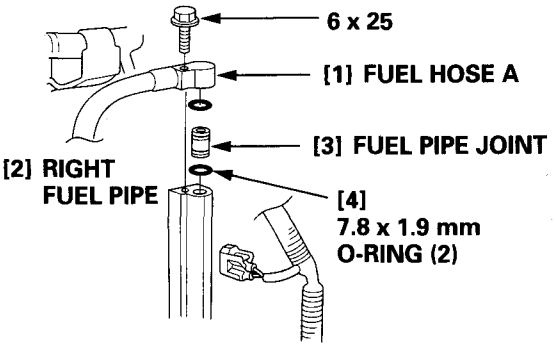
- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**
- **Disconnect the battery cable from the battery negative (–) terminal.**
- **Relieve the fuel pressure according to "How to relieve fuel pressure" (P. 5-69).**

1) Remove the intake manifold (P. 5-112).

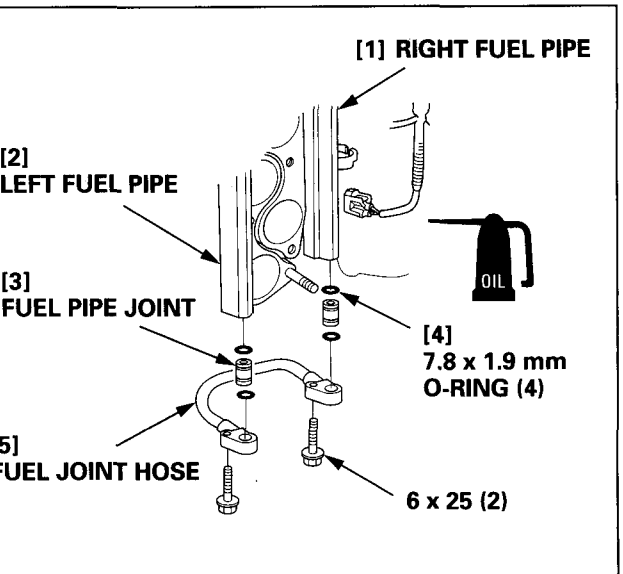
2) Disconnect the 2P connectors from the fuel injectors.



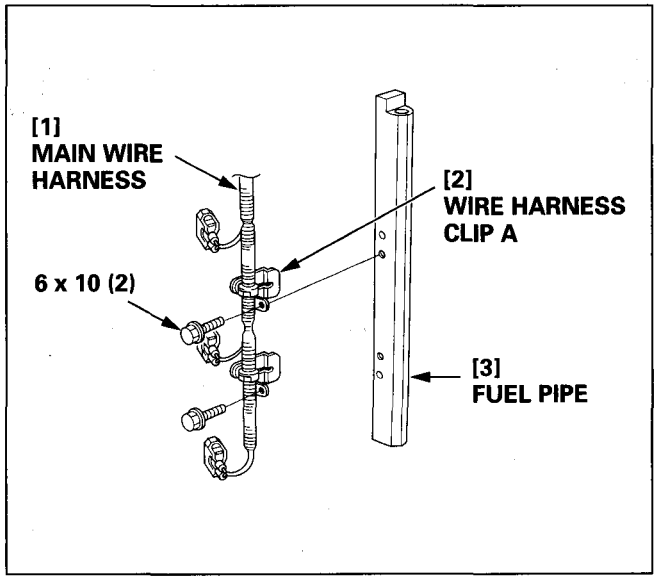
3) Remove the 6 x 25 mm flange bolt and the fuel hose A from the right fuel pipe.



4) Remove the 6 x 25 mm flange bolts from the both side of the fuel pipes and remove the fuel joint hose.

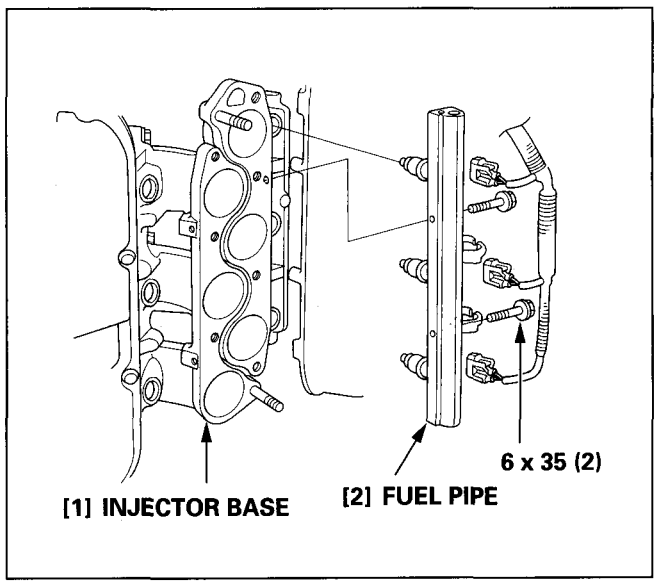


5) Remove the two 6 x 10 mm flange bolts, the wire harness clips and the main wire harness from the fuel pipe.

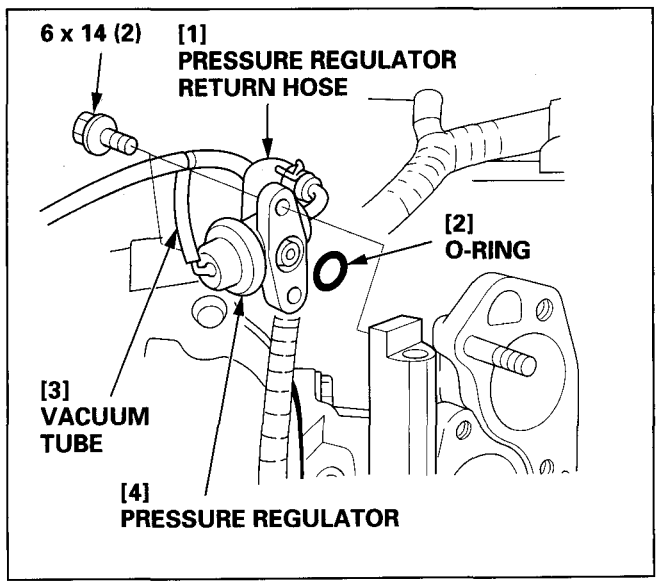


6) Disconnect the vacuum tube and the pressure regulator return hose from the pressure regulator. Loosen the two 6 x 14 mm flange bolts from the pressure regulator.

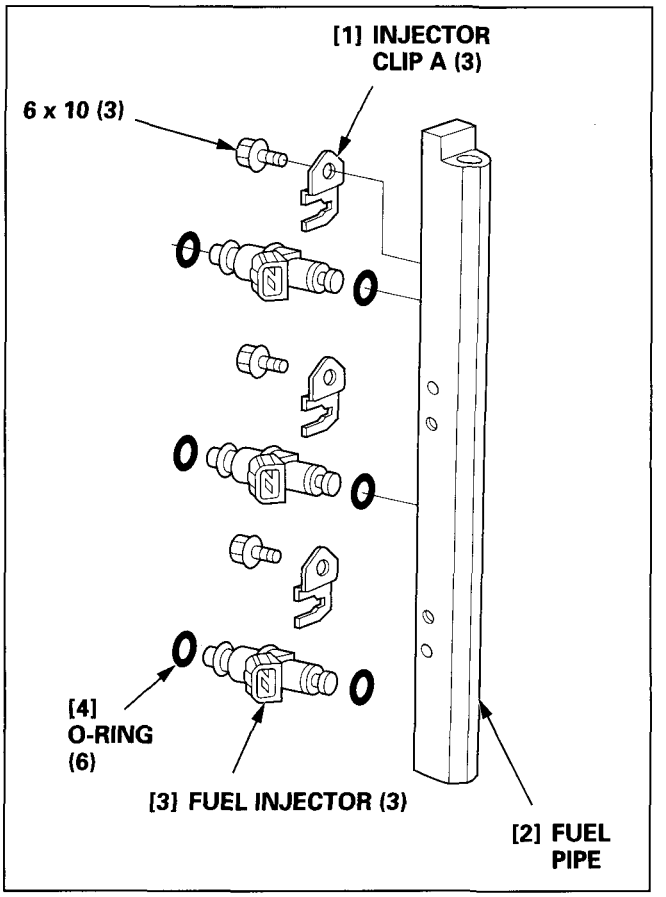
7) Remove the two 6 x 35 mm flange bolts and the fuel pipes from the injector bases.



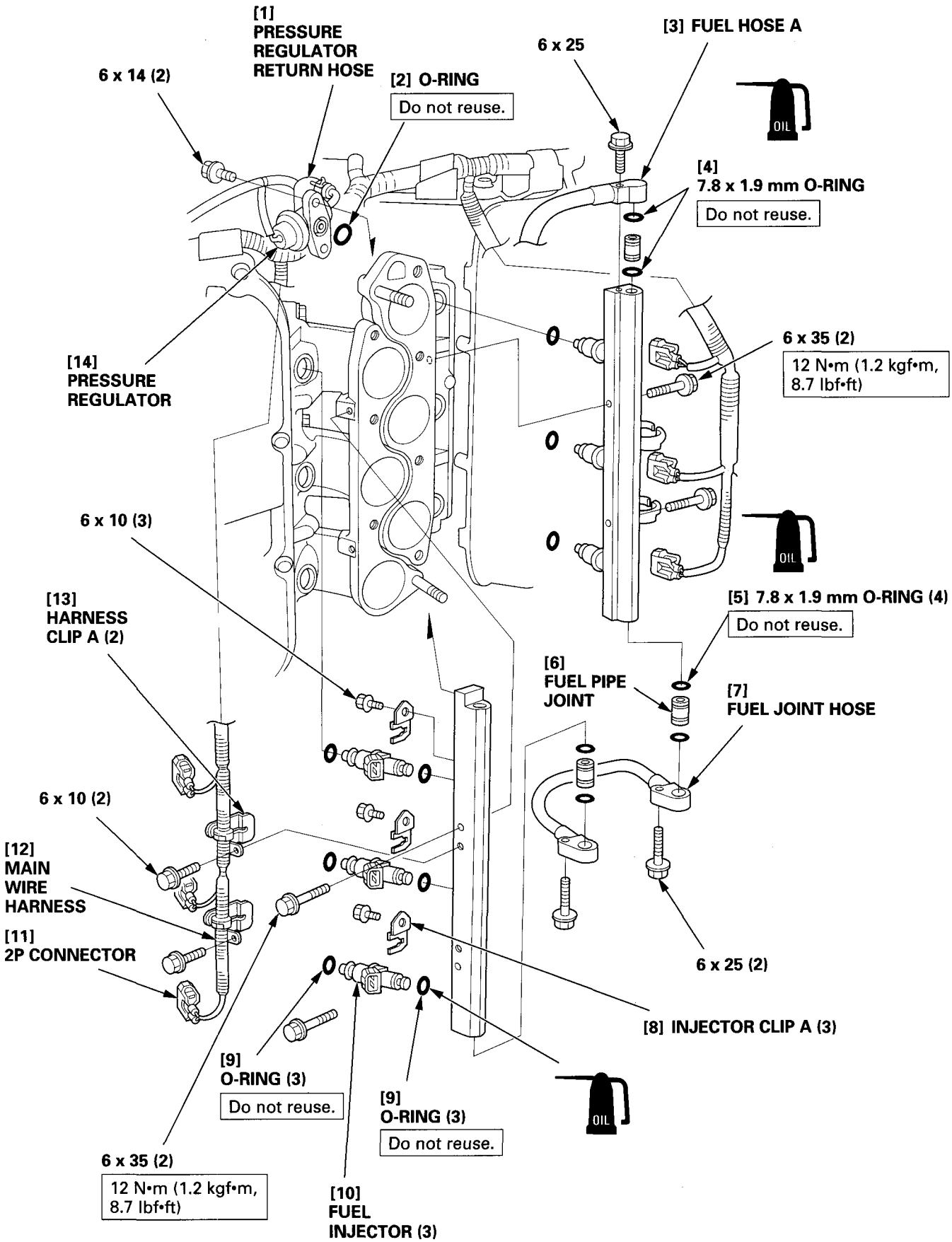
8) Remove the two 6 x 14 mm flange bolts and the pressure regulator from the left fuel pipe.



9) Remove the 6 x 10 mm flange bolts, the injector clips and the injectors from the fuel pipes.

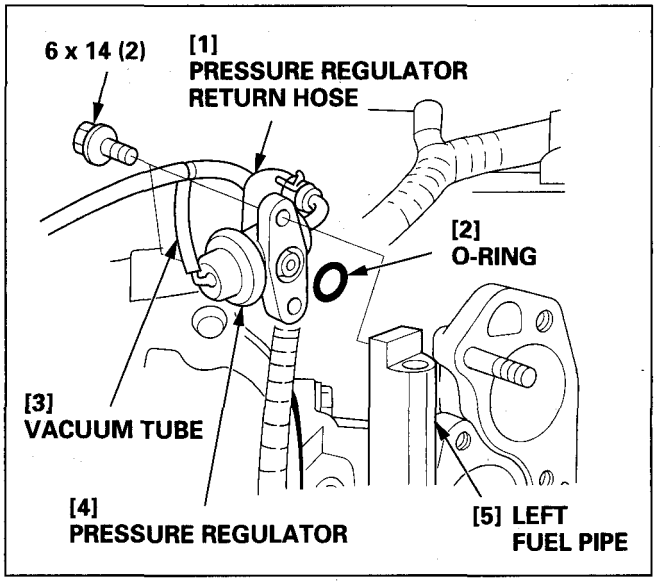


b. EXPLODED VIEW

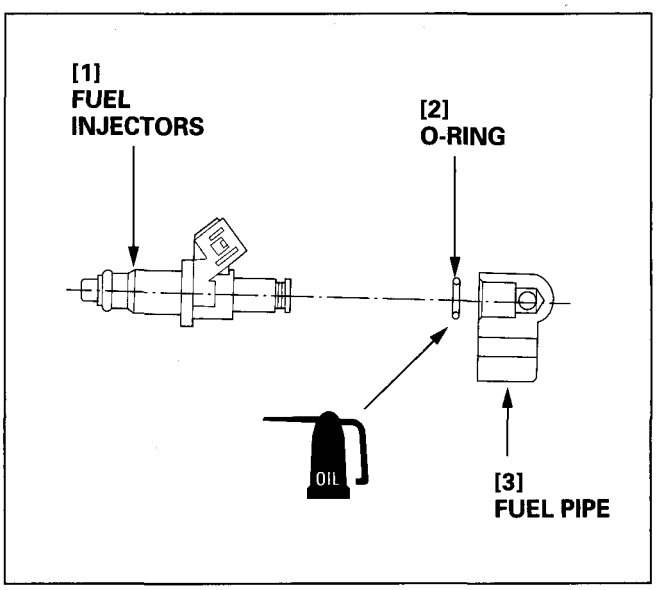


c. INSTALLATION

1) Replace the O-ring with a new one and install the pressure regulator to the left fuel pipe with the two 6 x 14 mm flange bolts.



2) Coat the engine oil to the new O-rings and install them to the injectors.

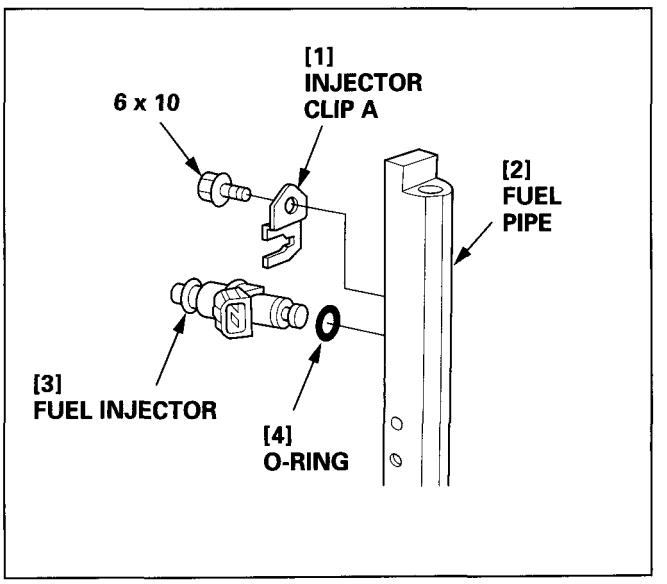


3) Set the all injectors to the fuel pipes.

NOTICE

Insert the fuel injectors straight into the fuel pipe.
Do not insert them into the fuel pipe slanted, and do not insert them with force. Damage to the O-rings can occur.

4) Install the injectors with the injector clips A and tighten the injector clips A with the 6 x 10 mm flange bolts to the fuel pipes.

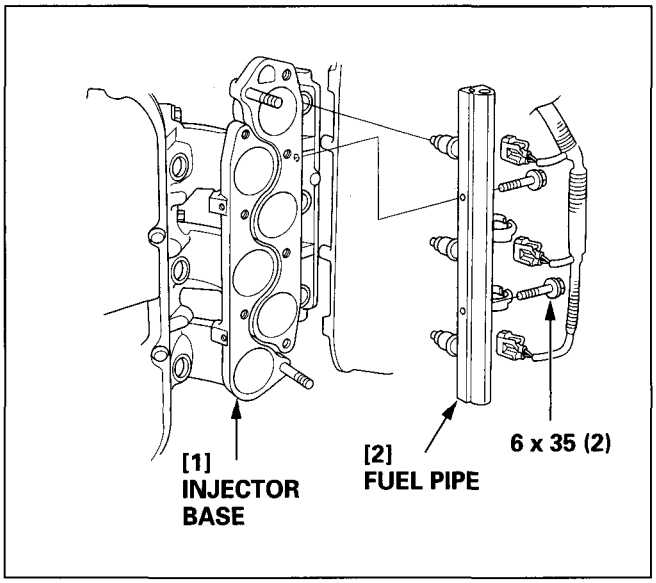


NOTICE

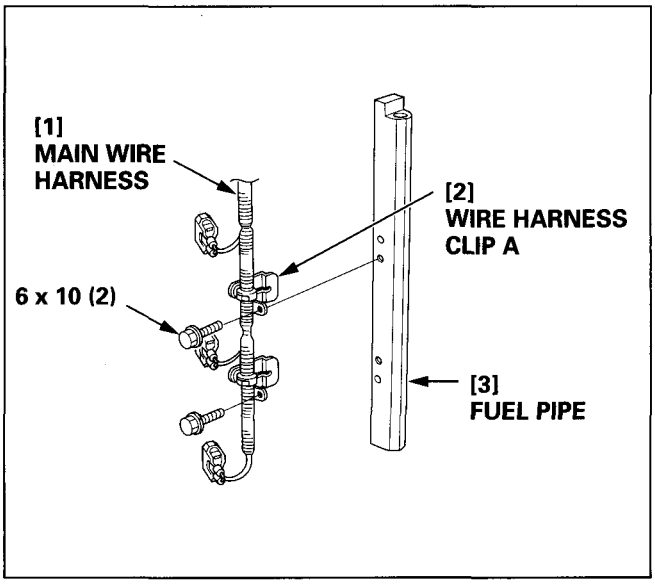
To prevent damage to the O-ring, install the injectors in the fuel pipe first, then install them in the injector bases.

5) Coat the new O-rings with clean engine oil, and insert the injectors into the fuel pipe.

6) Install the fuel pipes to the injector bases with the 6 x 35 mm flange bolts.



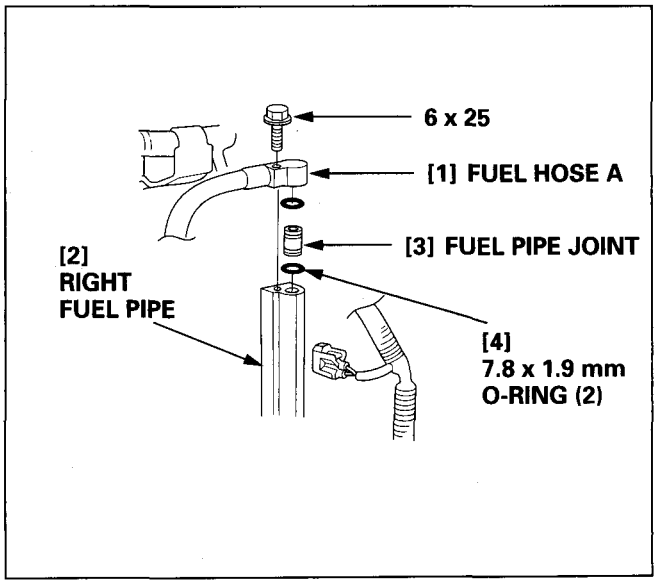
7) Install the wire harness clips A to the fuel pipes with the two 6 x 10 mm flange bolts, then clamp the main wire harness.



8) Coat the engine oil to the new O-rings and install them to the fuel pipe joint, then install the fuel hose A to the right fuel pipe with the 6 x 25 mm flange bolt.

NOTICE

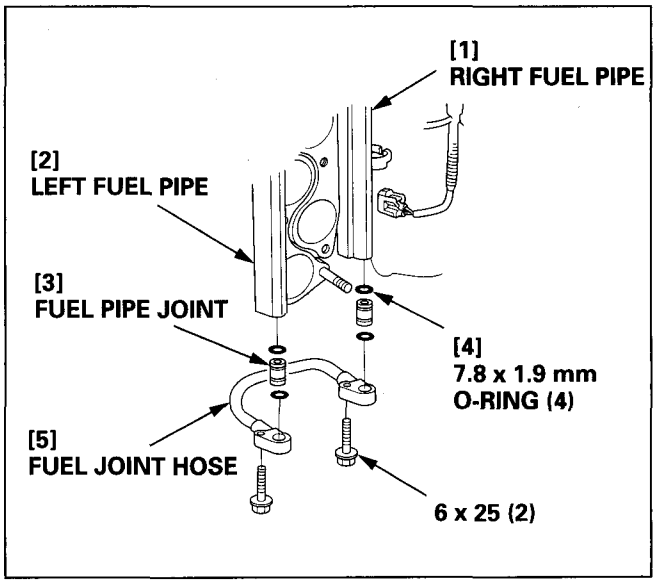
Before tightening the 6 x 25 mm flange bolt, make sure the fuel pipe joint and fuel hose A fixed to the fuel pipe securely.



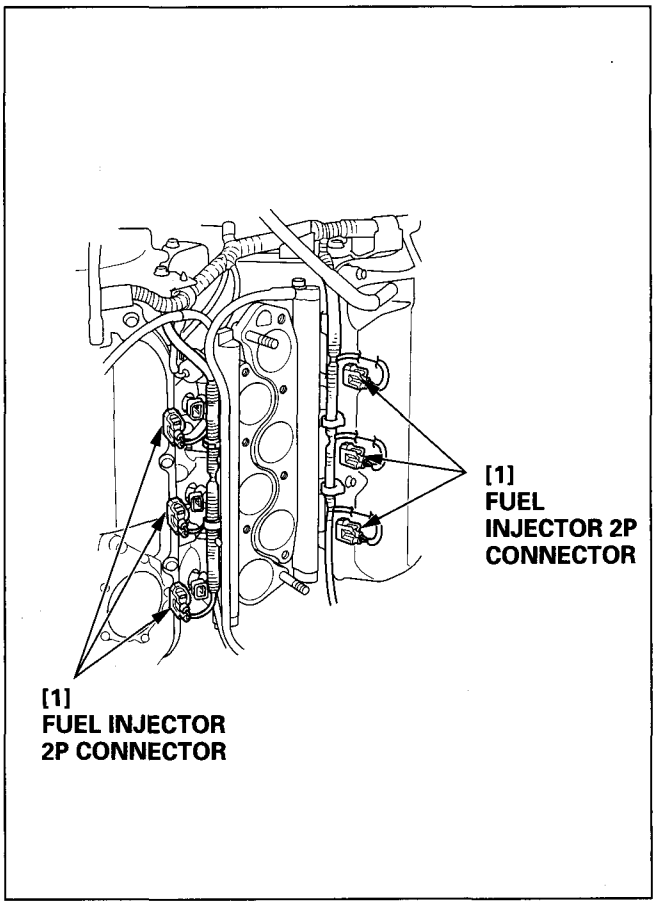
9) Coat the engine oil to the new O-rings and install them to the fuel pipe joints, then install the fuel joint hose to the fuel pipes with the two 6 x 25 mm flange bolts.

NOTICE

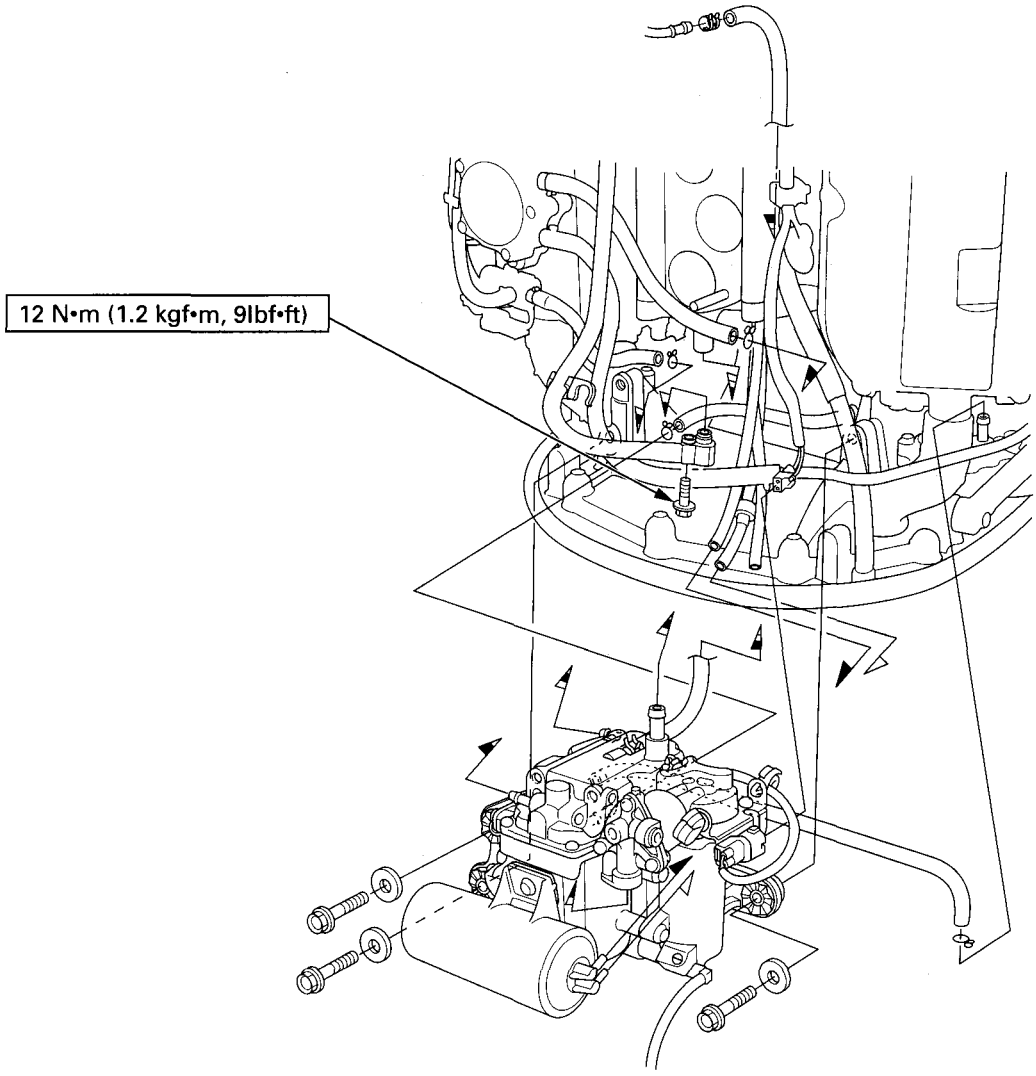
Before tightening the 6 x 25 mm flange bolts, make sure the fuel pipe joints and fuel joint hose fixed to the fuel pipes securely.



10) Connect the 2P connectors to the fuel injectors.



7. FUEL PUMP (HIGH PRESSURE SIDE)/VAPOR SEPARATOR



a. FUEL PUMP (HIGH PRESSURE SIDE)

- Turn the ignition switch OFF before disconnecting and reconnecting the connectors.

INSPECTION:

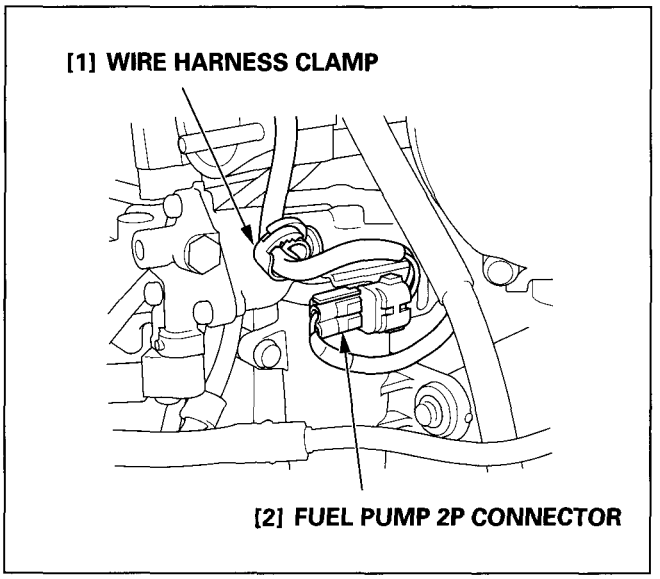
<Check>
Turn the ignition switch ON and be sure that the fuel pump operation sound can be heard for approximately 2 seconds. If there is no operation sound, perform the following check.

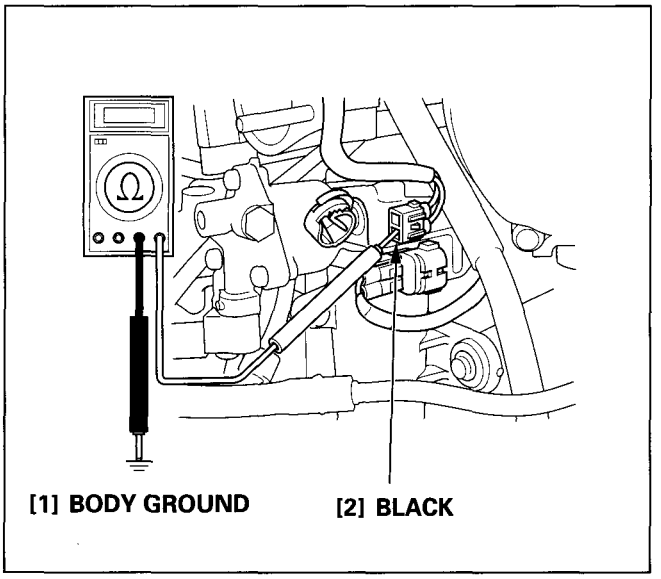
<Voltage check>

NOTICE
Use the known-good battery and fuses for the voltage check.

1) Check for continuity between the main wire harness side of the 2P connector Black wire terminal and body ground.

   - If there is no continuity, check for:
     — An open in the Black wire, or
     — Poor ground (Tighten the each ground bolt securely).
   - If there is continuity, go to step 3.

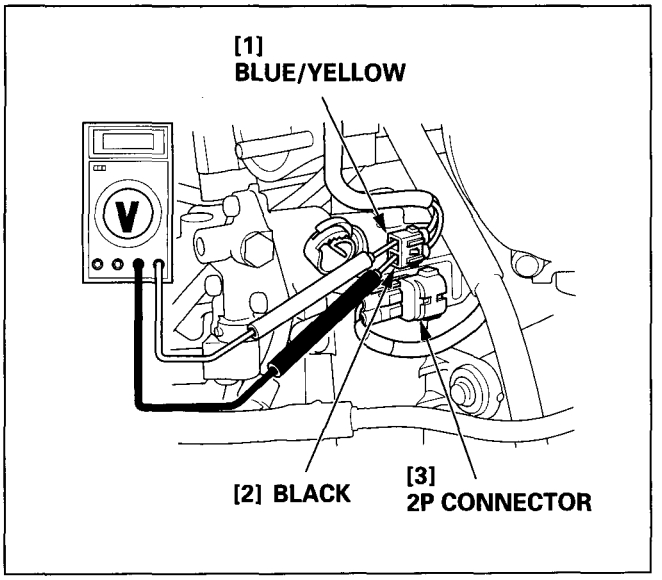




2) Attach the positive (+) tester lead to the Blue/Yellow wire terminal and the negative (–) tester lead to the Black wire terminal of the main wire harness side 2P connector as shown.

3) Turn the ignition switch ON and check the voltage. There should be battery voltage approximately for 2 seconds when the ignition switch is ON.

   - If there is no battery voltage, check for:
     — The PGM-FI main relay (P. 5-59), or
     — An open in the Blue/Yellow or Black wire.
   - If there is battery voltage, check the discharge volume as follows.



<Discharge volume check>

- Use a known-good battery for the voltage check.

1) Disconnect the pressure regulator return hose from the pressure regulator, and connect a hose that is equivalent to the pressure regulator return hose to the pressure regulator.

2) Turn the ignition switch ON. Operate the fuel pump for approximately 2 seconds and measure the gasoline discharge volume.

Discharge volume	60 m ℓ (2.0 US oz, 2.1 Imp oz) or more

⚠ WARNING

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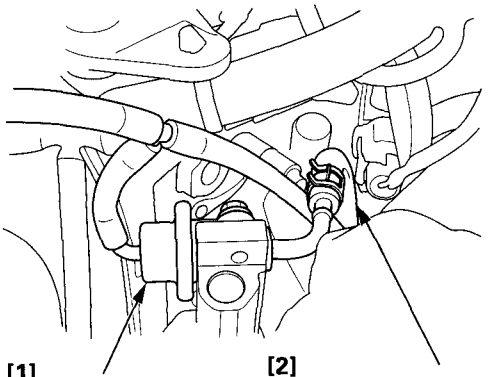
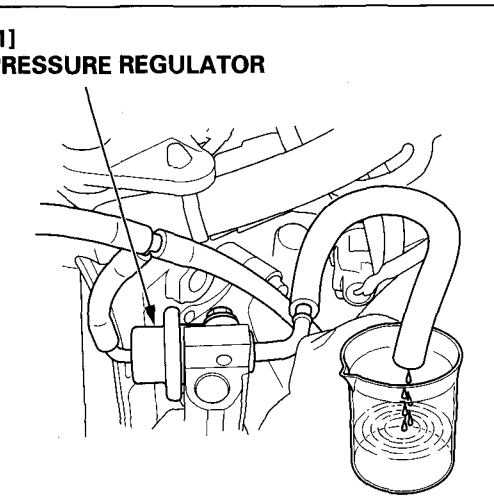
You can be burned or seriously injured when handling fuel.
- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

3) If gasoline is not discharged or the discharge volume is too small, check the following and replace the fuel pump (P. 5-84, 94).
   - Open circuit or poor contact of the main wire harness
   - Clogged fuel filter (high pressure side) or fuel hose/pipe
   - Faulty pressure regulator

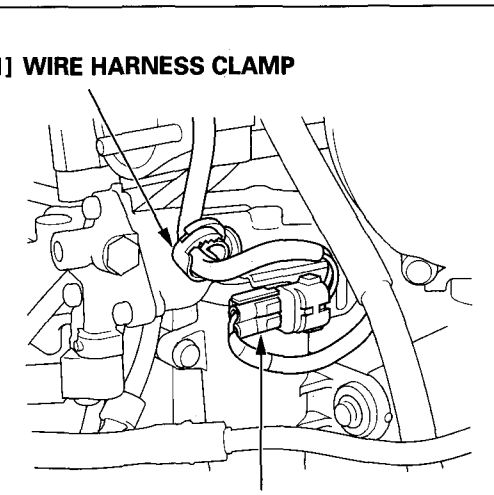
4) If the fuel pump (high pressure side) is OK, connect the 2P connector to the fuel pump (high pressure side) and clamp the wire harness securely.



[1] PRESSURE REGULATOR
[2] PRESSURE REGULATOR RETURN HOSE



[1] PRESSURE REGULATOR



[1] WIRE HARNESS CLAMP
[2] FUEL PUMP 2P CONNECTOR

b. REMOVAL

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

Disconnect the battery cable from the battery negative (–) terminal.

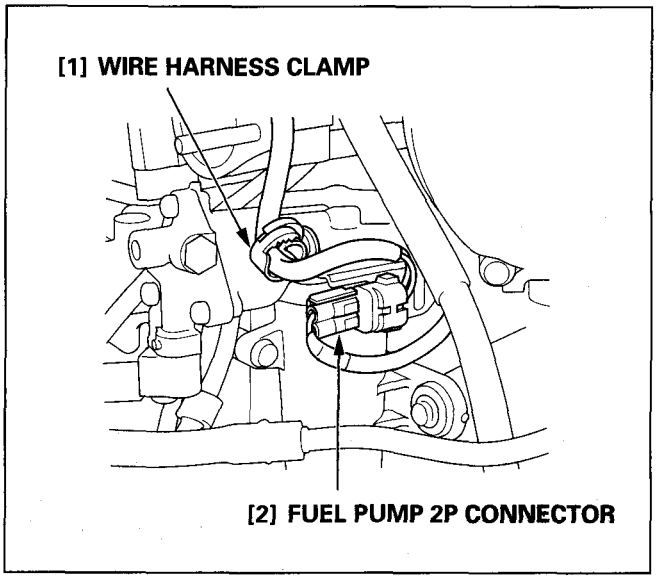
Relieve the fuel pressure according to "How to relieve fuel pressure" (P. 5-69).

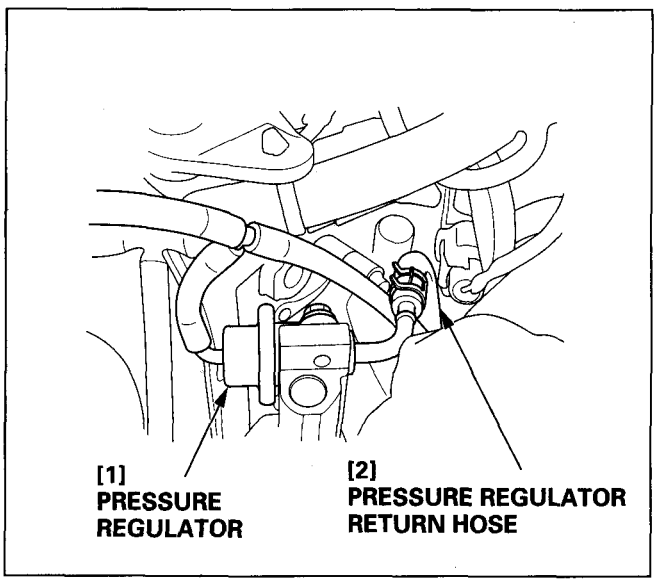
1) Remove the intake manifold (P. 5-112).

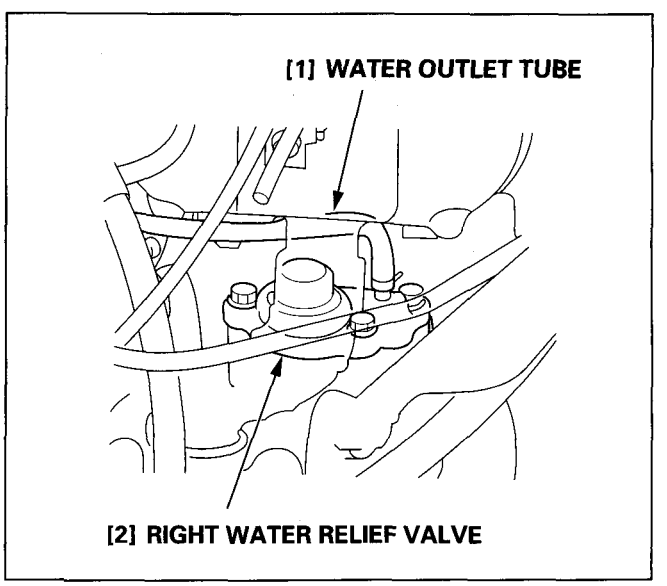
2) Disconnect the 2P connectors from the fuel pump (high pressure side).

3) Disconnect the pressure regulator return hose from the pressure regulator.

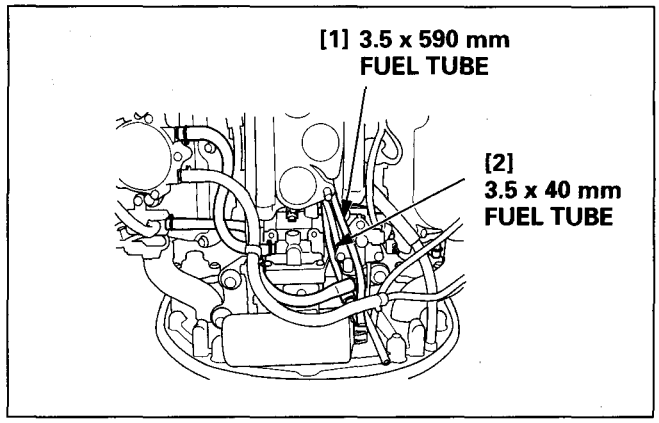
4) Disconnect the water outlet tube from the right water relief valve.





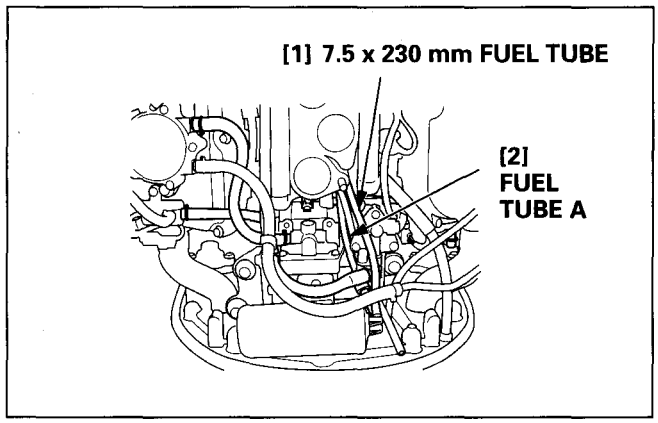


5) Disconnect the 3.5 x 40 mm fuel tube and the 3.5 x 590 mm fuel tube from the vacuum tank.

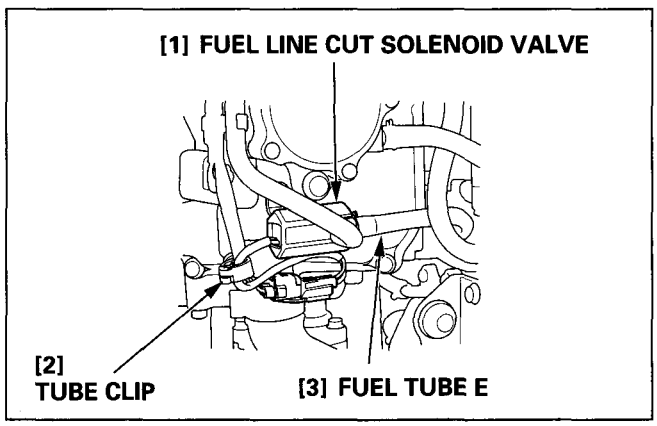


6) Disconnect the 7.5 x 230 mm fuel tube from the vapor separator.

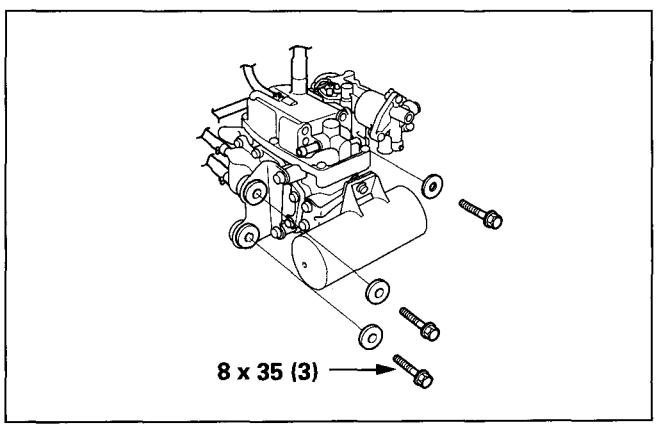
7) Disconnect the fuel tube A from the fuel strainer (high pressure side).



8) Disconnect the fuel tube E from the fuel line cut solenoid valve, and remove the fuel tube E from the tube clip.



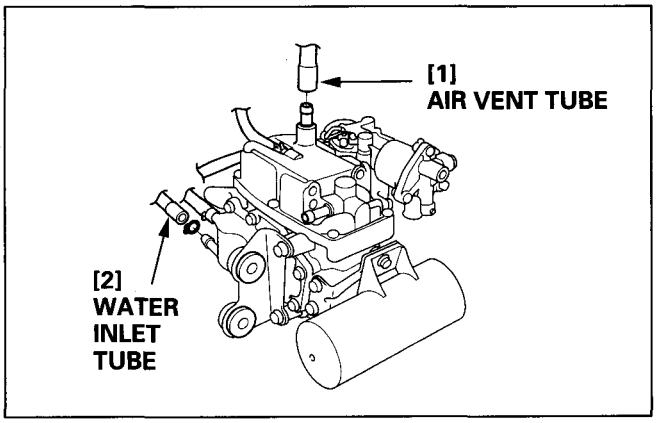
9) Remove the three 8 x 35 mm flange bolt and pull out the vapor separator slightly to disconnect the other tubes from behind the vapor separator.



10) Disconnect the air vent tube and water inlet tube from the vapor separator, and remove the vapor separator, *fuel strainer and fuel pump (high pressure side)* as an assembly.

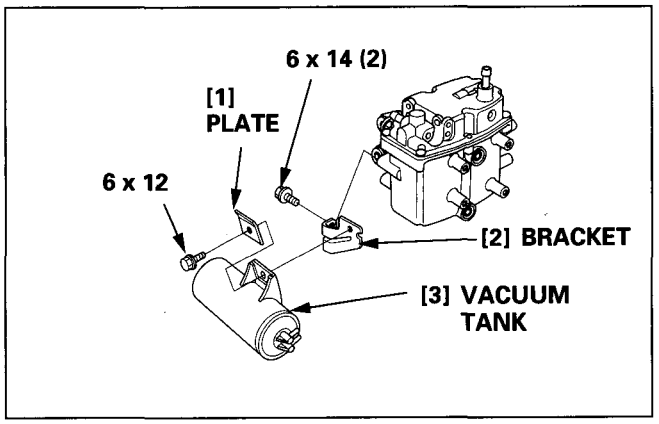
NOTICE

Take care not to damage the hoses and tubes.

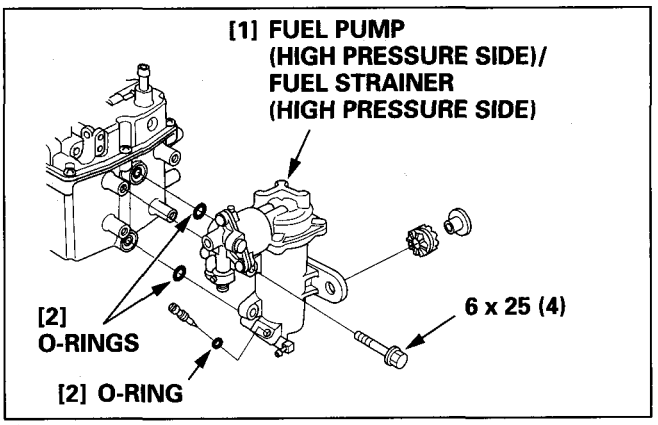


11) Remove the 6 x 12 mm flange bolt and the vacuum tank.

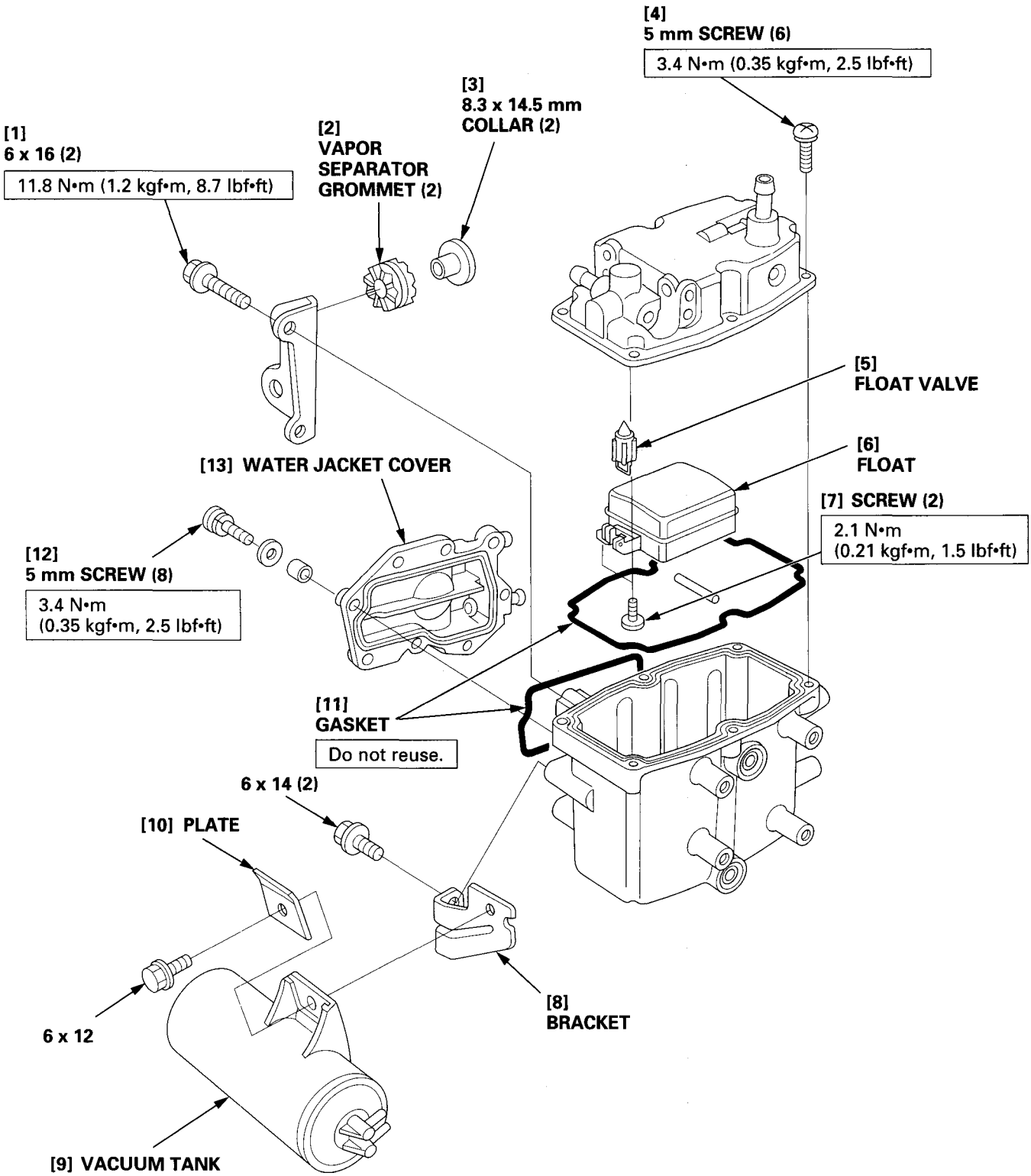
12) Remove the two 6 x 14 mm flange bolts and the bracket from the vapor separator.



13) Remove the four 6 x 25 mm flange bolts and the fuel strainer (high pressure side) and the fuel pump (high pressure side) as an assembly.



c. VAPOR SEPARATOR DISASSEMBLY



d. INSPECTION

• VAPOR SEPARATOR

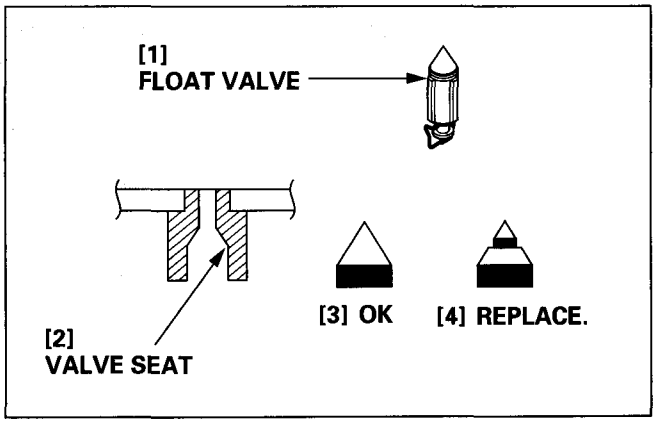
NOTICE

If gasoline overflows from the vapor separator, perform the following checks.

FLOAT VALVE:

1) Remove the float valve from the float.

2) Check the float valve head and the valve seat for wear and damage as shown. Replace the float valve or cover if necessary.



FLOAT HEIGHT:

1) The float valve and the float must be installed on the cover properly.

2) Place the cover as shown and measure the distance between the float and cover (i.e. float height) at the tip of the float.

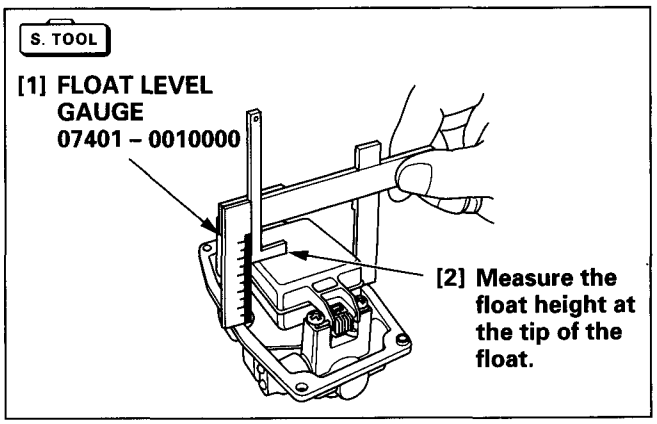
Float height	29 – 34 mm (1.1 – 1.3 in)

3) If the float height is outside the specification, adjust the float height by bending the brass float tab slowly with care not to damage the float.

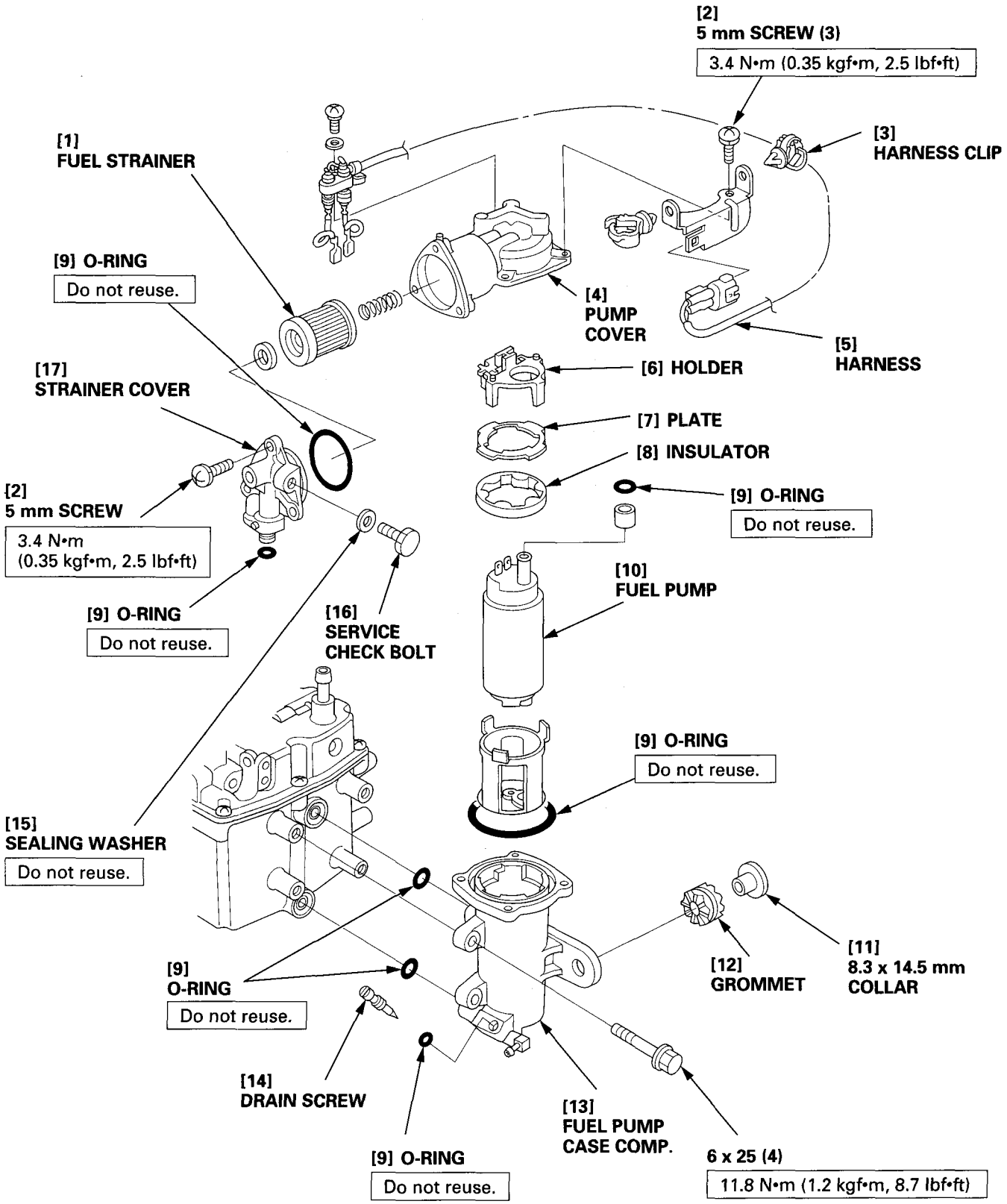
4) Check float operation.

TOOL:

Float level gauge	**07401 – 0010000**

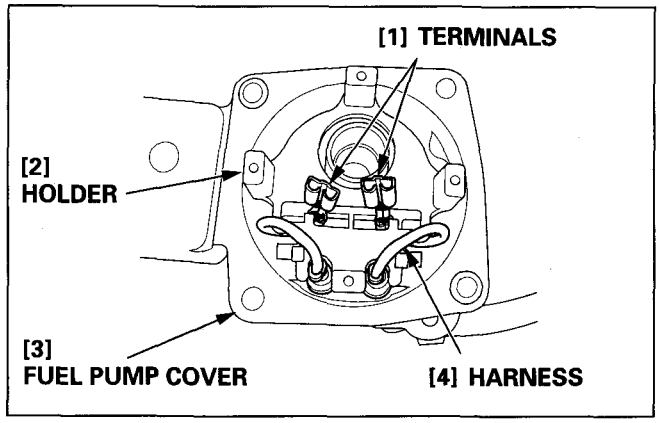


e. FUEL PUMP (HIGH PRESSURE SIDE)/FUEL STRAINER (HIGH PRESSURE SIDE) DISASSEMBLY



f. ASSEMBLY

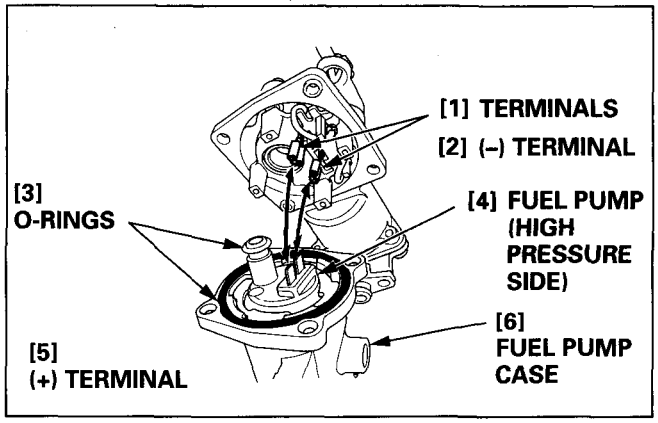
1) Install the holder to the fuel pump cover and set the two terminals of the harness as shown.



2) Replace the O-ring with a new one and set the fuel pump (high pressure side) to the fuel pump case.

3) Connect the two terminals of the fuel pump cover side to the terminals of the fuel pump side securely as shown.

NOTICE
Connect the Bu/Y wire to the (+) terminal and Bl wire to the (–) terminal.



4) *Tighten the fuel pump cover with the four 5 mm screws* to the specified torque.

TORQUE: 3.4 N•m (0.35 kgf•m, 25 lbf•ft)

5) Set the fuel strainer (high pressure side) to the fuel pump cover.

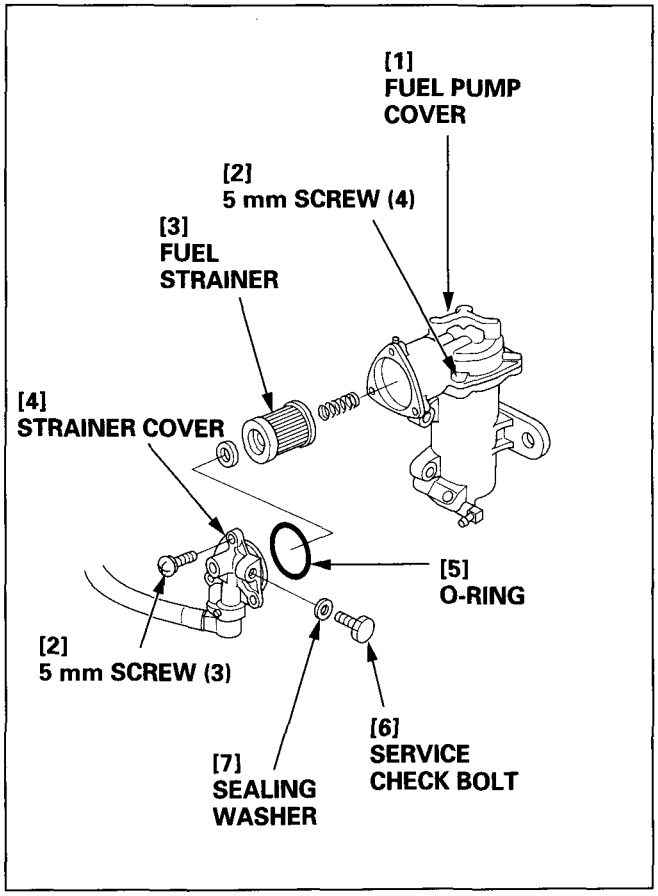
6) Replace the O-ring with a new one and tighten the strainer cover with the three 5 mm screws to the specified torque.

TORQUE: 3.4 N•m (0.35 kgf•m, 25 lbf•ft)

7) *Replace the sealing washer with a new one and tighten* the service check bolt to the specified torque.

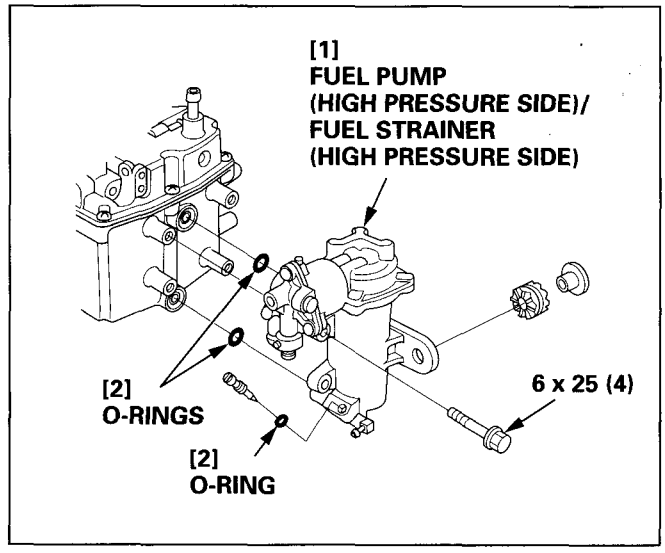
TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

NOTICE
Replace the sealing washer with a new one when loosen or remove the service check bolt.

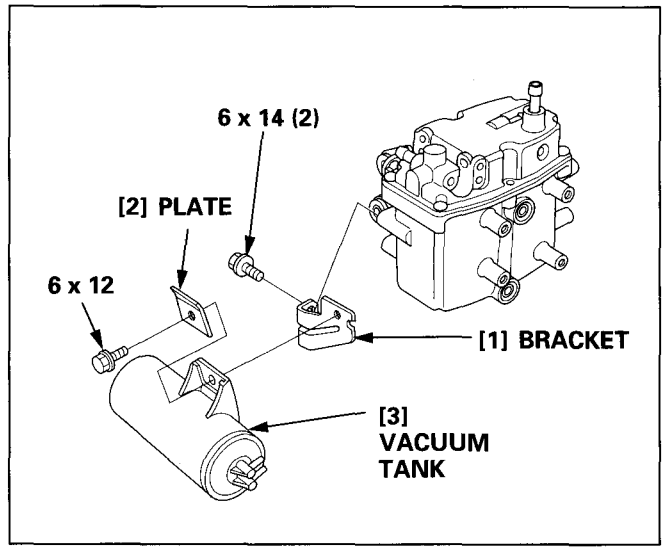


g. INSTALLATION

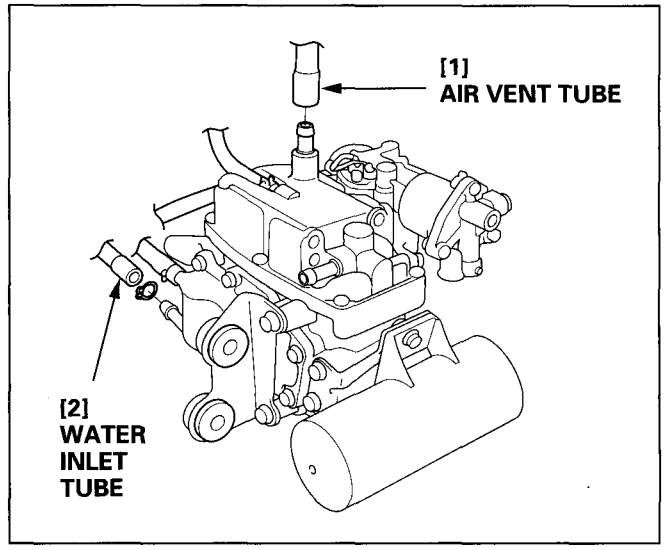
1) Replace the O-ring with a new one and install the fuel pump (high pressure side)/fuel strainer (high pressure side) to the vapor separator with the four 6 x 25 mm flange bolts.



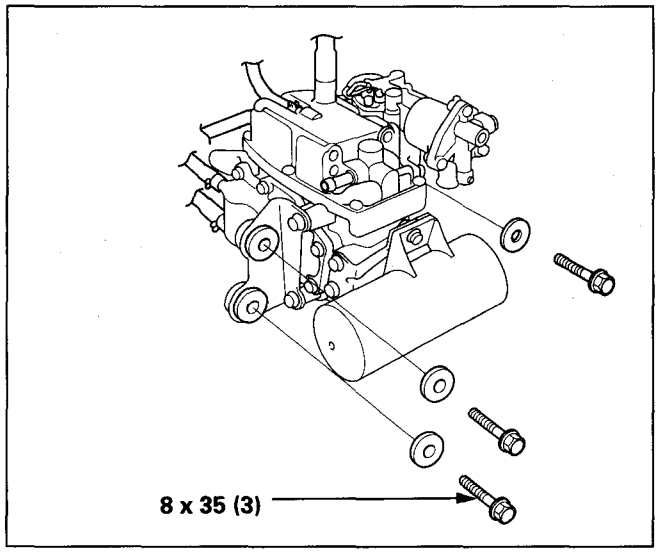
2) Install the bracket to the vapor separator with the two 6 x 14 mm flange bolts.
Install the vacuum tank to the bracket with the 6 x 12 mm flange bolt.



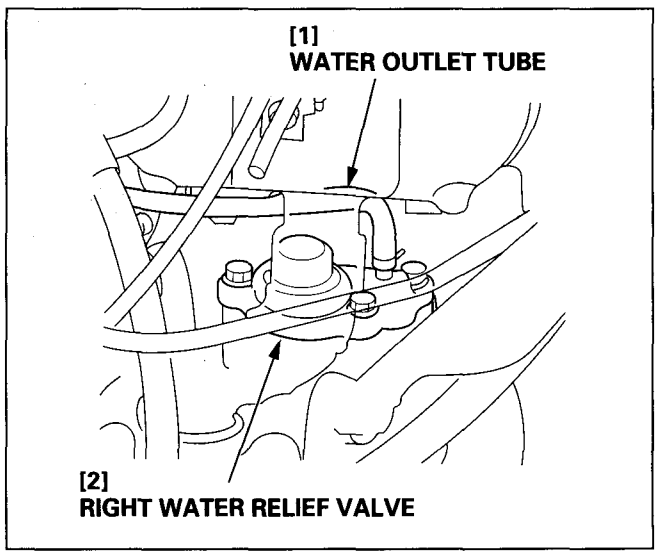
3) Connect the air vent tube and the water inlet tube to the vapor separator.



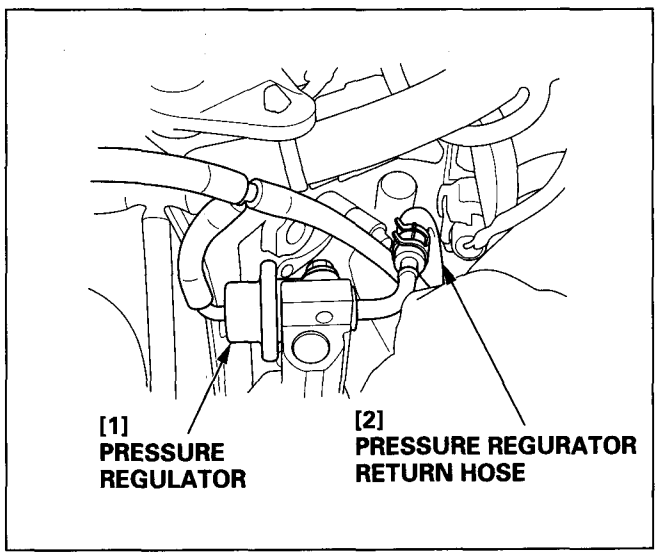
4) Loosely tighten the vapor separator with the three 8 x 35 mm flange bolts.



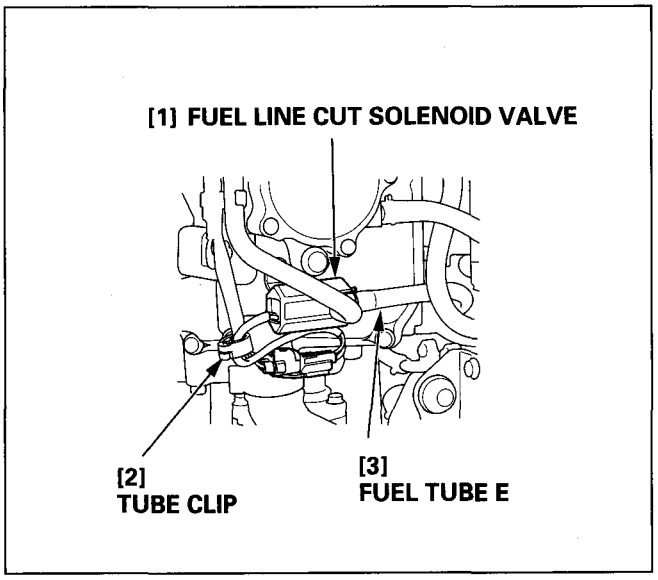
5) Connect the water outlet tube to the right water relief valve.



6) Connect the pressure regulator return hose to the pressure regulator.



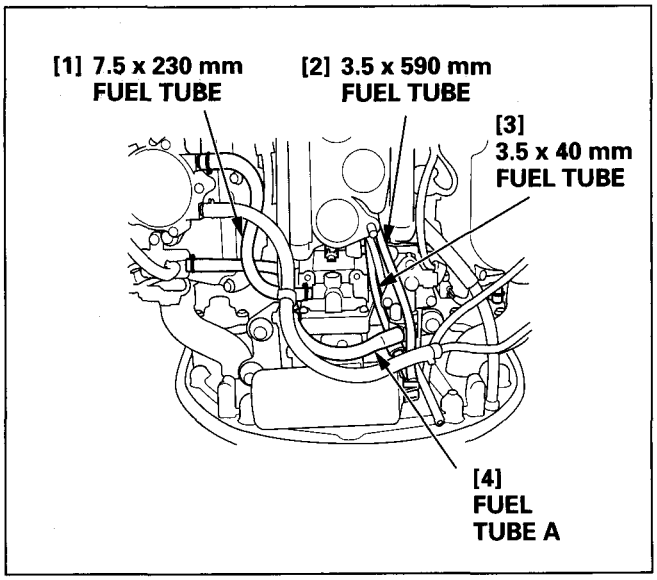
7) Connect the fuel tube E to the fuel line cut solenoid valve and clamp the fuel tube E to the tube clip.



8) Connect the 7.5 x 230 mm fuel tube to the vapor separator.

9) Replace the O-ring with a new one and connect the fuel tube A to the vapor separator.

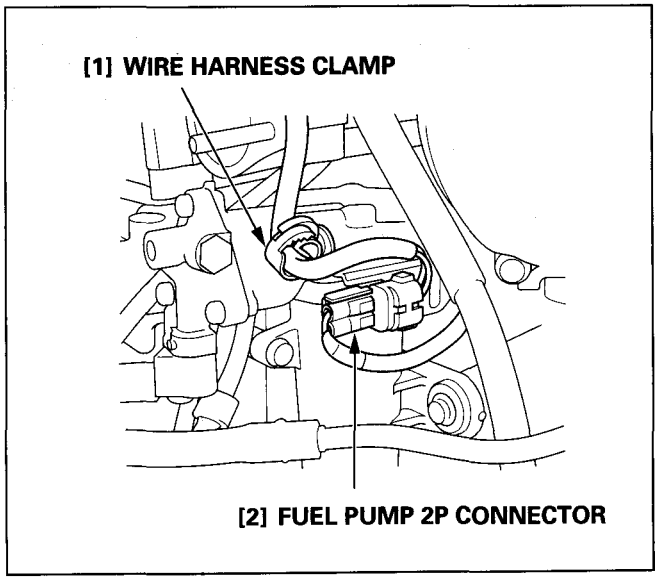
10) Connect the 3.5 x 40 mm fuel tube and the 3.5 x 590 mm fuel tube to the vacuum tank (the fuel tube with the check valve connect to the lower side of the vacuum tank joint.) (P. 2-45)



11) Make sure the tubes connection. (P. 2-45)

12) After checking, tighten the vapor separator with the three 8 x 35 mm flange bolts.

13) Connect the fuel pump (high pressure side) 2P connector and clamp the wire harness securely.



8. FUEL PUMP (LOW PRESSURE SIDE)

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned of seriously injured when handling fuel.

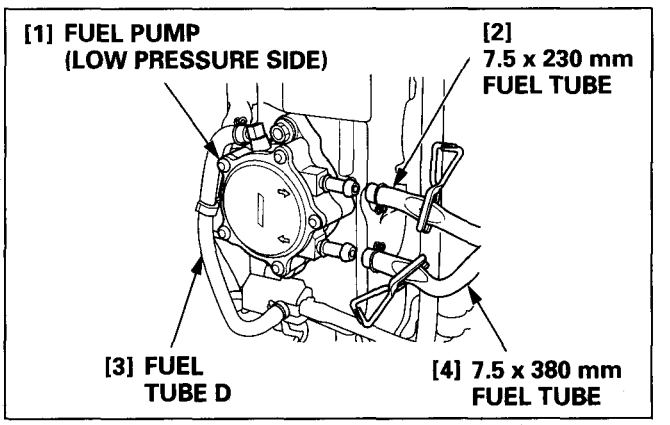
- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

Check for gasoline leakage after install the fuel tube.

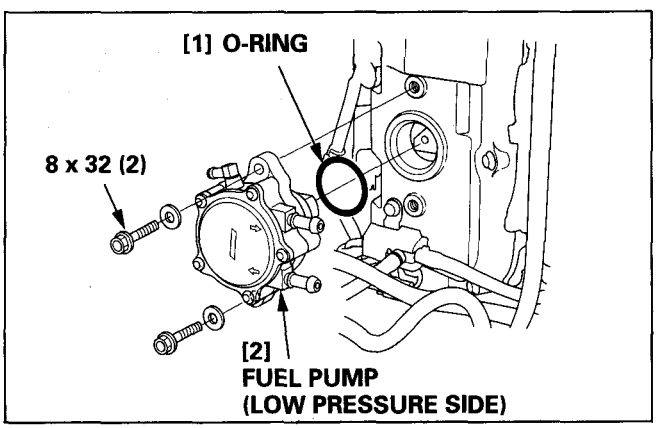
a. REMOVAL

1) Remove the intake manifold. (P. 5-112)

2) Disconnect the fuel tube D, 7.5 x 230 mm fuel tube and the 7.5 x 380 mm fuel tube from the fuel pump (low pressure side).



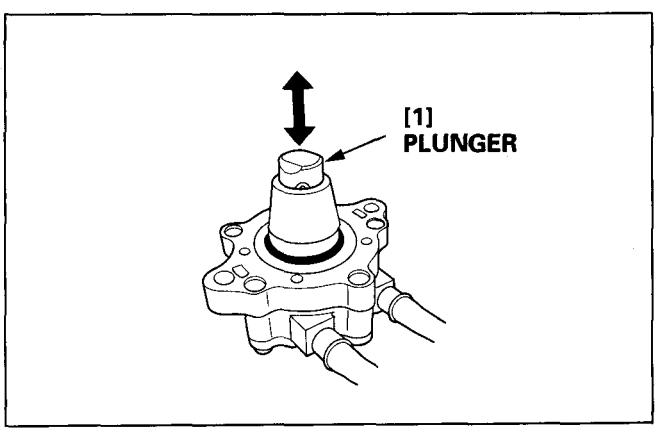
3) Remove the two 8 x 32 mm flange bolts and the fuel pump (low pressure side).



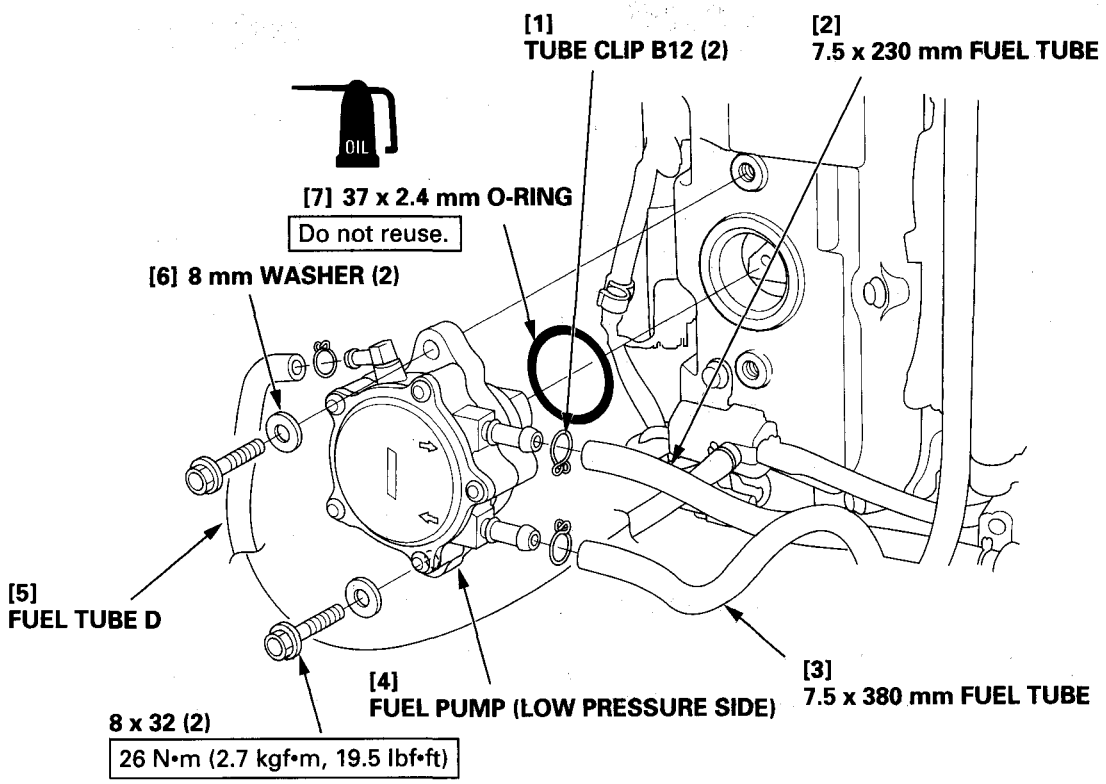
b. INSPECTION

1) Push the fuel pump plunger and make sure the plunger moves smoothly.

2) If the plunger is stiff, replace the fuel pump (low pressure side).



c. EXPLODED VIEW

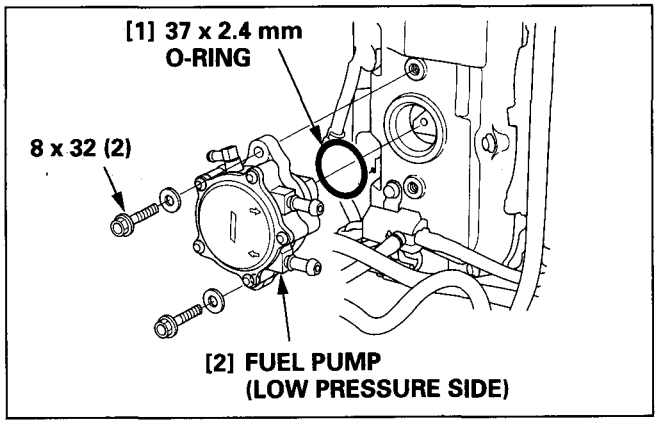


d. INSTALLATION

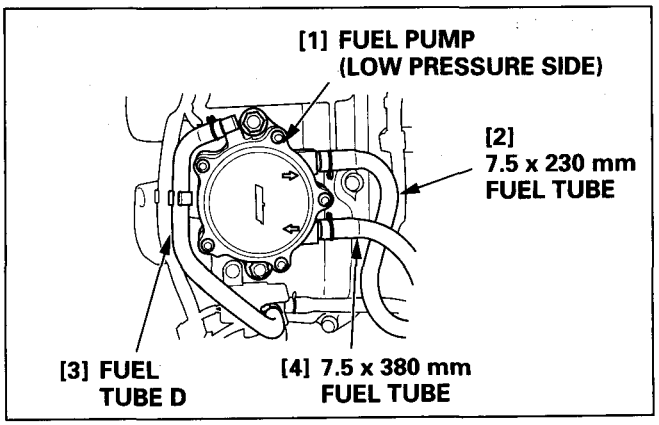
1) Replace the 37 x 2.4 mm O-ring with a new one and coat the engine oil to the O-ring.

2) Install the fuel pump (low pressure side) with the two 8 x 32 mm flange bolts to the specified torque.

   TORQUE: 26 N•m (2.7 kgf•m, 20 lbf•ft)



3) Connect the fuel tube D, 7.5 x 230 mm fuel tube and 7.5 x 380 mm fuel tube to the fuel pump (low pressure side) securely.



9. OIL PRESSURE SWITCH (HIGH PRESSURE SIDE)

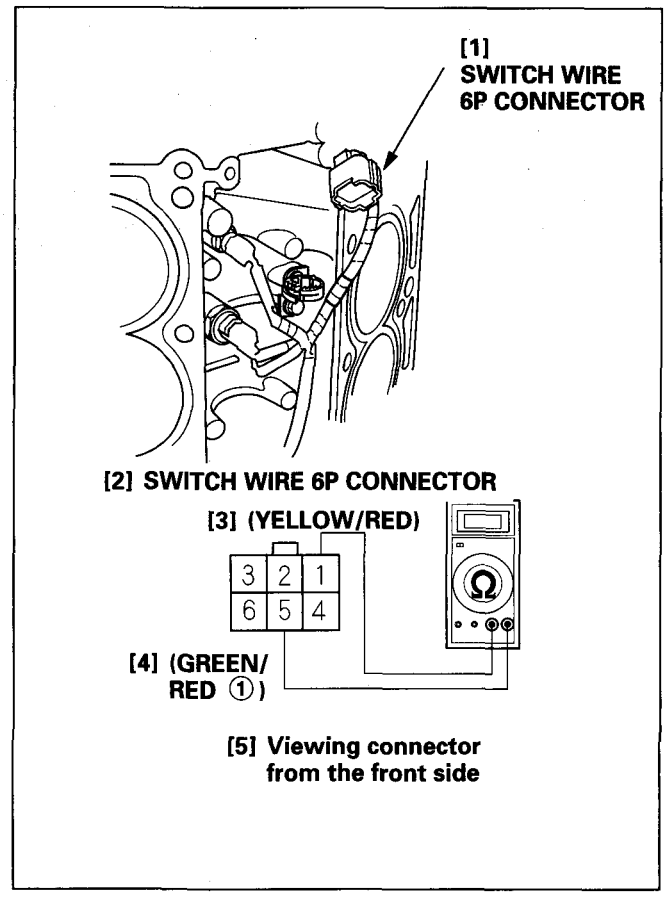
Remove the cylinder heads. (P. 9-1)

• TEST

<SWITCH WIRE HARNESS TEST>

1) Disconnect the switch wire harness 6P connector from the main wire harness.

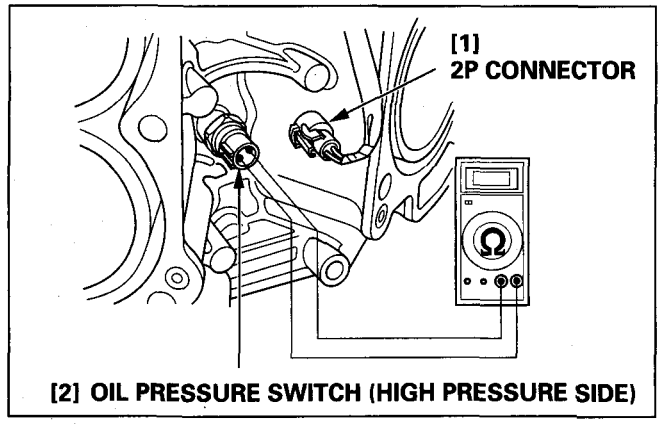
2) Check for continuity between the Yellow/Red and Green/Red ① terminals of the switch wire harness 6P connector.
   - If there is continuity, the switch wire harness is OK.
   - If there is no continuity, check for an open in the wire.
     If the wire is OK, check the oil pressure switch (high pressure side).



<OIL PRESSURE SWITCH (HIGH PRESSURE SIDE) TEST>

1) Disconnect the 2P connector from the oil pressure switch (high pressure side).

2) Check for continuity between the oil pressure switch (high pressure side) terminals.
   - If there is continuity, the oil pressure switch is OK.
   - If there is no continuity, replace the oil pressure switch (high pressure side).



• REPLACEMENT

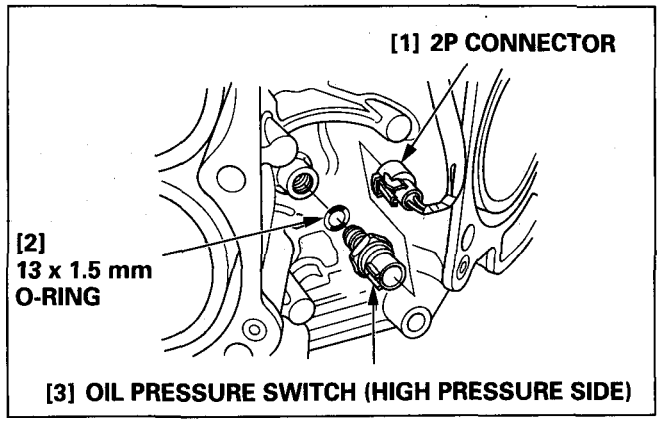
1) Remove the oil pressure switch (high pressure side).

2) Replace the 13 x 1.5 mm O-ring with a new one and tighten the oil pressure switch (high pressure side) to the specified torque.

   TORQUE: 21.6 N•m (2.2 kgf•m, 16 lbf•ft)

   NOTICE
   Be sure to use a torque wrench to tighten the switch. Overtightening will damage the cylinder block.

3) Connect the 2P connector to the oil pressure switch (high pressure side).



10. OIL PRESSURE SWITCH (LOW PRESSURE SIDE)

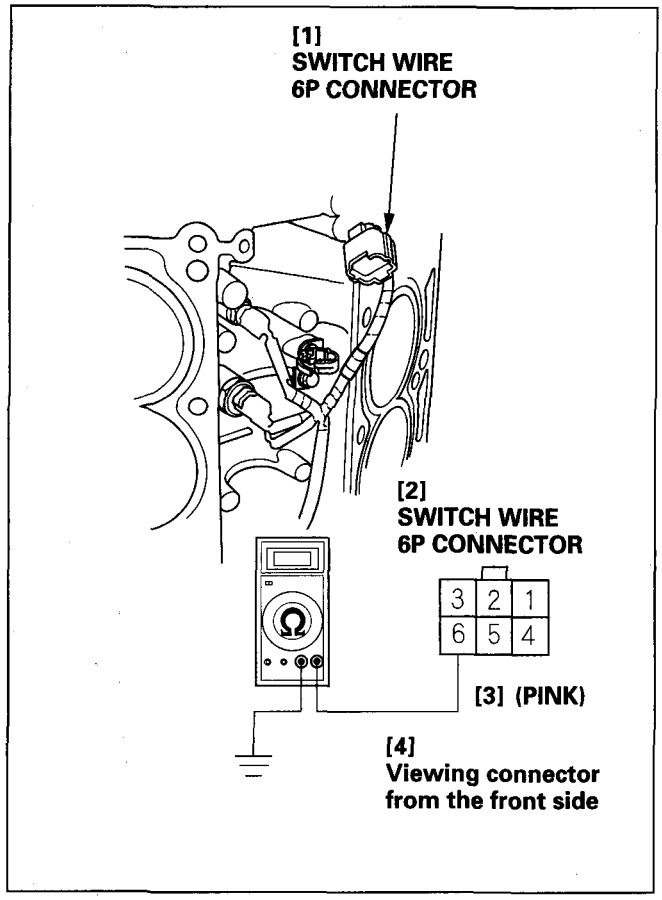
Remove the cylinder head. (P. 9-1)

• TEST

<SWITCH WIRE HARNESS TEST>

1) Disconnect the switch wire harness 6P connector from the main wire harness.

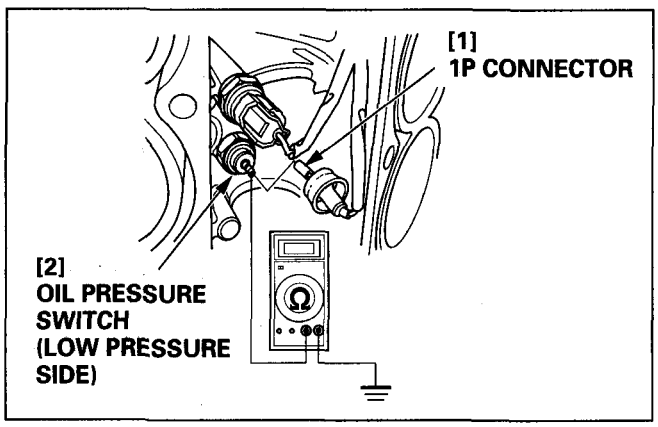
2) Check for continuity between the Pink wire terminal of the switch wire harness 6P connector and the body ground.
   - If there is continuity, the switch wire harness is OK.
   - If there is no continuity, repair an open in the wire. If the wire is OK. Check the oil pressure switch (low pressure side).



<OIL PRESSURE SWITCH (LOW PRESURE SIDE) TEST>

1) Disconnect the 1P connector from the oil pressure switch (low pressure side).

2) Check for continuity between the oil pressure switch (low pressure side) terminals.
   - If there is continuity, the switch wire harness is OK.
   - If there is no continuity, replace the oil pressure switch (low pressure side).



• REPLACEMENT

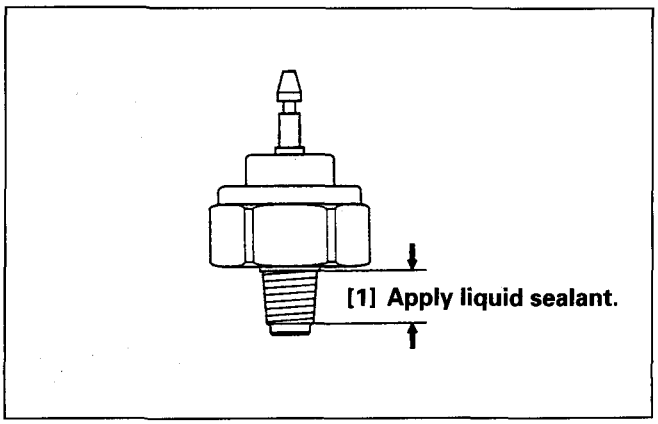
1) Remove the oil pressure switch (low pressure side).

2) Clean the oil pressure switch threads and apply liquid sealant (THREE BOND 1215) to the threads. Tighten the oil pressure switch to the specified torque.

   TORQUE: 8 N•m (0.85 kgf•m, 6.1 lbf•ft)

   NOTICE
   - Take care not to contaminate the switch end and oil passage with the liquid sealant.
   - Be sure to use a torque wrench to tighten the switch. Overtightening will damage the cylinder block.

3) Connect the 1P connector to the oil pressure switch (low pressure side).



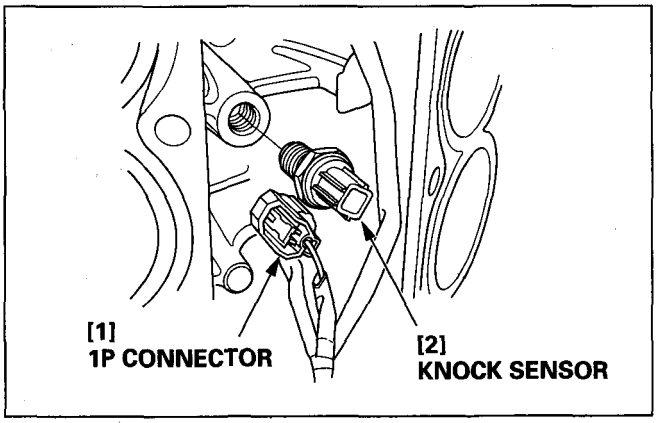
11. KNOCK SENSOR

REPLACEMENT

1) Remove the injector bases and cylinder heads. (P. 9-1)
2) Disconnect the 1P connector from the knock sensor.
3) Tighten the knock sensor as specified torque.

   TORQUE: 32 N•m (3.2 kgf•m, 23 lbf•ft)

4) After installing, connect the 1P connector to the knock sensor.



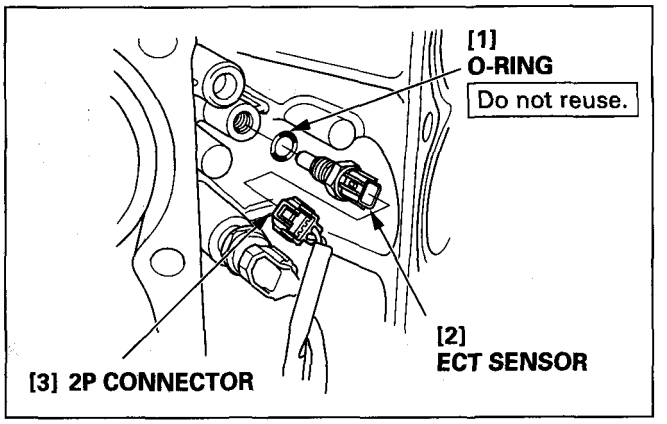
12. ECT SENSOR

REPLACEMENT

1) Remove the injector bases and cylinder heads. (P. 9-1)
2) Disconnect the 2P connector from the ECT sensor.
3) Clean the ECT sensor and install a new O-ring.
4) Tighten the ECT sensor as specified torque.

   TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

5) After installing, connect the 2P connector to the ECT sensor.



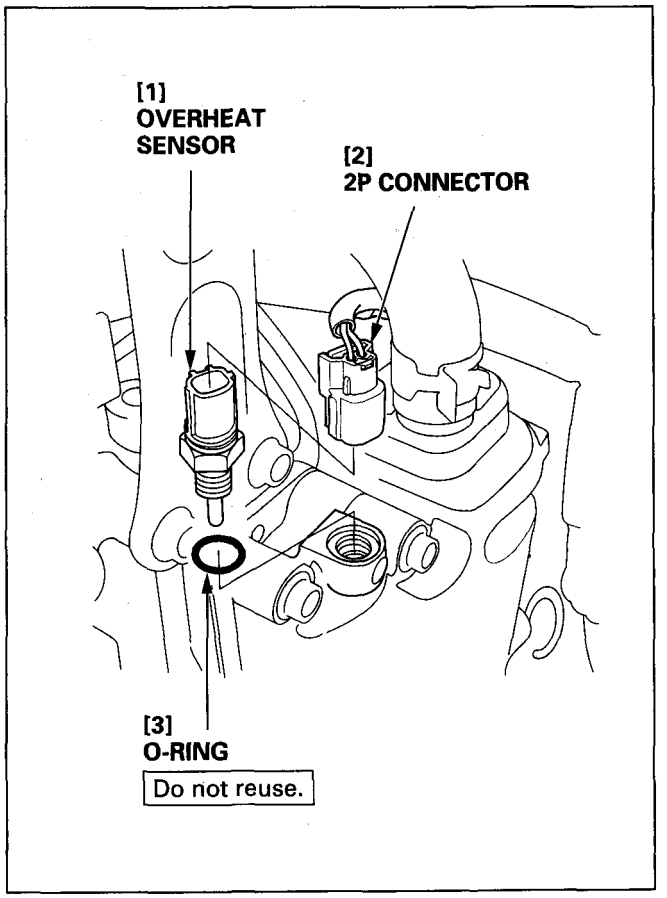
13. OVERHEAT SENSOR 1,2

REPLACEMENT

1) Remove the engine cover (P. 4-1).
2) Disconnect the 2P connectors from the overheat sensor 1 and sensor 2.
3) Remove the overheat sensor.
4) Replace a new O-ring and install the overheat sensor as specified torque.

   TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

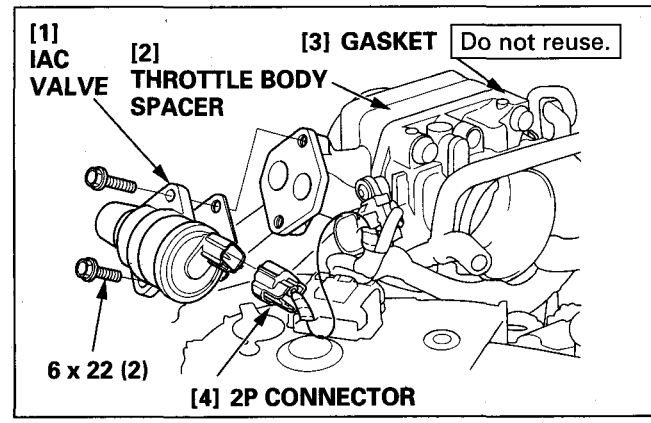
5) After installing, connect the 2P connectors to the overheat sensors.



14. IAC VALVE

REPLACEMENT

1) Remove the silencer case. (P. 5-103)
2) Disconnect the 2P connector from the IAC valve.
3) Remove the two 6 x 22 flange bolts and remove the IAC valve.
4) Install a new gasket and tighten the IAC valve to the throttle body spacer with the two 6 x 22 flange bolts.

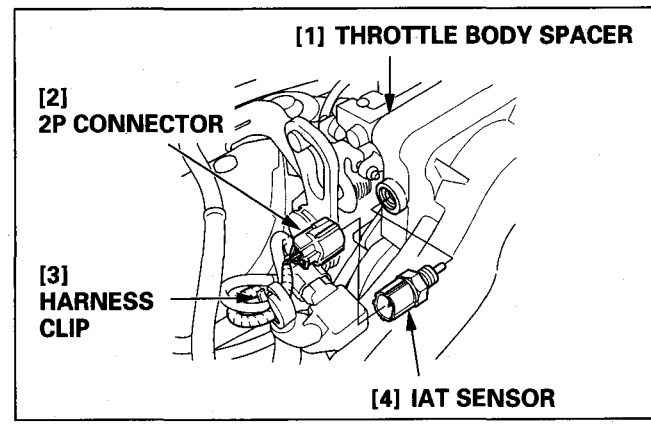


15. IAT SENSOR

REPLACEMENT

1) Remove the silencer case. (P. 5-103)
2) Disconnect the 2P connector from the IAT sensor and remove the wire harness from the harness clamp.
3) Remove the IAT sensor from the throttle body spacer.
4) Tighten the IAT sensor to the throttle body spacer as specified torque.

   TOQUE: 18 N•m (1.8 kgf•m, 13 lbf•ft)
5) After installing connect the 2P connector to the IAT sensor.

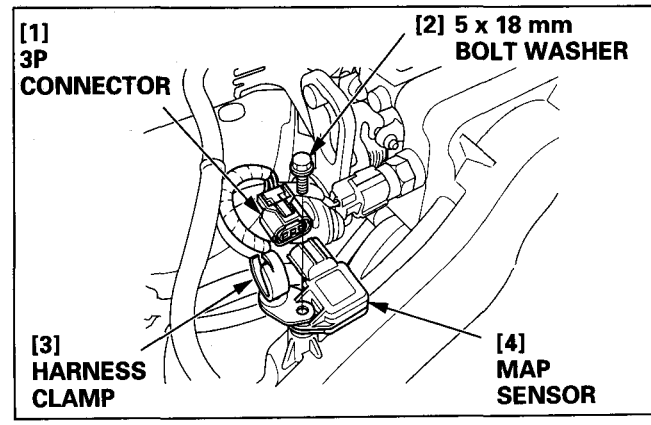


16. MAP SENSOR

REPLACEMENT

1) Disconnect the 3P connector from the MAP sensor and remove the wire harness from the harness clamp.
2) Remove the 5 x 18 mm bolt-washer and the MAP sensor.
3) Install the MAP sensor to the intake manifold with the 5 x 18 mm bolt-washer as specified torque.

   TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)
4) After installing, connect the 3P connector to the MAP sensor.



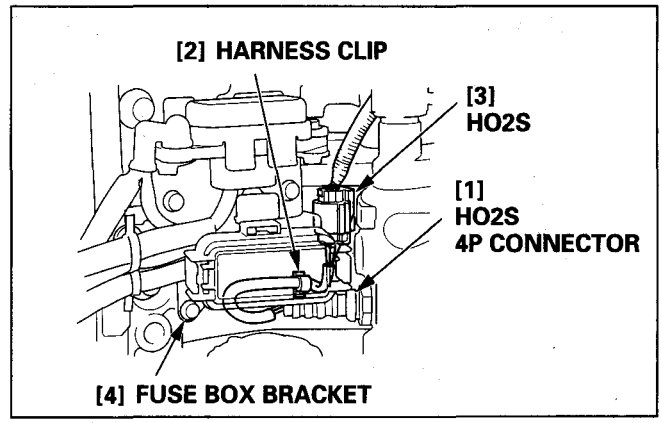
17. HO2S

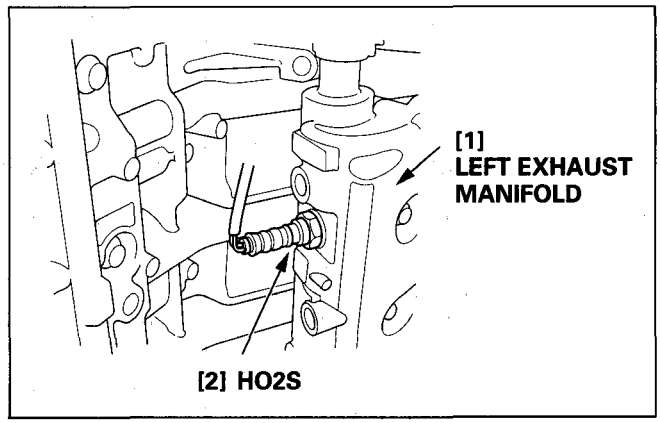
REPLACEMENT

1) Disconnect the 4P connector from HO2S and remove the harness clip from the fuse box bracket.
2) Remove the HO2S from the left exhaust manifold.
3) Tighten the HO2S to the left exhaust manifold as specified torque.

   TORQUE: 42 N•m (4.3 kgf•m, 31 lbf•ft)

4) After installing, connect the 4P connector to the HO2S and clamp the harness clip to the fuse box bracket.





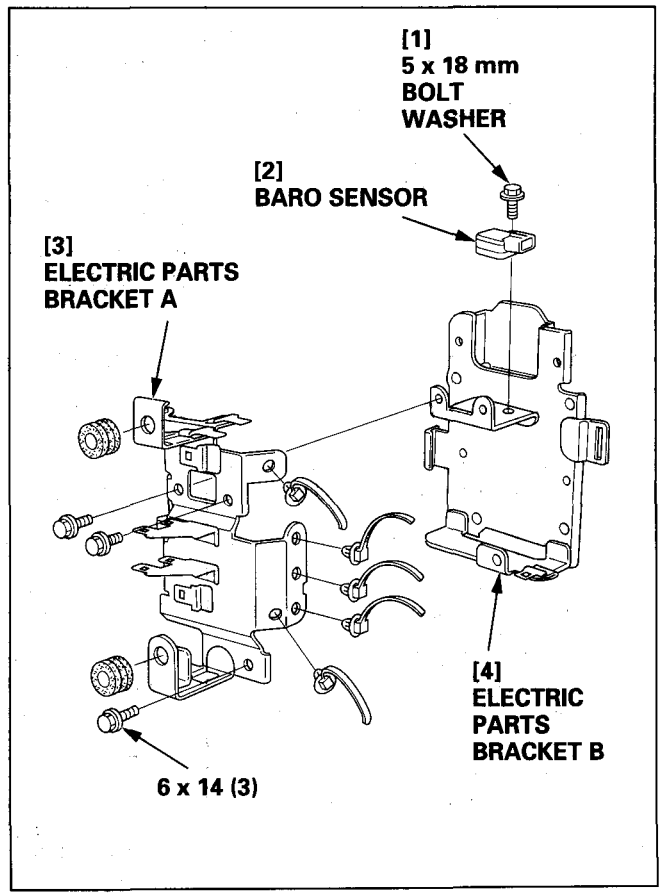
18. BARO SENSOR

REPLACEMENT

1) Remove the connectors from the connector holders of the electric parts bracket A.
2) Remove the three 6 x 14 mm flange bolts and the electric parts bracket A.
3) Disconnect the 3P connector from BARO sensor.
4) Remove the 5 x 18 mm bolt-washer and the BARO sensor from the electric parts bracket B.
5) Install the BARO sensor to the electric parts bracket B and tighten it with the 5 x 18 mm bolt-washer as specified torque.

   TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)

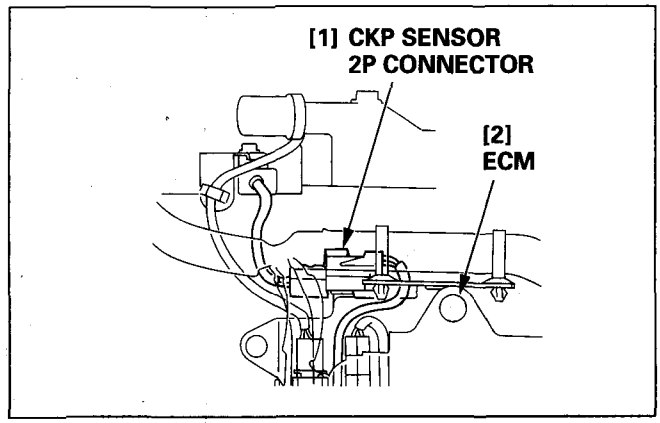
6) After installing, connect the 3P connector to the BARO sensor.

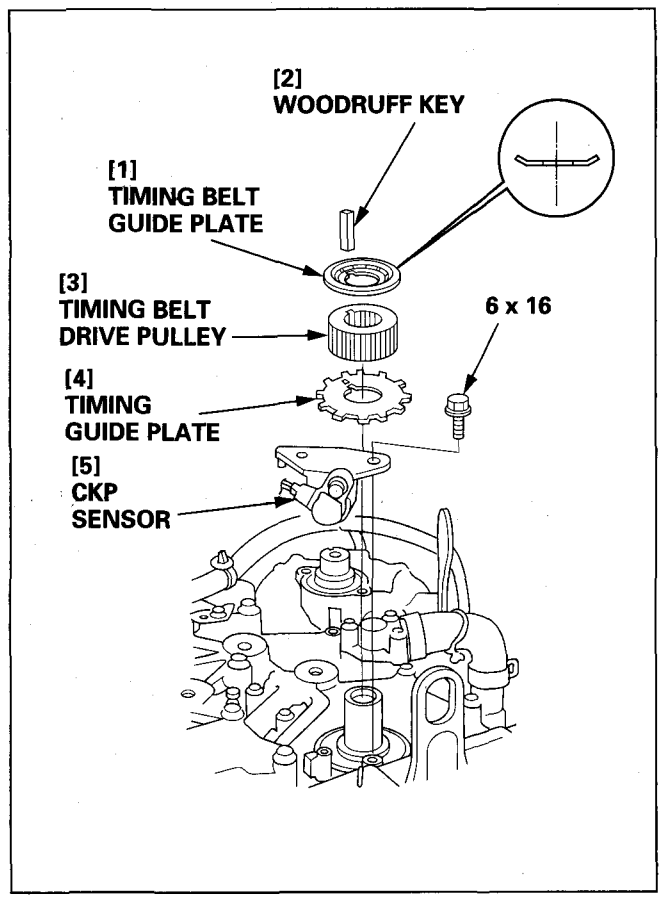


19. CKP SENSOR

REPLACEMENT

1) Disconnect the battery negative (–) terminal from the battery.
2) Disconnect the ECM connectors from the ECM.
3) Disconnect the CKP sensor 2P connector.
4) Remove the timing belt (P. 6-15).
5) Remove the alternator belt (P. 6-3).
6) Remove the timing belt guide plate and timing belt drive pulley.
7) Remove the 6 x 16 mm flange bolt and the CKP sensor.
8) After installing the CKP sensor, install the timing belt drive pulley, timing belt guide plate and the timing belt (P. 6-23).

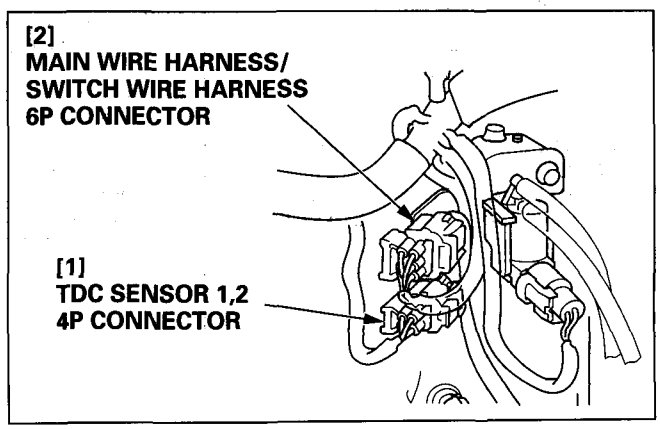




20. TDC SENSOR 1, 2

REPLACEMENT

1) Remove the silencer case (P. 5-103).
2) Remove the throttle body (P. 5-107).
3) Disconnect the TDC sensors 4P connector from the main wire harness.
4) Remove the timing belt and the left timing belt driven pulley (P. 6-15).
5) Remove the left timing belt back cover (P. 6-21).

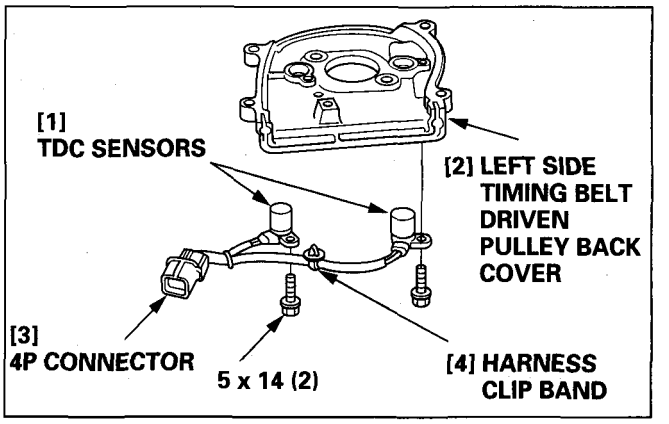


6) Remove the two 5 x 14 mm flange bolts from the left side of the timing belt back cover, and remove the harness clip band and the TDC sensor 1/TDC sensor 2.

7) Tighten the TDC sensor 1/TDC sensor 2 with the two 5 x 14 mm flange bolts.

TORQUE : 3.9 N•m (0.4 kgf•m,2.7 lbf•ft)

8) After installing the TDC sensors, install the left timing belt back cover, timing belt driven pulley and the timing belt (P. 6-23).



21. VTEC SOLENOID VALVE (BF225A)

• OPERATION CHECK

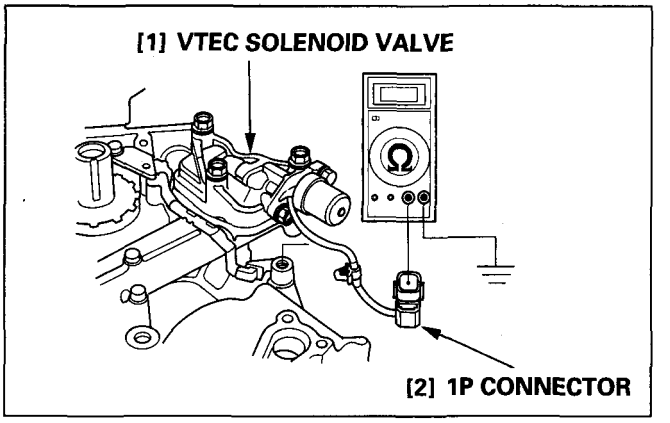
1) Remove the engine cover (P. 4-1).

2) Disconnect the VTEC solenoid valve 1P connector.

3) Check the resistance between the 1P connector terminal and body ground.

RESISTANCE	14.25 – 15.75 Ω

If the resistance is not as specified, replace the VTEC solenoid valve.



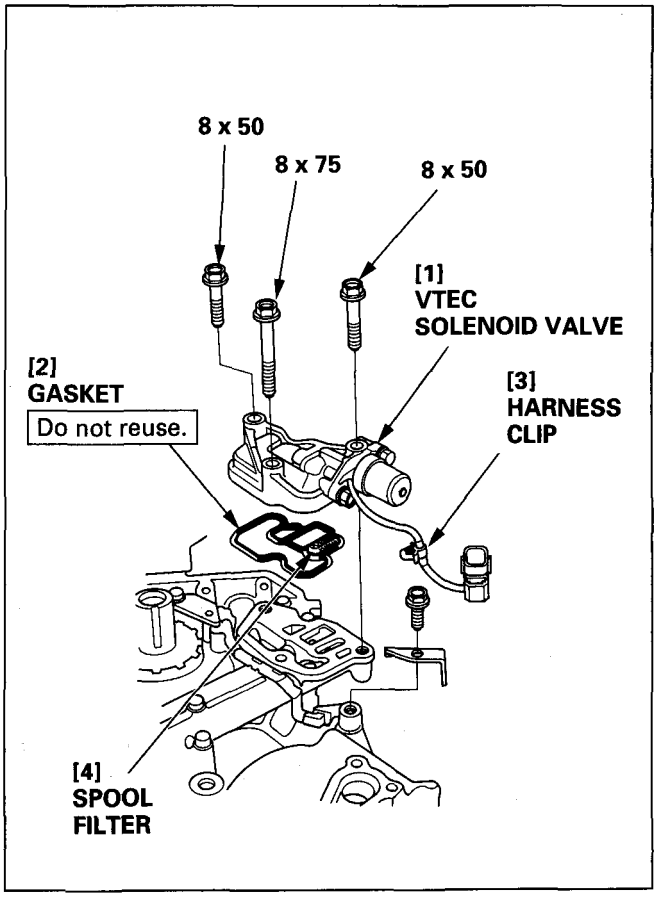
• REPLACEMENT

1) Remove the silencer case (P. 5-103).

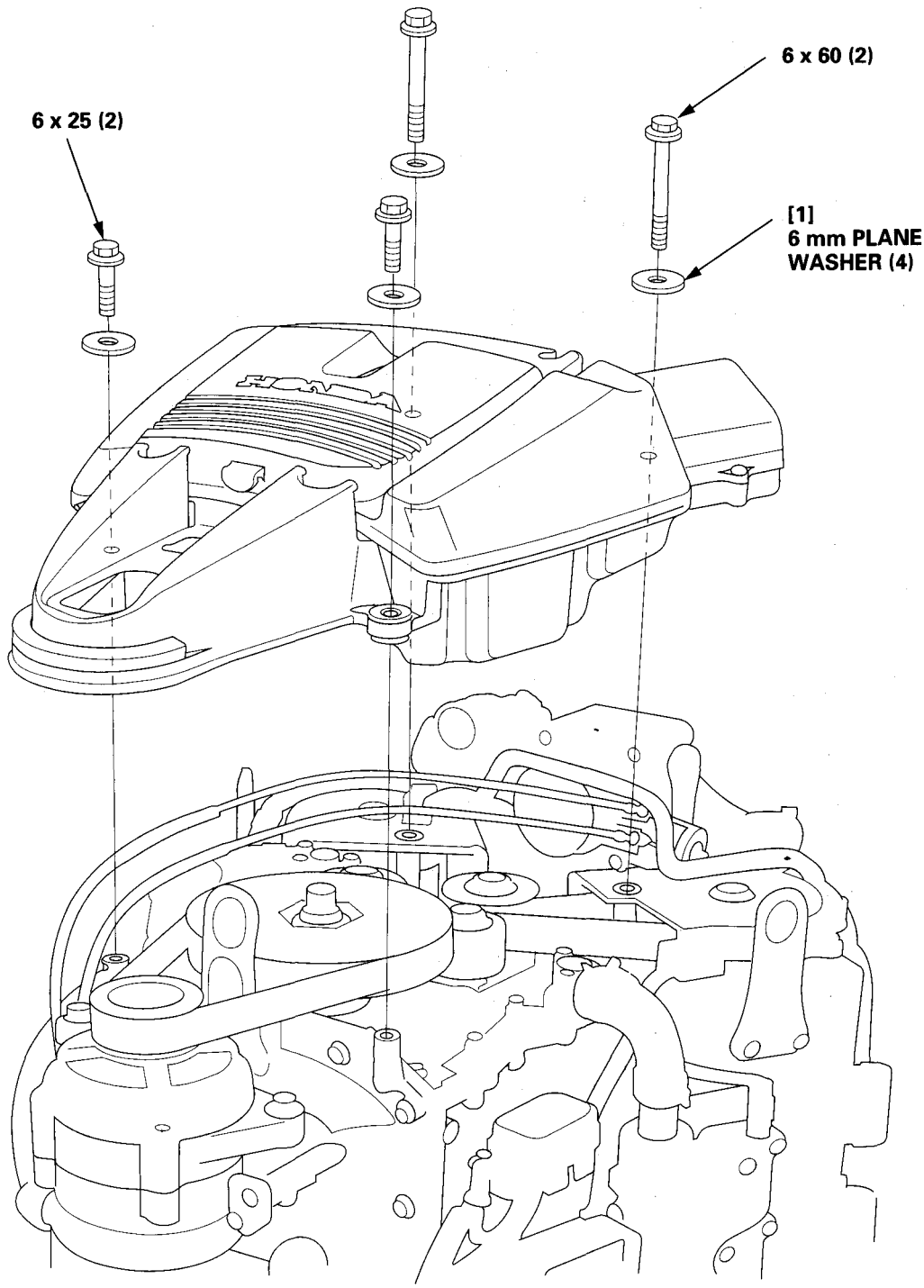
2) Remove the harness cilp from the VTEC solenoid valve wire harness.

3) Remove the 8 x 50 mm and 8 x 75 mm flange bolts and VTEC solenoid valve.

4) Install a new packing and tighten the VTEC solenoid valve with the 8 x 50 mm and 8 x 75 mm flange bolts.



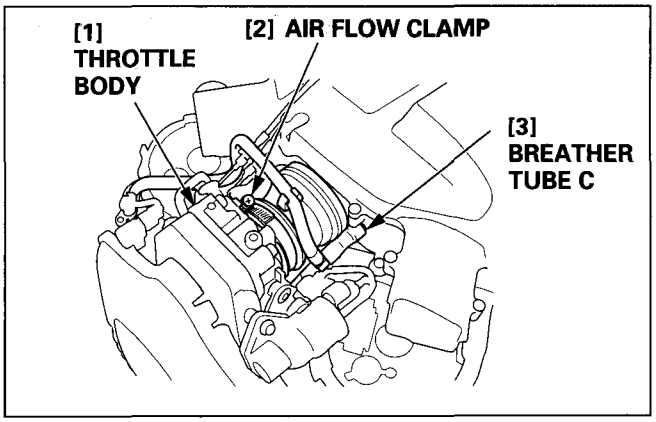
22. SILENCER CASE



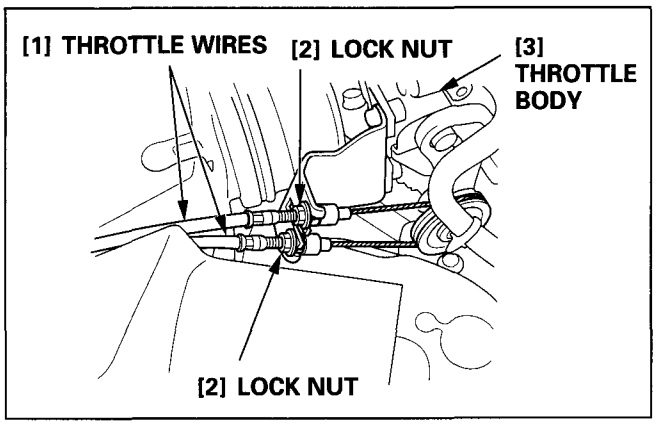
a. REMOVAL

1) Loosen the air flow clamp.

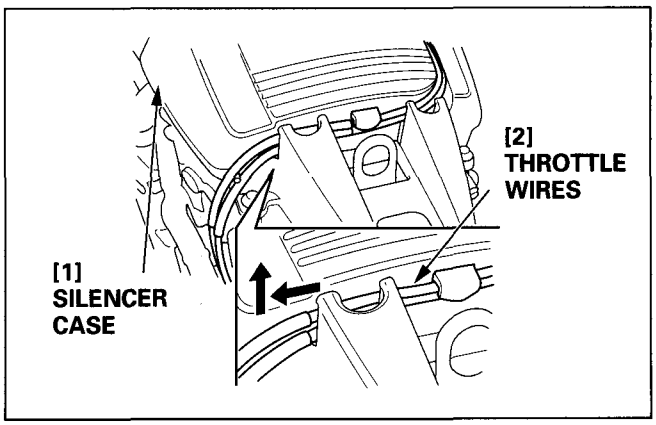
2) Disconnect the breather tube C from the silencer case.



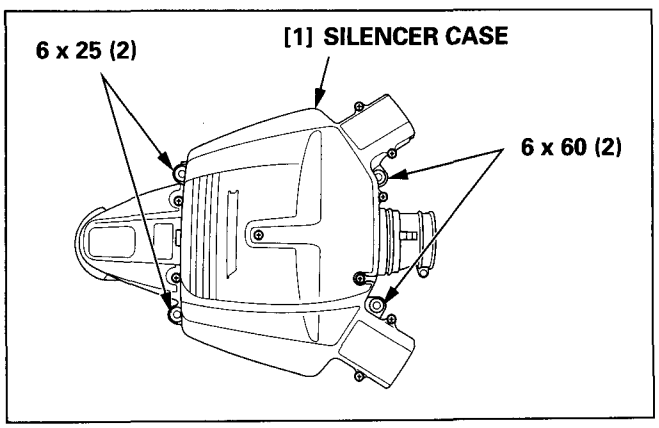
3) Loosen the lock nuts and remove the throttle wires from the throttle cam.



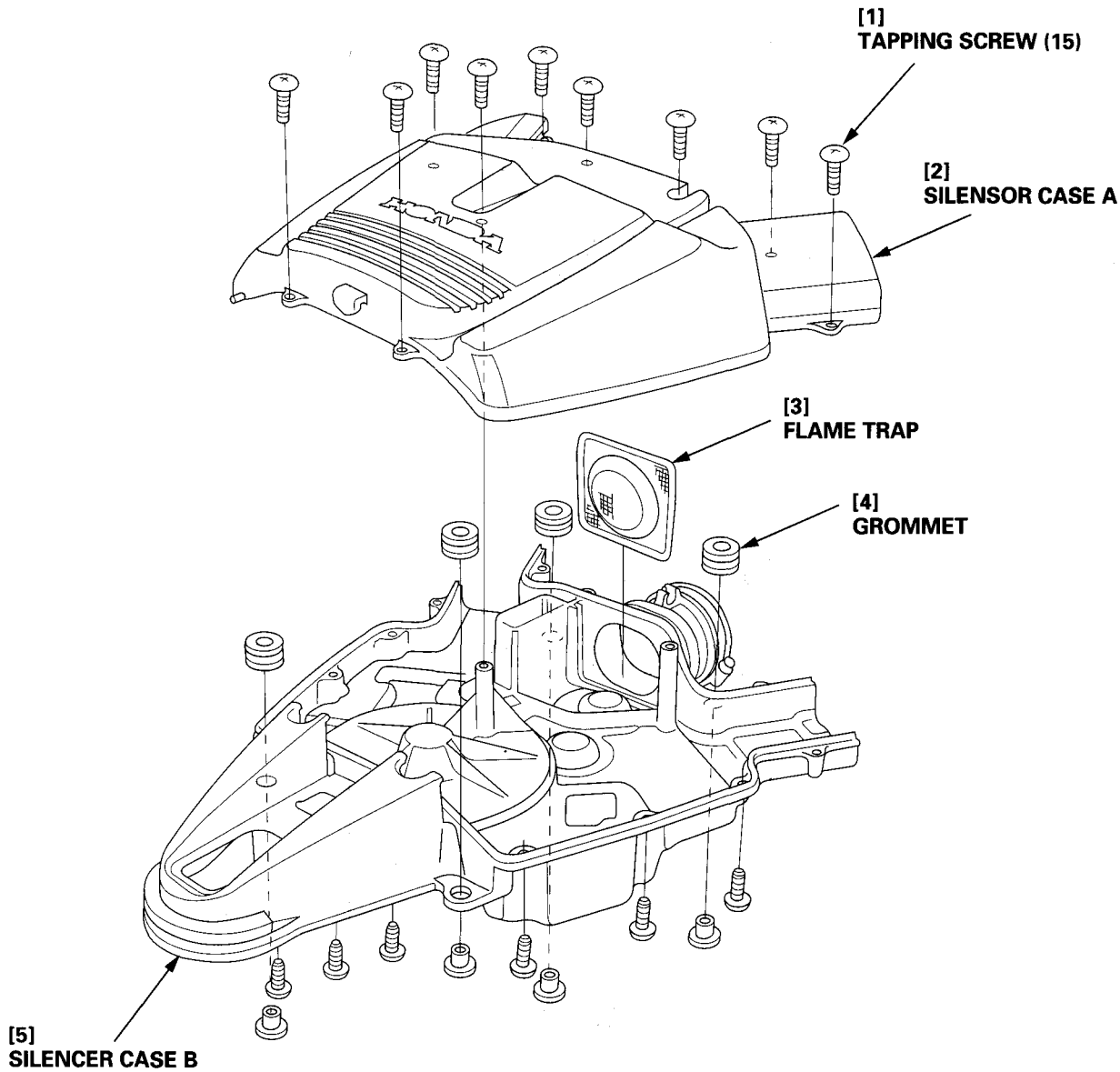
4) Remove the throttle wires from the slit of the silencer case.



5) Remove the two 6 x 25 mm flange bolts, two 6 x 60 mm flange bolts and the silencer case.

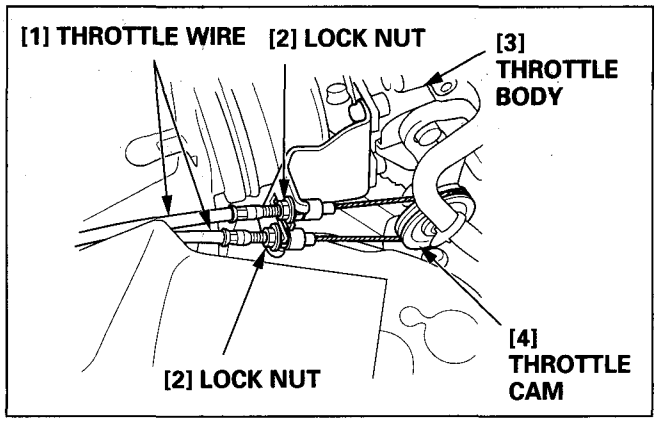


b. EXPLODED VIEW

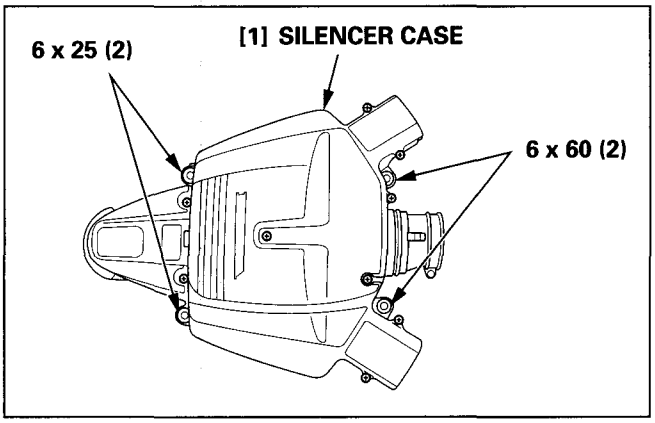


c. INSTALLATION

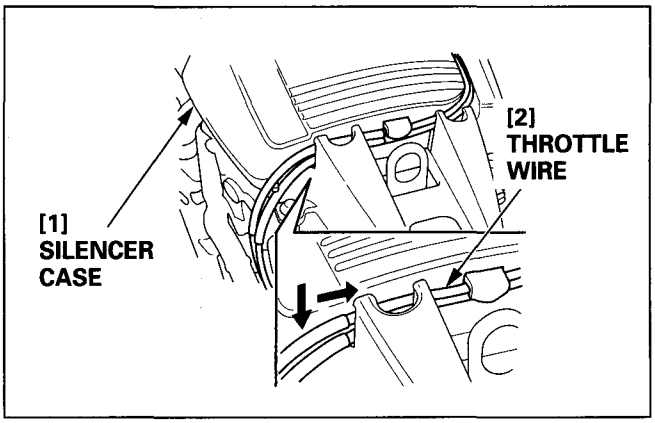
1) Install the throttle wires to the throttle cam and tighten the lock nut.



2) Install the silencer case with the two 6 x 25 mm flange bolts and two 6 x 60 mm flange bolts.

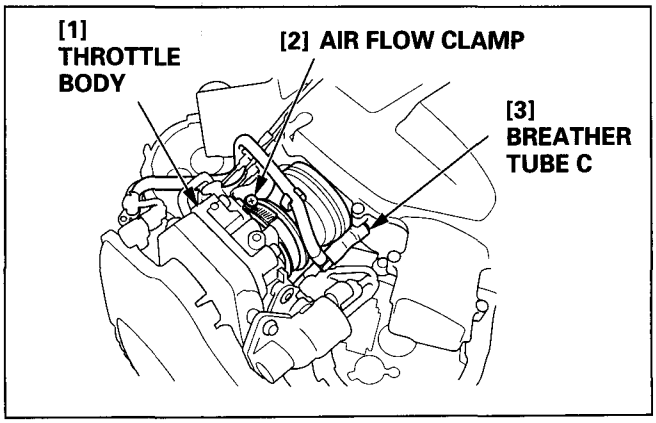


3) Put the throttle cable into the slit on the silencer case.



4) Connect the air flow tube to the throttle body and tighten the air flow clamp securely.

5) After installing, adjust the throttle wires (P. 3-18).

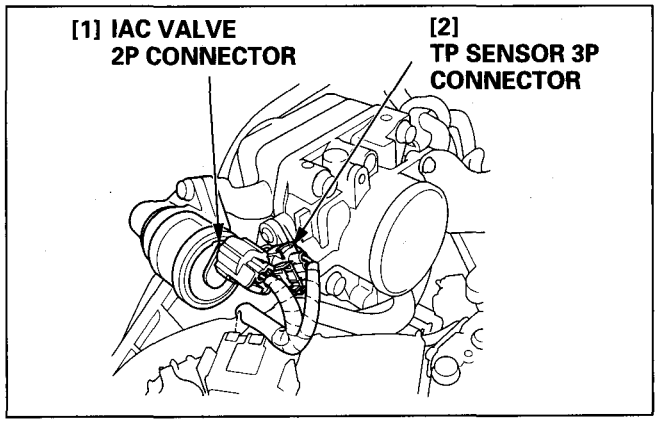


23. THROTTLE BODY

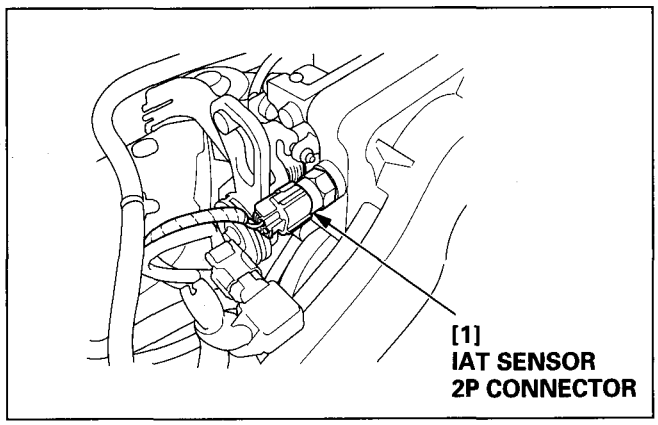
a. REMOVAL

1) Remove the silencer case (P. 5-103).

2) Disconnect the IAC valve 2P connector and the throttle position sensor 3P connector.

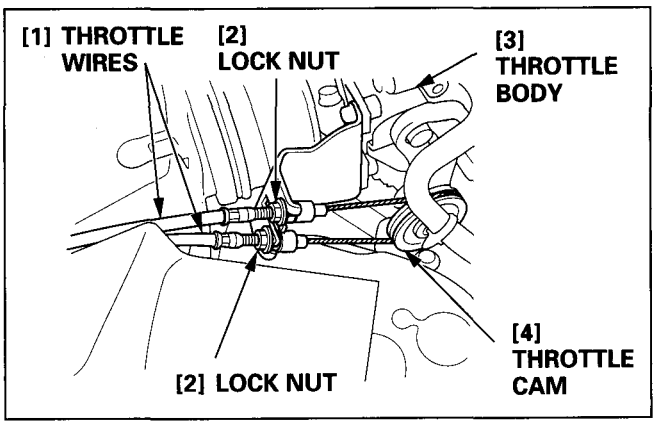


3) Disconnect the IAT sensor 2P connector.

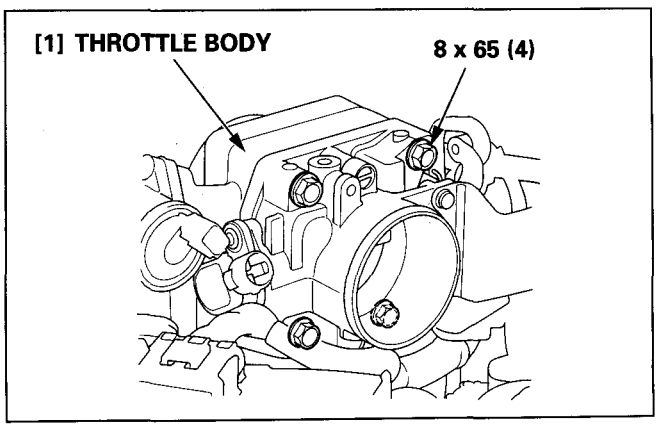


4) Loosen the lock nuts and remove the throttle wires from the throttle cam.

5) Remove the throttle wires from the throttle cam.



6) Remove the four 8 x 65 mm flange bolts and remove the throttle body.



b. INSPECTION

NOTICE

Do not adjust the throttle stop screw.

1) Check that the throttle valve turns smoothly when the throttle cam is turned.

2) Check that there is no worn out of the throttle valve shaft.

3) Make sure there is no clearance between the idle stop screw and the throttle valve lever.

4) Check the dirt or stain on the throttle valve and the bore.

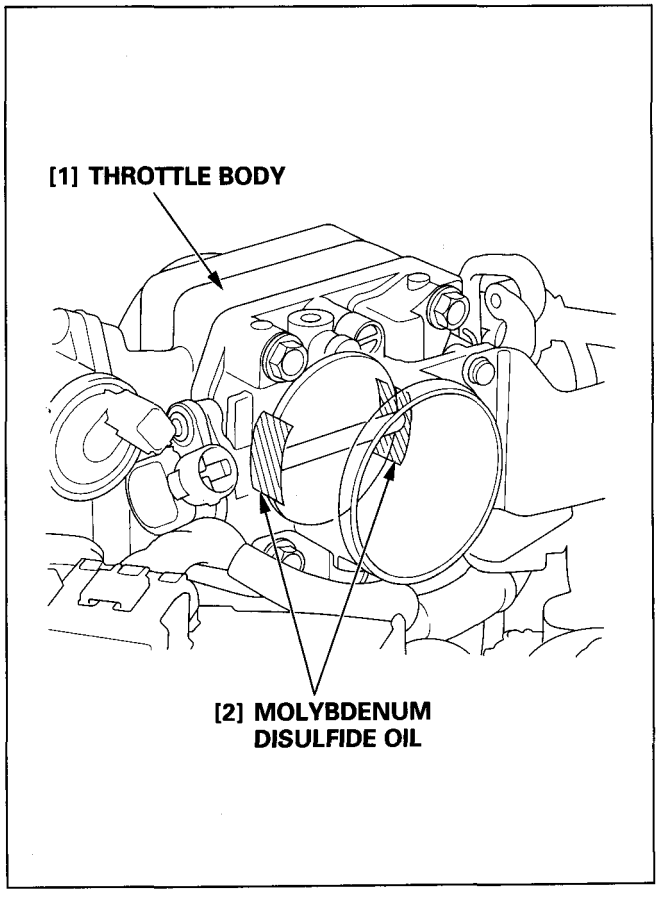
If the throttle valve does not turn smoothly, or the throttle valve shaft is worn out, replace the throttle body assembly. If the throttle valve and bore have dirt or stain, clean the throttle body.

c. CLEANING

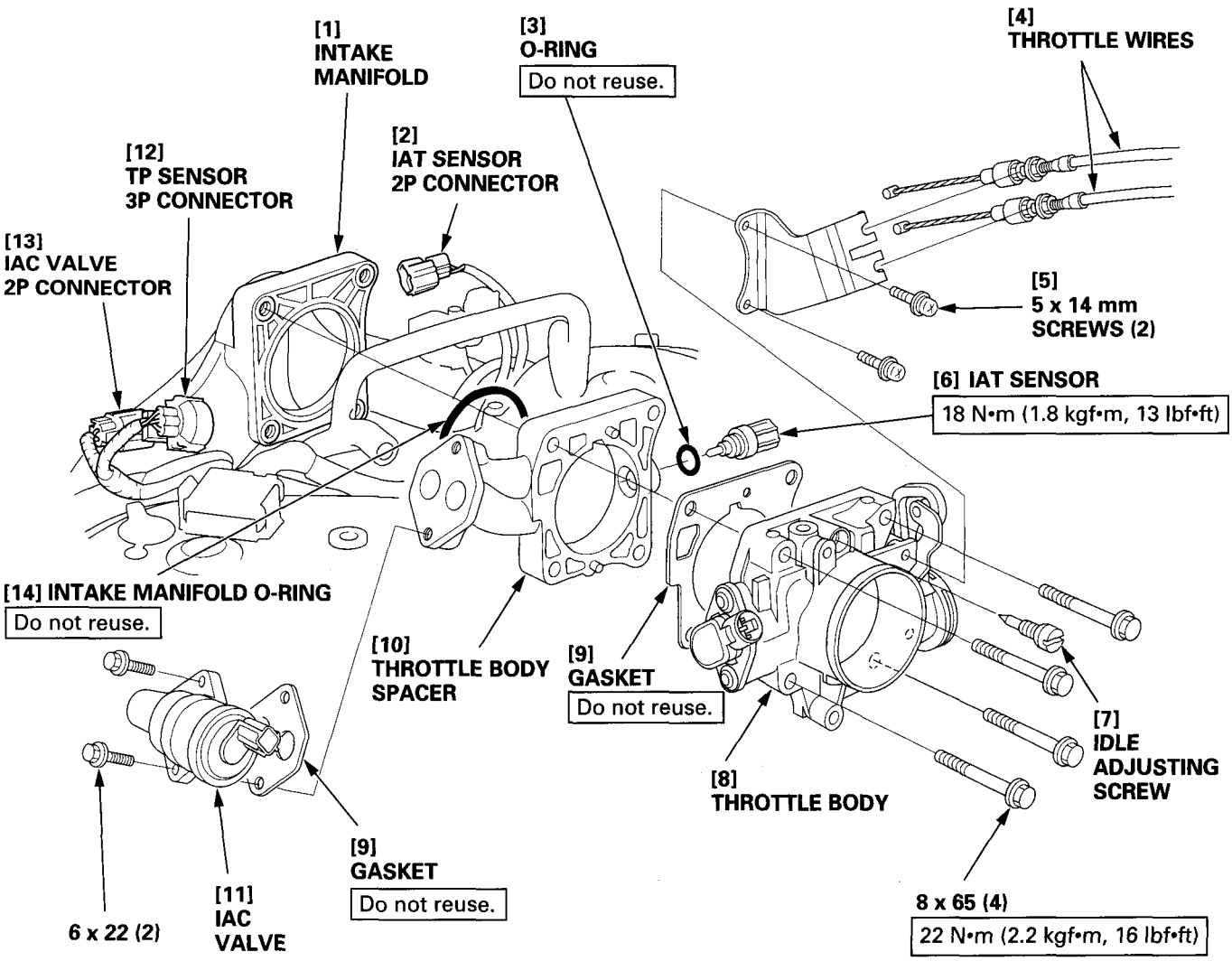
1) Wipe up the carbon or any other dirt, stain with soft dry shop towels sprayed a carburetor cleaner and clean the throttle valve and bore.

   NOTICE

   The inside of the throttle body is coated with molybdenum. Do not clean the throttle body excessively.



d. EXPLODED VIEW

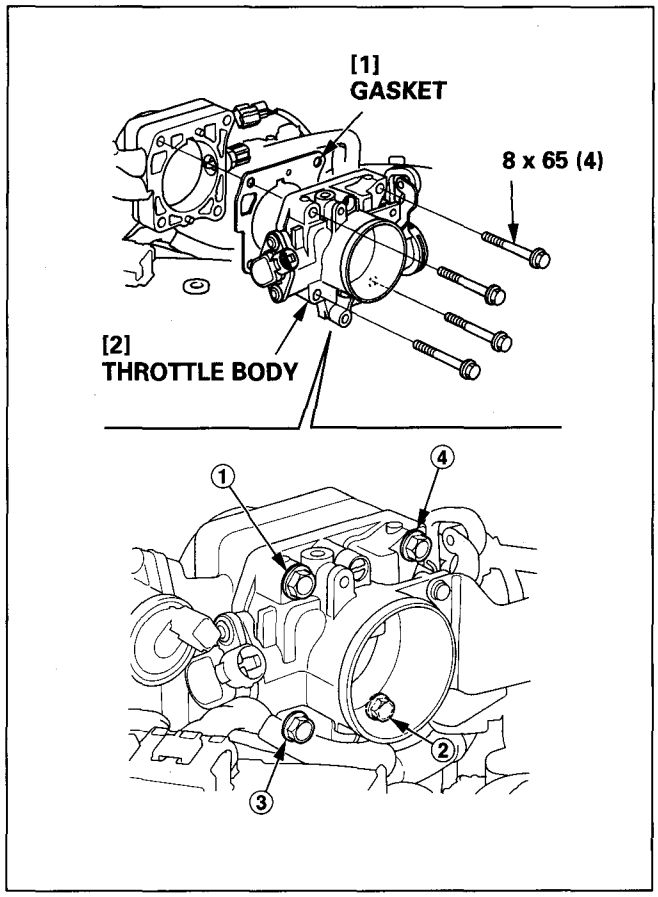


e. INSTALLATION

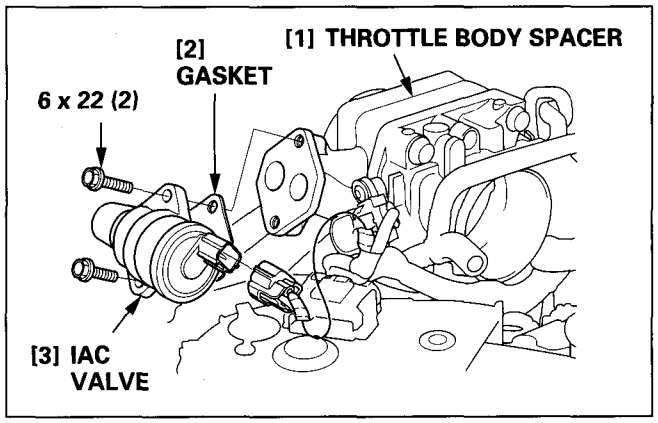
1) Install a new O-ring to the groove of intake manifold.

2) Install a new gasket and the throttle body with the four 8 x 65 mm flange bolts in the numbered order as the specified torque.

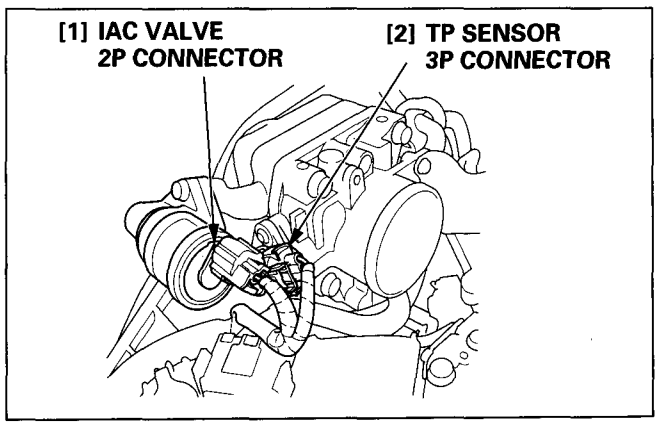
TORQUE: 21.6 N•m (2.2 kgf•m,16 lbf•ft)



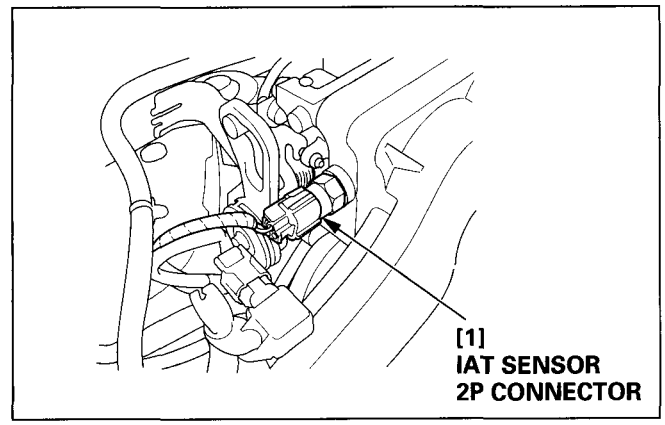
3) Install a new gasket and the IAC valve to the throttle body spacer with the two 6 x 22 mm flange bolts.



4) Connect the IAC valve 2P connector and throttle position (TP) sensor 3P connector.

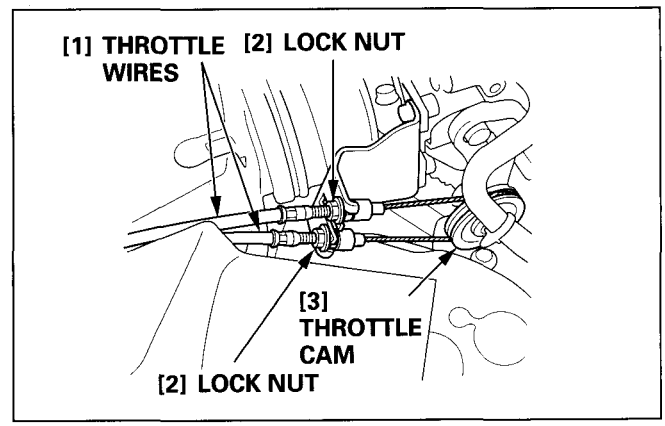


5) Connect the IAT sensor 2P connector.



6) Install the throttle wires to the throttle cam and tighten the lock nut.

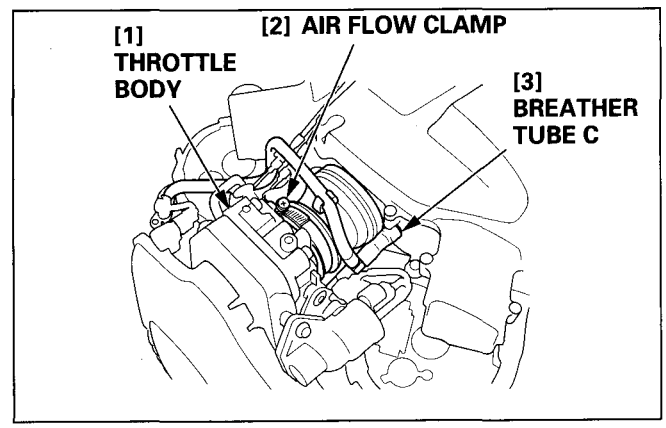
7) Install the silencer case (P. 5-106).



8) Tighten the air flow clamp securely.

9) *Connect the breather tube C to the silencer case.*

10) After installing, adjust the throttle wires (P. 3-18) and check the idle speed (P. 3-16).



24. INTAKE MANIFOLD

a. REMOVAL

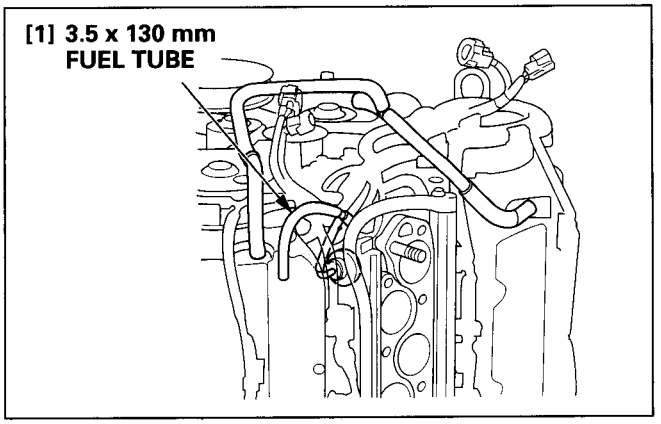
1) Remove the silencer case (P. 5-103).

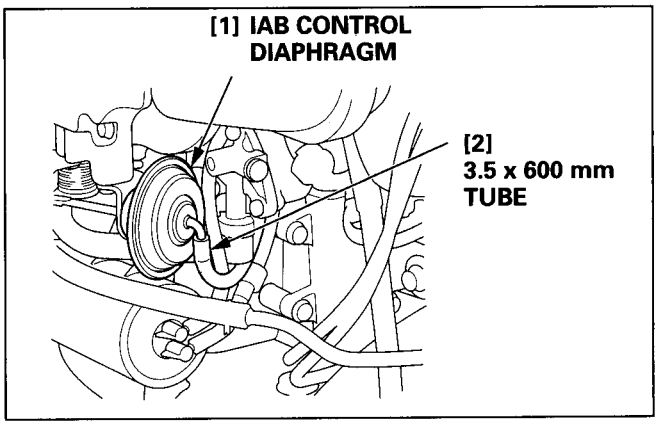
2) Remove the throttle wires from the throttle body (P. 5-107).

3) Disconnect the IAC valve 2P connector, throttle position sensor 3P connector and IAT sensor 2P connector (P. 5-107).

4) Disconnect the 3.5 x 130 mm fuel tube from the intake manifold.

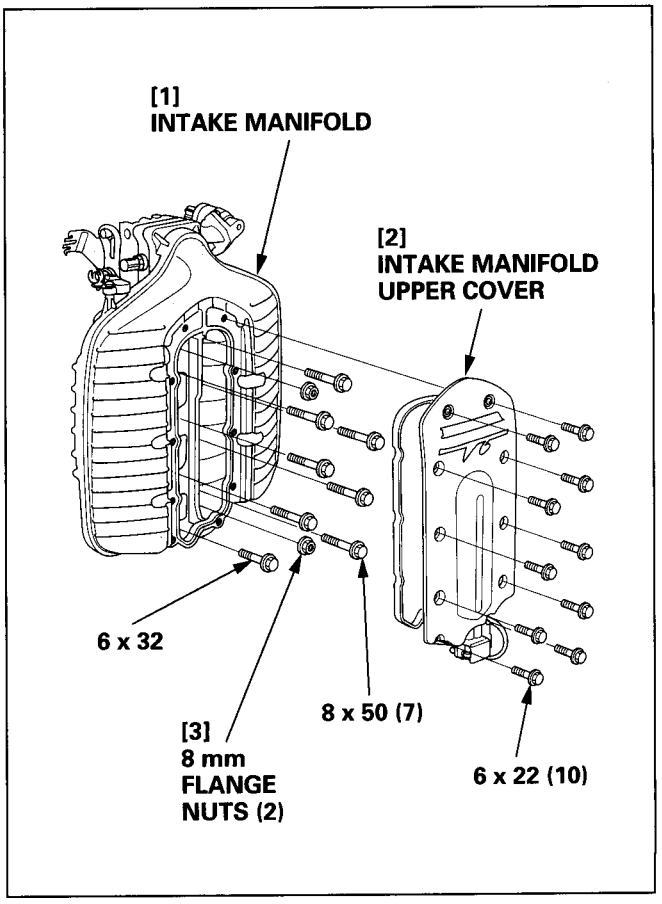
5) Disconnect the 3.5 x 600 mm tube from the IAB control diaphragm.





6) Remove the 6 x 22 mm flange bolts and the intake manifold upper cover from the intake manifold.

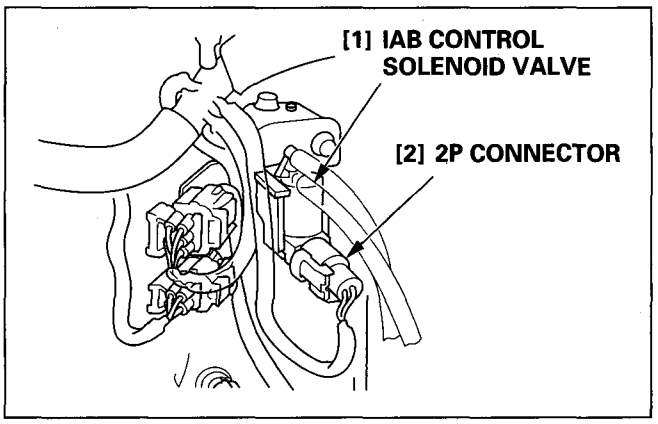
7) Remove the 8 x 50 mm flange bolts, 8 mm flange nuts, 6 x 32 mm flange bolt and the intake manifold.



b. TEST

• INTAKE AIR BYPASS (IAB) CONTROL SOLENOID VALVE TEST

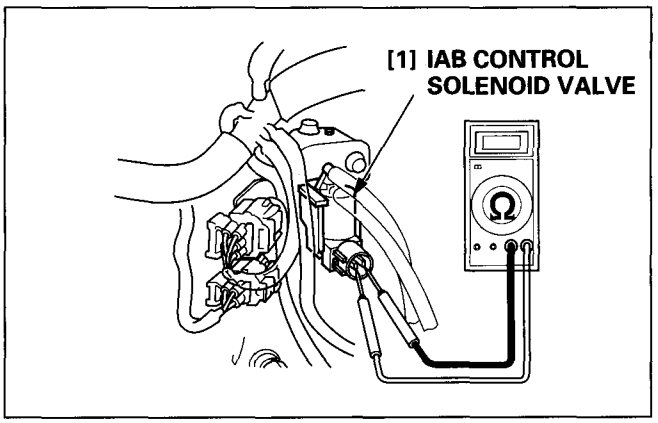
1) Disconnect the 2P connector from the intake air bypass (IAB) control solenoid valve.



2) Measure the resistance between the IAB control solenoid valve terminals.

Resistance	37 – 44 Ω

If the resistance is out of the specification, replace the IAB control solenoid valve.



• IAB CONTROL VALVE TEST

NOTICE

Do not adjust the stop screw. It was preset at the factory.

1) Check the IAB control valve for smooth movement.

2) Check the IAB valve shaft for binding or sticking.

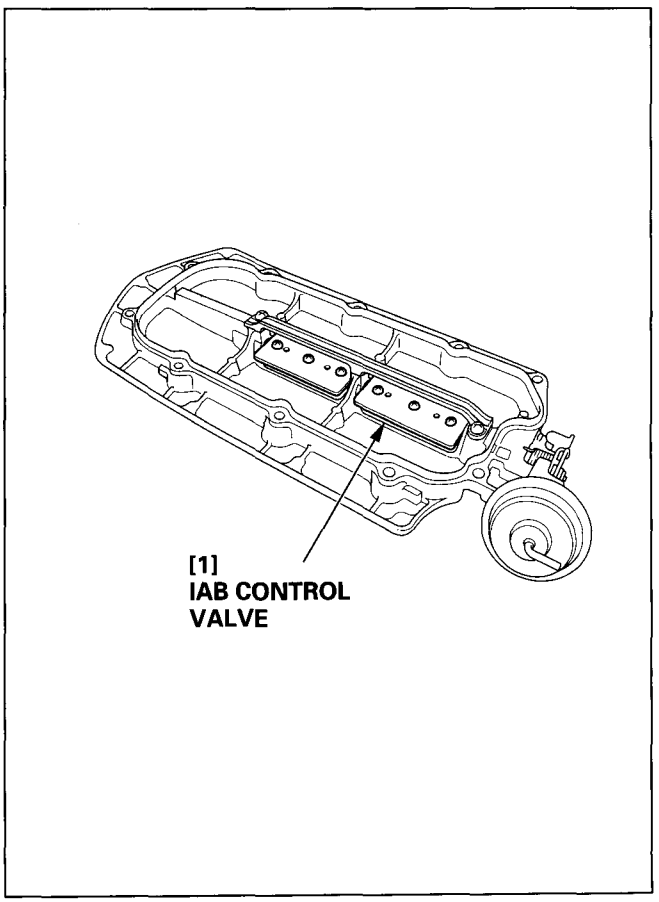
3) Check there is no clearance between the stop screw and the fully closed position stopper when the IAB control valve is fully closed position.

4) Check there is no clearance between the IAB control valve and the fully opened position stopper when the IAB control valve is fully opened position.

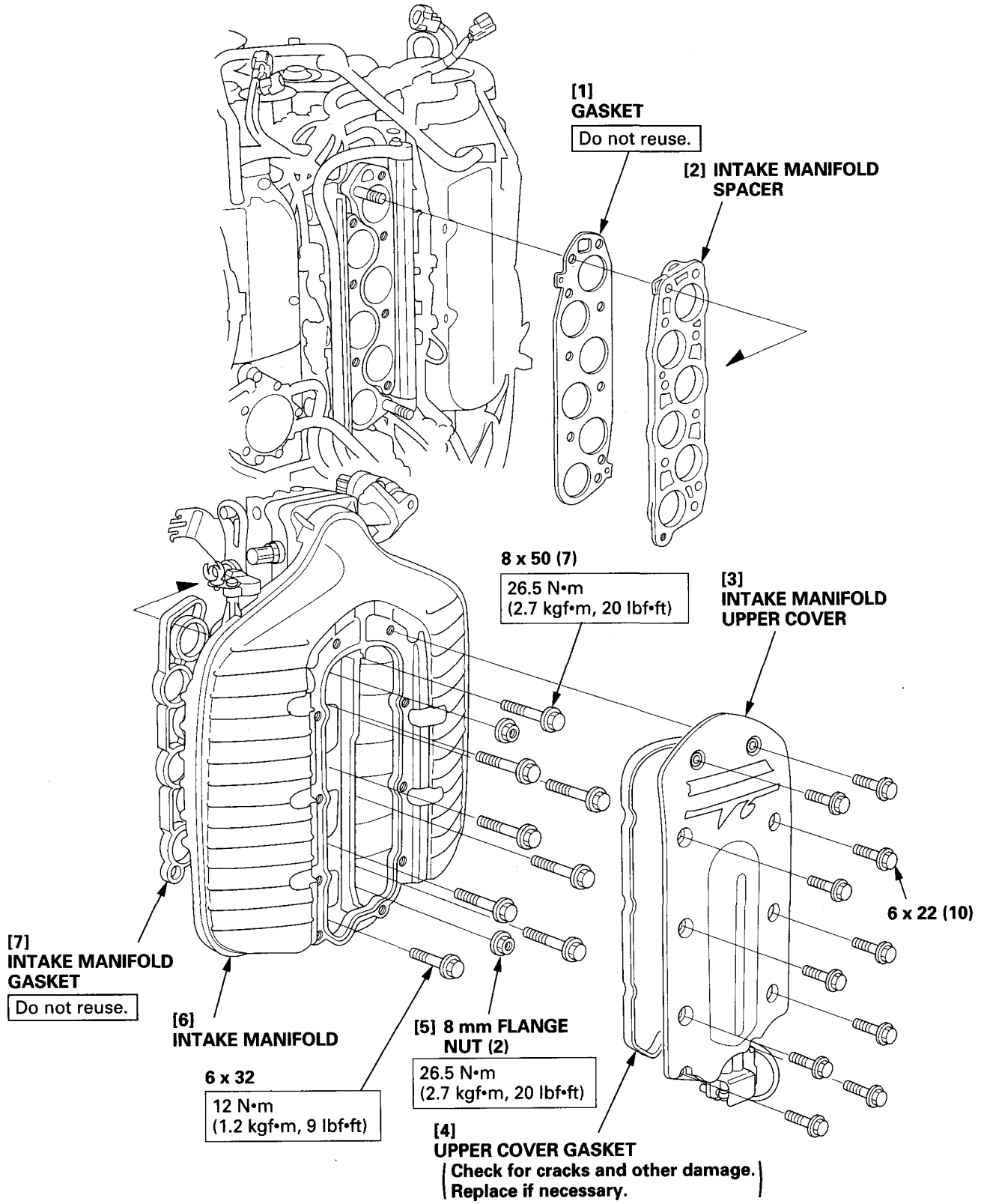
5) If the IAB control valve does not move smoothly, clean it with a carburetor cleaner.

NOTICE

- Always use Genuine Honda Carburetor Cleaner.
- IAB control valve is molybdenum coated, do not clean the valve excessively.
- Do not spray the carburetor cleaner directly to the shaft of the IAB control valve.

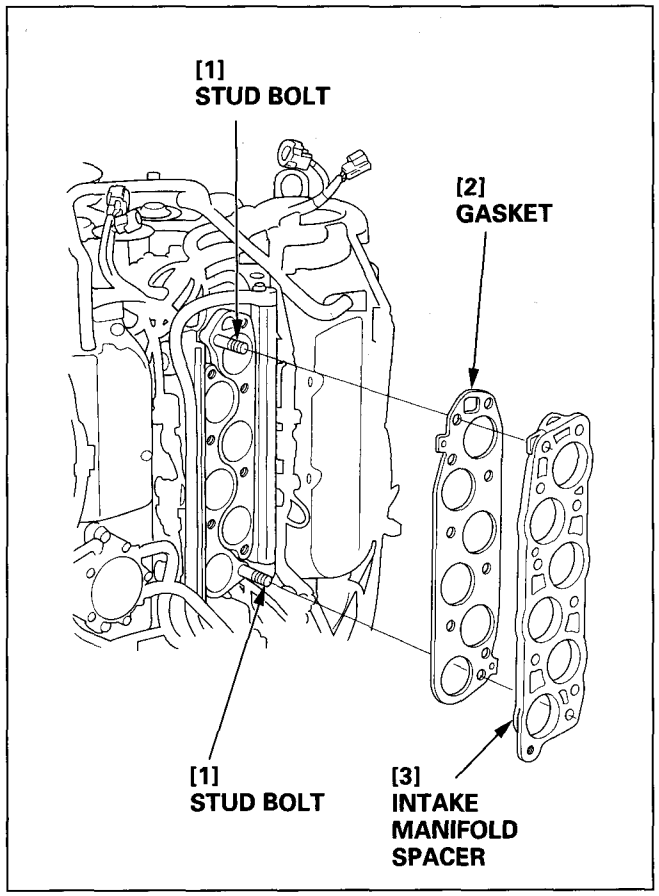


c. EXPLODED VIEW



d. INSTALLATION

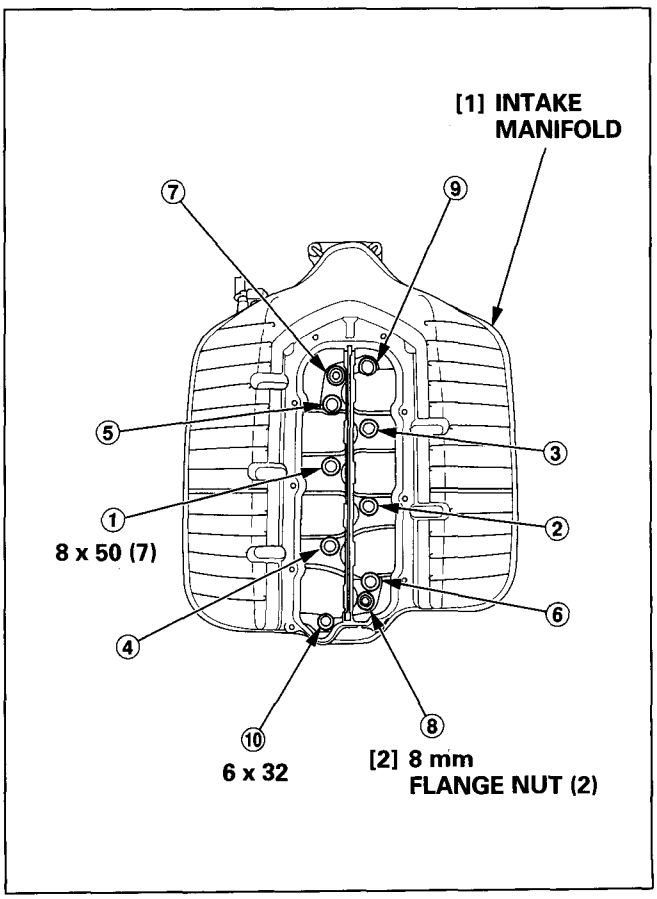
1) Install a new intake manifold gasket and the intake manifold spacer to the stud bolts.



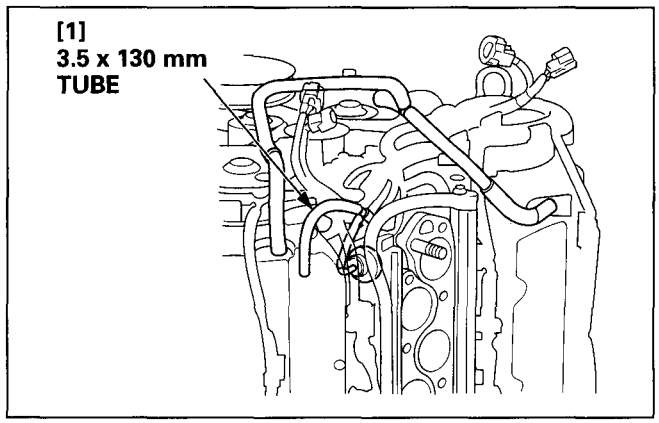
2) Tighten the intake manifold with the 8 x 50 mm flange bolts, 8 mm flange nut and the 6 x 32 mm flange bolt in two or three steps as the specified torque.

TORQUE:
26.5 N•m (2.7 kgf•m, 20 lbf•ft) (8 x 50 mm flange bolts and 8 mm flange nuts)
12 N•m (1.2 kgf•m, 9 lbf•ft) (6 x 32 mm flange bolt)

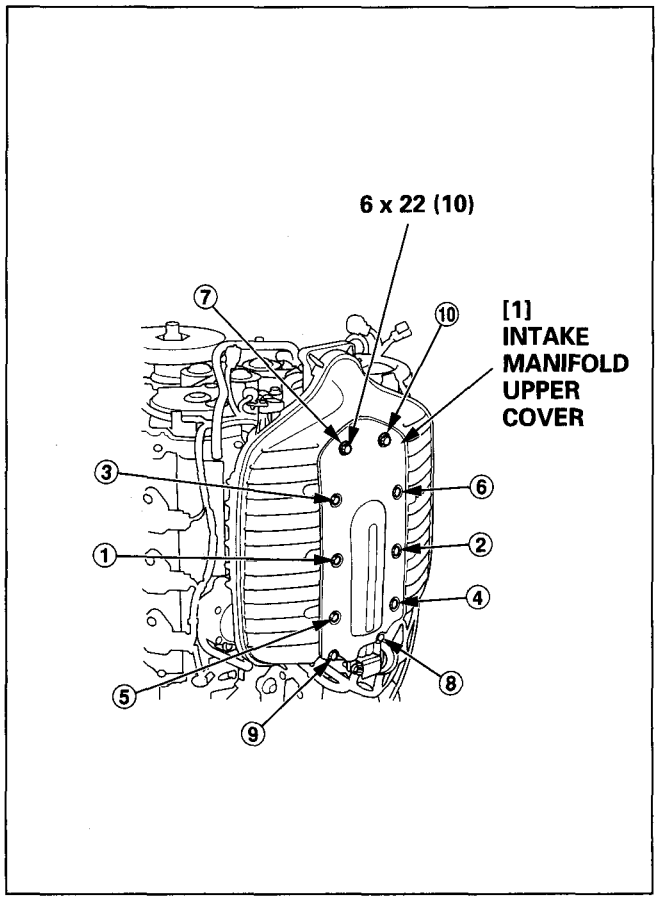
NOTICE
Be sure not to be pinched the vacuum tube and fuel tube.



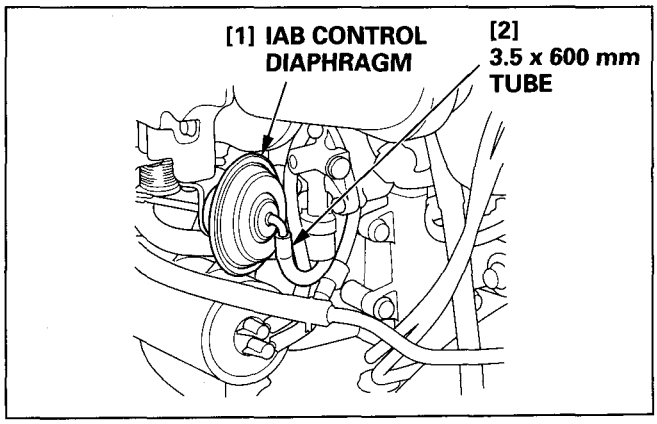
3) Connect the 3.5 x 130 mm fuel tube to the intake manifold.



4) Install the intake manifold upper cover with the 6 x 22 mm flange bolts in the numbered order. Be sure to tighten them in two or three steps as the specified torque.



5) Connect the 3.5 x 600 mm tube to the chamber volume control valve.

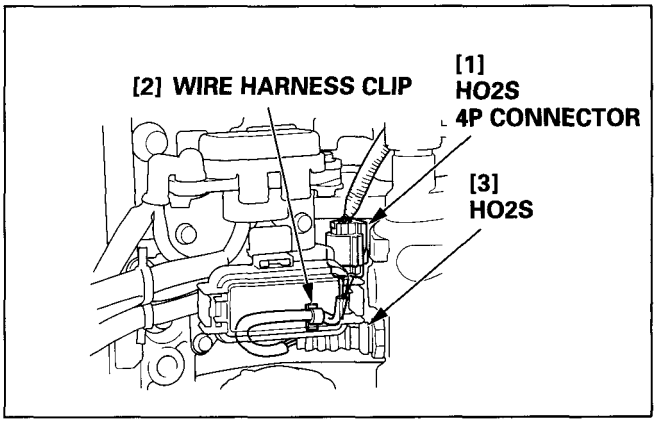


25. EXHAUST MANIFOLD

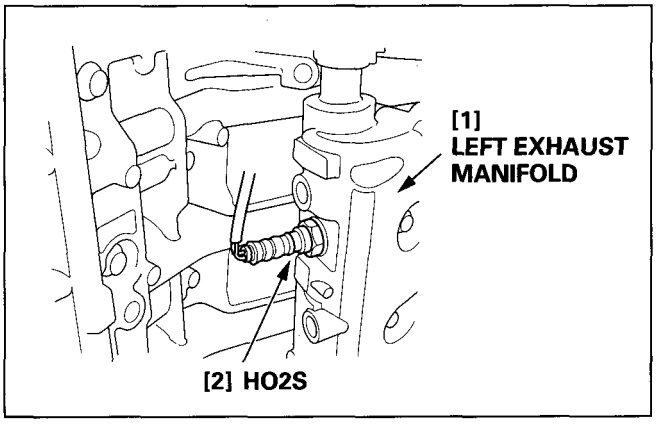
a. REMOVAL

1) Remove the silencer case (P. 5-103).

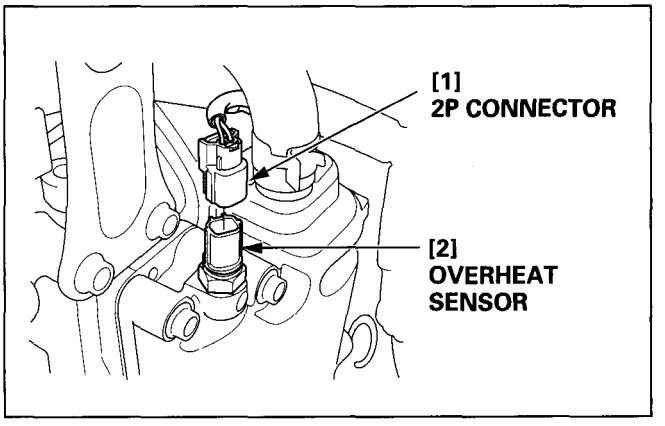
2) Disconnect the 4P connector from the HO2S and remove the wire harness clip from the fuse box bracket.



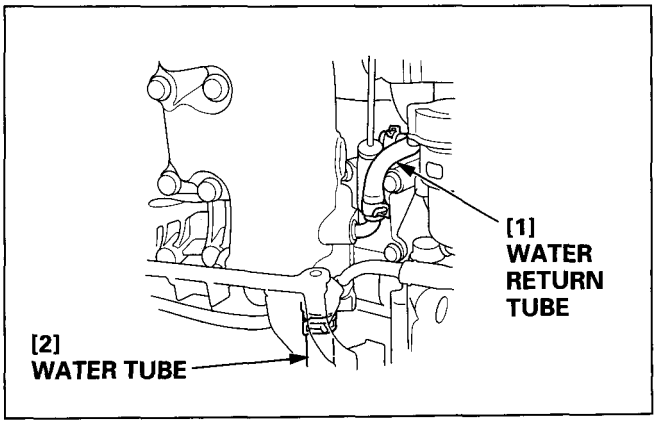
3) Remove the HO2S from the left exhaust manifold.



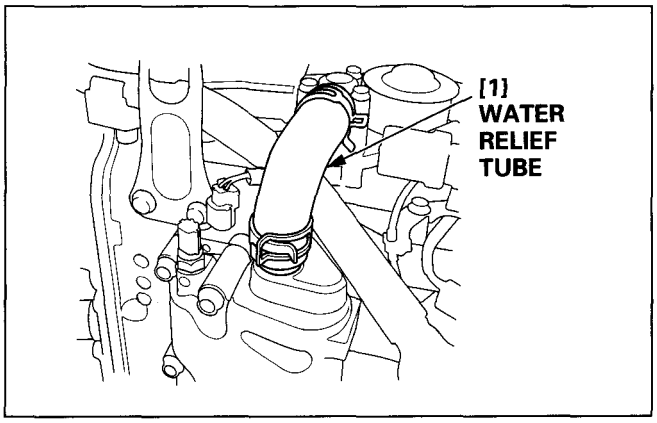
4) Disconnect the overheat sensor 2P connectors and remove the overheat sensors from the each side of exhaust manifold.



5) Remove the water return tubes and water tubes from the both side of the exhaust manifolds.



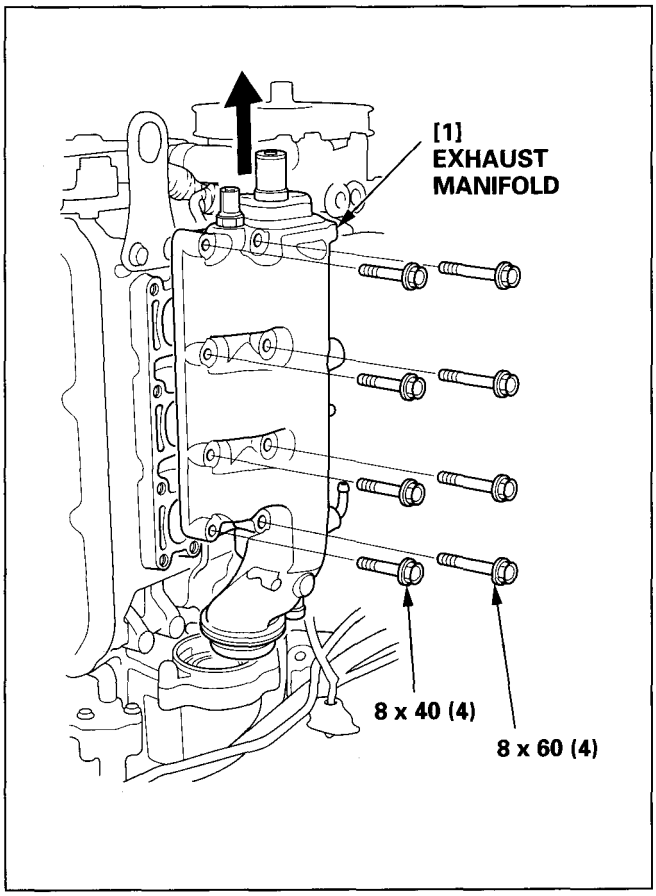
6) Remove the water relief tubes from the both side of the exhaust manifolds.



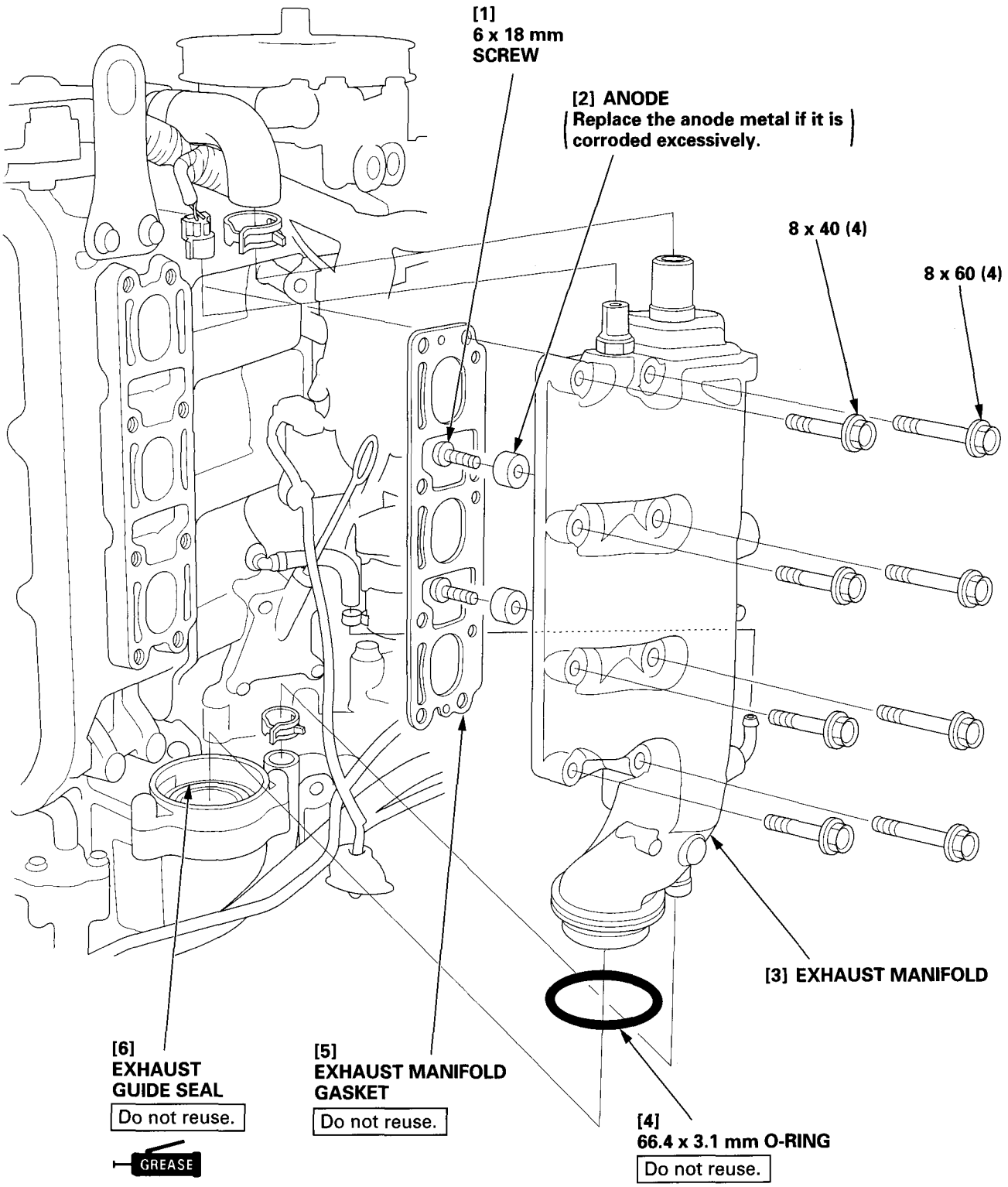
7) Remove the four 8 x 40 mm and the four 8 x 60 mm flange bolts, and remove the exhaust manifold to the upper side.

NOTICE

Take care not to shake the exhaust manifold on removal.



b. EXPLODED VIEW



c. INSTALLATION

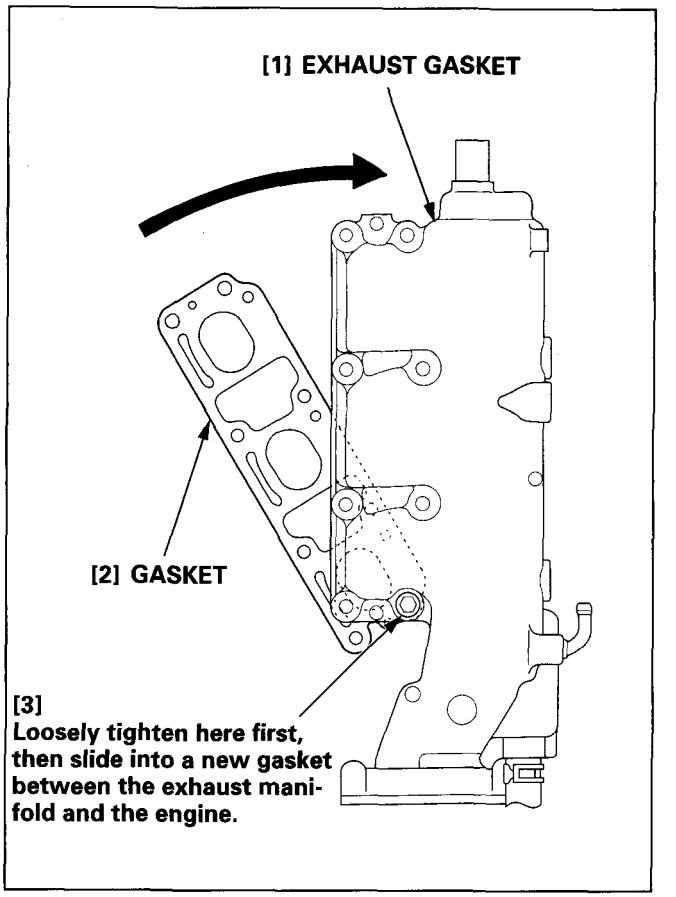
1) Remove the extension case (P. 12-56).

2) Loosen the 8 x 30 mm, 8 x 100 mm and 6 x 120 mm flange bolts from the water jacket and 6 x 40 mm flange bolt from the exhaust guide (P. 8-3).

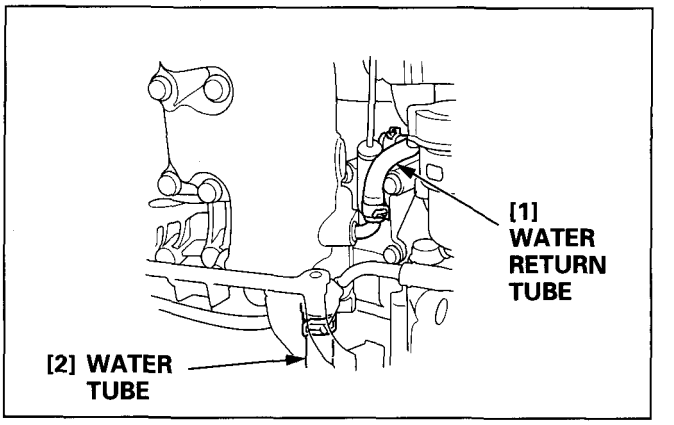
3) Set a new gasket to the exhaust manifold and loosely tighten the 8 x 40 mm flange bolt to the lower corner of the exhaust manifold.

4) Slide the gasket as shown and install the exhaust manifold with the 8 x 40 mm flange bolts and the 8 x 60 mm flange bolts.

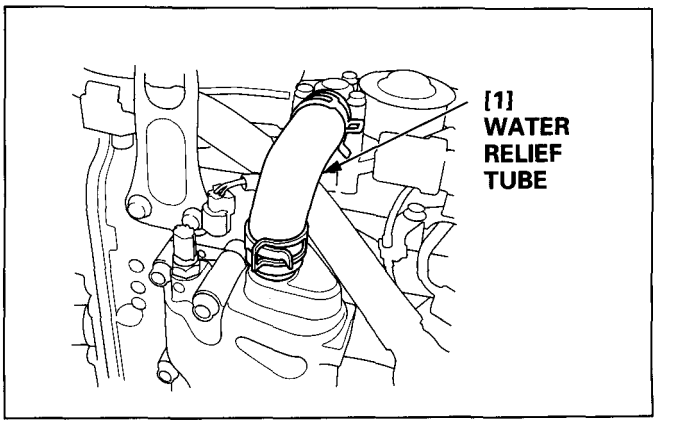
5) After installing the exhaust manifold, tighten the 6 x 40 mm flange bolt (exhaust guide bolt), then tighten the 8 x 30 mm, 8 x 100 mm and 6 x 120 mm flange bolts (water jacket cover bolts) (P. 8-3).



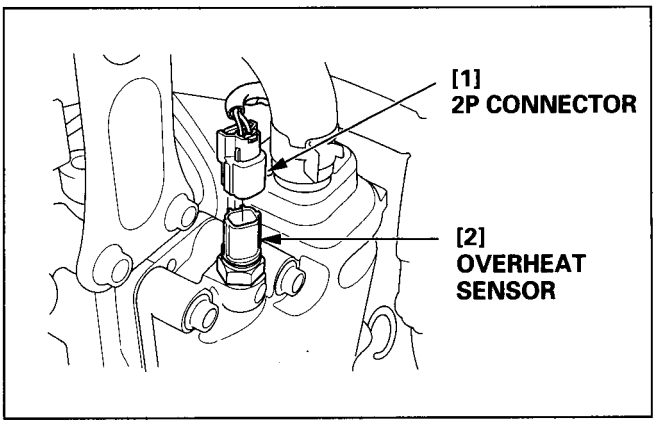
6) Install the water return tubes and water tubes to the left and right exhaust manifolds.



7) Install the water relief tubes to the left and right exhaust manifolds.

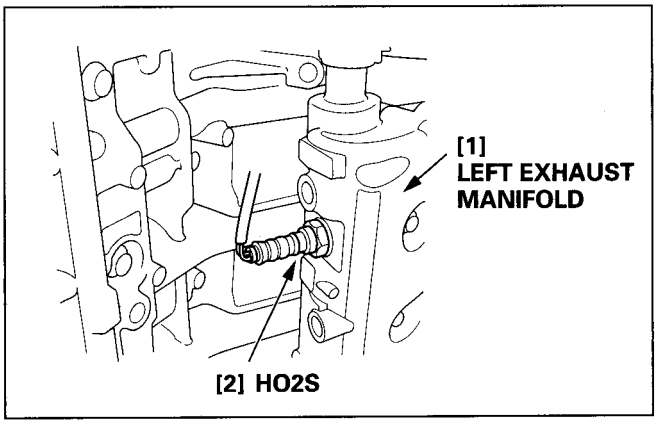


8) Install the overheat sensors to the exhaust manifolds, and connect the 2P connectors to the overheat sensors.



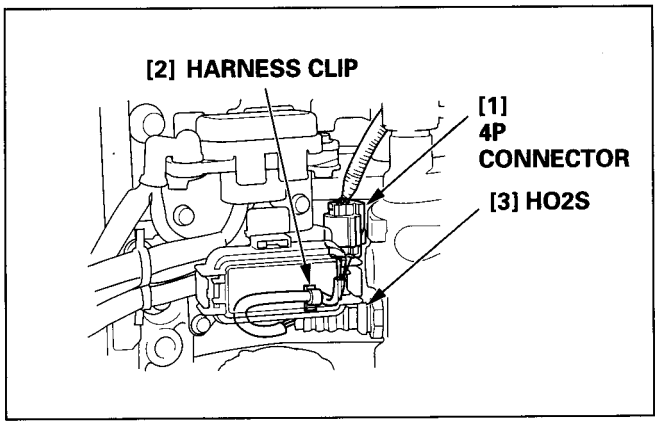
9) Install the HO2S to the left exhaust manifold and tighten it as specfied torque.

TORQUE: 43 N•m (4.3 kgf•m, 31 lbf•ft)

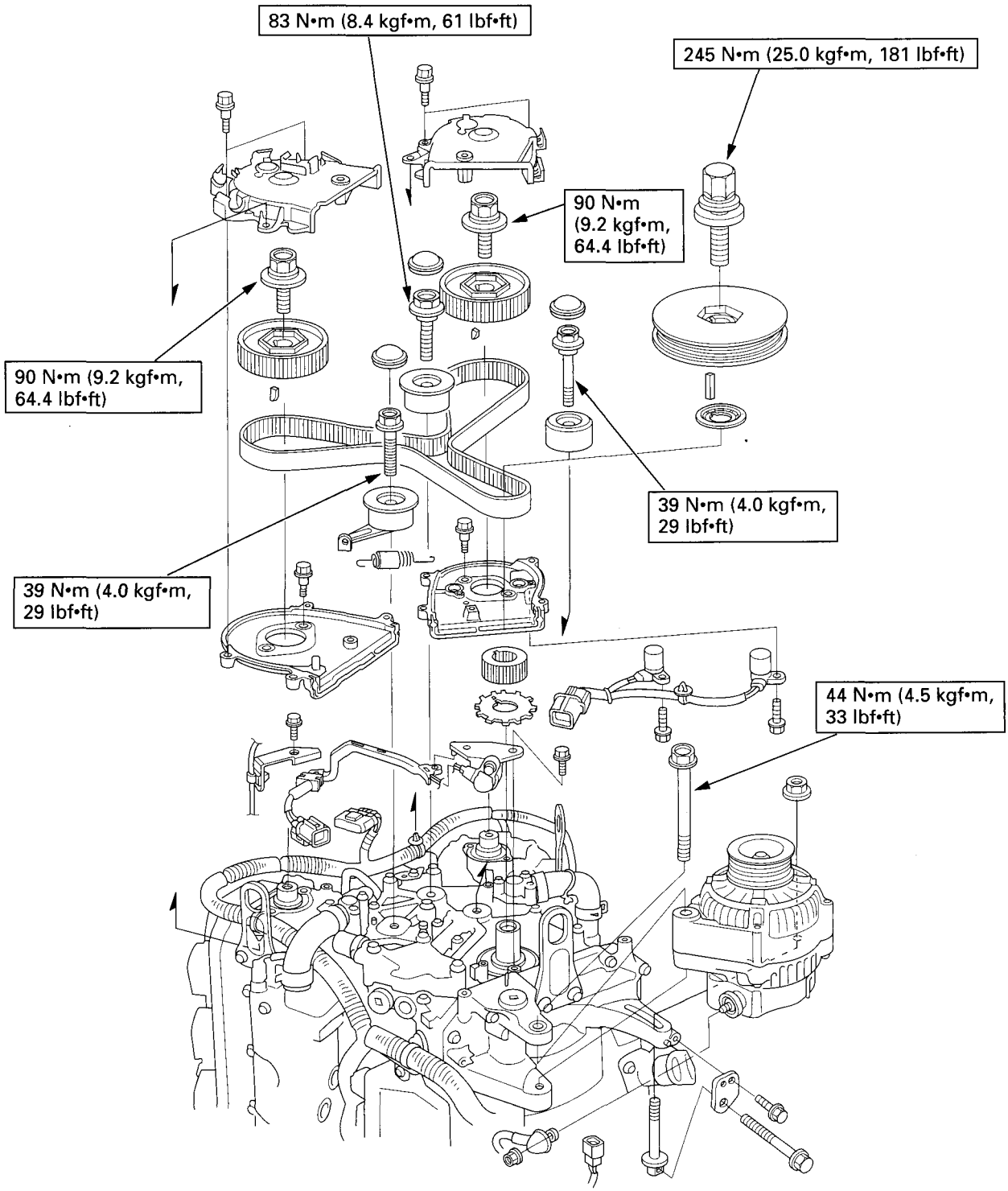


10) Connect the HO2S 4P connector and install the connector to the connector holder of the fuse box bracket.

11) Clamp the HO2S harness clip to the fuse box bracket.



1. ALTERNATOR	2. TIMING BELT/TIMING BELT DRIVE PULLEY/DRIVEN PULLEYS



a. ALTERNATOR ASSEMBLY INSPECTION
(With the alternator assembly mounted on the outboard motor)

NOTICE
Do not disconnect the battery terminals while the alternator is running.

- Alternator assembly inspection must be made with the assembly mounted on the outboard motor.
- Replace the IC regulator when the battery voltage exceeds 16V.
- Before disconnecting the ACG fuse cable, be sure to disconnect the battery negative (–) terminal.

Check for following before starting the alternator assembly inspection.

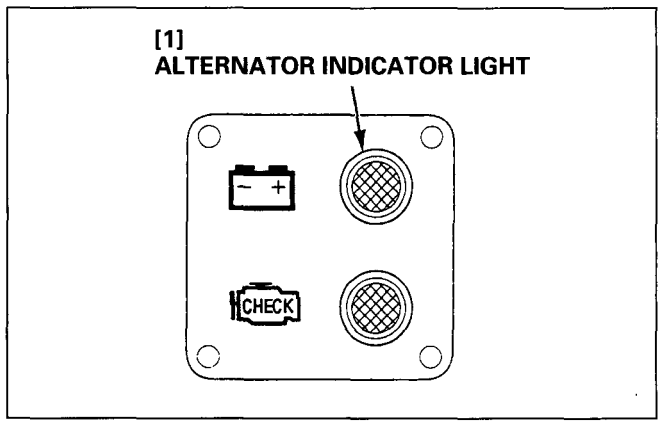
- Battery condition and cable connection
- Alternator belt for looseness, cut and/or fraying (P. 3-24)
- Alternator connector and ACG fuse cable for connection
- Blown ACG fuse and 10A fuse
- Open or short circuit in each harness and cable

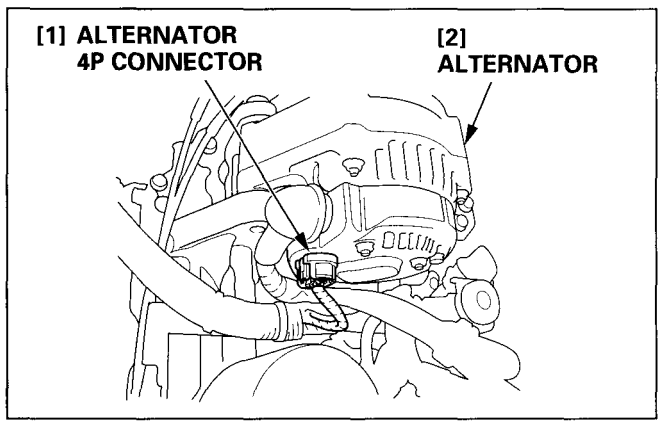
1) Turn the ignition switch to ON and check whether the alternator indicator light comes ON.

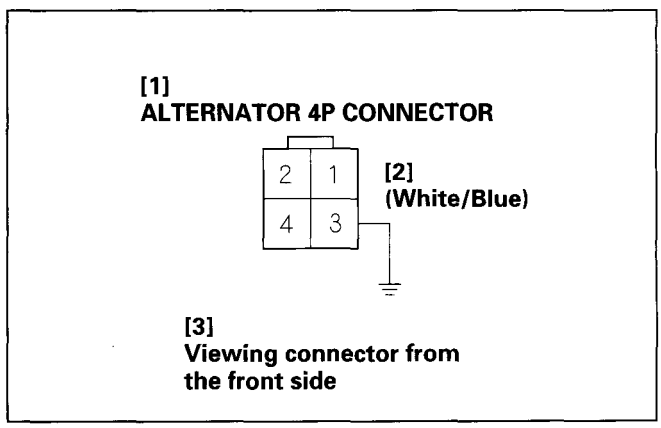
2) If the alternator indicator light does not come ON, disconnect the alternator connector, and short-circuit the white/blue terminal of the harness side connector to the ground.

3) If the indicator light still does not come ON, check the following.
   - Indicator light (P. 15-10)
   - Remote control cable A for open or short circuit

4) Start the engine and check whether the alternator indicator light goes OFF.
   - The alternator is normal when the light goes OFF.
   - If the indicator light is still ON, check each part of the alternator and repeat the above steps 2 and 3.
   - When the alert system functions while the alternator is in operation, the warning buzzer sounds intermittently.







b. REMOVAL:

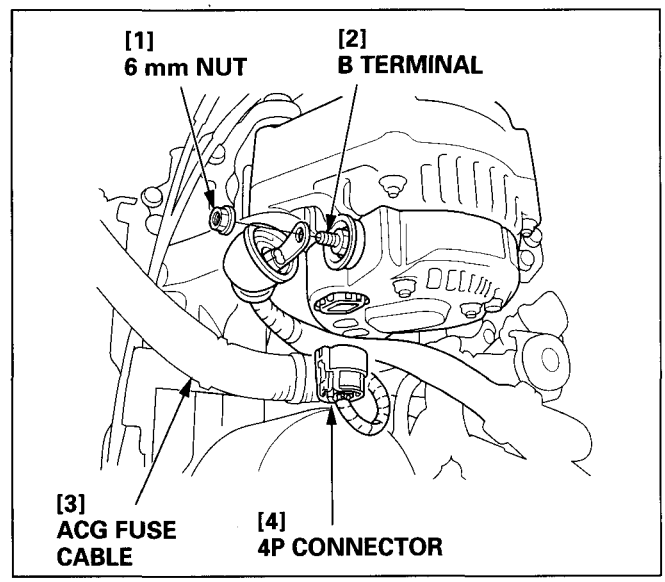
1) Disconnect the battery negative (–) cable.

2) Remove the engine cover (P. 4-1).

3) Remove the silencer case (P. 5-103).

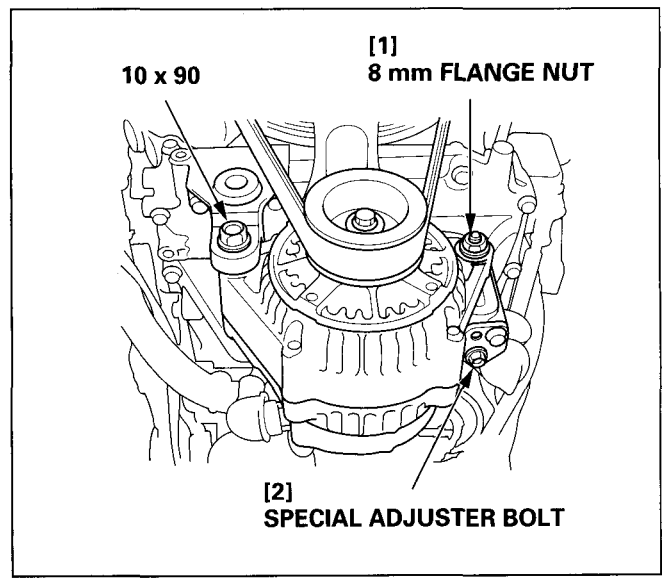
4) Disconnect the 4P connector from the alternator.

5) Remove the 6 mm nut from the alternator B terminal and remove the ACG fuse cable.

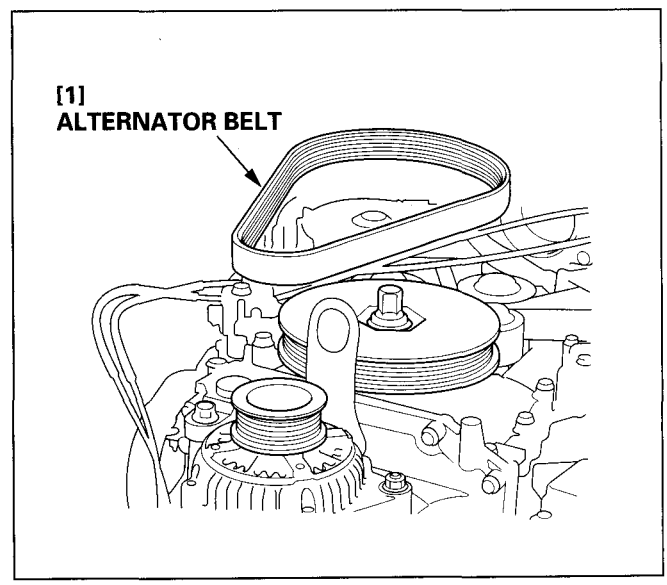


6) Loosen the 10 x 90 mm flange bolt and the 8 mm flange nut.

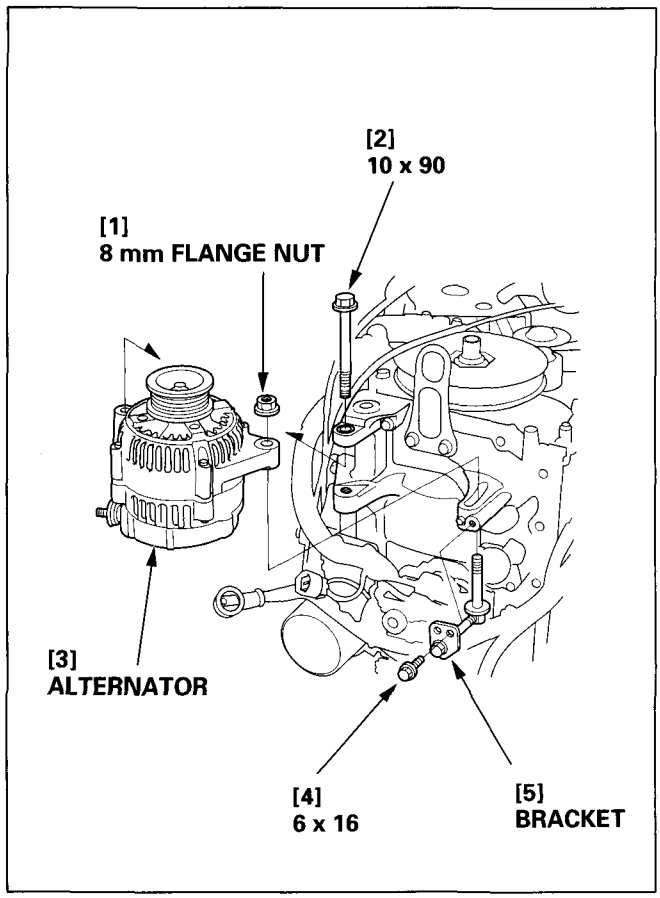
7) Loosen the special adjuster bolt.



8) Move the alternator to the engine side as full as it goes, and remove the alternator belt.

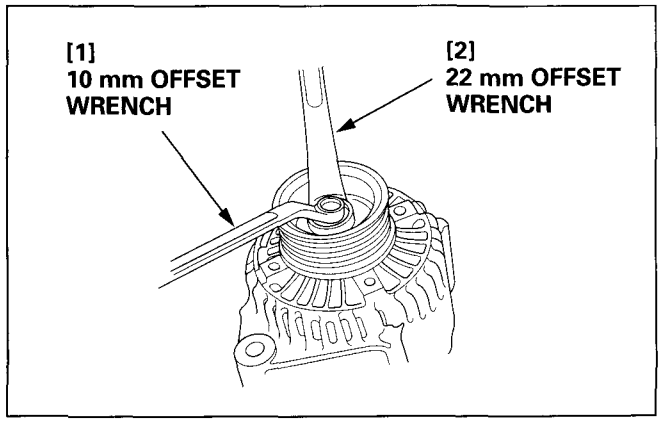


9) Remove the 10 x 90 mm flange bolt and the 8 mm flange nut.
Remove the 6 x 16 mm flange bolt from the bracket, and remove the alternator.



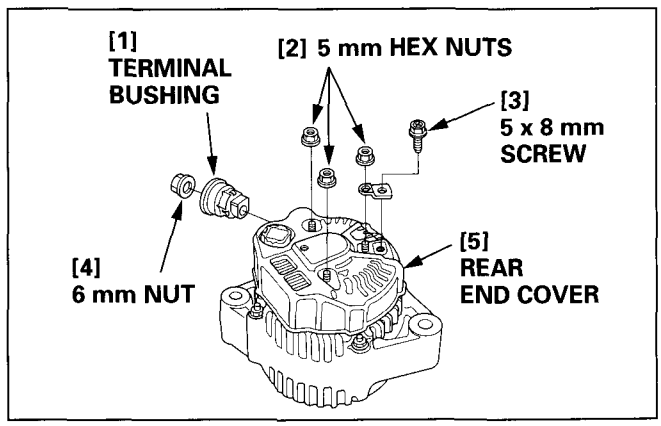
c. DISASSEMBLY:

1) Remove the alternator pulley using the two offset wrenched (10 mm and 22 mm) as shown.



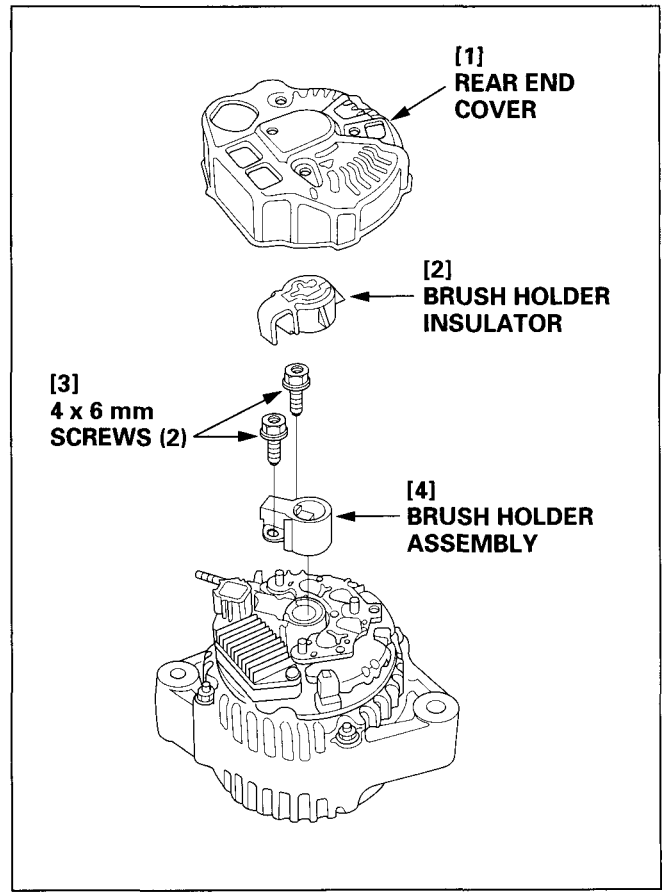
2) Remove the 6 mm nut from the alternator B terminal and remove the insulator bushing.

3) Remove the three 5 mm hex nuts and the 5 x 8 mm screw, and remove the alternator rear end cover.

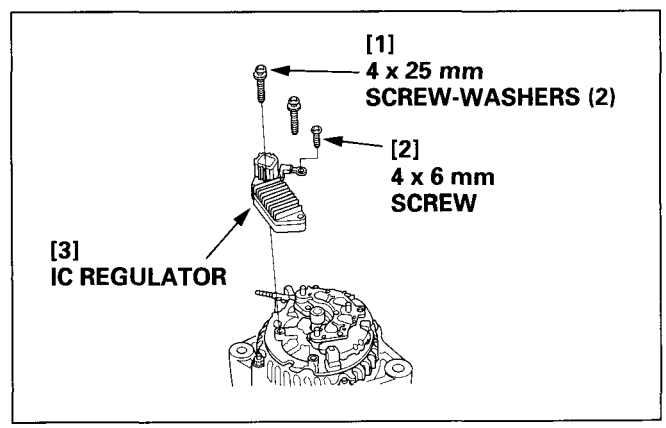


4) Remove the brush holder insulator.

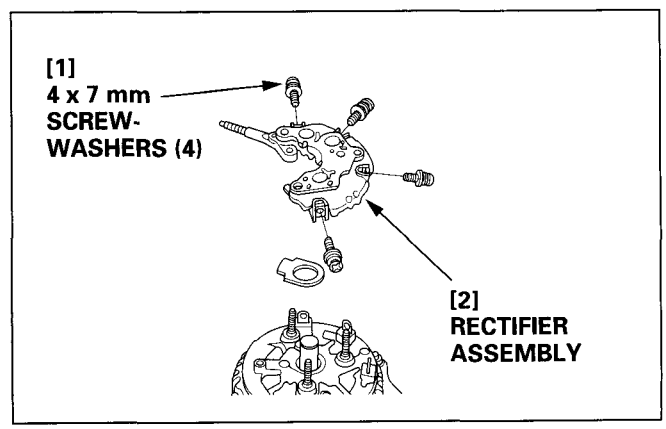
5) Remove the two 4 x 6 mm screws and the brush holder assembly.



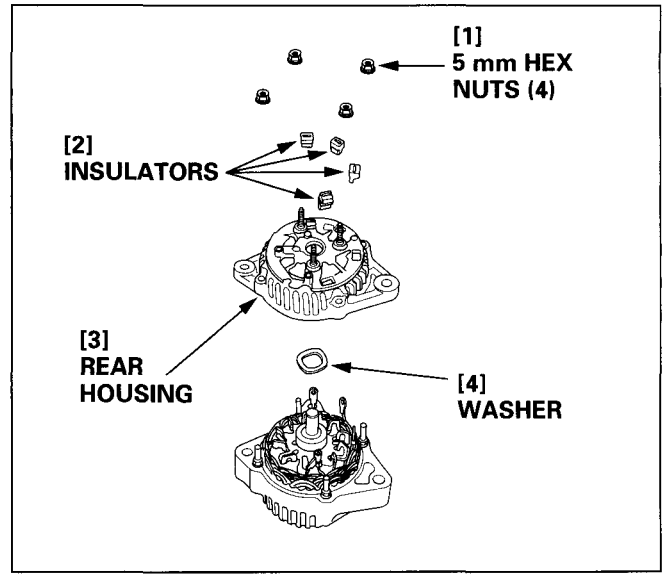
6) Remove the three 4 x 25 mm screw-washers, 4 x 6 mm screw and the IC regulator.



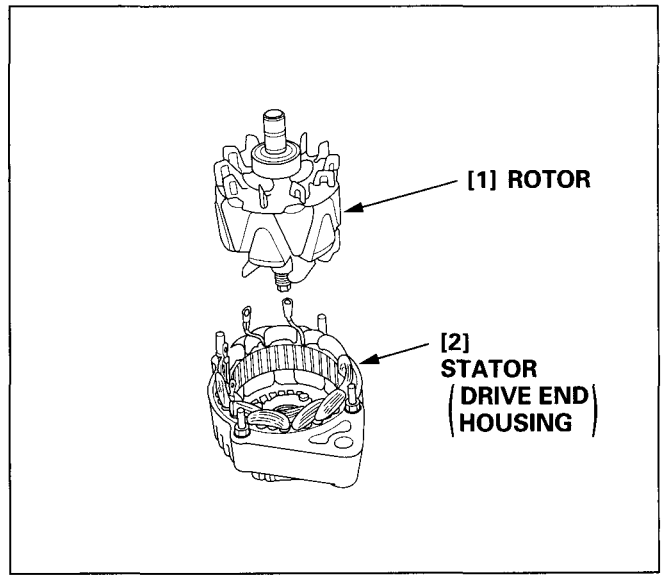
7) Remove the four 4 x 7 mm screw-washers and the rectifier assembly.



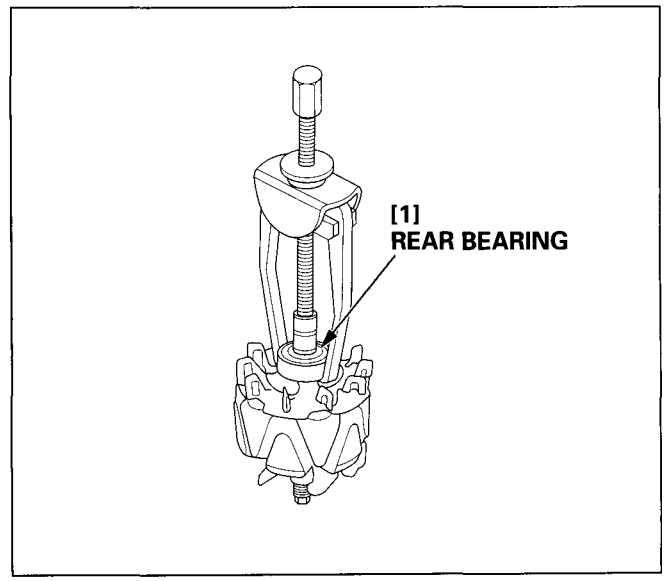
8) Remove the four 5 mm hex nuts and the rear housing.



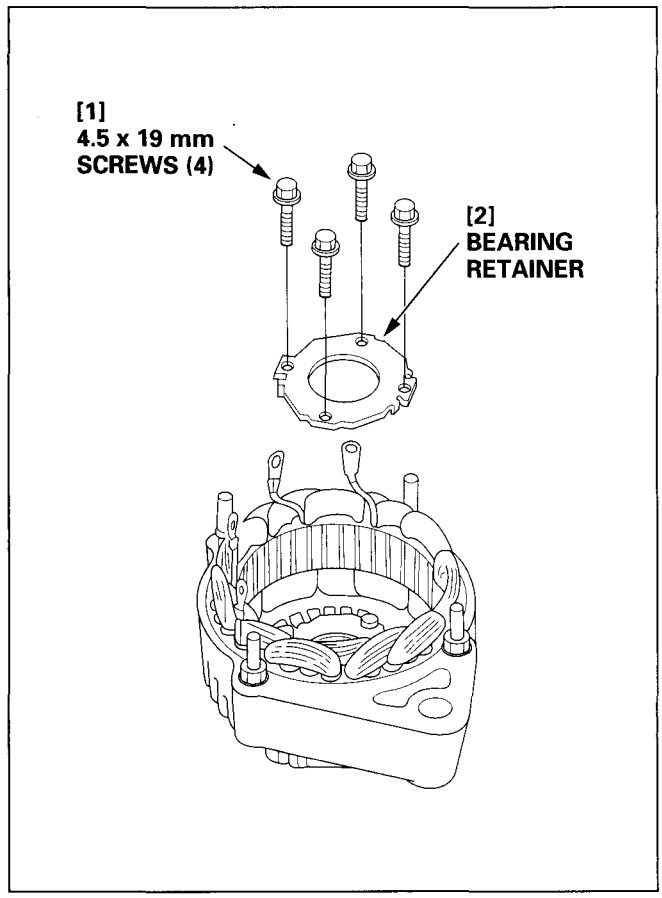
9) Remove the rotor from the stator (drive end housing).



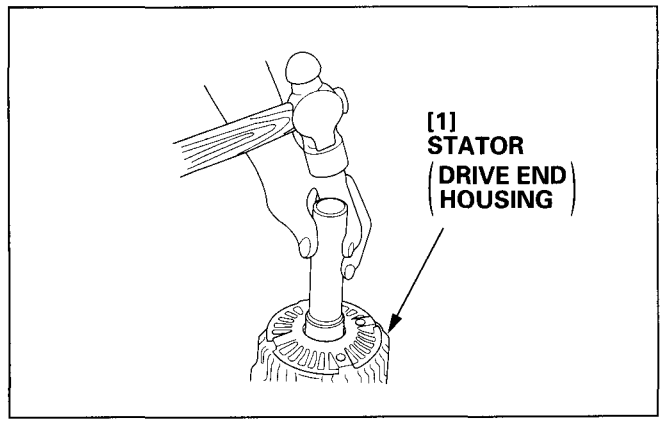
10) Remove the rear bearing from the rotor.



11) Remove the four 4.5 x 19 mm screws and bearing retainer.



12) Support the stator housing in a vise, and drive out the front bearing with a brass drift (commercially available) and a hammer.

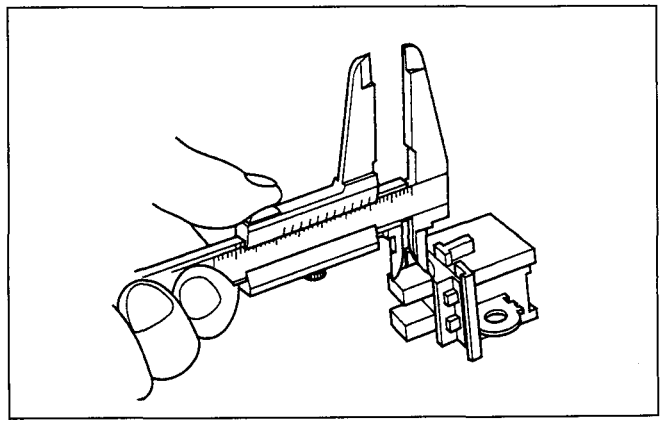


d. INSPECTION (Unit inspection)

- **BRUSH HOLDER ASSEMBLY**

Measure the brush length.
If the measurement is less than the service limit, replace the brush holder assembly.

STANDARD	SERVICE LIMIT
10.5 mm (0.41 in)	9.0 mm (0.35 in)

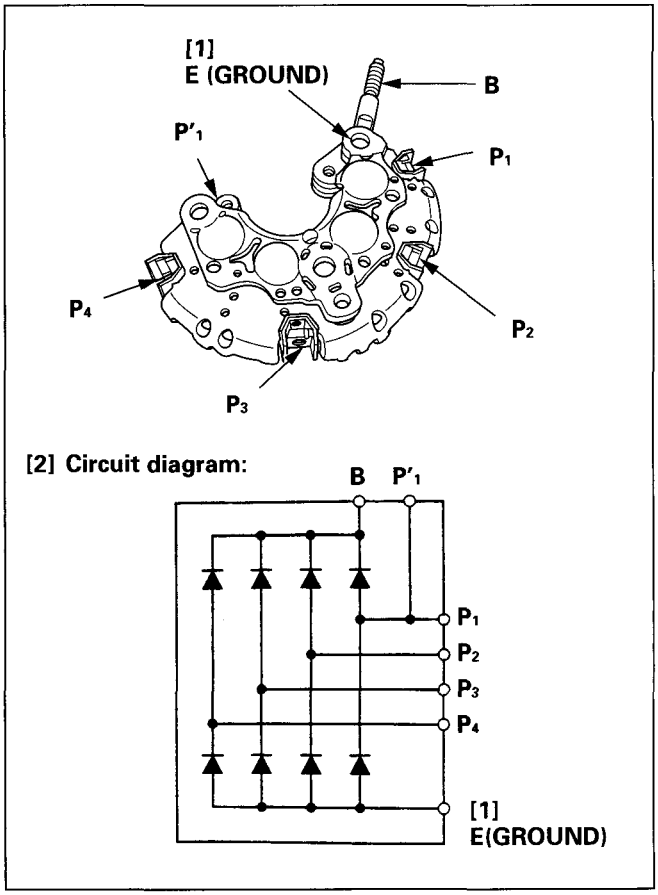


• RECTIFIER ASSEMBLY

• Inspect the rectifier assembly by removing it from the outboard motor.

Check for continuity between the B terminal and the respective P terminals (P1, P2, P3 and P4), and between the E terminal and the respective P terminals (P1, P2, P3 and P4). Note to check for continuity in two directions by reversing the polarities.

There should be continuity only in one direction.
Replace the rectifier assembly as necessary.



• ROTOR

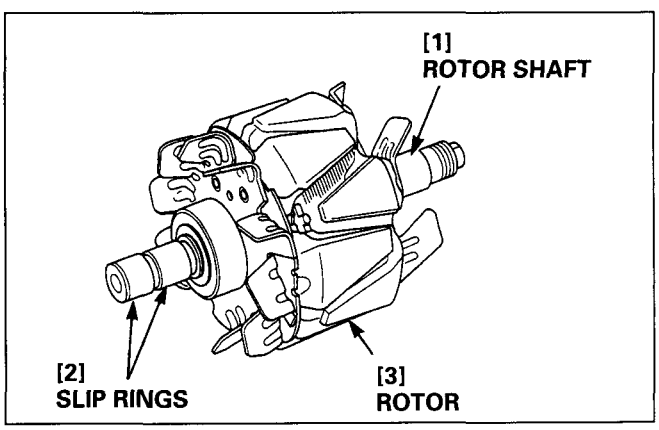
1) Check to be sure that there is continuity between the sip rings.

2) Check to see that there is no continuity between a slip ring and the rotor, and between a slip ring and the rotor shaft.

3) Measure the slip ring O.D.

STANDARD	SERVICE LIMIT
14.2 – 14.4 mm (0.56 – 0.57 in)	13.8 mm (0.54 in)

4) If the measurement is less than the service limit, replace the rotor.

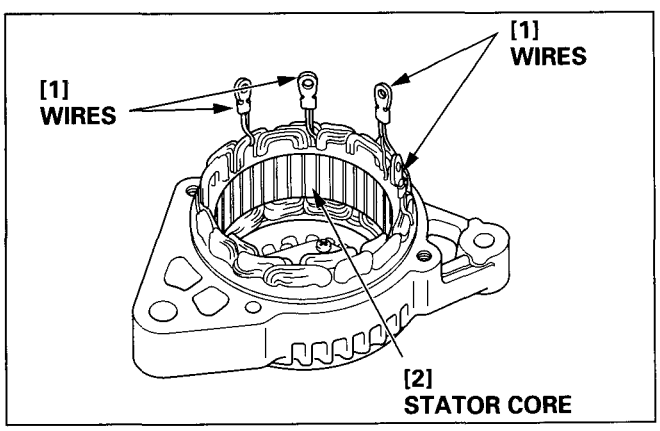


• STATOR

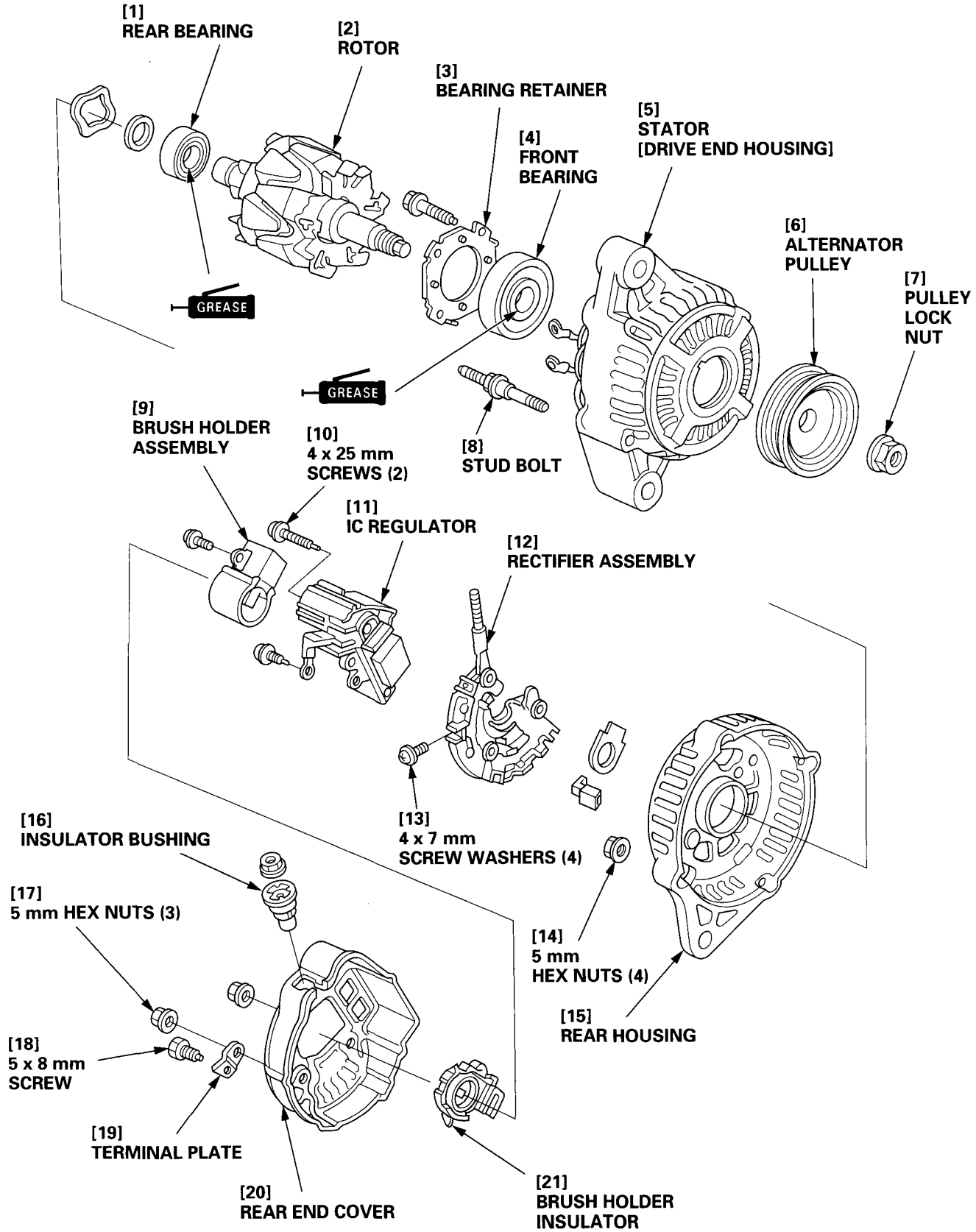
Inspect the stator by removing it from the outboard motor.

1) *Check to see that there is continuity between the wires.*

2) Check to see that there is no continuity between each wires and the stator core.



e. ALTERNATOR ASSEMBLY DISASSEMBLY/ASSEMBLY

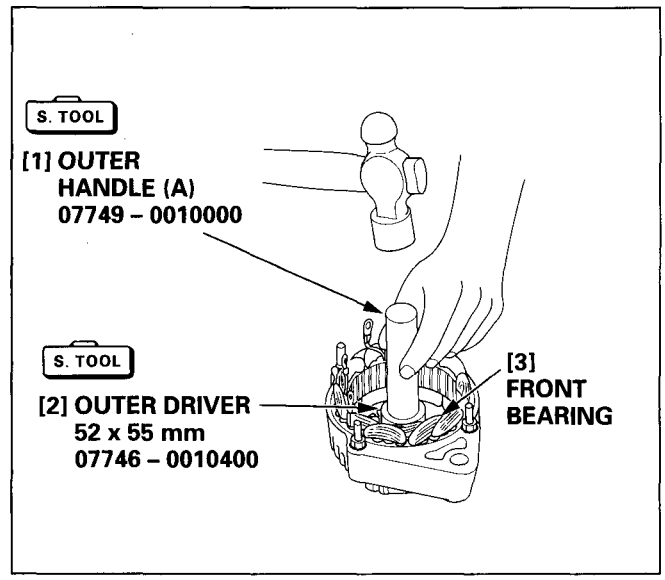


f. REASSEMBLY

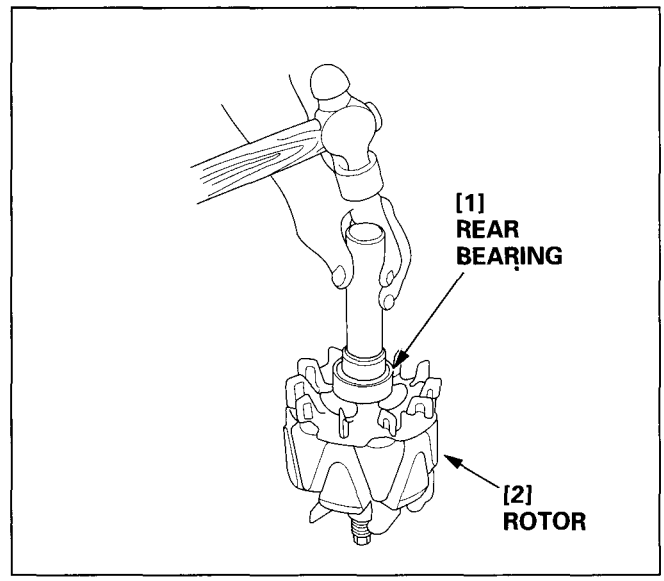
1) If the bearings are removed, replace new bearings.
   - With a hammer and the special tools, install a new front bearing in the stator housing and apply grease to the bearing.

TOOLS:

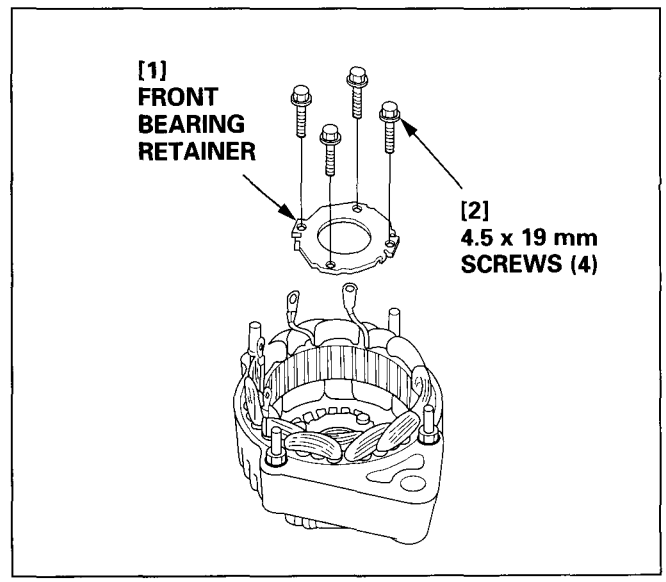
Outer handle A	**07749 – 0010000**
Outer driver 52 x 55 mm	**07746 – 0010400**



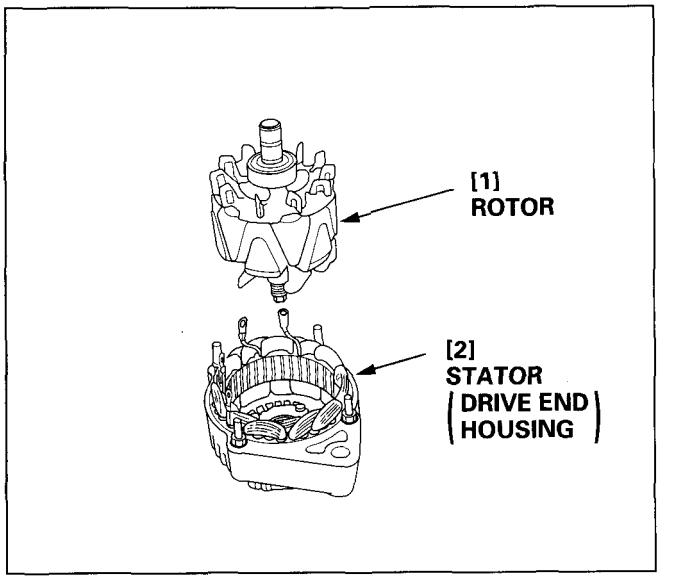
   - With a hammer and commercially available tools shown, install a rear bearing in the rotor shaft and apply grease to the bearing.



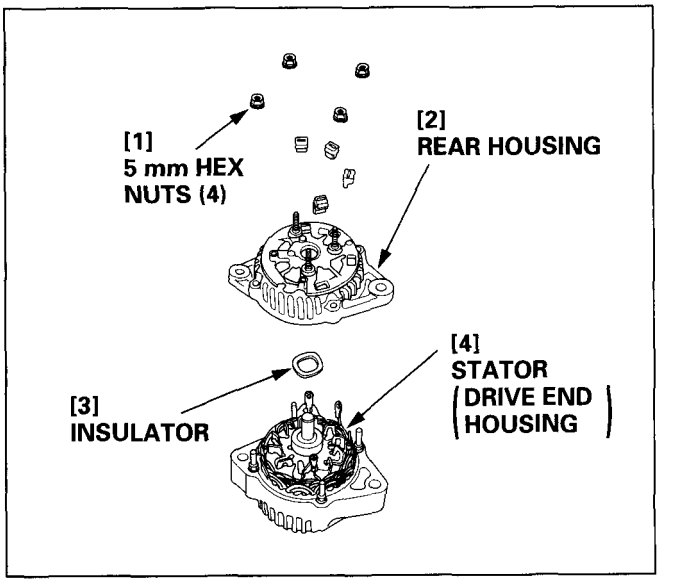
2) Install the front bearing retainer plate with the four 4.5 x 19 mm screws.



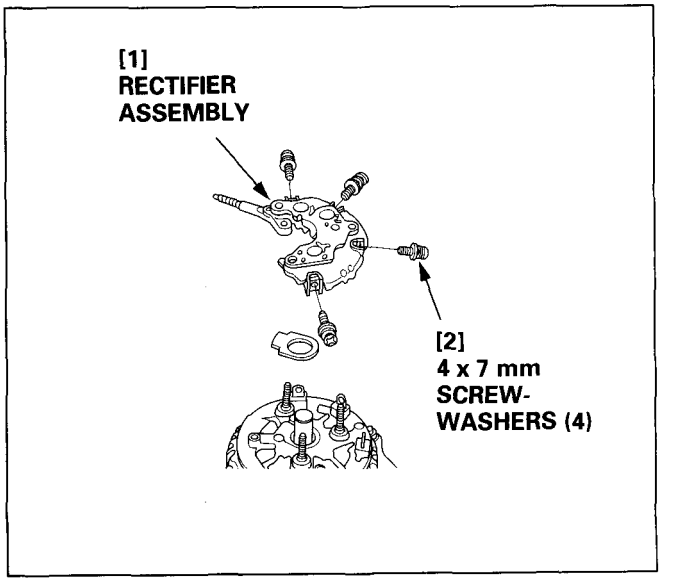
3) Install the rotor to the stator.



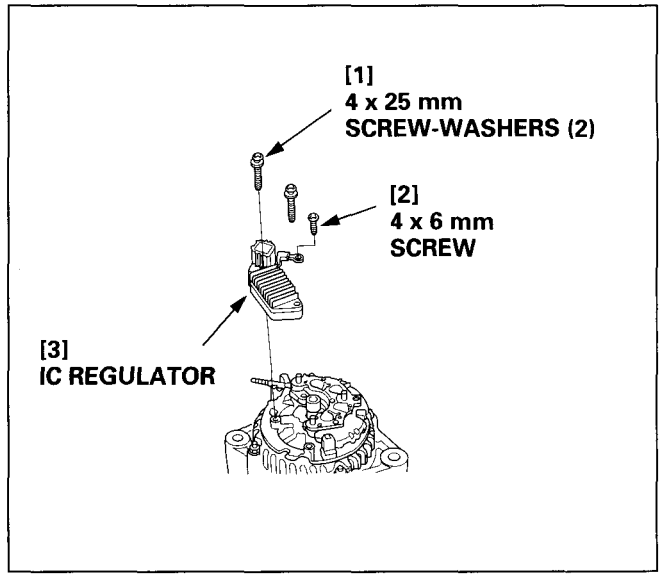
4) Install the rear housing to the stator with the four 5 mm hex nuts.



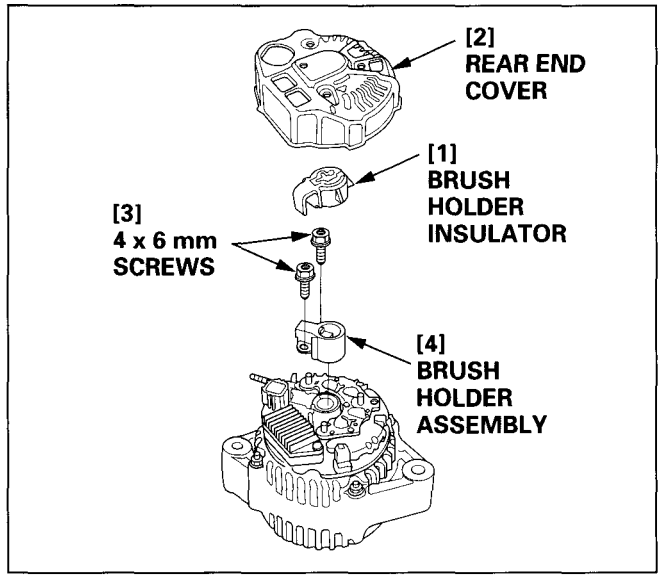
5) Install the rectifier assembly with the four 4 x 7 mm screw washers.



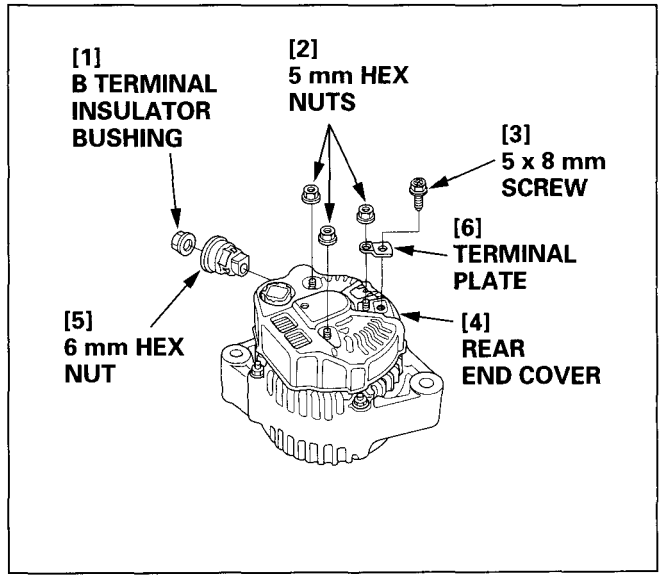
6) Install the IC regulator with the two 4 x 25 mm screw-washers and the 4 x 6 mm screw.



7) Install the brush holder assembly with the two 4 x 6 mm screws, then install the brush holder insulator.

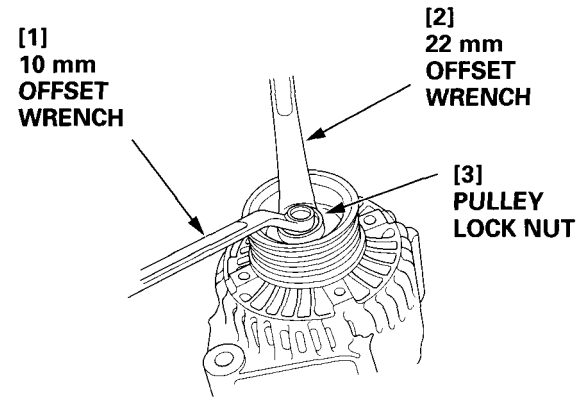


8) Install the rear end cover and the terminal plate with the three 5 mm hex nuts and the 5 x 8 mm screw, then install the B terminal insulator bushing with the 6 mm hex nut.



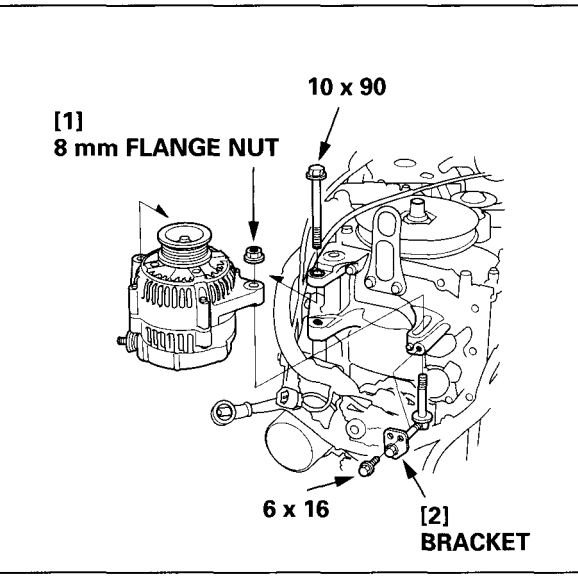
9) Tighten the alternator pulley lock nut using the two offset wrenches (10 mm and 22 mm).

TORQUE: 110 N•m (11.2 kgf•m, 81 lbf•ft)



g. INSTALLATION

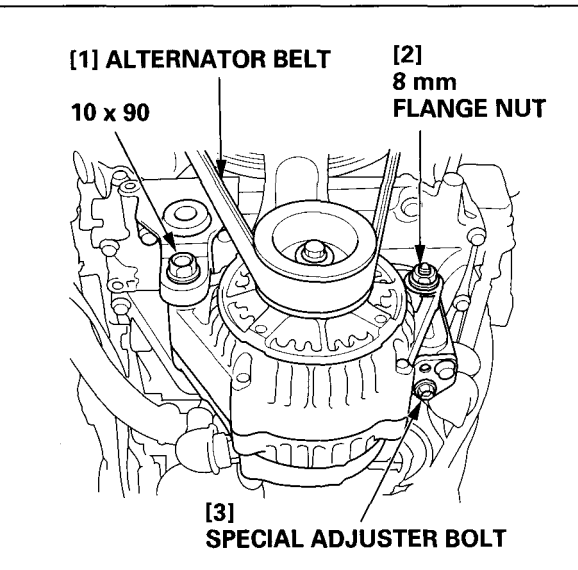
1) Install the bracket with the 6 x 16 mm flange bolt, and install the alternator and loosely tighten the 10 x 90 mm flange bolt and 8 mm flange nut.



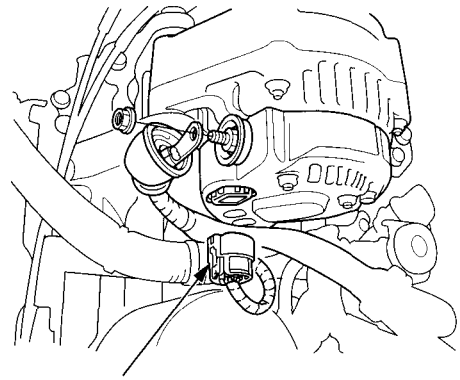
2) Install the alternator belt to the alternator and adjust the belt tension by turning the special adjuster bolt.
Refer to P. 3-24 for the belt tension adjustment.

3) After adjusting the belt tension, tighten the 10 x 90 mm flange bolt and 8 mm flange nut to the specified torque.

TORQUE:
10 x 90 mm flange bolt: 44 N•m (4.5 kgf•m, 33 lbf•ft)
***8 mm flange nut*: 26 N•m (2.7 kgf•m, 20 lbf•ft)**



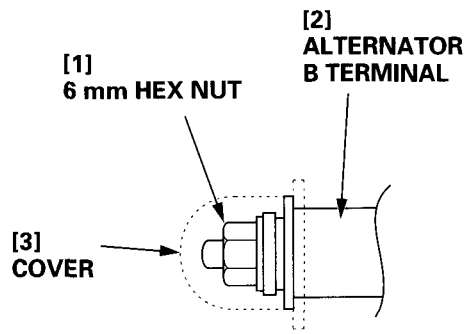
4) Connect the 4P connector to the alternator.

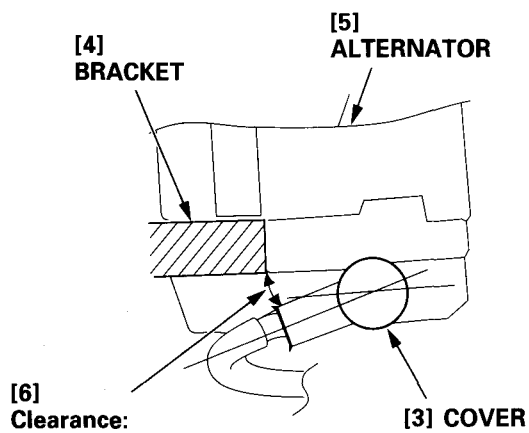


5) Connect the ACG fuse cable to the alternator B terminal with the caulked part toward you.
Tighten the 6 mm hex nut to the specified torque so that the ACG fuse cable not to touch the bracket as shown.

TORQUE: 8 N•m (0.8 kgf•m, 5.8 lbf•ft)

6) After installation, place the cover over the B terminal securely.





2. TIMING BELT/TIMING BELT DRIVE PULLEY/DRIVEN PULLEY

a. REMOVAL

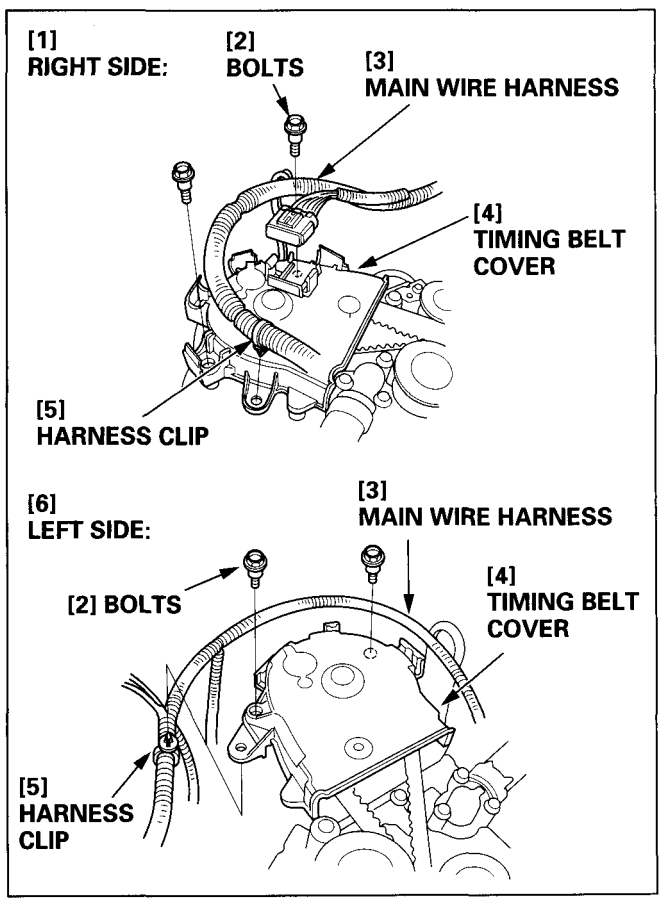
1) Disconnect the battery negative (–) cable.

2) Make sure the remote control lever is in "N" (neutral) position.

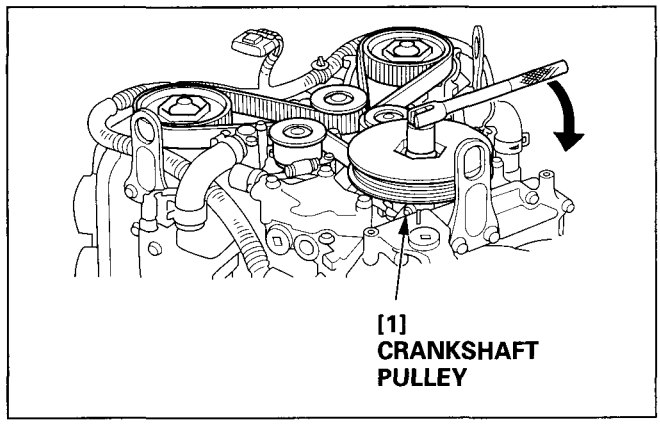
3) Remove the following parts:
   - *Engine cover* (P. 4-1)
   - Engine under covers (P. 4-5)
   - Silencer case (P. 5-103)
   - Throttle body (P. 5-107)
   - Intake manifold (P. 5-112)
   - Ignition coils (P. 3-5)
   - Spark plugs (P. 3-5)
   - Alternator belt (P. 6-3)

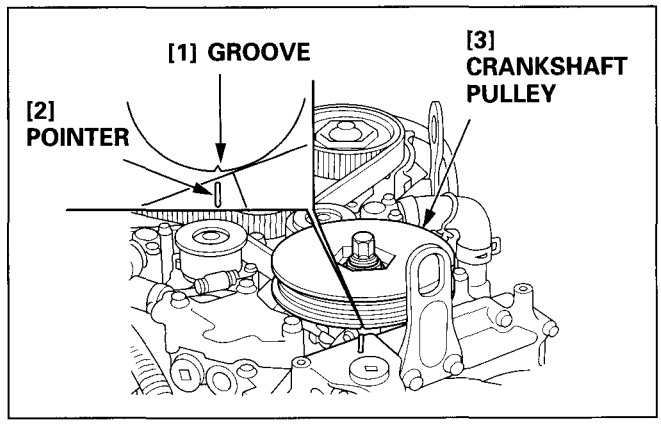
4) Remove the main wire harness from the timing belt covers.

5) Remove the bolts and the timing belt covers.

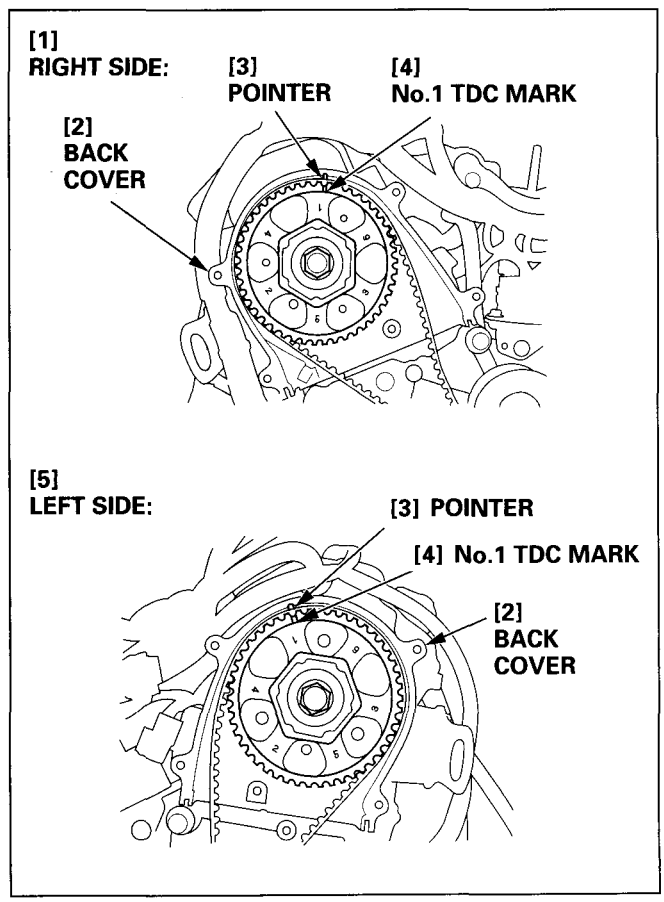


6) Turn the crankshaft clockwise so that the goove of the crankshaft pulley lines up with the pointer.





7) Check that the No.1 piston TDC marks on the both side of the timing belt driven pulleys and the pointers on the timing belt back covers are aligned.



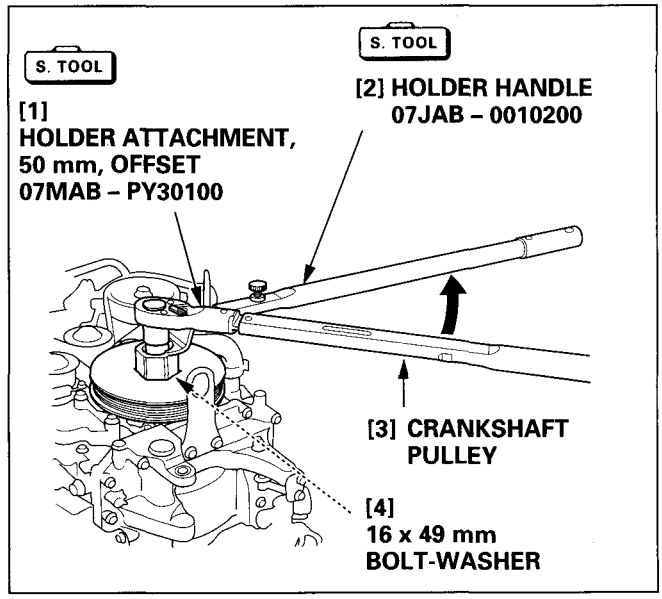
8) Remove the 16 x 49 mm bolt-washer using the special tools as shown.

NOTICE

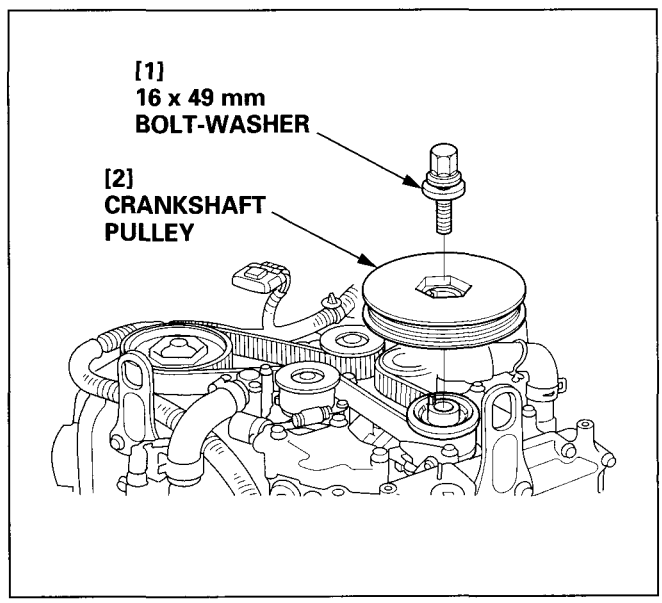
Do not use an impact wrench. Remove the 16 x 49 mm bolt-washer while holding the crankshaft pulley with the special tool.
Do not turn the crankshaft counterclockwise.

TOOLS:

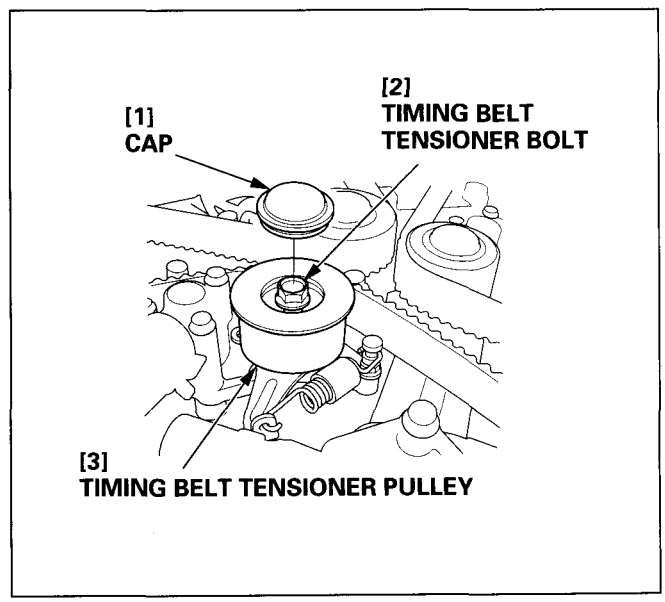
Holder attachment, 50 mm, offset	**07MAB – PY30100**
Holder handle	**07JAB – 0010200**



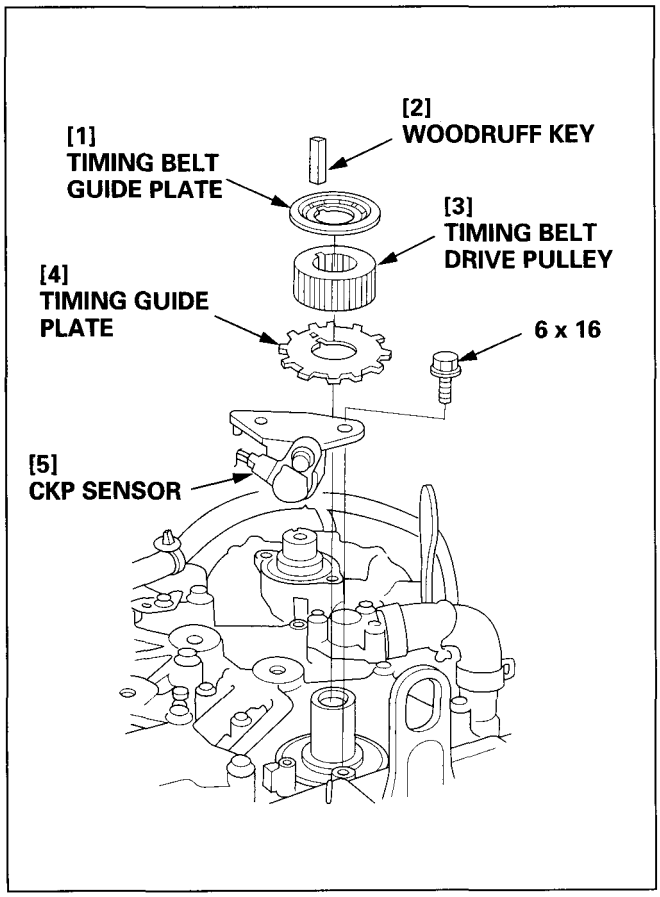
9) Remove the crankshaft pulley.



10) Loosen the timing belt tensioner bolt about one or one and half turns, then remove the timing belt.



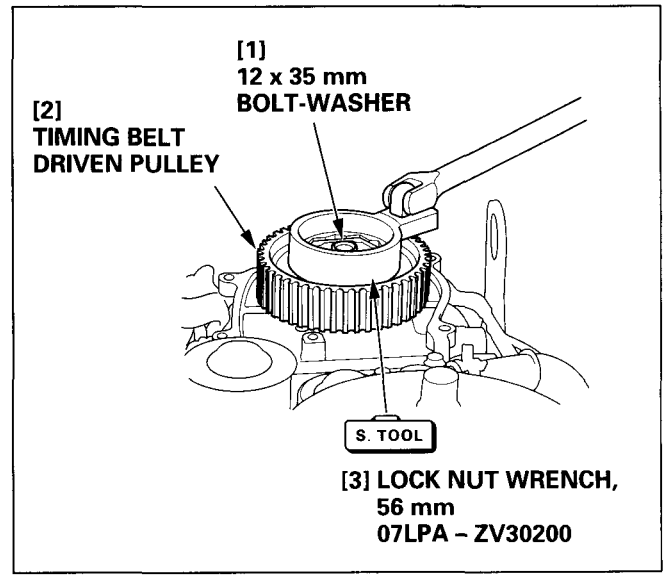
11) Disconnect the woodruff key, then remove the timing belt guide plate, timing belt drive pulley. Before removing the timing guide plate, remove the 6 x 16 mm flange bolt and the CKP sensor.



• TIMING BELT DRIVEN PULLEYS REMOVAL

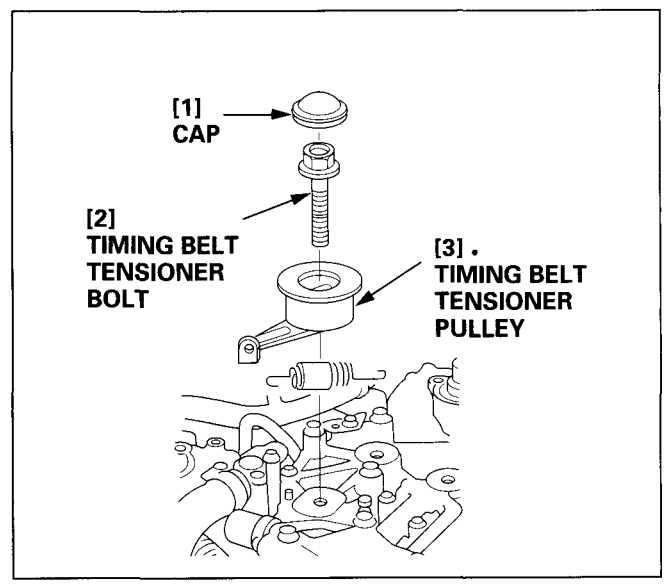
Using the special tool as shown, remove the 12 x 35 mm bolt-washer and timing belt driven pulley.

TOOL:
Lock nut wrench, 56 mm **07LPA – ZV30200**



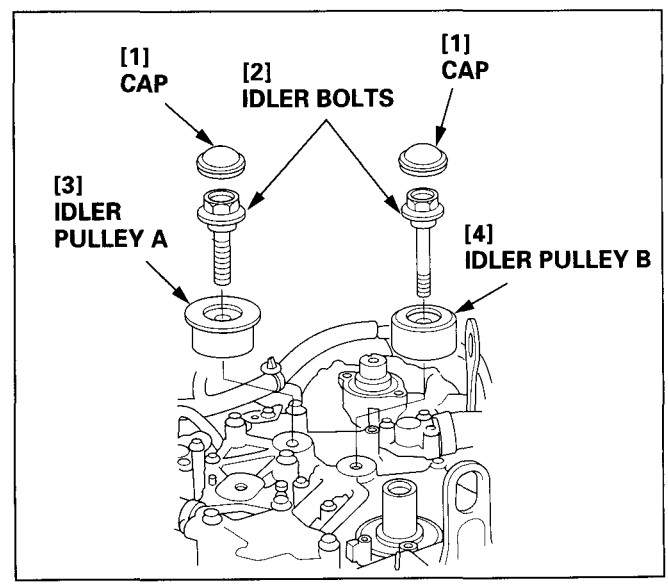
• TIMING BELT TENSIONER PULLEY REMOVAL

Remove the cap and timing belt tensioner bolt, then remove the timing belt tensioner pulley.



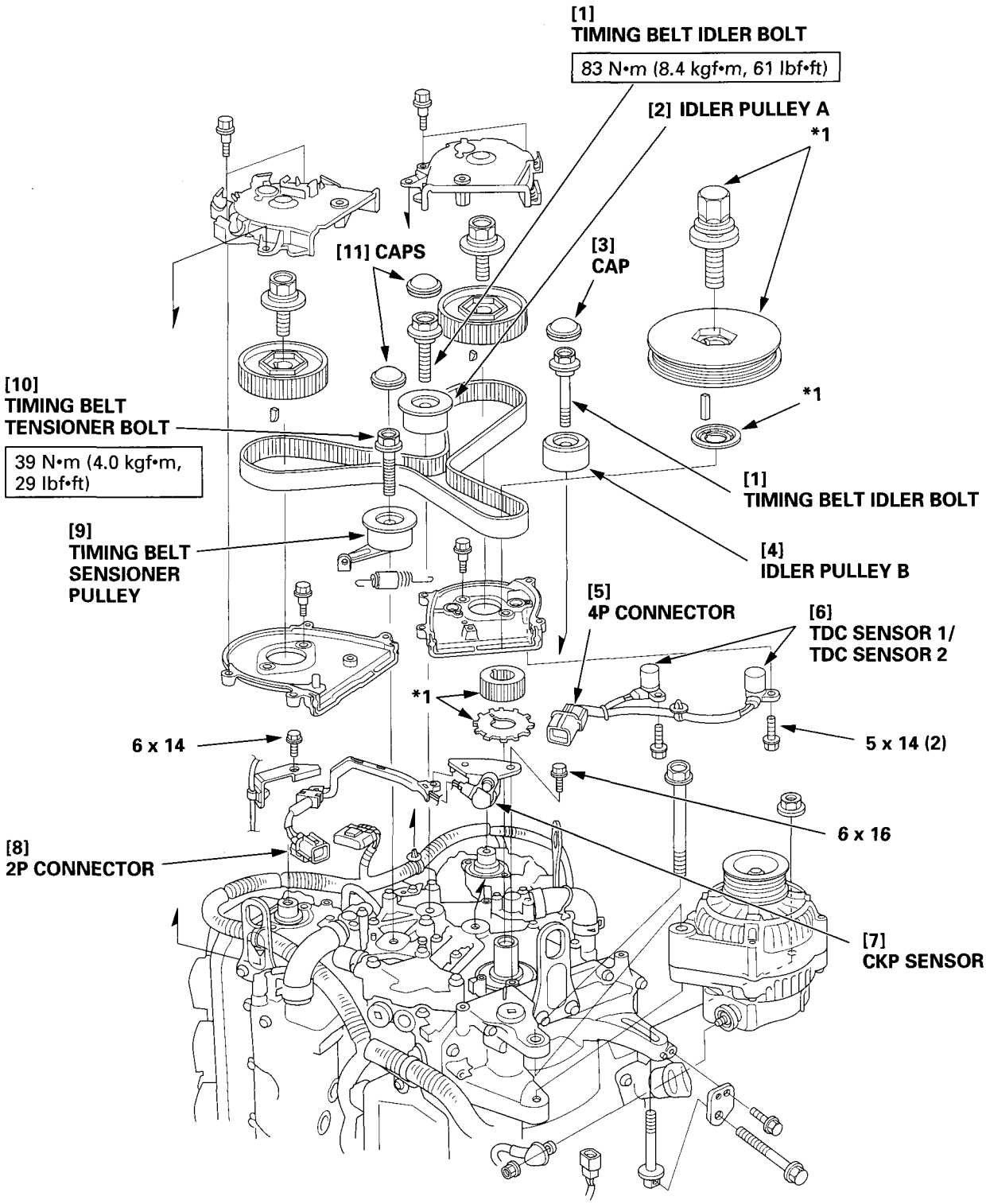
• IDLER PULLEY A, IDLER PULLEY B REMOVAL

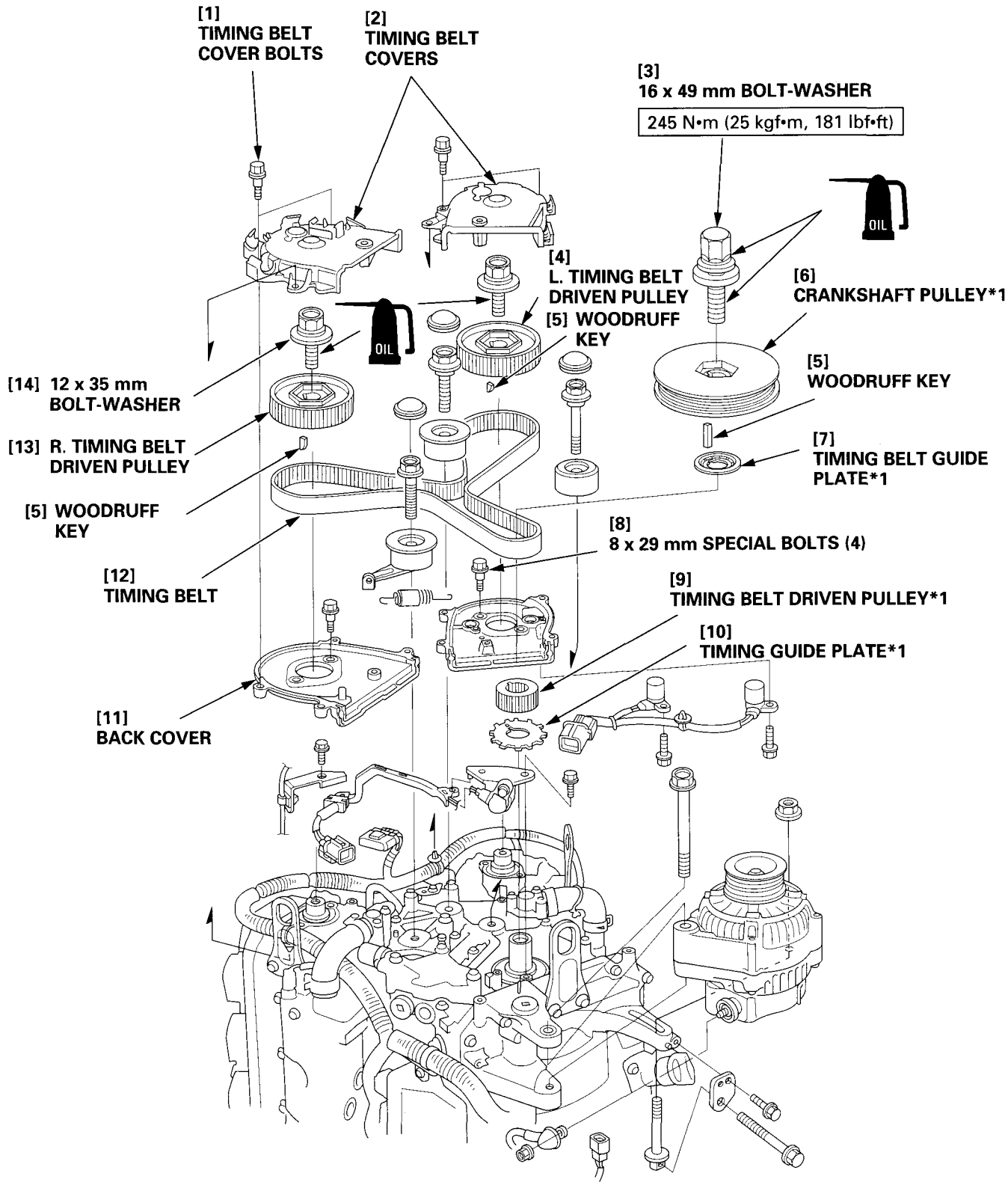
Remove the caps and idler pulley bolts, then remove the idler pulleys.



b. EXPLODED VIEW

- Degrease, clean and/or lubricate the parts marked with *1 according to the DEGREASING/CLEANING/LUBRICATION instructions. Do not lubricate any part unless instructed to do so (P. 6-22).




[1]
TIMING BELT
COVER BOLTS
[2]
TIMING BELT
COVERS
[3]
16 x 49 mm BOLT-WASHER
245 N•m (25 kgf•m, 181 lbf•ft)
OIL
[4]
L. TIMING BELT
DRIVEN PULLEY
[5] WOODRUFF
KEY
[6]
CRANKSHAFT PULLEY*1
[14] 12 x 35 mm
BOLT-WASHER
[13] R. TIMING BELT
DRIVEN PULLEY
[5] WOODRUFF
KEY
[5]
WOODRUFF KEY
[7]
TIMING BELT GUIDE
PLATE*1
[8]
8 x 29 mm SPECIAL BOLTS (4)
[12]
TIMING BELT
[9]
TIMING BELT DRIVEN PULLEY*1
[10]
TIMING GUIDE PLATE*1
[11]
BACK COVER

c. DEGREASING/CLEANING/LUBRICATION

Be sure to degrease, clean or lubricate the following parts before installation.

<16 x 49 mm bolt-washer>

- Wipe the stain of entire surface of the bolt–washer (especially the washer and the crankshaft pulley mating suface) with a clean shop towel.
- Apply engine oil to the flanged part of the bolt and the washer mating surface.
- Apply engine oil to the threaded part of the bolt.
  - Do not apply engine oil to the washer and the crankshaft pulley mating surface.

<Crankshaft pulley>

- Remove oil from the bottom of the crankshaft pulley boss using a degreasing cleaning agent.
- Wipe the stain of bolt–washer mounting surface on the crankshaft pulley using a clean shop towel.
  - Do not contaminate the belt installation parts with oil.

<Timing belt guide plate>

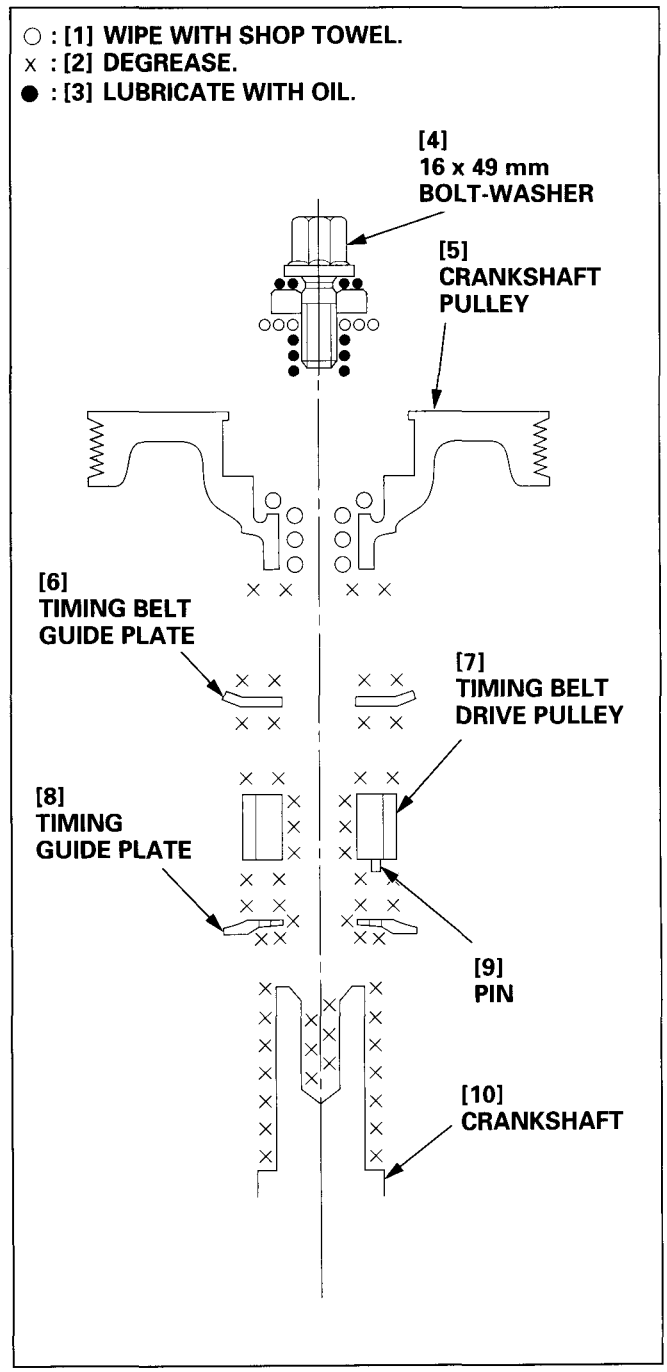
- Remove oil from the crankshaft pulley and the timing belt guide plate mating surface tuoroughly using a degreasing cleaning agent.
  - Do not contaminate the belt installation parts with a degreasing cleaning agent.

<Timing belt drive pulley/timing guide plate>

- Wipe the stain of entire surface of the timing belt drive pulley and the timing belt guide plate using a clean shop towel.

<Crankshaft>

- Spray a degreasing cleaning agent over a clean shop towel, and wipe the entire surface of the crankshaft to remove oil thoroughly.
  - Do not let the oil seals and other rubber parts get sprayed or contaminated with the degreasing cleaning agent.
  - Do not spray the degreasing cleaning agent directly over the crankshaft. Be sure to wipe the crankshaft with a clean shop towel sprayed with the degreasing cleaning agent.



• **TIMING BELT DRIVEN PULLEYS INSTALLATION**

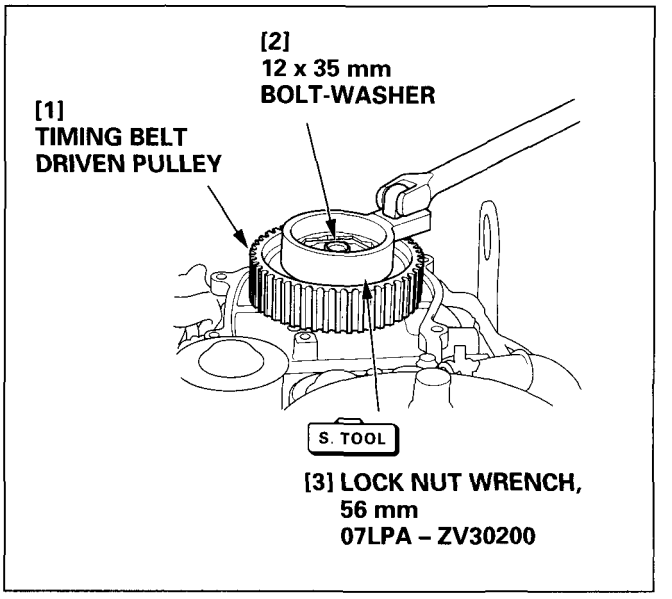
1) Apply engine oil to the threaded part and the seat of the 12 x 35 mm flange bolt.

2) Install the timing belt driven pulley and align the No.1 TDC "I" mark on the driven pulleys with the "I" mark on the timing belt lower cover.

3) Using the special tool as shown, tighten the 12 x 35 mm bolt-washer and timing belt driven pulley.

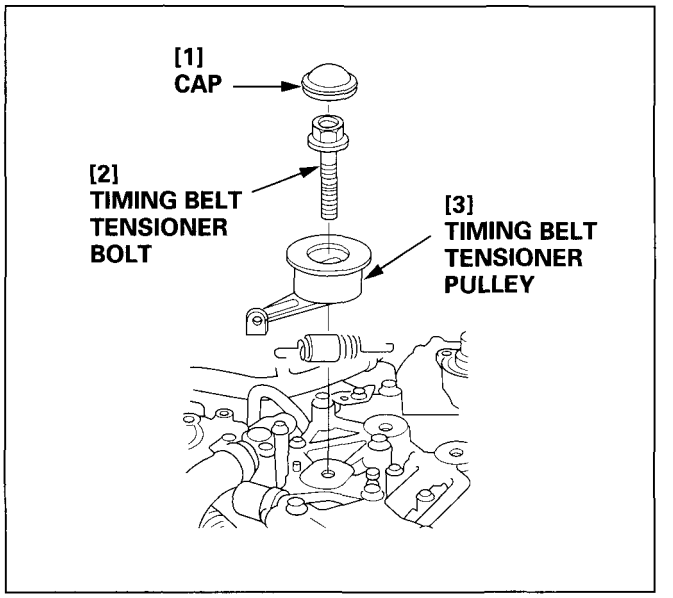
TORQUE: 90 N•m (9.2 kgf•m, 67 lbf•ft)

TOOL:
Lock nut wrench, 56 mm 07LPA – ZV30200



• **TIMING BELT TENSIONER PULLEY INSTALLATION**

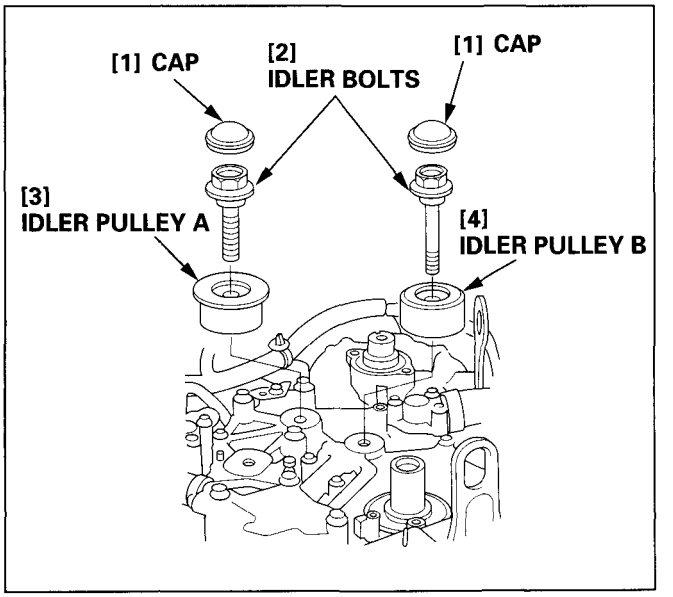
Install the timing belt tensioner pulley and loosely tighten the timing belt tensioner bolt. After installing a timing belt, install the cap on the pulley.



• **IDLER PULLEY A, IDLER PULLEY B INSTALLATION**

Install the idler pulleys and tighten the idler pulley bolts to the specified torque, then install the caps on the pulleys.

TORQUE:
Idler pulley A: 83 N•m (8.4 kgf•m, 61 lbf•ft)
Idler pulley B: 39 N•m (4.0 kgf•m, 29 lbf•ft)

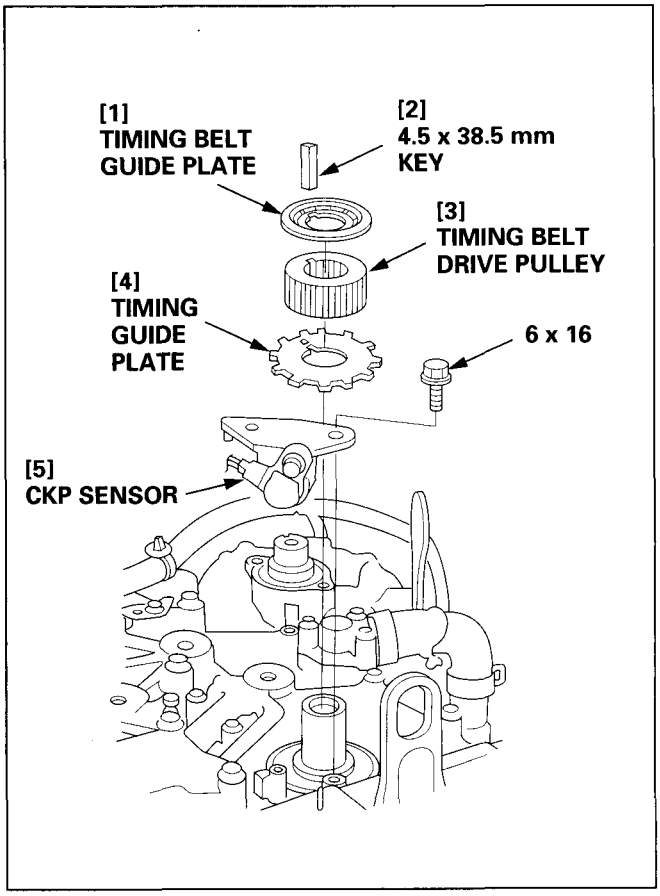


• **TIMING BELT DRIVE PULLEY INSTALLATION**

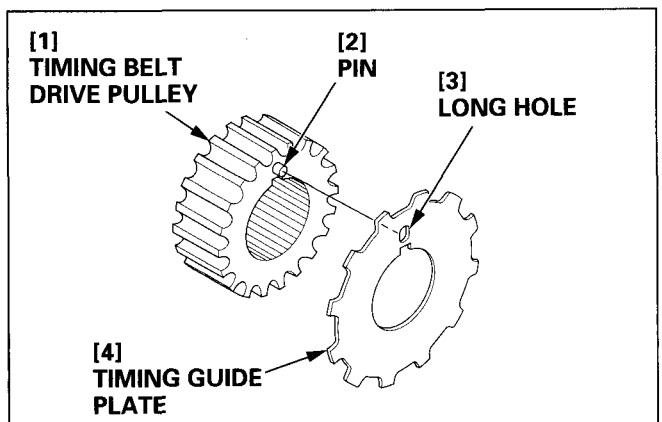
Before installing the timing guide plate, drive pulley and timing belt guide plate, refer to P. 6-22 and be sure to degrease, clean or lubricate the parts.

1) Install the timing guide plate on the crankshaft, then tighten the CKP sensor with the 6 x 16 mm flange bolt.

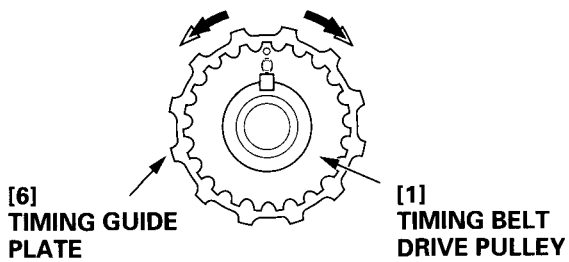
2) Install the timing belt drive pulley by aligning the pin on the pulley in the long hole in the guide plate.



3) Align the key groove in the crankshaft with the key groove in the drive pulley, and install the 4.5 x 38.5 mm key.



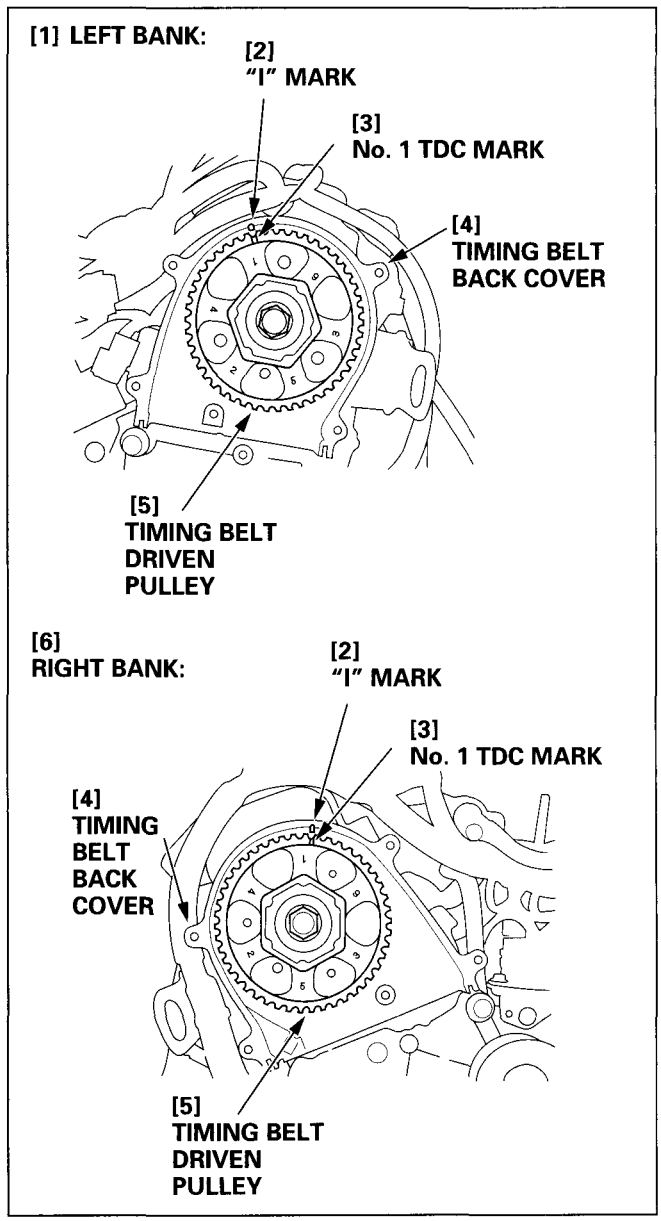
[5] The guide plate must not turn larger than the distance equal to the drive pulley pin moving in the long hole in the guide plate.



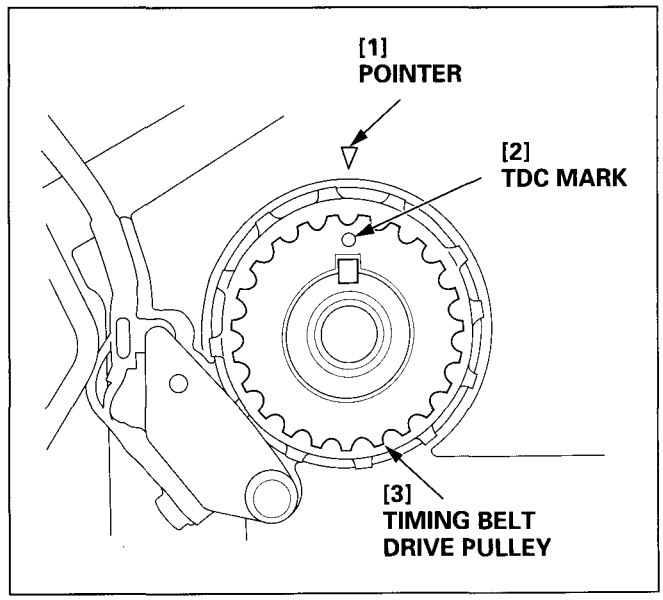
- **TIMING BELT INSTALLATION**

1) Clean the timing belt pulleys, and the upper and lower covers.

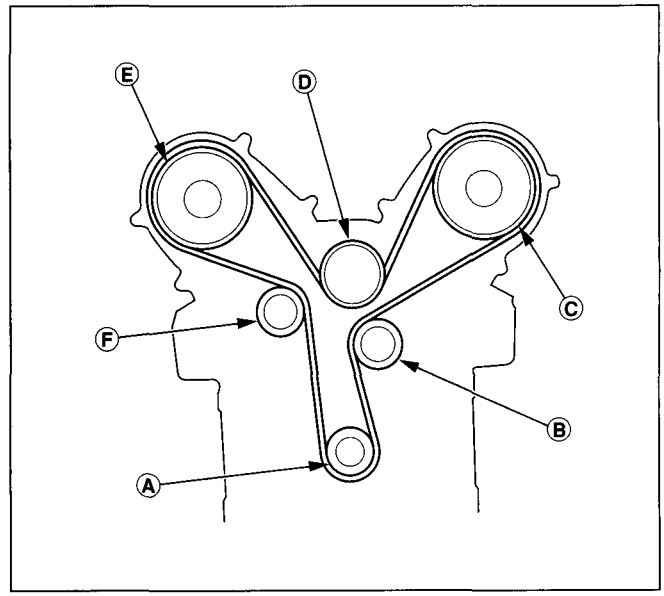
2) Set the timing belt driven pulleys to No. 1 TDC by aligning the TDC marks on the timing belt driven pulleys with the pointers on the timing belt back cover.



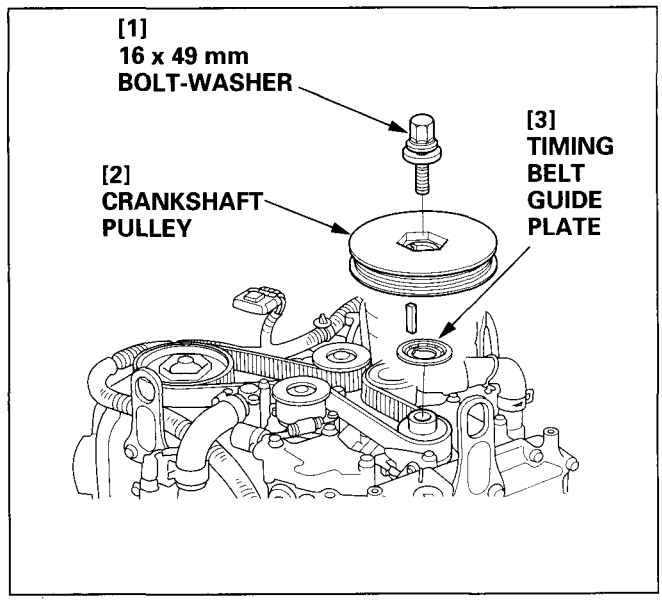
3) Set the timing belt drive pulley to TDC by aligning the TDC mark on the tooth of the timing belt drive pulley with the pointer on the crankcase.



4) Install the timing belt in a counterclockwise sequence starting with the drive pulley. Take care not to damage the timing belt when installing the belt.
   –1 Drive pulley Ⓐ
   –2 Idler pulley B Ⓑ
   –3 Left timing belt driven pulley Ⓒ
   –4 Idler pulley A Ⓓ
   –5 Right timing belt driven pulley Ⓔ
   –6 Timing belt tensioner pulley Ⓕ



5) Install the timing belt guide plate and crankshaft pulley and loosely tighten the 16 x 49 mm bolt-washer.



6) Clean any oil off the inside face of the crankshaft pulley, and apply lubricant to the 16 x 49 mm bolt-washer (P. 6-22).

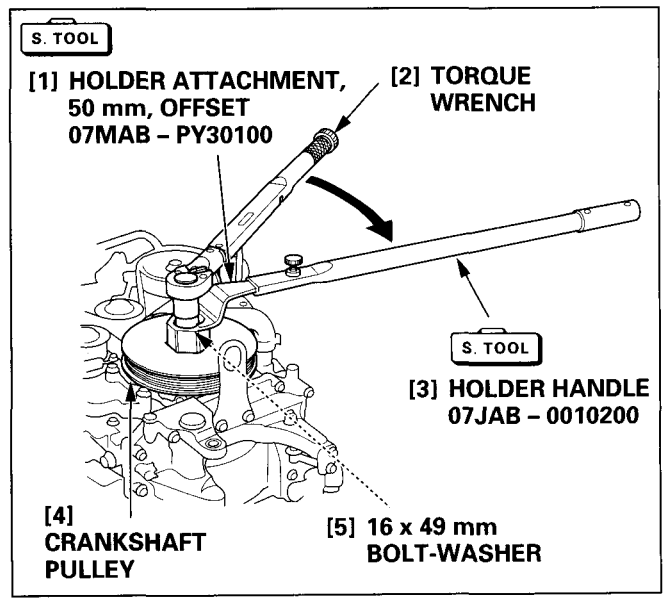
7) Install the crankshaft pulley, and tighten the 16 x 49 mm bolt-washer to the specified torque with using the special tools. Do not use the impact wrench.

TORQUE: 245 N•m (25.0 kgf•m, 181 lbf•ft)

— Hold the pulley with the holder handle and attachment.
— Tighten the bolt with a torque wrench.
— Be sure to degrease, clean or lubricate the drive pulley, crankshaft pulley and the 16 x 49 mm bolt-washer (P. 6-22).

TOOLS:

Holder attachment, 50 mm, offset	**07MAB – PY30100**
Holder handle	**07JAB – 0010200**



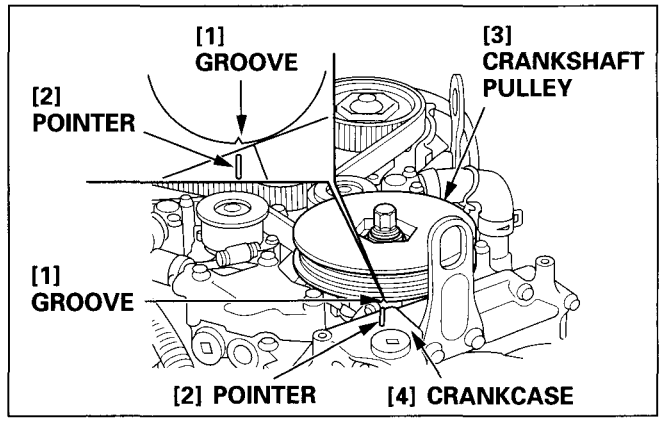
8) Tighten the timing belt tensioner bolt to the specified torque, and install the cap on the pulley. (P.6-23)

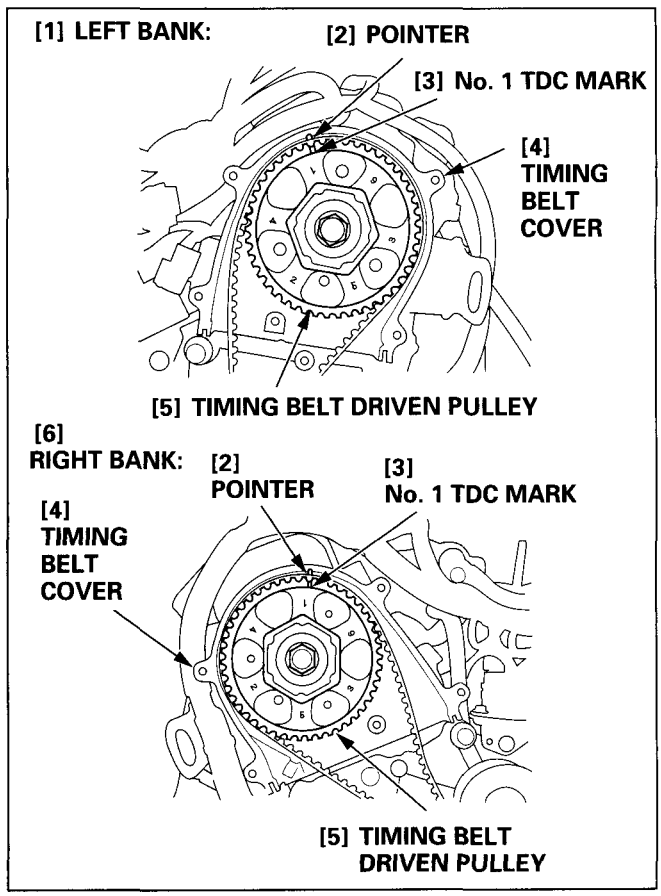
TORQUE: 39 N•m (4.0 kgf•m, 29 lbf•ft).

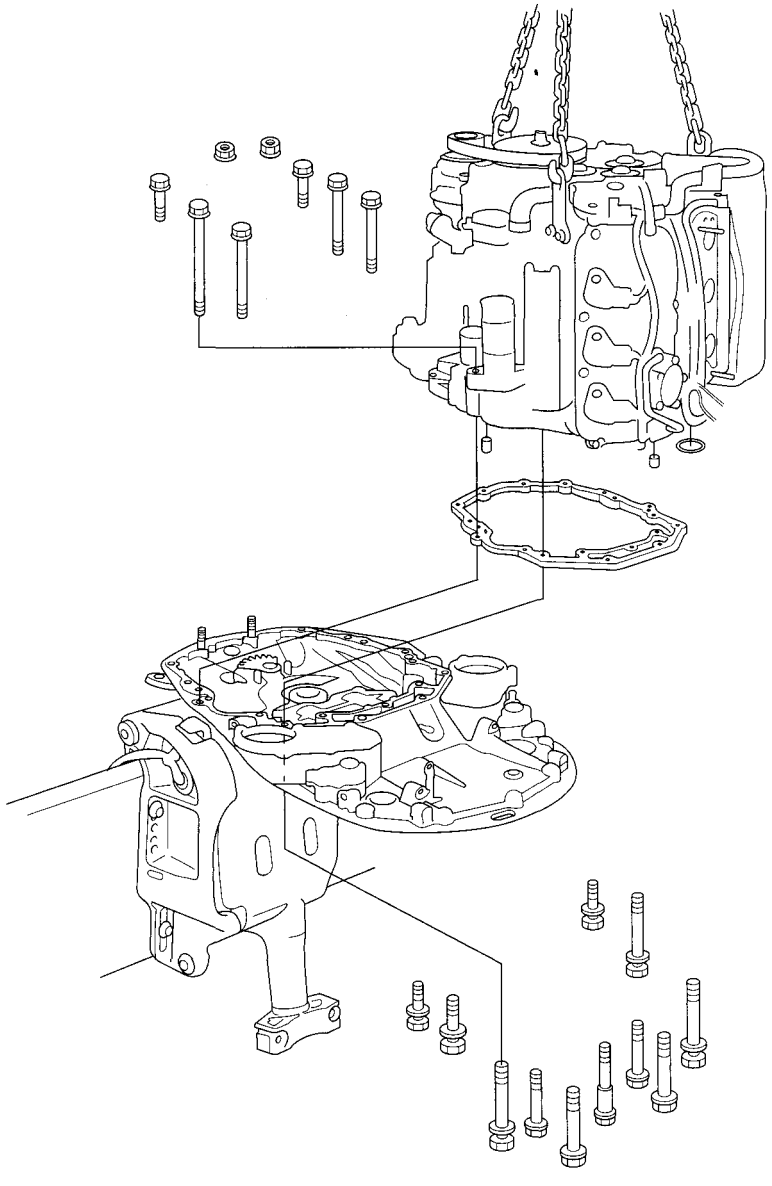
9) Turn the crankshaft pulley clockwise so the groove of the crankshaft pulley lines up wiht the pointer.

10) Make sure the No. 1 piston TDC marks on the both side of the timing belt driven pulleys and the pointers on the timing belt covers are aligned when the groove of the crankshaft pulley lines up with the pointer on the crankcase.

11) If the alignment marks do not align, remove the timing belt and repeat the timing belt installation steps.







1. REMOVAL

1) Remove the following parts.

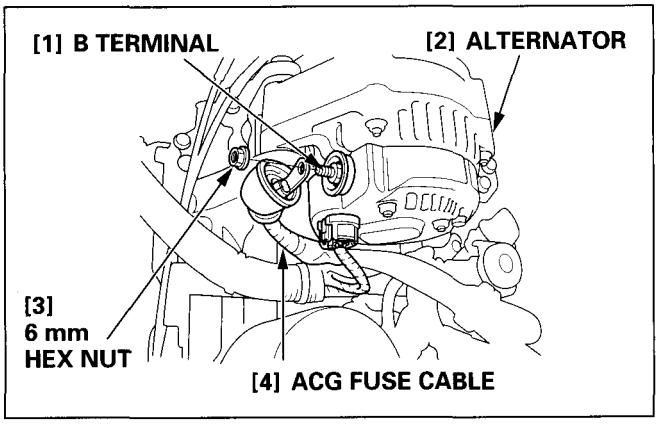
— Engine cover (P. 4-1)
— Front separate case (P. 4-3)
— Engine under cover (P. 4-5)
— Cover lock cable/bracket (P. 4-10)
— Fuel strainer (low) (P. 3-10)
— Silencer case (P. 5-103)
— Throttle body/Intake manifold (P. 5-107, 112)
— Exhaust manifold (P. 5-117)
— Vapor separator (P. 5-84)
— Cover lock cable/engine cover bracket (P. 4-10)
— Gear case assembly (P. 12-3)
— Lower rubber motor mounting (P. 12-59)
— Extension case (P. 12-59)
— Oil pan/Exhaust pipe/Water tube (P. 13-2)
— Remote control cable (P. 16-1)
— Switch panel wire harness and indicator wire harness (P. 17-24)

2) Disconnect the negative (–) and the positive (+) cables of the starter cable from the battery.

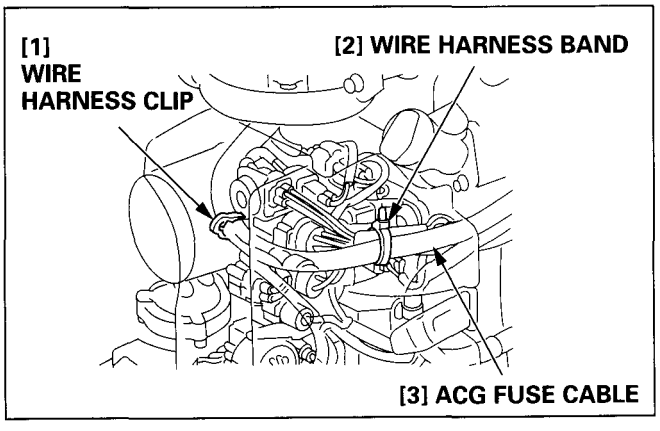
3) Shift the remote control lever in N (neutral) position.

4) Relieve the fuel pressure. (P. 5-69)

5) Remove the 6 mm hex nut from the alternator B terminal, and disconnect the ACG fuse cable from the alternator.

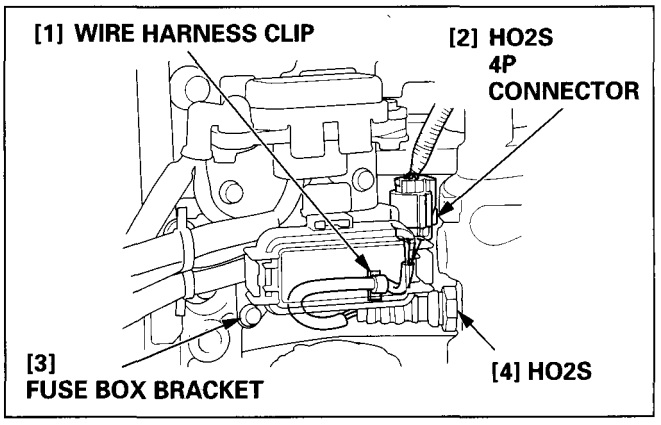


6) Remove the ACG fuse cable from the harness clamp.

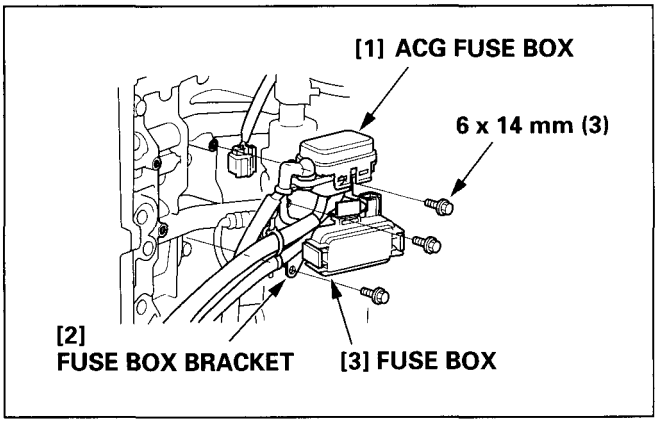


7) Disconnect the HO2S 4P connector from the connector holder of the fuse box bracket.

8) Remove the wire harness clip of the HO2S harness from the fuse box bracket.



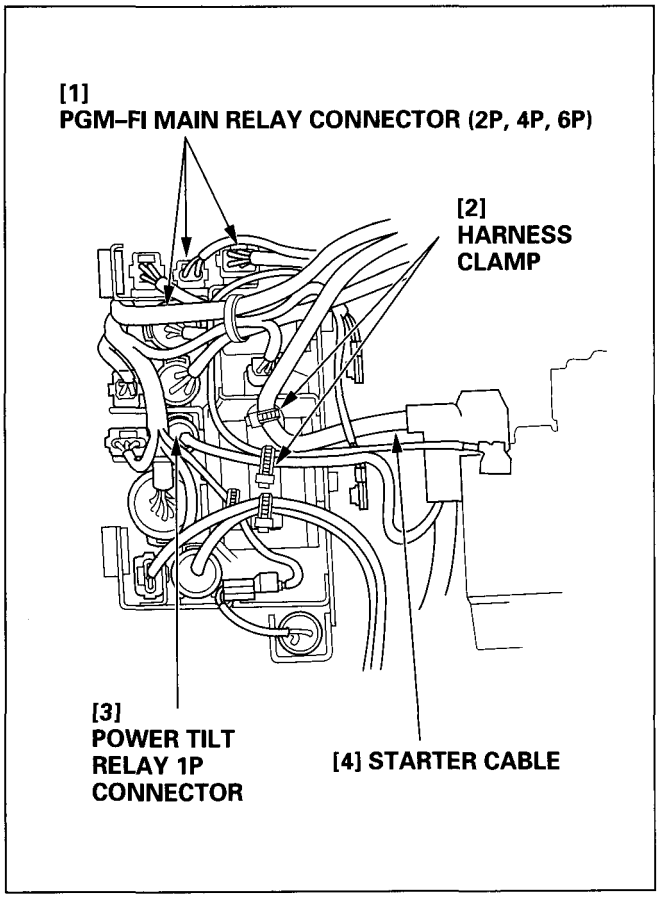
9) Remove the three 6 x 14 mm flange bolts from the fuse box bracket, then remove the ACG fuse box and the fuse box together with the fuse box bracket.



10) Remove the starter cable from the harness clamp.

11) Disconnect the PGM-FI main relay connectors (2P, 4P, 6P).

12) Disconnect the power tilt relay 1P connector and remove it from the wire harness clamp.



13) Disconnect the starter motor S terminal.

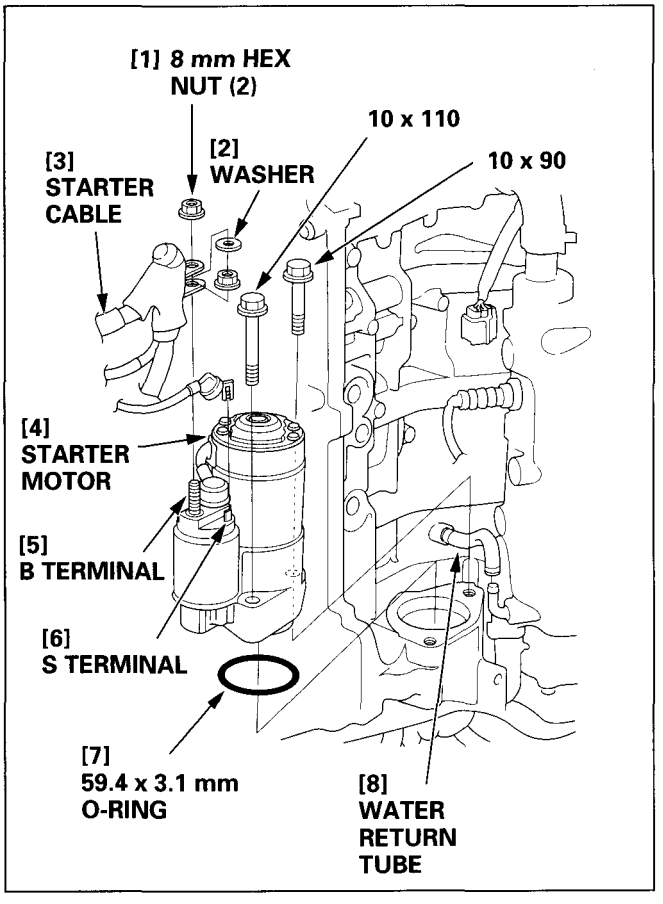
14) Remove the 8 mm hex nuts and washer from the starter motor B terminal, and disconnect the starter cable from the starter motor.

15) Disconnect the L. water return tube from the left exhaust manifold.

16) Remove the 10 x 110 mm flange bolt and the 10 x 90 mm flange bolt and the starter motor.

NOTE

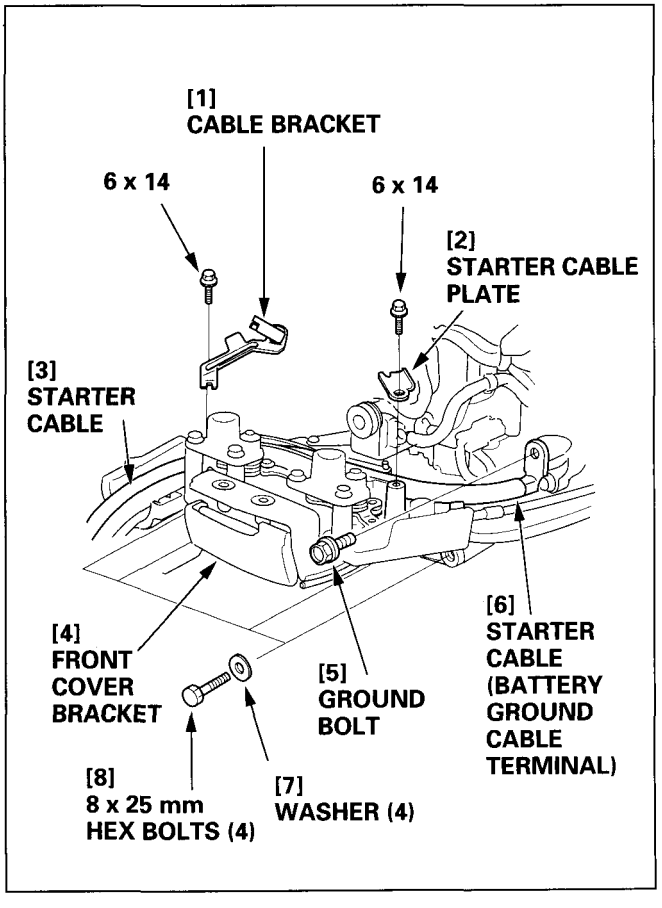
When removing the bolts, take care not to damage the L. water return tube.



17) Remove the ground bolt of the starter cable (battery ground cable terminal).

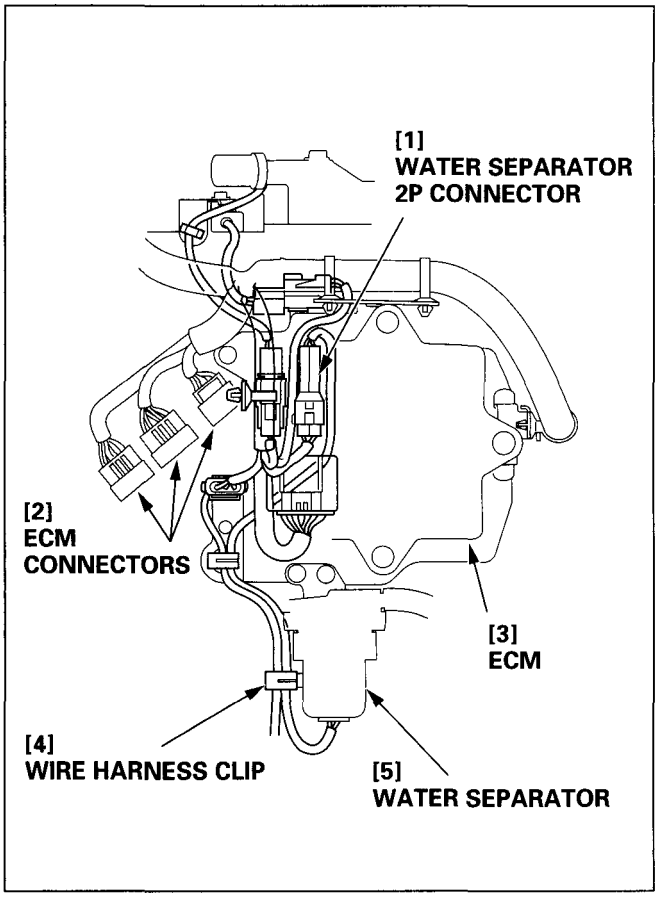
18) Remove the two 6 x 14 mm flange bolts, remove the cable bracket and the starter cable plate.

19) Remove the four 8 x 25 mm hex bolts and the front cover bracket.

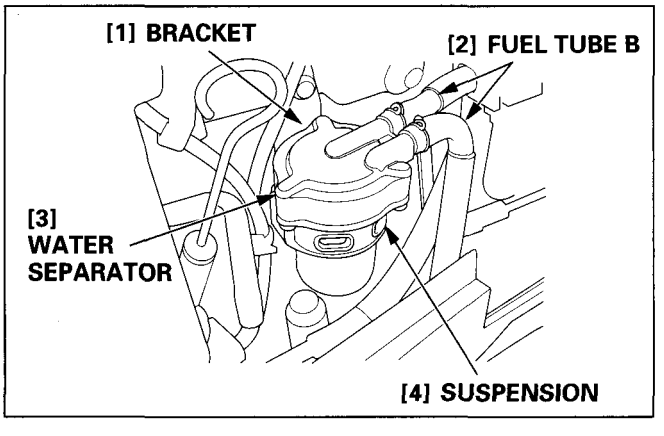


20) Disconnect the ECM connectors (26P, 34P, 12P).

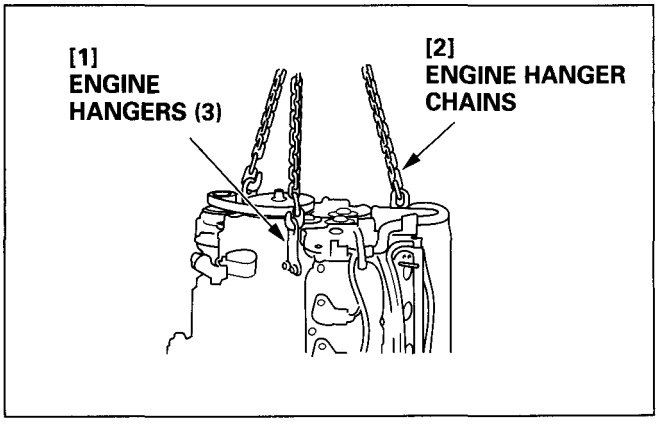
21) Disconnect the water separator 2P connector (Bu), and disconnect the wire from the wire harness clip.



22) Disconnect the fuel tube B, and remove the water separator with the suspension from the bracket.



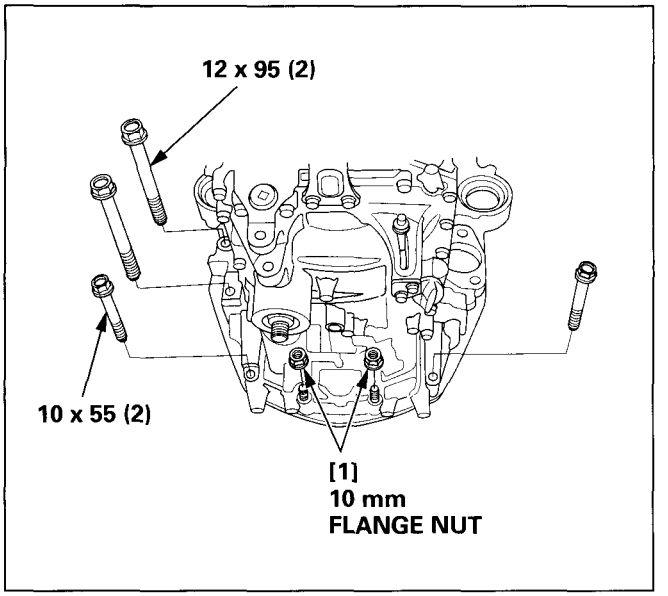
23) Attach the engine hanger chains to the engine hangers.



24) Remove the two 10 mm flange nuts, two 10 x 55 mm flange bolts and the two 12 x 95 mm flange bolts from the engine assembly.

NOTICE

Check to attach the engine chains to the engine hanger securely.



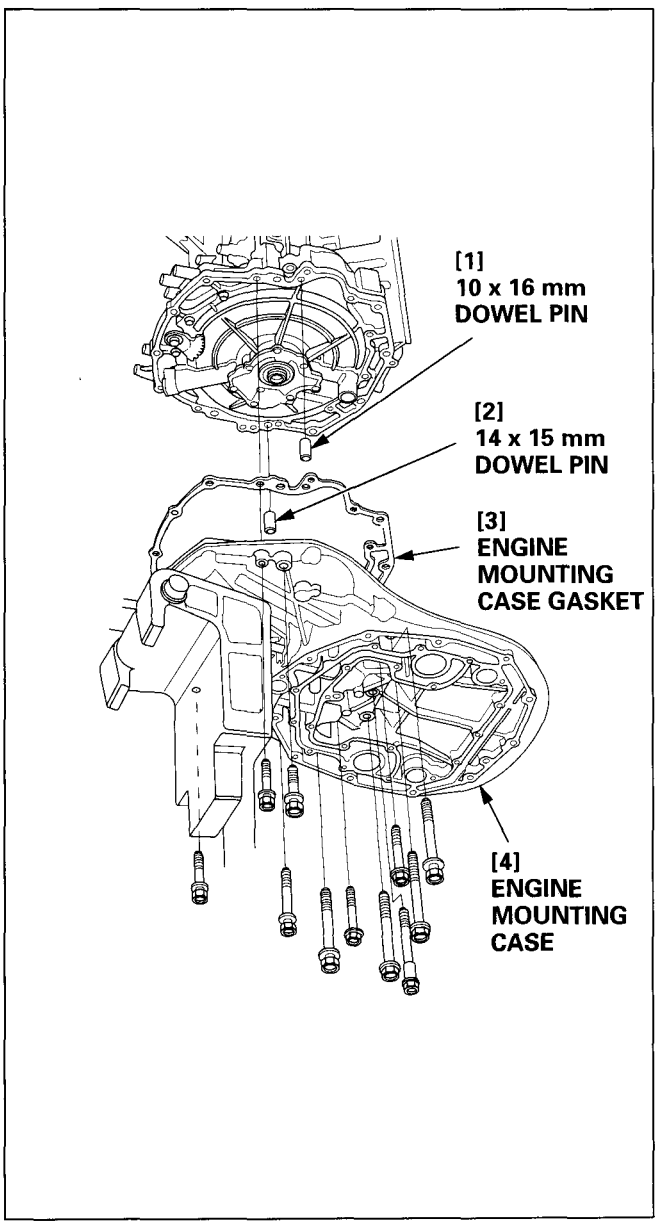
25) Remove the following bolts from the under side of the engine mounting case.
- 10 x 60 mm hex. bolts (two)
- 10 x 85 mm hex. bolt (one)
- 12 x 65 mm hex. bolt (one)
- 12 x 120 mm hex. bolts (two)
- 10 x 70 mm flange bolts (two)
- 10 x 120 mm flange bolt (one)
- 12 x 120 mm flange bolts (two)

26) Lift up the engine assembly slowly with a hoist, and remove the engine from the engine mount case.

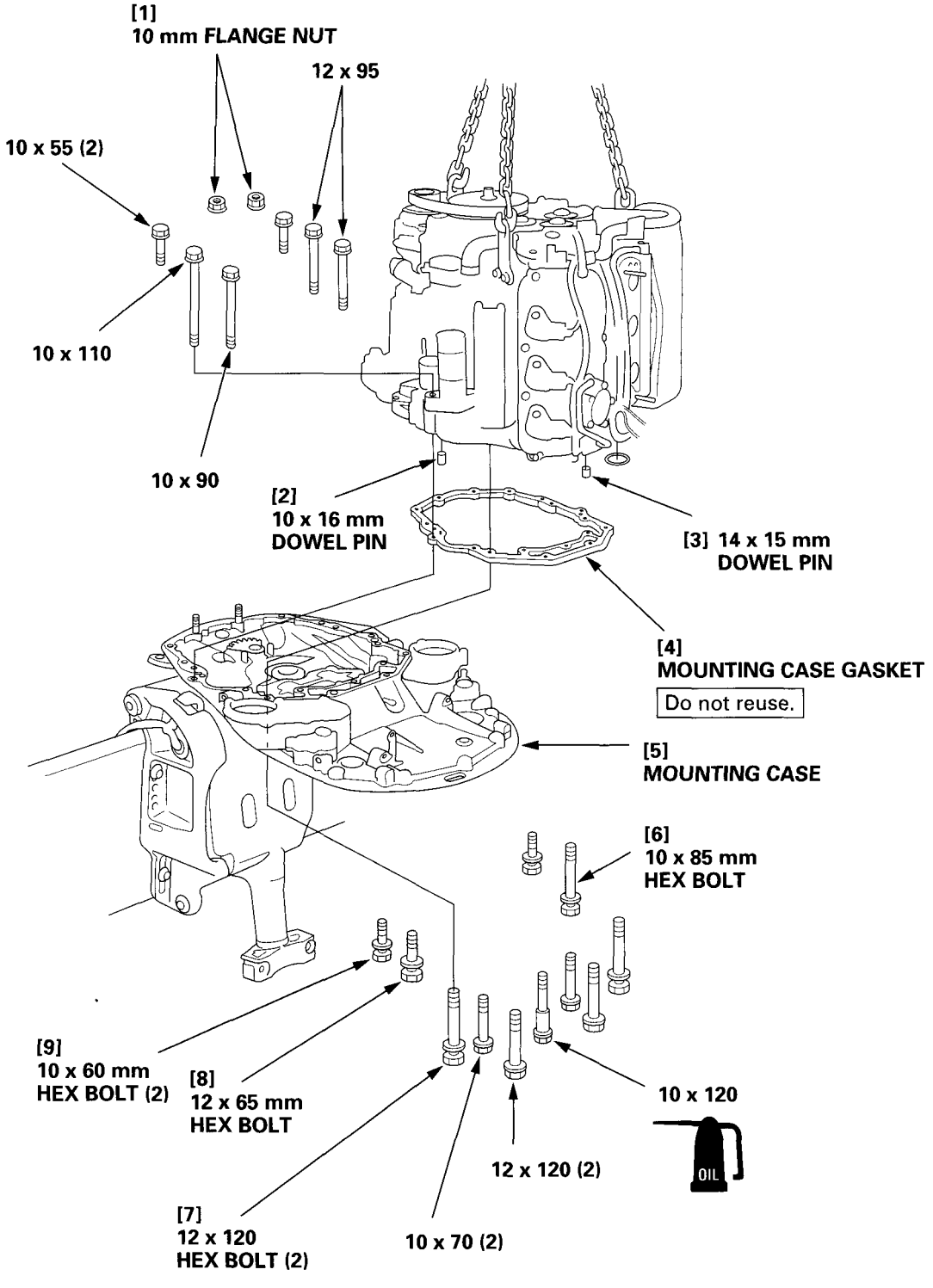
NOTICE

When lift up the engine assembly, take care to keep the engine level.

27) Remove the 10 x 16 mm dowel pin, 14 x 15 mm dowel pin and the engine mounting case gasket.



2. EXPLODED VIEW

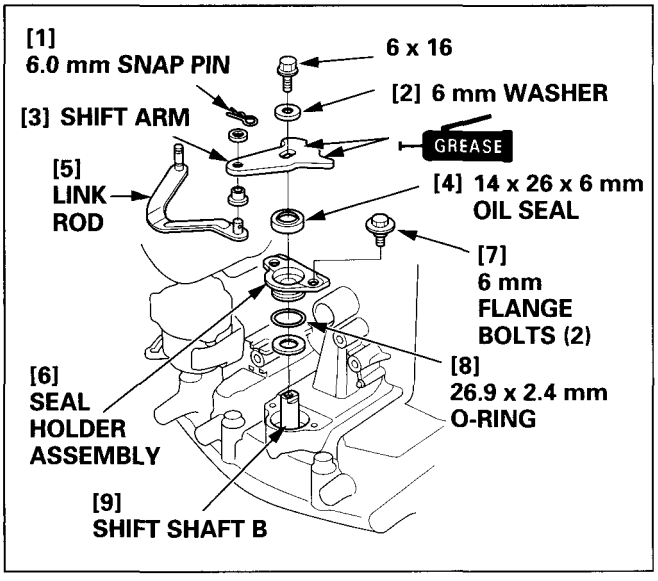


3. INSTALLATION

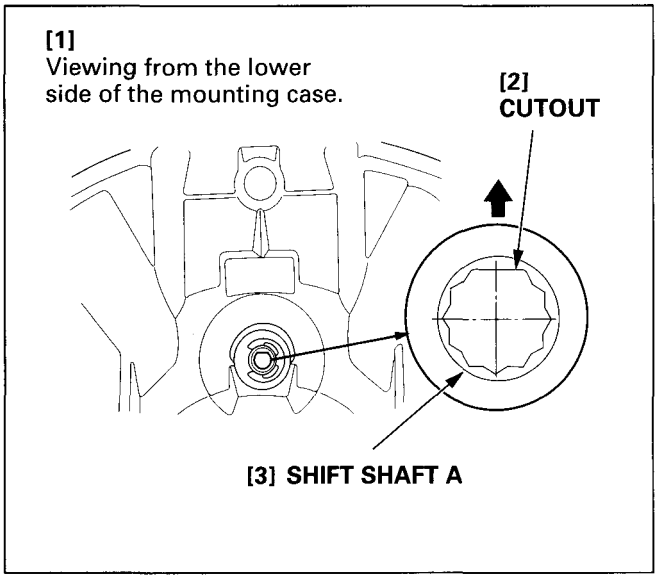
1) Remove the 6 mm snap pin and the link rod from the shift arm before installing the engine assembly.

2) Remove the 6 x 16 mm flange bolt from the sift shaft B and remove the shift arm.

3) Remove the two 6 mm flange bolts and the seal holder assembly, and remove the shift shaft B from the back side of the engine assembly.



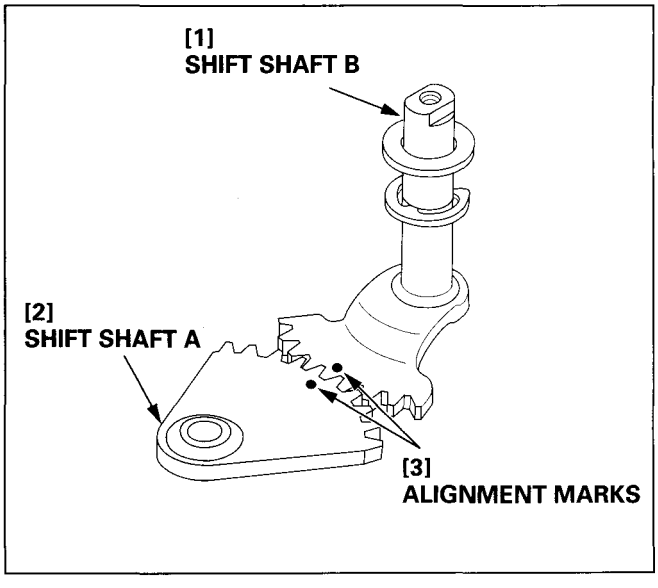
4) Turn the cutout of the shift shaft A spline as shown. (This position shows the shift shaft A is in the neutral position.)



5) Install the shift shaft A and B by aligning the punch mark on the shift shaft A with the punch mark on the shift shaft B.

NOTICE

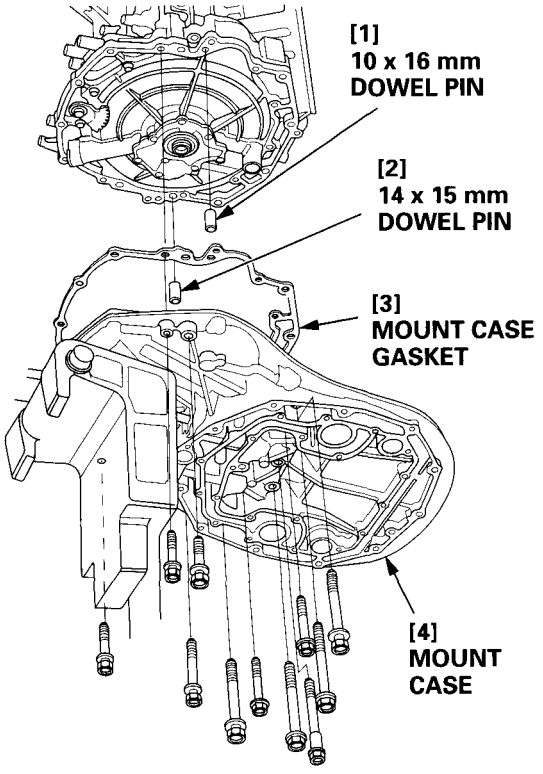
- Do not install the engine assembly without aligning the punch marks. Take care not to let the punch marks get out of alignment during the engine installation.
- Note that proper shifting cannot occur unless the punch marks are aligned.



6) Set the 10 x 16 mm dowel pin and the 14 x 15 mm *dowel pin to the mount case.*

7) Install a new mount case gasket.

8) Install the engine assembly slowly to the mount case. Be careful not to let the shift shaft B position come out of alignment.

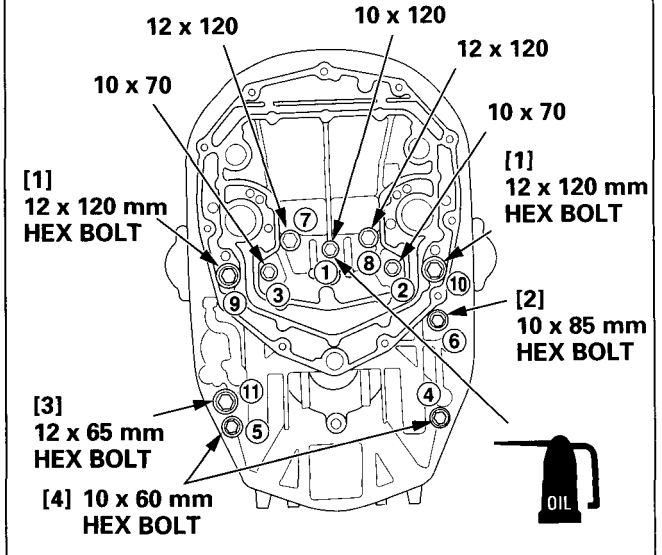


9) Tighten the bolts from the under side of the mount case in the numbered order to the specified torque.

10) Before tighten ① 10 x 120 mm flange bolt, apply engine oil to the threaded part and the seating surface of it.

TORQUE:

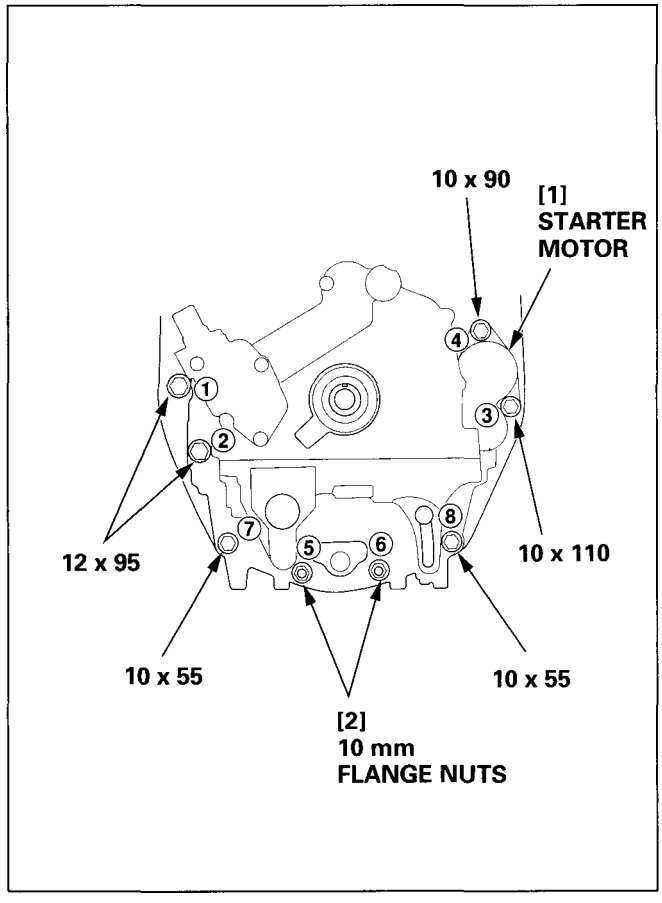
44 N•m (4.5 kgf•m, 33 lbf•ft):	**10 x 60 mm flange bolt,** **10 x 70 mm hex bolt,** **10 x 85 mm hex bolt,** **10 x 120 mm flange bolt**
64 N•m (6.5 kgf•m, 45 lbf•ft):	**12 x 65 mm hex bolt** **12 x 120 mm hex bolt** **12 x 120 mm flange bolt**

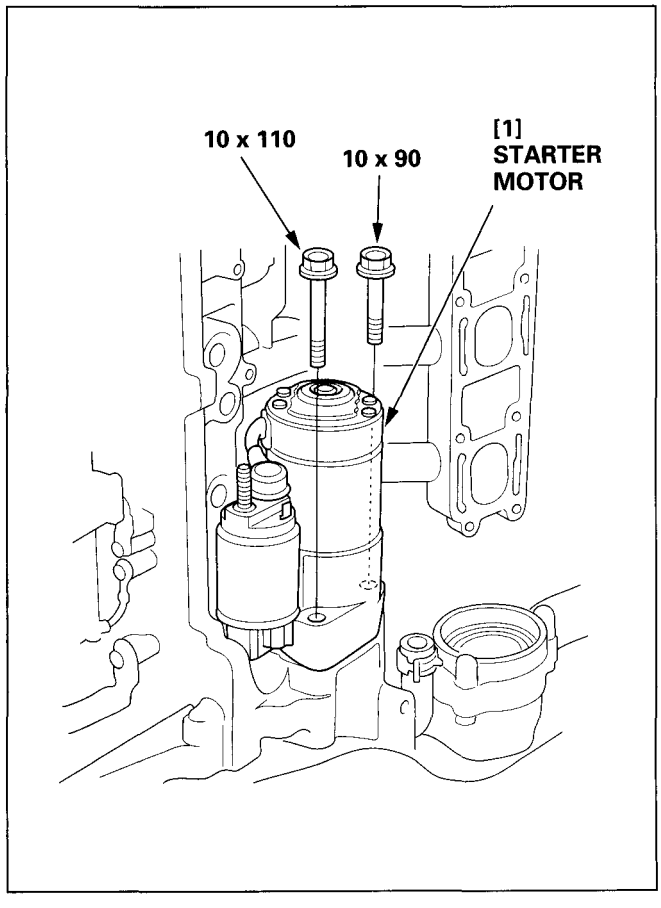


[5]
Viewing from the lower side of the undercase.

11) As the ③ and ④ flange bolts are tightened with the starter motor together, so install the new 59.4 x 3.1 mm O-ring to the starter motor and set the starter motor on the engine assembly.
Tighten the bolts and nuts to the upper side of the engine assembly in the numbered order to specified torque.

TORQUE:
10 x 55 mm flange bolts
10 x 90 mm flange bolts
10 x 110 mm flange bolts: 44 N•m (4.5 kgf•m, 33 lbf•ft)
12 x 95 mm flange bolts: 64 N•m (6.5 kgf•m, 45 lbf•ft)
10 mm flange nut: 44 N•m (4.5 kgf•m, 33 lbf•ft)

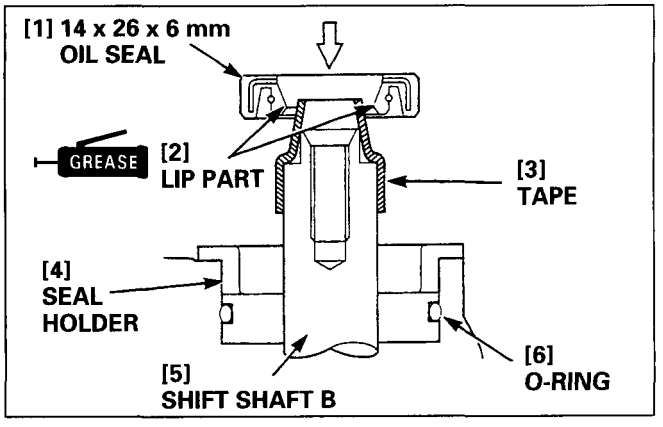




12) Install a new 26.9 x 2.4 mm O-ring to the seal holder assembly, and apply the grease to it.

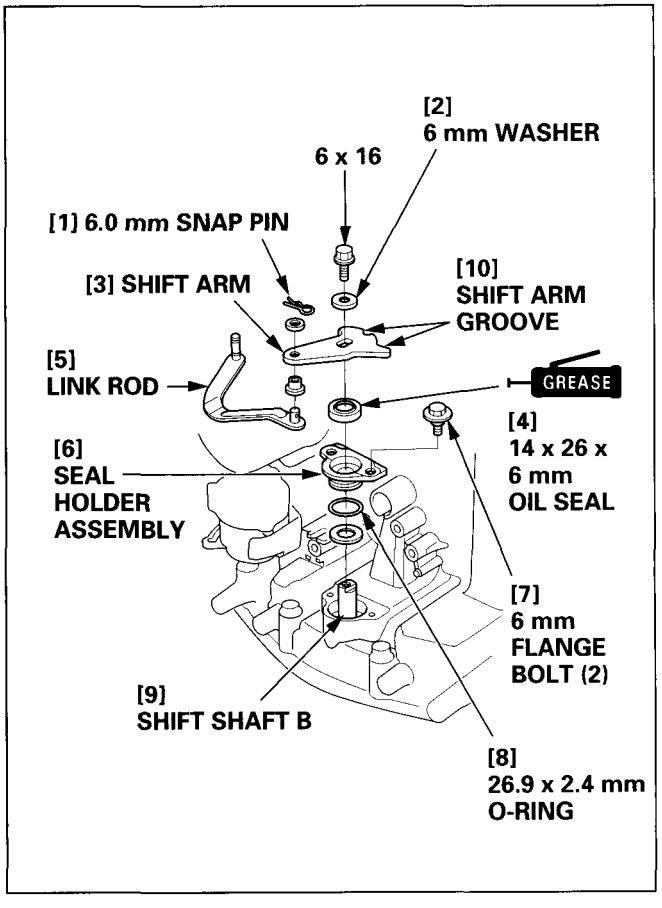
13) Install the seal holder on the shift shaft B so that the shift shaft B does not tilt on the mount case.
Tighten the shift holder assembly with the 6 mm flange bolts.

14) Tape the shift shaft B as shown. Apply the grease to the lip part and the circumference of the 14 x 26 x 6 mm oil seal, and install the oil seal to the shift shaft B so that the oil seal lip part toward lower side.

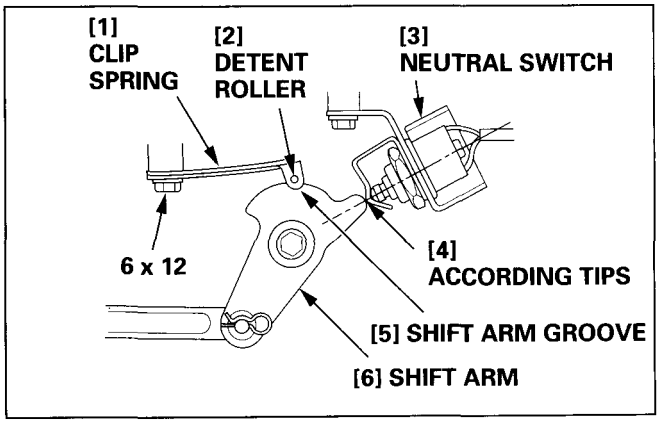


15) After installing the seal holder assembly, tighten the shift arm to the shift shaft B with the 6 x 16 mm flange bolt.

16) Install the link rod to the shift arm with the 6.0 mm snap pin.



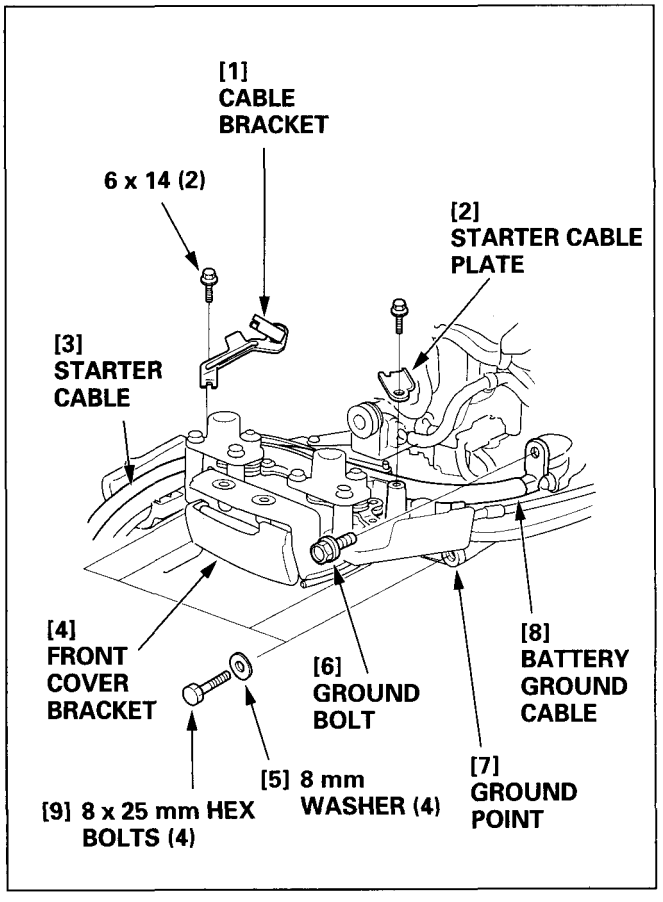
17) Make sure the detent spring roller is in the shift arm groove, and the shift arm end should align with the neutral switch end.



18) Install the front cover bracket to the engine with the four 8 x 25 mm hex bolts.

19) Route the starter cable, and tighten the battery ground cable with the ground bolt (P. 2-42).

20) Install the cable bracket and the starter cable plate with the 6 x 14 mm flange bolts.

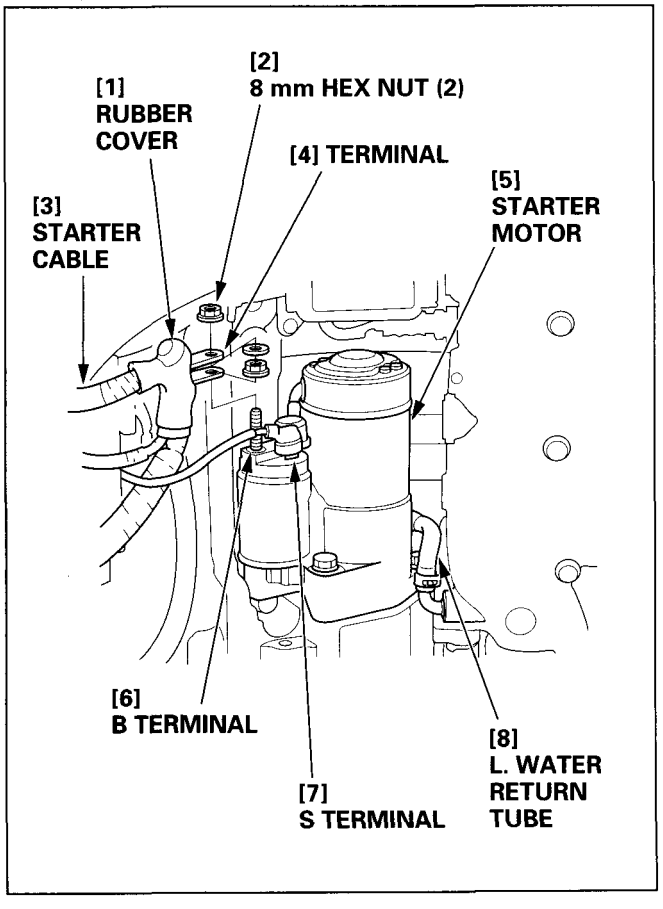


21) Install the exhaust manifolds (P. 5-120)

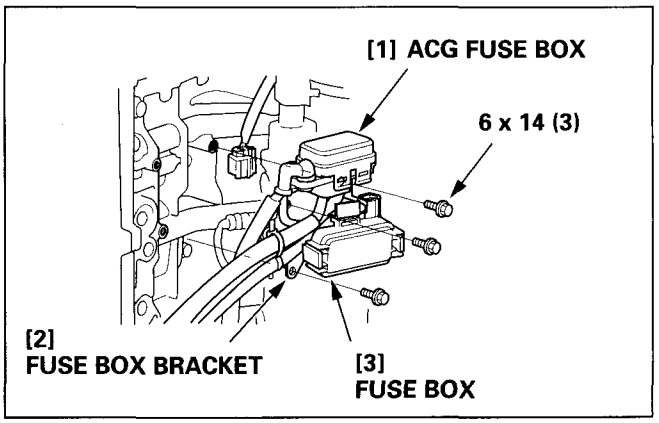
22) Tighten the starter cable terminal to the starter motor B terminal securely with the 8 mm hex nuts, and cover it with the cover.

TORQUE: 10.8 N•m (1.1 kgf•m, 7 lbf•ft)

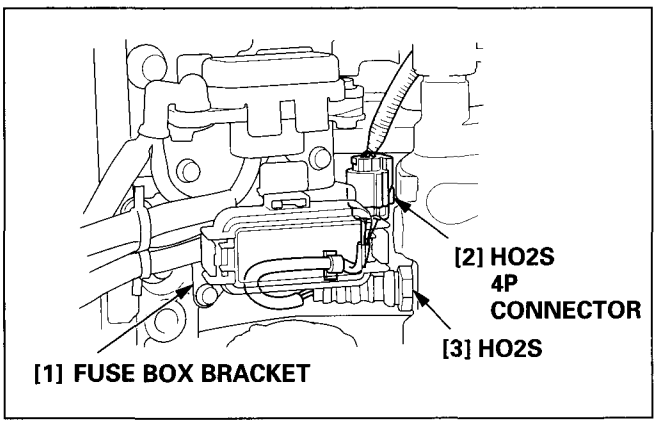
23) Connect the S terminal harness to the starter motor S terminal, and connect the L. water return tube.



24) Install the fuse box bracket with the three 6 x 14 mm flange bolts.



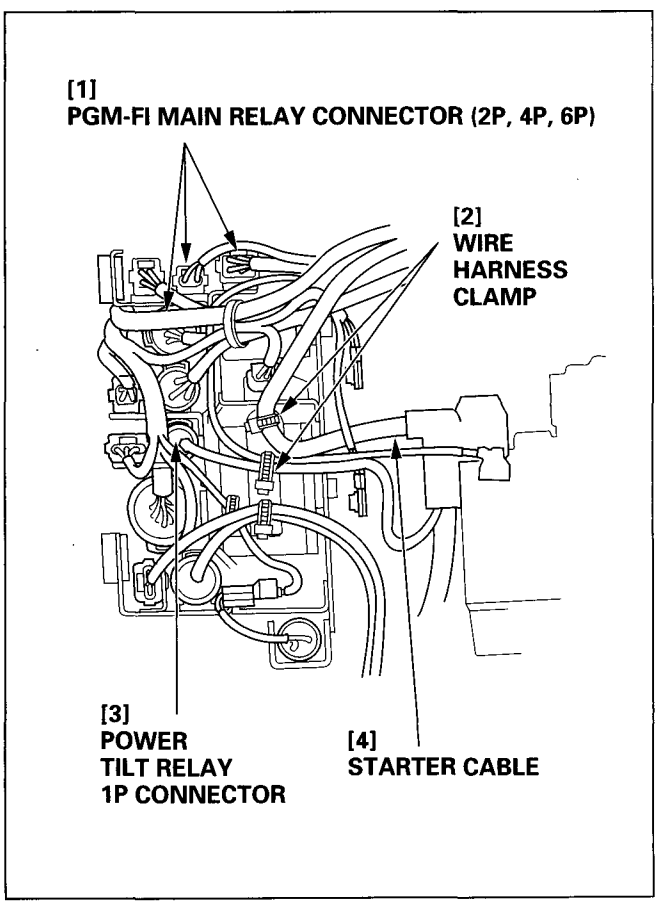
25) Connect the HO2S 4P connector and fix the connector to the connector holder. Clamp the HO2S harness to the fuse box bracket.



26) Connect the PGM-FI main relay 2P, 4P and 6P connectors.

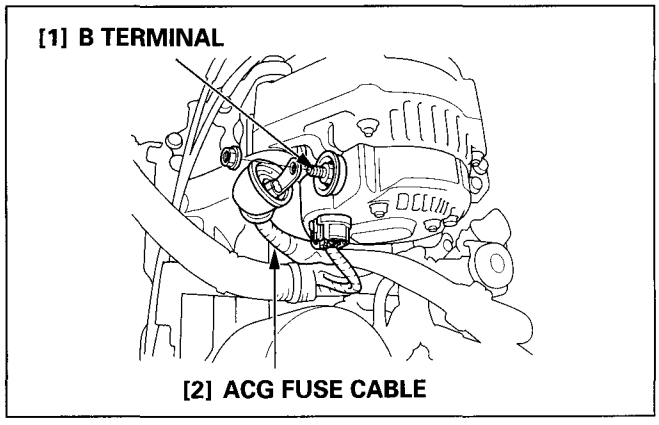
27) Connect the power tilt relay 1P connector.

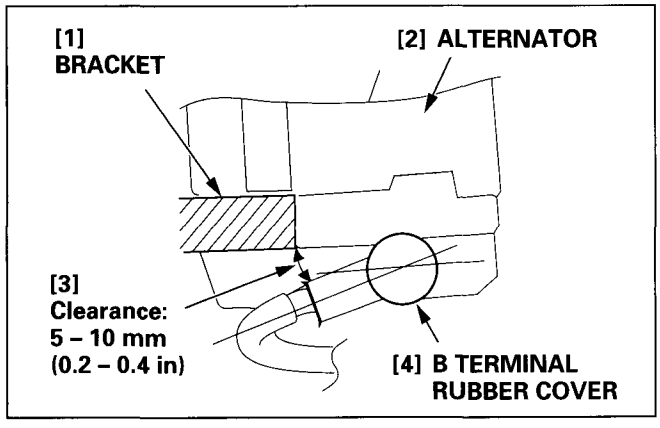
28) Clamp the starter cable and the power tilt relay securely (P. 2-38).



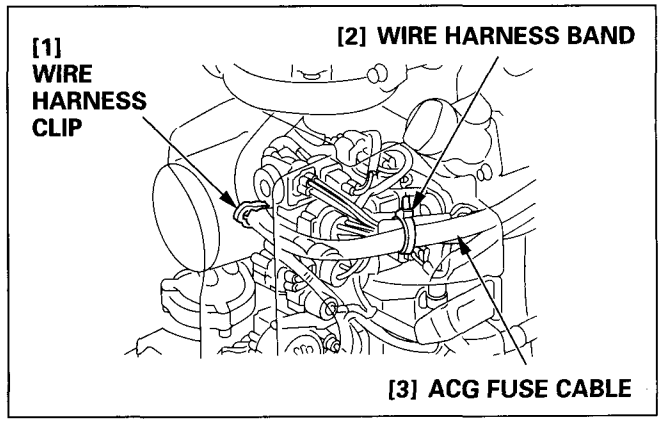
29) Tighten the ACG fuse cable to the alternator B terminal with the 6 mm hex bolt securely, and cover it with the cover.

30) Attach the ACG fuse cable not to contact with the alternator bracket. Clearance should be about 5 – 10 mm (0.2 – 0.4 in).



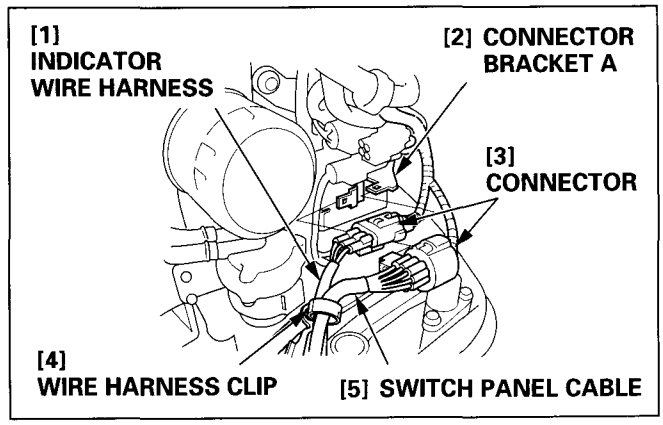


31) Clamp the ACG fuse cable with the wire harness clip and the wire harness band.

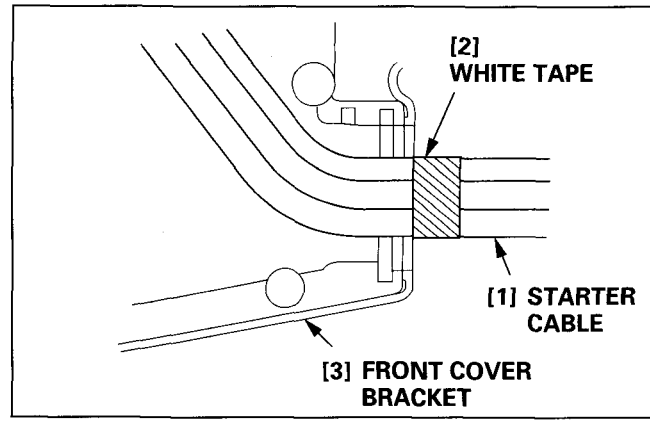


32) Connect the switch panel wire harness 14P connector and the indicator wire harness 3P connector. Fix the connectors to the connector bracket A and clamp the wire harness.

33) Clamp the switch panel wire harness and the indicator wire harness with the wire harness clip together.

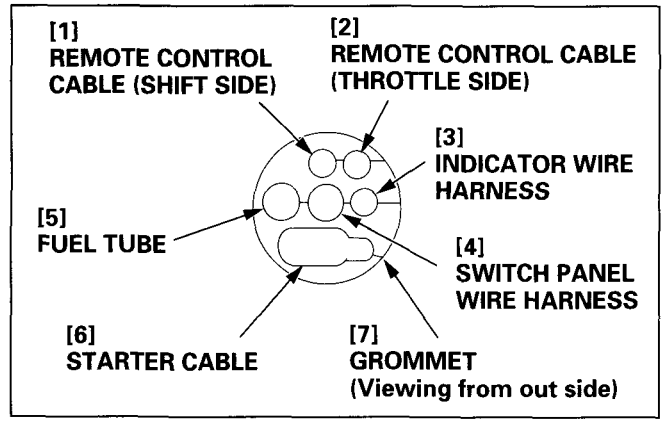


34) Route the starter cable so that the white tape end on the cable is on the side of the front cover bracket (P. 17-25).

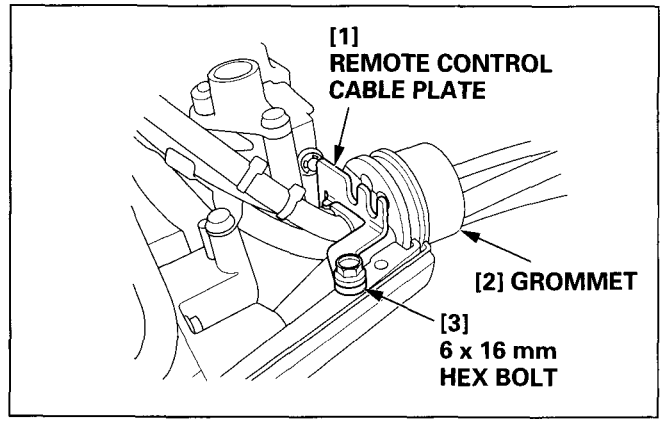


35) Pass the indicator wire harness, switch panel wire harness, starter cable and the fuel tube through the undercase grommet A, and install the grommet to the front cover bracket (P. 17-25).

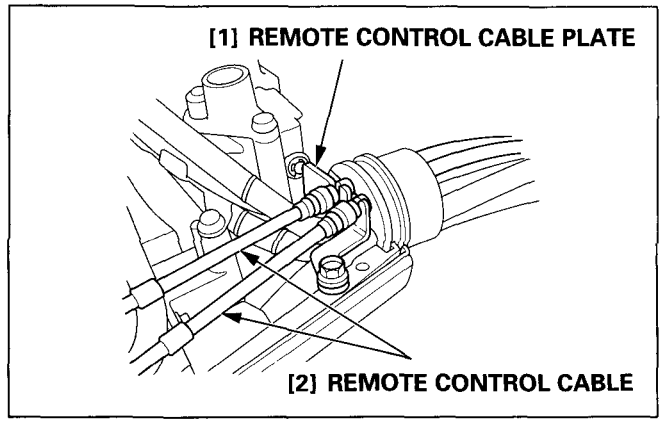
36) Position tie-wrap bandson the switch panel wire harness and indicator wire harness at the inside of the undercase grommet A (P. 17-25).



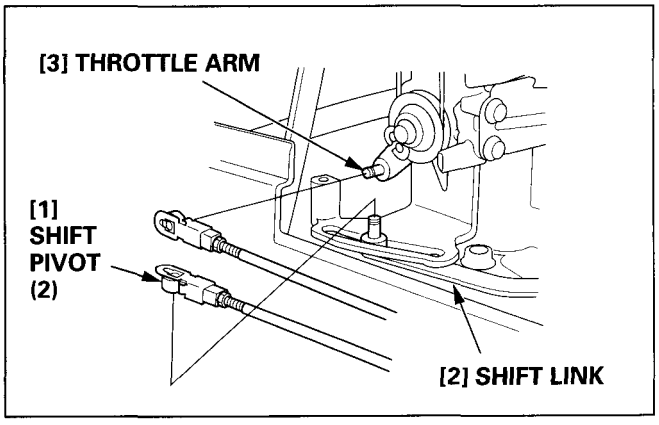
37) Install the remote control cable plate with the 6 x 16 mm hex bolt.
Check the fuel tube not to be pinched with the undercase grommet A and the remote control cable plate.



38) Install the remote control cables so that the cables align with the groove of the remote control cable plate.

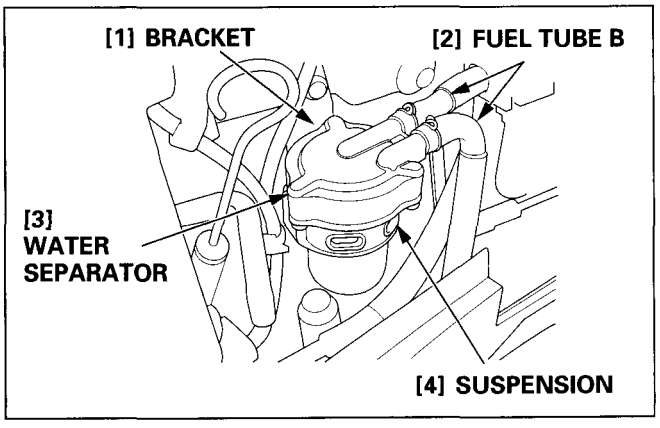


39) Install the shift pivots to the shift link and the throttle arm.



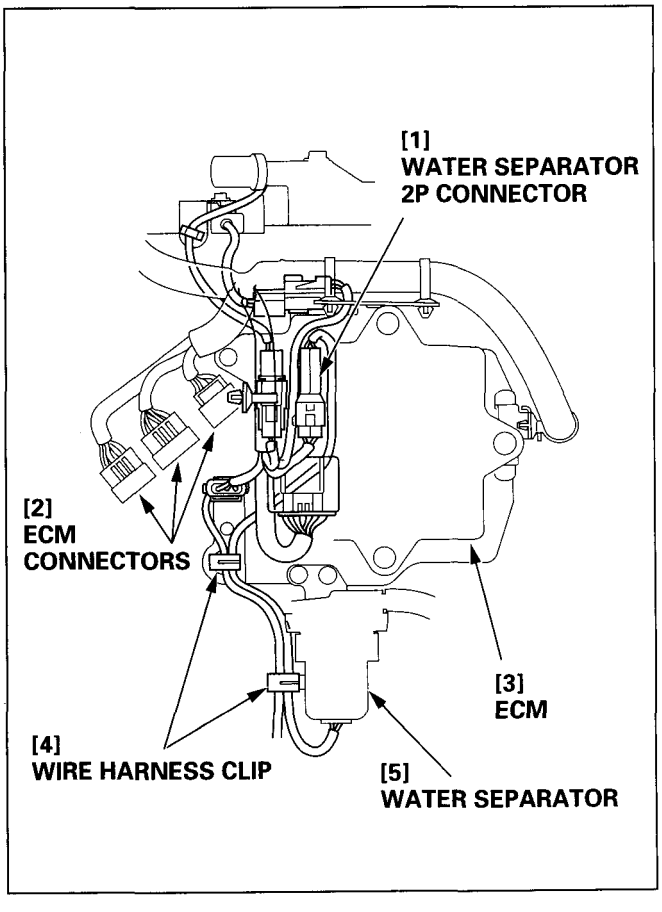
40) Install the water separator to the suspension, then install it to the bracket, and connect the fuel tube B.

41) Connect the water separator 2P connector and clamp the harness.

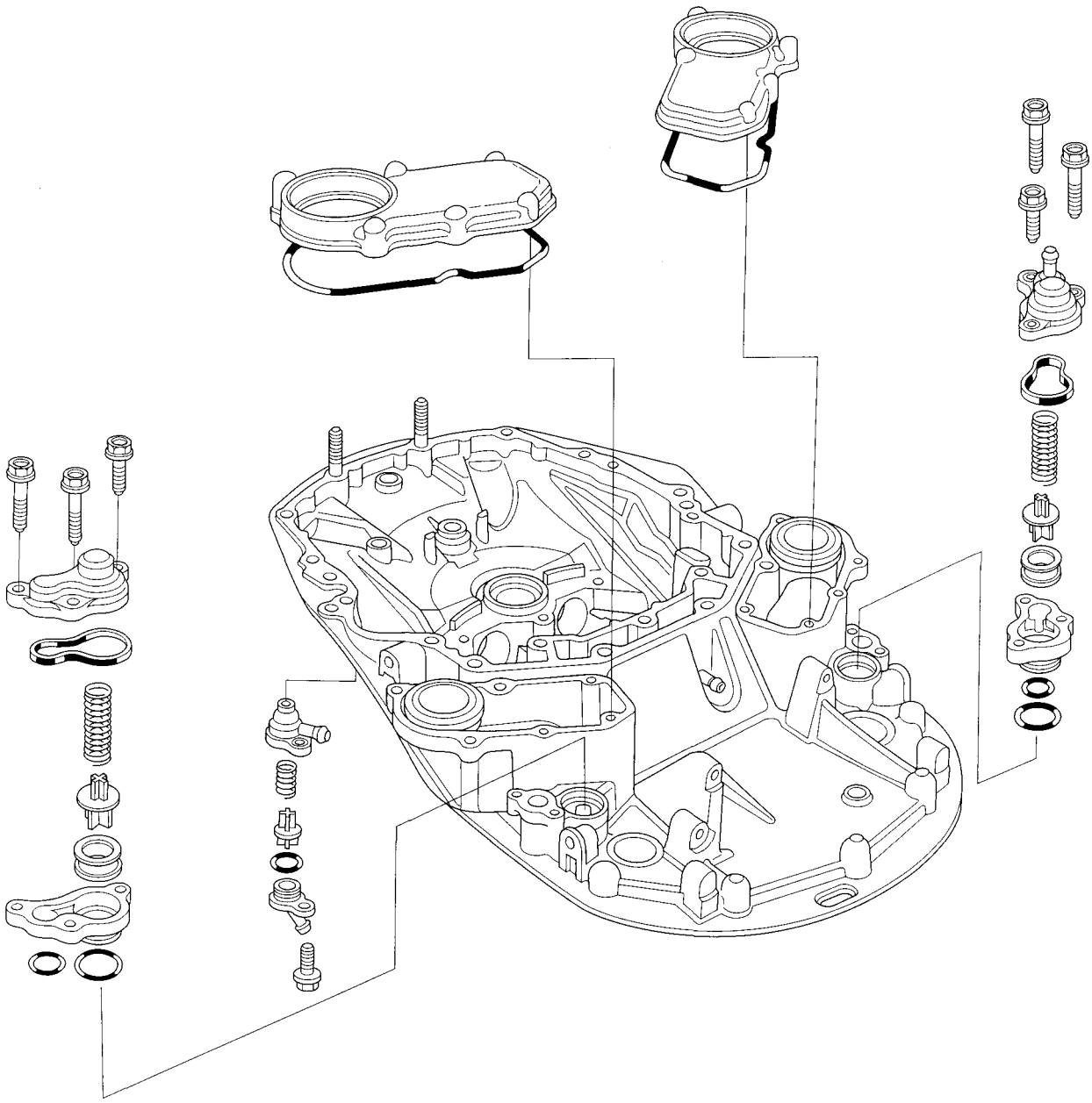


42) Connect the ECM 26P, 34P and 12P connectors.

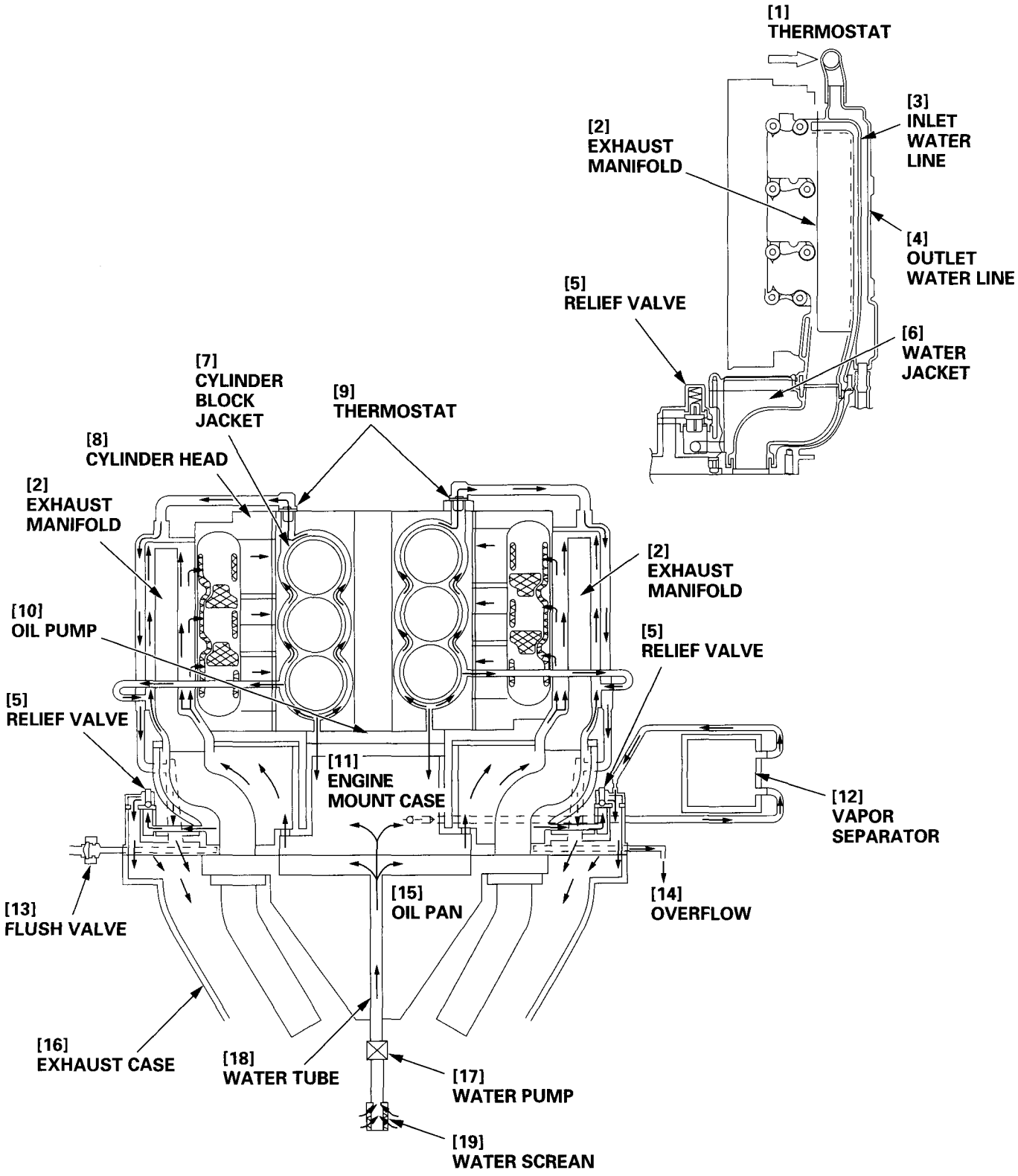
43) After installing the engine, adjust the shift control cable and the throttle control cable (P. 3-18).



1. WATER LINE DESCRIPTION
2. WATER JACKET
3. RELIEF VALVE
4. FLUSH VALVE



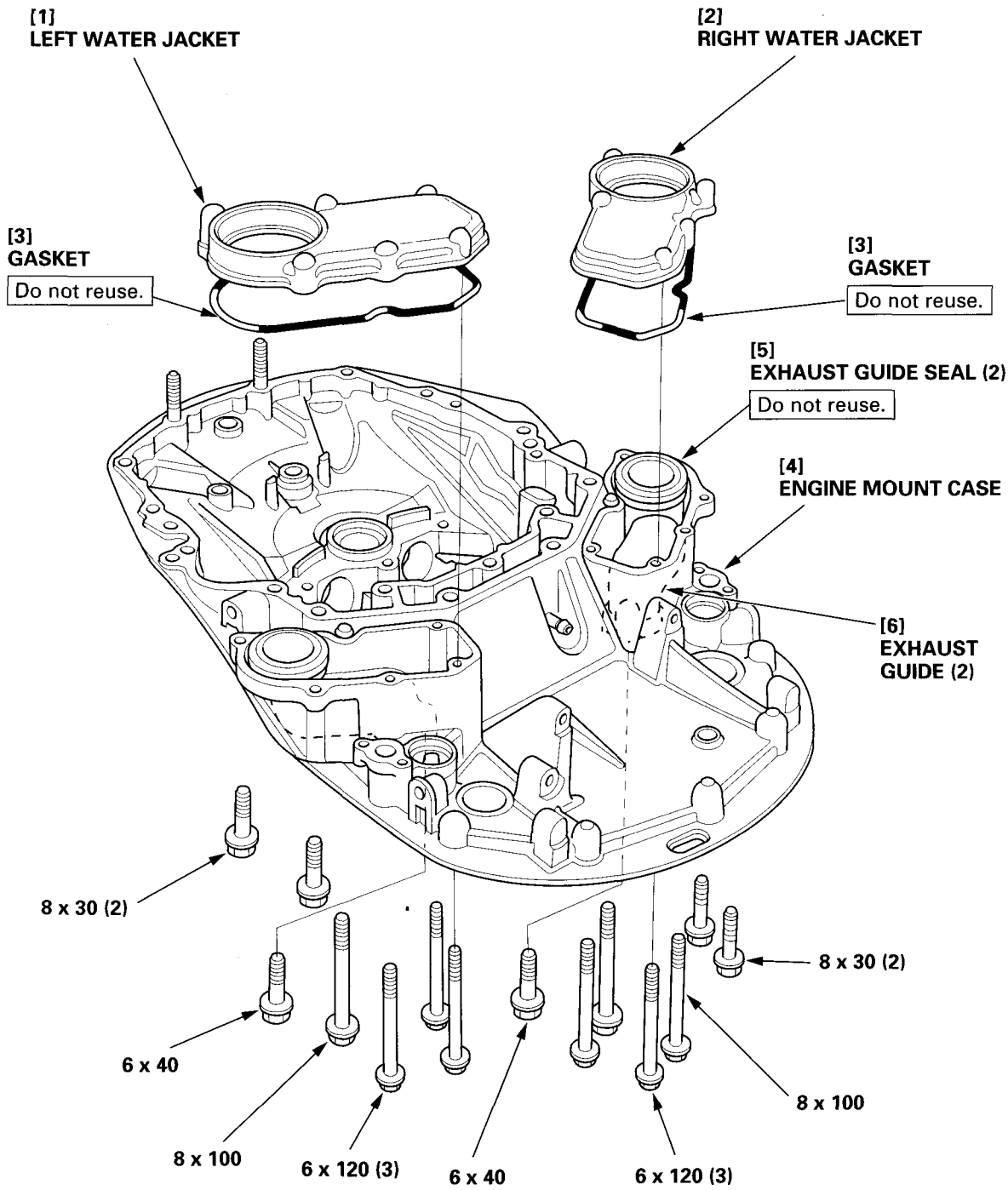
1. WATER LINE DESCRIPTION



2. WATER JACKET

REMOVAL/INSTALLATION

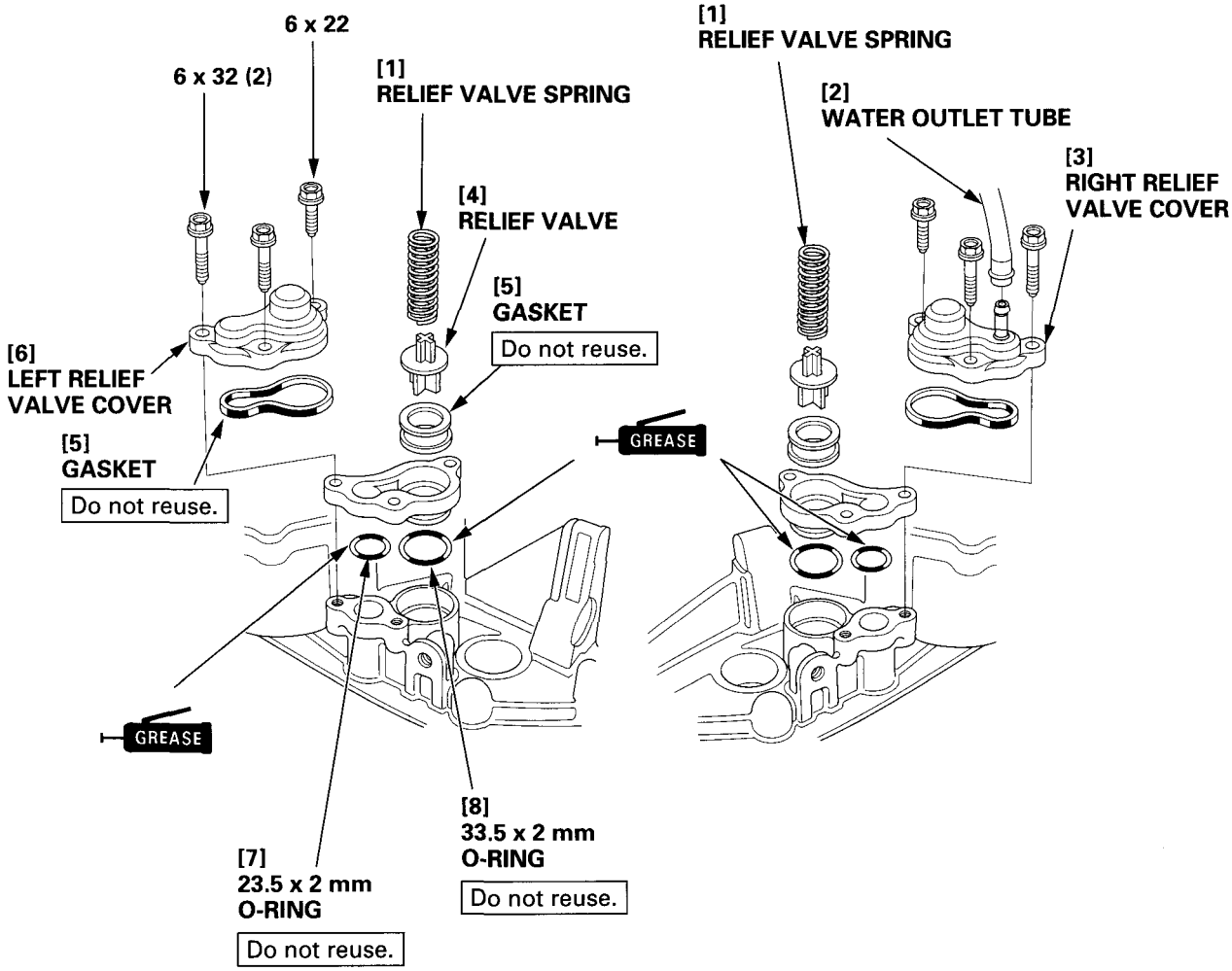
1) Remove the engine (P. 7-1).
2) Remove the bolts and the water jacket from the engine mount case.
3) Always use a new gaskets and install the water jacket.



3. RELIEF VALVE

DISASSEMBLY/REASSEMBLY

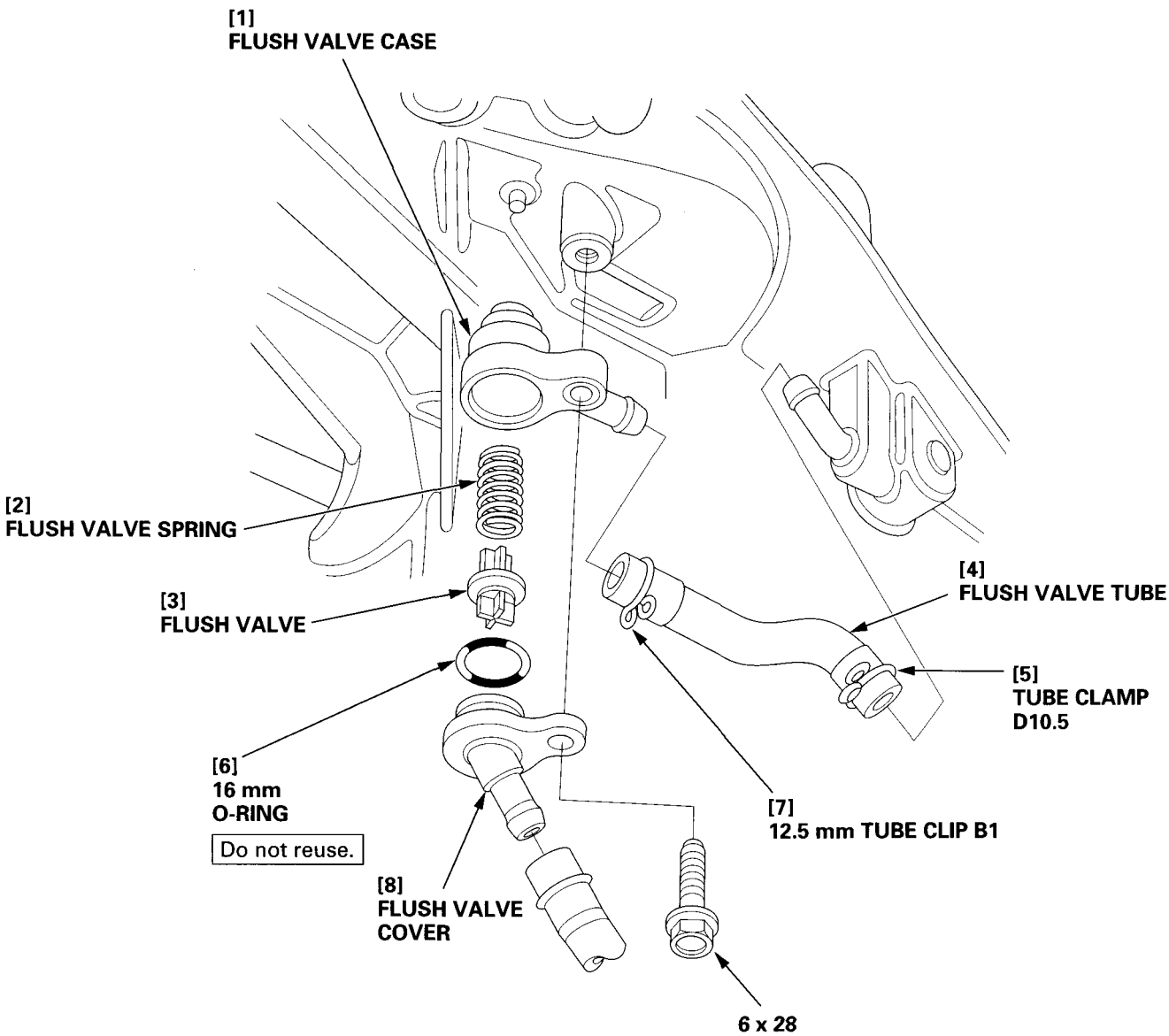
1) Remove the engine cover (P. 4-1).
2) Disconnect the water outlet tube from the right relief valve.
3) Remove the bolts and the relief valve.
4) Always use a new O-ring and gaskets and install the relief valve.

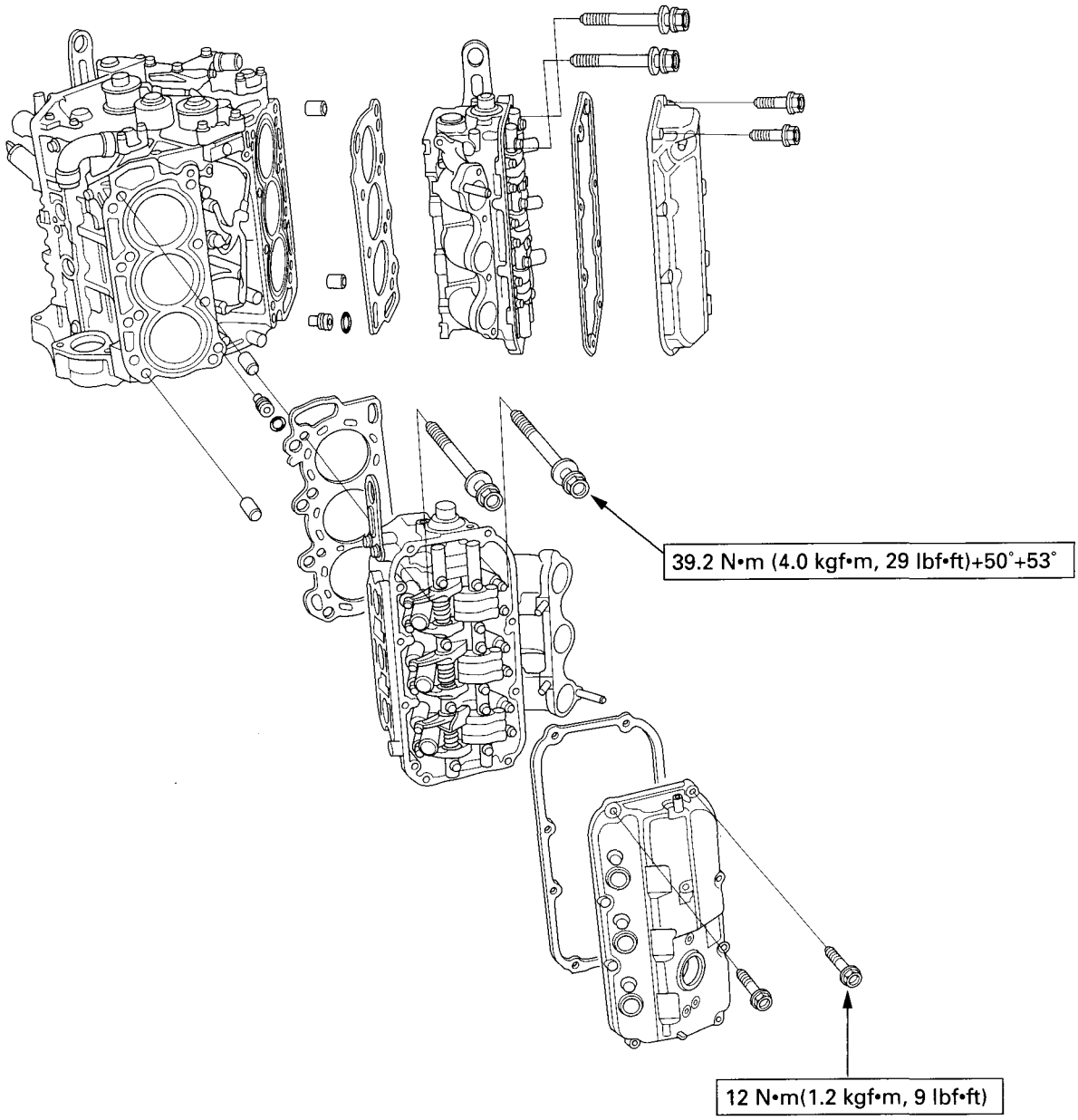


4. FLUSH VALVE

DISASSEMBLY/REASSEMBLY

1) Remove the engine cover (P. 4-1).
2) Remove the engine under cover (P. 4-5).
3) Remove the bolts and the flush valve.
4) Install a new O-ring and the flush valve.

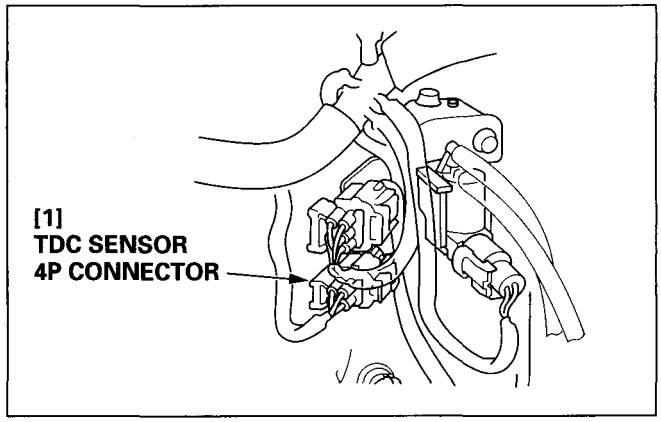




1. CYLINDER HEAD ASSEMBLY

NOTICE

- Cylinder head assembly removal/installation must be made when the engine is cold.
- Set the timing belt driven pulley at the top dead center of the compresion stroke of the No.1 cylinder before removal/installation of the cylinder head assembly (P. 3-7).



1) Disconnect the battery negative (–) terminals.

2) Shift the remote control lever in N (neutral) position.

3) Turn the crankshaft pulley clockwise, and set it at the top dead center (TDC) of the compresion stroke of the No.1 piston.

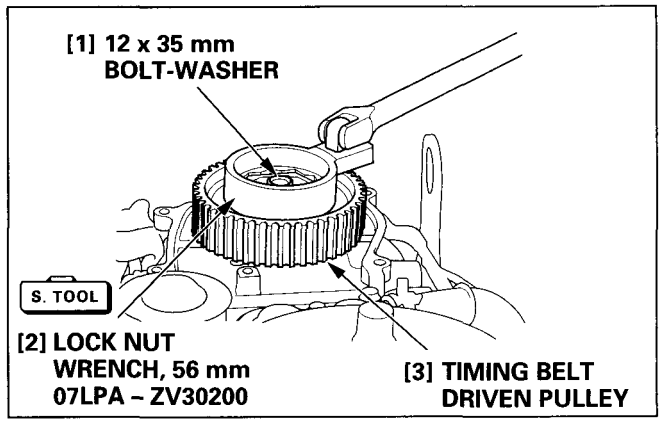
4) Remove the following parts.
   - Engine cover (P. 4-1)
   - Engine undercover (P. 4-5)
   - Ignition coils (P. 3-5)
   - Spark plugs (P. 3-5)
   - Silencer case (P. 5-103)
   - Intake manifold (P. 5-112)
   - Throttle body (P. 5-107)
   - Exhaust manifolds (P. 5-117)
   - Alternator belt (P. 6-3)
   - Timing belt (P. 6-15)
   - Fuel pump (low pressure side) (P. 5-94)
   - Vapor separator/Fuel pump (high pressure side) (P. 5-81)
   - Fuel pipe and injectors (P. 5-74)

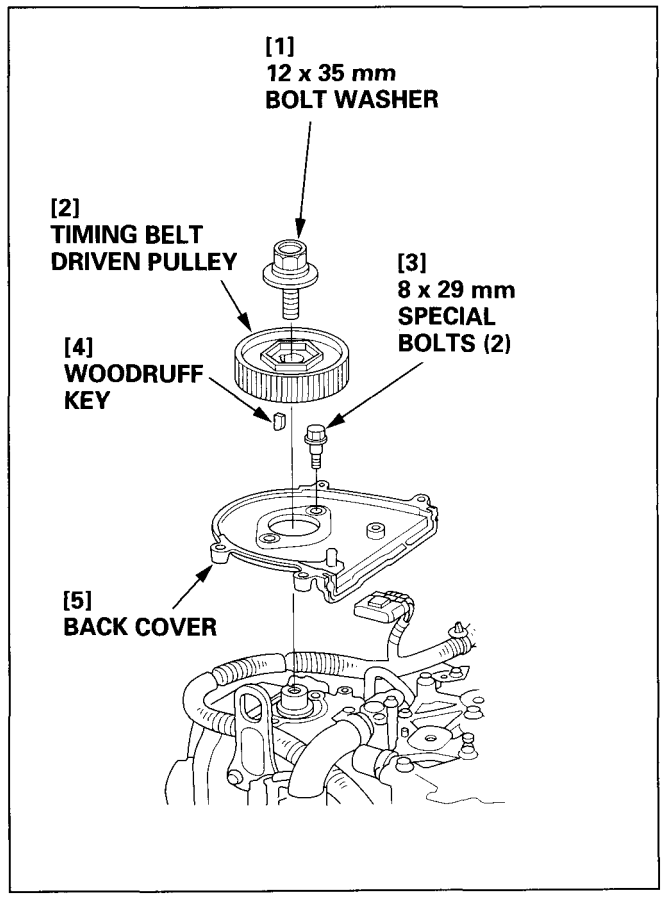
5) Disconnect the TDC sensor 4P connector.

6) Using the special tool, remove the 12 x 35 mm bolt-washer and the timing belt driven pulley.
   Take care not to loose the woodruff key.

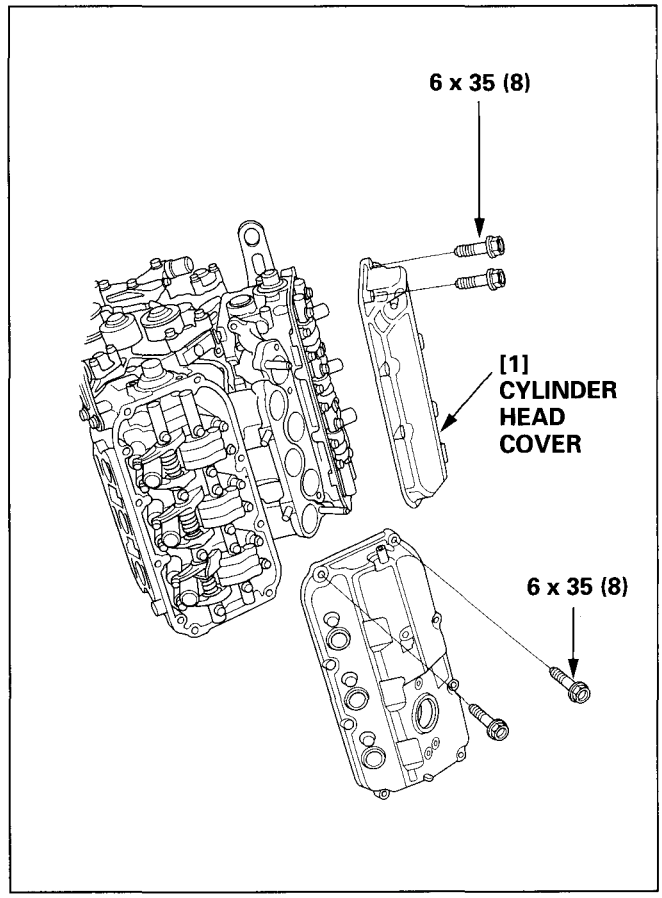
   TOOL:
   Lock nut wrench, 56 mm 07LPA – ZV30200

7) Remove the 8 x 29 mm special bolts, and the timing belt driven pulley back cover.

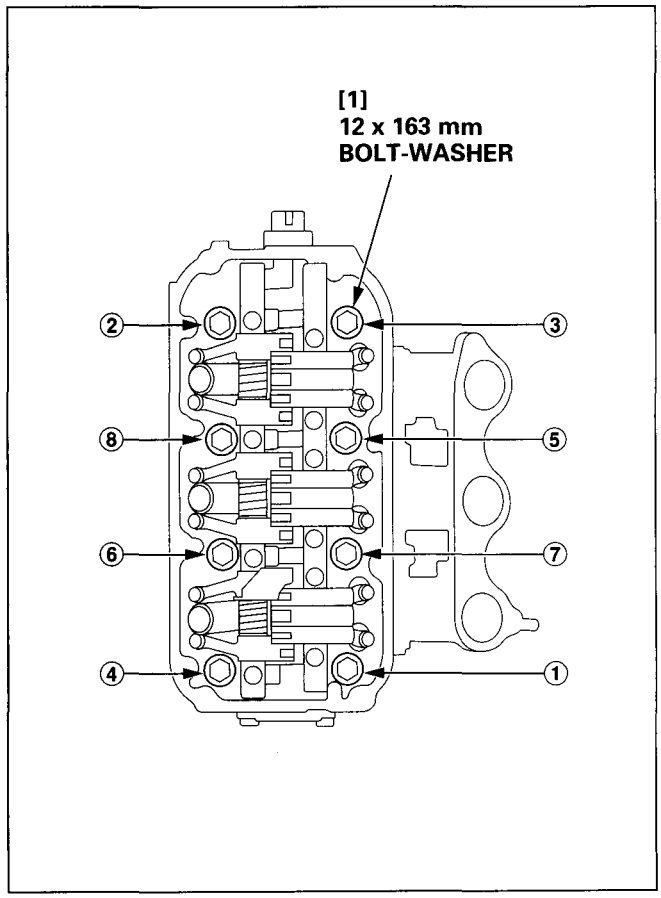




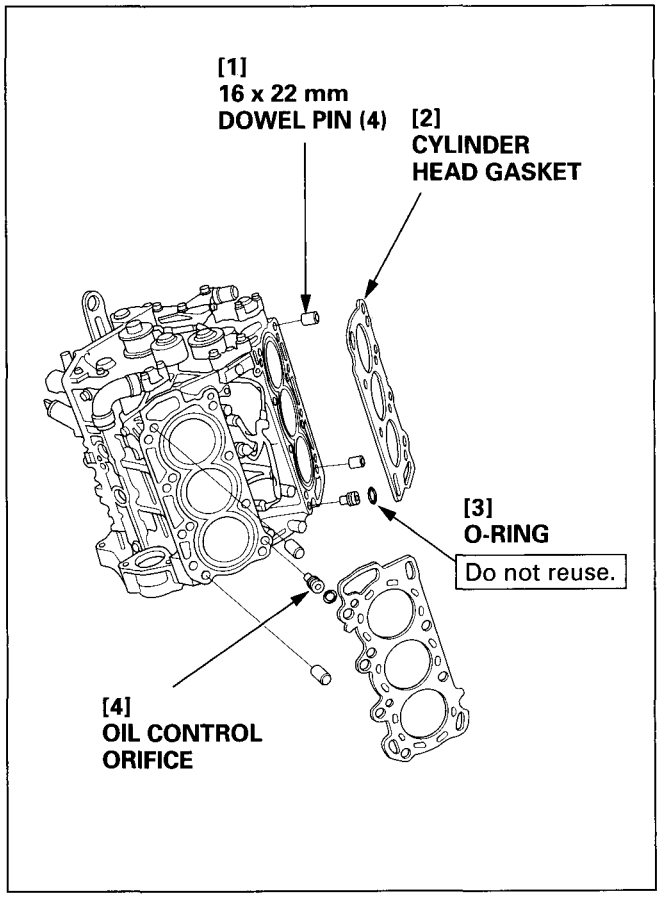
8) Remove the eight 6 x 35 mm flange bolts from the each cylinder head cover, then remove the cylinder head cover.



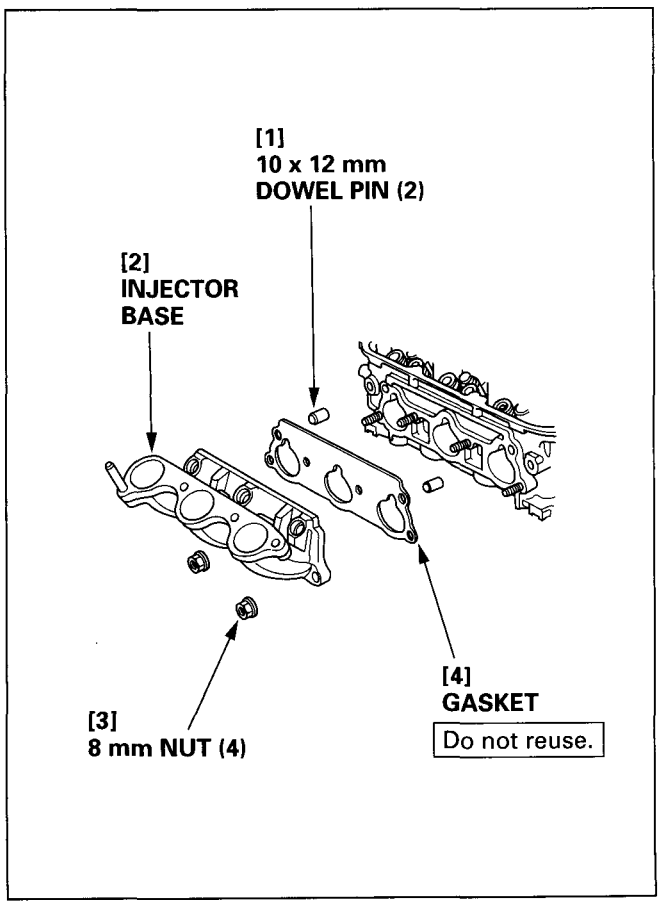
9) Remove the 12 x 163 mm bolt-washers in the numbered order in the two or three steps.



10) Remove the cylinder head assembly, and remove the cylinder head gasket and the four 16 x 22 mm dowel pins.
Take care not loose the oil control orifice and the dowel pins.



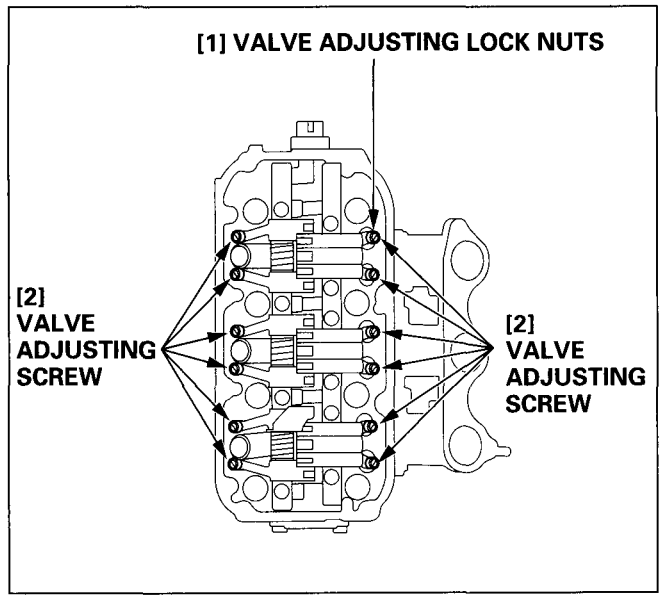
11) Remove the injector base, packing and the two 10 x 12 mm dowel pins.



2. CYLINDER HEAD DISASSEMBLY

• ROCKER ARM REMOVAL

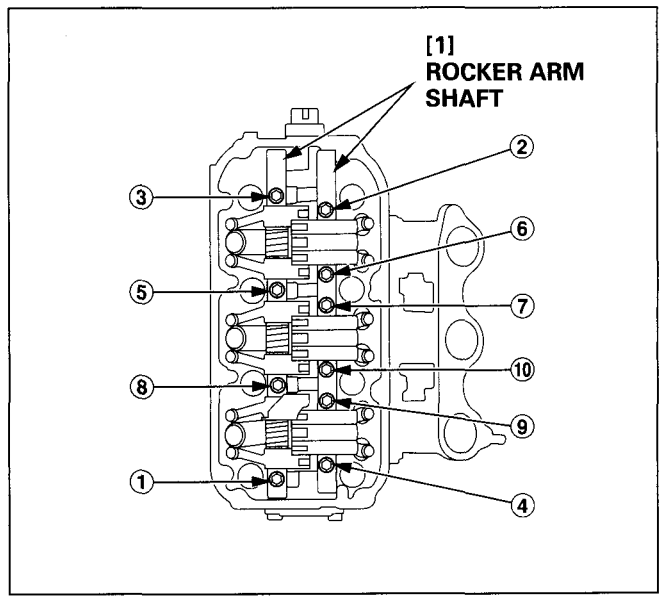
1) Loosen the adjusting lock nuts, and the adjusting screws.



2) Loosen the bolts in the numbered order in the two or three steps, and remove the rocker arm shaft.

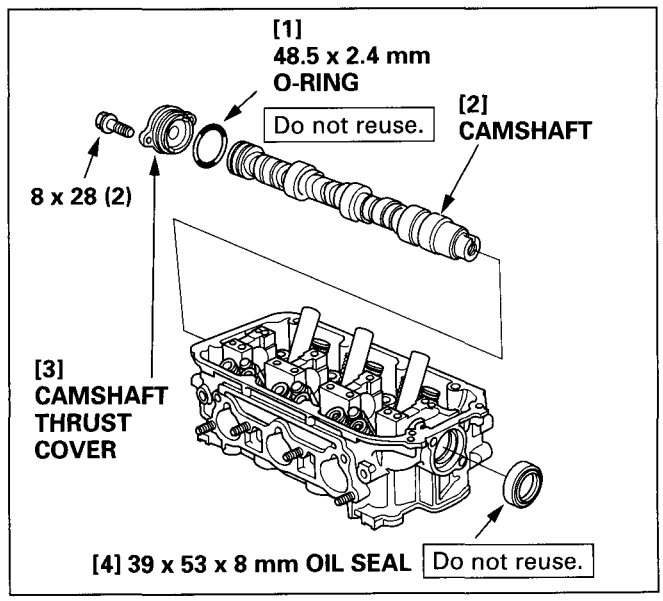
NOTICE

- Identify parts as they are removed so they can be reinstalled in their original locations.
- Remove the cylinder head with the bolts inserted.



• CAMSHAFT REMOVAL

1) Remove the two 8 x 28 flange bolts, then remove the camshaft thrust cover and the camshaft.

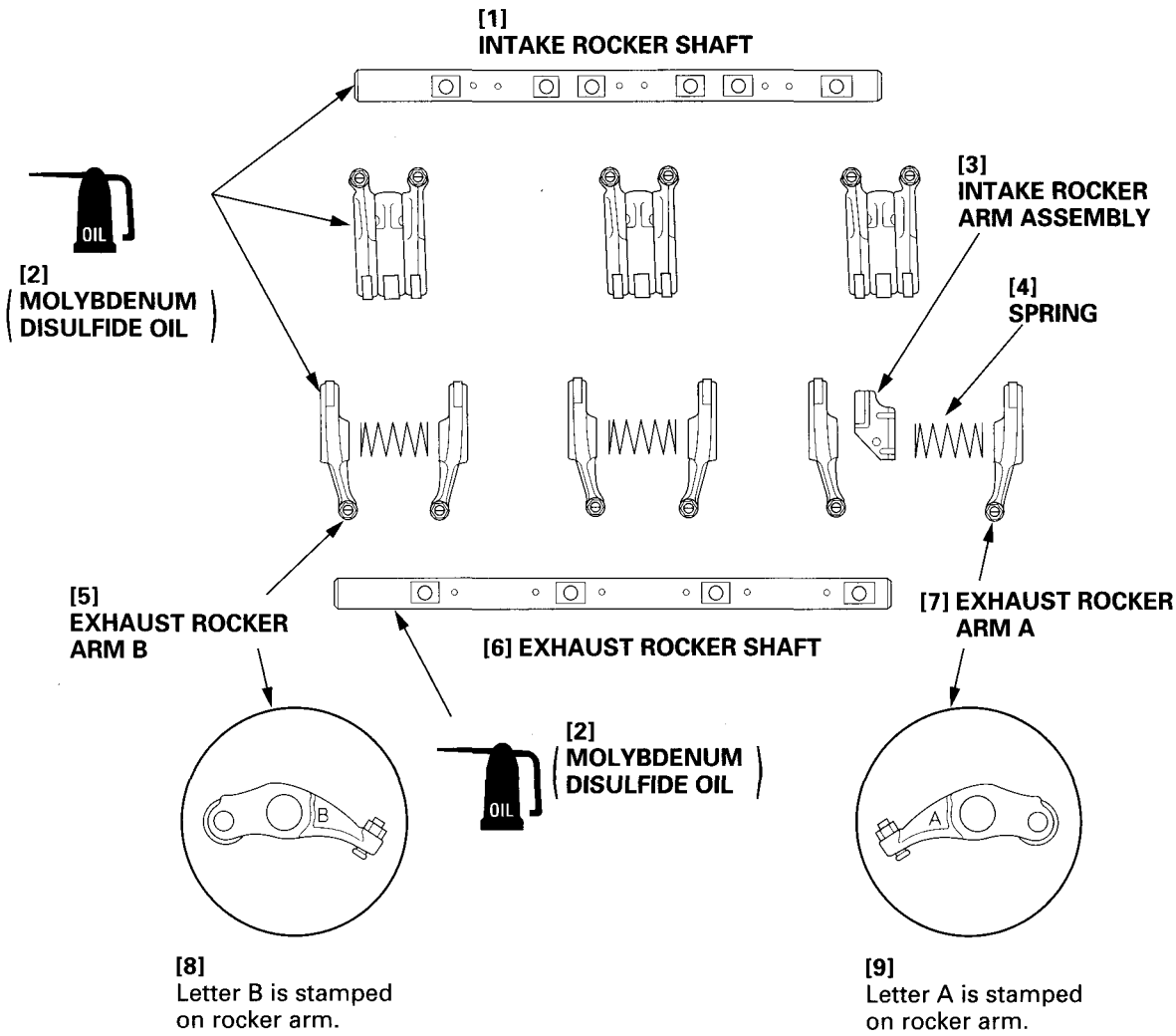


• Rocker Arms and Shafts Disassembly/Reassembly

NOTICE

- Identify parts as they are removed so they can be reinstalled in their original locations.
- Inspect the rocker shafts and rocker arms (see page 9-10).
- Rocker arms must be installed in the same positions if reused.
- When removing or installing the rocker arm assembly, do not remove the rocker shaft mounting bolts. The bolts will keep the springs and rocker arms on the shaft.
- Bundle the intake rocker arms with rubber bands to keep them together as a set.
- Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact points.

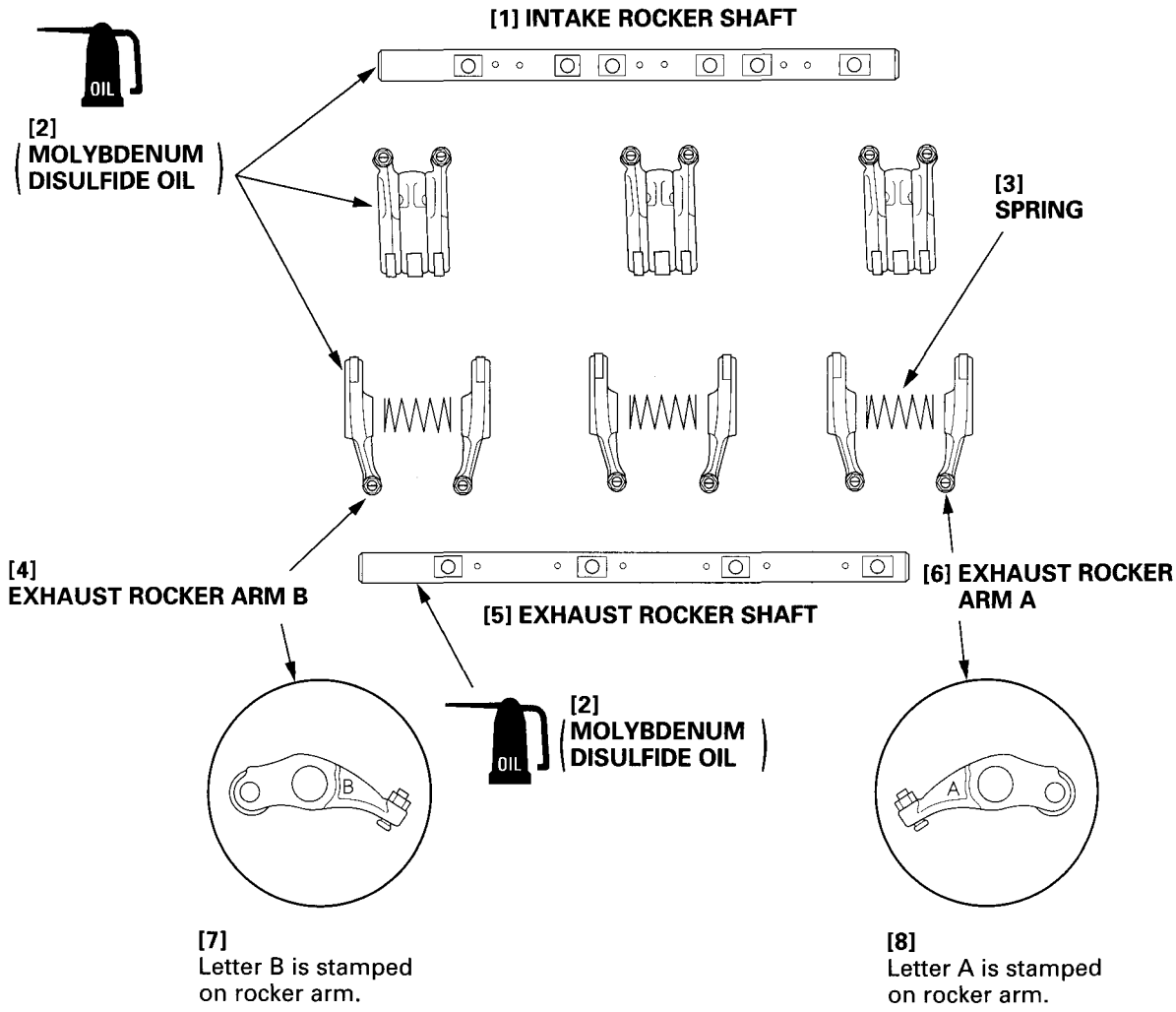
LEFT BANK :



[8]
Letter B is stamped on rocker arm.

[9]
Letter A is stamped on rocker arm.

RIGHT BANK :



[7]
Letter B is stamped on rocker arm.

[8]
Letter A is stamped on rocker arm.

• VALVE/STEM SEAL/SPRING REMOVAL

1) Select the socket that matches the diameter of the valve spring retainer. Attach the socket to the retainer and lightly tap on the socket to separate the cotters and the retainer.

NOTICE

Tap at right angles with each valve stem head.
Take care not to bend the valves.

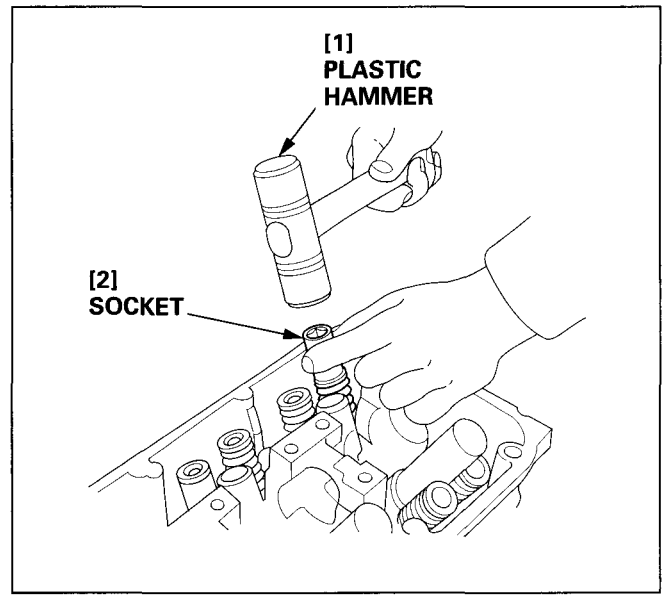
2) Using the special tool, compress the valve springs and remove the valve cotters.
Remove the valve springs.

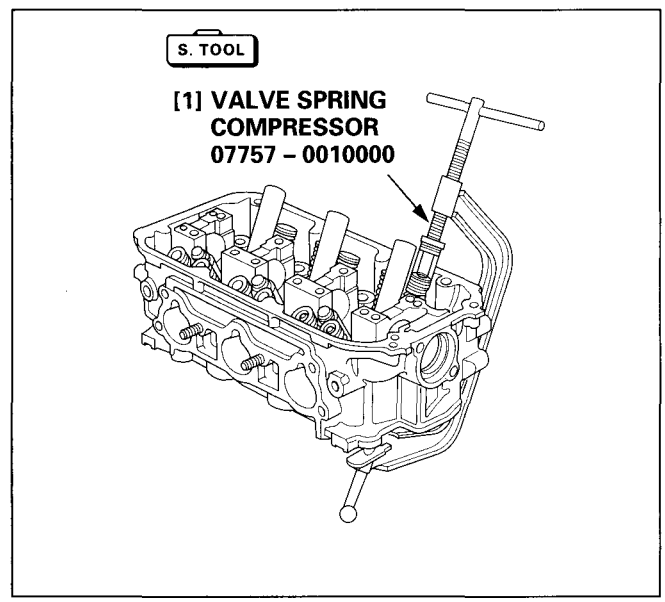
TOOL:
Valve spring compressor 07757 – 0010000

NOTICE

- Take care not to hit the cylinder head by the special tool.
- Identify cotters as they are removed so they can be reinstalled in their original locations.

3) Remove the other valve cotters.

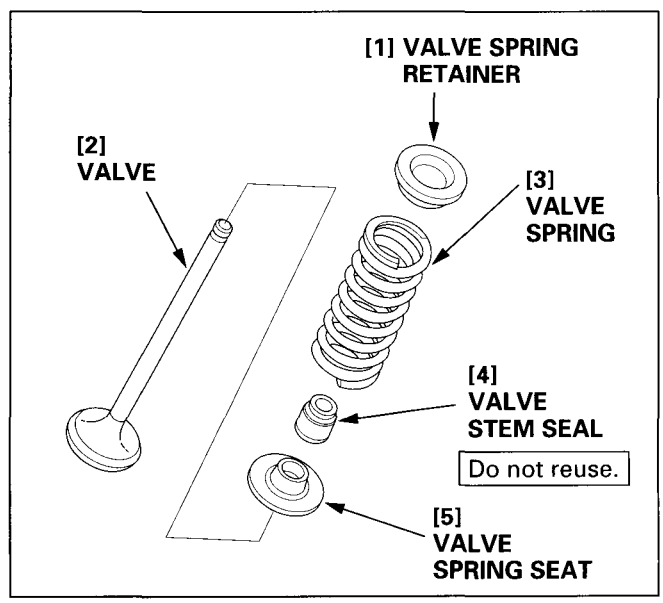




4) Remove the valve spring retainer, valve spring, valve, valve spring seat and valve stem seal.
Replace the valve stem seal when reassembling.
Check the valve head for nicks and carbon deposits before installation.

NOTICE

Identify parts as they are removed so they can be reinstalled in their original locations.



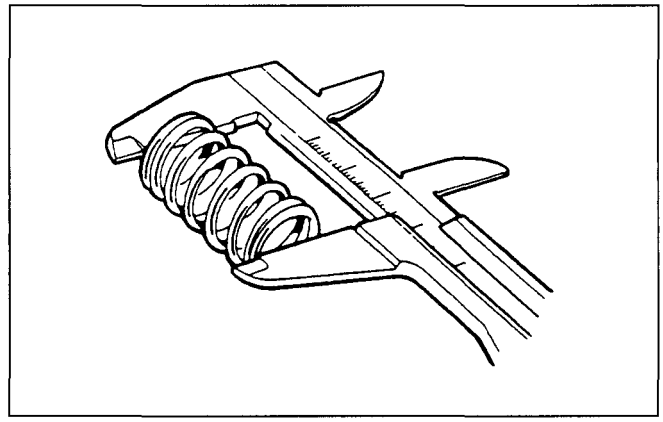
3. INSPECTION

• VALVE SPRING FREE LENGTH

Measure the free length of the valve springs.

	STANDARD	SERVICE LIMIT
IN	50.07 mm (1.971 in)	———
EX	53.48 mm (2.106 in)	———

Replace the springs if they are shorter than the service limit.

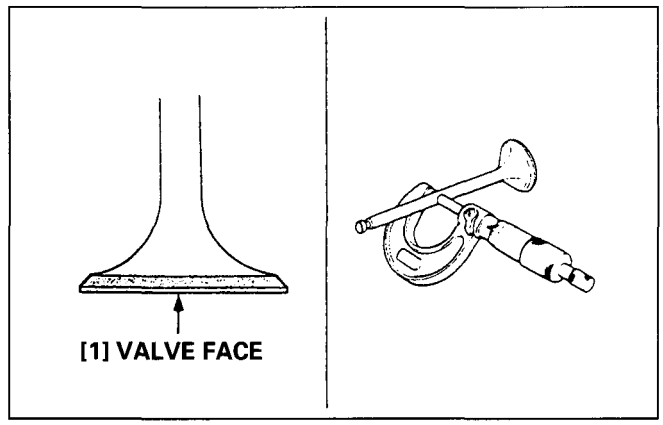


• VALVE FACE/STEM O.D.

Inspect each valve face for pitting or wear irregularities.
Inspect each valve stem for bending or abnormal stem wear. Replace the valve if necessary.
Measure and record each valve stem O.D.

	STANDARD	SERVICE LIMIT
IN	5.485 – 5.495 mm (0.2159 – 0.2163 in)	5.455 mm (0.2148 in)
EX	5.450 – 5.460 mm (0.2146 – 0.2150 in)	5.420 mm (0.2134 in)

Replace the valves if their O.D. is smaller than the service limit.

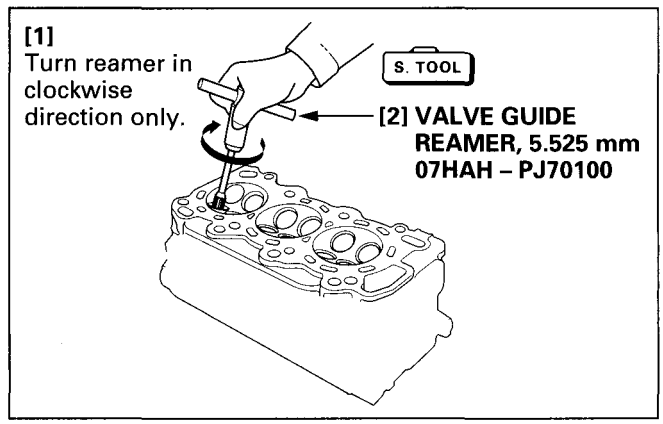


• VALVE GUIDE I.D.

Using the valve guide reamer (special tool), ream the valve guides to remove any carbon deposits before measuring.
Measure and record each valve guide I.D.

	STANDARD	SERVICE LIMIT
IN/EX	5.515 – 5.530 mm (0.2171 – 0.2177 in)	5.55 mm (0.219 in)

Replace the guides if they are over the service limit (P. 9-21).



• VALVE STEM-TO-VALVE GUIDE CLEARANCE

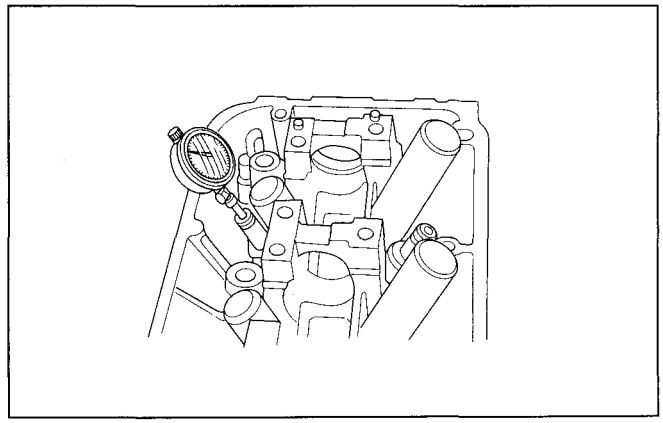
Subtract each valve steam O.D. from the corresponding guide I.D..

	STANDARD	SERVICE LIMIT
IN	0.020 – 0.045 mm (0.0008 – 0.0018 in)	0.080 mm (0.0031 in)
EX	0.055 – 0.080 mm (0.0022 – 0.0031 in)	0.120 mm (0.0047 in)

If the stem-to-guide clearance exceeds the service limit, determine if the new guide with standard dimensions would bring the clearance within tolerance. If so, replace any guide as necessary and ream to fit. If the stem-to-guide clearance exceeds the service limit with new guides, replace the valves as well.

NOTICE

Recondition the valve seats whenever the valve guides are replaced (P. 9-18).

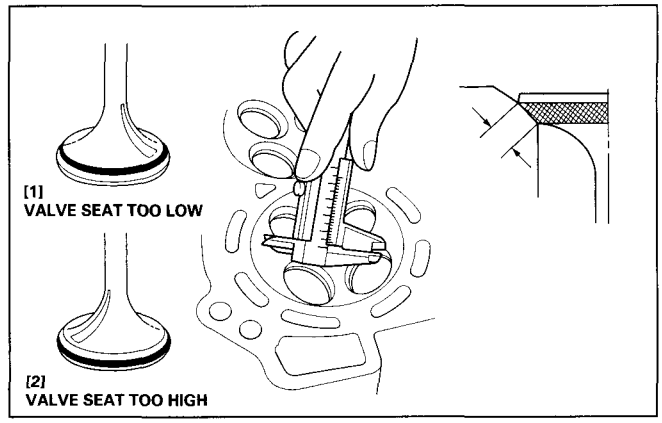


• VALVE SEAT WIDTH

Measure the valve seat width.

	STANDARD	SERVICE LIMIT
IN/EX	1.25 – 1.55 mm (0.049 – 0.061 in)	2.0 mm (0.08 in)

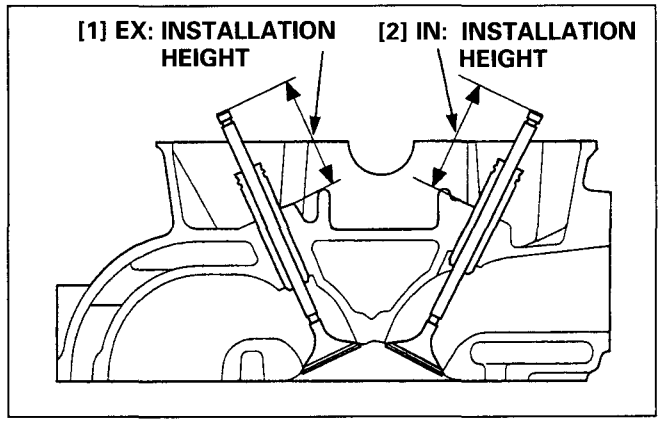
If the valve seat width is under the standard, or over the service limit, or if the valve seat is too high/low, recondition the valve seat (P. 9-18).



• VALVE INSTALLATION HEIGHT

Replace the cylinder head if the measurement exceeds the service limit (P. 9-5).

	STANDARD	SERVICE LIMIT
IN	46.75 – 47.55 mm (1.841 – 1.872 in)	47.80 mm (1.882 in)
EX	46.68 – 47.48 mm (1.838 – 1.869 in)	47.73 mm (1.879 in)

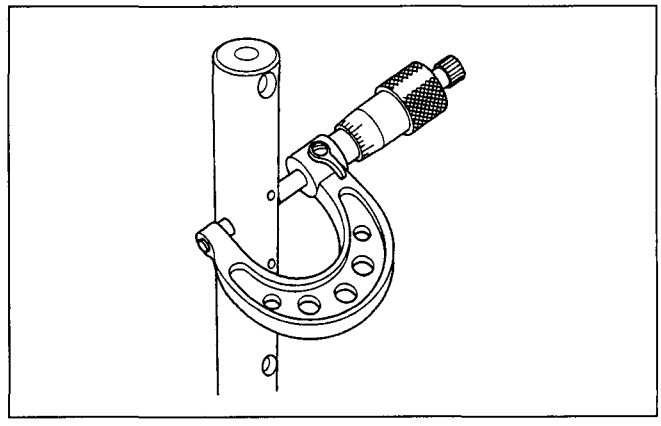


• ROCKER ARM SHAFT O.D.

Measure the O.D. of the rocker arm shaft.

	STANDARD	SERVICE LIMIT
IN	19.972 – 19.993 mm (0.7863 – 0.7871 in)	———
EX	17.976 – 17.994 mm (0.7077 – 0.7084 in)	———

Replace the rocker arm shaft if its O.D. is smaller than the service limit.

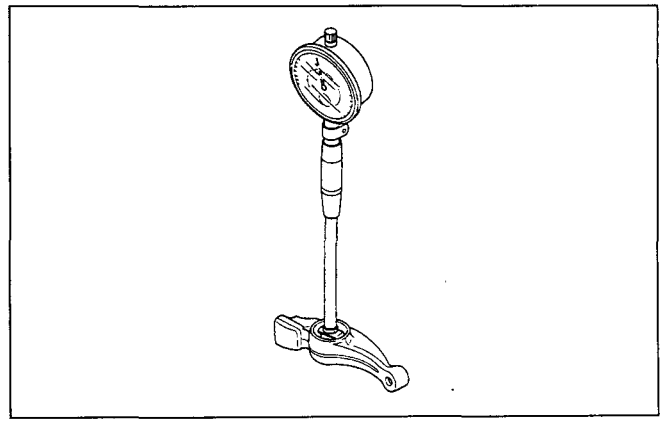


• ROCKER ARM I.D.

Measure the I.D. of the rocker arm.

	STANDARD	SERVICE LIMIT
IN	20.012 – 20.030 mm (0.7879 – 0.7886 in)	———
EX	18.012 – 18.030 mm (0.7091 – 0.7098 in)	———

Replace the rocker arms if their I.D. is larger than the service limit.
Also check the rocker arm-to-cam contact surface for any wear or scratches.



• ROCKER ARM SHAFT-TO-ROCKER ARM CLEARANCE

	STANDARD	SERVICE LIMIT
IN	0.026 – 0.067 mm (0.0010 – 0.0026 in)	0.067 mm (0.0026 in)
EX	0.026 – 0.077 mm (0.0010 – 0.0030 in)	0.077 mm (0.0030 in)

If the measurement exceeds the service limit, replace the rocker arm or the rocker arm shaft (P. 9-22).

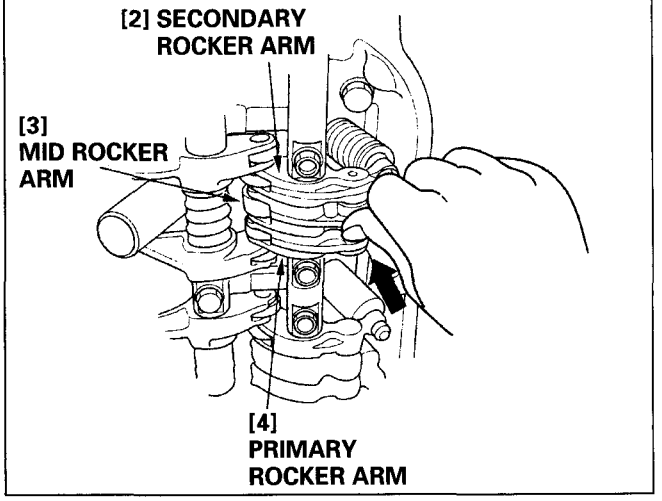
VTEC Rocker Arm Test (BF225A)

1) Remove the cylinder head covers (P. 9-3).

2) Set No. 1 piston at TDC (P. 3-7).

3) Push on the intake mid rocker arm for the No.1 cylinder. The mid rocker arm should move independently of the primary rocker arm and secondary rocker arms.

[1]
The illustration shows the left bank.



- If the intake mid rocker arm does not move, remove the mid, primary, and secondary intake rocker arms as an assembly, and check that the pistons in the mid and primary rocker arms move smoothly (P. 9-13).
- If the mid rocker arm moves freely, go to step 4.

4) Repeat step 3 on the remaining intake mid rocker arms with each piston at TDC. When all the mid rocker arms pass the test, go to step 5.

5) Check that the air pressure on the shop air compressor gauge indicates over 690 kPa (7.0 kgf/cm^2, 100 psi).

6) Inspect the valve clearance (P. 3-6).

7) Cover the timing belt with a shop towel to protect the belt.

8) Remove the two end intake rocker shaft mounting bolts, then install and connect the special tools and an air pressure regulator with a 0 – 100 psi gauge as shown below.

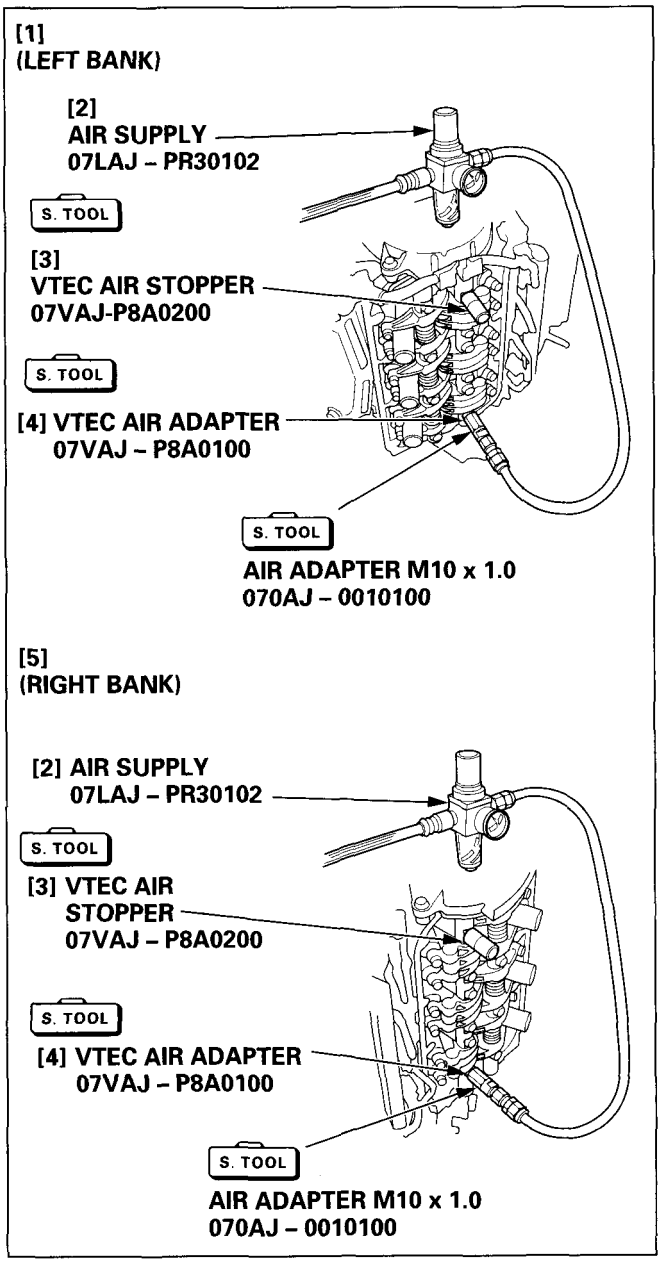
TOOL:

Air supply:	**07LAJ – PR30102**
Air adapter:	**070AJ – 0010100**
VTEC air adapter:	**07VAJ – P8A0100**
VTEC air stopper:	**07VAJ – P8A0200**

9) Loosen the valve on the regulator, and apply the specified air pressure.

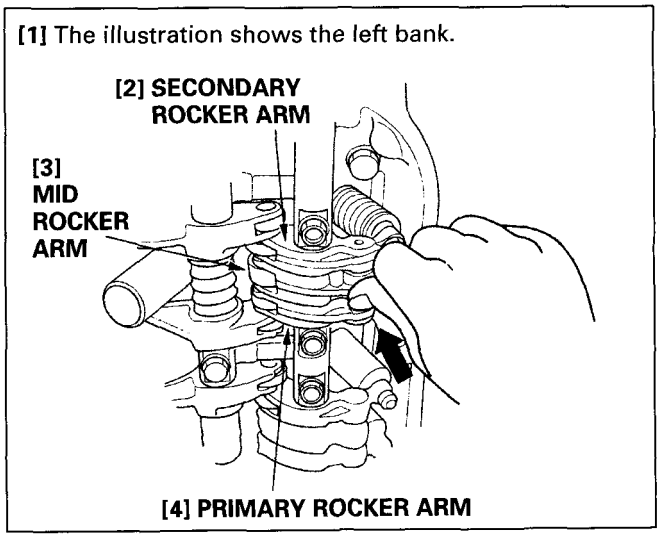
Specified Air Pressure:
390 kPa (4.0 kgf/cm², 57 psi)

NOTE: If the synchronizing pistons do not move after applying air pressure, move the primary or secondary rocker arm up and down manually.



10) Make sure that the intake primary rocker arm and intake secondary rocker arm are mechanically connected by the piston and that the mid rocker arm does not move when pushed manually. If any intake mid rocker arm moves independently of the primary and secondary rocker arms, replace the rocker arms as a set.

11) *After inspection, check that the MIL does not come on.*

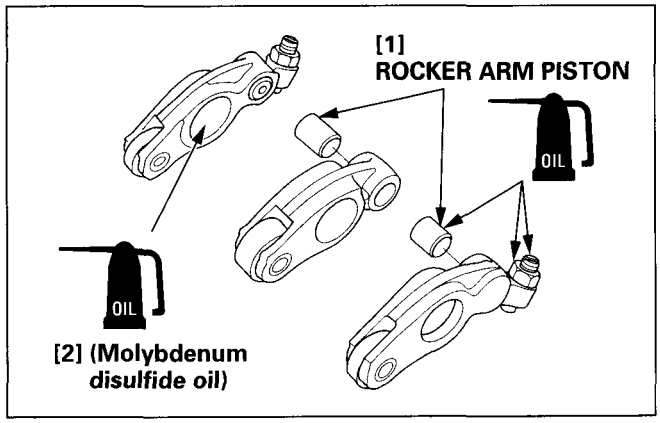


• VTEC ROCKER ARM PISTONS INSPECTION

Disassemble the rocker arms and inspect the rocker arm pistons. Push them manually. If they are not smoothly, replace the rocker arm assembly.

NOTICE

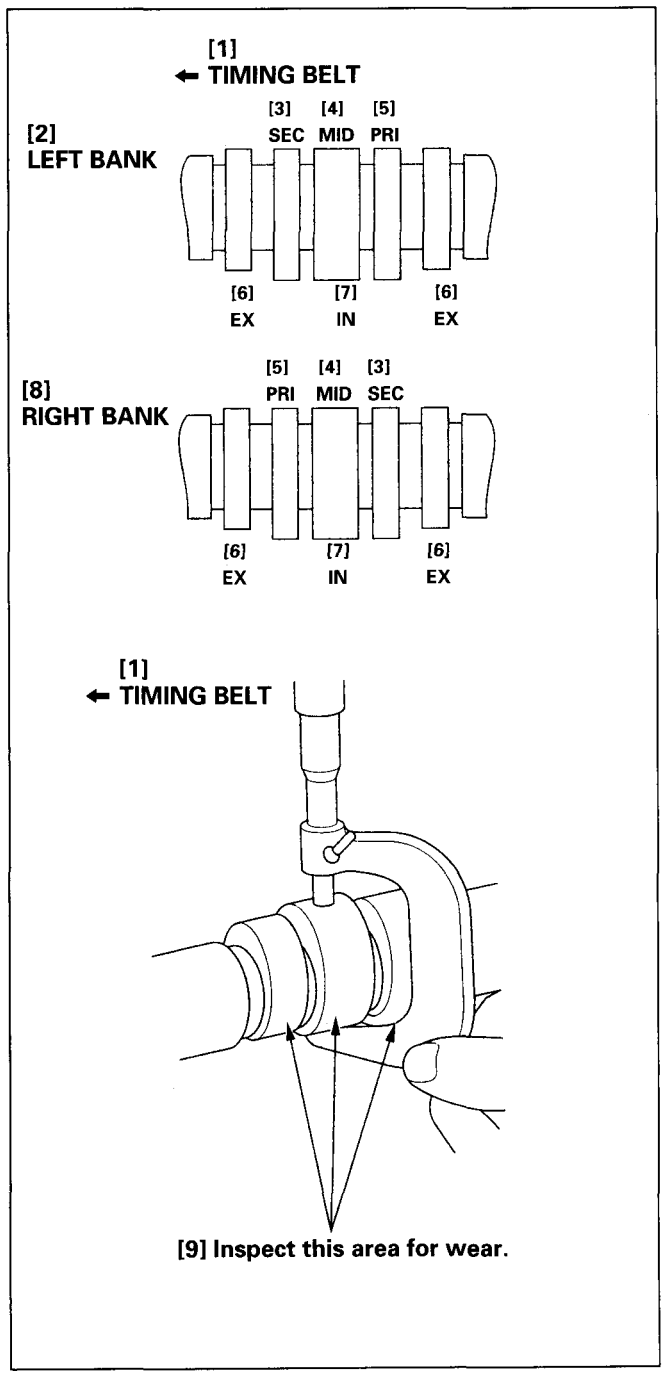
- Apply oil to the pistons when reassembling.
- When reassembling the primary rocker arm (B), carefully apply air pressure to the oil passage of the rocker arm.



• CAM LOBE HEIGHT

1. Wipe the camshaft clean, then inspect the lift ramps. Replace the camshaft if any lobes are pitted, scored or excessively worn.
2. Clean the camshaft bearing surfaces in the cylinder head. Measure the inside diameter of each camshaft bearing surface, and check for an out-of-round condition.
3. Measure cam lobe height.

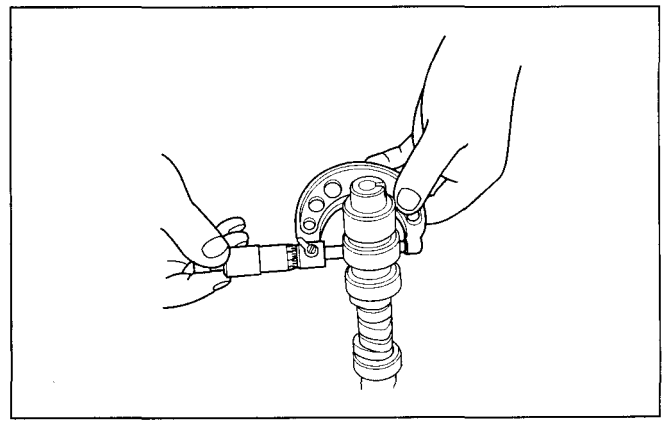
	STANDARD	SERVICE LIMIT
IN/PRI	34.769 – 35.054 mm (1.369 – 1.380 in)	———
IN/MID	36.295 – 36.580 mm (1.429 – 1.440 in)	———
IN/SEC	35.073 – 35.358 mm (1.381 – 1.392 in)	———
EX	36.176 – 36.461 mm (1.424 – 1.435 in)	———



• CAMSHAFT JOURNAL O.D.

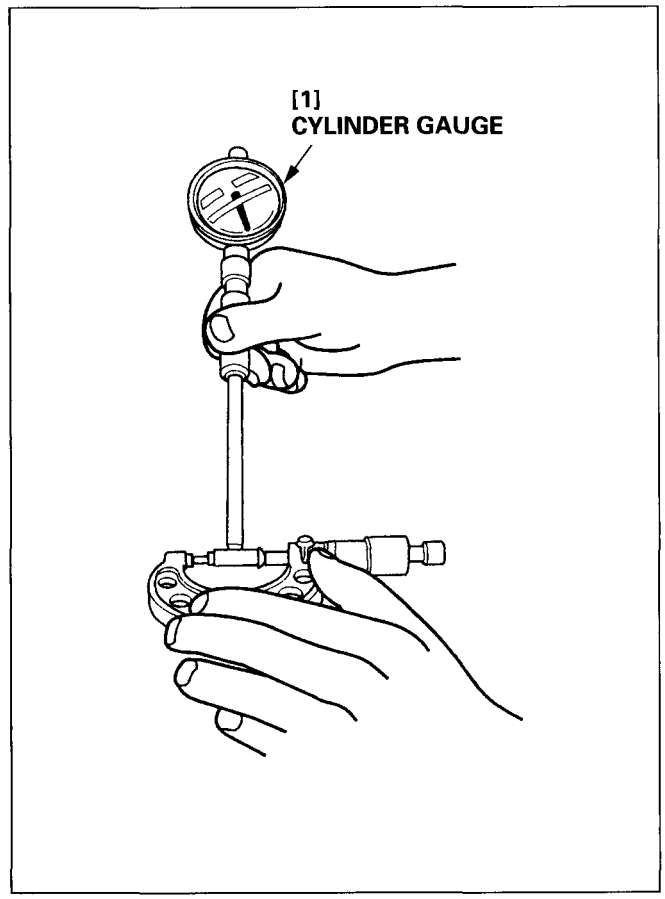
Measure the camshaft O.D.

STANDARD	SERVICE LIMIT
42.935 – 42.950 mm (1.690 – 1.691 in)	———



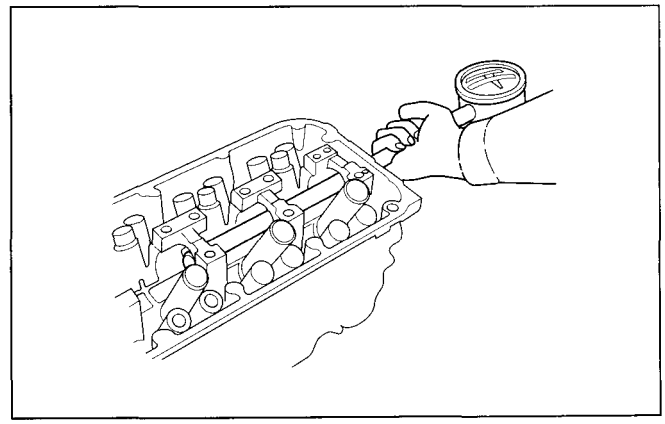
• CAMSHAFT OIL CLEARANCE

1) Zero the gauge to the journal diameter.



2) Clean the camshaft bearing surfaces in the cylinder head. Measure the inside diameter of each camshaft bearing surface, and check for an out-of-round condition. If the camshaft oil clearance is below the service limit, replace the camshaft or cylinder head.

STANDARD	SERVICE LIMIT
0.050 – 0.089 mm (0.0020 – 0.0035 in)	0.15 mm (0.006 in)



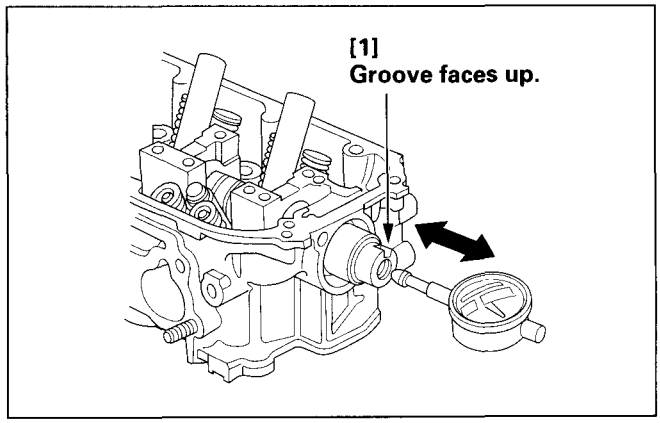
• CAMSHAFT AXIAL CLEARANCE

1) Put the camshaft at the top dead center of the compression stroke of the No. 1 piston (with groove toward up). Check the camshaft axial play by pushing and pulling the camshaft of the opposite side from the gauge.

STANDARD	SERVICE LIMIT
0.05 – 0.20 mm (0.002 – 0.008 in)	0.2 mm (0.008 in)

2) If the measurement exceeds the service limit, replace the camshaft.

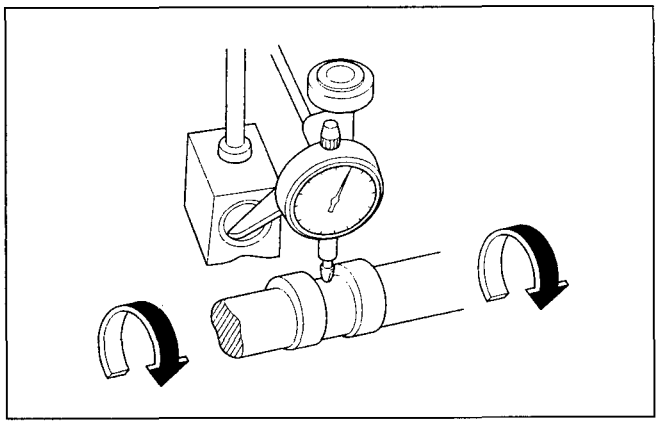
   Install a new camshaft and recheck the axial play. If the measurement still exceeds the service limit, replace the cylinder head and all camshaft holders.



• CAMSHAFT RUNOUT

STANDARD	SERVICE LIMIT
0.03 mm (0.001 in) Max	0.04 mm (0.002 in)

Camshaft runout is half of maximum gauge reading.



• CYLINDER HEAD WARPAGE

1) Remove the carbon deposits from the combustion chamber.
   Clean off any gasket material from the cylinder head surface.

2) Check the spark plug holes and valve areas for cracks.

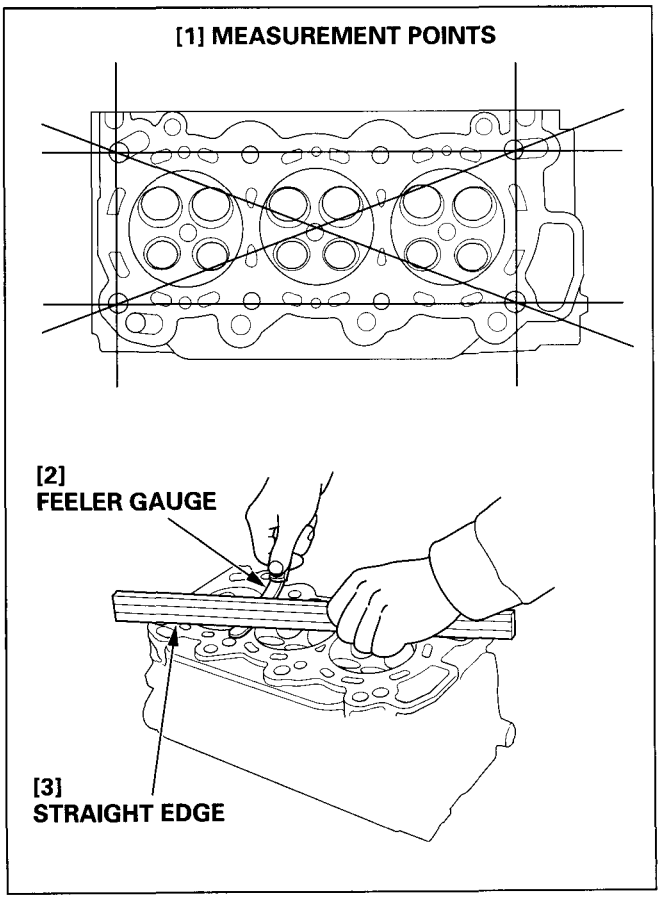
3) Check the cylinder head for warpage using a straight edge and a feeler gauge.

SERVICE LIMIT	0.05 mm (0.002 in)

4) If the measurement exceeds the service limit, recondition.

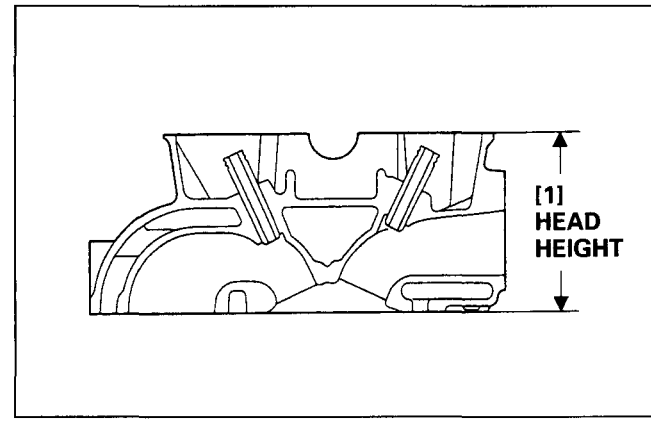
   NOTICE

   Reconditioning must be made within the standard value of the cylinder head height.



• CYLINDER HEAD HEIGHT

STANDARD	SERVICE LIMIT
120.95 – 121.05 mm (4.762 – 4.766 in)	——



Cylinder head reconditioning procedure:

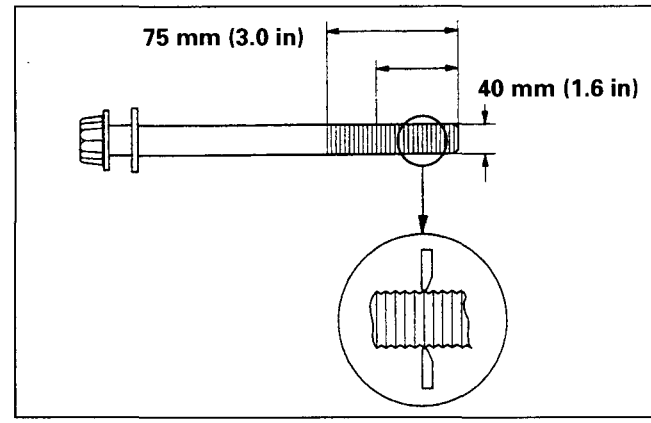
Apply Prussian blue compound to the level block to identify the warpage, and using a fine oil stone, grind the cylinder head in the figure of "8" with the warped part being the center of the ground part. Or use the lapping machine to recondition the cylinder head.

• 12 x 163 mm BOLT-WASHER (CYLINDER HEAD BOLT) O.D.

1) Measure the bolt O.D. at two points as shown.

SERVICE LIMIT	11.3 mm (0.44 in)

2) If the measurement is below the service limit, replace the bolt.



4. VALVE GUIDE REPLACEMENT

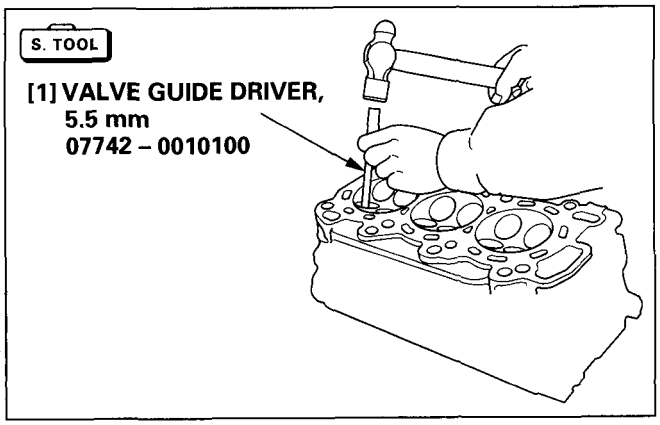
1) Chill the replacement valve guides in the freezer section of a refrigerator for about an hour.

2) Drive the valve guide out of the combustion chamber side using a valve guide drivers (special tool).

CAUTION:

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

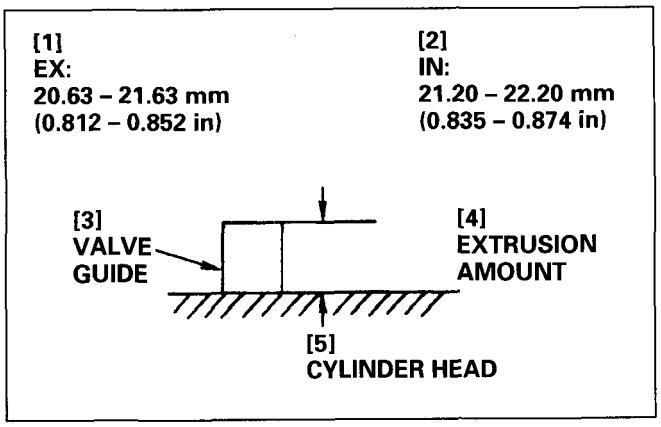
TOOL:
Valve guide driver, 5.5 mm 07742 – 0010100



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

4) Install the new valve guides from the valve spring side of the cylinder head. Drive each valve guide as shown.

Valve guide extrusion amount	IN	21.20 – 22.20 mm (0.835 – 0.874 in)
	EX	20.63 – 21.63 mm (0.812 – 0.852 in)



5) After installation, inspect the valve guide for damage. Replace any damaged valve guide.

• VALVE GUIDE REAMING

NOTICE

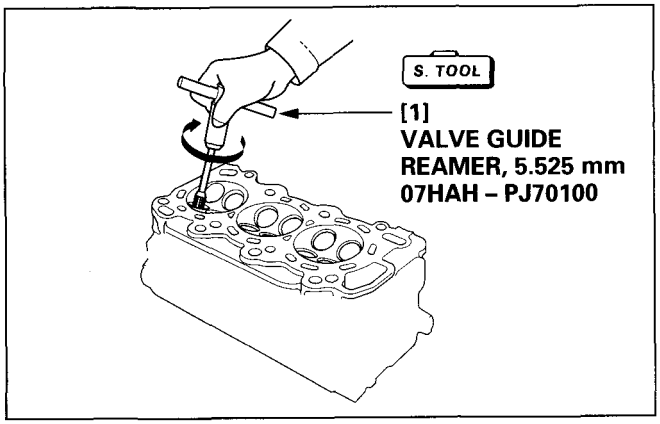
For best results, be sure the cylinder head is at room temperature before reaming valve guides.

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

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

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

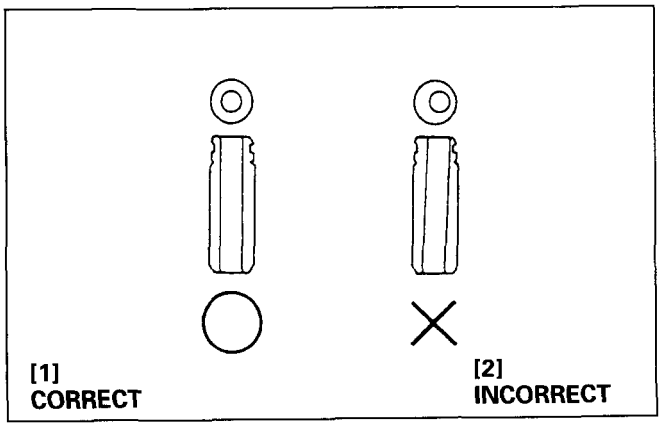
TOOL:
Valve guide reamer, 5.525 mm 07HAH – PJ70100



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.

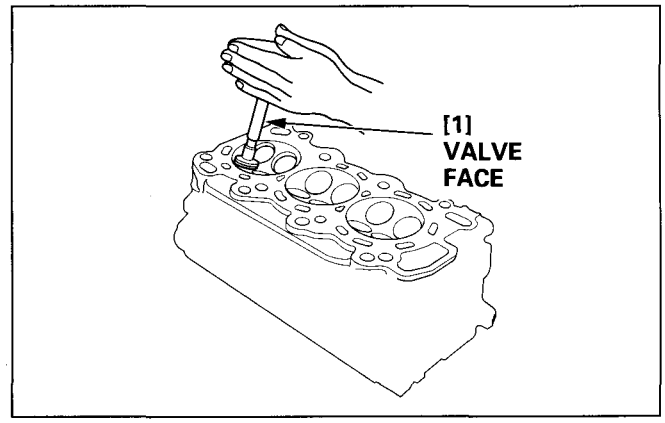
6) Check the Valve Guide-to-Stem Clearance (P. 9-9).



5. VALVE SEAT RECONDITIONING

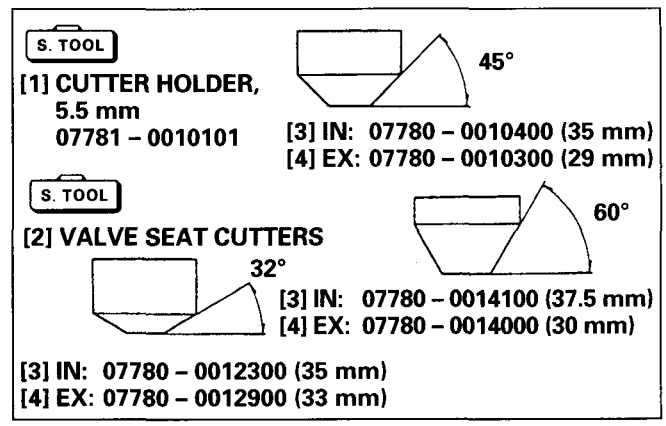
1) Thoroughly clean the combustion chambers and valve seats to remove carbon deposits. Apply a light coat of Prussian Blue compound or erasable felt-tipped marker ink to the valve faces.

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.

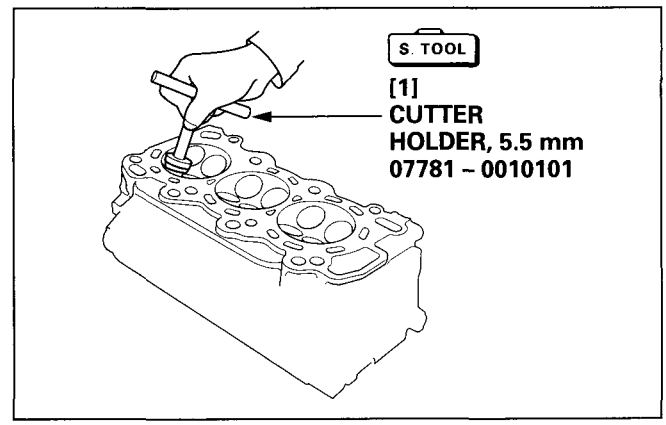


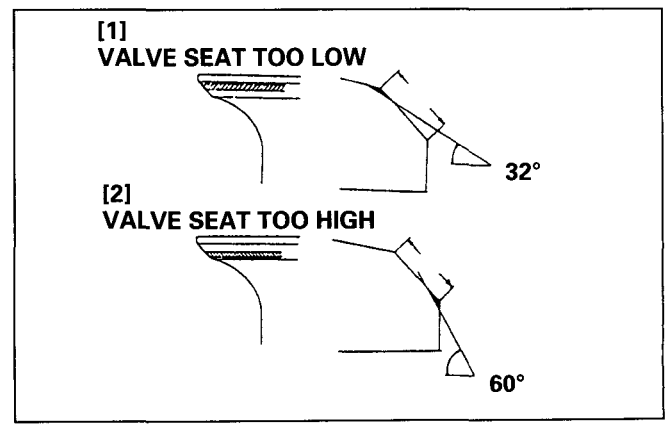
3) Using a 45° cutter, remove enough material to produce a smooth and concentric seat. Follow the Valve Seat Cutter Manufacturer's Instructions.

   Turn the cutter clockwise, never counterclockwise. Continue to turn the cutter as you lift it from the valve seat.



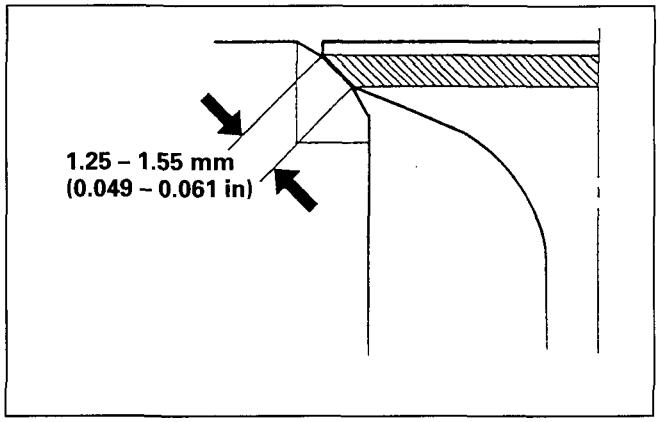
4) Use the 30°–32° and 60° cutters to narrow and adjust the valve seat so that it contacts the middle of the vale face.
   The 30° – 32° cutter removes material from the top edge.
   The 60° cutter removes material from the bottom edge.
   Be sure that the width of the finished valve seat is within specification.





• VALVE SEAT WIDTH

STANDARD	SERVICE LIMIT
1.25 – 1.55 mm (0.049 – 0.061 in)	2.0 mm (0.008 in)



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

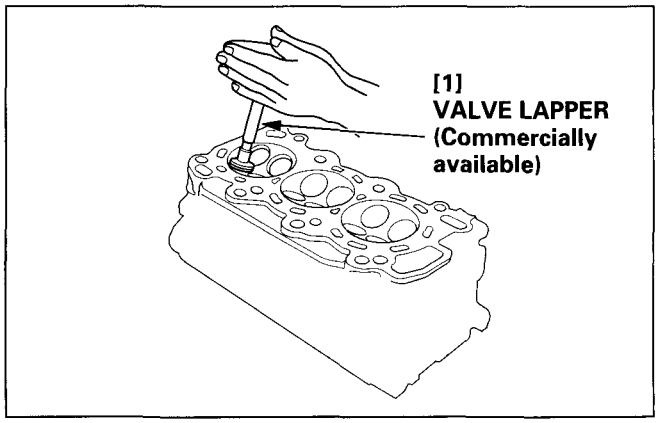
6) After resurfacing the seats, inspect for even valve seating.
Apply Prussian Blue compound or erasable felt-tipped marker ink to the valve faces. Insert the valves, and then lift them and snap them closed against their seats several times. Be sure the valve does not rotate on the seat. The seating 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 cylinder head before assembly.

8) Check valve clearance after assembly.



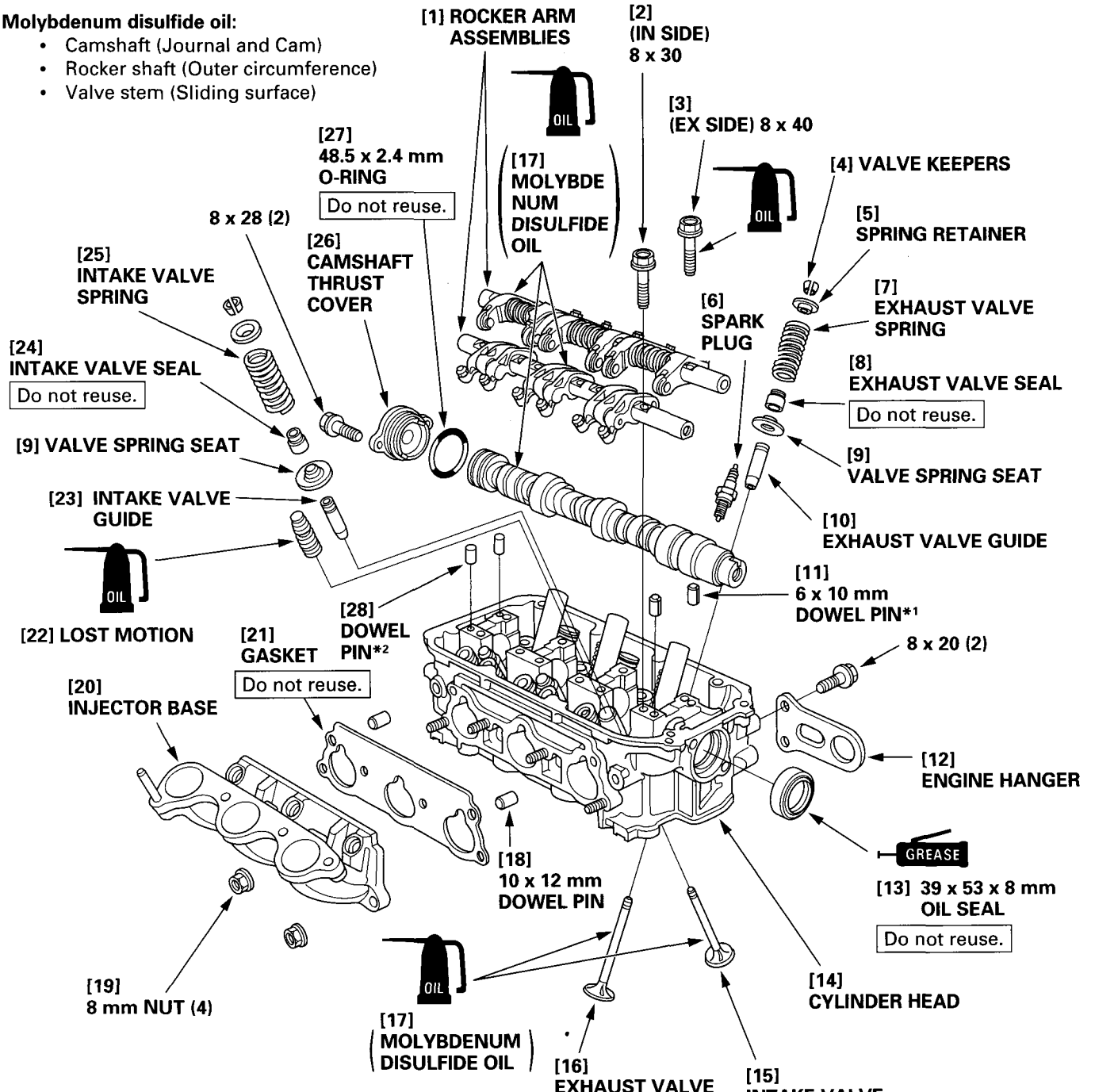
6. CYLINDER HEAD REASSEMBLY

• EXPLODED VIEW

Apply the oil to the following parts when reassembling.

Engine oil:
- Lost motion (Full face)
- Exhaust rocker shaft bolt (Threaded part and Seat)
- Valve stem seal (Internal circumference)
- Valve adjusting screw (Threaded part)
- Valve adjusting lock nut (Threaded part and Seat)

Molybdenum disulfide oil:
- Camshaft (Journal and Cam)
- Rocker shaft (Outer circumference)
- Valve stem (Sliding surface)



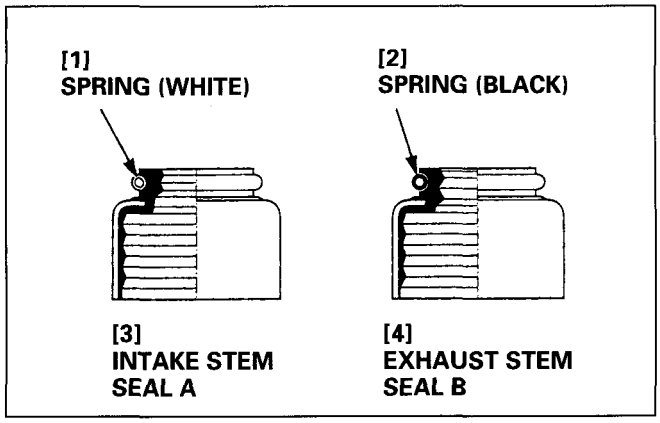
*1: Install the dowel pin so that the upper side is a hollow.
*2: Install the dowel pin so that the lower side is a hollow.

• VALVE STEM SEAL A/B

INSTALLATION:

1) Check whether the valve spring seat is mounted.

2) Note that the valve stem seal A (intake side) and B (exhaust side) are different. Do not confuse them.



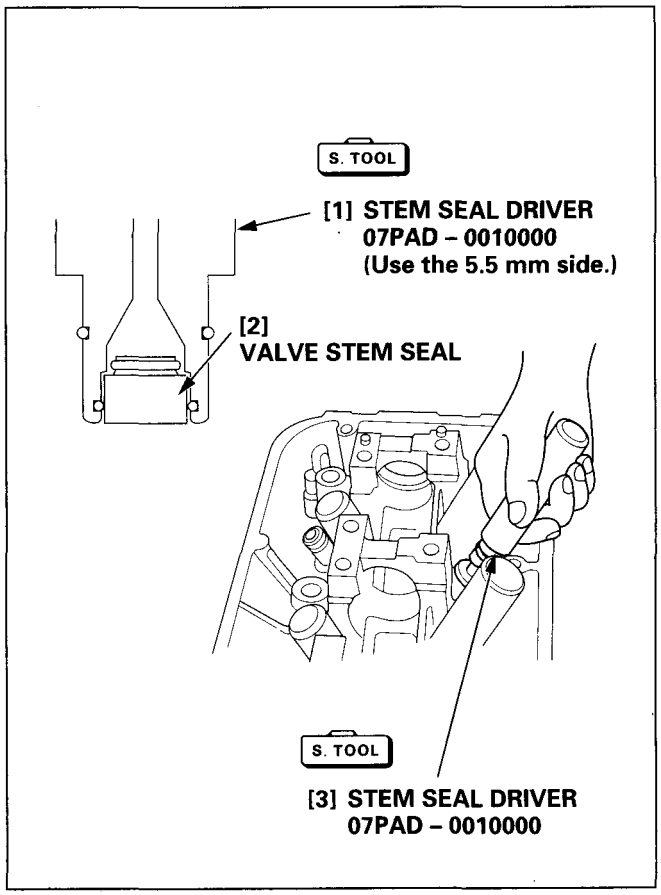
3) Set the valve stem seal in the special tool, and push it straight into the valve guide by hand.

NOTICE

Use the 5.5 mm side of the special tool.

TOOL:

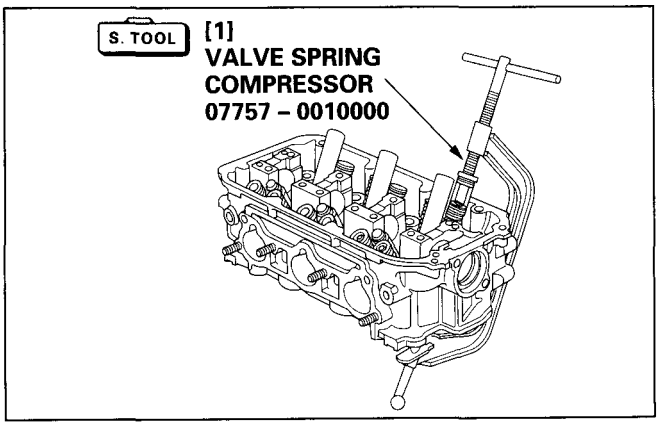
Stem seal driver	**07PAD – 0010000**



4) Install the valve springs and the retainer, and install the valve cotters using the special tool.

TOOL:

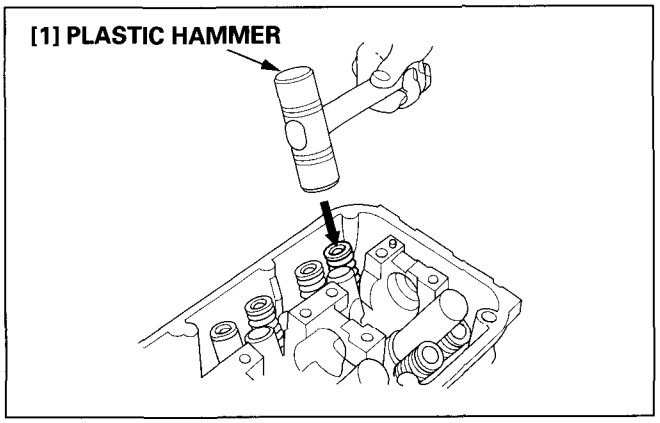
Valve spring compressor	**07757 – 0010000**



5) Lightly tap the end of each valve stem two or three times with a plastic hammer to ensure proper seating of the valve and valve cotters.

NOTICE

Tap the valve stem only along its axis so you do not bend the stem.



• ROCKER ARM/CAMSHAFT/CAMSHAFT OIL SEAL INSTALLATION

NOTICE

- Loosen the intake and exhaust valve adjusting lock nuts. Remove and install the rocker arm assembly with the valve adjusting screw loosened fully as shown.
- Hold the bolt inserted when the rocker arm assembly is not disassembled.

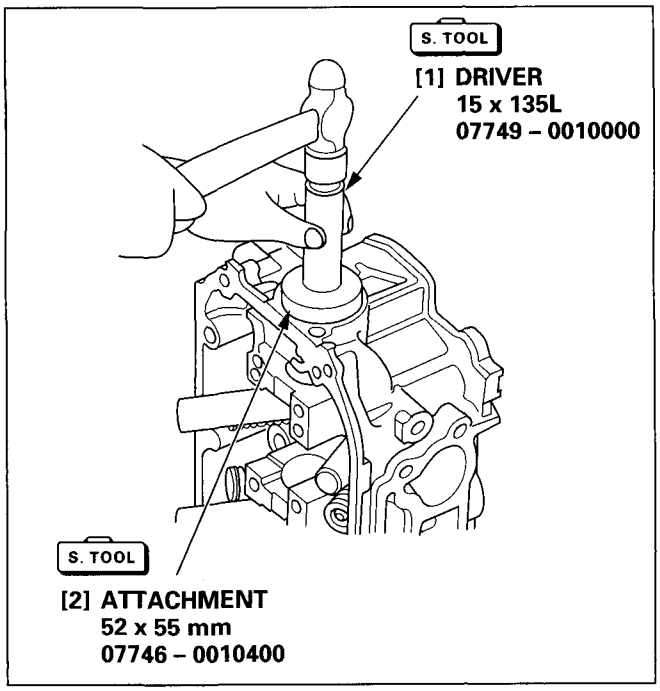
1) Gently tap the 39 x 53 x 8 mm camshaft oil seal into the cylinder head.

NOTICE

Install the oil seal in the cylinder head about 0.5 – 1.5 mm (0.02 – 0.06 in.) from the surface of the cylinder head.

TOOLS:

Driver 15 x 135L	**07749 – 0010000**
Attachment, 52 x 55 mm	**07746 – 0010400**

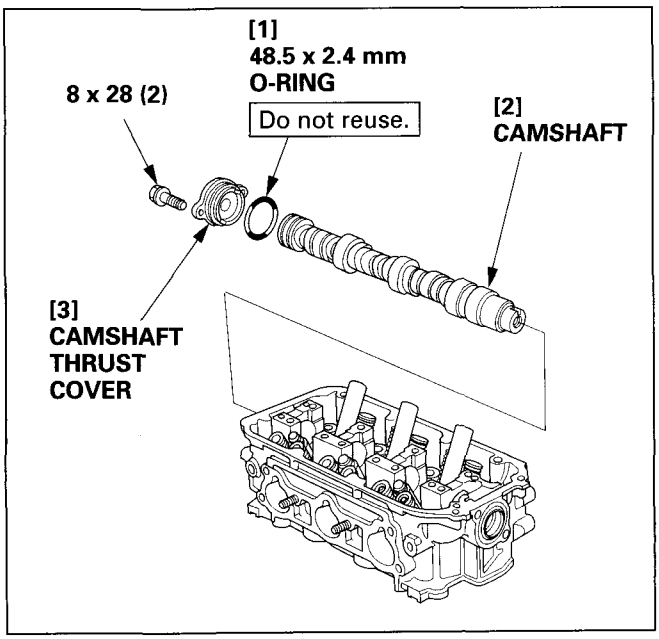


2) Insert the camshaft into the cylinder head, then install the camshaft thrust cover with the two 8 x 28 mm flange bolts. Always use a new O-ring.

TORQUE: 22 N•m (2.2 kgf•m, 16 lbf•ft)

NOTICE

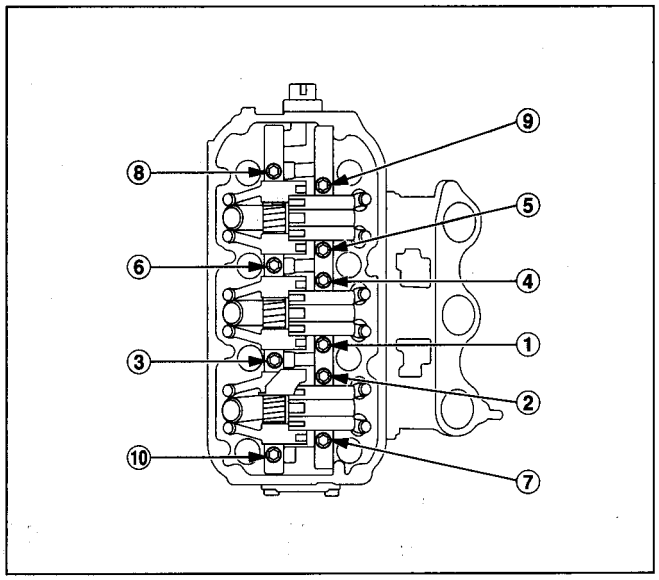
Check that the oil seal lips are not distorted.



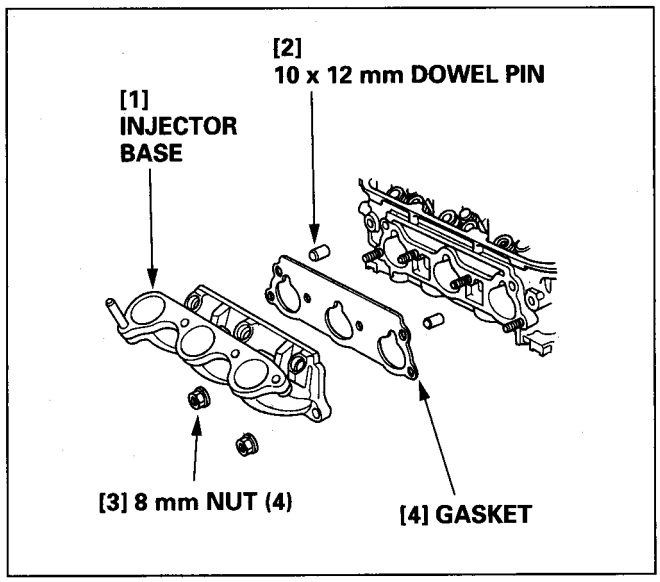
3) Set the rocker arm assembly in place, and loosely install the bolts. Make sure that the rocker arms are properly positioned on the valve stems.

4) Apply the engine oil to the threaded section and the seating surface of each bolt, and tighten the bolts in the numbered order in two or three steps to the standard torque.

TORQUE: 24 N•m (2.4 kgf•m, 17 lbf•ft)



5) Set the new gasket and the two 10 x 12 mm dowel pin and install the injector base with the four 8 mm nuts. Always use a new gasket.



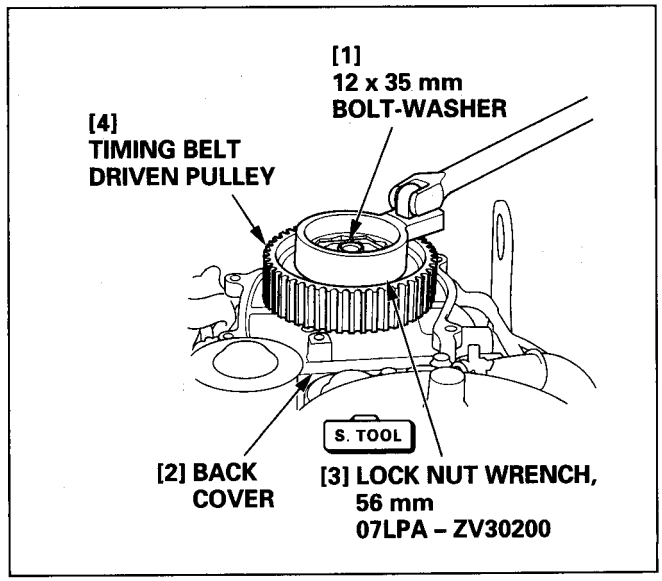
6) Install the back cover.

7) Apply the engine oil to the threaded section and the seating surface of the 12 x 35 mm bolt-washer.

8) Set the timing belt driven pulley on the camshaft. Using the special tool, tighten the 12 x 35 mm bolt-washer to the standard torque.

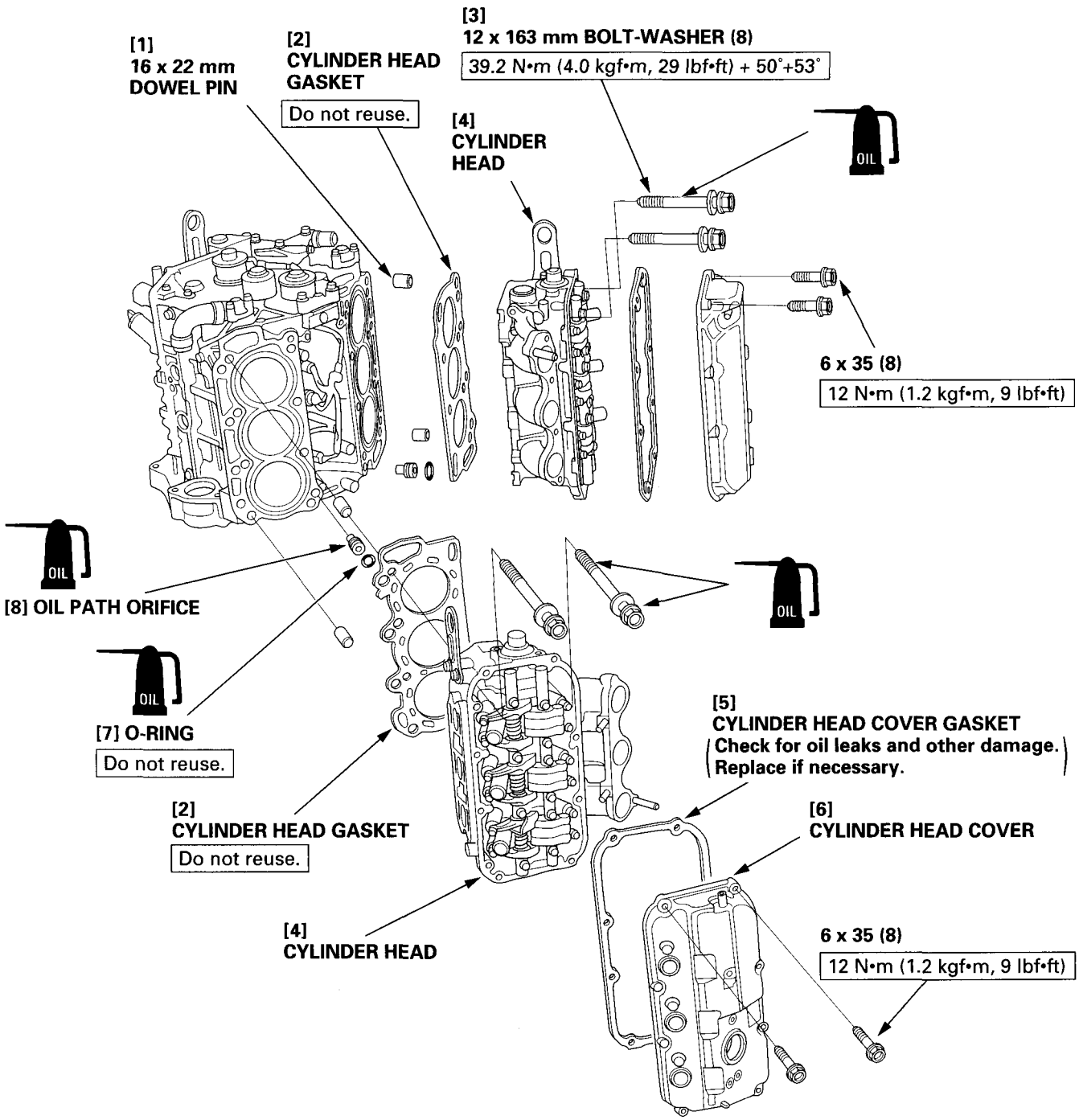
TORQUE: 92 N•m (9.2 kgf•m, 67 lbf•ft)

TOOL:
Lock nut wrench, 56 mm 07LPA – ZV30200



7. CYLINDER HEAD ASSEMBLY INSTALLATION

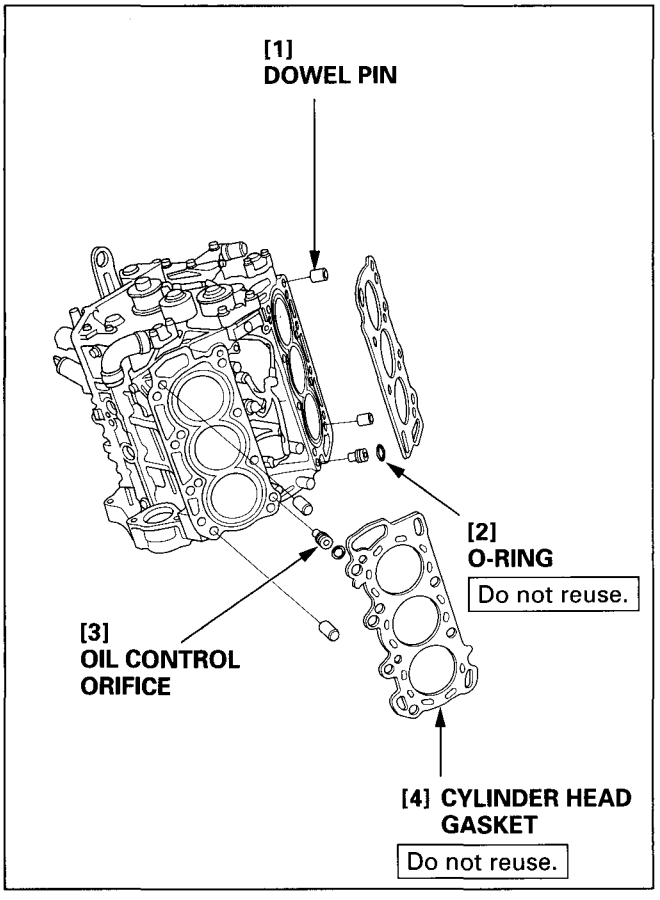
- **EXPLODED VIEW**



b. INSTALLATION

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

- Check that the oil control orifice is mounted on the cylinder block. Install the two 14 x 20 mm dowel pins and a new cylinder head gasket.

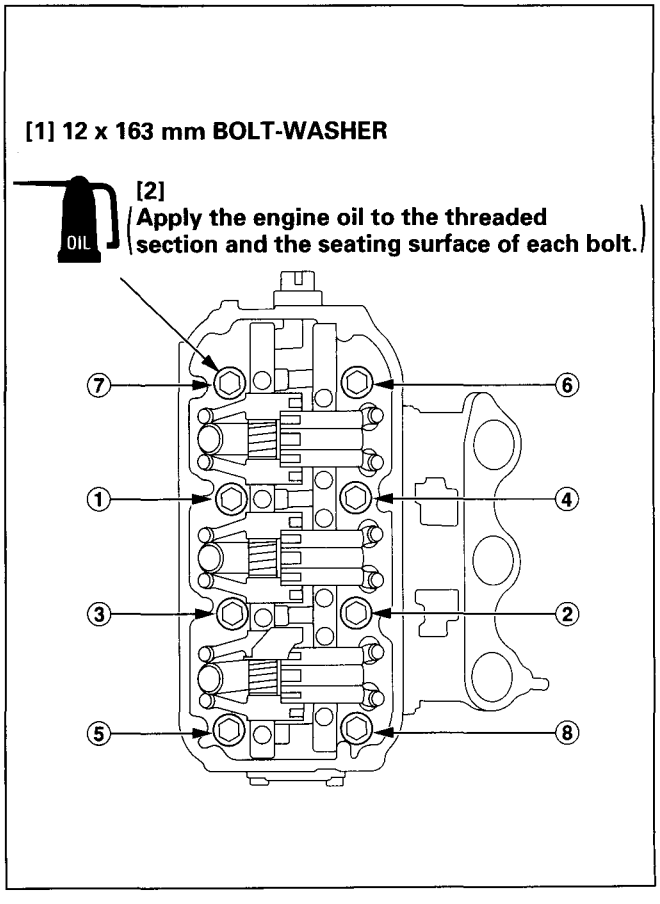


1) Install the cylinder head assembly.

2) Apply the engine oil to the threaded section and the seating surface of each bolt, and loosely tighten the bolts against the cylinder head.

3) Tighten the 12 x 163 mm bolt-washers in the numbered order. Be sure to tighten them in two or three steps to the specified torque.

   STANDARD TORQUE:
   39.2 N•m (4.0 kgf•m, 29 lbf•ft) + 50° + 53°

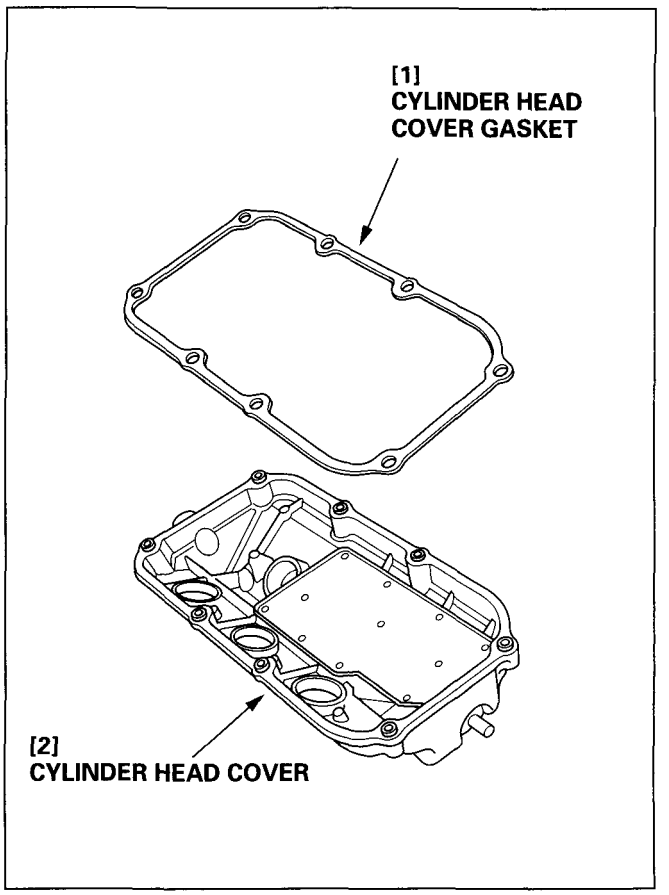


• CYLINDER HEAD COVER INSTALLATION

1) Check the cylinder head cover gasket, and replace it if necessary.

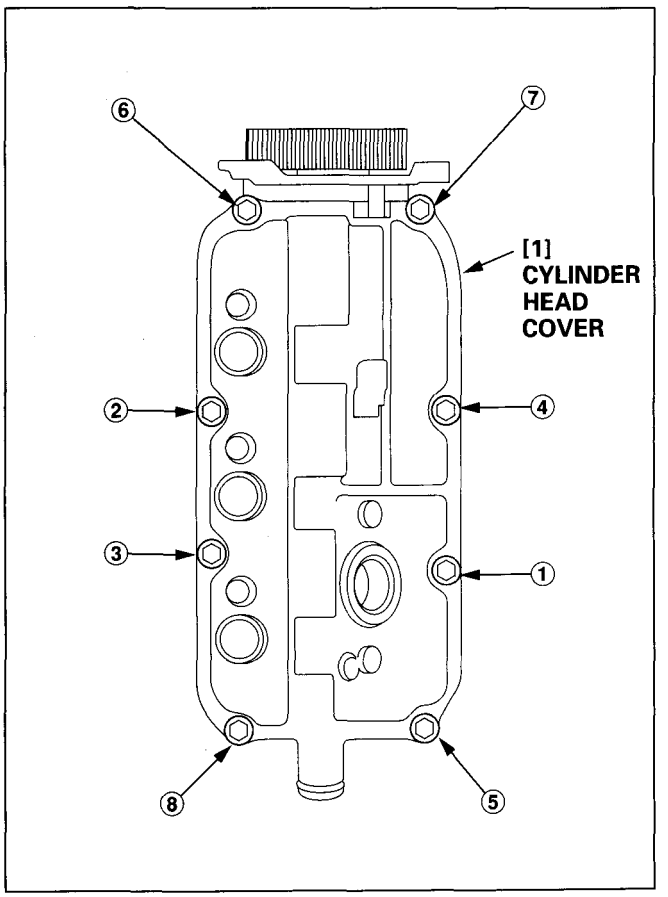
2) Clean the cylinder head mating surfaces with a shop towel or equivalent material. Align the spark plug tube and the spark plug tube seal by inserting the return tube into the hole in the mounting case, and install the cylinder head cover.

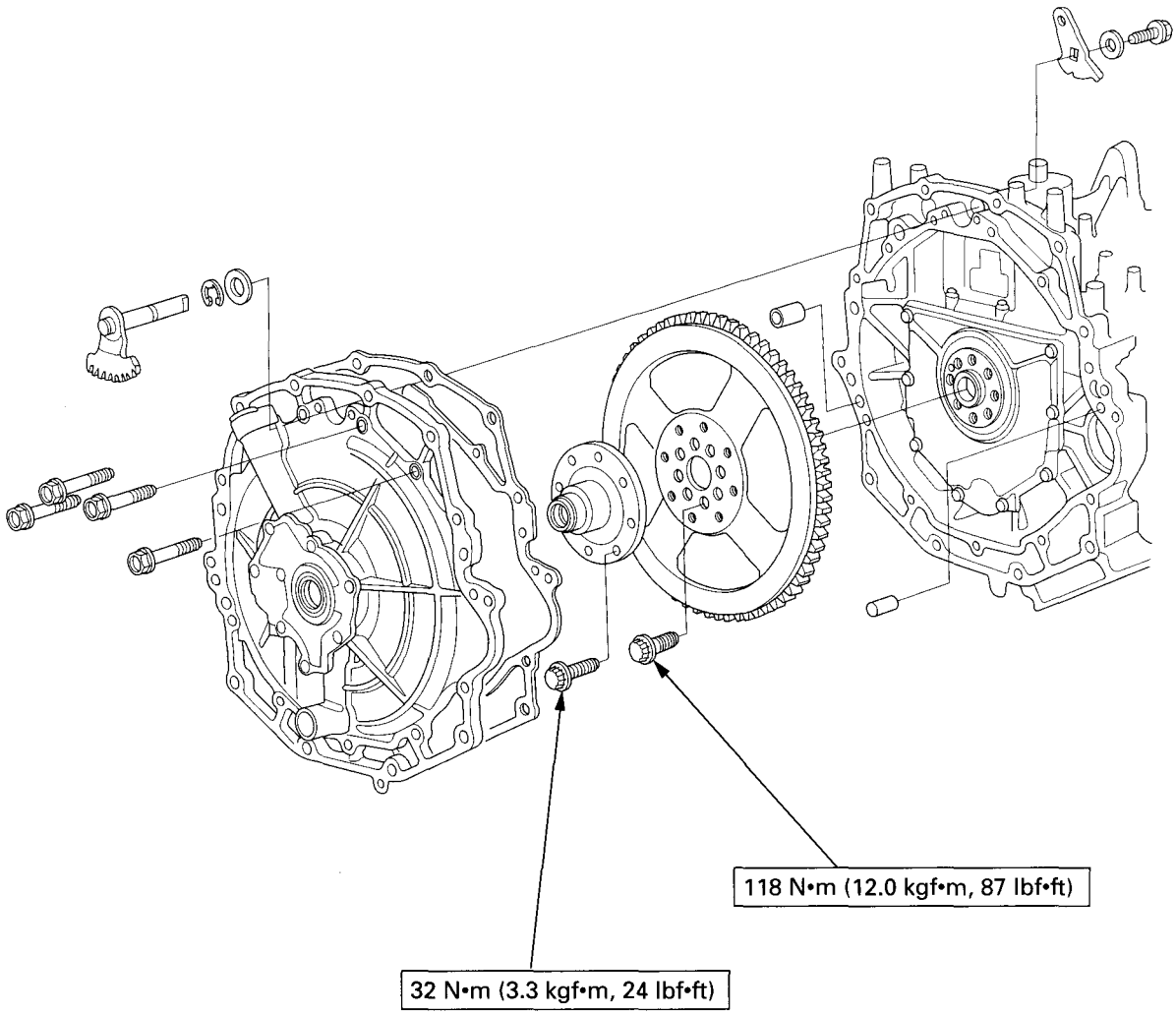
3) Apply the engine oil to the spark plug tube.



4) Tighten the bolts in the numbered order in two steps to the standard torque.

STANDARD TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)





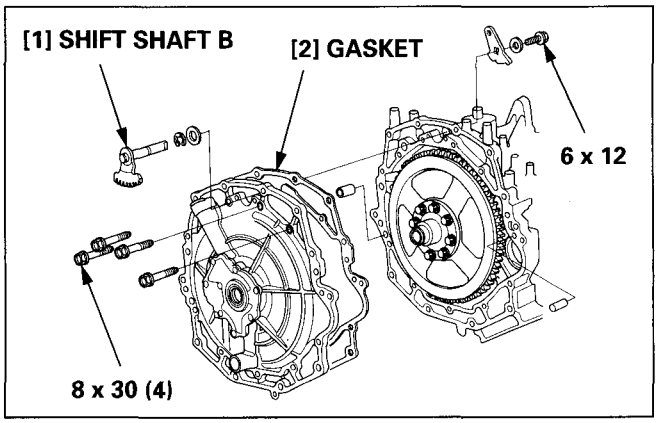
1. REMOVAL

- **OIL PUMP ASSEMBLY REMOVAL**

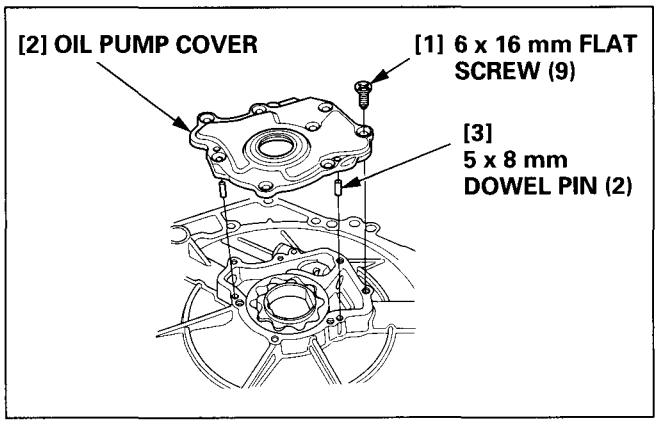
1) Remove the engine. (P.7-1)

2) Remove the 6 x 12 mm flange bolts from the shift shaft B, and remove the shift shaft B.

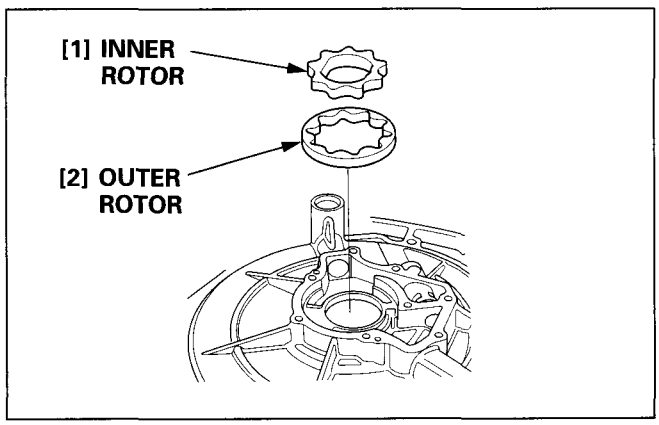
3) Remove the four 8 x 30 mm flange bolts and remove the oil pump assembly.



4) Remove the 6 x 16 mm flat screws from the oil pump body assembly and remove the oil pump cover.

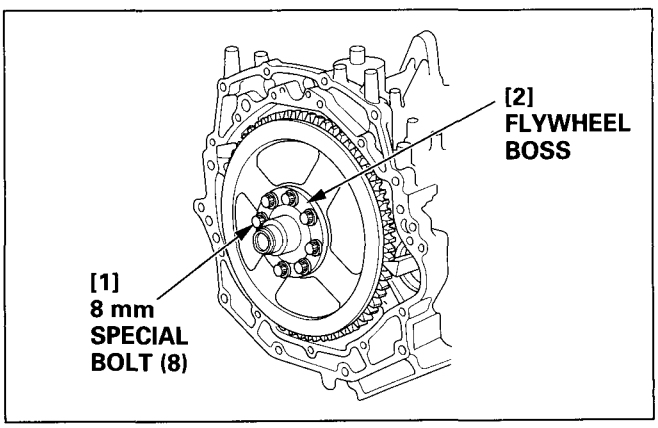


5) Remove the inner and outer rotors.



- **FLY WHEEL BOSS REMOVAL**

Remove the eight 8 mm special bolts and remove the fly-wheel boss.

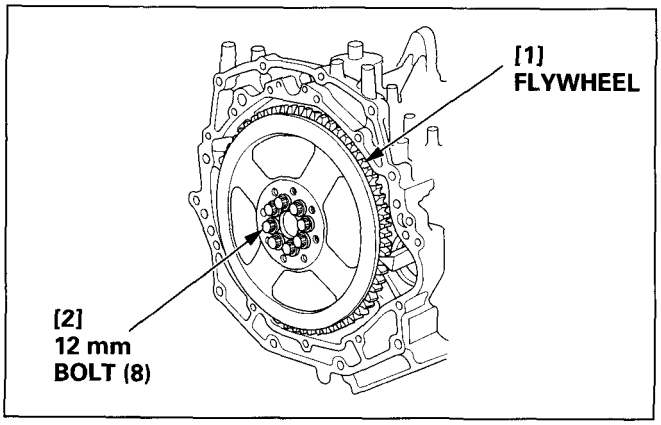


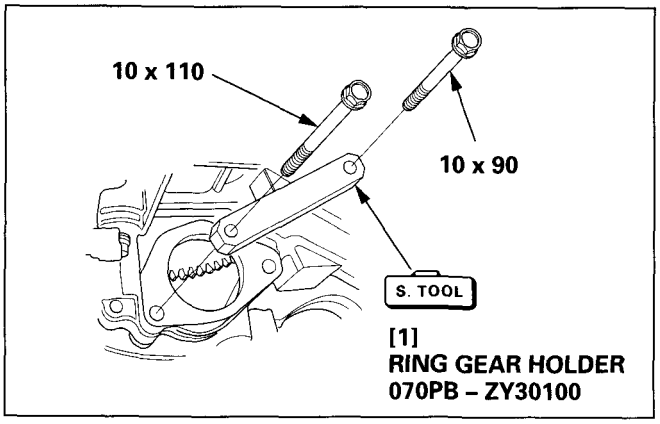
• FLYWHEEL REMOVAL

1) Set the special tool on the starter motor mounting position and tighten it with the 10 x 90 mm bolt and 10 x 110 mm bolt.

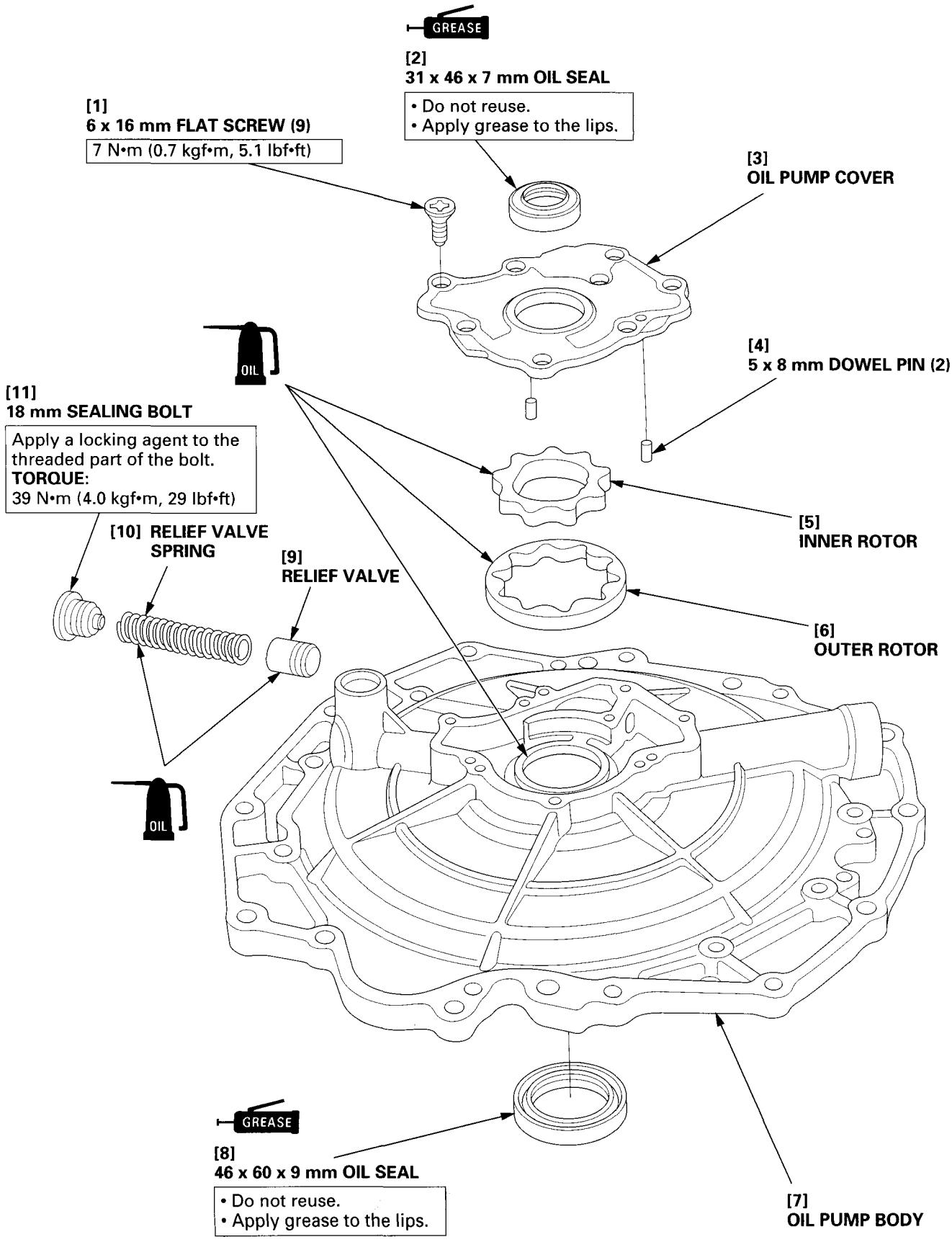
TOOL:
Ring gear holder **070PB – ZY30100**

2) Remove the 12 mm bolts and the flywheel.

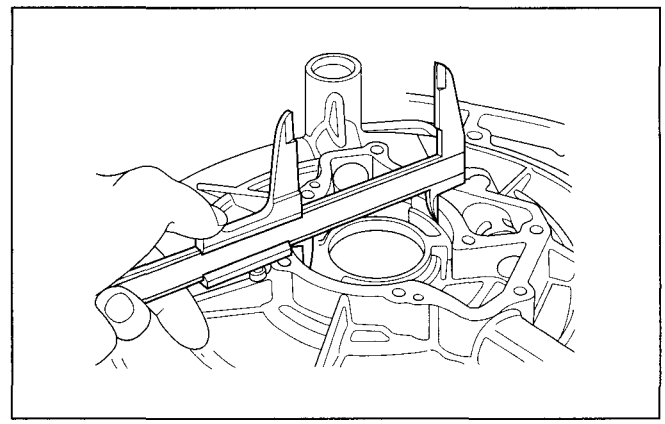




2. OIL PUMP DISASSEMBLY

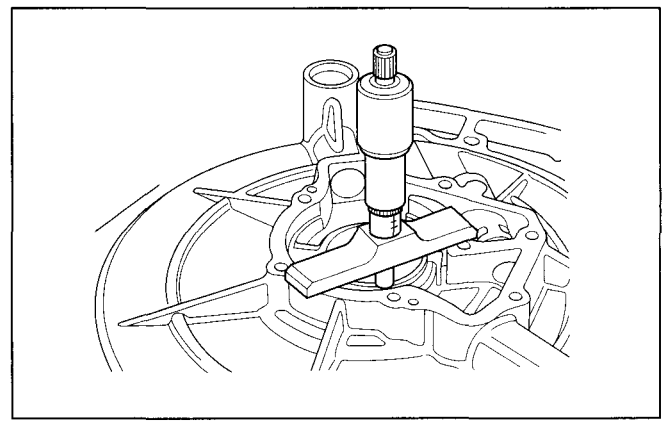


3. INSPECTION



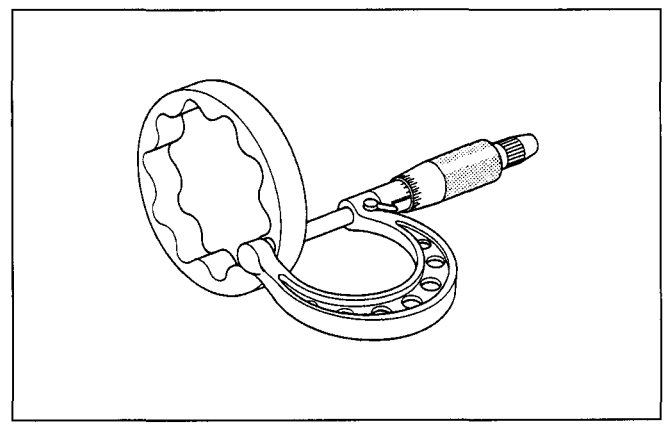
- **OIL PUMP BODY I.D.**

STANDARD	SERVICE LIMIT
84.000 – 84.030 mm (3.3071 – 3.3083 in)	———



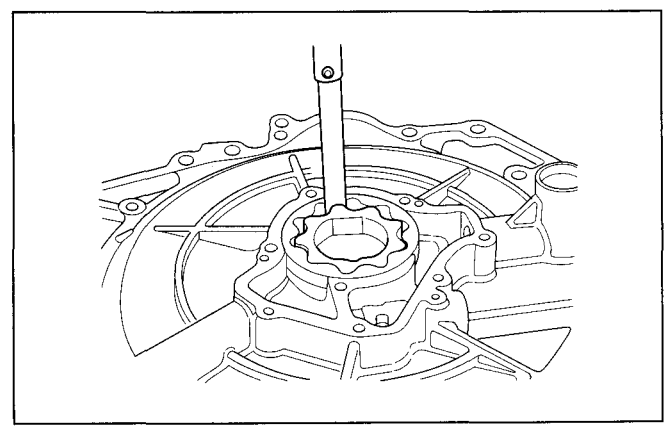
- **OIL PUMP BODY DEPTH**

STANDARD	SERVICE LIMIT
12.520 – 12.550 mm (0.4929 – 0.4941 in)	———



- **OUTER ROTOR HEIGHT**

STANDARD	SERVICE LIMIT
12.480 – 12.500 mm (0.4913 – 0.4921 in)	———

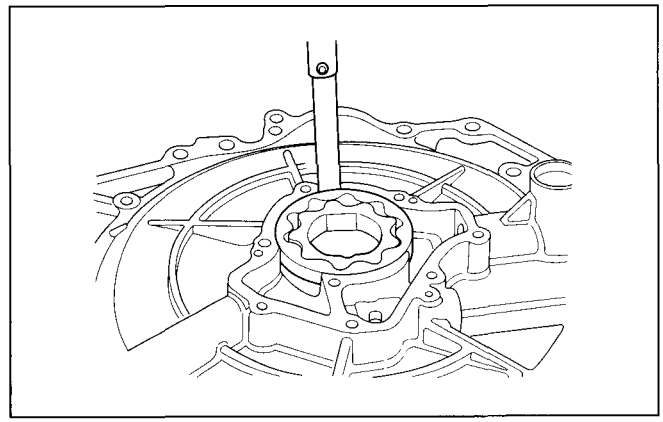


- **INNER ROTOR-TO-OUTER ROTOR CLEARANCE**

STANDARD	SERVICE LIMIT
0.04 – 0.16 mm (0.002 – 0.006 in)	0.20 mm (0.008 in)

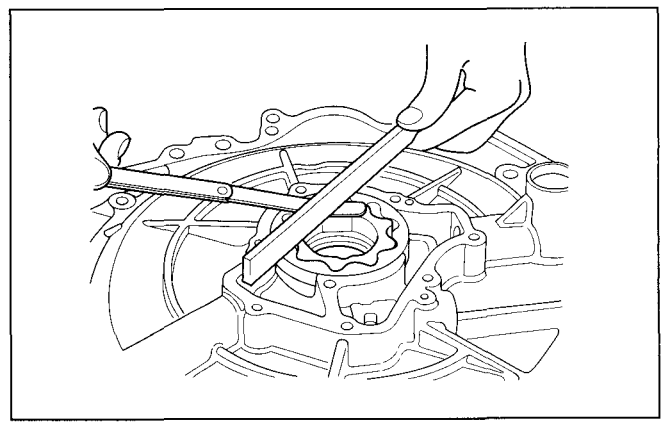
- **OUTER ROTOR-TO-PUMP BODY CLEARANCE**

STANDARD	SERVICE LIMIT
0.10 – 0.18 mm (0.004 – 0.007 in)	0.20 mm (0.008 in)

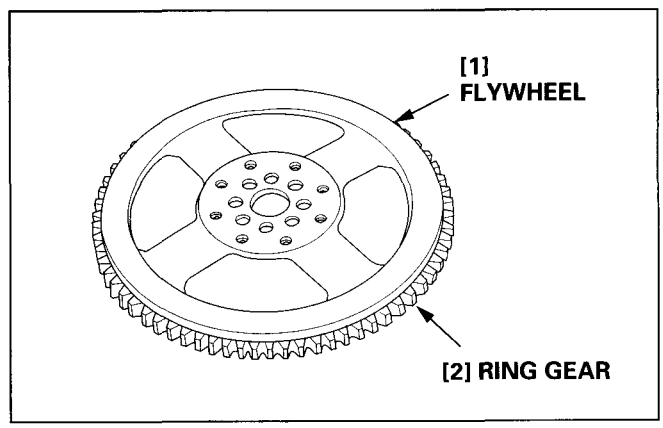


- **OUTER ROTOR-TO-OIL PUMP BODY SIDE CLEARANCE**

STANDARD	SERVICE LIMIT
0.02 – 0.07 mm (0.001 – 0.003 in)	0.12 mm (0.005 in)



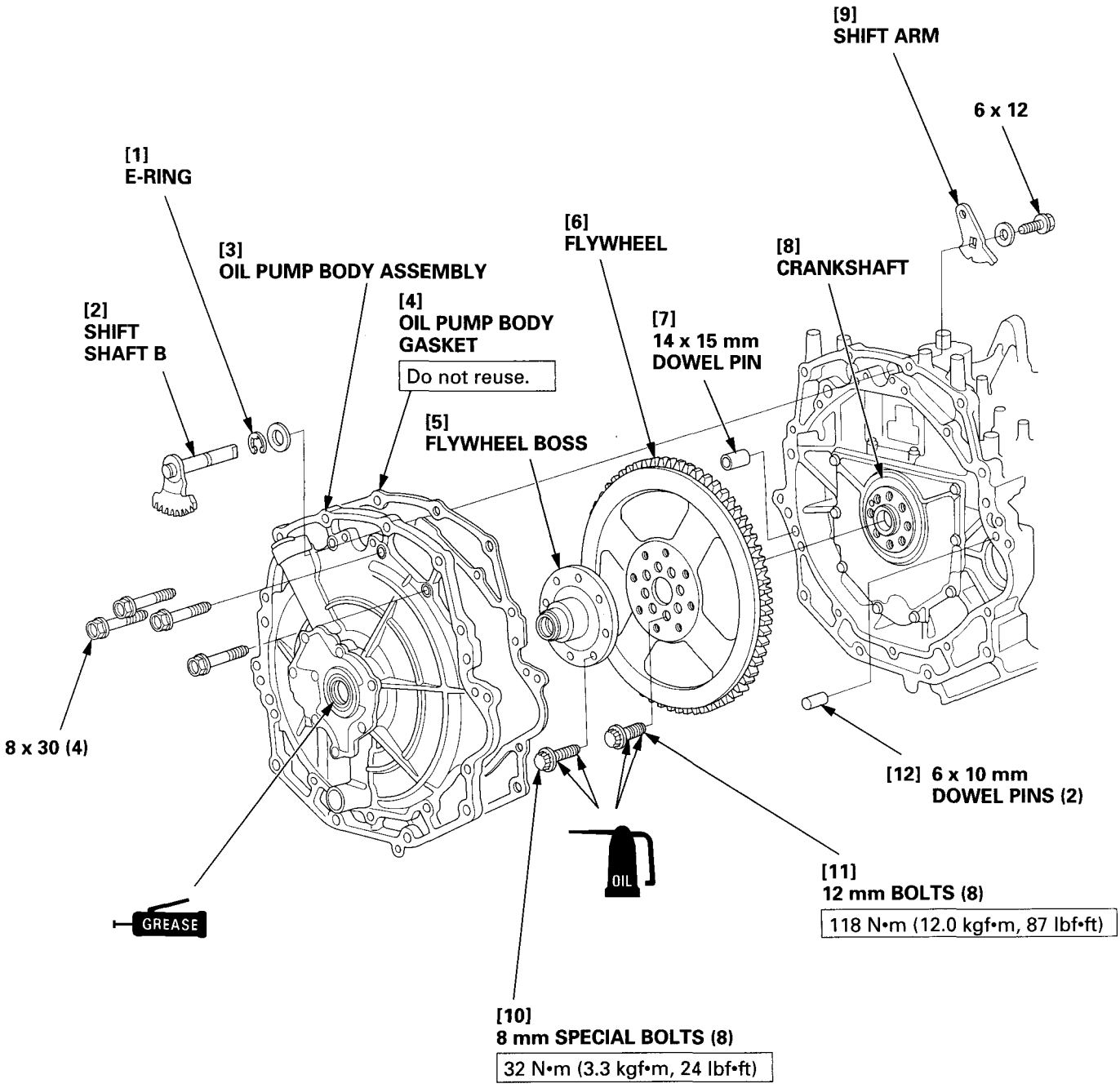
- **FLYWHEEL INSPECTION**
  - Check the ring gear for wear and damage. If the ring gear is worn or damaged, check the starter motor pinion gear as well (P. 17-13).



4. EXPLODED VIEW

NOTICE

Degrease oil from the mating surface between the crankshaft and the flywheel, and the mating surface between the flywheel and the flywheel boss, using a degreasing cleaning agent before installing the flywheel and the flywheel boss.



5. INSTALLATION:

• FLYWHEEL/FLYWHEEL BOSS INSTALLATION

1) Clean the mating surfaces between the crankshaft and the flywheel with a degreasing cleaning agent, and set the flywheel on the crankshaft.

2) Apply engine oil to the seat and the threaded part of the 12 mm bolt.

3) Loosely tighten the eight 12 mm bolts.
Install the special tool used for the flywheel boss/flywheel removal on the starter motor mounting position.

TOOL:
Ring gear holder **070PB – ZY30100**

4) Tighten the 12 mm bolts in the numbered sequence shown.
Tighten them in two or three steps to the specified torque.

TORQUE: 118 N•m (12.0 kgf•m, 87 lbf•ft)

5) Clean the mating surfaces between the flywheel and the flywheel boss with a degreasing cleaning agent, and set the flywheel boss on the flywheel.

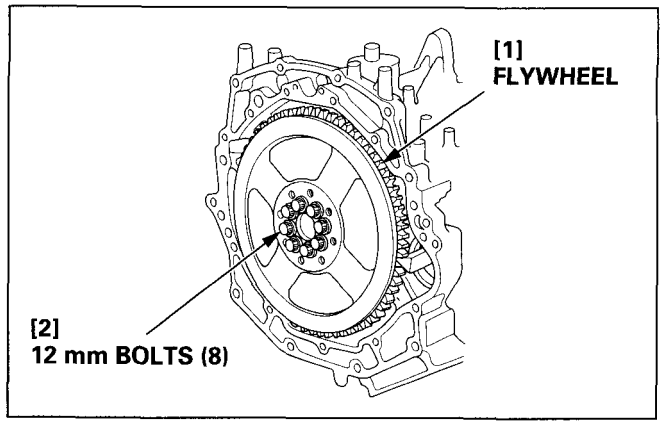
6) Apply engine oil to the seat and the threaded part of the 8 mm special bolt.

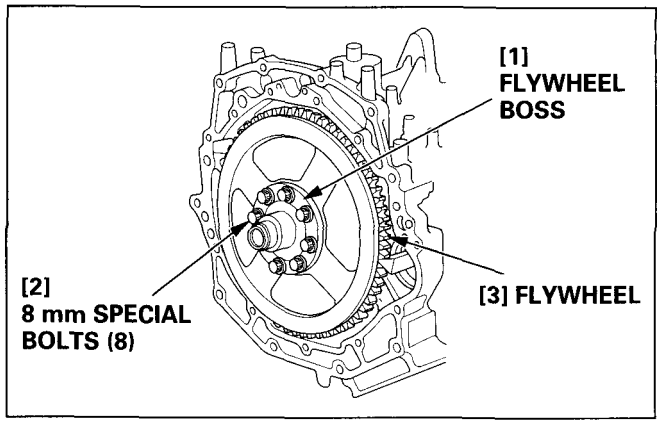
TOOL:
Ring gear holder **070PB – ZY30100**

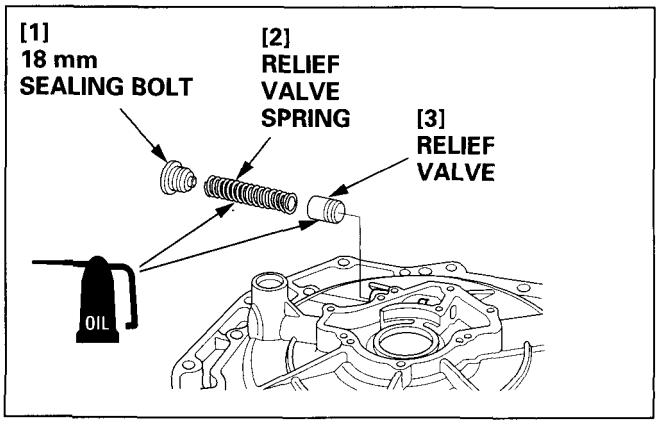
7) Loosely tighten the eight 8 mm special bolts, then tighten them in the numbered sequence shown to the specified torque.

TORQUE: 32 N•m (3.2 kgf•m, 24 lbf•ft)

NOTICE
Clean the mating surfaces between the crankshaft, flywheel and the flywheel boss thoroughly, using a degreasing cleaning agent.







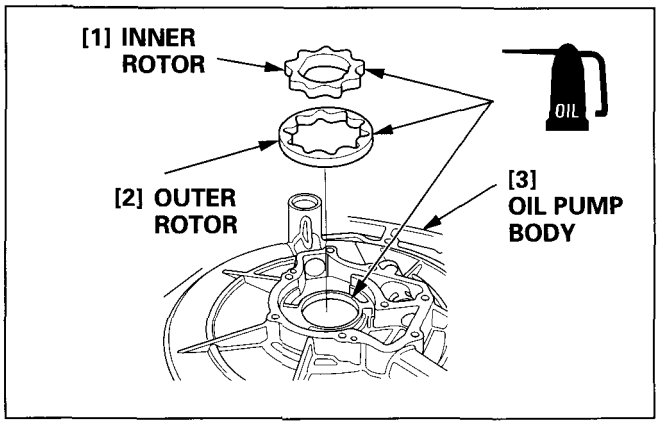
• OIL PUMP REASSEMBLY

1) Apply a locking agent to the threaded part of the bolt.

2) Check the valve surface for damage before installation.
Install the relief valve and the relief valve spring with the 18 mm sealing bolt.

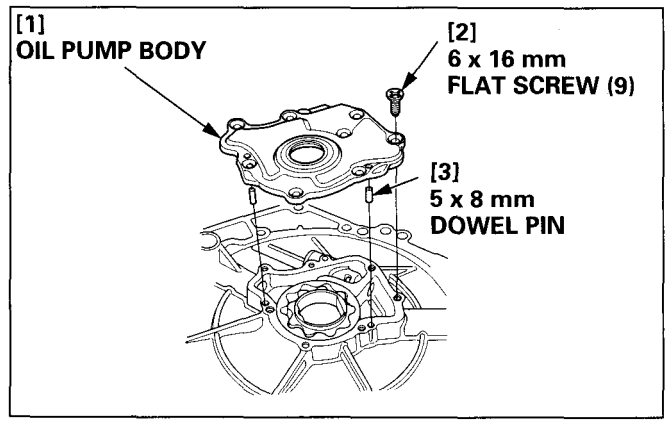
TORQUE: 39 N•m (4.0 kgf•m, 29 lbf•ft)

3) Clean the inner and outer rotors thoroughly. Apply the oil and set them to the oil pump body. Install the rotors same turn of disassembling.



4) Install the 5 x 8 mm dowel pins and install the oil pump cover with the 6 x 16 mm flat screws.

5) Inspect the rotor moves smoothly after reassembling.



- **46 x 60 x 9 mm OIL SEAL/31 x 46 x 7 mm OIL SEAL**

INSTALLATION:

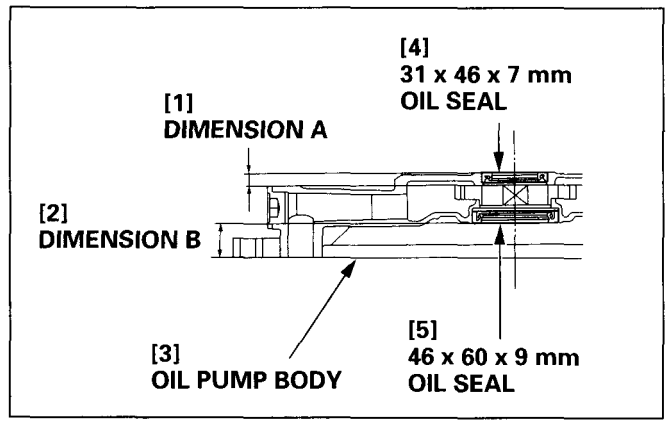
1) Apply grease to the lips of each oil seal.

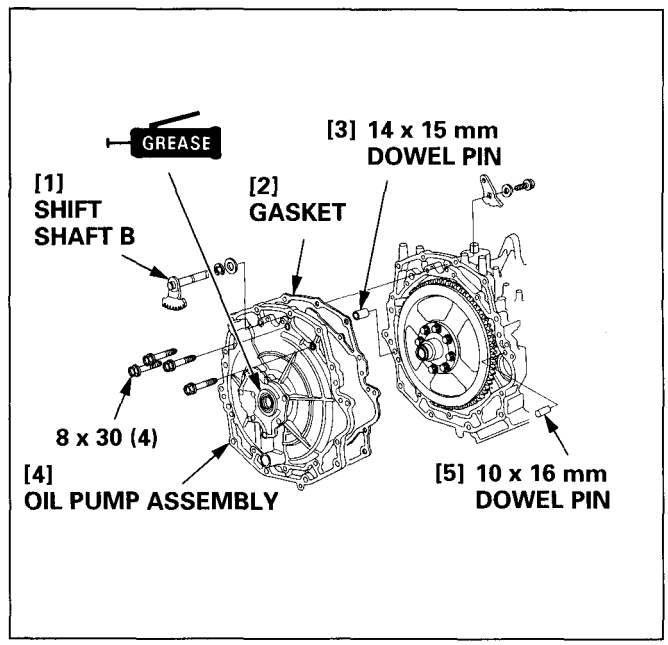
2) Using the special tools or hydraulic press, install each oil seal to the position shown.
   - Press-fit the 46 x 60 x 9 mm oil seal to the position 23.2 – 23.8 mm (0.24 – 0.27 in) (dimension A) from the body end to the oil seal face.
   - Press-fit the 31 x 46 x 7 mm oil seal to the position 8.7 – 9.3 mm (1.74 – 1.76 in) (dimension B) from the body end to the oil seal face with the oil pump cover mounted with the flat screws.

3) Install the 10 x 16 mm and 14 x 15 mm dowel pins.

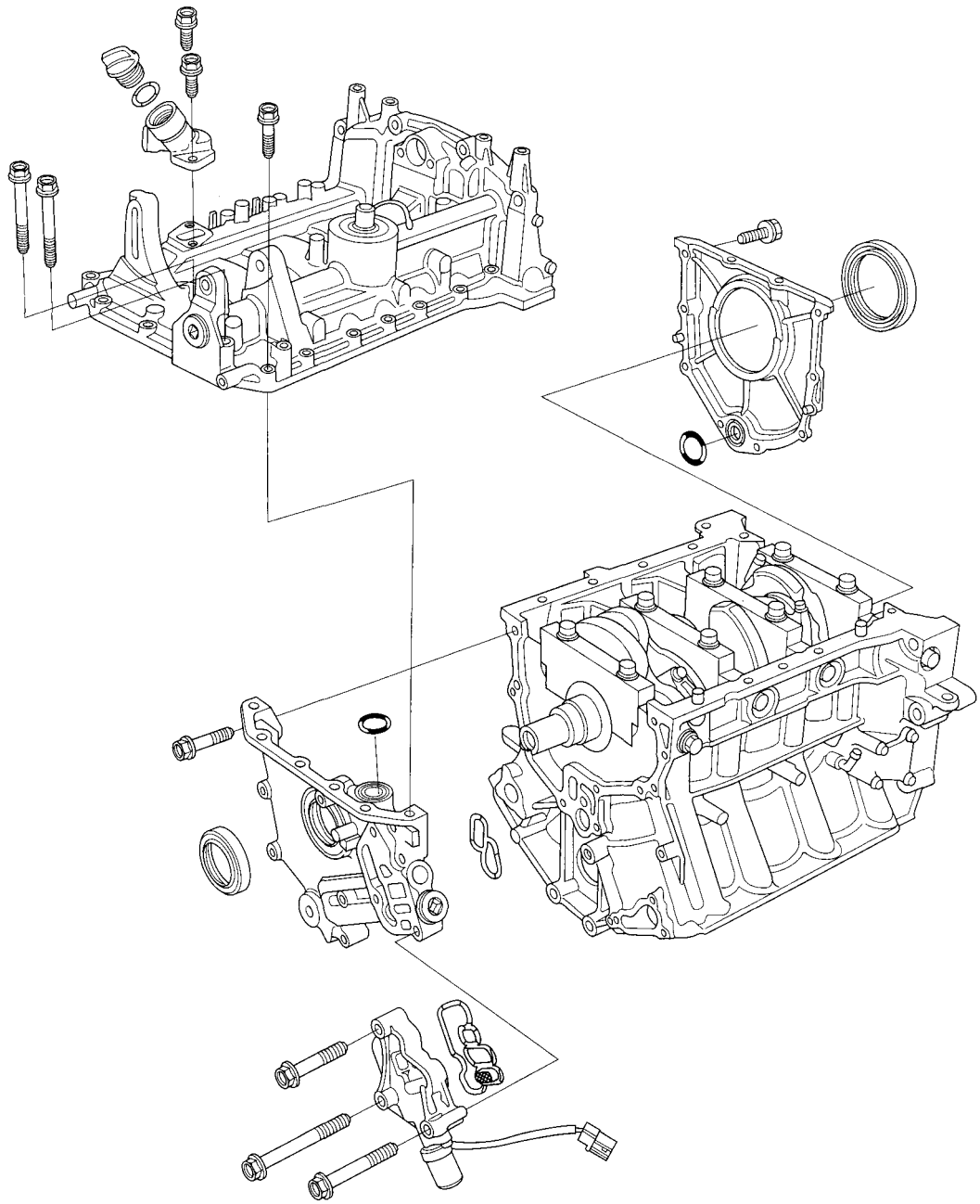
4) Replace the oil pump body gasket and install the oil pump assembly with the four 8 x 30 mm flange bolts.

5) Install the shift shaft B. (P. 7-8)





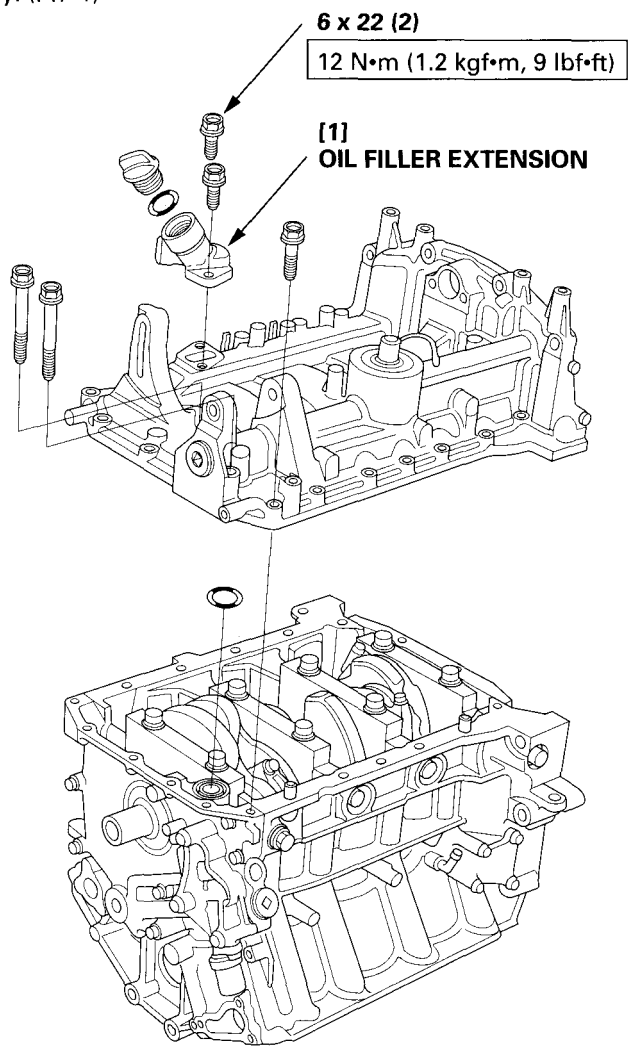
11. CYLINDER BLOCK/CRANKSHAFT/PISTON BF200A•225A



1. OIL FILLER EXTENSION

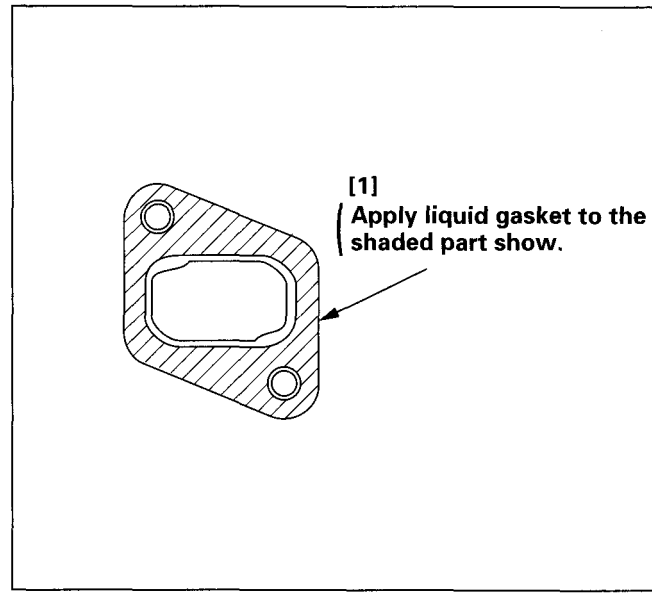
a. EXPLODED VIEW

1) Remove the engine assembly. (P.7-1)



b. INSTALLATION

1) Before installing the oil filler extension, apply liquid gasket (Three Bond #1141C or equivalent) to the shaded part shown.

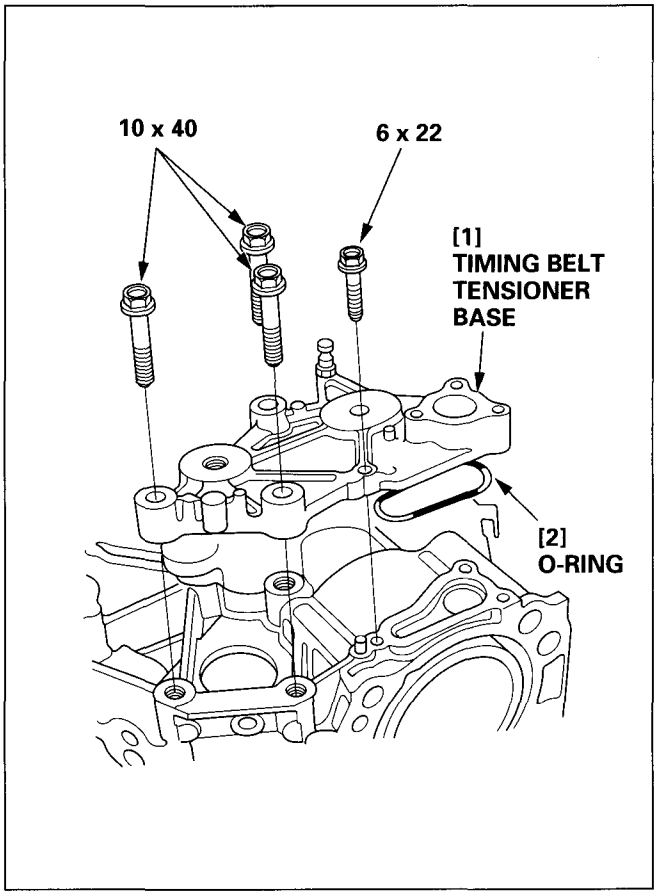


2. CRANKCASE COVER/CRANKSHAFT/ PISTON DISASSEMBLY

a. CRANKCASE COVER/CRANKSHAFT DISASSEMBLY

1) Remove the following parts.
   — Engine assembly (P. 7-1)
   — Cylinder head (P. 9-1)
   — Oil filter cartridge (P. 3-3)

2) Remove the 10 x 40 mm and 6 x 22 mm flange bolts and the timing belt tensioner base.

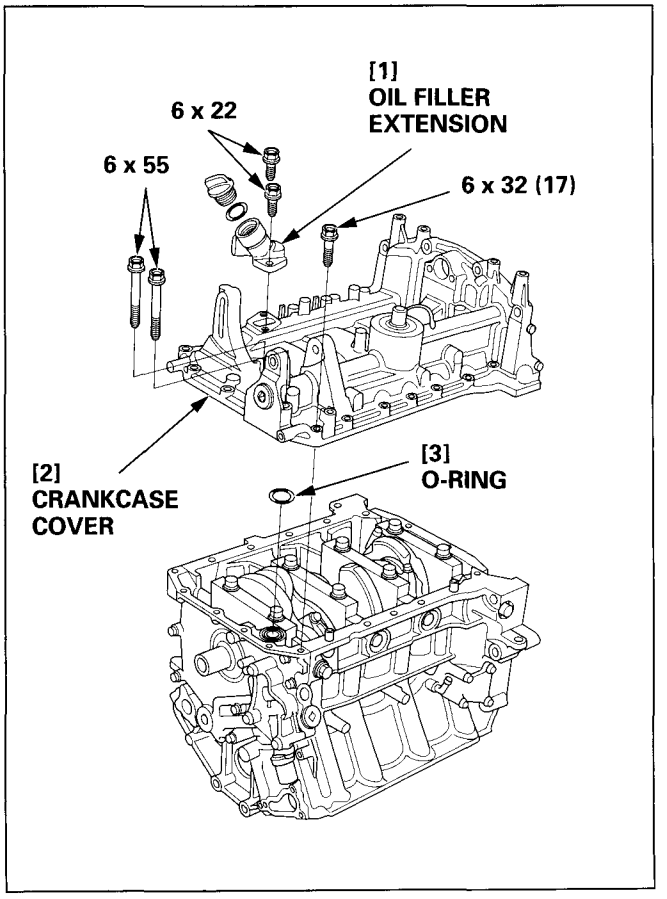


3) Remove the 6 x 22 mm flange bolts and oil filler extension from the crankcase cover.

4) Remove 6 x 32 mm and 6 x 55 mm flange bolts from the crankcase cover.

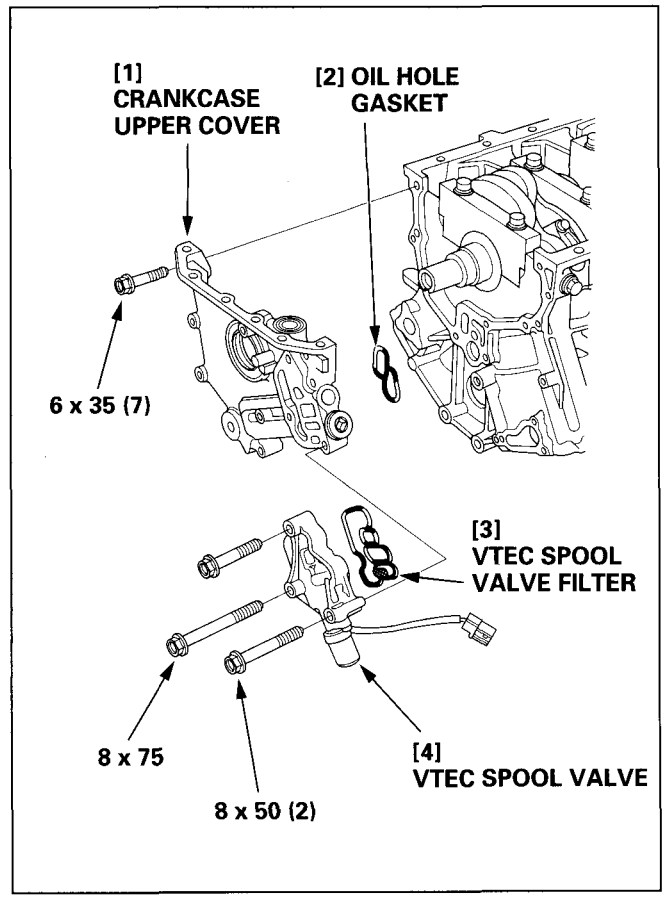
5) Insert a screwdriver or equivalent tool into the recesses in the crankcase, and raise the cylinder block slowly to remove it.
   • Do not damage the mating surfaces between the crankcase cover and the cylinder block during removal.

6) Remove the crankcase cover and the O-ring from the cylinder block.

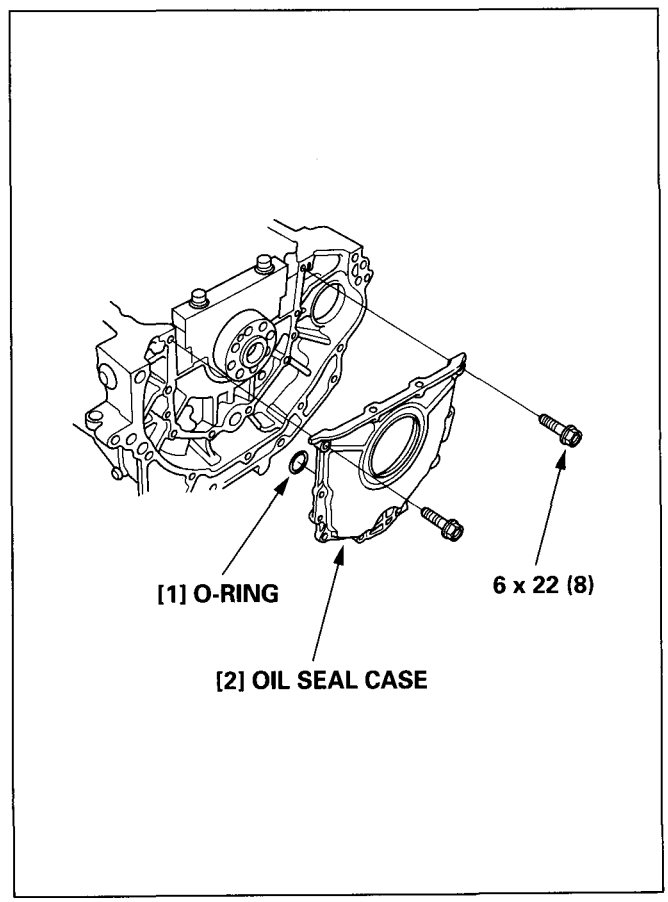


7) Remove the VTEC spool valve and the VTEC spool valve filter (BF225A).

8) Remove the crankcase upper cover and oil hole gasket.



9) Remove the oil seal case and the O-ring.



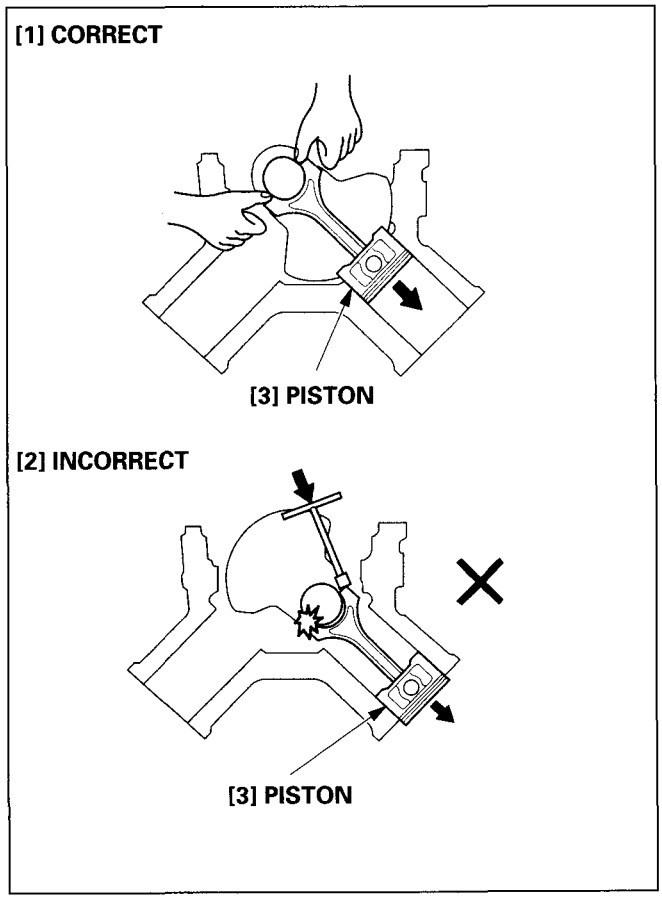
10) Set the piston at BDC for each cylinder.

11) Remove the connecting rod bolt and remove the connecting rod cap.

12) Remove the piston assembly by pushing on the connecting rod.

NOTICE

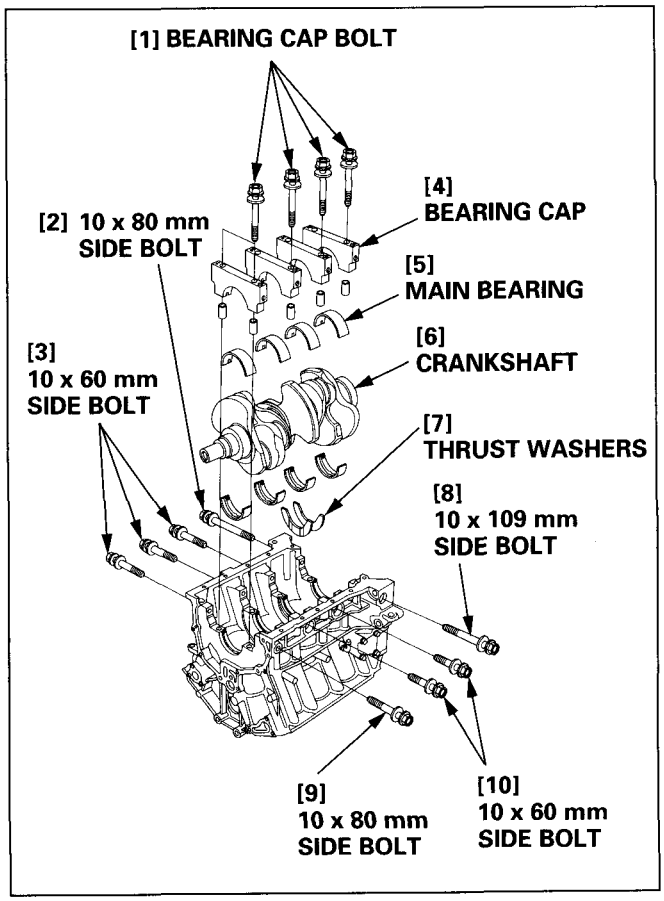
To avoid mix up during reassembly, mark each piston/connecting rod assembly with its cylinder number.



13) Remove the bearing cap side bolts and bearing cap bolts, then remove the bearing caps and the main bearings.

14) Check the main bearings, replace it if the main bearing is damaged.

15) Remove the crankshaft not to damage the journal pins.

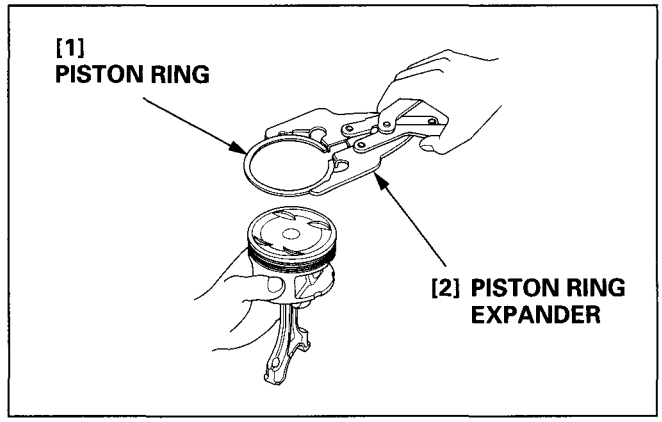


b. PISTON DISASSEMBLY

1) Remove the piston ring using a piston ring expander (commercially available).

NOTICE

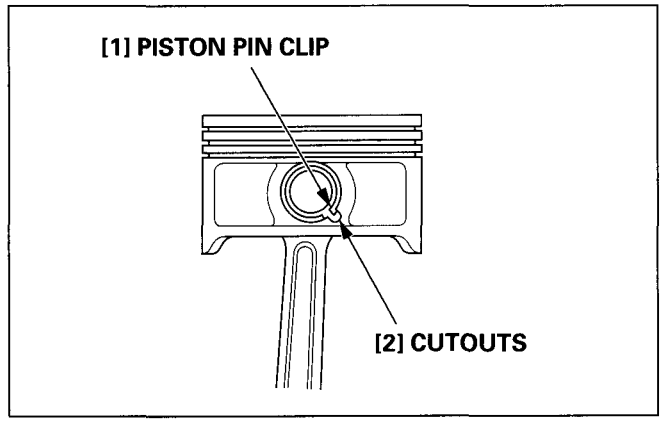
- Take care not to damage the piston ring by spreading the ends too far.
- Be careful not to damage the piston during the piston ring removal.



2) Apply engine oil to the piston pin clip and turn them in the ring grooves until the end gaps are lined up with the cutouts in the piston pin holes.

NOTICE

Take care not to damage the ring grooves.



3) Remove both piston pin clips. Start at the cutout in the piston pin holes.

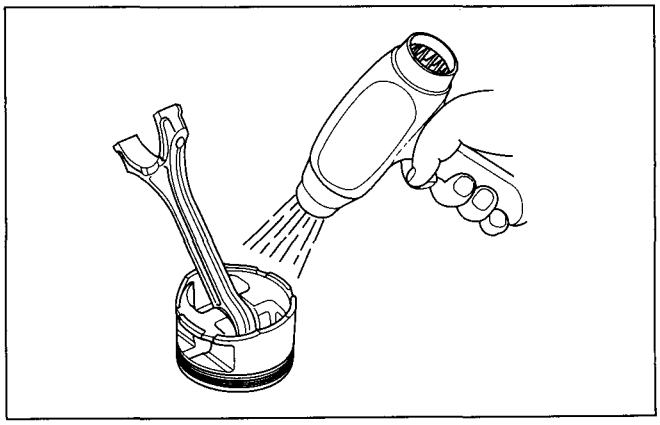
NOTICE

Remove the piston pin clips carefully so they do not go flying or get lost.

4) Heat the piston and connecting rod assembly to approximately 158°F (70°C), then remove the piston pin.

CAUTION:

Take care not to get your hand, etc. burned during disassembly.

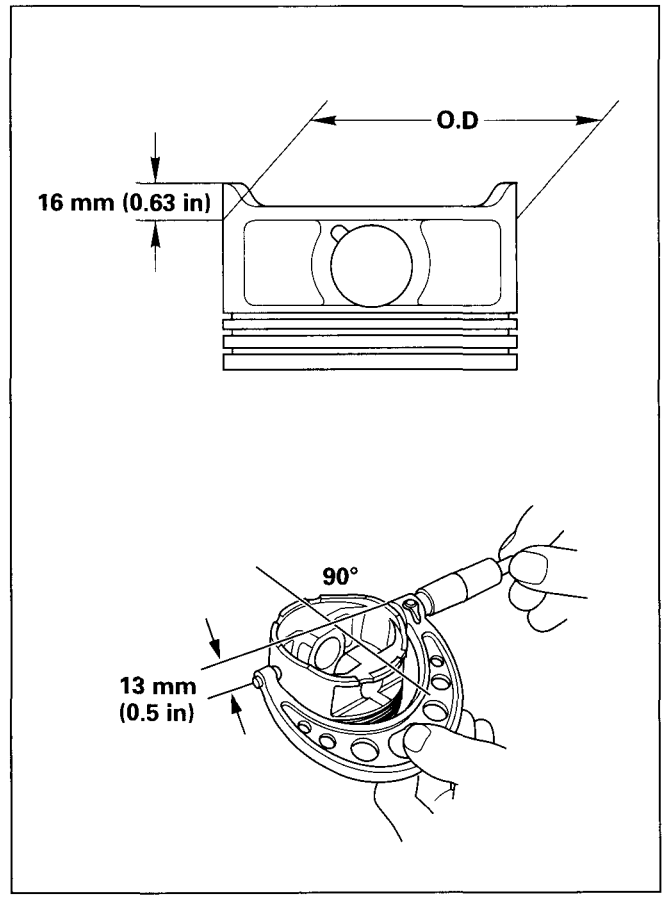


3. INSPECTION

• PISTON SKIRT O.D.

Measure and record the piston O.D. at a point 13 mm (0.5 in) from the bottom, and 90° to the piston pin bore.

STANDARD	SERVICE LIMIT
88.975 – 88.985 mm (3.503 – 3.503 in)	88.965 mm (3.503 in)



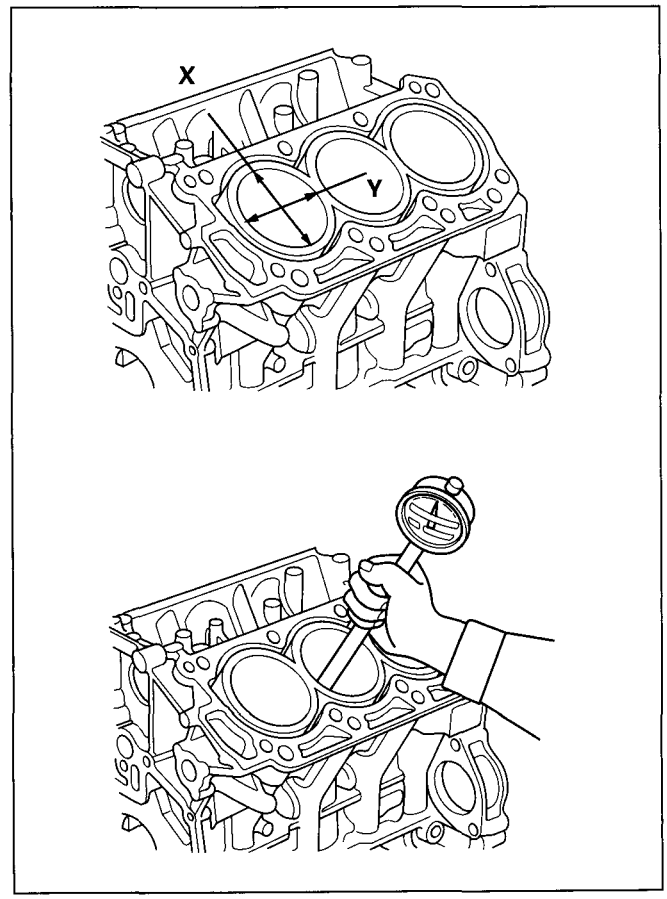
• CYLINDER I.D.

Measure and record the cylinder I.D. at three levels in both X and Y axis. Take the maximum reading to determine the cylinder wear.

STANDARD	SERVICE LIMIT
89.00 – 89.015 mm (3.504 – 3.505 in)	89.065 mm (3.506 in)

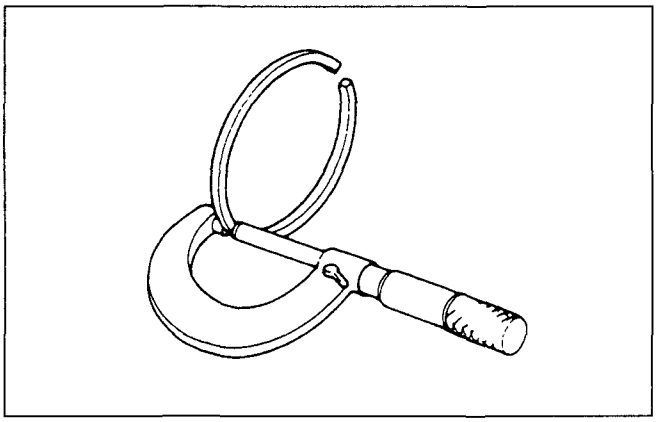
• PISTON-TO-CYLINDER CLEARANCE

STANDARD	SERVICE LIMIT
0.015 – 0.040 mm (0.001 – 0.002 in)	0.080 mm (0.003 in)



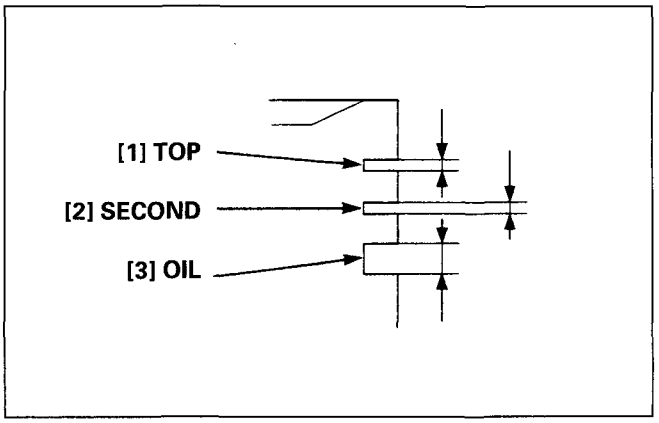
• PISTON RING THICKNESS

	STANDARD	SERVICE LIMIT
TOP	1.170 – 1.185 mm (0.0461 – 0.0467 in)	——
SECOND	1.175 – 1.190 mm (0.0462 – 0.0469 in)	——



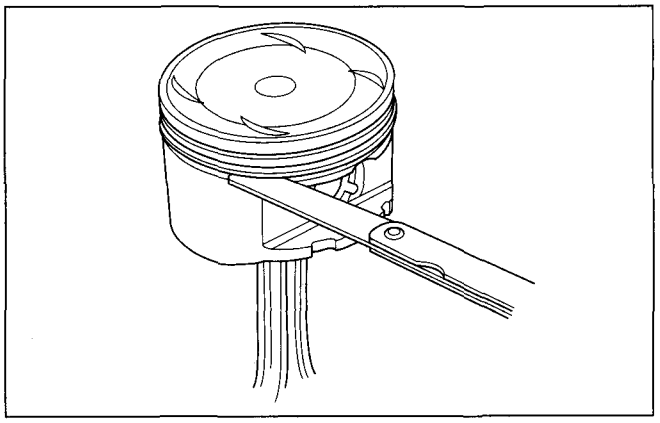
• PISTON RING GROOVE WIDTH

	STANDARD	SERVICE LIMIT
TOP/ SECOND	1.220 – 1.230 mm (0.0480 – 0.0484 in)	1.25 mm (0.049 in)
OIL	2.805 – 2.825 mm (0.1104 – 0.1112 in)	2.85 mm (0.112 in)



• PISTON RING SIDE CLEARANCE

	STANDARD	SERVICE LIMIT
TOP	0.035 – 0.060 mm (0.0014 – 0.0024 in)	0.13 mm (0.005 in)
SECOND	0.030 – 0.055 mm (0.0012 – 0.0022 in)	0.13 mm (0.005 in)

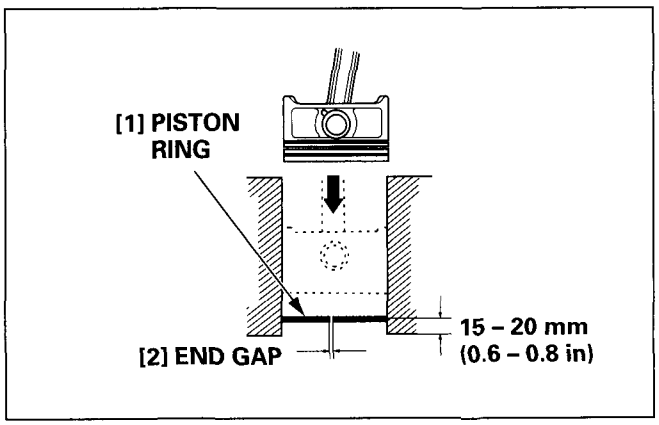


• PISTON RING END GAP

Measure the piston ring end gap 15 – 20 mm (0.6 – 0.8 in) from the cylinder bottom.
Before measurement, be sure to set the ring on the cylinder securely using the piston.

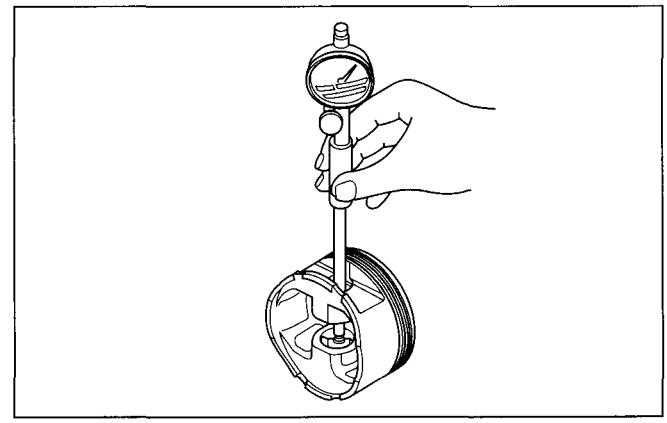
	STANDARD	SERVICE LIMIT
TOP	0.20 – 0.35 mm (0.008 – 0.014 in)	0.6 mm (0.024 in)
SECOND	0.40 – 0.55 mm (0.016 – 0.022 in)	0.7 mm (0.028 in)
OIL	0.20 – 0.70 mm (0.008 – 0.028 in)	0.8 mm (0.031 in)

If the measurement is too large, install a new piston ring and measure again. Then, measure the cylinder sleeve I.D. (P. 11-7).



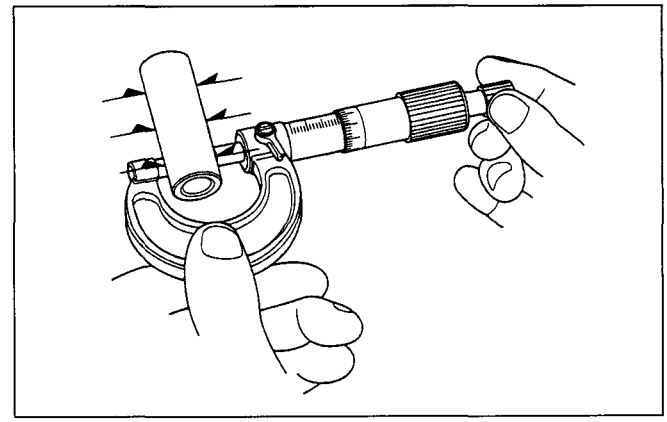
• PISTON PIN BORE I.D.

STANDARD	SERVICE LIMIT
21.960 – 21.963 mm (0.8645 – 0.8647 in)	———



• PISTON PIN O.D.

STANDARD	SERVICE LIMIT
21.961 – 21.965 mm (0.8646 – 0.8648 in)	21.954 mm (0.864 in)

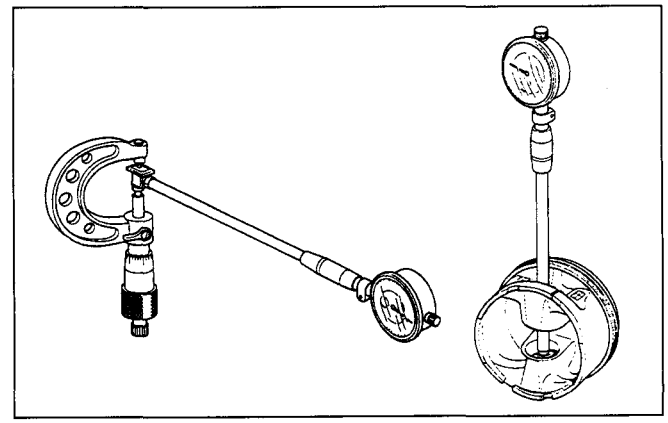


• PISTON PIN-TO-PIN BORE CLEARANCE

1) Set the cylinder gauge at the piston pin O.D., and set the gauge needle at zero "0".

2) Set the cylinder gauge in the piston pin hole, and measure the piston pin-to-pin bore clearance.

STANDARD	SERVICE LIMIT
–0.005 – +0.002 mm (–0.0002 – +0.0001 in)	———

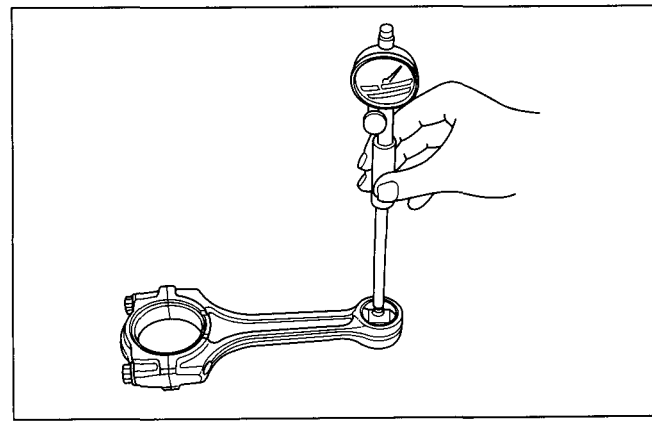


• CONNECTING ROD SMALL END I.D.

STANDARD	SERVICE LIMIT
21.970 – 21.976 mm (0.8650 – 0.8652 in)	———

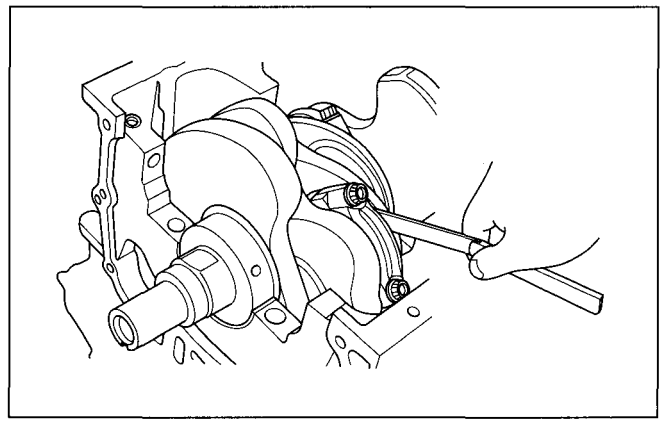
• CONNECTING ROD SMALL END-TO-PISTON PIN CLEARANCE

STANDARD	SERVICE LIMIT
0.005 – 0.015 mm (0.0002 – 0.0006 in)	———



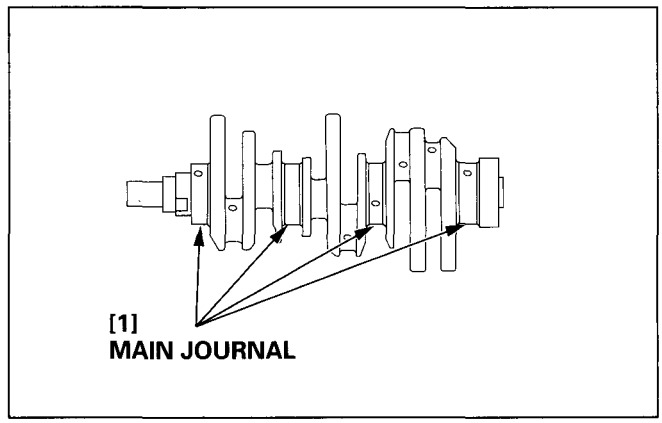
- **CONNECTING ROD BIG END AXIAL CLEARANCE**

STANDARD	SERVICE LIMIT
0.15 – 0.35 mm (0.006 – 0.014 in)	0.45 mm (0.018 in)



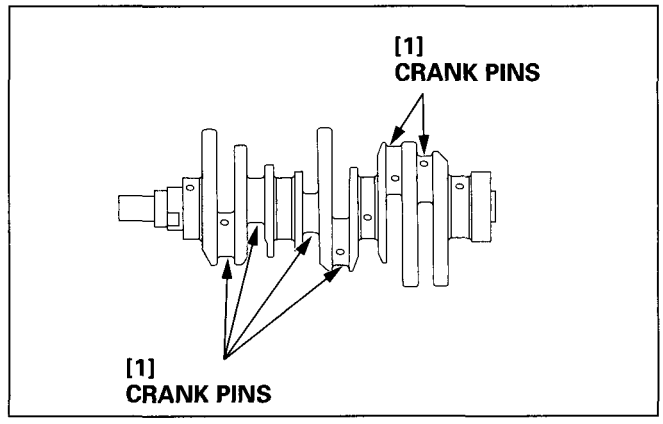
- **CRANKSHAFT MAIN JOURNAL O.D.**

STANDARD	SERVICE LIMIT
71.976 – 72.000 mm (2.834 – 2.835 in)	———



- **CRANK PIN O.D.**

STANDARD	SERVICE LIMIT
54.976 – 55.000 mm (2.164 – 2.165 in)	———



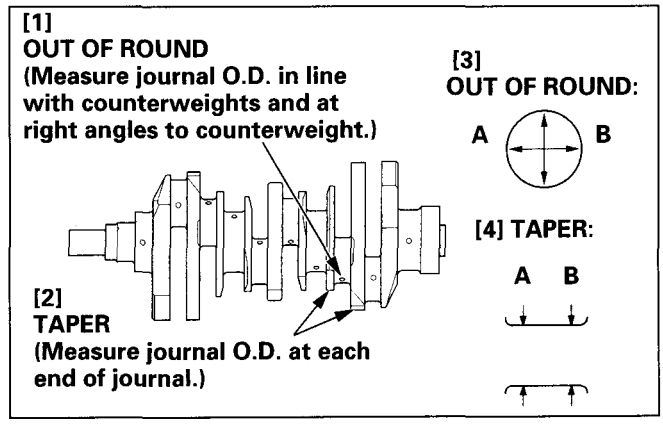
- **CRANKSHAFT JOURNAL ROUNDNESS (MAIN/CRANK PIN JOURNALS)**

1) Measure out-of-round at the middle of each rod and main journal in two places. The difference between measurements on each journal must not be more than the service limit.

STANDARD	SERVICE LIMIT
0.005 mm (0.0002 in) Max	0.0/00 mm (0.0004 in)

2) Measure taper at the edges of each rod and main journal. The difference between measurements on each journal must not be more than the service limit.

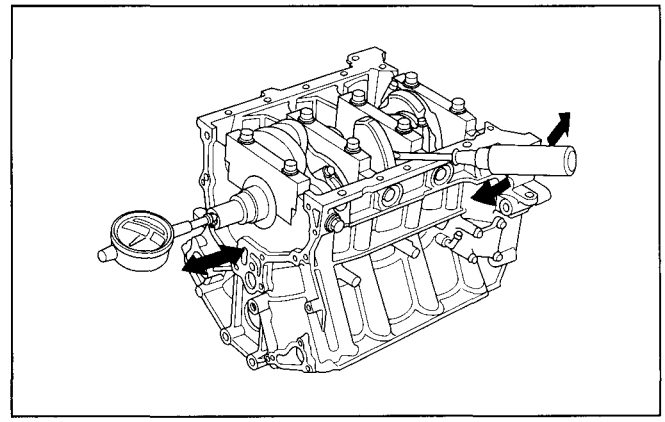
STANDARD	SERVICE LIMIT
0.005 mm (0.0002 in) Max	0.0/00 mm (0.0004 in)



• CRANKSHAFT AXIAL CLEARANCE

STANDARD	SERVICE LIMIT
0.10 – 0.35 mm (0.004 – 0.014 in)	0.45 mm (0.018 in)

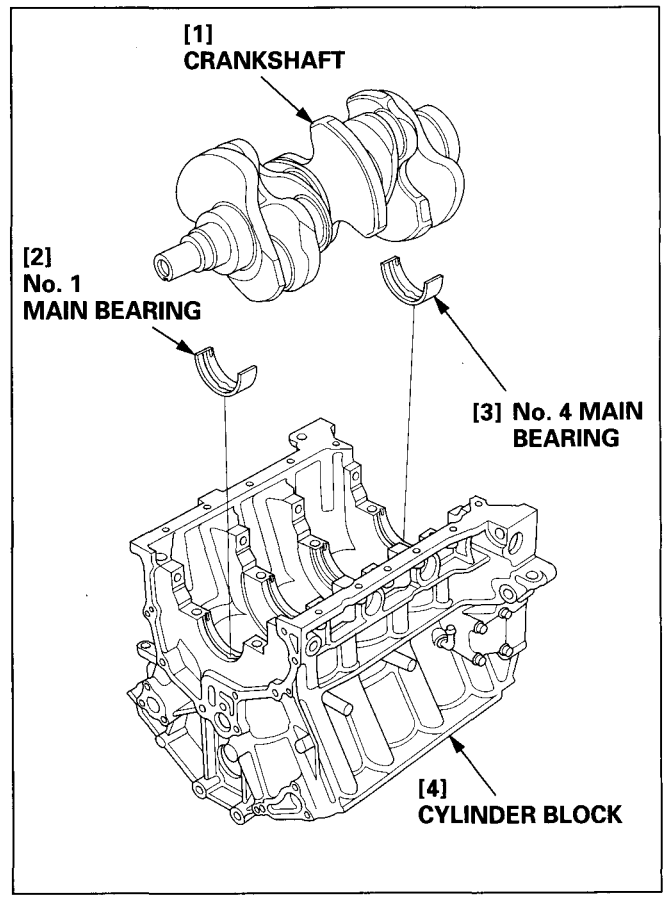
If the measurement exceeds the service limit, check the thrust washers and the thrust surface of the crankshaft and replace the thrust washers with new one.



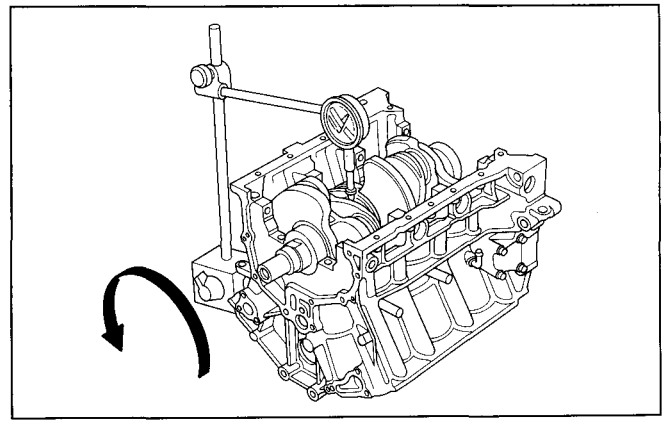
• CRANKSHAFT RUNOUT

1) Install the No.1 and No.4 main bearings to the cylinder block.

2) Install the crankshaft to the cylinder block.



STANDARD	SERVICE LIMIT
0.020 mm (0.001 in) Max	0.030 mm (0.001 in)

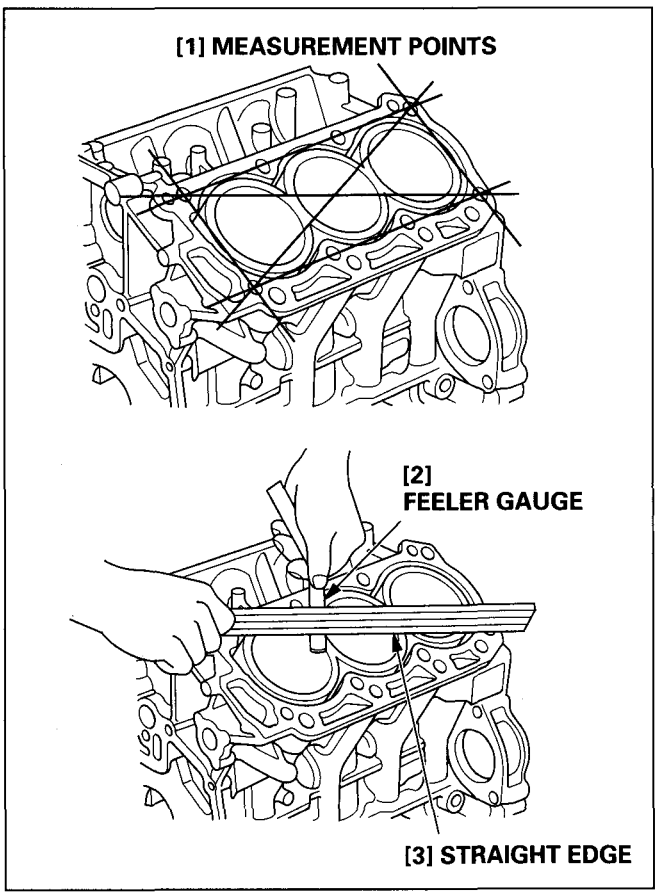


• CYLINDER HEAD SURFACE WARPAGE

1) Take care not to damage (scores, scratches, etc.) the mating surface with the gasket.

2) Measure the surface warpage using a straight edge and a feeler gauge as shown.

STANDARD	SERVICE LIMIT
0.07 mm (0.003 in) Max	0.10 mm (0.004 in)



• CONNECTING ROD BOLT

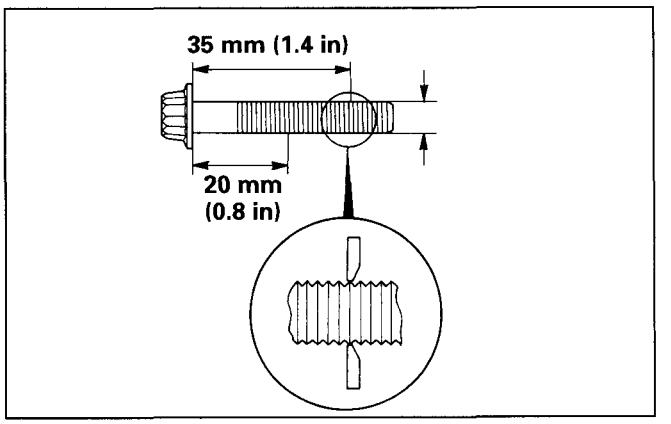
1) Measure the bolt O.D. at the two points as shown and calculate the gap between the measurements.

STANDARD	0 – 0.1 mm (0 – 0.004 in)

2) If the gap exceeds the standard value, replace the connecting rod bolt.

NOTICE

Measure the O.D. of all connecting rod bolts.



• CRANKSHAFT MAIN BEARING OIL CLEARANCE

1) To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.

2) Clean each main journal and bearing half with a clean shop towel.

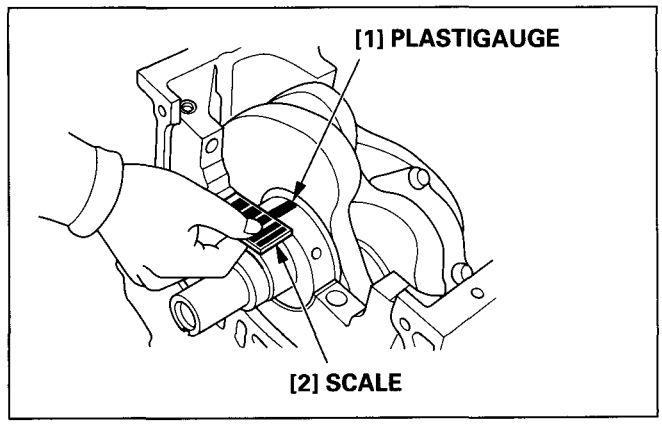
3) Place one strip of plastigage across each main journal.

4) Reinstall the bearings and caps, then torque the bolts. Do not rotate the crankshaft.

5) Remove the cylinder block and measure the pressured width of the plastigauge using the scale printed on the plastigauge's bag.

STANDARD	SERVICE LIMIT
0.020 – 0.044 mm (0.001 – 0.002 in)	0.050 mm (0.002 in)

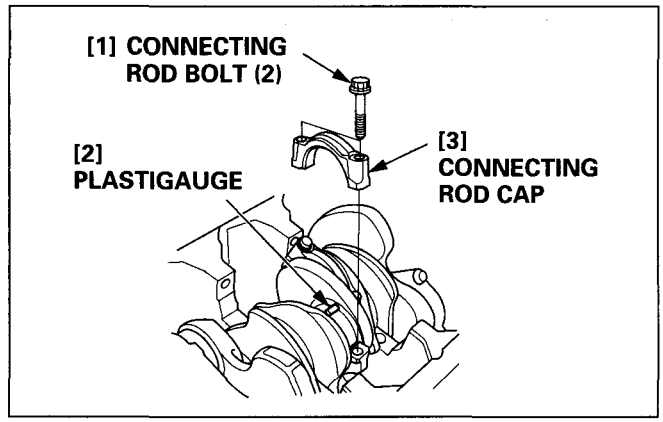
6) If the measurement exceeds the service limit, check the cylinder block and the cylinder block's main bearing I.D., and check the crankshaft main journal O.D.. If they are OK, replace with the undersize bearing by referring to the main bearing selection table and recheck the oil clearance.



• CONNECTING ROD BEARING OIL CLEARANCE

1) Wipe the oil off the crank pin and the connecting rod bearing mating surface.

2) Set the plastigauge on the crank pin. Set the connecting rod and cap by aligning the alignment marks on the connecting rod and the cap (P. 11-25).



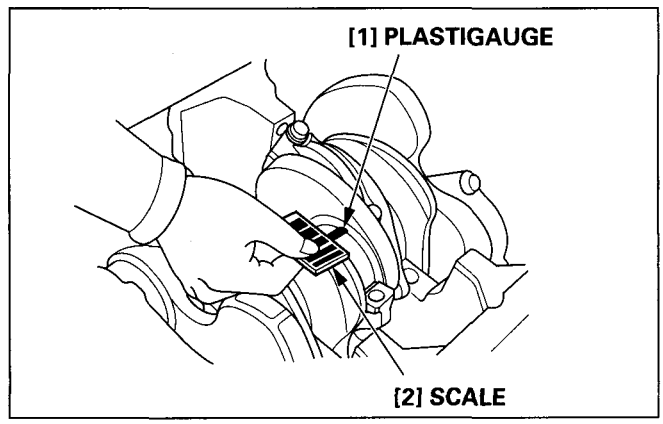
3) Tighten the connecting rod bolts to the specified torque. (P. 11-25)

NOTICE
- Set the plastigauges axially.
- Tighten the two nuts equally while holding the crankshaft not to turn.

4) Remove the connecting rod cap and measure the pressured width of the plastigauge using the scale printed on the plastigauge's bag.

STANDARD	SERVICE LIMIT
0.020 – 0.044 mm (0.001 – 0.002 in)	——

5) If the measurement exceeds the service limit, check the connecting rod big end I.D. and the crank pin O.D. If they are OK, replace with the undersize bearing by referring to the connecting rod bearing selection table (P.11-17), and measure the oil clearance again.



4. BEARING SELECTION

a. CRANKSHAFT MAIN BEARING

NOTICE

- When replacing the main bearing, check the crankshaft main journal code number and the cylinder block I.D. code letter or number, and select the correct bearing by referring to the bearing selection table.
- If the code letter and/or number is not clear, clean the area with a cleaning solvent and check again. Do not scrub with a stiff wire brush or driver to clean.

1) Check the cylinder block I.D. code letters or numbers and record them.

NOTICE

The cylinder block I.D. code letters or numbers are for the No.1 and the subsequent number journals when viewed from the left side code.

Cylinder block I.D. : 77 mm (3.031 in)

Code number	Tolerance ranges
A or I	+0.000 – +0.006 mm (+0.000 – +0.0002 in)
B or II	+0.006 – +0.012 mm (+0.0002 – +0. 0005 in)
C or III	+0.012 – +0.018 mm (+0.0005 – +0.0007 in)
D or IIII	+0.018 – +0.024 mm (+0.0007 – +0.0009 in)

2) Check the crankshaft main journal code numbers and record them.

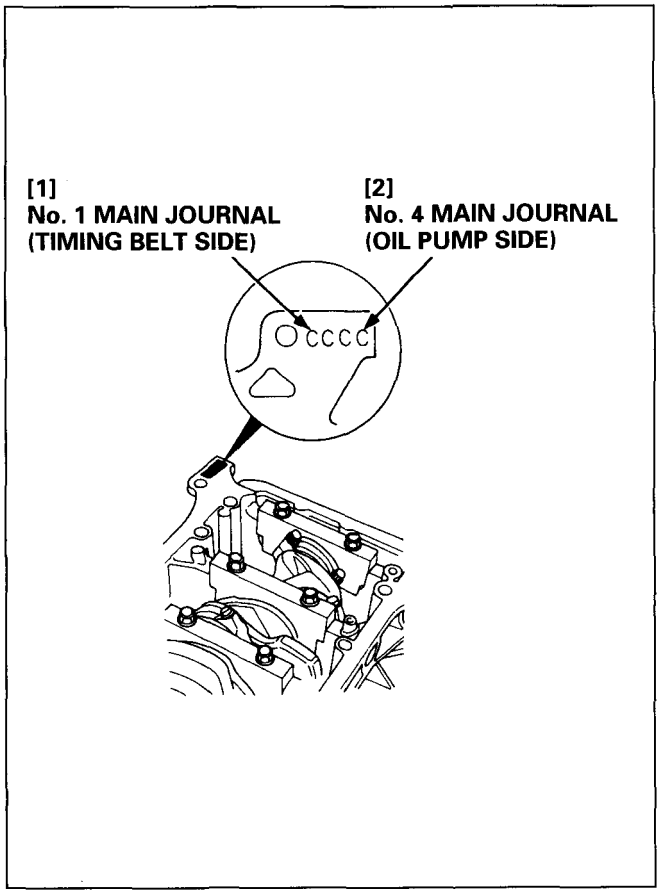
NOTICE

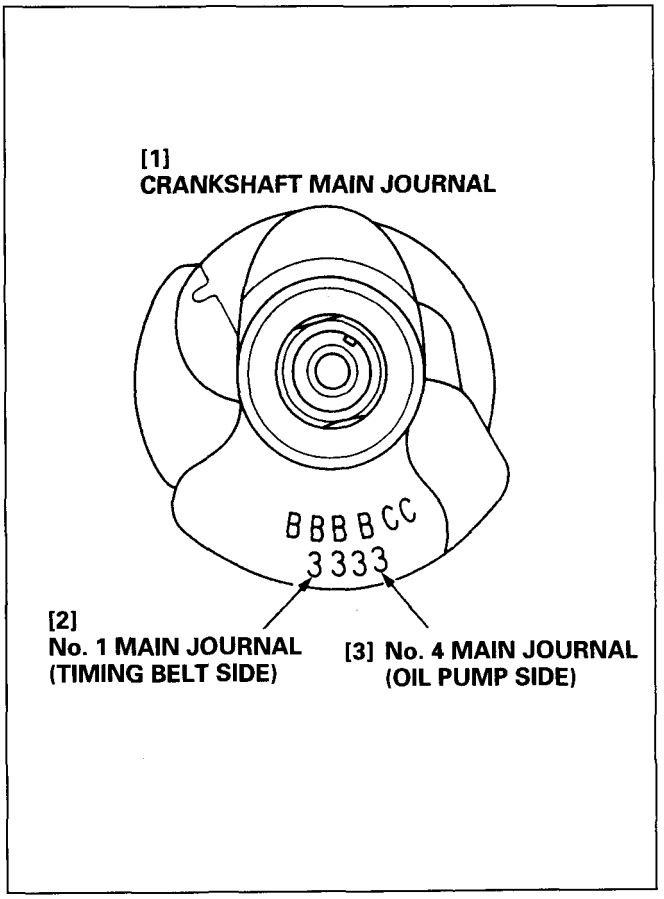
The crankshaft main journal code numbers are for the No.1 and the subsequent number journals when viewed from the arrow-mark side. The main journals are the No.1 and the subsequent number journals when viewed from the timing belt driven pulley side.

Crankshaft main journal: 72 mm (2.835 in)

Code number	Tolerance ranges
1 or I	0.000 – –0.004 mm (0.000 – –0.0002 in)
2 or II	–0.004 – –0.008 mm (–0.0002 – –0.0003 in)
3 or III	–0.008 – –0.012 mm (–0.0003 – –0.0005 in)
4 or IIII	–0.012 – –0.016 mm (–0.0005 – –0.0006 in)
5 or IIIII	–0.016 – –0.020 mm (–0.0006 – –0.0008 in)
6 or IIIIII	–0.020 – –0.024 mm (–0.0008 – –0.0009 in)

3) Select the correct bearing by referring to the cylinder block I.D. code letter or number and the crankshaft main journal code number.





Crankshaft main bearing selection table:

Crank-shaft main journal code number	Cylinder block I.D. code number or letter			
	A or I	B or II	C or III	D or IIII
	Bearing I.D. color			
1 or I	Red/ Pink	Pink	Pink/ Yellow	Yellow
2 or II	Pink	Pink/ Yellow	Yellow	Yellow/ Green
3 or III	Pink/ Yellow	Yellow	Yellow/ Green	Green
4 or IIII	Yellow	Yellow/ Green	Green	Green/ Brown
5 or IIIII	Yellow/ Green	Green	Green/ Brown	Brown
6 or IIIIII	Green	Green/ Brown	Brown	Brown/ Black

Main bearing identification table:

Number	I.D. color	Tolerance ranges
F	Red	–0.006 – –0.010 mm (–0.0002 – –0.0004 in)
E	Pink	–0.002 – –0.006 mm (–0.0001 – –0.0002 in)
D	Yellow	+0.002 – –0.002 mm (+0.0001 – –0.0001 in)
C	Green	+0.006 – +0.002 mm (+0.0002 – +0.0001 in)
B	Brown	+0.010 – +0.006 mm (+0.0004 – +0.0002 in)
A	Black	+0.014 – +0.010 mm (+0.0006 – +0.0004 in)

When using bearing halves of different colors, it does not matter which color is used in the top or bottom. Each rod falls into one of six tolerance ranges (from –0.006 mm (–0.0002 in) to 0.010 mm (0.0004 in)), in 0.004 mm (0.0002 in).

4) Note that the bearings are selected so that the oil clearance is in the range between 0.020 – 0.044 mm (0.0008 – 0.00017 in.)

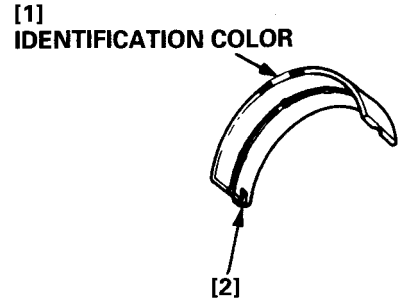
5) After installing the selected bearing(s), measure the oil clearance (P. 11-13).

6) Apply the molybdenum disulfide oil to the crankshaft mating surface. Do not apply to the crankcase mating surface.

   Align the bearing lug with the grooves in the crankcase and cylinder block, and assemble carefully not to damage the sliding surface.

NOTICE

- Be sure to measure the main bearing oil clearance after selecting the bearing by referring to the selection table.
- If the two bearing I.D. colors are shown on the selection table, use a bearing of the respective colors.



b. CONNECTING ROD BEARING

NOTICE

- When replacing the connecting rod bearing, check the crank pin code letter and the connecting rod code number, and select the correct bearing by referring to the bearing selection table.
- If the code letters and/or numbers are not clear, clean the areas with a cleaning solvent and check again. Do not scrub with a stiff wire brush or driver to clean.

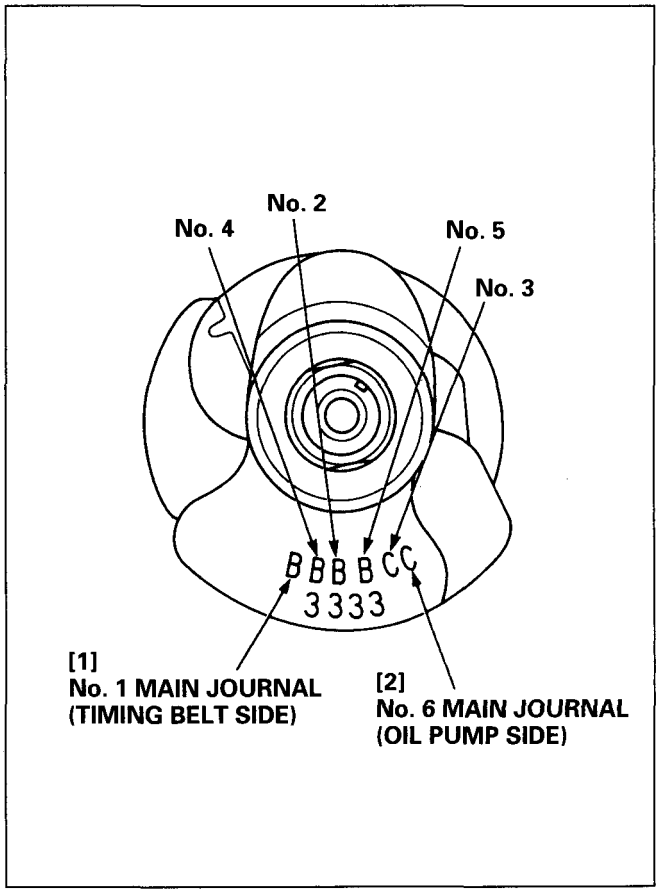
1) Check the crank pin code letters and record them.

NOTICE

The crank pin code letters are for the No. 1 and the subsequent number journals when viewed from left side.

Crank pin : 55 mm (2.165 in)

Code number	Tolerance ranges
A or I	0.000 – –0.004 mm (0.000 – –0.0002 in)
B or II	–0.004 – –0.008 mm (–0.0002 – –0.0003 in)
C or III	–0.008 – –0.012 mm (–0.0003 – –0.0005 in)
D or IIII	–0.012 – –0.016 mm (–0.0005 – –0.0006 in)
E or IIIII	–0.016 – –0.020 mm (–0.0006 – –0.0008 in)
F or IIIIII	–0.020 – –0.024 mm (–0.0008 – –0.0009 in)



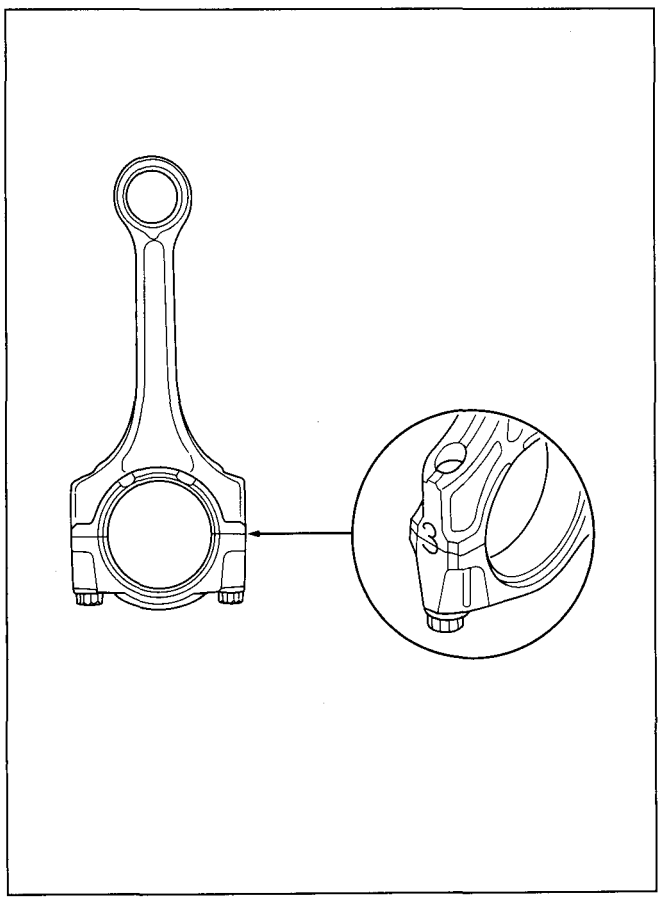
2) Check the connecting rod code numbers and record them.

NOTICE

The connecting rod code numbers are for the No.1 and the subsequent number journals when viewed from the timing belt driven pulley side.

Connecting rod : 58 mm (2.283 in)

Code number	Tolerance ranges
1 or I	0.000 – +0.006 mm (0.000 – +0.0002 in)
2 or II	+0.006 – +0.012 mm (+0.0002 – +0.0005 in)
3 or III	+0.012 – +0.018 mm (+0.0005 – +0.0007 in)
4 or IIII	+0.018 – +0.024 mm (+0.0007 – +0.0009 in)



3) Select the correct bearing by referring to the crank pin code letter and the connecting rod code number.

Connecting rod bearing selection table:

Crank pin code letter	Connecting rod code number			
	1 or I	2 or II	3 or III	4 or IIII
	Bearing I.D. color			
A or I	Pink	Pink/ Yellow	Yellow	Yellow/ Green
B or II	Pink/ Yellow	Yellow	Yellow/ Green	Green
C or III	Yellow	Yellow/ Green	Green	Green/ Brown
D or IIII	Yellow/ Green	Green	Green/ Brown	Brown
E or IIIII	Green	Green/ Brown	Brown	Brown/ Black
F or IIIIII	Green/ Brown	Brown	Grown/ Black	Black

Connecting rod bearing identification table:

Number	I.D. color	Tolerance ranges
E	Pink	–0.001 – –0.005 mm (–0.00004 – 0.0002 in)
D	Yellow	+0.003 – –0.001 mm (+0.0001 – –0.00004 in)
C	Green	+0.007 – +0.003 mm (+0.0003 – +0.0001 in)
B	Brown	+0.011 – +0.007 mm (+0.0004 – +0.0003 in)
A	Black	+0.015 – +0.011 mm (+0.0006 – +0.0004 in)

When using bearing halves of different colors, it does not matter which color is used in the top or bottom.
Each rod falls into one of five tolerance ranges (from–0.001 mm (–0.0002 in) to 0.011 mm (0.0004 in)), in 0.004 mm (0.0002 in).

4) Note that the bearings are selected so that the oil clearance is in the range between 0.026 – 0.044 mm (0.0010 – 0.0017 in).

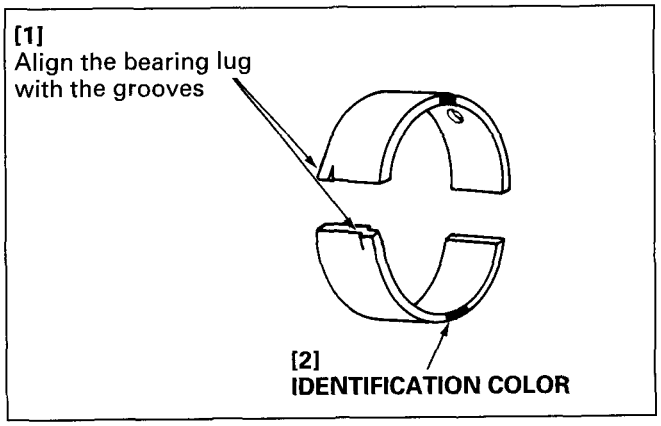
5) Be sure to measure the oil clearance after installing the selected bearing(s) (P. 11-14).

6) Apply engine oil to the entire surface of the bearings.

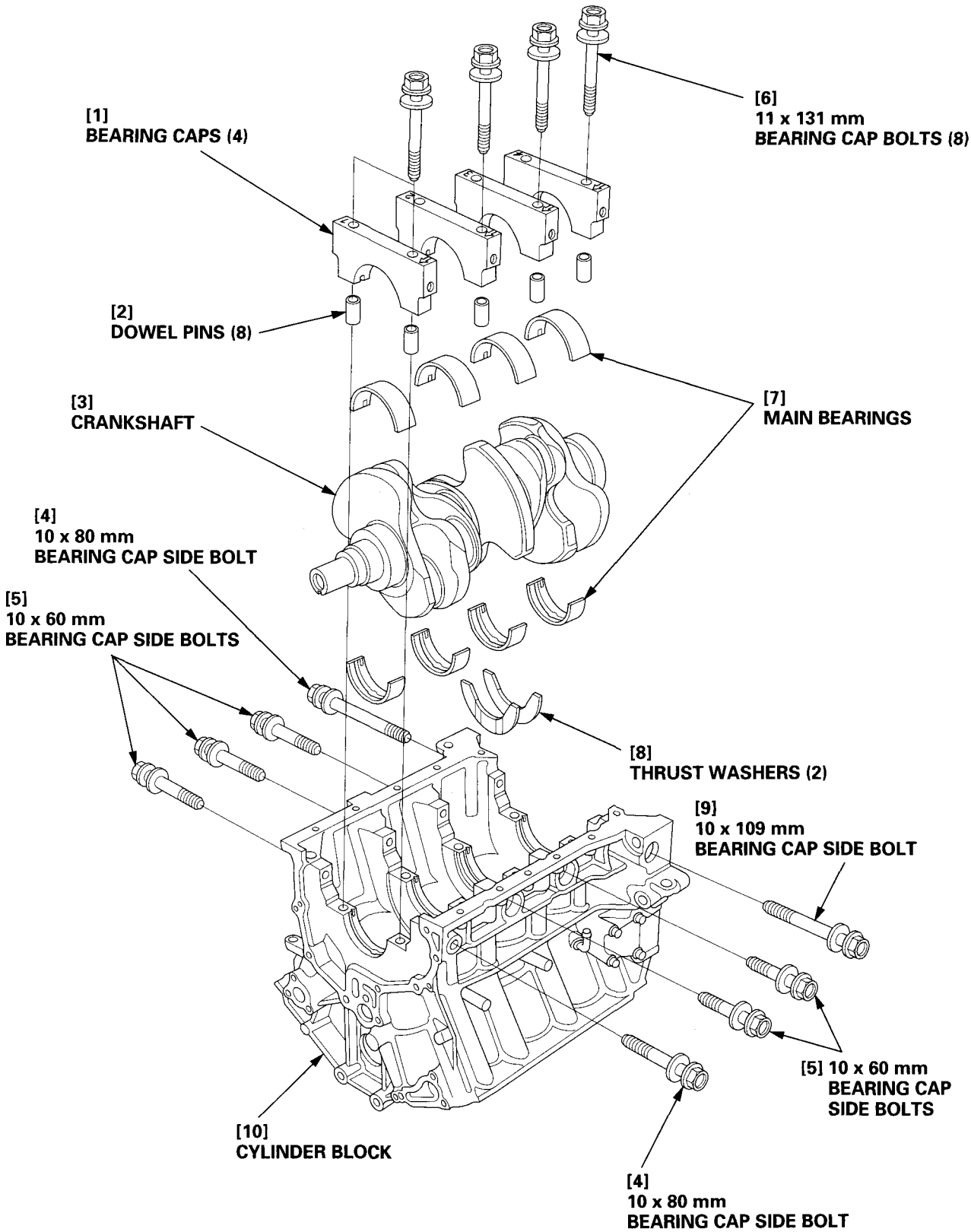
Align the bearing lug with the cutout in the connecting rod or cap, and install with care not to damage the sliding surface.

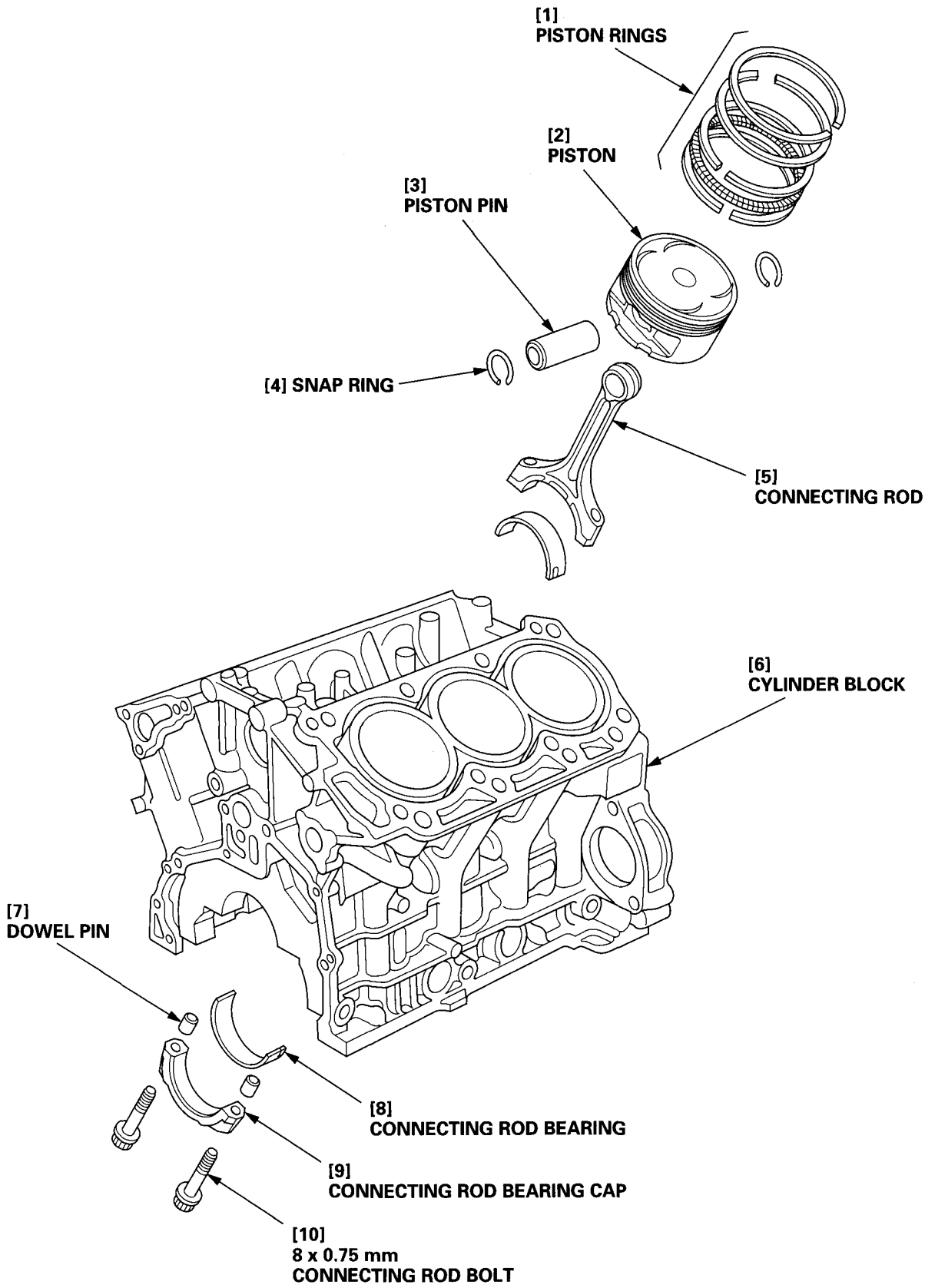
NOTICE

- Be sure to measure the main bearing oil clearance after selecting the bearing by referring to the selection table.
- If the two bearing I.D. colors are shown on the selection table, use a bearing of the respective colors.



5. EXPLODED VIEW



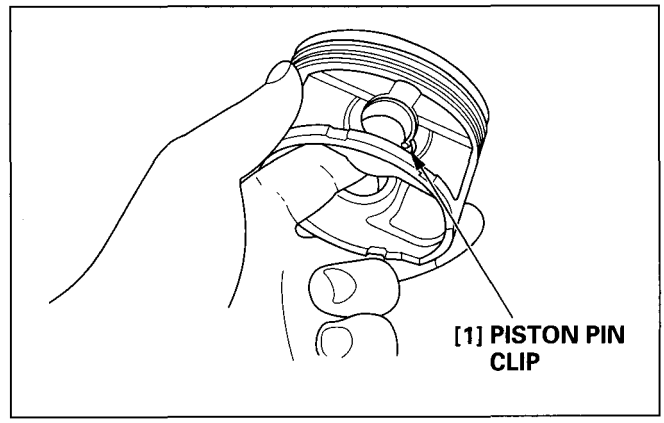

[1]
PISTON RINGS
[2]
PISTON
[3]
PISTON PIN
[4] SNAP RING
[5]
CONNECTING ROD
[6]
CYLINDER BLOCK
[7]
DOWEL PIN
[8]
CONNECTING ROD BEARING
[9]
CONNECTING ROD BEARING CAP
[10]
8 x 0.75 mm
CONNECTING ROD BOLT

6. CRANKCASE COVER/CRANKSHAFT/ PISTON REASSEMBLY

a. PISTON REASSEMBLY

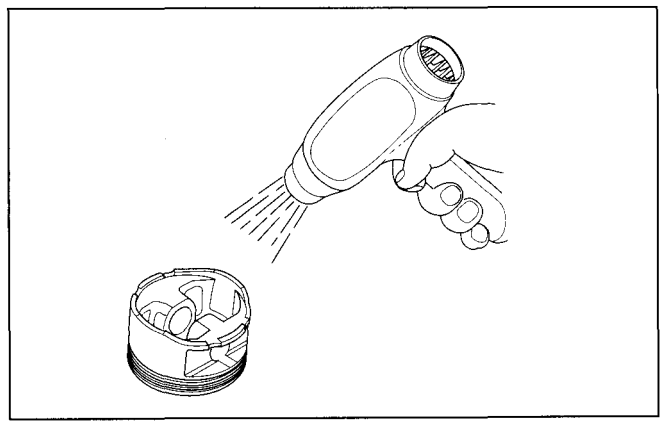
1) Install the piston pin clip on one side only.

NOTICE
Install the piston pin clip carefully so they do not go flying or get lost.



2) Heat the piston to approximately 158°F (70°C).

CAUTION:
Take care not to get your hand, etc. burned during disassembly.

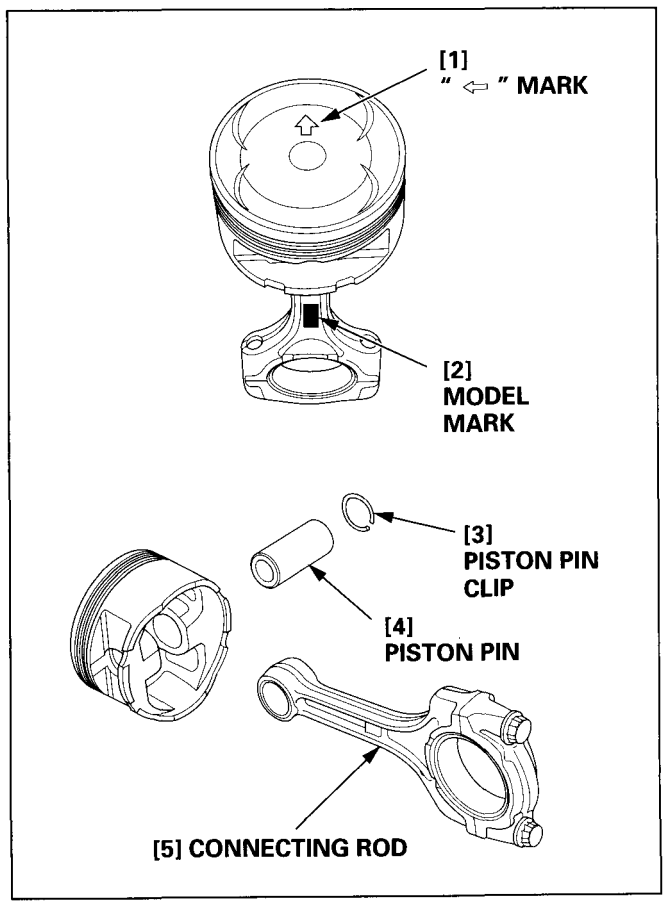


3) Apply engine oil to the pin holes in the piston pin and the piston and to the connecting rod small end.

NOTICE
Install the piston pin so that the " ⇦ " mark on the piston head points to the opposite side from the model mark on the connecting rod.

4) Install another piston pin clip on the opposite side from where the piston pin clip was installed in step 1.

NOTICE
Install the piston pin clip carefully so they do not go flying or get lost.



5) Install the piston rings to the piston as shown.

NOTICE

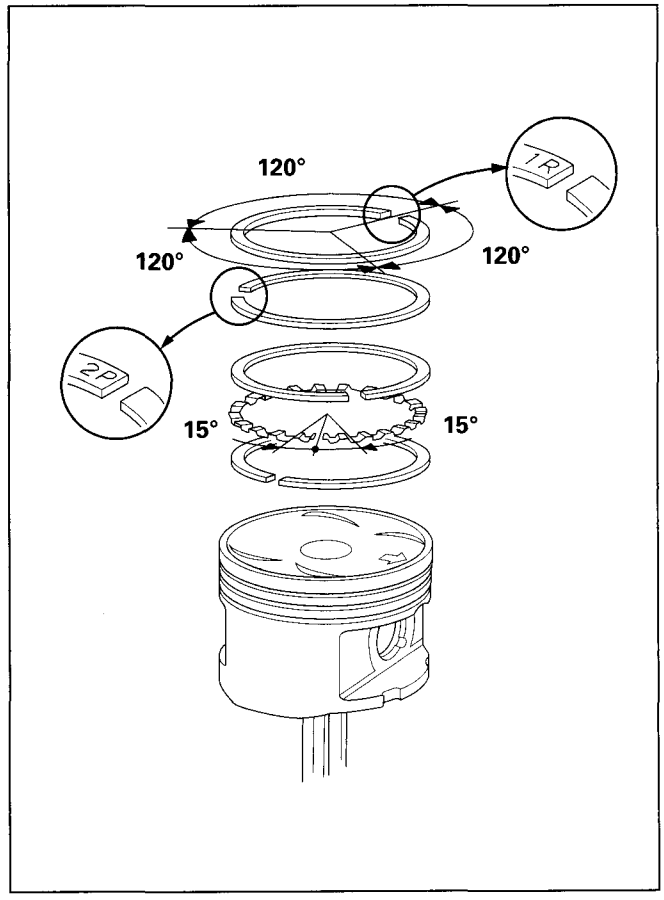
- The top ring has a 1R mark and the second ring has a 2P mark. The manufacturing marks must be facing upward.
- After assembly, check whether the piston moves freely with the dead weight.

6) Rotate the rings in their grooves to make sure they do not bind.

7) Position the ring end gaps as shown:

NOTICE

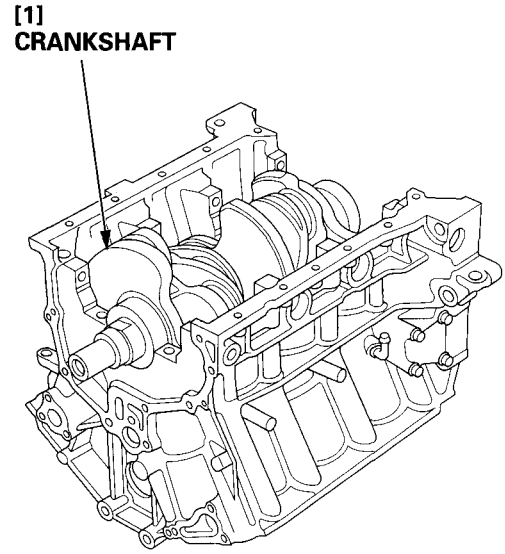
- Do not position any ring gap at piston thrust surfaces.
- Do not position any ring gap in line with piston pin hole.



b. CRANKCASE COVER/CRANKSHAFT REASSEMBLY

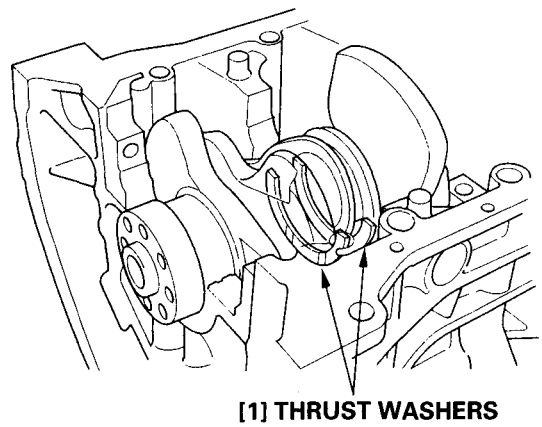
1) Install the crankshaft.

NOTICE
Apply engine oil or the molybdenum disulfide oil to the bearing surface.

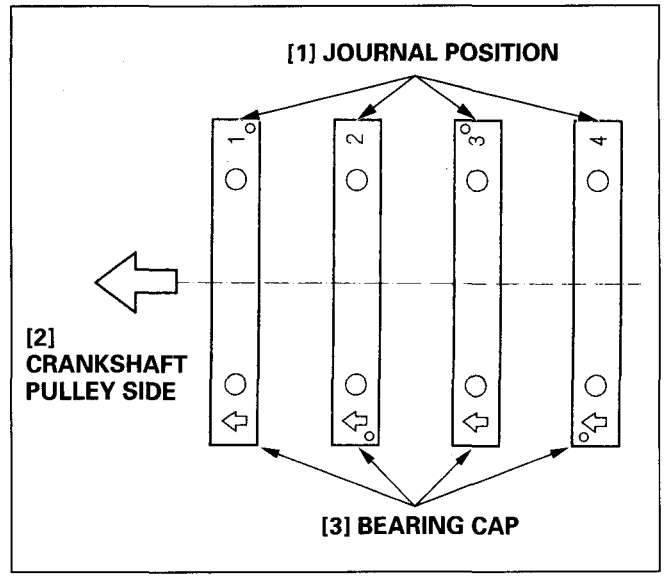


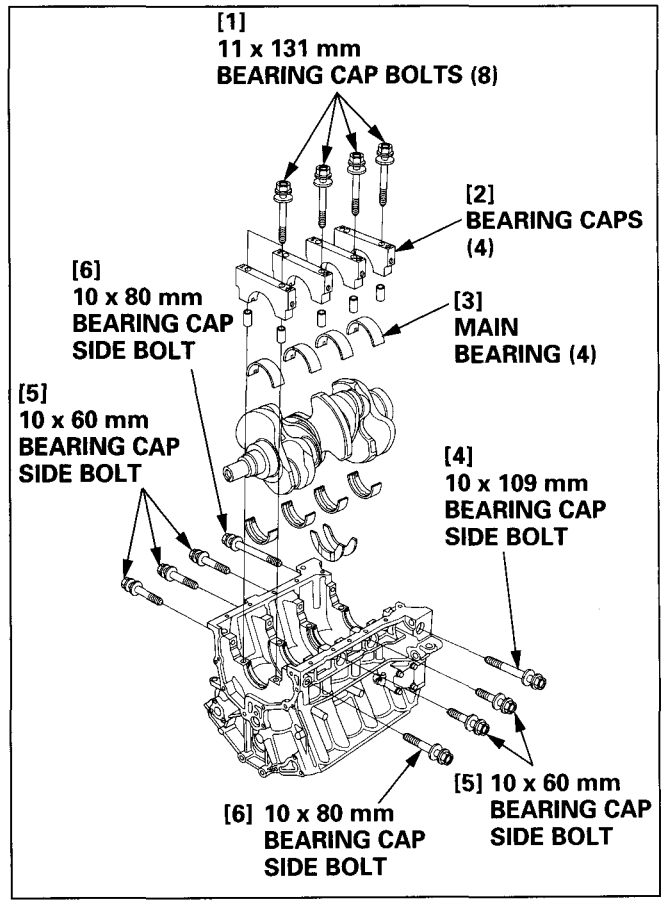
2) Install the thrust washers in the No. 3 journal.

NOTICE
Apply engine oil and install the washer so that the grooves facing out.



3) Install the bearings and bearing caps with the arrows *facing the timing belt end of the engine.*
Apply engine oil to the bolt threads and flange, then install the 11 x 131 mm bearing cap bolts and bearing cap side bolts.

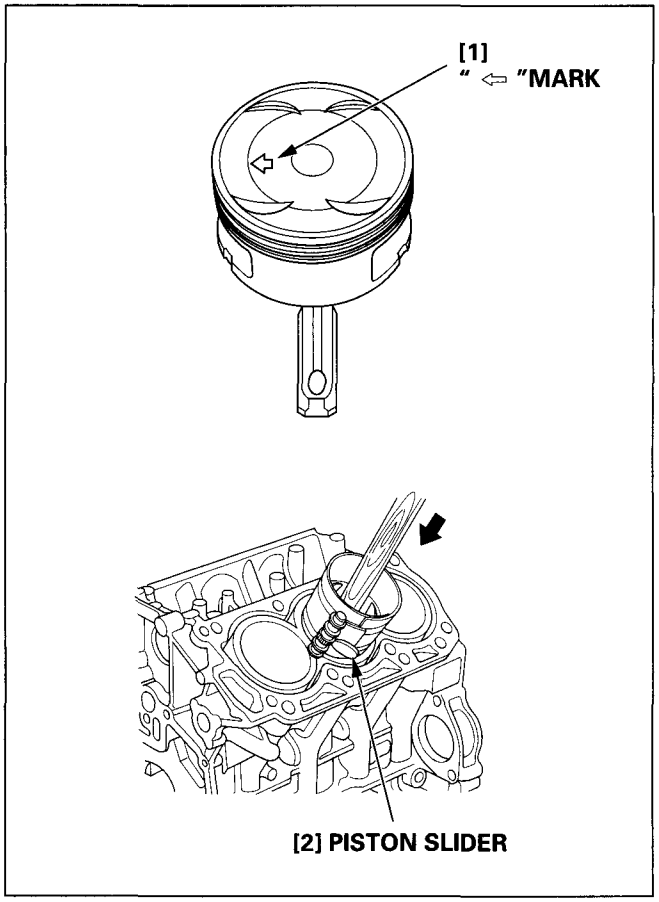




4) Install the piston with the arrow facing the timing belt side of the engine. Position the piston in the cylinder block, and tap it in using the wooden handle of a hammer.

NOTICE

- Apply the engine oil to the piston ring groove and the inside of cylinder wall.
- Apply the engine oil or the molybdenum disulfide oil to the bearing surface.
- Insert the piston to BDC for the cylinder.



5) Install the connecting rod bearing and connecting rod cap.

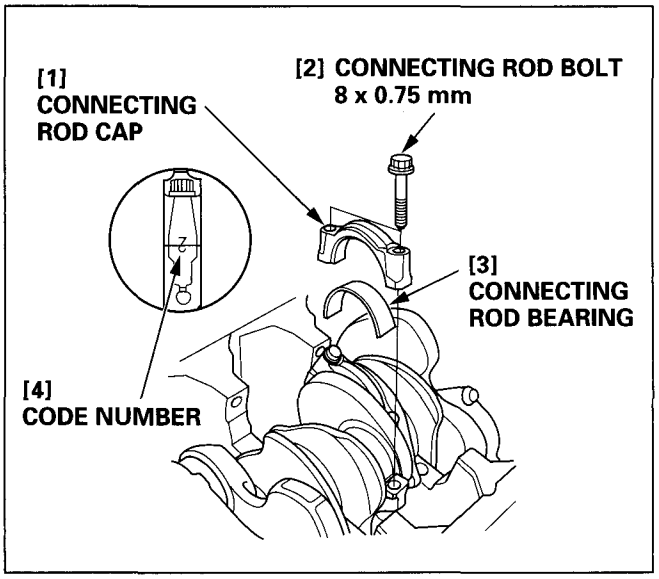
NOTICE

Line up the code number mark on the connecting rod and cap, then install the cap.

6) Apply engine oil to the outer surface and thread of the connecting rod bolts.

7) Make sure the each connecting rod mark as shown. Tighten the connecting rod bolts to the specified torque and additionally tighten the bolts to 90°.

TORQUE: 20 N•m (2.0 kgf•m, 14 lbf•ft) + 90°

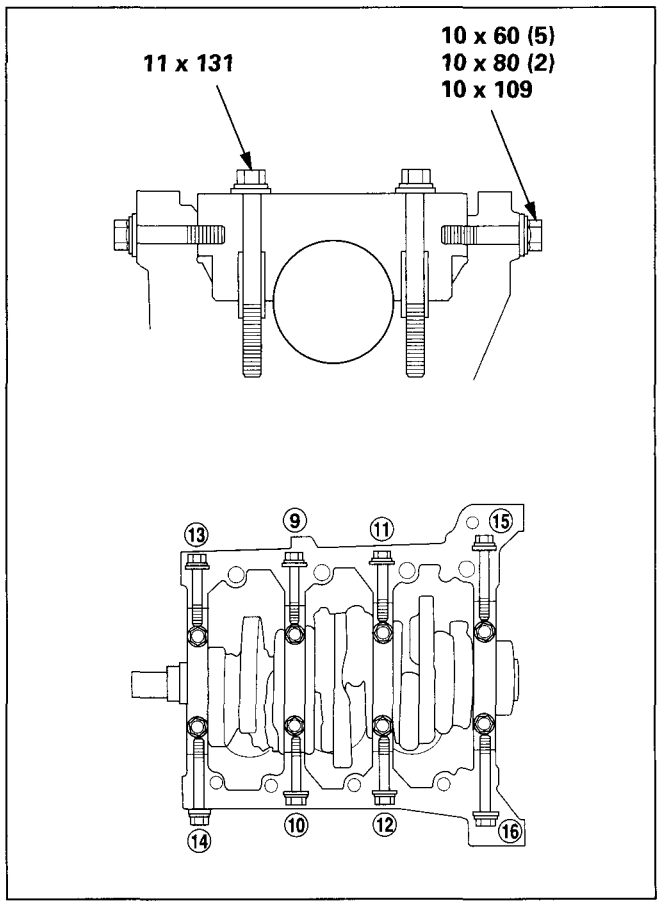


8) Tighten the 11 x 131 mm bearing cap bolts to the specified torque.

TORQUE: 29 N•m (3 kgf•m, 22 lbf•ft) + 51°

9) Tighten the five 10 x 60 mm, 10 x 109 mm, and two 10 x 80 mm bearing cap side bolts. Following the numbered sequence shown to the specified torque.

TORQUE: 49 N•m (5 kgf•m, 36 lbf•ft)

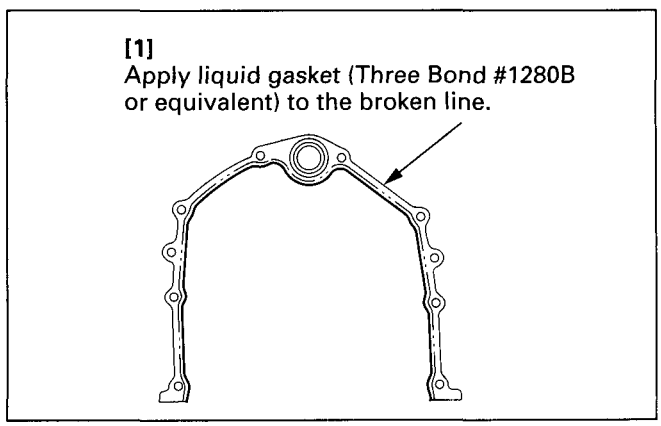


10) Wipe the oil off the mating surface of the cylinder block and the oil seal case.

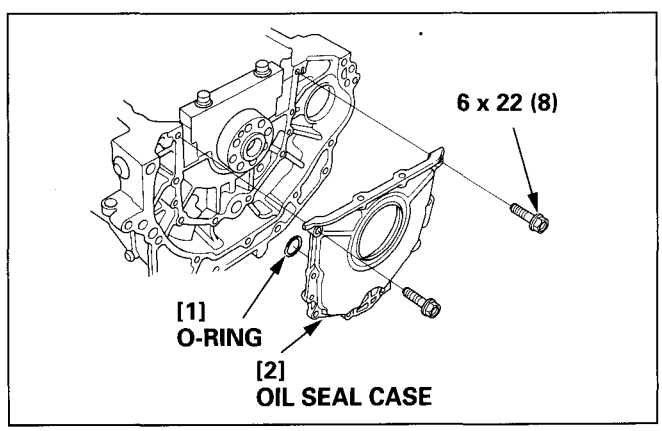
11) Before installing the oil seal case, apply liquid gasket (Three Bond #1280B or equivalent) to the shaded part shown.

NOTICE

- Do not install the parts if 5 minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the old residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.
- Do not apply liquid gasket to the groove installing the O-ring.



12) Install a new O-ring and the oil seal case to the cylinder block.



13) Wipe the oil off the mating surface of the cylinder block and the crankcase upper cover.

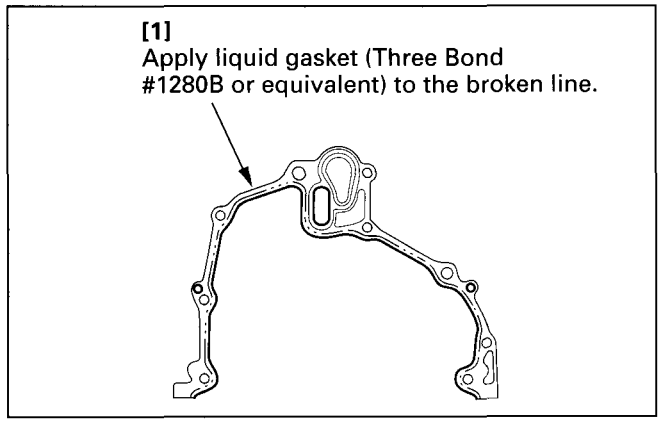
14) Before installing the crankcase upper cover, apply liquid gasket (Three Bond #1280B or equivalent) to the shaded part shown.

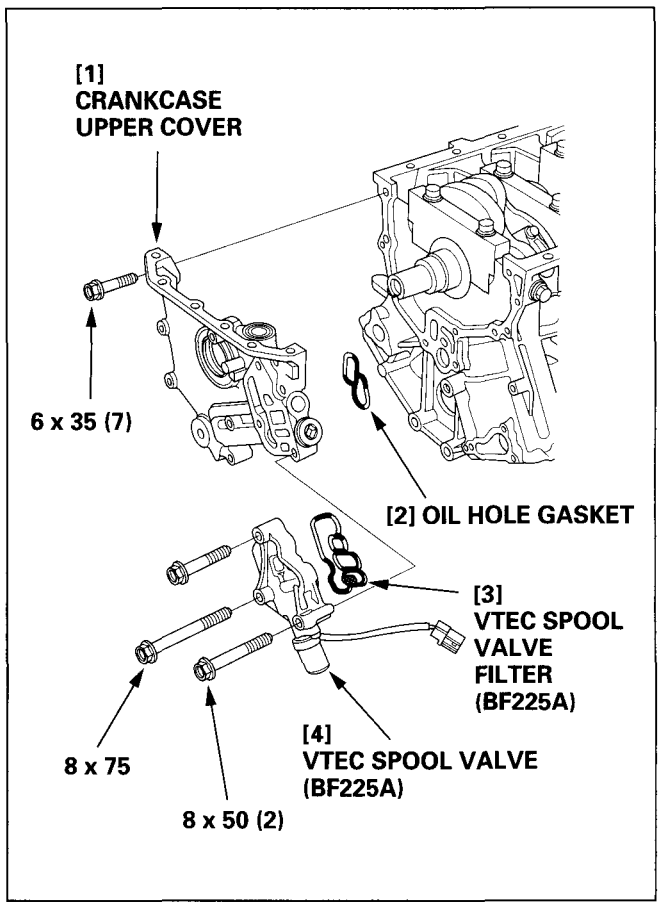
NOTICE

- Do not install the parts if 5 minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the old residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.
- Do not apply liquid gasket to the groove installing the O-ring.

15) Install a new O-ring and the crankcase upper cover to the cylinder block.

16) Install a new VTEC spool valve filter and the VTEC spool valve to the cylinder block (BF225A).





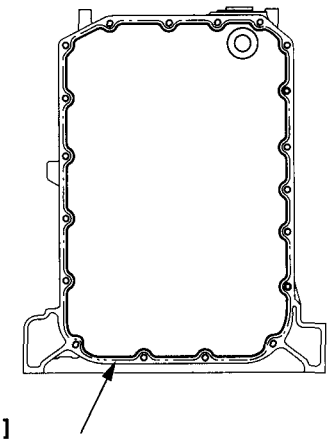
17) Wipe the oil off the mating surface of the cylinder block and the crankcase cover.

18) Before installing the crankcase cover, apply liquid gasket (Three Bond #1280B or equivalent) to the shaded part shown.

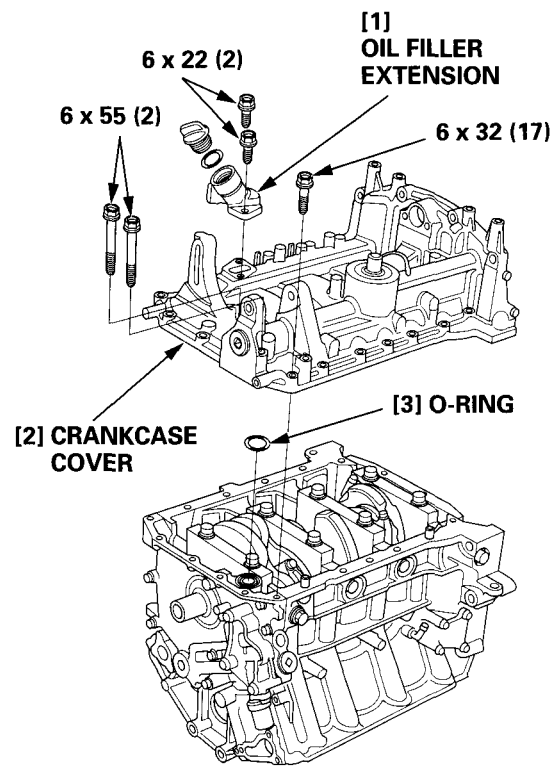
NOTICE

- Do not install the parts if 5 minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the old residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

19) Install a new O-ring and the crankcase cover to the cylinder block.



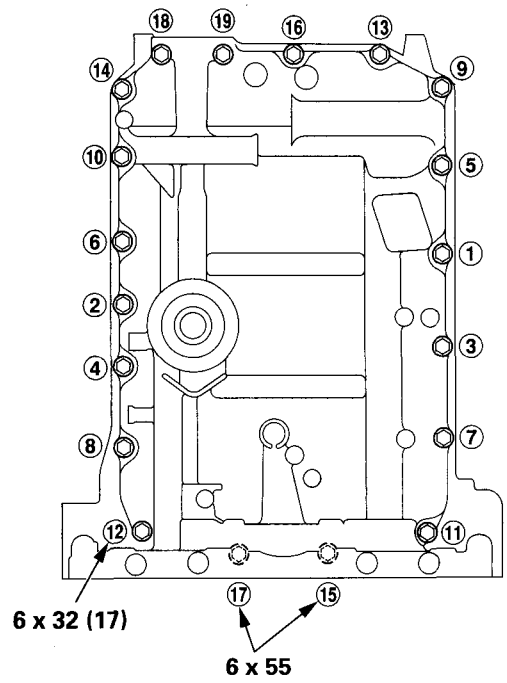
[1]
Apply liquid gasket (Three Bond #1280B or equivalent) to the broken line.



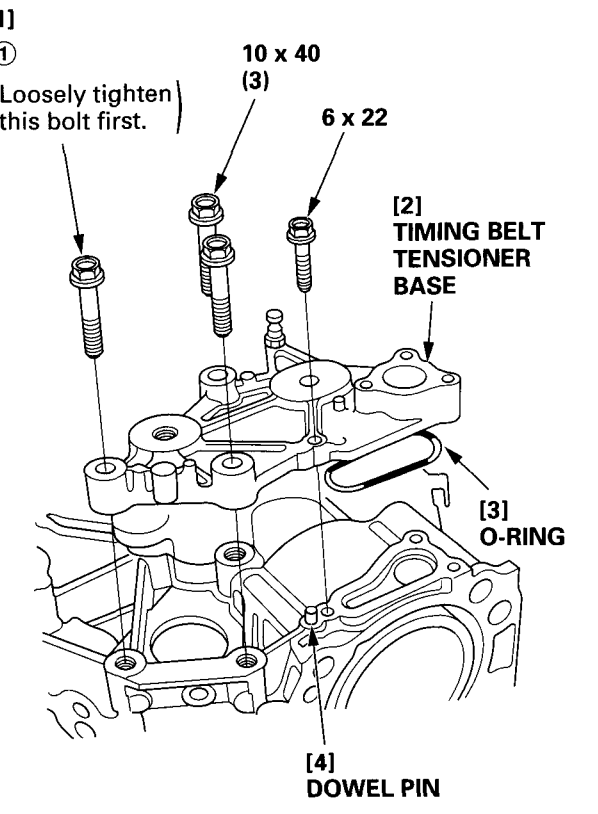
20) Apply engine oil to the seat and the threads of each bolt, and loosely tighten them in the positions shown.

21) Tighten the 6 x 32 mm and 6 x 55 mm flange bolts in the numbered sequence shown in two or three steps.

22) Install the following parts.
— Oil filler extension (P. 11-2)
— Oil filter cartridge (P. 3-3)
— Cylinder head (P. 9-25)
— Engine assembly (P. 7-8)

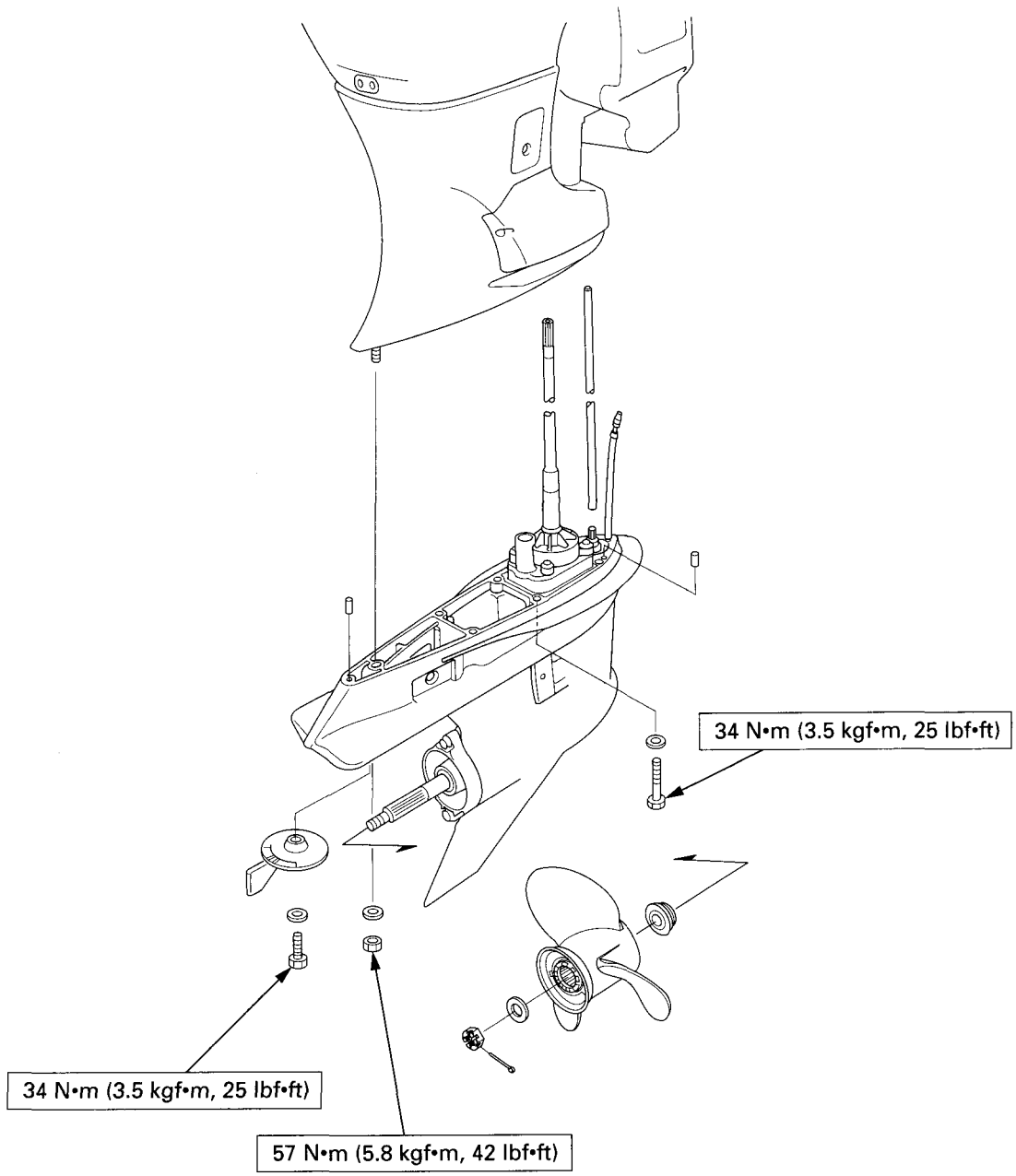


23) Replace a new O-ring and install the timing belt tensioner base. Align the dowel pin and loosely tighten the ① 10 x 40 mm flange bolt first, then tighten the other 10 x 40 mm flange bolts and 6 x 22 mm flange bolt.



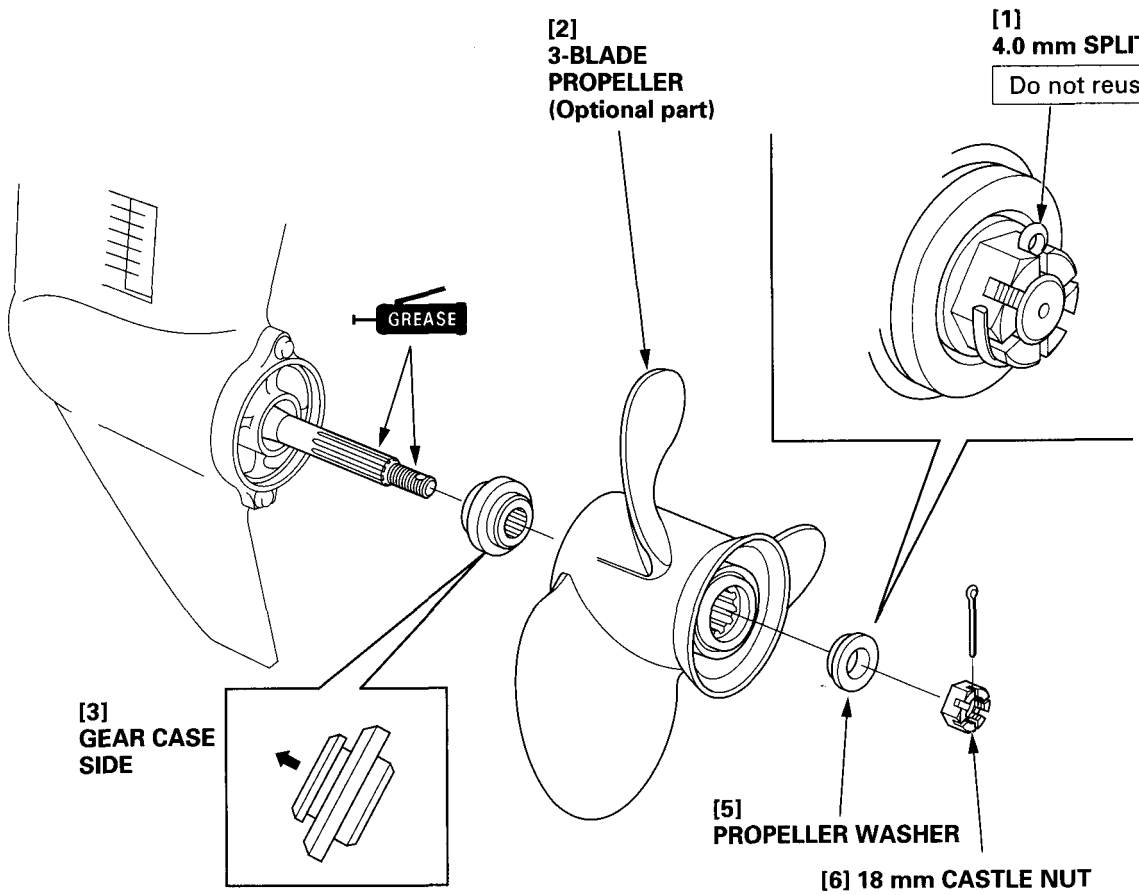
12. PROPELLER/GEAR CASE/EXTENSION CASE BF200A•225A

1. PROPELLER
2. GEAR CASE ASSEMBLY
3. WATER PUMP/SHIFT ROD
4. PROPELLER SHAFT HOLDER ASSEMBLY
5. PROPELLER SHAFT/PROPELLER SHAFT HOLDER
6. VERTICAL SHAFT/BEVEL GEAR
7. SHIM SELECTION
8. SHIM POSITION
9. BACKLASH ADJUSTMENT
10. LOWER RUBBER MOTOR MOUNT
11. EXTENSION CASE/UNDERCOVER



1. PROPELLER

a. REMOVAL/INSTALLATION



2. GEAR CASE ASSEMBLY

a. REMOVAL

1) Set the remote control lever in the "N" (Neutral) position.

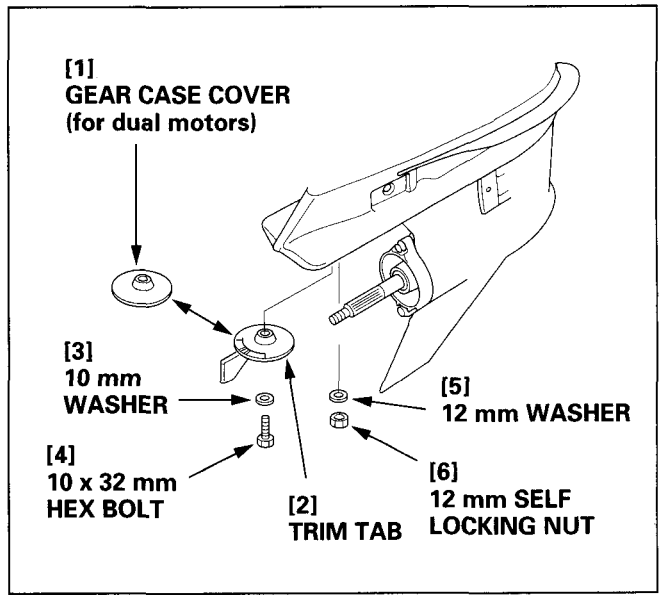
2) Tilt up the motor.

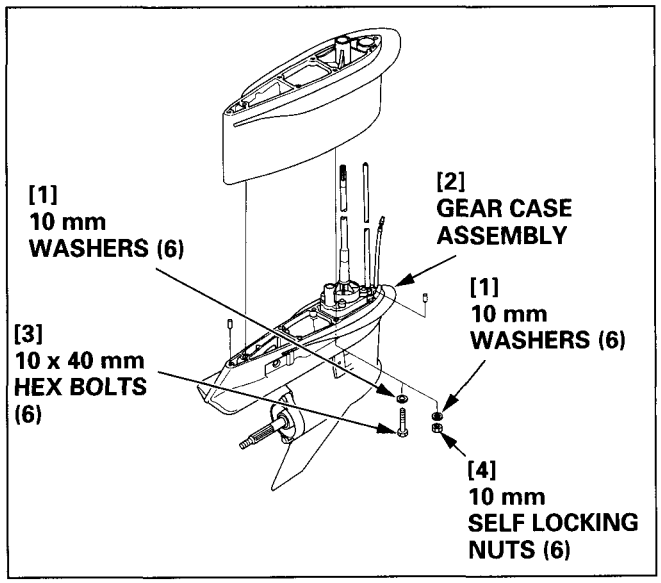
3) Remove the 10 x 32 mm hex bolt, the 10 mm washer and the trim tab.

4) Remove the 12 mm self-locking nut and the 12 mm washer.

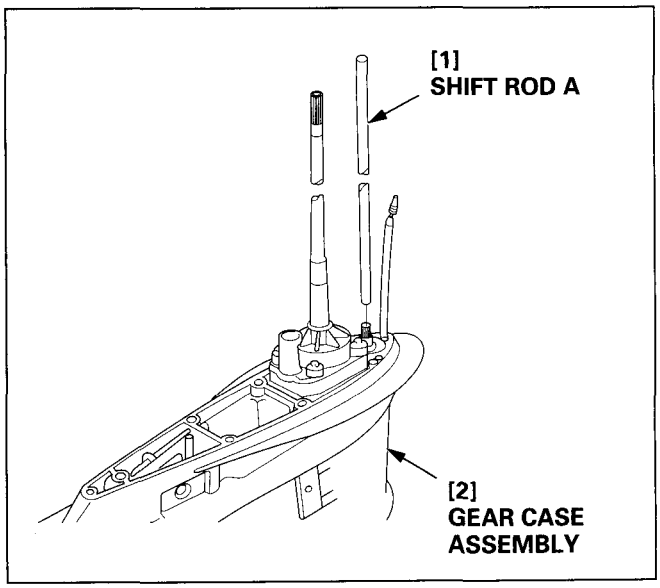
5) Remove six 10 x 40 mm hex bolt and six 10 mm washer tightening the gear case assembly, and remove the gear case assembly. (LD, XD, XCD types)
Remove six 10 mm self-locking nuts and six 10 mm washer tightening the gear case assembly, and remove the gear case assembly and the extention separator. (XXD and XXCD types)

6) After removal, tilt down the motor.

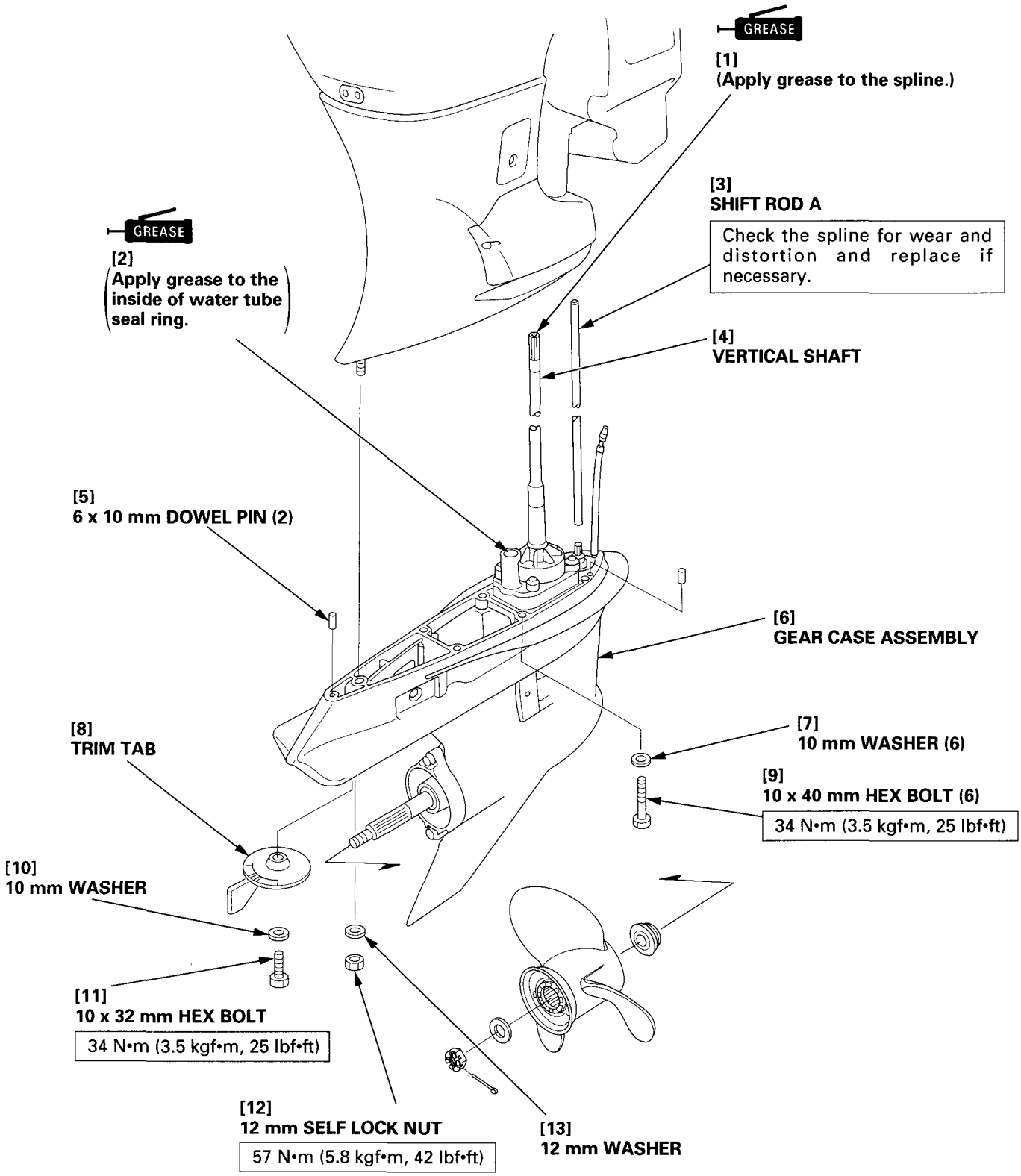




7) Remove the shift rod A from the gear case assembly.

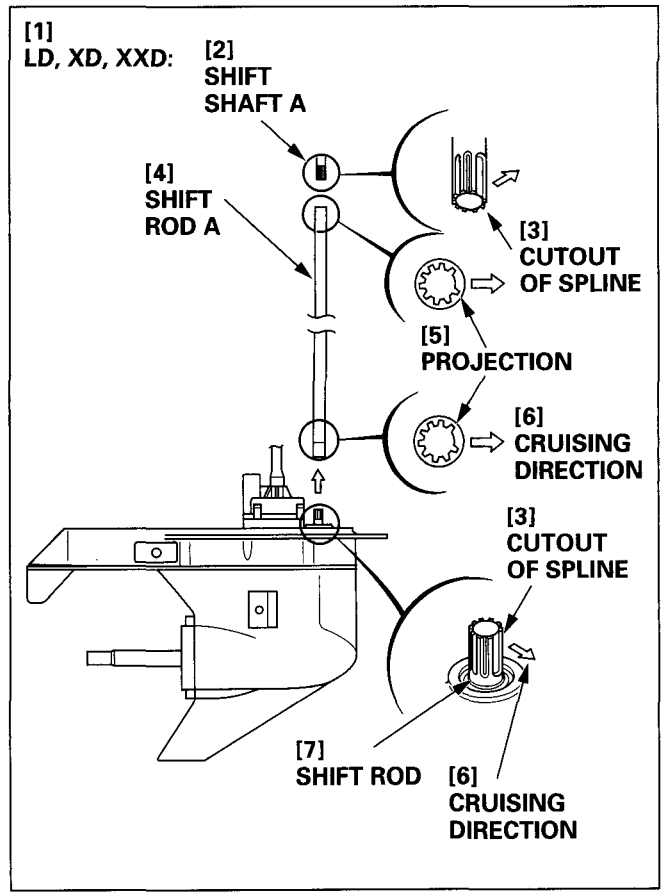


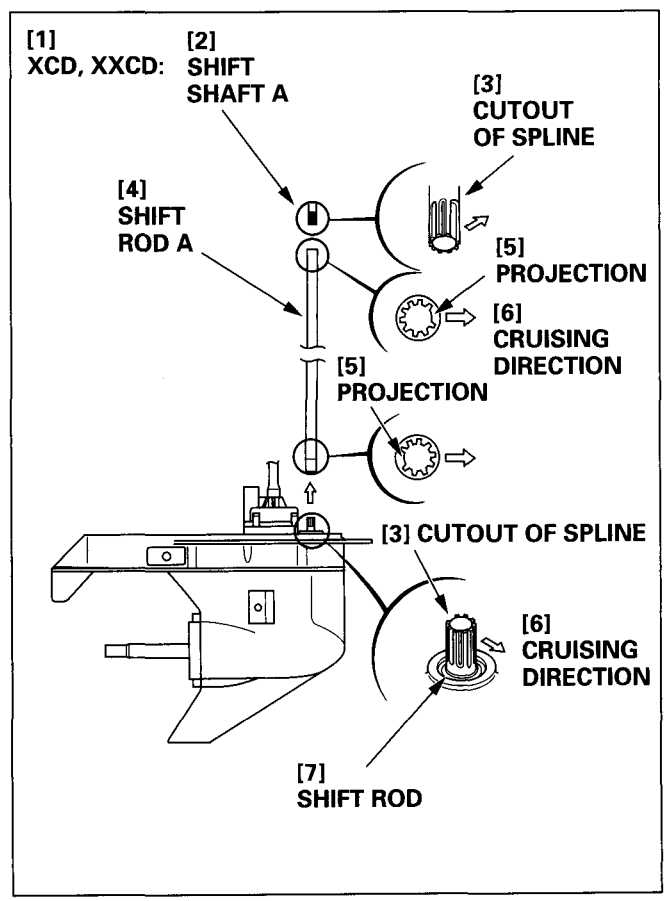
b. EXPLODED VIEW



c. INSTALLATION:

1) Install the shift shaft A by aligning the cutout of the shift rod spline with the projection of the spline of the shift rod A (i.e. part set on the shift rod).

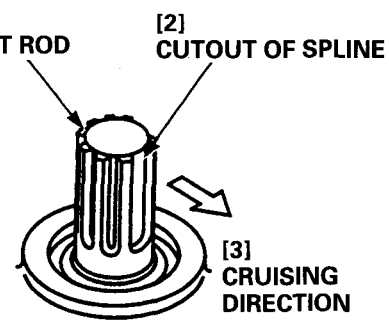




2) Set the remote control lever in the "N" (Neutral) position.

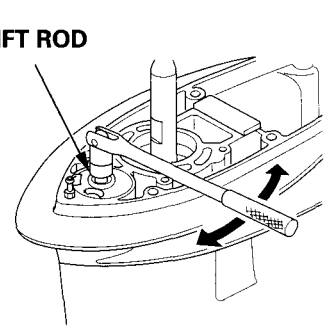
3) Check that shift rod of the gear case is at the "N" (Neutral) position.

To check (LD, XD, and XXD types):
Check whether the cutout of the shift rod spline faces in the direction shown. (It indicates that the shift rod is at the "N" (Neutral) position.)
To check (XCD and XXCD types):
The cutout of the shift rod spline for a counter rotation faces against the cruising direction. (It indicates that the shift rod is at the "N" (Neutral) Position.)



[4]
The illustration shows the standard rotation.

4) If the cutout of the spline is not in the direction shown, and turn the shift rod right and left with the 12 point 10 mm socket until the cutout faces toward the specified direction.



5) Tilt up the motor.

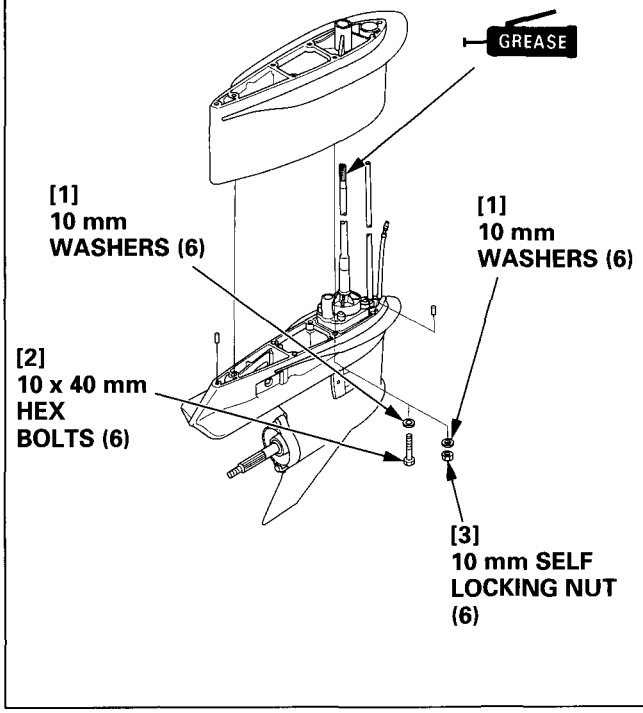
6) Apply grease to the vertical shaft bush of the extention separator and install the extention separator to the extention case. (XXD, XXCD types)

7) Apply grease and install the gear case assembly to the vertical shaft spline, loosely tighten six 10 mm washers and six 10 x 40 mm hex bolts. (LD, XD, XCD types)

Apply grease and install the gear case assembly to the vertical shaft spline, loosely tighten six 10 mm washers and six 10 mm self-locking nuts. (XXD and XXCD types)

8) Tilt down the motor.
Tighten six hex bolts (LD, XD, XCD types) or six 10 mm self-locking nuts (XXD and XXCD types) to the specified torque.

TORQUE: 34 N•m (3.5 kgf•m, 25 lbf•ft)



9) Install the 12 mm washer and the 12 mm self-locking nut.

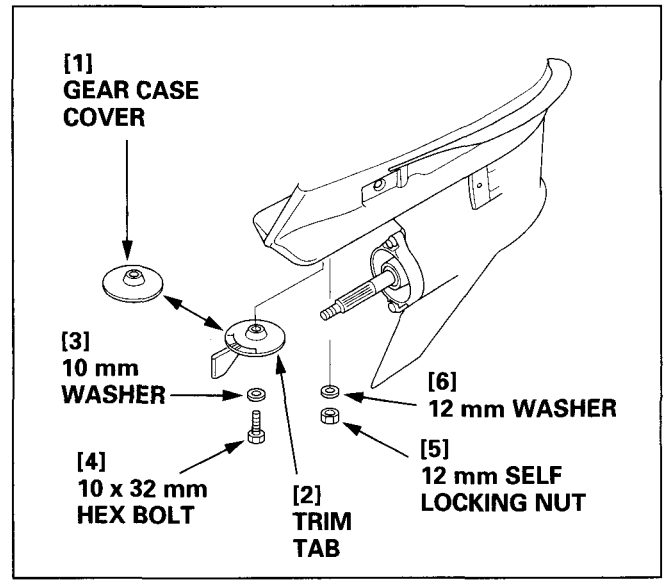
TORQUE: 57 N•m (5.8 kgf•m, 42 lbf•ft)

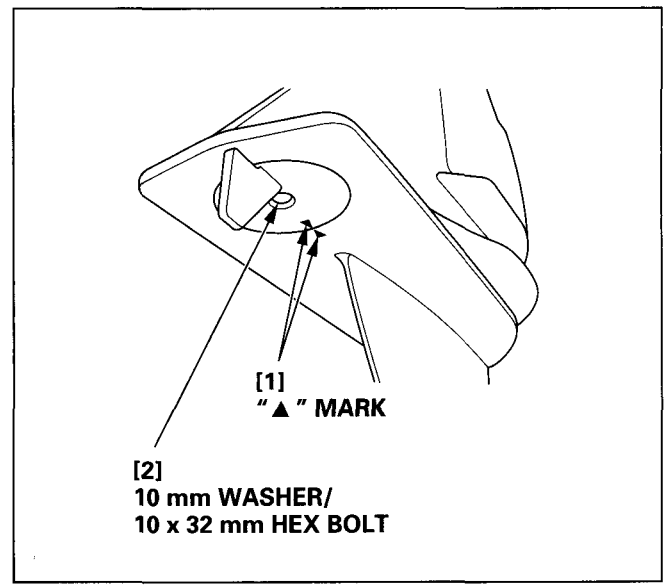
10) Set the trim tab (or gear case cover) to the gear case assembly.

11) Align the "▲" mark, and install the 10 mm washer and the 10 x 32 mm hex bolt.

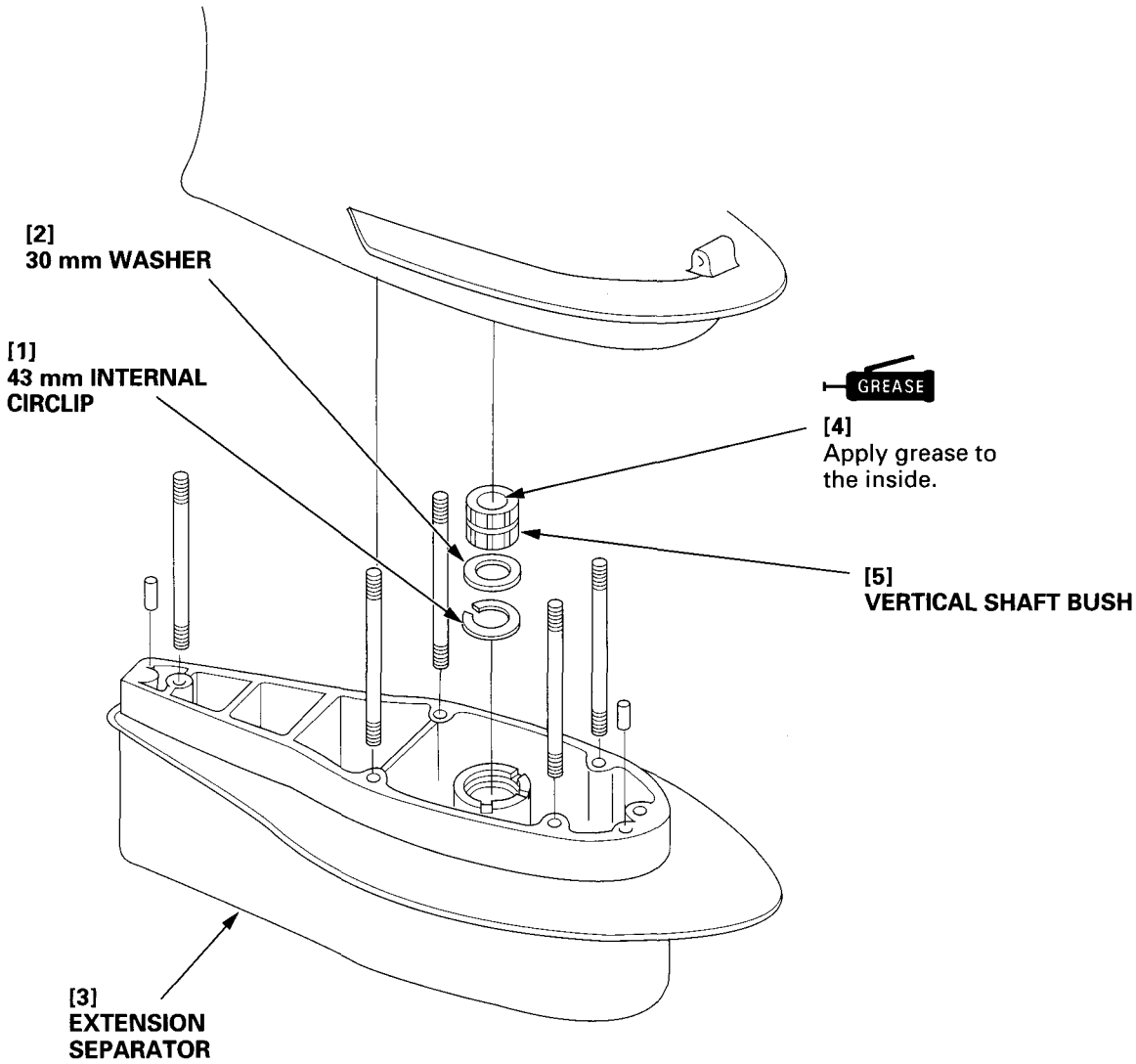
TORQUE: 34 N•m (3.5 kgf•m, 25 lbf•ft)

12) After install the gear case assembly, adjust the shift rod.





d. DISASSEMBLY/ASSEMBLY OF THE EXTENTION SEPARATOR and VERTICAL SHAFT BUSH



3. WATER PUMP/SHIFT ROD

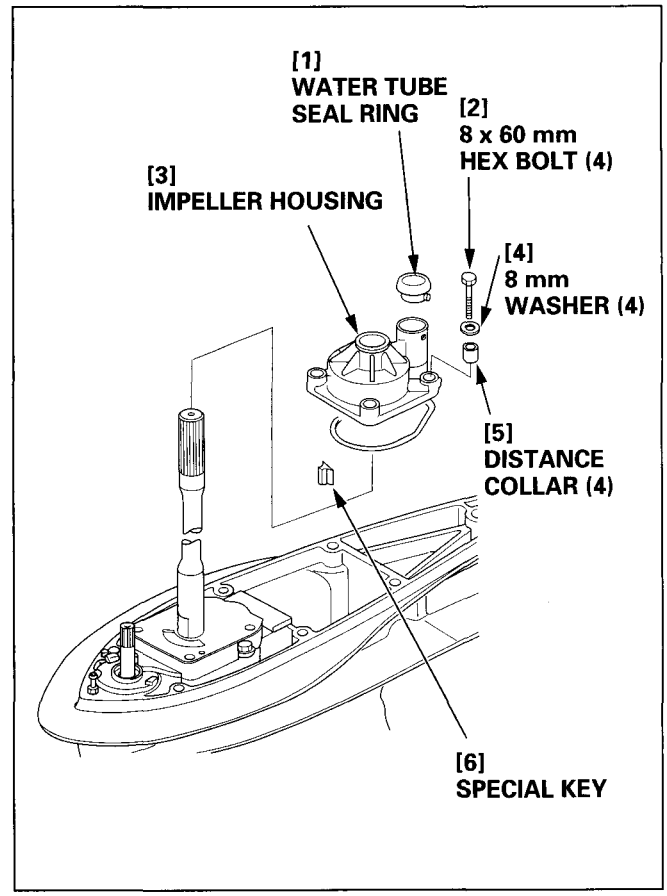
a. DISASSEMBLY

Remove the following:
— Propeller (P. 12-2)
— Gear case assembly (P. 12-3)

1) Remove the water tube seal ring from the impeller housing.

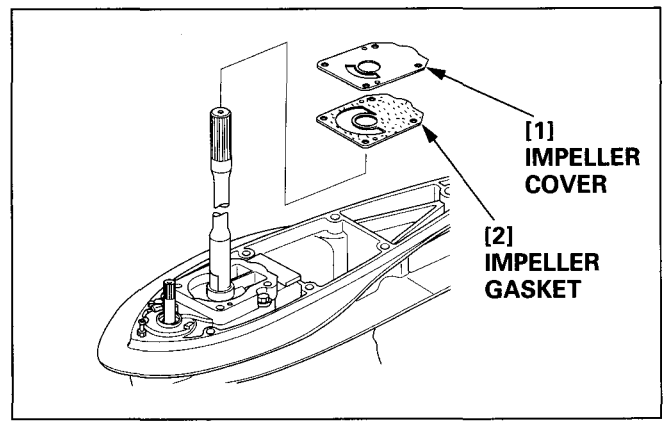
2) Remove four 8 x 60 mm hex bolts, 8 mm washers and distance collar, tightening the impeller housing.

3) Remove the special key from the vertical shaft.



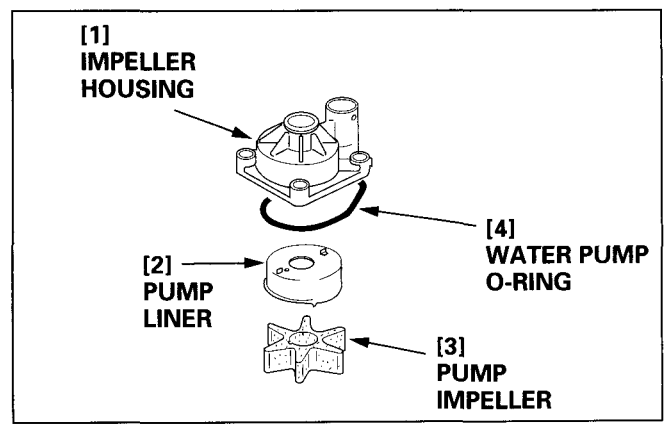
4) Remove the impeller cover and the impeller gasket.

NOTICE
Replace the impeller gasket on disassembly.



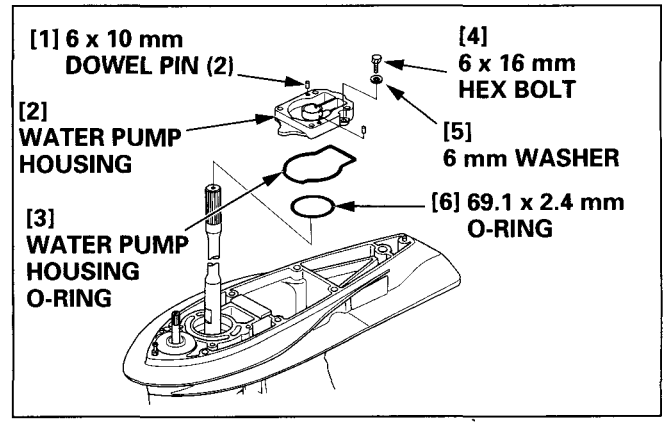
5) Remove the pump impeller, pump liner and the water pump O-ring from the impeller housing.

6) Check the impeller for cracks, wear or damage from overheating, if necessary replace it.

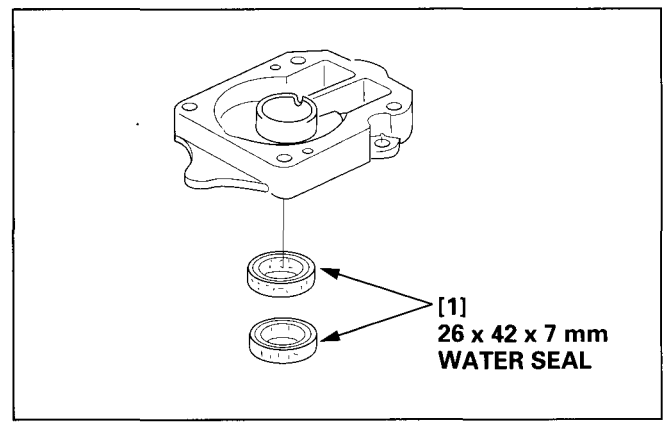


7) Remove the 6 x 16 mm hex bolt, 6 mm washer, two 6 x 10 mm dowel pins, then remove the water pump housing.

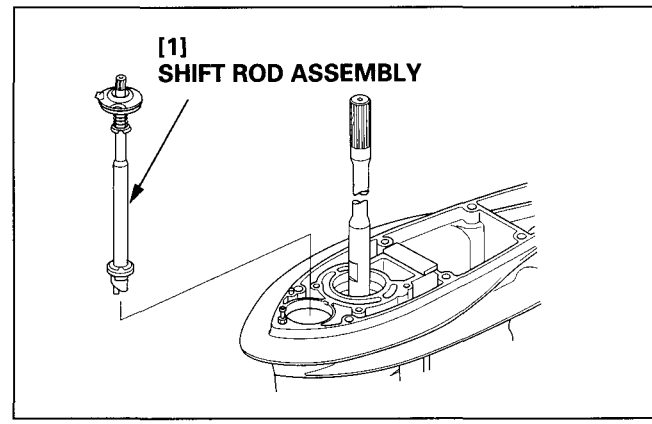
8) Remove the water pump housing O-ring and 69.1 x 2.4 mm O-ring. Check the O-ring for damage or wear, if necessary replace it.



9) Remove the two 26 x 42 x 7 mm water seal using the commercially available oil seal remover.



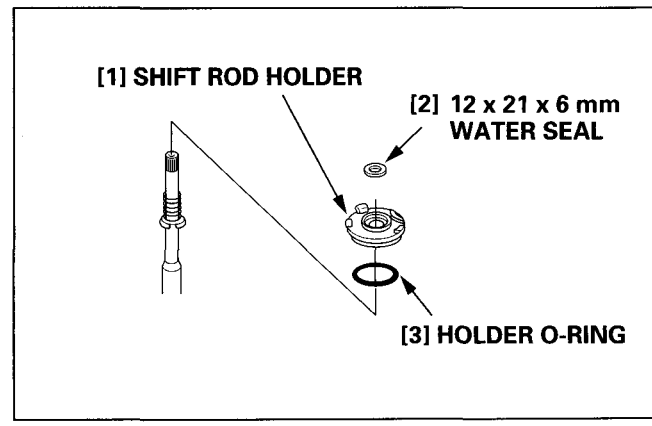
10) Remove the shift rod assembly.



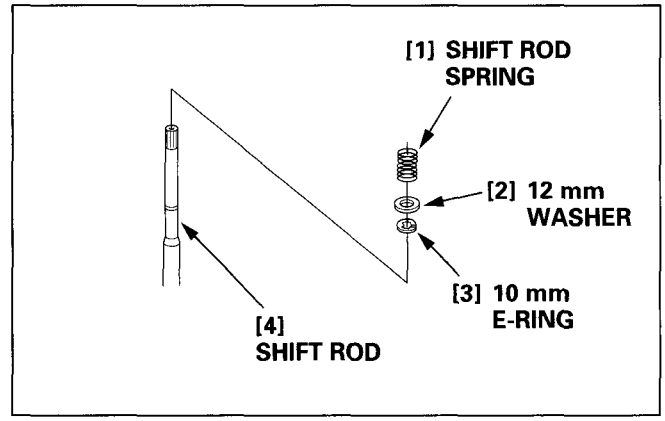
11) Remove the shift rod holder.

12) Remove the 12 x 21 x 6 mm water seal using the commercially available oil seal remover.

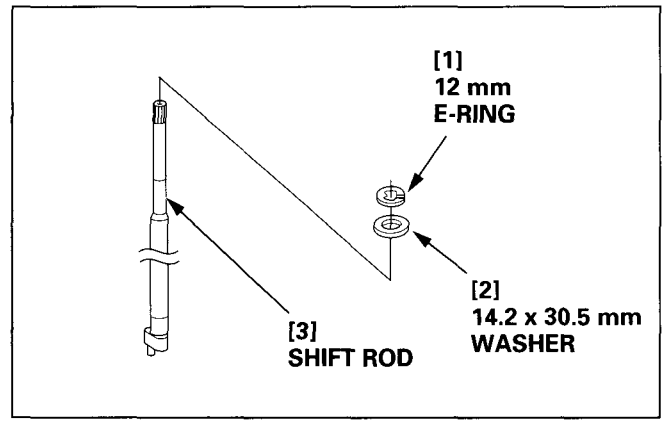
13) Remove the holder O-ring from the shift rod holder. Check the O-ring for damage or wear, if necessary replace it.



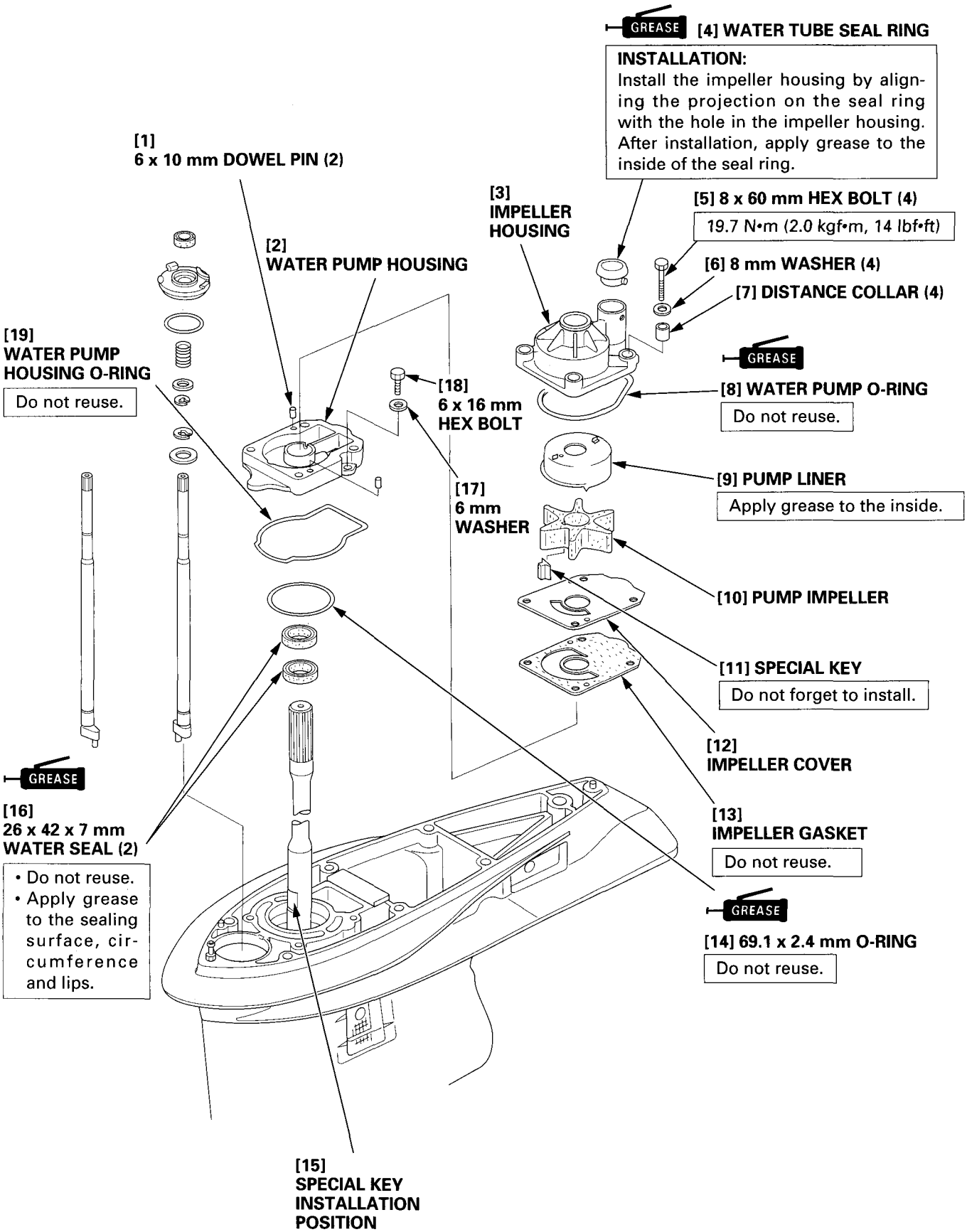
14) Remove the shift rod spring, 12 mm washer and 10 mm E-ring from the shift rod.

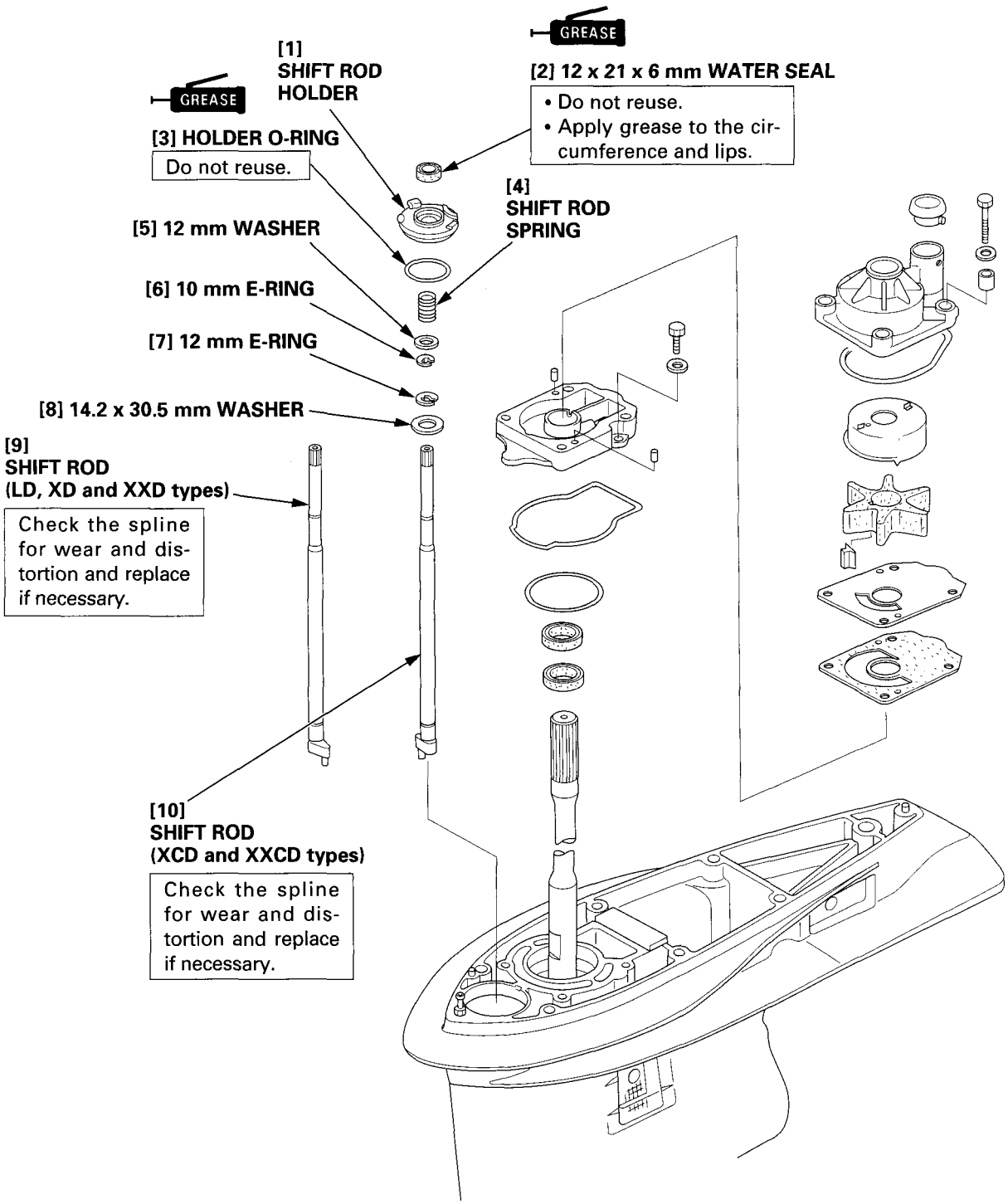


15) Remove the 12 mm E-ring and 14.2 x 30.5 mm washer from the shift rod.



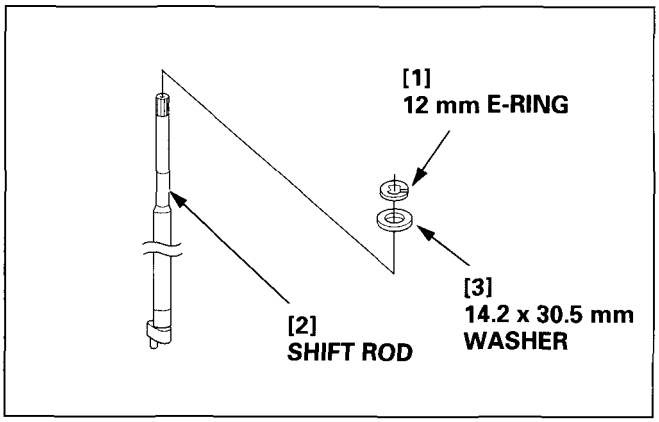
b. EXPLODED VIEW



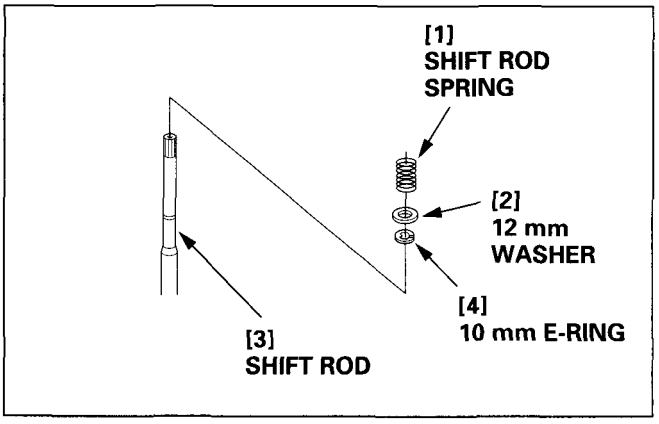

GREASE
[1]
SHIFT ROD
HOLDER
GREASE
[2] 12 x 21 x 6 mm WATER SEAL
• Do not reuse.
• Apply grease to the circumference and lips.
[3] HOLDER O-RING
Do not reuse.
[4]
SHIFT ROD
SPRING
[5] 12 mm WASHER
[6] 10 mm E-RING
[7] 12 mm E-RING
[8] 14.2 x 30.5 mm WASHER
[9]
SHIFT ROD
(LD, XD and XXD types)
Check the spline for wear and distortion and replace if necessary.
[10]
SHIFT ROD
(XCD and XXCD types)
Check the spline for wear and distortion and replace if necessary.

c. INSTALLATION

1) Install the 14.2 x 30.5 mm washer and 12 mm E-ring into the shift rod.

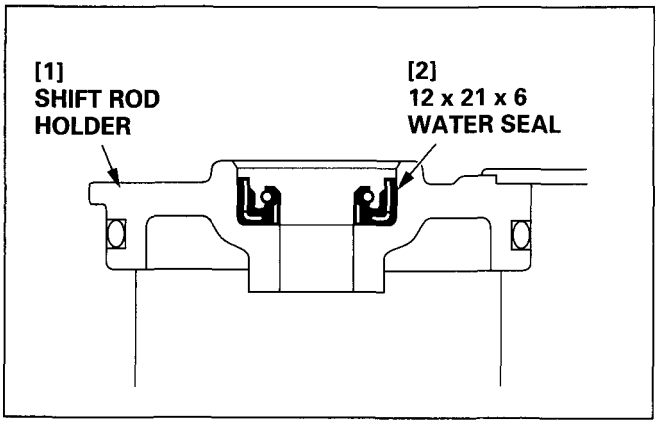


2) Install the 10 mm E-ring, 12 mm washer and shift rod spring into the shift rod.



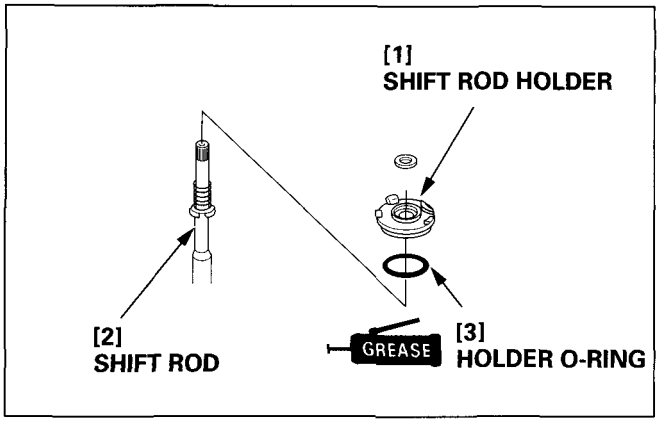
3) Apply soapy water to the circumference and lips of the new 12 x 21 x 6 water seal.

4) With the lips facing up, drive the 12 x 21 x 6 water seal into the shift rod holder as shown.



5) Apply grease to the holder O-ring and install it into the shift rod holder.

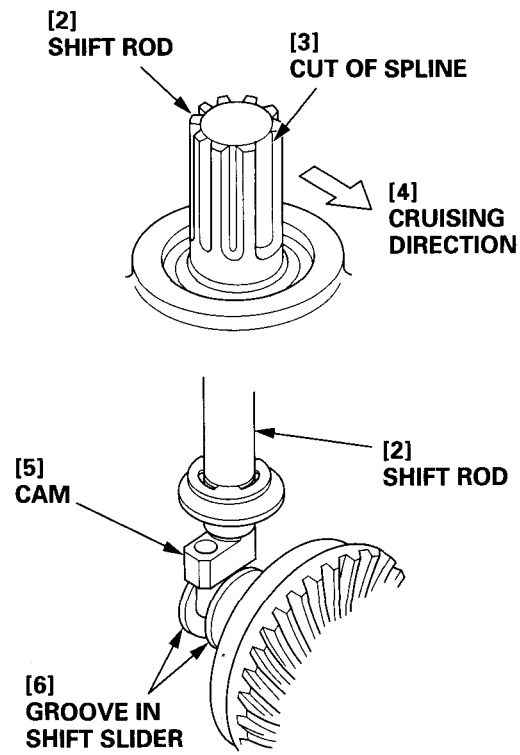
6) Install the shift rod holder into the shift rod.



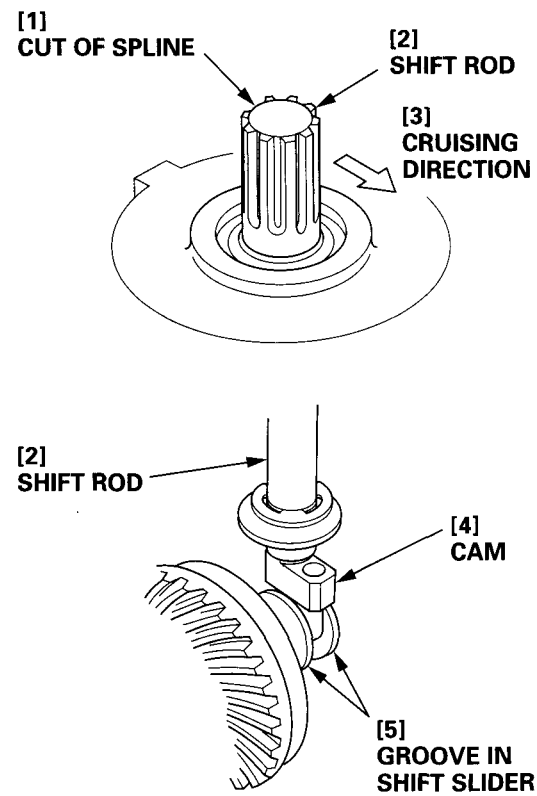
7) Install the shift rod assembly.

8) Install the shift rod by aligning the shift cam of the shift rod with the groove in the shift slider.

[1]
<LD, XD and XXD types>



[6]
<XCD and XXCD types>



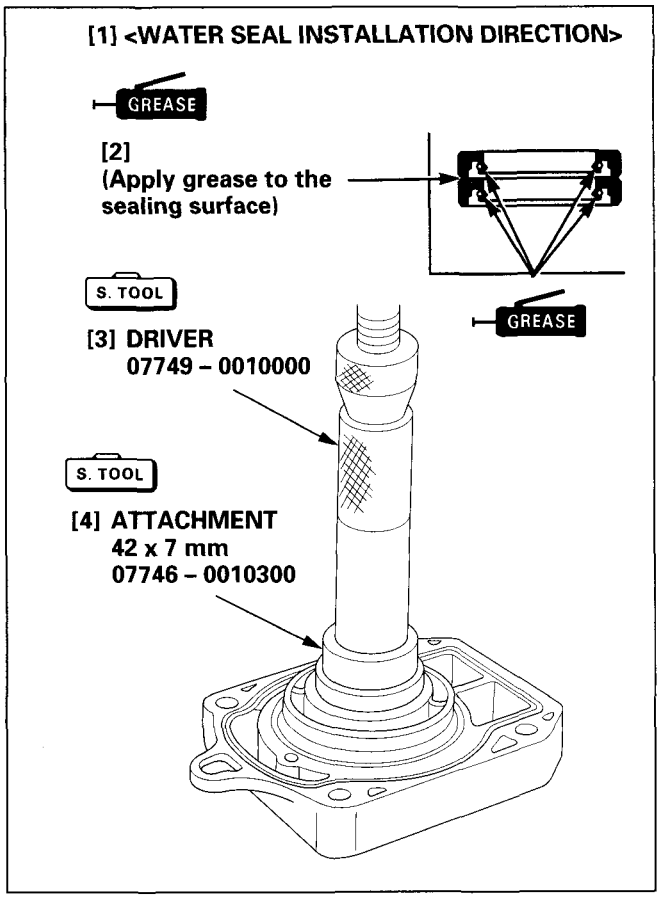
9) Apply grease to the sealing surface and the circumference of the new 26 x 42 x 7 mm water seals.

10) Drive the 26 x 42 x 7 mm water seals one by one into the water pump housing using the special tools. Note the installation direction of the water seals.

11) After installation, apply grease to the lip of the seals.

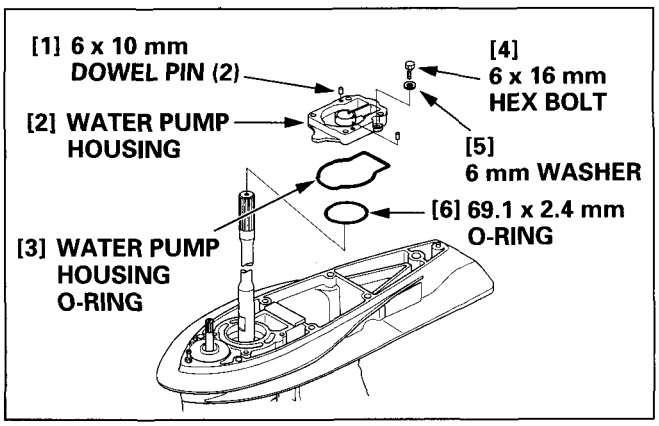
TOOLS:

Driver	**07749 – 0010000**
Attachment, 42 x 47 mm	**07746 – 0010300**



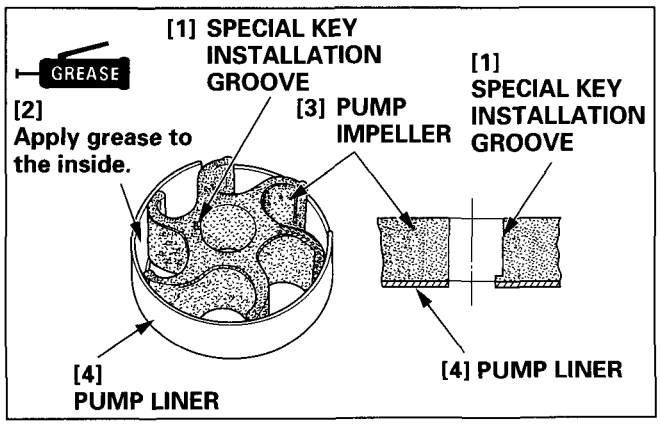
12) Apply grease to the new 69.1 x 2.4 mm O-ring and water pump housing O-ring, and install them to the water pump housing.

13) Install the two 6 x 10 mm dowel pins to the water pump housing, and install the 6 mm washer and 6 x 16 mm hex bolt.



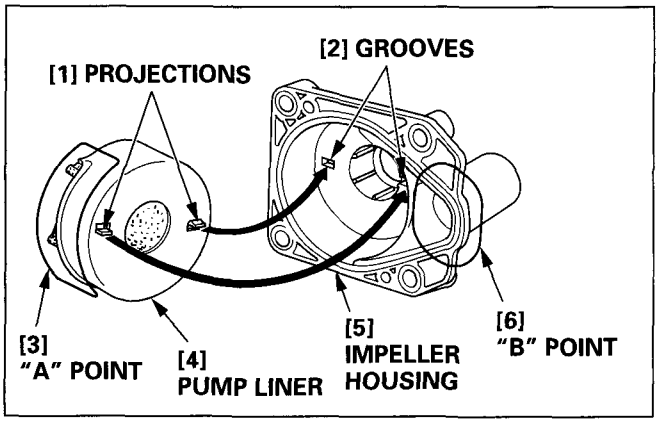
14) Check the impeller for cracks, wear or damage from overheating.

15) Apply grease to the inner wall of the pump liner, and install the pump impeller in the pump liner with the side that has the special key installation groove facing up. Be sure to align the hole in the pump liner with the hole in the pump impeller.



16) Install the pump liner in the impeller housing by aligning the two projections on the pump liner with the two grooves in the impeller housing. Be sure that part "A" of the pump liner is in alignment with the part "B" of the impeller housing, too.

    Set the impeller housing over the vertical shaft, and set the special key in the position shown in the drawing (P. 12-12).



17) Align the groove in the pump impeller with the special key, and install the impeller housing on the pump housing by turning the impeller housing clockwise viewed from the top of the housing

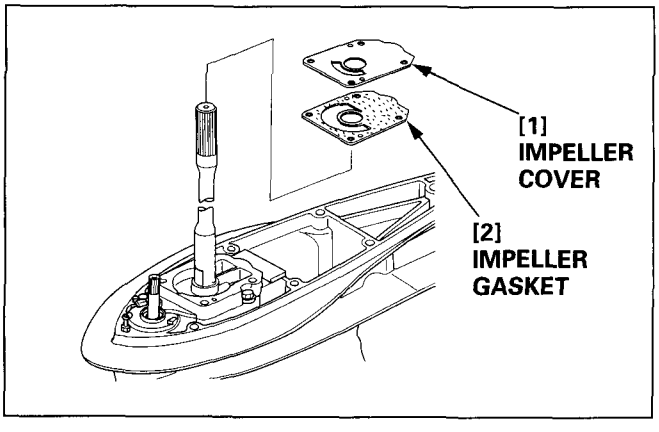
    - After installation, check that the impeller gasket is set in the proper position.

NOTICE

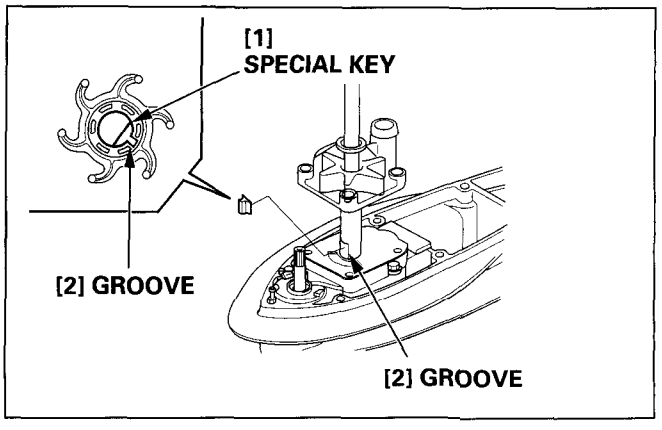
Do not turn the impeller housing counterclockwise with the pump impeller installed in the impeller housing.

18) Apply grease to the water pump O-ring, and install it into the impeller housing.

19) Install the new impeller gasket and impeller cover.



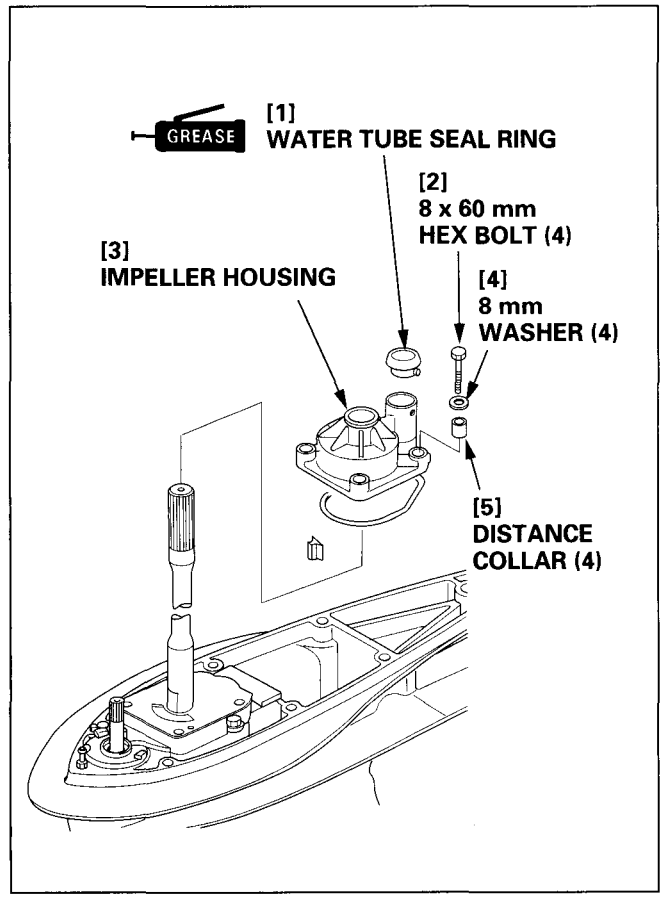
20) Install the impeller housing assembly by aligning the key groove of the impeller with the key on the vertical shaft by turning the vertical shaft clockwise taking care not to allow the key to come off from the vertical shaft.



21) Install the impeller housing, distance collars, washers and bolts.

TORQUE: 20 N•m (2.0 kgf•m, 14 lbf•ft)

22) Install the impeller housing by aligning the projection on the water seal ring with the hole in the impeller housing. After installation, apply grease to the inside of the water seal ring.



23) Install the following:
— Gear case assembly. (P. 12-5)
— Propeller. (P. 12-2)

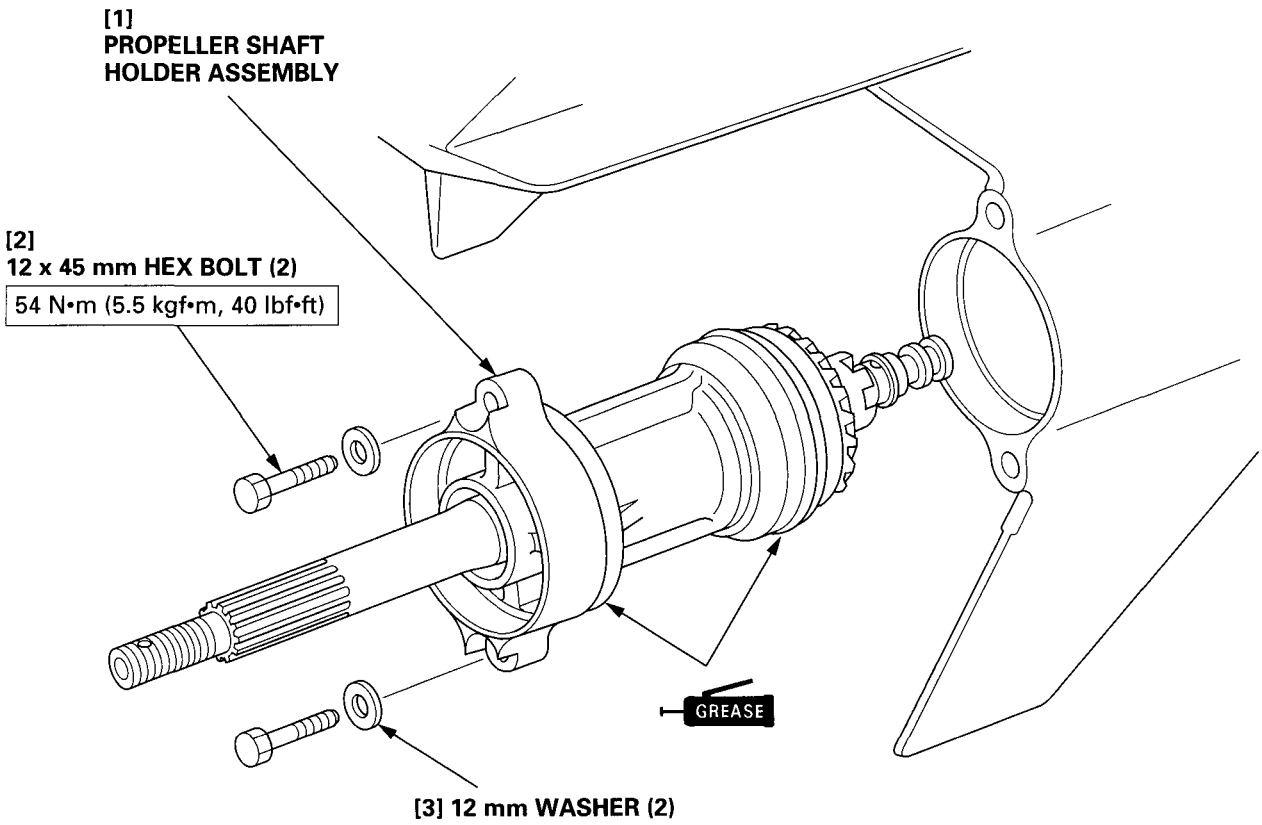
4. PROPELLER SHAFT HOLDER ASSEMBLY

a. REMOVAL/INSTALLATION

- Remove the shift rod before removal/installation of the propeller shaft holder assembly.

1) Remove the propeller (P. 12-2) and gear case assembly (P. 12-3).

2) Remove the water pump/shift rod (P. 12-9).

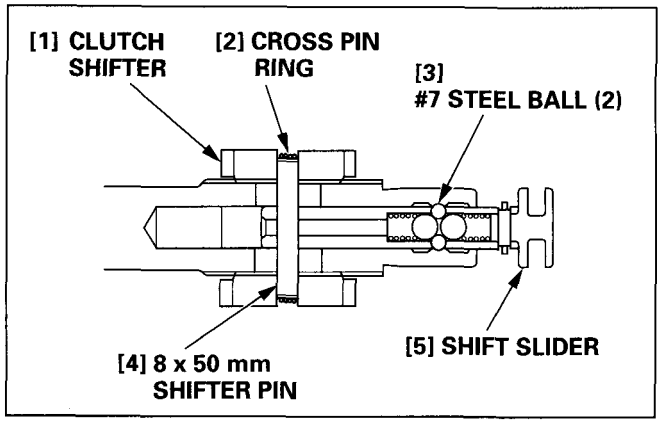


5. PROPELLER SHAFT/PROPELLER SHAFT HOLDER

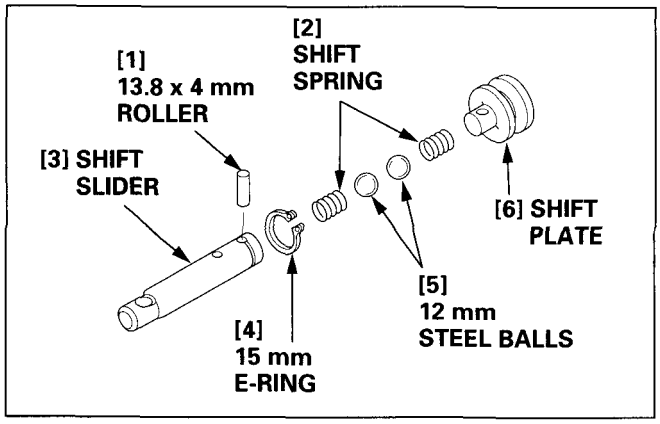
a. REMOVAL

1) Remove the cross pin ring and 8 x 50 mm shifter pin, and remove the clutch shifter.

2) *Pull the shift slider with care not to let the #7 steel ball* pop out, and remove the #7 steel ball and shift slider.



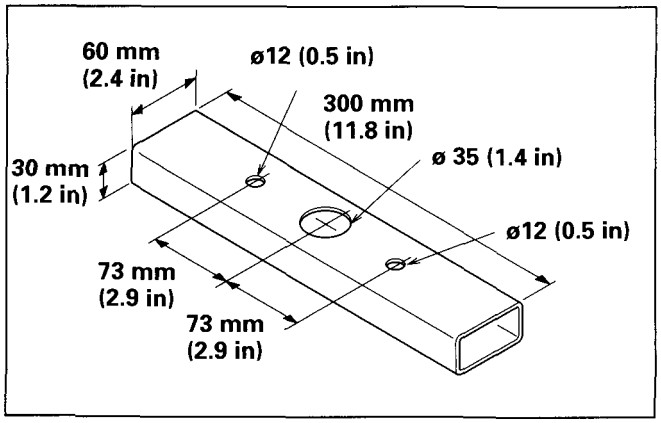
3) Remove the 15 mm E-ring and 13.8 x 4 mm roller, and remove the shift plate, shift spring and #12 steel balls.



(LD,XD and XXD types only)

4) Remove the clutch shifter, shift slider and the shifter pin.

5) Prepare the fixing tool of the dimensions shown.



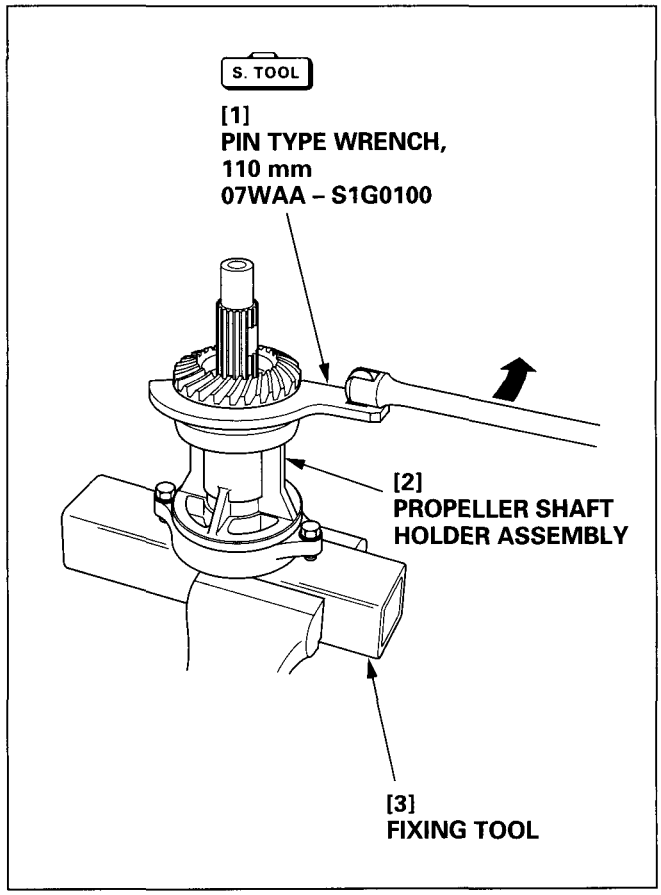
5) Set the propeller shaft holder assembly on the fixing tool, and secure the propeller shaft holder assembly with the bolts.

6) Secure the fixing tool with a vice.

7) Loosen the bearing holder using the special tool as shown.

8) Remove the bearing holder assembly from the propeller shaft.

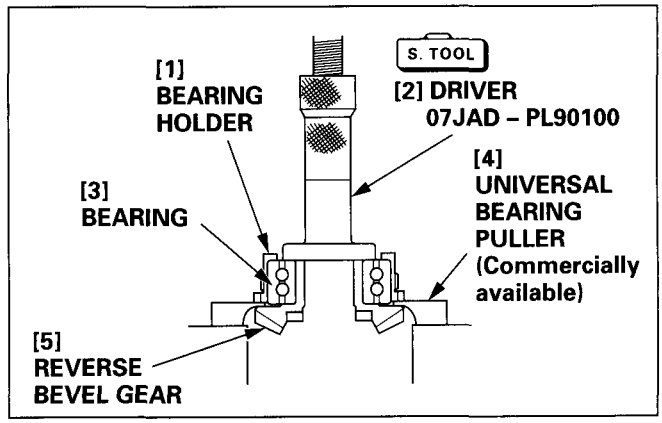
TOOL:
Pin type wrench, 110 mm 07WAA – S1G0100



9) Set the commercially available universal bearing puller between the bearing holder and the reverse bevel gear.

10) Remove the reverse bevel gear and the bearing from the bearing holder using the special tool and the hydraulic press.

TOOLS:
Driver 07JAD – PL90100

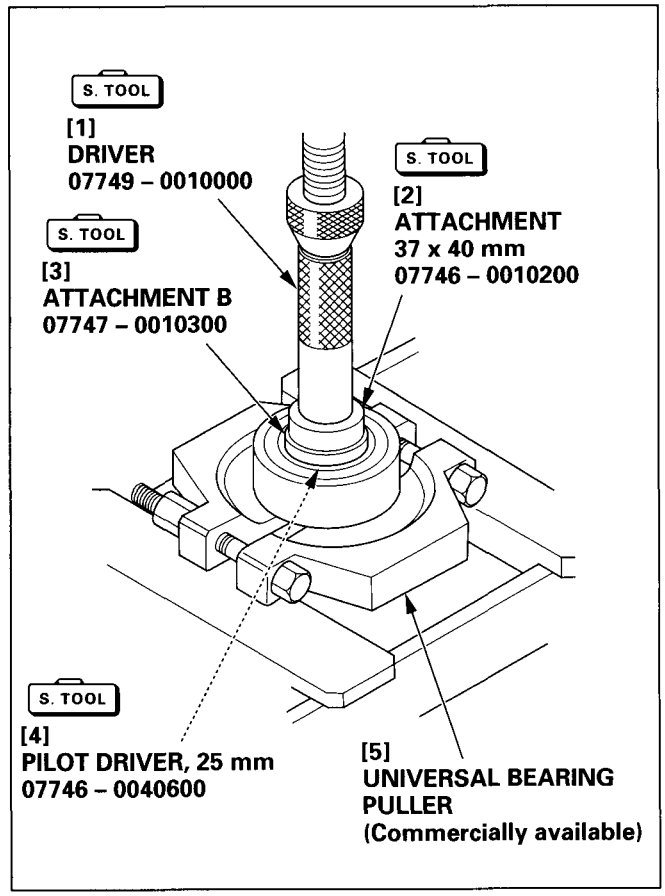


11) Set the commercially available universal bearing puller between the reverse bevel gear and the bearing.

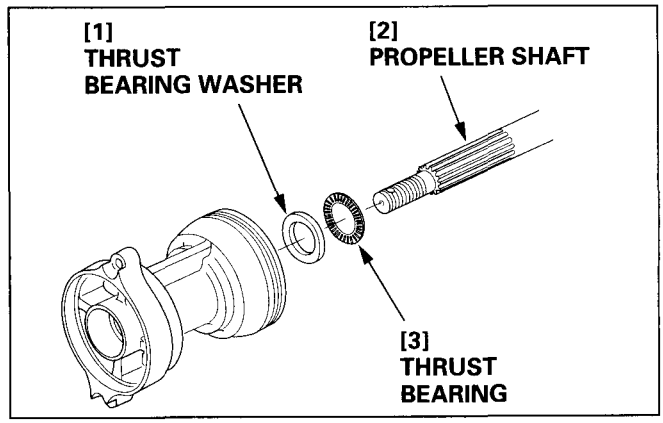
12) Remove the reverse bevel gear from the bearing using the special tools and the hydraulic press.

TOOLS:

Driver	**07749 – 0010000**
Attachment, 37 x 40 mm	**07746 – 0010200**
Pilot driver, 25 mm	**07746 – 0040600**
Attachment B	**07747 – 0010300**



13) Remove the propeller shaft, thrust bearing and thrust bearing washer.



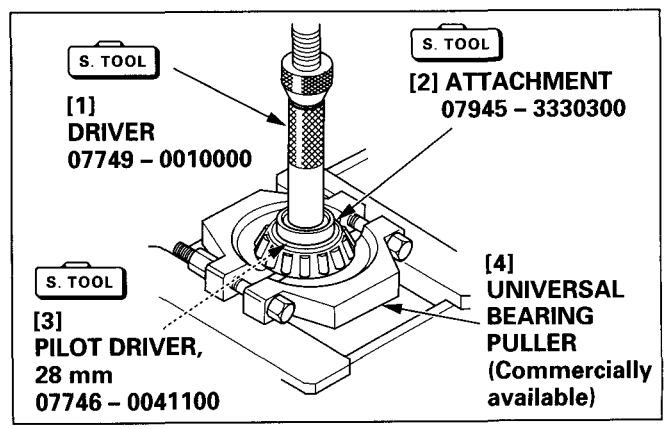
<XCD, XXCD types>

1) Set the commercially available universal bearing puller between the bearing holder and the forward bevel gear.

2) Remove the forward bevel gear from the taper roller bearing (inner race) using the special tool and the hydraulic press.

TOOLS:

Driver	**07749 – 0010000**
Attachment	**07945 – 3330300**
Pilot driver, 28 mm	**07746 – 0041100**

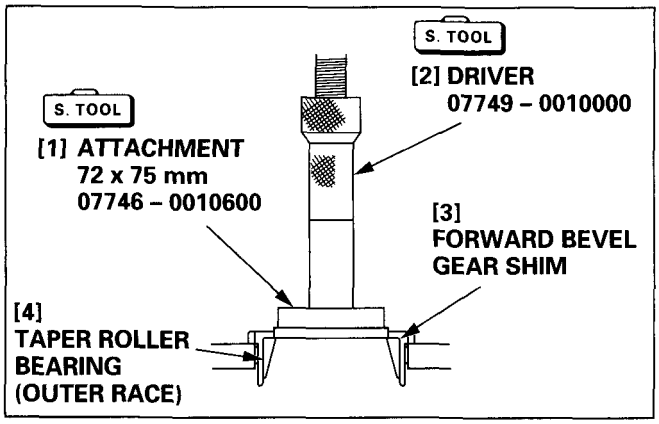


3) Remove the taper roller bearing (outer race) using the special tool and the hydraulic press.

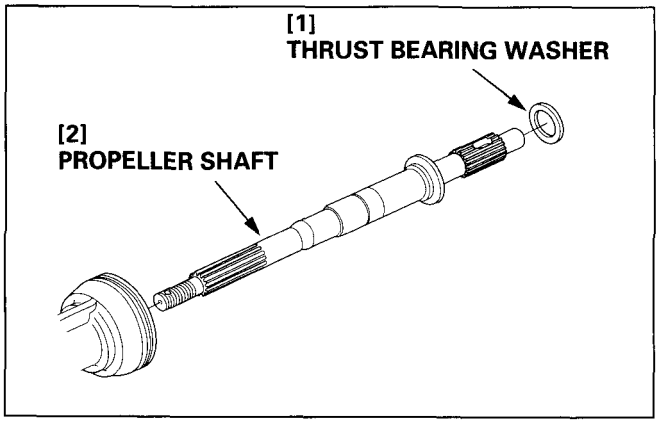
4) Remove the forward bevel gear shim.

NOTICE

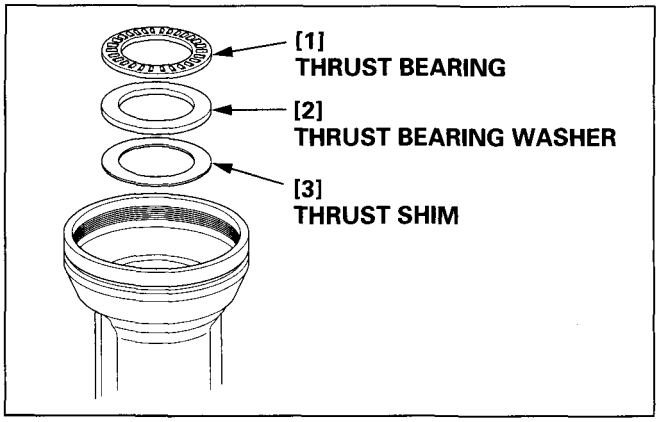
Take care not to damage with remove the taper roller bearing (outer race).



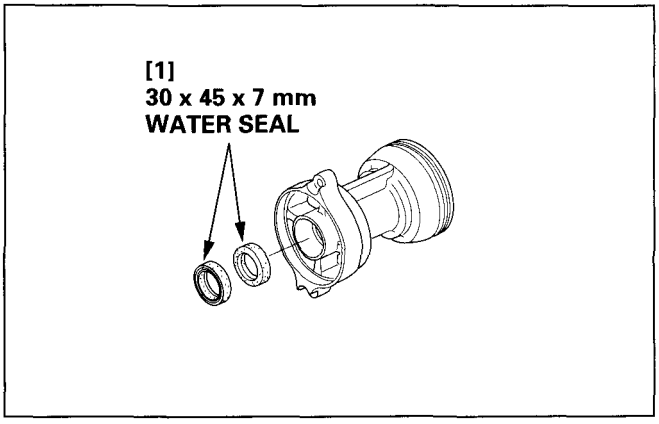
5) Remove the thrust bearing washer and the propeller shaft.



6) Remove the thrust bearing, thrust bearing washer and thrust shim.



7) Remove the 30 x 45 x 7 mm water seal using the commercially available oil seal remover.

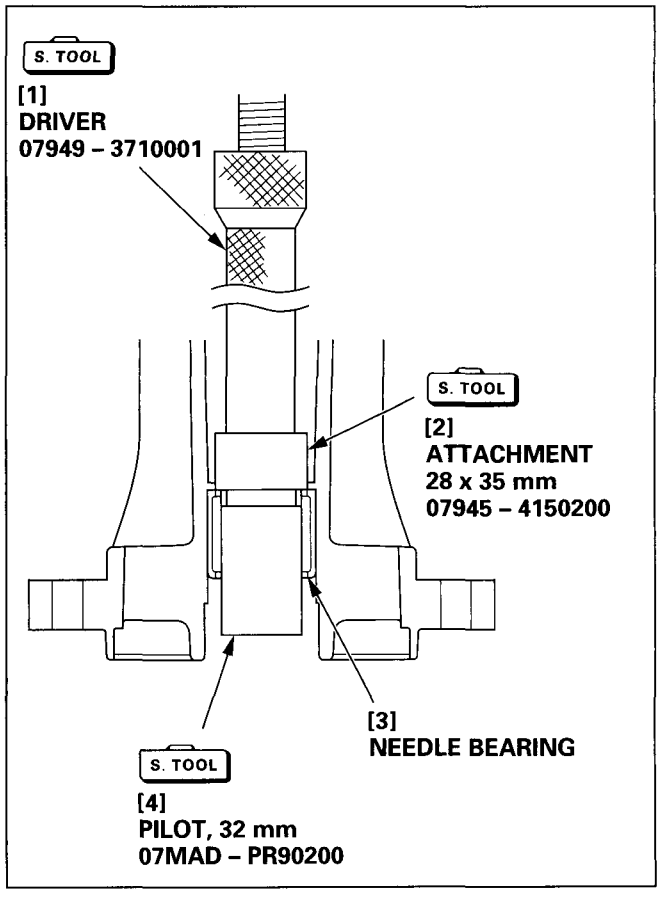


8) Remove the 32 x 42 x 30 mm needle bearing using the special tool as shown.

NOTICE
Replace the needle bearing on disassembly.

TOOL:

Driver	**07949 – 3710001**
Attachment, 28 x 35 mm	**07945 – 4150200**
Pilot, 32 mm	**07MAD – PR90200**

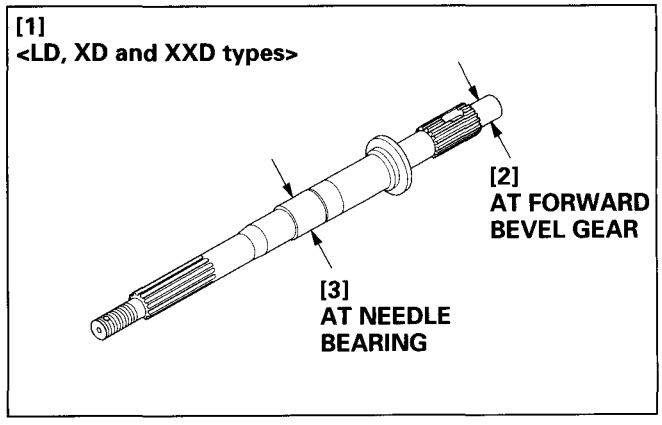


b. INSPECTION

• PROPELLER SHAFT O.D.

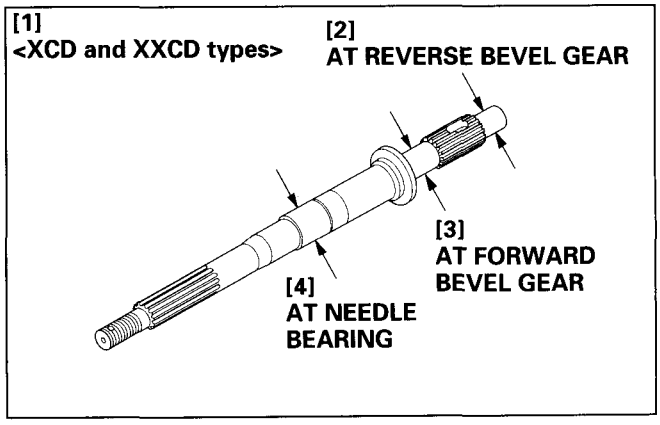
<LD, XD and XXD types>

	STANDARD	SERVICE LIMIT
At forward bevel gear	27.974 – 27.983 mm (1.1013 – 1.1017 in)	24.966 mm (0.9829 in)
At needle bearing	32.007 – 32.020 mm (1.2601 – 1.2606 in)	29.990 mm (1.1807 in)



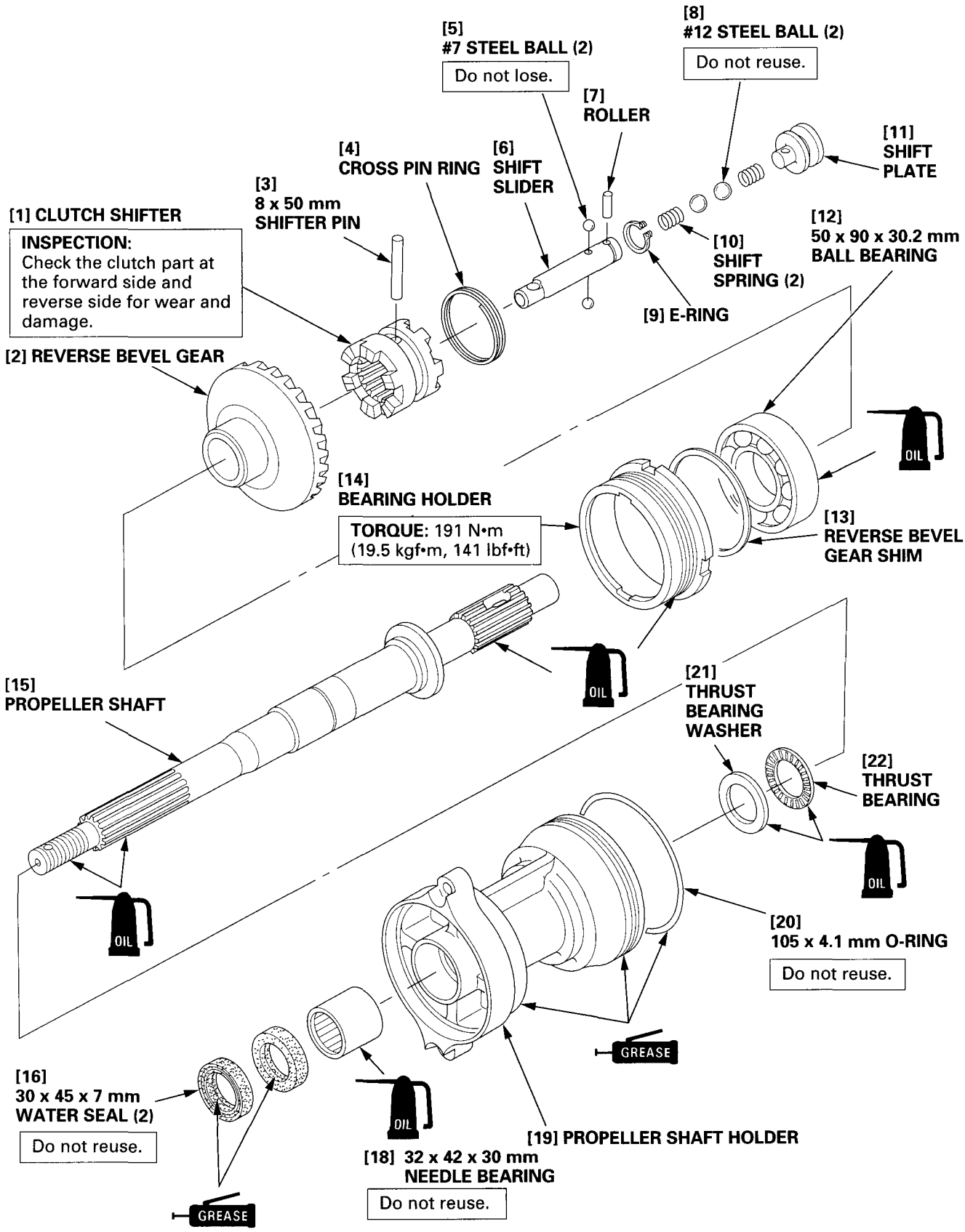
<XCD and XXCD types>

	STANDARD	SERVICE LIMIT
At reverse bevel gear	27.974 – 27.983 mm (1.1013 – 1.1017 in)	24.966 mm (0.9829 in)
At needle bearing	32.007 – 32.020 mm (1.2601 – 1.2606 in)	29.990 mm (1.1807 in)

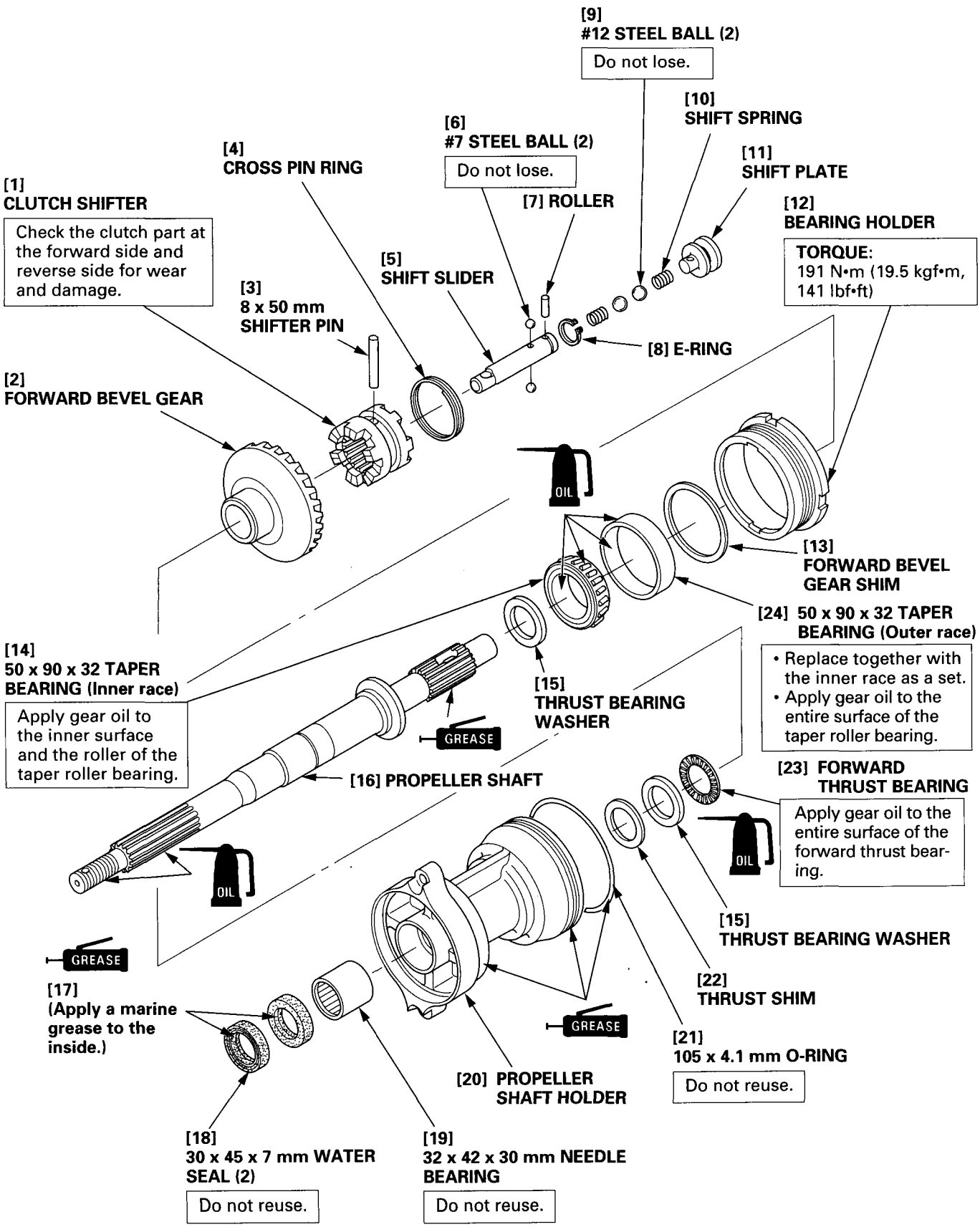


c. EXPLODED VIEW

- **LD, XD and XXD types**



• **XCD and XXCD types**



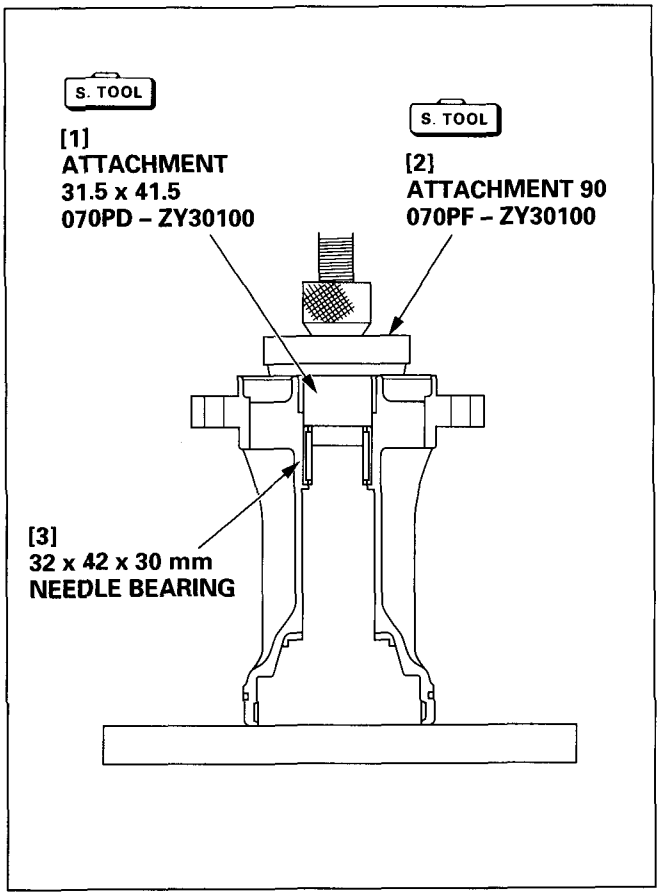
1) Apply gear oil to the circumference of a new needle bearing.

2) Press the needle bearing in the propeller shaft holder using the special tools and hydraulic press.

   - Install the needle bearing with the stamp mark at the end of the needle bearing facing the special tool.

TOOLS:

Attachment 90	**070PF – ZY30100**
Attachment 31.5 x 41.5	**070PD – ZY30100**



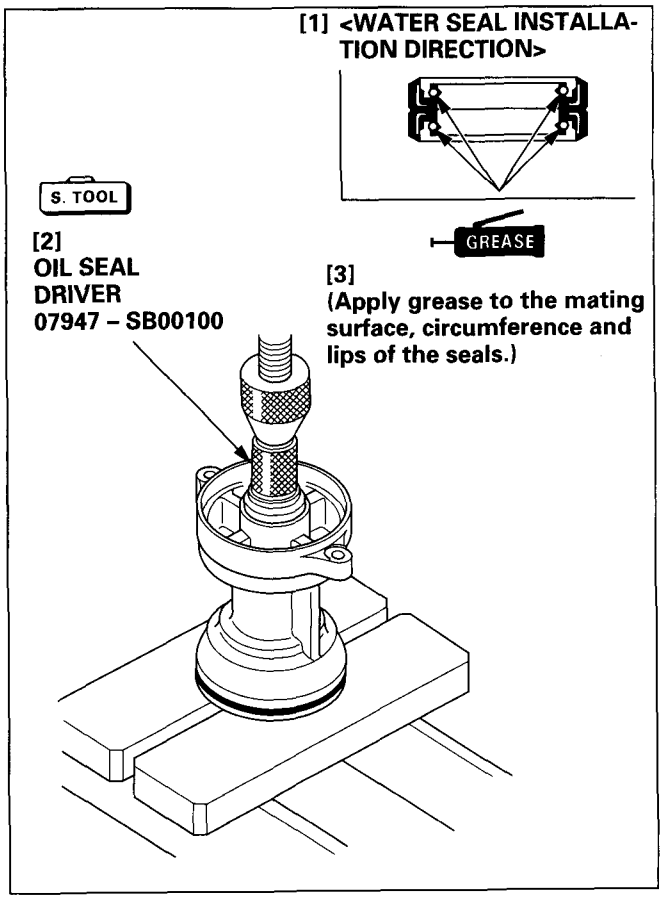
3) Apply soapy water to the circumference of the new 30 x 45 x 7 mm water seals.

4) Drive the 30 x 45 x 7 mm water seals into the propeller shaft holder one by one using the special tools. Note the installation direction of the water seals.

5) After installation of the water seals, apply grease to the lips of the seals.

TOOL:

Oil seal driver	**07947 – SB00100**

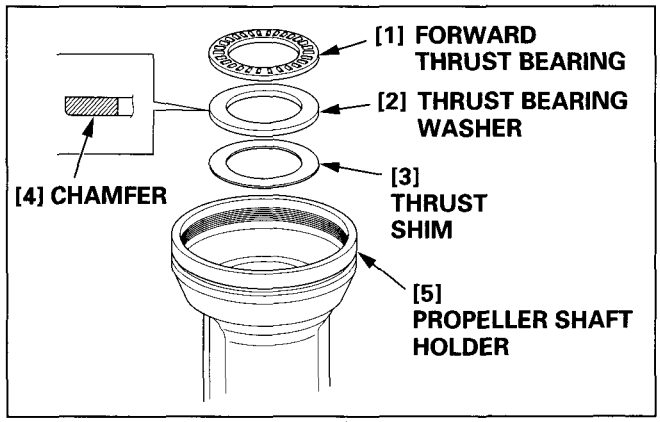


<XCD, XXCD types>

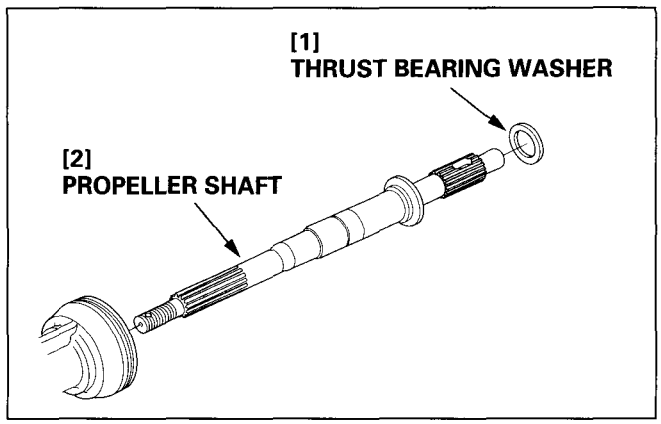
6) Install the thrust shim in the propeller shaft holder.

7) Install the thrust bearing washer with the chamfered side toward the shim.

8) Apply gear oil to the circumference of the forward thrust bearing, and set the bearing on the thrust bearing washer.



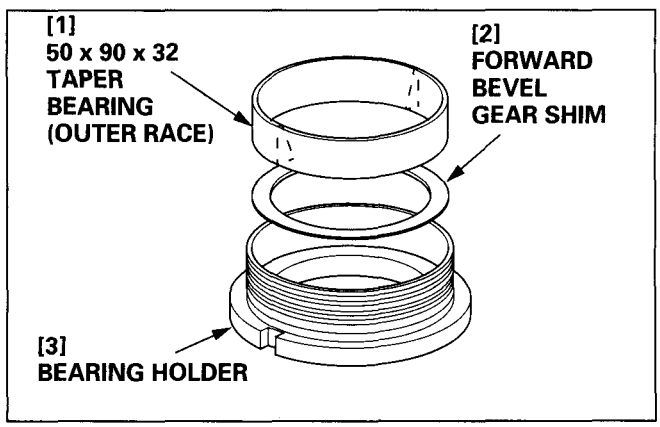
9) Install the propeller shaft and thrust bearing washer.



- Replace the taper bearing (outer race) together with the taper bearing (inner race) as a set.

10) Set the forward bevel gear shim on the bearing holder.

11) Apply gear oil to the circumference of a new taper bearing (outer race), and install it on the bearing holder with the small I.D. side toward the shim.



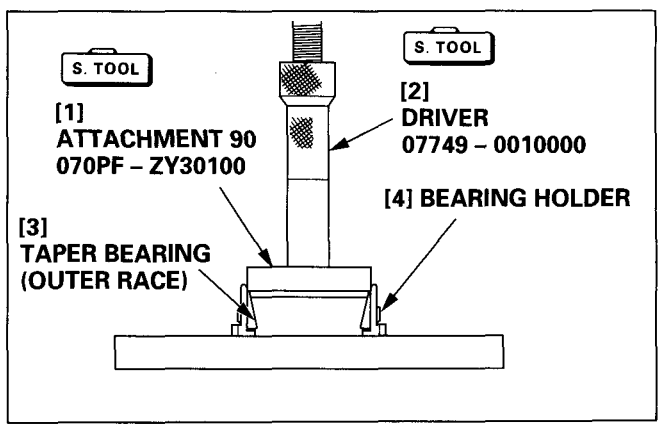
12) Using the special tools and the hydraulic press, install the taper bearing (outer race) on the bearing holder.

TOOLS:

Driver	**07749 – 0010000**
Attachment, 90	**070PF – ZY30100**

NOTICE

Take care not to cause the special tool to come in contact with the outer surface of the bearing holder.



13) Place the wood block on the gear face of the forward bevel gear.

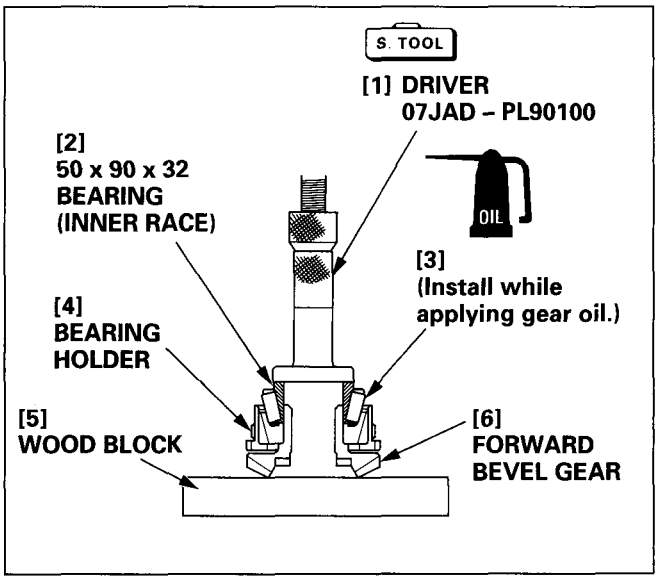
14) Set the bearing holder assembled in the step 4 on the forward bevel gear.

15) Apply gear oil to the inner surface of the taper bearing (inner race), and set it on the forward bevel gear.

16) Using the special tool and hydraulic press, set the inner race on the forward bevel gear while applying gear oil between the inner race and the outer race of the taper bearings.

TOOL:

Driver	**07JAD – PL90100**

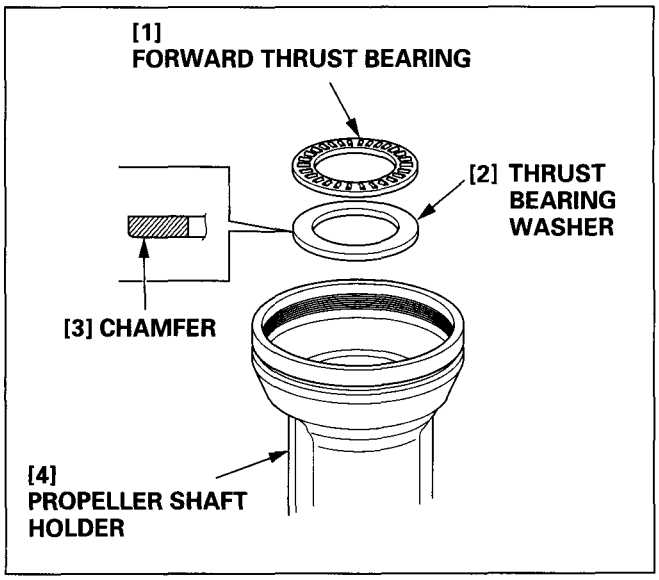


<LD, XD, XXD types only>

1) Install the thrust bearing washer with the chamfered side toward the shim.

2) Apply gear oil to the circumference of the forward thrust bearing, and set the bearing on the thrust bearing washer.

3) Install the propeller shaft.

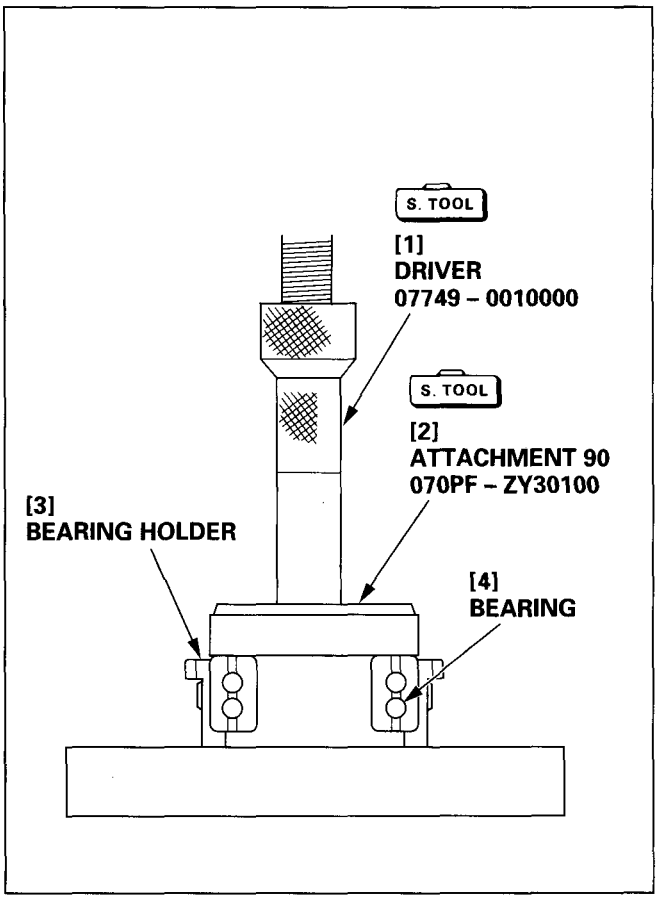


4) Check the bearing for play and abnormal sound by turning it by hand. Replace the bearing with a new one if necessary.

5) Apply gear oil to the entire surface of the bearing, and drive the bearing into the bearing holder using the special tool and hydraulic press.

TOOL:

Driver	**07749 – 0010000**
Attachment, 90	**070PF – ZY30100**

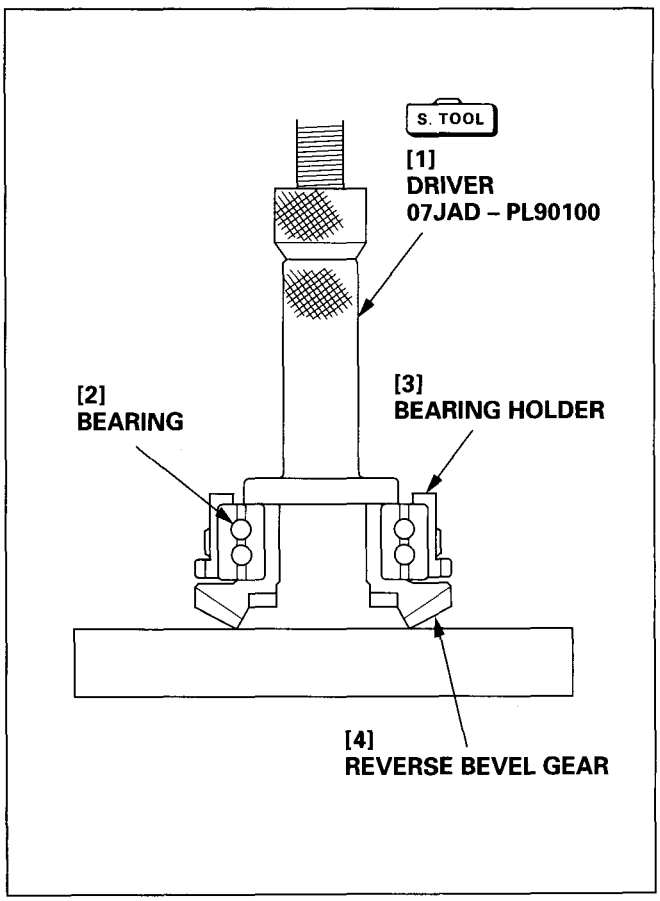


6) Place a wood block under the reverse bevel gear.

7) Apply gear oil to the entire surface of the bearing, and drive the reverse bevel gear into the bearing and bearing holder assembly using the special tool and hydraulic press.

TOOL:

Driver	**07JAD – PL90100**



8) Set the bearing holder assembly assembled in the step 27 on the propeller shaft. Loosely tighten the bearing holder assembly against the propeller shaft holder by hand.

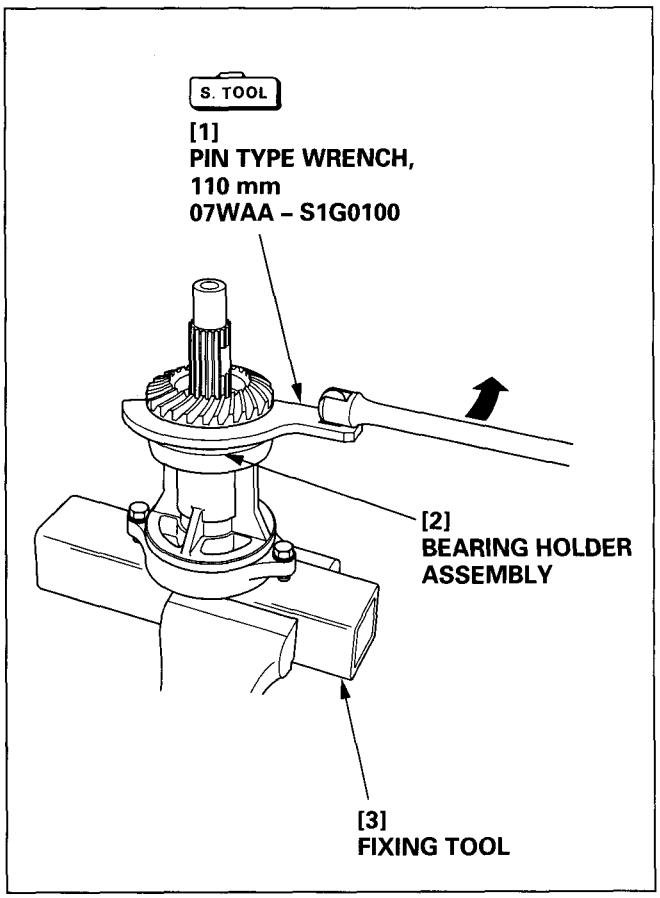
9) Install the fixing tool, that was used during removal, on the propeller shaft holder assembly.

10) Using the special tool, tighten the bearing holder to the specified torque.

TORQUE: 191 N•m (19.5 kgf•m, 141 lbf•ft)

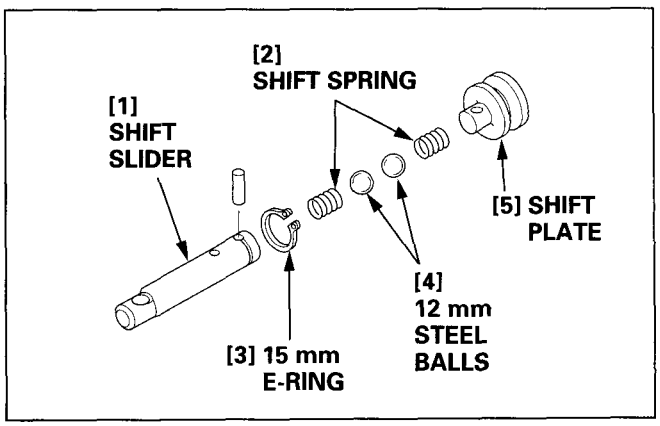
TOOL:
Pin type wrench, 110 mm 07WAA – S1G0100

NOTICE
Do not secure the propeller shaft holder on a vise directly. Use the fixing tool.



11) Install the shift spring, 12 mm steel balls, shift spring, and shift plate in the order shown.

12) Install the 13.8 x 4 mm roller and 15 mm external circlip by aligning the hole in the shift slider with the shift plate hole.

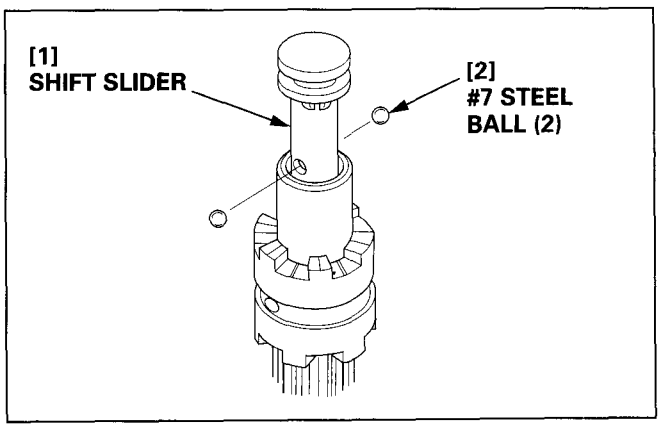


13) Position the propeller shaft vertically so the shift slider is facing up.

14) Pull up the shift slider until the #7 steel ball installation holes in the shift slider appear.

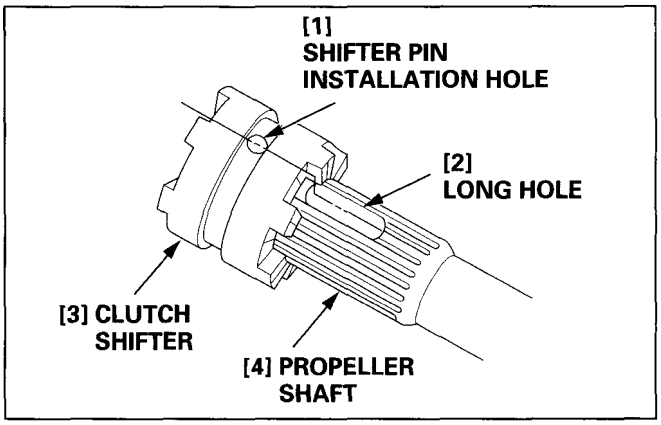
15) Set the #7 steel balls in the right and left #7 steel ball installation holes respectively, and push the shift slider into the propeller shaft slowly.

- Push in the shift slider with care not to let the steel balls pop out.



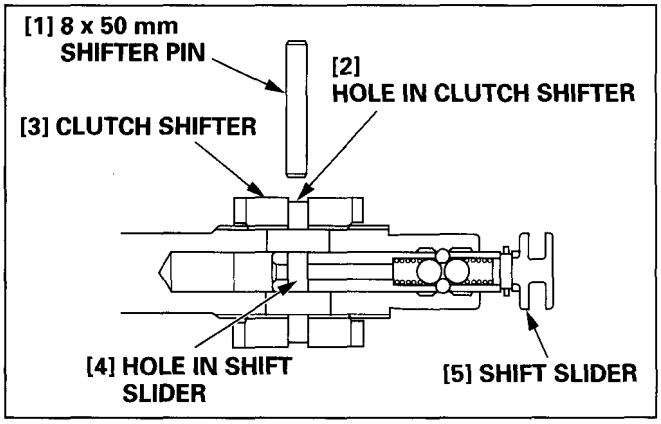
- XCD and XXCD types: Be sure that the bearing holder assembly, thrust bearing, washer and the shim are set on the propeller shaft holder assembly (P. 12-28).

16) Assemble the clutch shifter and the propeller shaft by aligning the long hole in the propeller shaft with the 8 x 50 mm shifter pin hole.



17) Align the clutch shifter hole and the hole in the shift slider, and install the 8 x 50 mm shifter pin.

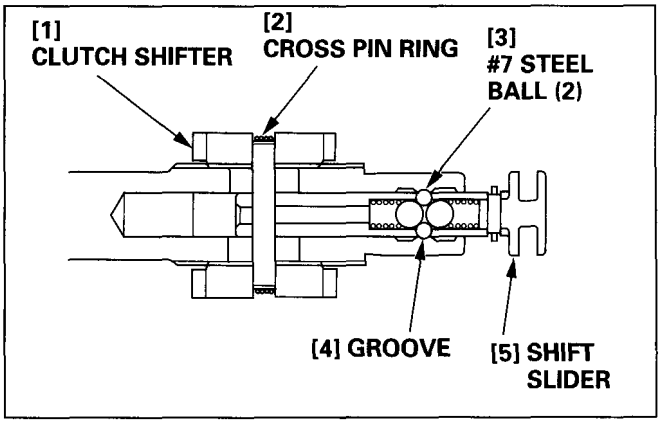
18) Install it so that spiral line of the cross pin ring may not pile up.



19) Be sure that the #7 steel balls are in the groove in the propeller shaft securely as shown.

Check procedure:

Be sure that the clutch shifter is not at the reverse bevel gear installation side. If it is at the reverse bevel gear installation side, pull up the shift slider slowly.



6. VERTICAL SHAFT/BEVEL GEAR

a. DISASSEMBLY

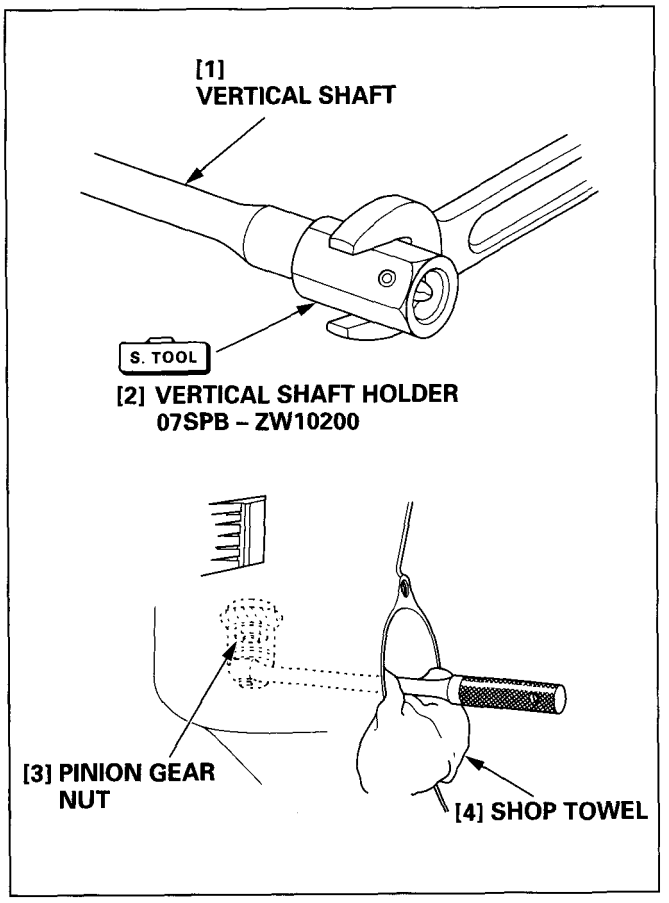
Remove the following:
— Propeller (P. 12-2)
— Gear case assembly (P. 12-3)
— Water pump/shift rod (P. 12-9)
— Propeller shaft holder assembly (P. 12-19)

1) Attach the special tool to the vertical shaft end.

2) Use a shop towel or equivalent cloth to protect the gear case as shown.

3) Holding the special tool, remove the pinion gear nut.

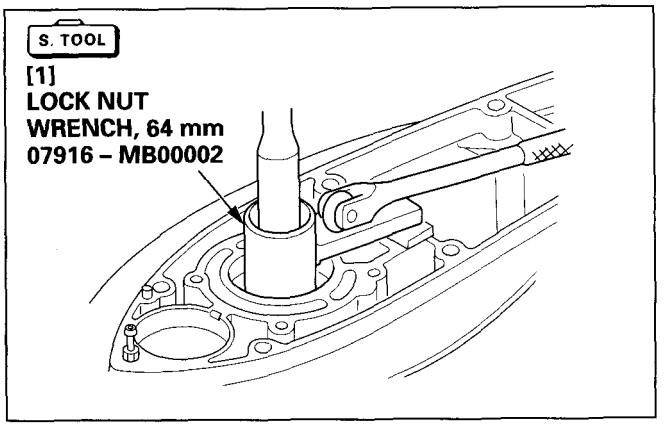
TOOL:
Vertical shaft holder **07SPB – ZW10200**



4) Remove the 64 mm lock nut using the special tool.

TOOL:
Lock nut wrench, 64 mm **07916 – MB00002**

5) Remove the vertical shaft.



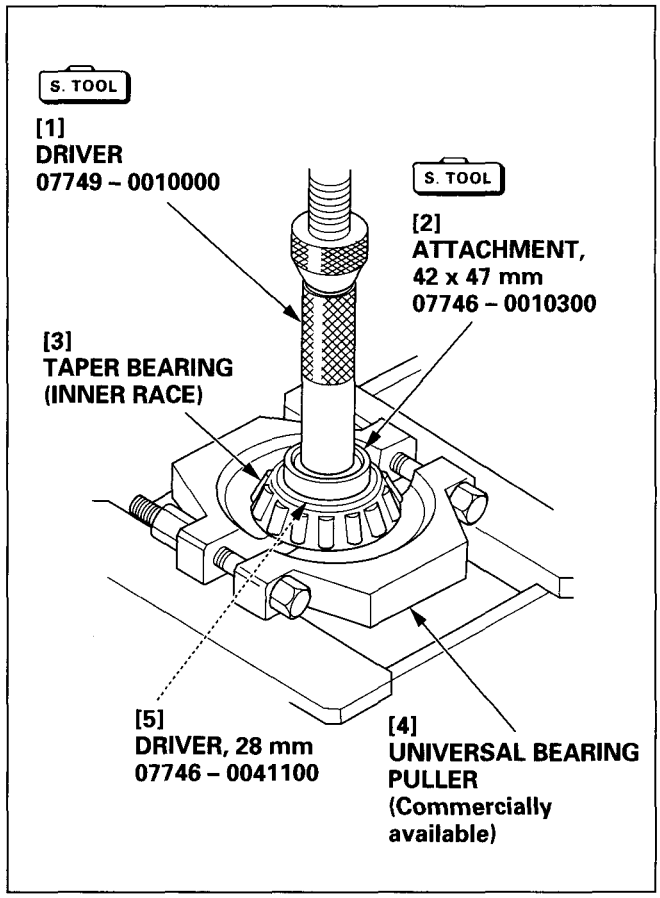
<LD, XD and XXD types only>

6) Set the commercially available universal bearing puller between the taper bearing (inner race) and forward bevel gear.

7) Set the special tools on the taper bearing (inner race) as shown, and drive out the taper bearing (inner race) using the hydraulic press.

TOOLS:

Driver	**07749 – 0010000**
Attachment	**07945 – 3330300**
Driver 28 mm	**07746 – 0041100**

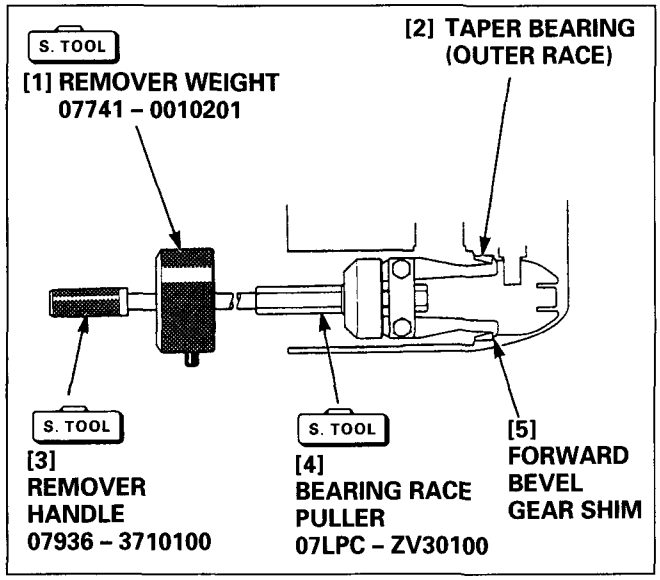


8) Remove the taper bearing (outer race) using the special tools. Remove the forward bevel gear shim.

- Replace the taper bearing (outer race) and the taper bearing (inner race) as a set on disassembly.

TOOLS:

Bearing race puller	**070PC – ZY30100**
Remover weight	**07741 – 0010201**
Remover handle	**07936 – 3710100**

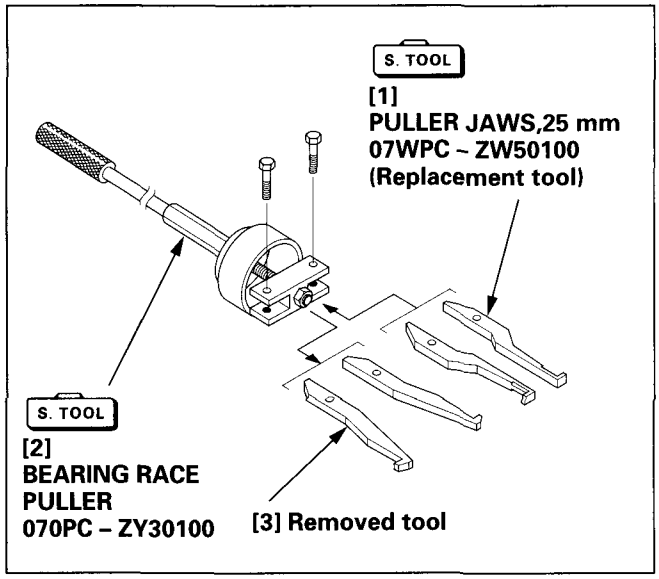


<XCD and XXCD types only>

9) Replace the puller jaws of the special tool as shown.

TOOLS:

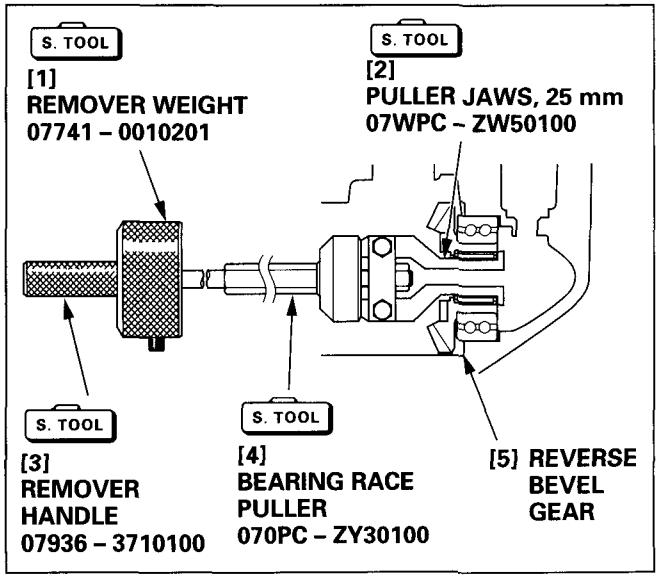
Bearing race puller	**070PC – ZY30100**
Puller jaws, 25 mm	**07WPC – ZW50100**



10) Remove the reverse bevel gear using the special tools with the new puller jaws replaced in step 2.

TOOLS:

Bearing race puller	**070PC – ZY30100**
Remover weight	**07741 – 0010201**
Remover handle	**07936 – 3710100**
Puller jaws, 25 mm	**07WPC – ZW50100**

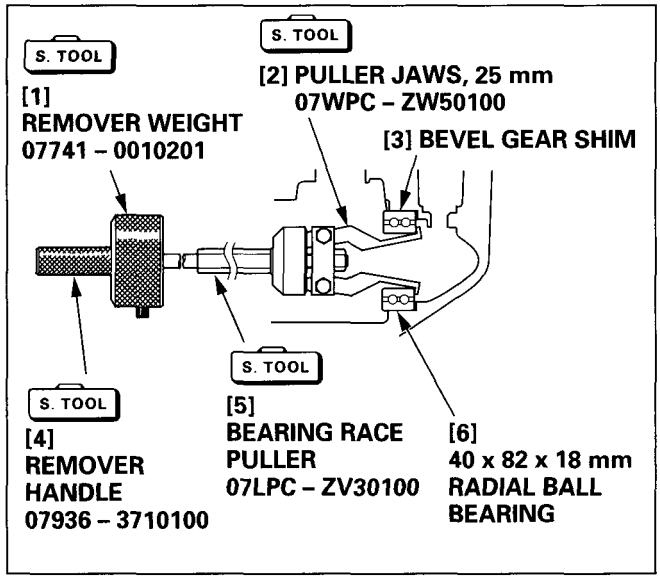


11) Using the same special tools, remove the 50 x 90 x 30.2 mm radial ball bearing.

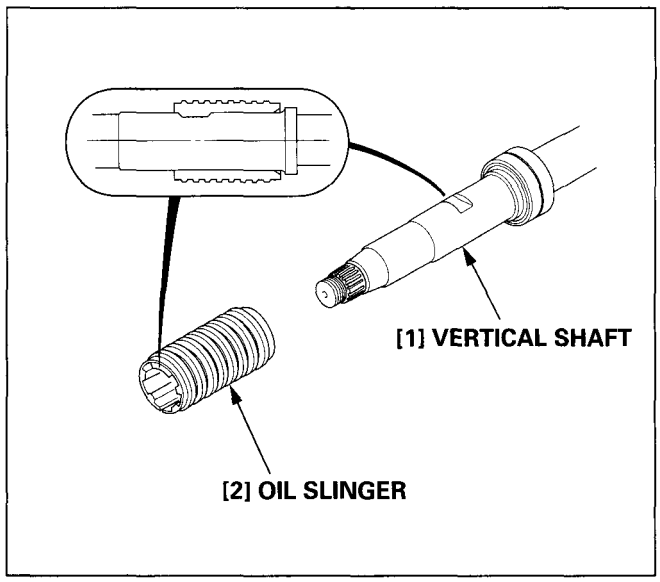
12) Remove the bevel gear shim.

TOOLS:

Bearing race puller	**070PC – ZY30100**
Remover weight	**07741 – 0010201**
Remover handle	**07936 – 3710100**
Puller jaws, 25 mm	**07WPC – ZW50100**



13) Remove the oil slinger from the vertical shaft.

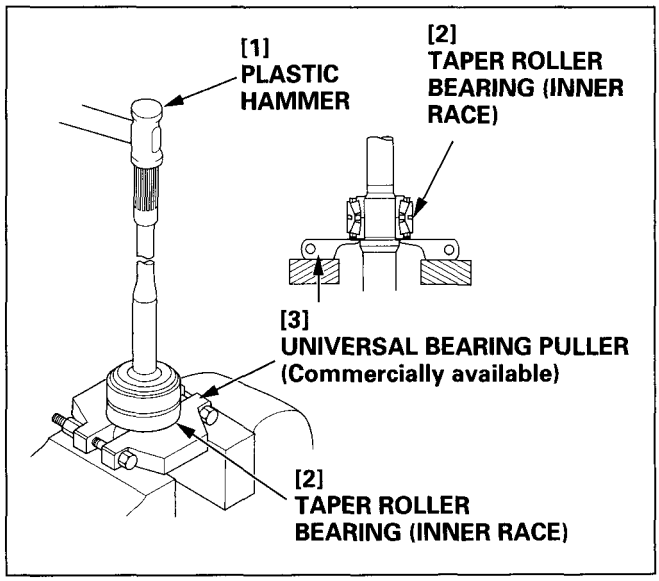


14) Set the commercially available universal bearing puller on the taper roller bearing (inner race), then set the universal bearing puller on the vice.

15) Remove the taper roller bearing by tapping on the end of the vertical shaft using a plastic hammer.

NOTICE

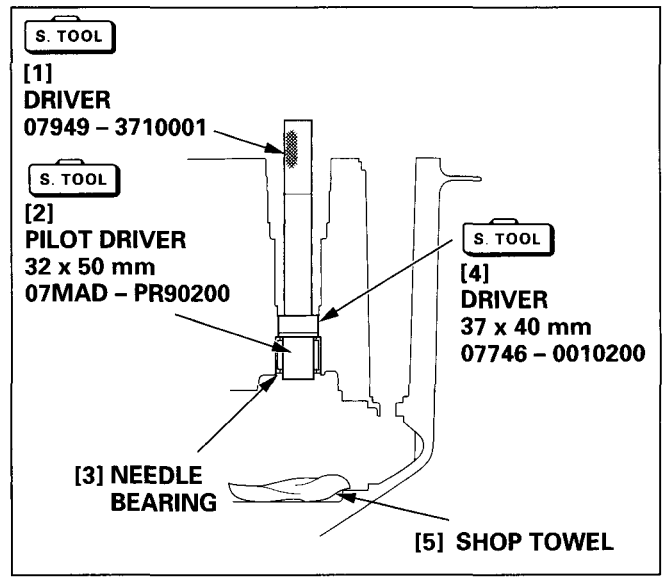
Do not hold the vertical shaft with a vise. Use a plastic hammer to tap on the end of the vertical shaft.



16) Set the special tools on the 36 x 46 x 37 mm needle bearing as shown. Place a shop towel or equivalent material under the needle bearing.

TOOLS:

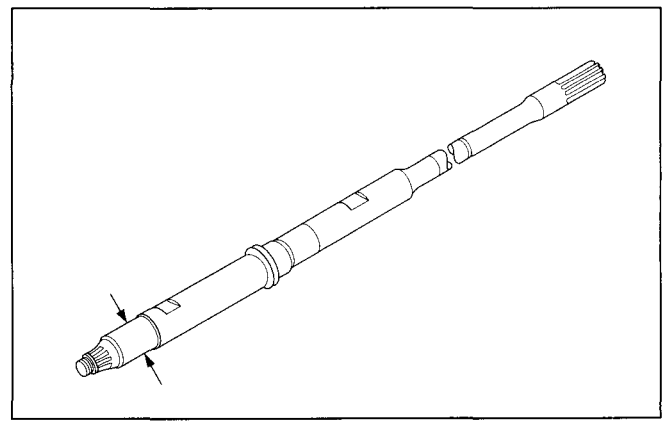
Driver	**07949 – 3710001**
Driver 37 x 40 mm	**07746 – 0010200**
Pilot driver 32 x 50 mm	**07MAD – PR90200**



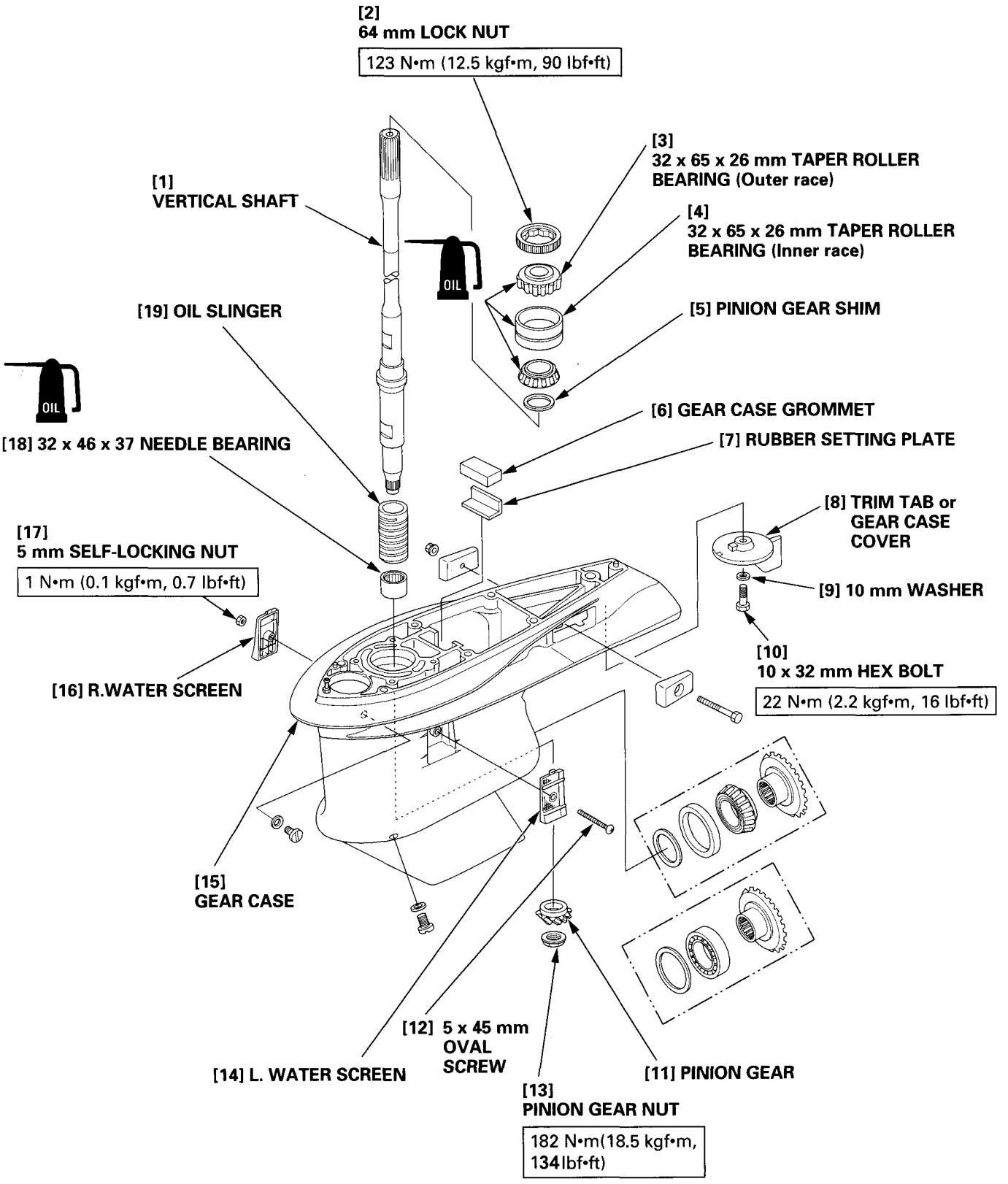
b. INSPECTION

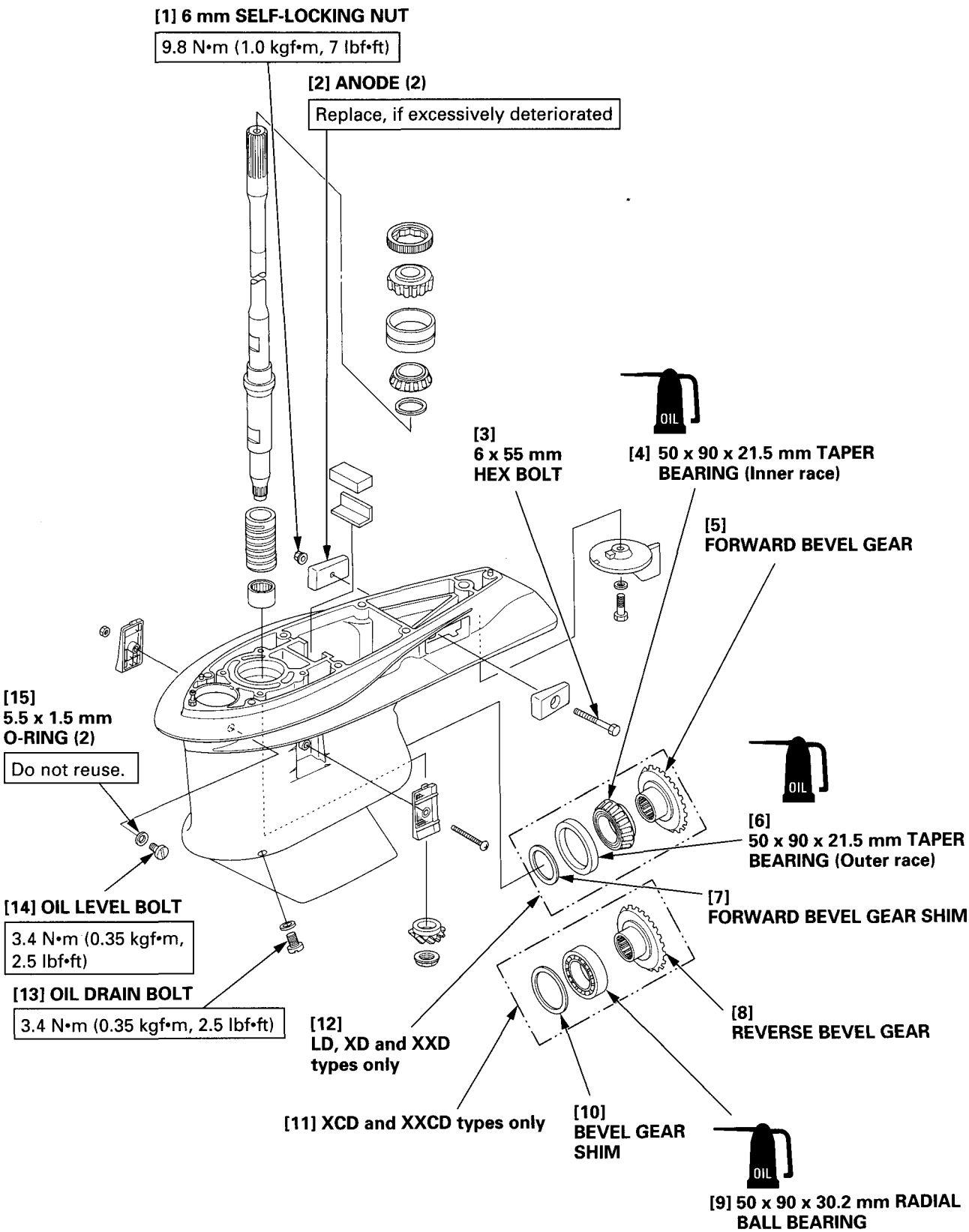
- **VERTICAL SHAFT O.D. (At needle bearing)**

STANDARD	SERVICE LIMIT
31.991 – 32.000 mm (1.2595 – 1.2598 in)	28.545 mm (1.1238 in)



c. EXPLODED VIEW




[1] 6 mm SELF-LOCKING NUT
9.8 N•m (1.0 kgf•m, 7 lbf•ft)
[2] ANODE (2)
Replace, if excessively deteriorated
OIL
[3]
6 x 55 mm
HEX BOLT
[4] 50 x 90 x 21.5 mm TAPER
BEARING (Inner race)
[5]
FORWARD BEVEL GEAR
[15]
5.5 x 1.5 mm
O-RING (2)
Do not reuse.
OIL
[6]
50 x 90 x 21.5 mm TAPER
BEARING (Outer race)
[7]
FORWARD BEVEL GEAR SHIM
[14] OIL LEVEL BOLT
3.4 N•m (0.35 kgf•m,
2.5 lbf•ft)
[13] OIL DRAIN BOLT
3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)
[12]
LD, XD and XXD
types only
[8]
REVERSE BEVEL GEAR
[11] XCD and XXCD types only
[10]
BEVEL GEAR
SHIM
OIL
[9] 50 x 90 x 30.2 mm RADIAL
BALL BEARING

d. INSTALLATION

1) Apply gear oil to the circumference of the 36 x 46 x 37 mm new needle bearing.

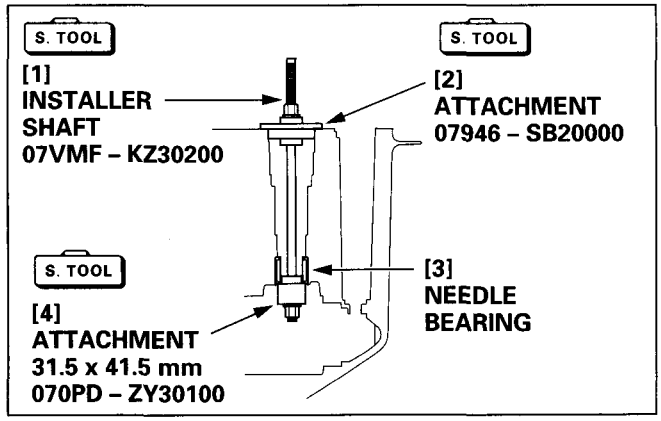
2) Using the special tools, install the 36 x 46 x 37 mm needle bearing. Install the needle bearing stamped side toward down.

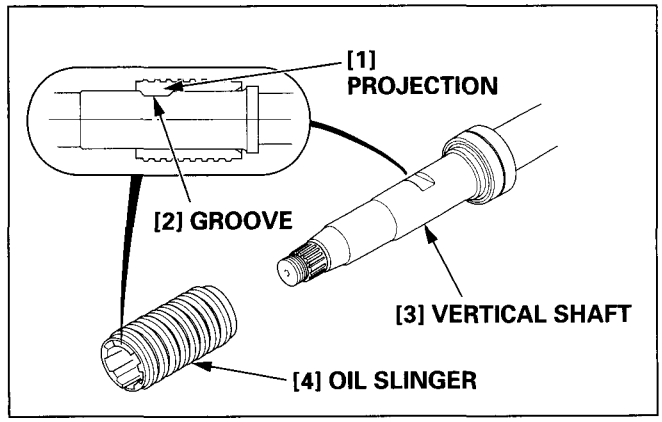
3) After installation of the needle bearing, check whether the underside of the bearing is level with the bottom of the gear case.

TOOLS:

Installer shaft	**07VMF – KZ30200**
Attachment	**07946 – SB20000**
Attachment 31.5 x 41.5 mm	**070PD – ZY30100**

4) Install by aligning the projection on the inner wall of the oil slinger with groove of the vertical shaft.





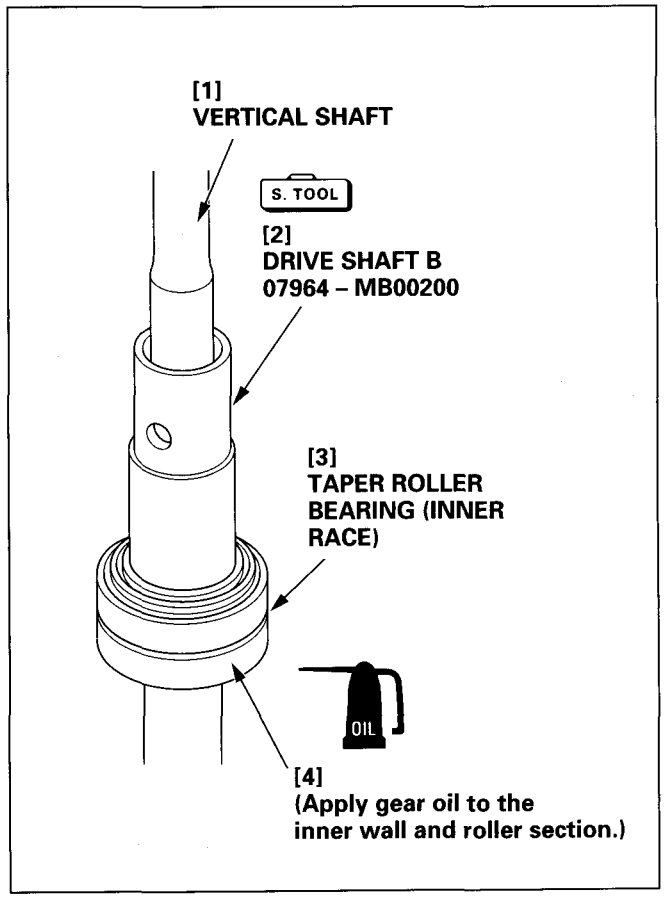
5) Set the pinion gear on the vertical sahaft and temporarily tighten the pinion gear nut by hand.

6) Apply gear oil to the inner wall and the roller section of the taper roller bearing (inner race).

7) Set the pinion gear shim, taper roller bearing and the special tool on the vertical shaft.

TOOL:

Drive shaft B	**07964 – MB00200**



8) Set the vertical shaft upright on the hydraulic press with the pinion gear side toward up as shown.

9) Install the taper roller bearing on the vertical shaft using the hydraulic press.

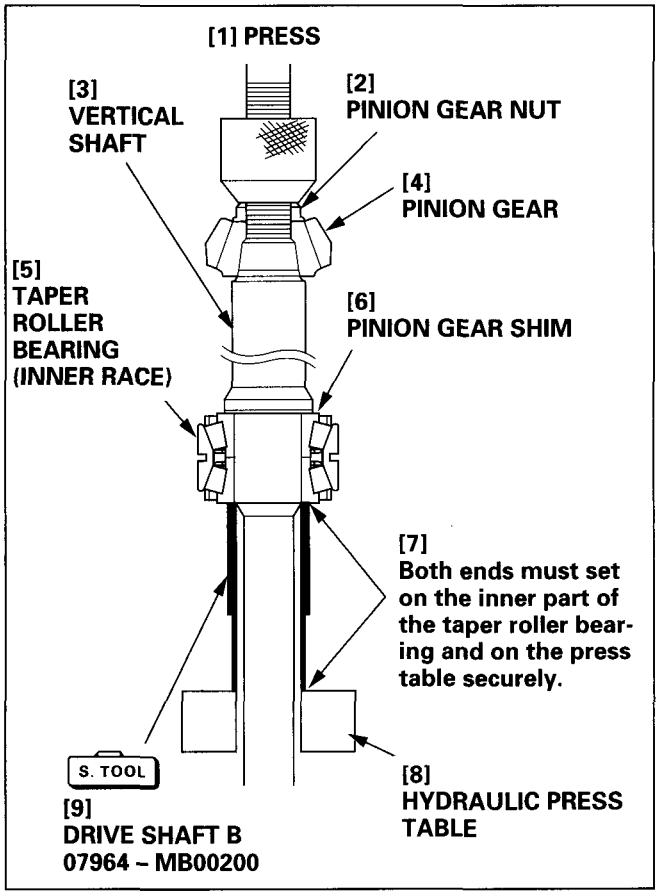
   • Be sure that the ends of the special tool securely set on the inner part of the taper roller bearing and on the hydraulic press table respectively.

NOTICE

Take care not to damage the threaded part (i. e. pinion gear nut installation part) at the end of the vertical shaft.

TOOL:

Drive shaft B	**07964 – MB00200**



<XCD and XXCD type only>

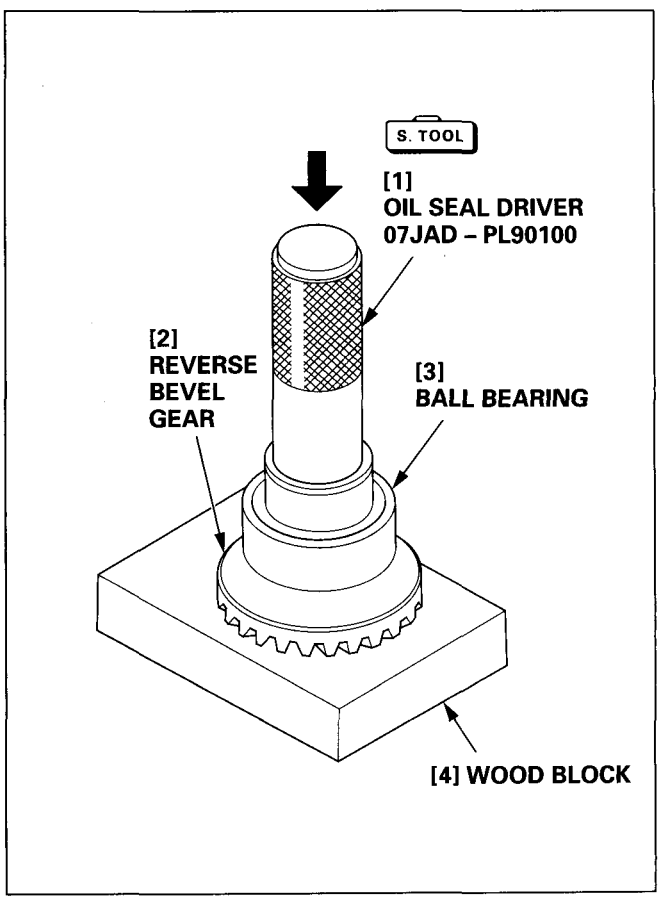
10) Place a wood block under the reverse bevel gear.

11) Check the bearing for play and abnormal sound by turning it by hand. Replace the bearing with a new one if necessary.

12) Apply gear oil to the entire surface of the bearing, and drive the bearing into the reverse bevel gear using the special tool and hydraulic press.

TOOL:

Oil seal driver	**07JAD – PL90100**



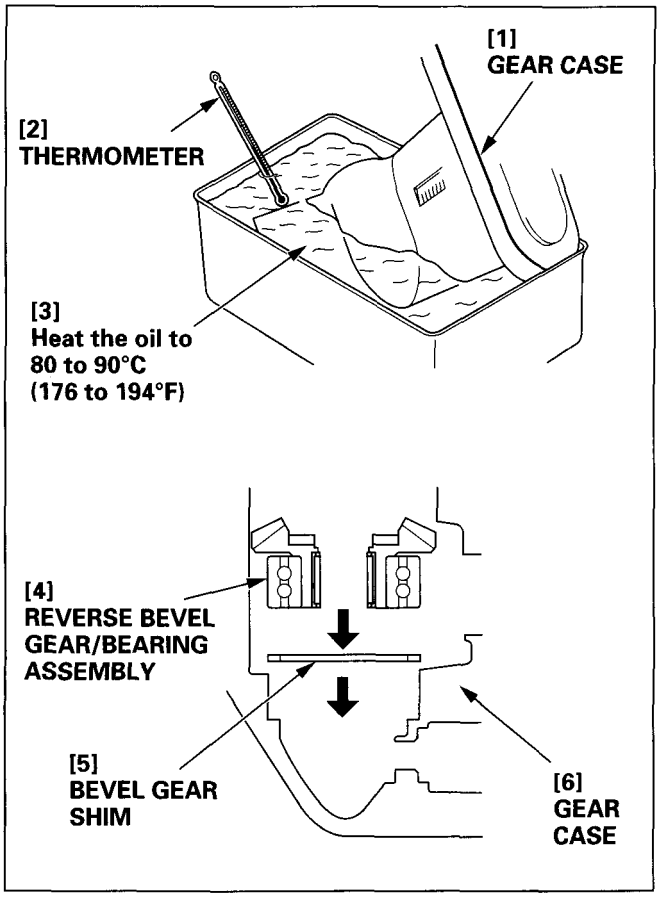
13) Soak the gear case in the container filled with oil with the bearing installation side toward down.

14) Heat the oil to 80 to 90°C (176 to 194°F).

15) After the entire of the bearing installation side of the gear case becomes hot, remove the gear case from the container and install the bevel gear shim and the reverse bevel gear/bearing assembly on the gear case quickly.

CAUTION:

- **Do not heat the oil above 90°C (194°F).**
- **The entire gear case becomes hot. Be sure to wear the gloves during the operation.**
- **Do not apply 9,000 N (917 kgf, 2,022 lbs) or more when installing.**



<LD, XD and XXD types only>

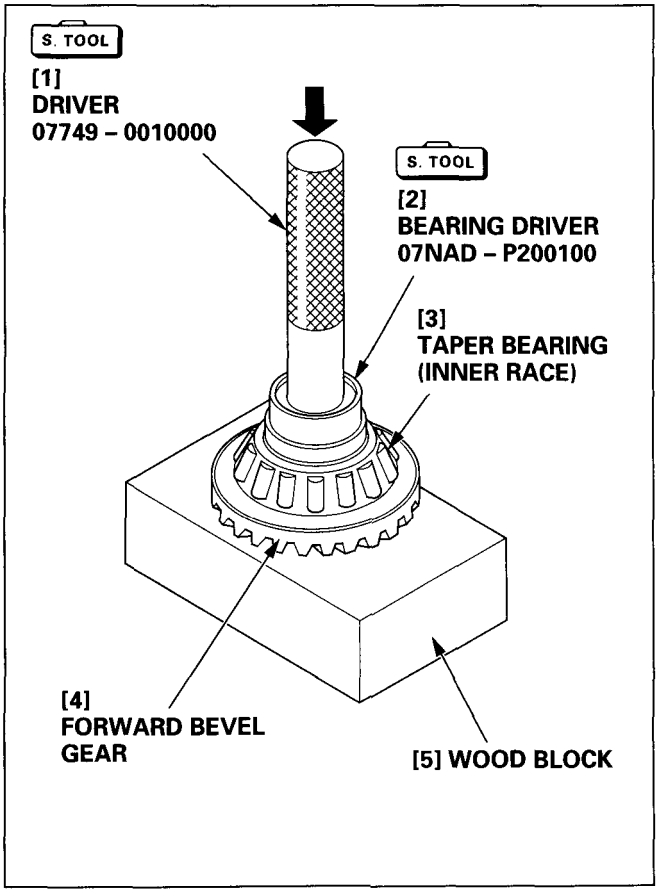
16) Apply gear oil to the inner wall and the roller of the taper roller bearing (inner race).

17) Place a wood block under the forward bevel gear.

18) Drive the taper bearing into the forward bevel gear using the special tools and hydraulic press as shown.

TOOLS:

Driver	**07749 – 0010000**
Bearing driver	**07NAD – P200100**



- Install the new taper bearing with the larger I. D. side facing out.

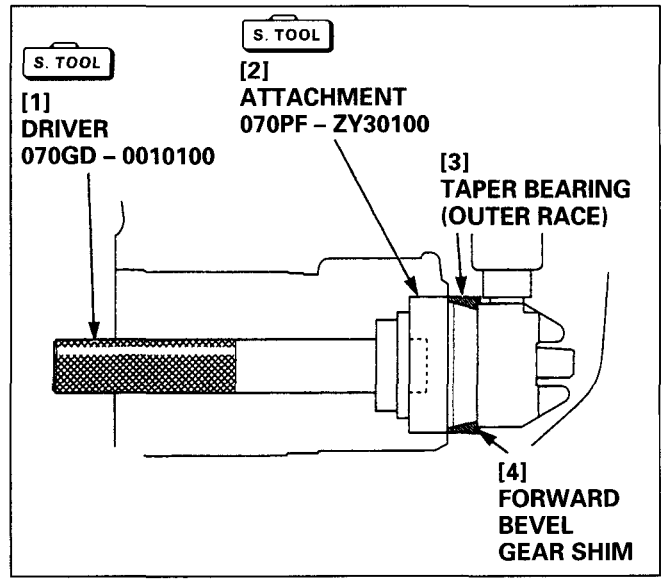
19) Place the forward bevel gear shim in the gear case.

20) Apply gear oil to the circumference of a new taper bearing, and set the bearing in the gear case.

21) Install the taper bearing (outer race) in the gear case using the special tools as shown.

TOOLS:

Driver	**070GD – 0010100**
Attachment	**070PF – ZY30100**



22) Set the taper bearing and forward bevel gear in the gear case.

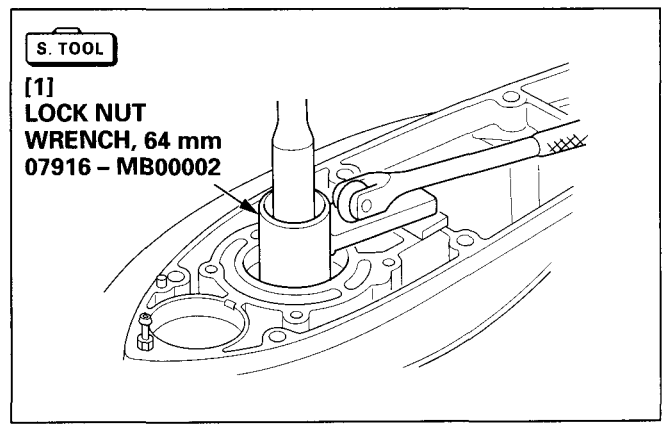
23) Take care not to remove the roller of needle bearing, and install the vertical shaft.

24) Install the 64 mm lock nut using the special tool.

TORQUE: 123 N•m (12.5 kgf•m, 90 lbf•ft)

TOOL:

Lock nut wrench, 64 mm	**07916 – MB00002**



Be sure that the forward bevel gear is mounted properly.

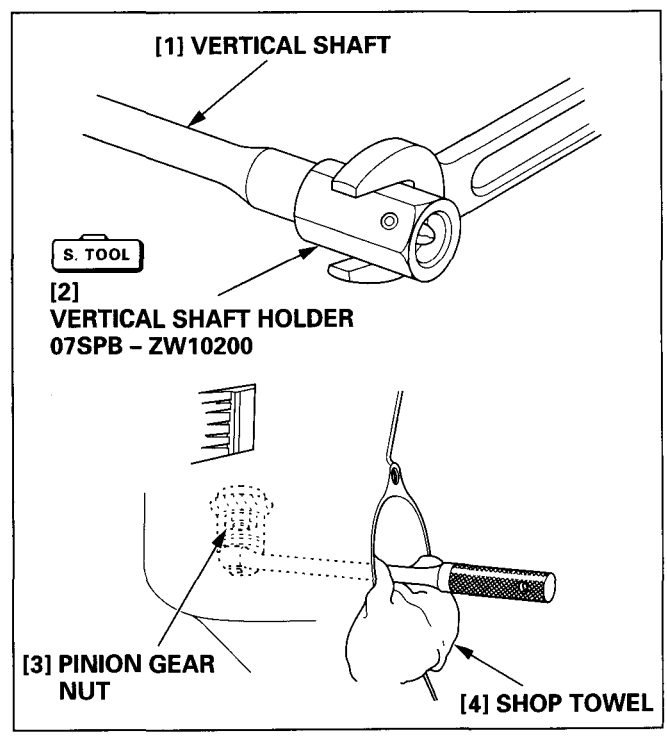
25) Clean the vertical shaft and the tapered part of the pinion gear thoroughly with degreasing cleaning agent.

26) Tighten the pinion gear nut to the specified torque in the same procedure as of removal.

TORQUE: 181 N•m (18.5 kgf•m,134 lbf•ft)

TOOL:

Vertical shaft holder	**07SPB – ZW10200**



7. SHIM SELECTION

• PINION GEAR SHIM

Remove the 32 x 65 x 26 mm taper roller bearing (inner race) if it is mounted on the vertical shaft (P. 12-37).

1) Wipe the tapered part of the vertical shaft and pinion gear with a shop towel and a degreasing cleaning solvent.

2) Install the pinion gear on the vertical shaft and tighten the pinion gear nut to the specified torque.

   TORQUE: 181 N•m (18.5 kgf•m, 134 lbf•ft)

   - Do not install the vertical shaft in the gear case.
   - We recommend that you attach the special tool (vertical shaft holder) at the end of the vertical shaft to facilitate tightening of the pinion gear nut to the specified torque (P. 12-45).

3) Be sure that the side of the special tool (i.e. side with the stamped tool number) is facing to the opposite side from the pinion gear, and be sure that the tool of the pinion gear nut side is not set on the nut.

   Tighten the bolts by hands while pushing both tools toward the pinion gear side.

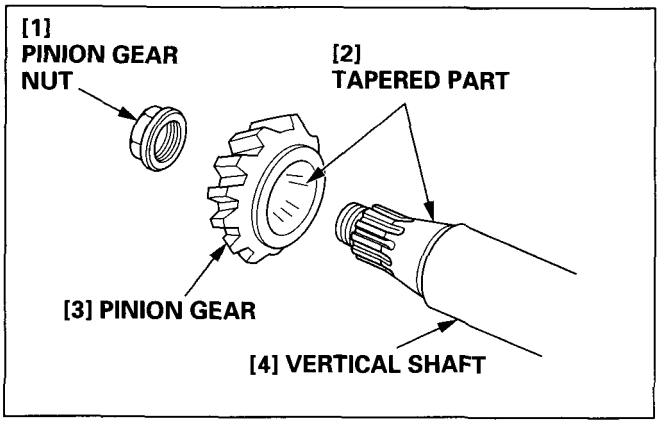
   - Do not confuse the pinion gear side and the taper roller bearing side of the spepcial tool.
   - Do not score and scratch the opposite side (measurement side) from the side where the tool number is stamped.
   - Do not tighten the bolts with a tool.
   - There must be no wobbling in the special tool. It must securely set on the pinion gear.

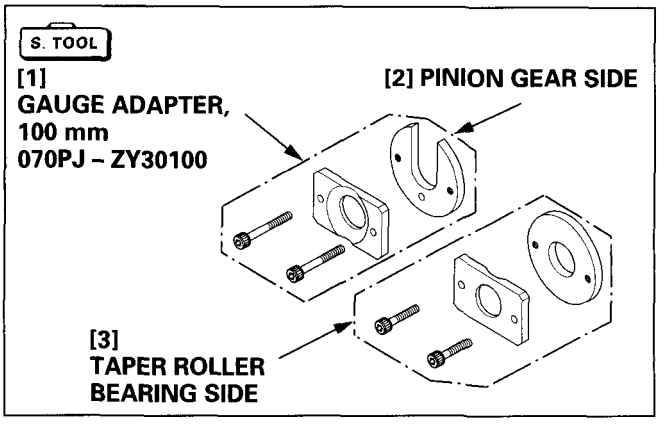
   TOOL:
   Gauge adapter, 100 mm 070PJ – ZY30100

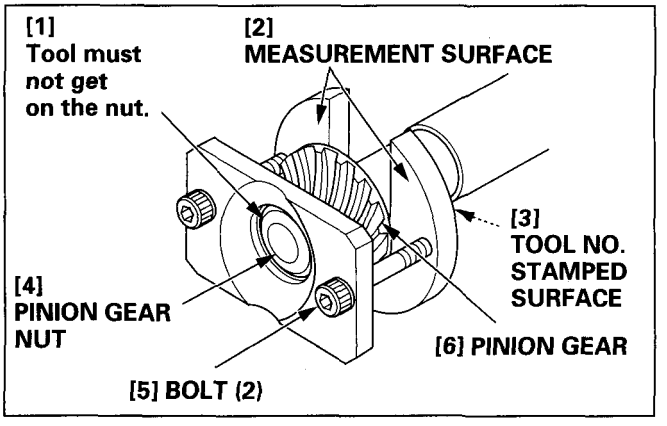
4) Set the both tools on both sides of the projection on the vertical shaft so that the side of the special tool stamped with the tool number faces to the opposite side from the pinion gear as shown. Tighten the bolts by hands.

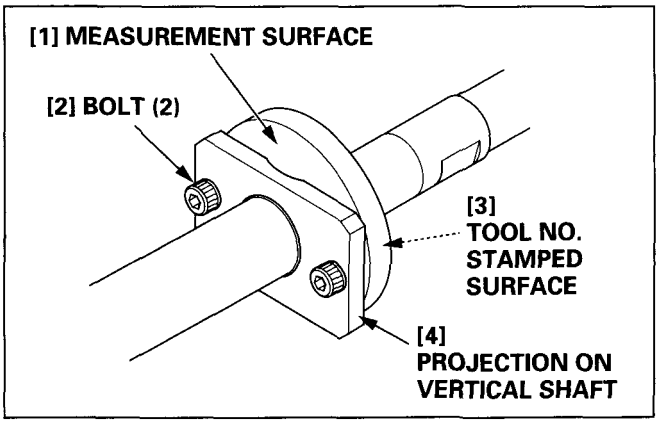
   Align the tool end gap of the pinion gear side with the tool end gap of the taper roller bearing side.

   - Do not tighten the bolts with a tool.
   - There must be no wobbling in the special tool. It must securely set on the pinion gear.





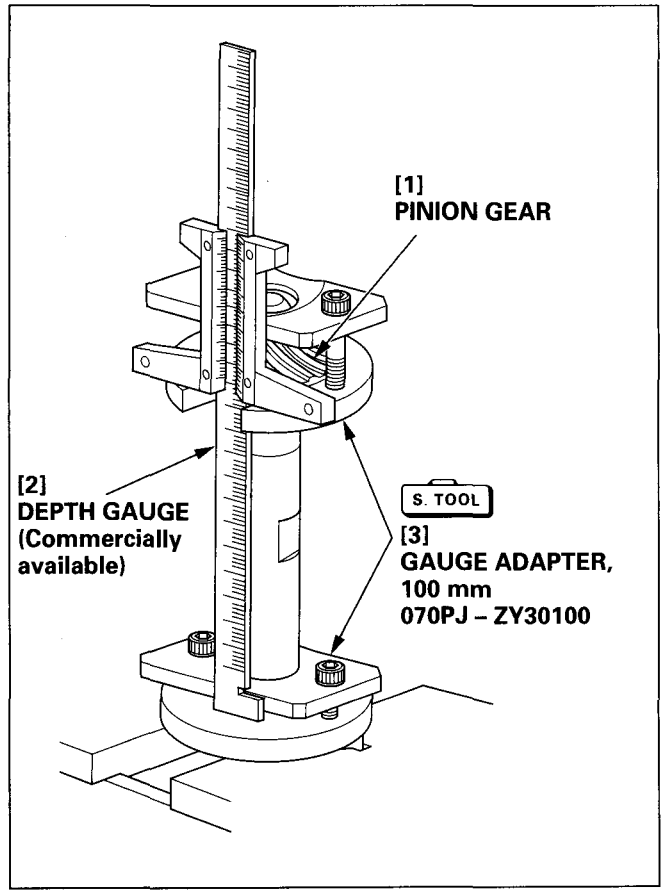




5) Hold the vertical shaft upright (with the pinion gear *toward up) and secure the vertical shaft.*

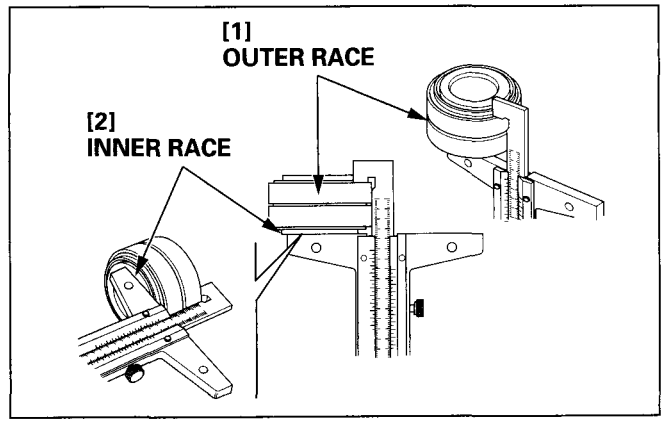
6) Set the commercially available depth gauge at the gauge adapter of the pinion gear side as shown. Measure the vertical shaft length (dimension "D") and record it.

TOOL:
Gauge adapter, 100 mm 070PJ – ZY30100

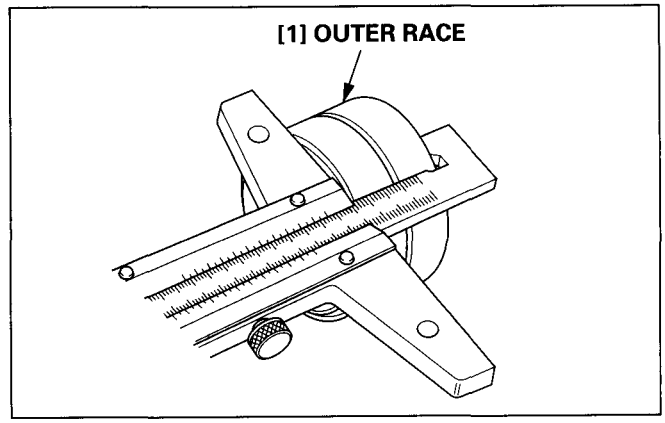


7) Assemble the outer race and inner race of the 30 x 62 x 40 mm taper roller bearing.

8) Measure the bearing height from the outer race end to the inner race end as shown, and record the measurement.



9) Measure the height of the 30 x 62 x 40 mm taper roller bearing outer race and record the measurement.



10) Calculate the gap (distance E) between the outer race and inner race using the measuremnets obtained in the step 8 and 9 and the following formula.

Formula:
Bearing height – Outer race height = Gap (distance E)

Example:
When, bearing height from the outer race end to the inner race end is 40.1 mm,
And, outer race height is 34.9 mm (1.37 in):
40.1 – 34.9 = 5.2

Therefore, the gap (distance E) is 5.2 mm (0.20 in).

11) Determine the calculation value using the vertical shaft length (distance D) obtained in step 6 and the gap (distance E) obtained in step 10 and the following formula.

Formula:
Vertical shaft length (distance D) + Gap (distance E) – 156 = Caluculation value.

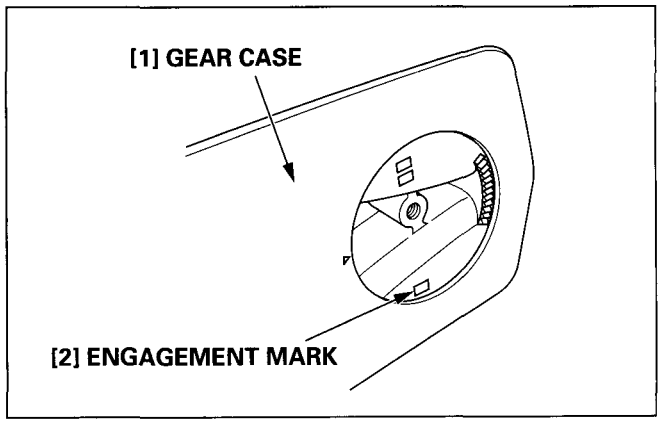
Example:
When, vertical shaft length (distance D) is 150.6 mm (5.929 in),
And, gap (distance E) is 5.2 mm (0.20 in):
150.6 + 5.2 – 156 = – 0.20

Therefore, the calculation value is – 0.20 mm (– 0.008 in)

12) Cross reference the calculation value and the engagement mark located on the trim tab installation part of the gear case, and select the shim of the appropriate thickness from the shim selection table accordingly.

- Shim type table

Parts name	Thickness
Pinion gear shim A	0.10 mm (0.004 in)
Pinion gear shim B	0.15 mm (0.006 in)
Pinion gear shim C	0.30 mm (0.012 in)
Pinion gear shim D	0.50 mm (0.020 in)



- **Pinion gear shim selection table**

[1] Unit: mm (in)

[3] Engagement mark on the gear case	[2] Calculation value								
	0.41 (0.016) – 0.35 (0.014)	0.35 (0.014) – 0.30 (0.012)	0.30 (0.012) – 0.25 (0.010)	0.25 (0.010) – 0.20 (0.008)	0.20 (0.008) – 0.15 (0.006)	0.15 (0.006) – 0.10 (0.004)	0.10 (0.004) – 0.05 (0.002)	0.05 (0.002) – 0 (0.000)	0 (0.000) – –0.05 (–0.002)
F	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)
E	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)
D	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)
C	0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)
B		0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)
A			0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)

[1] Unit: mm (in)

[3] Engagement mark on the gear case	[2] Calculation value						
	–0.05 (–0.002) – –0.10 (–0.004)	–0.10 (–0.004) – –0.15 (–0.006)	–0.15 (–0.006) – –0.20 (–0.008)	–0.20 (–0.008) – –0.25 (–0.010)	–0.25 (–0.010) – –0.30 (–0.012)	–0.30 (–0.012) – –0.35 (–0.014)	–0.35 (–0.014) – –0.41 (–0.016)
F	0.70 (0.028)	0.75 (0.030)	0.80 (0.031)	0.85 (0.033)	0.90 (0.035)	0.95 (0.037)	1.00 (0.039)
E	0.65 (0.026)	0.70 (0.028)	0.75 (0.030)	0.80 (0.031)	0.85 (0.033)	0.90 (0.035)	0.95 (0.037)
D	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)	0.75 (0.030)	0.80 (0.031)	0.85 (0.033)	0.90 (0.035)
C	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)	0.75 (0.030)	0.80 (0.031)	0.85 (0.033)
B	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)	0.75 (0.030)	0.80 (0.031)
A	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)	0.75 (0.030)

- **How to read shim selection table**

[4] When the engagement mark on the gear case is E and the calculation value is –0.20 mm (–0.008 in) or more, the shim thickness is 0.75 mm (0.030 in). (See Example 1 below.)
When the calculation value is less than –0.20 mm (–0.008 in), the shim thickness is 0.80 mm (0.031 in). (See Example 2 below.)

Example 1: Unit: mm (in)

	[5] Calculation value
	[6] –0.20 mm (–0.008 in) or above to less than –0.15 mm (–0.006 in)
F	—
E	0.75 (0.030)

Example 2: Unit: mm (in)

	[5] Calculation value
	[7] –0.25 mm (–0.010 in) or above to less than –0.20 mm (–0.008 in)
F	—
E	0.80 (0.031)

- **Shim combination**

[8] To obtain 0.75 mm (0.030 in) of shim thicknesss, combine one gear shim B, or combine three gear shim A, and one gear shim C by referring to the shim type table.

• FORWARD BEVEL GEAR SHIM

1) Assemble the outer race and the inner race of the new 50 x 90 x 32 mm taper bearing.

2) Measure the bearing height (distance F) from the outer race end to the inner race end as shown, and record the measurement.

3) Determine the calculation value using the bearing height (distance F) and the following formula.

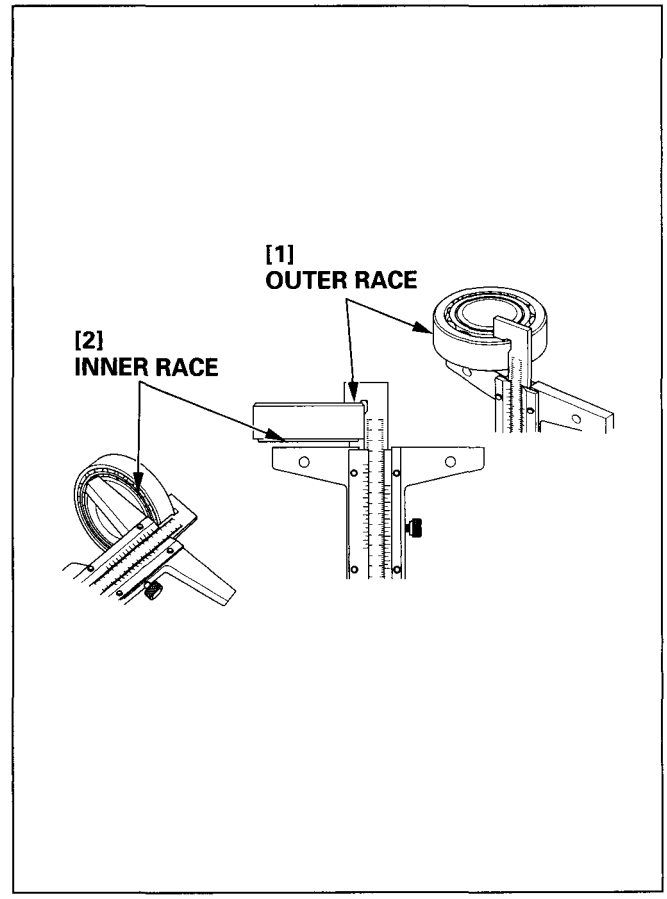
   Formula:
   Bearing height (distance F) –32 = Calculation value

   Example:
   When bearing height (distance F) is 32.05 mm (0.848 in).

   32.05 – 32 = 0.05

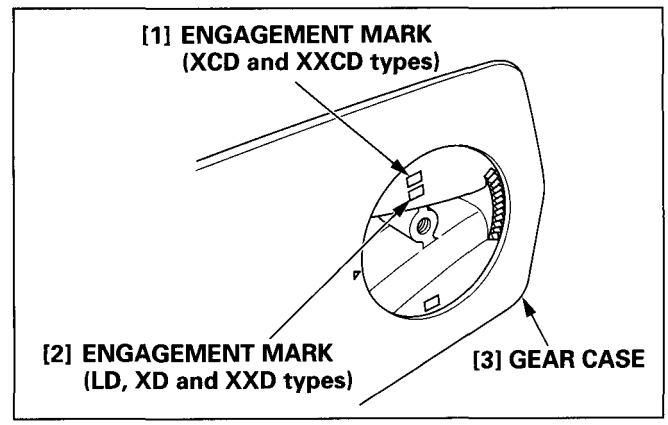
   Therefore, the calculation value is 0.05 mm (0.002 in).

4) Cross reference the calculation value and the engagement mark located on the trim tab installation part of the gear case, and select the shim of the appropriate thickness from the shim selection table accordingly.



• **Shim type table**

Parts name	Thickness
Forward bevel gear shim A	0.10 mm (0.004 in)
Forward bevel gear shim B	0.15 mm (0.006 in)
Forward bevel gear shim C	0.30 mm (0.012 in)
Forward bevel gear shim D	0.50 mm (0.020 in)



• **Forward bevel gear shim selection table**

<LD, XD and XXD types>

[1] Unit: mm (in)

		[2] Calculation value			
		0.20 – 0.15 (0.008 – 0.006)	0.15 – 0.10 (0.006 – 0.004)	0.10 – 0.05 (0.004 – 0.002)	0.05 – 0 (0.002 – 0.000)
[3] Engagement mark on the gear case	1	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)
	2	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)
	3	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)
	4	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)
	5	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)
	6	0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)

<XCD and XXCD types>

[1] Unit: mm (in)

		[2] Calculation value				
		0.23 – 0.15 (0.009 – 0.006)	0.15 – 0.10 (0.006 – 0.004)	0.10 – 0.05 (0.004 – 0.002)	0.05 – 0 (0.002 – 0.000)	0 – –0.05 (0.000 – –0.002)
[3] Engagement mark on the gear case	A	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)	0.75 (0.030)
	B	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)
	C	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)
	D	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)
	E	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)
	F	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)

[4] Refer to page 12-47 for information on how to read the shim selection table and shim combination.

• REVERSE BEVEL GEAR SHIM

1) Measure the bearing height (distance F) from the outer race end to the inner race end as shown, and record the measurement.

2) Determine the calculation value using the bearing height (distance F) and the following formula.

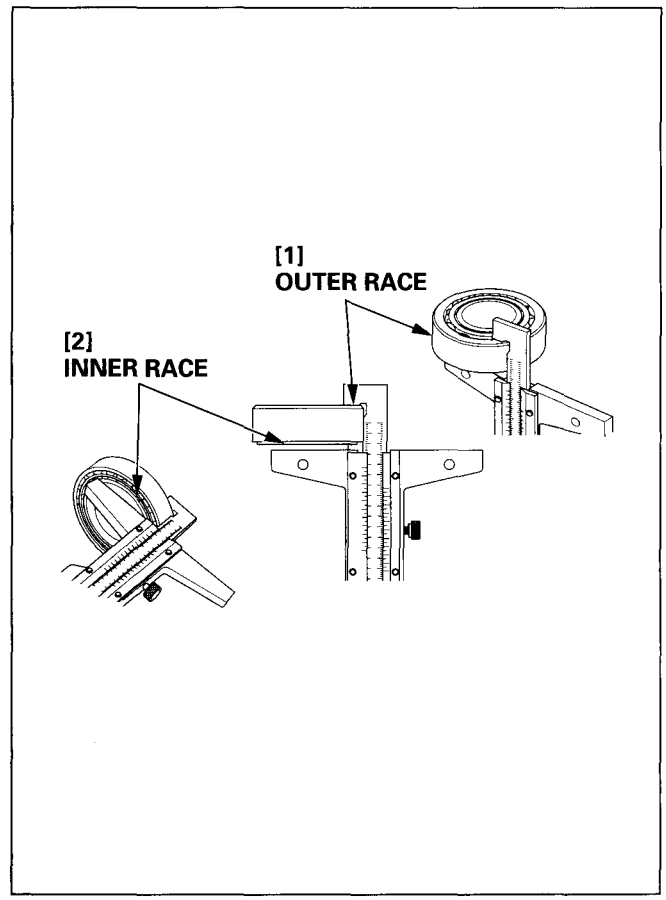
   Formula:
   Bearing height (distance F) –30.2 = Calculation value

   Example:
   When bearing height (distance F) is 30.15 mm (1.187 in).

   30.15 – 30.2 = –0.05

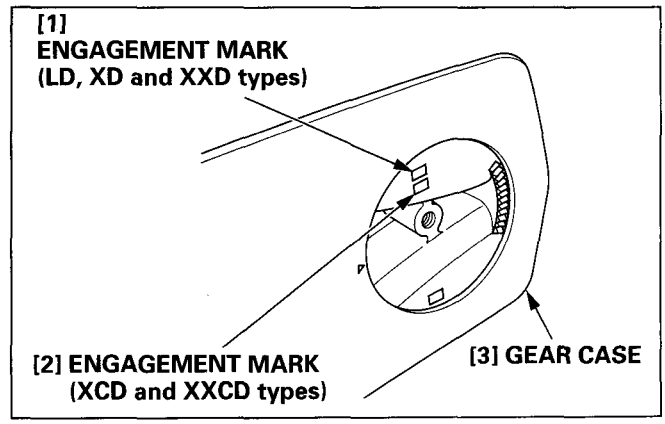
   Therefore, the calculation value is –0.05 mm (–0.002 in).

3) Cross reference the calculation value and the engagement mark located on the trim tab installation part of the gear case, and select the shim of the appropriate thickness from the shim selection table accordingly.



- **Shim type table**

Parts name	Thickness
Reverse bevel gear shim A	0.10 mm (0.004 in)
Reverse bevel gear shim B	0.15 mm (0.006 in)
Reverse bevel gear shim C	0.30 mm (0.012 in)
Reverse bevel gear shim D	0.50 mm (0.020 in)



• **Reverse bevel gear shim selection table**

<LD, XD and XXD types> **[1]** Unit: mm (in)

		[2] Calculation value	
		0 – –0.05 (0.000 – –0.002)	–0.05 – –0.12 (–0.002 – –0.005)
[3] Engagement mark on the gear case	F	0.25 (0.010)	0.30 (0.012)
	E	0.20 (0.008)	0.25 (0.010)
	D	0.15 (0.006)	0.20 (0.008)
	C	0.10 (0.004)	0.15 (0.006)
	B		0.10 (0.004)
	A		

(XCD and XXCD types) **[1]** Unit: mm (in)

		[2] Calculation value	
		0 – –0.05 (0.000 – –0.002)	–0.05 – –0.12 (–0.002 – –0.005)
[3] Engagement mark on the gear case	1	0.60 (0.024)	0.65 (0.026)
	2	0.55 (0.022)	0.60 (0.024)
	3	0.50 (0.020)	0.55 (0.022)
	4	0.45 (0.018)	0.50 (0.020)
	5	0.40 (0.016)	0.45 (0.018)
	6	0.35 (0.014)	0.40 (0.016)

[4] Refer to page 12-47 for information on how to read the shim selection table and shim combination.

• THRUST SHIM (XCD and XXCD types only)

Remove the 50 x 90 x 32 mm taper bearing inner race if it is mounted on the bearing holder assembly (P. 12-22).

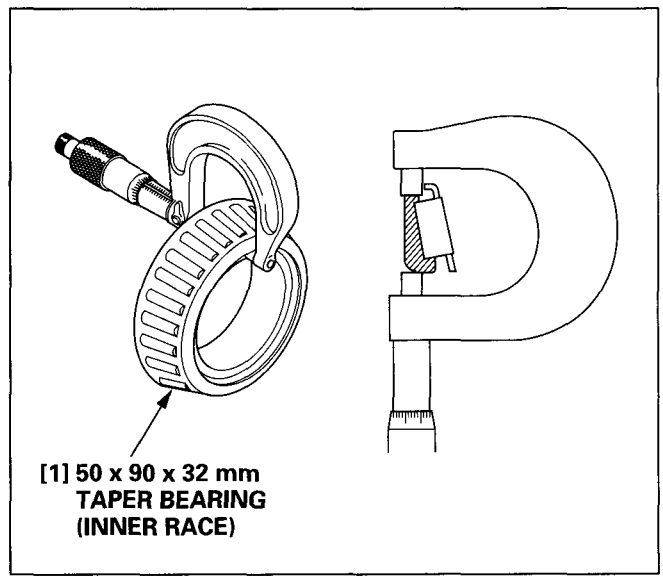
1) Measure the height of the 50 x 90 x 32 mm taper bearing inner race (distance J) and record it.

2) Determine the calculation value using the inner race height (distance J) and the following formula.

   Formula:
   Inner race height (distance J) –32 = Tolerance

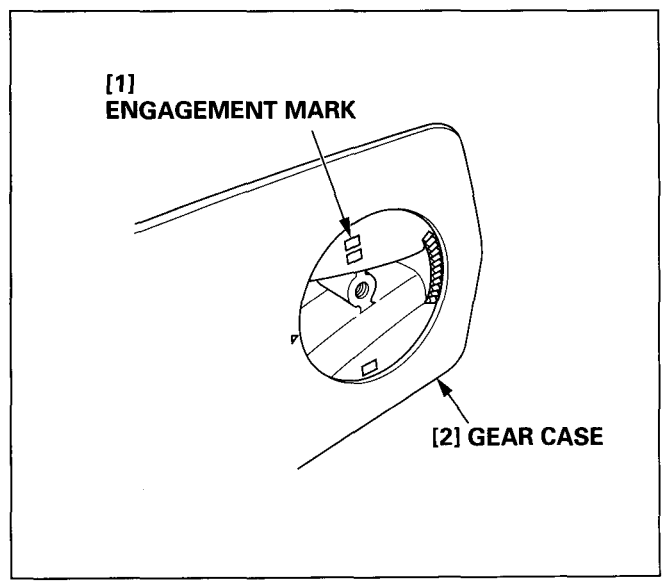
   Example:
   When the inner race height (distance J) is 32.1 mm (0.85 in).
   32.1 – 32.0 = 0.1
   Therefore, the calculation value is 0.1 mm (0.004 in).

3) Cross reference the calculation value and the engagement mark located on the trim tab installation part of the gear case, and select the shim of the appropriate thickness from the shim selection table accordingly.



• **Shim type table**

Parts name	Thickness
Thrust shim A	0.10 mm (0.004 in)
Thrust shim B	0.15 mm (0.006 in)
Thrust shim C	0.30 mm (0.012 in)
Thrust shim D	0.50 mm (0.020 in)



- **Thrust shim selection table**

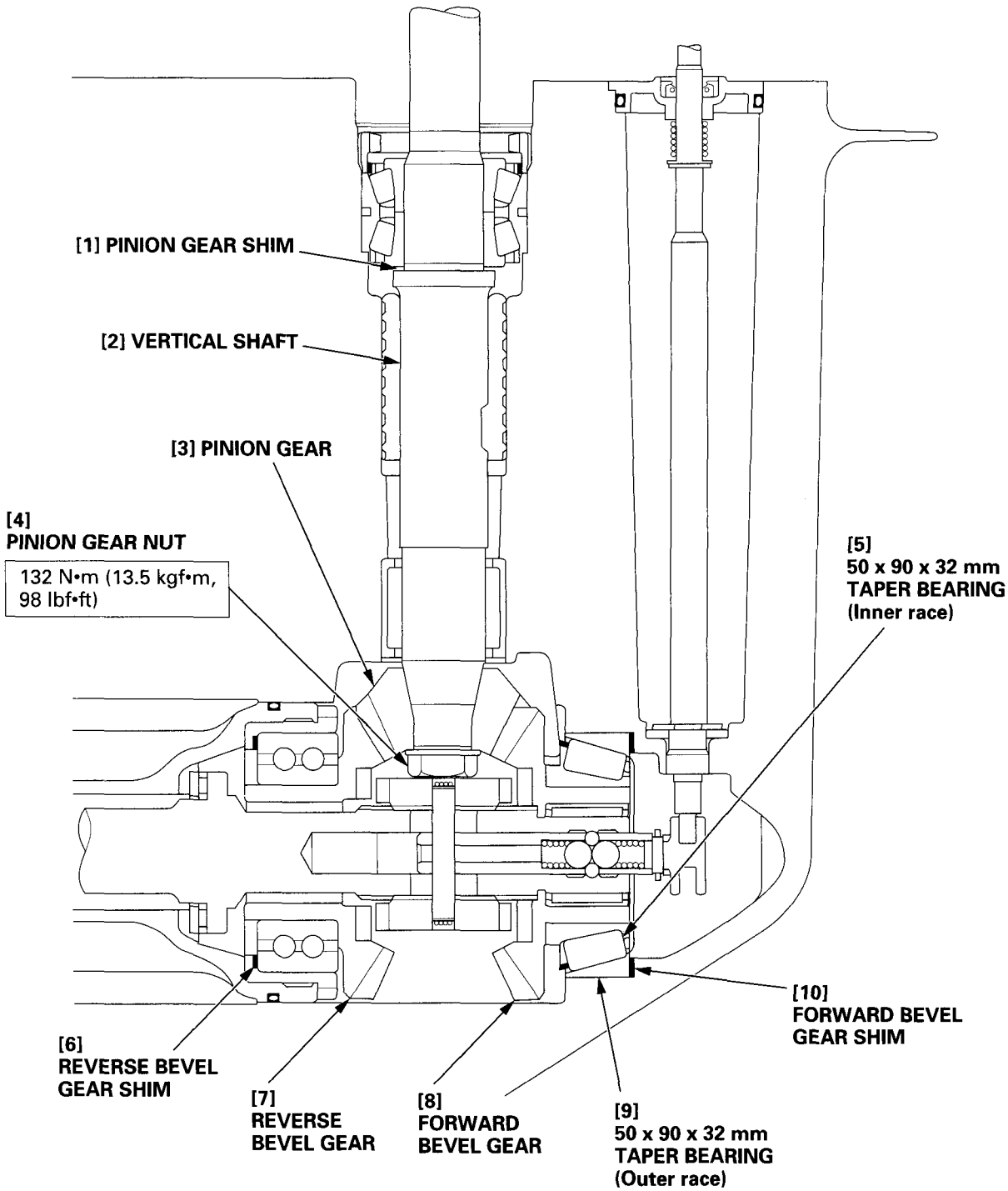
[1] Unit: mm (in)

		[2] Calculation value	
		0 – (–0.05) (0 – (–0.002))	–0.05 – (–0.12) (–0.002 – (–0.0047))
[3] Engagement mark on the gear case	1	0.35 (0.014)	0.40 (0.016)
	2	0.30 (0.012)	0.35 (0.014)
	3	0.25 (0.010)	0.30 (0.012)
	4	0.20 (0.008)	0.25 (0.010)
	5	0.15 (0.006)	0.20 (0.008)
	6	0.10 (0.004)	0.15 (0.006)

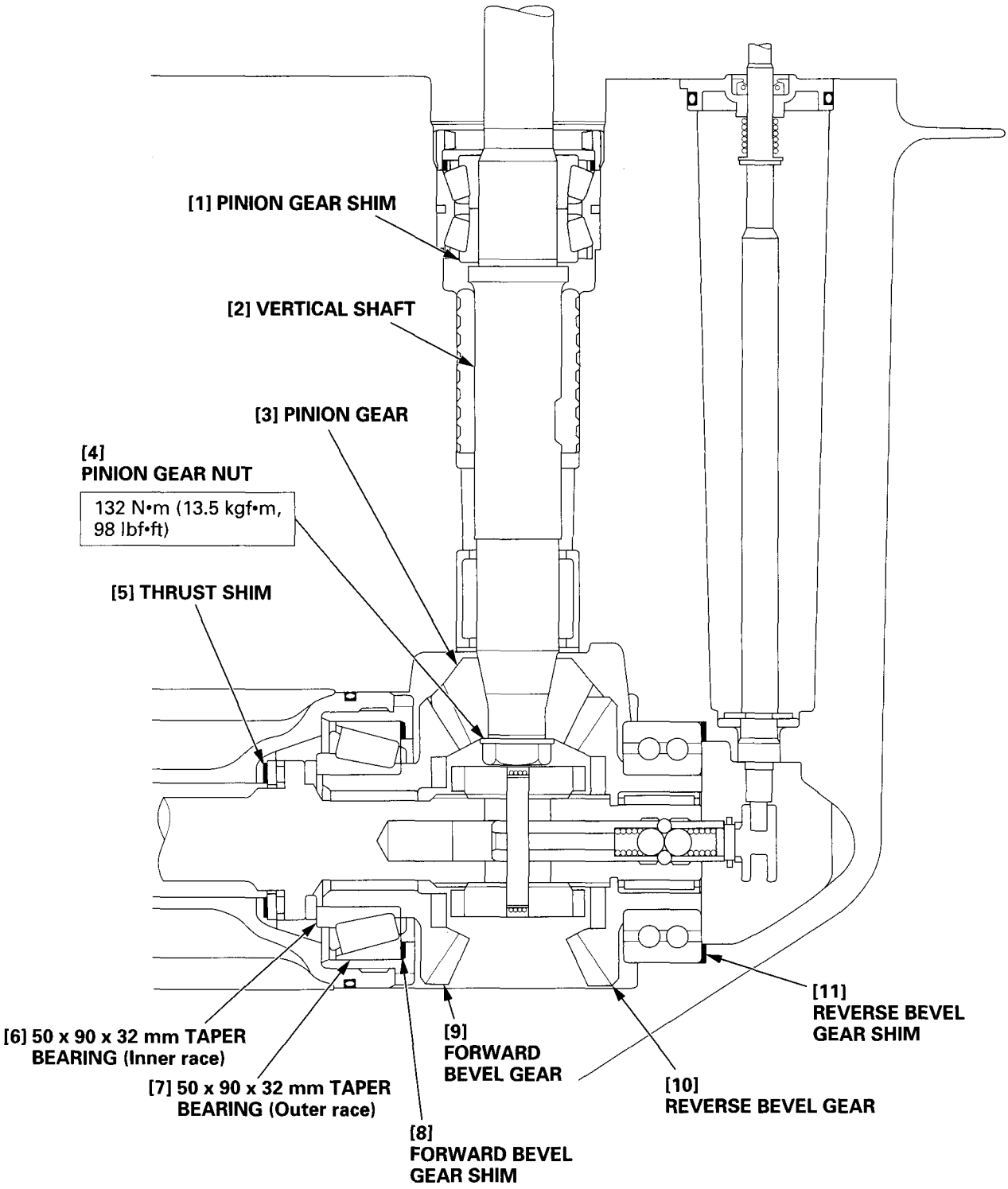
[4] Refer to page 12-47 for information on how to read the shim selection table and shim combination.

8. SHIM POSITION

- **LD, XD and XXD types**



• **XCD and XXCD types**



9. BACKLASH ADJUSTMENT

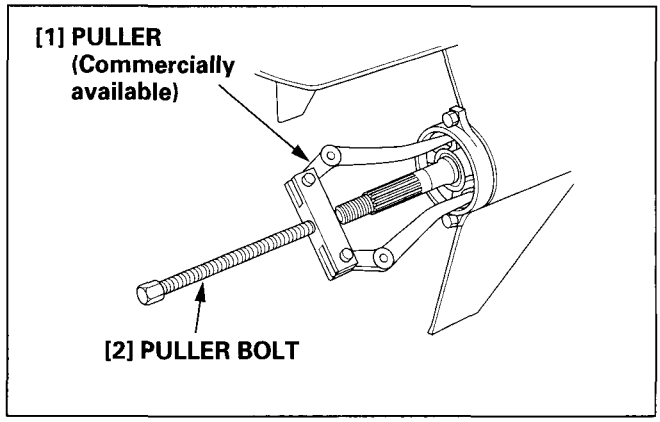
• FORWARD BEVEL GEAR BACKLASH

<LD, XD and XXD types only>

1) Hold the propeller shaft securely with a puller as shown, and tighten the puller bolt to the specified torque.

   TORQUE: 5 N•m (0.5 kgf•m, 3.6 lbf•ft)

   Turn the vertical shaft 5 to 10 turns.



2) Attach the special tool to the vertical shaft as shown, and adjust the dial gauge so its needle is at line "2" of the special tool.
   Turn the vertical shaft lightly right or left and record the dial gauge reading.
   Measure the backlash at the four points (by turning the vertical shaft 90°) in the same manner.

   - Do not turn the propeller shaft when turning the vertical shaft.

3) Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

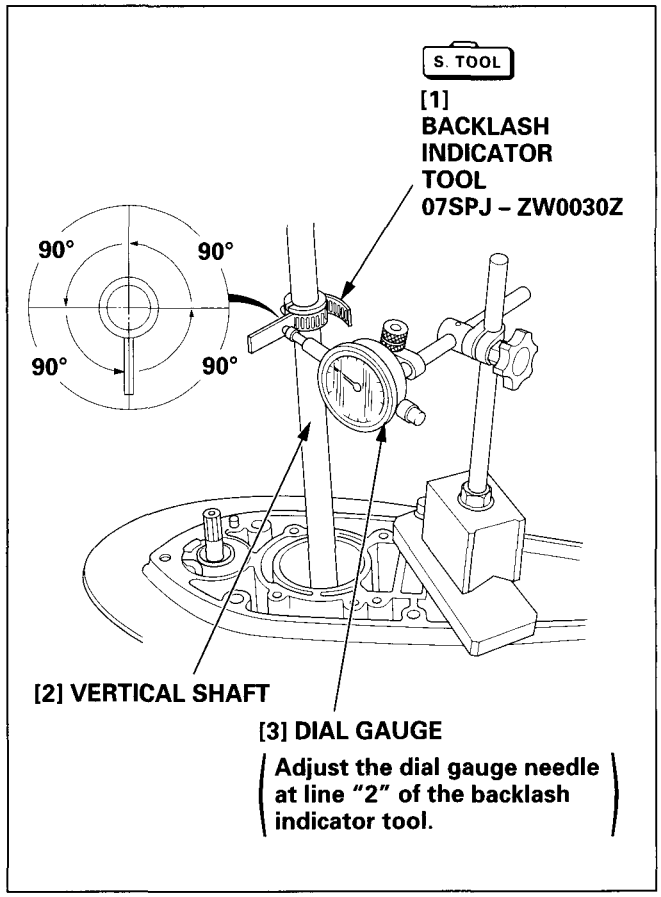
   Formula:
   Dial gauge runout ÷ 0.857 = Backlash

   Example:
   When dial gauge runout is 0.195 mm (0.0077 in):
   0.195 ÷ 0.857 = 0.23
   Therefore, the backlash is 0.23 mm (0.009 in).

Standard value	0.20 – 0.35 mm (0.008 – 0.014 in)

   If the backlash is too large, increase the forward bevel gear shim thickness and recheck the backlash.
   If the backlash is too small, reduce the forward bevel gear shim thickness and recheck the backlash.

   TOOL:
   Backlash indicator tool 07SPJ – ZW0030Z

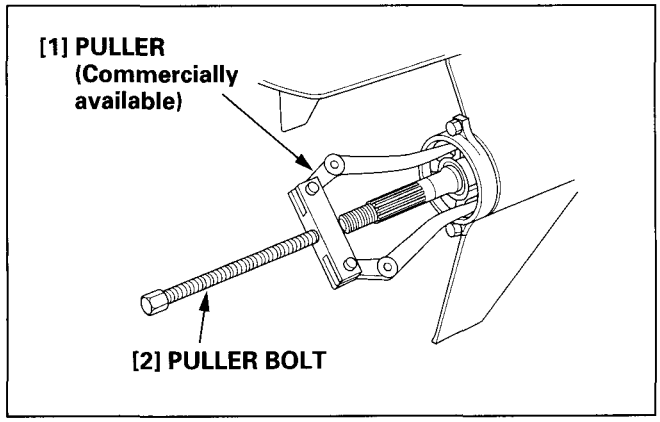


<XCD and XXCD types only>

8) Hold the propeller shaft securely with a puller as shown, and tighten the puller bolt to the specified torque.

   TORQUE: 5 N•m (0.5 kgf•m, 3.6 lbf•ft)

   Turn the vertical shaft 5 to 10 turns.



9) Attach the special tool to the vertical shaft as shown, and adjust the dial gauge so its needle is at line "2" of the special tool.
   Turn the vertical shaft lightly right or left and record the dial gauge reading.
   Measure the backlash at the four points (by turning the vertical shaft 90°) in the same manner.

   • Do not turn the propeller shaft when turning the vertical shaft.

10) Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

    Formula:
    Dial gauge runout ÷ 0.857 = Backlash

    Example:
    When dial gauge runout is 0.195 mm (0.0077 in):
    0.195 ÷ 0.857 = 0.23
    Therefore, the backlash is 0.23 mm (0.009 in).

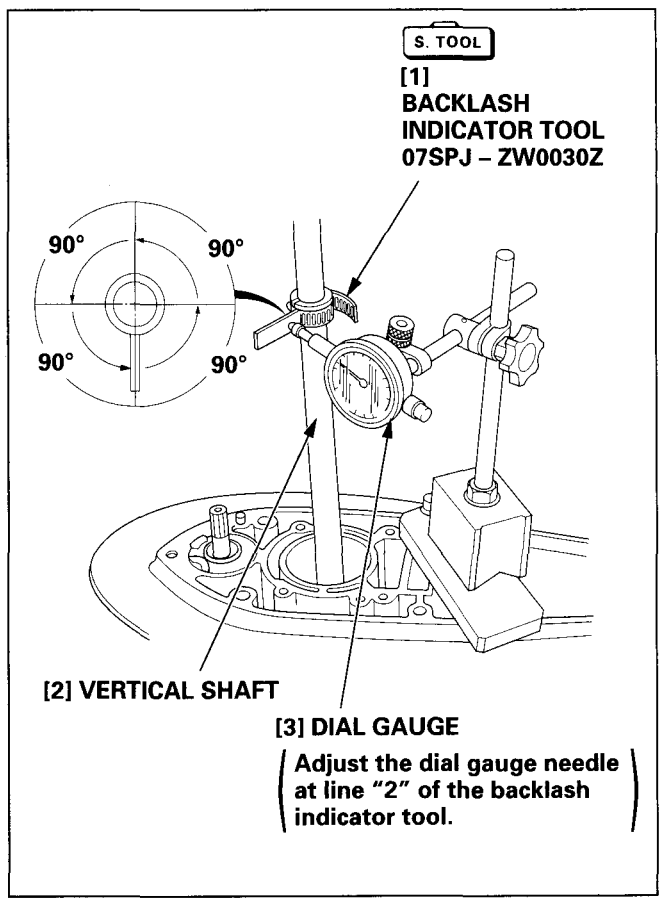
Standard value	0.20 – 0.35 mm (0.008 – 0.014 in)

11) If the backlash is too large, reduce the forward bevel gear shim thickness and recheck the backlash.

    If the backlash is too small, increase the forward bevel gear shim thickness and recheck the backlash.

12) When the forward bevel gear shim is replaced, adjust the thrust clearance (P. 12-56).

    TOOL:
    Backlash indicator tool 07SPJ – ZW0030Z



• THRUST CLEARANCE ADJUSTMENT (XCD and XXCD types only)

Adjust the thrust clearance after replacing the forward bevel gear shim.

1) Be sure that the bearing holder assembly is tightened against the propeller shaft holder to the specified torque securely (P. 12-31).

   Note that the shift slider and the clutch shifter are not mounted.

2) Set the propeller shaft holder assembly on the fixing tool as shown, and tighten with the bolts securely.

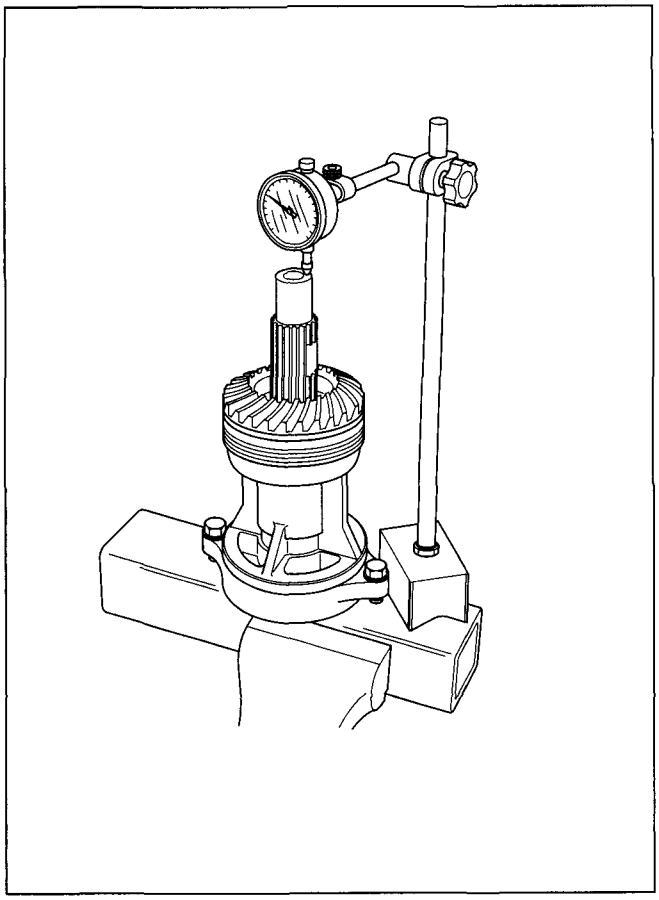
3) Attach the tip of the dial gauge to the propeller shaft end perpendicularly.

4) Move the propeller shaft up and down and read the runout of the dial gauge. It should be within the specified range.

Runout	0.2 – 0.3 mm (0.008 – 0.012 in)

5) If the thrust clearance is larger than the specification, increase the thrust shim thickness and recheck the thrust clearance.

   If the thrust clearance is smaller than the specification, reduce the thrust shim thickness and recheck the thrust clearance.



10. EXTENSION CASE/LOWER RUBBER MOTOR MOUNT

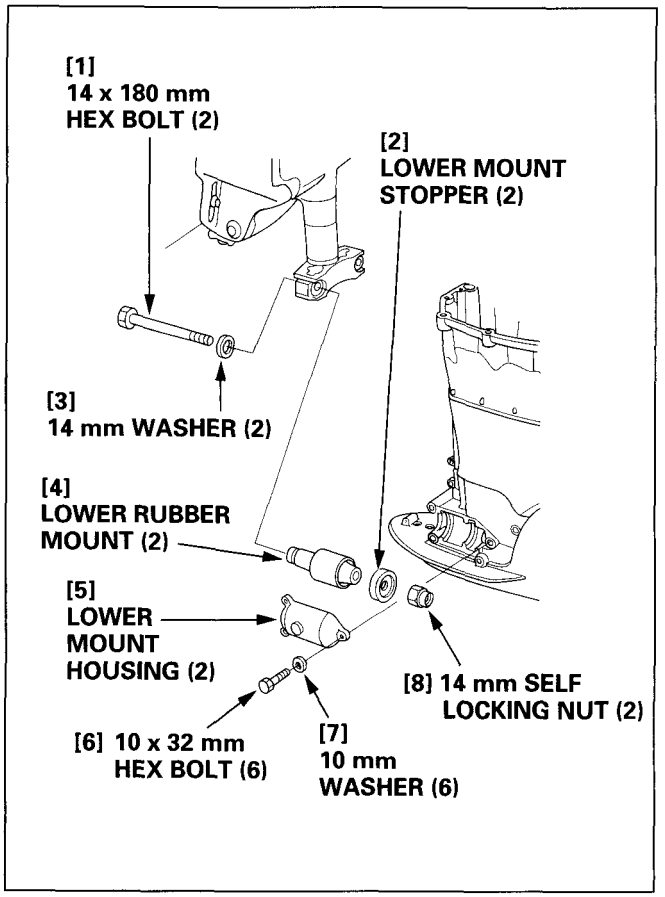
a. REMOVAL

1) Remove the following:
   — Engine cover (P. 4-1)
   — L./R. engine under cover (P. 4-5)
   — Gear case assembly (P. 12-3)

2) Remove the six 10 x 32 mm hex bolts and 10 mm washer from the lower mount housing.

3) Remove the two 14 mm self locking nuts, two 14 mm washer and two 14 x 180 mm hex bolts, and remove the two lower rubber mount and two lower mount stopper.

NOTICE
Raise the extension case to install the 14 x 180 mm bolts.



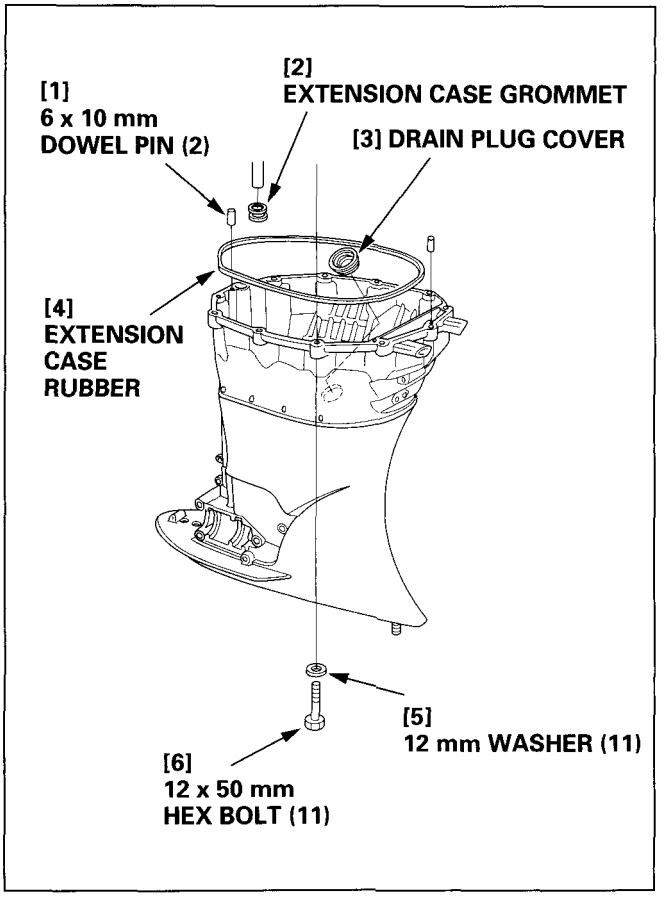
4) Remove the eleven 12 x 50 mm hex bolts and eleven 12 mm washers, and remove the extension case.

NOTICE
Take care not to fall the extension case, and remove the extension case.

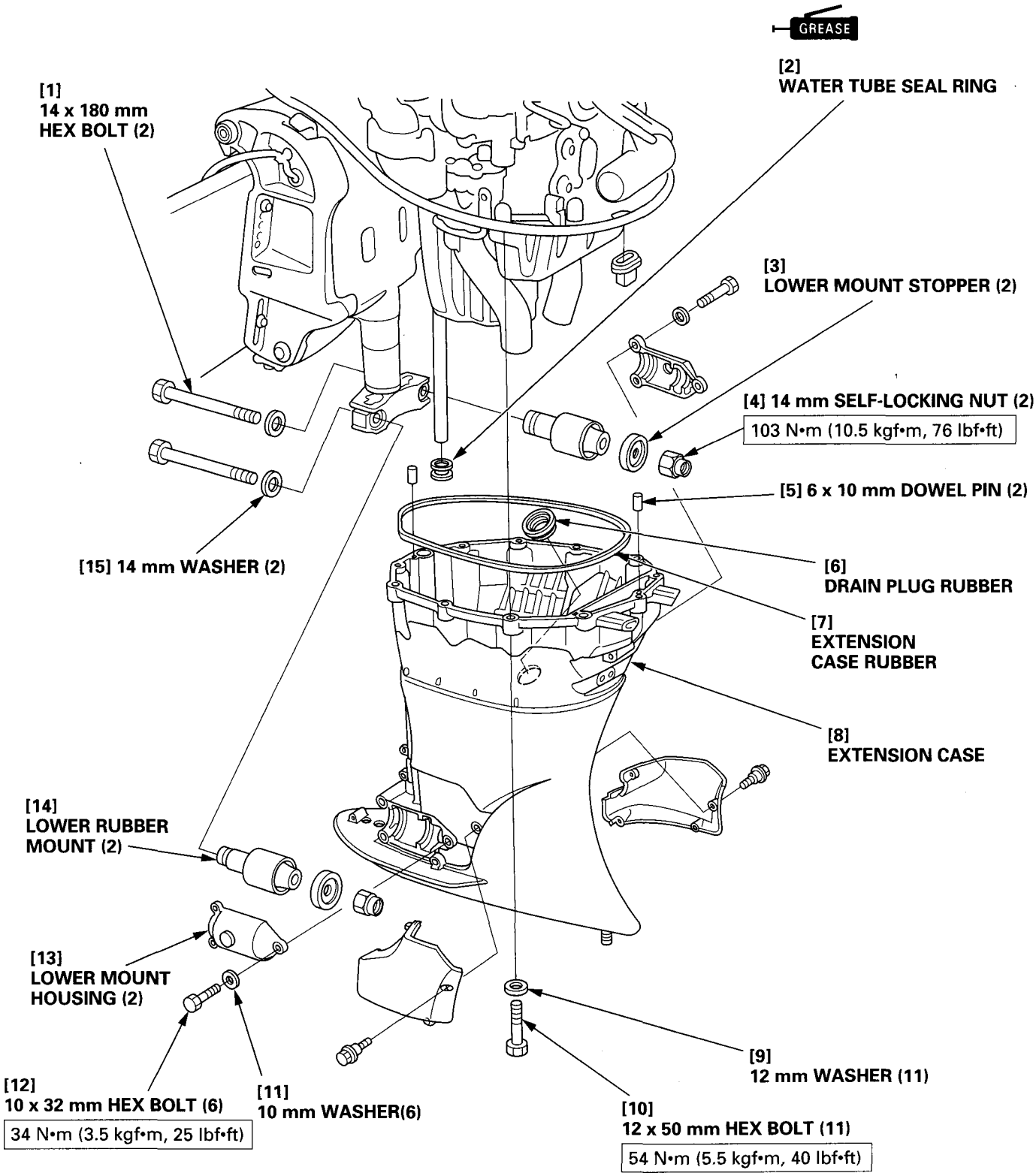
5) Remove the extension rubber.

6) Remove the drain plug cover and two 6 x 10 mm dowel pins from the extension case.

7) Remove the extension case grommet.



b. EXPLODED VIEW



c. INSTALLATION

1) Apply grease to the extension case grommet, and install it.

2) Install the drain plug cover and two 6 x 10 mm dowel pins to the extension case.

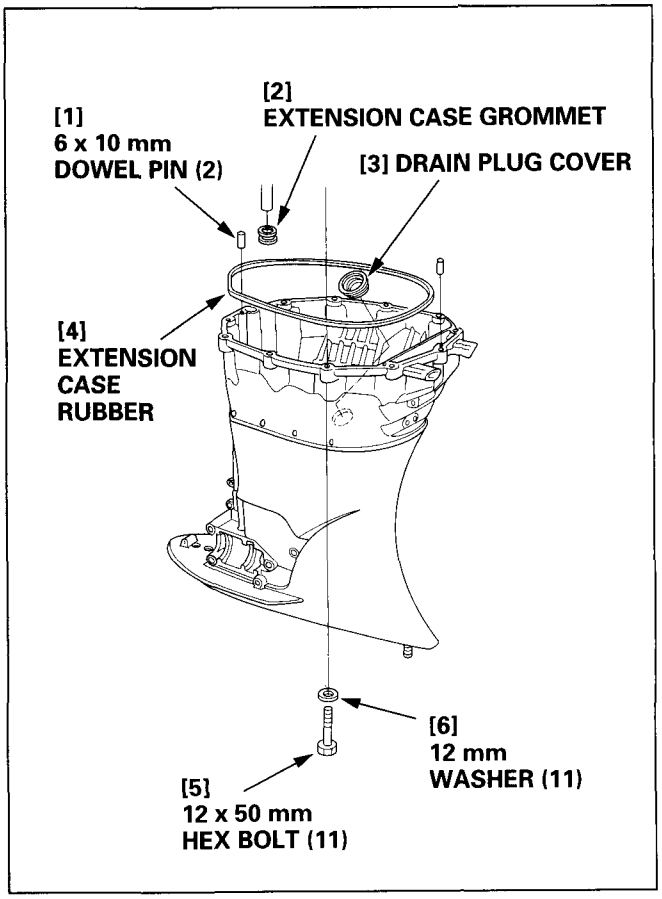
3) Install the extension rubber.

NOTICE

Take care not to fall the extension case, and install the extension case.

4) Set the extension case and install the eleven 12 mm washers and eleven 12 x 50 mm hex bolts.

TORQUE: 54 N•m (5.5 kgf•m, 40 lbf•ft)



NOTICE

Raise the extension case to remove the 14 x 180 mm bolts.

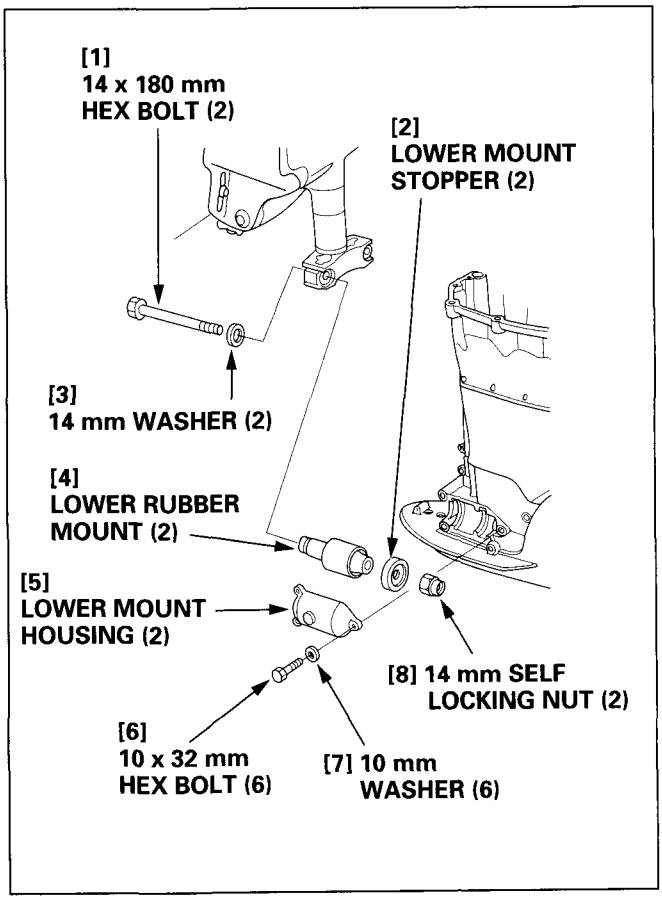
5) Set the two lower rubber mount and two lower mount stopper into the extension case, and install the two 14 x 180 mm hex bolts, two 14 mm washers and two 14 mm self locking nuts.

TORQUE: 103 N•m (10.5 kgf•m, 76 lbf•ft)

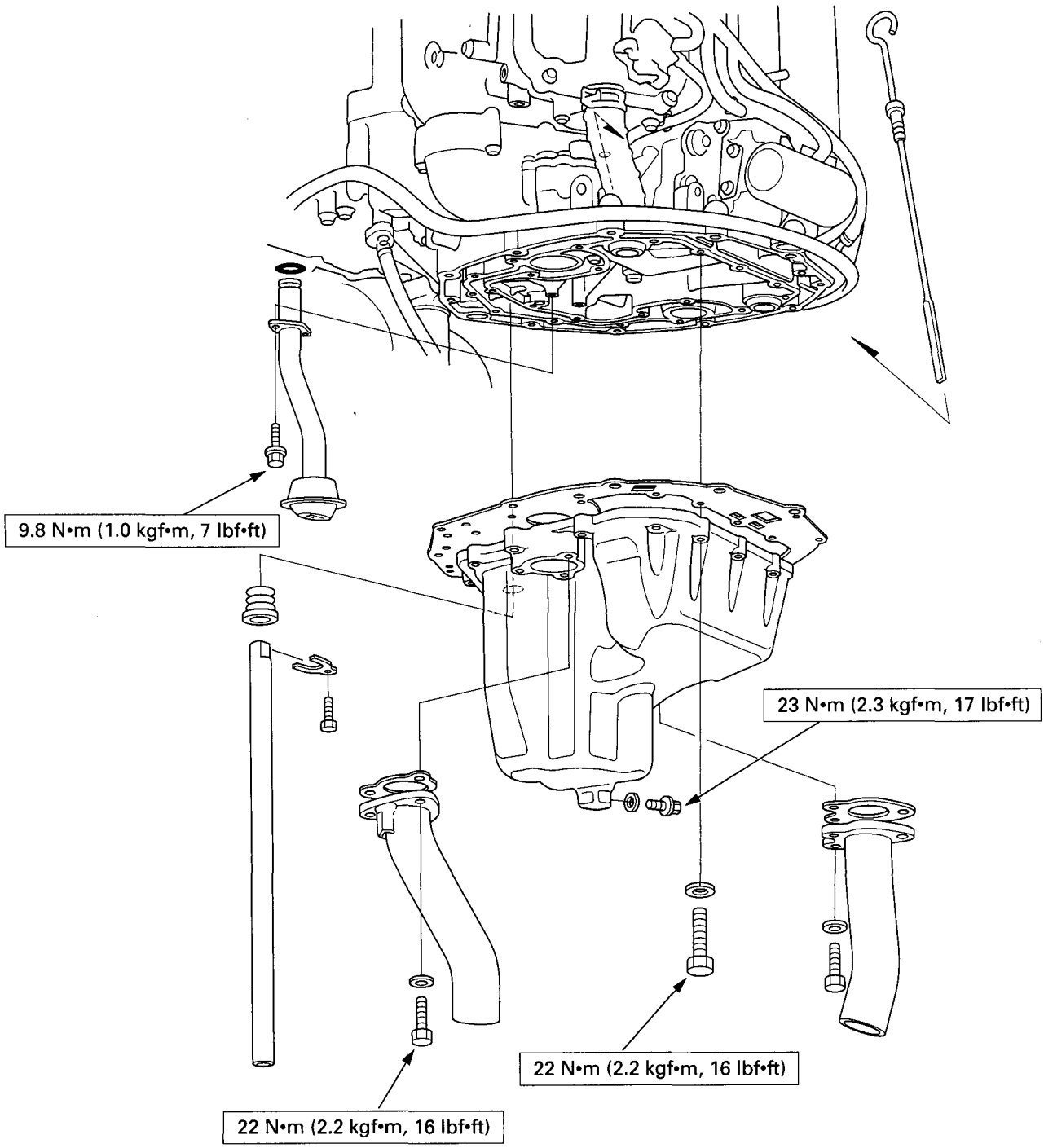
6) Set the lower mount housing, and install the six 10 mm washers and six 10 x 32 mm hex bolts.

TORQUE: 34 N•m (3.5 kgf•m, 25 lbf•ft)

7) Install the following:
— Gear case assembly (P. 12-5)
— L./R. engine under cover (P. 4-8)
— Engine cover (P. 4-1)



1. OIL PAN/EXHAUST PIPE/WATER TUBE	2. MOUNT CASE/UPPER MOUNT RUBBER/SHIFT SHAFT A



1. OIL PAN/EXHAUST PIPE/WATER TUBE

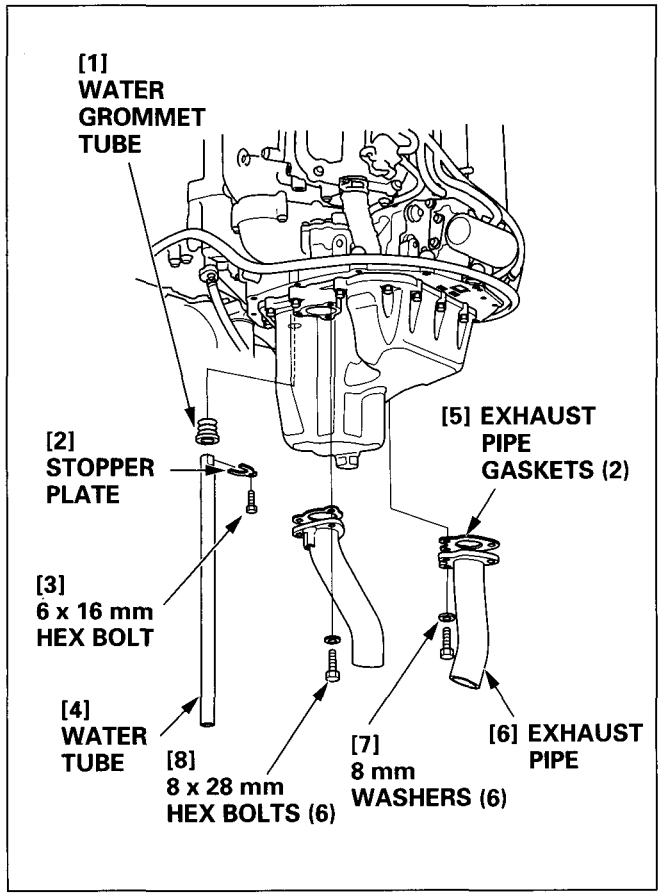
a. REMOVAL

1) Remove the following parts.
   — Gear case assembly (P. 12-3)
   — Extension case (P. 12-59)

2) Drain the engine oil.

3) Remove the six 8 x 28 mm hex bolts and six 8 mm washers, and remove the two exhaust pipes and two exhaust pipe gaskets.

4) Remove the 6 x 16 mm hex bolts and stopper plate, and remove the water tube and water tube grommet.



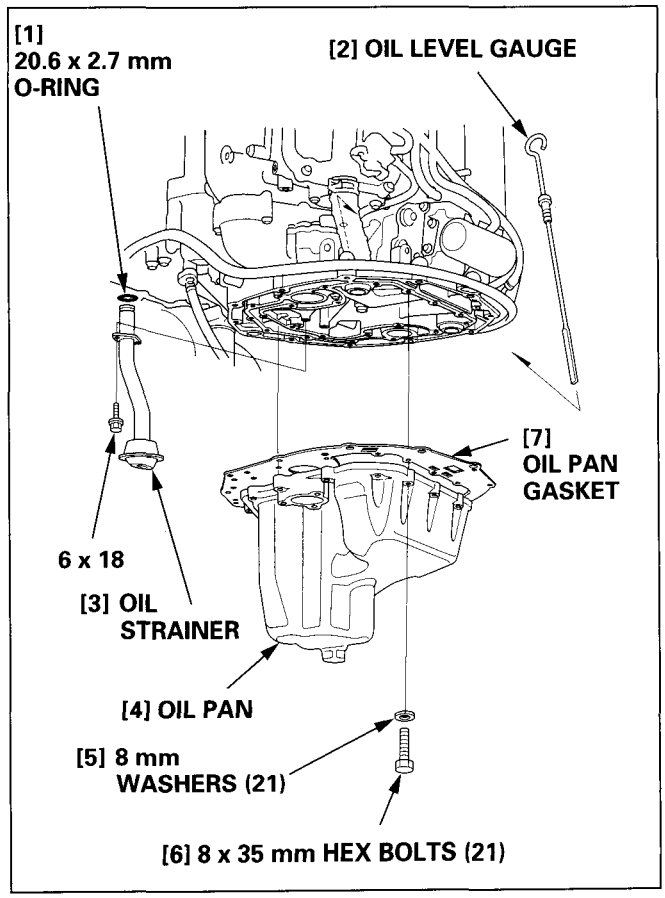
5) Remove the twenty one 8 x 35 mm hex bolts and twenty one 8 mm washers, and remove the oil pan.
   Remove the oil drain plug and drain plug washer.

6) Remove the 6 x 18 mm flange bolt, and remove the oil strainer and oil pan gasket.

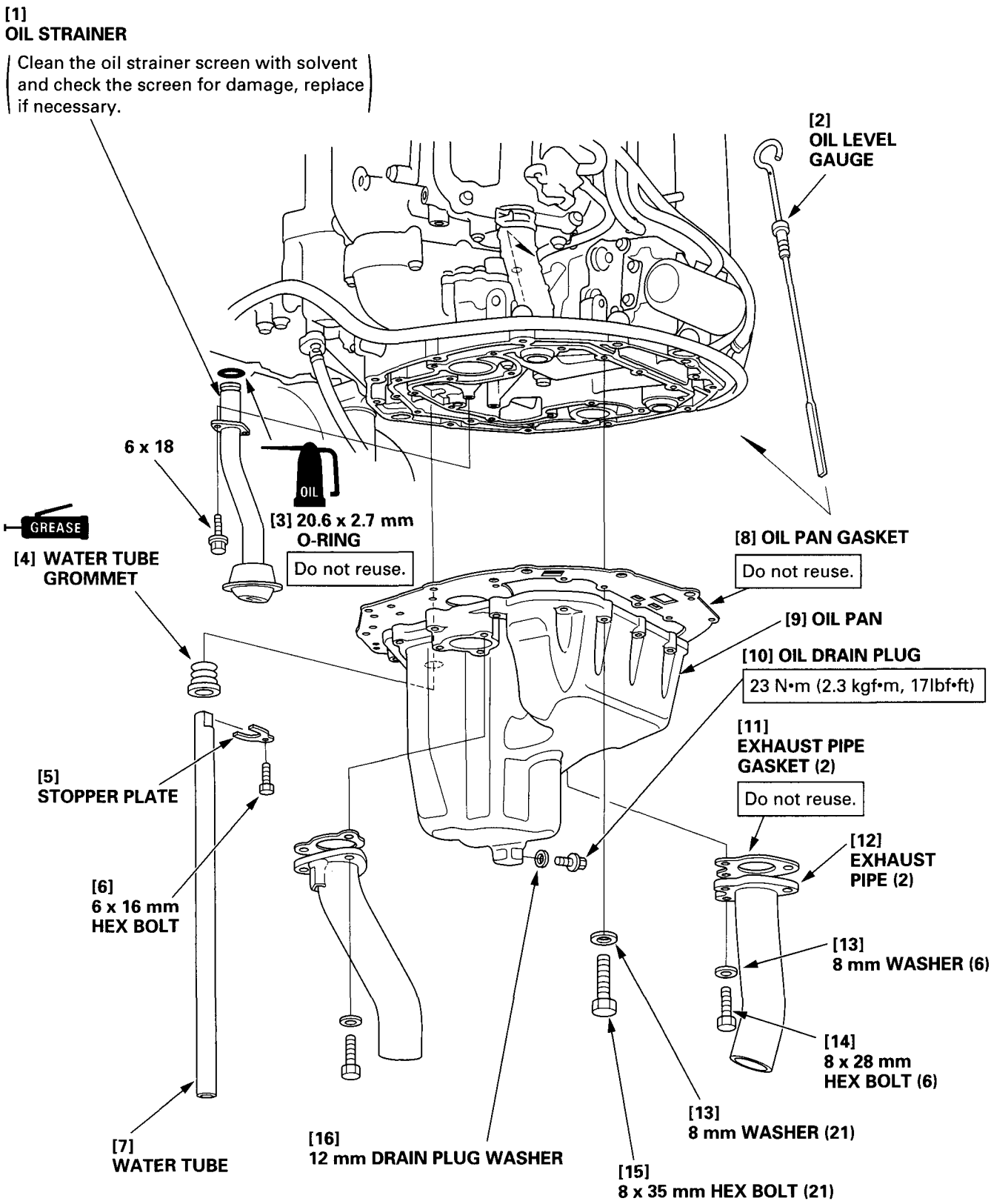
7) Remove the 20.6 x 2.7 mm O-ring from the oil strainer.

8) Remove the dowel pins from the mount case.

9) Remove the oil level gauge.



b. EXPLODED VIEW



C. INSTALLATION

1) Install the oil level gauge.
2) Install the two dowel pins to the mount case.
3) Apply engine oil to a new 20.6 x 2.7 mm O-ring, and install it to the oil strainer.
4) Install the oil pan gasket and oil strainer with the 6 x 18 mm flange bolt.

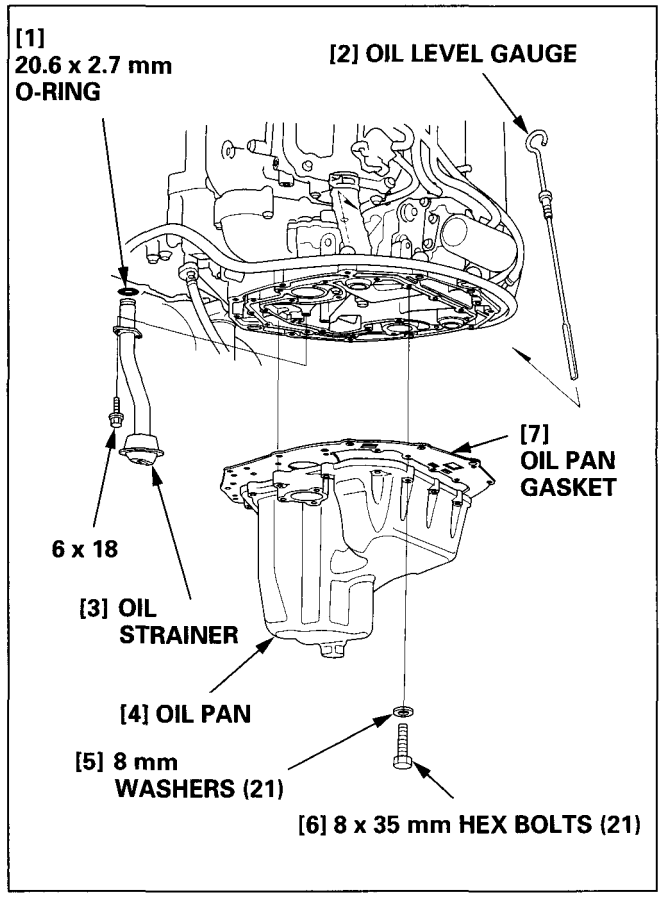
   TORQUE: 9.8 N•m (1.0 kgf•m, 7 lbf•ft)

5) Install the drain plug washer and oil drain plug to the oil pan.

   TORQUE: 23 N•m (2.3 kgf•m, 17 lbf•ft)

6) Set the oil pan to the under case, and install the twenty one 8 mm washers and twenty one 8 x 35 mm hex bolts.

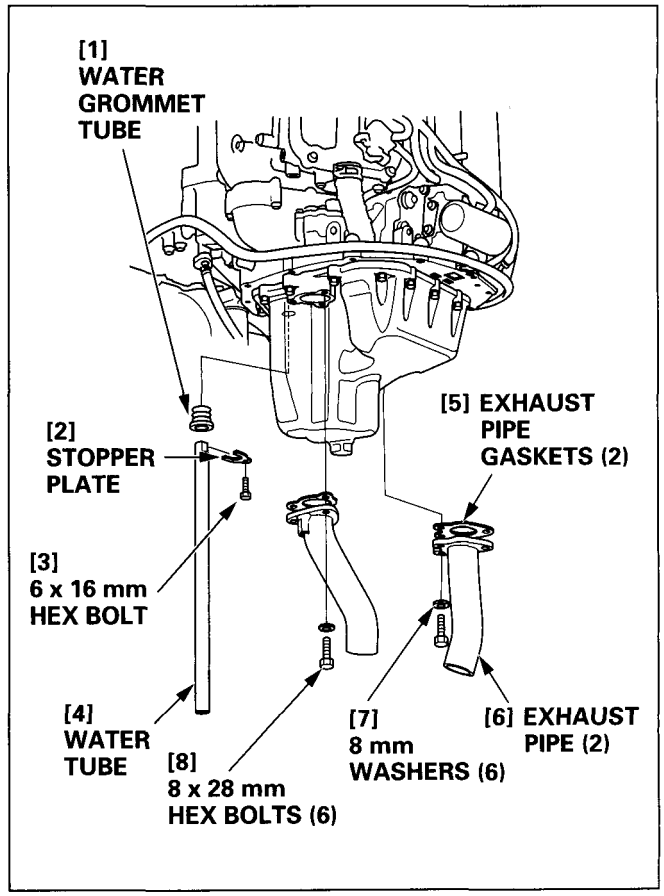
   TORQUE: 22 N•m (2.2 kgf•m, 16 lbf•ft)



7) Apply grease to the entire circumference of water tube grommet.
8) Set the water tube, and install the stopper plate and 6 x 16 mm hex bolts.
9) Set the new exhaust pipe gasket and exhaust pipe, and install the 8 mm washers and 8 x 28 mm hex bolts.

   TORQUE: 22 N•m (2.2 kgf•m, 16 lbf•ft)

10) Refill the engine oil.
11) Install the following.
    — Extension case (P. 12-61)
    — Gear case assembly (P. 12-5)



2. MOUNT CASE/UPPER MOUNT RUBBER/SHIFT SHAFT A

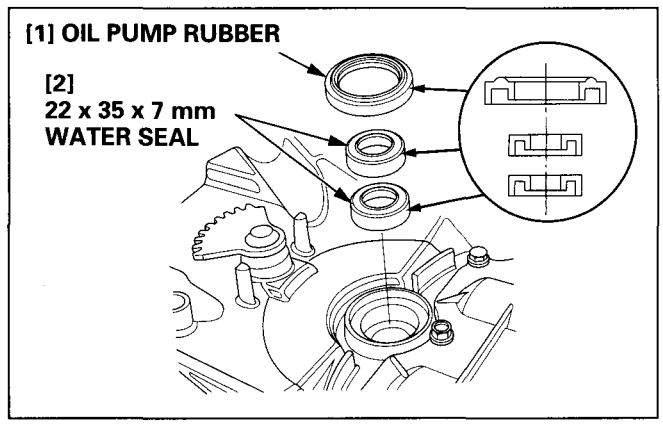
a. DISASSEMBLY

Remove the following:

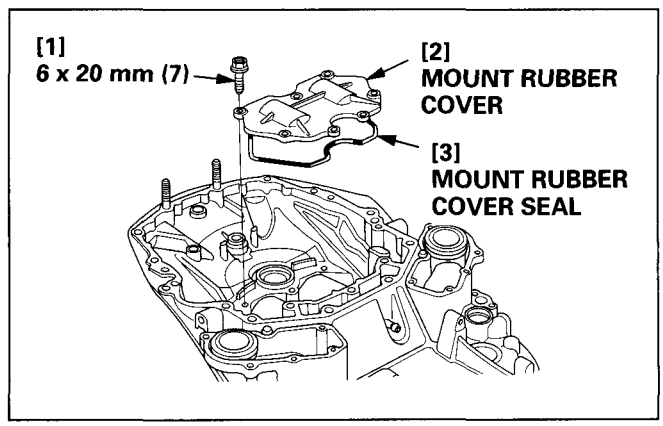
— Gear case assembly (P. 12-3)
— Extension case/lower rubber motor mount (P. 12-59)
— Oil pan/exhaust pipes/water tubes (P. 13-2)
— Engine assembly (P. 7-1)
— Swivel case/stern bracket assembly (P. 14-2)
— Water jacket covers/relief valve (P. 8-3, 4)
— Flush valve (P. 8-5)

1) Remove the oil pump rubber from the mount case.

2) Remove the two 22 x 35 x 7 mm water seals from the mount case.

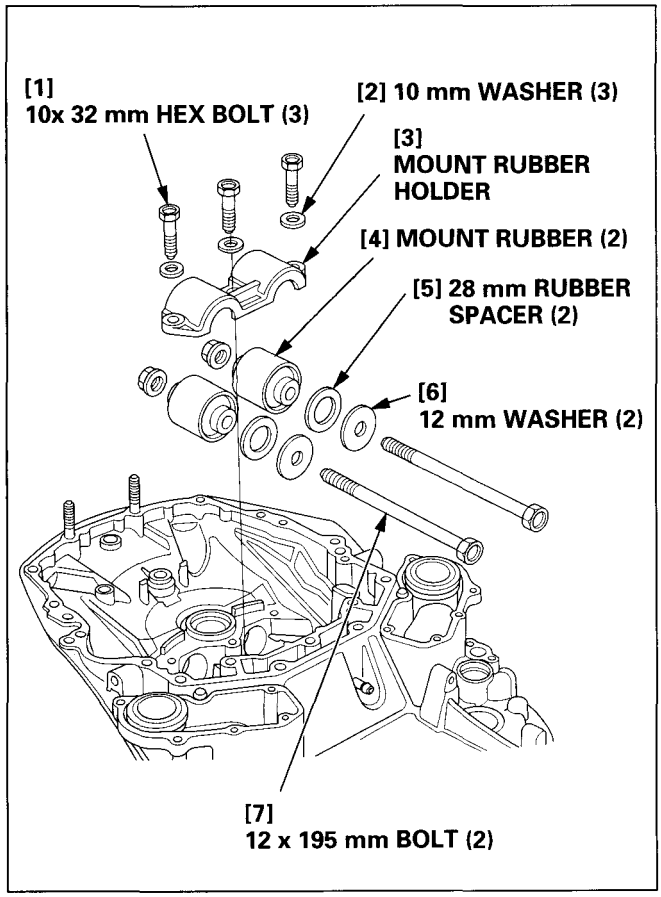


3) Remove the seven 6 x 20 mm flange bolts, mount rubber cover, and mount rubber cover seal from the mount case.

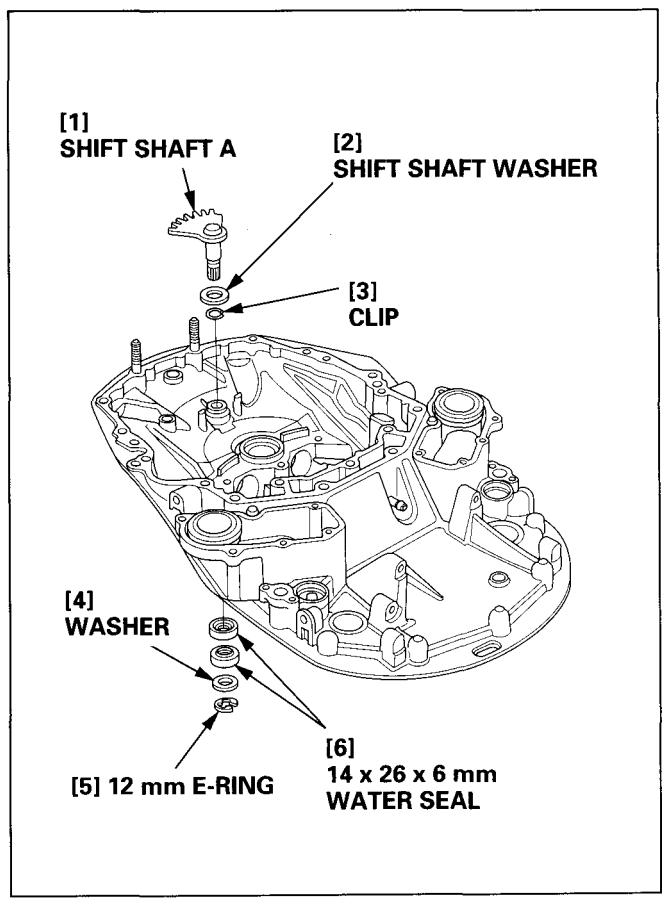


4) Remove the three 10 x 32 mm hex bolts, three 10 mm washers and mount rubber holder.

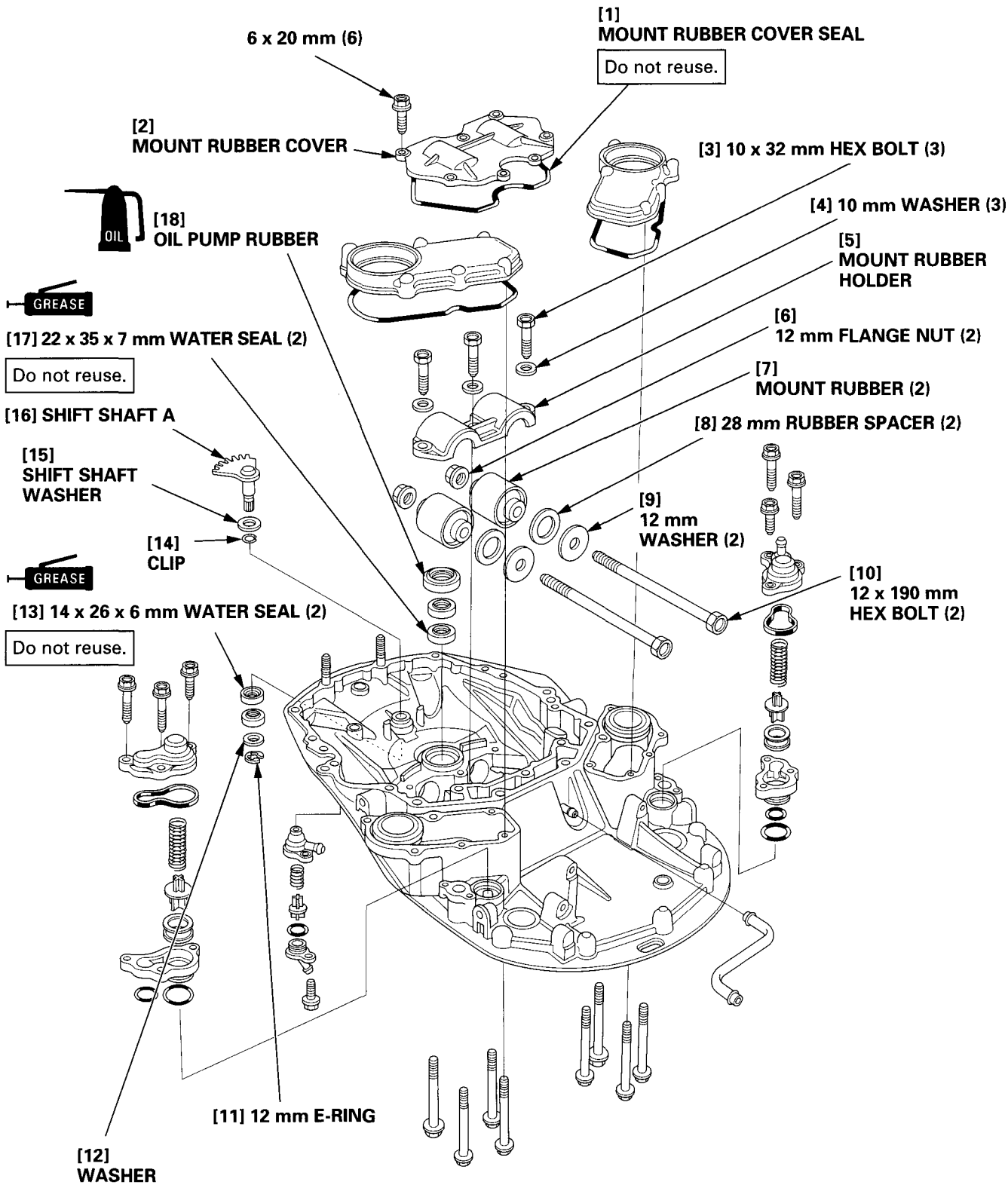
5) Remove the two mount rubbers, two 28 mm rubber spacers, two 12 mm washers and 12 x 195 mm bolts from the mount case.



6) Remove the 12 mm E-ring, washer, two 14 x 26 x 6 mm water seals, shift shaft A, shift shaft washer and clip from the mount case.



b. EXPLODED VIEW



c. INSTALLATION

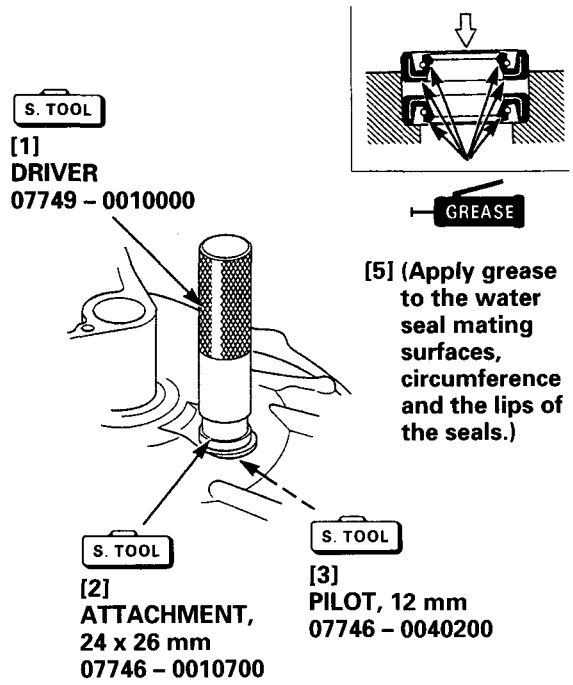
1) Apply grease to the circumference and lips of the new water seals.

2) Install the new water seals on the mount case using the special tools as shown.

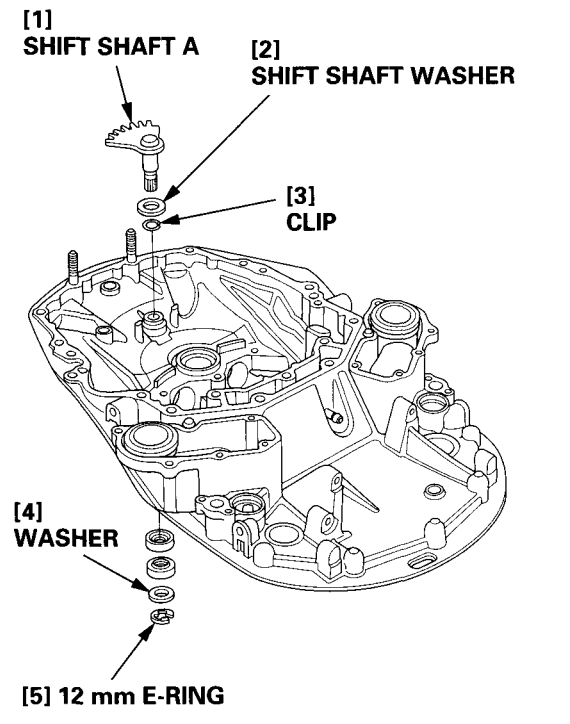
   • Install the water seals as shown, noting the installation direction. Replace the water seals with the new ones when they are removed.

TOOLS:

Driver	**07749 – 0010000**
Attachment, 24 x 26 mm	**07746 – 0010700**
Pilot, 12 mm	**07746 – 0040200**



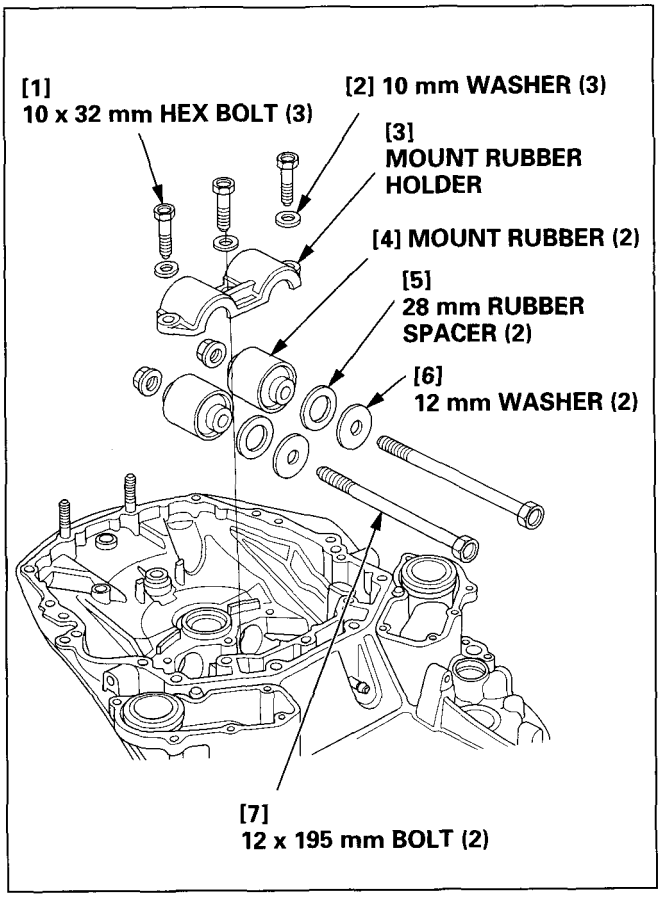
3) Install the clip, shift shaft washer, shift shaft A, washer and 12 mm E-ring into the mount case.



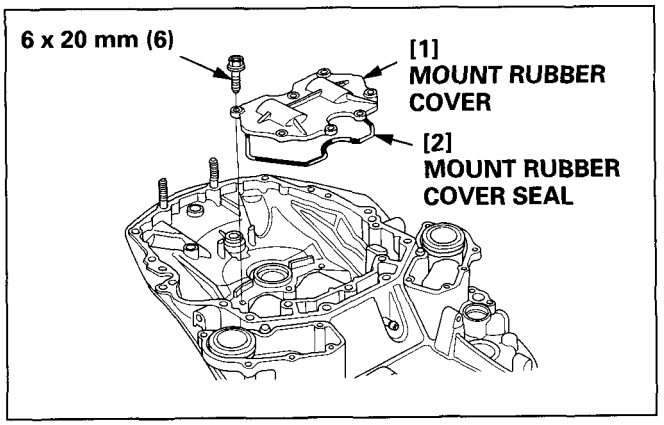
4) Install the two mount rubbers, two 28 mm rubber spacers, two 12 mm washers and two 12 x 195 mm bolts into the mount case.

5) Install the mount rubber holder, three 10 mm washers and three 10 x 32 mm hex bolts.

TORQUE: 34 N•m (3.5 kgf•m, 25 lbf•ft)



6) Install the mount rubber cover seal, mount rubber cover and six 6 x 20 mm flange bolts into the mount case.



7) Apply grease to the new water seals.

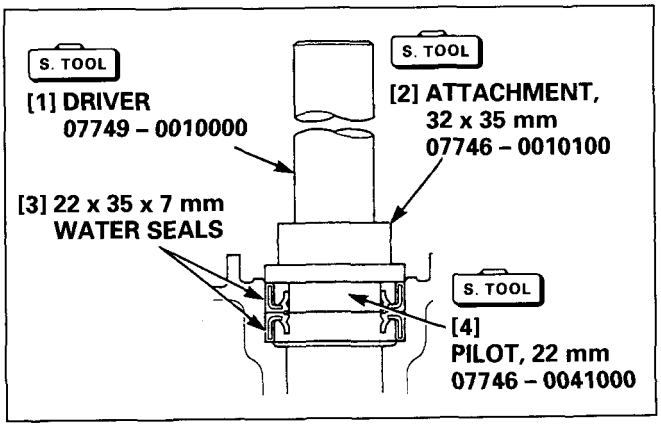
8) Using the special tools, install the new water seals on the mount case as shown.

9) After installing the water seals, apply 2 – 4 g (0.07 – 0.14 oz) of grease to the seal lips and the adjacent areas.

- Install the water seals as shown noting the installation direction. Replace the water seals with the new ones when they are removed.

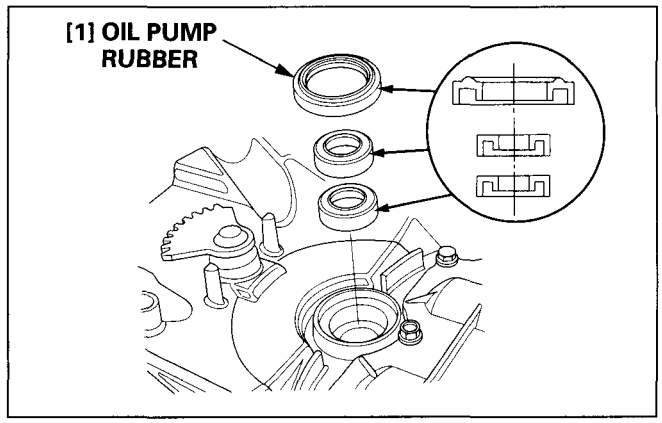
TOOLS:

Driver	**07749 – 0010000**
Attachment, 32 x 35 mm	**07746 – 0010100**
Pilot, 22 mm	**07746 – 0041000**

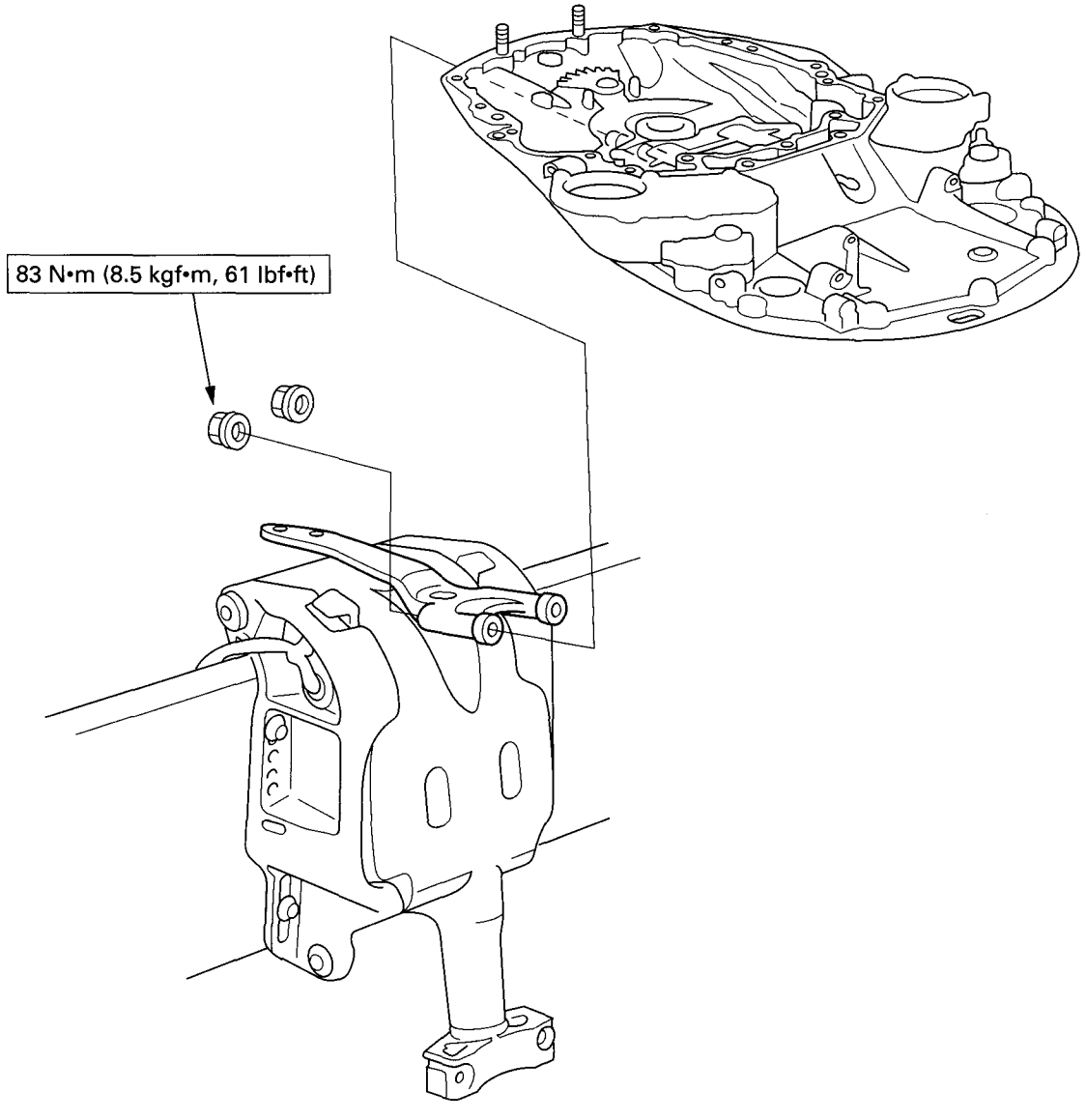


10) Apply engine oil to the oil pump rubber.
Take care the direction of the oil pump rubber and install the oil pump rubber.

11) Install the following parts:
— Flush valve (P. 8-5)
— Water jacket cover/relief valve (P. 8-3,4)
— Swivel case/stern bracket (P. 14-2)
— Engine assembly (P. 7-8)
— Shift shafts A and B (P. 7-8)
— Oil pan/exhaust pipe/water tube (P. 13-4)
— Extension case/lower rubber motor mount (P. 12-61)
— Gear case assembly (P. 12-5)



1. SWIVEL CASE/STERN BRACKET ASSEMBLY REMOVAL/INSTALLATION
2. POWER TRIM/TILT ASSEMBLY/STERN BRACKET/SWIVEL CASE ASSEMBLY
3. SWIVEL CASE/MOUNT FRAME
4. POWER TRIM/TILT ASSEMBLY
5. POWER TILT MOTOR ASSEMBLY



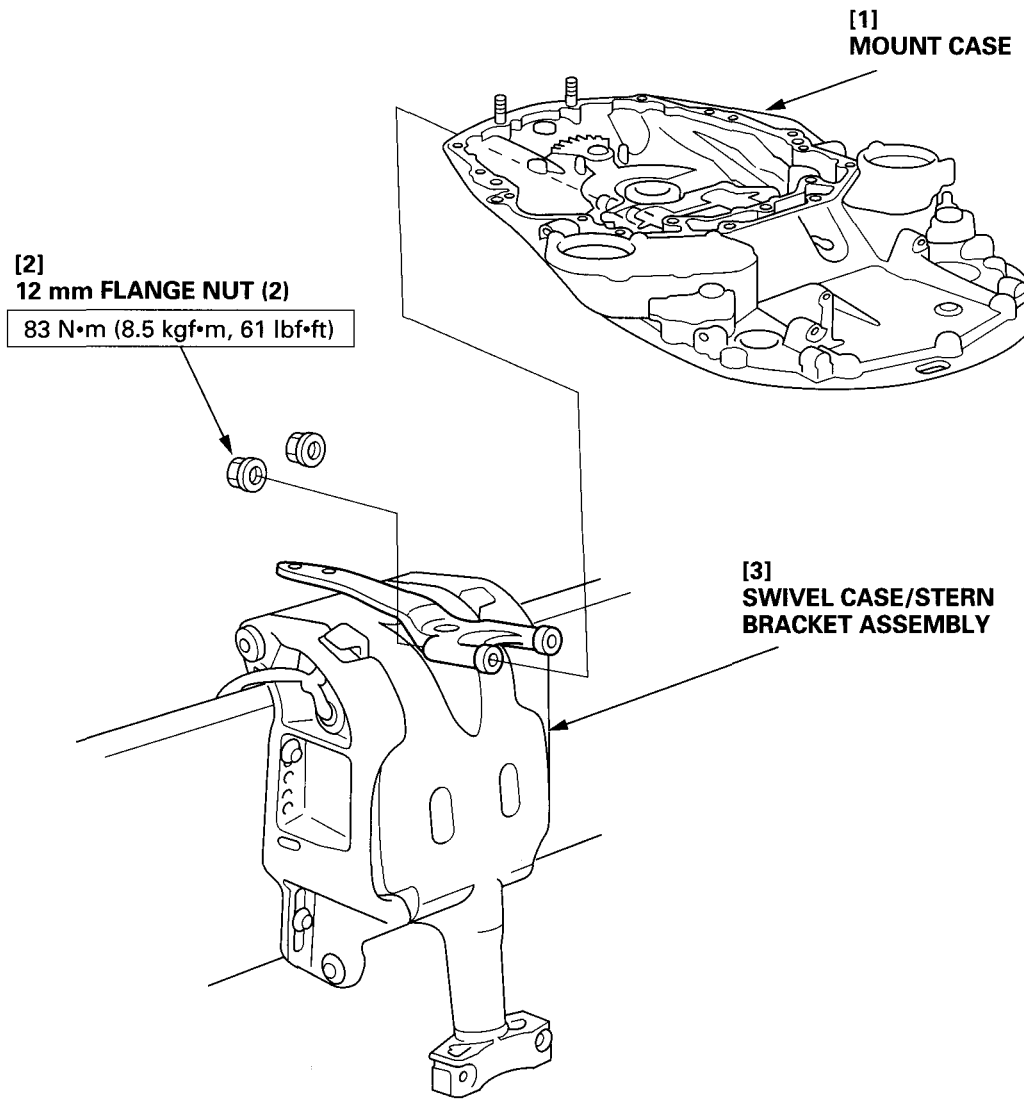
1. SWIVEL CASE/STERN BRACKET ASSEMBLY

a. REMOVAL/INSTALLATION

Set the outboard motor vertically (engine is set vertically) by adjusting with the adjusting rod.

1) Remove the following parts.
   — Engine cover (P. 4-1)
   — Propellar (P. 12-2)
   — Gear case assembly (P. 12-3)
   — Extension case/lower rubber motor mount (P. 12-59)
   — Oil pan/mount case (P. 13-2)
   — Engine assembly (P. 7-1)

2) Remove the swivel case and the stern bracket assembly from the mount case.



2. POWER TRIM/TILT ASSEMBLY/STERN BRACKET/SWIVEL CASE ASSEMBLY

a. DISASSEMBLY

NOTICE

Loosen the manual valve fully and raise the swivel case to the uppermost position to remove the power trim/tilt assembly.

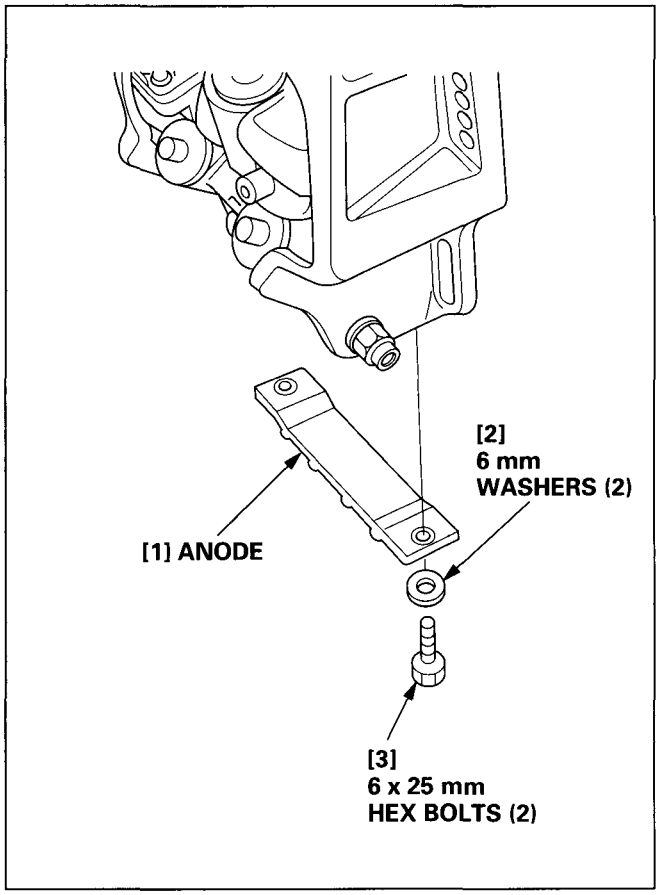
1) Remove the swivel case/stern bracket assembly. (P. 14-2)

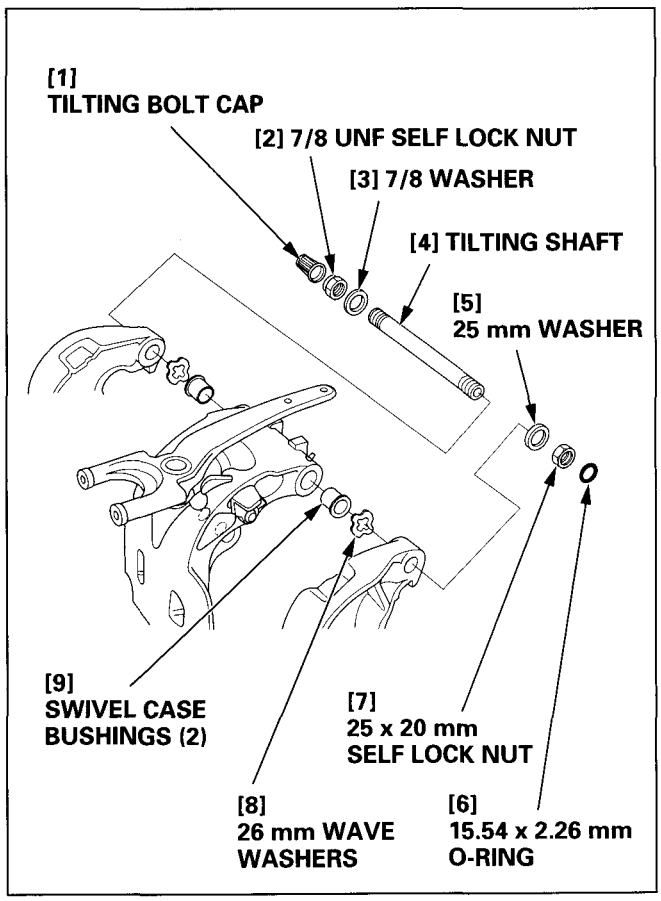
2) Remove the two 6 x 25 mm hex bolts, two 6 mm washers and anode.

3) Remove the tilting bolt cap.

4) Remove the 7/8 – 14 UNF self lock nut, 7/8 washer 25 x 20 mm self lock nut, 25 mm washer, tilting shaft and 15.54 x 2.26 mm O-ring.

5) Remove the two 26 mm wave washers and two swivel case bushings.

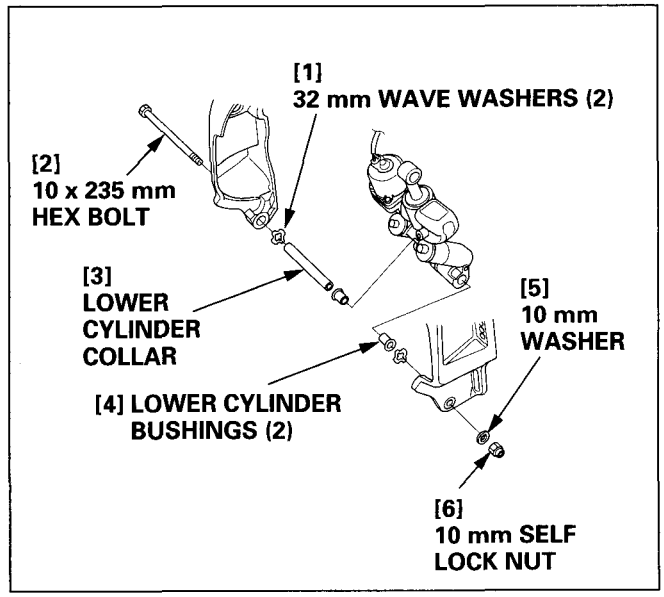




6) Remove the 10 mm self lock nut, 10 mm washer and 10 x 235 mm hex bolt.

7) Remove the two 32 mm wave washers, lower cylinder collar and the two swivel case bushings.

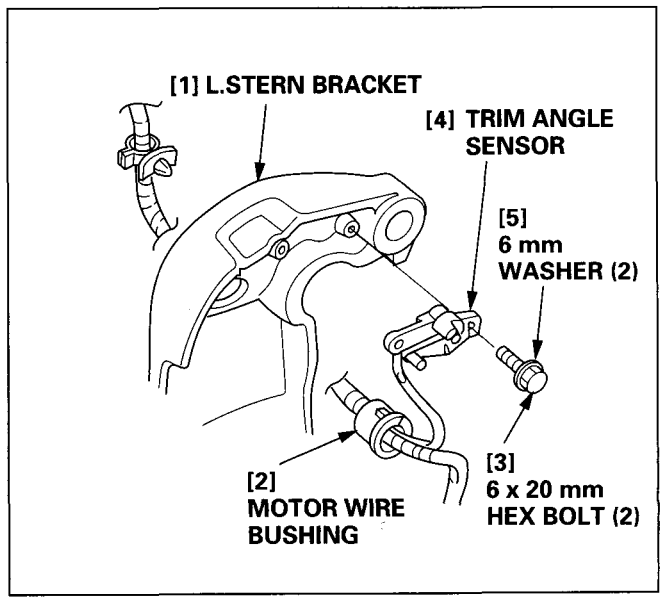
8) Remove the R. stern bracket.



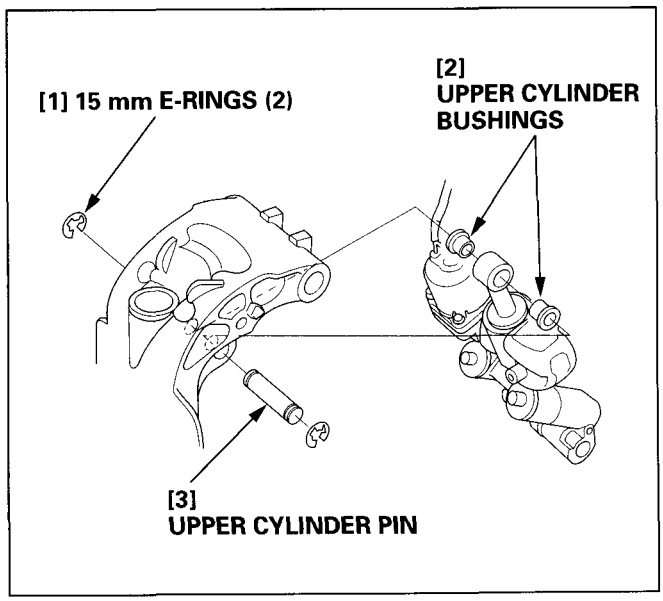
9) Remove the two 6 x 20 mm hex bolts and trim angle sensor.

10) Remove the motor wire bushing from the L. stern bracket.

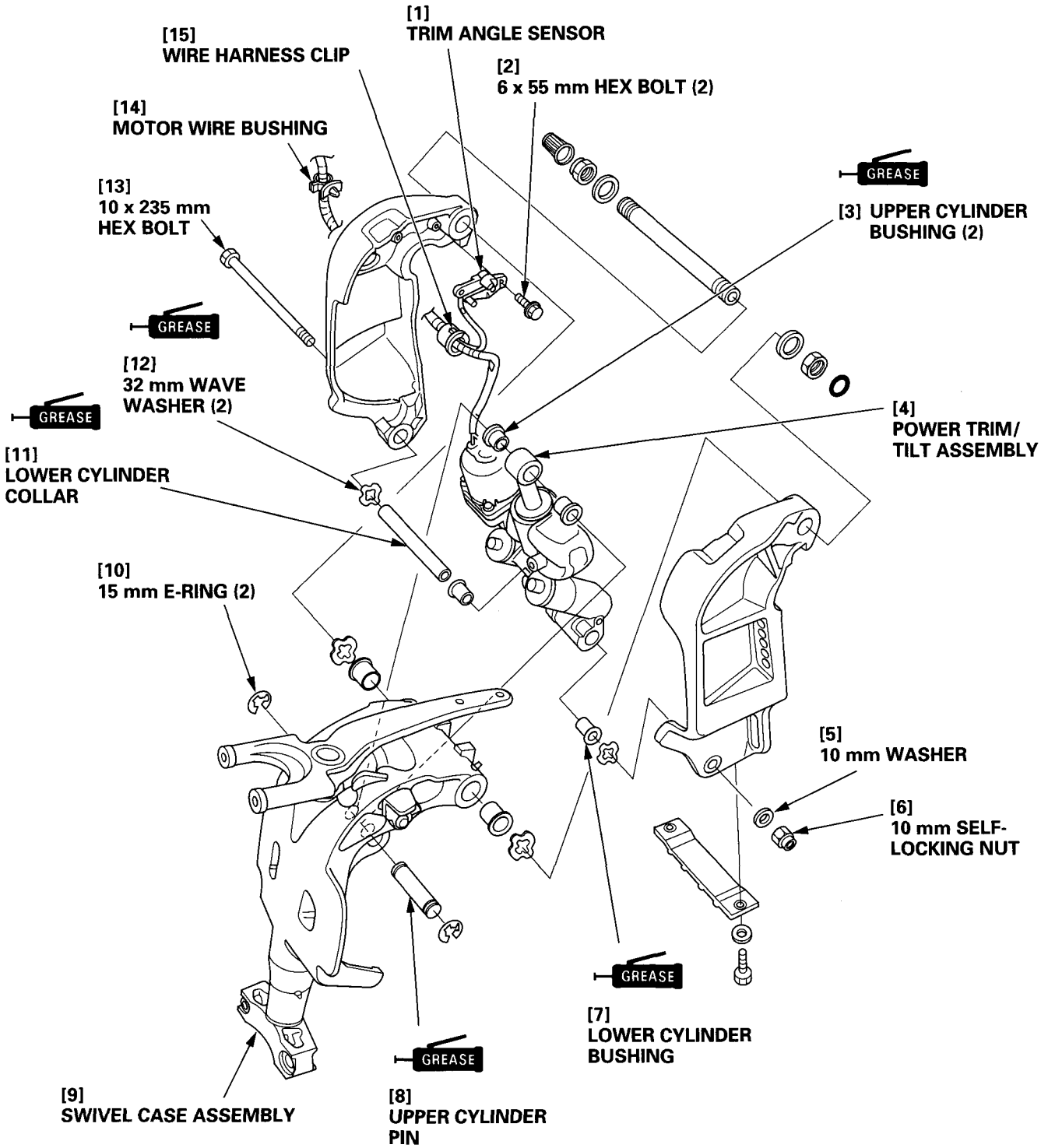
11) Remove the L. stern bracket.

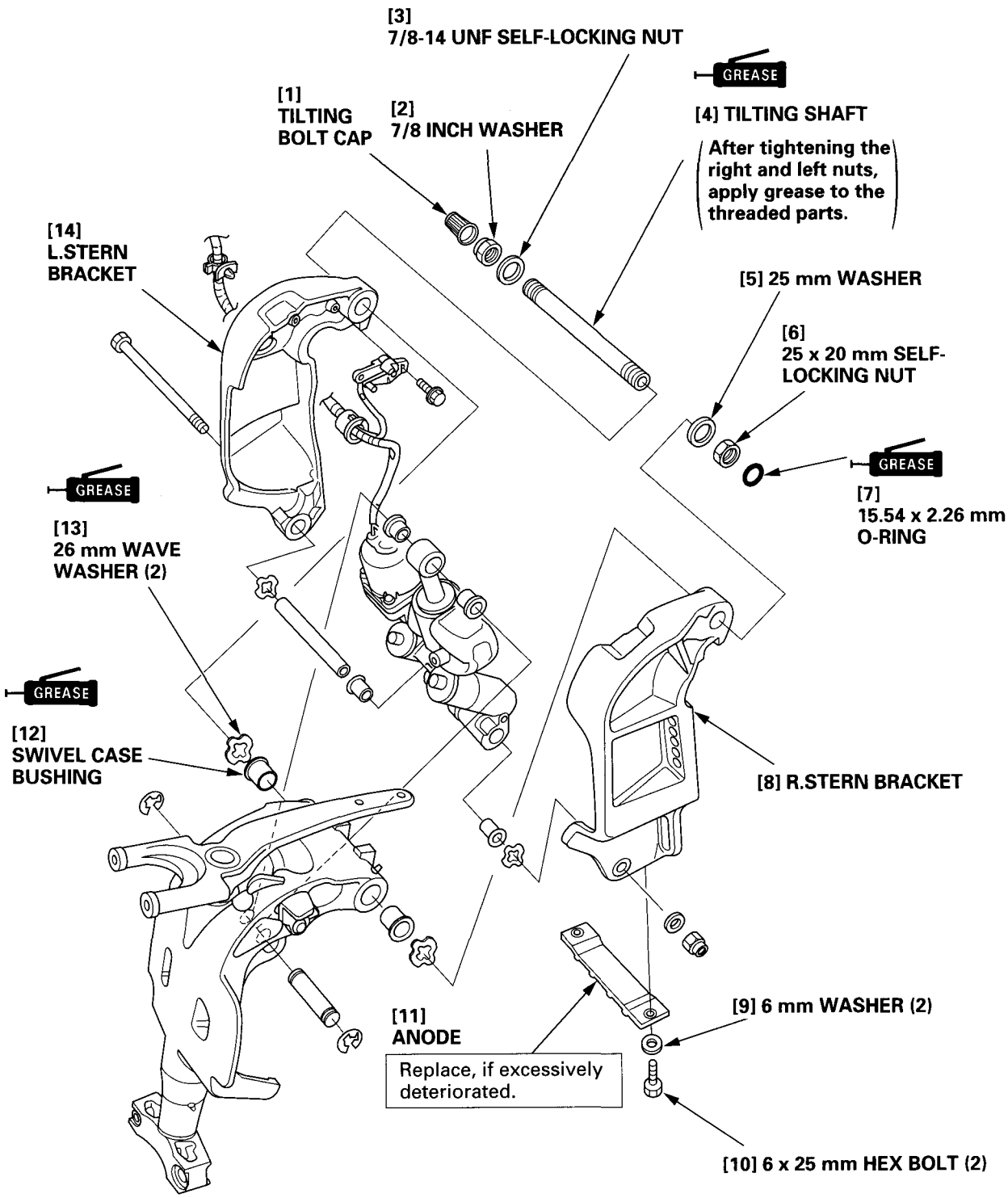


12) Remove the two 15 mm E-rings, upper cylinder pin and the two upper cylinder bushing, and remove the power trim/tilt assembly.



b. EXPLODED VIEW

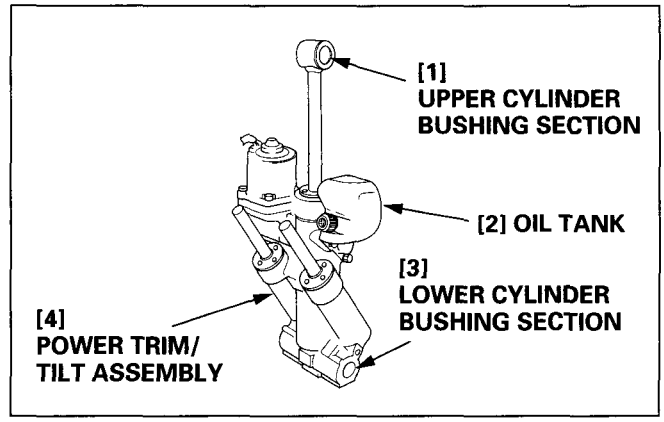



[3]
7/8-14 UNF SELF-LOCKING NUT
GREASE
[1]
TILTING
BOLT CAP
[2]
7/8 INCH WASHER
[4] TILTING SHAFT
After tightening the right and left nuts, apply grease to the threaded parts.
[14]
L.STERN
BRACKET
[5] 25 mm WASHER
[6]
25 x 20 mm SELF-
LOCKING NUT
GREASE
[7]
15.54 x 2.26 mm
O-RING
GREASE
[13]
26 mm WAVE
WASHER (2)
GREASE
[12]
SWIVEL CASE
BUSHING
[8] R.STERN BRACKET
[11]
ANODE
Replace, if excessively deteriorated.
[9] 6 mm WASHER (2)
[10] 6 x 25 mm HEX BOLT (2)

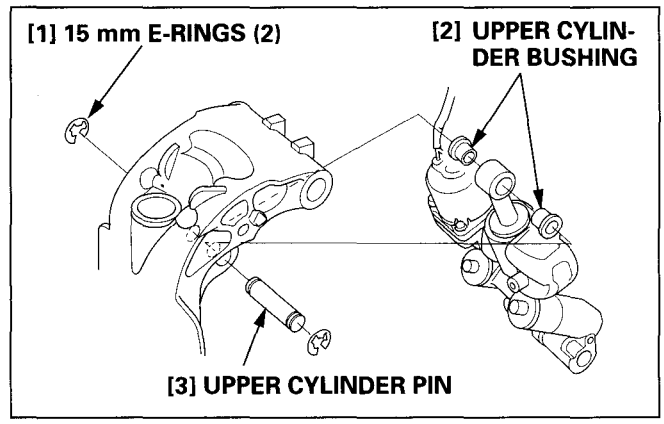
c. ASSEMBLY

NOTICE

Store the power trim/tilt assembly vertical with the upper cylinder bushing section facing up after removal. Never store the power trim/tilt assembly with the motor assembly facing up or with the lower cylinder bushing section facing up.

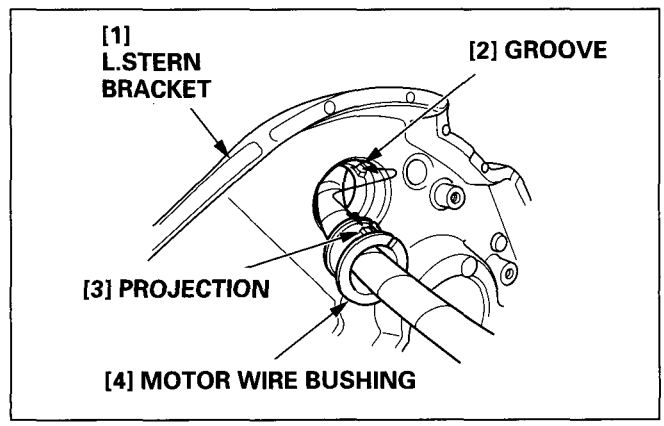


1) Apply grease to the two upper cylinder bushings, and install the upper cylinder pin, two 15 mm E-rings and power trim/tilt assembly.



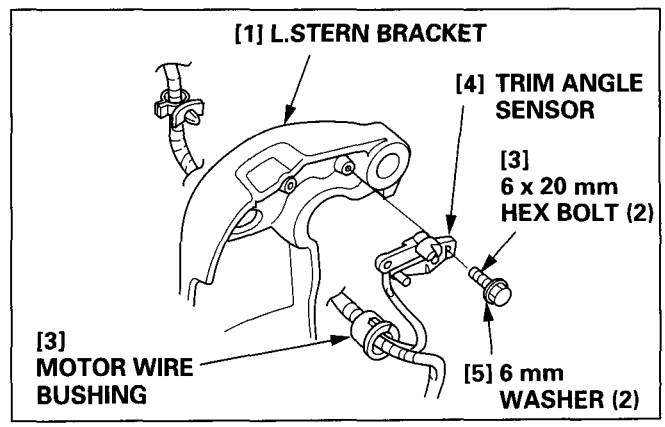
2) Pass each wire through the motor wire bushing.

3) Install the motor wire bushing by aligning the projection on the motor wire bushing with the groove in the left stern bracket.



4) Install the trim angle sensor with the two 6 x 20 mm hex bolts.

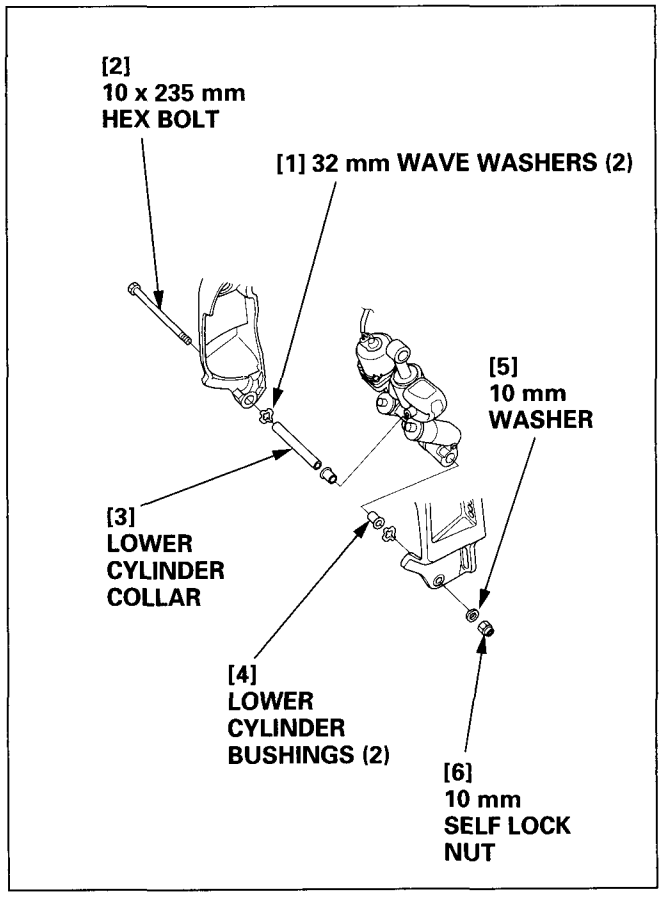
TORQUE: 9.8 N•m (1.0 kgf•m, 7 lbf•ft)



5) Apply grease to the two swivel case bushings, lower cylinder collar, two 32 mm wave washers, install them to the power trim/tilt assembly.

6) Install the L./R. stern bracket, 10 x 235 mm hex bolt, 10 mm washer and 10 mm seft lock nut.

TORQUE: 34 N•m (3.5 kgf•m, 25 lbf•ft)



7) Apply grease to the two swivel case bushings, install them to the swivel case assembly.

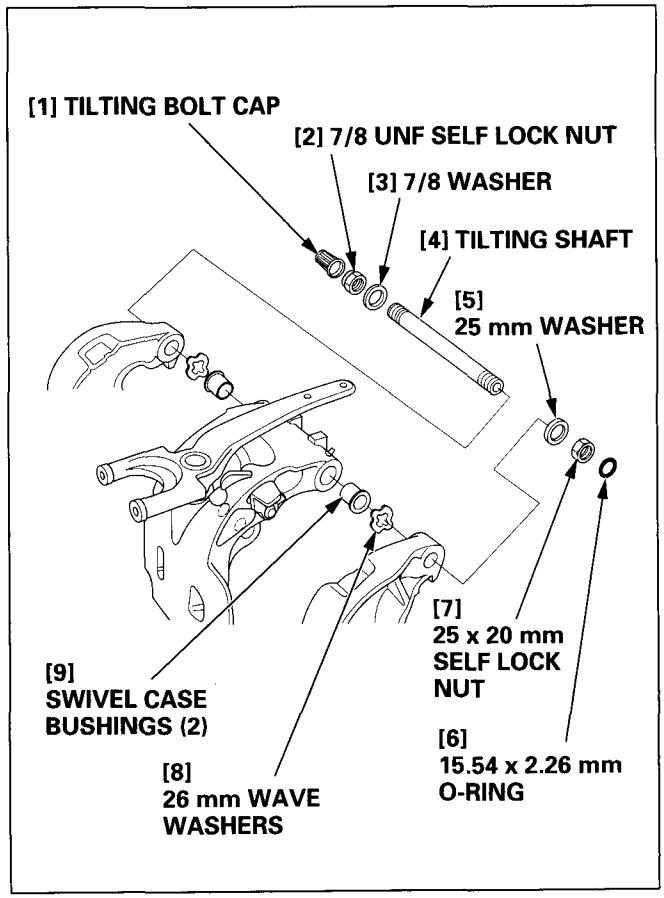
8) Apply grease to the two 26 mm wave washers and tilting shaft threaded parts.

9) Install the L./R. stern bracket, tilting shaft, 25 mm washer, 25 x 2.0 mm self lock nut, 7/8 washer and 7/8–14 UNF self lock nut.

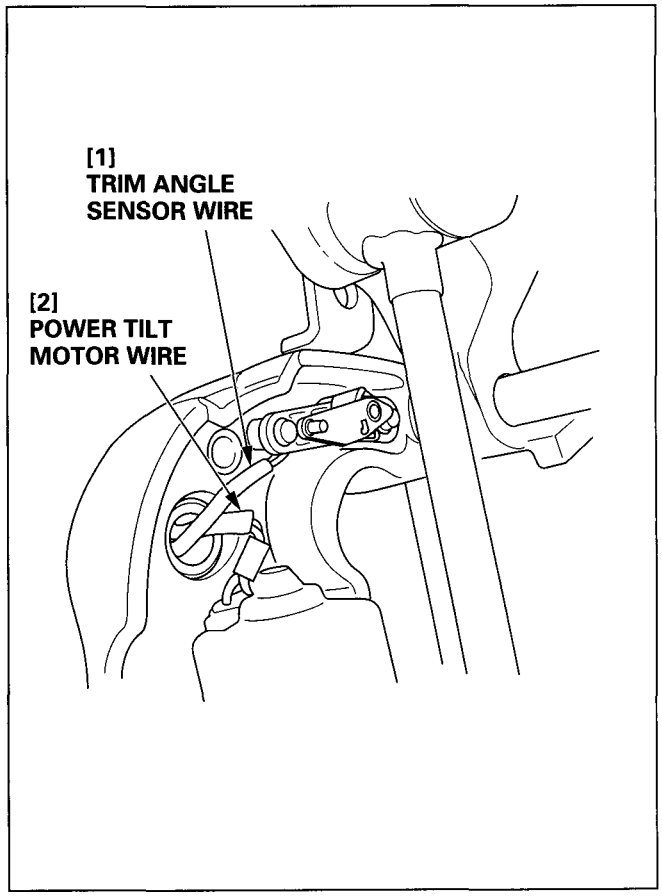
TORQUE: 34 N•m (3.5 kgf•m, 25 lbf•ft)

10) Install the 15.54 x 2.26 mm O-ring.

11) Install the tilting bolt cap.



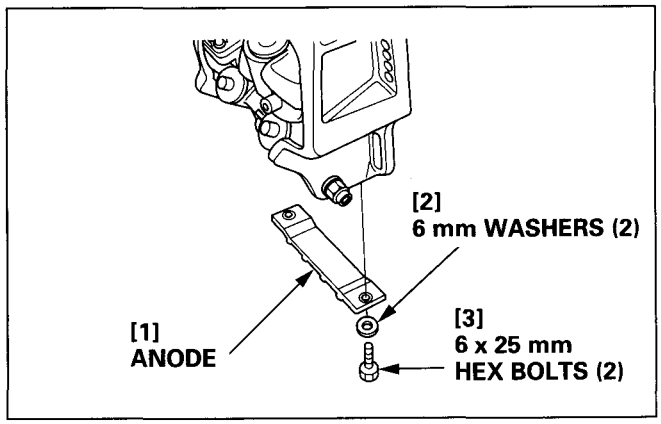
12) After installing the power trim/tilt assembly, check each wire and be sure they are not slack.



13) Install the anode, two 6 mm washers and two 6 x 25 mm hex bolts.

TORQUE: 9.8 N•m (1.0 kgf•m, 7 lbf•ft)

14) Install the swivel case/stern bracket assembly. (P.14-2)

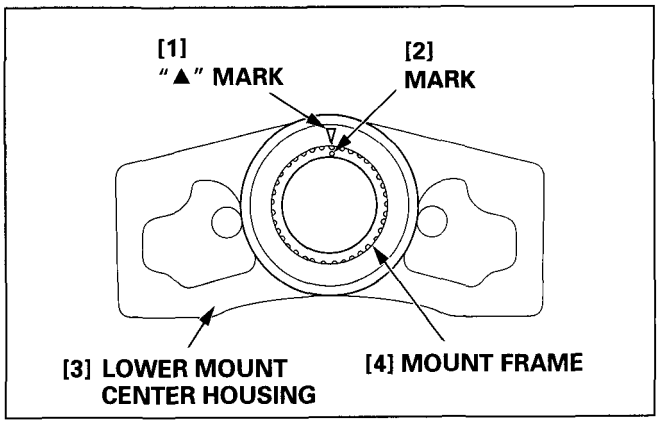


3. SWIVEL CASE/MOUNT FLAME

a. DISASSEMBLY

1) Remove the 39 mm external circlip.

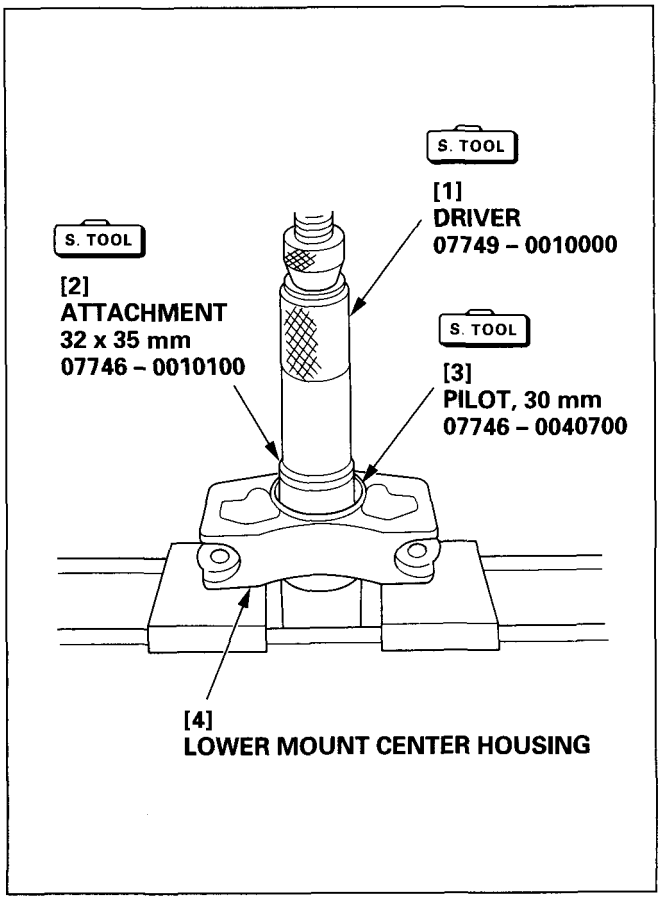
2) Mark the mount frame so that it aligns with the "▲" mark on the lower mount center housing.



3) Remove the lower mount center housing using the special tools as shown.

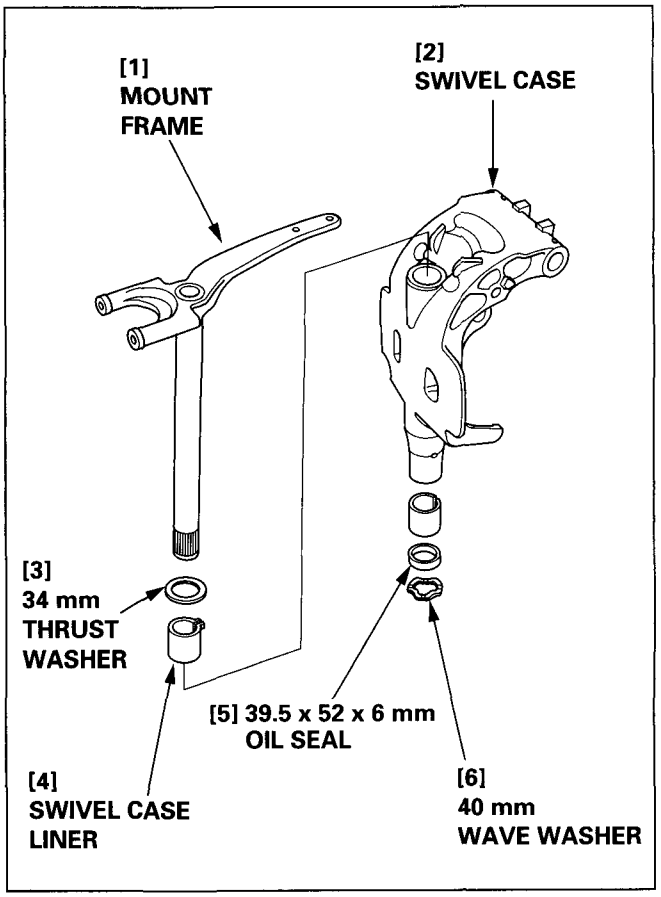
TOOLS:

Driver	**07749 – 0010000**
Attachment, 32 x 35 mm	**07746 – 0010100**
Pilot, 30 mm	**07746 – 0040700**



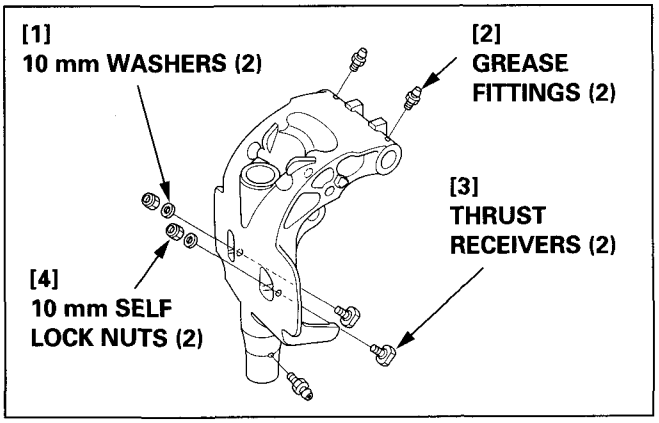
4) Remove the mount frame from the swivel case.

5) Remove the 40 mm wave washer, 39.5 x 52 x 6 mm oil seal, two swivel case liner and 34 mm thrust washer from the swivel case.

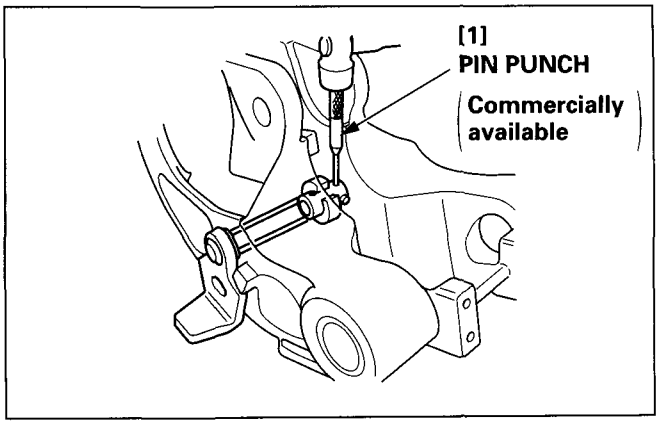


6) Remove the three grease fittings from the swivel case.

7) Remove the two 10 mm self lock nuts, two 10 mm washers and two thrust receivers from the swivel case.



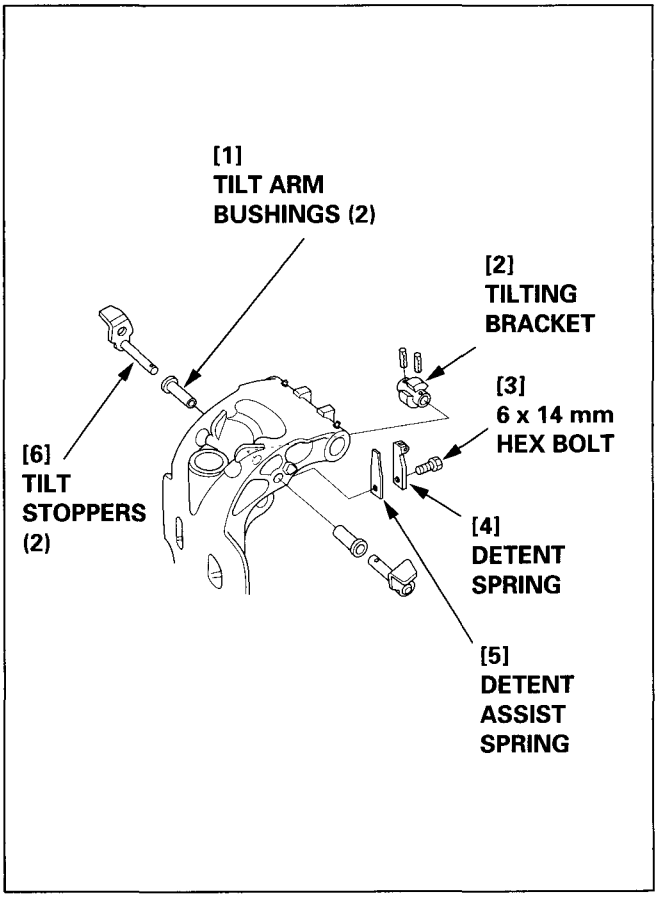
8) Remove the 3 x 20 mm spring pins using a commercially available 3 mm or 3/32-inch pin punch.



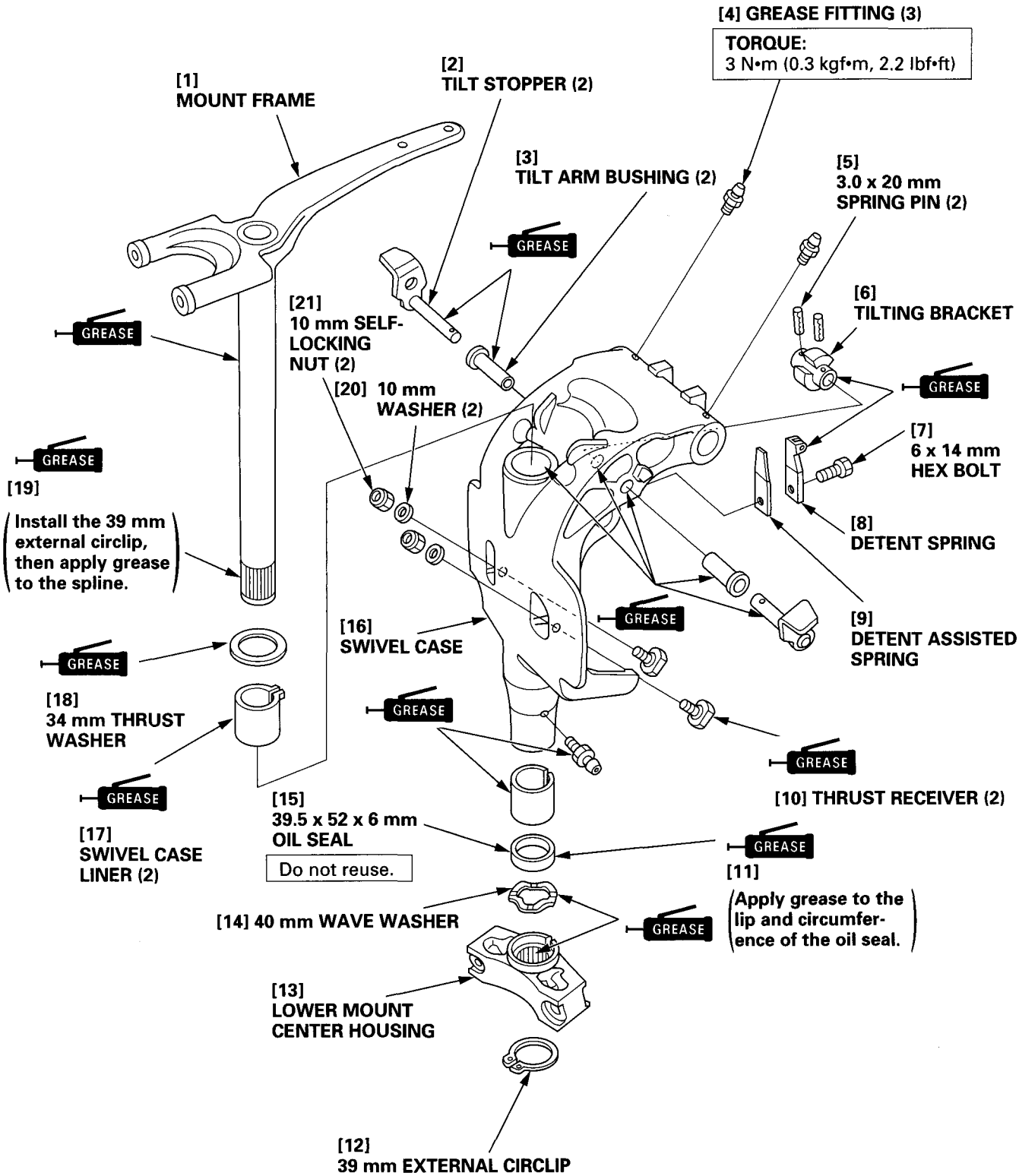
9) Remove the two tilt stoppers, two tilt arm bushings and tilting bracket.

10) Check the tilt arm bushing for wear and damaged. Replace if necessary.

11) Remove the 6 x 14 mm hex bolt, detent spring and detent assisted spring.



b. EXPLODED VIEW



c. ASSEMBLY

1) Install the detent assisted spring, detent spring and 6 x 14 mm hex bolt. Apply grease to the roller of detent spring.

   TORQUE: 9.8 N•m (1.0 kgf•m, 7 lbf•ft)

2) Apply grease to the two tilt stopper and two tilt arm bushing.

3) Set the tilting bracket, tilt arm bushing and tilt stopper to the swivel case.

4) Insert the tilting bracket into the right and left tilt stopper shafts, so that the projection on the tilting bracket is at the right side and facing up when viewed from the mount frame installation hole side in the swivel case.

   Drive in the 2.5 x 20 mm spring pins using a commercially available 2.5 mm or 3/32-inch pin punch.

   Drive in the pins so that 1 – 2 mm (0.04 – 0.08 in) of the pin end is out of the tilting bracket at the opposite side from the driving side.

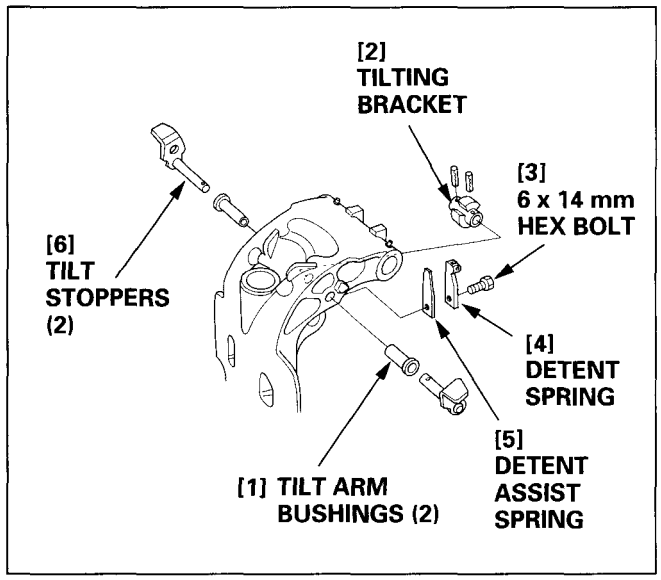
   - Do not drive in the spring pins excessively. The tilt stopper cannot operate properly if the extrusion length of the pin end is more than 1 – 2 mm (0.04 – 0.08 in).

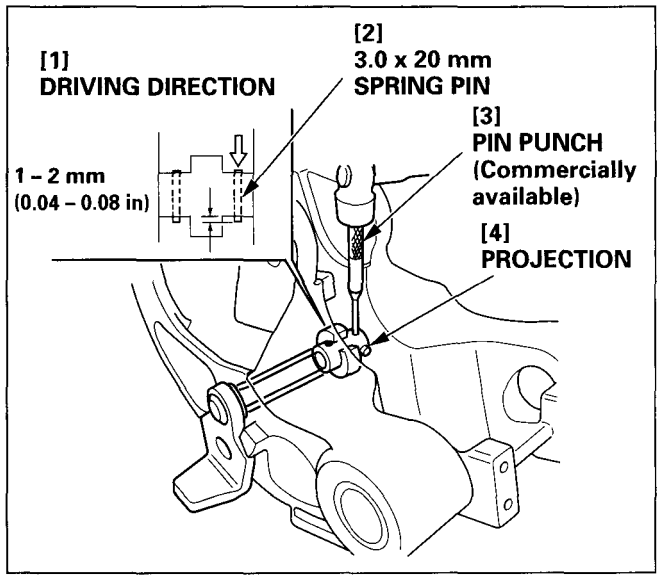
5) Install the two thrust receivers, two 10 mm washers and two 10 mm self lock nuts to the swivel case.

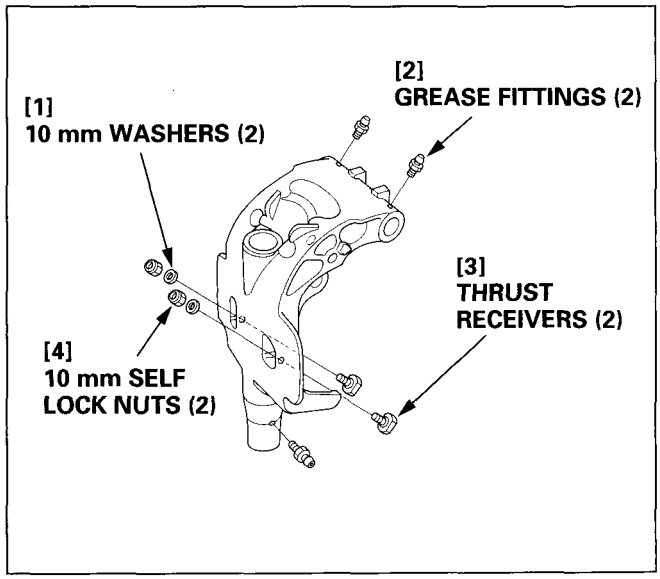
   TORQUE: 37 N•m (3.75 kgf•m, 27 lbf•ft)

6) Install the three grease fittings to the swivel case.

   TORQUE: 2.9 N•m (0.3 kgf•m, 2.2 lbf•ft)

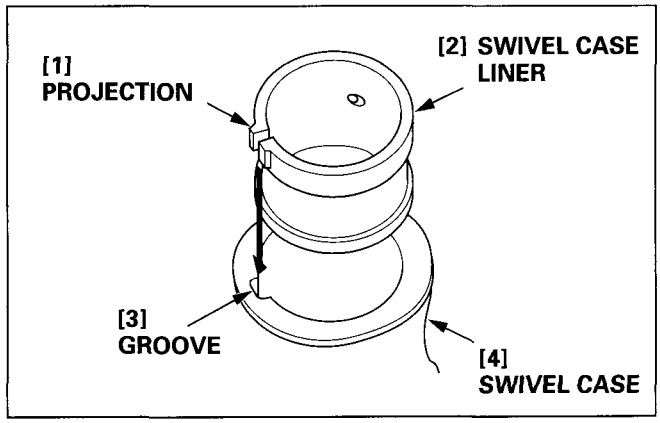




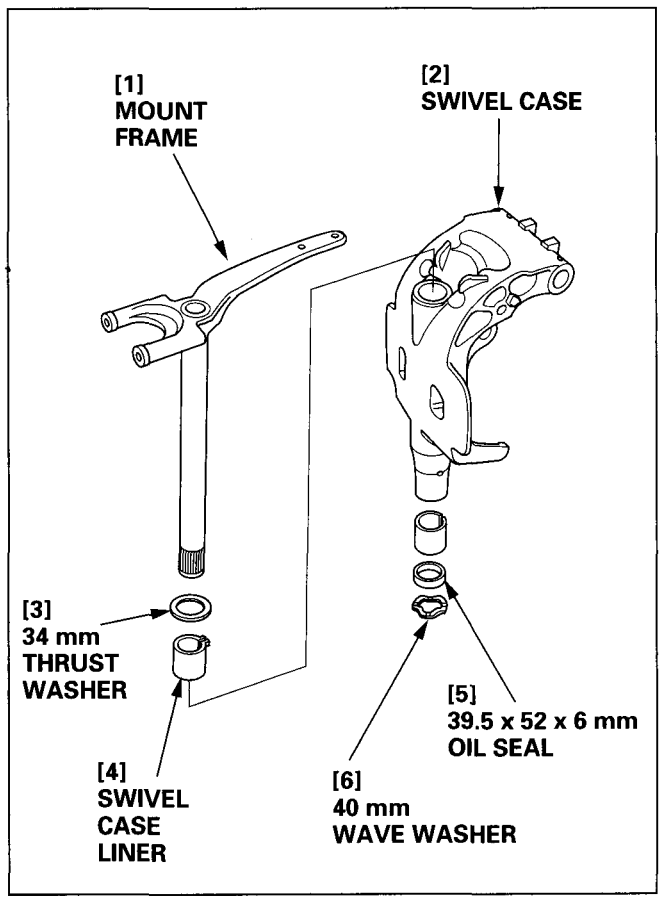


7) Apply grease to the circumference of the swivel case liner.

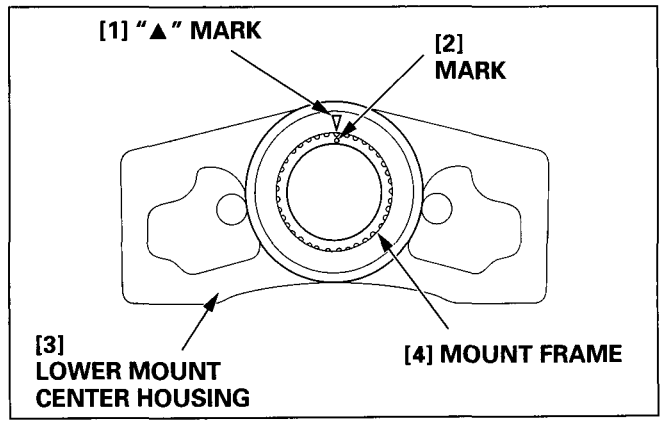
8) Install the swivel case liner by aligning the projection on the swivel case liner with the groove in the swivel case.



9) Apply grease to the 34 mm thrust washer, new 39.5 x 52 x 6 mm oil seal, 40 mm wave washer and shaft of mount flame and install them to the swivel case.



10) Apply grease to the spline of the lower mount center housing. Set the lower mount center housing on the mount frame by aligning the mark put on the mount frame during removal with the "▲" mark on the lower mount center housing.

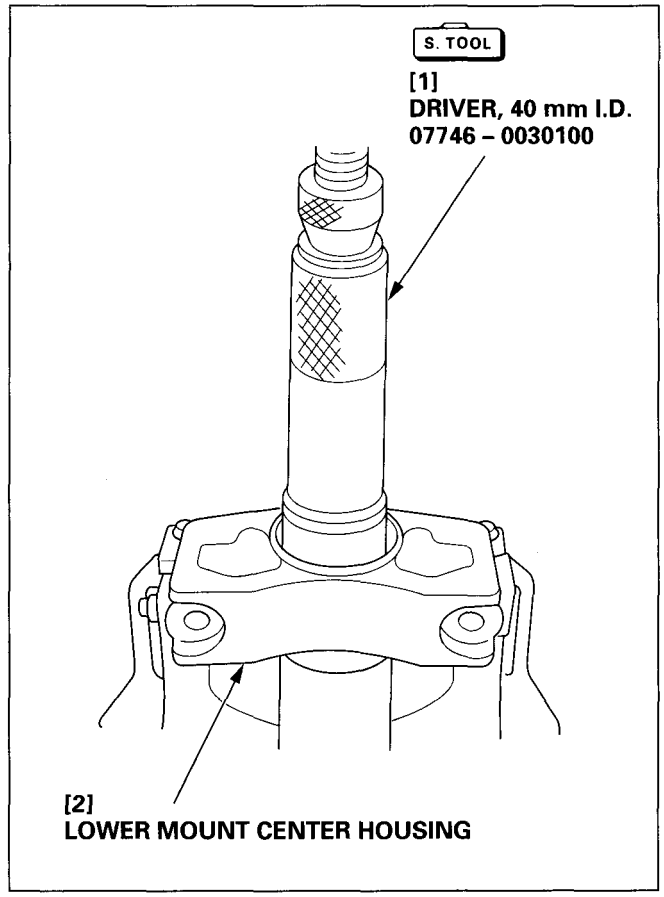


11) Set the swivel case/mount frame on a hydraulic press as shown.

12) Set the special tool on the lower mount center housing as shown, and press the lower mount center housing until it contacts the swivel case (i.e. until the hydraulic pressure of the press rises slightly).

TOOL:

Driver, 40 mm I.D.	**07746 – 0030100**



13) Remove the swivel case assembly and the special tool from the hydraulic press.

14) Check the mount frame for smooth rotation. Check whether the 39 mm external circlip can be installed.

TOOLS:

Driver	**07749 – 0010000**
Attachment, 32 x 35 mm	**07746 – 0010100**
Pilot, 30 mm	**07746 – 0040700**

<When the mount frame turns smoothly and the circlip can be installed>

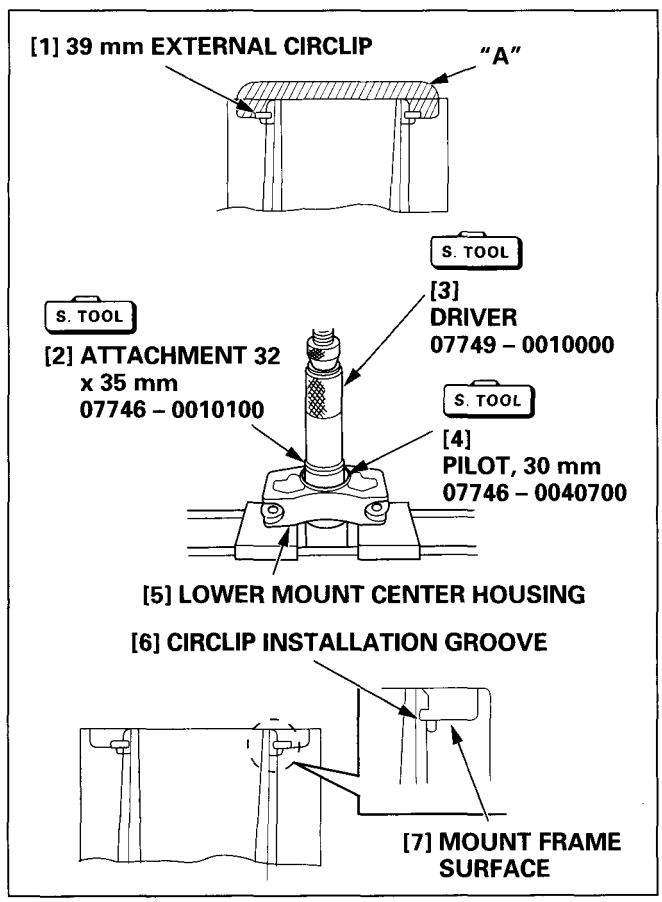
- Install the 39 mm external circlip, and apply grease to the part of "A" shown in the drawing.

<When the circlip can be installed but the mount frame does not turn smoothly>

1) Attach the special tools to the lower mount center housing.

2) Press until the circlip installation groove in the mount frame aligns with the lower mount center housing face. Remove the special tools.

3) Install the 39 mm external circlip, and apply grease to the part "A" shown in the drawing.

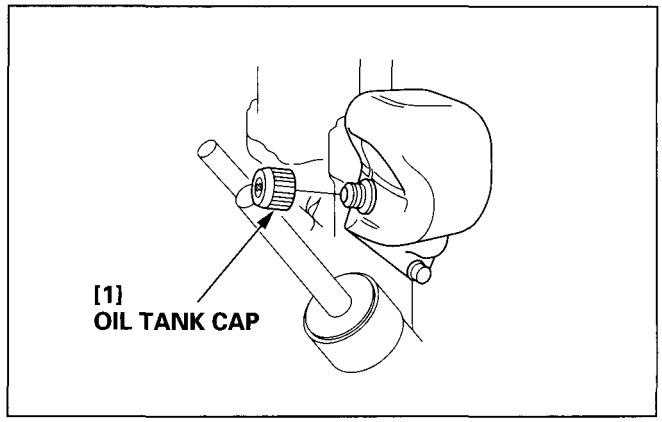


4. POWER TRIM/TILT ASSEMBLY

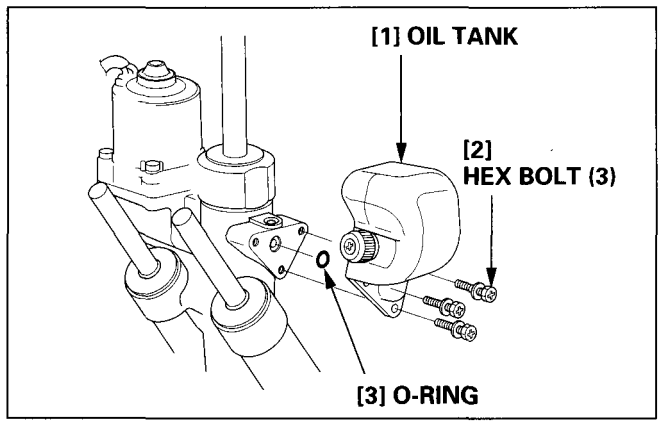
a. DISASSEMBLY

1) Remove the swivel case/stern bracket assembly.

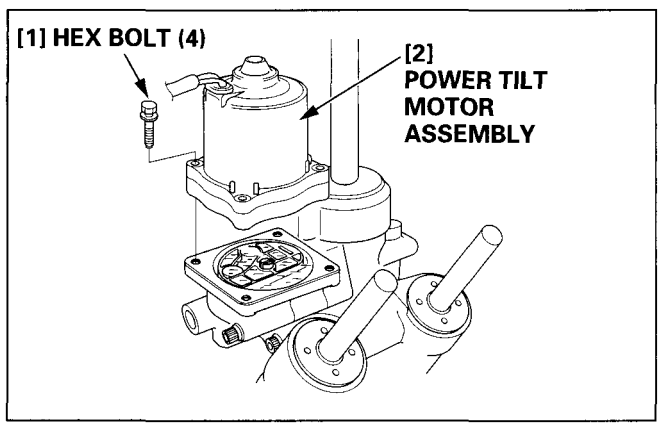
2) Remove the oil tank cap, and drain the Automatic Transmission Fluid (ATF).



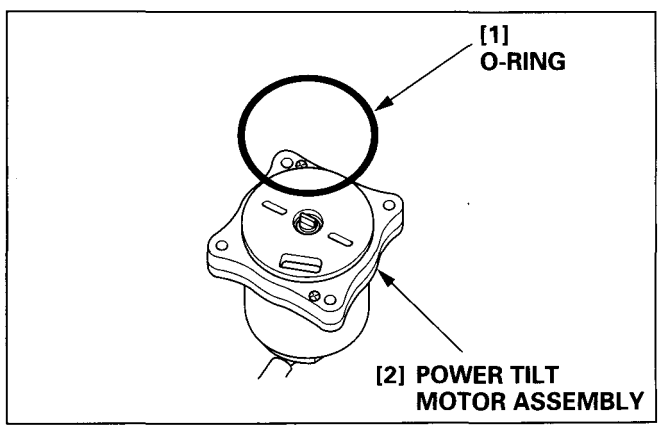
3) Remove the three hex bolts and oil tank from the cylinder comp. Remove the O-ring from the cylinder comp.



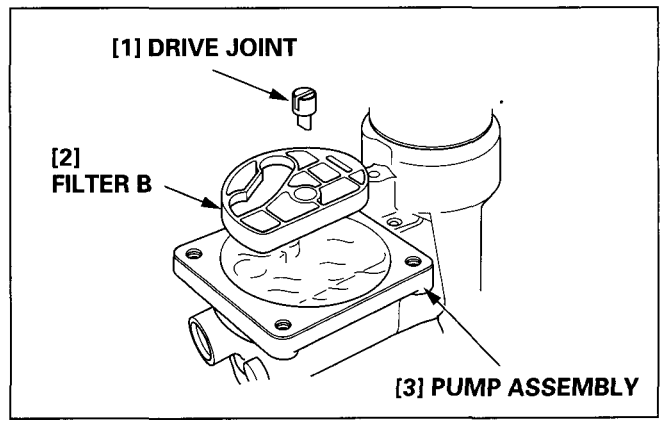
4) Remove the four hex bolts and power tilt motor assembly from the pump assembly.



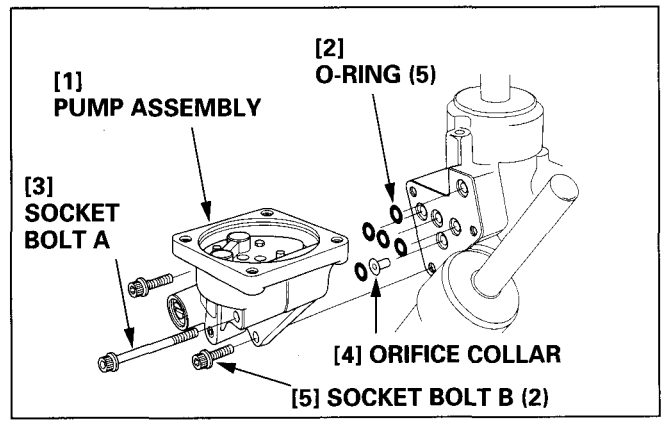
5) Remove the O-ring from the power tilt motor assembly.



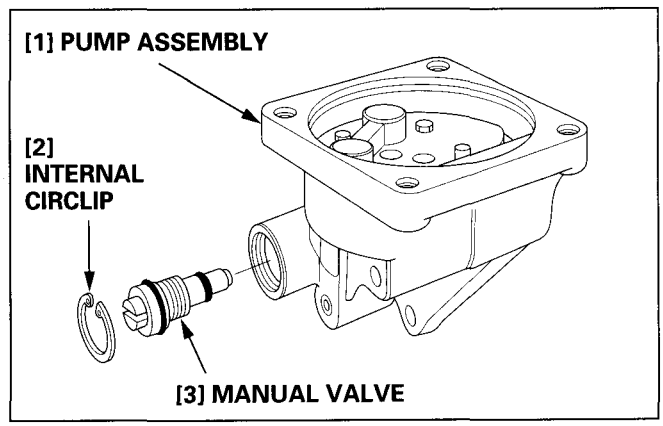
6) Remove the drive joint and filter B from the pump assembly.



7) Remove the socket bolts A, B and pump assembly. Remove the five O-rings and orifice collar from the cylinder comp.



8) Remove the internal circlip and manual valve from the pump assembly.

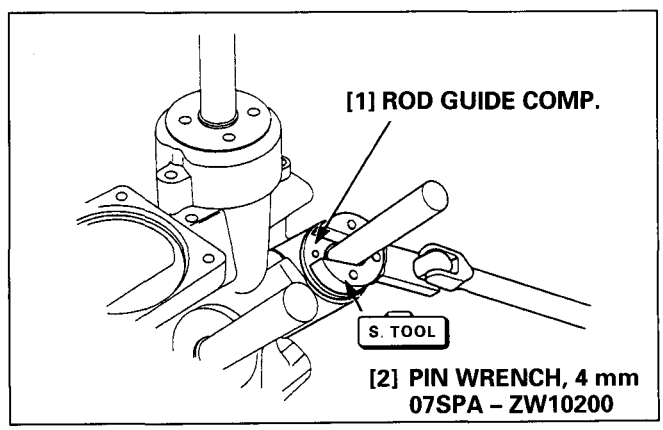


9) Hold the cylinder comp with a vice (P. 14-13).

10) Make sure the right and left piston rod B must be extended fully.

11) Remove the rod guide comp., using the special tool as shown.

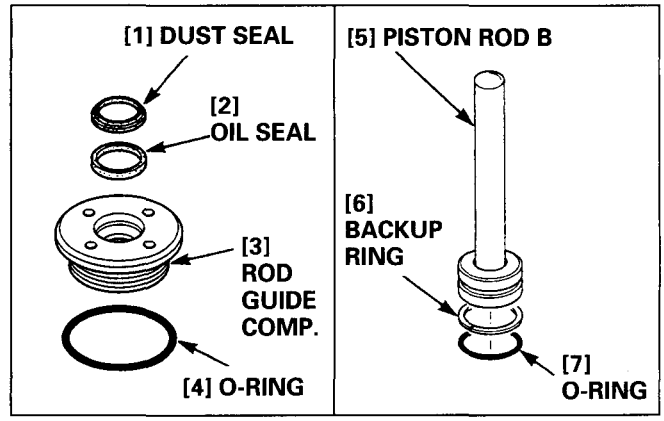
TOOL:
Pin wrench, 4 mm **07SPA – ZW10200**



12) Remove the O-rings from the piston rod B.

13) Remove the O-ring and oil seal from the rod guide comp.

14) Remove the dust seal from the rod guide comp.

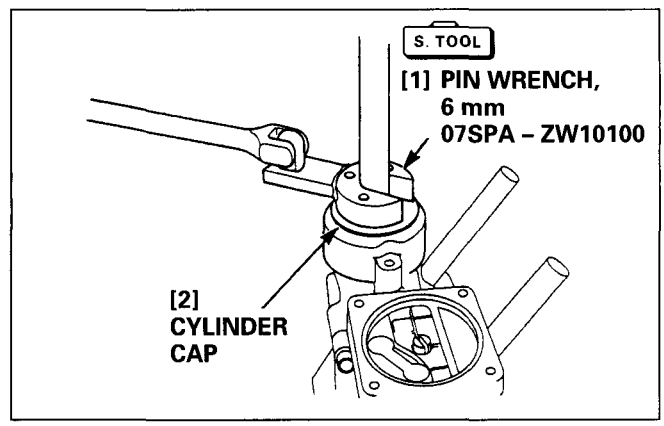


15) Hold the cylinder comp with a vice (P. 14-21).

16) The piston rod comp. must be extended fully.

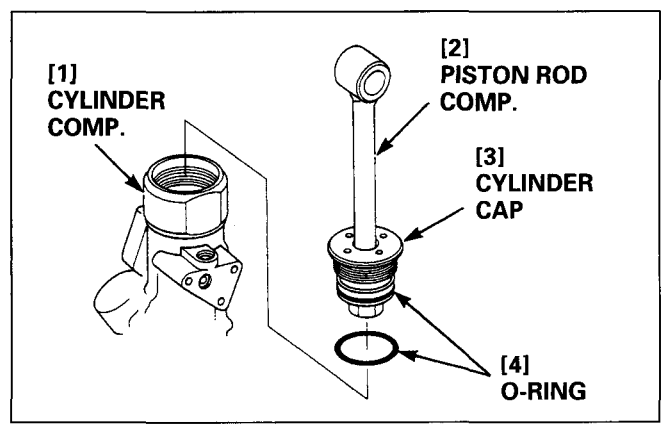
17) Set the special tool on the cylinder cap as shown, and remove the piston rod comp.

TOOL:
Pin wrench, 6 mm **07SPA – ZW10100**

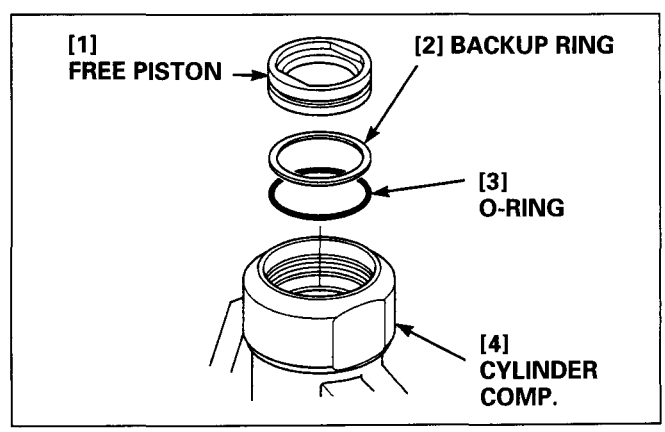


18) Remove the piston rod comp from the cylinder comp.

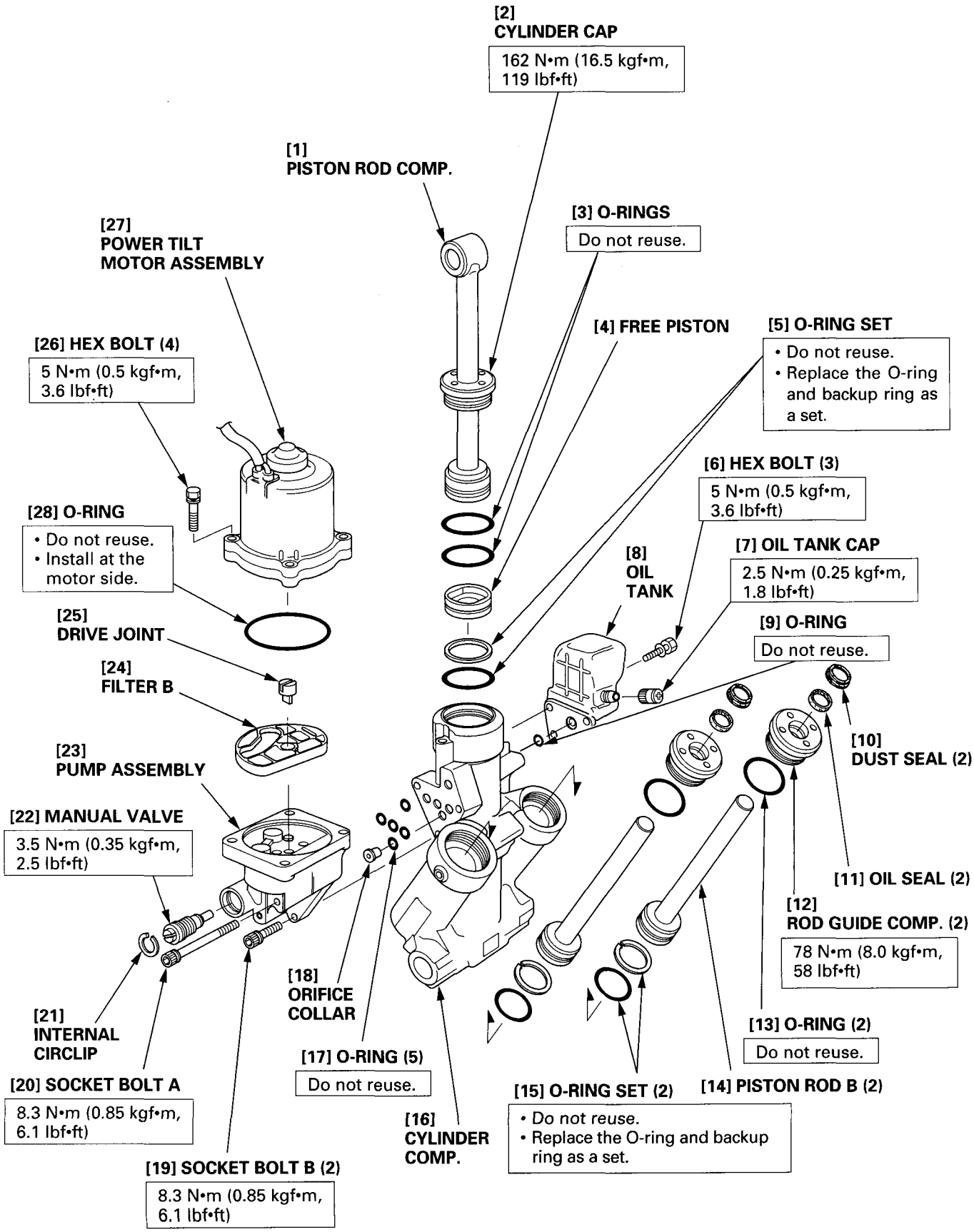
19) Remove the O-ring from the cylinder cap.



20) Remove the free piston and O-rings from the cylinder comp.



b. EXPLODED VIEW



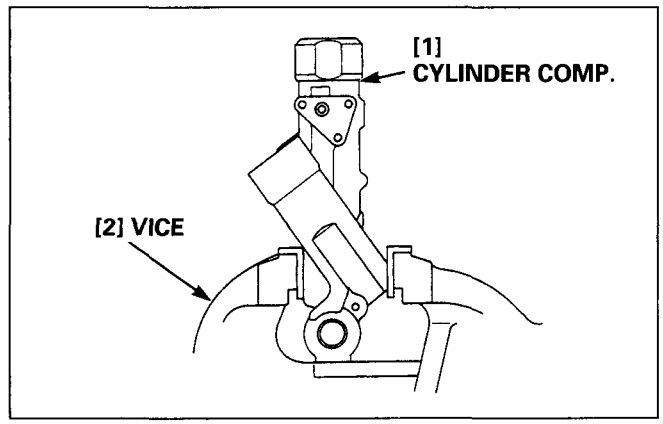
c. ASSEMBLY

- Do not reuse the O-ring.
- Assemble with the rods of the piston rod comp. and the piston rod B extended fully. Do not push in the extended rods after pouring the oil in each cylinder.
- Apply Automatic Transmission Fluid (ATF) to the new O-rings on assembly.
- Do not use a shop towel or equivalent cloth, and do not wear gloves during this operation.
- Do not reuse the drained Automatic Transmission Fluid (ATF).
- After assembly, coat the joints or mating sections of the parts and the sections where the paint came off with rust preventive paint of the same color.

1) Hold the cylinder comp. with a vice as shown.

NOTICE

Take care not to tighten the vice excessively, as it damages the cylinder comp.

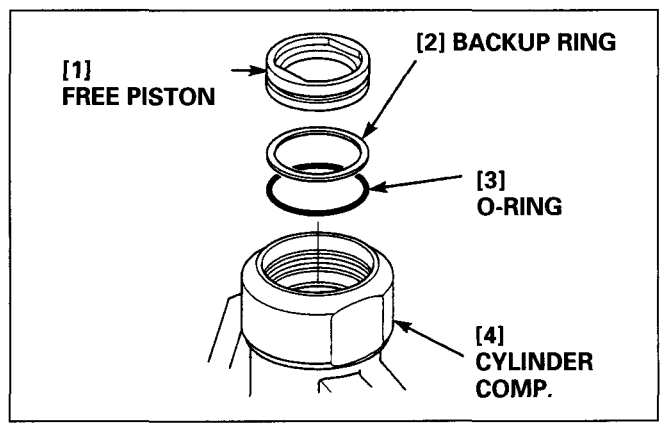


2) Pour approximately 30 cm^3 (1.0 fl oz) of Automatic Transmission Fluid (ATF) into the piston rod of the cylinder comp.

Recommended oil	Genuine Honda Automatic Transmission Fluid (ATF) DEXRON®, or equivalent

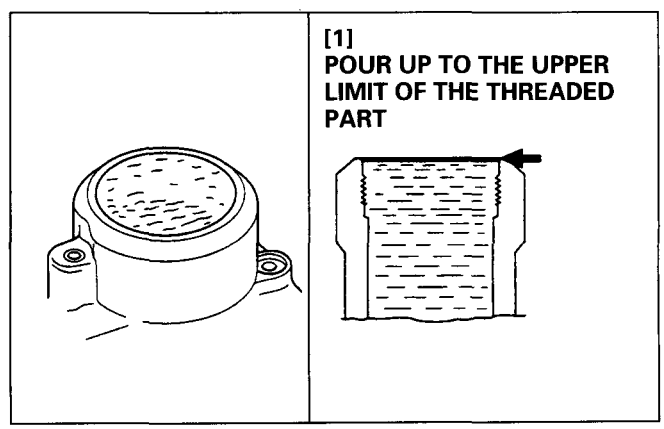
3) Check the free piston for wear and damage and replace if necessary.

Install a new backup ring and O-ring on the free piston.



4) After inspection, push in the free piston slowly until it bottoms out.

5) Pour new Automatic Transmission Fluid (ATF) up to the upper limit (i.e. lower edge of the threaded section) of the piston rod.

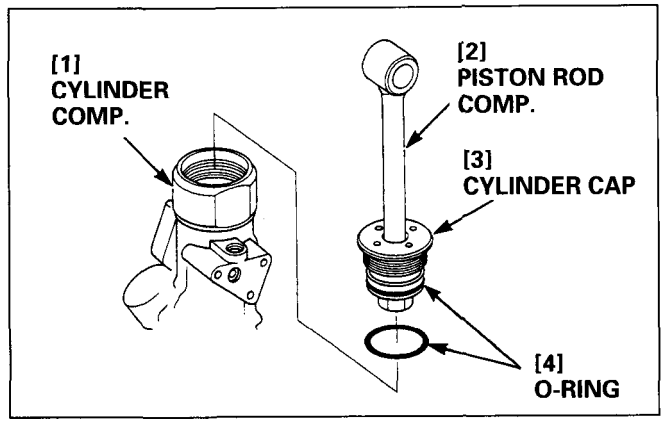


6) Install a new O-ring at the bottom (i.e. nut side) of the piston rod comp.

7) Install a new O-ring on the cylinder cap of the piston rod comp.

8) Set the cylinder cap at the bottom (i.e. nut side) of the piston rod comp., and install the piston rod comp. in the cylinder comp.

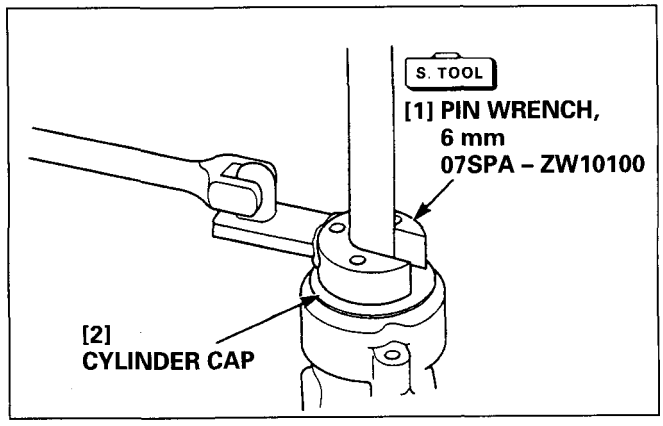
   • When installing the piston rod comp., do not push the piston rod comp, into the cylinder comp.



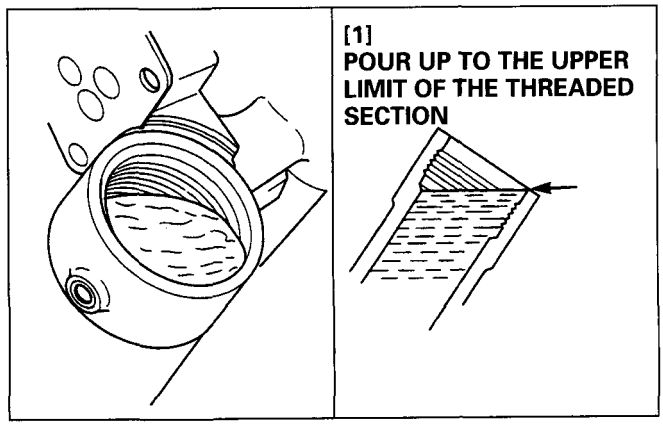
9) Using the special tool, tighten the cylinder cap to the specified torque.

   TORQUE: 162 N•m (16.5 kgf•m, 119 lbf•ft)

   TOOL:
   Pin wrench, 6 mm 07SPA – ZW10100



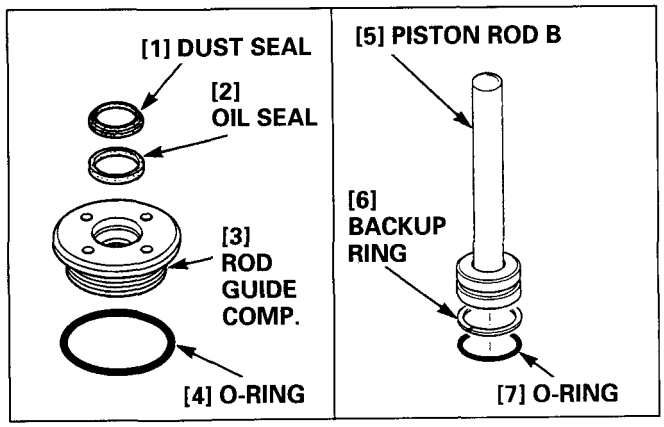
10) Pour new Automatic Transmission Fluid (ATF) to the upper limit of the right and left trim cylinders.



11) Install a new dust seal inside the rod guide comp.

12) Install a new O-ring and oil seal on the rod guide comp.

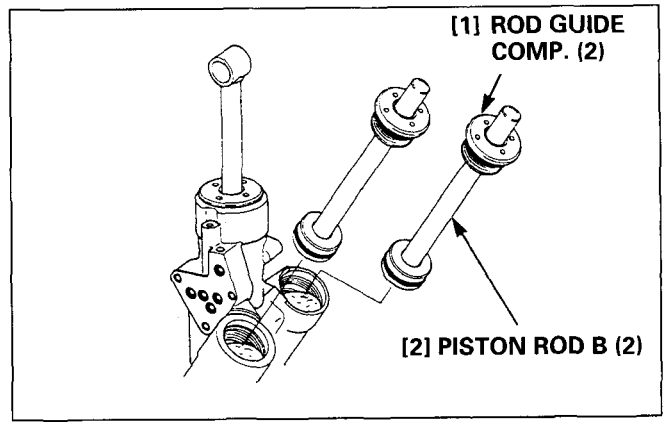
13) Install a new backup ring and O-ring on the piston rod B.



14) Set the rod guide comp. on each piston rod B. Hold the right and left trim cylinders at an angle, and insert each piston rod B in the respective trim cylinder.

- Do not install the piston rod Bs by pushing them into the respective trim cylinders.

15) Install piston rod B in the right and left trim cylinders slowly.



16) Holding piston rod B in place, tighten the rod guide comp. against the cylinder comp.

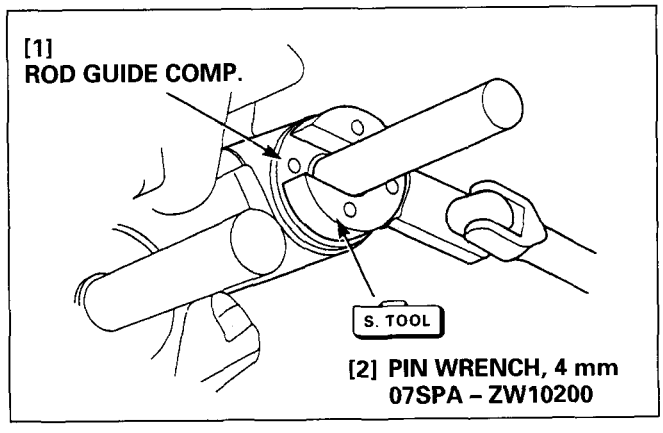
Tighten the other rod guide comp. against the cylinder comp. in the same manner.

- Take care not to push the piston rod B into the trim cylinders when tightening the rod guide comp. against the cylinder comp.

17) Using the special tool, tighten the right and left rod guide comps. to the specified torque.

TORQUE: 78 N•m (8.0 kgf•m, 58 lbf•ft)

TOOL:
Pin wrench, 4 mm 07SPA – ZW10200

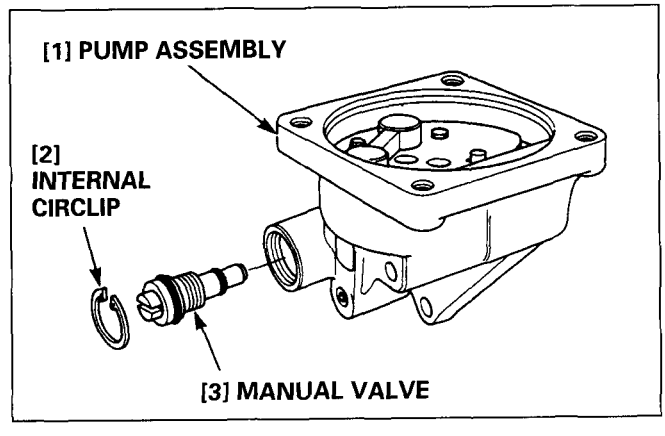


18) Check the manual valve for wear and damage and replace if necessary.

19) Tighten the manual valve against the pump assembly securely.

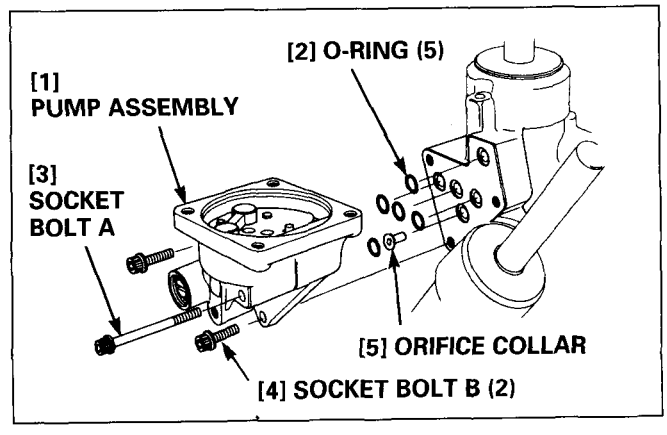
TORQUE: 3.5 N•m (0.35 kgf•m, 2.5 lbf•ft)

Install the internal circlip.

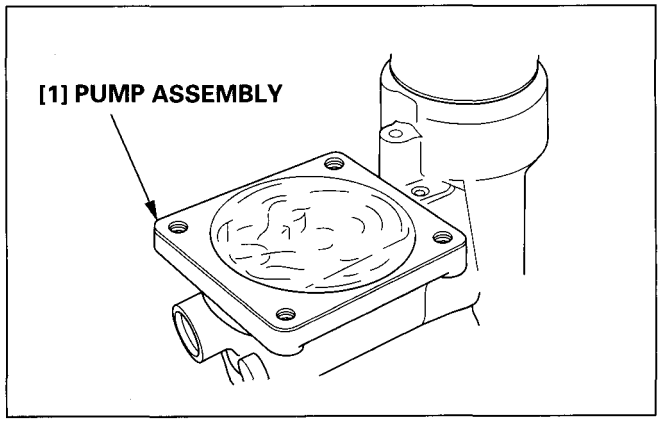


20) Install the five new O-rings and orifice collar in the cylinder comp., and install the pump assembly on the cylinder comp. using socket bolts A and B.

TORQUE: 8.3 N•m (0.85 kgf•m, 6.1 lbf•ft)



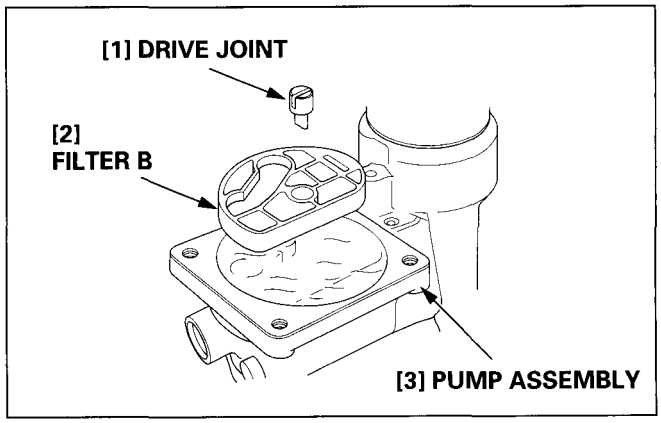
21) Fill the pump assembly fully with new Automatic Transmission Fluid (ATF).



22) Check filter B for clogging and damage. Replace filter B if it is damaged.

    Blow air through filter B if it is clogged. Clean filter B carefully to avoid damage.

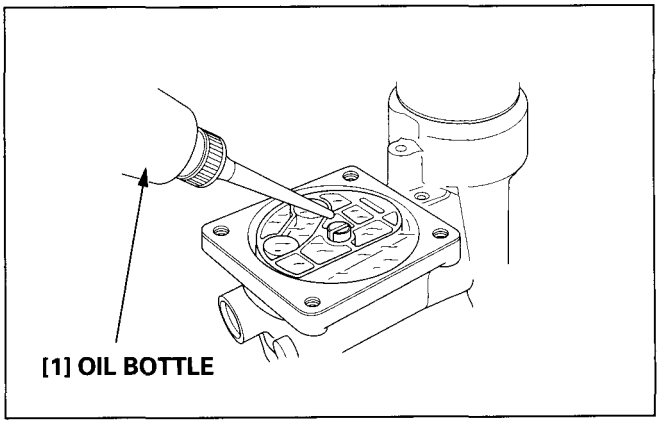
23) Install filter B and the drive joint on the pump assembly.



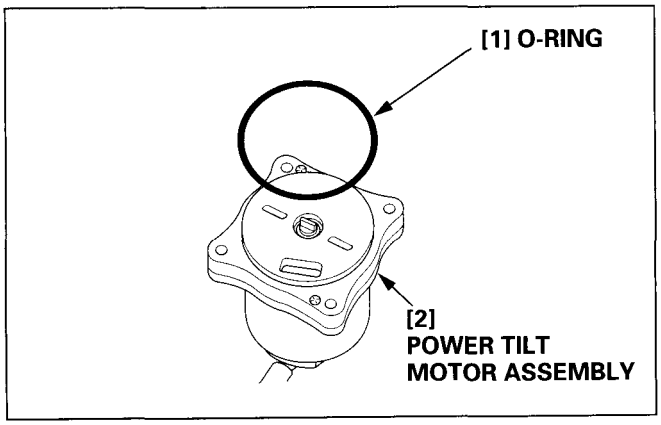
24) After installation, check filter B for bubbles. Remove the bubbles with the oil bottle or an equivalent tool if necessary.

    • Be sure to remove the air bubbles, or it will cause air in the system.

25) After removing the air bubbles, fill the pump assembly fully with Automatic Transmission Fluid (ATF) again.



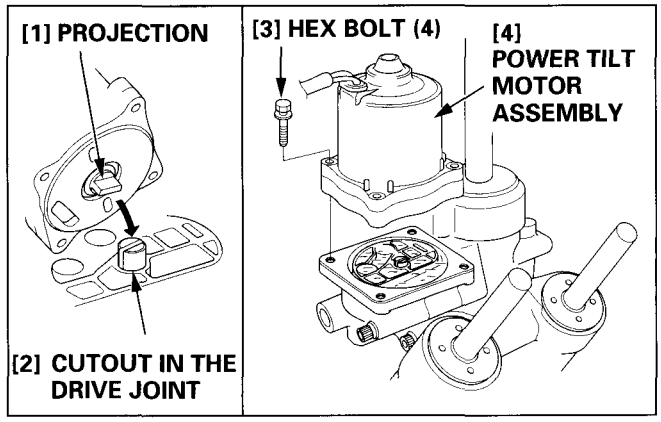
26) Install a new O-ring on the power tilt motor assembly.



27) Install the power tilt motor assembly on the pump assembly by aligning the projection on the motor assembly with the cutout in the drive joint.

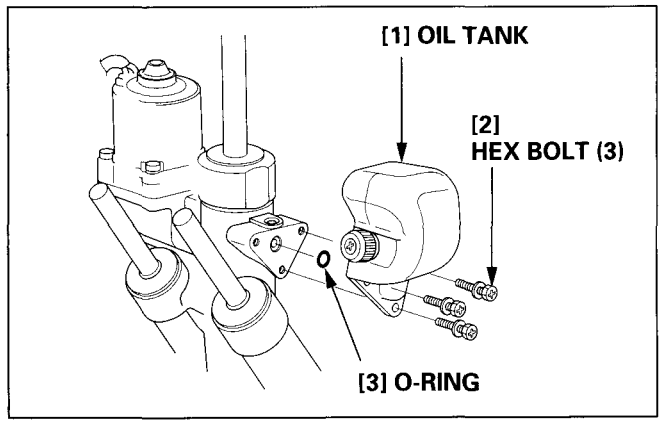
Tighten the four hex bolts to the specified torque.

TORQUE: 5 N•m (0.5 kgf•m, 3.6 lbf•ft)



28) Install a new O-ring on the cylinder comp. Install the oil tank on the cylinder comp., and tighten the three hex bolts to the specified torque.

TORQUE: 5 N•m (0.5 kgf•m, 3.6 lbf•ft)



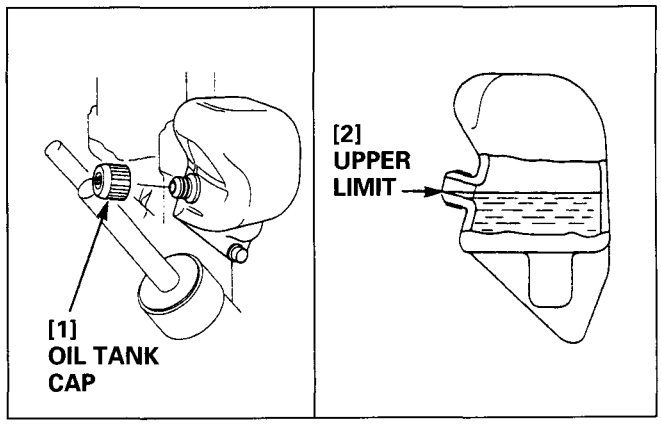
29) Remove the oil tank cap. Pour new Automatic Transmission Fluid (ATF) to the upper limit of the oil tank filler port.

Oil capacity	0.68 ℓ (0.72 US qt, 0.60 Imp qt)

NOTICE

Do not overfill with ATF. Pouring the ATF while it is flowing out of the filler port will overfill the tank, and that will damage the oil seal of the motor when each rod is compressed.

30) After filling the oil tank with ATF, bleed air from the power tilt/trim assembly (without mounting on the outboard motor) (P. 14-26).



d. AIR BLEEDING

<Power trim/tilt assembly not mounted on the outboard motor>

- Bleed air from the unit whenever the power trim/tilt assembly is disassembled.
- Be sure to perform the air bleeding in the following order.
  Air bleeding without mounting the unit on the outboard motor; Check on blow pressure; Air bleeding after mounting the unit on the outboard motor.

Connect each cable to operate the power trim/tilt assembly.

— Connect the positive (+) and negative (–) starter cables.

— Connect the power tilt motor 2P connector to the power tilt relay.

— Be sure that the starter cables are conneted to the battery.

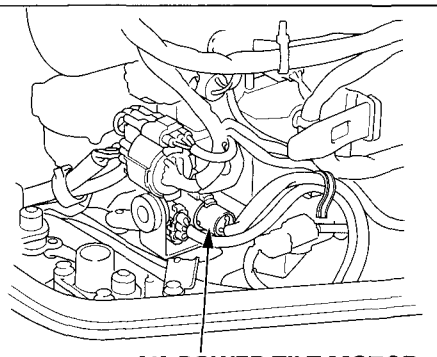
1) Hold the power trim/tilt assembly vertically.
2) Push the "DN" side of the power tilt switch to compress each rod fully.
3) Push the "UP" side of the power tilt switch to extend each rod fully.
4) Remove the oil tank cap with each rod extended fully. Check whether the Automatic Transmission Fluid (ATF) is at the upper limit of the filler port.

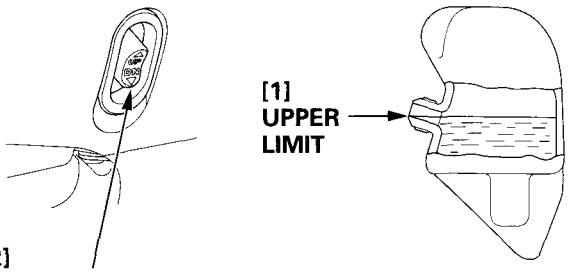
   If ATF does not flow out of the filler port, add ATF until it flows out.

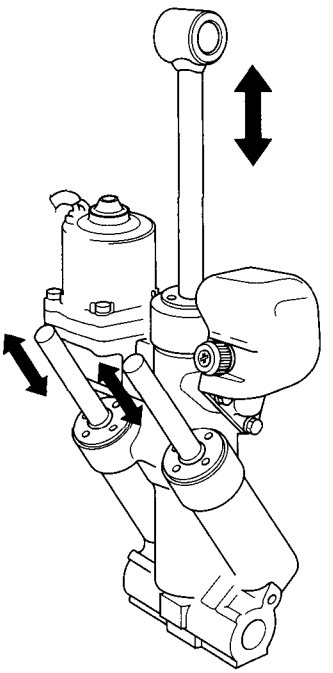
   - Check the fluid level with the rods fully extended. Note that ATF will spurt out when the oil tank cap is removed with the rods fully compressed.

5) After adding ATF, repeat the procedure from step 2 through 4 two or three times to bleed air from the unit.
6) Be sure that the rods extend and compress during the step 5 operation.

   - When the rods extend and compress fully, perform the blow pressure check (P. 14-28) and air bleeding with the unit mounted on the outboard motor (P. 14-27).
   - When the rods do not compress fully, perform the procedure explained under <when the rods do not compress fully> (P. 14-27).







<When the rods do not compress fully>

1) With the rods extended fully, push the "UP" side of the power tilt switch until the unit blows again. Push the "DN" side of the power tilt switch, and be sure that the rods compress.

   If the rods compress fully, go to the blow pressure check (P. 14-28).

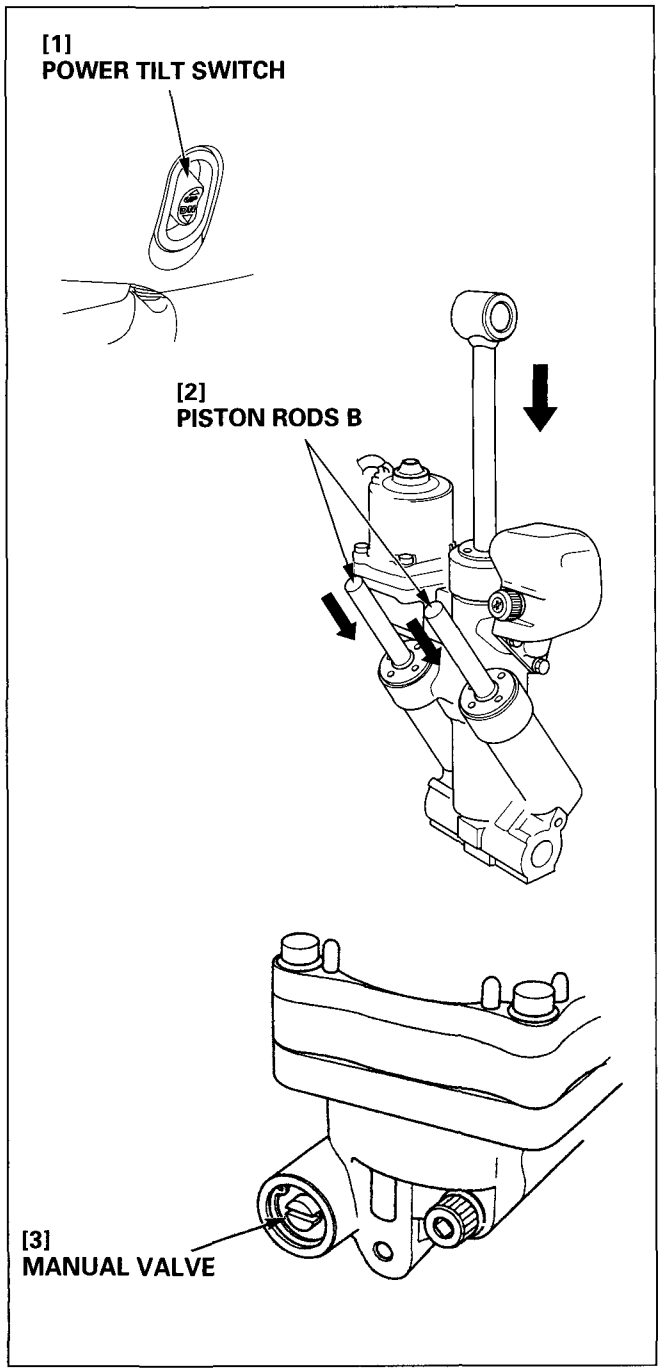
2) If the rods do not compress after the step 1 operation, push the "DN" side of the power tilt switch while pushing the piston rod B, and check whether the rods compress.

   If the rods compress fully, go to the blow pressure check (P. 14-28).

3) If the rods still do not compress after the step 2 operation, loosen the manual valve and compress each rod. Tighten the manual valve securely again. Push the "UP" side of the power tilt switch to extend the rods fully, then push the "DN" side of the switch and check whether the rods compress fully.

   If the rods compress fully, go to the blow pressure check (P. 14-28).

4) If the rods do not compress after the above operations, disassemble and reassemble the power trim/tilt assembly (P. 14-17 through 25), and bleed air with the power trim/tilt assembly not mounted on the outboard motor (P. 14-26).



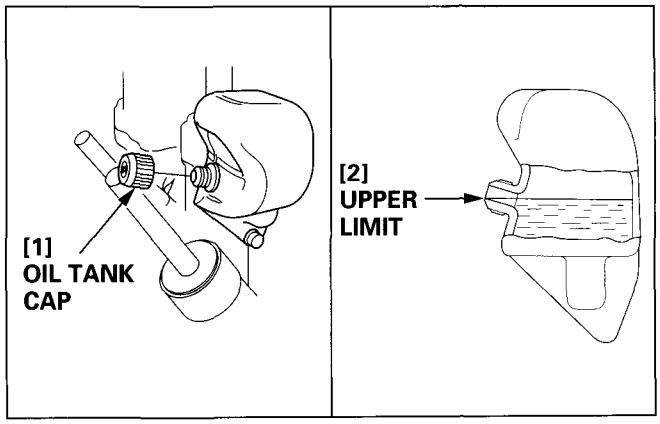
<Air bleeding with the power trim/tilt assembly mounted on the outboard motor>

Perform the following procedure after bleeding air without mounting the power trim/tilt assembly on the outboard motor and after checking the blow pressure.

1) Install the power trim/tilt assembly on the outboard motor securely (P. 14-2).

2) Push the "UP" side of the power tilt switch, and raise the outboard motor to the uppermost position.

   Remove the oil tank cap, and check whether the Automatic Transmission Fluid (ATF) is at the upper limit of the oil filler port. Add ATF if necessary.



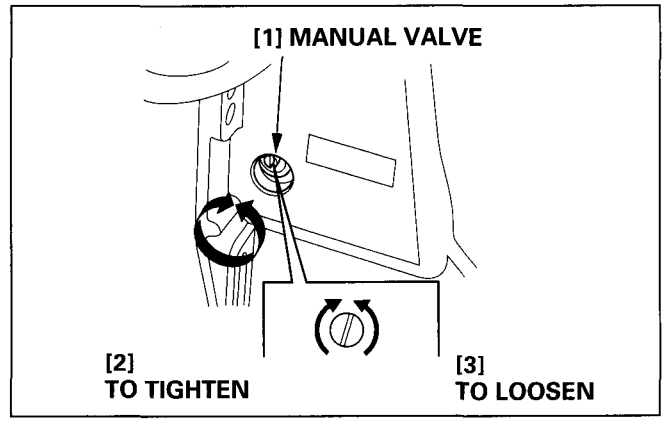
3) Lower the outboard motor slowly to the lowermost position by loosening the manual valve.

4) Tighten the manual valve securely.

5) Hold the outboard motor in the lowermost position for five minutes.

6) Then, push the "UP" side of the power tilt switch, and raise the outboard motor to the uppermost position. Hold the outboard motor in this position for five minutes. After five minutes, check the fluid level in the oil tank.

7) Repeat the procedure from step 3 through 6 five times.



e. BLOW PRESSURE CHECK

After bleeding air from the power trim/tilt assembly without mounting on the outboard motor and checking each rod for proper compression, perform the following operation in the same manner as bleeding air without mounting on the outboard motor.

- Be sure each rod is extended fully.
- Check the blow pressure both at the upper and lower chambers.

<Lower chamber blow pressure>

1) Remove the internal circlip and manual valve from the power trim/tilt assembly.
   - A small amount of oil will flow out when the manual valve is removed. Catch it with a container or suitable material.

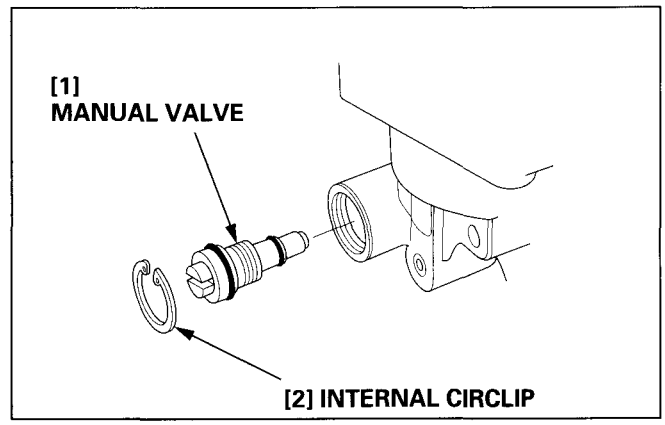
2) Tighten the special tool (oill pressure gauge joint B) to the manual valve installation section as shown.

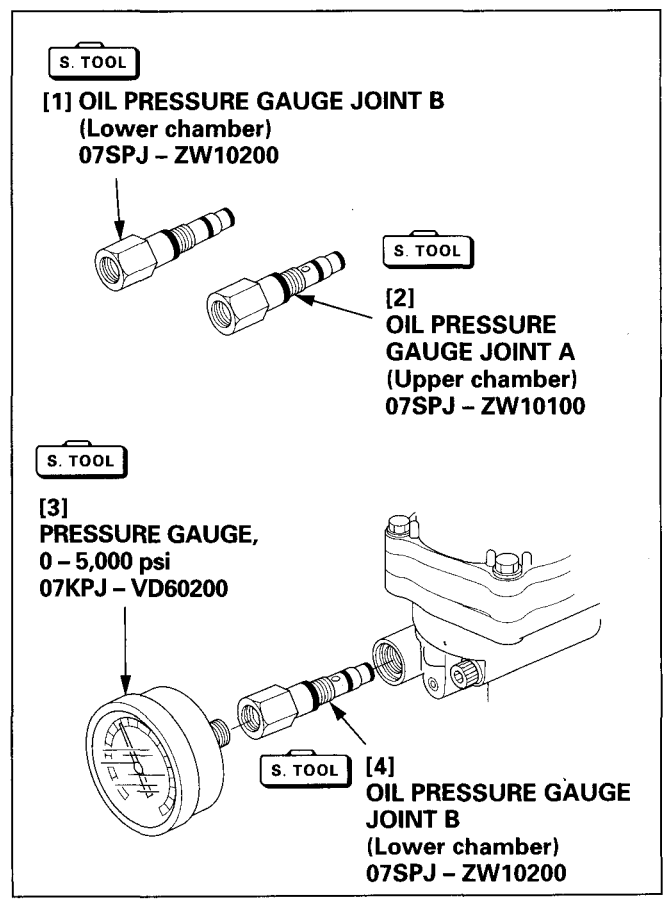
   TORQUE: 9 N•m (0.9 kgf•m, 6.5 lbf•ft)

3) Attach the special tools which measures 14,710 kPa (150 kgf/cm², 2,133 psi) as shown.

   TOOLS:

Pressure gauge, 0 – 5,000 psi	**07KPJ – VD60200**
Oil pressure gauge joint B	**07SPJ – ZW10200**





4) Remove the oil tank cap and check whether the *Automatic Transmission Fluid (ATF) is at the upper limit* of the filler port (P. 14-25).

5) Push the "DN" side of the power tilt switch to compress each rod fully.

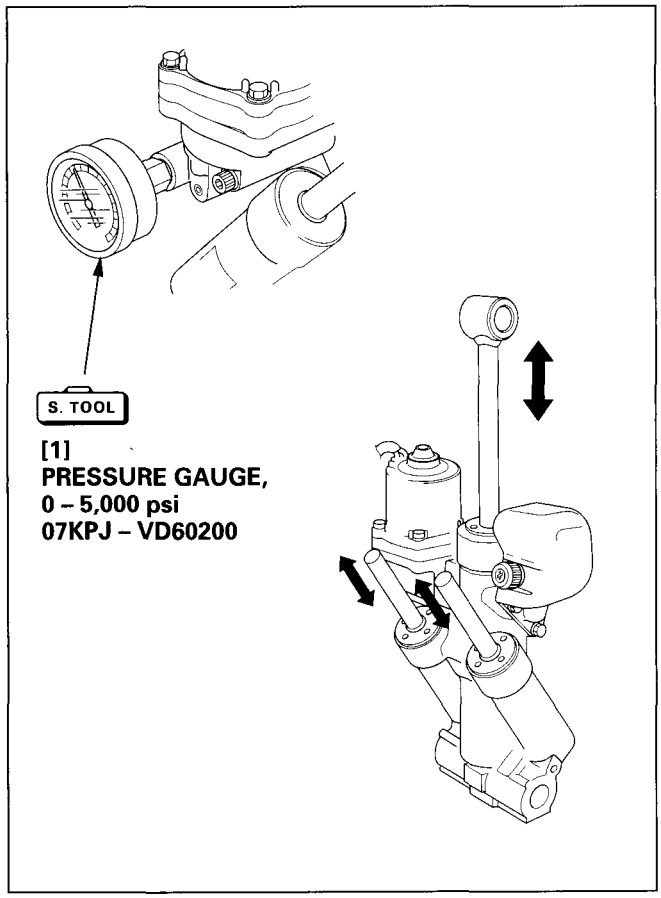
6) Push the "UP" side of the power tilt switch to extend each rod fully again, and measure the lower chamber blow pressure.

Lower chamber blow pressure	8,826 – 11,768 kPa (90 – 120 kgf/cm², 1,280 – 1,707 psi)

7) If a sharp pressure drop is observed, check the power tilt motor for a damaged oil seal (P. 14-34).

   If the blow pressure is lower than the specified pressure, check for oil leaks.

8) Measure the upper chamber blow pressure.



[1]
PRESSURE GAUGE,
0 – 5,000 psi
07KPJ – VD60200

<Upper chamber blow pressure>

1) After measuring the lower chamber blow pressure, remove the special tool (oil pressure gauge joint B) and the pressure gauge with each rod fully extended.

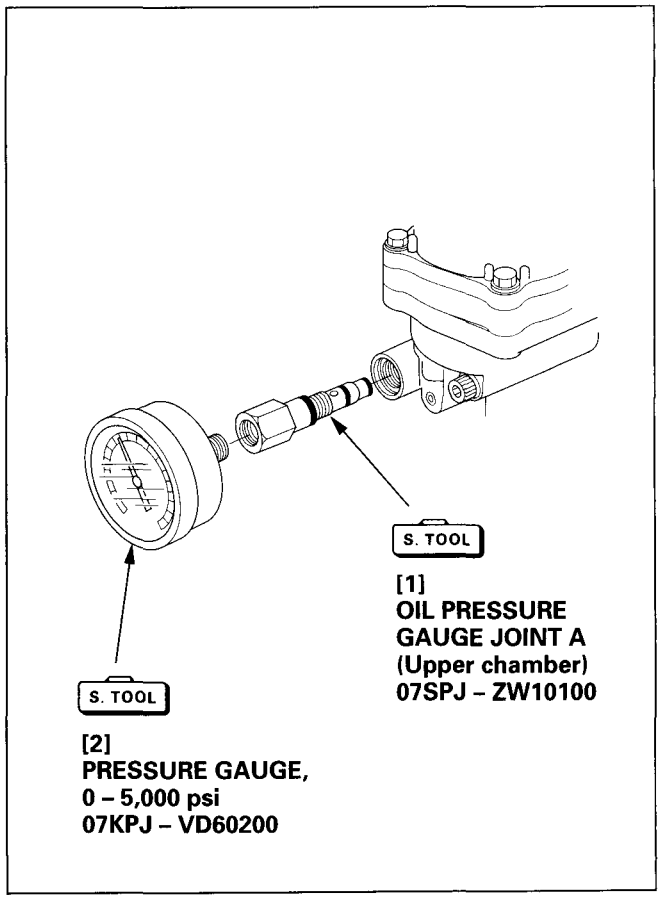
2) Tighten the upper chamber special tool (oil pressure gauge joint A).

   TORQUE: 9 N•m (0.9 kgf•m, 6.5 lbf•ft)

3) Attach the special tools which measures 14,710 kPa (150 kgf/cm², 2,133 psi) as shown.

   TOOLS:

Pressure gauge, 0 – 5,000 psi	**07KPJ – VD60200**
Oil pressure gauge joint A	**07SPJ – ZW10100**



[1]
OIL PRESSURE GAUGE JOINT A (Upper chamber)
07SPJ – ZW10100

[2]
PRESSURE GAUGE,
0 – 5,000 psi
07KPJ – VD60200

4) Remove the oil tank cap and check whether the Automatic Transmission Fluid (ATF) is at the upper limit of the filler port (P. 14-25).

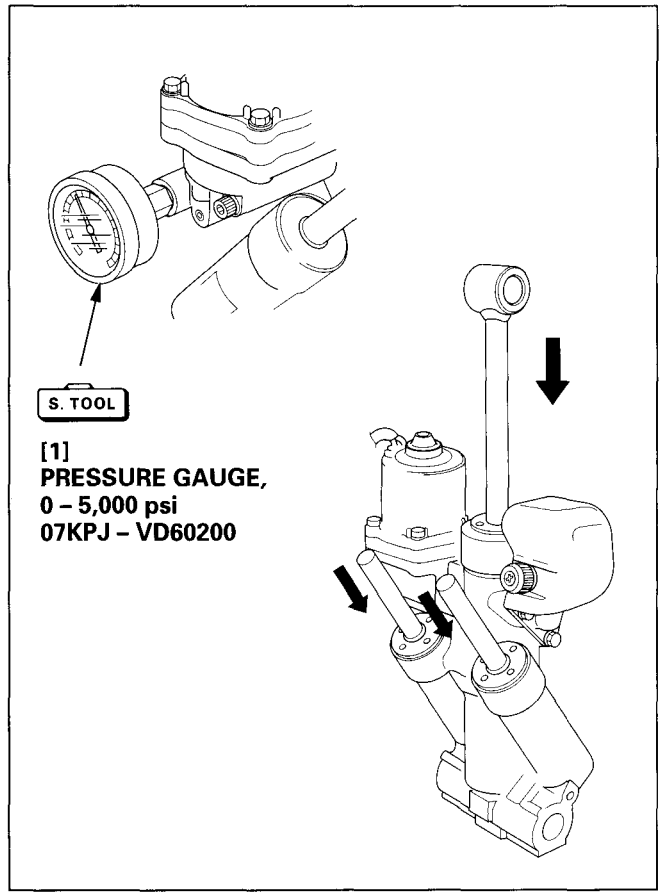
5) Push the "DN" side of the power tilt switch to compress each rod fully, and measure the upper chamber blow pressure.

6) If the blow pressure is lower than the specified pressure, check for oil leaks.

Upper chamber blow pressure	3,923 – 7,355 kPa (40 – 75 kgf/cm², 569 – 1,067 psi)

7) After checking, push the "UP" side of the power tilt switch. With each rod extended fully, remove the special tool and install the manual valve and internal circlip.

8) Recheck the Automatic Transmission Fluid (ATF) level (P. 14-25).



[1]
PRESSURE GAUGE,
0 – 5,000 psi
07KPJ – VD60200

5. POWER TILT MOTOR ASSEMBLY

a. DISASSEMBLY

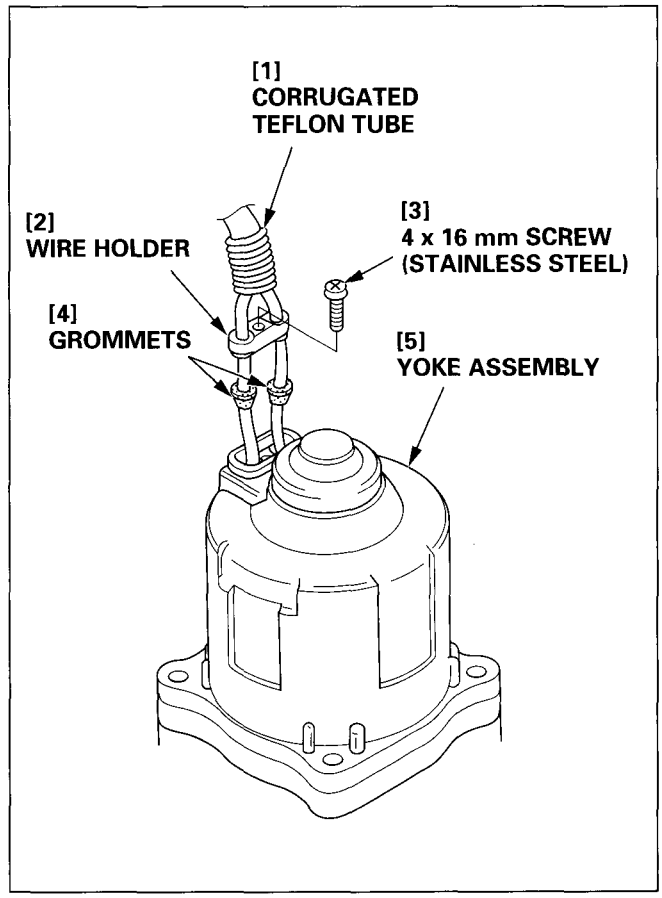
1) Untape the corrugated teflon tube, and pull the tube to the connector side.

2) Remove the 4 x 16 mm screw. Pull out the wire holder and the two grommets from the yoke assembly, and move them to the tube side.

NOTICE

Pull out the grommets with care not to damage them.

3) Remove the two 4 x 16 mm screws (P. 14-34).



4) Wrap the armature shaft with a shop towel or equivalent material to protect, and hold the shaft with pliers.

Pushing the two motor wires toward the yoke assembly, remove the armature/front bracket assembly from the yoke assembly.

5) Remove the armature from the front bracket.

- Do not allow the commutator to become contaminated with oil or grease.

6) Disconnect the blue wire terminal while holding the breaker assembly with a screwdriver.

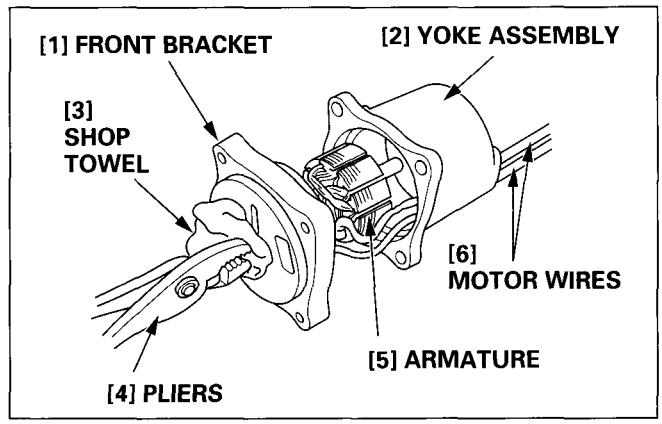
NOTICE

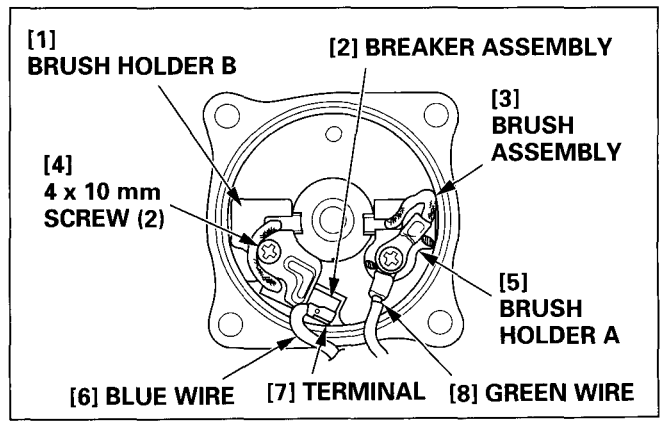
Do not disconnect the blue wire terminal without holding the breaker assembly, or it can cause damage to brush holder B. Be sure to disconnect the terminal while holding the breaker assembly.

7) Remove the two screws. Remove brush holder A and B, brush assembly, two springs and the breaker assembly.

- Take care not to touch the bimetal part of the breaker assembly.

8) Remove the oil seal and metal from the front bracket (P. 14-34).



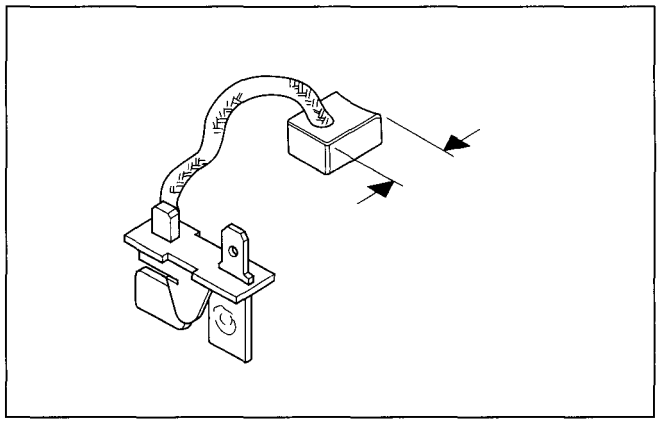


b. INSPECTION

• BRUSH LENGTH

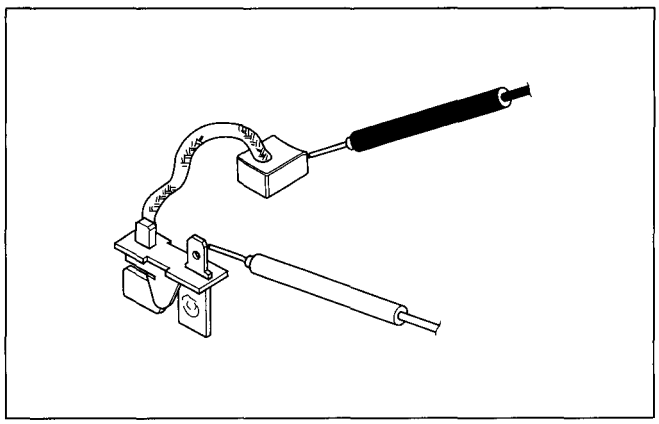
Measure the brush length.
If brush length is less than the service limit, replace the brush.

STANDARD	SERVICE LIMIT
9.8 mm (0.39 in)	4.8 mm (0.19 in)



• BREAKER ASSEMBLY

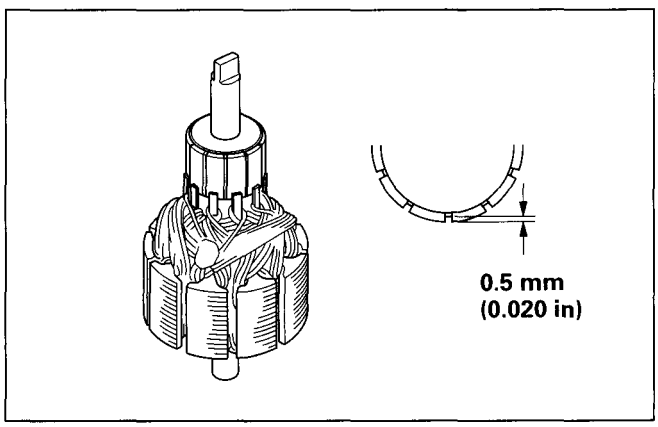
Check for continuity between the brush and terminal.
Replace the breaker assembly if there is no continuity.



• MICA DEPTH

If the grooves are clogged or mica depth is less than the service limit, recut the grooves using a hacksaw blade or a small file.

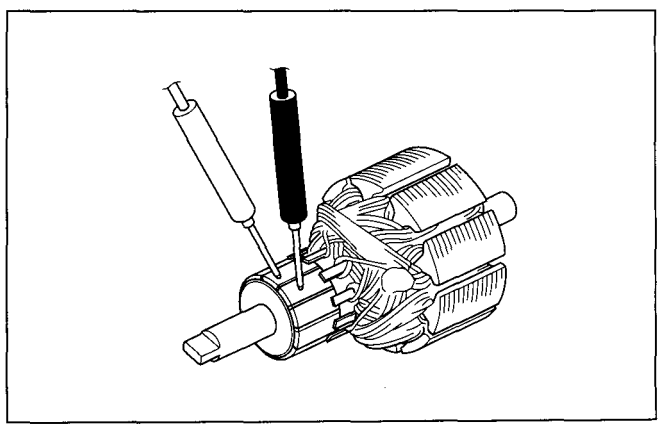
SERVICE LIMIT	0.5 mm (0.020 in)



• ARMATURE

CONTINUITY CHECK–SEGMENTS

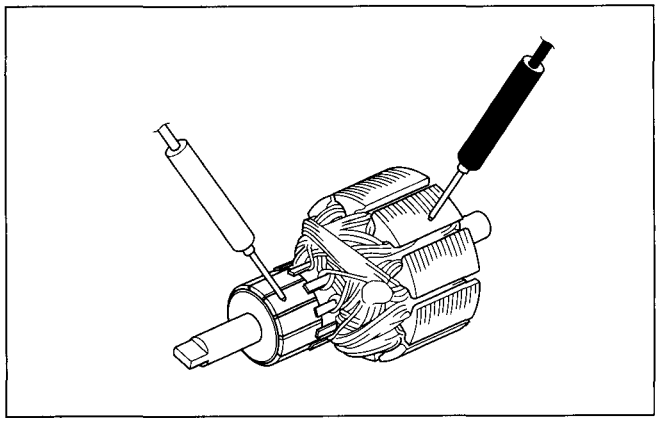
Check for continuity between each segment. If an open circuit exists between any two segments, replace the armature.



SHORT CIRCUIT TEST–CORD-TO-COMMUTATOR

Check for continuity between the commutator and armature coil core.

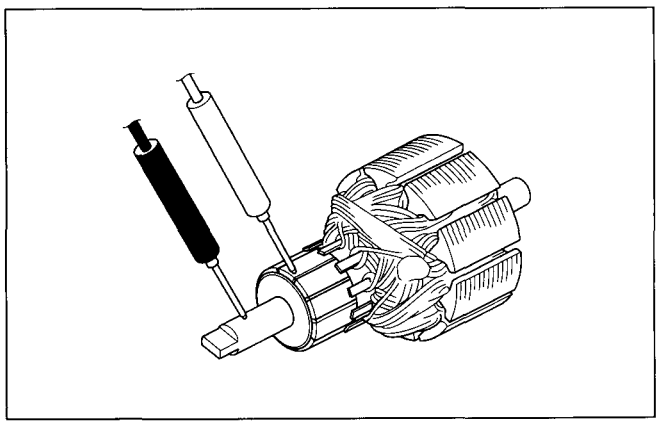
If continuity exists, replace the armature.



SHORT CIRCUIT TEST–SHAFT-TO-COMMUTATOR

Check for continuity between the commutator and armature shaft.

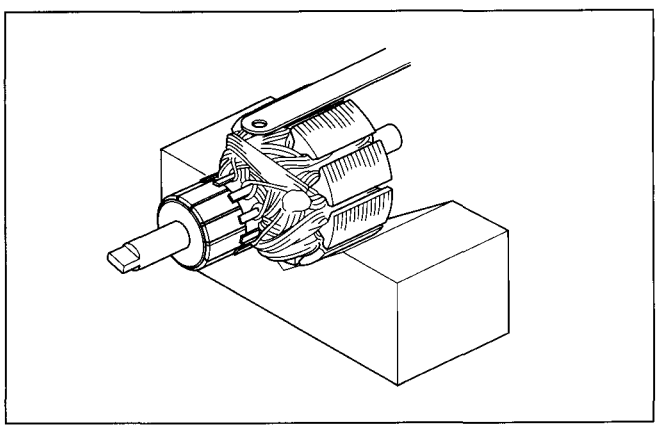
If there is continuity, replace the armature.



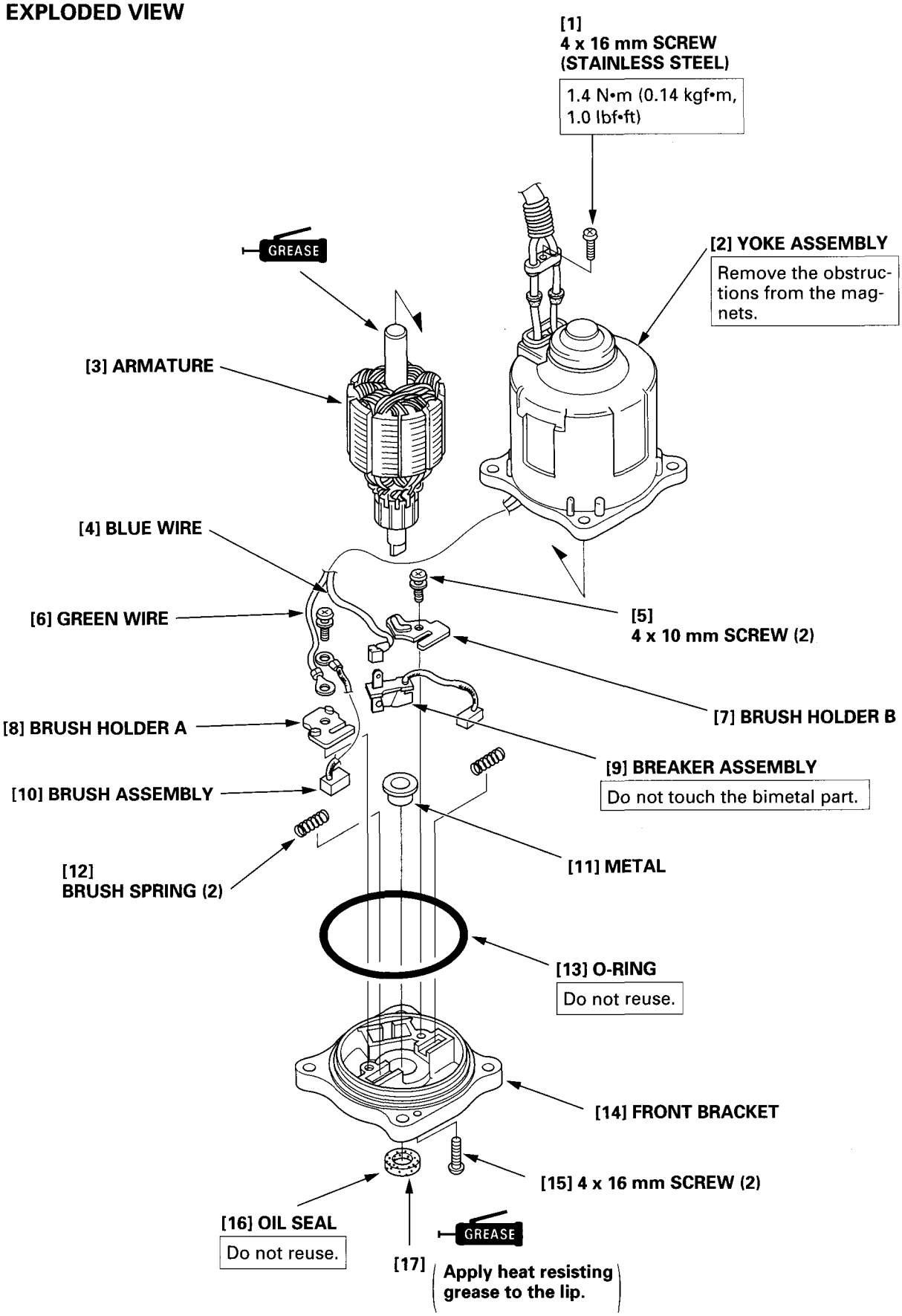
SHORT CIRCUIT TEST–ARMATURE

Place the armature on an armature tester (commercially available.)

Hold a hacksaw blade close to the armature core. If the blade is attracted to the core or vibrates when the core is turned, the armature is shorted. Replace the armature.



c. EXPLODED VIEW



d. ASSEMBLY

1) Install the O-ring, oil seal and metal on the front bracket (P. 14-34).

2) Install the breaker assembly and brush holder B, and tighten the screws.

   Connect the blue wire terminal to the breaker assembly.

   - Do not touch the bimetal part of the breaker assembly.

3) Install the brush holder A on the front bracket. With the brush assembly terminal above the green wire terminal, tighten together with the green wire terminal.

   Be sure that the brush assembly terminal and the green wire terminal contact the respective projections as shown.

4) Install the two springs and install the armature on the front bracket while pushing the brush terminal into the holder.

5) Wrap the armature shaft with a shop towel or equivalent material, and hold the shaft with pliers.

6) Pulling the two motor wires of the yoke assembly side, install the armature/front bracket assembly on the yoke assembly.

   If it is hard to install the armature/front bracket assembly on the yoke assembly, check whether the armature shaft is out of position.

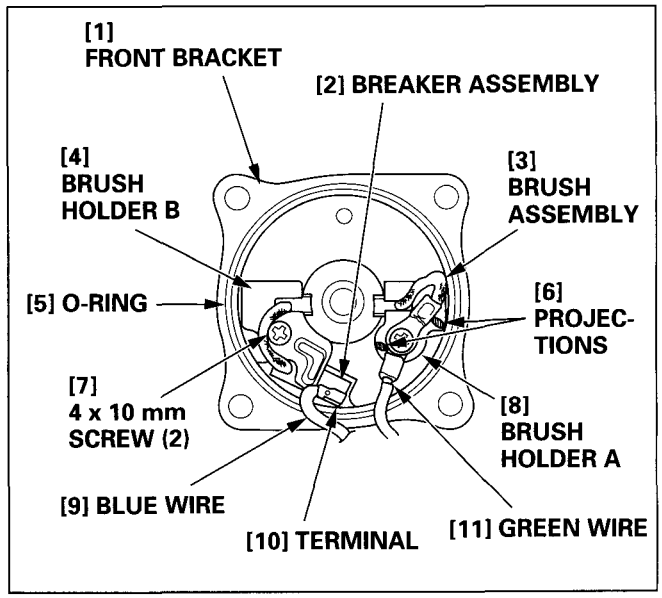
7) After installation, check the armature for smooth rotation, and tighten the two 4 x 16 mm screws.

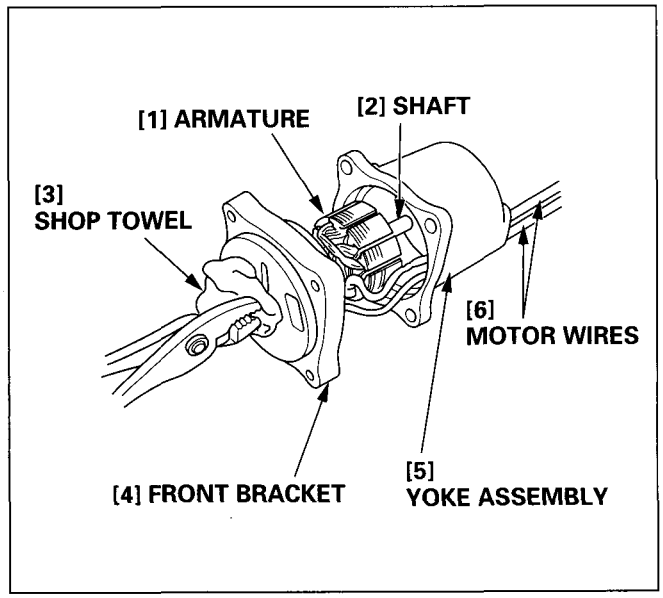
8) After tightening the two 4 x 16 mm screws, connect the motor assembly 2P connector and check whether the motor turns. If the motor does not turn, disassemble the power tilt motor assembly again, and check whether the blue wire terminal is disconnected.

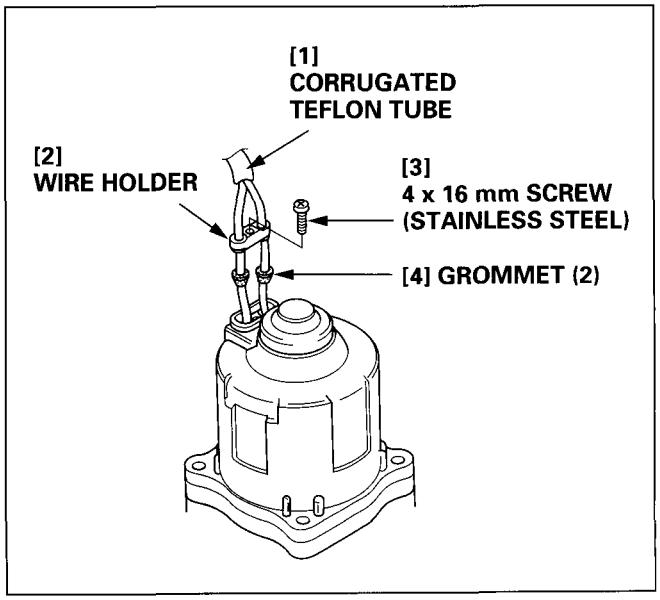
9) Install the two grommets and wire holder on the yoke assembly.

   Tighten the 4 x 16 mm screw (stainless steel screw) to the specified torque. Do not overtighten it.

   TORQUE: 1.4 N•m (0.14 kgf•m, 1.0 lbf•ft)



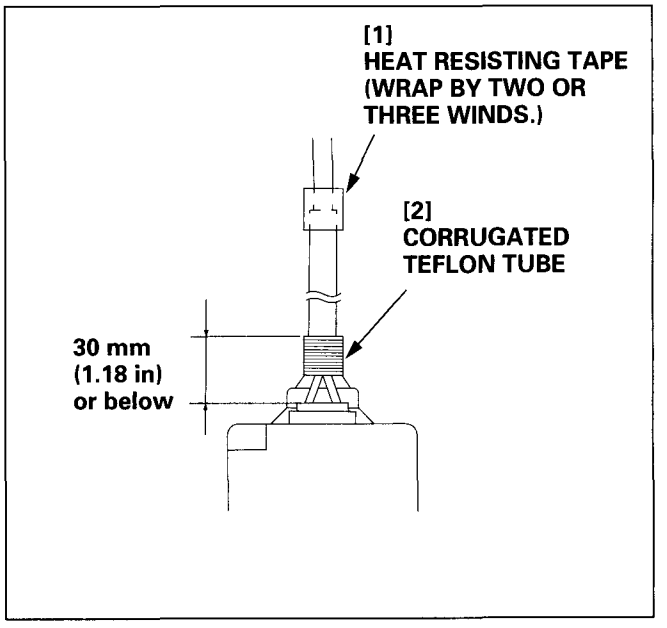




10) Tape the corrugated teflon tube with heat resisting tape, so that the distance from the wire holder end to the tube end is 30 mm (1.18 in) or less as shown.

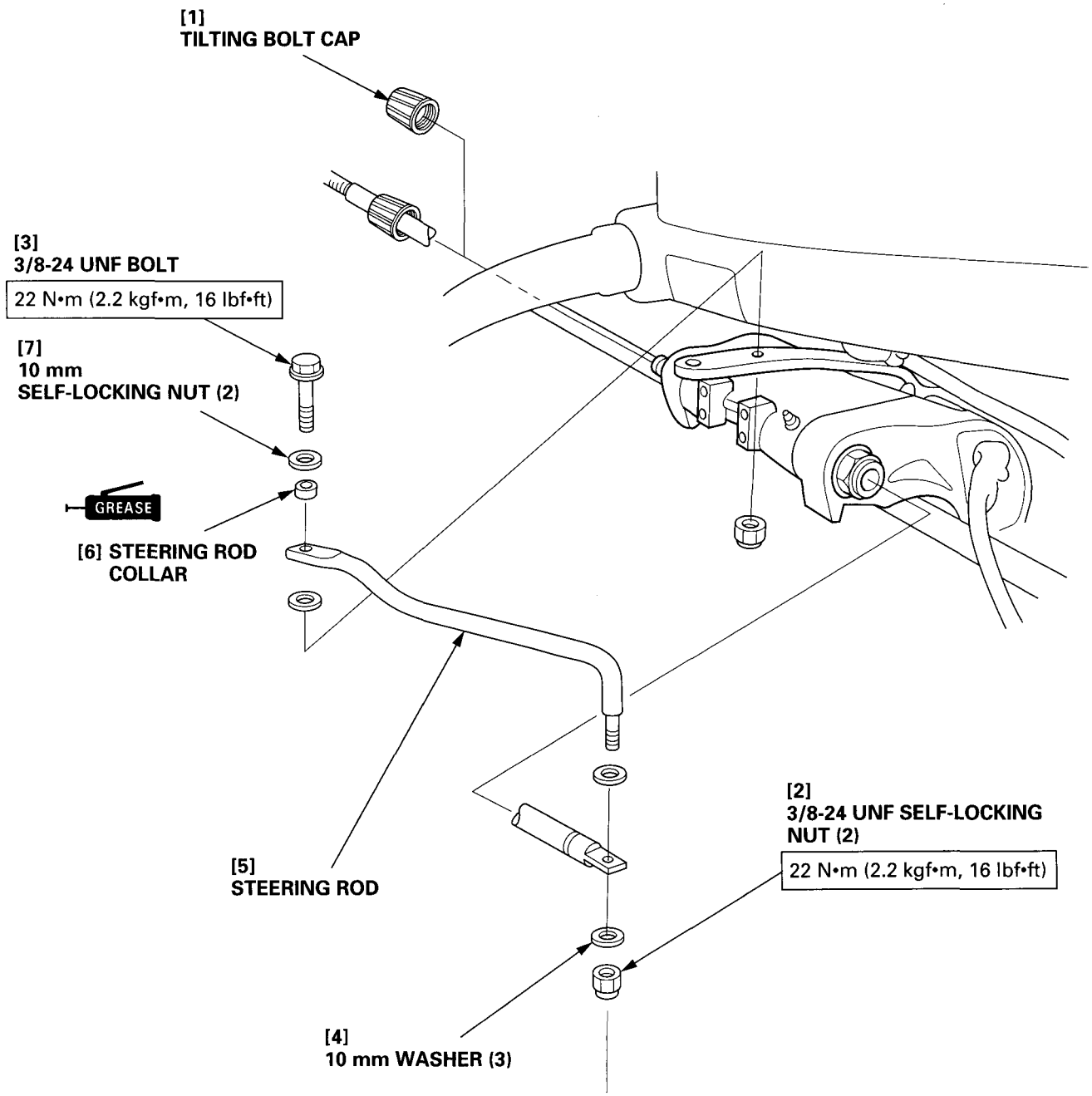
11) Install the power tilt motor assembly on the power trim/tilt assembly. Coat the joints or mating sections of the parts and the sections where the paint came off with rust preventive paint of the same color.

12) Bleed air from the power trim/tilt assembly without mounting on the outboard motor (P. 14-26).



1. STEERING ROD (OPTIONAL PART)

a. REMOVAL/INSTALLATION

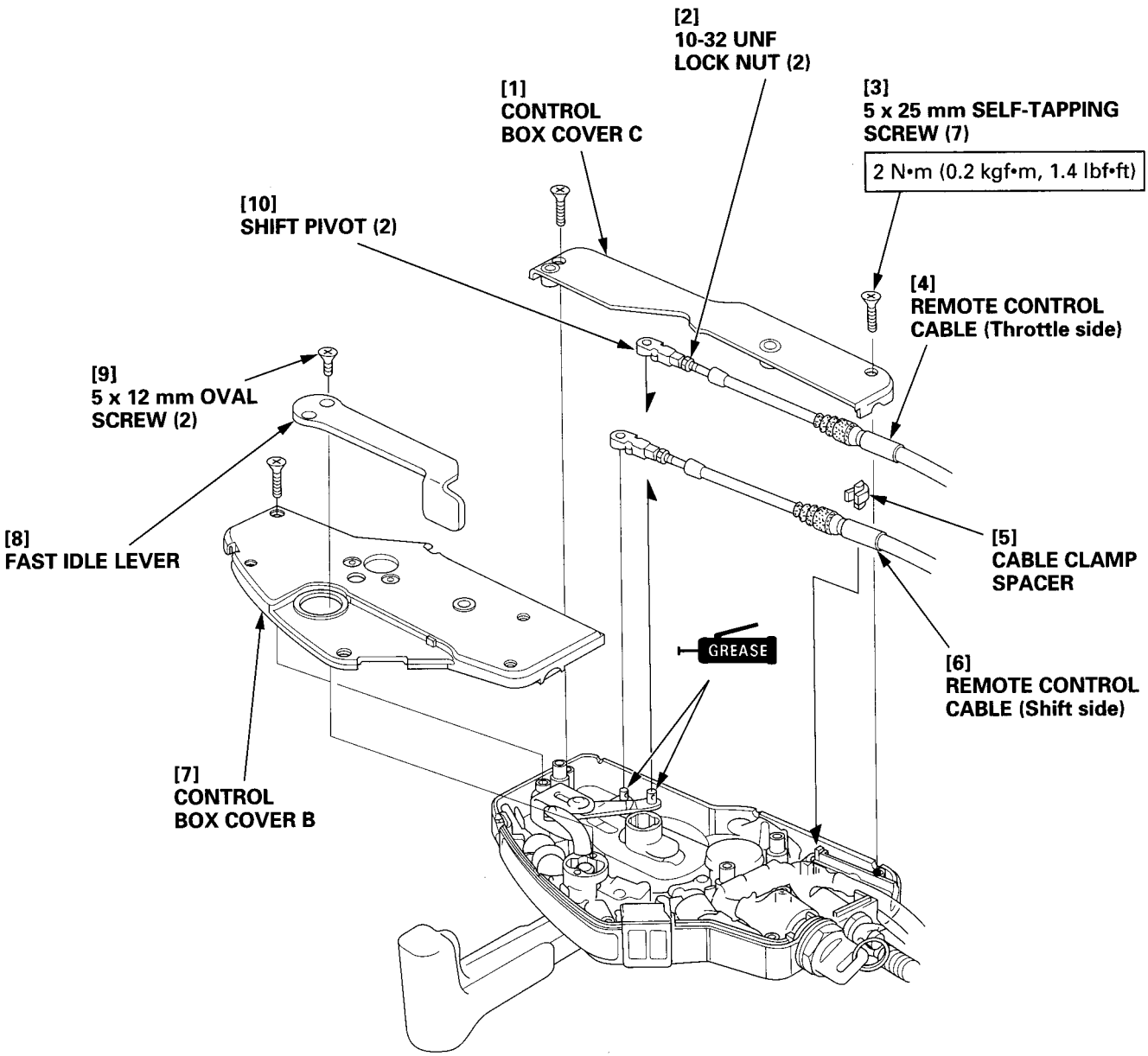


2. REMOTE CONTROL BOX (OPTIONAL PART)

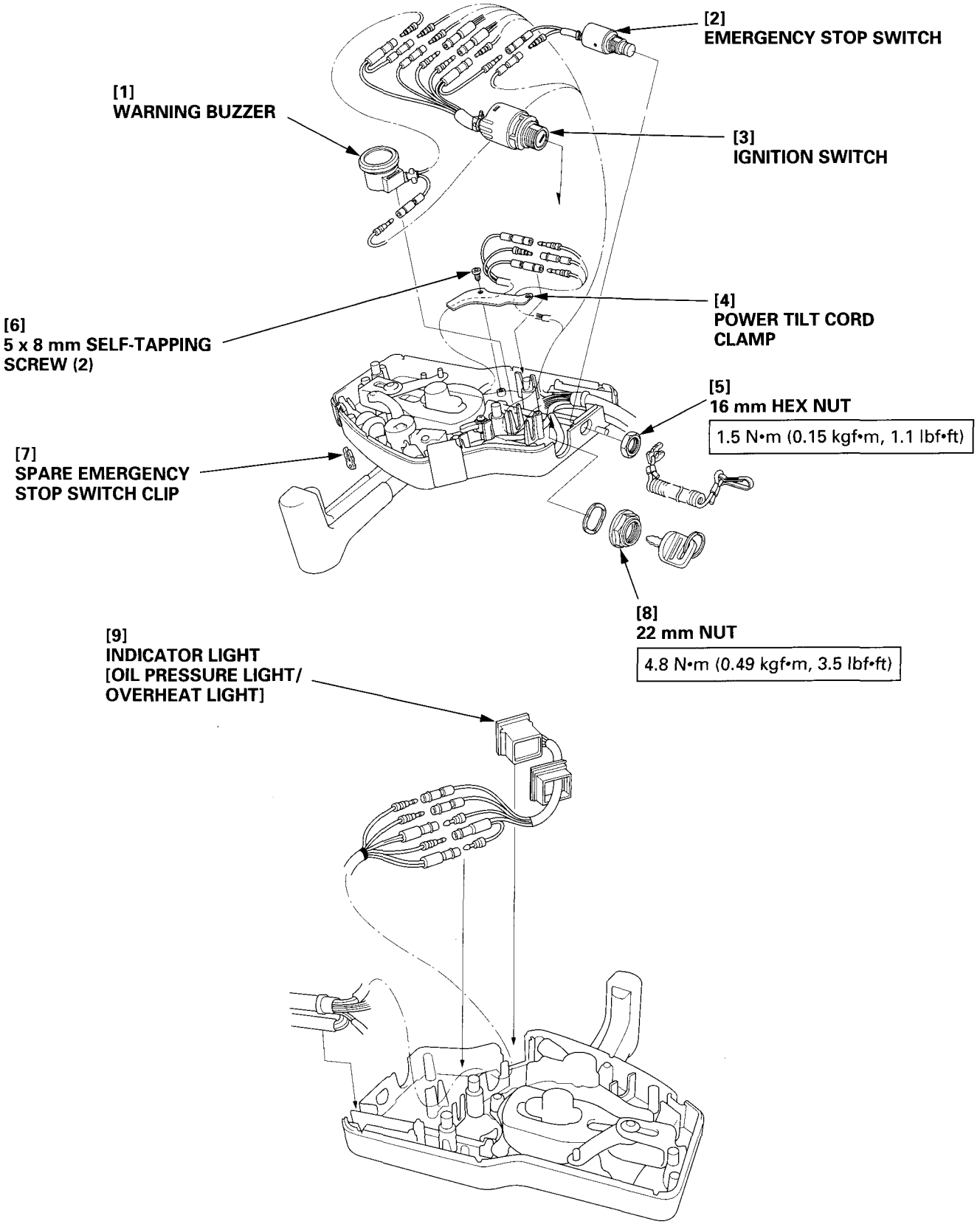
a. DISASSEMBLY/ASSEMBLY

- **SIDE-MOUNT REMOTE CONTROL BOX**

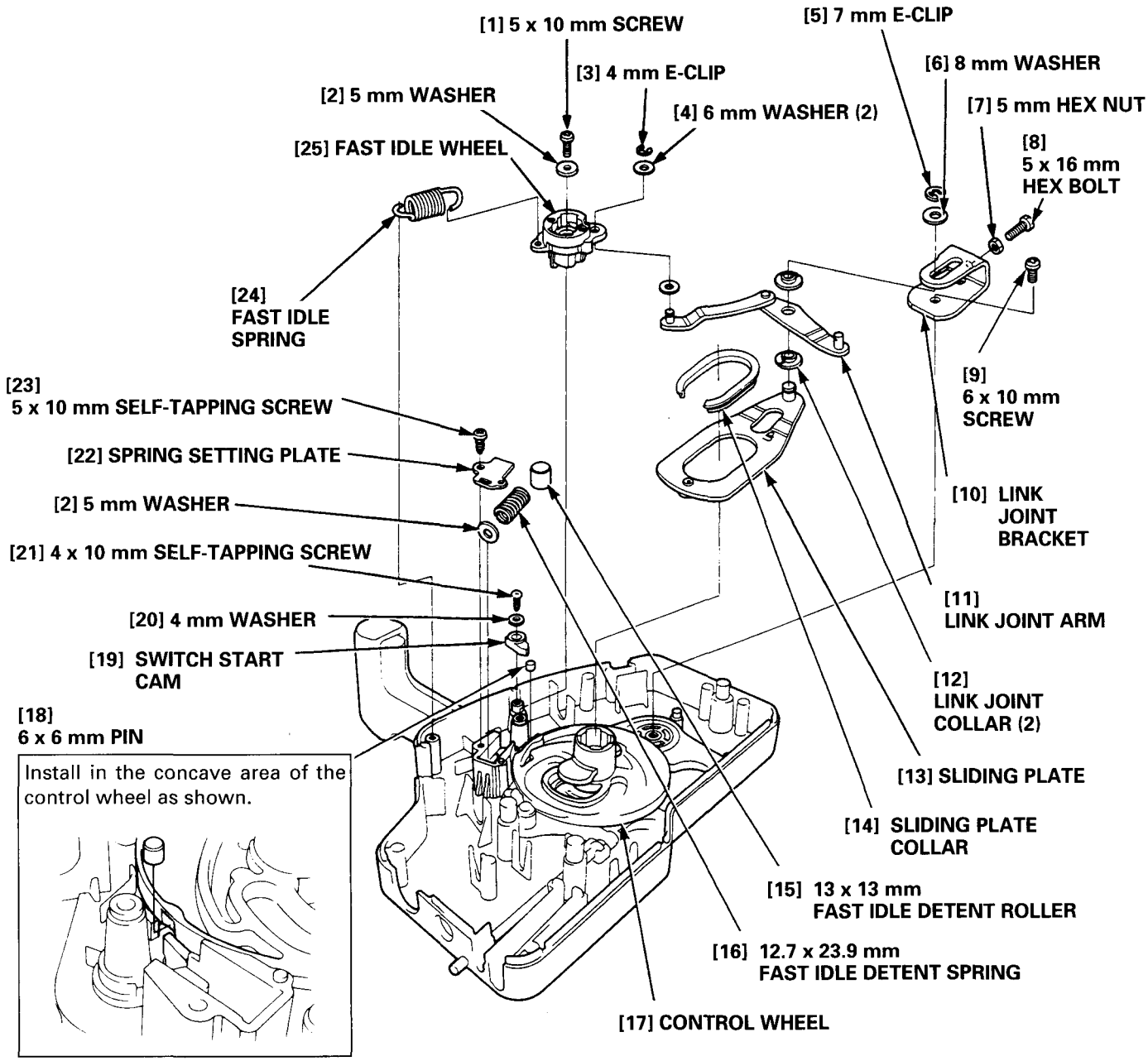
REMOTE CONTROL CABLE:



ELECTRIC COMPONENTS:



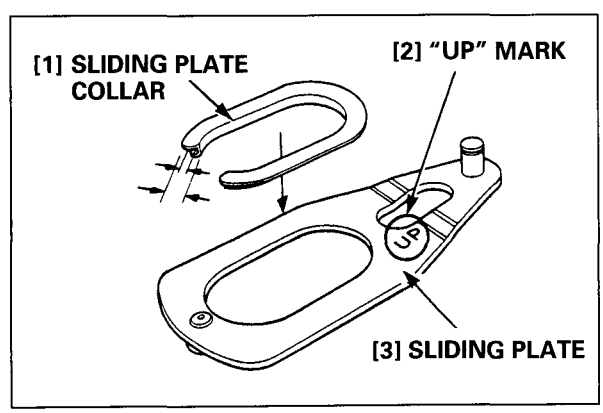
SLIDING PLATE:



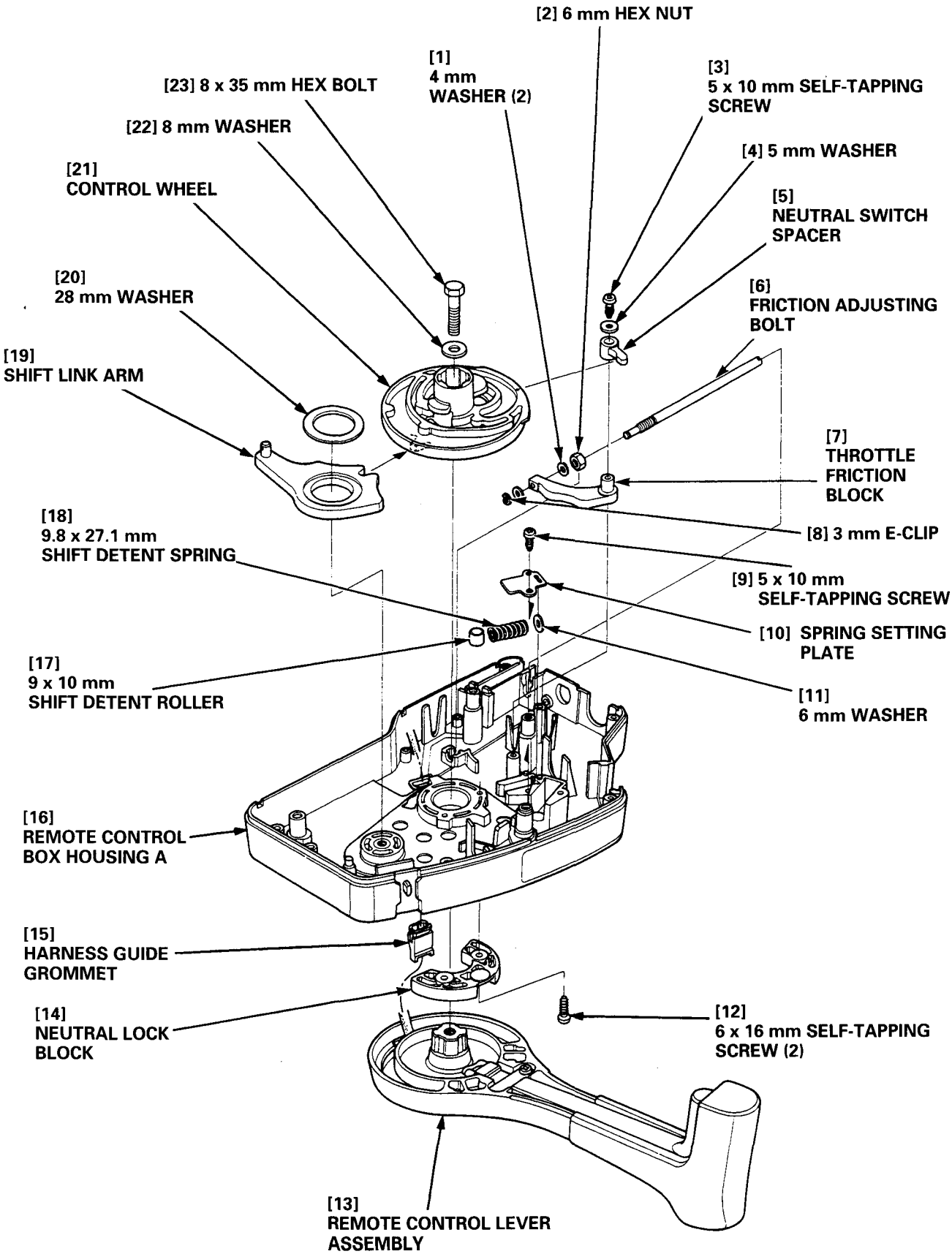
Install in the concave area of the control wheel as shown.

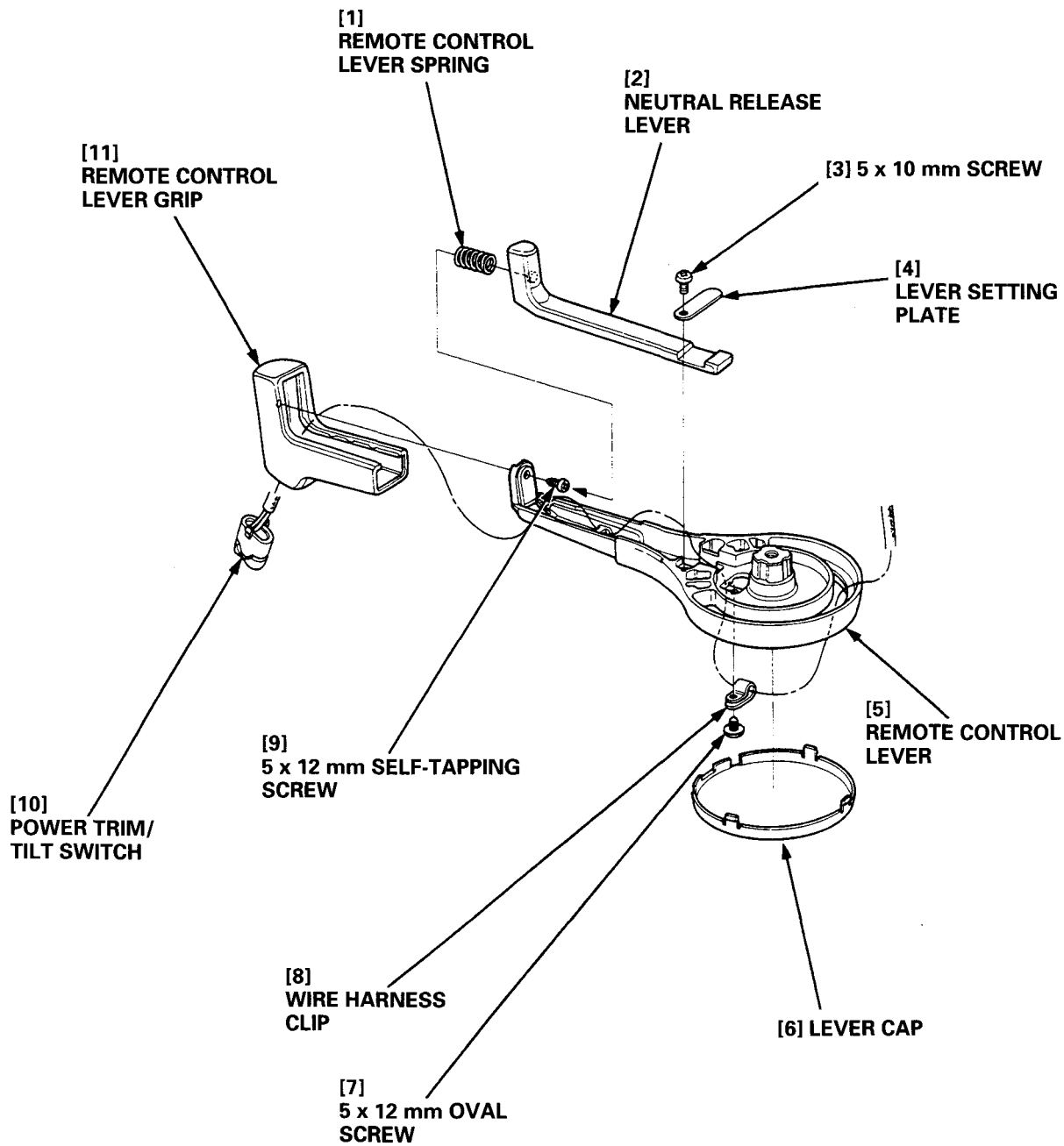
• SLIDING PLATE/COLLAR INSTALLATION

Install the sliding plate with the "UP" mark facing up. Attach the sliding plate collar to the sliding plate with its opening toward the opposite end of the "UP" mark side of the sliding plate and the lip facing down.



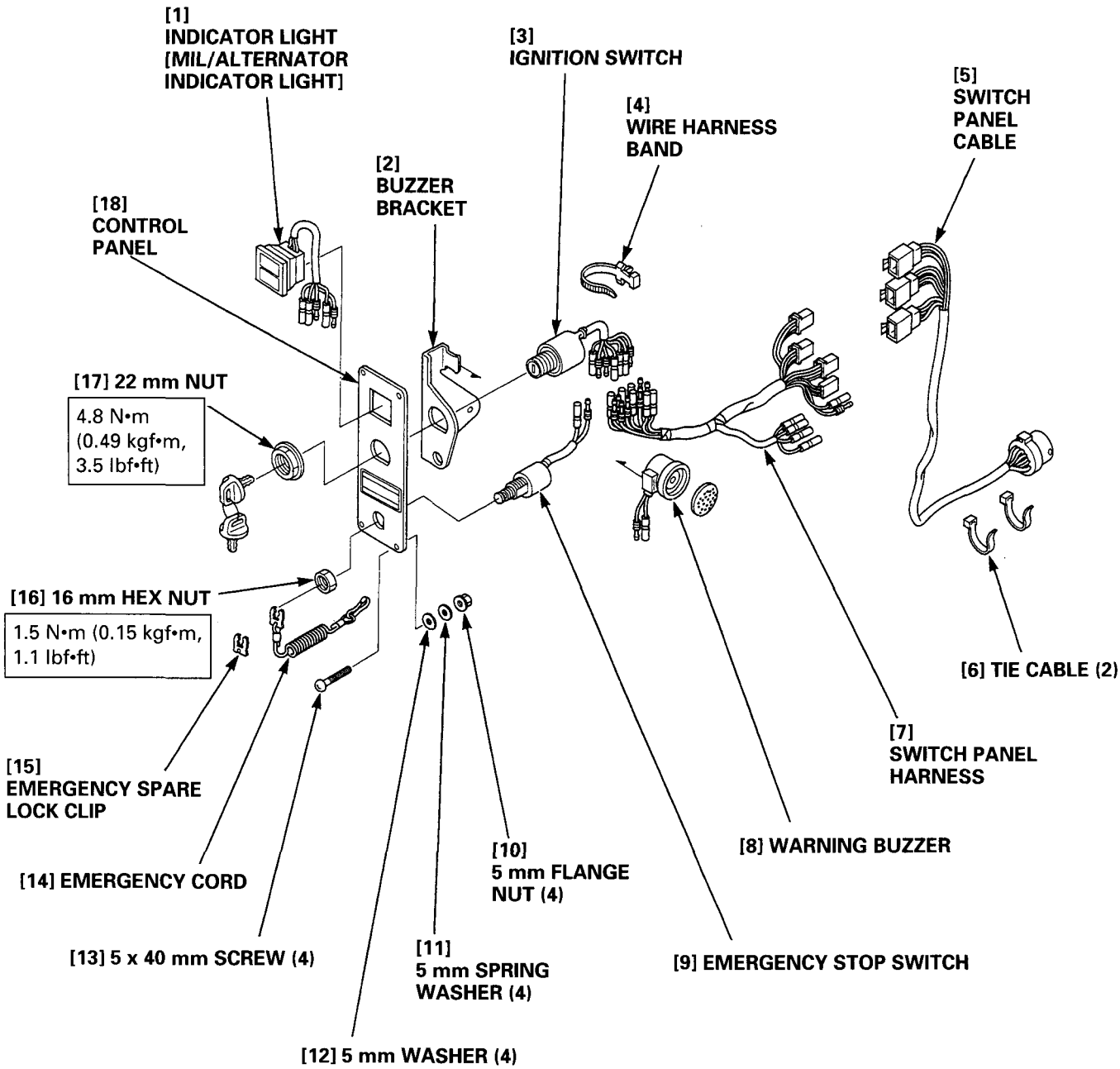
REMOTE CONTROL LEVER:




[1]
REMOTE CONTROL
LEVER SPRING
[2]
NEUTRAL RELEASE
LEVER
[3] 5 x 10 mm SCREW
[4]
LEVER SETTING
PLATE
[5]
REMOTE CONTROL
LEVER
[6] LEVER CAP
[7]
5 x 12 mm OVAL
SCREW
[8]
WIRE HARNESS
CLIP
[9]
5 x 12 mm SELF-TAPPING
SCREW
[10]
POWER TRIM/
TILT SWITCH
[11]
REMOTE CONTROL
LEVER GRIP

3. CONTROL PANEL (OPTIONAL PART)

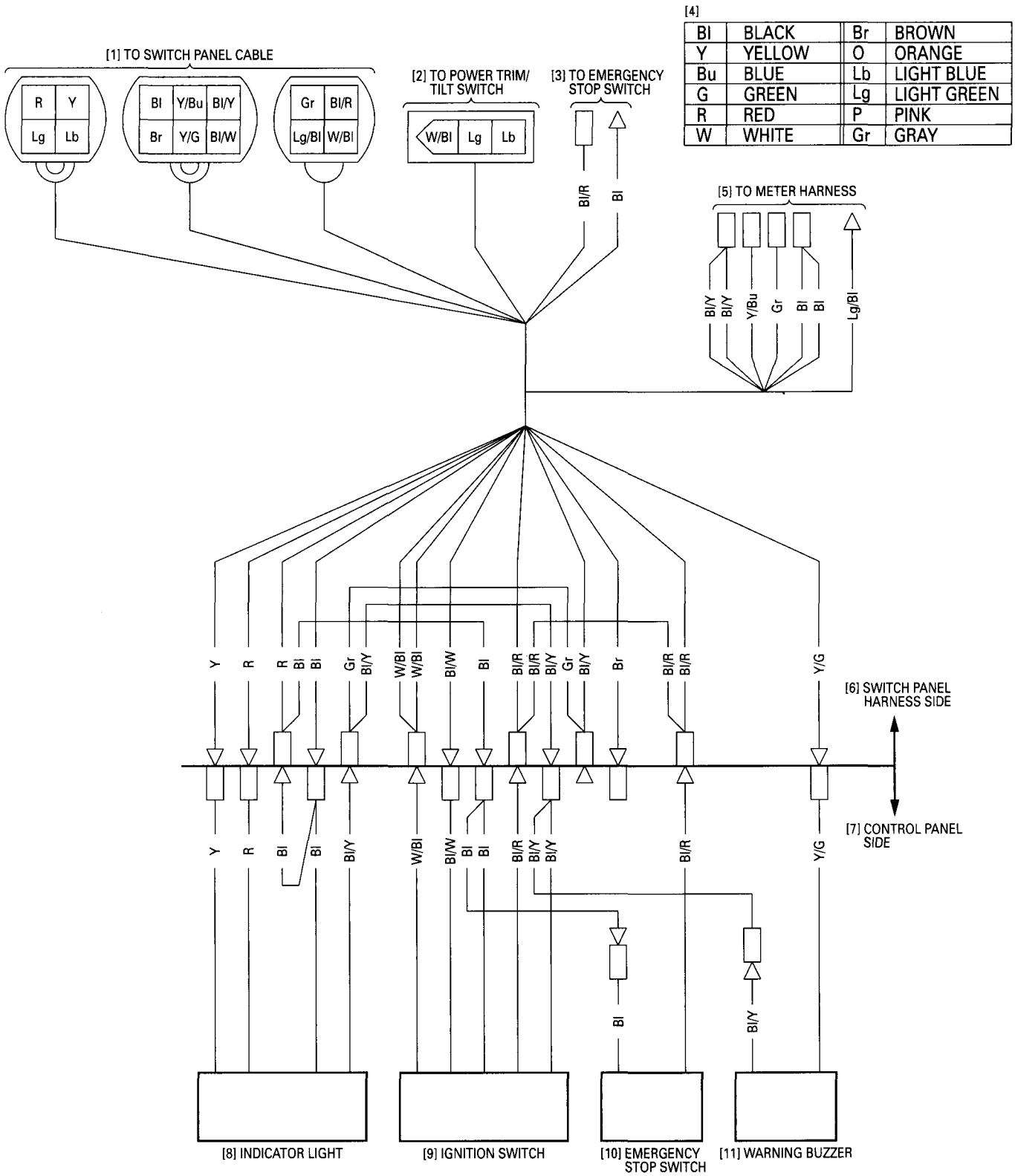
a. DISASSEMBLY/ASSEMBLY



• SWITCH PANEL HARNESS

CONNECTION:

Connect each switch wire as shown.



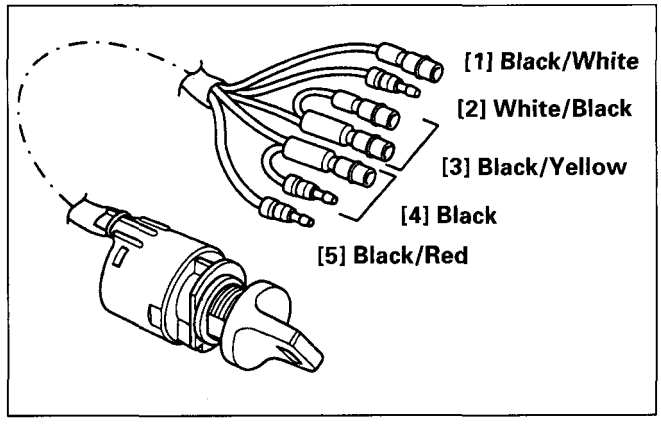
4. INSPECTION

• IGNITION SWITCH

Check for continuity between the terminals with the switch in each position.

Color / Position	E (Black)	IG (Black/ Red)	BAT (White/ Black)	LO (Black/ Yellow)	ST (Black/ Red)
OFF	○—○				
ON			○—○		
START					○

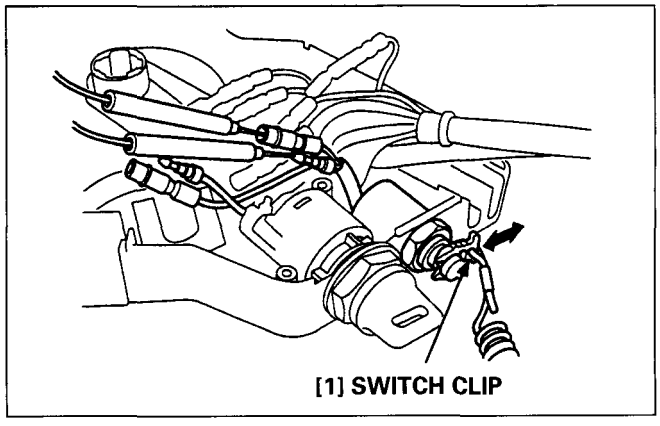
○—○: Continuity



• EMERGENCY STOP SWITCH

Attach the tester leads to the two terminals of the emergency stop switch and check for continuity.

Emergency stop switch clip	Continuity
Engaged	No
Disengaged	Yes
Engaged and button pushed	Yes

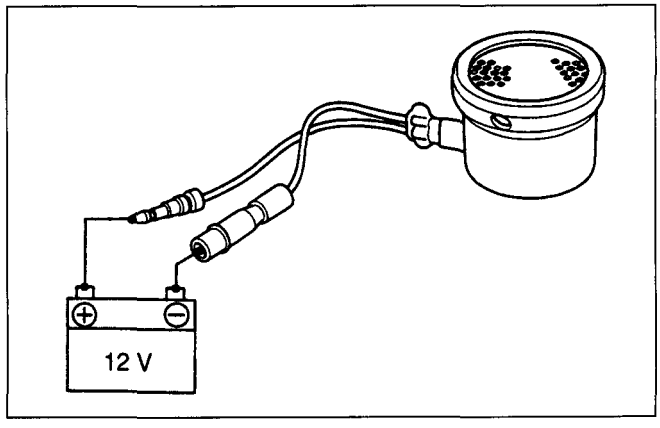


• WARNING BUZZER

NOTICE

Use a known-good battery for the test.

Connect the black/yellow terminal of the warning buzzer to the positive (+) terminal of the 12 V battery and the yellow/green terminal to the negative (–) terminal of the battery. The warning buzzer should sound.



• INDICATOR LIGHT [OIL PRESSURE LIGHT, OVERHEAT LIGHT]

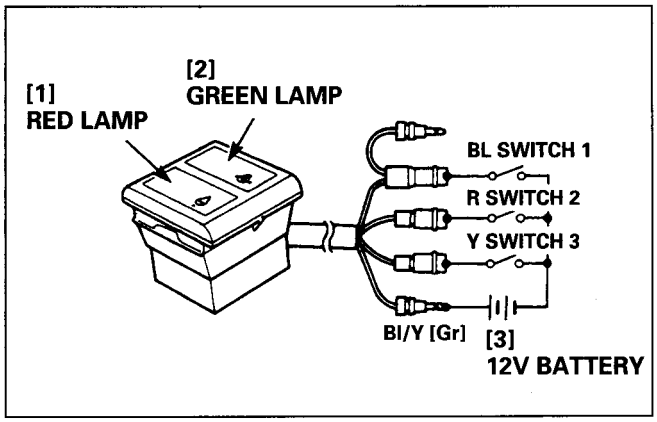
NOTICE

Use a known-good battery for the test.

Apply 12 V to the Bl/Y [Gr] terminal and connect the switches 1, 2 and 3 to the Bl, R and Y terminals respectively.

When SW1 is ON: The green lamp should come on.
When SW2 is ON: The red lamp should come on.
When SW1 and SW3 are ON: The green lamp should go out.

The color in brackets is for the side-mount remote control type only.

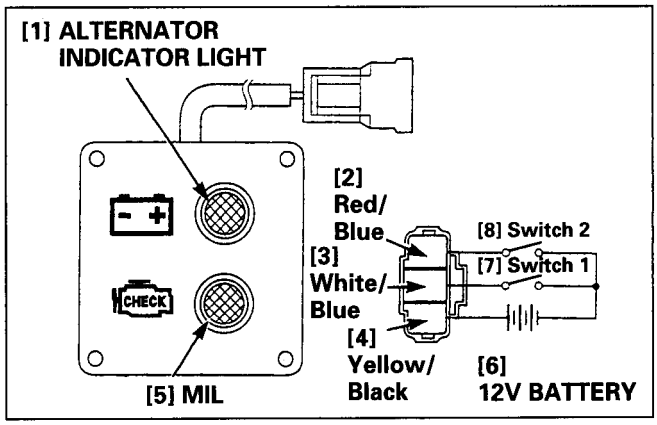


• INDICATOR LIGHT [MIL, ALTERNATOR INDICATOR LIGHT]

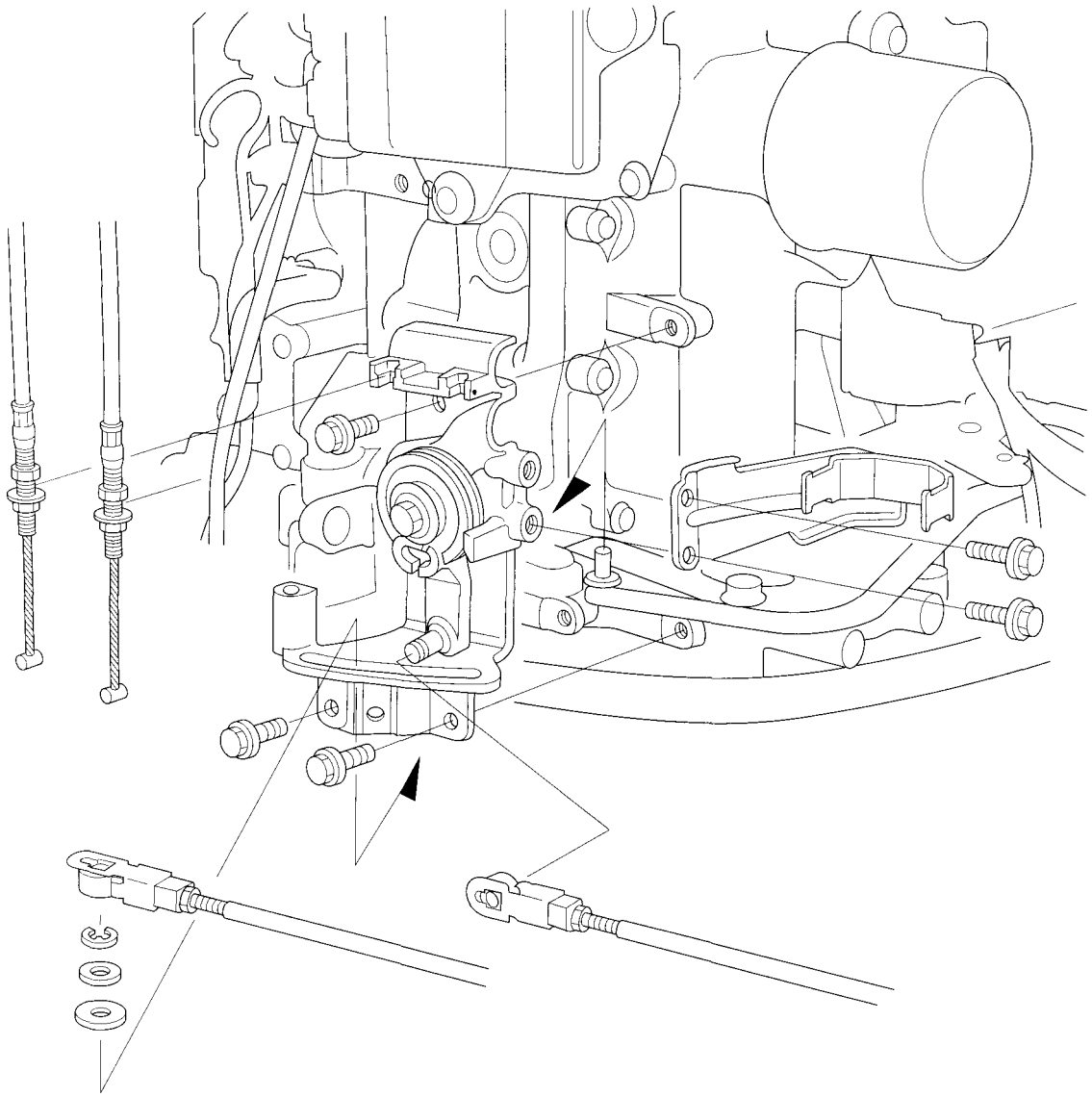
- Use a known-good battery for the test.

Route the indicator light cable as shown. Connect the switch 1 to the white/blue terminal and the switch 2 to the red/blue terminals respectively, and apply the battery voltage.

Switch 1 ON: Alternator indicator light should be ON.
Switch 2 ON: MIL should be ON.



1. REMOTE CONTROL CABLE (SHIFT SIDE/THROTTLE SIDE)
2. THROTTLE ARM/SHIFT LINK BRACKET
3. SHIFT ARM/LINK ROD/NEUTRAL SWITCH



1. REMOTE CONTROL CABLE

• SHIFT CONTROL CABLE REMOVAL

1) Remove the engine cover (P. 4-1).

2) Remove the shift pivot and the shift control cable.

• SHIFT CONTROL CABLE INSTALLATION

Before install the cable to the body, check the following.

- Before connecting the cable to the outboard motor, be sure that the cable is connected to the remote control box side securely.
- Be sure that the shift arm end aligns with the neutral switch end as shown. (Note that the detent spring roller must be set in the shift arm groove ["N" (Neutral) position] securely.

1) Apply marine grease to the mating surface of the shift pivot.
Install the shift pivot on the shift control cable.

2) Move the remote control lever fully to the "F" (Forward) side.

Return the lever to the "N" (Neutral) position slowly.

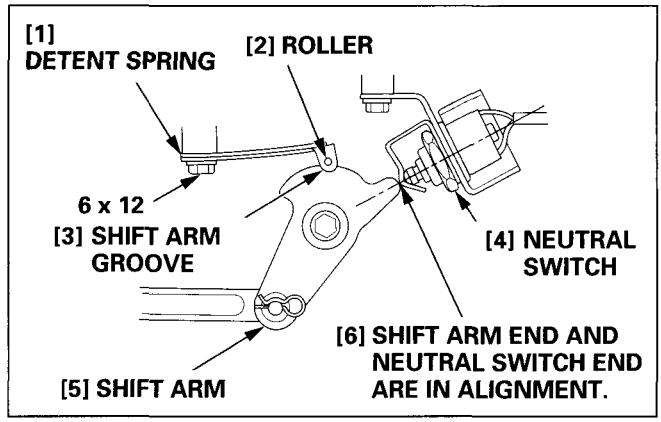
3) With the lever returned to the "N" (Neutral) position, mark at the cable outer seal end of the inner cable [Mark (A)].

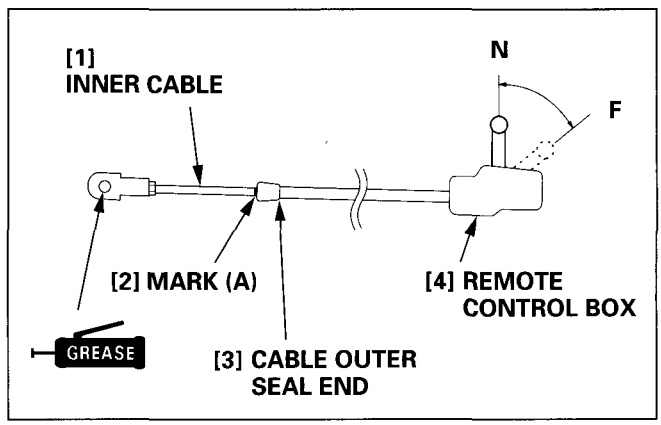
4) Move the remote control lever fully to the "R" (Reverse) side.

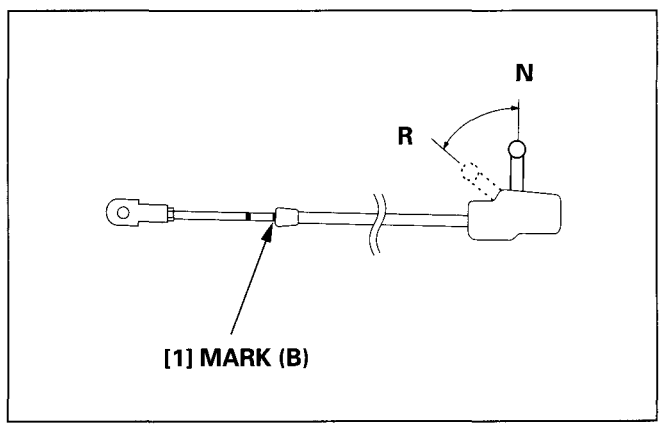
Return the lever to the "N" (Neutral) position slowly.

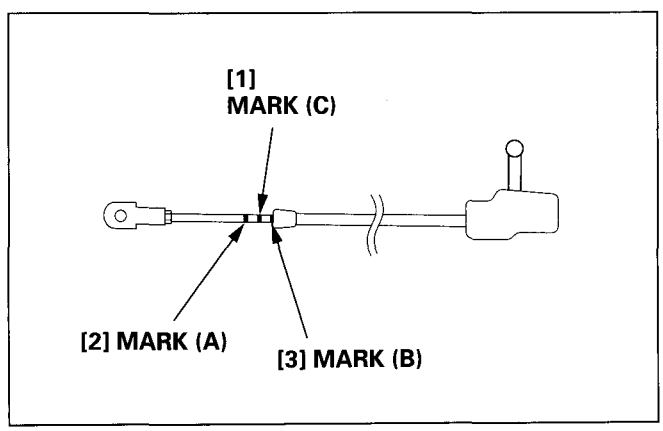
5) With the lever returned to the "N" (Neutral) position, mark at the cable outer seal end of the inner cable [Mark (B)].

6) Mark at the mid point between the mark (A) and mark (B) of the inner cable [Mark (C)].

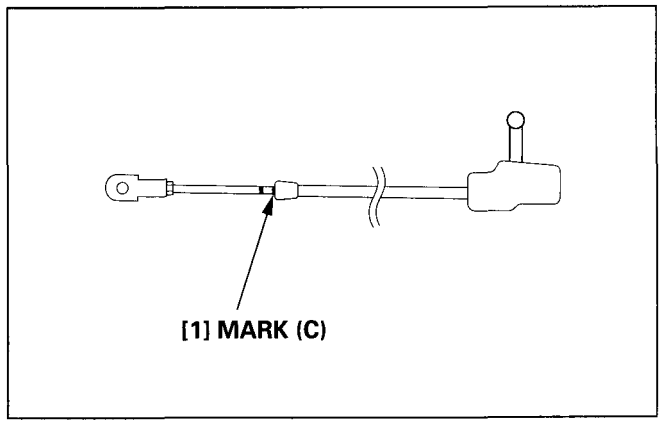




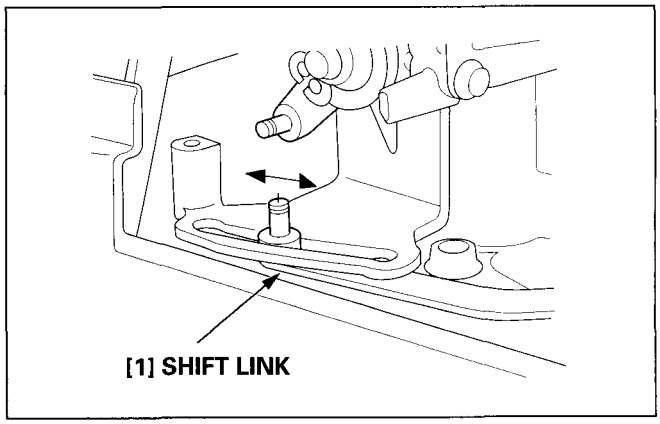




7) Align the mark (C) with the cable outer seal end.



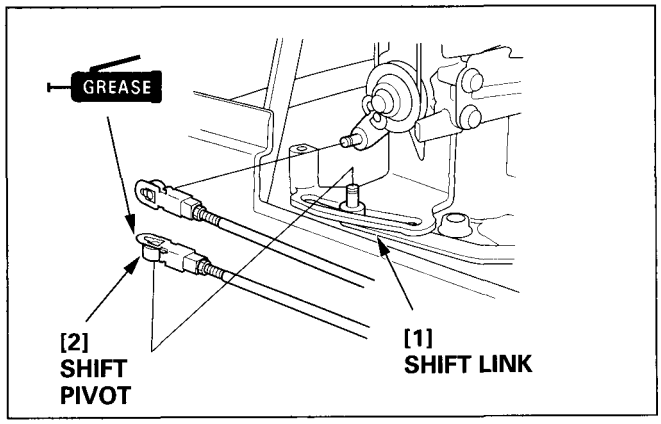
8) Push on the shift link end lightly and check for play. If there is play in the shift link, set the link at the center of the play.

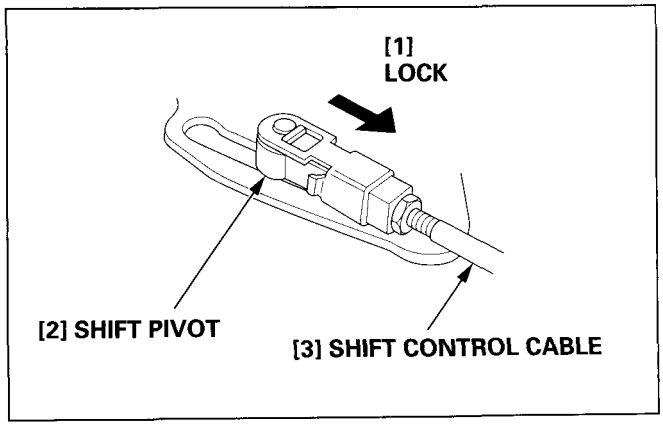


9) With the shift side cable in the condition of the above step 7, connect the shift side cable to the shift link while turning the shift pivot so the shift pivot sets on the shift link smoothly.

NOTICE

Take care not to move the mark (C) and outer seal end out of alignment. Hold the shift link at the center of the play, too.





10) After connecting the cable, move the remote control lever back and forth and check for shift.

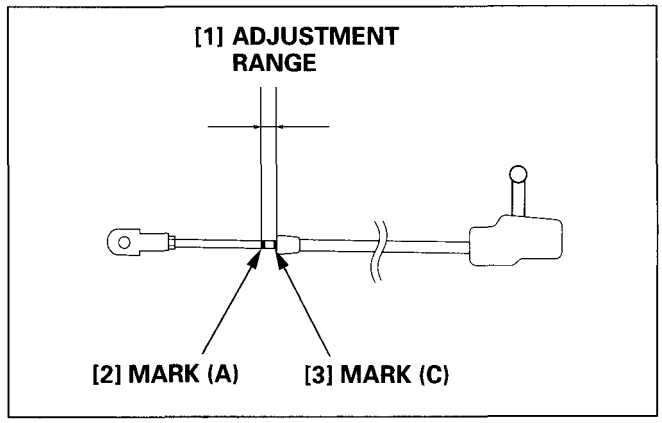
NOTICE

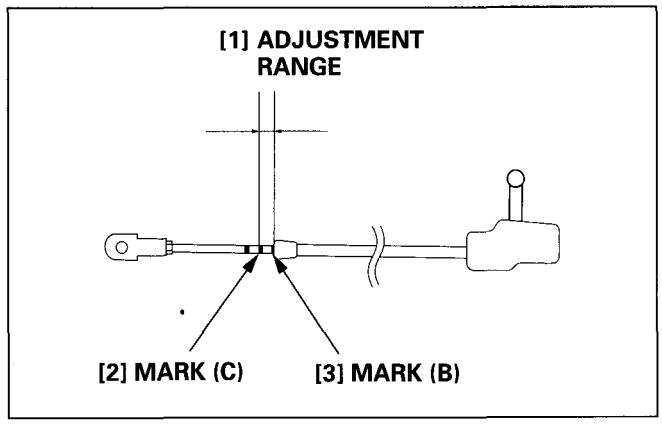
When it is hard to put the remote control lever in the "F" (Forward) or "R" (Reverse) position with the engine stopped, shift the gear while turning the propeller or propeller shaft. Do not shift the gear with force, or damage to the shift system can result.

11) If the gear is not in neutral by moving the remote control lever from the "F" (Forward) to the "N" (Neutral) position, remove the shift side cable and move the inner cable toward the mark (A). Repeat the procedure from the step 8.

12) If the gear is not in neutral by moving the remote control lever from the "R" (Reverse) to the "N" (Neutral) position, remove the shift side cable and move the inner cable toward the mark (B). Repeat the procedure from the step 8.

13) After adjustment, check operation of each lever. If the gear is not in neutral securely, perform the step 11 or 12 again.





• THROTTLE CONTROL CABLE REMOVAL

1) Remove the engine cover (P. 4-1).

2) Remove the shift pivot and the throttle control cable.

• THROTTLE CONTROL CABLE INSTALLATION

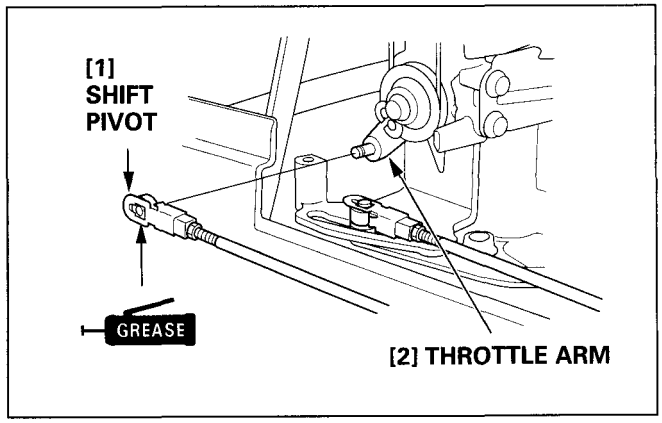
Before install the cable to the body, check the following.

- Before connecting the cable to the outboard motor, be sure that the cable is connected to the remote control box side securely.

1) Apply marine grease to the mating surface of the shift pivot. Install the shift pivot on the throttle side cable.

2) Install the shift pivot of the throttle control cable to the throttle arm.

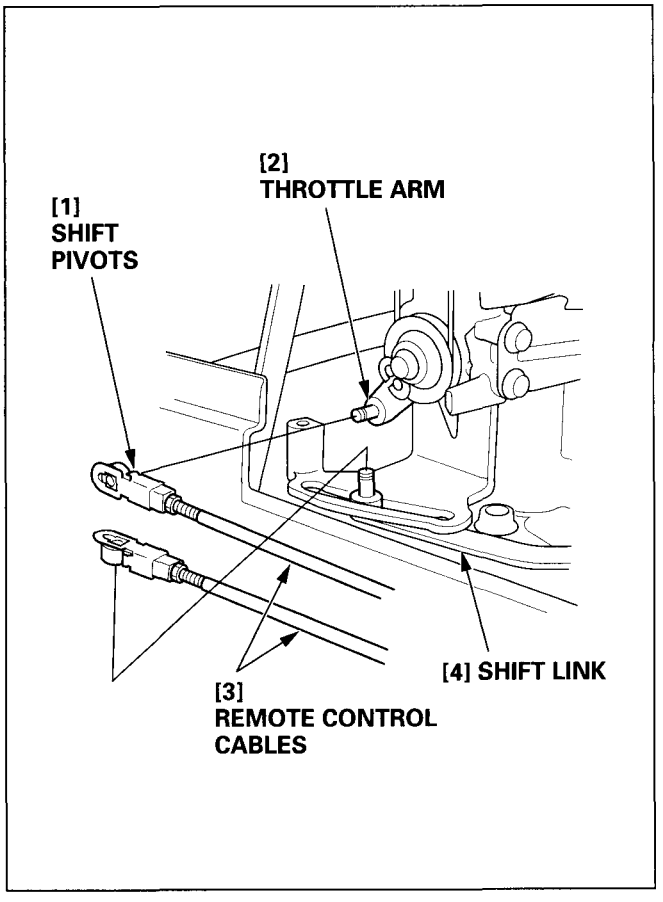
3) After installing, adjust the throttle control cable (P. 3-18).



2. THROTTLE ARM/SHIFT LINK BRACKET

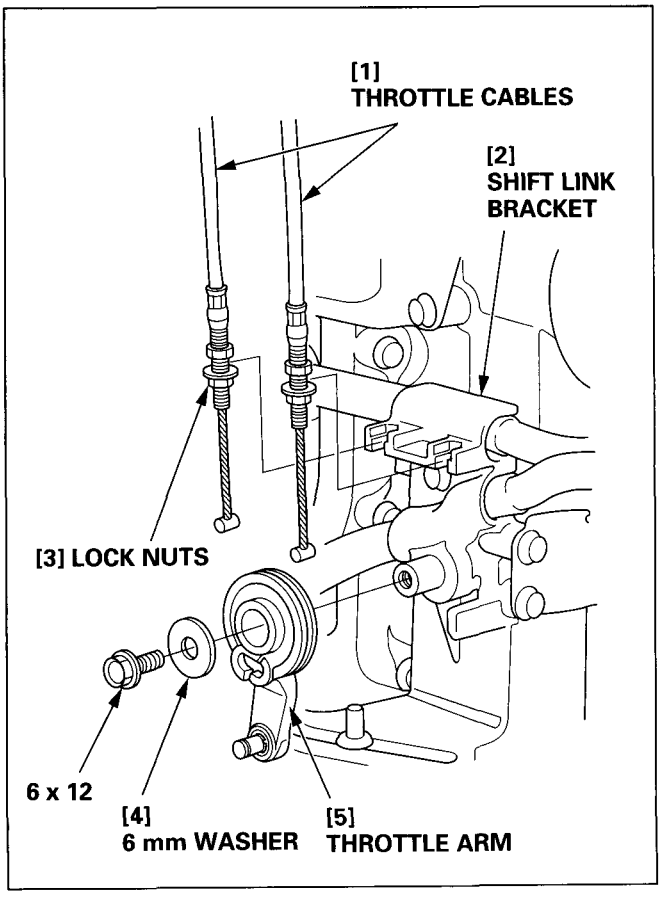
Removal:

1) Remove remote control cables from the shift link and throttle arm.



2) Loosen the lock nuts of the throttle cables from the shift link bracket.

3) Remove the 6 x 12 mm flange bolt and the throttle arm.



4) Disconnect the fuel tubes B and C from the fuel strainer (low pressure side).

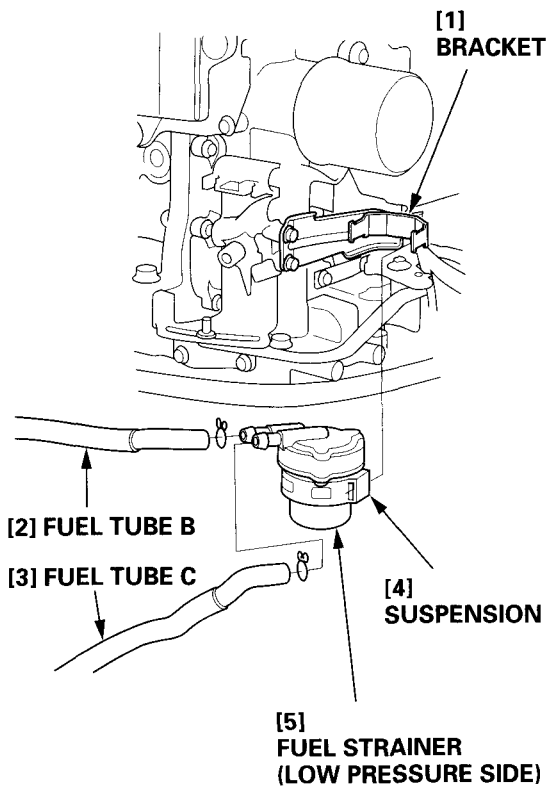
⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

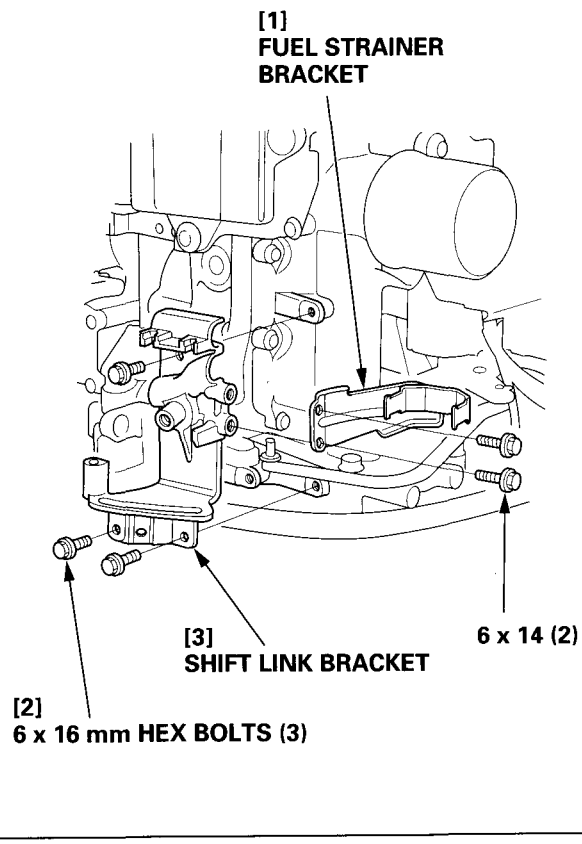
- **Keep heat, sparks, and flame away.**
- **Handle fuel only outdoors.**
- **Wipe up spills immediately.**

5) Remove the fuel strainer (low pressure side) with the suspension.



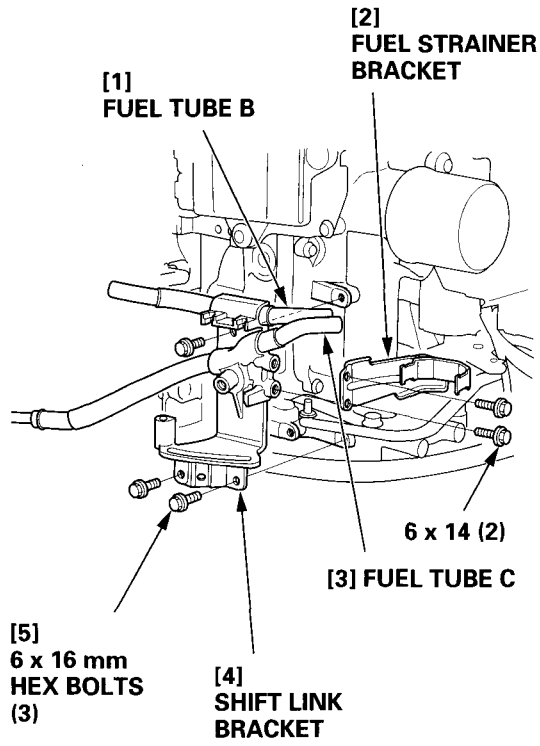
6) Remove the three 6 x 16 mm hex bolts and the shift link bracket.

7) Remove the two 6 x 14 mm flange bolts and the fuel strainer (low pressure side) bracket.

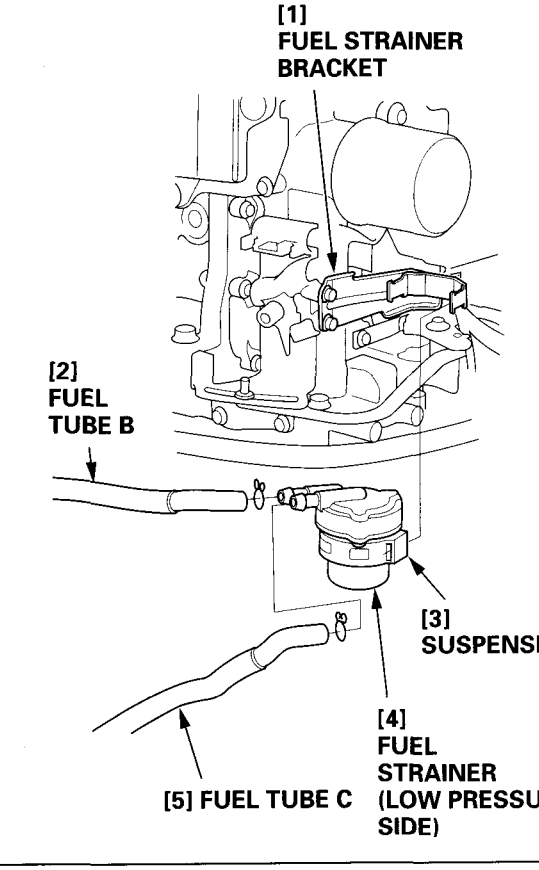


INSTALLATION:

1) Set the fuel tubes B and C in the groove of the shift link bracket, and install the shift link bracket with the three 6 x 16 mm hex bolts.
   - Set the fuel tube B in the upper side of the groove and the fuel tube C in the lower side of the groove.
2) Install the fuel strainer (low pressure side) bracket to the shift link bracket with the two 6 x 14 mm flange bolts.



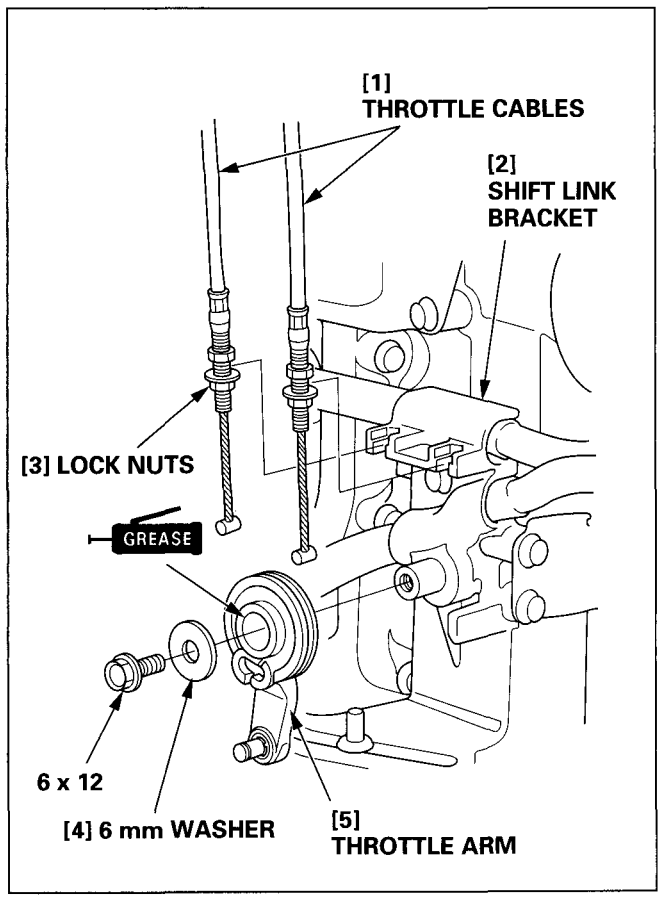
3) Install the fuel strainer (low pressure side) to the bracket.
4) Connect the fuel tube B to the " ➡ " mark fuel joint and the fuel tube C to the " ⬅ " mark fuel joint.



5) Apply marine grease to the throttle arm moving surface.

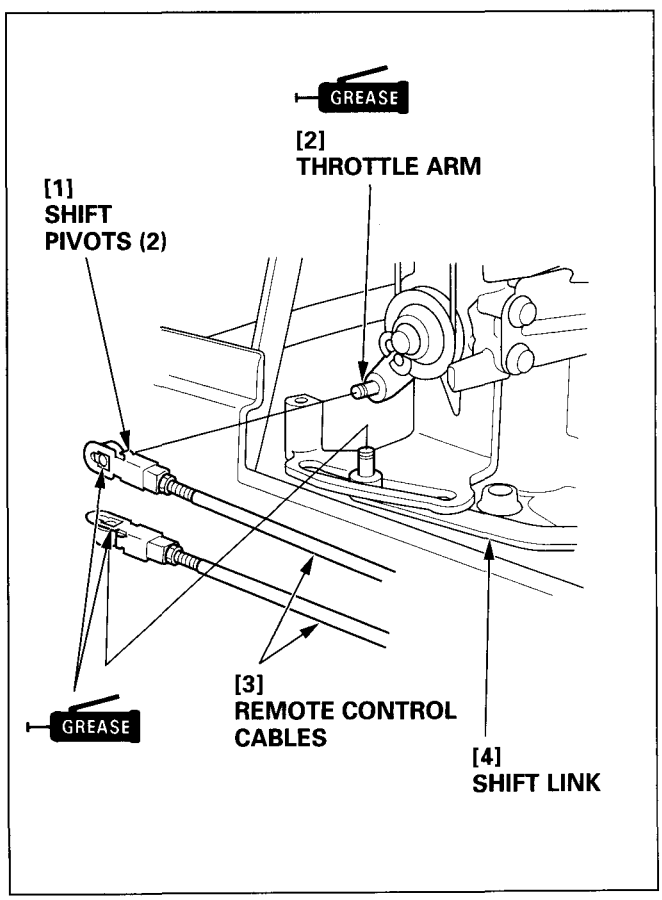
6) Install the throttle arm with the 6 x 12 mm flange bolt.

7) Install the throttle cables to the throttle arm.



8) Apply marine grease to the mating surface of the shift pivots and install the remote control cables to the throttle arm and the shift link.

9) After installing, adjust the throttle cables and the remote control cables (P. 3-18).



3. SHIFT ARM/LINK ROD/NEUTRAL SWITCH

REMOVAL:

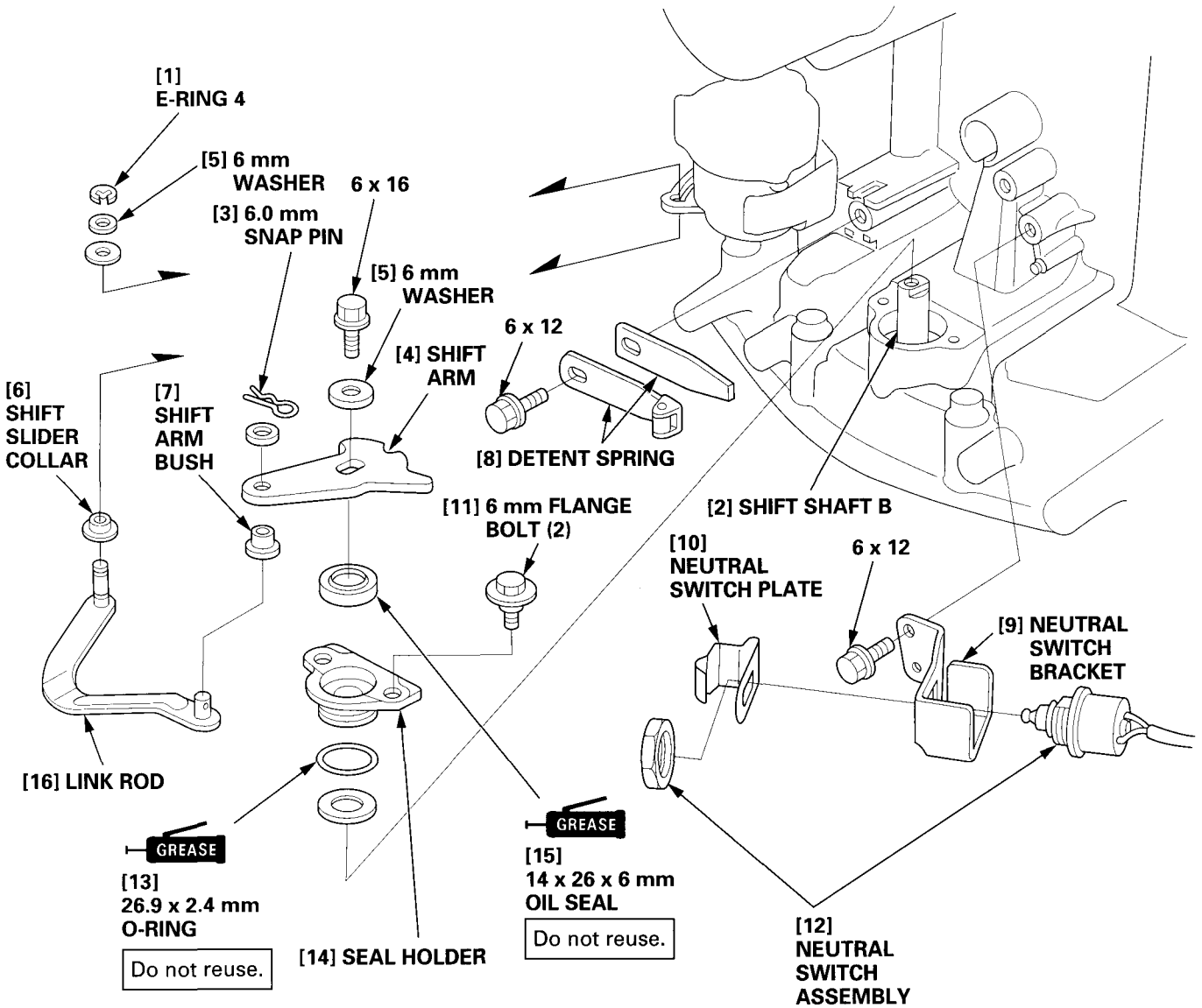
1) Remove the engine cover (P. 4 - 1).

2) Remove the electric parts cover (P. 4 - 4).

3) Move the remote control lever to the "N" (Neutral) position.

NOTICE

- Remove the seal holder from the shift shaft B but do not to raise shift shaft B.
- If the shift shaft B is raised or gets out of place in the mount case, reposition the shift shaft B (P. 16-11).

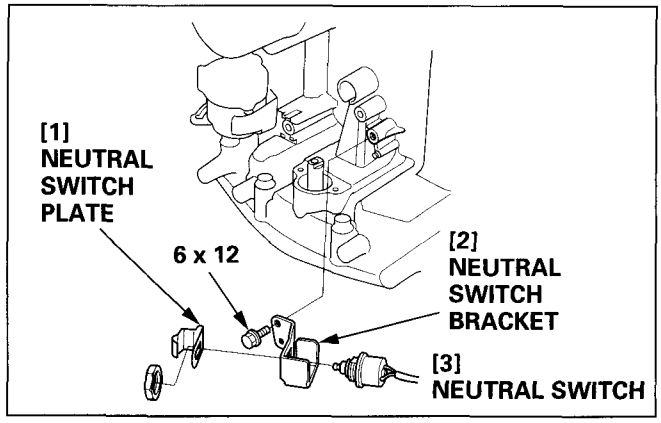


• NEUTRAL SWITCH

INSTALLATION:

1) Install the neutral switch bracket to the crankcase with the 6 x 12 mm flange bolt.

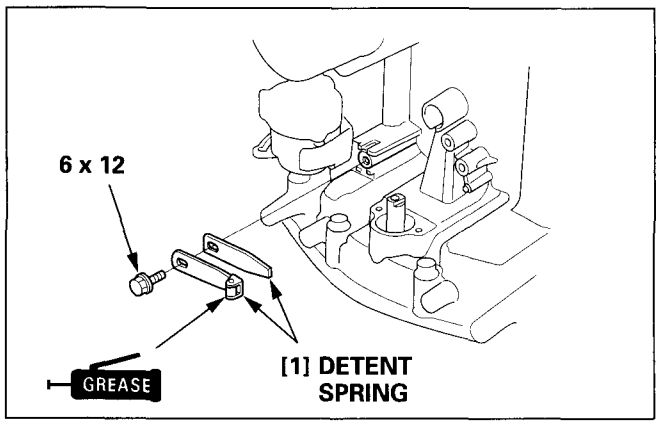
2) Install the neutral switch and the neutral switch plate to the bracket.



• DETENT SPRING

INSTALLATION:

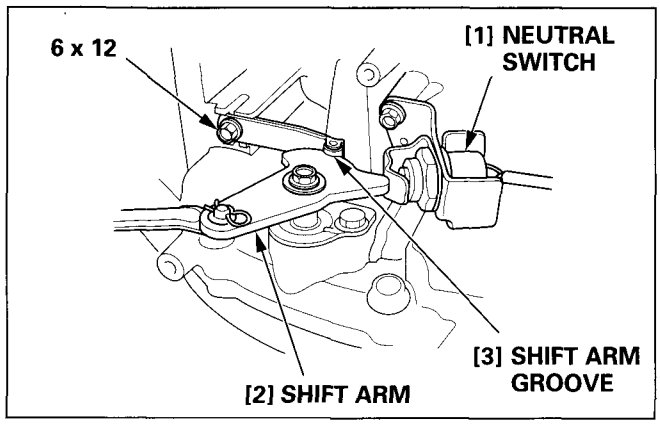
1) Apply marine grease to the roller of the detent spring, then loosely tighten the detent springs to the crankcase with the 6 x 12 mm flange bolt.

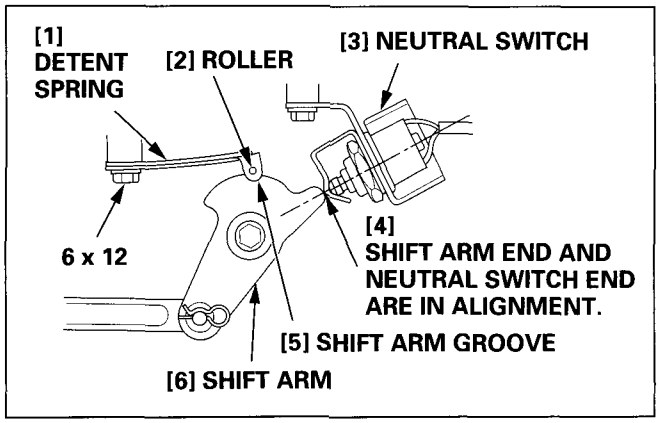


2) Be sure that the shift arm end aligns with the neutral switch end as shown. (Note that the detent spring roller must be set in the shift arm groove ["N" (Neutral) position] securely.

3) If the shift arm end and neutral switch end are not in alignment, loosen the 6 x 12 mm flange bolt and adjust by moving the detent spring right or left.

4) After adjustment, tighten the 6 x 12 mm flange bolt.





• SHIFT SHAFT B ALIGNMENT

1) Make sure the gear position is in the neutral position.

2) If the gear position is not in the neutral, remove the shift rod A (P. 13-6) and turn the shift shaft A so that the direction of the shift shaft A cut out toward front as shown. This position shows the shift shaft A is in the neutral position.

3) Correct the shift shaft B from the condition of the seal holder being out of position.

4) Loosely tighten the shift arm to the shift shaft B with the 6 x 16 mm flange bolt.

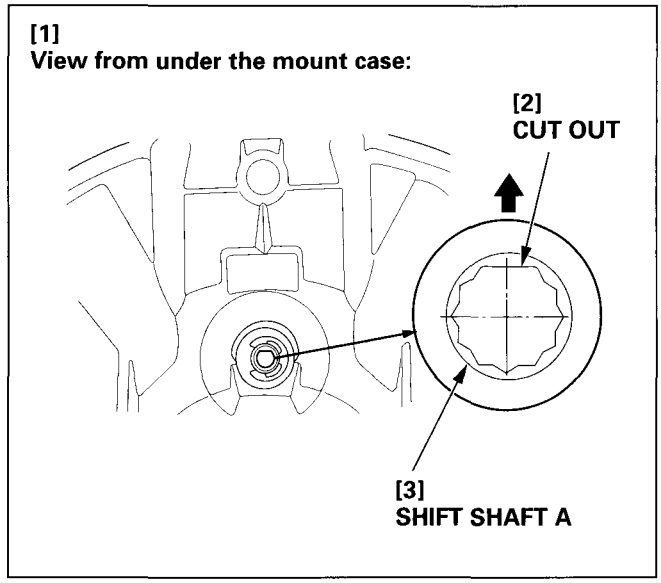
5) Pull the shift shaft B up and turn the shift shaft B right or left so that the shift arm end aligns with the neutral switch end.

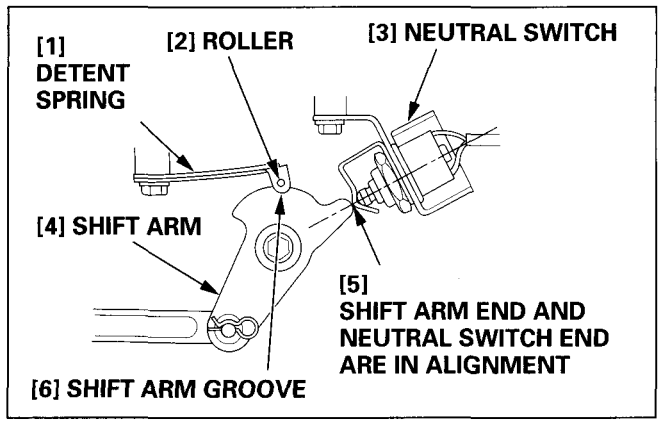
6) With this position, slowly take down the shift shaft B vertically and engage the gear of the shift shaft A and the gear of shift shaft B.
Engage the gears with care not to move the shift shaft A.

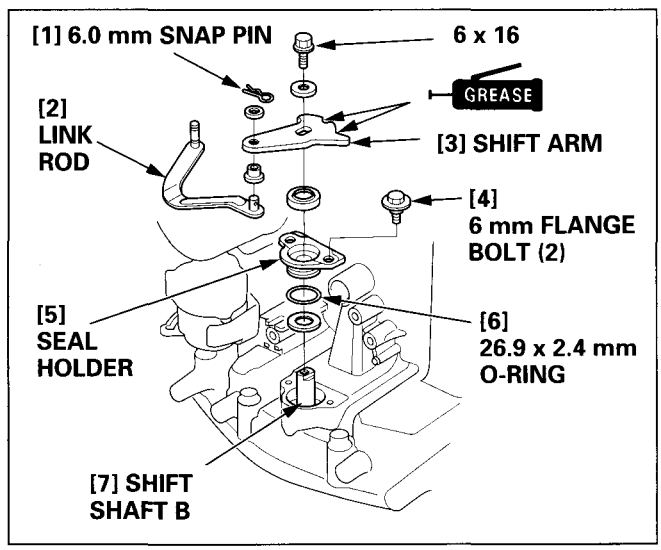
7) After engaging, make sure the direction of the shift shaft A cut out toward front and the shift arm end and the neutral switch end are in alignment.

8) After correcting the shift shaft B alignment, remove the shift arm and install the seal holder.

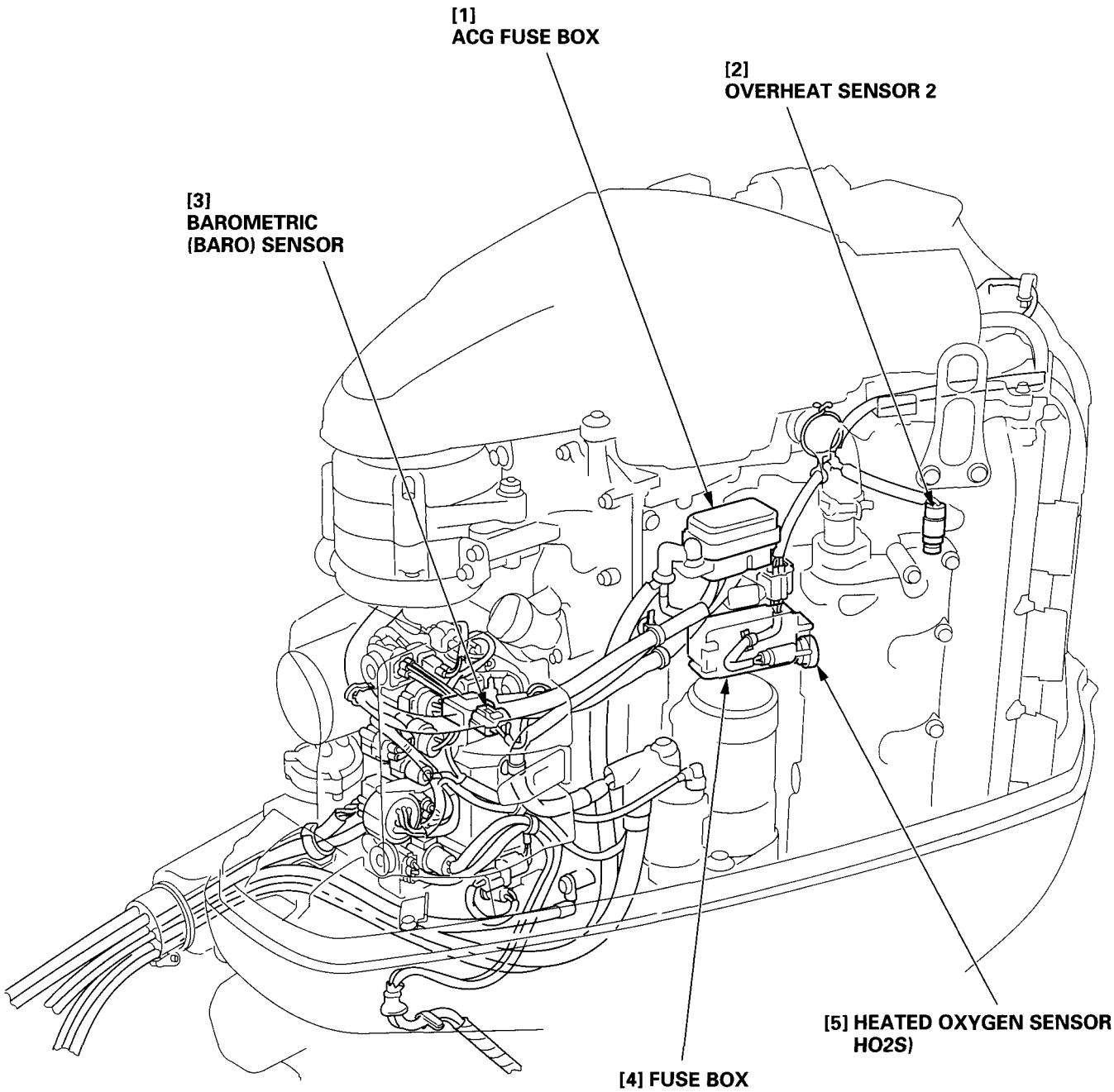
9) After installing the seal holder, install the shift arm to the shift shaft B with the 6 x 16 mm flange bolt.
Install the link rod to the shift arm with the 6.0 mm snap pin.

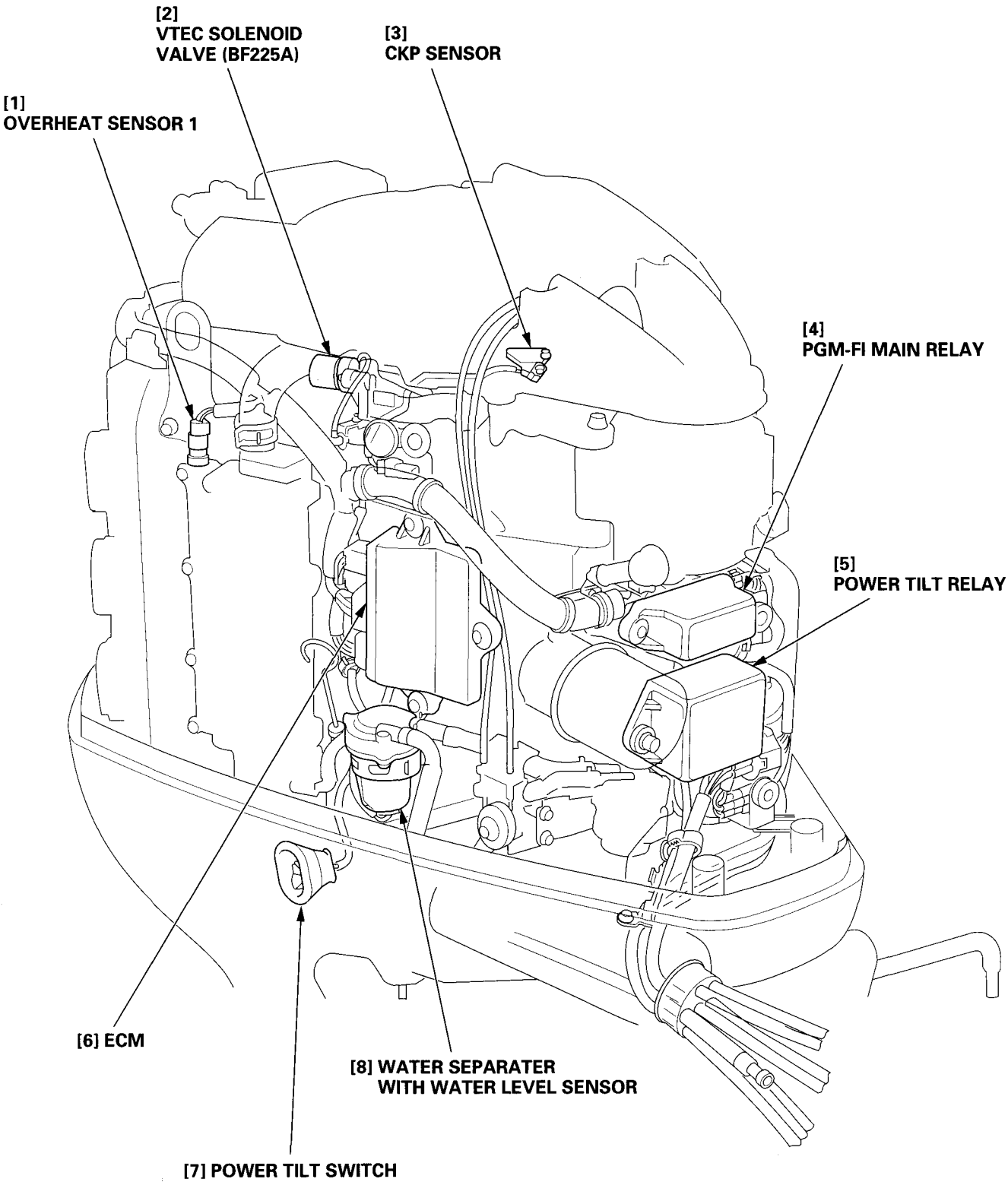


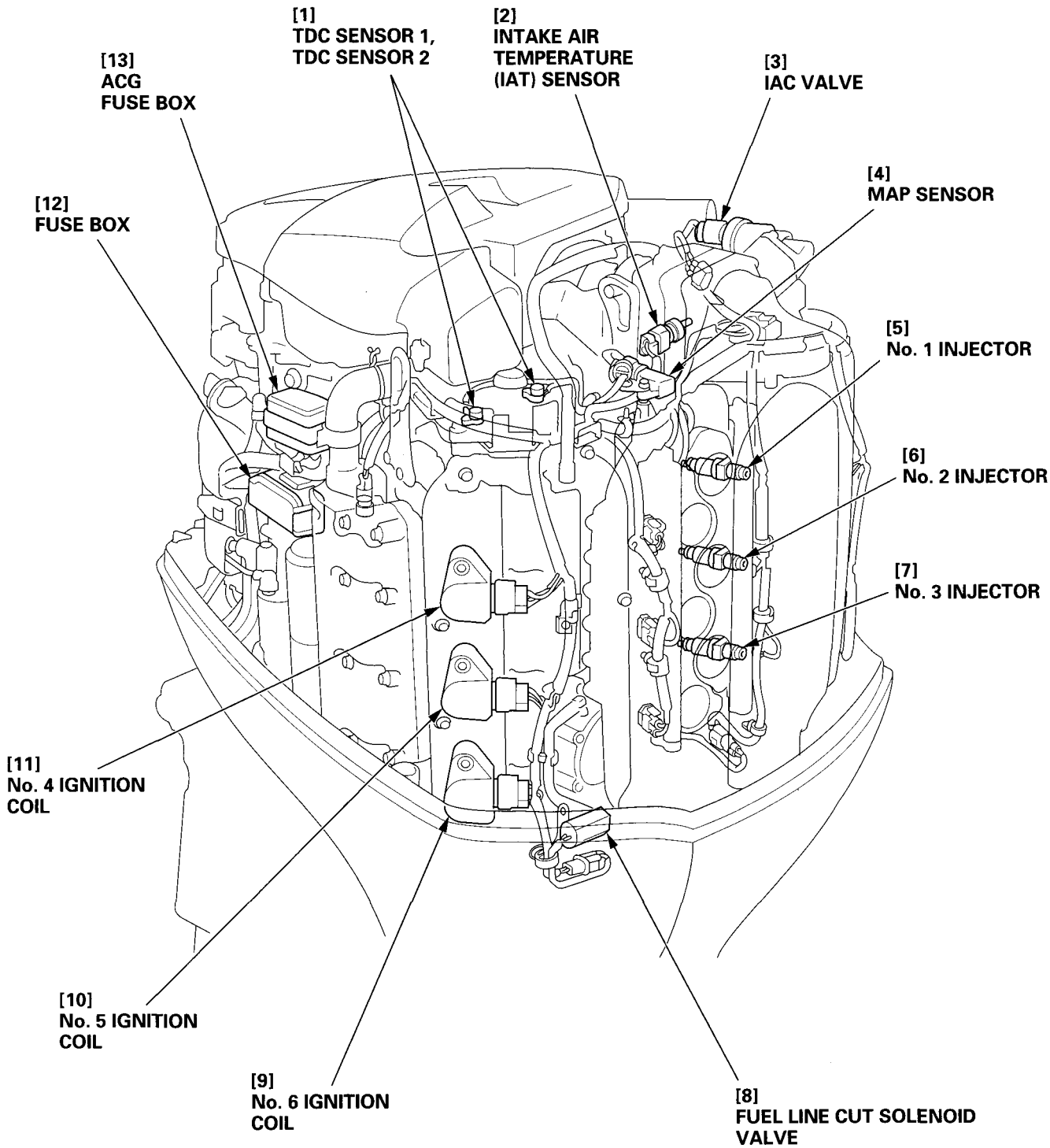


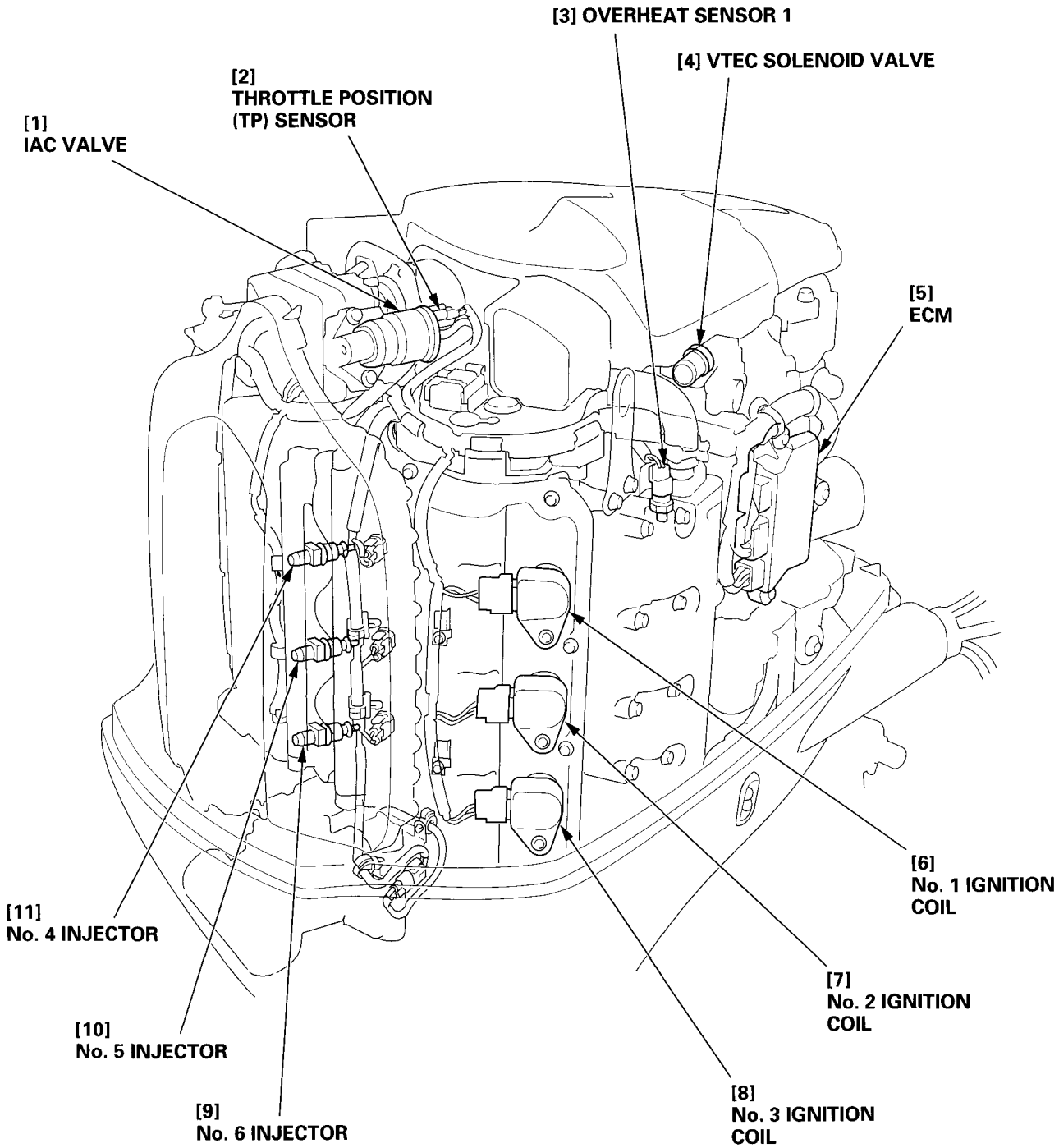


1. COMPONENT LOCATION

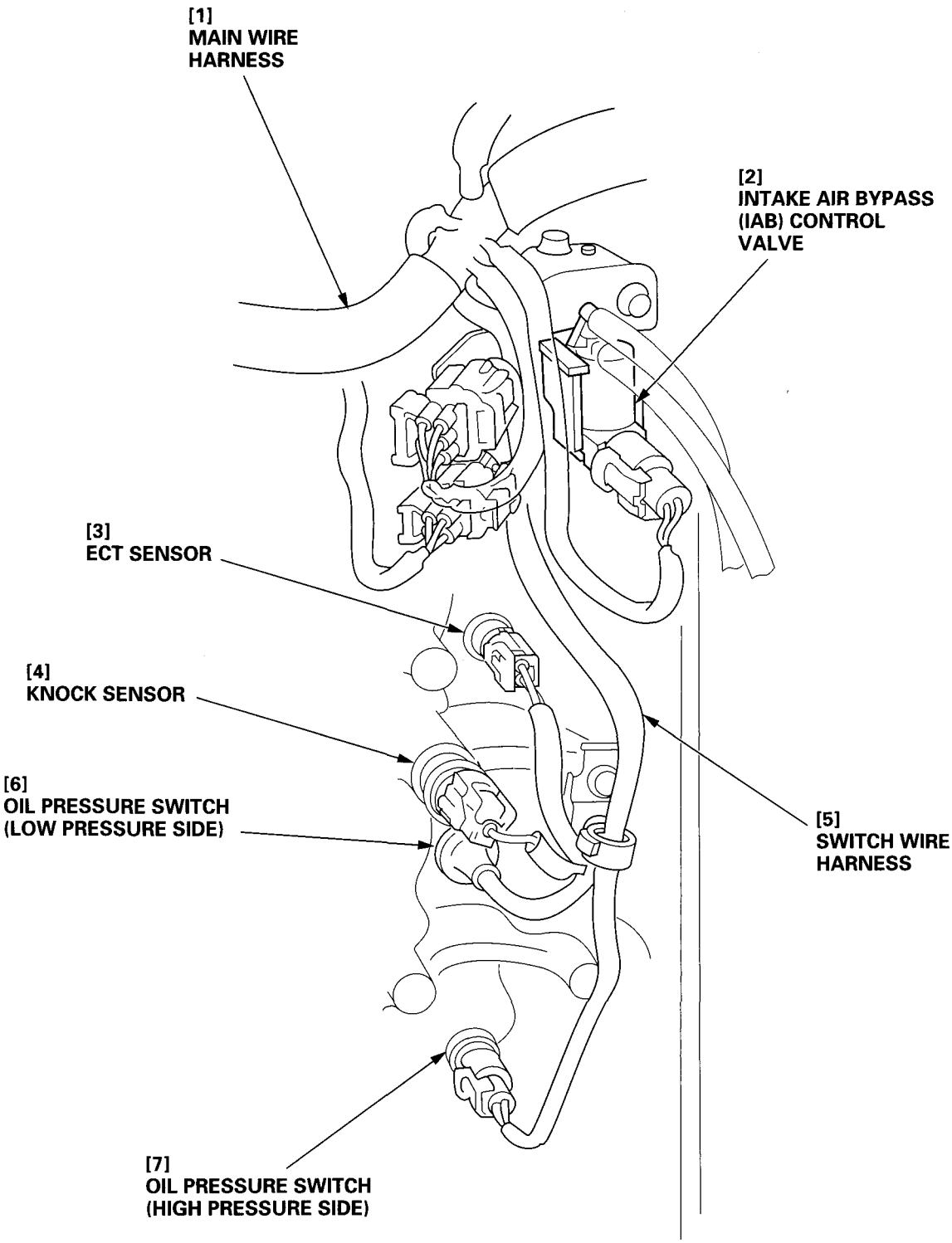


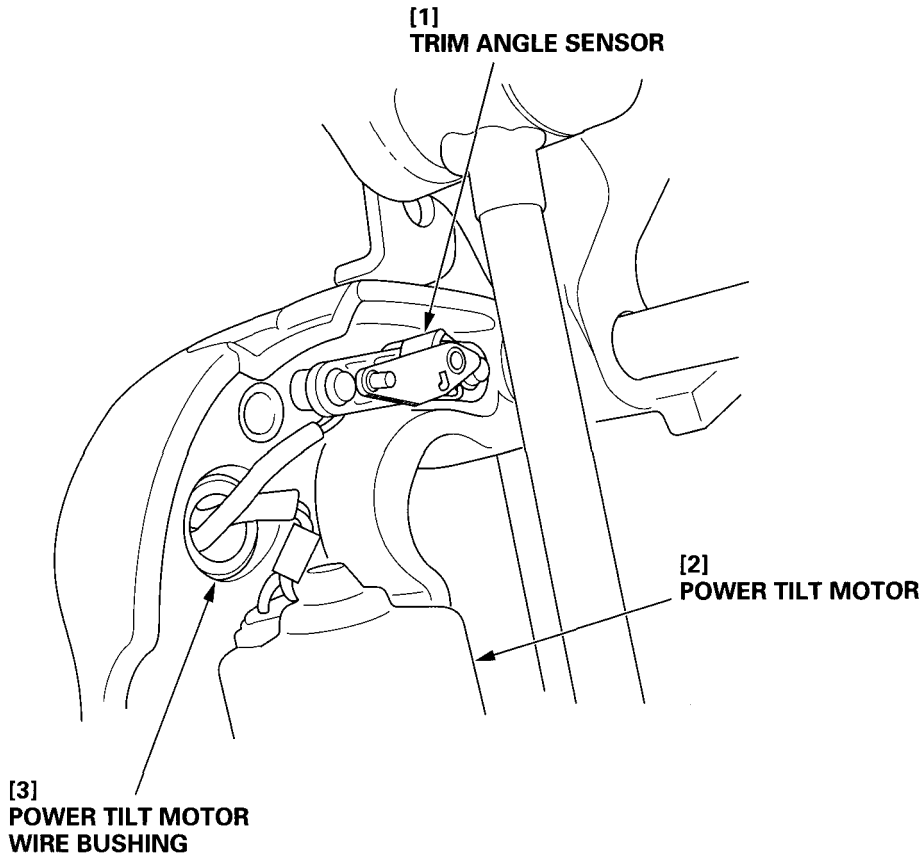

[2]
VTEC SOLENOID
VALVE (BF225A)
[3]
CKP SENSOR
[1]
OVERHEAT SENSOR 1
[4]
PGM-FI MAIN RELAY
[5]
POWER TILT RELAY
[6] ECM
[8] WATER SEPARATER
WITH WATER LEVEL SENSOR
[7] POWER TILT SWITCH


[1]
TDC SENSOR 1,
TDC SENSOR 2
[2]
INTAKE AIR
TEMPERATURE
(IAT) SENSOR
[3]
IAC VALVE
[4]
MAP SENSOR
[5]
No. 1 INJECTOR
[6]
No. 2 INJECTOR
[7]
No. 3 INJECTOR
[8]
FUEL LINE CUT SOLENOID
VALVE
[9]
No. 6 IGNITION
COIL
[10]
No. 5 IGNITION
COIL
[11]
No. 4 IGNITION
COIL
[12]
FUSE BOX
[13]
ACG
FUSE BOX

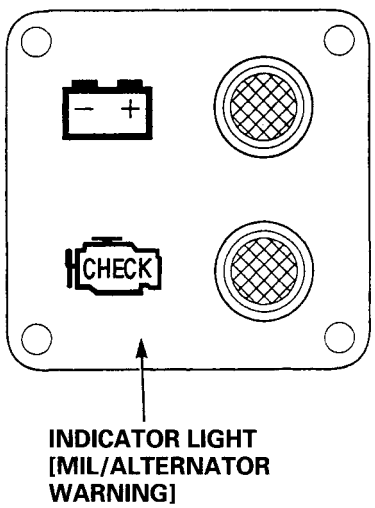

[3] OVERHEAT SENSOR 1
[4] VTEC SOLENOID VALVE
[2]
THROTTLE POSITION
(TP) SENSOR
[1]
IAC VALVE
[5]
ECM
[6]
No. 1 IGNITION
COIL
[11]
No. 4 INJECTOR
[7]
No. 2 IGNITION
COIL
[10]
No. 5 INJECTOR
[8]
No. 3 IGNITION
COIL
[9]
No. 6 INJECTOR

• V BANK

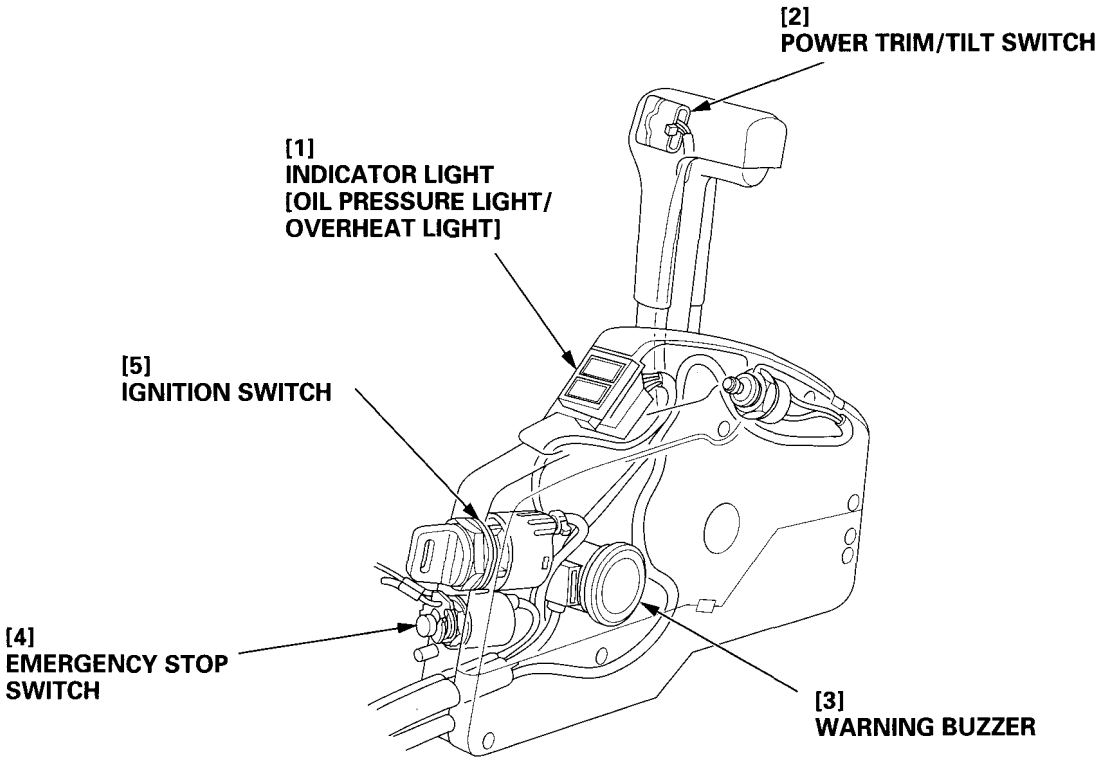

[1]
MAIN WIRE
HARNESS
[2]
INTAKE AIR BYPASS
(IAB) CONTROL
VALVE
[3]
ECT SENSOR
[4]
KNOCK SENSOR
[6]
OIL PRESSURE SWITCH
(LOW PRESSURE SIDE)
[5]
SWITCH WIRE
HARNESS
[7]
OIL PRESSURE SWITCH
(HIGH PRESSURE SIDE)



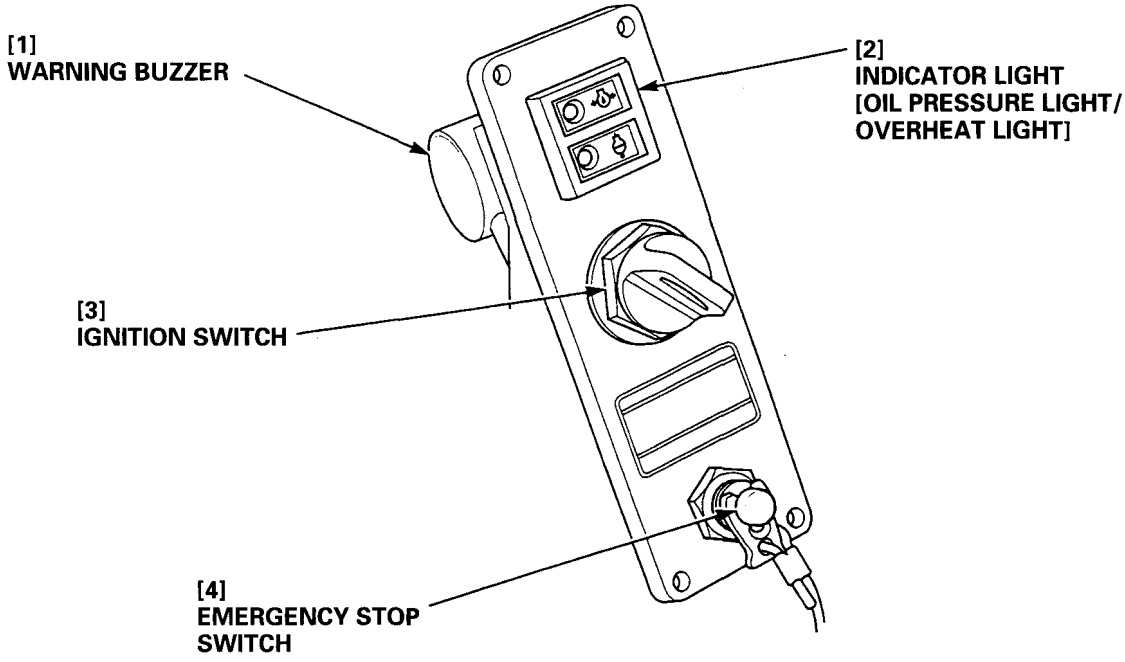
- **INDICATOR LIGHT [MIL/ALTERNATOR WARNING LIGHT]**



- **REMOTE CONTROL BOX (OPTIONAL)**



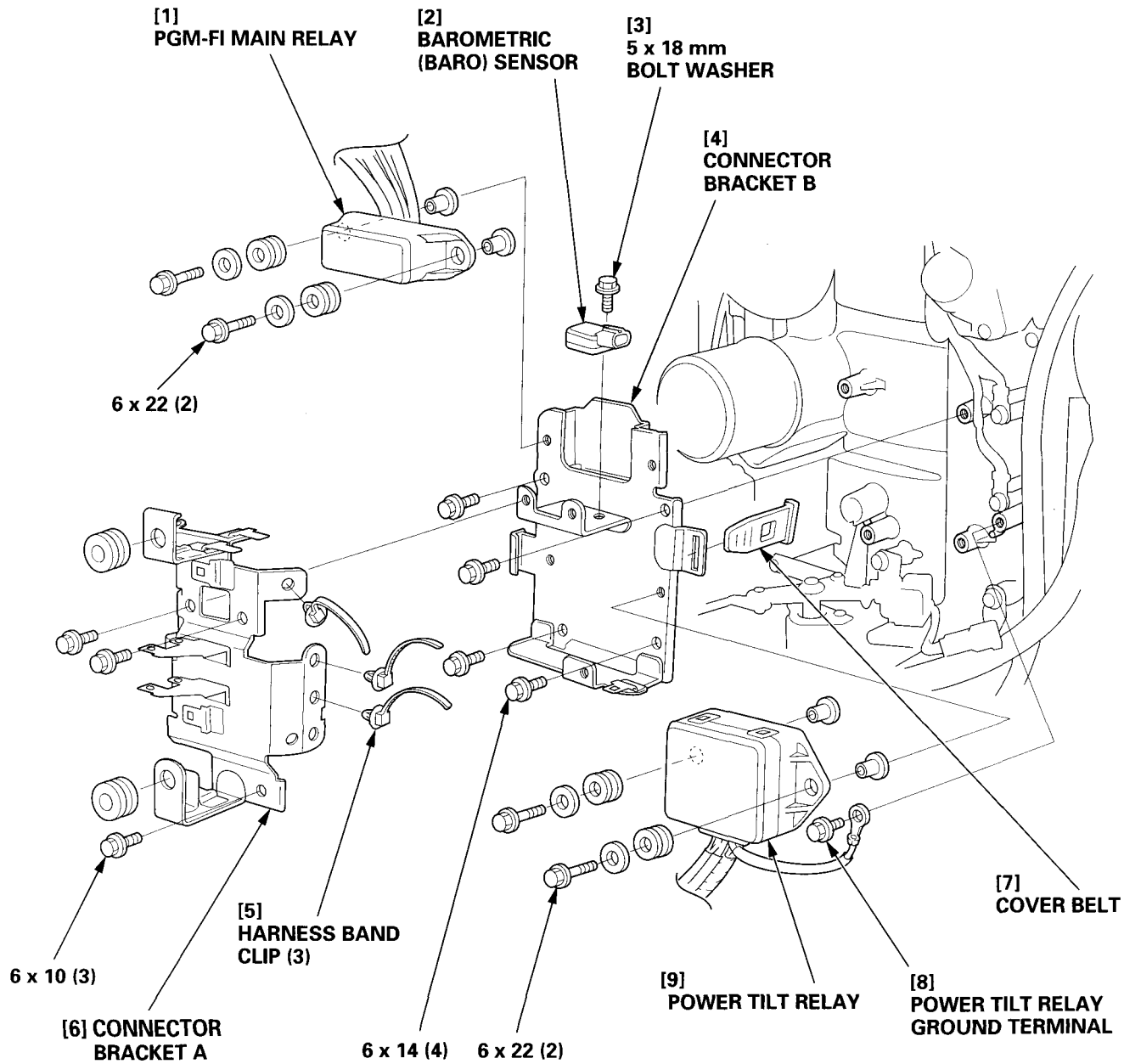
- ***CONTROL PANEL (OPTIONAL)***



2. PGM-FI MAIN RELAY/POWER TILT RELAY

REMOVAL:

1) Disconnect the battery negative (–) terminal, then positive (+) terminal from the battery.
2) Remove the engine cover (P. 4-1).
3) Remove the electric parts cover (P. 4-3).
4) Disconnect the each connector and remove the connectors from the connector bracket A.
5) Remove the three 6 x 10 mm flange bolts and the connector bracket A.
6) Remove the two 6 x 22 mm flange bolts and the PGM-FI main relay from the connector bracket B.
7) Remove the 6 x 12 mm flange bolt and the power tilt relay ground terminal.
8) Remove the two 6 x 22 mm flange bolts and the power tilt relay from the connector bracket B.



b. INSPECTION:

1) Check the battery condition before starting the inspection.

2) Connect the PGM-FI main relay 6P connector black/yellow terminal to the battery positive (+) terminal, and the black terminal to the battery negative (–) terminal, and check the continuity between the PGM-FI main relay 4P connector terminals shown.

   - Between the white/yellow and white/green terminals.
   - Between the white/yellow and white/red terminals.
   - Between the white/yellow and white/black terminals.

3) Connect the PGM-FI main relay 6P connector white terminal to the battery positive (+) terminal, and the light green/red terminal to the battery negative (–) terminal, and check for continuity between the white/black and blue/red terminals of the PGM-FI main relay 2P connector.

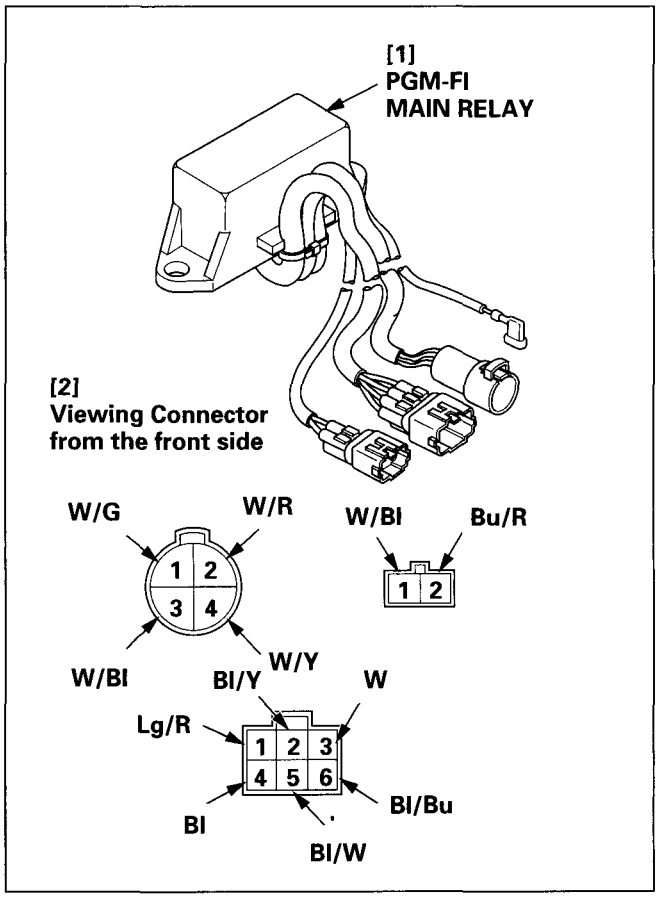
4) Connect the PGM-FI main relay 6P connector black/white terminal to the battery positive (+) terminal, and the black/blue terminal to the battery negative (–) terminal, and check the continuity shown.

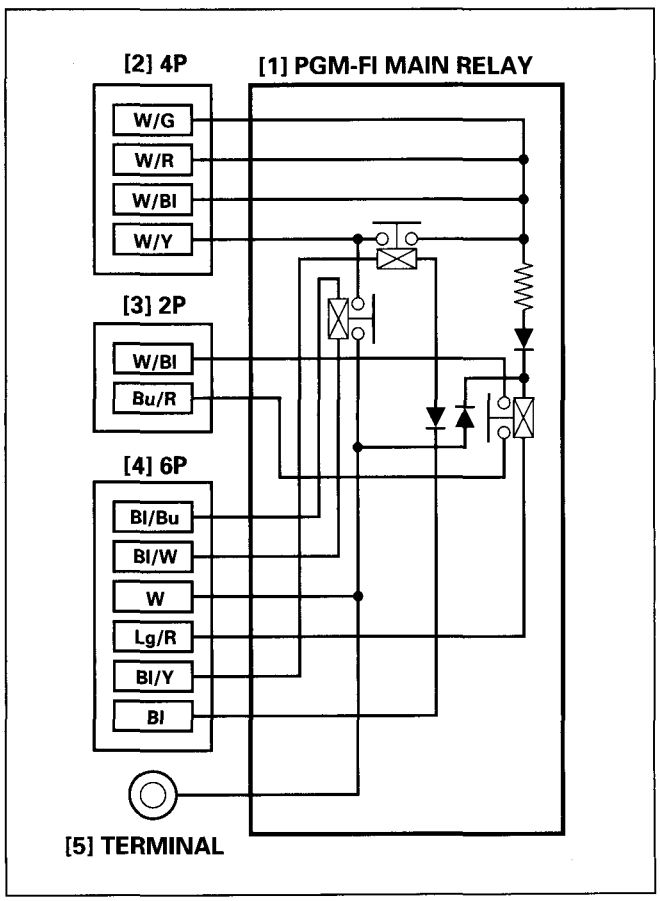
   - Between the white/yellow terminal of the PGM-FI main relay 4P connector and the PGM-FI main relay terminal.
   - Between the white/yellow terminal of the PGM-FI main relay 4P connector and the white terminal of the PGM-FI main relay 6P connector.

5) Connect the white/green terminal of the PGM-FI main relay 4P connector to the battery positive (+) terminal, and connect the light green/red terminal of the PGM-FI main relay 6P connector to the battery negative (–) terminal, and check for continuity between the white/black and blue/red terminals of the PGM-FI main relay 2P connector.

6) If there is no continuity, replace the PGM-FI main relay.

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



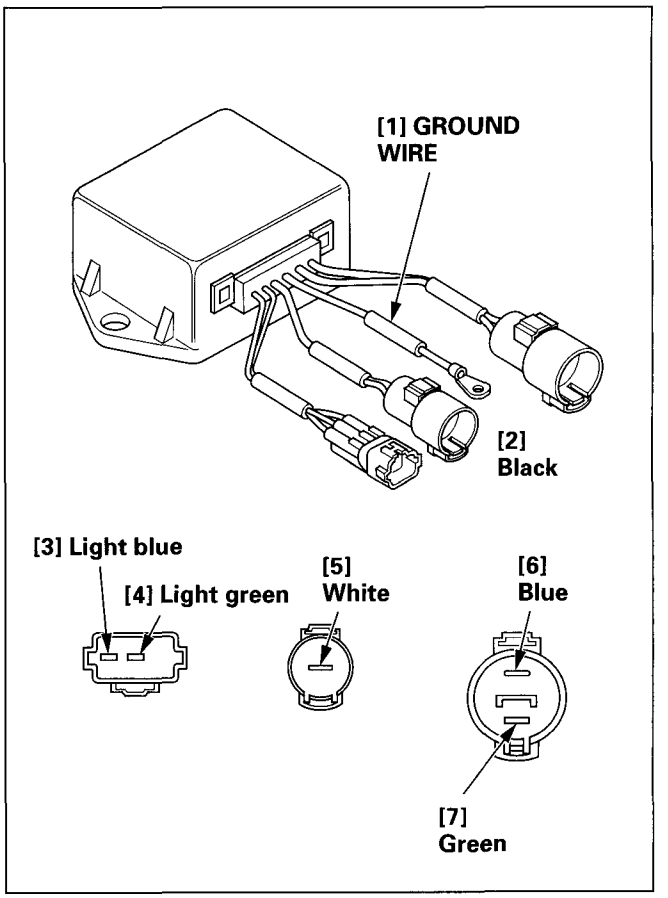


• POWER TILT RELAY

• Disconnect the power tilt relay connectors and remove the relay from the outboard motor to check.

1) Check for continuity between the following terminals.

Between Green and Black	Continuity
Between Blue and Black	Continuity
Between Green and White	No continuity
Between Blue and White	No continuity



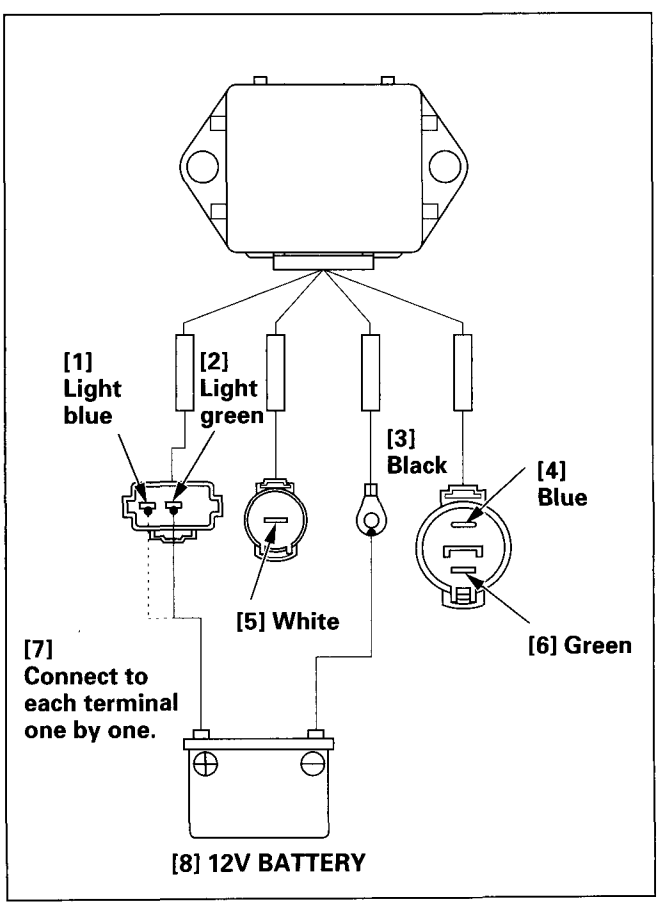
2) Connect the wires as shown. There must be continuity/no continuity between the terminals shown.

- Use a known-good battery for the test.
- **Positive (+) battery terminal connected to light green terminal:**

Between Green and Black	No continuity
Between Blue and Black	Continuity
Between Green and White	Continuity
Between Blue and White	No continuity

- **Positive (+) battery terminal connected to light blue terminal:**

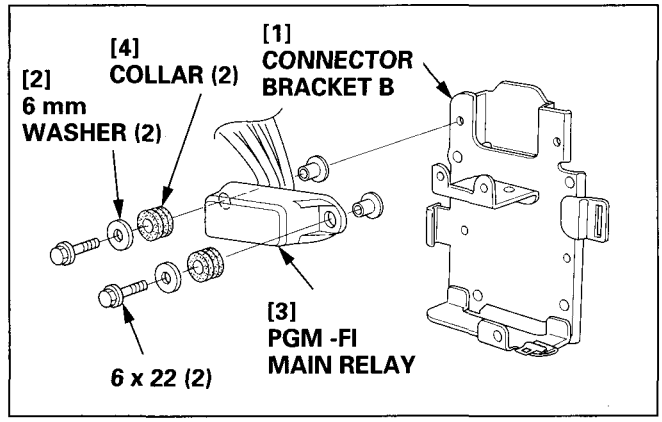
Between Green and Black	Continuity
Between Blue and Black	No continuity
Between Green and White	No continuity
Between Blue and White	Continuity



c. INSTALLATION:

1) Install the PGM-FI main relay to the connector bracket B with the two 6 x 22 mm flange bolts.

2) Connect the PGM-FI main relay 2P, 4P and 6P connectors.

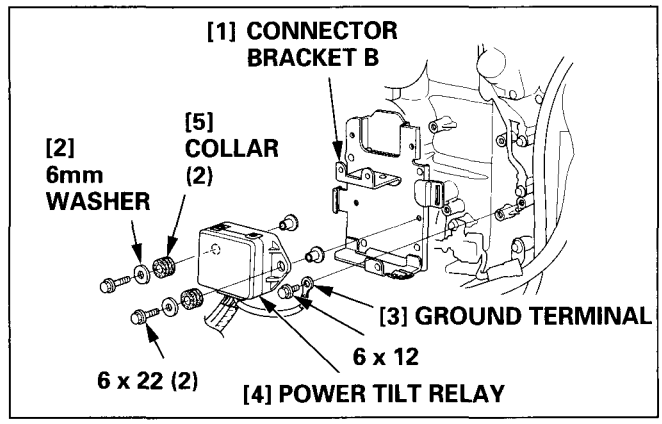


3) Install the power tilt relay to the connector bracket B with the two 6 x 22 mm flange bolts.

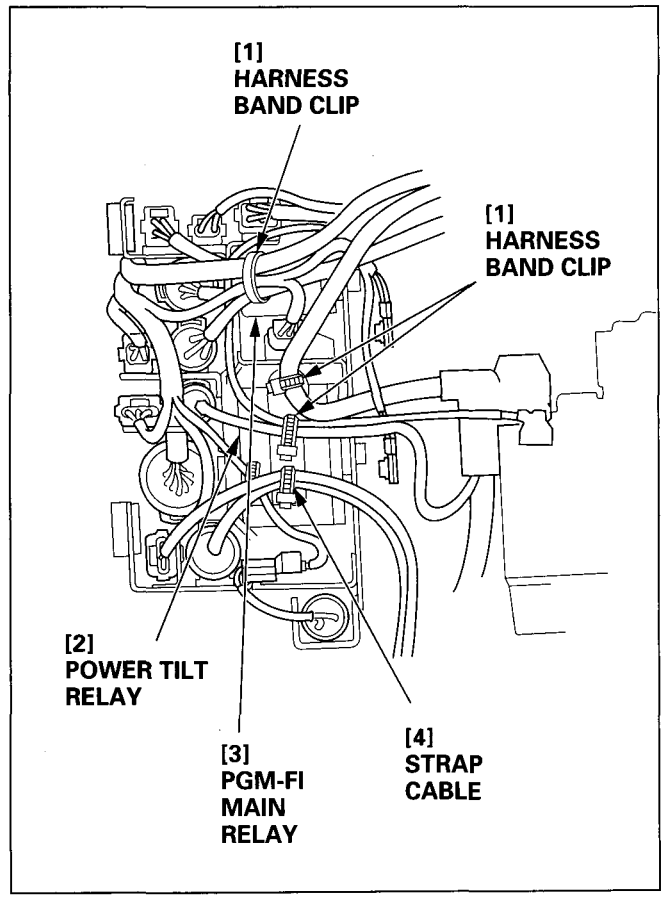
4) Install the power tilt relay ground terminal to the engine with the 6 x 12 mm ground bolt.

5) Connect the power tilt relay 1P, 2P and 3P connectors.

6) Install the connector bracket A to the connector bracket B with the three 6 x 10 mm flange bolts (P. 17-24).



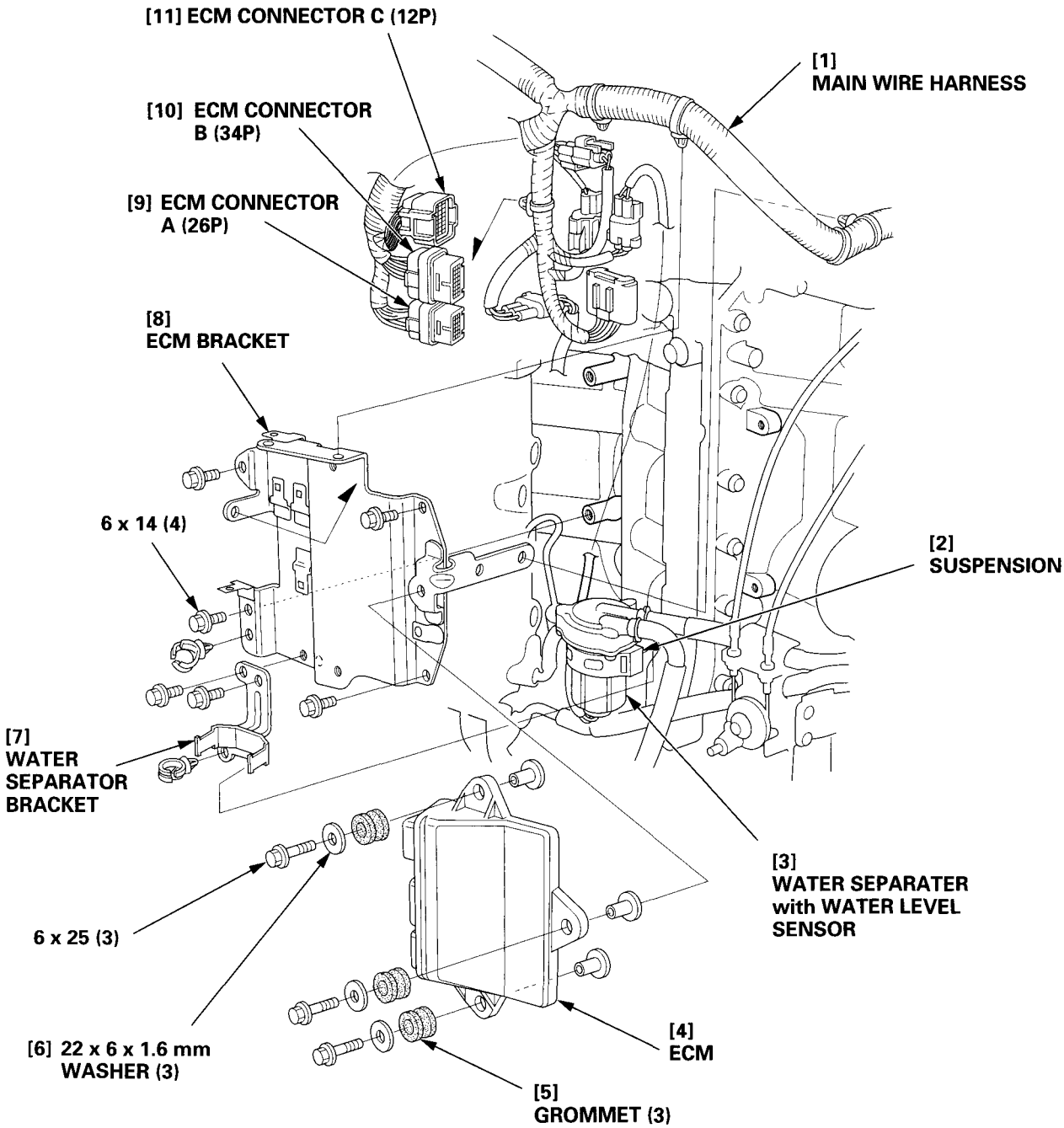
7) Connect the each connector to the connector brackets and clamp or tie up the wire harnesses with the harness band clips and strap cables.



3. ECM

REMOVAL:

1) Disconnect the battery negative (–) terminal, then positive (+) terminal from the battery.
2) Remove the engine cover (P. 4-1).
3) Remove the water separater (P.3-12).
4) Disconnect the 26P, 34P and 12P connectors from the ECM.
5) Remove the three 6 x 25 mm flange bolts and the ECM.
6) Remove the four 6 x 14 mm flange bolts and the ECM bracket.



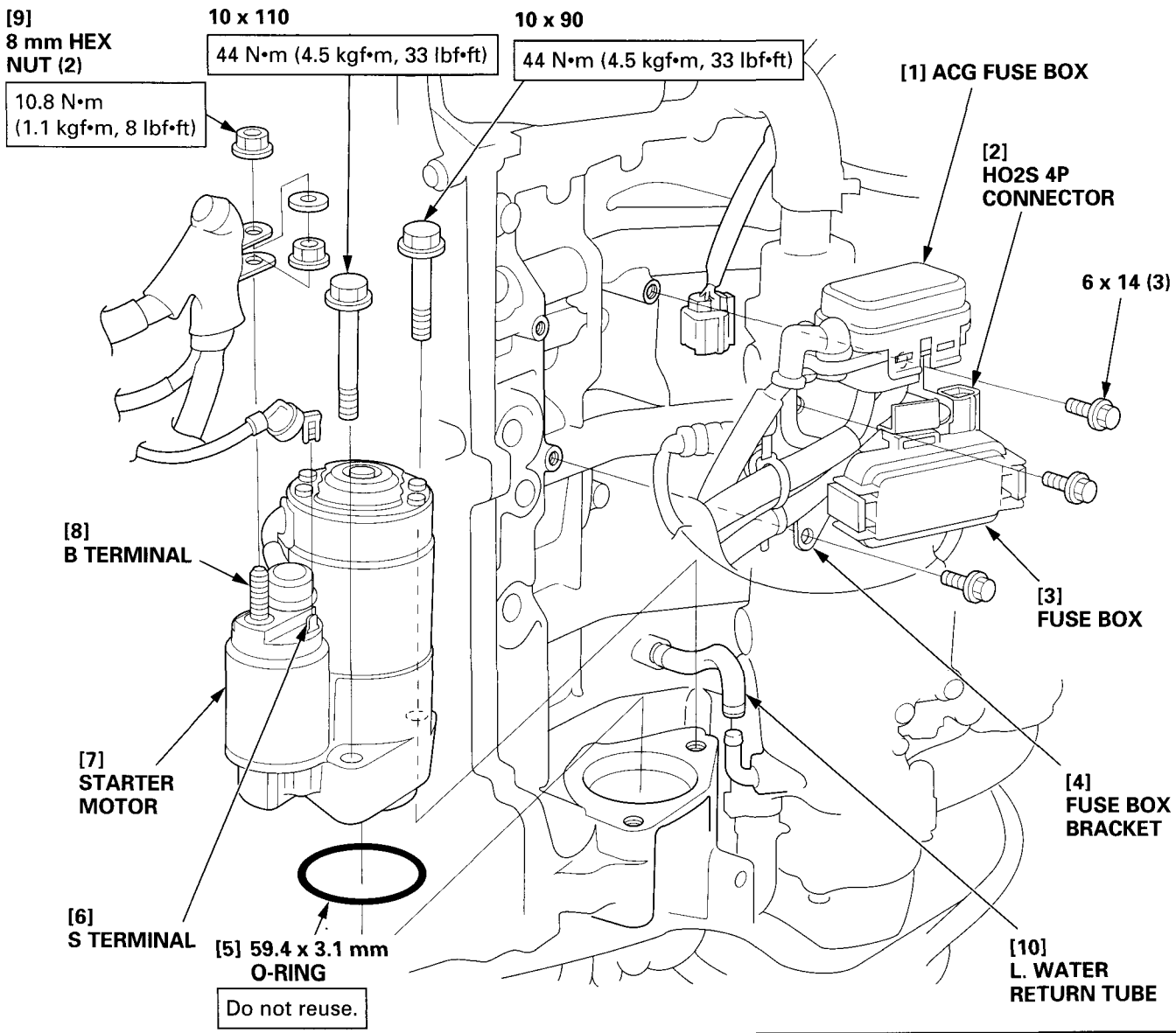
4. STARTER MOTOR

REMOVAL:

1) Disconnect the battery negative (–) terminal, then positive terminal from the battery.
2) Remove the engine cover (P. 4-1).
3) Disconnect the HO2S 4P connector.
4) Remove the three 6 x 14 mm flange bolts and the fuse box bracket with ACG fuse box and fuse box together.
5) Disconnect the starter motor S terminal.
6) Remove the 8 mm hex nuts and washer and starter cable from the starter B terminal.
7) Disconnect the L. water return tube from the left exhaust manifold.
8) Remove the 10 x 90 mm and 10 x 110 mm flange bolts and the starter motor.

NOTICE

Take care not to damage the L. water return tube.

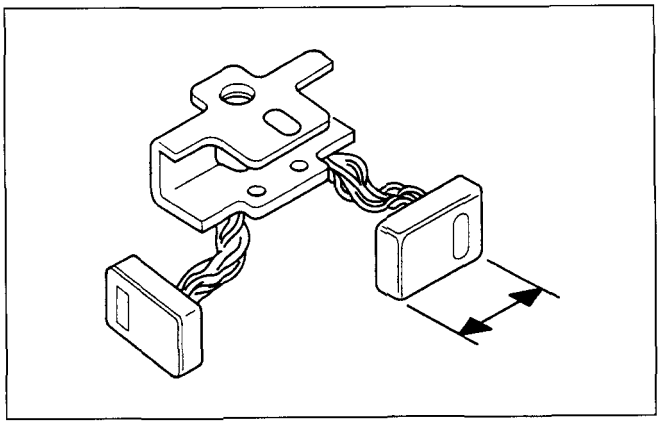


b. INSPECTION

• BRUSH LENGTH

Measure the brush length. If brush length is less than the service limit, replace the brushes as a set.

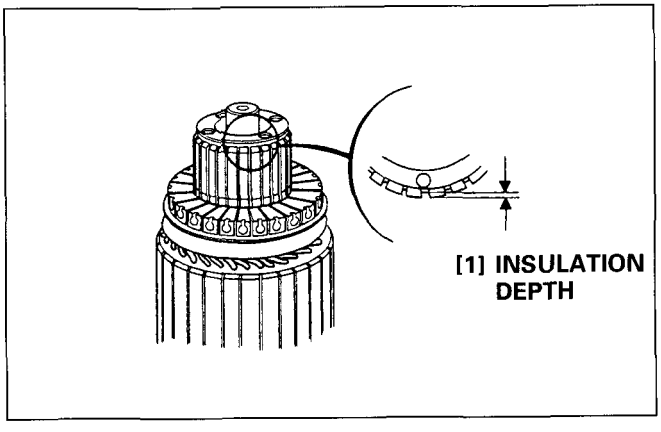
STANDARD	SERVICE LIMIT
12.3 mm (0.48 in)	7.0 mm (0.28 in)



• INSULATION DEPTH

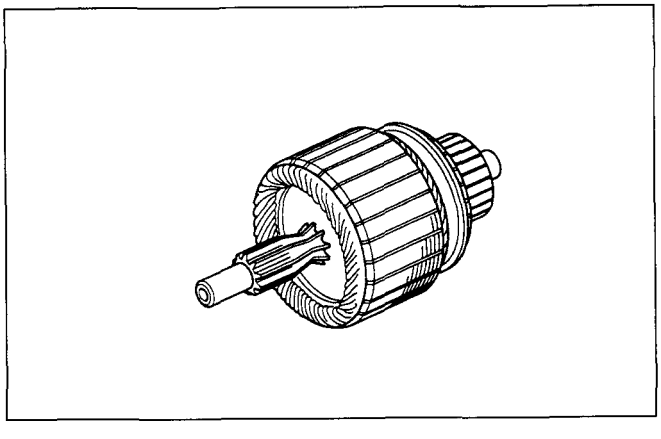
If the grooves are clogged or insulation depth is less than the service limit, recut the grooves using a hacksaw blade or a small file.

STANDARD	SERVICE LIMIT
0.4 – 0.5 mm (0.016 – 0.020 in)	0.2 mm (0.008 in)



• ARMATURE

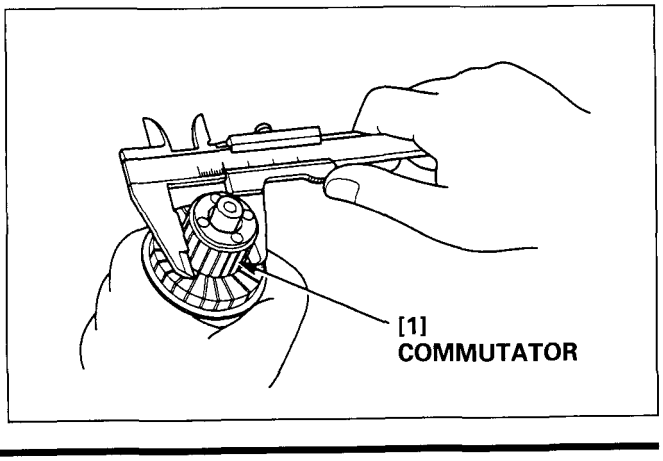
Check the armature and shaft gear for wear and damage.



• COMMUTATOR O.D.

Measure the commutator O.D. If the measurement is less than the service limit, replace the armature with a new one.

STANDARD	SERVICE LIMIT
29.4 mm (1.16 in)	28.8 mm (1.13 in)

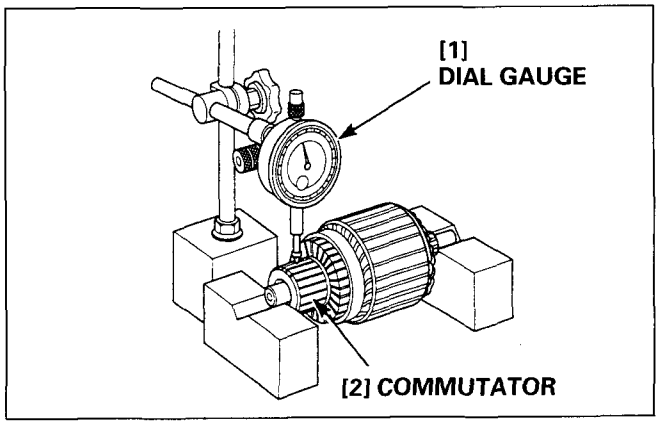


• COMMUTATOR RUNOUT

Measure commutator runout using a dial gauge.

If the measurement is more than the service limit, replace the armature with a new one.

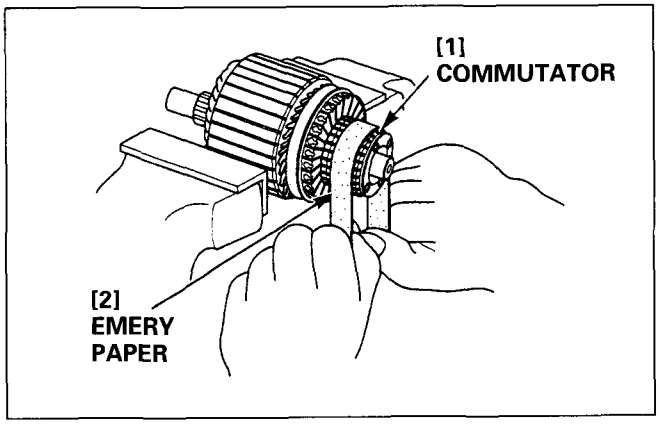
SERVICE LIMIT	0.1 mm (0.004 in)



• COMMUTATOR CLEANING

Check the commutator for damage, dust, dirt and metal particles.

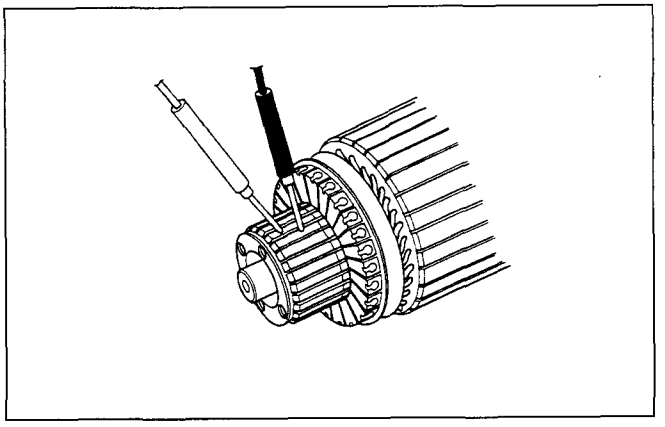
If there is stain, irregularity and/or evidence of burning, clean with an emery paper #500 or #600.



• ARMATURE

CONTINUITY CHECK - SEGMENTS

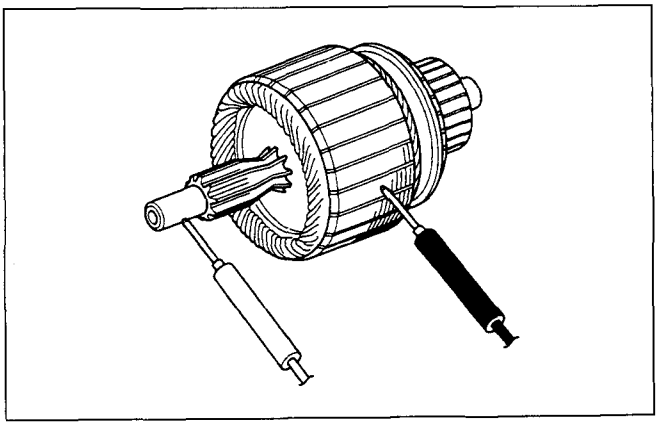
Check for continuity between each segment. If an open circuit exists between any two segments, replace the armature.



SHORT CIRCUIT TEST – SHAFT - TO - ARMATURE

Check for continuity between the armature and armature shaft.

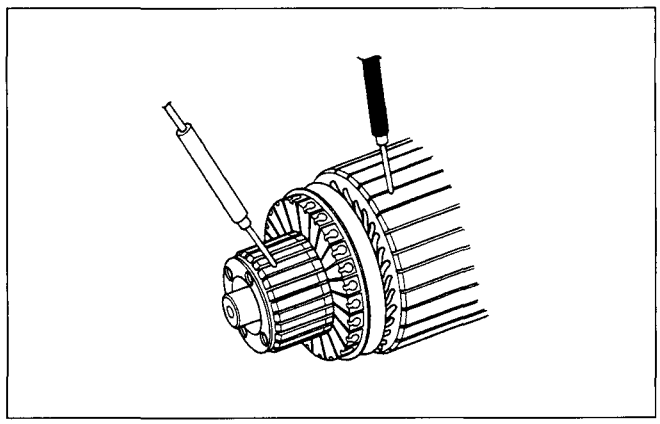
If there is continuity, replace the armature.



SHORT CIRCUIT TEST – CORE - TO - COMMUTATOR

Check for continuity between the commutator and armature coil core.

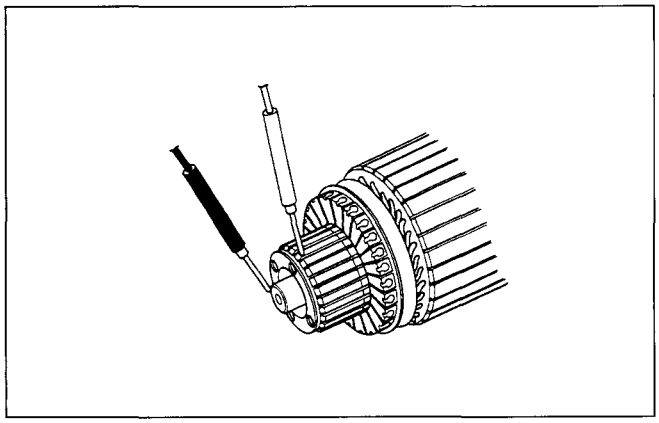
If continuity exists, replace the armature.



SHORT CIRCUIT TEST – SHAFT - TO - COMMUTATOR

Check for continuity between the commutator and armature shaft.

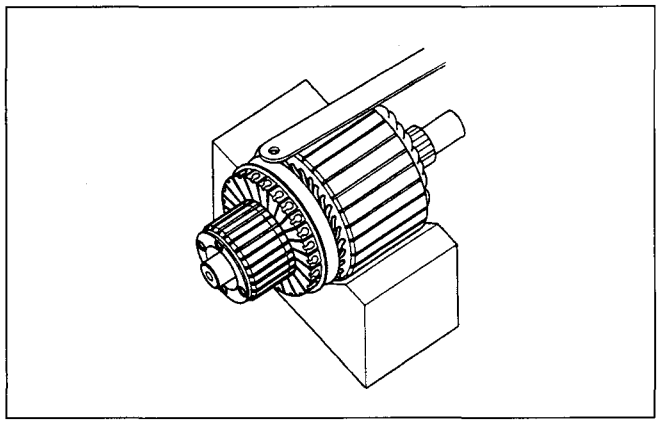
If there is continuity, replace the armature.



SHORT CIRCUIT TEST – ARMATURE

Place the armature in an armature tester (commercially available).

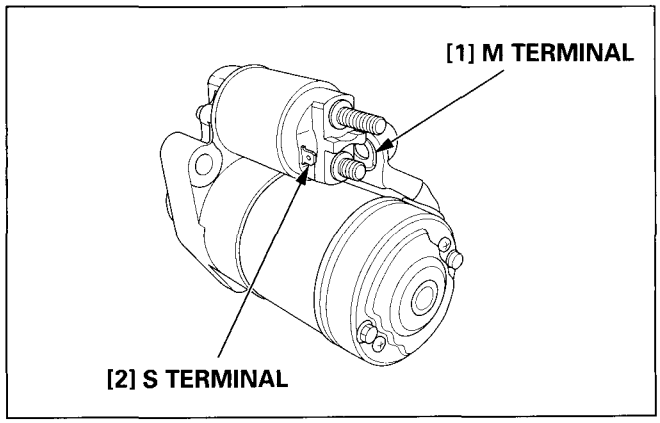
Hold a hacksaw blade close to the armature core. if the blade is attracted to the core or vibrates when the core is turned, the armature is shorted. Replace the armature.



• STARTER SOLENOID

Check for continuity between the S terminal and yoke (ground) as shown. There should be continuity.

Check whether there is continuity between the S terminal and M terminal as well.

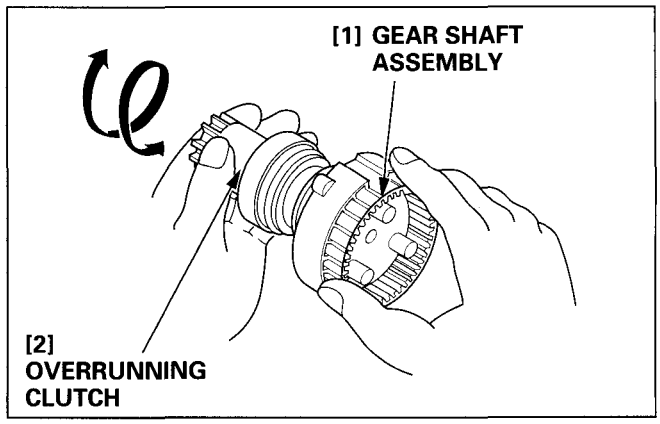


• OVERRUNNING CLUTCH

1) Check the overrunning clutch for smooth axial movement.

   Clean or apply grease to the spline, if necessary.

   If the overrunning clutch does not move smoothly after cleaning or coated with grease, replace the overrunning clutch or the gear shaft assembly.

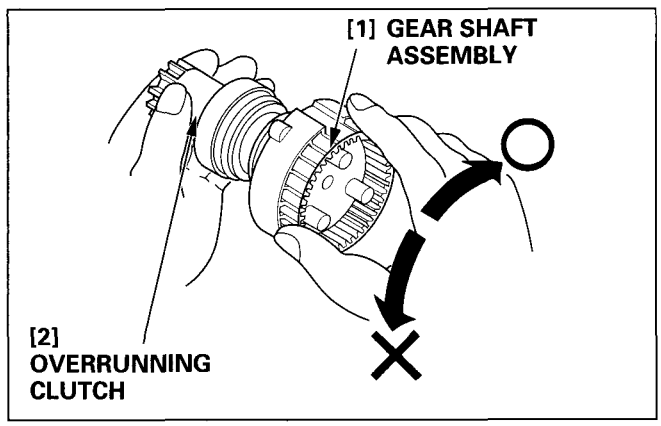


2) Turn the gear shaft assembly by holding the overrunning clutch. The gear shaft assembly should turn only clockwise.

   If the clutch turns freely in both directions or if it does not turn at all, replace the overrunning clutch.

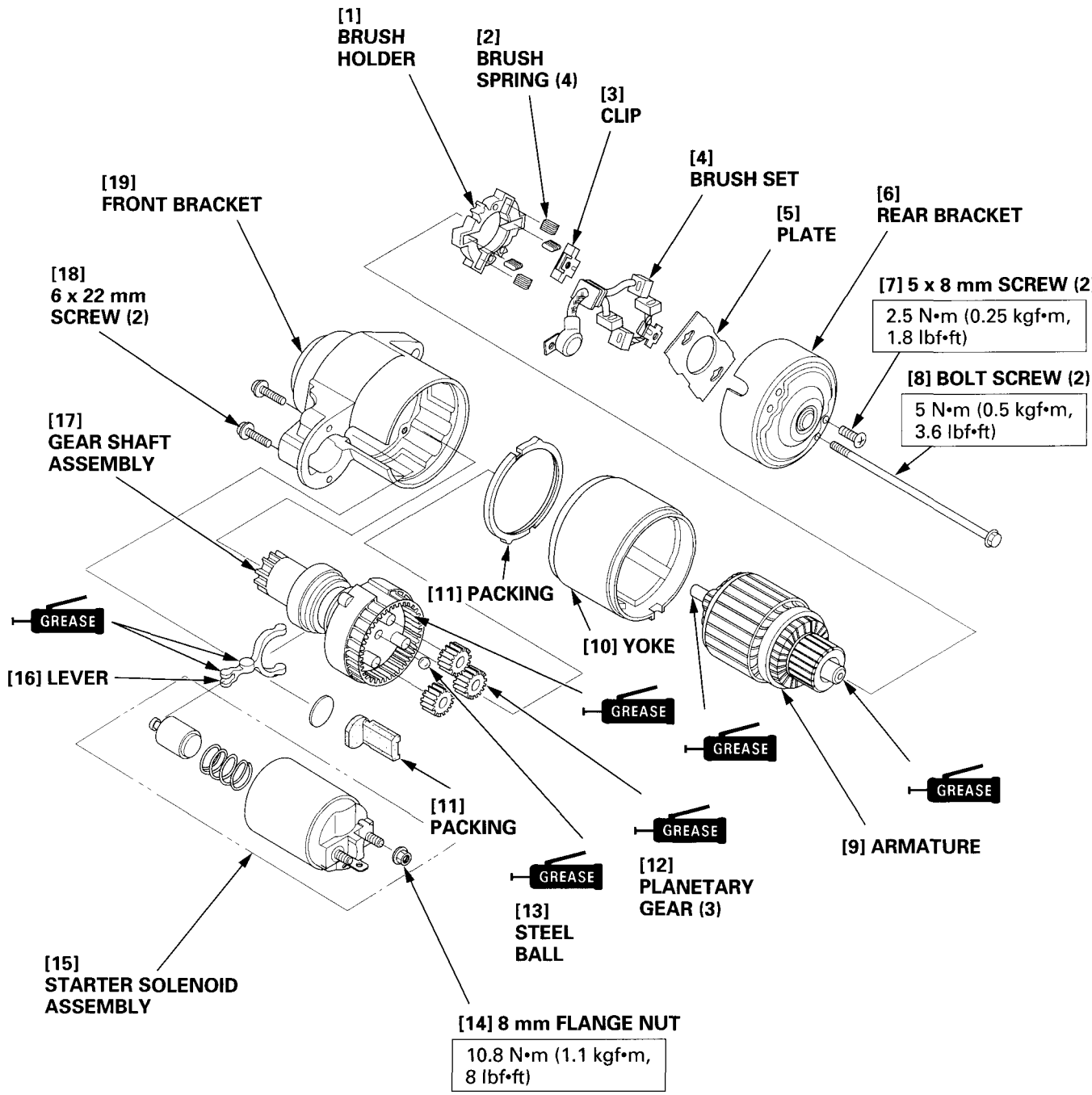
3) Check the pinion gear teeth for wear and damage and replace if necessary.

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



c. EXPLODED VIEW

- After assembling the starter motor, apply waterproof sealing agent (Sumitomo 3M padding sealer No. 8533 or equivalent) to the mating surface of each part (P. 17-16).



d. FRONT BRACKET/YOKE/BRUSH HOLDER

ASSEMBLY:

1) Install the armature in the yoke.

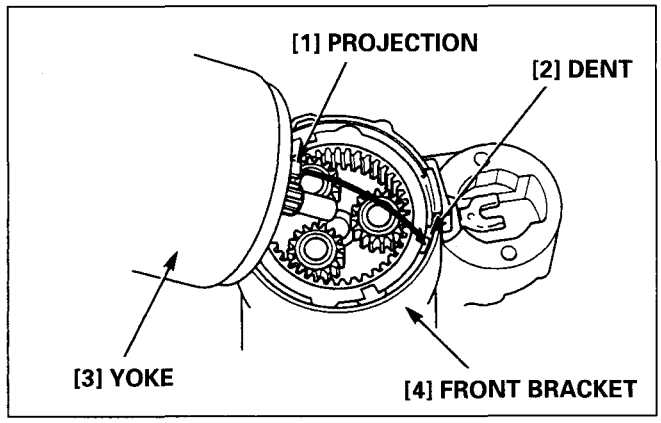
2) Assemble the yoke and front bracket by aligning the projections on the yoke with the dents in the front bracket.

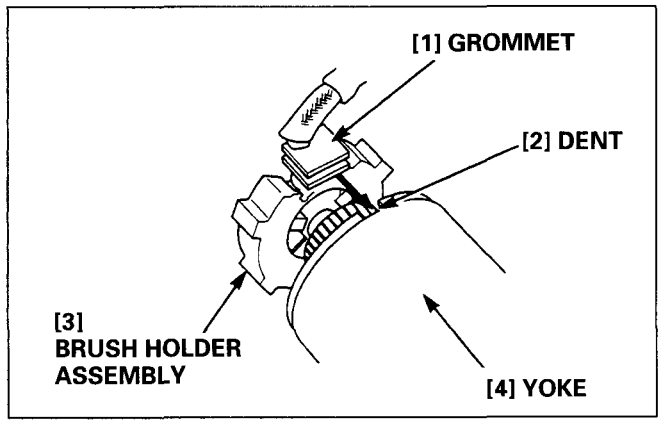
3) Assemble the brush set and spring plate with the brush holder, and secure with the clips.

4) Assemble the brush holder assembly with the armature's commutator by aligning the grommets on the brush holder assembly with the dents in the yoke.

5) Install the rear bracket, and tighten the two 5 x 8 mm screws and the two bolt - screws to the specified torque.

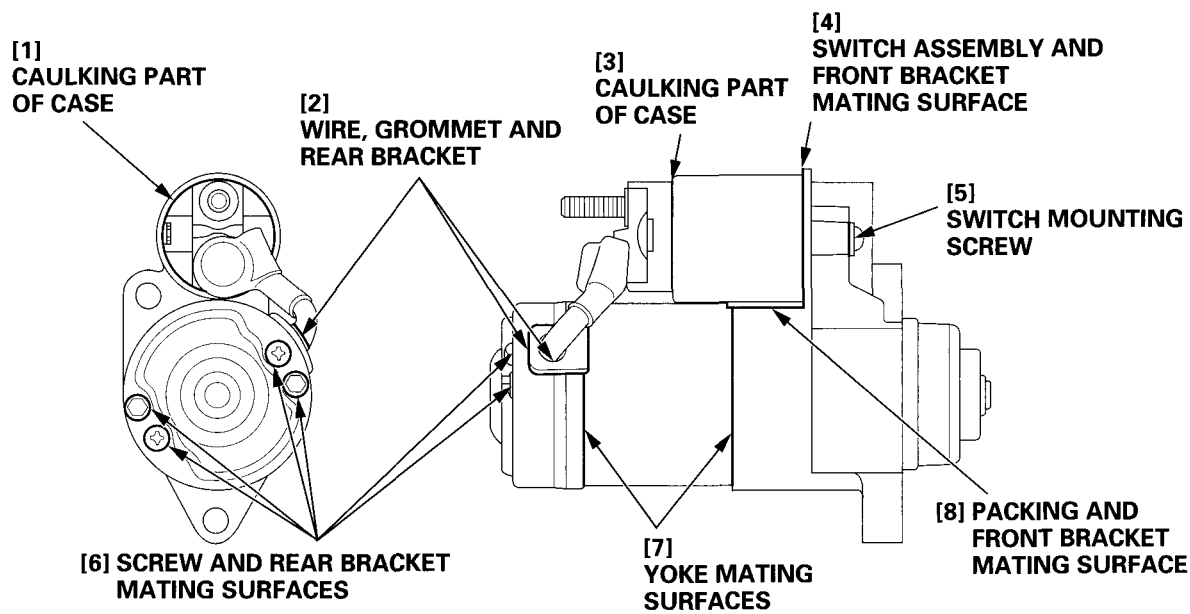
TORQUE:
Bolt screw: 5 N•m (0.5 kgf•m, 3.6 lbf•ft)
5 x 8 mm screw: 2.5 N•m (0.25 kgf•m, 1.8 lbf•ft)





e. WATER-RESISTING SEALANT APPLICATION POINTS

After assembling the starter motor, apply a sufficient amount of water-resisting sealant (Sumitomo 3M Padding Sealer 8533 or equivalent) to the mating surfaces shown below.



f. INSTALLATION:

1) Install a new 59.4 x 3.1 mm O-ring to the starter motor.

2) Install the starter motor with the 10 x 90 mm flange bolt and the 10 x 110 mm flange bolt to specified torque.

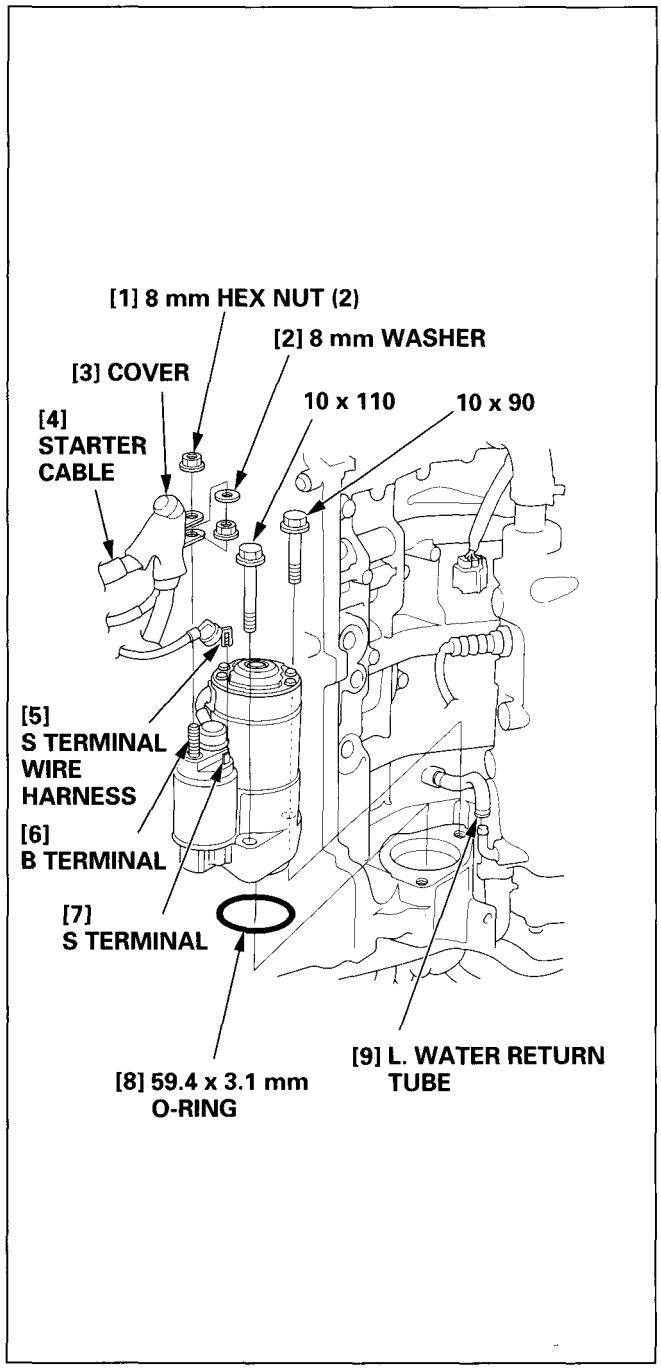
   10 x 90 mm flange bolt,
   10 x 110 mm flange bolt:
   TORQUE: 44 N•m (4.5 kgf•m, 33 lbf•ft)

3) Connect the starter cable to the starter motor B terminal with the 8 mm hex nut to specified torque.

   TORQUE: 10.8 N•m (1,1 kgf•m, 8 lbf•ft)

4) Connect the starter cable S terminal wire harness to the starter motor S terminal.

5) After connecting the cable and wire harness, set the covers over the terminal securely, then connect the L. water return tube securely.



5. ACG FUSE BOX/FUSE BOX

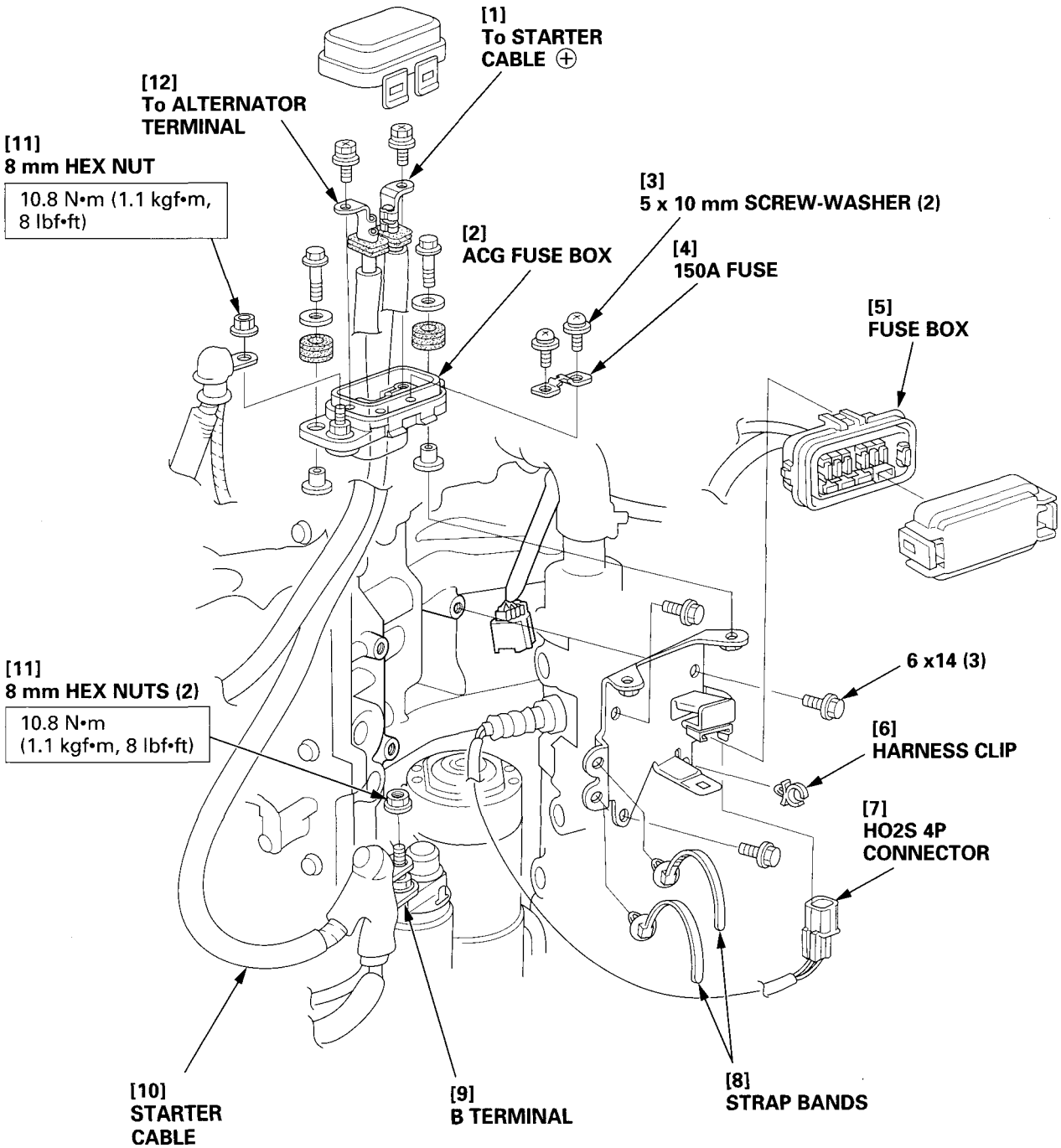
REMOVAL:

1) Disconnect the battery negative (–) terminal, then positive (+) terminal from the battery.

2) Remove the engine cover (P. 4-1).

3) Disconnect the 4P connector from the HO2S.

4) Remove the 8 mm hex nuts and the starter cables from the starter motor B terminal.



b. INSPECTION:

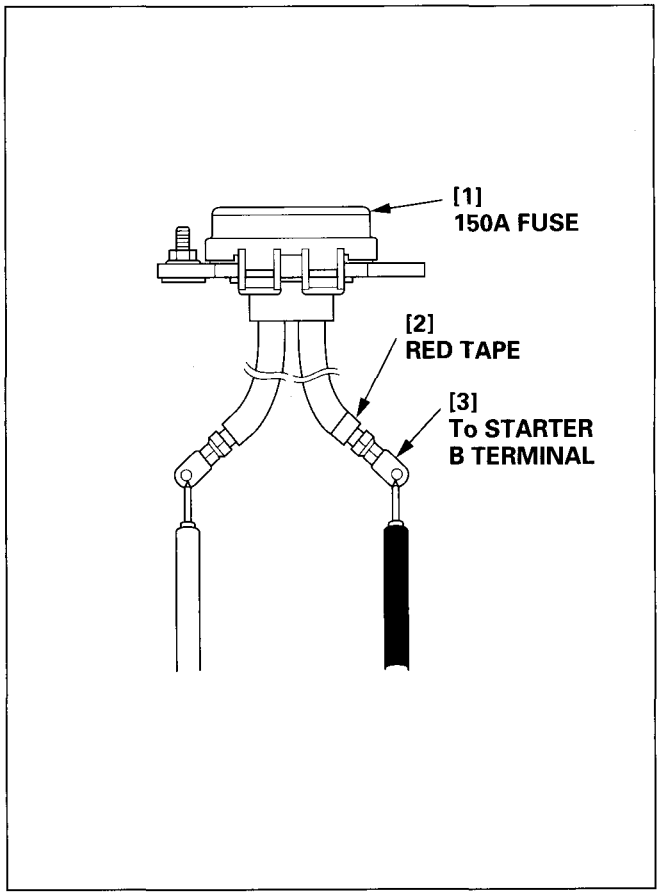
- Disconnect the battery negative (–) terminal, then positive (+) terminal from the battery.

<ACG FUSE BOX>

1) Check the 150A fuse.
   - If the fuse is faulty, replace it.
   - If the fuse is OK, go to step 2.

2) Install the 150A fuse in the ACG fuse box so that you can see the stamped side.

3) Check for continuity between the ACG fuse box cables. There should be continuity. If there is no continuity, replace the cables.



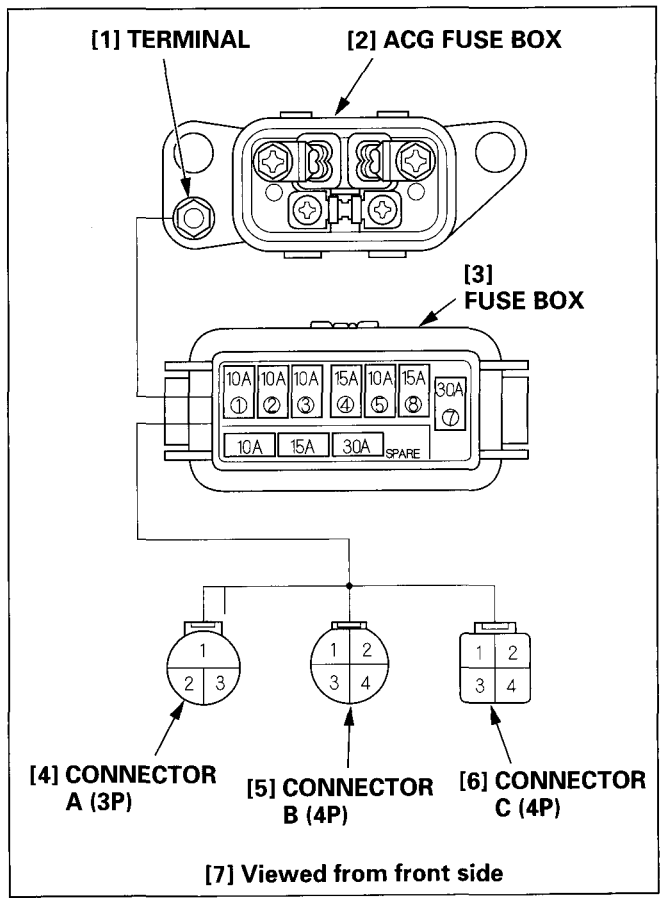
<FUSE BOX/FUSE INSPECTION>

1) Check the each fuse continuity before fuse box check. If there is any blown fuse, replace the fuse. If the fuses are OK, go to step 2.

2) Install the all fuses in the fuse box.

3) Check for continuity between the terminals according to the table.

FUSE No.	TEST TERMINALS
1	Between the C connector No. 1 and No. 4 terminals.
2	Between the C connector No. 3 and ACG fuse box terminal.
3	Between the C connector No. 2 and ACG fuse box terminal.
4	Between the A connector No. 3 terminal and B connector No. 4 terminal.
5	Between the A connector No. 2 terminal and B connector No. 1 terminal.
6	Between the A connector No. 1 terminal and B connector No. 2 terminal.
7	Between the B connector No. 3 and ACG fuse box terminal.

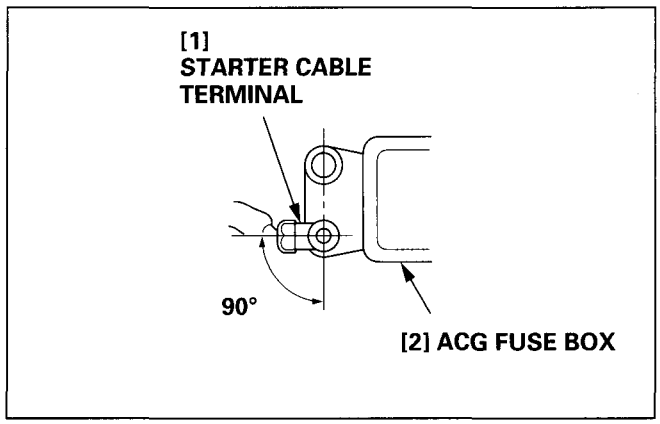


INSTALLATION:

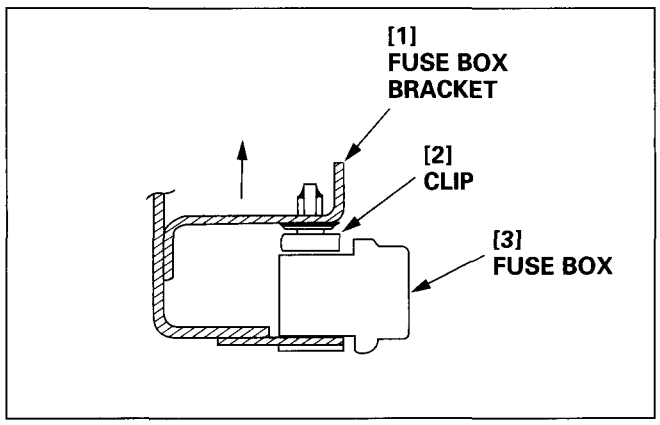
1) Install the ACG fuse cable terminal to the ACG fuse box as shown.

2) Tighten the ACG fuse cable terminal with the 8 mm hex nut to specified torque.

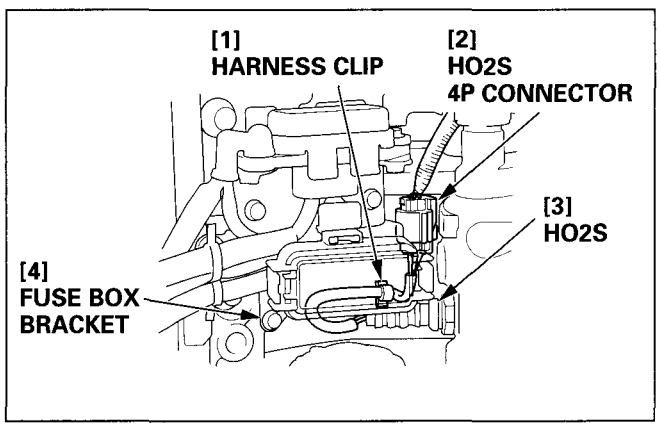
   TORQUE: 10.8 N•m (1.1 kgf•m, 8 lbf•ft)



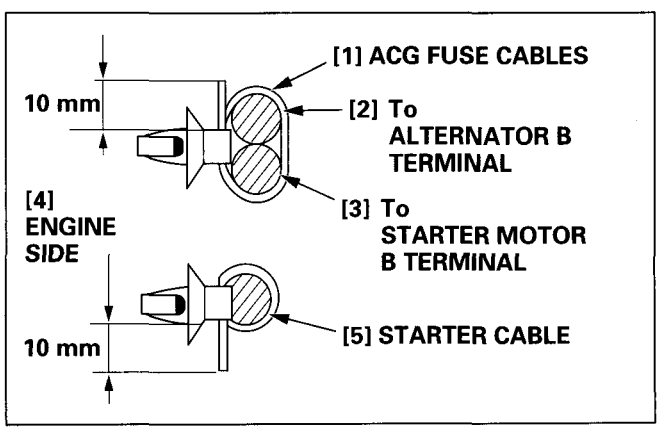
3) Install the fuse box to the fuse box bracket.



4) Connect the HO2S 4P connector and clamp the harness clip of the HO2S sensor wire harness to the fuse box bracket.



5) Tighten the ACG fuse cable and starter cable with the strap cables as shown.



6. SWITCH PANEL AND INDICATOR WIRE HARNESSES

a. REMOVAL:

1) Remove the engine cover (P. 4-1)

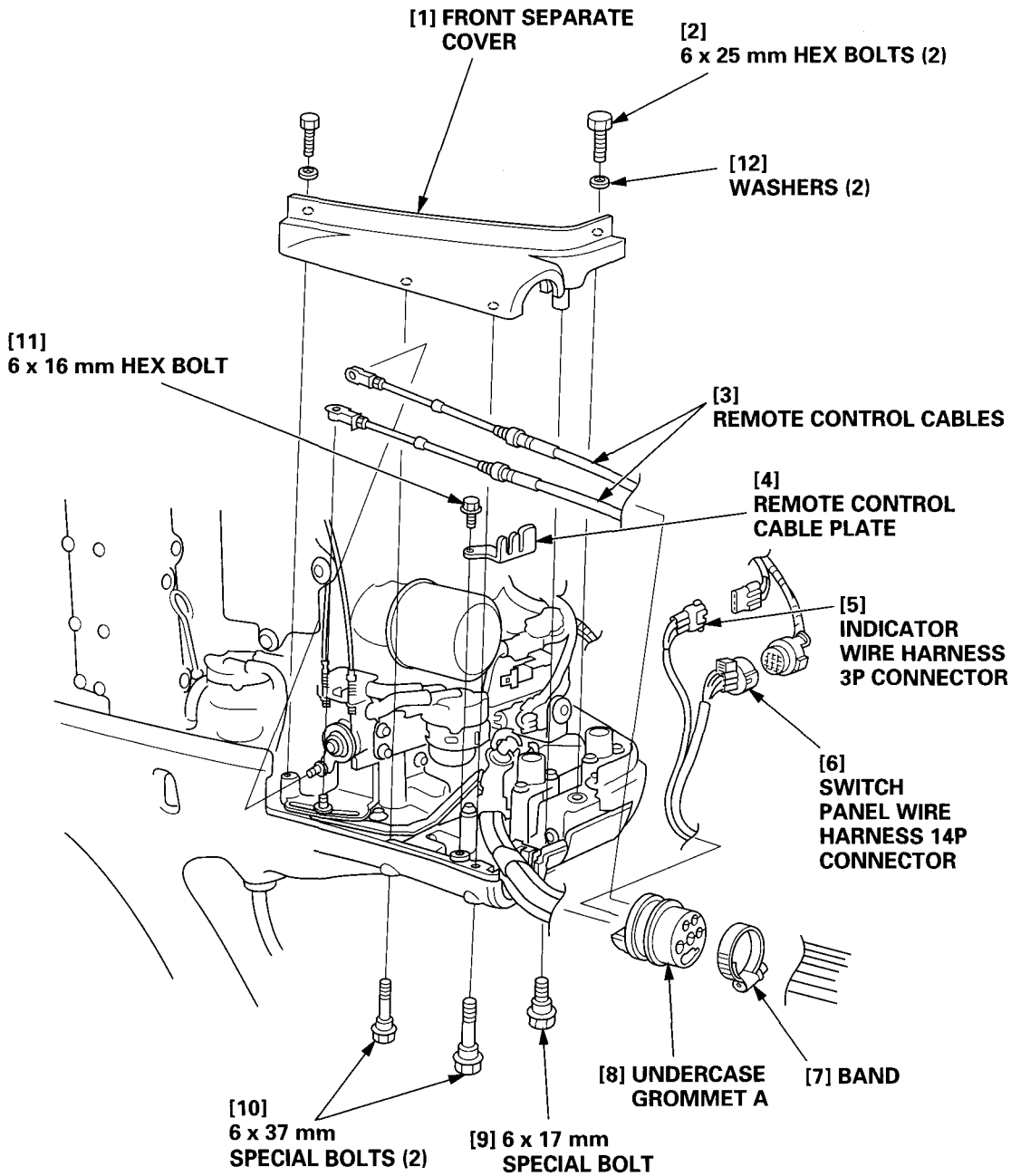
2) Remove the two 6 x 25 mm hex bolts, 6 x 17 mm special bolt and two 6 x 37 mm special bolts, then remove the front separate cover.

3) Remove the shift pivots from the throttle arm and the shift link, then remove the remote control cables.

4) Remove the 6 x 16 mm bolt and the remote control cable plate.

5) Disconnect the switch panel wire harness 14P connector and the indicator wire harness 3P connector.

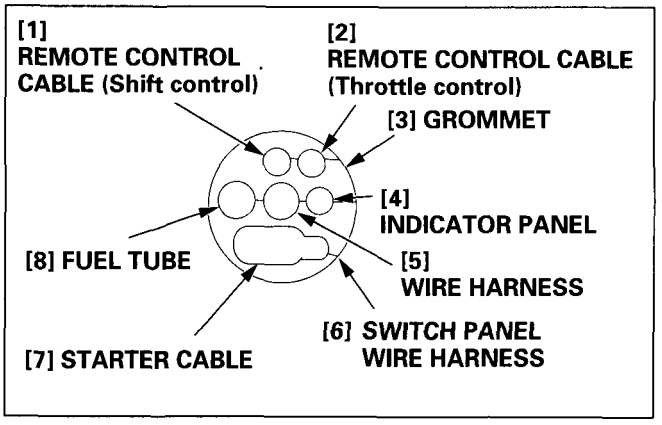
6) Remove the band from the undercase grommet A.

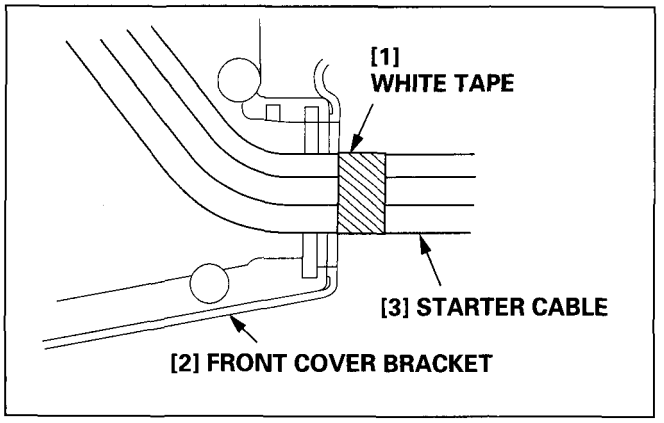


b. INSTALLATION

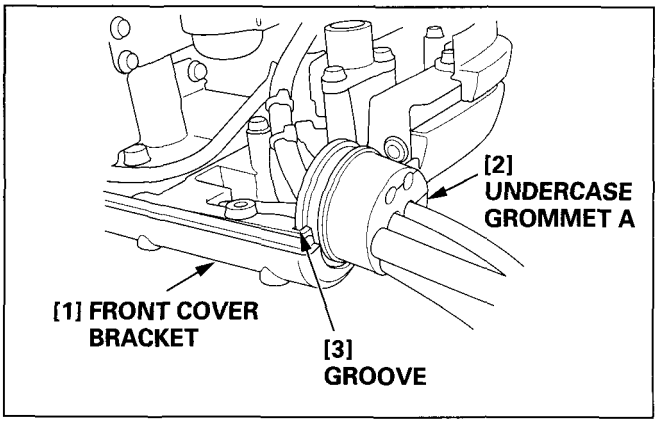
1) Pass the fuel tube, indicator panel wire harness, starter cables, switch panel wire harness through the grommet.

2) Make sure that the white mark on the starter cable aligns with the edge of the front cover bracket.

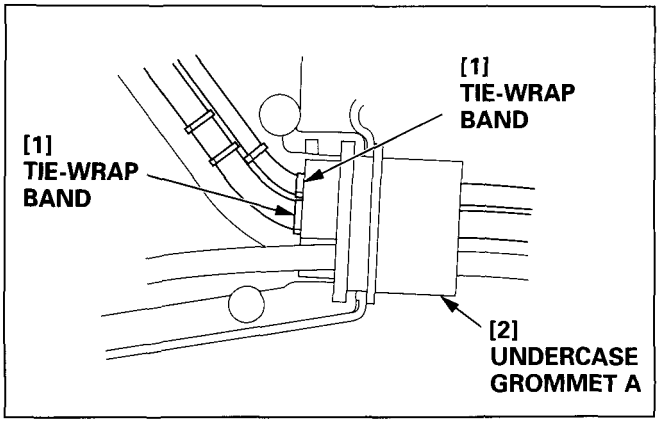




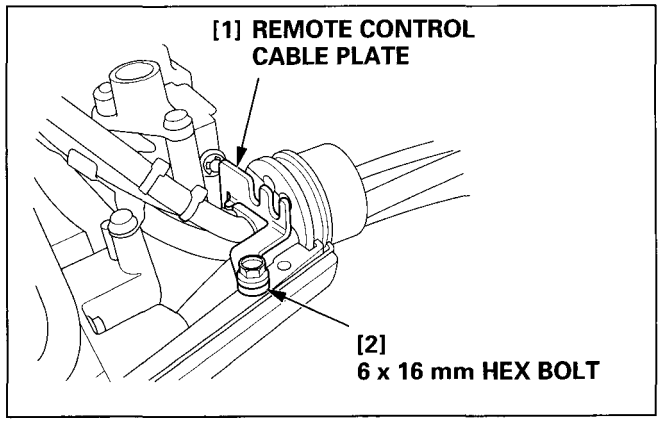
3) Install the undercase grommet A by aligning it with the groove in the front cover bracket.



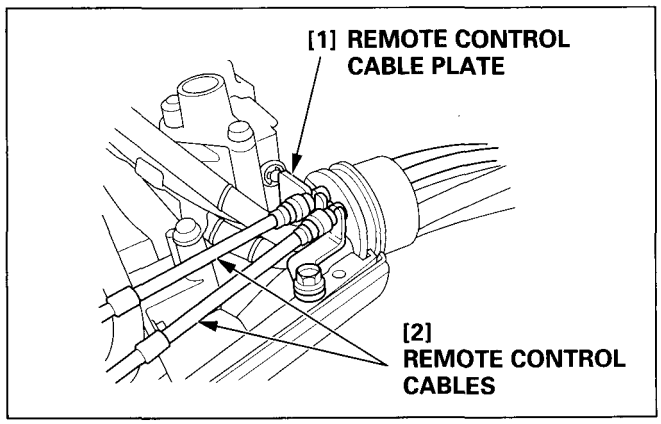
4) Position tie-wrap bands on the switch panel wire harness and indicator wire harness at the inside of the undercase grommet A.



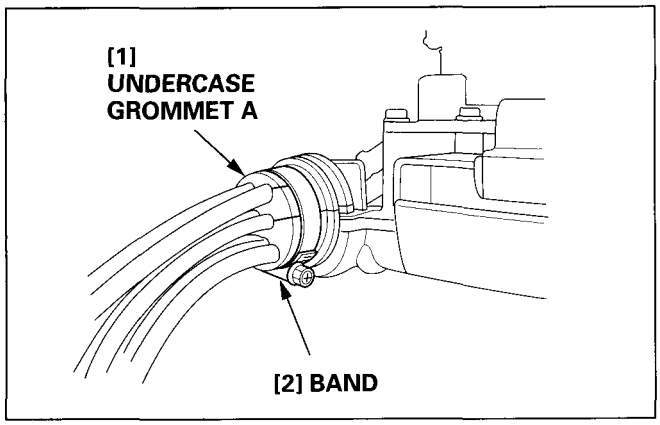
4) Tighten the remote control cable plate with the 6 x 16 mm hex bolt.



5) Install the remote control cable plate by aligning it with the groove in the control cables.

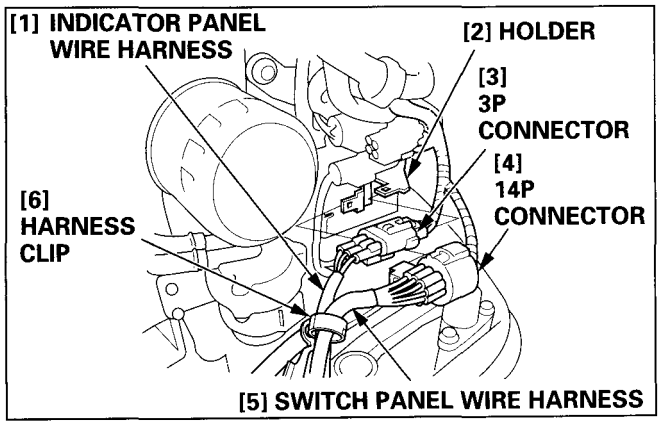


6) Tighten the undercase grommet A by the band securely. Make sure the fuel tube is not pinched with the grommet.



7) Connect the main wire harness 14P connector to the switch panel wire harness connector and the 3P connector to the indicator panal wire harness connector, then attach them to the connectors holder.

8) Clamp the switch panel wire harness and the indicator panel wire harness with a harness clip.

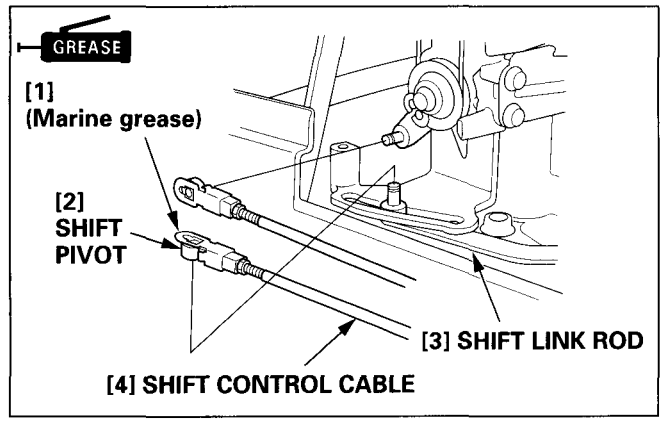


9) Apply marine grease to the joint hole of the shift pivot and shift link.

10) Adjust the shift pivot until it will attach to the shift link.

11) Install the shift pivot to the shift link, then tighten the lock nut securely.

- Shift control cable adjustment (P. 3-21).

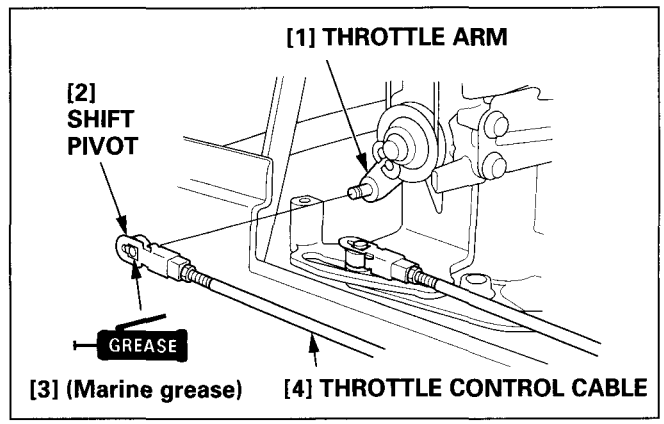


12) Apply marine grease to the joint hole of the shift pivot and throttle arm link.

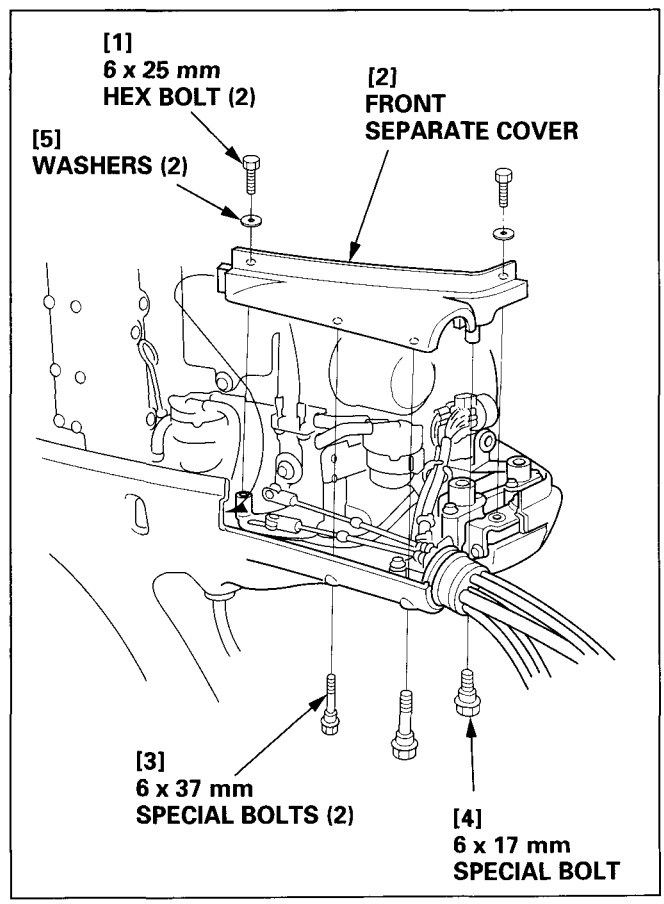
13) Adjust the shift pivot until it will attach to the throttle arm link.

14) Install the shift pivot to the throttle arm link, then tighten the locknut securely.

- Throttle control cable adjustment (P. 3-18).



15) Install the front separate case with the two 6 x 25 mm hex bolts, 6 x 17 mm and two 6 x 37 mm special bolts (P. 4-3).

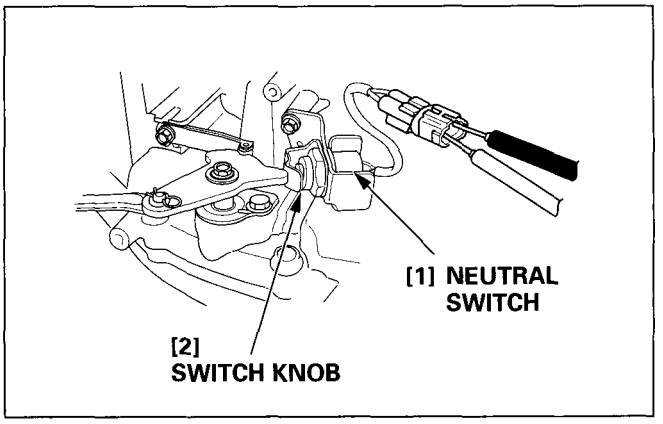


7. INSPECTION

• NEUTRAL SWITCH

Attach the tester leads to the two terminals at the neutral switch and check for continuity. There should be continuity when the switch knob is pushed.

SWITCH PUSHED (Shift lever in "N")	Continuity
SWITCH RELEASED (Shift lever in "F" or "R")	No continuity



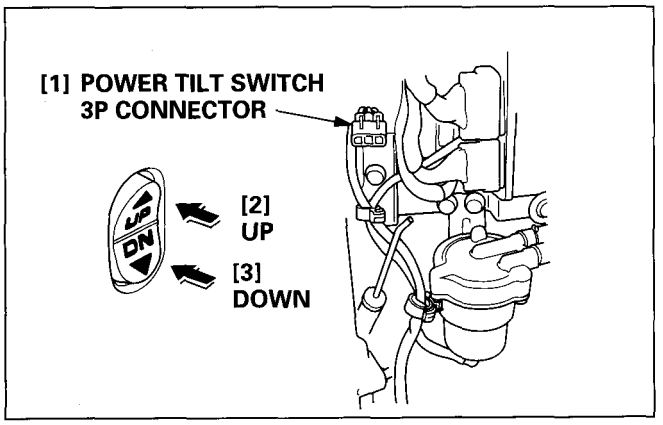
• POWER TILT SWITCH

• POWER TRIM/TILT SWITCH [Side-mount remote control box type only]

Attach the tester lead to each terminal and check for continuity.
When the switch is pushed "UP" or "DN" there should be continuity between the terminals marked with a circle in the table below.

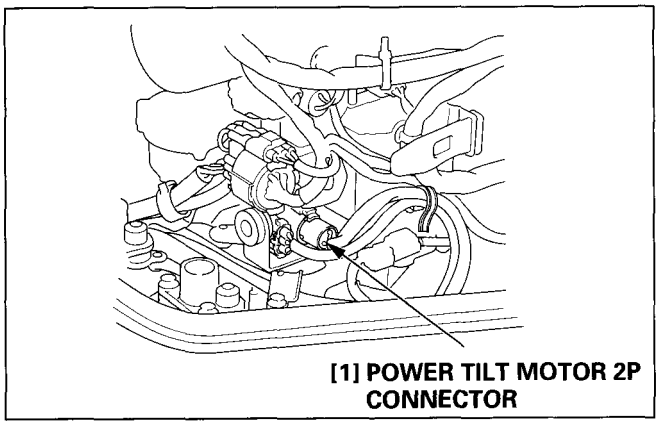
	Lg	W/Bl	Lb
UP	○——	——○	
DOWN		○——	——○

○—○: Continuity



• POWER TILT MOTOR

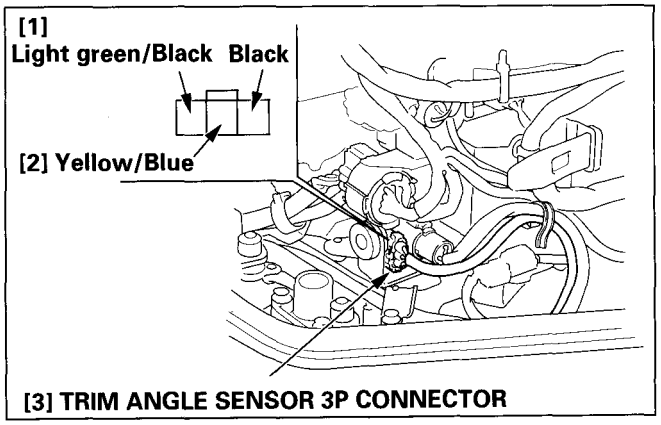
Check for continuity between the terminals.



• TRIM ANGLE SENSOR

Attach the tester leads to the trim angle sensor connectors and measure the resistance.

Resistance between Light green/black and Black	3.8 – 5.8 kΩ
Resistance between Yellow/blue and Black	2.7 – 4.3 kΩ



1. PROGRAMMED FUEL INJECTION SYSTEM (PGM-FI)

General:

The engines used in the BF200A and BF225A use an electronic fuel injection and ignition system called the Programmed Fuel Injection (PGM-FI) system. The system optimizes the fuel injection amount, injection timing, ignition timing, and other factors to match different operating conditions of the engine, thereby achieving the objectives of high output, low fuel consumption and low emission.

The nucleus of the system is the ECM. The ECM receives the operating condition of the engine and other types of information from various sensors and switches, processes the information and outputs signals for optimum control of the multi-point sequential fuel injection system and direct ignition system. The ECM also supports the system self-diagnosis function and the alert/warning system.
The PGM-FI system provides the following controls.

- Basic controls
  Controls the fuel injection system, ignition system and idle air control (IAC) valve according to the basic programs set for startup and operation.

- Correction controls
  To cope with changes in operating condition, the PGM-FI applies correction controls to the basic controls for the fuel injection system, ignition system and IAC valve on the basis of the various types of operational information.

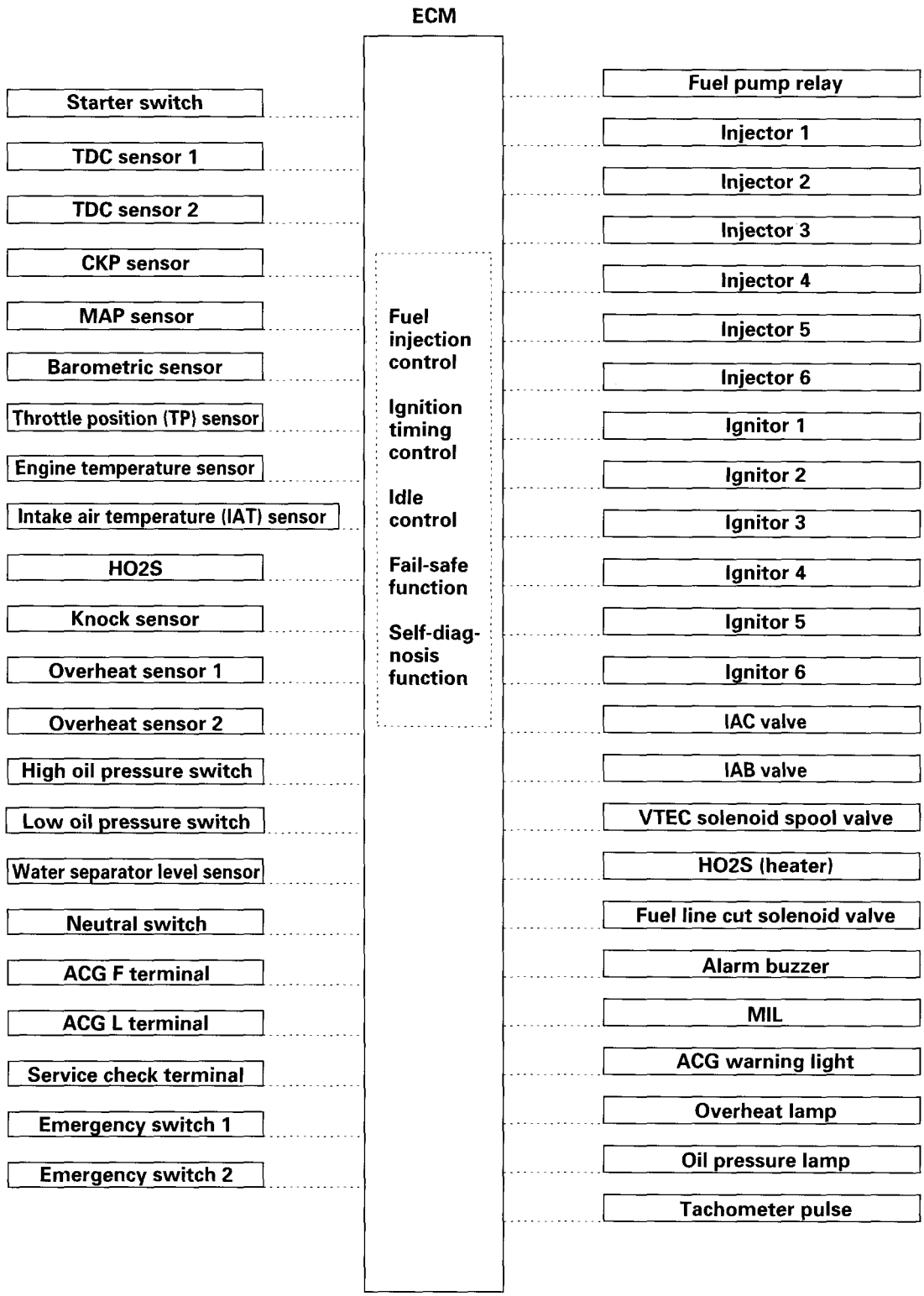
- Device controls
  Controls the VTEC system, variable intake system, fuel line cut solenoid valve, high pressure fuel pump, etc.

- Fail-safe controls
  When a sensor or IAC valve fails, the PGM-FI uses preset values to allow the engine to operate without any problem.

- Alert/warning controls
  Activates the engine oil pressure, overheat, alternator, water level sensor full alarms, and also controls the overrev limiter.

- Self-diagnosis function
  Stores a sensor or IAC valve fault in terms of a diagnostic trouble code (DTC). When the service check connector is short-circuited by the SCS short connector, the malfunction indicator lamp (MIL) is made to flash the number of times associated with the DTC.

System Configuration

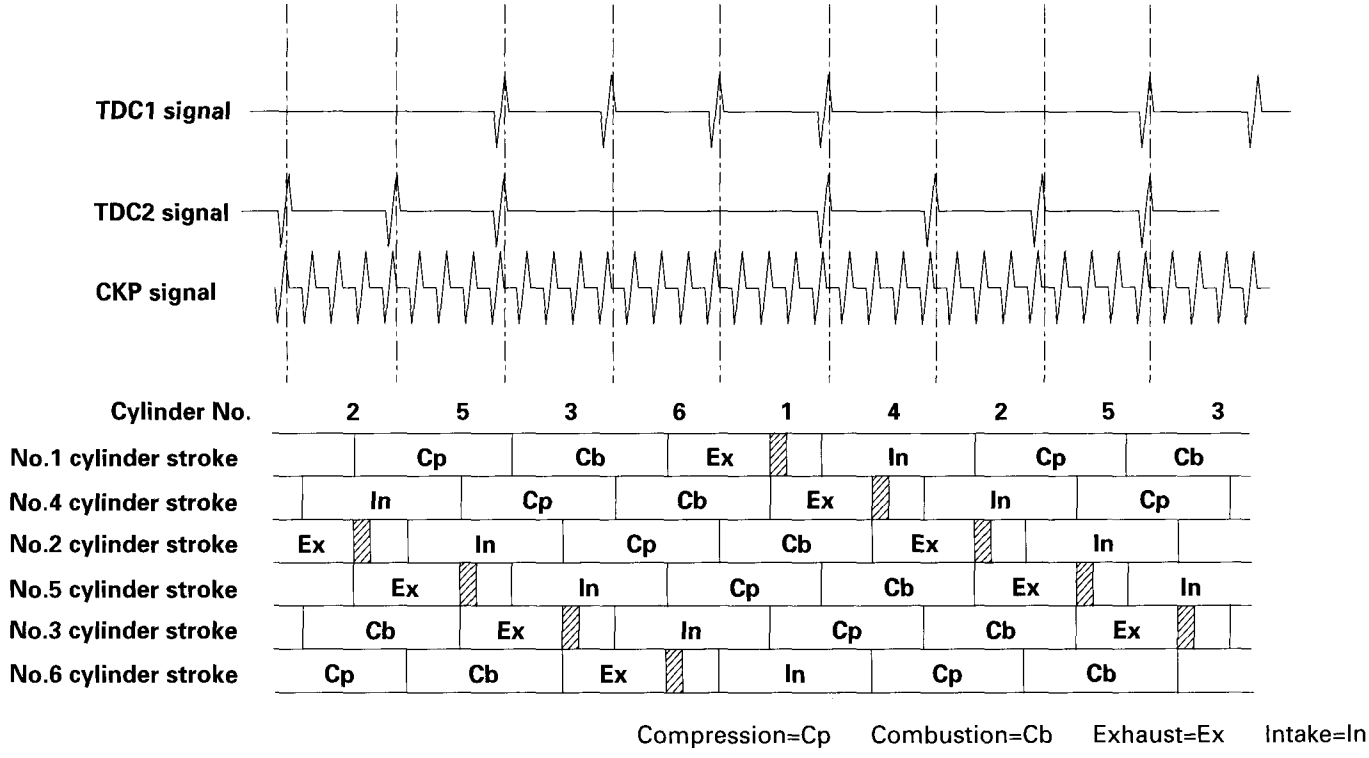


Basic Controls

The ECM controls fuel injection using the control program inside the ECM (basic fuel injection quantity lookup table) and the following signals.

— Cylinder identification signal and engine speed sinal from TDC sensor 1, TDC sensor 2 and CKP sensors to determine in which cylinder and at what timing fuel should be injected.

— Intake manifold vacuum pressure signal from the MAP sensor to determine the fuel injection quantity (injector opening time).



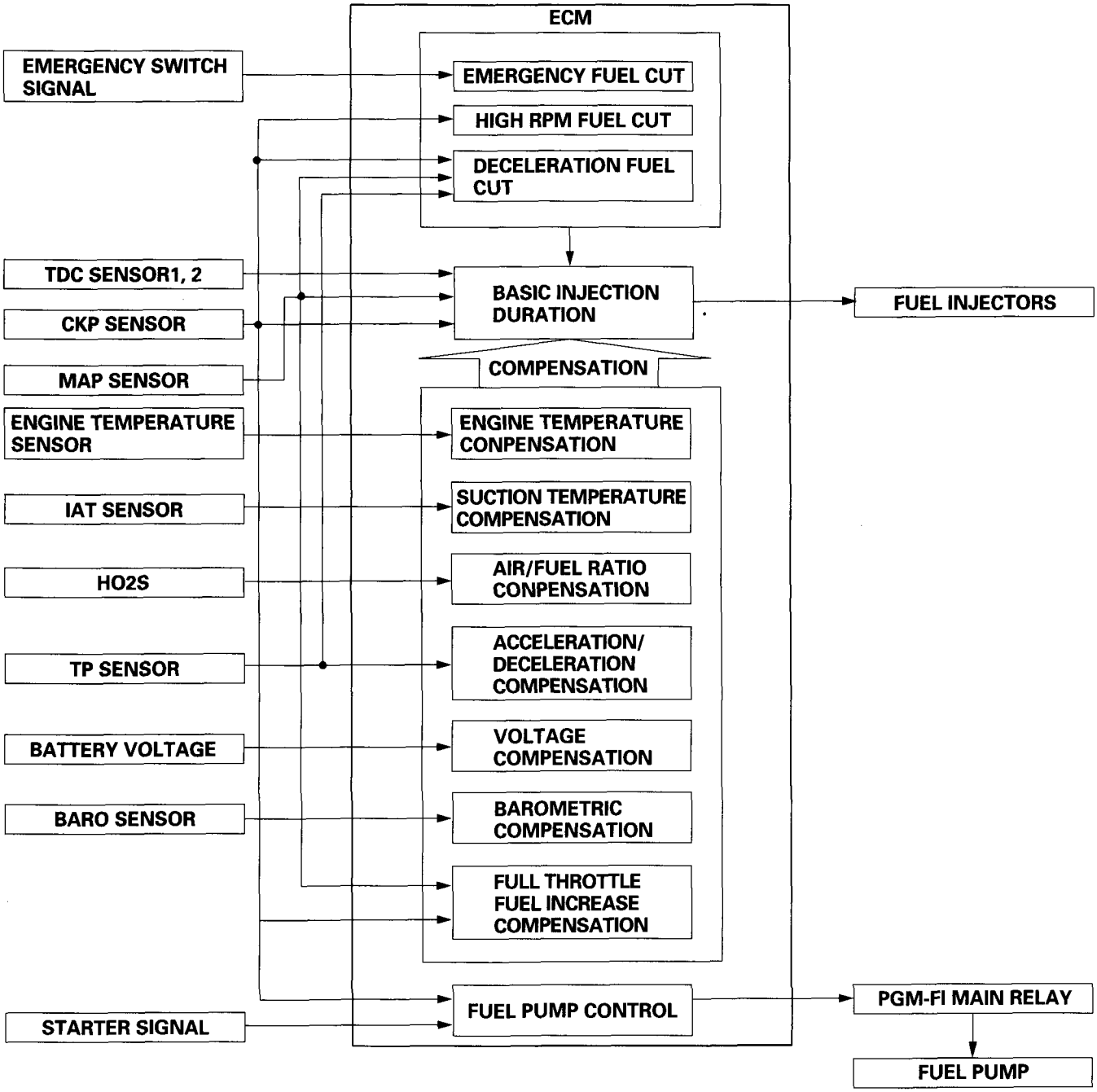
Fuel Injection Control

- For fuel injection control, a speed-density method that determines the fuel injection quantity according to the levels of engine speed and intake manifold negative pressure is used. This method features high responsiveness to changes in operational status and high accuracy.
- In addition to preprogrammed basic controls, the ECM effects correction controls to optimize the fuel injection quantity in accordance with output signals from the engine temperature sensor, intake air temperature sensor, barometric sensor, heated oxygen sensor and other sensors.
- For fuel injection, a multipoint sequential injection system is used. The system works in such a way that the fuel injectors, one provided for each cylinder, spray the fuel in accordance with the respective suction strokes of six cylinders.

Correction Controls

The ECM makes necessary correction to the basic controls to achieve optimum fuel injection control in accordance with the changing engine operating condition using the following signals:

— Intake manifold vacuum pressure signals from MAP sensor to increase the injection quantity when the engine is operating under a high load (when manifold vacuum pressure exceeds a predetermined level).
— Throttle valve opening signal from throttle position sensor to make correction to MAP sensor out put according to acceleration and deceleration of the engine.
— Intake air temperature signal from intake air temperature sensor to modify the quantity of intake air according to the air temperature and adjust the injection fuel quantity accordingly.
— Engine temperature signal from engine temperature sensor to increase the injection fuel quantity according to the intake manifold vacuum pressure when the engine is cold.
— Air-fuel ratio signal from heated oxygen sensor to adjust injection fuel quantity to achieve the stoichiometric air-fuel ratio.
— Battery voltage signal to compensate for delay in injector operation due to drop in battery voltage.



Device Control

The ECM effects controls described below over the following systems. These controls are collectively called device control. Device control is carried out according to output signals from various sensors and switches.

System	Related sensor and switch	Description of control
VTEC	CKP sensor, TDC sensors 1/2, MAP sensor, engine temperature sensor, barometric pressure sensor, neutral switch, oil pressure switch (high pressure side)	Valve timing and switching of valve lift for high/low engine speed are controlled according to engine load, engine speed, vehicle speed and engine temperature data.
Variable air intake system	CKP sensor, TDC sensors 1/2	Butterfly valve is closed for low speed mode when engine speed drops below approximately 3,950 rpm.
Fuel cut solenoid valve	CKP sensor, TDC sensors 1/2, MAP sensor, engine temperature sensor	Fuel cut solenoid valve is control according to engine temperature, speed and load to prevent vapor locking of low pressure fuel pump.
High pressure fuel pump	CKP sensor, TDC sensors 1/2	Operation of high pressure fuel pump is controlled.

Fail-safe Control

The ECM is preloaded with substitute data for emergency use to prevent the loss of engine control to disable the boat due to the failure of any engine control-related sensor or intake air control (IAC) valve. When a sensor fails, the ECM is switched to control the engine using these substitute data so that navigation continues to a minimum extent. This is called fail-safe control.

When a device failure occurs, the beeper and malfunction indicator lamp (MIL) are activated to inform the boat operator of the abnormality.

Self-diagnosis Function

When any engine control-related sensor or IAC valve fails, the ECM detects the failure and writes the corresponding trouble code into the non-volatile storage (EEPROM). This data is not erased even when the ignition switch is turned to OFF or when the battery is disconnected. (The trouble data is erased when the ECM is reset after repair.)

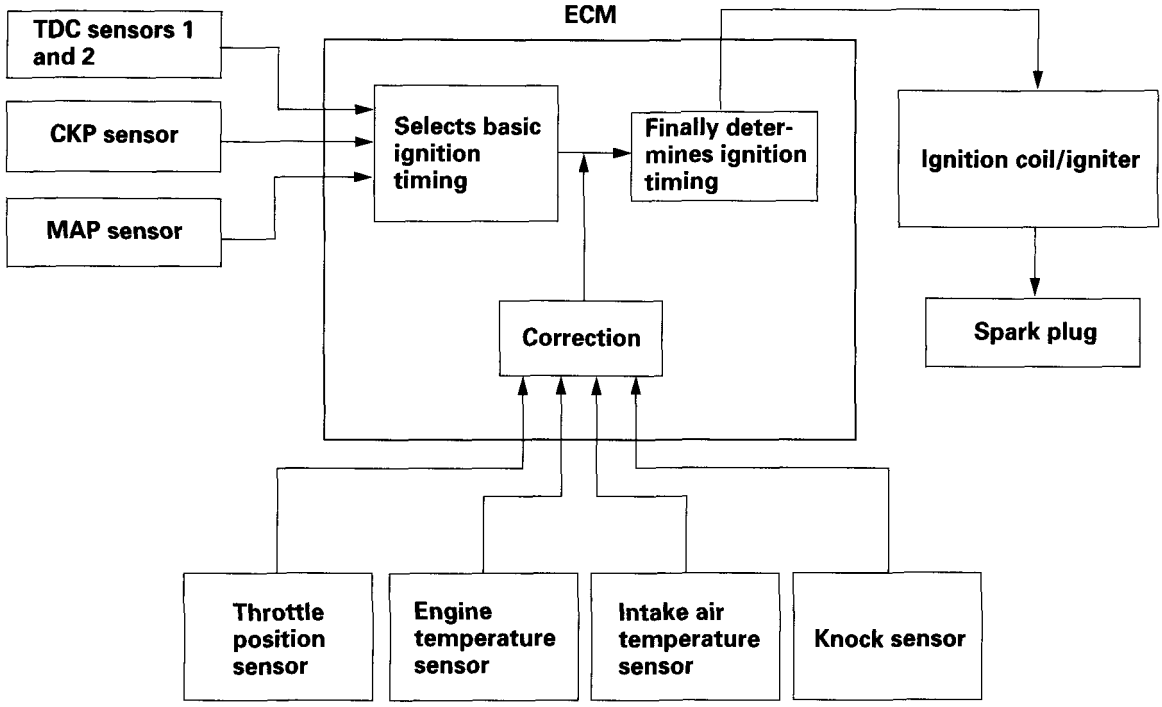
Trouble codes are identified according to the corresponding blinking patterns of the MIL, with the service check connector short circuited.

Ignition Timing Control

The ECM controls the ignition timing to make it best matched to operating conditions of the engine. To determine the ignition timing, the ECM uses primarily the basic ignition timing lookup table that is defined by the engine speed, TDC timing, and intake manifold vacuum pressure and stored in the ECM memory, then it makes correction to the basic ignition timing thus selected in accordance with signals from the engine temperature sensor, intake air temperature sensor, throttle position sensor, knock sensor, etc. to determine the final ignition timing.

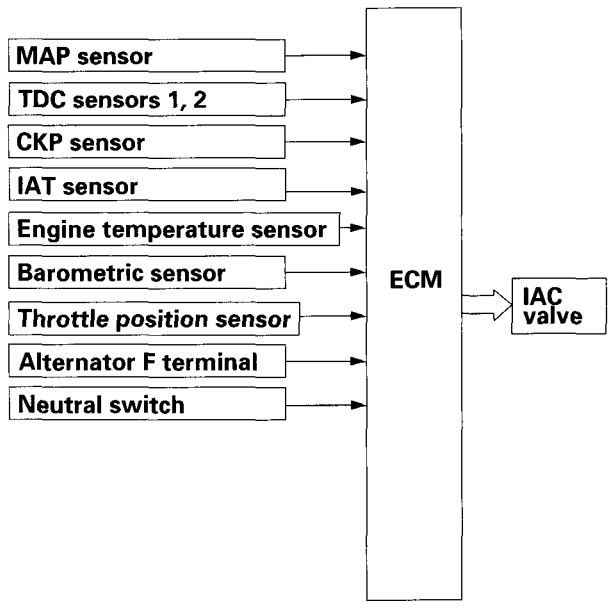
Overrev Limiter System

The overrev limiter system is for protecting the engine against adverse effects of overrevving.
When the engine speed rises over the limit, the ECM makes a control to cut supply of fuel to injectors and supply of current to igniters for all cylinders to prevent the engine speed from rising above the permissible limit.



Idle Control System

The idle control system controls the linear type IAC valve's opening, based on the signals transmitted from each sensor to the ECM, according to the engine condition. The IAC valve adjusts the amount of the bypass air to the intake manifold to maintain the optimum idle speed.



- Idle Air Control (IAC) Valve
  The IAC valve regulates the flow of bypass air to the intake manifold. It keeps the idling speed optimum and prevents instable operation and stall of the engine by increasing the amount of intake air at the engine startup.

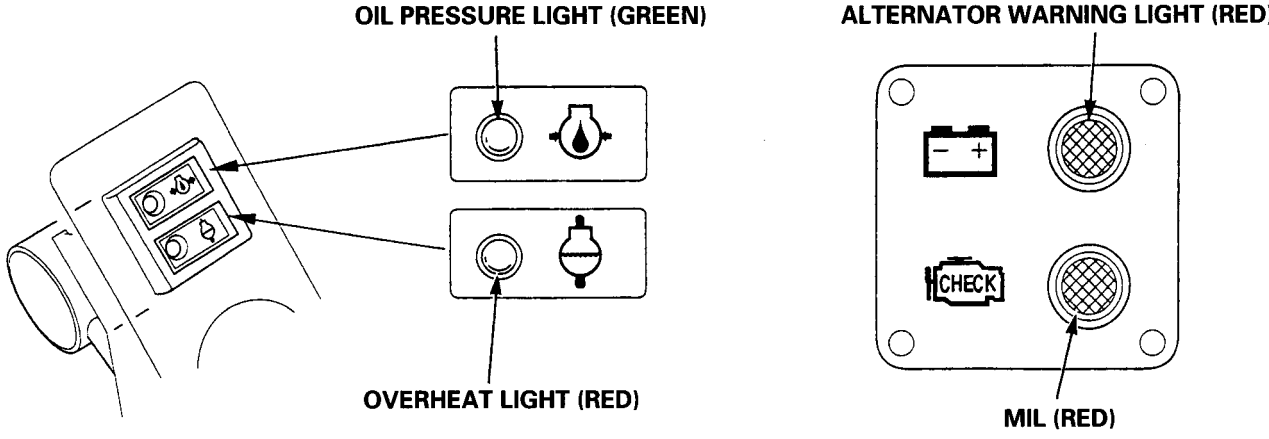
  The ECM effects basic and correction controls on the IAC valve using the signals from the CKP sensor, TDC sensors 1 and 2, barometric sensor, intake air temperature sensor, engine temperature sensor, neutral switch, throttle position sensor and alternator F terminal.

Alert and Warning System

The ECM has alert/warning system to alert the driver to a system abnormally by a light and buzzer.
When the ignition switch is ON, the ECM does the initial check once and make sure the system function is normal.

Mode / Engine condition	Light/Buzzer System Operation				
	Oil pressure light (Green)	Overheat (Red)	MIL (Red)	Alternator warning light (Red)	Warning buzzer
Check once with the ignition switch ON	ON (2 sec.)	ON (2 sec.)	ON (2 sec.)	ON	Sounds (2 sec.)

Before starting the engine, do the initial check and make sure the system function is ON.



Indicator Light/Buzzer Operation Mode List

Sensor/Light / Engine conditon	Alert/Warning System Condition				Light/Buzzer system operation				
	Low oil pressure	Over-heat	Abnormal charging	Filled water detection	Oil pres-sure light (Green)	Over-heat (Red)	MIL (Red)	Alternator Warning light (Red)	Warning buzzer
At engine stop, with normal con-dition (2seconds after ignition switch ON).	ON	OFF	ON	OFF	OFF	OFF	OFF	ON	No sound
Normal operation	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	No sound
Low oil pressure	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Continuous sound
Overheat	OFF	ON	OFF	OFF	ON	ON	OFF	OFF	Continuous sound
Abnormal PGM-FI	OFF	OFF	OFF	OFF	ON (*1)	OFF (*2)	ON	OFF	Long intemit-tent sound
Abnormal alternator	OFF	OFF	ON	OFF	ON	OFF	OFF	ON	Long intemit-tent sound
Filled water detection	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	Short intemit-tent sound
Low oil pressure and overheat	ON	ON	OFF	OFF	OFF	ON	OFF	OFF	Continuous sound
Low oil pressure and abnormal PGM-FI	ON	OFF	OFF	OFF	OFF	OFF (*2)	ON	OFF	Continuous sound
Low oil pressure and abnormal alternator	ON	OFF	ON	OFF	OFF	OFF	OFF	ON	Continuous sound
Low oil pressure and filled water detection	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	Continuous sound
Overheat and abnormal PGM-FI	OFF	ON	OFF	OFF	ON (*1)	ON	ON	OFF	Continuous sound
Overheat and abnormal alternator	OFF	ON	ON	OFF	ON	ON	OFF	ON	Continuous sound
Overheat and filled water detection	OFF	ON	OFF	ON	ON	ON	OFF	OFF	Continuous sound
Abnormal PGM-FI and abnormal alternator	OFF	OFF	ON	OFF	ON (*1)	OFF (*2)	ON	ON	Long intemittent sound
Abnormal PGM-FI and filled water detection	OFF	OFF	OFF	ON	ON (*1)	OFF (*2)	ON	OFF	Long intemittent sound
Abnormal alter-nator and filled water detection	OFF	OFF	ON	ON	ON	OFF	OFF	ON	Long intemittent sound

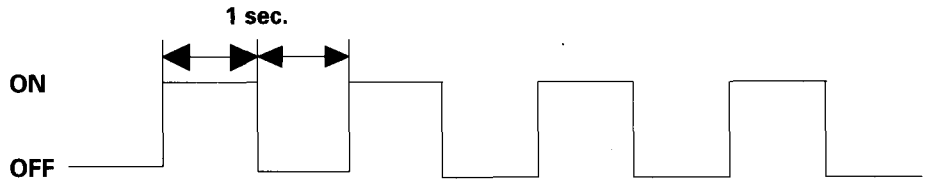
*1: Blink the light when the PGM-FI detects the abnormal oil pressure (high pressure side).
*2: Blink the light when the PGM-FI detects the engine overheat.

Alternator Warning System

The regulator in the alternater has a built-in function to detect a fault in the alternater.
When the function detects any of the problems shown below, it will light the alternater warning lamp.

Problem	Description
Power generation failure	The alternator has stopped generating power (alternator has stopped rotation, the exciting circuit in the alternator has been open-circuited, etc.)
Battery voltage sensing terminal disconnected	Battery voltage sensing terminal (terminal S) disconnected (Connector disconnected, harness open-circuited)
Battery charge output terminal disconnected	Battery charge output terminal (terminal B) disconnected (Eyelet terminal disconnected, harness open-circuited, alternator fuse blown)
Overcharge	Battery voltage increased beyond regulated voltage of regulator during power generation (Adverse effects could be porduced on battery and other devices.)
Low voltage	Battery voltage reduced to approx. 10 V or less (Battery rundown could occur due to excessive use of electrical loads.)

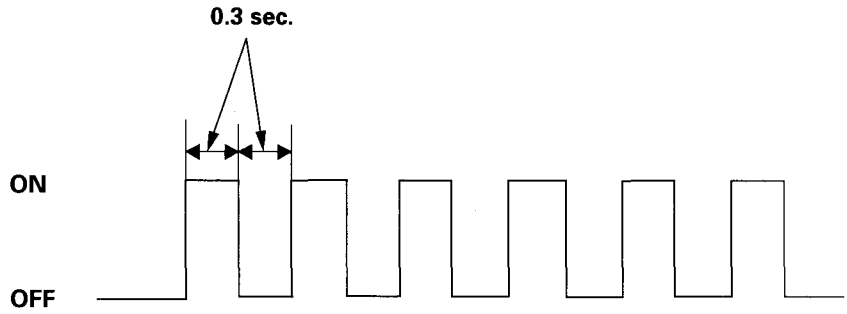
At the same time, the function sends a signal to the ECM. In response to the signal, the ECM sounds the buzzer intermittently according to the pattern shown below.



Intermittent buzzer sounds at intervals of ON for 1 second and OFF for 1 second

Water Separator Water Level Sensor Full Level Warning System

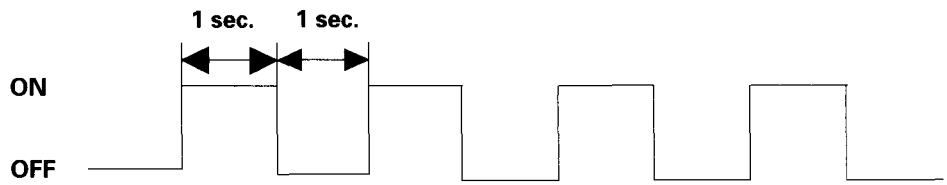
When more than a given amount of water is collected in the water separator provided in the fuel supply passage, the water level sensor (float and reed switch) mounted at the water separator will detect it and will send a signal to the ECM. In response to the signal, the ECM will sound the buzzer intermittently according to the following pattern.



Intermittent buzzer sounds at intervals of ON for 0.3 seconds and OFF for 0.3 seconds

PGM-FI Buzzer Warning System

When the PGM-FI system detects an anomaly in the various sensors, IAC valve, VTEC and solenoid spool valve associated with the engine controls and determines that there is a problem by the self-diagnosis function, it will light the malfunction indicator lamp (MIL) and sound the buzzer intermittently according to the following pattern.

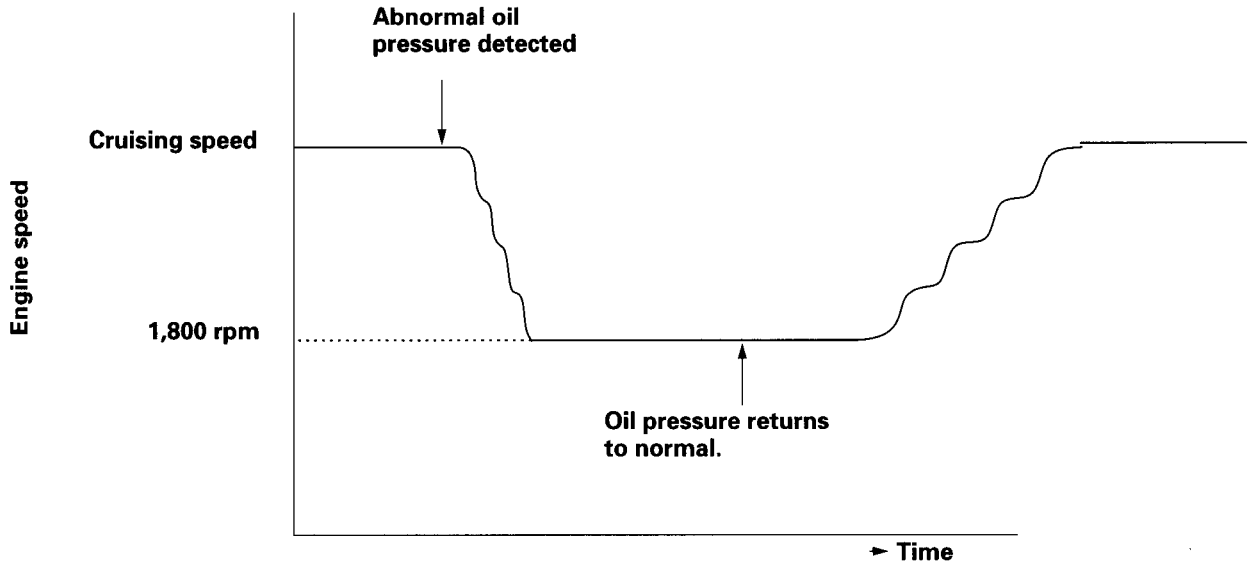


Intermittent buzzer sounds at intervals of ON for 1 second and OFF for 1 second

Oil Pressure Alert System

Two oil pressure switches, one for high pressure (OPH) and one for low pressure (OPL), are mounted on the cylinder block. When either of the switches detects an oil pressure lower than a specified value, it sends a signal to the ECM. In response to the signal, the ECM determines on the basis of the operating condition that varies with the engine speed and engine temperature (see the drawing shown below) whether the signal is due to an abnormal oil pressure. If it finds that the oil pressure is abnormal, it will provide the control to reduce the engine speed to 1,800 rpm.

When the abnormal oil pressure is cleared, the ECM will put out the oil pressure lamp (green) and silence the buzzer. Then the ECM will gradually increase the engine speed to resume normal operation.



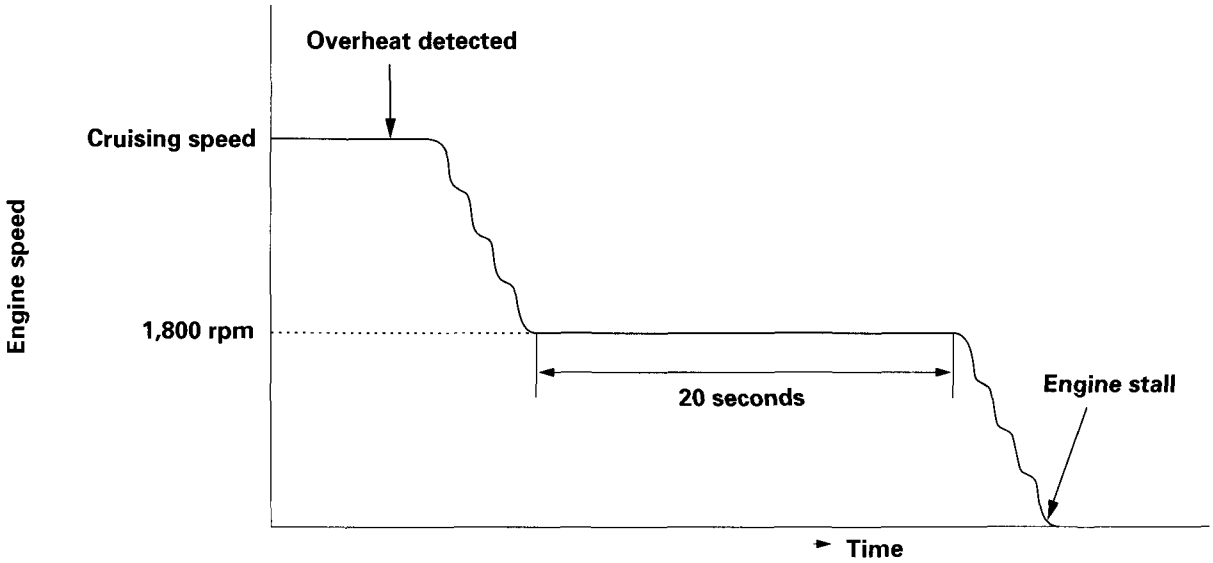
Steps to take when oil pressure alert system operates

1) Immediately stop the engine, and check the engine oil level. Add if low.
2) If the engine oil level is normal, restart the engine and let it run at idle for about 30 seconds.
3) If the alert system does not operate during the 30 seconds of idling, then everything is in order.
   If the alert system operates during the 30 seconds of idling, preform Troubleshooting of the Alarm System (Continuous Sound) checks.

Overheat Alert System

An overheat sensor is mounted on the top of each exhaust manifolds on the right and left banks of the engine. These sensors detect the temperature of engine coolant, and send an electrical signal to the ECM. If the ECM receives a signal that indicates a temperature exceeding the limit, it causes the overheat lamp (red) to light, the warning buzzer to sound continuously, and the engine speed to reduce to 1,800 rpm.

If the ECM continues to receive the overheat signal approx. 20 seconds after the engine speed has been reduced to 1,800 rpm, it causes the engine to stop. If overheating condition disappears during control, the ECM turns off the overheat lamp (red), silences the buzzer, and gradually increases the engine speed to resume normal operation.



Steps to take when overheat alert system operates

1) Immediately stop the engine and check for a clogged water screen. Clean if clogged.
2) Restart the engine and check to see if the cooling water smoothly runs out of the water measuring hole. If the cooling water does not run out, check the water pump, water tube and thermostat.
3) If the cooling water is smoothly running out of the water measuring hole, let the engine run at idle. If the alert system does not operate, everything is in order.
   If the alert system operates and the engine stalls, perform Troubleshooting of the Alarm System (Continuous Sound) checks.

Fuel Line Cut Solenoid Valve

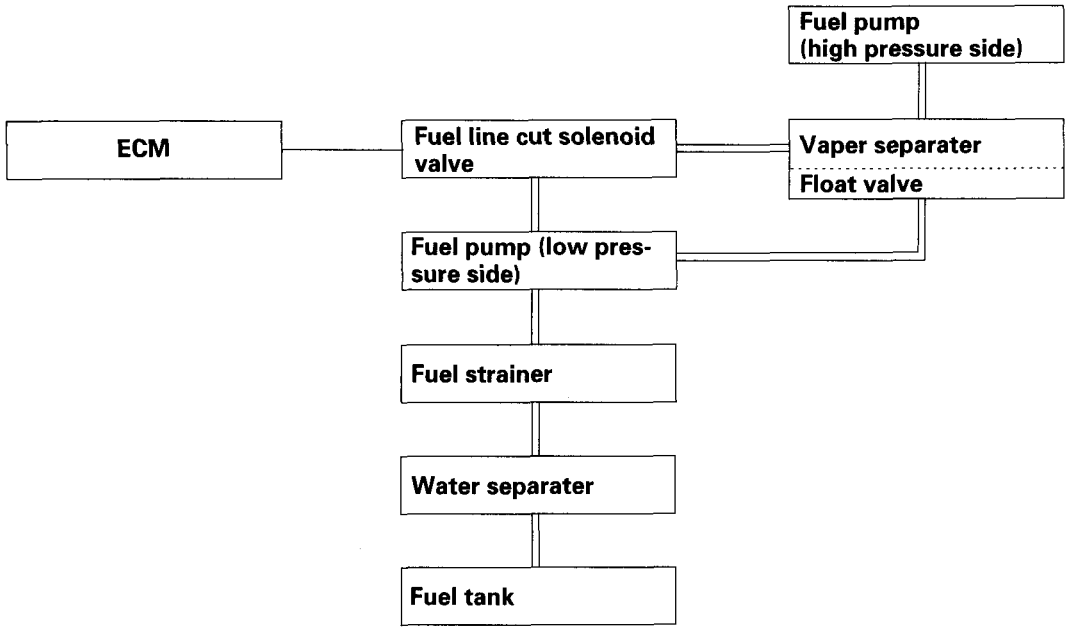
The fuel pump (low pressure side) is equipped with a fuel line cut solenoid valve which helps facilitate restart of the engine when it is still hot.

When the engine is shut down after propelling a boat, fuel vapor may form in the low-pressure fuel line due to the heat remaining under the engine cover. The fuel vapor can cause vapor lock which prevent the engine from being supplied with fuel by the fuel pump (low pressure side), so it may result in difficult hot engine starting or engine stall.

The fuel line cut solenoid valve is a mechanism that lets the vapor trapped in the low-pressure fuel line escape into the vapor separator to prevent the vapor lock.

The fuel line cut solenoid valve opens under the following conditions.

Fuel cut solenoid valve opening conditions	Opened time
When the ignition switch is ON.	For 4 seconds
When the engine temperature sensor detects 60°C (140°F) or more and both the engine speed and engine load are in excess of given values after the engine has been restarted.	For 50 seconds

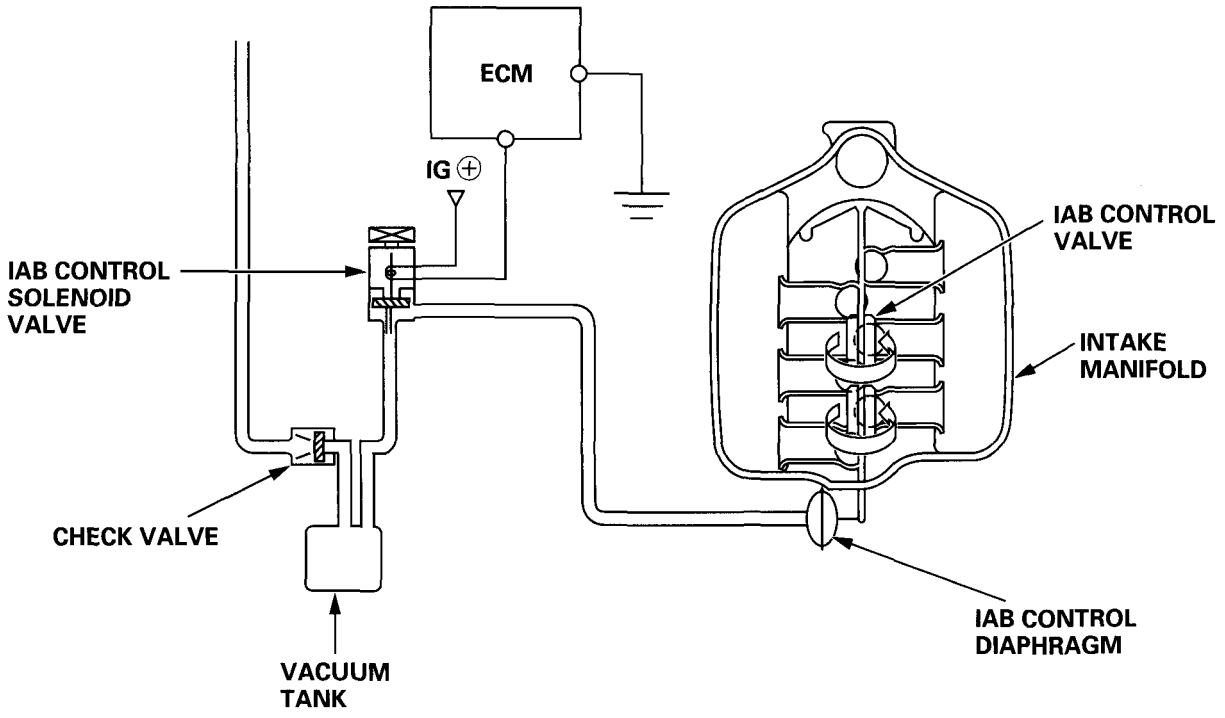


Intake Air Bypass (IAB) Control System

With the IAB control system, a IAB control valve is located between the left and right banks intake manifolds and connected to both intake manifolds. In the middle of the chamber is a intake air bypass control valve. Opening and closing movement of the IAB control valve permits the folw of intake air in the intake manifolds to be altered such that the amount of air entering the combustion chambers is maximized. Specifically, the IAB control valve is used to optimize the resonance-charging effect with low and mid-range engine speeds and to optimize the inertia-charging effect with higher engine speeds. The system thus maximizes low-end and mid-range torque and high-end output.

The IAB control system consists mainly of the intake manifolds, the chamber, the IAB control valve, the ECM that makes control to open and close the IAB control valve, a IAB control solenoid valve, and a diaphragm.

The system controls the IAB control valve's open/closed position with reference to the engine speed only.
Closed → Open : When engine speed increases to 3,950 rpm
Open → Closed : When engine speed decreases to 3,750 rpm



VTEC System (BF225A)

The VTEC system switches the valve timing and valve lift between low-and high-speed settings to maximize the amount of intake air in all ranges, thus exploiting the full potential of the engine throughout its entire operating range from high speeds to low speeds.

- The VTEC arrangement consists of three rocker arms for each cylinder (primary, secondary and mid rocker arms; synchronizing pistons; low-speed high-speed cams; a VTEC solenoid valve; and ECM.
- When the engine is operating in the low-speed range, the VTEC solenoid valve is closed, blocking the hydraulic pressure passage to the synchronizing piston incorporated in the rocker arms. Each rocker arm is driven by its low-speed cam independently of the other rocker arm. When the engine is operating in the high-speed range, the VTEC solenoid valve opens, allowing hydraulic pressure to be applied to the synchronizing piston. The synchronizing piston then moves and links the three rocker arms together. As a result, all the rocker arms are moved by the high-lift high-speed cam that drives the mid rocker arm.

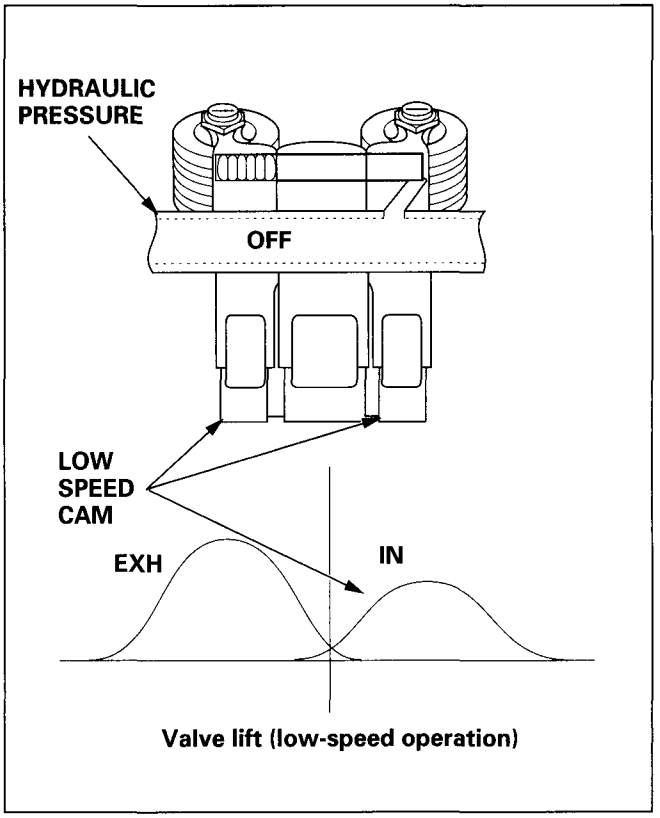
The VTEC system switches from the low-speed cams to the high-speed cams when all of the following conditions are satisfied.

- At least two seconds have elapsed since engine startup.
- A forward or reverse gear selection has been made. (The neutral switch is OFF.)
- The engine temperature (as indicated by the engine temperature sensor) is –20°C (28.4°F) or higher.
- The engine speed is 4,500 rpm or higher.
- There is no low-pressure alert. (The high-pressure oil switch is ON.)
- The high-pressure oil switch is not faulty.

The system switches back from the high-speed cams to the low-speed cams when the engine speed drops to 4,300 rpm.

Low-speed Operation:

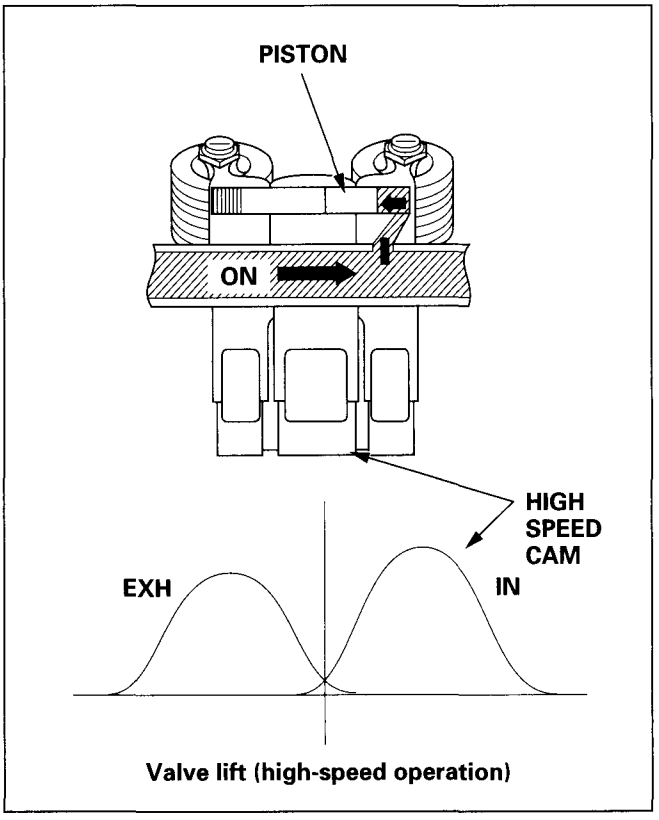
When the engine speed is lower than 4,500 rpm, hydraulic pressure is not applied to the synchronizing pistons in the rocker arms so the primary and secondary rocker arms are independently activated by their respective low-speed cams, which give relatively little cam lift. Consequently, the intake valves open by a degree that realizes an intake air volume appropriate for low-speed operation.



Valve lift (low-speed operation)

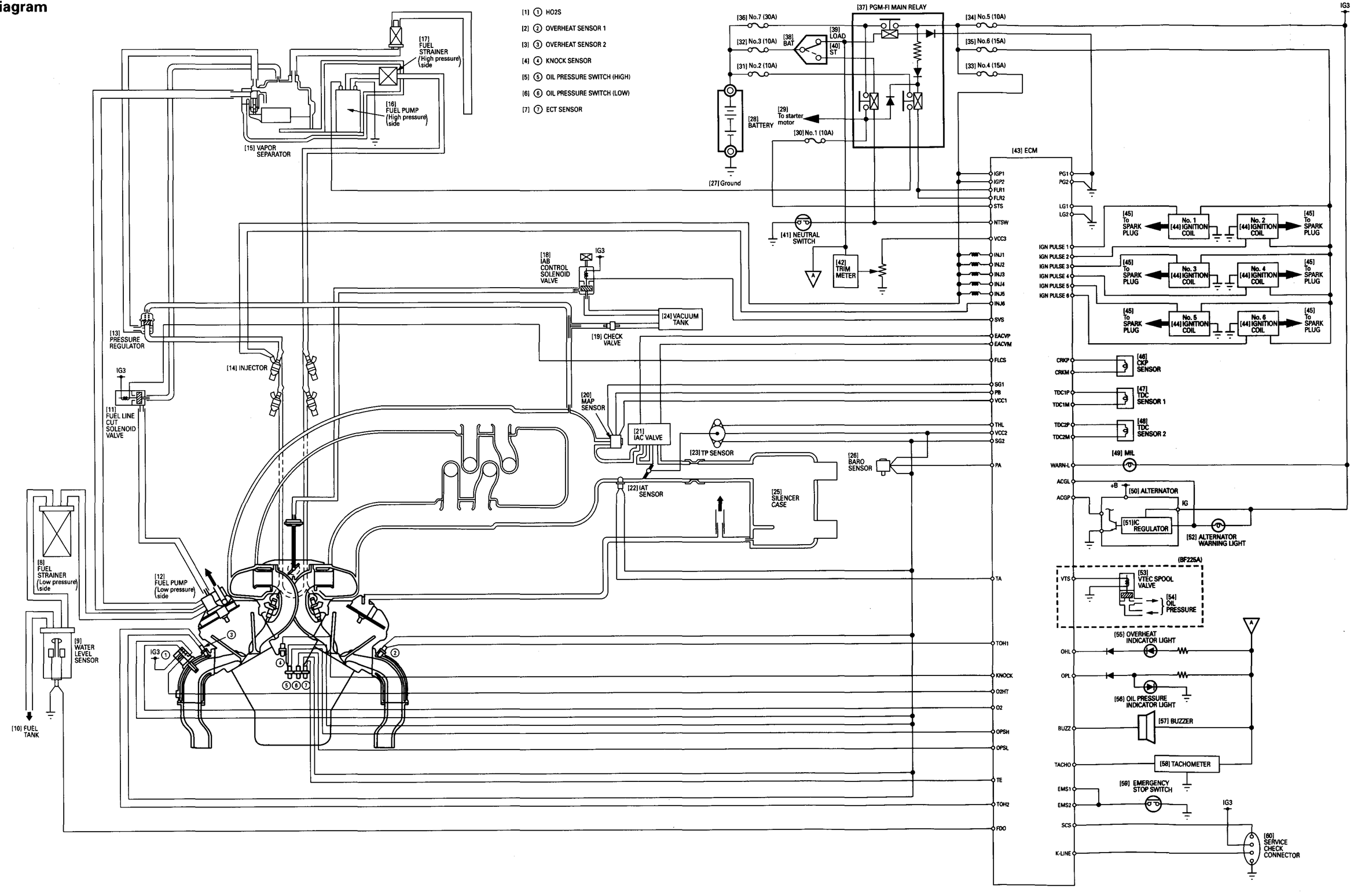
High-speed Operation:

When the engine speed is 4,500 rpm or higher and all other necessary conditions are satisfied, the ECM issues a signal that activates the VTEC solenoid valve, causing hydraulic pressure to act upon the synchronizing pistons. The synchronizing pistons link the three rocker arms such that they form a single unit. This single unit is activated by the high-speed cam, which yields a relatively long valve stroke and a consequently large intake air volume appropriate for high-speed operation.

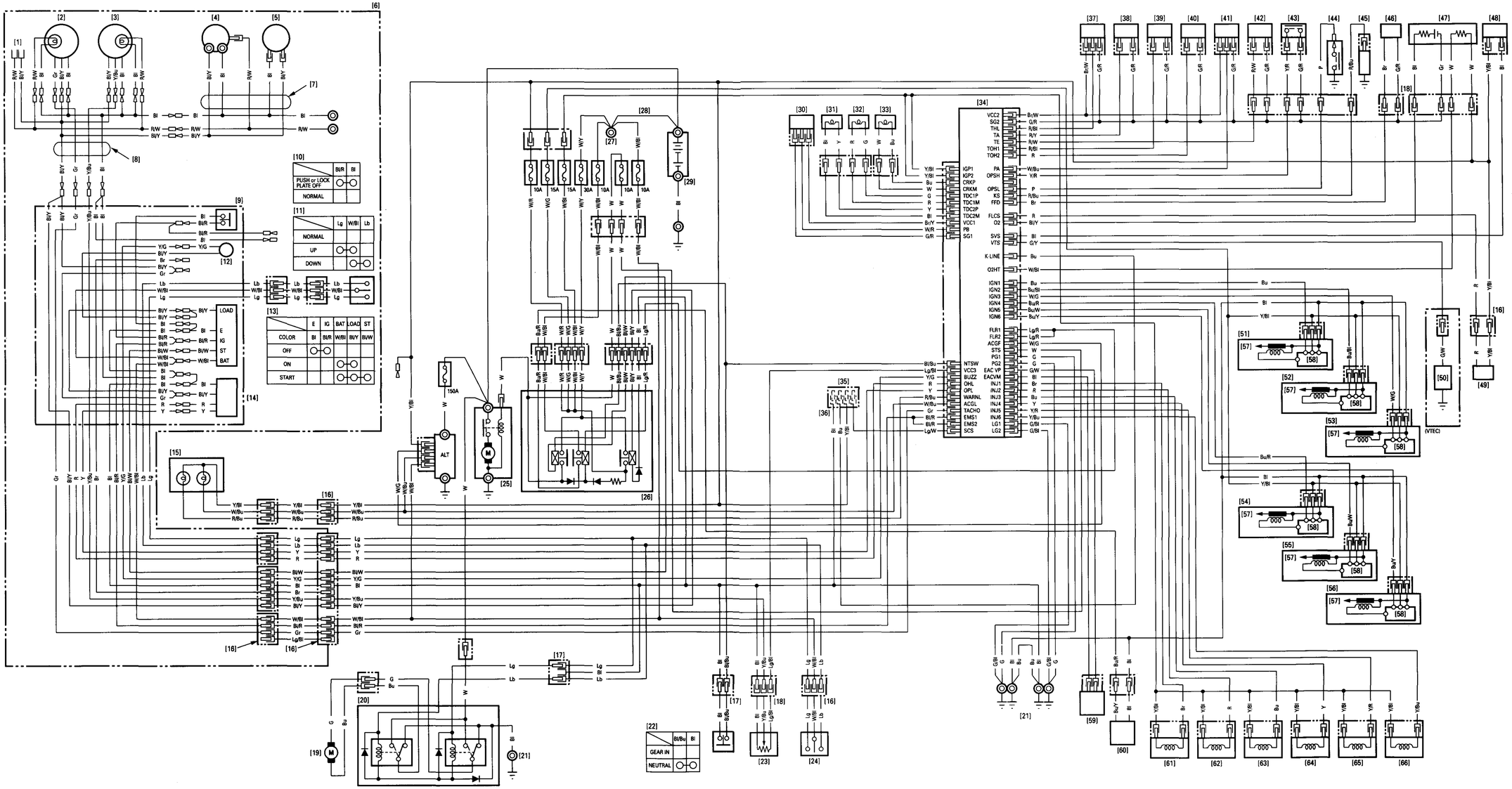


Valve lift (high-speed operation)

System Diagram



Top Mount/Panel Mount Control Box



WIRING DIAGRAMS

Top Mount/Panel Mount Control Box

[1] To LIGHTING SWITCH
[2] TACHOMETER
[3] TRIM METER
[4] VOLT METER
[5] HOUR METER
[6] OPTIONAL
[7] METER HARNESS B
[8] METER HARNESS A
[9] CONTROL PANEL ASSEMBLY
[10] EMERGENCY STOP SWITCH

	Bl/R	Bl
PUSH or LOCK PLATE OFF	○——○	
NORMAL		

[11] POWER TRIM/TILT SWITCH

	Lg	W/Bl	Lb
NORMAL			
UP	○——○		
DOWN		○——○	

[12] BUZZER
[13] IGNITION SWITCH

	E	IG	BAT	LOAD	ST
COLOR	Bl	Bl/R	W/Bl	Bl/Y	Bl/W
OFF	○——○				
ON			○——○		
START			○——○——○		

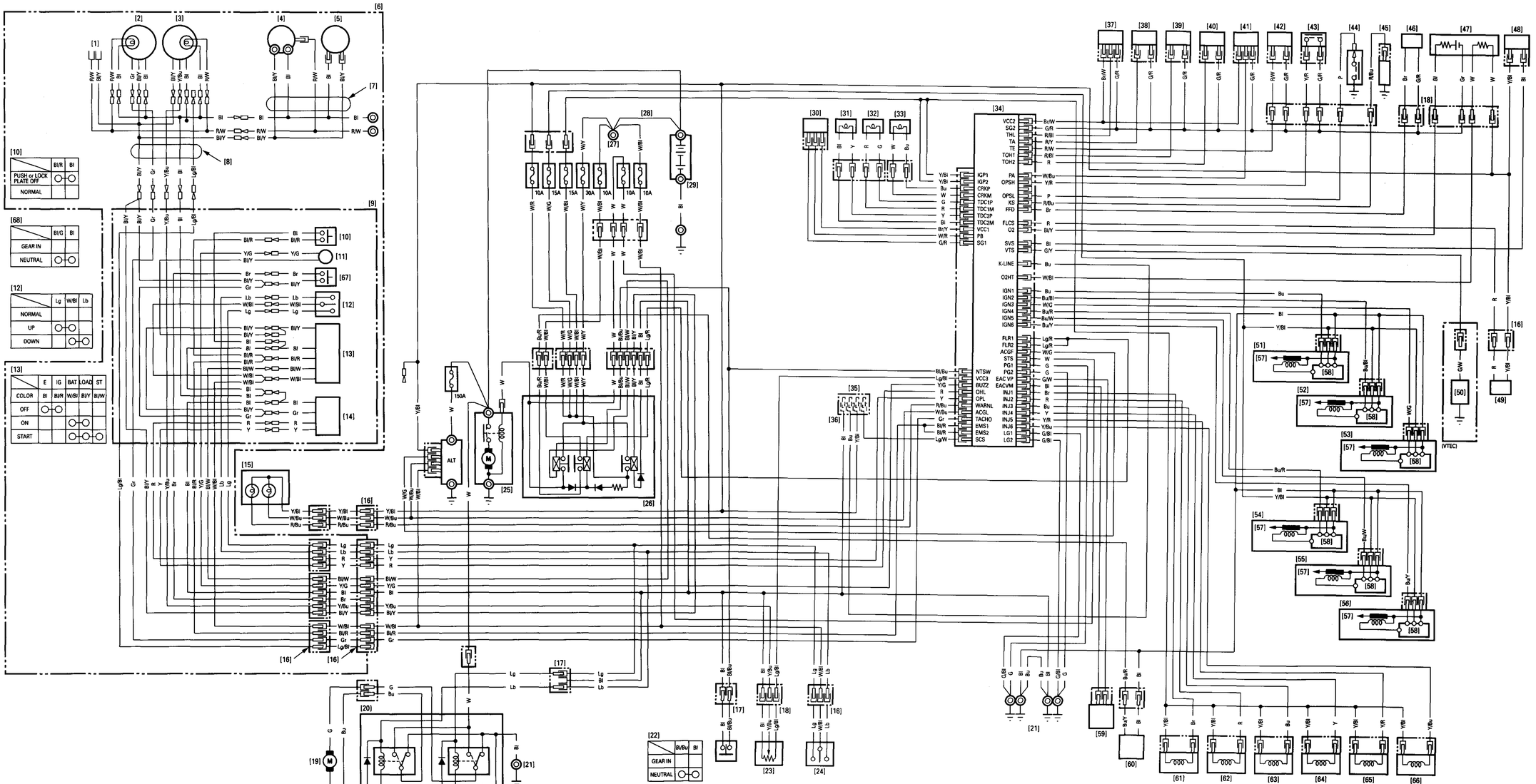
[14] INDICATOR LIGHT (overheat, oil pressure)
[15] INDICATOR LIGHT (MIL, alternator)
[16] BLACK CONNECTOR
[17] GREEN CONNECTOR
[18] BLUE CONNECTOR
[19] POWER TILT MOTOR
[20] POWER TILT RELAY
[21] GROUND
[22] NEUTRAL SWITCH

	Bl/Bu	Bl
GEAR IN		
NEUTRAL	○——○	

[23] TRIM ANGLE SENSOR
[24] POWER TILT SWITCH
[25] STARTER MOTOR
[26] PGM-FI MAIN RELAY
[27] TERM, ON FUSE
[28] Bl (W-LINE)
[29] BATTERY (12V)
[30] MAP SENSOR
[31] TDC SENSOR 2
[32] TDC SENSOR 1
[33] CKP SENSOR
[34] ECM
[35] SERVICE CHECK CONNECTOR
[36] RED CONNECTOR
[37] THROTTLE POSITION SENSOR
[38] INTAKE AIR TEMPERATURE (IAT) SENSOR
[39] OVERHEAT SENSOR 1
[40] OVERHEAT SENSOR 2
[41] BARO SENSOR
[42] ECT SENSOR
[43] ENGINE OIL PRESSURE SWITCH (HIGH)
[44] ENGINE OIL PRESSURE SWITCH (LOW)
[45] KNOCK SENSOR
[46] WATER LEVEL SWITCH
[47] HEATED OXYGEN SENSOR (HO2S)
[48] INTAKE AIR BYPASS (IAB) CONTROL VALVE
[49] FUEL LINE CUT SOLENOID VALVE
[50] VTEC SOLENOID VALVE
[51] No.1 IGNITION COIL
[52] No.2 IGNITION COIL
[53] No.3 IGNITION COIL
[54] No.4 IGNITION COIL
[55] No.5 IGNITION COIL
[56] No.6 IGNITION COIL
[57] To PLUG
[58] IGNITOR
[59] IDLE AIR CONTROL (IAC) VALVE
[60] FUEL PUMP
[61] No.1 INJECTOR
[62] No.2 INJECTOR
[63] No.3 INJECTOR
[64] No.4 INJECTOR
[65] No.5 INJECTOR
[66] No.6 INJECTOR

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

Side Mount Control Box



WIRING DIAGRAMS

Side Mount Control Box

[1] To LIGHTING SWITCH
[2] TACHOMETER
[3] TRIM METER
[4] VOLT METER
[5] HOUR METER
[6] OPTIONAL
[7] METER HARNESS B
[8] METER HARNESS A
[9] CONTROL PANEL ASSEMBLY
[10] EMERGENCY STOP SWITCH

	Bl/R	Bl
PUSH or LOCK PLATE OFF	○——	——○
NORMAL		

[11] POWER TRIM/TILT SWITCH

	Lg	W/Bl	Lb
NORMAL			
UP	○——	——○	
DOWN		○——	——○

[12] BUZZER
[13] IGNITION SWITCH

	E	IG	BAT	LOAD	ST
COLOR	Bl	Bl/R	W/Bl	Bl/Y	Bl/W
OFF	○——	——○			
ON			○——	——○	
START			○——	——○	——○

[14] INDICATOR LIGHT (overheat, oil pressure)
[15] INDICATOR LIGHT (MIL, alternator)
[16] BLACK CONNECTOR
[17] GREEN CONNECTOR
[18] BLUE CONNECTOR
[19] POWER TILT MOTOR
[20] POWER TILT RELAY
[21] GROUND
[22] NEUTRAL SWITCH

	Bl/Bu	Bl
GEAR IN		
NEUTRAL	○——	——○

[23] TRIM ANGLE SENSOR
[24] POWER TILT SWITCH
[25] STARTER MOTOR
[26] PGM-FI MAIN RELAY
[27] TERM, ON FUSE
[28] Bl (W-LINE)
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[32] TDC SENSOR 1
[33] CKP SENSOR
[34] ECM
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[57] To PLUG
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[61] No.1 INJECTOR
[62] No.2 INJECTOR
[63] No.3 INJECTOR
[64] No.4 INJECTOR
[65] No.5 INJECTOR
[66] No.6 INJECTOR
[67] SOLENOID SWITCH
[68] NEUTRAL SWITCH

	Bl/G	Bl
GEAR IN		
NEUTRAL	○——	——○

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

PREFACE

This supplement describes the major differences between the Honda BF175A Outboard Motor.

For service information which is not covered in this supplement, please refer to the base shop manual, part number 66ZY200.

Careful observance of these instructions will result in better, safer service work.

Pay attention to these symbols and their meaning:

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

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

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CONTENTS

Date of Issue: Mar. 2002

1. SPECIFICATIONS

1. SPECIFICATIONS

DIMENSIONS AND WEIGHTS

Model	BF175A				
Description code	BAJJ			BAKJ	
Item / Type	LD	XD	XXD	XCD	XXCD
Overall length	920 mm (36.2 in)				
Overall width	625 mm (24.6 in)				
Overall height	1,670 mm (65.7 in)	1,800 mm (70.8 in)	1,925 mm (75.8 in)	1,800 mm (70.8 in)	1,925 mm (75.8 in)
Dry weight (*1)	270 kg (595 lbs)	275 kg (606 lbs)	280 kg (617 lbs)	278 kg (613 lbs)	283 kg (624 lbs)
Dry weight (*2)	267 kg (589 lbs)	272 kg (600 lbs)	277 kg (611 lbs)	272 kg (600 lbs)	277 kg (611 lbs)
Operating weight (including oil)	279 kg (615 lbs)	284 kg (626 lbs)	289 kg (637 lbs)	287 kg (633 lbs)	292 kg (644 lbs)

*1: With propeller mounted.
*2: Without propeller mounted.

FRAME

Model	BF175A				
Item / Type	LD	XD	XXD	XCD	XXCD
Transom height (*1)	508 mm (20.0 in)	635 mm (25.0 in)	762 mm (30.0 in)	635 mm (25.0 in)	762 mm (30.0 in)
Tilting angle	72°				
Tilting stage	Stageless				
Trim angle (*1)	–4° to 16°				
Swivel angle	30° right and left				

*1: Transom angle is at 12°.

TYPES OF Honda BF175A OUTBOARD MOTOR

It may be necessary to refer to this chart for reference purposes when reading this manual.

Model	BF175A				
Type	LD	XD	XXD	XCD	XXCD
Shaft Length type	L	XL	XXL	XL	XXL
Counter Rotation				○	○
Remote control	○	○	○	○	○
Power Trim/Tilt	○	○	○	○	○
Tachometer	(○)	(○)	(○)	(○)	(○)
Trimmeter	(○)	(○)	(○)	(○)	(○)

XL: Extra long, XXL: Extra-extra long
(○): Optional part

The power trim/tilt type motors use an electric/hydraulic power cylinder to trim or tilt the motor.

ENGINE

Item \ Model	BF175A
Description code	BEAJJ
Type	4-stroke, O.H.C., 6-cylinder
Displacement	3,471 cm³ (211.7 cu in)
Bore x stroke	89 x 93 mm (3.5 x 3.7 in)
Rated power *1	128.7 kW (175 PS)
Maximum torque	265 N•m (27.0 kgf•m, 195.3 lbf•ft)
Compression ratio	9.4 : 1
Fuel consumption ratio	349 g/kWh (257 g/PSh, 9.1 oz/PSh)
Cooling system	Forced water circulation by impeller pump with thermostat
Ignition system	Full transistorized, battery ignition
Ignition timing	10° at 650 rpm B.T.D.C.
Spark plug	IZFR6F11 (NGK), VKJ20RZ-M11 (DENSO)
Fuel supply system	Programmed fuel injection
Fuel injection system	Electronic control
Fuel injection nozzle	Pintle type
Fuel	Unleaded gasoline with a pump octane rating of 86 or higher
Fuel pump	Electric and mechanical plunger type
Lubrication system	Pressure lubrication by trochoid pump
Lubrication capacity	8.8 ℓ (9.3 US qt, 7.7 Imp qt)
Starter system	Electric starter
Stopping system	Primary circuit ground
Exhaust system	Underwater type

*1: Full throttle range.

LOWER UNIT

Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	0.536 (15/28)
Reduction	Spiral bevel
Gear case oil capacity	1.17 ℓ (1.24 US qt, 1.03 Imp qt)
Propeller rotating direction	Clockwise (viewed from rear): LD, XD and XXD types Counterclockwise (viewed from rear): XCD and XXCD types

1. TROUBLESHOOTING

a. TP SENSOR

- **MIL blinks 7 times with service check connector shorted.**

Check that the throttle cable is adjusted properly (P. 3-18) before starting the TP sensor inspection/troubleshooting.

1) Reset the ECM.
2) Start the engine.
3) Check the MIL. For the number of blinks.

Does it blink 7 times?

NO → Loose connection between the ECM and the TP sensor. Connect securely.

YES

1) Turn the ignition switch OFF.
2) Disconnect the TP sensor 3P connector.
3) Turn the ignition switch ON.
4) Connect the positive (+) tester lead to the Br/W terminal of the harness side TP sensor 3P connector, and the negative (–) tester lead to the G/R terminal of the 3P connector. Measure the voltage.

Is there 4.75 – 5.25 V?

NO → Connect the positive (+) tester lead to the Br/W terminal of the harness side TP sensor 3P connector, and the negative (–) tester lead to the body ground. Measure the voltage.

Is there 4.75 – 5.25 V?

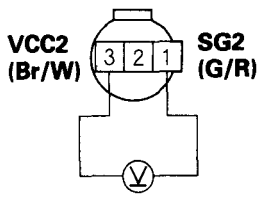
YES → Repair open in the G/R wire between the ECM and the TP sensor.

NO

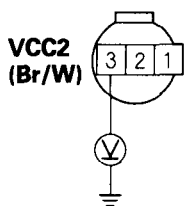
YES → A → To P. 5-2

NO → B → To P. 5-2

TP SENSOR 3P CONNECTOR



Viewing connector from the front side



From P. 5-1

A

1) Turn the ignition switch OFF.
2) Connect the TP sensor 3P connector.
3) Connect the test harness to the ECM and the connectors.
4) Turn the ignition switch ON.
5) Measure the voltage between the test harness positive (+) B12 terminal and the negative (–) B34 terminal with the throttle fully open and fully closed respectively.

Is there 0.44 – 0.56 V* with the throttle is fully closed and is there 2.55 – 3.15 V* with the throttle is fully opened?

NO

- The TP sensor is faulty.
- Repair open or short in the R/Bl wire between the ECM and the TP sensor.

YES

Substitute a known-good ECM and recheck.

From P. 5-1

B

1) Turn the ignition switch OFF.
2) Connect the test harness to the ECM and the connectors.
3) Turn the ignition switch ON.
4) Measure the voltage between the test harness positive (+) A26 terminal and the negative (–) B34 terminal.

Is there 4.75 – 5.25 V?

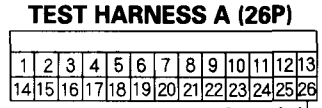
YES

Repair open in the Br/Y wire between the ECM and the TP sensor.

NO

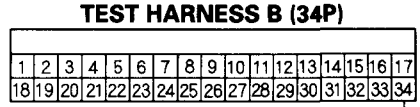
Substitute a known-good ECM and recheck.

TEST HARNESS A (26P)



A 26 (+)

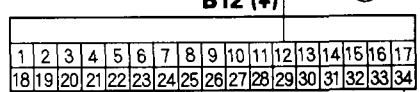
TEST HARNESS B (34P)



B 34 (–)

TEST HARNESS B (34P)

B12 (+)



B34(–)

When the power supply voltage between the No. 3 and No. 1 terminals of the TP sensor 3P connector is 5V, the TP sensor voltage are shown.
If the power supply voltage is 4.75 V, the TP sensor voltage with the throttle fully closed position is 0.42 - 0.53 V by this calculation.

$$0.44\ (V) \times \frac{4.75\ (V)}{5.0\ (V)} = 0.42\ (V)$$

$$0.56\ (V) \times \frac{4.75\ (V)}{5.0\ (V)} = 0.53\ (V)$$

PREFACE

This supplement describes the major differences between the following models of the Honda BF175A·BF200A·BF225A outboard motors.

MODEL	FRAME SERIAL NUMBER
BF175A	BF175A: BAJJ – 1000078 and subsequent BF175A: BAKJ – 1000011 and subsequent
BF200A	BF200A: BAEJ – 1000856 and subsequent BF200A: BAFJ – 1000210 and subsequent
BF225A	BF225A: BAGJ – 1003023 and subsequent BF225A: BAHJ – 1000558 and subsequent

For service information which is not covered in this supplement, please refer to the base shop manuals, part number 66ZY200·66ZY200Z.

Pay attention to these symbols and their meaning:

⚠ WARNING Indicates a strong possibility of severe personal injury or loss of life if instructions are not followed.

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CONTENTS

The marked sections contain no changes. They are not covered in this manual.

Date of Issue: March, 2003

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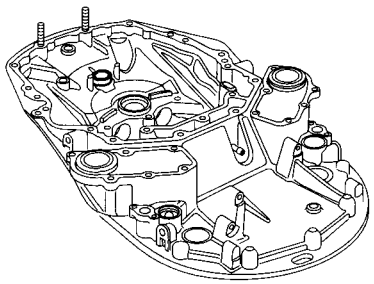
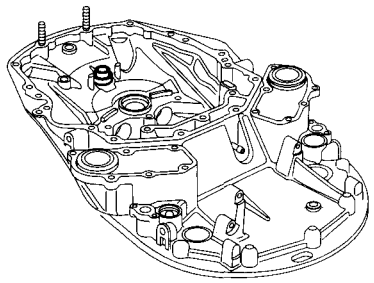
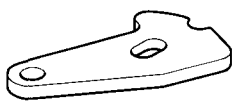
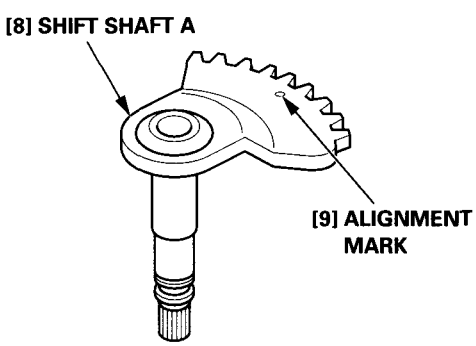
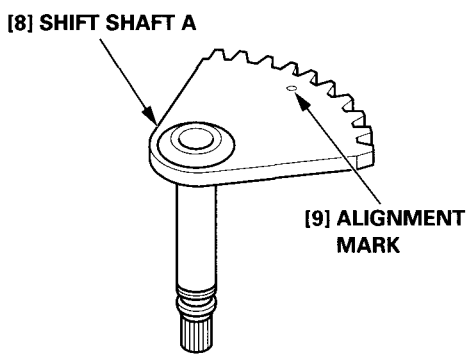
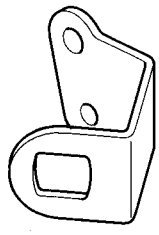
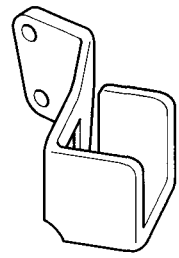
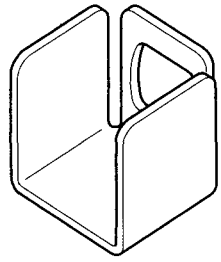
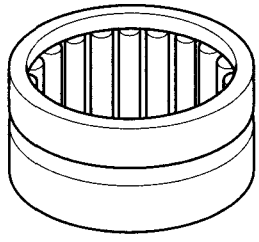
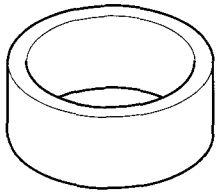
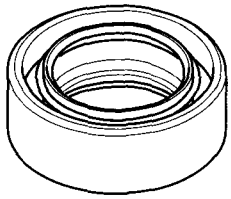
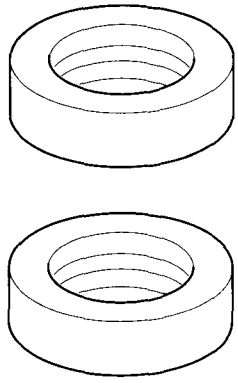
[2] Model / [1] Item	[3] After modifications	[4] Before modifications
[5] MOUNT CASE		
[6] SHIFT ARM		
[7] SHIFT SHAFT A		

[1] Item	[2] After modification	[3] Before modification
[4] NEUTRAL SWITCH BRACKET		
[5] NEUTRAL SWITCH PLATE		—
[6] 20 x 28 x 13 NEEDLE BEARING		—

[1] Item	[2] After modification	[3] Before modification
[4] 15 x 20 x 23 INNER RACE		———
[5] 14 x 26 x 8 WATER SEAL		
[6] 10 mm E-RING		

1. SHIFT CONTROL CABLE

Inspection/Adjustment:

1) Remove the engine cover (P. 4-1 of the base shop manual).

2) Remove the electric parts cover (P. 4-4 of the base shop manual).

3) Move the remote control lever to the "N" (Neutral) position (P. 16-2 of the base shop manual).

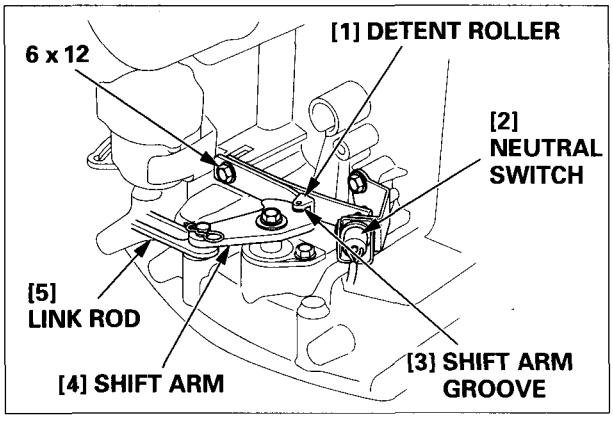
4) Remove the shift control cable.

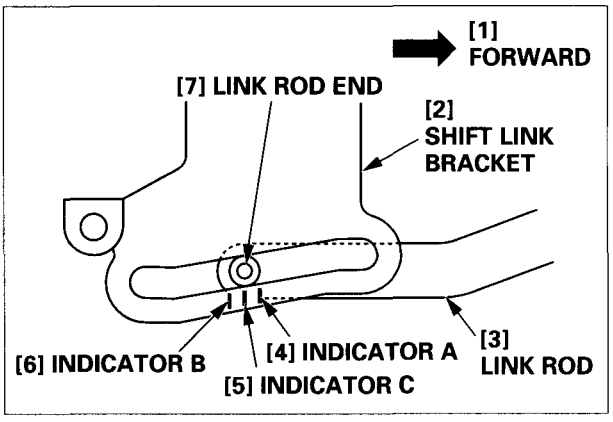
5) Loosen the 6 x 12 mm flange bolt.

6) Move the link rod forward lightly until it stops at the end of the free play; mark indicator A on the shift link bracket as shown.

7) Move the link rod until it stops at the opposite end of the free play; mark indicator B on the shift link bracket as shown.

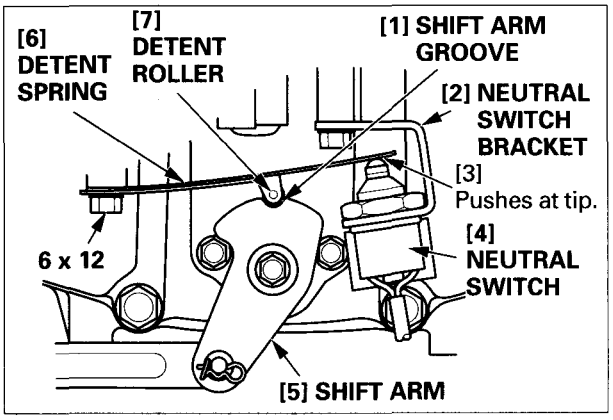
8) Mark indicator C between indicator A and indicator B.





9) Tighten the 6 x 12 mm flange bolt securely, aligning the link rod end with indicator C and holding the detent roller in the shift arm groove.

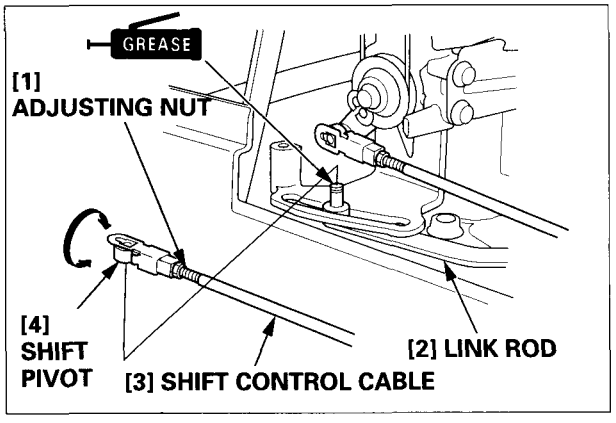
10) If the detent spring end does not push the neutral switch, check the detent spring and neutral switch bracket for deformation.
Replace them, if necessary.



11) Loosen the adjusting nut of the shift control cable.

12) Adjust the shift control cable by turning the shift pivot until the shift cable pivot will install over the link rod end without moving the link rod.

13) After adjustment, apply grease to the link rod end and install the shift control cable on the link rod end. Lock the shift cable to the link rod end securely and tighten the adjusting nut.



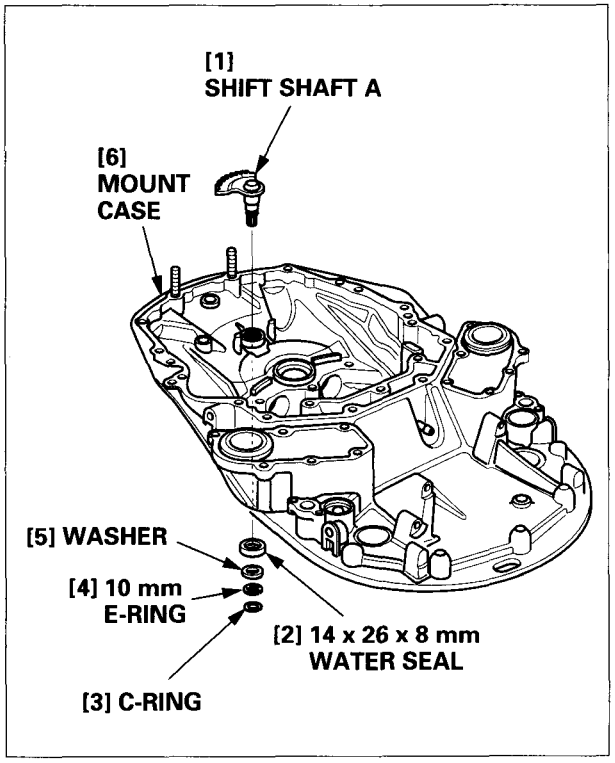
1. MOUNT CASE/UPPER MOUNT RUBBER/SHIFT SHAFT A

1. MOUNT CASE/UPPER MOUNT RUBBER/SHIFT SHAFT A

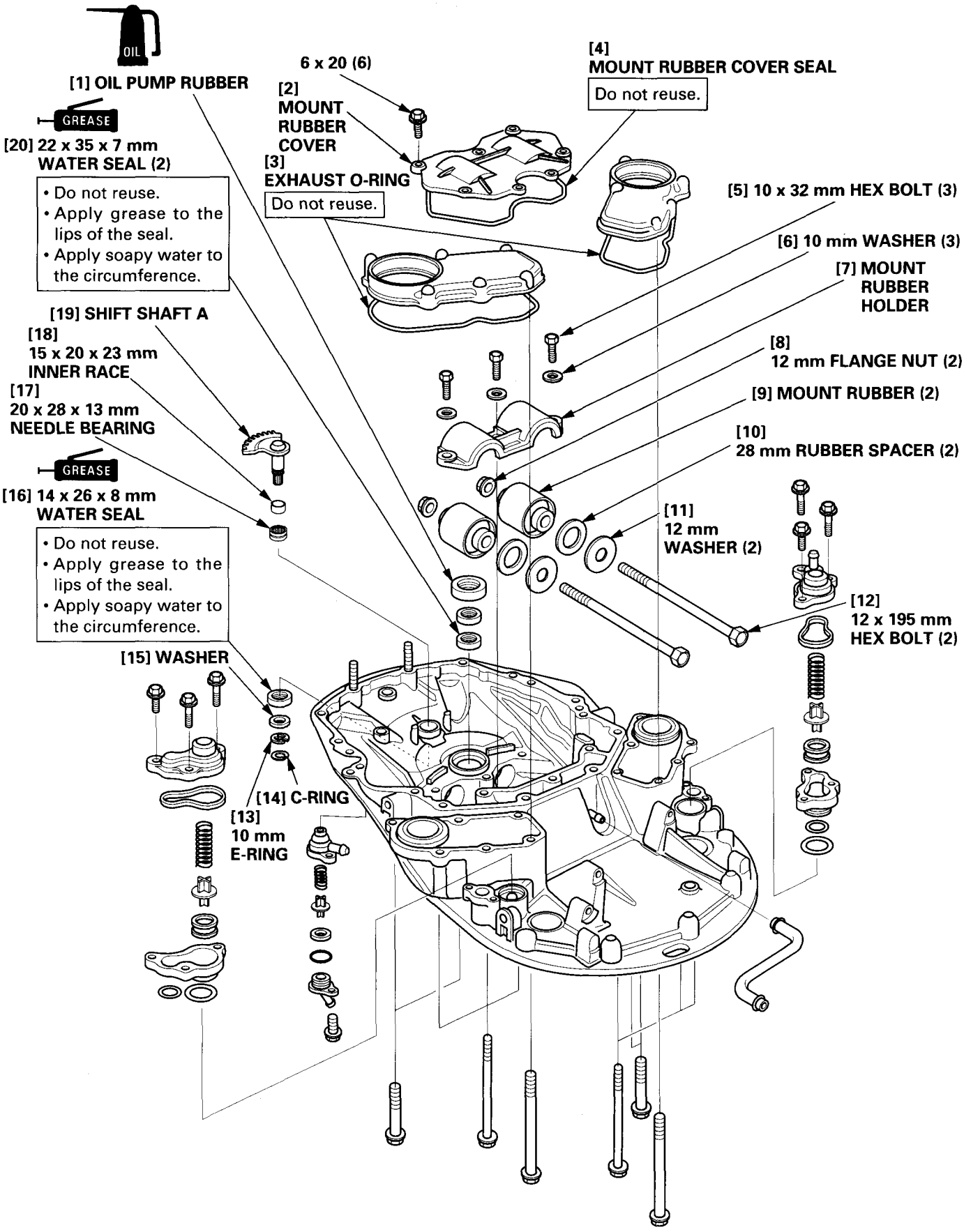
a. REMOVAL

1) Remove the engine (P. 7-1 – 7 of the base shop manual).

2) Remove the C-ring, 10 mm E-ring, washer, 14 x 26 x 8 mm water seal and shift shaft A from the mount case.



b. EXPLODED VIEW



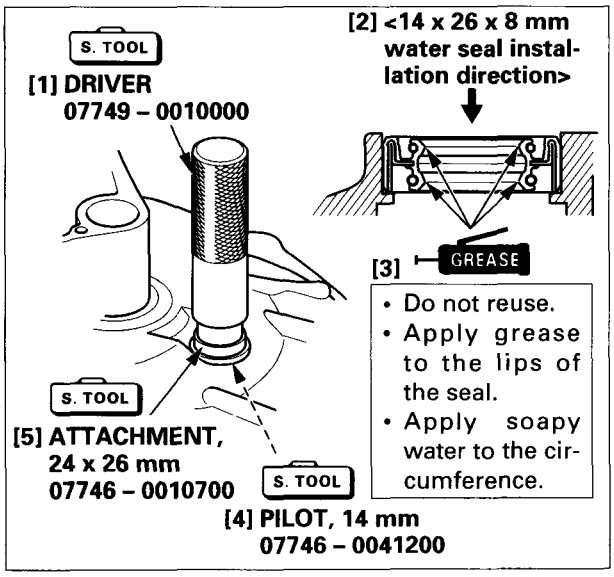
c. INSTALLATION

1) Apply soapy water to the circumference and grease to the lips of the new 14 x 26 x 8 mm water seal.

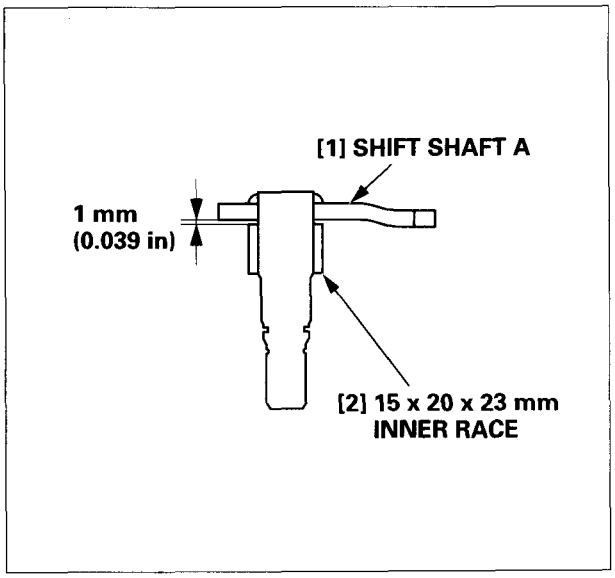
2) Install the new water seal into the mount case using the special tools as shown noting the installation direction. Replace the water seal with a new one when it is removed.

TOOLS:

Driver	**07749 – 0010000**
Attachment, 24 x 26 mm	**07746 – 0010700**
Pilot, 14 mm	**07746 – 0041200**



3) Using the special tools or press, install the 15 x 20 x 23 mm inner race to the position shown so that the inner race face is 1 mm (0.039 in) from the shift shaft A.

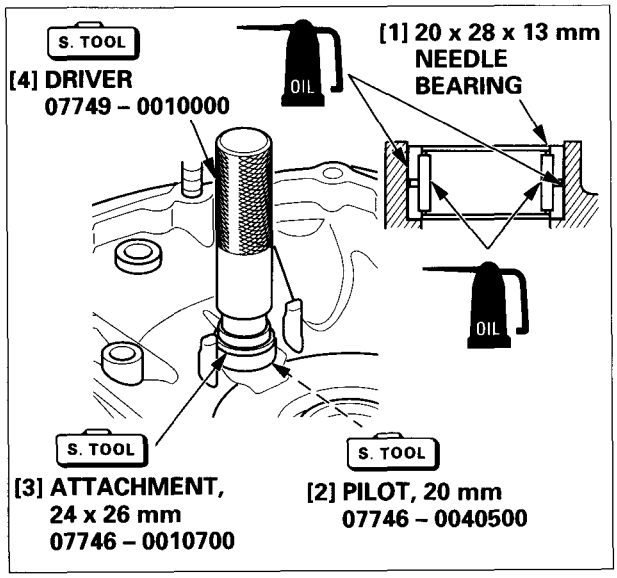


4) Apply engine oil to the outside circumference and the inside of the 20 x 28 x 13 mm new needle bearing.

5) Install the new 20 x 28 x 13 mm needle bearing in the mount case using the special tools as shown.

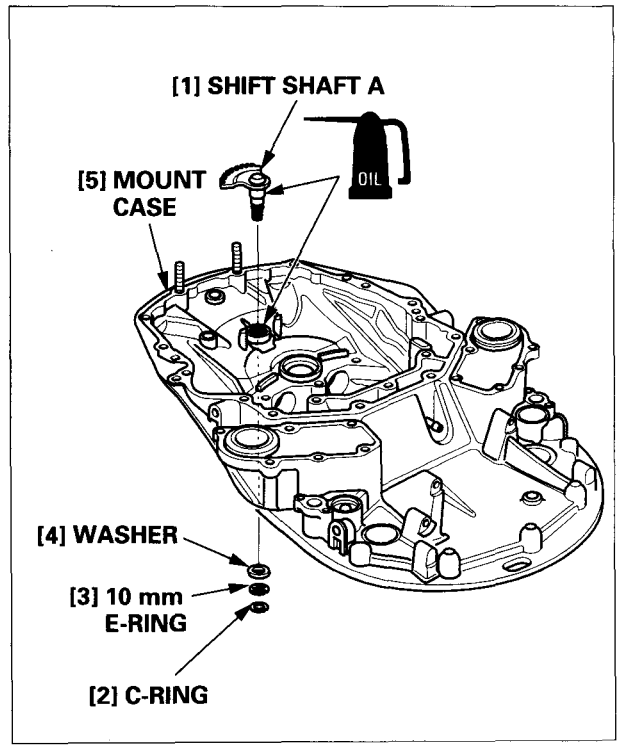
TOOLS:

Driver	**07749 – 0010000**
Attachment, 24 x 26 mm	**07749 – 0010700**
Pilot, 20 mm	**07746 – 0040500**



6) Install shift shaft A into the mount case.

7) Install the C-ring, 10 mm E-ring, washer, and shift shaft A to the mount case.



1. SHIFT ARM/LINK ROD/NEUTRAL SWITCH/DETENT SPRING

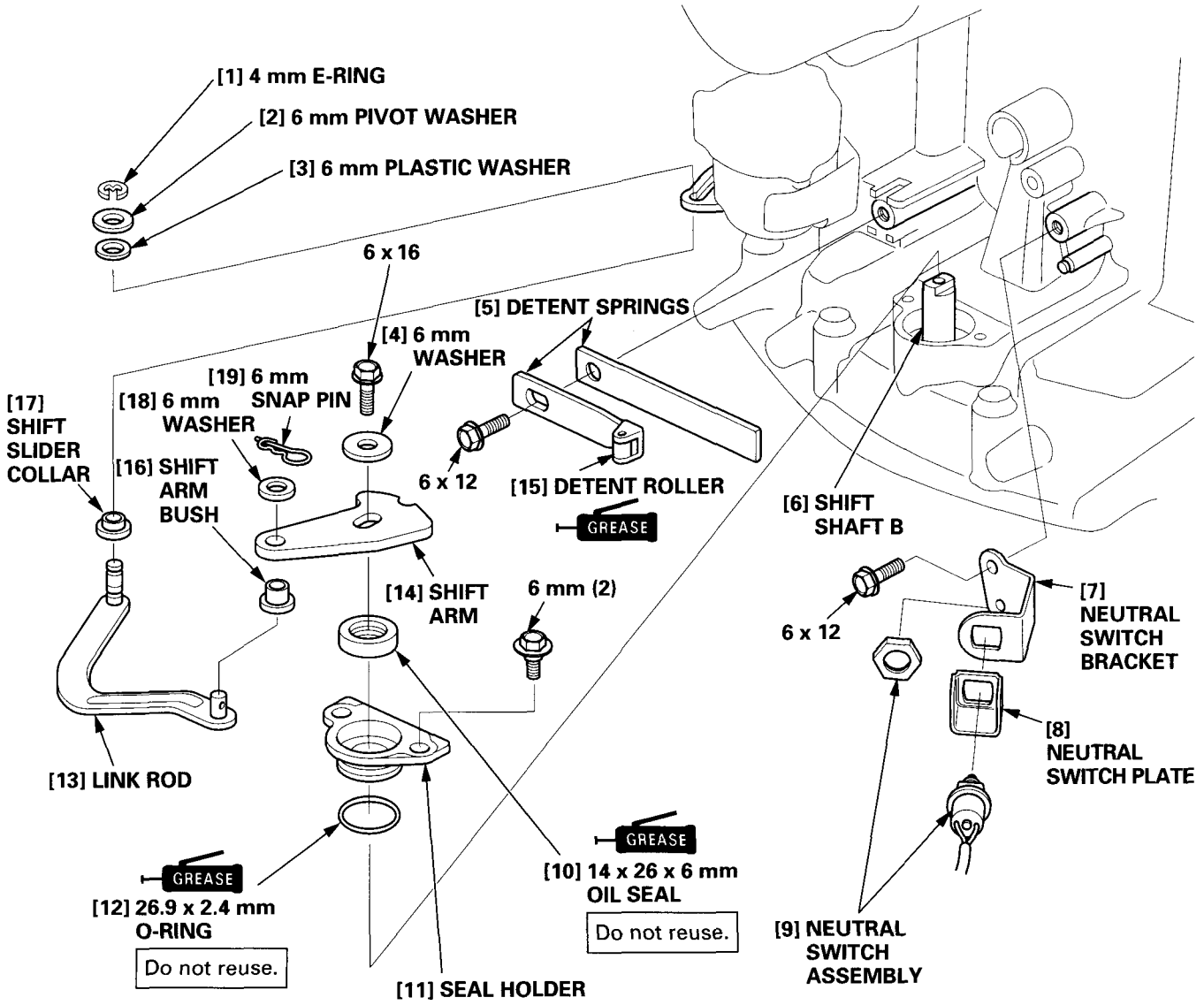
1. SHIFT ARM/LINK ROD/NEUTRAL SWITCH/DETENT SPRING

REMOVAL:

1) Move the remote control lever to the "N" (Neutral) position.
2) Remove the electric parts cover (P. 4-4 of.the base shop manual.)
3) Remove the 6 x 12 mm flange bolt and detent spring.
4) Remove the 6 mm snap pin and 6 mm washer from the shift arm.
5) Remove the 6 x 16 mm flange bolt, 6 mm washer and the shift arm.
6) Remove the neutral switch assembly.
7) Remove the 6 x 12 mm flange bolt and the neutral switch bracket.

NOTICE

- Remove the seal holder from the shift shaft B but do not raise the shift shaft B.
- If the shift shaft B is raised or gets out of place in the mount case, reposition the shift shaft B (P. 16-3).

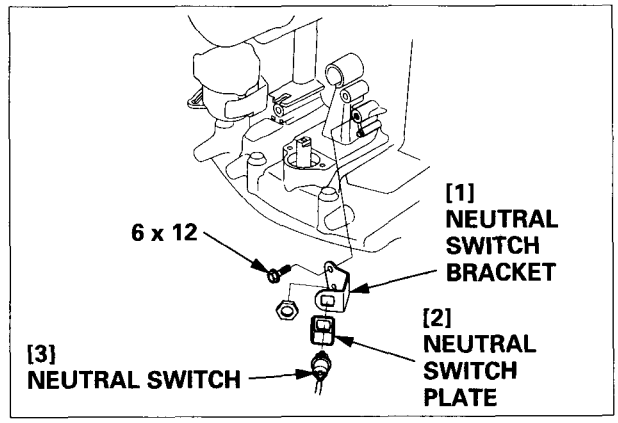


• NEUTRAL SWITCH

INSTALLATION:

1) Install the neutral switch bracket to the crankcase with the 6 x 12 mm flange bolt.

2) Install the neutral switch and neutral switch plate to the bracket.

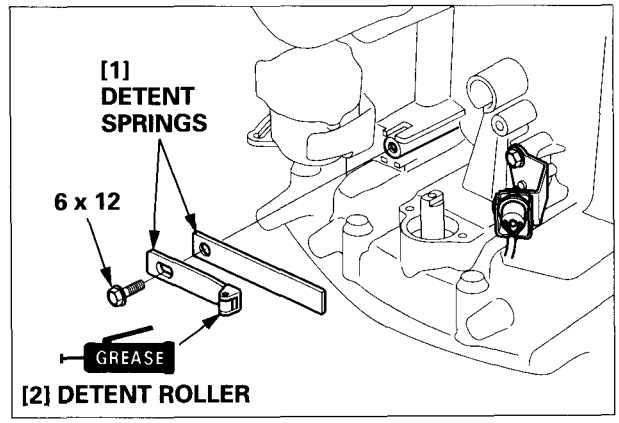


• DETENT SPRING

INSTALLATION:

1) Loosely tighten the detent spring to the crankcase with the 6 x 12 mm flange bolt.

2) After adjusting the shift control cable, tighten the 6 x 12 mm flange bolt.

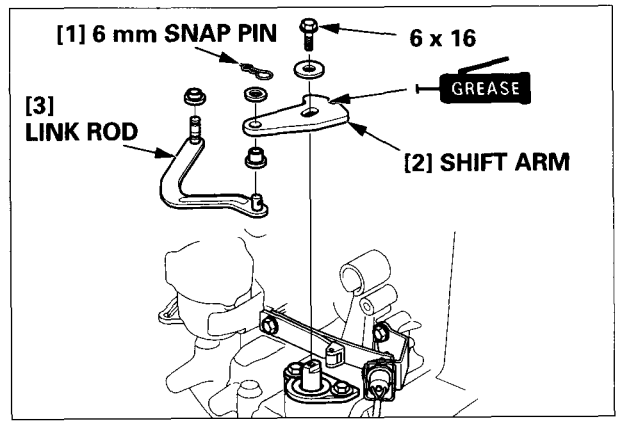


• SHIFT ARM/LINK ROD

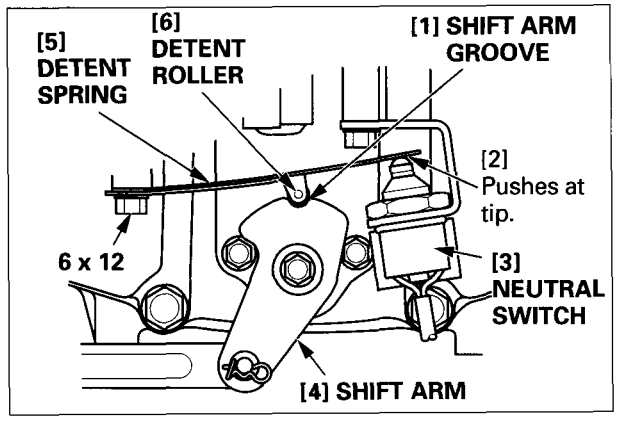
INSTALLATION:

1) Install the shift arm to the shift shaft B with the 6 x 16 mm flange bolt.

2) Install the link rod to the shift arm with the 6 mm snap pin.



3) Make sure the detent roller is in the shift arm groove then tighten the 6 x 12 mm flange bolt.
If the shift arm groove and the detent roller do not fit, loosen the 6 x 12 mm flange bolt, fit them, and tighten the bolt again.



• MODIFICATION OF THE SHIFT SHAFT B

1) Make sure that the gear has been in neutral position. (Turn the propeller shaft by hand and check for smoothness.)

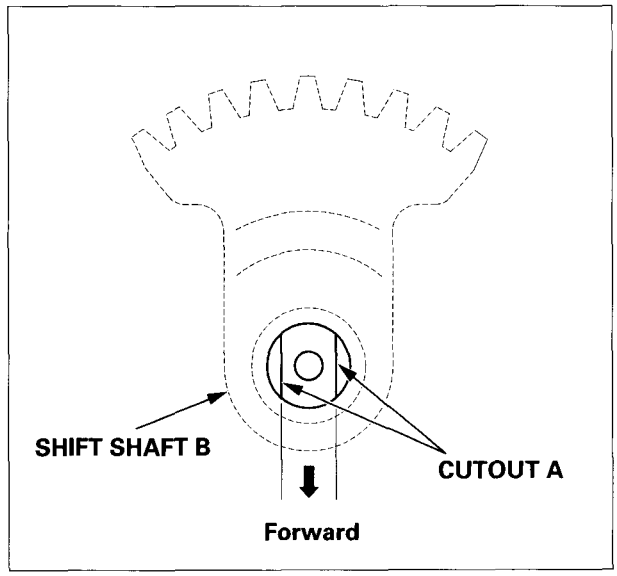
2) Remove the seal holder (P. 16-1).

3) Lift up the shift shaft B, turn it slightly right and left, and set it with the cutout A as shown.

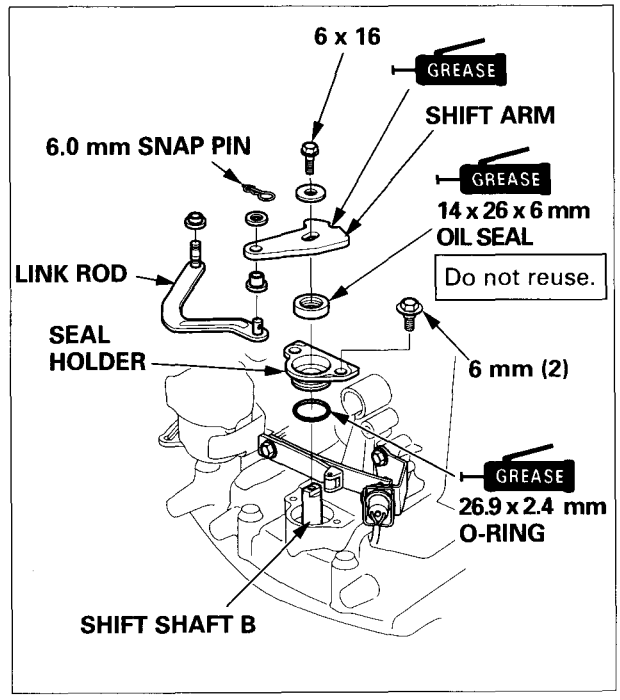
4) Lower the shift shaft B slowly, and engage the gear of the shift shaft A and the gear of the shift shaft B

NOTICE

If the gears do not engage, you may not be able to control the shift.



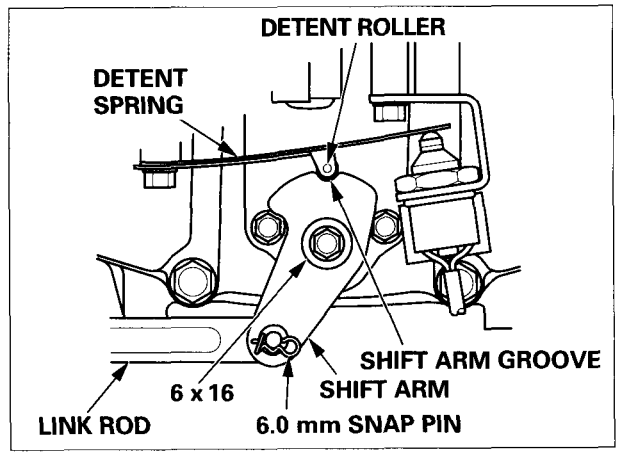
5) After modifying the shift shaft B, install the seal holder.



6) After installing the seal holder assembly, tighten the shift arm to the shift shaft B with the 6 x 16 mm flange bolt. Also, check that the shift arm groove and the detent roller fit.

7) Install the link rod to the shift arm with the 6.0 mm snap pin.

8) Check the shift control cable and adjust it securely (P. 3-1).



HONDA

Shop Manual News

OUTBOARD MOTOR

Power Equipment

News No.	Issue Date
P/P-171	NOV. 2003

SOME PARTS OF CHANGES

Applicable Information	Publication No.	Applicable Page
BF200A·BF225A	66ZY200	2-43, 2-44

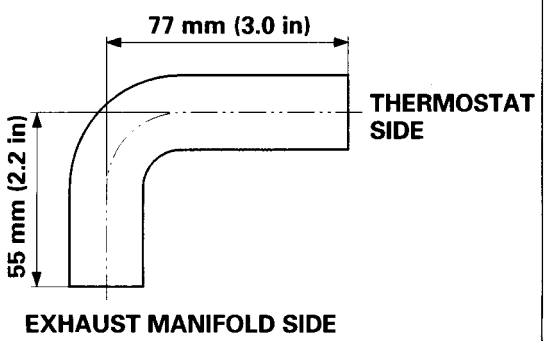
CHANGE LOCATIONS

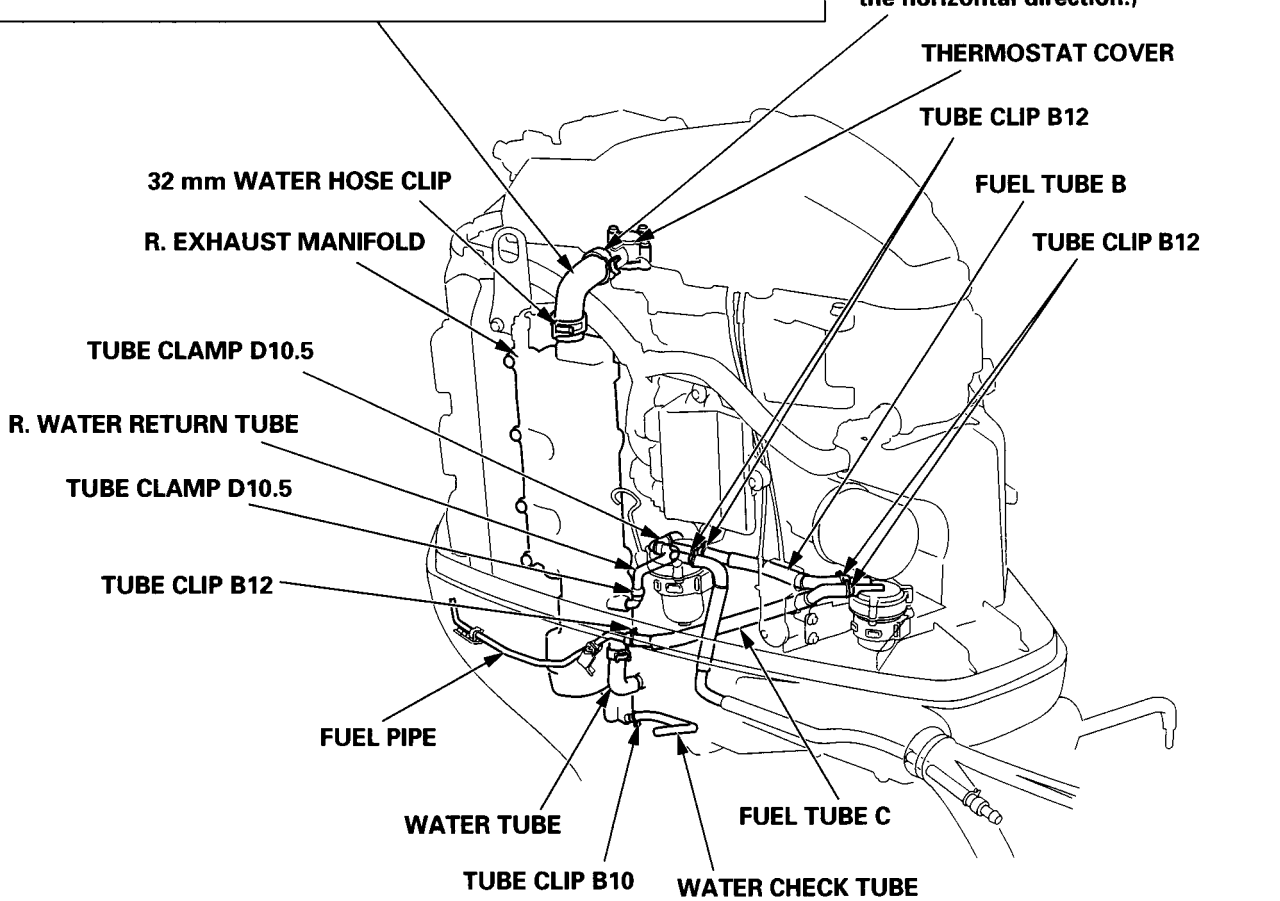
1. About the installation direction of the water relief tube.

TUBE ROUTING

WATER RELIEF TUBE

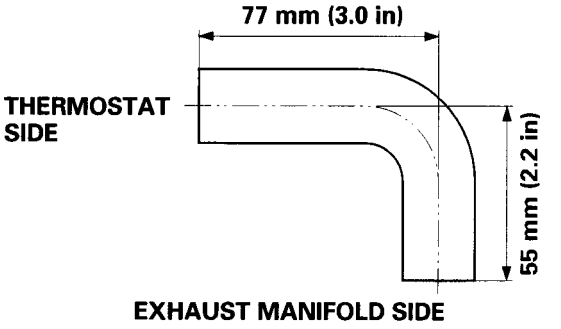
- Install the longer side of the water relief tube into the thermostat. Install the shorter side of the water relief tube into the exhaust manifold.
- The tubes that have a paint mark for the installation direction acknowledgement on the water relief tube should be installed so that the paint mark is on the exhaust manifold.

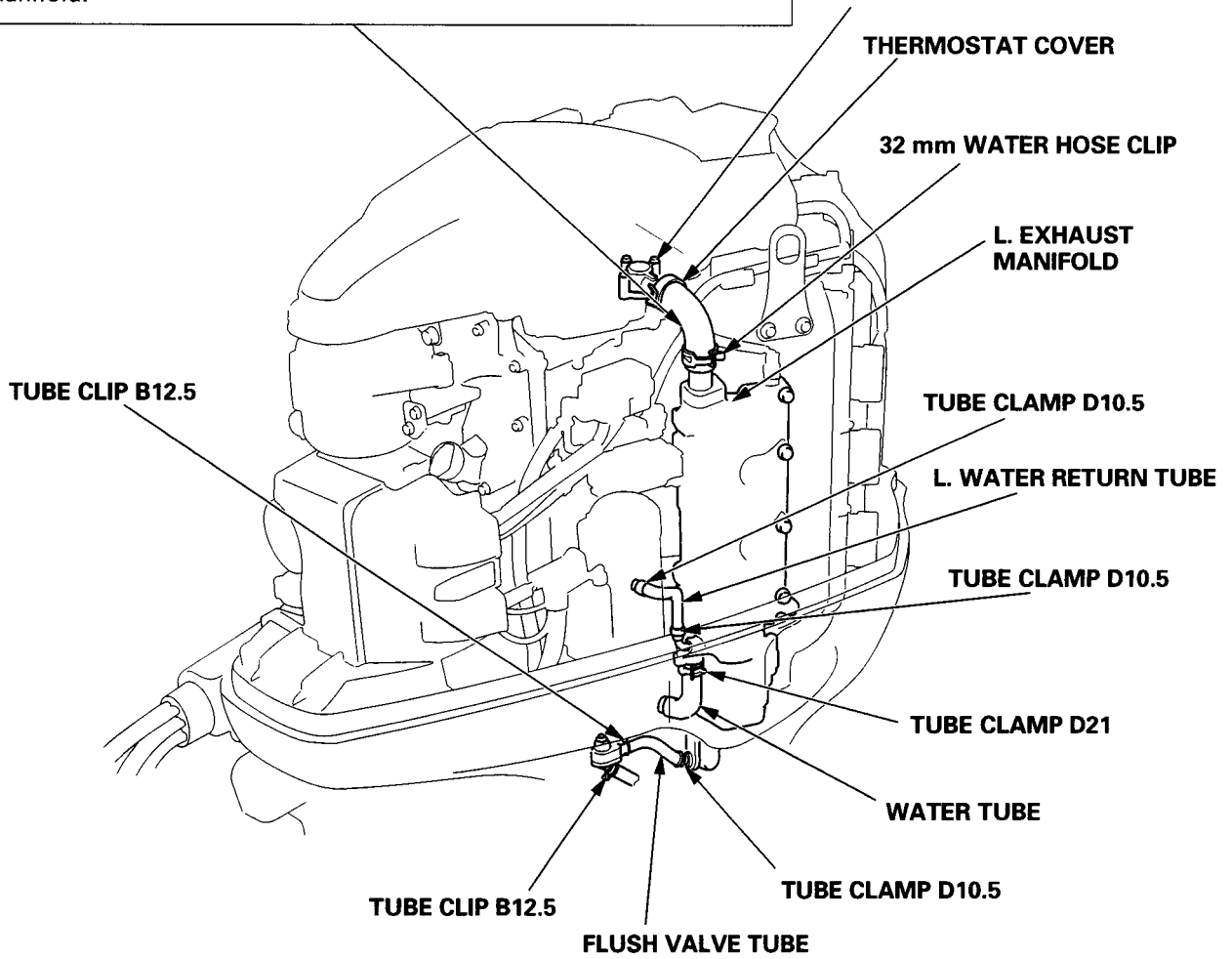




WATER RELIEF TUBE

- Install the longer side of the water relief tube into the thermostat. Install the shorter side of the water relief tube into the exhaust manifold.
- The tubes that have a paint mark for the installation direction acknowledgement on the water relief tube should be installed so that the paint mark is on the exhaust manifold.





Note: Make sure to select √ Shrink to fit in the printer dialog box when printing wiring diagrams.