

## PREFACE

This manual covers the construction, function and servicing procedures of the Honda BF115A / BF130A outboard motors.

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

ALL INFORMATION, ILLUSTRATIONS, DIRECTIONS AND SPECIFICATIONS INCLUDED IN THIS PUBLICATION ARE BASED ON THE LATEST PRODUCT INFORMATION AVAILABLE AT THE TIME OF APPROVAL FOR PRINTING. HONDA MOTOR CO., LTD. RESERVES THE RIGHT TO MAKE CHANGES WITHOUT INCURRING ANY OBLIGATION WHATEVER. NO PART OF THIS PUBLICATION MAY BE REPRODUCED WITHOUT WRITTEN PERMISSION.

HONDA MOTOR CO., LTD.  
SERVICE PUBLICATIONS OFFICE

## CONTENTS

<b>SPECIFICATIONS</b>	<b>1</b>
<b>SERVICE INFORMATION</b>	<b>2</b>
<b>MAINTENANCE</b>	<b>3</b>
<b>ENGINE COVER/TIMING BELT UPPER COVER</b>	<b>4</b>
<b>PROGRAMMED FUEL INJECTION (PGM-FI)</b>	<b>5</b>
<b>ALTERNATOR/BALANCER BELT /TIMING BELT</b>	<b>6</b>
<b>ENGINE REMOVAL/INSTALLATION</b>	<b>7</b>
<b>WATER JACKET COVER/THERMOSTAT/PRESSURE VALVE</b>	<b>8</b>
<b>CYLINDER HEAD/VALVES</b>	<b>9</b>
<b>FLYWHEEL/OIL PUMP</b>	<b>10</b>
<b>BALANCER SHAFT/CRANKCASE/CRANKSHAFT/PISTON</b>	<b>11</b>
<b>PROPELLER/GEAR CASE/EXTENSION CASE</b>	<b>12</b>
<b>OIL PAN/ENGINE UNDERCASE/MOUNTING CASE</b>	<b>13</b>
<b>SWIVEL CASE/POWER TRIM/TILT ASSEMBLY</b>	<b>14</b>
<b>STEERING ROD/REMOTE CONTROL BOX</b>	<b>15</b>
<b>CABLES/SHIFT LINK BRACKET/SHIFT ARM</b>	<b>16</b>
<b>ELECTRICAL EQUIPMENT</b>	<b>17</b>
<b>OPERATION</b>	<b>18</b>
<b>WIRING DIAGRAM</b>	<b>19</b>

# HONDA

## BF115A-130A

### Abbreviations

Abbreviations	
ACG	Alternator
API	American Petroleum Institute
Approx.	Approximately
Assy.	Assembly
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATT	Attachment
BAT	Battery
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
Comp.	Complete
CYL	Cylinder
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EX	Exhaust
F	Front or Forward
GND	Ground
IAC	Idle Air Control
IAT	Intake Air Temperature
I. D.	Inside Diameter
IG or IGN	Ignition
IN	Intake
INJ	Injection
L.	Left
MAP	Manifold Absolute Pressure
MIL	Malfunction Indicator Light
O. D.	Outside Diameter
OP	Optional Part
PCV	Positive Crankcase Ventilation
PGM-FI	Programmed-fuel Injection
P/N	Part Number
Qty	Quantity
R.	Right
SAE	Society of Automotive Engineers
SCS	Service Check Signal
STD	Standard
SW	Switch
TDC	Top Dead Center
TP	Throttle Position

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

**1. SPECIFICATIONS**
**2. DIMENSIONAL DRAWING**

## 1. SPECIFICATIONS

### DIMENSIONS AND WEIGHTS

Item	Model	BF115AX			
	Description code	BZBD	BZBG	BZBD	BZBG
	Type	LD	LCD	XD	XCD
Overall length		825 mm (32.5 in)			
Overall width		550 mm (21.7 in)			
Overall height		1,650 mm (65.0 in)		1,775 mm (69.9 in)	
Dry weight (*1)		225 kg (496 lbs)	228 kg (503 lbs)	230 kg (507 lbs)	233 kg (514 lbs)
Operating weight (including oil)		231 kg (509 lbs)	234 kg (516 lbs)	236 kg (520 lbs)	239 kg (527 lbs)

\*1: With propeller mounted.

Item	Model	BF130AX			
	Description code	BZBE	BZBH	BZBE	BZBH
	Type	LD	LCD	XD	XCD
Overall length		825 mm (32.5 in)			
Overall width		550 mm (21.7 in)			
Overall height		1,650 mm (65.0 in)		1,775 mm (69.9 in)	
Dry weight (*1)		225 kg (496 lbs)	228 kg (503 lbs)	230 kg (507 lbs)	233 kg (514 lbs)
Operating weight (including oil)		231 kg (509 lbs)	234 kg (516 lbs)	236 kg (520 lbs)	239 kg (527 lbs)

\*1: With propeller mounted.

### FRAME

Item	Model	BF115AX/BF130AX			
	Type	LD	LCD	XD	XCD
Transom height (*1)		537 mm (21.1 in)			664 mm (26.1 in)
Transom angle		5 stage adjustment (8°, 12°, 16°, 20°, 24°)			
Tilting angle		72°			
Tilting stage		Stageless			
Swivel angle		30° right and left			
Trim angle (*1)		−4° to 16°			
Remote control steering system		Motor-mounted			

\*1: Transom angle is at 12°.

### TYPES OF HONDA BF115A/BF130A OUTBOARD MOTORS

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

Model	Type	Shaft Length		Gear case		Remote Control	Control Panel	Power Trim/Tilt	Tachometer	Trimmer
		Long	Extra-long	Standard Rotation	Counter Rotation					
BF115A/ BF130A	LD	○		○		(○)	(○)	○	(○)	(○)
	XD		○	○		(○)	(○)	○	(○)	(○)
	LCD	○			○	(○)	(○)	○	(○)	(○)
	XCD		○		○	(○)	(○)	○	(○)	(○)

L: Long shaft X: Extra-long shaft C: Counter rotation ( ): Optional part

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

### ENGINE

Model	BF115AX		BF130AX	
Type	4-stroke, O.H.C., 4-cylinder			
Displacement	2,254 cm <sup>3</sup> (137.5 cu in)			
Bore x stroke	86 x 97 mm (3.4 x 3.8 in)			
Rated power	*1	84.6 kW (115 PS) at 5,000 – 6,000 min <sup>-1</sup> rpm	95.6 kW (130 PS) at 5,000 – 6,000 min <sup>-1</sup> (rpm)	
Maximum torque		169 N•m (17.2 kgf•m, 124 lbf•ft)	180 N•m (18.4 kgf•m, 133 lbf•ft)	
Compression ratio	8.8 : 1			
Fuel consumption ratio		310 g/kW•h (228 g/PS•h)	345 g/kW•h (254 g/PS•h)	
Cooling system	Forced water circulation by impeller pump with thermostat			
Ignition system	Full transistorized, battery ignition			
Ignition timing	10° at 650 min <sup>-1</sup> (rpm) B.T.D.C to 24° at 6,000 min <sup>-1</sup> (rpm) B.T.D.C.			
Spark plug	ZFR7F (NGK), KJ22CR-L8 (DENSO)			
Fuel supply system	Programmed fuel injection (PGM-FI)			
Fuel injection system	Electronic control			
Fuel injection nozzle	Pintle type			
Fuel pipe	Steel pipe and rubber tubes			
Lubrication system	Pressure lubrication by trochoid pump			
Lubrication capacity	5.6 ℓ (5.9 US qt, 4.9 Imp qt) [with oil filter replacement: 6.5 ℓ (6.9 US qt, 5.7 Imp qt)]			
Starter system	Electric starter			
Stopping system	Primary circuit ground			
Fuel	Automotive unleaded gasoline 91 research octane, 86 pump octane or higher.			
Optional fuel tank capacity	25 ℓ (6.6 US gal, 5.5 Imp gal)			
Fuel pump	Electric and mechanical plunger type			
Exhaust system	Underwater type			
Recommended oil	SAE 10W – 30/40			

\*1: Full throttle range.



# HONDA

## BF115A•130A

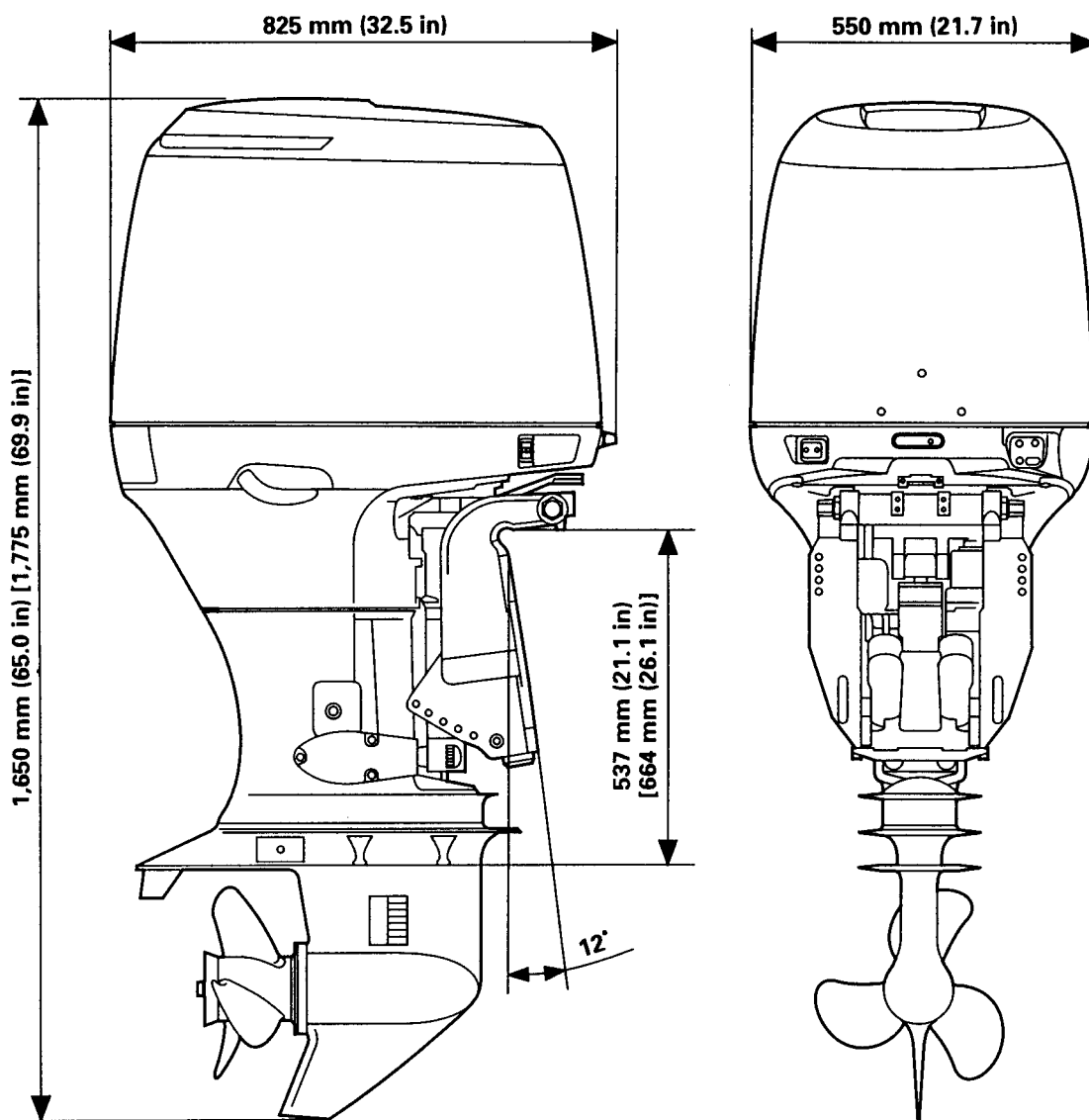
---

### LOWER UNIT

Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	0.50 (14/28)
Reduction	Spiral bevel
Gear case oil capacity	1.0 ℓ (1.1 US qt, 0.9 Imp qt)
Propeller No. of blades-Dia. x Pitch	Optional part
Propeller rotating direction	Clockwise (viewed from rear): LD and XD types Counterclockwise (viewed from rear): LCD and XCD types
Propeller driving system	Spline

## 2. DIMENSIONAL DRAWING

[ ]: Extra-long shaft type



- |  |  |
|--|--|
| <b>1. THE IMPORTANCE OF PROPER SERVICING</b> | <b>d. STARTER MOTOR</b>                              |
| <b>2. IMPORTANT SAFETY PRECAUTIONS</b>       | <b>e. IGNITION SYSTEM</b>                            |
| <b>3. SERVICE RULES</b>                      | Spark test   |
| <b>4. SERIAL NUMBER LOCATION</b>             | • FRAME  |
| <b>5. MAINTENANCE STANDARDS</b>              | <b>a. SHIFT</b>                                      |
| <b>6. TORQUE VALUES</b>                      | <b>b. POWER TRIM/TILT ASSEMBLY DOES NOT MOVE</b>     |
| <b>7. SPECIAL TOOLS</b>                      | <b>c. THE POWER TRIM/TILT ASSEMBLY DOES NOT HOLD</b> |
| <b>8. TROUBLESHOOTING</b>                    | <b>9. CABLE/HARNESS ROUTING</b>                      |
| • ENGINE                                     | <b>10. TUBE ROUTING</b>                              |
| <b>a. HARD STARTING</b>                      | <b>11. LUBRICATION</b>                               |
| Cylinder compression test                    |  |
| <b>b. ENGINE DOES NOT RUN SMOOTHLY</b>       |  |
| <b>c. IGNITION (POWER) SYSTEM</b>            |  |
| Fuse load list                               |  |

## 1. THE IMPORTANCE OF PROPER SERVICING

Proper servicing is essential to the safety of the operator and the reliability of the outboard motor. Any error or oversight made by the technician while servicing can easily result in faulty operation, damage to the outboard motor, or injury to the operator.

### WARNING

- **Improper servicing can cause an unsafe condition that can lead to serious injury or death.**
- **Follow the procedures and precautions in this shop manual carefully.**

Some of the most important precautions are given below. However, we cannot warn you of every conceivable hazard that can arise in performing maintenance or repairs. Only you can decide whether or not you should perform a given task.

### WARNING

- **Failure to follow maintenance instructions and precautions can cause you to be seriously hurt or killed.**
- **Follow the procedures and precautions in this shop manual carefully.**

## 2. IMPORTANT SAFETY PRECAUTIONS

Be sure you have a clear understanding of all basic shop safety practices and that you are wearing appropriate clothing and safety equipment. When performing maintenance or repairs, be especially careful of the following:

- **Read the instructions before you begin, and be sure you have the tools and skills required to perform the tasks safely.**

Be sure the engine is off before you begin any maintenance or repairs. This will reduce the possibility of several hazards:

- **Carbon monoxide poisoning from engine exhaust.**  
Be sure there is adequate ventilation whenever you run the engine.
- **Burns from hot parts.**  
Let the engine cool before you touch it.
- **Injury from moving parts.**  
Do not run the engine unless the instruction tells you to do so. Even then, keep your hands, fingers, and clothing away.

To reduce the possibility of a fire or explosion, be careful when working around gasoline. Use only a nonflammable solvent, not gasoline, to clean parts. Keep all cigarettes, sparks, and flames away from the battery and all fuel-related parts.

### 3. SERVICE RULES

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



: Apply oil.



: Use special tool.



: Apply grease

○ x ○ (○)

: Indicates the type, length, and number of the flange bolt used.

P.

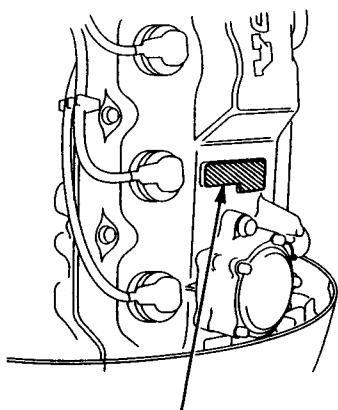
: Indicates the reference page.



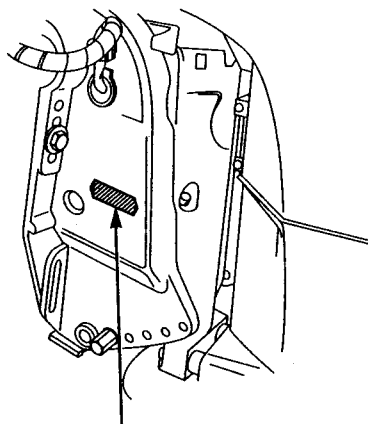
(Molybdenum disulfide oil) : Use molybdenum oil solution (mixture of the engine oil and molybdenum grease with the ratio 1 : 1).

### 4. SERIAL NUMBER LOCATION

The engine serial number is stamped on the cylinder head cover and the product identification number is located on the L. 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

## 5. MAINTENANCE STANDARDS

### • ENGINE

Unit: mm (in)

Part	Item		Standard	Service limit
Engine	Idle speed (in neutral)		750 ± 50 min <sup>-1</sup> (rpm)	————
	Trolling speed		650 ± 50 min <sup>-1</sup> (rpm)	————
	Cylinder compression		1,373–1,569 kPa (14–16 kgf/cm <sup>2</sup> , 199–228 psi) at 300 min <sup>-1</sup> (rpm)	————
Spark plugs	Gap		0.7 – 0.8 (0.028 – 0.031)	————
Valves	Valve clearance	IN	0.24 – 0.28 (0.009 – 0.011)	————
		EX	0.28 – 0.32 (0.011 – 0.013)	————
	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	53.66 (2.113)	————
		EX	55.58 (2.188)	————
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	0.019 – 0.058 (0.0007 – 0.0023)	0.08 (0.003)
		EX	0.018 – 0.054 (0.0007 – 0.0021)	0.08 (0.003)
Pistons	Skirt O.D.		85.97 – 85.98 (3.3846 – 3.3850)	85.96 (3.384)
	Piston-to-cylinder clearance		0.020 – 0.045 (0.0008 – 0.0018)	0.050 (0.0020)
	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)

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.	No.1–No.5		28.000 – 28.024 (1.1024 – 1.1033)	————
	Head height			99.95 – 100.05 (3.935 – 3.939)	————
Cylinder block	Cylinder sleeve I.D.			86.00 – 86.015 (3.3858 – 3.3864)	86.07 (3.389)
	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 – 0.30 (0.006 – 0.012)	0.4 (0.016)
	Connecting rod big end oil clearance			0.026 – 0.044 (0.0010 – 0.0017)	————
Crankshaft	Journal O. D.	Main	No.1/No.2	54.980 – 55.004 (2.1646 – 2.1655)	————
			No.3	54.976 – 55.000 (2.1644 – 2.1654)	————
			No.4	54.980 – 55.004 (2.1646 – 2.1655)	————
			No.5	54.992 – 55.016 (2.1650 – 2.1660)	————
		Pin		44.976 – 45.000 (1.7707 – 1.7717)	————
	Journal roundness (Main/Pin)			0.005 (0.0002) Max	0.006 (0.0002)
	Shaft runout			0.030 (0.0012) Max	0.040 (0.0016)
	Crankshaft main bearing oil clearance	No.1/No.2/ No.4	No.1/No.2/ No.4	0.027 – 0.045 (0.0011 – 0.0018)	0.050 (0.0020)
			No.3	0.031 – 0.049 (0.0012 – 0.0019)	0.055 (0.0022)
			No.5	0.017 – 0.035 (0.0007 – 0.0014)	0.040 (0.0016)
	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 – 0.15 (0.002 – 0.006)	0.5 (0.020)
	Shaft runout		0.03 (0.001) Max	0.04 (0.002)
	Journal O.D.	No.1–No.5	27.935 – 27.950 (1.0998 – 1.1004)	————
	Cam height	IN	38.274 – 38.359 (1.5068 – 1.5102)	————
		EX	37.651 – 37.756 (1.4823 – 1.4865)	————
	Shaft oil clearance	No.1–No.5	0.050 – 0.089 (0.0020 – 0.0035)	0.15 (0.006)
Balancer shaft	Journal O.D.	No.1 (EX side)	42.722 – 42.734 (1.6820 – 1.6824)	42.71 (1.681)
		No.1 (IN side)	20.938 – 20.950 (0.8243 – 0.8248)	20.92 (0.824)
		No.2	38.712 – 38.724 (1.5241 – 1.5246)	38.70 (1.524)
		No.3	34.722 – 34.734 (1.3670 – 1.3675)	34.71 (1.367)
	Journal roundness		0.005 (0.0002) Max	0.006 (0.0002)
	Shaft axial clearance	EX side	0.10 – 0.40 (0.004 – 0.016)	————
		IN side	0.04 – 0.15 (0.002 – 0.006)	————
	Shaft runout		0.02 (0.001) Max	0.03 (0.001)
	Journal oil clearance	No.1 (EX side)	0.066 – 0.098 (0.0026 – 0.0039)	0.12 (0.005)
		No.1 (IN side)	0.050 – 0.075 (0.0020 – 0.0030)	0.09 (0.004)
		No.2	0.076 – 0.108 (0.0030 – 0.0043)	0.13 (0.005)
		No.3	0.066 – 0.098 (0.0026 – 0.0039)	0.12 (0.005)
	Balancer shaft bearing I.D.	No.1 (EX side)	42.800 – 42.820 (1.6850 – 1.6858)	42.83 (1.686)
		No.1 (IN side)	21.000 – 21.013 (0.8268 – 0.8273)	21.02 (0.828)
		No.2	38.800 – 38.820 (1.5276 – 1.5283)	38.83 (1.529)
		No.3	34.800 – 34.820 (1.3701 – 1.3709)	34.83 (1.371)
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		0.10 – 0.18 (0.004 – 0.007)	0.20 (0.008)
	Outer rotor height		12.480 – 12.500 (0.4913 – 0.4921)	————
	Pump body depth		12.520 – 12.550 (0.4929 – 0.4941)	————
	Outer rotor-to-oil body side clearance		0.02 – 0.07 (0.001 – 0.003)	0.12 (0.005)
Fuel pump/ Fuel line	Discharge volume [with pump operated for 2 sec.]		45 m ℓ (1.5 US oz, 1.6 Imp oz) or more	————
	Fuel pressure [kPa (kgf/cm <sup>2</sup> , psi)]		265 – 314 (2.7 – 3.2, 38 – 46)	————

Unit: mm (in)

Part	Item		Standard	Service limit
Vapor separator	Float height		29 – 34 (1.1 – 1.3)	————
Ignition coil	Resistance	Primary coil	0.60 – 0.72 $\Omega$	————
		Secondary coil	25 – 38 k $\Omega$	————
Alternator	Brush length		10.5 (0.41)	8.4 (0.33)
	Brush spring pressure		3.2 N (0.33 kgf, 0.73 lbf)	————
	Rotor coil resistance		2.9 $\Omega$	————
	Slip ring O.D.		14.4 (0.57)	14.0 (0.55)
	Belt tension [N (kgf, lbf)] Measured between the pulleys with belt tension gauge.	Used belt	392 – 490 (40 – 50, 88 – 110)	————
		New belt	490 – 588 (50 – 60, 110 – 132)	————
	Belt deflection Measured with 98 N (10 kgf, 22 lbf) of force applied to the center of belt between the pulleys.	Used belt	7.7 – 9.0 (0.30 – 0.35)	————
		New belt	6.7 – 7.7 (0.26 – 0.30)	————
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)
Pulser coil	Resistance		970 – 1,170 $\Omega$	————

### • FRAME

Unit: mm (in)

Part	Item		Standard	Service limit
Vertical shaft	Shaft O.D. (at needle bearing)		28.566 – 28.575 (1.1246 – 1.1250)	28.545 (1.1238)
Bevel gear	Gear I.D.	Forward (LCD/XCD types only)	33.000 – 33.025 (1.2992 – 1.3002)	33.044 (1.3009)
Propeller shaft	Shaft O.D.	At needle bearing	30.007 – 30.020 (1.1814 – 1.1819)	29.990 (1.1807)
		At forward bevel gear (LD/XD types only)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)
		At forward bevel gear (LCD/XCD types only)	32.904 – 32.920 (1.2954 – 1.2961)	32.883 (1.2946)
		At reverse bevel gear (LCD/XCD types only)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)



## 6. TORQUE VALUES

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
• Engine				
Crankcase bolt (11 x 131 mm)	M11 x 1.5	51	5.2	38
(10 x 40 mm)	M10 x 12.5	47	4.8	35
(10 x 55 mm)	M10 x 1.25	39	4.0	29
Intake manifold nut	M10 x 1.25	39	4.0	29
12 mm bolt	M12 x 1.5	29	3.0	22
Oil filter	M22 x 1.5	21.6	2.2	16
Cylinder head bolt	M12 x 1.5	*1 44	4.5	33
Camshaft holder bolt	M8 x 1.25	22	2.2	16
Spark plug	M14 x 1.25	18	1.8	13
Connection rod bolt	M8 x 0.75	*2 20	2.0	14
Oil drain plug bolt	M12 x 1.5	23	2.3	17
Engine hanger bolt	M12 x 1.25	54	5.5	40
Timing belt adjusting spring bolt	M6 x 1.0	12	1.2	9
Crankshaft pulley bolt	M16 x 1.5	245	25.0	181
Balancer shaft thrust metal bolt	M6 x 1.0	20	2.0	14
Balancer belt driven pulley bolt	M8 x 1.25	29	3.0	22
Balancer driven gear bolt	M8 x 1.25	25	2.5	18
Balancer gear case Comp. bolt	M8 x 1.25	25	2.5	18
Balancer belt adjusting bracket bolt	M6 x 1.0	12	1.2	9
Timing belt adjusting bolt	M11 x 1.25	67	6.8	49
Tensioner adjusting nut	M10 x 1.25	44	4.5	33
Timing belt driven pulley bolt	M12 x 1.25	98	10.0	72
Valve adjusting lock nut	M7 x 0.75	20	2.0	14
Fuel pipe nut	M14 x 1.5	37	3.8	27
	M12 x 1.25	22	2.2	16
Fuel hose bolt	M12 x 1.25	33	3.4	25
Fuel pressure check nut	M12 x 1.25	22	2.2	16
Service check bolt	M6 x 1.0	12	1.2	9
Throttle body bolt, nut	M8 x 1.25	26	2.7	20
Engine mount bolt	M10 x 1.25	39	4.0	29
Flywheel bolt	M12 x 1.0	118	12.0	87
Flywheel boss bolt	M8 x 1.25	32	3.3	24
Alternator bracket bolt	M10 x 1.25	39	4.0	29
Alternator assembly bolt	M10 x 1.25	44	4.5	33
nut	M8 x 1.25	24	2.4	17
ECM bolt	M6 x 1.0	5	0.5	3.6
Oil pressure switch	PT 1/8	9	0.9	6.5
IAT sensor	M12 x 1.5	18	1.8	13
ECT sensor	M12 x 1.5	18	1.8	13
18 mm sealing bolt	M18 x 1.25	39	4.0	29
Oil pump cover screw	M6 x 1.0	7	0.7	5.1
30 mm sealing bolt	M30 x 1.5	78	8.0	58

\*1: Tighten the cylinder head bolts to 44 N•m (4.5 kgf•m, 33 lbf•ft) first, then tighten them an additional 180° (Snag torque [Angle method]).

\*2: Tighten the connection rod bolts to 20 N•m (2.0 kgf•m, 14 lbf•ft) first, then tighten them an additional 90° (Snag torque [Angle method]).

# HONDA

## BF115A•130A

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
<b>• GEAR CASE</b> 18 mm castle nut *1 Propeller shaft holder bolt Gear case bolt nut (XD and XCD types only) Extension separator stud bolt (XD and XCD types only) Oil drain bolt Oil level bolt Wash bolt Trim tab bolt Anode metal nut 64 mm lock nut Pinion gear nut Impeller housing bolt Water screen screw Bearing holder	M18 x 1.5 M10 x 12.5 M10 x 1.25 M10 x 1.25 M10 x 1.25 M8 x 1.25 M8 x 1.25 M8 x 1.25 M8 x 1.25 M6 x 1.0 M64 x 1.5 M16 x 1.5 M8 x 1.25 M5 x 0.8 M90 x 2.0	1 34 34 34 15 3.4 3.4 3.4 22 9.8 123 132 19.7 1 103	0.1 3.5 3.5 3.5 1.5 0.35 0.35 0.35 2.2 1.0 12.5 13.5 2.0 0.1 10.5	0.7 25 25 25 11 2.5 2.5 2.5 16 7 90 98 14 0.7 76
<b>• EXTENSION/MOUNT</b> Lower rubber motor mount nut Lower rubber motor mount housing bolt Extension case bolt Undercover screw Upper rubber mount nut Oil drain plug cover screw	M12 x 1.25 M8 x 1.25 M10 x 1.25 M6 x 1.0 M5 x 0.5 M12 x 1.25 M6 x 1.0	83 22 34 4.5 3 83 6.4	8.5 2.2 3.5 0.45 0.3 8.5 0.65	61 16 25 3.3 2.2 61 4.7
<b>• STERN BRACKET</b> Stern bracket nut	M25 x 2.0 7/8 – 14 UNC M10 x 1.25	34 34 34	3.5 3.5 3.5	25 25 25
<b>• POWER TRIM/TILT ASSEMBLY</b> Cylinder cap Rod guide comp. Manual valve Socket bolt A/B Power tilt motor assembly bolt Oil tank bolt Oil tank cap	_____ _____ M14 x 1.5 _____ 1/4 – 20 UNC _____ _____	162 78 3.5 8.3 5 5 2.5	16.5 8.0 0.35 0.85 0.5 0.5 0.25	119 58 2.5 6.1 3.6 3.6 1.8

\*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 N•m (4.5 kgf•m, 33 lbf•ft)

Item	Thread Dia. (mm) and pitch (length)	Torque values		
		N•m	kgf•m	lbf•ft
• FRAME/ELECTRICAL				
Separate top cover bolt	M6 x 1.0 (Flange) (Hex.)	12	1.2	9
		10	1.0	7
Steering rod bolt/nut	3/8 – 24 UNF	22	2.2	16
Starter motor bolt	M10 x 1.25	39	4.0	29
Starter solenoid switch screw nut	M6 x 1.0	6	0.6	4.3
	M8 x 1.25	10.8	1.1	8
Alternator pulley nut	M14 x 1.0	110	11.2	81
Starter motor terminal nut	M8 x 1.25	10.8	1.1	8
Starter magnetic switch terminal nut	M6 x 1.0	4.9	0.5	3.6
Alternator terminal nut	M6 x 1.0	7.9	0.8	5.8
Ignition switch nut	M22 x 1.0	4.8	0.49	3.5
Emergency stop switch nut	M16 x 1.0	1.5	0.15	1.1
Neutral switch nut	M20 x 1.0	2.5	0.25	1.8
Grease fitting	M6 x 1.0	3	0.3	2.2

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

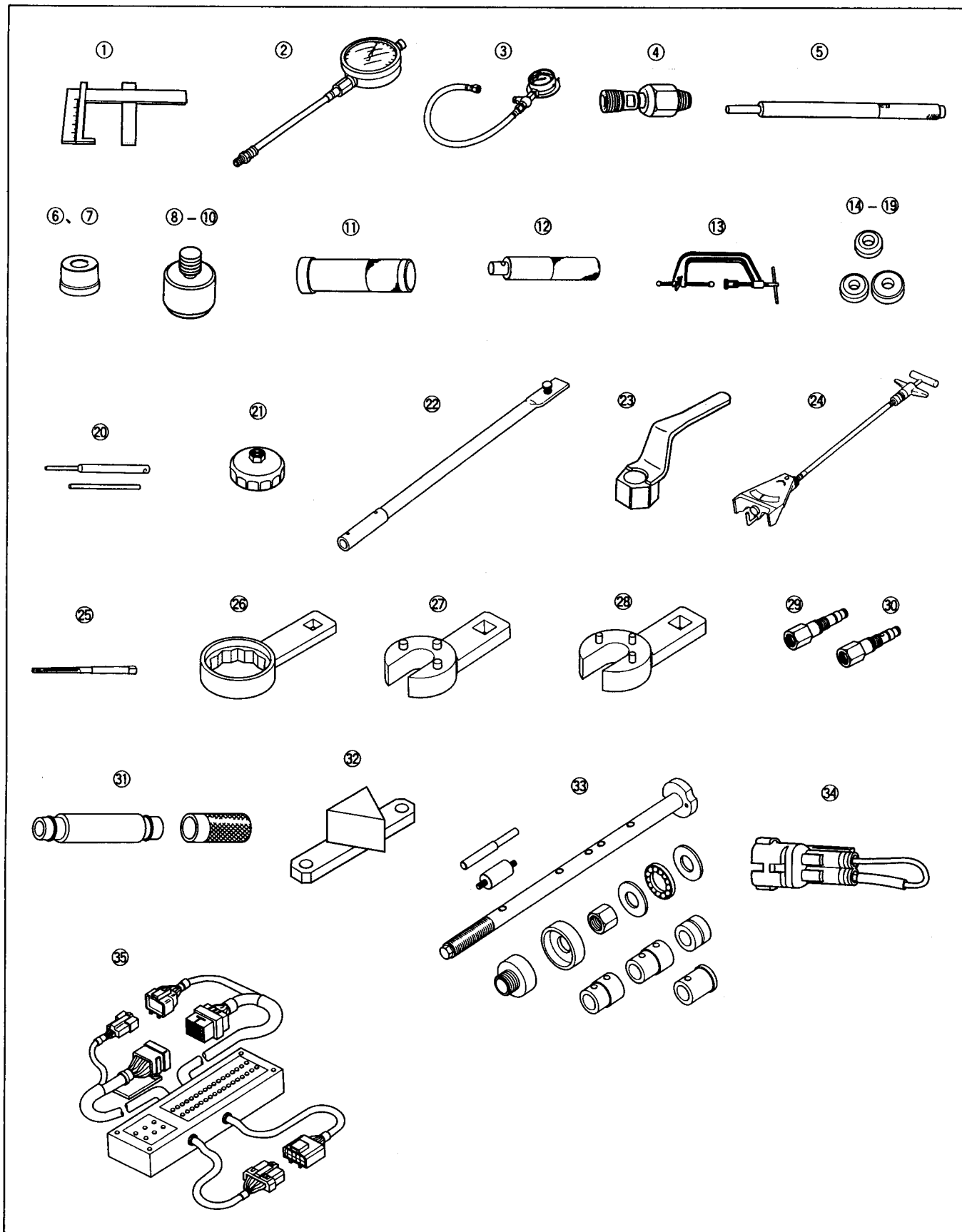
### STANDARD TORQUE VALUES

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


## 7. SPECIAL TOOLS

• Special tool applicable to the parts except gear case


Tool name		Tool number	Application
1	Float level gauge	07401-0010000	Vapor separator float level inspection
2	Fuel pressure gauge set	07406-0040002	Fuel pressure inspection
3	Oil pressure gauge set	07506-3000000	Oil pressure test
4	Oil pressure gauge attachment	07404-0030000	
5	Valve guide driver, 5.5 mm	07742-0010100	Valve guide removal/installation
6	Attachment, 32 x 35 mm	07746-0010100	22 x 35 x 7 mm water seal installation, lower mount center housing removal/installation
7	Attachment, 24 x 26 mm	07746-0010700	14 x 26 x 6 mm water seal installation
8	Pilot, 12 mm	07746-0040200	14 x 26 x 6 mm water seal installation
9	Pilot, 30 mm	07746-0040700	Lower mount center housing removal/installation
10	Pilot, 22 mm	07746-0041000	22 x 35 x 7 mm water seal installation
11	Driver, 40 mm I.D.	07746-0030100	Lower mount center housing installation
12	Driver	07749-0010000	Driver for 6, 7, 8, 9 and 10
13	Valve spring compressor	07757-0010000	Valve cotter removal/installation
14	Valve seat cutter, 45° 35 mm	07780-0010400	Valve seat reconditioning (IN)
15	Valve seat cutter, 45° 33 mm	07780-0010800	Valve seat reconditioning (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, 60° 37 mm	07780-0014100	Valve seat reconditioning (IN)
19	Valve seat cutter, 60° 30 mm	07780-0014000	Valve seat reconditioning (EX)
20	Cutter holder, 5.5 mm	07781-0010101	Valve seat reconditioning (IN/EX)
21	Oil filter wrench	07912-6110001	Oil filter removal/installation
22	Holder handle	07JAB-001020B	Crankshaft pulley bolt (16 x 49 mm bolt-washer) removal/installation
23	Holder attachment, 50 mm, offset	07MAB-PY30100	
24	Belt tension gauge	07JGG-0010101	Alternator belt tension inspection
25	Valve guide reamer, 5.525 mm	07HAH-PJ70100	Valve guide reaming
26	Lock nut wrench, 56 mm	07LPA-ZV30200	Timing belt driven pulley bolt removal/installation
27	ø6 pin type wrench	07SPA-ZW10100	Piston rod comp. removal/installation
28	ø4 pin type wrench	07SPA-ZW10200	Rod guide comp. removal/installation
29	Oil pressure gauge joint A	07SPJ-ZW10100	Power trim/tilt assembly blow pressure inspection
30	Oil pressure gauge joint B	07SPJ-ZW10200	
31	Stem seal driver	07PAD-0010000	Valve stem seal A/B installation
32	Ring gear holder	07WPB-ZW50100	Flywheel boss removal/installation, flywheel removal/installation
33	Balancer bearing replacement tool	07WPF-ZW50100	Balancer bearing removal/installation
34	SCS short connector	07WPZ-0010100	ECM troubleshooting, idling adjustment
35	Test harness	07WPZ-ZW50100	ECM troubleshooting



• Special tool applicable to all types of gear case

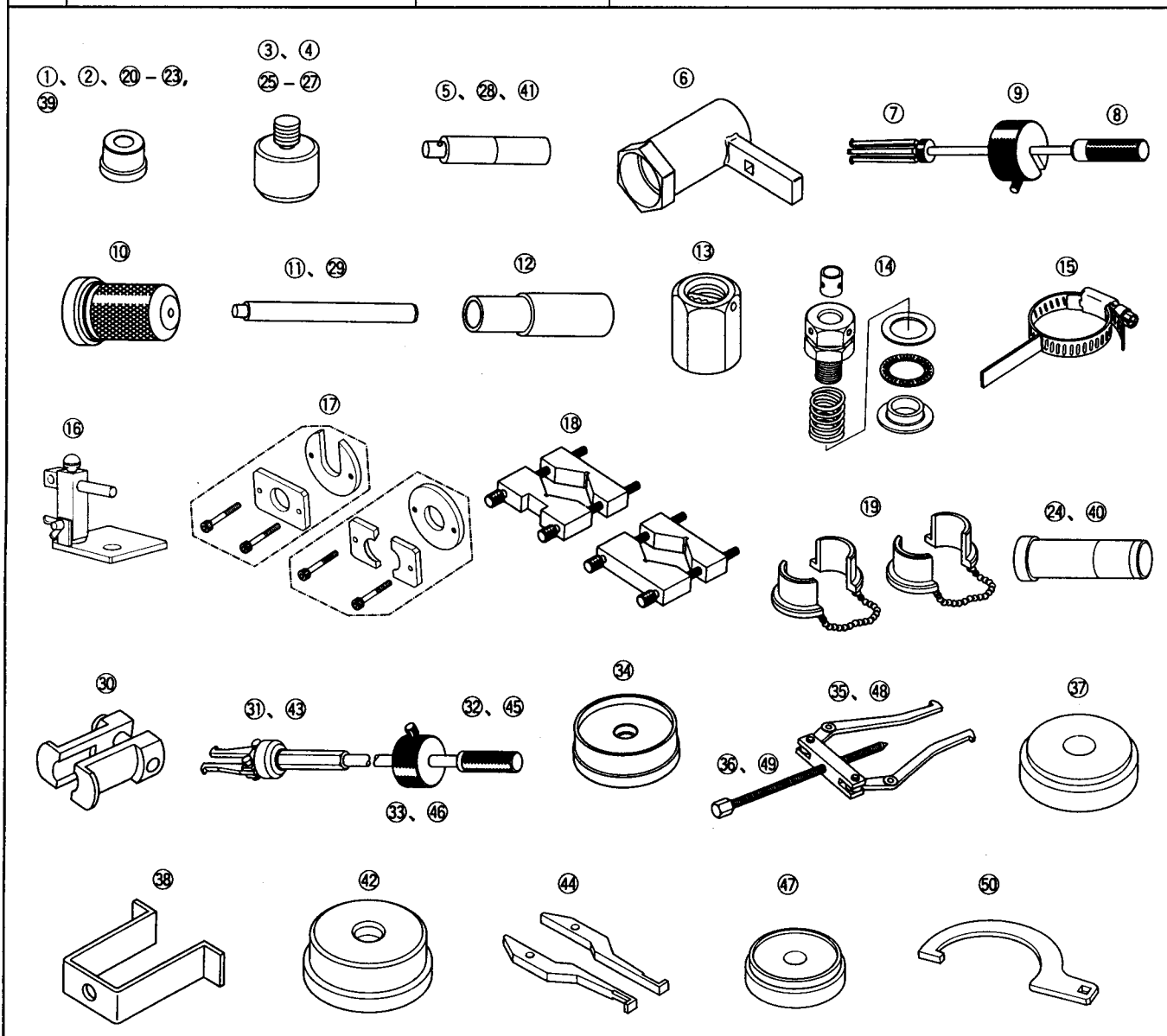
Tool name		Tool number	Application
1	Attachment, 32 x 35 mm	07746-0010100	23 x 36 x 6 mm water seal installation, 1-1/8 x 1-1/2 x 1-1/4 needle bearing removal/installation
2	Attachment, 37 x 40 mm	07746-0010200	30 x 37 x 26 mm needle bearing installation
3	Pilot, 30 mm	07746-0040700	30 x 37 x 26 mm needle bearing installation
4	Pilot, 28 mm	07746-0041100	1-1/8 x 1-1/2 x 1-1/4 needle bearing removal/installation
5	Driver	07749-0010000	Driver for 1, 2 and 3
6	Lock nut wrench, 64 mm	07916-MB00002	64 mm lock nut removal/installation
7	Bearing remover, 30 mm	07936-8890300	 30 x 37 x 26 mm needle bearing removal
8	Remover handle	07936-3710100	
9	Remover weight	07741-0010201	
10	Oil seal driver	07947-SB00100	30 x 45 x 7 mm water seal installation
11	Driver	07949-3710001	1-1/8 x 1-1/2 x 1-1/4 needle bearing removal/installation
12	Drive shaft B	07964-MB00200	30 x 62 x 21.25 taper roller bearing (inner race) installation
13	Vertical shaft holder	07SPB-ZW10200	Vertical shaft pinion gear nut removal/installation
14	Bearing preload tool	07SPJ-ZW0010Z	Forward/reverse bevel gear backlash inspection
15	Backlash indicator tool	07SPJ-ZW0030Z	Forward/reverse bevel gear backlash inspection
16	Dial indicator adapter kit	07SPJ-ZW0040Z	Forward/reverse bevel gear backlash inspection
17	Gauge adapter, 80 mm	07WPJ-ZW50100 or	Vertical shaft pinion gear shim adjustment
18	Vertical shaft gauge	07TPJ-ZW10100	Forward/reverse bevel gear backlash inspection (LD and LCD types only)
19	Vertical shaft indicator attachment	07WPK-ZW50100	

• Special tool applicable to LD and XD types of gear case

Tool name		Tool number	Application
20	Attachment, 37 x 40 mm	07746-0010200	Reverse bevel gear/6208 radial ball bearing removal
21	Attachment, 42 x 47 mm	07746-0010300	50 x 82 x 21.5 taper bearing (inner race) removal
22	Attachment, 52 x 55 mm	07746-0010400	50 x 82 x 21.5 taper bearing (outer race) installation
23	Attachment, 24 x 26 mm	07746-0010700	Reverse bevel gear/6208 radial ball bearing removal
24	Driver, 40 mm I.D.	07746-0030100	Reverse bevel gear/6208 radial ball bearing installation
25	Pilot, 17 mm	07746-0040400	Reverse bevel gear/6208 radial ball bearing removal
26	Pilot, 25 mm	07746-0040600	50 x 82 x 21.5 taper bearing (outer race) installation
27	Pilot, 30 mm	07746-0040700	Reverse bevel gear/6208 radial ball bearing removal
28	Driver	07749-0010000	Driver for 20, 21, 23, 25, 27 and 34
29	Driver	07949-3710001	50 x 82 x 21.5 taper bearing (outer race) installation
30	Bearing remover	07HMC-MR70100	Reverse bevel gear/6208 radial ball bearing removal
31	Bearing race puller	07LPC-ZV30100	 50 x 82 x 21.5 taper bearing (outer race) removal
32	Remover handle	07936-3710100	
33	Remover weight	07741-0010201	
34	Bearing driver	07NAD-P200100	50 x 82 x 21.5 taper bearing (inner race) installation
35	Puller jaws	07SPC-ZW0010Z	Forward bevel gear backlash inspection
36	Puller bolt	07SPC-ZW0011Z	Forward bevel gear backlash inspection
37	Mandrel	07SPD-ZW0010Z	50 x 82 x 21.5 taper bearing (outer race) installation
38	Propeller shaft holder	07TPB-ZW10100	Reverse bevel gear backlash inspection

• Special tool applicable to LCD and XCD types of gear case

Tool name		Tool number	Application
39	Attachment, 42 x 47 mm	07746-0010300	Forward bevel gear removal
40	Driver, 40 mm I.D.	07746-0030100	40 x 82 x 18 radial ball bearing installation
41	Driver	07749-0010000	Driver for 39, 42 and 47
42	Attachment, 78 x 90 mm	07GAD-SD40100	50 x 82 x 21.5 taper bearing (outer race) installation
43	Bearing race puller	07LPC-ZV30100	Reverse bevel gear/40 x 82 x 18 radial ball bearing removal [Puller jaws of the bearing race puller (07LPC-ZV30100) are removed and replaced with the puller jaws of part number 07WPC-ZW50100.]
44	Puller jaws, 25 mm	07WPC-ZW50100	
45	Remover handle	07936-3710100	
46	Remover weight	07741-0010201	
47	Attachment, 78 x 80 mm	07NAD-PX40100	50 x 82 x 21.5 taper bearing (outer race) installation
48	Puller jaws	07SPC-ZW0010Z	Forward/reverse bevel gear backlash inspection
49	Puller bolt	07SPC-ZW0011Z	Forward/reverse bevel gear backlash inspection
50	Pin type wrench, 103 mm	07WPA-ZW50100	Bearing holder assembly removal/installation

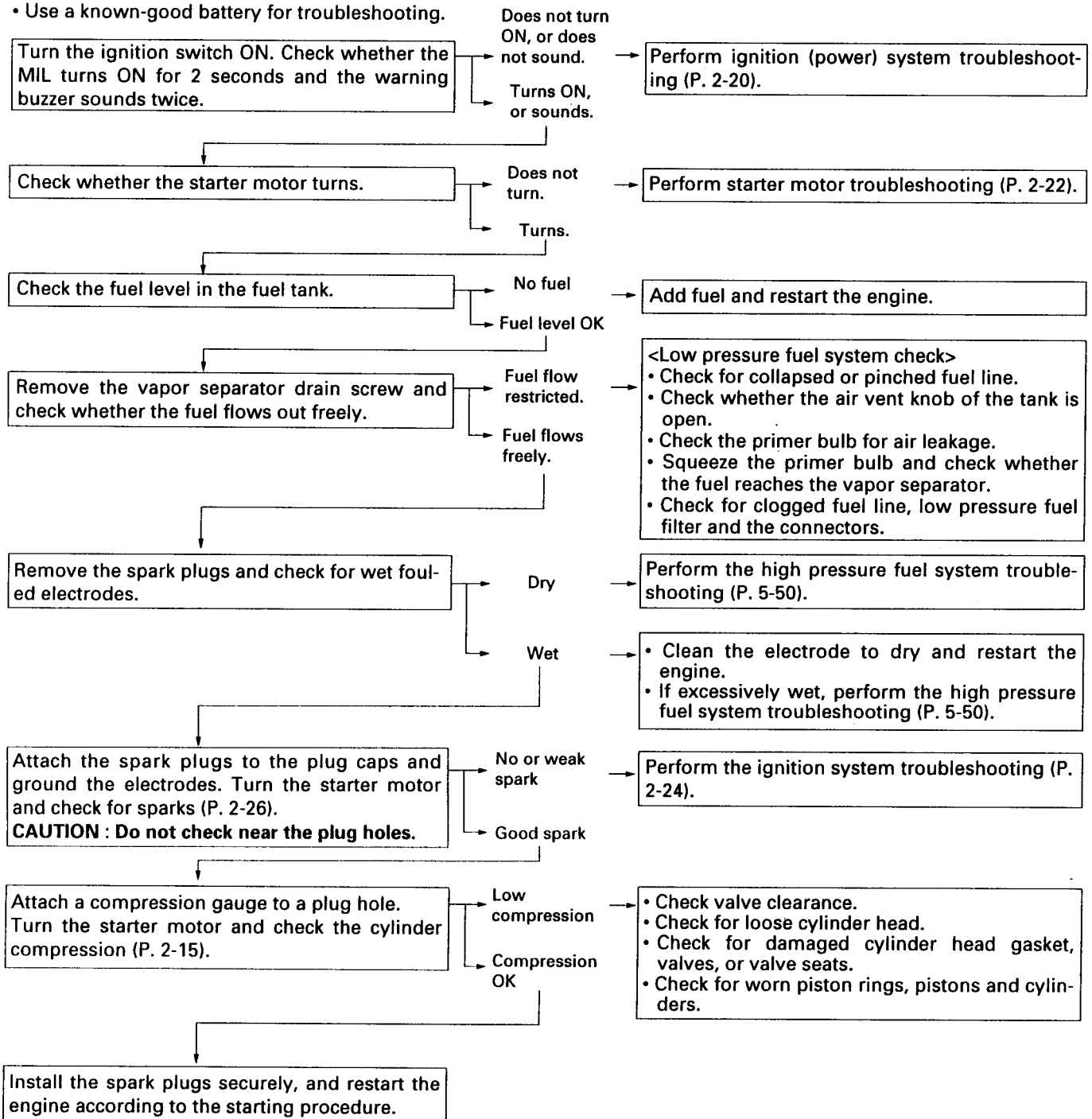


## 8. TROUBLESHOOTING

### • ENGINE

#### a. HARD STARTING

- Use a known-good battery for troubleshooting.

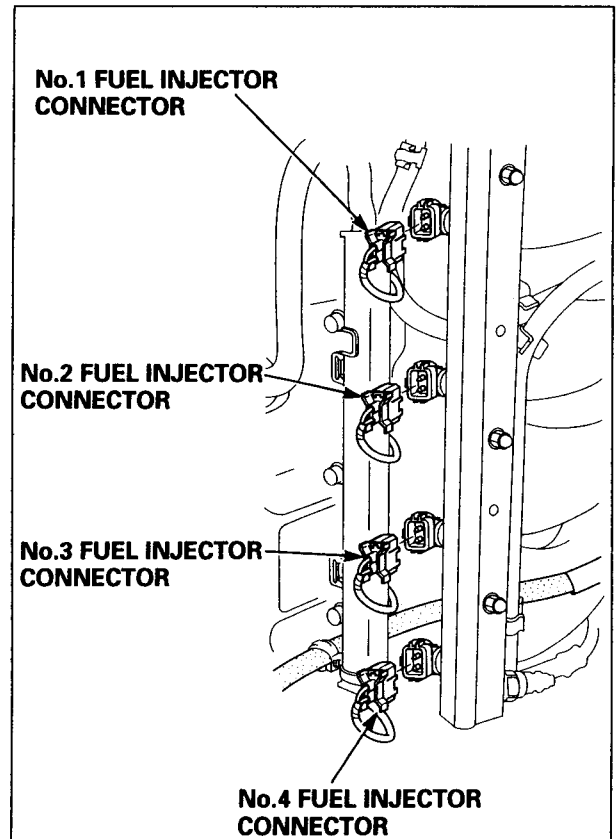


\*: When the gasoline overflow is detected, check the vapor separator (P. 5-64).

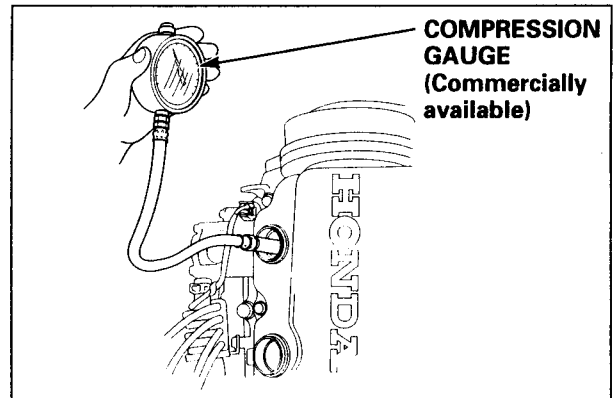


### ● CYLINDER COMPRESSION TEST

- 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 disconnect the fuel injector connectors of each cylinder.

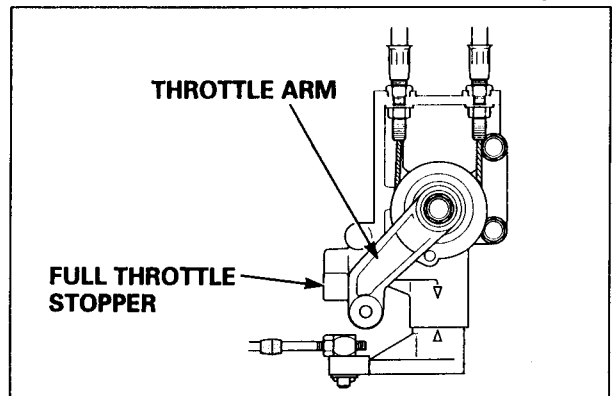


- 4) Remove the spark plug cap and the spark plug from each cylinder.
- 5) Install a compression gauge in the No.1 plug hole.
- 6) Disconnect the remote control cable [throttle side] from the throttle arm.
- 7) Set the throttle in the full throttle position by pulling the throttle arm against the full 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	1,373 – 1,569 kPa (14 – 16 kgf/cm <sup>2</sup> , 199 – 228 psi) at 300 min <sup>-1</sup> (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. 5-36).
- Warning buzzer sounds with an intermittent buzzer sound. → Perform the alert system troubleshooting (intermittent sound) (P. 5-38).

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 and/or adjust (P. 3-5).

Check for water in the fuel tank.

Drain the water from the tank (P. 3-10).

Check the air vent tube A/B or the fuel pump filter for damage and disconnection.

- Connect the air vent tube if it is disconnected.
- Replace. P. 5-73

Ignition system faulty.

Perform the ignition system troubleshooting (P. 2-24).

Check whether secondary air is being sucked.

- Loose throttle body assembly mounting bolts/nuts. Or check the gasket for damage and replace if necessary (P. 5-57).
- Loose intake manifold mounting nuts. Or check the packing for damage and replace if necessary (P. 5-71).
- Loose IAC valve assembly mounting bolts. Or check the packing for damage and replace if necessary (P. 5-74).
- Loose IAT sensor mounting bolts. Or check the O-ring for damage and replace if necessary (P. 5-74).
- Check the PCV tube and the vacuum tube for damage, and replace if necessary (P. 5-73 and 77).
- Check for loose fuel lin comp. mounting nuts (P. 5-59).
- Check the fuel injectors and seal rings for damage and replace if necessary (Inspection: P. 5-45, Replacement: P. 5-59).

High pressure fuel system faulty.

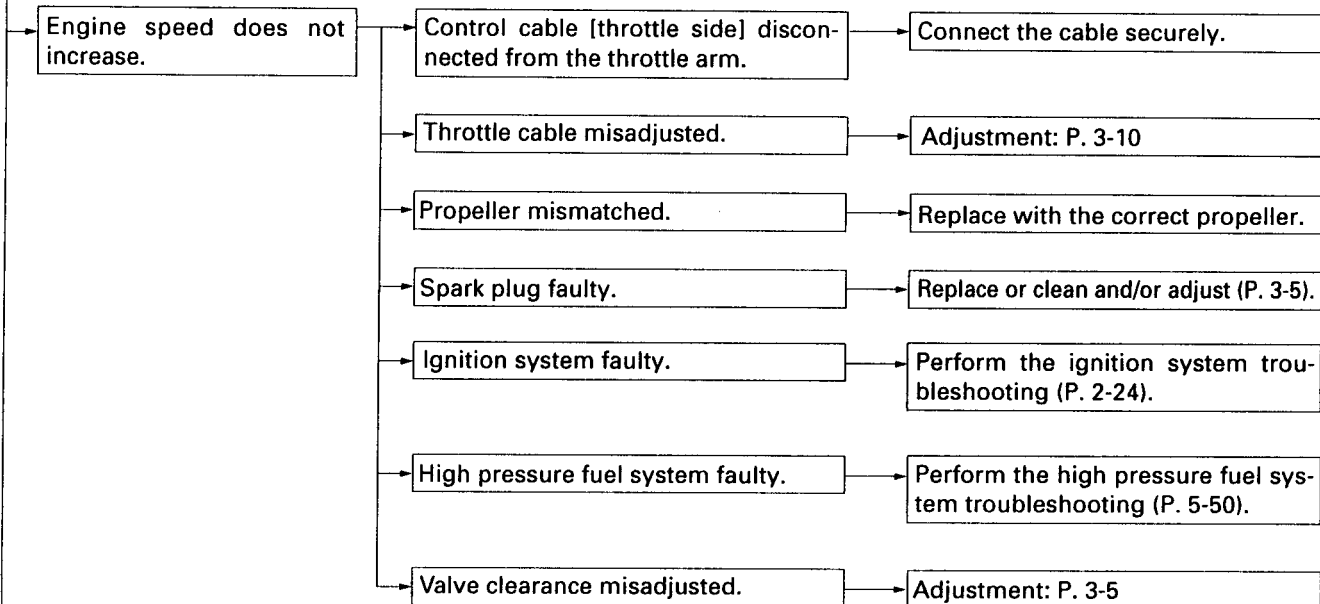
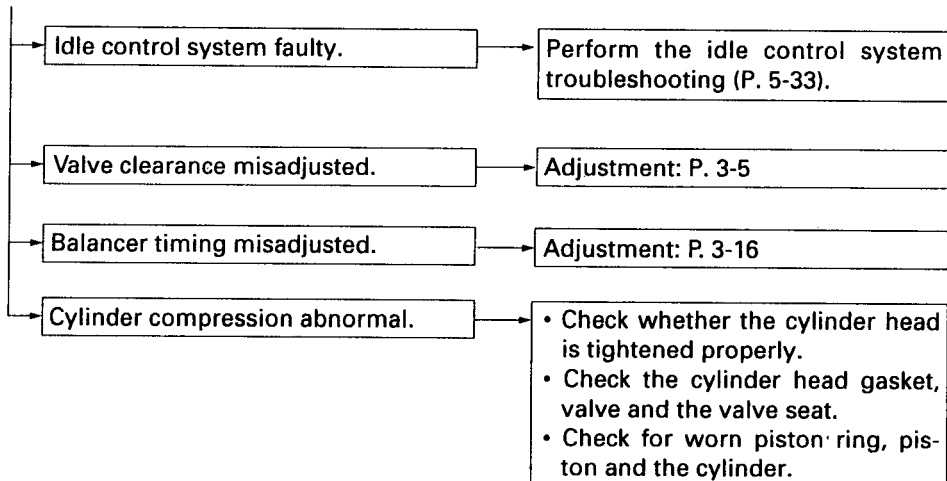
Perform the high pressure fuel system troubleshooting (P. 5-50).

To P. 2-17

To P. 2-17

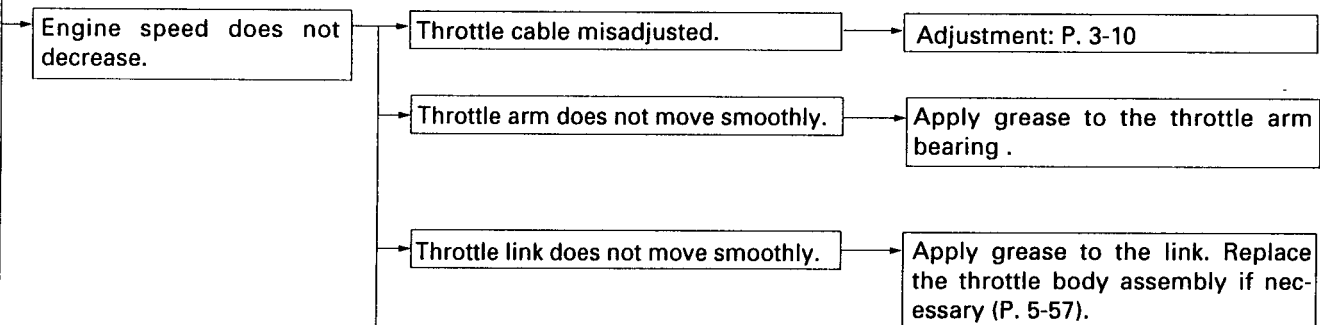
From P. 2-16

From P. 2-16



To P. 2-18

To P. 2-18



From P. 2-17

From P. 2-17

Check whether secondary air is being sucked.

- Loose throttle body assembly mounting bolts/nuts. Or check the gasket for damage and replace if necessary (P. 5-57).
- Loose intake manifold mounting nuts. Or check the packing for damage and replace if necessary (P. 5-71).
- Loose IAC valve assembly mounting bolts. Or check the packing for damage and replace if necessary (P. 5-74).
- Loose IAT sensor mounting bolts. Or check the O-ring for damage and replace if necessary (P. 5-74).
- Check the PCV tube and the vacuum tube for damage, and replace if necessary (P. 5-73 and 77).
- Check for loose fuel line comp. mounting nuts (P. 5-59).
- Check the fuel injectors and seal rings for damage and replace if necessary (Inspection: P. 5-45, Replacement: P. 5-59).

Engine sometimes misfires or stalls.

Check for water in the fuel tank.

Drain the water from the tank (P. 3-10).

Fuel tank, fuel tube, and/or low pressure fuel filter abnormal.

- Check for water and dirt in the low pressure fuel filter (P. 3-9).
- Check for pinched or collapsed fuel line.
- Check whether the air vent knob of the tank is open.
- Check the primer bulb for air leakage.
- Squeeze the primer bulb and check whether fuel reaches the vapor separator.
- Check for the clogged fuel line, low pressure fuel filter and connectors.

Ignition system faulty.

Perform the ignition system troubleshooting (P. 2-24).

High pressure fuel system faulty.

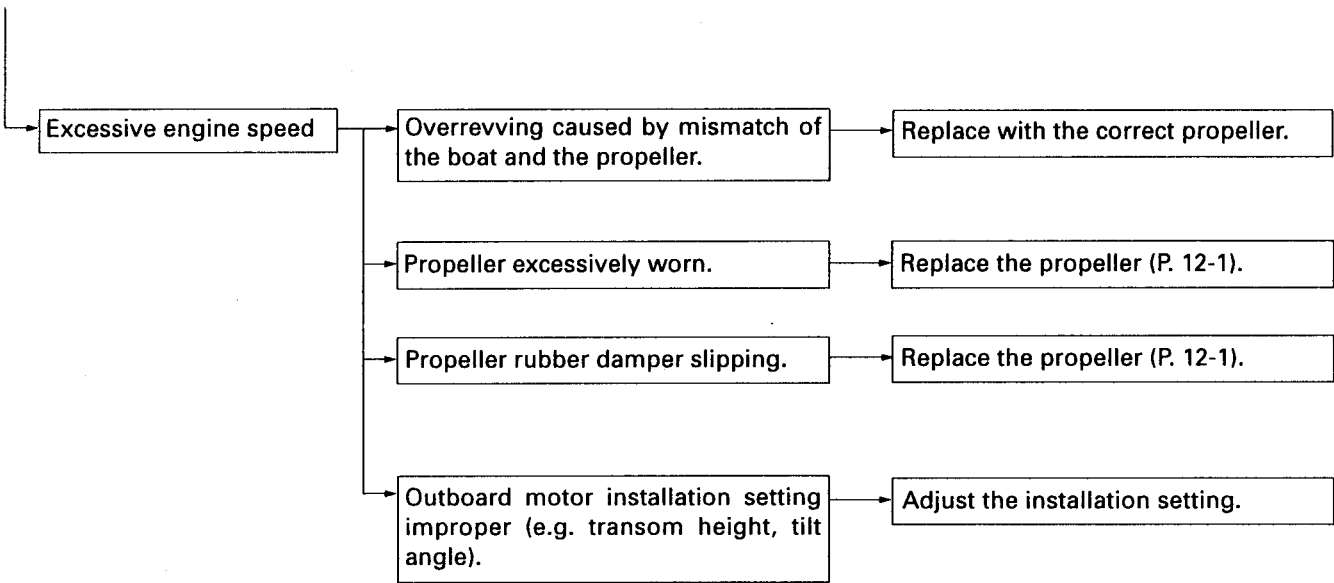
Perform the high pressure fuel system troubleshooting (P. 5-50).

Low pressure fuel pump faulty.

Replacement: P. 5-58

To P. 2-19

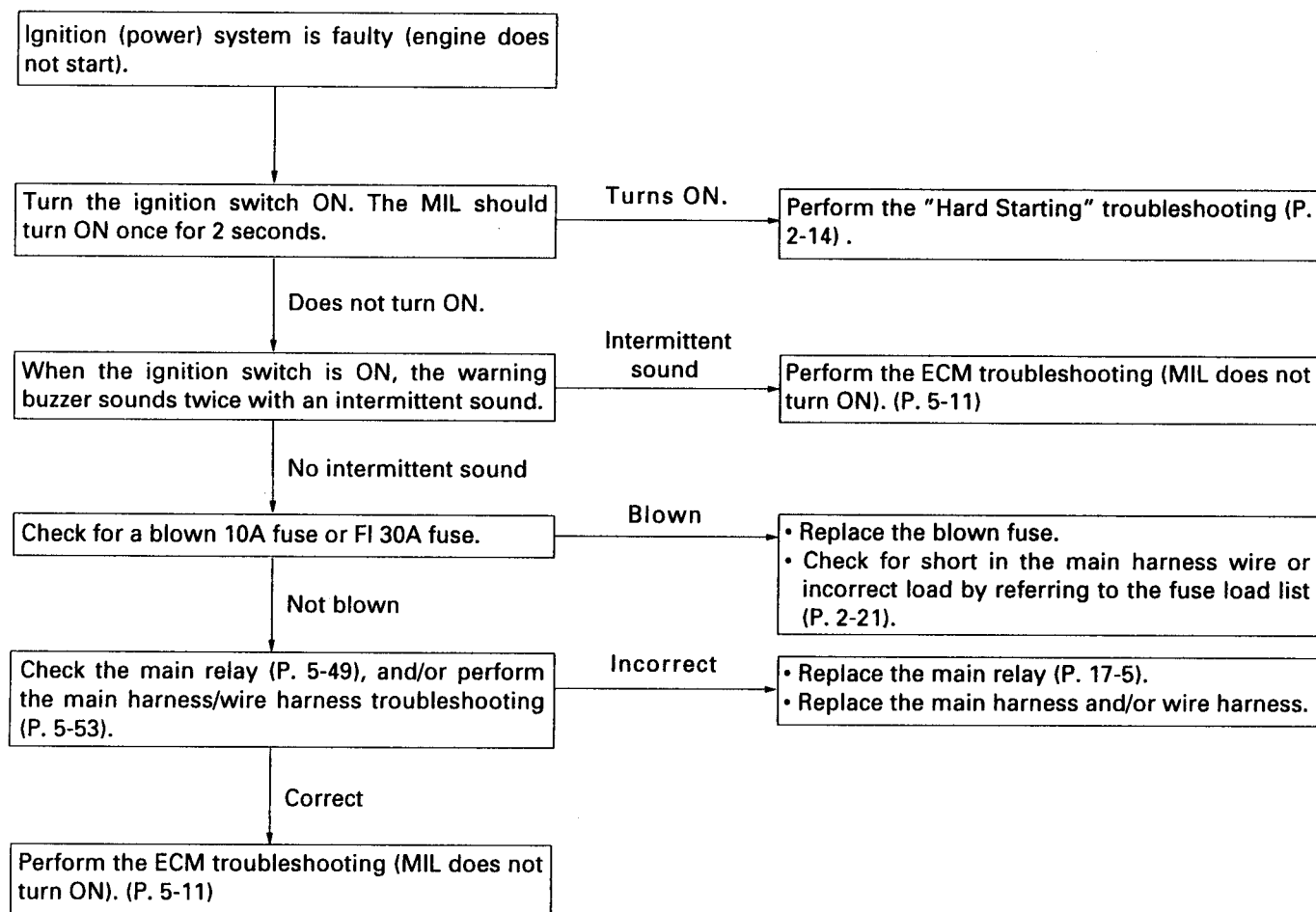
From P. 2-18



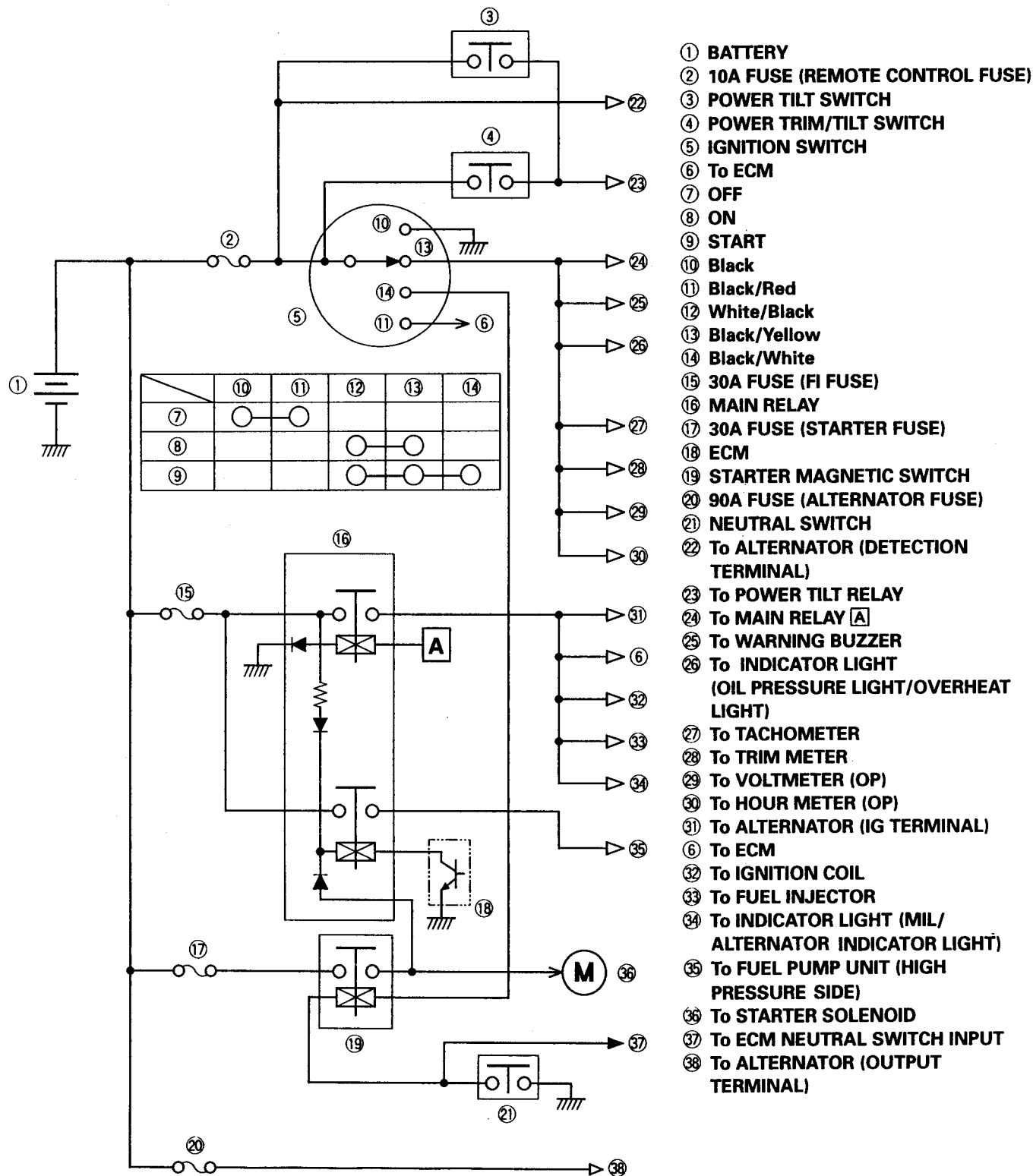
**\*: When fuel overflow is detected, check the vapor separator (P. 5-64).**

**c. IGNITION (POWER) SYSTEM**

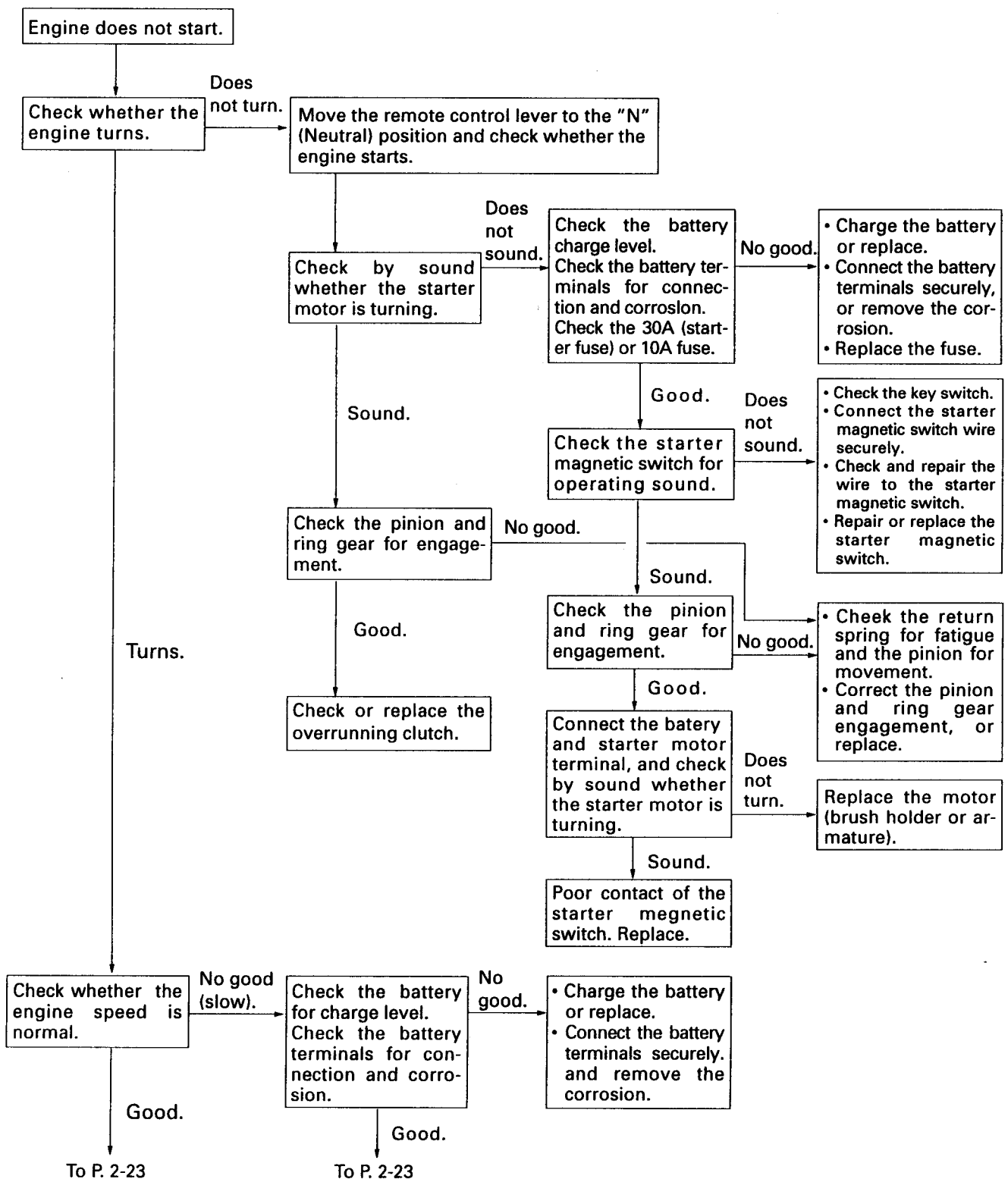
- Turn the ignition switch OFF before checking the ignition system.



### • FUSE LOAD LIST

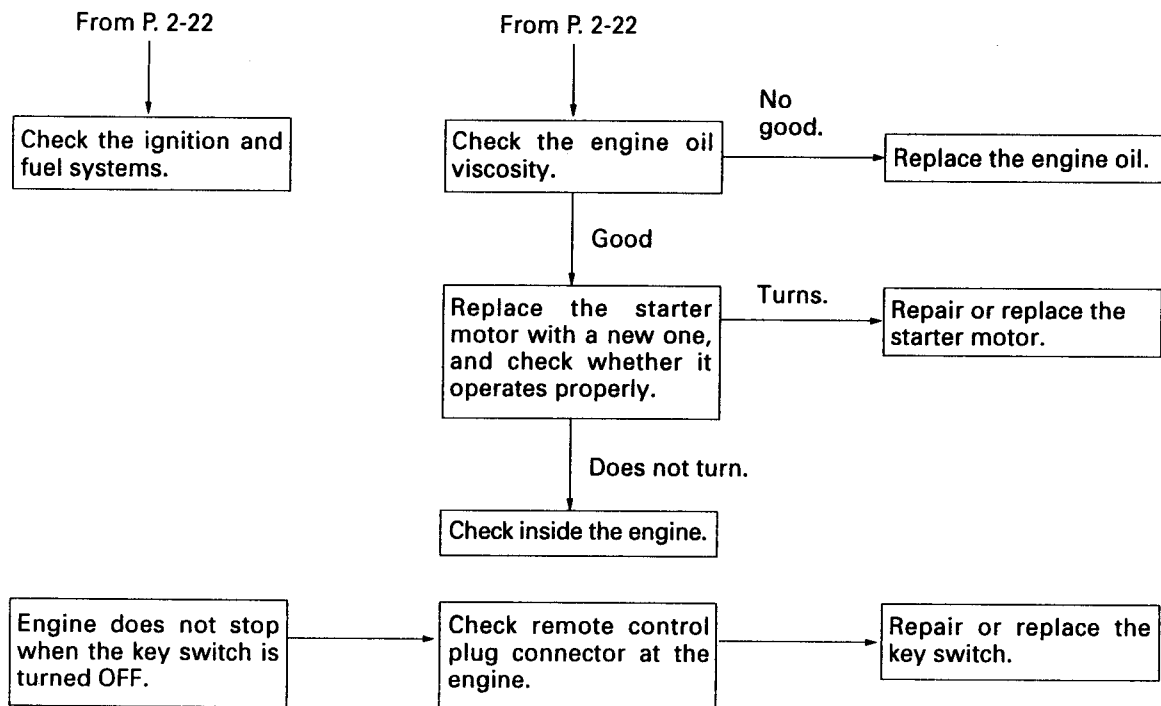


### d. STARTER MOTOR



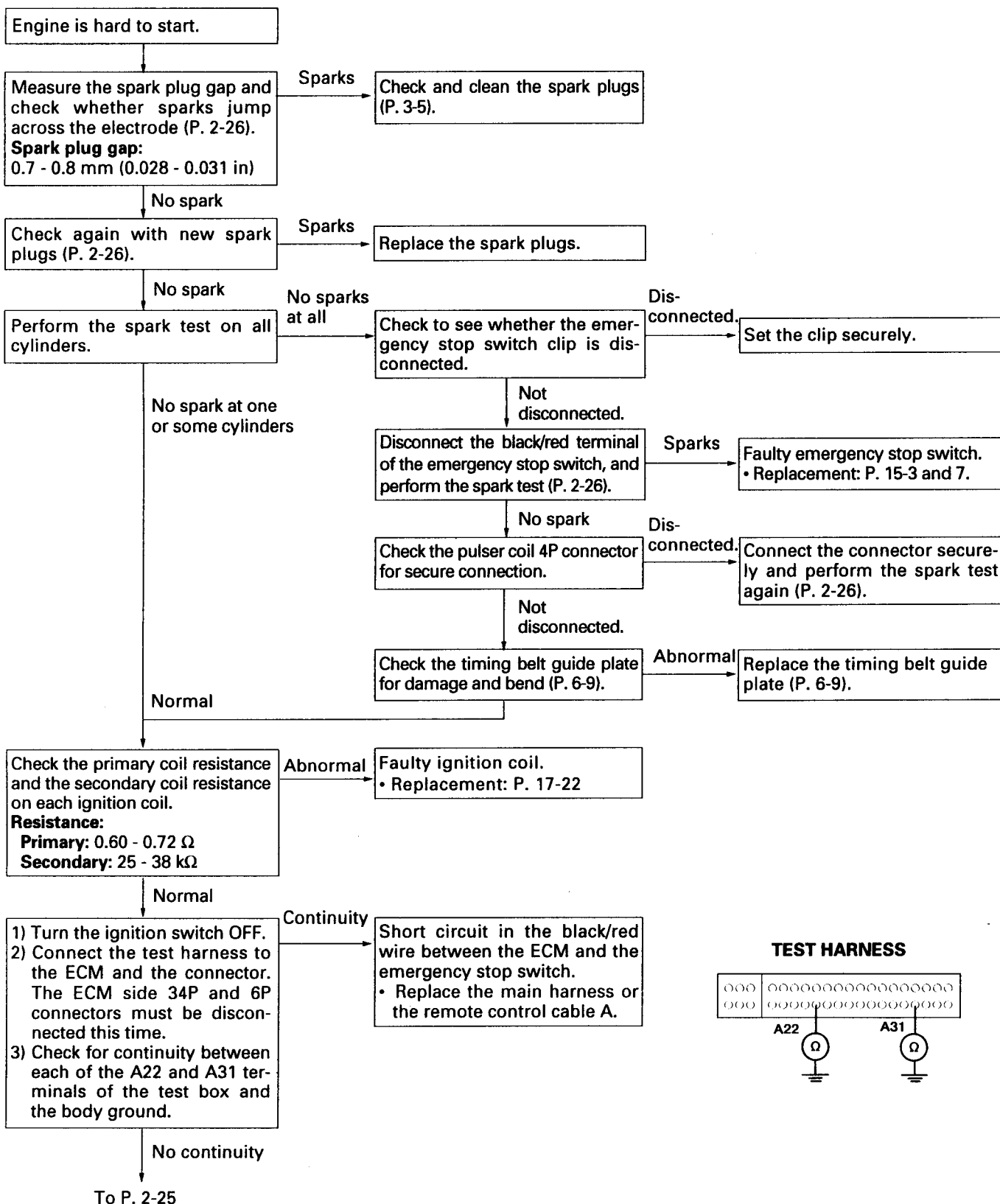
NOTE: When a problem occurs, disconnect the battery.

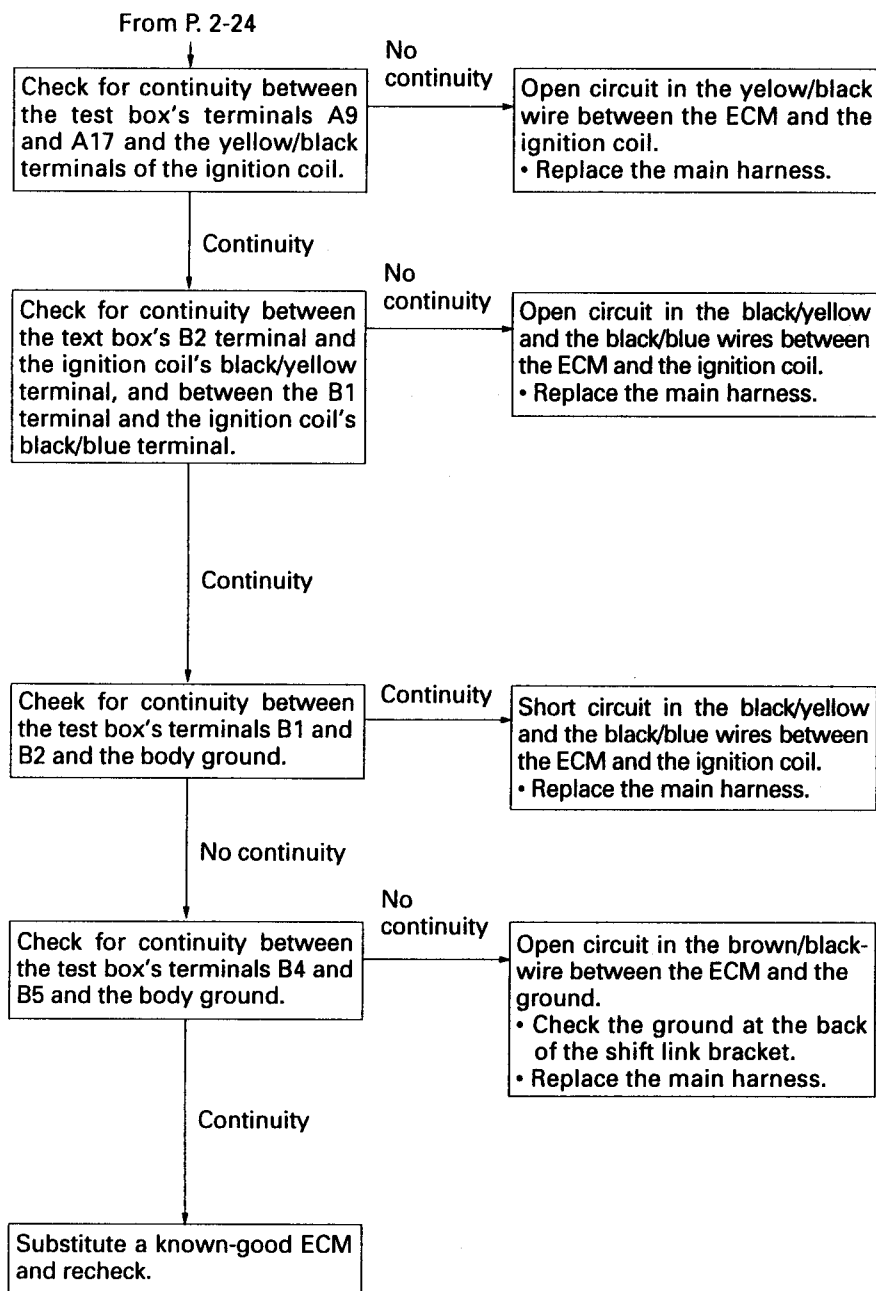




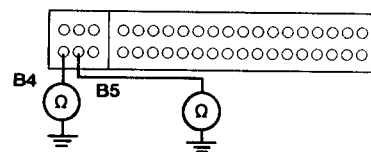
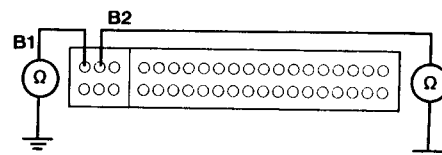
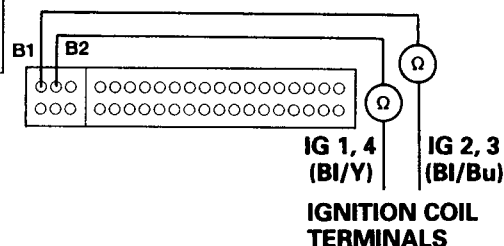
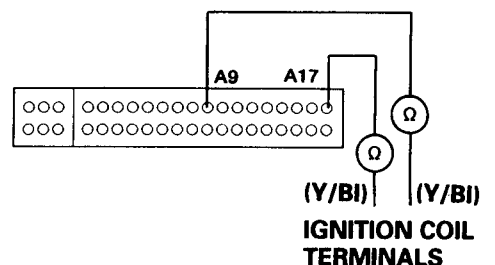
NOTE : When a problem occurs, disconnect the battery.

### e. IGNITION SYSTEM





### TEST HARNESS



### ● SPARK TEST

- 1) Set the remote control lever in the "N" (Neutral) position.
- 2) Remove each spark plug cap from the respective spark plugs.
- 3) Remove the spark plugs.  
Disconnect the fuel injector connector of the respective cylinders (P. 2-15).

- 4) Attach the spark plugs removed in step 2 to the No.1 and the No.4 spark plug caps respectively.
- 5) Connect a ground wire between the negative (-) electrode (threaded part) of the No.1 and the No.4 spark plugs and the body ground.

The engine is the simultaneous firing type. Perform the spark test using the paired spark plugs (No.1 and 4, or No.2 and 3) simultaneously.

#### **⚠ WARNING**

**Gasoline is highly flammable and explosive.**

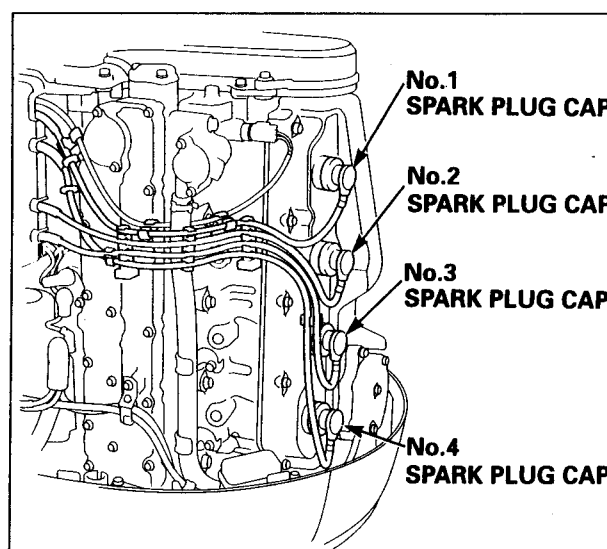
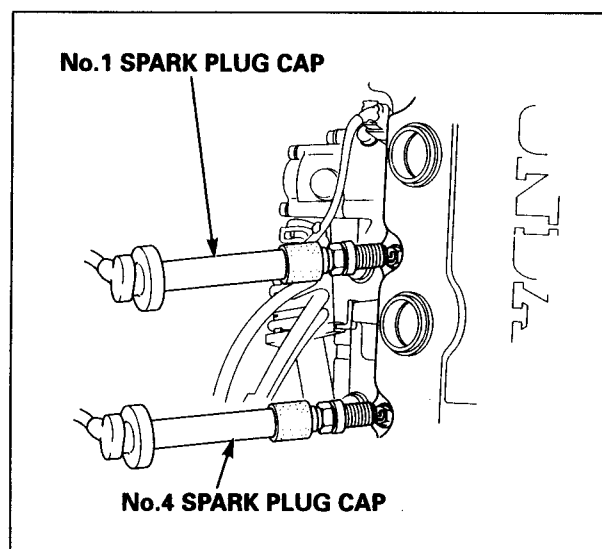
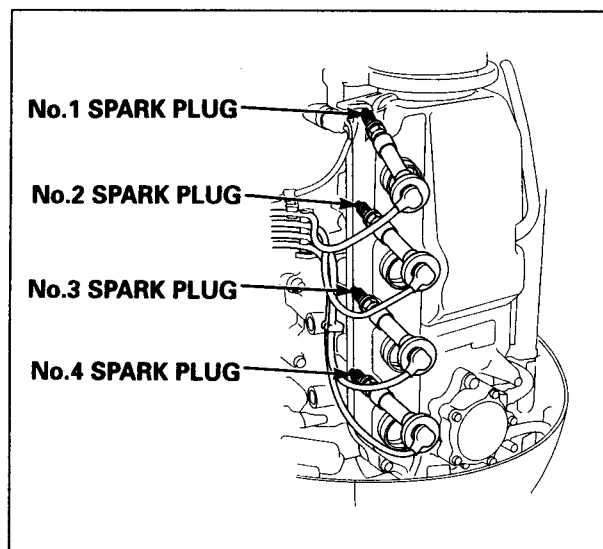
**If ignited, gasoline can burn you severely**

- Be sure there is no spilled fuel near the engine.
- Place the spark plugs away from the spark plug holes.

- 6) Turn the ignition switch to the START position and turn the starter motor. Check whether sparks jump across the spark plug electrodes.

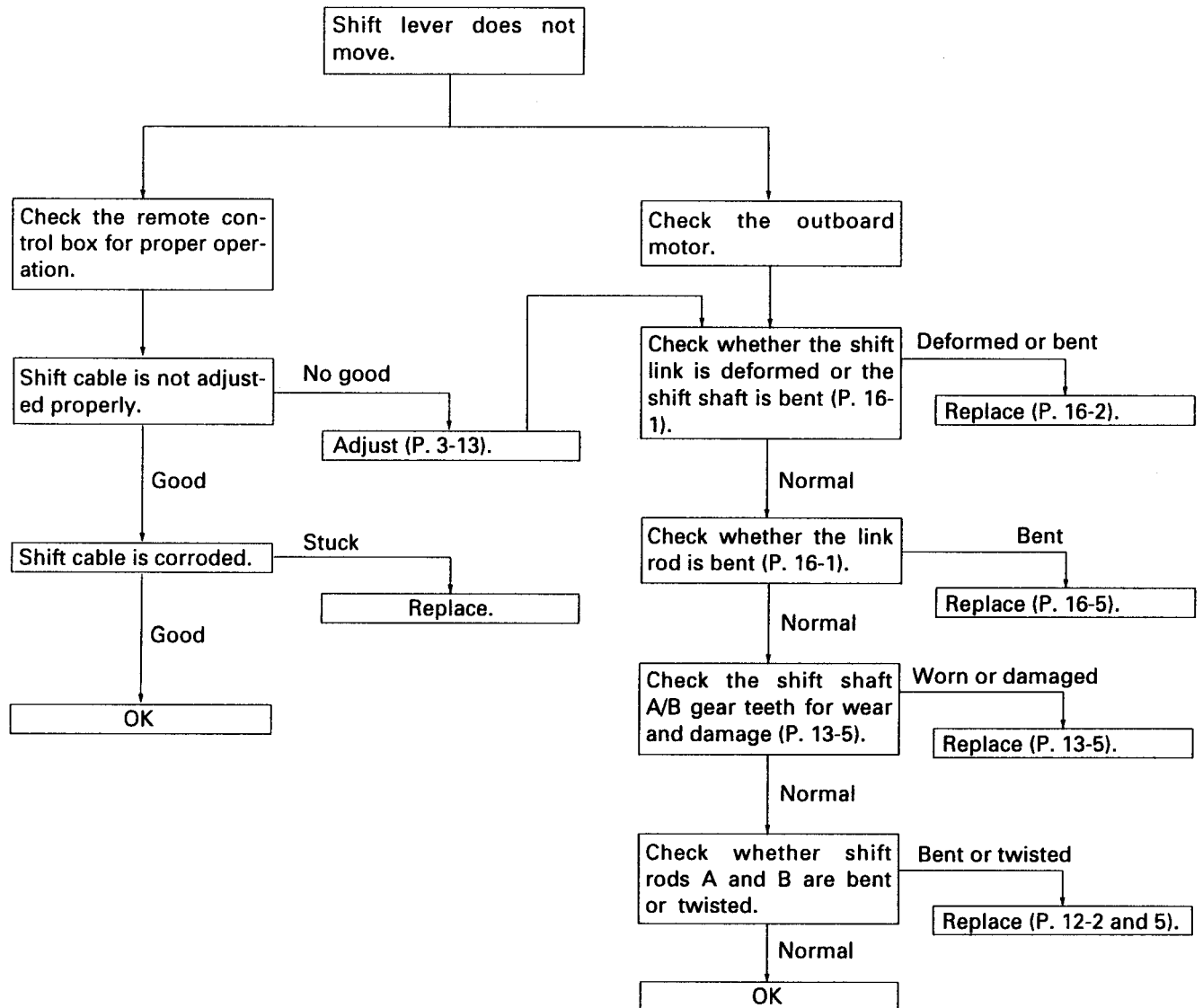
To prevent the possibility of electrical shock, avoid touching the spark plug wires or caps while performing the spark test.

- 7) Check for sparks on the No.2 and the No.3 spark plugs.
- 8) After the check, reinstall the spark plugs and caps correctly.



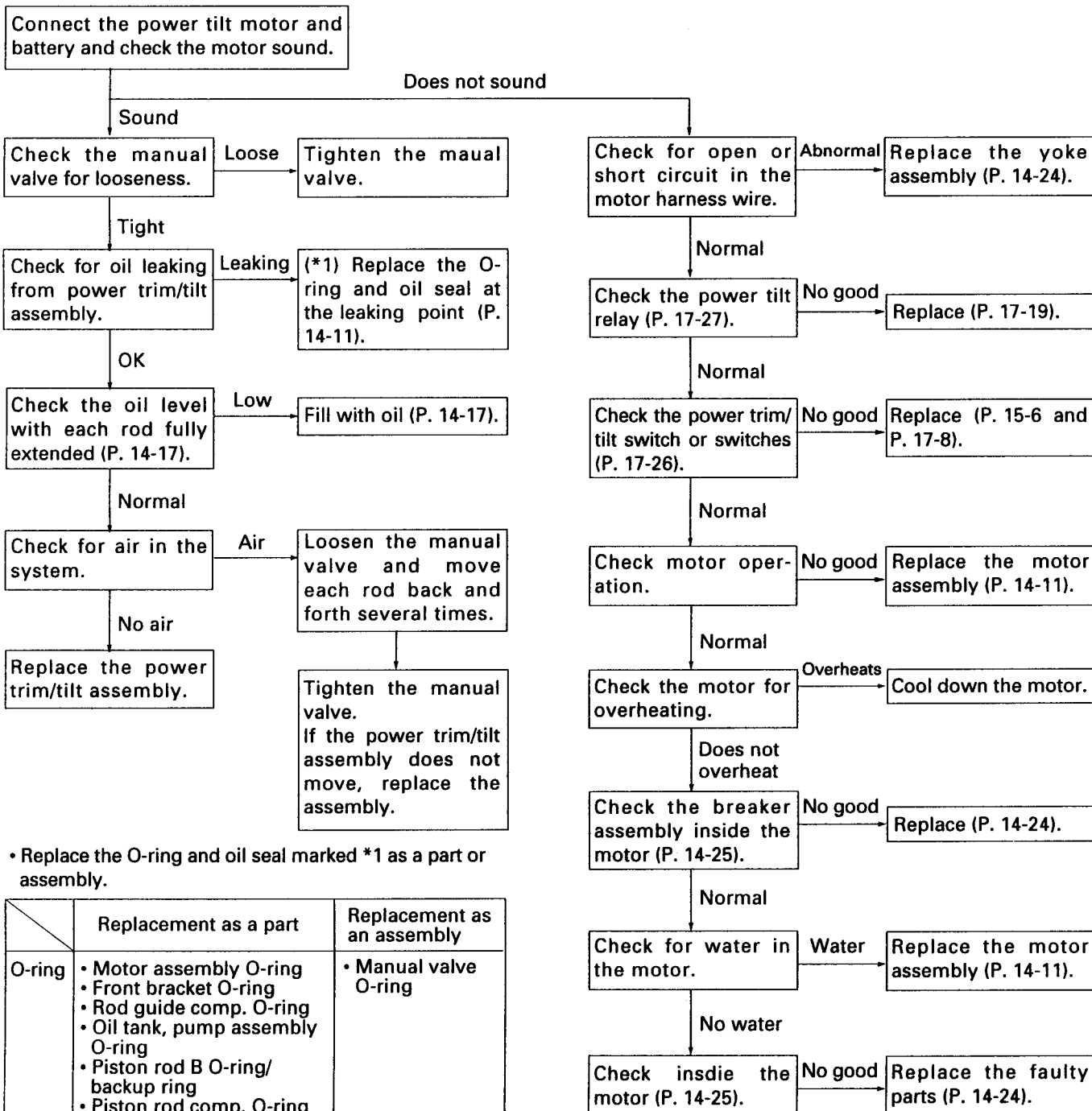
### • FRAME

#### a. SHIFT

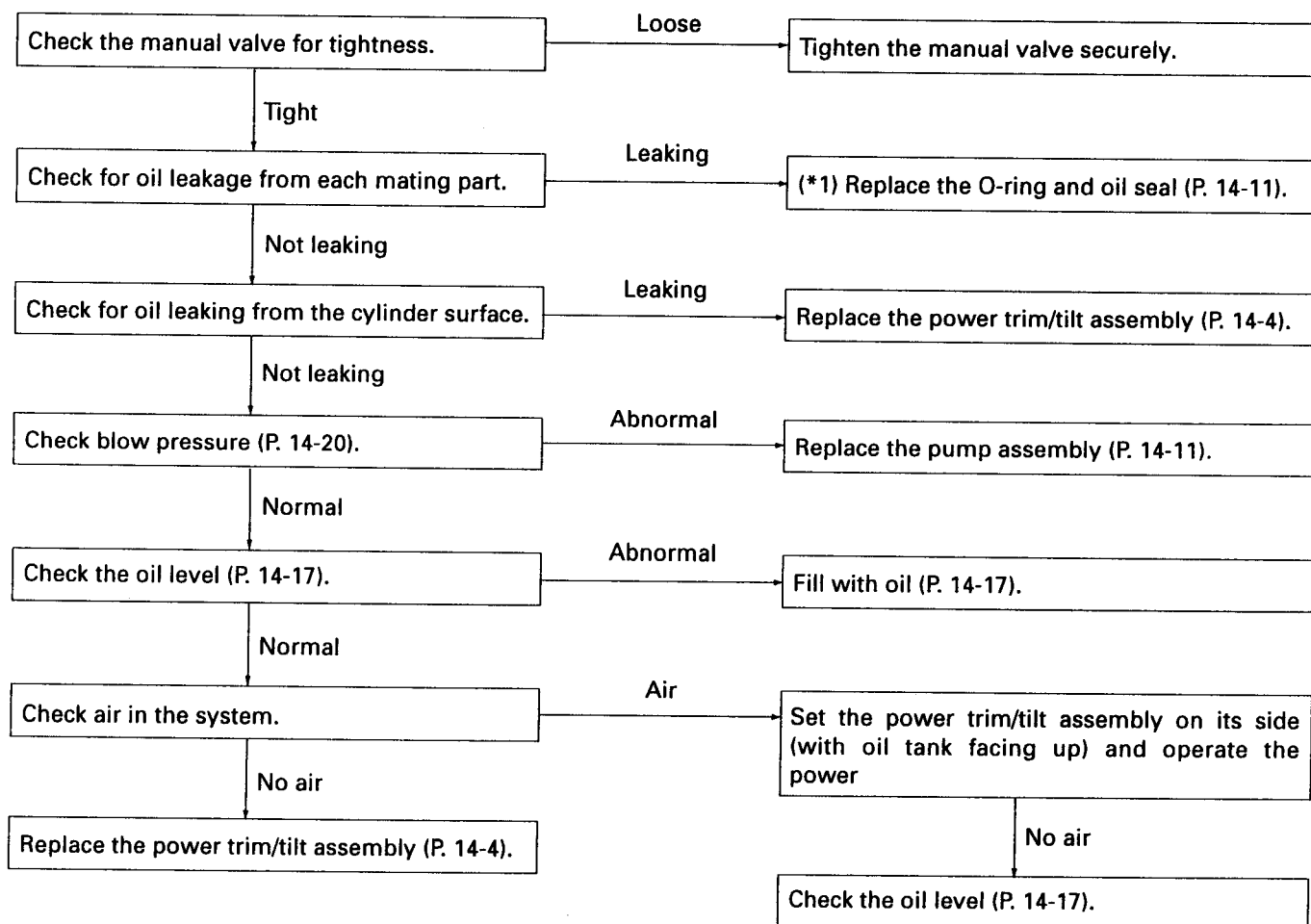


### b. POWER TRIM / TILT ASSEMBLY DOES NOT MOVE

- Use a fully charged 12V battery.



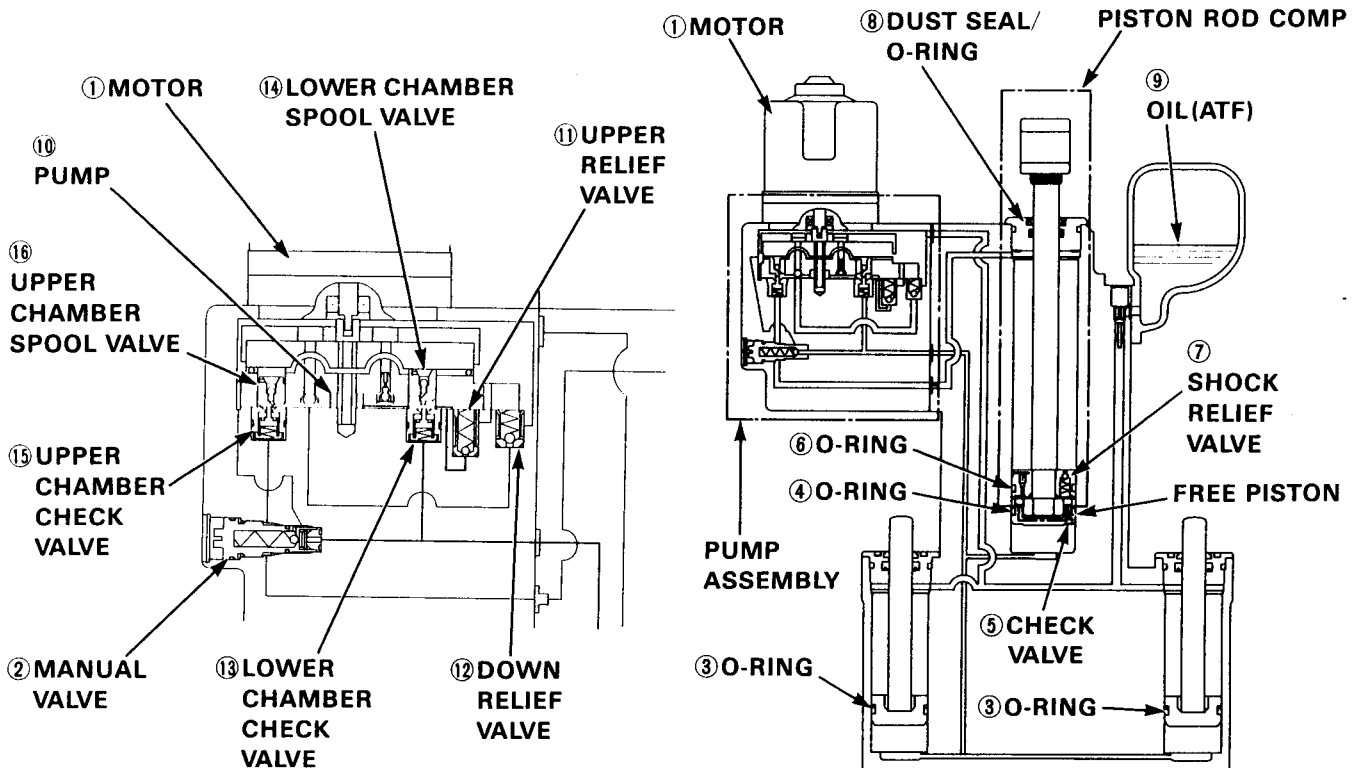
### c. THE POWER TRIM/TILT ASSEMBLY DOES NOT HOLD



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

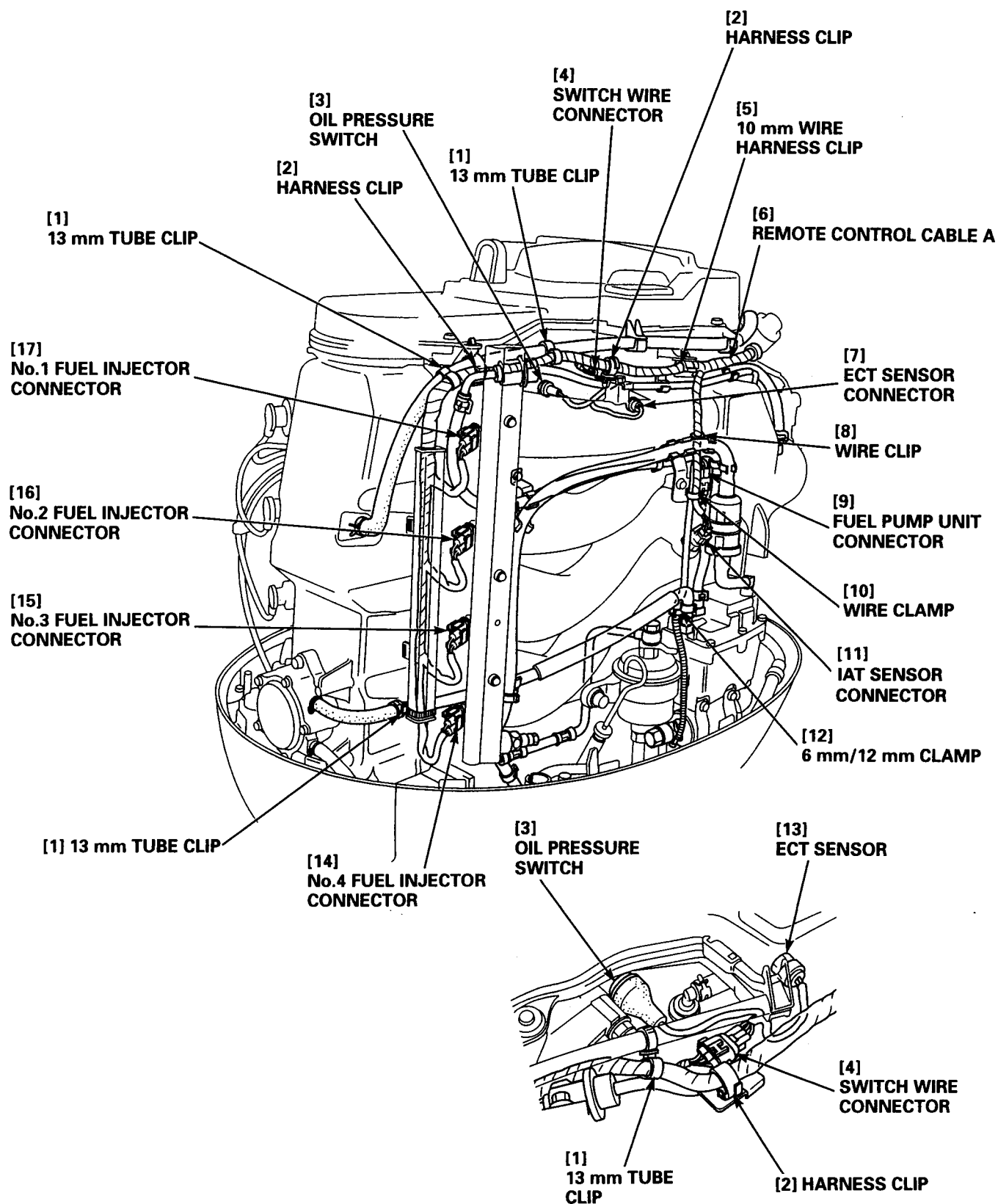
	Replacement as a part	Replacement as an assembly
O-ring	<ul style="list-style-type: none"> <li>• Motor assembly O-ring</li> <li>• Front bracket O-ring</li> <li>• Rod guide comp. O-ring</li> <li>• Oil tank, pump assembly O-ring</li> <li>• Piston rod B O-ring/backup ring</li> <li>• Piston rod comp. O-ring</li> <li>• Free piston O-ring/backup ring</li> </ul>	<ul style="list-style-type: none"> <li>• Manual valve O-ring</li> </ul>
Oil seal	<ul style="list-style-type: none"> <li>• Front bracket oil seal</li> <li>• Rod guide comp. oil seal/dust seal</li> </ul>	<ul style="list-style-type: none"> <li>• Piston rod comp. (cylinder cap) oil seal</li> </ul>

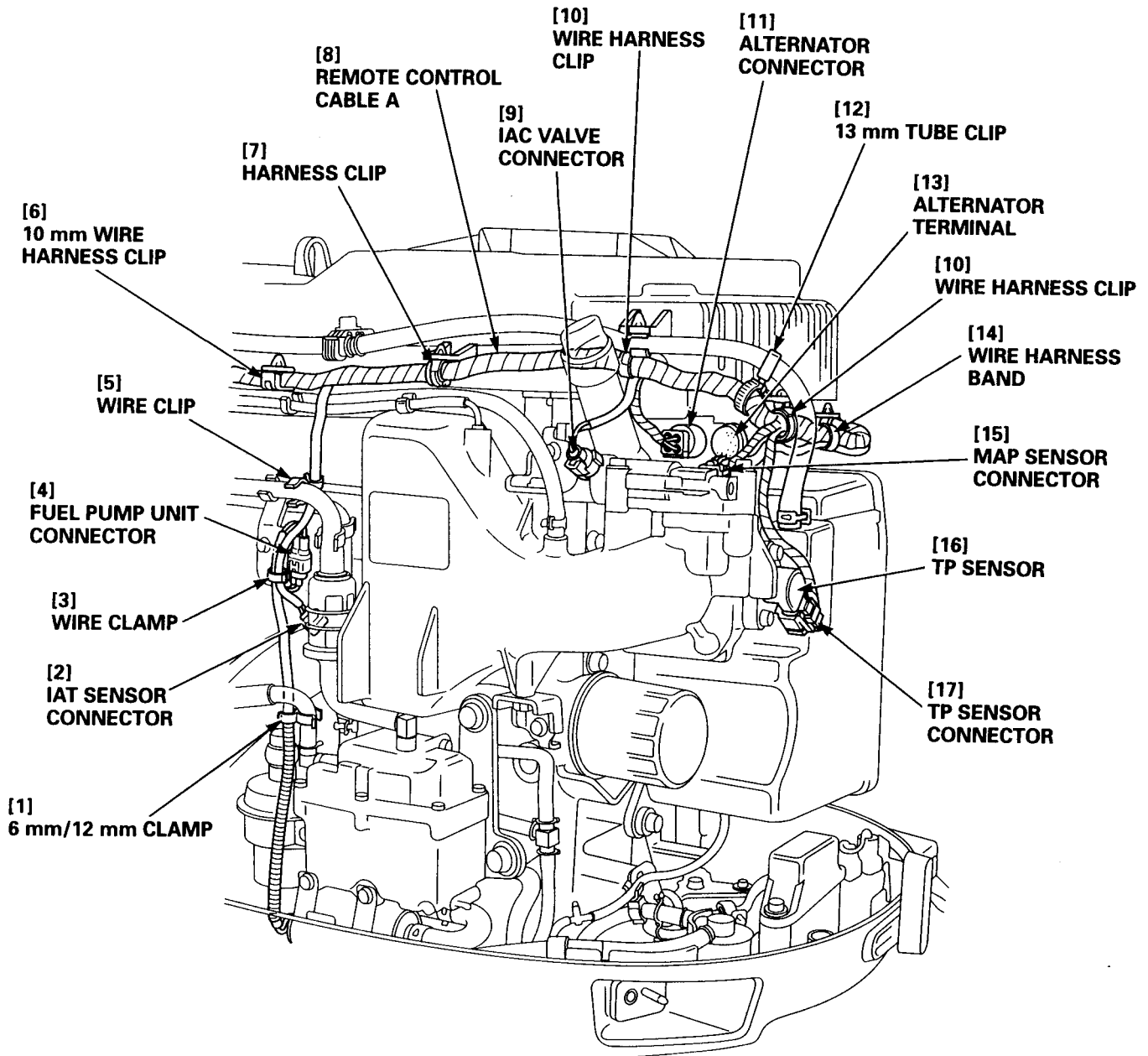
Symptom				Pressure check		Check point	Check/repair method
Does not tilt up.	Does not tilt down.	Does not hold.		Lower chamber blow-off pressure lower than spec. or pressure drops.	Upper chamber blow-off pressure lower than spec. or pressure drops.		
		Lowers.	Extends.				
○	○			○	○	① Motor	Check according 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 chamber check valve	
○	○	○		○		⑭ Lower chamber spool valve	
○	○		○		○	⑮ Upper chamber check valve	
○	○		○		○	⑯ Upper chamber spool valve	

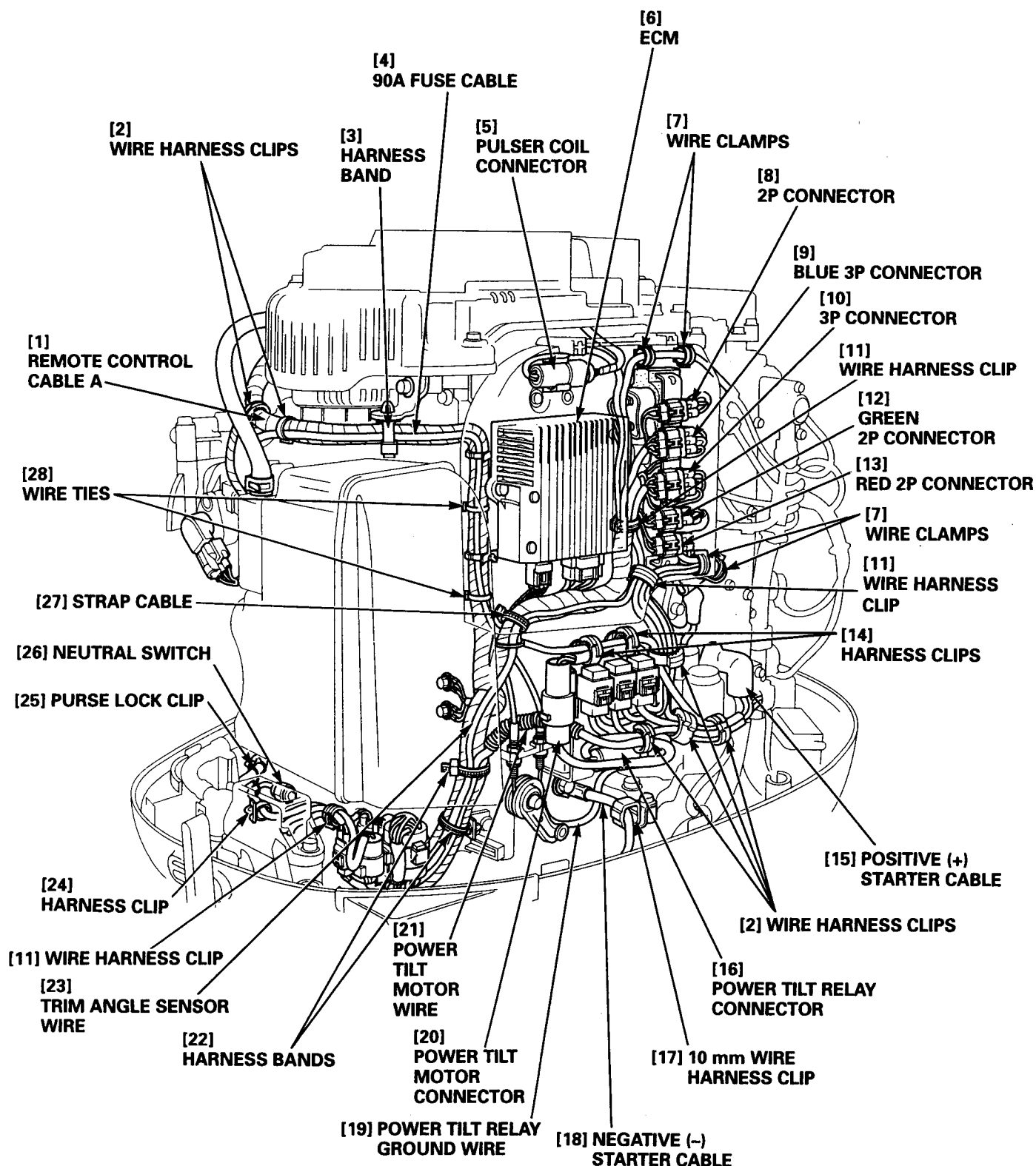


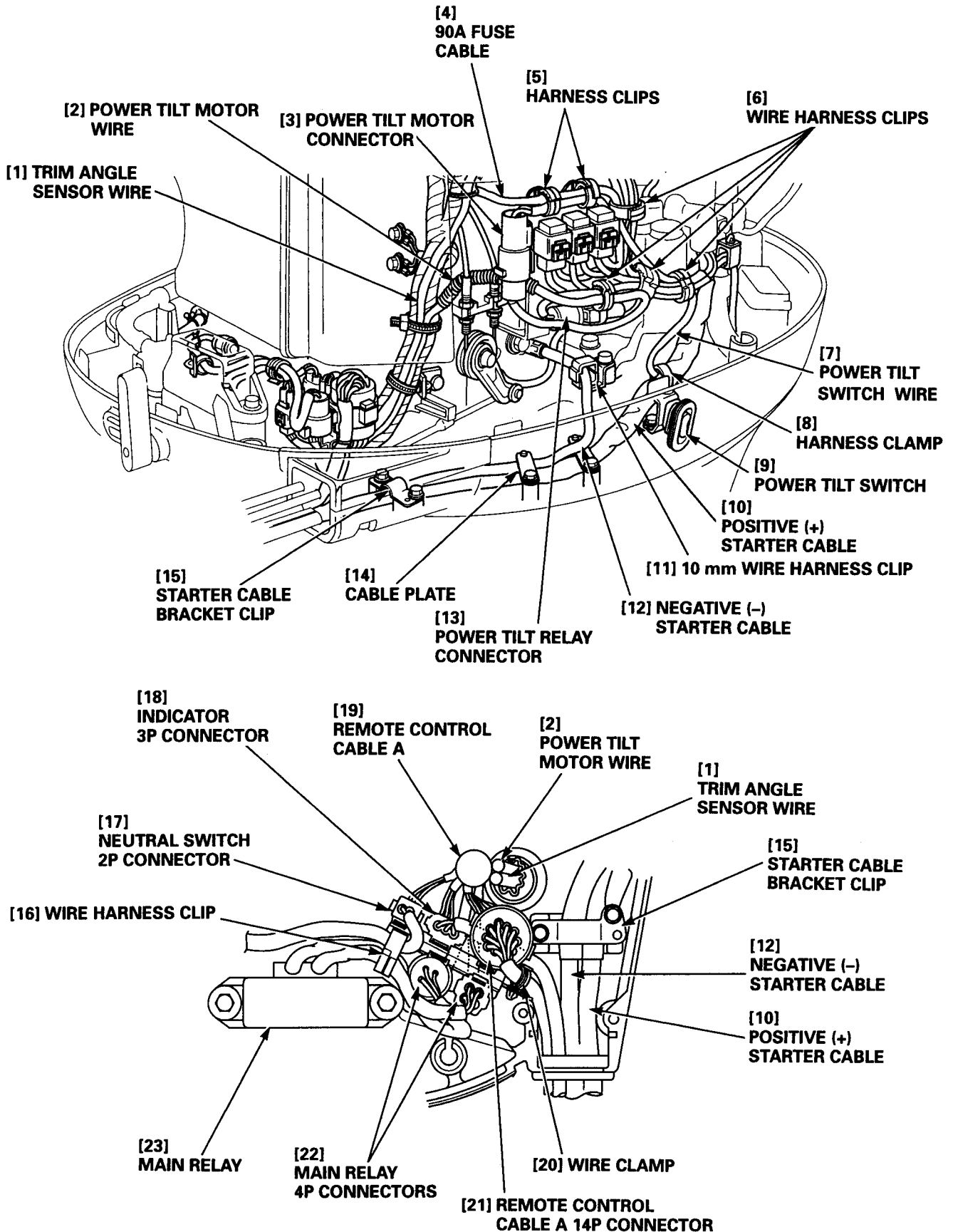


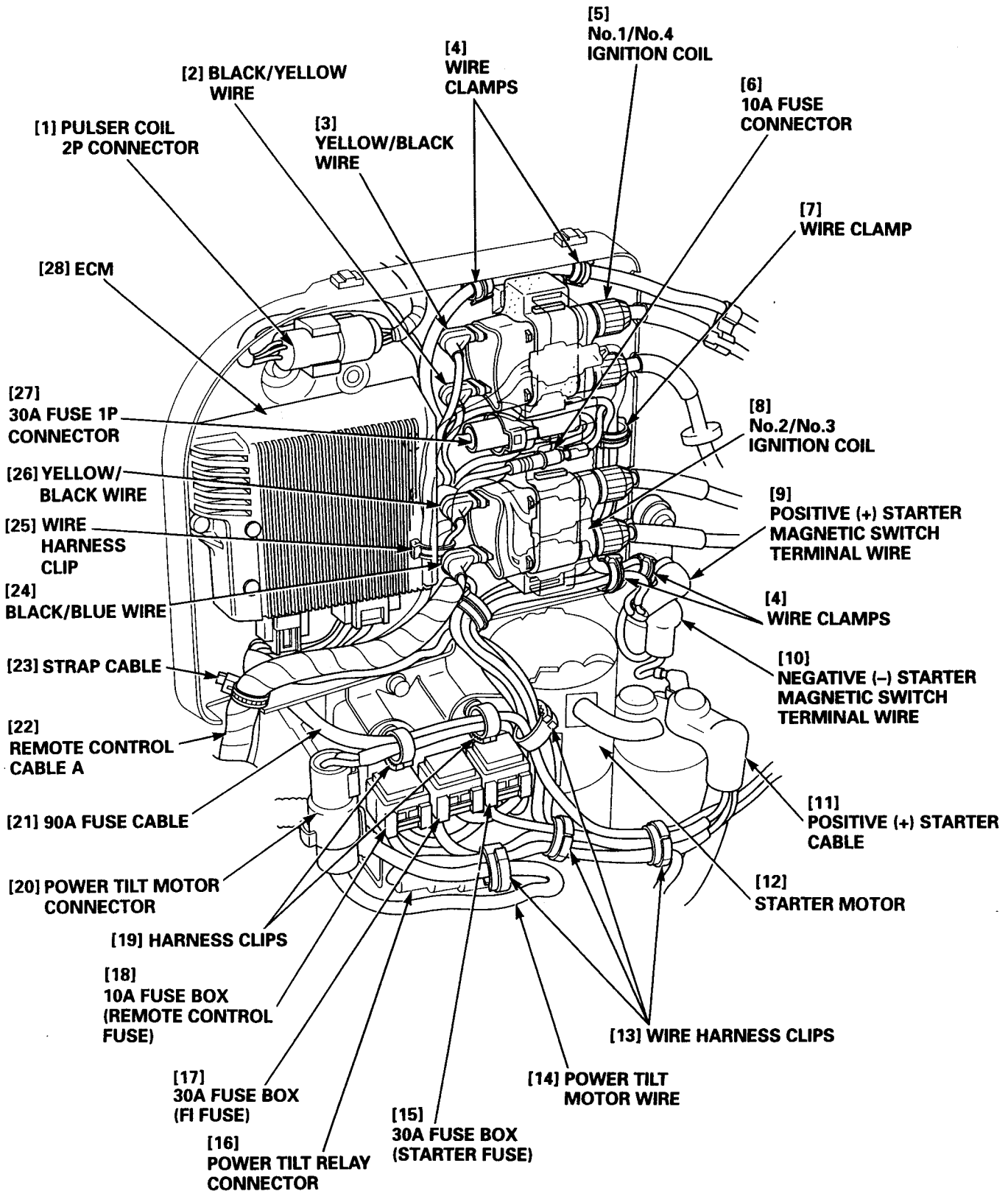
## 9. CABLE/HARNESS ROUTING

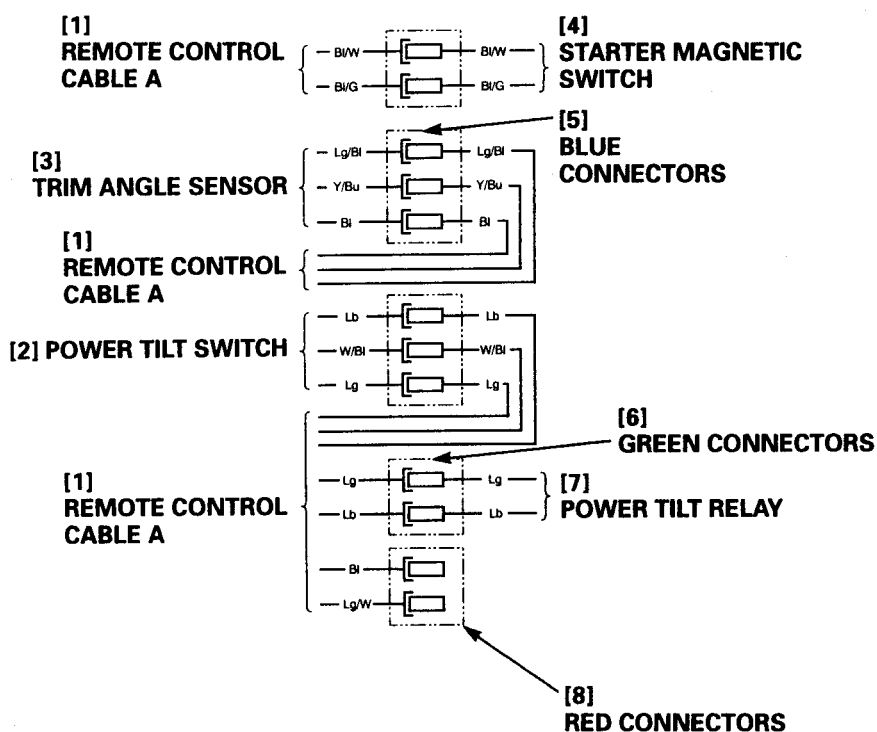




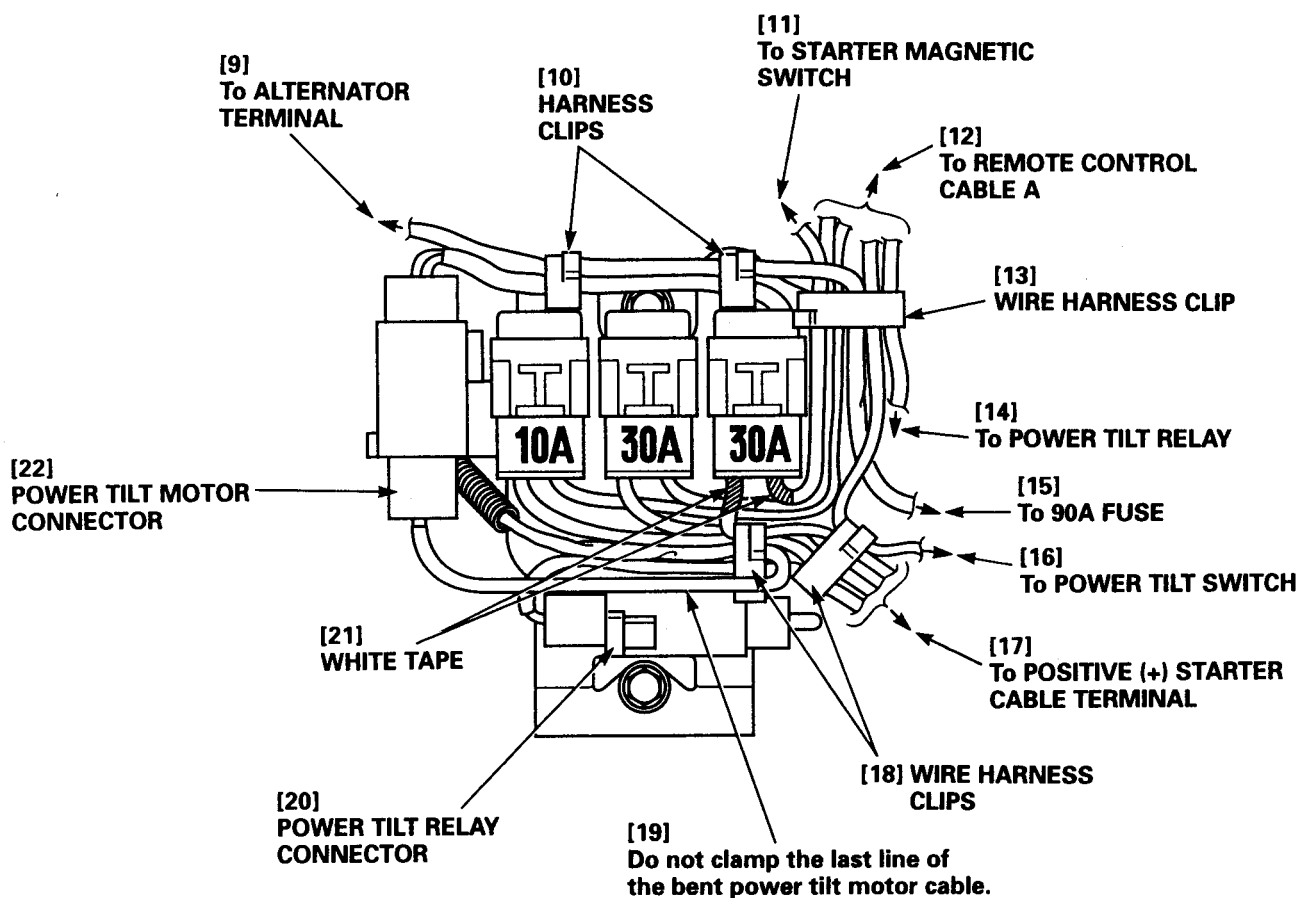


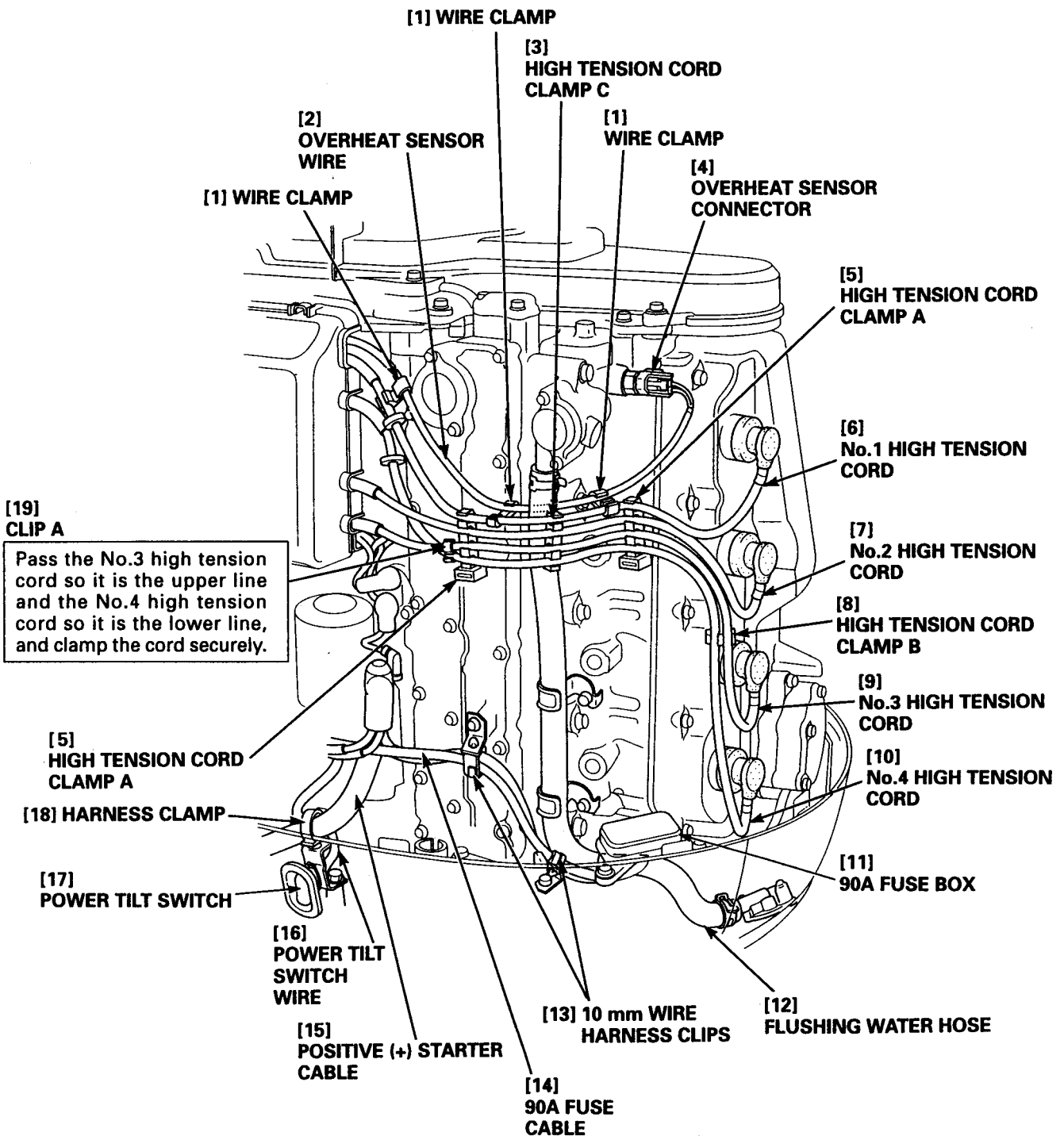


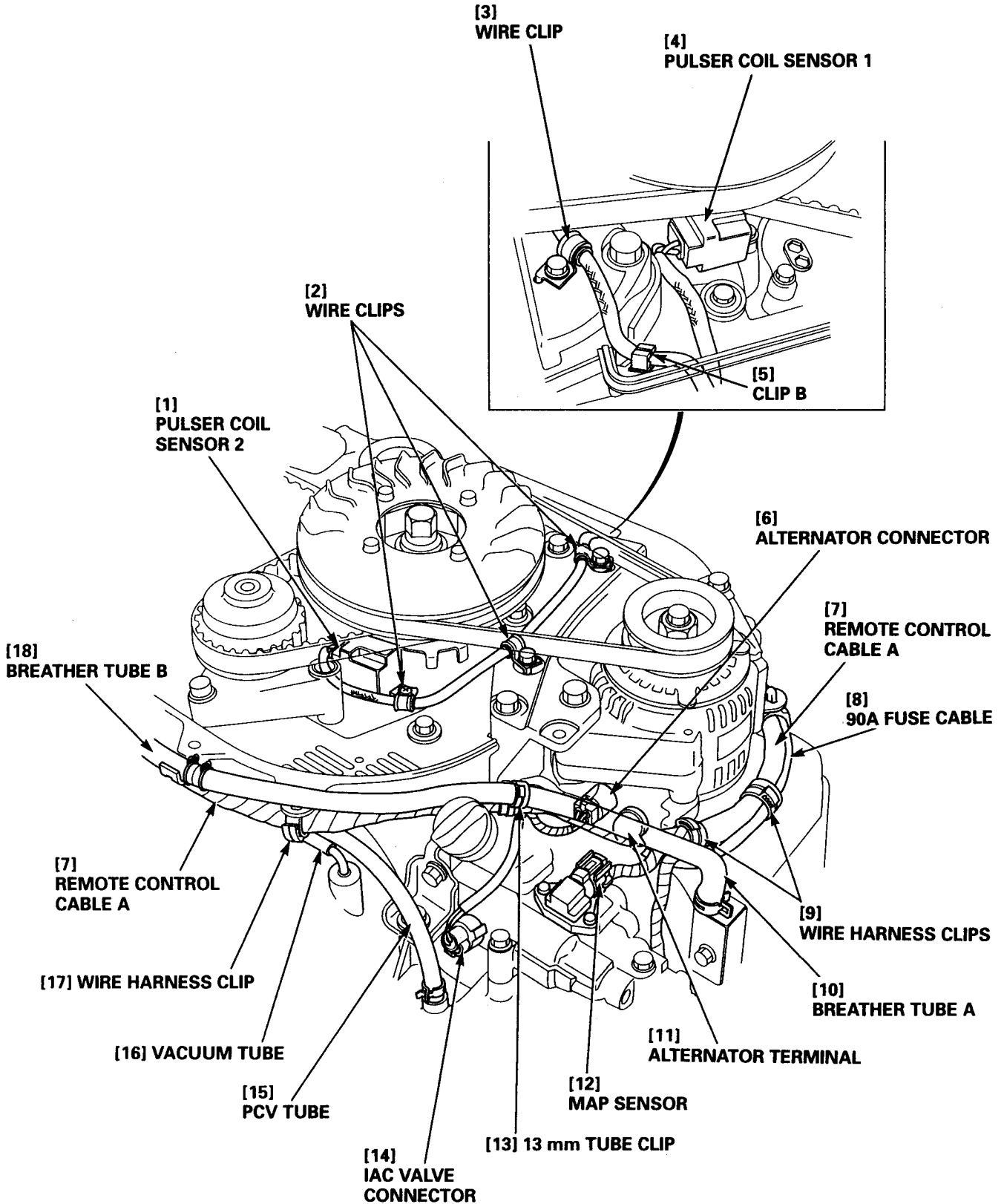




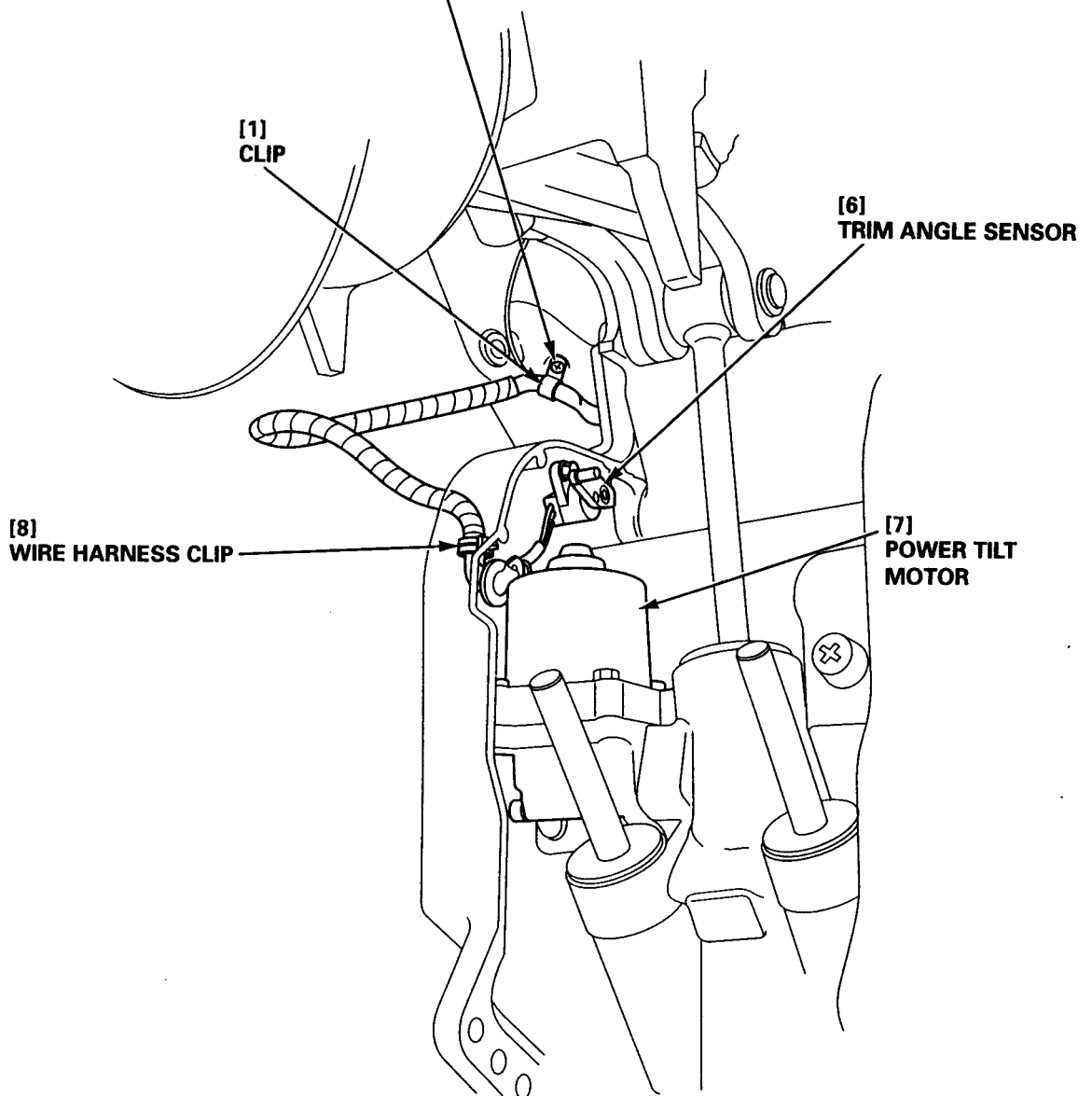
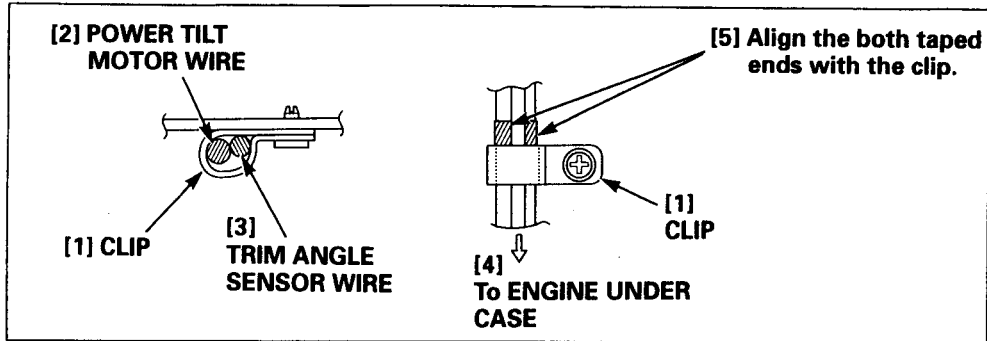
Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY



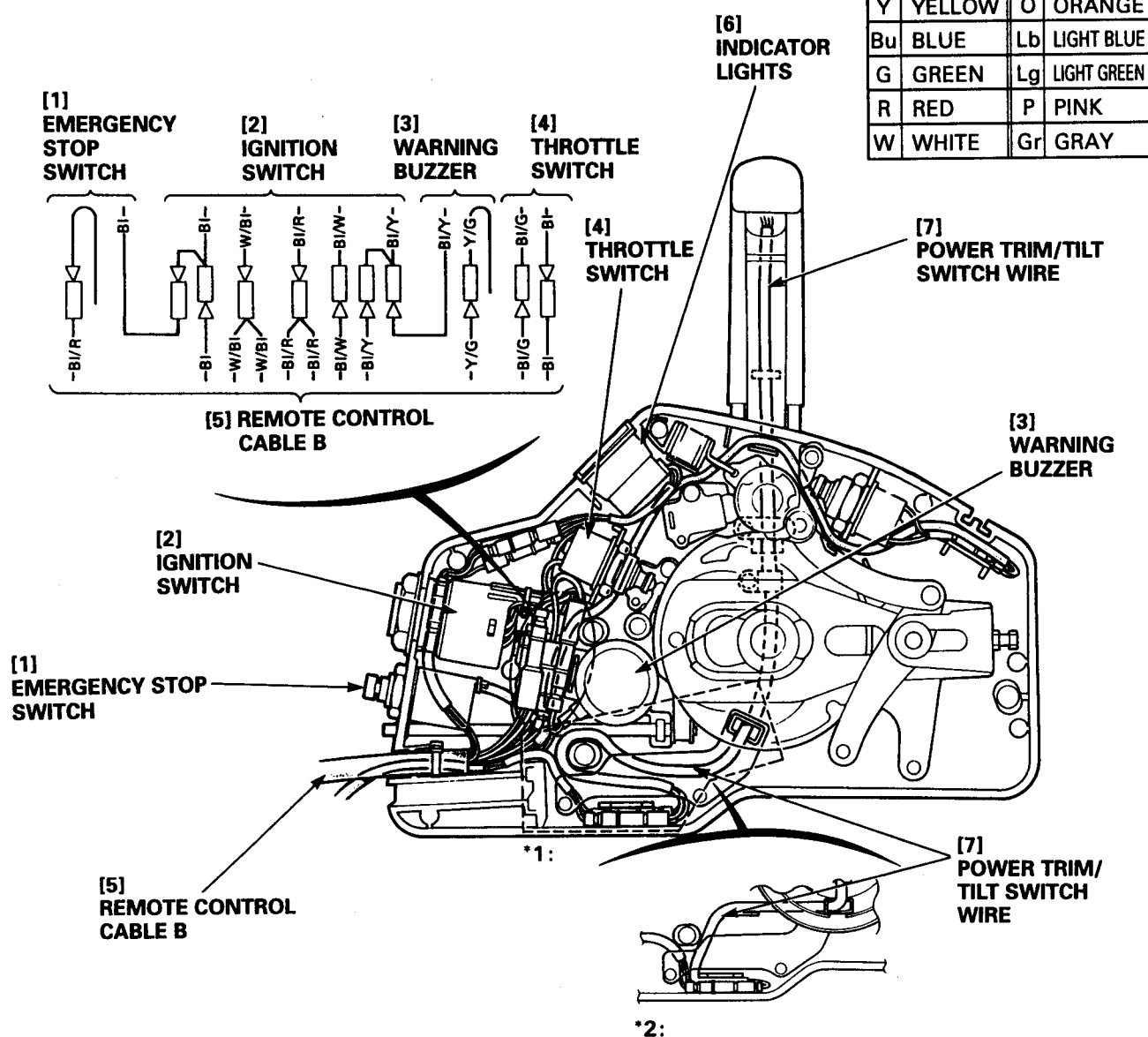






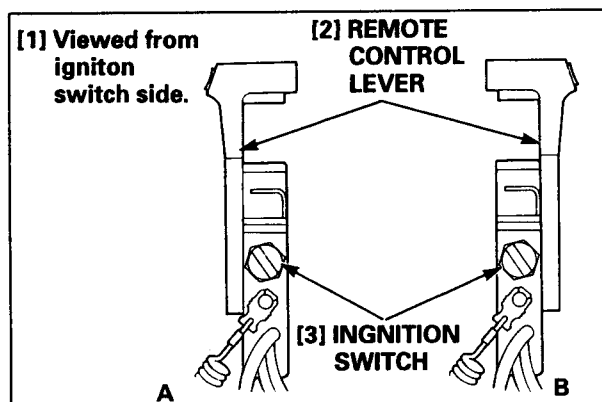


### • Side-mount remote control

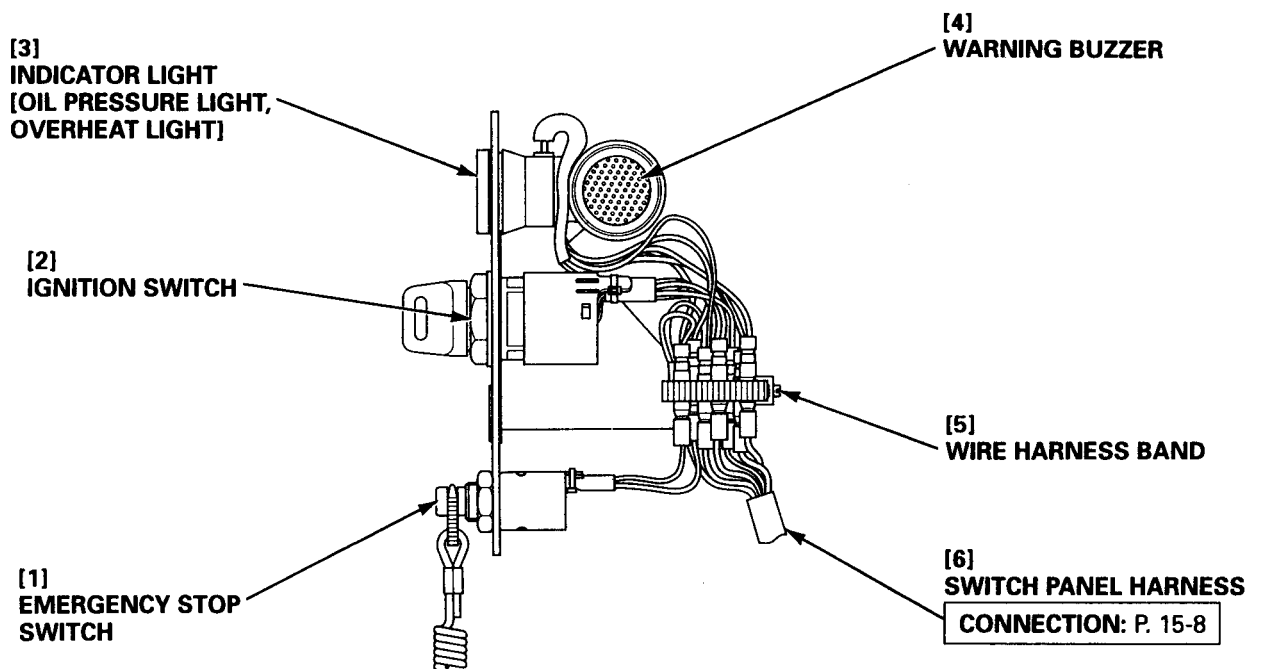


\*1: Power trim/tilt switch wire routing with remote control lever set as shown by A.

\*2: Power trim/tilt switch wire routing with remote control lever set as shown by B.



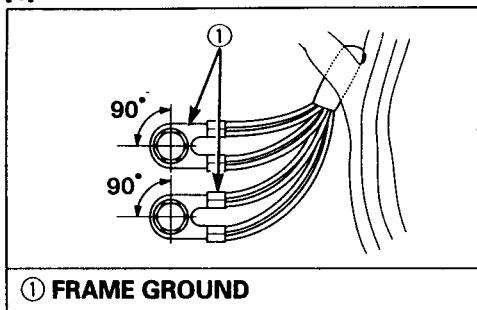
• Control panel



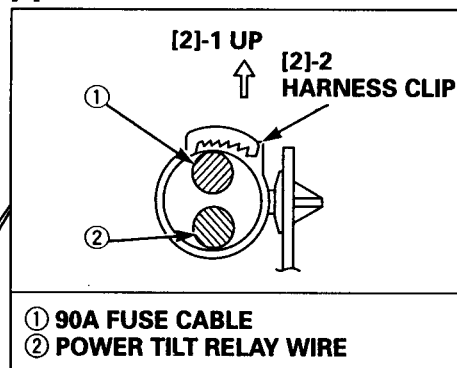
### ● CLAMPING WIRES WITH CLIPS AND BANDS

(\*1): Clamp the 90A fuse cable in the innermost recess.

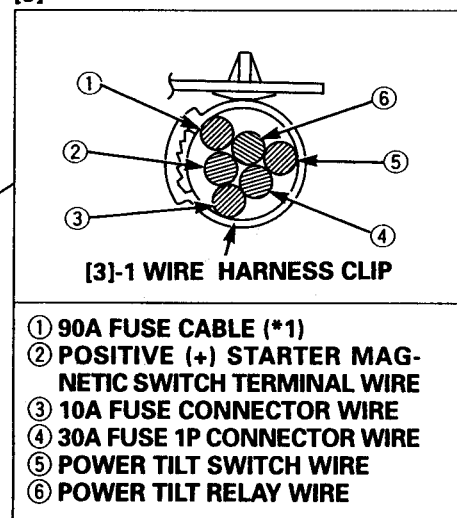
[1]



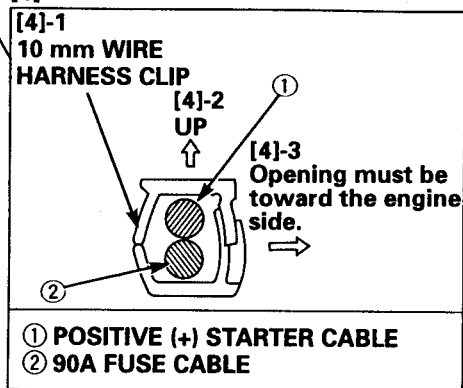
[2]



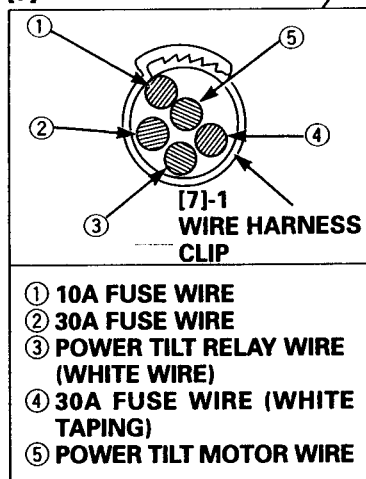
[3]



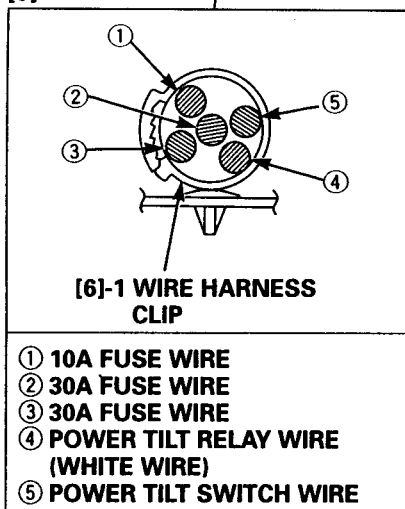
[4]



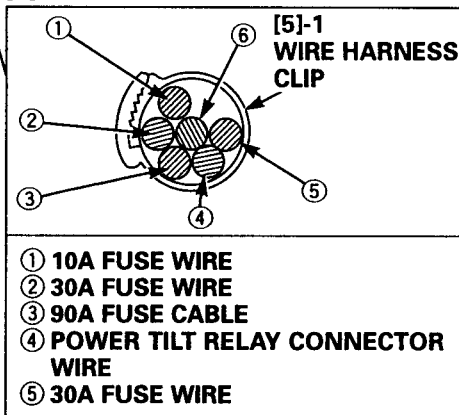
[7]



[6]



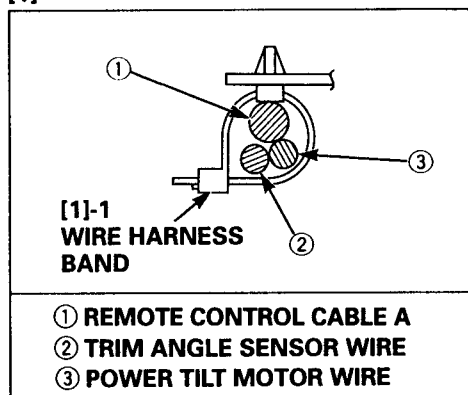
[5]



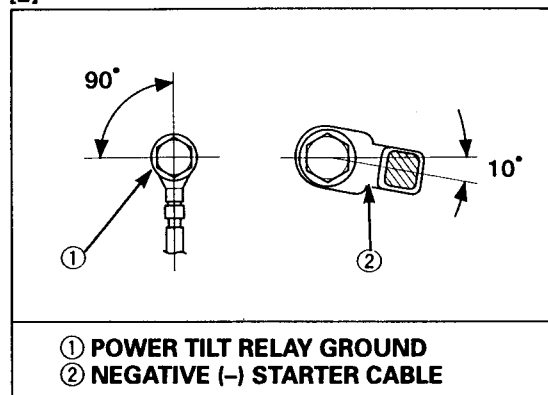
(\*1): Direct the harness clamp opening toward the engine.

(\*2): The power tilt switch wire must not be in contact with the stay.

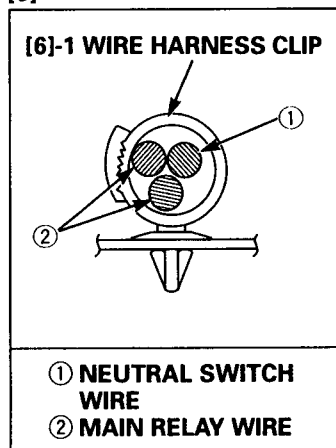
[1]



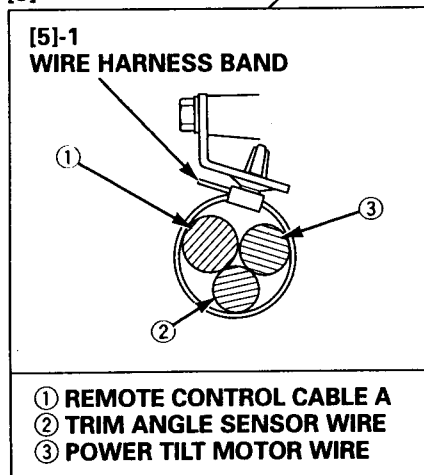
[2]



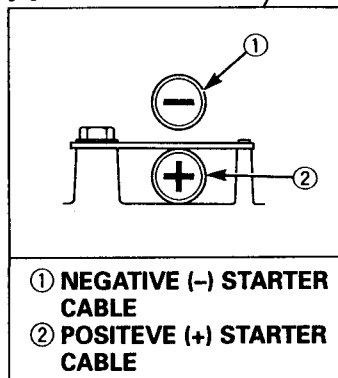
[6]



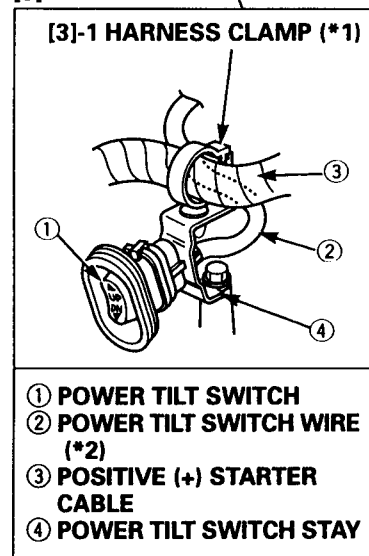
[5]



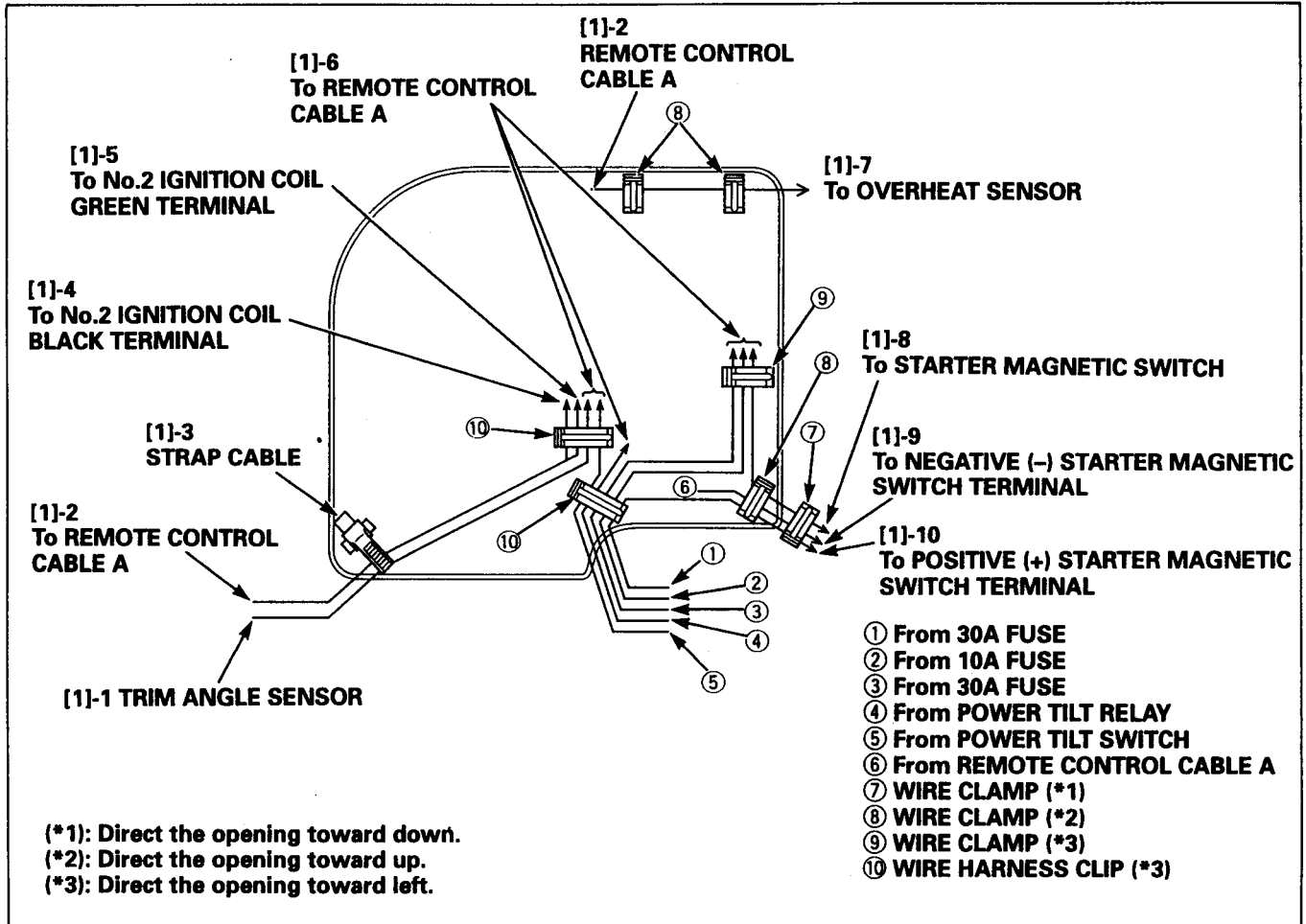
[4]



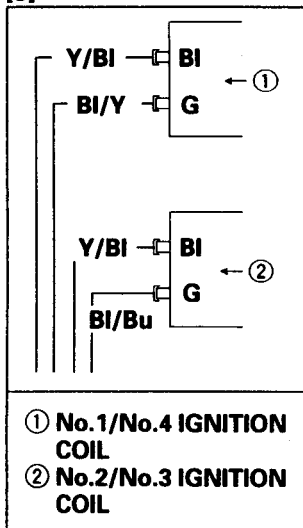
[3]



[1]

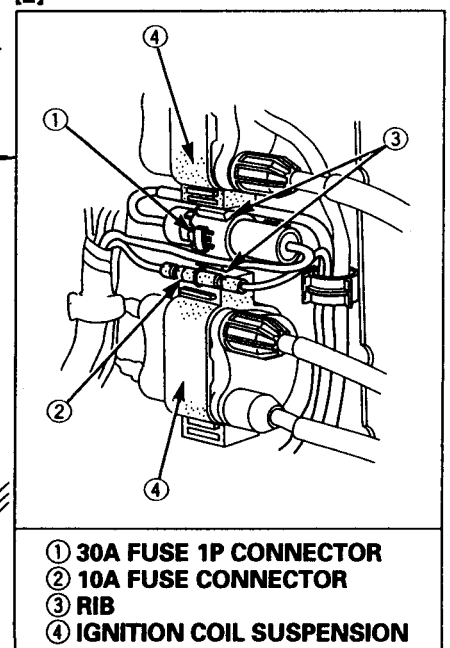


[3]

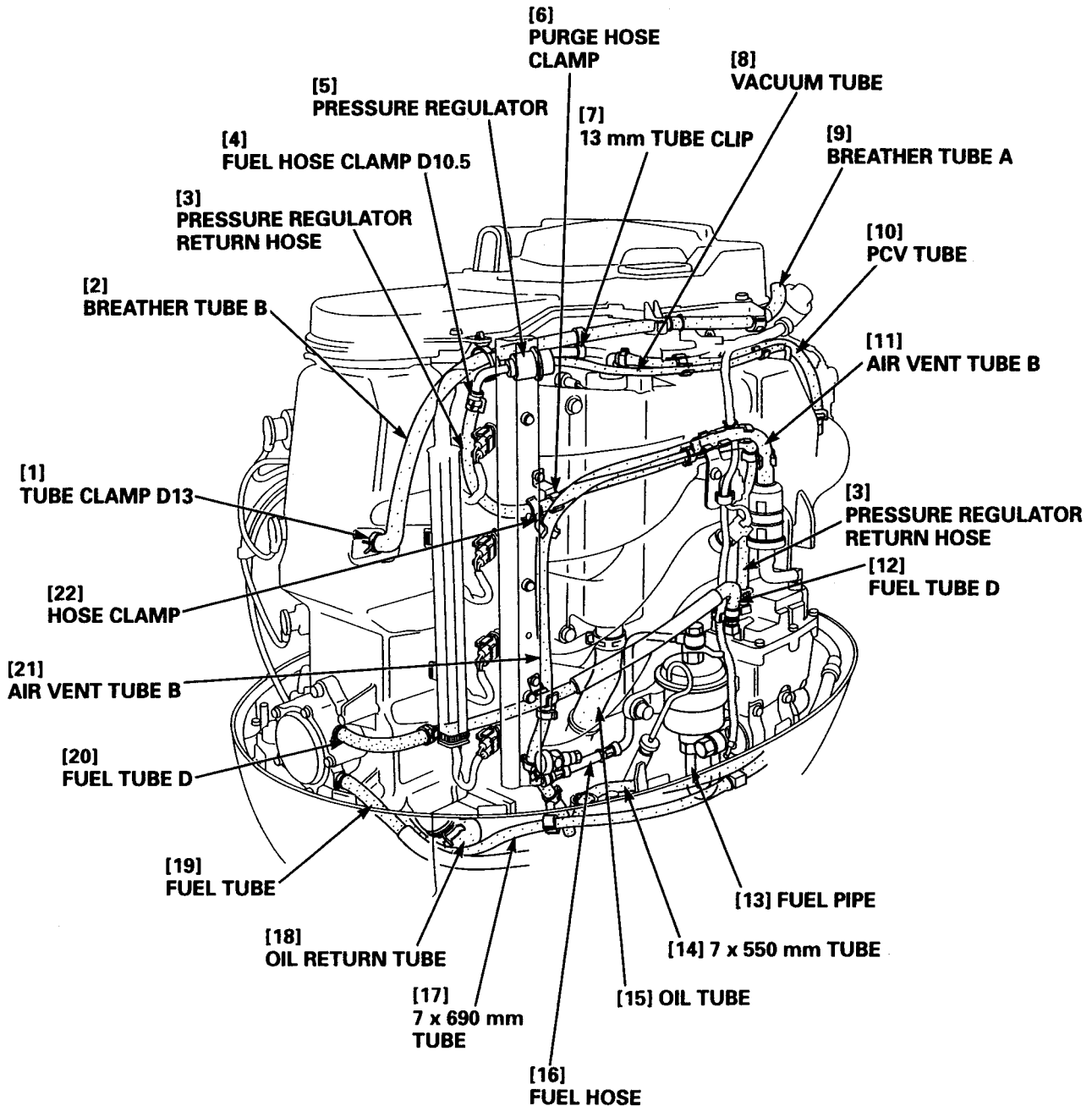


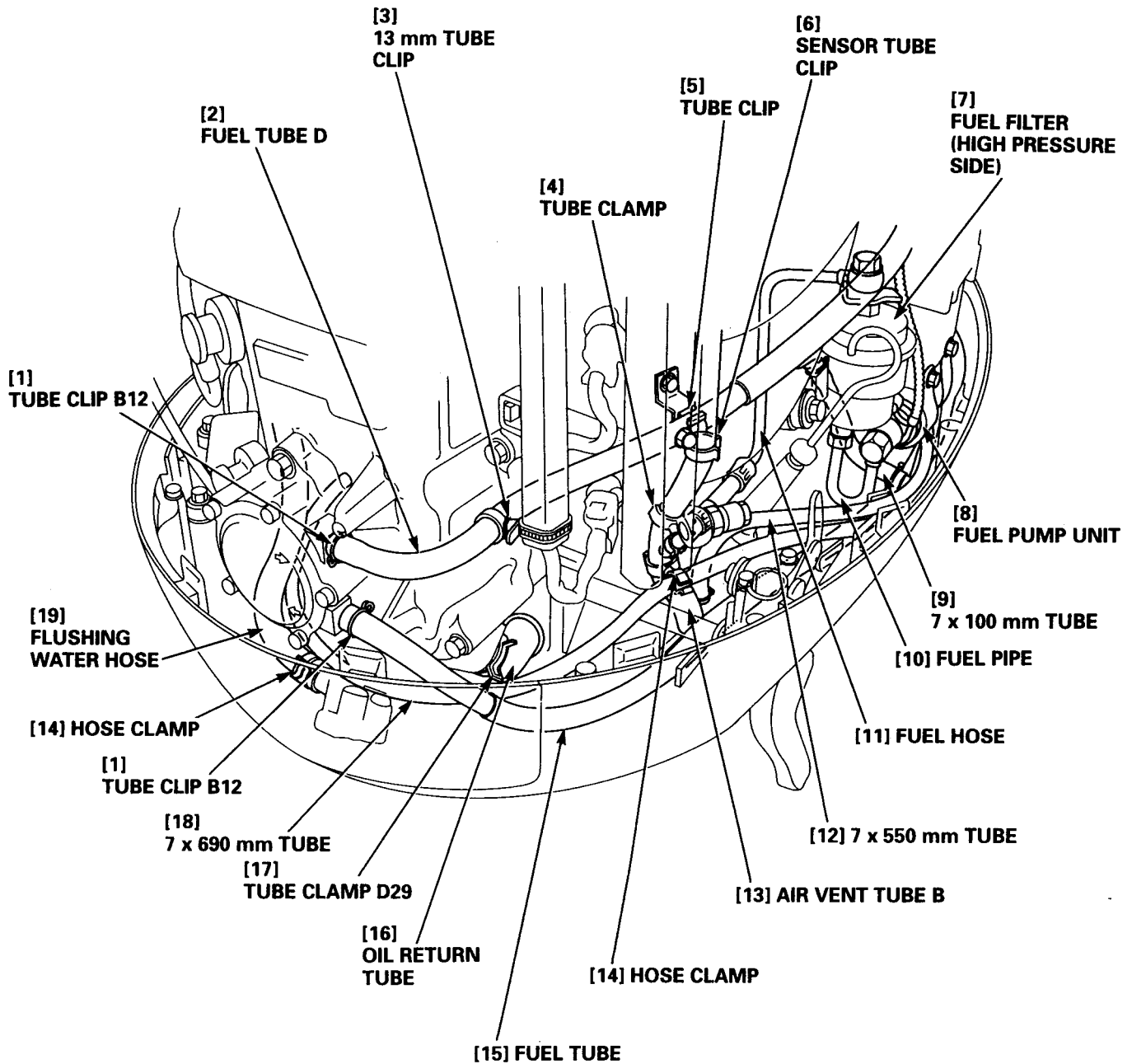
BI	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

[2]

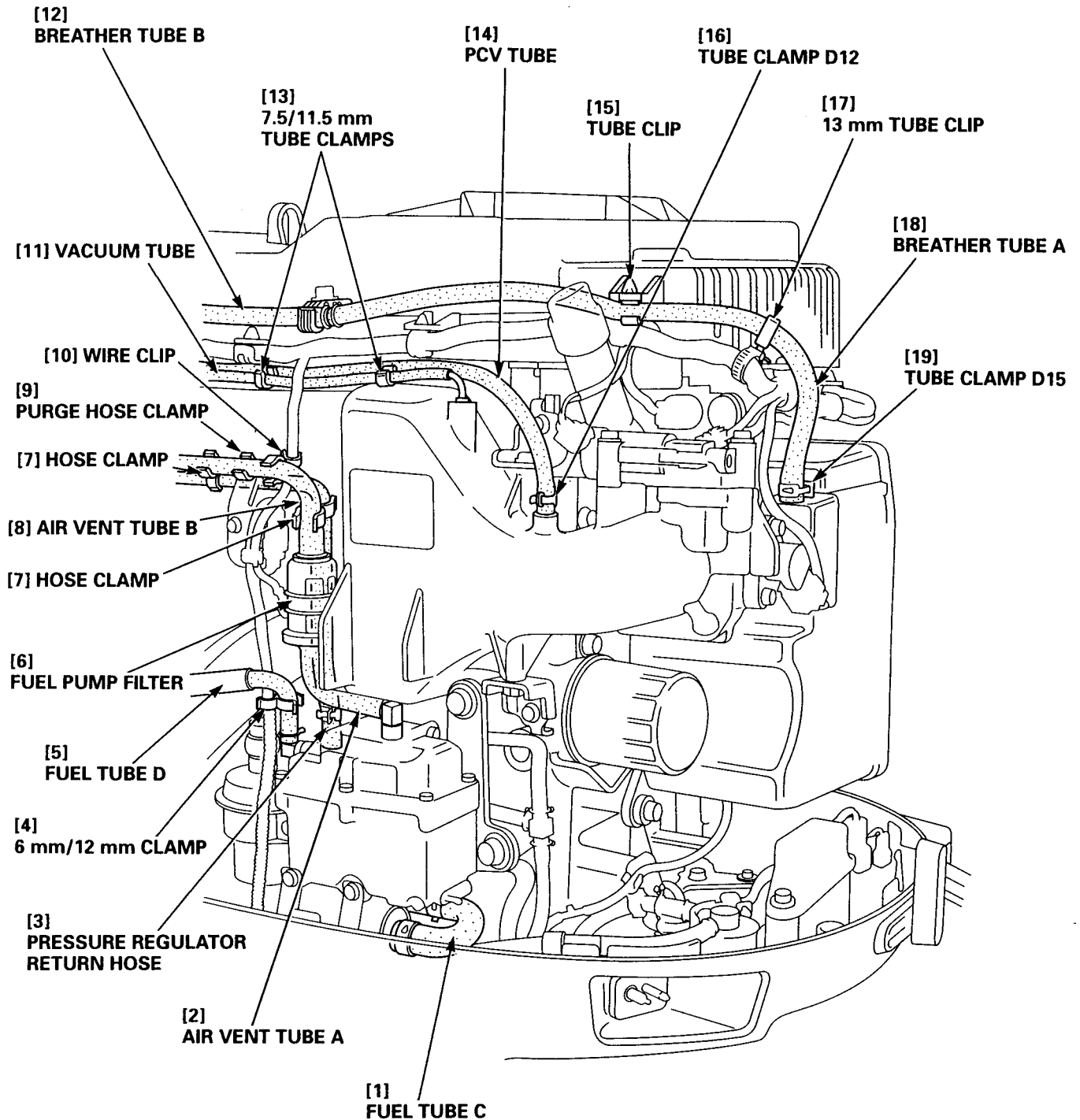


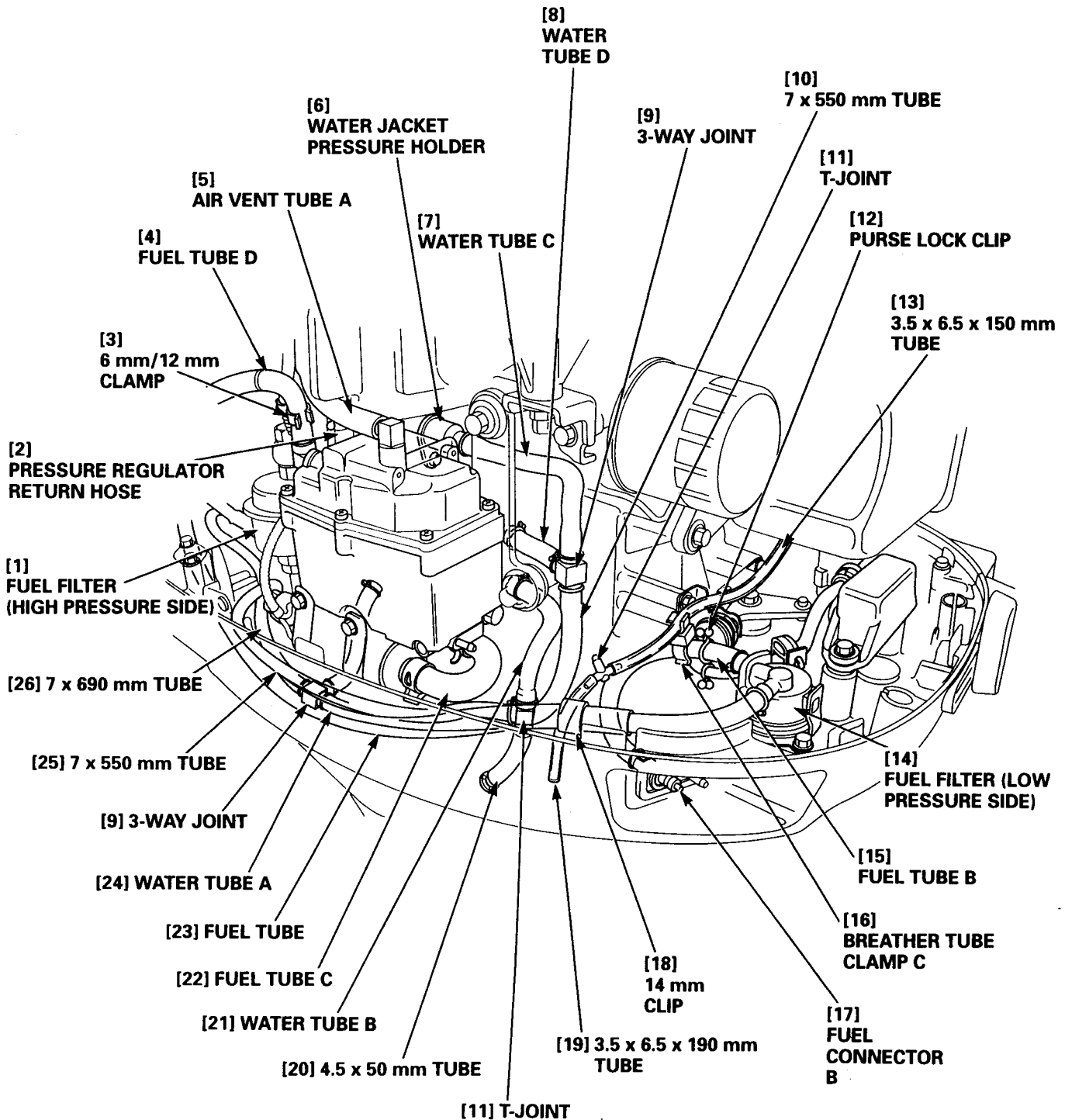
## 10. TUBE ROUTING

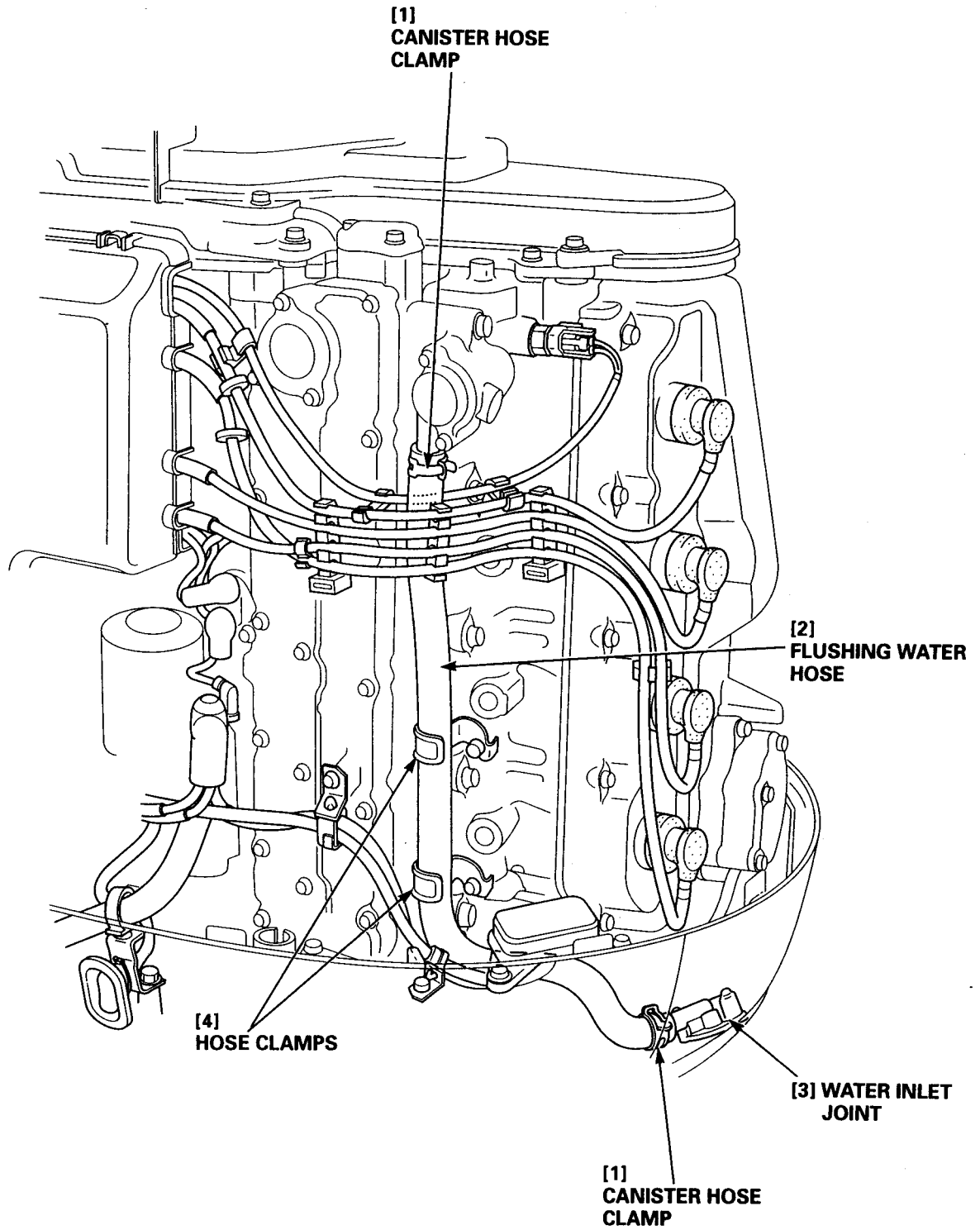








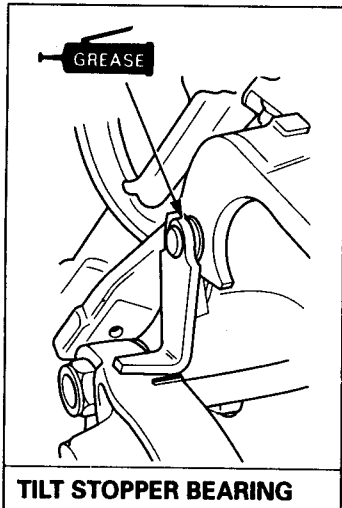




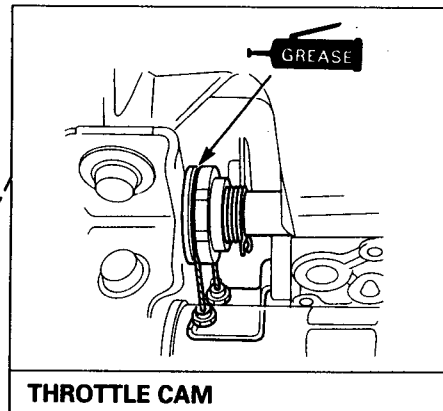
### 11. LUBRICATION

Apply marine grease to the following parts:

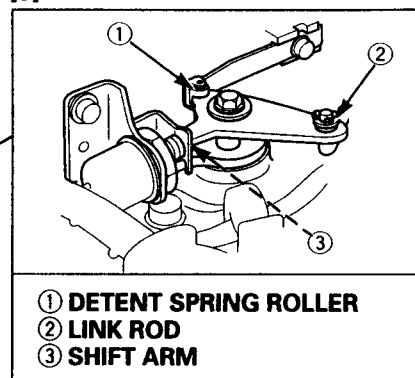
[1]



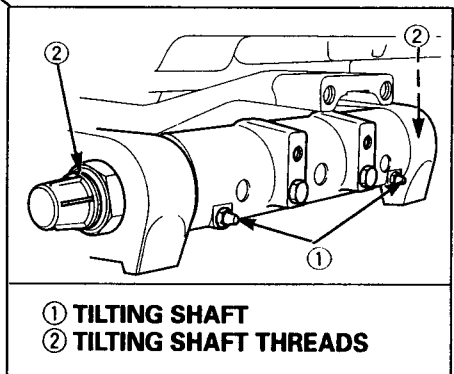
[2]



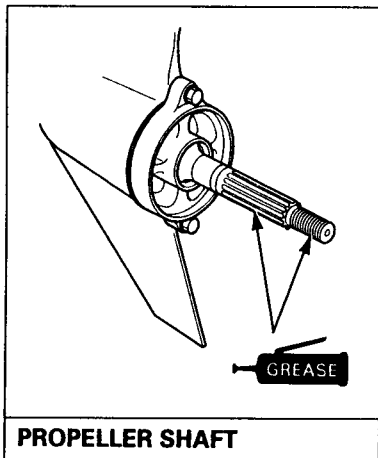
[3]



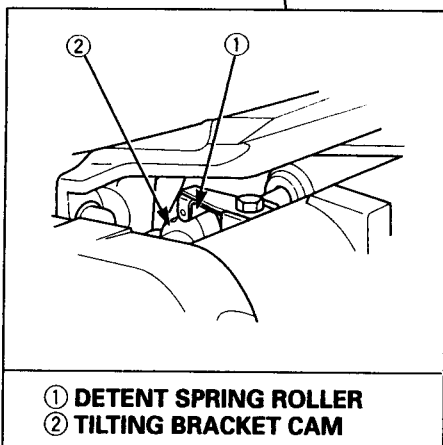
[4]

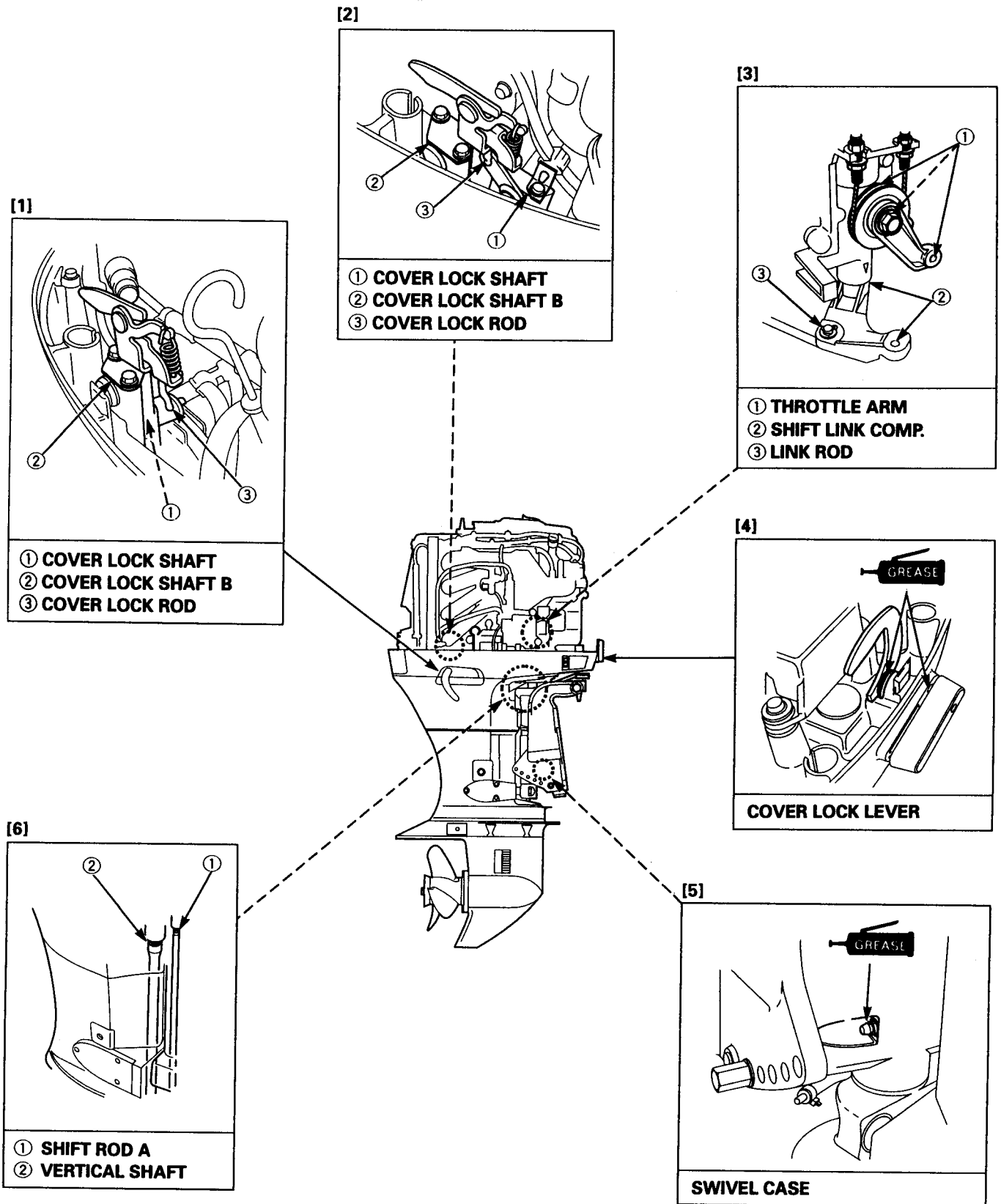


[6]

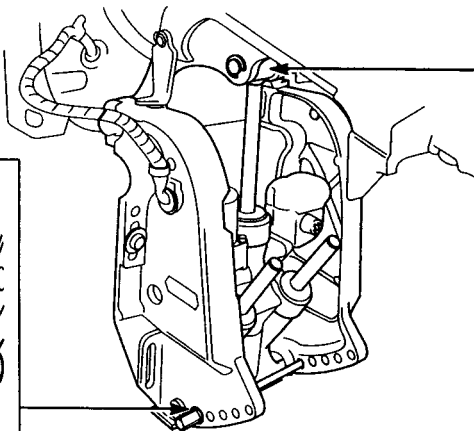
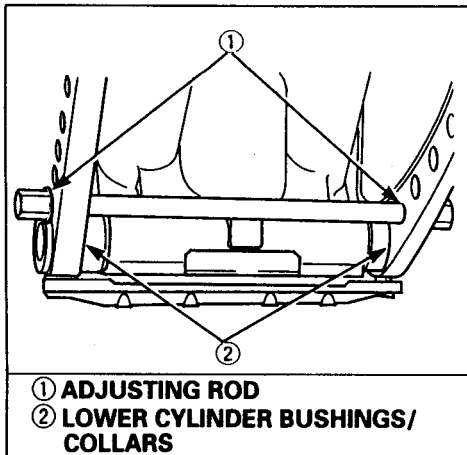


[5]

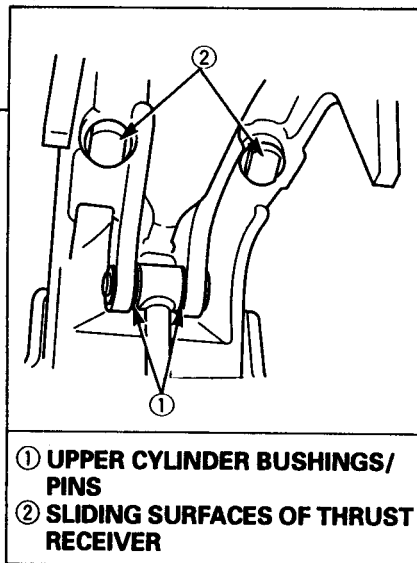




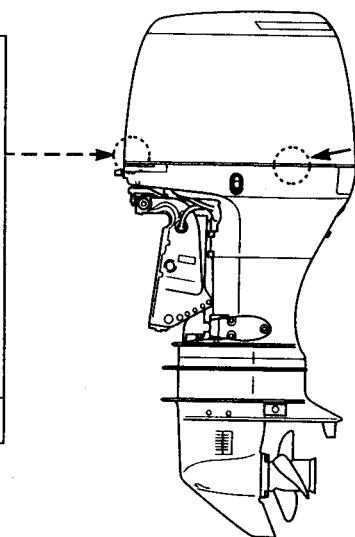
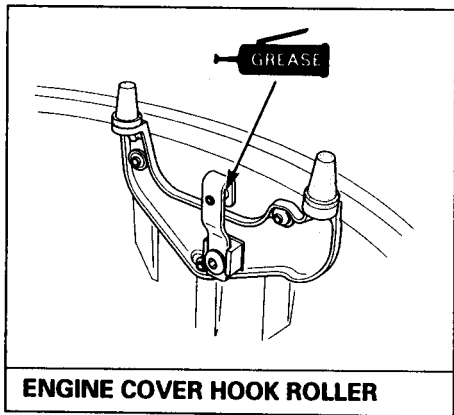
[1]



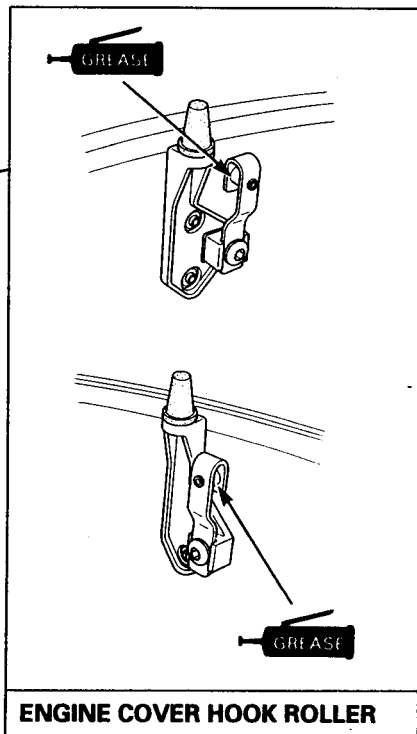
[2]



[3]



[3]



# 3. MAINTENANCE

**HONDA**  
**BF115A•130A**

1. MAINTENANCE SCHEDULE
2. ENGINE OIL
3. OIL FILTER
4. GEAR CASE OIL
5. SPARK PLUGS
6. VALVE CLEARANCE
7. FUEL FILTER  
(LOW PRESSURE SIDE)
8. FUEL TANK STRAINER  
(OPTIONAL FUEL TANK)

9. THROTTLE CABLE
10. SHIFT CABLE
11. ALTERNATOR BELT
12. BALANCER BELT
13. TIMING BELT
14. VAPOR SEPARATOR
15. BREATHER ELEMENT

## 1. MAINTENANCE SCHEDULE

REGULAR SERVICE PERIOD (3)		EACH USE	FIRST 20 HRS OR MONTH	EVERY 100 HRS OR 6 MONTHS	EVERY 200 HRS OR YEAR	EVERY 400 HRS OR 2 YEARS	REFER TO PAGE
ITEM	Perform at every indicated month or operating hour interval, whichever comes first.						
Engine oil	Check level	○					3-2
	Change		○	○			
Gear case oil	Check level and check for water contamination			○			3-4
	Change		○		○		
Engine oil filter	Change				○ (2)	○	3-3
Engine timing belt	Check-readjust				○		3-13 through 3-23
Balancer belt							
ACG belt							
Throttle linkage and idling speed	Check		○	○			5-31
	Adjust		○	○			
Valve clearance	Check-readjust		○		○		3-5
Spark plugs	Check-adjust (Replace if necessary)		○		○		3-5
Propeller and cotter pin	Check	○					12-1
	(Replace if necessary)			○			
Lubrication	Grease		○ (1)	○ (1)			2-50
Fuel tank and tank filter	Clean				○		3-10
	(Replace if necessary)				○		
Fuel filter	Check			○			3-9
	Change					○	5-76
Fuel filter (High pressure type)	Change					○	5-47
Thermostat	Check				○		8-4
Fuel line	Check	○					5-44
	(Replace if necessary)					○	
Battery cable	Check-tightness		○	○			—
Bolts and Nuts	Check-tightness		○	○			—

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

(2) For professional commercial use, replace every year or every 200 operating hours.

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

## 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.**

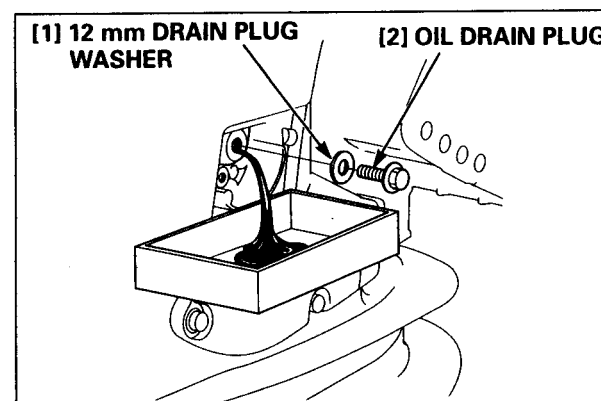
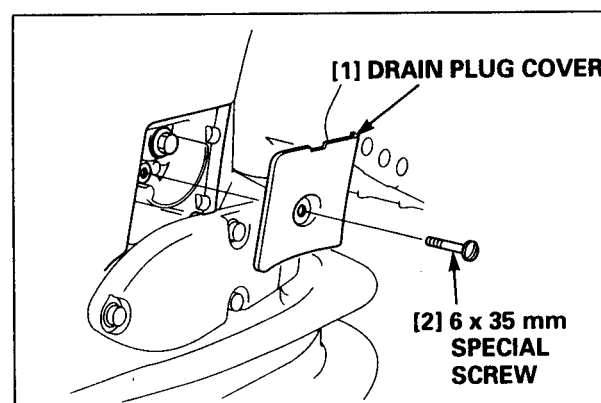
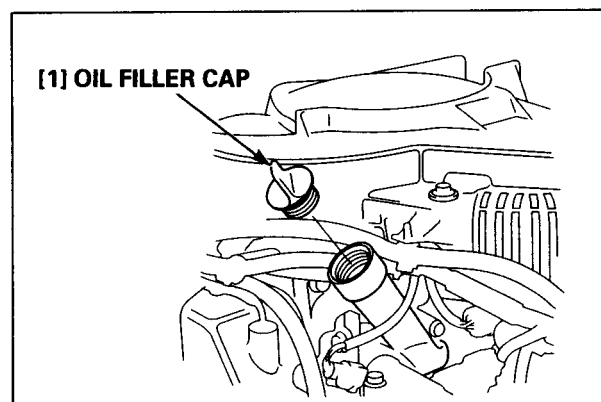
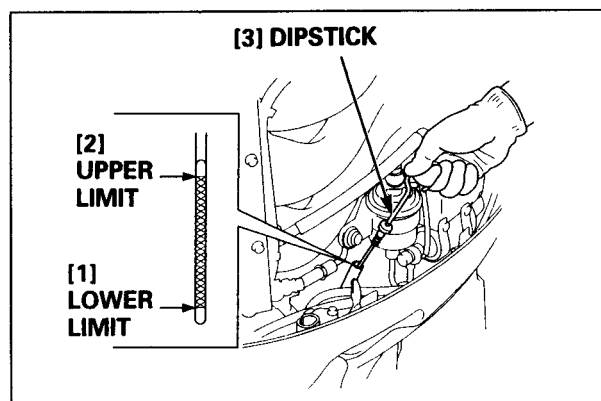
**Wash your hands thoroughly with soap and water as soon as possible after contact with used engine oil.**

- 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	5.6 l (5.9 US qt, 4.9 Imp qt) With oil filter replacement: 6.5 l (6.9 US qt, 5.7 Imp qt)
Recommended engine oil	SAE 10W – 30 API Service classification SG/SH

**NOTE:**

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 a special tool.

**TOOL:**

**Oil filter wrench 07912-6110001**

- 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.

**NOTE:**

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.

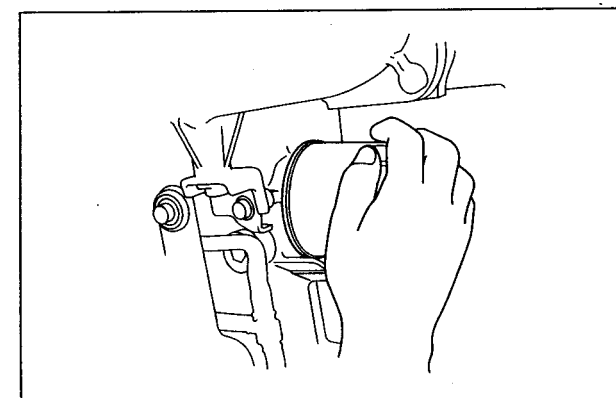
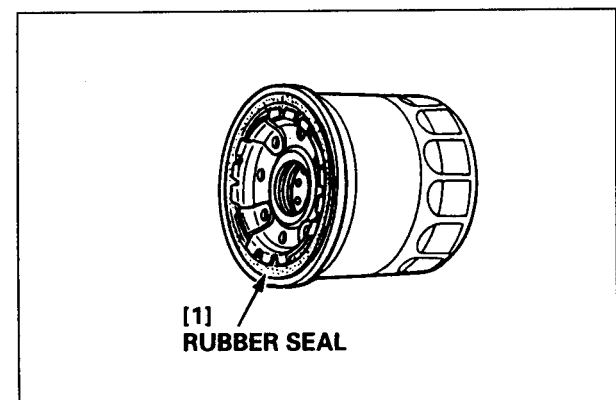
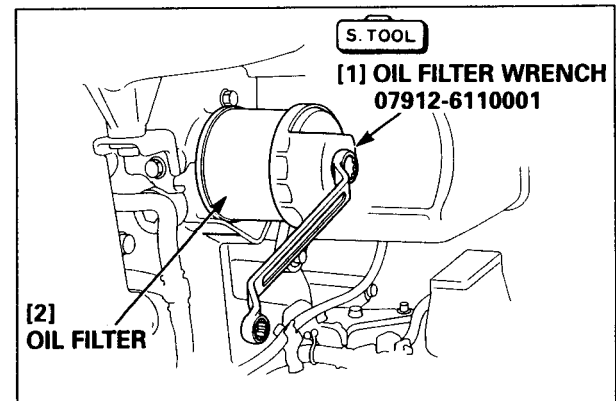
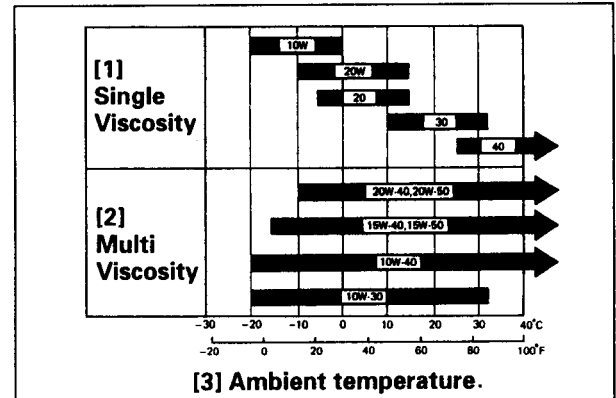
- 5) Screw on the new oil filter by hand, until the seal contacts the filter mounting base, then use an special tool to tighten the filter an additional 7/8 turn.

**TOOL:**

**Oil filter wrench 07912-6110001**

**TORQUE : 21.6 N·m (2.2 kgf·m, 16 lbf·ft)**

- 6) Refill the engine 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	1.0 ℓ (1.1 US qt, 0.9 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.

#### NOTE:

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.

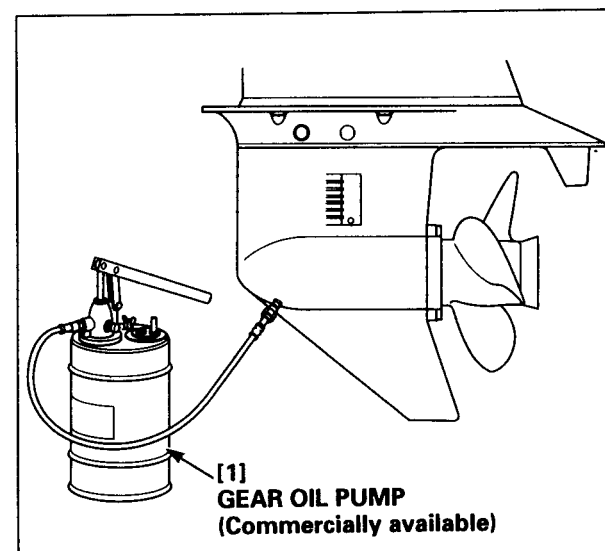
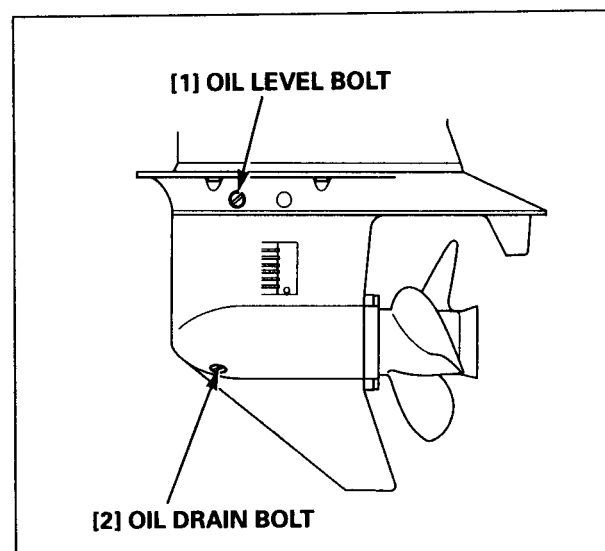
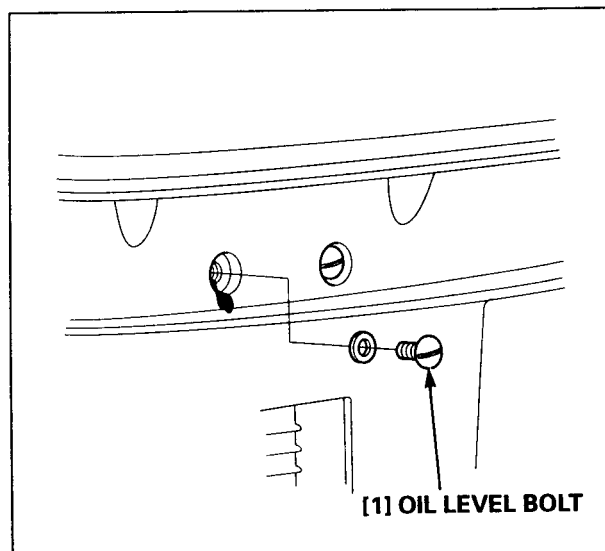
- 2) Check for metal particles on the magnet end of the oil drain bolt.
- 3) If there are metal particles on the magnet end of the oil drain bolt, disassemble the gear case assembly and check (P.12-22).
- 4) Install the commercially available gear oil pump in the oil drain bolt hole, and add gear oil until it flows out of the oil level bolt hole.

Gear oil capacity	1.0 ℓ (1.1 US qt, 0.9 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)**



## 5. SPARK PLUGS

### Inspection/Cleaning:

- 1) Remove the engine cover and spark plug caps.
- 2) Clean any dirt from around the spark plug bases.
- 3) Use a spark plug wrench to remove the spark plugs.
- 4) Visually inspect the spark plugs. Discard the plugs if the insulators are cracked or chipped.
- 5) Remove carbon or other deposits with a stiff wire brush.
- 6) Measure the plug gap with a wire-type feeler gauge.

Spark plug gap	0.7 – 0.8 mm (0.028 – 0.031 in)
Recommended spark plug	ZFR7F (NGK) KJ22CR-L8 (DENSO)

If necessary, adjust the gap by bending each side electrode.

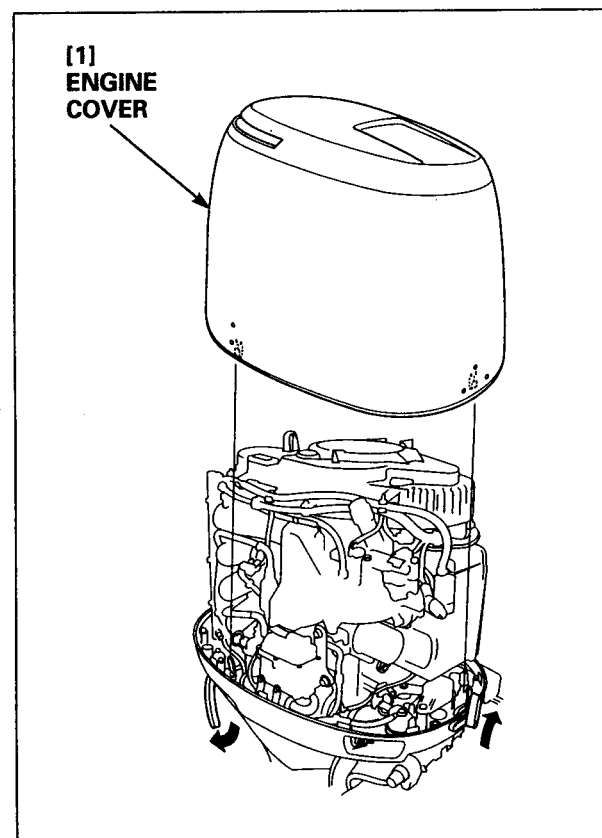
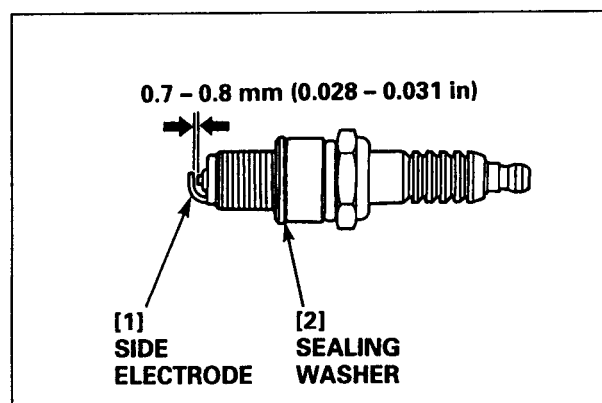
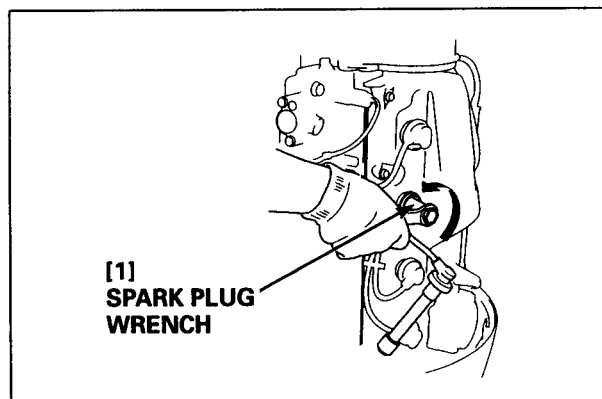
- 7) Make sure each sealing washer is in good condition. With each spark plug sealing washer attached, thread the spark plugs in by hand to seat the sealing washers and prevent crossthreading.

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)**

### CAUTION:

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



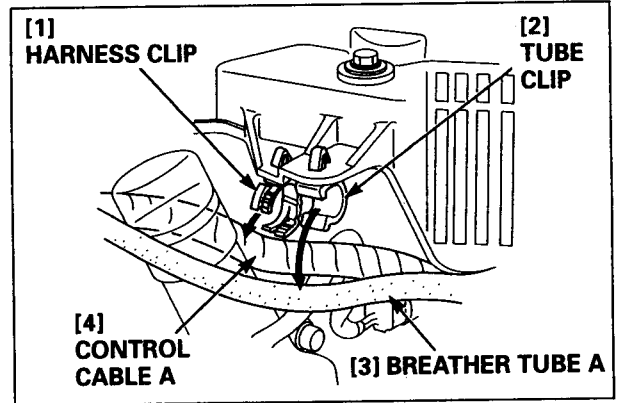
## 6. VALVE CLEARANCE

### Inspection/Adjustment:

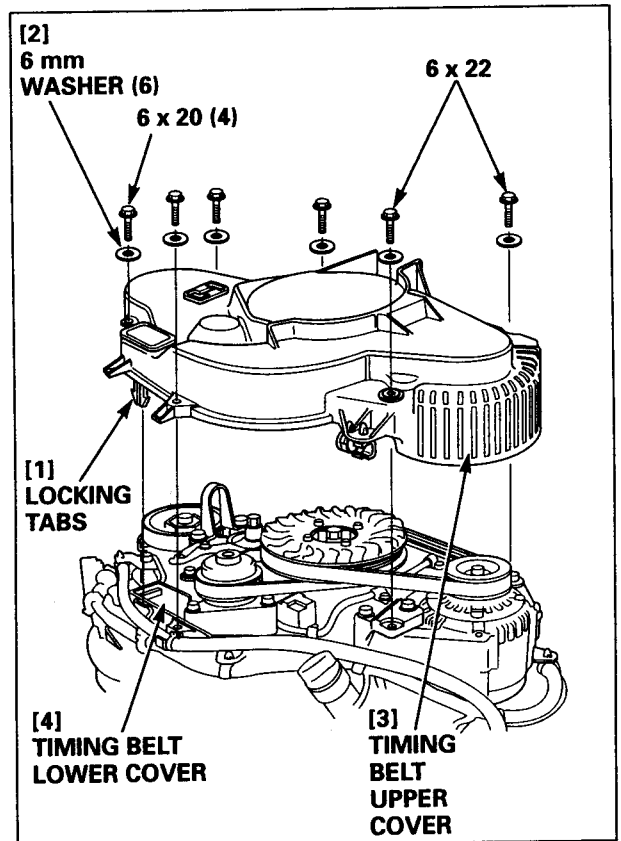
- Valve clearance inspection and adjustment must be performed with the engine cold.

- 1) Remove the engine cover.

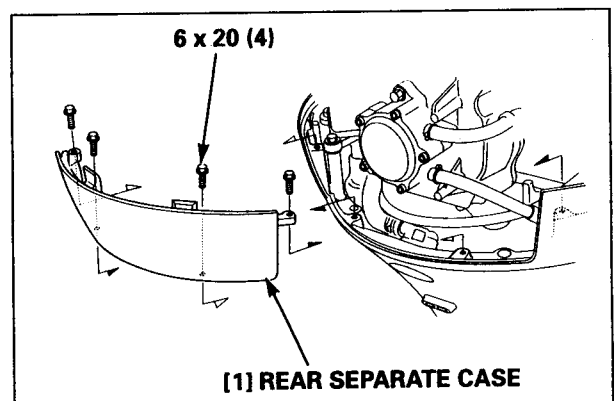
- 2) Move the remote control lever to the "N" (Neutral) position.
- 3) Release the breather tube A and the control cable A from the clamps.



- 4) Remove the four 6 x 20 mm flange bolts and the two 6 x 22 mm flange bolts. Disengage the locking tabs of the timing belt upper cover from the timing belt lower cover and remove the timing belt upper cover.
- 5) Remove the spark plug caps and the spark plugs.



- 6) Remove the four 6 x 20 mm flange bolts from the rear separate case and remove the rear separate case.



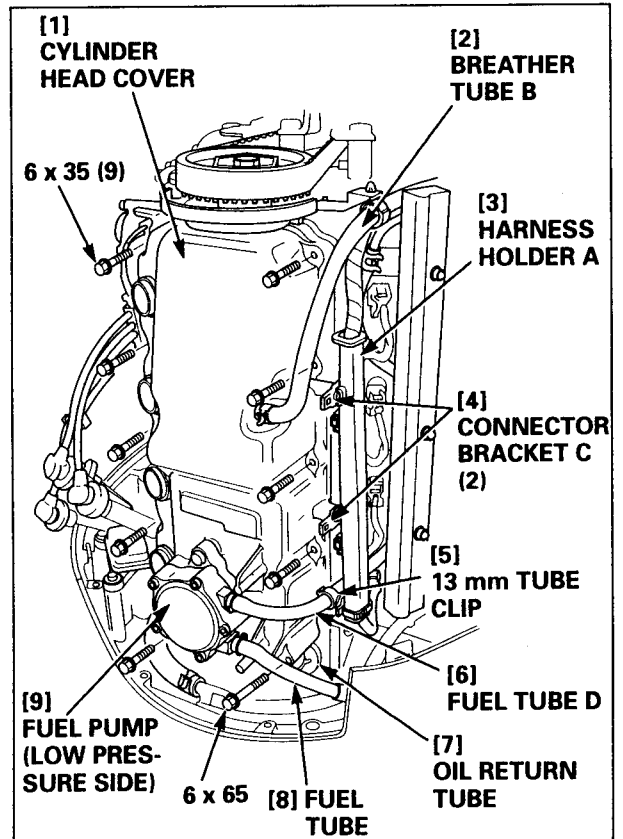
- 7) Open the 13 mm tube clip that secures the fuel tube D, and release the fuel tube D.
- 8) Disconnect the breather tube B from the cylinder head cover.
- 9) Remove the harness holder A from the connector brackets C.
- 10) Disconnect the fuel tube and the fuel tube D from the fuel pump (low pressure side). Remove the nine 6 x 35 mm flange bolts and one 6 x 65 mm flange bolt from the cylinder head cover, and remove the cylinder head cover and the oil return tube as a set.

### ⚠ WARNING

**Gasoline is highly flammable and explosive.**

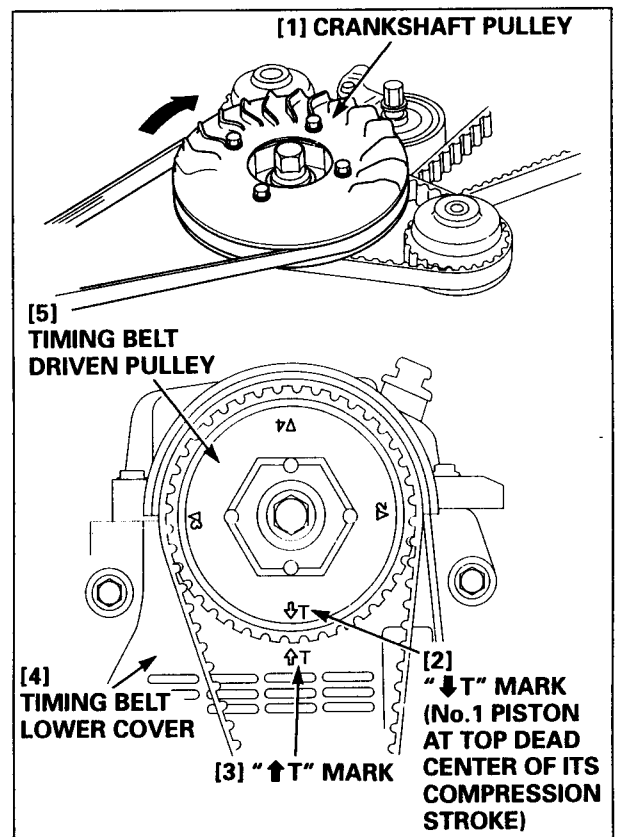
**You can be burned or seriously injured when handling fuel.**

- 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.



- 11) Manually turn the crankshaft pulley clockwise, and align the "↓T" mark on the timing belt driven pulley with the "↑T" mark on the timing belt lower cover. (In the position, the No. 1 piston is at the top dead center of its compression stroke.)

- Do not turn the crankshaft pulley counterclockwise.



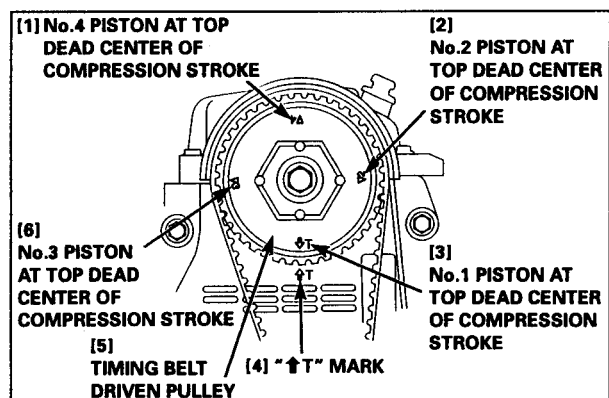
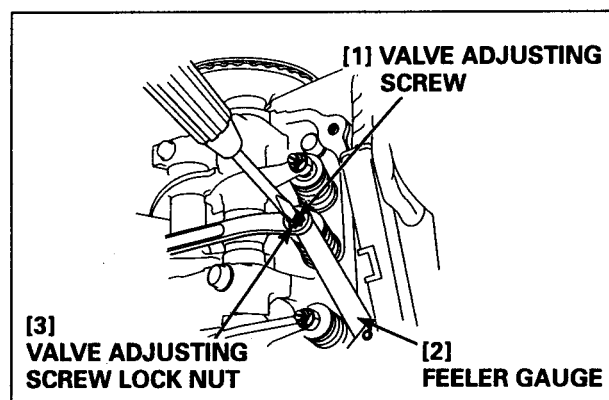
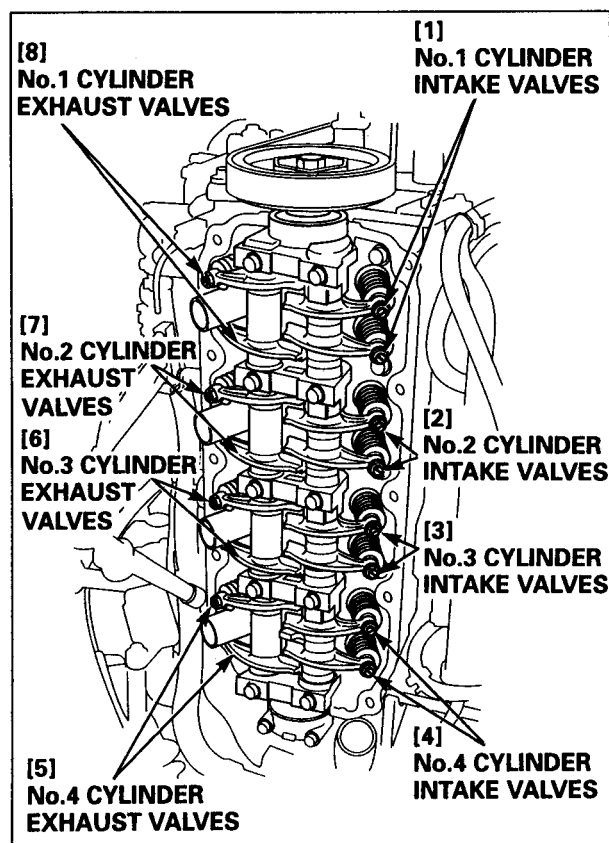
- 12) With the engine in the position described in step 10, check the intake and exhaust valve clearances on No. 1 cylinder with a feeler gauge and adjust if necessary.

Valve clearance	IN	0.24 – 0.28 mm (0.009 – 0.011 in)
	EX	0.28 – 0.32 mm (0.011 – 0.013 in)

- 13) If adjustment is needed, loosen the valve adjusting lock nut, and adjust the intake and exhaust valve clearances by turning the valve adjusting screw right or left.
- 14) After adjustment, secure the adjusting screw and loosely tighten the lock nut.
- 15) Recheck the valve clearances and tighten the valve adjusting lock nut securely.

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

- 16) After adjusting the intake and exhaust valve clearances of the No.1 cylinder, turn the crankshaft pulley clockwise, and align the "▼2" mark on the timing belt driven pulley with the "↑T" mark on the timing belt lower cover. In this position, the No.2 piston is at the top dead center of its compression stroke. With the engine in this position, adjust the intake and exhaust valve clearances of the No.2 cylinder.
- 17) After adjusting the intake and exhaust valve clearances of the No.2 cylinder, adjust the intake and exhaust valve clearances of the No.4 and the No.3 cylinders in this order in the same procedures from the above steps 11 through 15.
- 18) Reinstall the cylinder head cover in the reverse order of removal, but note the following.
- Oil return tube installation (P. 7-13).
  - Cylinder head cover installation (P. 9-5 through 7).



## 7. FUEL FILTER (LOW PRESSURE SIDE)

### Inspection:

- 1) Remove the engine cover.
- 2) Pull the fuel filter stay toward you, and lift the fuel filter up from the engine undercase.
- 3) Check the fuel filter for water accumulation or sediment. If no water or sediment is found, lower the fuel filter back down into the engine undercase properly.

### Replacement:

#### **⚠ WARNING**

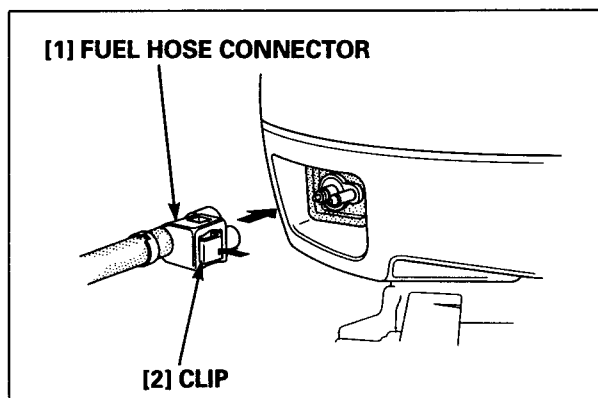
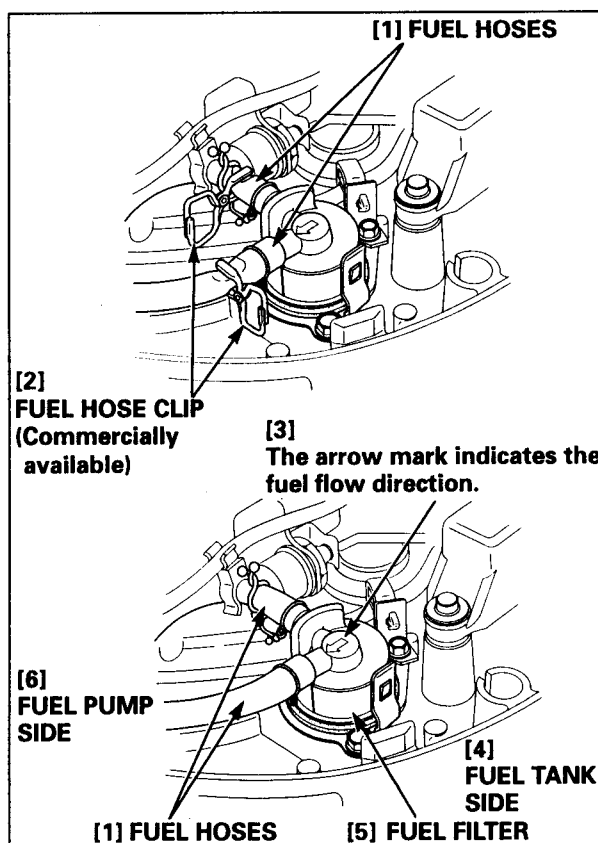
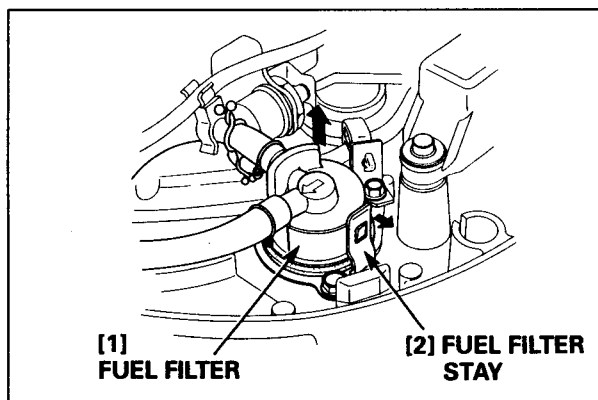
**Gasoline is highly flammable and explosive.**

**You can be burned or seriously injured when handling fuel.**

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

If water or sediment is found in the fuel filter proceed as follows:

- 1) Disconnect the fuel hose connector from the motor.
- 2) Pinch off the fuel lines at the fuel filter with two commercially available Fuel Hose Clips as shown.
- 3) Being careful to prevent fuel leakage, disconnect the fuel hoses from the fuel filter and remove fuel filter.
- 4) Install the new fuel filter so the arrow mark on the fuel filter points toward the fuel pump. Connect the fuel hoses to the fuel filter and remove the fuel hose clips. Secure the fuel hoses to the fuel filter with the hose clamps.
- 5) Lower the fuel filter into the engine undercase properly.
- 6) Connect the fuel hose connector to the motor with the clip to the outside. Pump the primer bulb, and check for leaks. Repair any fuel leaks before starting the engine.



## 8. FUEL TANK STRAINER (OPTIONAL FUEL TANK)

### Inspection/Cleaning:

#### ⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

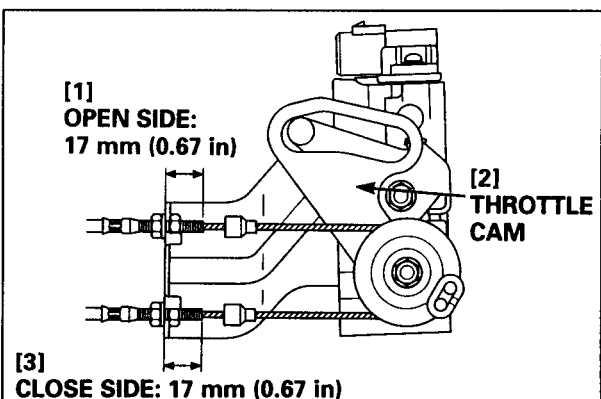
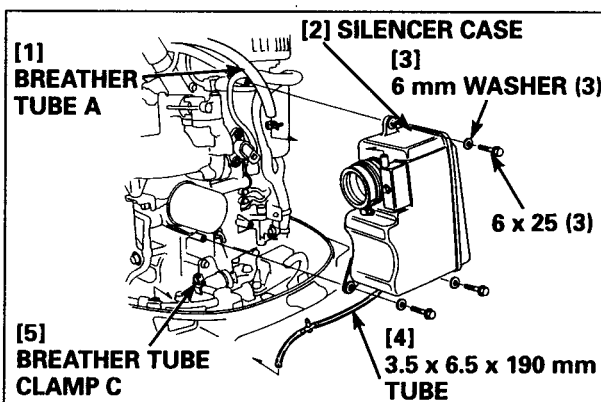
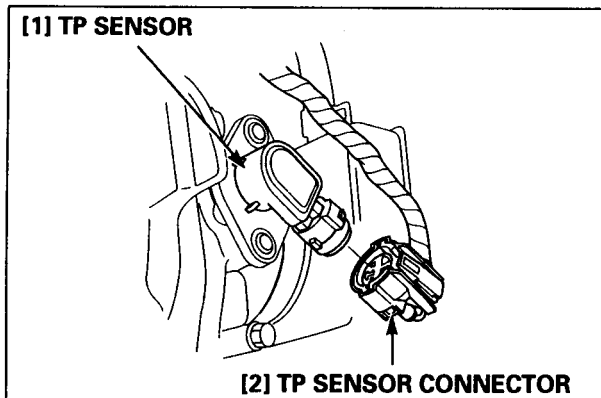
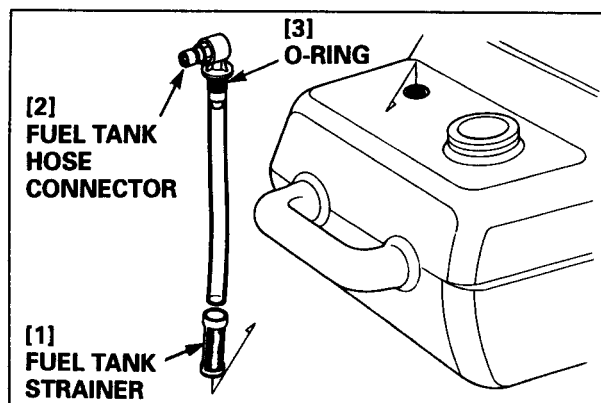
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

- 1) Drain the fuel tank into an approved gasoline container.
- 2) Remove the fuel tank hose connector and fuel tank strainer from the fuel tank.
- 3) Remove any dirt or foreign material from the fuel tank strainer and check for tears in the strainer mesh. Replace the strainer if it is torn or damaged.

## 9. THROTTLE CABLE

### Adjustment:

- 1) Remove the engine cover and disconnect the TP sensor connector.
- 2) Disconnect the breather tube A from the silencer case. Disconnect the 3.5 x 6.5 x 190 mm tube from the breather tube clamp C. Remove the silencer case from the throttle body.
- 3) 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 17 mm (0.67 in) from the point shown.
- 4) 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.





- 5) 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	18 mm (0.71 in)
Close side	16 mm (0.63 in)

- 6) 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.

- 7) Move the remote control lever to the "F" (Forward) fully open position.

**NOTE:**

- 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.

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

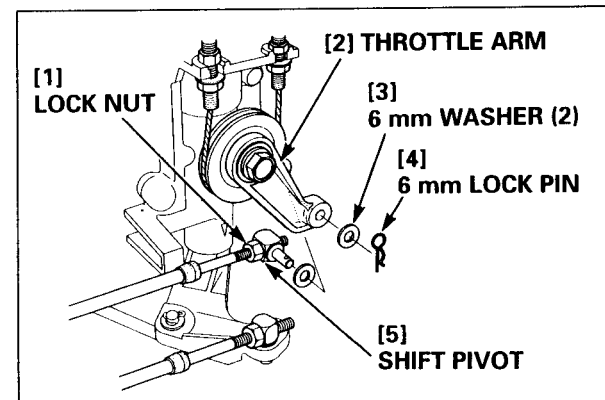
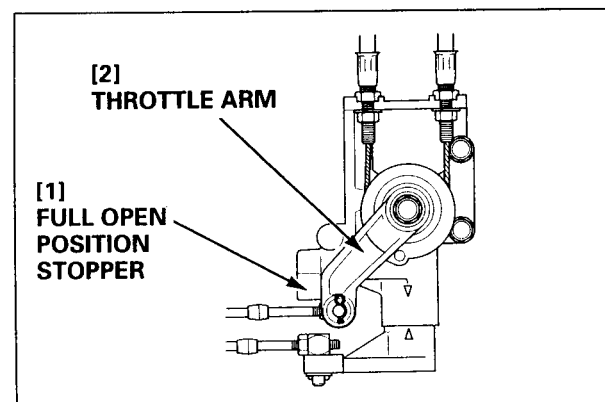
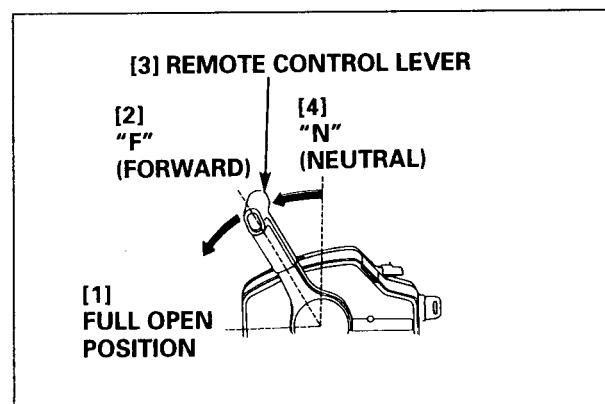
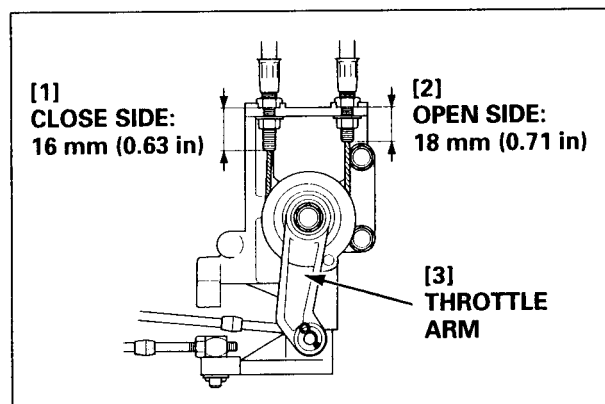
- 9) Move the remote control lever to the "N" (Neutral) position.

- 10) Loosen the shift pivot lock nut and remove the 6 mm lock pin and the 6 mm washers from the shift pivot.

Disconnect the shift pivot from the throttle arm and adjust by turning the shift pivot.

- 11) Install the shift pivot on the throttle arm. Move the remote control lever to the "F" (Forward) full open position and check that the throttle arm is in contact with the full open position stopper.

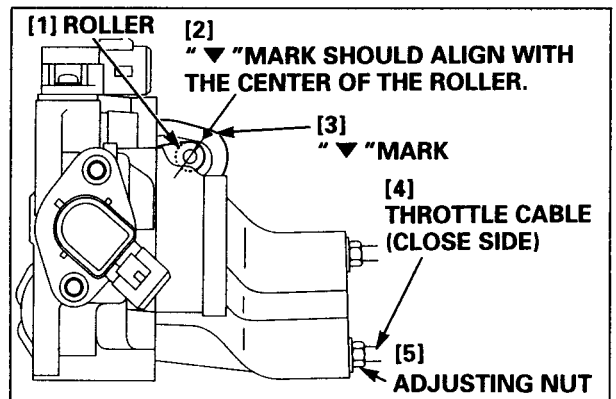
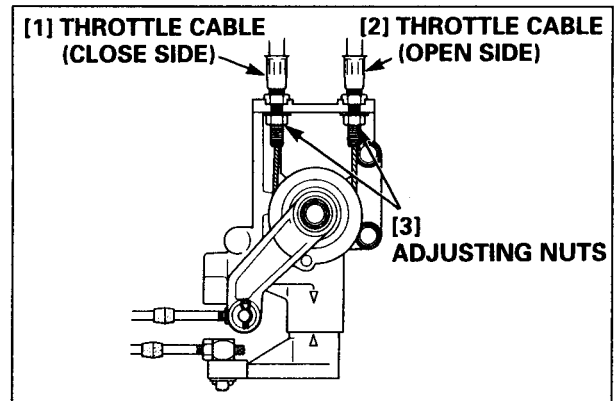
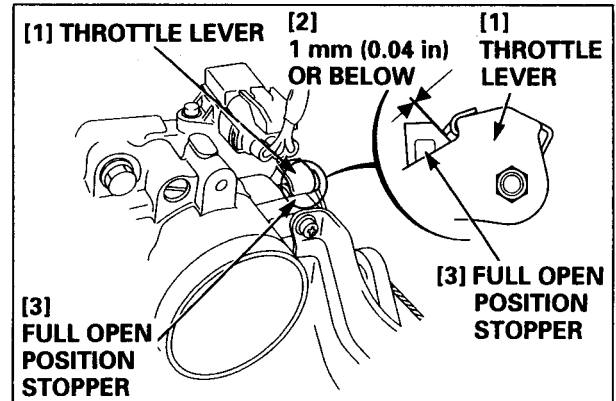
Then, move the remote control lever to the "N" (Neutral) position and tighten the shift pivot lock nut.



- 12) 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).

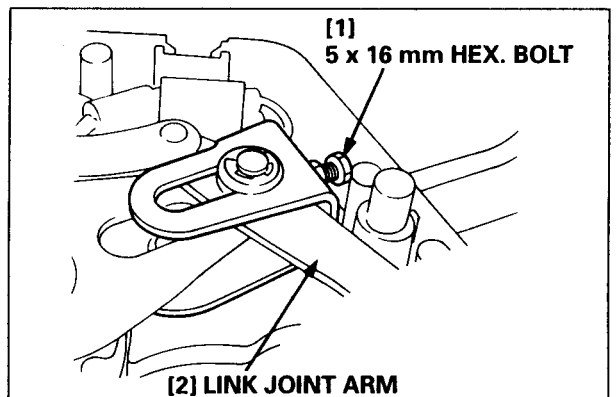
- 13) Adjustment must be made as follows. Move the remote control lever to the "N" (Neutral) position and loosen the adjusting nuts at the open side and the close side of the throttle cable of the throttle arm side.
- 14) Move the remote control lever to the "F" (Forward) full open position.
- 15) Turning 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.
- 16) Loosely tighten the adjusting nuts at the open side and the close side of the throttle cable, and return the remote control lever to the "N" (Neutral) position.
- 17) 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 close side of the throttle cable.
- 18) After adjustment, tighten the adjusting nuts at the open side and the close side of the throttle cable securely.
- 19) Install the silencer case and connect the TP sensor connector.



### • Check item

#### Side-mount remote control type only:

- 1) Remove the remote control box cover B/C (P. 15-2).
- 2) Move the remote control lever to the full open position and be sure that the link joint arm is in contact with the 5 x 16 mm hex. bolt. If not in contact, tighten the 5 x 16 mm hex. bolt until it contacts the link joint arm.

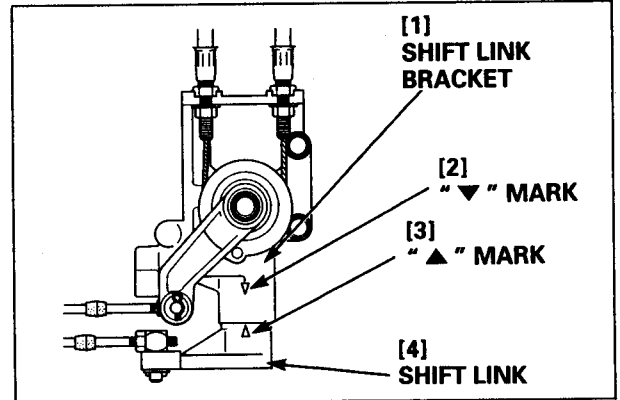


## 10. SHIFT CABLE

### Adjustment:

- 1) Move the remote control lever to the "N" (Neutral) position.
- 2) The "▼" mark on the shift link bracket should align with the "▲" mark on the shift link.

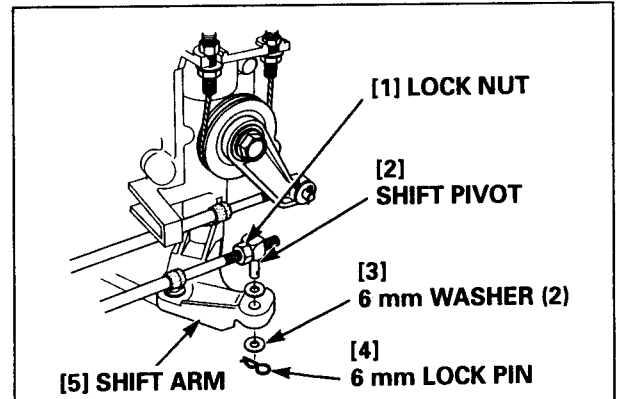
If the marks are not in alignment, adjust as follows.



- 3) To adjust, loosen the shift pivot lock nut, and remove the 6 mm lock pin and 6 mm washers from the shift pivot.

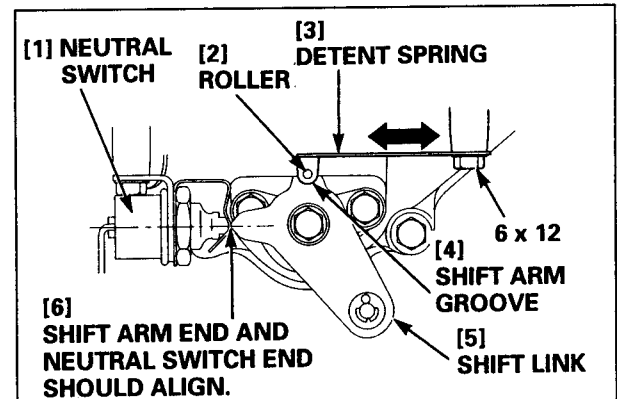
Remove the shift pivot from the shift link, and adjust by turning the shift pivot in or out.

- 4) Set the shift pivot on the shift link. The "▼" mark on the shift link bracket should align with the "▲" mark on the shift link. Tighten the lock nut.



- 5) 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.)
- 6) 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.

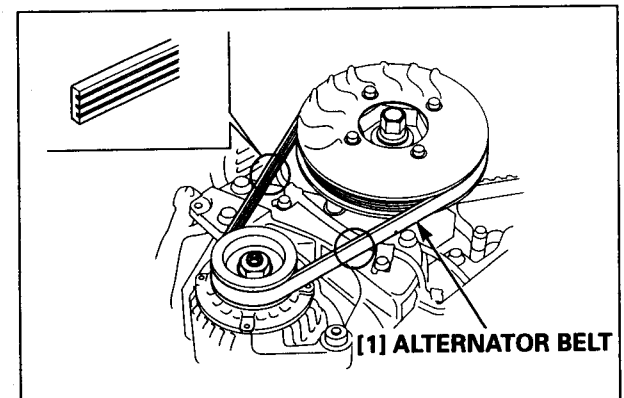
After adjustment, tighten the 6 x 12 mm flange bolt securely.



## 11. ALTERNATOR BELT

### Inspection:

- 1) Remove the engine cover and the timing belt upper cover (P. 3-5 and 6).
- 2) Check the alternator belt for wear and damage. Replace the belt if it is worn or damaged (P. 3-14).
- 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.



### a. Belt tension inspection using belt tension gauge

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

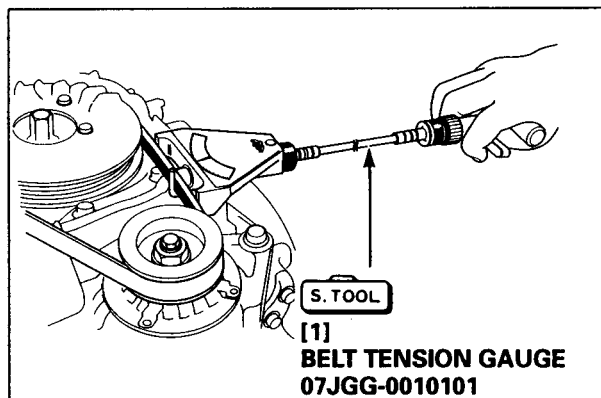
#### TOOL:

**Belt tension gauge**

**07JGG-0010101**

Belt tension	Used belt	392 – 490 N (40 – 50 kgf, 88 – 110 lbf)
	New belt	490 – 588 N (50 – 60 kgf, 110 – 132 lbf)

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

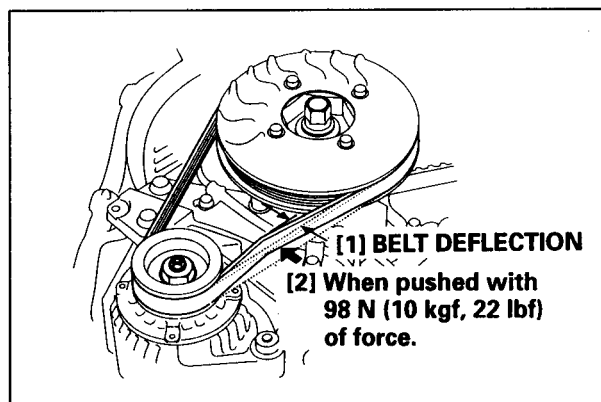


### b. Belt deflection inspection

- 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.

Belt deflection	Used belt	7.7 – 9.0 mm (0.30 – 0.35 in)
	New belt	6.7 – 7.7 mm (0.26 – 0.30 in)

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



#### Belt Tension Adjustment:

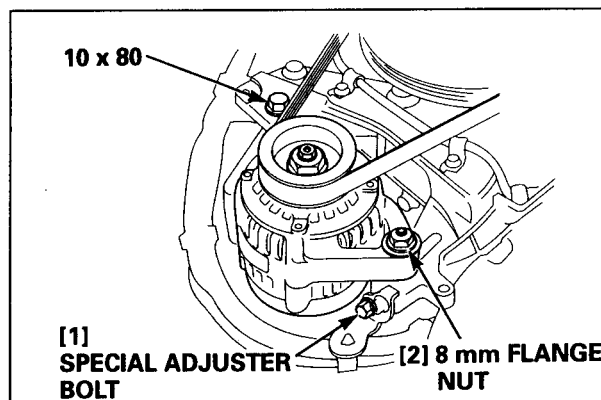
- 1) If the belt tension or the belt deflection is out of the specification, loosen the 10 x 80 mm flange bolt and the 8 mm flange nut and adjust the belt tension or deflection by turning the special adjuster bolt right or left.
- 2) After adjustment, tighten the 8 mm flange nut and the 10 x 80 mm flange bolt in this order to the specified torque.

#### TORQUE:

**44 N·m (4.5 kgf·m, 33 lbf·ft) (10 x 80 mm flange bolt)**

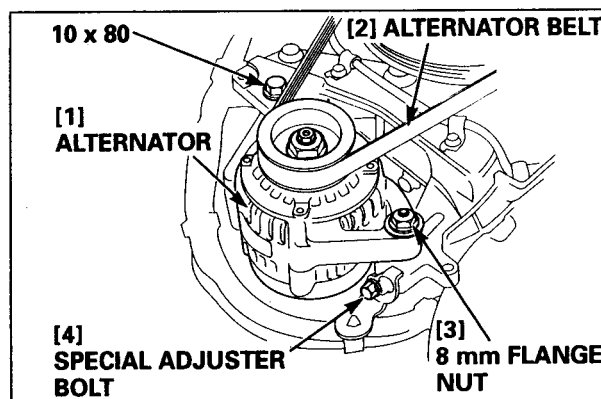
**24 N·m (2.4 kgf·m, 17 lbf·ft) (8 mm flange nut)**

- 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.



#### Replacement:

- 1) Loosen the 10 x 80 mm flange bolt and the 8 mm flange nut.
- 2) Loosen the special adjuster bolt and move the alternator fully to the engine side.
- 3) Remove the alternator belt.
  - Do not contaminate the alternator belt with oil or grease.
  - Do not bend the alternator belt. Store the belt by hanging it on the wall.



### Installation:

Install a new alternator belt in the reverse order of removal, but note the following.

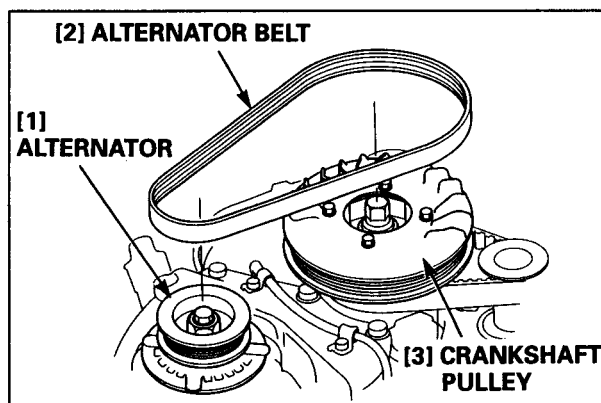
- Tighten the 8 mm flange nut and the 10 x 80 mm flange bolt in this order.

### TORQUE:

44 N·m (4.5 kgf·m, 33 lbf·ft) (10 x 80 mm flange bolt)

24 N·m (2.4 kgf·m, 17 lbf·ft) (8 mm flange nut)

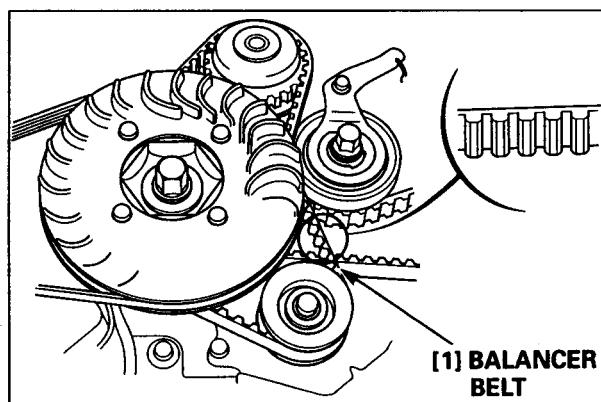
- Check the belt tension or deflection (P.3-14).
- Adjust the belt tension.



## 12. BALANCER BELT

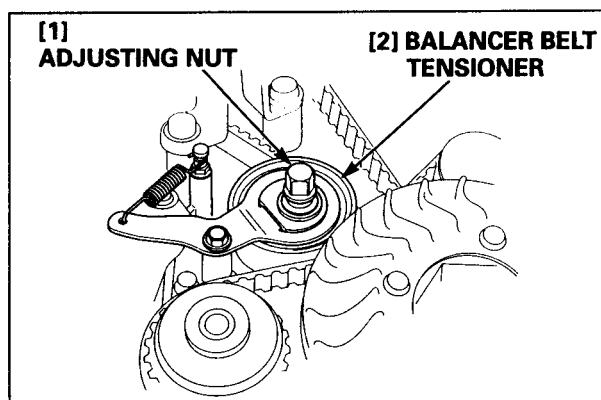
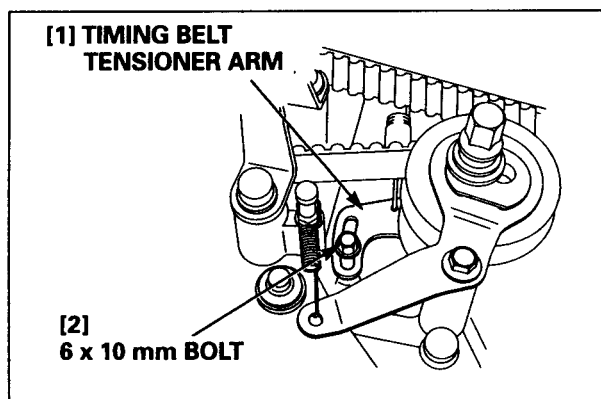
### Inspection:

- 1) Remove the engine cover and the timing belt upper cover (P. 3-5 and 6).
- 2) Check the balancer belt for wear and damage. Replace the balancer belt if it is worn or damaged.
- 3) If the balancer belt and the related parts are contaminated with oil or grease, clean them and replace the balancer belt with a new one.



### Replacement:

- 1) Remove the alternator belt (P. 3-14).
  - 2) Prepare the 6 x 10 mm bolt (pitch: 1.0 mm).
  - 3) Tighten the 6 x 10 mm bolt against the timing belt tensioner arm securely to fix the timing belt tensioner.
- 
- 4) Loosen the adjusting nut 2/3 to 1 turn. With the balancer belt tensioner pushed to the opposite side from the belt, tighten the adjusting nut.
    - Do not turn the adjusting nut more than 1 turn to loosen it.



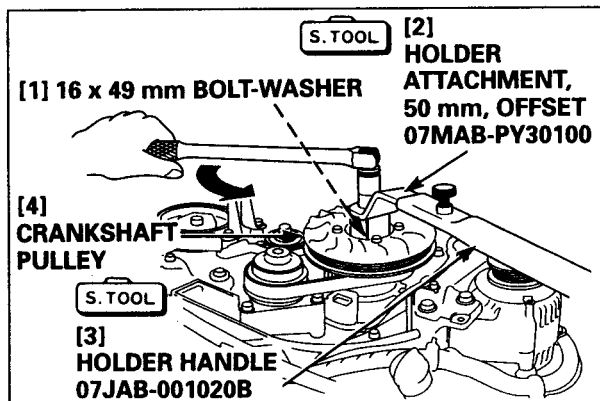
- 5) Remove the 16 x 49 mm bolt-washer from the crankshaft pulley using the special tool.

- Do not use an impact wrench to remove the 16 x 49 mm bolt-washer.

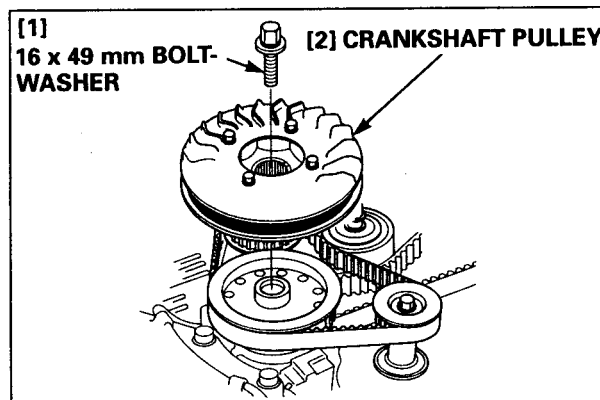
### TOOLS:

Holder attachment, 50 mm, offset  
Holder handle

07MAB-PY30100  
07JAB-001020B

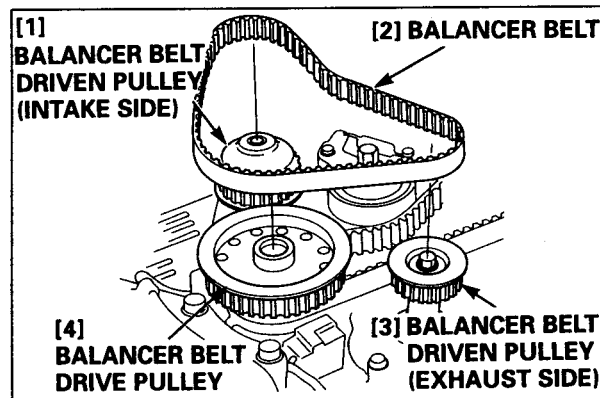


- 6) Remove the crankshaft pulley.



- 7) Remove the balancer belt from each pulley.

- Do not try to remove the balancer belt with force using a screwdriver, etc.
- Do not contaminate the balancer belt with oil or grease.
- Do not bend the balancer belt. Store the belt by hanging it on the wall.

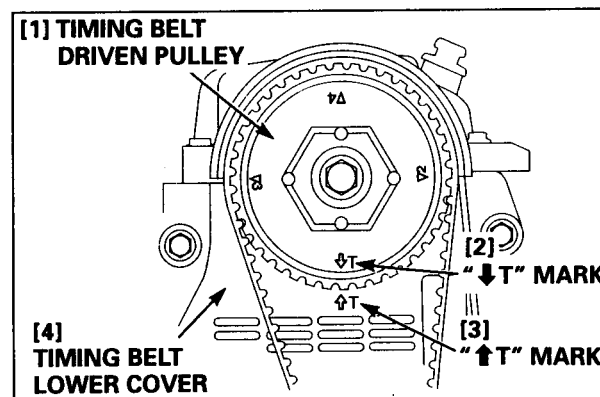


### Installation:

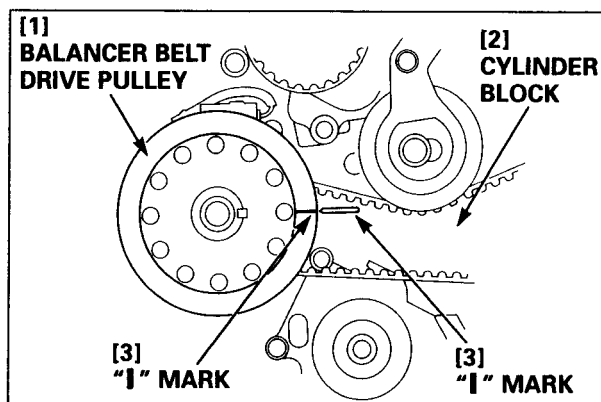
- 1) Remove the spark plug caps and the spark plugs.
- 2) Install the crankshaft pulley and loosely tighten the 16 x 49 mm bolt-washer.
- 3) Align the "↓T" mark on the timing belt driven pulley with the "↑T" mark on the timing belt lower cover as shown by turning the crankshaft pulley clockwise.

### NOTE:

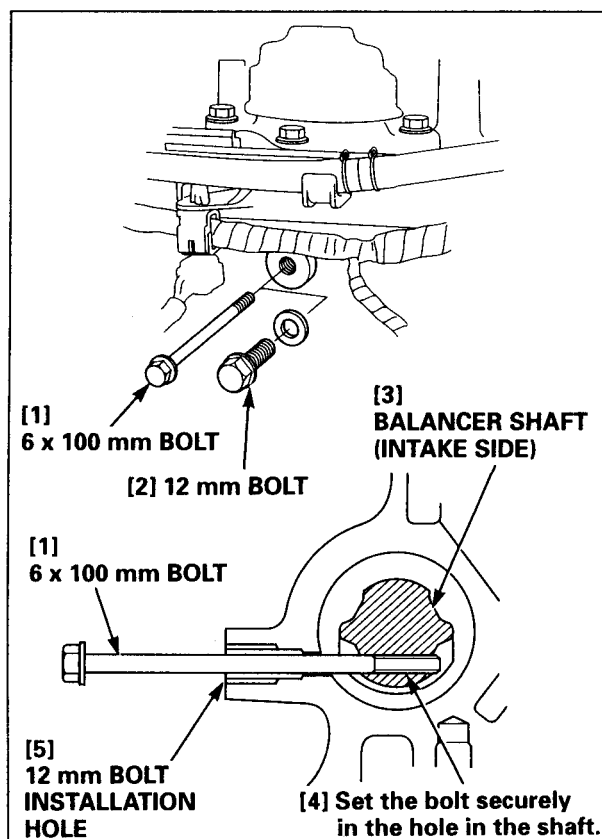
Do not turn the crankshaft pulley counterclockwise.



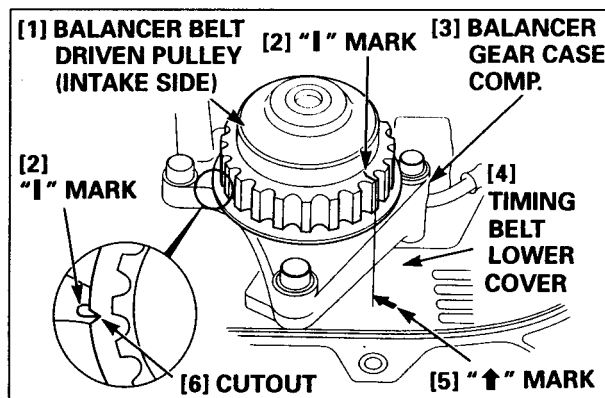
- 4) Remove the 16 x 49 mm bolt-washer and the crankshaft pulley.
- 5) With the marks on the timing belt driven pulley and on the timing belt lower cover aligned, check whether the "I" mark on the balancer belt drive pulley aligns with the "I" mark on the cylinder block.



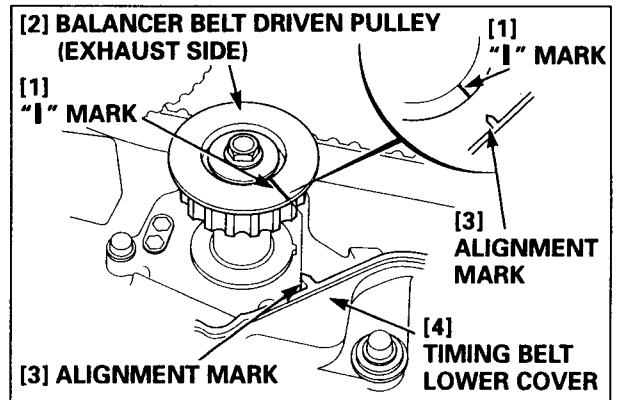
- 6) Remove the intake manifold assembly (P. 5-67).
- 7) Prepare the 6 x 100 mm bolt.
- 8) Remove the 12 mm bolt from the intake side of the cylinder block.  
Fix the balancer shaft (intake side) not to turn using the 6 x 100 mm bolt.



- 9) Holding the balancer shaft (intake side) not to turn, be sure that the "I" mark on the balancer belt driven pulley (intake side) aligns with the "↑" mark on the timing belt lower cover. Be sure that the cutout in the balancer belt driven pulley (intake side) aligns with the "I" mark on the balancer gear case comp.



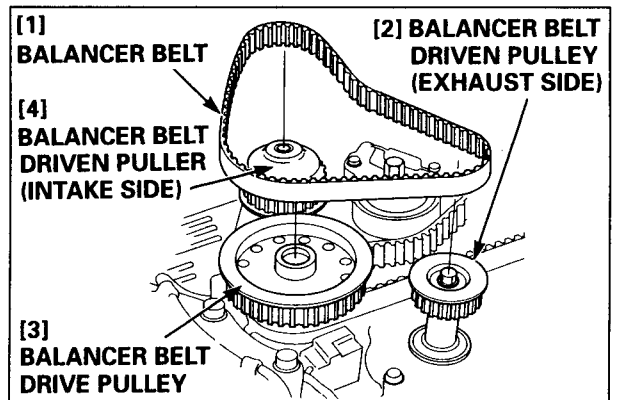
- 10) Align the "I" mark on the balancer belt driven pulley (exhaust side) with the alignment mark on the timing belt lower cover.



- 11) Install a new balancer belt on each pulley with care not to allow the alignment marks to come out of the alignment.

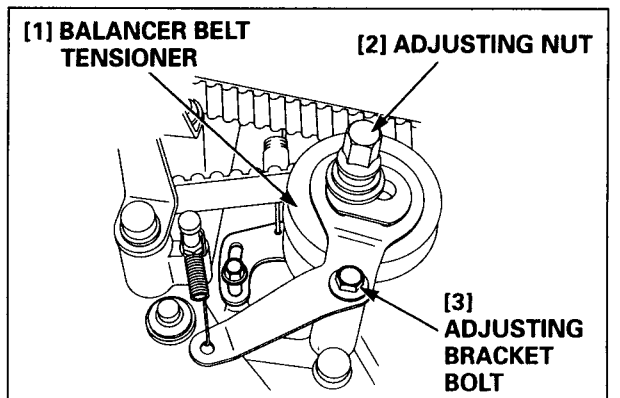
After installation, check each pulley for proper alignment.

Adjust the pulley alignment if necessary.



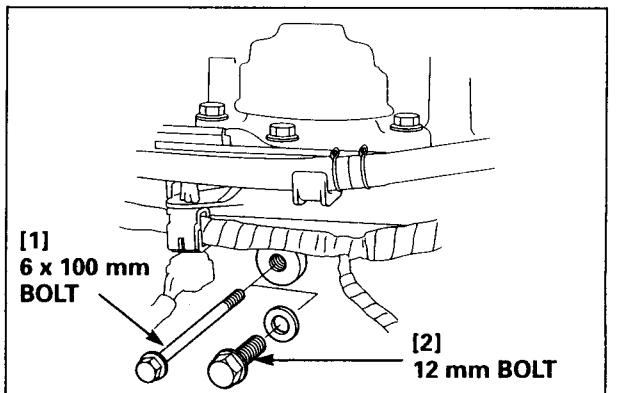
- 12) Loosen the adjusting nut and the adjusting bracket bolt 2/3 to 1 turn (i.e. as loose as the tensioner is moved by the spring force) and adjust the balancer belt tension.

- The balancer belt tensioner is the automatic adjustment type. Do not push the tensioner against the belt with your hand.
- Do not loosen the adjusting nut and the adjusting bracket bolt more than 1 turn.



- 13) Remove the 6 x 100 mm bolt and tighten the 12 mm bolt to the specified torque.

**TORQUE: 29 N•m (3.0 kgf•m, 22 lbf•ft)**





- 14) Remove oil and grease from the balancer belt drive pulley, crankshaft pulley and the 16 x 49 mm bolt-washer, clean them and check the oil application points on these parts (P. 6-4).
- 15) Install the crankshaft pulley and tighten the 16 x 49 mm bolt-washer using the special tools.

### TOOLS:

Holder attachment, 50 mm, offset      07MAB-PY30100  
Holder handle      07JAB-001020B

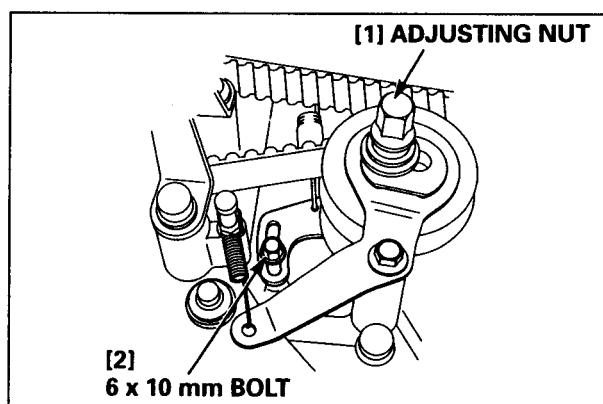
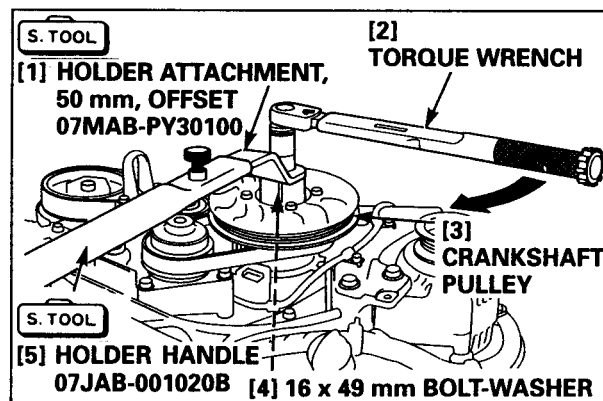
**TORQUE:** 245 N•m (25.0 kgf•m, 181 lbf•ft)

- 16) Check each pulley for proper alignment again. If the pulleys are out of alignment, adjust by repeating the procedure from the step 8 through step 11.  
If the pulleys are in proper alignment, tighten the adjusting nut and the adjusting bracket bolt to the specified torque.

### TORQUE:

44 N•m (4.5 kgf•m, 33 lbf•ft) (Adjusting nut)  
12 N•m (1.2 kgf•m, 9 lbf•ft) (Adjusting bracket bolt)

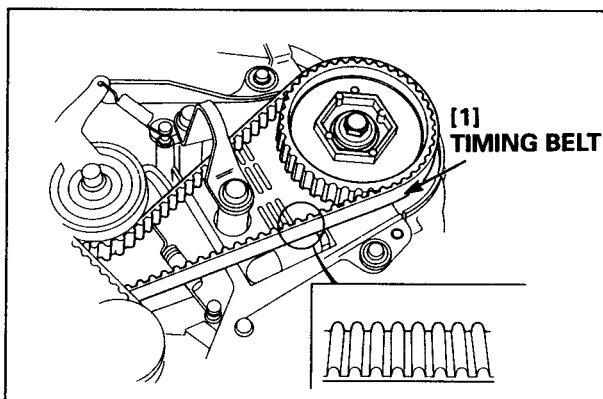
- 17) Remove the 6 x 10 mm bolt.
- 18) Install the alternator belt and adjust the alternator belt tension (P.3-14).
- 19) Install the intake manifold assembly (P. 5-72).



## 13. TIMING BELT

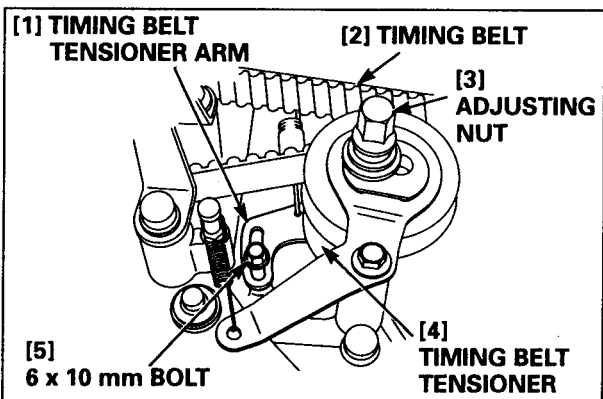
### Inspection:

- 1) Remove the engine cover 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.

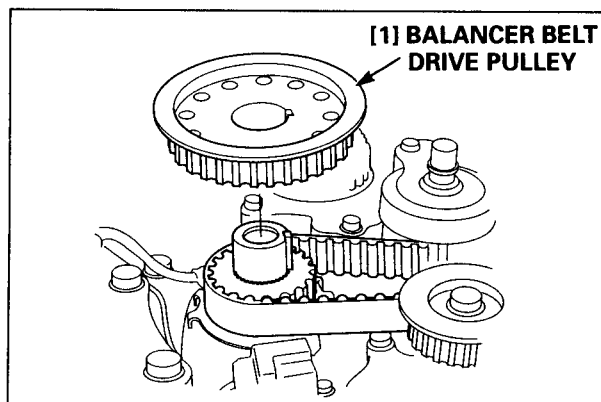


### Replacement:

- 1) Remove the alternator belt (P. 3-14).
- 2) Prepare the 6 x 10 mm bolt (pitch: 1.0 mm).
- 3) Loosen the adjusting nut 2/3 to 1 turn. Pushing the timing belt tensioner to the opposite side from the timing belt, tighten the 6 x 10 mm bolt securely.
- 4) Pushing the balancer belt tensioner to the opposite side from the balancer belt, tighten the adjusting nut.
- 5) Remove the balancer belt following the step 5 through step 7 of the Balancer Belt Replacement procedure (P. 3-16).
- 6) Remove the engine hanger (P. 6-10).

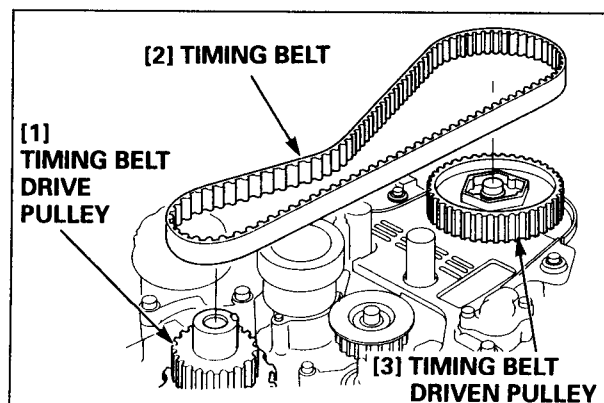


7) Remove the balancer belt drive pulley.



8) Remove the timing belt from the timing belt driven pulley, then remove the belt from the timing belt drive pulley.

- Do not remove the timing belt with force using a screw driver, etc.
- Do not contaminate the belt with oil and grease.
- Do not bend the timing belt. Store the belt by hanging it on the wall.



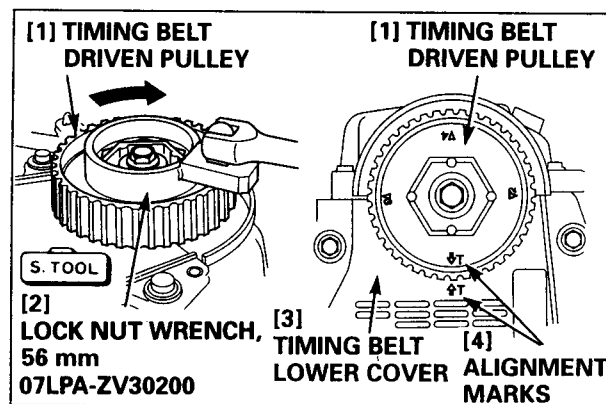
### Installation:

- 1) Remove the spark plug caps and the spark plugs.
- 2) Set the special tool on the timing belt driven pulley as shown. Align the "↓T" mark on the driven pulley with the "↑T" mark on the timing belt lower cover by turning the driven pulley.

### TOOL:

Lock nut wrench, 56 mm

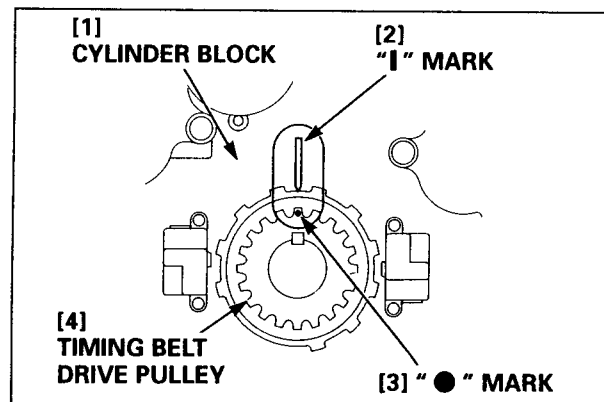
07LPA-ZV30200



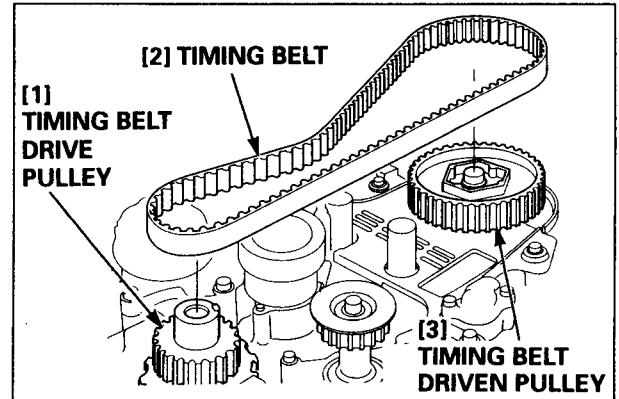
3) Align the "●" mark on the timing belt drive pulley with the "I" mark on the cylinder block.

- Be sure that the timing belt drive pulley and the timing belt guide plate are installed properly when the alignment marks are aligned. If there is a gap between the pulley and the plate, the pulley and the plate are not in proper alignment.

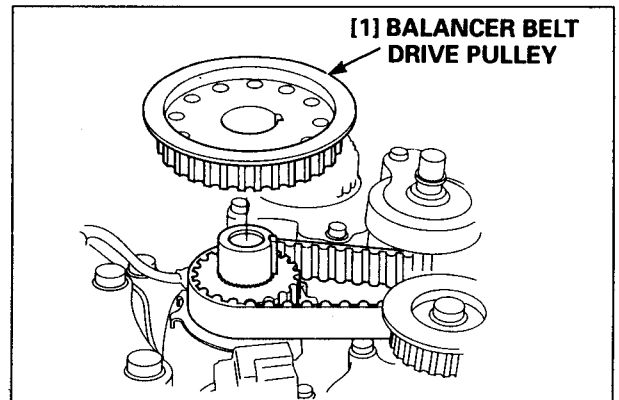
Align properly (P. 6-11).



- 4) Install a new timing belt on the timing belt drive pulley and on the timing belt driven pulley in this order. Take care not to allow the alignment marks to come out of alignment.
- 5) After installation, be sure that the alignment marks are in proper alignment.

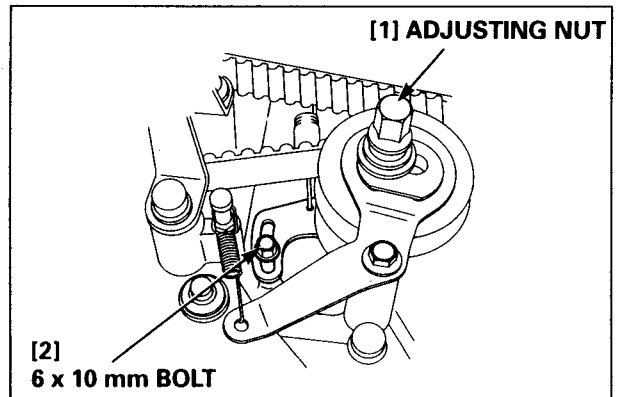


- 6) Remove oil and grease from the timing belt drive pulley and the balancer belt drive pulley, clean them and check the oil application points on these parts (P. 6-4).
- 7) Install the balancer belt drive pulley and install the engine hanger (P. 6-10).

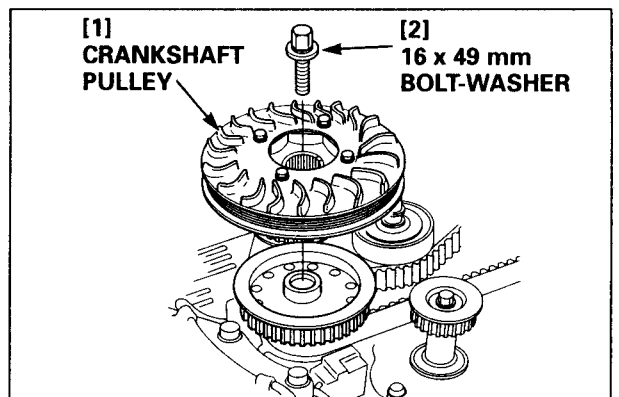


- 8) Remove the 6 x 10 mm bolt and loosen the adjusting nut 2/3 to 1 turn (i.e. as loose as each tensioner is moved by the spring force). Retighten the adjusting nut.

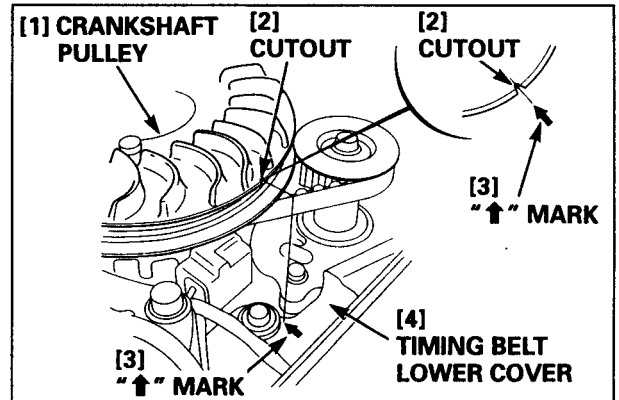
- Each tensioner is the automatic adjustment type. Do not push the tensioners against the belt with hand.



- 9) Install the crankshaft pulley and loosely tighten the 16 x 49 mm bolt-washer.
- 10) Turn the crankshaft pulley 5 to 6 turns clockwise.
- 11) Adjust the timing belt tension (P. 3-22).



- 12) Check whether the cutout in the crankshaft pulley aligns with the "↑T" mark on the timing belt lower cover. If they are not in proper alignment, reinstall the timing belt.
- 13) Remove the 16 x 49 mm bolt-washer and the crankshaft pulley. Install the balancer belt (P. 3-16).
- 14) After installing the balancer belt, tighten the 6 x 10 mm bolt against the timing belt tensioner and loosen the adjusting nut 2/3 to 1 turn. Adjust the balancer belt tension.

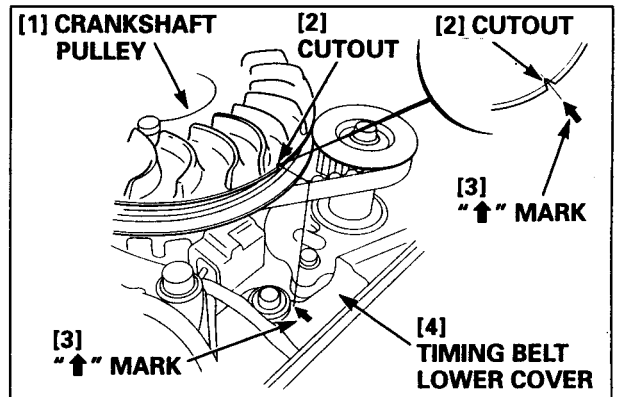
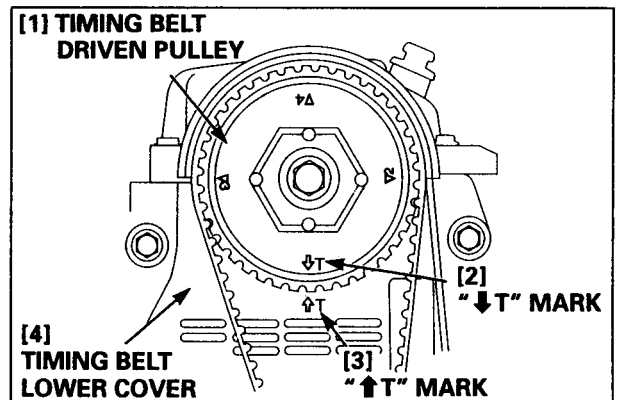


### Timing Belt/Balancer Belt Tension Adjustment:

Be sure that the valve clearance is correct before adjusting the belt tension (P. 3-5).

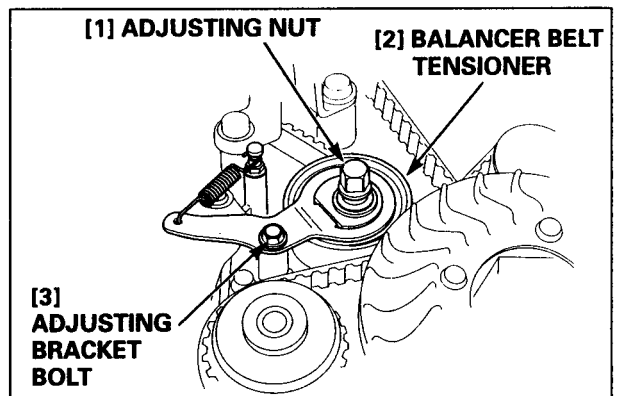
The balancer belt tension and the timing belt tension should be adjusted simultaneously.

- 1) Turning the crankshaft pulley clockwise, align the "↓T" mark on the timing belt driven pulley with the "↑T" mark on the timing belt lower cover. Check also that the cutout in the crankshaft pulley aligns with the "↑T" mark on the timing belt lower cover.



- 2) Loosen the adjusting nut and the adjusting bracket bolt 2/3 to 1 turn and be sure that the balancer belt tensioner moves freely to the opposite side from the belt (i.e. belt loosening direction).

- Do not loosen the adjusting nut and the adjusting bracket bolt more than one turn.



- 3) Be sure that each alignment mark is in proper alignment, turn the crankshaft pulley 2 turns clockwise, then slowly turn it clockwise further by 3 notches of the timing belt driven pulley gear. Then, return the crankshaft pulley counterclockwise by 1 notch of the timing belt driven pulley gear.

- If the crankshaft pulley was turned more than 3 notches 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.

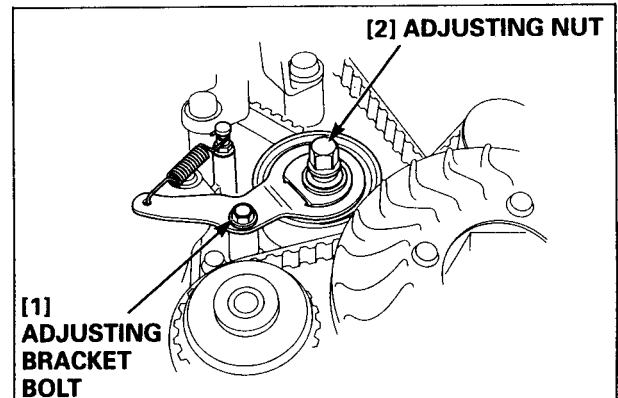
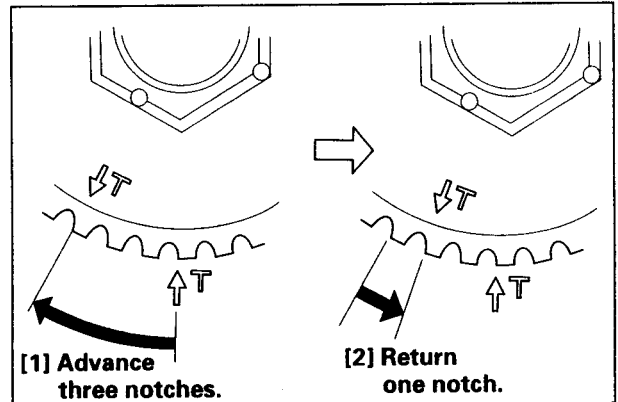
- 4) Tighten the adjusting nut and the adjusting bracket bolt to the specified torque.

### TORQUE:

44 N•m (4.5 kgf•m, 33 lbf•ft) (Adjusting nut)

12 N•m (1.2 kgf•m, 9 lbf•ft) (Adjusting bracket bolt)

- Note that each belt tensioner is the automatic adjustment type. Do not push the tensioners toward the belt with hand.



## 14. VAPOR SEPARATOR

### ⚠ WARNING

Gasoline is highly flammable and explosive.

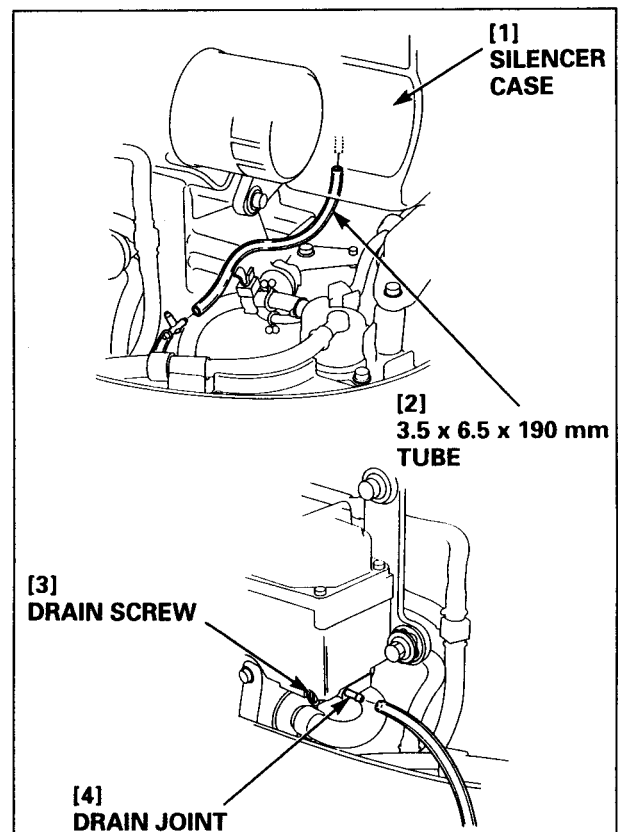
You can be burned or seriously injured when handling fuel.

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

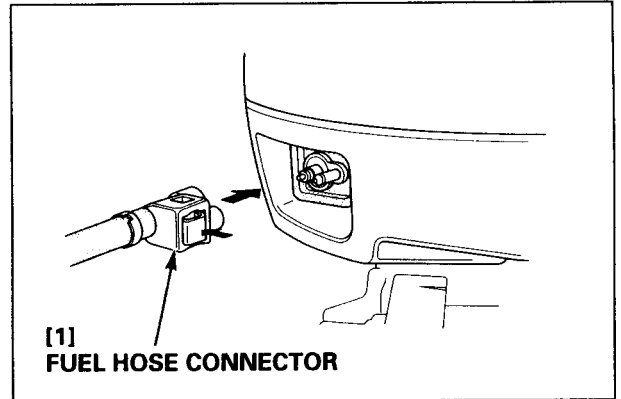
### Cleaning:

- 1) Disconnect the 3.5 x 6.5 x 190 mm tube from the underside of the silencer case and connect it to the vapor separator drain joint.
- 2) Tilt up the outboard motor.
- 3) Loosen the drain screw to drain the vapor separator, and check for water and dirt in the vapor separator. If the water or dirt was detected, clean the vapor separator.

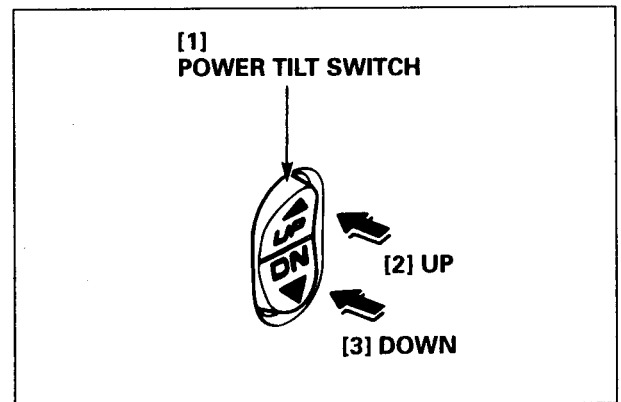
Tilt down the outboard motor and tighten the drain screw securely.



- 4) Connect the fuel hose connector to the outboard motor and feed the gasoline using the primer bulb.
  - 5) Turn the ignition switch to the ON position and operate the fuel pump assembly.  
Turn the ignition switch to the OFF position.
- Do not start the starter motor.



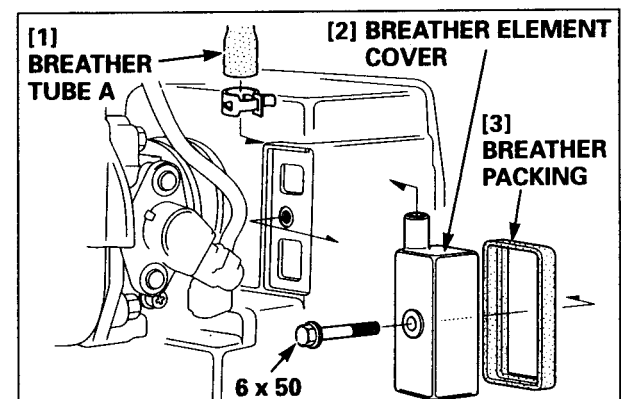
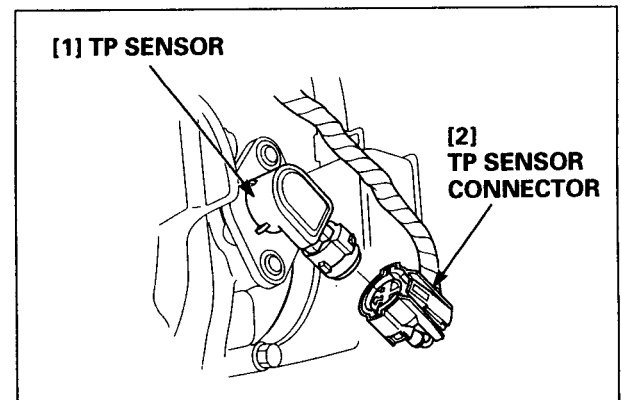
- 6) Tilt up the outboard motor and drain the gasoline by loosening the drain screw.
- 7) Repeat the above steps 5 and 6 three times.
- 8) Tilt down the outboard motor. Start the engine and run it for about one minute. Stop the engine.
- 9) Tilt up the outboard motor and drain the gasoline by loosening the drain screw. Check for water and dirt in the gasoline.
- 10) Tighten the drain screw securely and tilt down the outboard motor.
- 11) Connect the 3.5 x 6.5 x 190 mm tube to the silencer case.



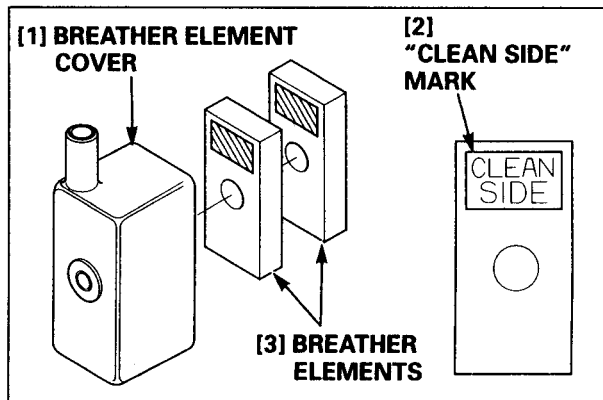
## 15. BREATHER ELEMENT

### Inspection:

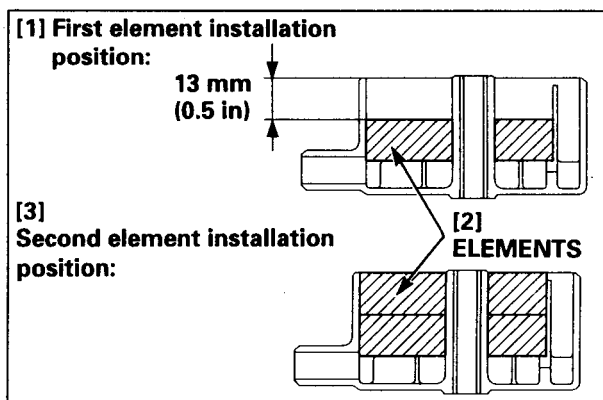
- 1) Remove the engine cover.
- 2) Disconnect the TP sensor connector.
- 3) Disconnect the breather tube A from the breather element cover.
- 4) Remove the 6 x 50 mm flange bolt and remove the breather element cover and the breather packing.



- 5) Remove the two breather elements from the breather element cover and check the elements.
- 6) If the oil drips from the elements or the elements are contaminated or clogged with dirt, replace the elements.
- 7) Install the elements with the side marked with "CLEAN SIDE" toward the breather tube.



- 8) Insert the first element to the position 13 mm (0.5 in) from the breather packing installation surface. Install the second element so that it mates with the breather packing installation surface.
- 9) Install the breather element cover on the silencer case and connect the breather tube A to the breather element cover.
- 10) Connect the TP sensor connector.



# 4. ENGINE COVER/TIMING BELT UPPER COVER

**HONDA**  
BF115A•130A

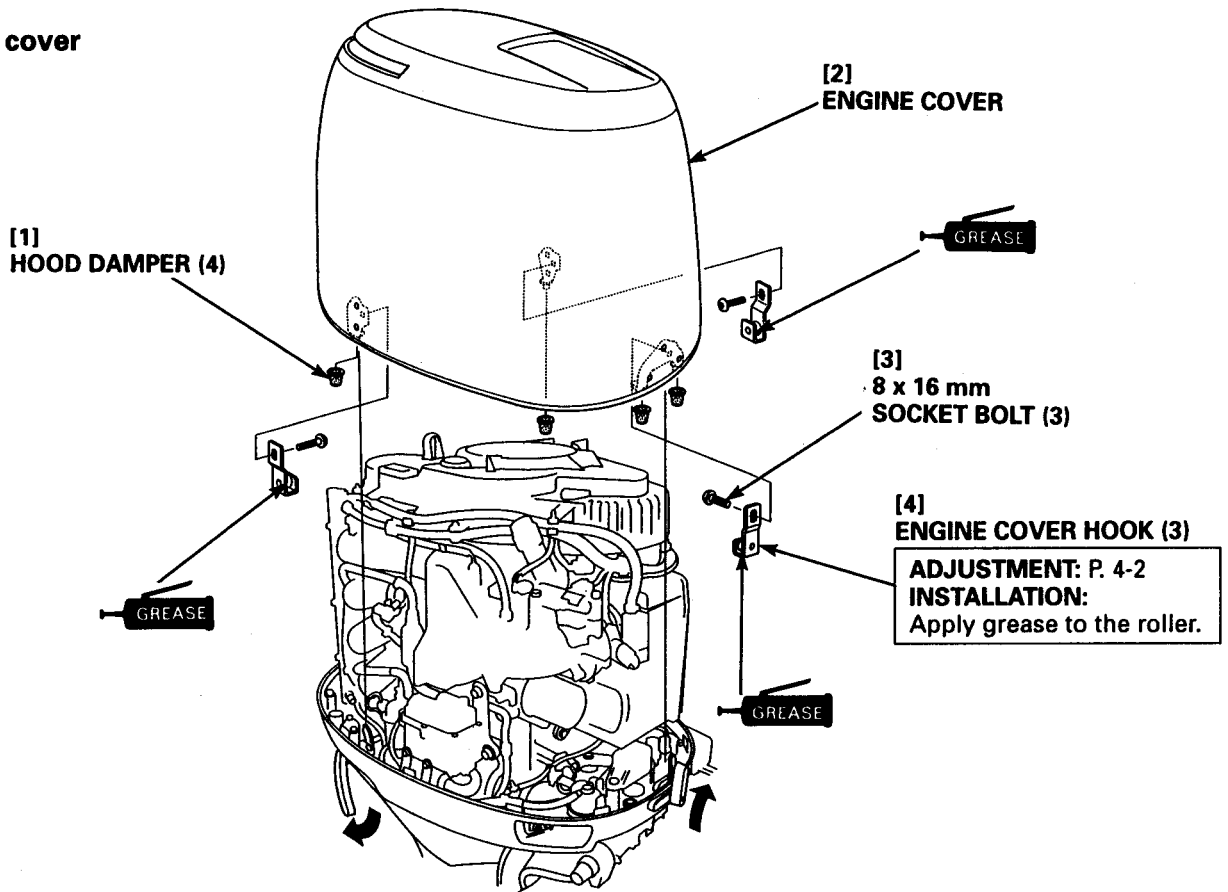
## 1. ENGINE COVER/REAR SEPARATE CASE

## 2. TIMING BELT UPPER COVER

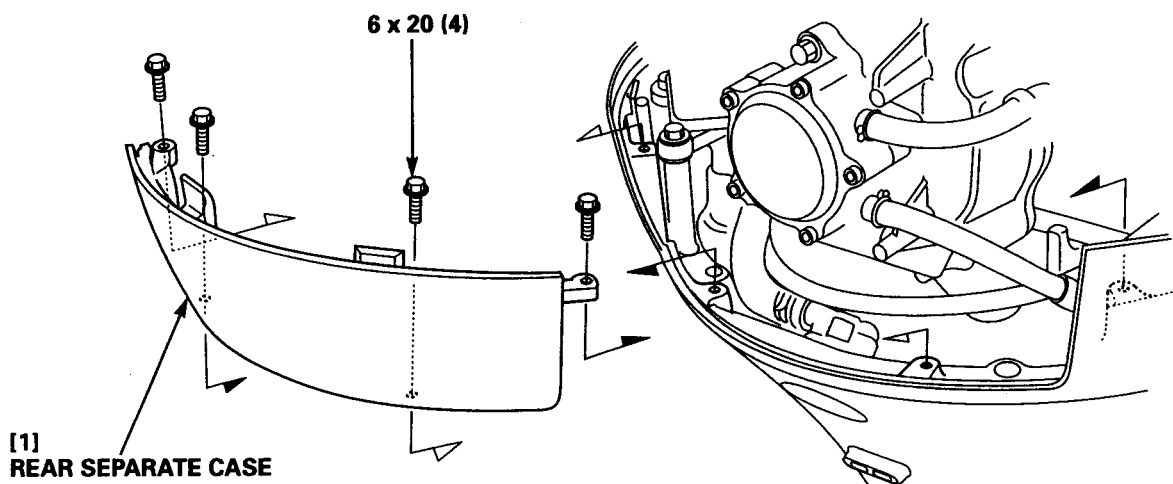
### 1. ENGINE COVER/REAR SEPARATE CASE

#### a. REMOVAL/INSTALLATION

##### • Engine cover



##### • Rear separate case





### b. ADJUSTMENT

#### • ENGINE COVER HOOK

- 1) Tighten the 8 x 16 mm socket bolt at the center of the long hole in the engine cover hook.
- 2) Install the engine cover on the outboard motor and secure the front/rear cover lock levers.
- 3) Be sure that the gap between the engine cover and the engine undercase is 4.8 – 5.8 mm (0.19 – 0.23 in) as shown.

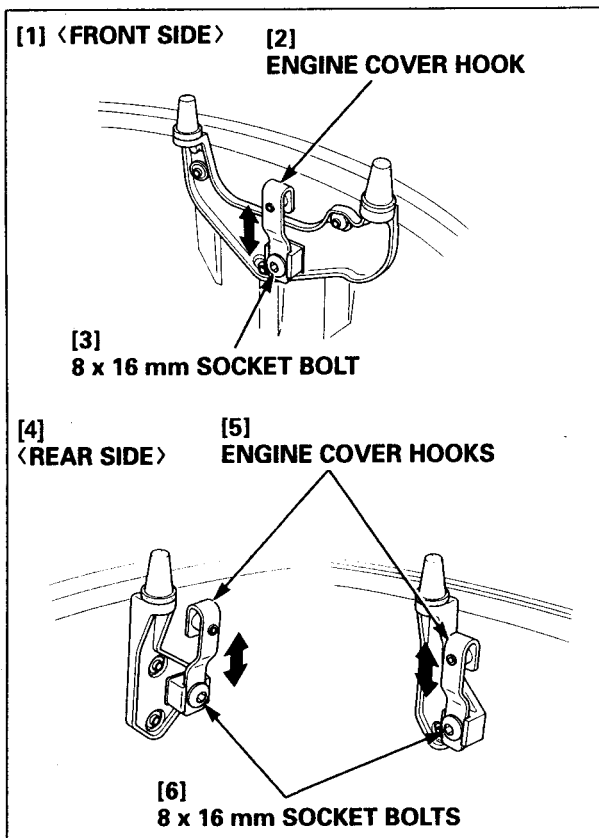
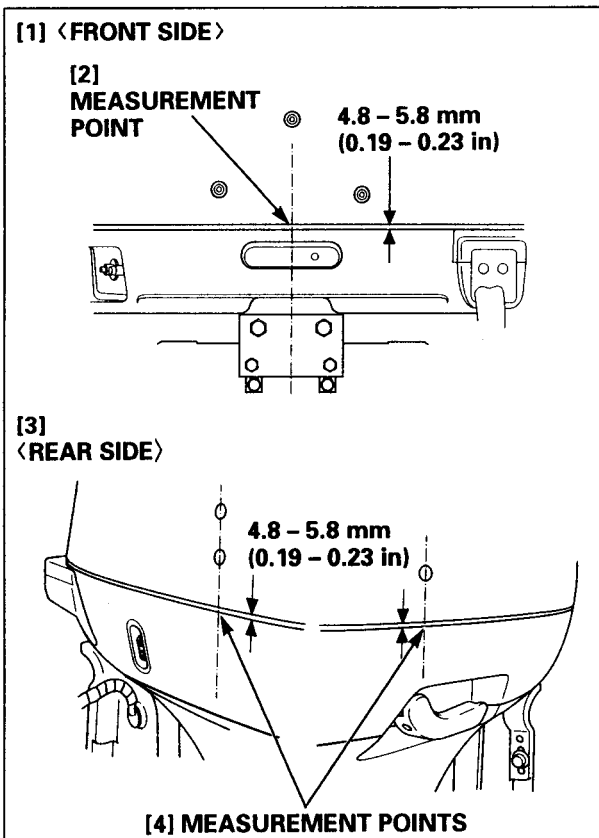
- Measure the gap at the front side and the rear side respectively.

- 4) If the measurement is outside the specification, adjust as follows.

- 5) Remove the engine cover. Loosen the 8 x 16 mm socket bolts and adjust the gap to 4.8 – 5.8 mm (0.19 – 0.23 in) by moving the engine cover hook up or down.

- Adjustment must be made at the front side and the rear side respectively.

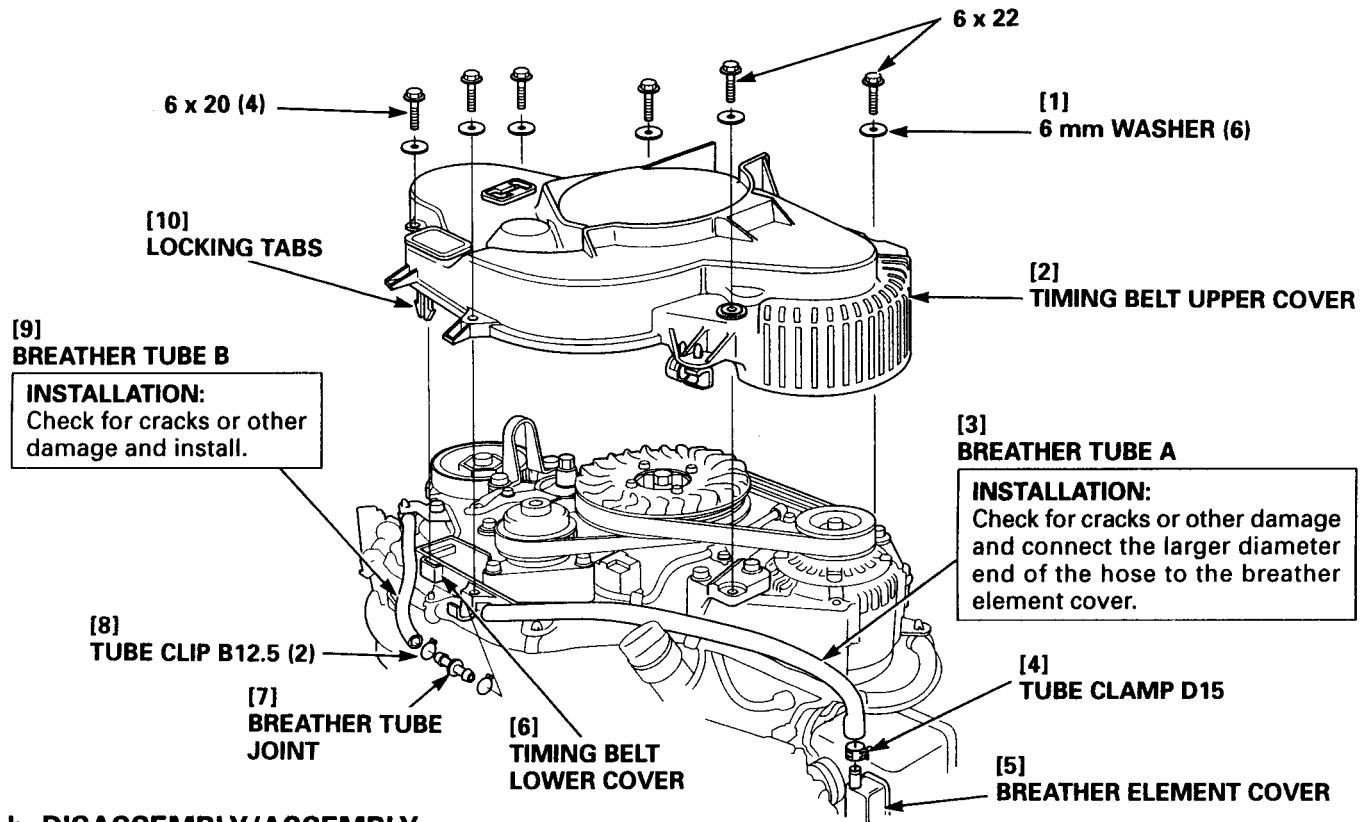
- 6) After adjustment, tighten the 8 x 16 mm socket bolts securely.



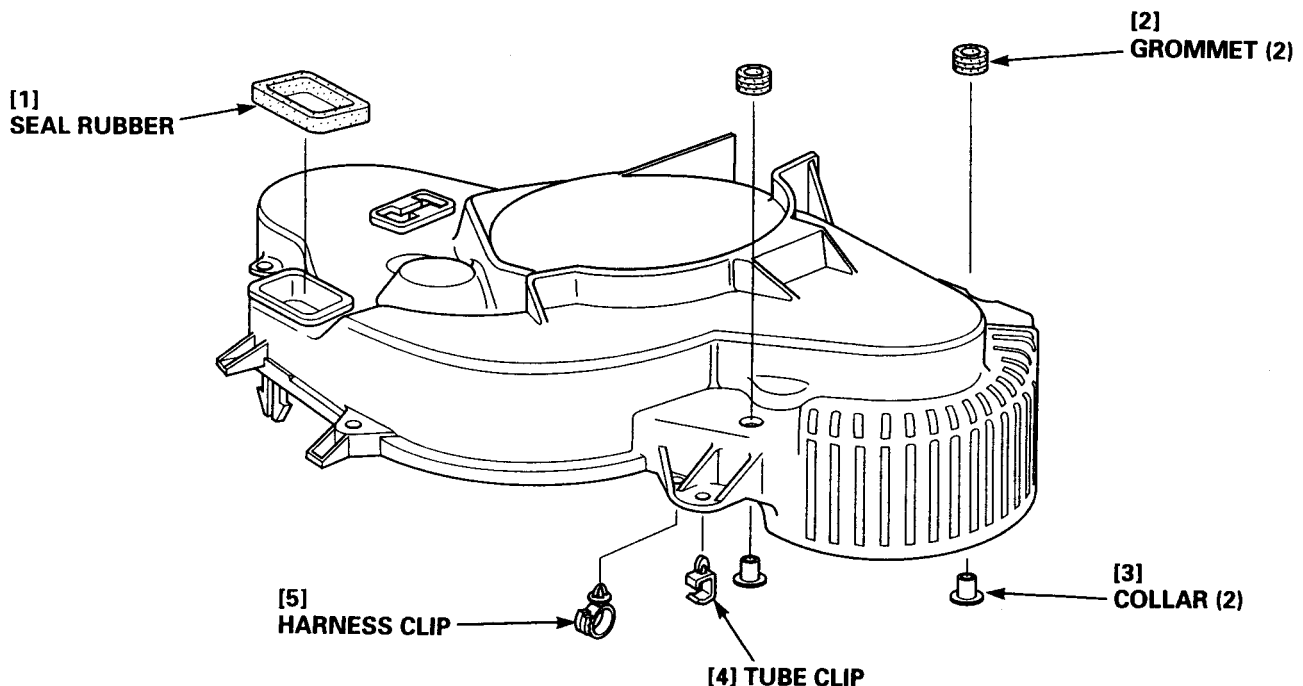
## 2. TIMING BELT UPPER COVER

### a. REMOVAL/INSTALLATION

Remove the engine cover. Disengage the locking tabs of the timing belt upper cover from the timing belt lower cover and remove the timing belt upper cover.



### b. DISASSEMBLY/ASSEMBLY



# 5. PROGRAMMED FUEL INJECTION (PGM-FI)

**HONDA**  
**BF115A•130A**

1. SERVICE PRECAUTIONS
2. VACUUM CONNECTIONS
3. CIRCUIT DIAGRAM
4. TROUBLESHOOTING  
PROGRAMMED FUEL INJECTION SYSTEM  
(PGM-FI SYSTEM)
  - ECM TERMINAL ARRANGEMENT
  - TROUBLESHOOTING GUIDE
  - TROUBLESHOOTING CHART
    - a. ECM
    - b. MAP SENSOR
    - c. TP SENSOR
    - d. PULSER COIL SENSOR 1, 2
    - e. ECT SENSOR
    - f. IAT SENSOR
- IDLE CONTROL SYSTEM
  - TROUBLESHOOTING GUIDE
  - IDLING
  - TROUBLESHOOTING CHART
    - a. IAC VALVE
- ALERT SYSTEM
  - OIL PRESSURE TEST
  - TROUBLESHOOTING CHART
    - a. CONTINUOUS SOUND
    - b. INTERMITTENT SOUND
    - c. OVERHEAT SENSOR

- FUEL SUPPLY SYSTEM**
- TROUBLESHOOTING GUIDE
  - HOW TO RELIEVE FUEL PRESSURE
  - FUEL PRESSURE MEASUREMENT
  - FUEL LINES
  - FUEL INJECTORS
  - PRESSURE REGULATOR
  - FUEL FILTER (HIGH PRESSURE SIDE)
  - FUEL PUMP UNIT
  - MAIN RELAY
  - TROUBLESHOOTING CHART
    - a. HIGH PRESSURE FUEL
    - b. FUEL INJECTOR POWER LINE
    - c. PGM-FI MAIN HARNESS/WIRE HARNESS (POWER SUPPLY LINE)
5. SILENCER CASE
  6. THROTTLE BODY ASSEMBLY
  7. FUEL PUMP (LOW PRESSURE SIDE)
  8. FUEL INJECTORS
  9. VAPOR SEPARATOR/FUEL PUMP UNIT
  10. INTAKE MANIFOLD ASSEMBLY  
REMOVAL/INSTALLATION
  11. INTAKE MANIFOLD/IAC VALVE
  12. FUEL FILTER (LOW PRESSURE SIDE)/FUEL TUBE
  13. PCV VALVE
  14. FUEL TANK (OPTIONAL PART)

## 1. SERVICE PRECAUTIONS

### 1) PGM-FI troubleshooting

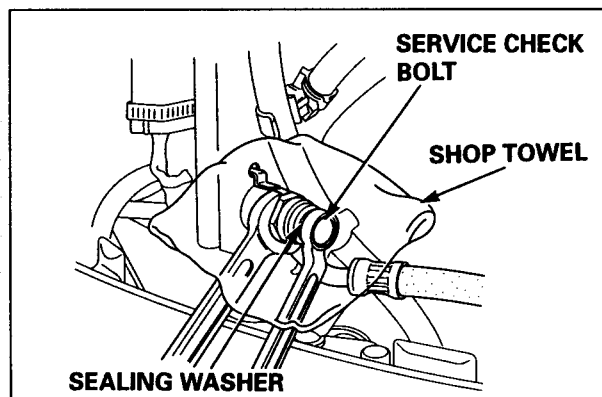
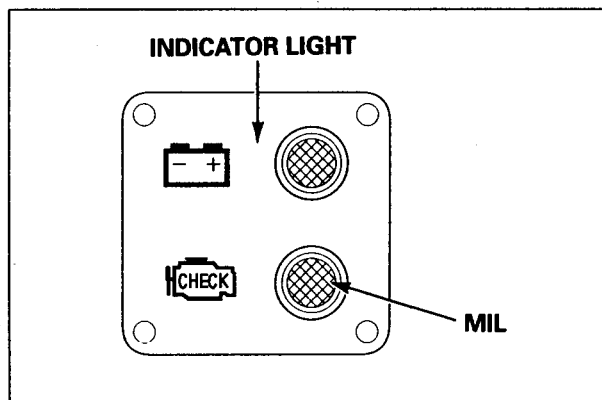
- First, check the MIL of the indicator.
- Be sure to turn the ignition switch OFF before disconnecting and connecting the ECM connector.
- After inspection and repair, reset the ECM memory (P. 5-6).

### 2) Fuel line removal/installation

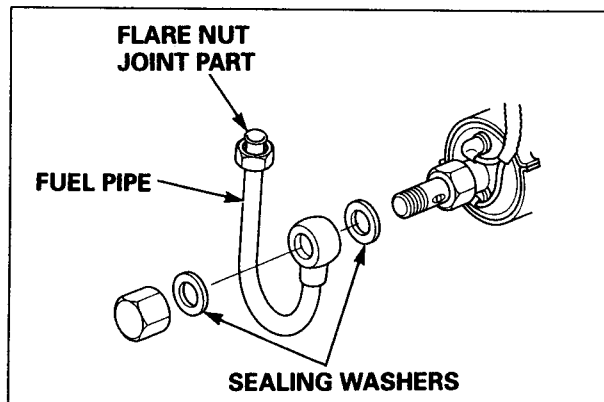
- Do not smoke while working on the fuel system. Keep open flame or sparks away from the work area.
- Disconnect the battery cable from the battery negative (-) terminal.
- Before removing and installing the fuel line, relieve the fuel pressure by loosening the service check bolt, as described in of "How to relieve fuel pressure (P. 5-43)".

**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.



- Clean the flare nut joint part of the fuel pipe before installing the fuel pipe.
- Install the injector noting the connector angle.



### 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:

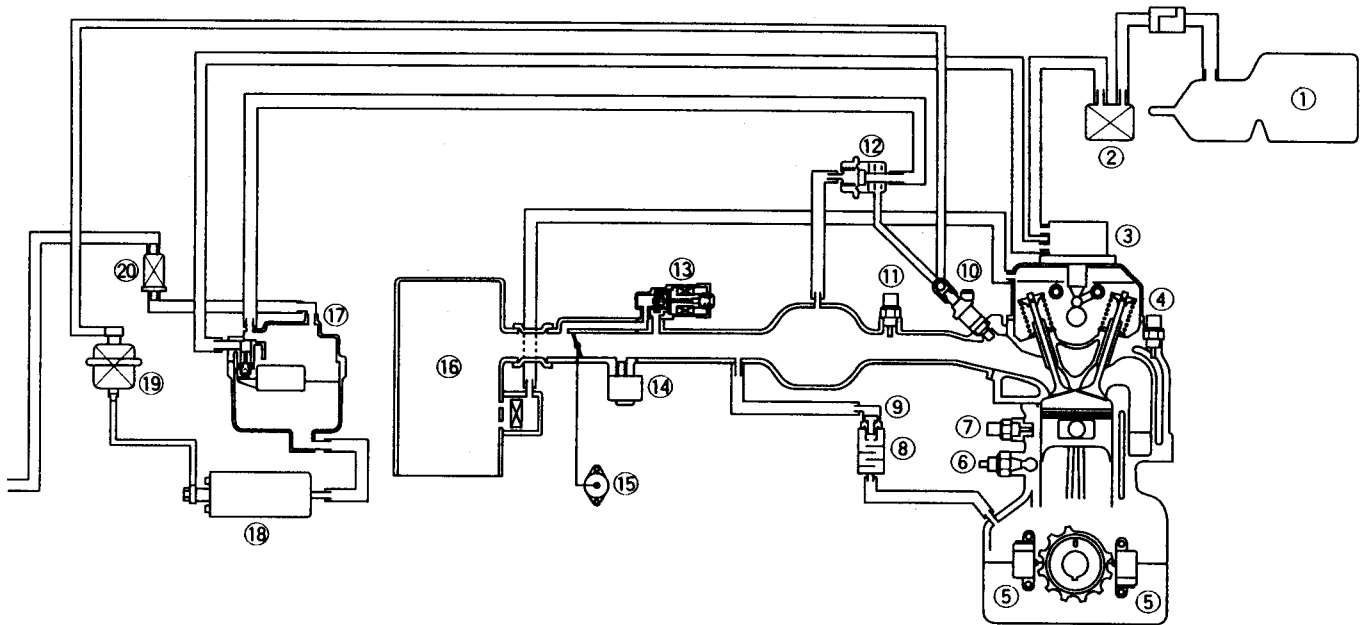
- Turn the ignition switch ON (but do not turn the starter) after connecting the fuel lines. The fuel pump unit should operate for approximately 2 seconds and the fuel pressure in the high pressure side fuel line should rise. Repeat this operation 2 or 3 times and check for fuel leakage.

### 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.

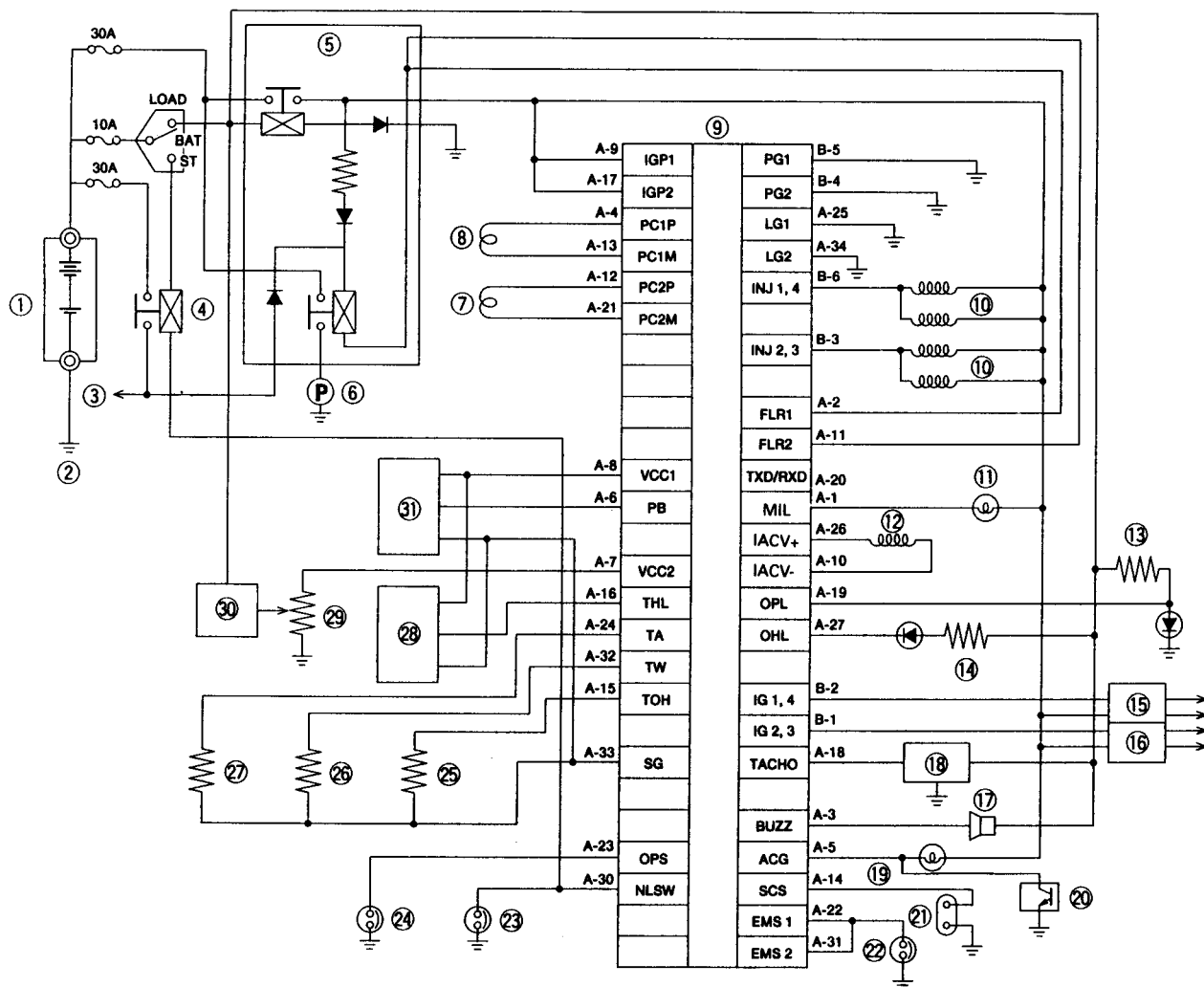
- Install the antenna and the body of the radio equipment at least 50 cm (20.0 in) away from the ECM, remote control cable A/B and the remote control box.
- Antenna wire must not be too long compared with the remote control cable A and other cables/wires.
- Do not mount radio equipment of large output 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 FUEL TANK                       | ⑪ IAT SENSOR                       |
| ② FUEL FILTER (LOW PRESSURE SIDE) | ⑫ PRESSURE REGULATOR               |
| ③ FUEL PUMP (LOW PRESSURE SIDE)   | ⑬ IAC VALVE                        |
| ④ OVERHEAT SENSOR                 | ⑭ MAP SENSOR                       |
| ⑤ PULSER COIL                     | ⑮ TP SENSOR                        |
| ⑥ OIL PRESSURE SWITCH             | ⑯ SILENCER CASE                    |
| ⑦ ECT SENSOR                      | ⑰ VAPOR SEPARATOR                  |
| ⑧ PCV CHAMBER                     | ⑱ FUEL PUMP UNIT                   |
| ⑨ PCV VALVE                       | ⑲ FUEL FILTER (HIGH PRESSURE SIDE) |
| ⑩ FUEL INJECTOR                   | ⑳ FUEL PUMP FILTER                 |

### 3. CIRCUIT DIAGRAM



- ① BATTERY
- ② GROUND
- ③ To STARTER MOTOR
- ④ STARTER MAGNETIC SWITCH
- ⑤ MAIN RELAY
- ⑥ FUEL PUMP UNIT
- ⑦ PULSER COIL SENSOR 2
- ⑧ PULSER COIL SENSOR 1
- ⑨ ECM
- ⑩ FUEL INJECTOR
- ⑪ MIL
- ⑫ IAC VALVE
- ⑬ OIL PRESSURE LIGHT
- ⑭ OVERHEAT LIGHT
- ⑮ IGNITION COIL 1
- ⑯ IGNITION COIL 2

- ⑰ WARNING BUZZER
- ⑱ TACHOMETER
- ⑲ ALTERNATOR INDICATOR LIGHT
- ⑳ ALTERNATOR IC REGULATOR
- ㉑ SERVICE CHECK CONNECTOR
- ㉒ EMERGENCY STOP SWITCH
- ㉓ NEUTRAL SWITCH
- ㉔ OIL PRESSURE SWITCH
- ㉕ OVERHEAT SENSOR
- ㉖ ECT SENSOR
- ㉗ IAT SENSOR
- ㉘ TP SENSOR
- ㉙ TRIM ANGLE SENSOR
- ㉚ TRIM METER
- ㉛ MAP SENSOR

## 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 the 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 is faulty, the overheat light as well as the MIL should blink simultaneously.

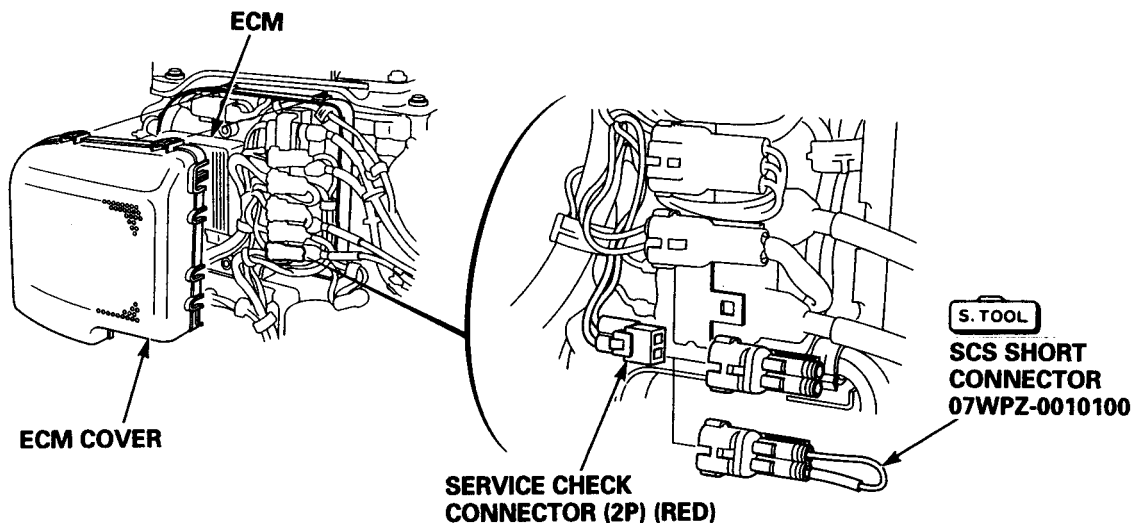
If the ECM body is faulty, the MIL turns ON and it stays ON when the service check connector is short-circuited. If the MIL blinks by short-circuiting the service check connector, detect the probable problem part by referring to the Troubleshooting Guide on page 5-10, and troubleshoot following the troubleshooting flow chart.

Observe the following instruction when using the troubleshooting flow chart.

### I. Lighting and blinking procedure of MIL

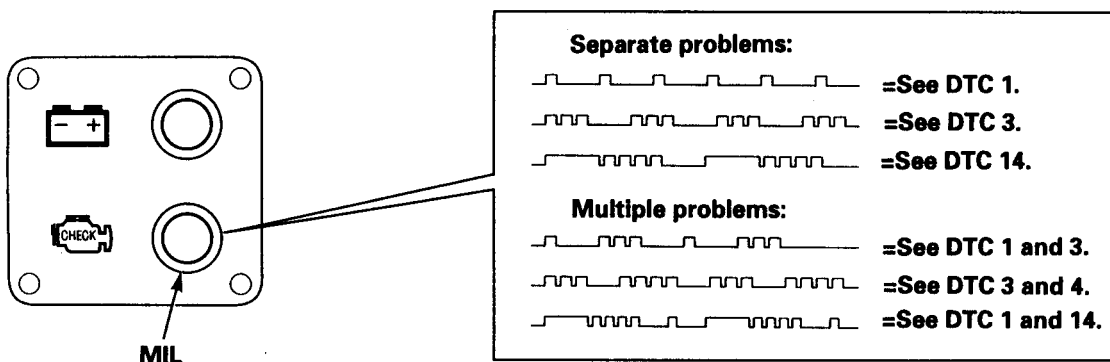
#### 1) Allow the MIL to blink.

When the MIL is ON, short-circuit the red 2P service check connector located inside the ECM case 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.



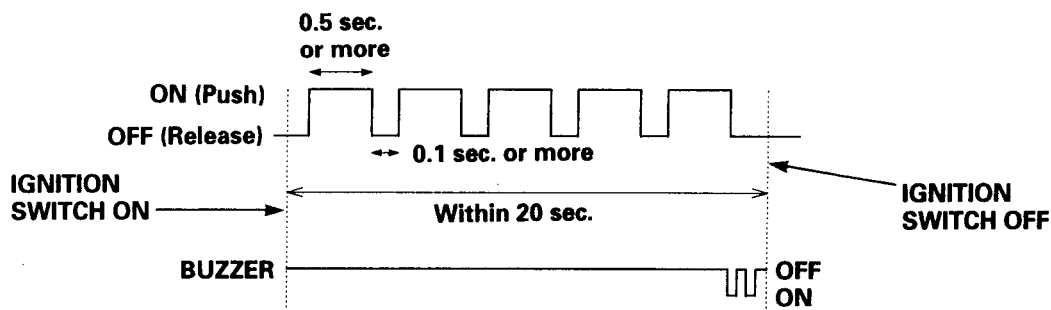
### II. ECM reset procedure

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

- 1) Turn the ignition switch OFF.
- 2) Short-circuit the 2P service check connector (red) located inside the ECM case using the special tool (SCS short connector) (P. 5-5).
- 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 short connector from the service check connector.
  - Note that the MIL stays ON while the SCS short 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 two 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 throttle cable (P. 3-10), idle adjustment (P. 5-31) and the fuel supply system (P. 5-42).

#### <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.

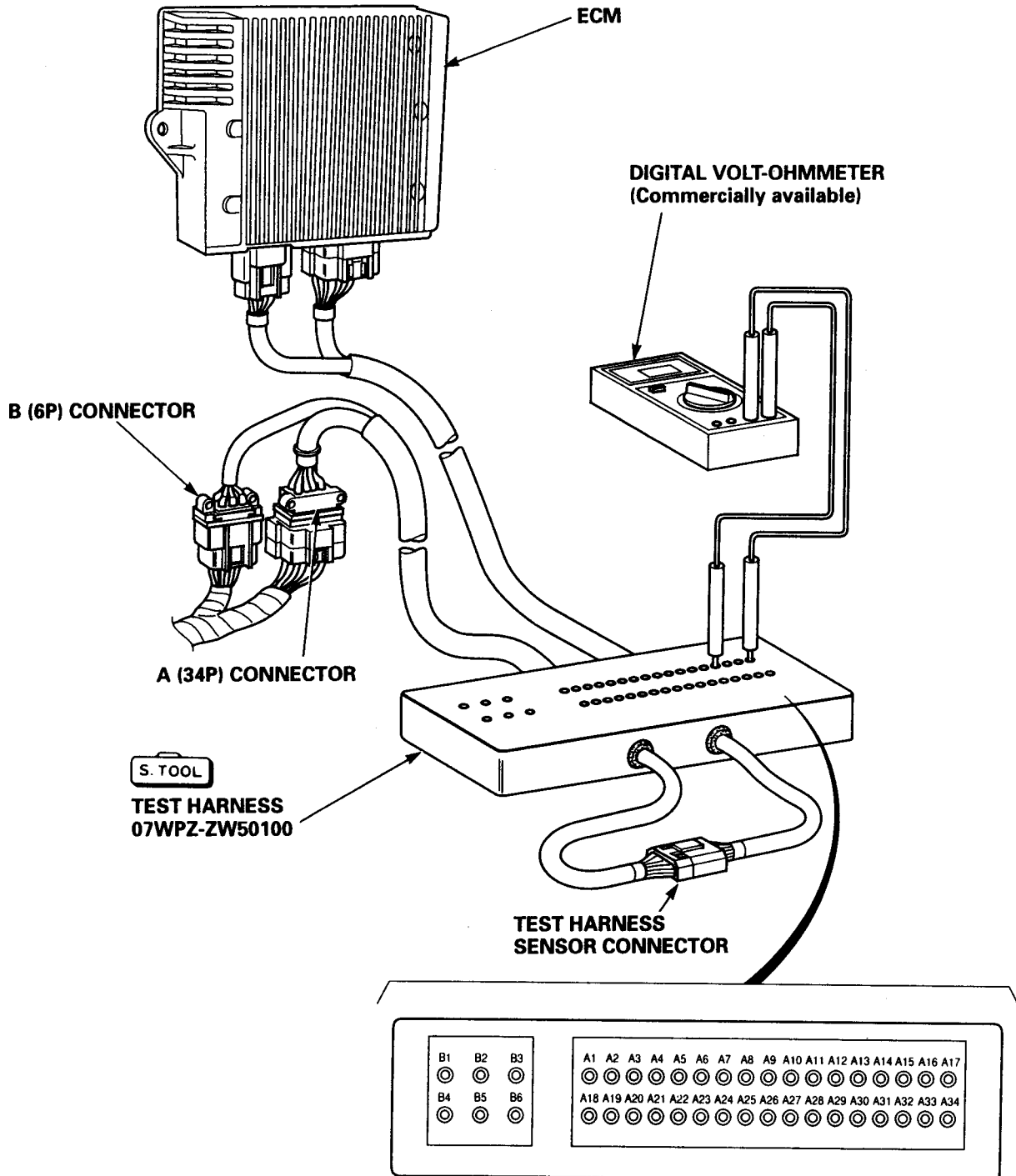
The MIL blinks when the SCS short connector is connected to the 2P (red) service check connector and the ignition switch is turned ON, because the memory of the problem is stored in the ECM. Turn the ignition switch ON again and, even though the MIL does not turn ON again, connect the SCS short connector to the 2P (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. Remove the ECM cover to connect the test harness to the ECM (P. 5-31).

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

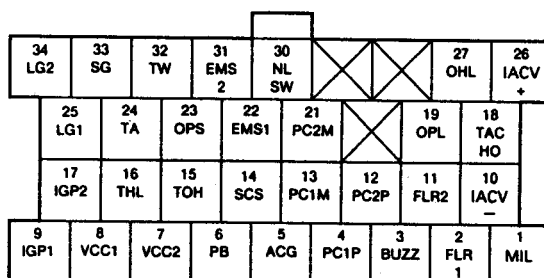


# HONDA

## BF115A•130A

### PROGRAMMED FUEL INJECTION SYSTEM

#### • ECM TERMINAL ARRANGEMENT

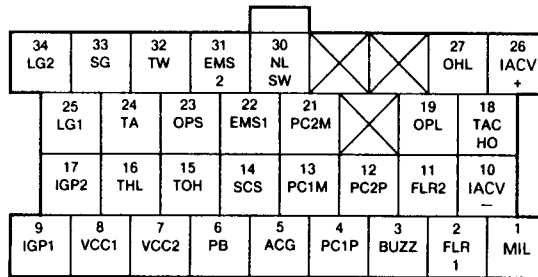


BI	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

Harness side connector  
viewed from front side

#### 34P connector (A)

Terminal No.	Wire color	Terminal	Name	Content	Signal
1	R/Bu	MIL	MIL	Turns the MIL ON.	With MIL ON: Approx. 0V With MIL OFF: Battery voltage
2	Lg/R	FLR1	Fule pump relay	Drives the fuel pump relay.	For 2 seconds after ignition switch ON: Approx. 0V 2 seconds after ignition switch ON: Battery voltage
3	Y/G	BUZZ	Buzzer	Drives the buzzer.	With buzzer ON: 0V With buzzer OFF: Battery voltage
4	O	PC1P	Pulser coil sensor 1, positive (+) side	Detects the top dead center, crank position and the engine speed.	With engine running: Pulse signal
5	W/Bu	ACG	Alternator	Detects the alternator regulator signal.	With alternator indicator light ON: 0V With indicator light OFF: Battery voltage
6	W/R	PB	MAP sensor	Detects the suction air pressure.	With ignition switch ON: Approx. 3V At idle (varies according to engine speed): Approx. 1.5V
7	Lg/BI	VCC2	Sensor output voltage	Outputs the sensor voltage (trim angle sensor).	With ignition switch ON: Approx. 5V With ignition switch OFF: Approx. 0V
8	Br/Y	VCC1	Sensor output voltage	Outputs the sensor voltage.	With ignition switch ON: Approx. 5V With ignition switch OFF: Approx. 0V
9	Y/BI	IGP1	ECM main power 1	Power source for the ECM control circuit.	With ignition switch ON: Battery voltage With ignition switch OFF: Approx. 0V
10	P	IACV -	IAC valve, negative (-) side	Drives the IAC valve.	With engine running: Pulse signal of approx. 0V - battery voltage
11	Lg/R	FLR2	Fuel pump relay	Drives the fuel pump relay.	For 2 seconds after ignition switch ON: Approx. 0V 2 seconds after ignition switch ON: Battery voltage
12	Gr/W	PC2P	Pulser coil sensor 2, positive (+) side	Detects the top dead center, crank position and the engine speed.	With engine running: Pulse signal
13	Br/Bu	PC1M	Pulser coil sensor 1, negative (-) side	Ground for the pulser coil sensor 1.	-----
14	Lg/W	SCS	Service check signal	Detects the service check connector (2P) signal (signal that shows a DTC code).	With the terminal connected: Approx. 0V With the terminal disconnected: Approx. 5V
15	R/G	TOH	Overheat sensor	Detects the exhaust port temperature.	With ignition switch ON: Varies according to exhaust port temperature: Approx. 0.1 - 4.8V
16	R/BI	THL	TP sensor	Detects the throttle valve angle.	With throttle fully open: BF115A: 2.50 - 3.10V BF130A: 4.25 - 4.85V With throttle fully closed: 0.44 - 0.56V
17	Y/BI	IGP2	ECM main power 2	Power source for the ECM control circuit	With ignition switch ON: Battery voltage With ignition switch OFF: Approx. 0V
18	Gr	TACHO	Tachometer	Outputs the engine running signal	With engine running: Pulse signal
19	Y	OPL	Oil pressure light	Turns the oil pressure light ON.	With oil pressure light ON: Battery voltage With oil pressure light OFF: Approx. 0V
21	Br/R	PC2M	Pulser coil sensor 2, negative (-) side	Ground for the pulser coil sensor 2	-----
22	BI/R	EMS1	Emergency stop switch 1	Detects the emergency stop switch 1 signal.	With emergency stop switch ON: Approx. 0V With emergency stop switch OFF: Battery voltage
23	Y/R	OPS	Oil pressure switch	Detects the oil pressure.	With oil pressure switch ON: Approx. 0V With oil pressure switch OFF: Battery voltage
24	R/Y	TA	IAT sensor	Detects the suction air temperature.	With ignition switch ON: Varies according to suction air temperature: Approx. 0.1 - 4.8V
25	G/BI	LG1	Logic ground 1	Ground for the ECM control circuit	-----

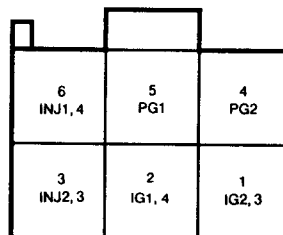


Bl	BLACK	Br	BROWN
Y	YELLOW	O	ORANGE
Bu	BLUE	Lb	LIGHT BLUE
G	GREEN	Lg	LIGHT GREEN
R	RED	P	PINK
W	WHITE	Gr	GRAY

**Harness side connector  
viewed from front side**

### 34P connector (A)

Terminal No.	Wire color	Terminal	Name	Content	Signal
26	Br/W	IACV +	IAC valve, positive (+) side	Drives the IAC valve.	With engine running: Pulse signal of approx. 0V – battery voltage
27	R	OHL	Overheat light	Turns the overheat light ON.	With overheat light ON: Approx. 0V With overheat light OFF: Battery voltage
30	Bl/G	NLSW	Neutral switch	Detects the neutral switch signal.	With neutral switch ON: Approx. 0V With neutral switch OFF: Battery voltage
31	Bl/R	EMS2	Emergency stop switch 2	Detects the emergency stop switch 2 signal.	With emergency stop switch ON: Approx. 0V With emergency stop switch OFF: Battery voltage
32	R/W	TW	ECT sensor	Detects the engine temperature.	With ignition switch ON: Varies according to engine temperature: Approx. 0.1– 4.8V
33	G	SG	Sensor ground	Ground for the sensor	_____
34	G/Bl	LG2	Logic ground 2	Ground for the ECM control circuit	_____













**Harness side connector  
viewed from front side**

### 6P connector (B)

Terminal No.	Wire color	Terminal	Name	Content	Signal
1	Bl/Bu	IG2, 3	Ignition coil No.2/ No.3	Drives the ignition coil.	With engine running: Pulse signal of approx. 0V – battery voltage
2	Bl/Y	IG1, 4	Ignition coil No.1/ No.4	Drives the ignition coil.	With engine running: Pulse signal of approx. 0V – battery voltage
3	Bu	INJ2, 3	No.2/No.3 fuel injector	Drives the No.2/No.3 fuel injector.	With engine running: Pulse signal of approx. 0V – battery voltage
4	Br/Bl	PG2	Power ground 2	Ground for ECM control circuit	_____
5	Br/Bl	PG1	Power ground 1	Ground for ECM control circuit	_____
6	Bu	INJ1, 4	No.1/No.4 fuel injector	Drives the No.1/No.4 fuel injector.	With engine running: Pulse signal of approx. 0V – battery voltage



### • TROUBLESHOOTING GUIDE

No. of blinks of MIL	MIL	Probable problem part	Page
MIL does not turn ON/blink		<ul style="list-style-type: none"> <li>• Open circuit in MIL wire</li> <li>• Blown MIL bulb</li> <li>• Open circuit in ECM ground wire</li> <li>• Faulty ECM</li> </ul>	5-11
MIL staying ON		<ul style="list-style-type: none"> <li>• Short circuit in service check connector wire</li> <li>• Short circuit in MIL wire</li> <li>• Short circuit in sensor system power supply line</li> <li>• Open circuit in power supply line for ECM</li> <li>• Faulty ECM</li> </ul>	5-12
3		<ul style="list-style-type: none"> <li>• Disconnected MAP sensor connector</li> <li>• Short or open circuit in MAP sensor wire</li> <li>• Faulty MAP sensor</li> </ul>	5-20
4		<ul style="list-style-type: none"> <li>• Loosely connected or disconnected pulser coil sensor connector</li> <li>• Short or open circuit in pulser coil sensor 1 wire</li> <li>• Faulty pulser coil sensor 1</li> </ul>	5-24
6		<ul style="list-style-type: none"> <li>• Disconnected ECT sensor connector</li> <li>• Short or open in ECT sensor wire</li> <li>• Faulty ECT sensor</li> </ul>	5-26
7		<ul style="list-style-type: none"> <li>• Disconnected TP sensor connector</li> <li>• Short or open circuit in TP sensor wire</li> <li>• Faulty TP sensor</li> </ul>	5-22
8		<ul style="list-style-type: none"> <li>• Loosely connected or disconnected pulser coil sensor connector</li> <li>• Short or open circuit in pulser coil sensor 2 wire</li> <li>• Faulty pulser coil sensor 2</li> </ul>	5-24
10		<ul style="list-style-type: none"> <li>• Disconnected IAT sensor connector</li> <li>• Short or open circuit in IAT sensor wire</li> <li>• Faulty IAT sensor</li> </ul>	5-28
14		<ul style="list-style-type: none"> <li>• Disconnected IAC valve connector</li> <li>• Faulty IAC valve</li> <li>• Short or open circuit in IAC valve wire</li> </ul>	5-33
24		<ul style="list-style-type: none"> <li>• Disconnected overheat sensor connector</li> <li>• Short or open circuit in overheat sensor wire</li> <li>• Faulty overheat sensor</li> </ul>	5-40

• DTC 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.

• If the number of blinks of the MIL is other than those listed above or when the MIL stays ON, it indicates that the ECM is faulty.

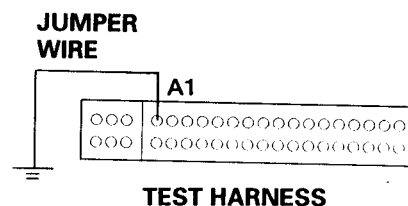
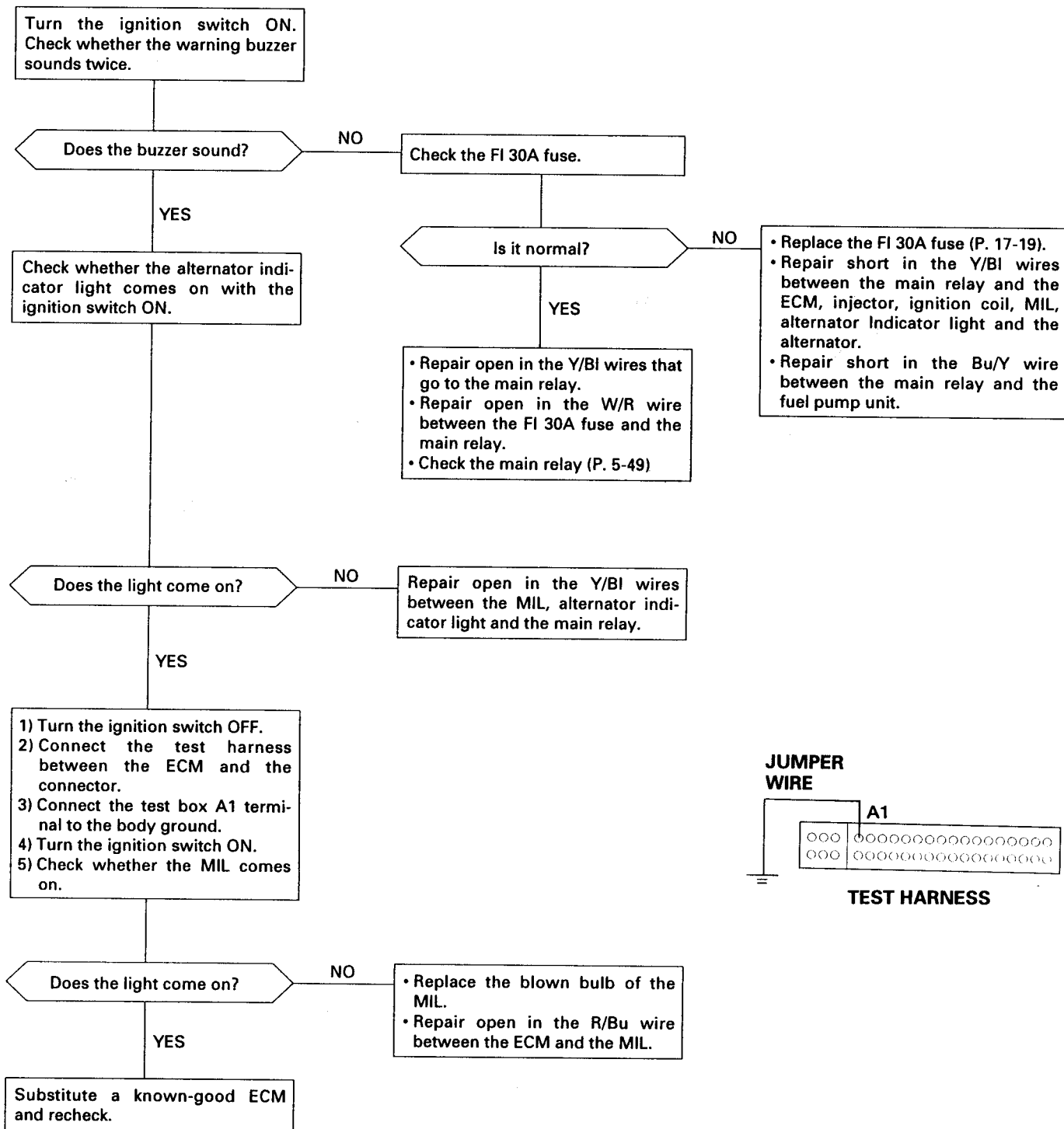
The MIL can indicate the multiple DTC codes by blinking the separate codes one after another. See the following table for the probable problem part of the multiple problems shown.

No. of blinks of MIL	MIL	Probable problem part	Page
3 and 7		Open circuit in sensor output voltage line (brown/yellow).	5-20 and 22
3, 6, 7, 10 and 24		Open circuit in sensor ground line (green).	5-20, 22, 26, 28 and 40

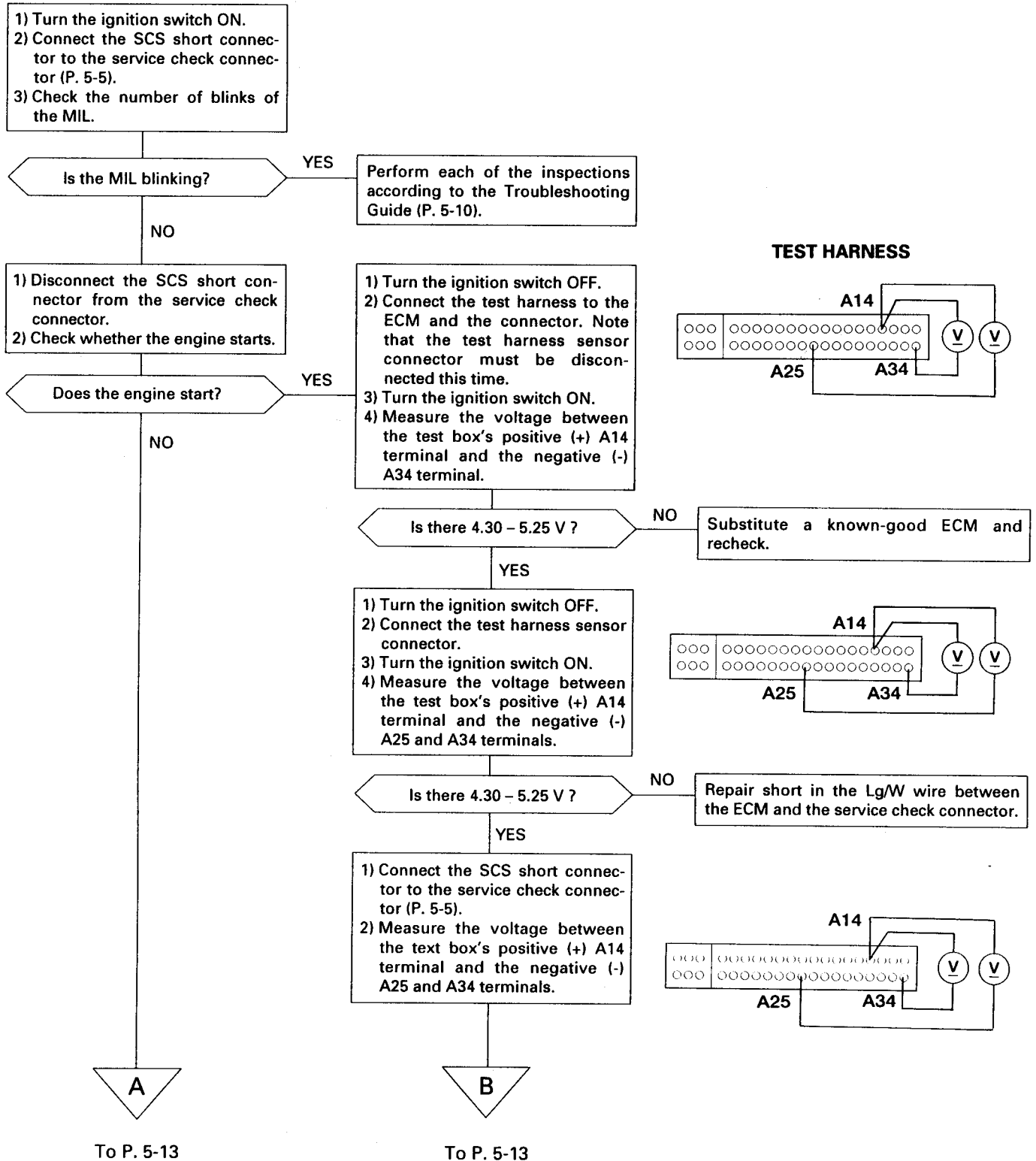
### a. ECM

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

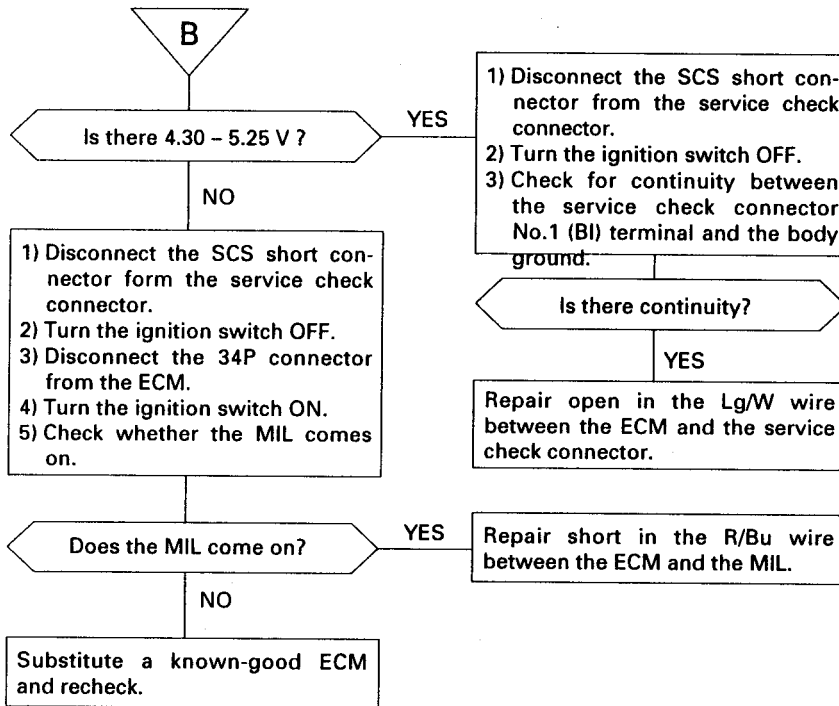
The MIL should come on for 2 seconds with the ignition switch ON. If the MIL does not come on or blink by short-circuiting with the service check connector, see the SCS line inspection flow chart (P. 5-12).



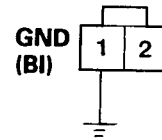
- MIL comes on but it does not blink by short-circuiting with the service check connector.
- MIL stays on with the service check connector short-circuited.
- When there is an open in the service check wire and a failure occurred, the MIL comes on but it does not blink by short-circuiting the service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



From P. 5-12

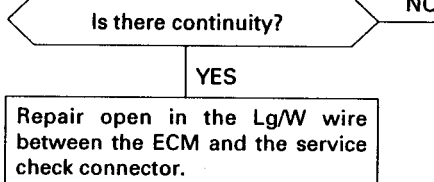


### SERVICE CHECK CONNECTOR

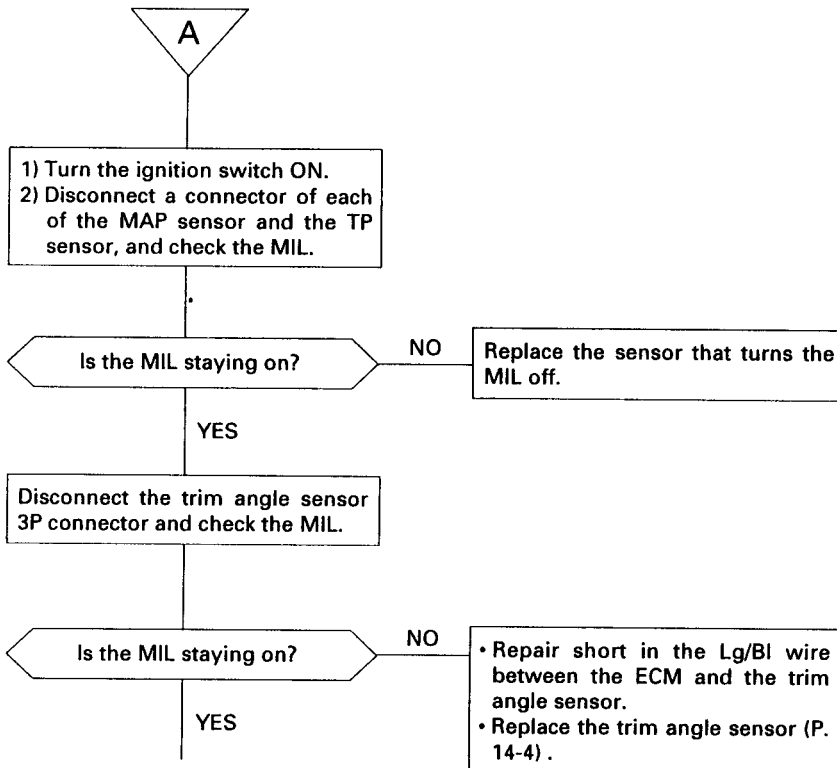


Viewing connector from the front side

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



From P. 5-12



To P. 5-14

From P. 5-13

- 1) Turn the ignition switch OFF.
- 2) Connect the test harness to the ECM and the connector. Note that the ECM side 34P connector must be disconnected this time.
- 3) Check for continuity between the test box's terminals A8 and A7 and the body ground.

Is there continuity?

YES

- Repair short in the Br/Y wire between the ECM and the MAP sensor or the TP sensor.
- Repair short in the Lg/Bl wire between the ECM and the trim angle sensor.

NO

- 1) Disconnect the IAC valve 2P connector, fuel injector connectors, alternator 4P connector, indicator 3P connector (MIL, alternator) and the ignition coil terminal.
- 2) Connect the test harness to the ECM side 34P connector.
- 3) Turn the ignition switch ON.
- 4) Measure the voltage between the test box's positive (+) A9 and A17 terminals and the negative (-) terminals A25 and A34 as shown.

Is there battery voltage?

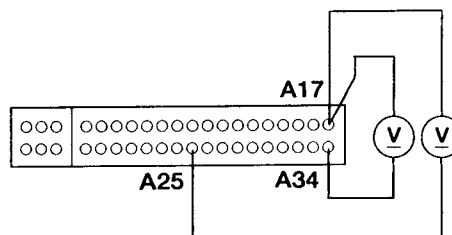
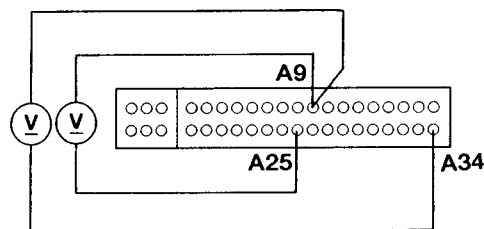
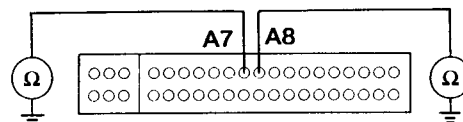
NO

- Repair open in the Y/Bl wire between the ECM and the main relay.
- Check the wire connection to the main relay and between the main relay and the IAC valve, fuel injector, alternator, indicator and the ignition coil.

YES

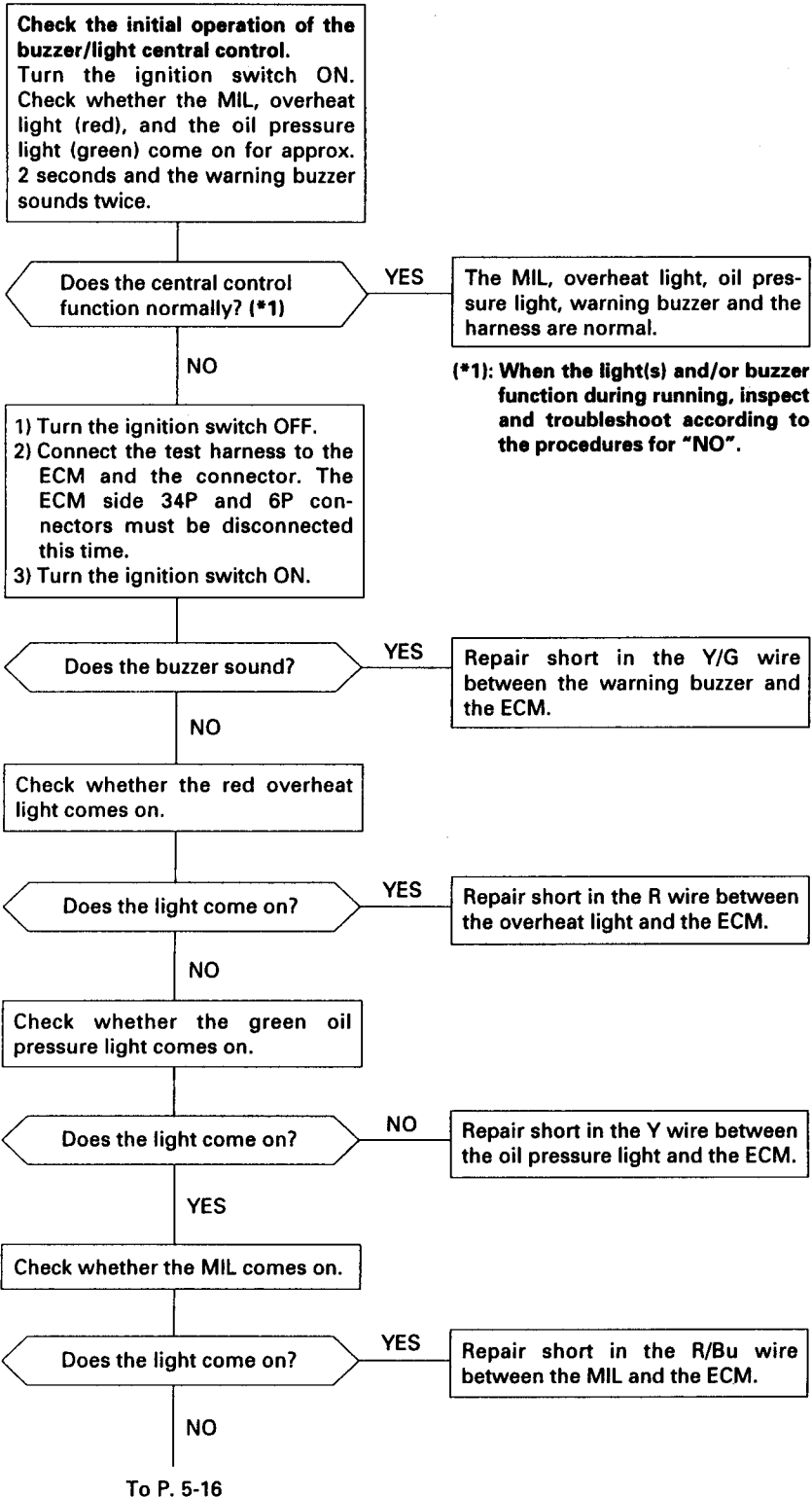
Substitute a known-good ECM and recheck.

### TEST HARNESS





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



# HONDA

## BF115A-130A

From P. 5-15

- 1) Turn the ignition switch OFF.
- 2) Connect the test box's A3 terminal to the body ground.
- 3) Turn the ignition switch ON.
- 4) Check whether the warning buzzer sounds.

Does the buzzer sound?

NO

- Repair open in the Y/G wire between the warning buzzer and the ECM.
- Check the warning buzzer (P. 17-30).
- Check the remote control system harnesses and the ignition switch (P. 17-29).

YES

- 1) Turn the ignition switch OFF.
- 2) Connect the test box's A27 terminal to the body ground.
- 3) Turn the ignition switch ON.
- 4) Check whether the red overheat light comes on.

Does the light come on?

NO

- Repair open in the R wire between the overheat light and the ECM.
- Replace the blown overheat light bulb.
- Check the remote control system harnesses and the ignition switch (P. 17-29).

YES

- 1) Turn the ignition switch OFF.
- 2) Connect the test box's A19 terminal to the body ground.
- 3) Turn the ignition switch ON.
- 4) Check whether the green oil pressure light comes on.

Does the light come on?

YES

- Repair open in the Y wire between the oil pressure light and the ECM.
- Replace the blown oil pressure light bulb.
- Check the remote control system harnesses and the ignition switch (P. 17-29).

NO

- 1) Turn the ignition switch OFF.
- 2) Connect the test box's A1 terminal to the body ground.
- 3) Turn the ignition switch ON.
- 4) Check whether the MIL comes on.

Does the light come on?

NO

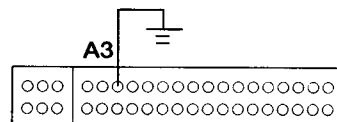
Perform the troubleshooting flow chart of "MIL does not come on. (MIL does not come on for 2 seconds with the ignition switch ON.)" (P. 5-11).

YES

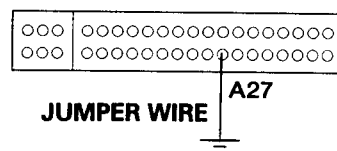
- 1) Turn the ignition switch OFF.
- 2) Disconnect the alternator 4P connector.
- 3) Check for continuity between the test box's A5 terminal and the body ground.

To P. 5-17

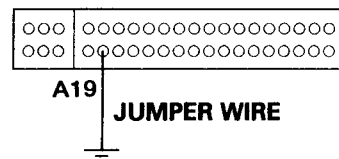
**JUMPER WIRE**



**TEST HARNESS**

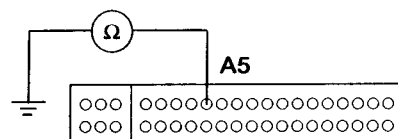
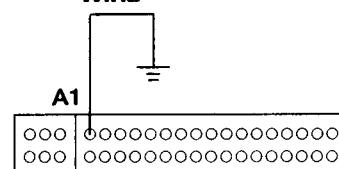


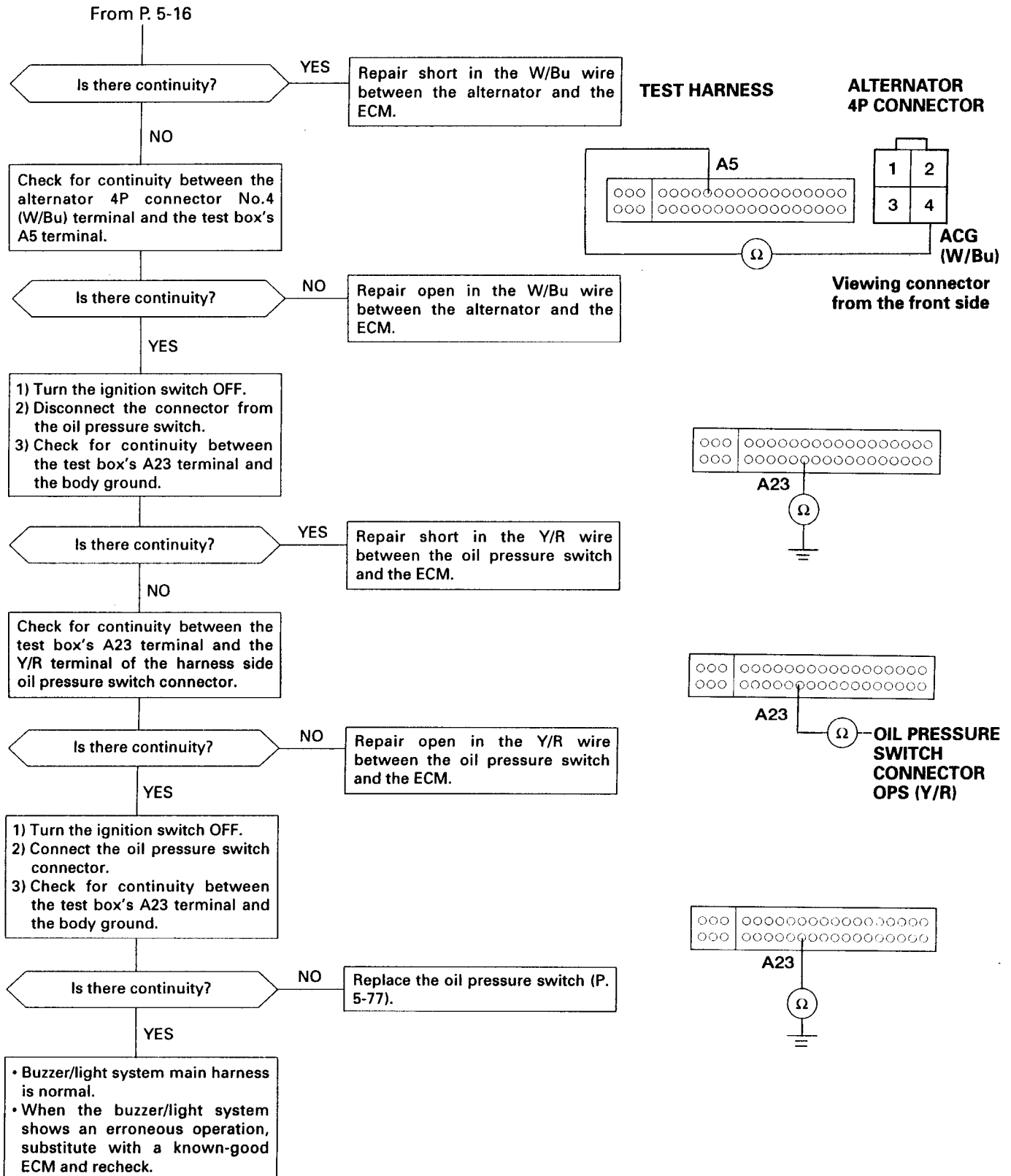
**JUMPER WIRE**



**JUMPER WIRE**

**JUMPER WIRE**



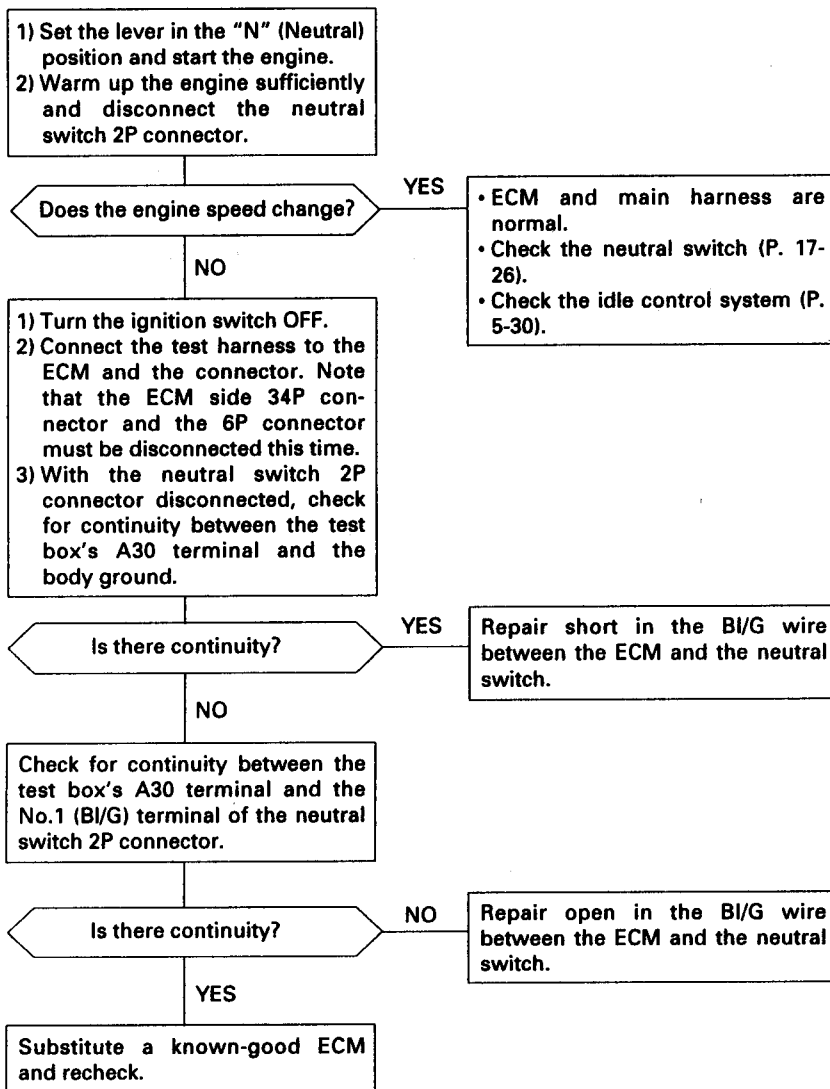


# HONDA

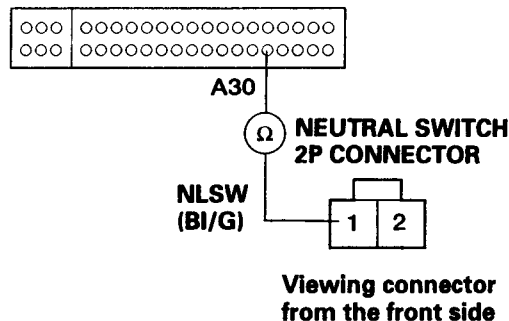
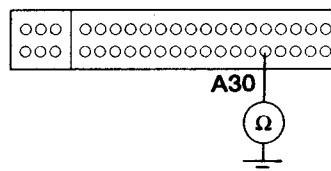
## BF115A•130A

### • Idling speed is low or trolling speed is high.

Check the idle control system and the neutral position. If it checked out normal, perform the inspection and troubleshooting according to the following flow chart.

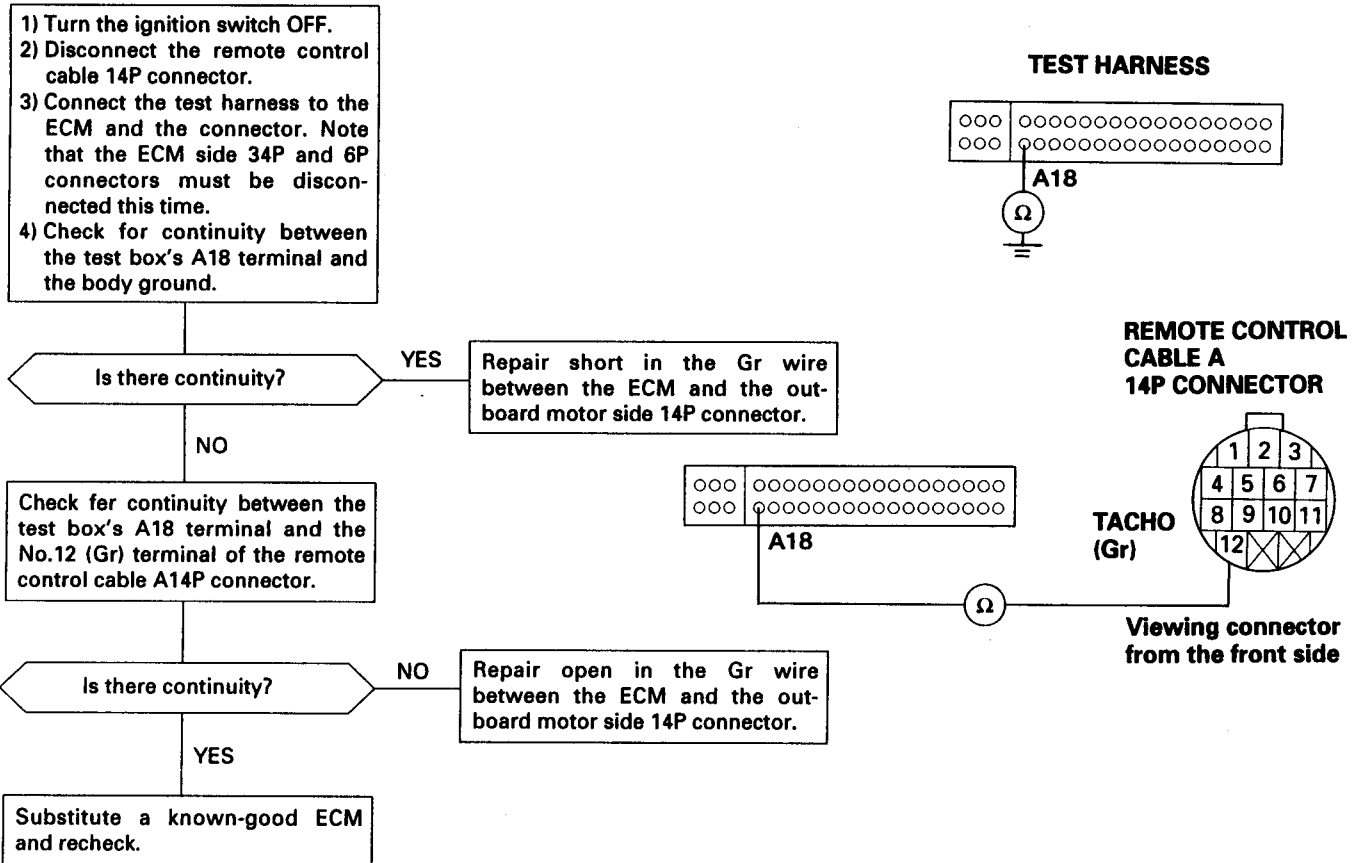


**TEST HARNESS**



### • 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.



### b. MAP SENSOR

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

1) Reset the ECM (P. 5-6).  
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 No.3 (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 No.3 (Br/Y) terminal of the harness side MAP sensor 3P connector, and the negative (-) tester lead to the No.2 (G) terminal. Measure the voltage.

Is there 4.75 – 5.25 V ?

NO

Repair open in the G wire between the ECM and the MAP sensor.

YES

Connect the positive (+) tester lead to the No.1 (W/R) terminal of the harness side MAP sensor 3P connector, and the negative (-) tester lead to the No.2 (G) 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

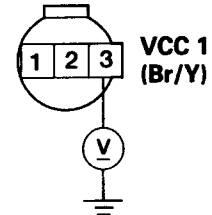
A

To P. 5-21

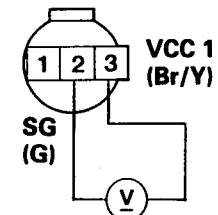
B

To P. 5-21

MAP SENSOR  
3P CONNECTOR

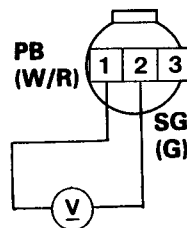


Viewing connector  
from the front side



Viewing connector  
from the front side

Viewing connector  
from the front side



From P. 5-20

**B**

- 1) Turn the ignition switch OFF.
- 2) Connect the MAP sensor 3P connector.
- 3) Connect the test harness to the ECM and the connector.
- 4) Turn the ignition switch ON.
- 5) Measure the voltage between the test box's positive (+) A6 terminal and the negative (-) A33 terminal.

Is there 2.76 – 2.96 V ?

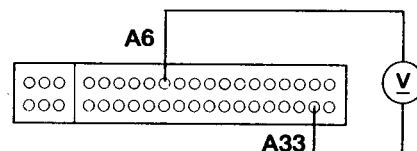
NO

Replace the MAP sensor (P. 5-57).

YES

Substitute a known-good ECM and recheck.

### TEST HARNESS



From P. 5-20

**A**

- 1) Turn the ignition switch OFF.
- 2) Connect the test harness to the ECM and the connector. 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 box's positive (+) A8 terminal and the negative (-) A33 terminal.

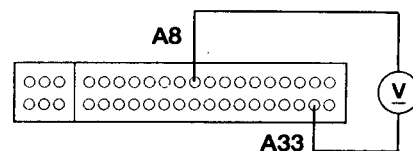
Is there 4.75 – 5.25 V ?

YES

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

NO

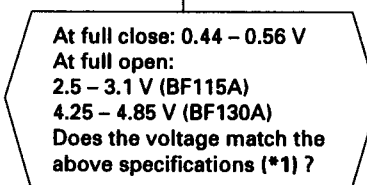
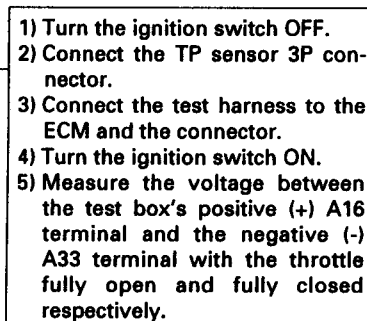
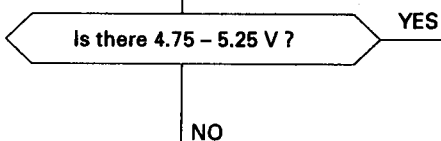
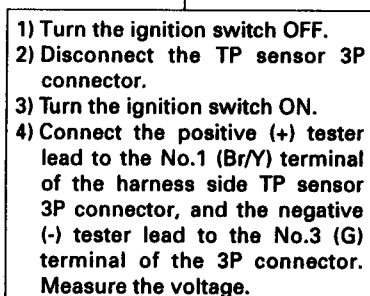
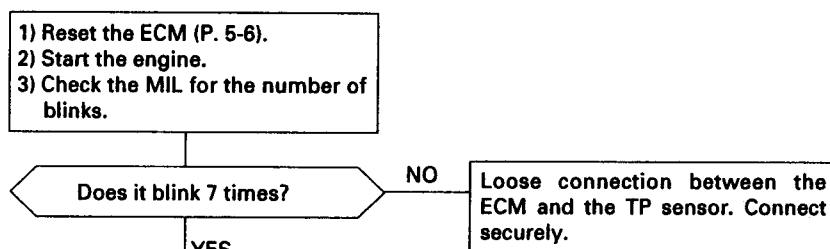
Substitute a known-good ECM and recheck.



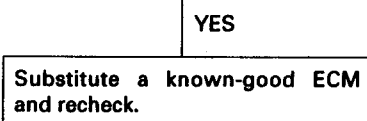
### c. TP SENSOR

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

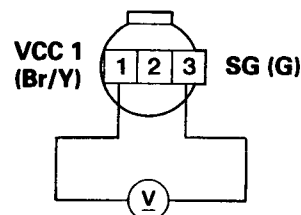
Check that the throttle cable is adjusted properly (P. 3-10) before starting the TP sensor inspection/troubleshooting.



- Replace the throttle body assembly (P. 5-57).
- Repair open or short in the R/B1 wire between the ECM and the TP sensor.

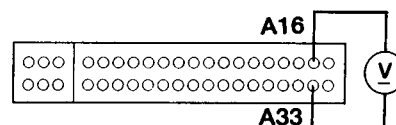


### TP SENSOR 3P CONNECTOR



Viewing connector  
from the front side

### TEST HARNESS



**\*1: Note that the voltage specifications are for the condition when the power to the sensor (i. e. voltage between the brown/yellow No. 1 terminal of the harness side TP sensor 3P connector and the brown No. 3 terminal) is 5.0 V or above.**

If the voltage is below 5.0 V, calculate the required voltage using the following formula and judge the condition accordingly.

**Example:** When the power to the sensor is 4.75 V, voltage in the range of 0.44 - 0.56 V should be calculated as,

$$0.44 \times \frac{4.75}{5.0} = \text{approx. } 0.42 \quad 0.56 \times \frac{4.75}{5.0} = \text{approx. } 0.53$$

Therefore, the required voltage should be [0.42 – 0.53 V].

To P. 5-23



From P. 5-22

Connect the positive (+) tester lead to the No.1 (Br/Y) 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 – 5.25V?

YES

Repair open in the G wire between the ECM and the TP sensor.

NO

- 1) Turn the ignition switch OFF.
- 2) Connect the test harness to the ECM and the connector.
- 3) Turn the ignition switch ON.
- 4) Measure the voltage between the test box's positive (+) A8 terminal and the negative (-) A33 terminal.

Is there 4.75 – 5.25 V ?

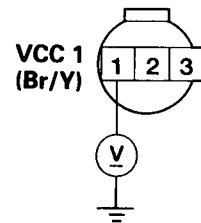
YES

Repair open in the Br/Y wire between the ECM and the TP sensor.

NO

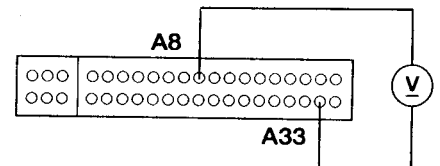
Substitute a known-good ECM and recheck.

### TP SENSOR 3P CONNECTOR



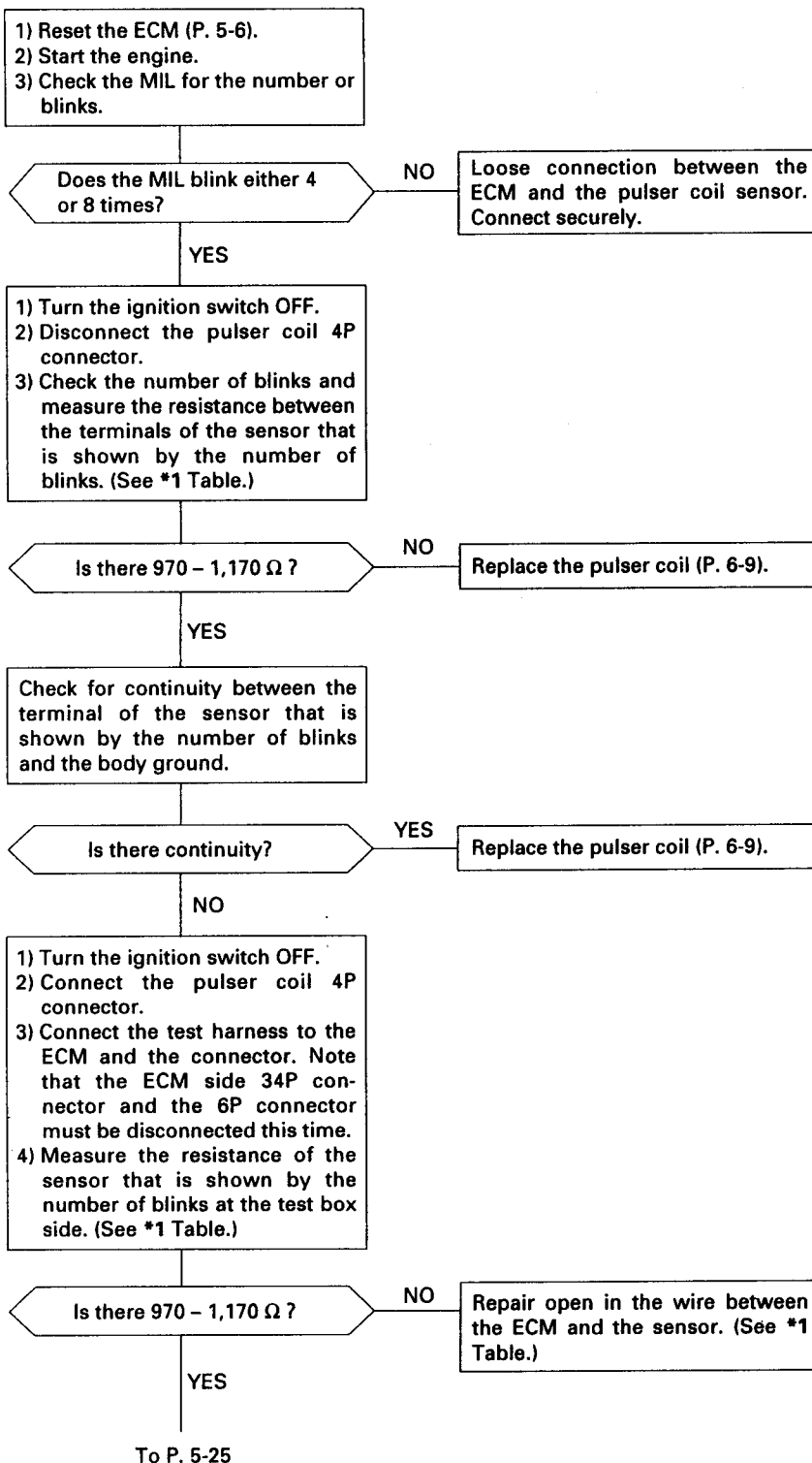
Viewing connector  
from the front side

### TEST HARNESS



### d. PULSER COIL SENSOR 1, 2

- MIL blinks either 4 or 8 times with service check connector shorted (P. 5-5).



(\*1 Table)

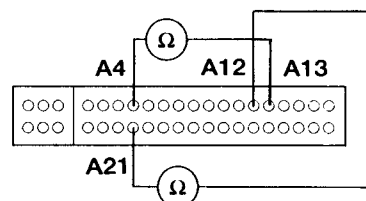
Sensor	No. of blinks	Sensor terminal	Test harness terminal	Code color
Pulser coil sensor 1	4	1	A4	O
		2	A13	Br/Bu
Pulser coil sensor 2	8	3	A12	Gr/W
		4	A21	Br/R

PULSER COIL 4P CONNECTOR



Viewing connector from the front side

TEST HARNESS



From P. 5-24

Check for continuity between the test box's terminals A4, A13, A12 and the A21 and the body ground.

Is there continuity?

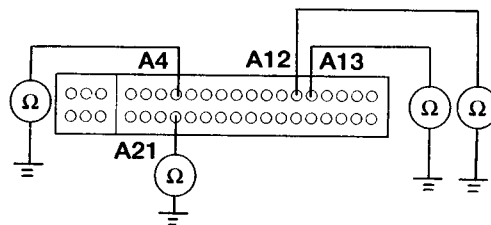
YES

Repair short in the wire between the ECM and the sensor. (See \*1 Table. P. 5-24)

NO

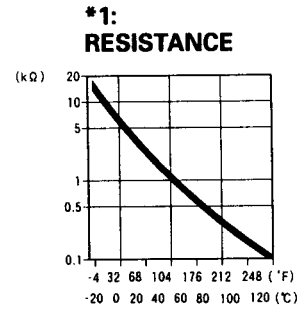
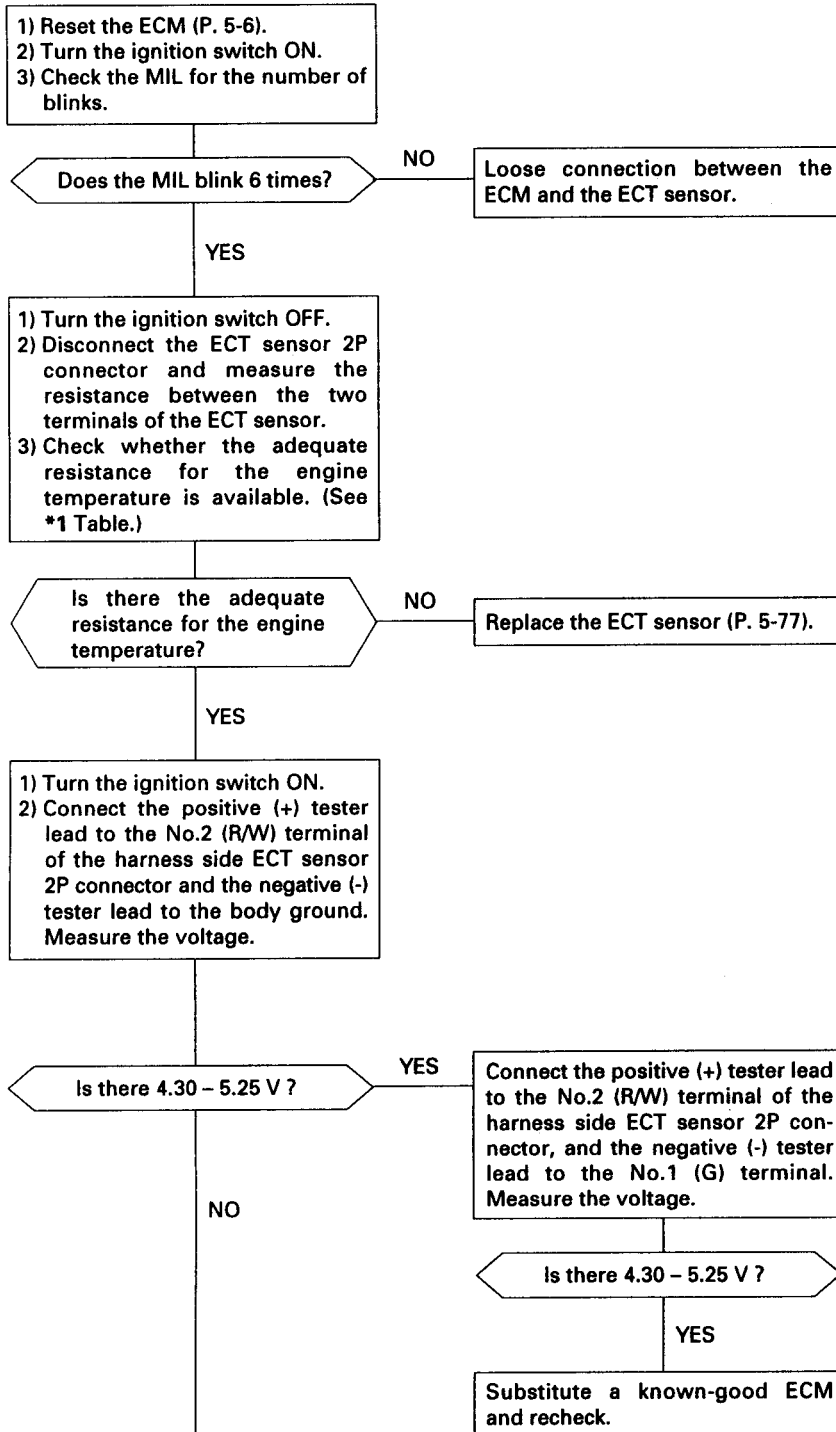
Substitute a known-good ECM and recheck.

**TEST HARNESS**



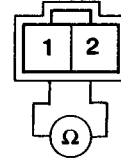
### e. ECT SENSOR

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



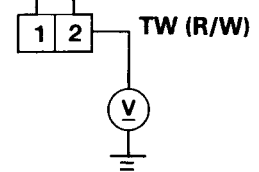
#### ENGINE TEMPERATURE

**ECT SENSOR  
2P CONNECTOR  
(ECT sensor side)**

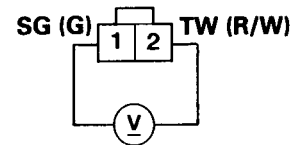


Viewing connector from the front side

**ECT SENSOR  
2P CONNECTOR  
(Harness side)**



Viewing connector from the front side



Viewing connector from the front side

From P. 5-26

- 1) Turn the ignition switch OFF.
- 2) Connect the test harness to the ECM and the connector. 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 box's positive (+) A32 terminal and the negative (-) A33 terminal. Measure the voltage.

Is there 4.30 – 5.25 V ?

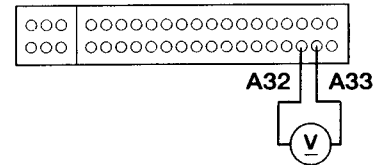
YES

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

NO

Substitute a known-good ECM and recheck.

### TEST HARNESS



### f. IAT SENSOR

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

- 1) Reset the ECM (P. 5-6).
- 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.
- 3) Check whether the adequate resistance for the intake air temperature is available. (See \*1 Table.)

Is there adequate resistance?

NO

Replace the IAT sensor (P. 5-74).

YES

- 1) Turn the ignition switch ON.
- 2) Connect the positive (+) tester lead to the No.2 (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 No.2 (R/Y) terminal of the harness side IAT sensor 2P connector, and the negative (-) tester lead to the No.1 (G) terminal. Measure the voltage.

Is there 4.30 – 5.25 V ?

NO

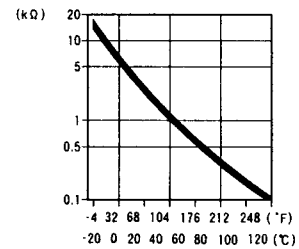
Repair open in the G wire between the ECM and the IAT sensor.

YES

Substitute a known-good ECM and recheck.

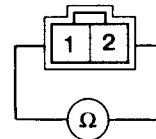
To P. 5-29

\*1:  
RESISTANCE



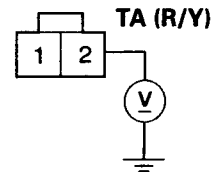
INTAKE AIR TEMPERATURE

IAT SENSOR 2P CONNECTOR  
(IAT sensor side)



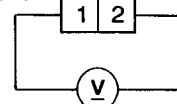
Viewing connector  
from the front side

IAT SENSOR 2P CONNECTOR  
(Harness side)



Viewing connector  
from the front side

SG (G) TA (R/Y)



Viewing connector  
from the front side

From P. 5-28

- 1) Turn the ignition switch OFF.
- 2) Connect the test harness to the ECM and the connector. 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 box's positive (+) A24 terminal and the negative (-) A33 terminal.

Is there 4.30 – 5.25 V ?

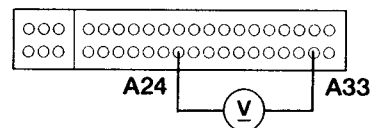
YES

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



### 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		Idle adjusting screw	IAC valve	Neutral switch	Vacuum pipe
Page					
Symptom		P. 5-31	P. 5-33	P. 17-26	P. 5-73 and 77
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

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. 5-31)
- Neutral switch (P. 17-26)
- Bypass passage, vacuum pipe
- IAC valve for proper installation and O-rings for condition

2) If the above parts checked out all right, perform the idle adjustment (P. 5-31).

- 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.



### • IDLING

#### INSPECTION:

Check the following before starting the idling inspection.

- Spark plug gap (P. 3-5)
- PCV valve operation (P. 5-77)
- 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.  
Remove the engine cover (P. 3-5).
- 3) Wait until the engine speed stabilizes under no load, and check the idle speed.

Specified idle speed (At neutral)	$750 \pm 50 \text{ min}^{-1} \text{ (rpm)}$
--------------------------------------	---

- When the idle speed is outside the specification or when a problem symptom shown on the Idle Control System Troubleshooting Guide (P. 5-30) appears, perform the following adjustment.

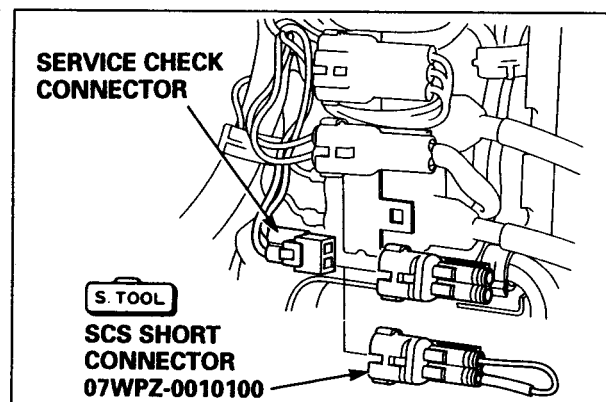
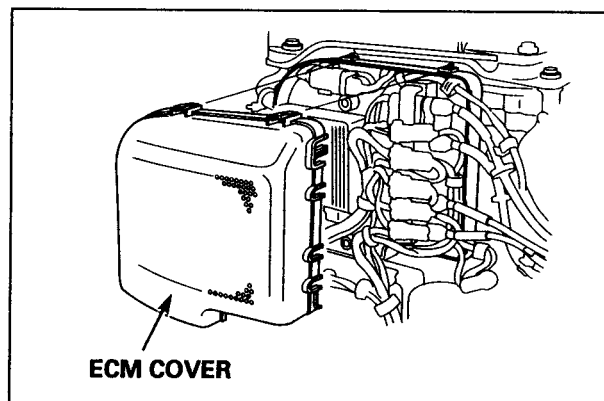
#### ADJUSTMENT:

- 1) Remove the ECM cover.
- 2) Disconnect the service check connector (red) and connect the SCS short connector (special tool) to the service check connector.
- 3) Remove the propeller and set the outboard motor gear case in a test tank filled with water. Start the engine.

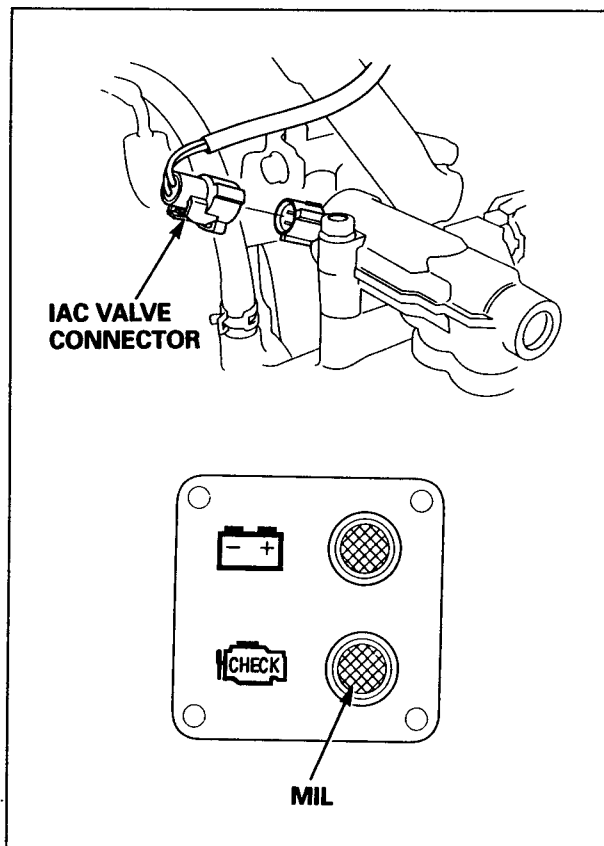
#### TOOL:

SCS short connector

07WPZ-0010100



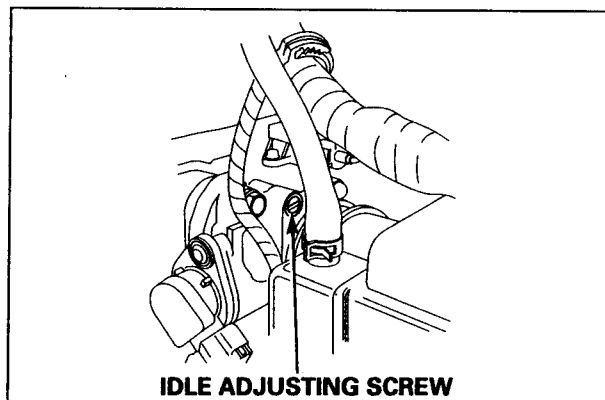
- 4) Disconnect the IAC valve connector. The MIL should come ON this time.



- 5) Wait until the engine speed stabilizes, then check the idle speed.
- 6) If the idle speed is outside the specification, adjust by turning the idle adjusting screw in or out.

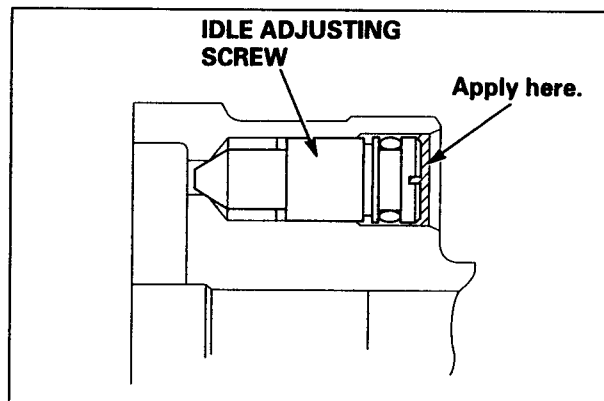
Idle speed (At neutral)	$600 \pm 30 \text{ min}^{-1} (\text{rpm})$
-------------------------	--

- 7) After adjustment, stop the engine and apply Nippon Paint Uni-pack 200 or equivalent to the entire surface of the idle adjusting screw head.
- 8) Connect the IAC valve connector and disconnect the SCS short connector (special tool) from the service check connector.
- 9) Reset the ECM (P. 5-6).
- 10) Start the engine. Wait until the engine speed stabilizes under no load, and recheck the idle speed.



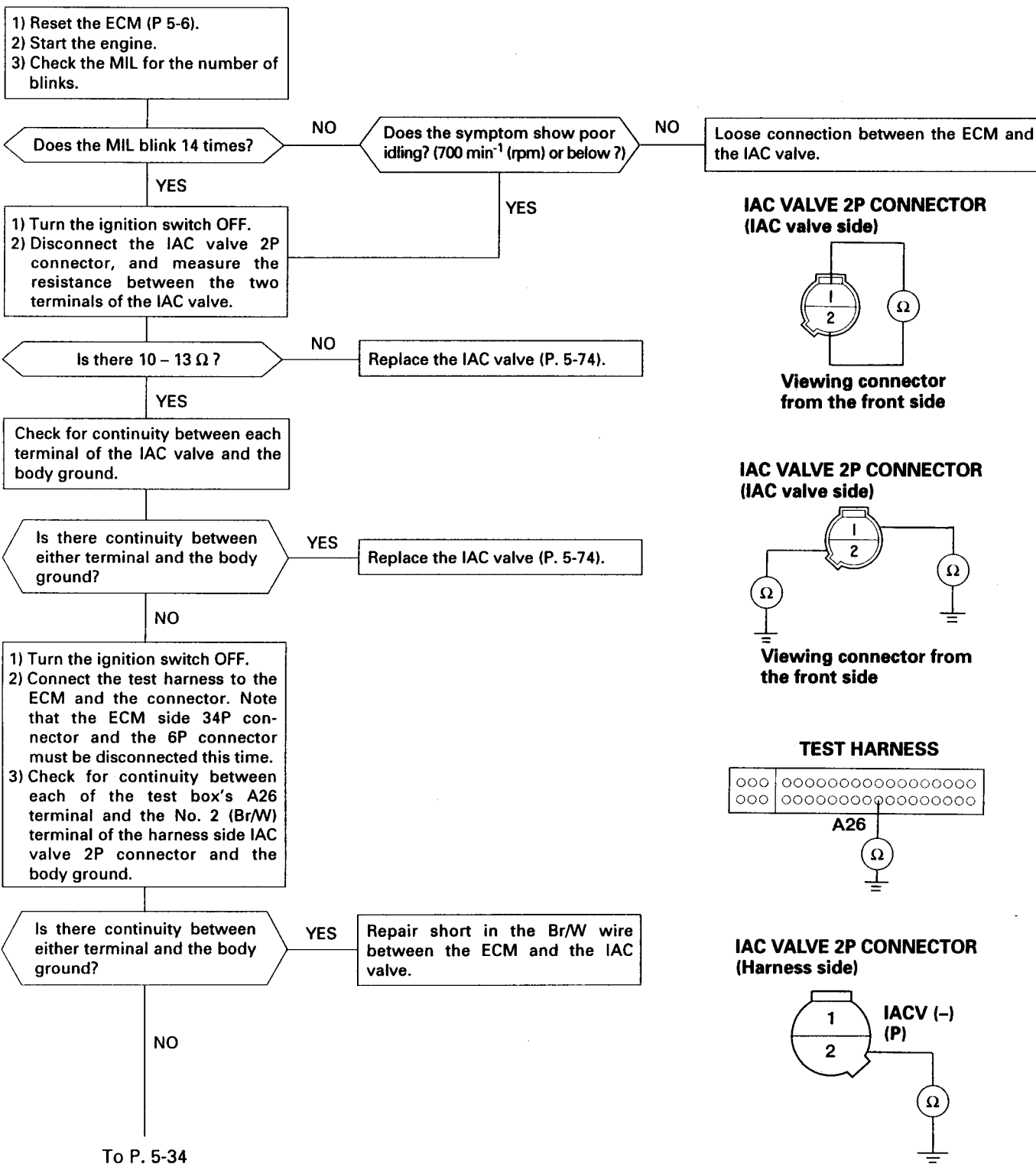
Specified idle speed (At neutral)	$750 \pm 50 \text{ min}^{-1} (\text{rpm})$
-----------------------------------	--

- 11) If the idle speed is outside the specification, inspect and troubleshoot the idle control system (P. 5-33).

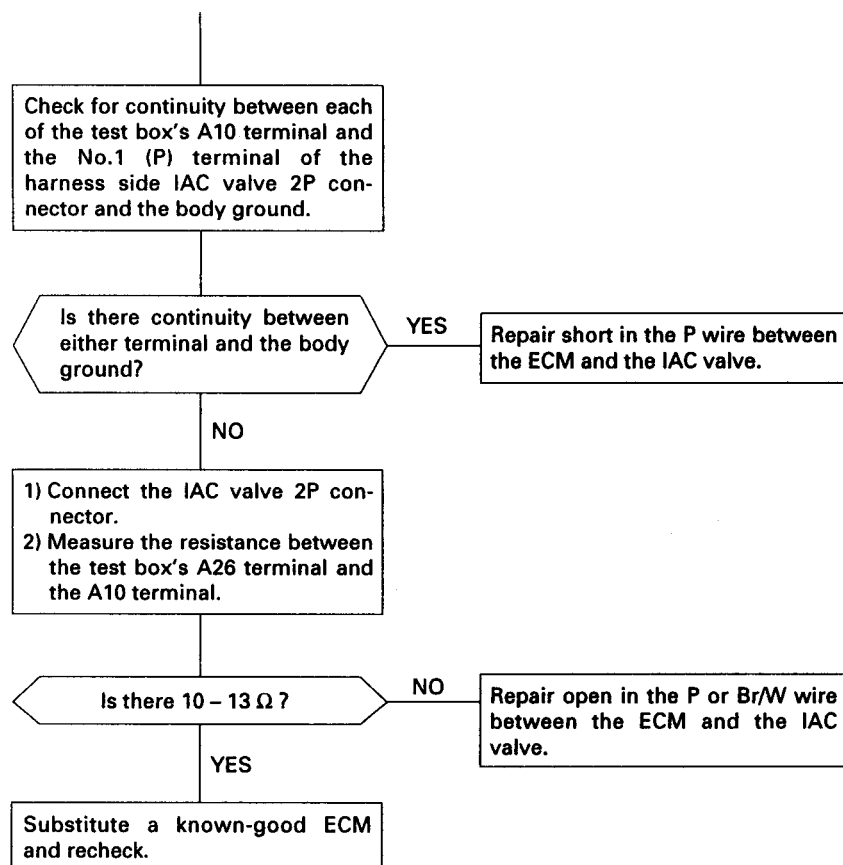


### a. IAC VALVE

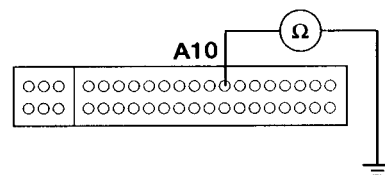
- MIL blinks 14 times with service check connector shorted (P. 5-5).



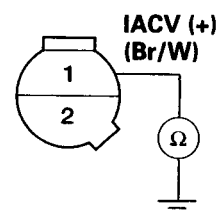
From P. 5-33



### TEST HARNESS

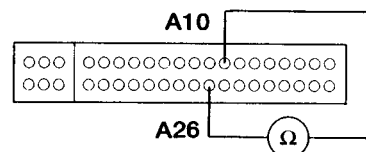


### IAC VALVE 2P CONNECTOR (Harness side)



Viewing connector from the front side

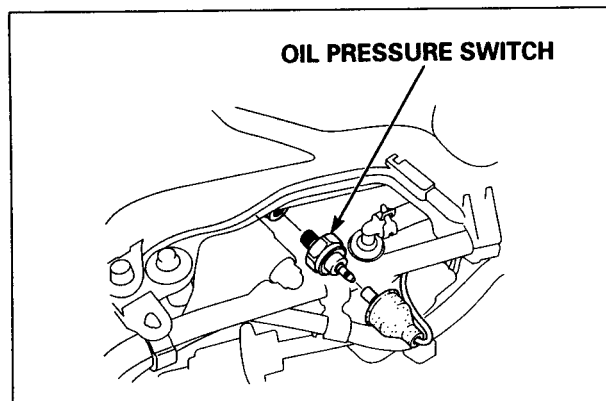
### TEST HARNESS



### ALERT SYSTEM

#### • OIL PRESSURE TEST

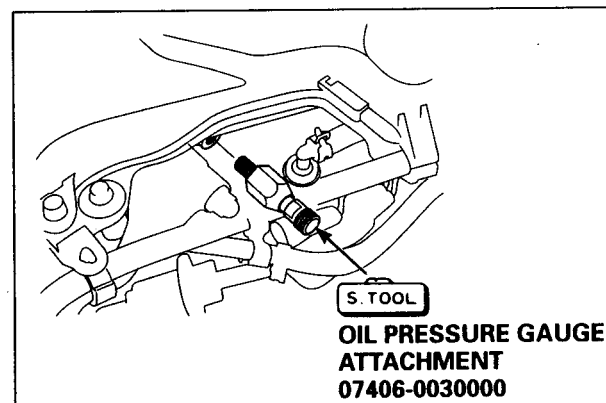
- 1) Check the engine oil level (P. 3-2).
- 2) Disconnect the oil pressure switch and remove it.



- 3) Install a pressure gauge attachment (special tool) on an oil pressure gauge that has a scale calibrated to a maximum of 196 – 490 kPa (2 – 5 kgf/cm<sup>2</sup>, 28 – 71 psi) to the outboard motor.

#### CAUTION:

- Tighten the gauge attachment to 9 N·m (0.9 kgf·m, 6.5 lbf·ft).
- Overtightening will damage the threads.



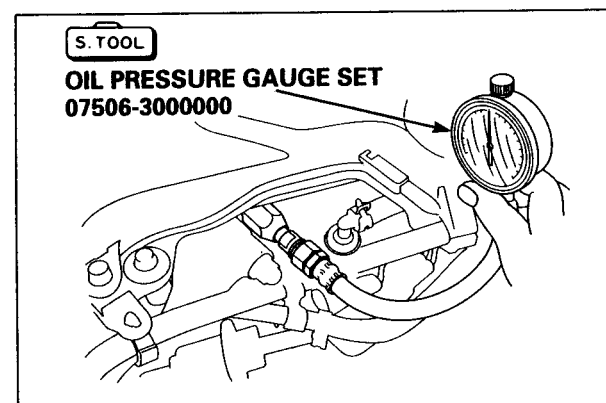
- 4) Remove the propeller (P. 12-1).  
Run the outboard motor in a test tank with the water level at least 4 inches above the antiventilation plate.

Allow the engine to warm up to normal operating temperature.

- 5) Check the oil pressure with the engine speed at  $750 \pm 50$  min<sup>-1</sup> (rpm).  
It should be 98 – 137 kPa (1.0 – 1.4 kgf/cm<sup>2</sup>, 14 – 20 psi).

Oil pressure [Engine speed $750 \pm 50$ min <sup>-1</sup> (rpm) in neutral]	98 – 137 kPa (1.0 – 1.4 kgf/cm <sup>2</sup> , 14 – 20 psi)
---	--

- 6) If the oil pressure is less than the specification, check the oil pump rotors and body for wear (P. 10-4 and 5).

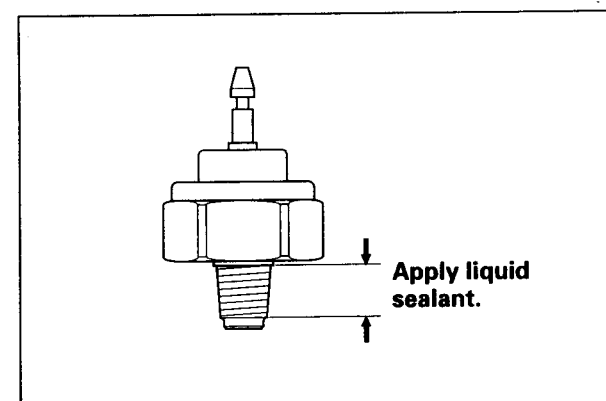


- 7) Clean the oil pressure switch threads and apply liquid sealant (THREE BOND 1215) to the threads. Tighten the oil pressure switch to the specified torque.

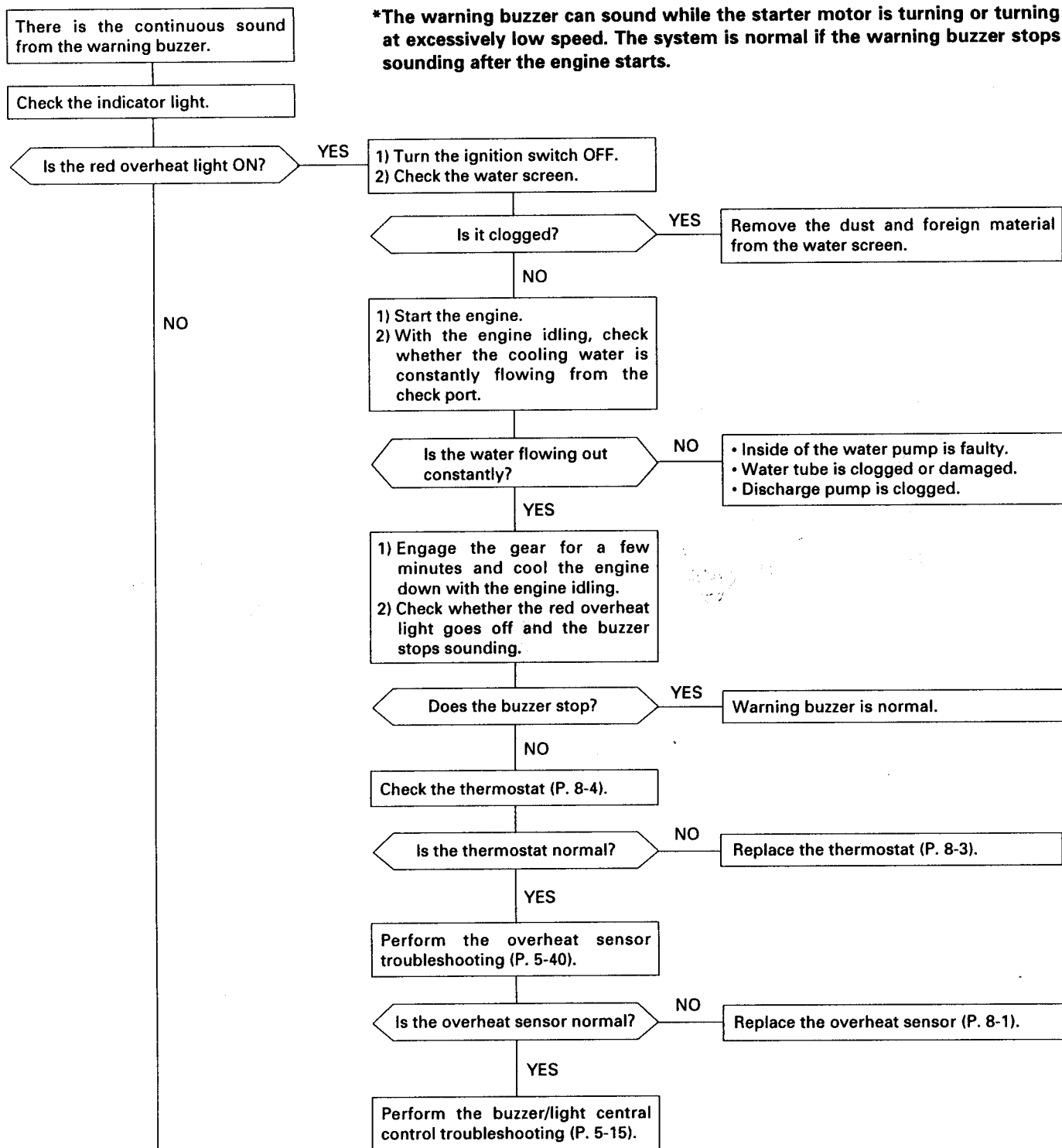
**TORQUE: 9 N·m (0.9 kgf·m, 6.5 lbf·ft)**

#### CAUTION:

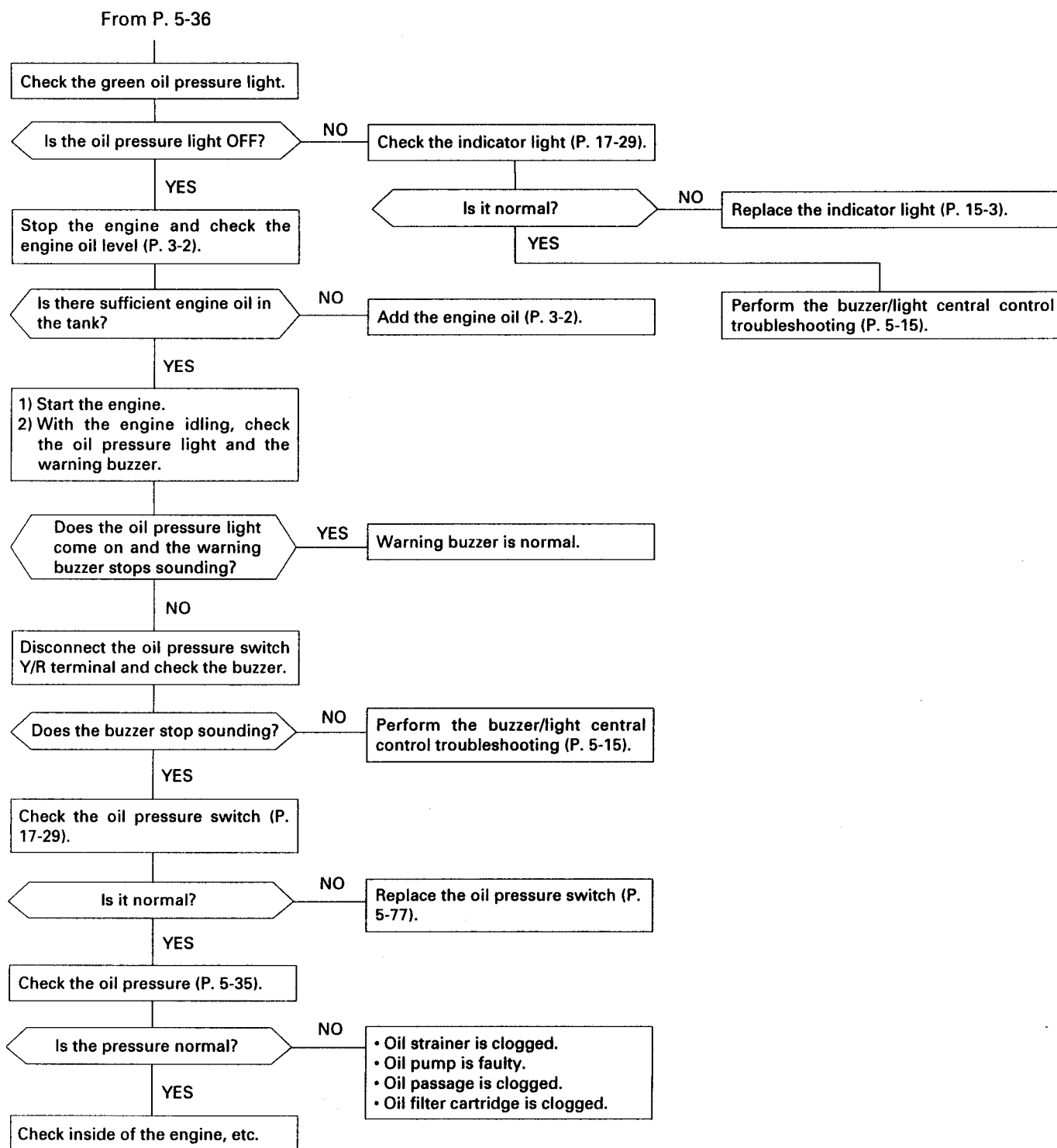
- Take care not to contaminate the switch end and oil passage with the liquid sealant.
- Be sure to use a torque wrench to tighten the switch. Overtightening will damage the cylinder block.



### a. CONTINUOUS SOUND



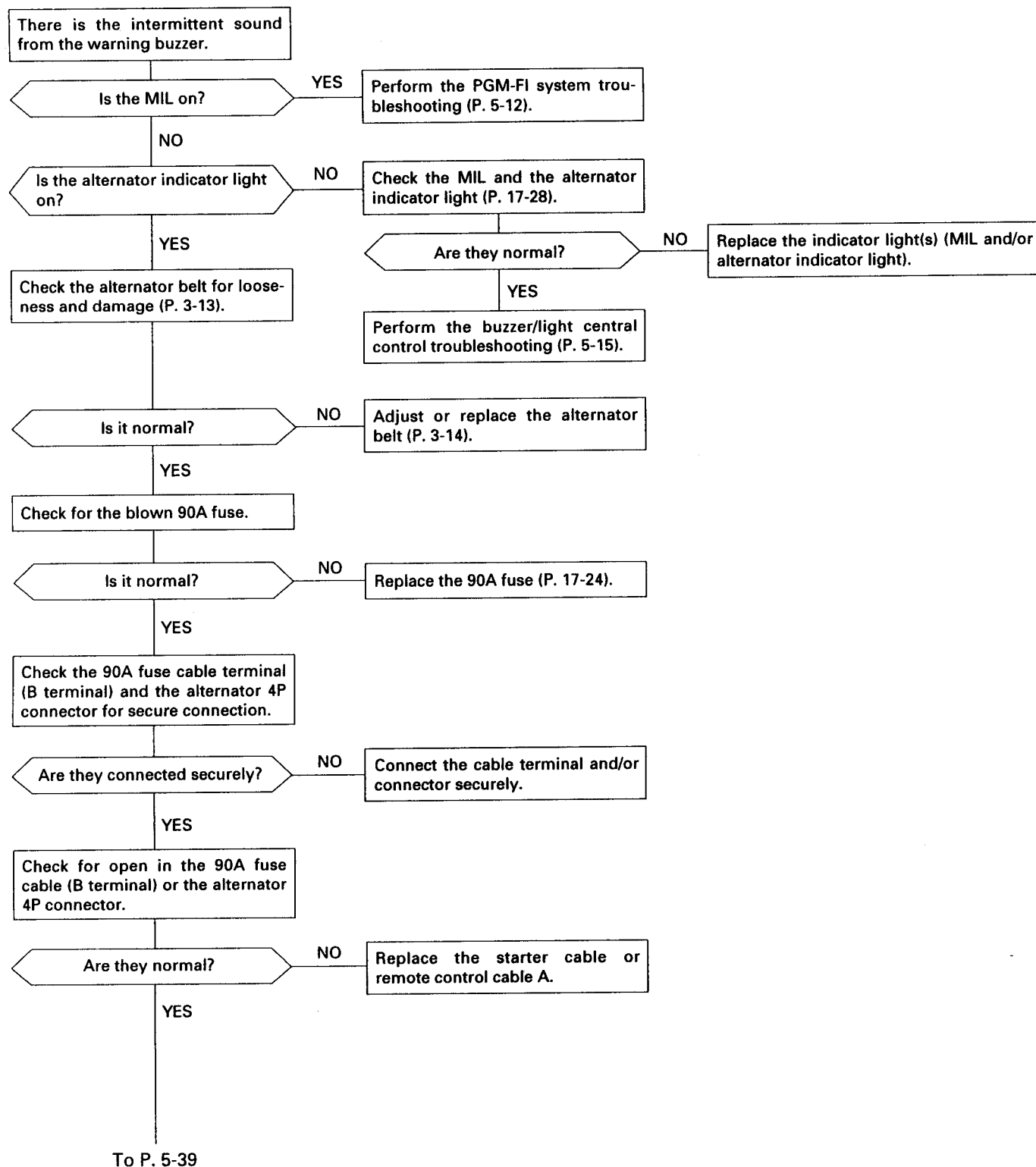
To P. 5-37



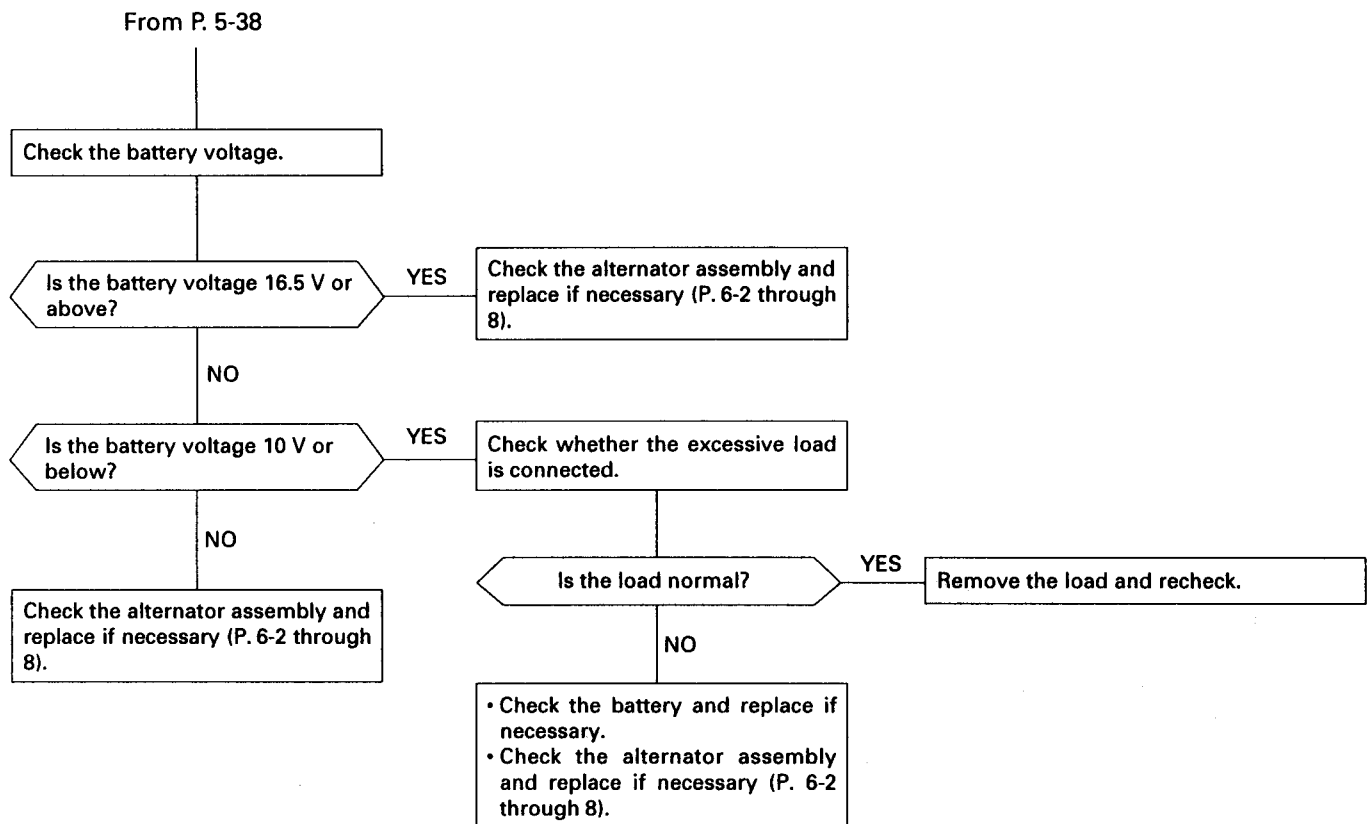
• The BF115A/BF130A outboard motor is equipped with the engine overrev limiter that functions when the engine speed exceeds 6,300 min<sup>-1</sup> (rpm). No sparks are produced at any cylinder when the overrev limiter is functioning.

• The overrev limiter functions when there is no load on the propeller or the engine speed rises excessively due to incorrect propeller selection, etc.

### b. INTERMITTENT SOUND

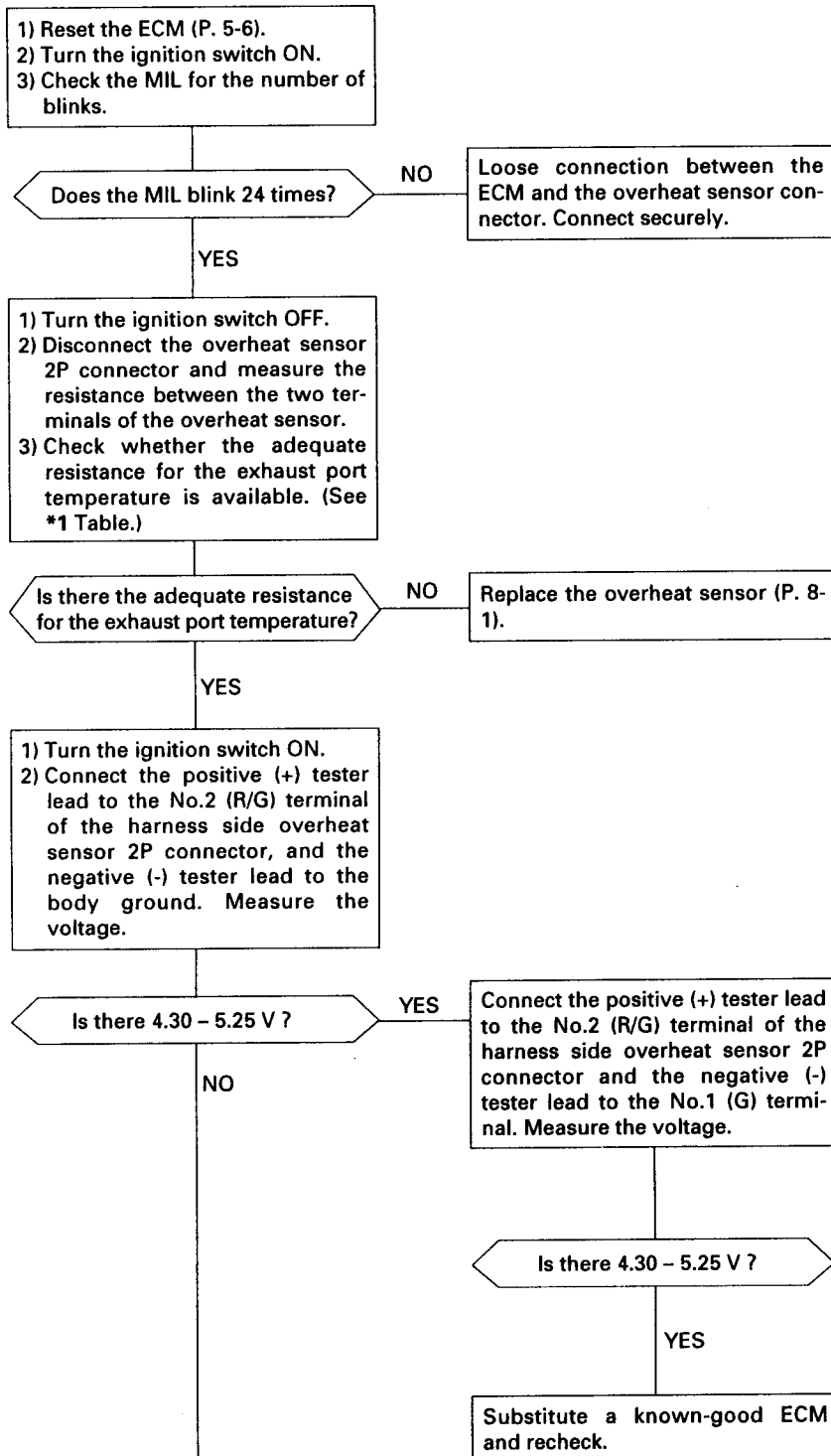






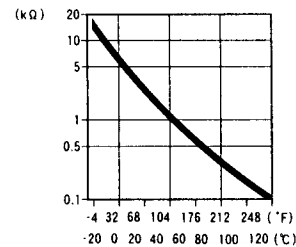
### c. OVERHEAT SENSOR

- MIL blinks 24 times with service check connector shorted (P. 5-5).



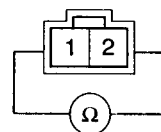
To P. 5-41

\*1:  
RESISTANCE



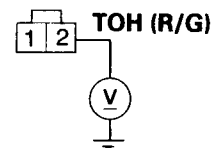
EXHAUST PORT TEMPERATURE

OVERHEAT SENSOR  
2P CONNECTOR (Sensor side)



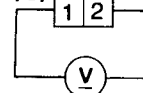
Viewing connector  
from the front side

OVERHEAT SENSOR  
2P CONNECTOR (Harness side)



Viewing connector  
from the front side

SG (G) TOH (R/G)

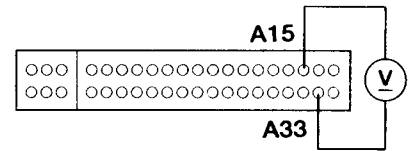


Viewing connector  
from the front side

From P. 5-40

- 1) Turn the ignition switch OFF.
- 2) Connect the test harness to the ECM and the connector. 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 box's positive (+) A15 terminal and the negative (-) A33 terminal.

### TEST HARNESS



Is there 4.30 – 5.25 V ?

YES

Repair open or short in the R/G wire between the ECM and the overheat sensor.

NO

Substitute a known-good ECM and recheck.

**FUEL SUPPLY 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		High pressure fuel pipe	Fuel injector	High pressure fuel pump unit	Pressure regulator	High pressure fuel filter	Main relay
Page							
Symptom		P. 5-44	P. 5-45	P. 5-48	P. 5-46	P. 5-47	P. 5-49
Hard to start		2	3	2			1
Poor engine running	Engine starts but stalls soon.	1	2		3		
	Idle speed does 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		

### • HOW TO RELIEVE FUEL PRESSURE

#### ⚠ WARNING

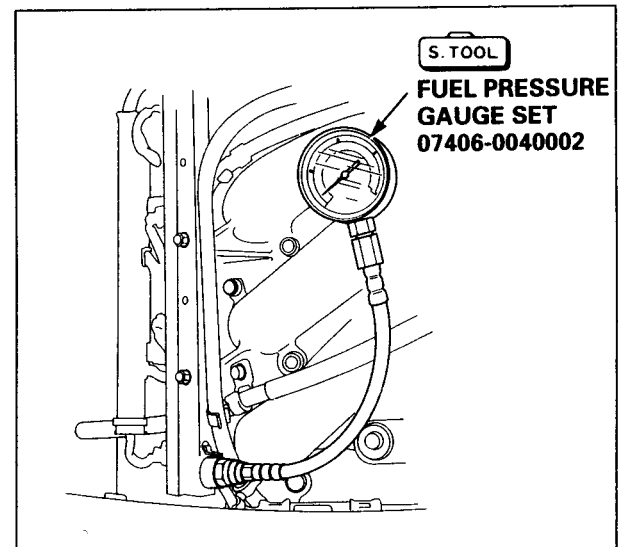
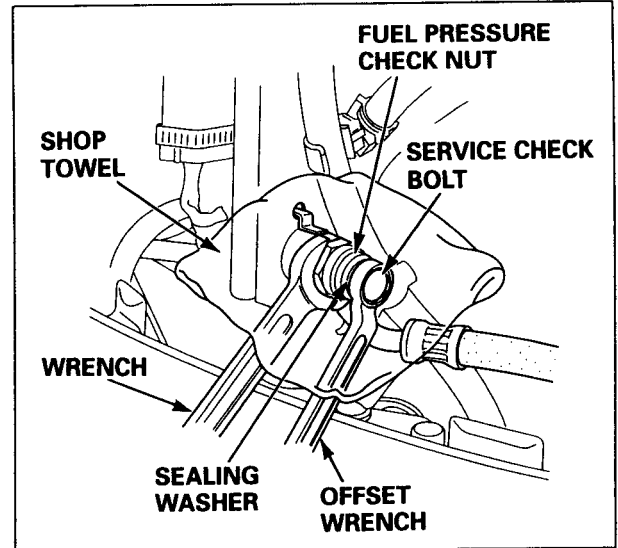
Gasoline is highly flammable and explosive.

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 an offset wrench on the service check bolt underside the fuel line comp.
  - 3) Set a wrench on the fuel pressure check nut.
  - 4) Holding the service check bolt and the fuel pressure check nut with the respective wrenches, place a shop towel or equivalent material over the service check bolt.
  - 5) Loosen the service check bolt approximately one turn slowly to relieve the fuel pressure.
  - 6) 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

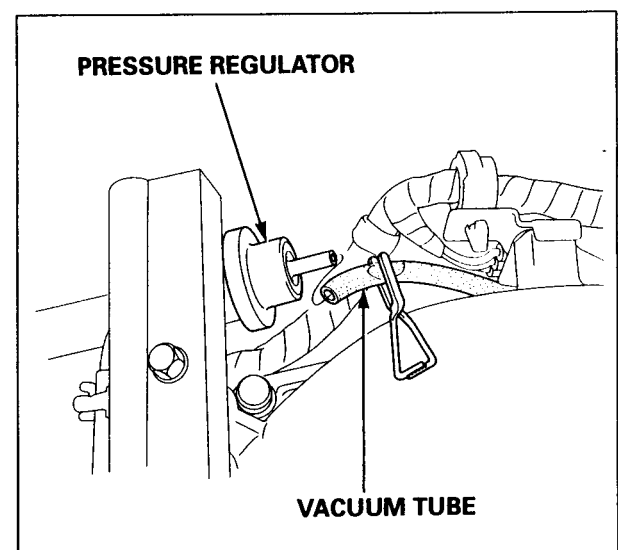
- 1) Relieve the fuel pressure according to "How to relieve fuel pressure" shown above.
- 2) Remove the service check bolt and set the special tool in the threaded bolt hole.

#### TOOL:

**Fuel pressure gauge set 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 750 ± 50 min <sup>-1</sup> (rpm)]	265 – 314 kPa (2.7 – 3.2 kgf/cm <sup>2</sup> , 38 – 46 psi)
--	---



5) When the fuel pressure is outside the specified standard pressure, check the following.

– When fuel pressure is higher than standard pressure:

- Check the pressure regulator return hose for kinking or restrictions.
- Check the pressure regulator for proper operation (Inspection: P. 5-46).

– When fuel pressure is lower than standard pressure:

- Check the pressure regulator for proper operation (Inspection: P. 5-46).
- Check the fuel filter (high pressure side) for clogging (Replacement: P. 5-47).
- Check the fuel pump unit (Inspection: P. 5-48).

6) After check, replace the sealing washers with the new ones and tighten the service check bolt to the specified torque.

**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**

### ● FUEL LINES

#### ⚠ WARNING

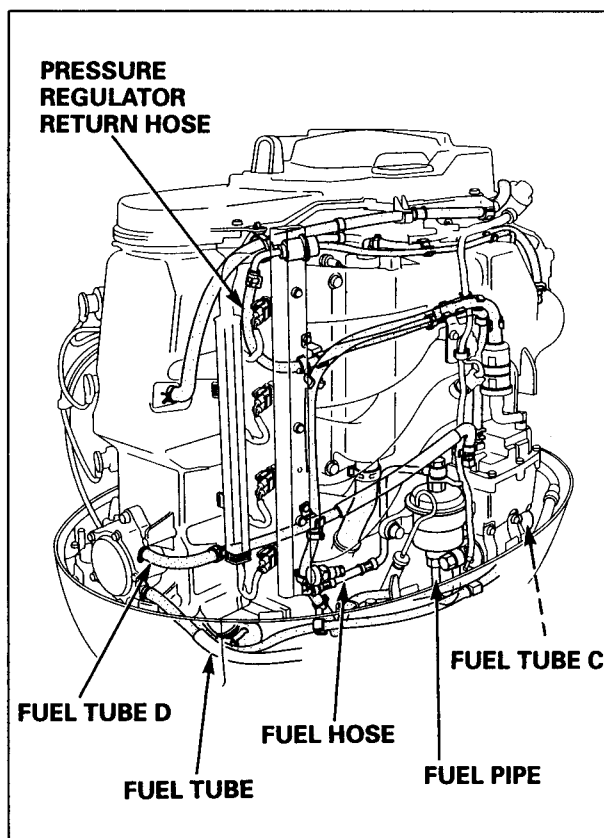
**Gasoline is highly flammable and explosive.**

**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.



### • FUEL INJECTORS

#### INSPECTION:

##### When the engine is hard to start:

- 1) Disconnect the fuel injector connector.
- 2) Measure the resistance between the fuel injector terminals.

Resistance	11.1 – 12.3 $\Omega$
------------	----------------------

- When the measurement is outside the specification, replace the fuel injector (P. 5-59).
- If the fuel injector is normal, check the following parts. If they are checked out all right, replace the ECM (P. 5-11).

– FI 30A fuse

– Main relay

– Brown wire and blue 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.

##### When the engine starts:

- 1) With the engine idling, disconnect the fuel injector connector of each cylinder and check the idle speed change and idling stability.

- The fuel injector is normal when the idling condition changes.

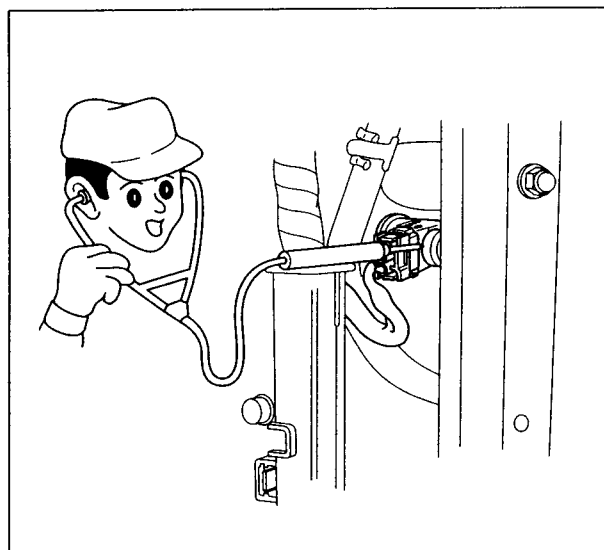
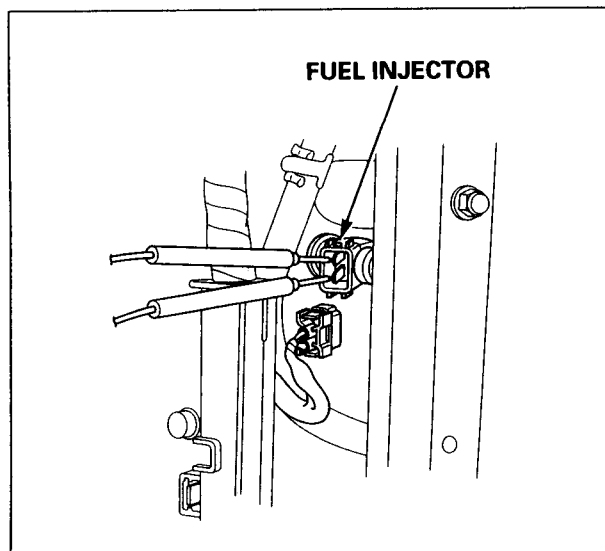
- If the idling condition does not change when the fuel injector connector is disconnected, replace the fuel injector of the cylinder and recheck the idling condition.

- 2) With the engine idling, check for the operation sound of the fuel injectors using a sound scope (or with a screwdriver or equivalent if a sound scope is not available).

- If there is no operation sound, replace the fuel injector and recheck. If an abnormality is detected, check the following parts. If they check out all right, replace the ECM with a new one and recheck.

– Brown wire and blue wire between the fuel injector and ECM for short/open circuit and poor 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 unit (P. 5-48) 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.

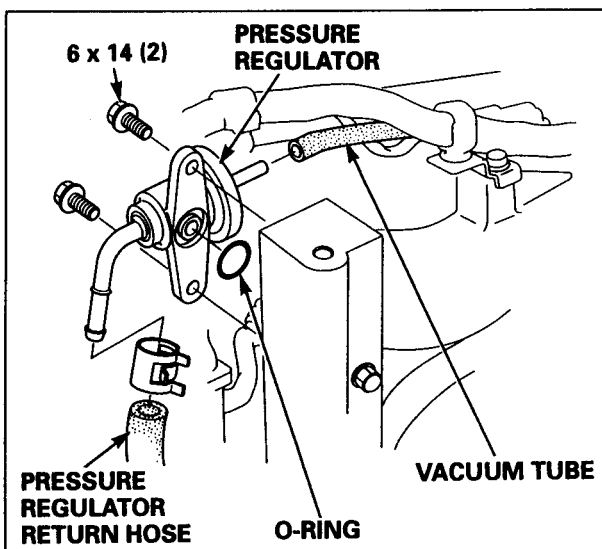
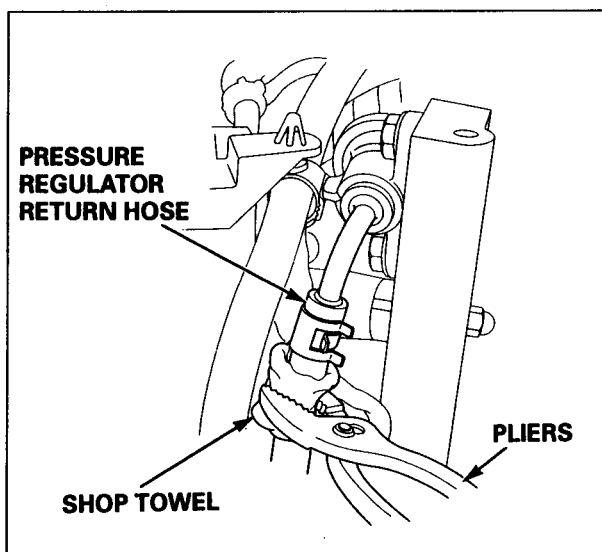
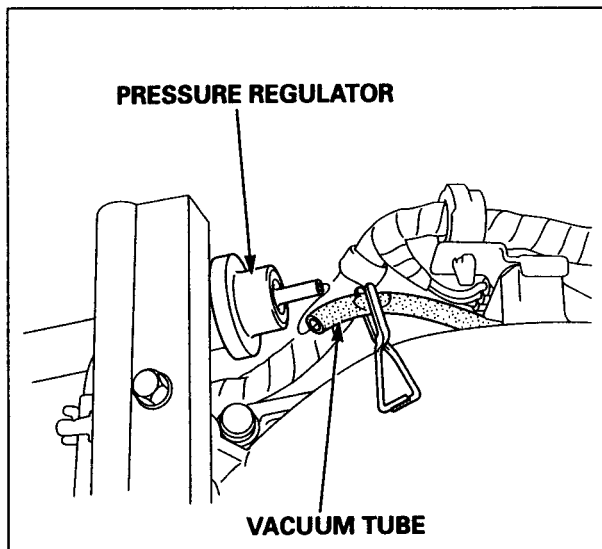
- 1) Check that the pressure regulator vacuum tube is not bent, disconnected and damaged.
- 2) Remove the propeller. Set the gear case in a test tank filled with water and start the engine.
- 3) With the engine idling, disconnect the vacuum tube from the pressure regulator and clamp the vacuum tube.
- 4) Check the fuel pressure. It should be higher than the pressure measured with the vacuum tube connected.

Standard fuel pressure [At idle speed of 750 ± 50 min <sup>-1</sup> (rpm)]	265 – 314 kPa (2.7 – 3.2 kgf/cm <sup>2</sup> , 38 – 46 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.

#### REPLACEMENT:

- Disconnect the battery cable from the battery negative (-) terminal before relieving the fuel pressure.
  - Replace the sealing washers when the service check bolt is loosened or removed.
- 1) Relieve the fuel pressure following the instruction of "How to relieve fuel pressure" (P. 5-43).
  - 2) Disconnect the vacuum tube and the pressure regulator return hose from the pressure regulator.
  - 3) Remove the two 6 x 14 mm flange bolts and remove the pressure regulator.
  - 4) Installation is the reverse order of removal. Note the following.
    - Replace the O-ring with a new one and coat it with the engine oil.





### • FUEL FILTER (HIGH PRESSURE SIDE)

- Disconnect the battery cable from the battery negative (-) terminal before relieving the fuel pressure.
- Replace the sealing washers 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 filter (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 265 – 314 kPa (2.7 – 3.2 kgf/cm<sup>2</sup>, 38 – 46 psi) with the pressure regulator vacuum tube connected, be sure that the fuel pump unit (P. 5-48) and the pressure regulator (P. 5-46) are normal, and replace the fuel filter (high pressure side).

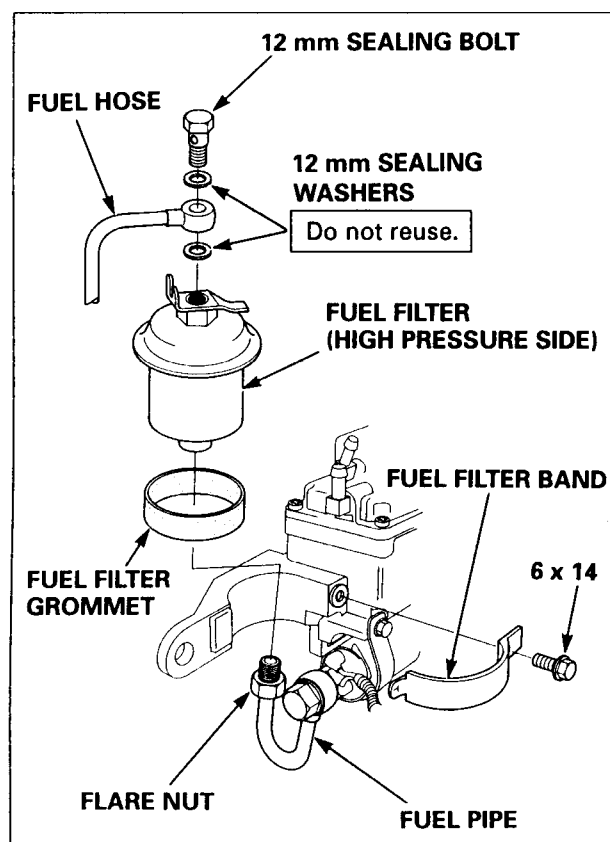
#### **REPLACEMENT:**

- 1) Relieve the fuel pressure following the instruction of "How to relieve fuel pressure" (P. 5-43).
- 2) Remove the vapor separator assembly (P. 5-61).
- 3) Remove the 12 mm sealing bolt and the flare nut from the fuel filter.

#### **CAUTION:**

**Take care not to apply excessive force onto the fuel filter body.**

- 4) Remove the 6 x 14 mm flange bolt and remove the fuel filter band.
- 5) Replace the fuel filter with a new one.
- 6) Install the new fuel filter on the vapor separator assembly (P. 5-65).
- 7) Install the vapor separator assembly (P. 5-65).



### • FUEL PUMP UNIT

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

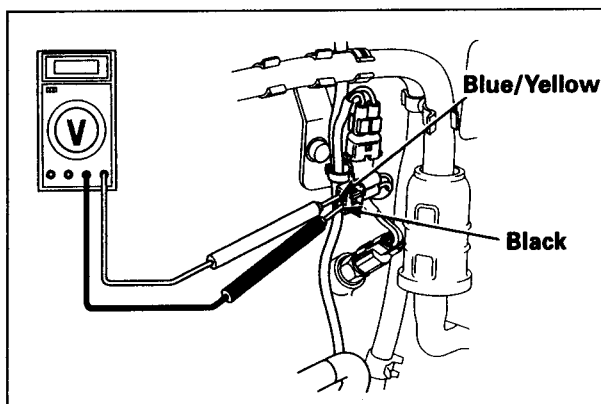
#### INSPECTION:

##### <Check>

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

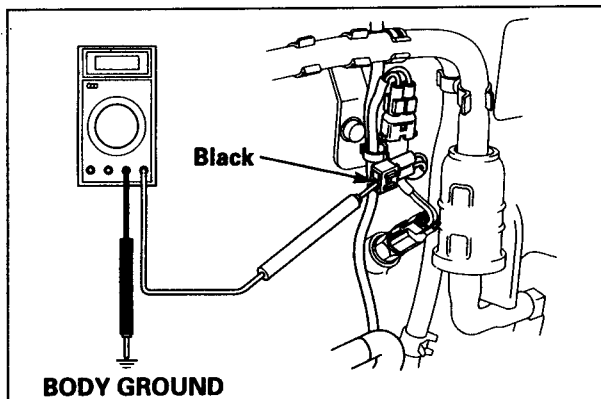
##### <Voltage check>

- Use the known-good battery for the voltage check.
- 1) Disconnect the fuel pump unit 2P connector.
  - 2) Attach the positive (+) tester lead to the blue/yellow terminal and the negative (-) tester lead to the black terminal of the remote control cable A side as shown. Turn the ignition switch ON and be sure that there is battery voltage for approximately 2 seconds.
  - 3) If there is no battery voltage, check the main relay (P. 5-49) and the PGM-FI main harness/wire harness (P. 5-53). Check to be sure that there is continuity between the black terminal of the remote control cable A side and the body ground. If there is no continuity, it indicates the open circuit in the black wire of the remote control cable A.
  - 4) 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 unit for approximately 2 seconds and measure the gasoline discharge volume.



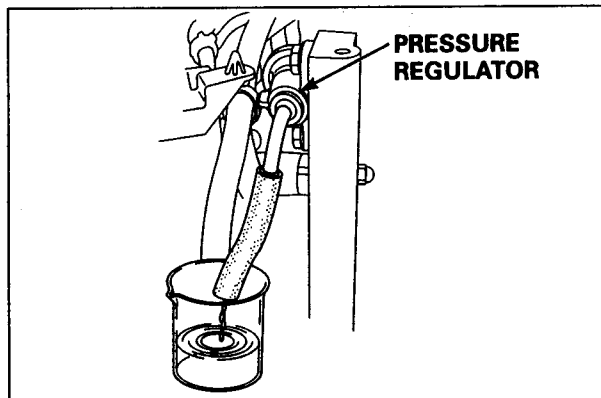
Discharge volume	45 ml (1.5 US oz, 1.6 Imp oz) or more
------------------	---------------------------------------

#### ⚠ 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.

- 3) If gasoline is not discharged or the discharge volume is too small, check the following and replace the fuel pump unit (P. 5-62).
  - Open circuit or poor contact of the main harness
  - Clogged fuel filter (high pressure side) or fuel hose/pipe
  - Faulty pressure regulator



### • MAIN RELAY

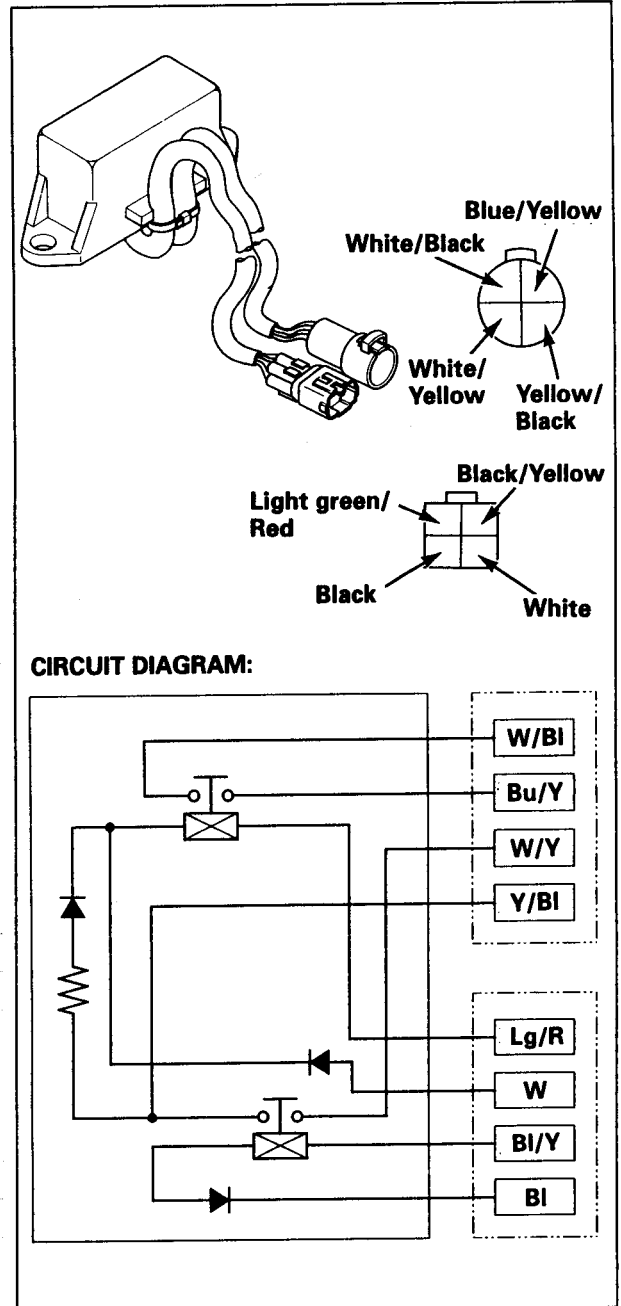
- Use the known-good battery for the voltage check.

#### INSPECTION:

- 1) Remove the main relay (P. 17-5).
- 2) Connect the battery positive (+) terminal to the main relay black/yellow terminal and the battery negative (-) terminal to the main relay black terminal. There should be continuity between the white/yellow terminal and the yellow/black terminal.
- 3) Connect the battery positive (+) terminal to the main relay white terminal and the battery negative (-) terminal to the main relay light green/red terminal. There should be continuity between the white/black terminal and the blue/yellow terminal.
- 4) Connect the battery positive (+) terminal to the main relay yellow/black terminal and the battery negative (-) terminal to the main relay light green/red terminal. There should be continuity between the white/black terminal and the blue/yellow terminal.
- 5) If there is no continuity, replace the main relay (P. 17-5).

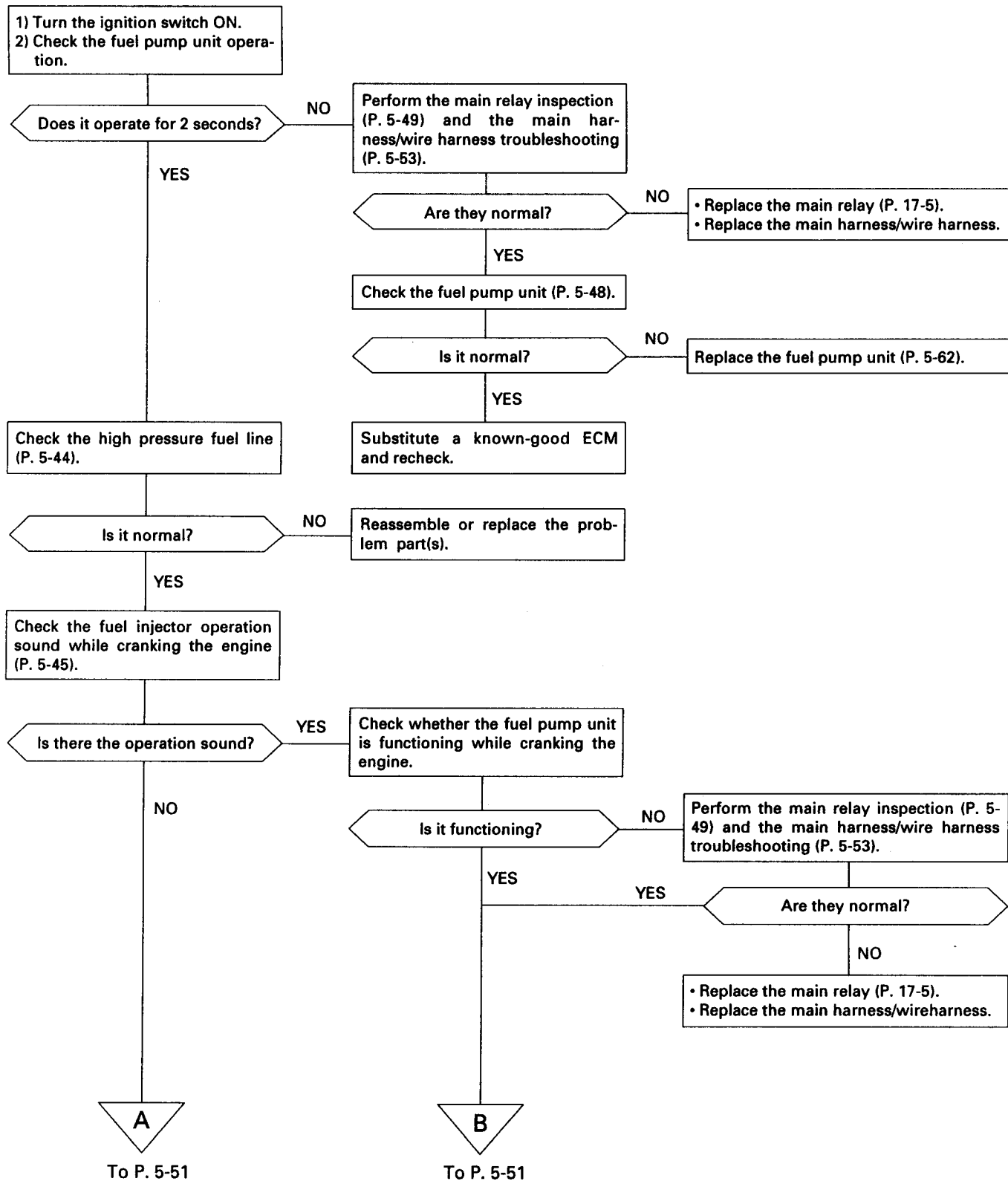
#### CAUTION:

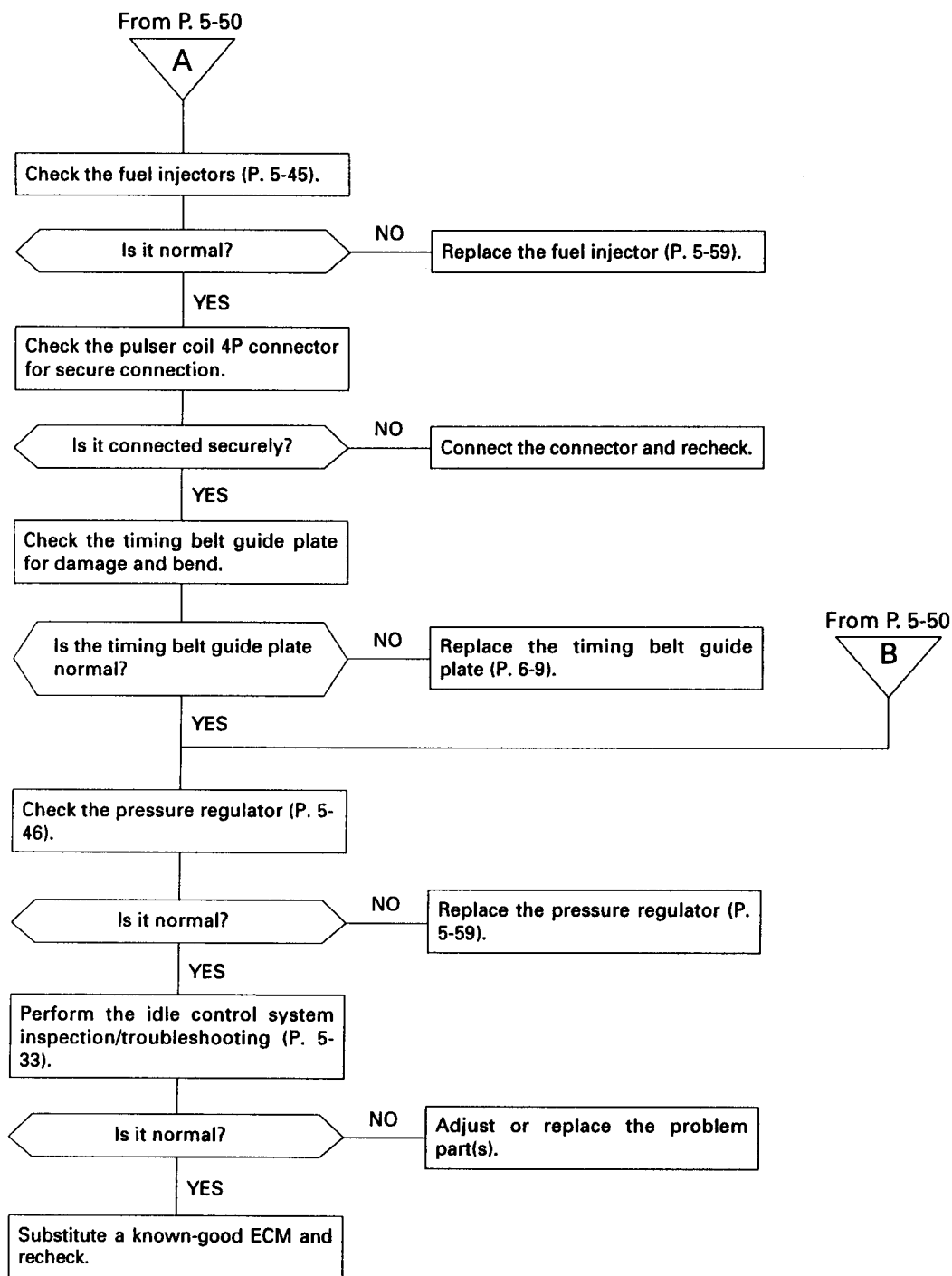
**Do not connect the battery for longer than 30 seconds.  
Wait for at least 1 minute before starting another check.**



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

### a. HIGH PRESSURE FUEL

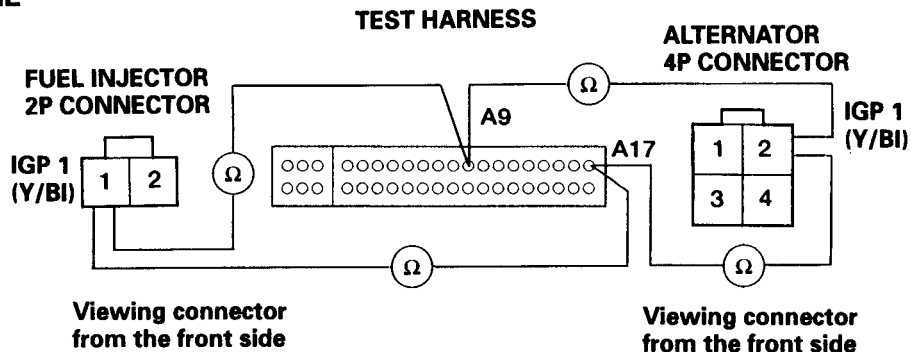




\*: Check the vapor separator if the fuel is overflowing (P. 5-64).

### b. FUEL INJECTOR POWER LINE

- 1) Turn the ignition switch OFF.
- 2) Disconnect the 2P connectors of all fuel injectors and the alternator 4P connector.
- 3) Connect the test harness to the ECM and the connector. Note that the ECM side 34P connector and the 6P connector must be disconnected this time.
- 4) Check for continuity between the test box's terminals A9 and A17 and the No.1 (Y/BI) terminal of each harness side fuel injector 2P connector and the No.2 (Y/BI) terminal of the alternator 4P connector as shown.



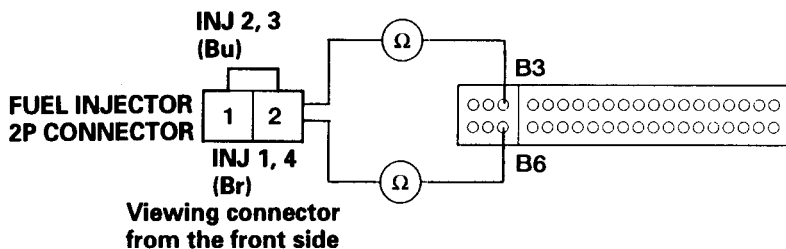
Is there continuity?

NO

Repair open in the Y/BI wire between the ECM and the fuel injector, and between the ECM and the alternator.

YES

Check for continuity between the test box's B6 terminal and the No.2 (Br) terminal of the harness side No.1/No.4 fuel injector 2P connector, and between the B3 terminal and the No.2 (Bu) terminal of the No.2/No.3 fuel injector 2P connector.



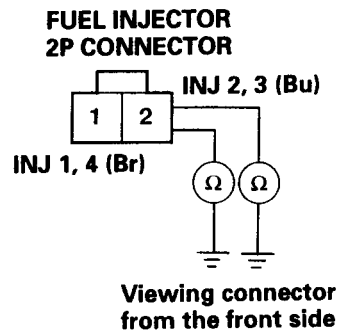
Is there continuity?

NO

Repair open in the Br and Bu wires between the ECM and the fuel injectors.

YES

Check for continuity between the body ground and each of the No.2 (Br) terminal of the harness side No.1/No.4 fuel injector 2P connector and the No.2 (Bu) terminal of the No.2/No.3 fuel injector 2P connector.



Is there continuity?

YES

Repair short in the Br and Bu wires between the ECM and the fuel injectors.

NO

Check for continuity between the body ground and the test box's terminals B4 and B5.

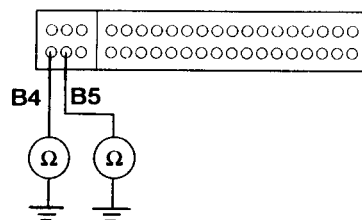
Is there continuity?

NO

- Repair open in the Br/BI wire between the ECM and the body ground.
- Connect the ground wire securely.

YES

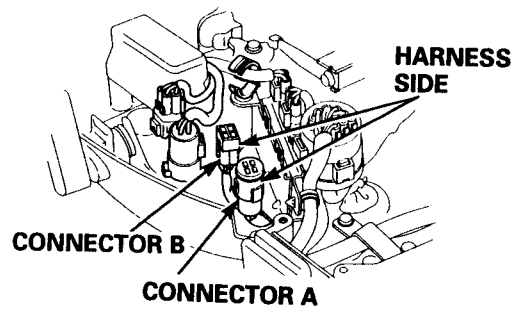
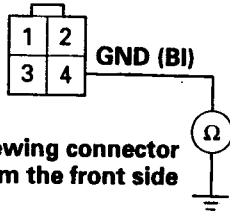
Fuel injector line main harness is normal.



### c. PGM-FI MAIN HARNESS/WIRE HARNESS (POWER SUPPLY LINE)

- 1) Turn the ignition switch OFF.
- 2) Disconnect the two 4P connectors from the main relay.
- 3) Check for continuity between the No.4 (BI) terminal of the harness side main relay 4P connector B and the body ground.

**CONNECTOR B**



Is there continuity?

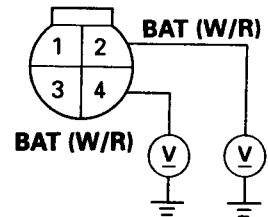
NO

Repair open in the BI wire between the main relay and the body ground.

YES

- Connect the positive (+) tester lead to the No.2 (W/R) and No.4 (W/R) terminals of the harness side main relay 4P connector A, and connect the negative (-) tester lead to the body ground. Measure the voltage.

**CONNECTOR A**



Is there the battery voltage?

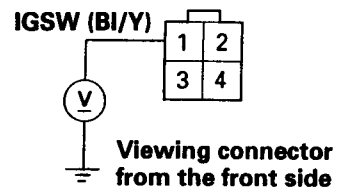
NO

- Replace the FI 30A fuse (P. 17-19).
- Repair open or short in the W/R wire between the main harness' main relay 4P connector A and the FI 30A fuse.

YES

- 1) Turn the ignition switch ON.
- 2) Connect the positive (+) tester lead to the No.1 (BI/Y) terminal of the harness side main relay 4P connector B and the negative (-) tester lead to the body ground. Measure the voltage.

**CONNECTOR B**



Is there the battery voltage?

NO

- Replace the 10A fuse (P. 17-19).
- Repair open or short in the BI/Y wire between the main harness' main relay 4P connector B and the ignition switch.
- Replace the ignition switch (P. 15-3 and 7).

YES

- 1) Turn the ignition switch OFF.
- 2) Disconnect the starter magnetic switch wire (S terminal) from the starter motor (P. 17-9). [\*1]
- 3) Set the lever in the "N" (neutral) position.
- 4) Turn the ignition switch to the START position and check the starter magnetic switch.

\*1: When the ignition switch is at the START position, the starter magnetic switch wire (S terminal) is under the battery voltage, which is very dangerous. When the starter magnetic switch wire (S terminal) is disconnected, wrap a piece of the tape or equivalent around the starter magnetic switch wire (S) terminal and protect it.

Is there the operation sound from the starter magnetic switch?

NO

Check the starter main line.

YES

To P. 5-54

From P. 5-53

- 1) Turn the ignition switch to START.
- 2) Connect the positive (+) tester lead to the No.3 (W) terminal of the harness side main relay 4P connector B and the negative (-) tester lead to the body ground. Measure the voltage.

Is there the battery voltage?

YES

NO

Repair open in the W wire between the main harness' main relay 4P connector B and the starter magnetic switch.

- 1) Turn the ignition switch OFF.
- 2) Connect the test harness to the ECM and the connector. Note that the ECM side 34P and the 6P connectors must be disconnected this time.
- 3) Check for continuity between the No.2 (Lg/R) terminal of the harness side main relay 4P connector B and the test box's respective terminals of A2 and A11.

Is there continuity?

YES

NO

Repair open in the Lg/R wire between the ECM and the main harness' main relay 4P connector B.

- 1) Disconnect the fuel pump unit 2P connector.
- 2) Check for continuity between the No.1 (Bu/Y) wire of the harness side main relay 4P connector A and the No.1 (Bu/Y) terminal of the harness side fuel pump unit 2P connector.

Is there continuity?

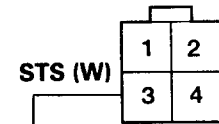
YES

NO

Repair open in the Bu/Y wire between the main harness' main relay 4P connector A and the fuel pump unit.

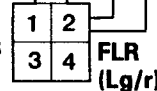
To P. 5-55

CONNECTOR B

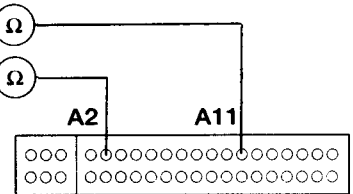


Viewing connector from the front side

CONNECTOR B



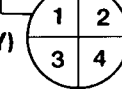
Viewing connector from the front side



TEST HARNESS

CONNECTOR A

FP (Bu/Y)



Viewing connector from the front side

FUEL PUMP UNIT 2P CONNECTOR

FP (Bu/Y)



Viewing connector from the front side



From P. 5-54

- 1) Connect the test harness 34P connector to the ECM.
- 2) Connect the two 4P connectors to the main relay.
- 3) Turn the ignition switch ON.
- 4) Measure the voltage between the test box's A9, A17 terminals and the A25, A34 terminals respectively.

Is there the battery voltage?

NO

- Repair open in the Y/BI wire between the ECM and the main relay.
- Replace the main relay (P. 17-5).

YES

- 1) Turn the ignition switch OFF.
- 2) Measure the voltage between the test box's A2, A11 terminals and the A25, A34 terminals 2 seconds after turning the ignition switch ON.

Is there the battery voltage?

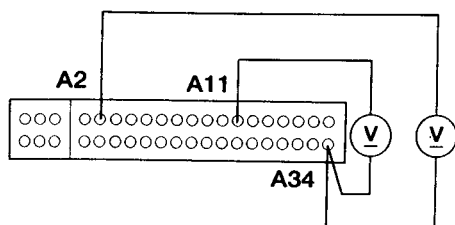
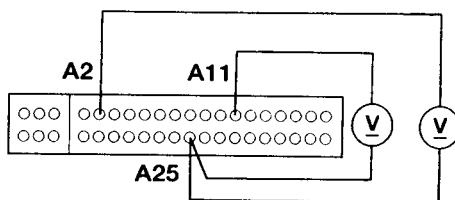
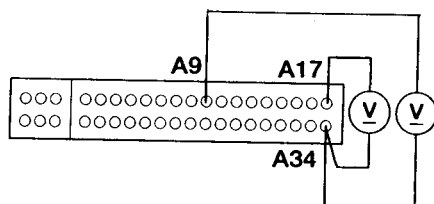
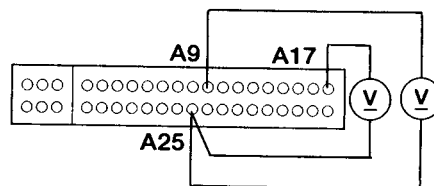
NO

- Repair short in the Lg/R wire between the ECM and the main relay.
- Replace the main relay (P. 17-5).

YES

PGM-FI main harness and the wire harness (power supply line) are normal.

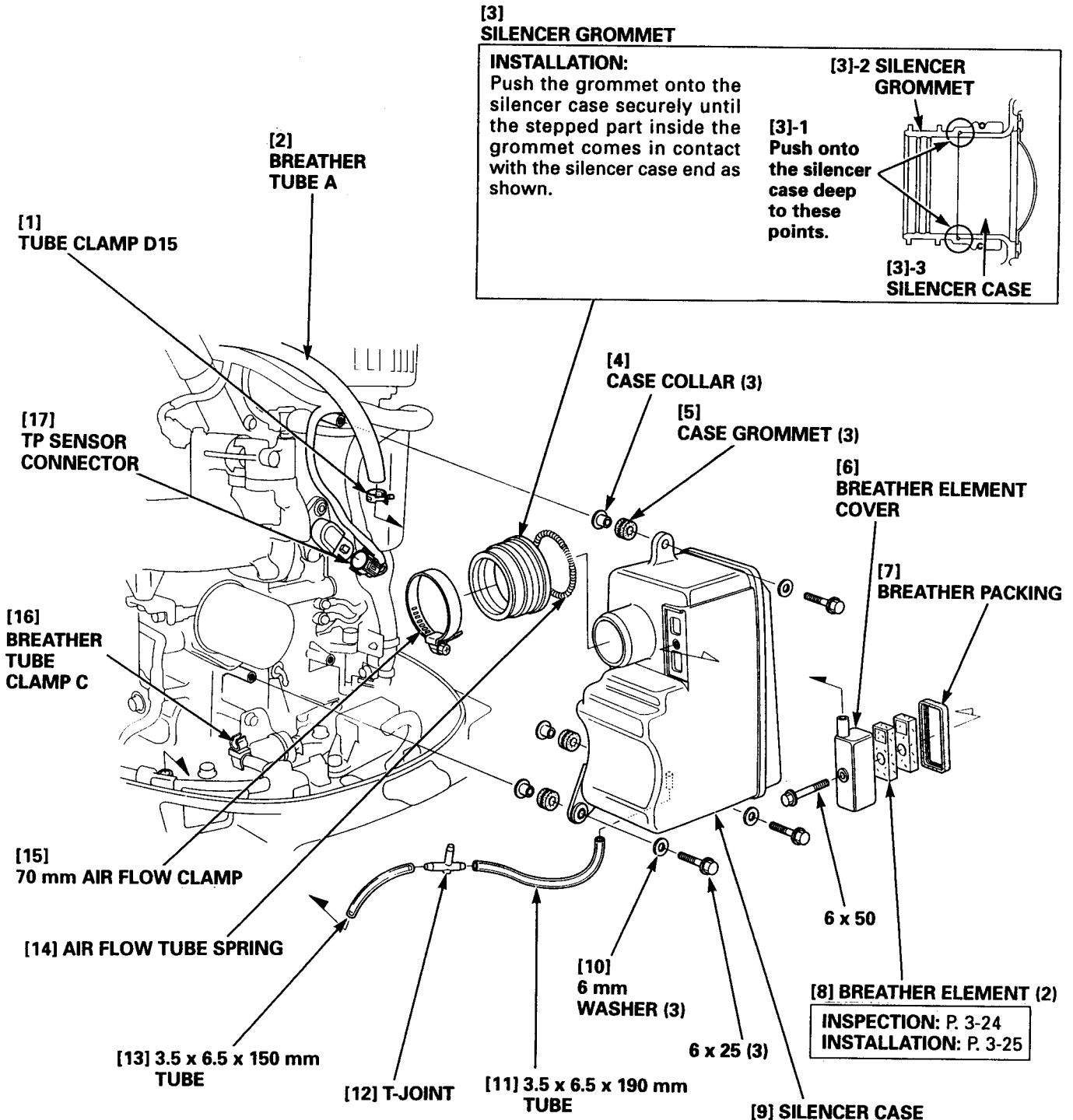
### TEST HARNESS



### 5. SILENCER CASE

#### a. REMOVAL/INSTALLATION

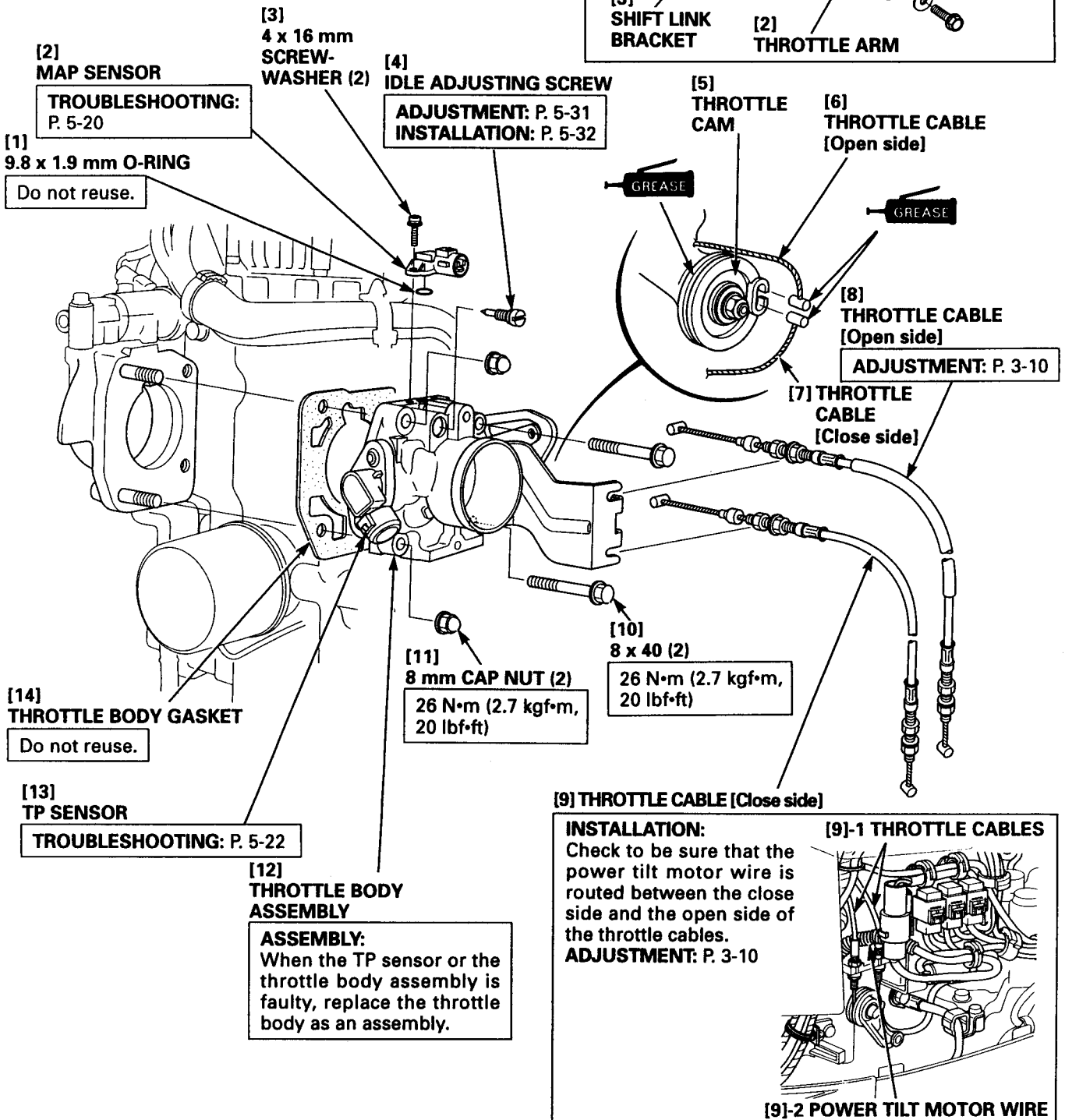
Remove the engine cover and disconnect the TP sensor connector.



### 6. THROTTLE BODY ASSEMBLY

#### a. REMOVAL/INSTALLATION

- 1) Remove the silencer case (P. 5-56).
- 2) Disconnect the remote control cable (throttle side) (P. 16-1).
- 3) Remove the throttle arm from the shift link bracket. Disconnect the two throttle cables from the throttle arm.



## 7. FUEL PUMP (LOW PRESSURE SIDE)

### a. REMOVAL/INSTALLATION

- After connecting the fuel tube, check for gasoline leakage from the fuel tube and joints.

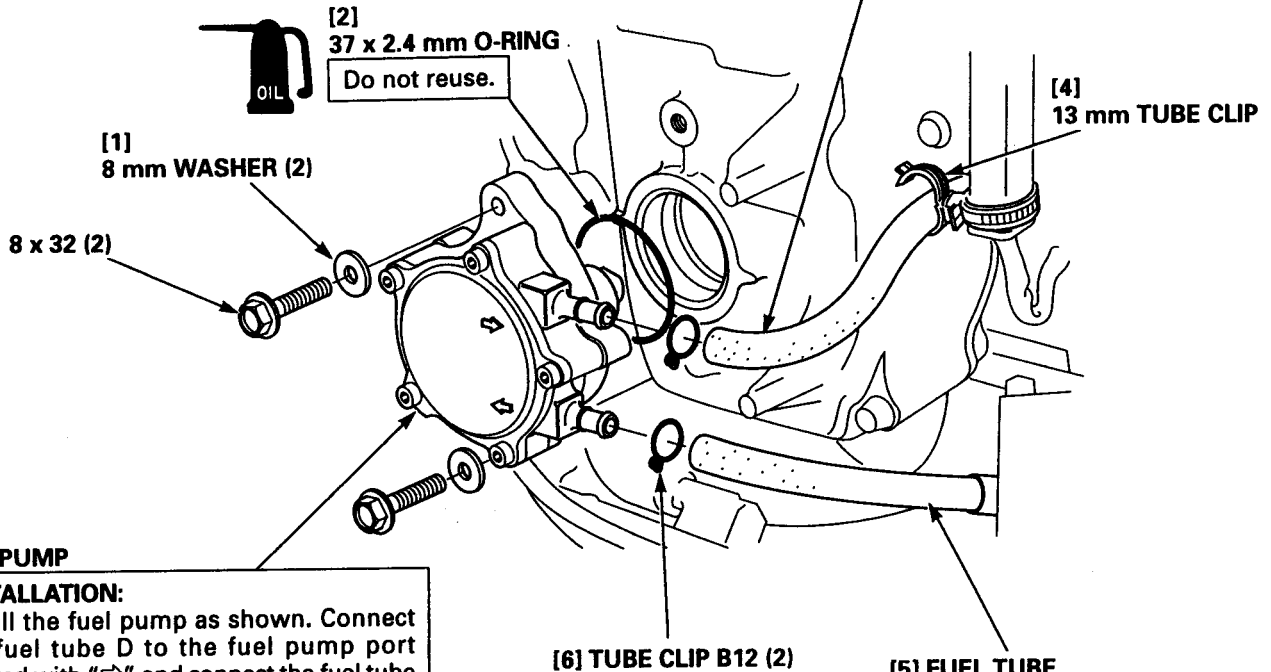
#### ⚠ WARNING

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) Remove the engine cover (P. 3-5).
- 2) Remove the rear separate case (P. 3-6).



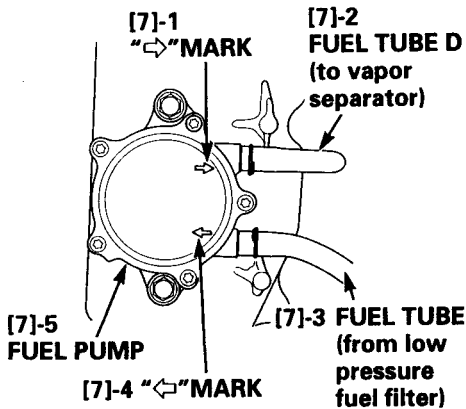
#### INSPECTION:

Check for the cracks and other damage and replace if necessary.

#### [7] FUEL PUMP

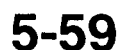
##### INSTALLATION:

Install the fuel pump as shown. Connect the fuel tube D to the fuel pump port marked with "⇐" and connect the fuel tube to the port marked with "⇐" as shown.



#### INSPECTION:

Check for the cracks and other damage and replace if necessary.



**b. INSTALLATION**

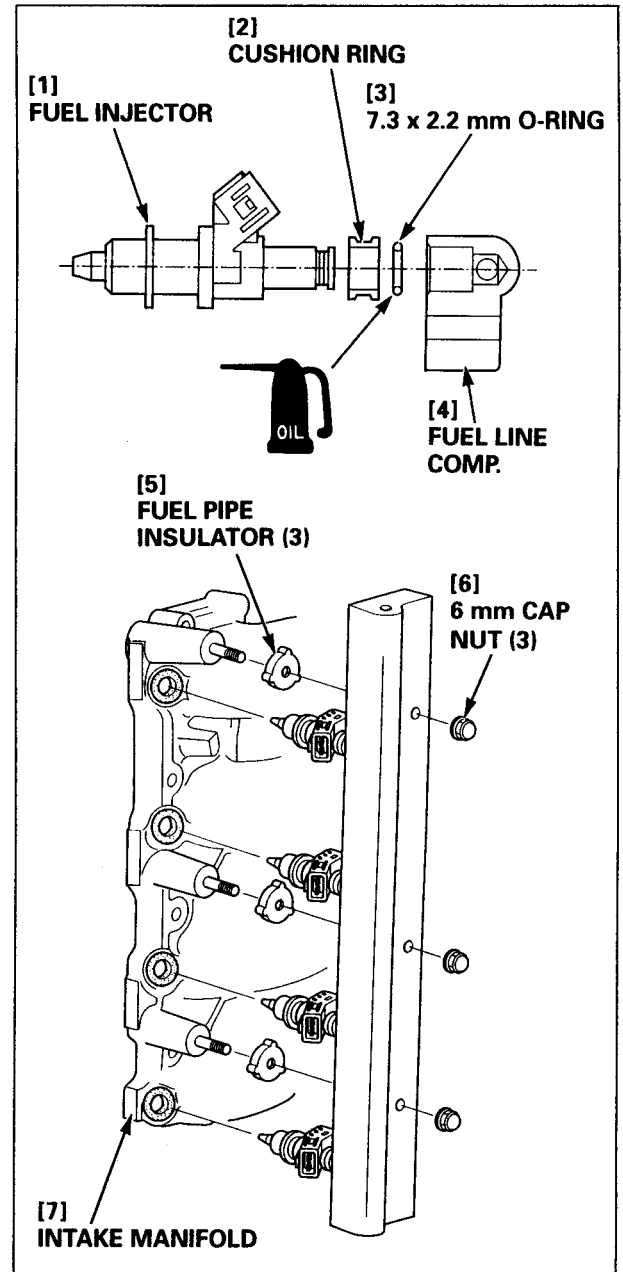
- Replace the O-ring, cushion ring and the injector seal ring with the new ones on disassembly.

- 1) Install a new cushion ring on the fuel injector.
- 2) Apply the engine oil to a new 7.3 x 2.2 mm O-ring, and set it in the groove in the fuel injector.
- 3) Install the four fuel injectors on the fuel line comp.

**NOTE:**

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

- 4) Apply engine oil to the inner wall of the new injector seal rings, and install the seal rings in the intake manifold (P. 5-59).
- 5) Install the fuel pipe insulators on the intake manifold (P. 5-59).
- 6) Install the fuel line comp. mounted with the fuel injectors on the intake manifold.
  - To prevent damage to the O-rings, install the fuel injectors on the fuel line comp. side, and install the assembly on the intake manifold.
- 7) Tighten the fuel line comp. with the three 6 mm cap nuts.
- 8) Connect the vacuum tube, pressure regulator return hose, injector connectors and the fuel hose (P. 5-59).
- 9) Connect the battery cable to the battery negative (–) terminal and turn the ignition switch ON. The fuel pump should run for approximately 2 seconds, and the fuel pressure in the high pressure fuel line should rise. Repeat this procedure 2 or 3 times, and check for fuel leakage from the fuel line and joints.
- 10) Measure the fuel pressure (P. 5-43).



## 9. VAPOR SEPARATOR/FUEL PUMP UNIT

### a. REMOVAL/INSTALLATION

- Disconnect the battery cable from the battery negative (-) terminal.
- Relieve the fuel pressure before removing the vapor separator (P. 5-43).

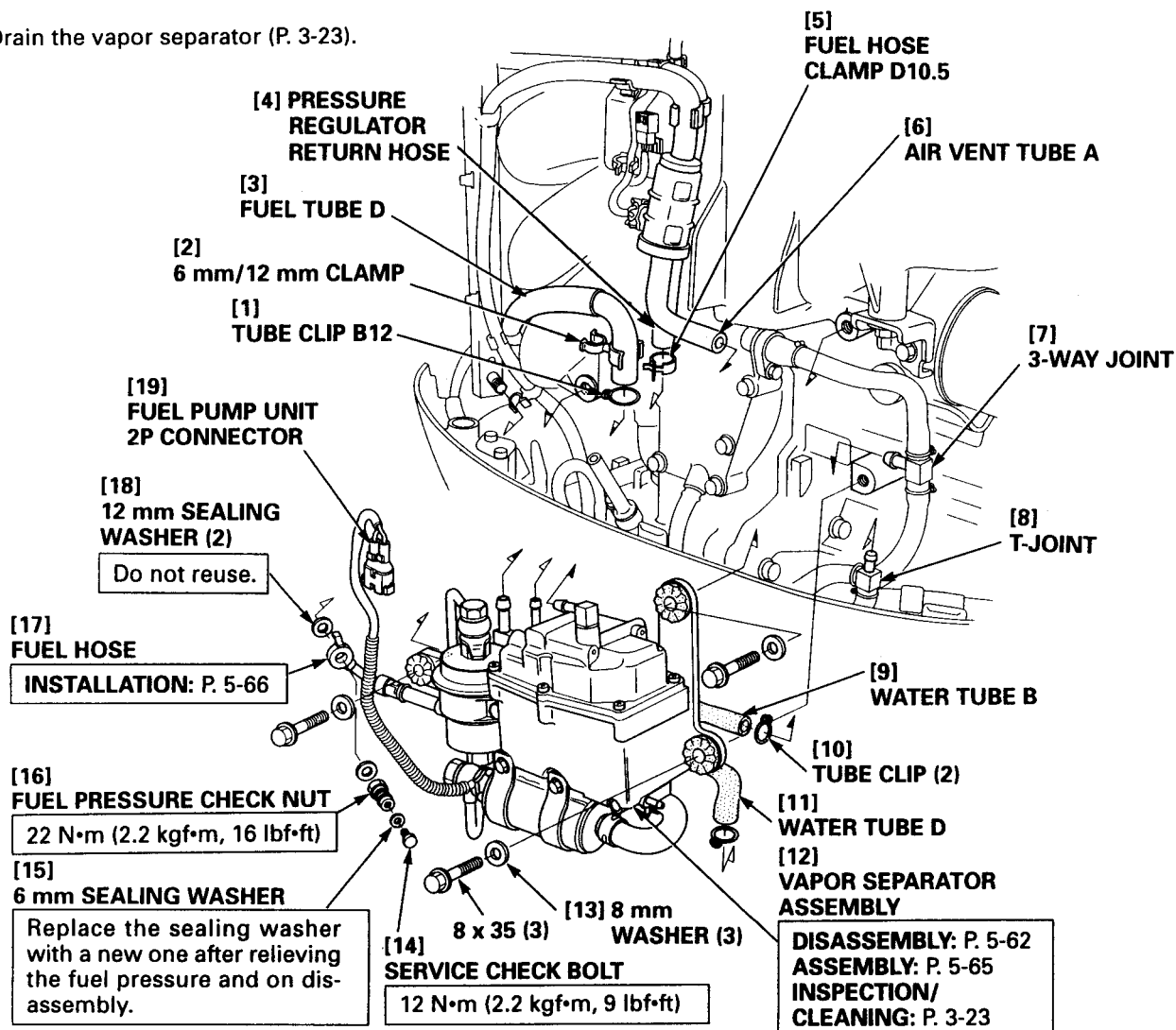
#### ⚠ WARNING

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) Remove the engine cover, relieve the fuel pressure (P. 5-43), and remove the oil level gauge.
- 2) Drain the vapor separator (P. 3-23).



## **b. DISASSEMBLY**

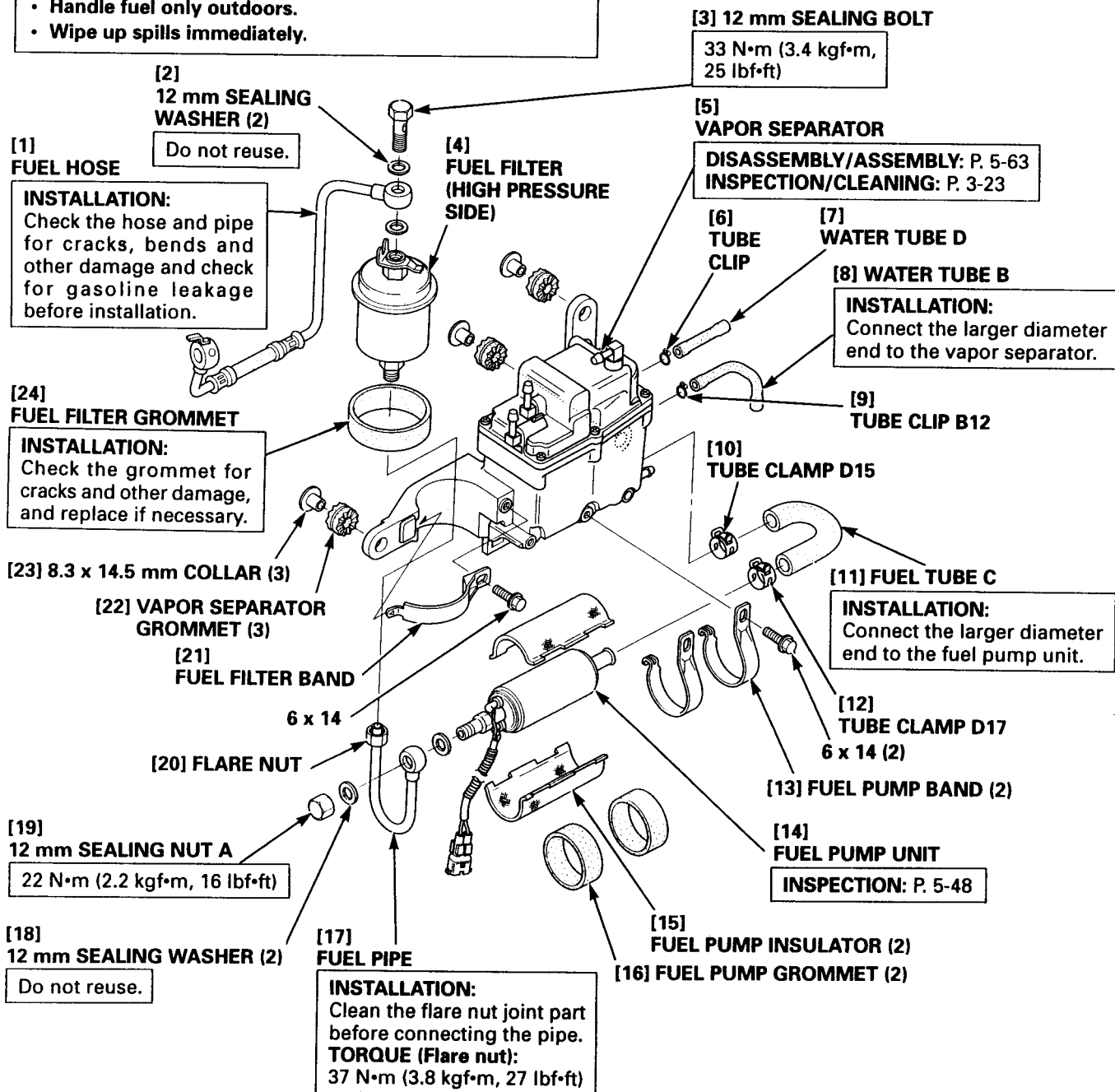
- Check each tube for cracks and other damage and replace if necessary.
- After connecting the hoses and tubes, check for gasoline leakage from the hoses/tubes and the joints.

**! 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.**





### • VAPOR SEPARATOR DISASSEMBLY/ASSEMBLY

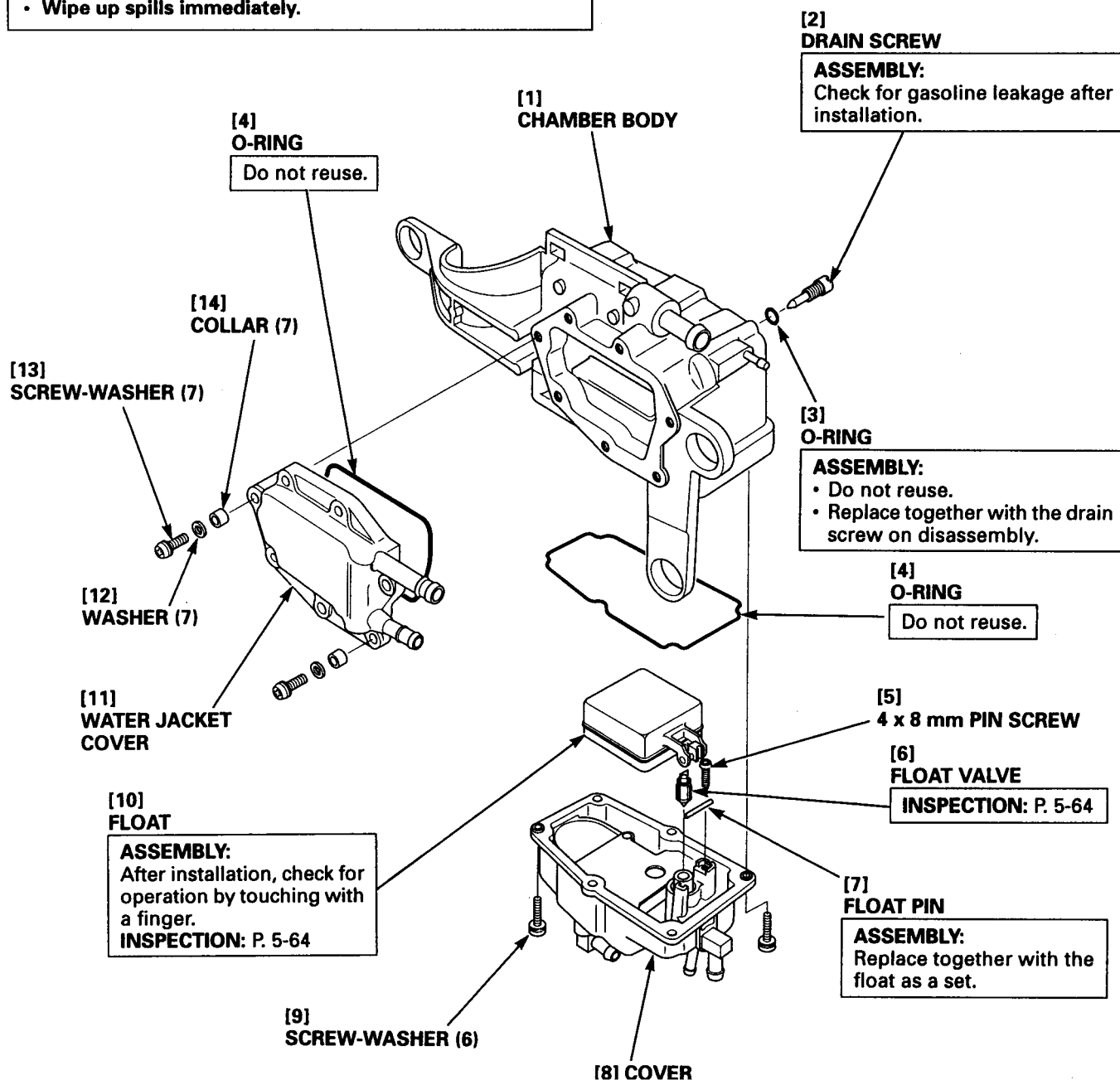
- Loosen the drain screw and drain the vapor separator before disassembly (P. 3-23).

#### ⚠ 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.



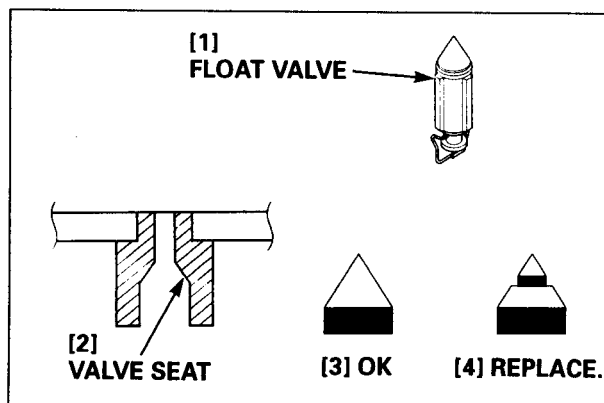
### c. INSPECTION

#### ● VAPOR SEPARATOR

- 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.



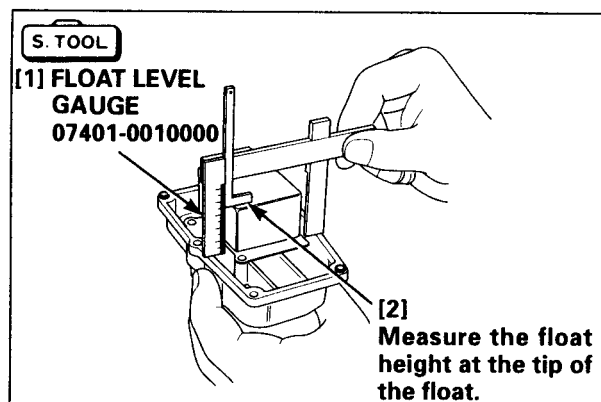
#### FLOAT HEIGHT:

- 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.



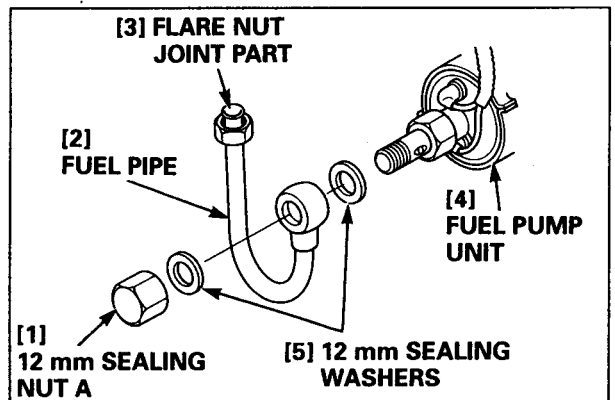
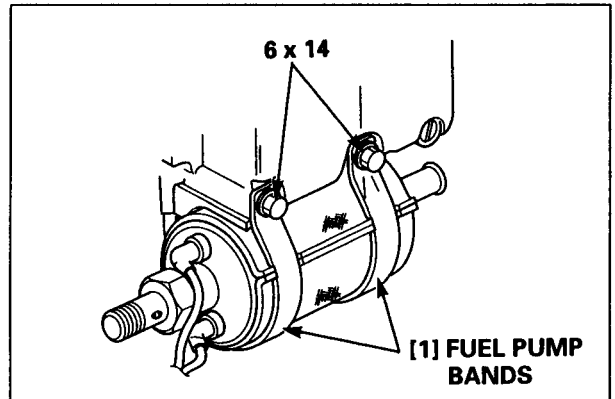
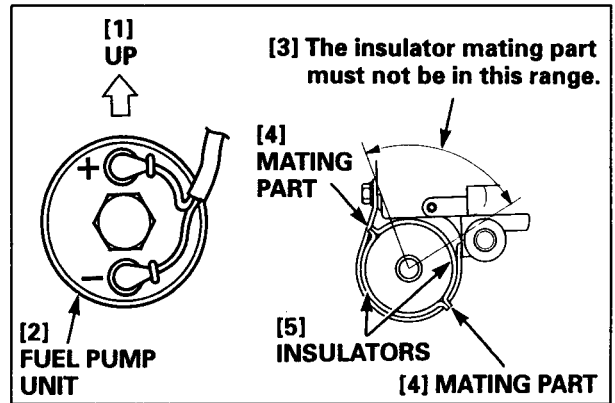
#### TOOL:

Float level gauge

07401-0010000

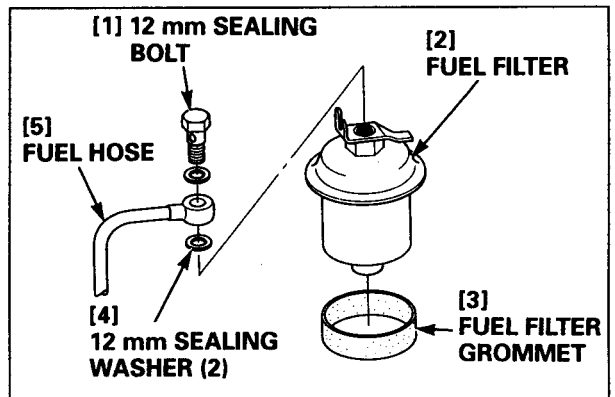
### d. ASSEMBLY

- Replace the sealing washers with new ones.
- 1) Set the two insulators on the fuel pump unit and secure with the two grommets.
- 2) Hold the fuel pump unit with the positive (+) side of the wire toward up when viewing the fuel pipe installation part of the pump unit from the front side. Hold the fuel pump unit at the angle where the insulator mating part does not contact the bottom of the vapor separator when viewing the fuel tube C installation part of the fuel pump unit from the front side as shown.
- 3) Holding the fuel pump unit securely, so that it does not come out of position (explained in step 2), install the two fuel pump bands and loosely tighten the two 6 x 14 mm flange bolts.
- 4) Clean the flare nut joint part of the fuel pipe. Install new 12 mm sealing washers on the fuel pump unit, and loosely tighten the 12 mm sealing nut A.

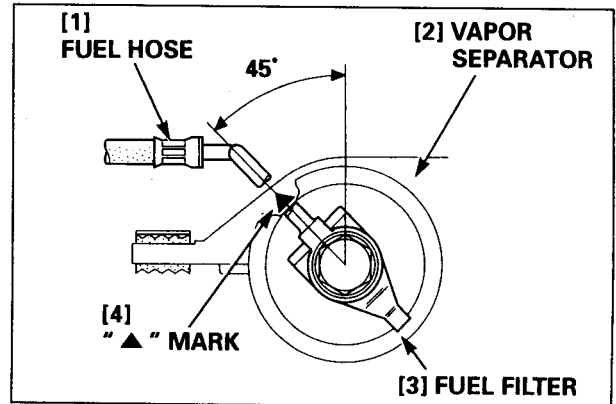


- 5) Install the fuel filter grommet on the fuel filter.
- 6) Install new 12 mm sealing washers and the fuel hose on the top of the fuel filter, and tighten the 12 mm sealing bolt securely.

**TORQUE: 33 N·m (3.4 kgf·m, 25 lbf·ft)**



- 7) Set the fuel filter on the vapor separator by aligning the "▲" mark on the vapor separator with the fuel filter as shown.



- 8) Loosely tighten the fuel pipe flare nut.
- 9) Install the fuel filter band, and loosely tighten the 6 x 14 mm flange bolts.
- 10) Tighten the fuel pipe flare nut securely taking care not to let the alignment mark on the vapor separator and the fuel hose come out of alignment.

**TORQUE: 37 N·m (3.8 kgf·m, 27 lbf·ft)**

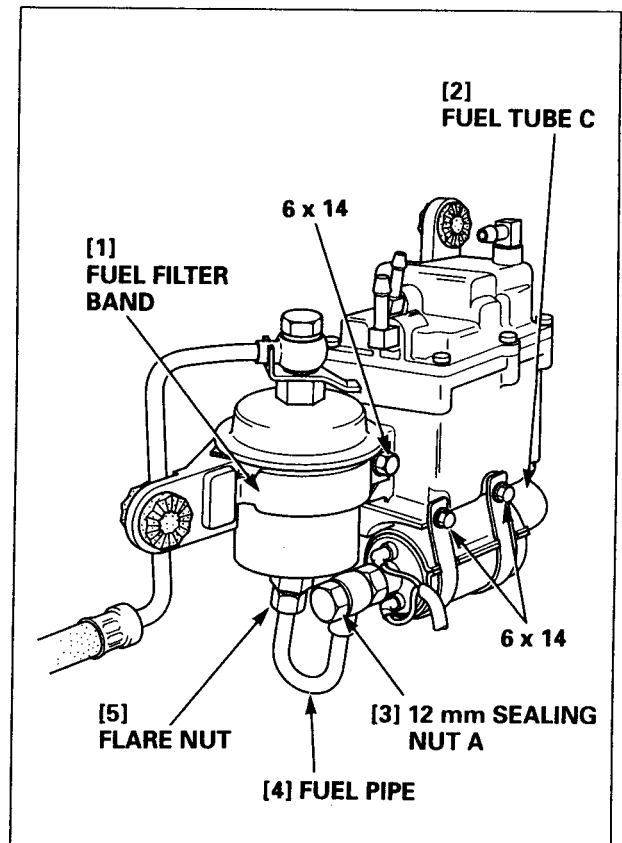
- 11) Tighten the 12 mm sealing nut A to the specified torque.

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

- 12) Tighten the three 6 x 14 mm flange bolts securely.

- 13) Install the fuel tube C (P. 5-62).

- 14) Install the vapor separator on the outboard motor.



- 15) Set the new 12 mm sealing washer on the fuel hose under the fuel line comp., and install the fuel hose by aligning the fuel hose tab with the hole in the fuel line.

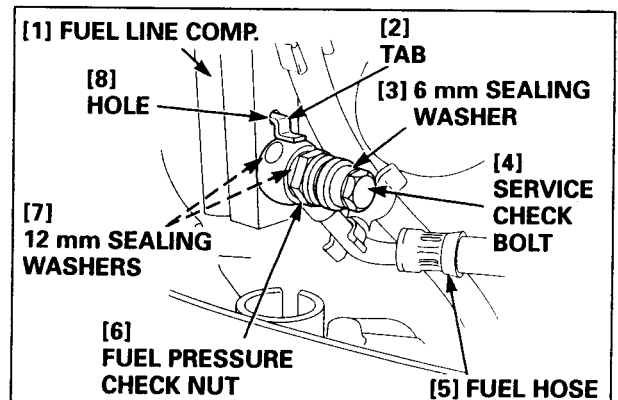
Install the new 12 mm sealing washers and tighten the fuel pressure check nut to the specified torque.

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

- 16) Set the new 6 mm sealing washer on the service check bolt, and tighten the service check bolt to the specified torque.

**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**

- 17) Tighten the vapor separator using the three 8 x 35 mm flange bolts.



## 10. INTAKE MANIFOLD ASSEMBLY REMOVAL/INSTALLATION

### a. REMOVAL

- Disconnect the battery cable from the battery negative (-) terminal.

- 1) Remove the engine cover (P. 3-5).
- 2) Relieve the fuel pressure per "How to relieve fuel pressure" (P. 5-43).

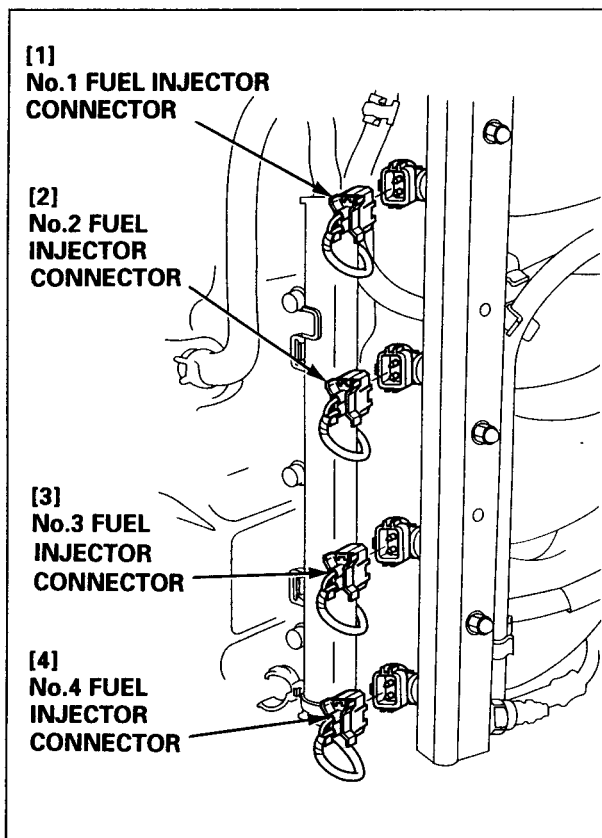
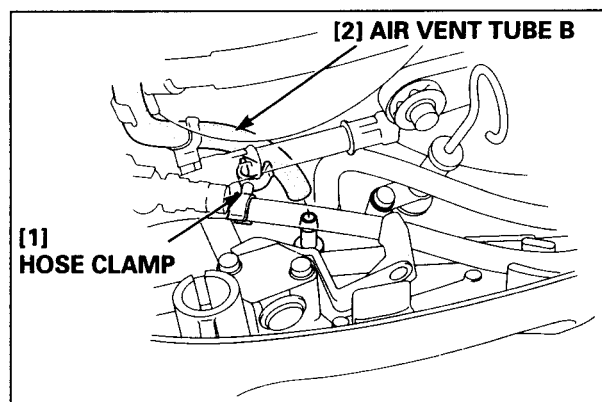
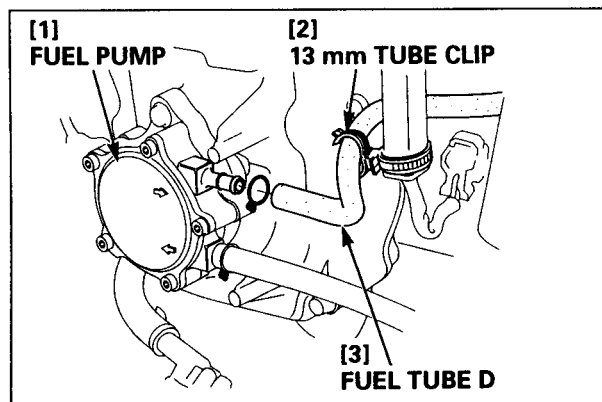
#### **⚠ WARNING**

**Gasoline is highly flammable and explosive.**

**You can be burned or seriously injured when handling fuel.**

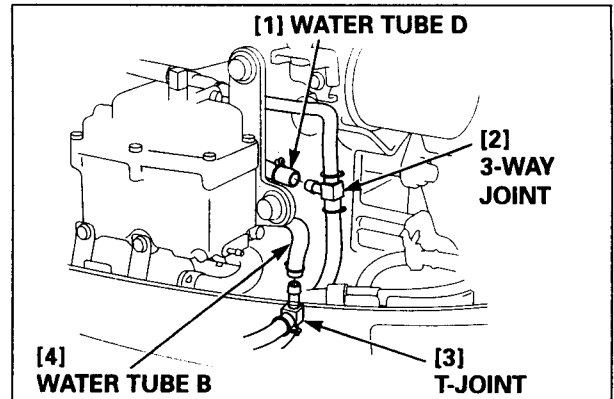
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

- 3) Remove the rear separate case (P. 3-6).
- 4) Disconnect the fuel tube D from the fuel pump and release the 13 mm tube clip.
- 5) Release the air vent tube B from the hose clamp and disconnect the air vent tube B from the mounting case.
- 6) Disconnect all fuel injector connectors from the fuel injector.



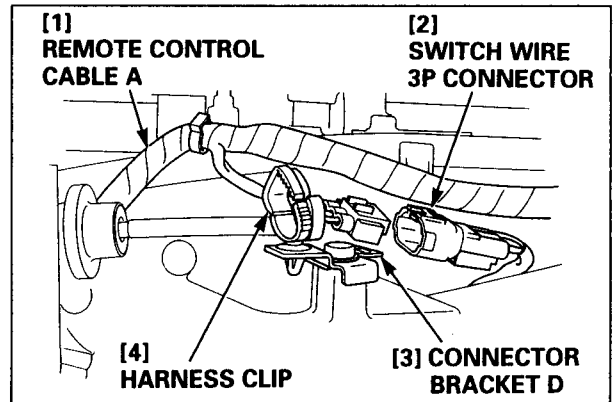
- 7) Disconnect the water tube D from the 3-way joint.

Disconnect the water tube B from the T-joint.



- 8) Open the harness clip and release the remote control cable A.

Remove the switch wire 3P connector from the connector bracket D, and disconnect the connector.

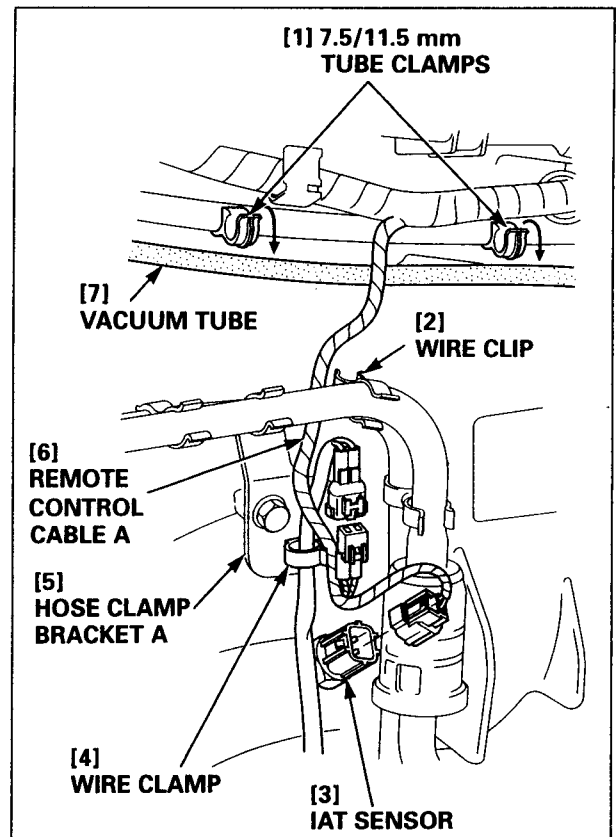


- 9) Release the vacuum tube from the two 7.5/11.5 mm tube clamps.

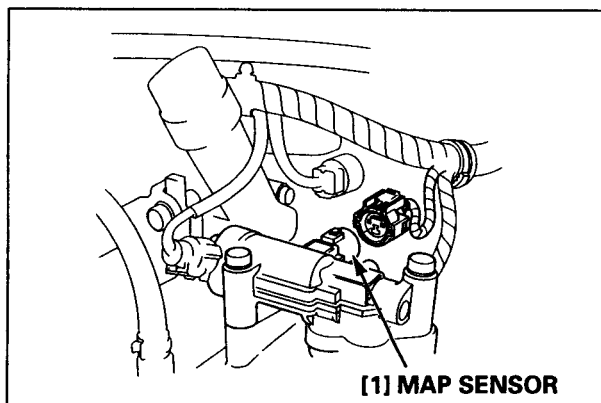
Remove the fuel pump unit 2P connector from the hose clamp bracket A, and disconnect the connector.

Disconnect the connector from the IAT sensor.

Release the remote control cable A from the wire clamp and the wire clip.



10) Disconnect the connector from the MAP sensor.

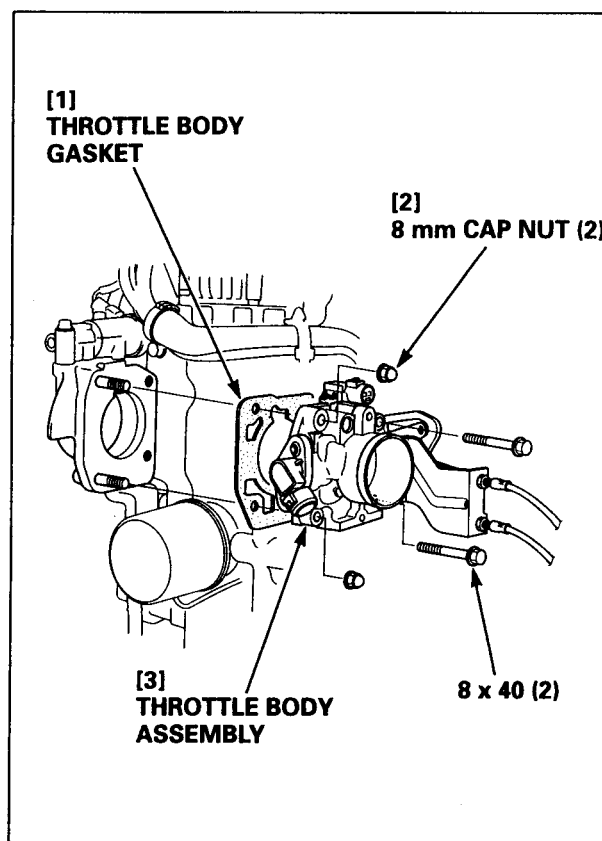


11) Remove the silencer case (P. 3-10).

12) Remove the throttle body assembly from the intake manifold.

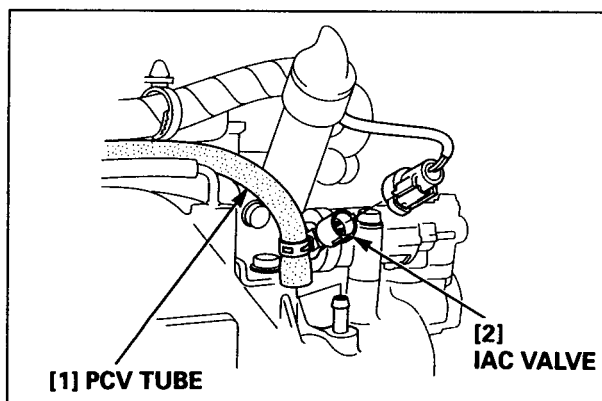
Remove the throttle body gasket.

- Do not reuse the throttle body gasket.



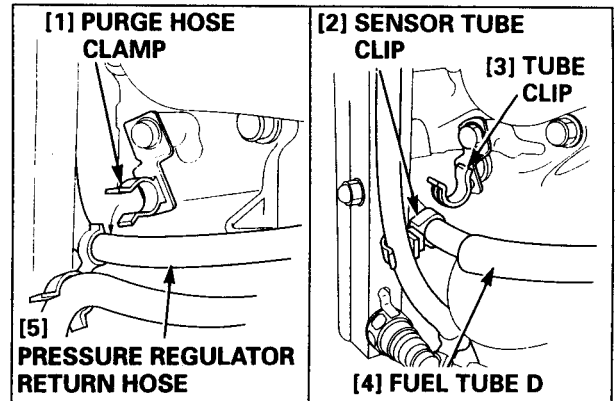
13) Disconnect the connector from the IAC valve.

Disconnect and remove the PCV tube.

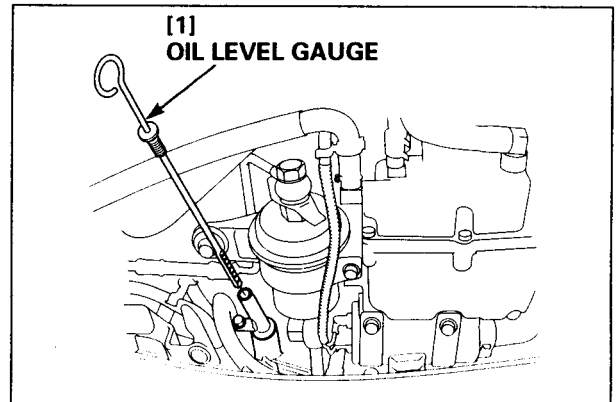


- 14) Release the pressure regulator return hose from the purge hose clamp.

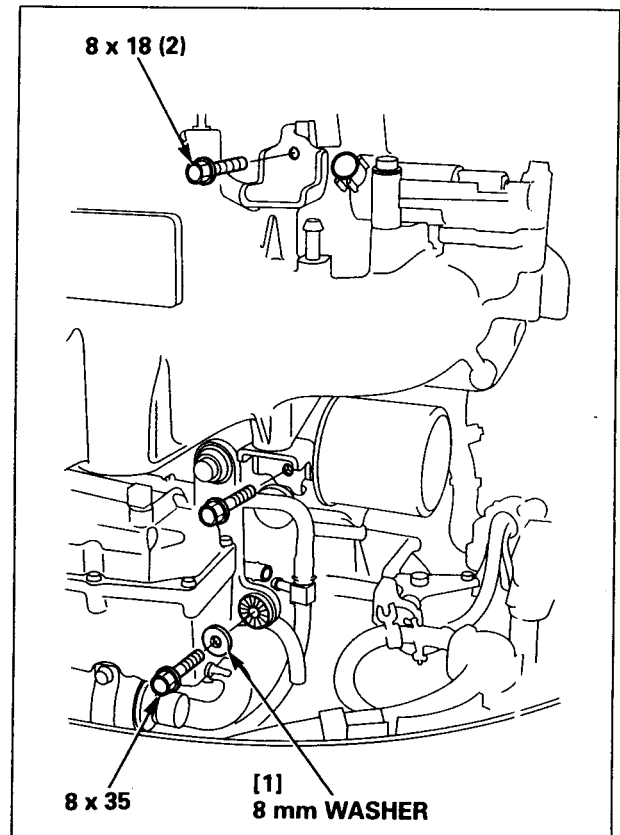
Release the fuel tube D from the tube clip and the sensor tube clip.



- 15) Remove the oil level gauge.



- 16) Remove the two 8 x 18 mm flange bolts and a an 8 x 35 mm flange bolt.

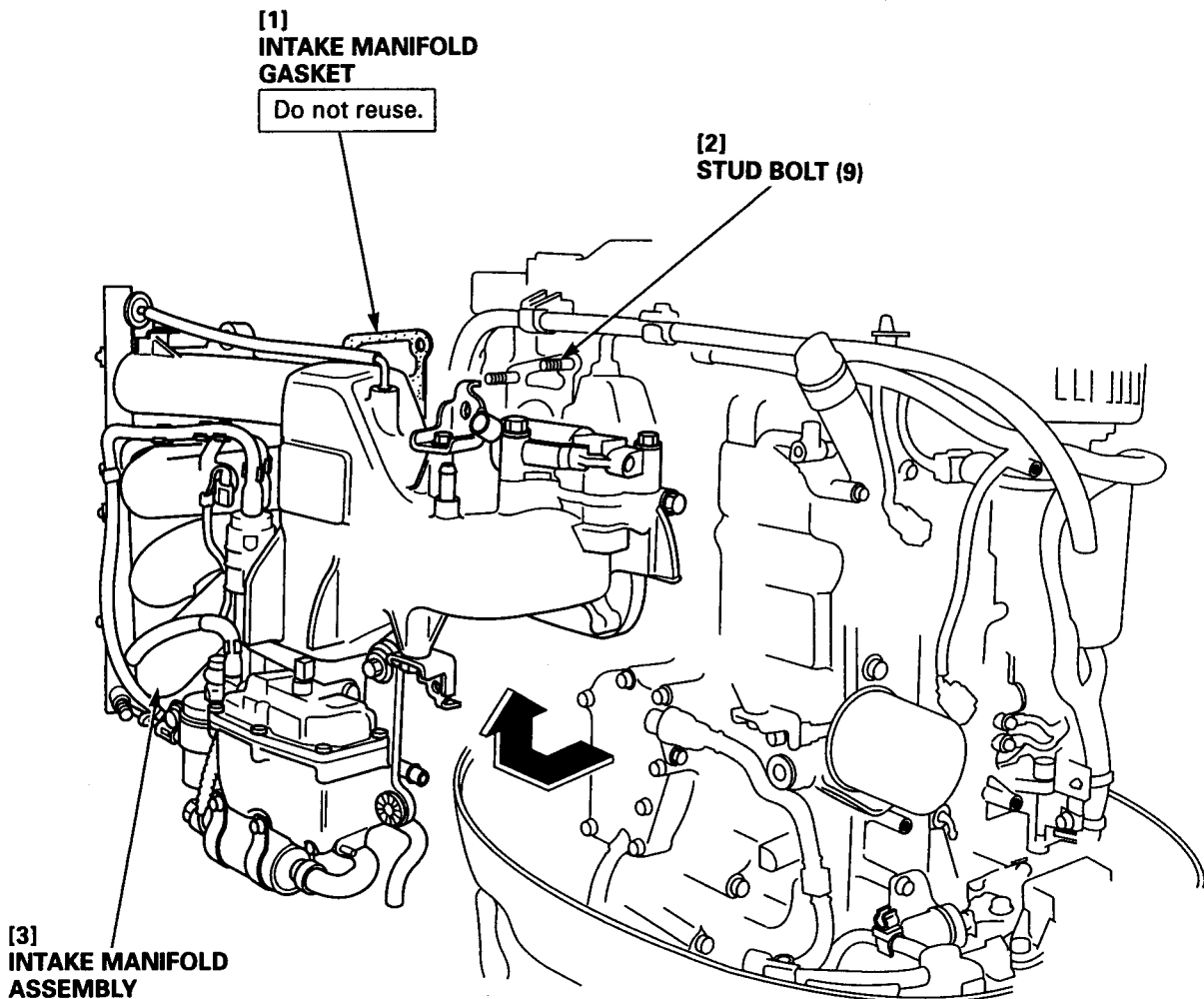
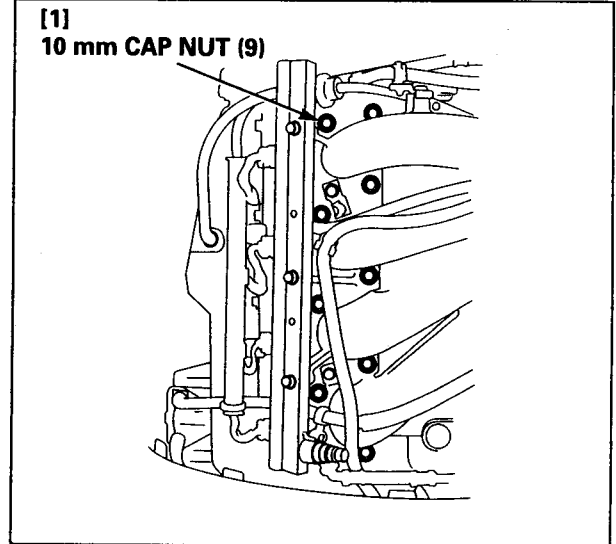




17) Remove the nine 10 mm cap nuts from the intake manifold.

18) Pull out the intake manifold assembly toward you. When the intake manifold assembly has cleared the stud bolts, move the intake manifold assembly a little toward the cylinder head and lift it up to remove.

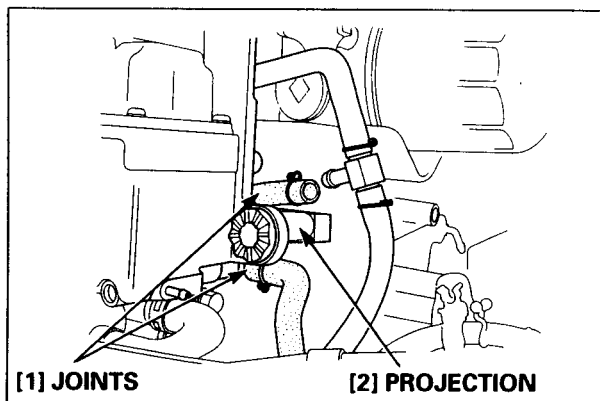
19) Remove the intake manifold gasket.



### b. INSTALLATION

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

- 1) When installing the intake manifold assembly, set the protection on the cylinder block between the hose joints. Take care not to damage the area between the hose joints at the back of the vapor separator with the projection on the cylinder block this time.

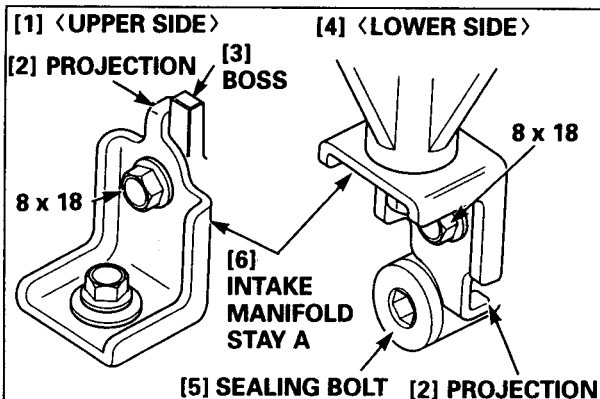


- 2) Loosely tighten the 10 mm cap nuts against the intake manifold assembly.

- 3) Position the upper intake manifold stay A in contact with the left side of the boss of the crankcase, and position the lower intake manifold stay A in contact with the crankcase sealing bolt. Then, loosely tighten the respective 8 x 18 mm flange bolts.

- 4) Loosely tighten the 8 x 35 mm flange bolts (P. 5-70).

- When the intake manifold stay A's are removed from the intake manifold, check the 14 mm washer and 8 x 16 mm special bolt (P. 5-75) and loosely tighten the bolts.



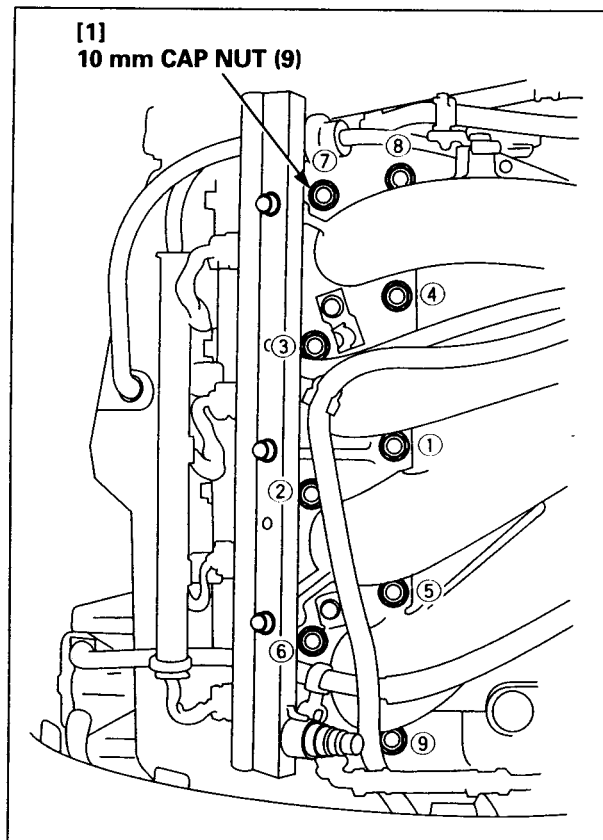
- 5) Tighten the 10 mm cap nuts to the specified torque in the numbered sequence shown. Be sure to tighten the nuts in two or three steps.

**TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)**

- 6) Tighten the two 8 x 18 mm flange bolts and the 8 x 35 mm flange bolt securely.

- When the intake manifold stay A's are removed from the intake manifold, tighten the 10 mm cap nuts, then tighten the 8 x 16 mm special bolt, 8 x 18 mm flange bolt and the 8 x 35 mm flange bolt in the listed order (P. 5-75).

- 7) Install the throttle body assembly (P. 5-57).

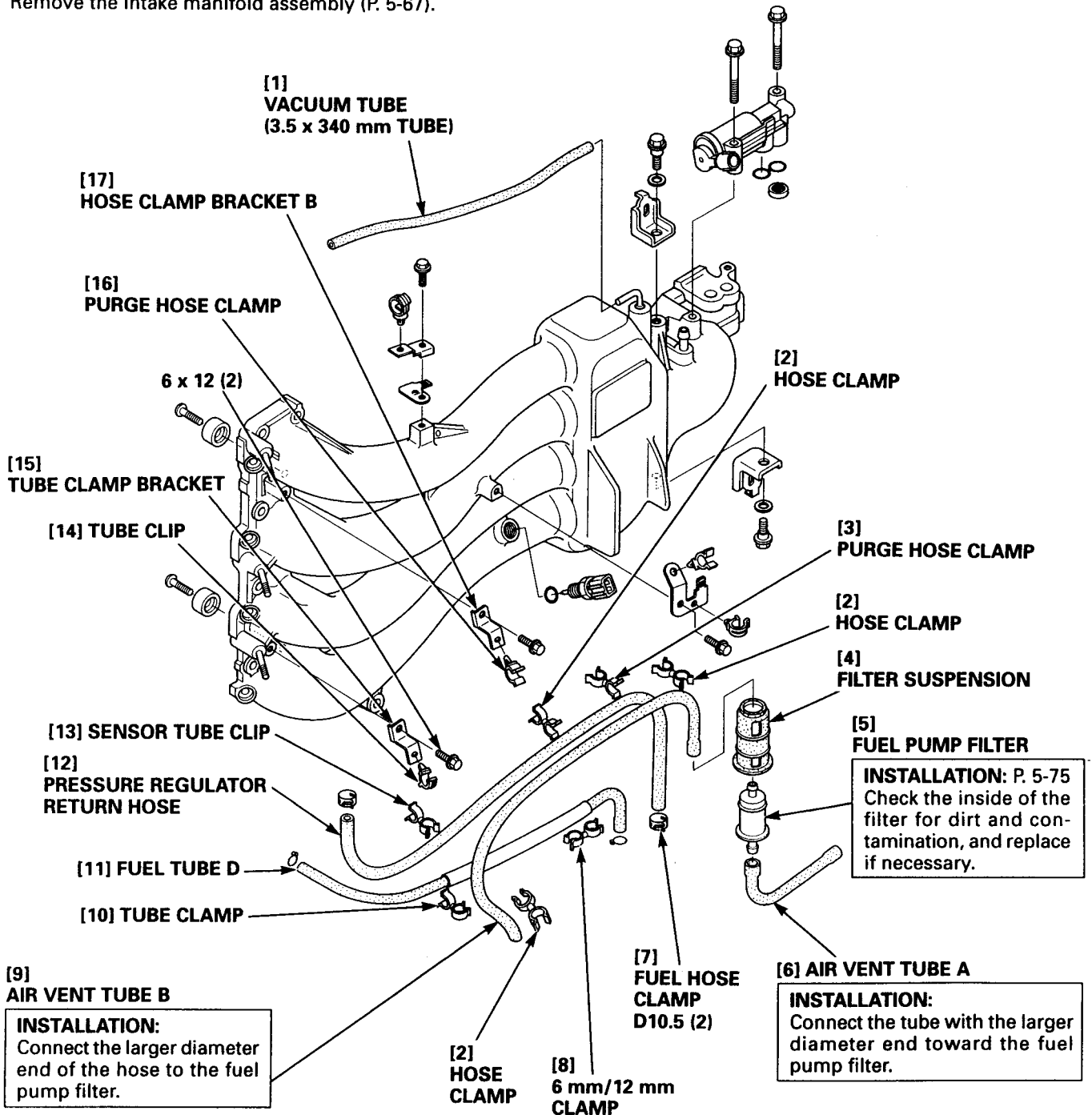


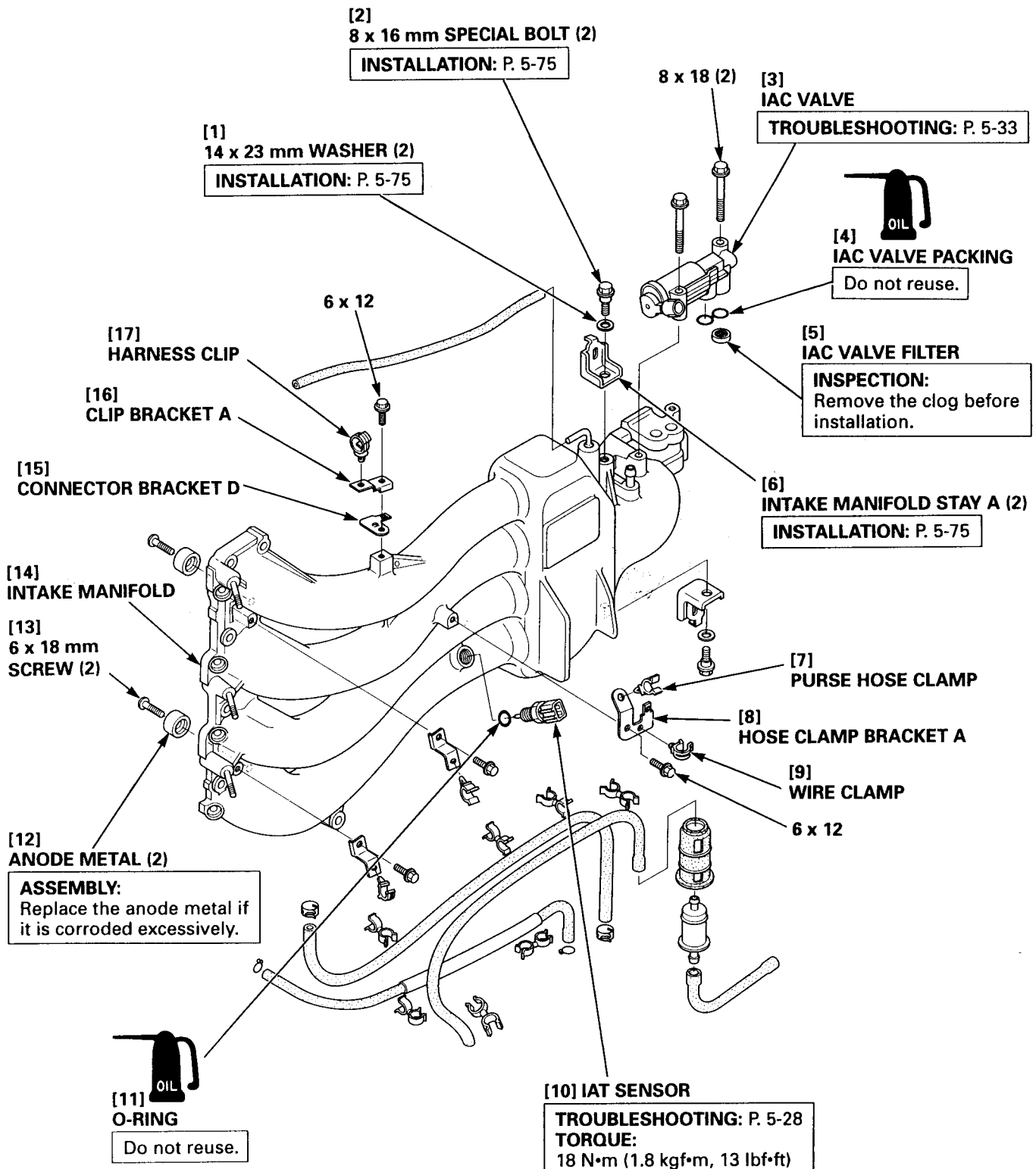
# 11. INTAKE MANIFOLD/IAC VALVE

## a. REMOVAL/INSTALLATION

- Check each tube and hose for cracks and other damage before connection. Replace the tubes and hoses if necessary.
- Set the clips, clamps and other fittings in the designated places securely by referring to the tube routing (P. 2-45).
- Removal/installation of the parts/units other than the intake manifold can be made with the intake manifold assembly mounted on the outboard motor.

Remove the intake manifold assembly (P. 5-67).

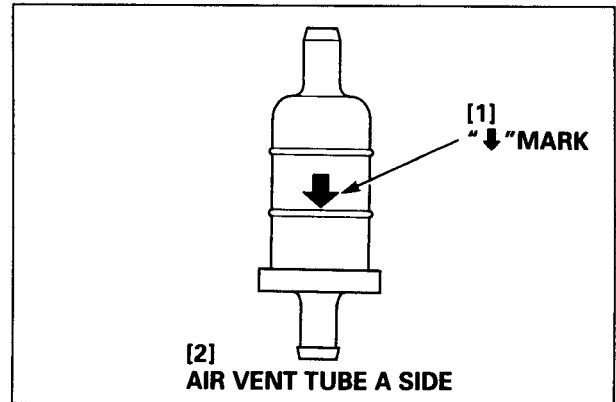




### • FUEL PUMP FILTER

#### INSTALLATION:

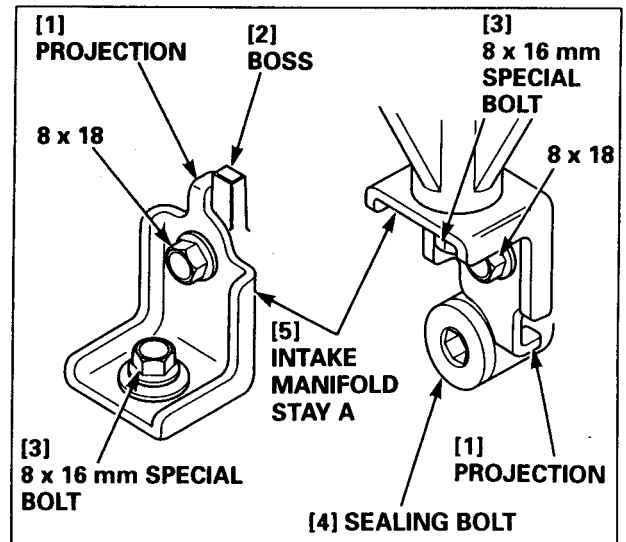
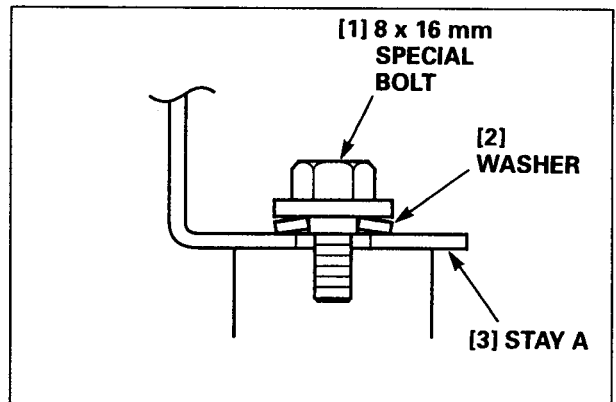
Install the filter suspension with the "↓" mark on the filter toward the air vent tube A, and connect the tube.



### • 14 x 23 mm WASHER/8 x 16 mm SPECIAL BOLT/ INTAKE MANIFOLD STAY A

#### INSTALLATION:

- 1) Install the 14 x 23 mm washers as shown noting the installation direction.
  - 2) Be sure that the shoulders of the 8 x 16 mm special bolts are through the washers and stay A's, and loosely tighten the special bolts.
  - 3) Position the projection of the upper intake manifold stay A in contact with the left side of the boss of the crankcase, and position the projection of the lower intake manifold stay A in contact with the crankcase sealing bolt. Then, loosely tighten the respective 8 x 18 mm flange bolts.
  - 4) Tighten the 10 mm cap nuts to the specified torque (P. 5-72), then tighten the 8 x 16 mm special bolts and the 8 x 18 mm flange bolts in the listed order securely.
- After tightening the bolts, be sure that the 8 x 16 mm special bolts do not set on the washers and the stay As.



## 12. FUEL FILTER (LOW PRESSURE SIDE)/FUEL TUBE

### a. REMOVAL/INSTALLATION

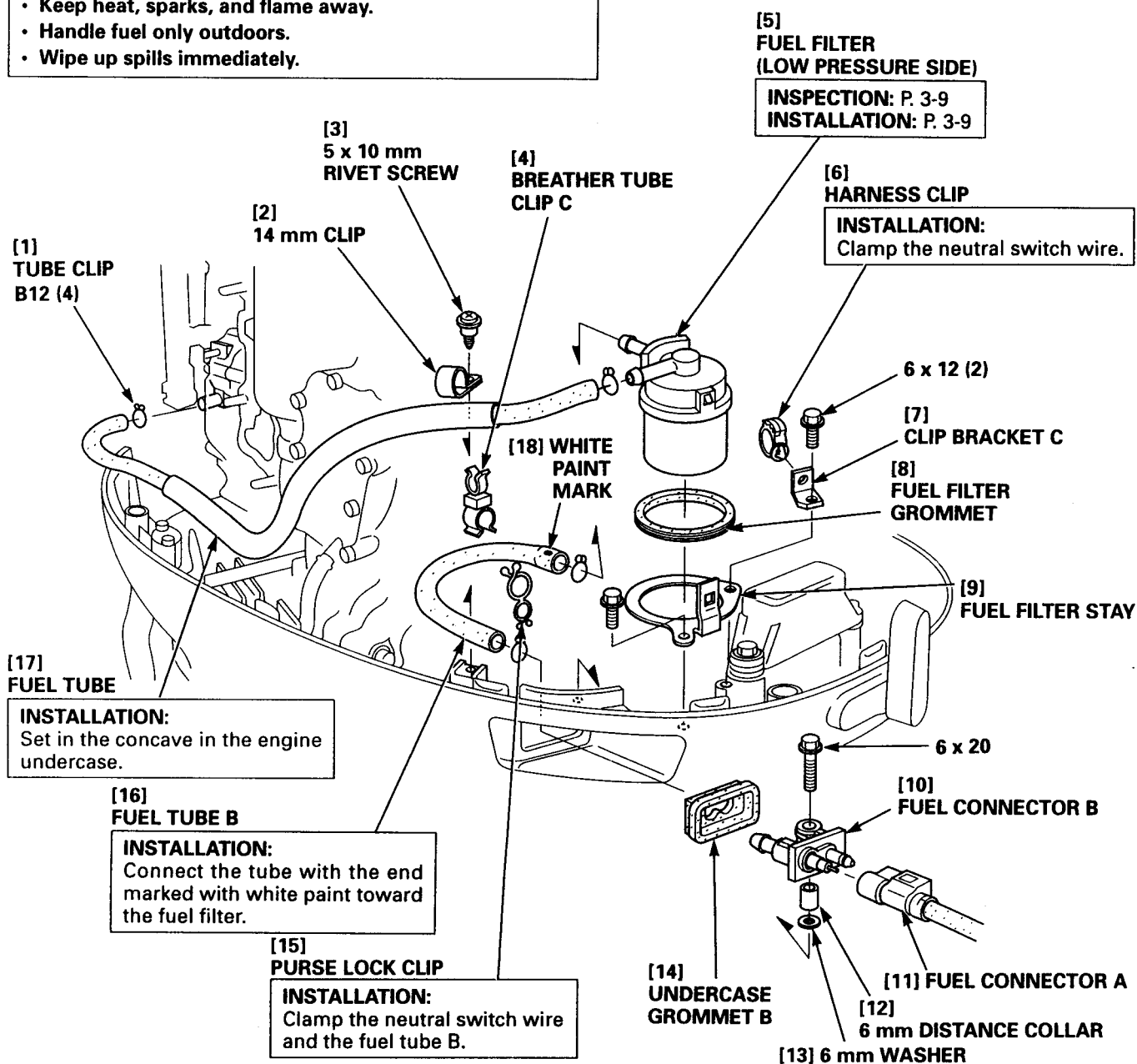
- Check the fuel tube for cracks and other damage before connection. Replace the fuel tube if necessary.
- After connecting the fuel tube, check for gasoline leakage from the tube and joints.

#### ⚠ 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.



### 13. PCV CHAMBER

#### a. OPERATION CHECK

- Check the PCV chamber operation before disassembly.

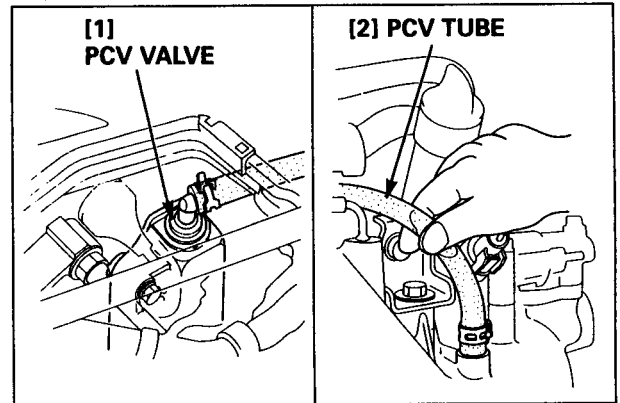
Remove the propeller and place the outboard motor gear case in a test tank filled with water. Start the engine and warm it up to the normal operating temperature, then check the operation.

Check the PCV tube and the breather tube A and B for cracks, disconnection, clog, looseness, etc.

- 1) Pinch the PCV tube lightly with the fingers during idling. Check the PCV valve for operation sound.
- 2) If there is no operation sound, replace the PCV valve and recheck.

#### b. REMOVAL/INSTALLATION

Remove the intake manifold assembly (P. 5-67).

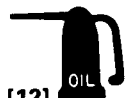


#### [3] OIL PRESSURE SWITCH

**INSPECTION:** P. 17-29  
**INSTALLATION:** P. 5-35  
**TORQUE:**  
9 N•m (0.9 kgf•m, 6.5 lbf•ft)

#### [4] ECT SENSOR

**TROUBLESHOOTING:** P. 5-26  
**TORQUE:**  
18 N•m (1.8 kgf•m, 13 lbf•ft)



#### [12] PCV VALVE GROMMET

#### [1] PCV VALVE

#### [2] TUBE CLAMP D12 (2)

#### [5] 9.5 x 1.5 mm O-RING

Do not reuse.

#### [11] PCV CHAMBER

#### [10] SWITCH WIRE

6 x 35 (4)

#### [9] TUBE CLAMP D29

#### [8] OIL TUBE

**INSTALLATION:**  
Check the tube for cracks and other damage, and connect to the cylinder block and the PCV chamber securely.

#### [6] PCV TUBE

**INSTALLATION:**  
Check the tube for cracks and other damage, and replace if necessary.

#### [7] 7.5/11.5 mm TUBE CLAMP (2)

**INSTALLATION:**  
• Clamp the PCV tube and the vacuum tube.  
• The vacuum tube should be routed in this side.

### 14. FUEL TANK (OPTIONAL PART)

#### a. DISASSEMBLY/ASSEMBLY

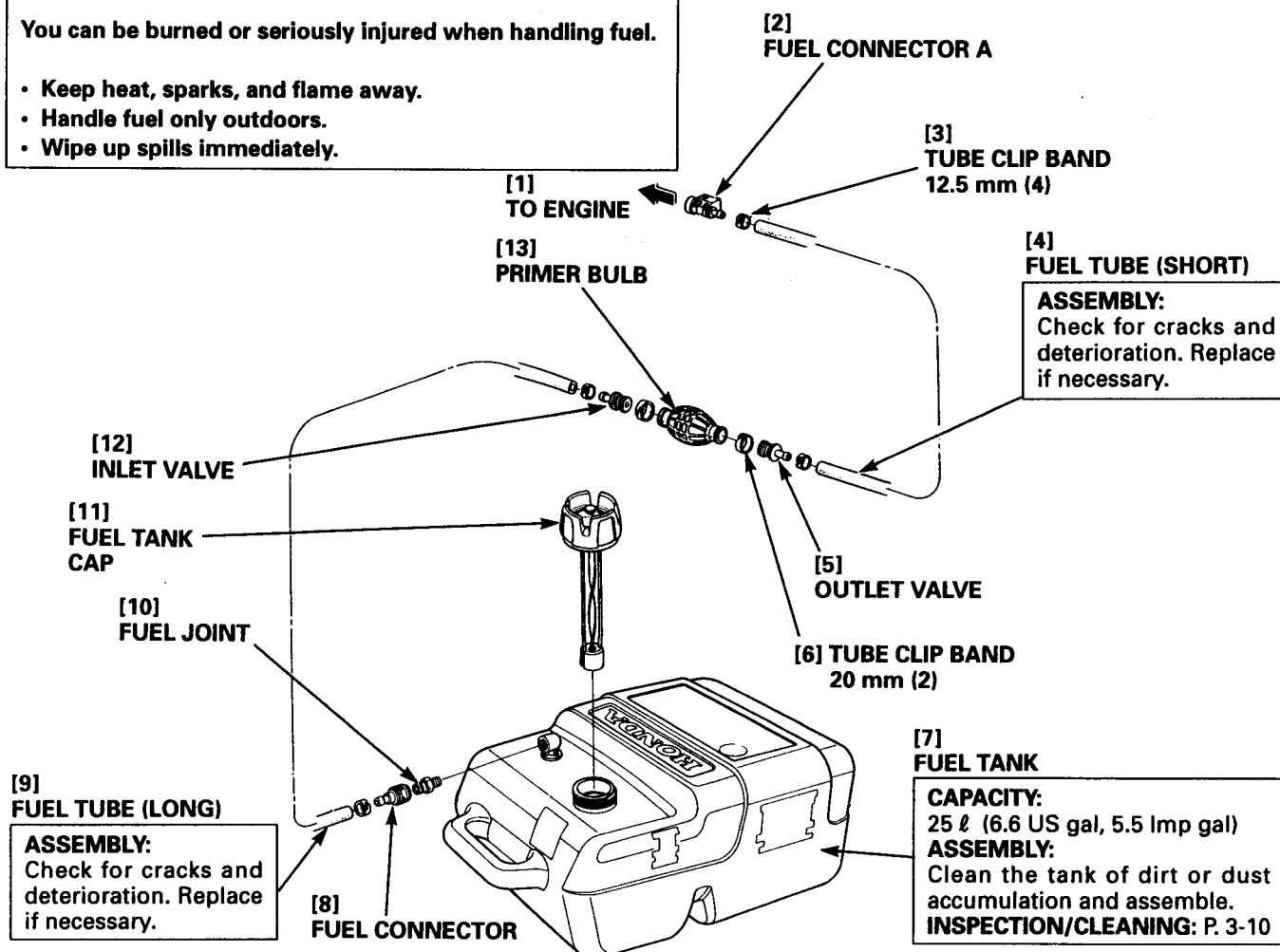
Drain the fuel tank and fuel line completely before disassembly.

#### ⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

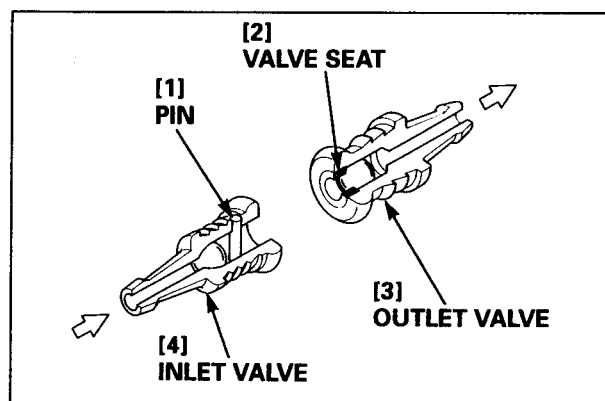
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.



#### • INLET/OUTLET VALVE

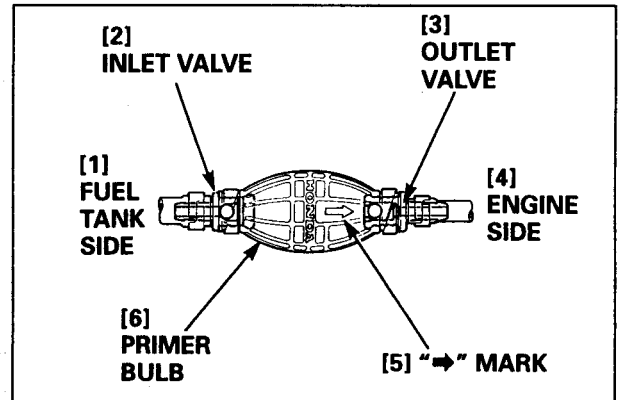
##### INSTALLATION:

- 1) Do not confuse the inlet valve and the outlet valve. They can be identified as follows.
  - The inlet valve has the pin.
  - The outlet valve has the valve seat.





- 2) Install the outlet valve at the side marked with "➡" on the primer valve.
- 3) Install the primer bulb with the "➡" mark toward the engine side.



# 6. ALTERNATOR/BALANCER BELT/TIMING BELT

**HONDA**  
**BF115A·130A**

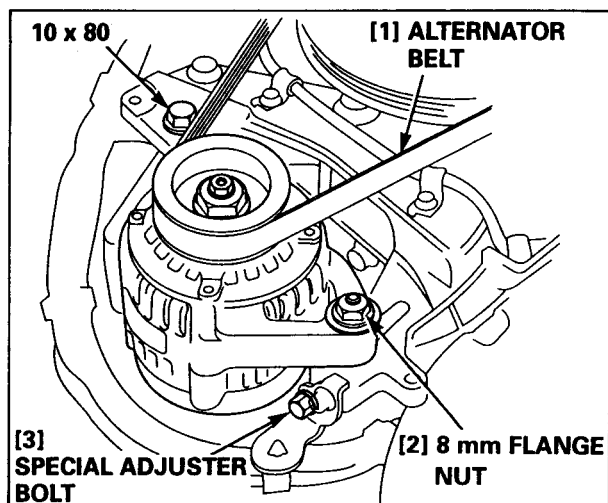
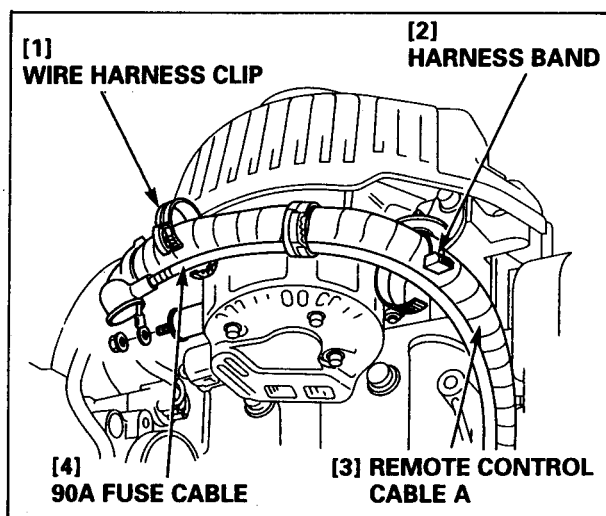
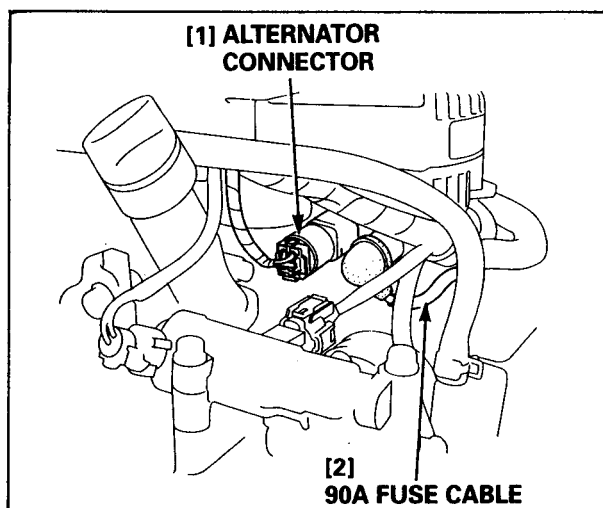
## 1. ALTERNATOR ASSEMBLY

## 2. BALANCER BELT/TIMING BELT/PULLEY

### 1. ALTERNATOR ASSEMBLY

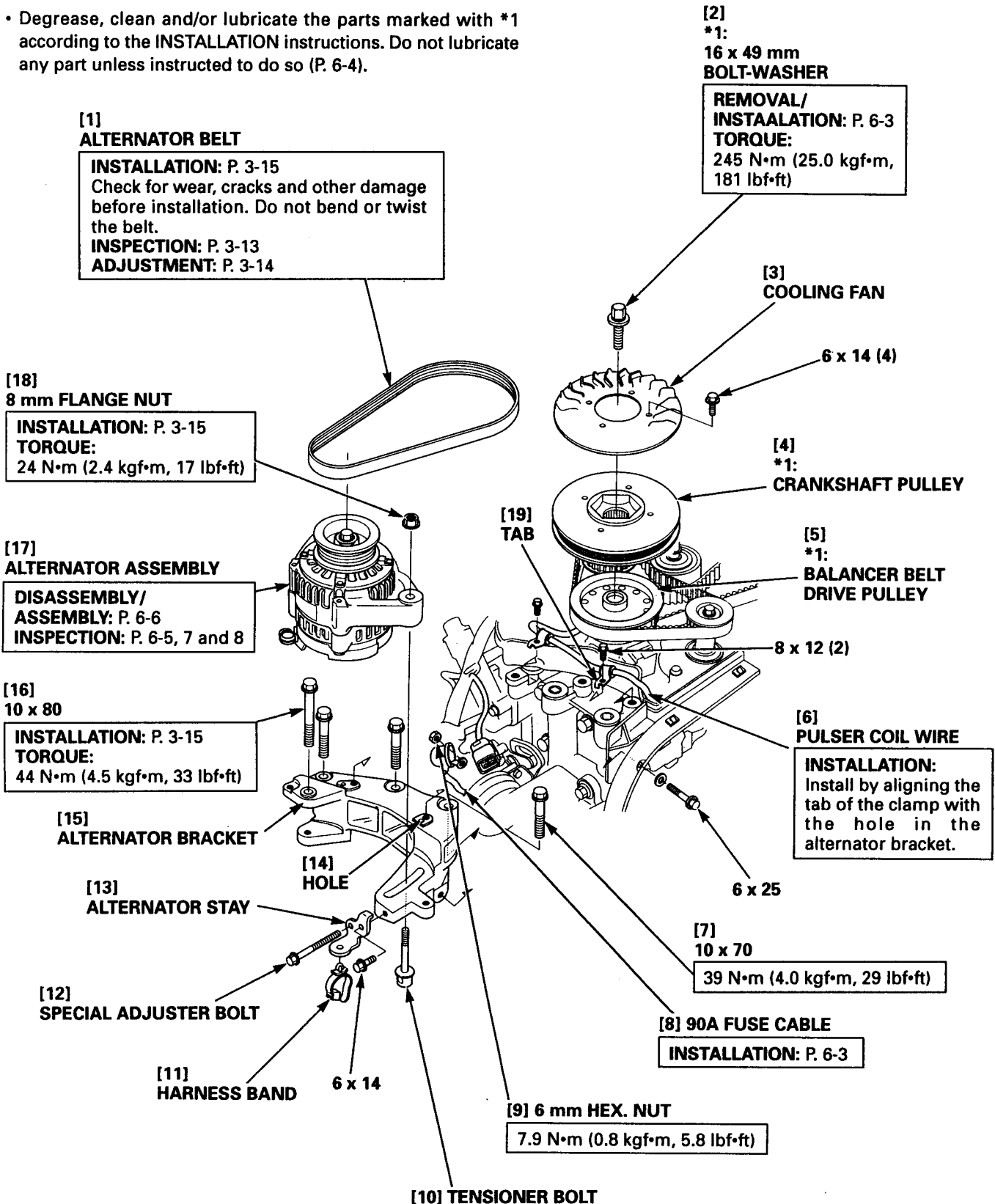
#### a. REMOVAL/INSTALLATION

- 1) Remove the engine cover (P.3-5).
- 2) Disconnect the battery negative (-) cable from the battery negative terminal.
- 3) Disconnect the connector and the 90A fuse cable from the alternator.
- 4) Remove the timing belt upper cover (P. 3-6).
- 5) Open the wire harness clip and the harness band and remove the two cables.
- 6) Loosen the 10 x 80 mm flange bolt and the 8 mm flange nut.
- 7) Loosen the special adjuster bolt. Move the alternator to the engine side as full as it goes, and remove the alternator belt.
- 8) Remove the ECM cover (P. 17-21).



### • DISASSEMBLY/ASSEMBLY DRAWING

- Degrease, clean and/or lubricate the parts marked with \*1 according to the INSTALLATION instructions. Do not lubricate any part unless instructed to do so (P. 6-4).



### • 16 x 49 mm BOLT-WASHER

#### REMOVAL:

Remove the 16 x 49 mm bolt-washer using the special tools as shown.

#### NOTE:

- 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-001020B

#### INSTALLATION:

#### NOTE:

- Do not use an impact wrench.
- Tighten the 16 x 49 mm bolt-washer while holding the crankshaft pulley with the special tool. Do not turn the crankshaft pulley counterclockwise.

- Check the balancer belt drive pulley, crankshaft pulley, and the 16 x 49 mm bolt-washer for degreasing, cleaning and lubrication (P. 6-4).

Using the special tools, tighten the 16 x 49 mm bolt-washer to the specified torque.

**TORQUE: 245 N·m (25.0 kgf·m, 181 lbf·ft)**

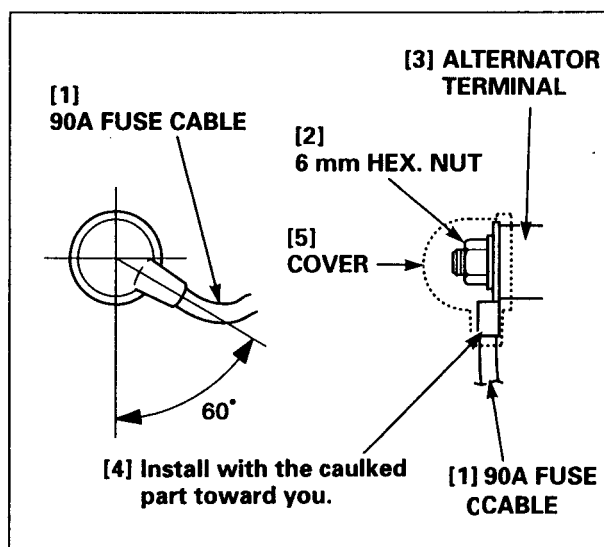
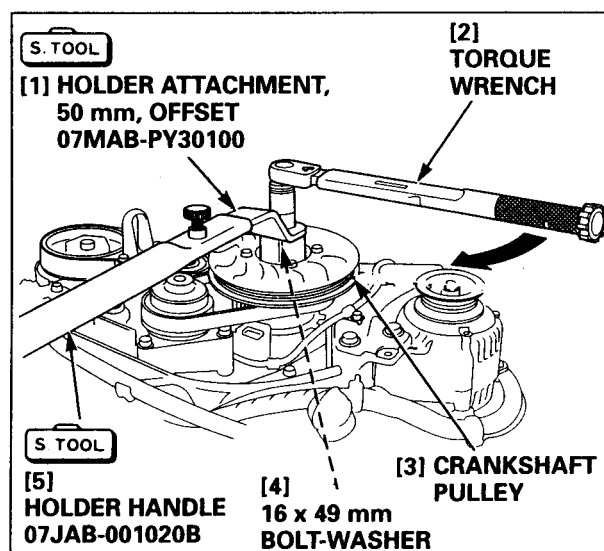
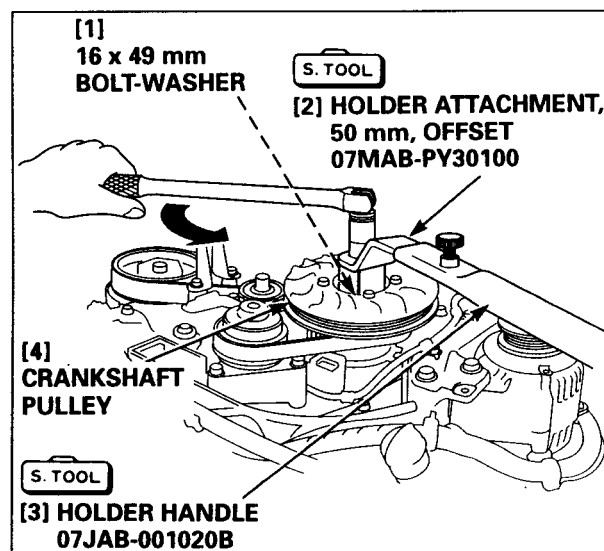
#### TOOLS:

Holder attachment, 50 mm, offset

07MAB-PY30100

Holder handle

07JAB-001020B



### • 90A FUSE CABLE

#### INSTALLATION:

- 1) Connect the 90A fuse cable to the alternator terminal with the caulked part toward you.
- 2) Tighten the 6 mm hex. nut to the specified torque so that the installation angle is 60° as shown.

**TORQUE: 7.9 N·m (0.8 kgf·m, 5.8 lbf·ft)**

- 3) After installation, place the cover over the terminal securely.

### b. DEGREASING/CLEANING/LUBRICATION

Be sure to degrease, clean or lubricate the following parts before installation.

#### <16 x 49 mm bolt-washer>

- Wipe the entire surface of the bolt-washer (especially the washer and the crankshaft pulley mating surface) 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 bolt-washer mounting surface on the crankshaft pulley using a clean shop towel.
  - Do not contaminate the belt installation parts with oil.

#### <Balancer belt drive pulley>

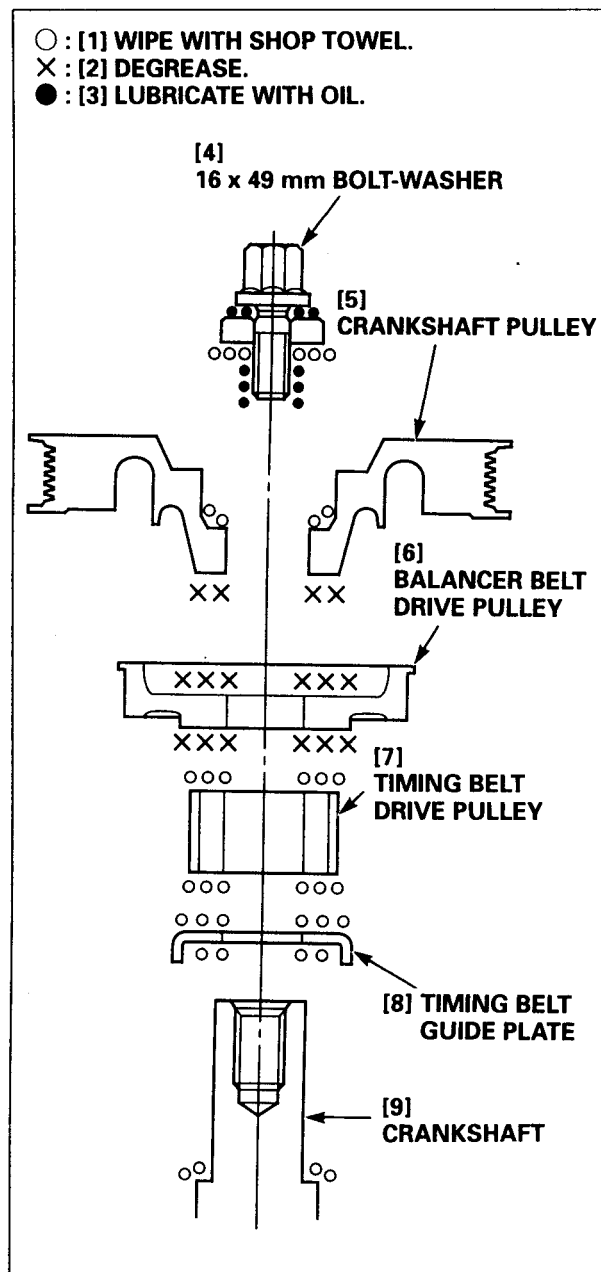
- Remove oil from the crankshaft pulley and the timing belt drive pulley mating surface thoroughly using a degreasing cleaning agent.
- Do not contaminate the belt installation parts with a degreasing cleaning agent.

#### <Timing belt drive pulley/timing belt guide plate>

- Wipe the 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.



### c. ALTERNATOR ASSEMBLY INSPECTION

(With the alternator assembly mounted on the outboard motor)

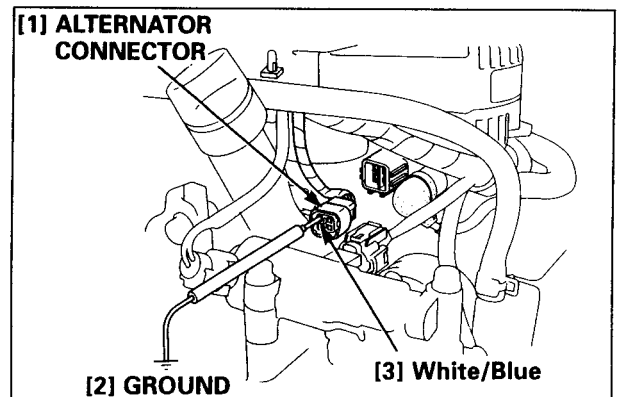
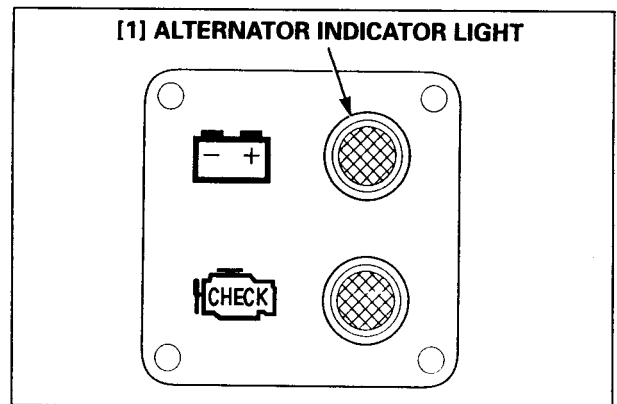
#### CAUTION:

**Do not disconnect the battery terminals while the alternator is running.**

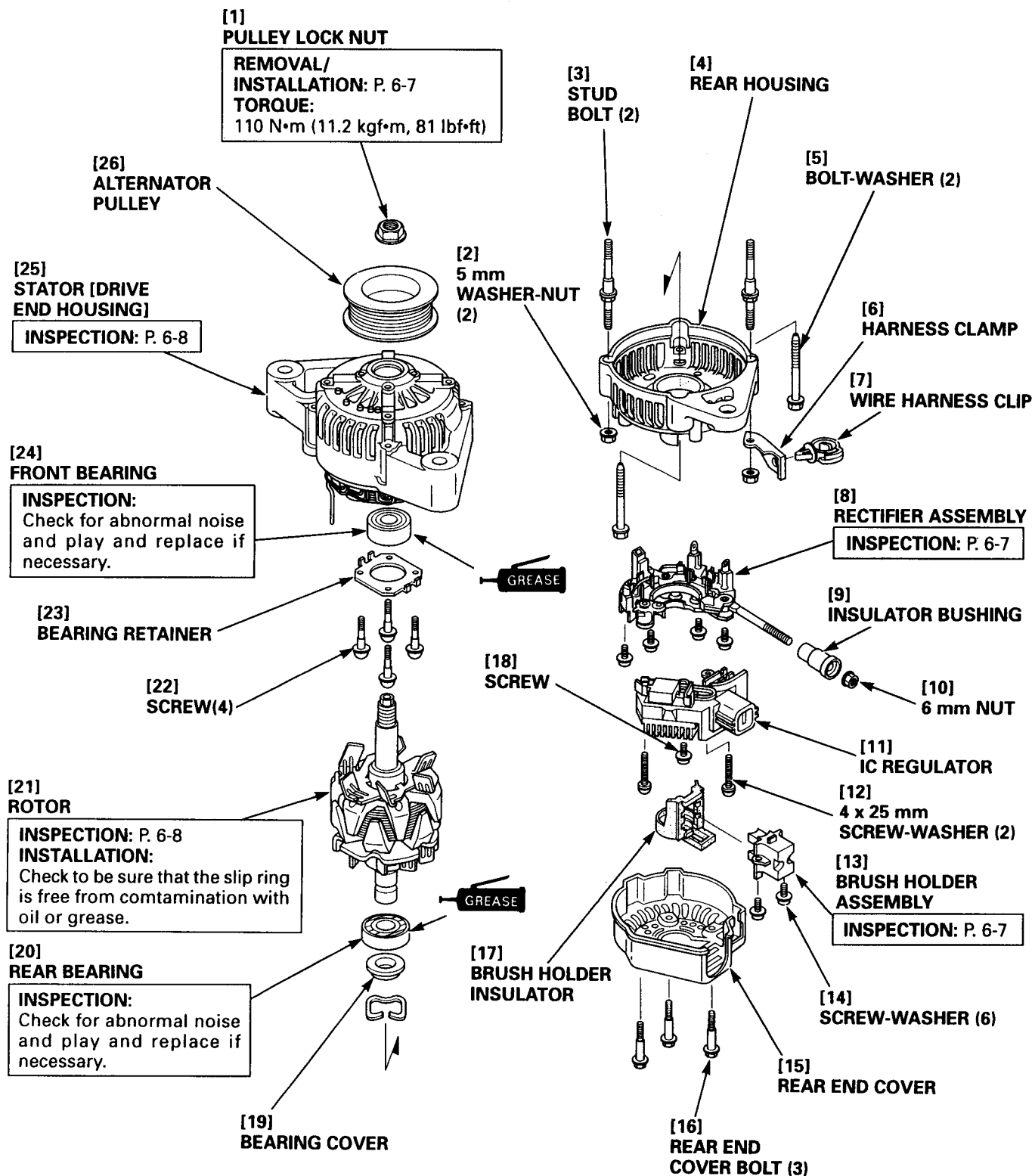
- Alternator assembly inspection must be made with the assembly mounted on the outboard motor.
- Replace the IC regulator when the battery voltage exceeds 16V.
- Before disconnecting the 90A fuse cable, be sure to disconnect the battery negative (-) terminal.

Check for following before starting the alternator assembly inspection.

- Battery condition and cable connection
  - Alternator belt for looseness, cut and/or fraying (P. 3-13)
  - Alternator connector and 90A fuse cable for connection
  - Blown 90A 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. 17-28)
    - 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.



### d. ALTERNATOR ASSEMBLY DISASSEMBLY/ASSEMBLY

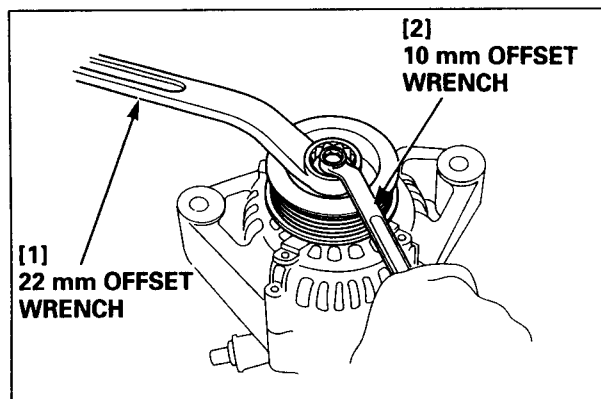


### • PULLER LOCK NUT

#### REMOVAL/INSTALLATION:

Using the two offset wrenches (10 mm and 22 mm) as shown, remove and install the puller lock nut.

**TORQUE:** 110 N·m (11.2 kgf·m, 81 lbf·ft)



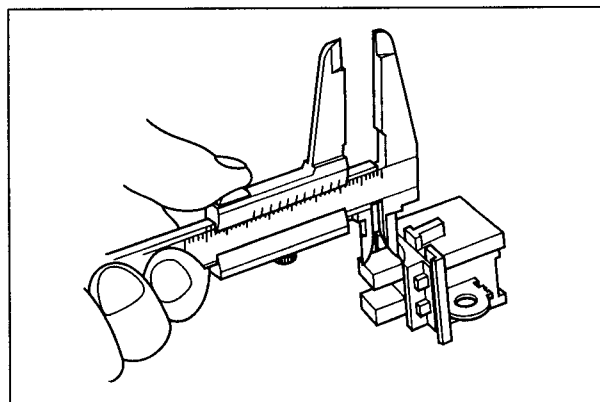
### e. INSPECTION (Unit inspection)

#### • 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)	8.4 mm (0.33 in)

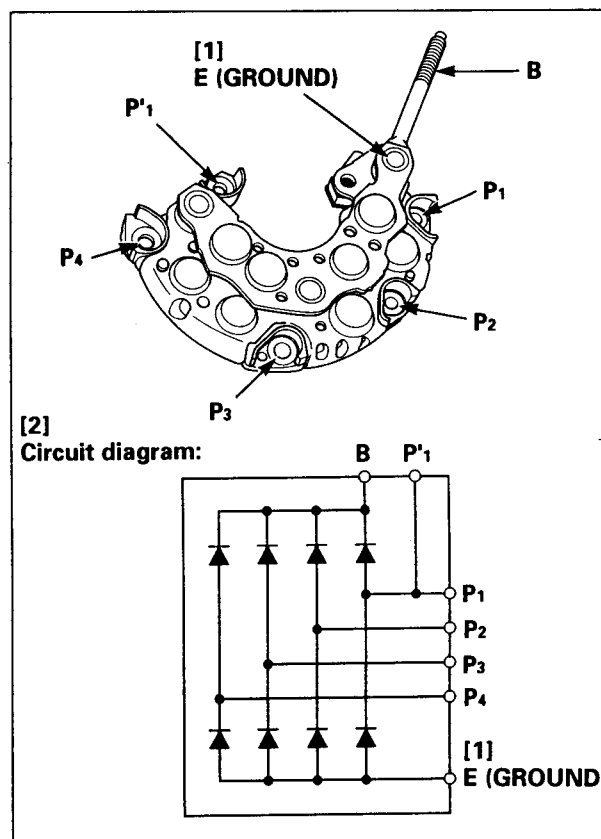


#### • RECTIFIER ASSEMBLY

- Inspect the rectifier assembly by removing it from the outboard motor.

Check for continuity between the B terminal and the respective P terminals (P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>), and between the E terminal and the respective P terminals (P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>). 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 slip 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.

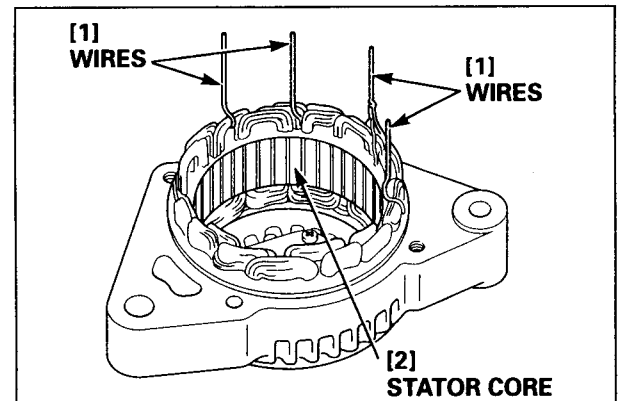
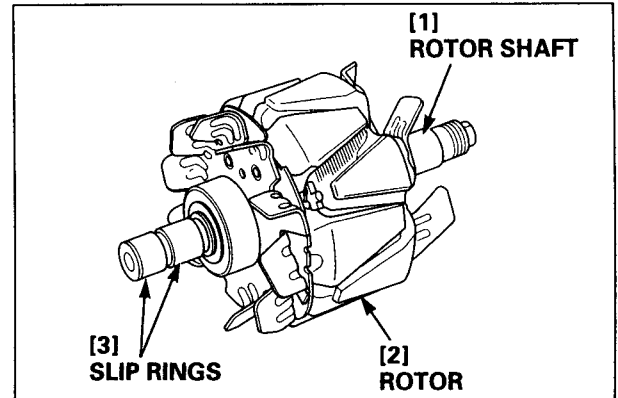
STANDARD	SERVICE LIMIT
14.4 mm (0.57 in)	14.0 mm (0.55 in)

- 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.

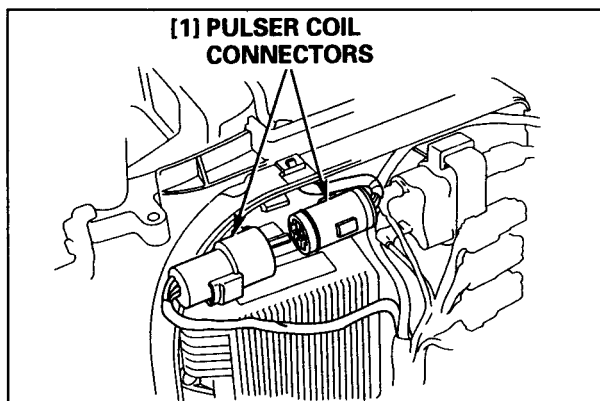


## 2. BALANCER BELT/TIMING BELT/PULLEY

### a. REMOVAL/INSTALLATION

- 1) Remove the timing belt upper cover (P. 3-5 and 6).
- 2) Set the No.1 cylinder piston at the top dead center of its compression stroke (P. 3-7).
- 3) Remove the alternator belt (P. 3-14).  
Remove the crankshaft pulley (P. 6-3).
- 4) Remove the ECM cover (P. 17-21) and disconnect the pulser coil connectors.

- Be sure to degrease, clean or lubricate the parts marked with \*1 according to the INSTALLATION instructions. Do not lubricate any part unless instructed to do so (P. 6-4).



#### [1] TIMING BELT

**INSTALLATION:** P. 3-20

Check for wear, cracks and other damage before installation. Do not bend or twist the belt.

**INSPECTION:** P. 3-19

**ADJUSTMENT:** P. 3-22

#### [12] 12 x 38

**REMOVAL/**

**INSTALLATION:** P. 6-11

Apply engine oil to the threads and the bolt seat.

**TORQUE:**

98 N•m (10.0 kgf•m,  
72 lbf•ft)



#### [11] 12.5 x 34 x 5 mm WASHER

#### [10] TIMING BELT DRIVEN PULLEY

#### [2] 4.5 x 38.5 mm KEY

#### [3] \*1: BALANCER BELT DRIVE PULLEY

#### [4] BALANCER BELT

**INSTALLATION:** P. 3-16

Check for wear, cracks and other damage before installation. Do not bend or twist the belt.

**INSPECTION:** P. 3-15

**ADJUSTMENT:** P. 3-22

#### [5] \*1: TIMING BELT DRIVE PULLEY

**INSTALLATION:** P. 6-11

#### [6] \*1: TIMING BELT GUIDE PLATE

**INSTALLATION:** P. 6-11

6 x 12 (2)

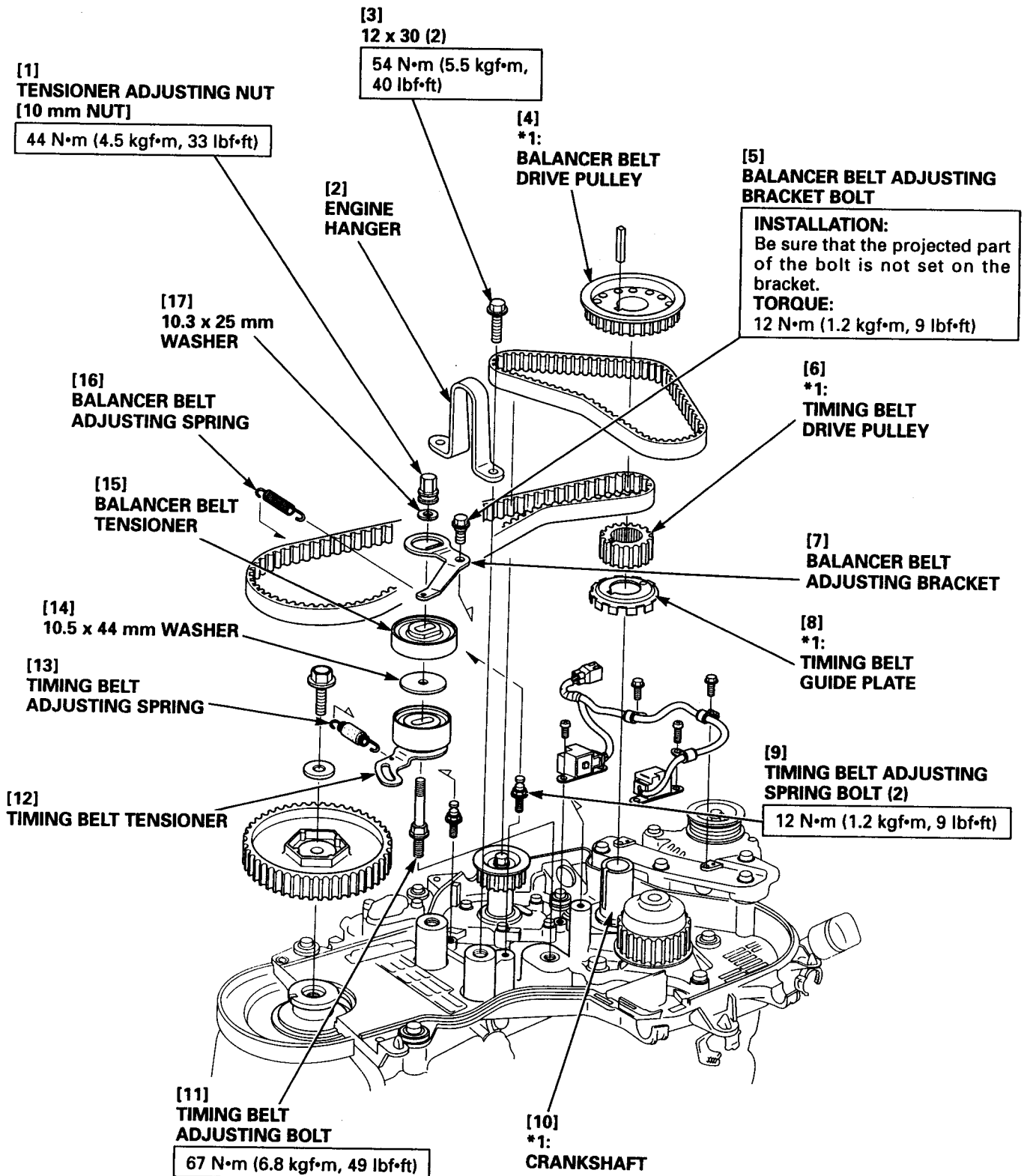
#### [7] 5 x 14 mm SCREW (4)

#### [8] PULSER COIL

**INSPECTION:** P. 17-28  
**TROUBLESHOOTING:**  
P. 5-24

#### [9] \*1: CRANKSHAFT

- Be sure to degrease, clean or lubricate the parts marked with \*1 according to the INSTALLATION instructions. Do not lubricate any part unless instructed to do so (P. 6-4).



### • 12 x 38 mm FLANGE BOLT

#### REMOVAL/INSTALLATION:

Using the special tool as shown, remove and install the 12 x 38 mm flange bolt.

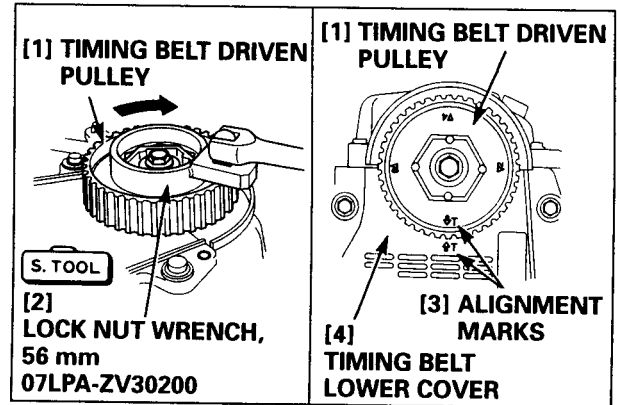
On installation, apply engine oil to the threaded part and the seat of the 12 x 38 mm flange bolt, and align the "↓T" mark on the driven pulley with the "↑T" mark on the timing belt lower cover.

**TORQUE:** 98 N·m (10.0 kgf·m, 72 lbf·ft)

#### TOOL:

Lock nut wrench, 56 mm

07LPA-ZV30200



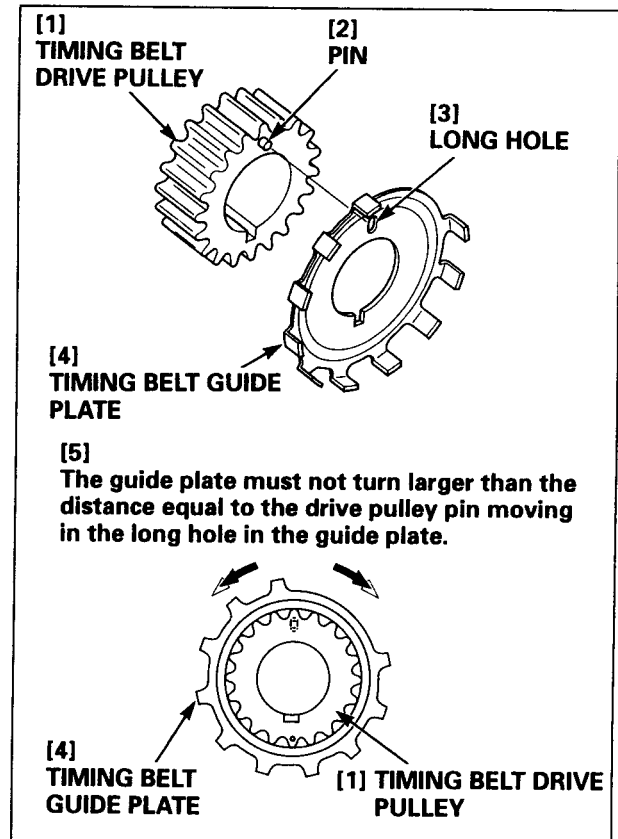
### • TIMING BELT DRIVE PULLEY/TIMING BELT GUIDE PLATE

#### INSTALLATION:

- Before installing the drive pulley and the guide plate, be sure to degrease, clean or lubricate the parts according to the INSTALLATION instructions (P. 6-4).
- 1) Install the timing belt guide plate on the crankshaft.
  - 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.
  - 4) Install the balancer belt drive pulley and the crankshaft pulley.
    - Before installing the balancer belt drive pulley and the crankshaft pulley, be sure to degrease, clean or lubricate the parts according to the INSTALLATION instructions (P. 6-4).
  - 5) Temporarily tighten the 16 x 49 mm bolt-washer until the timing belt drive pulley comes in close contact with the timing belt guide plate (P. 6-2).

Apply force to the timing belt drive pulley in the turning direction, and be sure that the guide plate does not turn larger than the distance equal to the drive pulley pin moving in the long hole in the guide plate.

- Before tightening the 16 x 49 mm bolt-washer, be sure to degrease, clean or lubricate the parts according to the INSTALLATION instructions (P. 6-4).



## 1. REMOVAL

## 2. INSTALLATION

### 1. REMOVAL

- 1) Remove the following parts.
  - Engine cover (P. 3-5)
  - Rear separate case (P. 3-6)
  - Remote control cable (P. 16-1)
  - Gear case assembly (P. 12-2)
  - Lower rubber motor mount (P. 12-47)
  - Extension case/undercover (P. 12-48)
  - Oil pan/exhaust pipe/water tube (P. 13-1)
- 2) Disconnect the positive (+) and the negative (-) cables of the starter cable from the battery.
- 3) Disconnect the fuel tube from the fuel pump.

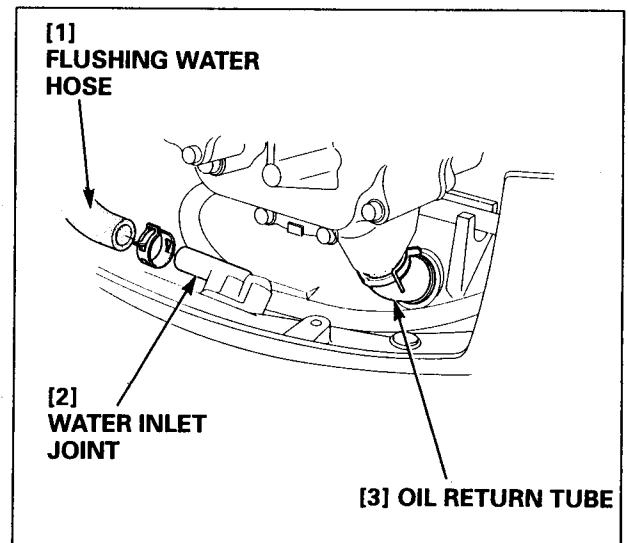
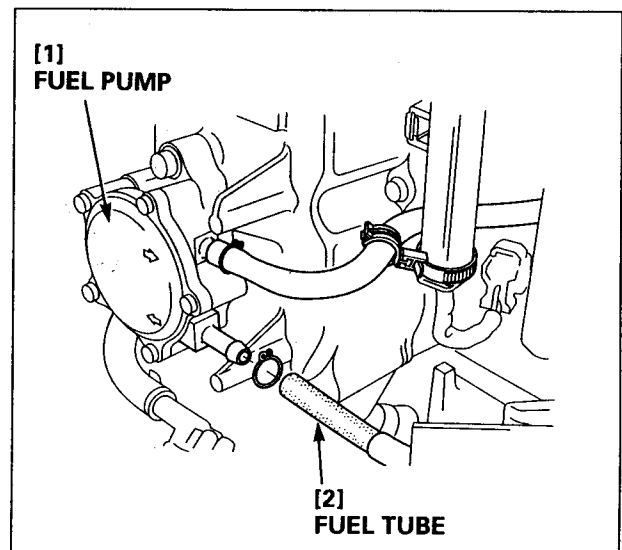
#### **⚠ WARNING**

**Gasoline is highly flammable and explosive.**

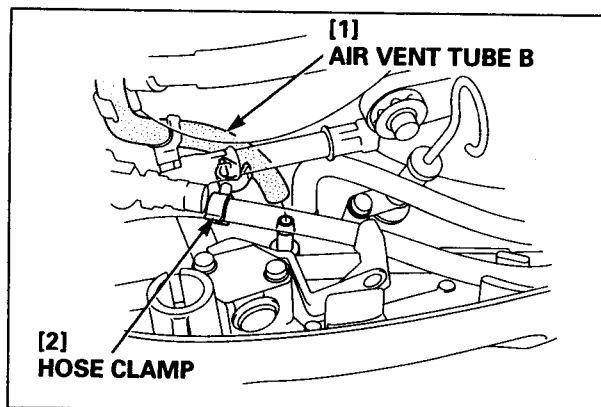
**You can be burned or seriously injured when handling fuel.**

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

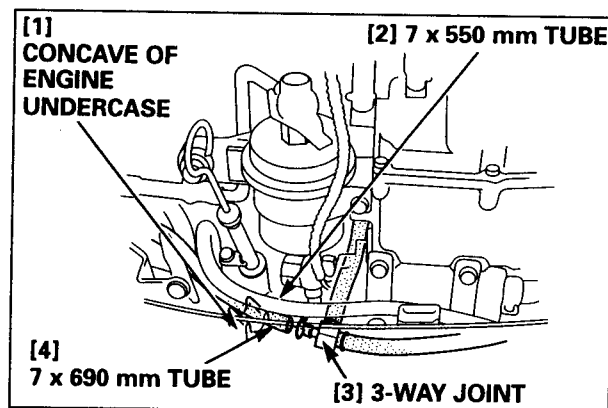
- 4) Disconnect the oil return tube.  
Disconnect the flushing water hose from the water inlet joint.



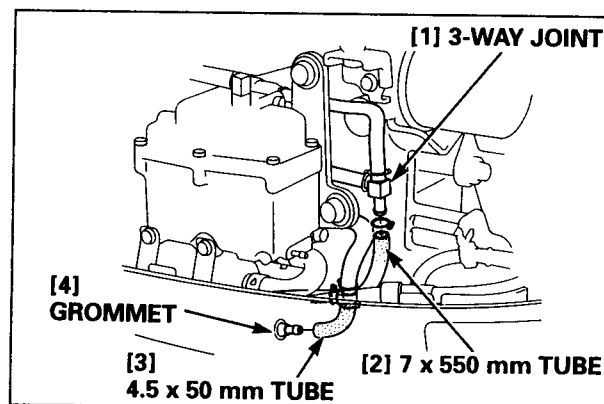
- 5) Release the air vent tube B from the hose clamp and disconnect the air vent tube B from the mounting case.



- 6) Disconnect the 7 x 550 mm tube and the 7 x 690 mm tube from the engine undercase. Disconnect the 7 x 690 mm tube from the 3-way joint.

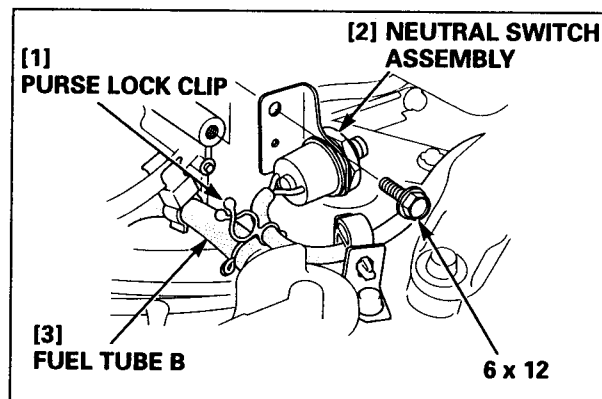


- 7) Disconnect the 7 x 550 mm tube from the 3-way joint. Disconnect the 4.5 x 50 mm tube from the grommet mounted on the engine undercase.



- 8) Remove the purse lock clip from the fuel tube B. Remove the 6 x 12 mm flange bolt and remove the neutral switch assembly.

- 9) Remove the silencer case (P. 3-10).

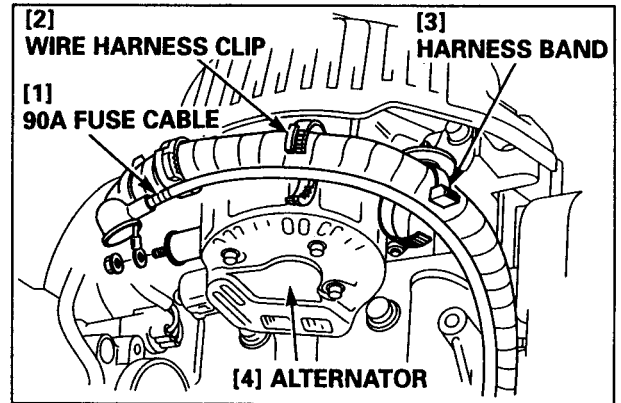


- 10) Disconnect the 90A fuse cable from the alternator.

**CAUTION:**

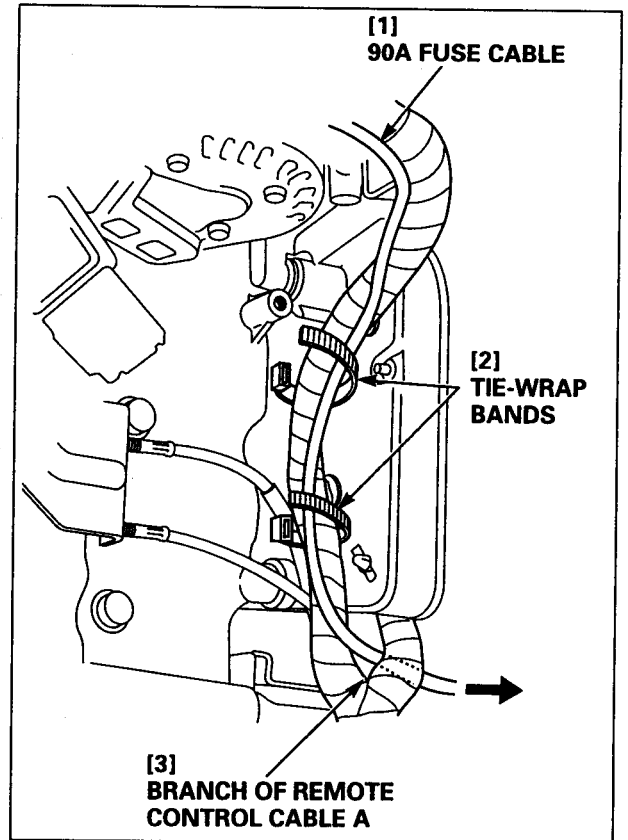
Be sure that the positive (+) and the negative (-) starter cables are disconnected from the battery before disconnecting the 90A fuse cable.

- 11) Open the wire harness clip and the harness band and release the 90A fuse cable.

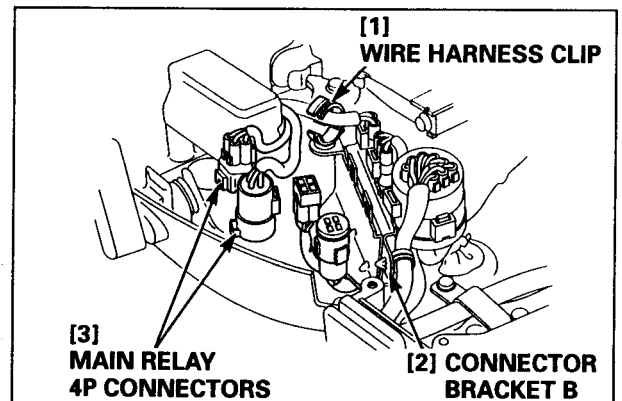


- 12) Remove the two tie-wrap bands from the 90A fuse cable.

- 13) Pull out the 90A fuse cable from the branch of the remote control cable A.

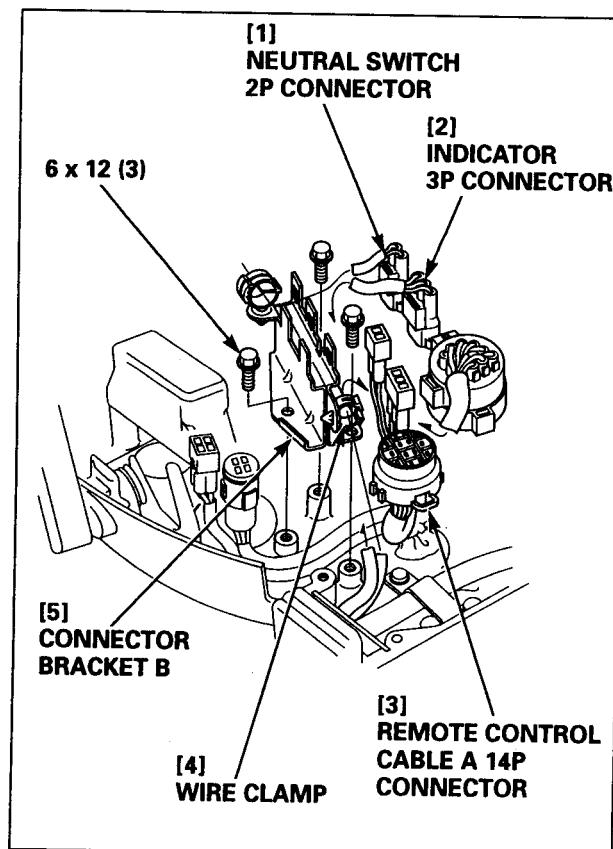


- 14) Open the wire harness clip. Remove the two main relay 4P connectors from the connector bracket B and disconnect the connector.



15) Disconnect the neutral switch 2P connector, indicator 3P connector and the remote control cable A 14P connector from the connector bracket B.

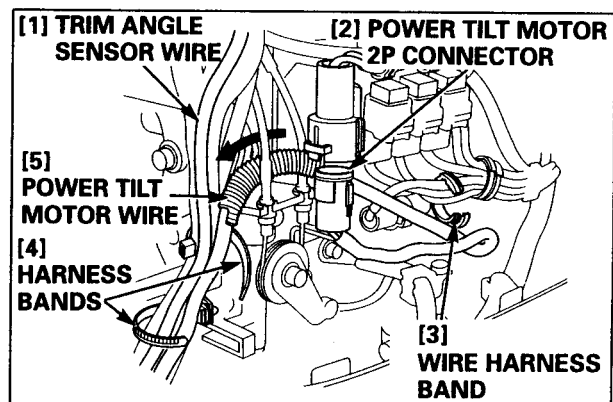
16) Remove the connector bracket B.  
Remove the ECM cover (P. 17-21).



17) Open the two harness bands located on the shift link bracket, and release the power tilt motor wire and the trim angle sensor wire.

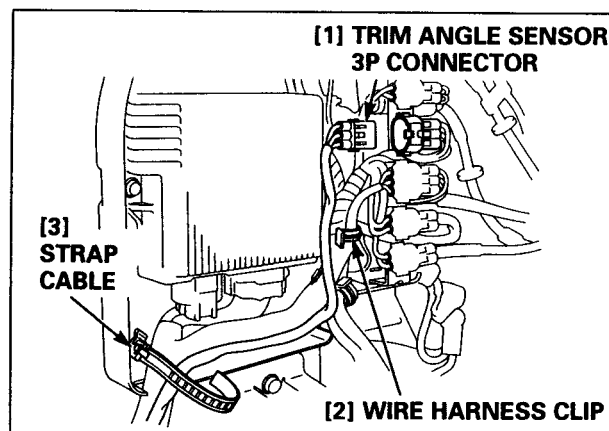
18) Open the wire harness band and release the power tilt motor wire.

Disconnect the power tilt motor 3P connector, and pull out the power tilt motor wire from the throttle cable.



19) Open the strap cable and release the trim angle sensor wire from the strap cable and the wire harness clip.

Disconnect the trim angle sensor 3P connector.

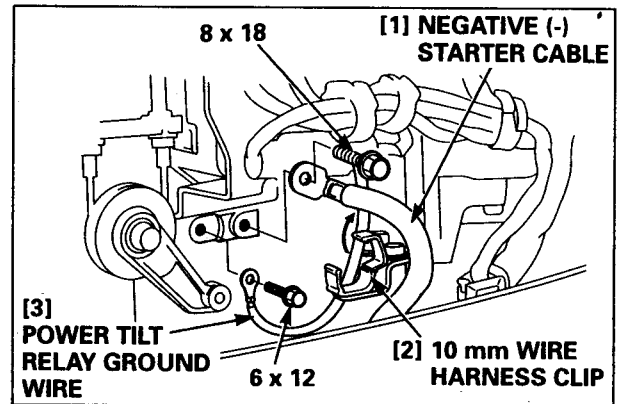




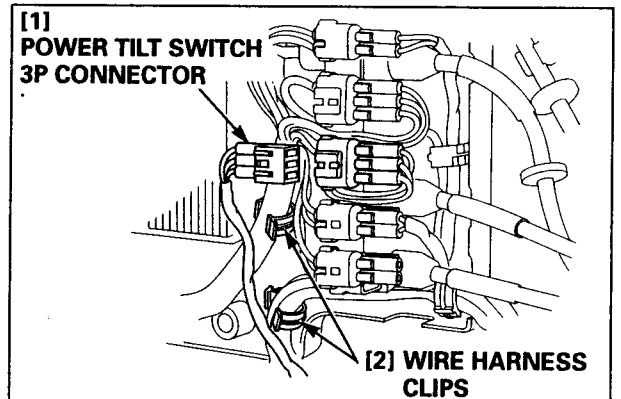
- 20) Open the 10 mm wire harness clip and release the negative (-) starter cable from the clip.

Remove the 8 x 18 mm flange bolt, and disconnect the negative (-) starter cable.

Remove the 6 x 12 mm flange bolt, and disconnect the power tilt relay ground wire.

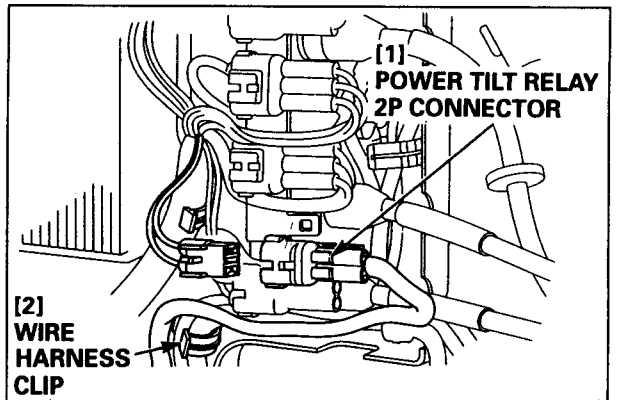


- 21) Disconnect the power tilt switch 3P connector, and release the power tilt switch wire from the wire harness clip.



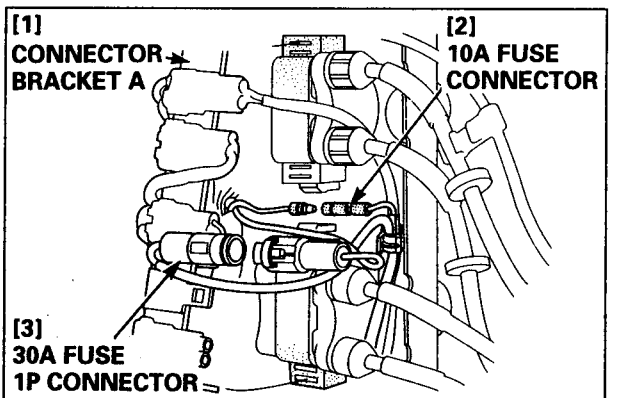
- 22) Remove the power tilt relay 2P connector from the connector bracket A.

Disconnect the power tilt relay 2P connector, and release the power tilt relay wire from the wire harness clip.

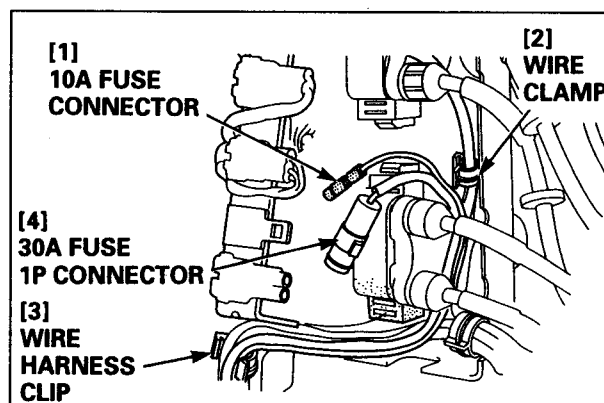


- 23) Remove the connector bracket A from the ignition suspension.

Disconnect the starter cable 30A fuse 1P connector and the 10A fuse connector.



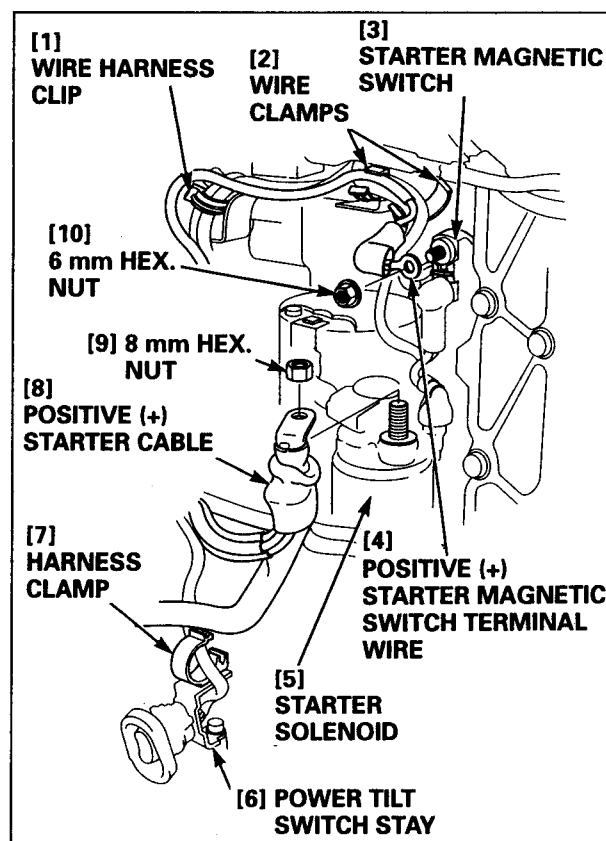
- 24) Release the 30A fuse 1P connector wire and the 10A fuse connector wire disconnected in the previous step 23 from the wire clamp and the harness clip.



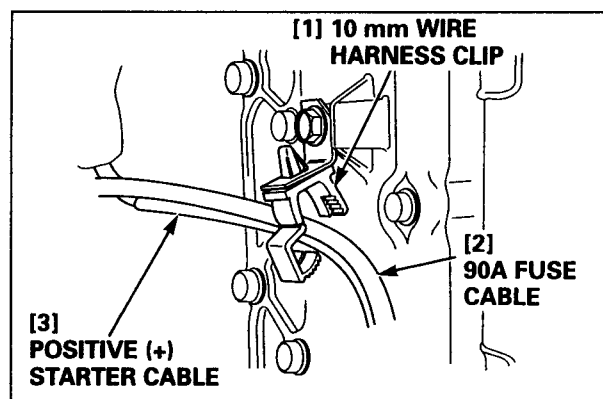
- 25) Disconnect the positive (+) starter magnetic switch terminal wire from the starter magnetic switch.

Release the positive (+) starter magnetic switch terminal wire from the wire clamps and the wire harness clip.

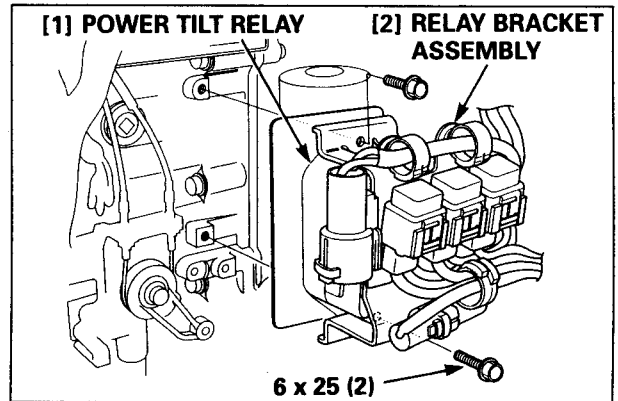
- 26) Open the harness clamp that is attached to the power tilt switch stay, and disconnect the positive (+) starter cable from the magnet switch.



- 27) Open the 10 mm wire harness clip, and release the positive (+) starter cable and the 90A fuse cable.



- 28) Remove the two 6 x 25 mm flange bolts, and remove the relay bracket assembly and the power tilt relay as a set.

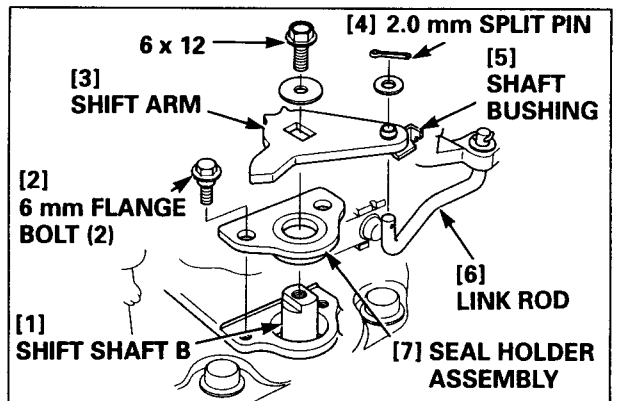


- 29) Remove the 2.0 mm split pin and the washer from the link rod.

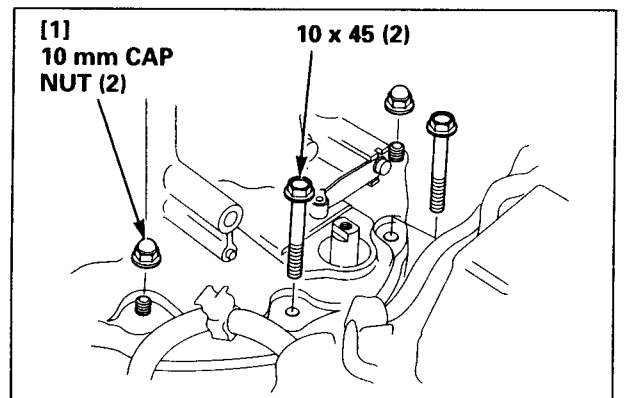
Remove the shaft bushing from the link rod, and remove the link rod from the shift arm.

Remove the 6 x 12 mm flange bolt and remove the shift arm.

Remove the two 6 mm flange bolts, and remove the seal holder assembly while holding the head of the shift shaft B.

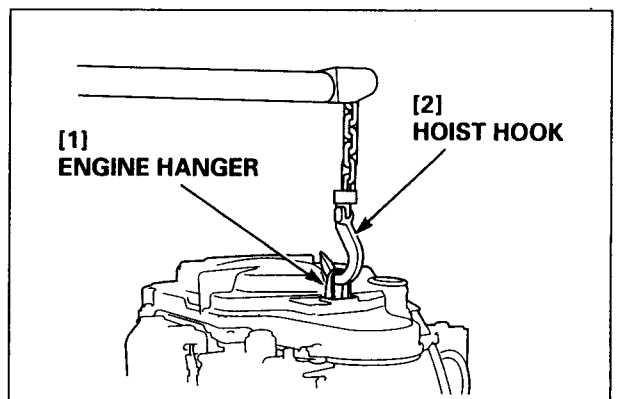


- 30) Remove the two 10 x 45 mm flange bolts and the two 10 mm cap nuts.



- 31) Hook the hoist hook on the engine hanger.

- After hooking the hoist hook on the engine hanger, be sure that the engine is held vertically.

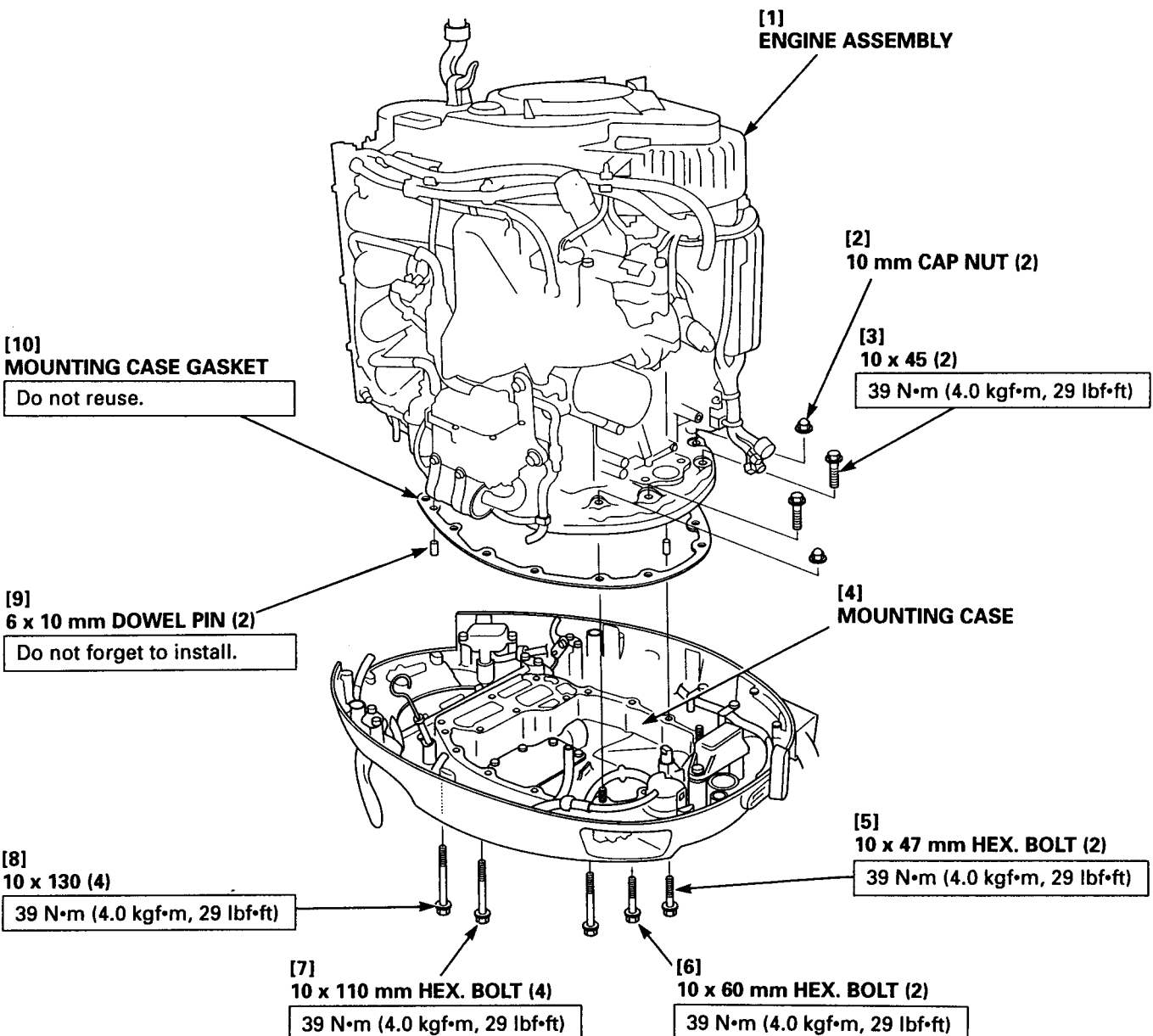
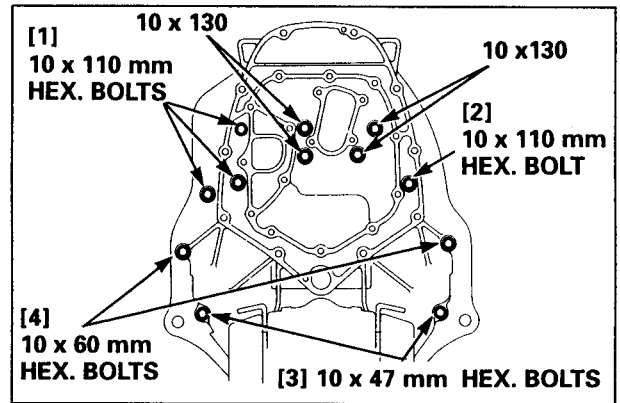


32) Remove the four 10 x 130 mm flange bolts, four 10 x 110 mm hex. bolts, two 10 x 60 mm hex. bolts and the two 10 x 47 mm hex. bolts.

Remove the engine assembly from the mounting case.

33) Remove the two 6 x 10 mm dowel pins and the mounting case gasket.

- Lift up the engine assembly while holding the engine vertically.



## 2. INSTALLATION

Engine installation is the reverse order of removal, but note the following.

- Do not reuse the mounting case gasket.

- 1) Align the punch mark on the shift shaft A with the punch mark on the shift shaft B.

### NOTE:

- Be sure to align the punch marks securely before installing the engine assembly. Install the engine assembly with care not to let the punch marks come out of alignment.
- Note that the proper shifting cannot be made unless the punch marks are in proper alignment.

- 2) After installing the engine assembly on the mounting case, install the shift holder assembly (P. 16-6).

- Before tightening the bolts, apply oil to the threaded part and the seating surface of the engine mount bolts (10 mm bolts.)

- 3) Loosely tighten the engine mount bolts at the designated places, then tighten the bolts in the numbered order. Be sure to tighten the bolts in two or three steps to the specified torque.

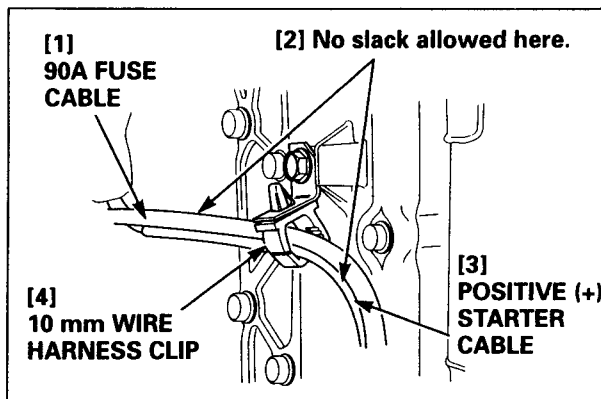
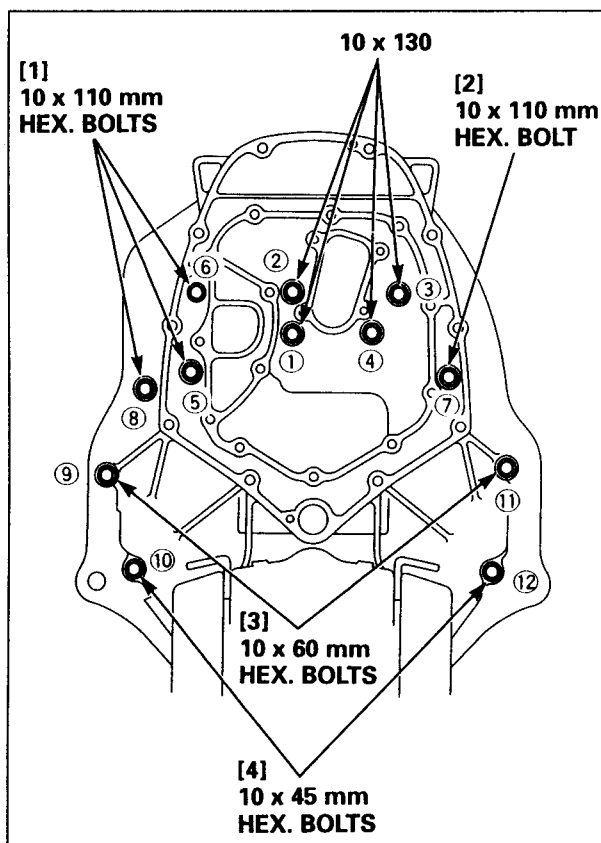
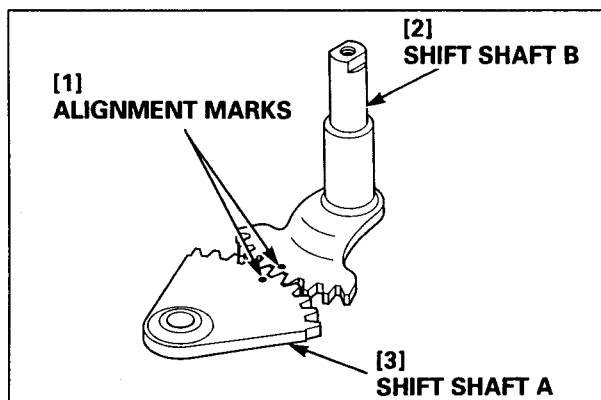
**TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)**

Tighten the two 10 x 45 mm flange bolts at the side of the seal holder to the specified torque (P. 7-8).

**TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)**

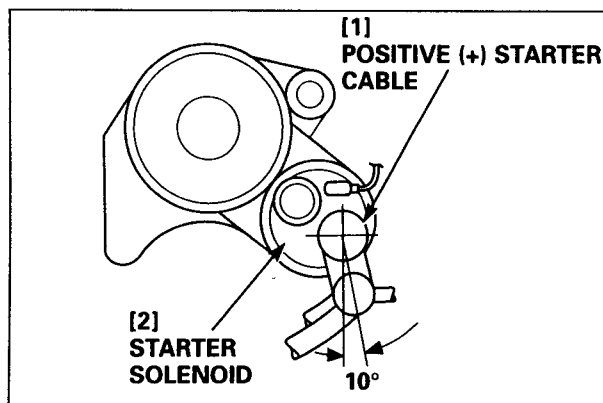
Tighten the two 10 mm cap nuts.

- 4) Clamp the positive (+) starter cable and the 90A fuse cable using the 10 mm wire harness clip. Note that there must be no slack in the starter cable and the 90A fuse cable.



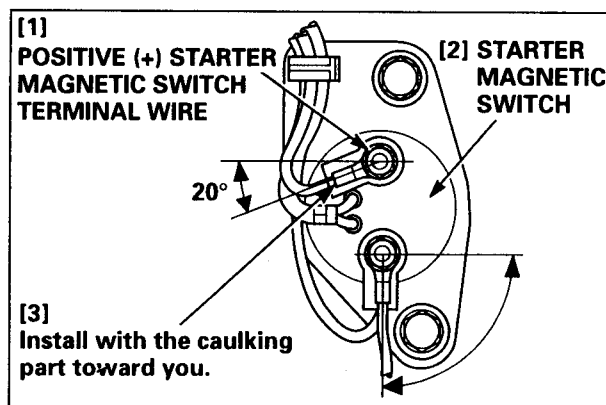
- 5) Connect the positive (+) starter cable to the starter solenoid at an angle of 10° and tighten the 8 mm hex. nut to the specified torque.

**TORQUE: 10.8 N•m (1.1 kgf•m, 8 lbf•ft)**



- 6) Connect the positive (+) starter magnetic switch terminal wire to the starter magnetic switch at an angle of 20° with the caulking part of the terminal toward you. Tighten the 6 mm hex. nut to the specified torque.

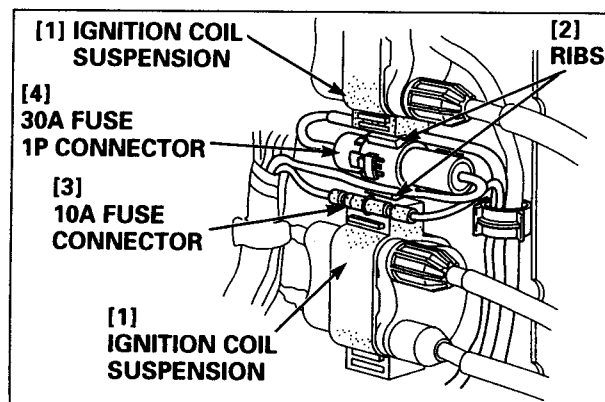
**TORQUE: 4.9 N•m (0.5 kgf•m, 3.6 lbf•ft)**



- 7) Connect the starter cable 30A fuse 1P connector and the 10A fuse connector.

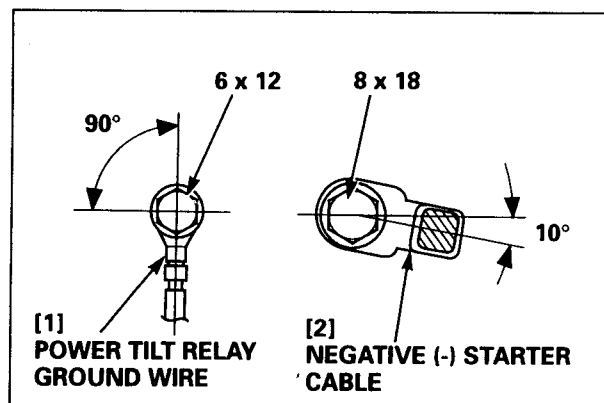
Set the 1P connector between the ribs of the ECM case by turning the connector 180° as shown, and set the wire between the ignition coil suspension and the rib.

Set the 10A fuse connector between the lower rib of the ECM case and the ignition coil suspension.

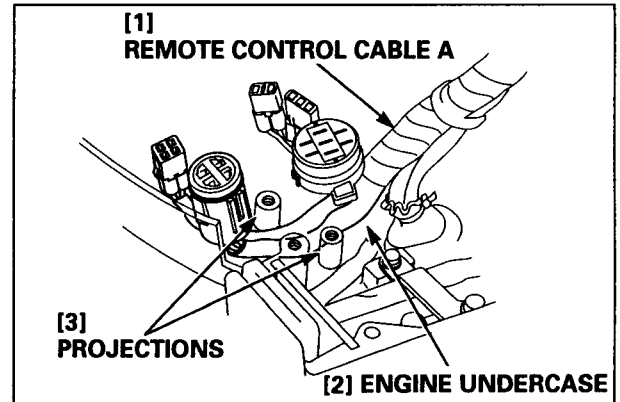


- 8) Connect the negative (-) starter cable at an angle of 10° and tighten the 8 x 18 mm flange bolt.

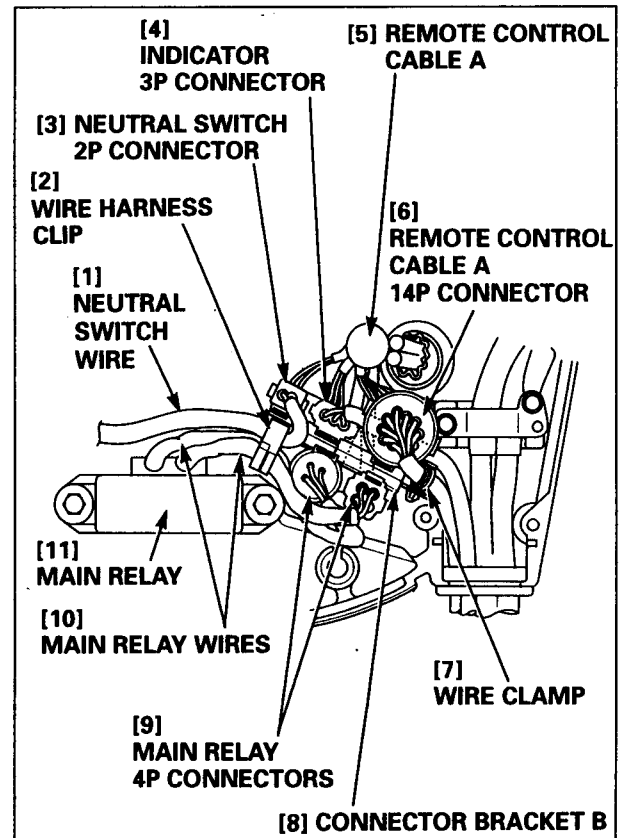
Connect the power tilt relay ground wire at an angle of 90° and tighten the 6 x 12 mm flange bolt.



- 9) Pass the remote control cable A between the projections on the engine undercase and install the connector bracket B.

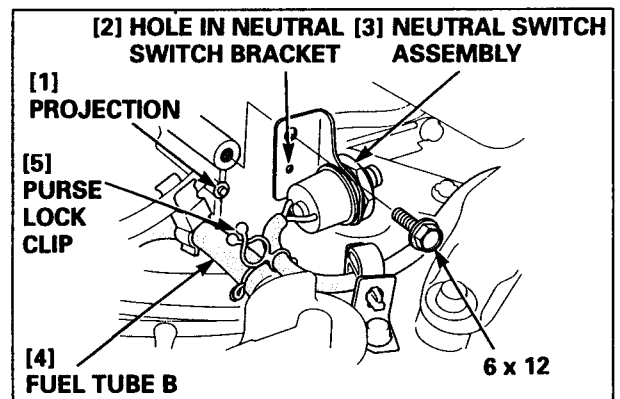


- 10) Connect each connector to the connector bracket B and clamp the wires.

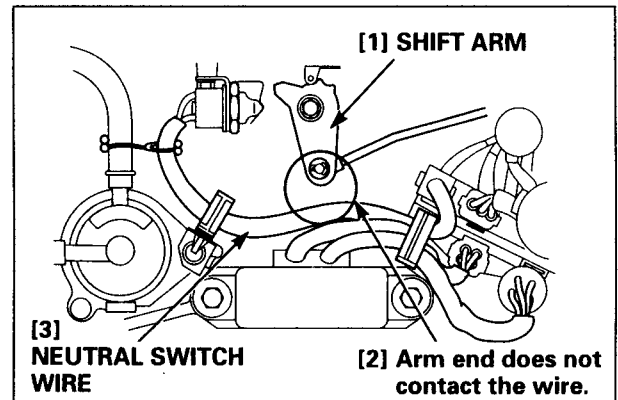


- 11) Install the neutral switch assembly by aligning the hole in the neutral switch bracket with the projection on the crankcase.

Set the purse lock clip on the fuel tube B.

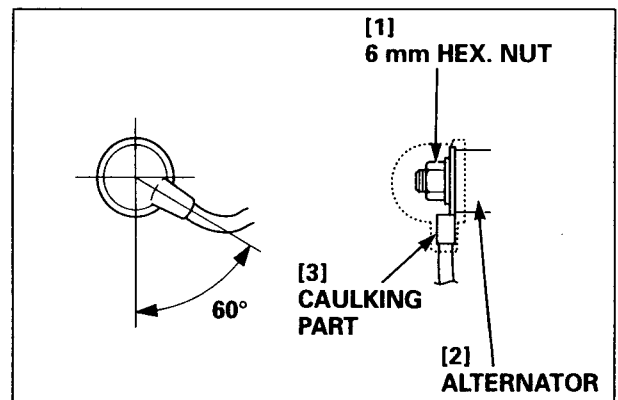


- 12) Move the shift arm and be sure that the arm end does not contact the neutral switch wire.



- 13) Connect the 90A fuse cable to the alternator at an angle of 60° with the caulking part toward you. Tighten the 6 mm hex. nut to the specified torque.

**TORQUE: 7.9 N·m (0.8 kgf·m, 5.8 lbf·ft)**

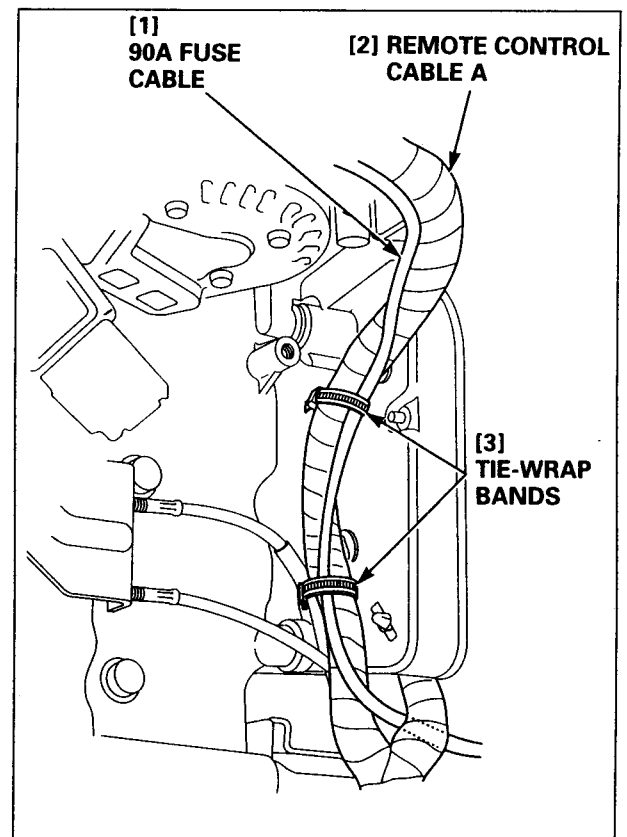


- 14) Secure the 90A fuse cable with the two tie-wrap bands so that the 90A fuse cable is at your side from the remote control cable A.

**CAUTION:**

**Install the silencer case with care not to let the 90A fuse cable be pinched in the silencer case.**

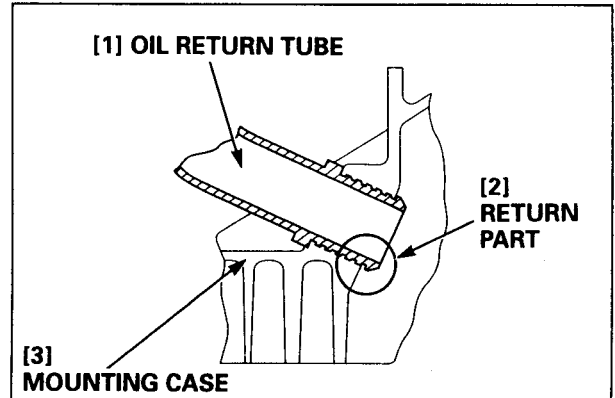
- 15) Install the silencer case (P. 5-56).





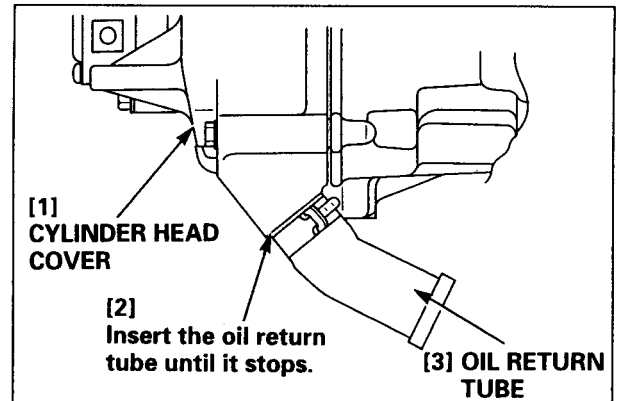
16) Check that the return part at the end of the oil return tube sets on the mounting case securely.

- If it is hard to set the return part on the mounting case, apply soapy water to the end of the tube.
- Do not apply oil to the tube.



17) Insert the oil return tube into the oil return pipe of the cylinder head cover until it contacts the head cover surface.

- If it is hard to set the return part on the mounting case, apply soapy water to the end of the tube.
- Do not apply oil to the tube.



# 8. WATER JACKET COVER/THERMOSTAT/ PRESSURE VALVE

**HONDA**  
BF115A•130A

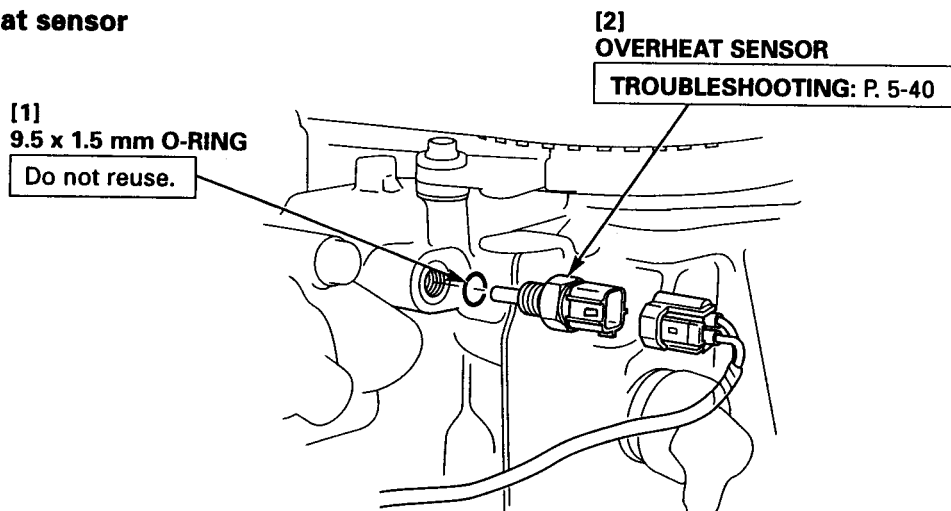
- |  |                                    |
|--|------------------------------------|
| 1. OVERHEAT SENSOR/FLUSHING WATER HOSE | 3. THERMOSTAT/WATER JACKET COVER   |
| 2. FLUSH VALVE                         | 4. OIL WATER JACKET PRESSURE VALVE |

## 1. OVERHEAT SENSOR/FLUSHING WATER HOSE

### a. REMOVAL/INSTALLATION

Remove the engine cover (P. 3-5).

#### • Overheat sensor



#### • Flushing water hose

Remove the rear separate case (P. 3-6).

#### [1] CANISTER HOSE CLAMP

**INSTALLATION:**  
Do not interfere with the  
overheat sensor wire.

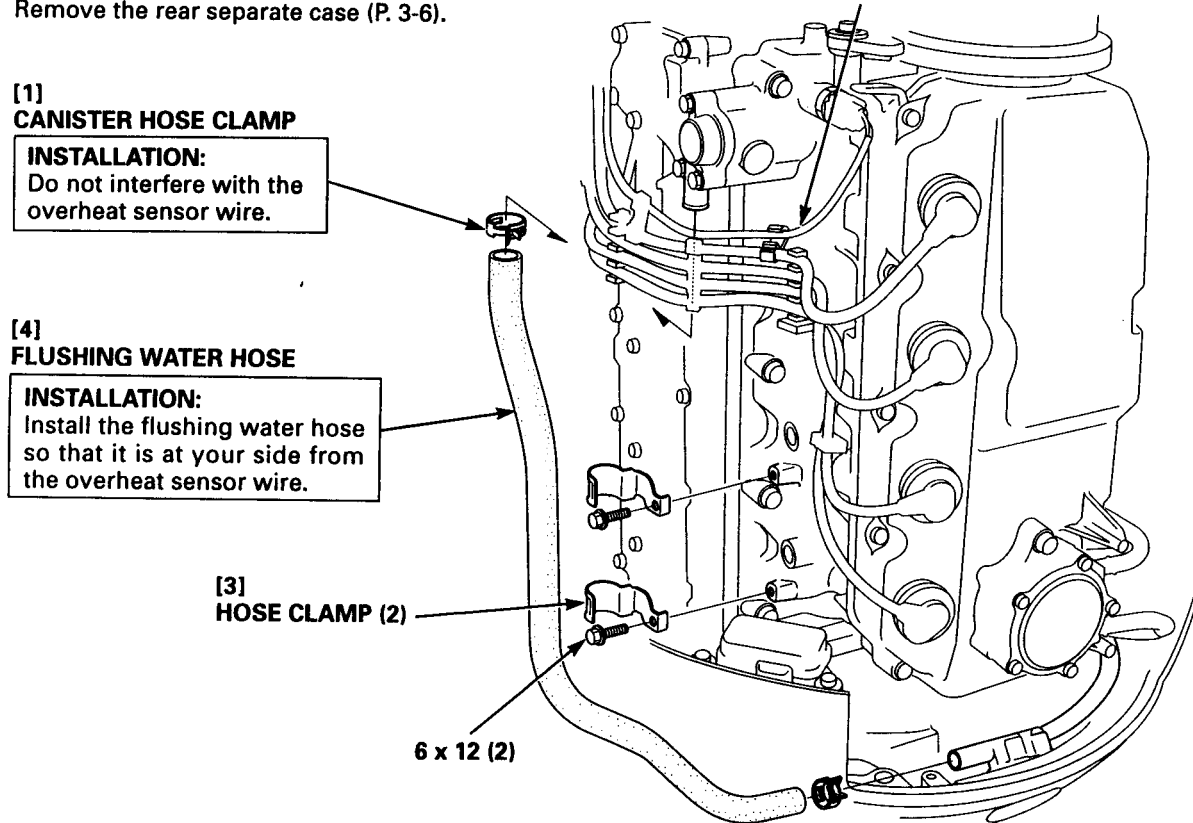
#### [4] FLUSHING WATER HOSE

**INSTALLATION:**  
Install the flushing water hose  
so that it is at your side from  
the overheat sensor wire.

#### [3] HOSE CLAMP (2)

6 x 12 (2)

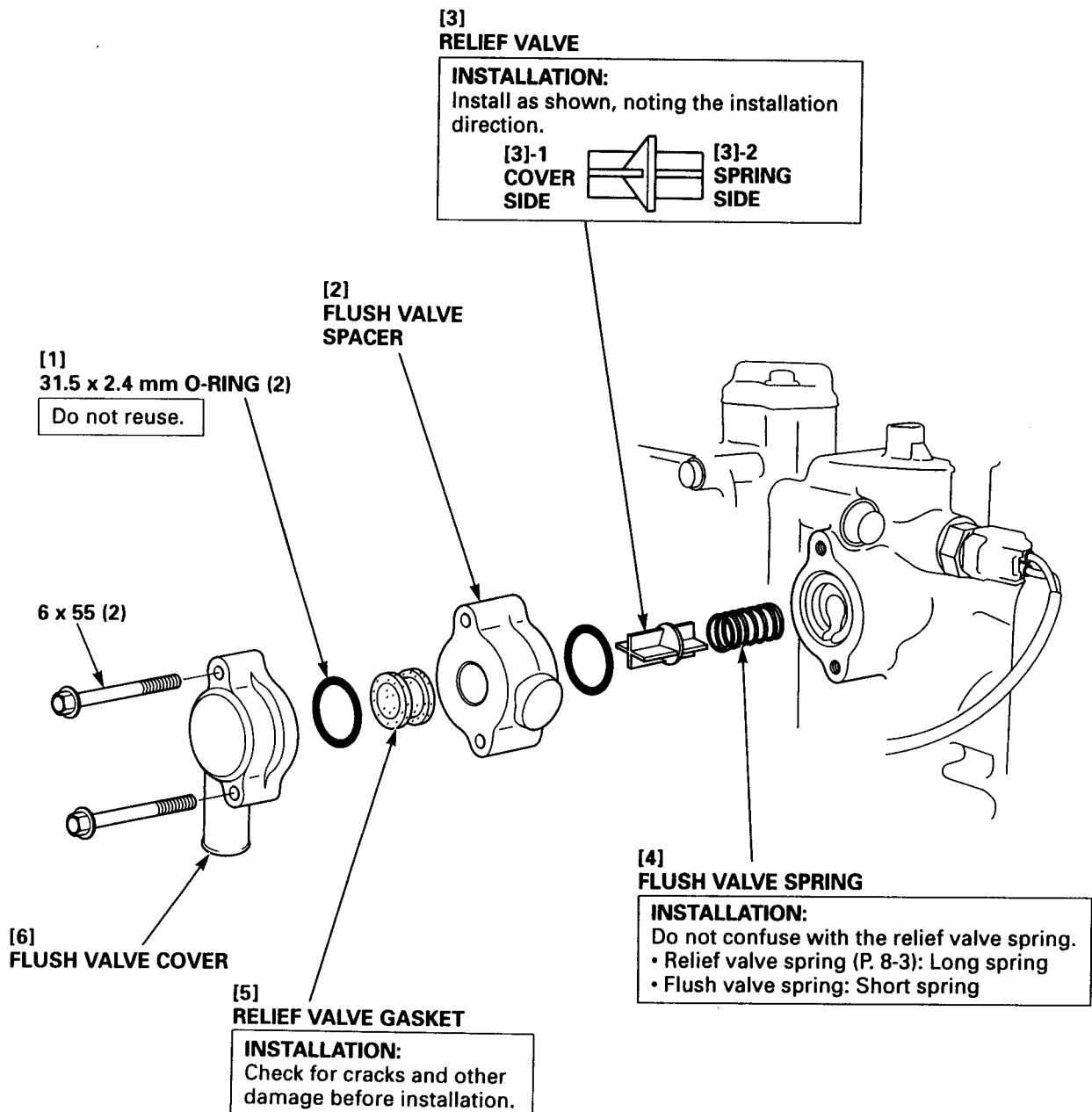
#### [2] OVERHEAT SENSOR WIRE



## 2. FLUSH VALVE

### a. REMOVAL/INSTALLATION

Remove the flushing water hose (P. 8-1).



### 3. THERMOSTAT/WATER JACKET COVER

#### a. REMOVAL/INSTALLATION

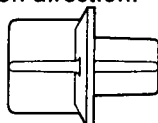
- 1) Remove the engine cover.
- 2) Remove the spark plug caps and disconnect the overheat sensor connector (P. 9-1).  
Remove the two high tension cord clamp A's securing the high tension cord from the stay (P. 9-1).
- 3) Open the 10 mm wire harness clip and release the starter cable and the 90A fuse cable (P. 7-6).

#### [2] RELIEF VALVE

##### INSTALLATION:

Install the relief valve as shown noting the installation direction.

[2]-1  
COVER  
SIDE



[2]-2  
SPRING  
SIDE

#### [1] RELIEF VALVE GASKET

##### INSTALLATION:

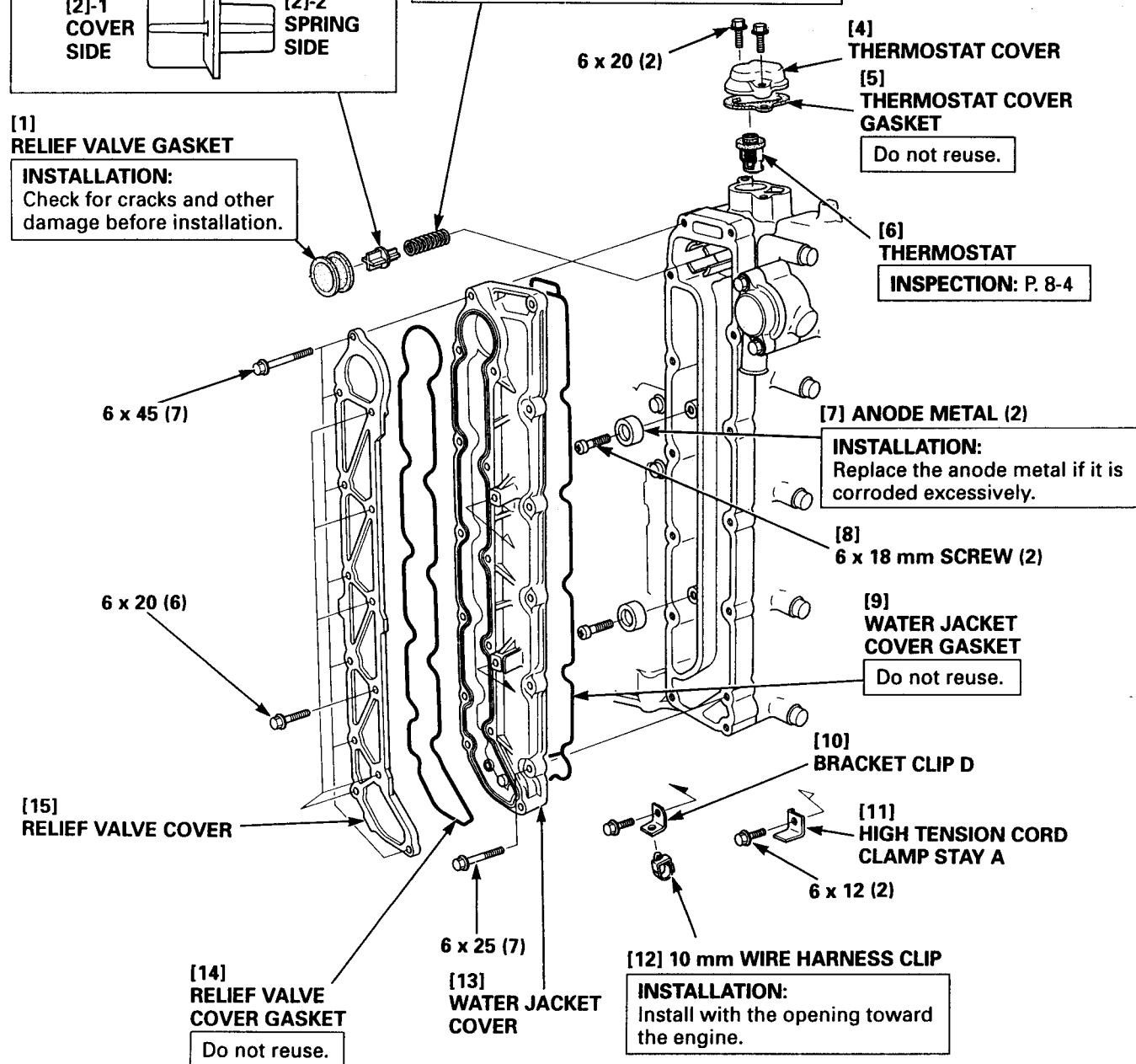
Check for cracks and other damage before installation.

#### [3] RELIEF VALVE SPRING

##### INSTALLATION:

Do not confuse with the flush valve spring.

- Relief valve spring: Long spring
- Flush valve spring (P. 8-2): Short spring



### b. INSPECTION

#### • THERMOSTAT

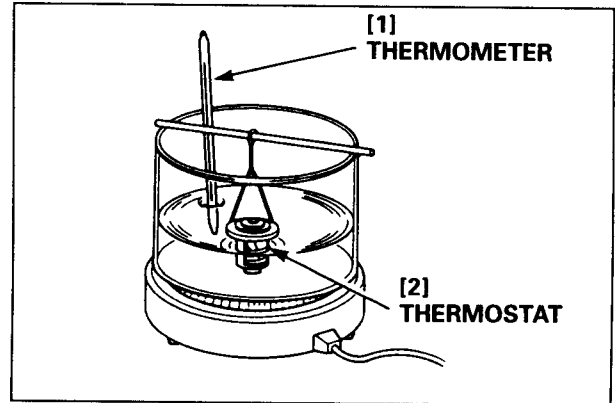
- 1) Immerse the thermostat in water.
- 2) Heat the water and observe the operation of the thermostat as the water temperature increases.
- 3) Measure the water temperature when the thermostat starts opening.

#### NOTE:

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	72 °C (162 °F)
Fully open	82 °C (180 °F)
Lift height	More than 3.0 mm (0.12 in)

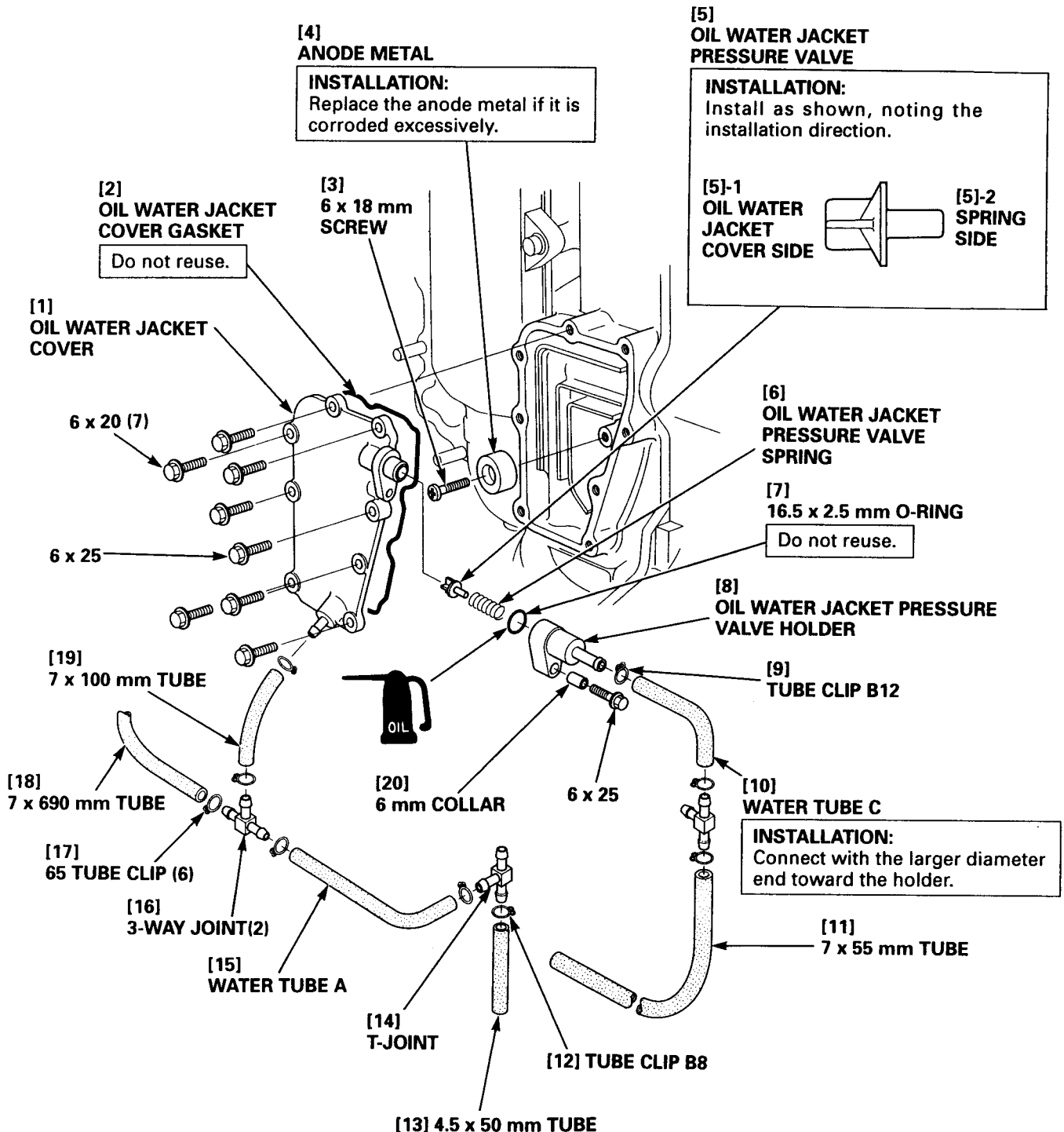


### 4. OIL WATER JACKET PRESSURE VALVE

#### a. REMOVAL/INSTALLATION

Remove the intake manifold assembly (P. 5-67).

- Check each tube for cracks and other damage before installation and replace as needed.



# 9. CYLINDER HEAD/VALVES

**HONDA**  
**BF115A·130A**

- 1. CYLINDER HEAD ASSEMBLY REMOVAL/  
INSTALLATION
- 2. CYLINDER HEAD

- 3. INSPECTION
- 4. VALVE GUIDE REPLACEMENT
- 5. VALVE SEAT RECONDITIONING

## 1. CYLINDER HEAD ASSEMBLY REMOVAL/ INSTALLATION

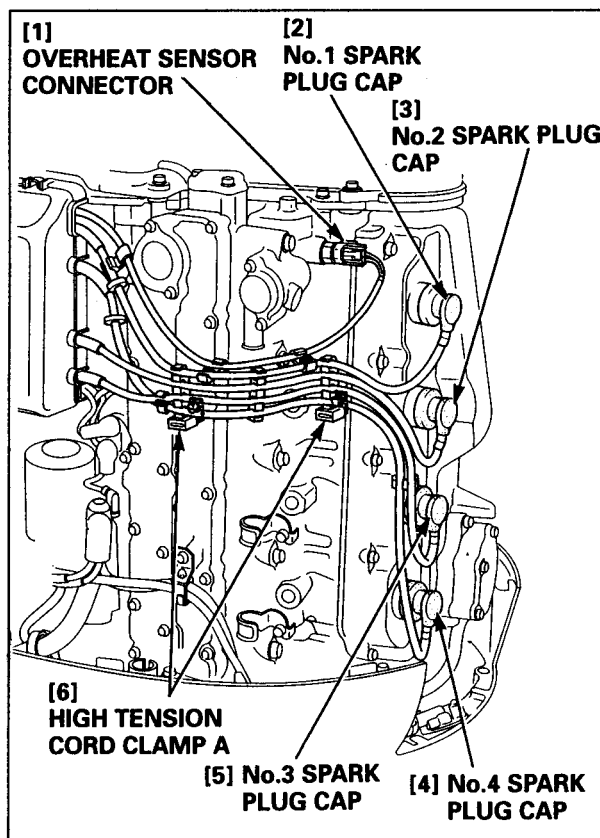
### a. REMOVAL

- Cylinder head assembly removal/ instalation 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).

Remove the follwing parts.

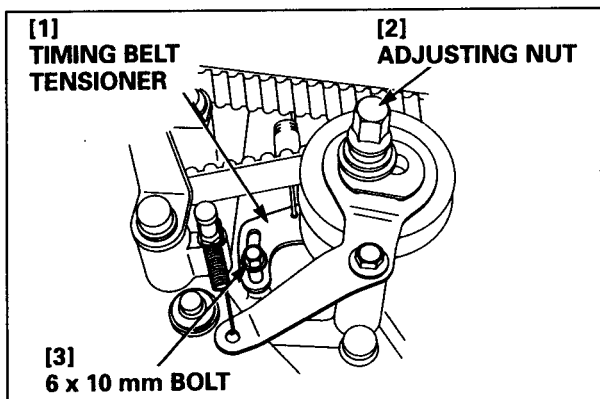
- Timing belt upper cover (P. 3-5 and 6).
- Flushing water hose (P. 8-1).
- Intake manifold assembly (P. 5-67).

- 1) Remove the spark plug caps. Disconnect the connector from the overheat sensor.  
Remove the two high tension cord clamp A's, that secure the high tension cord, from the stay.

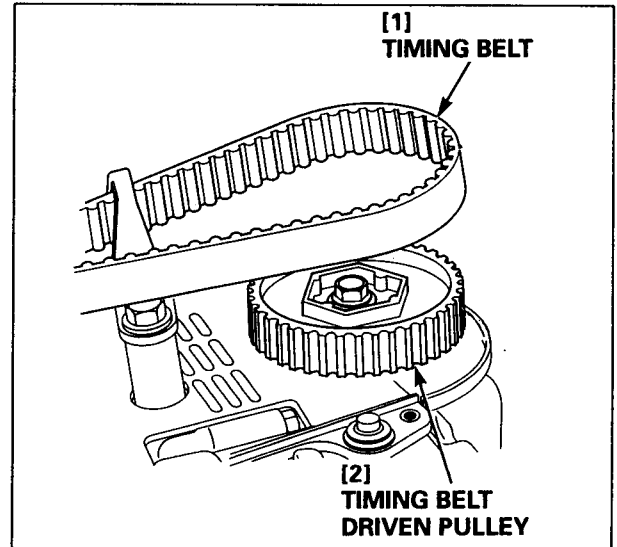


- 2) Be sure that the timing belt driven pulley is at the top dead center of the compression stroke of the No.1 cylinder (P. 3-7).
- 3) Prepare the 6 x 10 mm bolt (pitch: 1.0 mm). Loosen the adjusting nut 2/3 to 1 turn. Pushing the timing belt tensioner to the opposite side from the timing belt, tighten the 6 x 10 mm bolt.  
Tighten the adjusting nut.

- Do not loosen the adjusting nut more than 1 turn.



- 4) Remove the timing belt from the timing belt driven pulley.

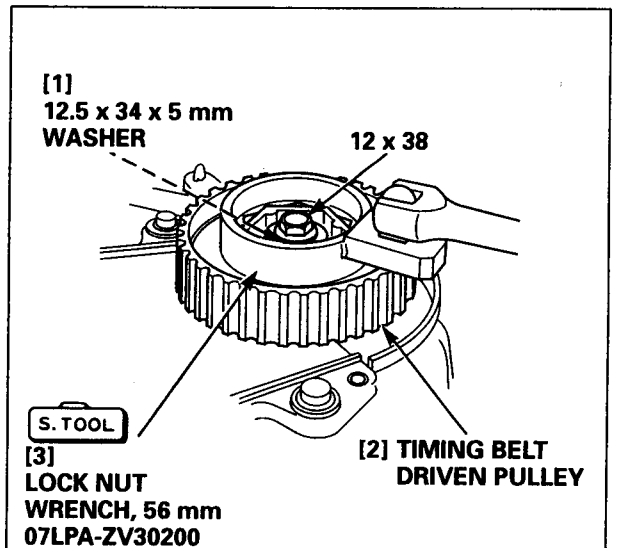


- 5) Using the special tool, remove the 12 x 38 mm flange bolt and the 12.5 x 34 x 5 mm washer that secure the timing belt driven pulley.

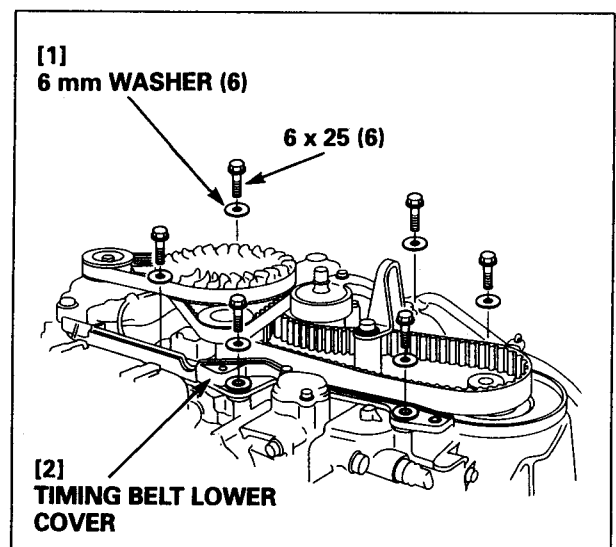
**TOOL:**

Lock nut wrench, 56 mm

07LPA-ZV30200



- 6) Remove the six 6 x 25 mm flange bolts and the six 6 mm washers that secure the timing belt lower cover.





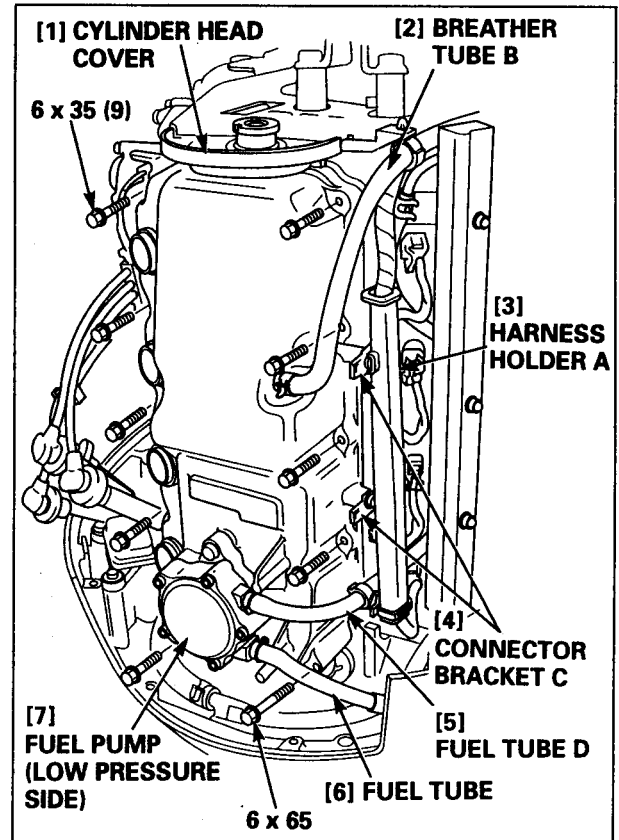
- 7) Disconnect the breather tube B from the cylinder head cover.

Remove the harness holder A from the connector bracket C.

- 8) Disconnect the fuel tube and the fuel tube D from the fuel pump (low pressure side). Remove the nine 6 x 35 mm flange bolts and the 6 x 65 mm flange bolt from the cylinder head cover, and remove the cylinder head cover and the oil return tube as a set.

- Before disconnecting the fuel tube and the fuel tube D, clamp the tubes with the fuel tube clips to prevent gasoline leakage.

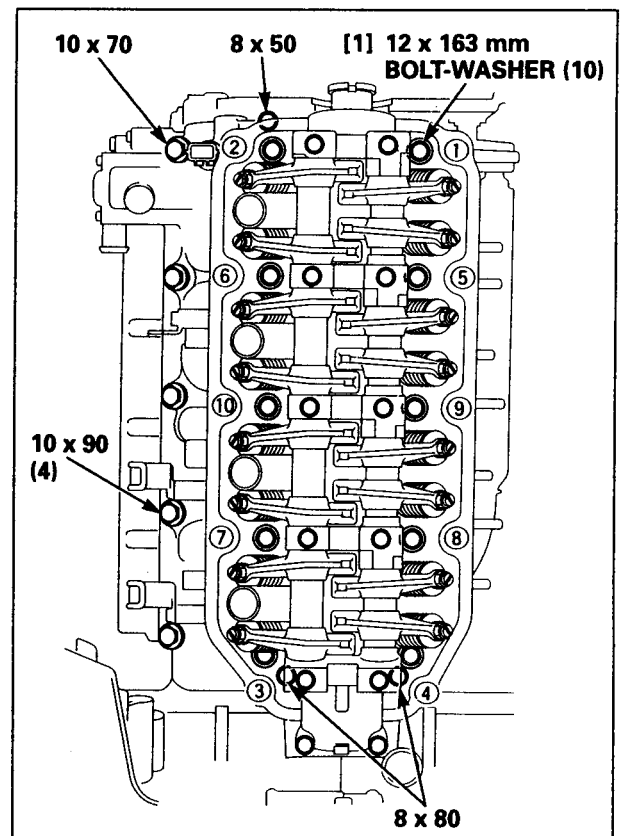
- 9) Remove the 90A fuse box (P. 17-24).



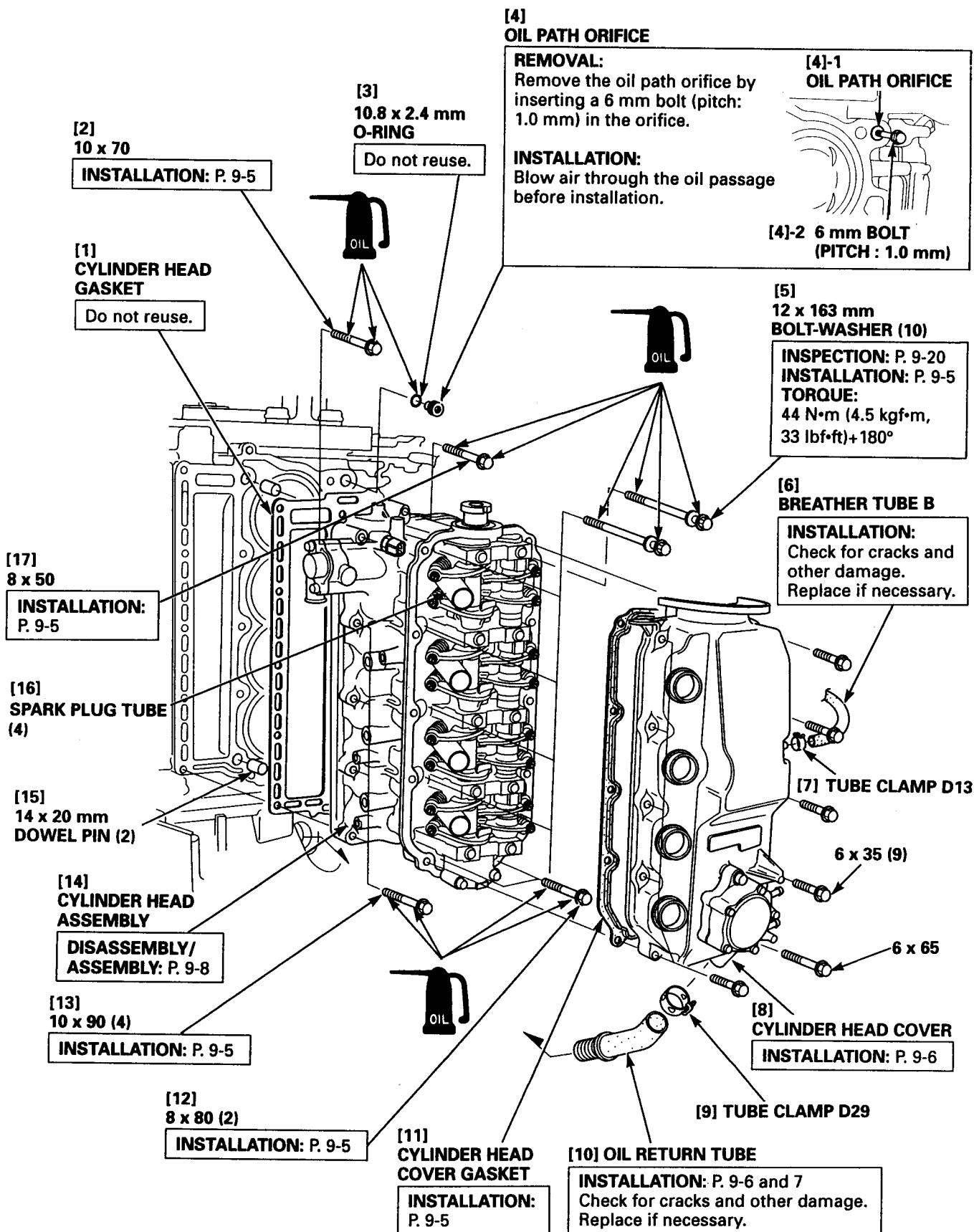
- 10) Remove the following bolts in the listed order.

- 8 x 50 mm flange bolt
- Two 8 x 80 mm flange bolts
- 10 x 70 mm flange bolt
- Four 10 x 90 mm flange bolts

- 11) Remove the 12 x 163 mm bolt-washers in the numbered order in the two or three steps.



12) Remove the cylinder head assembly, cylinder head gasket and the two 14 x 20 mm dowel pins.



### b. INSTALLATION

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

- 1) 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 (P. 9-4).
- 2) Install the cylinder head assembly.
- 3) Apply the engine oil to the threaded section and the seating surface of each bolt, and loosely tighten the bolts against the cylinder head.
- 4) 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.

**TORQUE: 44 N·m (4.5 kgf·m, 33 lbf·ft)**

- 5) With the "I" mark on the flanged part of each 12 x 163 mm bolt-washer as the reference point, mark on the cylinder head at right angles to each reference mark. Tighten the bolt-washers to 90° in two steps in the numbered order.
- 6) After tightening the 12 x 163 mm bolt-washers, tighten the other bolts in the numbered order (11 to 18) in two or three steps to the standard torque.

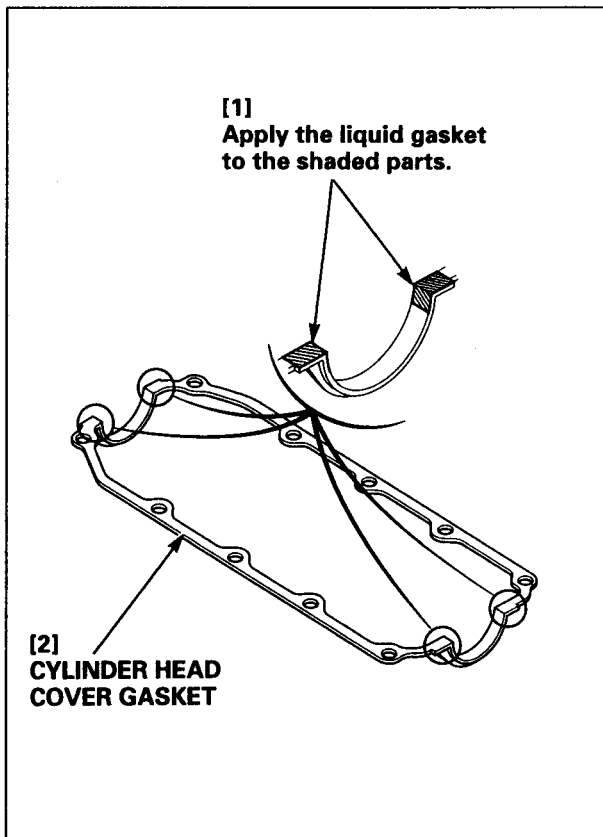
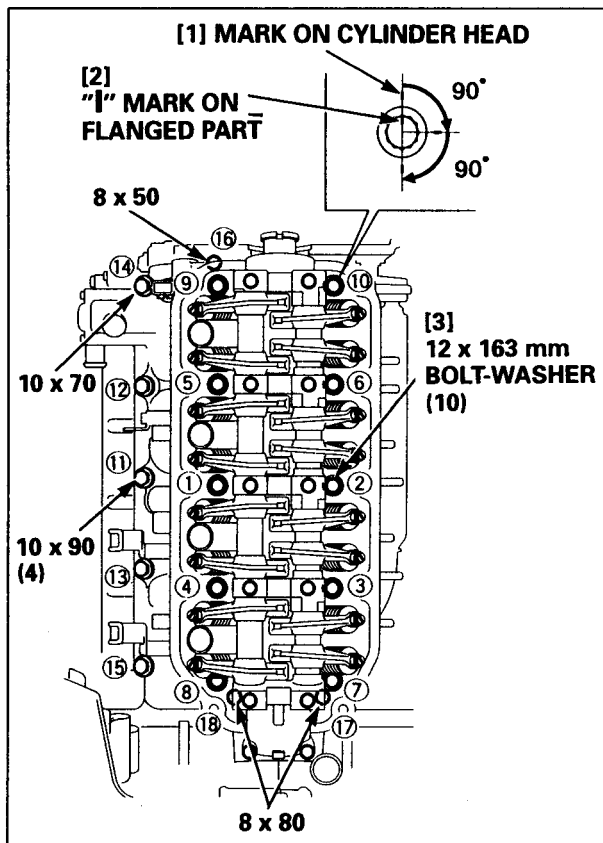
#### STANDARD TORQUE:

**39 N·m (4.0 kgf·m, 29 lbf·ft) (10 mm flange bolt)**

**26 N·m (2.7 kgf·m, 20 lbf·ft) (8 mm flange bolt)**

- 7) Apply the liquid gasket (Three Bond #1201 or #1215, or equivalent) to the indicated points of the head cover gasket.

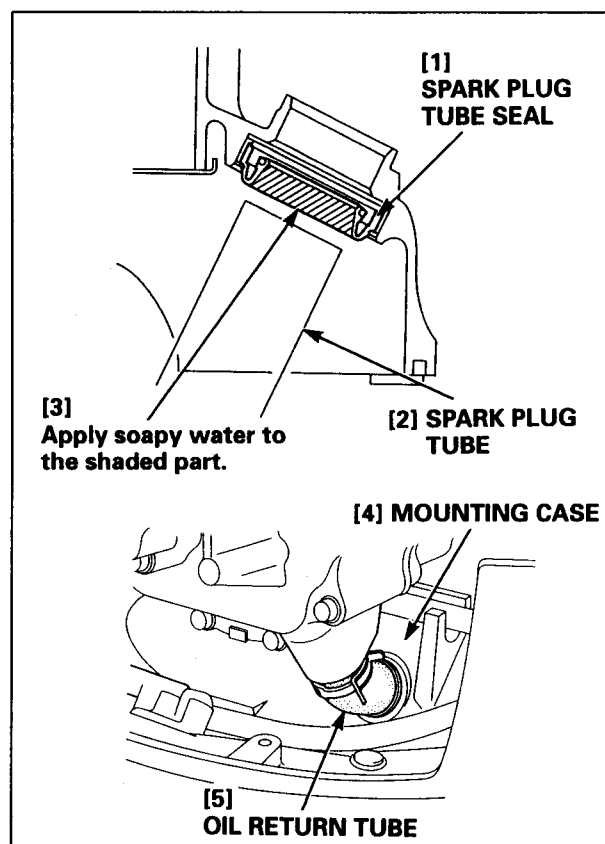
- Remove the old liquid gasket from the head cover gasket.
- Install the cylinder head cover gasket within 5 minutes after applying the liquid gasket. If you failed to install the cylinder head gasket within 5 minutes after application of the liquid gasket, remove the cylinder head gasket and coat it with the liquid gasket again.



8) Apply soapy water to the lip (shaded part) of the spark plug tube seal as shown.

9) 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.

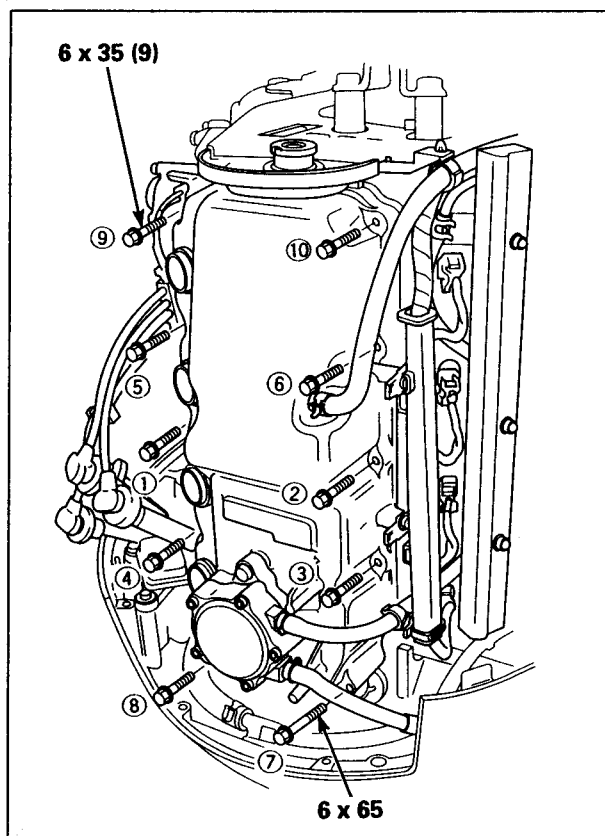
- Insert the spark plug tube into the spark plug tube seal with care not to cut or turn up the seal.
- After installing the cylinder head cover, visually check the seal for turn-up or damage.
- Wipe up the excessive soapy water that oozed out from the lip of the spark plug tube.



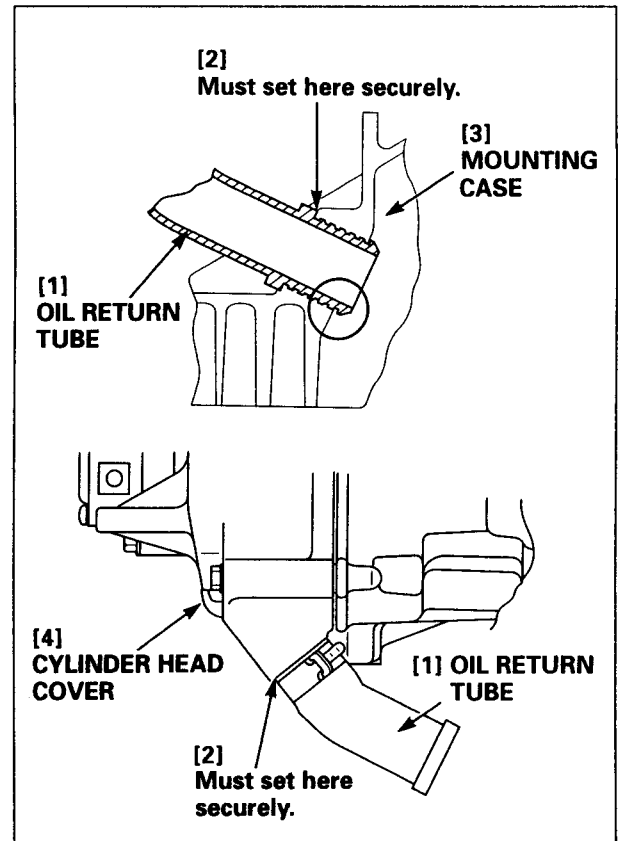
10) Loosely tighten the nine 6 x 35 mm flange bolts and the 6 x 65 mm flange bolt against the cylinder head cover.

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)**



- 11) After tightening the 6 mm flange bolts, check whether the oil return tube is inserted in the hole in the mounting case securely. Check whether the oil return tube sets securely on the cylinder head cover surface, too.



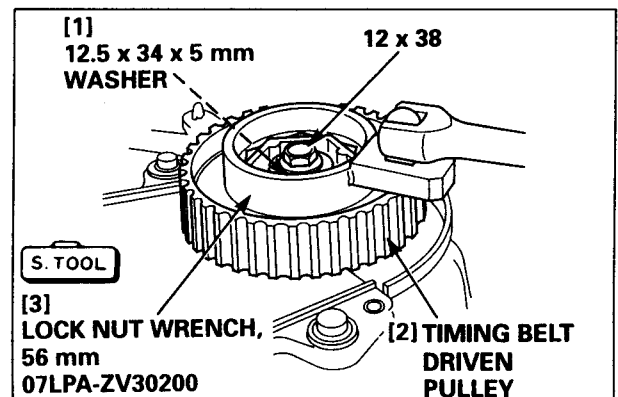
- 12) Set the timing belt driven pulley on the camshaft.  
Apply oil to the threaded part and the seating surface of the 12 x 38 mm flange bolt. Using the special tool, tighten the 12 x 38 mm flange bolt to the specified torque.

**TORQUE: 98 N·m (10.0 kgf·m, 72 lbf·ft)**

**TOOL:**

Lock nut wrench, 56 mm

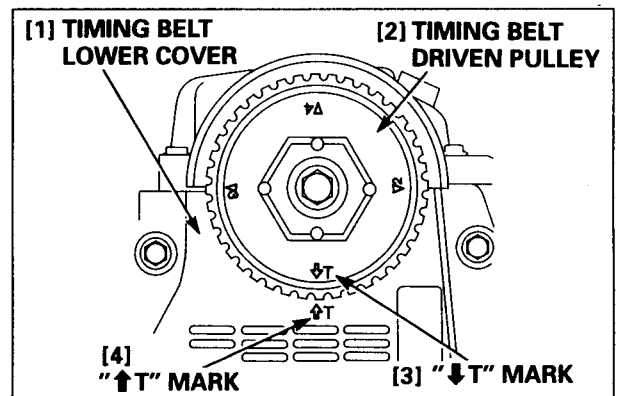
07LPA-ZV30200



- 13) Check whether the cutout in the crankshaft pulley aligns with the "↑" mark on the timing belt lower cover (P. 3-22).

- 14) Check the "↓T" mark on the timing belt driven pulley aligns with the "↑T" mark on the timing belt lower cover, then install the timing belt.

- 15) Remove the 6 x 10 mm bolt and adjust the timing belt tension (P. 3-22).

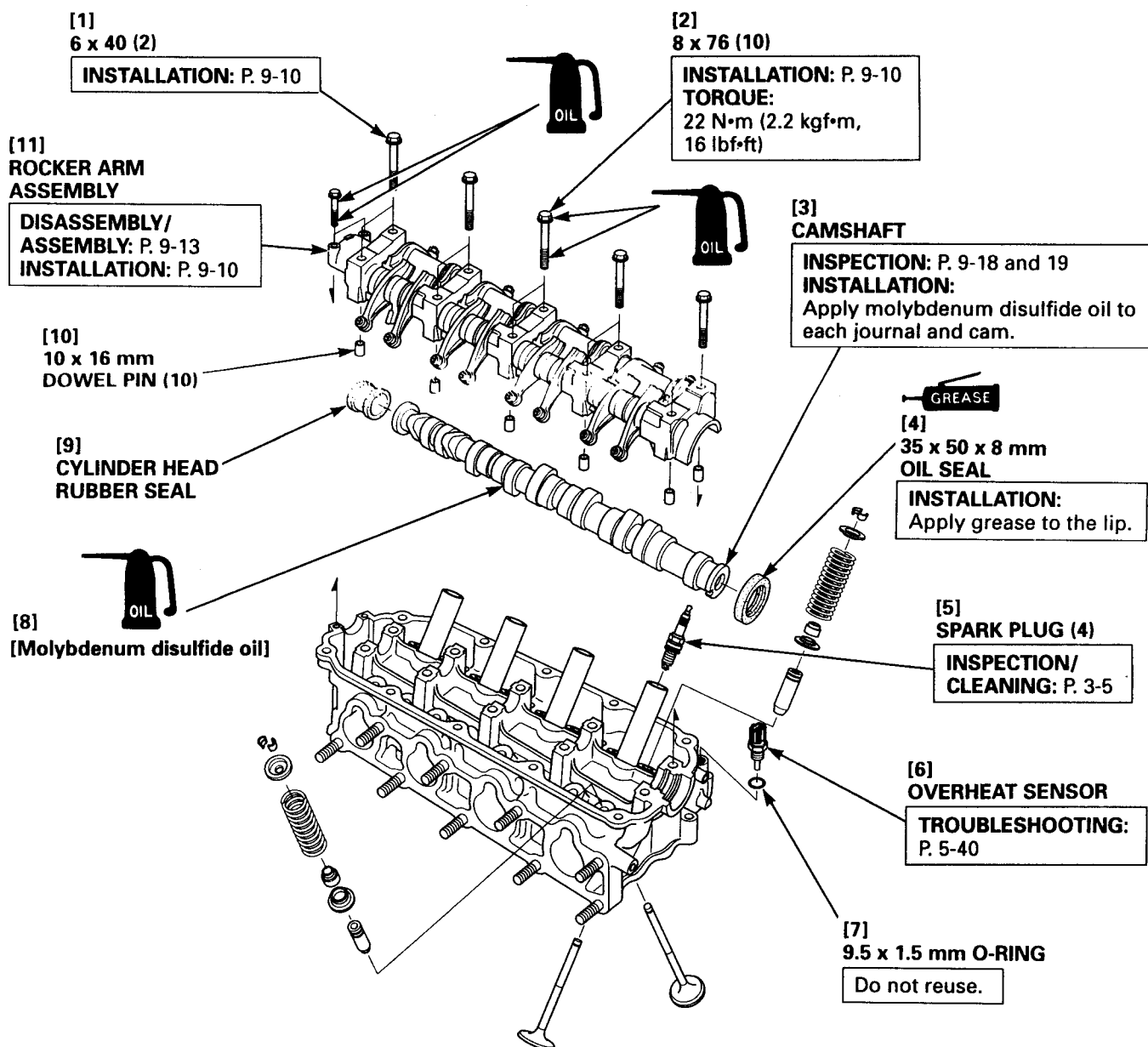


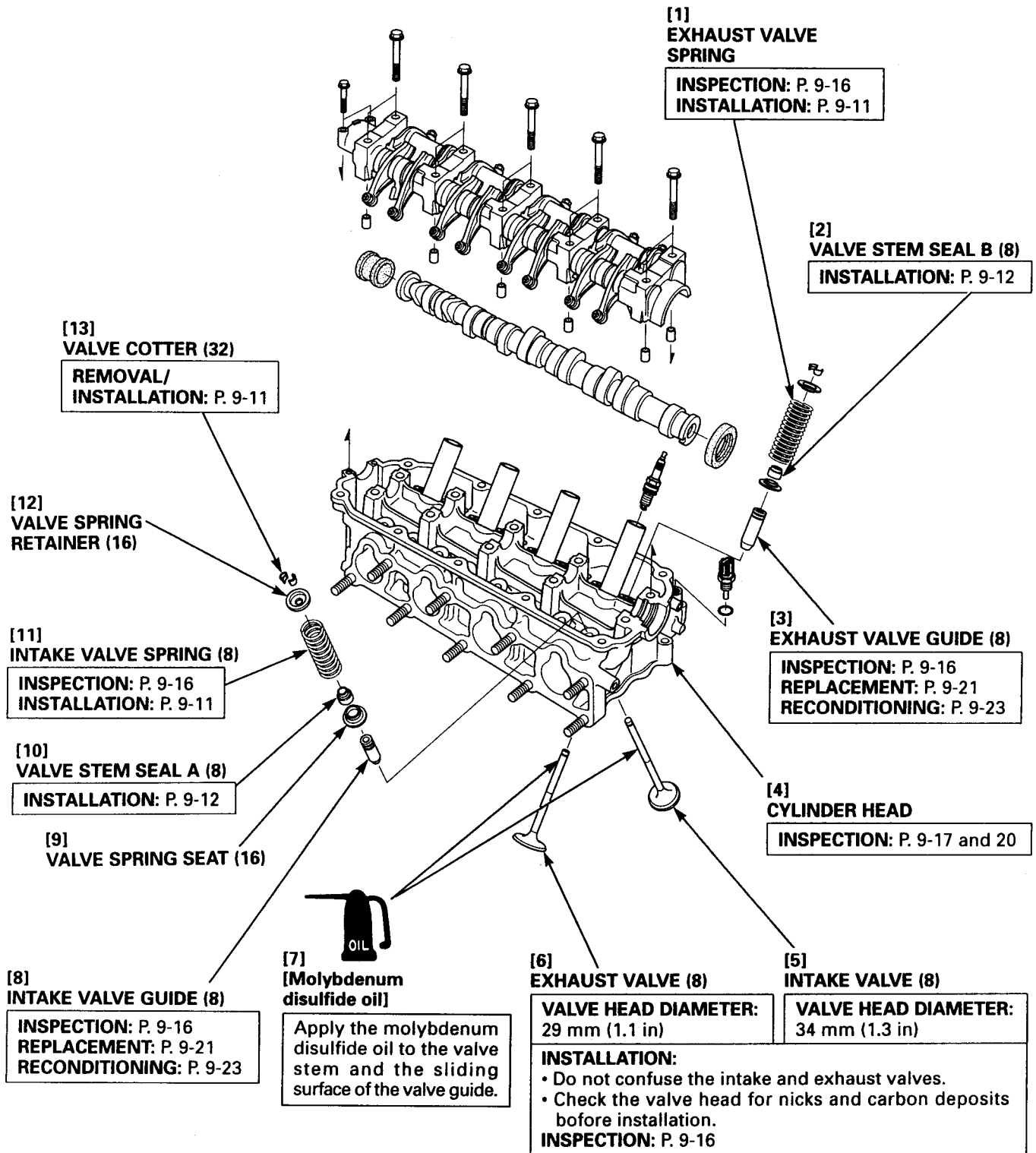
## 2. CYLINDER HEAD

### a. DISASSEMBLY/ASSEMBLY

Remove the cylinder head assembly (P. 9-1).

- Store the removed parts securely classifying them into the groups of the intake side and the exhaust side of each cylinder.
- Replace the valve stem seals A and B whenever they are removed.
- Remove the valves slowly. Removing the valves quickly can damage the valve stem seals.
- Apply engine oil to each cylinder head component before assembly.
- Removal/installation of the rocker arm assembly must be made by loosening the lock nuts of all rocker arms and loosening the adjusting screws fully (P. 9-10). Remove the rocker arm assembly from the cylinder head without removing the rocker arm assembly mounting bolts (12 bolts).



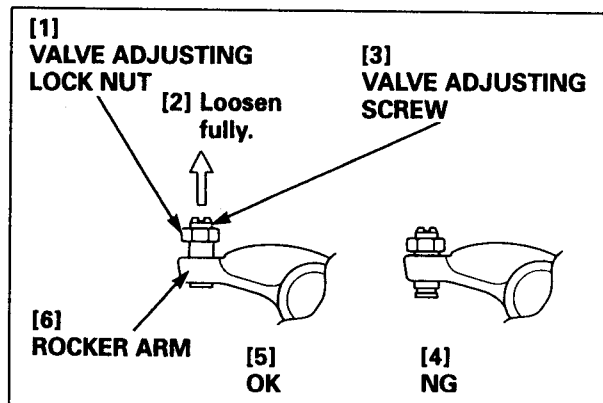


### • ROCKER ARM ASSEMBLY

#### REMOVAL/INSTALLATION:

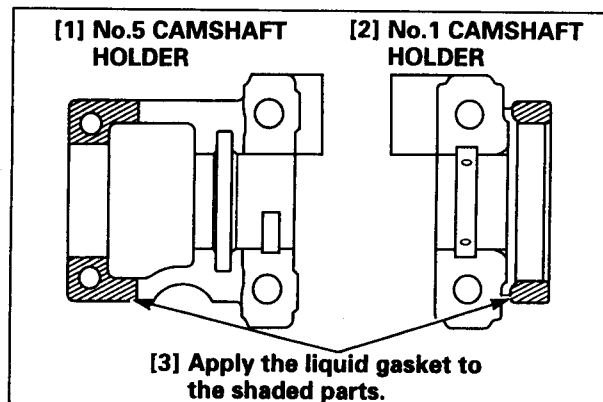
- 1) Loosen the intake and exhaust valve adjusting lock nuts. Remove and install the rocker arm assembly with the valve adjusting screw loosened fully as shown.

- Hold the bolt inserted when the rocker arm assembly is not disassembled.



- 2) Apply the liquid gasket (Three Bond #1201 or #1215 or equivalent) to the cylinder head mating surfaces of the No.1 and the No.5 camshaft holders. Install the rocker arm assembly.

- Install the rocker arm assembly on the cylinder head with the groove in the head of the camshaft facing up.



### • 6 x 40 mm FLANGE BOLT/8 x 76 mm FLANGE BOLT

#### INSTALLATION:

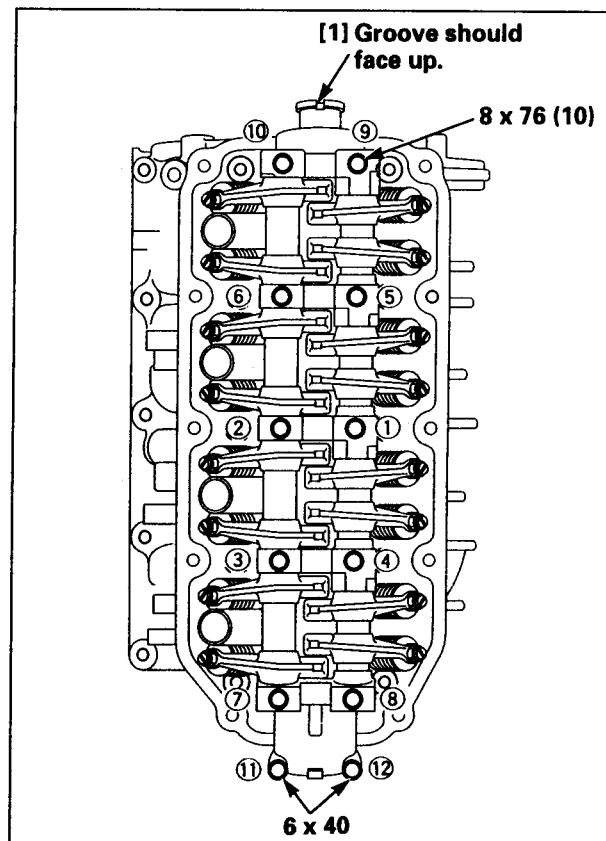
- 1) Check whether the groove in the head of the camshaft is facing up.
- 2) Tighten the bolts in the numbered order in two or three steps. Be sure to tighten the 8 x 76 mm flange bolts to the specified torque and tighten the 6 x 40 mm flange bolts to the standard torque.

#### TORQUE:

22 N·m (2.2 kgf·m, 16 lbf·ft) (8 x 76 mm flange bolt)

#### STANDARD TORQUE:

12 N·m (1.2 kgf·m, 9 lbf·ft) (6 x 40 mm flange bolt)





### • VALVE COTTERS/VALVE SPRING

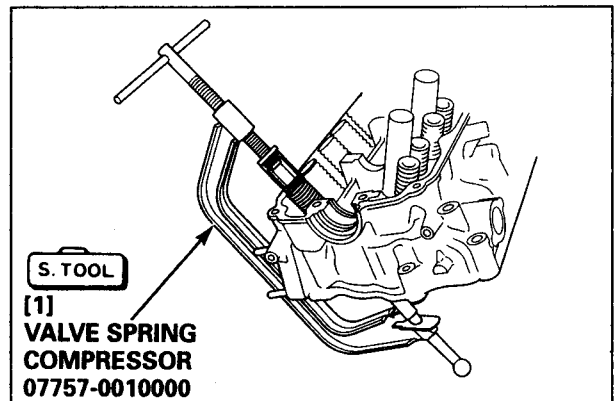
#### REMOVAL:

- After removing the valve cotters, store the related parts of the valves and the valve springs by classifying them into the respective cylinders. On installation, install the parts in the designated position securely.
- 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.
    - 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



#### INSTALLATION:

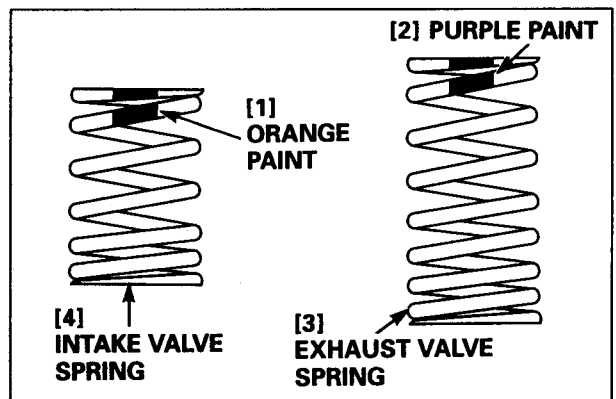
- 1) Do not confuse the intake and the exhaust valve springs.  
Note the installation direction.

#### <Identification>

The intake side can be identified with the orange paint mark on the spring. The exhaust side can be identified with the purple paint.

#### <Installation direction>

Install the intake and the exhaust valve springs with the side marked with the paint toward the valve spring retainer.



- 2) Using the same special tool as that used during removal, compress the valve springs and set the valve cotters in the groove in the respective valve stems securely.

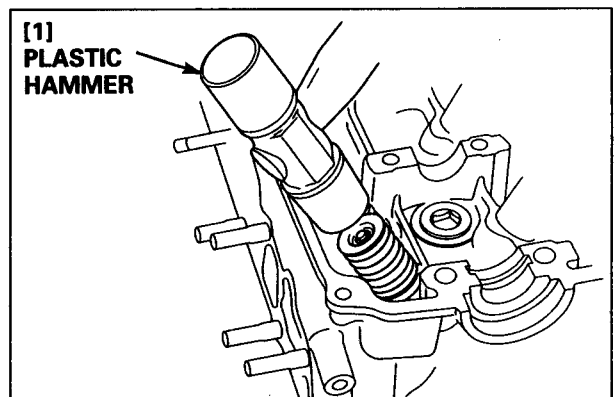
#### TOOL:

Valve spring compressor

07757-0010000

- 3) Tap on the valve stem head lightly with a plastic hammer two or three times and set the valve and cotters in the proper position securely.

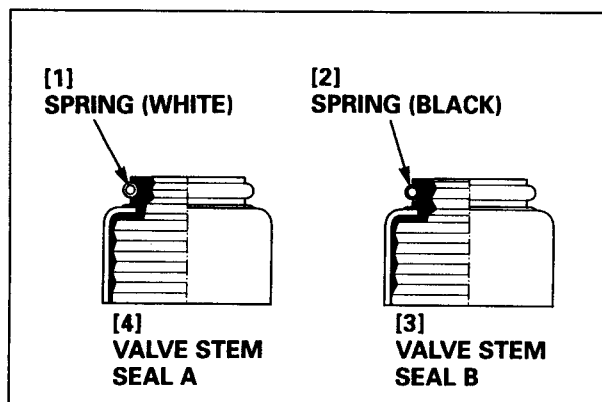
- Tap at right angles with each valve stem head.  
Take care not to bend the valves.



## • 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.



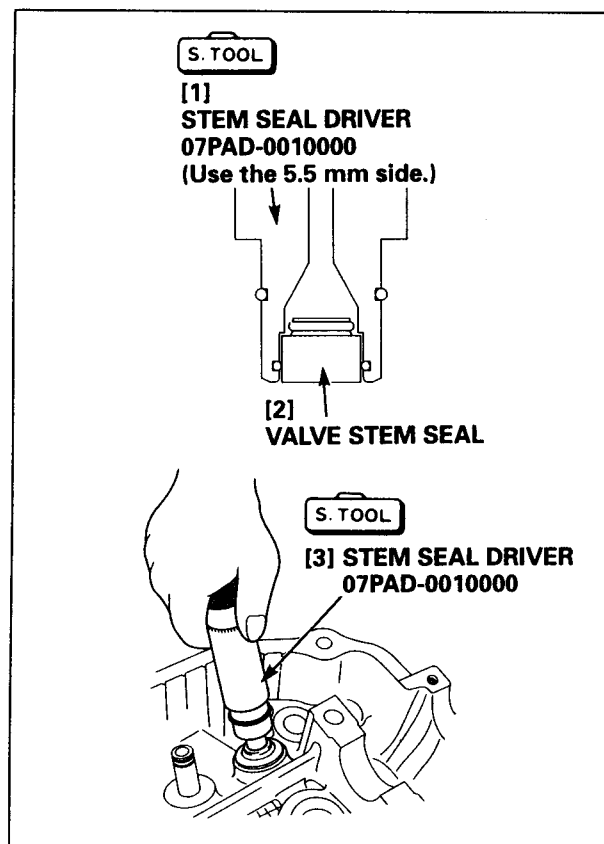
- 3) Set the valve stem seal in the special tool, and push it straight into the valve guide by hand.

- Use the 5.5 mm side of the special tool.

### TOOL:

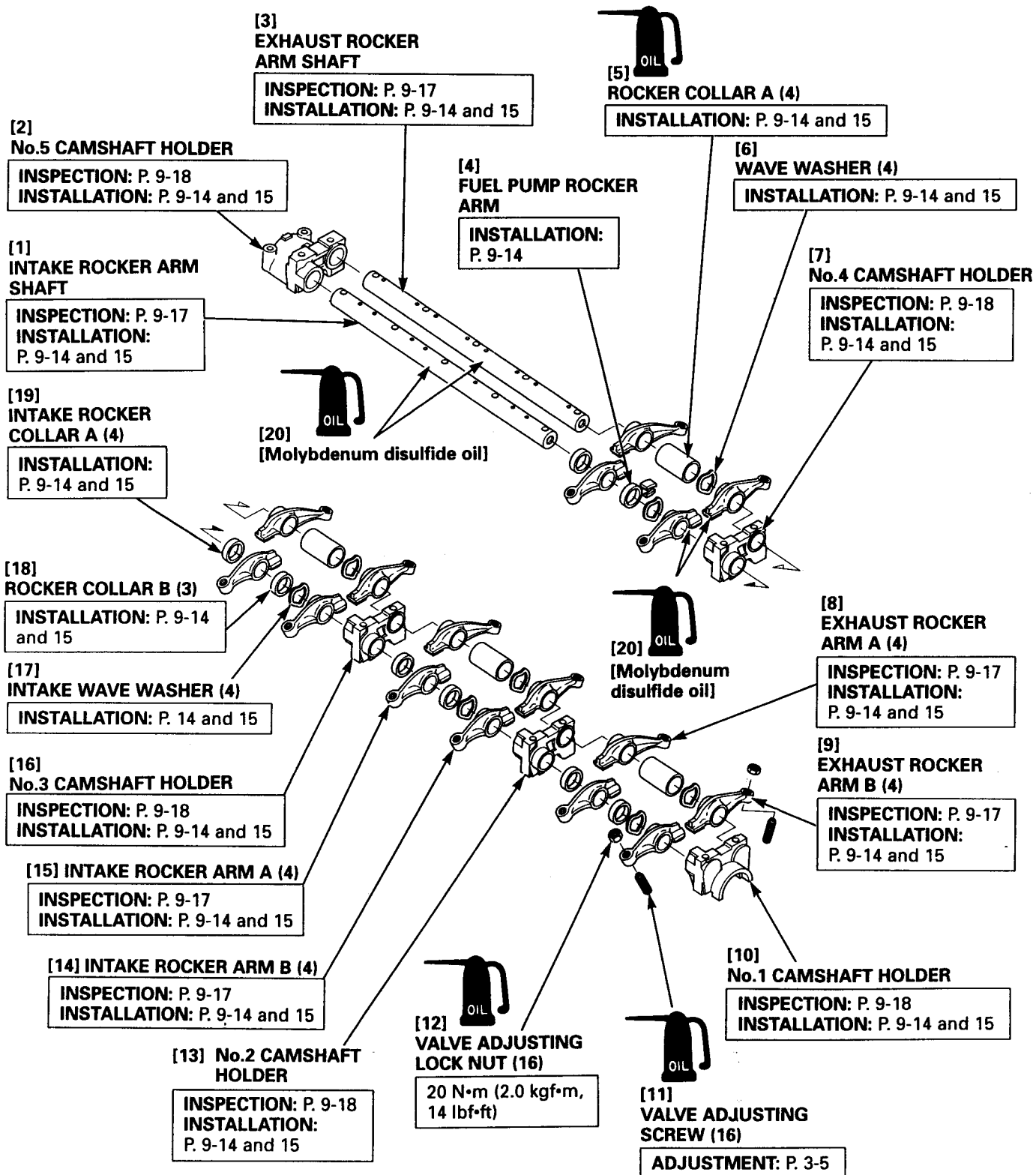
Stem seal driver

07PAD-0010000



### • ROCKER ARM ASSEMBLY DISASSEMBLY/ASSEMBLY

- Check the installation position of each part before disassembly. Install the parts in the proper position on reassembly.
- Check the rocker arms and fuel pump rocker arm in the surfaces that contact with the camshaft for wear and damage.



### ● ROCKER ARM SHAFT/CAMSHAFT HOLDER/ ROCKER ARM/WAVE WASHER/ROCKER COLLAR/ FUEL PUMP ROCKER ARM

#### INSTALLATION:

Install the following parts noting the installation direction. Do not confuse the parts and see page 9-15 for the installation order.

#### <Rocker arm shaft>

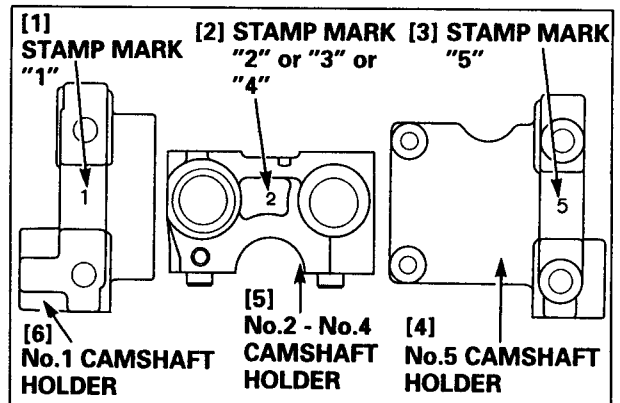
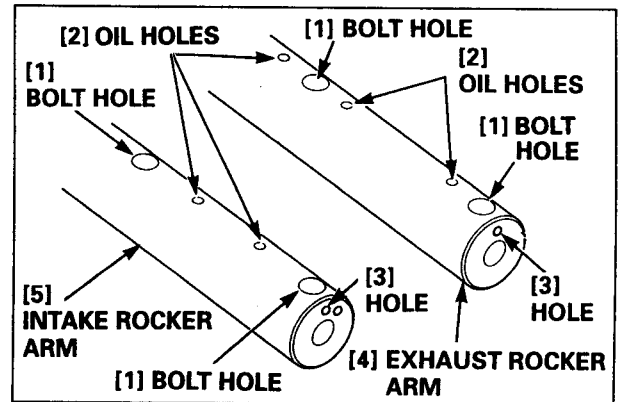
Install the rocker arm shafts at the No.1 camshaft holder side so that the hole at the end of the rocker arm shafts faces up.

Note that the intake rocker arm shaft can be identified with the larger shaft diameter and the exhaust rocker arm shaft can be identified with the smaller shaft diameter.

#### <Camshaft holder>

Each camshaft holder has the stamped number for identification. Check the number and do not confuse the camshaft holders.

Apply the liquid gasket to the No.1 and the No.5 camshaft holders (P. 9-10).



#### <Rocker arm>

Both the intake and the exhaust rocker arms are stamped with A or B for identification. Assemble them properly.

#### <Wave washer>

The intake wave washer can be identified by the larger diameter, and the exhaust side can be identified by the smaller diameter.

#### <Rocker collar>

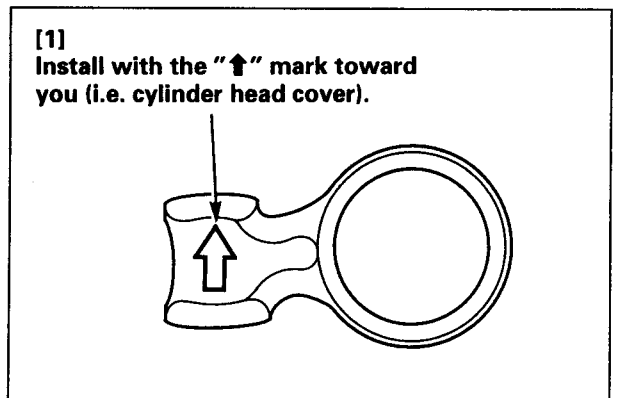
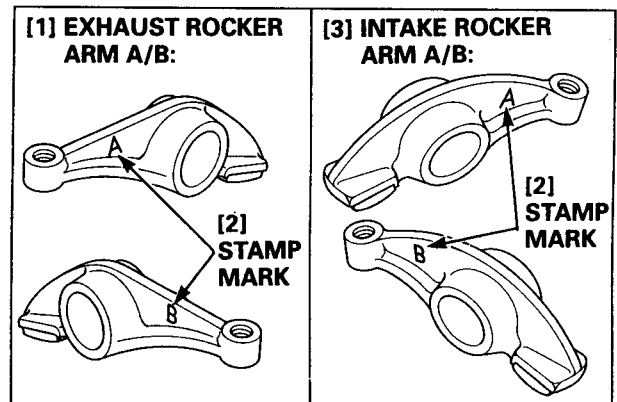
Rocker collar A: Highest collar

Rocker collar B: Higher than the intake rocker collar A

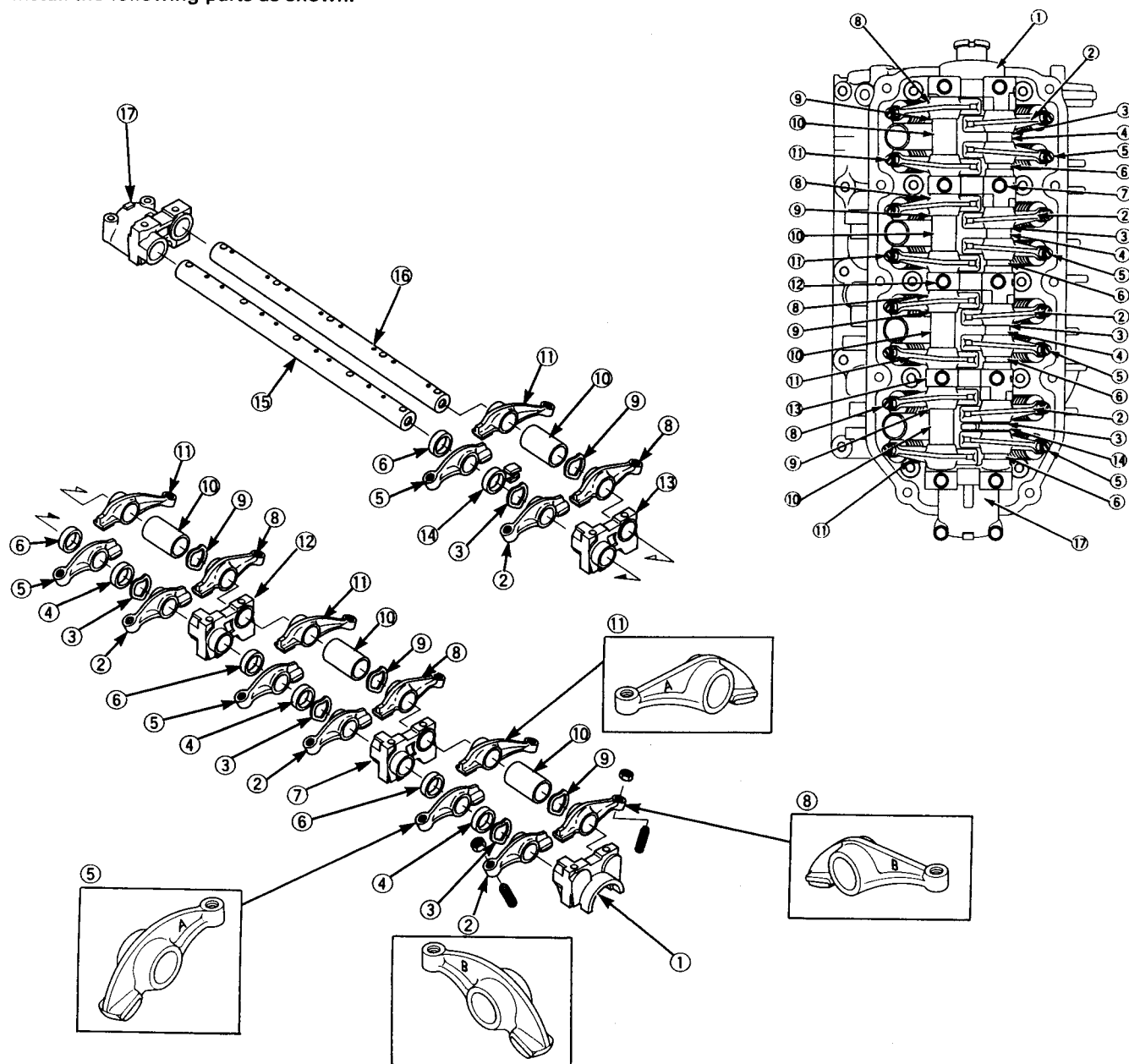
Intake rocker collar A: Lower than the rocker collar B

#### <Fuel pump rocker arm>

Install on the intake rocker arm shaft with the "↑" mark toward you (i.e. cylinder head cover).



Install the following parts as shown.



No.	Part name	Q'ty
①	No.1 camshaft holder	1
②	Intake rocker arm B	4
③	Intake wave washer	4
④	Rocker collar B	3
⑤	Intake rocker arm A	4
⑥	Intake rocker collar A	4
⑦	No.2 camshaft holder	1
⑧	Exhaust rocker arm B	4
⑨	Wave washer	4

No.	Part name	Q'ty
⑩	Rocker collar A	4
⑪	Exhaust rocker arm A	4
⑫	No.3 camshaft holder	1
⑬	No.4 camshaft holder	1
⑭	Fuel pump rocker arm	1
⑮	Intake rocker arm shaft	1
⑯	Exhaust rocker arm shaft	1
⑰	No.5 camshaft holder	1

### 3. INSPECTION

#### • VALVE SPRING FREE LENGTH

Measure the free length of the valve springs.

	STANDARD	SERVICE LIMIT
IN	53.66 mm (2.113 in)	—
EX	55.58 mm (2.188 in)	—

Replace the springs if they are shorter than the service limit (P. 9-9).

#### • 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 (P. 9-9).

#### • 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

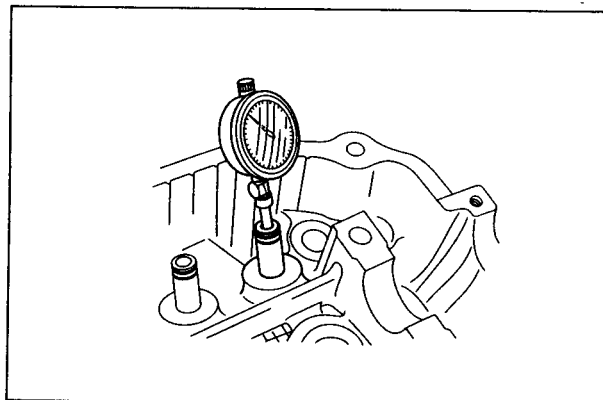
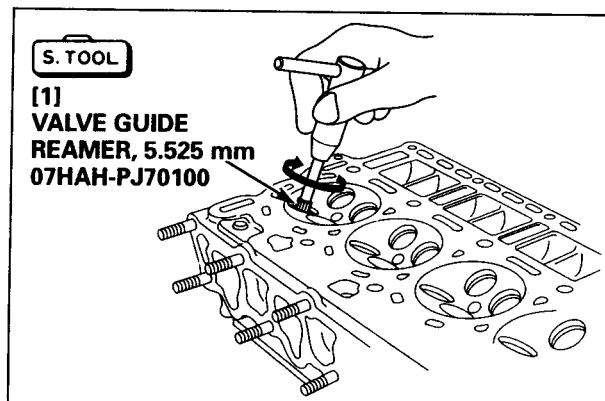
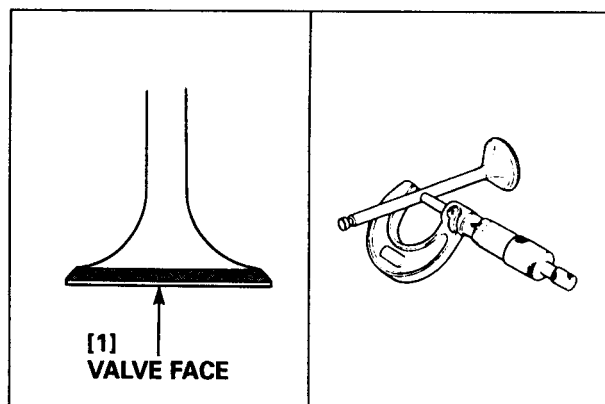
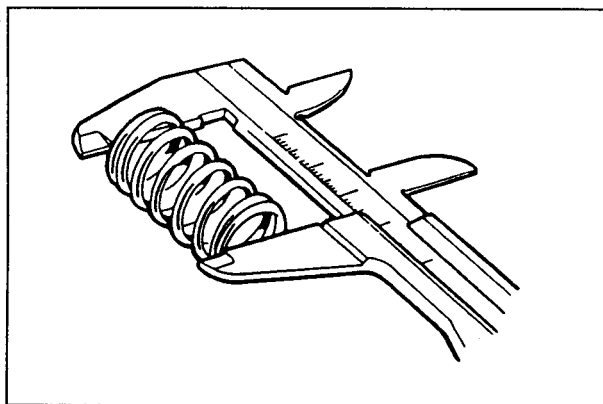
Subtract each valve stem O.D. from the corresponding guide clearance.

	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.

NOTE:

Recondition the valve seats whenever the valve guides are replaced.

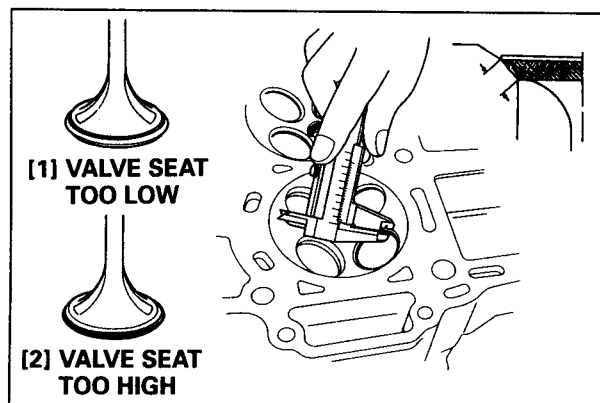


### ● VALVE SEAT WIDTH

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)

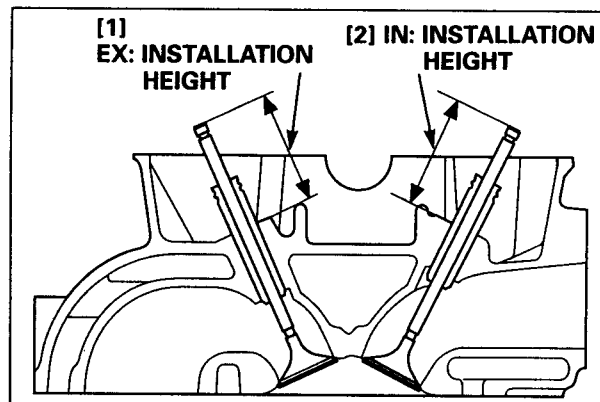
If the valve seat width is under the standard, or over the service limit, or if the valve seat is too high/low, recondition the valve seat (P. 9-23).



### ● VALVE INSTALLATION HEIGHT

Replace the cylinder head if the measurement exceeds the service limit (P. 9-9).

	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)	—

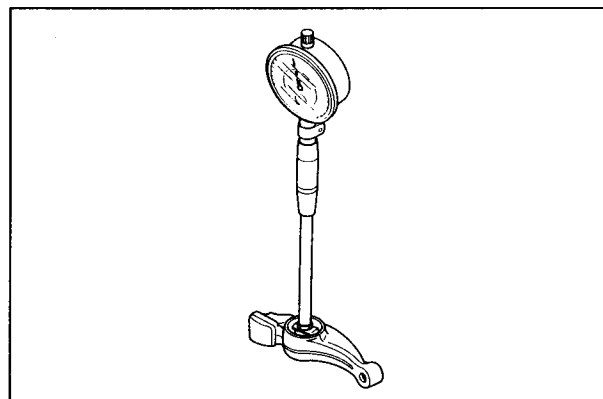
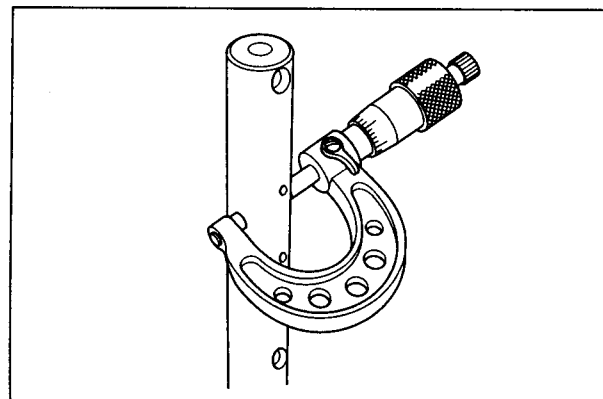
Replace the rocker arms if their I.D. is larger than the service limit.

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	0.019 - 0.058 mm (0.0007 - 0.0023 in)	0.08 mm (0.003 in)
EX	0.018 - 0.054 mm (0.0007 - 0.0021 in)	0.08 mm (0.003 in)

If the measurement exceeds the service limit, replace the rocker arm or the rocker arm shaft (P. 9-13).

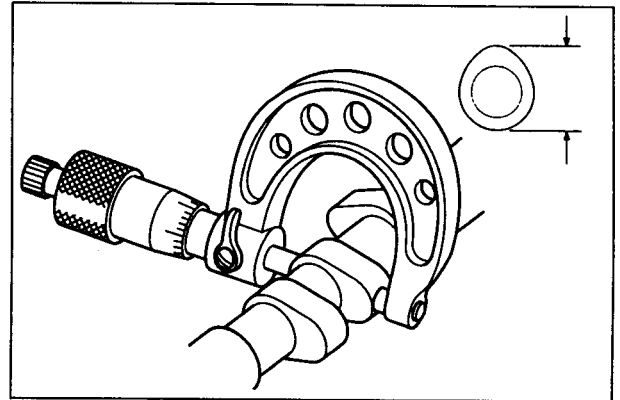


### ● CAM HEIGHT

Check the cam surface for wear and damage.  
Measure the cam height.

	STANDARD	SERVICE LIMIT
IN	38.274 - 38.359 mm (1.5068 - 1.5102 in)	_____
EX	37.651 - 37.756 mm (1.4823 - 1.4865 in)	_____

Replace the camshaft if the cam height is lower than the service limit.

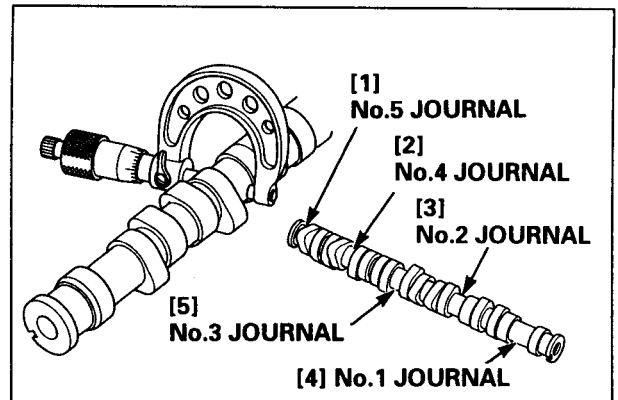


### ● CAMSHAFT JOURNAL O.D.

Measure the camshaft O.D.

	STANDARD	SERVICE LIMIT
No.1 - No.5	27.935 - 27.950 mm (1.0998 - 1.1004 in)	_____

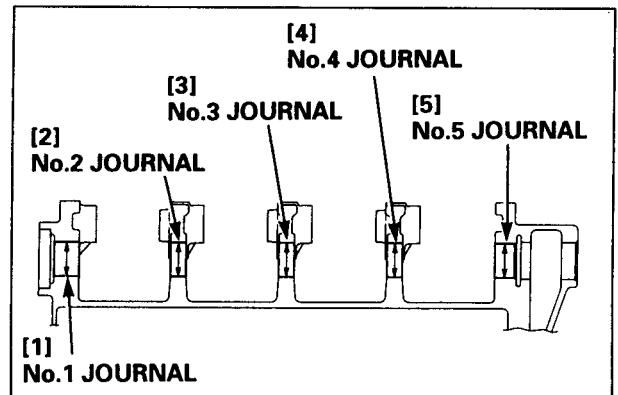
Replace the camshaft if its O.D. is smaller than the service limit.



### ● CAMSHAFT JOURNAL I.D.

Measure the camshaft I.D.

	STANDARD	SERVICE LIMIT
No.1 - No.5	28.000 - 28.024 mm (1.1024 - 1.1033 in)	_____



### ● CAMSHAFT OIL CLEARANCE

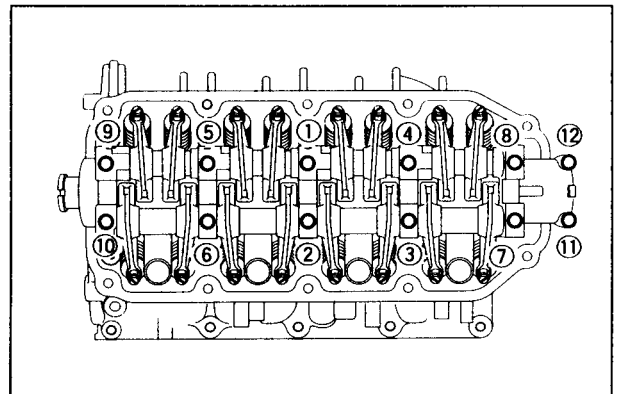
- 1) Clean the camshaft and check the cams and journals for damage.
- 2) Clean the cylinder head and the camshaft holder bearings. Install the camshaft on the cylinder head.
- 3) Set a plastigauge in the axial direction on each journal.
- 4) Install the camshaft holder. Tighten the bolts in the numbered order in two or three steps. Be sure to tighten the 8 x 76 mm flange bolts to the specified torque and tighten the 6 x 40 mm flange bolts to the standard torque.

#### TORQUE:

22 N·m (2.2 kgf·m, 16 lbf·ft) (8 x 76 mm flange bolt)

#### STANDARD TORQUE:

12 N·m (1.2 kgf·m, 9 lbf·ft) (6 x 40 mm flange bolt)





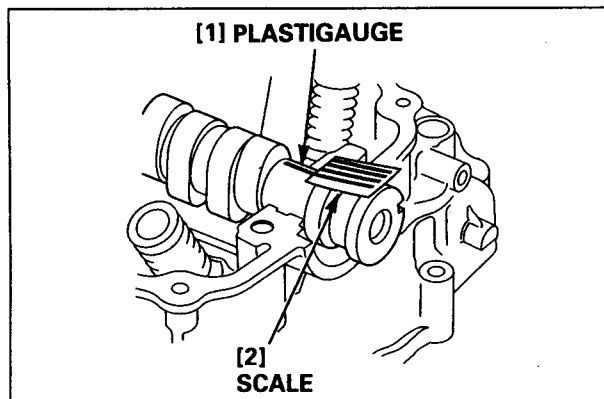
- 5) Remove the camshaft holder. Measure the width of the pressed part of the plastigauge using the scale printed on the bag of the plastigauge.

- Measure the widest width on the plastigauge.

	STANDARD	SERVICE LIMIT
No.1 - No.5	0.050 - 0.089 mm (0.0020 - 0.0035 in)	0.15 mm (0.006 in)

- 6) If the camshaft oil clearance exceeds the service limit, replace the camshaft.

Measure the cam height of the new camshaft. If the oil clearance exceeds the service limit, replace the cylinder head or camshaft holders.



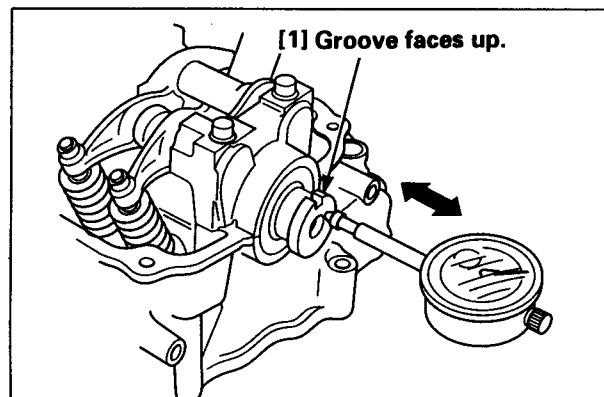
### • CAMSHAFT AXIAL CLEARANCE

- 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 - 0.15 mm (0.002 - 0.006 in)	0.5 mm (0.020 in)

- 2) If the measurement exceeds the service limit, replace the camshaft.

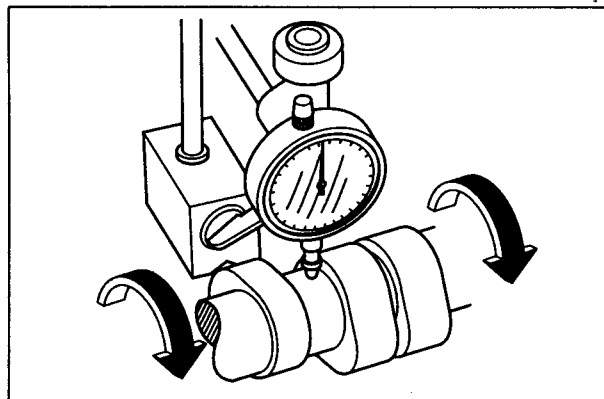
Install a new camshaft and recheck the axial play. If the measurement still exceeds the service limit, replace the cylinder head and all camshaft holders.



### • 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.

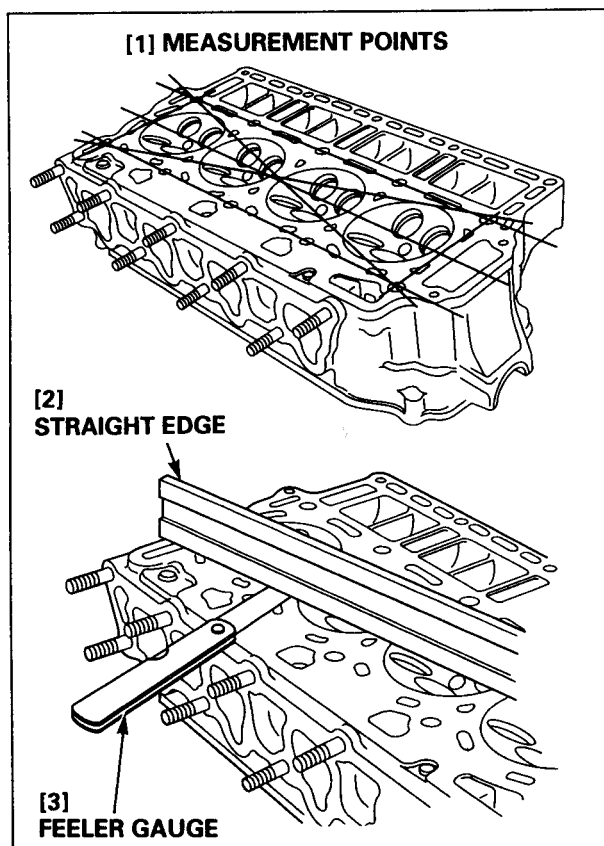


### ● CYLINDER HEAD WARPAGE

- 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.
  - Reconditioning must be made within the standard value of the cylinder head height.

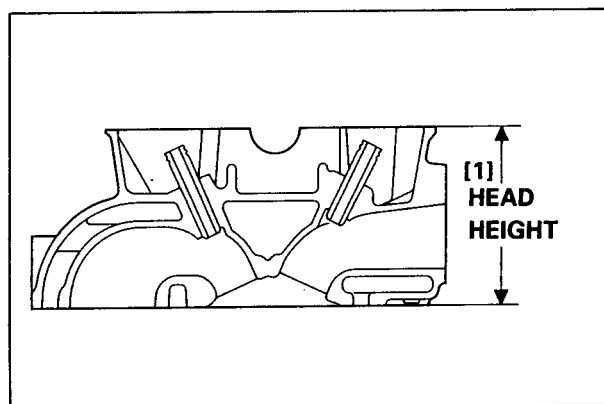


### ● CYLINDER HEAD HEIGHT

STANDARD	SERVICE LIMIT
99.95 - 100.05 mm (3.935 - 3.939 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.

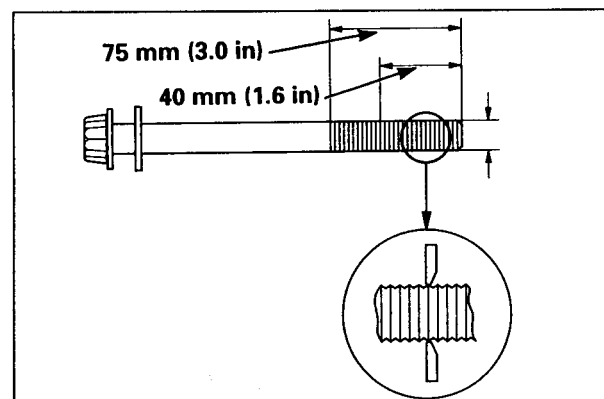


### ● 12 x 163 mm BOLT-WASHER (CYLINDER HEAD BOLT) O.D.

- 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.**

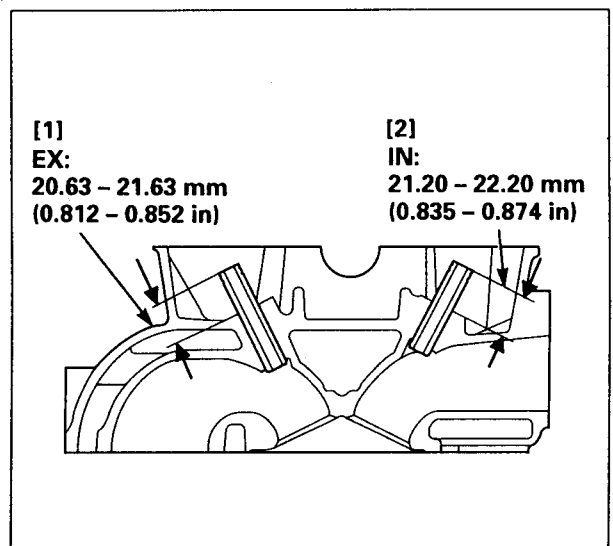
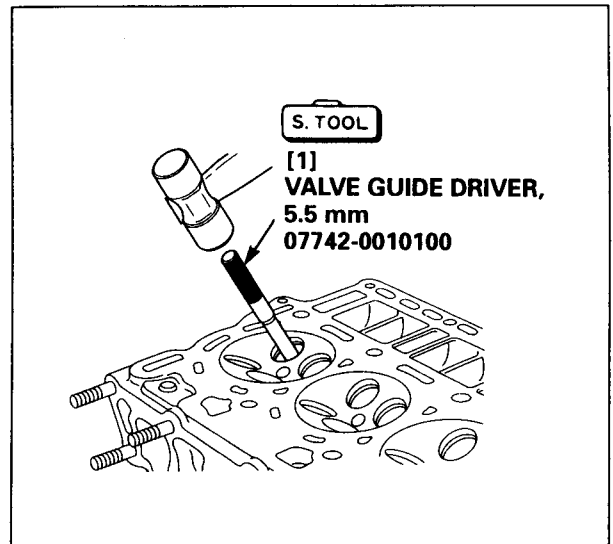
#### TOOL:

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

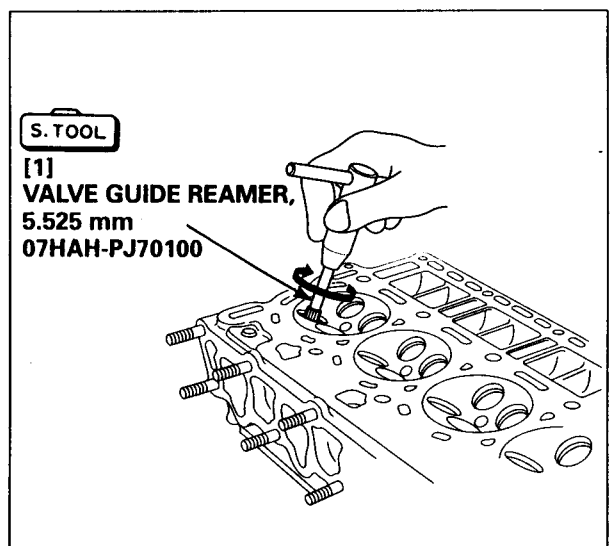
#### NOTE:

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

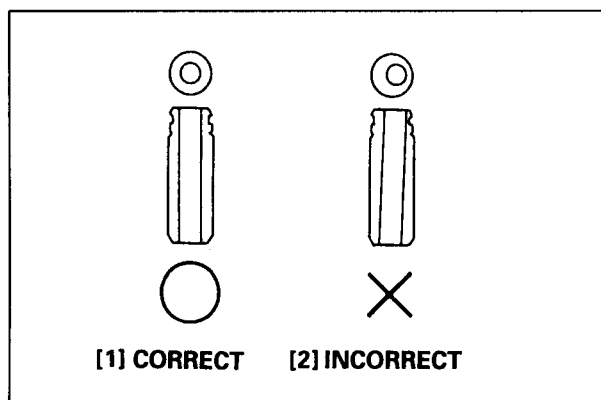
- 1) Coat the reamer and valve guide with cutting oil.
- 2) Rotate the reamer clockwise through the valve guide for the full length of the reamer.
- 3) Continue to rotate the reamer clockwise while removing it from the valve guide.

#### TOOL:

Valve guide reamer, 5.525 mm                      07HAH-PJ70100



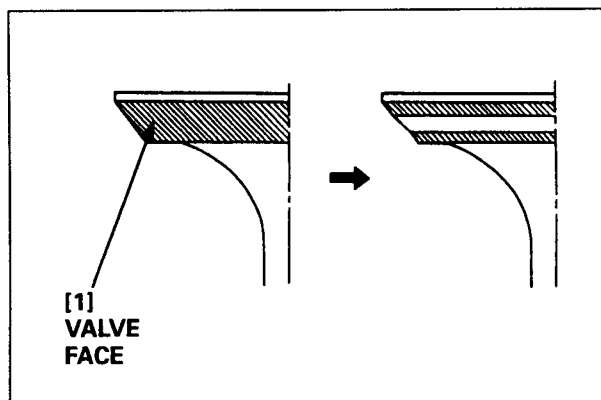
- 4) Thoroughly clean the cylinder head to remove any cutting residue.
- 5) Check the valve guide bore; it should be straight, round and centered in the valve guide, insert the valve and check operation. If the valve does not operate smoothly, the guide may have been bent during installation. Replace the valve guide if it is bent or damaged.
- 6) Check the Valve Guide-to-Stem Clearance. See page 9-16.



### 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.



S. TOOL

[1] CUTTER HOLDER, 5.5 mm  
07781-00101

S. TOOL

[2] VALVE SEAT CUTTERS



[3]  
IN : 07780-0014100 (37 mm)  
EX : 07780-0014000 (30 mm)

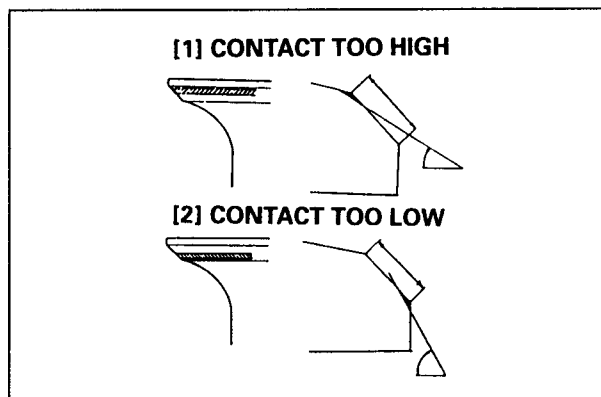


[4]  
IN : 07780-0012300 (35 mm)  
EX : 07780-0012900 (33 mm)



[5]  
IN : 07780-0010400 (35 mm)  
EX : 07780-0010800 (33 mm)

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



### • VALVE SEAT WIDTH

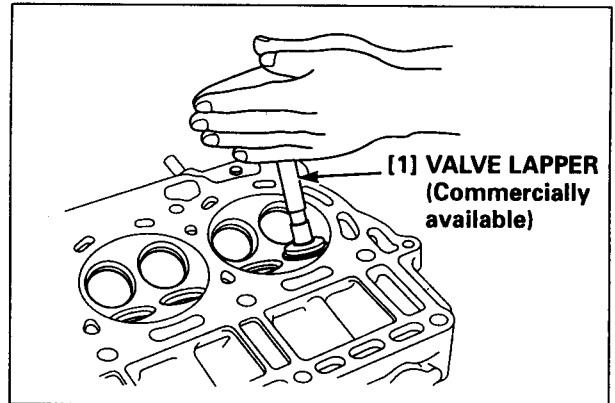
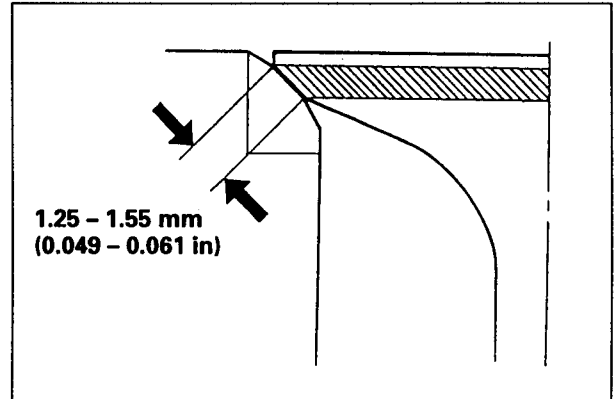
STANDARD	SERVICE LIMIT
1.25 – 1.55 mm (0.049 – 0.061 in)	2.0 mm (0.008 in)

- 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.



## 1. OIL PUMP/FLYWHEEL

## 2. INSPECTION

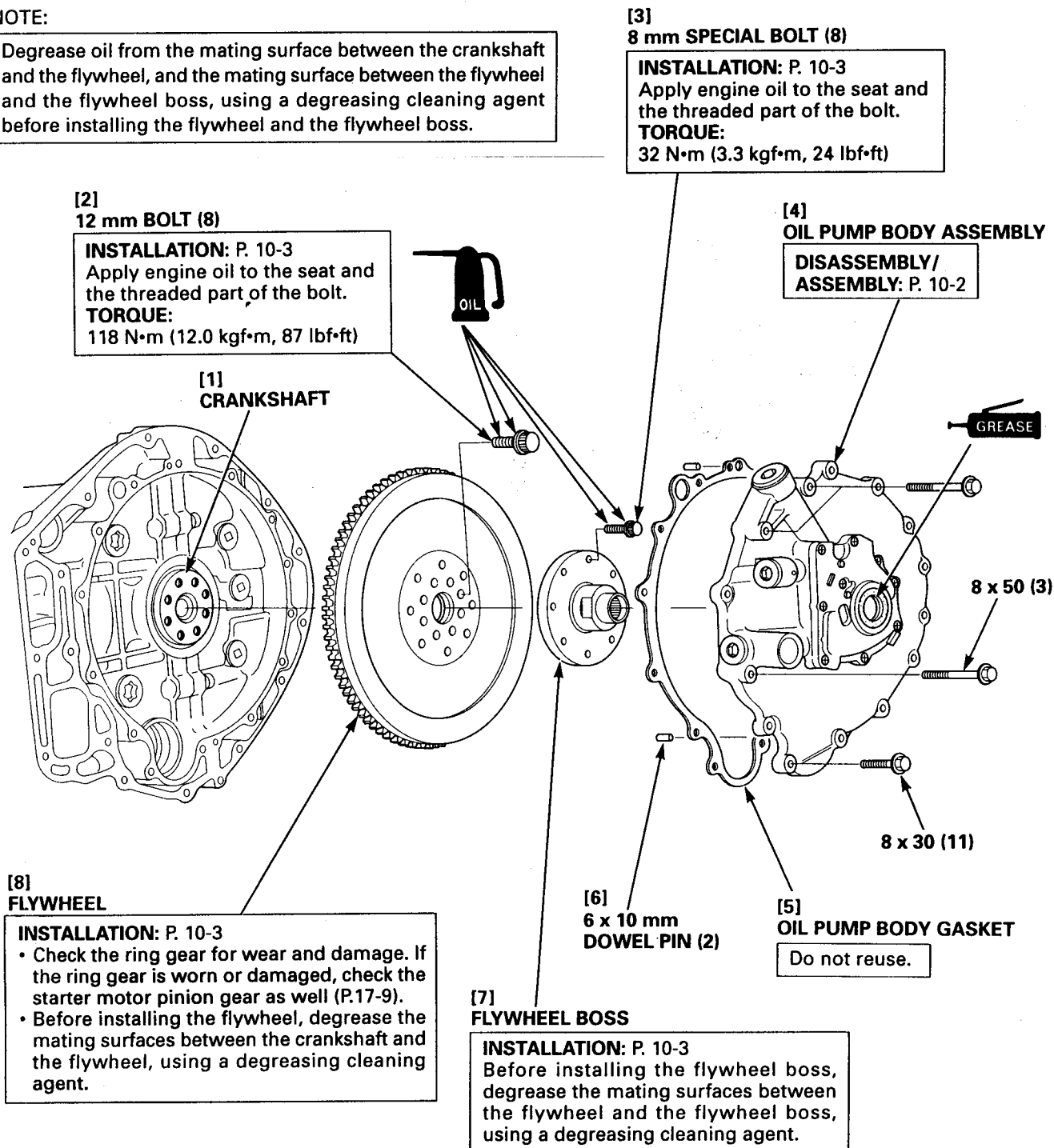
### 1. OIL PUMP/FLYWHEEL

#### a. REMOVAL/INSTALLATION

Remove the engine (P. 7-1).

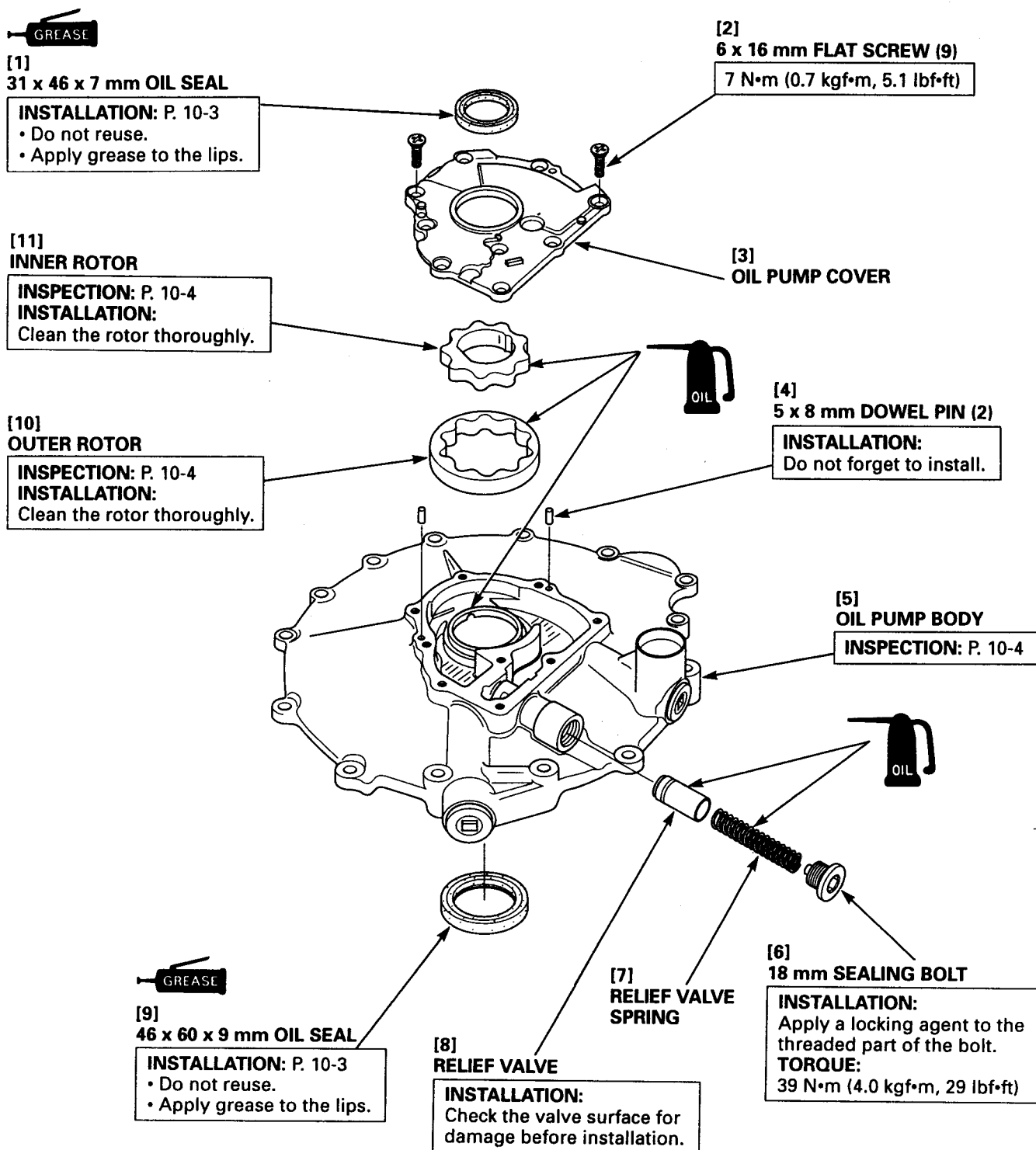
#### NOTE:

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.



### • OIL PUMP ASSEMBLY DISASSEMBLY/ASSEMBLY

- Install the rotors so that they face in the same direction as they had been mounted before disassembly.
- After assembly, check to see that the rotors move freely.





### ● FLYWHEEL BOSS/FLYWHEEL

#### REMOVAL:

- 1) Set the special tool on the starter motor mounting position.
- 2) Tighten the two starter motor mounting bolts (10 x 35 mm flange bolts), and remove the flywheel boss and the flywheel.

#### TOOL:

Ring gear holder **07WPB-ZW50100**

#### 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 **07WPB-ZW50100**

- 4) Tighten the 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.

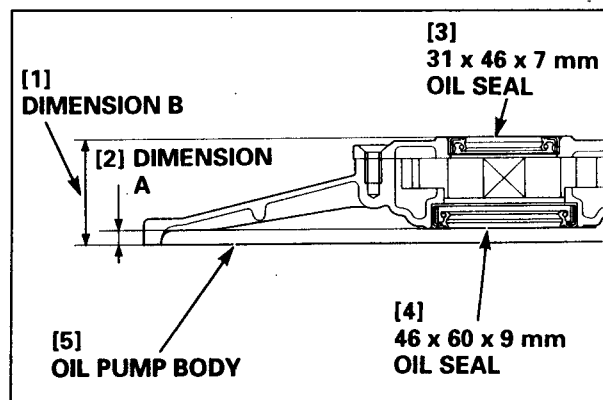
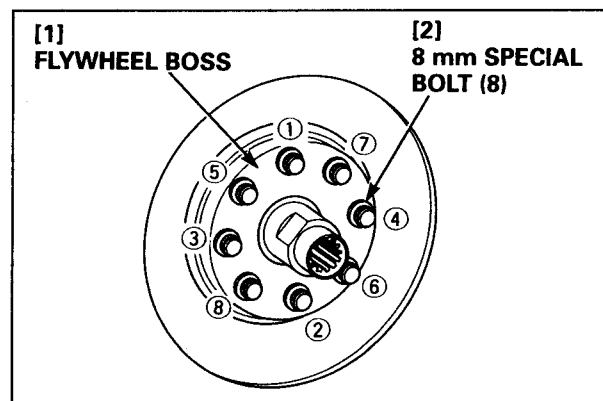
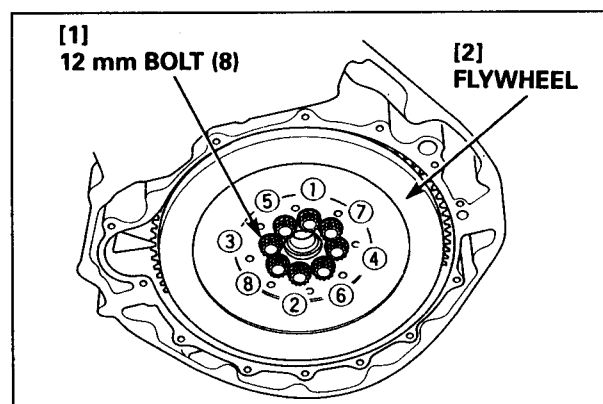
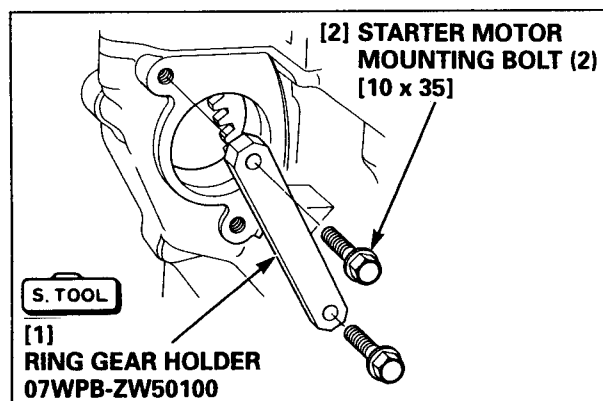
#### TOOL:

Ring gear holder **07WPB-ZW50100**

- 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 (3.3 kgf·m, 24 lbf·ft)**

- Clean the mating surfaces between the crankshaft, flywheel and the flywheel boss thoroughly, using a degreasing cleaning agent.



### ● 46 x 60 x 9 mm OIL SEAL/31 x 46 x 7 mm OIL SEAL

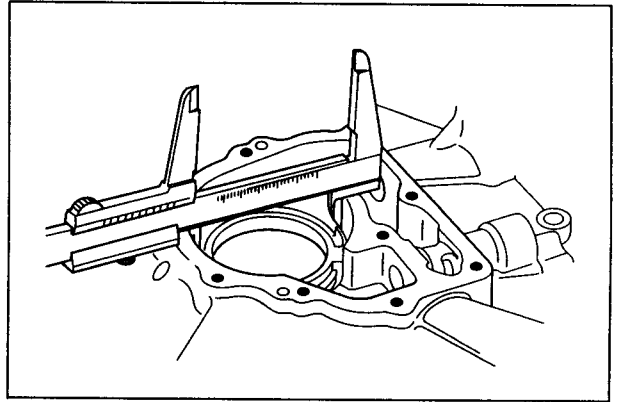
#### INSTALLATION:

- 1) Apply grease to the lips of each oil seal.
- 2) Using a hydraulic press, press-fit each oil seal to the position shown.
  - Press-fit the 46 x 60 x 9 mm oil seal to the position 6.2 - 6.8 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 44.2 - 44.8 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.

## 2. INSPECTION

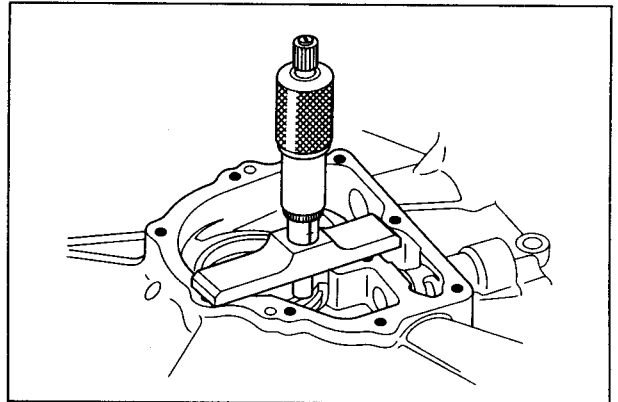
### • OIL PUMP BODY I.D.

STANDARD	SERVICE LIMIT
84.000 - 84.030 mm (3.3071 - 3.3083 in)	—



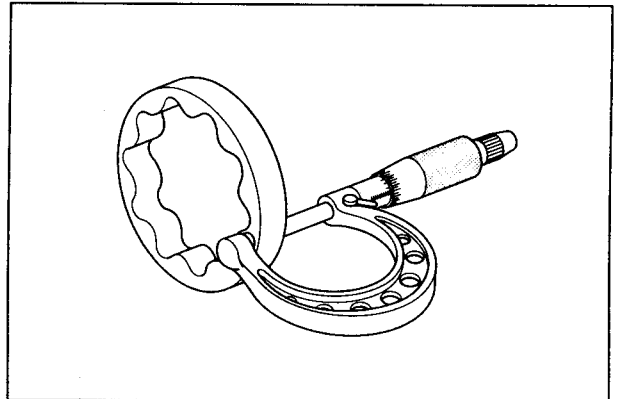
### • OIL PUMP BODY DEPTH

STANDARD	SERVICE LIMIT
12.520 - 12.550 mm (0.4929 - 0.4941 in)	—



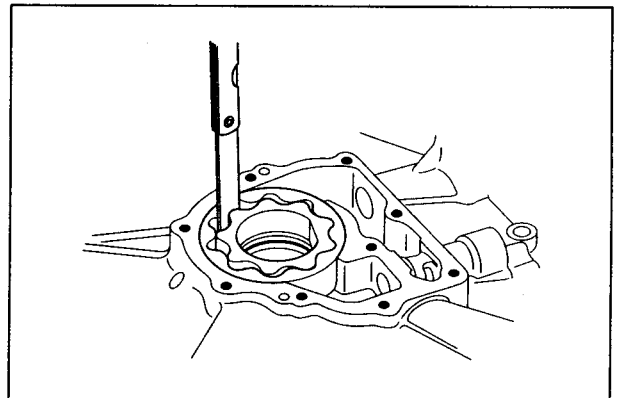
### • OUTER ROTOR HEIGHT

STANDARD	SERVICE LIMIT
12.480 - 12.500 mm (0.4913 - 0.4921 in)	—



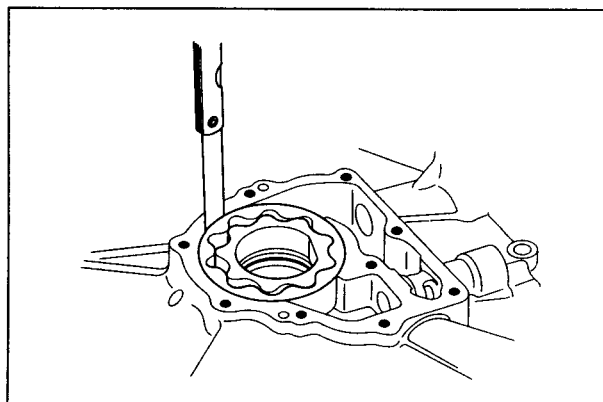
### • INNER ROTOR-TO-OUTER ROTOR CLEARANCE

STANDARD	SERVICE LIMIT
0.04 - 0.16 mm (0.002 - 0.006 in)	0.20 mm (0.008 in)



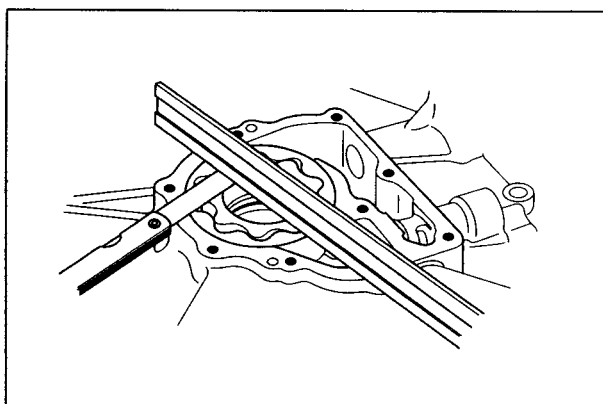
### • OUTER ROTOR-TO-PUMP BODY CLEARANCE

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)



# 11. BALANCER SHAFT/CRANKCASE/ CRANKSHAFT/PISTON

**HONDA**  
**BF115A•130A**

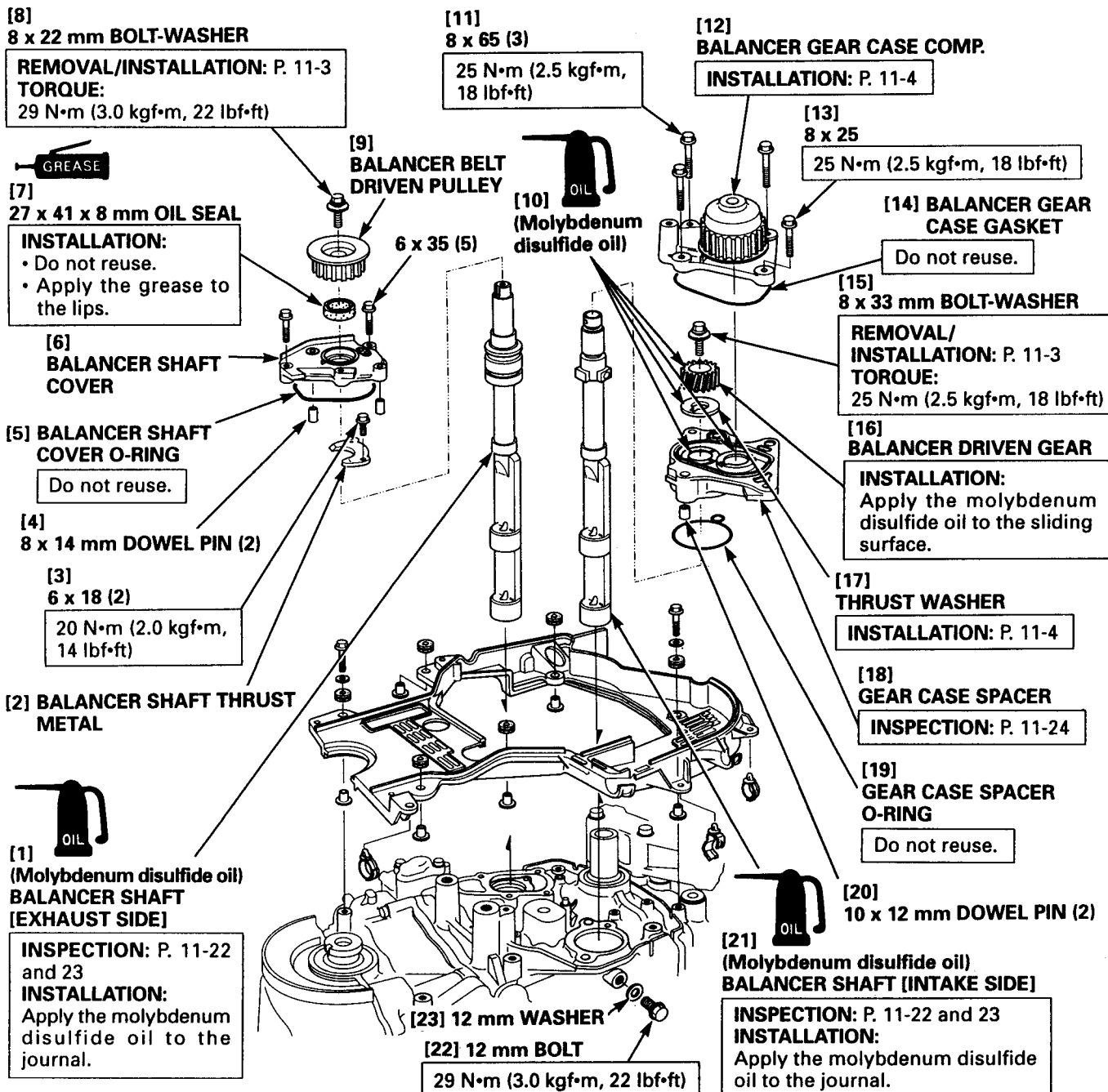
1. BALANCER SHAFT/PULLEY
2. CRANKCASE
3. CYLINDER BLOCK/CRANKSHAFT
4. BALANCER BEARING REPLACEMENT

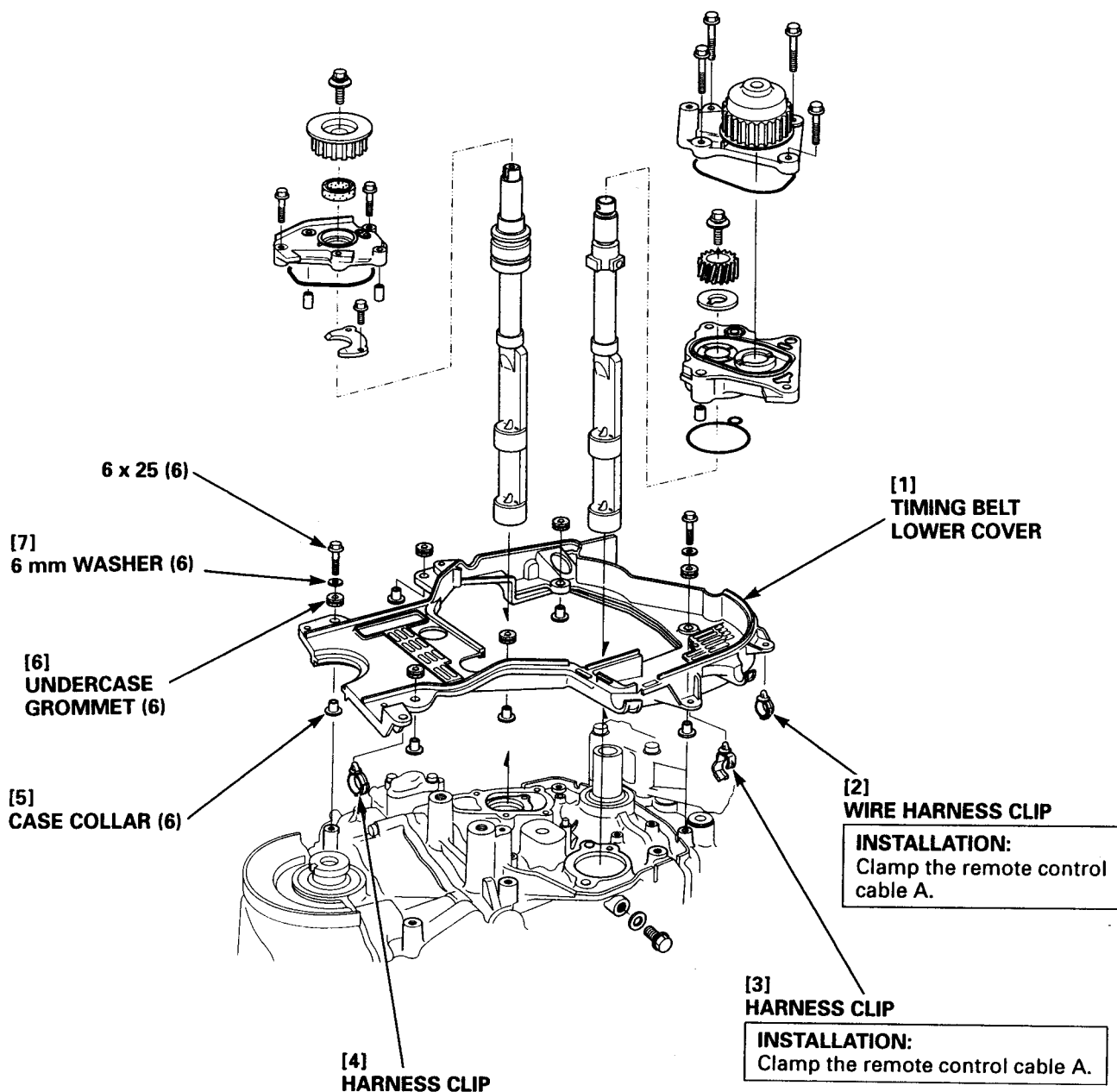
5. PISTON
6. INSPECTION
7. BEARING SELECTION

## 1. BALANCER SHAFT/PULLEY

### a. REMOVAL/INSTALLATION

The balancer shaft can be removed with the timing belt mounted. To remove the timing belt lower cover, remove the balancer belt/timing belt (P. 6-9) and disconnect the tubes and the cables from the clamps.





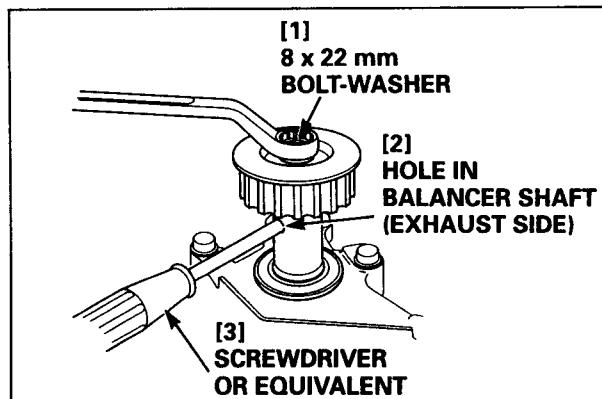
### • 8 x 22 mm BOLT-WASHER

#### REMOVAL/INSTALLATION:

Insert a screwdriver or equivalent tool into the hole in the balancer shaft.

Remove and install the 8 x 22 mm bolt-washer while holding the balancer shaft.

**TORQUE: 29 N·m (3.0 kgf·m, 22 lbf·ft)**

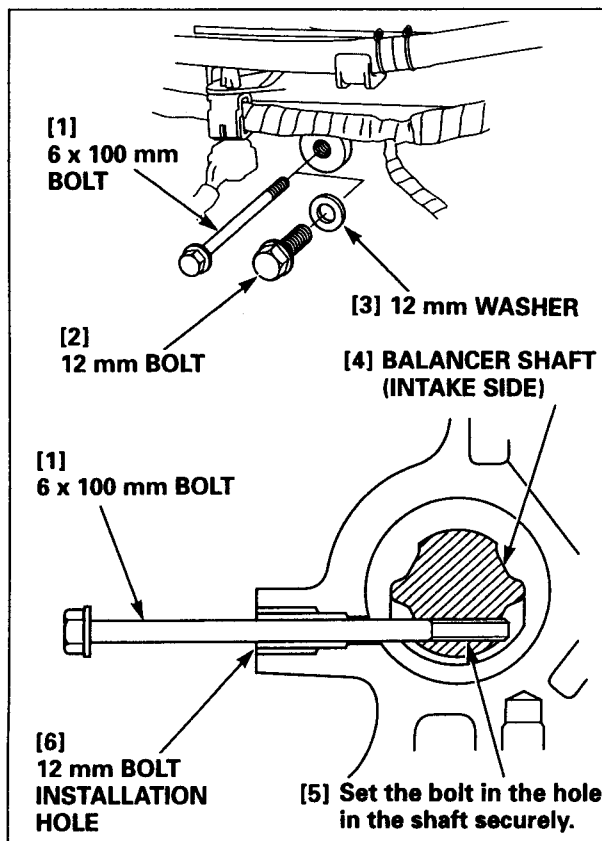


### • 8 x 33 mm BOLT-WASHER

#### REMOVAL/INSTALLATION:

Remove the intake manifold assembly if it is mounted (P. 5-65).

- 1) Prepare a 6 x 100 mm bolt.
- 2) Remove the 12 mm bolt and washer. Hold the balancer shaft (Intake side) to avoid turning, using the 6 x 100 mm bolt.

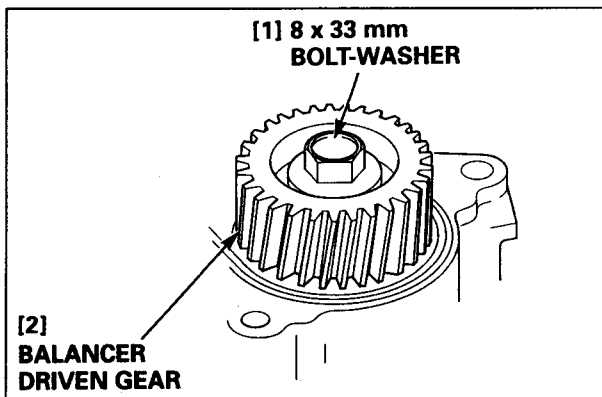


- 3) Remove and install the 8 x 33 mm bolt-washer while holding the balancer shaft.

**TORQUE: 25 N·m (2.5 kgf·m, 18 lbf·ft)**

- 4) Remove the 6 x 100 mm bolt and tighten the 12 mm bolt to the specified torque.

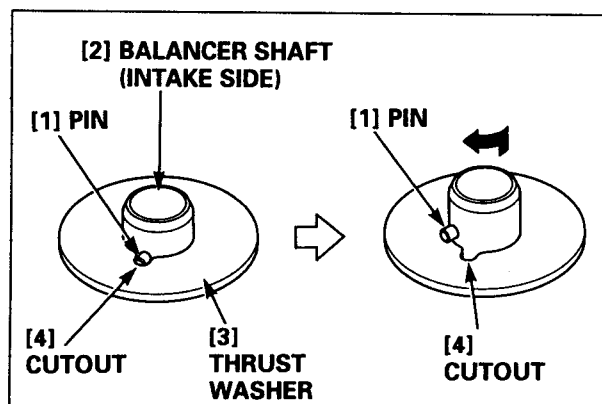
**TORQUE: 29 N·m (3.0 kgf·m, 22 lbf·ft)**



### • THRUST WASHER

#### INSTALLATION:

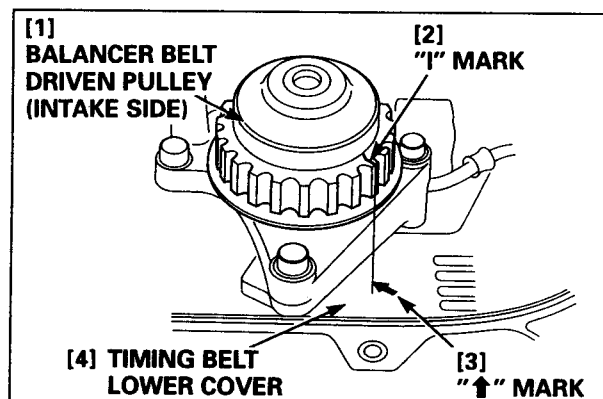
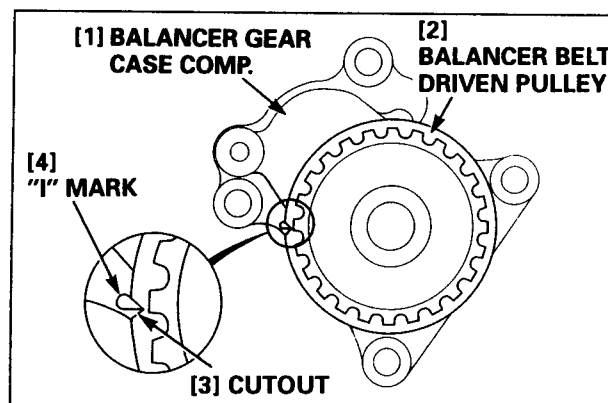
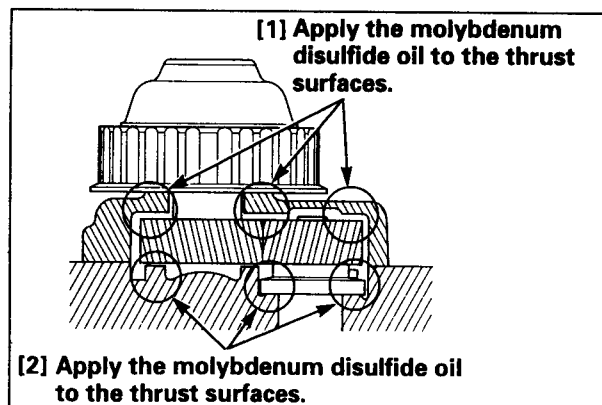
- 1) Apply the molybdenum disulfide oil to the entire surface of the thrust washer.
- 2) Install the thrust washer by aligning the cutout in the thrust washer with the pin of the balancer shaft (Intake side).
- 3) Turn the balancer shaft (Intake side) by pulling it up, and bring the pin of the balancer shaft (Intake side) so it gets on the thrust washer.



### • BALANCER GEAR CASE COMP.

#### INSTALLATION:

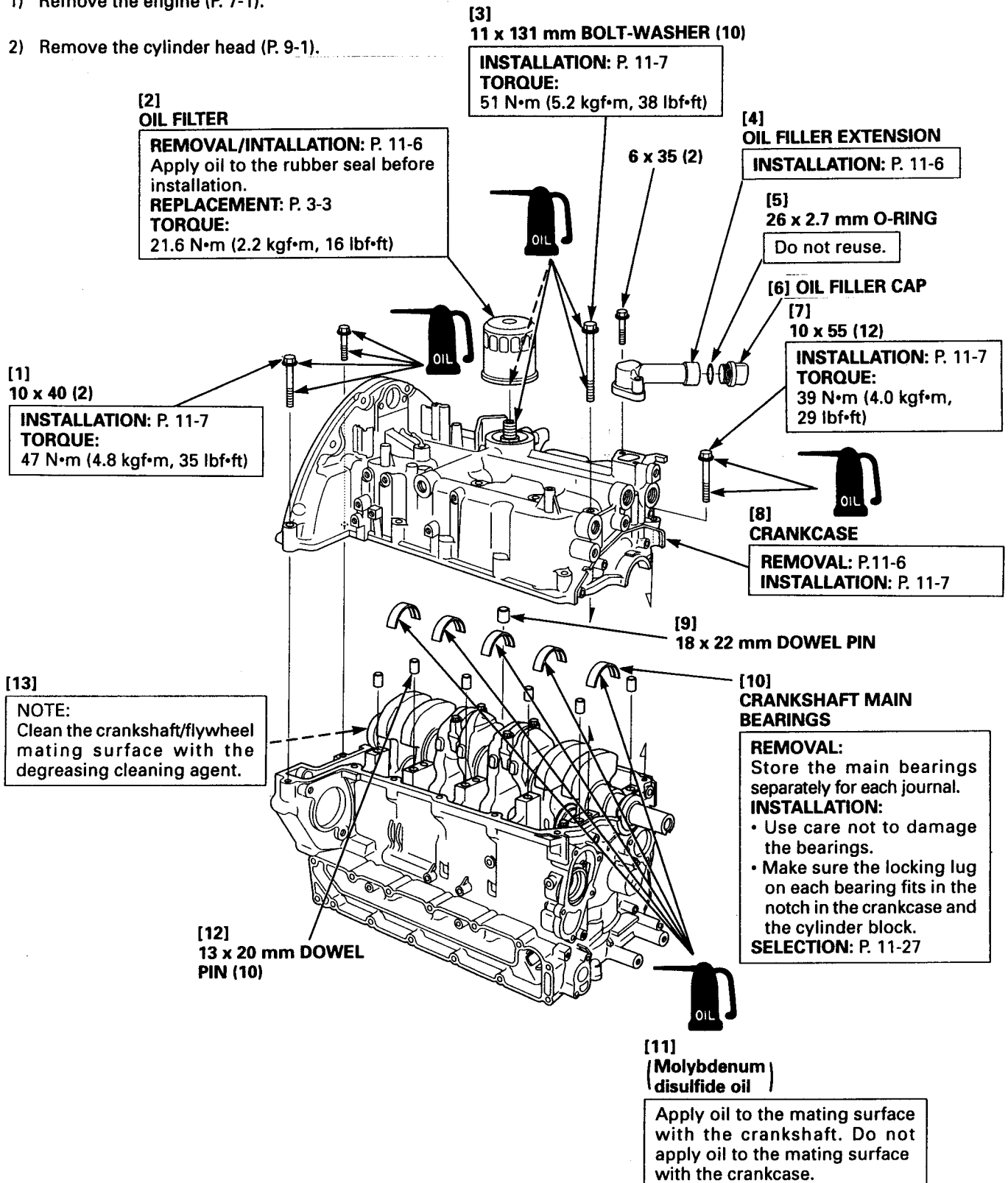
- 1) Apply the molybdenum disulfide oil to the point as shown.
- 2) Hold the balancer shaft (Intake side) using the 6 x 100 mm bolt (P. 11-3).
- 3) Align the cutout in the balancer belt driven pulley with the "I" mark on the balancer gear case comp., and install the balancer gear case on the gear case spacer.
- 4) After installing the balancer gear case comp., check to see that the "I" mark on the balancer driven pulley aligns with the "↑" mark on the timing belt lower cover.



## 2. CRANKCASE

### a. REMOVAL/INSTALLATION

- 1) Remove the engine (P. 7-1).
- 2) Remove the cylinder head (P. 9-1).





### • OIL FILTER

#### REMOVAL/INSTALLATION:

Remove and install the oil filter using the special tool.

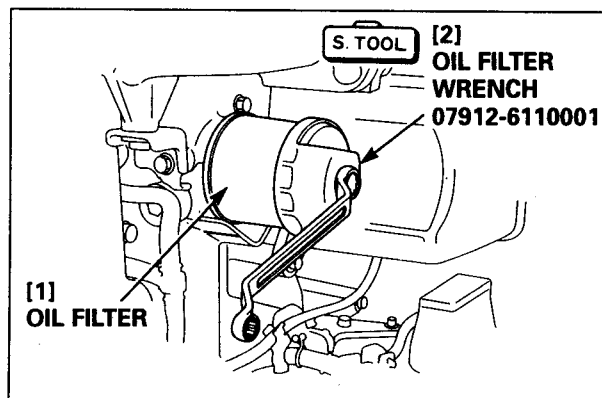
Before installation, coat the rubber seal and threads with clean engine oil.

**TORQUE:** 21.6 N·m (2.2 kgf·m, 16 lbf·ft)

#### TOOL:

Oil filter wrench

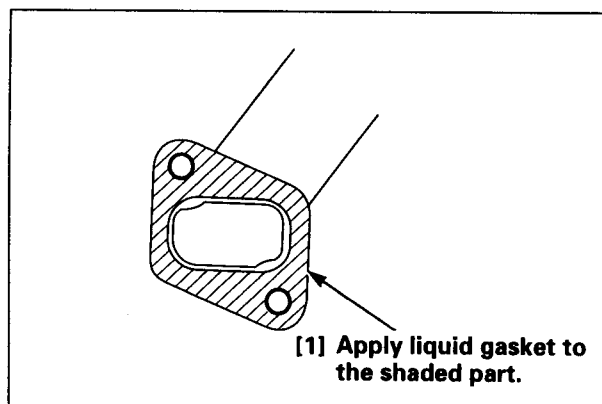
07912-6110001



### • OIL FILLER EXTENSION

#### INSTALLATION:

Before installing the oil filler extension, apply liquid gasket (Three Bond #1141C or equivalent) to the shaded part shown.

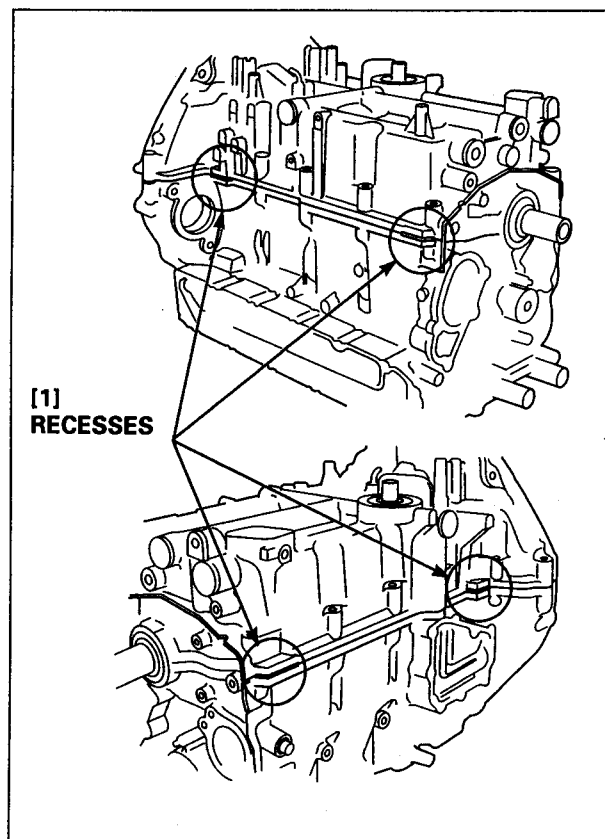


### • CRANKCASE

#### REMOVAL:

Insert a screwdriver or equivalent tool into the recesses in the crankcase, and raise the crankcase slowly to remove it.

- Do not damage the mating surfaces between the crankcase and the cylinder block during removal.



### INSTALLATION:

1) Degrease the mating surface between the crankcase and the cylinder block.

2) Before installing the crankcase, apply the liquid gasket (Three Bond #1141C or equivalent) to the lightly shaded part shown.

Apply liquid gasket (Three Bond #1280B or equivalent) to the deeply shaded part shown.

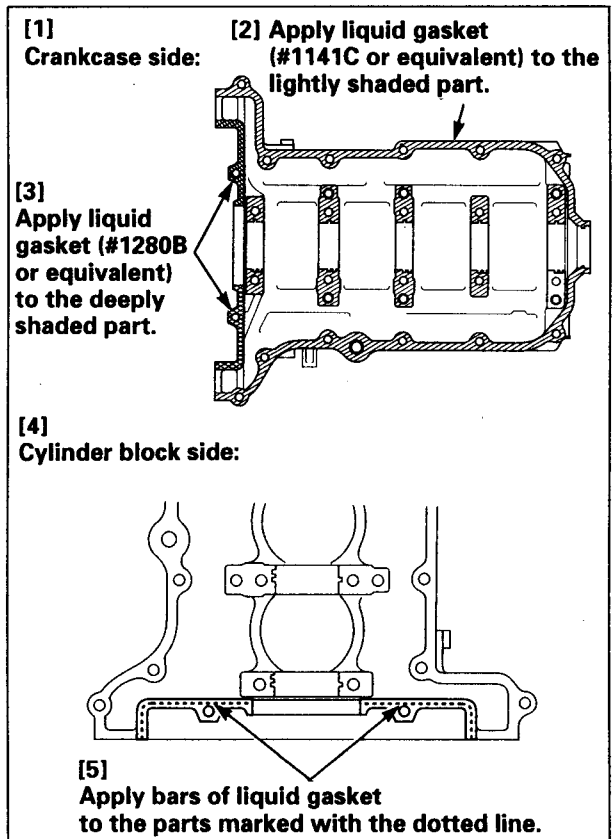
- Do not apply liquid gasket to the crankshaft main journal and the bolt holes.

3) Apply bars [ø3.0 - 4.0 (0.12 - 0.16 in ) in thickness] of liquid gasket (Three Bond #1280B or equivalent) to the indicated points of the cylinder block.

4) When tightening the bolts, be sure that a small amount of liquid gasket (Three Bond #1280B or equivalent) is oozing out from the flywheel installation side of the mating surface.

- If the cylinder block has been left for 5 minutes or more after application with liquid gasket, remove the crankcase and apply the liquid gasket to the specified parts again.

- After installing the crankcase, wait for 2 minutes or more and pour the engine oil.



### • 11 x 131 mm BOLT-WASHER/10 x 55 mm FLANGE BOLT/10 x 40 mm FLANGE BOLT

#### INSTALLATION:

1) Apply engine oil to the threaded part and the seat of the bolts, and loosely tighten the bolts.

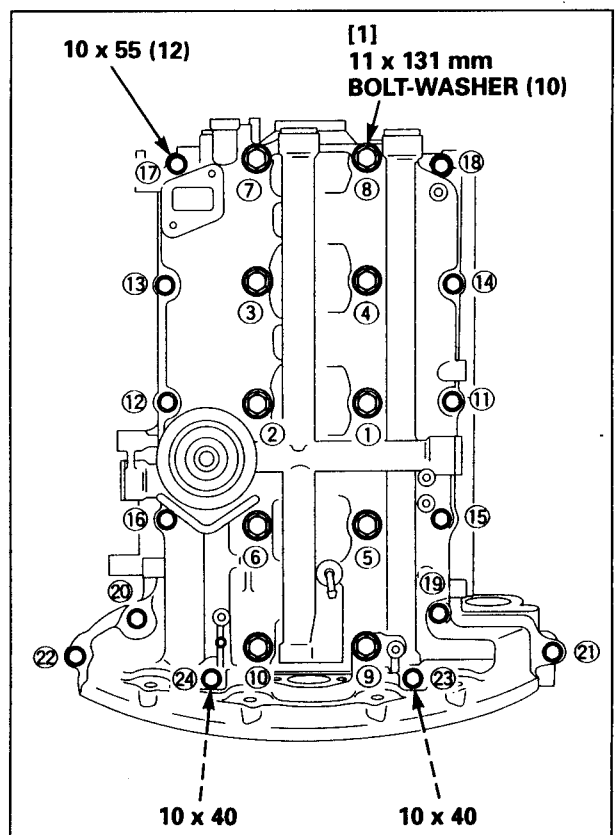
2) Tighten the bolts in the numbered sequence shown. Tighten them in two or three steps to the specified torque.

#### TORQUE:

51 N·m (5.2 kgf·m, 38 lbf·ft) (11 x 131 mm bolt-washer)

47 N·m (4.8 kgf·m, 35 lbf·ft) (10 x 40 mm flange bolt)

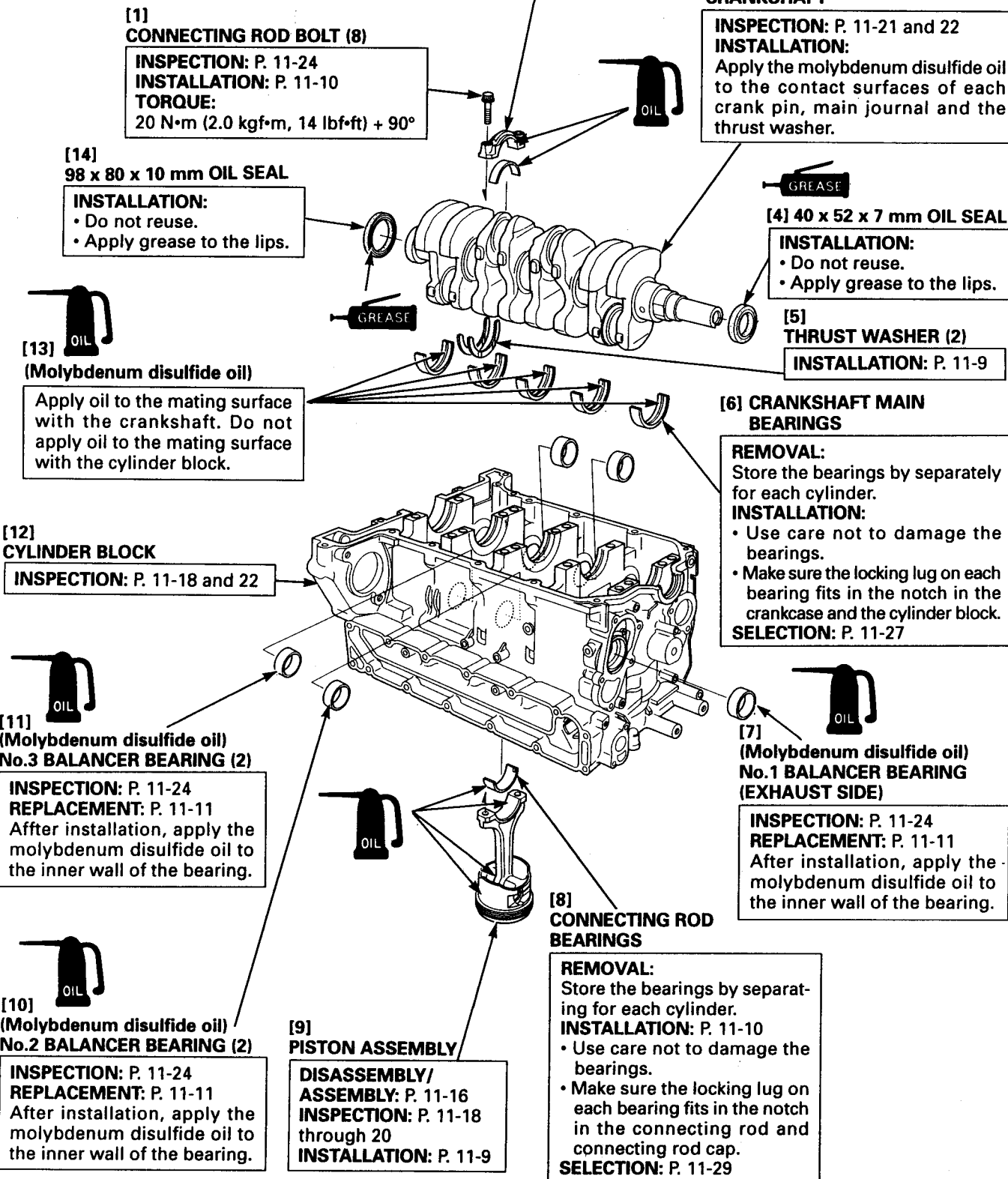
39 N·m (4.0 kgf·m, 29 lbf·ft) (10 x 55 mm flange bolt)



### 3. CYLINDER BLOCK/CRANKSHAFT

#### a. DISASSEMBLY/ASSEMBLY

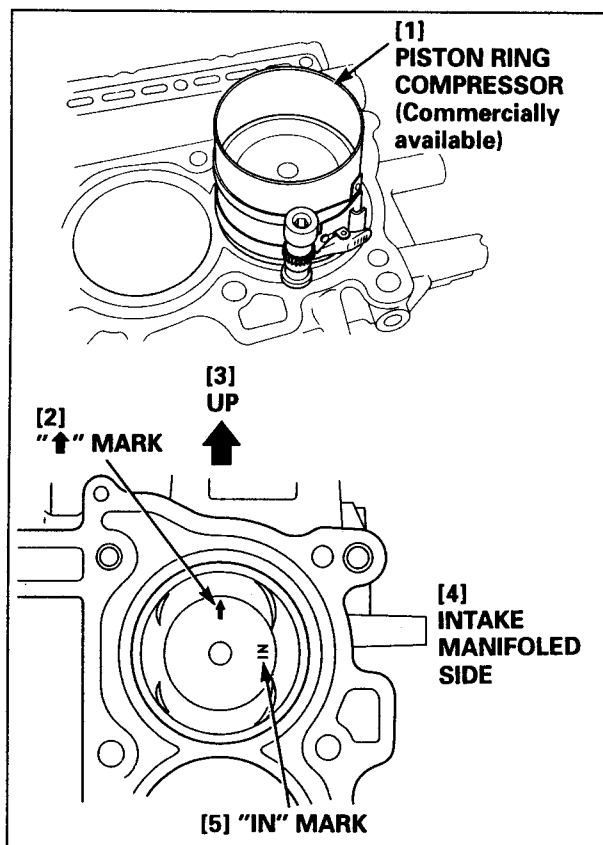
Remove the crankcase (P. 11-5).



### • PISTON ASSEMBLY

#### INSTALLATION:

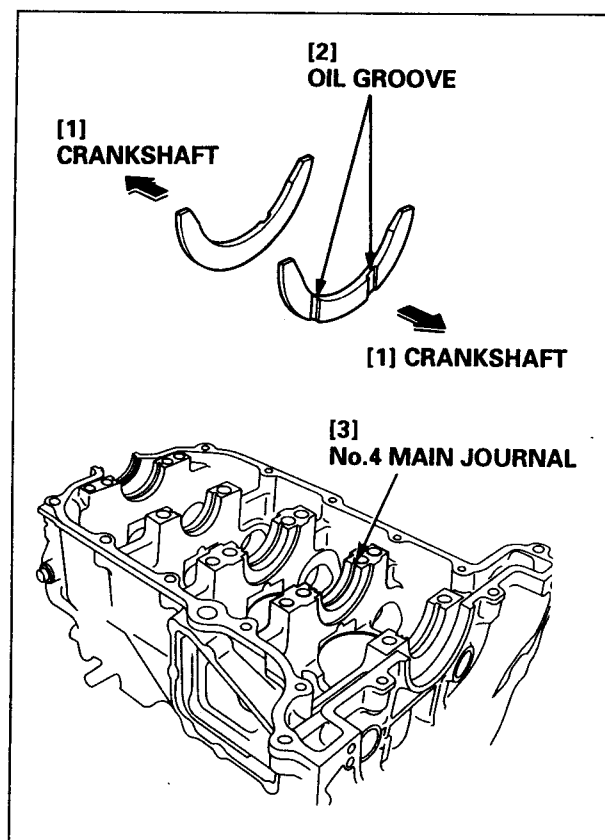
Install the piston assembly with the "IN" mark on the piston head faces to the intake manifold. Use a commercially available piston ring compressor and install with the "↑" mark toward up.



### • THRUST BEARING

#### INSTALLATION:

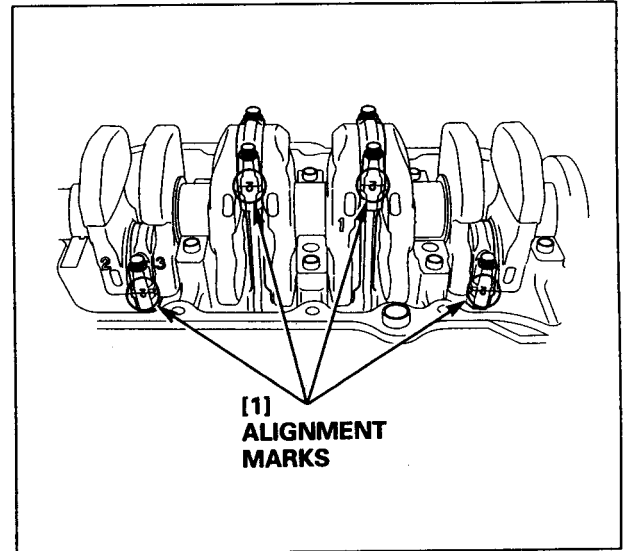
Install the thrust bearings so that they set on both sides of the No.4 main journal. Install with the oil grooves facing to the crankshaft.



### • CONNECTING ROD CAP/BEARING/BOLT

#### REMOVAL:

Store the connecting rod caps and bearings separately for each cylinder after removal.

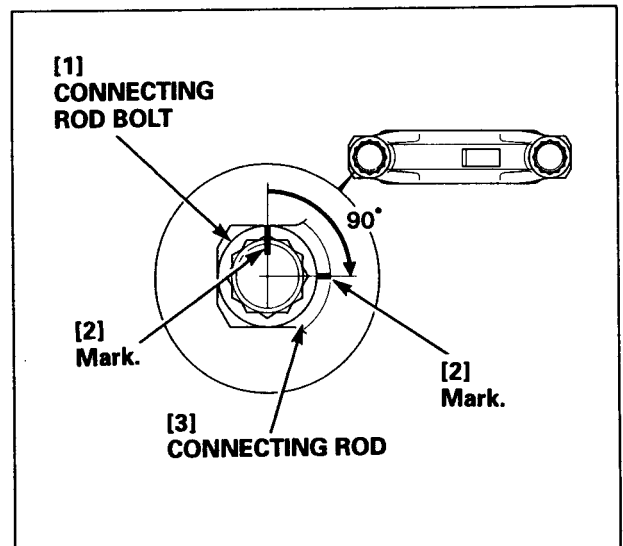


#### INSTALLATION:

- 1) Apply engine oil to the outer surface of the connecting rod bearings. Install the bearings aligning the aligning lug of the bearings with the cutout in the connecting rod caps or connecting rods.
- 2) Install the connecting rod caps aligning the alignment marks of the connecting rods and caps.

#### CAUTION:

Do not confuse the connecting rod cap and bearing with the others; incorrect assembly can cause the crankshaft seizure.



- 3) Tighten the connecting rod bolts to the specified torque.
- 4) Mark each connecting rod bolt and the connecting rod as shown. Tighten the connecting rod bolts additionally until the two marks align (90°).

**TORQUE: 20 N·m (2.0 kgf·m, 14 lbf·ft) + 90°**

### 4. BALANCER BEARING REPLACEMENT

- Dismount the cylinder block as a single unit and place it on a firm level surface with the crankcase-mating surface toward up.
- Removal/installation should be made for each bearing one after another.
- Remove each bearing from the flywheel side to the timing belt side. Installation must be made from the timing belt side to the flywheel side.
- The balancer bearing removal mounted on the cylinder block can be made in the same manner by changing the attachment size and the installation position.

#### REMOVAL:

- 1) Remove the two 30 mm sealing bolts from the cylinder block.
- 2) Install each special tool as shown.

- When the balancer bearings are removed successively, pass each attachment on the shaft without securing them.
- Note that each shaft and attachment are stamped with the work code near the stopper pin hole.

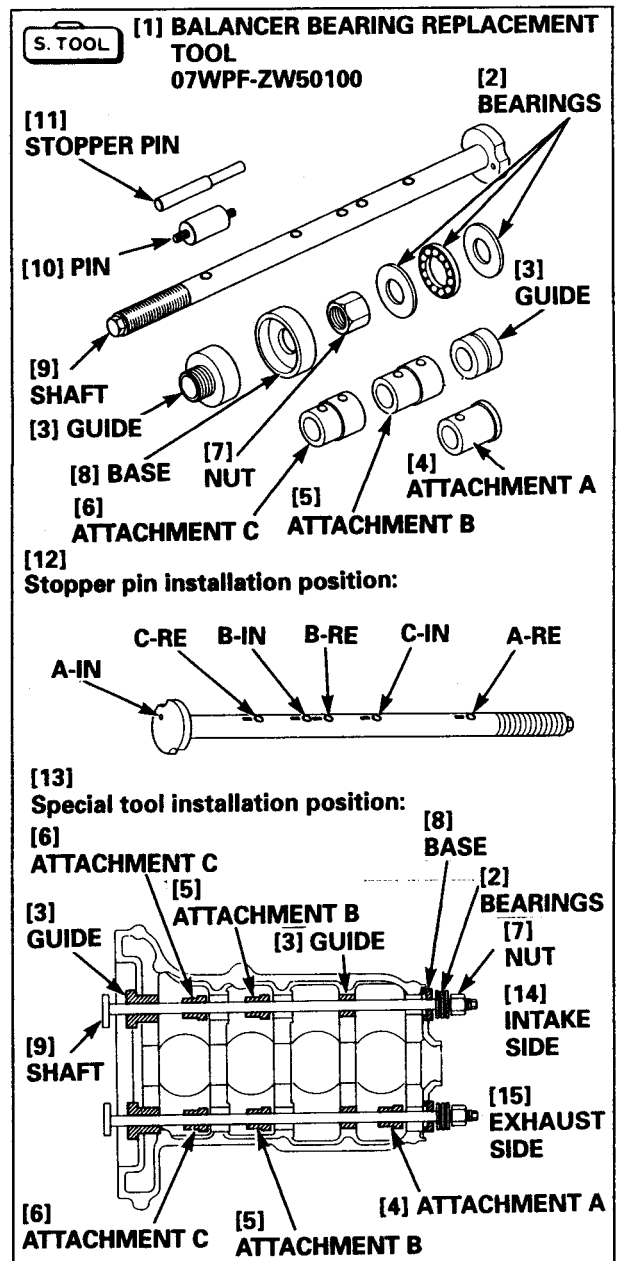
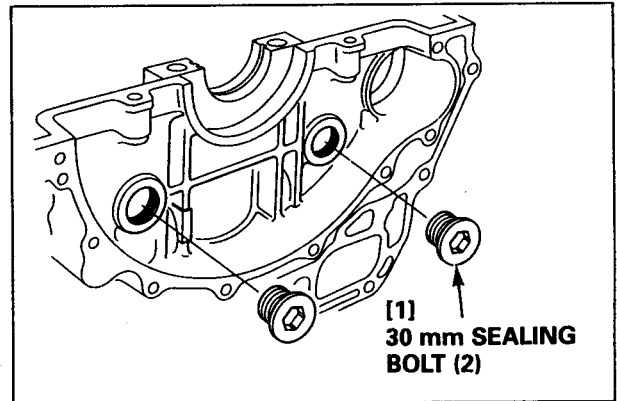
#### • Code and Work

Code	Work
A-RE	No.1 bearing removal
B-RE	No.2 bearing removal
C-RE	No.3 bearing removal
A-IN	No.1 bearing installation
B-IN	No.2 bearing installation
C-IN	No.3 bearing installation

#### TOOL:

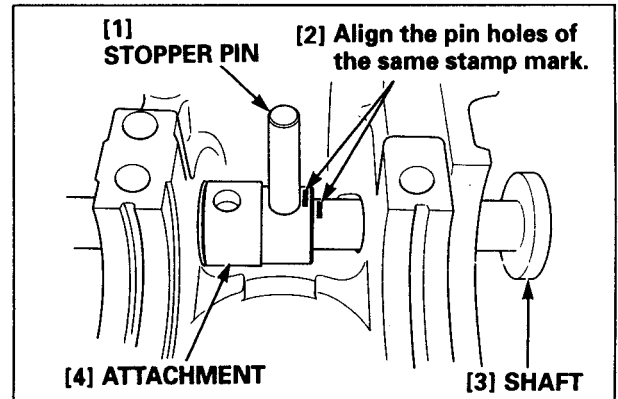
**Balancer bearing replacement tool**

**07WPF-ZW50100**



- 3) With the larger diameter side of the attachment toward the bearing, align the stopper pin hole in the attachment of the bearing you are to remove with the stopper pin hole in the shaft, and insert the stopper pin into the holes to fix the attachment.

- Align the pin hole of the stamped mark on the shaft with the pin hole of the stamped mark on the attachment.

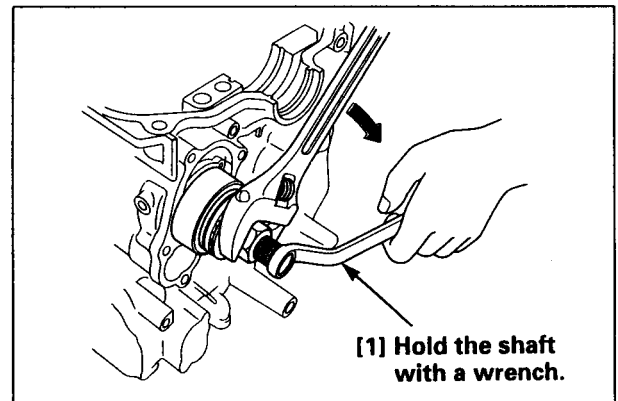


- 4) Holding the shaft end with a wrench, tighten the nut until the bearing comes out.

- Do not turn the shaft.

- 5) When the balancer bearings are removed successively, loosen the nut and remove the stopper pin from the attachment fixed in the above step 3.

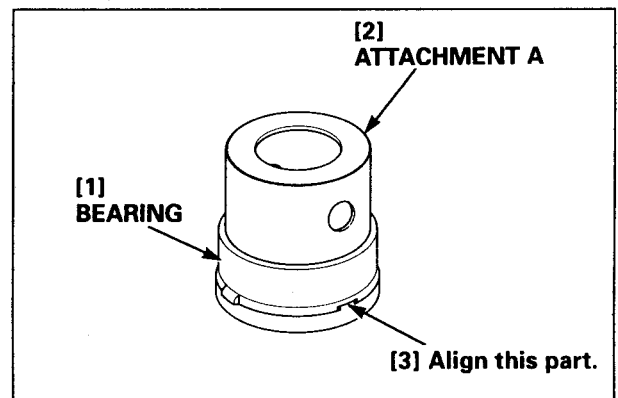
Secure the attachment of the next place you are to work on in the same procedure as explained in the step 3, and repeat the work.



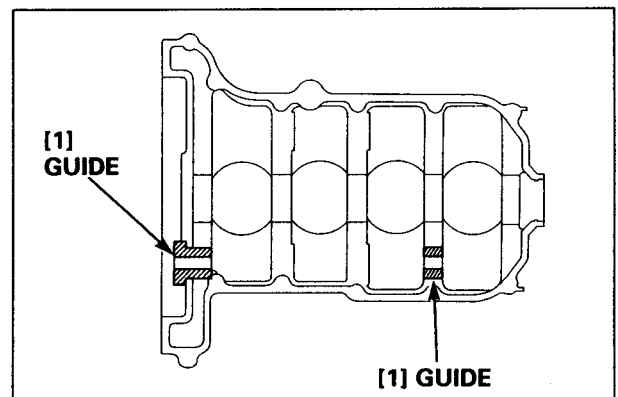
### INSTALLATION:

#### <No. 1 bearing installation (Exhaust side)>

- 1) Install the No.1 bearing by aligning the notch in the bearing with the projection on the attachment A (special tool).



- 2) Set the two guides (special tool) at the indicated positions of the cylinder block (Exhaust side).

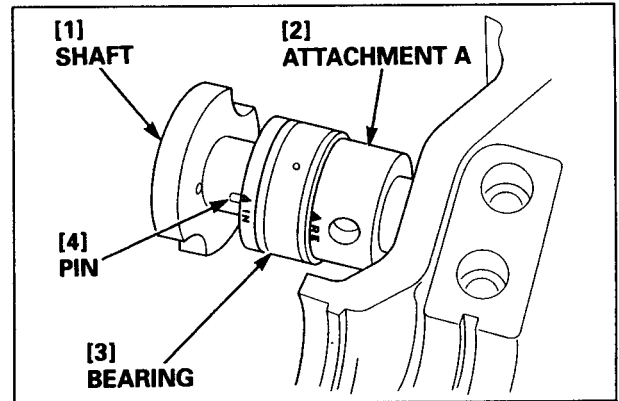


- 3) Insert the bearing and attachment A that were set in the step 1 into the shaft of the special tool as shown.

- Insert the attachment A into the shaft from the reverse side of the attachment A where the pin is provided.

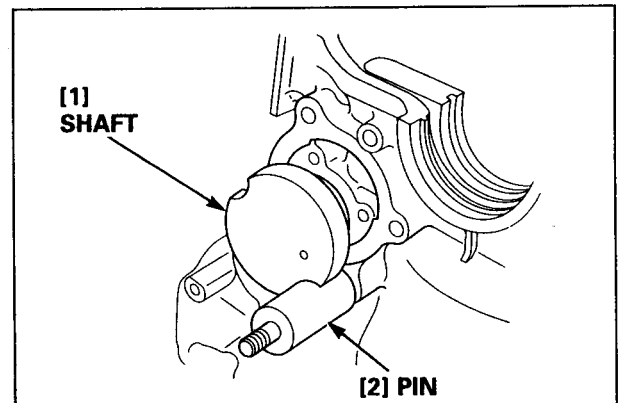
- 4) Insert the shaft of the special tool into the cylinder block (Exhaust side).

- Insert the shaft with care not to cause the guide set in the block to come out of position.



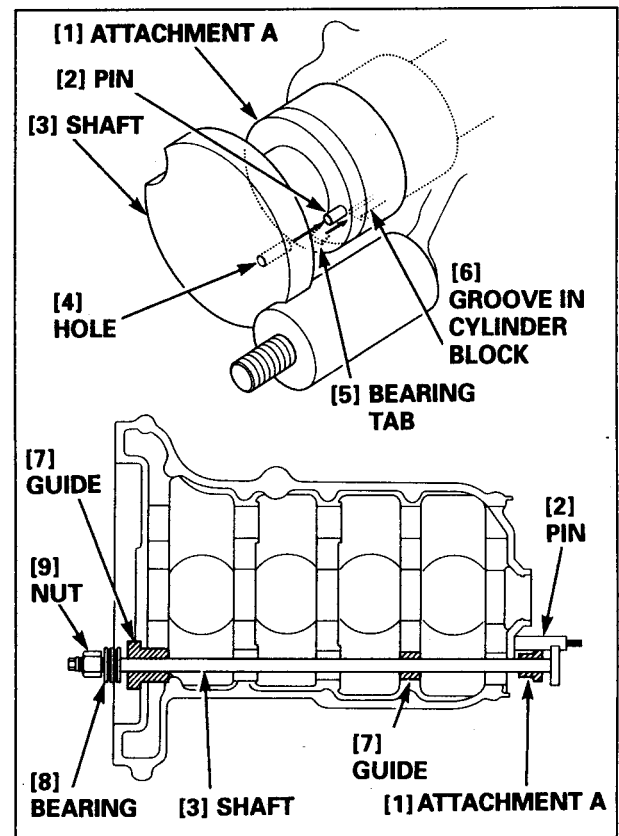
- 5) Align the pin of the special tool with the cutout in the shaft as shown, and tighten the pin against the cylinder block.

- Screw the finer threads of the pin into the cylinder block.



- 6) Align the pin of attachment A with the hole in the shaft. Be sure that the projection on attachment A aligns with the notch in the bearing. Note, too, that the bearing tab should align with the groove in the cylinder block.

- 7) Push the shaft in toward the cylinder block side.

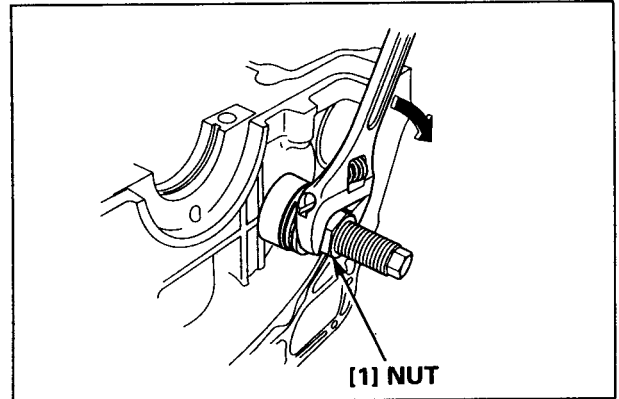




- 8) Install the bearing by tightening the nut.

**CAUTION:**

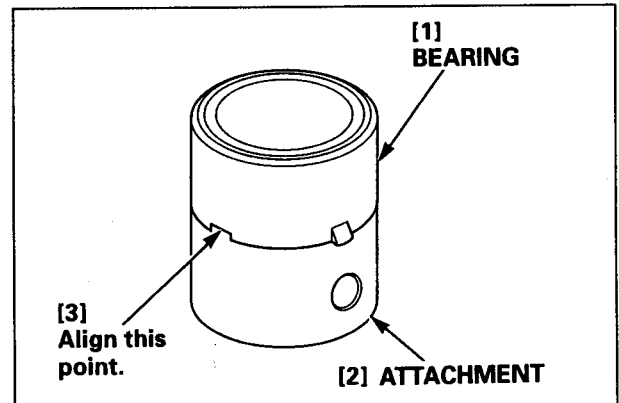
Be sure that the bearing tab aligns with the groove in the cylinder block, and tighten the nut slowly.



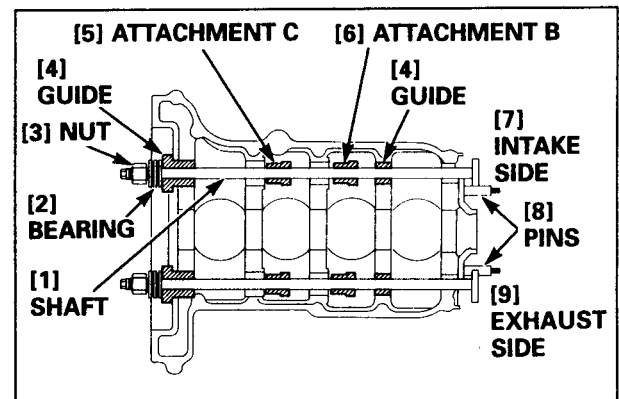
**<No.2/No.3 bearing installation>**

- Do not perform the bearing installation at several places simultaneously. Complete installation one by one securely.

- 1) Set the bearing by aligning the notch in the bearing with the projection on the attachment.



- 2) Install the special tools at the positions shown.

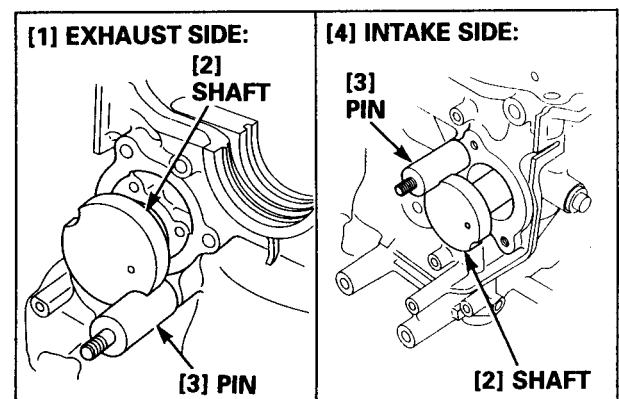


- 3) Align the pin of the special tool with the cutout in the shaft as shown, and tighten the pin against the cylinder block.

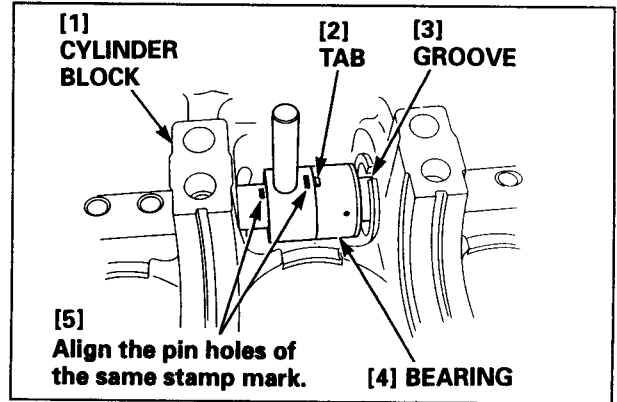
- Tighten the pin noting the installation direction as shown.

Exhaust side: Tighten with the finer threads toward the cylinder block.

Intake side: Tighten with the wider threads toward the cylinder block.



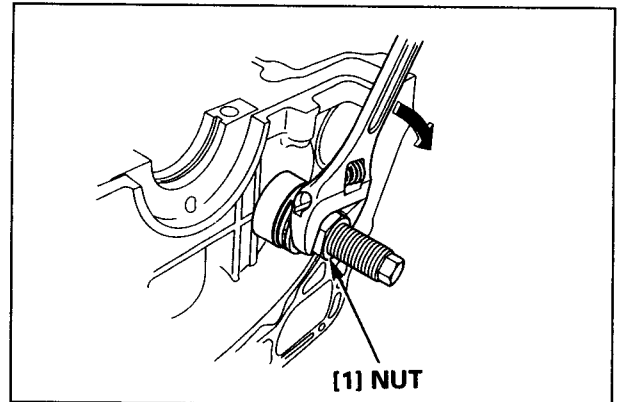
- 4) Align the stopper pin hole in the attachment and the stopper pin hole in the shaft, and insert the stopper pin into the holes to fix the attachment.
- 5) Align the bearing tab with the groove in the cylinder block.



- 6) Install the bearing by tightening the nut.

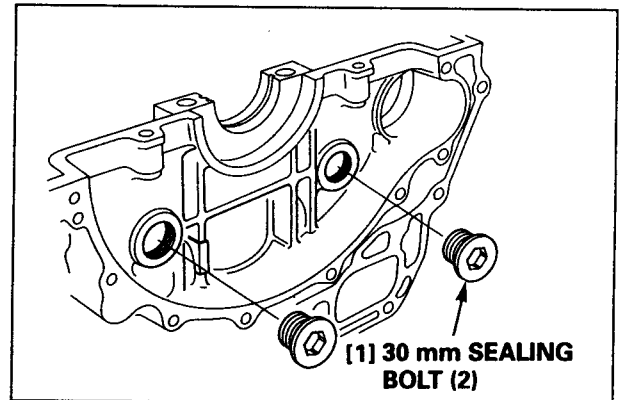
**CAUTION:**

Be sure that the bearing tab aligns with the groove in the cylinder block, and tighten the nut slowly.



- 7) Remove the special tools after tightening all bearings.
- 8) Apply an adhesive agent (Three Bond #1386B or equivalent) to the threaded part of the 30 mm sealing bolts, and tighten the bolts to the specified torque.

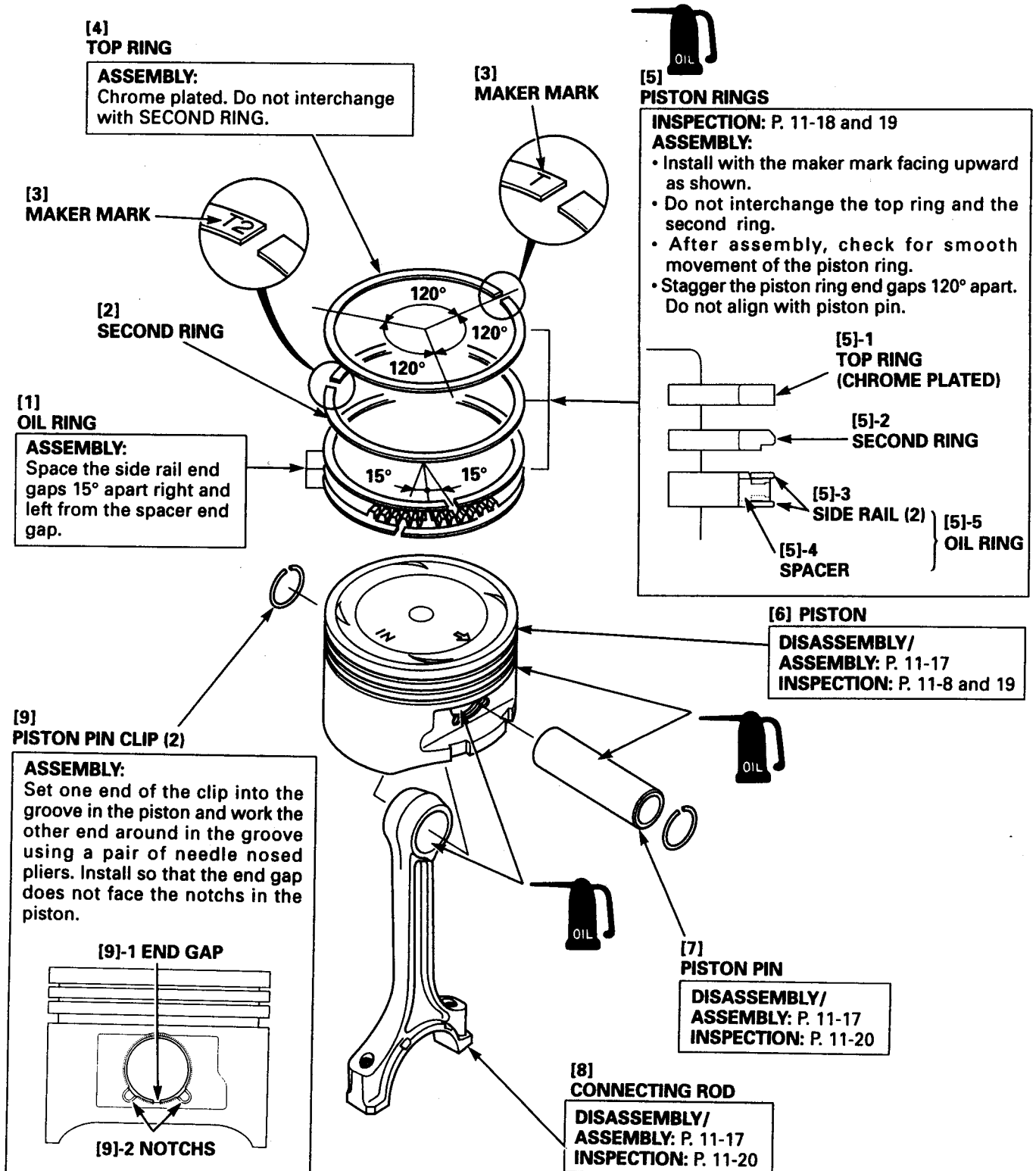
**TORQUE: 78 N·m (8.0 kgf·m, 58 lbf·ft)**



### 5. PISTON

#### a. DISASSEMBLY/ASSEMBLY

After installing the pistons and connecting rods in the cylinder block, secure the rods to the crankshaft.



## ● PISTON/PISTON PIN/CONNECTING ROD

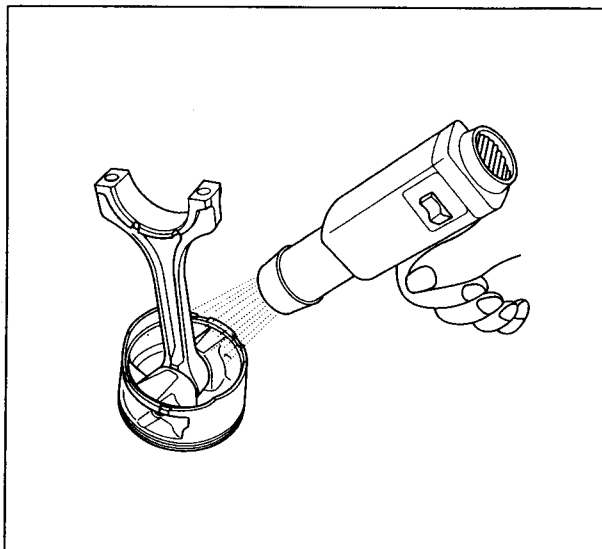
### DISASSEMBLY:

- 1) Remove the piston ring and the piston pin clip (P. 11-16).
- 2) Warm up the piston/connecting rod assembly to approximately 50°C - 80°C (122°F - 176°F), and remove the piston pin.

#### ⚠ WARNING

Take care not to get your hand, etc. burned during disassembly.

Note that the check of the piston, piston pin and the connecting rod must be made after the parts return to the normal room temperature.

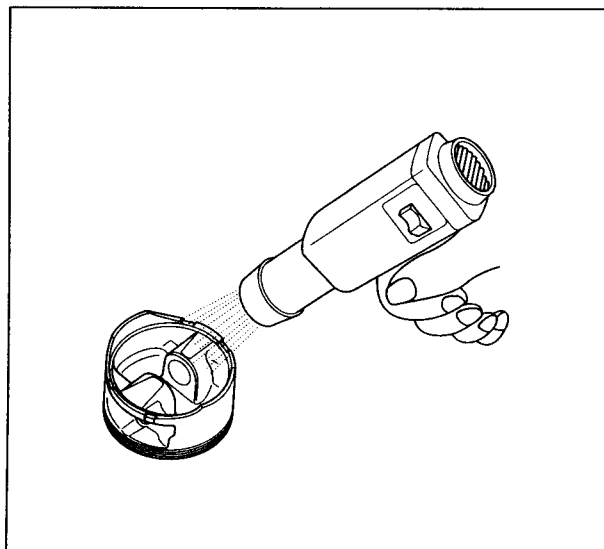


### ASSEMBLY:

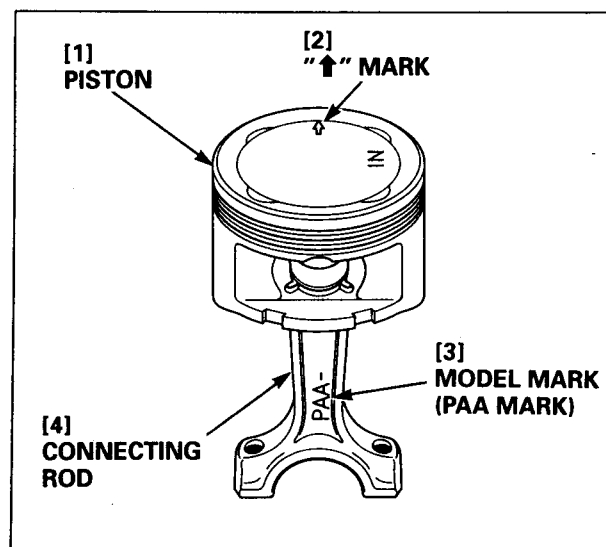
- 1) Install the piston pin clip on one side only (P. 11-16).
- 2) Warm up the piston to approximately 50°C - 80°C (122°F - 176°F)

#### ⚠ WARNING

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.
- 4) Install the piston pin so that the "↑" mark on the piston head points to the opposite side from the model mark (PAA mark) on the connecting rod.
- 5) Install another piston pin clip on the opposite side from where the piston pin clip was installed in step 1 (P. 11-16).
- 6) After assembly, check whether the piston moves freely with the dead weight.



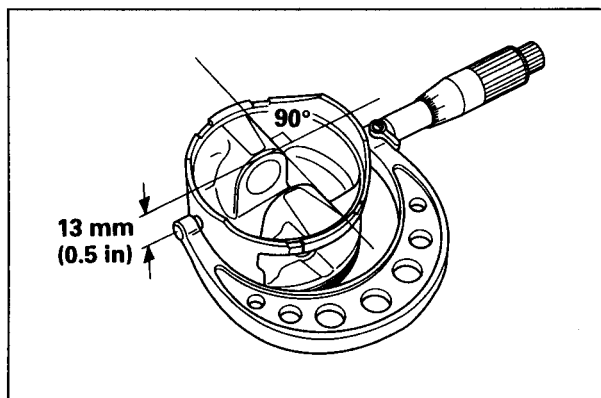
## 6. INSPECTION

For pistons, crankshaft, and cylinder inspection, measure the following. If needed, replace them.

### • 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.

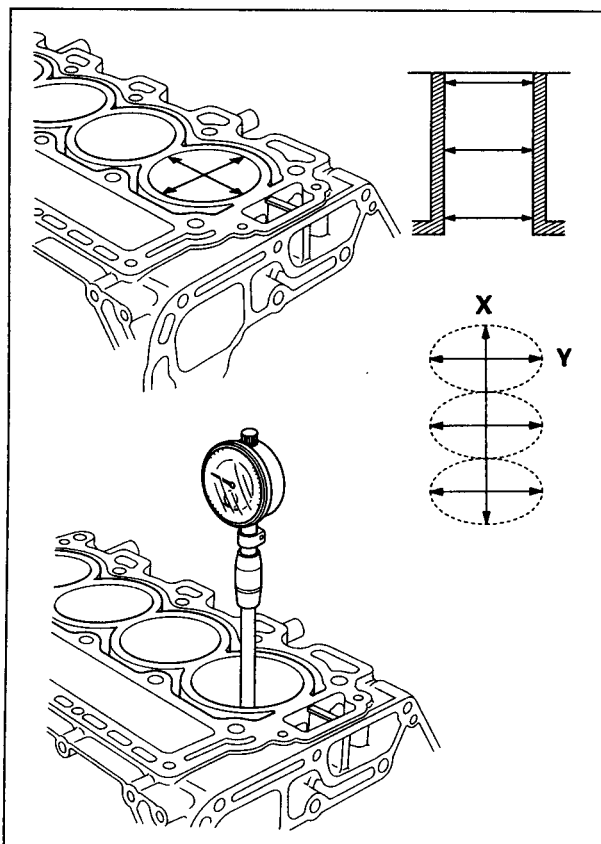
STANDARD	SERVICE LIMIT
85.97 - 85.98 mm (3.3846 - 3.3850 in)	85.96 mm (3.384 in)



### • 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
86.00 - 86.015 mm (3.3858 - 3.3864 in)	86.07 mm (3.389 in)

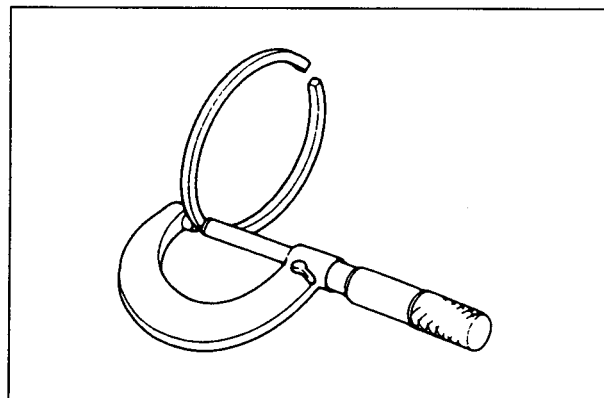


### • PISTON-TO-CYLINDER CLEARANCE

STANDARD	SERVICE LIMIT
0.020 - 0.045 mm (0.0008 - 0.0018 in)	0.050 mm (0.0020 in)

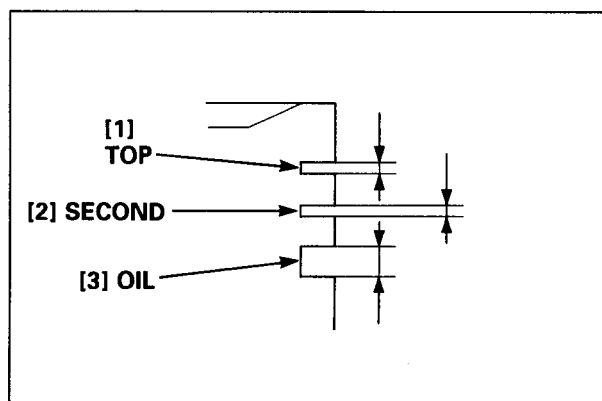
### • PISTON RING THICKNESS

	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)	—



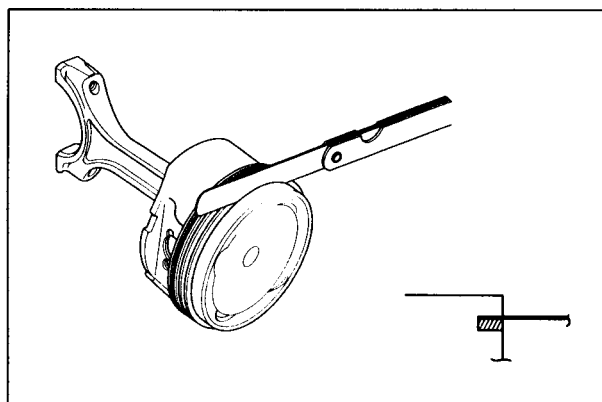
### • PISTON RING GROOVE WIDTH

	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)

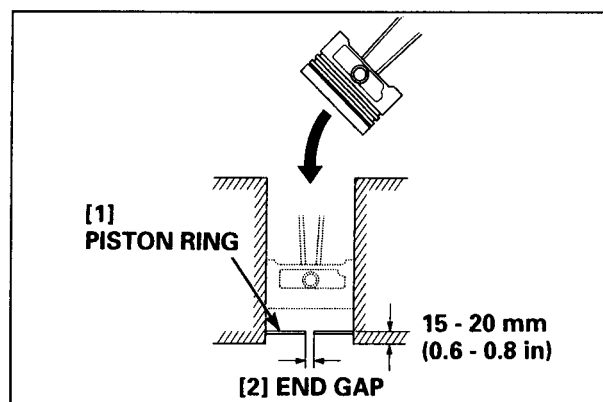


### • PISTON RING END GAP

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.

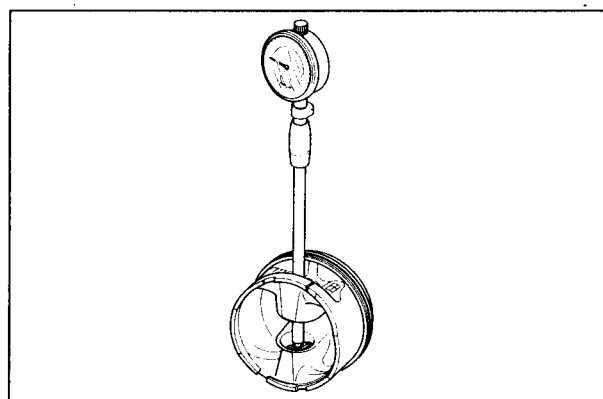
	STANDARD	SERVICE LIMIT
TOP	0.20 - 0.35 mm (0.008 - 0.014 in)	0.6 mm (0.024 in)
SECOND	0.40 - 0.55 mm (0.016 - 0.022 in)	0.7 mm (0.028 in)
OIL	0.20 - 0.70 mm (0.008 - 0.028 in)	0.8 mm (0.031 in)



If the measurement is too large, install a new piston ring and measure again. Then, measure the cylinder sleeve I.D. (P. 11-18).

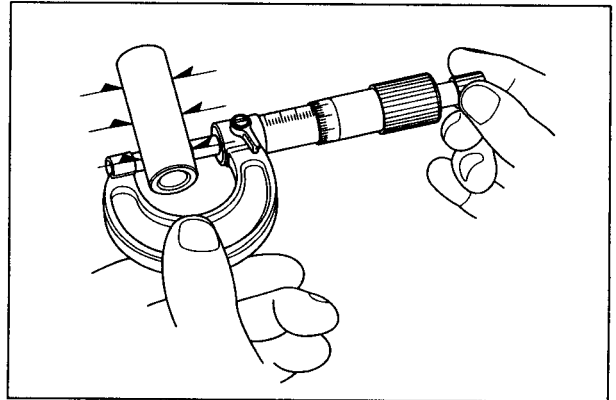
### • PISTON PIN BORE I.D.

STANDARD	SERVICE LIMIT
21.960 - 21.963 mm (0.8645 - 0.8647 in)	—



### ● PISTON PIN O.D.

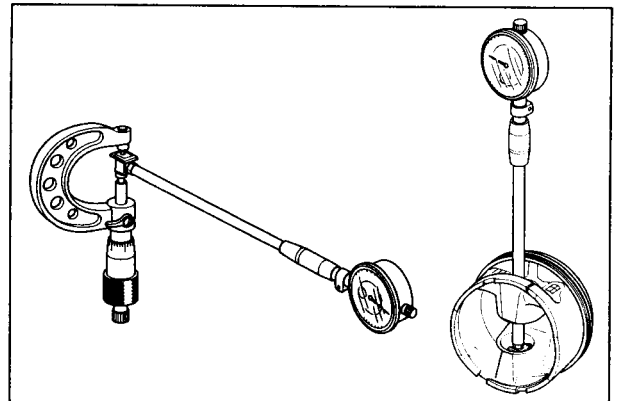
STANDARD	SERVICE LIMIT
21.961 - 21.965 mm (0.8646 - 0.8648 in)	—



### ● PISTON PIN-TO-PIN BORE CLEARANCE

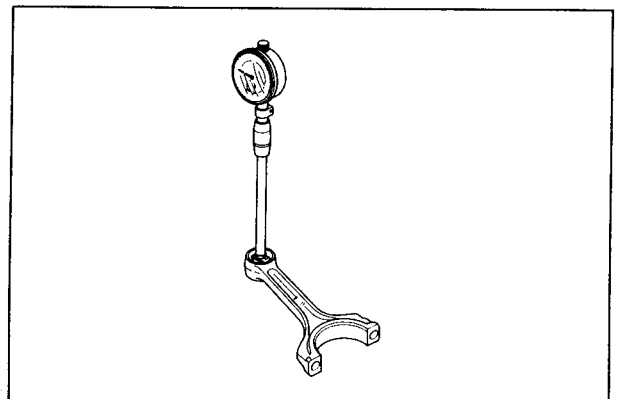
- 1) Set the cylinder gauge at the piston pin O.D., and set the gauge needle at zero "0".
- 2) Set the cylinder gauge in the piston pin hole, and measure the piston pin-to-pin bore clearance.

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)	—



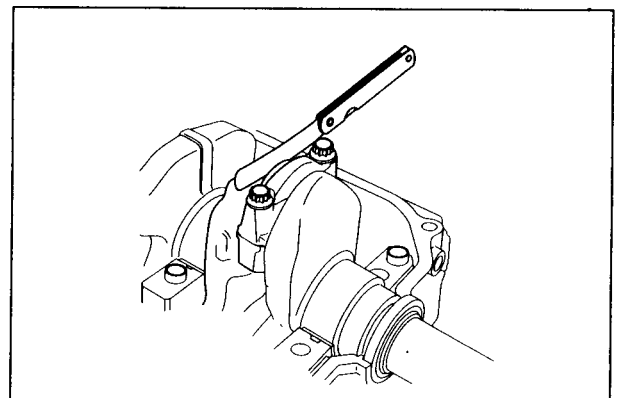
### ● CONNECTING ROD SMALL END-TO-PISTON PIN CLEARANCE

STANDARD	SERVICE LIMIT
0.005 - 0.015 mm (0.0002 - 0.0006 in)	—

### ● CONNECTING ROD BIG END AXIAL CLEARANCE

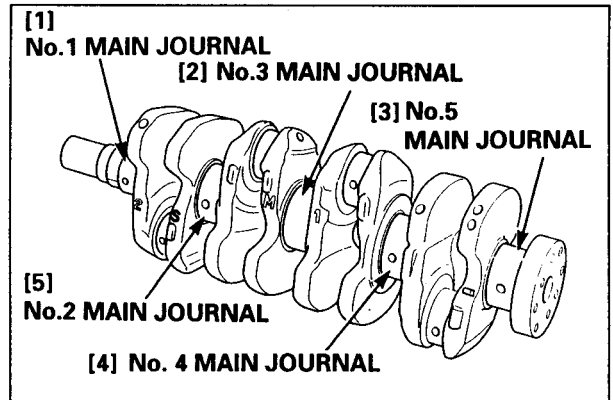
Measure the clearances with a feeler gauge.

STANDARD	SERVICE LIMIT
0.15 - 0.30 mm (0.006 - 0.012 in)	0.4 mm (0.016 in)



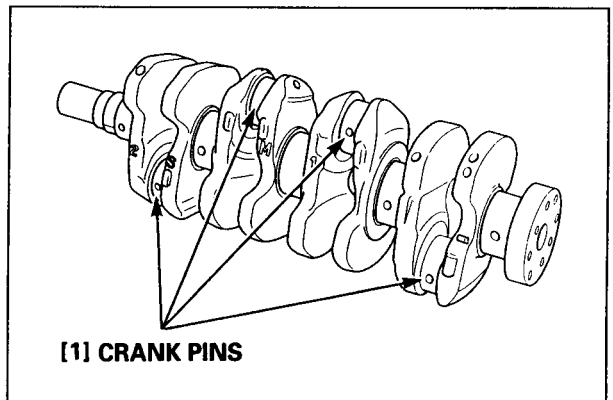
### ● CRANKSHAFT MAIN JOURNAL O.D.

	STANDARD	SERVICE LIMIT
No.1/No.2	54.980 - 55.004 mm (2.1646 - 2.1655 in)	_____
No.3	54.976 - 55.000 mm (2.1644 - 2.1654 in)	_____
No.4	54.980 - 55.004 mm (2.1646 - 2.1655 in)	_____
No.5	54.992 - 55.016 mm (2.1650 - 2.1660 in)	_____



### ● CRANK PIN O.D.

STANDARD	SERVICE LIMIT
44.976 - 45.000 mm (1.7707 - 1.7717 in)	_____

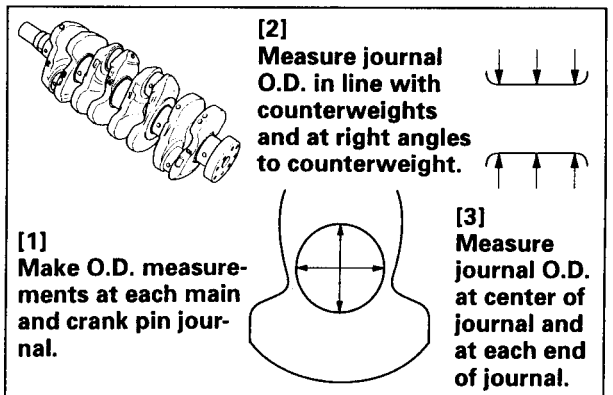


### ● CRANKSHAFT JOURNAL ROUNDNESS (MAIN/CRANK PIN JOURNALS)

Measure each journal O.D. in line with the counterweights and at right angles to the counterweights. Make these O.D. measurements in the center of the journal and again at each end of the journal (6 measurements overall at each journal).

At each journal, the largest O.D. value measured must not exceed the smallest O.D. value by more than the roundness service limit.

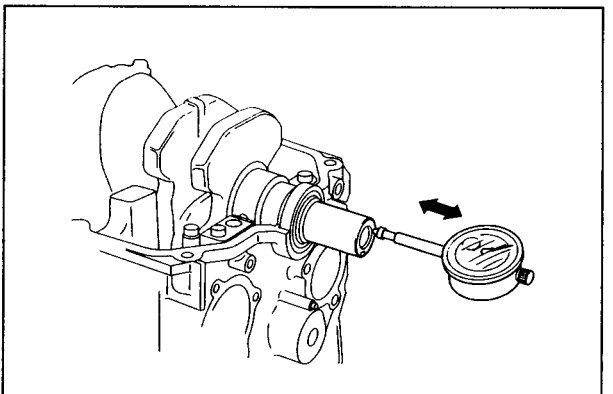
STANDARD	SERVICE LIMIT
0.005 mm (0.0002 in) Max	0.006 mm (0.0002 in)



### ● CRANKSHAFT AXIAL CLEARANCE

STANDARD	SERVICE LIMIT
0.10 - 0.35 mm (0.004 - 0.014 in)	0.45 mm (0.018 in)

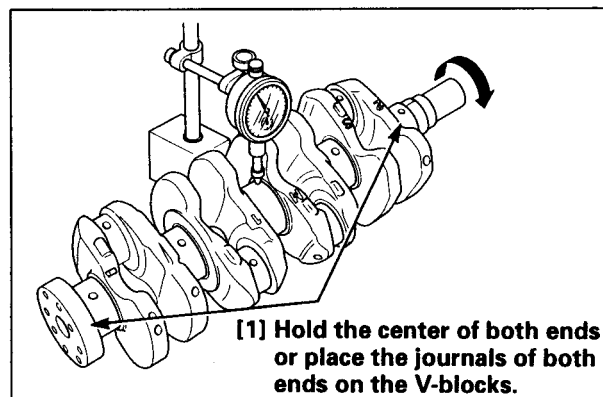
If the measurement exceeds the service limit, check the thrust washer and the thrust surface of the crankshaft and replace the thrust washer with a new one.





### • CRANKSHAFT RUNOUT

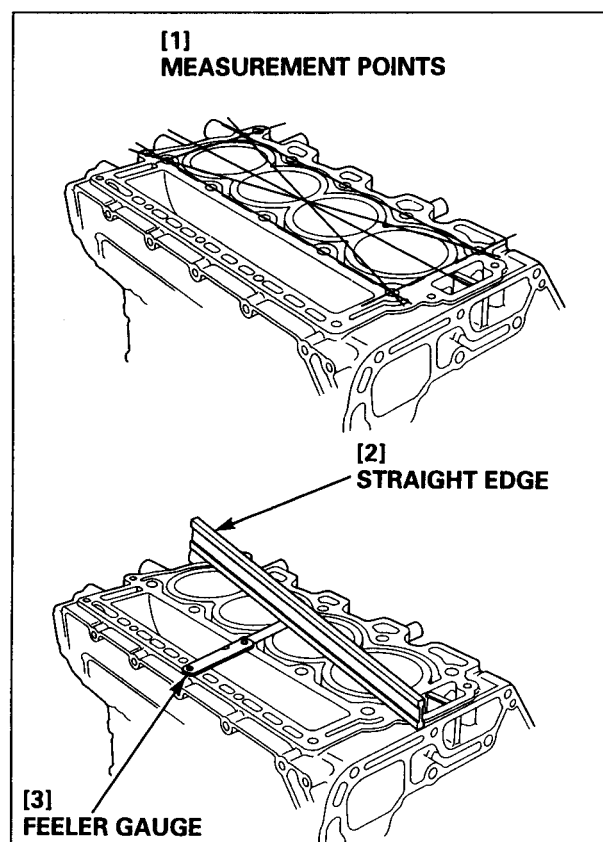
STANDARD	SERVICE LIMIT
0.030 mm (0.0012 in) Max	0.040 mm (0.0016 in)



### • CYLINDER HEAD SURFACE WARPAGE

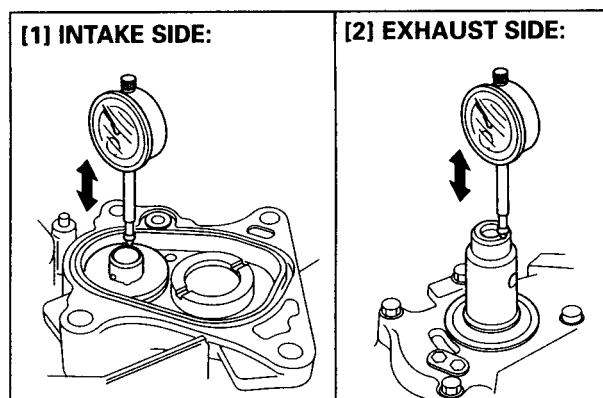
- 1) Take care not to damage (scores, scratches, etc.) the mating surface with the gasket.
- 2) Measure the surface warpage using a straight edge and a feeler gauge as shown.

STANDARD	SERVICE LIMIT
0.07 mm (0.003 in) Max	0.10 mm (0.004 in)



### • BALANCER SHAFT AXIAL CLEARANCE

	STANDARD	SERVICE LIMIT
INTAKE SIDE	0.04 - 0.15 mm (0.002 - 0.006 in)	—
EXHAUST SIDE	0.10 - 0.40 mm (0.004 - 0.016 in)	—

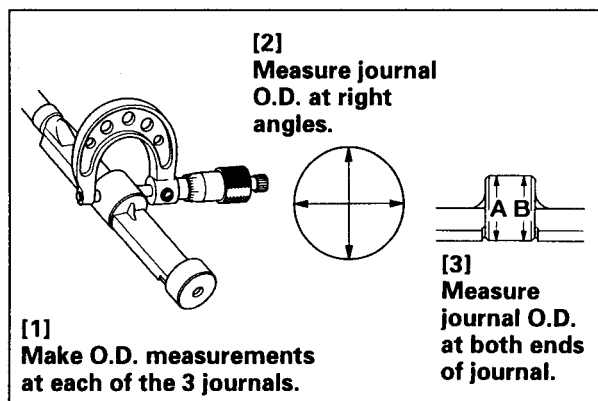


### ● BALANCER SHAFT JOURNAL ROUNDNESS

Measure each journal O.D. as shown in the illustration, and again at right angles to that measurements. Make these O.D. measurements at both ends of the journal (4 measurements overall at each journal).

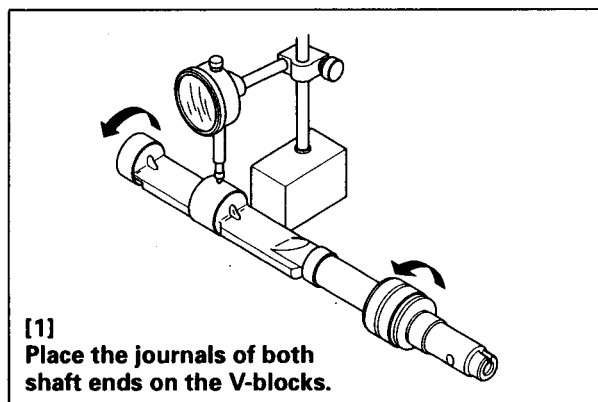
At each journal, the largest O.D. value measured must not exceed the smallest O.D. value by more than the roundness service limit.

STANDARD	SERVICE LIMIT
0.005 mm (0.0002 in) Max	0.006 mm (0.0002 in)



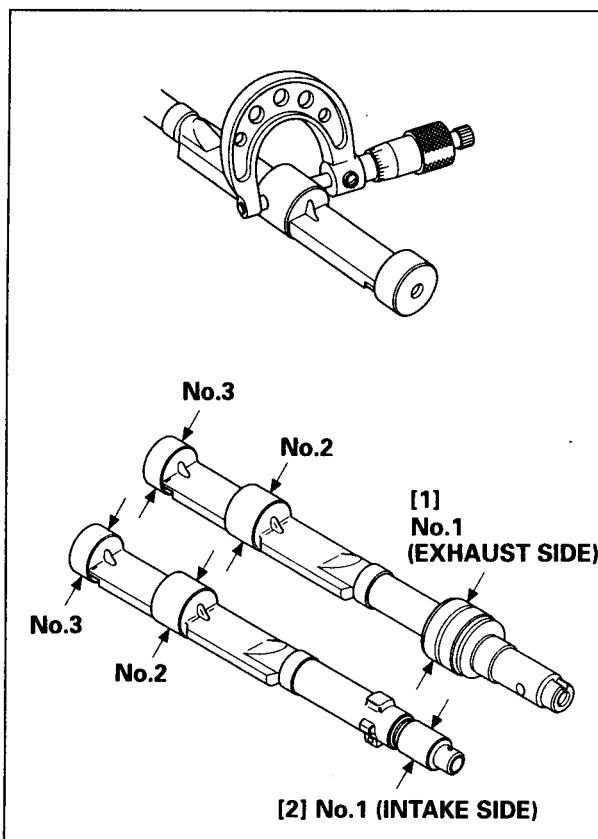
### ● BALANCER SHAFT RUNOUT

STANDARD	SERVICE LIMIT
0.02 mm (0.001 in) Max	0.03 mm (0.001 in)



### ● BLANCER SHAFT MAIN JOURNAL O.D.

	STANDARD	SERVICE LIMIT
No.1 (EXHAUST SIDE)	42.722 - 42.734 mm (1.6820 - 1.6824 in)	42.71 mm (1.681 in)
No.1 (INTAKE SIDE)	20.938 - 20.950 mm (0.8243 - 0.8248 in)	20.92 mm (0.824 in)
No.2	38.712 - 38.724 mm (1.5241 - 1.5246 in)	38.70 mm (1.524 in)
No.3	34.722 - 34.734 mm (1.3670 - 1.3675 in)	34.71 mm (1.367 in)



### ● BALANCER SHAFT BEARING I.D.

Clean the inner wall of each balancer shaft bearing and measure the bearing I.D.

	STANDARD	SERVICE LIMIT
No.1 (EXHAUST SIDE)	42.800 - 42.820 mm (1.6850 - 1.6858 in)	42.83 mm (1.686 in)
No.1 (INTAKE SIDE)	21.000 - 21.013 mm (0.8268 - 0.8273 in)	21.02 mm (0.828 in)
No.2	38.800 - 38.820 mm (1.5276 - 1.5283 in)	38.83 mm (1.529 in)
No.3	34.800 - 34.820 mm (1.3701 - 1.3709 in)	34.83mm (1.371 in)

### ● BALANCER SHAFT JOURNAL OIL CLEARANCE

	STANDARD	SERVICE LIMIT
No.1 (EXHAUST SIDE)	0.066 - 0.098 mm (0.0026 - 0.0039 in)	0.12 mm (0.005 in)
No.1 (INTAKE SIDE)	0.050 - 0.075 mm (0.0020 - 0.0030 in)	0.09 mm (0.004 in)
No.2	0.076 - 0.108 mm (0.0030 - 0.0043 in)	0.13 mm (0.005 in)
No.3	0.066 - 0.098 mm (0.0026 - 0.0039 in)	0.12 mm (0.005 in)

### ● CONNECTING ROD BOLT

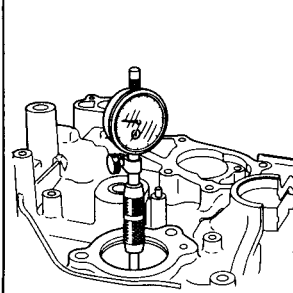
- 1) Measure the bolt O.D. at the two points as shown and calculate the gap between the measurements.

STANDARD	0 - 0.1 mm (0 - 0.004 in)
----------	---------------------------

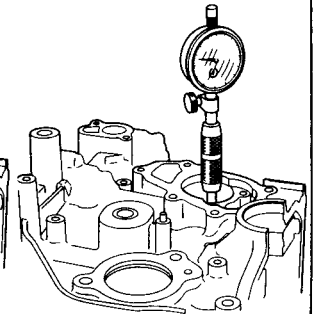
- 2) If the gap exceeds the standard value, replace the connecting rod bolt.

- Measure the O.D. of all connecting rod bolts.

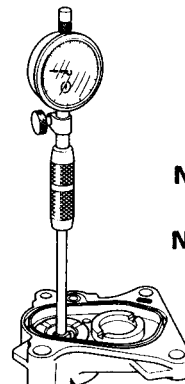
[1] INTAKE SIDE:



[2] EXHAUST SIDE:

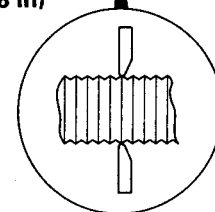
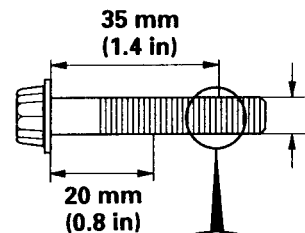
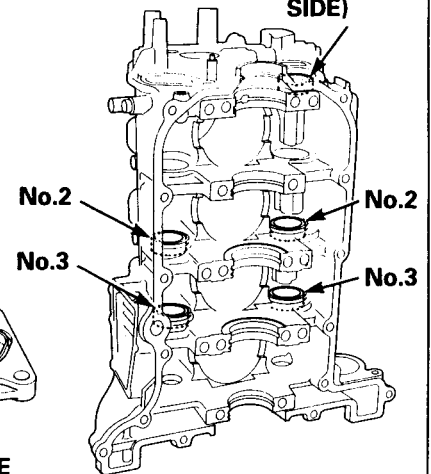


[4] No.1 (INTAKE SIDE):



[5] GEAR CASE SPACER

[3] No.1 (EXHAUST SIDE)



### ● CRANKSHAFT MAIN BEARING OIL CLEARANCE

- 1) Set the crankshaft main bearings on the crankcase and the cylinder block. Wipe the oil off the main bearing surface.
- 2) Wipe the oil off the crankshaft main journal, and set the crankshaft on the cylinder block.

Set the 40 x 52 x 7 mm oil seal, 98 x 80 x 10 mm oil seal and the two thrust washers on the crankshaft.

- 3) Place the plastigauges on the main journal of each crankshaft. Install the crankcase.

- Align the 18 x 22 mm dowel pins and the ten 13 x 20 mm dowel pins between the crankcase and the cylinder block securely.

- Set the plastigauges axially.

- 4) Apply engine oil to the seat and the threads of each bolt, and loosely tighten them in the positions shown. Then, tighten the bolts in the numbered sequence shown in two or three steps to the specified torque.

#### TORQUE:

51 N·m (5.2 kgf·m, 38 lbf·ft) (11 x 131 mm bolt-washer)

47 N·m (4.8 kgf·m, 35 lbf·ft) (10 x 40 mm flange bolt)

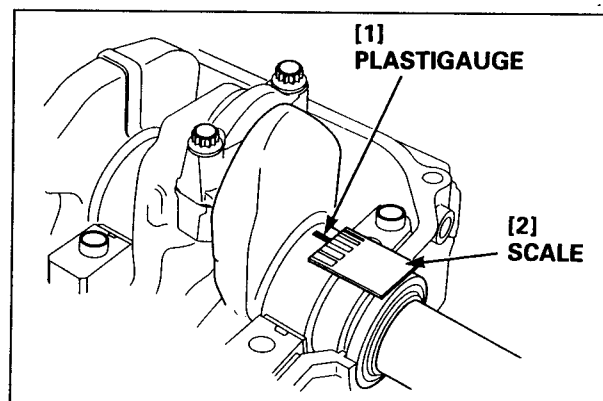
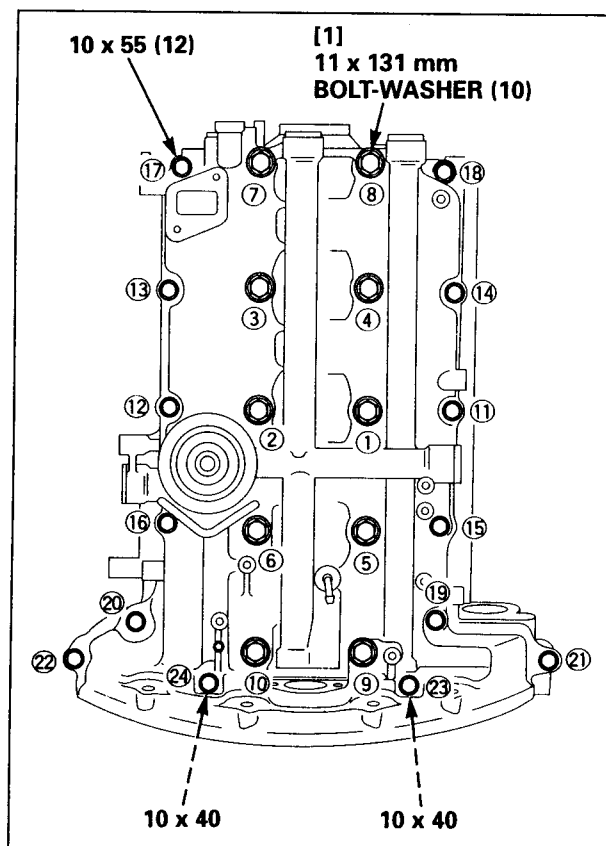
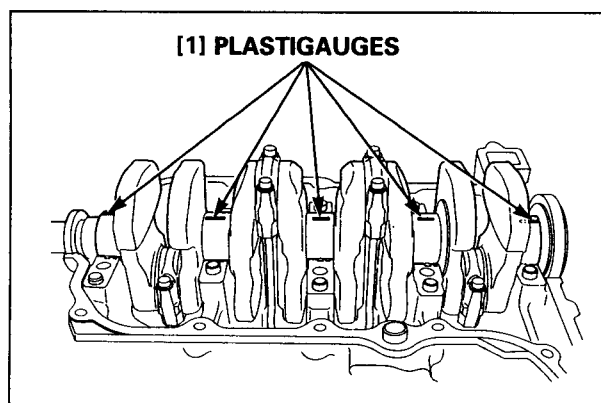
39 N·m (4.0 kgf·m, 29 lbf·ft) (10 x 55 mm flange bolt)

- Tighten the bolts while holding the crankshaft not to turn.

- 5) Remove the crankcase and measure the pressured width of the plastigauge using the scale printed on the plastigauge's bag.

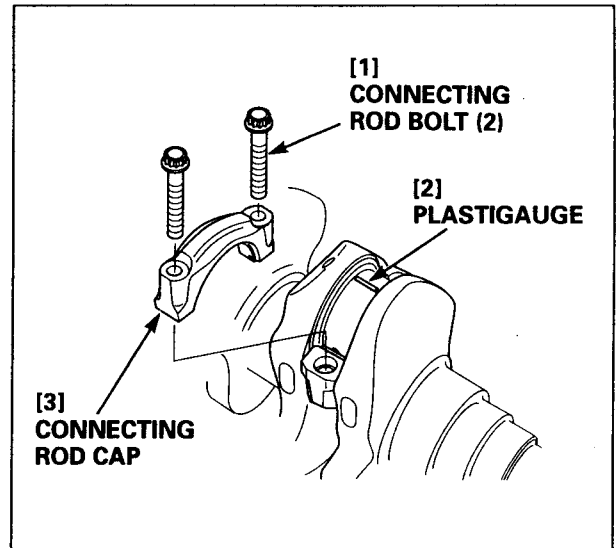
	STANDARD	SERVICE LIMIT
No.1 / No.2 / No.4	0.027 - 0.045 mm (0.0011 - 0.0018 in)	0.050 mm (0.0020 in)
No.3	0.031 - 0.049 mm (0.0012 - 0.0019 in)	0.055 mm (0.0022 in)
No.5	0.017 - 0.035 mm (0.0007 - 0.0014 in)	0.040 mm (0.0016 in)

- 6) If the measurement exceeds the service limit, check the crankcase 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

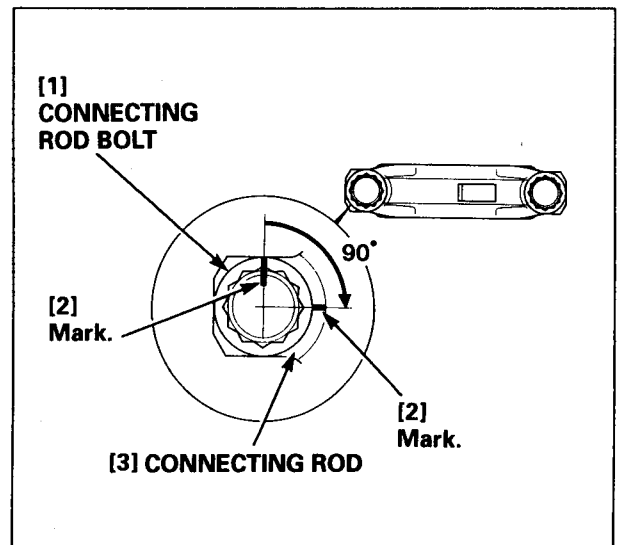
- 1) Wipe the oil off the crank pin and the connecting rod bearing mating surface.
- 2) Set the plastigauge on the crank pin. Set the connecting rod and cap by aligning the alignment marks on the connecting rod and the cap (P. 11-10).



- 3) Tighten the connecting rod bolts to the specified torque.
- 4) Mark each of the connecting rod bolts and the connecting rods as shown. Tighten the connecting rod bolts additionally until the two marks align (90°).

**TORQUE: 20 N·m (2.0 kgf·m, 14 lbf·ft) + 90°**

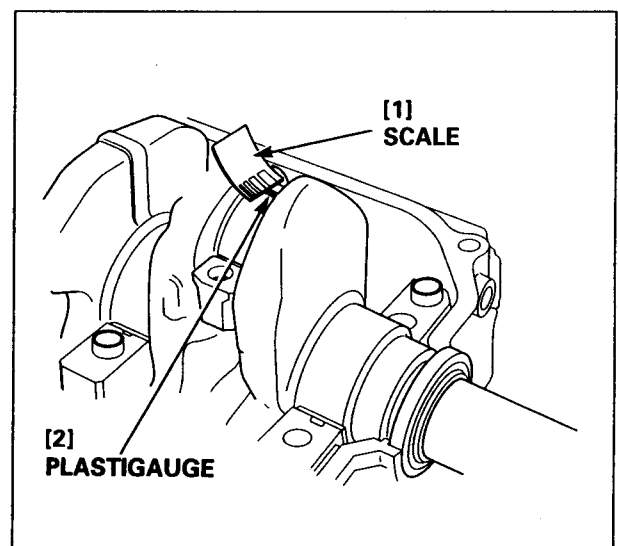
- Set the plastigauges axially.
- Tighten the two nuts equally while holding the crankshaft not to turn.



- 5) 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
0.026 - 0.044 mm (0.0010 - 0.0017 in)	—

- 6) 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.11-29), and measure the oil clearance again.



## 7. BEARING SELECTION

### a. CRANKSHAFT MAIN BEARING

- 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.

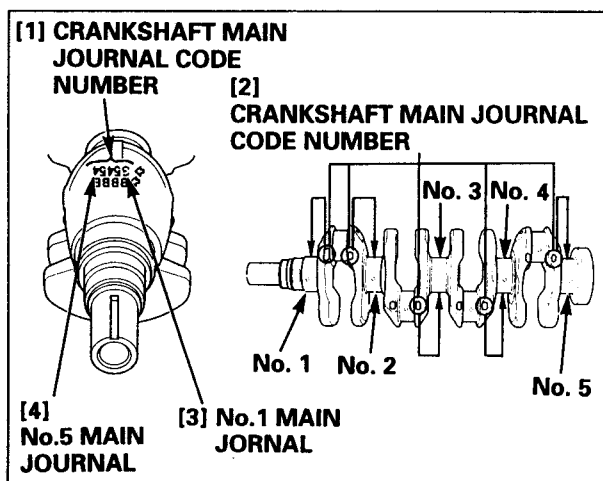
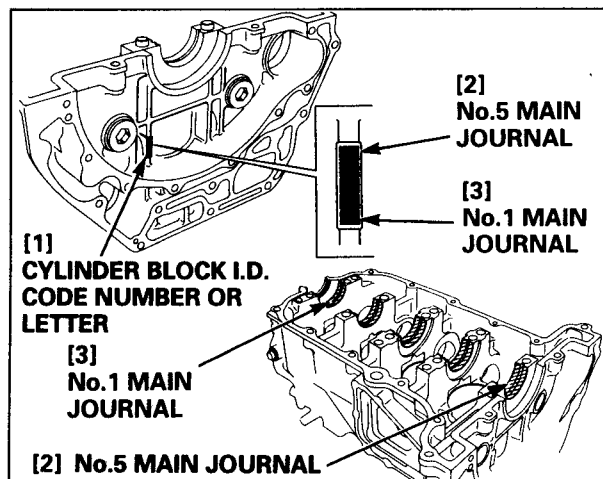
1) Check the cylinder block I.D. code letters or numbers and record them.

- The cylinder block I.D. code letters or numbers are for the No.1 and the subsequent number journals when viewed from the lowermost code.

2) Check the crankshaft main journal code numbers and record them.

- 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.

3) Select the correct bearing by referring to the cylinder block I.D. code letter or number and the crankshaft main journal code number.



Bearing selection table for No.1 through No.4 journals:

Crankshaft main journal code number	Cylinder block I.D. code number or letter			
	1 or A or I	2 or B or II	3 or C or III	4 or D or IIII
	Bearing I.D. color			
1 or I	Yellow	Yellow/ Green	Green	Green/ Brown
2 or II	Yellow/ Green	Green	Green/ Brown	Brown
3 or III	Green	Green/ Brown	Brown	Brown/ Black
4 or IIII	Green/ Brown	Brown	Brown/ Black	Black
5 or IIIII	Brown	Brown/ Black	Black	Black/ Blue
6 or IIIIII	Brown/ Black	Black	Black/ Blue	Blue

Bearing selection table for No.5 journal:

Crankshaft main journal code number	Cylinder block I.D. code number or letter			
	1 or A or I	2 or B or II	3 or C or III	4 or D or IIII
	Bearing I.D. color			
1 or I	Pink	Pink/ Yellow	Yellow	Yellow/ Green
2 or II	Pink/ Yellow	Yellow	Yellow/ Green	Green
3 or III	Yellow	Yellow/ Green	Green	Green/ Brown
4 or IIII	Yellow/ Green	Green	Green/ Brown	Brown
5 or IIIII	Green	Green/ Brown	Brown	Brown/ Black
6 or IIIIII	Green/ Brown	Brown	Brown/ Black	Black

- 4) Note that the bearings are selected so that the oil clearance is in the range blow.

No.1, 2, 4 journals: 0.027 - 0.045 mm (0.0011 - 0.0018 in)

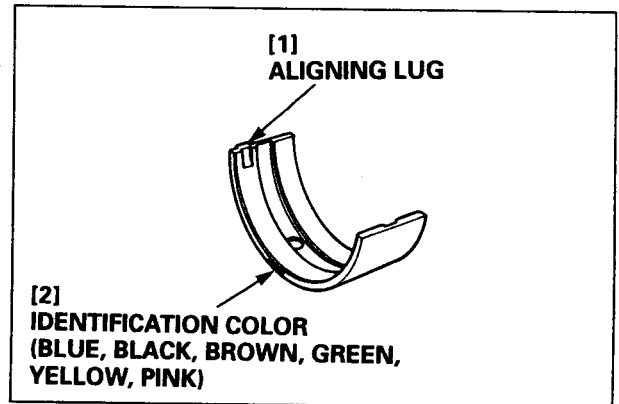
No.3 journal: 0.031 - 0.049 mm (0.0012 - 0.0019 in)

No.5 journal: 0.017 - 0.035 mm (0.0007 - 0.0014 in)

- 5) After installing the selected bearing(s), measure the oil clearance (P. 11-25).
- 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.

- 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

- 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.

- The crank pin code letters are for the No.1 and the subsequent number journals when viewed from the arrow-mark side. The crank pins are the No.1 and the subsequent number journals when viewed from the timing belt driven pulley side.

#### 2) Check the connecting rod code numbers and record them.

- The connecting rod code numbers are for the No.1 and the subsequent number journals when viewed from the timing belt driven pulley side.

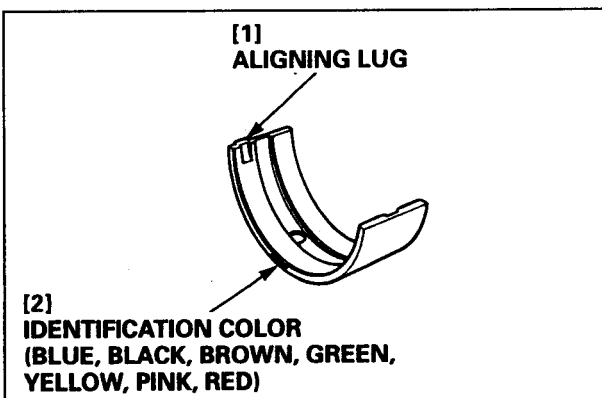
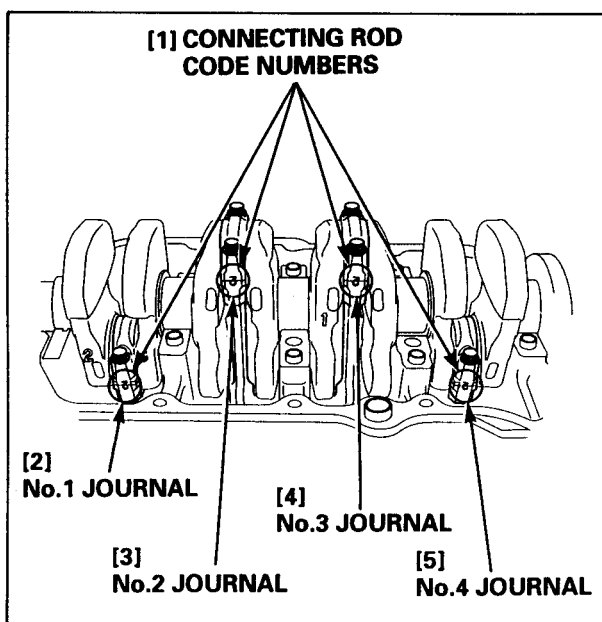
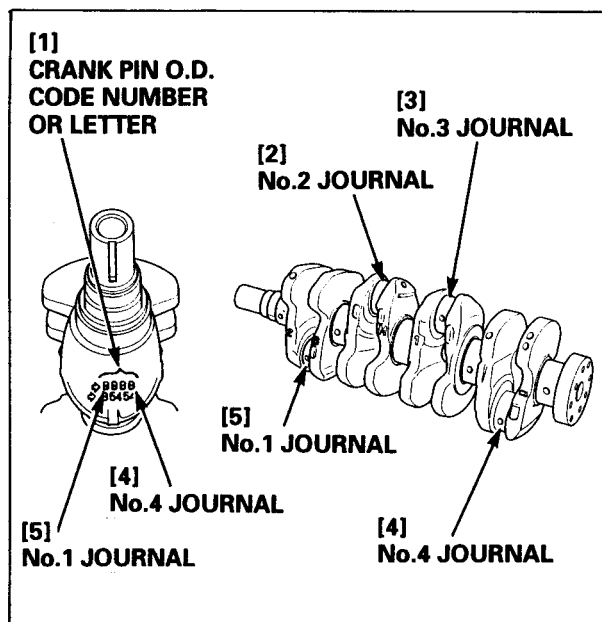
#### 3) Select the correct bearing by referring to the crank pin code letter and the connecting rod code number.

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	Red	Pink	Yellow	Green
B or II	Pink	Yellow	Green	Brown
C or III	Yellow	Green	Brown	Black
D or IIII	Green	Brown	Black	Blue

- 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).
- Be sure to measure the oil clearance after installing the selected bearing(s) (P. 11-26).
- 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.





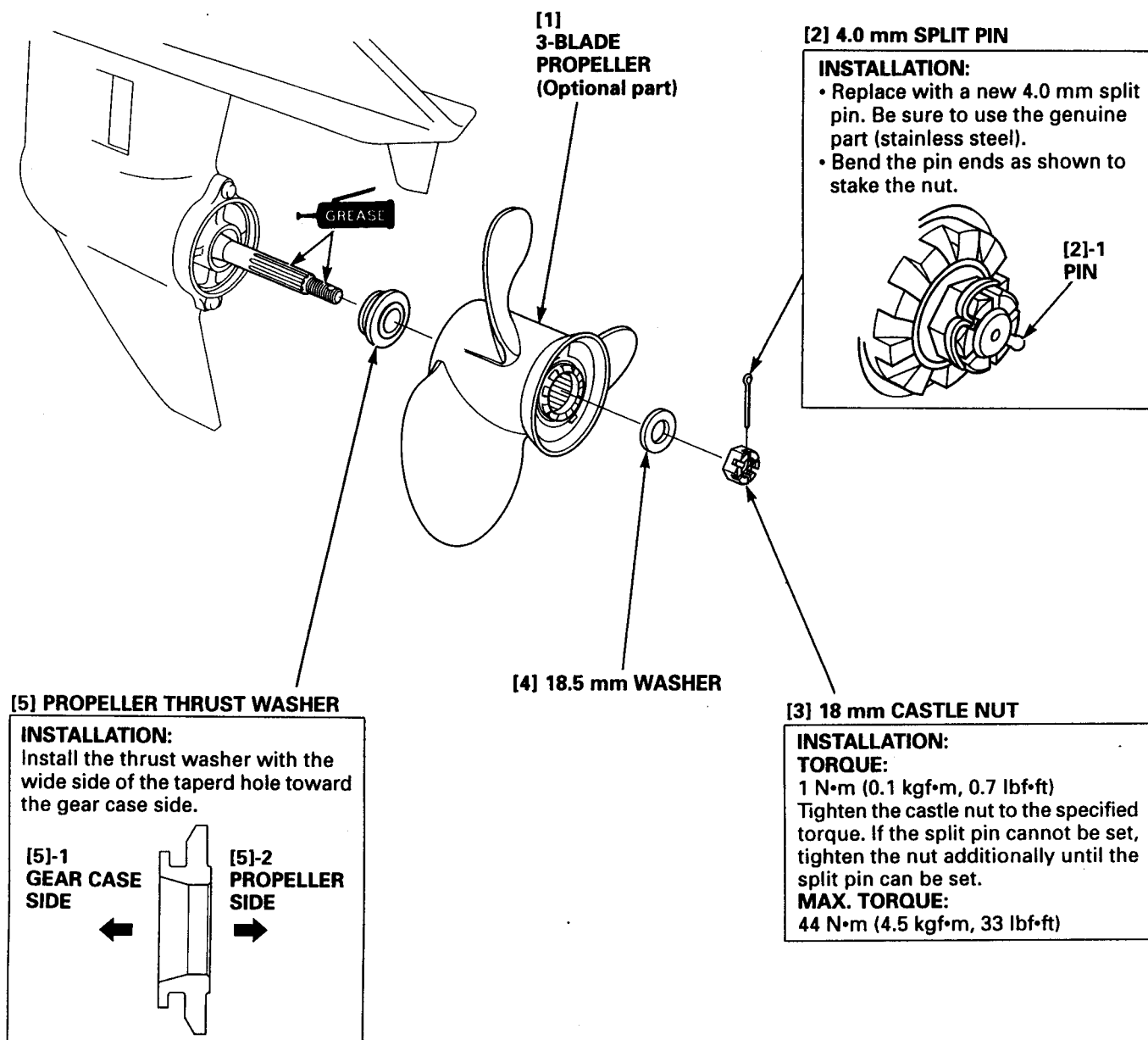
# 12. PROPELLER/GEAR CASE/ EXTENSION CASE

**HONDA**  
**BF115A•130A**

- |   |                               |
|---|-------------------------------|
| 1. PROPELLER                              | 6. VERTICAL SHAFT/BEVEL GEAR  |
| 2. GEAR CASE ASSEMBLY                     | 7. SHIM SELECTION             |
| 3. WATER PUMP/SHIFT ROD                   | 8. SHIM POSITION              |
| 4. PROPELLER SHAFT HOLDER ASSEMBLY        | 9. BACKLASH ADJUSTMENT        |
| 5. PROPELLER SHAFT/PROPELLER SHAFT HOLDER | 10. LOWER RUBBER MOTOR MOUNT  |
|   | 11. EXTENSION CASE/UNDERCOVER |

## 1. PROPELLER


### a. REMOVAL/INSTALLATION

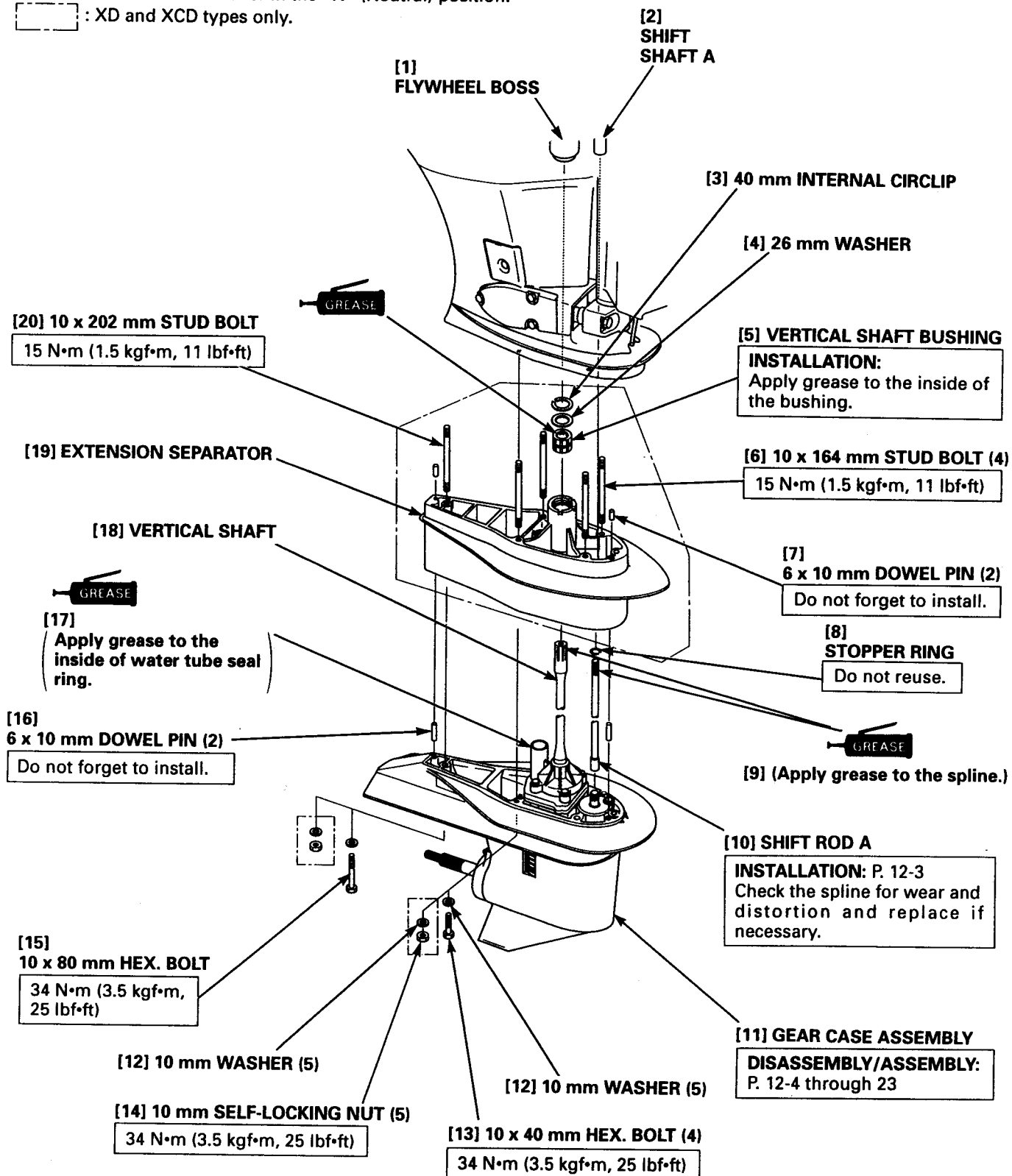


## 2. GEAR CASE ASSEMBLY

### a. REMOVAL/INSTALLATION

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

 : XD and XCD types only.



### ● SHOFT ROD A

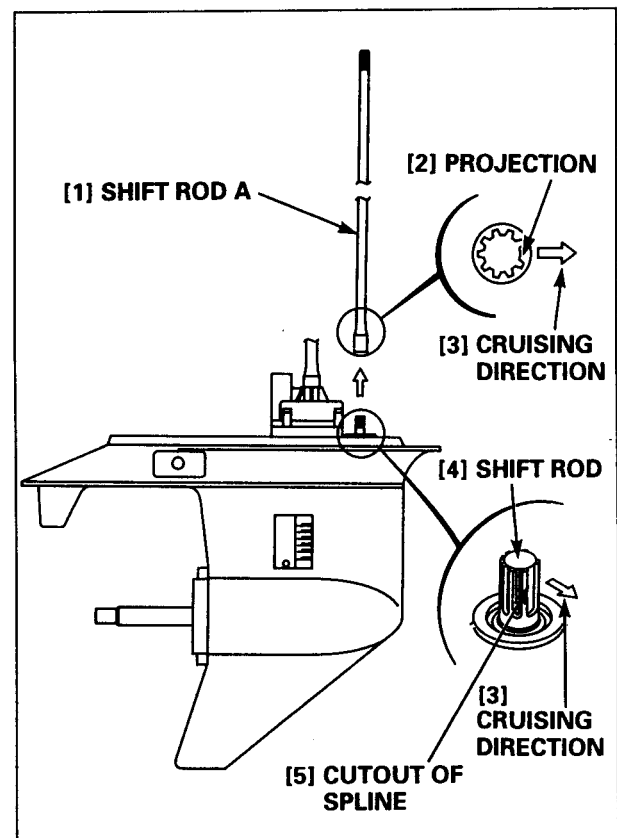
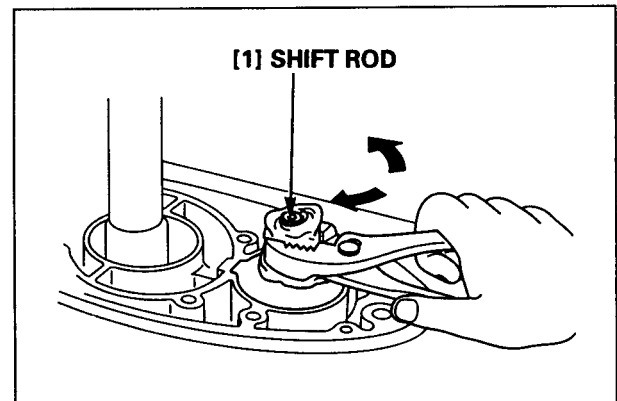
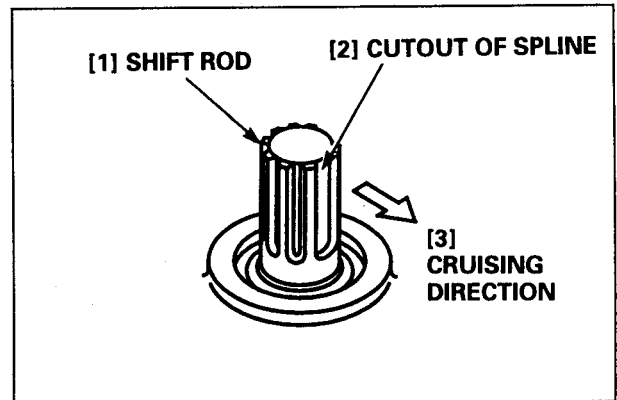
#### INSTALLATION:

- 1) Set the remote control lever in the "N" (Neutral) position.
- 2) Check that shift rod of the gear case is at the "N" (Neutral) position.

#### To check:

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.)

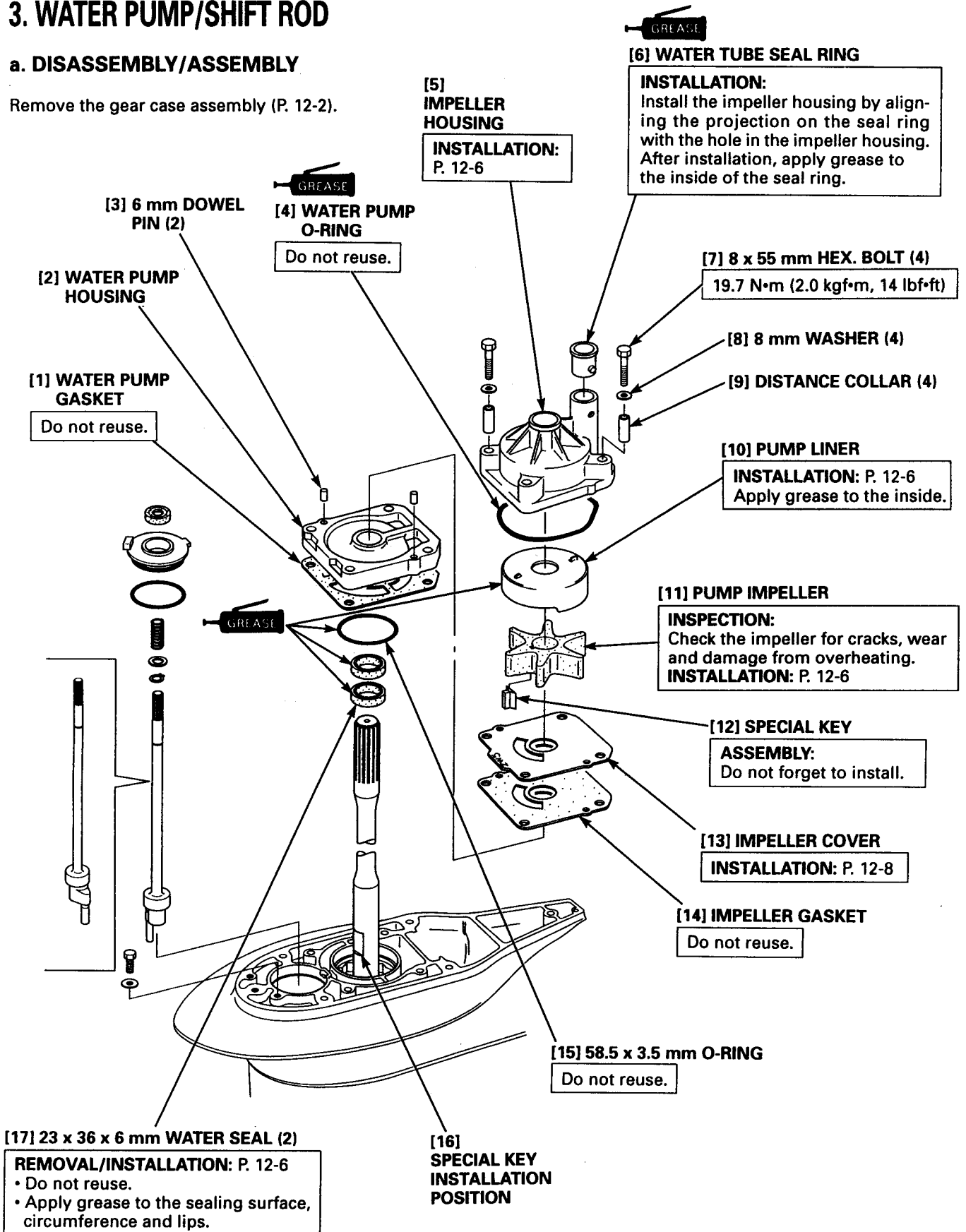
- 3) If the cutout of the spline is not in the directin shown, protect the spline with a shop towel or equivalent material and turn the shift rod right and left with a wrench until the cutout faces toward the specified direction.
- 4) Install the shift rod A by aligning the cutout of the shift rod spline with the projection of the spline of the shift rod A (i. e. part set on the shift rod).

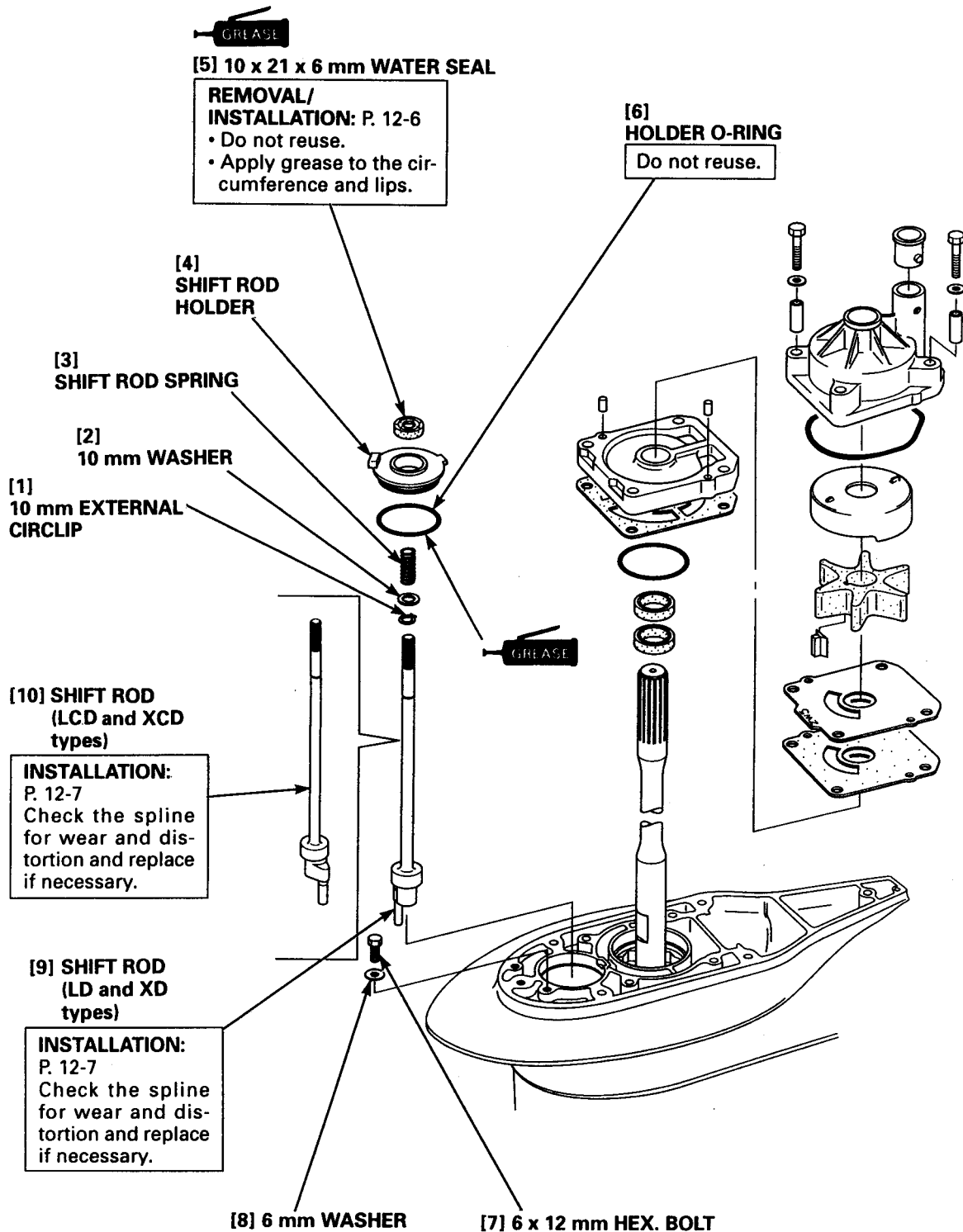


### 3. WATER PUMP/SHIFT ROD

#### a. DISASSEMBLY/ASSEMBLY

Remove the gear case assembly (P. 12-2).





### b. REMOVAL/INSTALLATION

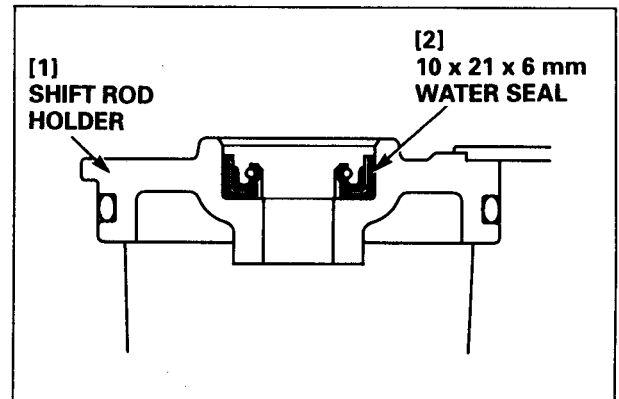
#### • 10 x 21 x 6 mm WATER SEAL

##### REMOVAL:

Remove the 10 x 21 x 6 mm water seal using the commercially available oil seal remover.

##### INSTALLATION:

- 1) Apply grease to the circumference and lips of the new water seal.
- 2) With the lips facing up, drive the water seal into the shift rod holder as shown.



#### • 23 x 36 x 6 mm WATER SEAL

##### REMOVAL:

Remove the 23 x 36 x 6 mm water seals using the commercially available oil seal remover.

##### INSTALLATION:

- 1) Apply grease to the sealing surface and the circumference of the new water seals.
- 2) Drive the water seals one by one into the water pump housing using the special tools. Note the installation direction of the water seals.
- 3) After installation, apply grease to the lip of the seals.

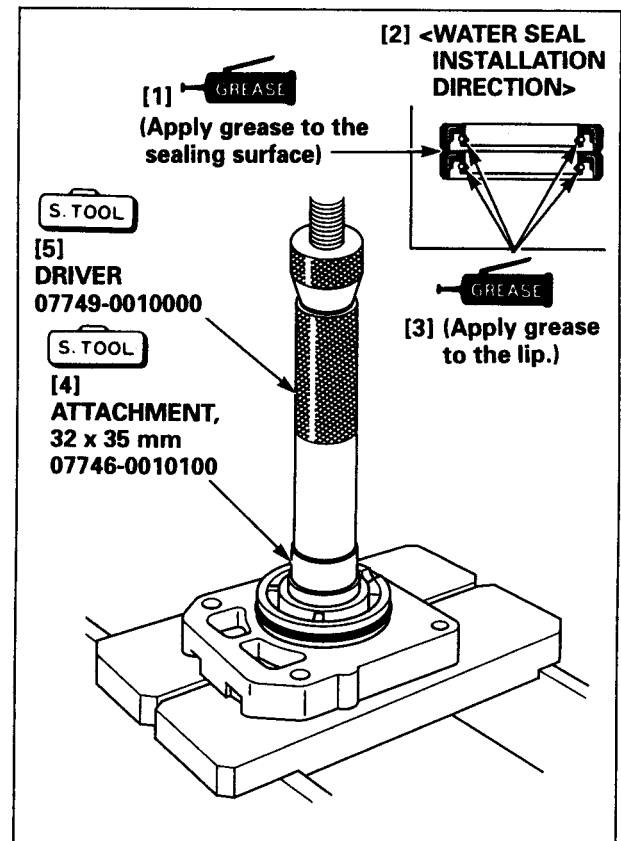
##### TOOLS:

Driver

07749-0010000

Attachment, 32 x 35 mm

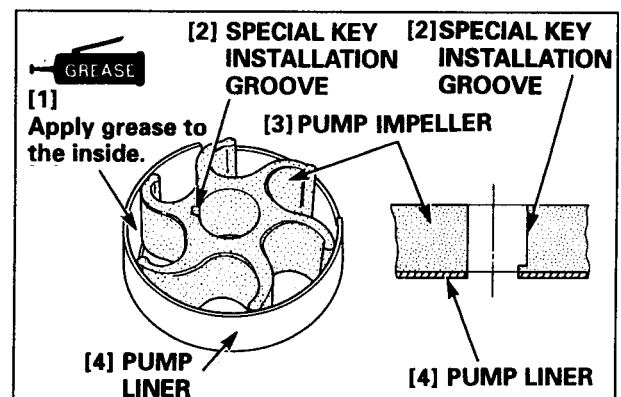
07746-0010100



#### • PUMP IMPELLER/IMPELLER HOUSING/PUMP LINER

##### INSTALLATION:

- 1) Check the impeller for cracks, wear or damage from overheating.
- 2) 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.

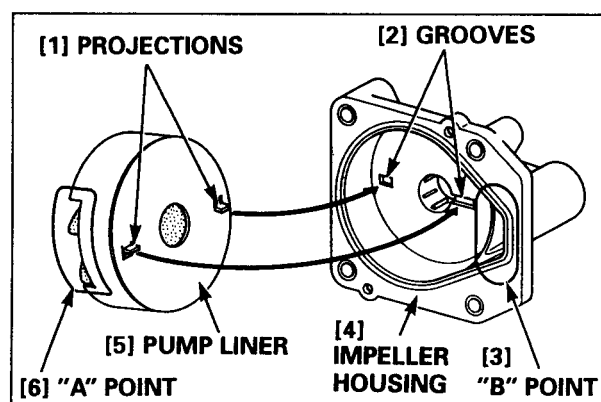


- 3) Install the pump liner in the impeller housing by aligning the two projections on the pump liner with the two grooves in the impeller housing. Be sure that the part "A" of the pump liner is in alignment with the part "B" of the impeller housing, too.
- 4) Set the impeller housing over the vertical shaft, and set the special key in the position shown in the drawing (P. 12-4).

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.

**NOTE:**

- Do not turn the impeller housing counterclockwise with the pump impeller installed in the impeller housing.
- After installation, check that the impeller gasket is set in the proper position.



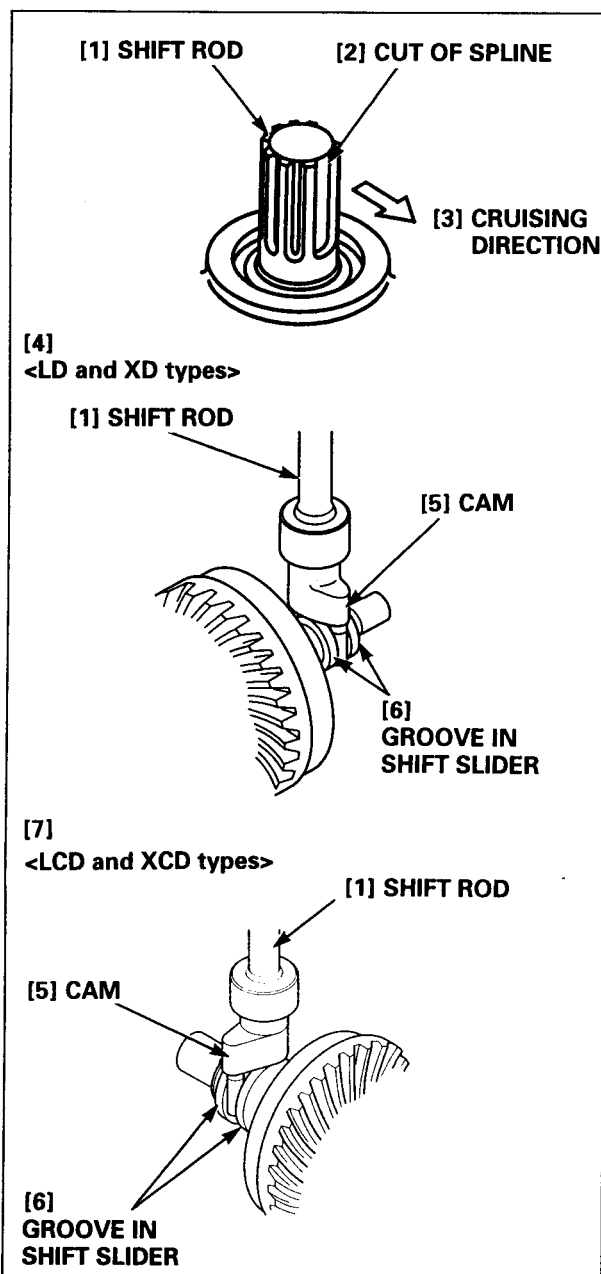
### • SHIFT ROD

**INSTALLATION:**

Install the shift rod by aligning the shift cam of the shift rod with the groove in the shift slider so that the cutout of the shift rod spline faces in the cruising direction.

**NOTE:**

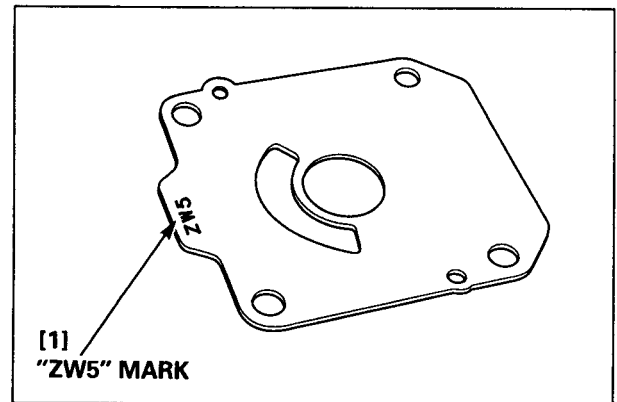
If the shift cam is in alignment with the shift slider groove but the cutout of the spline is not in the cruising direction, see the step 3 on page 12-3 and adjust accordingly.



- IMPELLER COVER

**INSTALLATION:**

Install with the "ZW5" mark toward the pump impeller.





## 4. PROPELLER SHAFT HOLDER ASSEMBLY

### a. REMOVAL/INSTALLATION

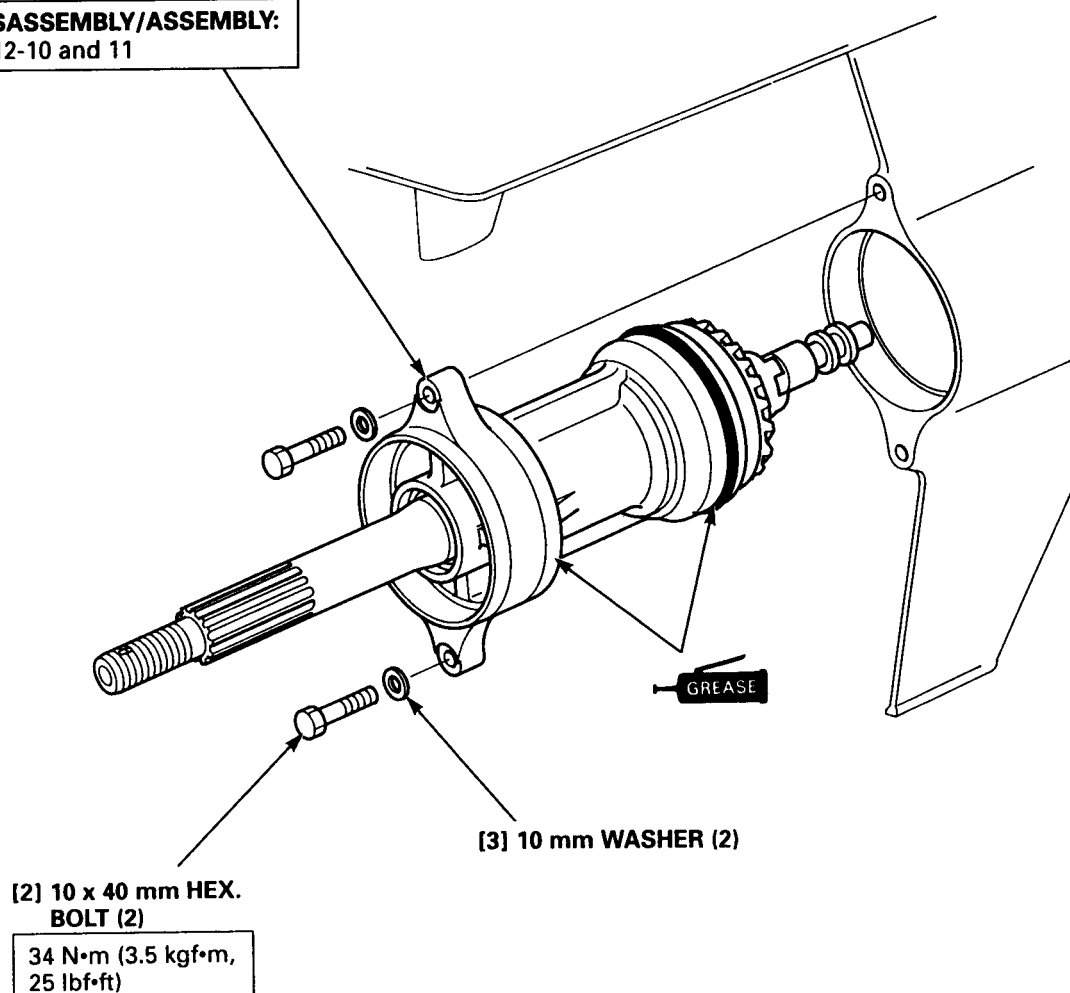
NOTE:

Remove the shift rod before removal/installation of the propeller shaft holder assembly.

- 1) Remove the propeller (P. 12-1) and gear case assembly (P. 12-2).
- 2) Remove the water pump/shift rod (P. 12-4).

**[1]  
PROPELLER SHAFT  
HOLDER ASSEMBLY**

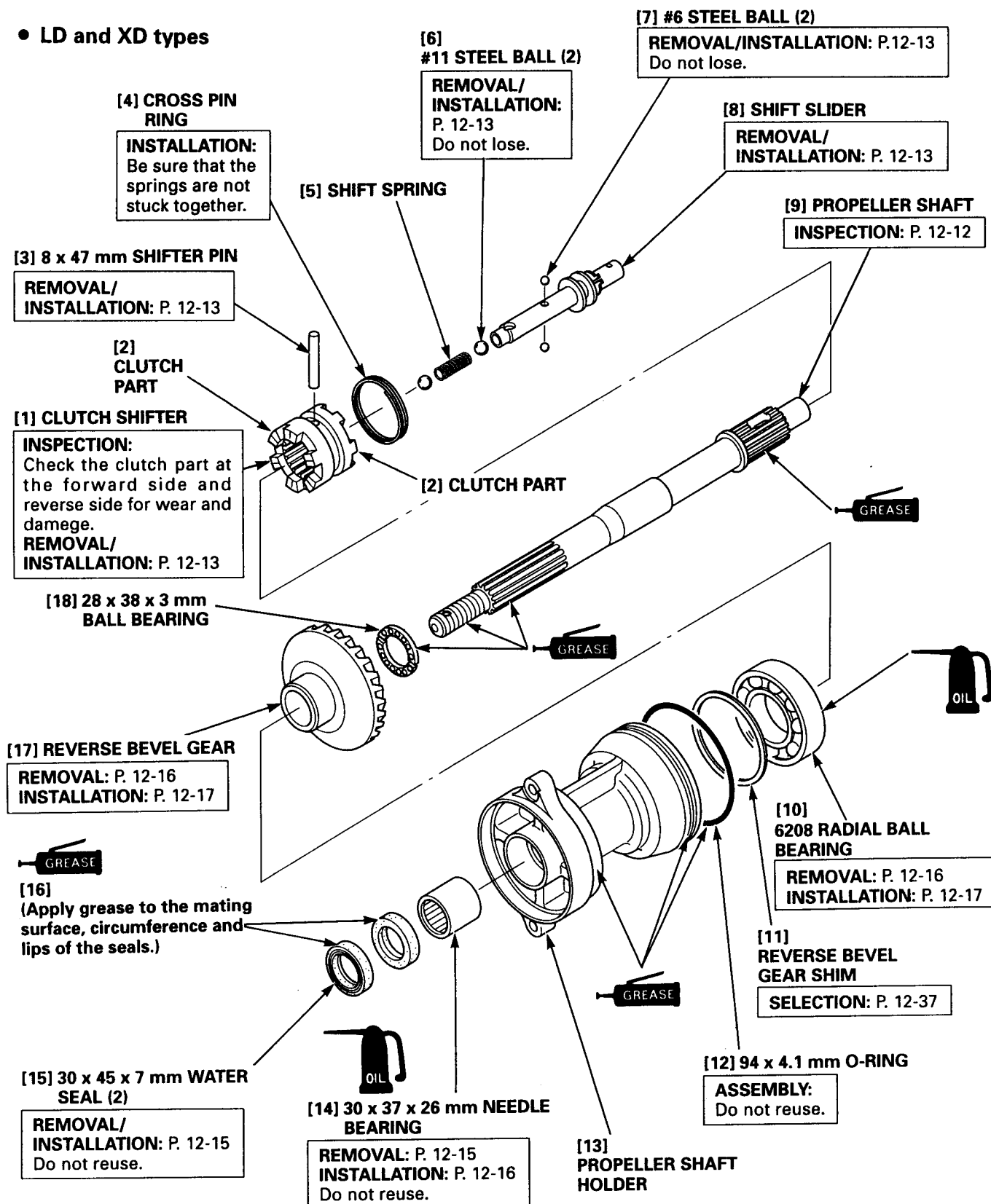
**DISASSEMBLY/ASSEMBLY:  
P. 12-10 and 11**



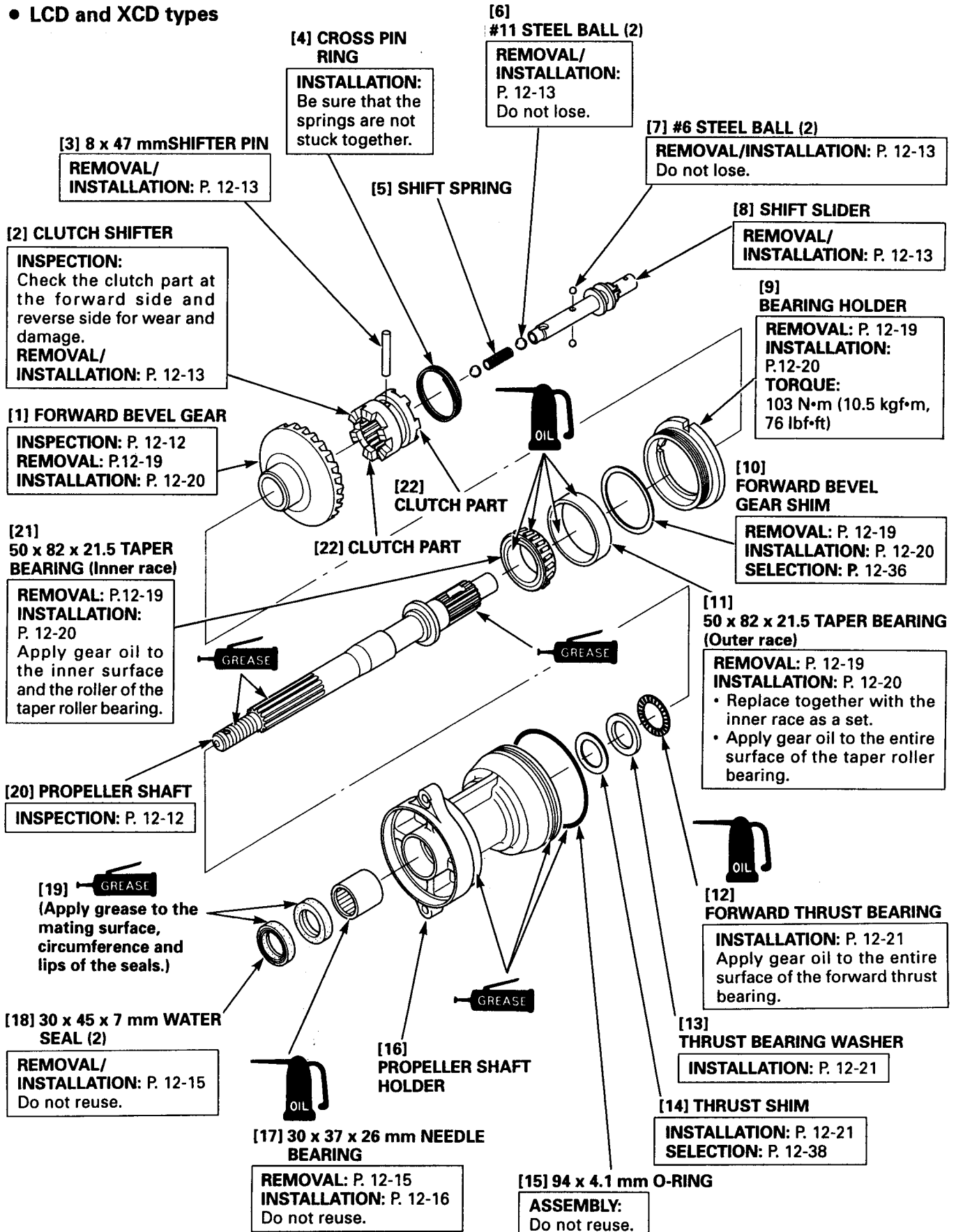
## 5. PROPELLER SHAFT/PROPELLER SHAFT HOLDER

### a. DISASSEMBLY/ASSEMBLY

- LD and XD types



• LCD and XCD types



### b. INSPECTION

#### • PROPELLER SHAFT O.D.

<LD and XD types>

	STANDARD	SERVICE LIMIT
At forward bevel gear	24.987 - 25.000 mm (0.9837 - 0.9843 in)	24.966 mm (0.9829 in)
At needle bearing	30.007 - 30.020 mm (1.1814 - 1.1819 in)	29.990 mm (1.1807 in)

<LCD and XCD types>

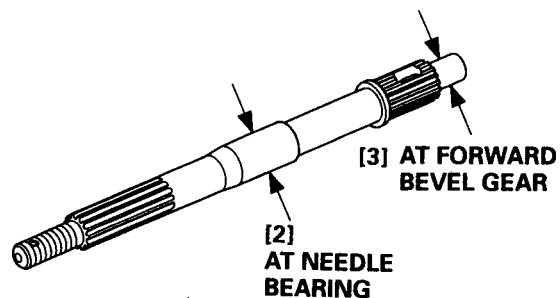
	STANDARD	SERVICE LIMIT
At reverse bevel gear	24.987 - 25.000 mm (0.9837 - 0.9843 in)	24.966 mm (0.9829 in)
At needle bearing	30.007 - 30.020 mm (1.1814 - 1.1819 in)	29.990 mm (1.1807 in)
At forward bevel gear	32.904 - 32.920 mm (1.2954 - 1.2961 in)	32.883 mm (1.2946 in)

#### • FORWARD BEVEL GEAR I.D.

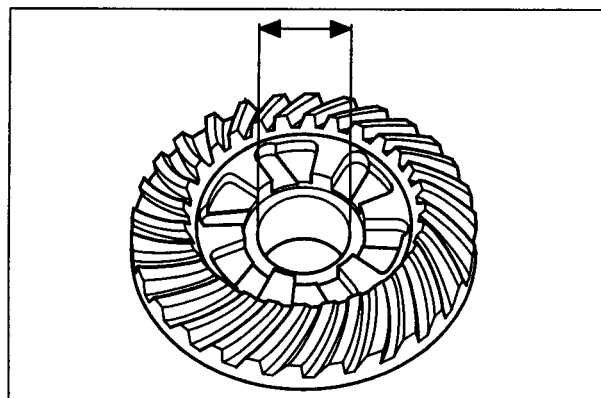
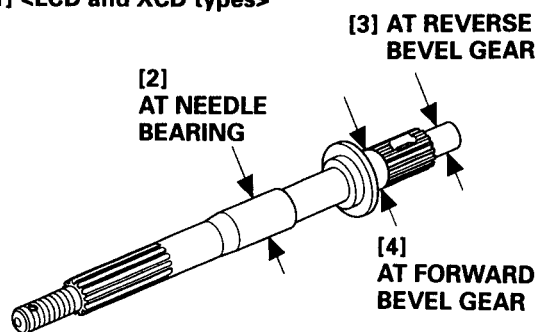
<LCD and XCD types only>

STANDARD	SERVICE LIMIT
33.000 - 33.025 mm (1.2992 - 1.3002 in)	33.044 mm (1.3009 in)

[1] <LD and XD types>



[1] <LCD and XCD types>

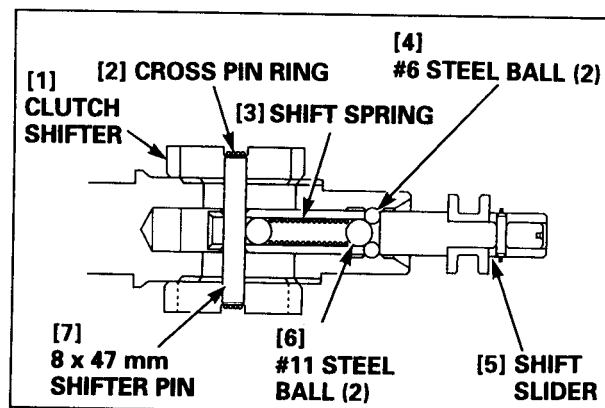


### c. REMOVAL/INSTALLATION

#### • CLUTCH SHIFTER/SHIFT SLIDER/SHIFTER PIN

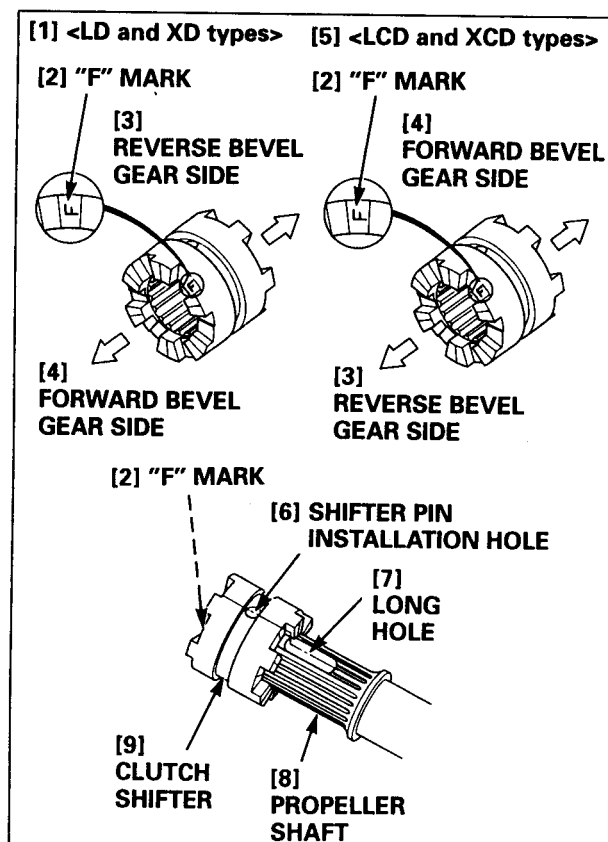
##### REMOVAL:

- 1) Pull the shift slider with care not to let the #6 steel balls pop out, and remove the #6 steel balls.
- 2) Remove the cross pin ring and 8 x 47 mm shifter pin, and remove the clutch shifter, shift slider, two #11 steel balls and the shift spring.

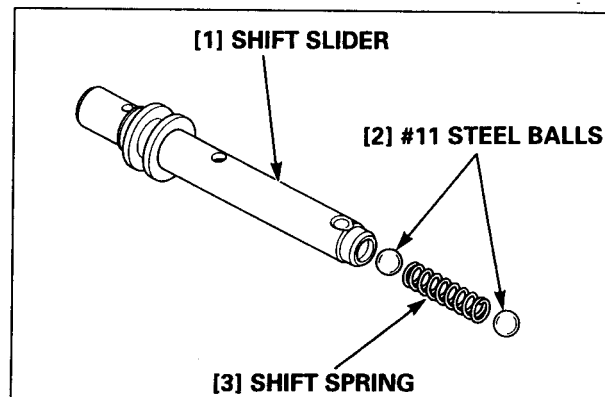


##### INSTALLATION:

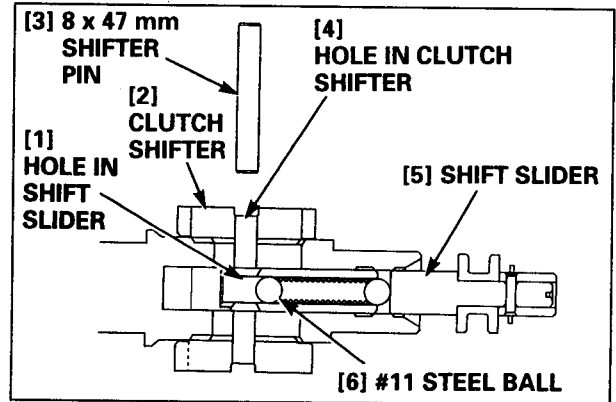
- LCD and XCD types: Be sure that the bearing holder assembly, thrust bearing, washer and the shim are set on the propeller shaft holder assembly (P. 12-20 and 21).
- 1) With the "F" mark on the clutch shifter toward you (toward the forward bevel gear on the LD and XD types or toward the reverse bevel gear on the LCD and XCD types), assemble the clutch shifter and the propeller shaft by aligning the long hole in the propeller shaft with the 8 x 47 mm shifter pin hole.



- 2) Install the #11 steel ball, shift spring and the #11 steel ball in the shift slider in the order shown.



- 3) Taking care not to let the #11 steel balls come out of the shift slider, align the clutch shifter hole and the hole in the shift slider, and install the 8 x 47 mm shifter pin.

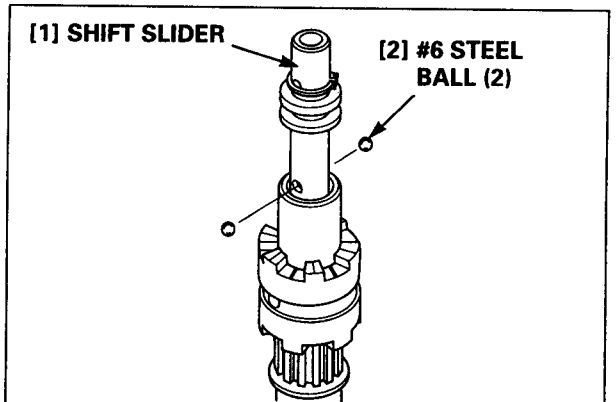


- 4) Position the propeller shaft vertically so the shift slider is facing up.
- 5) Pull up the shift slider until the #6 steel ball installation holes in the shift slider appear.
- 6) Set the #6 steel balls in the right and left #6 steel ball installation holes respectively, and push the shift slider into the propeller shaft slowly.

**NOTE:**

Push in the shift slider with care not to let the steel balls pop out.

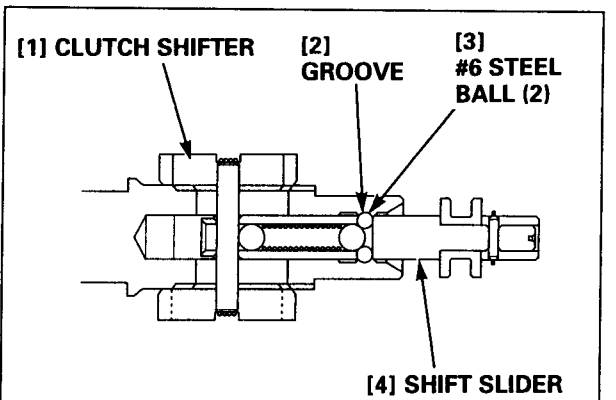
- 7) Be sure that the #6 steel balls are in the groove in the propeller shaft securely as shown.



**Check procedure:**

**<LD and XD types>**

- 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.
- Be sure that the steel balls cannot be checked through the gap between the propeller shaft and shift slider. If the steel balls can be checked, push in the shift slider slowly again.



**<LCD and XCD types>**

- Be sure that the clutch shifter is not at the forward bevel gear installation side. If it is at the forward bevel gear installation side, pull up the shift slider slowly.
- Be sure that the steel balls cannot be checked through the gap between the propeller shaft and shift slider. If the steel balls can be checked, push in the shift slider slowly again.

### • 30 x 45 x 7 mm WATER SEAL

#### REMOVAL:

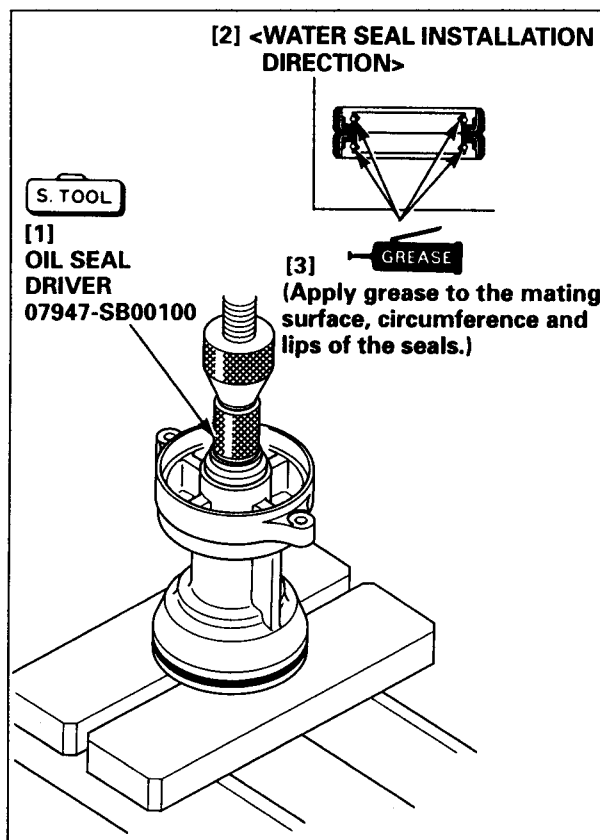
Remove the 30 x 45 x 7 mm water seals using the commercially available oil seal remover.

#### INSTALLATION:

- 1) Apply grease to the circumference of the new water seals.
- 2) Drive the water seals into the propeller shaft holder one by one using the special tools. Note the installation direction of the water seals.
- 3) After installation of the water seals, apply grease to the lips of the seals.

#### TOOL:

Oil seal driver 07947-SB00100



### • 30 x 37 x 26 mm NEEDLE BEARING

#### REMOVAL:

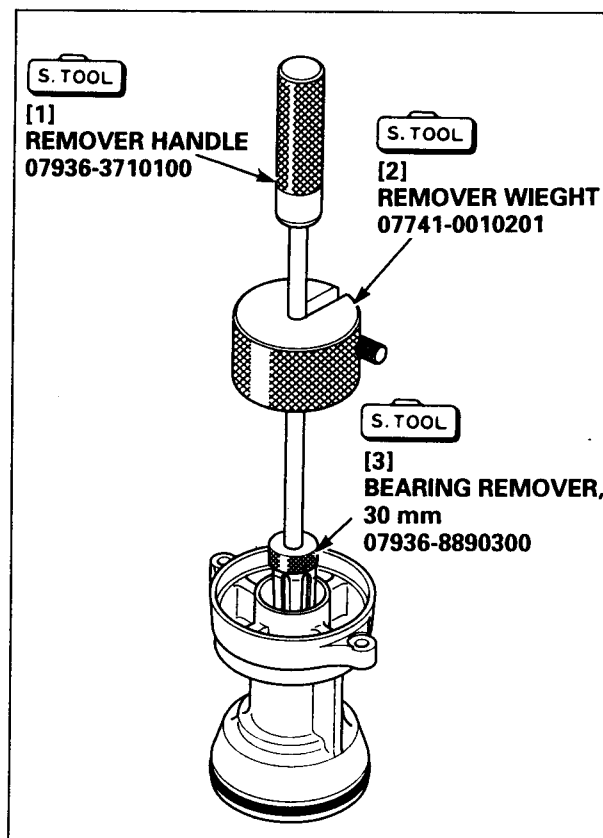
- 1) Remove the 30 x 45 x 7 mm water seals.
- 2) Remove the needle bearing using the special tools.

#### NOTE:

- Set the jaws of the special tool (bearing remover, 30 mm) against the needle bearing.
- Replace the needle bearing with a new one.

#### TOOLS:

Bearing remover, 30mm	07936-8890300
Remover weight	07741-0010201
Remover handle	07936-3710100



### INSTALLATION:

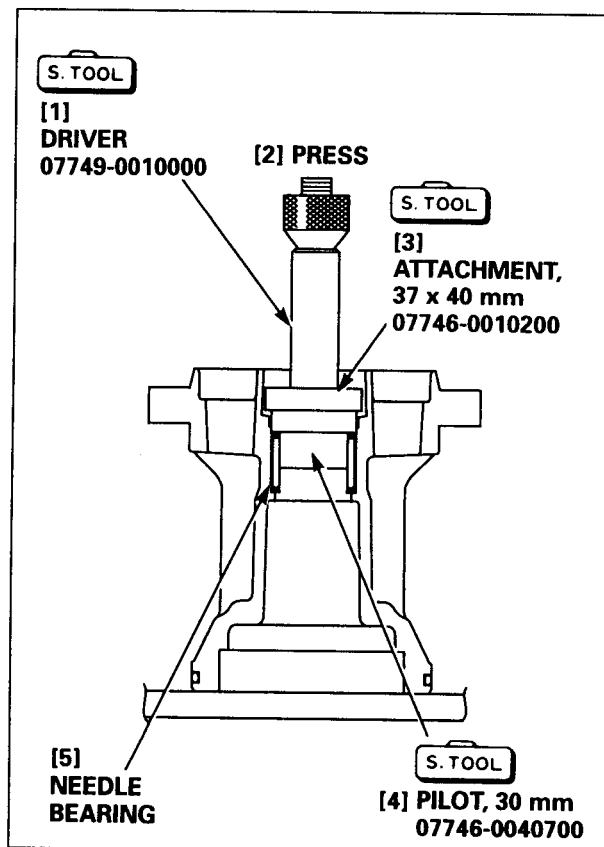
- 1) Apply gear oil to the circumference of a new needle bearing.
- 2) Press the needle bearing in the propeller shaft holder using the special tools and hydraulic press.
- 3) Install the 30 x 45 x 7 mm water seals (P. 12-15).

#### NOTE:

Install the needle bearing with the stamp mark at the end of the needle bearing facing the special tool (attachment, 37 x 40 mm).

#### TOOLS:

Driver	07749-0010000
Attachment, 37 x 40 mm	07746-0010200
Pilot, 30 mm	07746-0040700



### • REVERSE BEVEL GEAR/6208 RADIAL BALL BEARING (LD and XD types only)

#### REMOVAL:

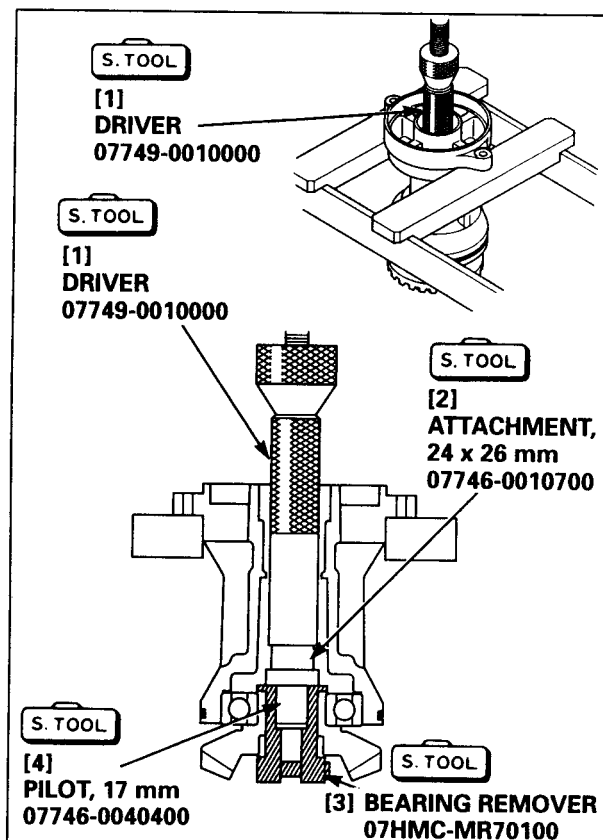
- 1) Remove the 30 x 45 x 7 mm water seals (P. 12-15).
- 2) Using the hydraulic press and the special tools as shown, remove the reverse bevel gear and 6208 radial ball bearing as an assembly.

#### CAUTION:

Remove the reverse bevel gear/6208 radial ball bearing using a hydraulic press. Do not try to remove the reverse bevel gear/6208 radial ball bearing by striking with a hammer.

#### TOOLS:

Driver	07749-0010000
Attachment, 24 x 26 mm	07746-0010700
Pilot, 17 mm	07746-0040400
Bearing remover	07HMC-MR70100

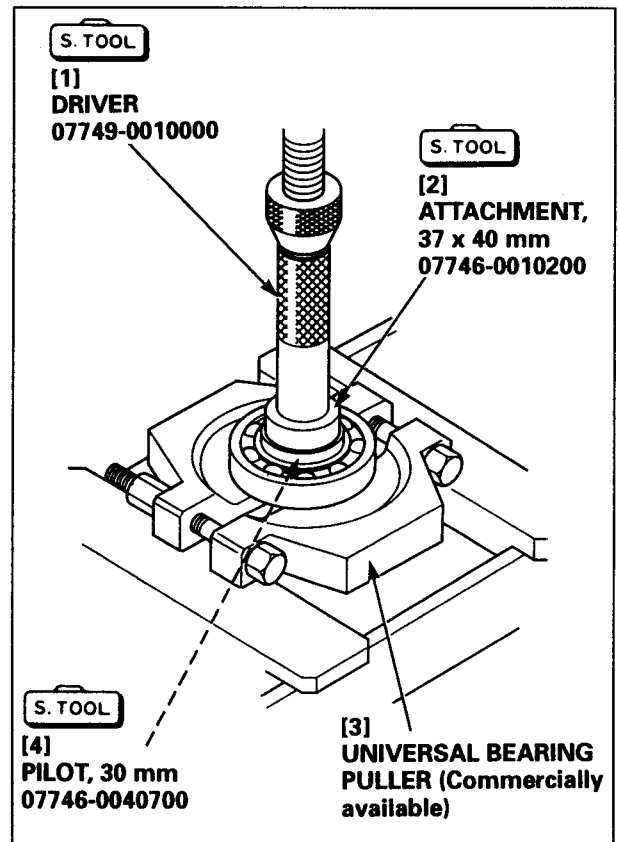




- 3) Set the commercially available universal bearing puller between the reverse bevel gear and the bearing.
- 4) Remove the reverse bevel gear from the bearing using the hydraulic press and the special tools.

### TOOLS:

Driver	07749-0010000
Attachment, 37 x 40 mm	07746-0010200
Pilot, 30 mm	07746-0040700

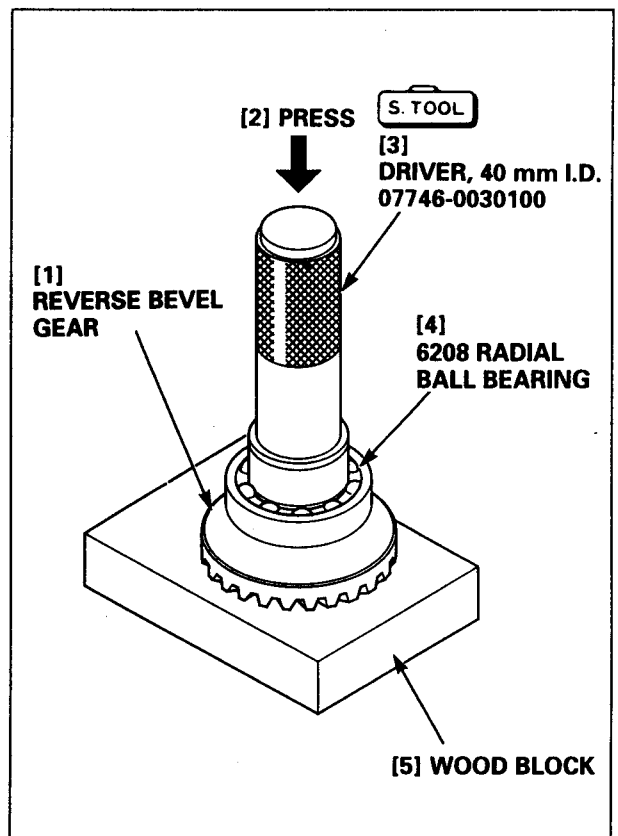


### INSTALLATION:

- 1) Place a wood block under the reverse bevel gear.
- 2) Check the bearing for play and abnormal sound by turning it by hand. Replace the bearing with a new one if necessary.
- 3) 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.
- 4) Remove the 94 x 4.1 mm O-ring from the propeller shaft holder (P. 12-10).

### TOOL:

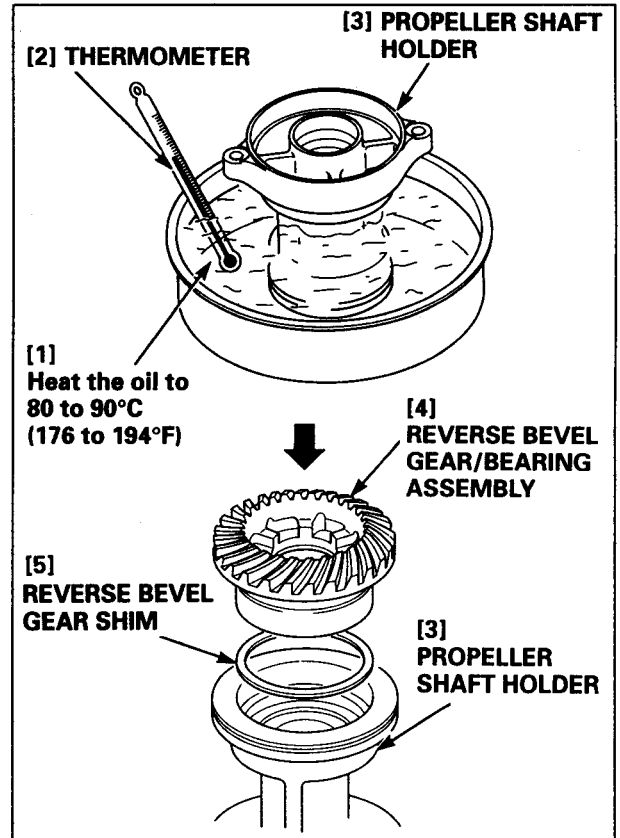
Driver, 40 mm I.D.	07746-0030100
--------------------	---------------



- 5) Soak the propeller shaft holder in the container filled with oil with the bearing installation side toward down.
- 6) Heat the oil to 80 to 90 °C (176 to 194 °F).
- 7) After the entire of the propeller shaft holder becomes hot, remove the holder from the container, and install the reverse bevel gear shim and the reverse bevel gear/bearing assembly on the propeller shaft holder quickly.

**⚠ WARNING**

Do not heat the oil above 90°C (194°F).  
The entire holder becomes hot. Be sure to wear the gloves during the operation.



● **FORWARD BEVEL GEAR/BEARING HOLDER/FORWARD BEVEL GEAR SHIM/50 x 82 x 21.5 TAPER BEARING (Inner/outer race) [LCD and XCD types only]**

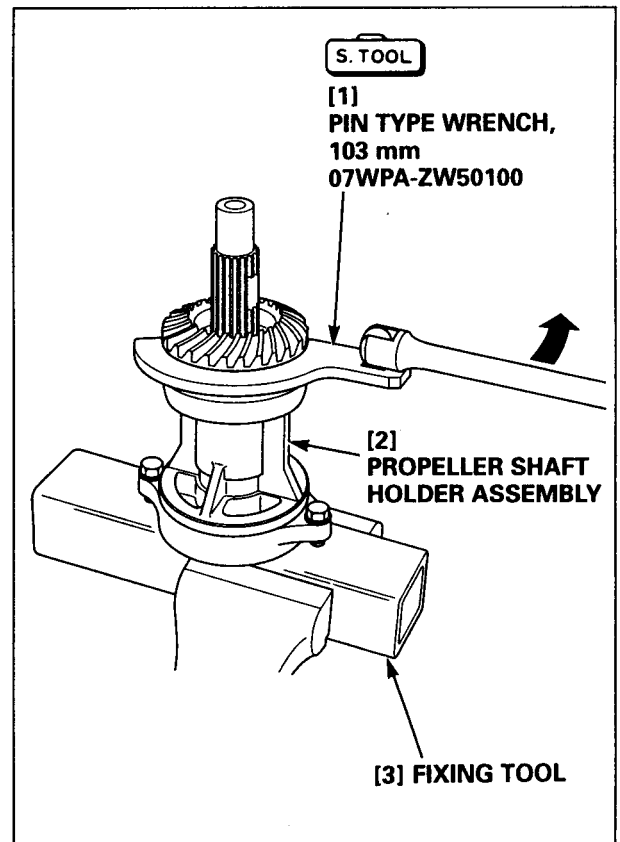
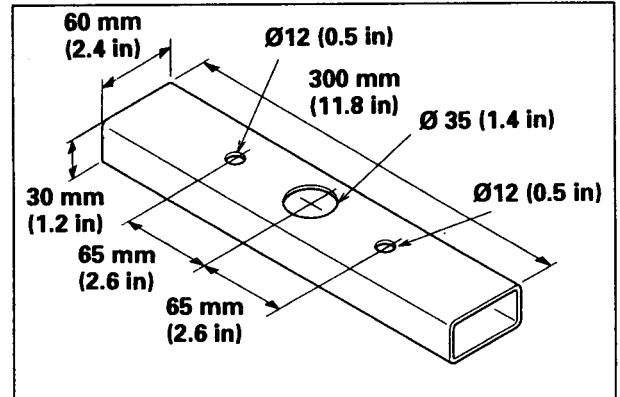
**REMOVAL:**

- 1) Remove the clutch shifter, shift slider and the shifter pin (P. 12-13).
- 2) Prepare the fixing tool of the dimensions shown.
- 3) Set the propeller shaft holder assembly on the fixing tool, and secure the propeller shaft holder assembly with the bolts.
- 4) Secure the fixing tool with a vice.
- 5) Loosen the bearing holder using the special tool as shown.
- 6) Remove the bearing holder assembly from the propeller shaft.

**TOOL:**

Pin type wrench, 103 mm

07WPA-ZW50100



- 7) Set the commercially available universal bearing puller between the bearing holder and the forward bevel gear.
- 8) Using the special tools and the hydraulic press, remove the forward bevel gear from the taper bearing (inner race).

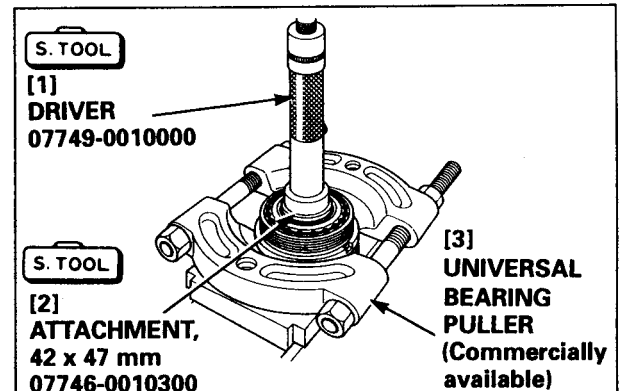
**TOOLS:**

Driver

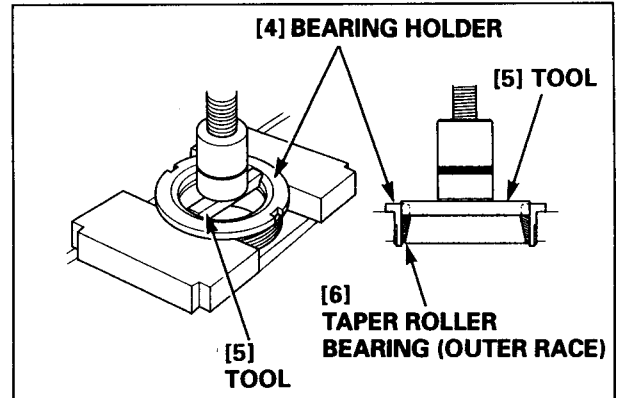
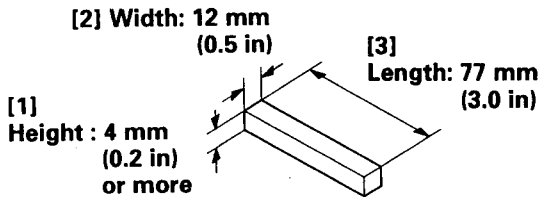
07749-0010000

Attachment, 42 x 47 mm

07746-0010300



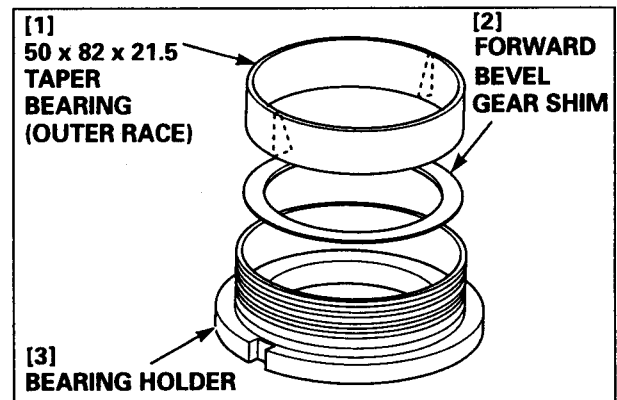
- 9) Prepare the tool of the dimensions shown.
- 10) Set the tool in the groove of the bearing holder, and remove the taper bearing (outer race) using the hydraulic press.
- 11) Remove the forward bevel gear shim.



### INSTALLATION:

- Replace the taper bearing (outer race) together with the taper bearing (inner race) as a set.

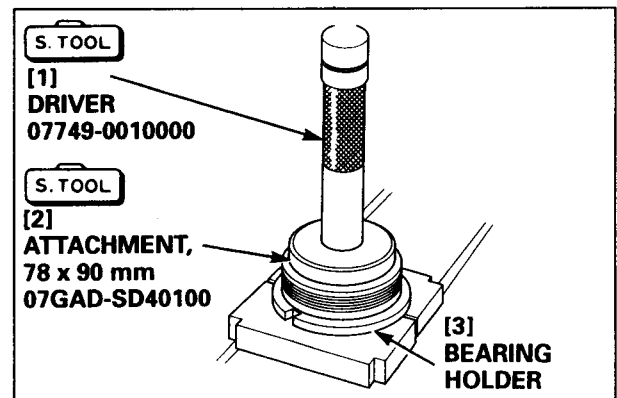
- 1) Set the forward bevel gear shim on the bearing holder.
- 2) Apply gear oil to the circumference of a new taper bearing (outer race), and install it on the bearing holder with the small I.D. side toward the shim.



- 3) Using the special tools and the hydraulic press, install the taper bearing (outer race) on the bearing holder.

### TOOLS:

Driver 07749-0010000  
Attachment, 78 x 90 mm 07GAD-SD40100



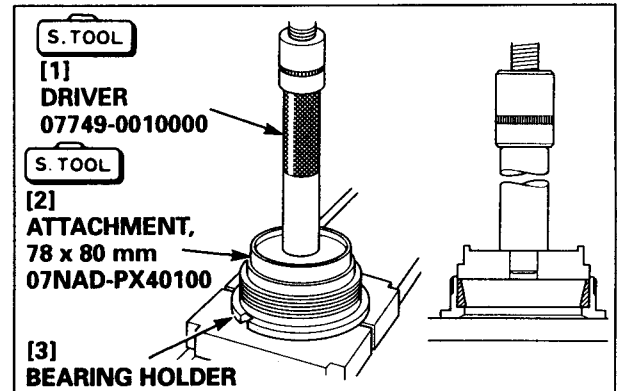
- 4) Remove the special tools used in step 3. Install another special tool at the outer side of the taper bearing, and install the taper bearing deep in the bearing holder using the hydraulic press.

### NOTE:

Take care not to cause the special tool to come in contact with the outer surface of the bearing holder.

### TOOLS:

Driver 07749-0010000  
Attachment, 78 x 80 mm 07NAD-PX40100



- 5) Place the wood block on the gear face of the forward bevel gear.
- 6) Set the bearing holder assembled in the step 4 on the forward bevel gear.
- 7) Apply gear oil to the inner surface of the taper bearing (inner race), and set it on the forward bevel gear.
- 8) Using the 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.

- Adjust the reverse bevel gear backlash with the bearing holder assembly in the condition that it is before tightened against the propeller shaft holder (but the thrust bearing, bearing washer and the thrust shim are mounted) (P. 12-44).

- 9) Set the bearing holder assembly assembled in the step 8 on the propeller shaft. Loosely tighten the bearing holder assembly against the propeller shaft holder by hand.
  - Be sure that the thrust bearing, washer and the shim are properly mounted before installing the bearing holder assembly on the propeller shaft.

- 10) Install the fixing tool, that was used during removal, on the propeller shaft holder assembly.

- 11) Using the special tool, tighten the bearing holder to the specified torque.

**TORQUE: 103 N·m (10.5 kgf·m, 76 lbf·ft)**

**TOOL:**

**Pin type wrench, 103 mm**

**07WPA-ZW50100**

**NOTE:**

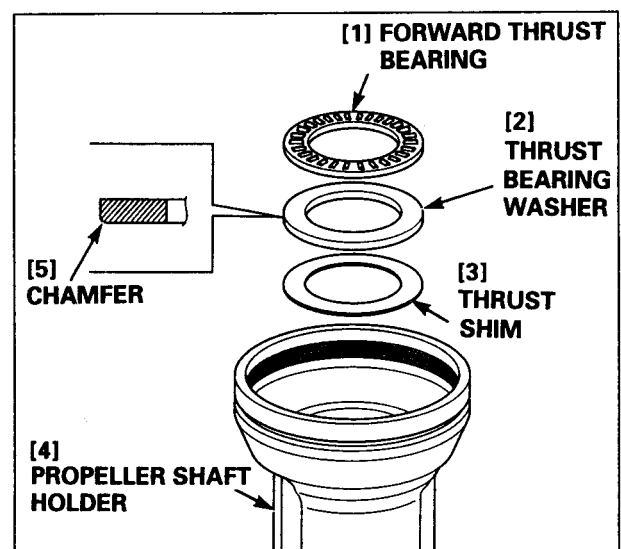
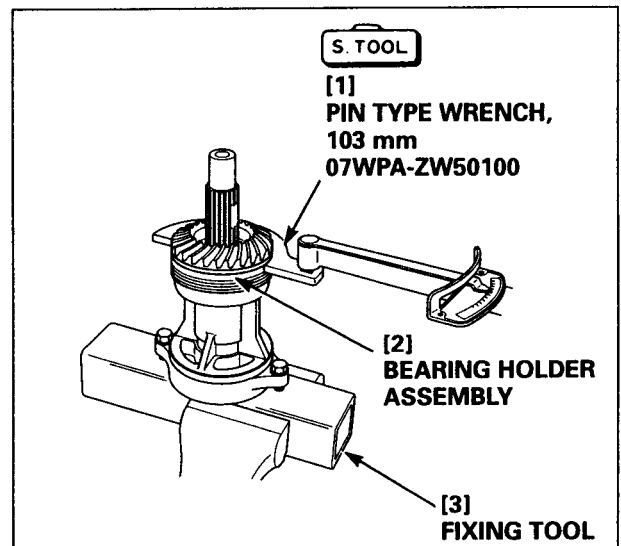
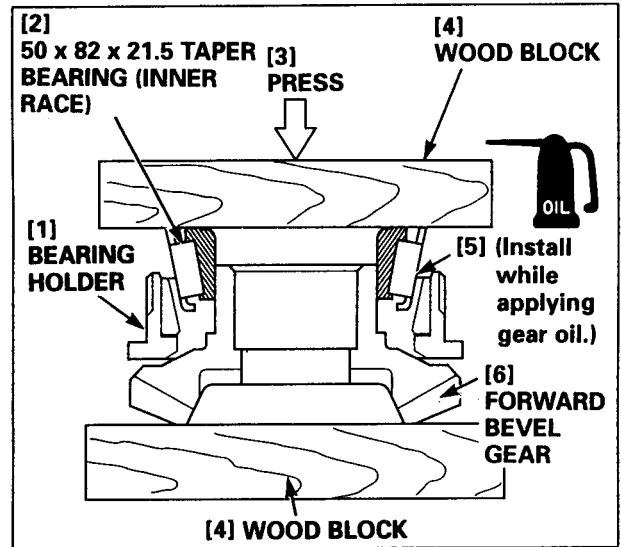
Do not secure the propeller shaft holder on a vise directly. Use the fixing tool.

- 12) After tightening the bearing holder assembly against the propeller shaft holder (i. e. condition before installing the shift slider and the clutch sifter), adjust the thrust clearance (P. 12-46).

### • FORWARD THRUST BEARING/THRUST BEARING WASHER/THRUST SHIM [LCD and XCD types only]

#### REMOVAL:

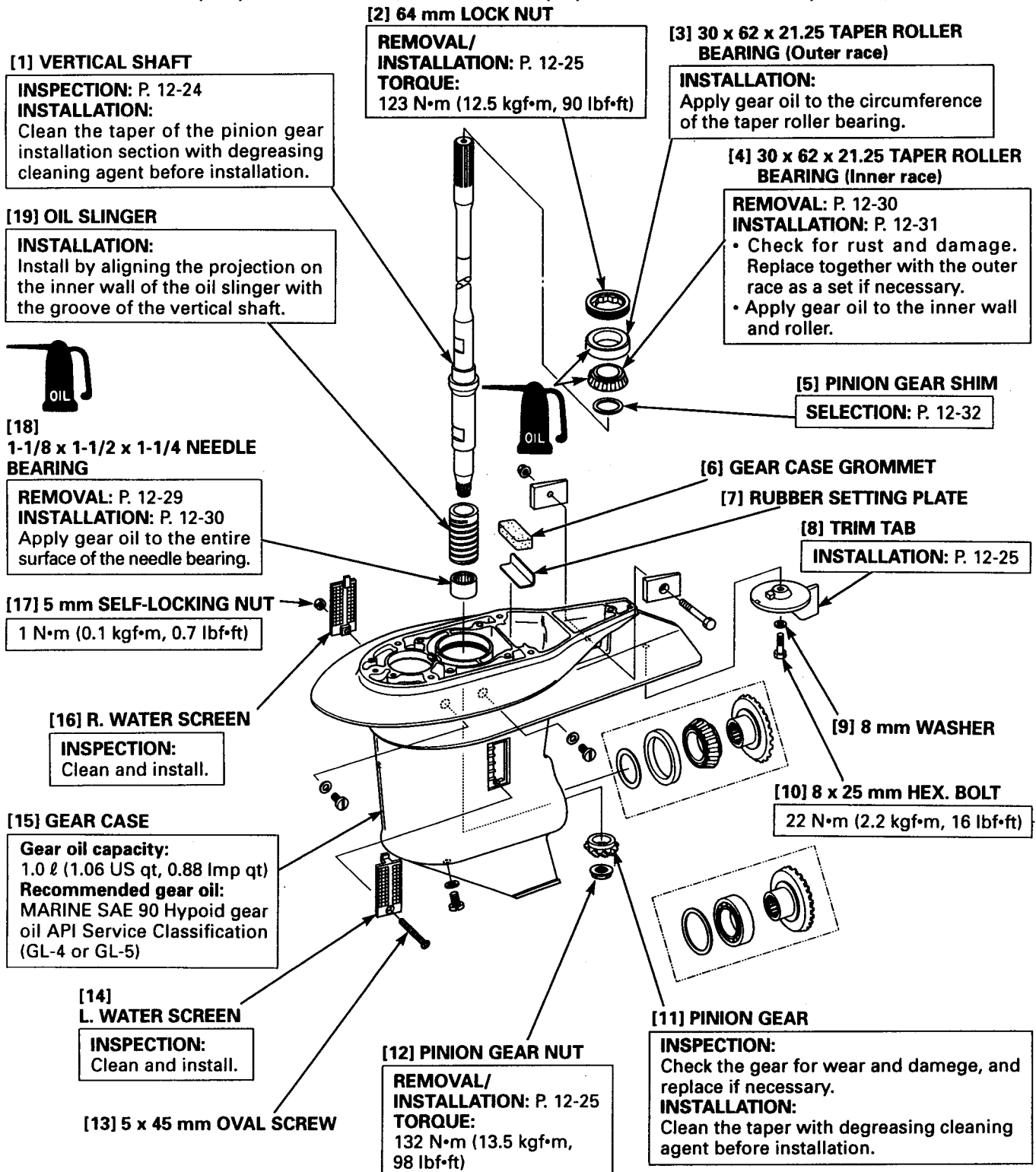
- 1) Install the thrust shim in the propeller shaft holder.
- 2) Install the thrust bearing washer with the chamfered side toward the shim.
- 3) Apply gear oil to the circumference of the forward thrust bearing, and set the bearing on the thrust bearing washer.
- 4) Install the propeller shaft and check to see whether the propeller shaft turns smoothly.

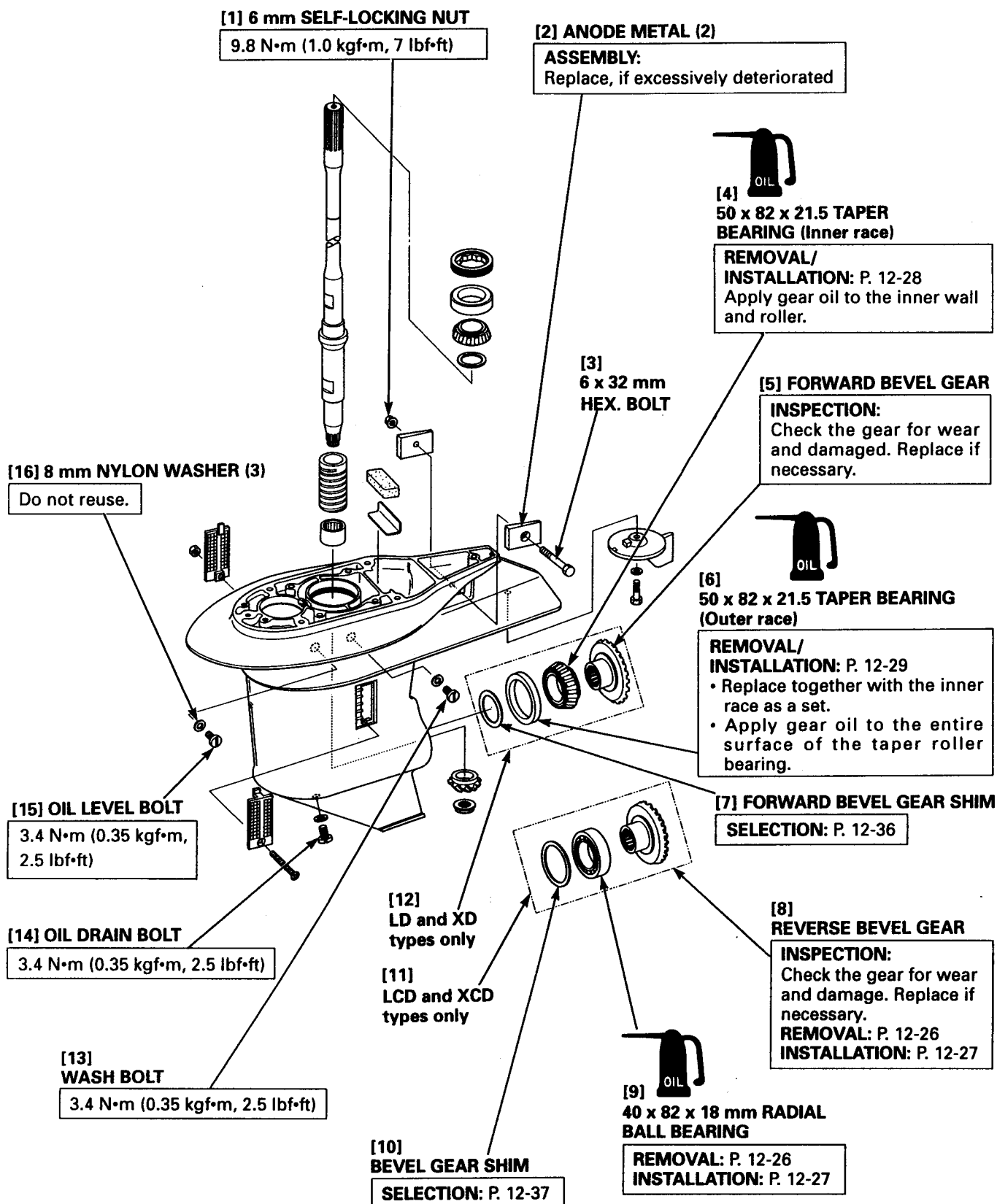


## 6. VERTICAL SHAFT/BEVEL GEAR

### a. DISASSMBLY/ASSEMBLY

- 1) Remove the propeller (P. 12-1) and gear case assembly (P. 12-2).
- 2) Remove the water pump/shift rod (P. 12-4), and remove the propeller shaft holder assembly (P. 12-9).

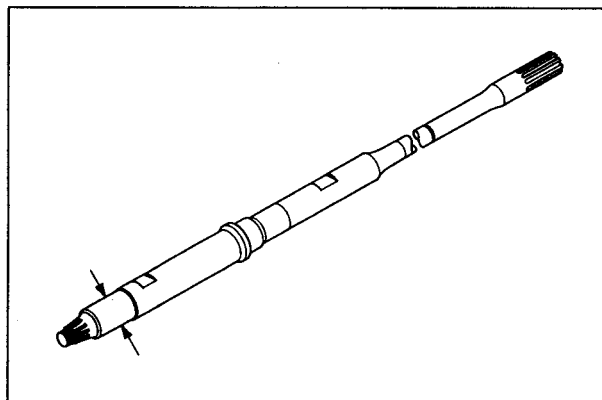




**b. INSPECTION**

● **VERTICAL SHAFT O.D. (At needle bearing)**

STANDARD	SERVICE LIMIT
28.566 - 28.575 mm (1.1246 - 1.1250 mm)	28.545 mm (1.1238 in)





### c. REMOVAL/INSTALLATION

#### • PINION GEAR NUT

##### REMOVAL:

- 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

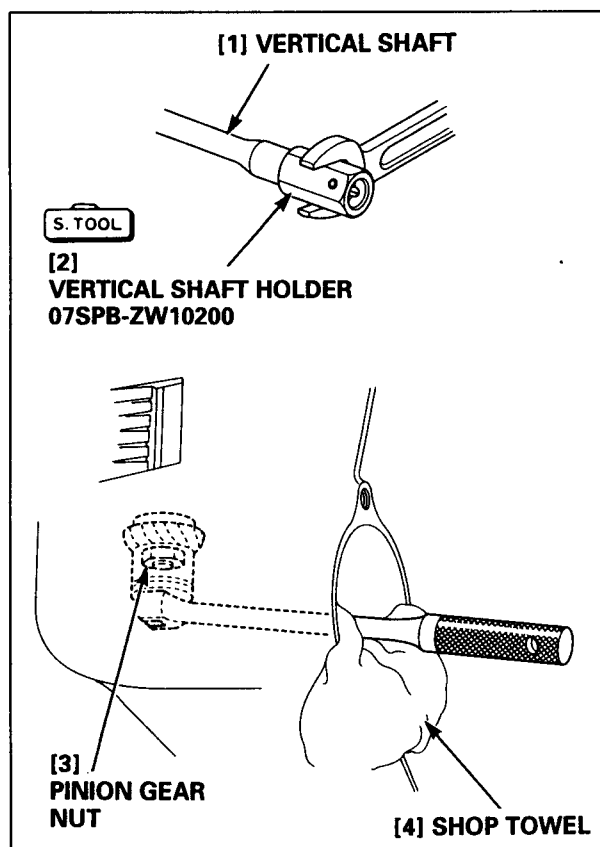
07SPB-ZW10200

##### INSTALLATION:

Be sure that the forward bevel gear is mounted properly.

- 1) Clean the vertical shaft and the tapered part of the pinion gear thoroughly with degreasing cleaning agent.
- 2) Tighten the pinion gear nut to the specified torque in the same procedure as of removal.

**TORQUE: 132 N•m (13.5 kgf•m, 98 lbf•ft)**



#### • 64 mm LOCK NUT

##### REMOVAL/INSTALLATION:

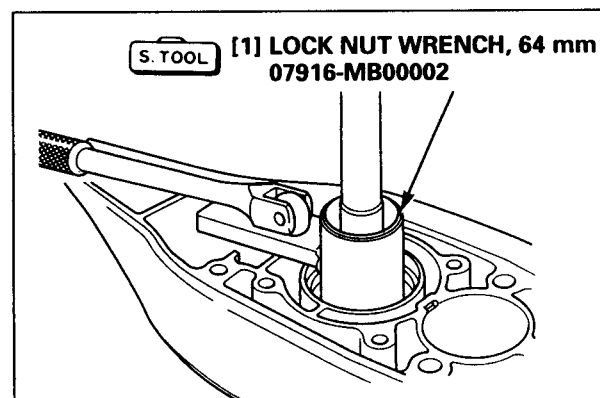
Remove/install the 64 mm lock nut using the special tool.

**TORQUE: 123 N•m (12.5 kgf•m, 90 lbf•ft)**

##### TOOL:

Lock nut wrench, 64 mm

07916-MB00002

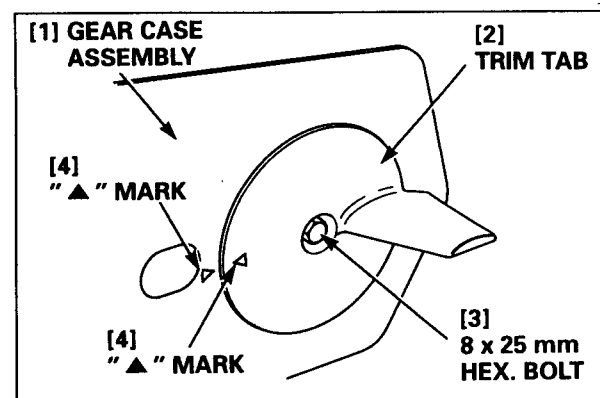


#### • TRIM TAB

##### INSTALLATION:

Align the "▲" mark on the trim tab with the "▲" mark on the gear case assembly, then install the trim tab. Tighten the 8 x 25 mm hex. bolt to the specified torque.

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



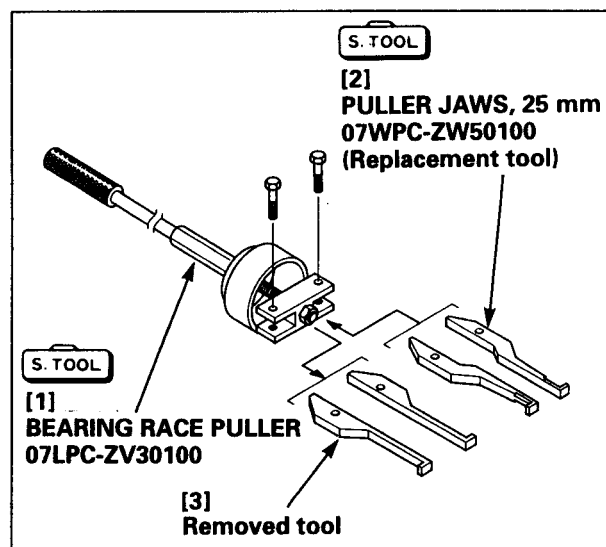
### ● REVERSE BEVEL GEAR/40 x 82 x 18 mm RADIAL BALL BEARING [LCD and XCD types only]

#### REMOVAL:

- 1) Remove the vertical shaft.
- 2) Replace the puller jaws of the special tool as shown.

#### TOOLS:

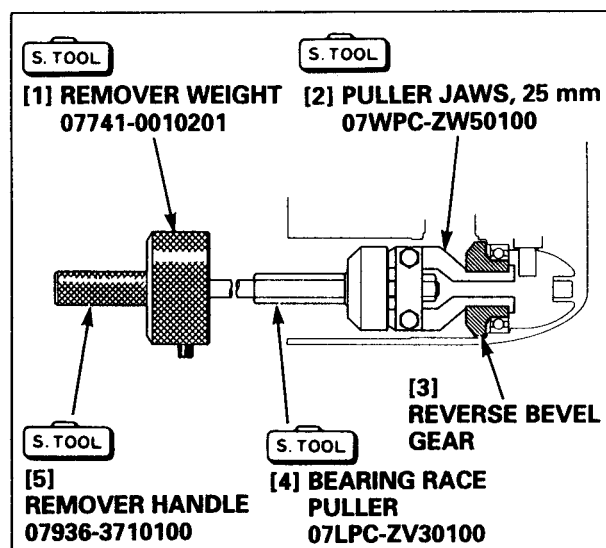
Bearing race puller	07LPC-ZV30100
Puller jaws, 25 mm	07WPC-ZW50100



- 3) Remove the reverse bevel gear using the special tools with the new puller jaws replaced in step 2.

#### TOOLS:

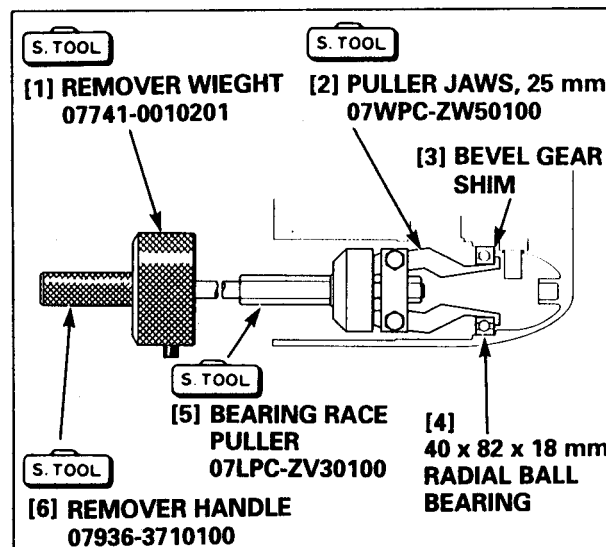
Bearing race puller	07LPC-ZV30100
Remover weight	07741-0010201
Remover handle	07936-3710100
Puller jaws, 25 mm	07WPC-ZW50100



- 4) Using the same special tools, remove the 40 x 82 x 18 mm radial ball bearing.
- 5) Remove the bevel gear shim.

#### TOOLS:

Bearing race puller	07LPC-ZV30100
Remover weight	07741-0010201
Remover handle	07936-3710100
Puller jaws, 25 mm	07WPC-ZW50100



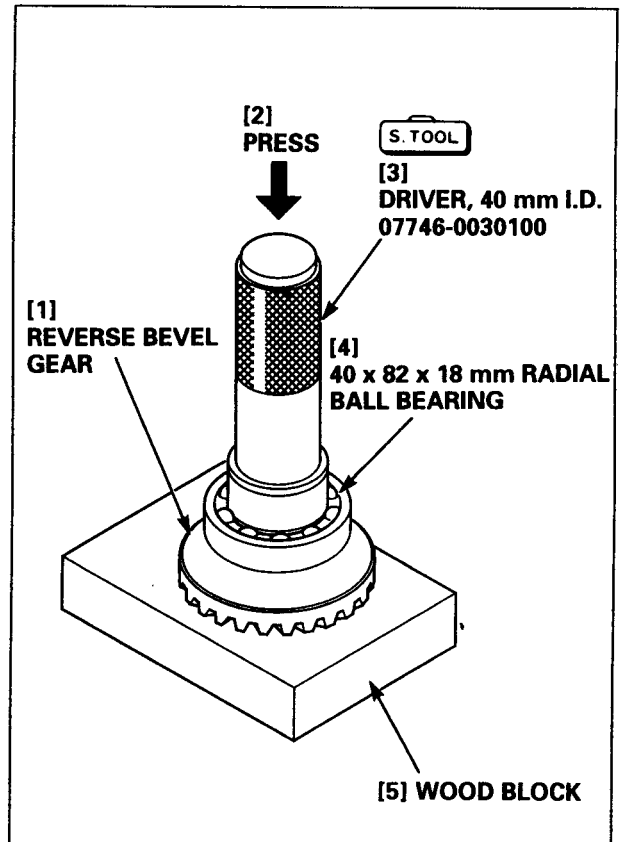
### INSTALLATION:

- 1) Place a wood block under the reverse bevel gear.
- 2) Check the bearing for play and abnormal sound by turning it by hand. Replace the bearing with a new one if necessary.
- 3) 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:

Driver, 40 mm I.D.

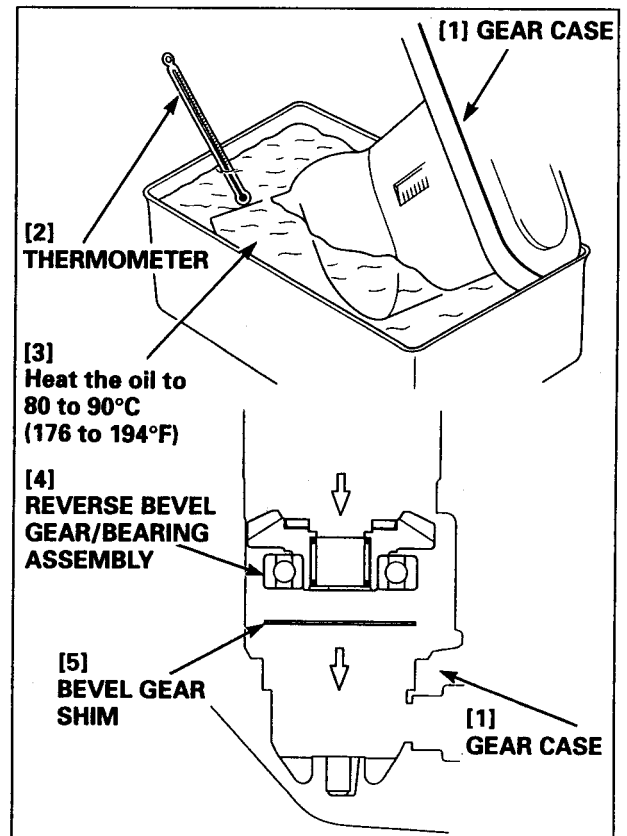
07746-0030100



- 4) Soak the gear case in the container filled with oil with the bearing installation side toward down.
- 5) Heat the oil to 80 to 90°C (176 to 194°F)
- 6) 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.

#### ⚠ WARNING

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.



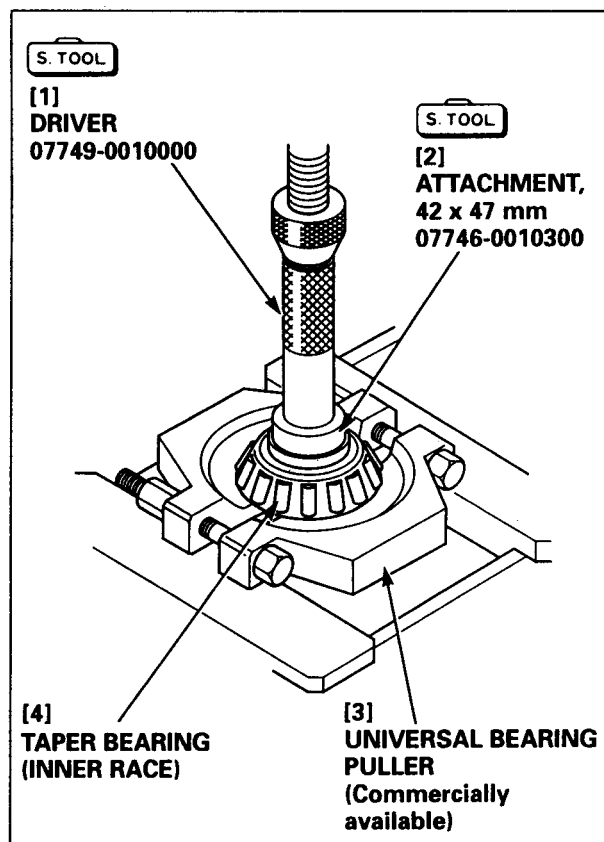
### • 50 x 82 x 21.5 TAPER BEARING (Inner race) [LD and XD types only]

#### REMOVAL:

- 1) Set the commercially available universal bearing puller between the taper bearing (inner race) and forward bevel gear.
- 2) 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, 42 x 47 mm	07746-0010300

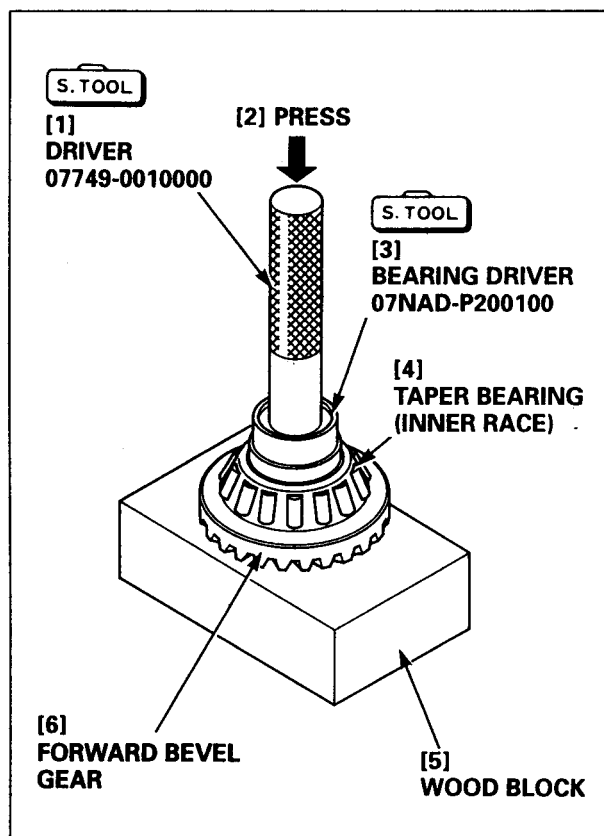


#### INSTALLATION:

- 1) Apply gear oil to the inner wall and the roller of the taper roller bearing (inner race).
- 2) Place a wood block under the forward bevel gear.
- 3) 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



### • 50 x 82 x 21.5 TAPER BEARING (Outer race) [LD and XD types only]

#### REMOVAL:

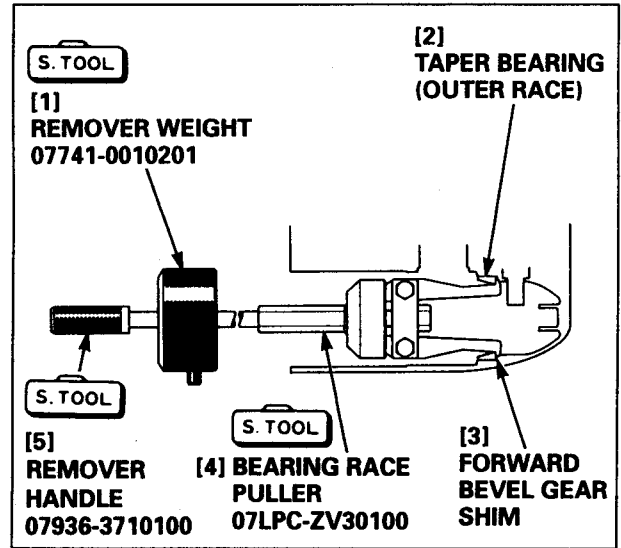
- 1) Remove the vertical shaft (P. 12-22)
- 2) Remove the taper bearing (outer race) using the special tools.  
Remove the forward bevel gear shim.

#### NOTE:

Replace the taper bearing (outer race) and the taper bearing (inner race) as a set on disassembly.

#### TOOLS:

Bearing race puller	07LPC-ZV30100
Remover weight	07741-0010201
Remover handle	07936-3710100



#### INSTALLATION:

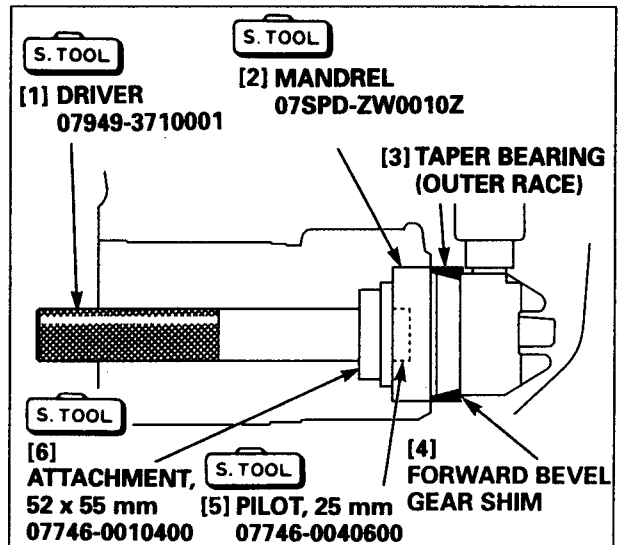
#### NOTE:

Install the new taper bearing with the larger I.D. side facing out.

- 1) Place the forward bevel gear shim in the gear case.
- 2) Apply gear oil to the circumference of a new taper bearing, and set the bearing in the gear case.
- 3) Install the taper bearing (outer race) in the gear case using the special tools as shown.

#### TOOLS:

Driver	07949-3710001
Attachment, 52 x 55 mm	07746-0010400
Pilot, 25 mm	07746-0040600
Mandrel	07SPD-ZW0010Z



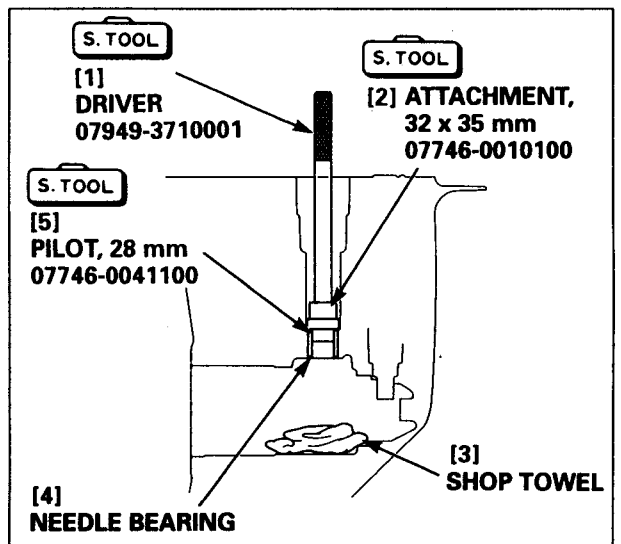
### • 1-1/8 x 1-1/2 x 1-1/4 NEEDLE BEARING

#### REMOVAL:

- 1) Set the special tools on the needle bearing as shown.  
Place a shop towel or equivalent material under the needle bearing.

#### TOOLS:

Driver	07949-3710001
Attachment, 32 x 35 mm	07746-0010100
Pilot, 28 mm	07746-0041100



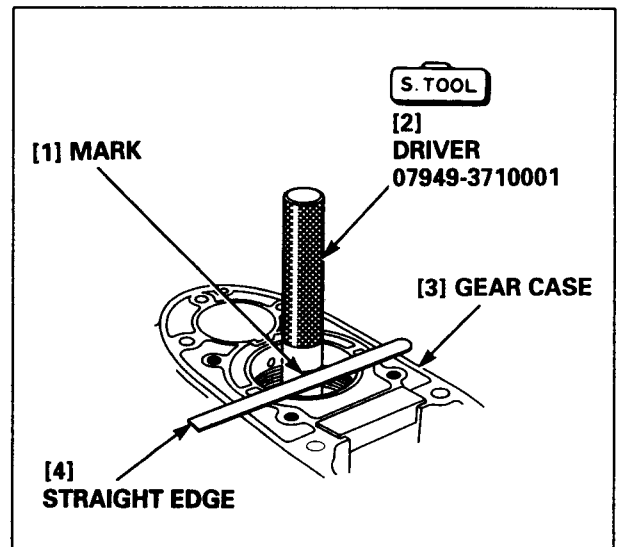
- 2) Before removing the needle bearing, mark the special tool (driver) in the same position as on the gear case end using a straight edge or equivalent tool as shown.
- 3) Remove the needle bearing from the gear case using the special tools.

**NOTE:**

- Replace the needle bearing.
- Remove the needle bearing with care not to damage the gear case.

**TOOLS:**

Driver	07949-3710001
Attachment, 32 x 35 mm	07746-0010100
Pilot, 28 mm	07746-0041100

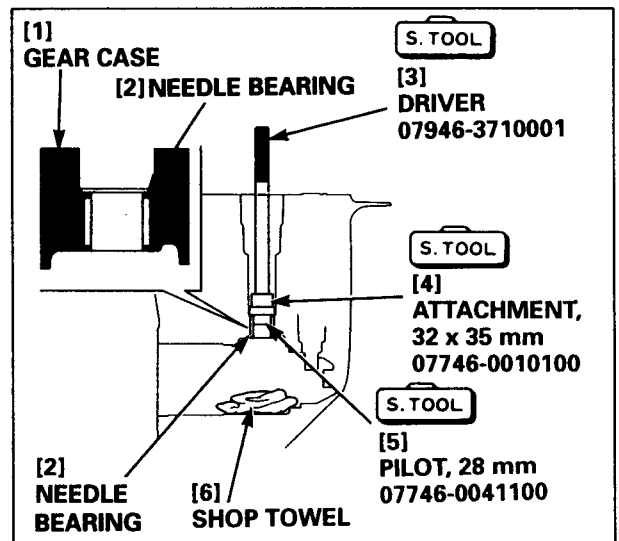


**INSTALLATION:**

- 1) Apply gear oil to the circumference of the new needle bearing.
- 2) Using the special tools, drive in the needle bearing deep to the marked level on the special tool (driver) that was marked on removal.
- 3) After installation of the needle bearing, check whether the underside of the bearing is level with the bottom of the gear case.

**TOOLS:**

Driver	07949-3710001
Attachment, 32 x 35 mm	07746-0010100
Pilot, 28 mm	07746-0041100



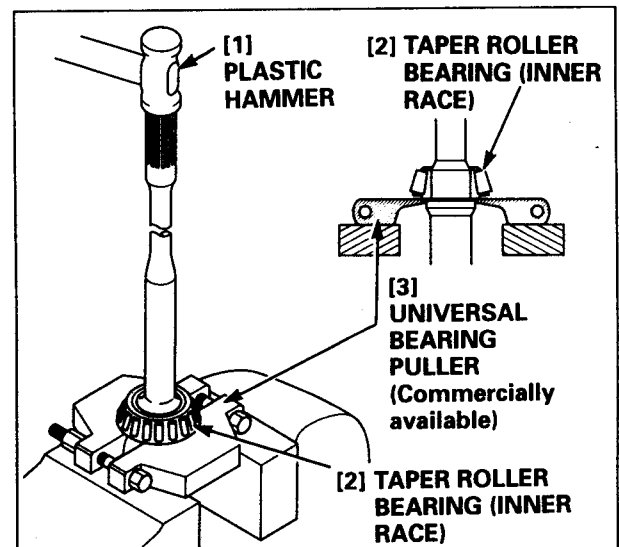
● **30 x 62 x 21.25 TAPER ROLLER BEARING (Inner race)**

**REMOVAL:**

- 1) Set the commercially available universal bearing puller on the taper roller bearing (inner race), then set the universal bearing puller on the vice.
- 2) Remove the taper roller bearing by tapping on the end of the vertical shaft using a plastic hammer.

**NOTE:**

Do not hold the vertical shaft with a vise. Use a plastic hammer to tap on the end of the vertical shaft.



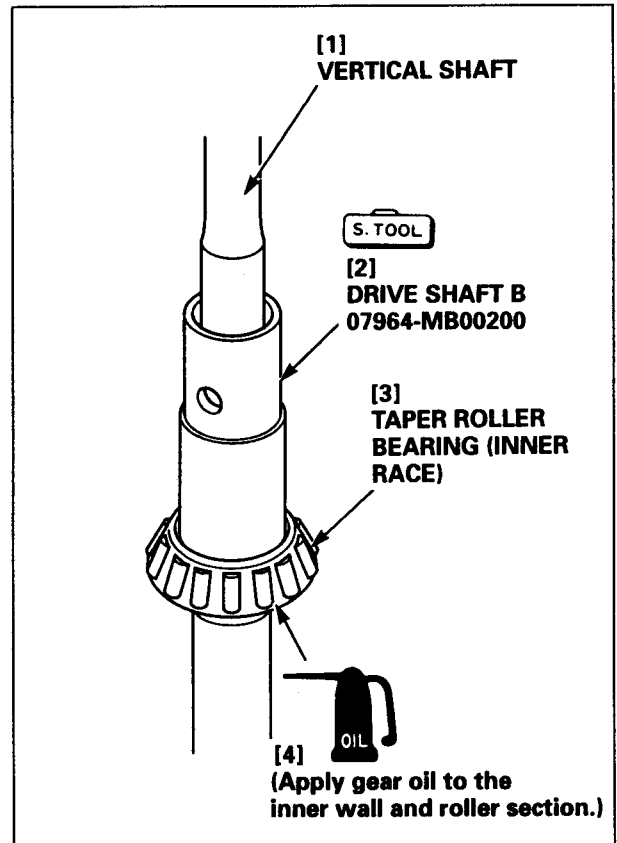
### INSTALLATION:

- 1) Set the pinion gear on the vertical shaft and temporarily tighten the pinion gear nut by hand.
- 2) Apply gear oil to the inner wall and the roller section of the taper roller bearing (inner race).
- 3) Set the pinion gear shim, taper roller bearing (inner race) and the special tool on the vertical shaft.

#### TOOL:

Drive shaft B

07964-MB00200



- 4) Set the vertical shaft upright on the hydraulic press with the pinion gear side toward up as shown.
- 5) Install the taper roller bearing (inner race) on the vertical shaft using the hydraulic press.

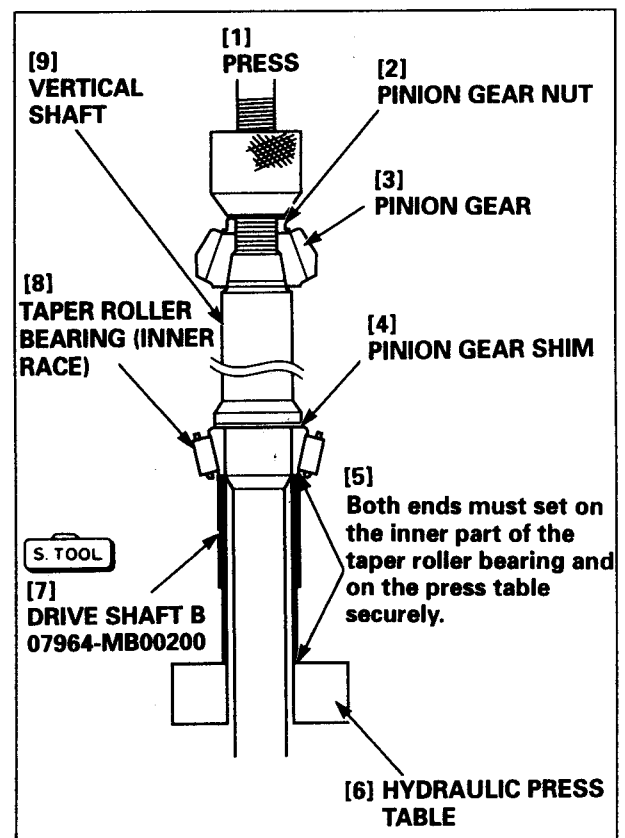
#### NOTE:

- 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.
- 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



## 7. SHIM SELECTION

### • PINION GEAR SHIM

Remove the 30 x 62 x 21.25 taper roller bearing (inner race) if it is mounted on the vertical shaft (P. 12-30).

- 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: 132 N·m (13.5 kgf·m, 98 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. 12-25).
- 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 special 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:

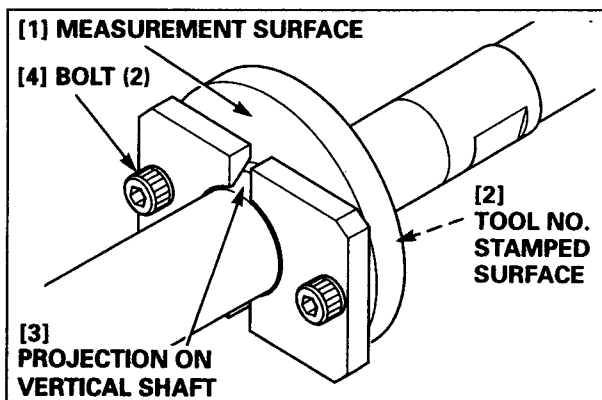
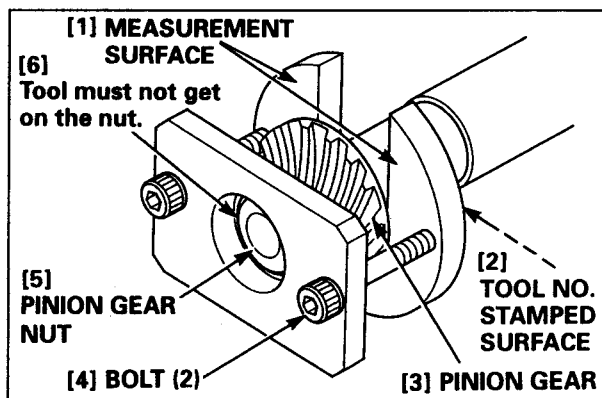
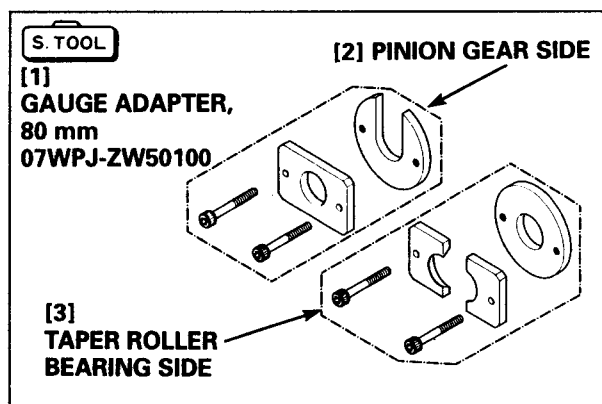
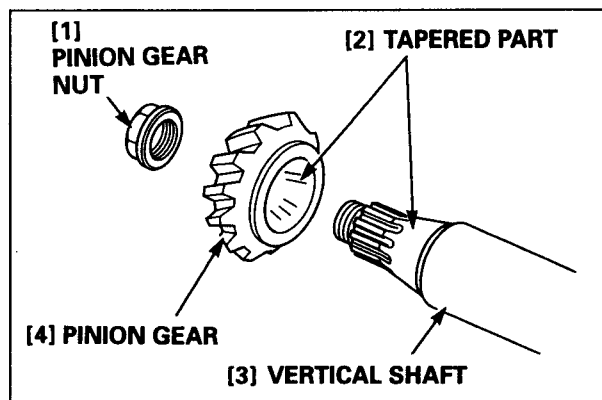
Gauge adapter, 80 mm

07WPJ-ZW50100

- 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.



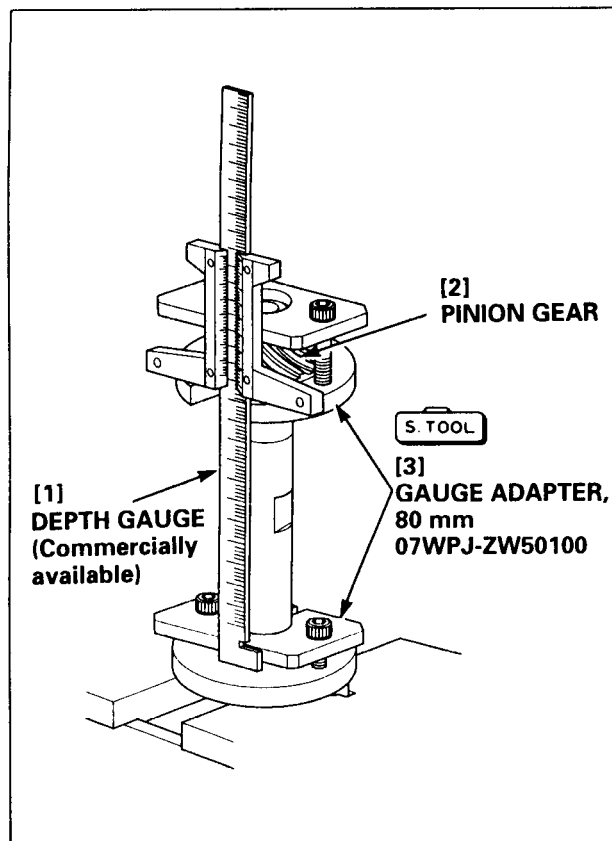


- 5) Hold the vertical shaft upright (with the pinion gear toward up) and secure the vertical shaft.
- 6) Set the commercially available depth gauge at the gauge adapter of the pinion gear side as shown. Measure the vertical shaft length (dimension "D") and record it.

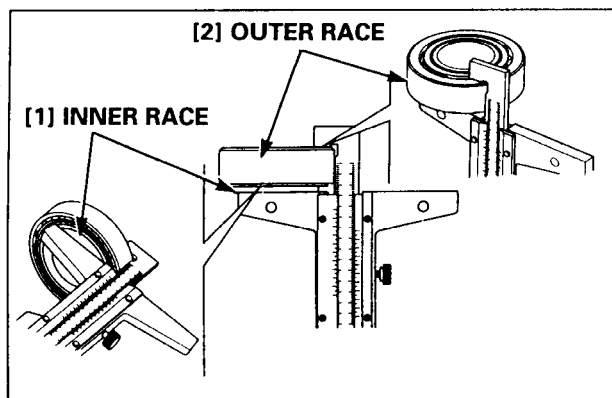
**TOOL:**

Gauge adapter, 80 mm

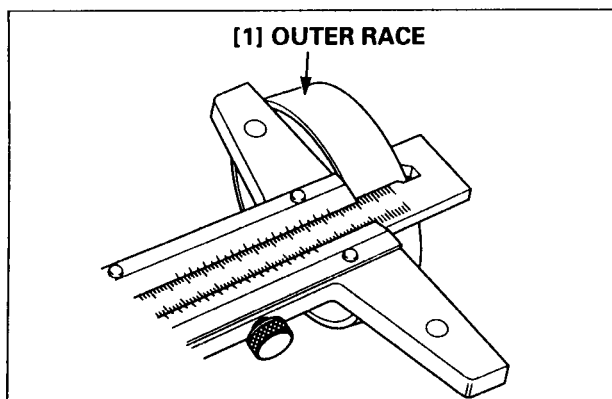
07WPJ-ZW50100



- 7) Assemble the outer race and inner race of the 30 x 62 x 21.25 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 21.25 taper roller bearing outer race and record the measurement.



- 10) Calculate the gap (distance E) between the outer race and inner race using the measurements 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 21.25 mm,

And, outer race height is 17.00 mm (0.669 in):

$$21.25 - 17.00 = 4.25$$

Therefore, the gap (distance E) is 4.25 mm (0.167 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) – 162.95  
= Calculation value.

**Example:**

When, vertical shaft length (distance D) is 158.5 mm (6.240 in),

And, gap (distance E) is 4.25 mm (0.167 in):

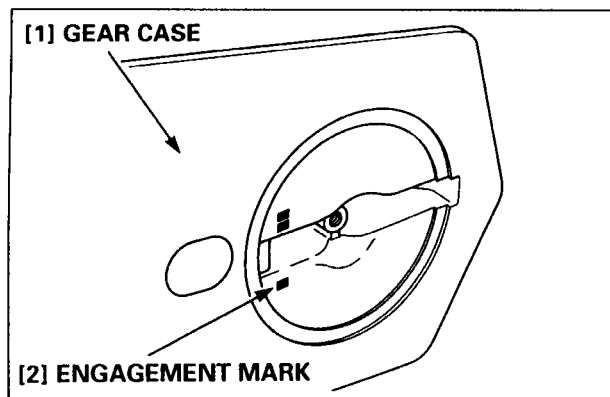
$$158.5 + 4.25 - 162.95 = -0.20$$

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**

[1] Parts name	[2] Thickness
[3] Pinion gear shim A	0.10 mm (0.0039 in)
[4] Pinion gear shim B	0.15 mm (0.0060 in)
[5] Pinion gear shim C	0.30 mm (0.0118 in)
[6] Pinion gear shim D	0.50 mm (0.0197 in)



• Pinion gear shim selection table

[3] Unit: mm (in)

		[2] Calculation value								
		0.57 (0.022) – 0.55 (0.021)	0.55 (0.021) – 0.50 (0.020)	0.50 (0.020) – 0.45 (0.018)	0.45 (0.018) – 0.40 (0.016)	0.40 (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)
[1] Engagement mark on the gear case	F	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)	0.70 (0.028)	0.75 (0.030)
	E	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)	0.70 (0.028)
	D	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)
	C	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)
	B	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)
	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)	0.45 (0.018)	0.50 (0.020)

[3] Unit: mm (in)

		[2] Calculation value							
		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)	– 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)
[1] Engagement mark on the gear case	F	0.80 (0.031)	0.85 (0.033)	0.90 (0.035)	0.95 (0.037)	1.00 (0.039)	1.05 (0.041)	1.10 (0.043)	1.15 (0.045)
	E	0.75 (0.030)	0.80 (0.031)	0.85 (0.033)	0.90 (0.035)	0.95 (0.037)	1.00 (0.039)	1.05 (0.041)	1.10 (0.043)
	D	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)	1.05 (0.041)
	C	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)	1.00 (0.039)
	B	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)	0.95 (0.037)
	A	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)	0.90 (0.035)

• How to read shim selection table

When the engagement mark on the gear case is E and the calculation value is – 0.2 mm (– 0.008 in) or more, the shim thickness is 1.05 mm (0.041 in). (See Example 1 below.)

When the calculation value is less than – 0.2 mm (– 0.008 in), the shim thickness is 1.10 mm (0.043 in). (See Example 2 below.)

[1] Example 1:

[6] Unit: mm (in)

		[2] Calculation value	
		[3] – 0.20 mm (– 0.008 in) or above to less than – 0.15 mm (– 0.006 in)	
	F		
	E		1.05 (0.041)

[4] Example 2:

[6] Unit: mm (in)

		[2] Calculation value	
		[5] – 0.25 mm (– 0.010 in) or above to less than – 0.20 mm (– 0.008 in)	
	F		
	E		1.10 (0.043)

• Shim combination

To obtain 1.05 mm (0.041 in) of shim thickness, combine five gear shim Bs and one gear shim C, or combine three gear shim Bs, one gear shim A and one gear shim D 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 82 x 21.5 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) – 21.5 = Calculation value

#### Example:

When bearing height (distance F) is 21.55 mm (0.848 in).

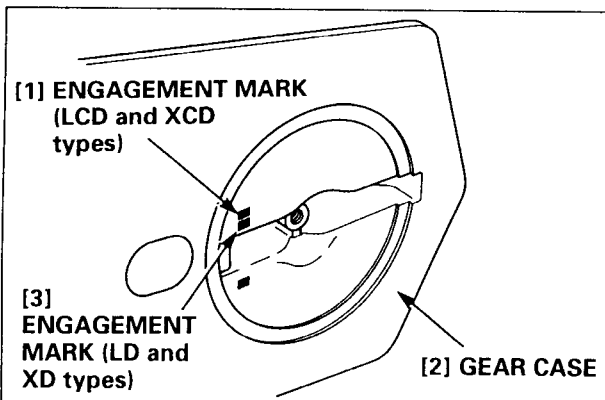
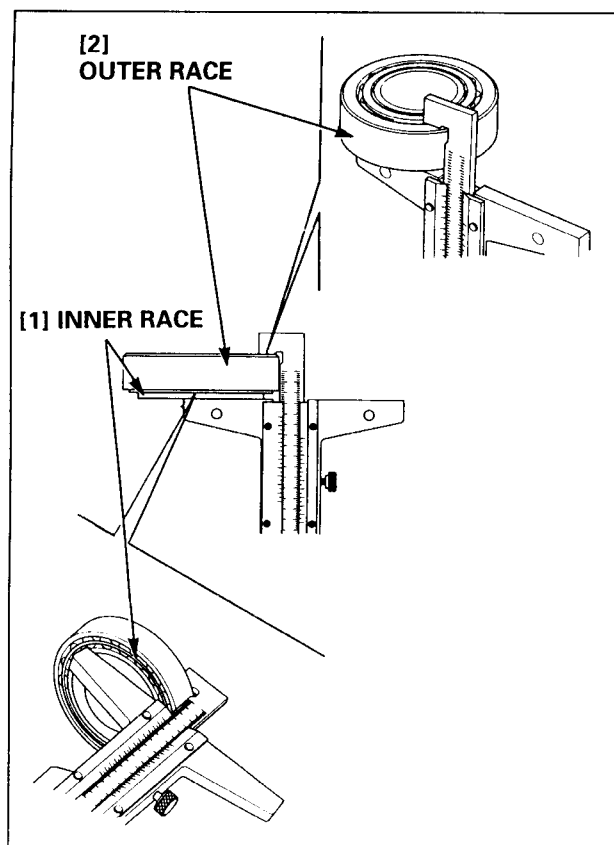
$$21.55 - 21.5 = 0.05$$

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

[1] Parts name	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.0039 in)
[4] Forward bevel gear shim B	0.15 mm (0.0060 in)
[5] Forward bevel gear shim C	0.30 mm (0.0118 in)
[6] Forward bevel gear shim D	0.50 mm (0.0197 in)



#### • Forward bevel gear shim selection table (LD and XD types)

[3] 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)
[1] Engagement mark on the gear case	1	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)
	2	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)
	3	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)
	4	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)
	5	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)
	6	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)

Refer to page 12-35 for information on how to read the shim selection table and shim combination.

(LCD and XCD types)

[3] Unit: mm (in)

		[2] Calculation value						
		0.32 (0.013) – 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)
[1] Engagement mark on the gear case	A	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)
	B	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	0.20 (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)
	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)
	E	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)
	F	0.05 (0.002)	0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)

Refer to page 12-35 for information on how to read the shim selection table and shim combination.

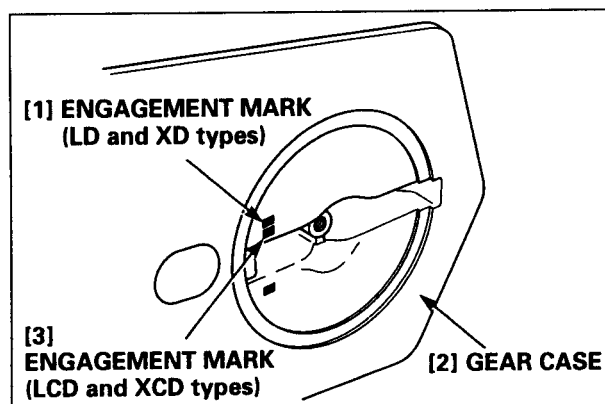
### ● REVERSE BEVEL GEAR SHIM

- 1) Refer to 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.

#### Example:

When the engagement mark on the gear case is C, the appropriate shim thickness should be 0.25 mm (0.010 in) [LD and XD types].

When the engagement mark on the gear case is 3, the appropriate shim thickness should be 0.55 mm (0.022 in) [LCD and XCD types].



#### • Reverse bevel gear shim selection table (LD and XD types)

[1] Engagement mark on the gear case	[2] Thickness
A	0.15 mm (0.006 in)
B	0.20 mm (0.008 in)
C	0.25 mm (0.010 in)
D	0.30 mm (0.012 in)
E	0.35 mm (0.014 in)
F	0.40 mm (0.016 in)

(LCD and XCD types)

[1] Engagement mark on the gear case	[2] Thickness
1	0.65 mm (0.026 in)
2	0.60 mm (0.024 in)
3	0.55 mm (0.022 in)
4	0.50 mm (0.020 in)
5	0.45 mm (0.018 in)
6	0.40 mm (0.016 in)

#### • Shim type table (LD and XD types)

[1] Parts name	[2] Thickness
[3] Reverse bevel gear shim A	0.10 mm (0.0039 in)
[4] Reverse bevel gear shim B	0.15 mm (0.0060 in)
[5] Reverse bevel gear shim C	0.30 mm (0.0118 in)
[6] Reverse bevel gear shim D	0.50 mm (0.0197 in)

(LCD and XCD types)

[1] Parts name	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.0039 in)
[4] Forward bevel gear shim B	0.15 mm (0.0060 in)
[5] Forward bevel gear shim C	0.30 mm (0.0118 in)
[6] Forward bevel gear shim D	0.50 mm (0.0197 in)

Refer to page 12-35 for information on how to read the shim selection table and shim combination.

### • THRUST SHIM (LCD and XCD types only)

Remove the 50 x 82 x 21.5 taper bearing inner race if it is mounted on the bearing holder assembly (P. 12-19).

- 1) Measure the height of the 50 x 82 x 21.5 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) – 21.5 = Tolerance

#### Example:

When the inner race height (distance J) is 21.4 mm (0.84 in)

$21.4 - 21.5 = -0.1$

Therefore, the calculation value is  $-0.1\text{mm}$  ( $-0.004\text{ in}$ )

- 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

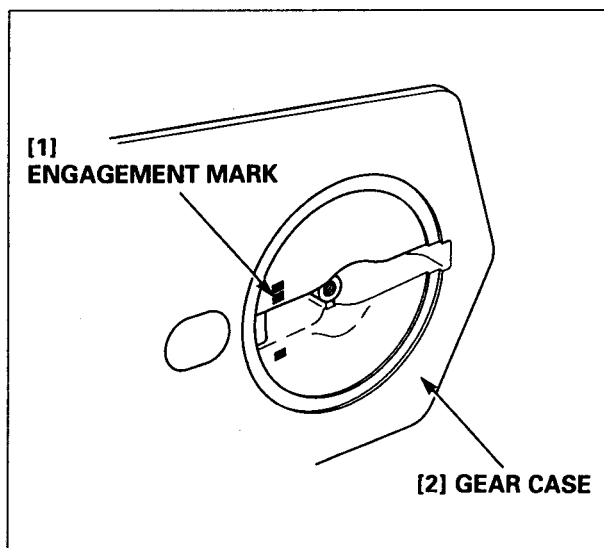
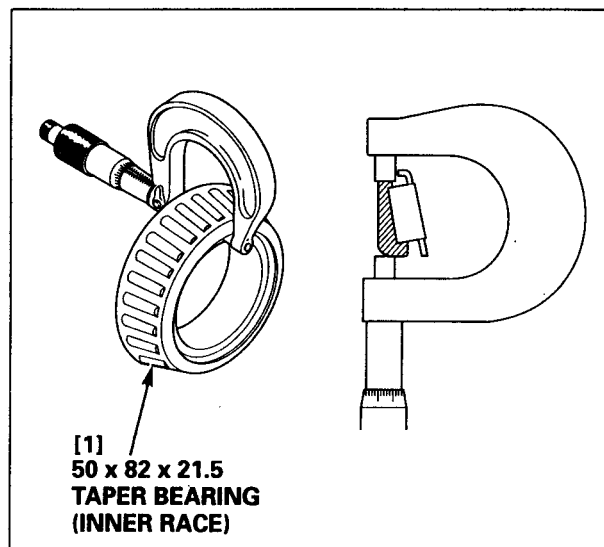
[1] Parts name	[2] Thickness
[3] Thrust shim A	0.10 mm (0.0039 in)
[4] Thrust shim B	0.15 mm (0.0060 in)
[5] Thrust shim C	0.30 mm (0.0118 in)
[6] Thrust shim D	0.50 mm (0.0197 in)

#### • Thrust shim selection table

[3] Unit: mm (in)

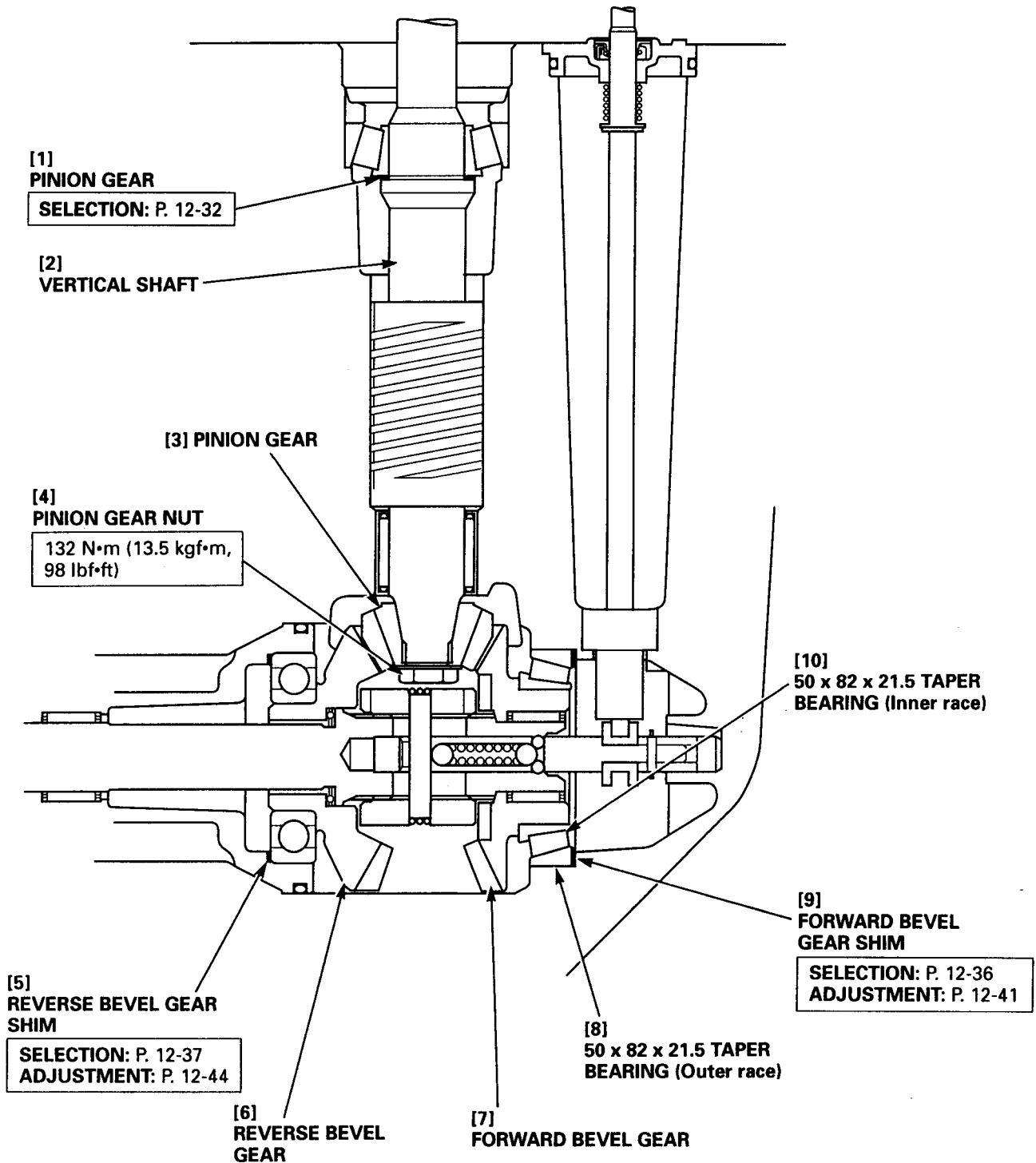
		[2] Calculation value		
		0 (0.000) – – 0.05 (– 0.002)	– 0.05 (– 0.002) – – 0.10 (– 0.004)	– 0.10 (– 0.004) – – 0.15 (– 0.006)
[1] Engagement mark on the gear case	F	0.95 (0.037)	1.00 (0.039)	1.05 (0.041)
	E	0.90 (0.035)	0.95 (0.037)	1.00 (0.039)
	D	0.85 (0.033)	0.90 (0.035)	0.95 (0.037)
	C	0.80 (0.031)	0.85 (0.033)	0.90 (0.035)
	B	0.75 (0.030)	0.80 (0.031)	0.85 (0.033)
	A	0.70 (0.028)	0.75 (0.030)	0.80 (0.031)

Refer to page 12-35 for information on how to read the shim selection table and shim combination.

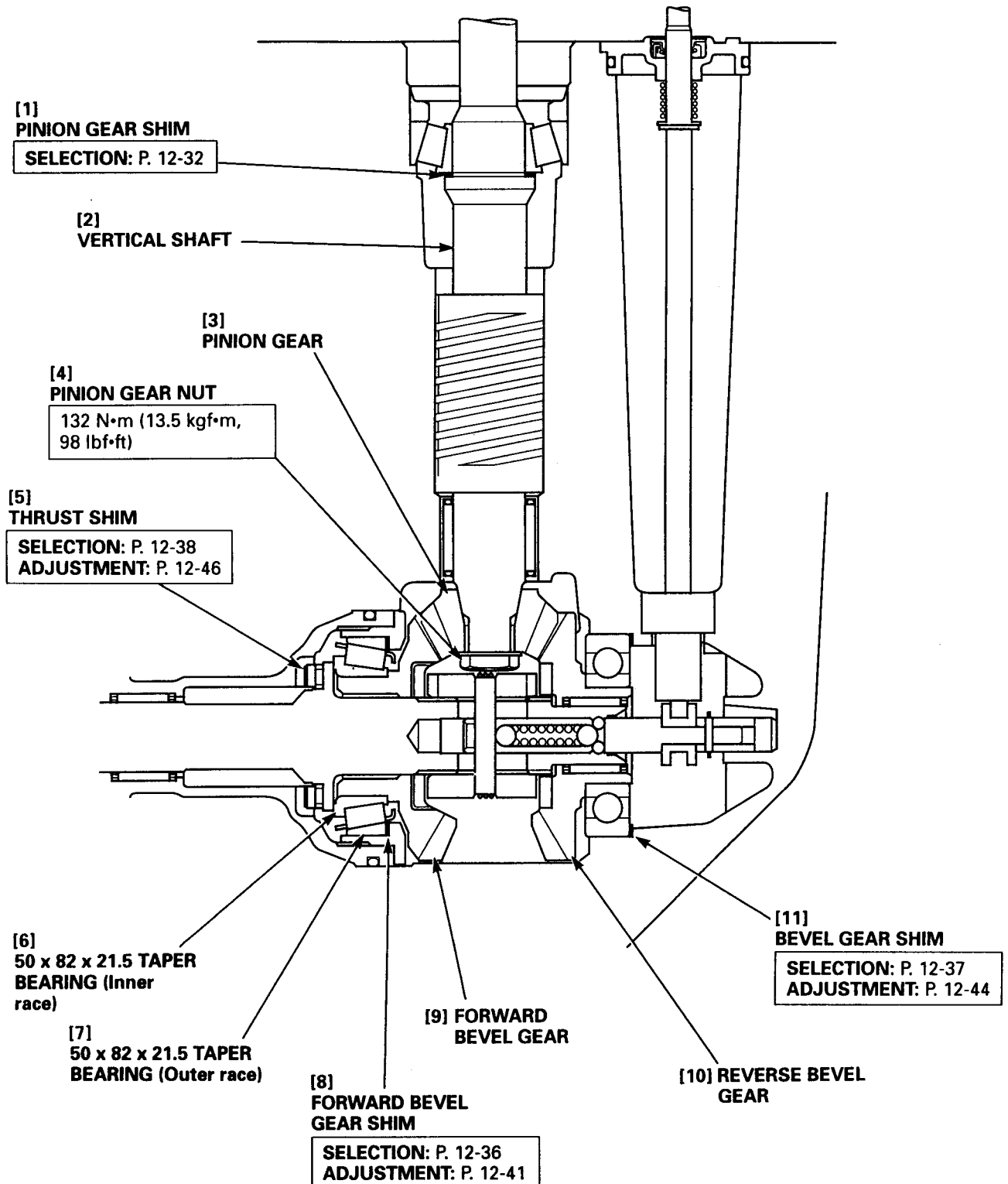


## 8. SHIM POSITION

- LD and XD types



• LCD and XCD types





## 9. BACKLASH ADJUSTMENT

### • FORWARD BEVEL GEAR BACKLASH

- LCD and XCD types: Forward bevel gear backlash adjustment must be made after adjusting the reverse bevel gear backlash (P. 12-44).

#### <Common to LD, XD, LCD and XCD types>

Backlash adjustment must be made after adjustment of each gear shim (P. 12-32 through 38).

Install the parts except the water pump in the gear case (P. 12-5, 9, 22 and 23).

- 1) Set the vertical shaft vertically.
- 2) Raise the adjusting nut i.e. part ⑤ of the special tool, to the uppermost position.
- 3) Check whether the part ⑥ of the special tool is set on the part ⑤ securely.  
If not, tighten the set screw by aligning with the hole in the part ⑥.

#### NOTE:

Tighten with care not to let the end of the two set screws come out of the part ⑥ of the special tool.

- 4) Set the parts from ① to ⑤ of the special tool on the vertical shaft.

#### TOOL:

**Bearing preload tool** **07SPJ-ZW0010Z**

- 5) Set the special tool (vertical shaft indicator attachment) on the special part ⑥, and tighten the set screws (LD and LCD types only).

#### NOTE:

Do not tighten the set screws with the part ⑤ of the special tool pushing down.

#### TOOL:

**Vertical shaft indicator attachment** **07WPK-ZW50100**

- 6) Measure the clearance (distance A) between the end of the nut of the special tool part ⑤ and end of the adjusting nut as shown.  
Calculate the amount of tightening the adjusting nut using the following formula.

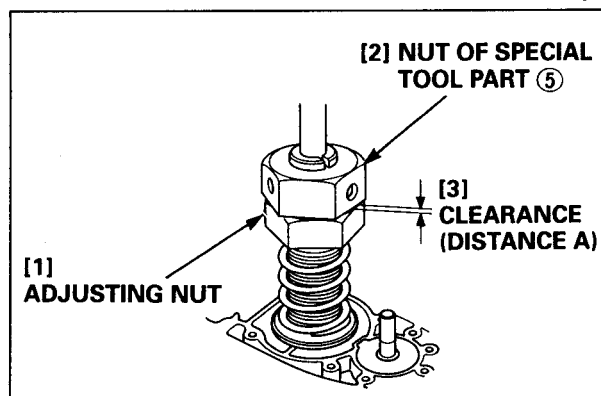
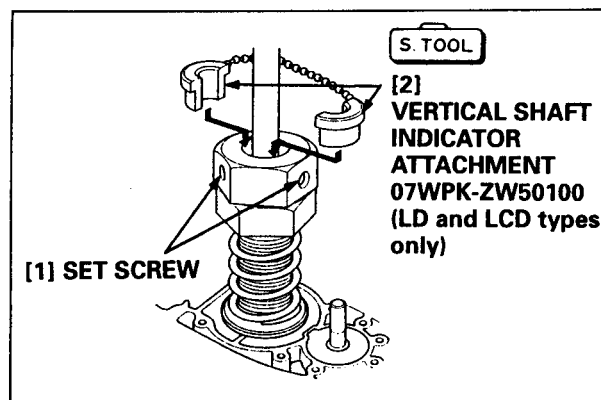
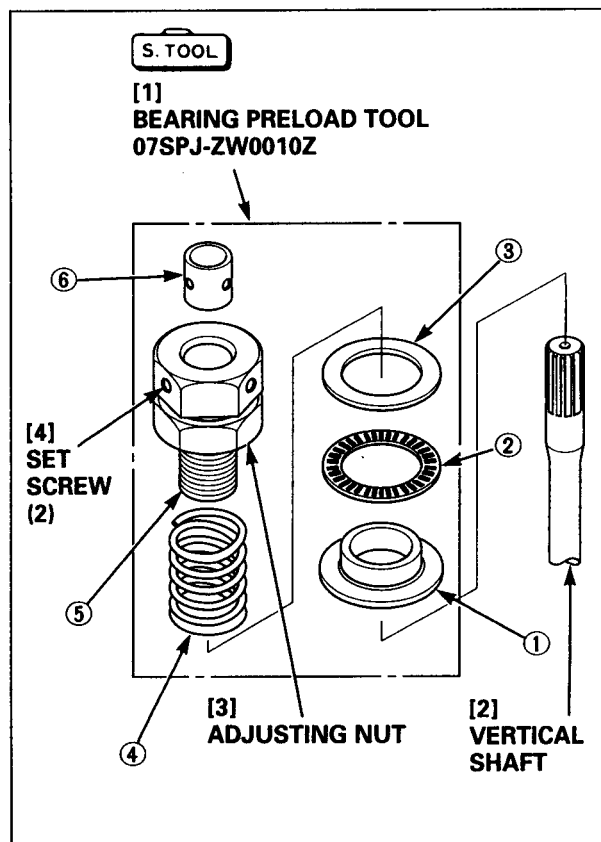
#### Formula:

Clearance (distance A) + 25 mm (0.9 in)  
= Amount of tightening adjusting nut  
Clearance between the end of the nut of the special tool part ⑤ and end of the adjusting nut.

#### Example:

When clearance (distance A) is 1 mm (0.04 in):  $1 + 25 = 26$   
Therefore, the amount of tightening of the adjusting nut should be 26 mm (1.0 in).

- 7) Tighten the adjusting nut until the clearance between the end of the nut of the special tool part ⑤ and end of the adjusting nut is the calculated value.
- 8) After tightening the adjusting nut, turn the vertical shaft 5 to 10 times clockwise.



**<LD and XD types only>**

- 9) Hold the propeller shaft securely with the special tool as shown, and tighten the puller bolt (special tool) to the specified torque.

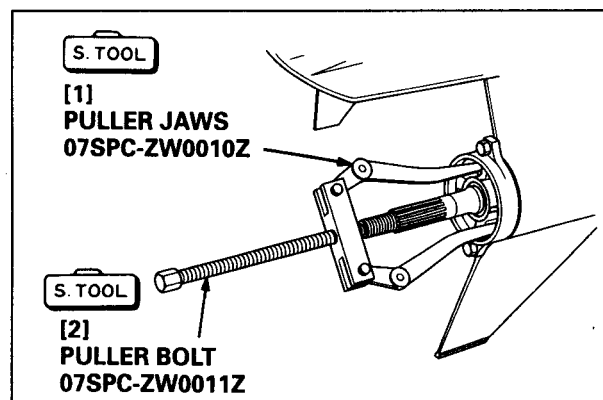
**TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)**

Turn the vertical shaft 5 to 10 times clockwise.

**TOOLS:**

**Puller jaws**  
**Puller bolt**

**07SPC-ZW0010Z**  
**07SPC-ZW0011Z**



- 10) 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.

- 11) 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.

**NOTE:**

Do not turn the propeller shaft when turning the vertical shaft.

- 12) Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

**Formula:**

Dial gauge runout x 1.03 = Backlash

**Example:**

When dial gauge runout is 0.195 mm (0.0077 in):  
0.195 x 1.03 = 0.20

Therefore, the backlash is 0.20 mm (0.008 in).

Standard value	0.12 - 0.29 mm (0.005 - 0.011 in)
----------------	-----------------------------------

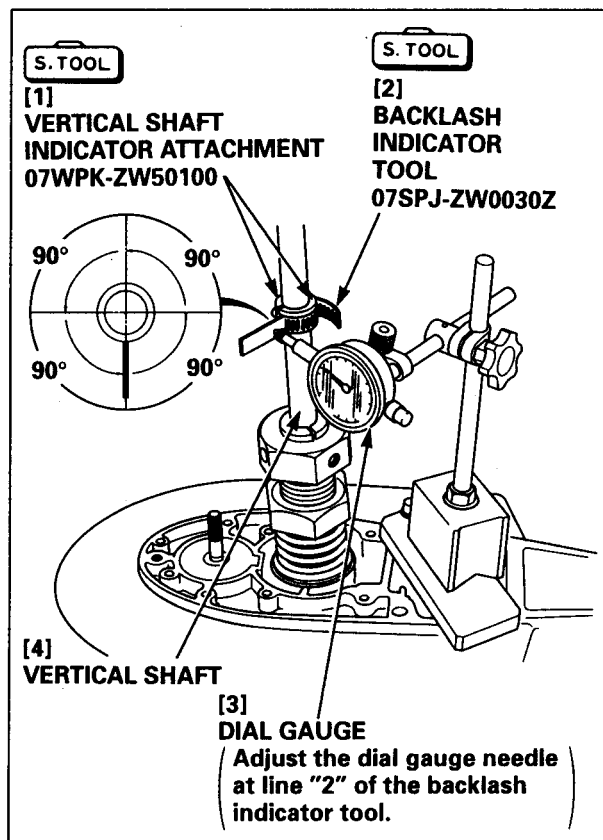
If the backlash is too large, increase the forward bevel gear shim thickness and recheck the backlash.

If the backlash is too small, reduce the forward bevel gear shim thickness and recheck the backlash.

**TOOLS:**

**Vertical shaft indicator attachment**  
**Backlash indicator tool**  
**Dial indicator adapter kit**

**07WPK-ZW50100**  
**07SPJ-ZW0030Z**  
**07SPJ-ZW0040Z**



**<LCD and XCD types only>**

- 9) Hold the propeller shaft securely with the a puller as show, and tighten the puller bolt to the specified torque.

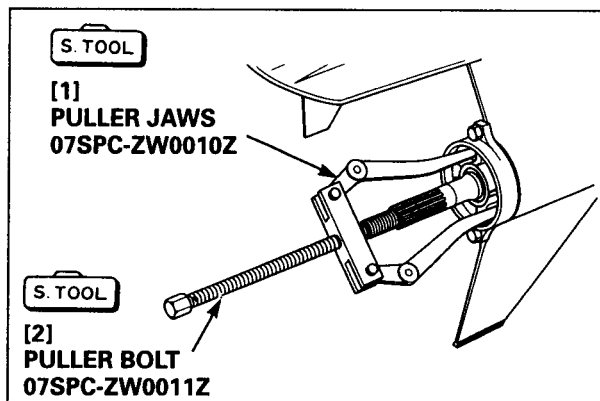
**TORQUE: 5 N•m (0.5 kgf•m, 3.6 lbf•ft)**

Turn the vertical shaft 5 to 10 times clockwise.

**TOOLS:**

**Puller jaws**  
**Puller bolt**

**07SPC-ZW0010Z**  
**07SPC-ZW0011Z**



- 10) 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.

- 11) 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.

**NOTE:**

Do not turn the propeller shaft when turning the vertical shaft.

- 12) Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

**Formula:**

Dial gauge runout x 1.03 = Backlash

**Example:**

When, dial gauge runout is 0.195 mm (0.0077 in):  
 $0.195 \times 1.03 = 0.20$

Therefore, the backlash is 0.20 mm (0.008 in).

Standard value	0.12 - 0.29 mm (0.005 - 0.011 in)
----------------	-----------------------------------

- 13) If the backlash is too large, reduce the forward bevel gear shim thickness and recheck the backlash.

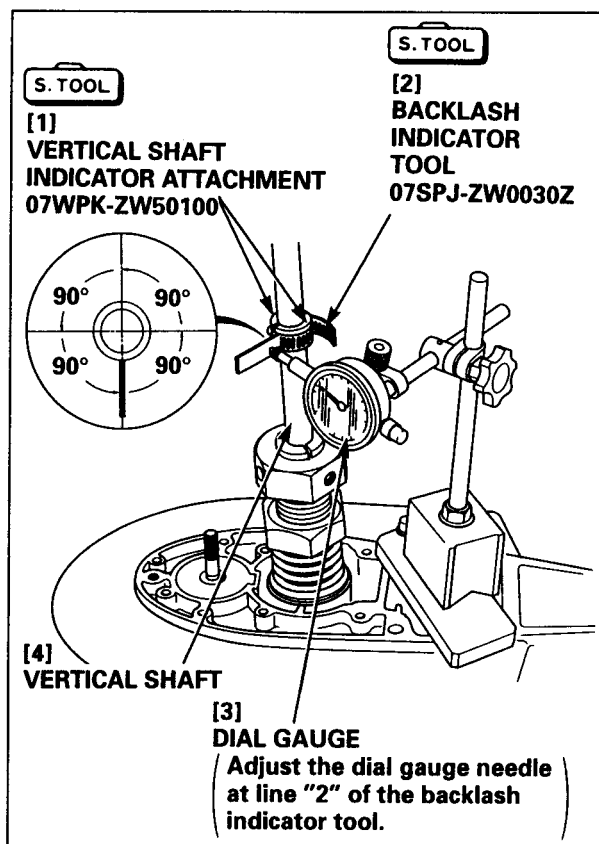
If the backlash is too small, increase the forward bevel gear shim thickness and recheck the backlash.

- 14) When the forward bevel gear shim is replaced, adjust the thrust clearance (P. 12-46).

**TOOLS:**

**Vertical shaft indicator attachment**  
**Backlash indicator tool**  
**Dial indicator adapter kit**

**07WPK-ZW50100**  
**07SPJ-ZW0030Z**  
**07SPJ-ZW0040Z**



### • REVERSE BEVEL GEAR BACKLASH

- LCD and XCD types: Reverse bevel gear backlash adjustment must be made before adjusting the forward bevel gear backlash (P. 12-41).

#### <Common to LD, XD, LCD and XCD types>

Reverse bevel gear backlash adjustment should be made after adjusting the forward bevel gear backlash (P. 12-41). Be sure that the special tools of the water pump mounting part and the vertical shaft are attached to the vertical shaft. If they are removed, install the special tools following the steps 1 through 8 and the step 10 on page 12-41 and 42.

#### <LD and XD types only>

- 1) Hold the propeller shaft with the special tool securely as shown.

- 2) Tighten the 18 mm castle nut to the specified torque.

**TORQUE: 1 N·m (0.1 kgf·m, 0.7 lbf·ft)**

If it is hard to set the split pin by tightening the castle nut to the specified torque, tighten the nut additionally until the split pin can be set.

Turn the vertical shaft 5 to 10 times clockwise.

#### TOOL:

**Propeller shaft holder** **07TPB-ZW10100**

- 3) Attach the tip of the dial gauge perpendicularly on the line of "2" of the special tool (backlash indicator tool).
- 4) 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.

#### NOTE:

Do not turn the propeller shaft when turning the vertical shaft.

- 5) Obtain the reverse bevel gear backlash using the dial gauge runout and the following formula.

#### Formula:

Dial gauge runout x 1.03 = Backlash

#### Example:

When dial gauge runout is 0.195 mm (0.0077 in):

$0.195 \times 1.03 = 0.20$

Therefore, the backlash is 0.20 mm (0.008 in).

Standard value	0.12 - 0.38 mm (0.005 - 0.015 in)
----------------	-----------------------------------

- 6) If the backlash is too large, increase the reverse bevel gear shim thickness and recheck the backlash.  
If the backlash is too small, reduce the reverse bevel gear shim thickness and recheck the backlash.

#### TOOLS:

**Vertical shaft indicator attachment**

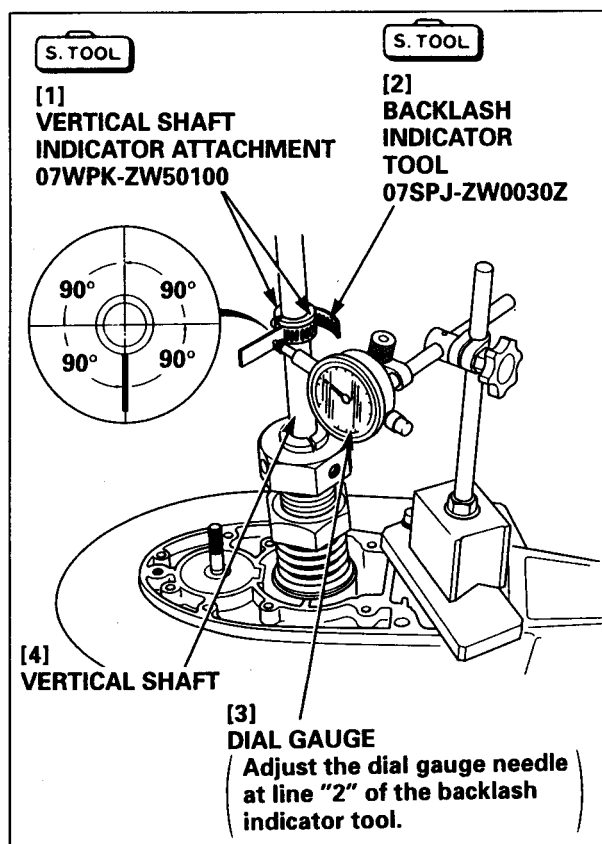
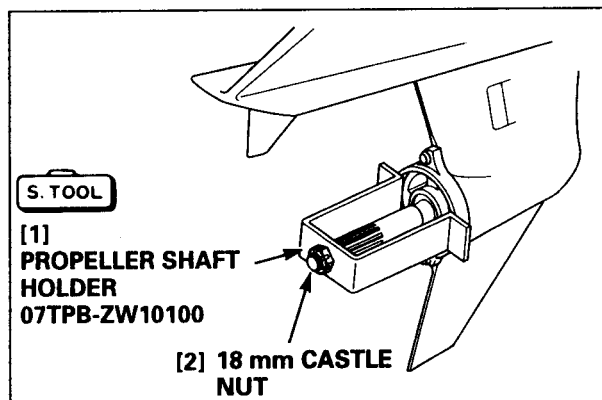
**07WPK-ZW50100**

**Backlash indicator tool**

**07SPJ-ZW0030Z**

**Dial indicator adapter kit**

**07SPJ-ZW0040Z**



**<LCD and XCD types only>**

Remove only the bearing holder assembly from the propeller shaft holder (P. 12-19), and adjust the reverse bevel gear backlash.

- 1) Hold the propeller shaft securely with the special tool as shown, and tighten the puller bolt (special tool) to the specified torque.

**TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)**

Turn the vertical shaft 5 to 10 times clockwise.

**TOOLS:**

**Puller jaws** **07SPC-ZW0010Z**  
**Puller bolt** **07SPC-ZW0011Z**

- 2) Attach the tip of the dial gauge perpendicularly on the line of "2" of the special tool (backlash indicator tool).
- 3) 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.

**NOTE:**

Do not turn the propeller shaft when turning the vertical shaft.

- 4) Obtain the reverse bevel gear backlash using the dial gauge runout and the following formula.

**Formula:**

Dial gauge runout x 1.03 = Backlash

**Example:**

When dial gauge runout is 0.195 mm (0.0077 in):

$0.195 \times 1.03 = 0.20$

Therefore, the backlash is 0.20 mm (0.008 in).

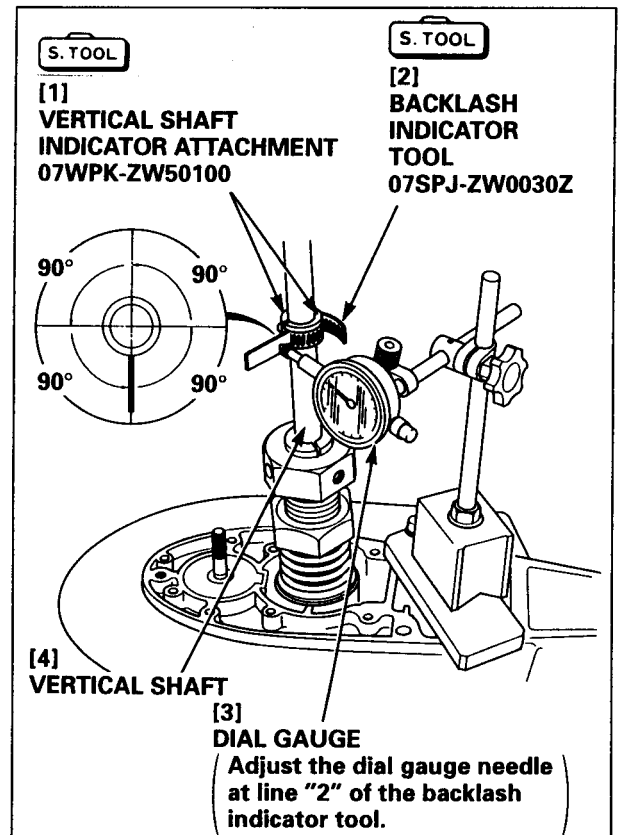
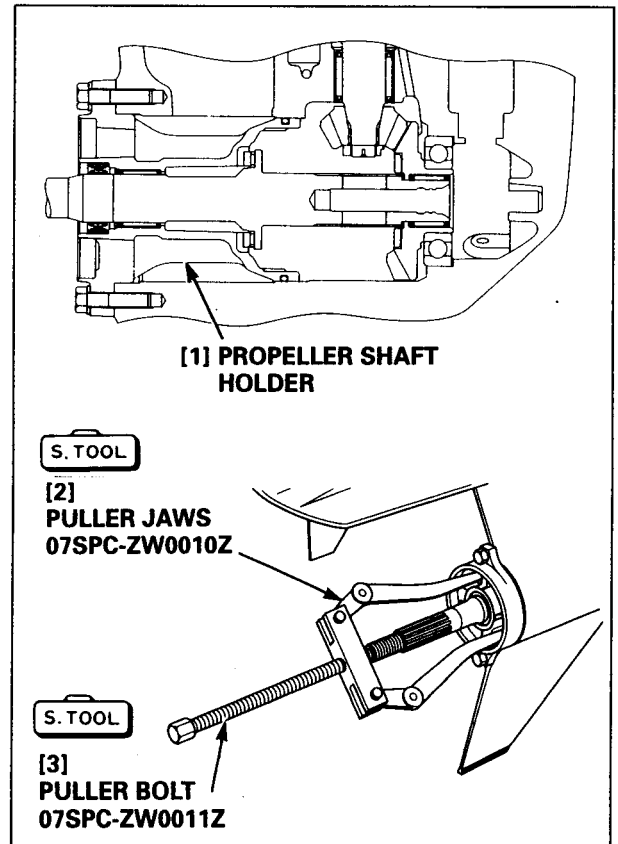
Standard value	0.12 - 0.38 mm (0.005 - 0.015 in)
----------------	-----------------------------------

- 5) 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.

**TOOLS:**

**Vertical shaft indicator attachment** **07WPK-ZW50100**  
**Backlash indicator tool** **07SPJ-ZW0030Z**  
**Dial indicator adapter kit** **07SPJ-ZW0040Z**



### ● THRUST CLEARANCE ADJUSTMENT (LCD and XCD 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. 12-21).

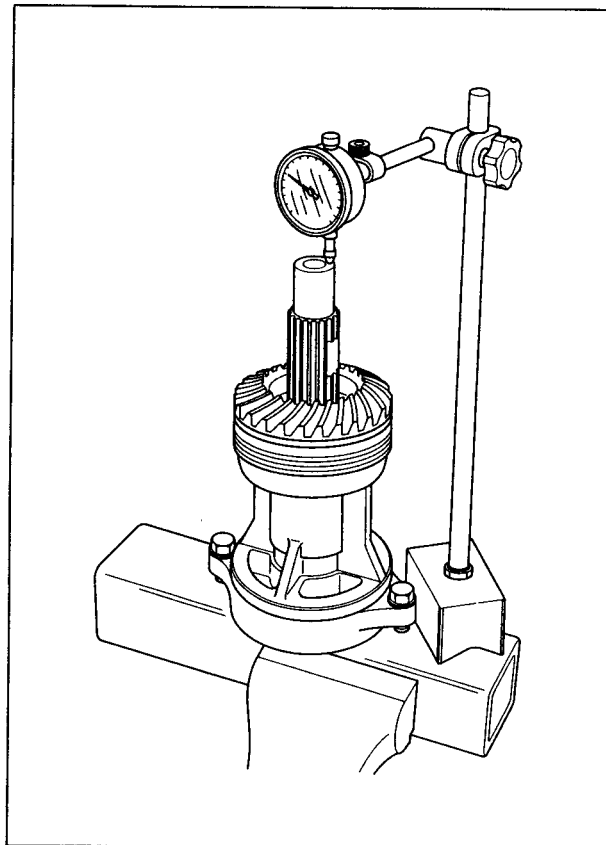
Note that the shift slider and the clutch shifter are not mounted.

- 2) Set the propeller shaft holder assembly on the fixing tool as shown, and tighten with the bolts securely (P. 12-19).
- 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.

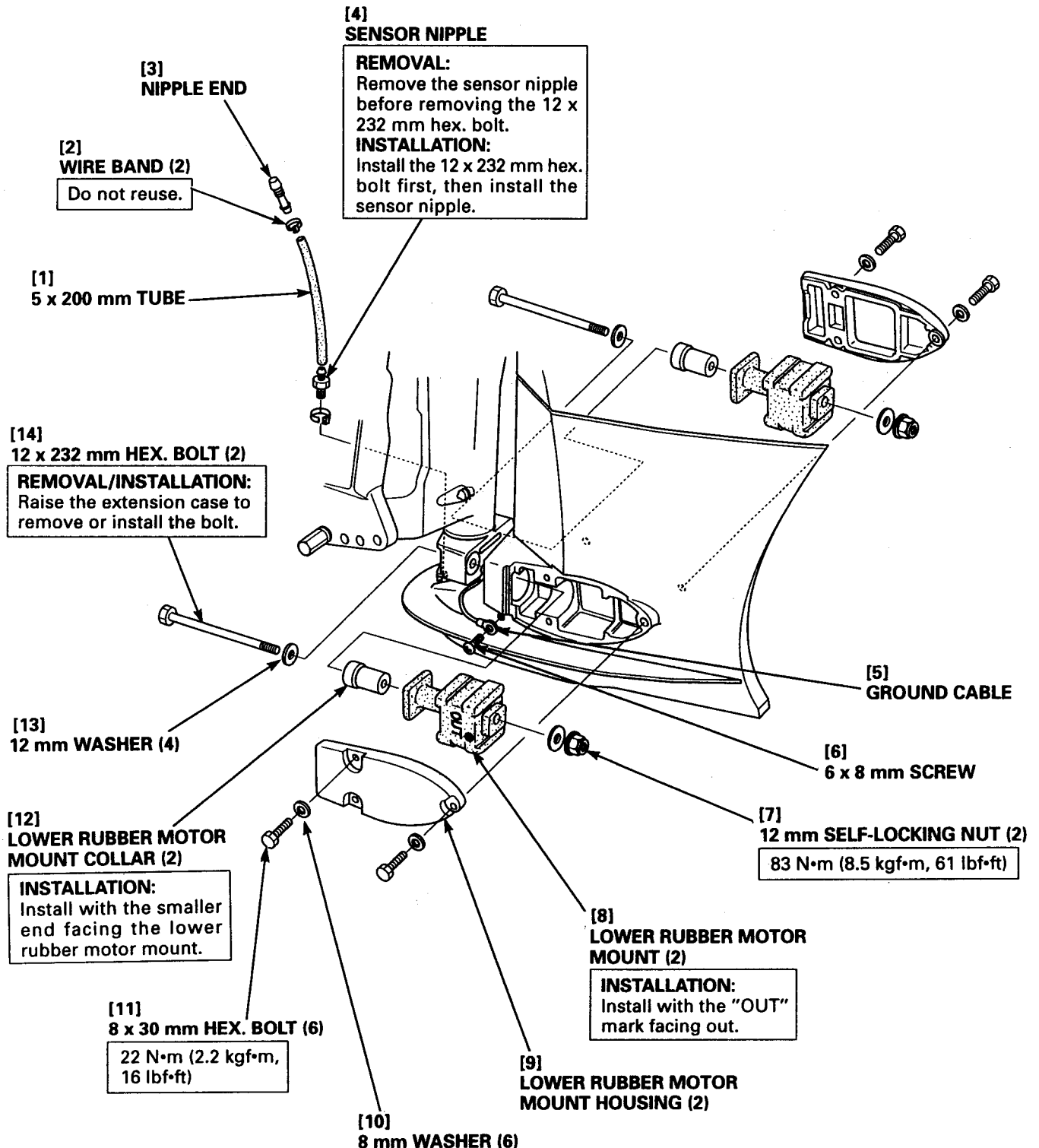
If the thrust clearance is smaller than the specification, reduce the thrust shim thickness and recheck the thrust clearance.



# 10. LOWER RUBBER MOTOR MOUNT

## a. DISASSEMBLY/ASSEMBLY

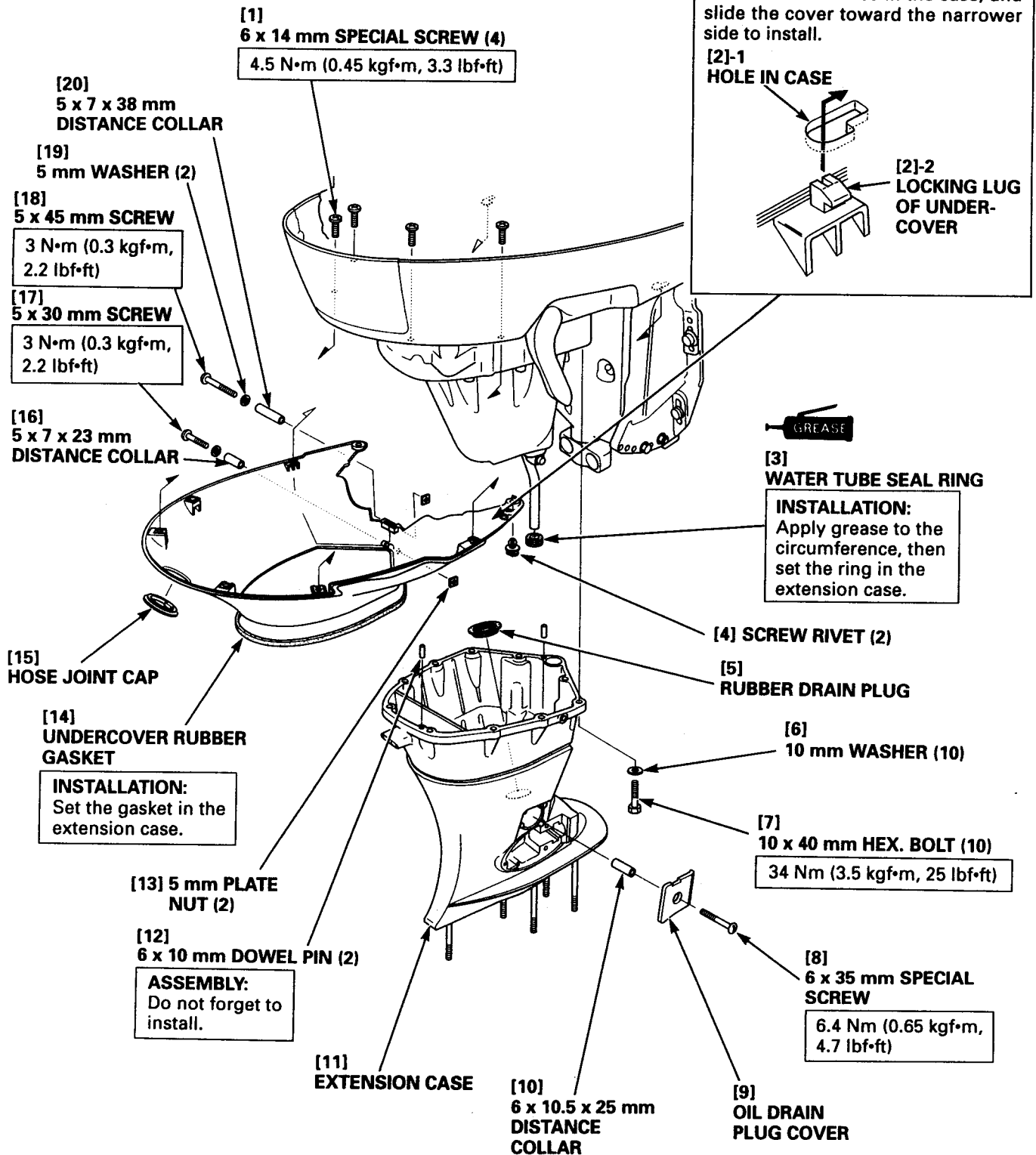
Remove the gear case assembly (P. 12-2).



## 11. EXTENSION CASE/UNDERCOVER

### a. DISASSEMBLY/ASSEMBLY

- 1) Remove the gear case assembly (P. 12-2).
- 2) Remove the lower rubber motor mount (P. 12-47).





# 13. OIL PAN/ENGINE UNDERCASE/ MOUNTING CASE

**HONDA**  
**BF115A•130A**

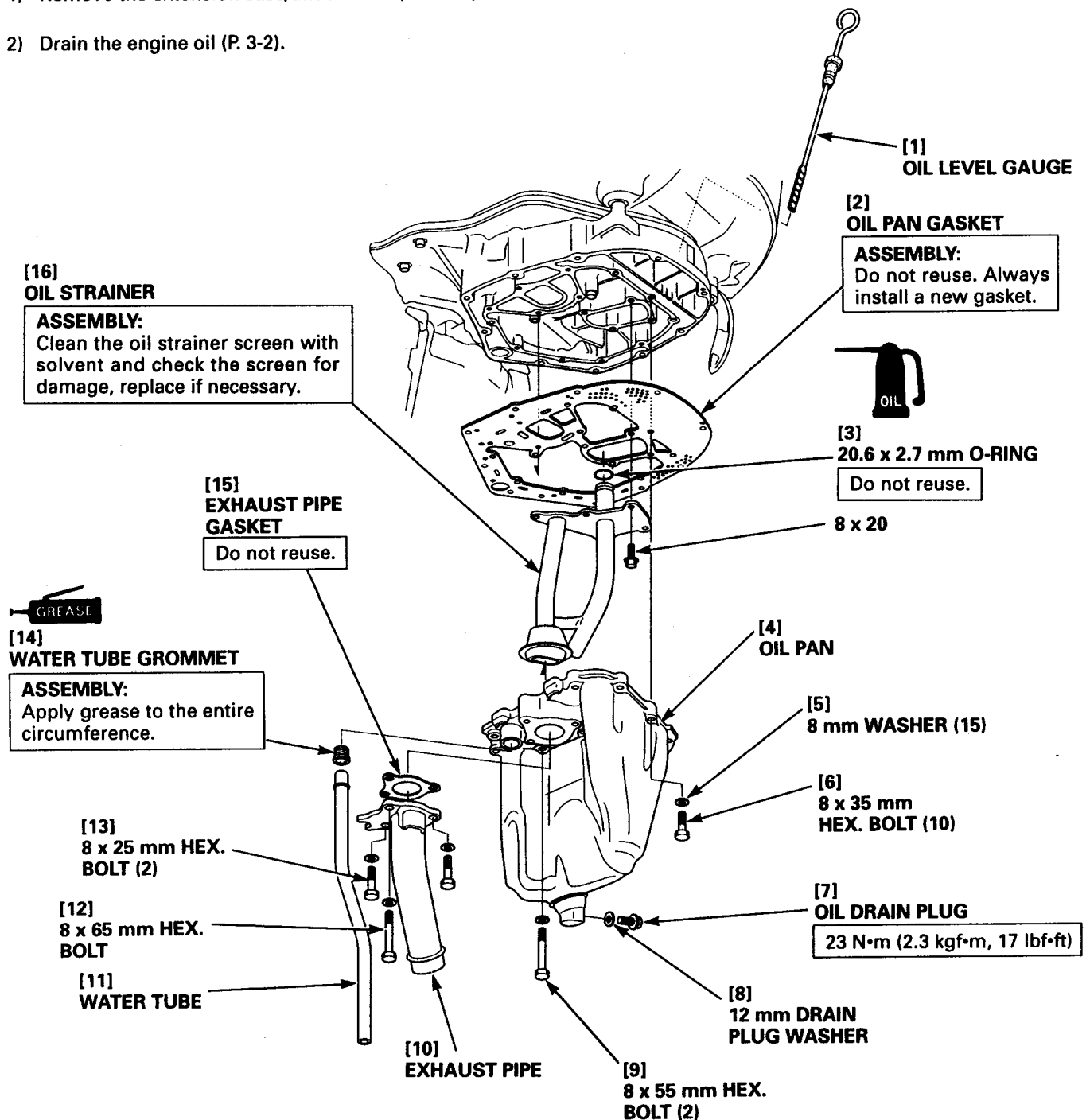
1. OIL PAN/EXHAUST PIPE/WATER TUBE
2. ENGINE UNDERCASE
3. COVER LOCK LEVER

4. MOUNTING CASE/UPPER RUBBER  
MOUNT/SHIFT SHAFT A/B

## 1. OIL PAN/EXHAUST PIPE/WATER TUBE

### a. REMOVAL/INSTALLATION

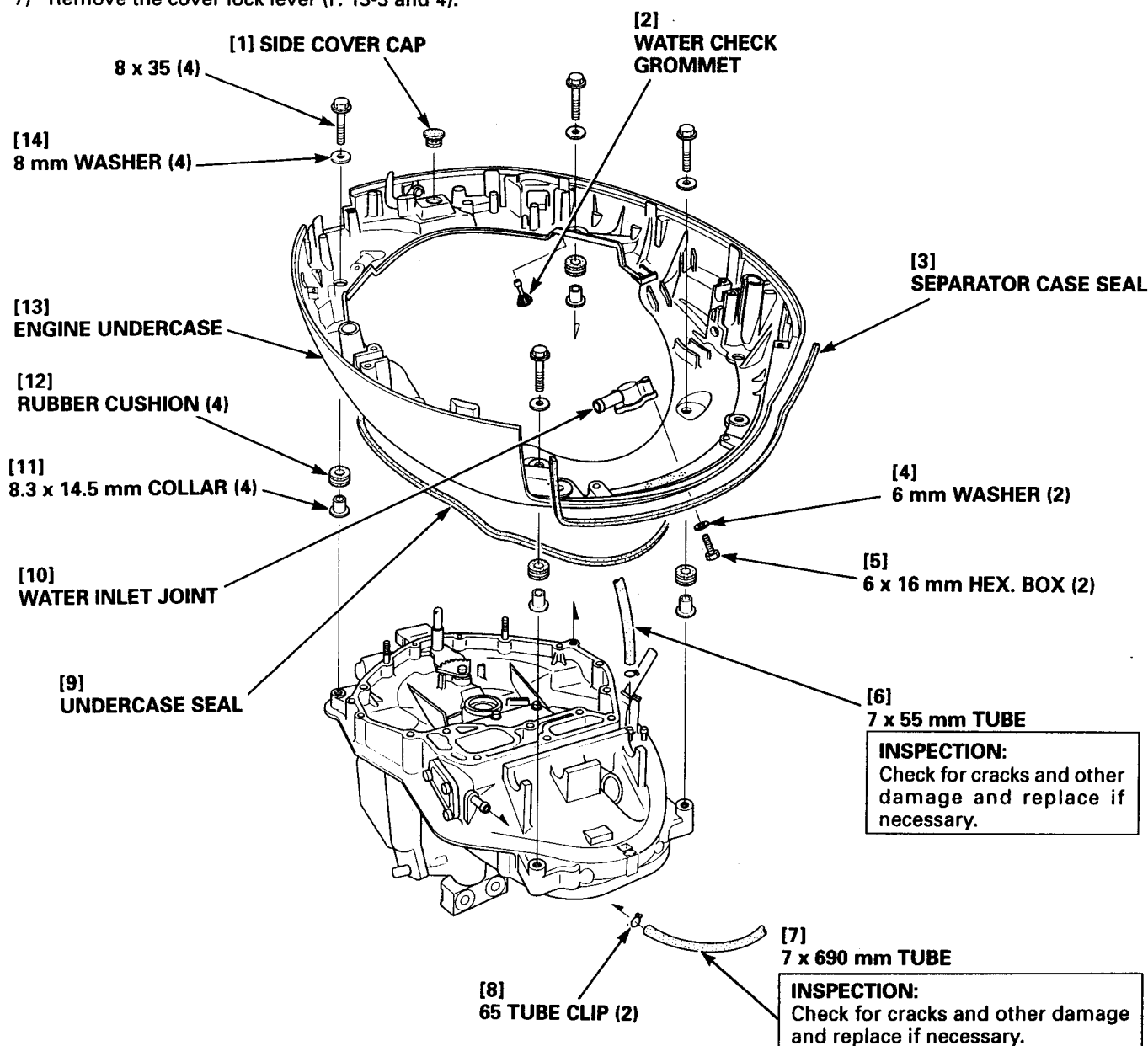
- 1) Remove the extension case/undercover (P. 12-48).
- 2) Drain the engine oil (P. 3-2).



## 2. ENGINE UNDERCASE

### a. REMOVAL/INSTALLATION

- 1) Remove the engine (P. 7-1).
- 2) Disconnect the starter cable (P. 17-8), remote control cable A, and shift and throttle cables (P. 17-5).
- 3) Remove the fuel filter (low pressure side) and fuel tube (P. 5-76).
- 4) Remove the main relay (P. 17-5).
- 5) Pull the trim angle sensor wire and the power tilt motor wire from the hole in the engine undercase (P. 14-2).
- 6) Remove the power tilt switch (P. 17-8) and the 90A fuse box (P. 17-24).
- 7) Remove the cover lock lever (P. 13-3 and 4).

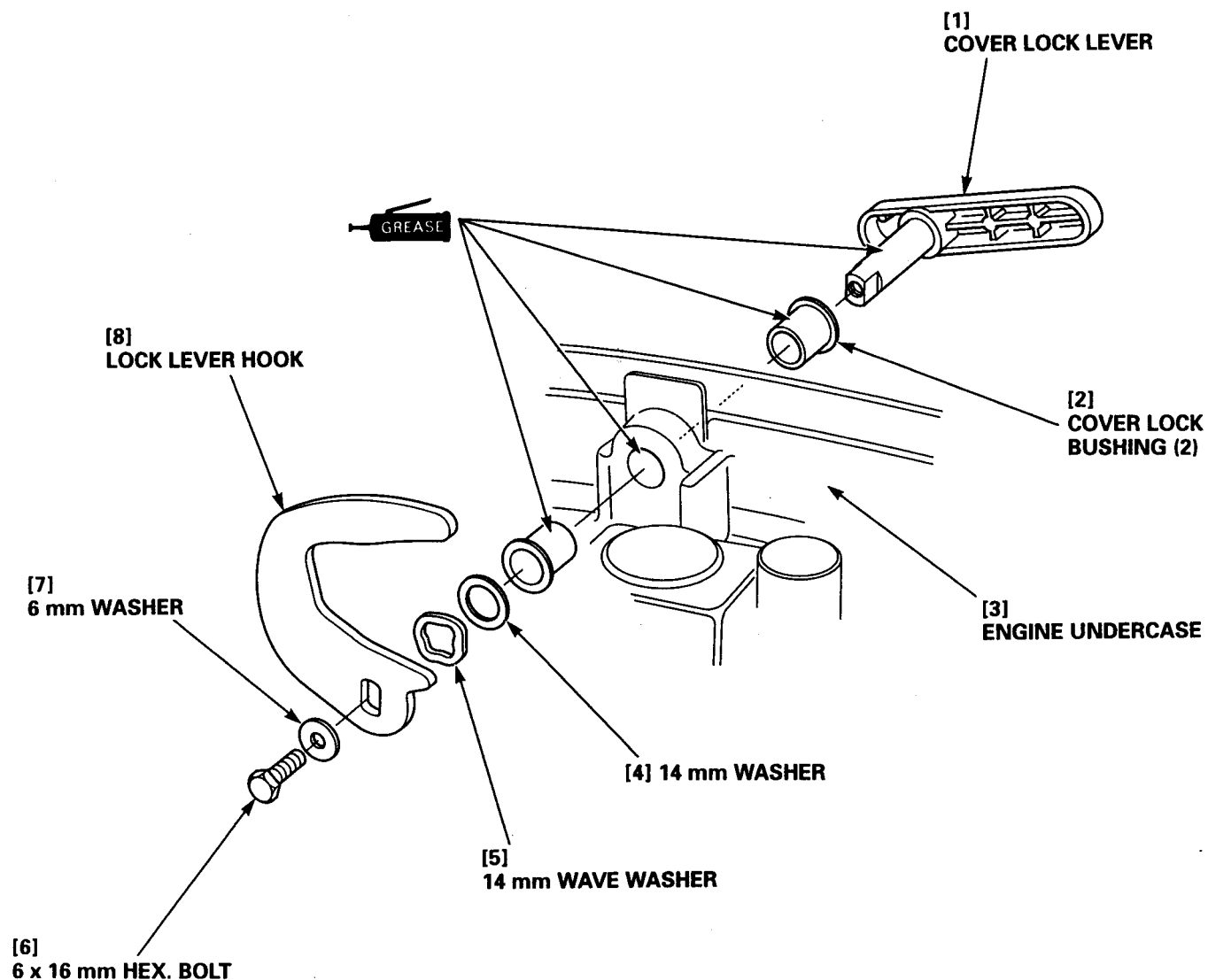


### 3. COVER LOCK LEVER

#### a. REMOVAL/INSTALLATION

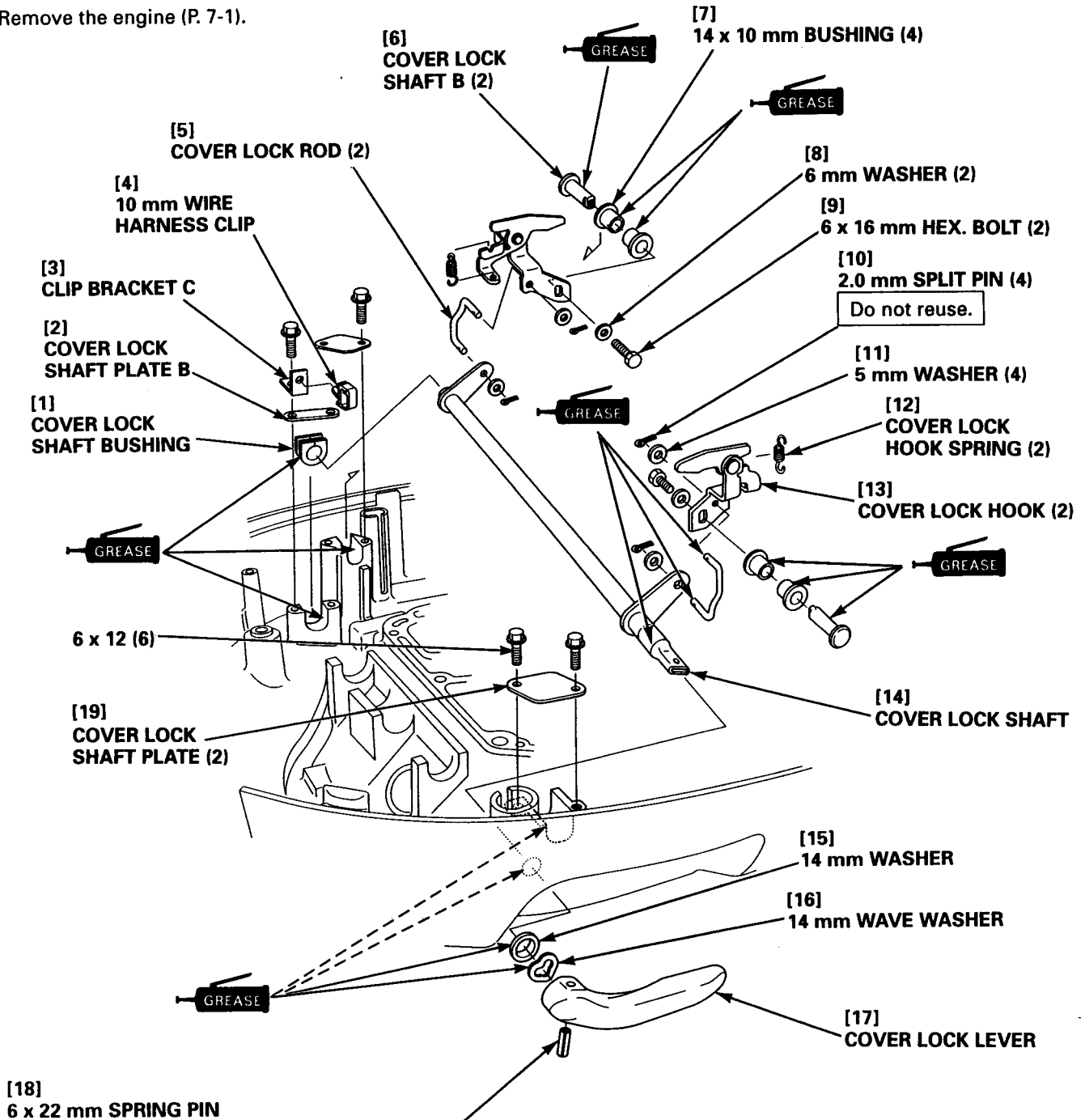
Remove the engine cover.

<Front side>



### <Rear side>

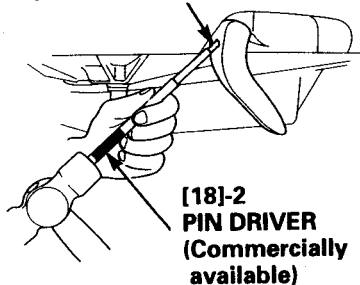
Remove the engine (P. 7-1).



#### REMOVAL/INSTALLATION:

- Remove/install the spring pin using a commercially available pin driver.
- Do not reuse.

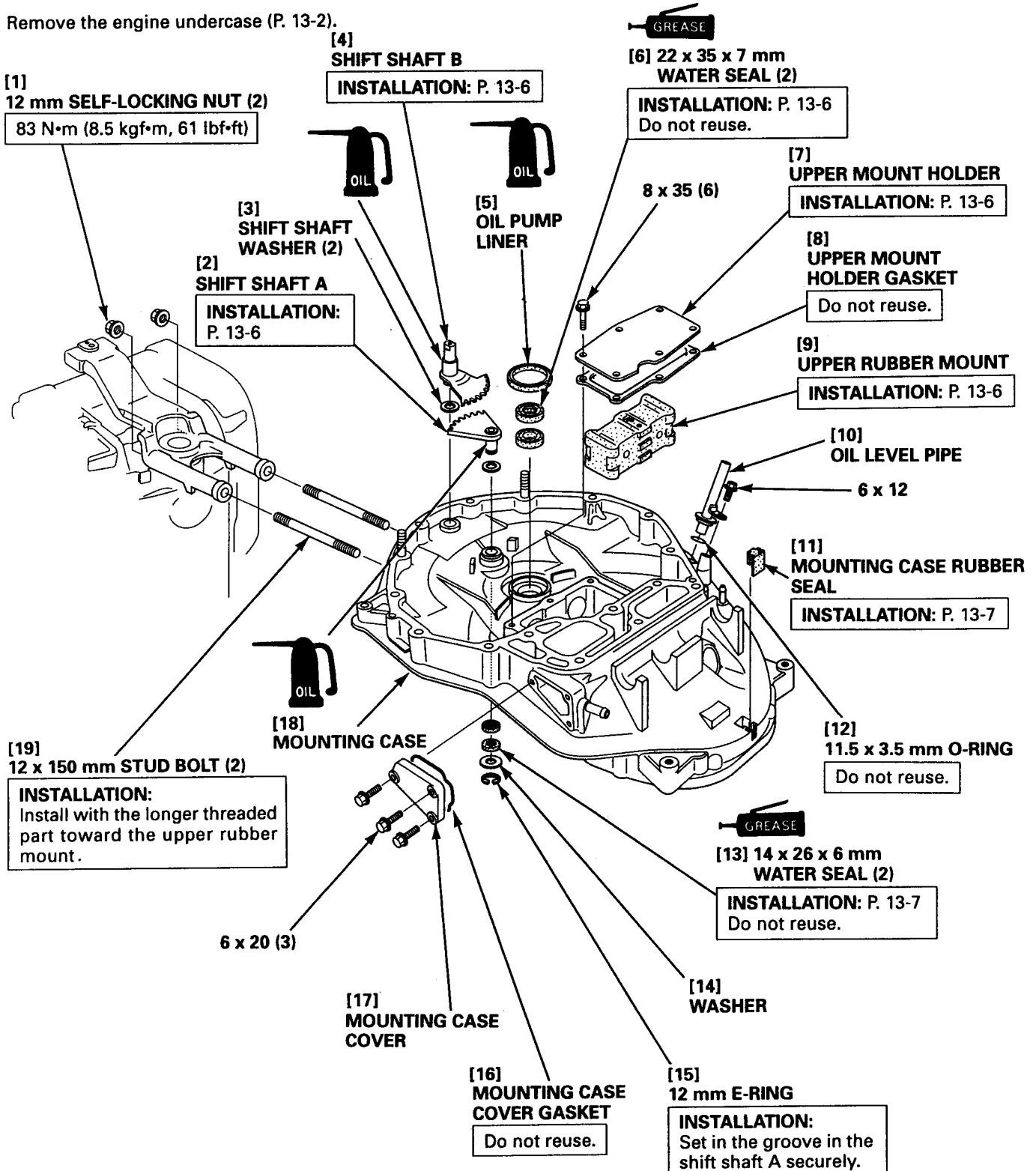
#### [18]-1 6 x 22 mm SPRING PIN



### 4. MOUNTING CASE/UPPER RUBBER MOUNT/SHIFT SHAFT A/B

#### a. REMOVAL/INSTALLATION

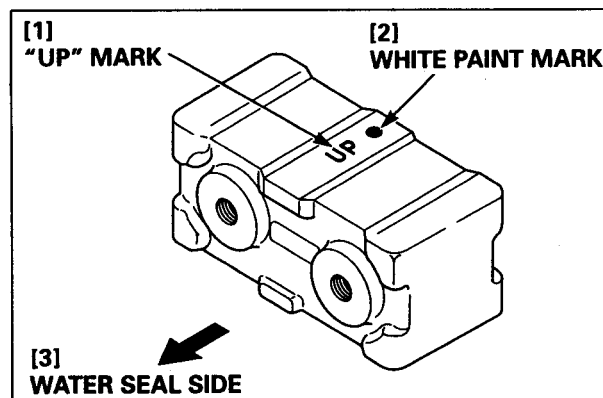
Remove the engine undercase (P. 13-2).



### • UPPER RUBBER MOUNT

#### INSTALLATION:

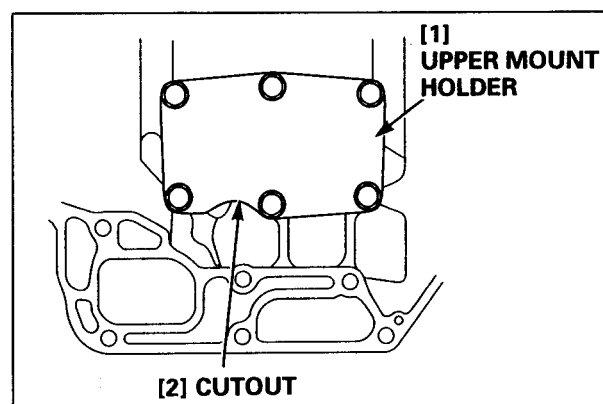
Install the upper rubber mount on the mounting case with the "UP" mark facing up and the white paint mark toward the opposite side from the water seal mounting part. Note the installation direction.



### • UPPER MOUNT HOLDER

#### INSTALLATION:

Install the upper mount holder on the mounting case with the cutout in the upper mount holder facing the opposite side from the water seal mounting part as shown. Note the installation direction.



### • 22 x 35 x 7 mm WATER SEAL

#### INSTALLATION:

- 1) Apply grease to the new water seals.
  - 2) Using the special tools, install the new water seals on the mounting case as shown.
  - 3) 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

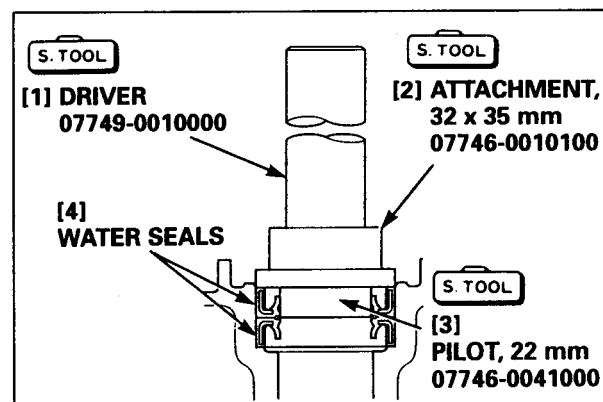
Attachment, 32 x 35 mm

Pilot, 22 mm

07749-0010000

07746-0010100

07746-0041000



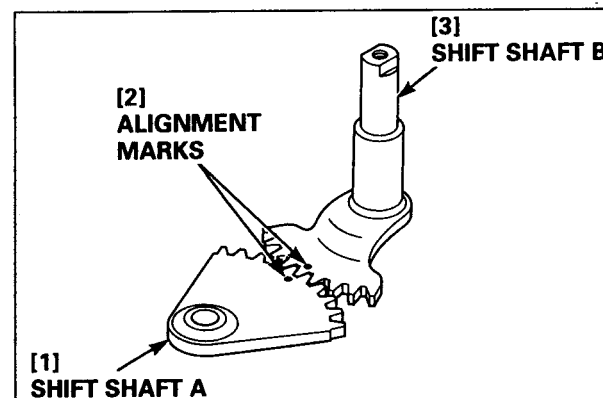
### • SHIFT SHAFT A/B

#### INSTALLATION:

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.

#### NOTE:

- 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.



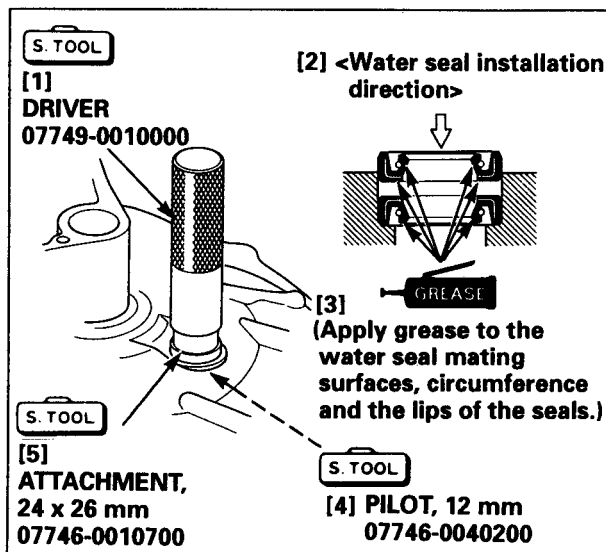
### • 14 x 26 x 6 mm WATER SEAL

#### INSTALLATION:

- 1) Apply grease to the circumference and lips of the new water seals.
- 2) Install the new water seals on the mounting 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



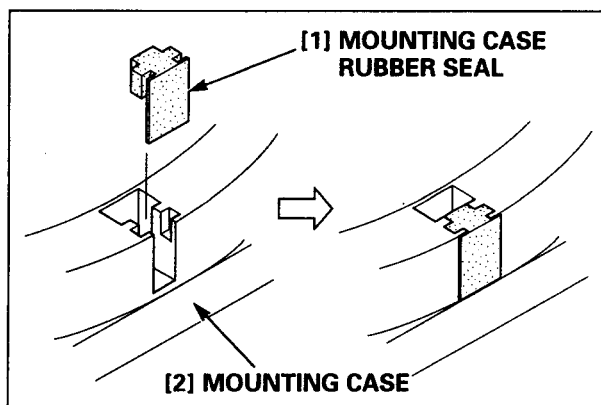
### • MOUNTING CASE RUBBER SEAL

#### INSTALLATION:

- 1) Check the rubber seal for cracks, deterioration and other damage, and replace if necessary.
- 2) Install the mounting case rubber seal on the mounting case as shown. Note the installation direction.

#### NOTE:

Set the rubber seal correctly, or water can enter the mounting case.



# 14. SWIVEL CASE/POWER TRIM/TILT ASSEMBLY

**HONDA**  
**BF115A•130A**

## 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 REMOVAL/INSTALLATION

### a. REMOVAL

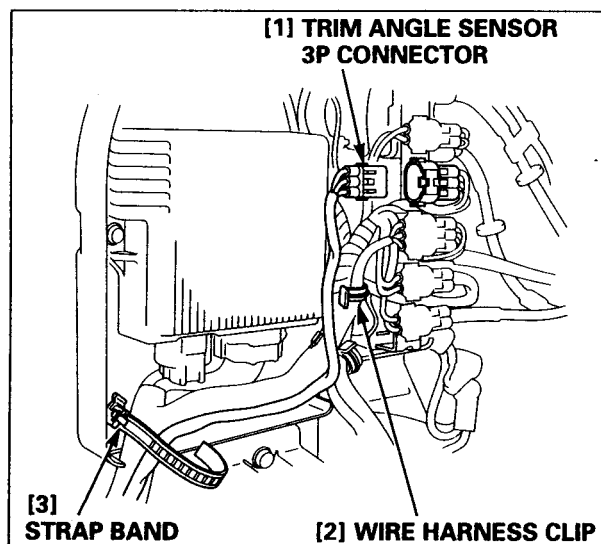
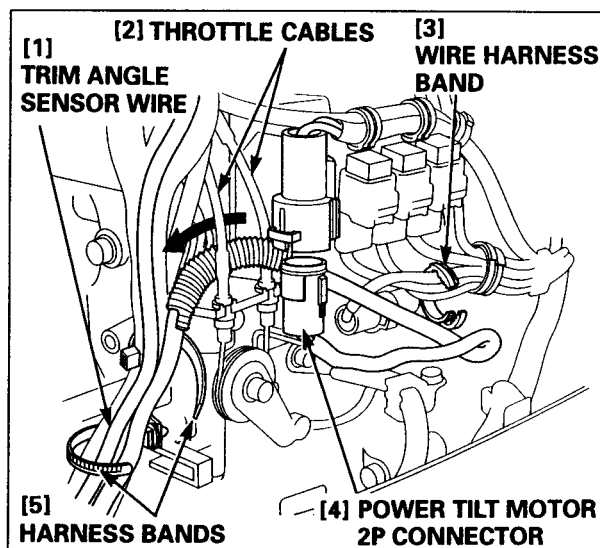
Set the outboard motor vertically (engine is set vertically) by adjusting with the adjusting rod.

Remove the following parts.

- Engine cover (P. 3-5)
- Gear case assembly (P. 12-2)
- Lower rubber motor mount (P. 12-47)
- Starter cable/remote control cable A/shift and throttle cables (P. 17-5)
- ECM cover (P. 17-21)

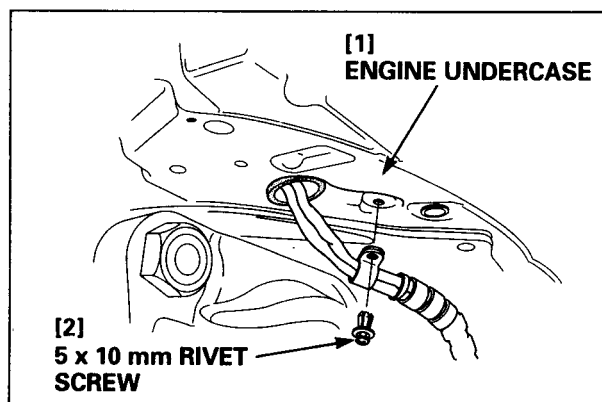
Be sure to remove the sensor nipple from the extension case (P. 12-47).

- 1) Open the two harness bands mounted on the shift link bracket, and release the power tilt motor wire and the trim angle sensor wire.
- 2) Open the wire harness band and release the power tilt motor wire.  
Disconnect the power tilt motor 2P connector, and remove the power tilt motor wire from between the throttle cables.
- 3) Open the strap band and release the trim angle sensor wire from the strap band and the wire harness clip. Disconnect the trim angle sensor 3P connector.



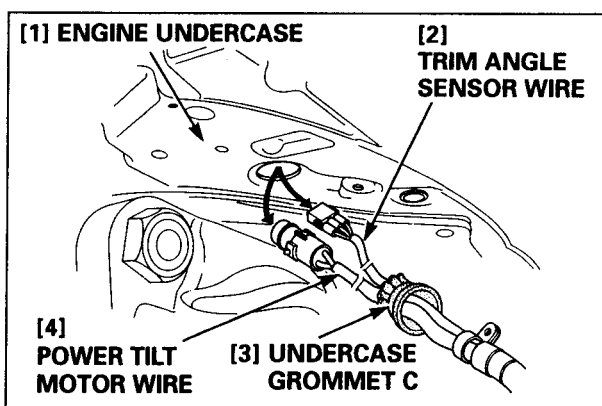


- 4) Remove the 5 x 10 mm rivet screw from the engine undercase.



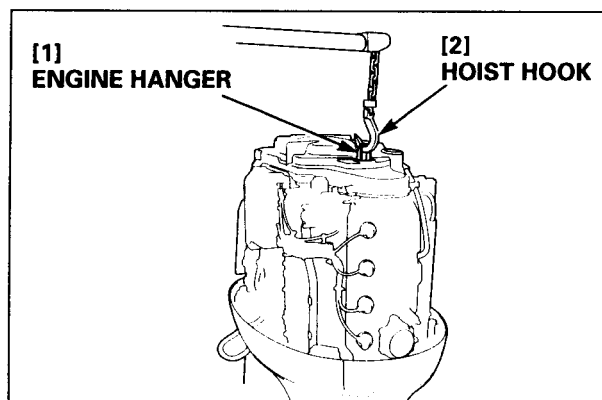
- 5) Remove the undercase grommet from the engine undercase.

Remove the trim angle sensor wire and the power tilt motor wire from the hole in the engine undercase.

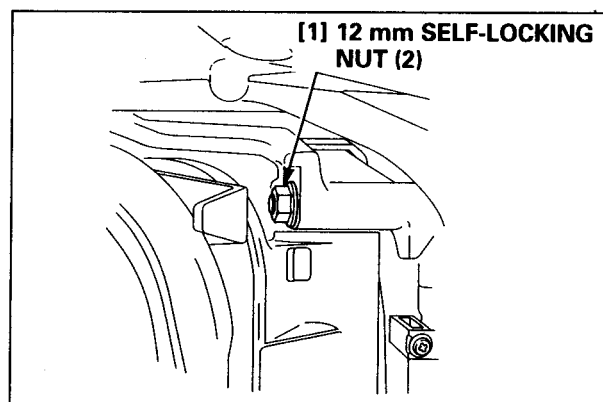


- 6) Hook the hoist hook on the engine hanger.

• Do not raise the outboard motor off the ground this time.



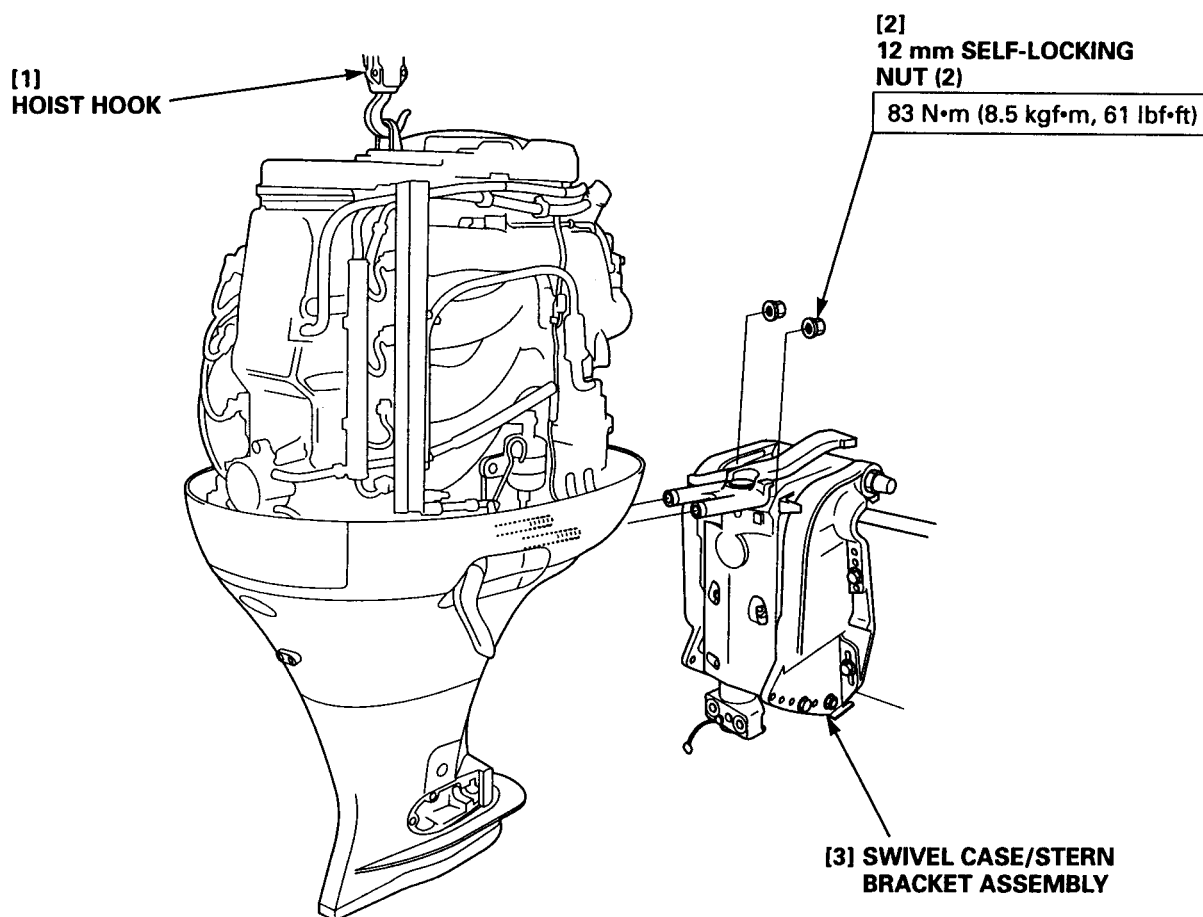
- 7) Remove the two 12 mm self-locking nut from the mounting frame.



- 8) While holding the outboard motor with the hoist, remove the swivel case/stern bracket assembly from the outboard motor. If it is hard to remove the swivel case/stern bracket assembly, remove by raising and lowering the outboard motor a little with the hoist.

- Do not raise the outboard motor stand off the ground while raising the outboard motor with the hoist.

- 9) After removing the swivel case/stern bracket assembly, lower the outboard motor slowly, and set it on the ground with the intake manifold side down.



### b. INSTALLATION:

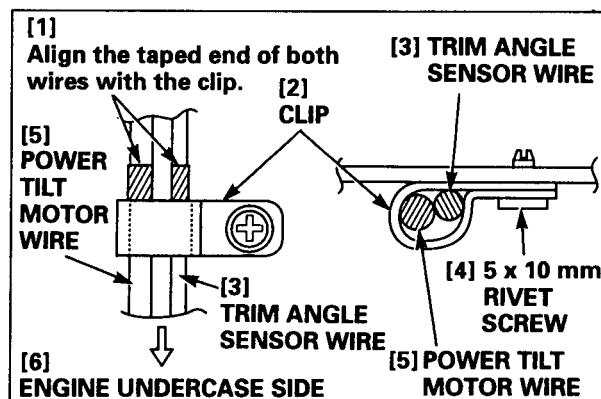
Installation is made in the reverse order of removal. Note the following.

- 1) Tighten the 12 mm self-locking nuts to the specified torque.

**TORQUE: 83 N·m (8.5 kgf·m, 61 lbf·ft)**

- 2) Connect the power tilt motor wire and the trim angle sensor wire so that the taped end of the wires align with the clip as shown.

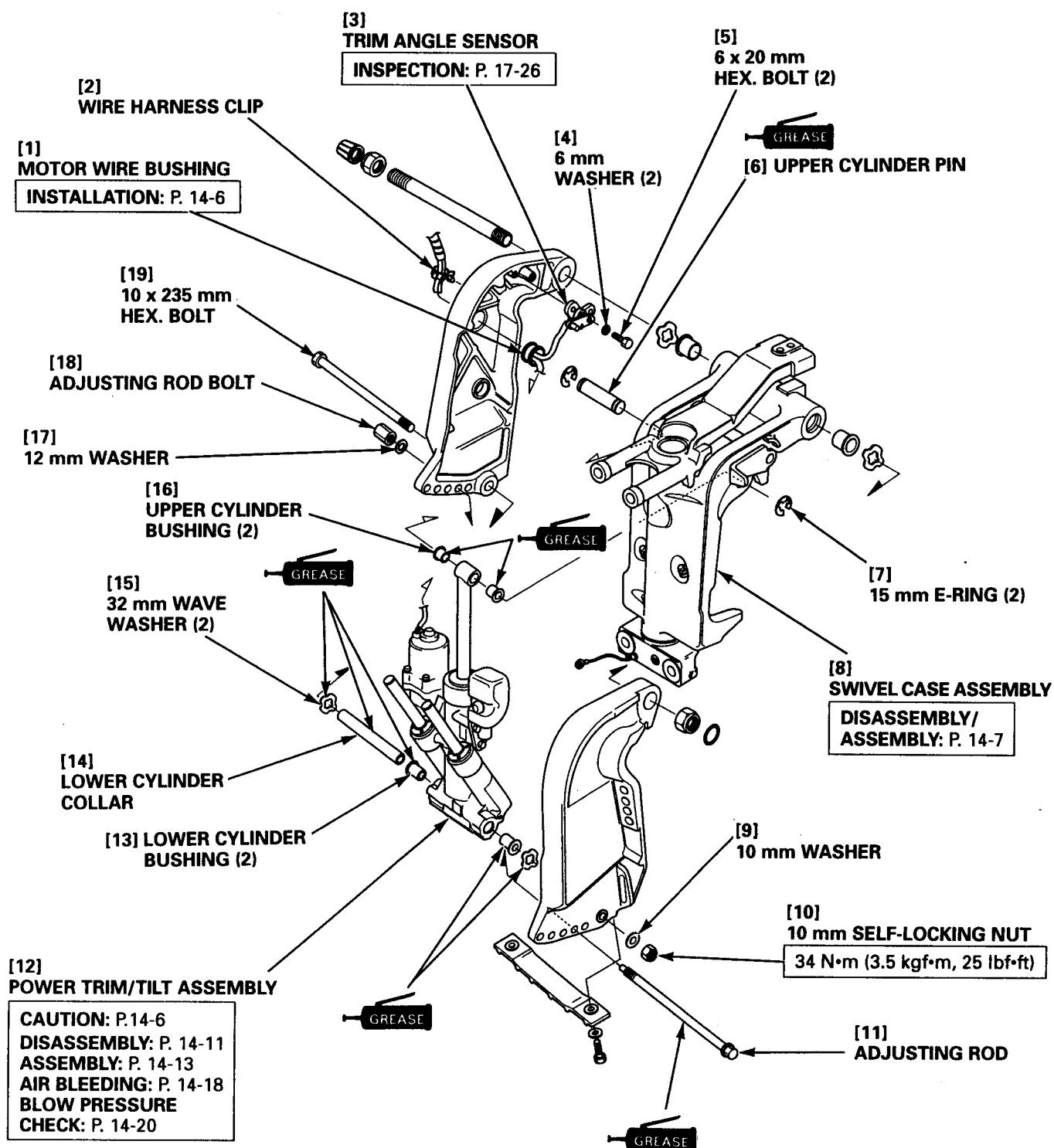
- 3) Tighten the 5 x 10 mm rivet screw.

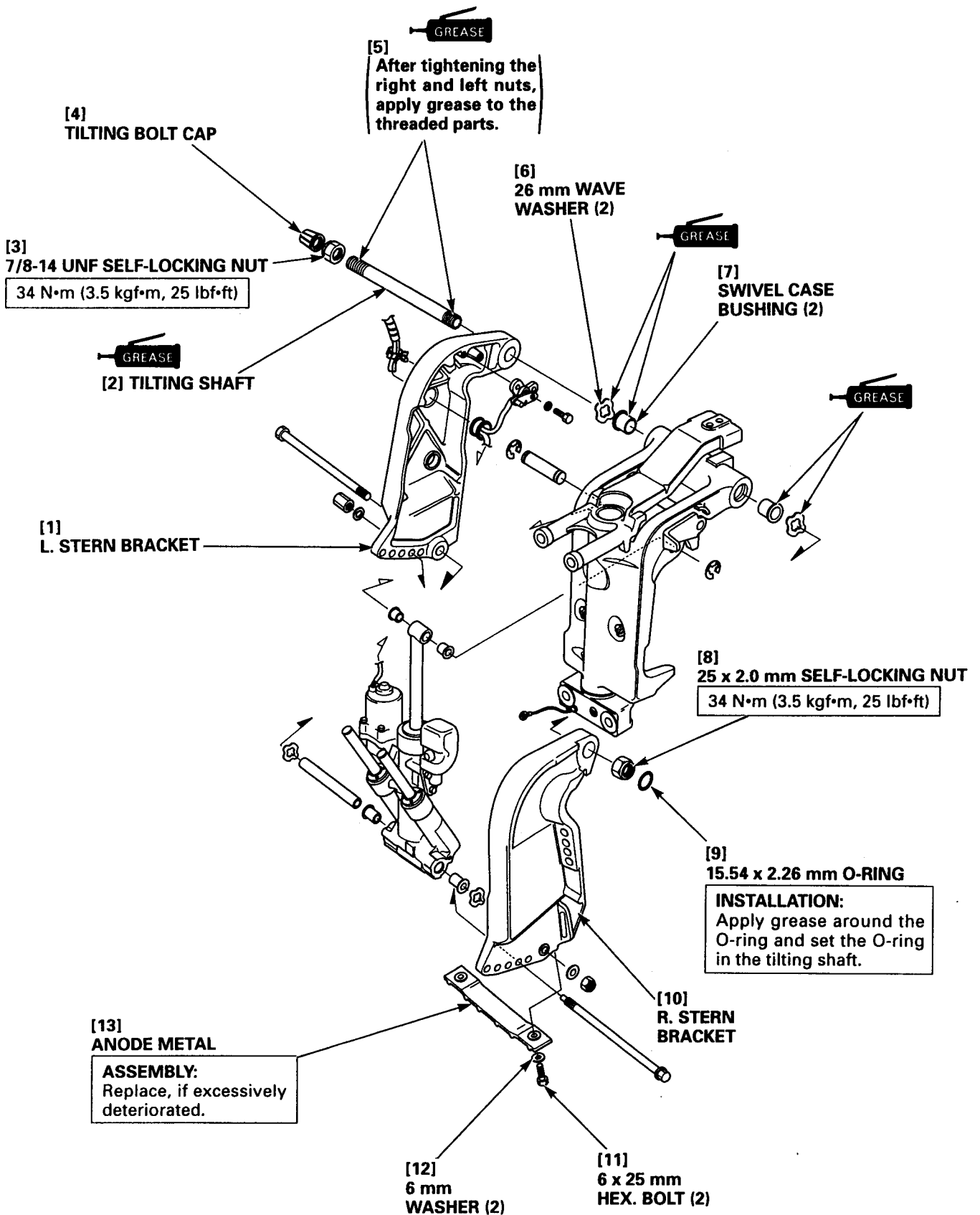


## 2. POWER TRIM/TILT ASSEMBLY/STERN BRACKET/SWIVEL CASE ASSEMBLY

### a. DISASSEMBLY/ASSEMBLY

- Loosen the manual valve fully and raise the swivel case to the uppermost position to remove the power trim/tilt assembly.

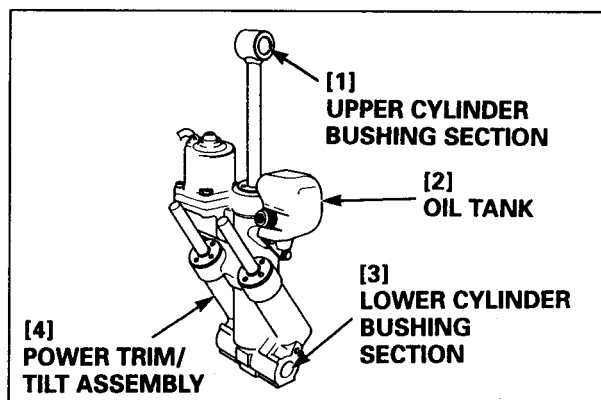




### • POWER TRIM/TILT ASSEMBLY

#### CAUTION:

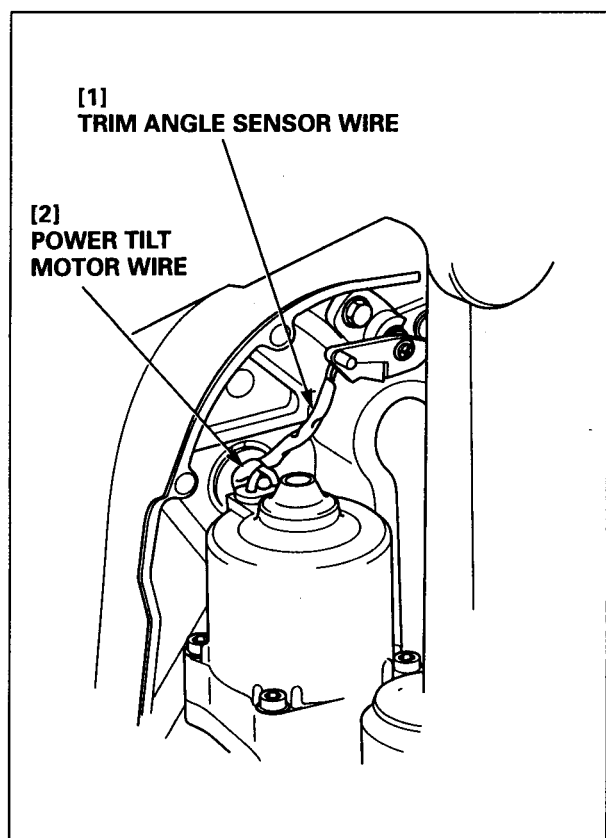
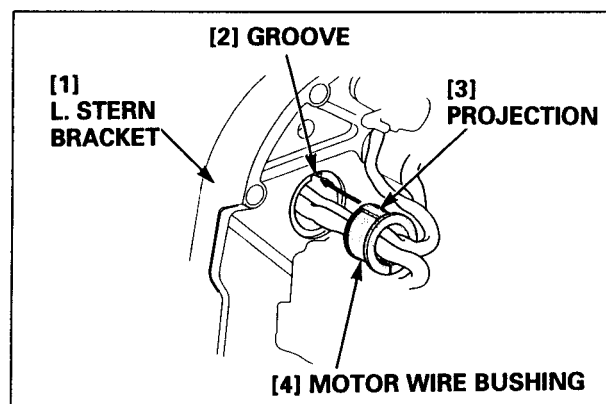
Store the power trim/tilt assembly vertical with the upper cylinder bushing section facing up after removal. Never store the power trim/tilt assembly with the motor assembly facing up or with the lower cylinder bushing section facing up.



### • MOTOR WIRE BUSHING

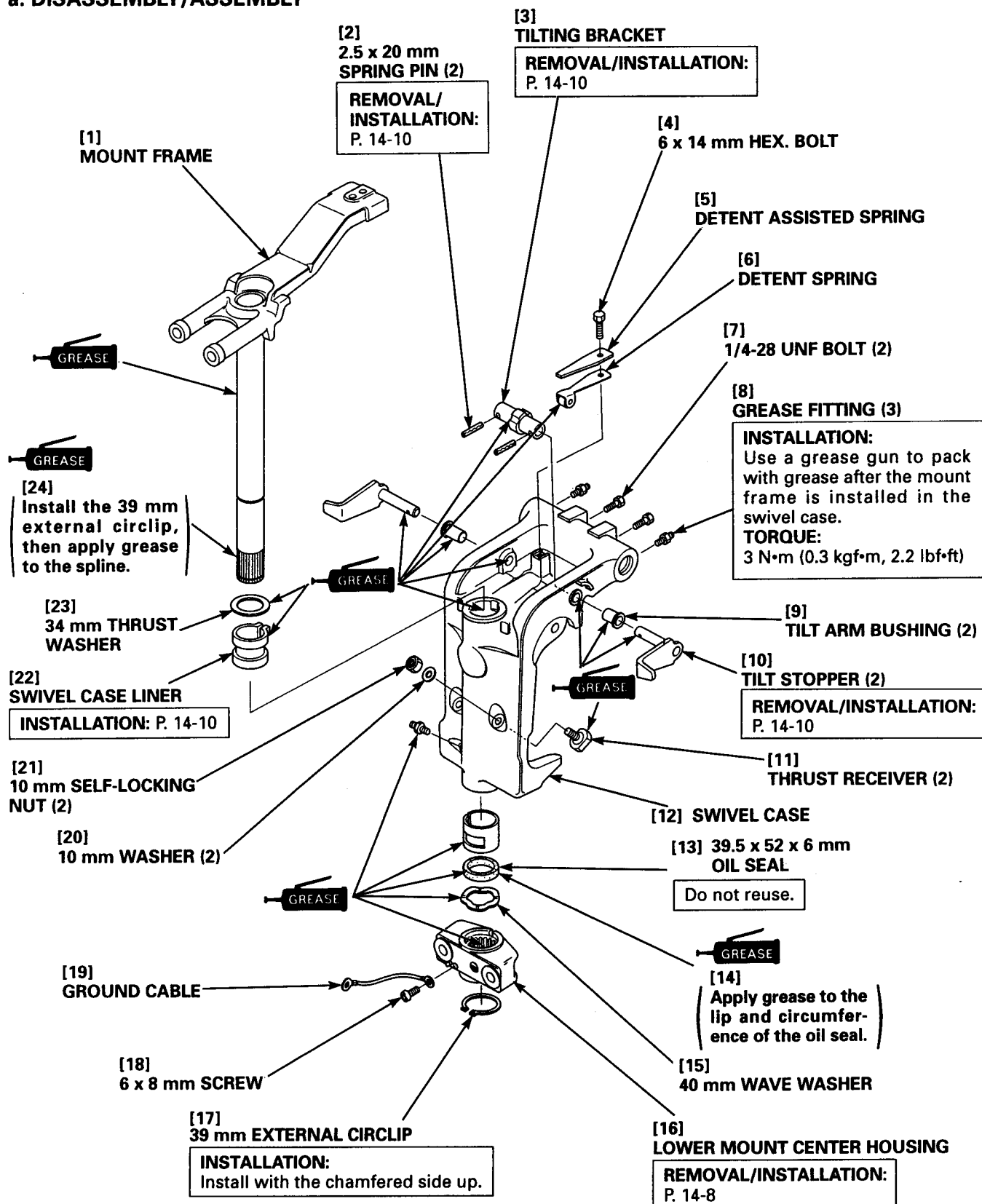
#### INSTALLATION:

- 1) Pass each wire through the motor wire bushing.
- 2) Install the motor wire bushing by aligning the projection on the motor wire bushing with the groove in the left stern bracket.
- 3) After installing the power trim/tilt assembly, check each wire and be sure they are not slack.



### 3. SWIVEL CASE/MOUNT FRAME

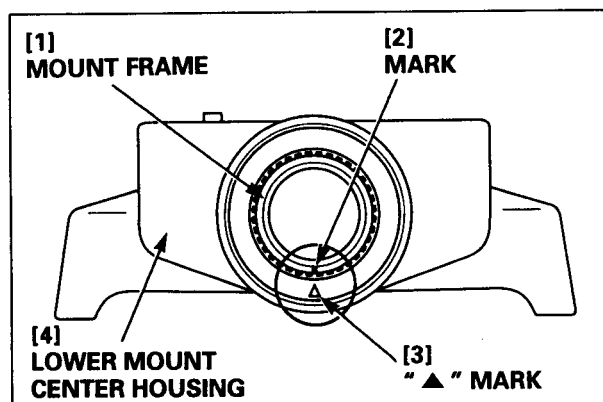
#### a. DISASSEMBLY/ASSEMBLY



### • LOWER MOUNT CENTER HOUSING

#### REMOVAL:

- 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 a hydraulic press and the special tools as shown.

#### TOOLS:

Driver

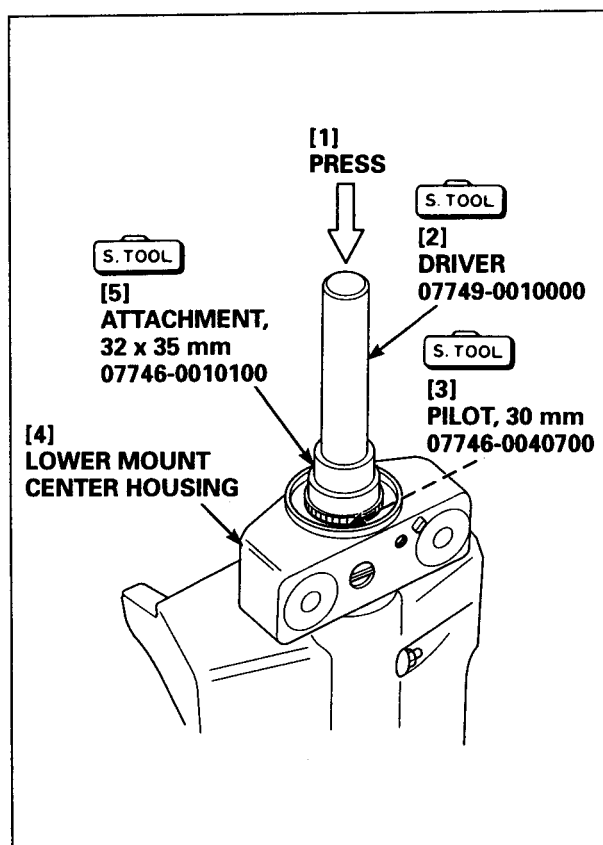
07749-0010000

Attachment, 32 x 35 mm

07746-0010100

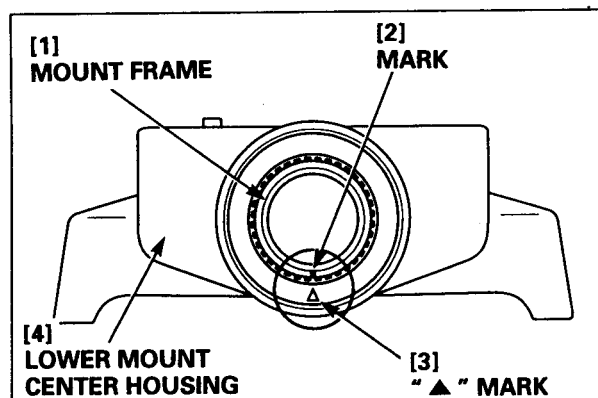
Pilot, 30 mm

07746-0040700



#### INSTALLATION:

- 1) Apply grease to the circumference and spline of the mount frame shaft, and set the mount frame in the swivel case.
- 2) 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.

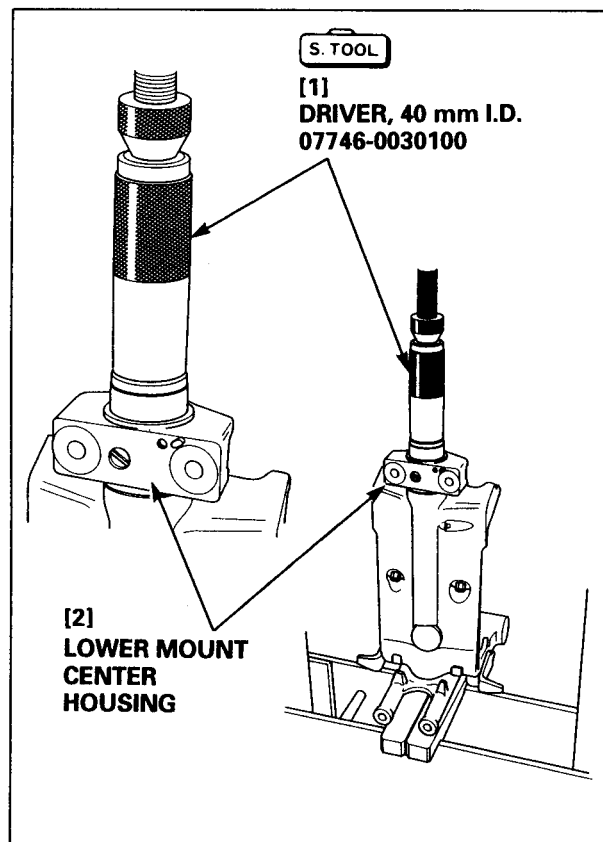


- 3) Set the swivel case/mount frame on a hydraulic press as shown.
- 4) Set the special tool on the lower mount center housing as shown, and press the lower mount center housing until it contacts the swivel case (i.e. until the hydraulic pressure of the press rises slightly).

**TOOL:**

Driver, 40 mm I.D.

07746-0030100



- 5) Remove the swivel case assembly and the special tool from the hydraulic press.
- 6) 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

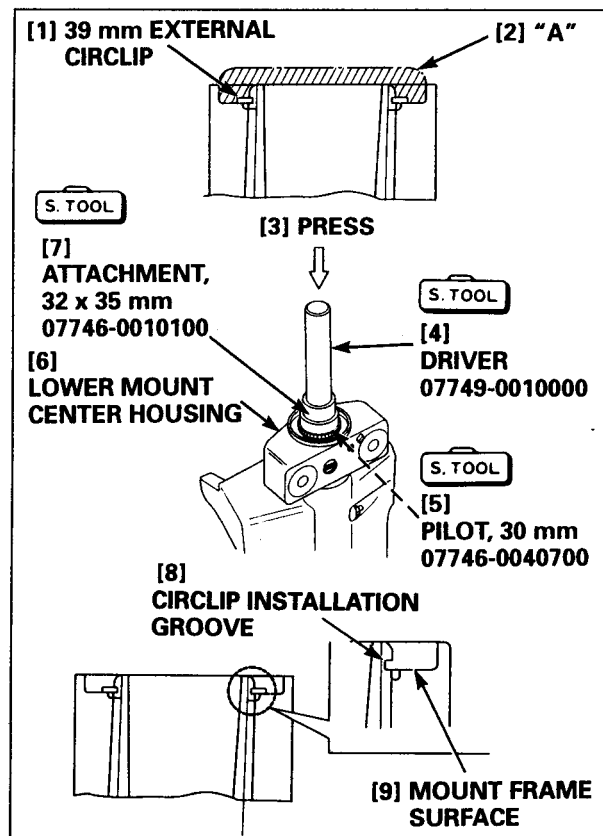
07746-0040700

<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 puller and the special tools.
- 3) Install the 39 mm external circlip, and apply grease to the part "A" shown in the drawing.





### • TILT STOPPER/2.5 x 20 mm SPRING PIN/TILTING BRACKET

#### REMOVAL:

Remove the 2.5 x 20 mm spring pins using a commercially available 2.5 mm or 3/32-inch pin punch. Remove the tilt stopper and tilting bracket.

#### INSTALLATION:

- 1) Place the tilt arm bushing and the tilt stoppers on both sides of the swivel case.
- 2) 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.
- 3) 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.

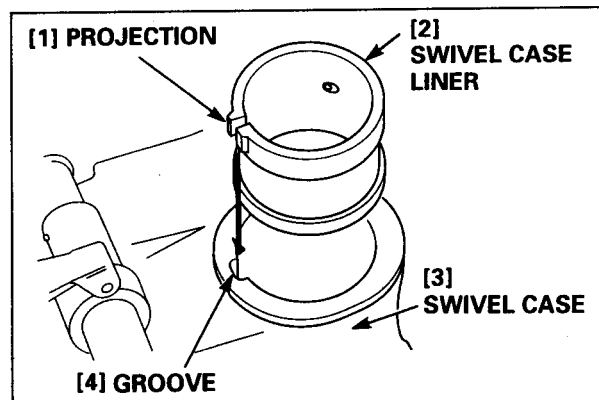
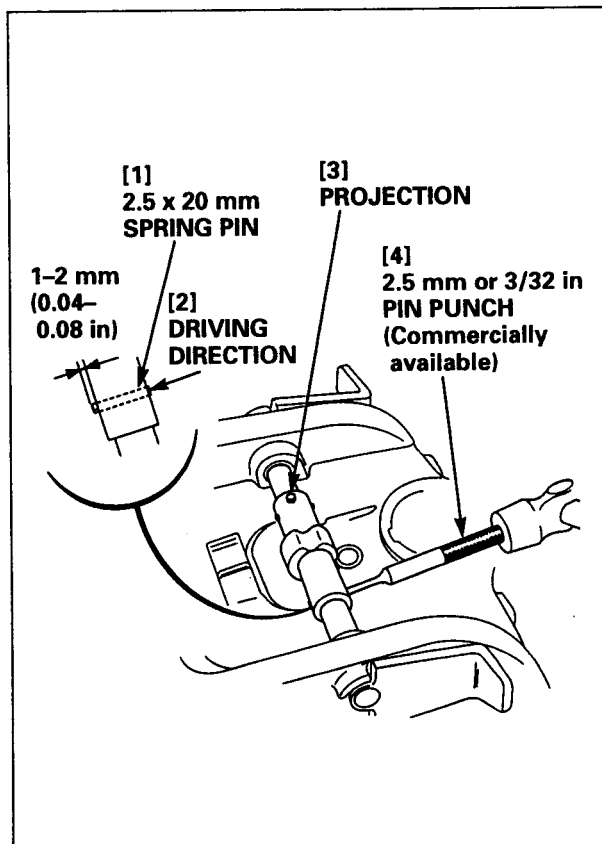
#### NOTE:

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).

### • SWIVEL CASE LINER

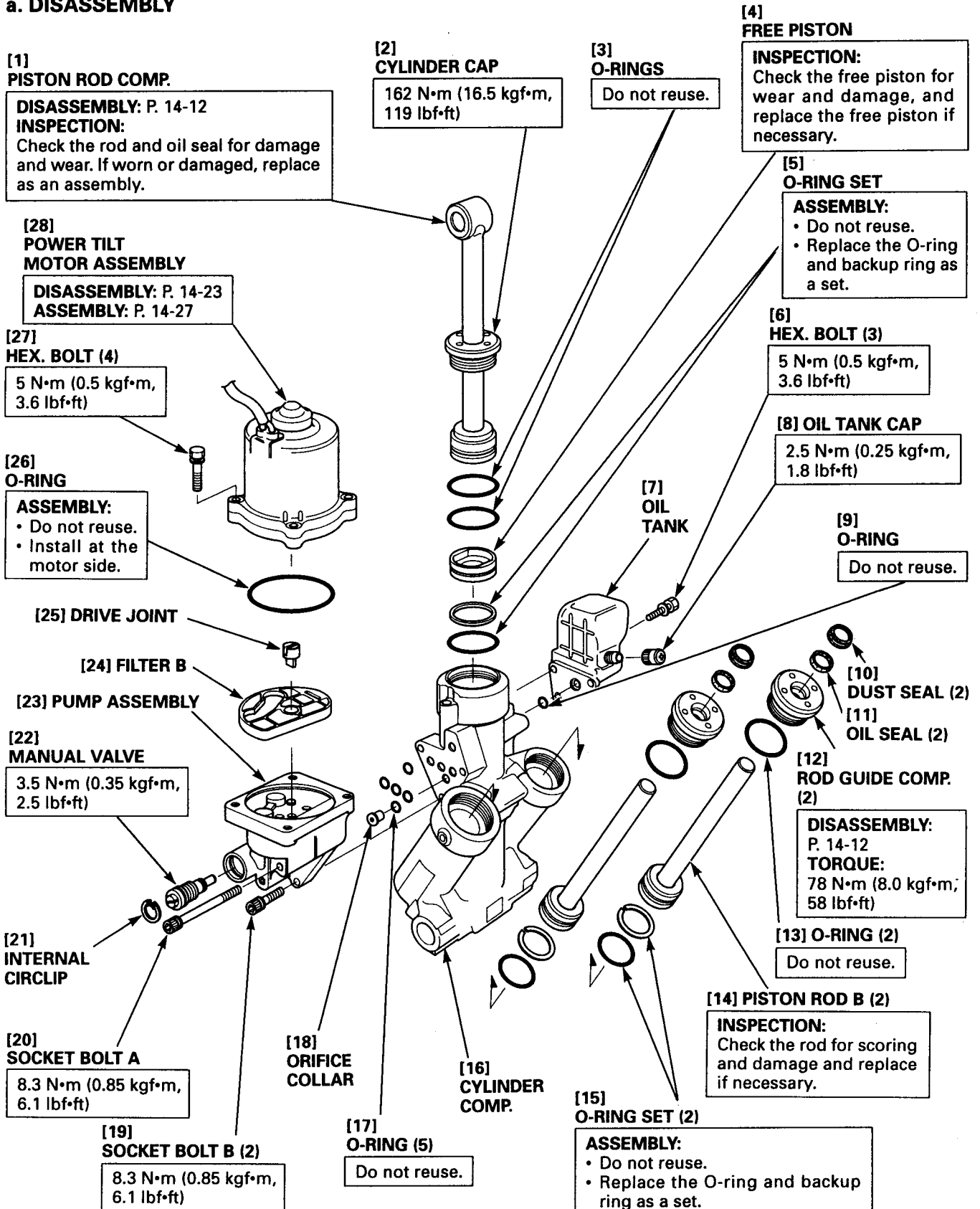
#### INSTALLATION:

- 1) Apply grease to the circumference of the swivel case liner.
- 2) Install the swivel case liner by aligning the projection on the swivel case liner with the groove in the swivel case.



### 4. POWER TRIM/TILT ASSEMBLY

#### a. DISASSEMBLY



### • PISTON ROD COMP

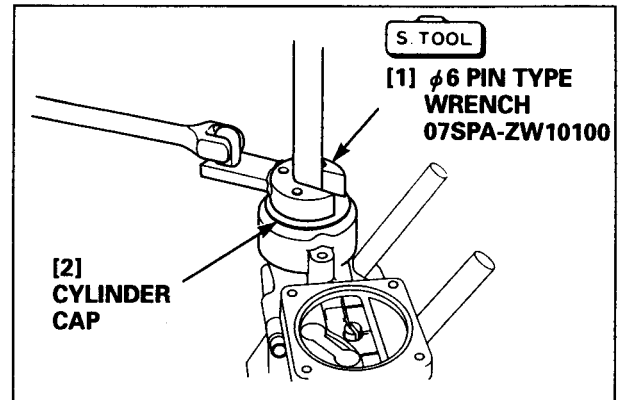
#### DISASSEMBLY:

- 1) Hold the cylinder comp with a vice (P. 14-13).
- 2) The piston rod comp. must be extended fully.
- 3) Set the special tool on the cylinder cap as shown, and remove the piston rod comp.

#### TOOL:

φ 6 pin type wrench

07SPA-ZW10100



### • ROD GUIDE COMP

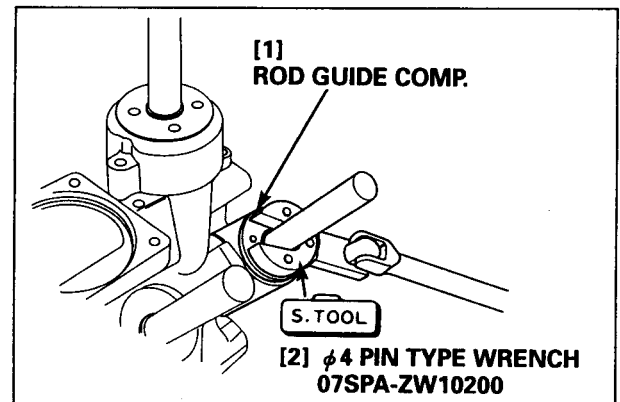
#### DISASSEMBLY:

- 1) Hold the cylinder comp with a vice (P. 14-13).
- 2) The right and left piston rod B must be extended fully.
- 3) Remove the rod guide comp. using the special tool as shown.

#### TOOL:

φ 4 pin type wrench

07SPA-ZW10200



### b. ASSEMBLY

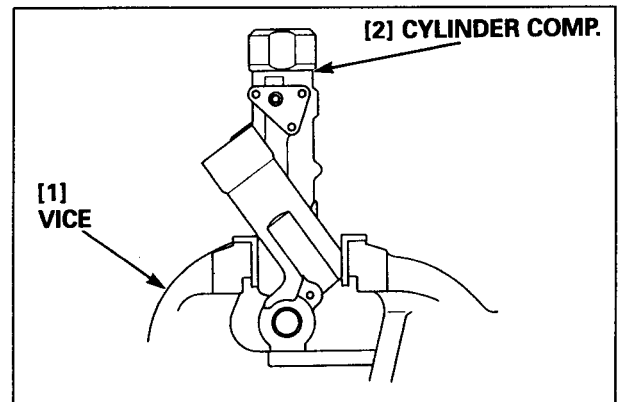
#### NOTE:

- Do not reuse the O-rings
- 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 in a vice as shown.

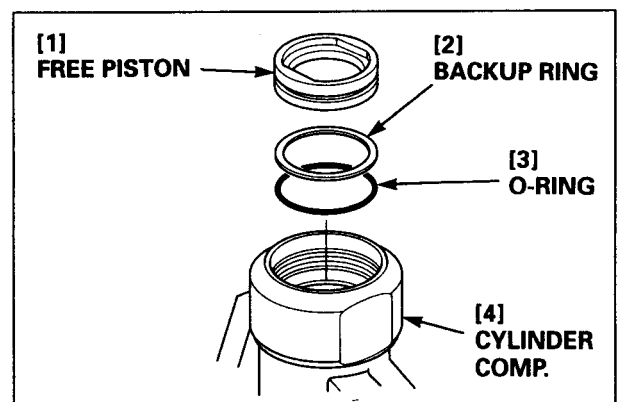
#### NOTE:

Take care not to tighten the vice excessively, as it damages the cylinder comp.



- 2) Pour approximately 30 cm<sup>3</sup> (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
-----------------	--

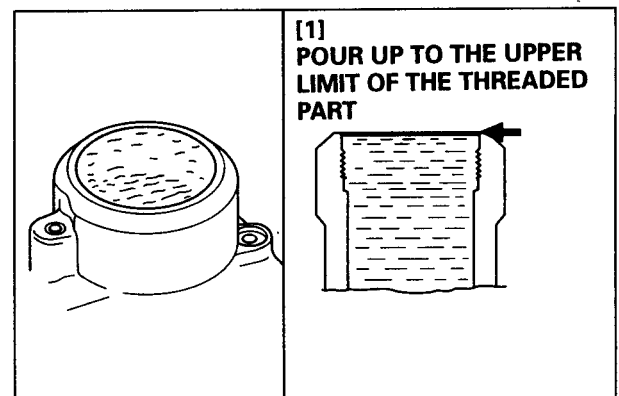


- 3) Check the free piston for wear and damage and replace if necessary.

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.

**NOTE:**

When installing the piston rod comp., do not push the piston rod comp. into the cylinder comp.

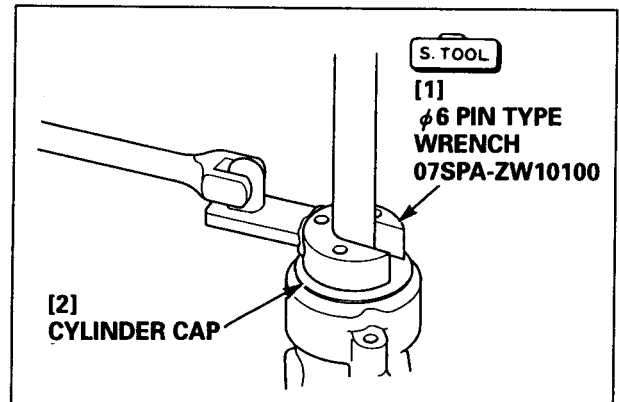
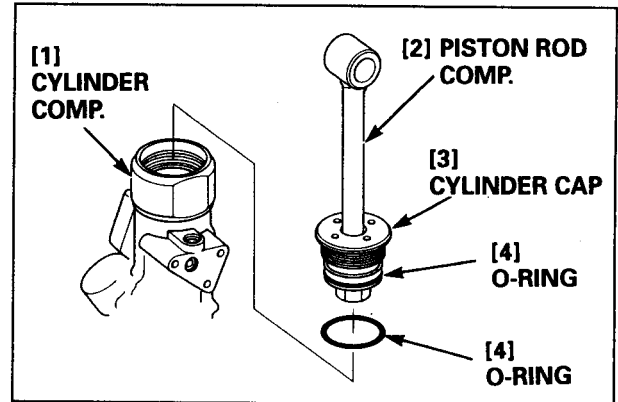
- 9) Using the special tool, tighten the cylinder cap to the specified torque.

**TORQUE: 162 N·m (16.5 kgf·m, 119 lbf·ft)**

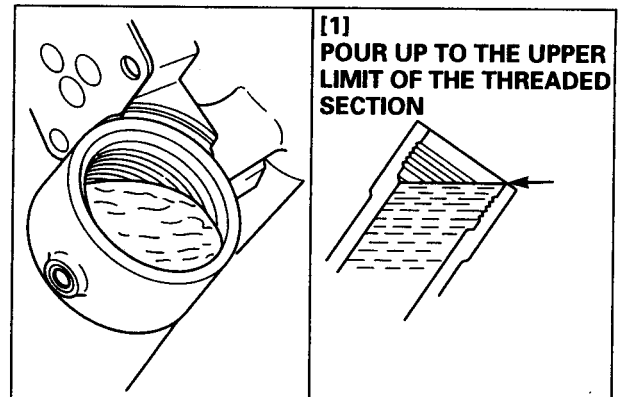
**TOOL:**

φ 6 pin type wrench

07SPA-ZW10100



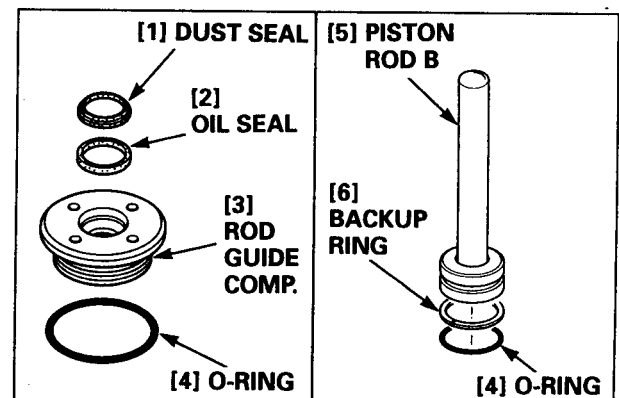
- 10) Pour new Automatic Transmission Fluid (ATF) to the upper limit of the right and left trim cylinders.



- 11) Install a new dust seal inside the rod guide comp.

Install a new O-ring and oil seal on the rod guide comp.

- 12) Install a new backup ring and O-ring on the piston rod B.



- 13) 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.

**NOTE:**

Do not install the piston rod Bs by pushing them into the respective trim cylinders.

- 14) Install piston rod B in the right and left trim cylinders slowly.

- 15) 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.

**NOTE:**

Take care not to push the piston rod B into the trim cylinders when tightening the rod guide comp. against the cylinder comp.

- 16) 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:**

φ 4 pin type wrench

07SPA-ZW10200

- 17) Check the manual valve for wear and damage and replace if necessary.

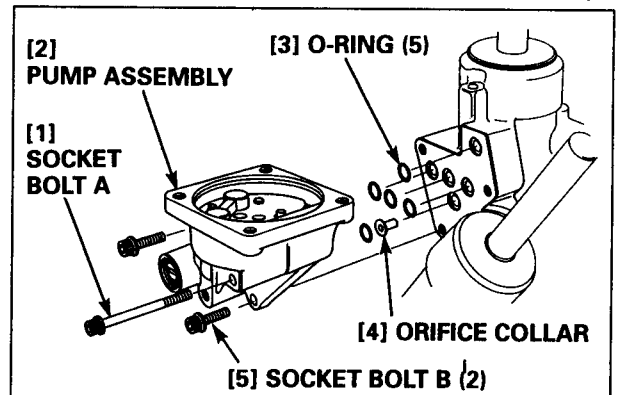
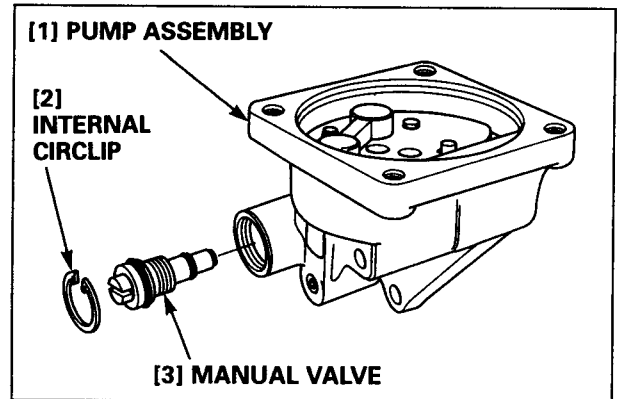
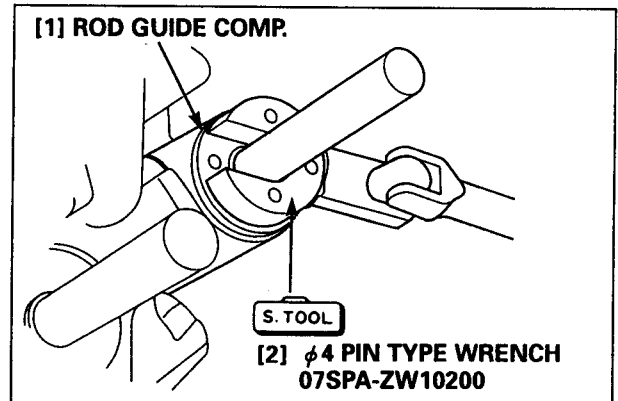
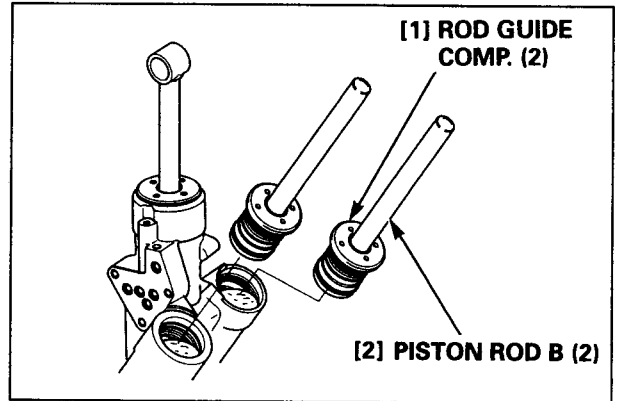
- 18) Tighten the manual valve against the pump assembly securely.

**TORQUE: 3.5 N·m (0.35 kgf·m, 2.5 lbf·ft)**

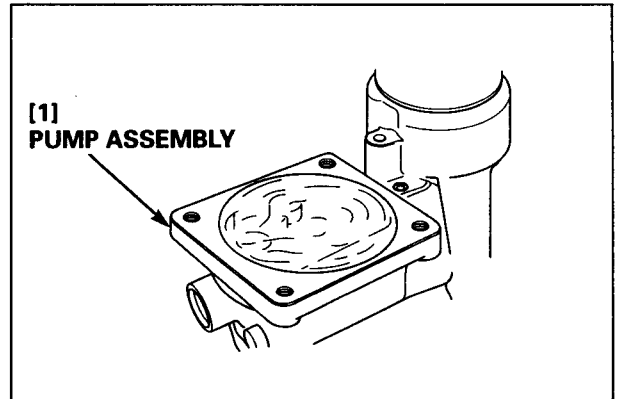
Install the internal circlip.

- 19) 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)**



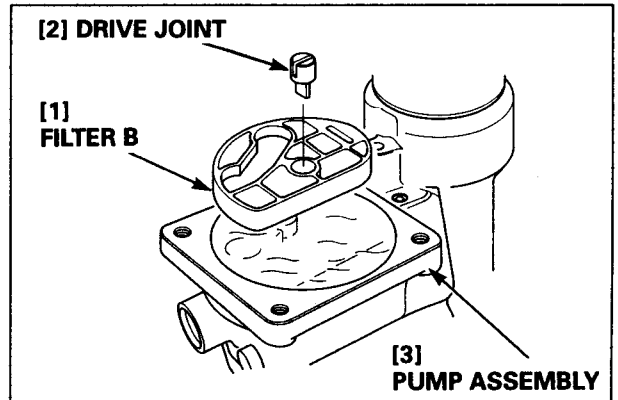
- 20) Fill the pump assembly fully with new Automatic Transmission Fluid (ATF).



- 21) 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.

- 22) Install filter B and the drive joint on the pump assembly.

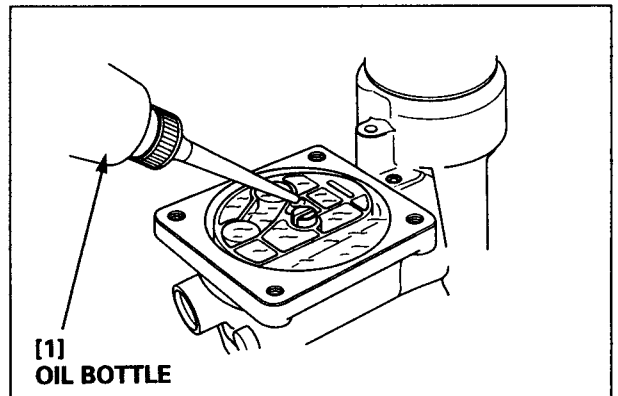


- 23) After installation, check filter B for bubbles. Remove the bubbles with the oil bottle or an equivalent tool if necessary.

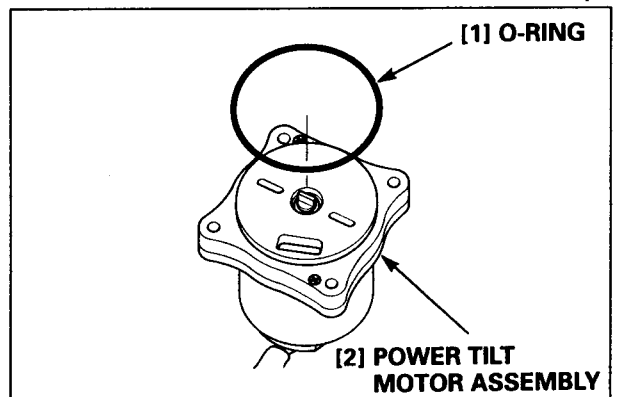
**NOTE:**

Be sure to remove the air bubbles, or it will cause air in the system.

- 24) After removing the air bubbles, fill the pump assembly fully with Automatic Transmission Fluid (ATF) again.



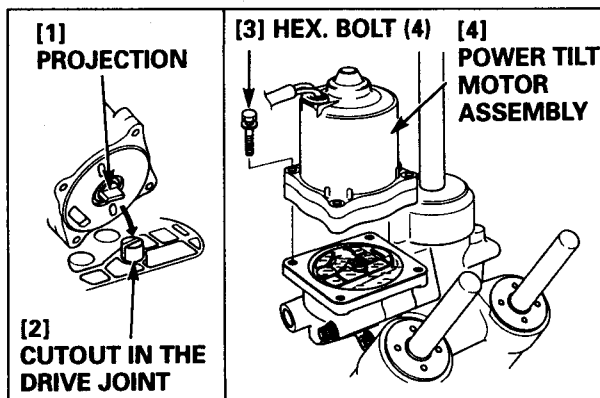
- 25) Install a new O-ring on the power tilt motor assembly.



- 26) 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.

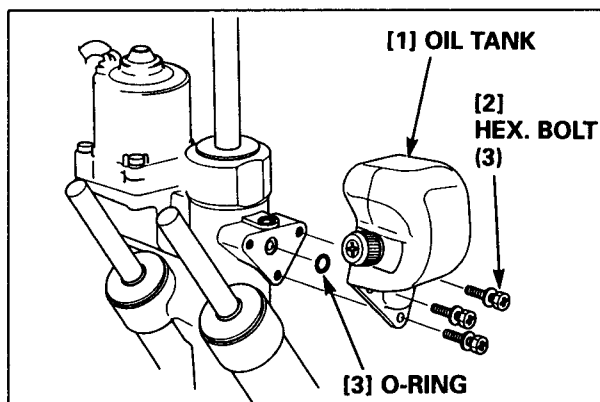
Tighten the four hex. bolts to the specified torque.

**TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)**



- 27) 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)**



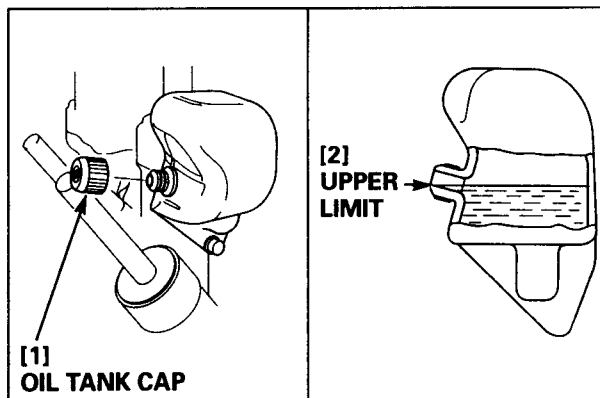
- 28) Remove the oil tank cap. Pour new Automatic Transmission Fluid (ATF) to the upper limit of the oil tank filler port.

Oil capacity	0.68 ℓ (0.72 US qt, 0.60 Imp qt)
--------------	----------------------------------

**NOTE:**

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.

- 29) After filling the oil tank with ATF, bleed air from the power tilt/trim assembly (without mounting on the outboard motor) (P. 14-18).





### c. 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 (P. 17-8).
- Connect the power tilt motor 2P connector to the power tilt relay.

- Be sure that the starter cables are connected to the battery.

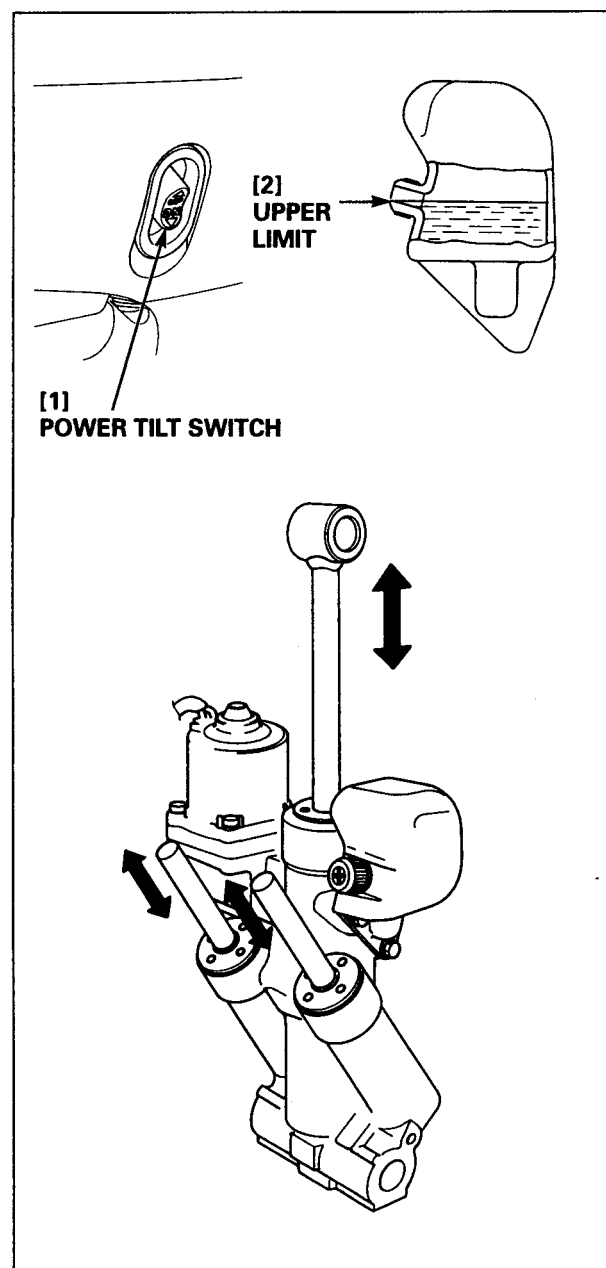
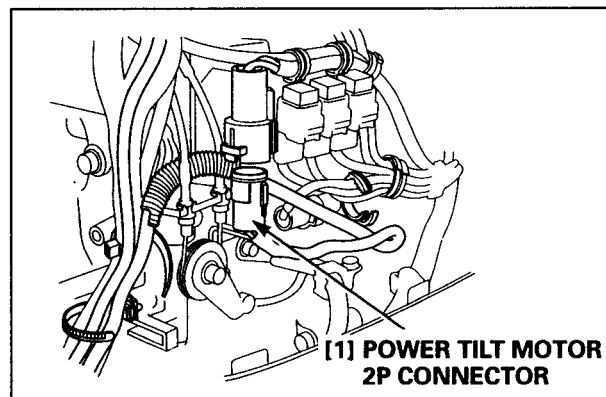
- 1) Hold the power trim/tilt assembly vertically.
- 2) Push the “DN” side of the power tilt switch to compress each rod fully.
- 3) Push the “UP” side of the power tilt switch to extend each rod fully.
- 4) Remove the oil tank cap with each rod extended fully. Check whether the Automatic Transmission 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.

#### NOTE:

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. 14-20) and air bleeding with the unit mounted on the outboard motor (P. 14-19).
  - When the rods do not compress fully, perform the procedure explained under <when the rods do not compress fully> (P. 14-19).



### <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. 14-20).

- 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. 14-20).

- 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. 14-20).

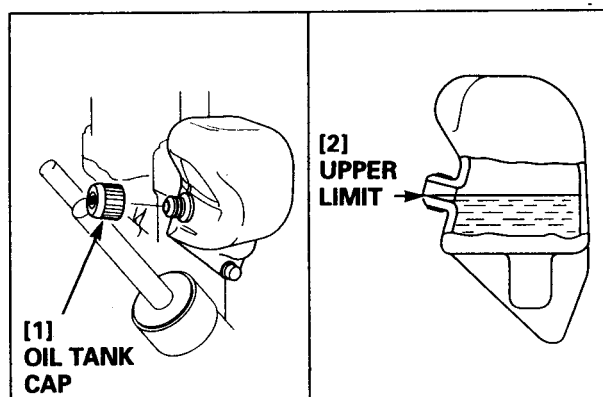
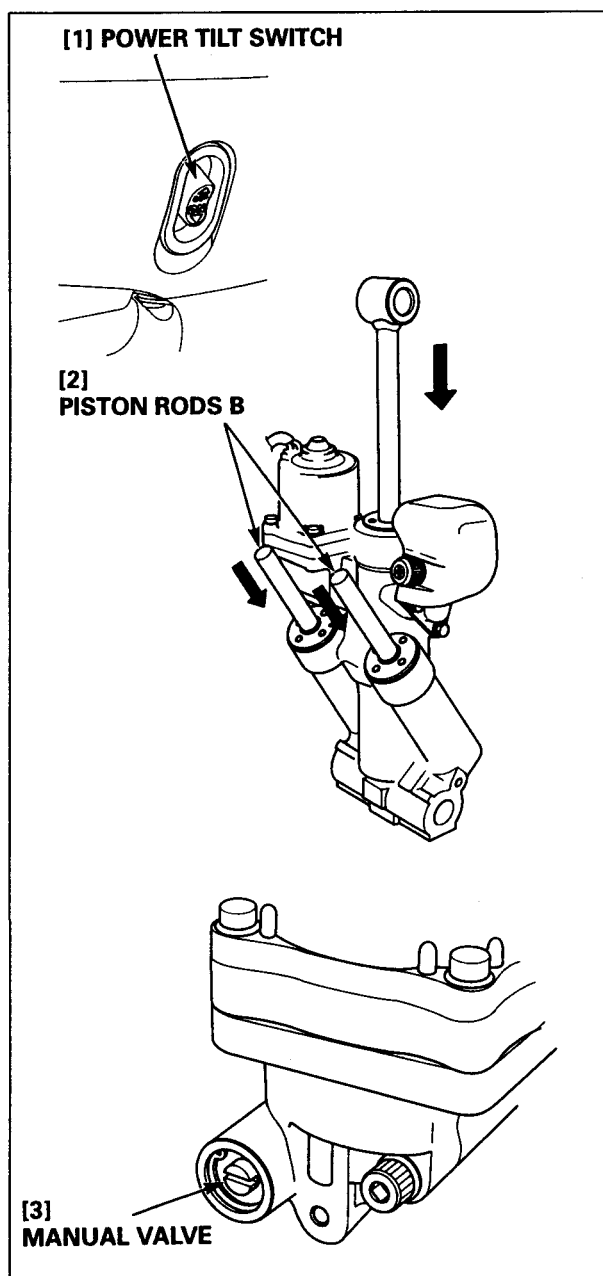
- 4) If the rods do not compress after the above operations, disassemble and reassemble the power trim/tilt assembly (P. 14-11 through 17), and bleed air with the power trim/tilt assembly not mounted on the outboard motor (P. 14-18).

### <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.

### d. 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.

#### NOTE:

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 (oil pressure gauge joint B) to the manual valve installation section as shown.

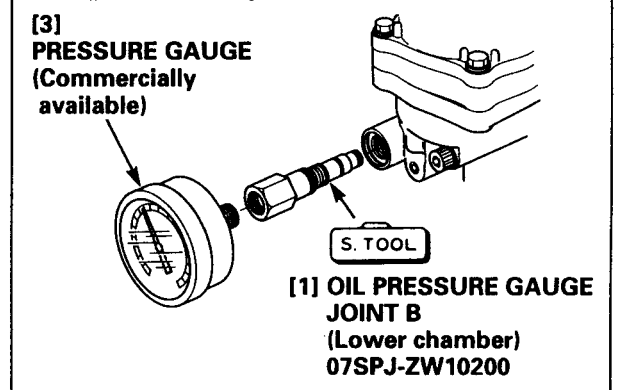
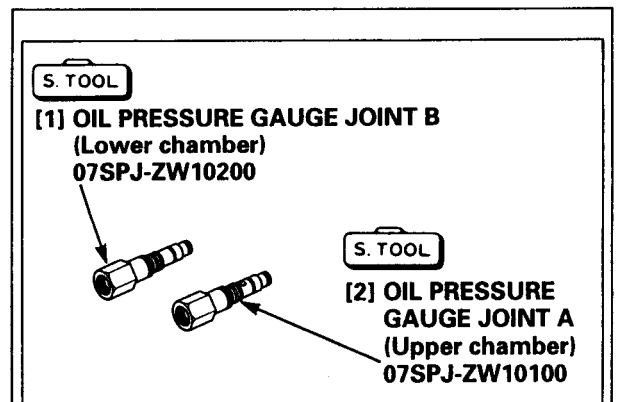
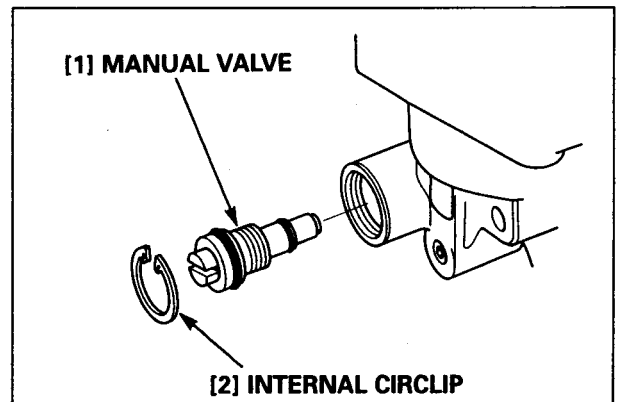
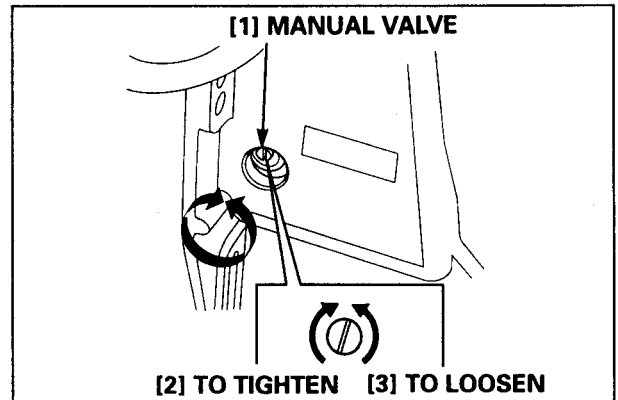
**TORQUE: 9 N·m (0.9 kgf·m, 6.5 lbf·ft)**

- 3) Attach the pressure gauge (commercially available) which measures 14,710 kPa (150 kgf/cm<sup>2</sup>, 2,133 psi) or above [P/F 1/4] to the special tool (oil pressure gauge joint B).

#### TOOL:

Oil pressure gauge joint B

07SPJ-ZW10200



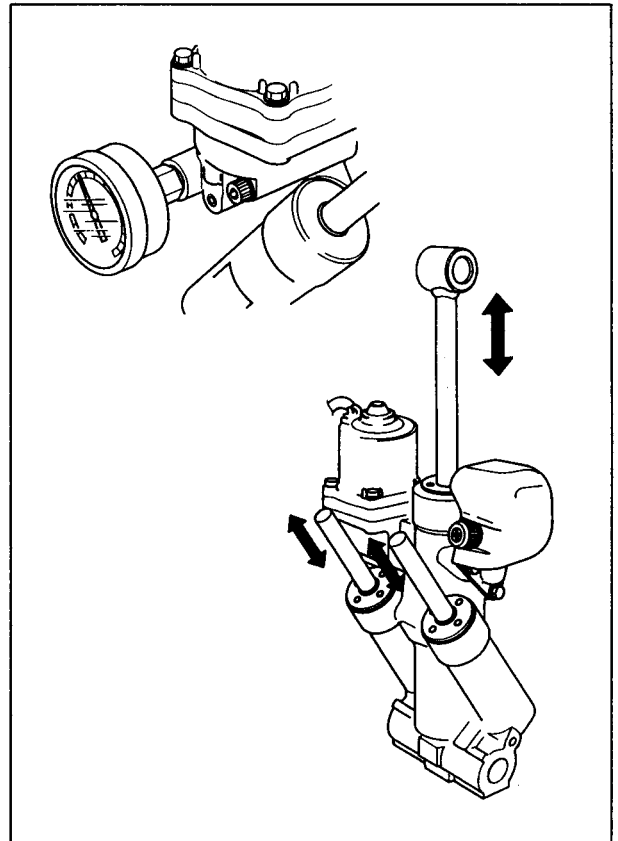
- 4) Remove the oil tank cap and check whether the Automatic Transmission Fluid (ATF) is at the upper limit of the filler port (P. 14-17).
- 5) Push the "DN" side of the power tilt switch to compress each rod fully.
- 6) Push the "UP" side of the power tilt switch to extend each rod fully again, and measure the lower chamber blow pressure.

Lower chamber blow pressure	8,826 – 11,768 kPa (90 – 120 kgf/cm <sup>2</sup> , 1,280 – 1,707 psi)
--------------------------------	--

- 7) If a sharp pressure drop is observed, check the power tilt motor for a damaged oil seal (P. 14-24).

If the blow pressure is lower than the specified pressure, check for oil leaks.

- 8) Measure the upper chamber blow pressure.



### <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).

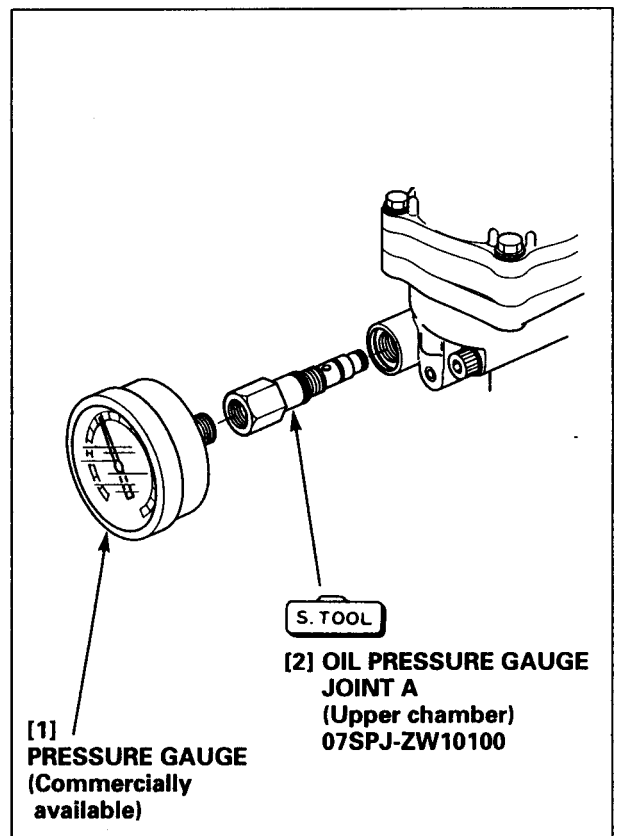
**TORQUE: 9 N·m (0.9 kgf·m, 6.5 lbf·ft)**

- 3) Attach the pressure gauge (commercially available) which measures 14,710 kPa (150 kgf/cm<sup>2</sup>, 2,133 psi) or above [P/F 1/4] to the special tool (oil pressure gauge joint B).

### TOOL:

Oil pressure gauge joint A

07SPJ-ZW10100



4) Remove the oil tank cap and check whether the Automatic Transmission Fluid (ATF) is at the upper limit of the filler port (P. 14-17).

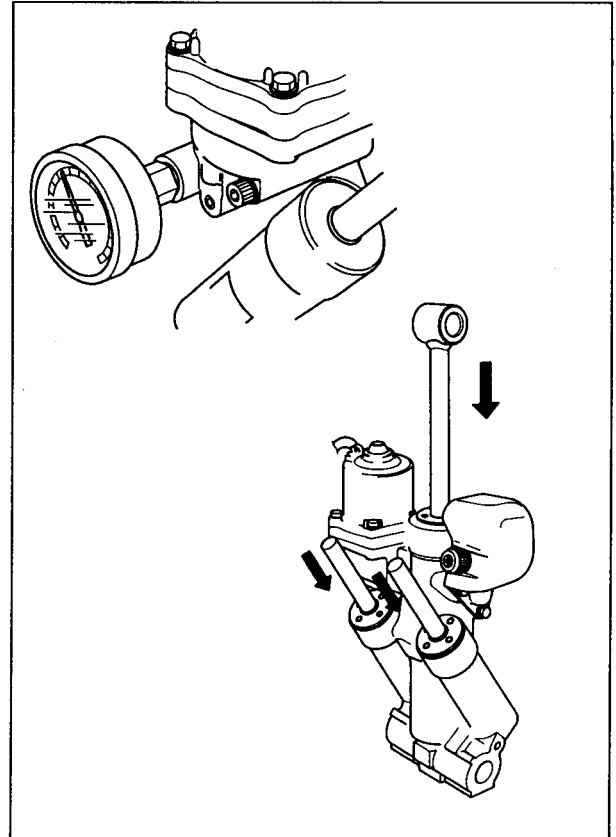
5) Push the "DN" side of the power tilt switch to compress each rod fully, and measure the upper chamber blow pressure.

Upper chamber blow pressure	3,923 – 7,355 kPa (40 – 75 kgf/cm <sup>2</sup> , 569 – 1,067 psi)
--------------------------------	--

6) If the blow pressure is lower than the specified pressure, check for oil leaks.

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. 14-17).



## 5. POWER TILT MOTOR ASSEMBLY

### a. DISASSEMBLY

- 1) Untape the varnished 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.

**NOTE:**

Pull out the grommets with care not to damage them.

- 3) Remove the two 4 x 16 mm screws (P. 14-24).
- 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.

**NOTE:**

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.

**NOTE:**

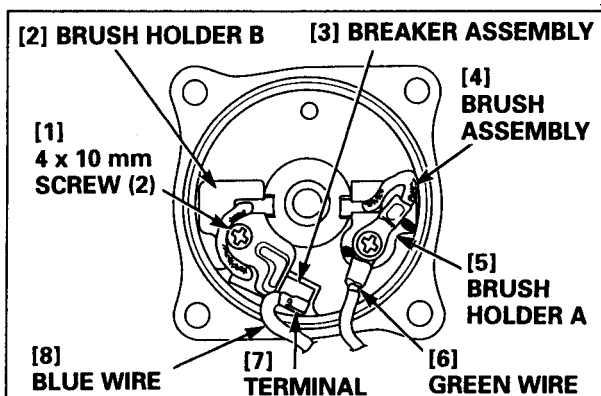
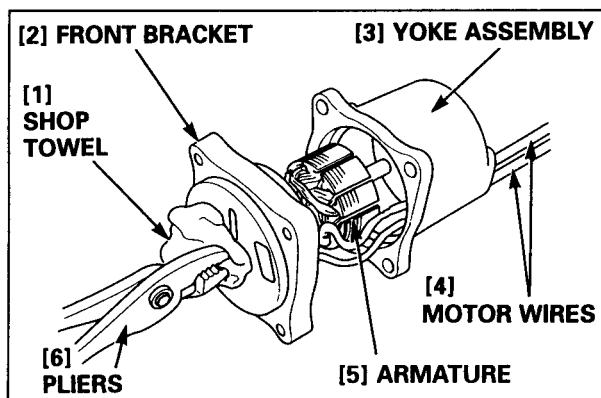
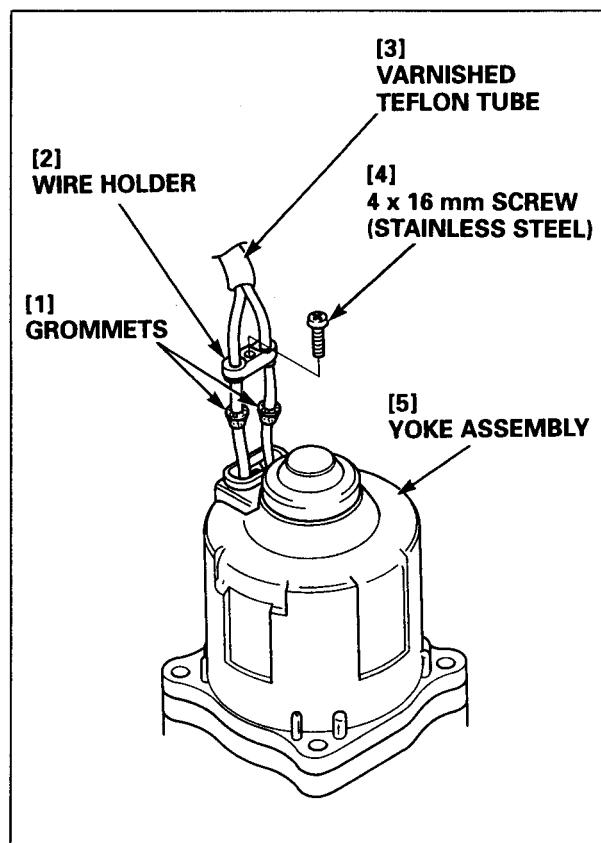
Do not disconnect the blue wire terminal without holding the breaker assembly, or it can cause damage to brush holder B. Be sure to disconnect the terminal while holding the breaker assembly.

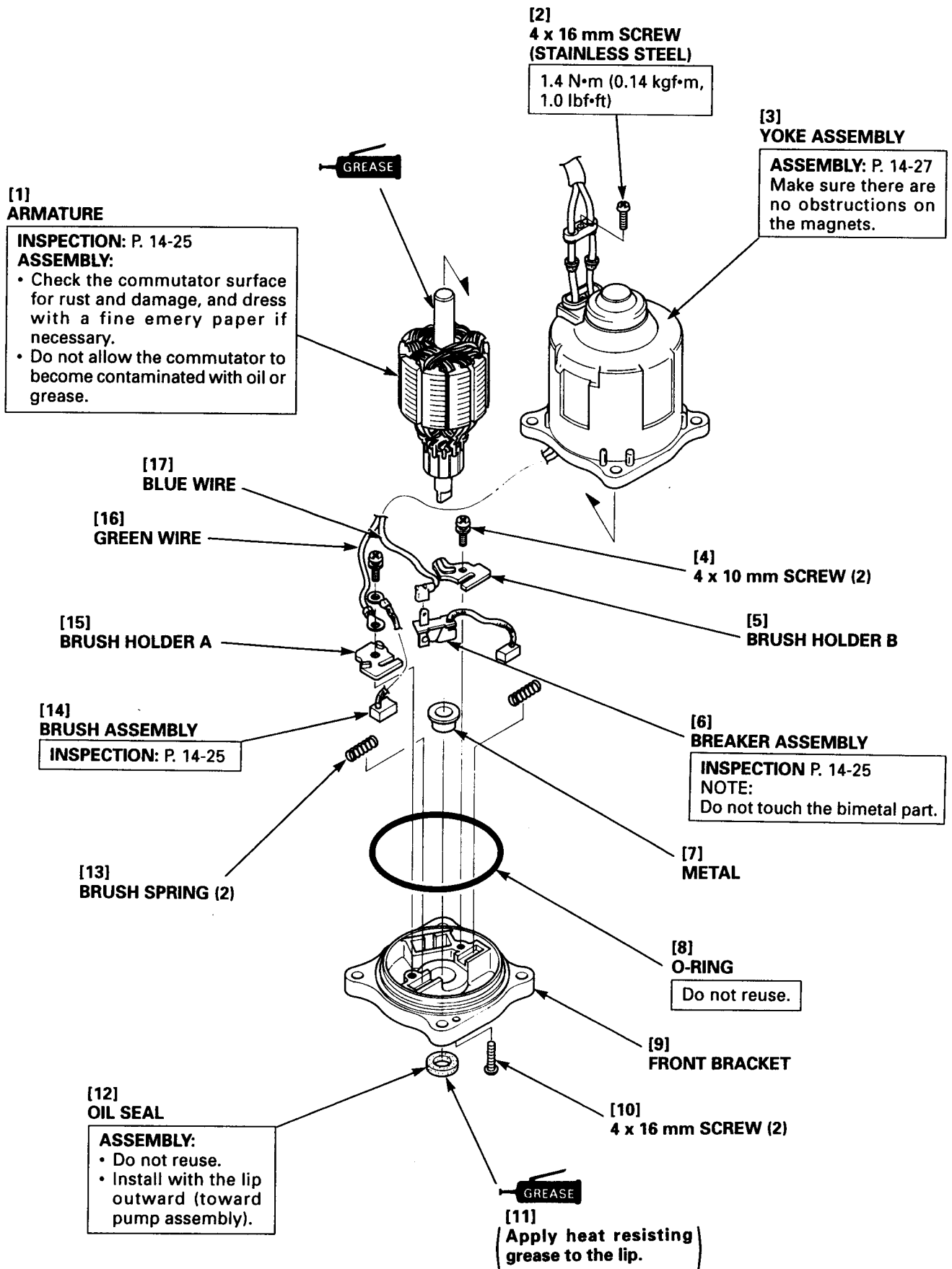
- 7) Remove the two screws. Remove brush holder A and B, brush assembly, two springs and the breaker assembly.

**NOTE:**

Take care not to touch the bimetal part of the breaker assembly.

- 8) Remove the oil seal and metal from the front bracket (P. 14-24).





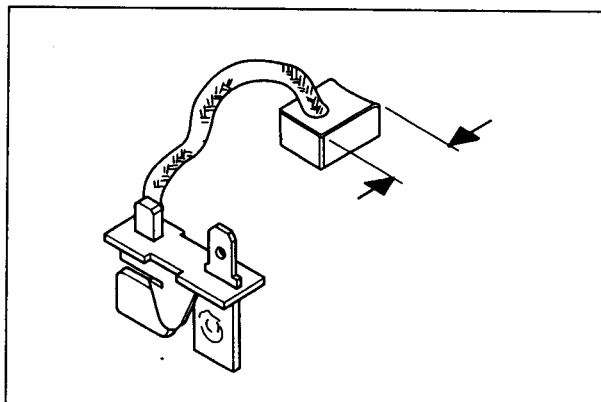
### b. INSPECTION

#### • BRUSH LENGTH

Measure the brush length.

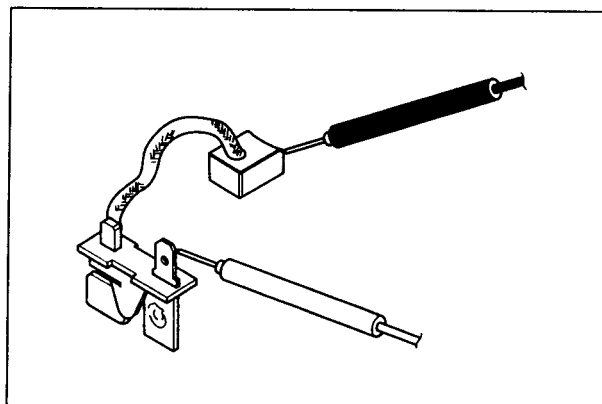
If brush length is less than the service limit, replace the brush.

STANDARD	SERVICE LIMIT
9.8 mm (0.39 in)	4.8 mm (0.19 in)



#### • BREAKER ASSEMBLY

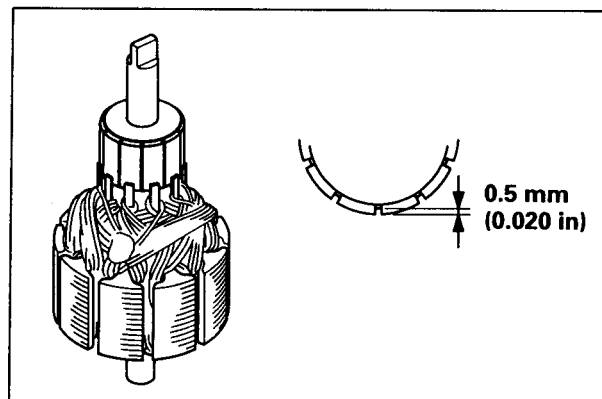
Check for continuity between the brush and terminal. Replace the breaker assembly if there is no continuity.



#### • 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.

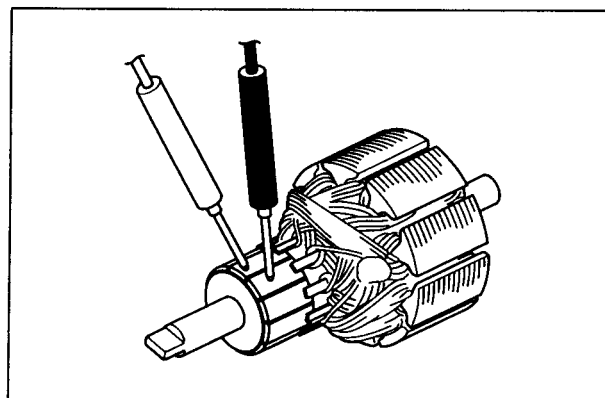
SERVICE LIMIT	0.5 mm (0.020 in)
---------------	-------------------



#### • ARMATURE

##### CONTINUITY CHECK-SEGMENTS

Check for continuity between each segment. If an open circuit exists between any two segments, replace the armature.

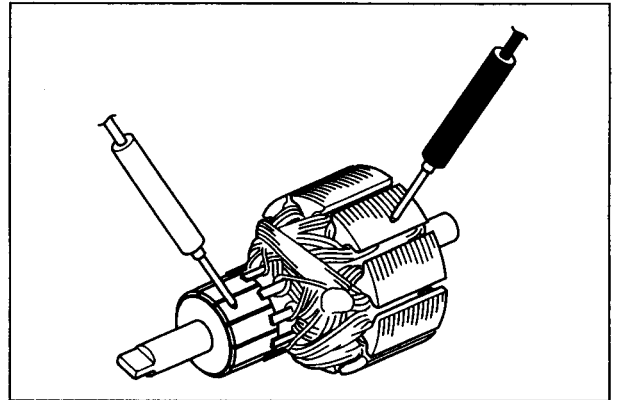




#### SHORT CIRCUIT TEST-CORE-TO-COMMUTATOR

Check for continuity between the commutator and armature coil core.

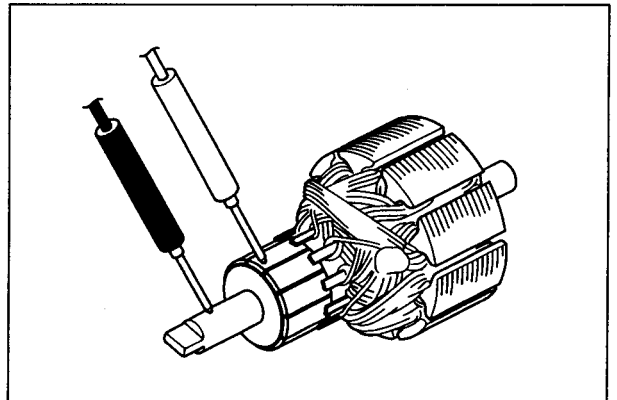
If continuity exists, replace the armature.



#### SHORT CIRCUIT TEST-SHAFT-TO-COMMUTATOR

Check for continuity between the commutator and armature shaft.

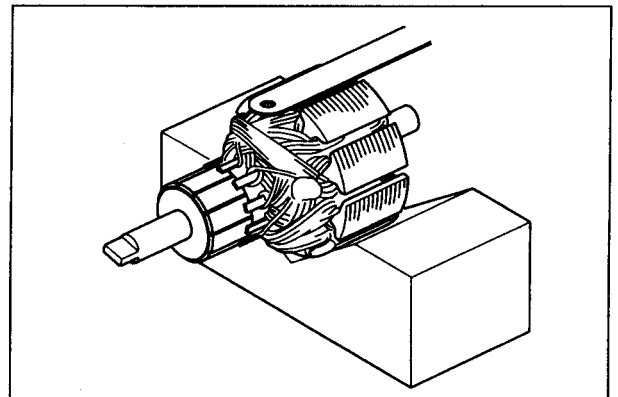
If there is continuity, replace the armature.



#### SHORT CIRCUIT TEST-ARMATURE

Place the armature 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. ASSEMBLY

- 1) Install the O-ring, oil seal and metal on the front bracket (P. 14-24).
- 2) Install the breaker assembly and brush holder B, and tighten the screws.

Connect the blue wire terminal to the breaker assembly.

#### NOTE:

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.

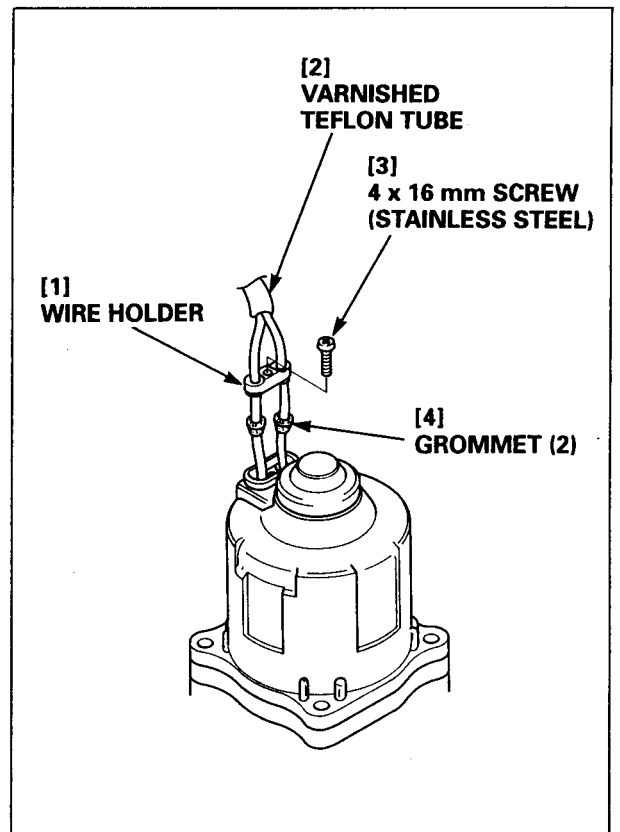
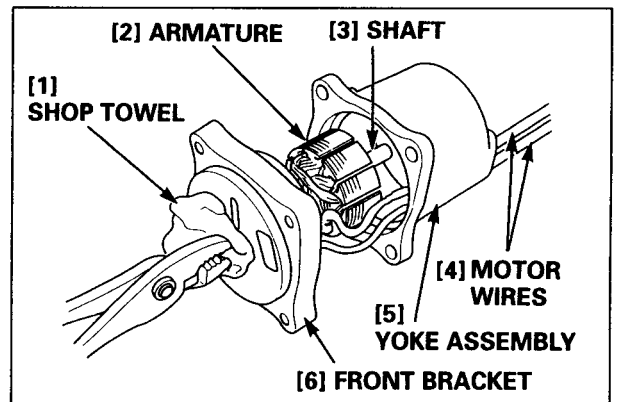
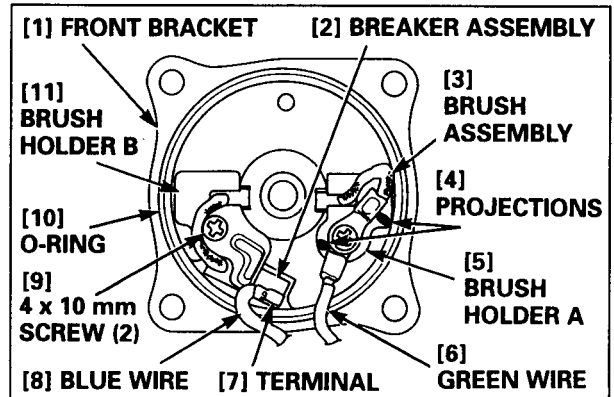
- 7) After installation, check the armature for smooth rotation, and tighten the two 4 x 16 mm screws.

- 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.

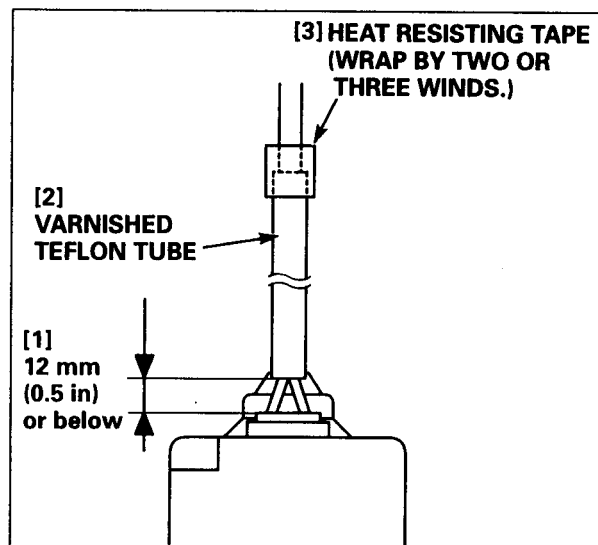
- 9) Install the two grommets and wire holder on the yoke assembly.

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 varnished teflon tube with heat resisting tape, so that the distance from the wire holder end to the tube end is 12 mm (0.5 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. 14-18).



# 15. STEERING ROD/REMOTE CONTROL BOX

**HONDA**  
**BF115A•130A**

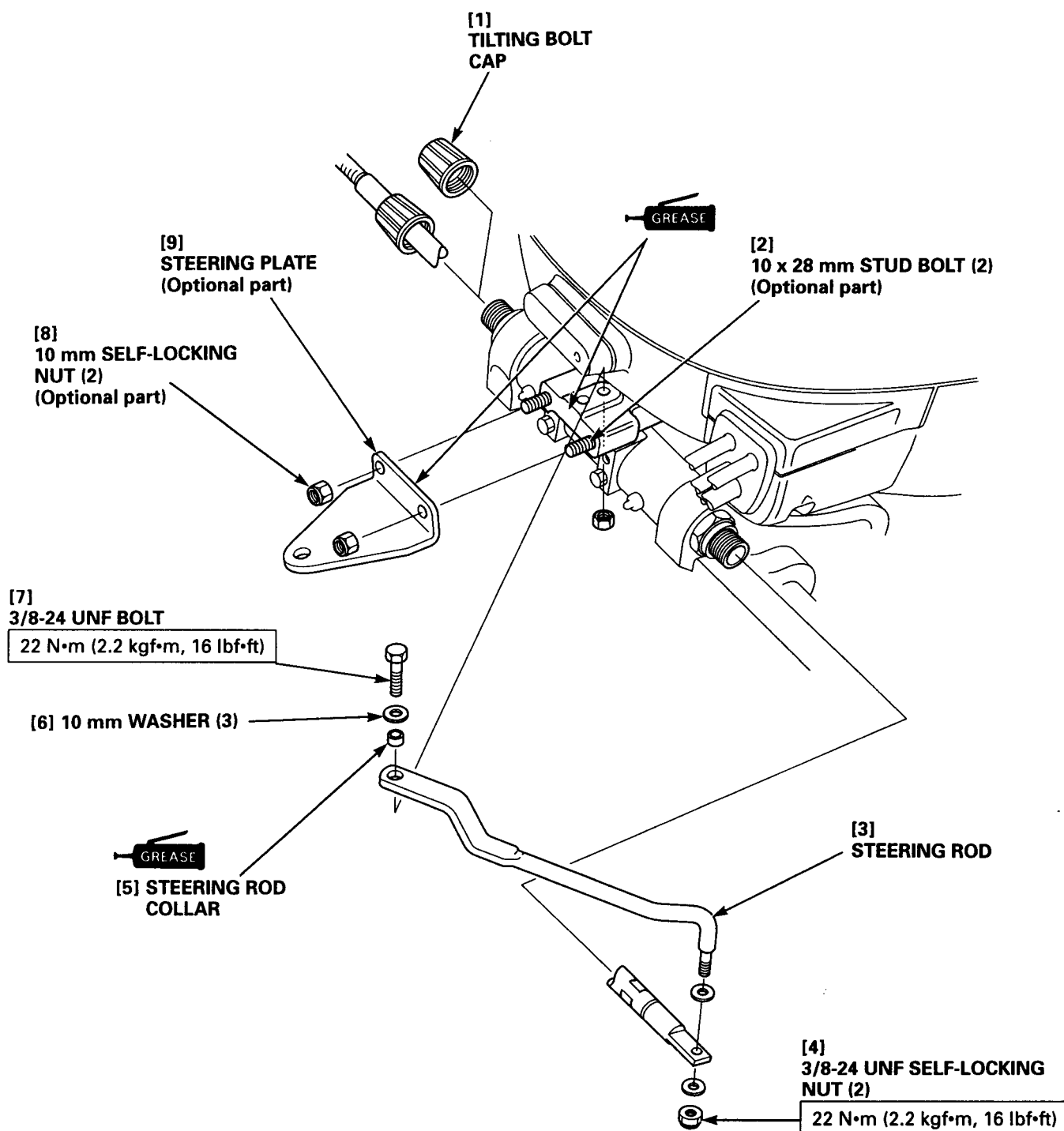
1. STEERING ROD

2. REMOTE CONTROL BOX (OPTIONAL PART)

3. CONTROL PANEL (OPTIONAL PART)

## 1. STEERING ROD

### a. REMOVAL/INSTALLATION

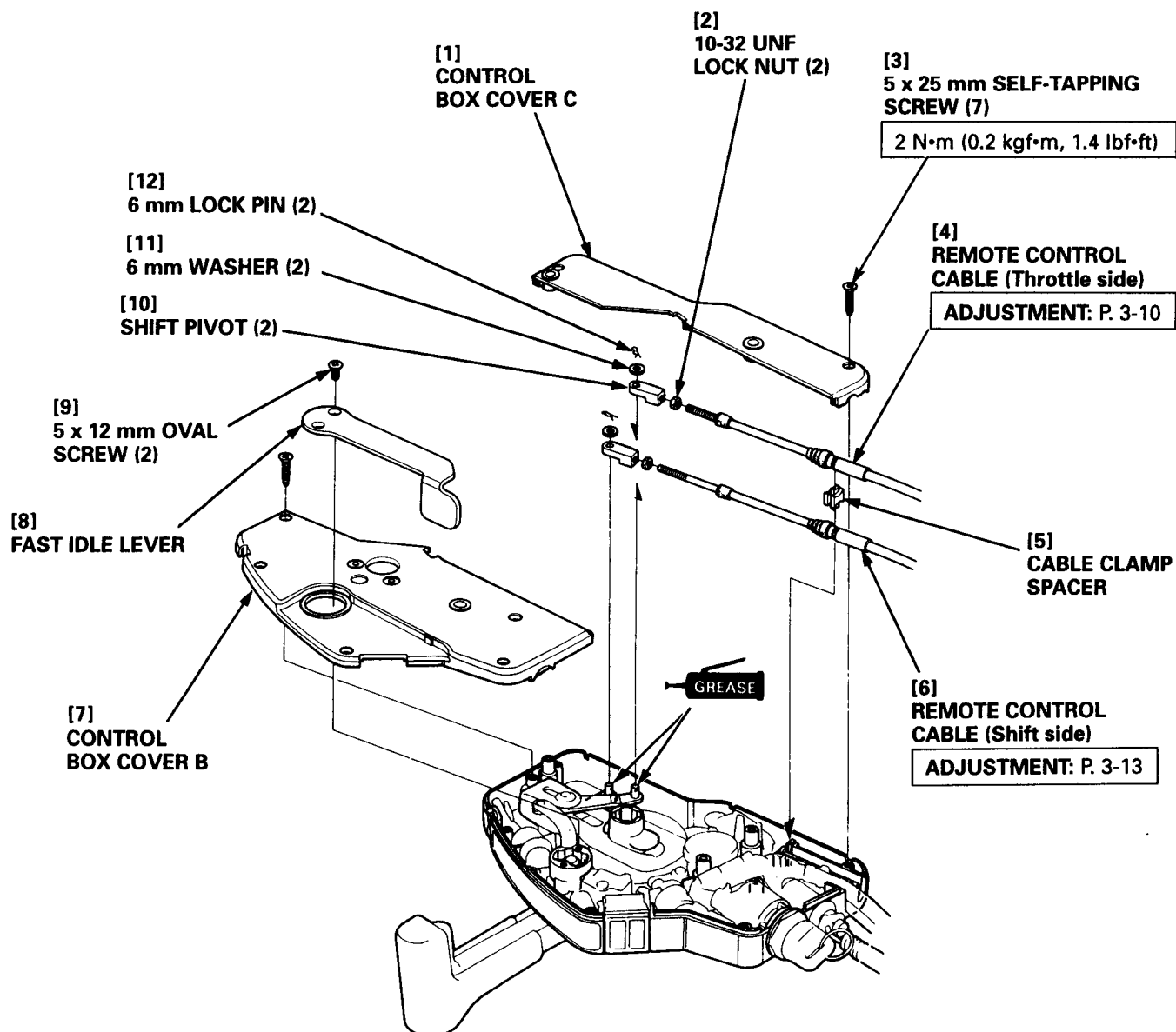


## 2. REMOTE CONTROL BOX (OPTIONAL PART)

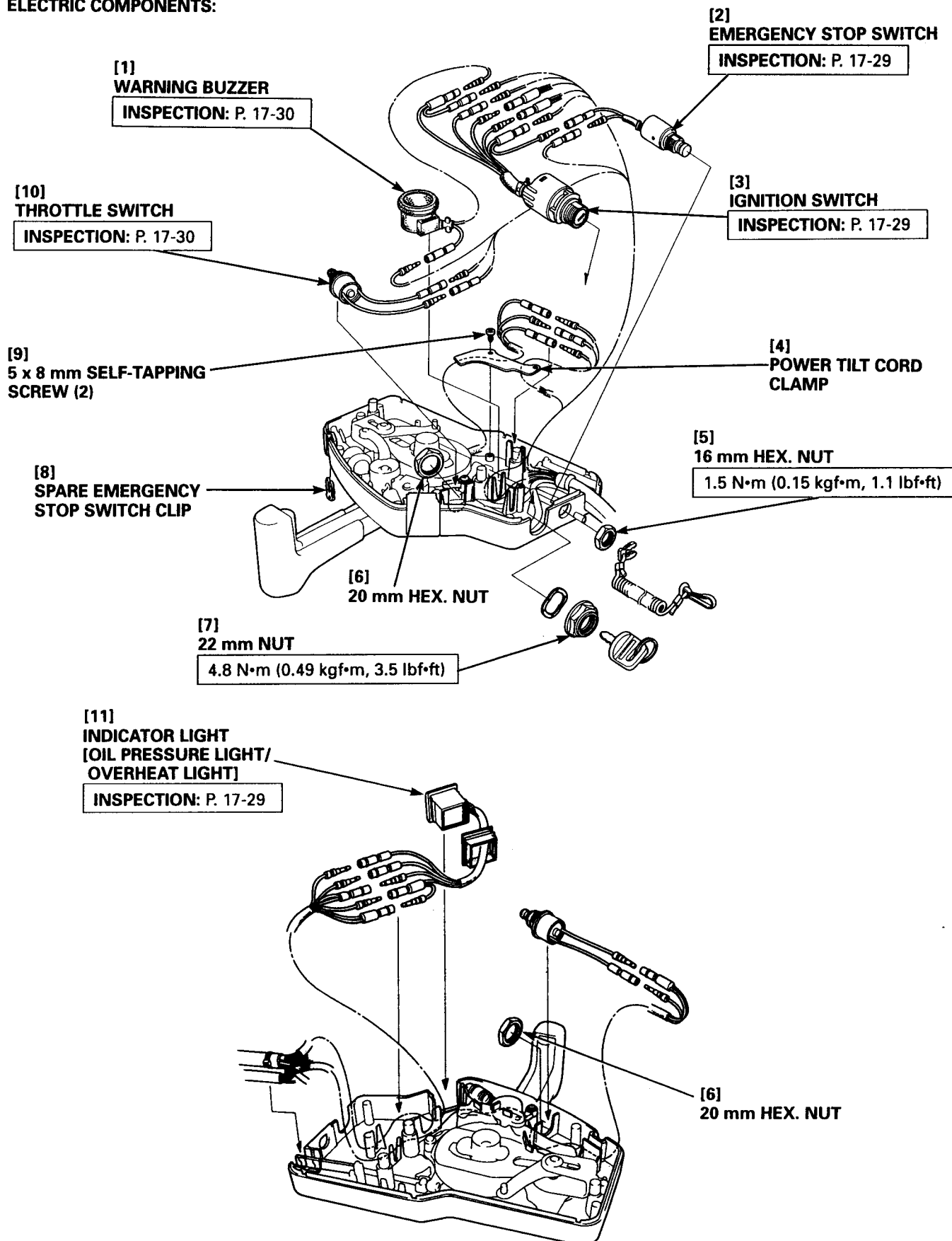
### a. DISASSEMBLY/ASSEMBLY

#### • SIDE-MOUNT REMOTE CONTROL BOX

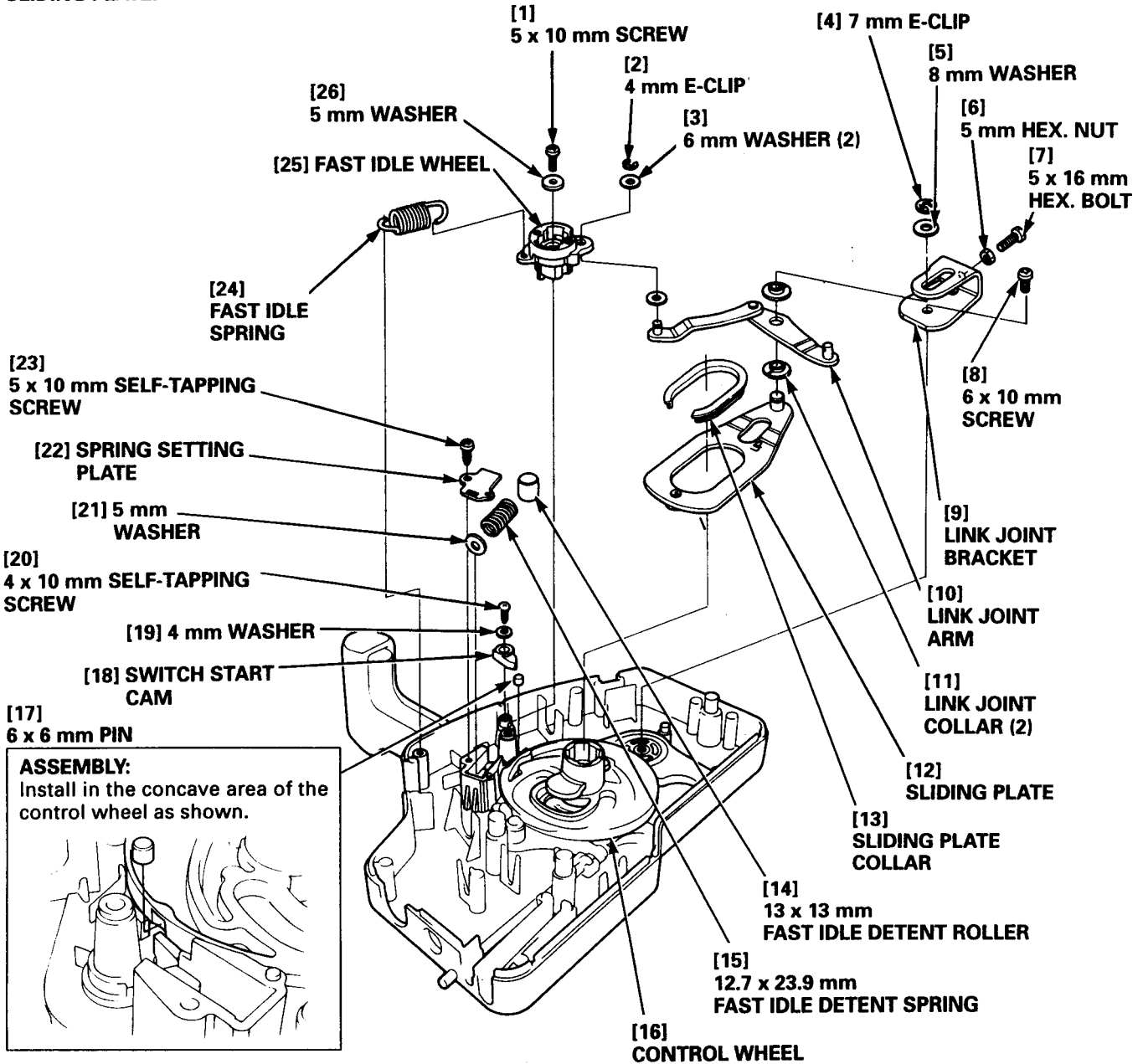
REMOTE CONTROL CABLE:



### ELECTRIC COMPONENTS:

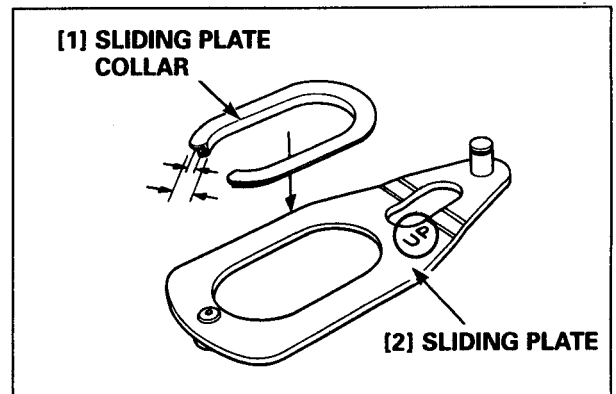


### SLIDING PLATE:

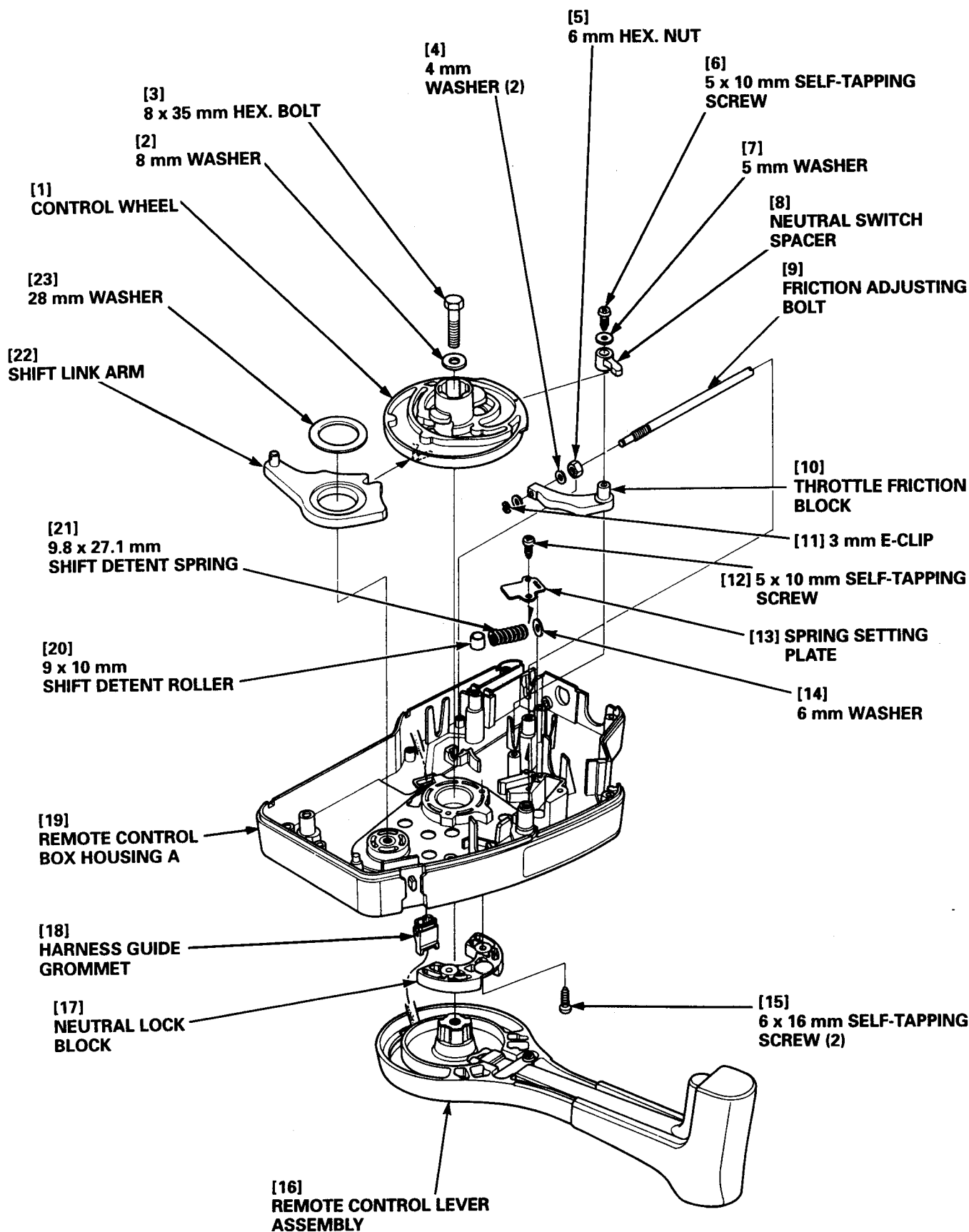


### • SLIDING PLATE/COLLAR INSTALLATION

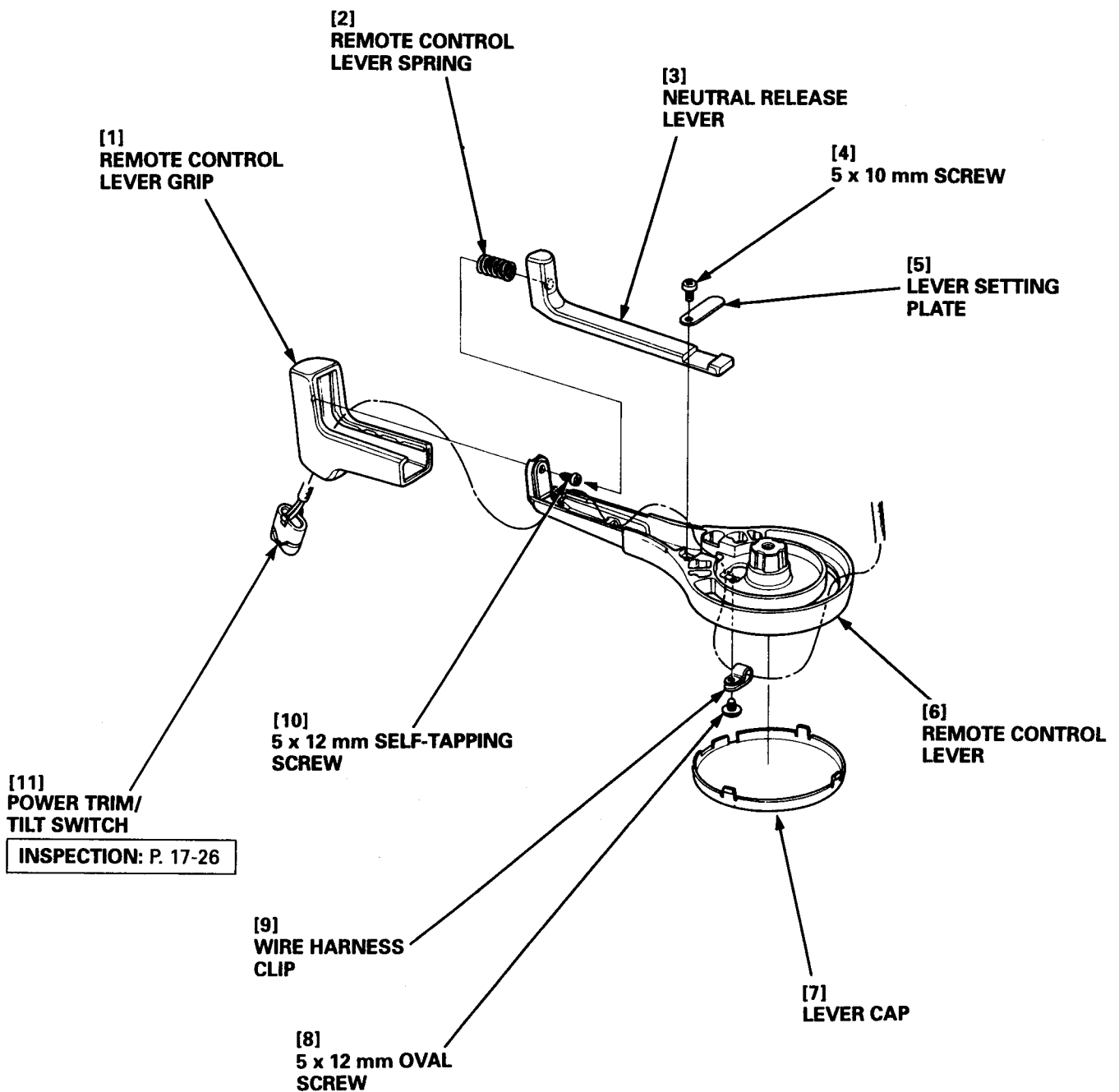
Install the sliding plate with the "UP" mark facing up. Attach the sliding plate collar to the sliding plate with its opening toward the opposite end of the "UP" mark side of the sliding plate and the lip facing down.



### REMOTE CONTROL LEVER:

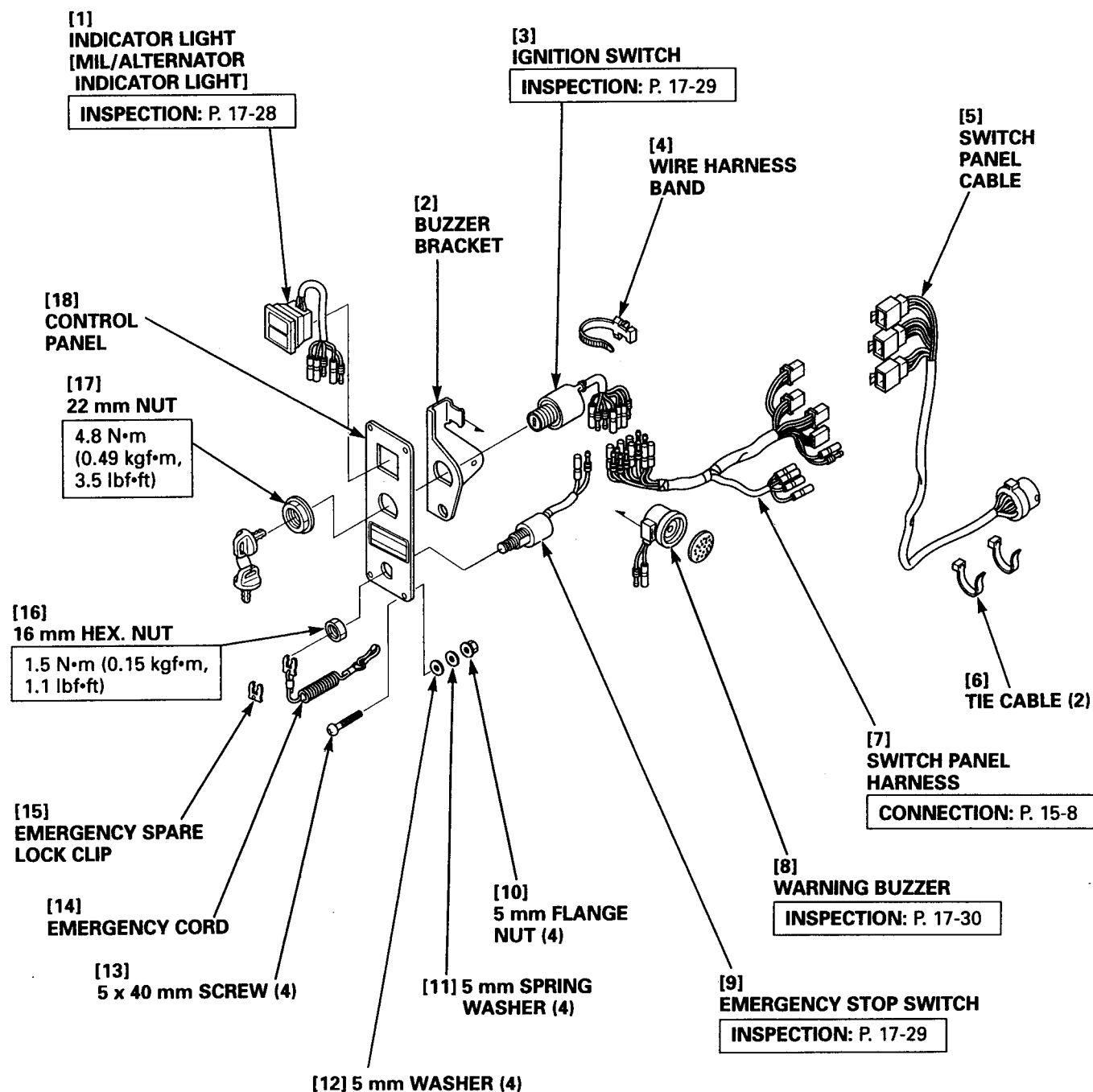






### 3. CONTROL PANEL (OPTIONAL PART)

#### a. DISASSEMBLY/ASSEMBLY

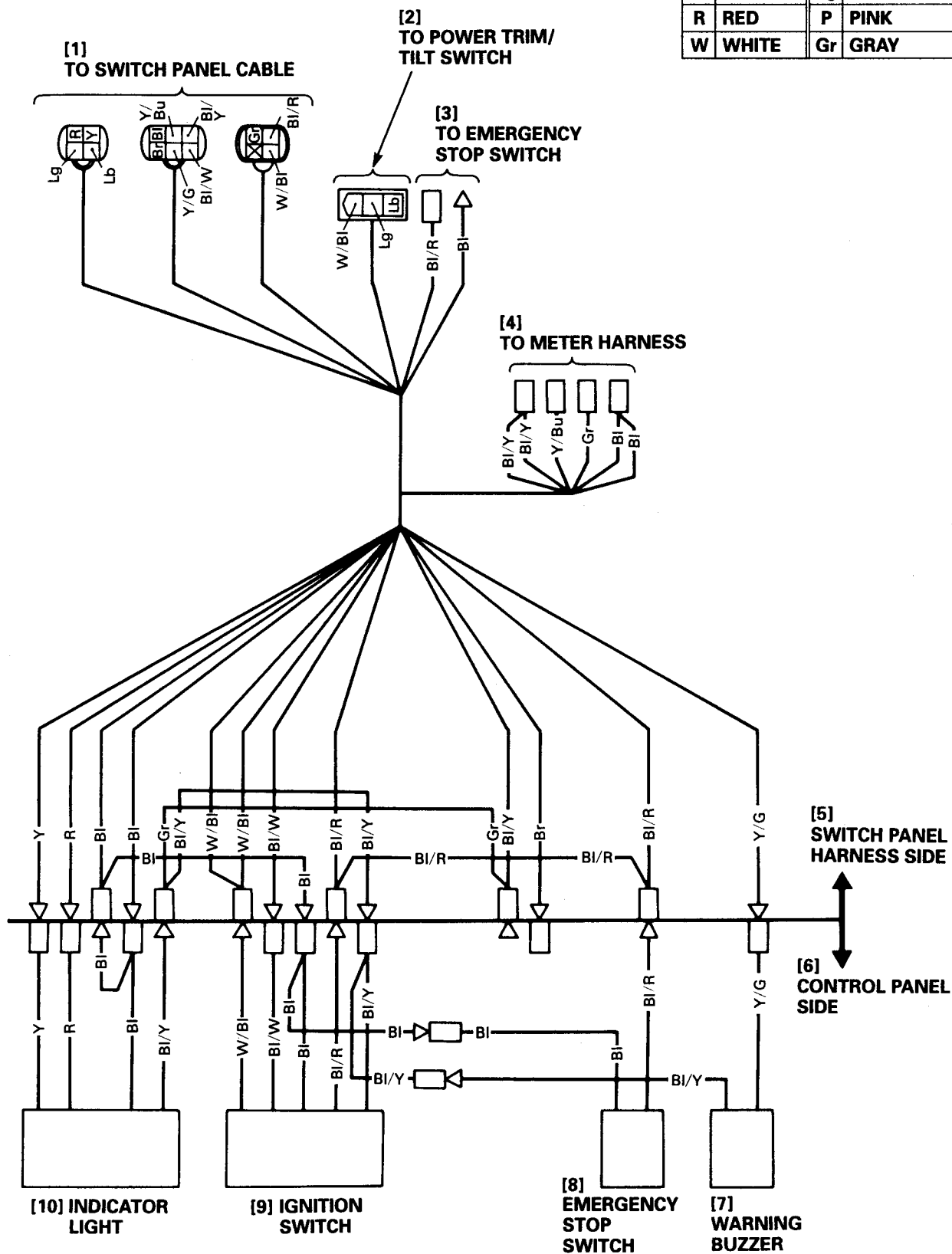


### • SWITCH PANEL HARNESS

#### CONNECTION:

Connect each switch wire as shown.

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



# 16. CABLES/SHIFT LINK BRACKET/SHIFT ARM

**HONDA**  
**BF115A•130A**

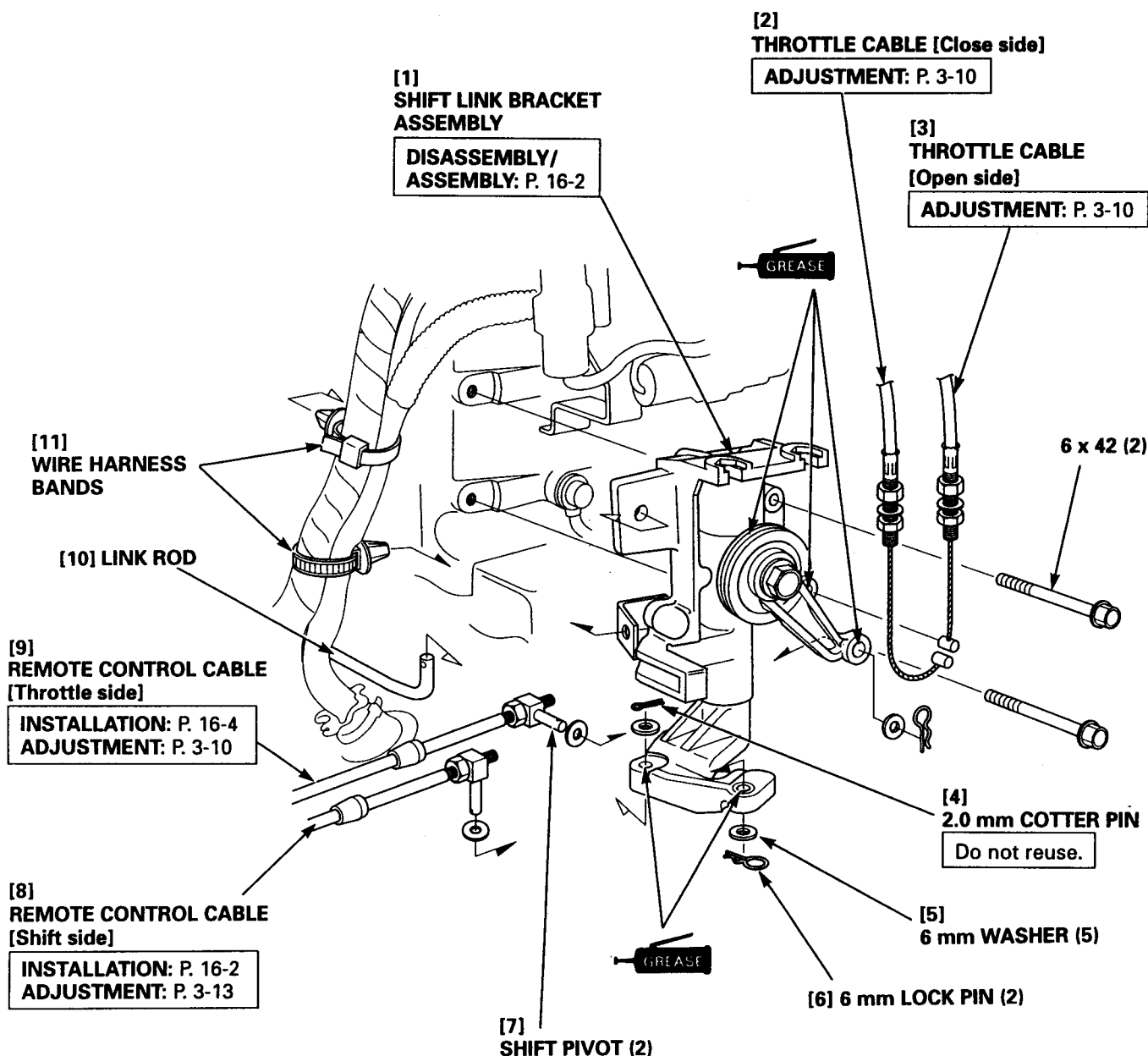
## 1. SHIFT LINK BRACKET

## 2. SHIFT ARM/LINK ROD/NEUTRAL SWITCH

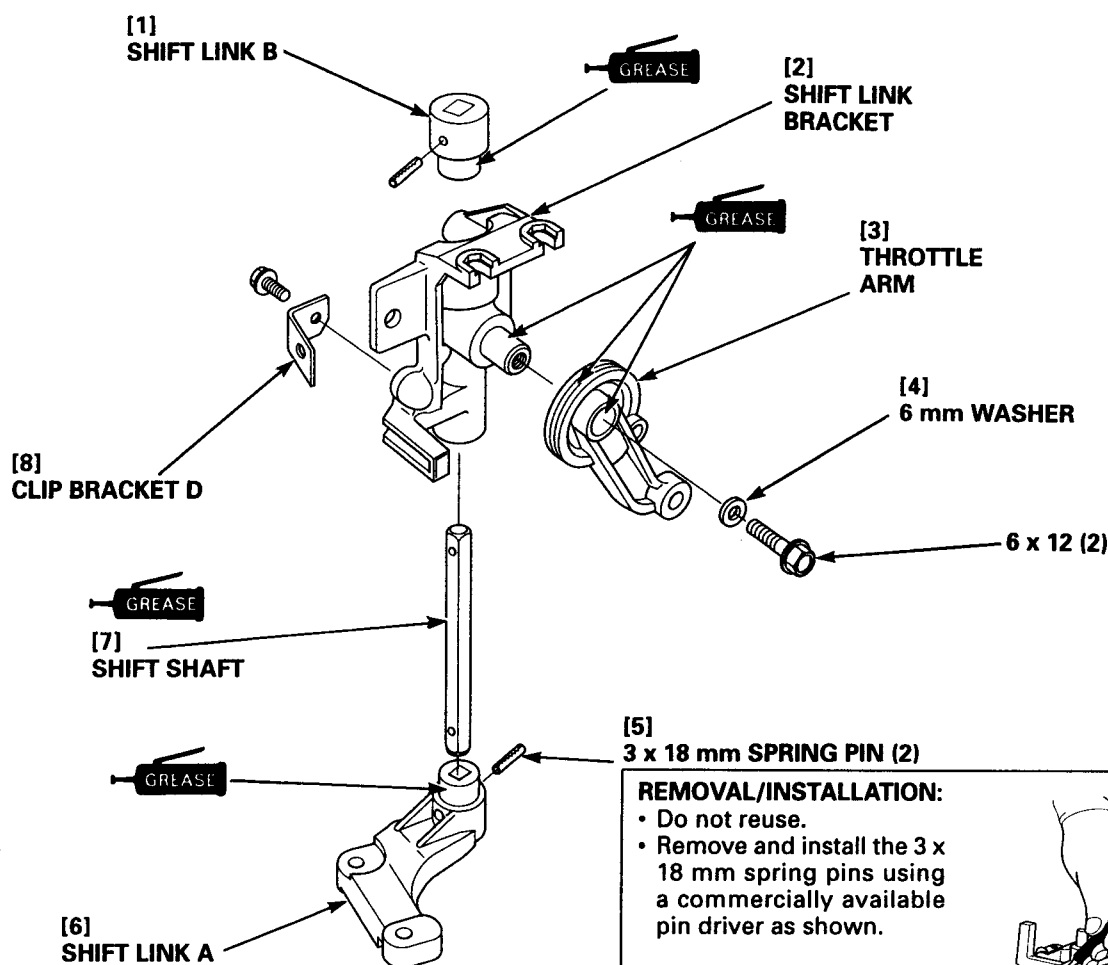
### 1. SHIFT LINK BRACKET

#### a. REMOVAL/INSTALLATION

- 1) Remove the engine cover (P. 3-5).
- 2) Remove the silencer case (P. 3-10).

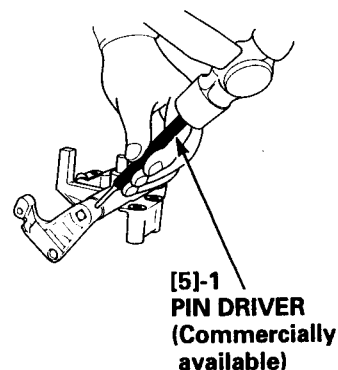


### • SHIFT LINK BRACKET ASSEMBLY DISASSEMBLY/ASSEMBLY



#### REMOVAL/INSTALLATION:

- Do not reuse.
- Remove and install the 3 x 18 mm spring pins using a commercially available pin driver as shown.



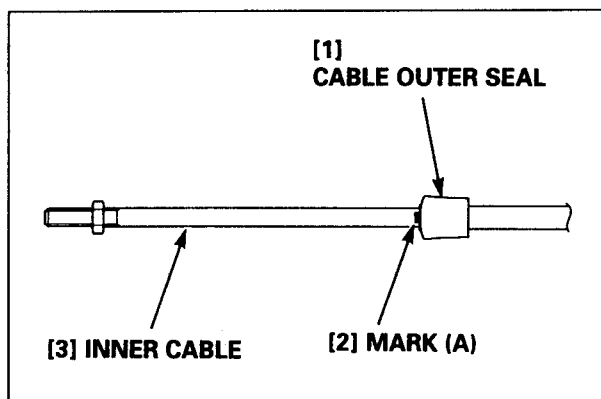
### • REMOTE CONTROL CABLE (SHIFT/THROTTLE CABLE)

#### INSTALLATION:

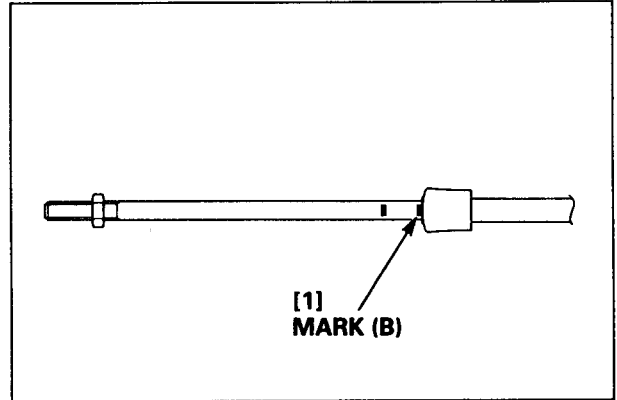
##### <Shift side>

Before connecting the cable to the outboard motor, be sure that the cable is connected to the remote control box side securely.

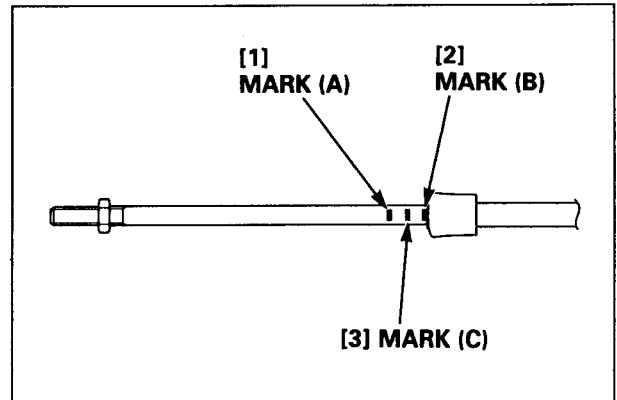
- 1) Move the remote control lever fully to the "F" (Forward) side.
- 2) Return the lever to the "N" (Neutral) position slowly.
- 3) With the lever returned to the "N" (Neutral) position, mark at the cable outer seal end of the inner cable [Mark (A)].



- 4) Move the remote control lever fully to the "R" (Reverse) side.
- 5) Return the lever to the "N" (Neutral) position slowly.
- 6) With the lever returned to the "N" (Neutral) position, mark at the cable outer seal end of the inner cable [Mark (B)].

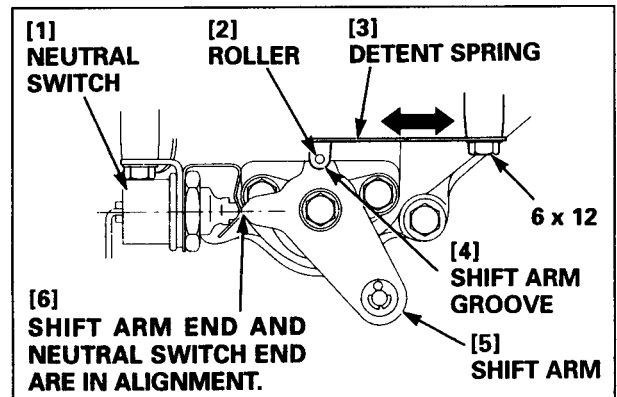


- 7) Mark at the mid point between the mark (A) and mark (B) of the inner cable [Mark (C)].

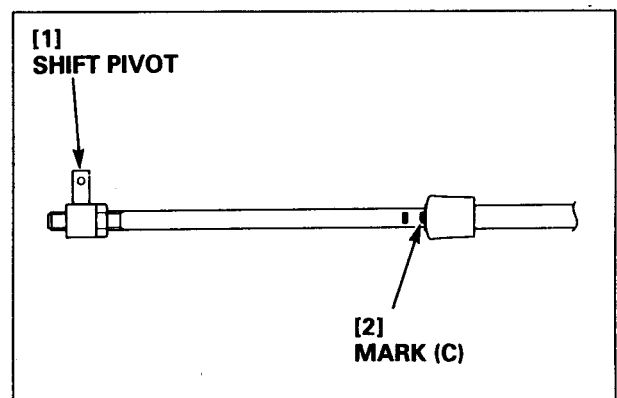


- 8) Be sure that the shift arm end aligns with the neutral switch end as shown. (Note that the detent spring roller must be set in the shift arm groove ["N" (Neutral) position] securely.
- 9) If the shift arm end and neutral switch end are not in alignment, loosen the 6 x 12 mm flange bolt and adjust by moving the detent spring right or left.

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



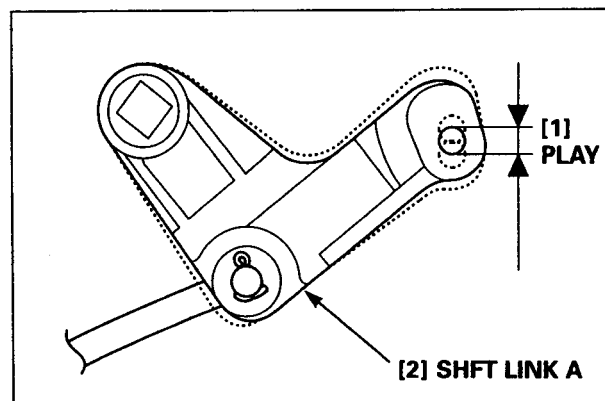
- 10) Install the shift pivot on the shift side cable.
- 11) Align the mark (C), that was made in the step 7, with the cable outer seal end.



- 12) Push on the shift link A end lightly and check for play. If there is play in the shift link A, set the link A at the center of the play.
- 13) With the shift side cable in the condition of the above step 7, connect the shift side cable to the shift link A while turning the shift pivot so the shift pivot sets on the shift link A smoothly.

**NOTE:**

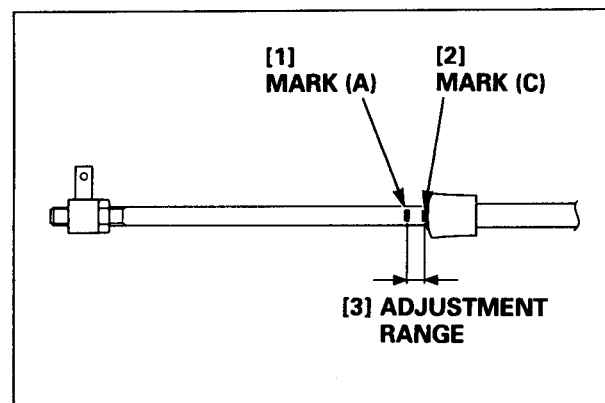
Take care not to move the mark (C) and outer seal end out of alignment. Hold the shift link A at the center of the play, too.



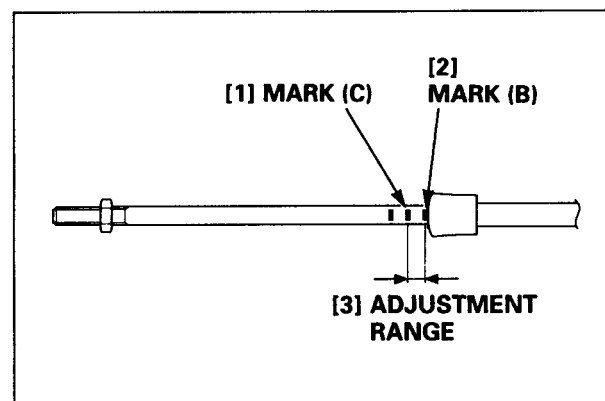
- 14) After connecting the cable, move the remote control lever back and forth and check for shift.

**NOTE:**

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.



- 15) 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 12.
- 16) 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 12.
- 17) After adjustment, check operation of each lever. If the gear is not in neutral securely, perform the step 15 or 16 again.



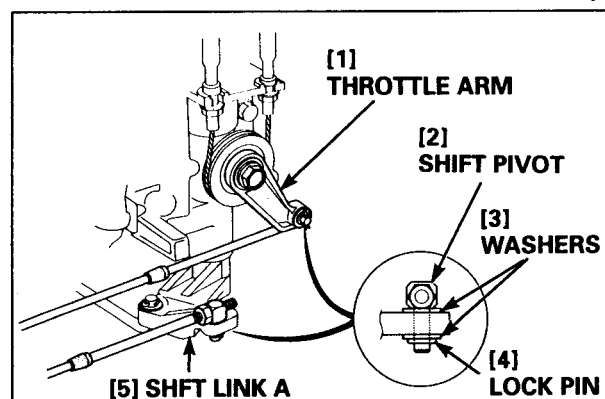
- 18) Connect the shift and throttle cables as shown.

**<Shift side>**

Insert the shift pivot from the top of the shift link A and secure with the two washers and the lock pin as shown.

**<Throttle side>**

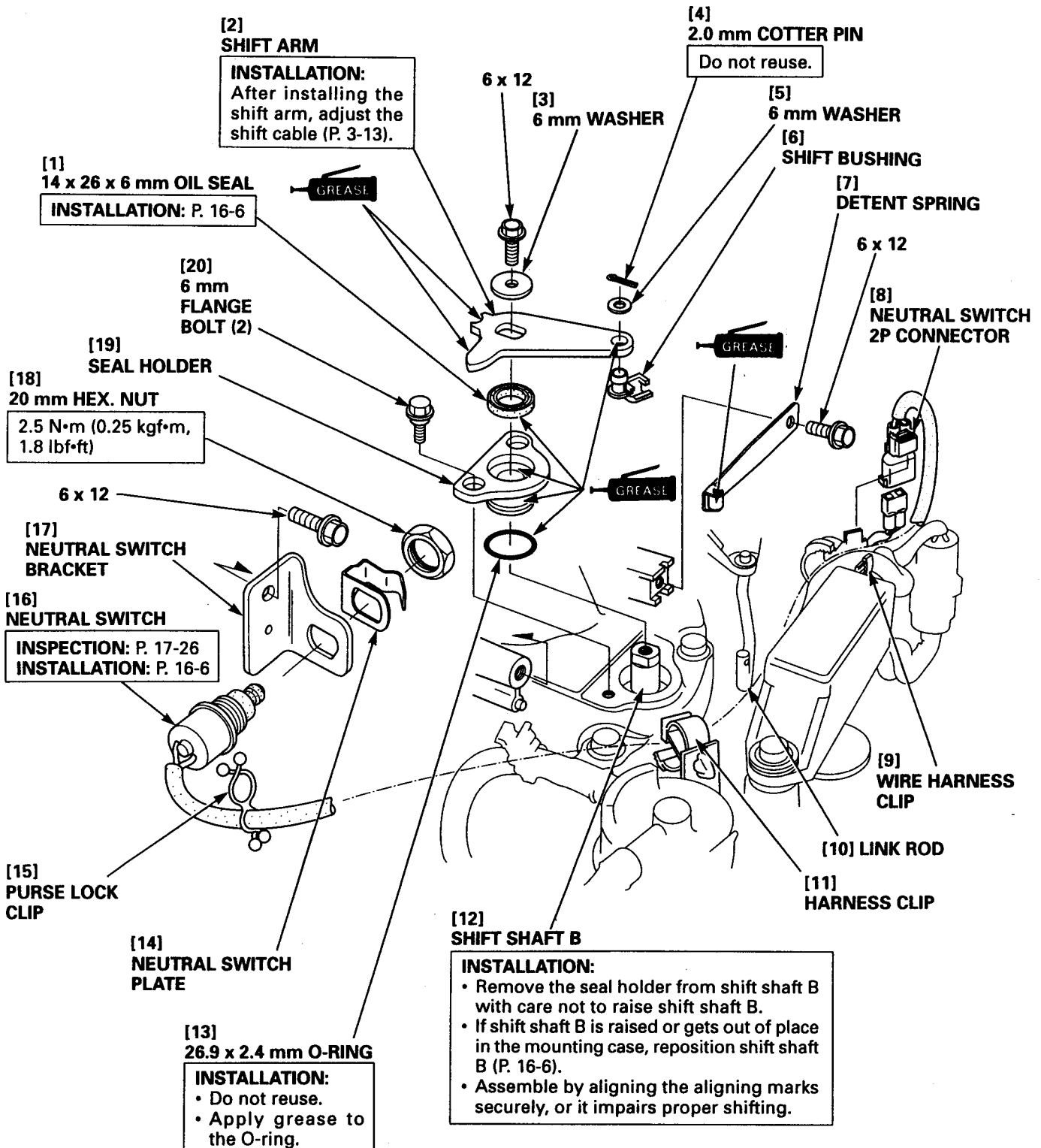
Insert the shift pivot from the reverse side of the throttle arm and secure with the two washers and the lock pin as shown.



## 2. SHIFT ARM/LINK ROD/NEUTRAL SWITCH

### a. REMOVAL/INSTALLATION

- 1) Move the remote control lever to the "N" (Neutral) position.
- 2) Remove the silencer case (P. 3-10).

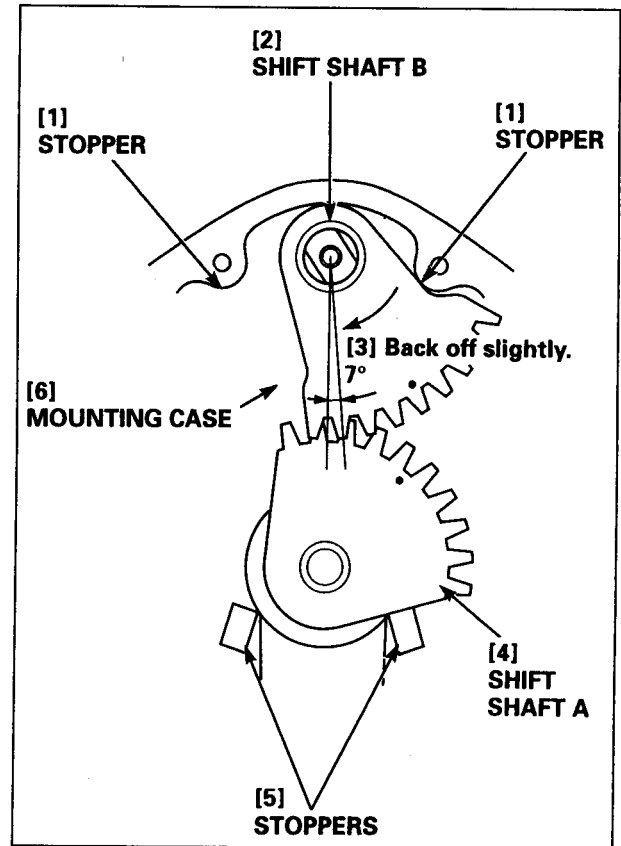




### • SHIFT SHAFT B ALIGNMENT

Correct the shift shaft B from the condition of the seal holder being out of position.

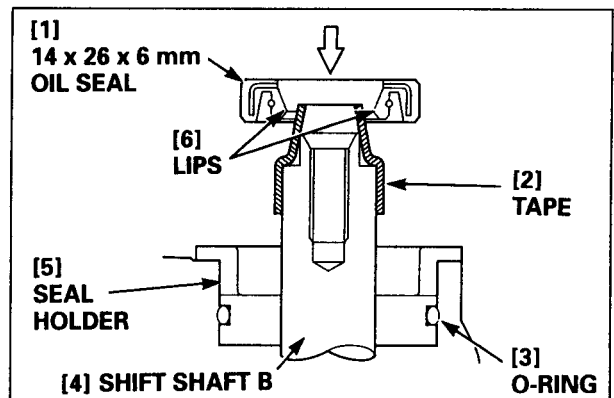
- 1) Turn the shift shaft B until the shift shafts A and B contact the stoppers in the mounting case as shown.
  - When turning in the same direction, it is all right for the shift shafts A and B to be in contact with either the right or left stopper.
- 2) With the shift shafts A and B in contact with their respective stoppers, turn the shift shaft B so that its gear is above the gear of the shift shaft A. Then, back off the shift shaft B slightly until the gear of the shift shaft B engages with the gear of the shift shaft A.
  - Engage the gears with care not to move the shift shaft A.
- 3) After correcting the shift shaft B, check whether shifting can be made properly.
- 4) Install the seal holder.



### • 14 x 26 x 6 mm OIL SEAL

#### INSTALLATION:

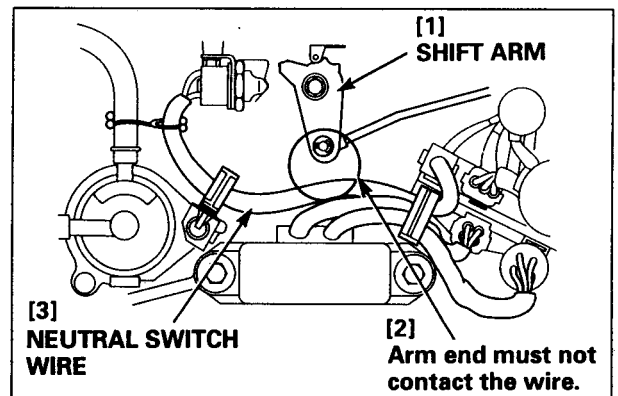
- 1) Check that the O-ring is mounted on the seal holder. Install the seal holder on the shift shaft B and tighten the 6 mm flange bolt.
- 2) Wind the tape around the shift shaft B as shown.
- 3) Apply grease to the oil seal lips and the circumference, and install the oil seal with the lips toward down.
  - Perform the same procedure when the 14 x 26 x 6 mm oil seal is mounted on the seal holder.



### • NEUTRAL SWITCH

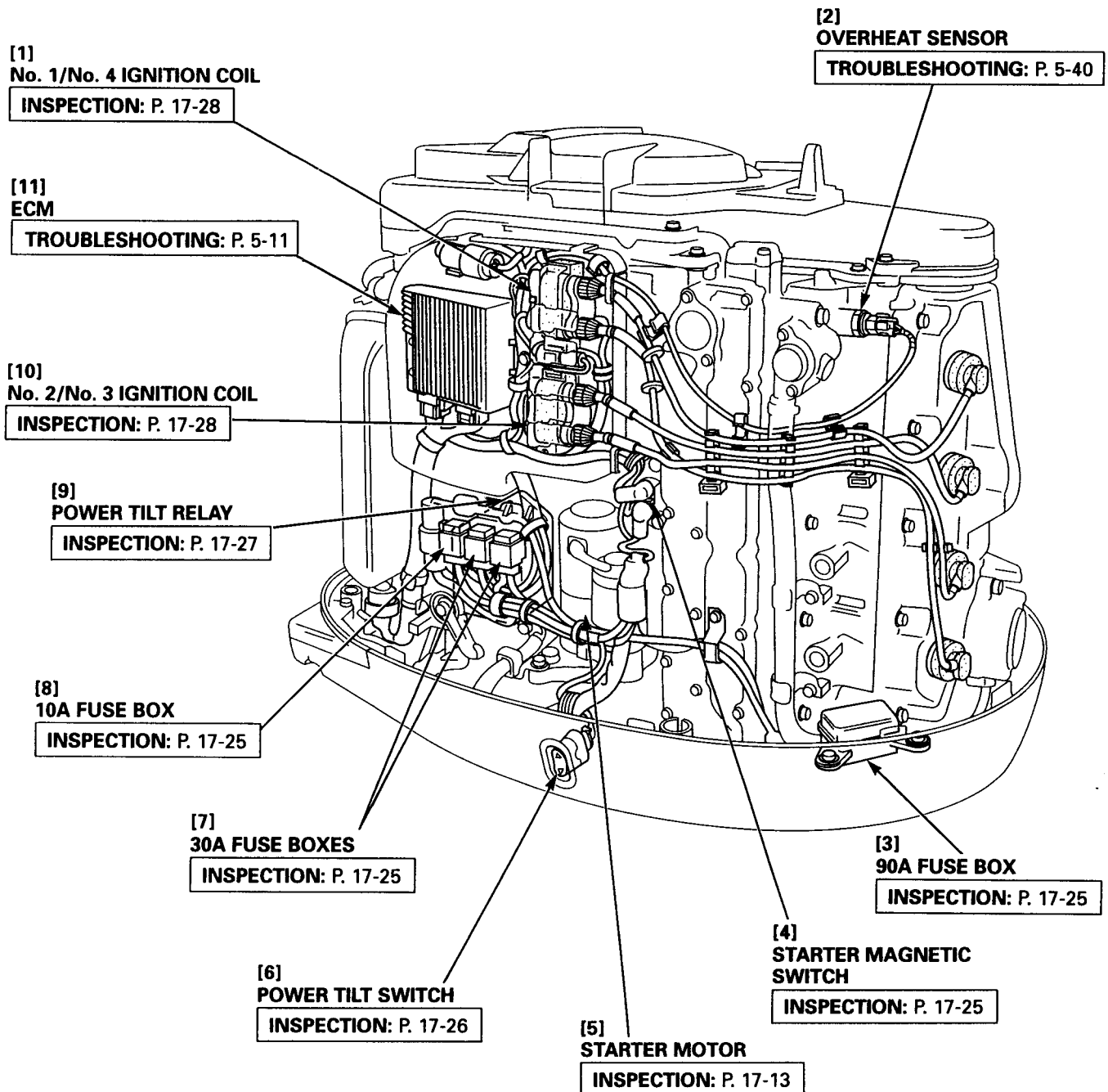
#### INSTALLATION:

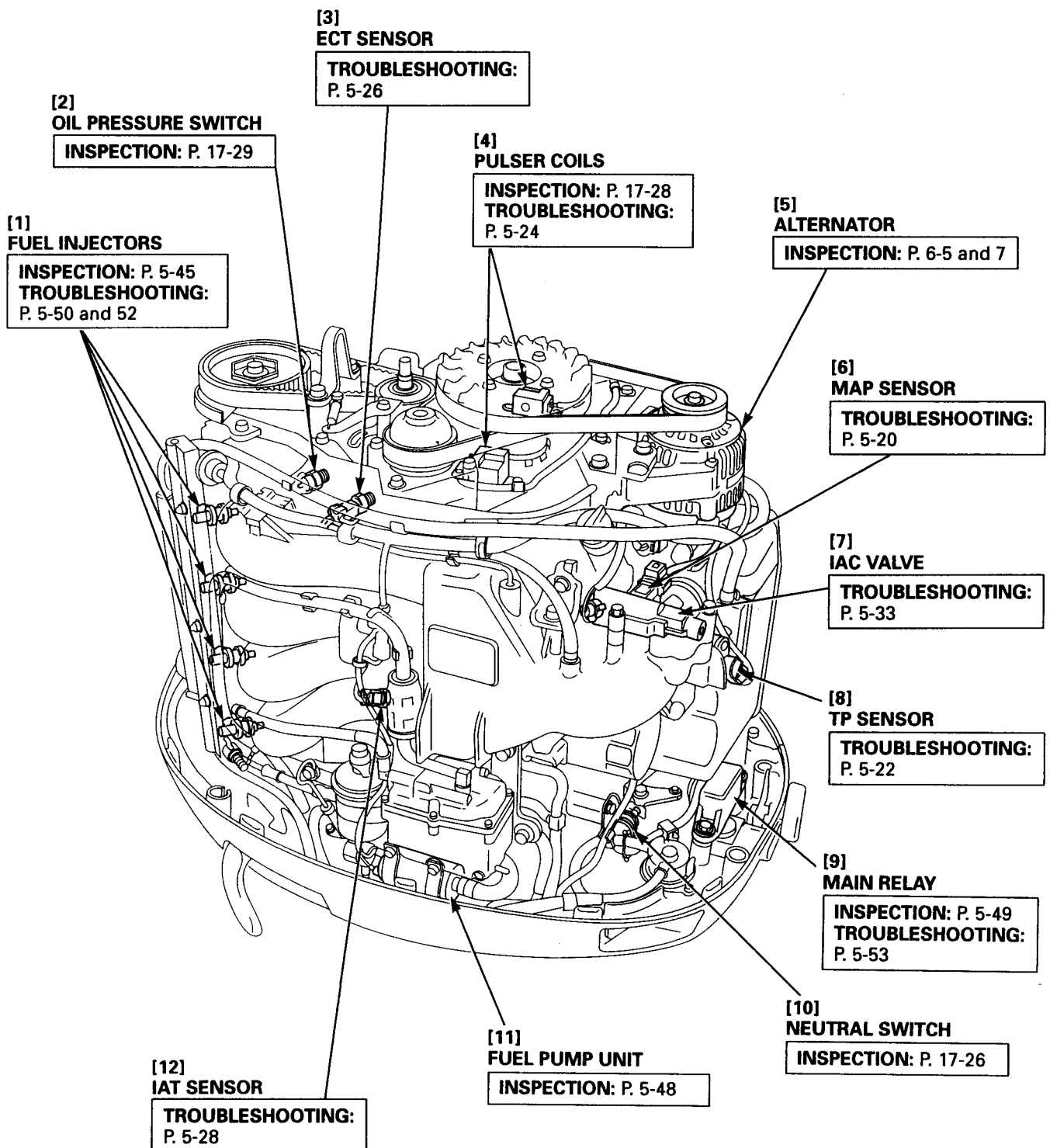
Move the shift arm and be sure that the arm end does not contact the neutral switch wire.

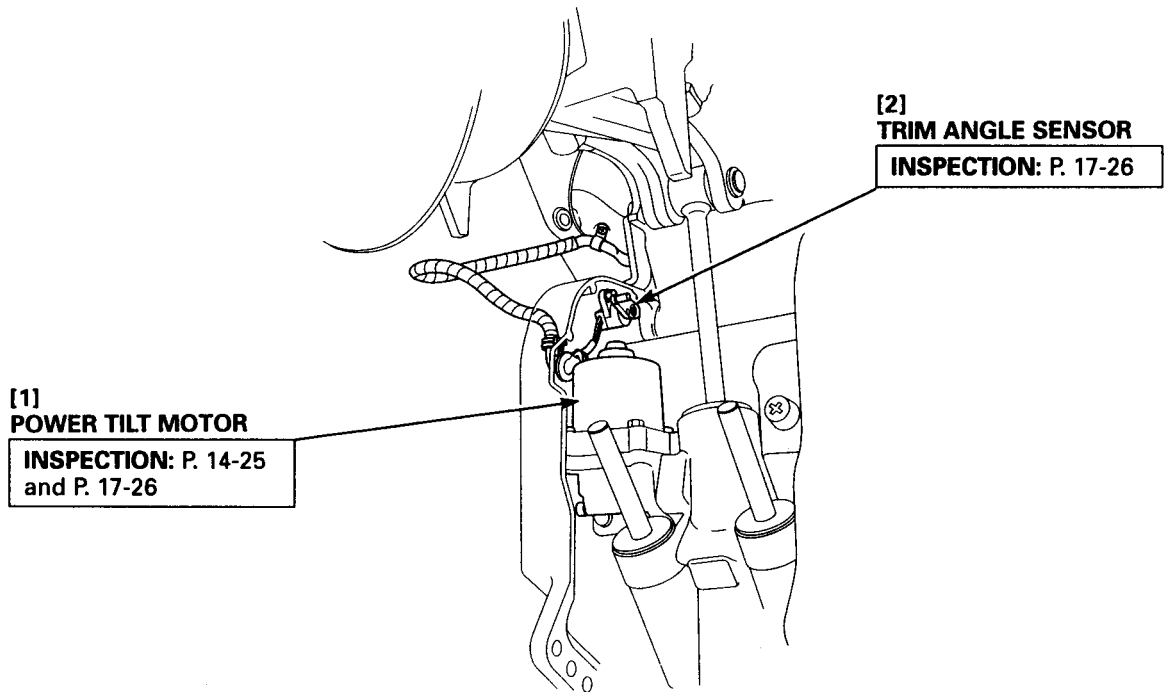


- |   |   |
|---|---|
| 1. COMPONENT LOCATION                       | 5. FUSE BOX/POWER TILT RELAY                    |
| 2. MAIN RELAY/SEPARATE CASE                 | 6. REMOTE CONTROL CABLE A/ECM/<br>IGNITION COIL |
| 3. STARTER CABLE/POWER TILT SWITCH          | 7. 90A FUSE BOX                                 |
| 4. STARTER MOTOR/STARTER MAGNETIC<br>SWITCH | 8. INSPECTION                                   |

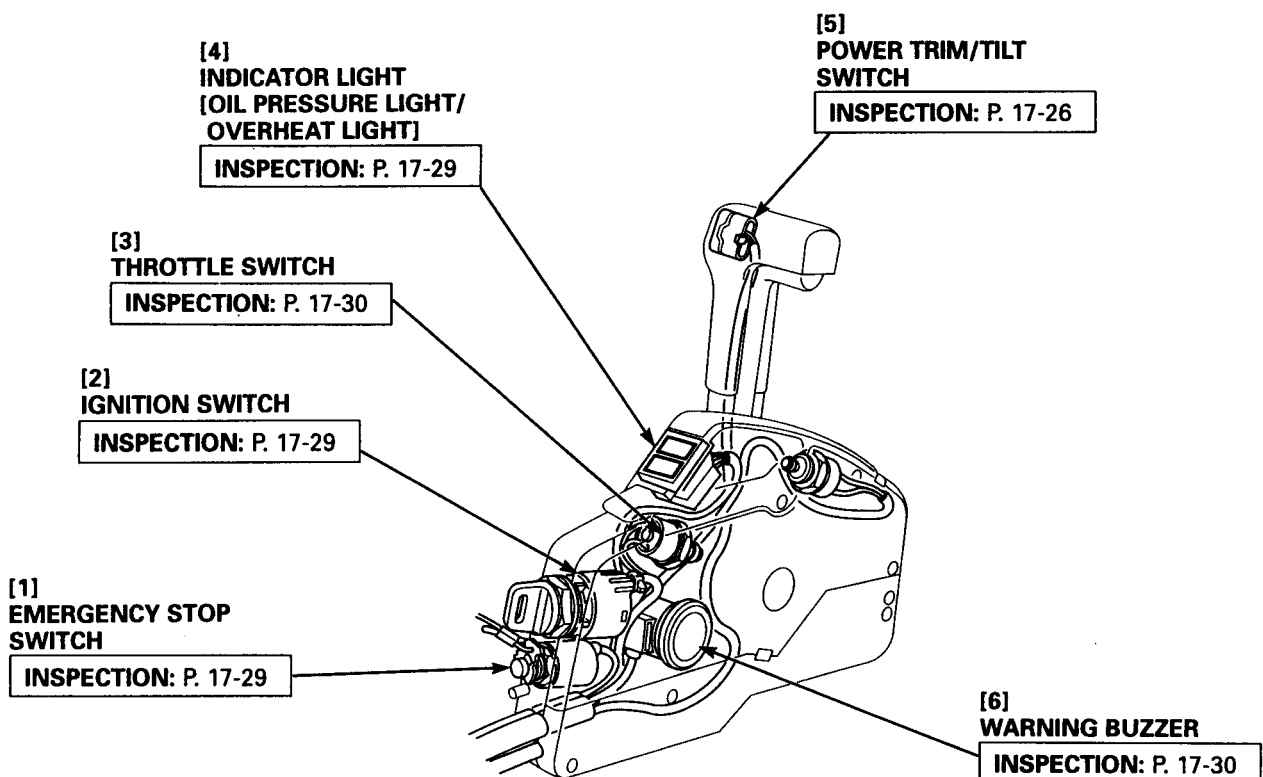
## 1. COMPONENT LOCATION



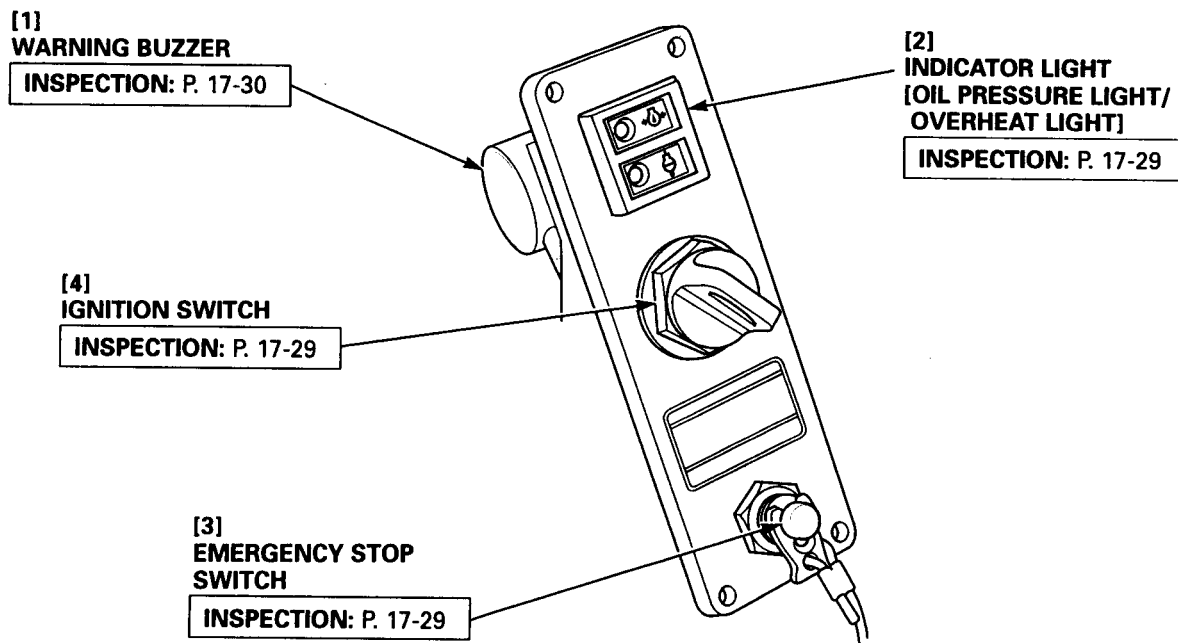




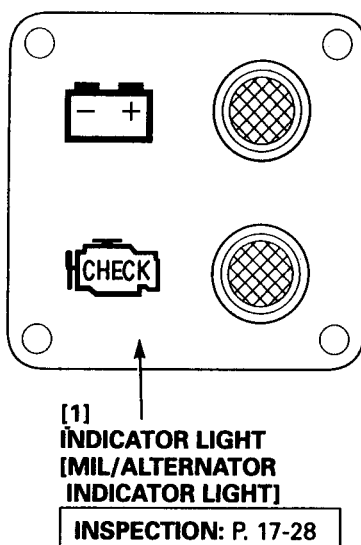
• **REMOTE CONTROL BOX**



• **CONTROL PANEL**



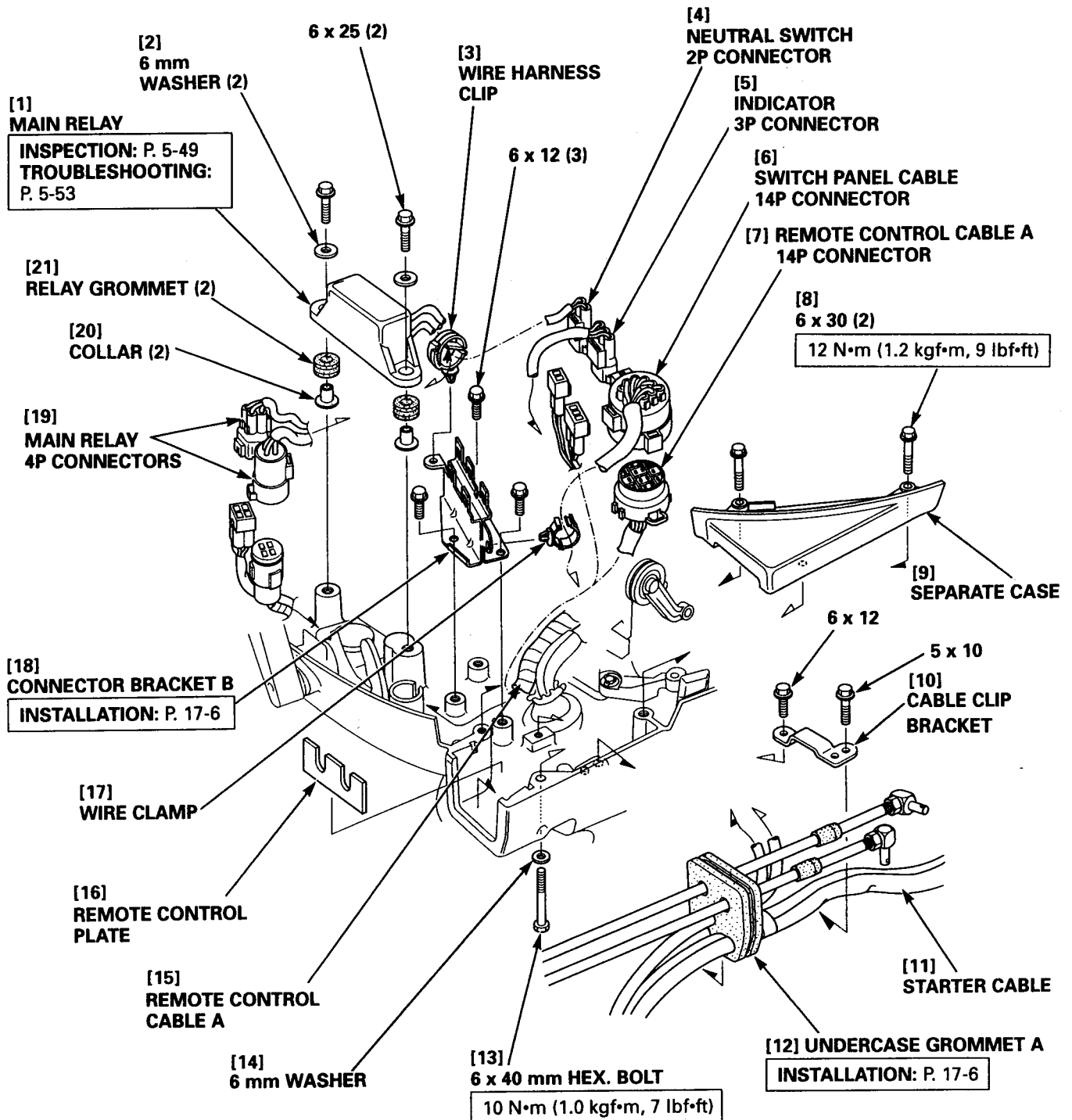
• **INDICATOR LIGHT [MIL/ALTERNATOR INDICATOR LIGHT]**



## 2. MAIN RELAY/SEPARATE CASE

### a. REMOVAL/INSTALLATION

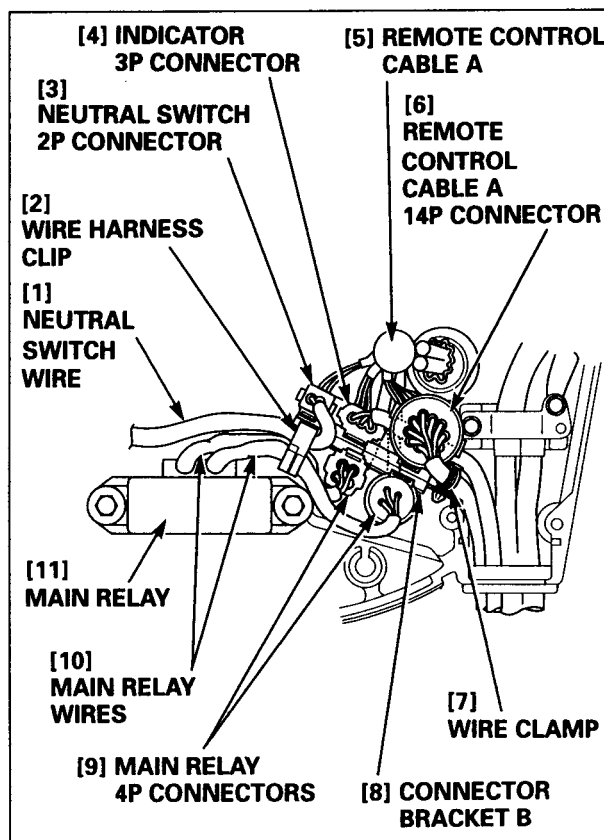
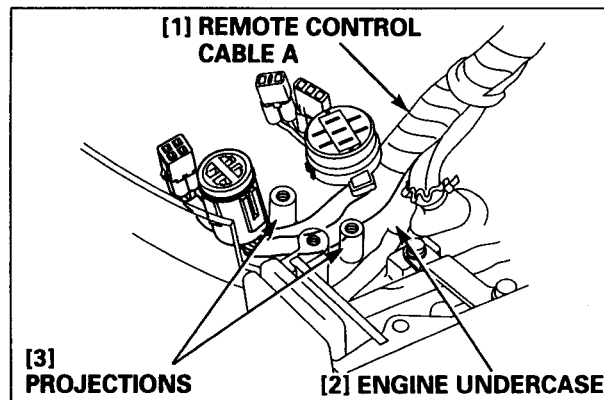
- 1) Remove the engine cover (P. 3-5) and the silencer case (P. 3-10).
  - 2) Remove the remote control (throttle and shift) cables (P. 16-1).
- Connect the cables properly by referring to the cable/harness routing (P. 2-31).



### • CONNECTOR BRACKET B

#### INSTALLATION:

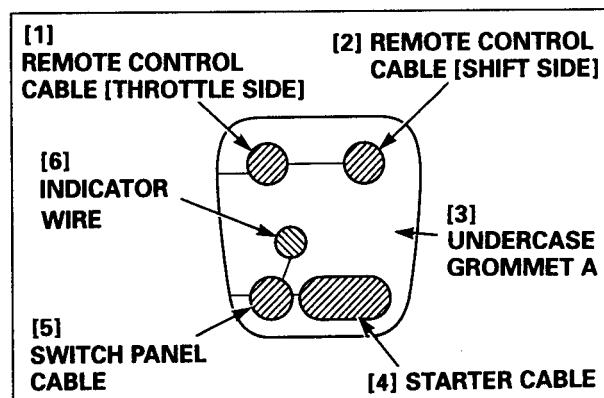
- 1) Pass the remote control cable A between the projections on the engine undercase as shown, and install the connector bracket B.
- 2) Connect each connector to the connector bracket B, and clamp the wires.



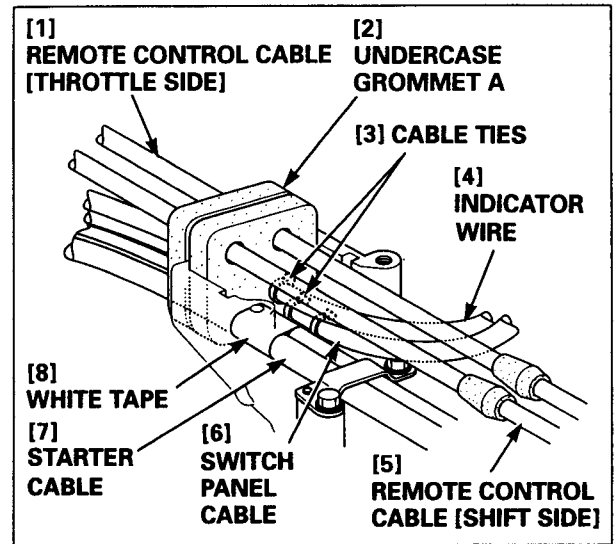
### • UNDERCASE GROMMET A

#### INSTALLATION:

- 1) Pass the cables and harnesses through the undercase grommet A.



- 2) Route the starter cable so that the white tape end on the cable is on the inner side of the undercase grommet A.
- 3) Route the switch panel cable and the indicator wire so that the respective cable ties are on the inner side of the undercase grommet A.
- 4) Check to see that the switch panel cable and the indicator wire do not interfere with the throttle remote control cable.





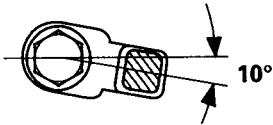
### 3. STARTER CABLE/POWER TILT SWITCH

#### a. REMOVAL/INSTALLATION

- Disconnect the positive (+) and the negative (-) starter cables from the battery.
- Connect the cables properly by referring to the cable/harness routing (P. 2-31).

#### [1] NEGATIVE (-) STARTER CABLE

**INSTALLATION:**  
Connect the cable at 10° from the horizontal line as shown.

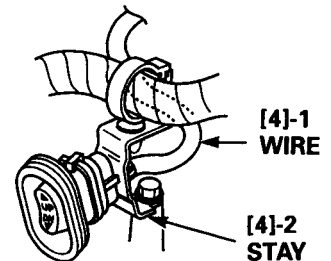


#### [3] POSITIVE (+) STARTER CABLE

**INSTALLATION:** P. 17-10

#### [4] HARNESS CLAMP

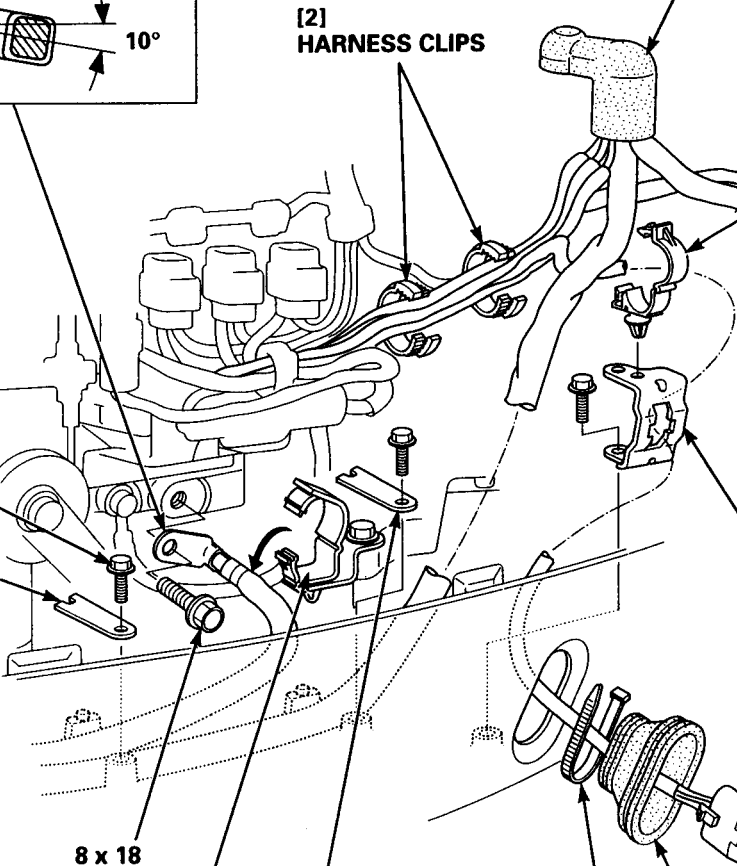
**INSTALLATION:**  
Set the harness clamp so that the opening faces the engine and the power tilt switch wire does not interfere with the stay.



#### [2] HARNESS CLIPS

#### [5] POWER TILT SWITCH STAY

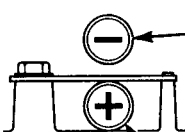
#### [11] CABLE PLATE



#### [10] 10 mm WIRE HARNESS CLIP

#### [9] CABLE PLATE

**INSTALLATION:**  
Clamp only the positive (+) starter cable as shown.



#### [9]-2 POSITIVE (+) STARTER CABLE

#### [9]-1 NEGATIVE (-) STARTER CABLE

#### [6] POWER TILT SWITCH

**INSPECTION:** P. 17-26

#### [8] CABLE TIE

**INSTALLATION:**  
Tie up the cable tie and cut the cable tie 5 mm (0.2 in) from the tie-up point.

#### [7] UNDERCASE GROMMET G

### 4. STARTER MOTOR/STARTER MAGNETIC SWITCH

#### a. REMOVAL/INSTALLATION

- Disconnect the positive (+) and the negative (-) starter cables from the battery.
- Connect the cables properly by referring to the cable/harness routing (P. 2-31).

Remove the ECM cover.

#### [1] WIRE CLAMP

##### INSTALLATION:

Clamp the positive (+) and the negative (-) terminal wires and clamp the starter magnetic switch wire.

#### [2] STARTER MAGNETIC SWITCH

INSPECTION: P. 17-25

#### [4] MOUNT COLLAR (2)

#### [3] RUBBER CUSHION (2)

#### [5] STARTER MAGNETIC SWITCH 2P CONNECTOR

#### [6] 8 mm HEX. NUT

10.8 N•m (1.1 kgf•m, 8 lbf•ft)

#### [17] 6 mm WASHER (2)

6 x 25 (2)

#### [16] POSITIVE (+) STARTER MAGNETIC SWITCH TERMINAL WIRE

INSTALLATION: P. 17-10

#### [15] 6 mm HEX. NUT (2)

4.9 N•m (0.5 kgf•m, 3.6 lbf•ft)

#### [14] NEGATIVE (-) STARTER MAGNETIC SWITCH TERMINAL WIRE

INSTALLATION: P. 17-10

#### [13] MAGNETIC SWITCH WIRE

#### [12] 10 mm WIRE HARNESS CLIP

##### INSTALLATION:

Clamp the positive (+) starter cable.

6 x 14

#### [11] CLIP BRACKET E

#### [10] STARTER MOTOR

DISASSEMBLY/  
ASSEMBLY: P. 17-11, 12, 17 and 18  
INSPECTION: P. 17-13 through 16

#### [7] POSITIVE (+) STARTER CABLE

INSTALLATION: P. 17-10

#### [8] 10 x 35 (2)

39 N•m (4.0 kgf•m, 29 lbf•ft)

#### [9] 54.4 x 3.1 mm O-RING

Do not reuse.

### • STARTER MAGNETIC SWITCH TERMINAL WIRE

#### INSTALLATION:

##### <Positive (+) terminal wire side>

- 1) Connect the positive (+) terminal wire to the starter magnetic switch with the caulked part toward you.
- 2) Be sure that the terminal wire is connected at 20° from the horizontal line as shown, and tighten the 6 mm hex. nut to the specified torque.

**TORQUE: 4.9 N·m (0.5 kgf·m, 3.6 lbf·ft)**

##### <Negative (-) terminal wire side>

- 1) Connect the negative (-) terminal wire to the starter magnetic switch with the caulked part toward you.
- 2) Be sure that the terminal wire is connected at 90° from the horizontal line as shown, and tighten the 6 mm hex. nut to the specified torque.

**TORQUE: 4.9 N·m (0.5 kgf·m, 3.6 lbf·ft)**

- 3) After connecting the terminal wires, set the covers over the respective terminals securely.

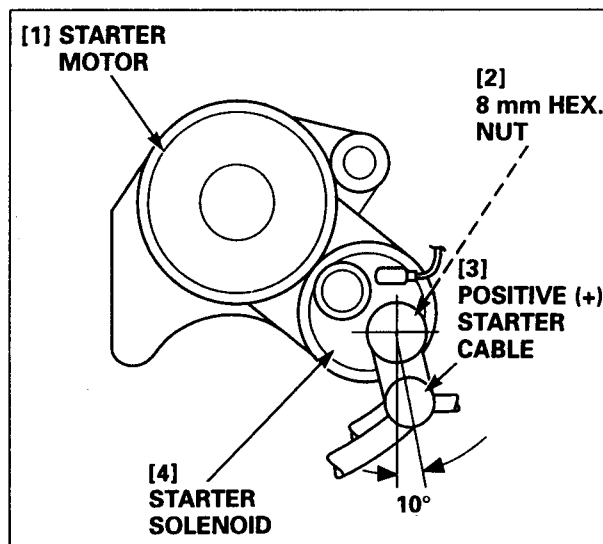
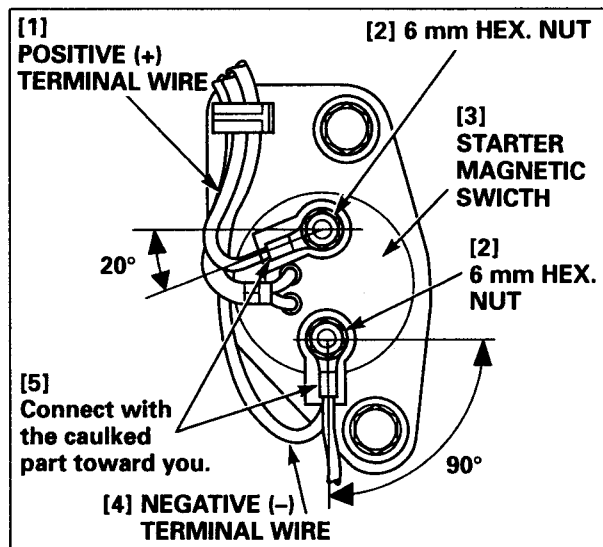
### • POSITIVE (+) STARTER CABLE

#### INSTALLATION:

- 1) Connect the positive (+) starter cable at 10° from the horizontal line as shown, and tighten the 8 mm hex. nut to the specified torque.

**TORQUE: 10.8 N·m (1.1 kgf·m, 8 lbf·ft)**

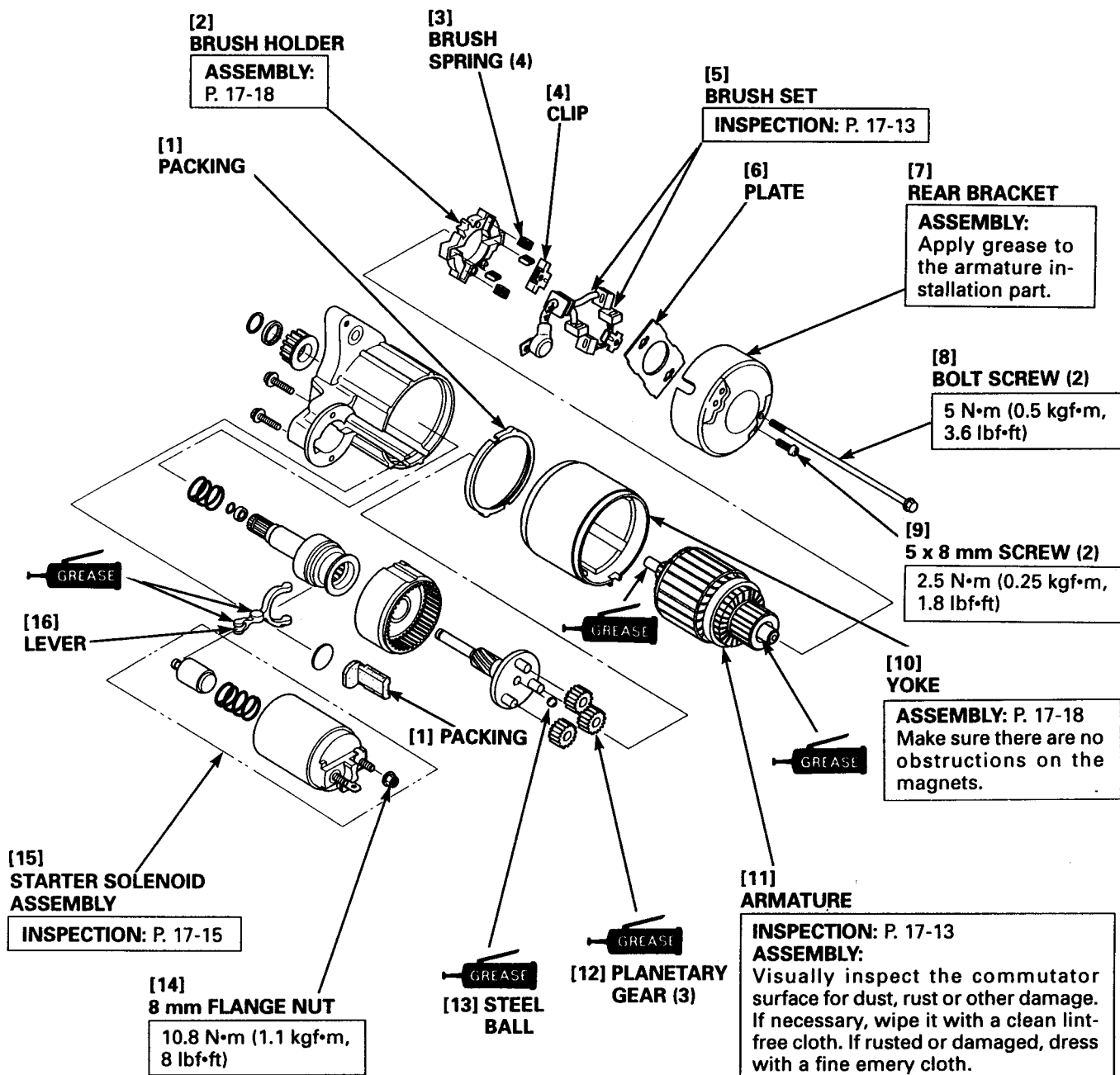
- 2) After connecting the cable, set the cover over the terminal securely.



### b. DISASSEMBLY/ASSEMBLY

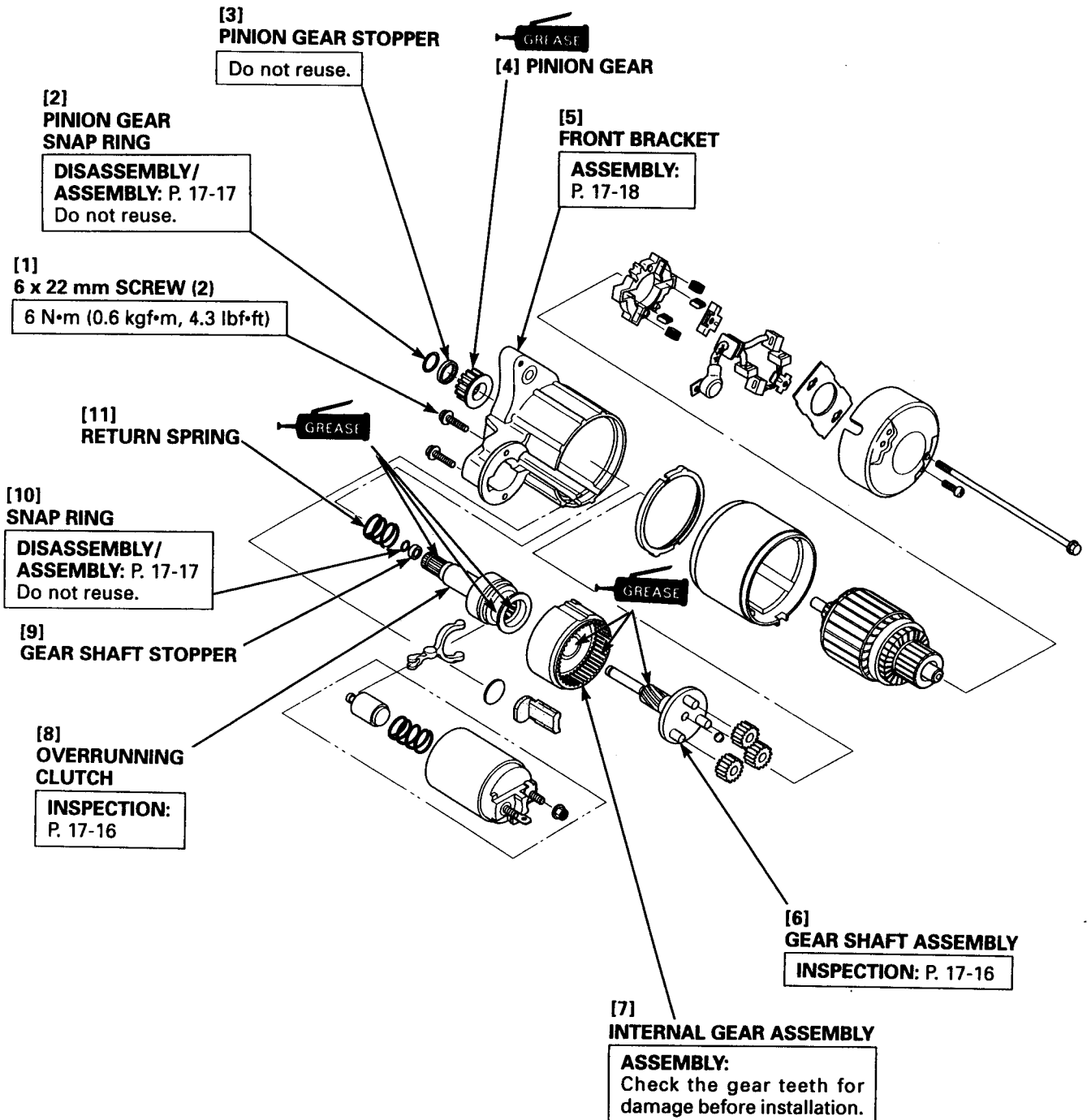
#### NOTE:

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).



### NOTE:

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).

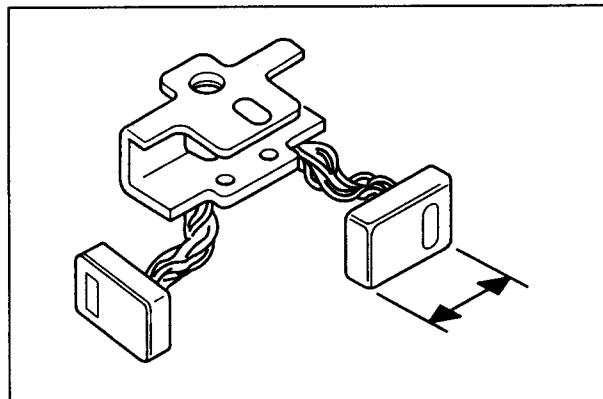


### c. INSPECTION

#### • BRUSH LENGTH

Measure the brush length. If brush length is less than the service limit, replace the brushes as a set.

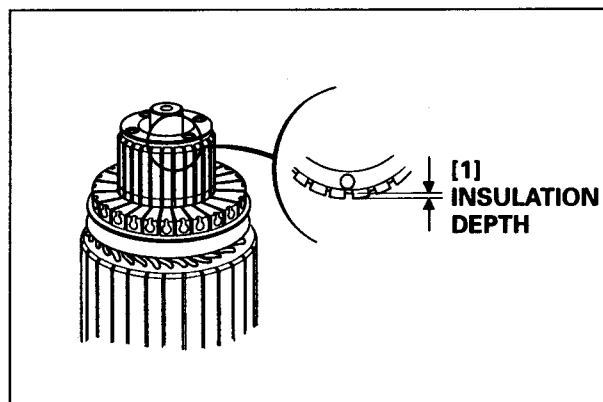
STANDARD	SERVICE LIMIT
12.3 mm (0.48 in)	7.0 mm (0.28 in)



#### • INSULATION DEPTH

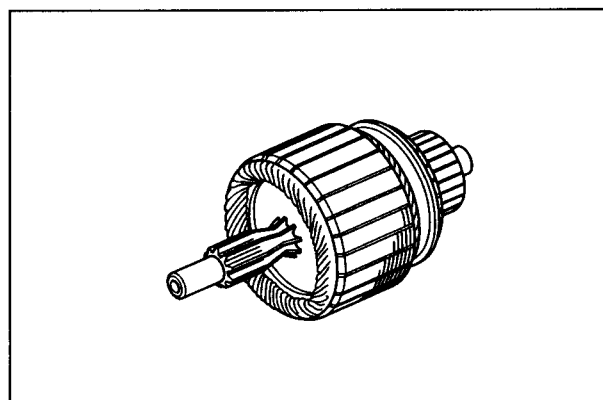
If the grooves are clogged or insulation depth is less than the service limit, recut the grooves using a hacksaw blade or a small file.

STANDARD	SERVICE LIMIT
0.4 – 0.5 mm (0.016 – 0.020 in)	0.2 mm (0.008 in)



#### • ARMATURE

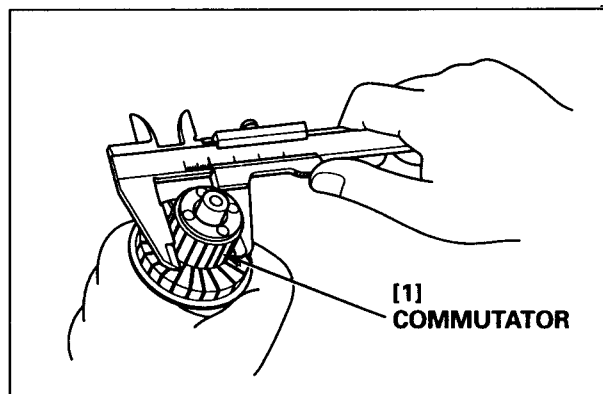
Check the armature and shaft gear for wear and damage.



#### • 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)

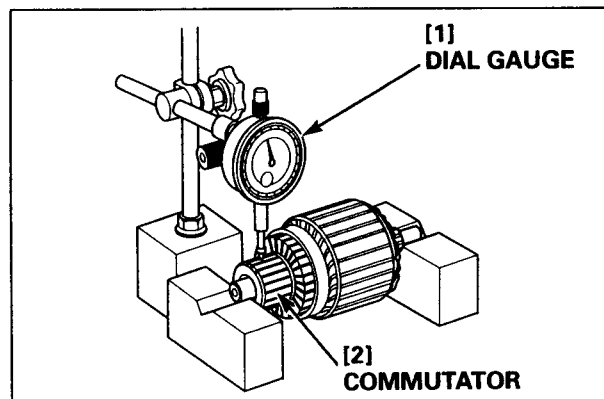


### • COMMUTATOR RUNOUT

Measure commutator runout using a dial gauge.

If the measurement is more than the service limit, replace the armature with a new one.

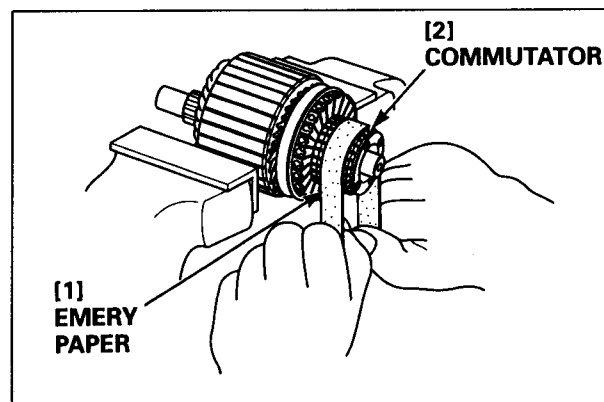
SERVICE LIMIT	0.1 mm (0.004 in)
---------------	-------------------



### • COMMUTATOR CLEANING

Check the commutator for damage, dust, dirt and metal particles.

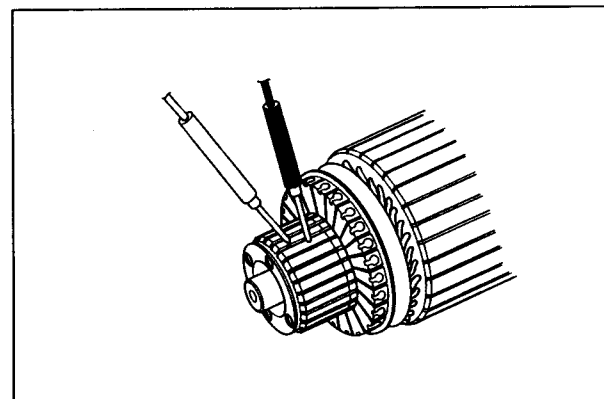
If there is stain, irregularity and/or evidence of burning, clean with an emery paper #500 or #600.



### • ARMATURE

#### CONTINUITY CHECK – SEGMENTS

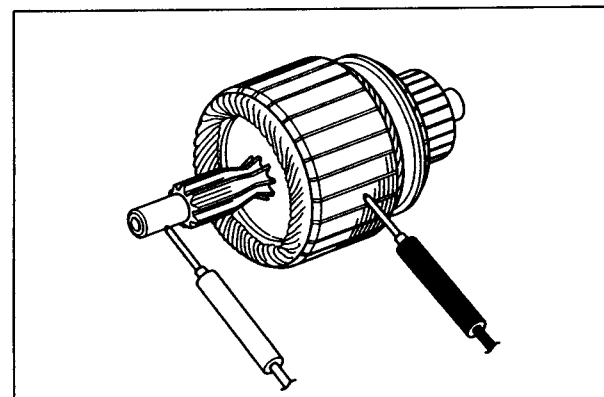
Check for continuity between each segment. If an open circuit exists between any two segments, replace the armature.



#### SHORT CIRCUIT TEST – SHAFT - TO - ARMATURE

Check for continuity between the armature and armature shaft.

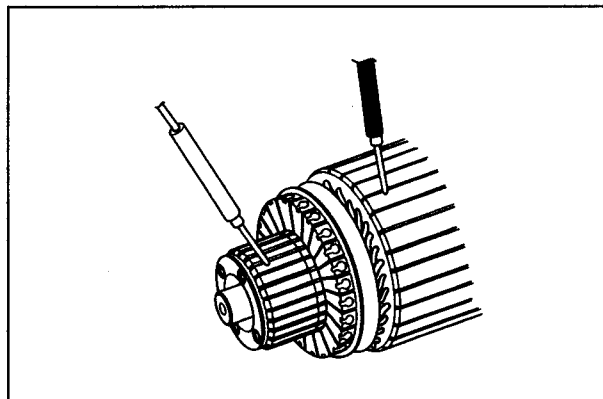
If there is continuity, replace the armature.



### SHORT CIRCUIT TEST – CORE - TO - COMMUTATOR

Check for continuity between the commutator and armature coil core.

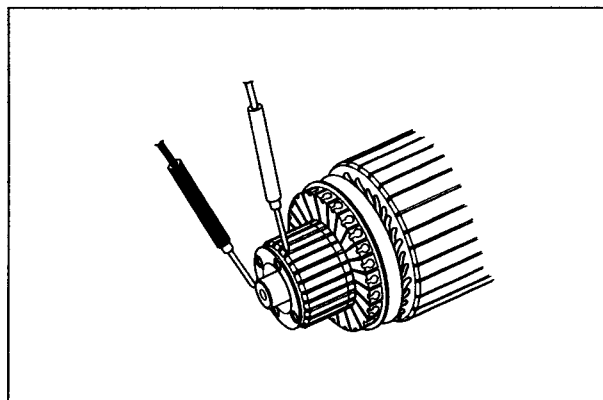
If continuity exists, replace the armature.



### SHORT CIRCUIT TEST – SHAFT - TO - COMMUTATOR

Check for continuity between the commutator and armature shaft.

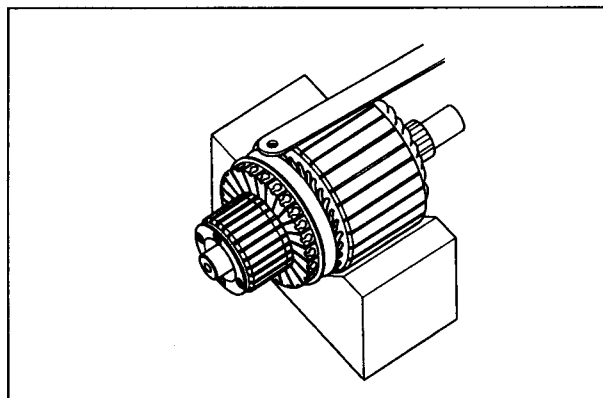
If there is continuity, replace the armature.



### SHORT CIRCUIT TEST – ARMATURE

Place the armature in an armature tester (commercially available).

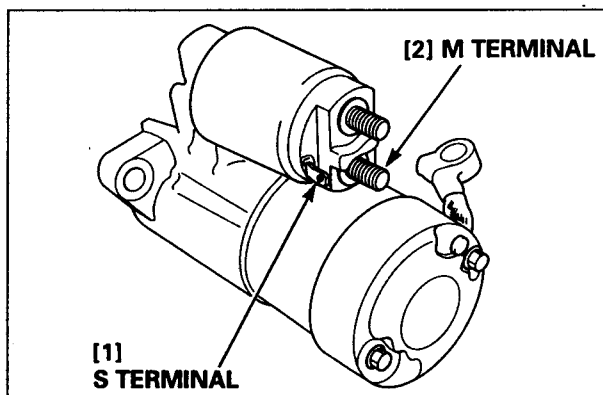
Hold a hacksaw blade close to the armature core. If the blade is attracted to the core or vibrates when the core is turned, the armature is shorted. Replace the armature.



### ● 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.



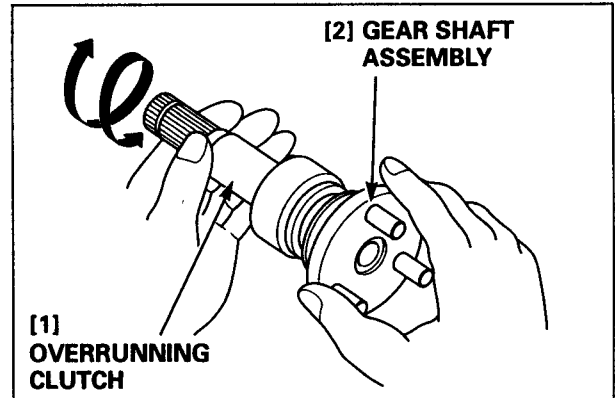


### • OVERRUNNING CLUTCH

- 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.



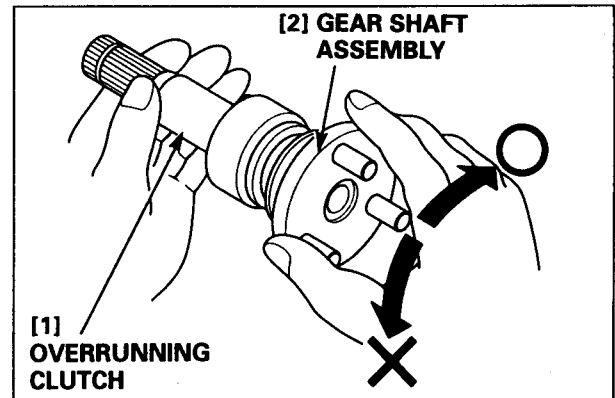
- 2) Turn the gear shaft assembly by holding the overrunning clutch. The gear shaft assembly should turn only clockwise.

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.

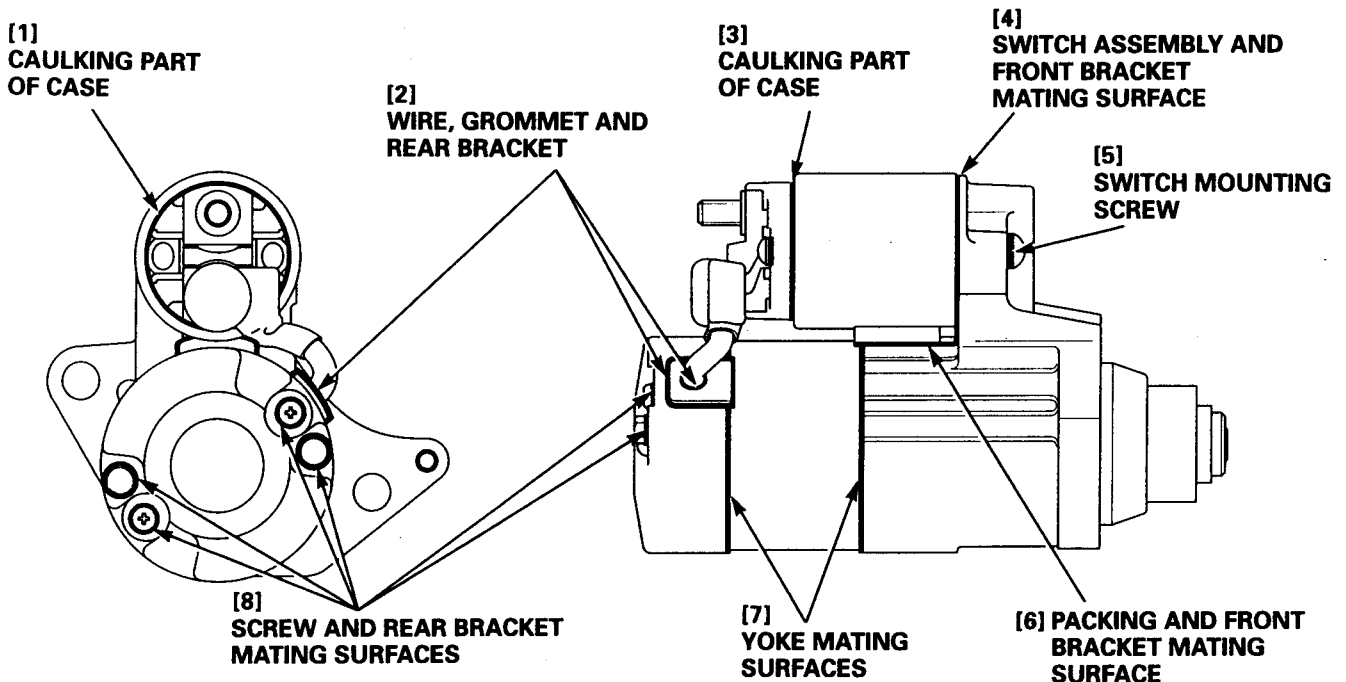
#### NOTE:

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



### • WATER-RESISTING SEALANT APPLICATION POINTS

After assembling the starter motor, apply a sufficient amount of water-resisting sealant (Sumitomo Three-M Padding Sealer 8533 or equivalent) to the mating surfaces shown below.



### • PINION GEAR SNAP RING

#### DISASSEMBLY:

Pinion gear snap ring disassembly and reassembly must be made with the pinion gear extended.

- 1) Connect to the battery as shown. Turn the switch ON and let the pinion gear extend.

#### CAUTION:

**Do not turn the switch ON for more than 10 seconds.**

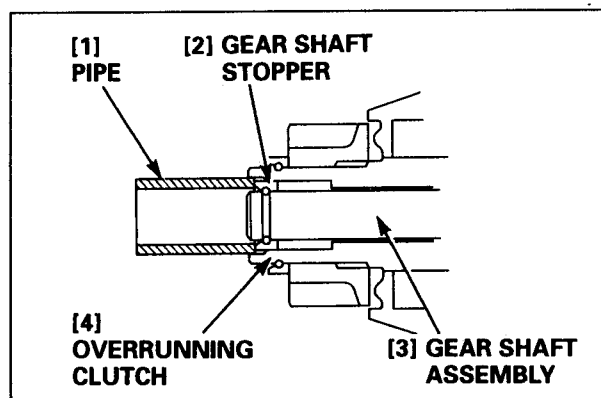
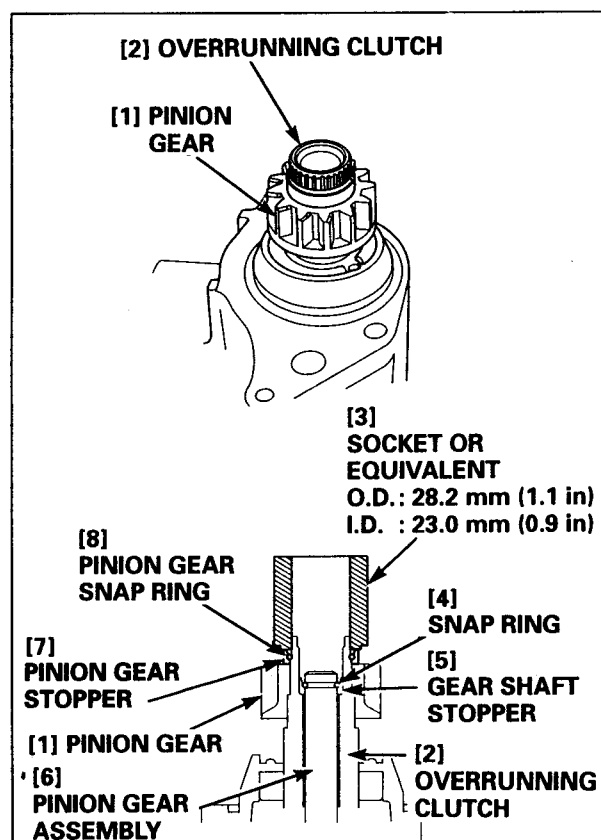
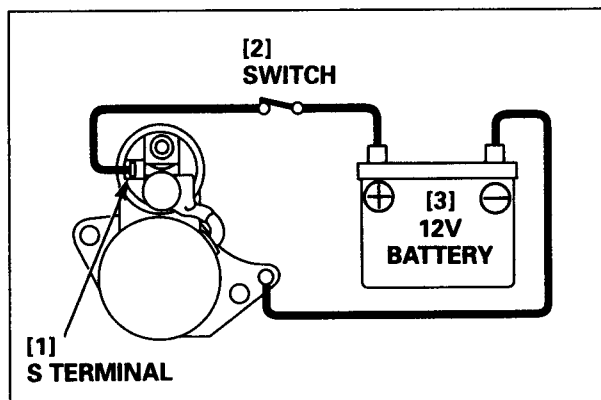
- 2) With the pinion gear extended, attach a commercially available socket or equivalent to the pinion gear.

Remove the pinion gear stopper from the snap ring by tapping on the socket or equivalent.

- 3) Remove the snap ring from the groove of the overrunning clutch.

#### ASSEMBLY:

- 1) Let the pinion gear extend in the same procedure as disassembly.
- 2) Install a new pinion gear stopper on the overrunning clutch. Install a new pinion gear snap ring in the groove of the overrunning clutch.
- 3) Install the snap ring in the groove of the pinion gear stopper.



### • SNAP RING

#### DISASSEMBLY:

- 1) Prepare a pipe to the following specifications.
  - I.D.: approx. 11 mm (0.4 in)
  - O.D.: approx. 15 mm (0.6 in)
  - Length: approx. 20 mm (0.8 in)
- 2) Raise the gear shaft assembly. Note that the end of the gear shaft assembly must be out of the overrunning clutch end a little at this time.

#### NOTE:

**Take care not to hit the internal gear assembly.**

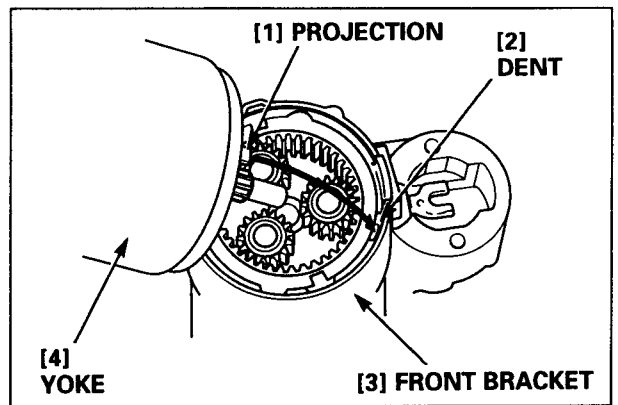
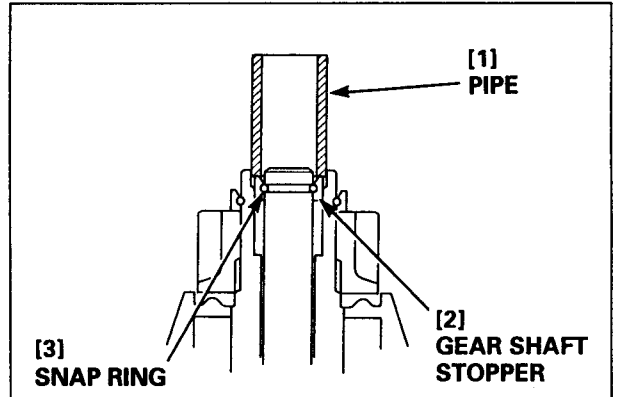
- 3) Set the pipe prepared in the step 2 over the gear shaft stopper, and remove the gear shaft stopper from the snap ring by tapping on the pipe.
- 4) Remove the snap ring from the groove of the gear shaft assembly.

### ASSEMBLY:

- 1) Install a new gear shaft stopper on the gear shaft assembly in the same procedure as DISASSEMBLY.

Install a new snap ring in the groove of the gear shaft assembly.

- 2) Raise the overrunning clutch, and install the snap ring in the groove of the gear shaft stopper.



### • FRONT BRACKET/YOKE/BRUSH HOLDER

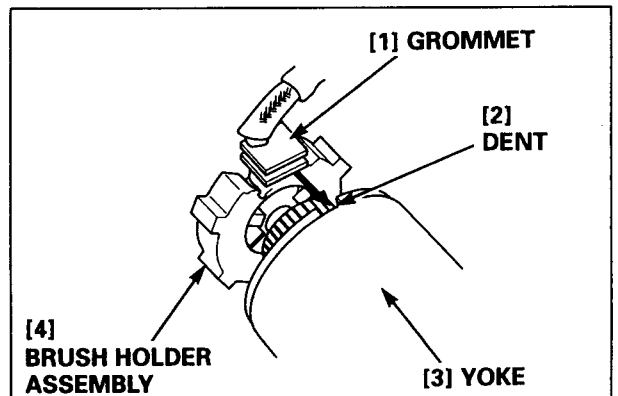
#### ASSEMBLY:

- 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)

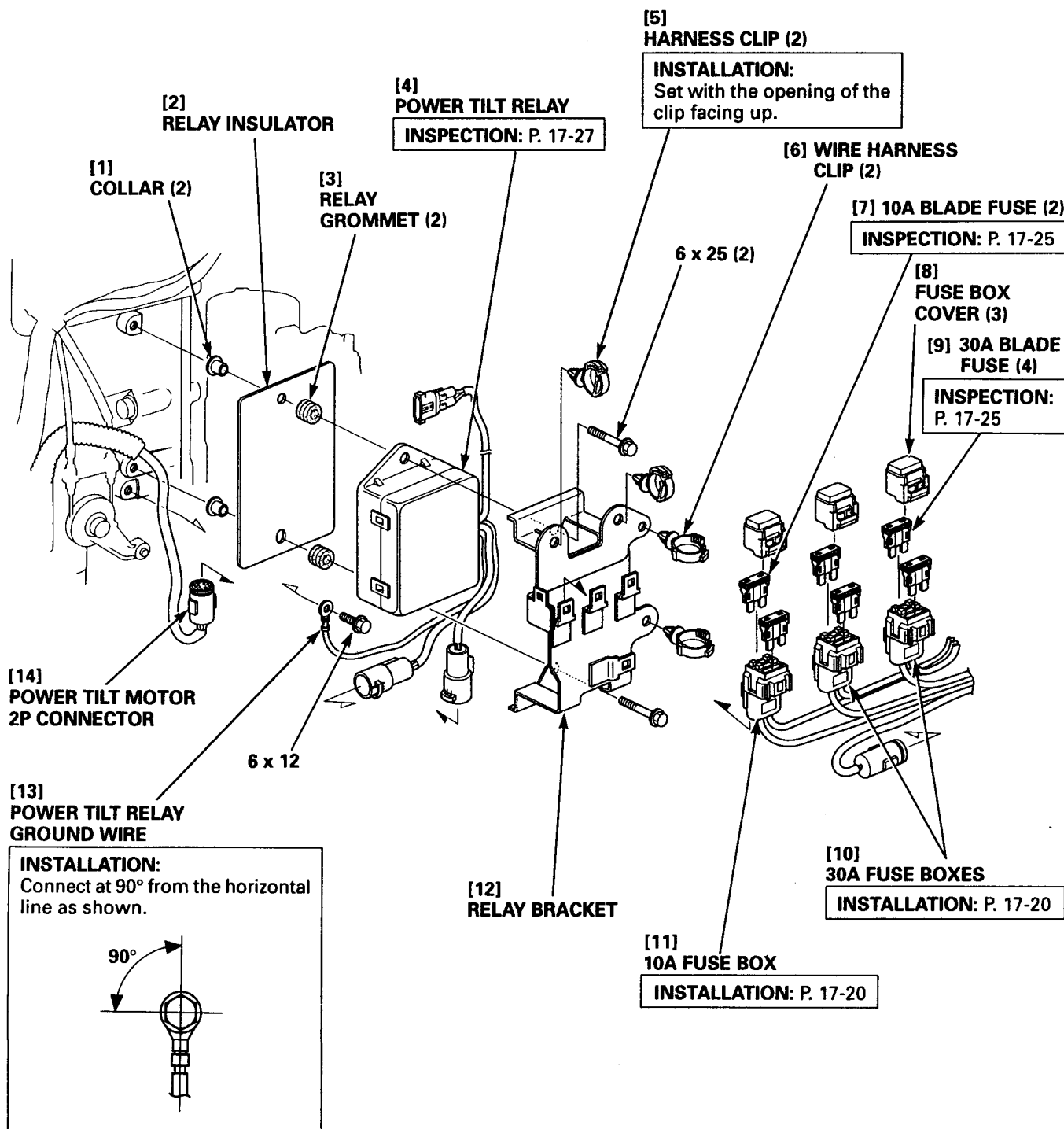
5 x 8 mm screw: 2.5 N·m (0.25 kgf·m, 1.8 lbf·ft)



## 5. FUSE BOX/POWER TILT RELAY

### a. REMOVAL/INSTALLATION

- Disconnect the positive (+) and the negative (-) starter cables from the battery.
- Connect the cables properly by referring to the cable/harness routing (P. 2-31).

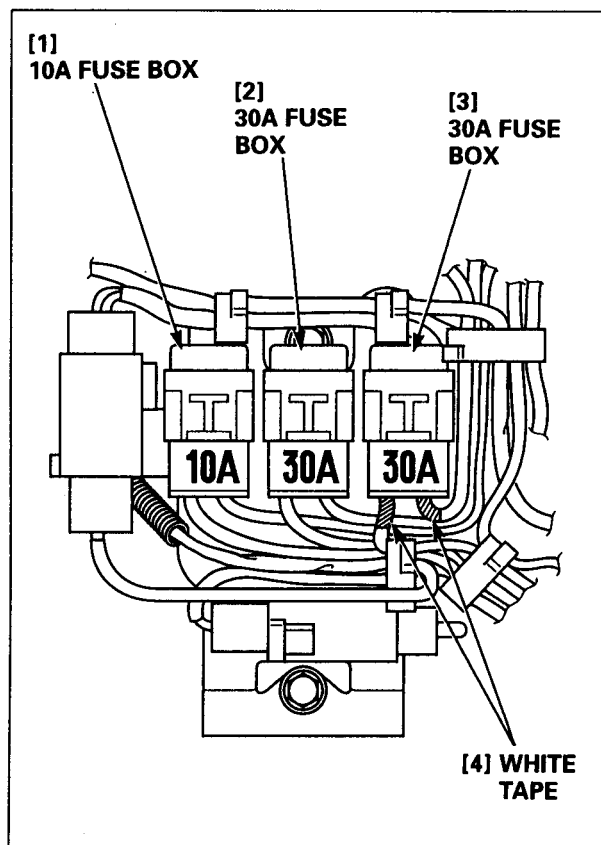


## • 30A/10A FUSE BOX

### INSTALLATION:

Install the 30A fuse box identified with the white tape around the wires at the right side of the relay bracket as shown.

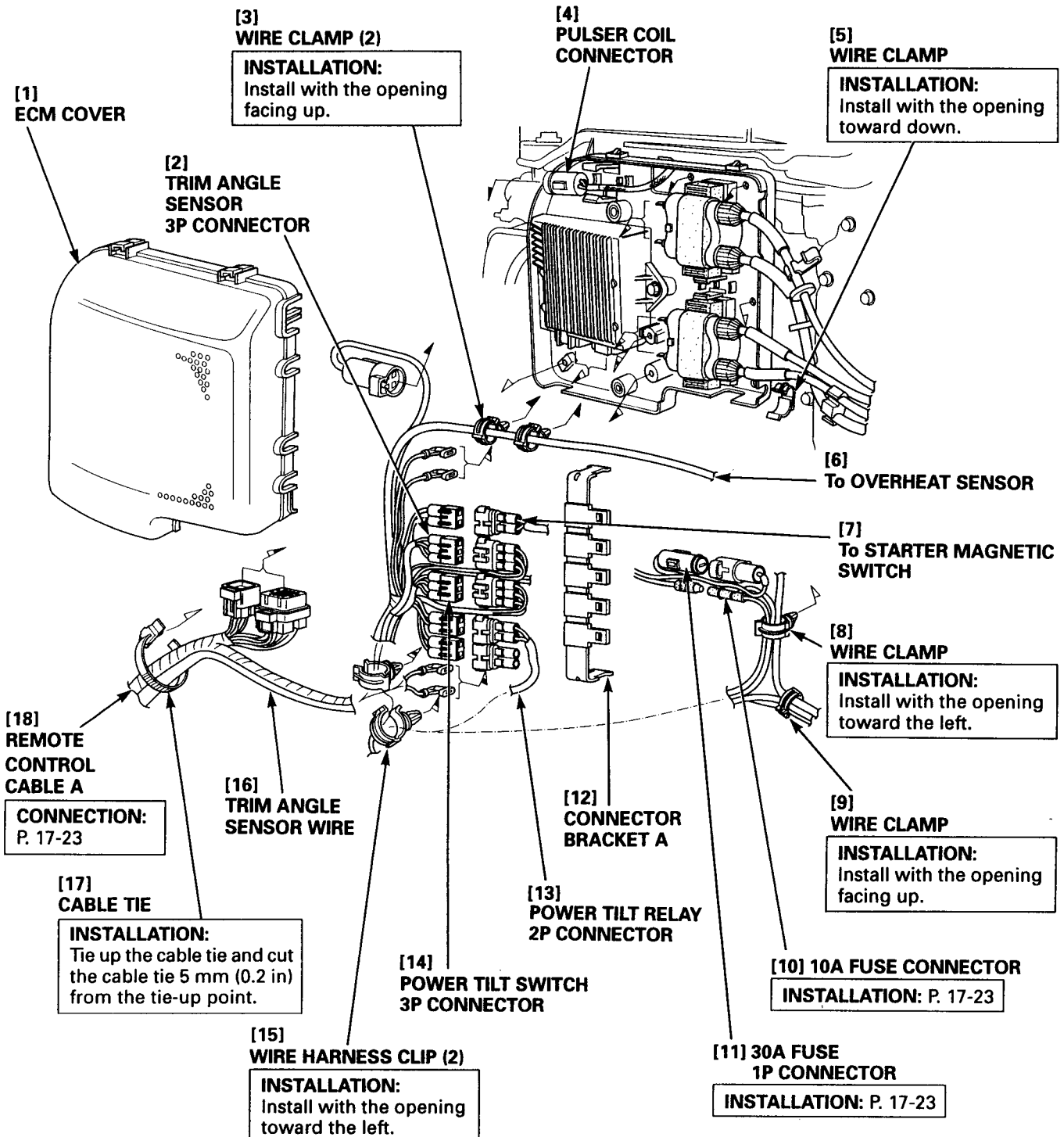
Install the 10A fuse box at the left side of the relay bracket.



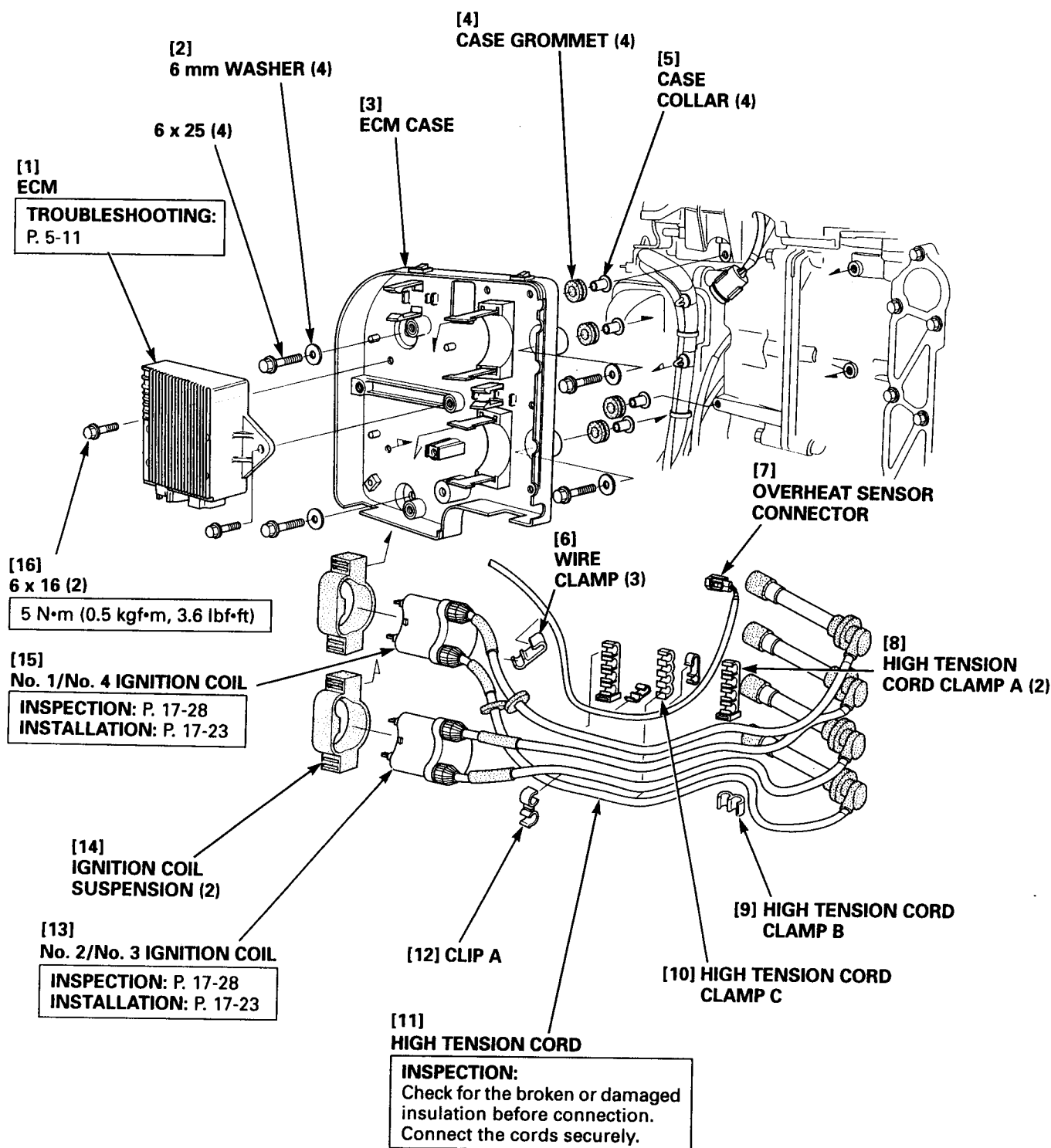
## 6. REMOTE CONTROL CABLE A/ECM/IGNITION COIL

### a. REMOVAL/INSTALLATION

- Disconnect the positive (+) and the negative (-) starter cables from the battery.
- Connect the cables properly by referring to the cable/harness routing (P. 2-31).



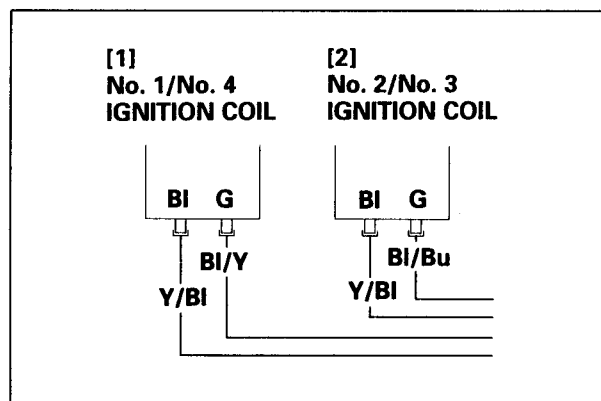
- Set the clamps in the designated positions securely by referring to the cable/harness routing (P. 2-31).



### • IGNITION COIL

#### INSTALLATION:

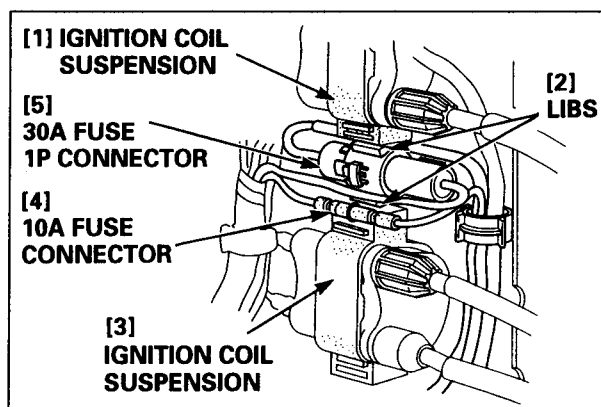
Connect the ignition coil wires to the respective ignition coils as shown.



### • 30A FUSE 1P CONNECTOR/10A FUSE CONNECTOR

#### INSTALLATION:

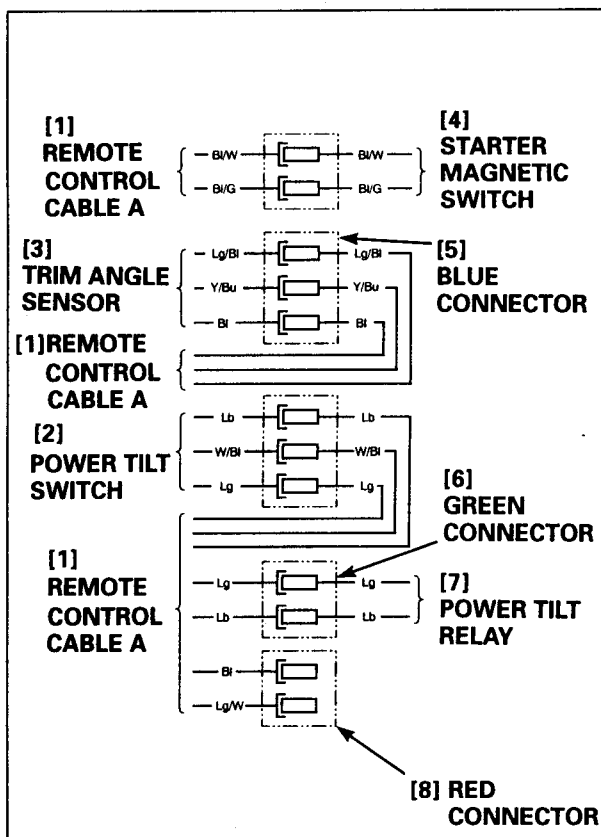
- 1) Set the 30A fuse 1P connector between the libs of the ECM case by turning it 180°, and set the wire between the ignition coil suspension and the lib as shown.
- 2) Set the 10A fuse connector between the lower lib of the ECM case and the ignition coil suspension.



### • REMOTE CONTROL CABLE A

#### CONNECTION:

Connect the connectors as shown and set them on the connector bracket A.

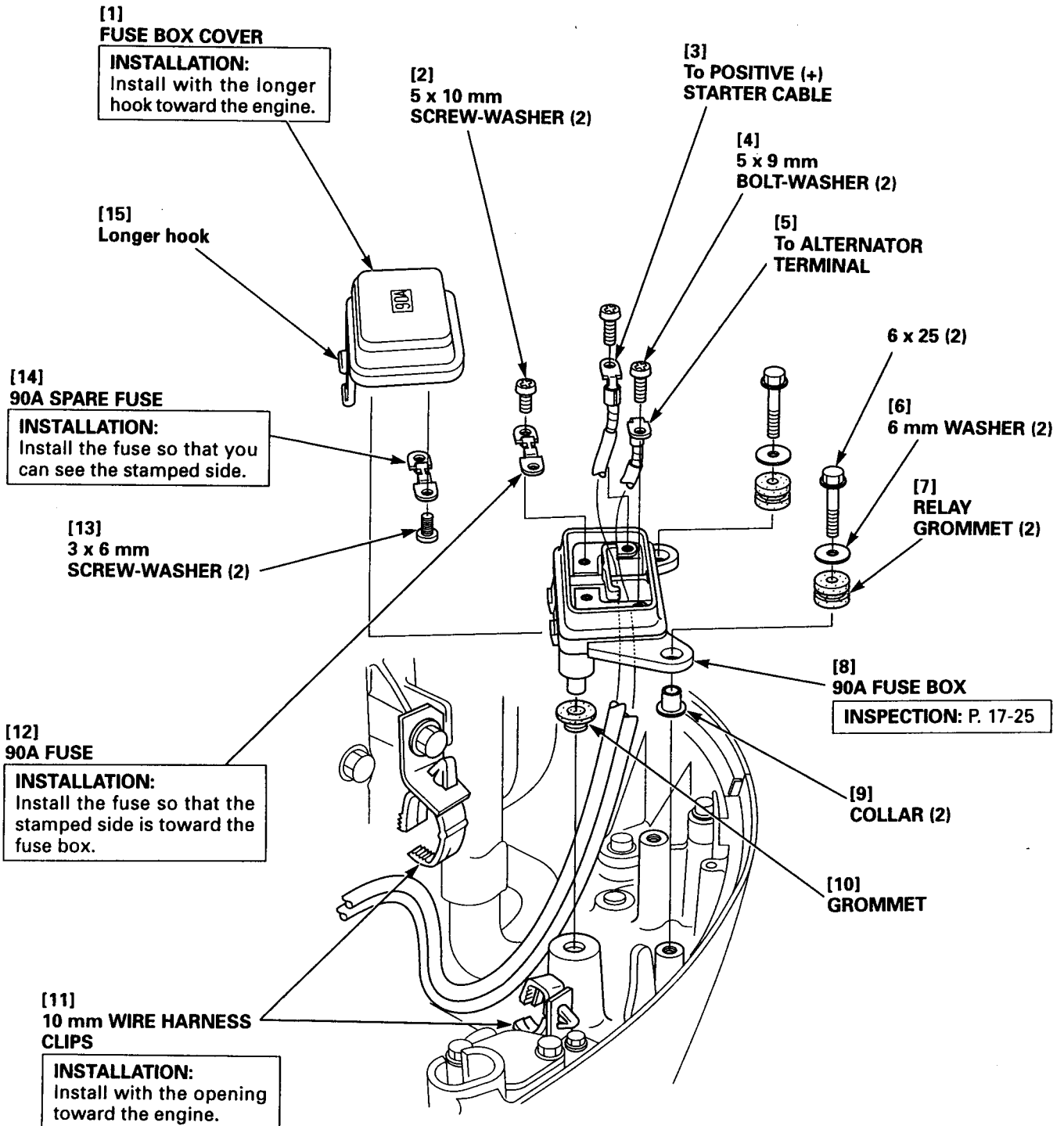




## 7. 90A FUSE BOX

### a. REMOVAL/INSTALLATION

- Disconnect the positive (+) and the negative (-) starter cables from the battery.



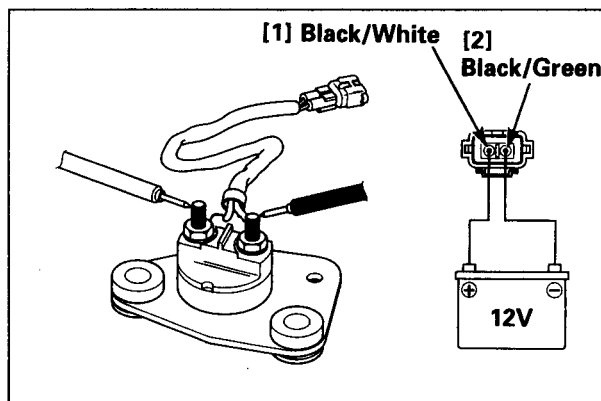
## 8. INSPECTION

### • STARTER MAGNETIC SWITCH

- Check the battery condition before starting the inspection.

Connect the black/white terminal of the starter magnetic switch 2P connector to the battery positive (+) terminal, and connect the black/green terminal to the battery negative (-) terminal. There must be continuity between the starter magnetic switch terminals.

Disconnect the starter magnetic switch 2P connector terminals from the battery terminals. There must be no continuity between the terminals.



### • 90A/30A/10A FUSE BOX/FUSE

- Disconnect the positive (+) and the negative (-) starter cables from the battery before inspection and replacement.

Check the fuses for continuity. Set the fuses on the respective fuse boxes and check the fuse boxes for continuity.

#### Inspection:

##### <90A fuse box>

There must be continuity between the positive (+) starter cable and the 90A fuse cable.

##### <30A fuse box (Identified with white taping around the cables)>

There must be continuity between the positive (+) starter cable and the positive (+) starter magnetic switch terminal wire.

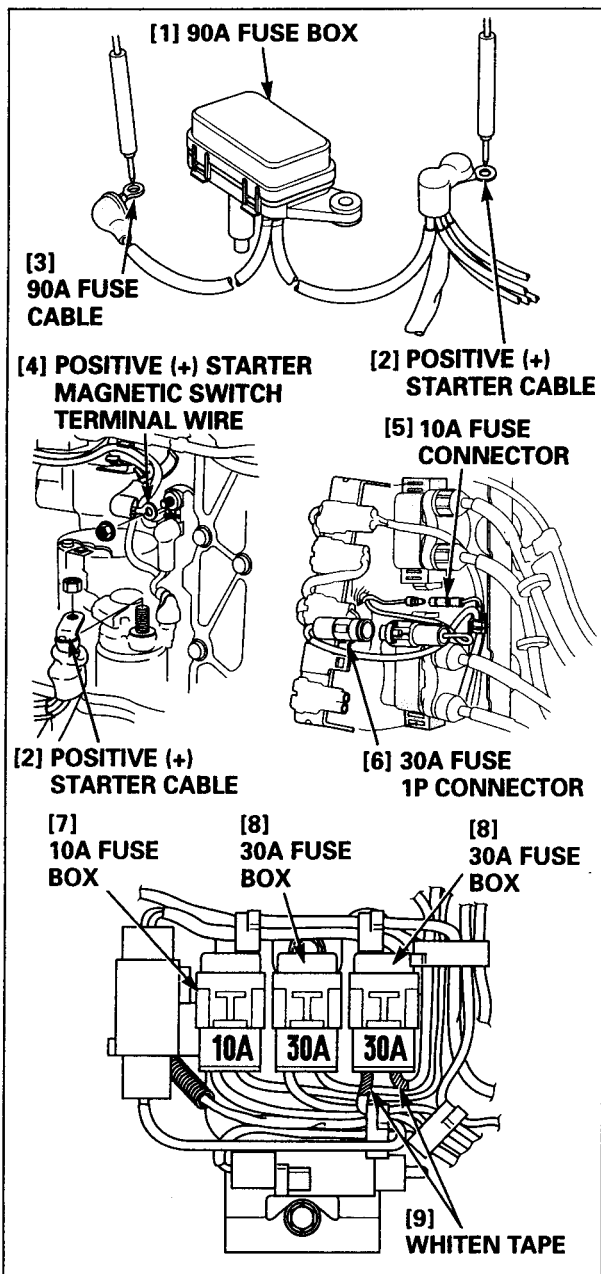
##### <30A fuse box (Center)>

There must be continuity between the positive (+) starter cable and the 30A fuse 1P connector.

##### <10A fuse box>

There must be continuity between the positive (+) starter cable and the 10A fuse connector.

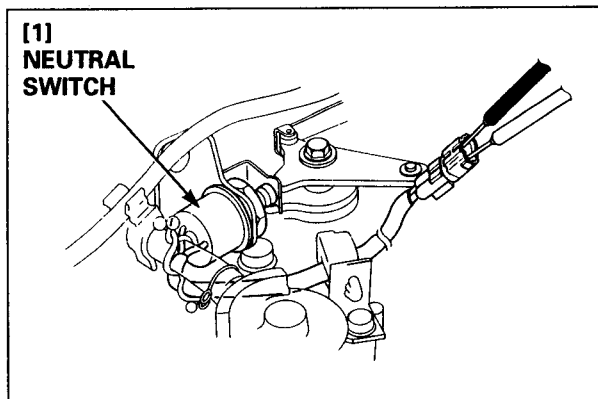
If each fuse is good but continuity is not present as specified, replace the starter cable assembly.



### • 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.

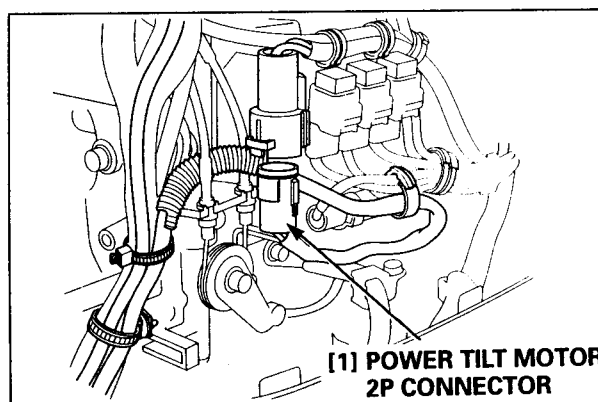
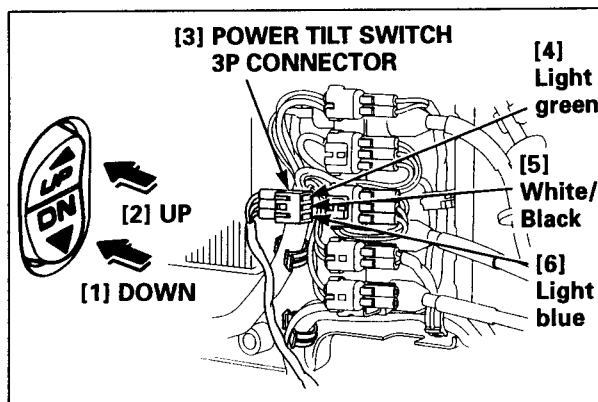
When the switch is pushed "UP" or "DN" there should be continuity between the terminals marked with a circle in the table below.

	Lg	W/BI	Lb
UP	○	○	
DOWN		○	○

○—○: Continuity

### • POWER TILT MOTOR

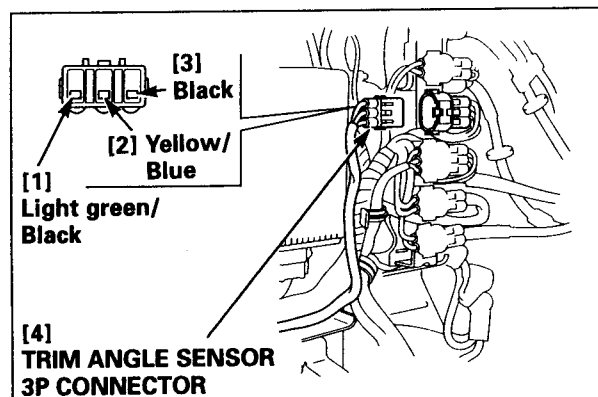
Check for continuity between the terminals.



### • TRIM ANGLE SENSOR

Attach the tester leads to the trim angle sensor connectors and measure the resistance.

Resistance between Light green/black and Black	4 – 6 kΩ
Resistance between Yellow/blue and Black	2.7 – 4.3 kΩ

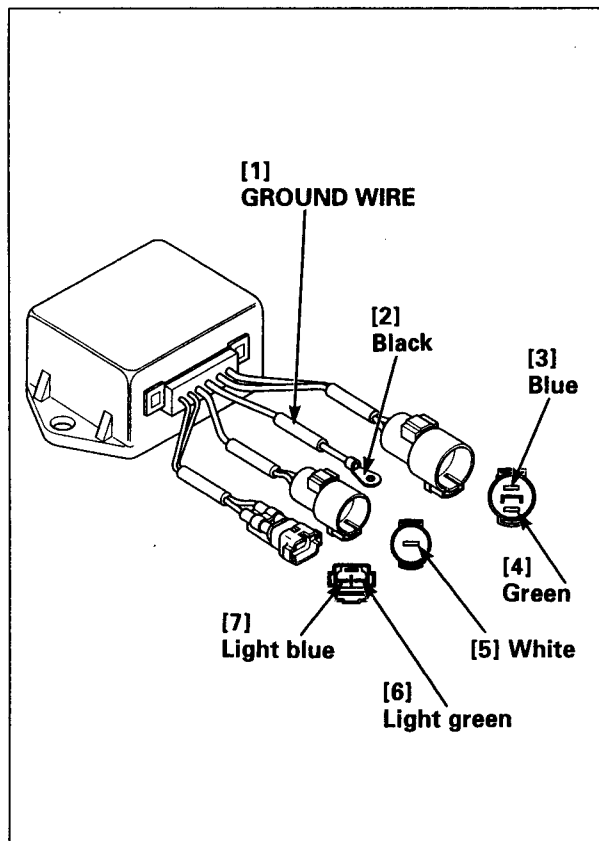


### • POWER TILT RELAY

- 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



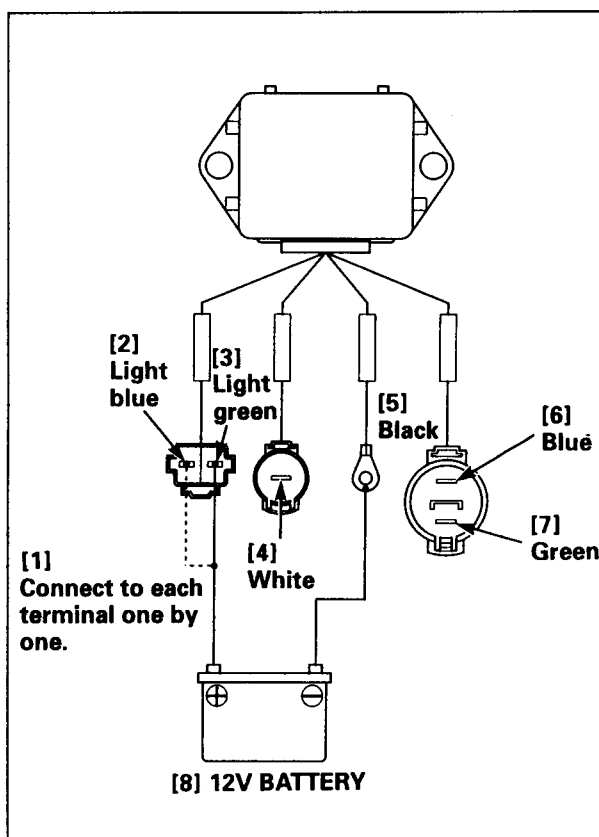
2) Connect the wires as shown. There must be continuity/no continuity between the terminals shown.

- 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

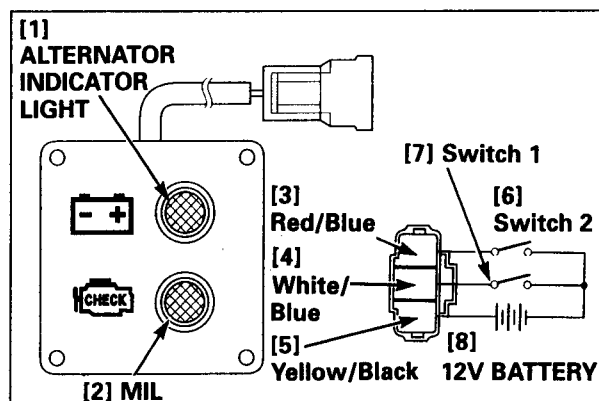


### • INDICATOR LIGHT [MIL, ALTERNATOR INDICATOR LIGHT]

- Use a known-good battery for the test.

Route the indicator light cable as shown. Connect the switch 1 to the red/blue terminal and the switch 2 to the white/blue terminals respectively, and apply the 12V voltage.

Switch 1 ON: Alternator indicator light should be ON.  
Switch 2 ON: MIL should be ON.

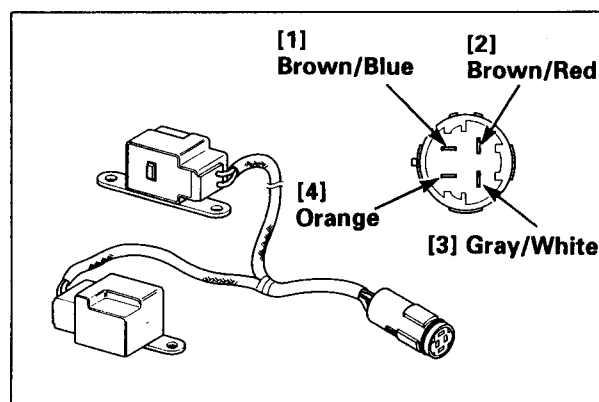


### • PULSER COIL

Measure the resistance between the terminals shown.

Resistance between Gray/White and Brown/Red	970 – 1,170 $\Omega$
Resistance between Orange and Brown/blue	

- For pulser coil replacement, see page 6-9.

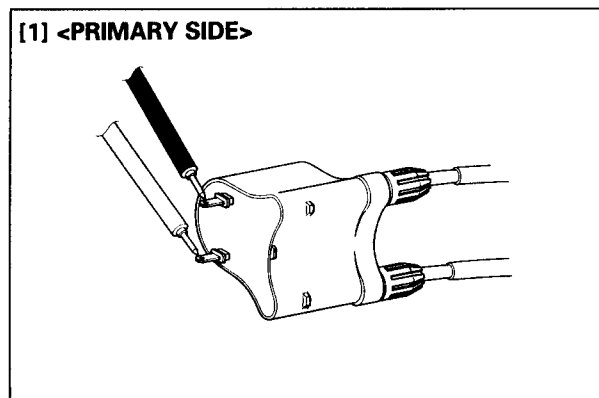


### • IGNITION COIL

#### <Primary side resistance>

Measure the resistance of the primary coil between the two terminals.

Resistance	0.60 – 0.72 $\Omega$
------------	----------------------

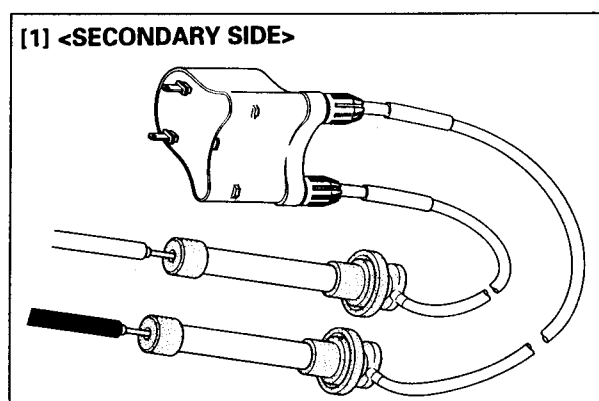


#### <Secondary side resistance>

With the spark plug caps installed, attach the tester leads to the inside of the respective spark plug caps, and measure the secondary resistance of the coil.

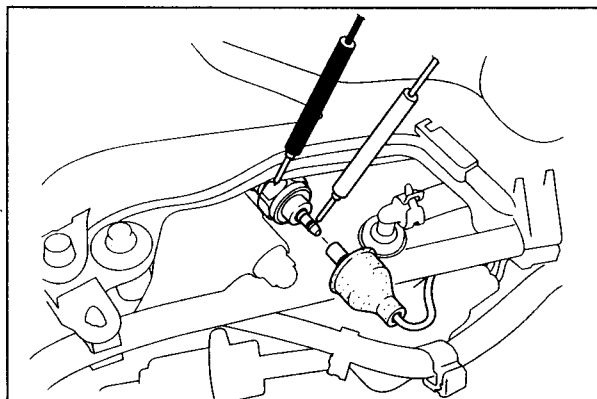
Resistance	25 – 38 k $\Omega$
------------	--------------------

- For ignition coil replacement, see page 17-22.



### • OIL PRESSURE SWITCH

- 1) Disconnect the oil pressure switch wire.
- 2) Attach the tester leads to the contact point of the terminal and the body, and check for continuity. There must be continuity.



### • 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/ White)
OFF	○	○			
ON			○	○	
START			○	○	○

○—○: Continuity

### • INDICATOR LIGHT [OIL PRESSURE LIGHT, OVER-HEAT LIGHT]

- Use a known-good battery for the test.

Apply 12V to the BI/Y [Gr] terminal and connect the switches 1, 2, and 3 to the BI, R, and Y terminals respectively.

When SW1 is ON: The green lamp should turn on.

When SW1 and SW3 are ON: The green lamp should go off.

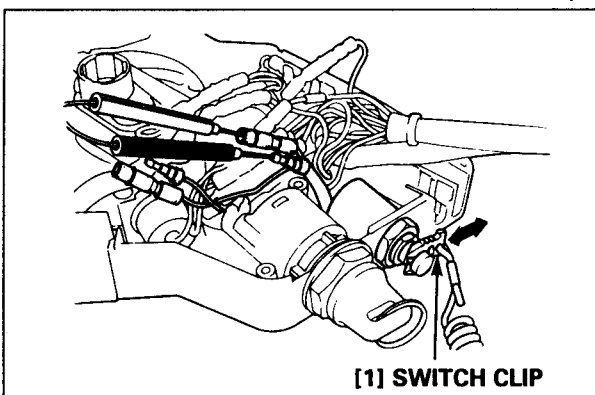
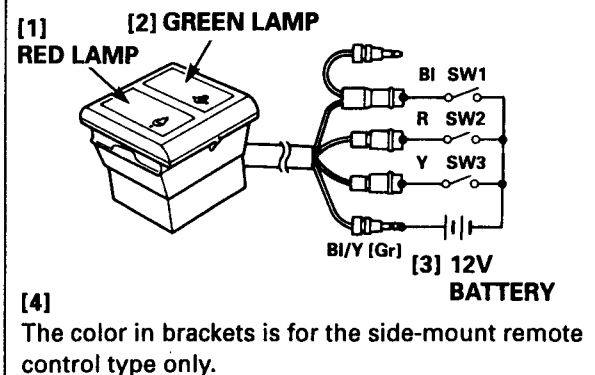
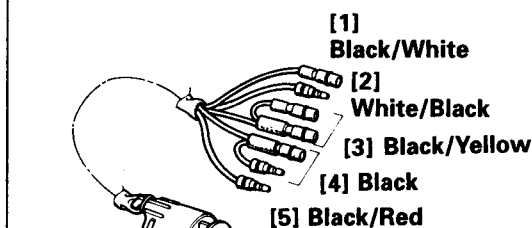
When SW2 is ON: The red lamp should turn on.

The color in brackets is for the side-mount remote control type only.

### • EMERGENCY STOP SWITCH

Attach the tester leads to the two terminals of the emergency stop switch and check for continuity.

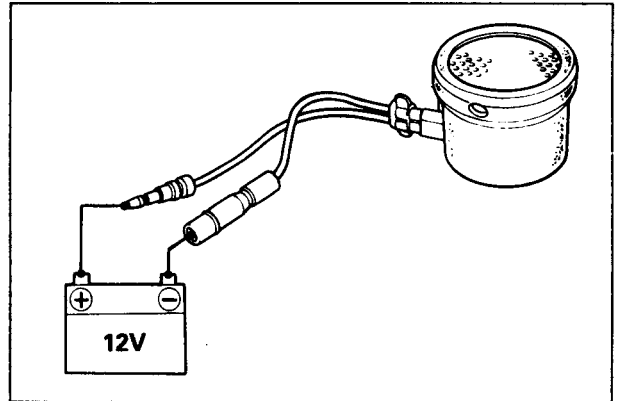
Emergency stop switch clip	Continuity
Engaged	No
Disengaged	Yes
Engaged and button pushed	Yes



### • WARNING BUZZER

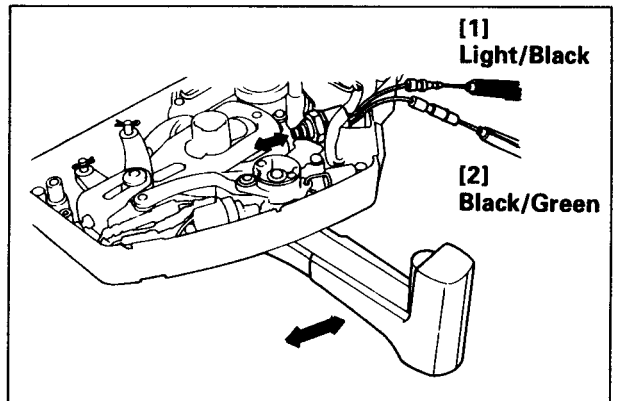
- Use a known-good battery for the test.

Connect the black/yellow terminal of the warning buzzer to the positive (+) terminal of the 12V battery and the yellow/green terminal to the negative (-) terminal of the battery. The warning buzzer should sound.



### • THROTTLE SWITCH [Side-mount remote control type only]

Attach the tester leads to the two terminals at the throttle switch and check for continuity. There should be continuity when the switch knob is pushed.



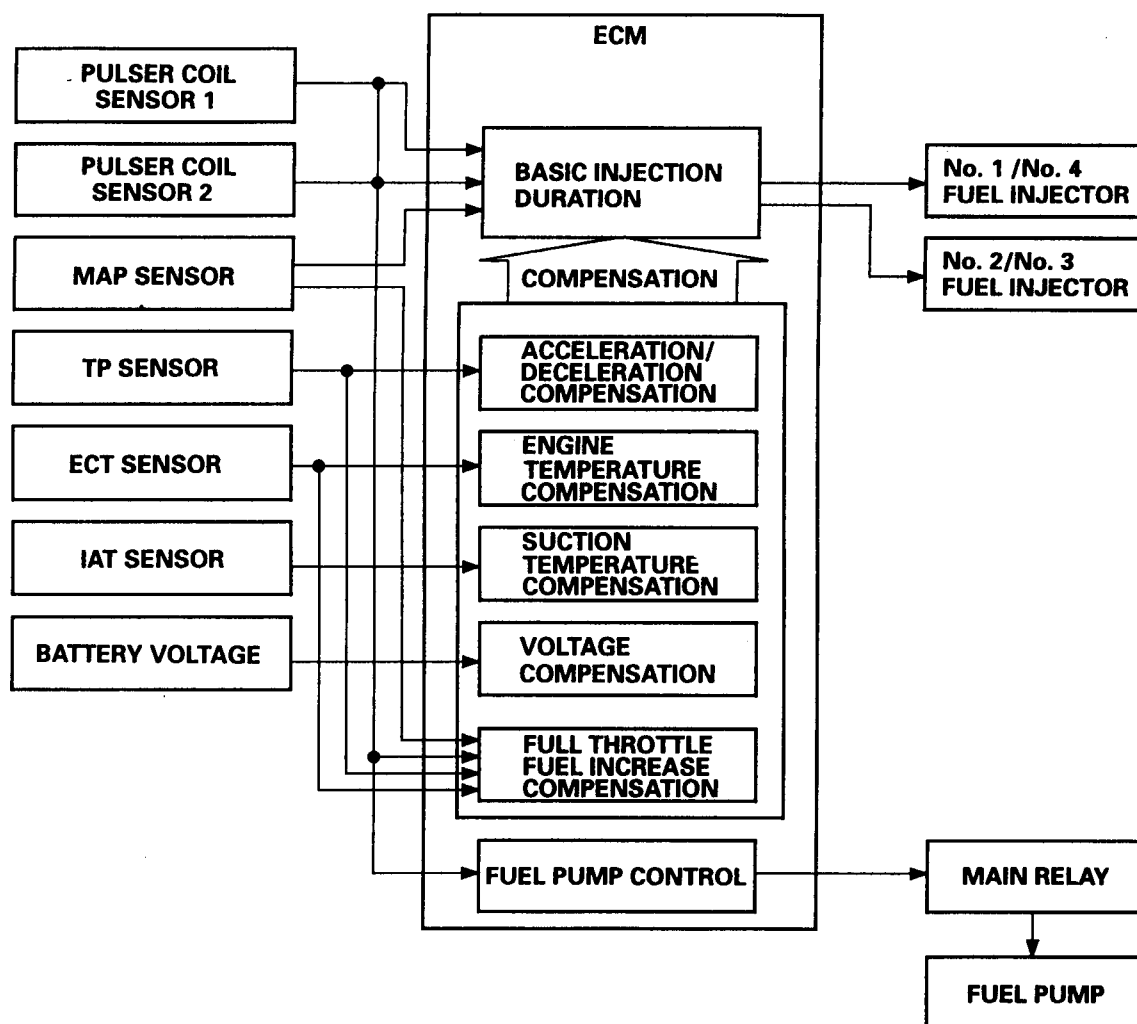
## 1. PROGRAMMED FUEL INJECTION SYSTEM (PGM-FI)

### 1. PROGRAMMED FUEL INJECTION SYSTEM (PGM-FI)

The BF115A/BF130A outboard motor is equipped with a programmed fuel injection system (PGM-FI) which allows accurate fuel control and thereby achieves high output power and low fuel consumption. It also has the following features.

#### • Features

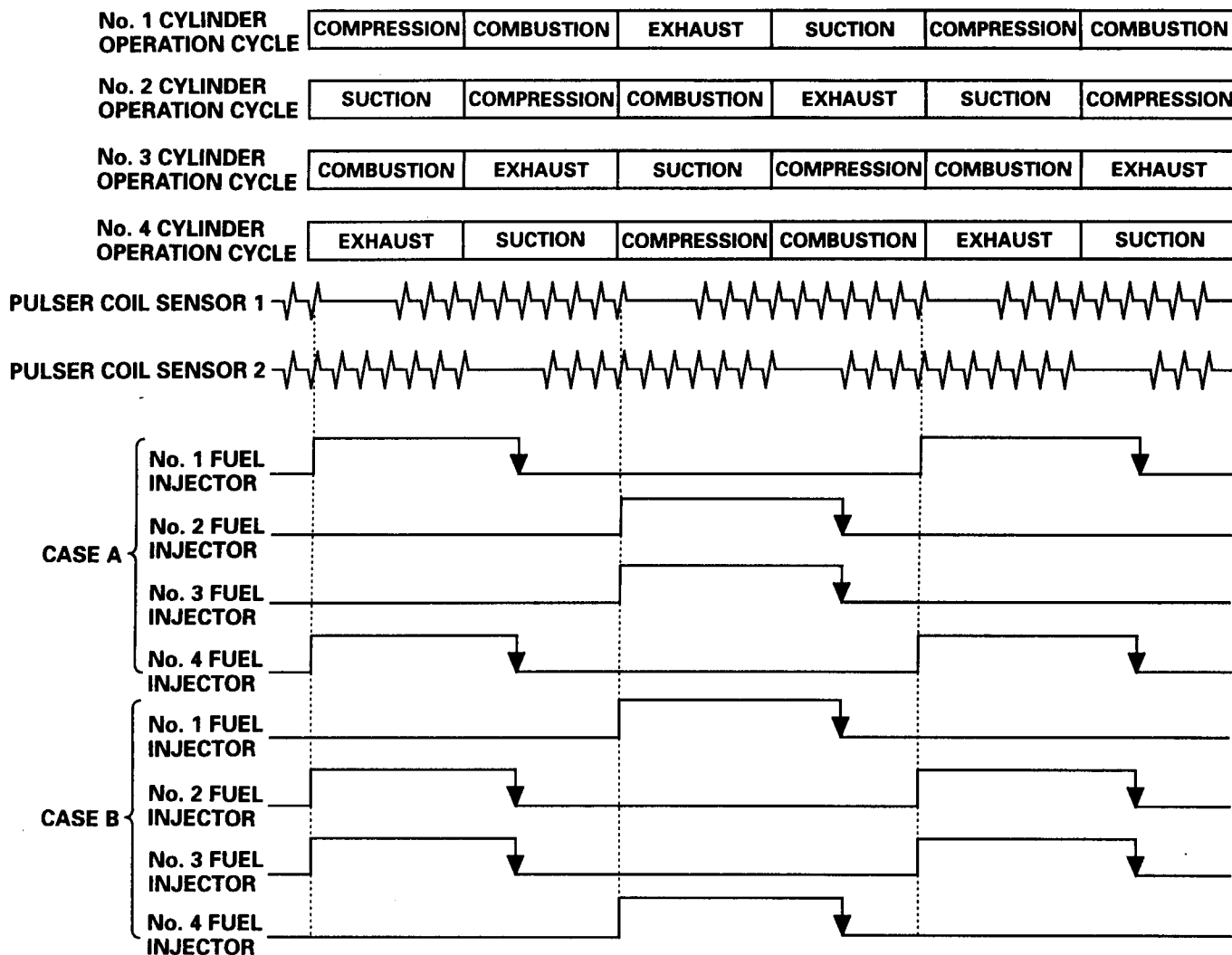
- 1) The speed density type, which is excellent in response to changes in the running conditions and provides accurate control of the injection amount, is adopted to determine the required fuel injection amount for the engine. It determines the basic injection amount based on engine speed and intake manifold pressure.
- 2) The two-group injection is adopted; this method injects fuel at each group of the cylinders separately by dividing the four cylinders, each of which is equipped with a fuel injector, into the two groups.
- 3) The gap between the intake manifold vacuum and the fuel pressure is controlled to be constant by the pressure regulator. This maintains the correct fuel injection amount regardless of the change in the intake manifold vacuum.
- 4) The high-precision 16-bit digital computer (ECM) of the latest semiconductor technology is adopted to determine the fuel injection amount and the injection duration.





### • Fuel Injection method

The functioning cylinder and its top dead center position, crank angle and the engine speed are detected by the pulser coil sensor 1 and 2, and the required amount of the fuel is injected by the respective fuel injectors of the two cylinders (group injection). The injection timing of each group is either the case A or the case B, which is determined according to the conditions memorized in the ECM.



**• Determination of injection amount****Basic injection amount:**

The basic fuel injection duration, which is determined by engine speed and intake manifold vacuum to be optimum for the running condition, is stored in the ECM. The optimum fuel injection duration for the environmental condition is determined by compensating the basic injection duration stored in the ECM with the signal from the corresponding sensor and transmitted to the fuel injectors as the voltage pulse. Because the fuel injector functions in a constant cycle, the fuel injection amount is determined by the injection duration.

**Startup injection amount:**

The engine requires more fuel than the basic injection amount when it starts. The basic injection duration is determined by engine temperature for starting, and it is memorized in the ECM. The optimum fuel injection amount for any starting conditions is determined by compensating the basic injection duration stored in the ECM with engine speed, battery voltage, etc.

**• Compensation of injection amount**

Compensation item	Related sensor and input information	Content
At high load	MAP sensor TP sensor	Increase the fuel injection amount when the intake manifold vacuum or the throttle angle exceeds the given value. It also compensates the injection amount according to the engine temperature when it is low.
At acceleration	TP sensor	Increases the fuel injection amount according to the angular velocity of the throttle valve during acceleration.
At deceleration	TP sensor	Decreases the fuel injection amount according to the angular velocity of the throttle valve during deceleration, and decreases the injection amount during deceleration with the throttle valve close to the full-close position.
Suction air temperature	IAT sensor	Compensates the fuel injection amount according to the suction air temperature.
Engine temperature	ECT sensor	When the engine temperature is low, it increases the fuel injection amount according to the intake manifold vacuum.
Battery voltage	Battery voltage signal	Compensates the delay of the fuel injector operation caused by the change or fluctuation of the battery voltage.
Right after engine start	ECT sensor	Gradually decreases the large injection amount after the engine starts.

### • ECM

The ECM, a brain for the fuel injection control system, ignition timing control system and the idle control system, has a high precision 16-bit digital computer. It consists of the CPU (central process unit), memory, and the I/O (input/output part).

The ECU has the following functions as well as control of the above systems.

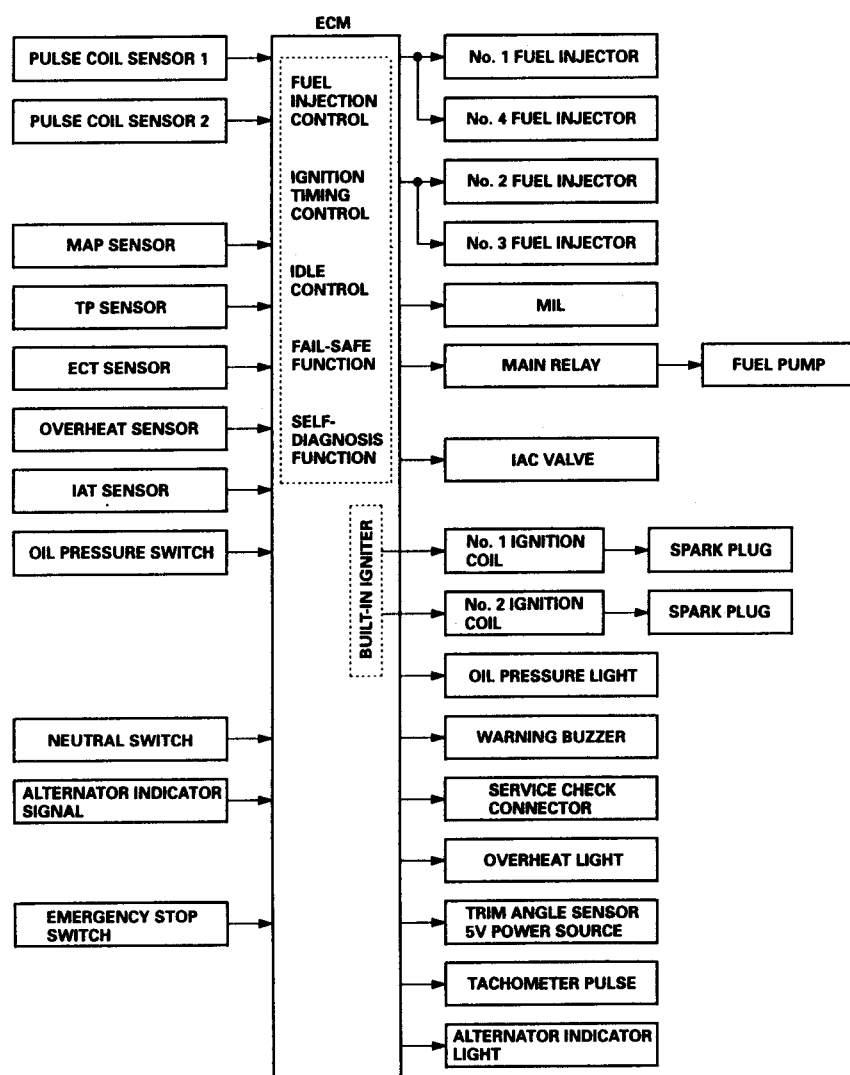
#### 1) Self-diagnosis function

When the ECM detects an abnormality with the input system, IAC valve, etc., the MIL blinks or stays ON to indicate the problem part by short-circuiting the red service check connector located above the ignition coil. The problem part can be detected by the number of blinks. When two or more parts are faulty, the MIL indicates the parts one after another by the number of blinks.

The problem data is stored in the EEP-ROM in the ECM, and it is not erased by disconnecting the battery. Refer to the ECM reset procedure (P. 5-6) for erasing the problem data.

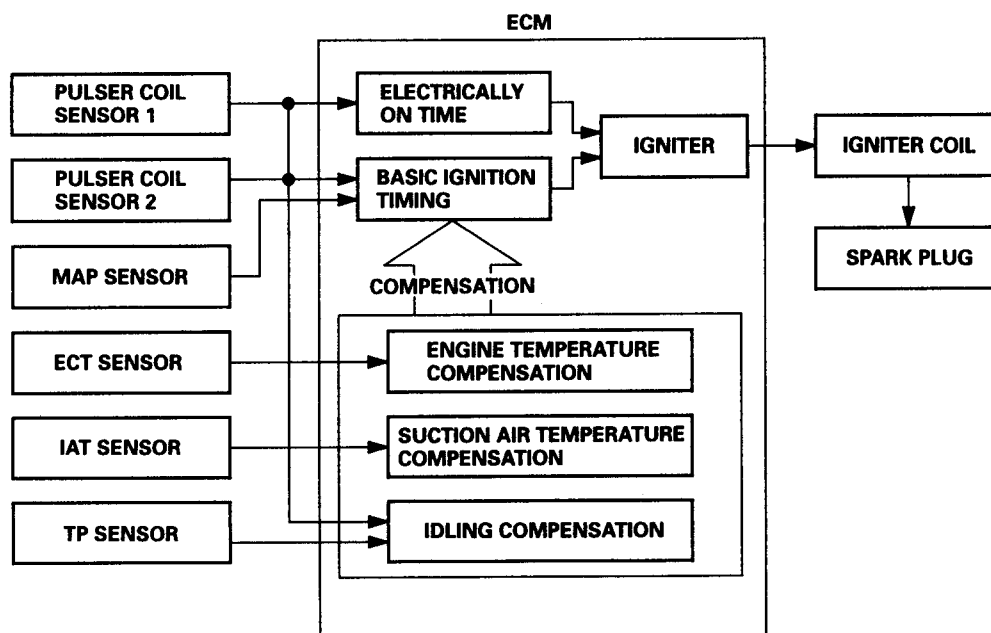
#### 2) Fail-safe function

When the ECM detects an abnormality with the input system, IAC valve, etc., it changes the value to the value that was set in the ECM in advance to enable minimum running of the outboard motor.



### • Ignition timing control system

The full transistorized ignition that is excellent in ignition performance and combustion stability is adopted on this out-board motor as the basic ignition system, and the igniter unit of the system is incorporated in the ECM. The ignition timing control system controls the ignition timing by first determining the basic ignition timing based on the engine speed signal sent from the pulser coil and the intake manifold vacuum signal sent from the MAP sensor. Then, the ignition timing control system compensates the basic timing with the TP sensor, ECT sensor and the IAT sensor for optimum ignition timing.

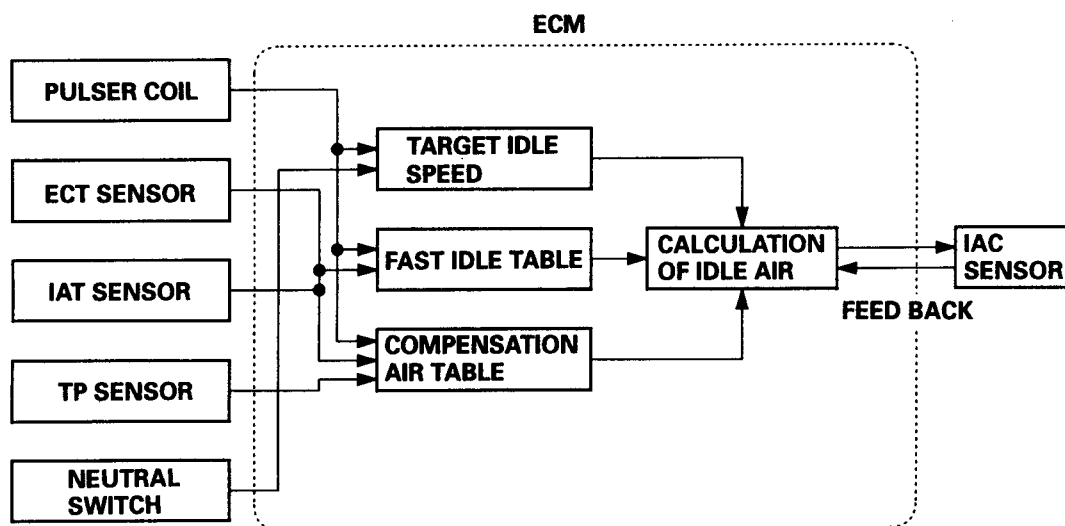
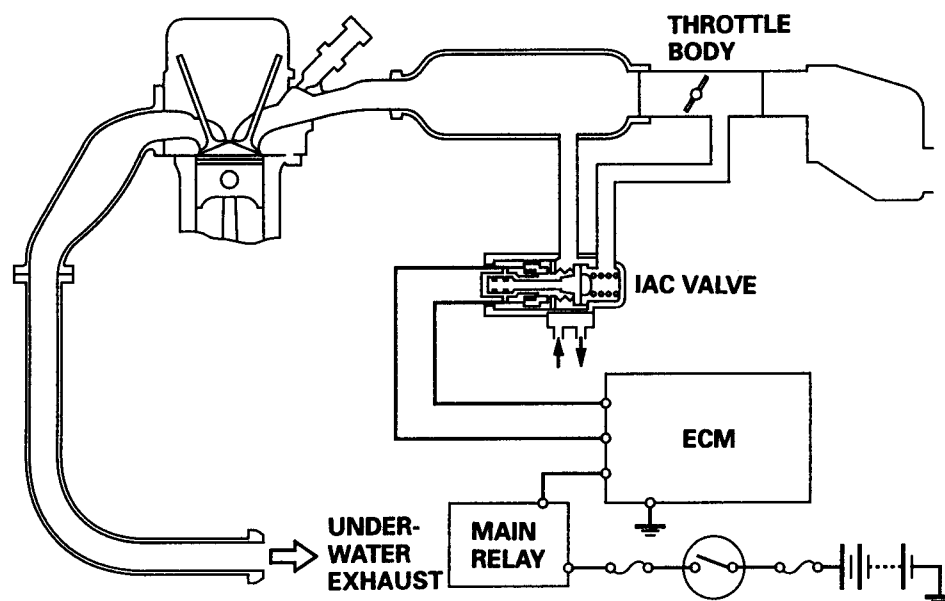


### • Ignition timing compensation

Compensation item	Related sensor and input information	Content
Idling compensation	Pulser coil sensor, TP sensor	Controls the idle speed to the target speed by retarding the ignition timing when the idle speed increases and by advancing the timing when the idle speed drops.
Low temperature compensation	ECT sensor	To obtain good running performance, it advances the ignition timing according to the engine temperature when it is low.
High temperature compensation	ECT sensor, IAT sensor	Protects the engine by retarding the ignition timing by a given angle when the engine temperature is high.

### • Idle control system

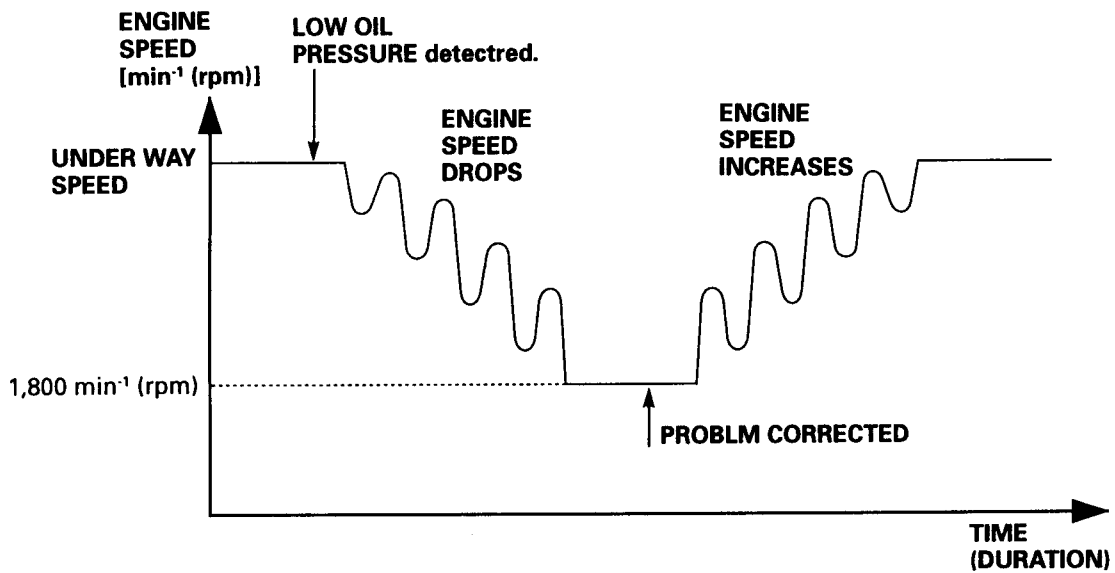
The idle control system controls the linear type IAC valve's opening, based on the signals transmitted from each sensor to the ECM, according to the engine condition. The IAC valve adjusts the amount of the bypass air to the intake manifold to maintain the optimum idle speed.



### • Oil alert system

When the oil pressure switch mounted on the cylinder block detects low oil pressure, the signal is transmitted to the ECM to alert the condition. The green oil pressure light turns OFF and the warning buzzer emits the continuous sound this time, then the engine speed drops to 1,800  $\text{min}^{-1}$  (rpm).

The engine returns to the normal speed gradually when the problem is corrected.

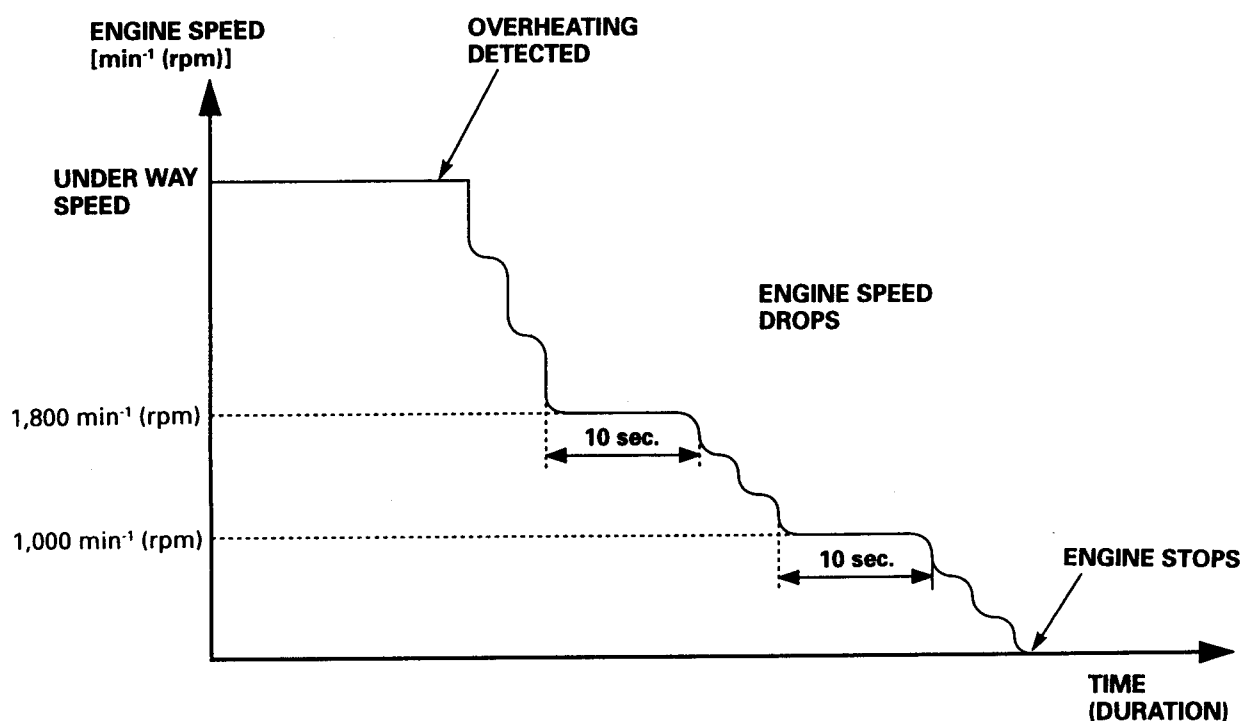


### • Overheat alert system

When the ECM receives the voltage signal from the overheat sensor mounted at the cylinder head exhaust port, the ECM detects overheating and alerts the condition by turning the red overheat light ON and with the continuous warning buzzer sound. Then, the ECM controls the engine speed.

The ECM drops the engine speed to  $1,800 \text{ min}^{-1} \text{ (rpm)}$ . If the ECM detects overheating again 10 seconds after the engine speed dropped, it drops the engine speed further to  $1,000 \text{ min}^{-1} \text{ (rpm)}$ . The ECM stops the engine if it still detects overheating 10 seconds after the engine speed dropped to  $1,000 \text{ min}^{-1} \text{ (rpm)}$ .

The engine returns to the normal speed gradually when the problem is corrected.



**• Alternator warning system**

The regulator built in the alternator has the abnormality detection function. When it detects either of the following abnormalities, the alternator indicator light turns ON, and the abnormality signal is transmitted to the ECM. The ECM in turn signals the abnormality with an intermittent buzzer sound.

Abnormality	Description
Stop of power generation	Warning when the alternator is not generating power (e.g. alternator at a stop, open excitation circuit inside alternator, etc.)
Disconnected sensing terminal	Warning when the battery voltage sensing terminal (S terminal) is disconnected (e.g. connector disconnected, open circuit in harness).
Disconnected charging output terminal	Warning when the battery charging output terminal (B terminal) is disconnected (e.g. eyelet terminal disconnected, open circuit in harness).
Overcharge	Warning when the battery voltage exceeds the regulator adjustment voltage regardless of the alternator generating the power (protection of battery and other equipment).
Low voltage	Warning when the battery voltage drops to approximately 10V or below (warning for prevention of dead battery caused by excessive application of electric load, etc.)

**• Overrev limiter system**

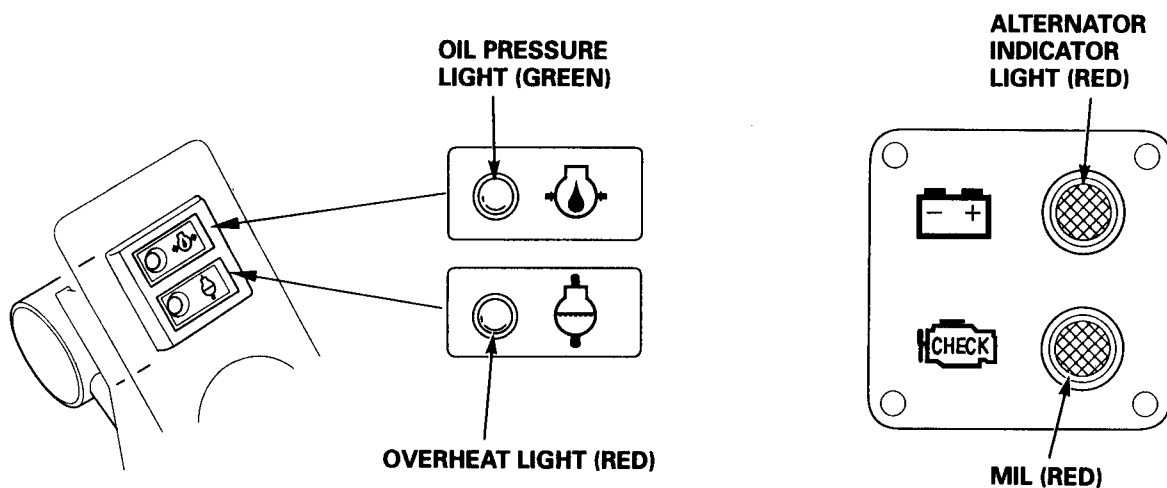
The ECM interrupts the ignition at all cylinders when the engine speed is  $6,350 \pm 50 \text{ min}^{-1}$  (rpm).



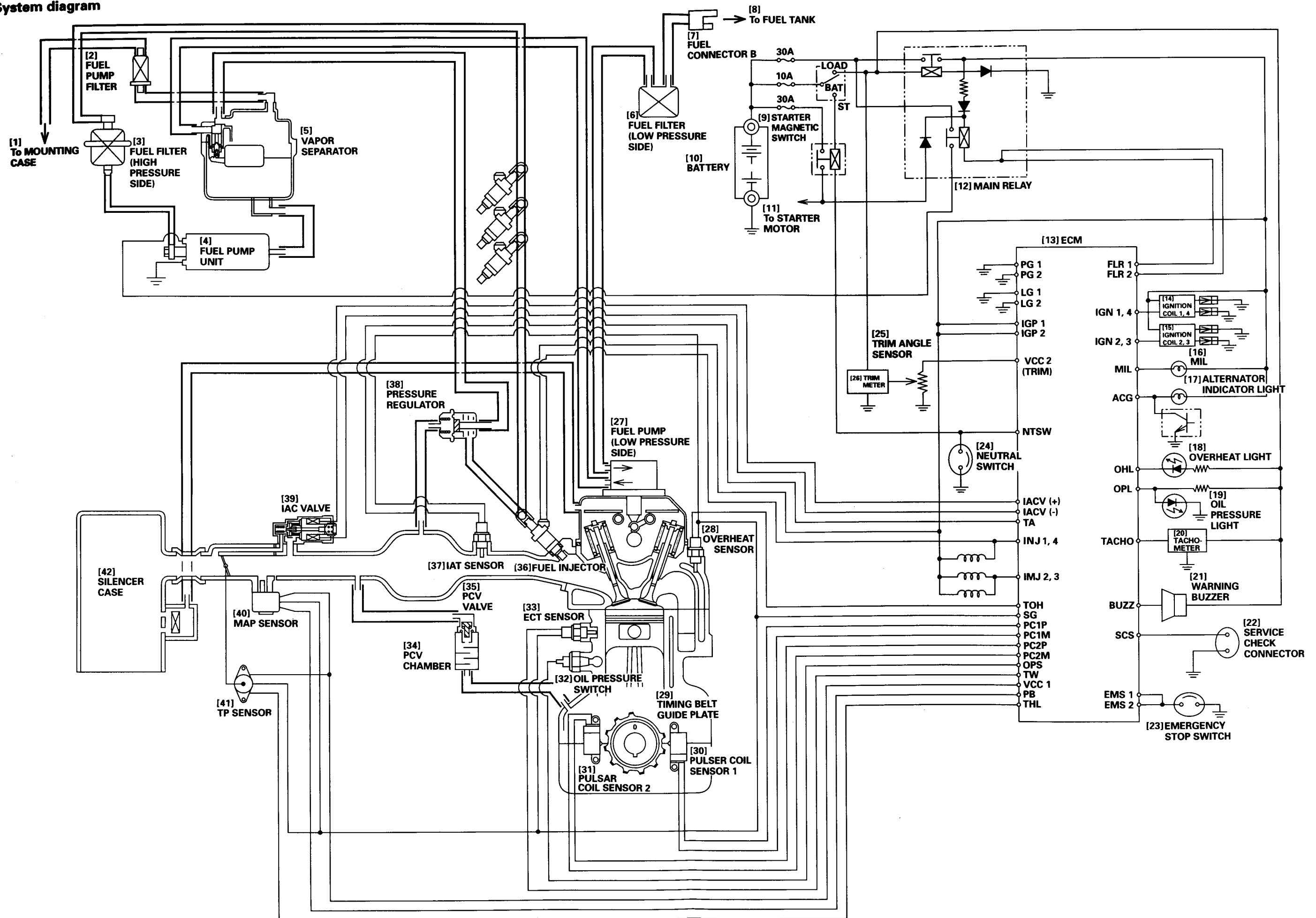
### • Indicator light/buzzer operation mode list

See the following table for problem indication of the alert/warning system (including the PGM-FI warning system).

Engine condition	Problem with sensor system			Control of light/buzzer				
	Oil pressure switch	Overheat sensor	Alternator warning	Oil pressure light (Green)	Overheat light (Red)	Alternator indicator light (Red)	MIL (Red)	Warning buzzer
At start	ON	OFF	ON	ON (2 sec.)	ON (2 sec.)	ON	ON (2 sec.)	Sounds twice when switch is ON.
Normal operation	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
Low oil pressure	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON (Continuous)
Overheat	OFF	ON	OFF	ON	ON	OFF	OFF	ON (Continuous)
Low oil pressure & overheat	ON	ON	OFF	OFF	ON	OFF	OFF	ON (Continuous)
Abnormal alternator	OFF	OFF	ON	ON	OFF	ON	OFF	ON (Intermittent)
Abnormal PGM-FI	OFF	OFF	OFF	ON	OFF	OFF	ON	ON (Intermittent)
Low oil pressure & abnormal alternator	ON	OFF	ON	OFF	OFF	ON	OFF	ON (Continuous)
Overheat & abnormal alternator	OFF	ON	ON	ON	ON	ON	OFF	ON (Continuous)
Abnormal PGM-FI & abnormal alternator	OFF	OFF	ON	ON	OFF	ON	ON	ON (Intermittent)
Low oil pressure & abnormal PGM-FI	ON	OFF	OFF	OFF	OFF	OFF	ON	ON (Continuous)
Overheat & abnormal PGM-FI	OFF	ON	OFF	ON	ON	OFF	ON	ON (Continuous)

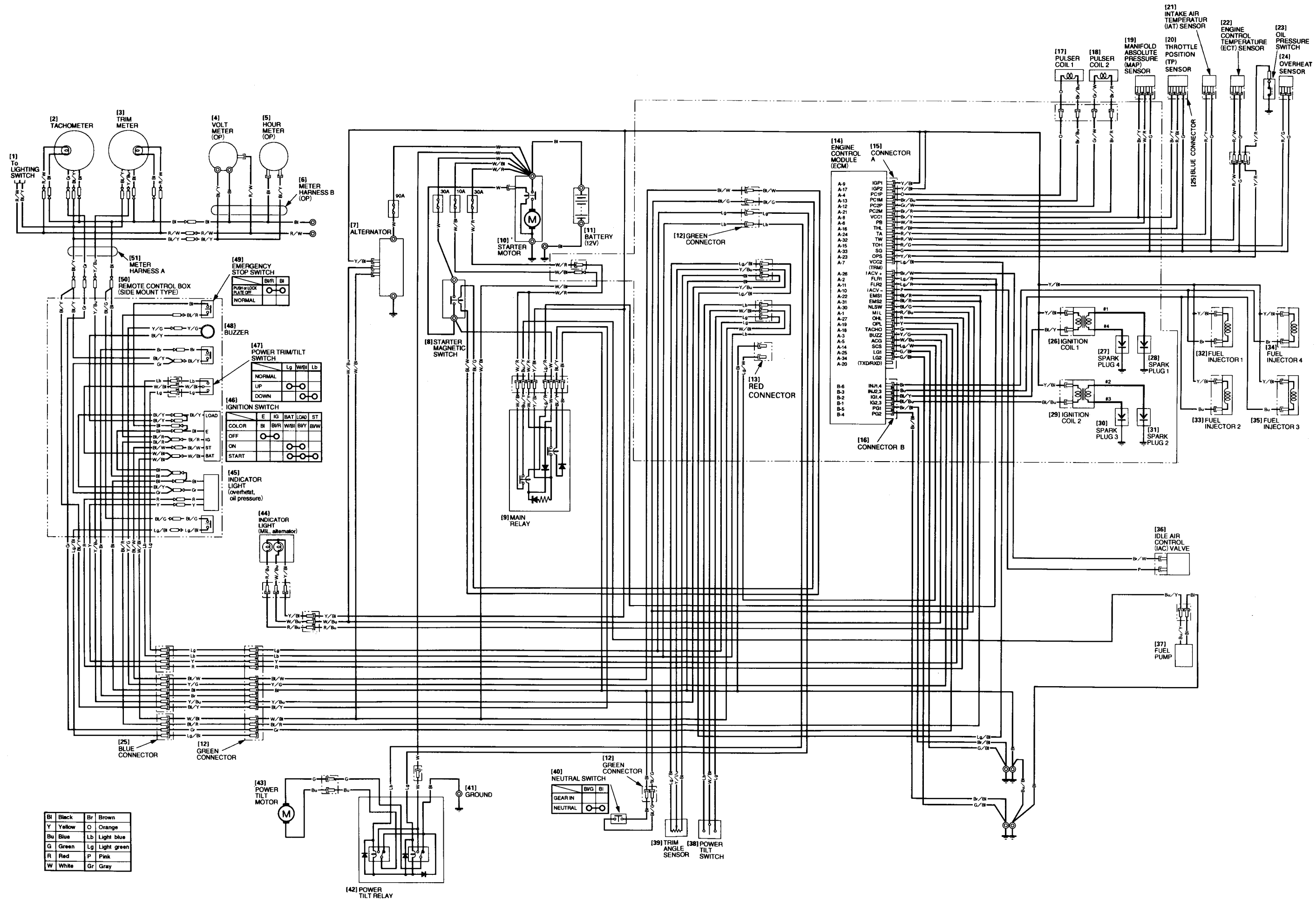


● System diagram

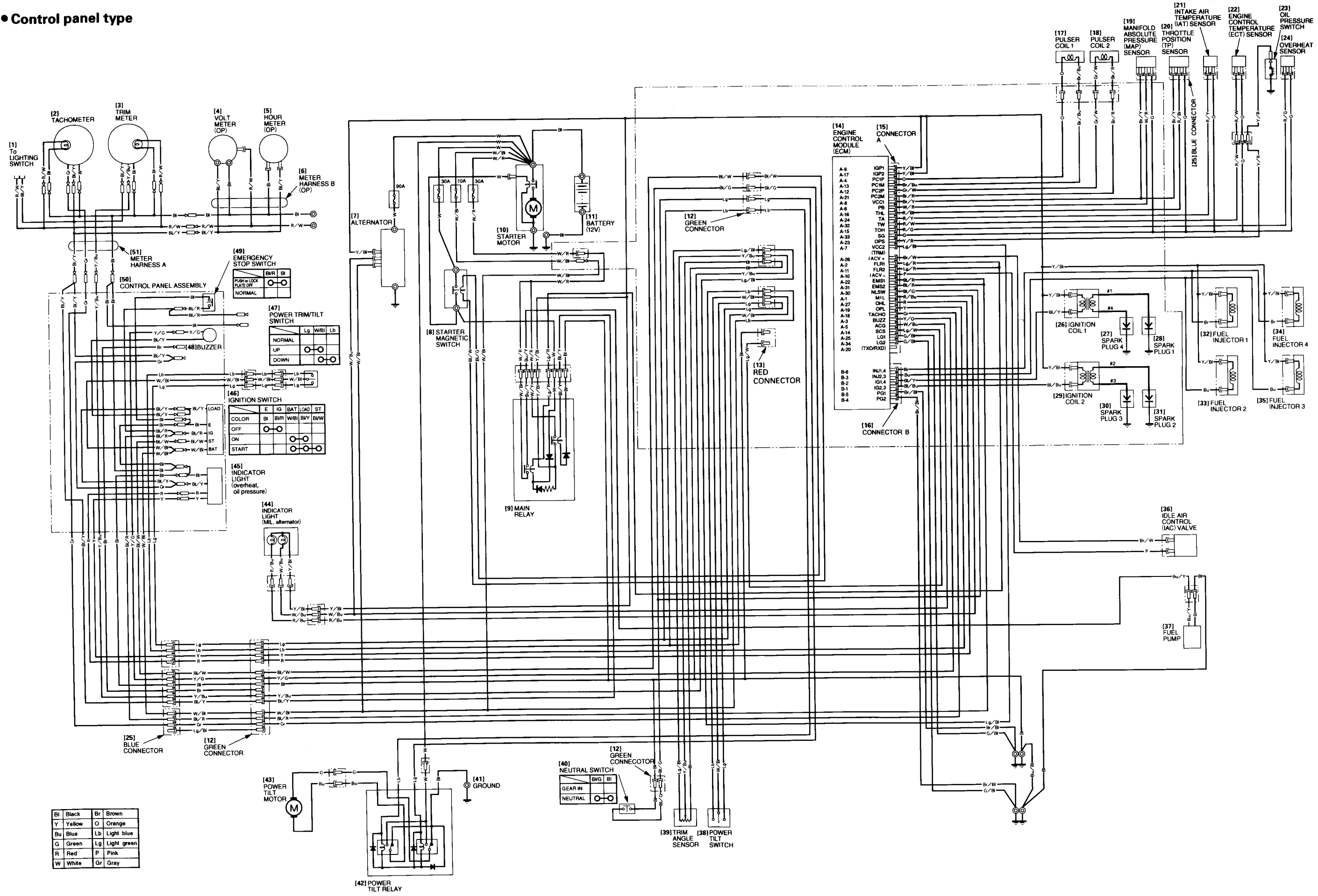


• Side-mount remote control box type

# 19. WIRING DIAGRAM



Control panel type



## PREFACE

This supplement describes the major differences between the following models of the Honda BF115A•BF130A outboard motors.

MODEL	FRAME SERIAL NUMBER
BF115A	BZBD-1300380 and subsequent
BF130A	BZBE-1302203 and subsequent

For service information which is not covered in this supplement, please refer to the base shop manuals, part number 66ZW500.

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.

ALL INFORMATION, ILLUSTRATIONS, DIRECTIONS AND SPECIFICATIONS INCLUDED IN THIS PUBLICATION ARE BASED ON THE LATEST PRODUCT INFORMATION AVAILABLE AT THE TIME OF APPROVAL FOR PRINTING. Honda Motor Co., Ltd. RESERVES THE RIGHT TO MAKE CHANGES WITHOUT INCURRING ANY OBLIGATION WHATEVER. NO PART OF THIS PUBLICATION MAY BE REPRODUCED WITHOUT WRITTEN PERMISSION.

Honda Motor Co., Ltd.  
Service Publications Office

## CONTENTS

### OUTLINE OF CHANGES

#### SPECIFICATIONS

1

#### SERVICE INFORMATION

2

#### MAINTENANCE

3

#### ENGINE COVER/TIMING BELT UPPER COVER

4

#### PROGRAMMED FUEL INJECTION (PFI) SYSTEM

5

#### ALTERNATOR/BALANCER BELT/TIMING BELT

6

#### ENGINE REMOVAL/INSTALLATION

7

#### WATER JACKET COVER/THERMOSTAT PRESSURE VALVE

8

#### CYLINDER HEAD/VALVES

9

#### FLYWHEEL/OIL PUMP

10

#### BALANCER SHAFT/CRANKCASE/CRANKSHAFT/PISTON

11

#### PROPELLER/GEAR CASE/EXTENSION CASE

12

#### OIL PAN/ENGINE THERMOSTAT/COOLING PUMP/GEAR CASE

13

#### SWIVEL CASE/POWER TRIM/CLUTCH ASSEMBLY

14

#### STEERING ROD/REMOTE CONTROL BOX

15

#### CABLES/SHIFT LINK RODS/CLUTCH CABLE/PISTON

16

#### ELECTRICAL EQUIPMENT


17

#### OPERATION

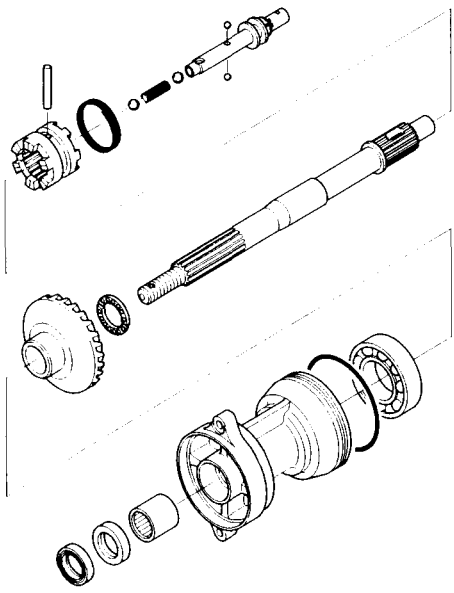
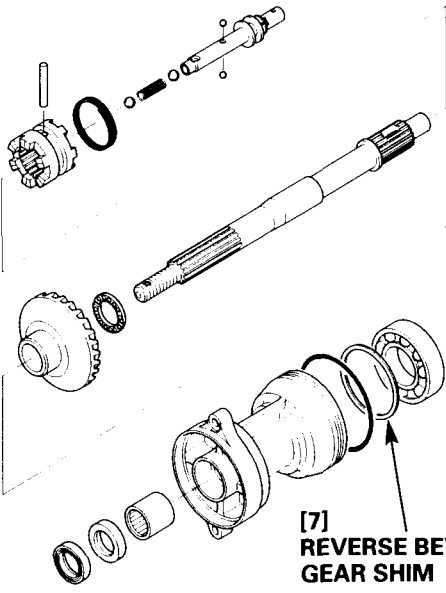
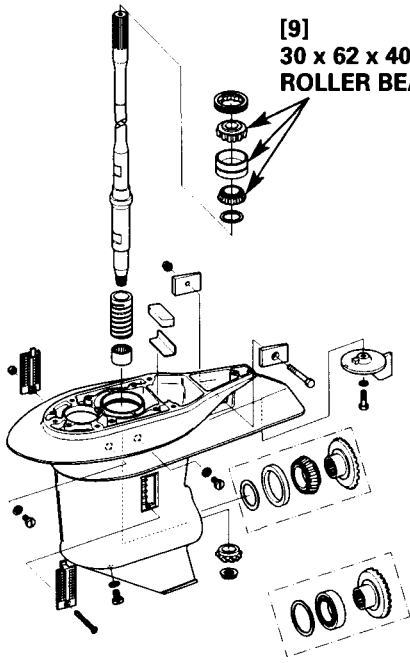
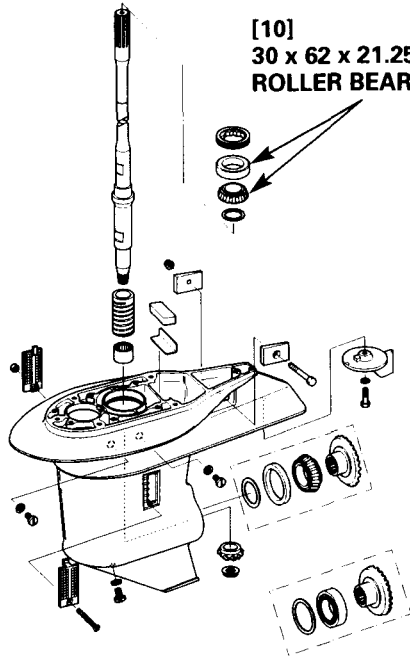
18

#### WIRING DIAGRAM

19

 The marked section contain no changes. They are not covered in this manual.

OUTLINE OF CHANGES .....	1
12. PROPELLER/GEAR CASE/EXTENSION CASE .....	12-1
1. VERTICAL SHAFT/BEVEL GEAR .....	12-1
2. SHIM SELECTION .....	12-4
3. SHIM POSITION .....	12-12
4. BACKLASH ADJUSTMENT .....	12-14

[2] Model		
[1] Item	[3] After modifications	[4] Before modifications
[5] Reverse bevel gear (LD and XD type only)	<b>[6] Reverse bevel gear shim being eliminated:</b> 	 <b>[7] REVERSE BEVEL GEAR SHIM</b>
[8] Taper roller bearing	 <b>[9] 30 x 62 x 40 TAPER ROLLER BEARING</b>	 <b>[10] 30 x 62 x 21.25 TAPER ROLLER BEARING</b>

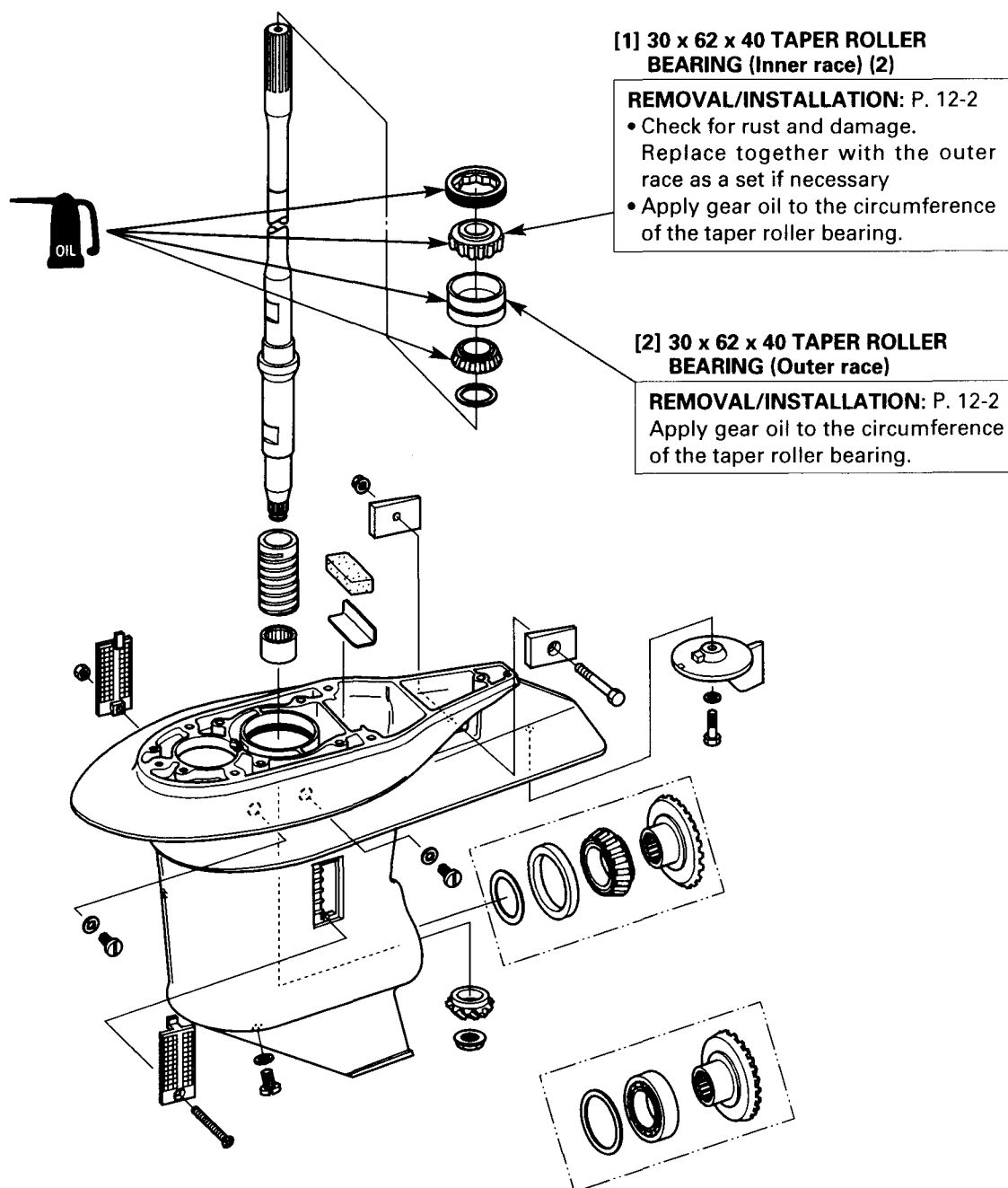
1. VERTICAL SHAFT/BEVEL GEAR
2. SHIM SELECTION

3. SHIM POSITION
4. BACKLASH ADJUSTMENT

## 1. VERTICAL SHAFT/BEVEL GEAR

### a. DISASSEMBLY/REASSEMBLY

- 1) Remove the propeller (P. 12-1 of the base shop manual) and gear case assembly (P. 12-2 of the base shop manual).
- 2) Remove the water pump/shift rod (P. 12-4 of the base shop manual) and remove the propeller shaft holder assembly (P. 12-9 of the base shop manual).
- 3) Remove the 64 mm lock nut using the special tool (P. 12-25 of the base shop manual).





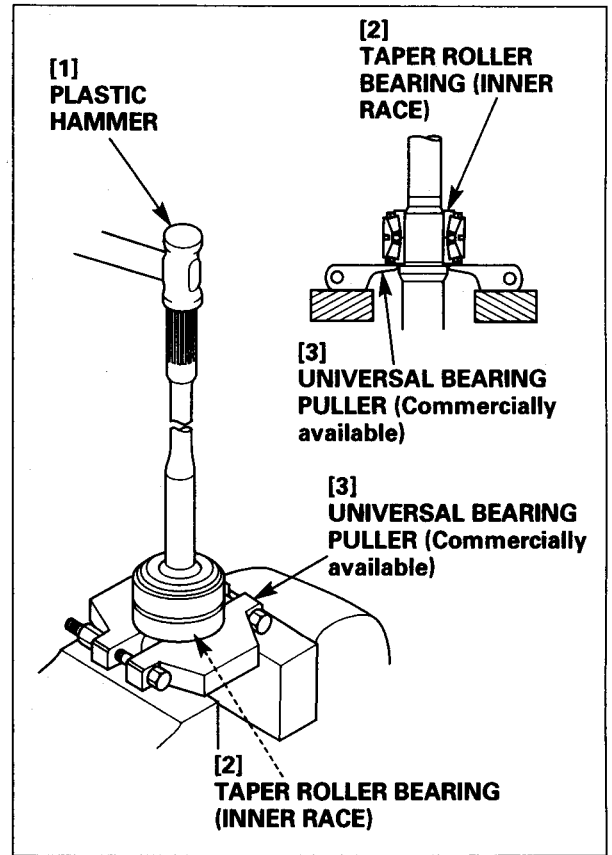
# •30 x 62 x 40 TAPER ROLLER BEARING

## REMOVAL:

- 1) Set the commercially available universal bearing puller on the taper roller bearing (inner race), then set the universal bearing puller on the vice.
- 2) Remove the taper roller bearing by tapping on the end of the vertical shaft using a plastic hammer.

## NOTE:

Do not hold the vertical shaft with a vise. Use a plastic hammer to tap on the end of the vertical shaft.



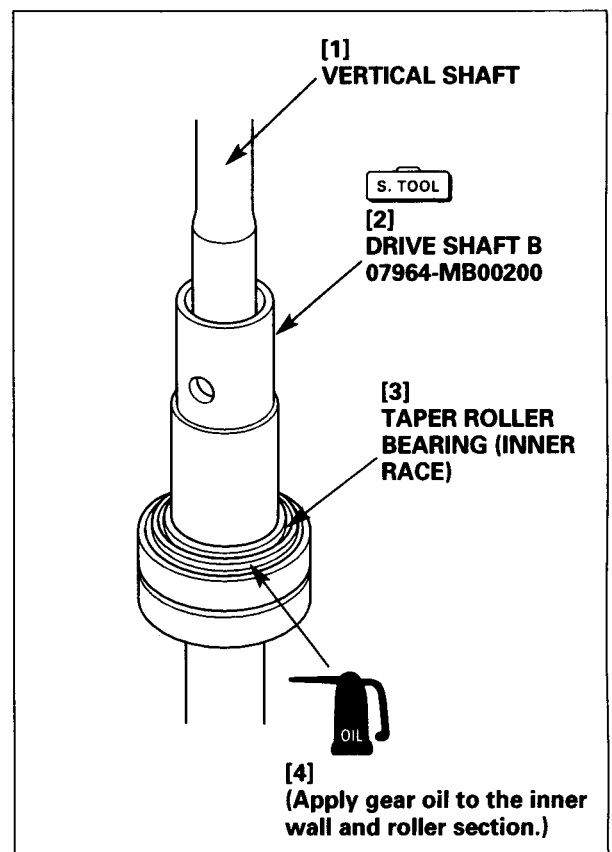
## INSTALLATION:

- 1) Set the pinion gear on the vertical shaft and temporarily tighten the pinion gear nut by hand.
- 2) Apply gear oil to the inner wall and the roller section of the taper roller bearing (inner race).
- 3) Set the pinion gear shim, taper roller bearing and the special tool on the vertical shaft.

## TOOL:

Drive shaft B

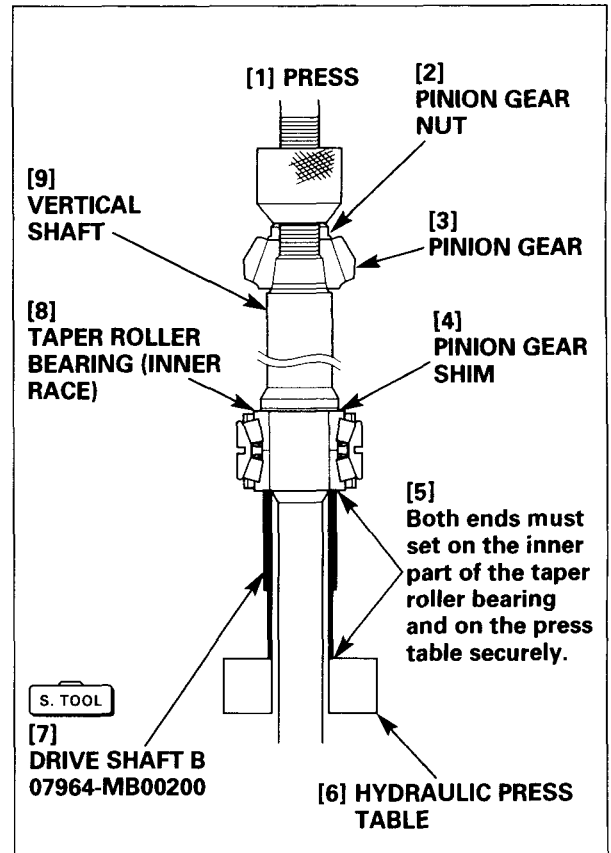
07964-MB00200



- 4) Set the vertical shaft upright on the hydraulic press with the pinion gear side toward up as shown.
- 5) Install the taper roller bearing on the vertical shaft using the hydraulic press.

**NOTE:**

- 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.
- 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**

## 2. SHIM SELECTION

### •PINION GEAR SHIM

Remove the 30 x 62 x 40 taper roller bearing (inner race) if it is mounted on the vertical shaft (P. 12-30 of the base shop manual).

- 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: 132 N·m (13.5 kgf·m, 98 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. 12-25 of the base shop manual).
- 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.

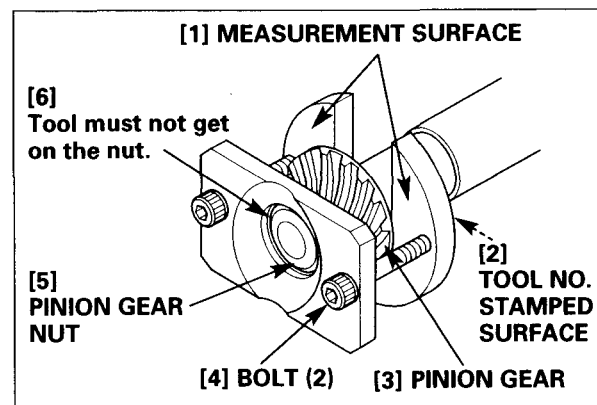
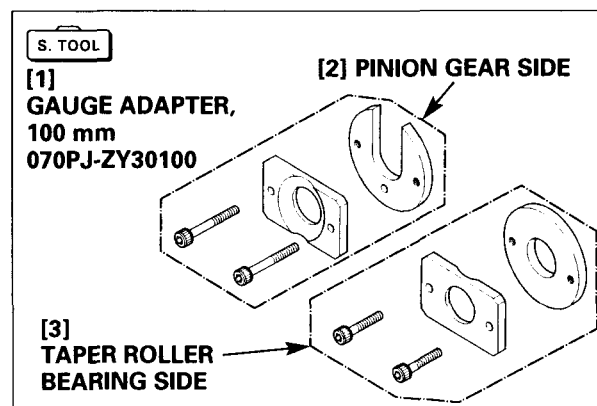
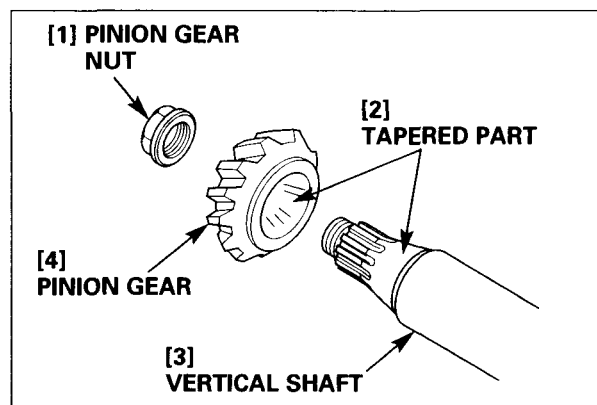
Tighten the bolts by hands while pushing both tools toward the pinion gear side.

- Do not confuse the pinion gear side and the taper roller bearing side of the special 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:

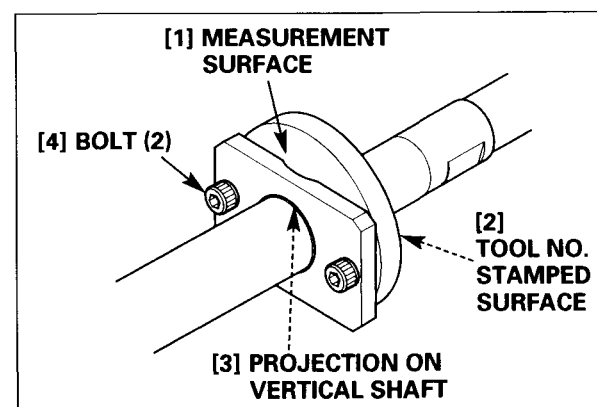
Gauge adapter, 100 mm

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 and tapered faces to the opposite side from the pinion gear as shown. Tighten the bolts by hands.

- 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.

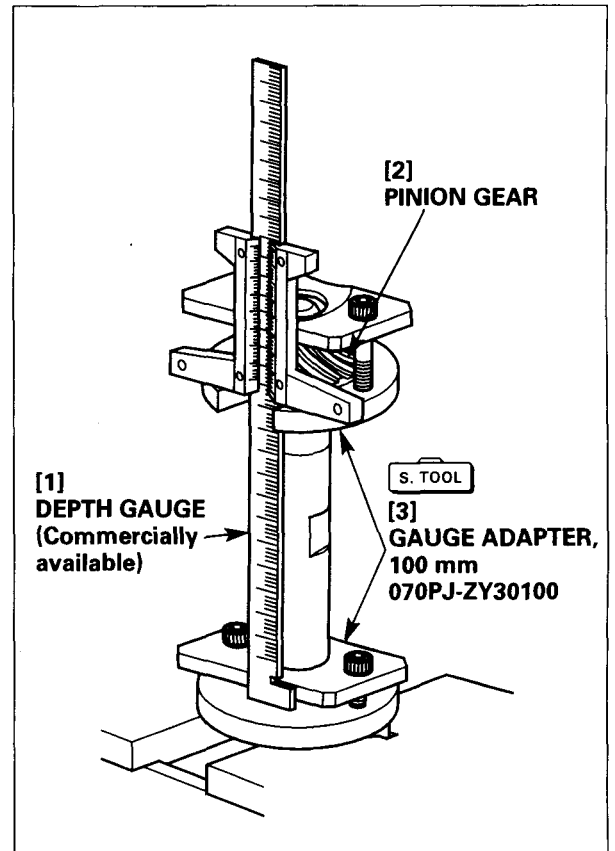


- 5) Hold the vertical shaft upright (with the pinion gear toward up) and secure the vertical shaft.
- 6) Set the commercially available depth gauge at the gauge adapter of the pinion gear side as shown. Measure the vertical shaft length (dimension "D") and record it.

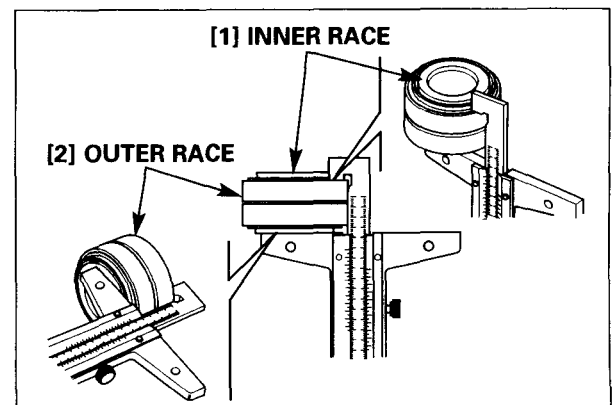
**TOOL:**

Gauge adapter, 100 mm

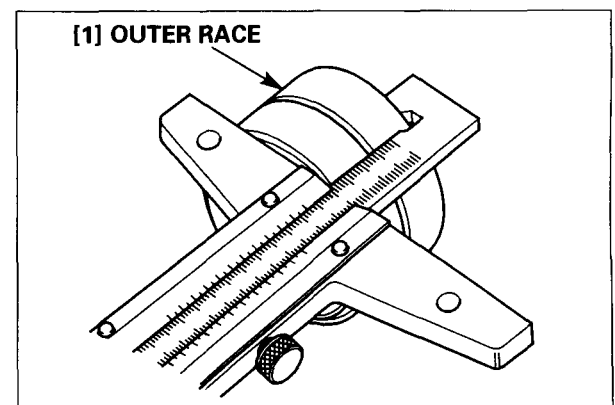
070PJ-ZY30100



- 7) Assemble the outer race and inner race of the 30 x 62 x 40 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 taper roller bearing outer race and record the measurement.



- 10) Calculate the gap (distance E) between the outer race and inner race using the measurements 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 (1.58 in),

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) – 147.45 = Calculation value.

**Example:**

When, vertical shaft length (distance D) is 142.3 mm (5.60 in),

And, gap (distance E) is 5.2 mm (0.20 in):

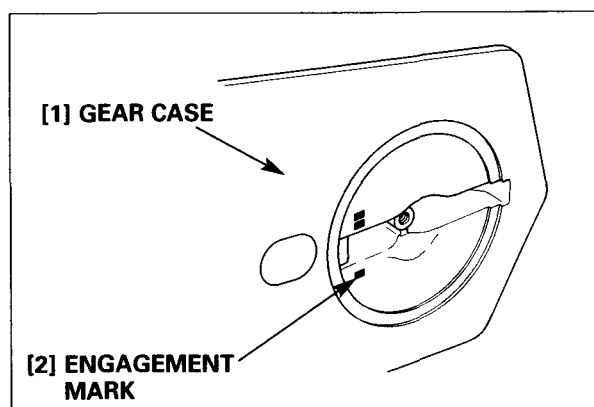
$$142.3 + 5.2 - 147.45 = 0.05$$

Therefore, the calculation value is 0.05 mm (0.002 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

[1] Parts name	[2] Thickness
[3] Pinion gear shim A	0.10 mm (0.0039 in)
[4] Pinion gear shim B	0.15 mm (0.0060 in)
[5] Pinion gear shim C	0.30 mm (0.0118 in)
[6] Pinion gear shim D	0.50 mm (0.0197 in)



## • Pinion gear shim selection table

[3] Unit: mm (in)

		[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)
[1] Engagement mark on the gear case	F	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.012)	0.60 (0.024)	0.65 (0.026)
	E	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	0.25 (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	0.20 (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	0.15 (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)

[3] Unit: mm (in)

		[2] Calculation value						
		0.05 (0.002) – 0 (0.000)	0 (0.000) – –0.05 (–0.002)	–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)
[1] Engagement mark on the gear case	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

When the engagement mark on the gear case is E and the calculation value 0.20 mm (0.008 in) or more and less than 0.25 mm (0.01 in), the shim thickness is 0.45 mm (0.018 in). (See Example 1 below.)

When the calculation value is 0.15 mm (0.006 in) or more and less than 0.20 mm (0.008 in), the shim thickness is 0.50 mm (0.020 in). (See Example 2 below.)

## [1] Example 1:

[4] Unit: mm (in)

		[2] Calculation value
		[3] 0.25 mm (0.010 in) or above to less than 0.20 mm (0.008 in)
	F	_____
	E	0.45 mm (0.018 in)

## [5] Example 2:

[4] Unit: mm (in)

		[2] Calculation value
		[6] 0.20 mm (0.008 in) or above to less than 0.15 mm (0.006 in)
	F	_____
	E	0.50 mm (0.020 in)

## • Shim combination

To obtain 0.45 mm (0.018 in) of shim thickness, combine one gear shim B and gear shim C, or combine three gear shim A and one gear shim B by referring to the shim type table.

## • FORWARD BEVEL GEAR SHIM

### <LD and XD types>

- 1) Assemble the outer race and the inner race of the new 50 x 82 x 21.5 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:

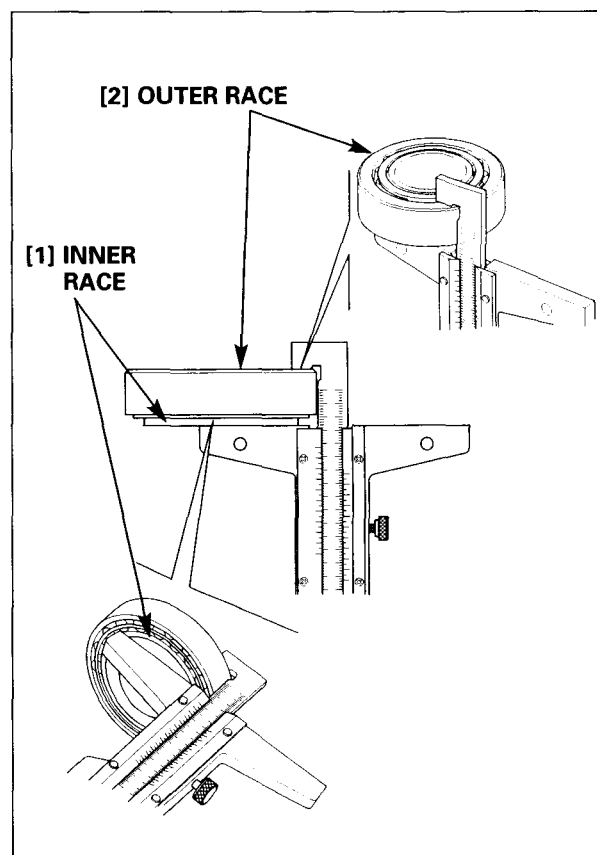
Bearing height (distance F) – 21.5 = Calculation value

#### Example:

When bearing height (distance F) is 21.55 mm (0.848 in).

$21.55 - 21.5 = 0.05$

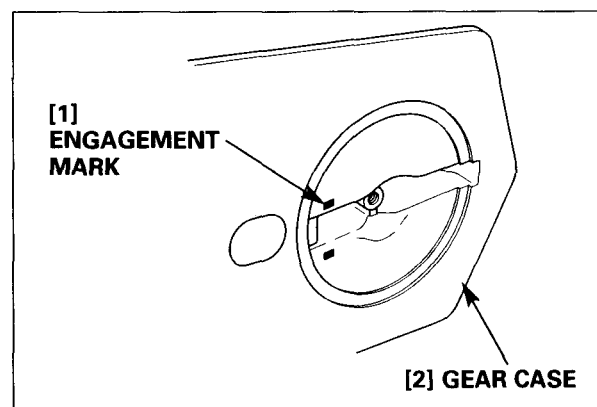
Therefore, the calculation value is 0.05 mm (0.002 in)



- 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

[1] Parts name	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.0039 in)
[4] Forward bevel gear shim B	0.15 mm (0.0060 in)
[5] Forward bevel gear shim C	0.30 mm (0.0118 in)
[6] Forward bevel gear shim D	0.50 mm (0.0197 in)



#### • Forward bevel gear shim selection table

		[2] Calculation value			
		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)
[1] Engagement mark on the gear case	1	0.45 (0.018)	0.50 (0.020)	0.55 (0.012)	0.60 (0.024)
	2	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)	0.55 (0.012)
	3	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)	0.50 (0.020)
	4	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	0.45 (0.018)
	5	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)
	6	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)

[3] Unit: mm (in)

Refer to page 12-7 for information on how to read the shim selection table and shim combination.

## &lt;LCD and XCD types&gt;

- 1) Assemble the outer race and the inner race of the new 50 x 82 x 21.5 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) Measure the height of the 50 x 82 x 21.5 taper bearing inner race (distance J) and record it.
- 4) Determine the tolerance between the bearing height (distance F) and inner race height (distance J) using the following formula.

**Formula:**

Bearing height (distance F) – Inner race height (distance J)  
= Tolerance

**Example:**

When the bearing height (distance F) is 21.55 mm (0.848 in)  
and the inner race height (distance J) is 21.4 mm (0.84 in):  
 $21.55 - 21.4 = 0.15$

Therefore, the calculation value is 0.15 mm (0.006 in).

- 5) 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.

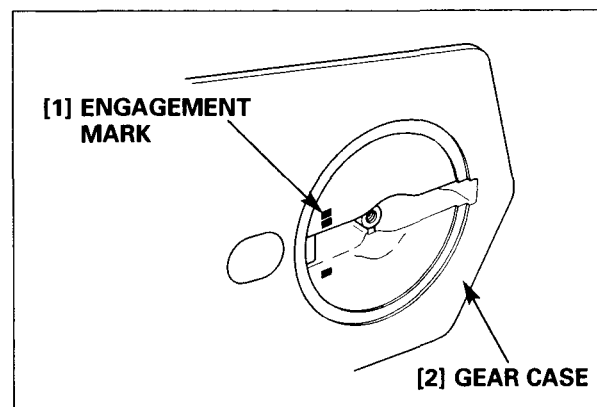
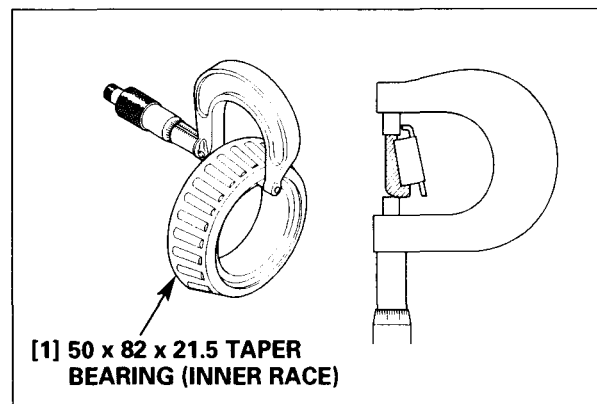
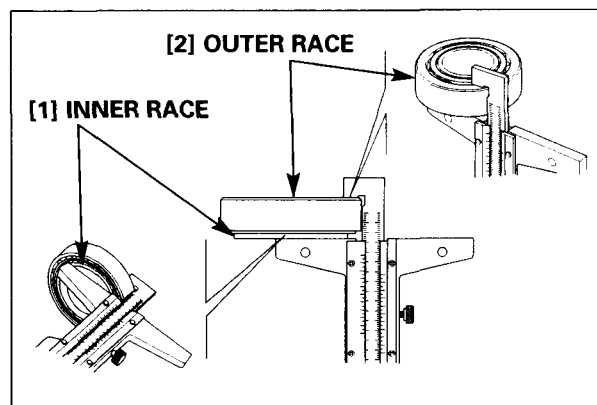
## • Shim type table

[1] Parts name	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.0039 in)
[4] Forward bevel gear shim B	0.15 mm (0.0060 in)
[5] Forward bevel gear shim C	0.30 mm (0.0118 in)
[6] Forward bevel gear shim D	0.50 mm (0.0197 in)

## • Forward bevel gear shim selection table

		[2] Calculation value						
		0.32 (0.013) – 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)
[1] Engagement mark on the gear case	A	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)
	B	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	0.20 (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)
	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)
	E	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)
	F	0.05 (0.002)	0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)

Refer to page 12-7 for information on how to read the shim selection table and shim combination.



[3] Unit: mm (in)



### • REVERSE BEVEL GEAR SHIM (LCD and XCD types only)

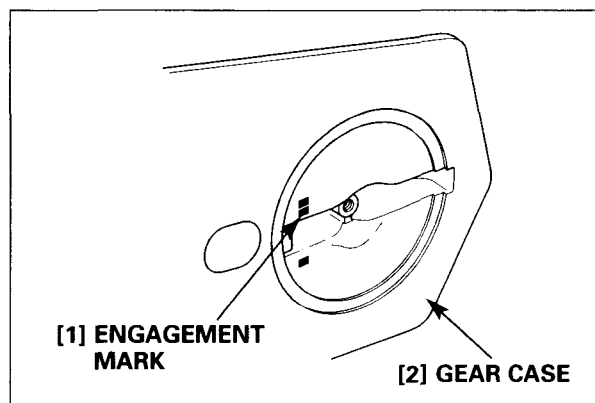
Refer to the engagement mark located on the trim tab installation part of the gear case, and select the shim of the appropriate thickness from the shim selection table accordingly.

#### Example:

When the engagement mark on the gear case is 3, the appropriate shim thickness should be 0.55 mm (0.022 in).

#### • Shim type table

[1] Parts name	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.0039 in)
[4] Forward bevel gear shim B	0.15 mm (0.0060 in)
[5] Forward bevel gear shim C	0.30 mm (0.0118 in)
[6] Forward bevel gear shim D	0.50 mm (0.0197 in)



#### • Reverse bevel gear shim selection table

[1] Engagement mark on the gear case	[2] Thickness
1	0.65 mm (0.026 in)
2	0.60 mm (0.024 in)
3	0.55 mm (0.022 in)
4	0.50 mm (0.020 in)
5	0.45 mm (0.018 in)
6	0.40 mm (0.016 in)

Refer to page 12-7 for information on how to read the shim selection table and shim combination.

### • THRUST SHIM (LCD and XCD types only)

Remove the 50 x 82 x 21.5 mm taper bearing inner race if it is mounted on the bearing holder assembly (P. 12-19 of the base shop manual).

- 1) Measure the height of the 50 x 82 x 21.5 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) – 21.5 = Tolerance

#### Example:

When the inner race height (distance J) is 21.4 mm (0.84 in),  
 $21.4 - 21.5 = -0.1$

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

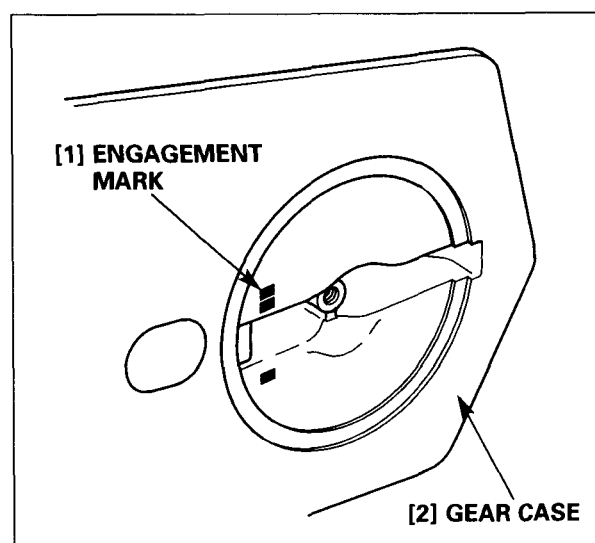
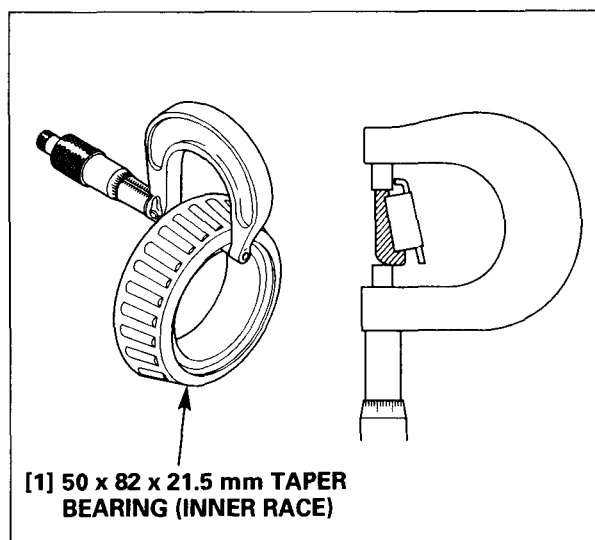
[1] Parts name	[2] Thickness
[3] Thrust shim A	0.10 mm (0.0039 in)
[4] Thrust shim B	0.15 mm (0.0060 in)
[5] Thrust shim C	0.30 mm (0.0118 in)
[6] Thrust shim D	0.50 mm (0.0197 in)

#### • Thrust shim selection table

[3] Unit: mm (in)

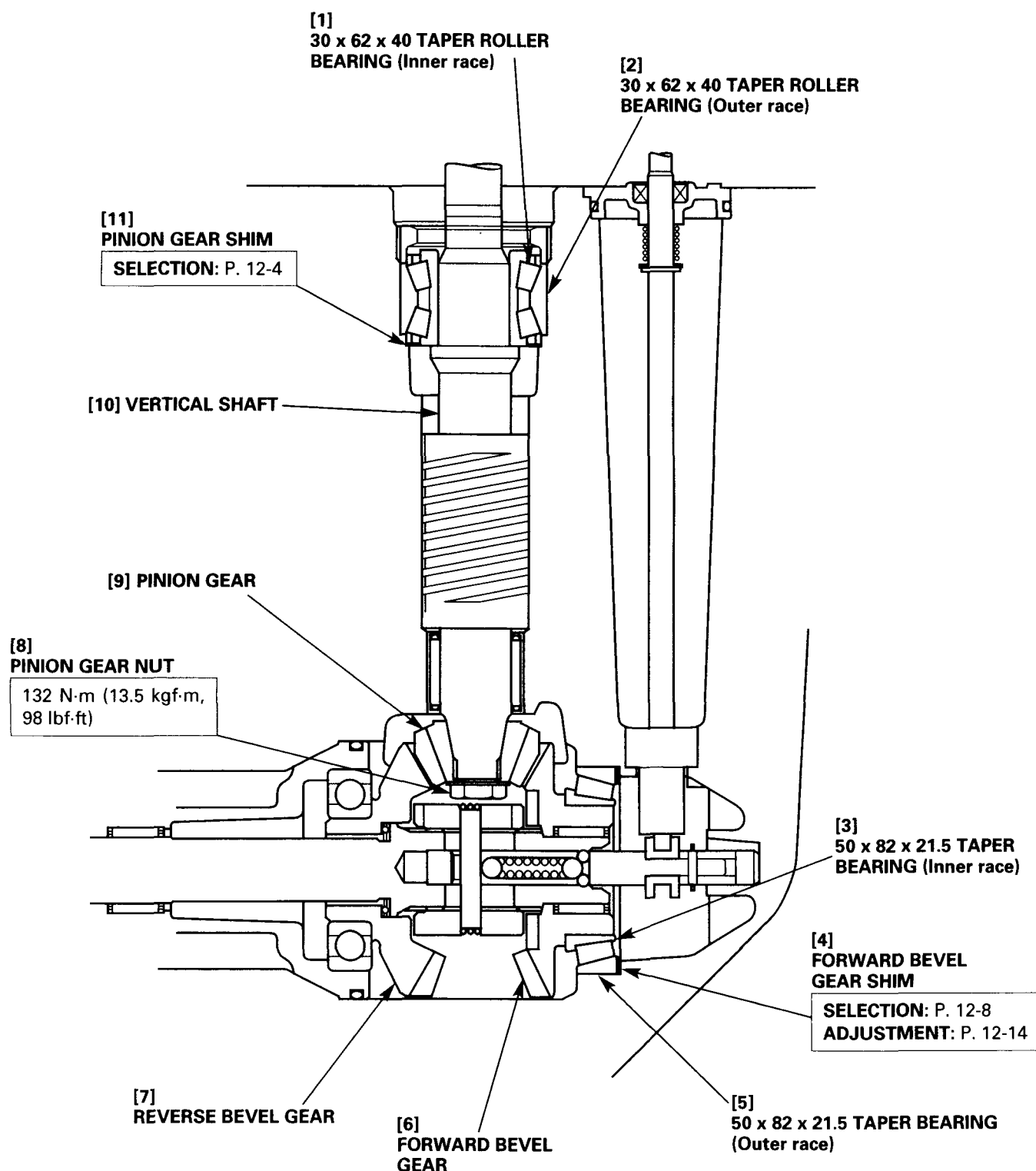
		[2] Calculation value		
		0 (0.000) – -0.05 (-0.002)	-0.05 (-0.002) – -0.10 (-0.004)	-0.10 (-0.004) – -0.15 (-0.006)
[1] Engagement mark on the gear case	F	0.95 (0.037)	1.00 (0.039)	1.05 (0.041)
	E	0.90 (0.035)	0.95 (0.037)	1.00 (0.039)
	D	0.85 (0.033)	0.90 (0.035)	0.95 (0.037)
	C	0.80 (0.031)	0.85 (0.033)	0.90 (0.035)
	B	0.75 (0.030)	0.80 (0.031)	0.85 (0.033)
	A	0.70 (0.028)	0.75 (0.030)	0.80 (0.031)

Refer to page 12-7 for information on how to read the shim selection table and shim combination.

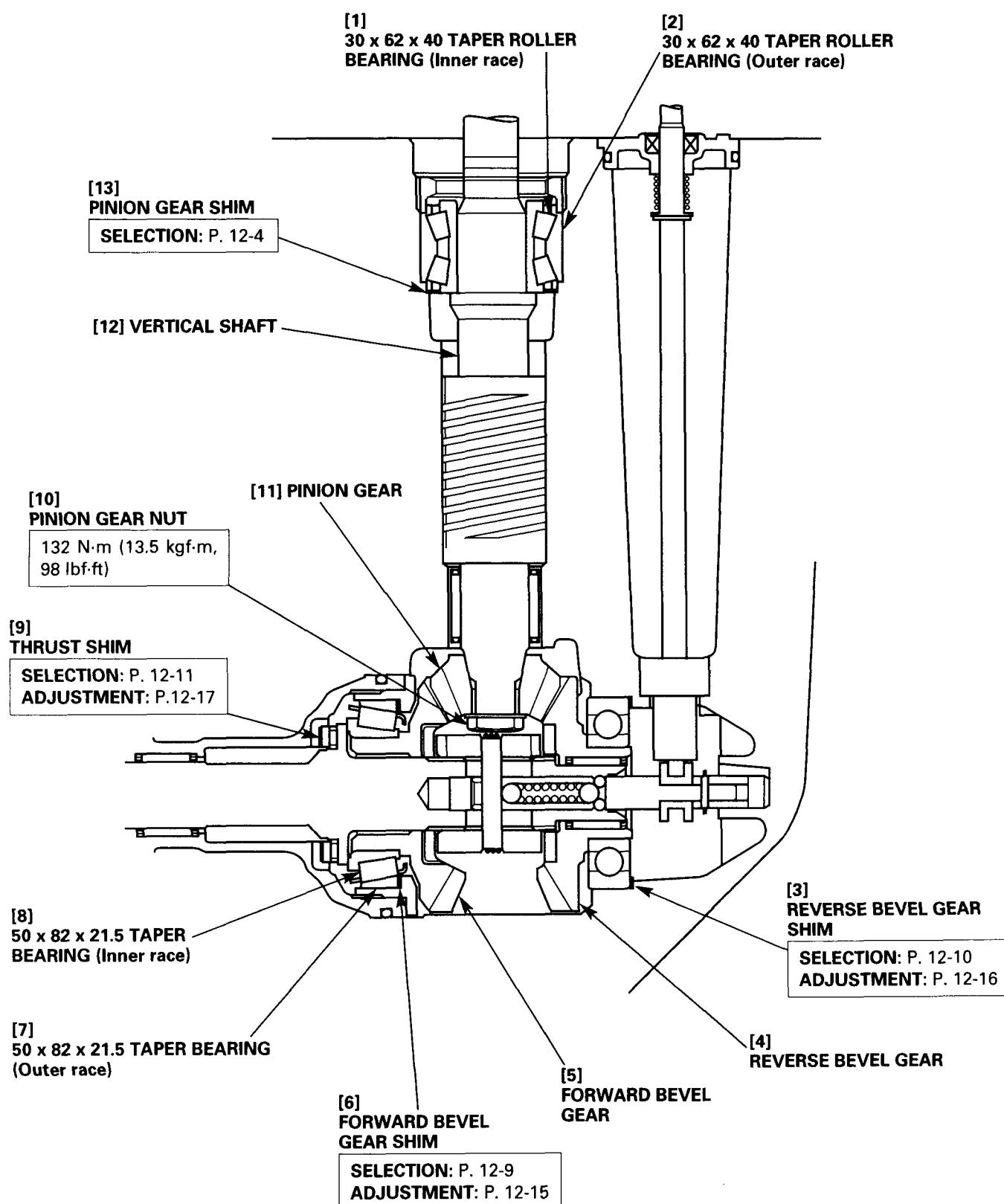


### 3. SHIM POSITION

•LD and XD types



•LCD and XCD types



## 4. BACKLASH ADJUSTMENT

### • FORWARD BEVEL GEAR BACKLASH

- Backlash adjustment must be made after adjustment of each gear shim (P. 12-4 through 11).
- Install the parts except the water pump in the gear case (P. 12-5, 9, 22 and 23 of the base shop manual).

#### <LD and XD types only>

- 1) Hold the propeller shaft securely with the special tool as shown, and tighten the puller bolt (special tool) to the specified torque.

**TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)**

Turn the vertical shaft 5 to 10 turns clockwise.

#### TOOLS:

Puller jaws  
Puller bolt

07SPC-ZW0010Z  
07SPC-ZW0011Z

- 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.
- 3) 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.

#### NOTE:

Do not turn the propeller shaft when turning the vertical shaft.

- 4) Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

#### Formula:

Dial gauge runout x 1.03 = Backlash

#### Example:

When dial gauge runout is 0.195 mm (0.0077 in):  
 $0.195 \times 1.03 = 0.20$

Therefore, the backlash is 0.20 mm (0.008 in).

Standard value	0.12 – 0.29 mm (0.005 – 0.011 in)
----------------	-----------------------------------

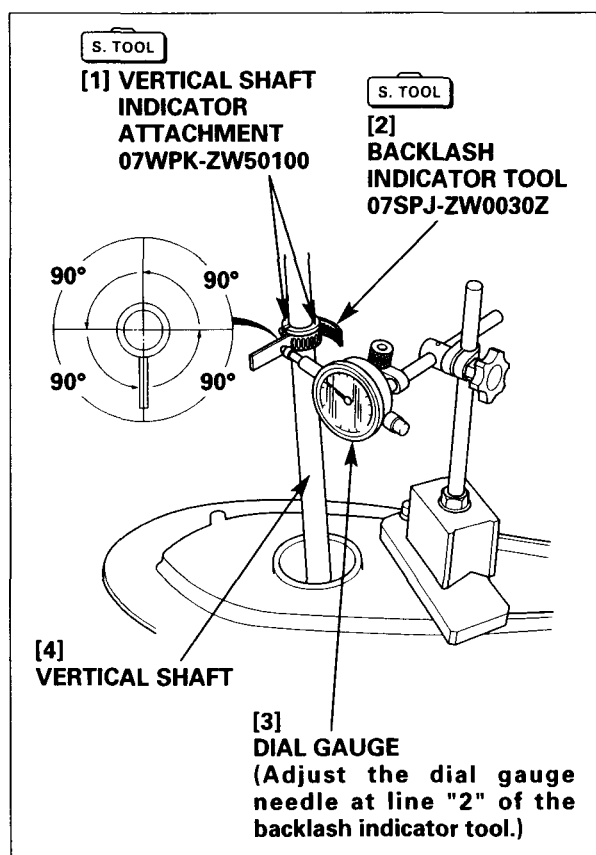
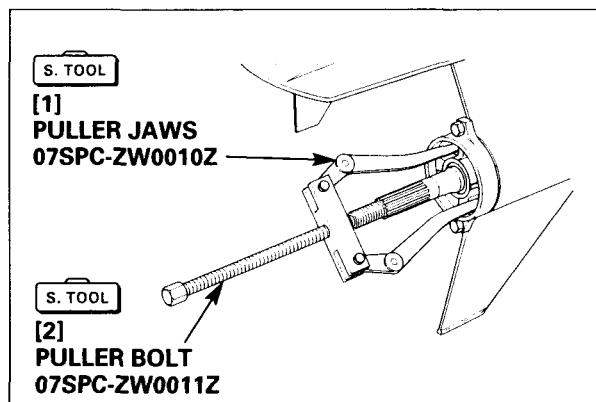
If the backlash is too large, increase the forward bevel gear shim thickness and recheck the backlash.

If the backlash is too small, reduce the forward bevel gear shim thickness and recheck the backlash.

#### TOOLS:

Vertical shaft indicator attachment  
Backlash indicator tool  
Dial indicator adapter kit

07WPK-ZW50100  
07SPJ-ZW0030Z  
07SPJ-ZW0040Z



## &lt;LCD and XCD types only&gt;

- Forward bevel gear backlash adjustment must be made after adjusting the reverse bevel gear backlash (P. 12-16).

- 1) Hold the propeller shaft securely with the special tool as shown, and tighten the puller bolt (special tool) to the specified torque.

**TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)**

Turn the vertical shaft 5 to 10 turns clockwise.

**TOOLS:**

**Puller jaws**  
**Puller bolt**

**07SPC-ZW0010Z**  
**07SPC-ZW0011Z**

- 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.
- 3) 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.

**NOTE:**

Do not turn the propeller shaft when turning the vertical shaft.

- 4) Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

**Formula:**

Dial gauge runout x 1.03 = Backlash

**Example:**

When dial gauge runout is 0.195 mm (0.0077 in):

$0.195 \times 1.03 = 0.20$

Therefore, the backlash is 0.20 mm (0.008 in).

Standard value	0.12 – 0.29 mm (0.005 – 0.011 in)
----------------	-----------------------------------

If the backlash is too large, reduce the forward bevel gear shim thickness and recheck the backlash.

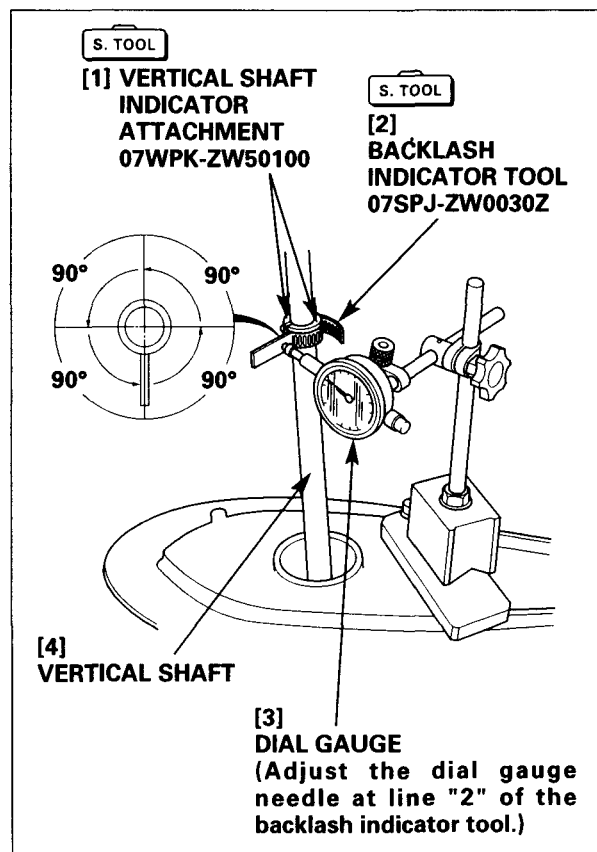
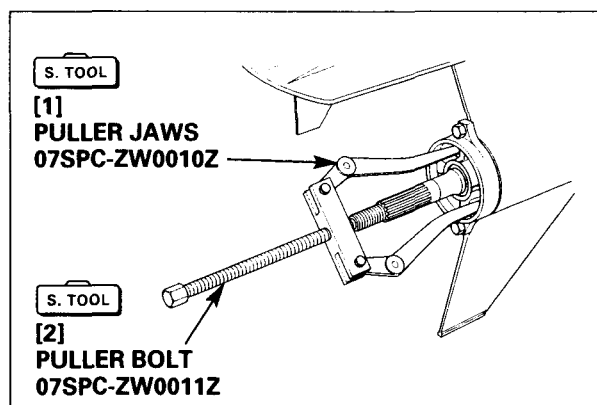
If the backlash is too small, increase the forward bevel gear shim thickness and recheck the backlash.

- 5) When the forward bevel gear shim is replaced, adjust the thrust clearance (P. 12-17).

**TOOLS:**

**Vertical shaft indicator attachment**  
**Backlash indicator tool**  
**Dial indicator adapter kit**

**07WPK-ZW50100**  
**07SPJ-ZW0030Z**  
**07SPJ-ZW0040Z**



## • REVERSE BEVEL GEAR BACKLASH

<LCD and XCD types only>

- Reverse bevel gear backlash adjustment must be made before adjusting the forward bevel gear backlash (P. 12-15).

- Remove only the bearing holder assembly from the propeller shaft holder (P.12-19 of the base shop manual), and adjust the reverse bevel gear backlash.

- 1) Hold the propeller shaft securely with the special tool as shown, and tighten the puller bolt (special tool) to the specified torque.

**TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)**

Turn the vertical shaft 5 to 10 turns clockwise.

### TOOLS:

Puller jaws

07SPC-ZW0010Z

Puller bolt

07SPC-ZW0011Z

- 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.

- 3) 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.

### NOTE:

Do not turn the propeller shaft when turning the vertical shaft.

- 4) Obtain the reverse bevel gear backlash using the dial gauge runout and the following formula.

### Formula:

Dial gauge runout x 1.03 = Backlash

### Example:

When dial gauge runout is 0.195 mm (0.0077 in):

$0.195 \times 1.03 = 0.20$

Therefore, the backlash is 0.20 mm (0.008 in).

Standard value	0.12 – 0.38 mm (0.005 – 0.015 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.

### TOOLS:

Vertical shaft indicator attachment

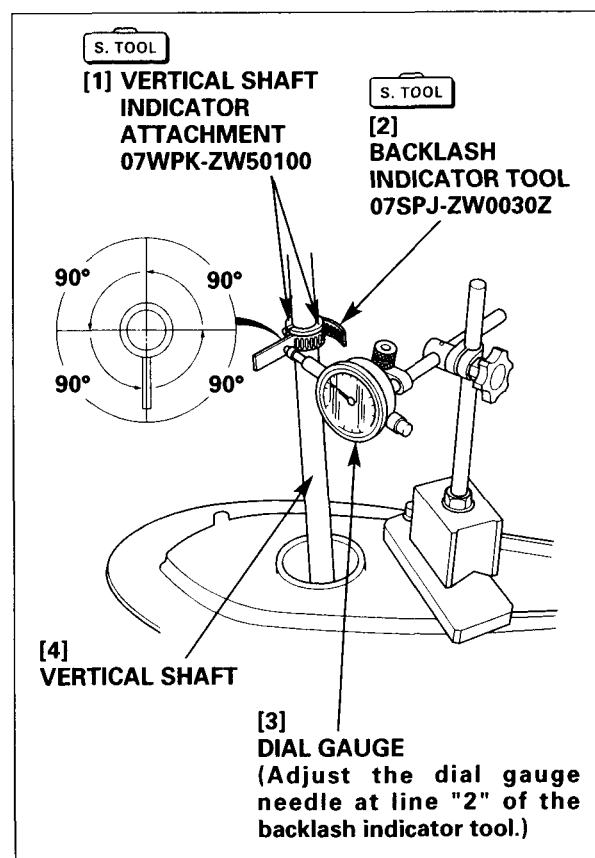
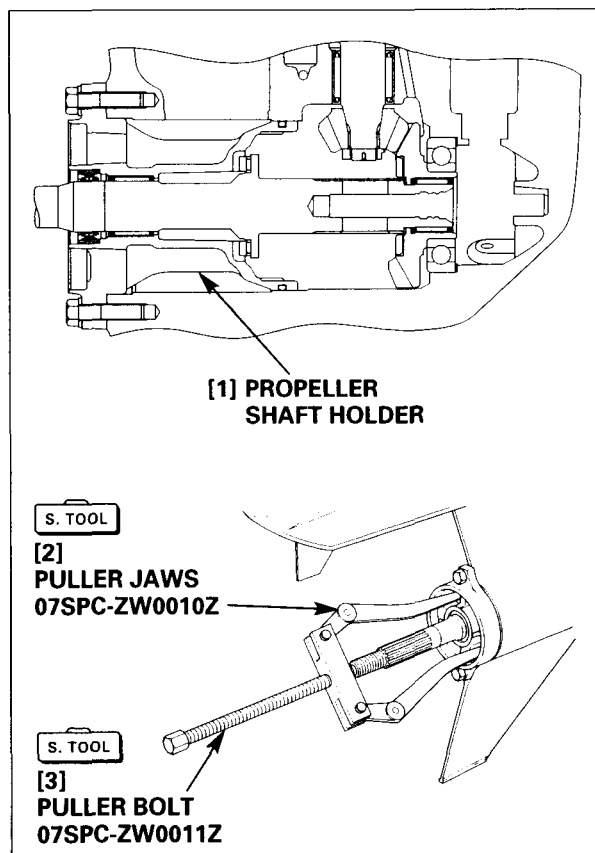
07WPK-ZW50100

Backlash indicator tool

07SPJ-ZW0030Z

Dial indicator adapter kit

07SPJ-ZW0040Z



### • THRUST CLEARANCE ADJUSTMENT (LCD and XCD 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. 12-21 of the base shop manual).

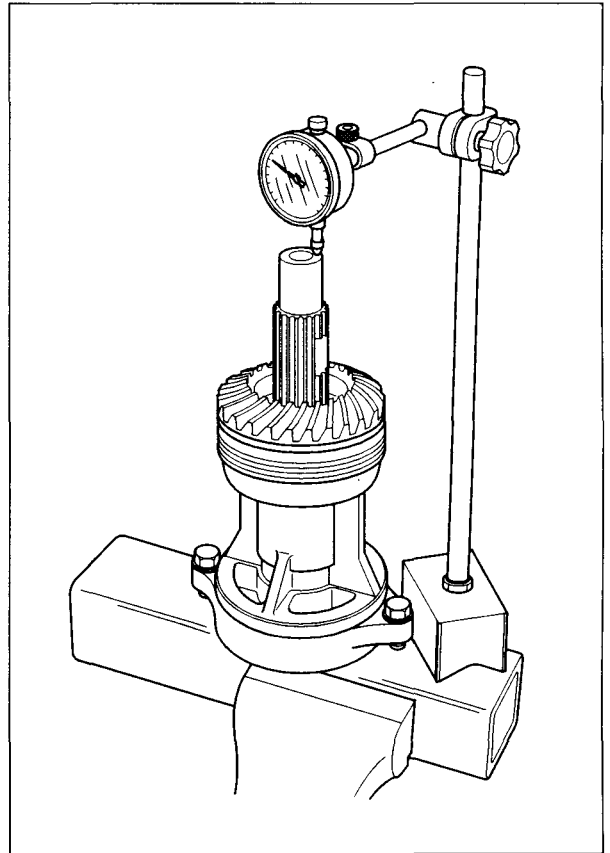
Note that the shift slider and the clutch shifter are not mounted.

- 2) Set the propeller shaft holder assembly on the fixing tool as shown, and tighten with the bolts securely (P. 12-19 of the base shop manual).
- 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.





## PREFACE

This supplement describes the major differences between the following models of the Honda BF115A and BF130A outboard motors.

MODEL	FRAME SERIAL NUMBER
BF115A	BZBD-1300690 and subsequent
	BZBG-1300035 and subsequent
BF130A	BZBE-1302748 and subsequent
	BZBH-1300363 and subsequent

For service information which is not covered in this supplement, please refer to the BF115A-BF130A base shop manuals, (part number 66ZW500 and 66ZW500Z).

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.

ALL INFORMATION, ILLUSTRATIONS, DIRECTIONS AND SPECIFICATIONS INCLUDED IN THIS PUBLICATION ARE BASED ON THE LATEST PRODUCT INFORMATION AVAILABLE AT THE TIME OF APPROVAL FOR PRINTING. Honda Motor Co., Ltd. RESERVES THE RIGHT TO MAKE CHANGES WITHOUT INCURRING ANY OBLIGATION WHATEVER. NO PART OF THIS PUBLICATION MAY BE REPRODUCED WITHOUT WRITTEN PERMISSION.

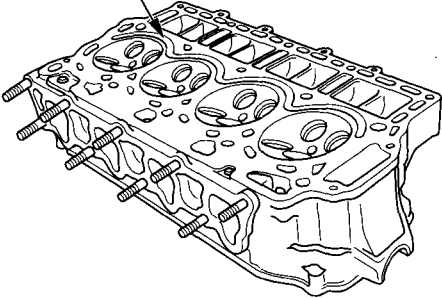
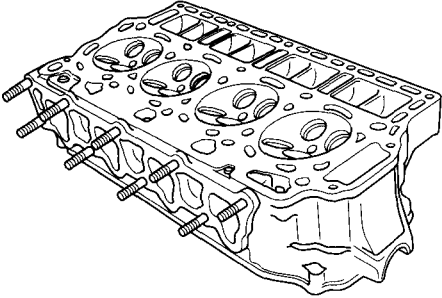
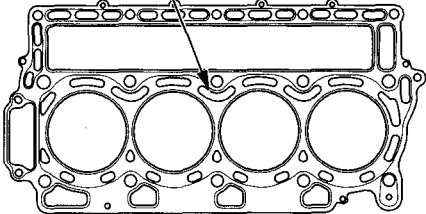
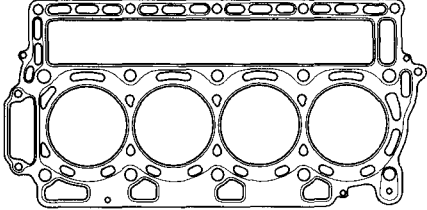
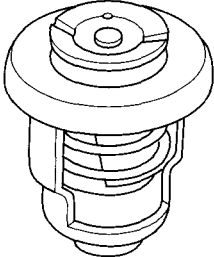
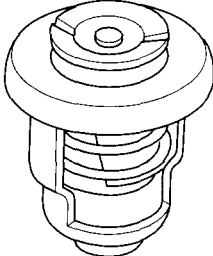
**Honda Motor Co., Ltd.  
Service Publications Office**

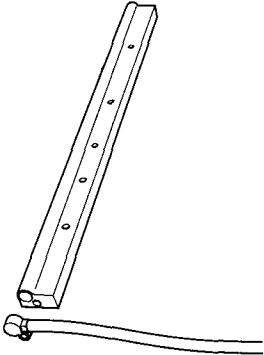
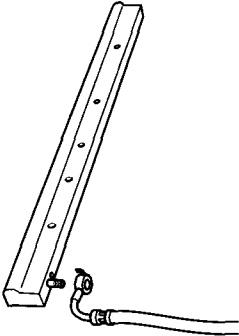
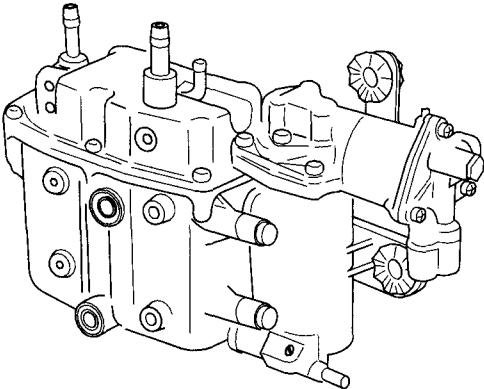
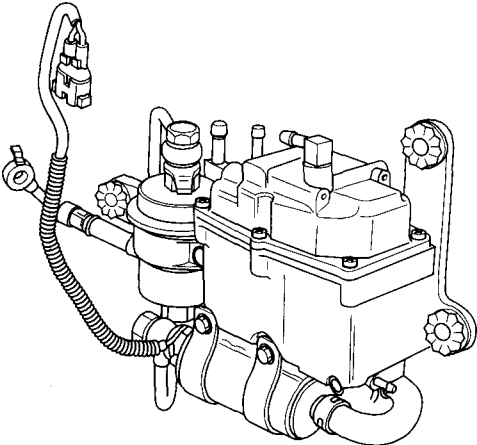
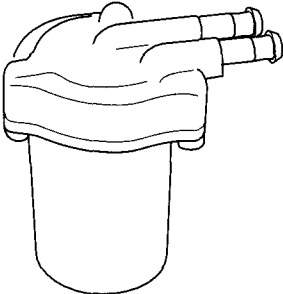

## CONTENTS

OUTLINE OF CHANGES	
SPECIFICATIONS	1
SERVICE INFORMATION	2
MAINTENANCE	3
ENGINE COVER/TIMING BELT UPPER COVER	4
PROGRAMMED FUEL INJECTION (PGM-FI)	5
ALTERNATOR/BALANCER BELT/TIMING BELT	6
ENGINE REMOVAL/INSTALLATION	7
WATER JACKET COVER/THERMOSTAT/PRESSURE VALVE	8
CYLINDER HEAD/VALVES	9
FLYWHEEL/OIL PUMP	10
BALANCER SHAFT/CRANKCASE/CRANKSHAFT/PISTON	11
PROPELLER/GEAR CASE/5X15/50/55 CASE	12
OIL PAN/ENGINE UNDERCASE/MOUNTING CASE	13
SWIVEL CASE/POWER TRIM/TILT ASSEMBLY	14
STEERING ROD/REMOTE CONTROL BOX	15
CABLES/SHIFT LINK BRACKET/SHIFT ARM	16
ELECTRICAL EQUIPMENT	17
OPERATION	18
WIRING DIAGRAM	19

 The marked sections contain no changes. They are not covered in this manual.

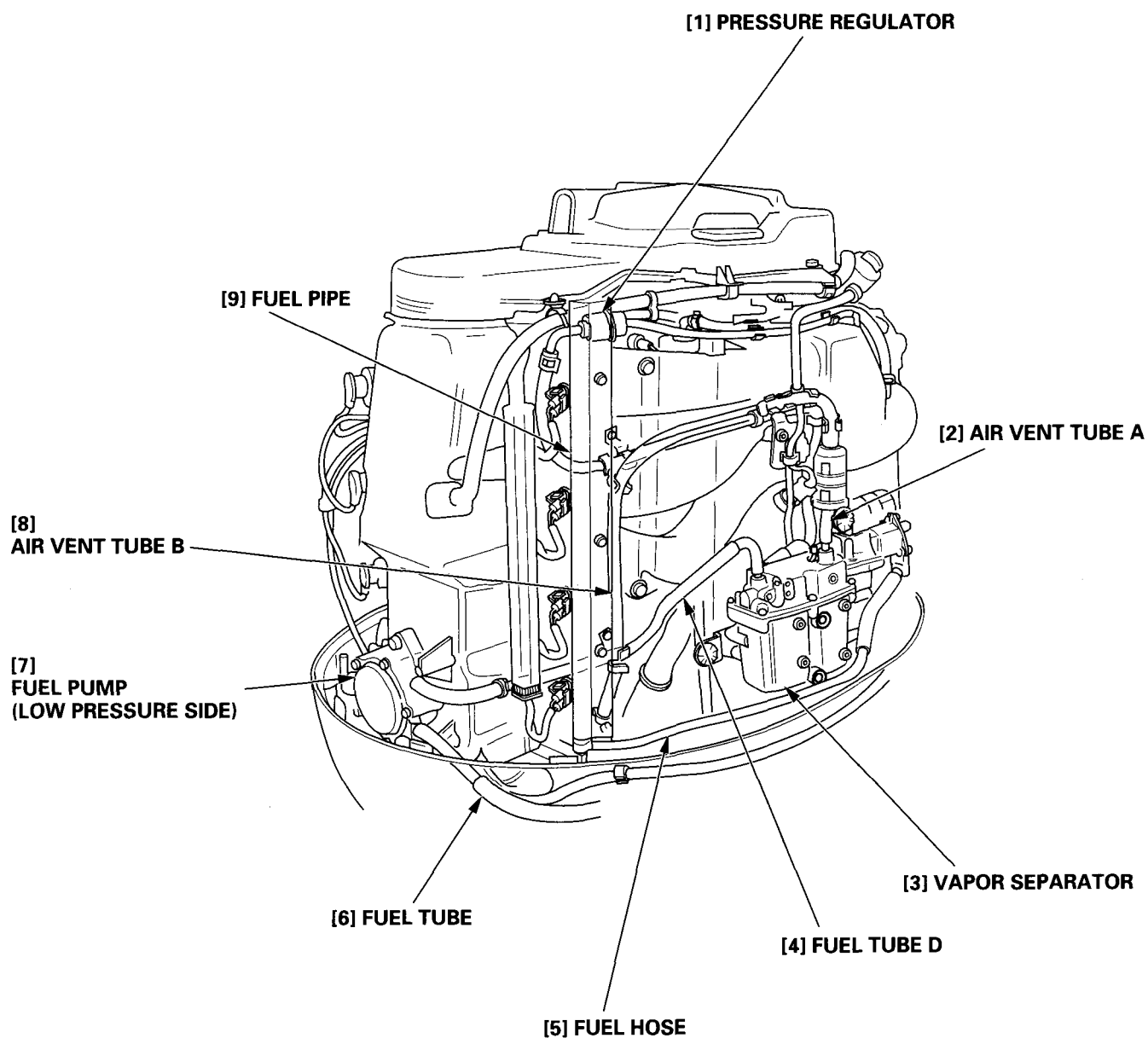
OUTLINE OF CHANGES .....	1
2. SERVICE INFORMATION .....	2-1
1. TUBE ROUTING .....	2-1
3. MAINTENANCE .....	3-1
1. MAINTENANCE SCHEDULE .....	3-1
2. WATER SEPARATOR .....	3-2
5. PROGRAMMED FUEL INJECTION (PGM-FI) .....	5-1
1. FUEL LINES .....	5-1
2. FUEL STRAINER (HIGH PRESSURE SIDE) .....	5-2
3. VAPOR SEPARATOR/FUEL PUMP UNIT .....	5-4

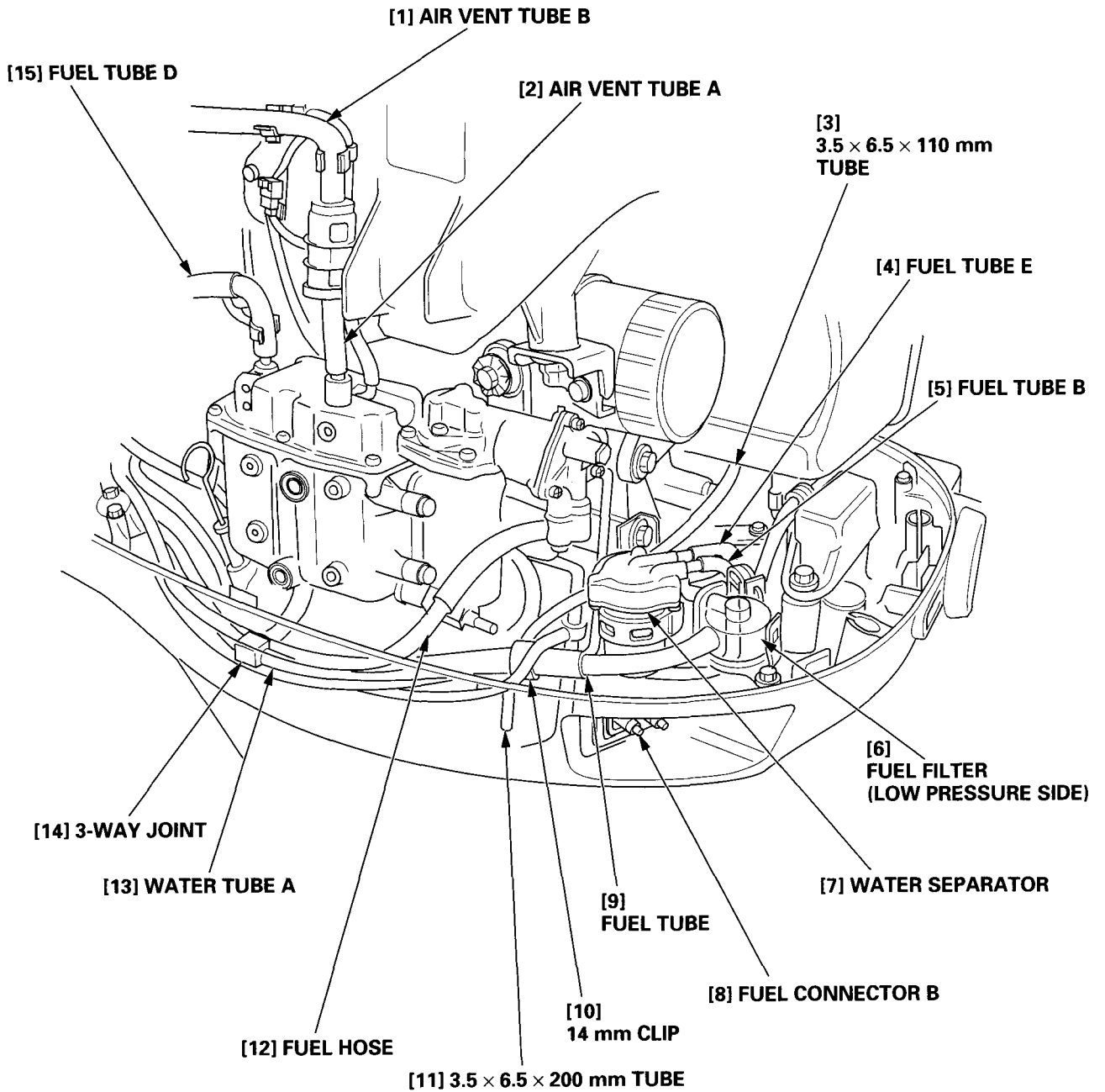
[1] Item	[2] After modification	[3] Before modification
[4] CYLINDER HEAD	<div>[6] WATER GALLERY</div> 	
[5] CYLINDER HEAD GASKET	<div>[6] WATER GALLERY</div> 	
[7] THERMOSTAT	<div>[8] Start opening 58 °C – 62 °C (136 °F – 144 °F) Fully open 70 °C (158 °F)</div> 	<div>[9] Start opening 70 °C – 74 °C (158 °F – 165 °F) Fully open 82 °C (180 °F)</div> 

[1] Item	[2] After modification	[3] Before modification
[4] FUEL PIPE		
[5] VAPOR SEPARATOR		
[6] WATER SEPARATOR		

## 1. TUBE ROUTING

### 1. TUBE ROUTING





**1. MAINTENANCE SCHEDULE**
**2. WATER SEPARATOR**

## 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.	Refer to base manual
Engine oil	Check level	○						3-2
	Change			○	○			
Gear case oil	Change			○	○			3-4
Engine oil filter	Replace					○		3-3
Timing belt	Check-adjust					○		3-19
ACG belt	Check-adjust					○		3-13
Balancer belt	Check-adjust					○		3-15
Throttle linkage	Check-adjust			○	○			5-31
Idling speed	Check-adjust			○	○			5-31
Valve clearance	Check-adjust			○		○		3-5
Spark plug	Check-adjust				○			3-5
	Replace					○		
Propeller and cotter pin	Check	○						12-1
Anode metal	Check	○						8-5
Lubrication	Grease			○ (1)	○ (1)			2-50
Water separator	Check	○						*3-2
Fuel tank and tank filter	Clean					○		3-10
Fuel filter	Check				○			3-9
	Replace						○	5-76
Fuel filter (high pressure side)	Replace						○	*5-2
Thermostat	Check					○		8-4
Fuel line	Check	○						5-44
	Replace	Every 2 years (If necessary)						
Battery and cable connection	Check level-tightness	○						—
Bolts and nuts	Check-tightness			○	○			—
Crankcase breather tube	Check					○		2-45
Cooling water passages	Clean		○ (3)					—

(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.

\* The supplement manual.

## 2. WATER SEPARATOR

### Inspection:

- 1) Remove the engine cover (P. 4-1 of the base shop manual).
- 2) Check the water separator for water accumulation or sediment. If water or sediment is found, remove the water separator 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 with the hose clips, and disconnect the fuel tubes from the water separator.
- 2) Remove the water separator with the suspension strap from the separator bracket.
- 3) Remove the water separator from the suspension strap.

### Disassembly/Cleaning:

- 1) Remove the three 5 × 12 mm pan screws and the separator bowl.
- 2) Clean the water or sediment in the bowl.

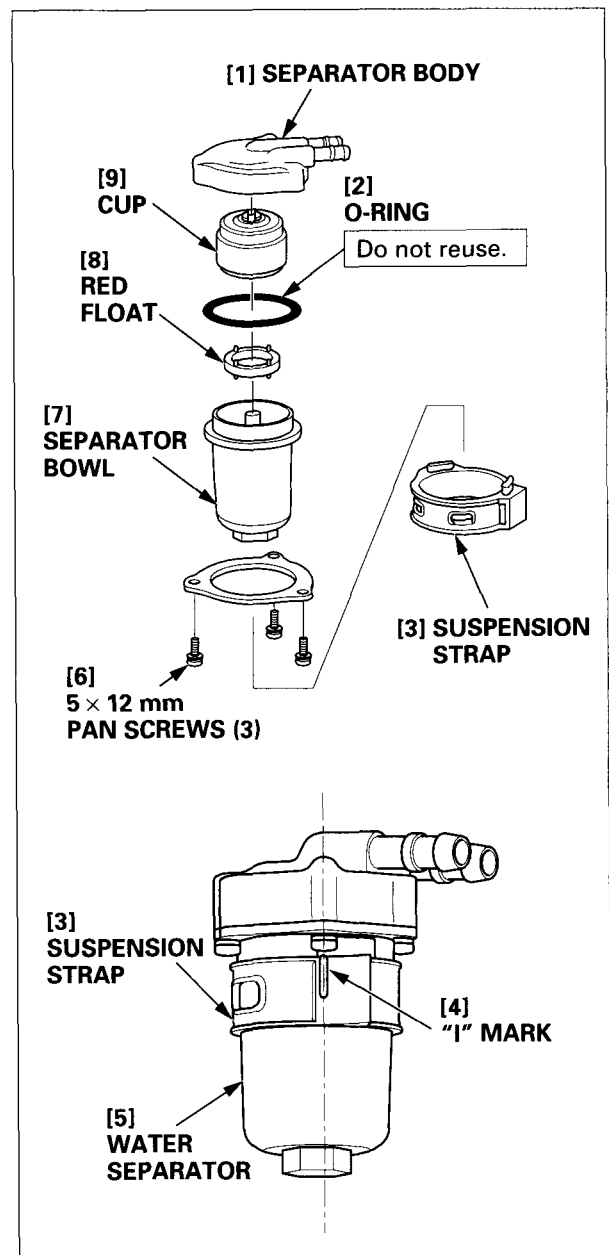
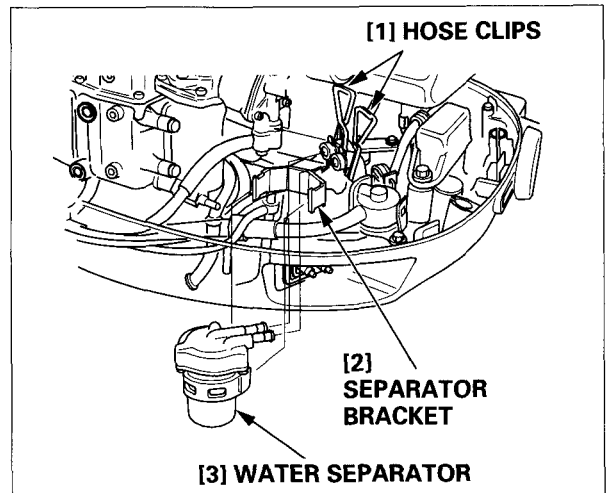
### Reassembly:

Replace the O-ring and reassemble the water separator. Tighten the three 5 × 12 mm pan screws to the specified torque.

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

### Installation:

- 1) Install the suspension strap onto the water separator.
- 2) Make sure to align with the "I" mark as shown in the illustration.
- 3) Connect the fuel tubes securely to the water separator.
- 4) Recheck the "I" mark alignment.





# 5. PROGRAMMED FUEL INJECTION (PGM-FI) BF115A•BF130A

1. FUEL LINES
2. FUEL STRAINER (HIGH PRESSURE SIDE)

3. VAPOR SEPARATOR/FUEL PUMP UNIT

## 1. FUEL LINES

### • HOW TO RELIEVE FUEL PRESSURE

#### ⚠ WARNING

Gasoline is highly flammable and explosive.

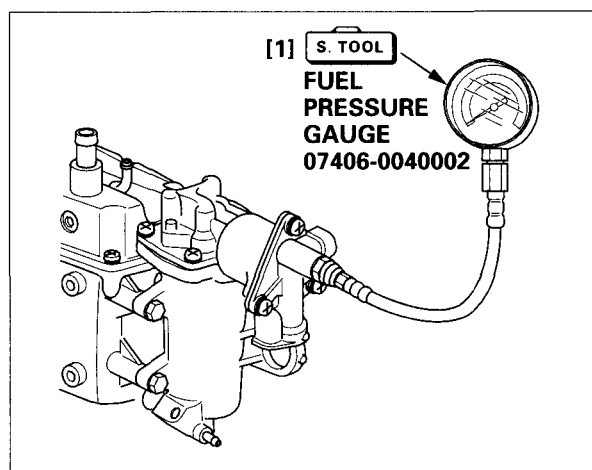
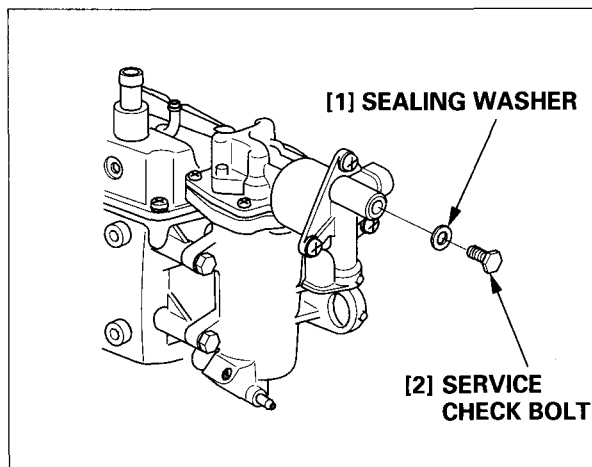
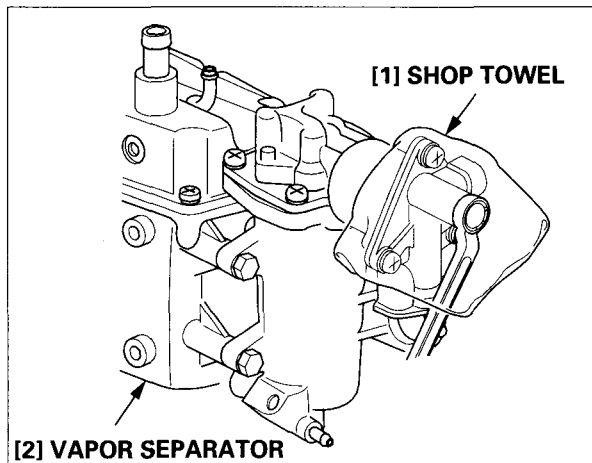
You can be burned or seriously injured when handling fuel.

- Keep heat, sparks, and flame away.
  - Handle fuel only outdoors.
  - Wipe up spills immediately.
- 1) Disconnect the battery cable from the battery negative (-) terminal before relieving the fuel pressure.
  - 2) Replace the sealing washer when the service check bolt is loosened or removed.
- 1) Remove the engine cover (P. 4-1 of the base shop manual).
  - 2) Set a wrench on the service check bolt beside 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 sealing washer with a new one. Tighten the service check bolt with 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.

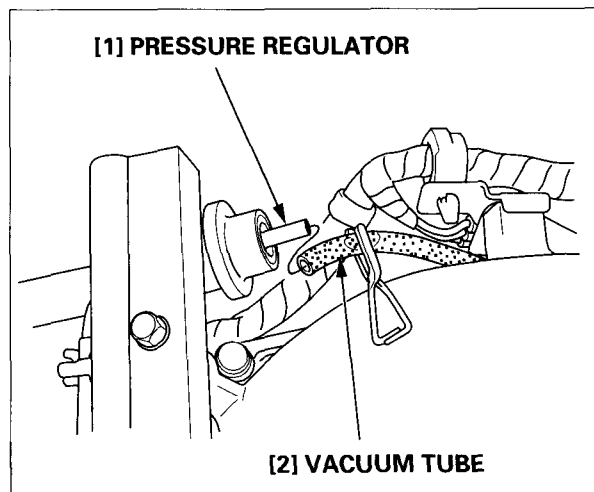


- 3) Disconnect the pressure regulator vacuum tube from the pressure regulator, and clamp the vacuum tube.
- 4) Remove the propeller. Set the outboard motor gear case in a test tank filled with water. Start the engine and measure the fuel pressure at idling.

Standard fuel pressure [At idle speed of 750 ± 50 rpm]	265 – 314 kPa (2.7 – 3.2 kgf/cm <sup>2</sup> , 38 – 46 psi)
--	---

- 5) When the fuel pressure is outside the specified standard pressure, check the following.
  - When fuel pressure is higher than standard pressure:
    - Check the pressure regulator return hose for kinking or restrictions.
    - Check the pressure regulator for proper operation (Inspection: P. 5-46 of the base shop manual).
  - When fuel pressure is lower than standard pressure:
    - Check the pressure regulator for proper operation (Inspection: P. 5-46 of the base shop manual).
    - Check the fuel filter (high pressure side) for clogging (Replacement: P. 5-3).
    - Check the fuel pump unit (Inspection: P. 5-48 of the base shop manual).
- 6) After check, replace the sealing washers with the new ones and tighten the service check bolt to the specified torque.

**TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)**



## 2. 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.**

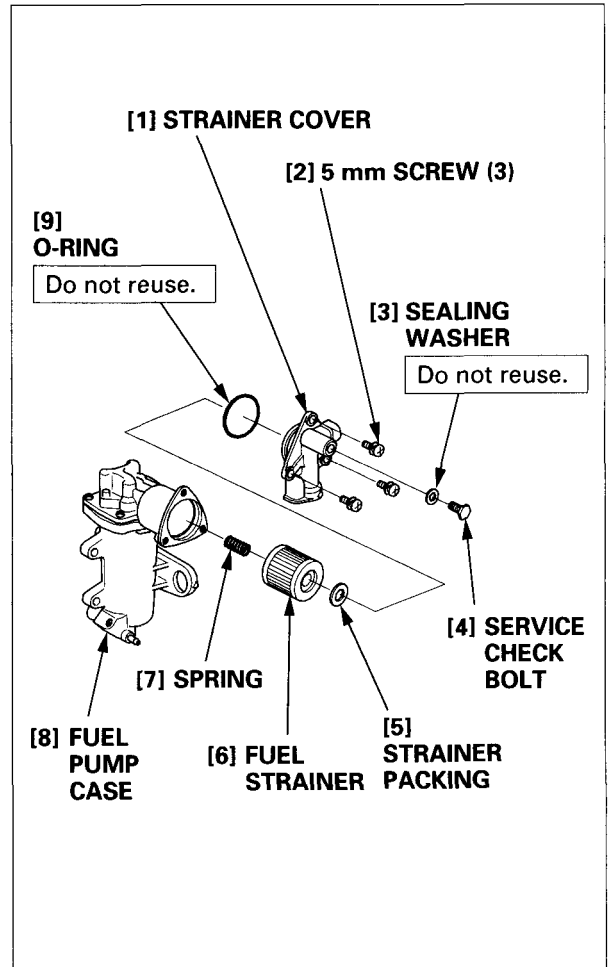
Replace the fuel strainer (high pressure side) at the replacement interval shown or in the following case.

- Regular replacement period of every 2 years or 400 operating hours.
- When the fuel pressure does not reach 265 – 314 kPa (2.7 – 3.2 kgf/cm<sup>2</sup>, 38 – 46 psi) with the pressure regulator vacuum tube connected, be sure that the fuel pump and the pressure regulator 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. 5-1).
- 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 the O-ring.
- 6) Install the fuel strainer.
- 7) Install the strainer cover with the 5 mm screw-washers.
- 8) Replace the sealing washer and tighten the service check bolt with specified torque.

**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**



### 3. VAPOR SEPARATOR/FUEL PUMP UNIT

#### a. REMOVAL/INSTALLATION

- Disconnect the battery cable from the battery negative (–) terminal.
- Relieve the fuel pressure before removing the vapor separator (P. 5-1).

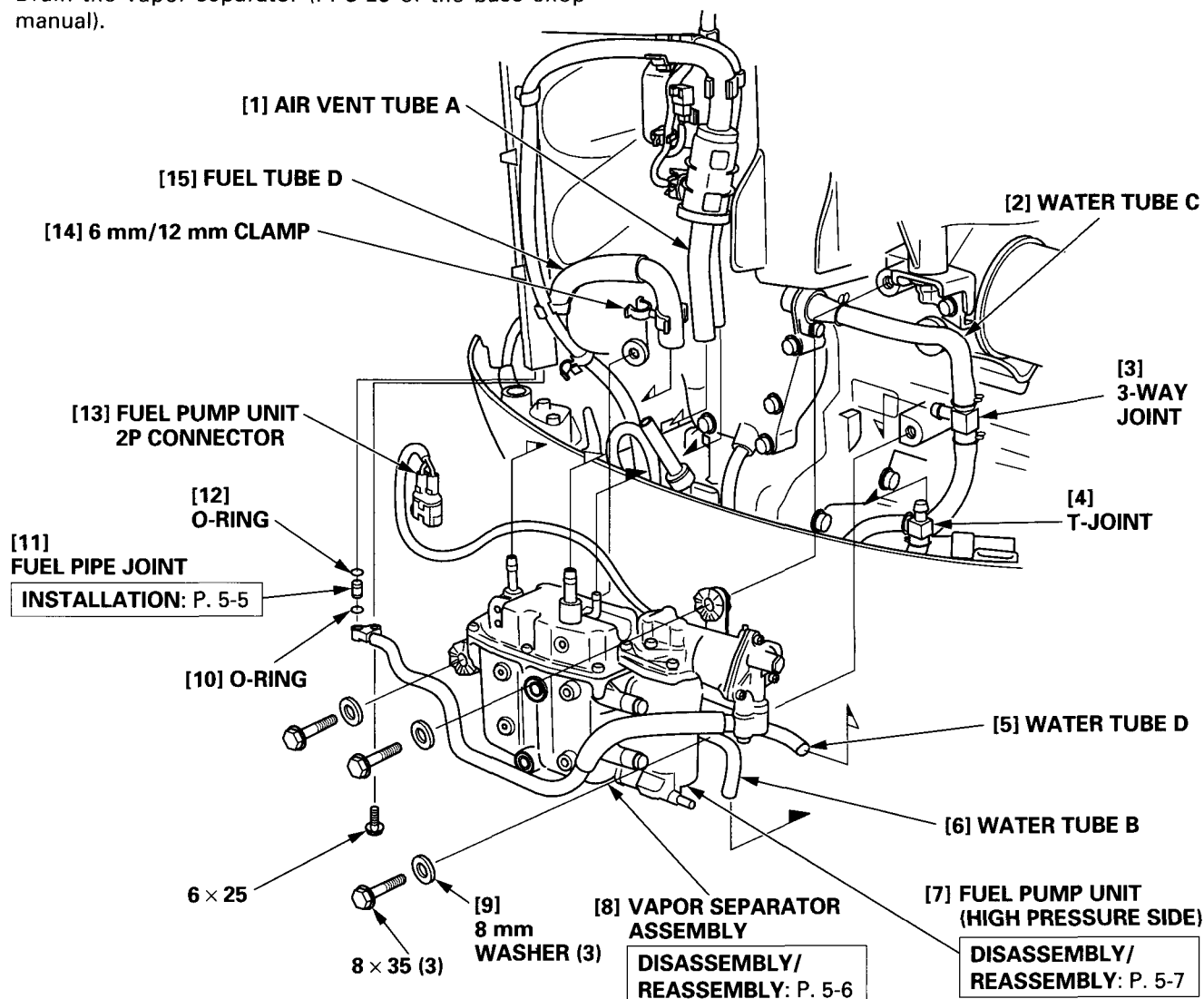
#### ⚠ WARNING

**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) Remove the engine cover and rear separate case (P. 4-1 of the base shop manual).
- 2) Relieve the fuel pressure and remove the engine oil dipstick.
- 3) Drain the vapor separator (P. 3-23 of the base shop manual).

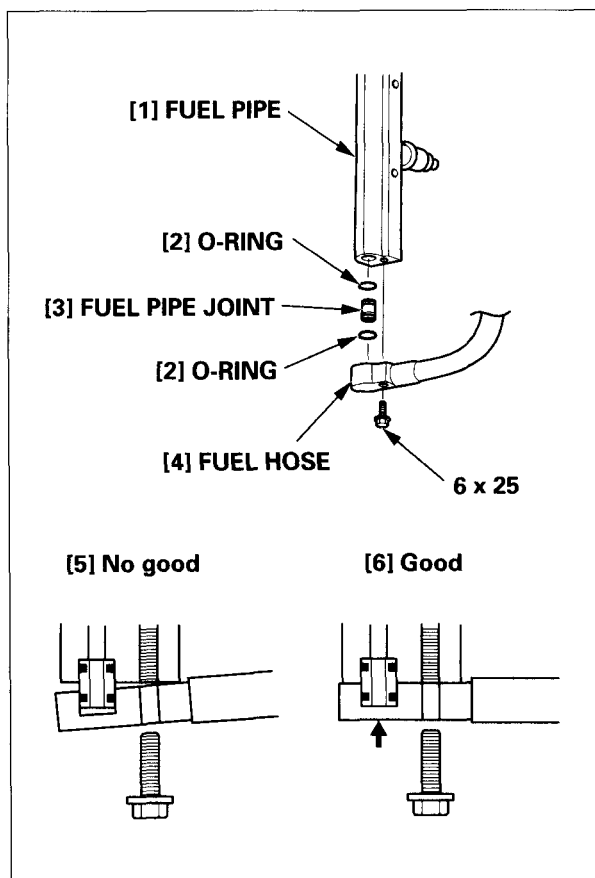


## • FUEL PIPE JOINT INSTALLATION

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

### NOTE:

To prevent the fuel leaks, make sure the fuel pipe joint and fuel hose fixed to the fuel pipe securely before tightening the 6 x 25 mm flange bolt.



## b. VAPOR SEPARATOR DISASSEMBLY/ REASSEMBLY

- Loosen the drain screw and drain the vapor separator before disassembly (P. 3-23 of the base shop manual).

### ⚠ 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] 5 mm SCREW-WASHER (6)

3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)

[15] COVER

[2] FLOAT VALVE

[3] FLOAT

**ASSEMBLY:**

After installation, check for operation by touching with a finger.  
**INSPECTION:** P. 5-64 of the base shop manual.

[14] FLOAT PIN

**ASSEMBLY:**

Replace together with the float as a set.

[13] WATER JACKET COVER

[4] 4 × 8 mm PIN SCREW

2.1 N•m (0.21 kgf•m, 1.5 lbf•ft)

[12] 5 mm WASHER (8)

[11] 5 mm SCREW-WASHER (8)

3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)

[5] O-RING

Do not reuse.

[10] COLLAR (8)

6 × 16 (2)

[9] VAPOR SEPARATOR GROMMET

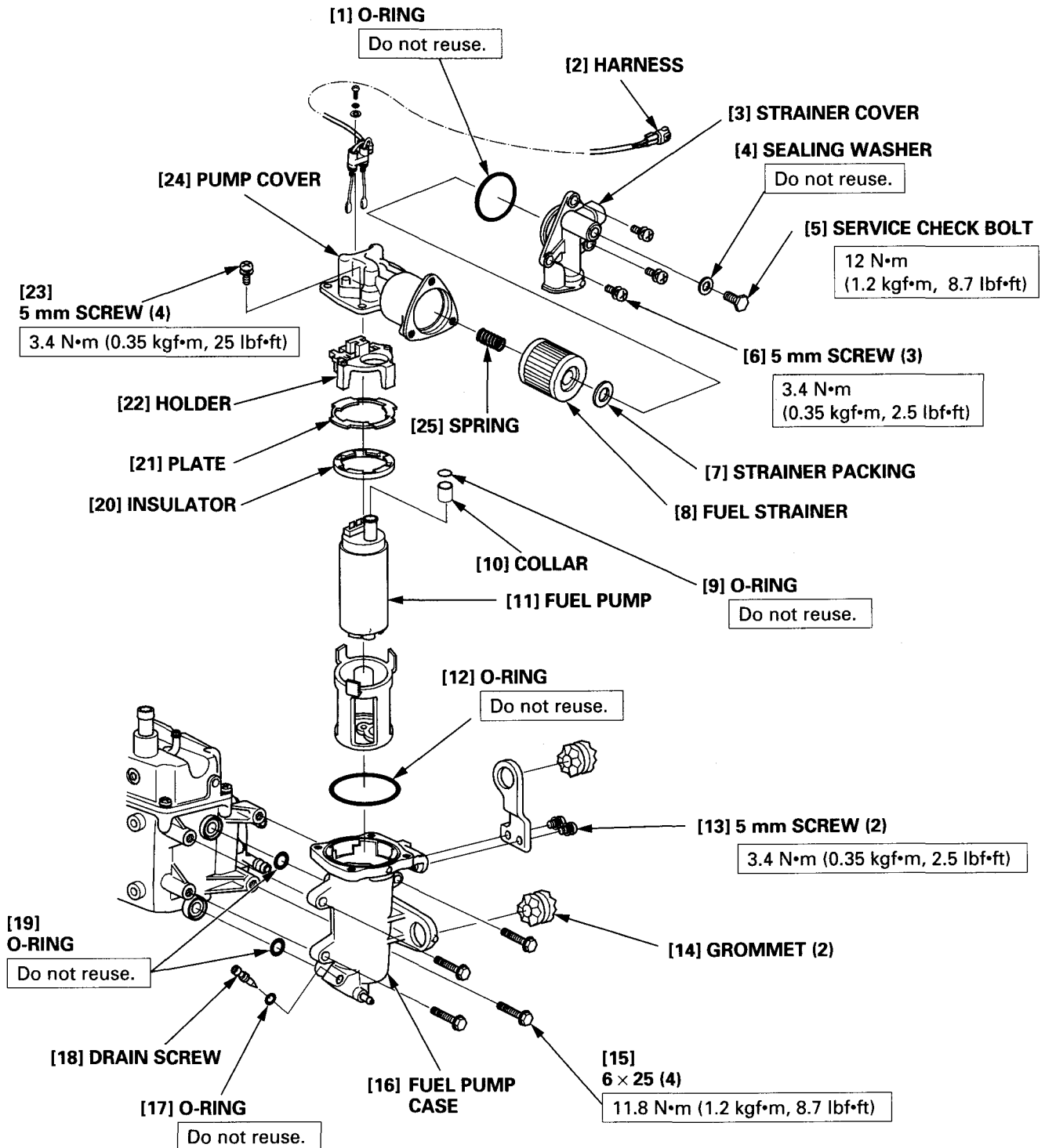
[8] BRACKET

[7] O-RING

Do not reuse.

[6] CHAMBER BODY

C. FUEL PUMP (HIGH PRESSURE SIDE)/  
FUEL STRAINER (HIGH PRESSURE SIDE) DISASSEMBLY/REASSEMBLY



1.	Specifications	3 - 6
2.	Service Information	7 - 58
3.	Maintenance	59 - 83
4.	Engine cover/Timing belt Upper cover	84 - 86
5.	Programmed Fuel Injection (PGM-FI)	87 - 165
6.	Alternator/Balancer belt/Timing belt	166 - 176
7.	Engine removal/Installation	177 - 189
8.	Water jacket cover/Thermostat/ Pressure valve	190 - 194
9.	Cylinder head/Valves	195 - 218
10.	Flywheel/Oil pump	219 - 223
11.	Balancer shaft/Crankcase/ Crankshaft/Piston	224 - 252
12.	Propeller/Gear case/Extension case	253 - 300
13.	Oil pan/Engine undercase /Mounting case	301 - 307
14.	Swivel case/Power trim/Tilt assembly	308 - 335
15.	Steering rod/Remote Control box	336 - 344
16.	Cables/Shift link bracket/Shift arm	345 - 349
17.	Electrical equipment	350 - 379
18.	Operation	380 - 389
19.	Wiring diagrams	390 - 392
	BF115 –130 Supplement Mar ' 02	393 - 412
	BF115 –130 Supplement Nov ' 02	413 - 427
	Shop Manual News Mar'00	429
	Shop Manual News Nov'00	430
	Service News Aug'00	431

**Note: Make sure to select  $\sqrt{\phantom{x}}$  Shrink to fit in the printer dialog box when printing wiring diagrams.**



## HONDA OUTBOARD MOTOR

### Power Equipment

News No.  
P/P-068

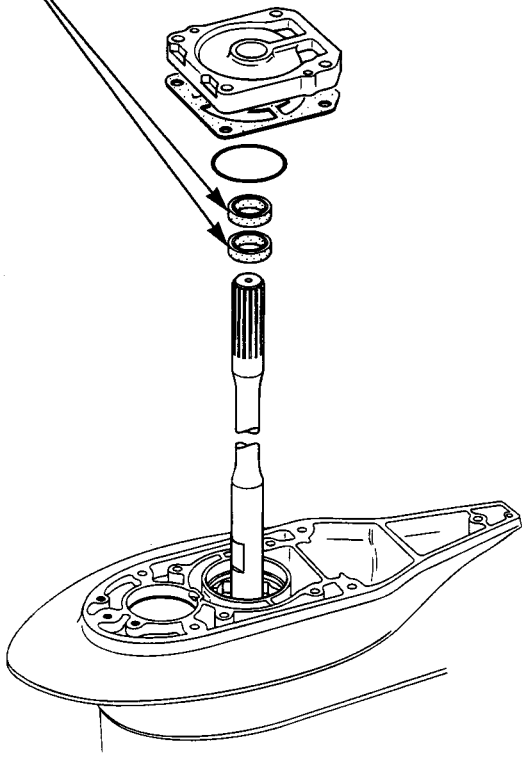
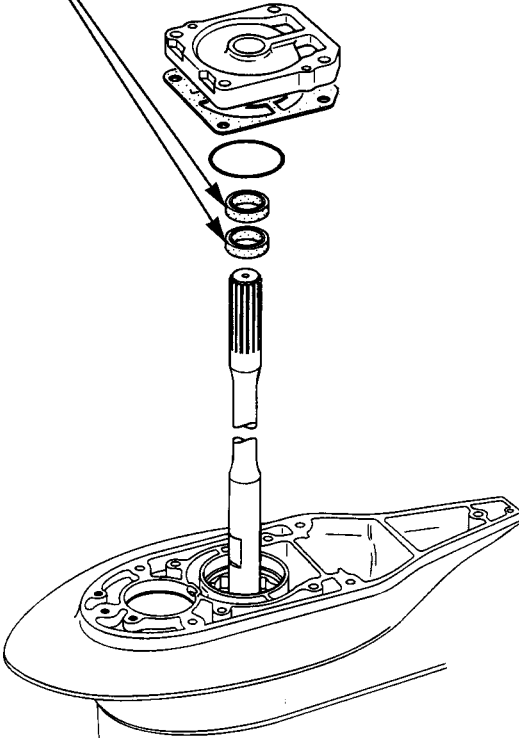
Issue Date  
MAR. '00

### SOME PARTS OF CHANGES

Applicable Information	Publication Number	Applicable Pages
BF75A/BF90A	66ZW000Z	11-4, 11-5
BF115A/BF130A	66ZW500	12-4, 12-6

### CHANGE LOCATIONS

The liquid applied to the circumference of water seals has been changed on the procedure of the water pump assembly.

After Modification	Before Modification
<p><b>23 x 36 x 6 mm WATER SEAL (2)</b></p> <ul style="list-style-type: none"><li>• Do not reuse.</li><li>• Apply grease to the lips.</li><li>• Apply soapy water to the sealing circumference.</li></ul> 	<p><b>23 x 36 x 6 mm WATER SEAL (2)</b></p> <ul style="list-style-type: none"><li>• Do not reuse.</li><li>• Apply grease to the sealing surface, circumference and lips.</li></ul> 

### SOME PARTS OF CHANGES

The method of installing the water seal which had been described to the undermentioned shop manual was changed.

Applicable Information	Publication No.	Applicable Pages	Size of Water Seal
BF2D	66ZW600	15-1, 15-2	11 x 21 x 8 mm
BF20A/25A	66ZV700	12-2, 12-5	22 x 35 x 7 mm
		12-8, 12-9	17 x 30 x 7 mm
		12-8	6 mm
BF35A/45A	66ZV300	11-5, 11-8	22 x 35 x 7 mm
		11-10, 11-11	17 x 30 x 7 mm
BF75A/90A	66ZW000Z	11-4, 11-5	10 x 21 x 6 mm
		11-8, 11-11	30 x 45 x 7 mm
BF115A/130A	66ZW500	12-5, 12-6	10 x 21 x 6 mm
		12-10, 12-15	30 x 45 x 7 mm

### CHANGE LOCATIONS

The liquid applied to the circumference of water seals has been changed.

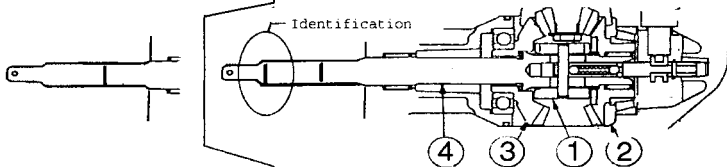
After Modification	Before Modification
<b>INSTALLATION:</b> <ul style="list-style-type: none"><li>● Do not reuse.</li><li>● Apply grease to the mating surface and lips of the seals.</li><li>● Apply soapy water to the circumference of the seals.</li></ul>	<b>INSTALLATION:</b> <ul style="list-style-type: none"><li>● Do not reuse.</li><li>● Apply grease to the mating surface, circumference and lips of the seals.</li></ul>

## Model: BF115/130AX

## Re: Change of the gear case assembly parts

Contents We would like to inform you that the parts related to the propeller shaft have been changed from the following models.

Change: STD

Old	New	Compatibility	
		Old to new	New to old
SHIFTER, CLUTCH	1 SHIFTER, CLUTCH	No	Yes
GEAR COMP., BEVEL F	GEAR COMP., BEVEL F	Yes	Yes
GEAR, BEVEL. R	GEAR, BEVEL. R	No	Yes
SHAFT, PROPELLER	SHAFT, PROPELLER	Yes	Yes
(Identification mark: Addition of one groove at the tip)			
			
ZW ZA CASE ASSY., GEAR(L)	ZW ZA CASE ASSY., GEAR(L)		
ZW ZA CASE ASSY., GEAR(UL)	ZW ZA CASE ASSY., GEAR(UL)		

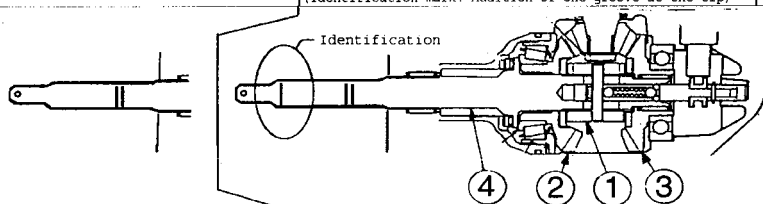
## Applicable model numbers

X STD ZBD	X STD ZBD
X STD ZBE	X STD ZBE

(Production from April 1998 to May 2000)

(Production from June 2000 on.)

Change: C.R.

Old	New	Compatibility	
		Old to new	New to old
SHIFTER, CLUTCH	1 SHIFTER, CLUTCH	No	Yes
GEAR COMP., BEVEL F C.R	GEAR COMP., BEVEL F C.R	Yes	Yes
GEAR, BEVEL. R C.R	GEAR, BEVEL. R C.R	No	Yes
SHAFT, PROPELLER C.R	SHAFT, PROPELLER C.R	Yes	Yes
(Identification mark: Addition of one groove at the tip)			
			
ZW ZA CASE ASSY., GEAR(L)	ZW ZA CASE ASSY., GEAR(L)		
ZW ZA CASE ASSY., GEAR(UL)	ZW ZA CASE ASSY., GEAR(UL)		

## Applicable model numbers

X C.R ZBG	X C.R ZBG
X C.R ZBH	X C.R ZBH

(Production from April 1998 to May 2000)

(Production from June 2000 on.)

Issued: HONDA MOTOR CO., LTD. POWER PRODUCT SERVICE DIVISION

## SERVICE NEWS

In case of troubles with the gear shaft operation for the old model range, perform the following Repair outline.

## Repair outline

- (1) Remove the gear case housing and clean the inside of the gear case housing and the gear-related parts.
  - (2) Inspect the clutch shifter, the bevel gear COMP. (F), and the bevel gear (R) and replace them with new parts as required.
  - (3) Also inspect the other parts and exchange them according to the service manual.
  - (4) Fill oil into the gear case.
- Place the engine vertically and slowly pour in oil from the drain bolt hole.  
Fill in oil until oil flows out from the oil detection bolt hole.

## Expense processing

Claims for parts and work shall be made.

Within the guarantee period: Repair expense claims are requested by means of guarantee service claim forms.