PREFACE

This manual covers the construction, function and serving procedures for the Honda BF135A•BF150A outboard motors.

All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at anytime without notice.

As you read this manual, you will find information that is preceded by a **NOTICE** symbol. The purpose of this message is to help prevent damage to the outboard motor, other property, or the environment.

SAFETY MESSAGES

Your safety, and the safety of others, are very important. To help you make informed decisions, we have provided safety messages and other safety information throughout this manual. Of course, it is not practical or possible to warn you about all the hazards associated with servicing these outboard motors. You must use your own good judgment.

You will find important safety information in a variety of forms, including:

- **Safety Labels** — on the engine cover.
- **Safety messages** — Preceded by a safety alert symbol ⚠ and one of three signal words, DANGER, WARNING, or CAUTION.

  These signal words mean:

  ⚠DANGER You WILL be KILLED or SERIOUSLY HURT if you don't follow instructions.

  ⚠WARNING You CAN be KILLED or SERIOUSLY HURT if you don't follow instructions.

  ⚠CAUTION You CAN be HURT if you don't follow instructions.

- **Instructions** — how to service this outboard motor correctly and safely.

Honda Motor Co., Ltd.
Service Publications Office

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Date of Issue: November, 2003

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Abbreviations

ACG	Alternator
A/F	Air Fuel Ratio
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
BARO	Barometric Pressure
CKP	Crankshaft Position
Comp.	Complete
CMP	Camshaft Position
CYL	Cylinder
DLC	Data Link Connector
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EOP	Engine Oil Pressure
EX	Exhaust
F	Front or Forward
GND	Ground
IAB	Intake Air Bypass
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 Lamp
O.D.	Outside Diameter
OP	Optional Part
PGM-FI	Programmed-Fuel Injection
P/N	Part Number
Qty	Quantity
R.	Right
SAE	Society of Automotive Engineers
SCS	Service Check Signal
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

• DIMENSIONS AND WEIGHTS

Model	BF135A						
Description code	BARJ		BASJ	BARJ		BASJ	
Types	LC	LD	LCD	XC	XD	XCC	XCD
Overall length	845 mm (33.3 in)						
Overall width	580 mm (22.8 in)						
Overall height	1,665 mm (65.6 in)			1,790 mm (70.5 in)			
Dry weight (*1)	220 kg (485 lbs)		223 kg (492 lbs)			226 kg (498 lbs)	
Operating weight (including oil)	228 kg (503 lbs)		231 kg (509 lbs)			234 kg (516 lbs)	

*1: With propeller mounted.

Model	BF150A						
Description code	BANJ		BAPJ	BANJ		BAPJ	
Types	LC	LD	LCD	XC	XD	XCC	XCD
Overall length	845 mm (33.3 in)						
Overall width	580 mm (22.8 in)						
Overall height	1,665 mm (65.6 in)			1,790 mm (70.5 in)			
Dry weight (*1)	220 kg (485 lbs)		223 kg (492 lbs)			226 kg (498 lbs)	
Operating weight (including oil)	228 kg (503 lbs)		231 kg (509 lbs)			234 kg (516 lbs)	

*1: With propeller mounted.

• FRAME

Model	BF135A•BF150A						
Types	LC	LD	LCD	XC	XD	XCC	XCD
Transom height (*1)	508 mm (20.0 in)			635 mm (25.0 in)			
Tilting angle	72°						
Tilting stage	Stageless						
Swivel angle	30° right and left						
Trim angle	– 4° to 16°						

*2: Transom angle is at 12°.

• TYPES OF Honda BF135A•BF150A OUTBOARD MOTORS

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

Model	BF135A•BF150A						
Types	LC	LD	LCD	XC	XD	XCC	XCD
Shaft length type	L	L	L	XL	XL	XL	XL
Remote control	(○)	(○)	(○)	(○)	(○)	(○)	(○)
Control panel	(○)	(○)	(○)	(○)	(○)	(○)	(○)
Counter rotation			○			○	○
Power trim/tilt	○	○	○	○	○	○	○

L: Long shaft XL: Extra-long shaft (○): Optional part

• ENGINE

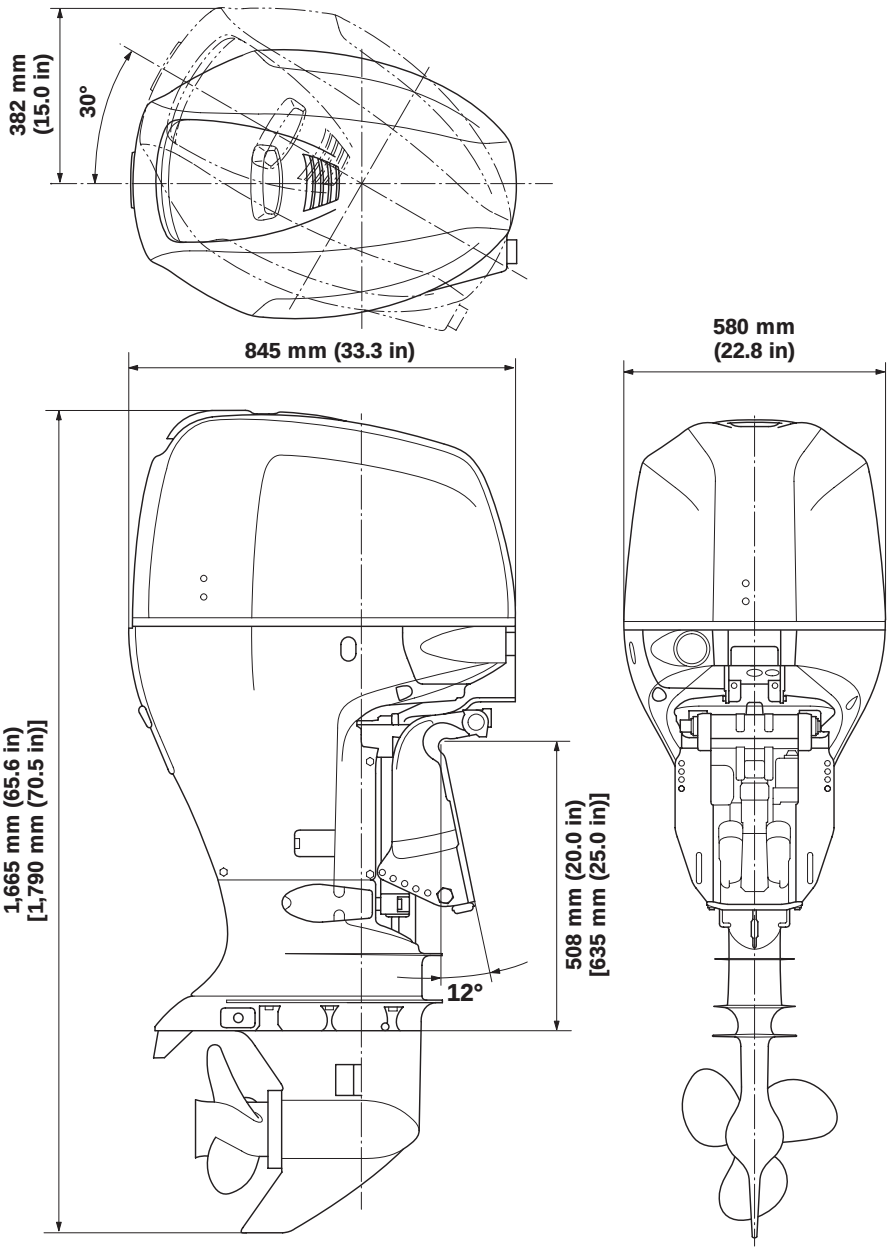
Model	BF135A	BF150A
Description code	BEARJ	BEANJ
Type	4-stroke, D.O.H.C., 4-cylinder	4-stroke, D.O.H.C., VTEC, 4-cylinder
Displacement	2,354 cm^3 (143.6 cu-in)	
Bore x stroke	87 x 99 mm (3.4 x 3.9 in)	
Rated power (Full throttle range)	100.7 kW (135 HP) at 5,000 – 6,000 min^{-1} (rpm)	111.9 kW (150 HP) at 5,000 – 6,000 min^{-1} (rpm)
Maximum torque	196 N·m (20.0 kgf·m, 145 lbf·ft)	202 N·m (20.6 kgf·m, 149 lbf·ft)
Compression ratio	9.6 : 1	
Fuel consumption ratio	350 g/kW·h (257 g/HP·h, 0.575 lb/HP·h)	320 g/kW·h (235 g/HP·h, 0.526 lb/HP·h)
Cooling system	Forced water circulation by impeller pump with thermostat	
Ignition system	Full transistorized, battery ignition	
Ignition timing	0° ± 2° at 750 min^{-1} (rpm) B.T.D.C.	
Spark plug	IZFR6K11 (NGK), SKJ20DR-M11 (DENSO)	
Fuel supply system	Programmed fuel injection	
Fuel injection system	Electronic control	
Fuel injection nozzle	Multi-hole type	
Fuel pipe	Rubber tubes	
Lubrication system	Pressure lubrication by trochoid pump	
Lubrication capacity	7.35r (7.8 US qt, 6.5 lmp qt) [with oil filter replacement: 6.7r (7.1 US qt, 5.9 lmp qt)] [without oil filter replacement: 6.5r (6.9 US qt, 5.7 lmp qt)]	
Starting system	Electric starter	
Stopping system	Primary circuit ground	
Fuel used	Unleaded gasoline with a pump octane number 86 or higher	
Fuel pump	Electric and mechanical plunger type	
Exhaust system	Underwater type	
Recommended oil	SAE 10W-30	

• LOWER UNIT

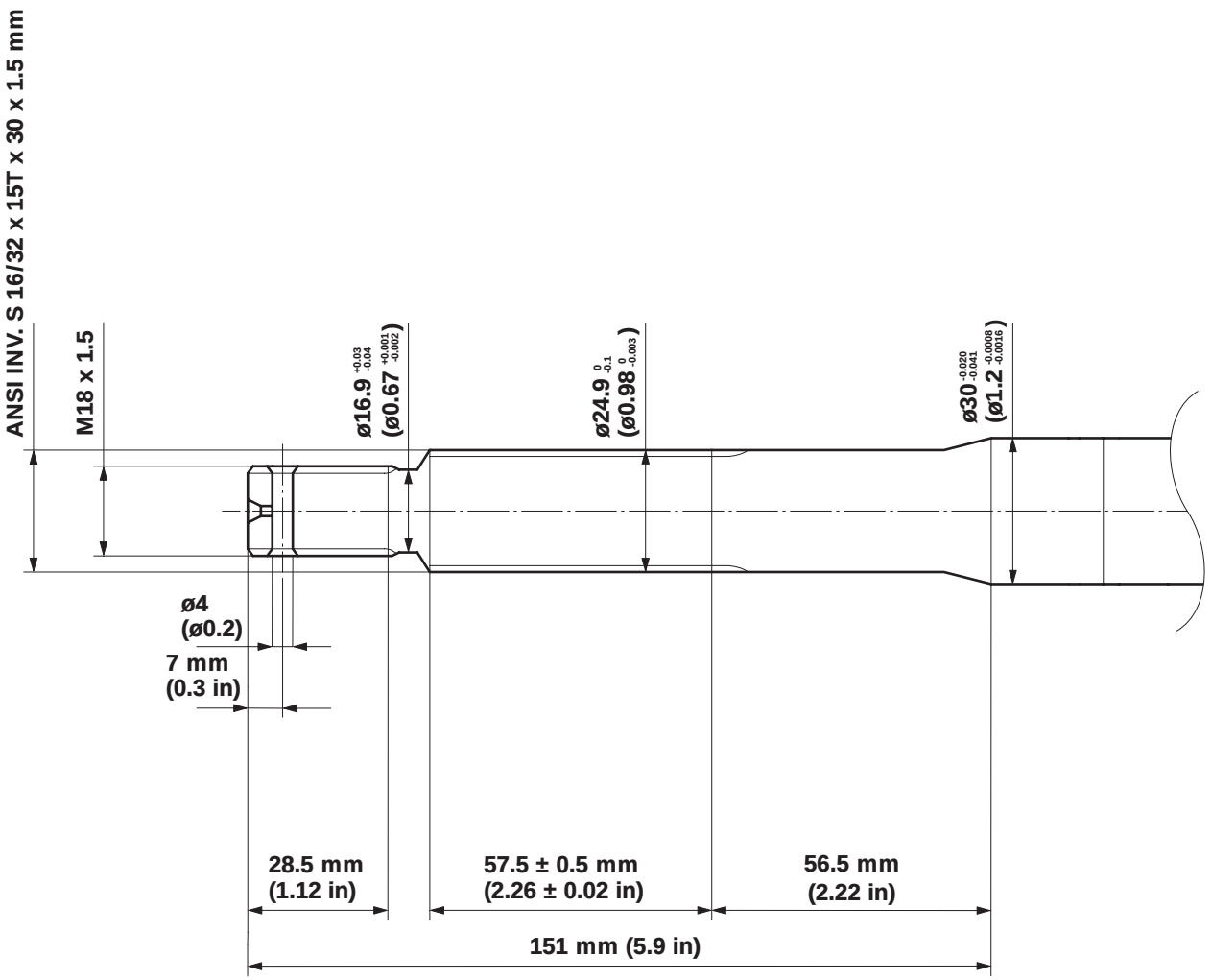
Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	0.467 (14/30)
Reduction	Spiral bevel
Gear case oil capacity	0.98r (1.04 US qt, 0.86 lmp qt)
Propeller rotating direction	Clockwise (viewed from rear): LC, LD, XC and XD types Counterclockwise (viewed from rear): LDC, XCC and XCD types
Propeller driving system	Spline

2. DIMENSIONAL DRAWINGS

[ ]: Extra-long shaft type



• PROPELLER SHAFT



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 properly 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

Make sure you have a clear understanding of all basic shop safety practices and that you are wearing appropriate clothing and using safety equipment. When performing any service task, be especially careful of the following:

- Read all of the instructions before you begin, and make sure you have the tools, the replacement or repair parts, and the skills required to perform the tasks safely and completely.
- Protect your eyes by using proper safety glasses, goggles, or face shields any time you hammer, drill, grind, or work around pressurized air or liquids, and springs or other stored-energy components. If there is any doubt, put on eye protection.
- Use other protective wear when necessary, for example, gloves or safety shoes. Handling hot or sharp parts can cause severe burns or cuts. Before you grab something that looks like it can hurt you, stop and put on gloves.
- Protect yourself and others whenever you have engine-powered equipment up in the air.
  Any time you lift an outboard motor with a hoist, make sure that the hoist hook is securely attached to the outboard motor.

Make sure the engine is off before you begin any servicing procedures, unless the instruction tells you to do otherwise. This will help eliminate several potential 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 and exhaust system cool before working in those areas.
- Injury from moving parts. If the instruction tells you to run the engine, be sure your hands, fingers, and clothing are out of the way.

Gasoline vapors and hydrogen gasses from batteries are explosive. To reduce the possibility of a fire or explosion, be careful when working around gasoline or batteries.

- Use only a nonflammable solvent, not gasoline, to clean parts.
- Never drain or store gasoline in an open container.
- 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 reassembling.
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 reassembly.
6. After reassembly, check all parts for proper installation and operation.
7. Many screws used in this machine are self-tapping. Be aware that cross-threading or overtightening these screws will strip the threads and ruin the hole.
8. Use only metric tools when servicing this unit. Metric bolts, nuts and screws are not interchangeable with non-metric fasteners. The use of incorrect tools and fasteners will damage the unit.

4. SYMBOLS USED IN THIS MANUAL

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

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

GREASE — Apply grease.

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

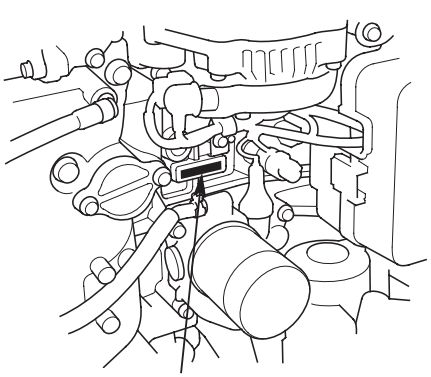
OIL — Apply oil.

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

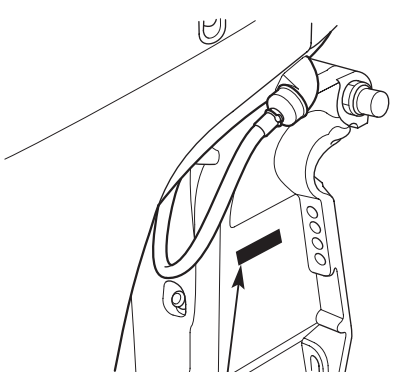
P. 1-1 Indicates the reference page.

5. SERIAL NUMBER LOCATIONS

The engine serial number is stamped on the right side of the cylinder block and the product identification number is located on the right side of the 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

6. MAINTENANCE STANDARDS

• ENGINE

Unit: mm (in)

Parts	Item		Standard	Service limit
Engine	Idle speed (in neutral)		750 ± 50 min^{-1} (rpm)	–
	Trolling speed		650 ± 50 min^{-1} (rpm)	–
	Cylinder compression [kPa (kgf/cm^2, psi) at 200 min^{-1} (rpm)]		1,532 – 1,728 (15.6 – 17.6, 222 – 250)	930 (9.5, 135)
	Compression gap between cylinders [kPa (kgf/cm^2, psi)]		–	200 (2.0, 28)
Spark plugs	Gap		1.0 – 1.1 (0.039 – 0.043)	1.3 (0.051)
Valves	Valve clearance	IN	0.21 – 0.25 (0.008 – 0.010)	–
		EX	0.28 – 0.32 (0.011 – 0.013)	–
	Overall length	IN	108.7 – 109.5 (4.28 – 4.31)	–
		EX	108.3 – 109.1 (4.26 – 4.30)	–
	Valve O.D.	IN	34.85 – 35.15 (1.372 – 1.384)	–
		EX	29.85 – 30.15 (1.175 – 1.187)	–
	Stem O.D.	IN	5.475 – 5.485 (0.2156 – 0.2159)	5.445 (0.2144)
		EX	5.450 – 5.460 (0.2146 – 0.2150)	5.420 (0.2134)
	Stem-to-guide clearance	IN	0.030 – 0.055 (0.0012 – 0.0022)	0.08 (0.003)
		EX	0.055 – 0.080 (0.0022 – 0.0031)	0.11 (0.004)
Valve seats	Seat width	IN/EX	1.25 – 1.55 (0.049 – 0.061)	2.0 (0.08)
	Seat installation height	IN/EX	44.0 – 44.6 (1.73 – 1.76)	–
Valve guides	Guide I.D.	IN/EX	5.51 – 5.53 (0.217 – 0.218)	5.55 (0.219)
	Guide extrusion amount	IN	15.2 – 16.2 (0.60 – 0.64)	–
		EX	15.5 – 16.5 (0.61 – 0.65)	–
Valve springs	Free length	IN	49.64 (1.954)	–
		EX	49.64 (1.954)	–
Rocker arms	Rocker arm I.D.	IN	17.019 – 17.035 (0.6700 – 0.6707)	–
		EX	17.012 – 17.039 (0.6698 – 0.6708)	–
	Rocker arm shaft O.D.	IN/EX	16.983 – 16.994 (0.6686 – 0.6690)	–
	Rocker arm-to-rocker arm shaft clearance	IN	0.025 – 0.052 (0.0010 – 0.0020)	0.08 (0.003)
		EX	0.018 – 0.056 (0.0007 – 0.0022)	0.08 (0.003)
Pistons	Skirt O.D.	A	86.98 – 86.99 (3.4244 – 3.4248)	86.93 (3.4224)
		B	86.97 – 86.98 (3.4240 – 3.4244)	86.92 (3.4220)
	Piston-to-cylinder clearance		0.02 – 0.04 (0.001 – 0.002)	0.05 (0.002)
	Piston pin bore I.D.		21.960 – 21.963 (0.8646 – 0.8647)	–

Unit: mm (in)

Parts	Item			Standard	Service limit
Pistons	Ring groove width		Top	1.23 – 1.24 (0.0484 – 0.0488)	1.25 (0.0492)
			Second	1.24 – 1.25 (0.0488 – 0.0492)	1.25 (0.0492)
			Oil	2.005 – 2.025 (0.0789 – 0.0797)	2.05 (0.081)
Piston pins	Pin O.D.			21.961 – 21.965 (0.8646 – 0.8648)	21.953 (0.8643)
	Pin-to-pin bore clearance			–0.005 – +0.002 (–0.0002 – +0.0001)	0.005 (0.0002)
Piston rings	Ring side clearance		Top	0.045 – 0.070 (0.0018 – 0.0028)	0.13 (0.005)
			Second	0.040 – 0.065 (0.0016 – 0.0026)	0.13 (0.005)
	Ring end gap		Top	0.20 – 0.35 (0.008 – 0.014)	0.6 (0.02)
			Second	0.50 – 0.65 (0.020 – 0.026)	0.75 (0.030)
			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 (0.0463 – 0.0469)	–
Cylinder head	Warpage			–	0.05 (0.002) Min.
	Camshaft journal I.D.			29.000 – 29.024 (1.1417 – 1.1427)	–
	Head height			103.95 – 104.05 (4.093 – 4.096)	–
Cylinder block	Cylinder sleeve I.D.		A or I	87.01 – 87.02 (3.4256 – 3.4260)	87.07 (3.4279)
			B or II	87.00 – 87.01 (3.4252 – 3.4256)	87.07 (3.4279)
	Gap between upper and lower points – of sleeve I.D.			–	0.05 (0.002)
	Warpage			0.07 (0.003) Max.	0.10 (0.004)
Connecting rods	Small end I.D.			23.969 – 23.982 (0.9437 – 0.9442)	–
	Small end-to-piston pin clearance			0.005 – 0.015 (0.0002 – 0.0006)	0.02 (0.001)
	Big end axial clearance			0.15 – 0.35 (0.006 – 0.014)	0.4 (0.02)
	Connecting rod bearing oil clearance			0.032 – 0.066 (0.0013 – 0.0026)	0.077 (0.0030)
Crankshaft	Journal O.D.	Main	No. 1, 2, 4, 5	54.984 – 54.992 (2.1647 – 2.1650)	–
			No. 3	54.976 – 55.000 (2.1644 – 2.1654)	–
	Pin			47.976 – 48.000 (1.8888 – 1.8898)	–
	Journal cylindricity			0.005 (0.0002) Max.	0.010 (0.0004)
	Journal roundness			0.005 (0.0002) Max.	0.010 (0.0004)
	Crankshaft runout			0.03 (0.001) Max.	0.04 (0.002)
	Crankshaft axial clearance			0.10 – 0.35 (0.004 – 0.014)	0.45 (0.018)
	Main bearing oil clearance		No. 1, 2, 4, 5	0.017 – 0.041 (0.0007 – 0.0016)	0.05 (0.002)
			No. 3	0.025 – 0.049 (0.0010 – 0.0019)	0.055 (0.0022)
	Thrust metal side clearance			0.10 – 0.35 (0.004 – 0.014)	0.45 (0.018)

Unit: mm (in)

Parts	Item		Standard	Service limit
Camshaft	Camshaft axial clearance		0.05 – 0.20 (0.002 – 0.008)	0.4 (0.02)
	Camshaft runout		0.03 (0.001) Max.	0.4 (0.02)
	Journal O.D.	No. 1	28.955 – 28.970 (1.1400 – 1.1405)	–
		No. 2 – No. 5	28.925 – 28.940 (1.1388 – 1.1394)	–
	Cam height	IN:PRI/SEC	32.626 – 32.931 (1.2845 – 1.2965)	–
		IN:MID	35.369 – 35.654 (1.3925 – 1.4037)	–
		EX	33.927 – 34.212 (1.3357 – 1.3469)	–
	Camshaft oil clearance	No. 1	0.030 – 0.069 (0.0012 – 0.0027)	0.15 (0.006)
		No. 2 – No. 5	0.060 – 0.099 (0.0024 – 0.0039)	0.15 (0.006)
Oil pump	Body I.D.		84.000 – 84.030 (3.3071 – 3.3083)	–
	Inner rotor-to-outer rotor clearance		0.04 – 0.16 (0.002 – 0.006)	0.20 (0.008)
	Outer rotor-to-oil pump body clearance		0.02 – 0.07 (0.001 – 0.003)	0.12 (0.005)
	Outer rotor height		9.480 – 9.500 (0.3732 – 0.3740)	–
	Pump body depth		9.520 – 9.550 (0.3748 – 0.3760)	–
	Outer rotor-to-oil body side clearance		0.14 – 0.19 (0.006 – 0.007)	0.20 (0.008)
Vapor separator	Float height		28.5 – 33.5 (1.12 – 1.32)	–
Fuel pump	Discharge volume [with pump operated for 2 sec. at 12V]		45 mR (1.5 Us oz, 1.6 Imp oz) or more	–
Fuel line	Fuel pressure [kPa (kgf/cm^2, psi)]		270 – 320 (2.8 – 3.3, 40 – 47)	–
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 Ω	–
	Slip ring O.D.		14.4 (0.57)	14.0 (0.55)
	Belt tension Measured at the center of belt between the pulleys with belt tension gauge.	Used belt	392 – 490 N (40 – 50 kgf, 88 – 100 lbf)	–
		New belt	490 – 588 N (50 – 60 kgf, 110 – 132 lbf)	–
	Belt deflection Measured with 98 N (10 kgf, 22 lbf) of force applied to the center of belt between the pulleys)	Used belt	10.6 – 11.1 (0.42 – 0.44)	–
		New belt	10.1 – 10.6 (0.40 – 0.42)	–
Starter motor	Brush length		12.3 (0.48)	7.0
	Insulator length (Mica 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)

PRI: Primary, MID: Mid, SEC: Secondary

• FRAME

Unit: mm (in)

Parts	Item		Standard	Service limit
Propeller shaft	Shaft O.D.	At forward bevel gear (LC, LD, XC and XD types)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)
		At reverse bevel gear (LCD, XCC and XCD types)	24.987 – 25.000 (0.9837 – 0.9843)	24.966 (0.9829)
		At needle bearing	30.007 – 30.020 (1.1814 – 1.1819)	29.990 (1.1807)
Vertical shaft	Shaft O.D. (at needle bearing)		28.556 – 28.575 (1.1242 – 1.1250)	28.545 (1.1238)

7. TORQUE VALUES

Item	Thread dia. (mm) and pitch (length)	Torque value		
		N·m	kgf·m	lbf·ft
• **ENGINE**				
Lower block bolt (*1)	M11 x 1.5	29	3.0	22
	M8 x 1.25	26	2.7	20
Crankcase bolt	M6 x 1.0	12	1.2	9
Oil case bolt	M10 x 1.25	34	3.5	25
Lower block orifice	M10 x 1.0	10	1.0	7
Oil jet bolt	M8 x 0.75 (Special bolt)	16	1.6	12
No.1 camshaft holder 10 mm sealing bolt	M10 x 1.0 (Special bolt)	20	2.0	14
Cylinder head bolt (*2)	M11 x 1.5	39	4.0	29
Cylinder head cover nut	M6 x 1.0	12	1.2	9
Spark plug	M14 x 1.25	18	1.8	13
Connecting rod bolt (*3)	M8 x 0.75 (Special bolt)	20	2.0	14
Crankshaft pulley bolt	M16 x 1.5	245	25.0	181
Balancer chain guide bolt	M6 x 1.0	12	1.2	9
Balancer driven sprocket bolt	M10 x 1.25	44	4.5	33
Balancer case assembly bolt (8 x 50 mm/8 x 75 mm)	M8 x 1.25	22	2.2	16
(8 x 55 mm)	M8 x 1.25	27	2.8	20
(10 x 105 mm)	M10 x 1.25	44	4.5	33
Balancer holder bolt	M6 x 1.0	12	1.2	9
	M8 x 1.25	27	2.8	20
Chain case special bolt	M6 x 1.0 (Special bolt)	12	1.2	9
Chain case bolt	M6 x 1.0	12	1.2	9
	M6 x 1.0 (SH bolt)	12	1.2	9
Chain case cover bolt	M6 x 1.0	12	1.2	9
Cam chain tensioner bolt	M6 x 1.0	12	1.2	9
Cam chain guide bolt	M6 x 1.0	12	1.2	9
Cam chain guide B bolt	M8 x 1.25	22	2.2	16
Cam chain tensioner arm bolt	M8 x 1.25 (Special bolt)	22	2.2	16
Exhaust camshaft sprocket bolt	M10 x 1.25	72	7.3	53
VTC flange bolt	M12 x 1.25 (Special bolt)	113	11.5	83
Camshaft holder bolt	M8 x 1.25	22	2.2	16
	M6 x 1.0	12	1.2	9
Camshaft collar bolt	M14 x 1.0 (Special bolt)	39	4.0	29
CMP pulse plate bolt	M14 x 1.0 (Special bolt)	39	4.0	29
Valve adjusting lock nut (IN side)	M7 x 0.75	20	2.0	14
Valve adjusting lock nut (EX side)	M7 x 0.75	14	1.4	10
Oil filter	M20 x 1.5	12	1.2	9
Oil drain plug bolt	M12 x 1.5	23	2.3	17
Throttle body bolt	M8 x 1.25	22	2.2	16
IAC valve bolt	M8 x 1.25	22	2.2	16
Injector base bolt, nut	M8 x 1.25	24	2.4	17
Fuel pipe bolt	M8 x 1.25	22	2.2	16
Pressure regulator nut	M18 x 1.0	27	2.8	20
IAB control valve bolt	M5 x 0.8	5.4	0.55	4.0

*1: Tighten the lower block bolts to 29 N·m (3.0 kgf·m, 22 lbf·ft) first, then tighten them to additional 56° (Angle method).
*2: Tighten the new cylinder head bolts to 39 N·m (4.0 kgf·m, 29 lbf·ft) (Snag torque), then tighten them to additional 278°. (Tighten to 90° at first, then to 90°, and to 98° in this order) (Angle method).
At assembly, tighten the lower block bolts to 39 N·m (4.0 kgf·m, 29 lbf·ft) (Snag torque), then tighten them to additional 180°. (Tighten to 90° at first, then to 90° in this order) (Angle method).
*3: Tighten the connecting rod bolts to 20 N·m (2.0 kgf·m, 14 lbf·ft) (Snag torque), then tighten them to additional 90° (Angle method).
• SH bolt: Small head bolt.

Item	Thread dia. (mm) and pitch (length)	Torque value		
		N·m	kgf·m	lbf·ft
• ENGINE				
Mounting case bolt	M12 x 1.25	64	6.5	47
	M10 x 1.25	44	4.5	33
	M8 x 1.25	26	2.7	20
Mounting case nut	M10 x 1.25	44	4.5	33
Plug hole coil bolt	M6 x 1.0	12	1.2	9
Flywheel boss bolt	M8 x 1.25	32	3.3	24
Flywheel bolt	M12 x 1.0	118	12.0	87
Alternator bolt	M10 x 1.25	44	4.5	33
nut	M8 x 1.25	26	2.7	20
Alternator pulley lock nut	M14 x 1.5	110	11.2	81
Starter motor bolt	M10 x 1.25	44	4.5	33
Starter motor front bracket screw	M5 screw	2.5	0.25	1.8
Starter motor bolt screw	M5	5	0.5	3.6
Starter solenoid switch screw	M6 screw	6	0.6	4.3
EOP switch (Low pressure side)	PT 1／8	8	0.8	5.8
EOP switch (High pressure side)	M10 x 1.25	22	2.2	16
ECT sensor	M10 x 1.25	12	1.2	9
A/F sensor	M18 x 1.5	42	4.3	31
Knock sensor	M12 x 1.25	31	3.2	23
MAP sensor bolt	M5 x 0.8	3.4	0.35	2.5
ECM bolt	M6 x 1.0	5	0.5	3.6
Intake manifold bolt, nut	M8 x 1.25	26	2.7	20
Exhaust manifold bolt	M10 x 1.25	39	4.0	29
Exhaust guide bolt	M8 x 1.25	26	2.7	20
Water separator body screw	M5 screw	3.4	0.35	2.5
Fuel strainer body screw	M5 screw	3.4	0.35	2.5
Fuel pump (low pressure side) bolt	M6 x 1.0	12	1.2	9
Vapor separator assembly bolt	M8 x 1.25	26	2.7	20
Vapor separator stay bolt	M8 x 1.25	26	2.7	20
Service check bolt	M6 x 1.0	12	1.2	9
Vapor separator cover screw	M5 screw	3.4	0.35	2.5
Water jacket cover screw	M5 screw	3.4	0.35	2.5
Strainer cover screw	M5 screw	3.4	0.35	2.5
Pump cover screw	M5 screw	3.4	0.35	2.5
Pump harness assembly screw	M4 screw	2.1	0.21	1.5
Float pin screw	———	2.1	0.21	1.5
Fuel pump case bolt	M6 x 1.0	12	1.2	9
Plate stay A bolt	M6 x 1.0	12	1.2	9
• GEAR CASE				
Propeller shaft holder bolt	M10 x 1.25	34	3.5	25
18 mm castle nut (*1)	M18 x 1.5	1	0.1	0.7
Gear case bolt	M10 x 1.25	34	3.5	25
Oil level bolt	M8 x 1.25	3.4	0.35	2.5
Oil drain bolt	M8 x 1.25	3.4	0.35	2.5
Water screen screw	M5 x 0.8	1	0.1	0.7
Sensor nipple	M8 x 1.0	3	0.3	2.2
Bearing holder (LCD, XCC and XCD types only)	M100 x 2.0	191	19.5	141
Impeller housing bolt	M8 x 1.25	19.7	2.0	14
64 mm lock nut	M64 x 1.5	123	12.5	90
Pinion gear nut	M18 x 1.0	142	14.5	105
• EXTENSION CASE/MOUNTING CASE				
Extension case bolt	M10 x 1.25	39	4.0	29
Lower rubber mounting bolt	M12 x 1.25	83	8.5	61
Upper rubber mounting bolt	M12 x 1.25	83	8.5	61

*1: If the split pin cannot be set by tightening the 18 mm castle nuts to 1 N·m (0.1 kgf·m, 0.7 lbf·ft), tighten the 18 mm castle nut 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 value		
		N·m	kgf·m	lbf·ft
• STERN BRACKET				
7/8-14 UNF self-locking nut	7/8-14 UNF	34	3.5	25
25 x 2.0 mm self-locking nut	M25 x 2.0	34	3.5	25
10 mm self-locking nut	M10 x 1.25	34	3.5	25
• POWER TRIM/TILT ASSEMBLY				
Cylinder cap comp.	———	162	16.5	119
Rod guide comp.	———	78	8.0	58
Manual valve	M14 x 1.5	3.5	0.35	2.5
Socket bolt A/B	———	8.5	0.85	6.1
Power tilt motor assembly bolt	1/4-20 UNF	5	0.5	3.6
Power tilt motor assembly code holder screw	M4 screw	1.4	0.14	1.0
Oil tank bolt	———	5	0.5	3.6
Oil tank cap	———	2.5	0.25	1.8
• FRAME/ELECTRICAL				
Grease fitting	M6 x 1.0	3	0.3	2.2
Neutral switch nut	M20 x 1.0	2.5	0.25	1.8
Starter motor B terminal washer-nut	M8 x 1.25	11	1.1	8
Alternator B terminal washer-nut	M6 x 1.0	8	0.8	5.8
Alternator fuse box B terminal washer-nut	M6 x 1.0	8	0.8	5.8
Alternator fuse box bolt	M6 x 1.0	5	0.5	3.6
Fuse box bracket bolt	M6 x 1.0	5	0.5	3.6
PGM-FI main relay bolt	M6 x 1.0	5	0.5	3.6
ECM bracket bolt	M6 x 1.0	5	0.5	3.6
L./R. engine under cover screw	M6 screw	4.5	0.45	3.3
Starter motor bolt	M10 x 1.25	44	4.5	33

• Use the standard torque values for the bolts, nuts and screws that are not listed in this table.

STANDARD TORQUE VALUES

Item	Thread dia. (mm) and pitch (length)	Torque value		
		N·m	kgf·m	lbf·ft
Screw	5 mm	4.2	0.42	3.0
	6 mm	9	0.9	6.5
Bolt and nut	5 mm	5.2	0.52	3.8
	6 mm	10	1.0	7
	8 mm	21.5	2.15	16
	10 mm	34	3.5	25
	12 mm	54	5.5	40
Flange bolt and nut	6 mm (SH bolt)	9	0.9	6.5
	6 mm (CT bolt)	12	1.2	9
	6 mm	12	1.2	9
	8 mm	26	2.7	20
	10 mm	39	4.0	29

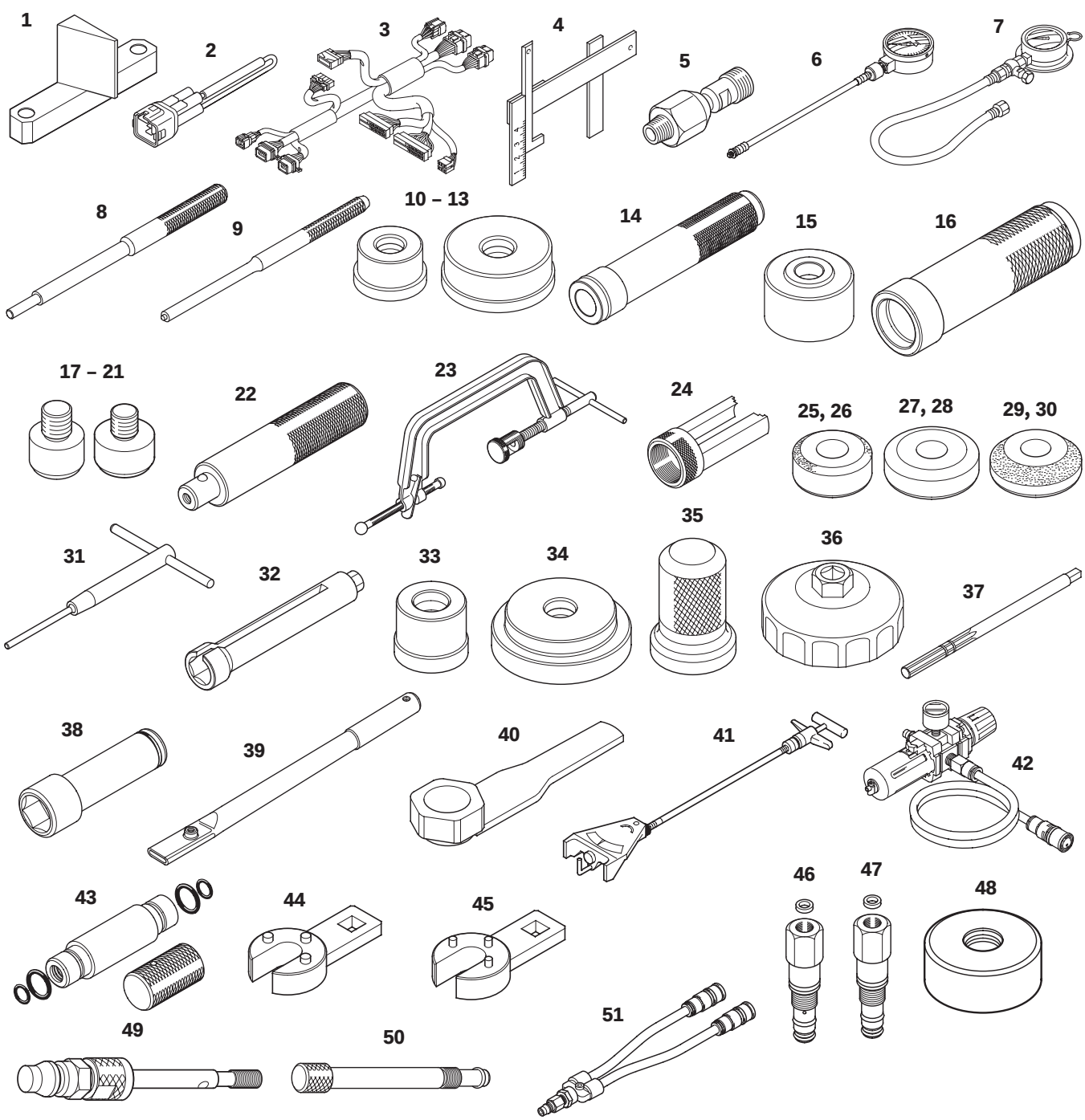
• CT bolt: Self-tapping bolt
• SH bolt: Small head bolt

8. SPECIAL TOOLS

• Special tools applicable to the parts except gear case

	Tool name	Tool number	Application
1	Ring gear holder	070PB-ZY60100	Flywheel boss, flywheel removal/installation
2	SCS service check connector	070PZ-ZY30100	ECU troubleshooting, idling adjustment
3	Test harness	070PZ-ZY60100	ECU troubleshooting
4	Float level gauge	07401-0010000	Vapor separator float level inspection
5	Oil pressure gauge attachment	07406-0030000	Oil pressure test
6	Fuel pressure gauge set	07406-0040003	Fuel pressure inspection
7	Oil pressure gauge set	07506-3000001	Oil pressure test
8	Valve guide driver, 5.5 mm	07742-0010100	Valve guide removal/installation
9	Pin driver, 6.0 mm	07744-0010500	Balancer shaft hold
10	Attachment, 32 x 35 mm	07746-0010100	22 x 35 x 7 mm water seal installation, Lower mount center hosing removal
11	Attachment, 37 x 40 mm	07746-0010200	Alternator front bearing installation
12	Attachment, 52 x 55 mm	07746-0010400	Alternator rear bearing, Chain case oil seal installation
13	Attachment, 24 x 26 mm	07746-0010700	Alternator front bearing removal, 14 x 26 x 8 mm water seal installation
14	Driver, 22 mm I.D.	07746-0020100	Alternator rear bearing installation
15	Attachment, 15 mm I.D.	07746-0020200	Alternator rear bearing installation
16	Driver, 40 mm I.D.	07746-0030100	Lower mount center housing installation
17	Pilot, 12 mm	07746-0040100	14 x 26 x 8 mm water seal installation
18	Pilot, 15 mm	07746-0040300	Alternator front bearing removal/installation
19	Pilot, 20 mm	07746-0040500	Mounting case needle bearing installation
20	Pilot, 30 mm	07746-0040700	Lower mount center housing removal
21	Pilot, 22 mm	07746-0041000	22 x 35 x 7 mm water seal installation
22	Driver	07749-0010000	Driver for 10 through 13, 17 through 21, 33 through 35 and 48
23	Valve spring compressor	07757-0010000	Valve keeper removal/installation
24	Valve spring compressor attachment	07757-PJ10100	
25	Valve seat cutter, 45° 35 mm	07780-0010400	Valve seat reconditioning (IN)
26	Valve seat cutter, 45° 33 mm	07780-0010800	Valve seat reconditioning (EX)
27	Valve seat cutter, 32° 38.5 mm	07780-0012400	Valve seat reconditioning (IN)
28	Valve seat cutter, 32° 33 mm	07780-0012900	Valve seat reconditioning (EX)
29	Valve seat cutter, 60° 30 mm	07780-0014000	Valve seat reconditioning (EX)
30	Valve seat cutter, 60° 37.5 mm	07780-0014100	Valve seat reconditioning (IN)
31	Cutter holder, 5.5 mm	07781-0010101	Valve seat reconditioning (IN/EX)
32	Sensor socket wrench, 22 x 150L	07906-PD10000	A/F sensor removal/installation
33	Attachment, 28 x 30 mm	07946-1870100	Mounting case needle bearing installation
34	Oil seal driver attachment, 72 mm	07947-6340201	Oil pump body oil seal installation
35	Oil seal driver	07947-SB00100	Oil pump cover oil seal installation
36	Oil filter wrench	07HAA-PJ70101	Oil filter removal/installation
37	Valve guide reamer, 5.525 mm	07HAH-PJ70100	Valve guide reaming
38	Socket wrench, 19 mm	07JAA-001020A	Crankshaft pulley bolt removal/installation
39	Handle	07JAB-001020B	
40	Pulley holder attachment, HEX 50 mm	07JAB-0010400	
41	Belt tension gauge	07JGG-0010101	Alternator belt tension inspection
42	Air supply	07LAJ-PR30102	VTEC system, VTEC valve inspection
43	Stem seal driver	07PAD-0010000	Valve stem seal A/B installation

	Tool name	Tool number	Application
44	Pin wrench, 6 mm	07SPA-ZW10100	Piston rod comp. removal/installation
45	Pin wrench, 4 mm	07SPA-ZW10200	Rod guide comp. removal/installation
46	Oil pressure gauge joint A	07SPJ-ZW10100	Power trim/tilt assembly blow pressure inspection
47	Oil pressure gauge joint B	07SPJ-ZW10200	
48	Oil seal driver attachment, 96	07ZAD-PNA0100	Crankshaft oil seal installation
49	VTEC air adapter	07ZAJ-PNA0101	VTEC system, VTEC valve inspection
50	VTEC air stopper	07ZAJ-PNA0200	
51	Air joint adapter	07ZAJ-PNA0300	



• Special tools applicable to all types of gear case

	Tool name	Tool number	Application
1	Outer driver attachment, 30 x 37	070PD-ZY60200	30 x 37 x 26 mm needle bearing installation
2	Gauge adapter, 110 mm	070PJ-ZY30100	Vertical shaft pinion gear shim adjustment
3	Attachment, 32 x 35 mm	07746-0010100	23 x 36 x 6 mm water seal installation
4	Attachment, 62 x 68 mm	07746-0010500	30 x 37 x 26 mm needle bearing installation
5	Pilot, 35 mm	07746-0040800	Needle bearing (outer race) removal
6	Driver	07749-0010000	Driver for 3 and 12
7	Lock nut wrench, 30/64 mm	07916-MB00002	Vertical shaft lock nut removal/installation
8	Remover weight	07741-0010201	30 x 37 x 26 mm needle bearing removal
9	Remover handle	07936-3710100	
10	Bearing remover, 30 mm	07936-8890300	
11	Oil seal driver	07947-SB00100	30 x 45 x 7 mm water seal installation
12	Oil seal driver attachment, 21 mm	07947-ZV00100	12 x 21 x 6 mm oil seal installation
13	Oil seal driver attachment, 27.5 x 44 mm	07948-9540000	Needle bearing installation
14	Driver handle, 15 x 280 mm	07949-3710001	Needle bearing (outer race) removal
15	Driver shaft, B	07964-MB00200	30 x 62 x 40 mm taper roller bearing installation
16	Attachment, 78 x 90 mm	07GAD-SD40101	Needle bearing installation
17	Vertical shaft holder	07SPB-ZW10200	Vertical shaft pinion gear nut removal/installation
18	Puller jaws	07SPC-ZW0010Z	Forward bevel gear backlash inspection
19	Puller bolt	07SPC-ZW0011Z	
20	Backlash indicator tool	07SPJ-ZW0030Z	
21	Backlash indicator attachment	07SPK-ZW10100	
22	Shaft installer, 15 x 370 mm	07VMF-KZ30200	Needle bearing installation
23	Bearing driver attachment, 37 mm	07ZMD-MBW0200	Needle bearing (outer race) removal

• Special tools applicable to LC, LD, XC and XD types of gear case

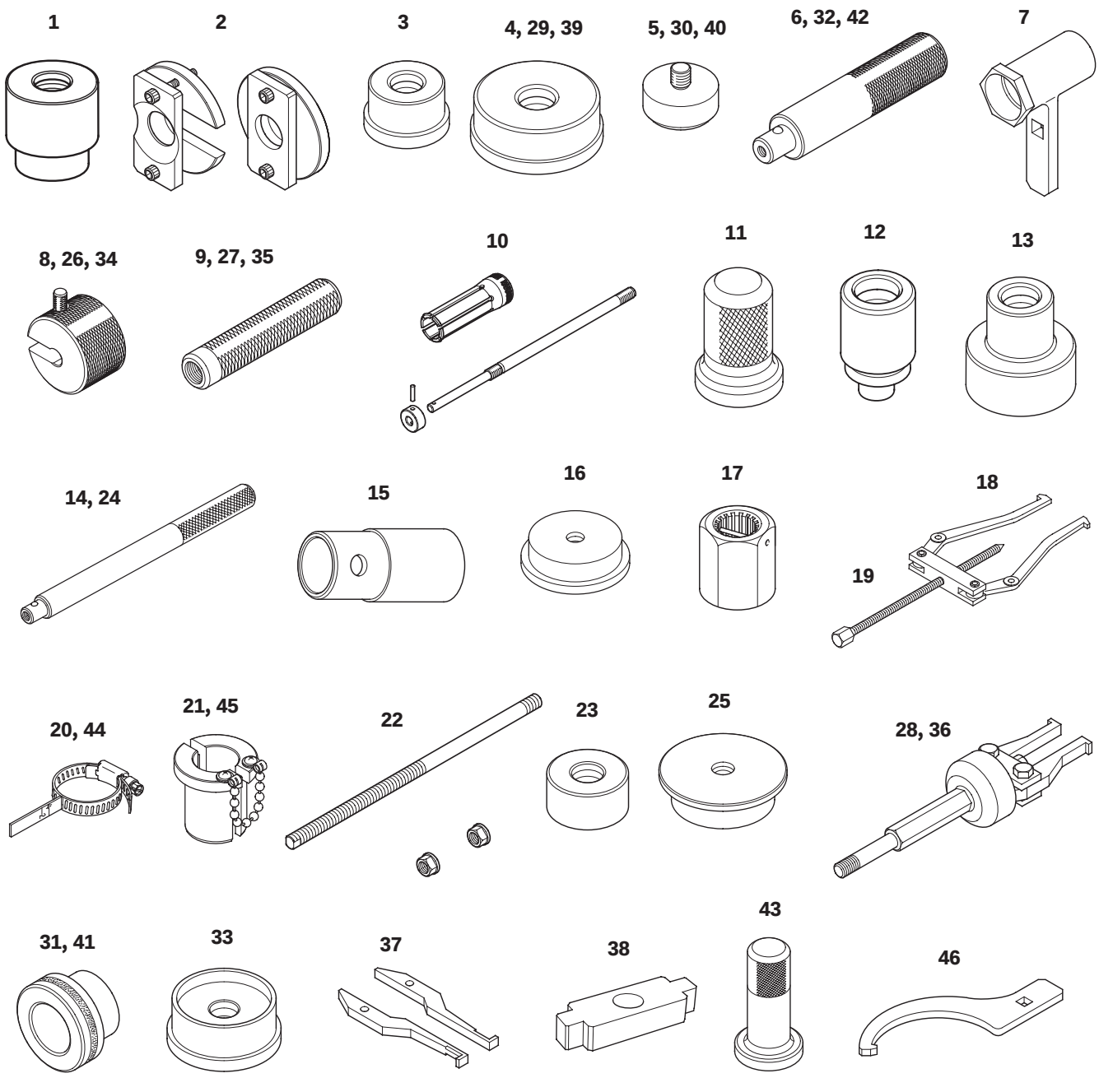
	Tool name	Tool number	Application
24	Driver handle, 480 mm	070GD-0010100	50 x 90 x 28 mm taper bearing (outer race) installation
25	Taper bearing installer attachment	070PF-ZY60100	
26	Remover weight	07741-0010201	50 x 90 x 28 mm taper bearing (outer race) removal
27	Remover handle	07936-3710100	
28	Bearing race puller	070PC-ZY3A100	
29	Attachment, 62 x 68 mm	07746-0010500	Reverse bevel gear installation
30	Pilot, 35 mm	07746-0040800	Reverse bevel gear removal/installation
31	Attachment, 27.2	07747-0010300	Reverse bevel gear removal
32	Driver	07749-0010000	Driver for 29, 30, 31 and 33
33	Oil seal driver, 52 x 55 mm	07NAD-P200100 or 07NAD-P20A100	50 x 90 x 28 mm taper bearing (inner race) installation

• Special tools applicable to LCD, XCC and XCD types of gear case

	Tool name	Tool number	Application
34	Remover weight	07741-0010201	Reverse bevel gear, 50 x 90 x 28 mm 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.]
35	Remover handle	07936-3710100	
36	Bearing race puller	070PC-ZY3A100	
37	Puller jaws, 25 mm	07WPC-ZW50100	
38	Taper bearing driver attachment	070PD-ZY60100	50 x 90 x 28 mm taper bearing (outer race) removal
39	Attachment, 62 x 68 mm	07746-0010500	50 x 90 x 28 mm taper bearing (inner race/outer race) installation

• Special tools applicable to LCD, XCC and XCD types of gear case

	Tool name	Tool number	Application
40	Pilot, 35 mm	07746-0040800	Forward bevel gear removal
41	Attachment, 27.2	07747-0010300	Forward bevel gear removal
42	Driver	07749-0010000	Driver for 38, 39, 40 and 41
43	Oil seal driver, 65 mm	07JAD-PL90100 or 07JAD-PL9A100	50 x 90 x 20 mm radial ball bearing installation
44	Backlash indicator tool	07SPJ-ZW0030Z	Reverse bevel gear backlash inspection
45	Backlash indicator attachment	07SPK-ZW10100	
46	Pin spanner wrench, 110 mm	07WAA-S1G0100	Bearing holder assembly removal/installation

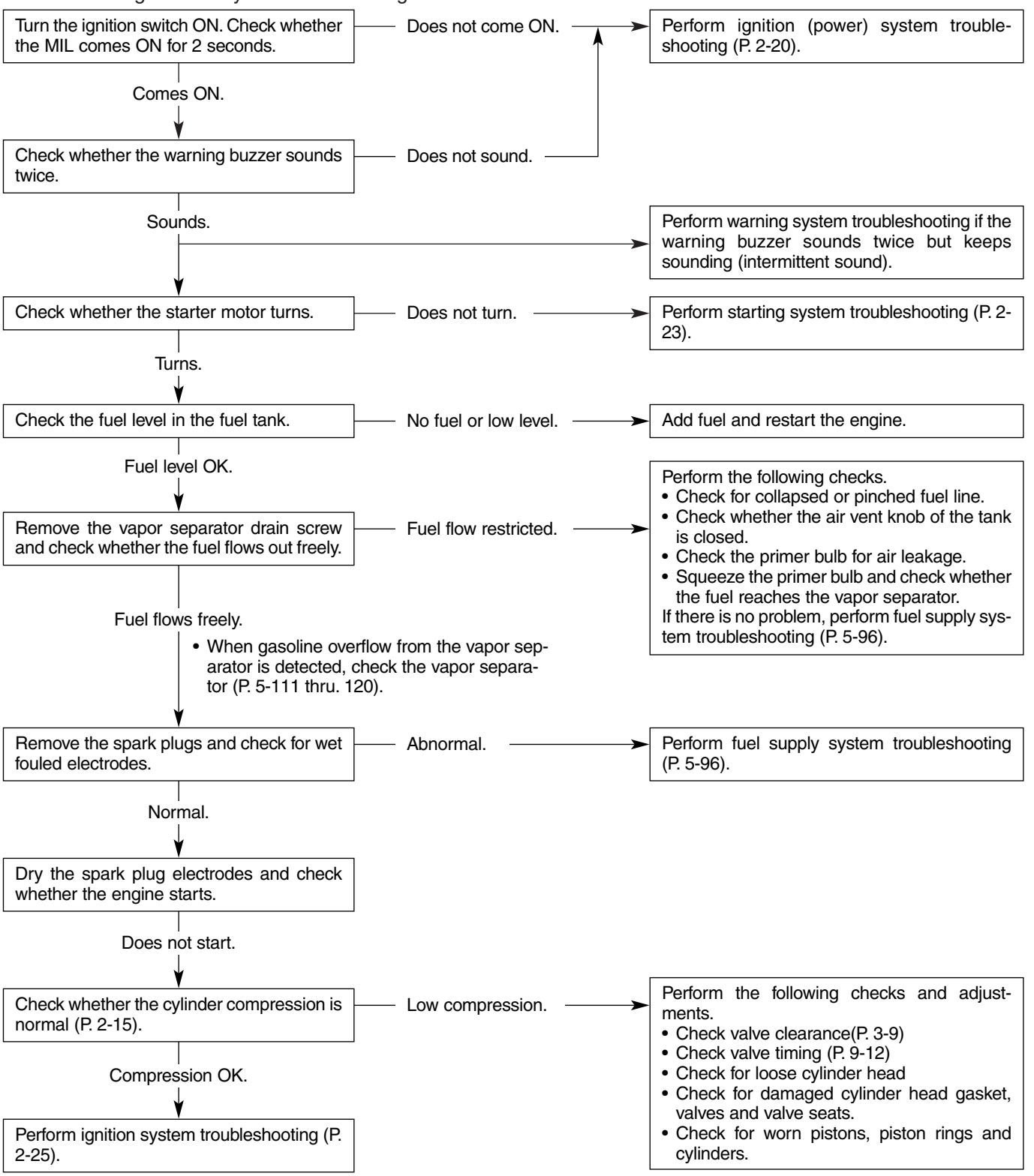


9. TROUBLESHOOTING

a. ENGINE

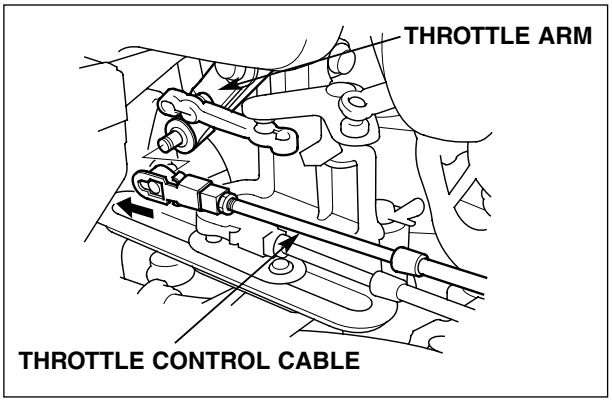
• HARD STARTING

• Use a known-good battery for troubleshooting.



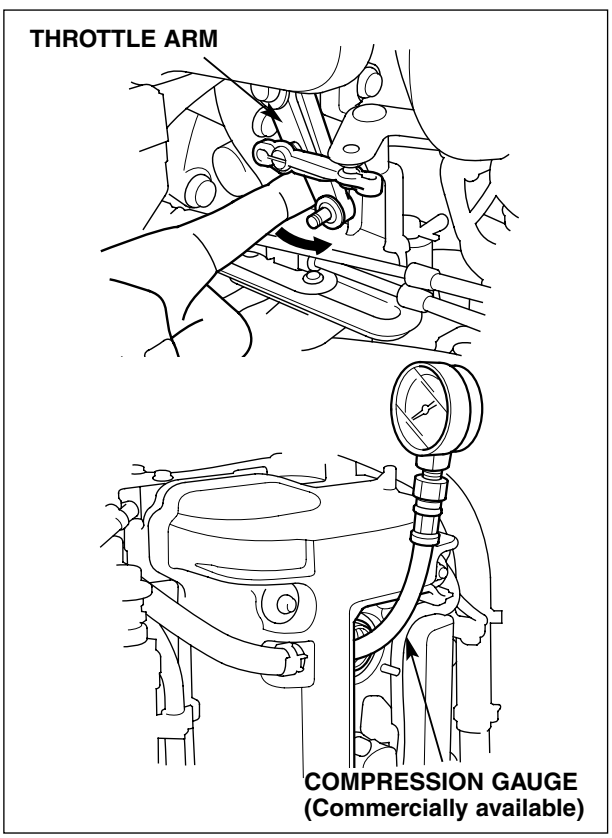
• CYLINDER COMPRESSION TEST

1) Move the remote control lever to 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) Disconnect the ignition coil connector of each cylinder and remove the spark plugs.



5) Disconnect the throttle control cable from the throttle arm.
6) Install a compression gauge in the No. 1 plug hole.
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.
9) Check the compression on all cylinders.

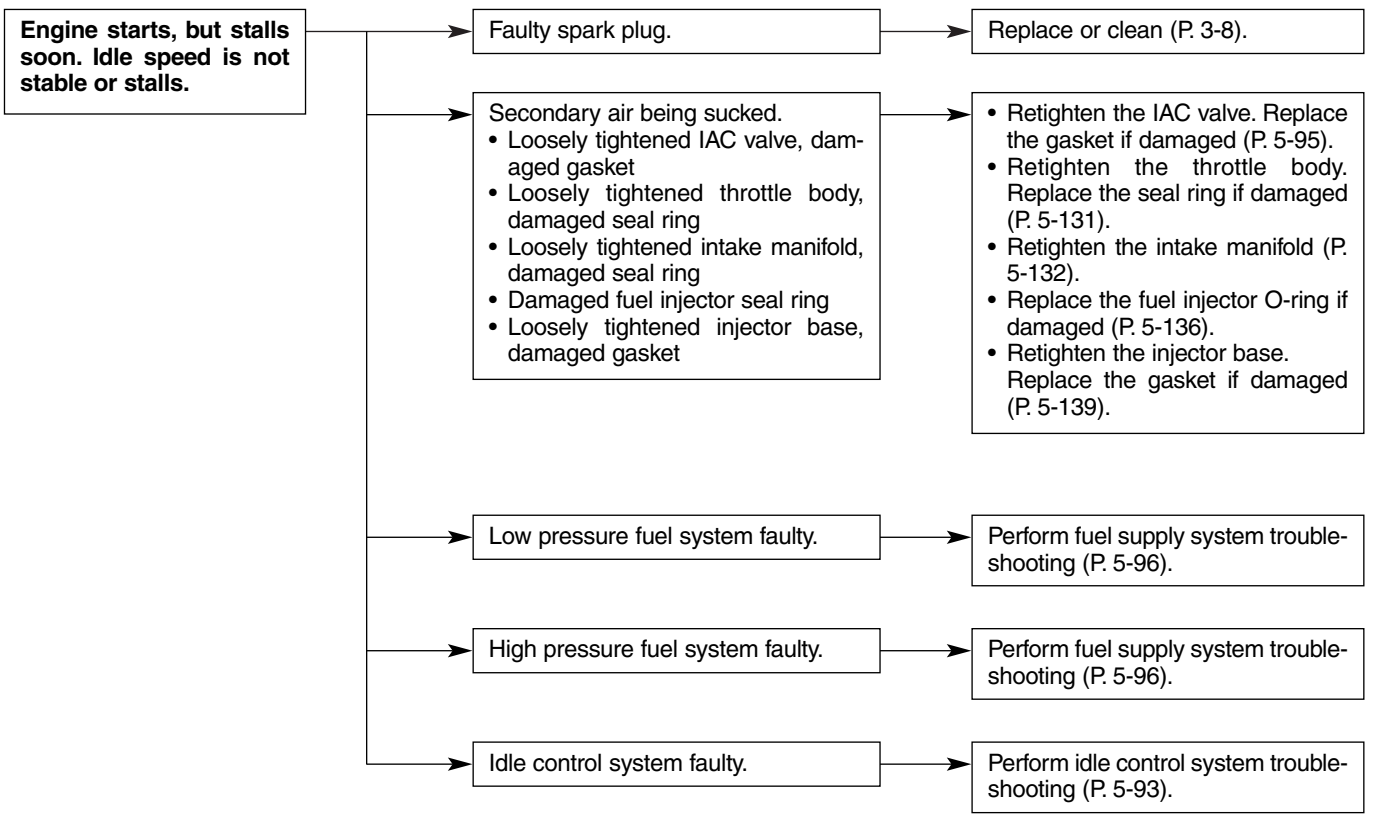
Cylinder compression	1,352 - 1,728 kPa (15.6 - 17.6 kgf/cm^2, 222 - 250 psi) at 200 min^{-1} (rpm)

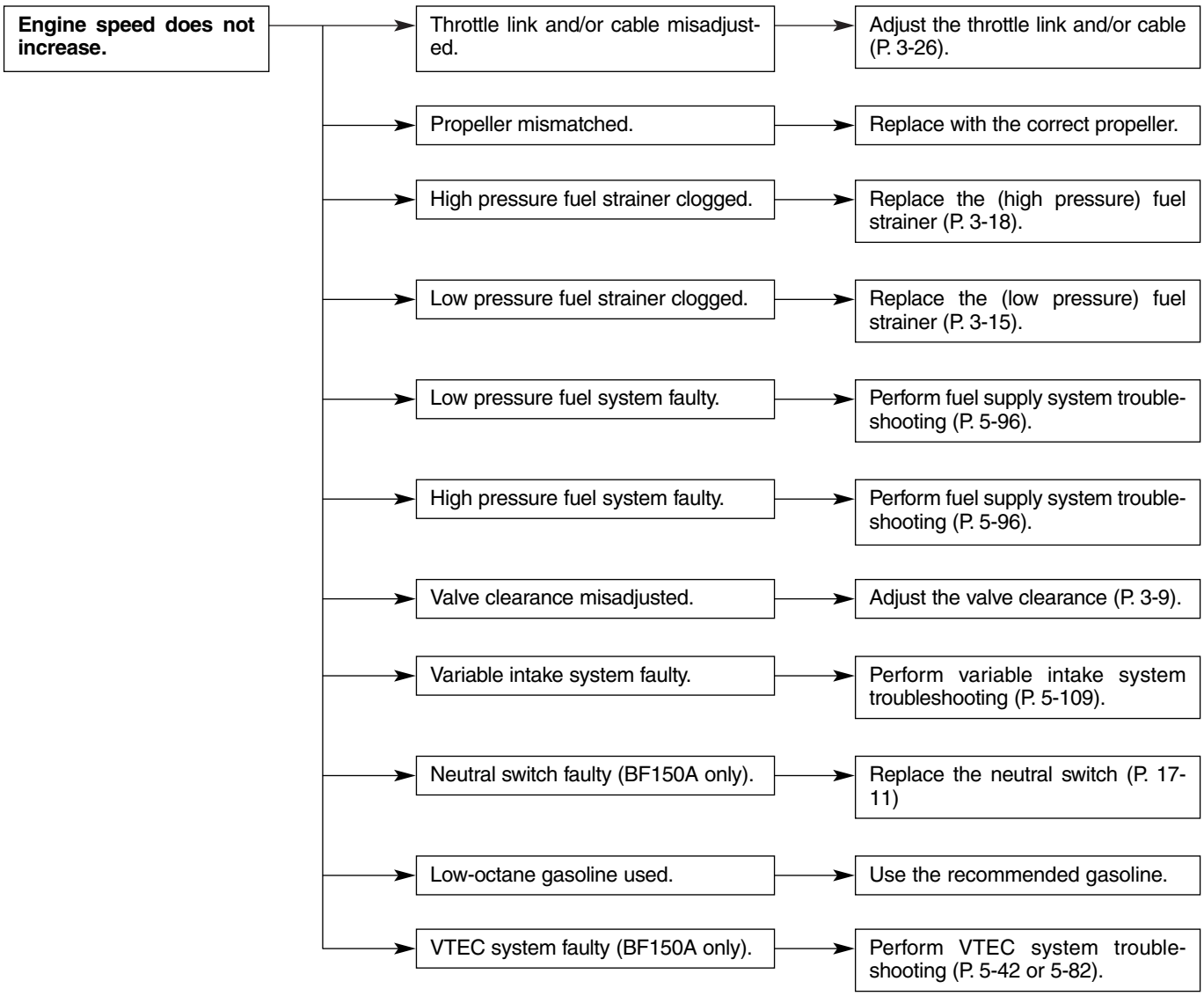


• ENGINE DOES NOT RUN SMOOTHLY

• Perform “g. ALERT SYSTEM” (P. 2-32) troubleshooting when the warning buzzer sounds.

Perform the following troubleshooting when the warning buzzer does not sound but the engine does not run smoothly.



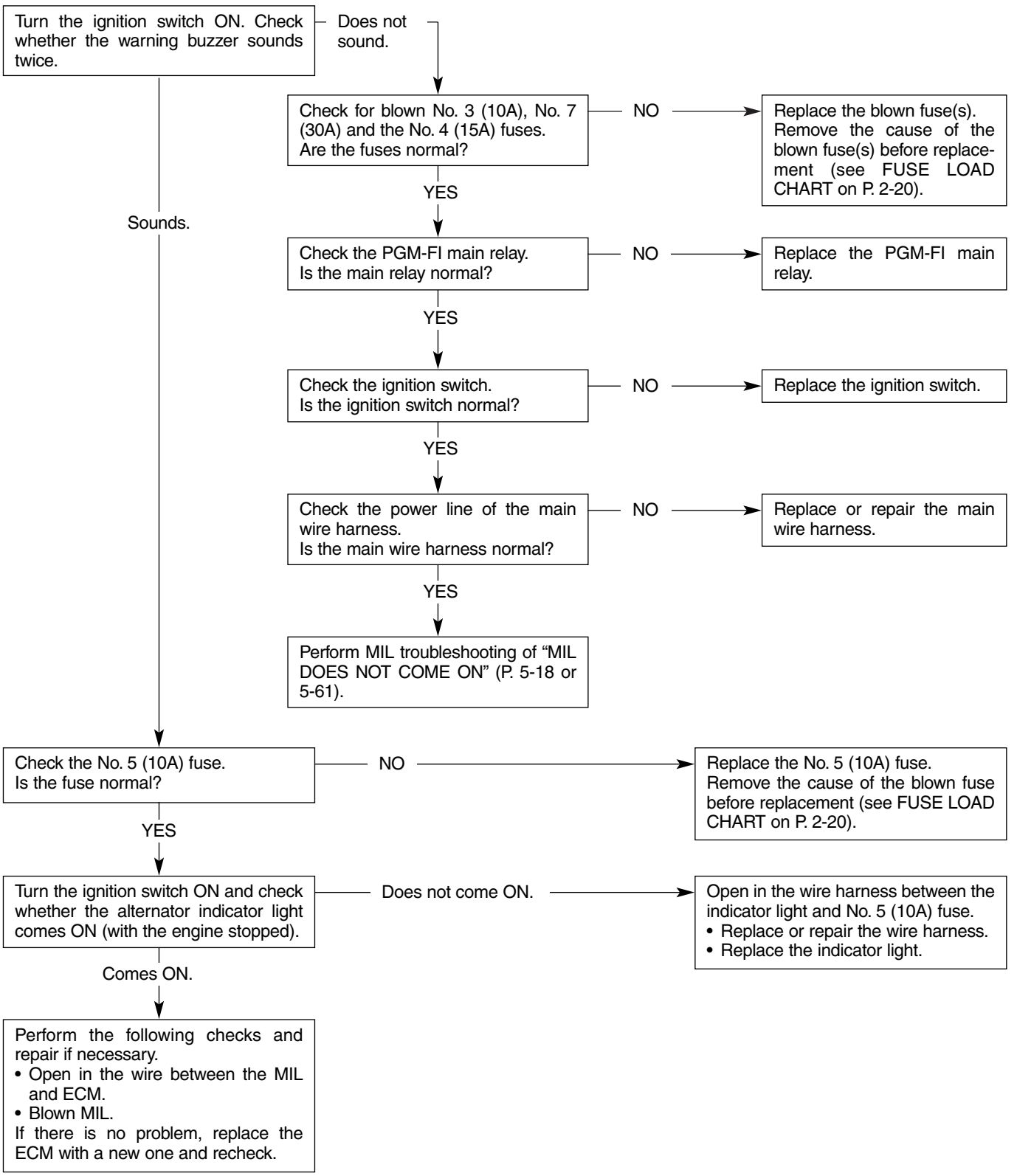

Engine speed does not increase.
Throttle link and/or cable misadjusted.
Adjust the throttle link and/or cable (P. 3-26).
Propeller mismatched.
Replace with the correct propeller.
High pressure fuel strainer clogged.
Replace the (high pressure) fuel strainer (P. 3-18).
Low pressure fuel strainer clogged.
Replace the (low pressure) fuel strainer (P. 3-15).
Low pressure fuel system faulty.
Perform fuel supply system troubleshooting (P. 5-96).
High pressure fuel system faulty.
Perform fuel supply system troubleshooting (P. 5-96).
Valve clearance misadjusted.
Adjust the valve clearance (P. 3-9).
Variable intake system faulty.
Perform variable intake system troubleshooting (P. 5-109).
Neutral switch faulty (BF150A only).
Replace the neutral switch (P. 17-11)
Low-octane gasoline used.
Use the recommended gasoline.
VTEC system faulty (BF150A only).
Perform VTEC system troubleshooting (P. 5-42 or 5-82).

Engine starts, but stalls soon. Idle speed is not stable or stalls.	Throttle link and/or cable misadjusted.	Adjust the throttle link and/or cable (P. 3-26).
	Throttle shaft not move smoothly.	Check the throttle body and clean if necessary (P. 5-95).
	Idle control system faulty.	Perform idle control system troubleshooting (P. 5-93).
	Secondary air being sucked. • Loosely tightened IAC valve, damaged gasket • Loosely tightened throttle body, damaged seal ring • Loosely tightened intake manifold, damaged seal ring • Damaged fuel injector seal ring • Loosely tightened injector base, damaged gasket	• Retighten the IAC valve. Replace the gasket if damaged (P. 5-95). • Retighten the throttle body. Replace the seal ring if damaged (P. 5-132). • Retighten the intake manifold (P. 5-133). • Replace the fuel injector O-ring if damaged (P. 5-136). • Retighten the injector base. Replace the gasket if damaged (P. 5-139).

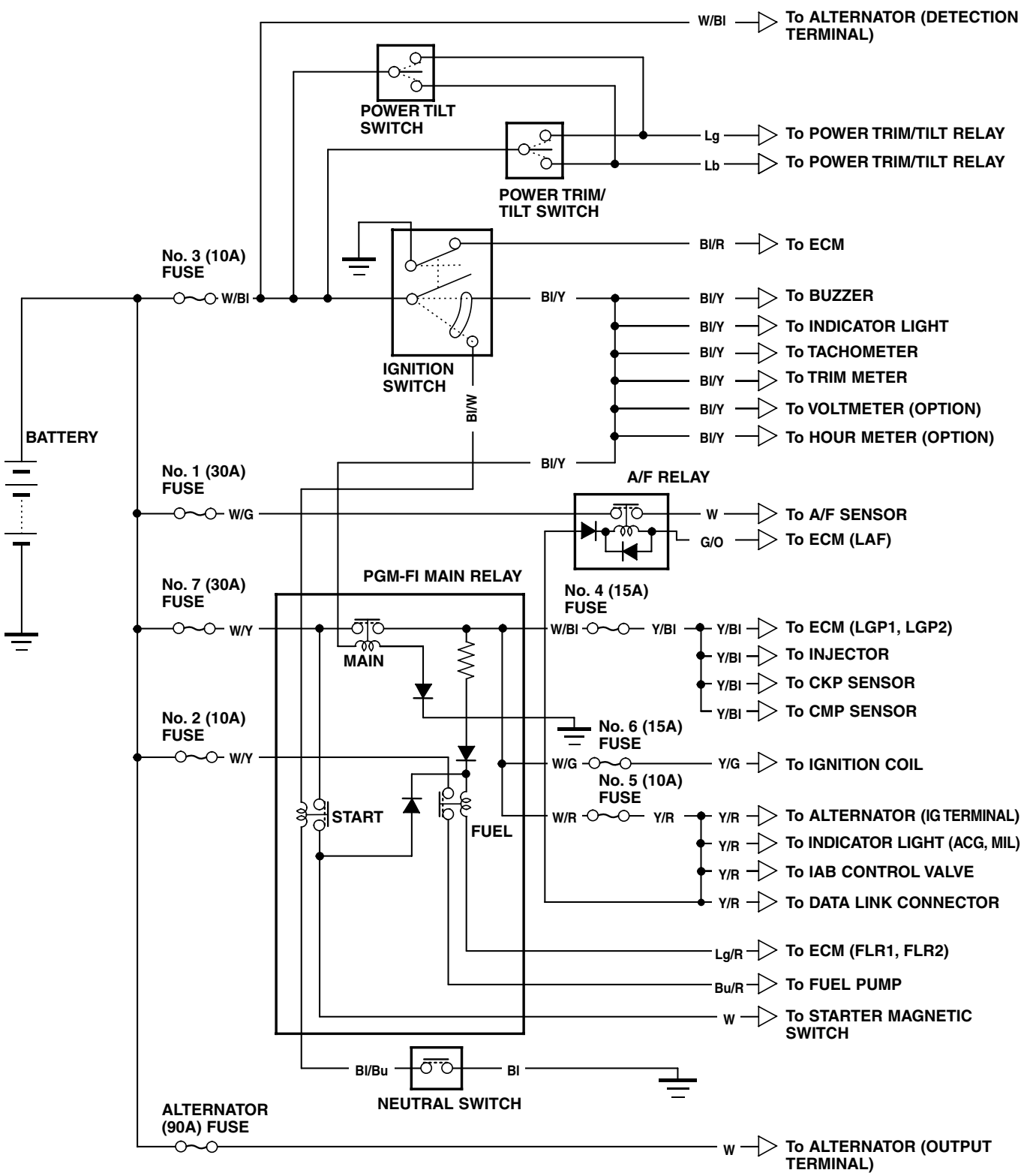
Engine sometimes misfires or stalls.	Water in the fuel.	• Check for water in the low pressure fuel strainer. Replace if necessary (P. 3-15). • Check for water in the water separator and drain if necessary (P. 3-19). • Check for water in the fuel tank and drain if necessary.
	High pressure fuel strainer clogged.	Replace the (high pressure) fuel strainer (P. 3-18).
	Low pressure fuel strainer clogged.	Replace the (low pressure) fuel strainer (P. 3-15).
	Fuel tube faulty.	• Check for pinched or collapsed tube line and correct if necessary. • Check the air vent knob of the tank. Open the air vent knob if it is closed. • Check the primer bulb for air leakage. Replace if necessary.
	High pressure fuel system faulty.	Perform fuel supply system troubleshooting (P. 5-96).
Excessive engine speed	Propeller mismatched.	Replace with the correct propeller.
	Propeller faulty.	Replace the propeller.
	Outboard installation setting incorrect (e.g. transom height, tilt angle, etc.)	Adjust the installation setting.

b. IGNITION (POWER) SYSTEM

• ENGINE DOES NOT START

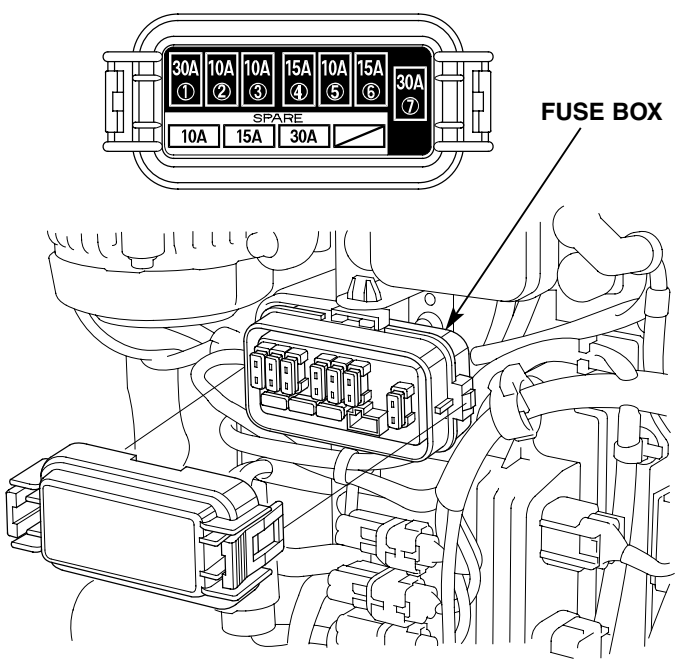


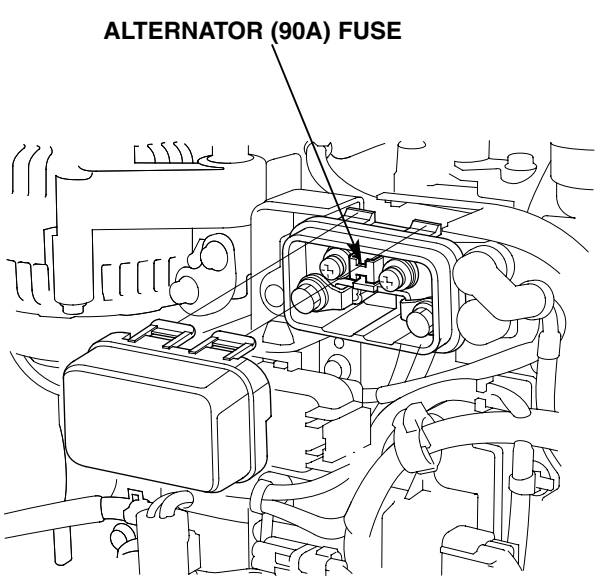
• FUSE LOAD CHART



• FUSE BOX CONNECTION TABLE

Fuse No.	Fuse capacity	Connect to
1	30A	A/F sensor heater
2	10A	High pressure side fuel pump
3	10A	Power trim/tilt relay, Alternator (detection terminal), Ignition switch, PGM-FI main relay, Warning buzzer, Indicator light (oil, overheat), Meters
4	15A	ECM, Fuel injector, CMP sensor, CKP sensor
5	10A	Alternator (IG terminal), A/F relay, Indicator light (MIL, ACG), IAB control valve, data link connector
6	15A	Ignition coil
7	30A	PGM-FI main relay

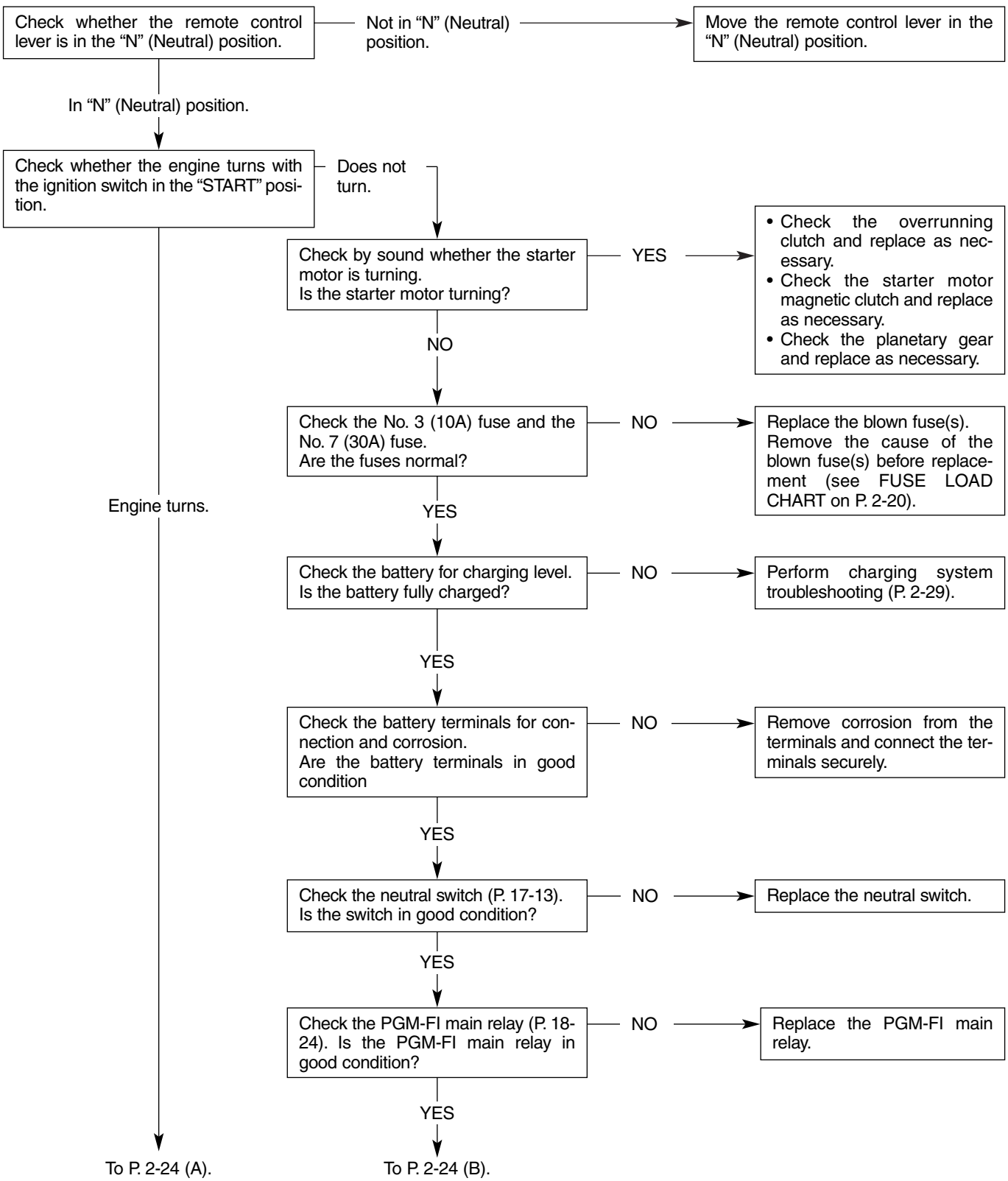


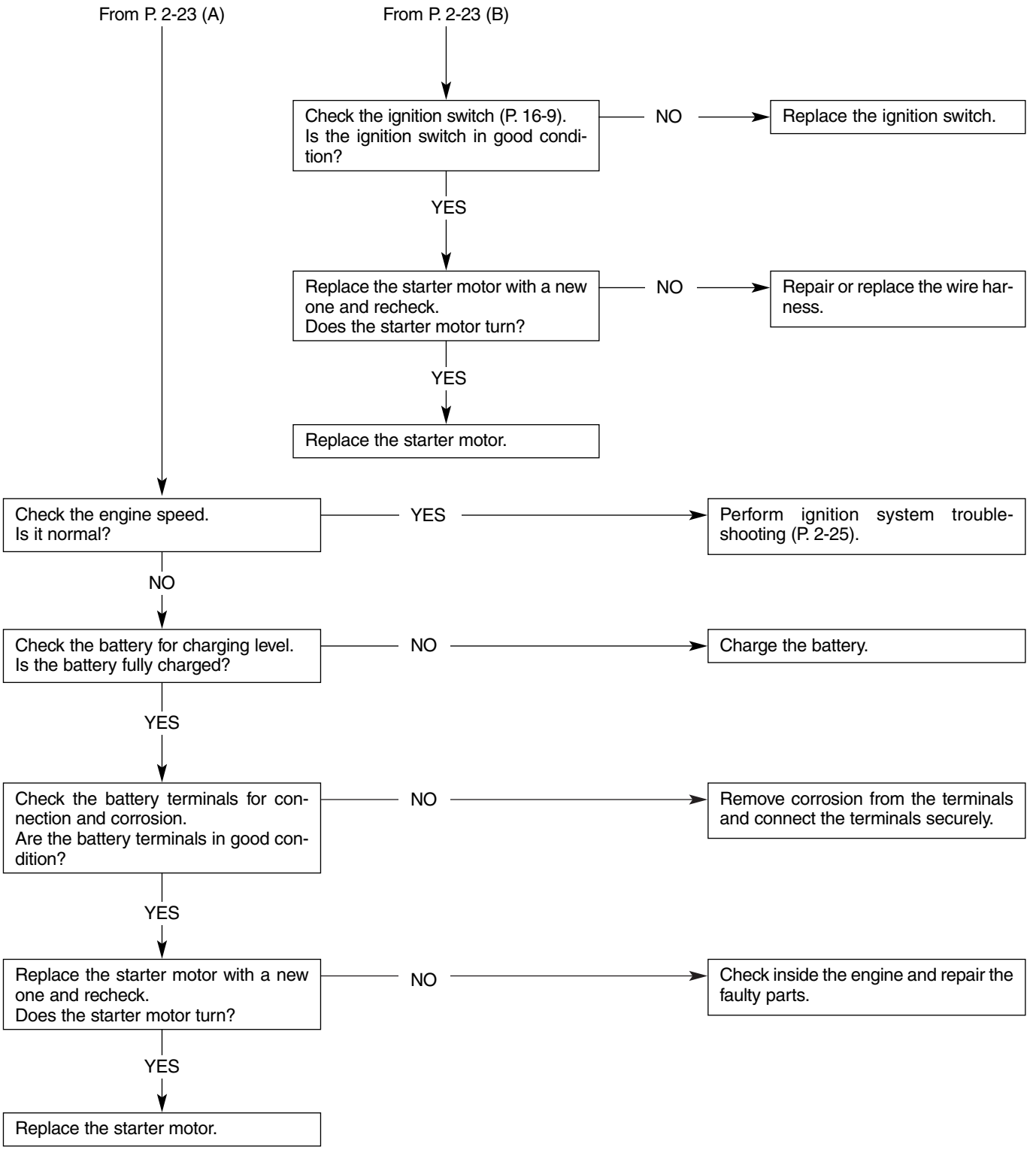


c. STARTING SYSTEM

• ENGINE DOES NOT START

• Before starting troubleshooting, check each wire for connection and correct as necessary.



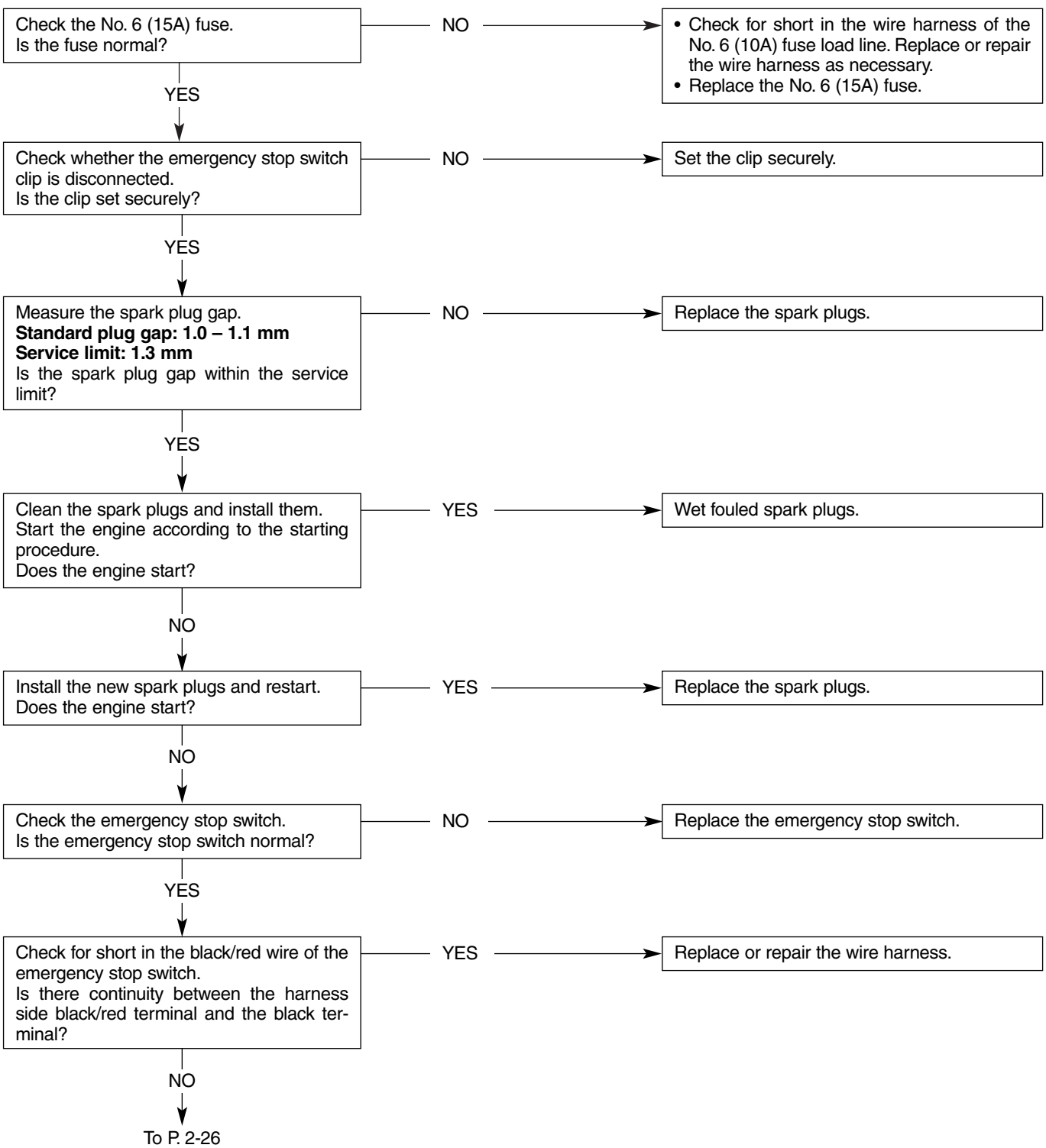

From P. 2-23 (A)
From P. 2-23 (B)
Check the ignition switch (P. 16-9). Is the ignition switch in good condition?
NO
Replace the ignition switch.
YES
Replace the starter motor with a new one and recheck. Does the starter motor turn?
NO
Repair or replace the wire harness.
YES
Replace the starter motor.
Check the engine speed. Is it normal?
YES
Perform ignition system troubleshooting (P. 2-25).
NO
Check the battery for charging level. Is the battery fully charged?
NO
Charge the battery.
YES
Check the battery terminals for connection and corrosion. Are the battery terminals in good condition?
NO
Remove corrosion from the terminals and connect the terminals securely.
YES
Replace the starter motor with a new one and recheck. Does the starter motor turn?
NO
Check inside the engine and repair the faulty parts.
YES
Replace the starter motor.

d. IGNITION SYSTEM

• ENGINE IS HARD TO START

* Before troubleshooting, turn the ignition switch ON and check whether the MIL comes ON for 2 seconds and the warning buzzer sounds twice intermittently.

  If the MIL does not come ON or the warning buzzer does not sound, perform power system troubleshooting (P. 2-20).



From P. 2-25

Check the CKP sensor connector.
Is the connector connected securely?

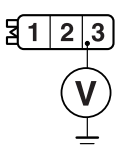
No → Connect the CKP sensor connector properly and recheck.

Yes

Check for open circuit in the ignition coil's power line.

1 Disconnect the 3P connectors from each of the ignition coils.
2 Turn the ignition switch ON. Measure the voltage between the No. 3 (Yellow/Green) terminal of each harness side 3P connector and the engine ground.

Ignition coil harness side 3P connector Viewing from terminal side



Is there the battery voltage?

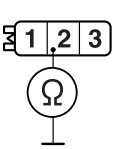
No → Replace or repair the wire harness. (Open circuit in the wire between the No. 6 (15A) fuse and the ignition coil.)

Yes

Check for open circuit in the ignition coil's ground line.

1 Turn the ignition switch OFF.
2 Check for continuity between the No. 2 (Black/White) terminal of the respective harness side 3P connectors and the engine ground.

Ignition coil harness side 3P connector Viewing from terminal side



Is there continuity?

No →
- Replace or repair the wire harness. (Open circuit in the wire harness between the ignition coil and the engine ground.)
- Check the engine ground and repair as necessary.

Yes

To P. 2-27

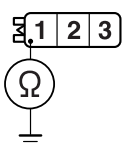
From P. 2-26

Check for short circuit in the ignition coil's signal line.

1 Turn the ignition switch OFF. Check for continuity between the No. 1 (Blue, Blue/Black, White/Green, Blue/Red) terminal of the respective harness side 3P connectors and the engine ground.

No. 1 ignition coil: Blue
No. 2 ignition coil: Blue/Black
No. 3 ignition coil: White/Green
No. 4 ignition coil: Blue/Red

Ignition coil harness side 3P connector Viewing from terminal side



Is there continuity?

Yes → Replace or repair the wire harness (Short circuit in the wire harness between the ignition coil and the ECM).

No

Replace the ignition coil and recheck. Does the engine start?

Yes → Replace the ignition coil.

No

Substitute a known-good ECM and recheck.

e. FUEL SYSTEM

• ENGINE IS HARD TO START

• When the gasoline is flowing out of the vapor separator, check the vapor separator (P. 5-112 thru. 5-120).

Turn the ignition switch ON and check the fuel pump operation.
Is there the operation sound for 2 seconds after the ignition switch is ON?

NO

Check the No. 2 (10A) fuse.
Is the fuse normal?

NO

- Check for short in the wire harness between the No. 2 (10A) fuse and the fuel pump. Replace or repair the wire harness as necessary.
- Replace the No. 2 (10A) fuse.

YES

Check the PGM-FI main relay.
Is the PGM-FI main relay normal?

NO

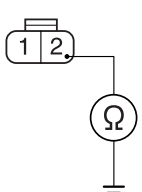
Replace the PGM-FI main relay.

YES

Check for open circuit in the fuel pump ground line.

1 Turn the ignition switch OFF and disconnect the fuel pump 2P connector.
2 Check for continuity between the No. 2 (Black/White) terminal of the harness side 2P connector and the engine ground.

Fuel pump harness side 2P connector Viewing from terminal side



Is there continuity?

NO

Replace or repair the wire harness (Open circuit in the ground line).

YES

Yes

To P. 2-29 (A)

To P. 2-29 (B)

From P. 2-28 (A)

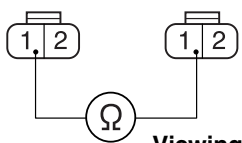
From P. 2-28 (B)

Check for open circuit in the fuel pump power line.

1 Disconnect the main relay 2P connector.
2 Check for continuity between the No. 1 (Blue/Red) terminal of the harness side main relay 2P connector and the No. 1 (Blue/Red) terminal of the fuel pump 2P connector.

Fuel pump harness side 2P connector

PGM-FI main relay harness side 2P connector



Viewing from terminal side

Is there continuity?

NO → Replace or repair the wire harness (Open circuit in the fuel pump power line).

YES

Check the (high pressure) fuel pump (P. 5-107).
Is the fuel pump normal?

NO → Replace the (high pressure) fuel pump.

YES

Substitute a known-good ECM and recheck.

Check the low pressure fuel system (P. 5-96).
Is the low pressure fuel system normal?

NO → Repair the faulty part.

YES

Check the high pressure fuel system (P. 5-96).
Is the high pressure fuel system normal?

NO → Repair the faulty part.

YES

Perform idle control system troubleshooting. If it is normal, Substitute a known-good ECM and recheck

f. CHARGING SYSTEM

• BATTERY UNDER CHARGED

Is the alternator belt tension correct (Inspection: P. 3-29)?

NO → Adjust the alternator belt tension (P. 3-29).

YES ↓

Start the engine and let it idle to warm up.
Measure the voltage between the battery terminals when the engine speed is 3,000 min^{-1} (rpm).
Is the voltage between the terminals 13.5V or above?

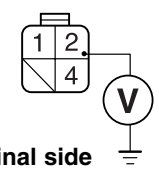
YES → Replace the battery.

NO ↓

Check for open circuit in the IG line.

1 Turn the ignition switch OFF and disconnect the alternator 4P connector.
2 Measure the voltage between the No. 2 (Yellow/Red) terminal of the alternator 4P connector and the engine ground.

Alternator harness side 4P connector



Viewing from terminal side

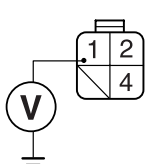
Is there the battery voltage with the ignition switch ON?

NO → Replace or repair the wire harness (Open in the wire between the alternator and No. 5 fuse).

Yes ↓

Check for open circuit in the BAT line.

1 Turn the ignition switch OFF and disconnect the alternator 4P connector.
2 Measure the voltage between the No. 1 (White/Black) terminal of the alternator 4P connector and the engine ground.



Alternator harness side 4P connector

Viewing from terminal side

Is there the battery voltage with the ignition switch ON?

NO → Replace or repair the wire harness (Open in the wire between the alternator and the ignition switch).

Yes ↓

Disassemble and service the alternator (P. 6-9).

• ALTERNATOR INDICATOR LINE INSPECTION

Turn the ignition switch ON.
Does the alternator indicator lightcome ON?

YES → Start the engine.
Does the alternator indicator light go OFF?

Yes → End of inspection (Good)

No → Check for short circuit in the L line.
1 Stop the engine and disconnect the alternator 4P connector.
Does the alternator indicator light come ON with the ignition switch ON?

YES → Replace or repair the wire harness (Short in the wire between the ECM and the alternator).

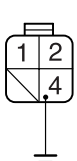
NO → Disassemble and service the alternator.

NO → Check the No. 5 (15A) fuse.
Is the fuse normal?

NO →
- Check for short circuit in the wire harness of the No. 5 (10A) fuse load line. Replace or repair the main harness if necessary.
- Replace the No. 5 (15A) fuse.

YES → Check for open circuit in the L line.
1 Stop the engine and disconnect the alternator 4P connector.
2 Connect the No. 4 (White/Blue) terminal of the alternator 4P connector to the body to short using a jumper wire.

Alternator harness side 4P connector Viewing from terminal side



Does the alternator indicator light come ON with the ignition switch ON?

NO → Check for open circuit in the wire harness (White/Blue) between the ECM and the alternator.
Is the wire harness normal?

NO → Replace or repair the wire harness (Open in the wire between the ECM and alternator).

YES → Check the alternator indicator light.
Is the alternator indicator light normal?

NO →
- Check the alternator indicator light bulb. Replace the bulb as necessary.
- If the bulb is normal, replace the alternator indicator light.

YES → Substitute a known-good ECM and recheck.

YES → Disassemble and service the alternator (P. 6-9).

g. ALERT SYSTEM

• OIL ALERT SYSTEM

When the oil pressure switch (low pressure side) detects low oil pressure, the ECM receives the signal from the oil pressure switch and decreases the engine speed gradually to 1,800 min^{-1} (rpm). The warning buzzer sounds and the oil indicator light goes OFF this time. When the problem is removed, the engine speed increases gradually and the engine is restored to the normal running.

• OVERHEAT ALERT SYSTEM

When the ECM detects overheat by receiving the signal from the thermo sensor, it decreases the engine speed gradually to 1,800 min^{-1} (rpm). The warning buzzer sounds and the overheat indicator light comes ON. When the problem is not removed within 20 seconds, the ECM decreases the engine speed further until it stops. When the problem is removed during this control, the ECM increases the engine speed gradually until the engine is restored to the normal running.

• ALTERNATOR WARNING SYSTEM

The IC regulator is equipped in the alternator to detect the disconnected sensor terminal, disconnected output terminal, overcharge and undercharge when generation stops. When a problem is detected, the IC regulator turns the alternator indicator lightON and the ECM sounds the warning buzzer (intermittent prolonged sound) by receiving the signal from the IC regulator.

• FULL WATER (IN WATER SEPARATOR) WARNING SYSTEM

When the water level in the water separator is above the specified level, the water level sensor detects the condition and transmits the signal to the ECM to sound the warning buzzer.

• MIL WARNING SYSTEM

The MIL indicator light comes ON and the buzzer sounds (intermittent prolonged sound) when the ECM detects a problem by its diagnostic function.

• WARNING SYSTEM

Condition	Indicator light		Warning indicator light		Warning buzzer
	Oil indicator light (Green)	Overheat indicator light (Red)	ACG indicator light (Red)	MIL (Red)	
Ignition switch ON (Initial check)	ON for 2 sec.	ON for 2 sec.	ON	ON for 2 sec.	Sounds twice
2 sec. after turning ignition switch ON	OFF	OFF	ON	OFF	Stop
Normal operation	ON	OFF	OFF	OFF	Stop
Engine oil pressure dropped	OFF	OFF	OFF	OFF	Continuous sound
Overheat	ON	ON	OFF	OFF	Continuous sound
MIL faulty	ON*1	OFF*2	OFF	ON	Intermittent prolonged sound
Alternator faulty	ON	OFF	ON	OFF	Intermittent prolonged sound
Water separator full	ON	OFF	OFF	OFF	Intermittent short sound

When two or more problems occur simultaneously, warning for each problem is indicated simultaneously.

When a problem occurred simultaneously with the malfunction of the MIL:

*1: The oil indicator light blinks when a problem with the high pressure oil pressure switch is detected.

*2: The overheat indicator light blinks when a problem with the overheat sensor is detected.

The warning buzzer of the prolonged sound takes precedence over the short sound.

Example: When the problems with the alternator and full water separator are detected simultaneously, the warning buzzer is the intermittent prolonged sound.

Example: When the overheat and a problem with the alternator are detected simultaneously, the warning buzzer is the continuous sound.

• WARNING BUZZER SOUNDS CONTINUOUSLY

Check the indicator light.
Is the overheat indicator light ON?

YES → To P. 2-36

NO (OFF)

Is the oil indicator light OFF?

NO (ON) → Check the oil indicator light.
Is the oil indicator light normal?

NO → Replace the oil indicator light.

YES

Check the warning buzzer.
Is the warning buzzer normal?

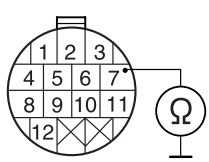
NO → Replace the buzzer.

YES

YES (OFF)

Check for short in the buzzer line.

1 Turn the ignition switch OFF and disconnect the remote control cable 14P connector.
2 Check for continuity between the No. 7 (Yellow/Green) terminal and the engine ground



Remote control cable 14P connector Viewing from terminal side

Is there continuity?

YES → Replace or repair the wire harness (Short in wire harness between the buzzer and ECM).

NO

Substitute a known-good ECM and recheck.

Stop the engine and check the oil level.
Is the oil level correct?

No → Add the oil to the correct level.

Yes

To P. 2-34

From P. 2-33

Start the engine.
Is the oil indicator light ON with the engine idling?

YES → Snap the engine (4,000 min^{-1} /rpm or above under no load) and check the oil indicator and warning buzzer.
Do the oil indicator light come ON and the buzzer stop sounding?

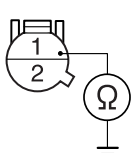
YES → Normal (End of inspection)

NO → Disconnect the high pressure side oil pressure switch 2P connector.
Do the oil indicator light come ON and the buzzer stop sounding?

YES → Replace the oil pressure switch.

NO → Check for short in the high pressure side oil pressure switch line.
1 Turn the ignition switch OFF.
2 Check for continuity between the No. 1 (Green/Red) terminal of the harness side oil pressure switch 2P connector and the engine ground.

Oil pressure switch 2P connector Viewing from terminal side



Is there continuity?

YES → Replace or repair the wire harness (Short in the wire harness between the high pressure side oil pressure switch and ECM).

NO → Substitute a known-good ECM and recheck.

NO → Disconnect the low pressure side oil pressure switch wire.
Do the oil indicator light come ON and the warning buzzer stop sounding?

NO → Check for short in the low pressure side oil pressure switch line.
1 Turn the ignition switch OFF.
2 Check for continuity between the oil pressure switch terminal and the engine ground.
Is there continuity?

NO → Replace or repair the wire harness (Short in the wire harness between the low pressure side oil pressure switch and ECM).

YES → Substitute a known-good ECM and recheck.

YES → To P. 2-35

From P. 2-34

Check the oil pressure.
Is the oil pressure within the specification?

No → Perform the following checks and repair or replace as necessary.
- Clogged oil strainer
- Clogged oil filter
- Faulty oil pump
- Clogged oil passage

Yes

Replace the oil pressure switch and start the engine.
Do the oil indictor light come ON and the buzzer stop sounding?

Yes → Oil pressure switch is faulty.

No

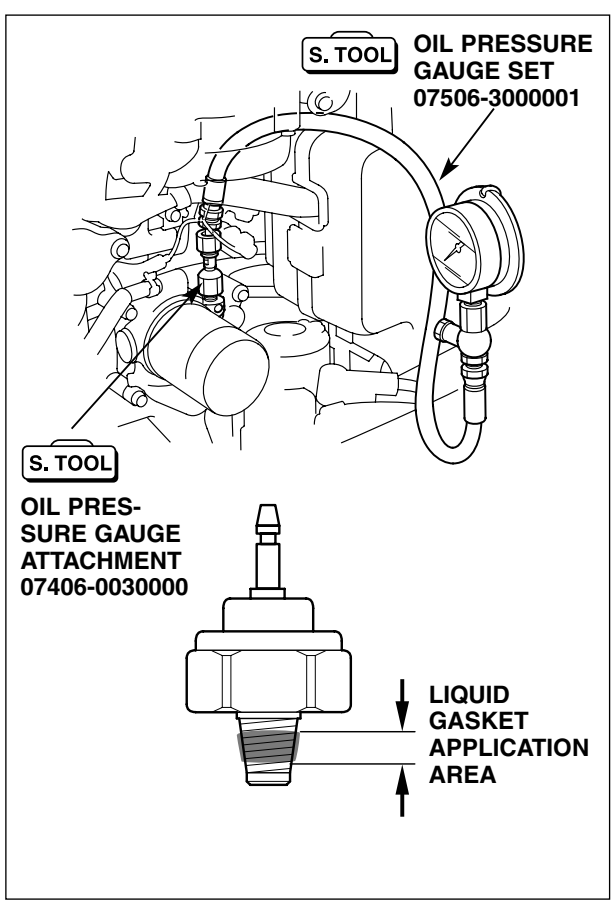
Substitute a known-good ECM and recheck.

• OIL PRESSURE INSPECTION

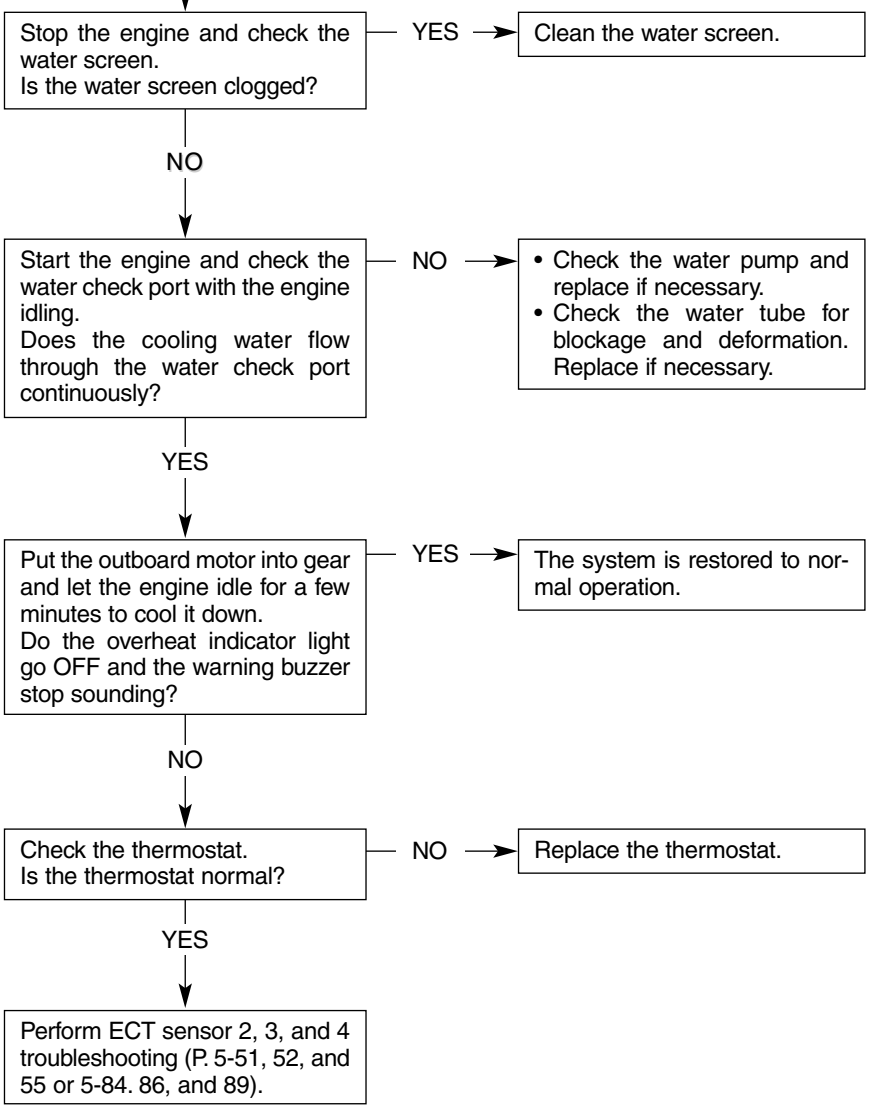
1) Remove the switch cover. Remove the 4 mm screw and the oil pressure switch wire.
2) Remove the oil pressure switch.
3) Install the oil pressure gauge attachment as shown.
   TORQUE: 8 N•m (0.8 kgf•m, 5.8 lbf•ft)
4) Install the oil pressure gauge set.
5) Start the engine and measure the oil pressure.

Oil pressure	0.147 MPa (1.5 kgf/cm^2, 21.3 psi) at 2,050 min^{-1} (rpm)

6) Clean the threads of the switch and apply the liquid gasket (Three Bond 1215 or equivalent) to the indicated area.
   Install the oil pressure switch to the specified torque.
   TORQUE: 8.3 N•m (0.85 kgf•m, 6.1 lbf•ft)



From P. 2-33

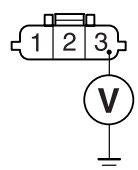

Stop the engine and check the water screen.
Is the water screen clogged?
YES
Clean the water screen.
NO
Start the engine and check the water check port with the engine idling.
Does the cooling water flow through the water check port continuously?
NO
• Check the water pump and replace if necessary.
• Check the water tube for blockage and deformation. Replace if necessary.
YES
Put the outboard motor into gear and let the engine idle for a few minutes to cool it down.
Do the overheat indicator light go OFF and the warning buzzer stop sounding?
YES
The system is restored to normal operation.
NO
Check the thermostat.
Is the thermostat normal?
NO
Replace the thermostat.
YES
Perform ECT sensor 2, 3, and 4 troubleshooting (P. 5-51, 52, and 55 or 5-84. 86, and 89).

• INTERMITTENT PROLONGED SOUND OF WARNING BUZZER KEEPS SOUNDING

Is the MIL ON?
- YES → Perform MIL troubleshooting (P. 5-18 or 5-61).
- NO ↓

Is the alternator indicator light ON?
- NO → Check for open in the indicator light power line.
  1 Turn the ignition switch OFF and disconnect the indicator light 3P connector.
  2 Turn the ignition switch ON. Measure the voltage between the No. 3 (Yellow/Black) terminal of the harness side 3P connector and the engine ground.

  Harness side connector Viewing from terminal side

  Is there the battery voltage?
  - NO → Replace or repair the wire harness (Open in the wire harness between the indicator light and No. 5 (10A) fuse).
  - Yes ↓
    - Check for blown bulb. Replace if necessary.
    - If the bulb is not blown out, replace the indicator light.
- Yes ↓

Is the alternator belt tension correct?
- No → Adjust the alternator belt tension.
- YES ↓

Is the alternator fuse (90A) normal?
- NO → Replace the fuse.
- YES ↓

Check the alternator 4P connector for connection.
Is the alternator 4P connector connected properly?
- NO → Replace the fuse.
- YES ↓

Measure the voltage between the measurement battery terminals.
Is the voltage 13.5V or above?
- NO → Check the load. If there is no problem, replace the battery.
- YES ↓

Perform alternator troubleshooting (P. 2-31).

• INTERMITTENT SHORT SOUND OF WARNING BUZZER KEEPS SOUNDING

Stop the engine. Check the water separator and the low pressure fuel strainer.
Is the water accumulated in the water separator and/or low pressure fuel strainer?

YES → Drain the water from the water separator and/or the low pressure fuel strainer (P. 3-15).

NO ↓

Disconnect the water level sensor 2P connector.
Does the buzzer stop sounding with the ignition switch turned ON?

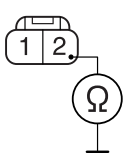
YES → Replace the water level sensor in the water separator.

NO ↓

Check for short in the water level sensor line.

1 Turn the ignition switch OFF.
2 Check for continuity between the No. 2 (Green/Red) terminal of the water level switch harness side 2P connector and the engine ground.

Water level switch harness side 2P connector Viewing from terminal side



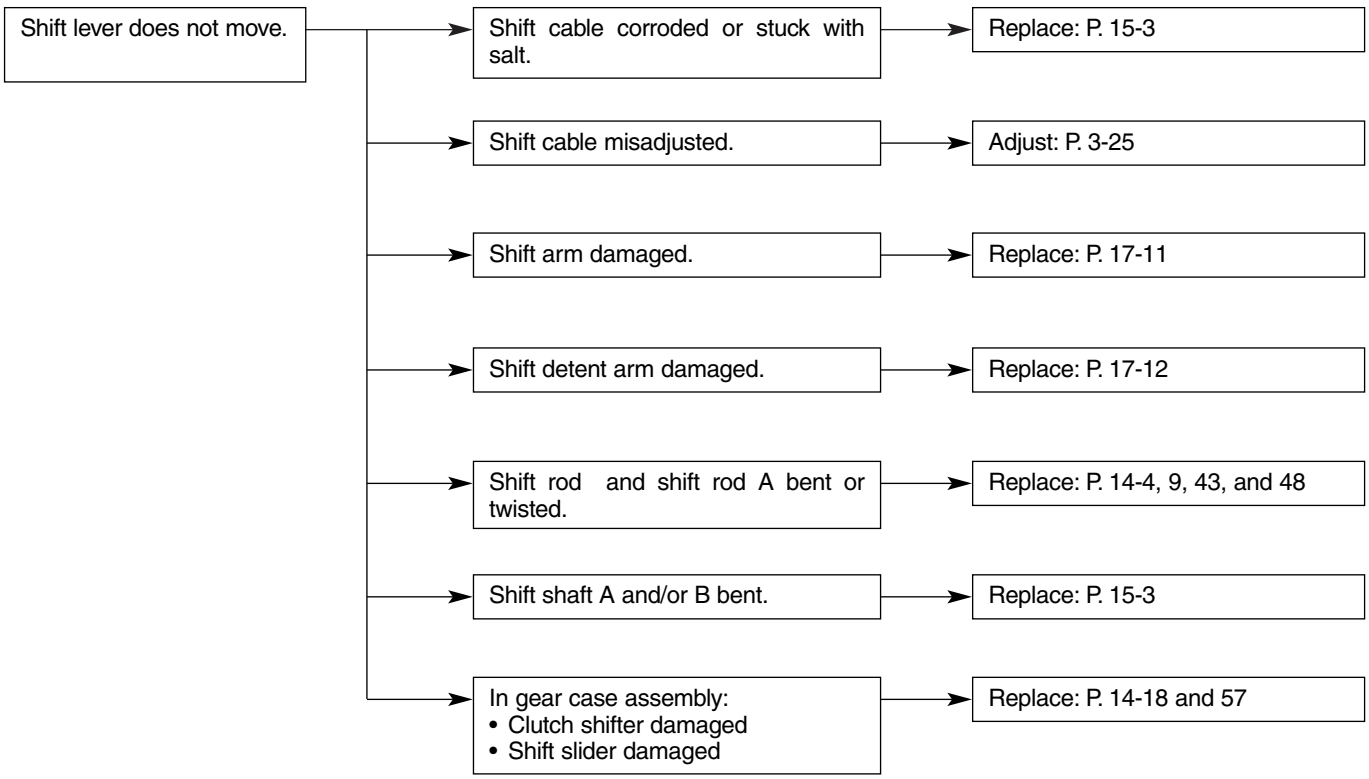
Is there continuity?

YES → Replace or repair the wire harness (Short in the wire between the water level sensor and ECM).

NO ↓

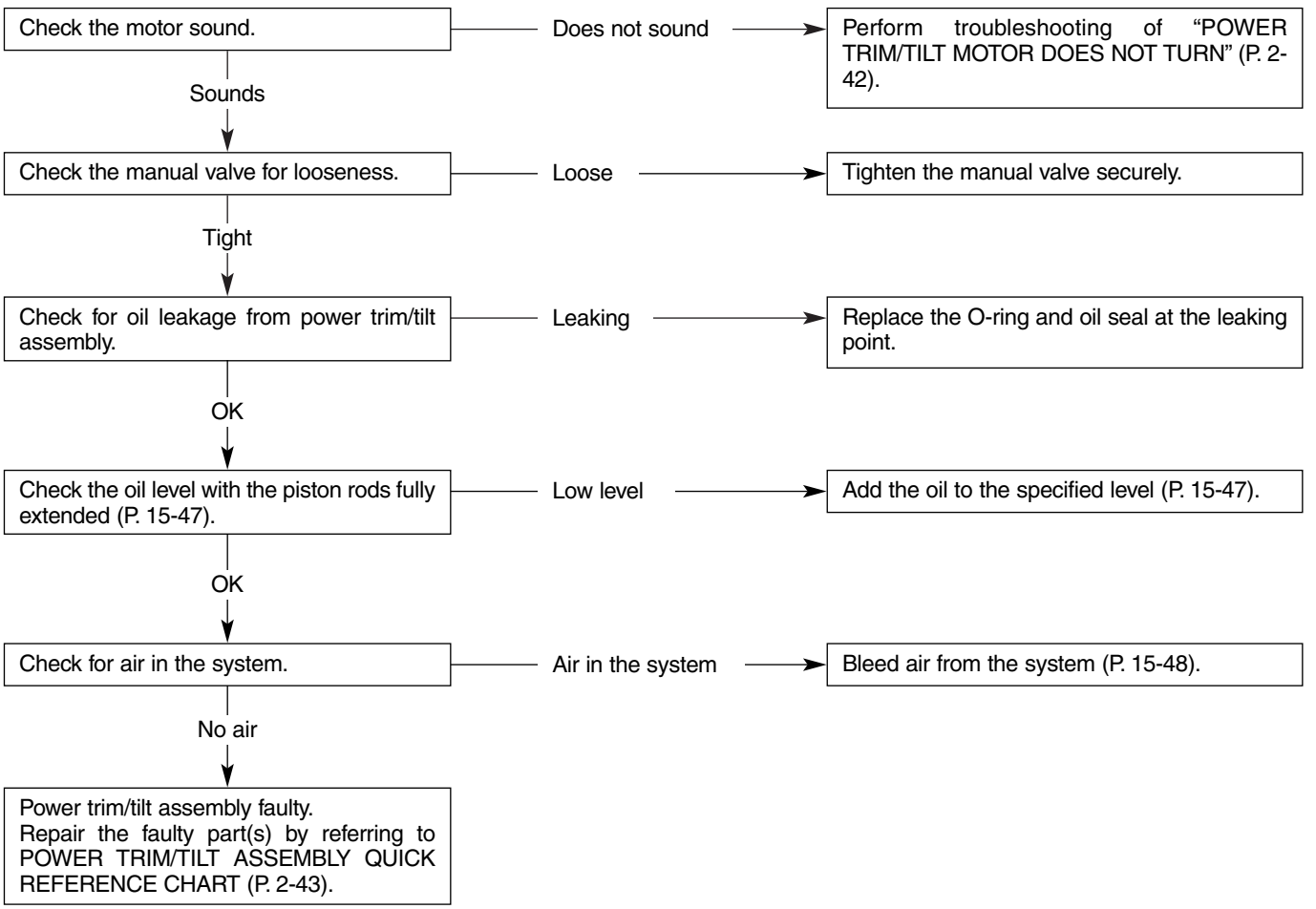
Substitute a known-good ECM and recheck.

h. SHIFT MECHANISM

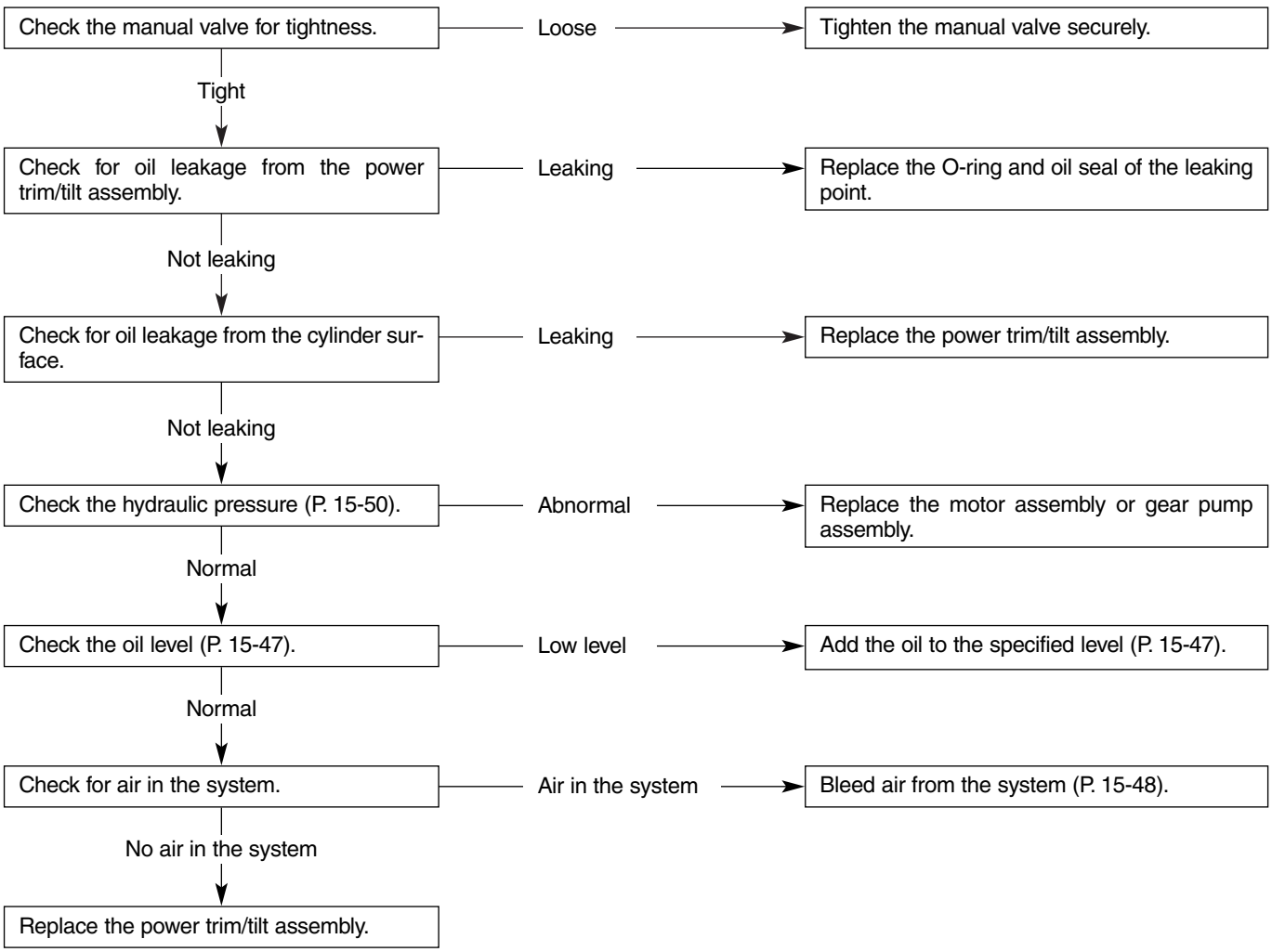


i. POWER TRIM/TILT ASSEMBLY

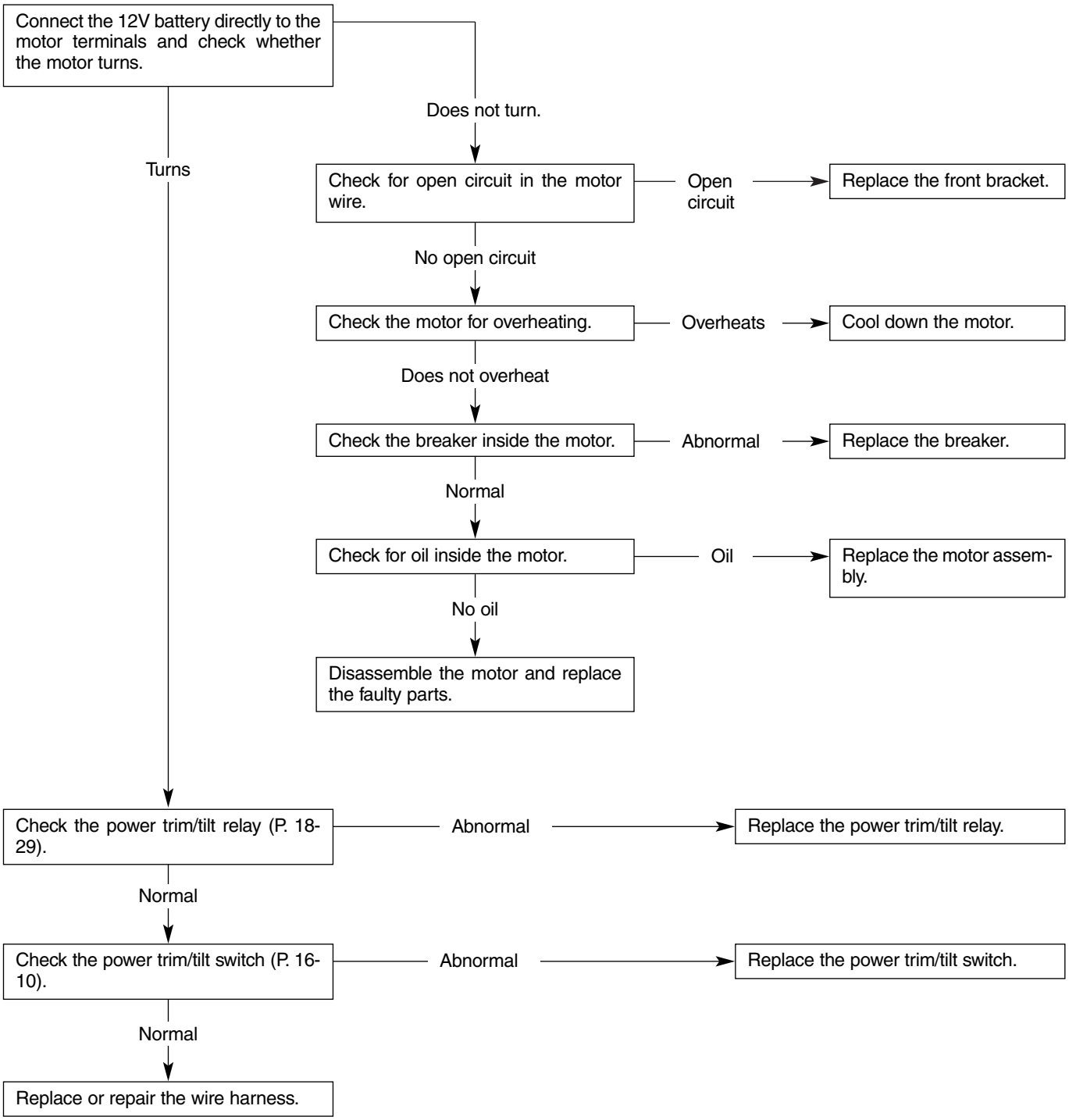
• POWER TRIM/TILT ASSEMBLY DOES NOT MOVE



• POWER TRIM/TILT ASSEMBLY DOES NOT HOLD



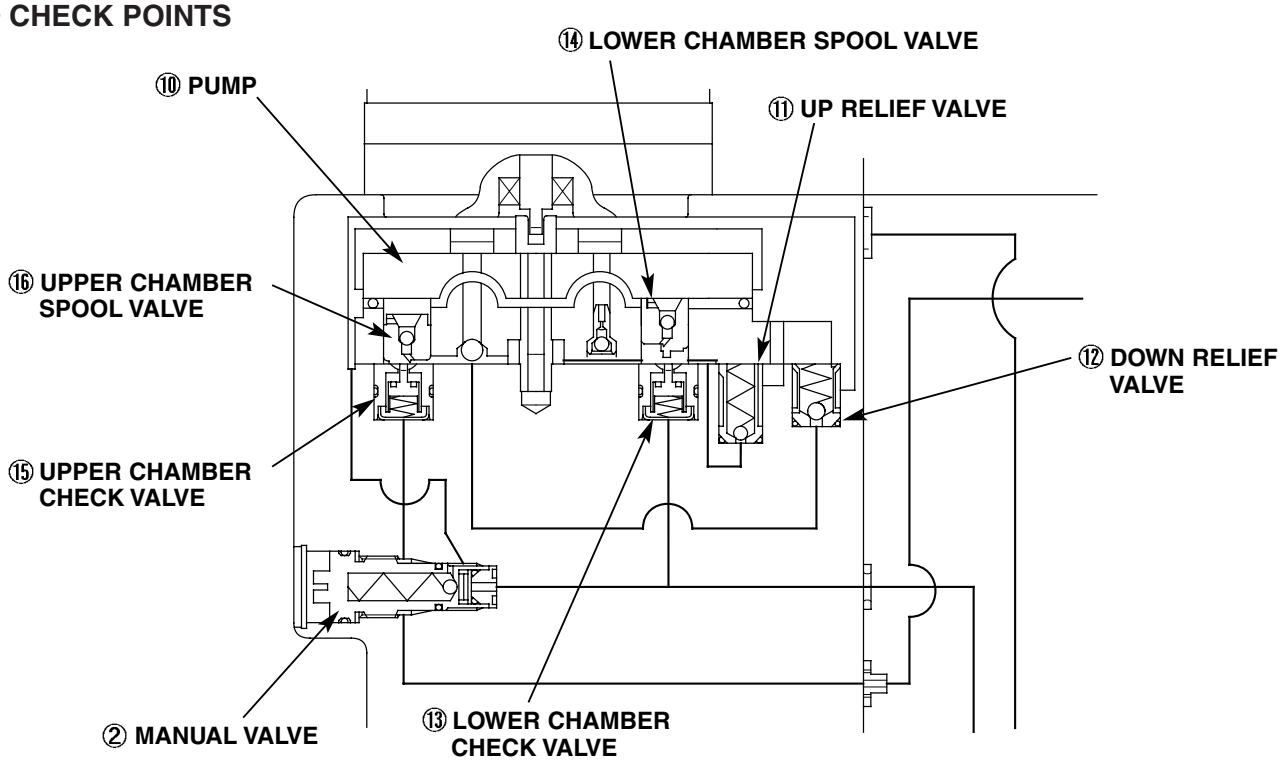
• POWER TRIM/TILT MOTOR DOES NOT TURN

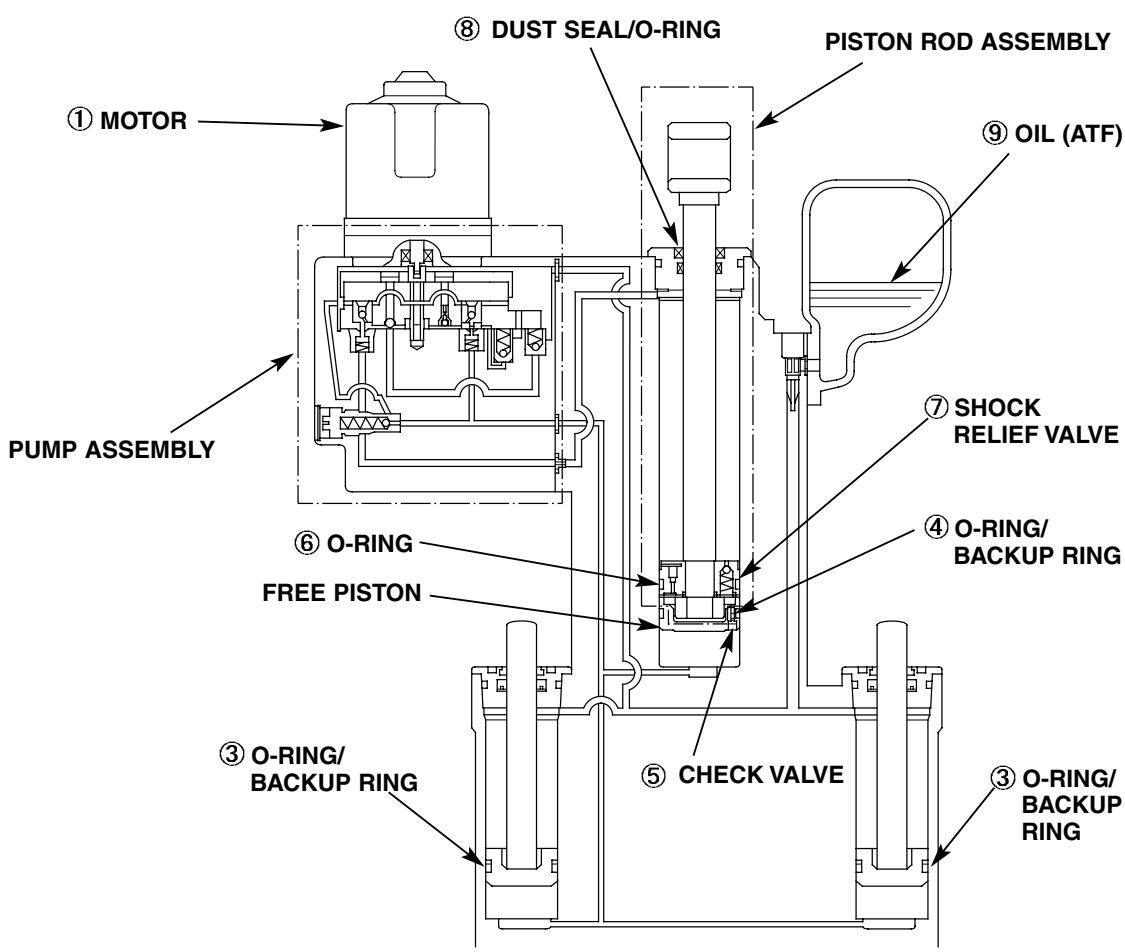


• POWER TRIM/TILT ASSEMBLY QUICK REFERENCE CHART

Symptom				Pressure check		Check point (See page 2-44)	Check/repair method
Does not tilt up	Does not tilt down	Does not hold		Lower chamber hydraulic pressure lower than spec. or pressure drops.	Upper chamber hydraulic pressure lower than spec. or pressure drops.		
		Lowers	Extends				
○	○	—	—	○	○	① Motor assembly	Check the motor assembly.
○	○	○	○	○		②Manual valve	Check that the manual valve is installed securely. Replace if it is damaged. Check the O-ring surface for damage and replace if necessary. If there is no damage, clean the O-ring and install on the manual valve properly.
○	○	○	—	○	—	③ Backup ring O-ring (Piston rod B)	Check the backup ring for damage and replace if necessary. Check the O-ring surface for damage and replace if necessary. If the backup ring and O-ring are normal, clean and install on the piston rod B properly.
○		○		○		④ Backup ring O-ring (Free piston)	Check the backup ring for damage and replace if necessary. Check the O-ring surface for damage and replace if necessary. If the backup ring and O-ring are normal, clean and install on the free piston properly.
○	—	○	—	○	—	⑤ Check valve (Free piston)	Check the ball seat and the neighboring area for damage and replace the free piston as an assembly if necessary. (Do not disassemble the free piston.)
—	○	—	○	—	○	⑥ O-ring (Piston rod comp.)	Check the O-ring surface for damage and replace if necessary.
—	○	—	○	—	○	⑦ Shock relief valve (Piston rod comp.)	Check the ball seat and the neighboring area for damage and replace the piston rod comp. as an assembly if necessary. (Do not disassemble the piston rod comp.)
—	○	—	○	—	○	⑧ Dust seal, O-ring (Cylinder cap)	Check the dust seal and O-ring for damage and foreign material (oil leakage). Replace if necessary.
○	○	—	—	—	—	⑨ Oil (ATF)	Check the oil level and add the oil if necessary.
○	○	—	—	○	○	⑩ Pump assembly	If the pump turns idle or excessively heavy, replace the pump assembly. (Do not disassemble the pump assembly.)
○				○		⑪ Up relief valve	The valves are built in the pump assembly. Replace the pump assembly if necessary. (Do not disassemble the pump assembly.)
—	○	—	—	—	○	⑫ Down relief valve	
○	○	○	—	○	—	⑬ Lower chamber check valve	
○	○	○	—	○	—	⑭ Lower chamber spool valve	
○	○		○		○	⑮ Upper chamber check valve	
○	○	—	○	—	○	⑯ Upper chamber spool valve	

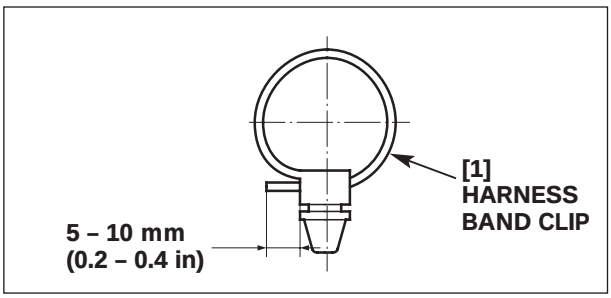
• CHECK POINTS

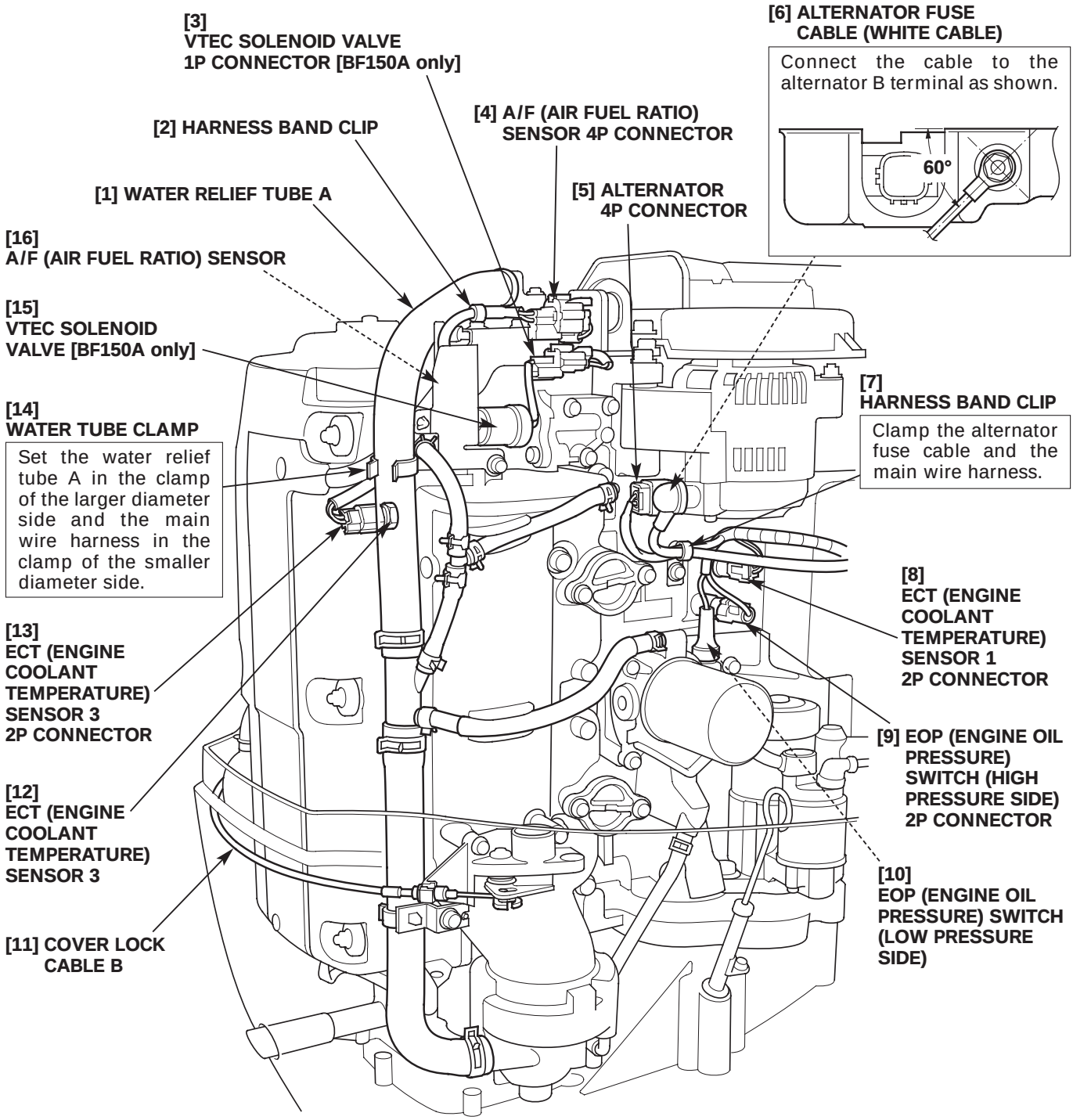


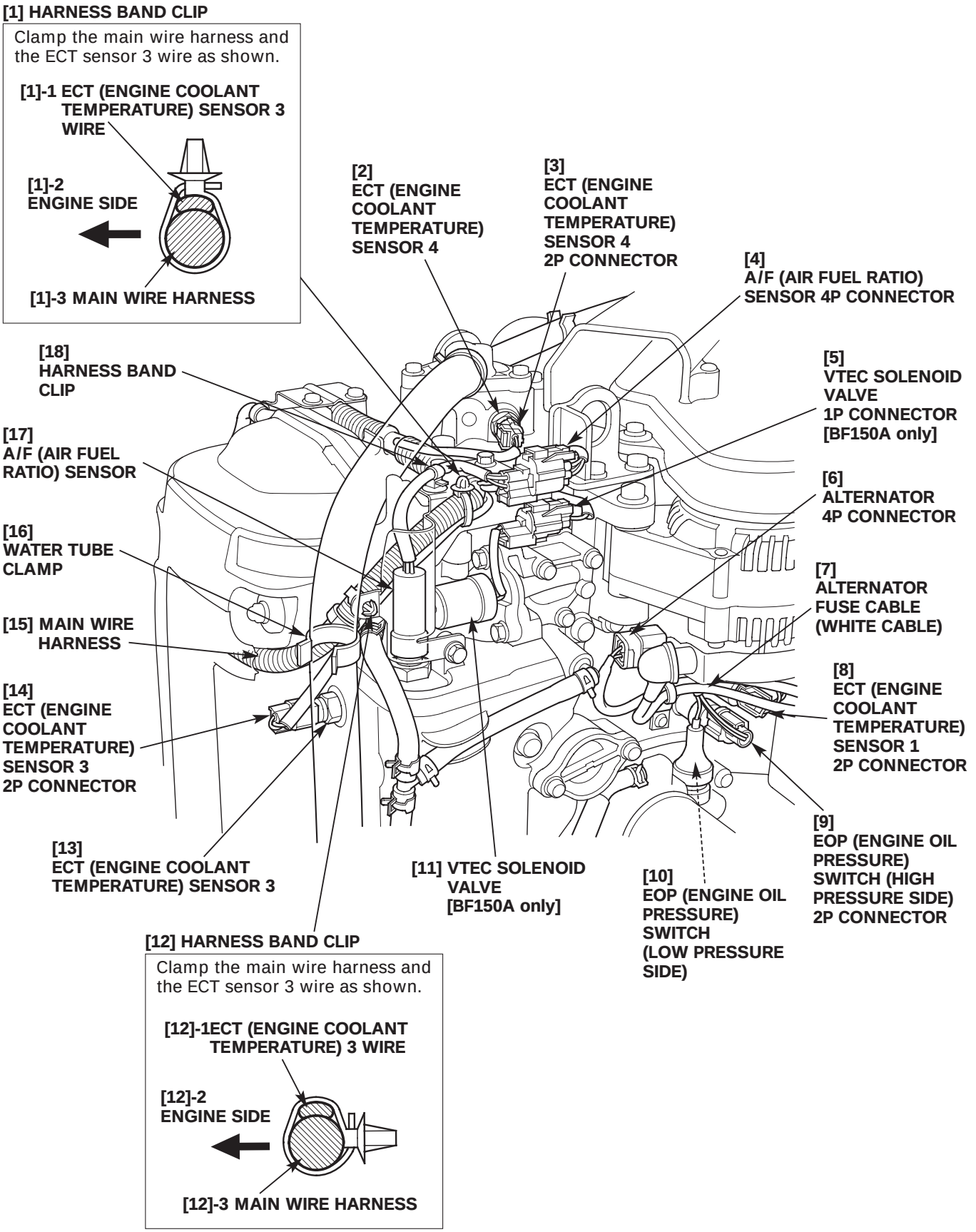


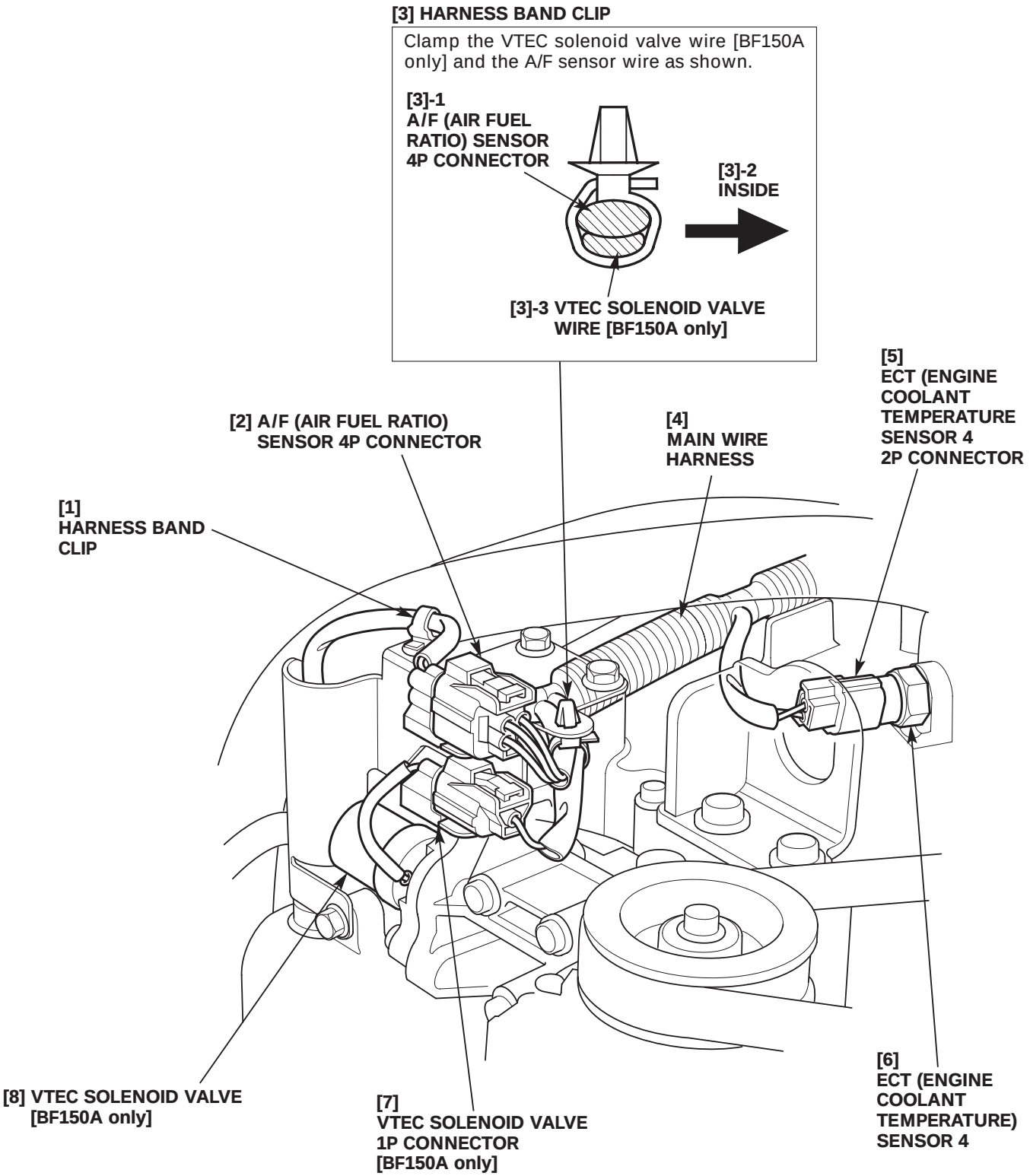
10. CABLE/HARNESS ROUTING

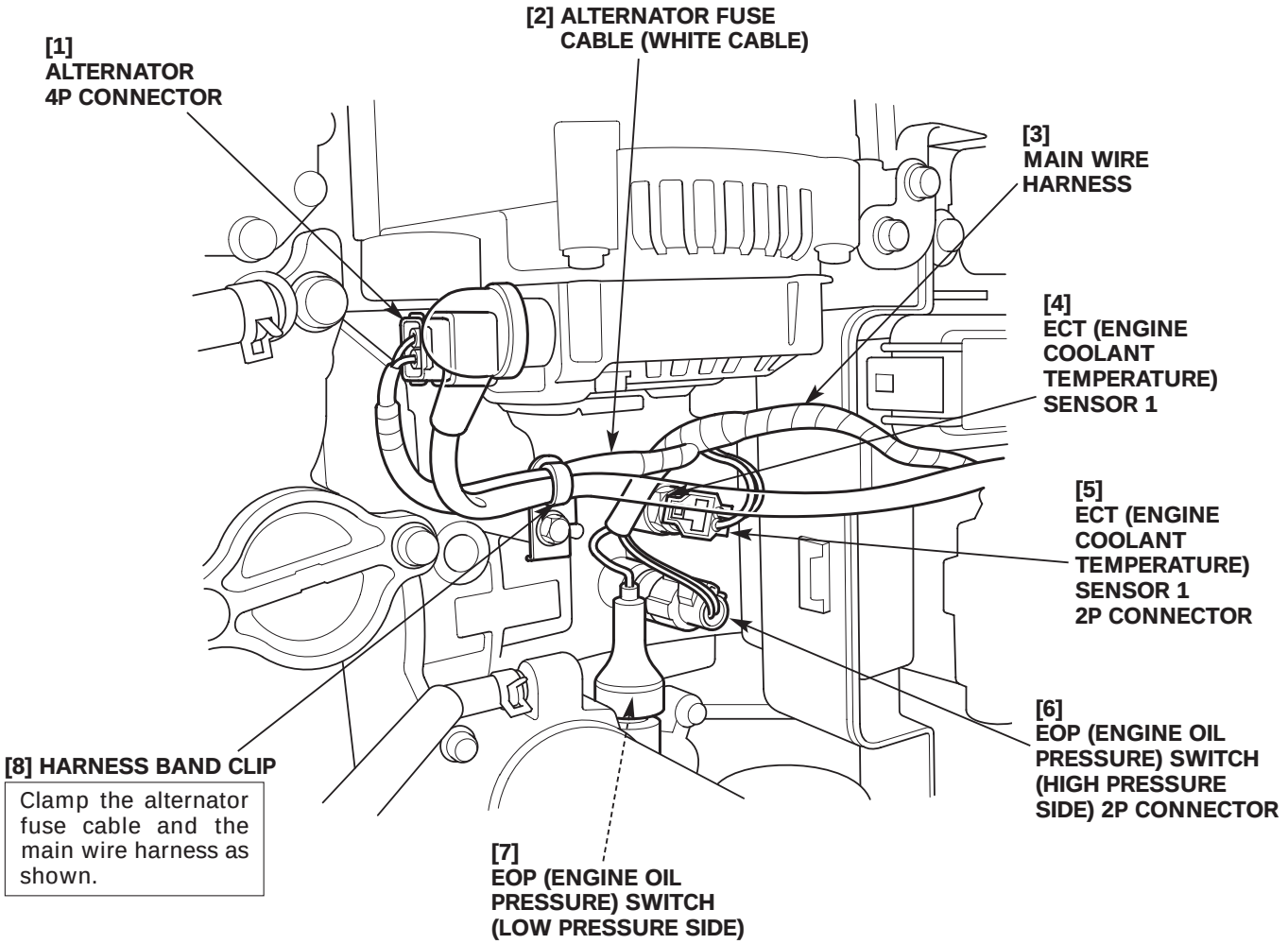
After securing the cables and harnesses with the harness band clips, cut the end of the harness band clips so that the projected length is 5 – 10 mm (0.2 – 0.4 in) as shown.

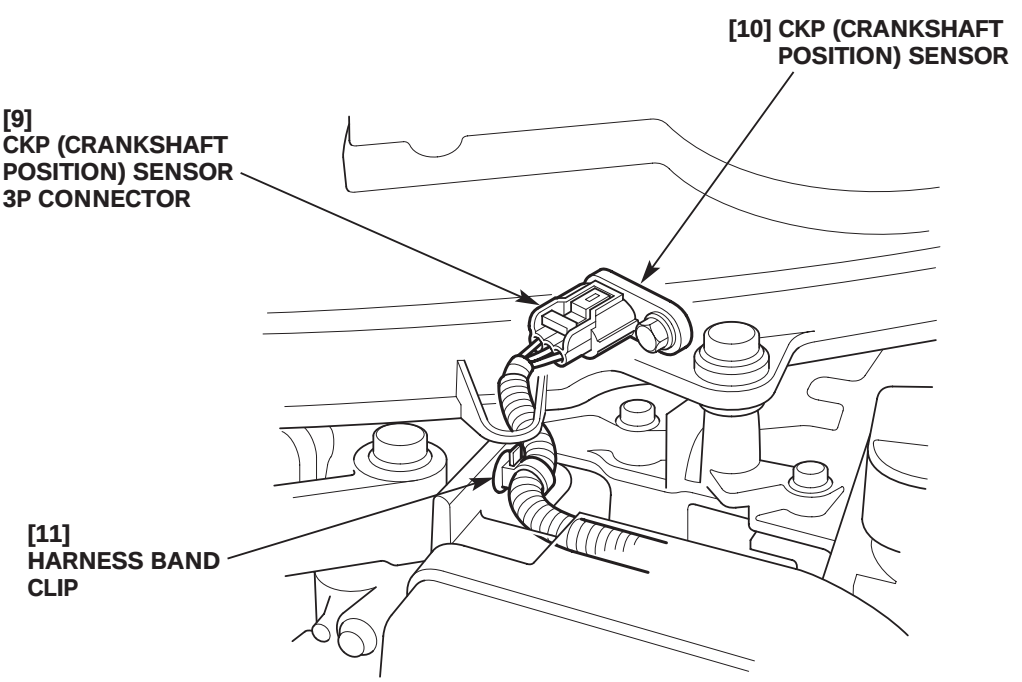


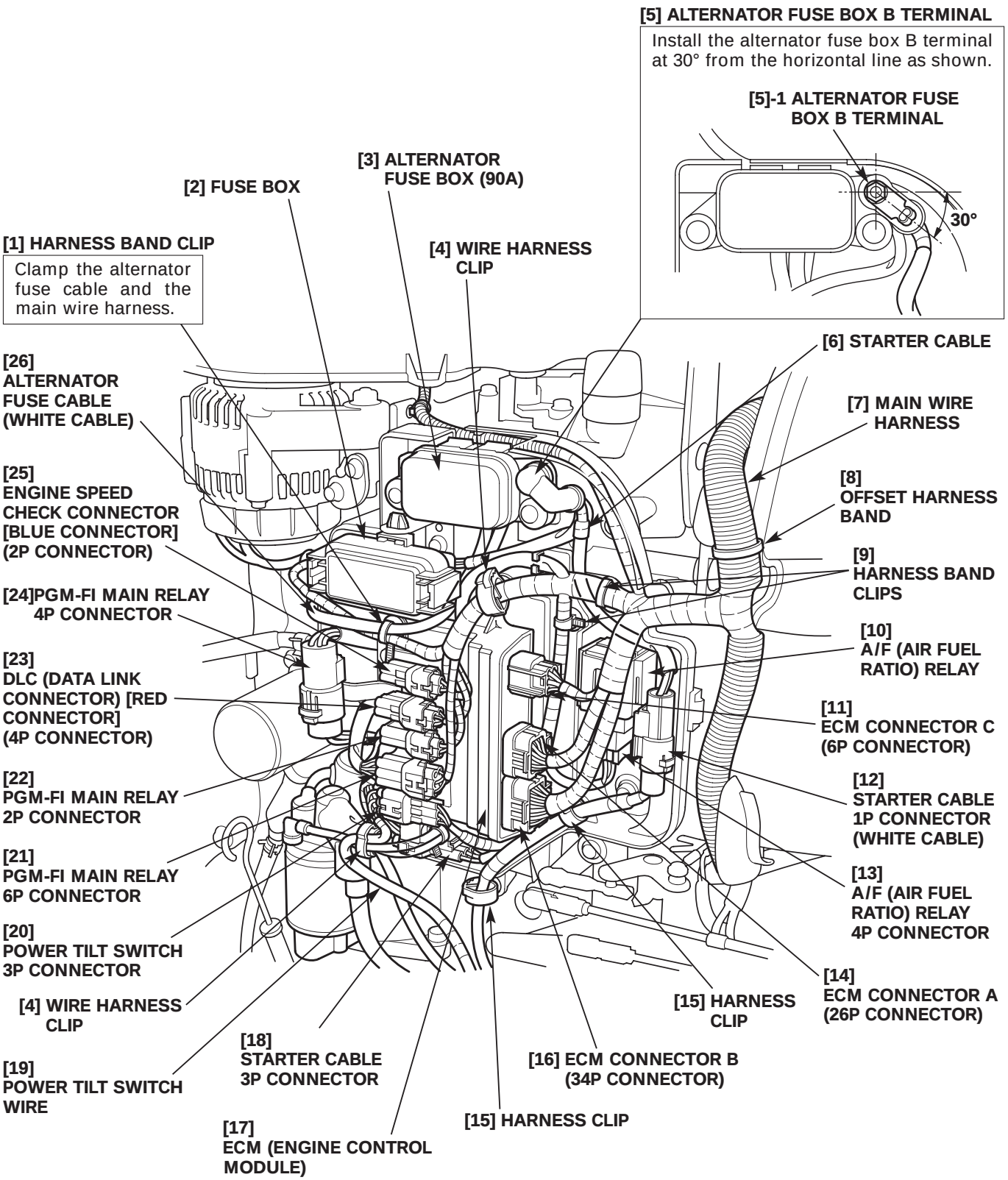


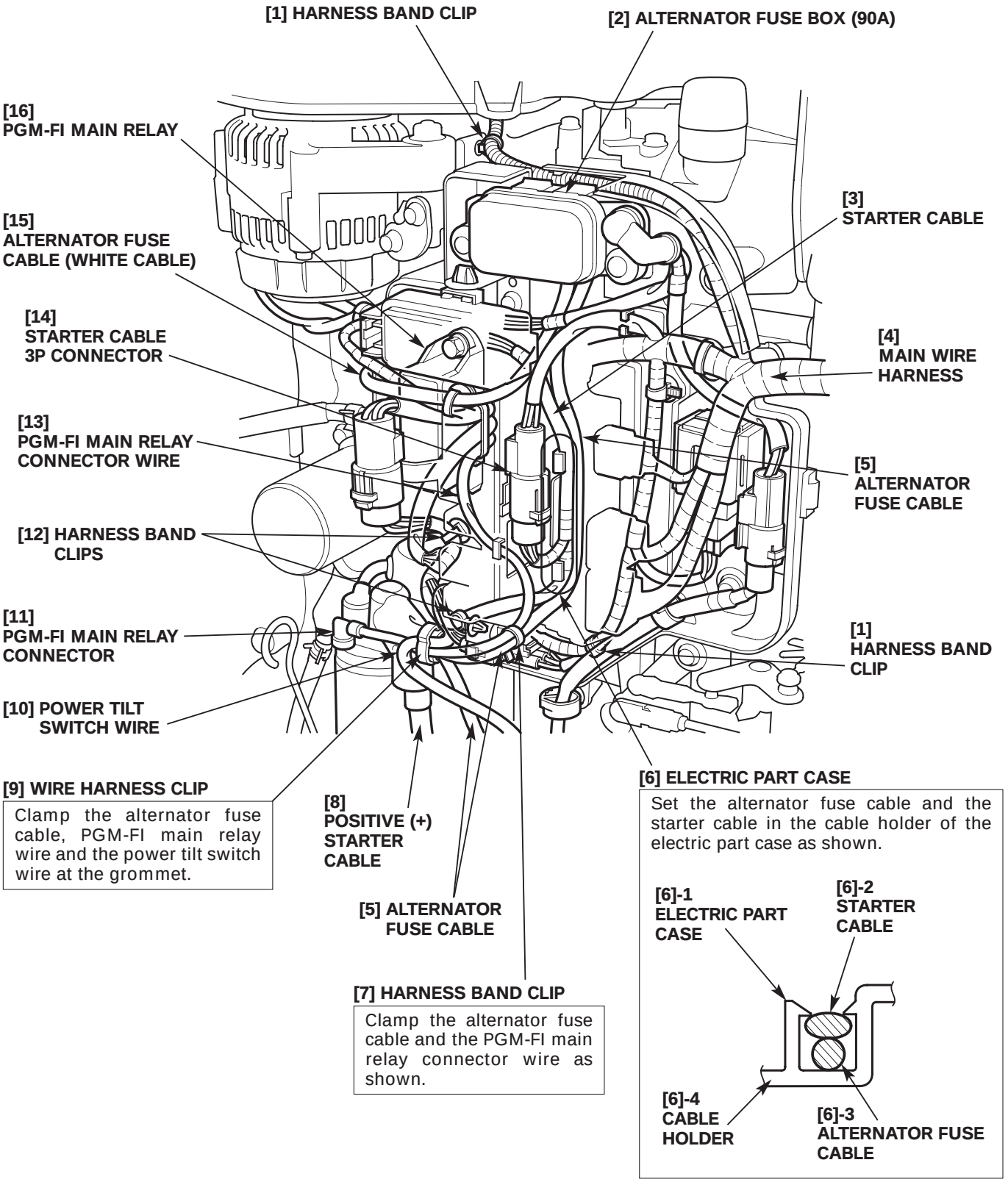

[1] HARNESS BAND CLIP
Clamp the main wire harness and the ECT sensor 3 wire as shown.
[1]-1 ECT (ENGINE COOLANT TEMPERATURE) SENSOR 3 WIRE
[1]-2 ENGINE SIDE
[1]-3 MAIN WIRE HARNESS
[2] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 4
[3] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 4 2P CONNECTOR
[4] A/F (AIR FUEL RATIO) SENSOR 4P CONNECTOR
[5] VTEC SOLENOID VALVE 1P CONNECTOR [BF150A only]
[6] ALTERNATOR 4P CONNECTOR
[7] ALTERNATOR FUSE CABLE (WHITE CABLE)
[8] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 1 2P CONNECTOR
[9] EOP (ENGINE OIL PRESSURE) SWITCH (HIGH PRESSURE SIDE) 2P CONNECTOR
[10] EOP (ENGINE OIL PRESSURE) SWITCH (LOW PRESSURE SIDE)
[11] VTEC SOLENOID VALVE [BF150A only]
[12] HARNESS BAND CLIP
Clamp the main wire harness and the ECT sensor 3 wire as shown.
[12]-1ECT (ENGINE COOLANT TEMPERATURE) 3 WIRE
[12]-2 ENGINE SIDE
[12]-3 MAIN WIRE HARNESS
[13] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 3
[14] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 3 2P CONNECTOR
[15] MAIN WIRE HARNESS
[16] WATER TUBE CLAMP
[17] A/F (AIR FUEL RATIO) SENSOR
[18] HARNESS BAND CLIP

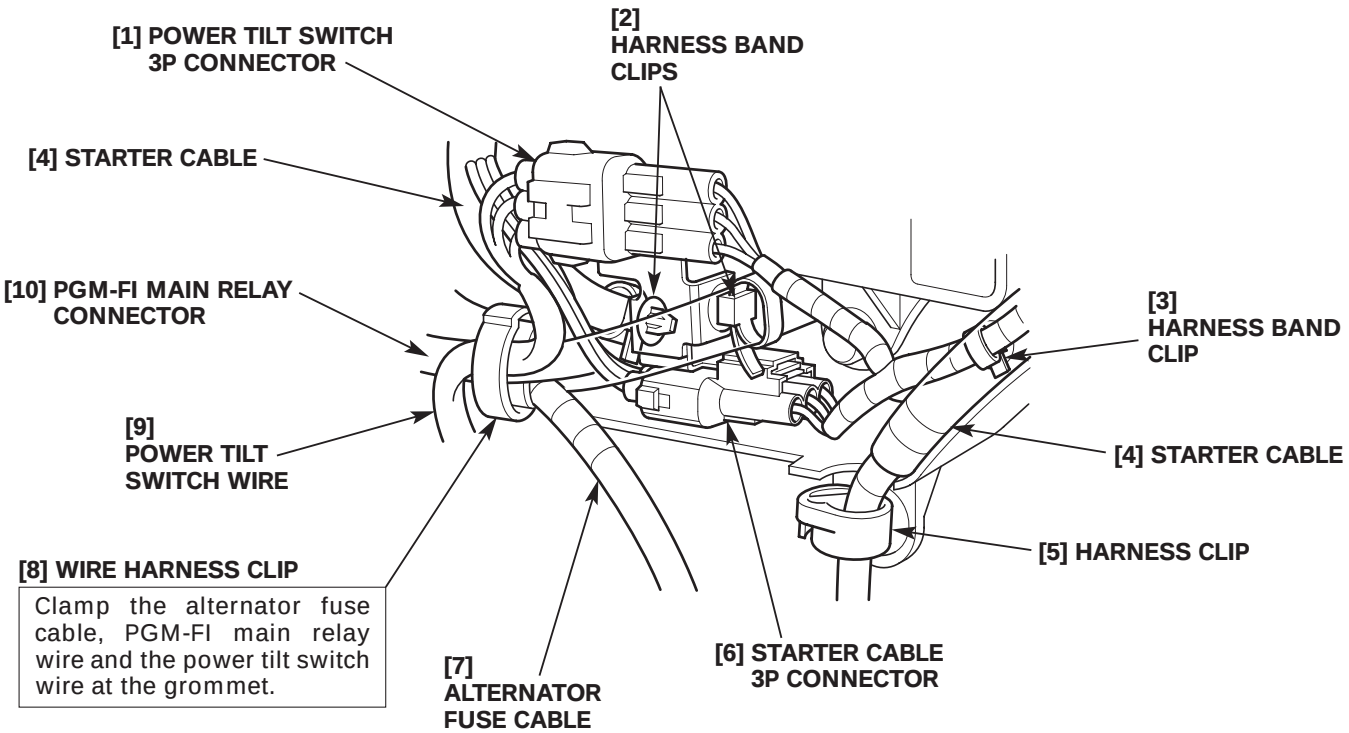

[3] HARNESS BAND CLIP
Clamp the VTEC solenoid valve wire [BF150A only] and the A/F sensor wire as shown.
[3]-1 A/F (AIR FUEL RATIO) SENSOR 4P CONNECTOR
[3]-2 INSIDE
[3]-3 VTEC SOLENOID VALVE WIRE [BF150A only]
[1] HARNESS BAND CLIP
[2] A/F (AIR FUEL RATIO) SENSOR 4P CONNECTOR
[4] MAIN WIRE HARNESS
[5] ECT (ENGINE COOLANT TEMPERATURE SENSOR 4 2P CONNECTOR
[6] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 4
[7] VTEC SOLENOID VALVE 1P CONNECTOR [BF150A only]
[8] VTEC SOLENOID VALVE [BF150A only]

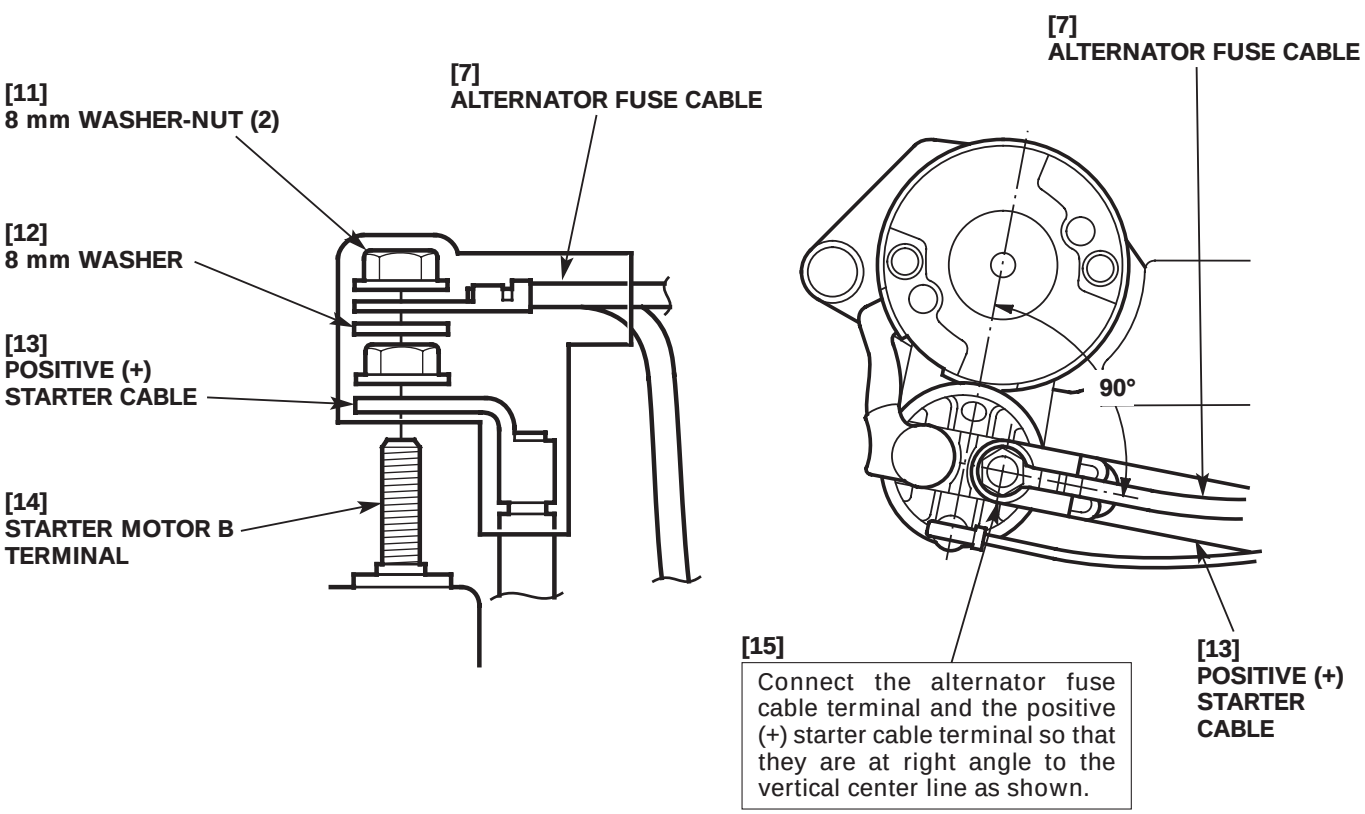

[1]
ALTERNATOR
4P CONNECTOR
[2] ALTERNATOR FUSE
CABLE (WHITE CABLE)
[3]
MAIN WIRE
HARNESS
[4]
ECT (ENGINE
COOLANT
TEMPERATURE)
SENSOR 1
[5]
ECT (ENGINE
COOLANT
TEMPERATURE)
SENSOR 1
2P CONNECTOR
[6]
EOP (ENGINE OIL
PRESSURE) SWITCH
(HIGH PRESSURE
SIDE) 2P CONNECTOR
[7]
EOP (ENGINE OIL
PRESSURE) SWITCH
(LOW PRESSURE SIDE)
[8] HARNESS BAND CLIP
Clamp the alternator fuse cable and the main wire harness as shown.

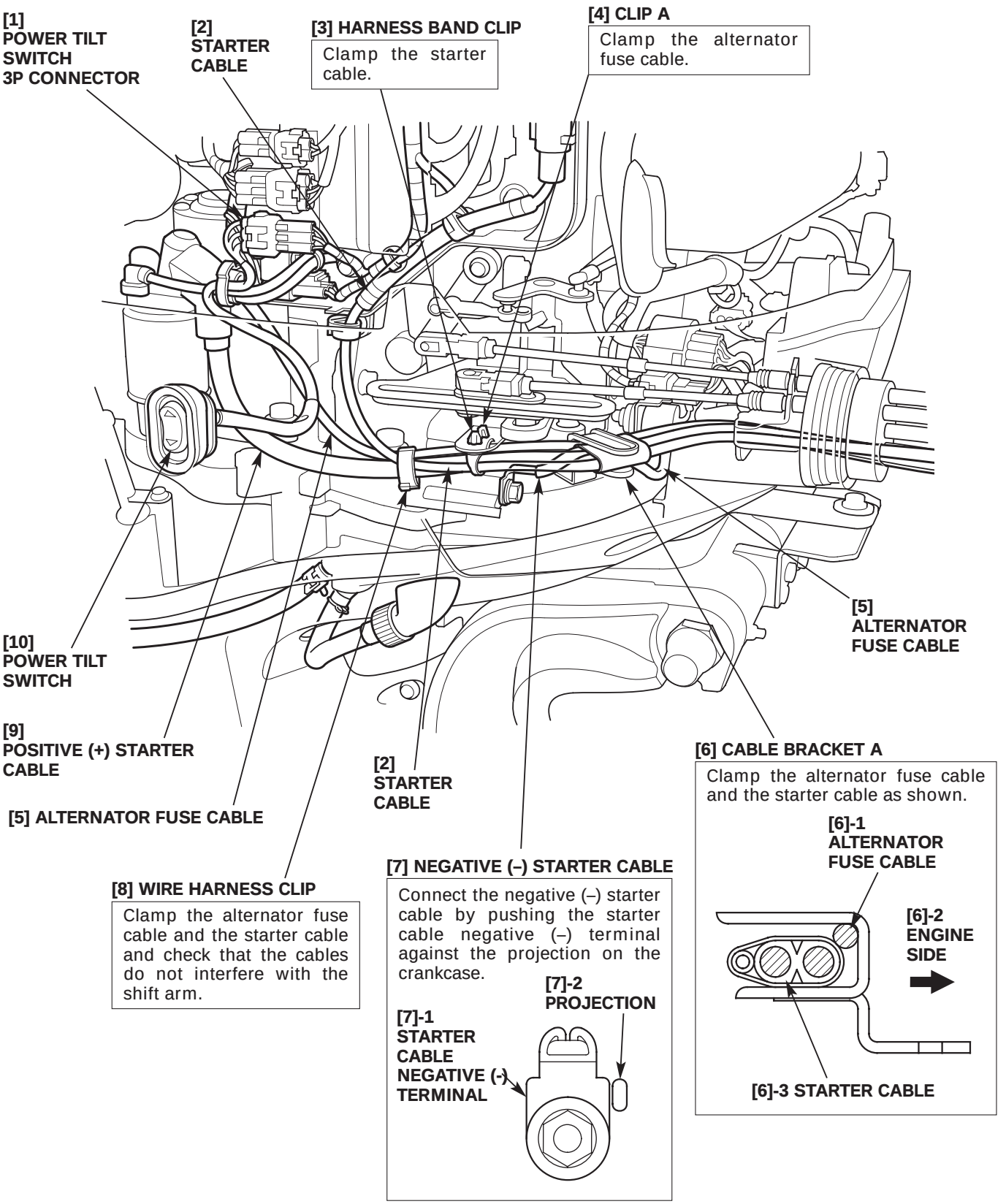

[9]
CKP (CRANKSHAFT
POSITION) SENSOR
3P CONNECTOR
[10] CKP (CRANKSHAFT
POSITION) SENSOR
[11]
HARNESS BAND
CLIP


[5] ALTERNATOR FUSE BOX B TERMINAL
Install the alternator fuse box B terminal at 30° from the horizontal line as shown.
[5]-1 ALTERNATOR FUSE BOX B TERMINAL
30°
[1] HARNESS BAND CLIP
Clamp the alternator fuse cable and the main wire harness.
[2] FUSE BOX
[3] ALTERNATOR FUSE BOX (90A)
[4] WIRE HARNESS CLIP
[6] STARTER CABLE
[7] MAIN WIRE HARNESS
[8] OFFSET HARNESS BAND
[9] HARNESS BAND CLIPS
[10] A/F (AIR FUEL RATIO) RELAY
[11] ECM CONNECTOR C (6P CONNECTOR)
[12] STARTER CABLE 1P CONNECTOR (WHITE CABLE)
[13] A/F (AIR FUEL RATIO) RELAY 4P CONNECTOR
[14] ECM CONNECTOR A (26P CONNECTOR)
[15] HARNESS CLIP
[16] ECM CONNECTOR B (34P CONNECTOR)
[15] HARNESS CLIP
[17] ECM (ENGINE CONTROL MODULE)
[18] STARTER CABLE 3P CONNECTOR
[19] POWER TILT SWITCH WIRE
[4] WIRE HARNESS CLIP
[20] POWER TILT SWITCH 3P CONNECTOR
[21] PGM-FI MAIN RELAY 6P CONNECTOR
[22] PGM-FI MAIN RELAY 2P CONNECTOR
[23] DLC (DATA LINK CONNECTOR) [RED CONNECTOR] (4P CONNECTOR)
[24]PGM-FI MAIN RELAY 4P CONNECTOR
[25] ENGINE SPEED CHECK CONNECTOR [BLUE CONNECTOR] (2P CONNECTOR)
[26] ALTERNATOR FUSE CABLE (WHITE CABLE)

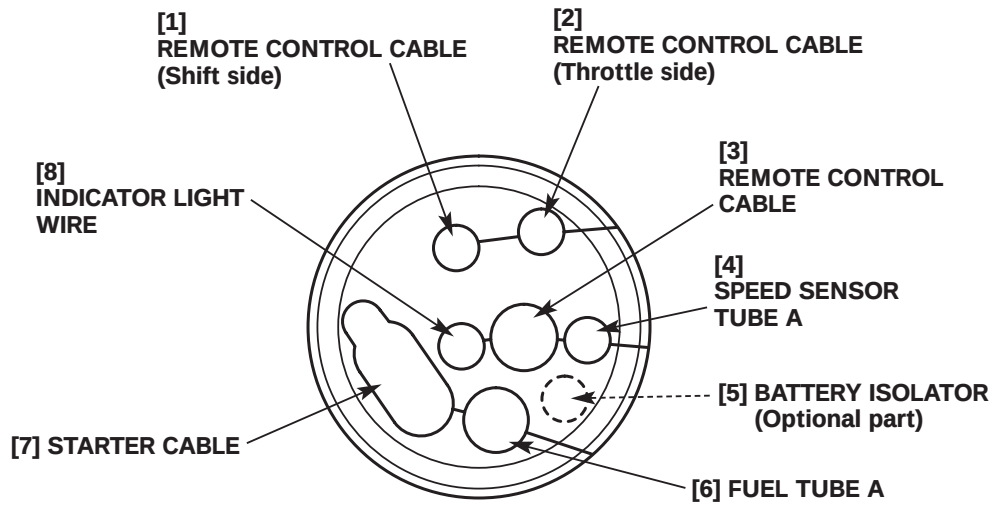

[1] HARNESS BAND CLIP
[2] ALTERNATOR FUSE BOX (90A)
[16] PGM-FI MAIN RELAY
[15] ALTERNATOR FUSE CABLE (WHITE CABLE)
[14] STARTER CABLE 3P CONNECTOR
[13] PGM-FI MAIN RELAY CONNECTOR WIRE
[12] HARNESS BAND CLIPS
[11] PGM-FI MAIN RELAY CONNECTOR
[10] POWER TILT SWITCH WIRE
[3] STARTER CABLE
[4] MAIN WIRE HARNESS
[5] ALTERNATOR FUSE CABLE
[1] HARNESS BAND CLIP
[6] ELECTRIC PART CASE
[9] WIRE HARNESS CLIP
Clamp the alternator fuse cable, PGM-FI main relay wire and the power tilt switch wire at the grommet.
[8] POSITIVE (+) STARTER CABLE
[5] ALTERNATOR FUSE CABLE
[7] HARNESS BAND CLIP
Clamp the alternator fuse cable and the PGM-FI main relay connector wire as shown.
Set the alternator fuse cable and the starter cable in the cable holder of the electric part case as shown.
[6]-1 ELECTRIC PART CASE
[6]-2 STARTER CABLE
[6]-4 CABLE HOLDER
[6]-3 ALTERNATOR FUSE CABLE

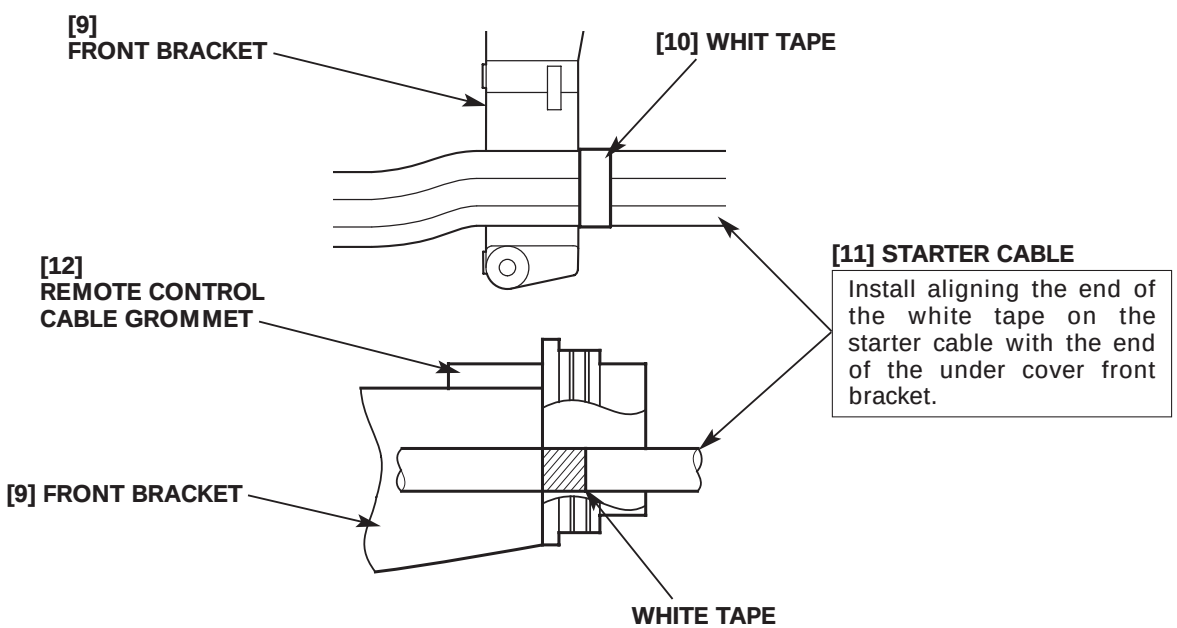

[1] POWER TILT SWITCH 3P CONNECTOR
[2] HARNESS BAND CLIPS
[4] STARTER CABLE
[10] PGM-FI MAIN RELAY CONNECTOR
[3] HARNESS BAND CLIP
[9] POWER TILT SWITCH WIRE
[4] STARTER CABLE
[5] HARNESS CLIP
[8] WIRE HARNESS CLIP
Clamp the alternator fuse cable, PGM-FI main relay wire and the power tilt switch wire at the grommet.
[7] ALTERNATOR FUSE CABLE
[6] STARTER CABLE 3P CONNECTOR

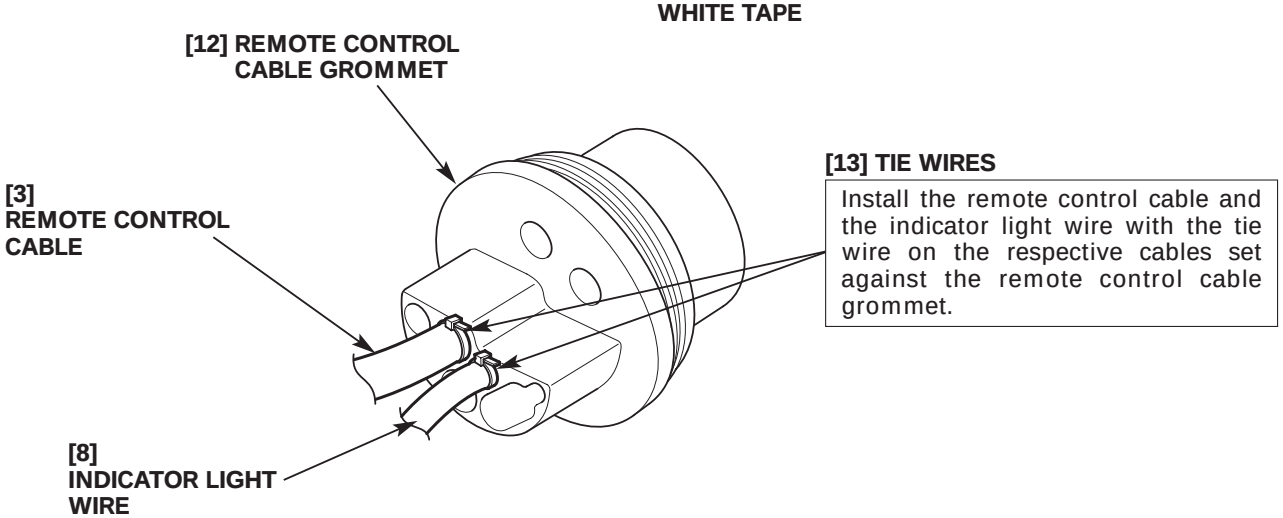

[11] 8 mm WASHER-NUT (2)
[7] ALTERNATOR FUSE CABLE
[12] 8 mm WASHER
[13] POSITIVE (+) STARTER CABLE
[14] STARTER MOTOR B TERMINAL
[7] ALTERNATOR FUSE CABLE
90°
[15]
Connect the alternator fuse cable terminal and the positive (+) starter cable terminal so that they are at right angle to the vertical center line as shown.
[13] POSITIVE (+) STARTER CABLE

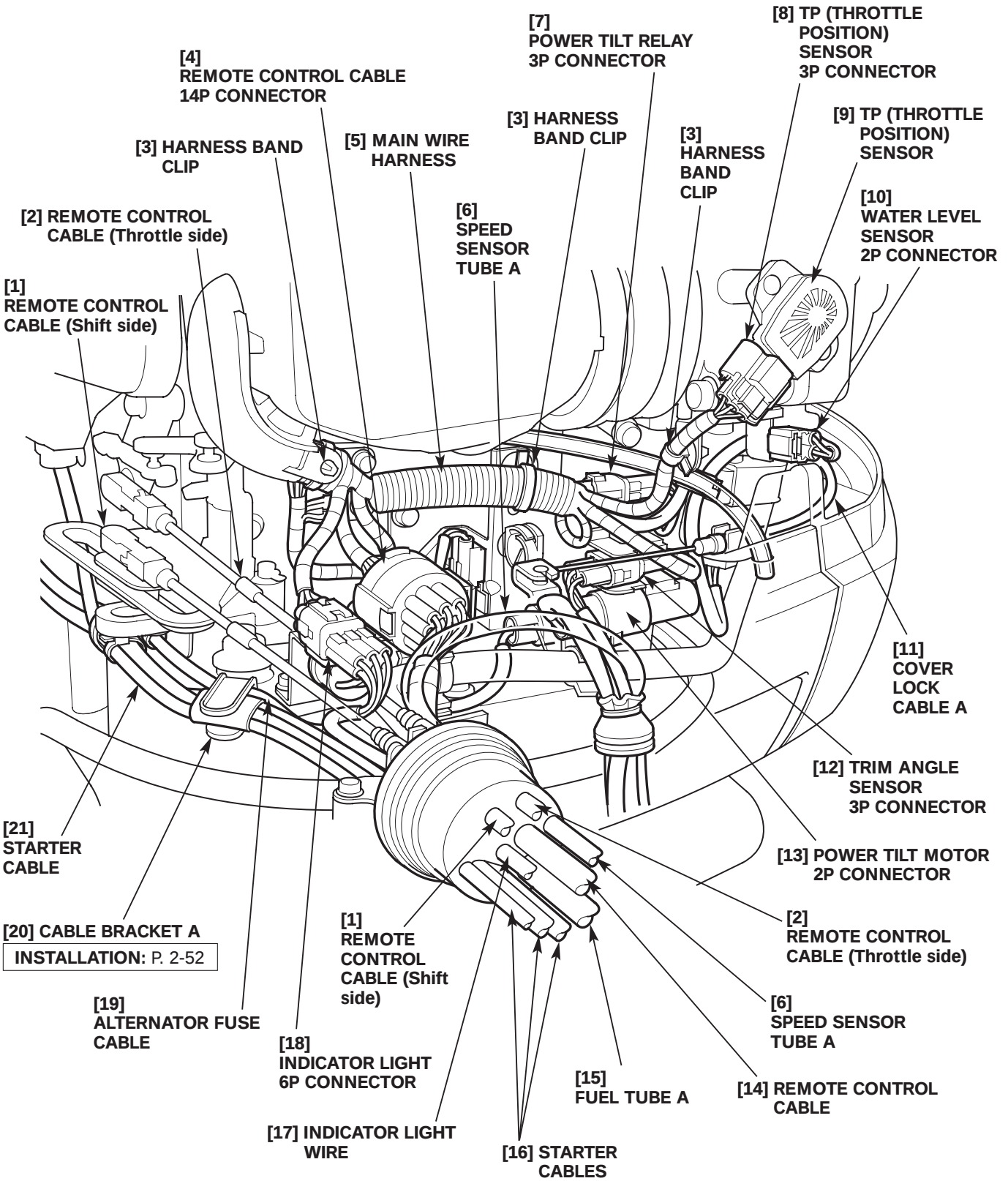

[1]
POWER TILT SWITCH 3P CONNECTOR
[2]
STARTER CABLE
[3] HARNESS BAND CLIP
Clamp the starter cable.
[4] CLIP A
Clamp the alternator fuse cable.
[5]
ALTERNATOR FUSE CABLE
[10]
POWER TILT SWITCH
[9]
POSITIVE (+) STARTER CABLE
[5] ALTERNATOR FUSE CABLE
[2]
STARTER CABLE
[8] WIRE HARNESS CLIP
Clamp the alternator fuse cable and the starter cable and check that the cables do not interfere with the shift arm.
[7] NEGATIVE (–) STARTER CABLE
Connect the negative (–) starter cable by pushing the starter cable negative (–) terminal against the projection on the crankcase.
[7]-1
STARTER CABLE NEGATIVE (-) TERMINAL
[7]-2
PROJECTION
[6] CABLE BRACKET A
Clamp the alternator fuse cable and the starter cable as shown.
[6]-1
ALTERNATOR FUSE CABLE
[6]-2
ENGINE SIDE
[6]-3 STARTER CABLE

<REMOTE CONTROL CABLE GROMMET viewed from outer side of the outboard motor>



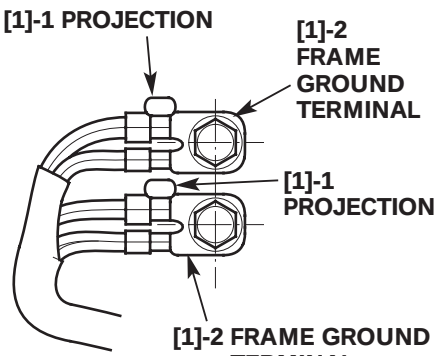





[4]
REMOTE CONTROL CABLE
14P CONNECTOR
[7]
POWER TILT RELAY
3P CONNECTOR
[8] TP (THROTTLE POSITION)
SENSOR
3P CONNECTOR
[3] HARNESS BAND CLIP
[5] MAIN WIRE HARNESS
[3] HARNESS BAND CLIP
[9] TP (THROTTLE POSITION)
SENSOR
[3] HARNESS
BAND
CLIP
[2] REMOTE CONTROL
CABLE (Throttle side)
[6]
SPEED
SENSOR
TUBE A
[10]
WATER LEVEL
SENSOR
2P CONNECTOR
[1]
REMOTE CONTROL
CABLE (Shift side)
[11]
COVER
LOCK
CABLE A
[12] TRIM ANGLE
SENSOR
3P CONNECTOR
[21]
STARTER
CABLE
[13] POWER TILT MOTOR
2P CONNECTOR
[20] CABLE BRACKET A
INSTALLATION: P. 2-52
[1]
REMOTE
CONTROL
CABLE (Shift
side)
[2]
REMOTE CONTROL
CABLE (Throttle side)
[19]
ALTERNATOR FUSE
CABLE
[18]
INDICATOR LIGHT
6P CONNECTOR
[6]
SPEED SENSOR
TUBE A
[15]
FUEL TUBE A
[14] REMOTE CONTROL
CABLE
[17] INDICATOR LIGHT
WIRE
[16] STARTER
CABLES

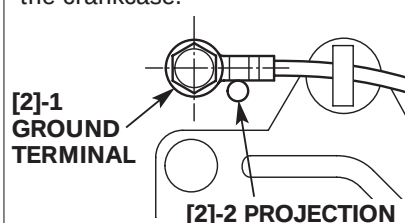
[1] FRAME GROUND TERMINALS

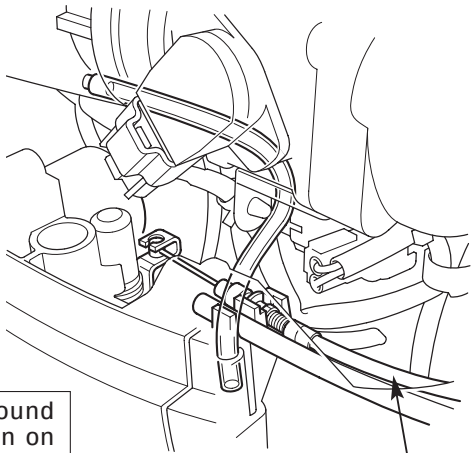
- Connect the black, blue, green/red and the green/white wires to the upper frame ground terminal, and the green, blue, black/white and the green/black wires to the lower frame ground terminal.
- Install by pushing the frame ground terminals against the corresponding projections on the crankcase.

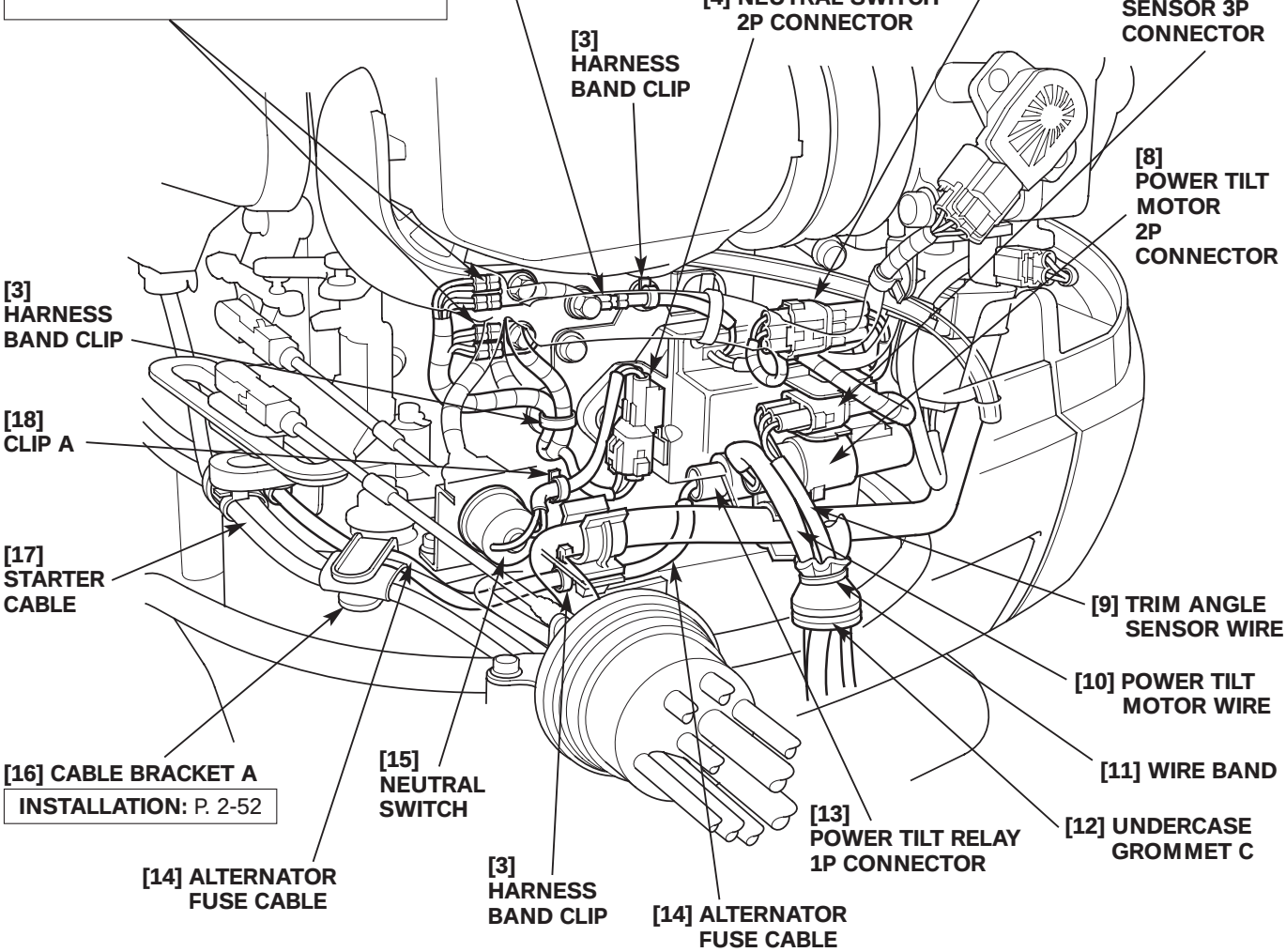


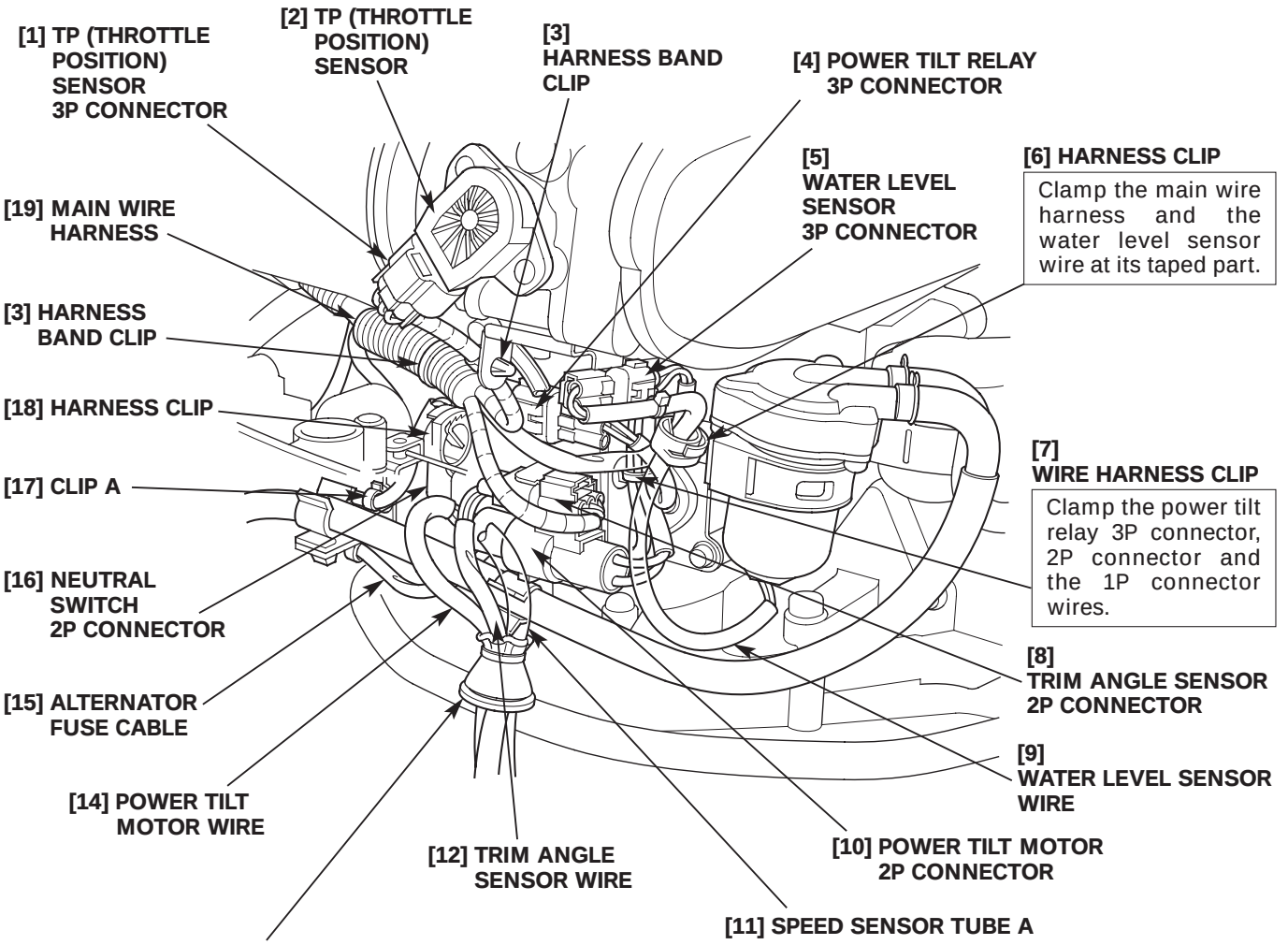
[2] POWER TILT RELAY GROUND TERMINAL

Install by pushing the ground terminal against the projection on the crankcase.

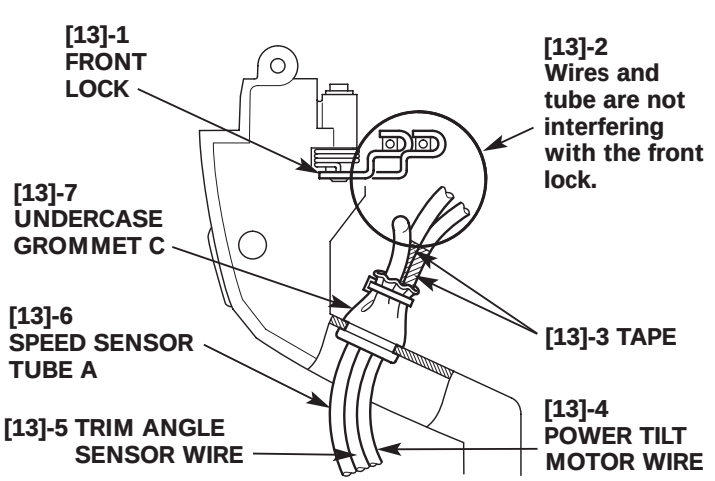


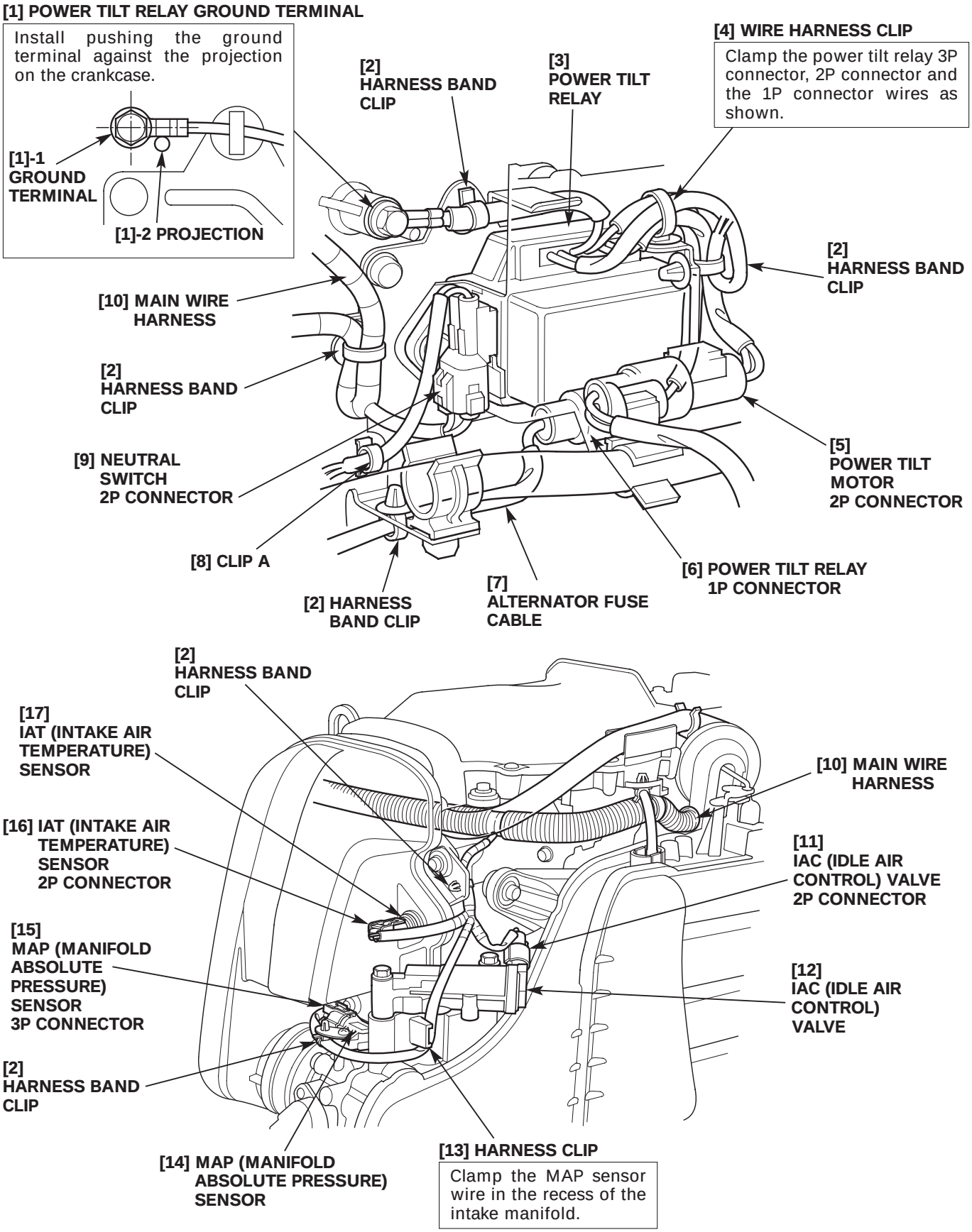


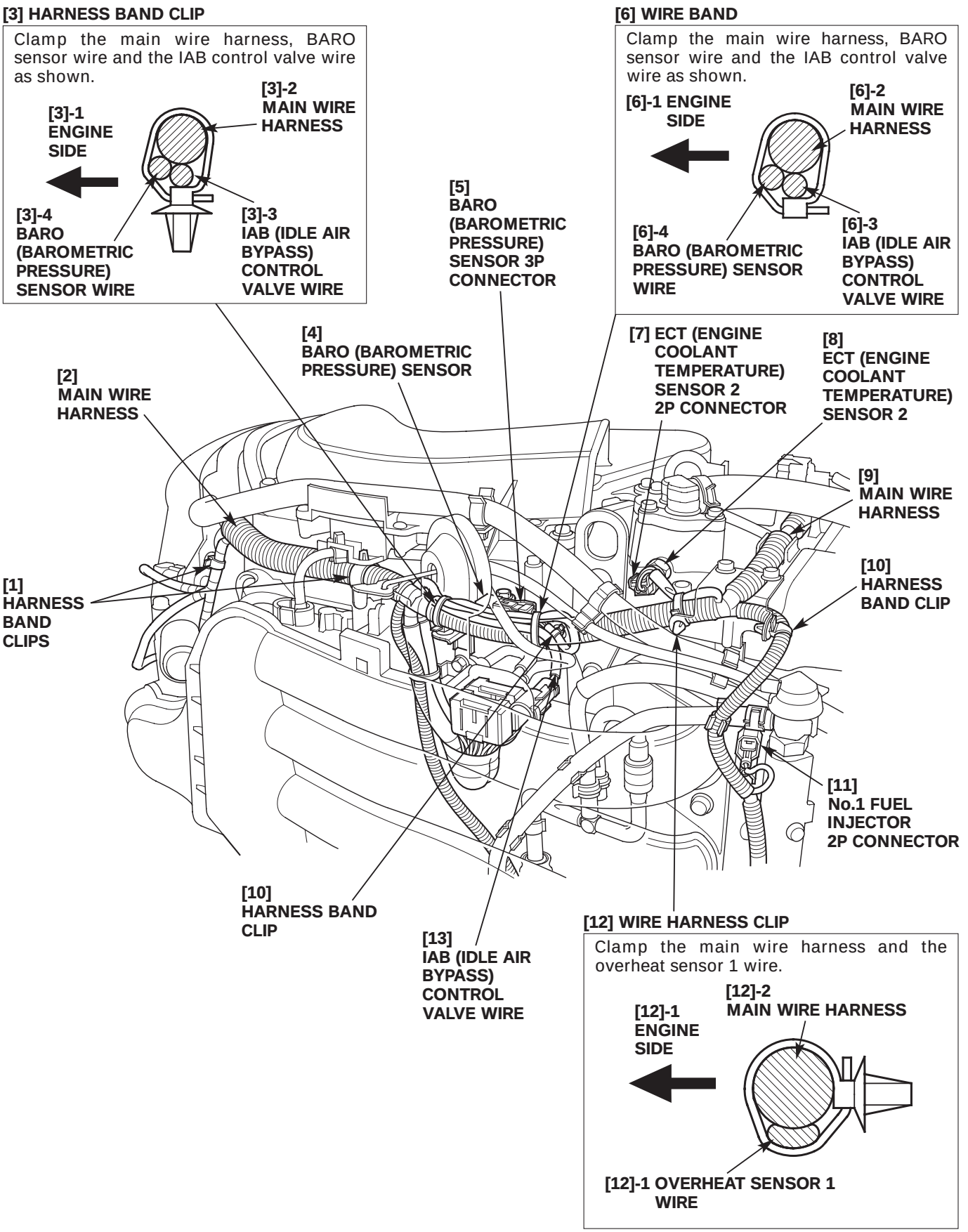




- Clamp the power tilt motor wire, trim angle sensor wire and the speed sensor tube A.
- Install the undercase grommet C aligning the taped ends of the power tilt motor wire and the trim angle sensor wire with the end of the undercase grommet C
- Check that the wires and tube are not interfering with the front lock of the under cover front bracket.

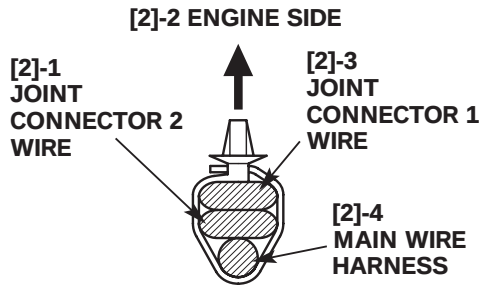


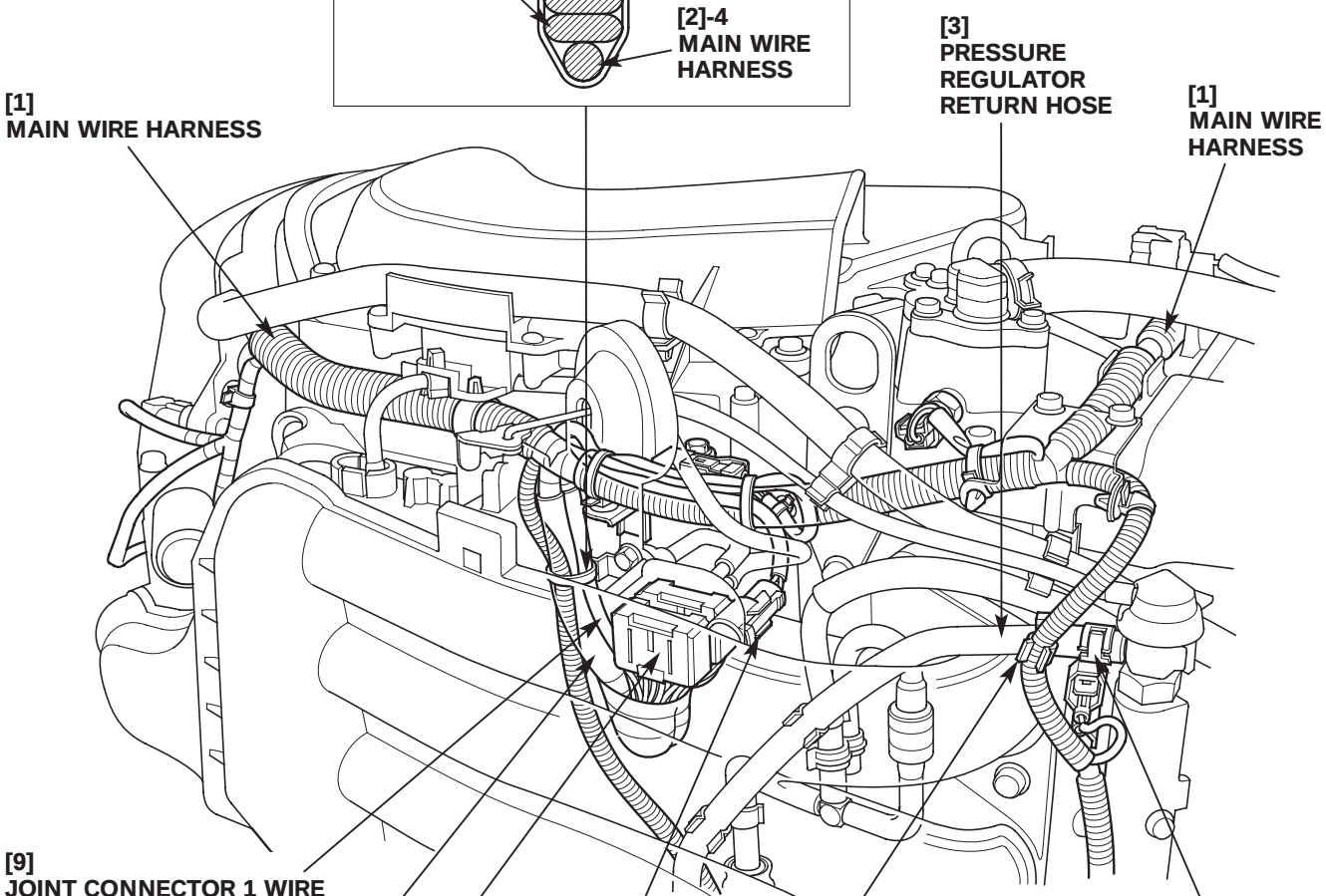

[1] POWER TILT RELAY GROUND TERMINAL
Install pushing the ground terminal against the projection on the crankcase.
[1]-1 GROUND TERMINAL
[1]-2 PROJECTION
[2] HARNESS BAND CLIP
[3] POWER TILT RELAY
[4] WIRE HARNESS CLIP
Clamp the power tilt relay 3P connector, 2P connector and the 1P connector wires as shown.
[2] HARNESS BAND CLIP
[10] MAIN WIRE HARNESS
[2] HARNESS BAND CLIP
[9] NEUTRAL SWITCH 2P CONNECTOR
[5] POWER TILT MOTOR 2P CONNECTOR
[8] CLIP A
[2] HARNESS BAND CLIP
[7] ALTERNATOR FUSE CABLE
[6] POWER TILT RELAY 1P CONNECTOR
[2] HARNESS BAND CLIP
[17] IAT (INTAKE AIR TEMPERATURE) SENSOR
[10] MAIN WIRE HARNESS
[16] IAT (INTAKE AIR TEMPERATURE) SENSOR 2P CONNECTOR
[11] IAC (IDLE AIR CONTROL) VALVE 2P CONNECTOR
[15] MAP (MANIFOLD ABSOLUTE PRESSURE) SENSOR 3P CONNECTOR
[12] IAC (IDLE AIR CONTROL) VALVE
[2] HARNESS BAND CLIP
[14] MAP (MANIFOLD ABSOLUTE PRESSURE) SENSOR
[13] HARNESS CLIP
Clamp the MAP sensor wire in the recess of the intake manifold.


[3] HARNESS BAND CLIP
Clamp the main wire harness, BARO sensor wire and the IAB control valve wire as shown.
[3]-1 ENGINE SIDE
[3]-2 MAIN WIRE HARNESS
[3]-3 IAB (IDLE AIR BYPASS) CONTROL VALVE WIRE
[3]-4 BARO (BAROMETRIC PRESSURE) SENSOR WIRE
[6] WIRE BAND
Clamp the main wire harness, BARO sensor wire and the IAB control valve wire as shown.
[6]-1 ENGINE SIDE
[6]-2 MAIN WIRE HARNESS
[6]-3 IAB (IDLE AIR BYPASS) CONTROL VALVE WIRE
[6]-4 BARO (BAROMETRIC PRESSURE) SENSOR WIRE
[1] HARNESS BAND CLIPS
[2] MAIN WIRE HARNESS
[4] BARO (BAROMETRIC PRESSURE) SENSOR
[5] BARO (BAROMETRIC PRESSURE) SENSOR 3P CONNECTOR
[7] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 2 2P CONNECTOR
[8] ECT (ENGINE COOLANT TEMPERATURE) SENSOR 2
[9] MAIN WIRE HARNESS
[10] HARNESS BAND CLIP
[11] No.1 FUEL INJECTOR 2P CONNECTOR
[10] HARNESS BAND CLIP
[13] IAB (IDLE AIR BYPASS) CONTROL VALVE WIRE
[12] WIRE HARNESS CLIP
Clamp the main wire harness and the overheat sensor 1 wire.
[12]-1 ENGINE SIDE
[12]-2 MAIN WIRE HARNESS
[12]-1 OVERHEAT SENSOR 1 WIRE

[2] HARNESS BAND CLIP

Clamp the main wire harness, joint connector 1 wire and the joint connector 2 wire as shown.



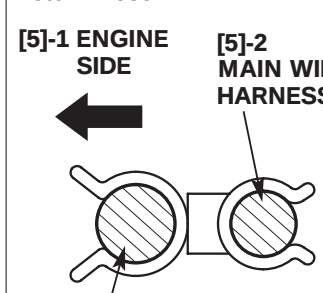


[4] TUBE CLAMP D10.7

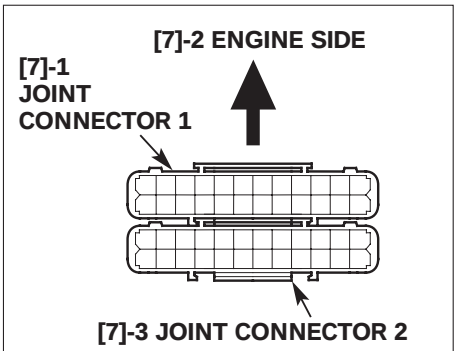
Check that the main wire harness does not interfere with the tube clamp D10.7.

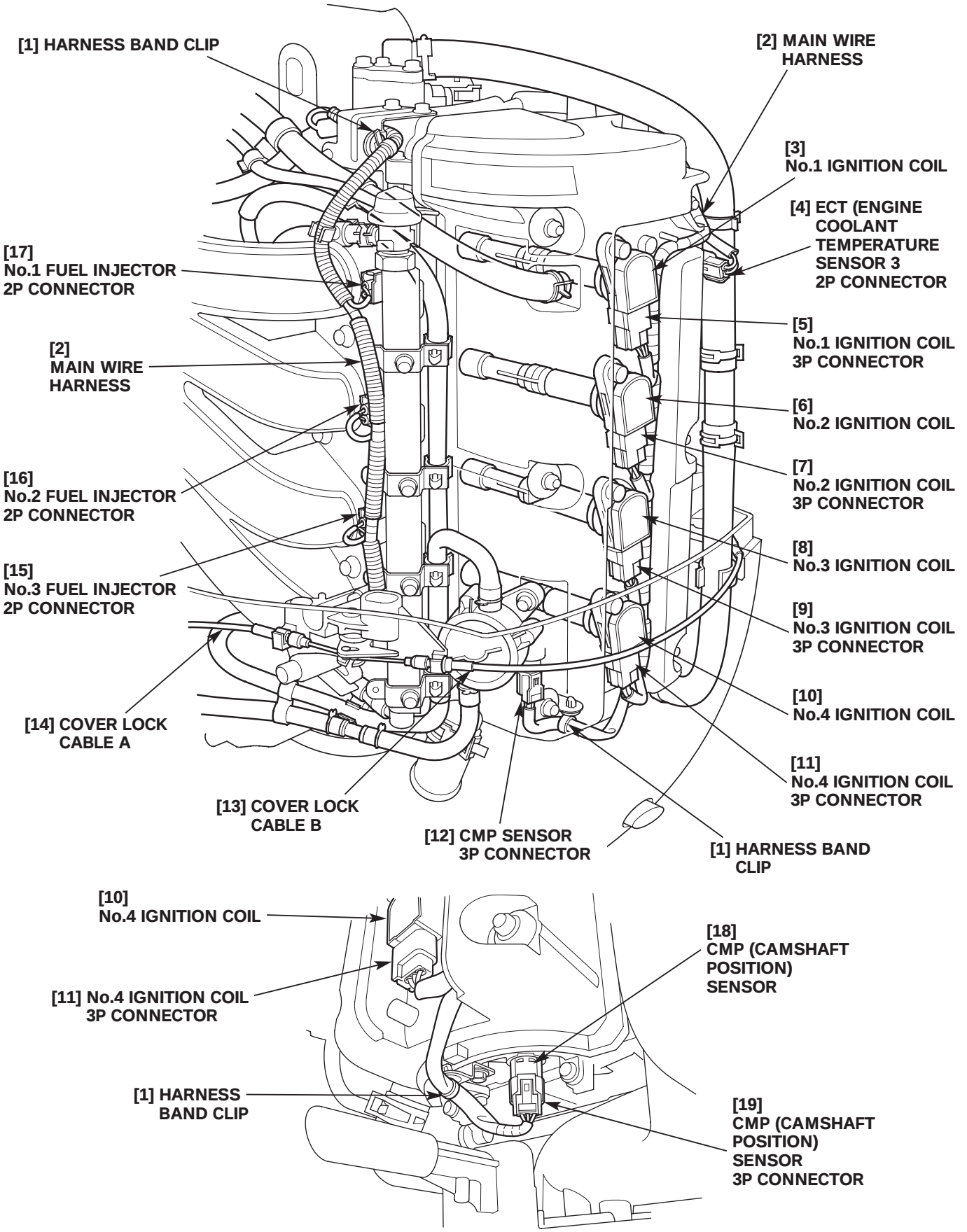
[5] HOSE CLIP

Clamp the main wire harness and the pressure regulator return hose.



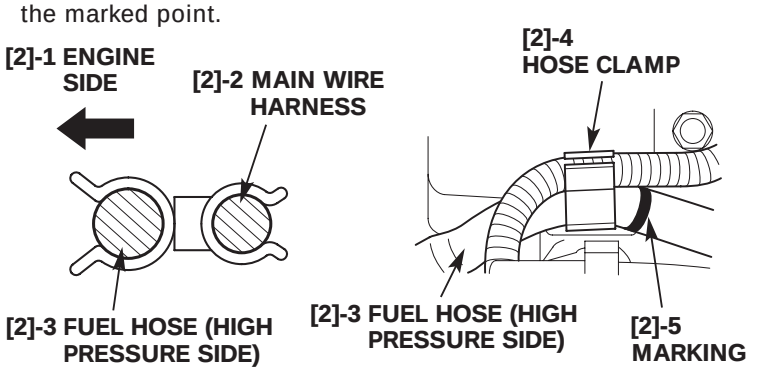
[7] JOINT CONNECTOR ASSEMBLY

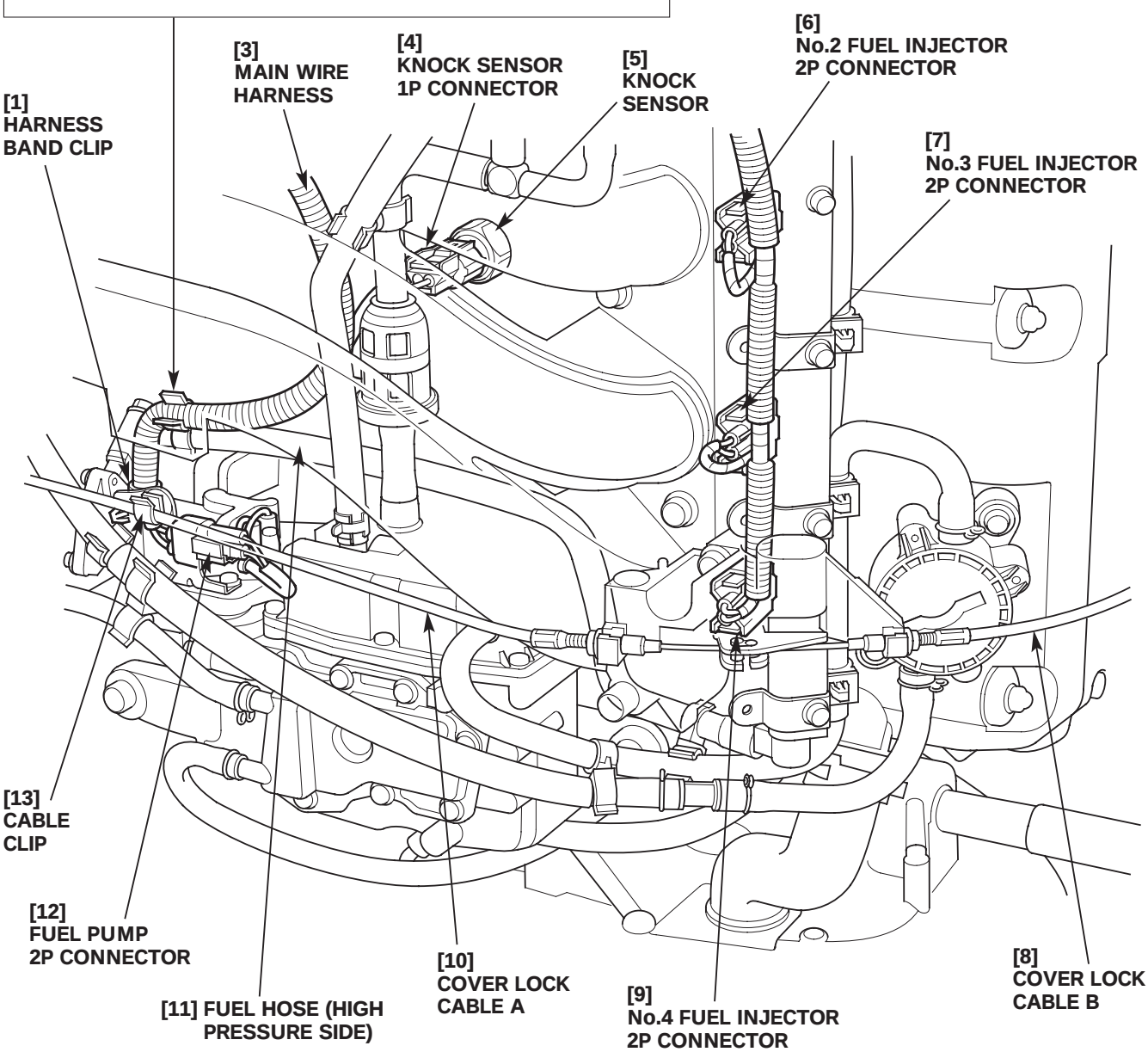


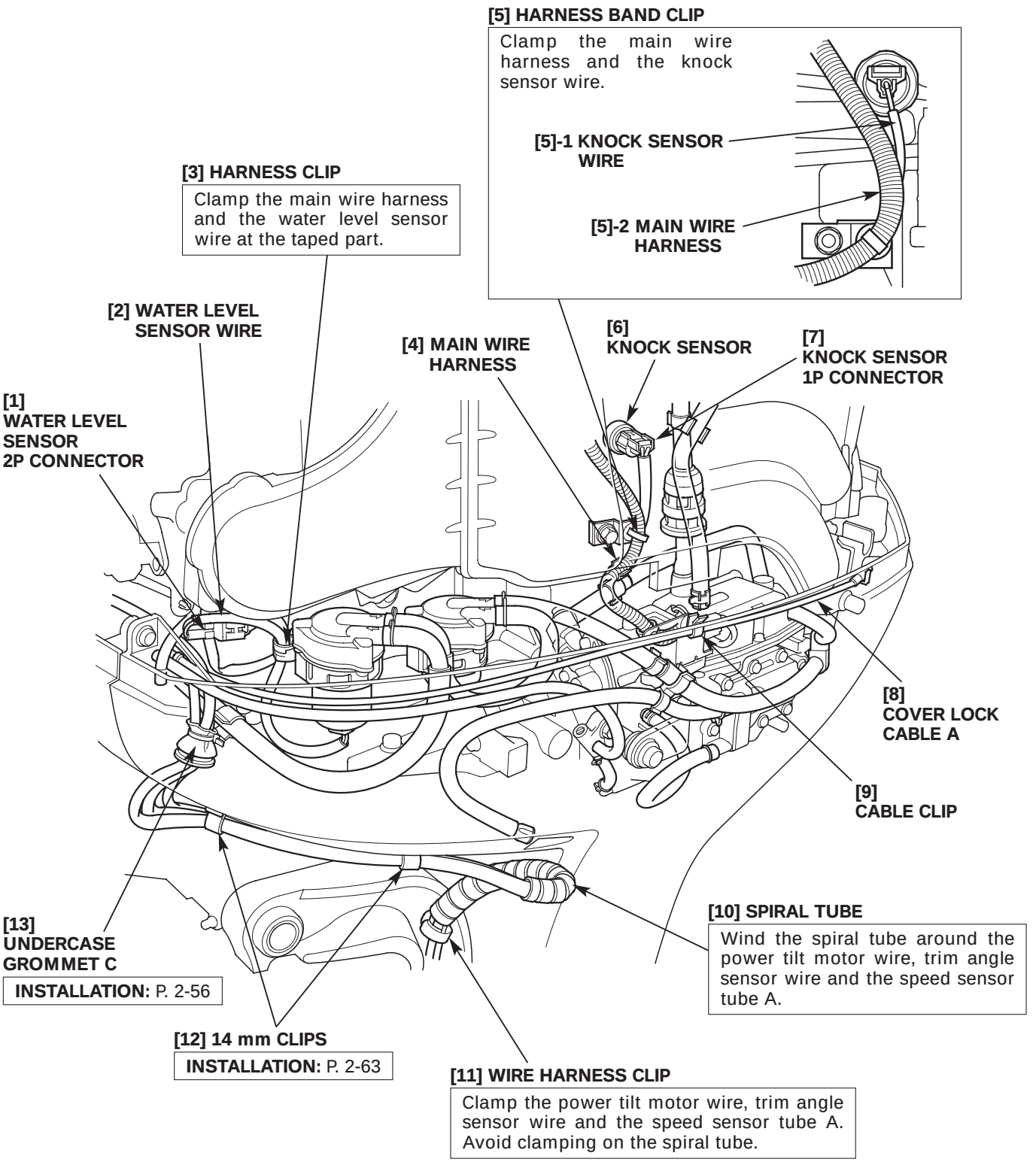

[1] HARNESS BAND CLIP
[2] MAIN WIRE HARNESS
[3] No.1 IGNITION COIL
[4] ECT (ENGINE COOLANT TEMPERATURE SENSOR 3 2P CONNECTOR
[17] No.1 FUEL INJECTOR 2P CONNECTOR
[5] No.1 IGNITION COIL 3P CONNECTOR
[2] MAIN WIRE HARNESS
[6] No.2 IGNITION COIL
[7] No.2 IGNITION COIL 3P CONNECTOR
[16] No.2 FUEL INJECTOR 2P CONNECTOR
[8] No.3 IGNITION COIL
[15] No.3 FUEL INJECTOR 2P CONNECTOR
[9] No.3 IGNITION COIL 3P CONNECTOR
[10] No.4 IGNITION COIL
[14] COVER LOCK CABLE A
[11] No.4 IGNITION COIL 3P CONNECTOR
[13] COVER LOCK CABLE B
[12] CMP SENSOR 3P CONNECTOR
[1] HARNESS BAND CLIP
[10] No.4 IGNITION COIL
[18] CMP (CAMSHAFT POSITION) SENSOR
[11] No.4 IGNITION COIL 3P CONNECTOR
[1] HARNESS BAND CLIP
[19] CMP (CAMSHAFT POSITION) SENSOR 3P CONNECTOR

[2] HOSE CLAMP

- Set the fuel hose (high pressure side) in the clamp of the larger diameter side and the main wire harness in the smaller diameter side.
- Clamp the fuel hose (high pressure side) at the left-hand side to the marked point.

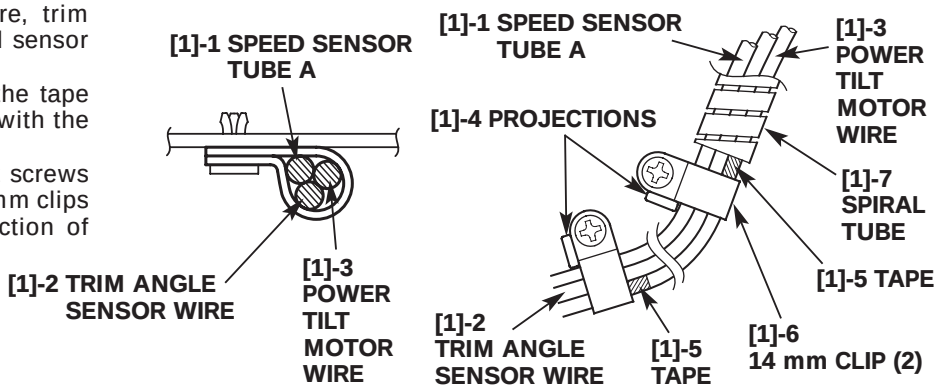


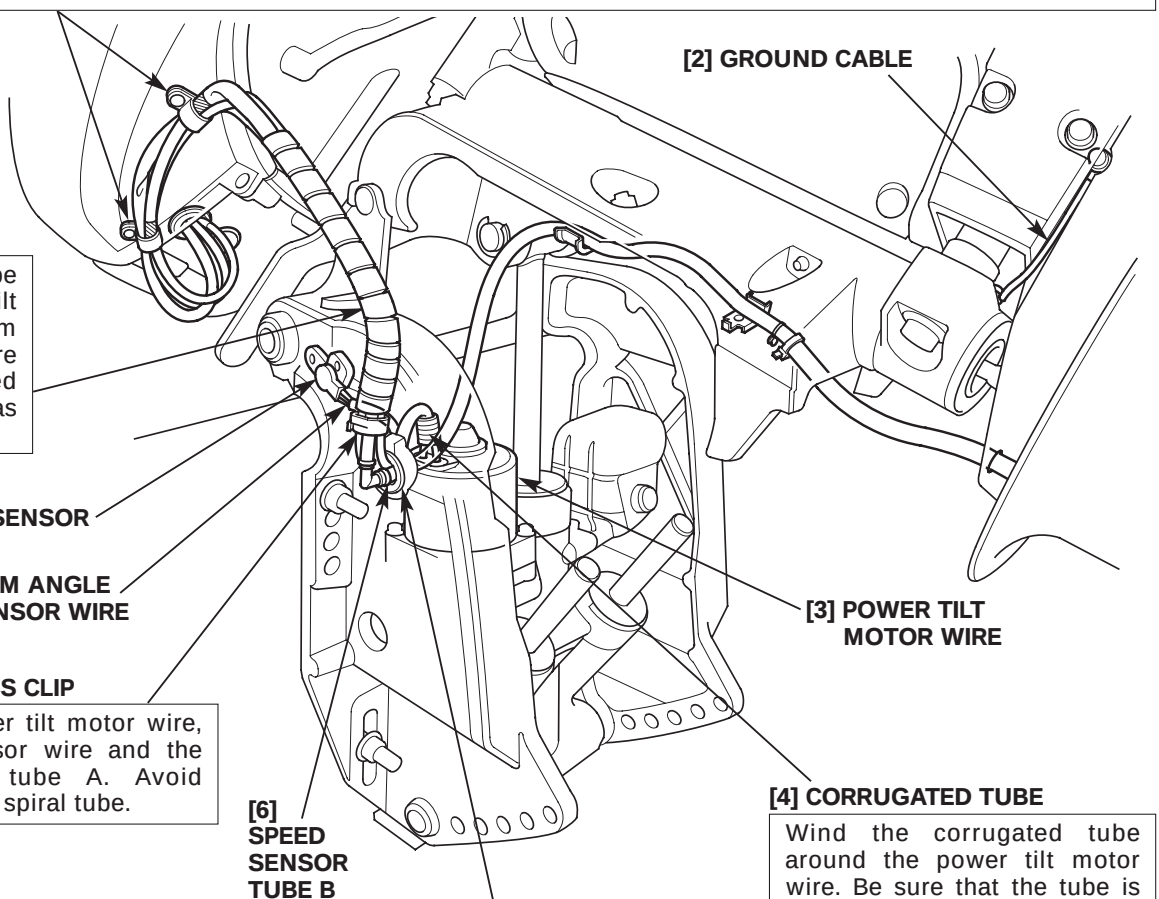



[5] HARNESS BAND CLIP
Clamp the main wire harness and the knock sensor wire.
[5]-1 KNOCK SENSOR WIRE
[5]-2 MAIN WIRE HARNESS
[3] HARNESS CLIP
Clamp the main wire harness and the water level sensor wire at the taped part.
[2] WATER LEVEL SENSOR WIRE
[4] MAIN WIRE HARNESS
[6] KNOCK SENSOR
[7] KNOCK SENSOR 1P CONNECTOR
[1] WATER LEVEL SENSOR 2P CONNECTOR
[8] COVER LOCK CABLE A
[9] CABLE CLIP
[13] UNDERCASE GROMMET C
INSTALLATION: P. 2-56
[10] SPIRAL TUBE
Wind the spiral tube around the power tilt motor wire, trim angle sensor wire and the speed sensor tube A.
[12] 14 mm CLIPS
INSTALLATION: P. 2-63
[11] WIRE HARNESS CLIP
Clamp the power tilt motor wire, trim angle sensor wire and the speed sensor tube A. Avoid clamping on the spiral tube.

[1] 14 mm CLIPS

- Clamp the power tilt motor wire, trim angle sensor wire and the speed sensor tube A.
- Install the 14 mm clip aligning the tape end of the power tilt motor wire with the 14 mm clip end.
- Tighten the two 5 x 10 mm rivet screws while pushing the respective 14 mm clips against the corresponding projection of the mounting case.





[10] SPIRAL TUBE

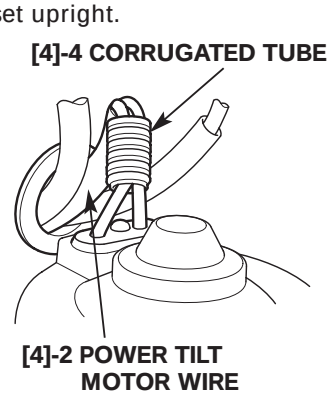
Set the spiral tube on the power tilt motor wire, trim angle sensor wire and the speed sensor wire as shown.

[7] WIRE HARNESS CLIP

Clamp the power tilt motor wire, trim angle sensor wire and the speed sensor tube A. Avoid clamping on the spiral tube.

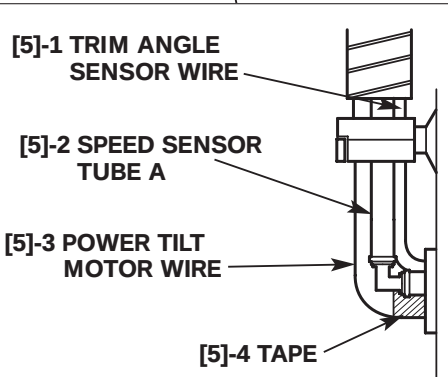
[4] CORRUGATED TUBE

Wind the corrugated tube around the power tilt motor wire. Be sure that the tube is set upright.



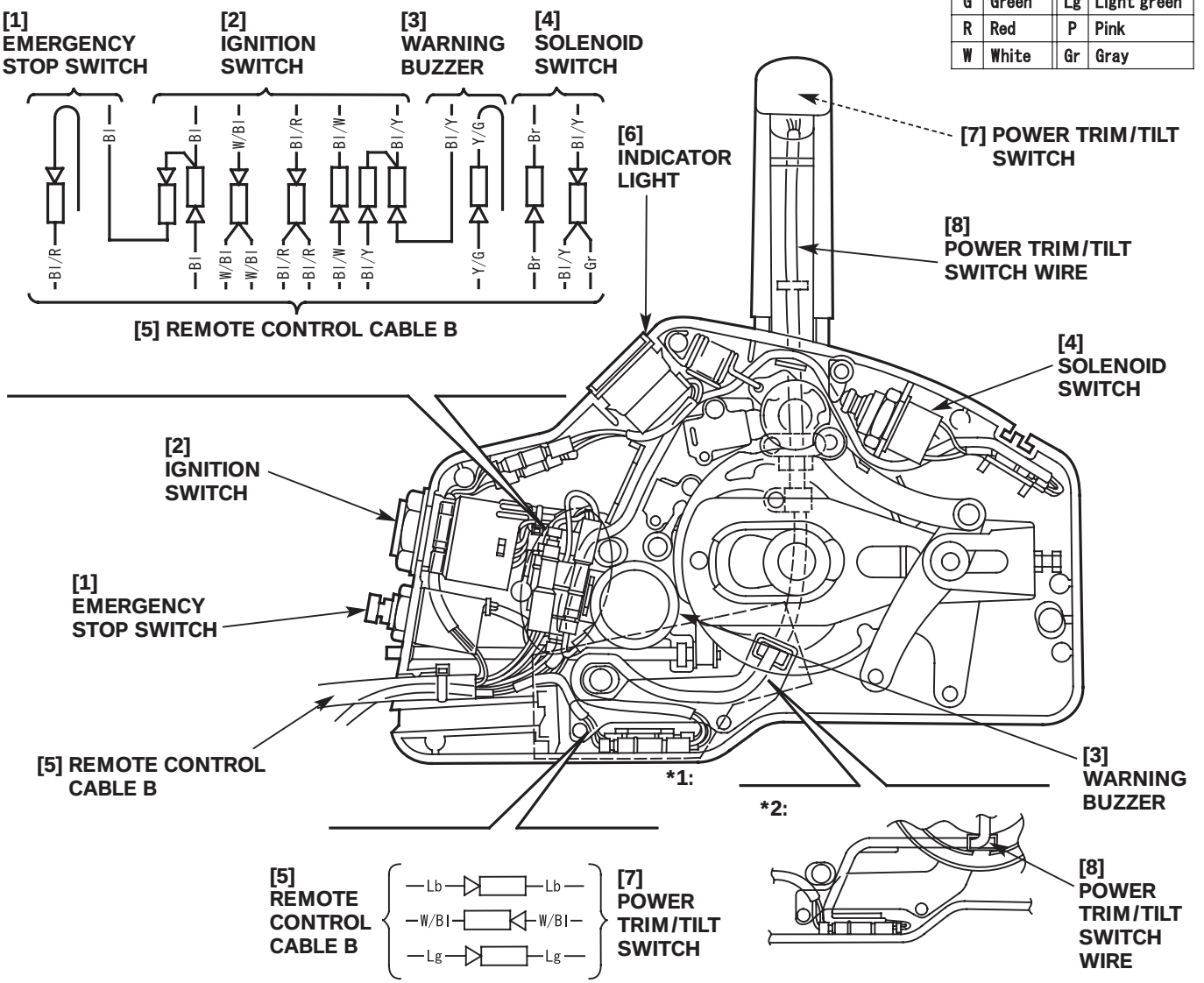
[5] MOTOR CORD BUSHING

Pass the power tilt motor wire, trim angle sensor wire and the speed sensor tube B through the motor cord bushing. Align the tape end of the power tilt motor wire with the end of the motor cord bushing.



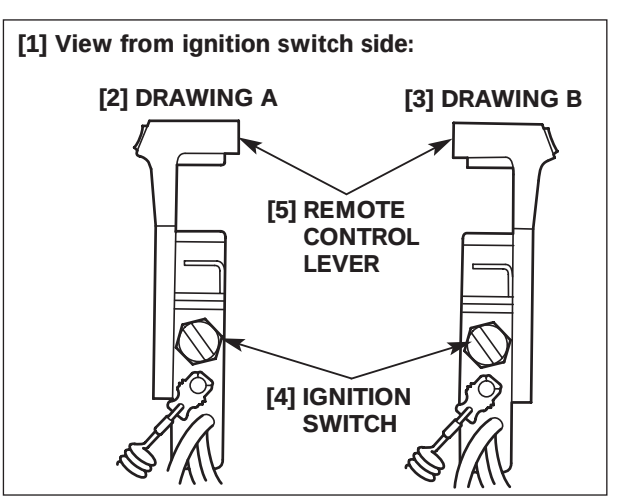
• Side-mount remote control

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

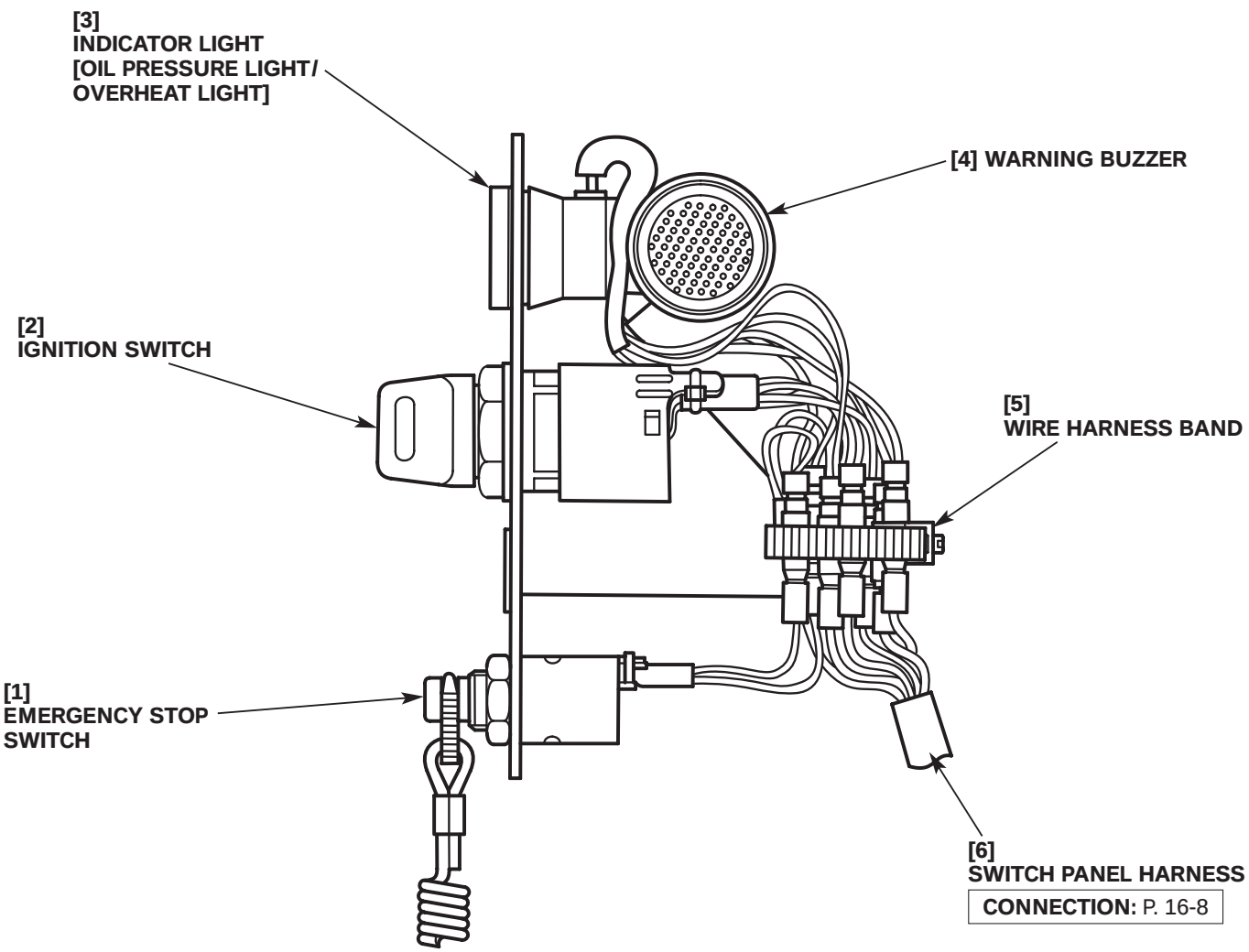


*1: Power trim/tilt switch wire routing when the remote control lever is installed as shown in the drawing A.

*2: Power trim/tilt switch wire routing when the remote control lever is installed as shown in the drawing B.



• **Control panel**

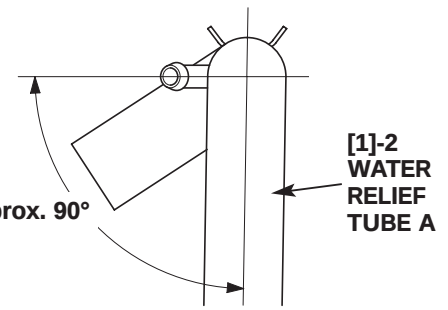


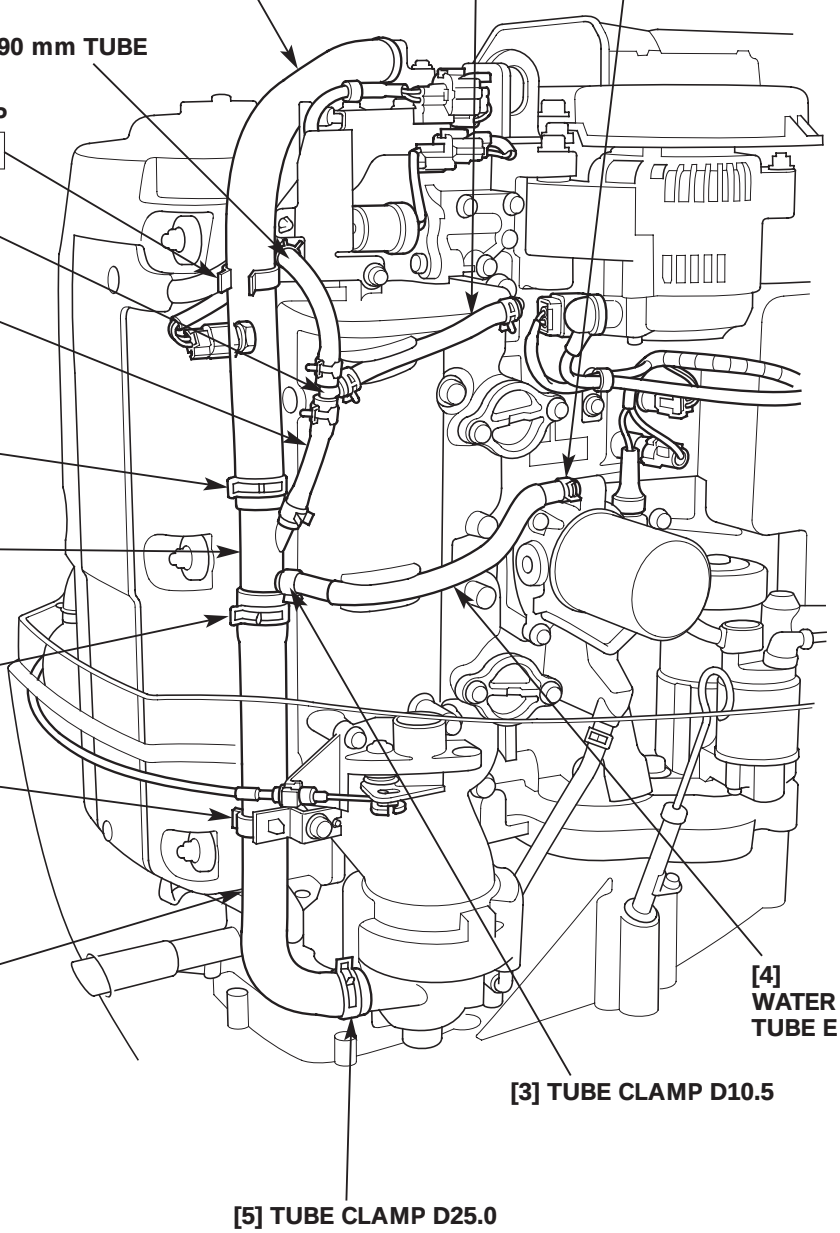
CONNECTION: P. 16-8

11. TUBE ROUTING

[1] WATER RELIEF TUBE A

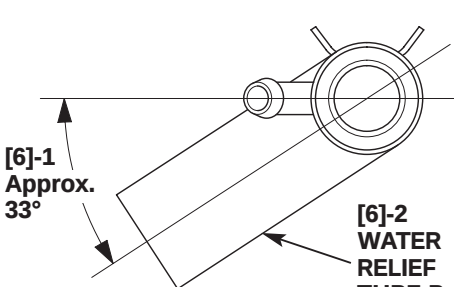
- Install at approximately right angles to the horizontal line.
- After installation, check the tube for twist, bend, etc.





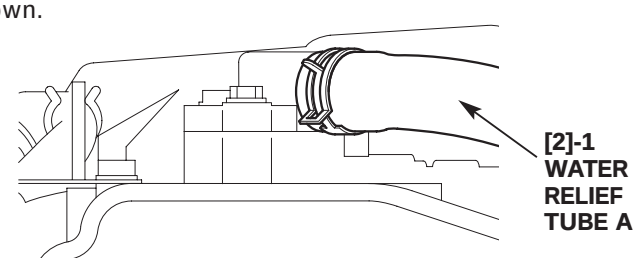
[6] WATER RELIEF TUBE B

- Install at 33° from the horizontal line.
- After installation, check the tube for twist, bend, etc.

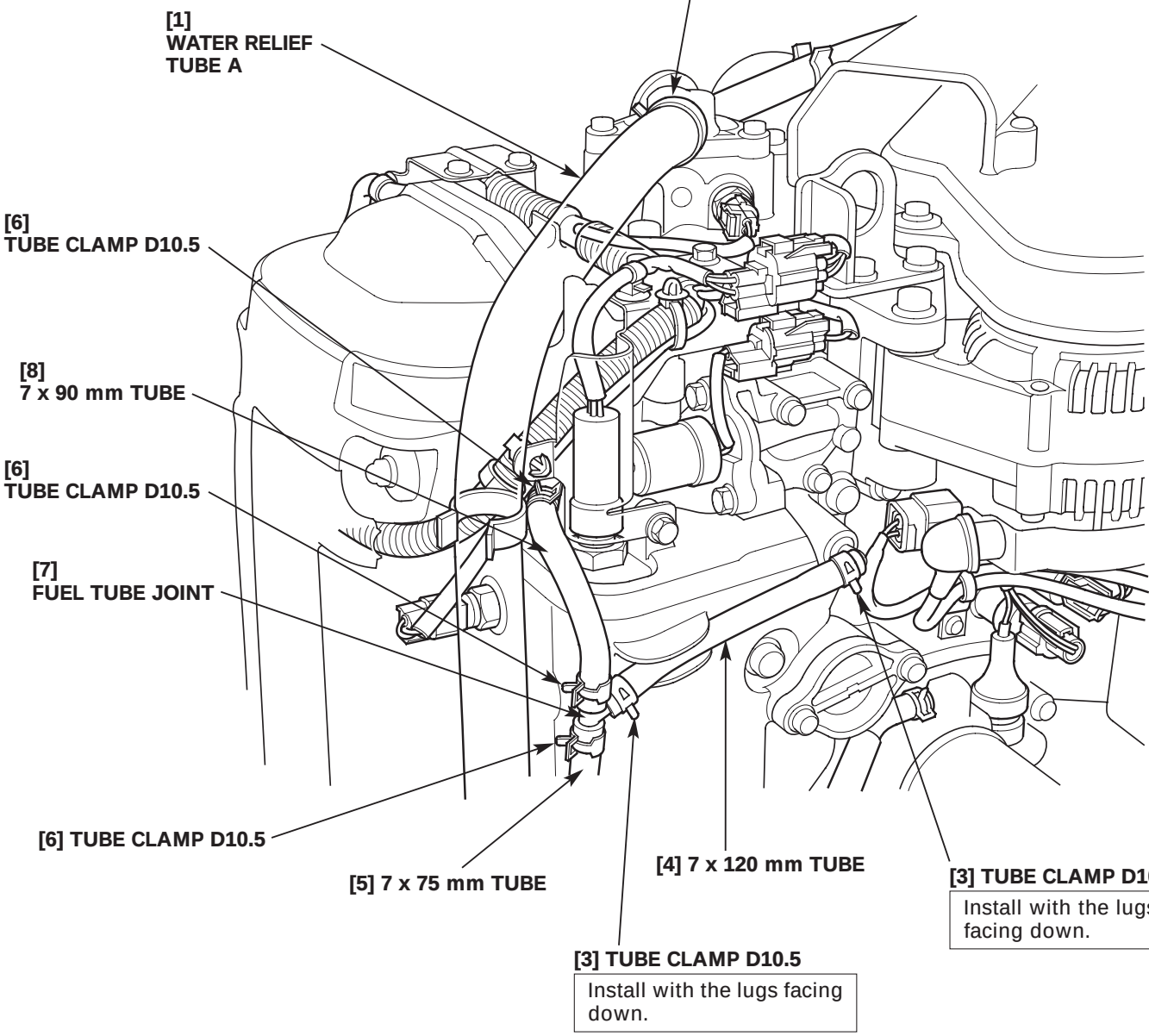


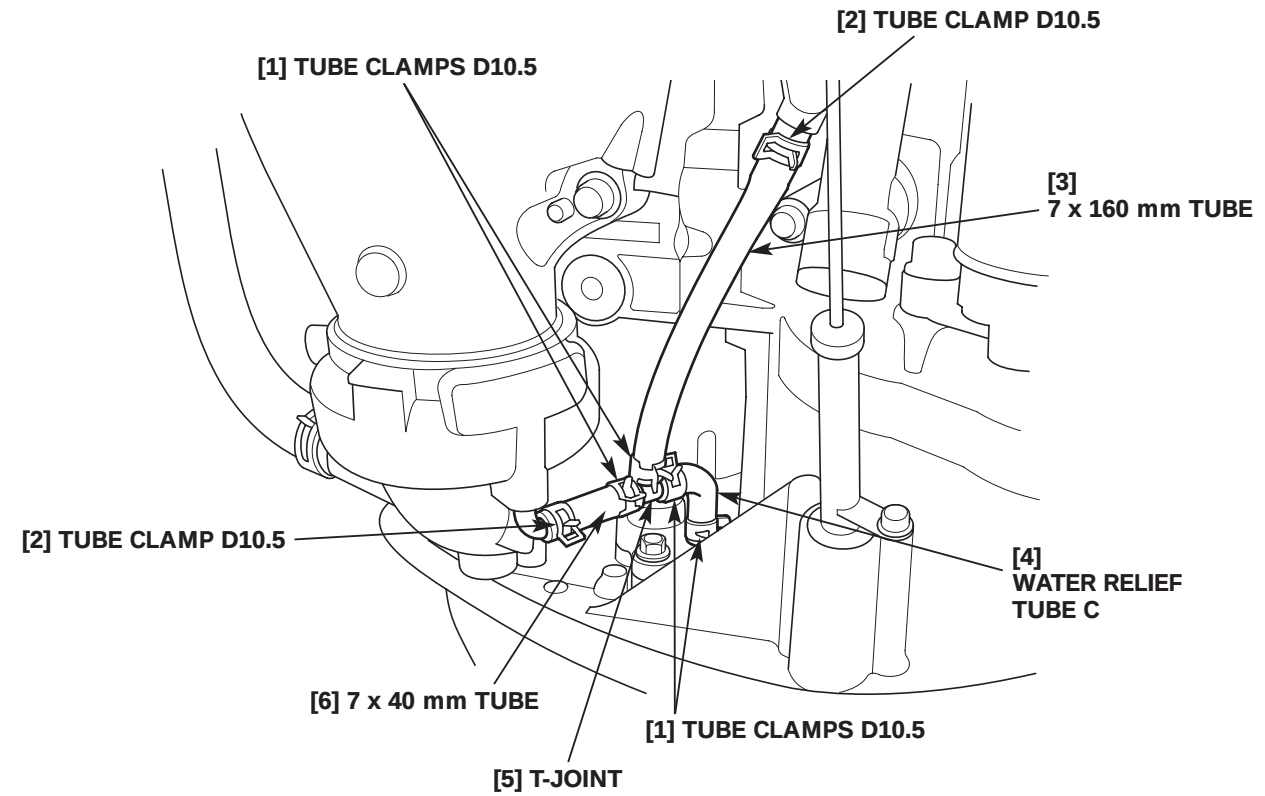
[2] TUBE CLAMP D25.0

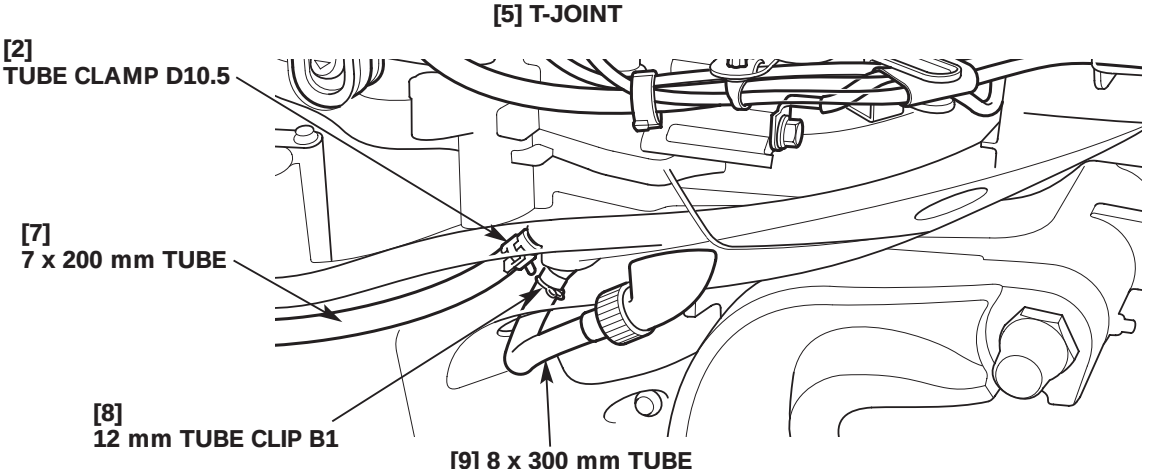
Install the tube clamp with the lugs facing in the direction shown.

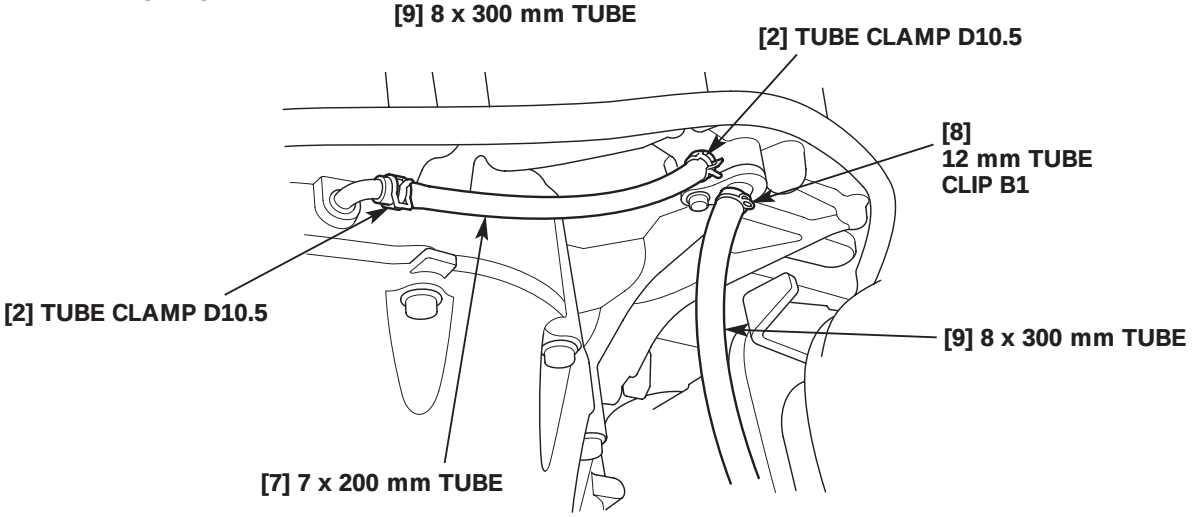


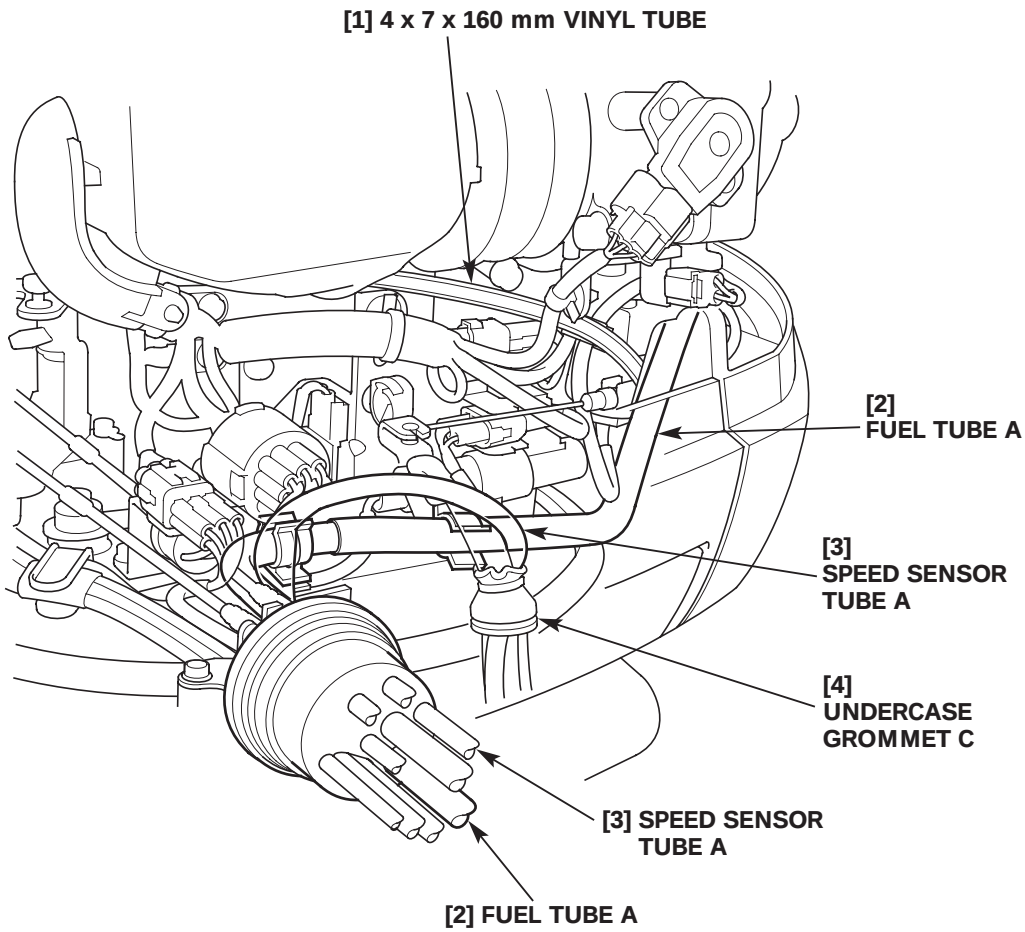
[2]-2 <Cylinder head cover viewed from the front>

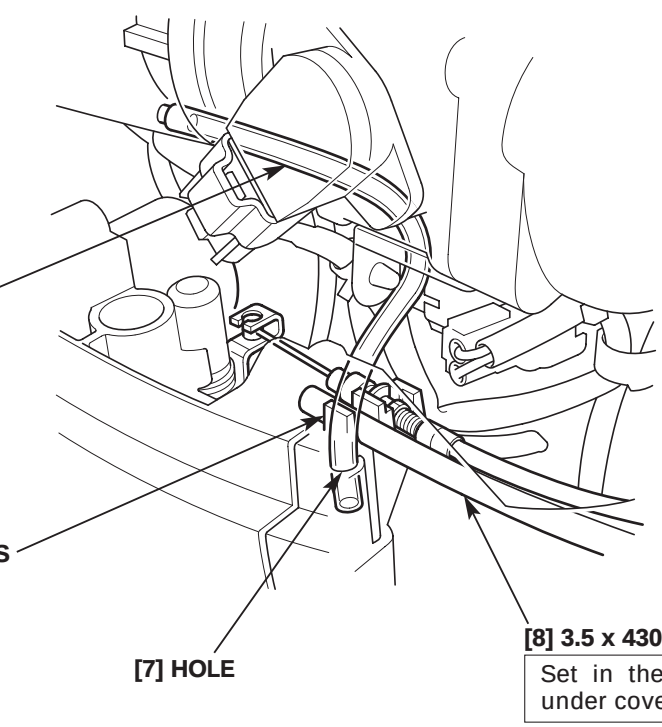


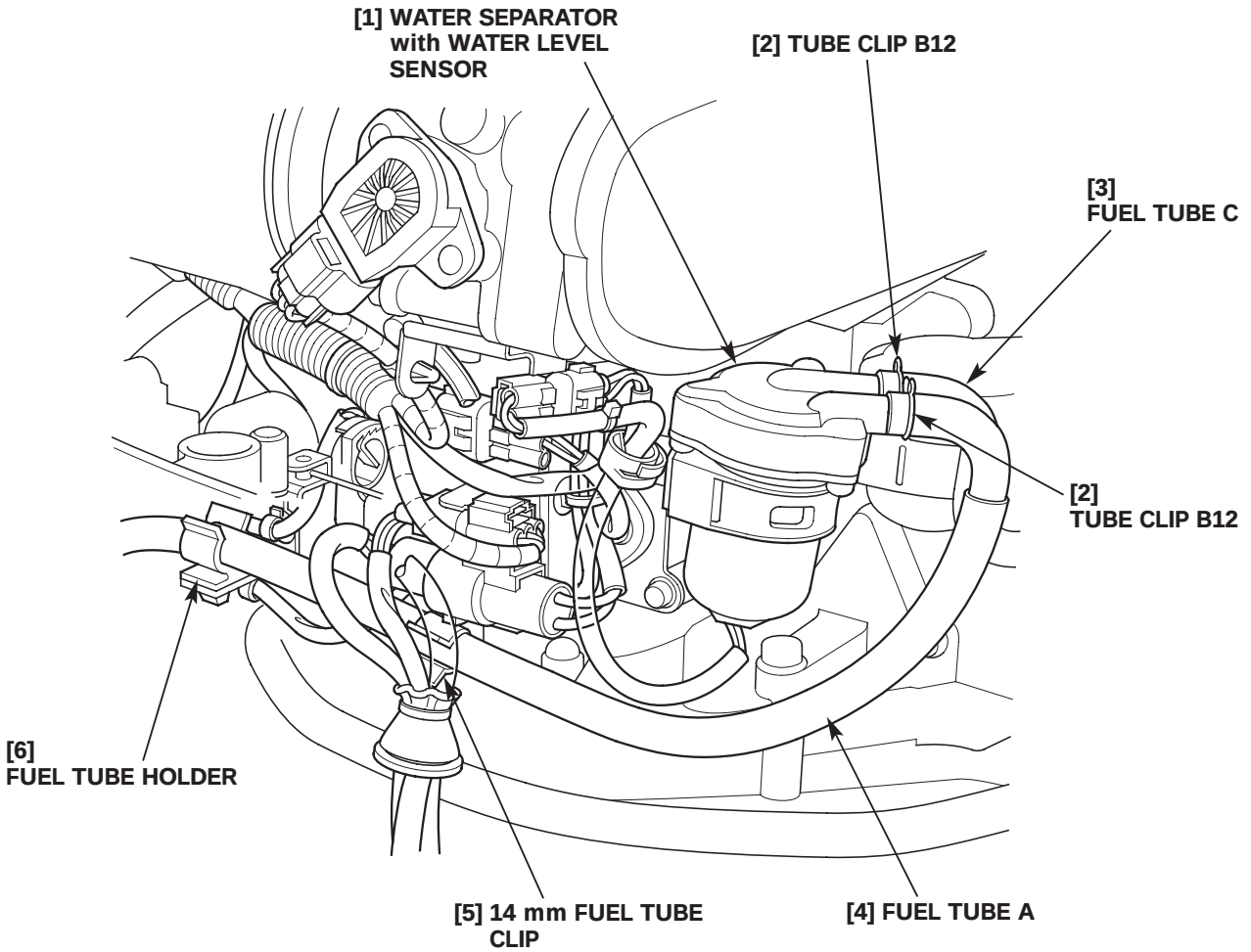

[2] TUBE CLAMP D10.5
[1] TUBE CLAMPS D10.5
[3]
7 x 160 mm TUBE
[2] TUBE CLAMP D10.5
[4]
WATER RELIEF
TUBE C
[6] 7 x 40 mm TUBE
[1] TUBE CLAMPS D10.5
[5] T-JOINT

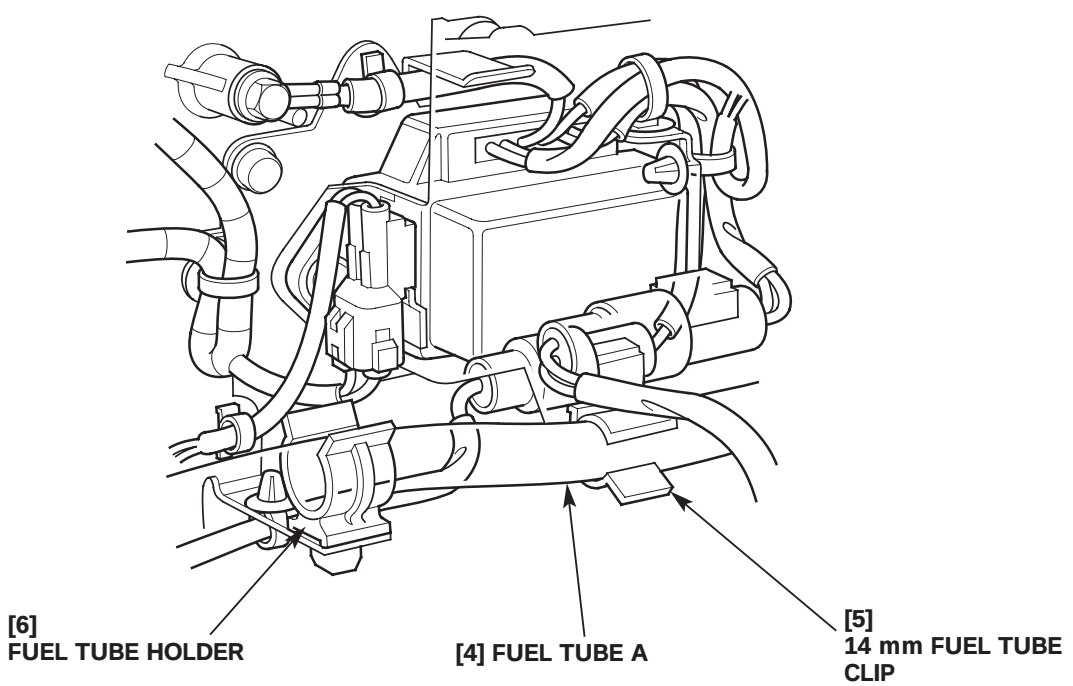

[2]
TUBE CLAMP D10.5
[7]
7 x 200 mm TUBE
[8]
12 mm TUBE CLIP B1
[9] 8 x 300 mm TUBE

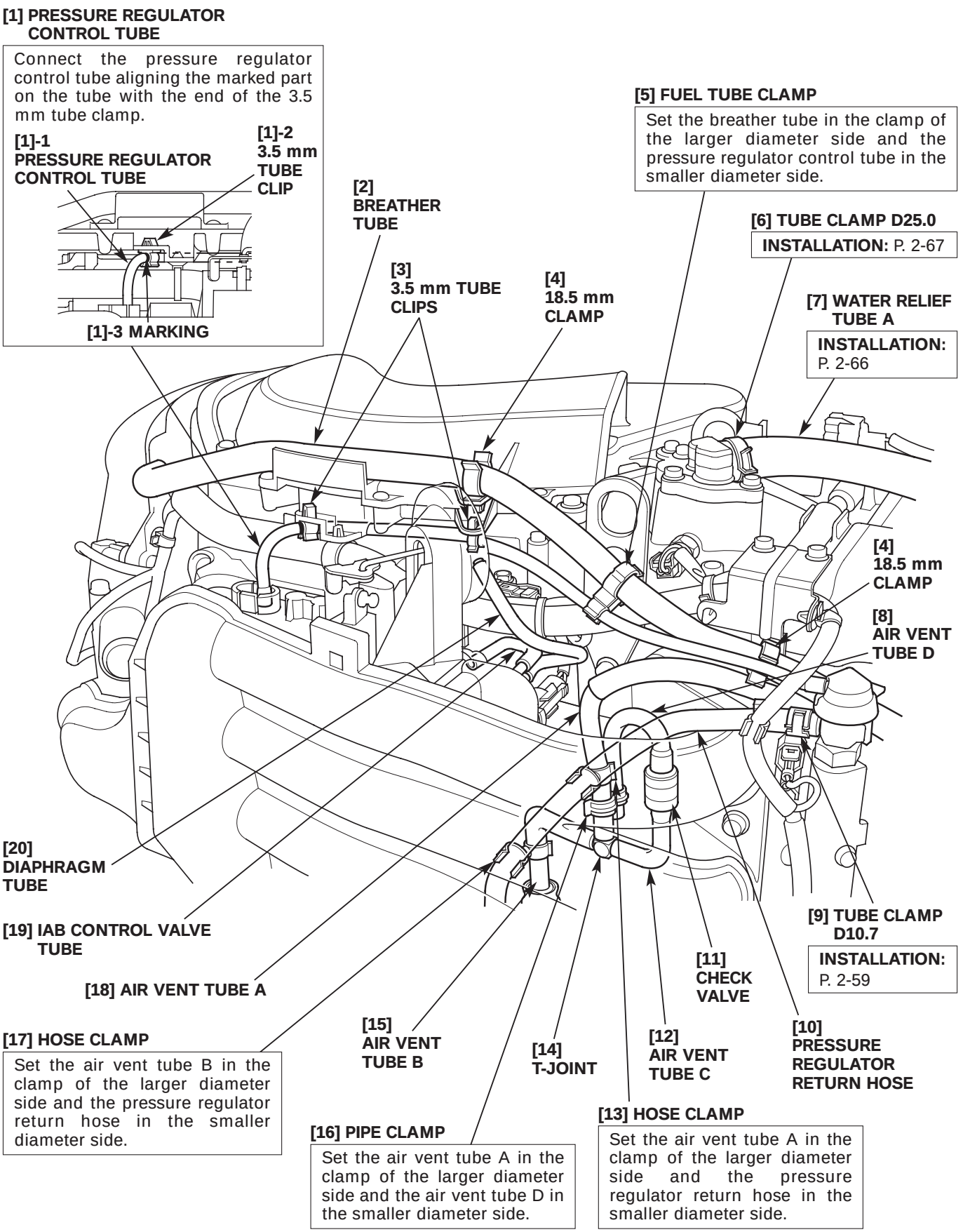

[2] TUBE CLAMP D10.5
[8]
12 mm TUBE
CLIP B1
[2] TUBE CLAMP D10.5
[9] 8 x 300 mm TUBE
[7] 7 x 200 mm TUBE

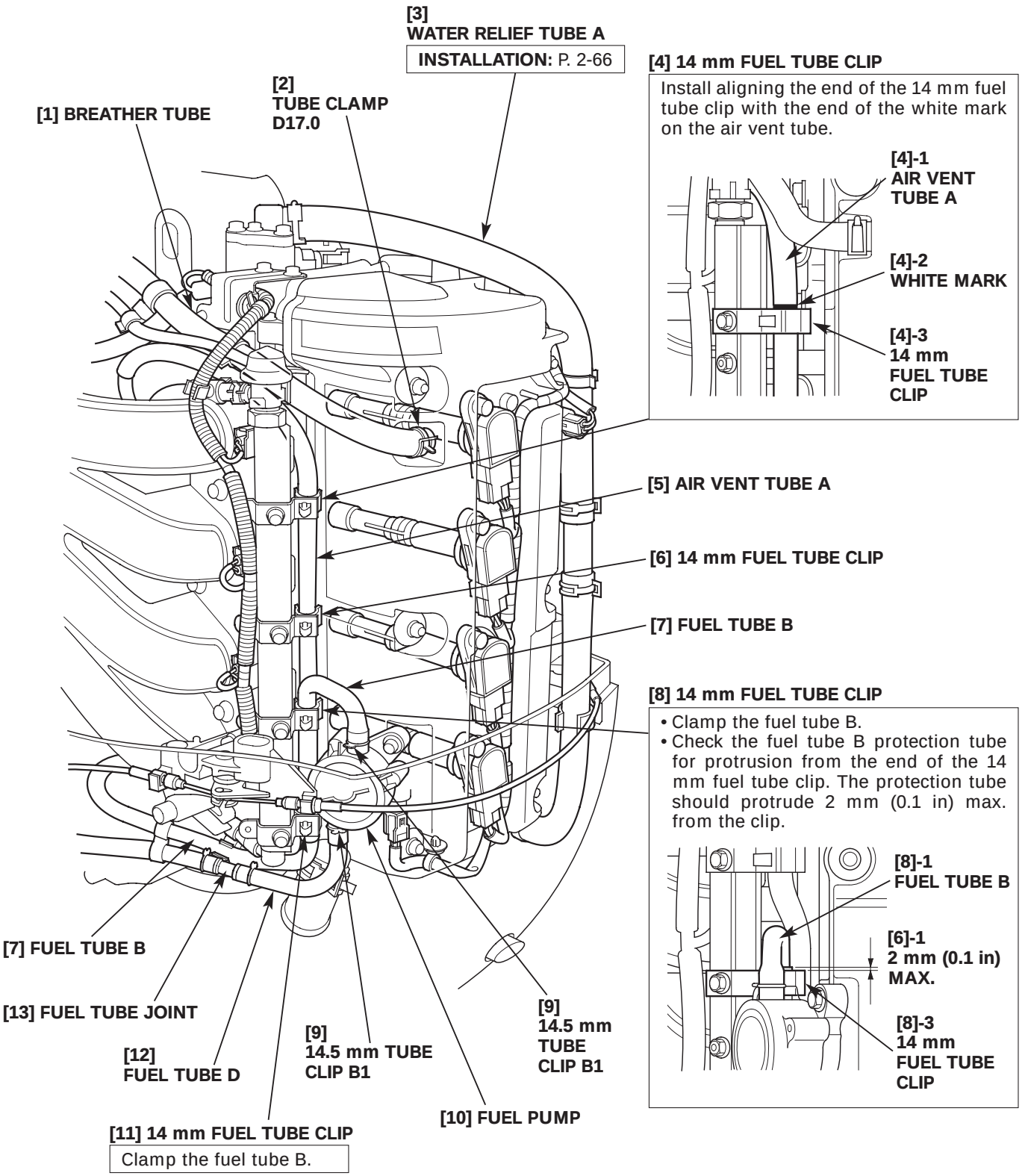

[1] 4 x 7 x 160 mm VINYL TUBE
[2]
FUEL TUBE A
[3]
SPEED SENSOR
TUBE A
[4]
UNDERCASE
GROMMET C
[3] SPEED SENSOR
TUBE A
[2] FUEL TUBE A

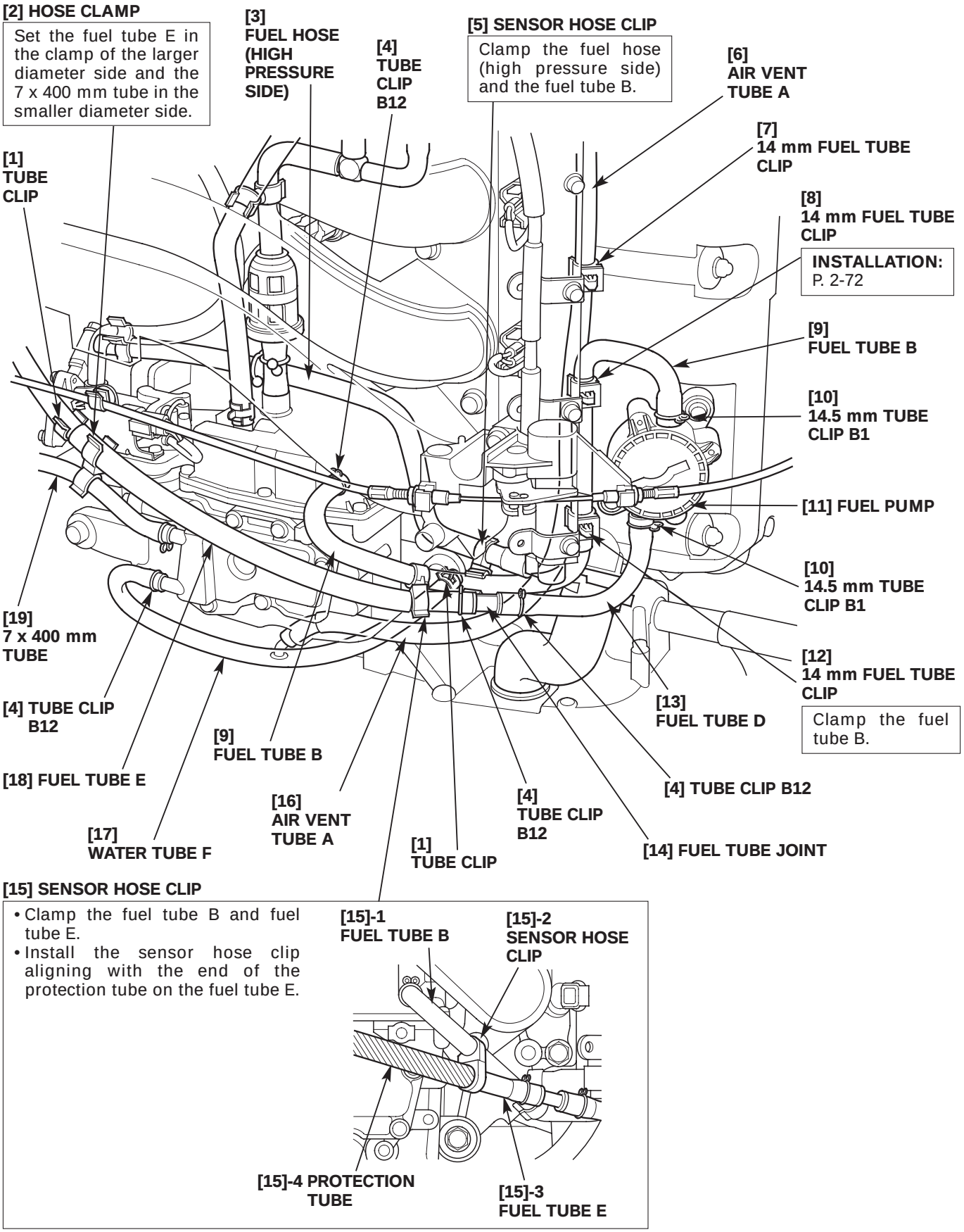

[5]
4 x 7 x 160 mm VINYL
TUBE
Insert into the hole in the under cover front bracket securely.
[6] RECESS
[7] HOLE
[8] 3.5 x 430 mm FUEL TUBE
Set in the recess in the under cover front bracket.

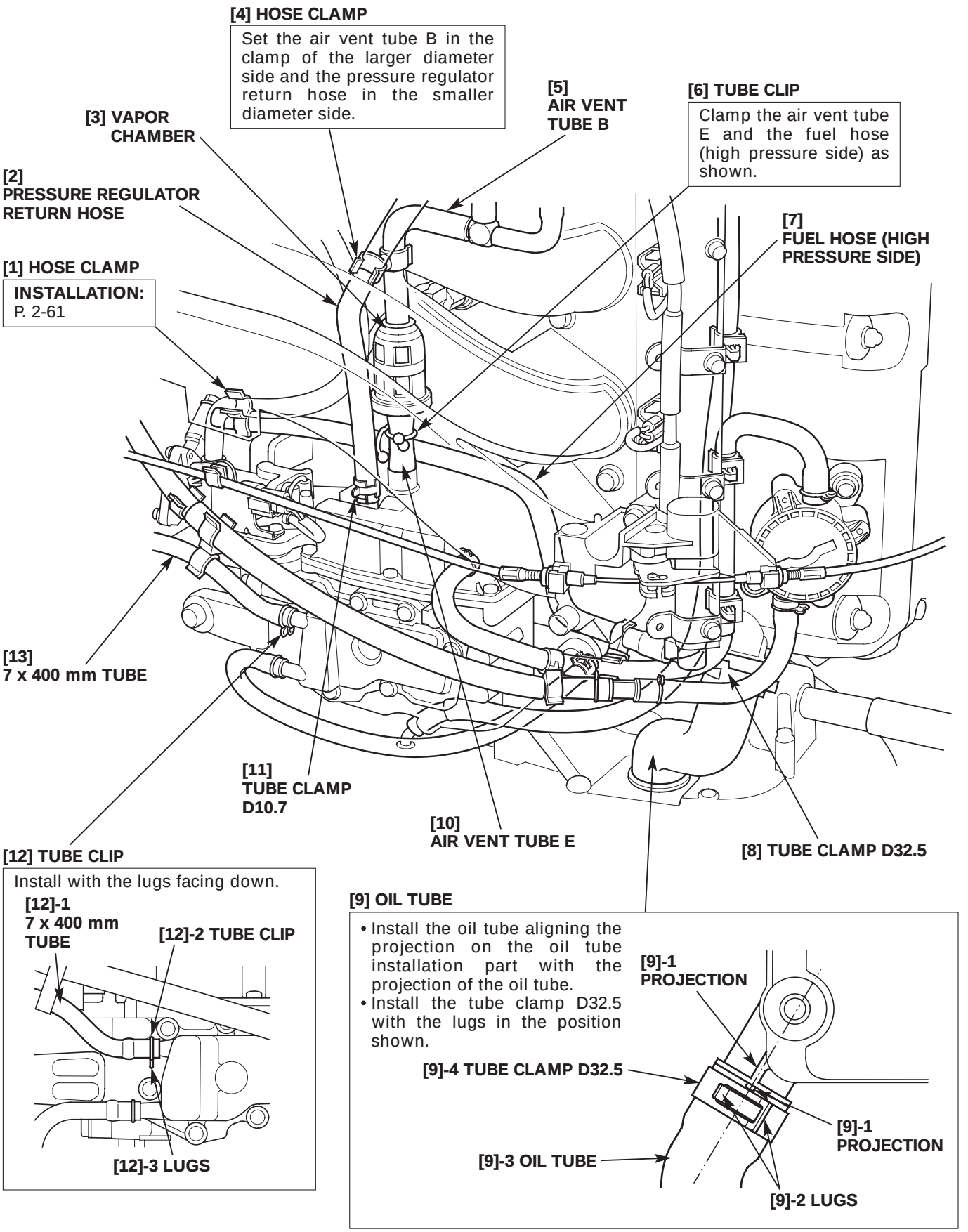

[1] WATER SEPARATOR with WATER LEVEL SENSOR
[2] TUBE CLIP B12
[3] FUEL TUBE C
[2] TUBE CLIP B12
[6] FUEL TUBE HOLDER
[5] 14 mm FUEL TUBE CLIP
[4] FUEL TUBE A

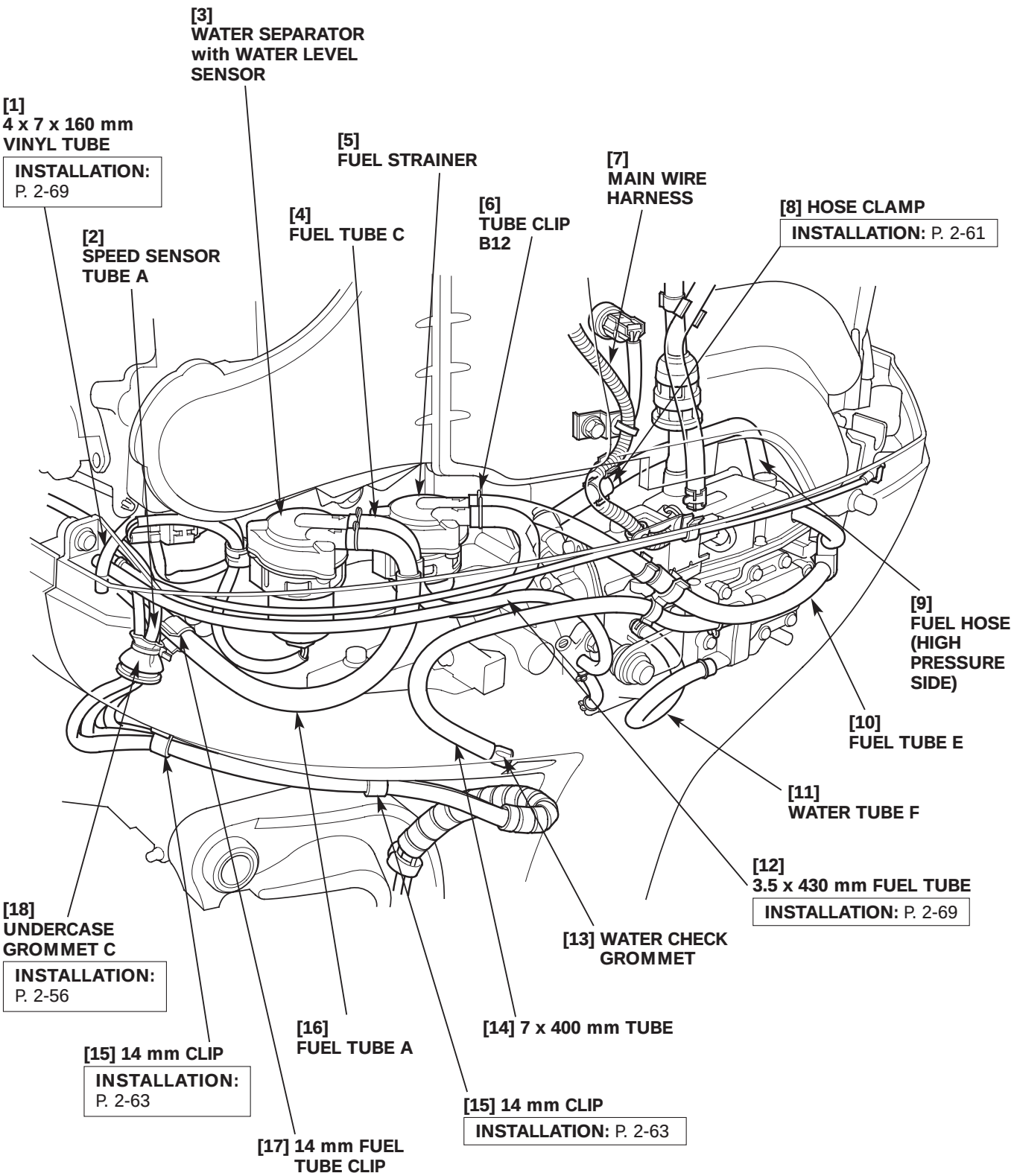

[6] FUEL TUBE HOLDER
[4] FUEL TUBE A
[5] 14 mm FUEL TUBE CLIP


[1] PRESSURE REGULATOR CONTROL TUBE
Connect the pressure regulator control tube aligning the marked part on the tube with the end of the 3.5 mm tube clamp.
[1]-1 PRESSURE REGULATOR CONTROL TUBE
[1]-2 3.5 mm TUBE CLIP
[1]-3 MARKING
[2] BREATHER TUBE
[3] 3.5 mm TUBE CLIPS
[4] 18.5 mm CLAMP
[5] FUEL TUBE CLAMP
Set the breather tube in the clamp of the larger diameter side and the pressure regulator control tube in the smaller diameter side.
[6] TUBE CLAMP D25.0
INSTALLATION: P. 2-67
[7] WATER RELIEF TUBE A
INSTALLATION: P. 2-66
[4] 18.5 mm CLAMP
[8] AIR VENT TUBE D
[9] TUBE CLAMP D10.7
INSTALLATION: P. 2-59
[10] PRESSURE REGULATOR RETURN HOSE
[11] CHECK VALVE
[12] AIR VENT TUBE C
[13] HOSE CLAMP
Set the air vent tube A in the clamp of the larger diameter side and the pressure regulator return hose in the smaller diameter side.
[14] T-JOINT
[15] AIR VENT TUBE B
[16] PIPE CLAMP
Set the air vent tube A in the clamp of the larger diameter side and the air vent tube D in the smaller diameter side.
[17] HOSE CLAMP
Set the air vent tube B in the clamp of the larger diameter side and the pressure regulator return hose in the smaller diameter side.
[18] AIR VENT TUBE A
[19] IAB CONTROL VALVE TUBE
[20] DIAPHRAGM TUBE


[3]
WATER RELIEF TUBE A
INSTALLATION: P. 2-66
[4] 14 mm FUEL TUBE CLIP
Install aligning the end of the 14 mm fuel tube clip with the end of the white mark on the air vent tube.
[4]-1
AIR VENT TUBE A
[4]-2
WHITE MARK
[4]-3
14 mm FUEL TUBE CLIP
[2]
TUBE CLAMP
D17.0
[1] BREATHER TUBE
[5] AIR VENT TUBE A
[6] 14 mm FUEL TUBE CLIP
[7] FUEL TUBE B
[8] 14 mm FUEL TUBE CLIP
• Clamp the fuel tube B.
• Check the fuel tube B protection tube for protrusion from the end of the 14 mm fuel tube clip. The protection tube should protrude 2 mm (0.1 in) max. from the clip.
[8]-1
FUEL TUBE B
[6]-1
2 mm (0.1 in)
MAX.
[8]-3
14 mm FUEL TUBE CLIP
[7] FUEL TUBE B
[13] FUEL TUBE JOINT
[12]
FUEL TUBE D
[9]
14.5 mm TUBE CLIP B1
[9]
14.5 mm TUBE CLIP B1
[10] FUEL PUMP
[11] 14 mm FUEL TUBE CLIP
Clamp the fuel tube B.

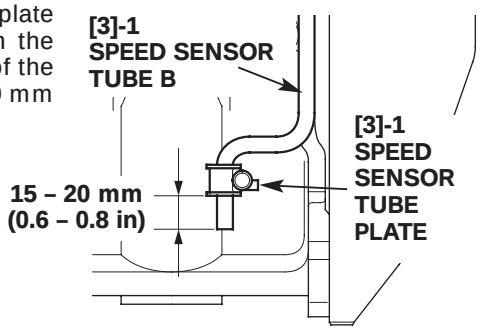

[2] HOSE CLAMP
Set the fuel tube E in the clamp of the larger diameter side and the 7 x 400 mm tube in the smaller diameter side.
[3] FUEL HOSE (HIGH PRESSURE SIDE)
[4] TUBE CLIP B12
[5] SENSOR HOSE CLIP
Clamp the fuel hose (high pressure side) and the fuel tube B.
[6] AIR VENT TUBE A
[7] 14 mm FUEL TUBE CLIP
[8] 14 mm FUEL TUBE CLIP
INSTALLATION: P. 2-72
[1] TUBE CLIP
[9] FUEL TUBE B
[10] 14.5 mm TUBE CLIP B1
[11] FUEL PUMP
[10] 14.5 mm TUBE CLIP B1
[12] 14 mm FUEL TUBE CLIP
Clamp the fuel tube B.
[13] FUEL TUBE D
[19] 7 x 400 mm TUBE
[4] TUBE CLIP B12
[9] FUEL TUBE B
[18] FUEL TUBE E
[4] TUBE CLIP B12
[16] AIR VENT TUBE A
[4] TUBE CLIP B12
[17] WATER TUBE F
[1] TUBE CLIP
[14] FUEL TUBE JOINT
[15] SENSOR HOSE CLIP
• Clamp the fuel tube B and fuel tube E.
• Install the sensor hose clip aligning with the end of the protection tube on the fuel tube E.
[15]-1 FUEL TUBE B
[15]-2 SENSOR HOSE CLIP
[15]-4 PROTECTION TUBE
[15]-3 FUEL TUBE E

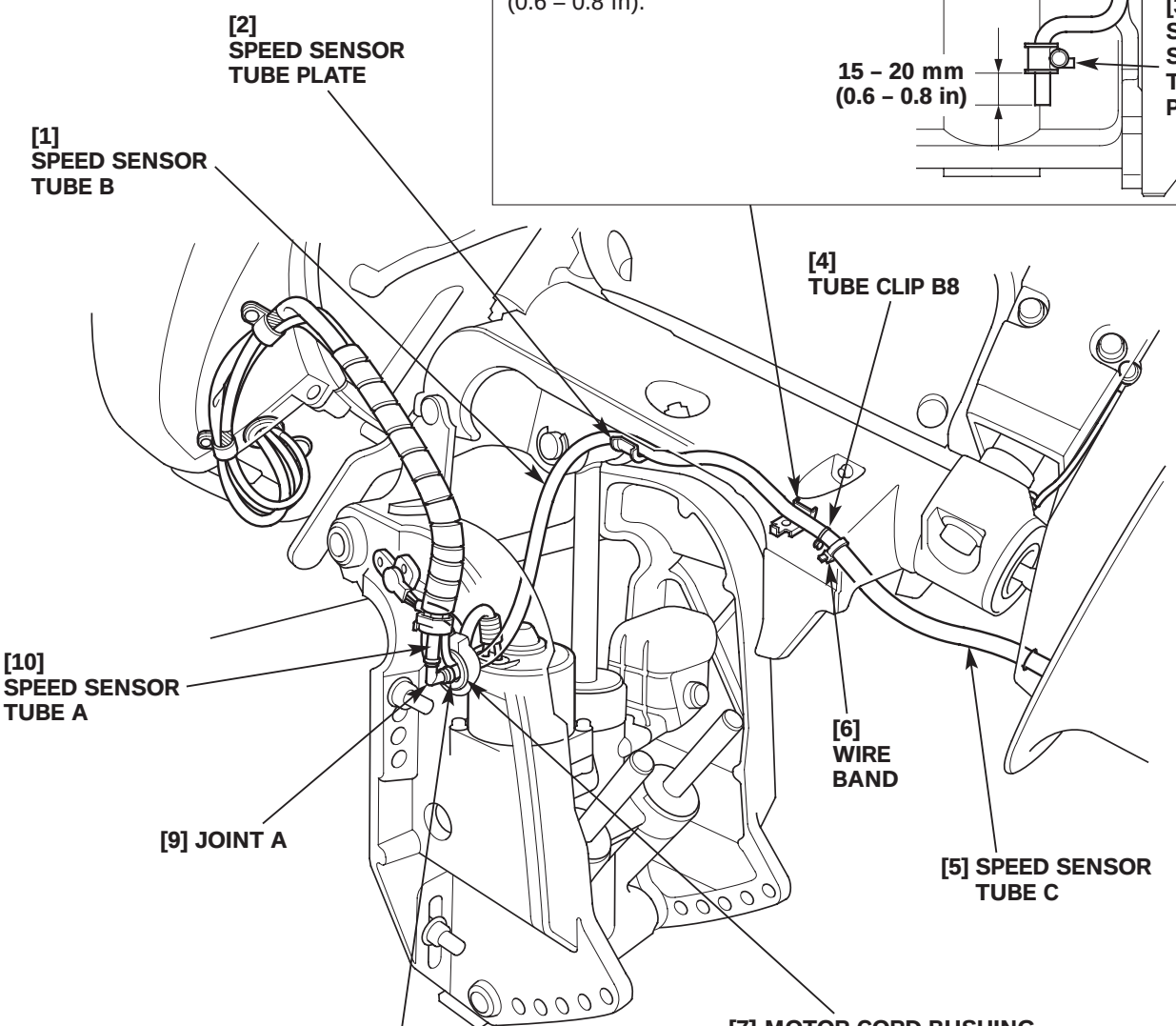

[4] HOSE CLAMP
Set the air vent tube B in the clamp of the larger diameter side and the pressure regulator return hose in the smaller diameter side.
[5] AIR VENT TUBE B
[6] TUBE CLIP
Clamp the air vent tube E and the fuel hose (high pressure side) as shown.
[3] VAPOR CHAMBER
[2] PRESSURE REGULATOR RETURN HOSE
[7] FUEL HOSE (HIGH PRESSURE SIDE)
[1] HOSE CLAMP
INSTALLATION: P. 2-61
[13] 7 x 400 mm TUBE
[11] TUBE CLAMP D10.7
[10] AIR VENT TUBE E
[8] TUBE CLAMP D32.5
[12] TUBE CLIP
Install with the lugs facing down.
[12]-1 7 x 400 mm TUBE
[12]-2 TUBE CLIP
[12]-3 LUGS
[9] OIL TUBE
• Install the oil tube aligning the projection on the oil tube installation part with the projection of the oil tube.
• Install the tube clamp D32.5 with the lugs in the position shown.
[9]-1 PROJECTION
[9]-4 TUBE CLAMP D32.5
[9]-1 PROJECTION
[9]-3 OIL TUBE
[9]-2 LUGS


[1]
4 x 7 x 160 mm
VINYL TUBE
INSTALLATION:
P. 2-69
[2]
SPEED SENSOR
TUBE A
[3]
WATER SEPARATOR
with WATER LEVEL
SENSOR
[4]
FUEL TUBE C
[5]
FUEL STRAINER
[6]
TUBE CLIP
B12
[7]
MAIN WIRE
HARNESS
[8] HOSE CLAMP
INSTALLATION: P. 2-61
[9]
FUEL HOSE
(HIGH
PRESSURE
SIDE)
[10]
FUEL TUBE E
[11]
WATER TUBE F
[12]
3.5 x 430 mm FUEL TUBE
INSTALLATION: P. 2-69
[13] WATER CHECK
GROMMET
[14] 7 x 400 mm TUBE
[15] 14 mm CLIP
INSTALLATION:
P. 2-63
[16]
FUEL TUBE A
[17] 14 mm FUEL
TUBE CLIP
[18]
UNDERCASE
GROMMET C
INSTALLATION:
P. 2-56

[3] SPEED SENSOR TUBE PLATE

Install the speed sensor tube plate so that the distance between the end of the plate and the end of the speed sensor tube B is 15 – 20 mm (0.6 – 0.8 in).

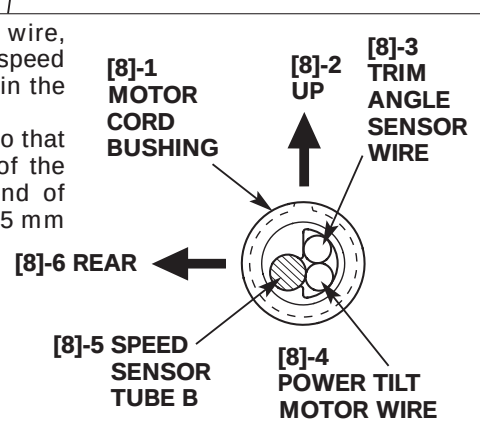


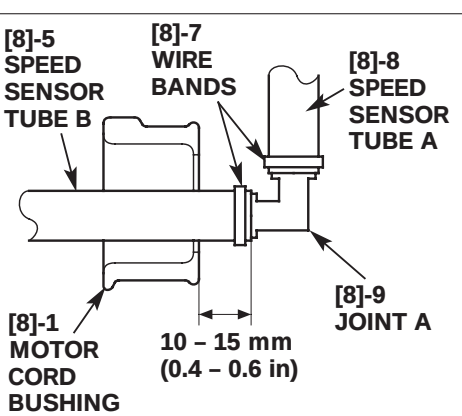


INSTALLATION: P. 2-63

[8] SPEED SENSOR TUBE B

- Pass the trim angle sensor wire, power tilt motor wire and the speed sensor tube B through the hole in the motor cord bushing as shown.
- Install the speed sensor tube B so that the distance between the end of the motor cord bushing and the end of the speed sensor tube B is 10 – 15 mm (0.4 – 0.6 in).

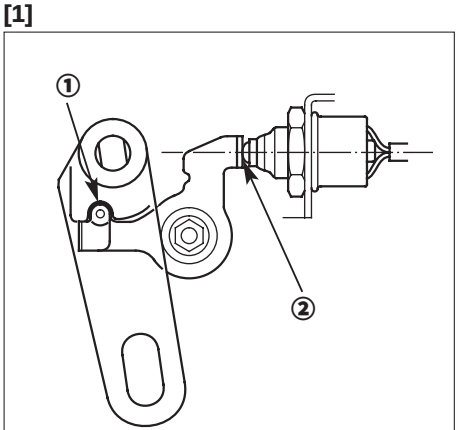




12. LUBRICATION

Apply oil or marine grease to the following parts.

[1]

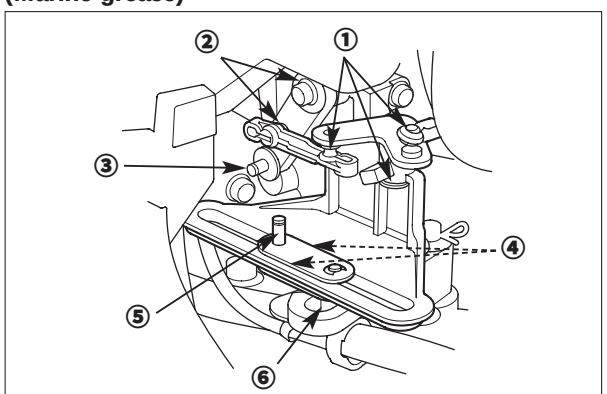


① DETENT ARM ROLLER
② NEUTRAL SWITCH

[2]

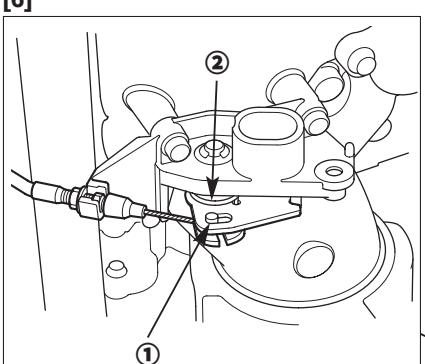
GREASE

(Marine grease)



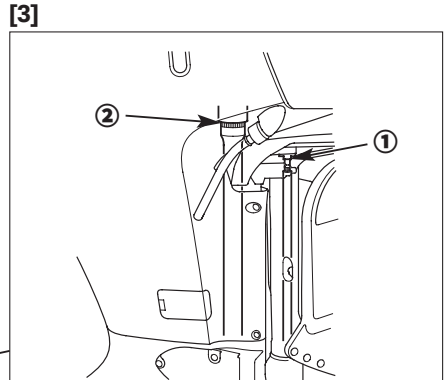
① THROTTLE PLATE
② THROTTLE ARM
③ THROTTLE ARM LINK PIN
④ SHIFT SLIDE PIVOT/SHIFT PIVOT PLATE
⑤ LINK PIN
⑥ SHIFT LINK PIN

[6]

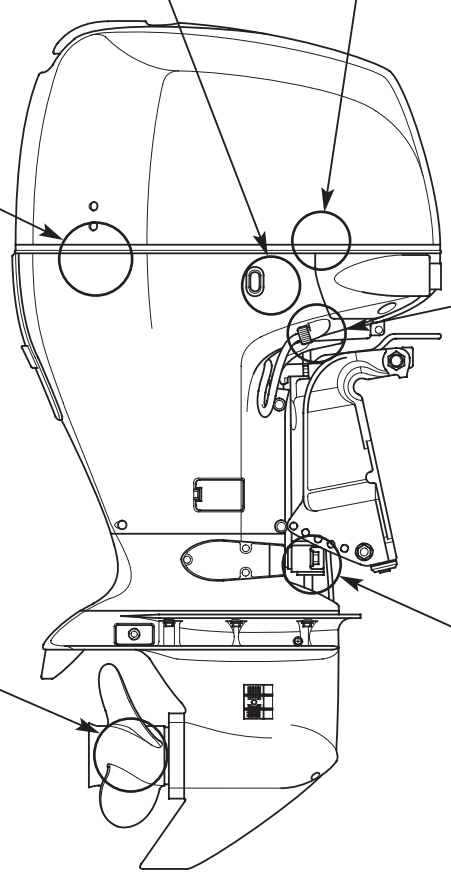


① COVER LOCK CABLE B CABLE END
② R. SIDE LOCK

[3]



① SHIFT ROD A
② VERTICAL SHAFT



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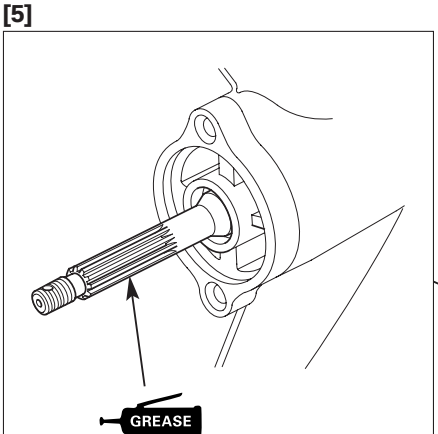
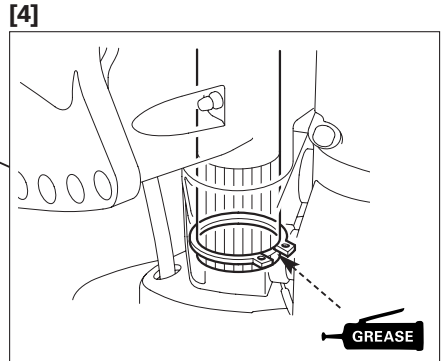


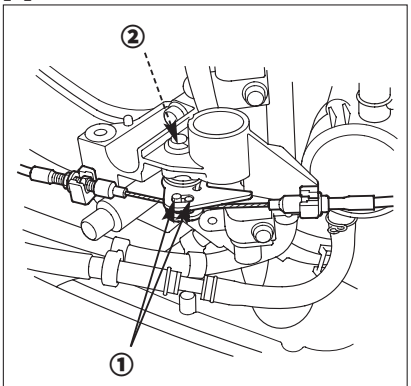
PROPELLER SHAFT

[4]



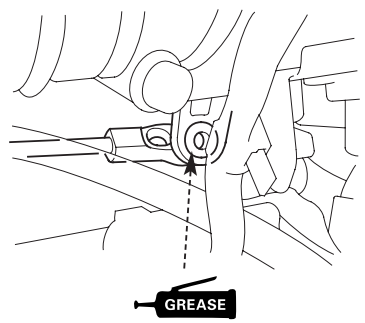
MOUNTING PLATE

[1]



① COVER LOCK CABLE A/B CABLE END
② L. SIDE LOCK

[2]

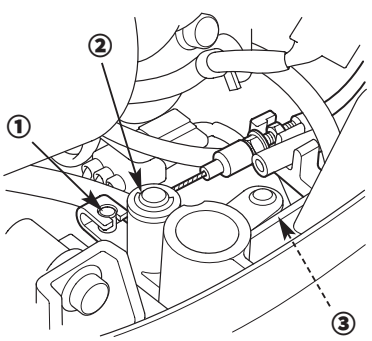


THROTTLE BODY

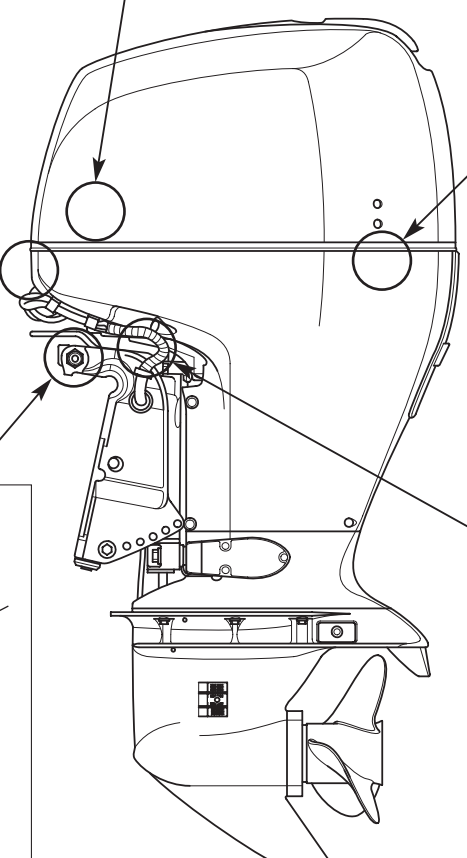
[3]

GREASE

(Marine grease)



① FRONT ROCK CABLE
② FRONT ROCK
③ COVER OPEN SHAFT



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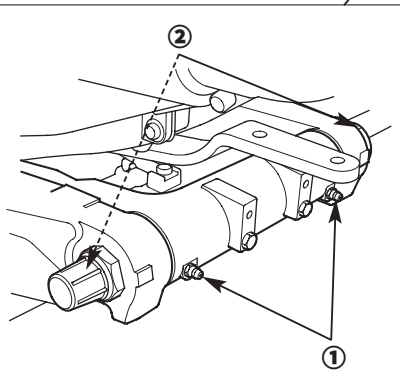
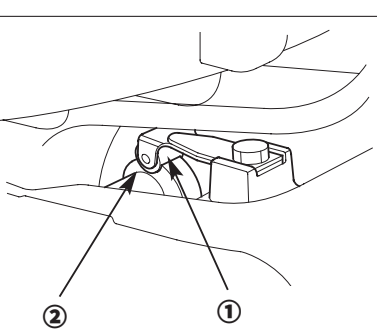


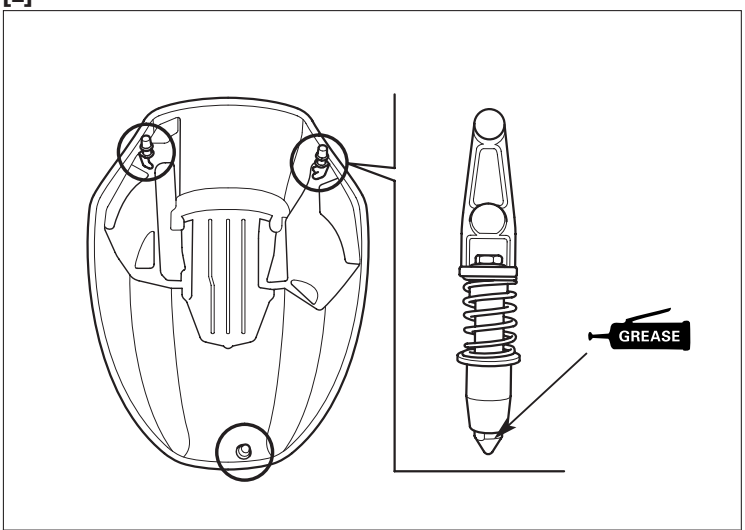
① TILTING SHAFT
② TILTING SHAFT (THREADS)

[4]



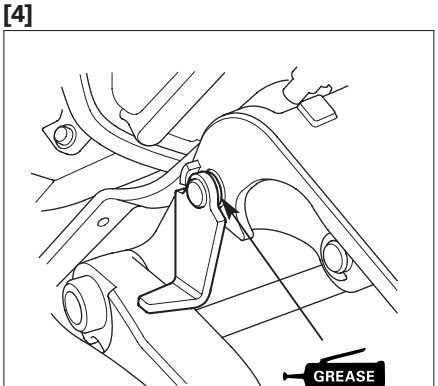
① DETENT SPRING ROLLER
② TILTING BRACKET CAM

[1]



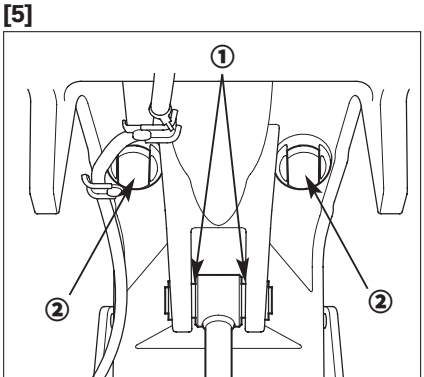
COVER LOCK BOLTS

[4]



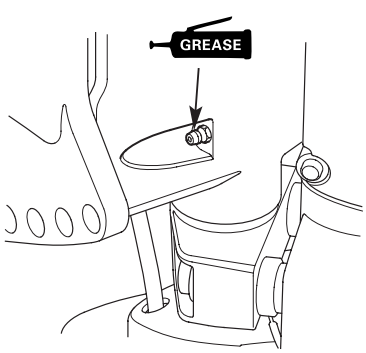
TILT STOPPER BEARING

[5]



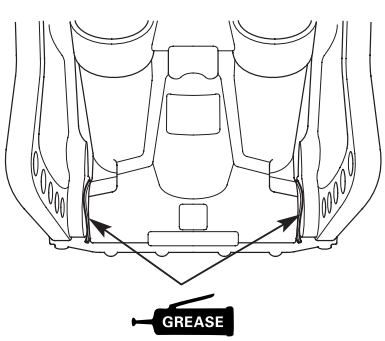
① UPPER CYLINDER BUSHING/ PIN
② SLIDING SURFACE OF THRUST RECEIVER

[3]

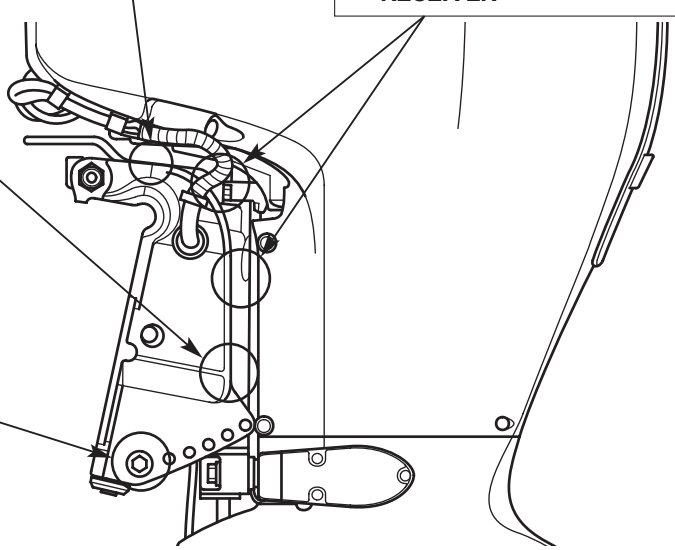


SWIVEL CASE

[2]



LOWER CYLINDER BUSHINGS/ COLLAR/WAVE WASHERS



1. MAINTENANCE SCHEDULE

REGULAR SERVICE PERIOD (1) Item — Perform at every indicated month or operating hour interval, whichever comes first.		Each use	After use	First month or 20 Hrs.	Every 6 month or 100 Hrs.	Every year or 200 Hrs.	Every 2 year or 400 Hrs.	Refer to page
Engine oil	Check level	○						3-2
	Change			○	○			
Gear case oil	Change			○	○			3-4
Engine oil filter	Replace					○		3-3
Alternator belt	Check-adjust					○		3-28
Throttle linkage	Check-adjust			○	○			3-26
Idling speed	Check-adjust			○	○			3-22
Valve clearance	Check-adjust					○		3-9
Spark plug	Check			○		○		3-8
	Clean			○		○		
	Replace						○	3-7
Propeller and cotter pin	Check	○						14-2
Anode metal	Check	○						14-88
Lubrication	Grease			○ (2)	○ (2)			2-77
Water separator	Check	○						3-19
Fuel strainer	Check				○			3-15
	Replace						○	
Fuel strainer (High pressure type)	Replace						○	3-18
Thermostat	Check					○		8-3
Fuel line	Check	○						5-104
	Replace	Every 2year (Replace if necessary)						
Battery and cable connection	Check level-tightness	○						–
Bolt and nuts	Check-tightness			○	○			–
Crankcase breather tube	Check					○		–
Cooling water passages	Clean		○ (3)					–

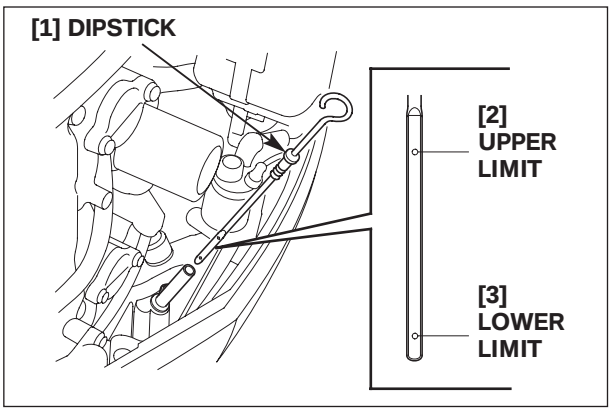
(1) For professional commercial use, log hours of operation to determine proper maintenance intervals.
(2) Lubricate more frequently when used in salt water.
(3) When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.

2. ENGINE OIL

Oil Level Inspection:

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

1) Remove the engine cover.
2) Remove the dipstick and wipe it clean.
3) Insert the dipstick all the way in the oil level pipe, 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 to reach the upper limit mark on the dipstick.
5) Reinstall the oil filler cap and dipstick.

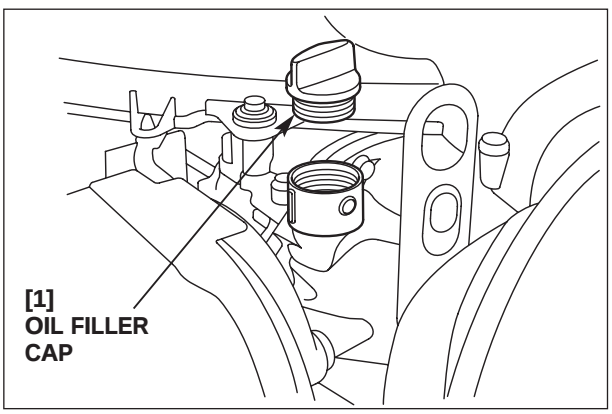


Oil Change:

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) Attach the drain plug cover to the oil drain guide of the oil case.
3) Place a suitable oil container next to the outboard motor, and remove the oil drain plug bolt.

   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 canter or service station for reclamation. Do not throw it in the trash, pour it on the ground, or down a drain.

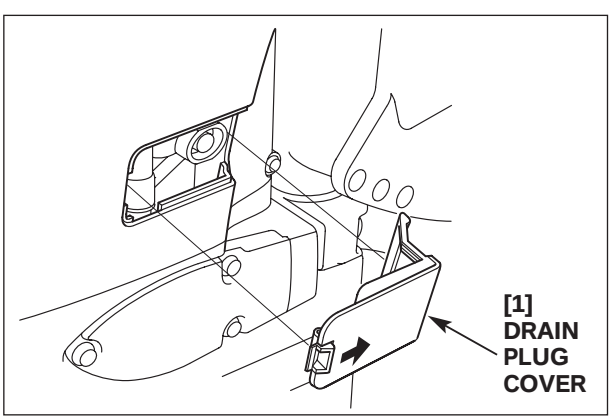


⚠CAUTION

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.

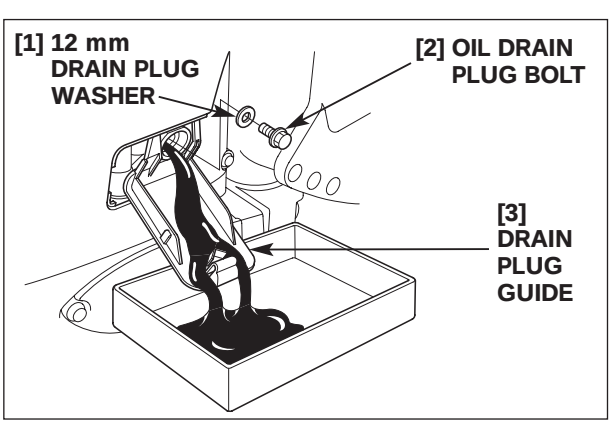
Wash your hands thoroughly with soap and water as soon as possible after contact with used engine oil.



4) Replace the 12 mm drain plug washer with a new one, and reinstall the oil drain plug bolt. Tighten the oil drain plug bolt to the specified torque.

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

5) Reinstall the drain plug cover.



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

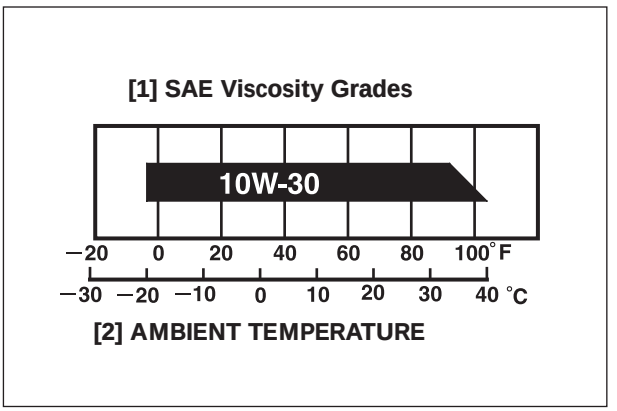
Engine oil capacity	Without oil filter replacement: 6.5R (6.9 US qt, 5.7 Imp qt) With oil filter replacement: 6.7R (7.1 US qt, 5.9 Imp qt)

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

NOTICE

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

7) Install the engine cover (P. 4-2).



3. OIL FILTER

Replacement:

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

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

TOOL:
Oil filter wrench **07HAA-PJ70101**

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

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

- Use only a genuine Honda oil filter or a filter of equivalent quality specified for you model. Using the wrong Honda filter, or a not-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 **07HAA-PJ70101**

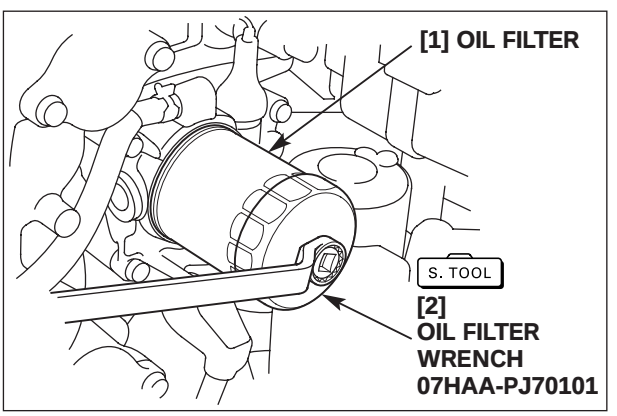
TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

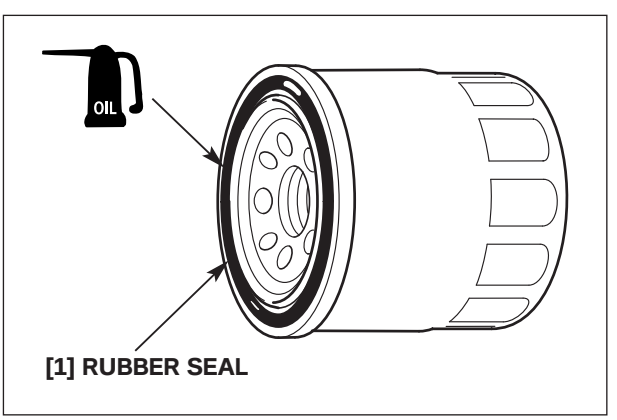
6) Refill the engine with the specified amount of the recommended oil, as described in the oil change procedure.
Reinstall the oil filter cap and dipstick.

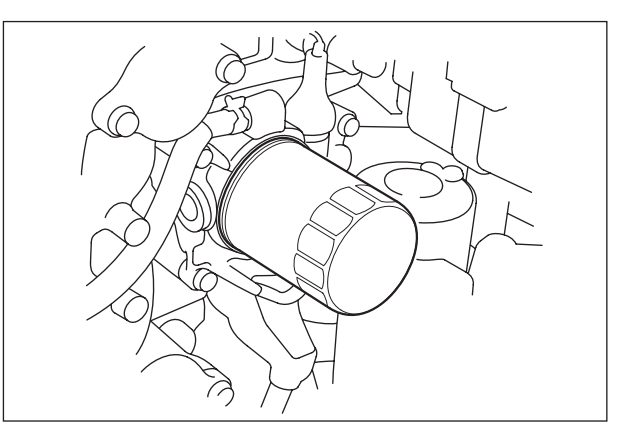
7) Start the engine, and check the leaks.

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.

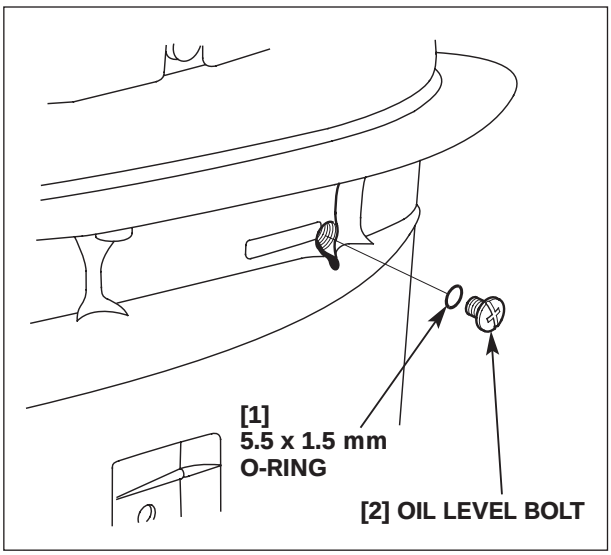
9) Reinstall the engine cover.







4. GEAR CASE OIL



Inspection:

1) Place the outboard motor on a level surface and position it 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.
Replace the O-ring on assembly.

3) If the oil does not flow out, add oil.

4) Coat a new O-ring with clean engine oil and install the O-ring on the oil level bolt.
Set the oil level bolt on the gear case and tighten the bolt to the specified torque.

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

Addition of gear oil:

1) Remove the oil drain bolt, and install the commercially available gear oil pump in the oil drain bolt hole.
Replace the O-ring on assembly.

2) Remove the oil level bolt, and add the gear oil until it flows out of the oil level bolt hole.
Replace the O-ring on assembly.

Gear oil capacity	0.98R (1.04 US qt, 0.86 Imp qt)

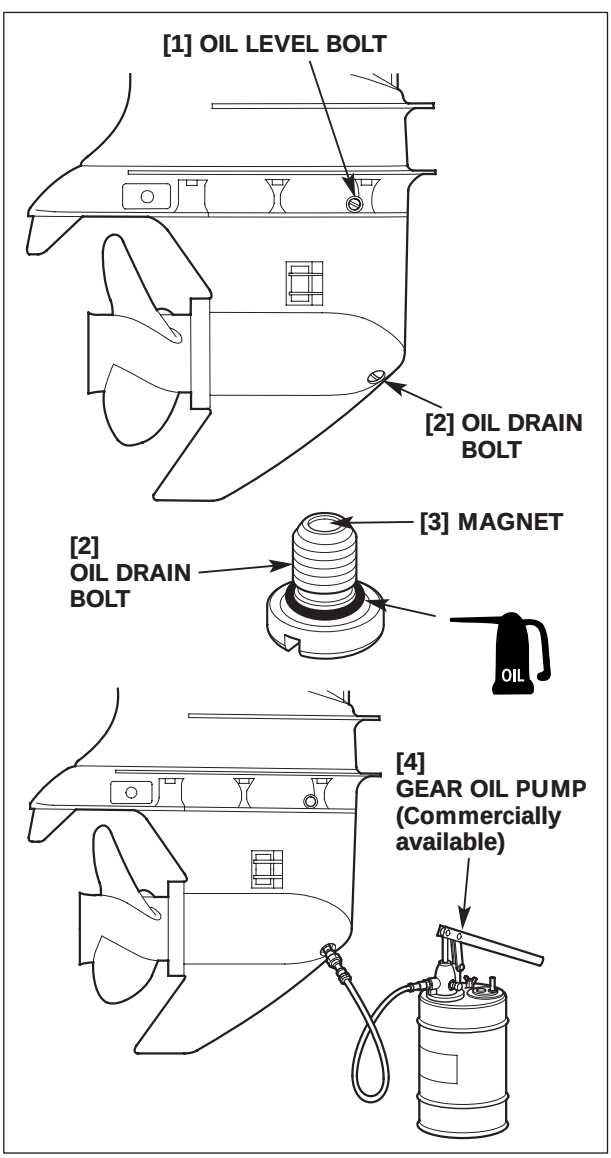
Recommended gear oil	MARINE SAE 90 Hypoid gear oil API Service classification (GL-4)

3) Check for the metal particles on the magnet end of the oil drain bolt.

4) If there are metal particles on the magnet end of the oil drain bolt, disassemble the gear case assembly and check (See section 14).

5) After adding the gear oil, apply clean engine oil to the new O-rings and install them on the oil drain bolt and the oil level bolt.
Set the oil drain bolt and the oil level bolt on the gear case, and tighten the bolts to the specified torque.

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



Replacement:

1) Place the outboard motor on a level surface and tilt up the outboard motor.

2) Remove the oil level bolt and the oil drain bolt, and drain the old oil.
Replace the O-rings on assembly.
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.

3) Check for the metal particles on the magnet end of the oil drain bolt (P. 3-4).

4) If there are metal particles on the magnet end of the oil drain bolt, disassemble the gear case assembly and check (See section 14).

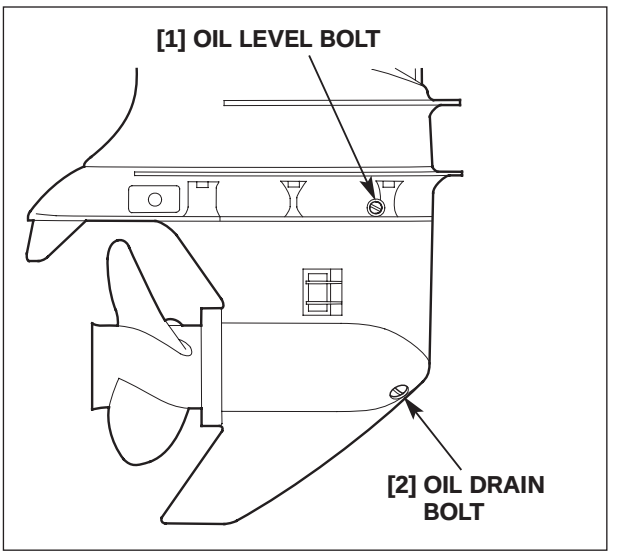
5) Install a commercially available gear oil pump in the oil drain bolt hole, and add gear oil until it flows out of the oil level bolt hole.

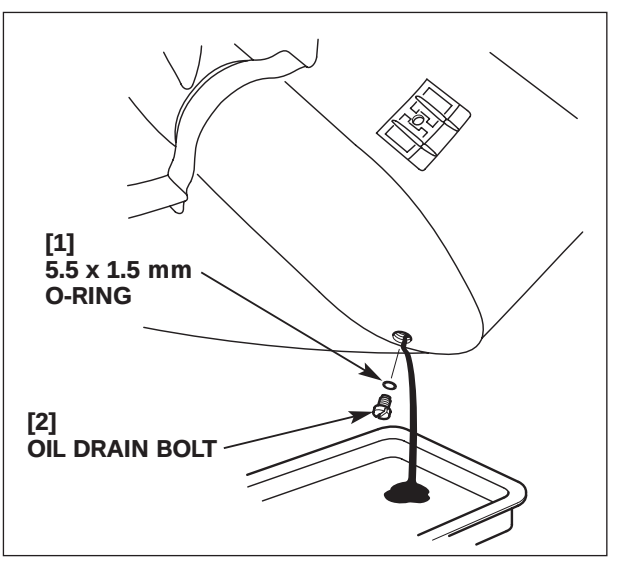
Gear oil capacity	0.98R (1.04 US qt, 0.86 Imp qt)

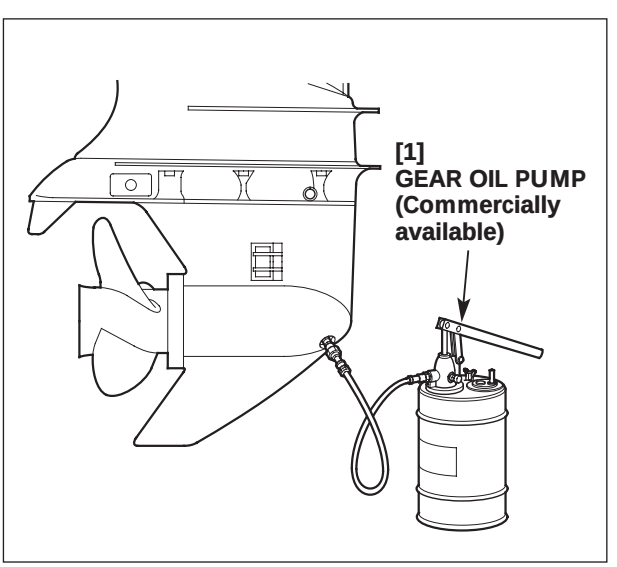
Recommended gear oil	MARINE SAE 90 Hypoid gear oil API Service classification (GL-4)

6) After adding the gear oil, apply clean engine oil to the new O-rings and install them on the oil drain bolt and the oil level bolt.
Set the oil drain bolt and the oil level bolt on the gear case, and tighten the bolts to the specified torque.

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







5. SPARK PLUGS

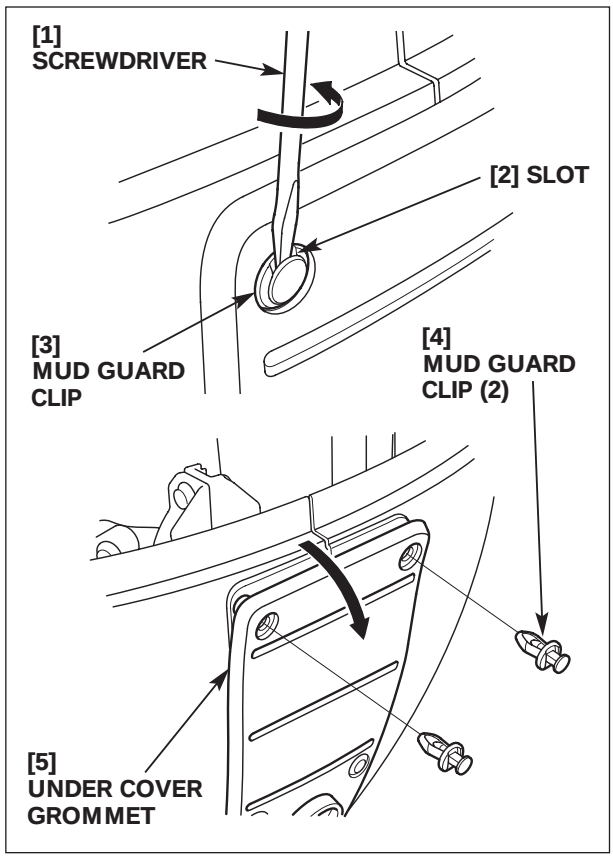
Removal:

1) Remove the engine cover (P. 4-2).

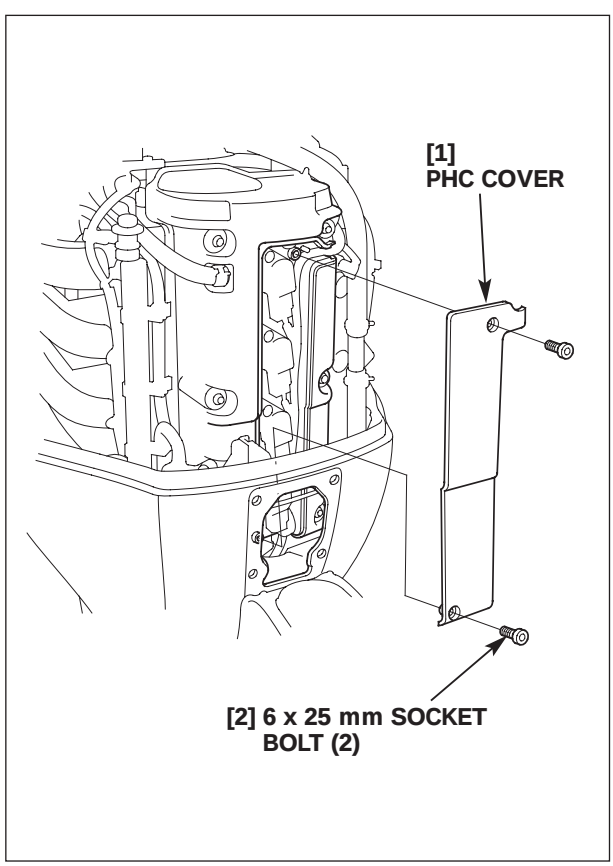
2) Set a screwdriver in the slot in the two mud guard clips at the top of the under cover grommet, and raise the mud guard clips.

   Remove the two mud guard clips.

3) Detach the upper part of the under cover grommet.



4) Remove the two 6 x 25 mm socket bolts and remove the PHC cover.



5) Remove the 6 x 25 mm socket bolts and remove each ignition coil from the corresponding spark plug.

   Pull out each ignition coil halfway.

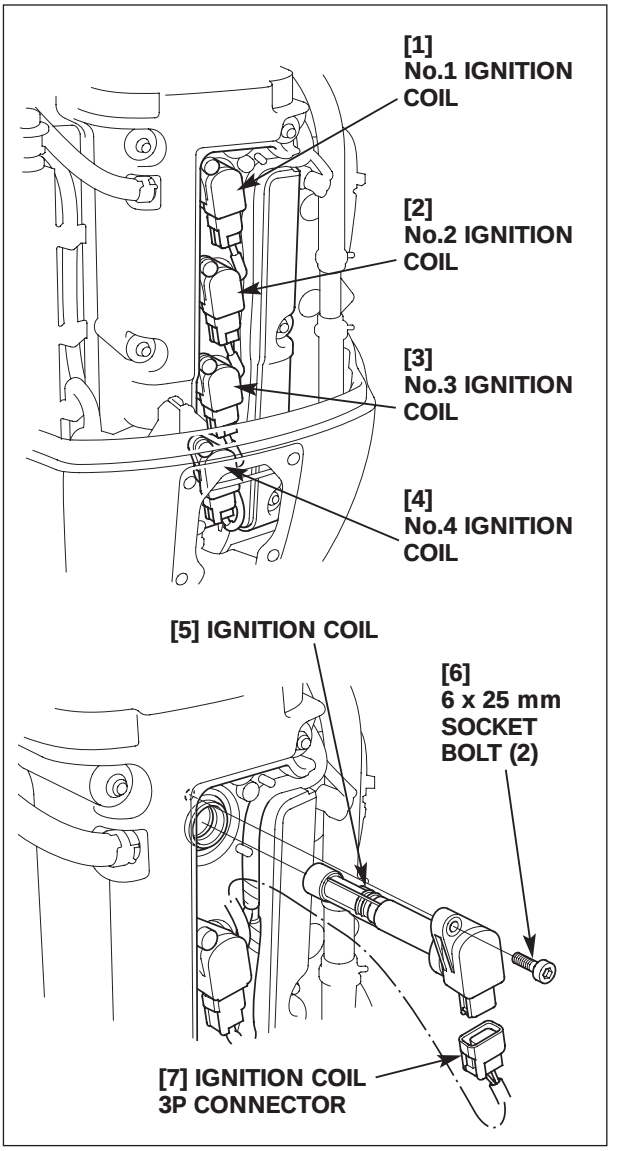
6) Disconnect the ignition coil 3P connector from each ignition coil.

   Remove each ignition coils.

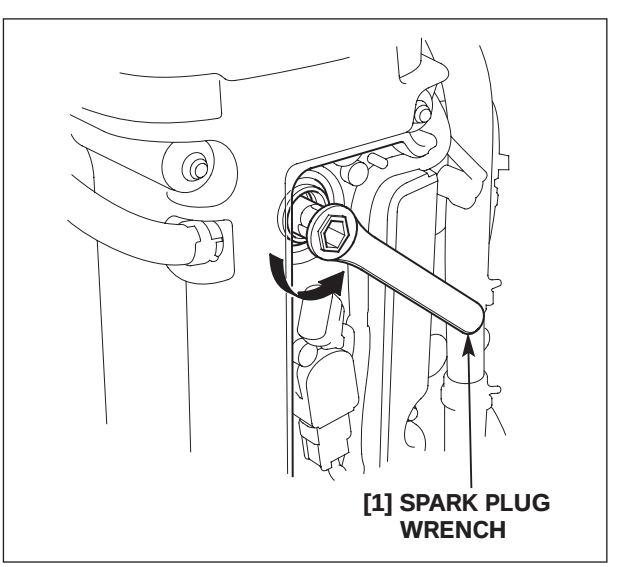
   NOTICE

   - *Do not pull out the ignition coils excessively.*
   - *Do not drop the ignition coils and do not strike on the ignition coils, either, during removal/installation of the coils.*
   - *Do not reuse the ignition coils when they are dropped.*

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



8) Remove the spark plugs using a spark plug wrench.



Inspection/Cleaning:

1) Visually inspect the spark plugs. Discard the plugs if the insulators are cracked or chipped.
2) Remove carbon or other deposits with a plug cleaner.

NOTICE

Do not spray the cleaner more than 20 seconds.

3) Measure the plug gap with a wire-type feeler gauge. If the measurement is out of the specification, replace the spark plug.

Spark plug gap	1.0 – 1.1 mm (0.039 – 0.043 in) Service limit: 1.3 mm (0.051 in)

Recommended spark plug	IZFR6K11 (NGK) SKJ20DR-M11 (DENSO)

4) Replace the spark plugs with the new ones if the center electrode is rounded as shown.

NOTICE

- *These outboard motors are equipped with the iridium spark plugs. Do not adjust the spark plug gap.*
- *After cleaning the spark plugs with a plug cleaner, remove the sand thoroughly from the spark plugs.*
- *Never clean the spark plugs with a stiff wire brush. It can damage the fine-grain film of the iridium chips of the iridium spark plug.*

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

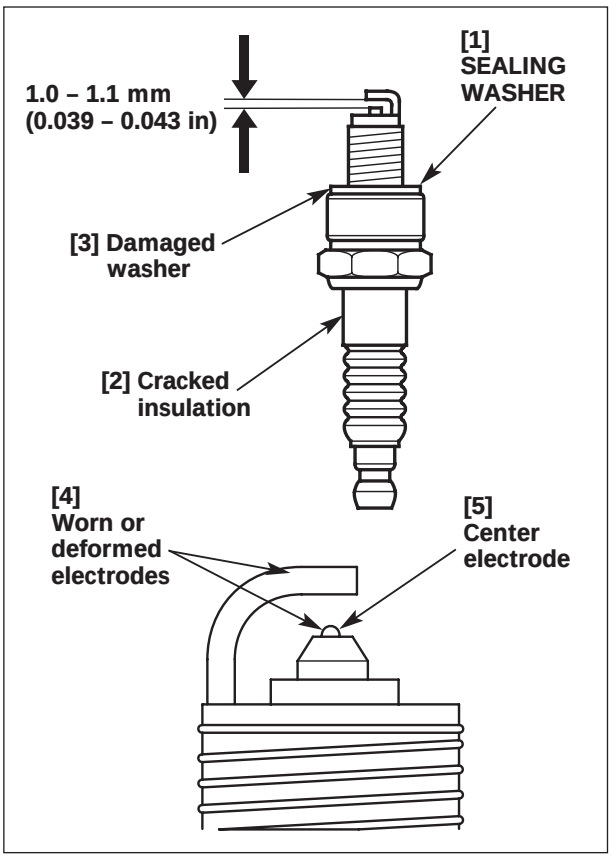
   Then tighten with a plug wrench (an additional 1/2 turn if a new plug) to compress the sealing washer. If you are reusing a plug, tighten 1/8 – 1/4 turn after the plug seats.

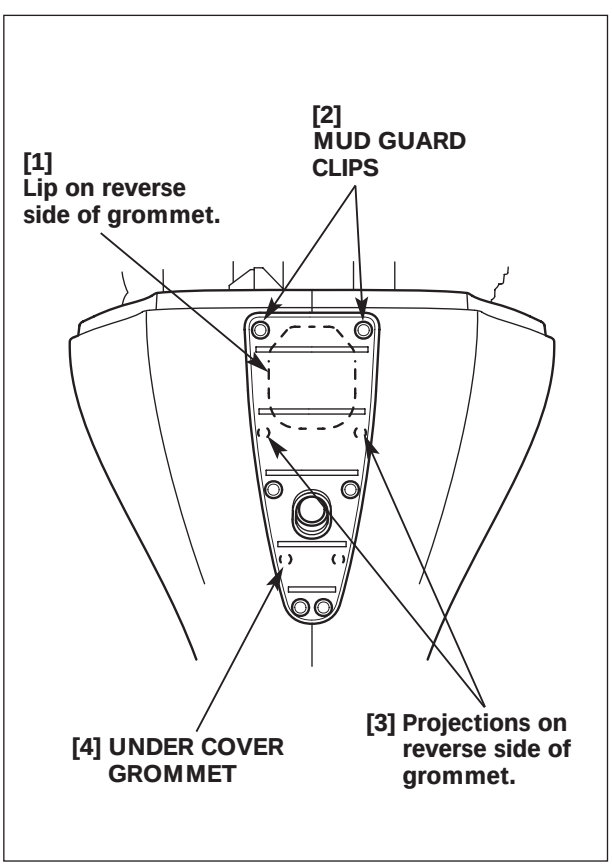
   TORQUE: 18 N·m (1.8 kgf·m, 13 lbf·ft)

NOTICE

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

6) Install the ignition coils and tighten each with the 6 x 25 mm socket bolt securely (P. 3-7).
7) Connect the ignition coil 3P connector to each ignition coil and install the PHC cover (P. 3-6 and 7).
8) Push in the two mud guard clips at the top of the under cover grommet securely until they click.
9) Check that the lip at the reverse side of the under cover grommet is engaged with the L./R. engine under covers securely.
   - Check that the under cover grommet adheres to the engine under covers securely.
   - If the projections on the reverse side of the under cover grommet are out of position, set them on the under cover grommet properly.
10) Install the engine cover (P. 4-2).





6. VALVE CLEARANCE

Inspection/Adjustment:

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

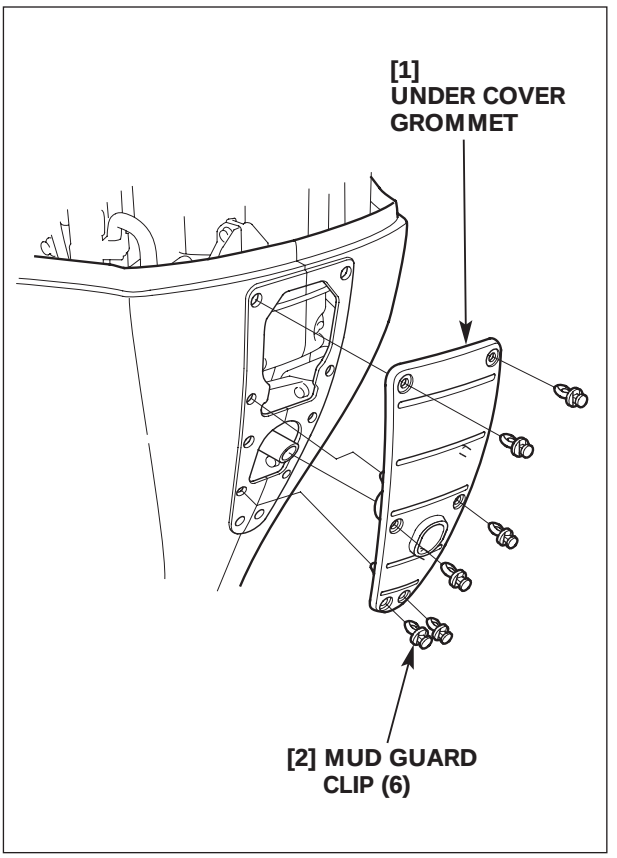
1) Remove the engine cover (P. 4-2).

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

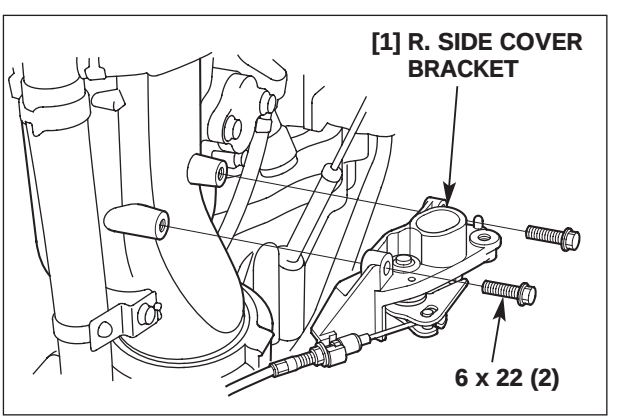
3) Set a screwdriver in the slot in the six mud guard clips, and raise the mud guard clips (P. 3-6).
   Remove the six mud guard clips.

4) Remove the under cover grommet.

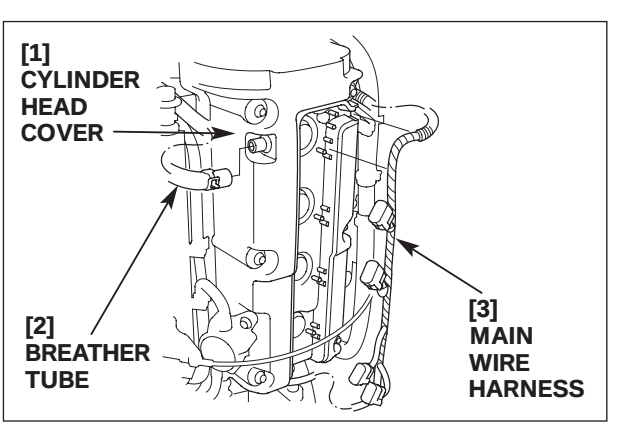
5) Remove the PHC cover (P. 3-6).
   Remove the four ignition coils and the four spark plugs (P. 3-7).
   Remove the L./R. engine under covers (P. 4-9).



6) Remove the two 6 x 22 mm flange bolts and remove the R. side cover bracket from the engine assembly.



7) Disconnect the breather tube and main wire harness from the cylinder head cover.
   Hold the main wire harness at the exhaust manifold side.



8) Clamp the fuel tube B and D with the commercially available tube clips as shown, and disconnect the fuel tube B and D from the fuel pump (low pressure side).

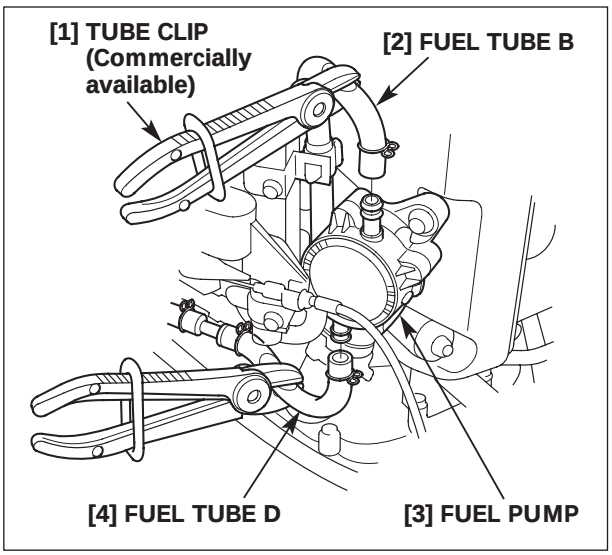
⚠WARNING

Gasoline is highly flammable and explosive.

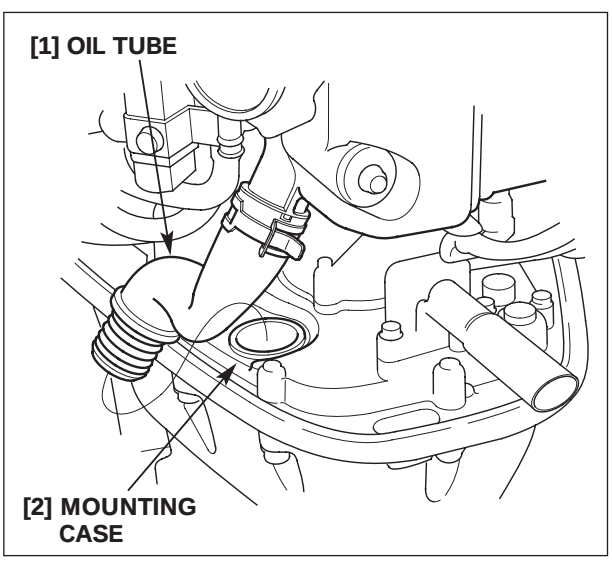
You can be burned or seriously injured when handling fuel.

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

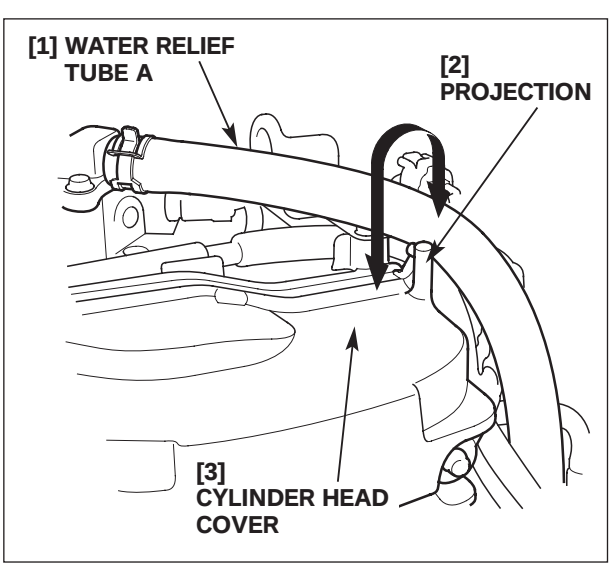
- Before disconnecting the fuel tubes, be sure to clamp the fuel tubes with a tube clips to prevent the gasoline from leaking.



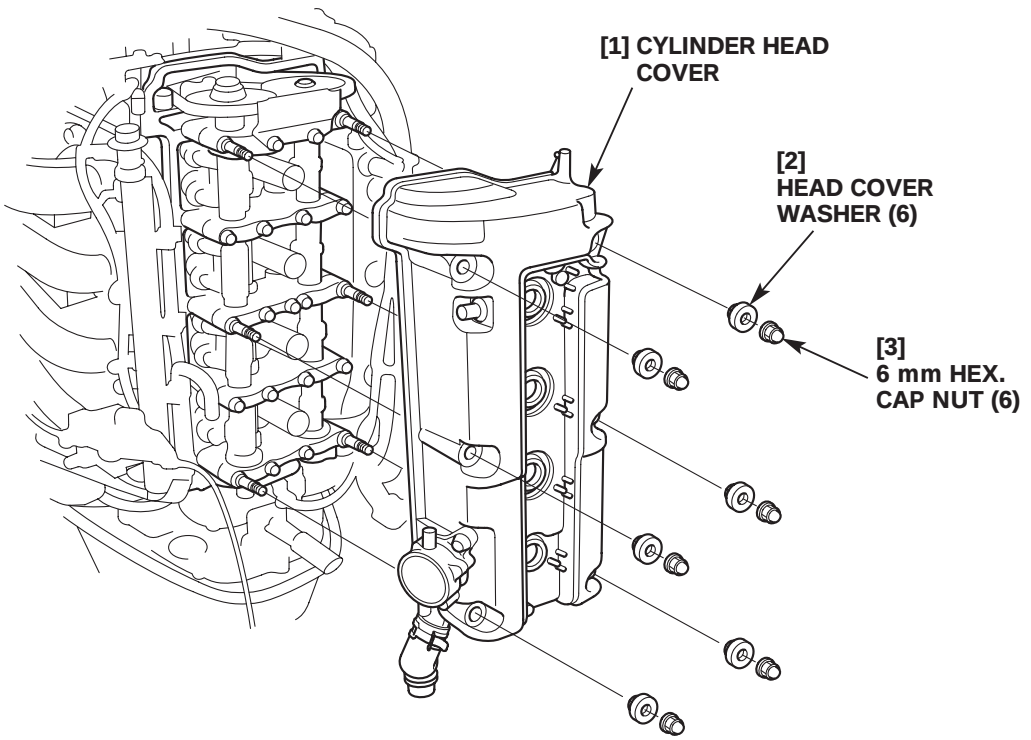
9) Disconnect the oil tube from the mounting case.



10) Move the water relief tube A from your side of the projection on the cylinder head cover to the other side.

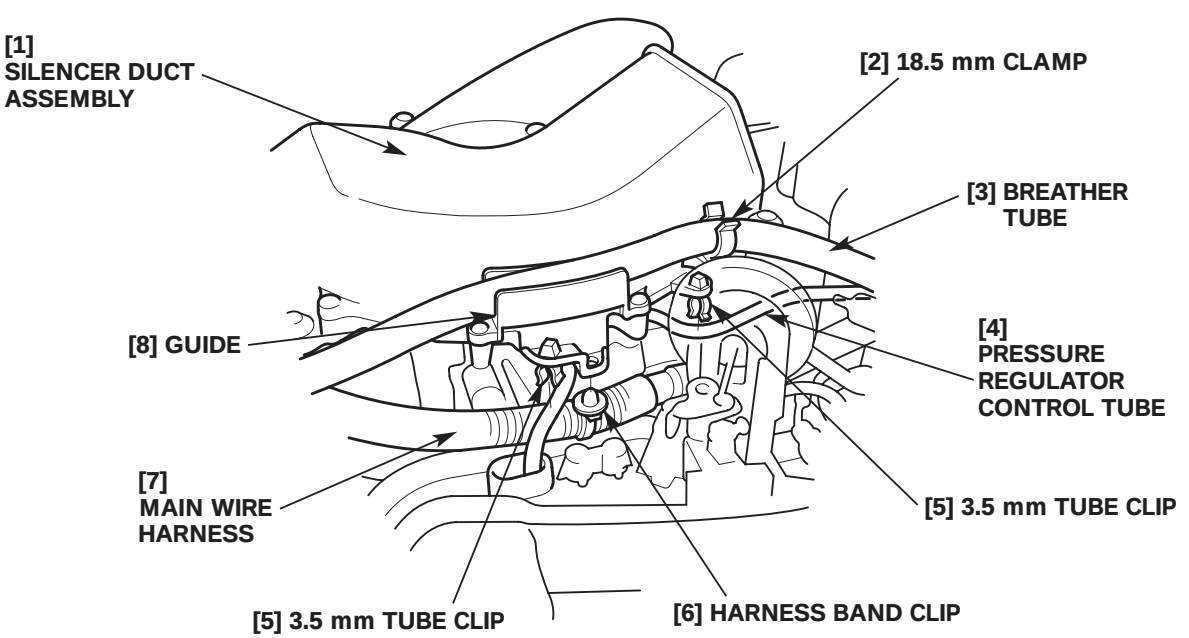


11) Remove the six 6 mm hex. cap nuts and the six head cover washers, and remove the cylinder head cover.

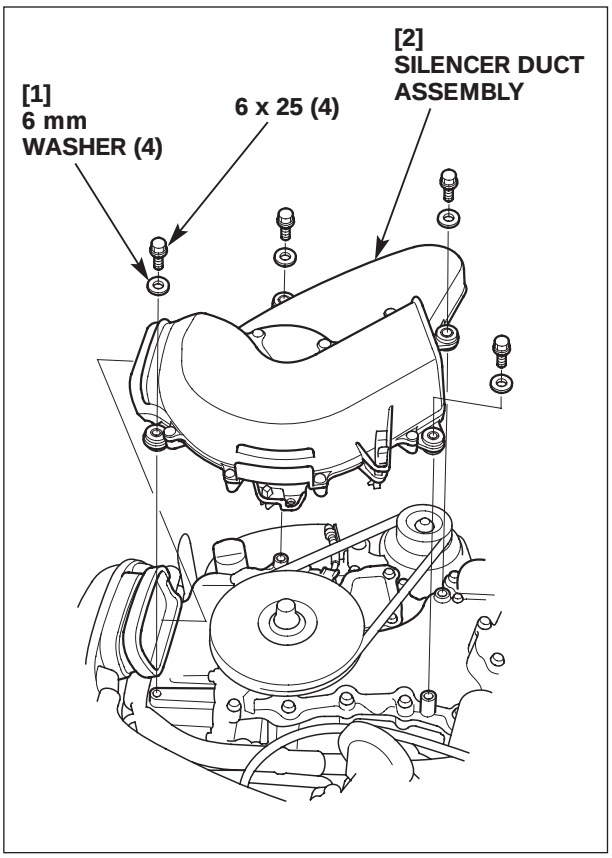


12) Release the pressure regulator control tube from the two 3.5 mm tube clips of the silencer duct assembly. Remove the harness band clip, that clamps the main wire harness, from the silencer duct assembly.

13) Remove the breather tube from the 18.5 mm clamp and the guide of the silencer duct assembly.



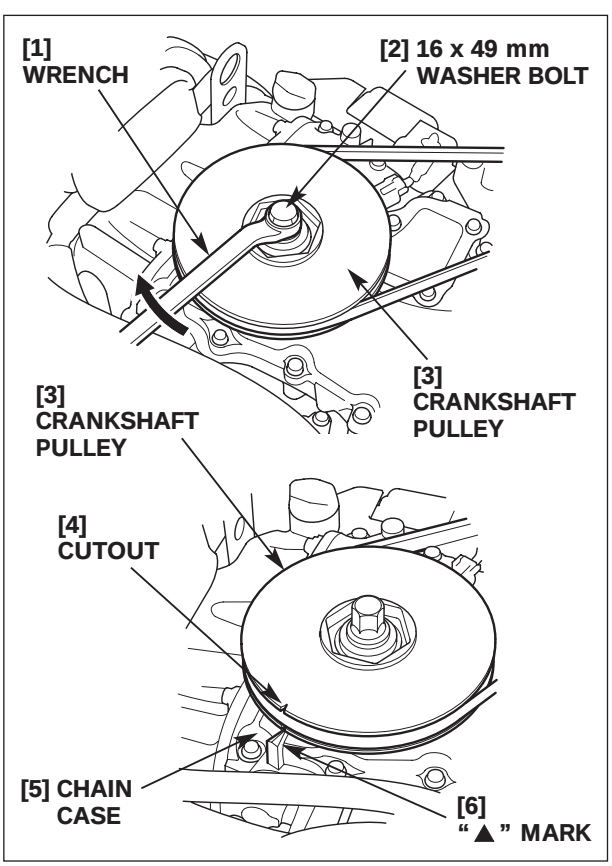
14) Remove the four 6 x 25 mm flange bolts and the four 6 mm washers, and remove the silencer duct assembly.



15) Attach the wrench to the 16 x 49 mm washer bolt on the crankshaft pulley as shown.
Turn the crankshaft pulley clockwise.

16) Align the cutout in the crankshaft pulley with the "▲" mark on the chain case.

- Do not turn the crankshaft pulley counterclockwise.

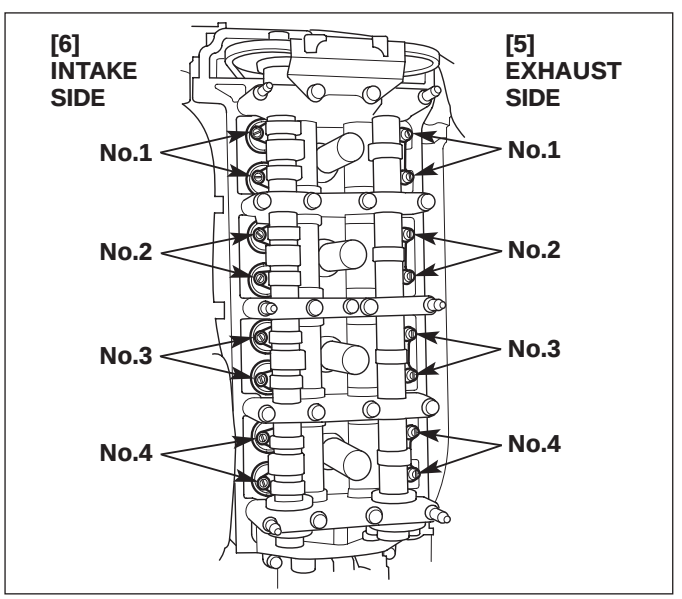


17) Holding the cutout in the crankshaft pulley aligned with the "▲" mark on the chain case, check that the "▮" mark on the intake camshaft sprocket is in alignment with the "▮" mark on the exhaust camshaft sprocket. (The No.1 piston is at the top dead center of its compression stroke this time.)

    • Perform this check on each cylinder with its piston at the top dead center of its compression stroke (i.e. both the intake and exhaust rocker arms are not lifted).

18) With the engine in the position described in step 17, check the intake and exhaust valve clearances on the No.1 cylinder by inserting a feeler gauge between the intake/exhaust side rocker arm valve adjusting screw and the valve stem end.

Valve clearance	IN	0.21 – 0.25 mm (0.008 – 0.010 in)
	EX	0.28 – 0.32 mm (0.011 – 0.013 in)



19) If adjustment is necessary, loosen the valve adjusting lock nut while holding the valve adjusting screw with a screwdriver.

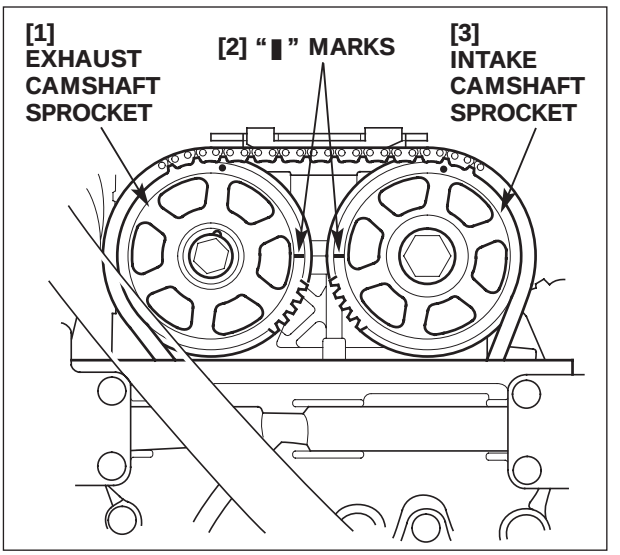
20) Insert a feeler gauge between the intake/exhaust side rocker arm valve adjusting screw and the valve stem end.

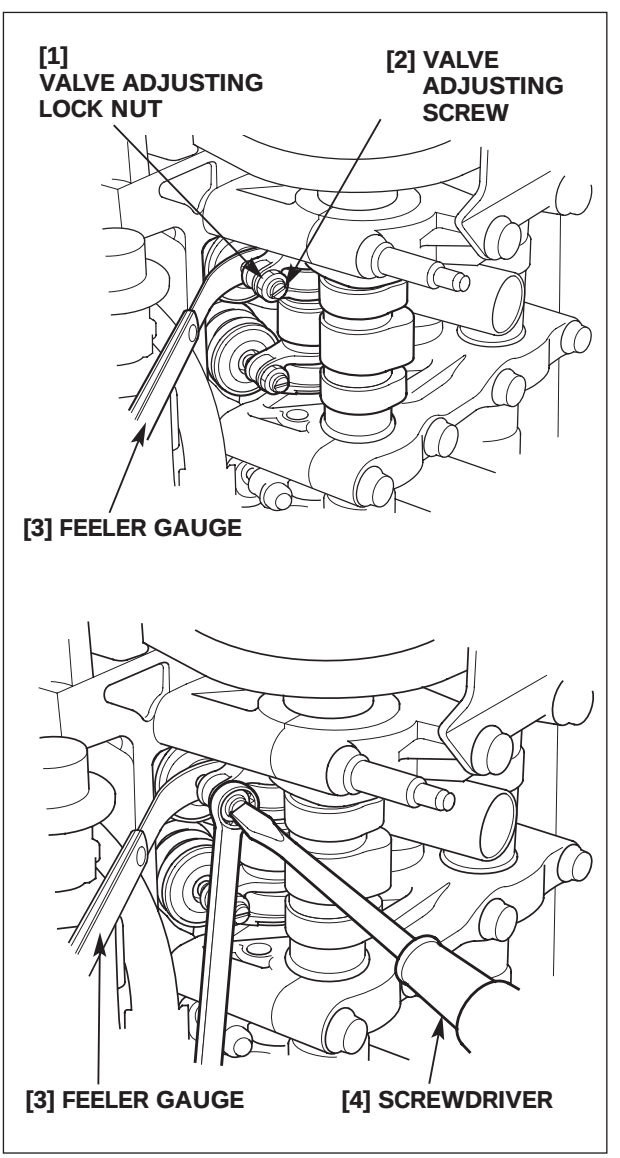
21) Adjust the intake and exhaust valve clearances by turning the valve adjusting screw.

22) After adjustment, secure the valve adjusting screw and loosely tighten the lock nut.

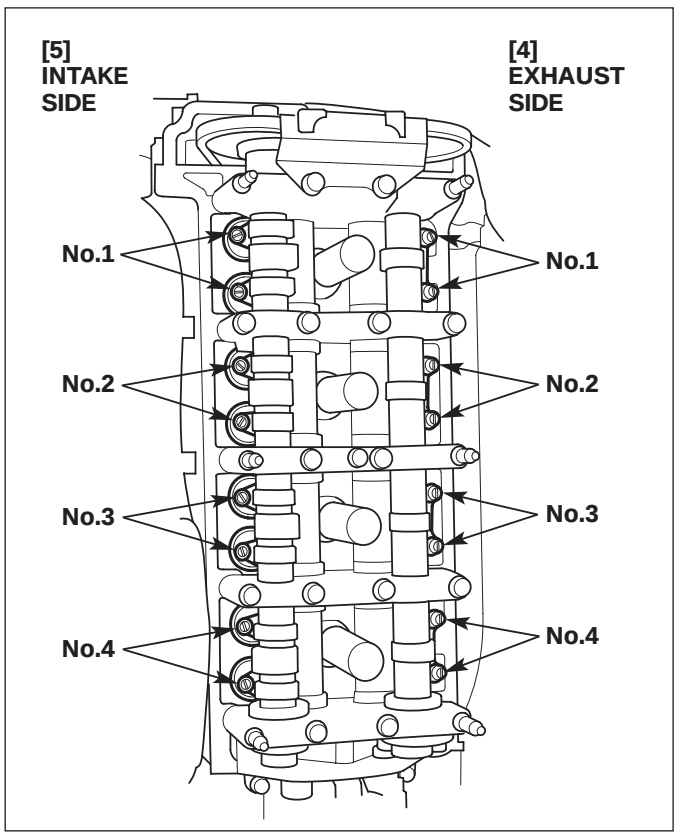
23) Recheck the valve clearances again. Tighten the valve adjusting lock nut to the specified torque.

    TORQUE:
    Intake side: 20 N·m (2.0 kgf·m, 14 lbf·ft)
    Exhaust side: 14 N·m (1.4 kgf·m, 10 lbf·ft)

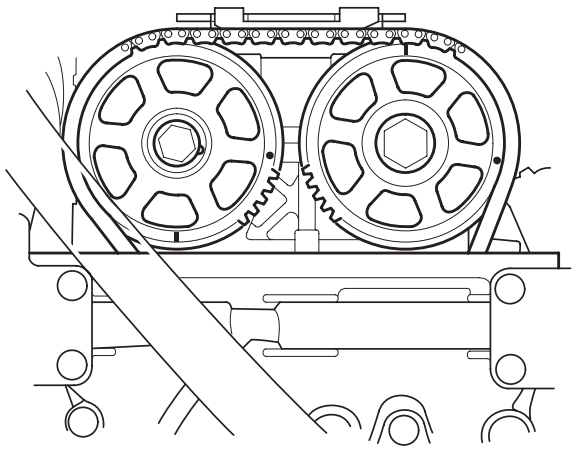




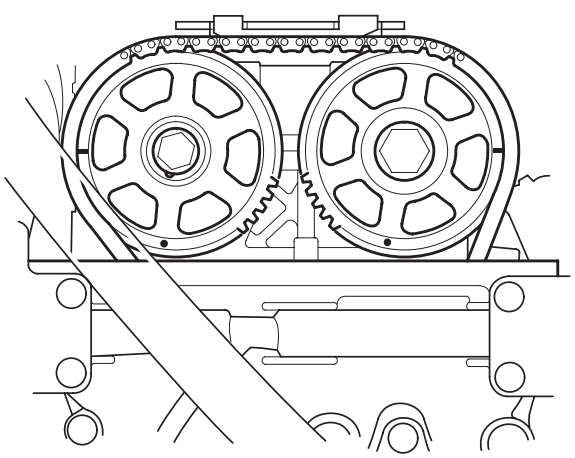
24) After adjusting the intake and exhaust valve clearances of the No.1 cylinder, turn the crankshaft pulley clockwise by increments of 180° and bring the piston of each cylinder at the top dead center of its compression stroke.
Repeat the procedure from step 18 through step 23.



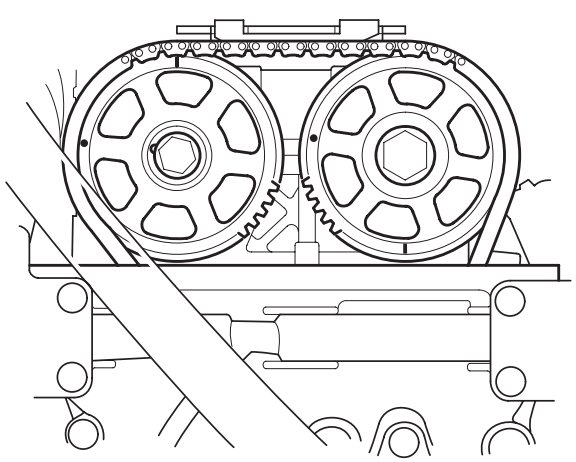
[1] No.3 PISTON AT TOP DEAD CENTER OF COMPRESSION STROKE:



[2] No.4 PISTON AT TOP DEAD CENTER OF COMPRESSION STROKE:

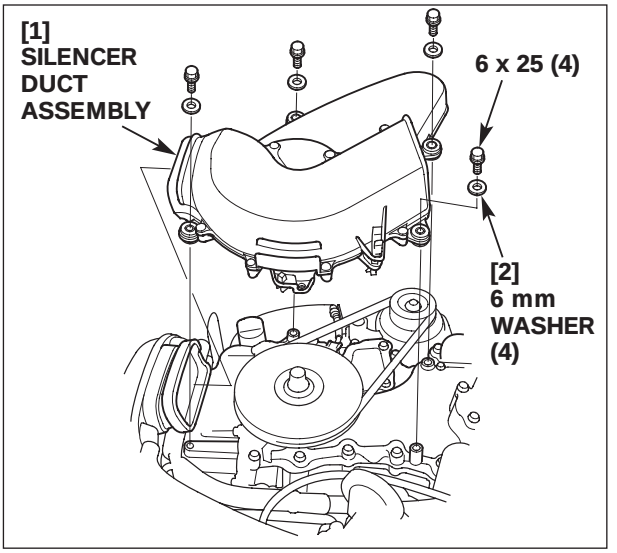


[3] No.2 PISTON AT TOP DEAD CENTER OF COMPRESSION STROKE:



25) After adjusting the valve clearances on each cylinder, install the silencer duct assembly on the silencer case.

26) Set the four 6 x 25 mm flange bolts and the four 6 mm washers, then tighten the four 6 x 25 mm flange bolts securely.



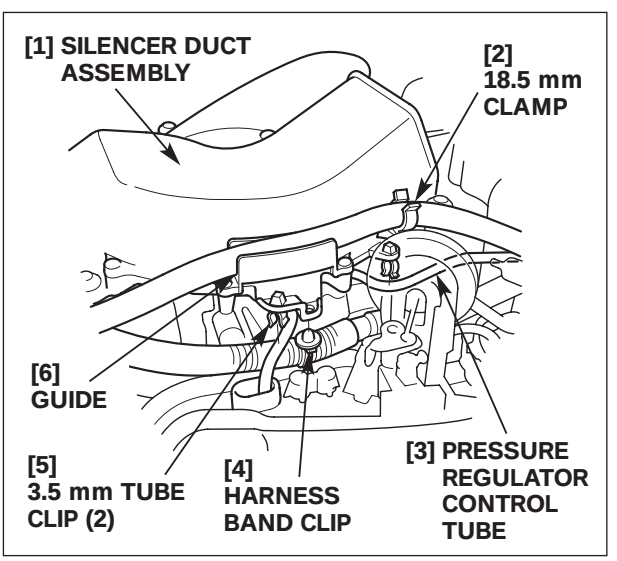
27) Set the breather tube in the guide of the silencer duct assembly and secure the tube with the 18.5 mm clamp.

28) Secure the pressure regulator control tube with the two 3.5 mm tube clips of the silencer duct assembly.

Connect the pressure regulator control tube aligning the marked part on the tube with the end of the 3.5 mm tube clip (P. 2-70).

29) Set the main wire harness' harness band clip on the silencer duct assembly.

30) Install the cylinder head cover (P. 10-40).



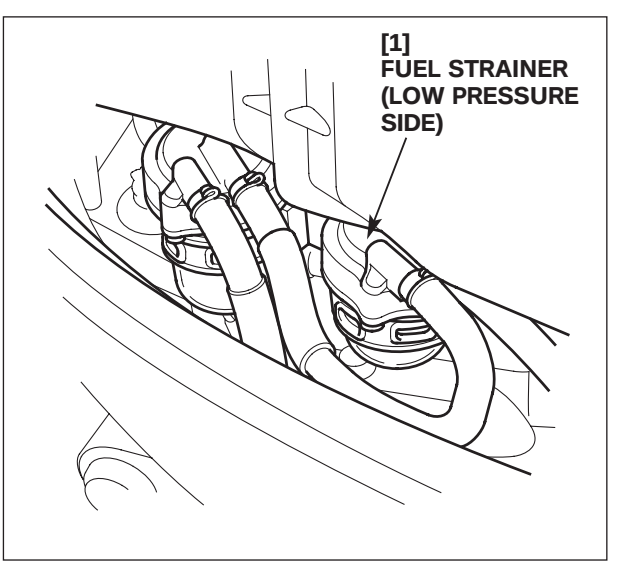
7. FUEL STRAINER (LOW PRESSURE SIDE)

Inspection:

1) Remove the engine cover (P. 4-2).

2) Visually check the fuel strainer cup (low pressure side) for water or foreign material in the cup. Check the fuel strainer for contamination.

3) If there is water or foreign material in the fuel strainer cup, or if the fuel strainer is contaminated, disassemble the strainer and clean it (P. 3-16).



Removal:

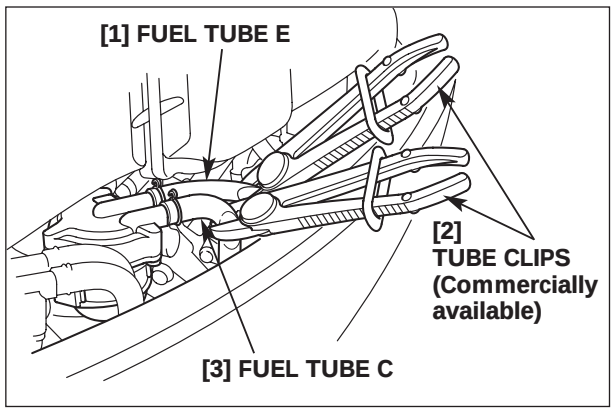
⚠WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

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

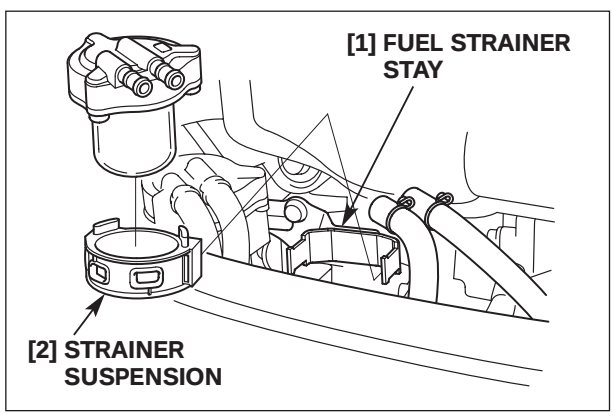
1) Clamp the fuel tube C and E securely with the two commercially available tube clips.



2) Remove the strainer suspension from the fuel strainer stay.

3) Disconnect the fuel tube C and E from the fuel strainer (low pressure side).
Remove the strainer suspension from the fuel strainer cup.

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



Disassembly/Cleaning:

1) Remove the three 5 x 12 mm screws from the fuel strainer body, then remove the plate and the fuel strainer cup.

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

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

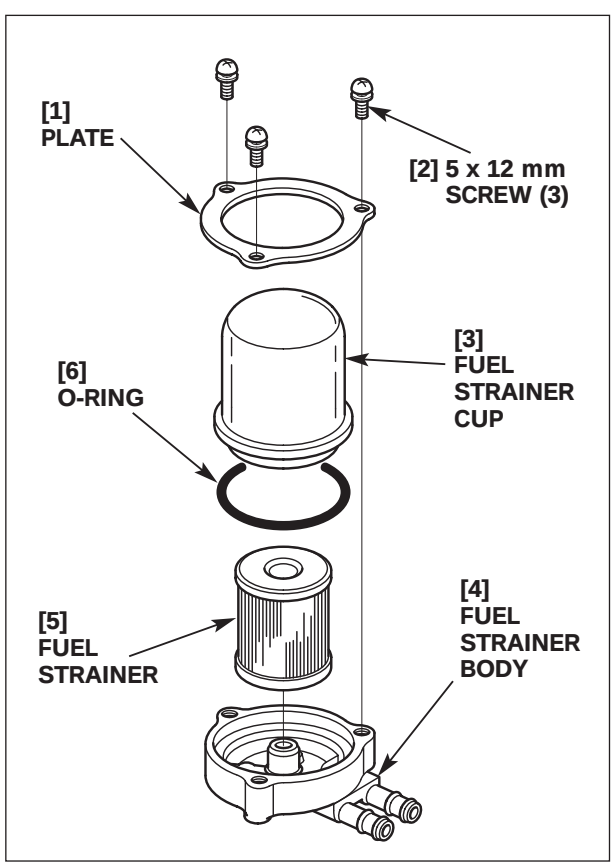
Assembly:

1) Install a new fuel strainer on the fuel strainer body.

2) Set a new O-ring on the fuel strainer cup.
Install the fuel strainer cup and the plate on the fuel strainer body.

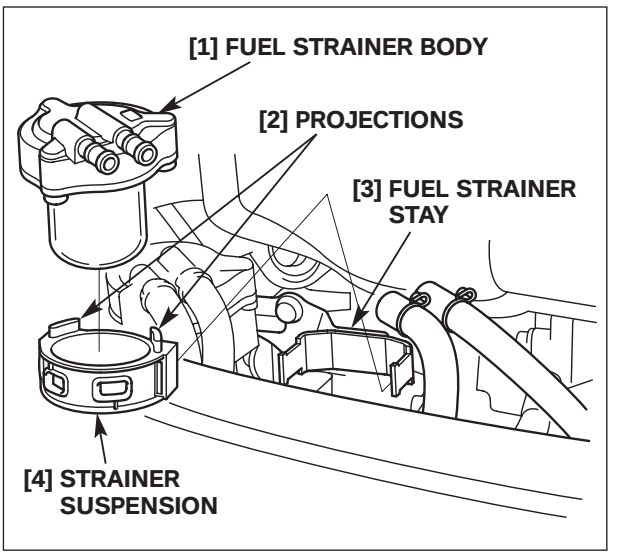
3) Tighten the three 5 x 12 mm screws to the specified torque.

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



4) Install the strainer suspension on the fuel strainer cup so that its projections are at the fuel strainer body side.

5) Install the fuel strainer (low pressure side) on the fuel strainer stay securely.

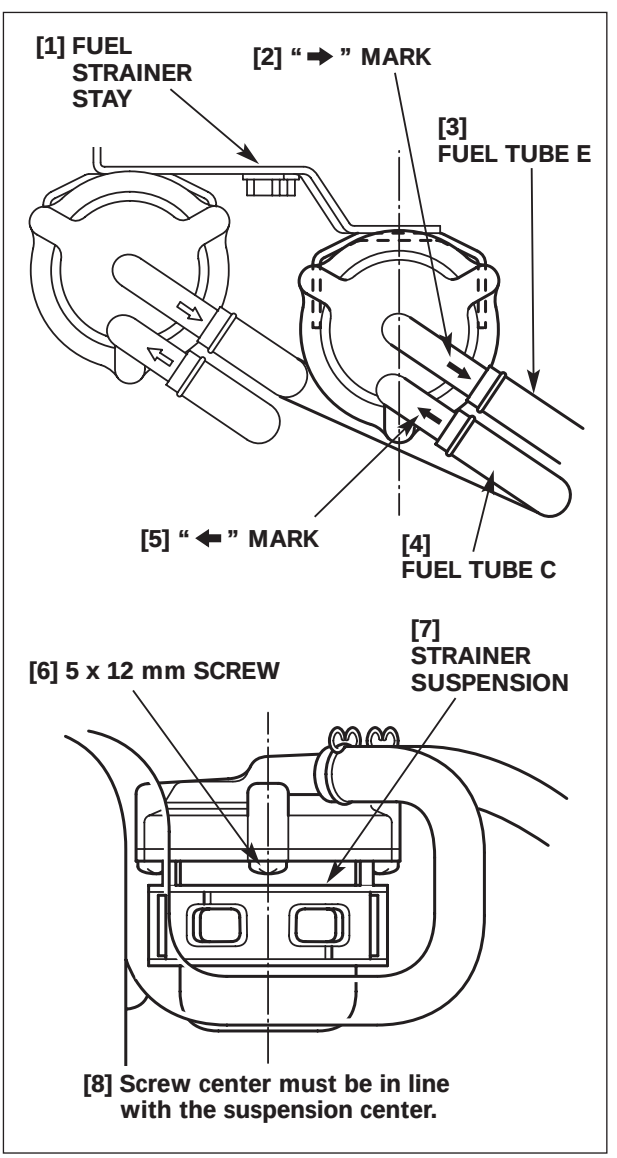


6) Check that the center of the 5 x 12 mm screw at the fuel tube C installation part is in line with the center of the strainer suspension as shown.

7) Connect the fuel tube C to the " ⬅ " mark side of the fuel strainer. Connect the fuel tube E to the " ➡ " mark side of the fuel strainer.

   • After connecting the tubes, check for gasoline leakage.

8) Install the engine cover (P. 4-2).



8. FUEL STRAINER (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 mot reach 270 – 320 kPa (2.8 – 3.3 kgf/cm^2, 40 – 47 psi) with the pressure regulator control tube connected, be sure that the fuel pump unit (P. 5-107) and the pressure regulator (P. 5-106) are normal, and replace the fuel filter (high pressure side).

Replacement:

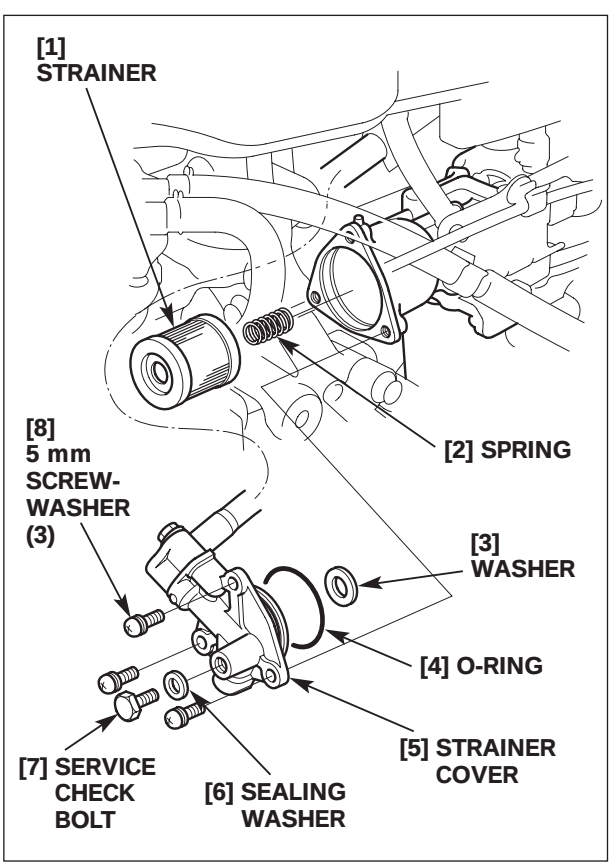
1) Remove the engine cover (P. 4-2).
   Remove the L./R. engine under covers (P. 4-9).
2) Relieve the fuel pressure following the instruction of “How to relieve fuel pressure” (P. 5-102).
3) Remove the three screw-washers from the strainer cover while wrapping the strainer cover with a cloth or shop towel.
   Replace the O-ring on assembly.
4) Remove the strainer. Replace the fuel strainer if it is contaminated or damaged.

Assembly:

1) Apply the engine oil to a new O-ring and install it on the strainer cover.
2) Install the spring, strainer and washer in the case, then install the strainer cover.
3) Tighten the three screw-washers to the specified torque.

   TORQUE: 3.4 N·m (0.35 kgf·m, 2.5 lbf·ft)
4) After tightening the screw-washers, check for gasoline leakage.
5) Set a new 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)
6) Install the L./R. engine under covers (P. 4-14).
   Install the engine cover (P. 4-2).



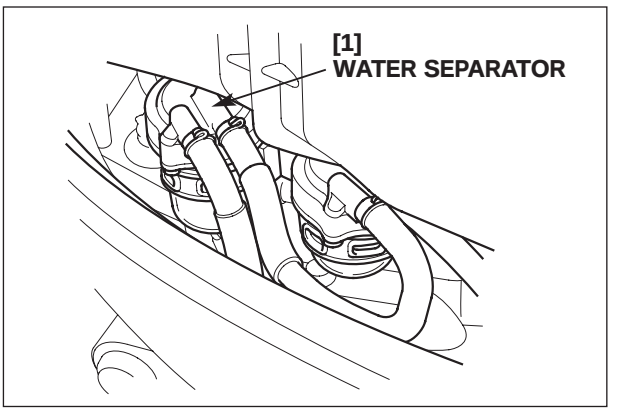
9. WATER SEPARATOR with WATER LEVEL SENSOR

⚠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) Remove the engine cover (P. 4-2).

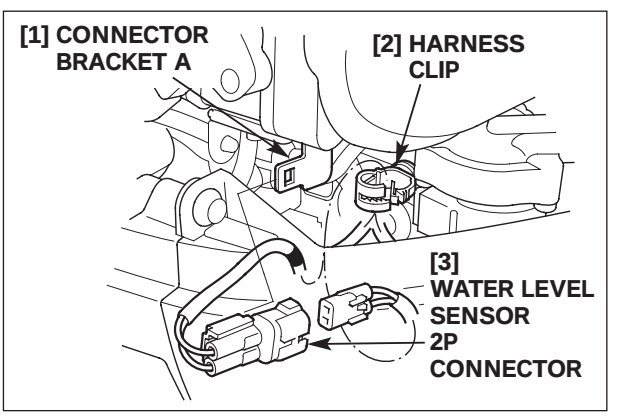
2) Check the water separator for water accumulation or sediment. If water or sediment is found, or the water filled alert buzzer is sound, remove the water separator as follows.

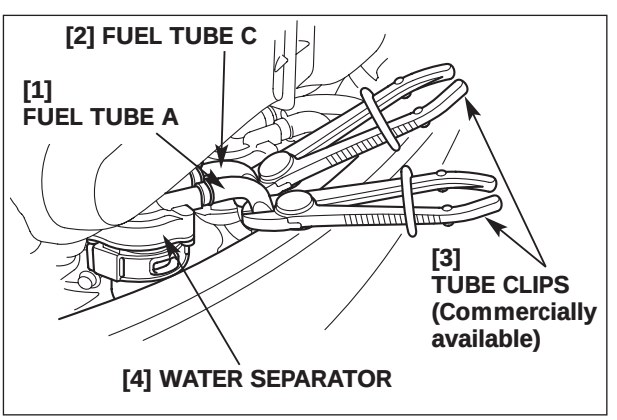
Removal/Cleaning:

- Turn the ignition switch to the OFF position, disconnect the battery negative (-) cable, then positive (+) cable.

1) Open the harness clip. Remove the water level sensor 2P connector from the connector bracket A.
   Disconnect the water level sensor 2P connector.

2) Clamp the fuel tube A and C with the commercially available tube clips securely.



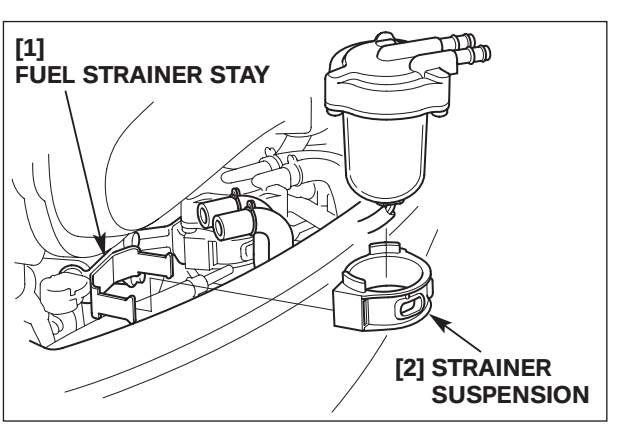


3) Remove the strainer suspension from the fuel strainer stay.

4) Disconnect the fuel tube A and C from the water separator with water level sensor.

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

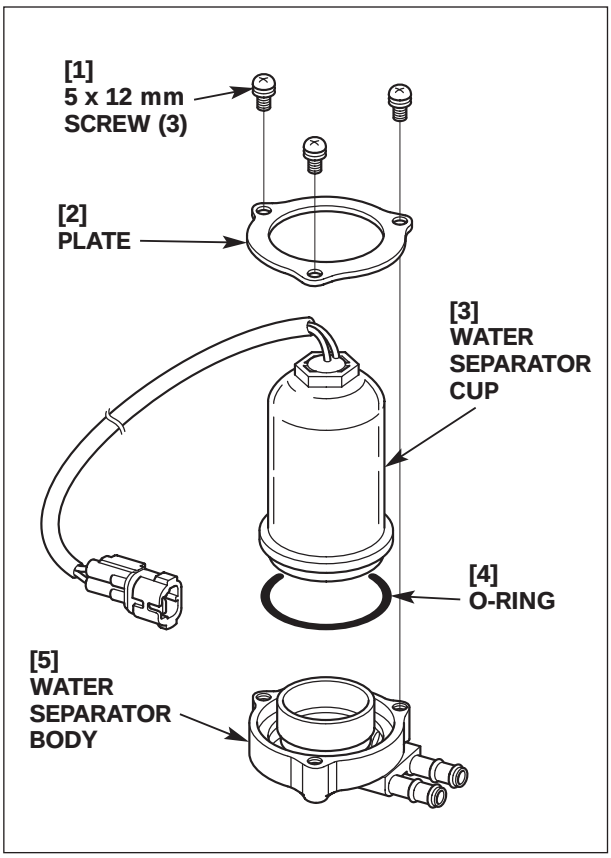
   Remove the strainer suspension from the water separator cup.



Disassembly:

1) Remove the three 5 x 12 mm screws from the water separator body, then remove the plate and the water separator cup.

2) Clean the water separator cup. Replace the fuel strainer with a new one if it is contaminated.
Replace the O-ring with a new one on assembly.



Water level sensor float check:

1) Check the float in the water separator cup for smooth operation.

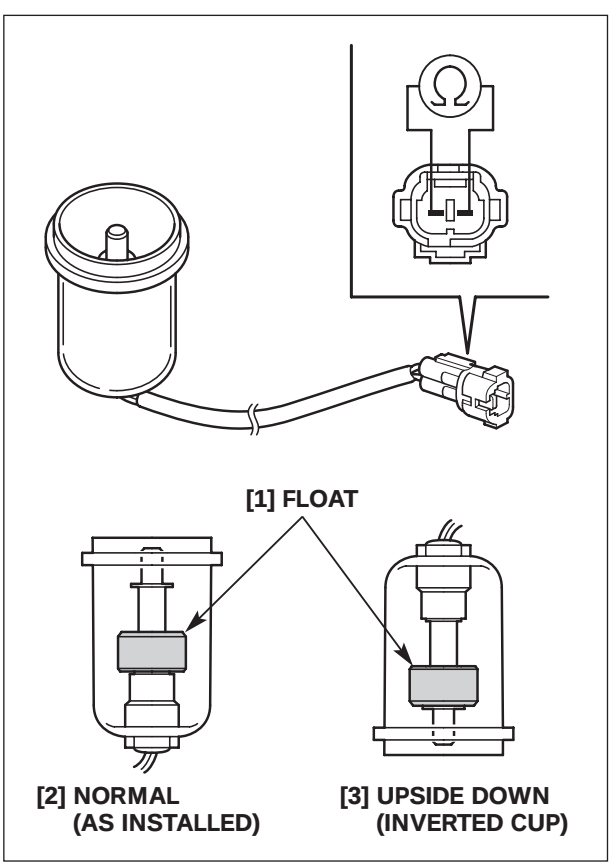
2) If it does not operate smoothly, replace the water separator cup.

Water level sensor continuity check:

1) With the water separator cup removed, hold the cup upright (i.e. as if it is mounted) and check for continuity between the 2P connecter terminals. There must be no continuity between the terminals.

2) With the water separator cup removed, hold the cup upside down and check for continuity between the 2P connector terminals. There must be continuity between the terminals.

3) If there is any abnormality during the check, replace the water separator cup.



Assembly:

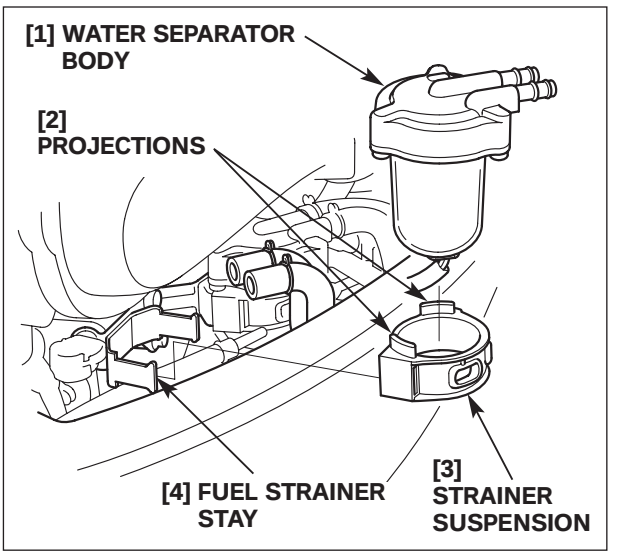
1) Set a new O-ring on the water separator cup. Install the water separator cup and the plate on the water separator body.

2) Tighten the three 5 x 12 mm screws to the specified torque.

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

3) Install the strainer suspension on the water separator cup so that its projections are at the water separator body side.

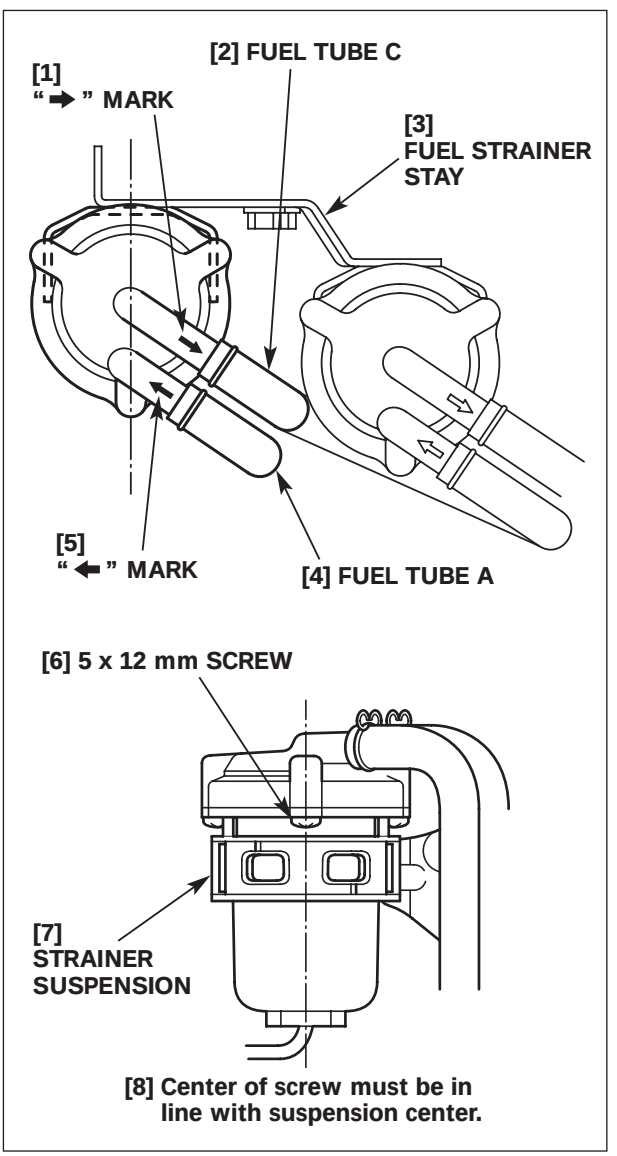
4) Install the water separator with water level sensor on the fuel strainer stay securely.



5) Check that the center of the 5 x 12 mm screw at the fuel tube A installation part is in line with the center of the strainer suspension as shown.

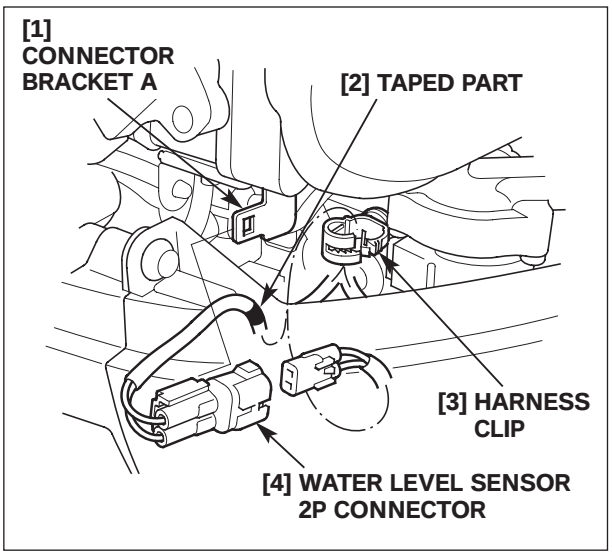
6) Connect the fuel tube A to the " ⬅ " mark side of the water separator with water level sensor. Connect the fuel tube C to the " ➡ " mark side of the water separator with water level sensor.

   • After connecting the tubes, check for gasoline leakage.



7) Connect the water level sensor 2P connector and install the 2P connector on the connector bracket A.
Route the water level sensor wire through the harness clip. Clamp at the taped part of the water level sensor wire and close the harness clip.

8) Install the engine cover (P. 4-2).



10. IDLING

Inspection:

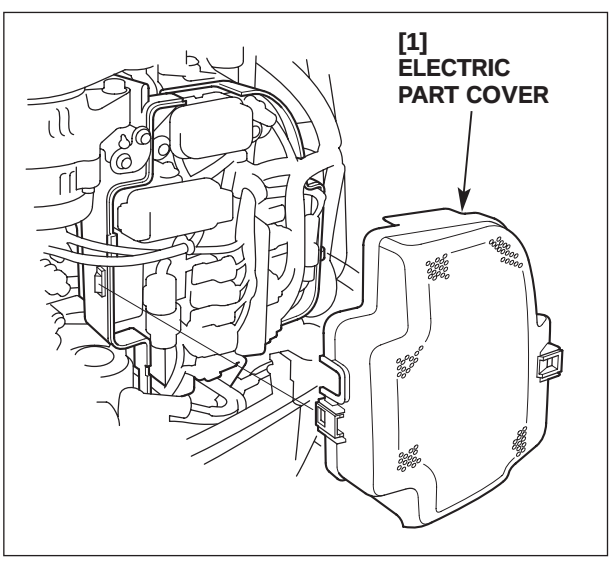
Check the following before starting the idling inspection.
– Spark plug gap (These models are equipped with the iridium spark plugs. If the spark plug gap is out of the specification, replace the spark plug with a new one.) (P. 3-8).

– 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.
Remove the engine cover (P. 4-2).

3) Remove the electric part cover.

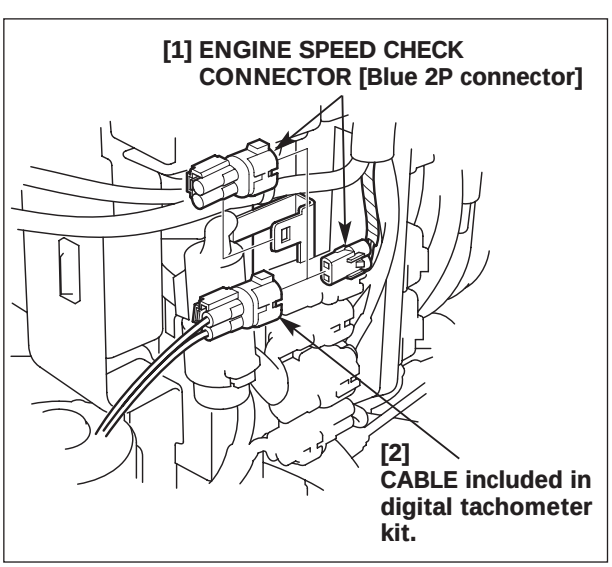


4) Install the commercially available digital tachometer (KOWA: KEK-8-MT600) or the HDS (Honda Diagnostic System).

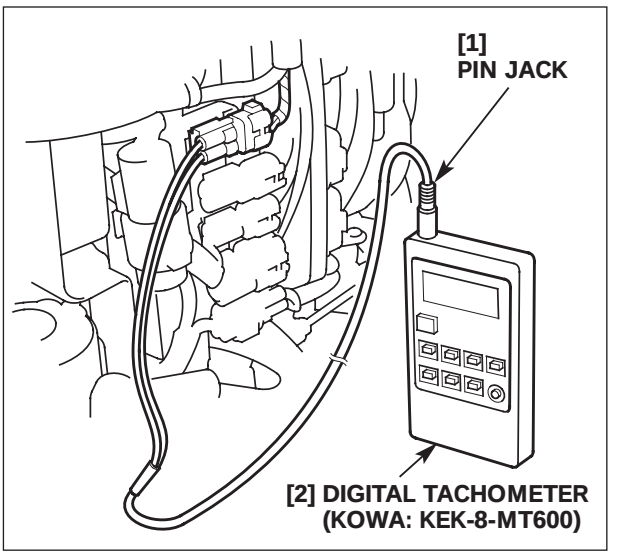
How to connect the digital tachometer (KOWA: KEK-8-MT600):

1) Disconnect the engine speed check connector (Blue connector: 2P connector).

2) Connect the 2P connector of the cable that is included in the digital tachometer kit (KOWA: KEK-8-MT600) to the engine side 2P connector.



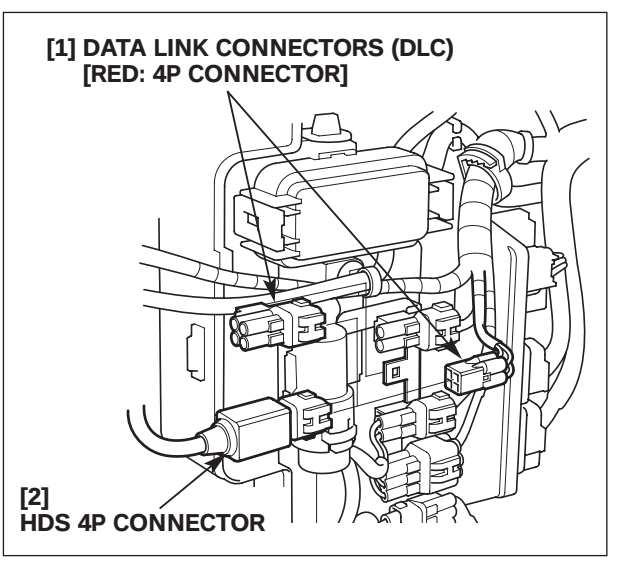
3) Connect the pin jack, that is the opposite side from the cable 2P connector, to the digital tachometer.



How to connect the HDS (Honda Diagnostic System):

1) Disconnect the data link connectors (Red connector: 4P connector).

2) Connect the 4P connector that goes to the HDS to the engine side 4P connector.

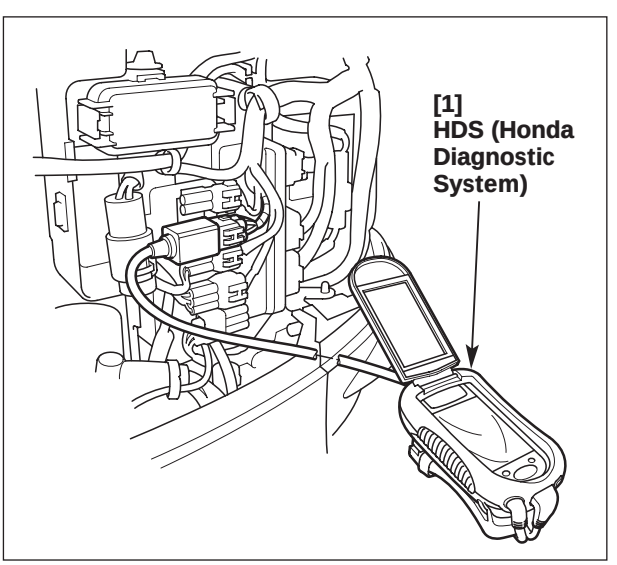


5) Start the engine and let it warm up sufficiently. Run the engine under no load until the engine speed stabilizes, and check the idling speed.

Specified idle speed (At neutral)	750 ± 50 min^{-1} (rpm)

- If the idle speed is out of the specification, adjust the idle (P. 5-94).
- When the idle speed is outside the specification or when a problem symptom shown on the Idle Control System Troubleshooting Guide (P. 5-93) appears, perform the adjustment.

6) Install the engine cover (P. 4-2).



11. SHIFT CONTROL CABLE

Inspection:

1) Remove the engine cover (P. 4-2).

   Remove the front separate cover (P. 4-7).

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

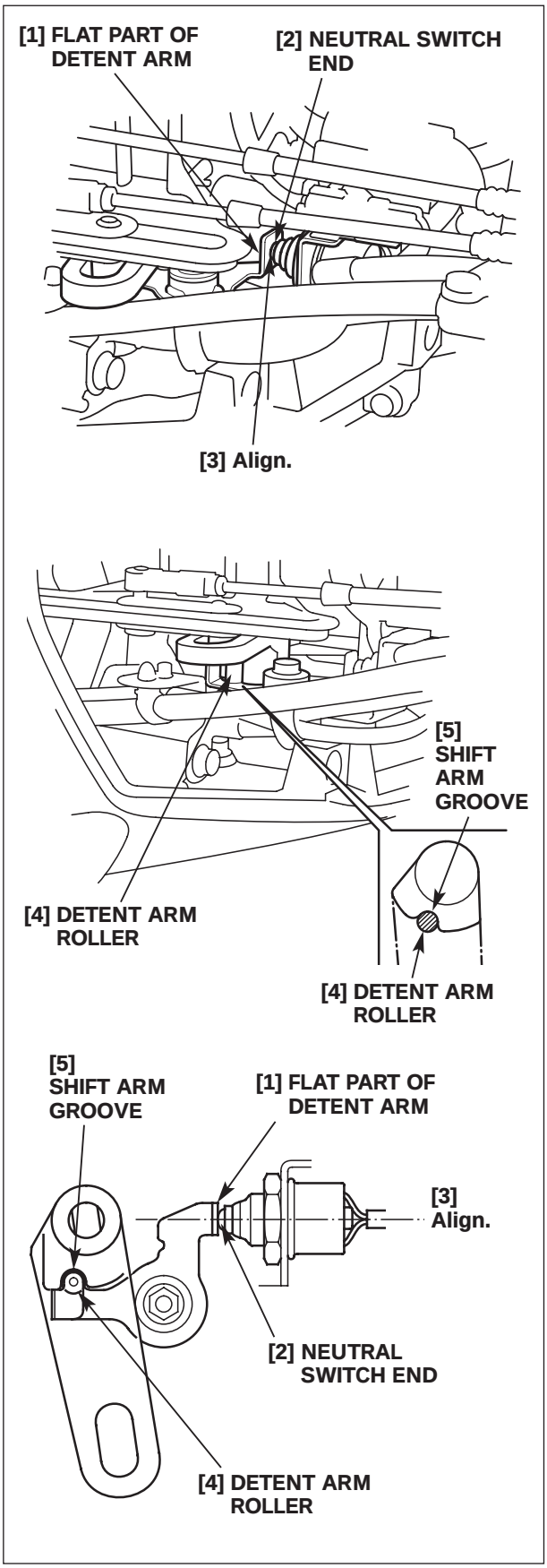
   Check that the detent arm roller sets in the groove in the shift arm as shown.

   Check that the center of the neutral switch end aligns with the center of the flat part of the detent arm.

3) If the center of the neutral switch end does not align with the center of the flat part of the detent arm, check the detent arm for deformation and damage.

   Replace the detent arm with a new one if necessary (P. 17-13).

   If the detent arm roller is not in the groove in the shift arm, adjust (P. 3-25).



Adjustment:

1) Move the remote control lever to the “N” (Neutral) position.

2) Loosen the shift pivot lock nut of the remote control cable (shift side) and detach the shift pivot from the shift link pin.

3) Check that the detent arm roller sets in the groove in the shift arm.

4) Turn the shift pivot right or left so that the shift pivot sets on the shift link pin smoothly.

5) Set the shift pivot on the shift link pin. Move the remote control lever back and forth several times to check that the detent arm roller is in the groove in the shift arm securely.

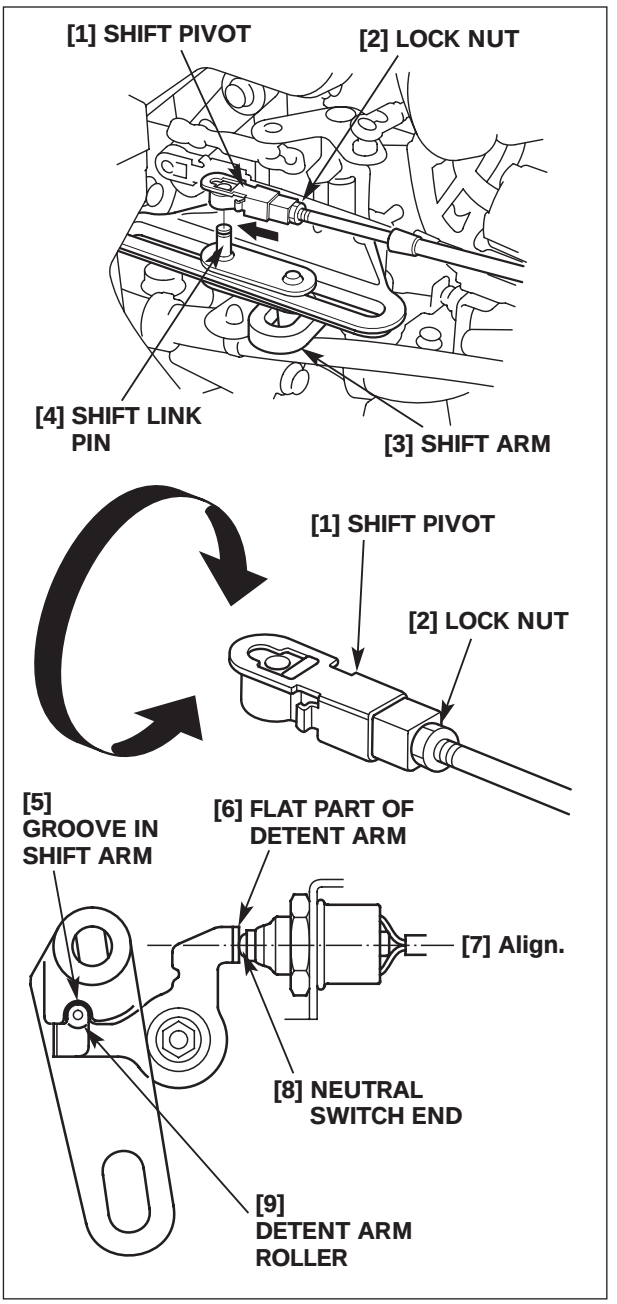
   Check that the center of the neutral switch end aligns with the center of the flat part of the detent arm.

   Tighten the lock nut securely.

   If the detent arm roller is not in the groove in the shift arm, readjust.

6) After adjustment, install the front separate cover (P. 4-7).

   Install the engine cover (P. 4-2).



12. THROTTLE CONTROL CABLE/ THROTTLE LINK

Inspection:

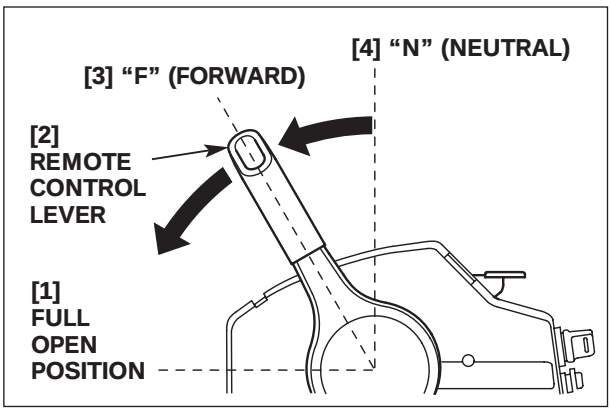
1) Remove the engine cover (P. 4-2).
   Remove the front separate cover (P. 4-7).

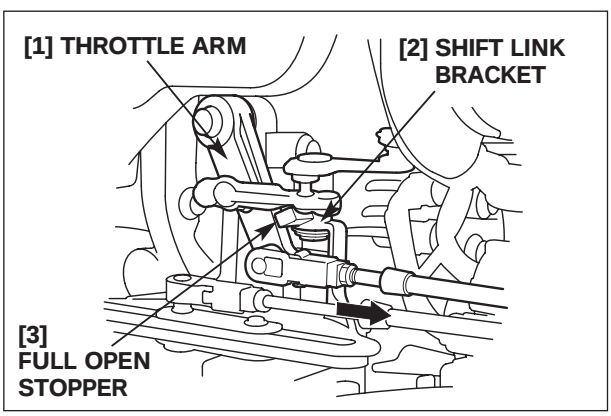
2) Move the remote control lever to the "F" (Forward) full open position.

   NOTICE

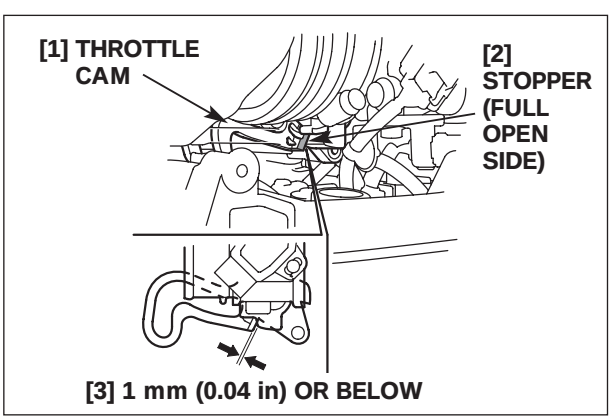
   - *If it is hard to move the remote control lever to the "F" (Forward) position with the engine stopped, move the lever while turning the propeller or propeller shaft.*
   - *Do not move the remote control lever with force, or damage to the gearshift system can result.*

3) With the remote control lever in the "F" (Forward) full open position, check that the throttle arm is in contact with the full open stopper of the shift link bracket.





4) With the throttle arm in the position described in step 3, check for clearance between the throttle cam of the throttle body and the full open side stopper. It must be 1 mm (0.04 in) or below.



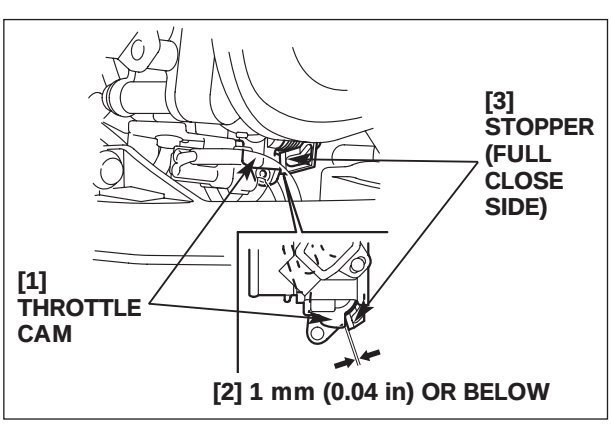
5) Move the remote control lever to the "N" (Neutral) position and check that the throttle cam of the throttle body is in the full close position.

   Check the clearance between the throttle cam and the full close side stopper. It must be 1 mm (0.04 in) or below.

6) If either of the above step 3, 4 or 5 is not satisfied, adjust as follows (P. 3-27).

   If step 3 is not satisfied: Go to <Throttle arm not in full open position>.

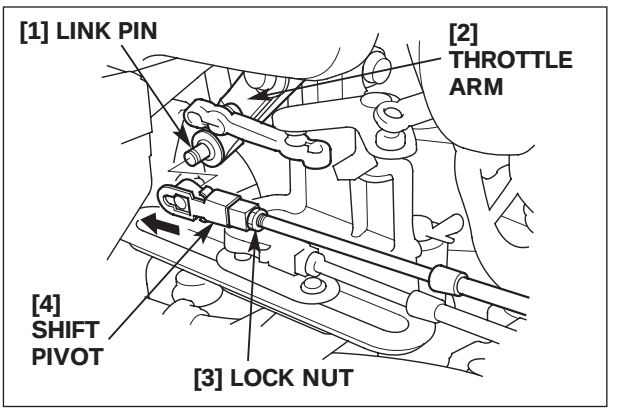
   If step 4 or 5 is not satisfied: Go to <Throttle cam not in full open position>.



Adjustment:

<Throttle arm not in full open position>

1) Loosen the shift pivot lock nut of the remote control cable (throttle side), and remove the shift pivot from the throttle arm link pin.

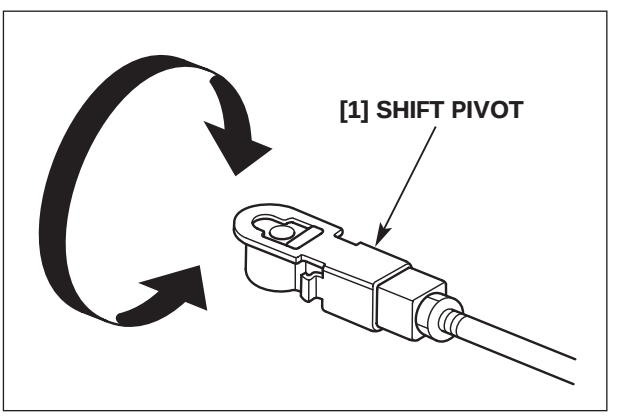


2) Screw in the shift pivot a little until the throttle arm contacts the full open stopper, and temporarily install the shift pivot on the throttle arm.

3) Move the remote control lever to the "F" (Forward) full open position (P. 3-26).

4) Check that step 3, 4 and 5 under the section of Inspection are satisfied (P. 3-26).
   If not, perform the adjustment procedure from step 1.
   If the throttle arm is in contact with the full open side stopper but the step 4 or 5 is not satisfied, go to <Throttle cam not in full open position>.

5) Move the remote control lever to the "N" (Neutral) and tighten the shift pivot lock nut securely.



<Throttle cam not in full open position>

- Perform this adjustment with the remote control cable (throttle side) installed on the throttle arm.
- Be sure that the throttle arm is in contact with the full open side stopper.

1) Remove the throttle rod linkage pivot from the throttle plate and loosen the linkage pivot lock nut.

2) With the throttle arm in contact with the full open side stopper, turn the throttle rod linkage pivot right or left to adjust the clearance between the throttle cam and the full open side stopper. It must be 1 mm (0.04 in) or below.

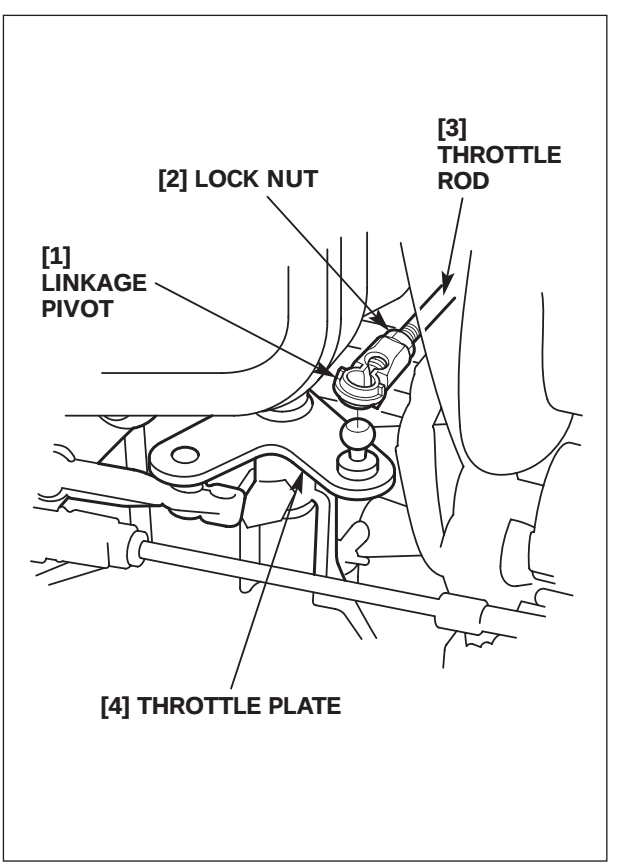
3) Temporarily install the linkage pivot on the throttle plate.

4) Check that step 3, 4 and 5 under the section of Inspection are satisfied (P. 3-26).

   If step 3 is not satisfied, readjust following the procedure of <Throttle arm not in full open position>.

   If the throttle cam is in contact with the full open side stopper but the step 5 is not satisfied, go to <Throttle cam not in full open position>.

5) Tighten the linkage pivot lock nut securely.



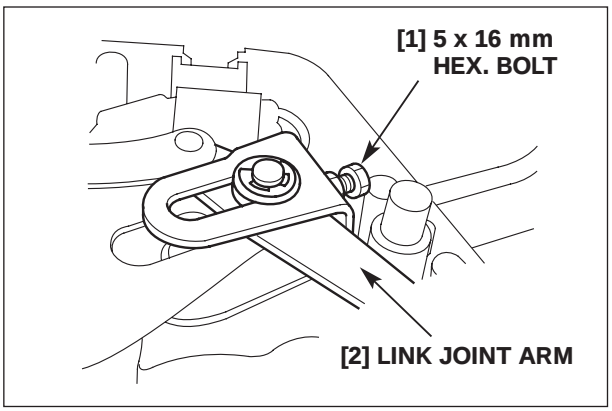
Check item:

<Side-mount remote control type only>

1) Remove the remote control box cover B and C (P. 16-2).

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 unit it contacts the link joint arm.

3) Install the remote control box cover B and C (P. 16-2).

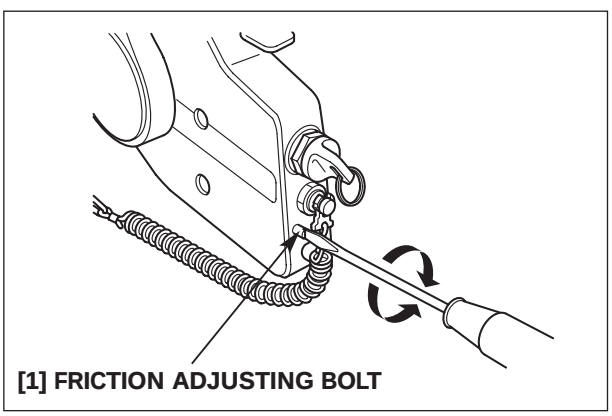


13. REMOTE CONTROL LEVER FRICTION

Inspection/Adjustment:

1) Check the remote control lever for smooth operation.
   If the lever movement is too light or too heavy, adjust the friction.

2) Adjust by turning the friction adjusting bolt right or left.



14. ALTERNATOR BELT

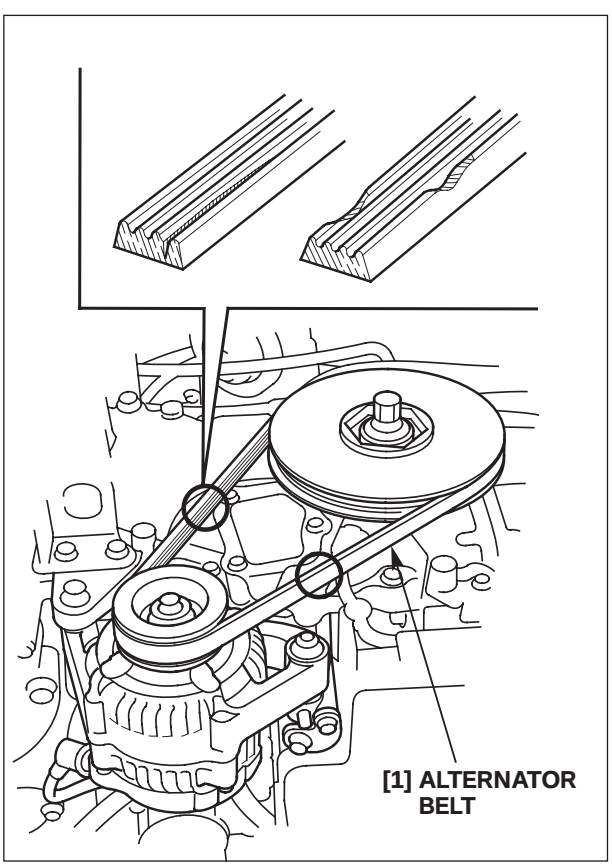
Inspection:

1) Remove the engine cover (P. 4-2).
   Remove the silencer duct assembly (P. 3-11 and 12).

2) Check the alternator belt for wear and damage.
   Replace the alternator belt if necessary (P. 3-29).

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

4) Check the belt tension and belt deflection (P. 3-29).



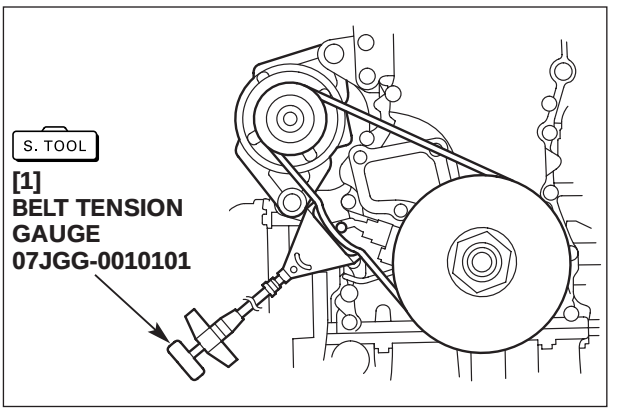
a. Best tension check using belt tension gauge:

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	329 – 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.

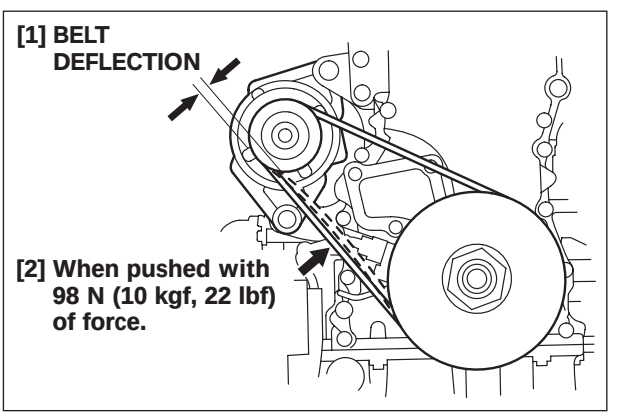


b. Belt deflection inspection

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	10.6 – 11.1 mm (0.42 – 0.44 in)
	New belt	10.1 – 10.6 mm (0.40 – 0.42 in)

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



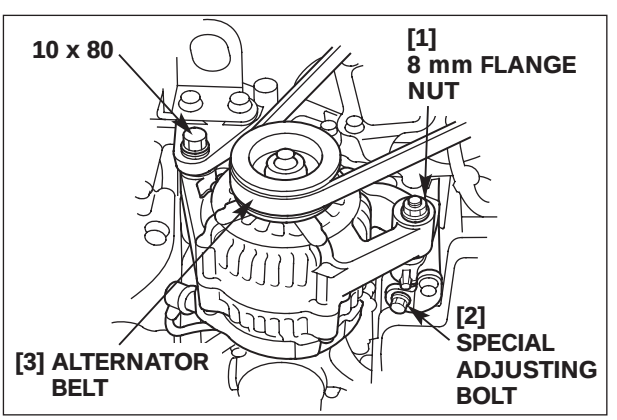
Belt Tension Adjustment:

1) If the belt tension or 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 adjusting 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.

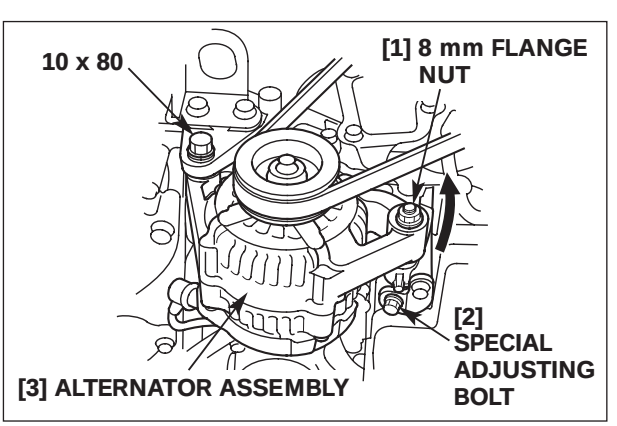
TORQUE:
8 mm flange nut: 26 N·m (2.7 kgf·m, 20 lbf·ft)
10 x 80 mm flange bolt: 44 N·m (4.5 kgf·m, 33 lbf·ft)

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



Replacement:

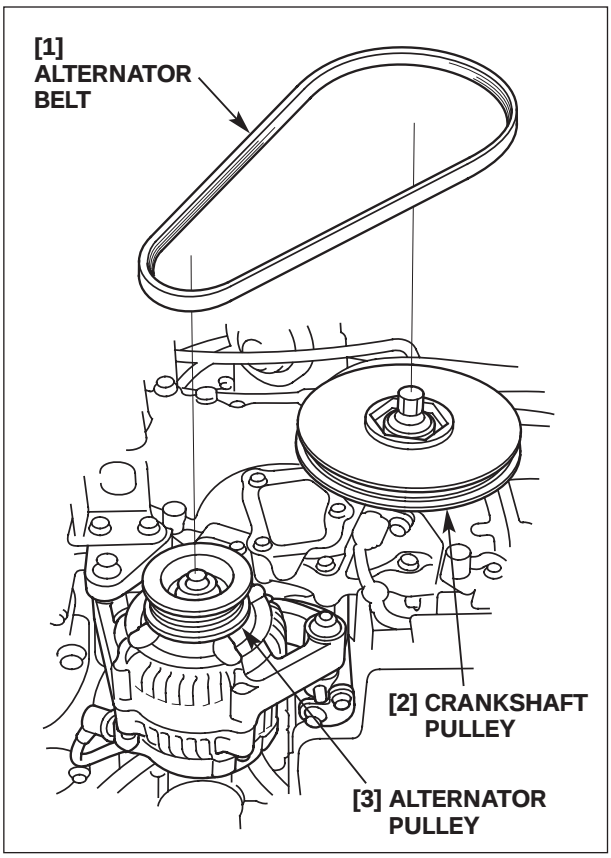
1) Loosen the 10 x 80 mm flange bolt and the 8 mm flange nut.
2) Loosen the special adjusting bolt and move the alternator assembly fully to the engine side.



3) Remove the alternator belt by removing it from the alternator pulley first, then from the crankshaft pulley.

   • 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:

1) Install a new alternator belt on the crankshaft pulley first, then install the other end of the belt on the alternator pulley.

   NOTICE

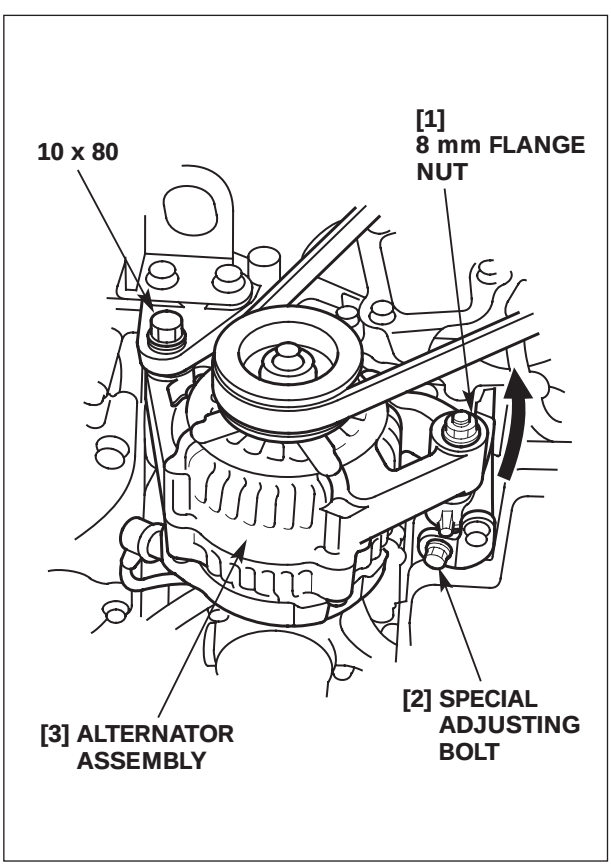
   Do not turn the crankshaft pulley counterclockwise.

2) Tighten the special adjusting bolt.
   Tighten the 8 mm flange nut and the 10 x 80 mm flange bolt in this order to the specified torque.

   TORQUE:
   8 mm flange nut: 26 N·m (2.7 kgf·m, 20 lbf·ft)
   10 x 80 mm flange bolt: 44 N·m (4.5 kgf·m, 33 lbf·ft)

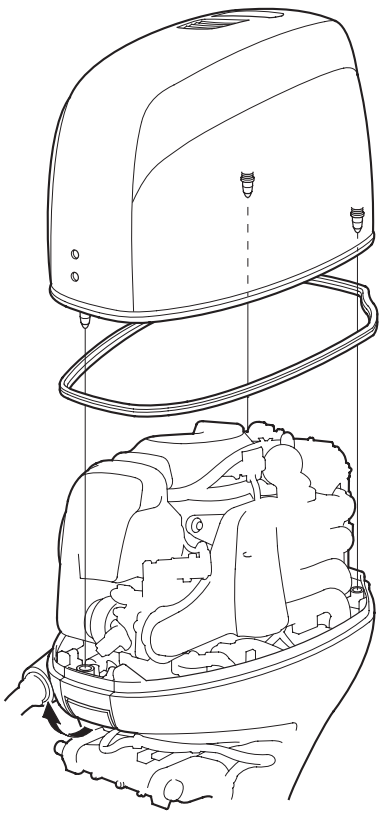
3) After tightening the nut and bolt to the specified torque, check the belt tension and deflection (P. 3-29).

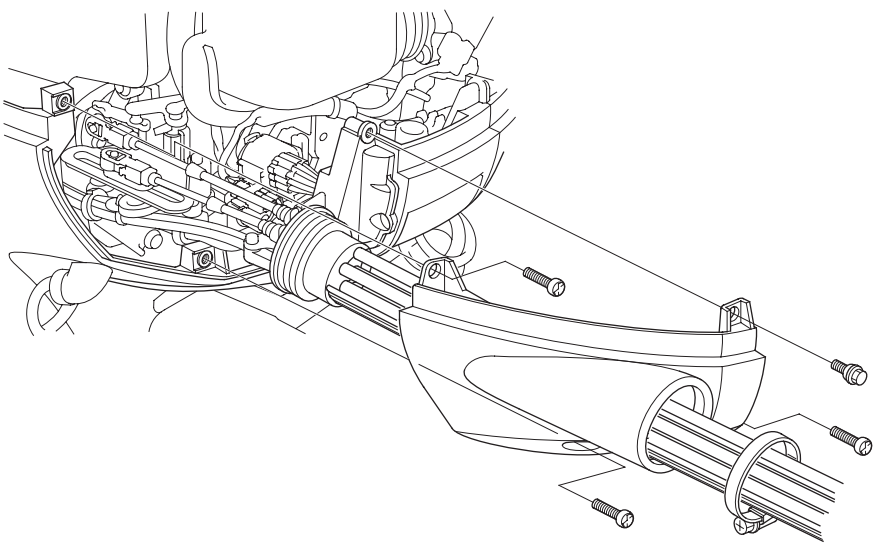
4) Install the silencer duct assembly (P. 3-11 and 12).
   Install the engine cover (P. 4-2).

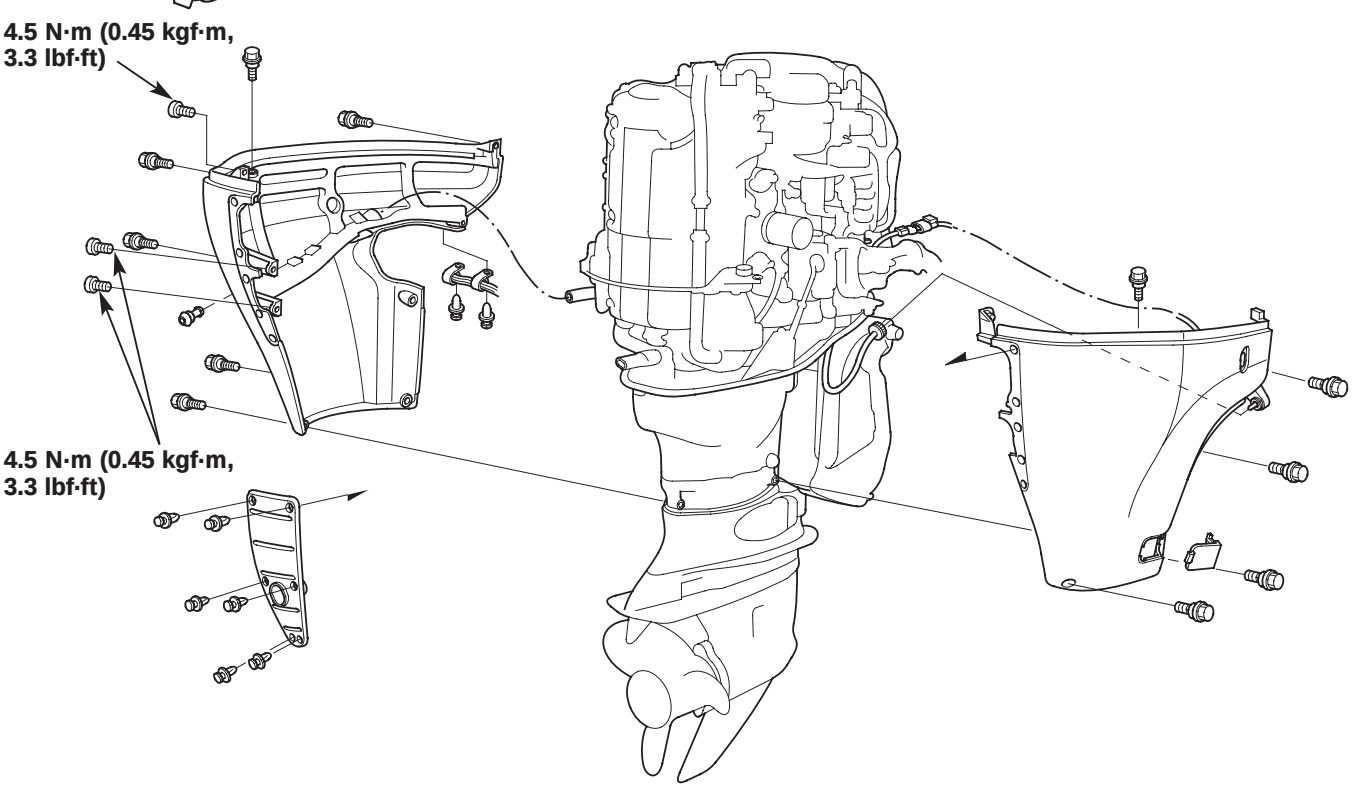


4. ENGINE COVER/COVER LOCK

1. ENGINE COVER
2. FRONT SEPARATE COVER
3. L./R. ENGINE UNDER COVERS
4. UNDER COVER FRONT BRACKET/ L./R. SIDE COVER BRACKETS





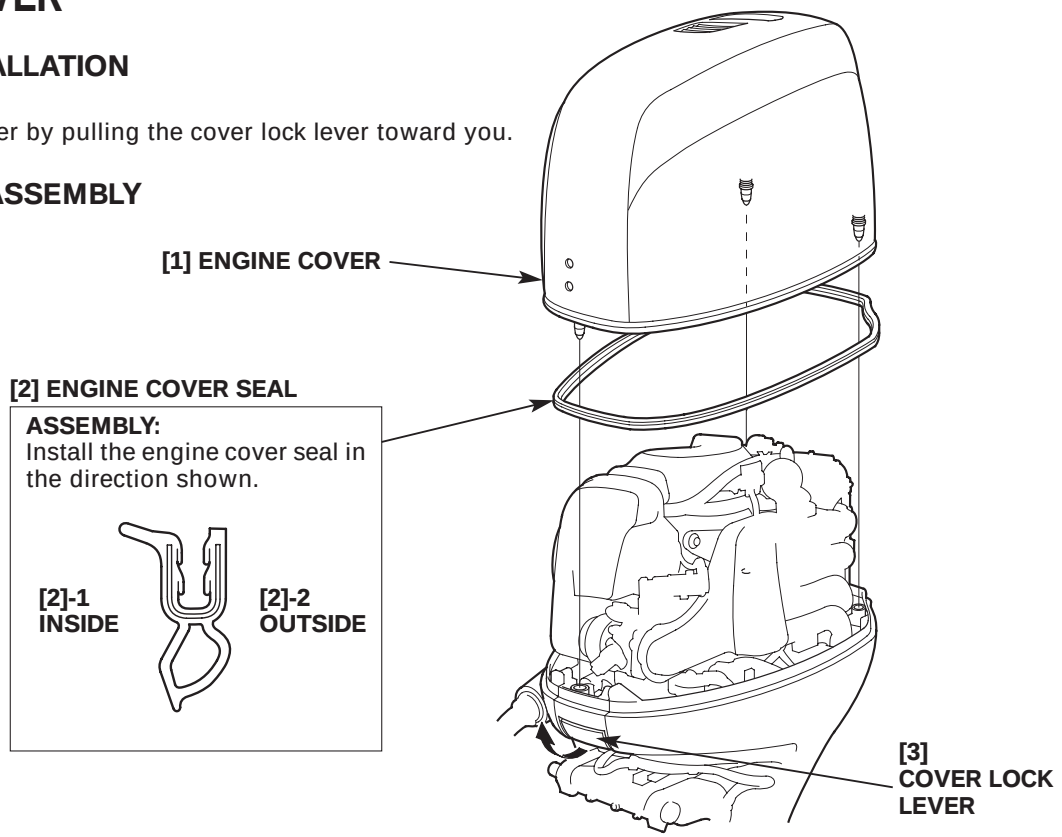


1. ENGINE COVER

a. REMOVAL/INSTALLATION

Remove the engine cover by pulling the cover lock lever toward you.

b. DISASSEMBLY/ASSEMBLY



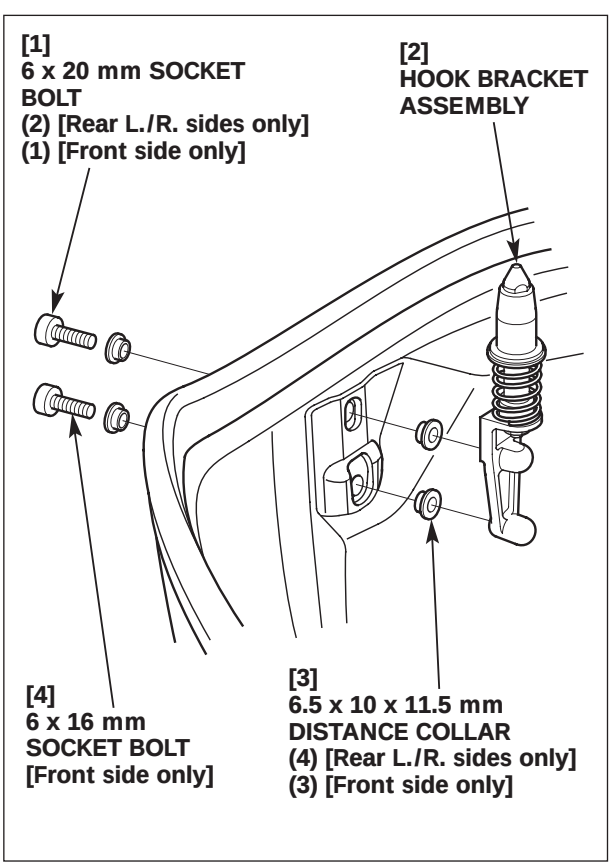
c. HOOK BRACKET ASSEMBLY REMOVAL

1) Remove the 6 x 20 mm socket bolt and the 6 x 16 mm socket bolt, then remove the hook bracket assembly (Front side hook bracket only).

   Remove the two 6 x 20 mm socket bolts and remove the hook bracket assembly (Rear L./R. side hook brackets only).

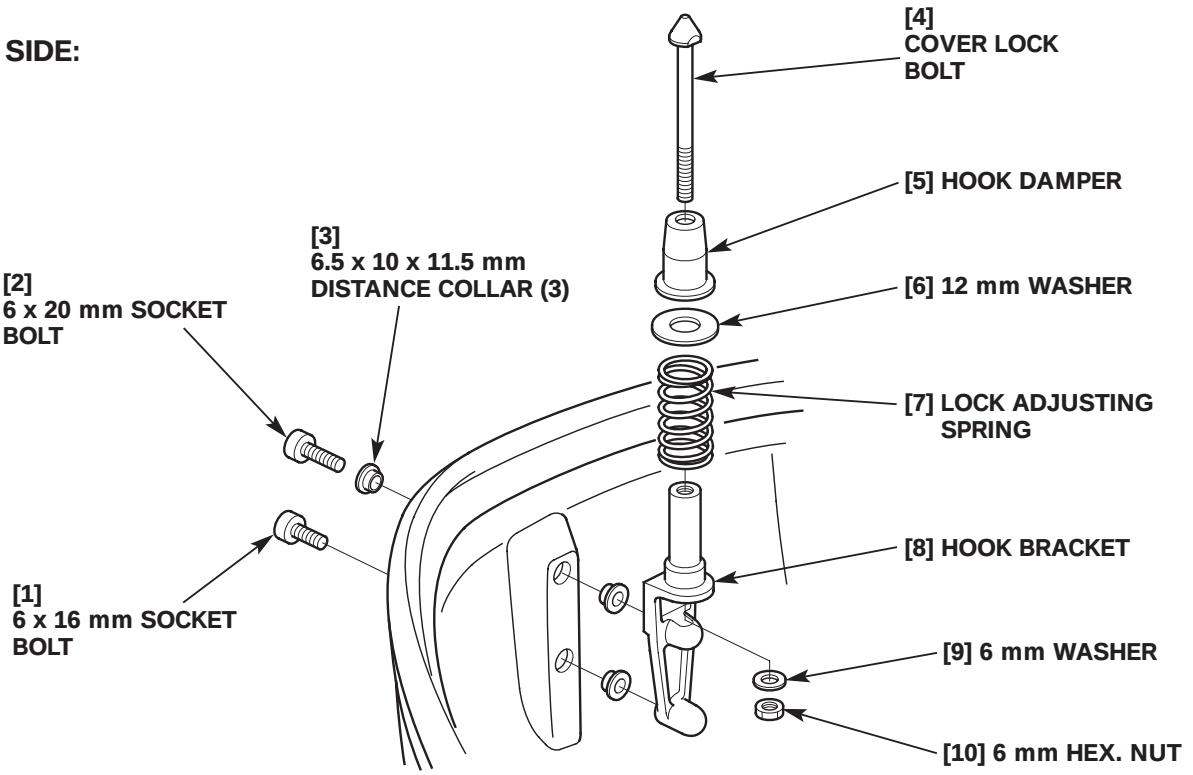
2) Remove the three 6.5 x 10 x 11.5 mm distance collars from the engine cover (Front side hook bracket only).

   Remove the four 6.5 x 10 x 11.5 mm distance collars from the engine cover (Rear L./R. side hook brackets only).

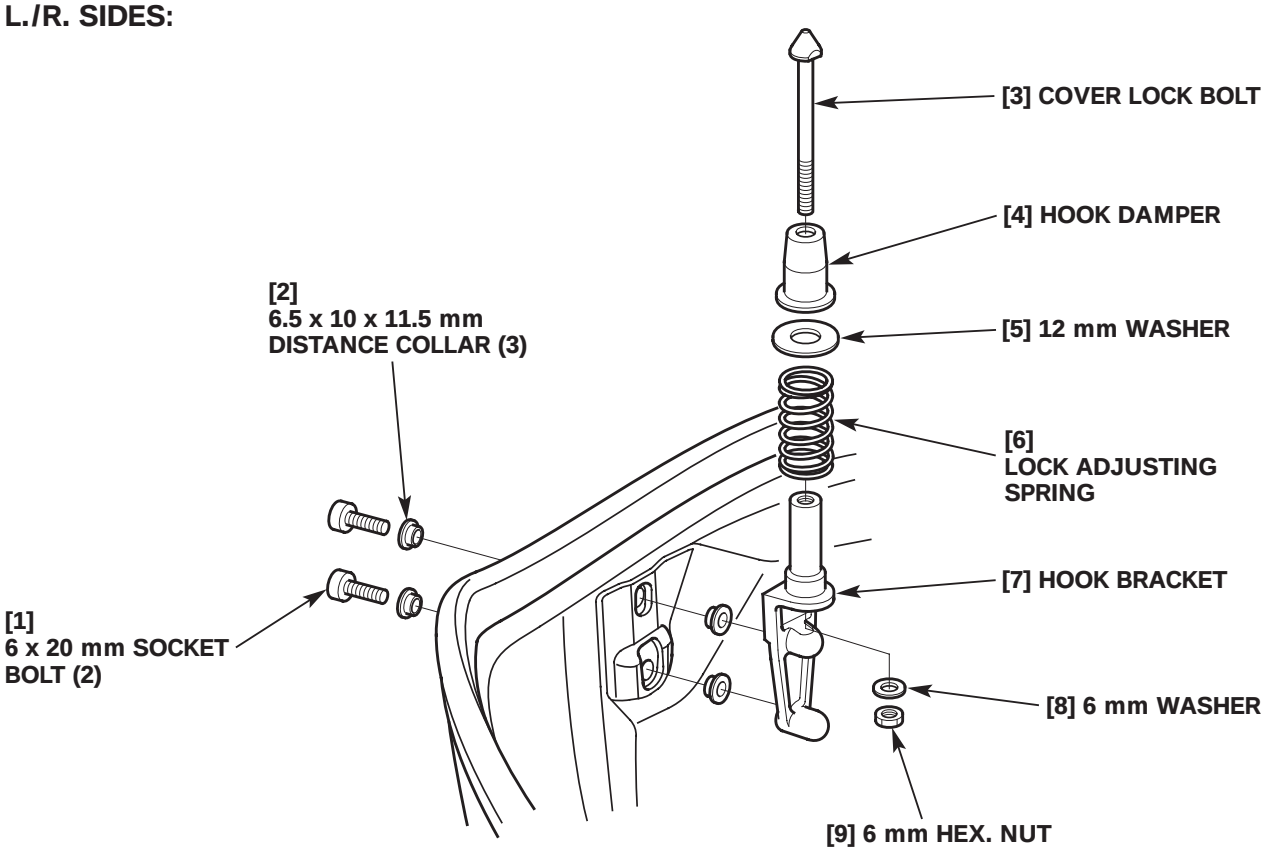


d. HOOK BRACKET DISASSEMBLY/ASSEMBLY

FRONT SIDE:



L./R. SIDES:



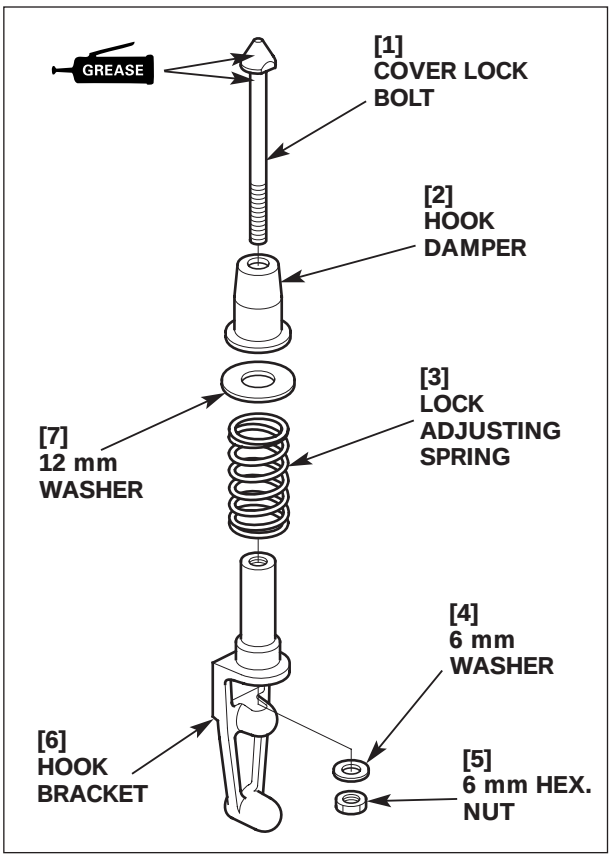
e. HOOK BRACKET ASSEMBLY

1) Apply grease to the cover lock bolt installation part of the hook bracket.

2) Install the lock adjusting spring, 12 mm washer and the hook damper on the hook bracket.

3) Apply grease to the flanged part of the cover lock bolt. Apply grease to the straight part under the flange of the cover lock bolt, too. Install the cover lock bolt on the hook bracket.

4) Position the 6 mm washer and 6 mm hex. nut on the cover lock bolt and tighten the 6 mm hex. nut securely.



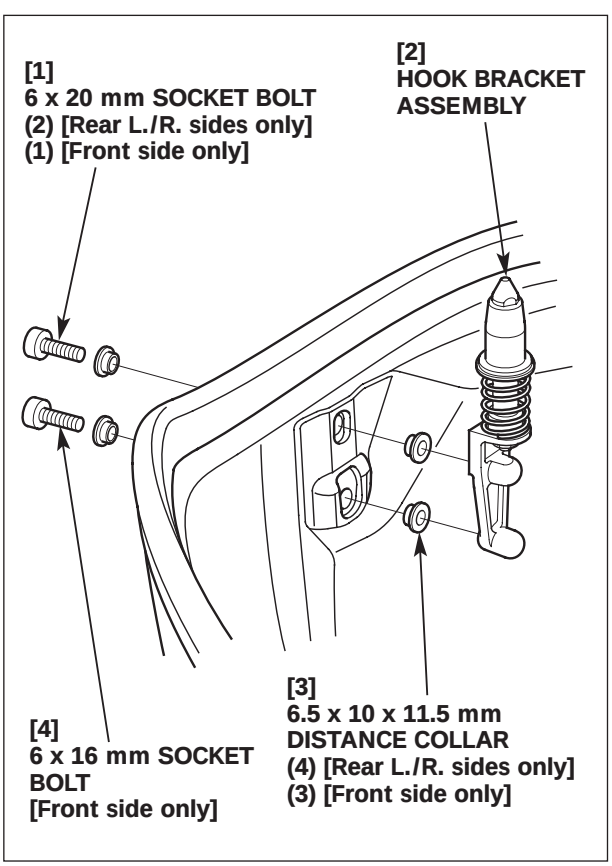
f. HOOK BRACKET ASSEMBLY INSTALLATION

1) Install the four 6.5 x 10 x 11.5 mm distance collars on the engine cover (Rear L./R. side hook brackets only).

   Install the three 6.5 x 10 x 11.5 mm distance collars on the engine cover (Front side hook bracket only).

2) Position the hook bracket assembly on the engine cover and secure it with the two 6 x 20 mm socket bolts (Rear L./R. side hook brackets only).

   Position the hook bracket assembly on the engine cover and secure it with the 6 x 20 mm socket bolt and the 6 x 16 mm socket bolt (Front side hook bracket only).



g. ADJUSTMENT

• HOOK BRACKET

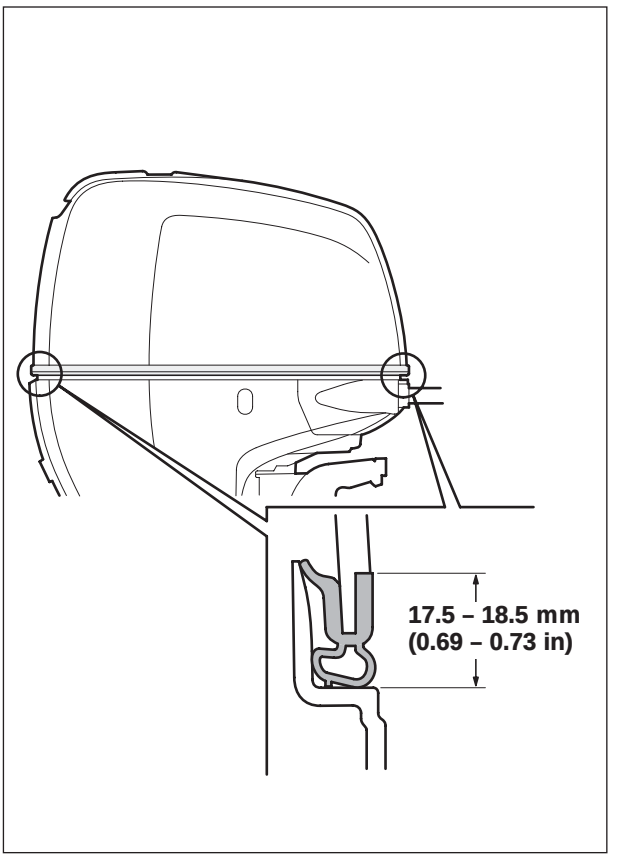
1) Install the engine cover on the outboard motor and lock it securely.

2) Measure the clearance between the engine cover and the L./R. engine under covers.

   • Measure the clearance at the three points, i.e. at the front and at the rear right and left sides.

3) Check that the measurement is within 17.5 – 18.5 mm (0.69 – 0.73 in) at each point.

4) If the measurement is out of the specification, adjust the clearance.



5) To adjust, remove the engine cover and set a wrench or equivalent tool in the cutout in the tapered part of the cover lock bolt. Loosen the 6 mm hex. nut of the hook bracket assembly.

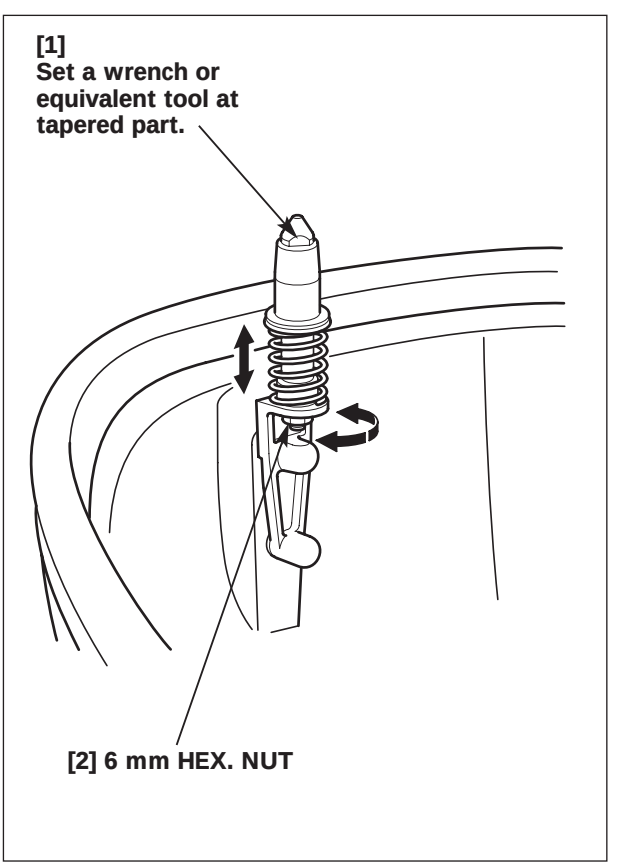
6) After assembly, loosely tighten the 6 mm hex. nut.

7) Install the engine cover on the outboard motor and lock it securely. Measure the clearance between the engine cover and the L./R. engine under covers again.

   If the clearance is out of the specification, repeat step 5.

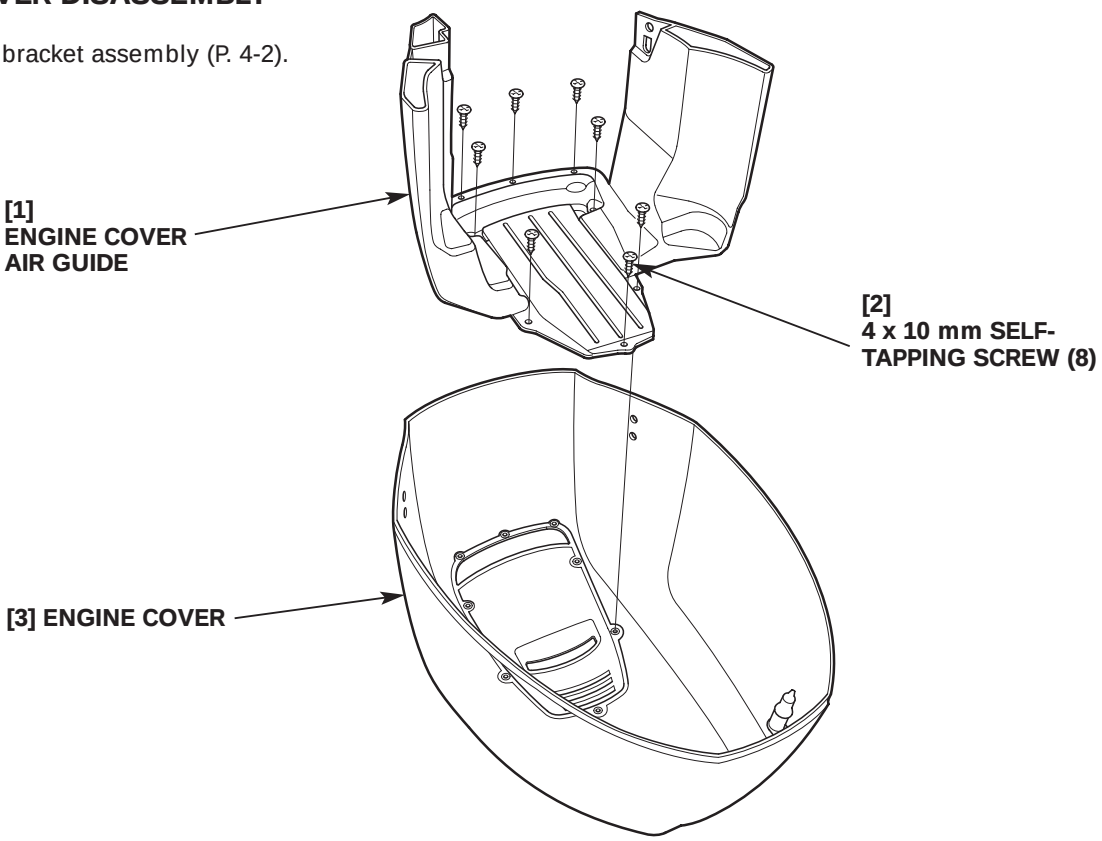
   If the clearance is within the specification, remove the engine cover and tighten the 6 mm hex. nut securely.

8) Install the engine cover (P. 4-2).



h. ENGINE COVER DISASSEMBLY

Remove the hook bracket assembly (P. 4-2).



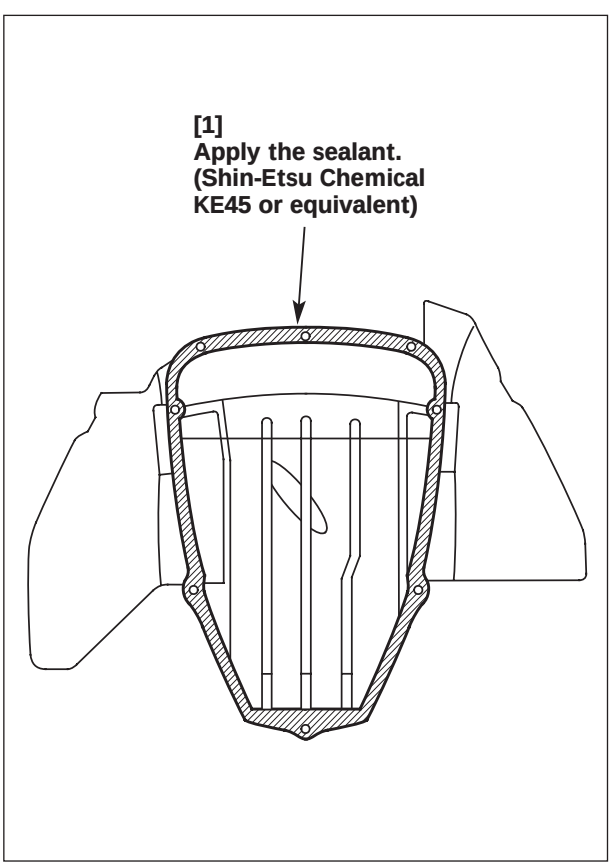
i. ENGINE COVER ASSEMBLY

1) Clean the engine cover and engine cover air guide mating surfaces.

2) Apply the sealant (Shin-Etsu Chemical KE45 or equivalent) to the indicated position of the engine cover air guide.

3) Tighten the engine cover air guide with the eight 4 x 10 mm self-tapping screws securely.

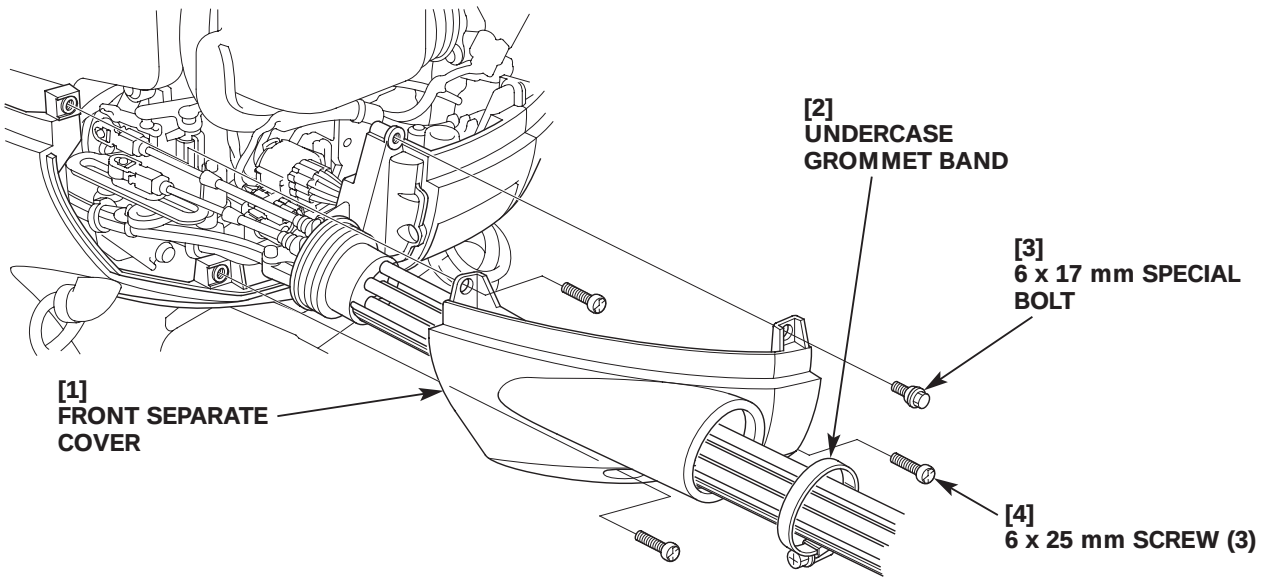
4) Install the hook bracket assembly (P. 4-4).



2. FRONT SEPARATE COVER

a. REMOVAL

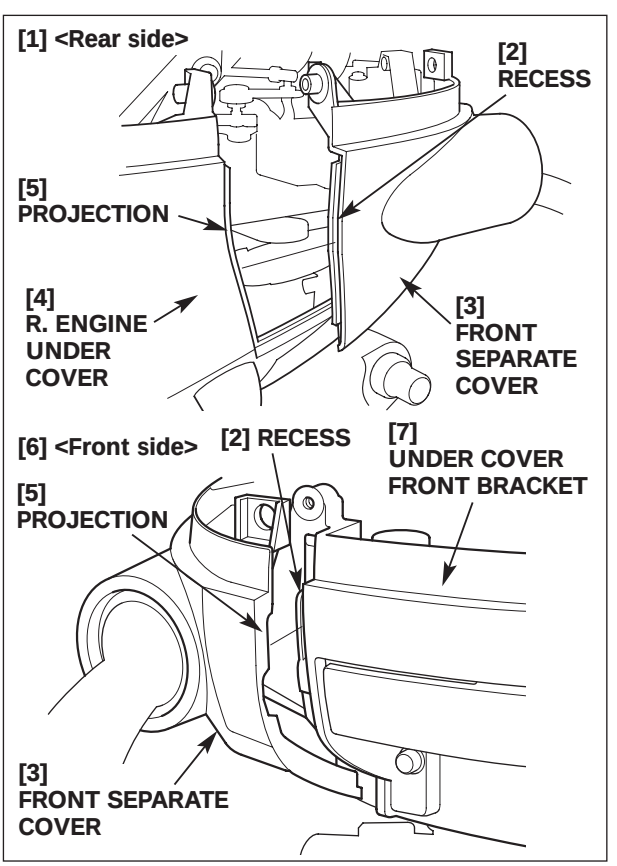
1) Remove the engine cover (P. 4-2).
2) Loosen the undercase grommet band and remove it from the remote control cable grommet.
3) Remove the 6 x 17 mm special bolt and the three 6 x 25 mm screws, then detach the front separate cover.
4) Remove the front separate cover.



b. INSTALLATION

1) Install the front separate cover by aligning the recess at the rear of the front separate cover (i.e. R. engine under cover side) with the projection of the R. engine under cover.

2) Install by aligning the projection at the front (i.e. under cover front bracket side) of the front separate cover with the recess of the under cover front bracket.



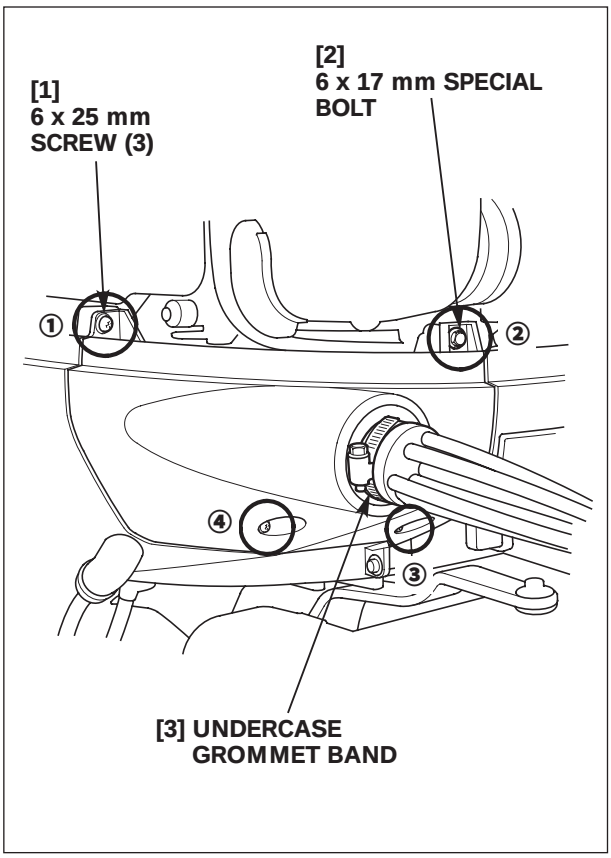
3) Loosely tighten the three 6 x 25 mm screws and one 6 x 17 mm special bolt.

   • Check that the special bolt is not on the case but it is tightened properly.

4) Tighten the 6 x 25 mm screws and the 6 x 17 mm special bolt securely in the numbered sequence shown in two or three steps.

5) Install the undercase grommet band on the remote control cable grommet and fasten the band securely.

   Install the engine cover (P. 4-2).

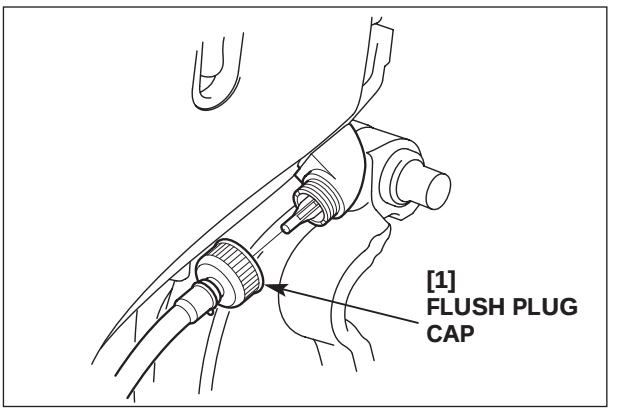


3. L./R. ENGINE UNDER COVERS

a. REMOVAL

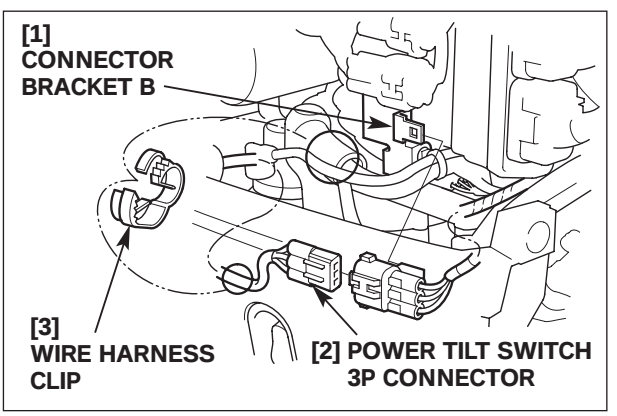
Remove the following parts.
– Engine cover (P. 4-2)
– Front separate cover (P. 4-7)
– Electric part cover (P. 3-22)

1) Remove the flush plug cap from the R. engine under cover.



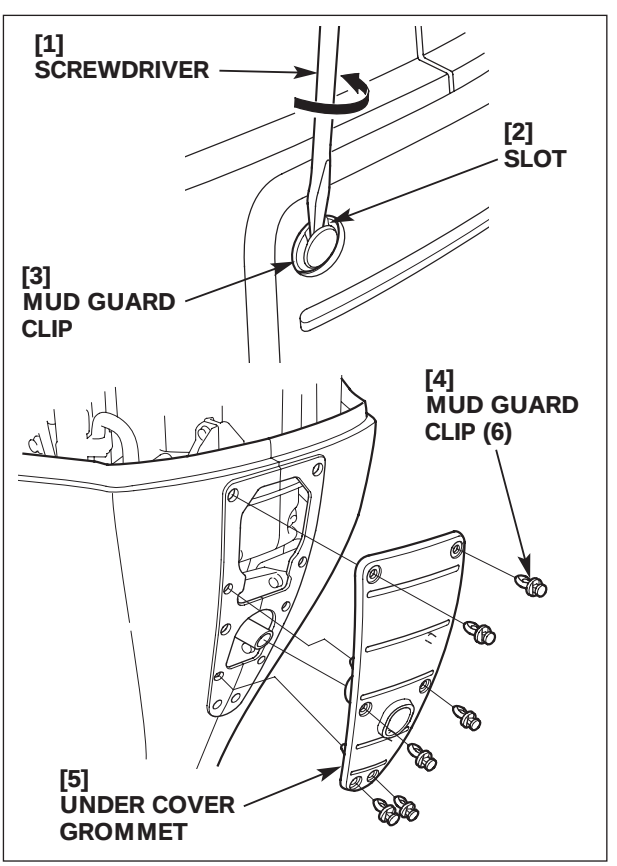
2) Open the wire harness clip. Remove the power tilt switch 3P connector from the connector bracket B.

3) Disconnect the power tilt switch 3P connector.

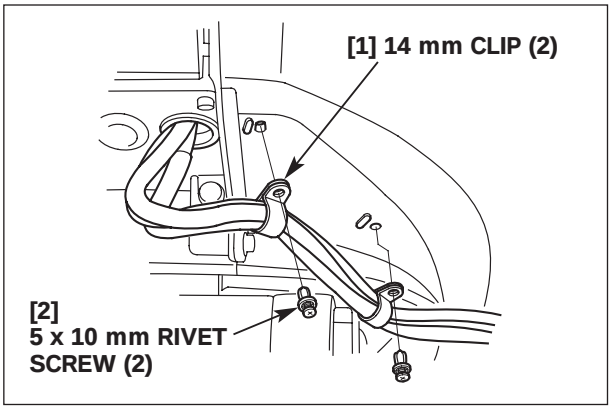


4) Set a screwdriver in the slot in each mud guard clip as shown and raise the mud guard clips.
Remove the six mud guard clips.

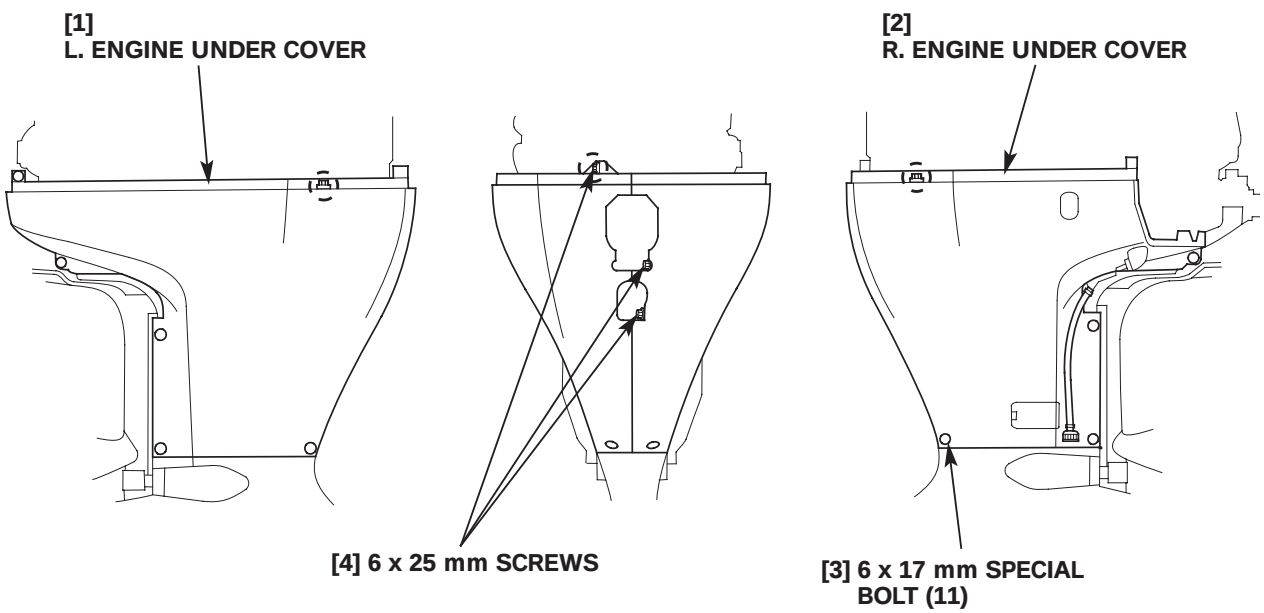
5) Remove the under cover grommet.



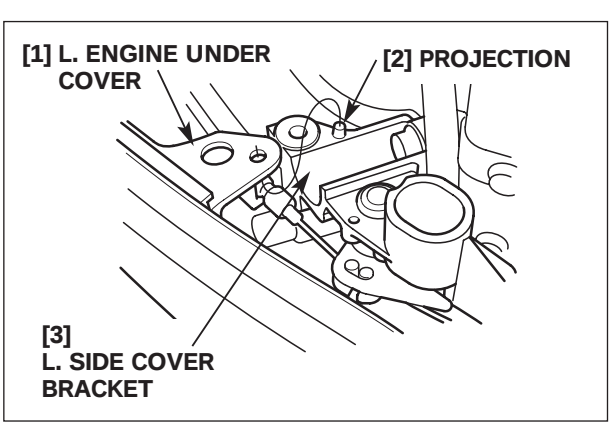
6) Loosen the two 5 x 10 mm rivet screws and remove the two 14 mm clips.



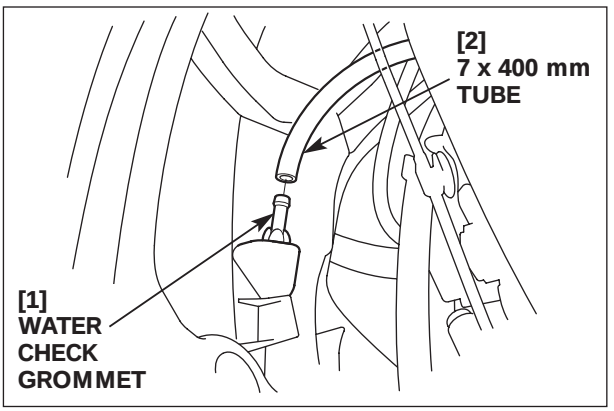
7) Remove the three 6 x 25 mm screws and the eleven 6 x 17 mm special bolts from the L./R. engine under covers.



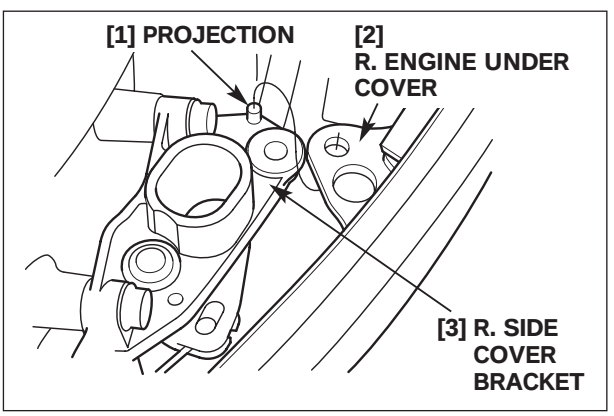
8) Detach the L. engine under cover from the projection of the L. side cover bracket.



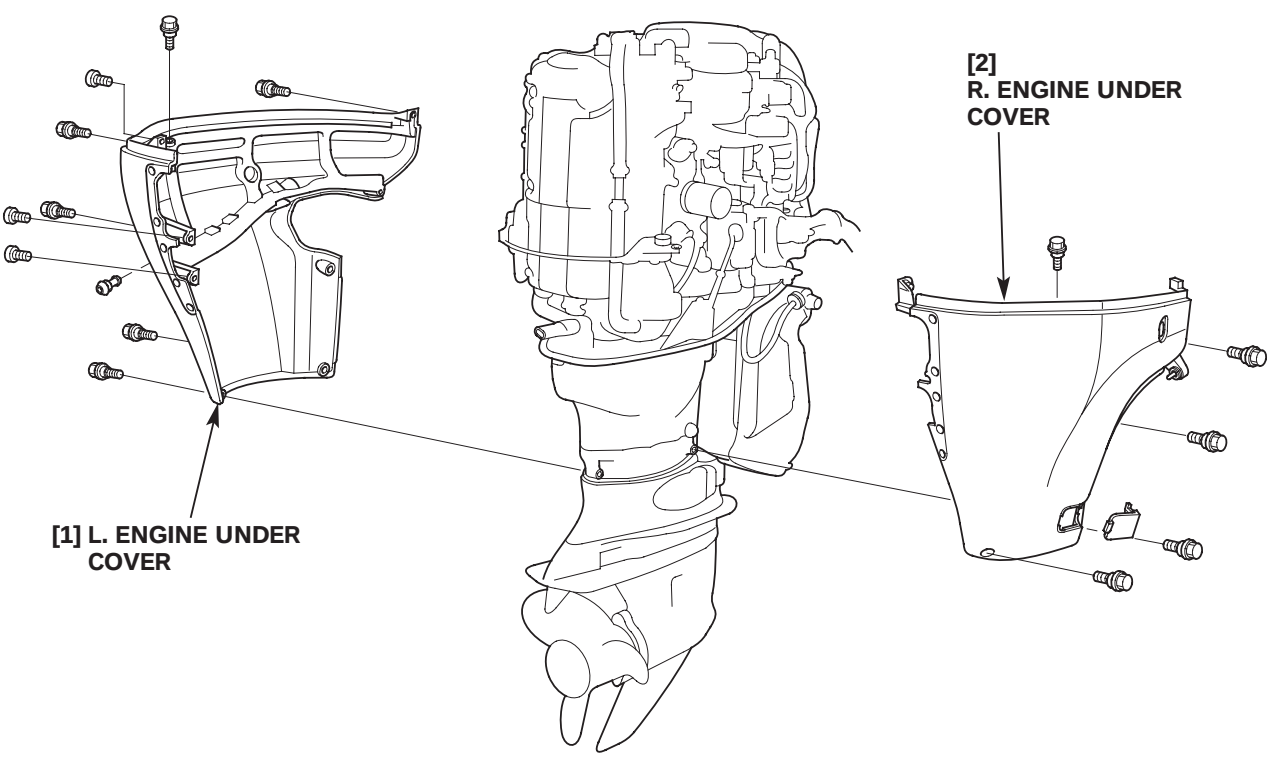
9) Open the L. engine under cover and disconnect the 7 x 400 mm tube from the water check grommet.



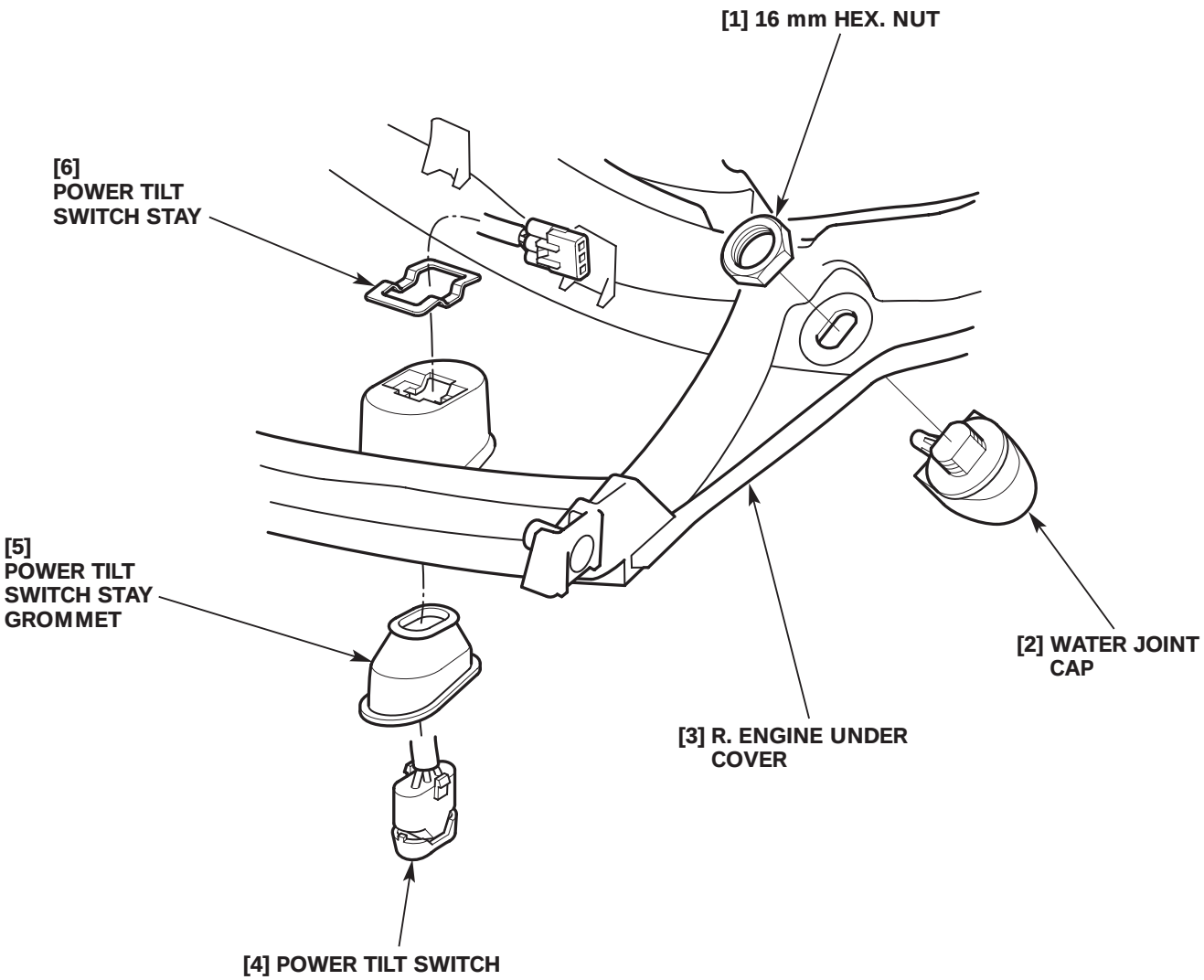
10) Detach the R. engine under cover from the projection of the R. side cover bracket.



11) Remove the L./R. engine under covers.



b. R. ENGINE UNDER COVER DISASSEMBLY



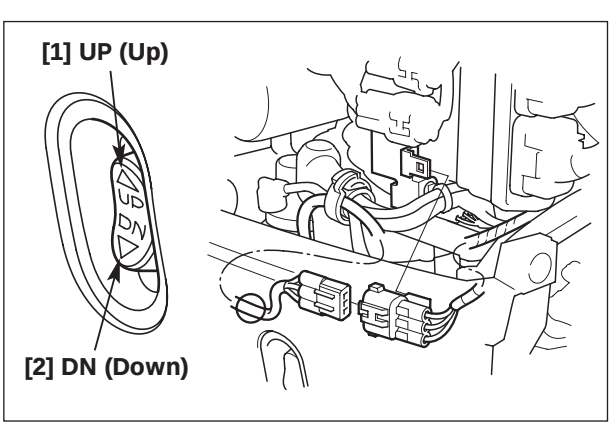
c. INSPECTION

• POWER TILT SWITCH

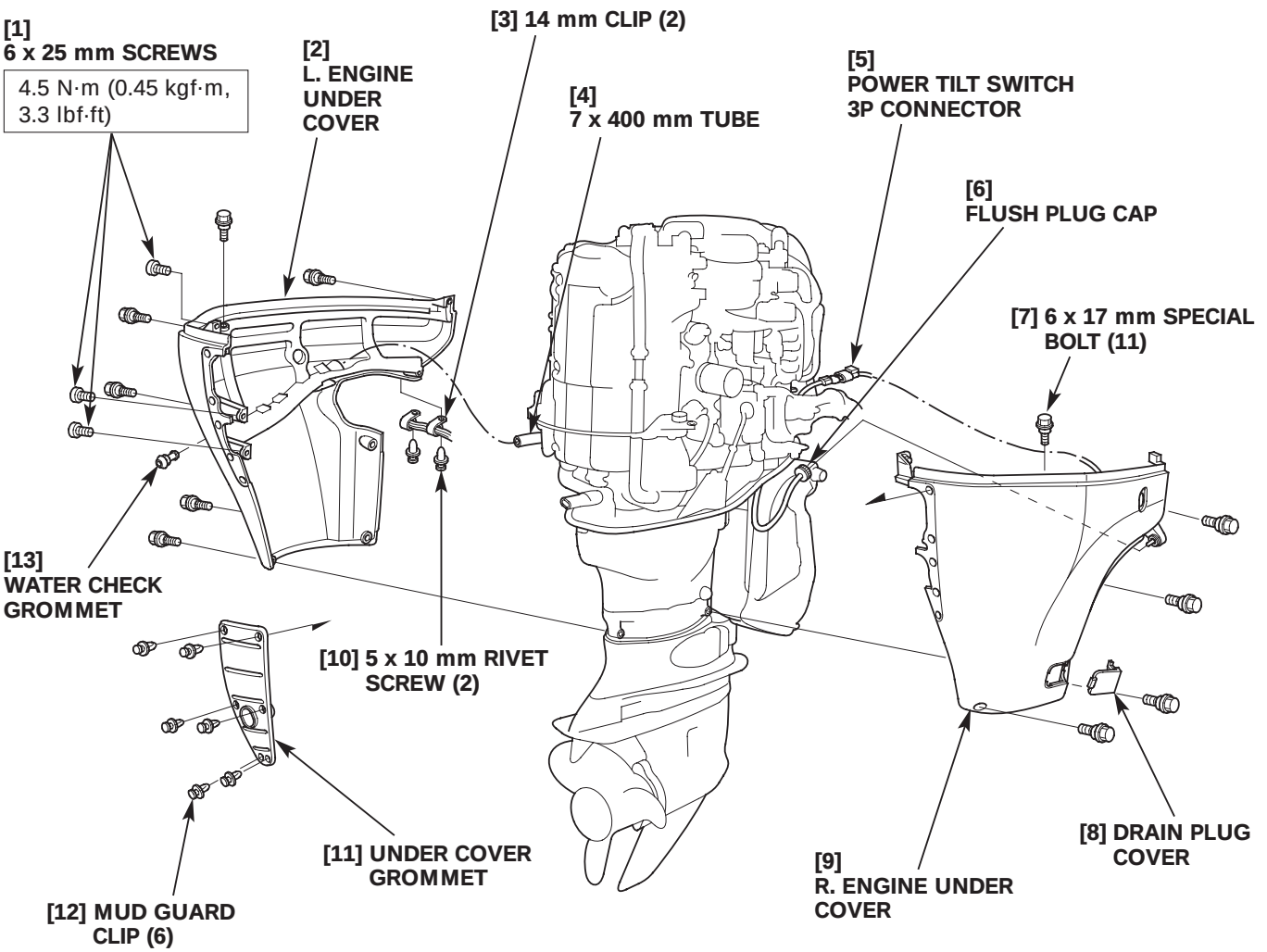
Check for continuity between the terminals with the switch in each position.

	Lb	W/Bl	Lg
UP (Up)	○———	———○	
DN (Down)		○———	———○

○———○: Continuity

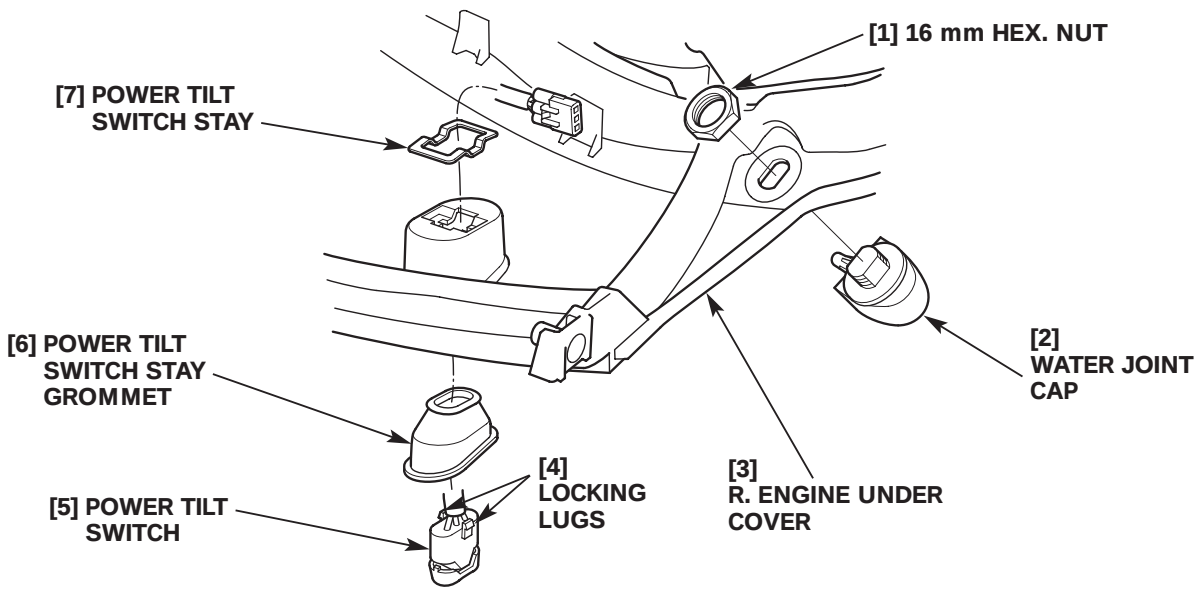


d. COMPONENTS DRAWING



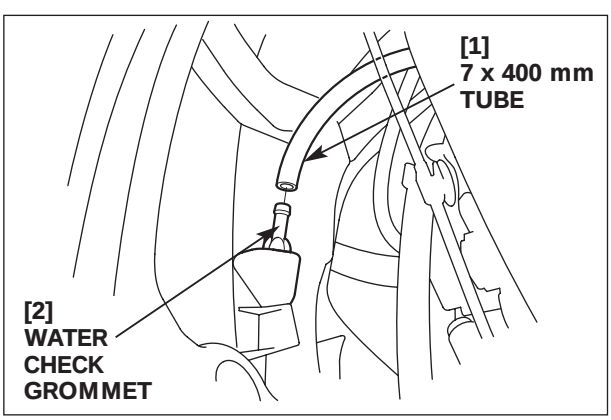
e. R. ENGINE UNDER COVER ASSEMBLY

1) Position the water joint cap on the R. engine under cover and tighten the 16 mm hex. nut securely. Note the installation direction of the water joint cap.
2) Position the power tilt switch on the power tilt switch grommet with the "UP" mark on the power tilt switch facing up.
3) Install the power tilt switch on the R. engine under cover and install the power tilt switch stay as shown. Secure the power tilt switch stay with the locking lugs of the power tilt switch.

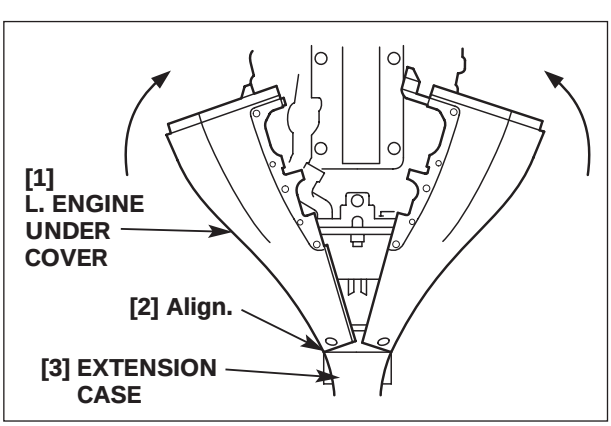


f. INSTALLATION

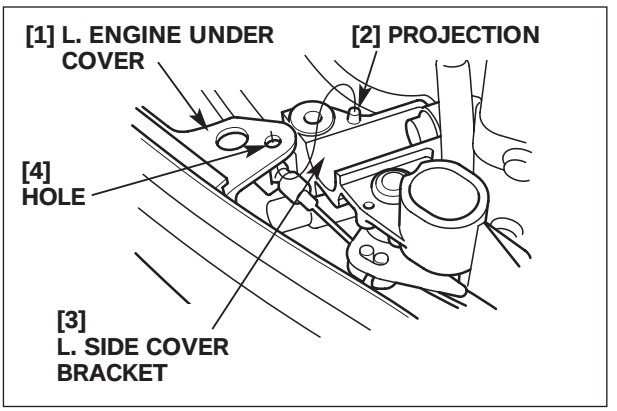
1) If the water check grommet is not mounted on the L. engine under cover, install it from the outside of the L. engine under cover.
2) Connect the 7 x 400 mm tube to the water check grommet.



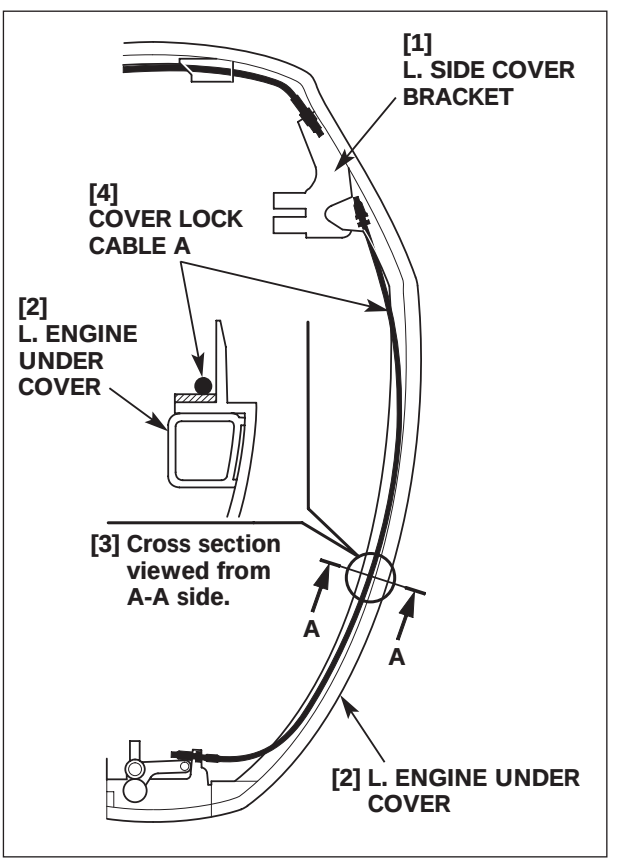
3) Install the L. engine under cover aligning the bottom edge of the L. engine under cover with the extension case as shown.



4) Install the L. engine under cover aligning the hole in the L. engine under cover with the projection on the L. side cover bracket.



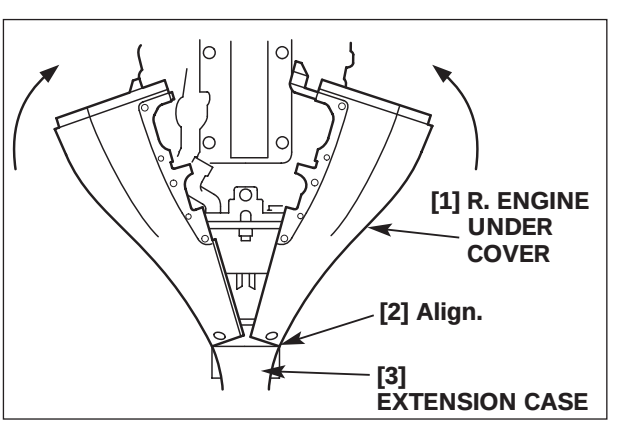
5) Check that the cover lock cable A is set on the L. engine under cover as shown.



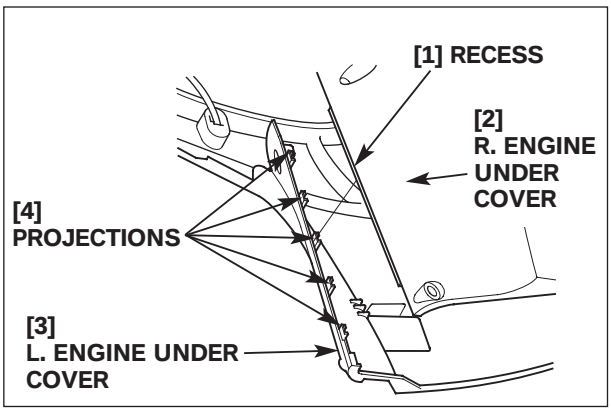
6) Hold the power tilt switch wire above the R. engine under cover.

7) Install the R. engine under cover aligning the bottom of the R. engine under cover with the extension case as shown.

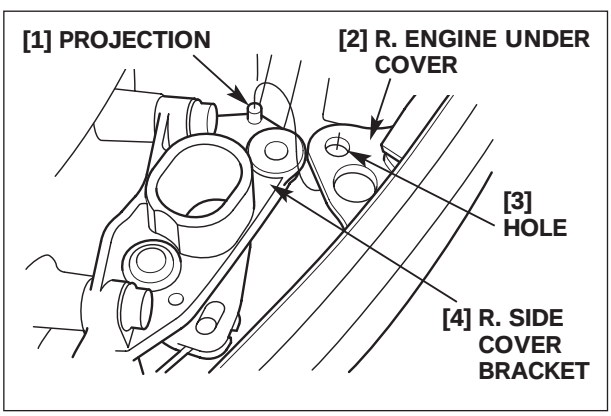
   Note that the 8 x 300 mm tube with the flush plug cap is outside the R. engine under cover this time.



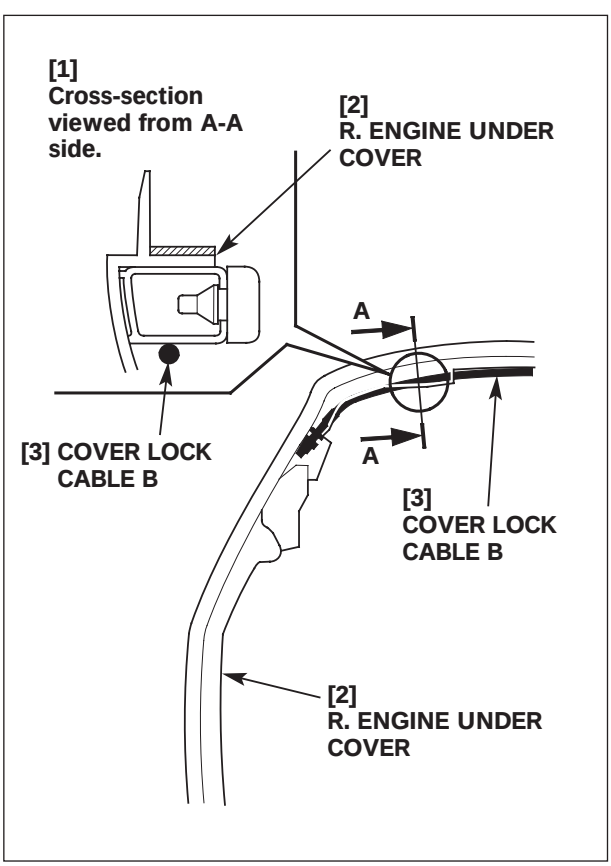
8) Align the projections at the front side (i.e. swivel case side) of the L. engine under cover with the recess in the R. engine under cover as shown.



9) With the R. engine under cover held in alignment with the L. engine under cover described in step 7, install the R. engine under cover by aligning the hole in the R. engine under cover with the projection on the R. side cover bracket.



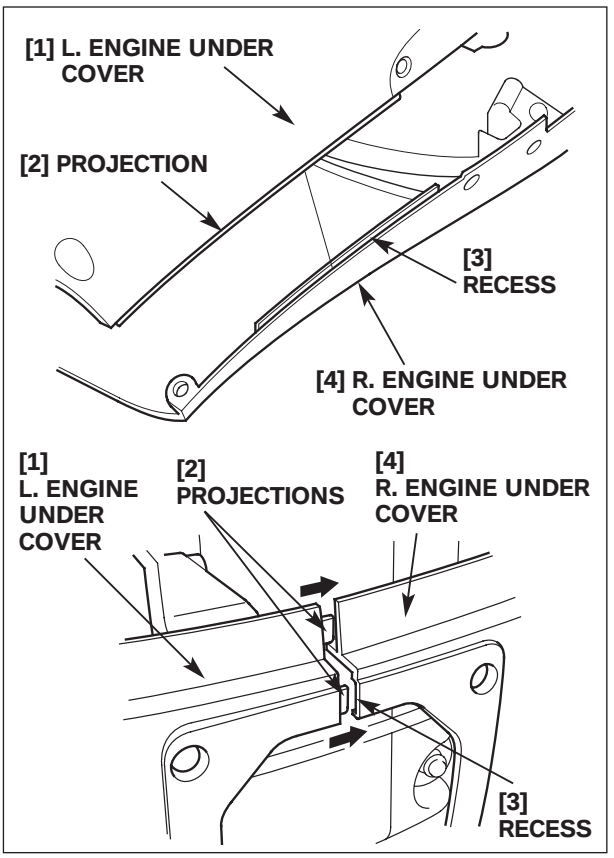
10) Check that the cover lock cable B sets underside the R. engine under cover as shown.



11) Install the L./R. engine under covers aligning the projection on the rear (i.e. cylinder head cover side) of the L. engine under cover with the recess in the R. engine under cover.

    Install the L./R. engine under covers, too, aligning the projections at the upper part of the L. engine under cover with the recess at the upper part of the R. engine under cover.

    • Check that each alignment performed in step 4 through step 11 is not out of alignment.



12) Loosely tighten the three 6 x 25 mm screws and the eleven 6 x 17 mm special bolts on the L./R. engine under covers.

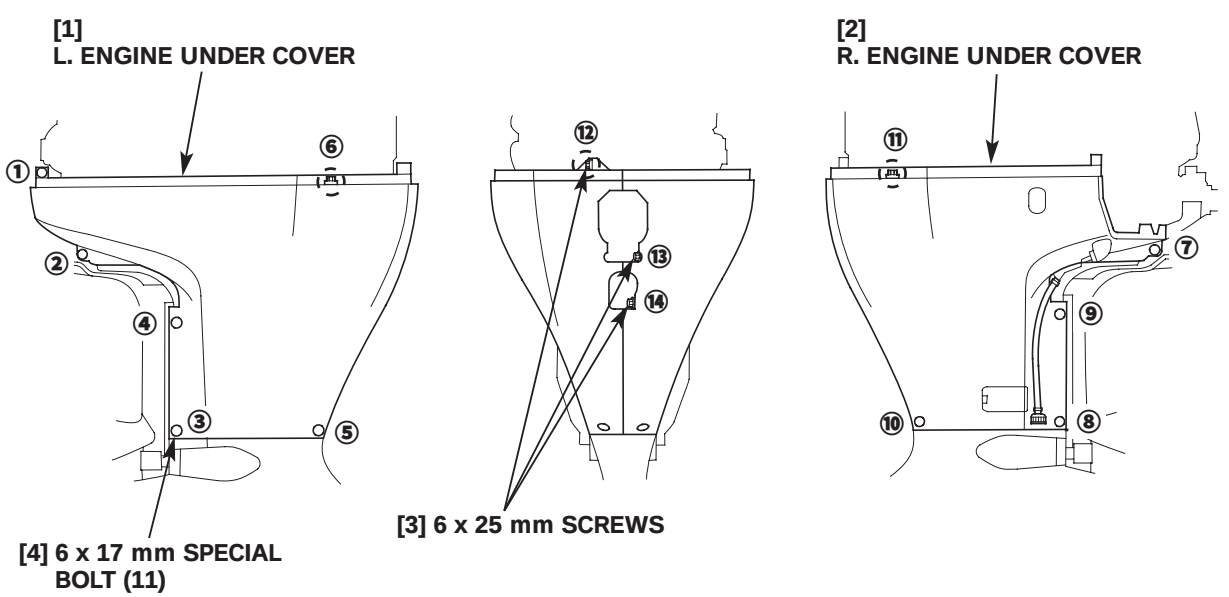
    • Check that the special bolts are not on the case but they are tightened properly.

13) Tighten the three 6 x 25 mm screws to the specified torque and the eleven 6 x 17 mm special bolts to the standard torque in the numbered sequence and in two or three steps securely.

    TORQUE:
    6 x 25 mm screws: 4.5 N·m (0.45 kgf·m, 3.3 lbf·ft)

    STANDARD TORQUE:
    6 x 17 mm special bolts: 4.2 N·m (0.42 kgf·m, 3.0 lbf·ft)

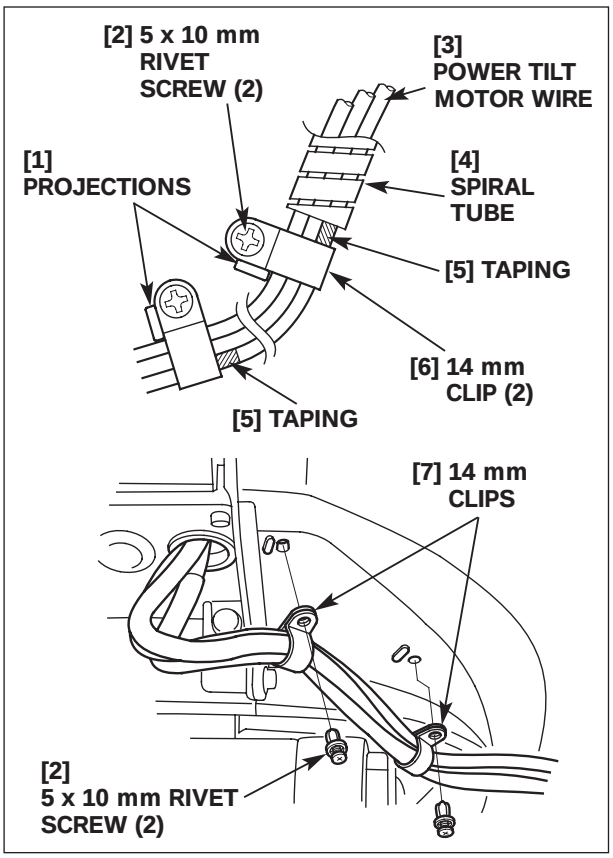
    • Check that each alignment performed in step 4 through step 11 is not out of alignment.



14) Check that the end of each 14 mm clip aligns with the end of the taped part of the power tilt motor wire as shown.

15) Tighten the two 5 x 10 mm rivet screws securely while pushing the end of the two 14 mm clips against the corresponding projection on the L. engine under cover.

    Take care not to let the alignment points described in the previous step come out of alignment.

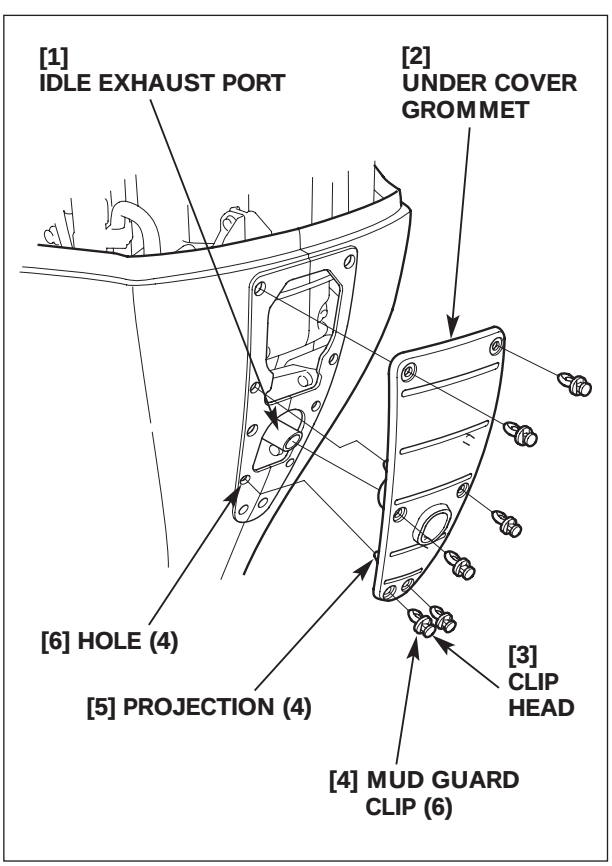


16) Insert the under cover grommet into the idle exhaust port as shown.

17) Insert the four projections on the under cover grommet into the holes in the engine under covers.

18) Aligning the holes in the under cover grommet with the holes in the engine under cover, set the six mud guard clips in the respective holes.

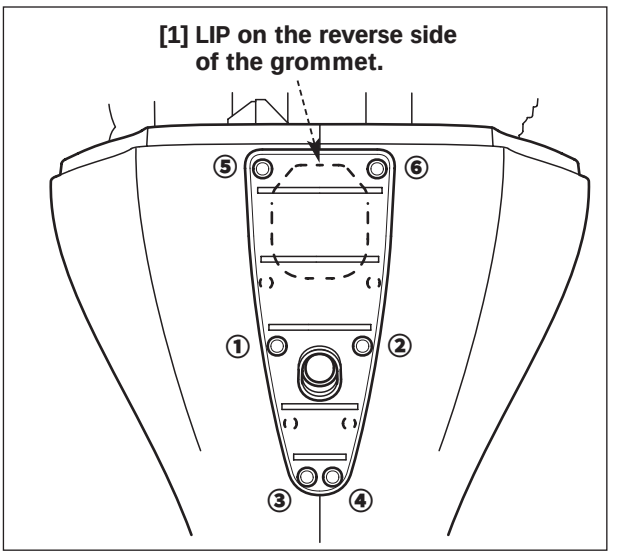
    • Do not push in the head of the mud guard clips.



19) Push in the head of the mud guard clips in the numbered sequence securely.

20) Check that the lip on the reverse side of the under cover grommet is set on the engine under cover.

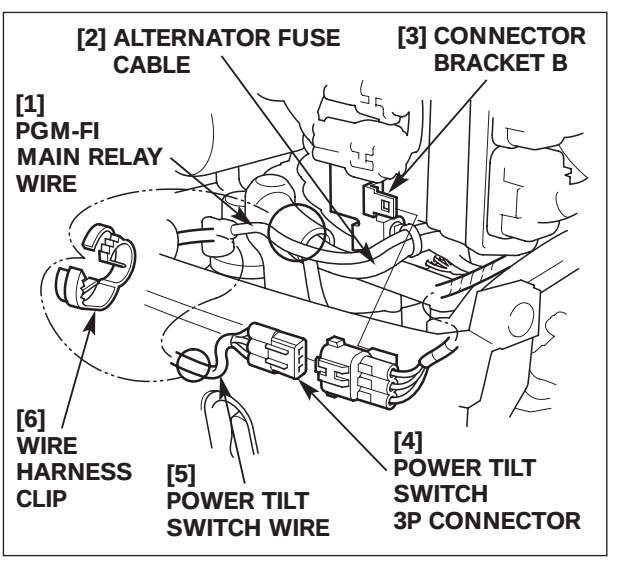
- Check that the under cover grommet adheres to the engine under cover securely.



21) Connect the power tilt switch 3P connector.

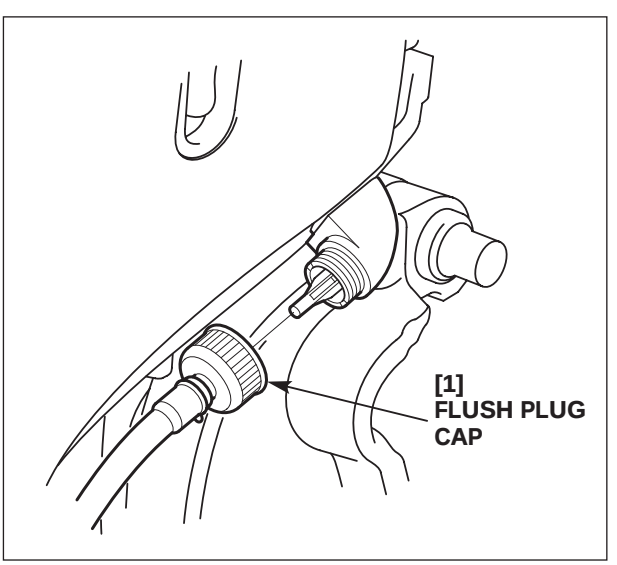
22) Install the power tilt switch 3P connector on the connector bracket B.

Clamp the alternator fuse cable, PGM-FI main relay wire and the power tilt switch wire with the wire harness clip.



23) Tighten the flush plug cap on the R. engine under cover.

24) Install the following parts.
– Electric part cover (P. 3-22)
– Front separate cover (P. 4-7)
– Engine cover (P. 4-2)



4. UNDER COVER FRONT BRACKET/ L./R. SIDE COVER BRACKETS

Remove the following pars.
– Engine cover (P. 4-2)
– Front separate cover (P. 4-7)
– L./R. engine under cover (P. 4-9)
– Remote control cable/grommet (P. 17-2)

a. UNDER COVER FRONT BRACKET

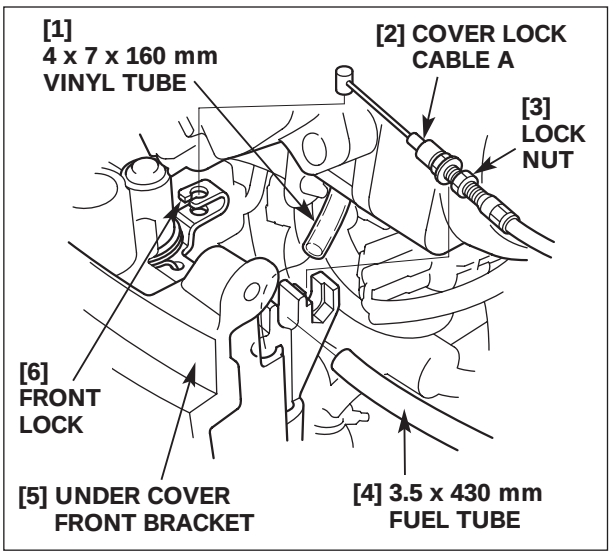
REMOVAL:

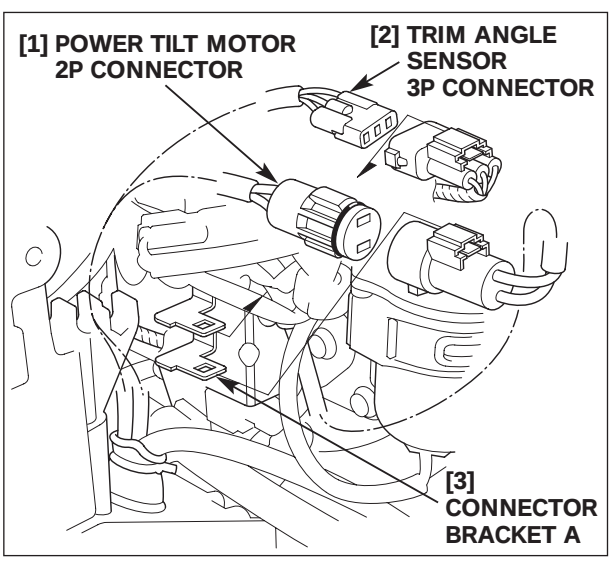
1) Remove the 4 x 7 x 160 mm vinyl tube and the 3.5 x 430 mm fuel tube from the under cover front bracket.

2) Loosen the cover lock cable A lock nut and remove the cover lock cable A from the front lock.

3) Remove the trim angle sensor 3P connector and the power tilt motor 2P connector from the connector bracket A.

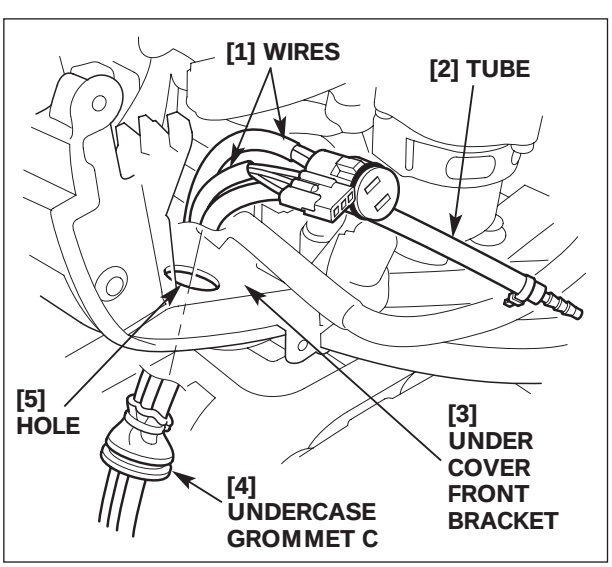
   Disconnect the trim angle sensor 3P connector and the power tilt motor 2P connector.



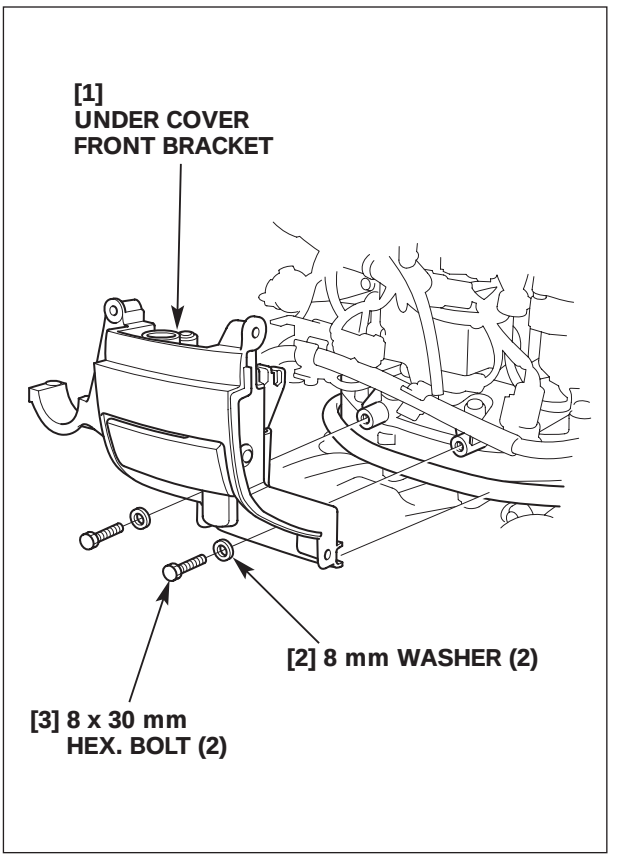


4) Remove the undercase grommet C outside from the under cover front bracket.

   Pull out the tube and wires through the hole in the under cover front bracket.



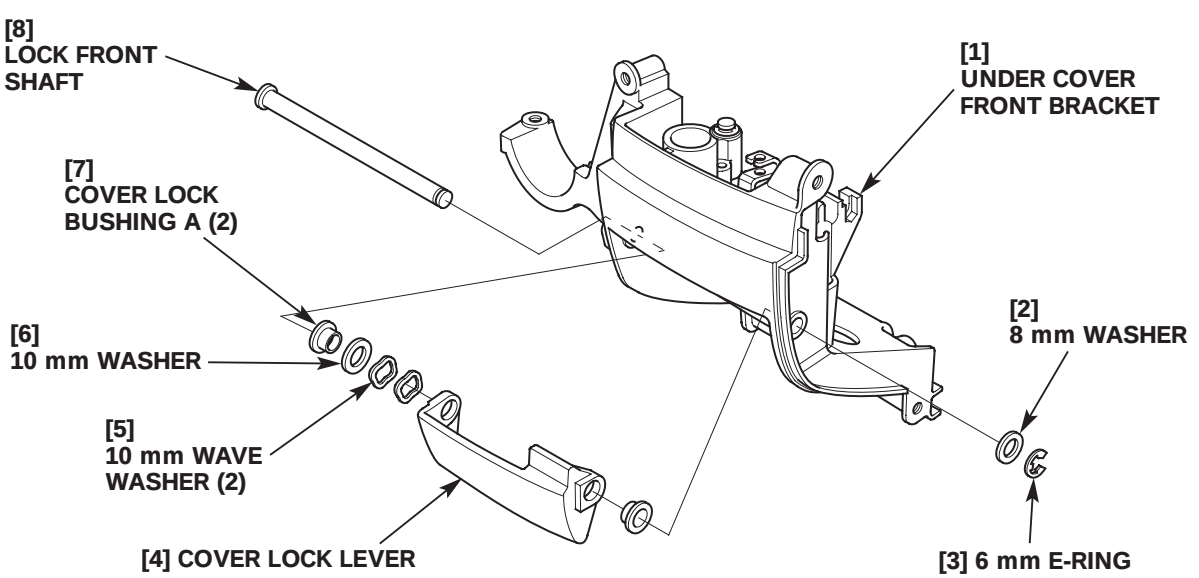
5) Remove the two 8 x 30 mm hex. bolts and the two 8 mm washers, then remove the under cover front bracket.



DISASSEMBLY:

1) Remove the 6 mm E-ring and the 8 mm washer from the lock front shaft.
2) Remove the lock front shaft from the under cover front bracket.
   Remove the cover lock lever, two cover lock bushing As, 10 mm washer and the two 10 mm wave washers.

   Check the cover lock bushing A for scores, scratches and other damage. Replace the cover lock bushing A with a new one if necessary.



3) Remove the 6 mm E-ring from the cover open shaft.

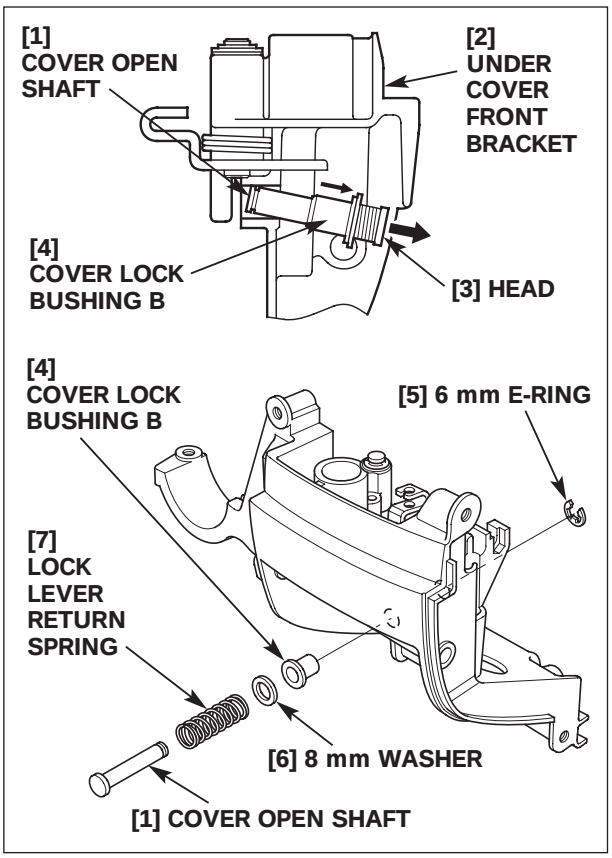
   Remove the cover lock bushing B in a manner of bringing it to the lock lever return spring side.

   With the return spring compressed with the bushing B, hold the cover open shaft at a slightly inclined angle.

   Remove the cover open shaft with care not to let its head contact the under cover front bracket.

4) Remove the cover lock bushing B, 8 mm washer, and the lock lever return spring from the cover open shaft.

   Check the cover lock bushing B for scores, scratches and other damage. Replace the cover lock bushing B with a new one if necessary.



5) Remove the 6 mm E-ring, 8 mm washer and the cover lock bushing A from the front lock.

   Check the cover lock bushing A for scores, scratches and other damage. Replace the cover lock bushing A with a new one if necessary.

6) Lower the front lock and detach the hook of the cover lock hook spring from the hole in the under cover front bracket.

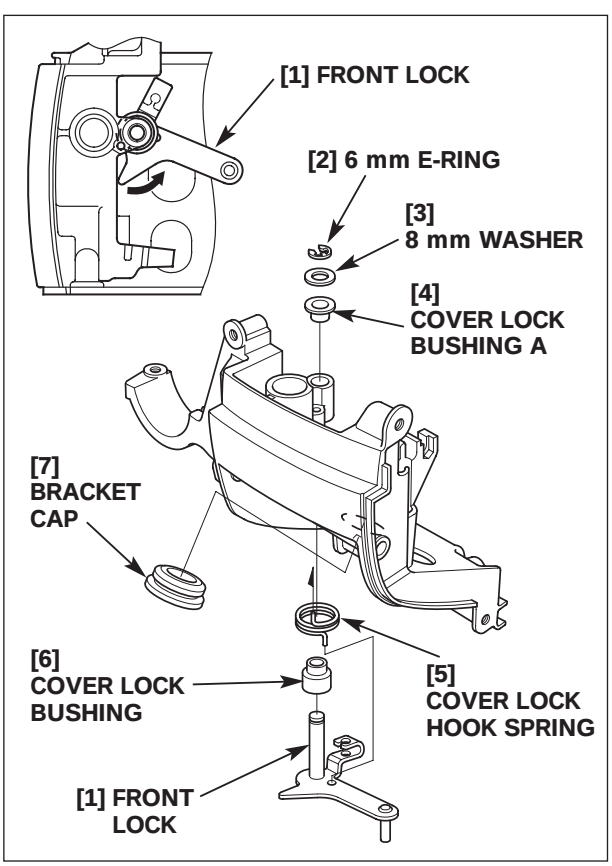
   Remove the cover lock bushing from the under cover front bracket and hold it at the front lock side.

7) Set the front lock in the position shown.

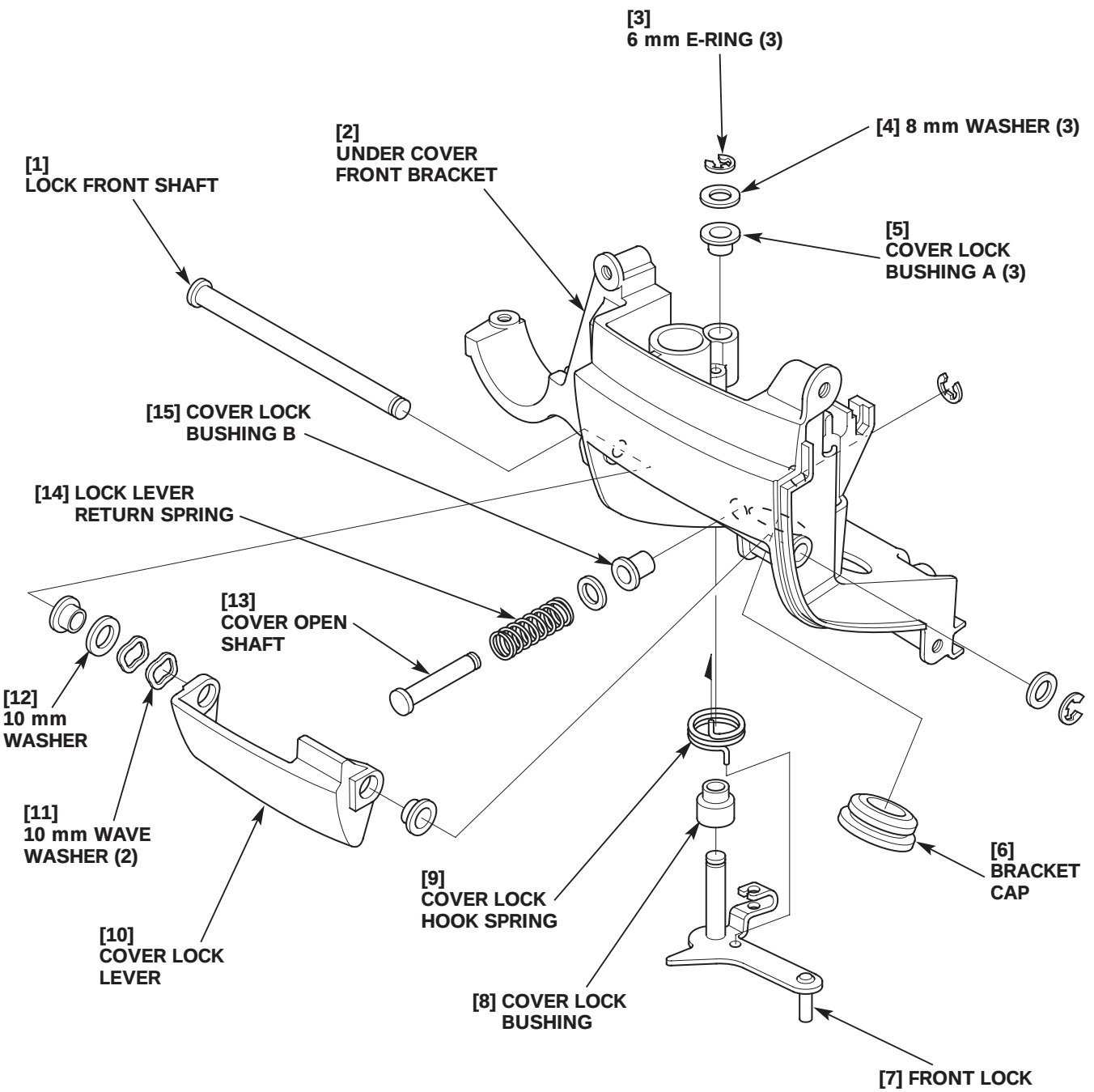
   With the front lock set at a slightly inclined angle in the position shown, remove the front lock from the under cover front bracket.

   Remove the cover lock bushing and the cover lock hook spring from the front lock.

8) Remove the bracket cap.



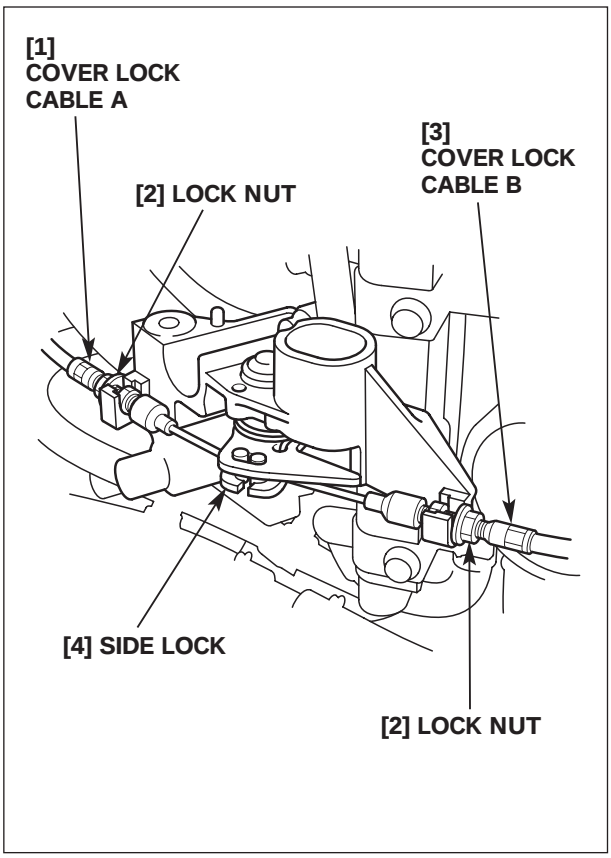
COMPONENTS DRAWING:



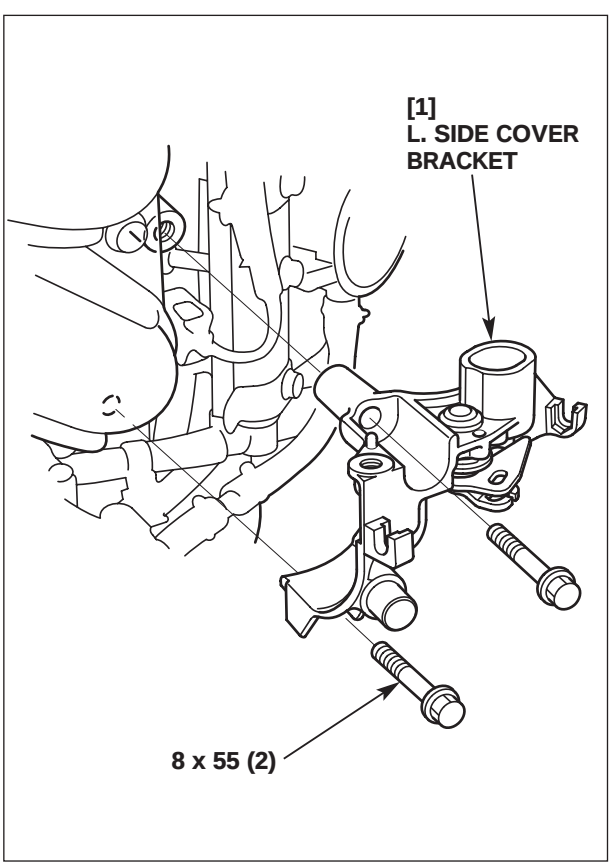
b. L. SIDE COVER BRACKET

REMOVAL:

1) Loosen the lock nuts on the cover lock cable A and B, and disconnect the cover lock cable A and B from the side lock.



2) Remove the two 8 x 55 mm flange bolts and remove the L. side cover bracket.



DISASSEMBLY:

1) Remove the 6 mm E-ring and the 8 mm washer from the side lock.

2) Lower the side lock and detach the hook of the cover lock hook spring from the hole in the L. side cover bracket.

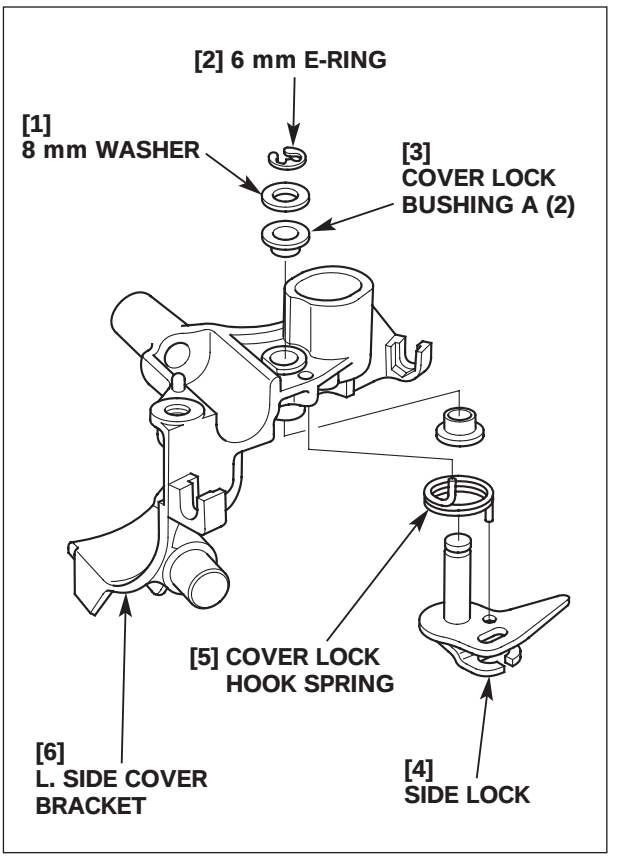
   Remove the side lock from the L. side cover bracket.

   Remove the cover lock hook spring from the side lock.

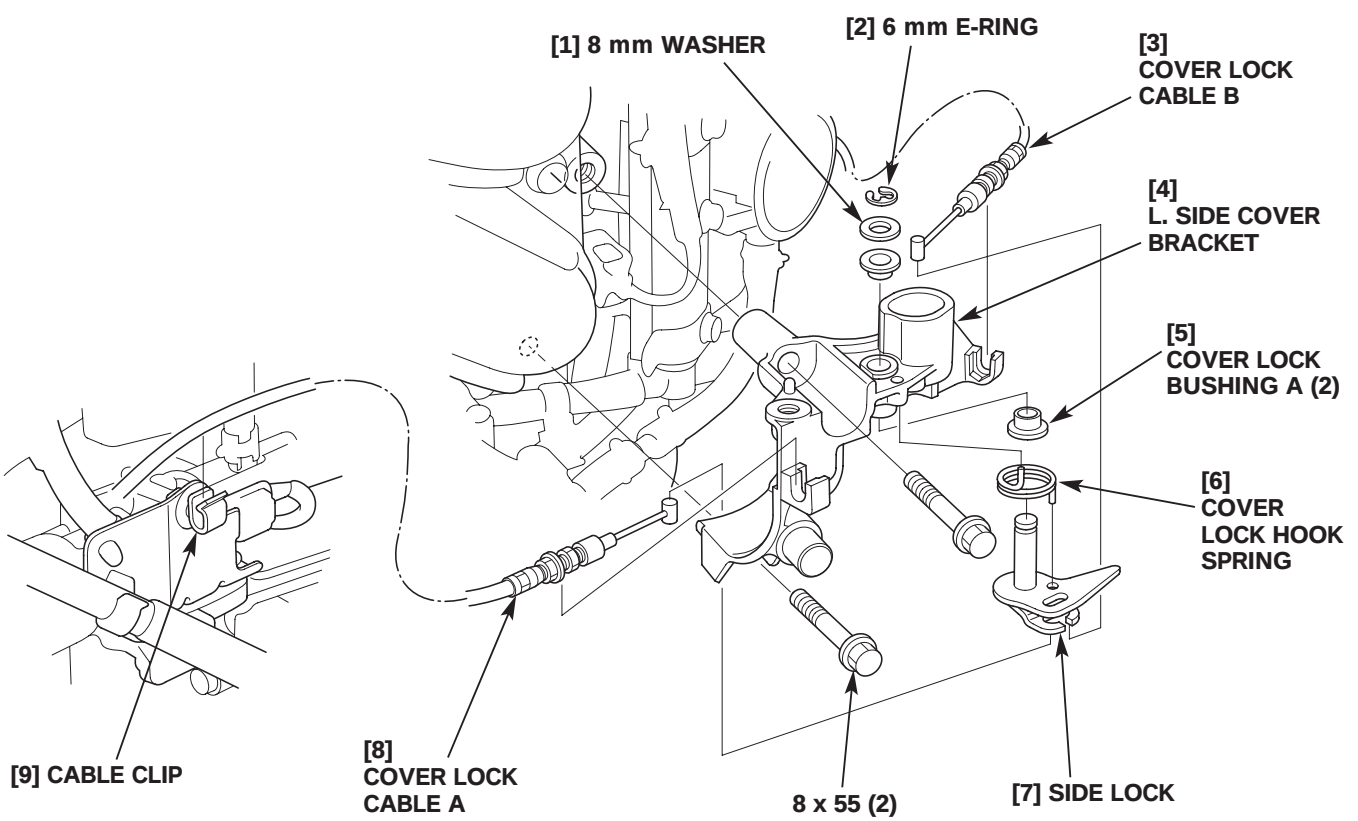
3) Remove the two cover lock bushing As from the L. side cover bracket.

   Check the two cover lock bushing As for wear and damage that are mounted on the side lock installation parts on the L. side cover bracket.

   Check the cover lock bushing A for scores, scratches and other damage. Replace the cover lock bushing A with a new one if necessary.



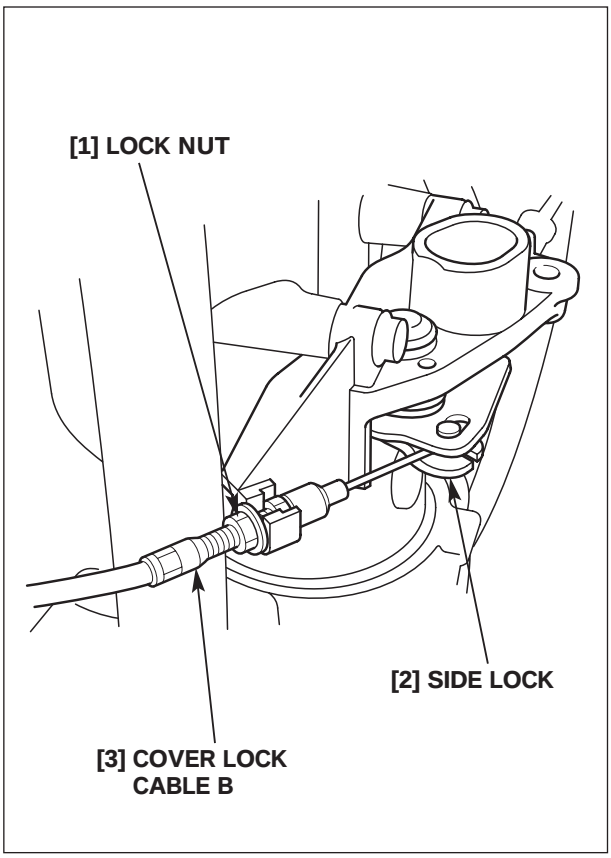
COMPONENTS DRAWING:



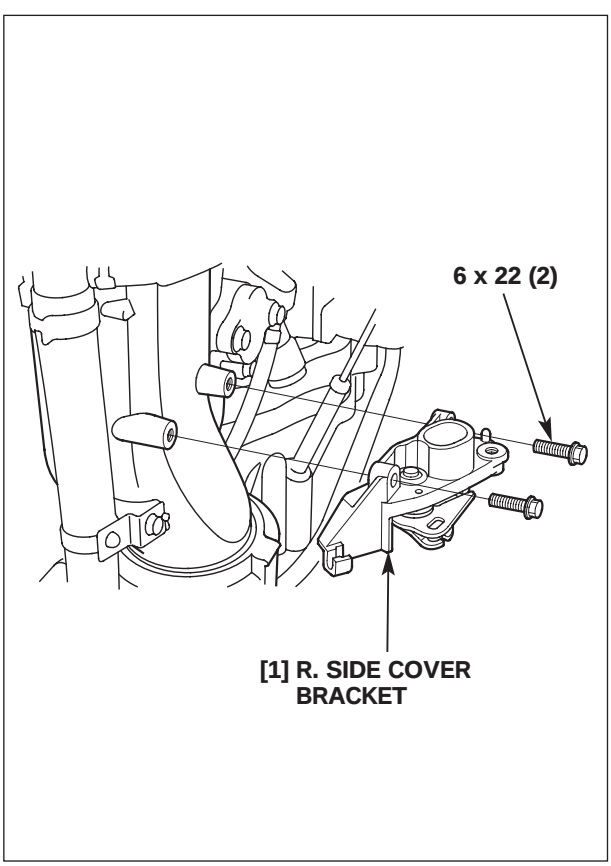
c. R. SIDE COVER BRACKET

REMOVAL:

1) Loosen the lock nut on the cover lock cable B, and disconnect the cover lock cable B from the side lock.



2) Remove the two 6 x 22 mm flange bolts and remove the R. side cover bracket.



DISASSEMBLY:

1) Remove the 6 mm E-ring and the 8 mm washer from the side lock.

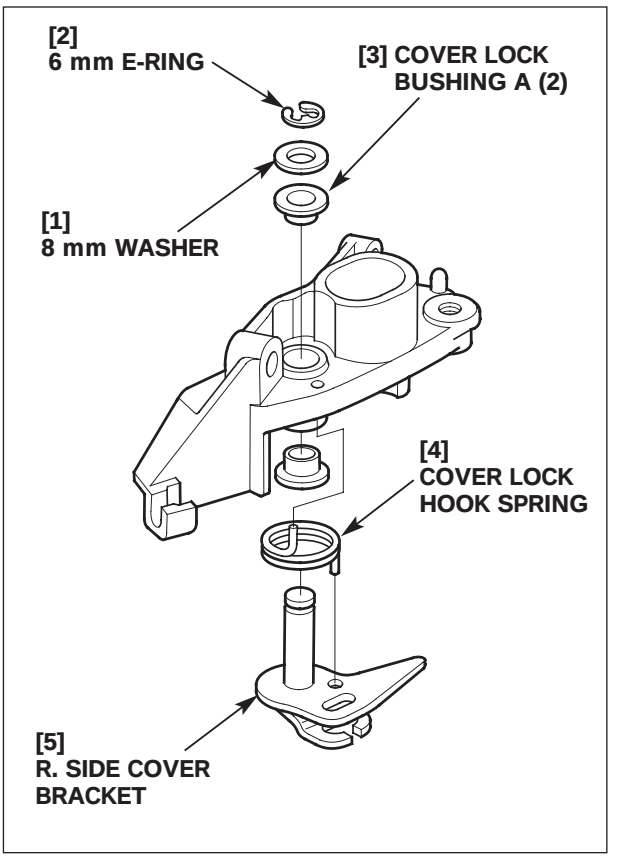
2) Lower the side lock and detach the hook of the cover lock hook spring from the hole in the R. side cover bracket.

   Remove the side lock from the R. side cover bracket.

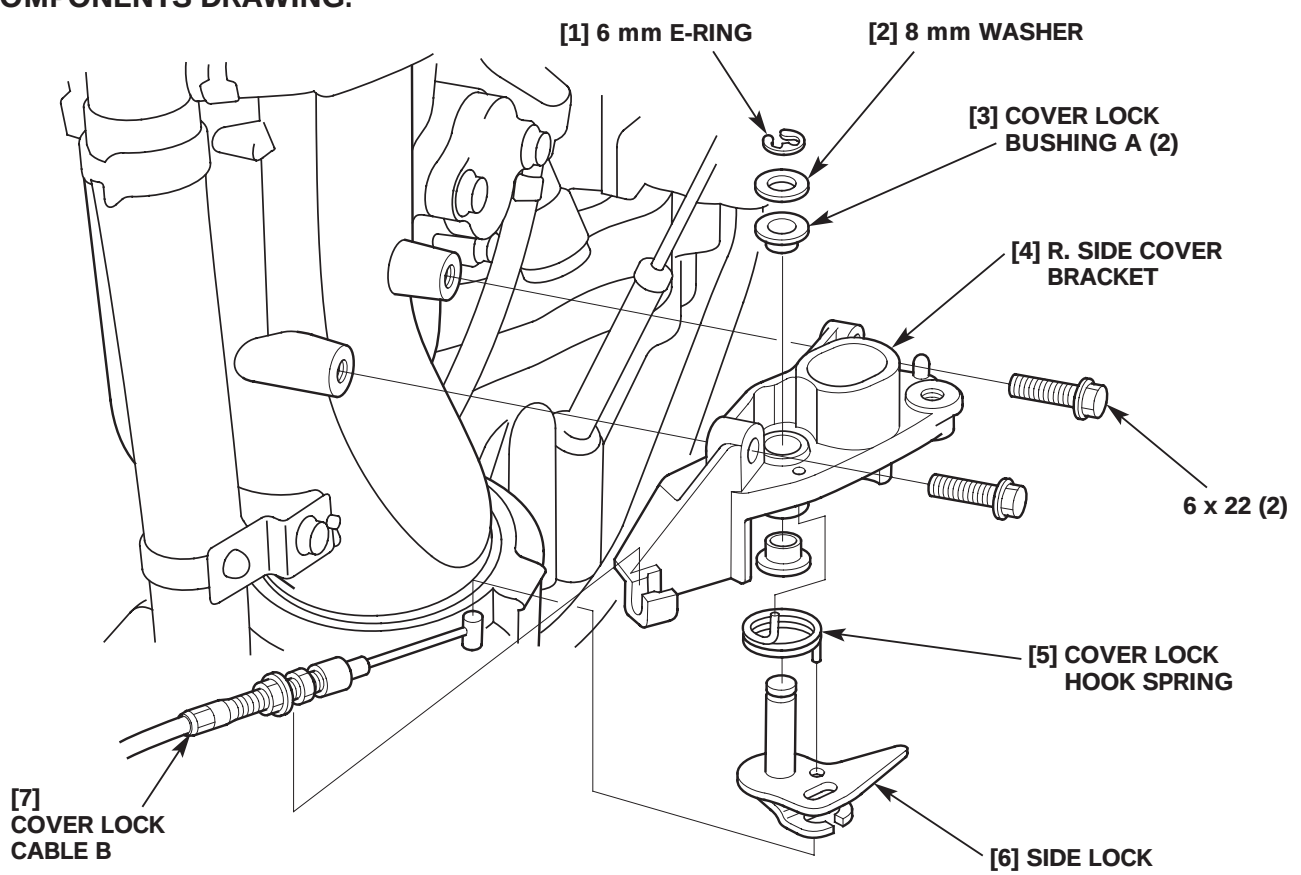
   Remove the cover lock hook spring from the side lock.

3) Remove the two cover lock bushing As from the R. side cover bracket.

   Check the cover lock bushing A for scores, scratches and other damage. Replace the cover lock bushing A with a new one if necessary.



COMPONENTS DRAWING:



d. R. SIDE COVER BRACKET/L. SIDE COVER BRACKET/UNDER COVER FRONT BRACKET ASSEMBLY

R. SIDE COVER BRACKET:

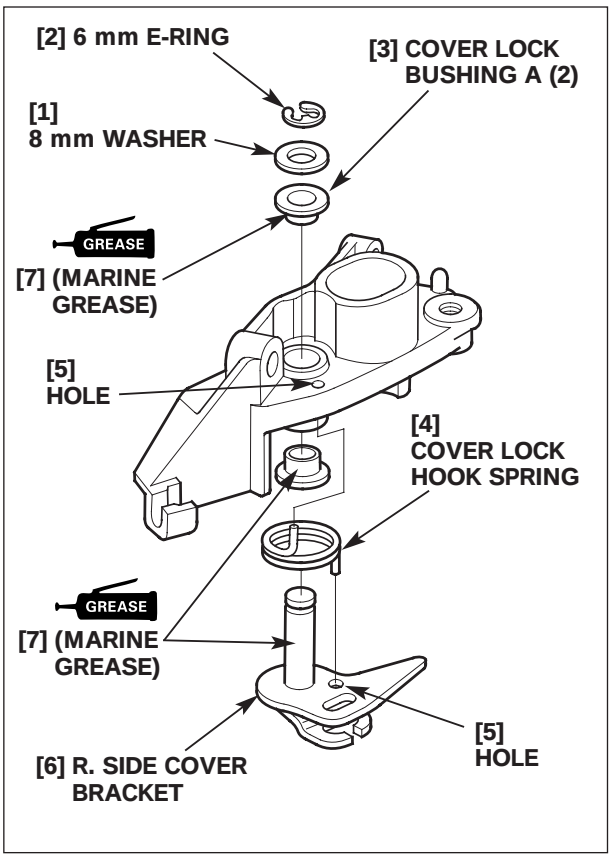
1) Apply marine grease to the outer surface of the cover lock bushing As, and install them on the R. side cover bracket.

2) Apply marine grease to the side lock shaft.

3) Install the cover lock hook spring on the side lock aligning the hook of the spring with the hole in the side lock.

   Install the cover lock hook spring on the R. side cover bracket aligning another hook of the spring with the hole in the R. side cover bracket.

4) Install the 8 mm washer and the 6 mm E-ring on the side lock.



L. SIDE COVER BRACKET:

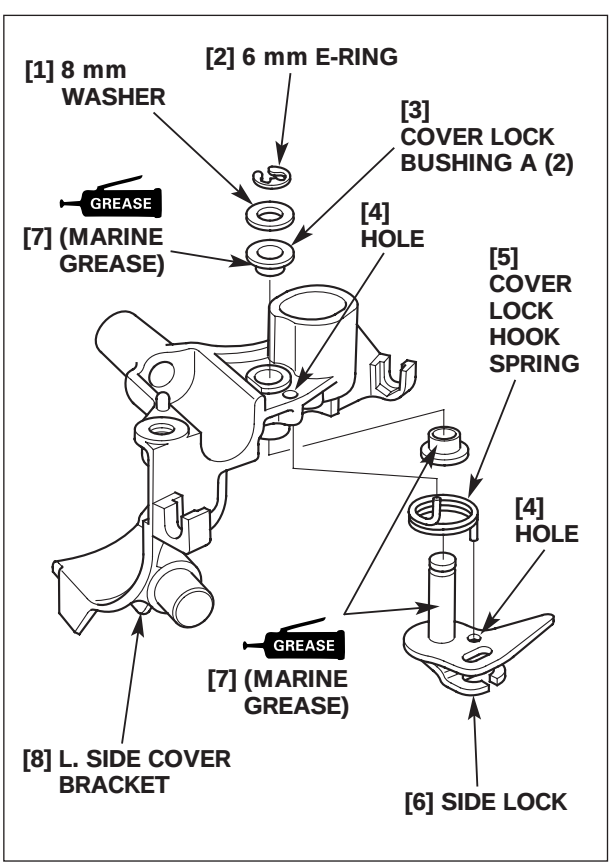
1) Apply marine grease to the cover lock bushing As and install them on the L. side cover bracket.

2) Apply marine grease to the side lock shaft.

3) Install the cover lock hook spring on the side lock aligning the hook of the spring with the hole in the side lock.

   Install the cover lock hook spring on the L. side cover bracket aligning another hook of the spring with the hole in the L. side cover bracket.

4) Install the 8 mm washer and the 6 mm E-ring on the side lock.



UNDER COVER FRONT BRACKET:

1) Install the bracket cap.

2) Apply marine grease to the front lock shaft and the outer surface of the cover lock bushing.

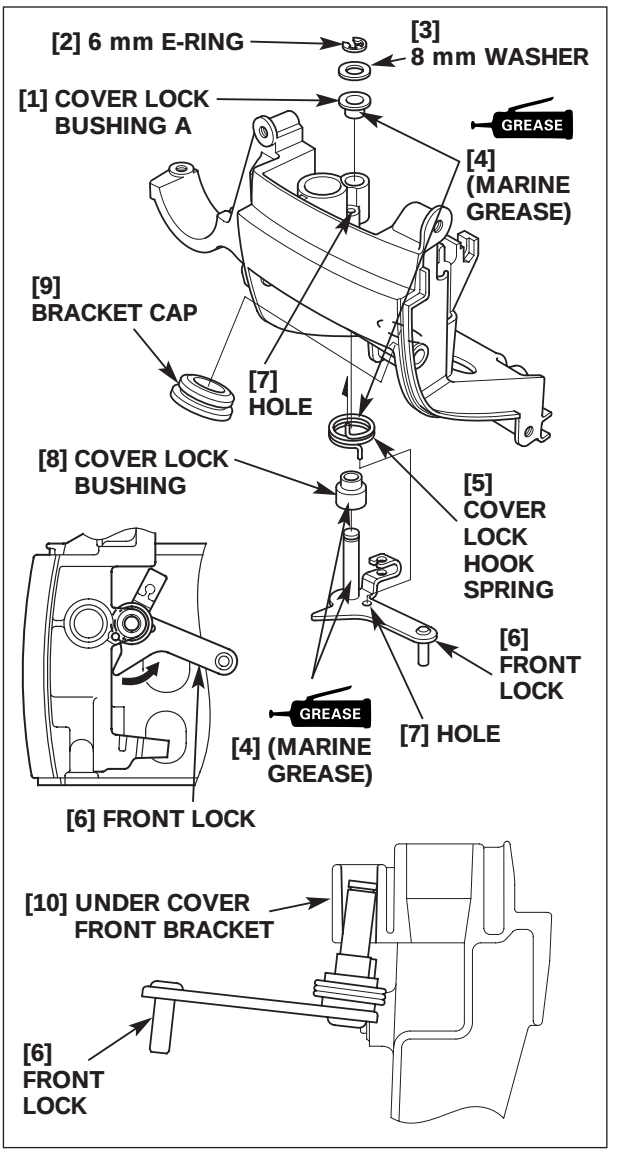
3) Apply marine grease to the outer surface of the cover lock hook spring. Install the cover lock hook spring aligning its hook with the hole in the front lock.

4) Set the front lock in the position shown. Install the front lock on the under cover front bracket at an inclined angle.

5) Install the cover lock hook spring on the under cover front bracket aligning its hook with the hole in the under cover front bracket.

6) Apply marine grease to the outer surface of a cover lock bushing A and install it on the under cover front bracket.

7) Install the 8 mm washer and the 6 mm E-ring on the front lock.



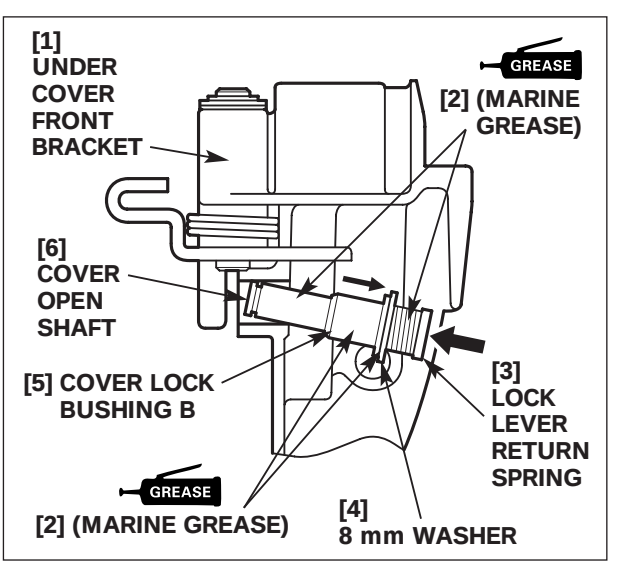
8) Apply marine grease to the outer surface of the cover open shaft, lock lever return spring, 8 mm washer and the cover lock bushing B. Install the lock lever return spring, 8 mm washer, and the cover lock bushing B on the cover open shaft.

   Hold the lock lever return spring compressed with the cover lock bushing B.

9) Install the cover open shaft at an inclined angle in the under cover front bracket.

10) Install the cover lock bushing B in the under cover front bracket.

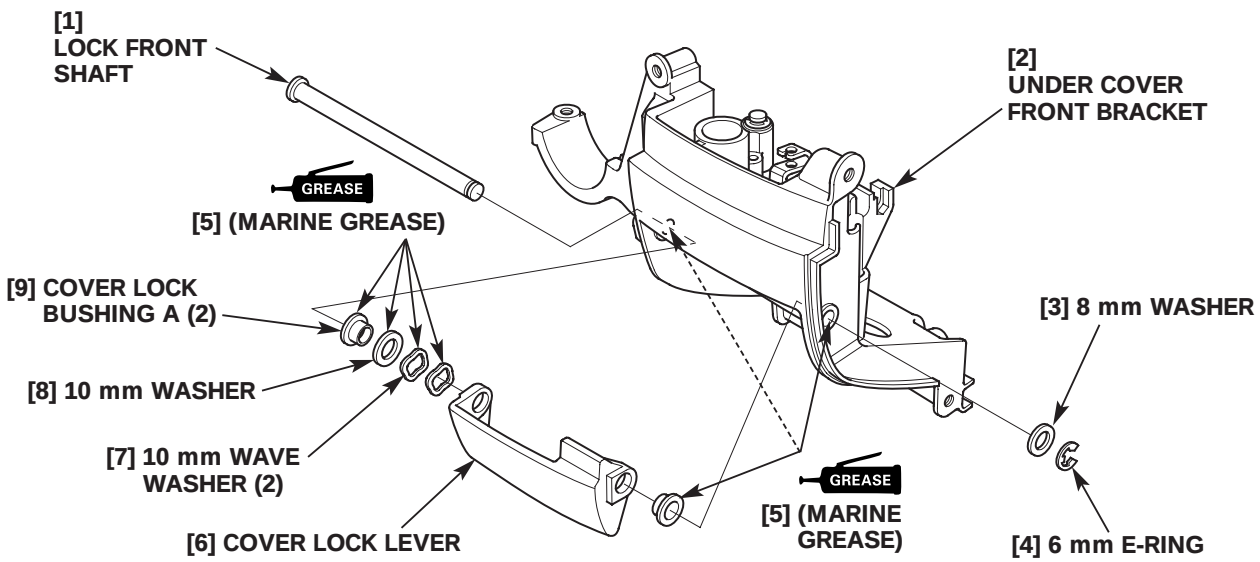
11) Install the 6 mm E-ring on the cover open shaft.



12) Apply marine grease to the outer surface of the 10 mm washer, two 10 mm wave washers and the cover lock bushing A and to the inner wall of the lock front shaft hole in the under cover front bracket.

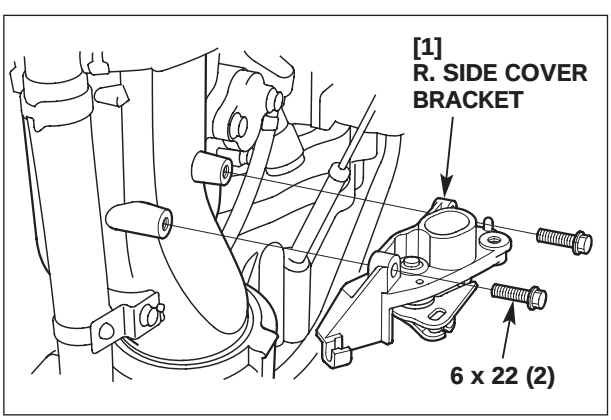
13) Install the two cover lock bushing As, 10 mm washer and the two 10 mm wave washers on the cover lock lever as shown. Install the cover lock lever on the under cover front bracket.

14) Install the lock front shaft.
Install the 8 mm washer and the 6 mm E-ring on the lock front shaft.

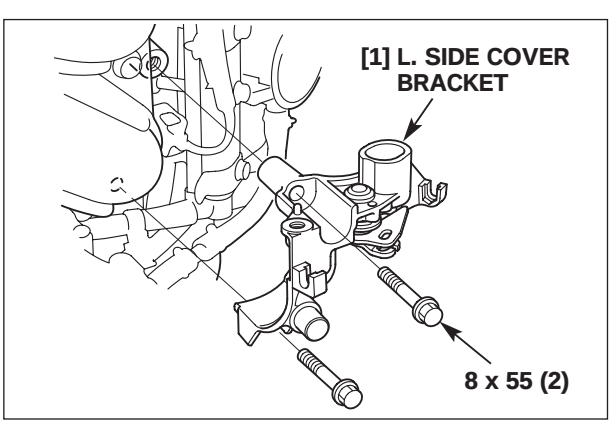


e. R. SIDE COVER BRACKET/L. SIDE COVER BRACKET/UNDER COVER FRONT BRACKET INSTALLATION

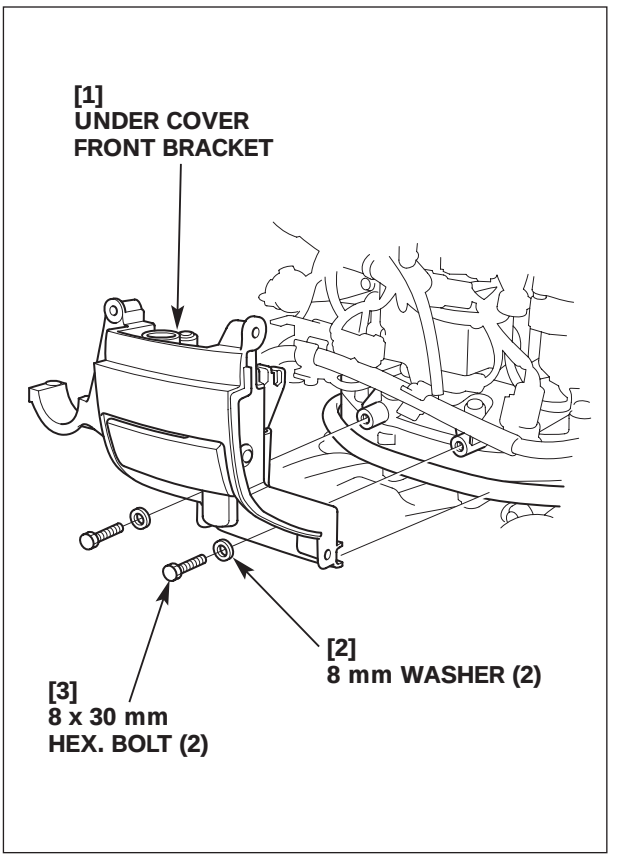
1) Install the R. side cover bracket with the two 6 x 22 mm flange bolts.



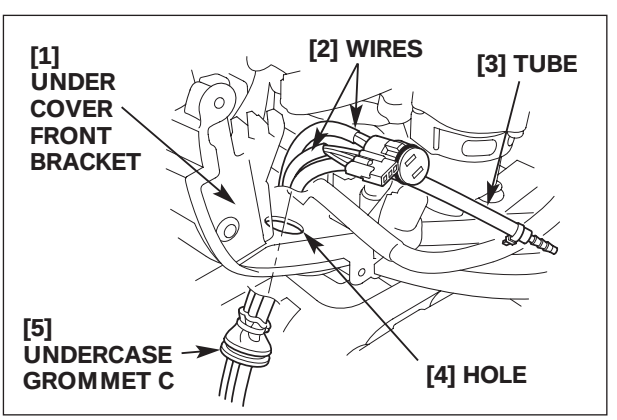
2) Install the L. side cover bracket with the two 6 x 55 mm flange bolts.



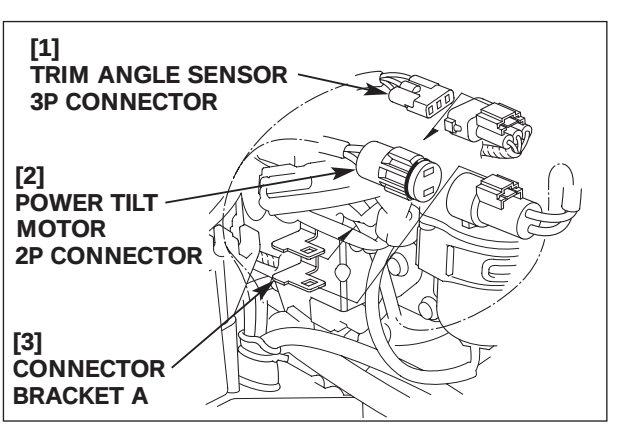
3) Install the under cover front bracket securely with the two 8 x 30 mm hex. bolts and the two 8 mm washers.



4) Pass the tube and the wires through the hole in the under cover front bracket.

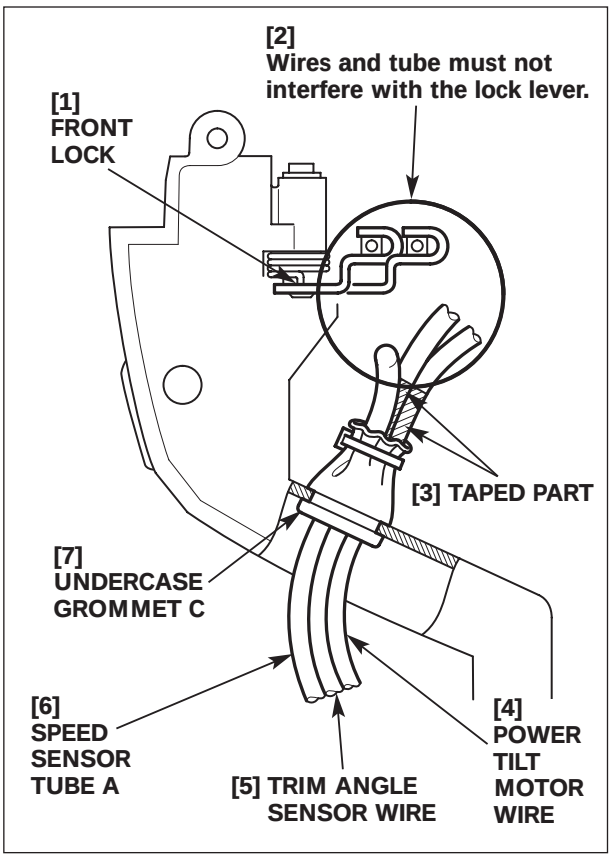


5) Connect the trim angle sensor 3P connector and the power tilt motor 2P connector. Install the power tilt motor 2P connector on the lower side of the connector bracket A and the trim angle sensor 3P connector on the upper side of the connector bracket A.



6) Check that the taped ends of the power tilt motor wire and trim angle sensor wire are in alignment with the end of the undercase grommet C. Install the undercase grommet C on the under cover front bracket so they engage securely in the groove of the undercase grommet C.

   Move the front lock with a hand and check that the wires and tube do not interfere with the front lock.

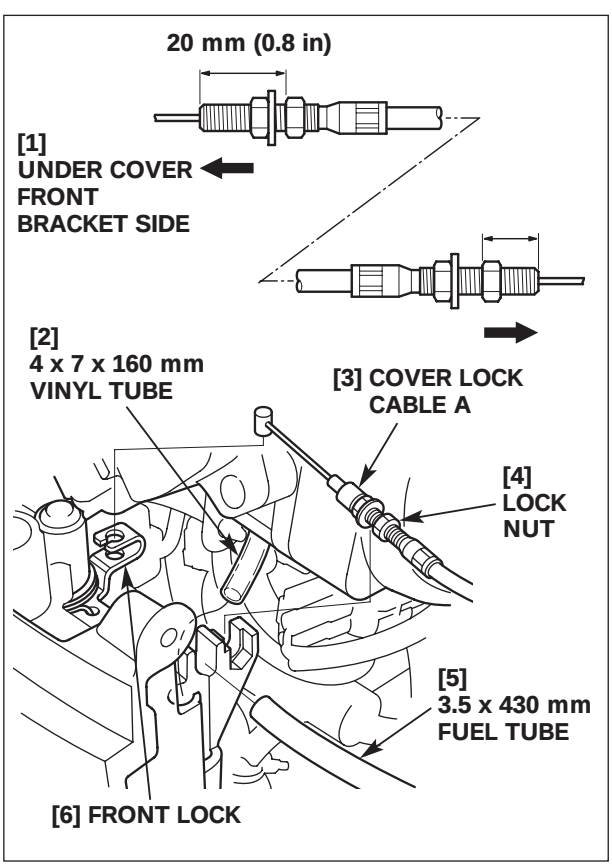


7) Adjust the length between the end of the cable outer and the end of the nut of the cover lock cable A (longer one) so that it is 20 mm (0.8 in) as shown.

8) Holding the nut in the position described in step 7, position the inner cable end of the cover lock cable A on the front lock and position the cable A nut on the under cover front bracket.
   Tighten the washer side lock nut securely.

   • Check that the nut set in step 7 is not out of the position. If it is, repeat the procedure from step 7.

9) Position the 4 x 7 x 160 mm vinyl tube and the 3.5 x 430 mm fuel tube on the under cover front bracket.



10) Adjust the length between the other end of the cable outer and the end of the nut of the cover lock cable A so that it is 13 mm (0.5 in) as shown.

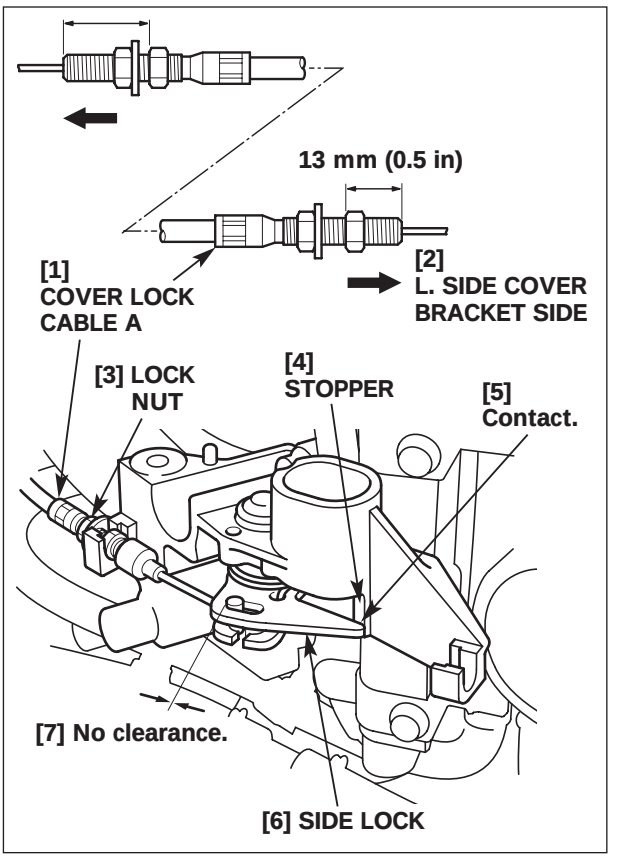
11) Holding the nut in the position described in step 10, position the inner cable end of the cover lock cable A on the side lock and position the cable A nut on the L. side cover bracket.
Tighten the washer side lock nut securely.

- Check that the nut set in step 10 is not out of the position. If it is, repeat the procedure from step 10.

12) Check for clearance between the end of the long hole in the side lock and the inner cable end as shown. There must be no clearance.

If there is clearance, repeat the procedure from step 7.

Check that the side lock is in contact with the stopper of the L. side cover bracket.



13) Adjust the length between the end of the cable outer and the end of the nut of the cover lock cable B (shorter one) so that it is 13 mm (0.5 in) as shown.

14) Holding the nut in the position described in step 13, position the inner cable end of the cover lock cable B on the side lock and position the cable B nut on the L. side cover bracket.

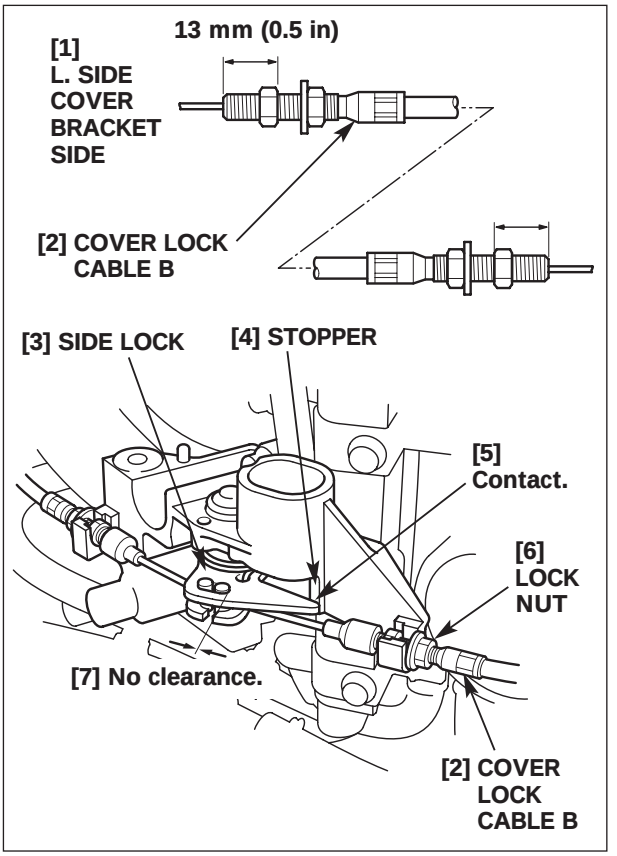
Tighten the washer side lock nut securely.

- Check that the nut set in step 13 is not out of the position. If it is, repeat the procedure from step 13.

15) Check for clearance between the end of the long hole in the side lock and the inner cable end as shown. There must be no clearance.

If there is clearance, repeat the procedure from step 7.

Check that the side lock is in contact with the stopper of the L. side cover bracket.



16) Adjust the length between the other end of the cable outer and the end of the nut of the cover lock cable B so that it is 13 mm (0.5 in) as shown.

17) Holding the nut in the position described in step 16, position the inner cable end of the cover lock cable B on the side lock and position the cable B nut on the R. side cover bracket.

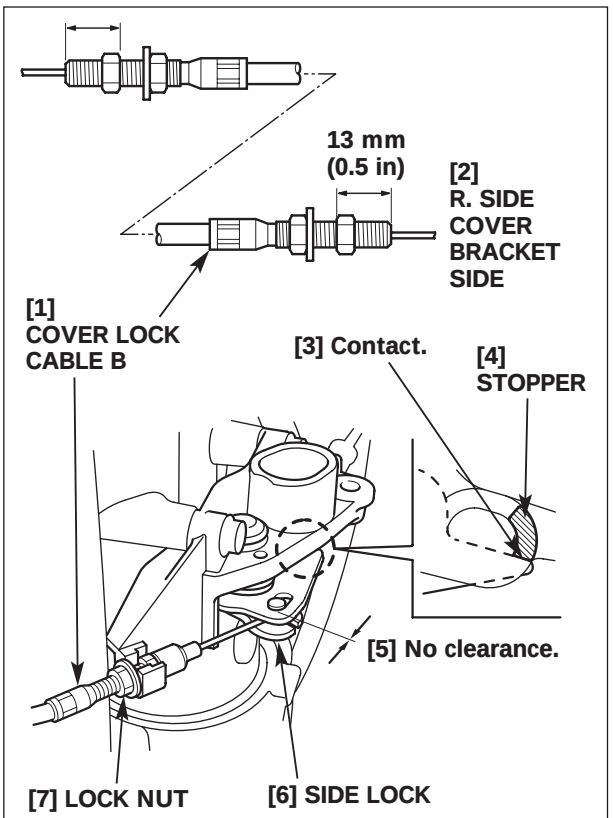
Tighten the washer side lock nut securely.

- Check that the nut set in step 16 is not out of the position. If it is, repeat the procedure from step 16.

18) Check for clearance between the end of the long hole in the side lock and the inner cable end as shown. There must be no clearance.

If there is clearance, repeat the procedure from step 7.

Check that the side lock is in contact with the stopper of the R. side cover bracket.



19) After installing the cover lock cable A and B, operate the cover lock lever and check the front lock and the L./R. side locks for smooth operation.

20) Pull up the cover lock lever (i.e. release the cover lock). Look down the cover lock bolt hole of each of the under cover front bracket and the L./R. side cover brackets and check that the front lock and the side lock do not appear.

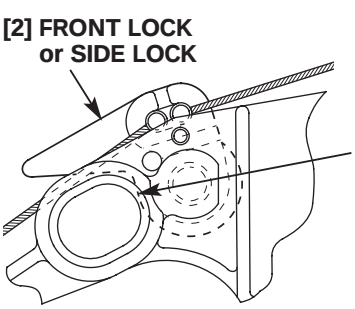
21) If the front lock or side lock appears when looking down the cover lock bolt hole, perform the following check.

<When L. side bracket side appears>
Loosen the lock nut at the cover lock cable A of the L. side bracket, and adjust by turning the adjusting nut right or left.

<When R. side bracket side appears>
Loosen the lock nut at the cover lock cable B of the R. side bracket, and adjust by turning the adjusting nut right or left.

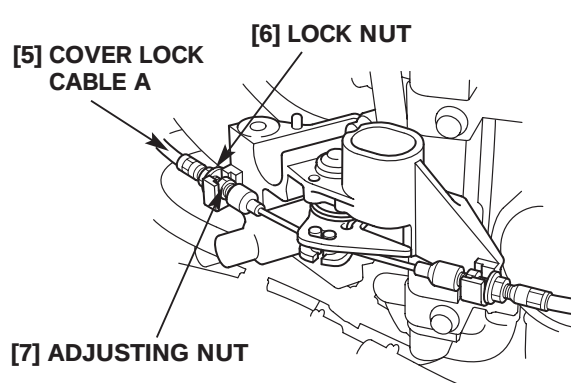
22) Install the following parts.
– Remote control cable/grommet (P. 17-5)
– L./R. engine under cover (P. 4-14)
– Front separate cover (P. 4-7)
– Engine cover (P. 4-2)

[1] View of each bracket from the top:



[3] COVER LOCK BOLT HOLE (The front lock and side lock must not appear when viewing the cover lock bolt hole from the top with the lever pulled up.)

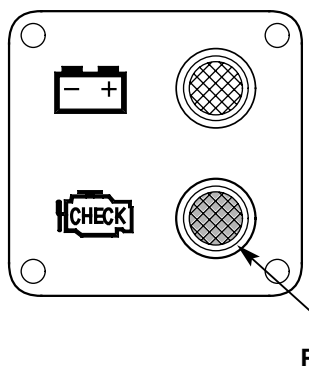
[4] L. SIDE COVER BRACKET SIDE:



1. SERVICE PRECAUTIONS

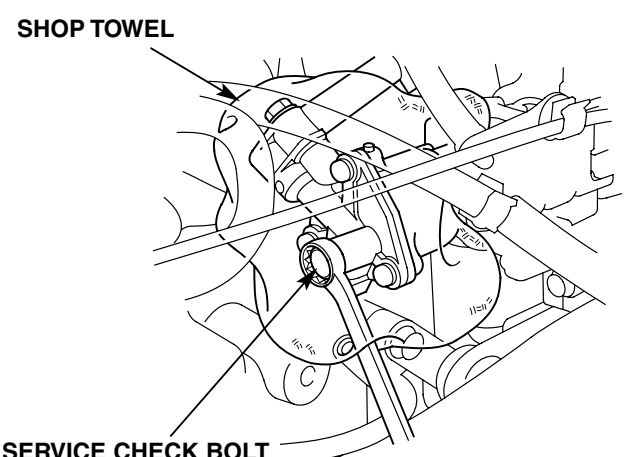
• PGM-FI (PROGRAMMED FUEL INJECTION) TROUBLESHOOTING

- 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, clear the DTC (P. 5-14) or reset the ECM memory (P. 5-57).



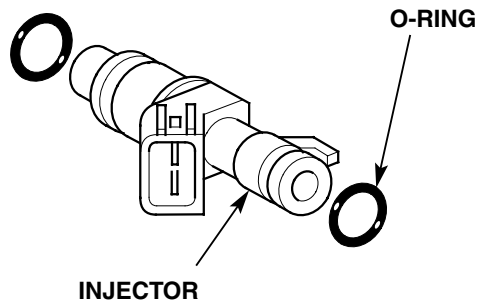
• FUEL LINE SERVICE

- 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 of the high pressure side fuel strainer, as described in "How to relieve fuel pressure" (P. 5-102).



12 N•m (1.2 kgf•m, 9 lbf•ft)

- Replace the sealing washers during reassembly.
- Replace the O-rings when the fuel line is removed/installed or replaced.
- Apply the recommended engine oil to the O-rings before installation. Avoid using the vegetable oil and the alcoholic grease.



• 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.

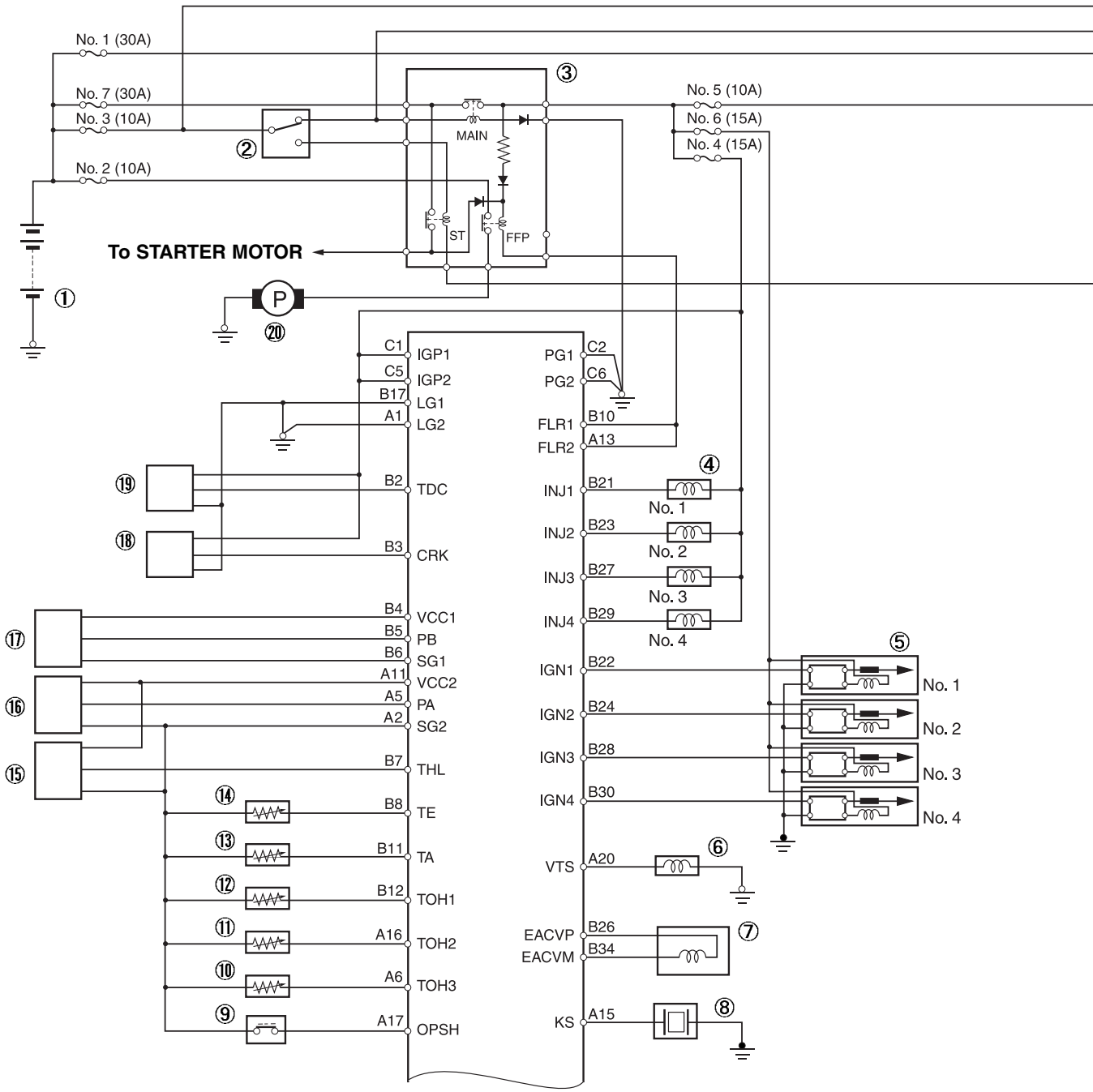
• FUEL LEAK CHECK

- Turn the ignition switch ON (but do not turn the starter) after connecting the fuel lines. The fuel pump unit (high pressure side) 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.

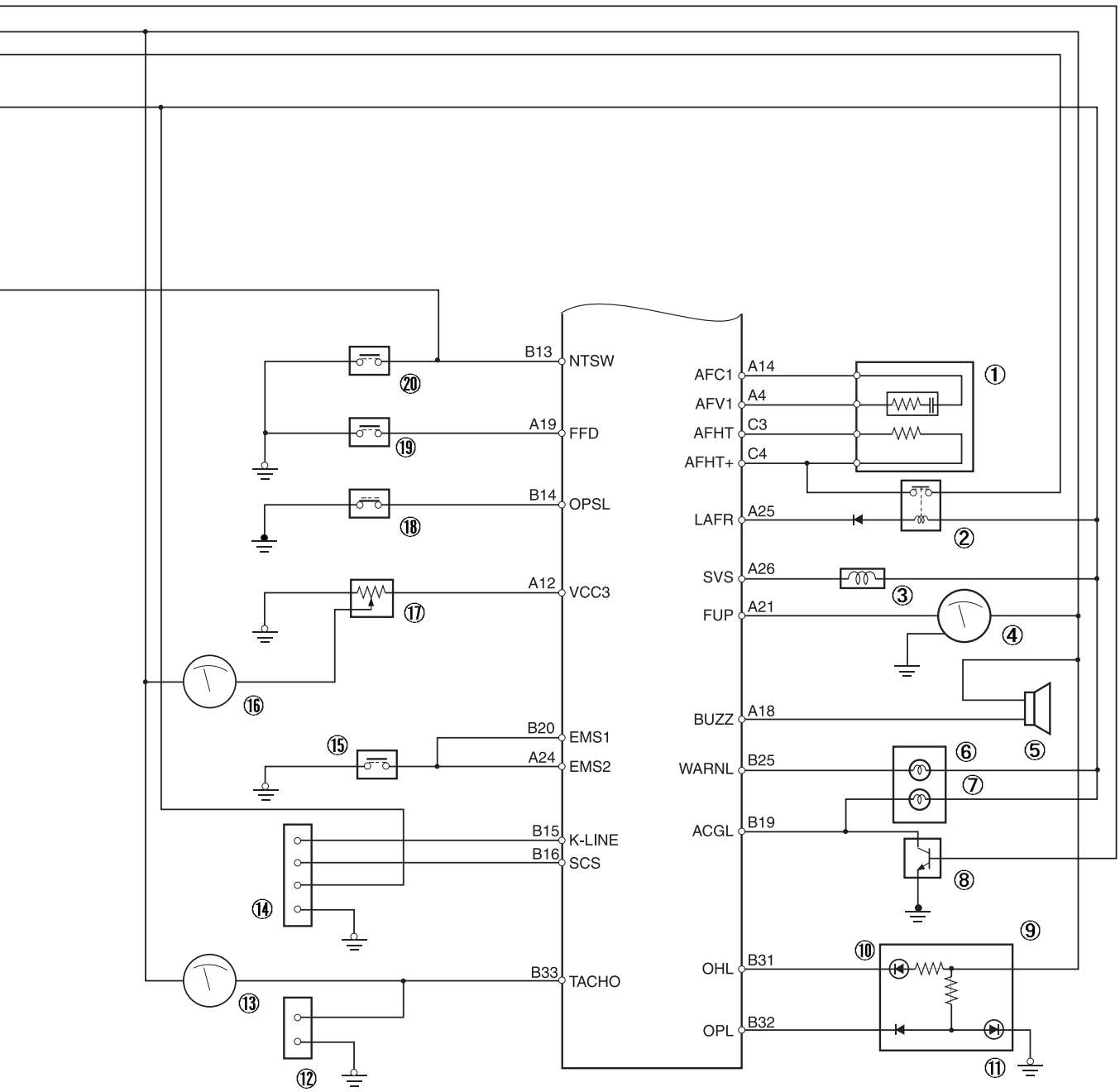
• WHEN THE BOAT IS EQUIPPED WITH RADIO EQUIPMENT

- 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 and the remote control box.
- Antenna wire must not be too long. Do not route the antenna wire along the remote control cable A and other cables/wires.
- Do not mount the radio equipment of large output power on the boat. (The maximum output power of the radio equipment should be 10W when mounted on a boat.)
- Install the D-GPS antenna and the body unit at least 3 m (10 ft) away from the engine.
- Connect the D-GPS antenna ground wire to ground.

2. CIRCUIT DIAGRAM

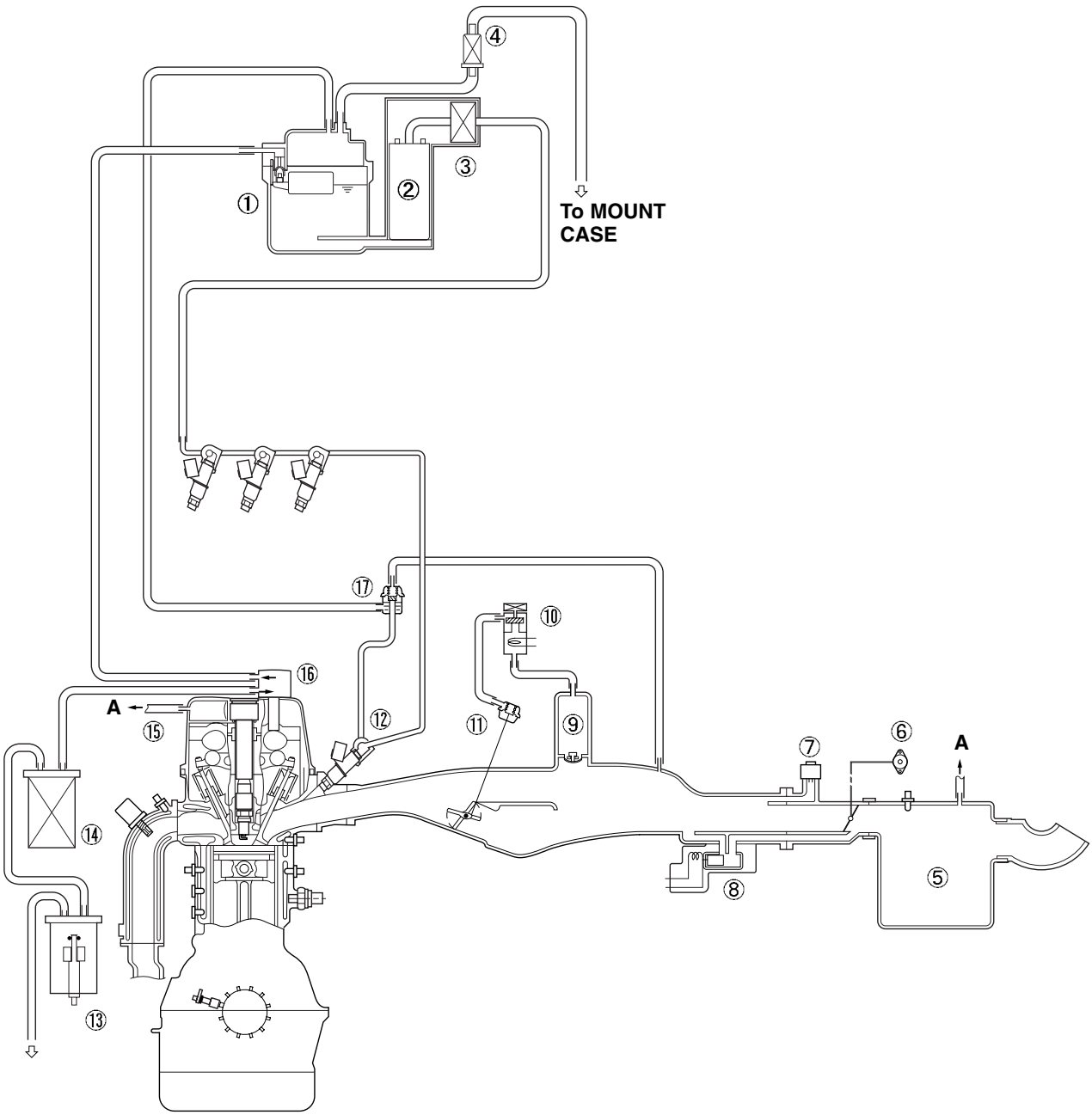


① BATTERY
② IGNITION SWITCH
③ PGM-FI MAIN RELAY
④ INJECTOR
⑤ IGNITION COIL
⑥ VTEC SOLENOID VALVE
⑦ IAC (IDLE AIR CONTROL) VALVE
⑧ KNOCK SENSOR
⑨ EOP (ENGINE OIL PRESSURE) SWITCH (HIGH PRESSURE SIDE)
⑩ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 4
⑪ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 3
⑫ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 2
⑬ IAT (INTAKE AIR TEMPERATURE) SENSOR
⑭ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 1
⑮ TP (THROTTLE POSITION) SENSOR
⑯ BARO (BAROMETRIC PRESSURE) SENSOR
⑰ MAP (MANIFOLD ABSOLUTE PRESSURE) SENSOR
⑱ CKP (CRANKSHAFT POSITION) SENSOR
⑲ CMP (CAMSHAFT POSITION) SENSOR
⑳ FUEL PUMP (HIGH PRESSURE SIDE)



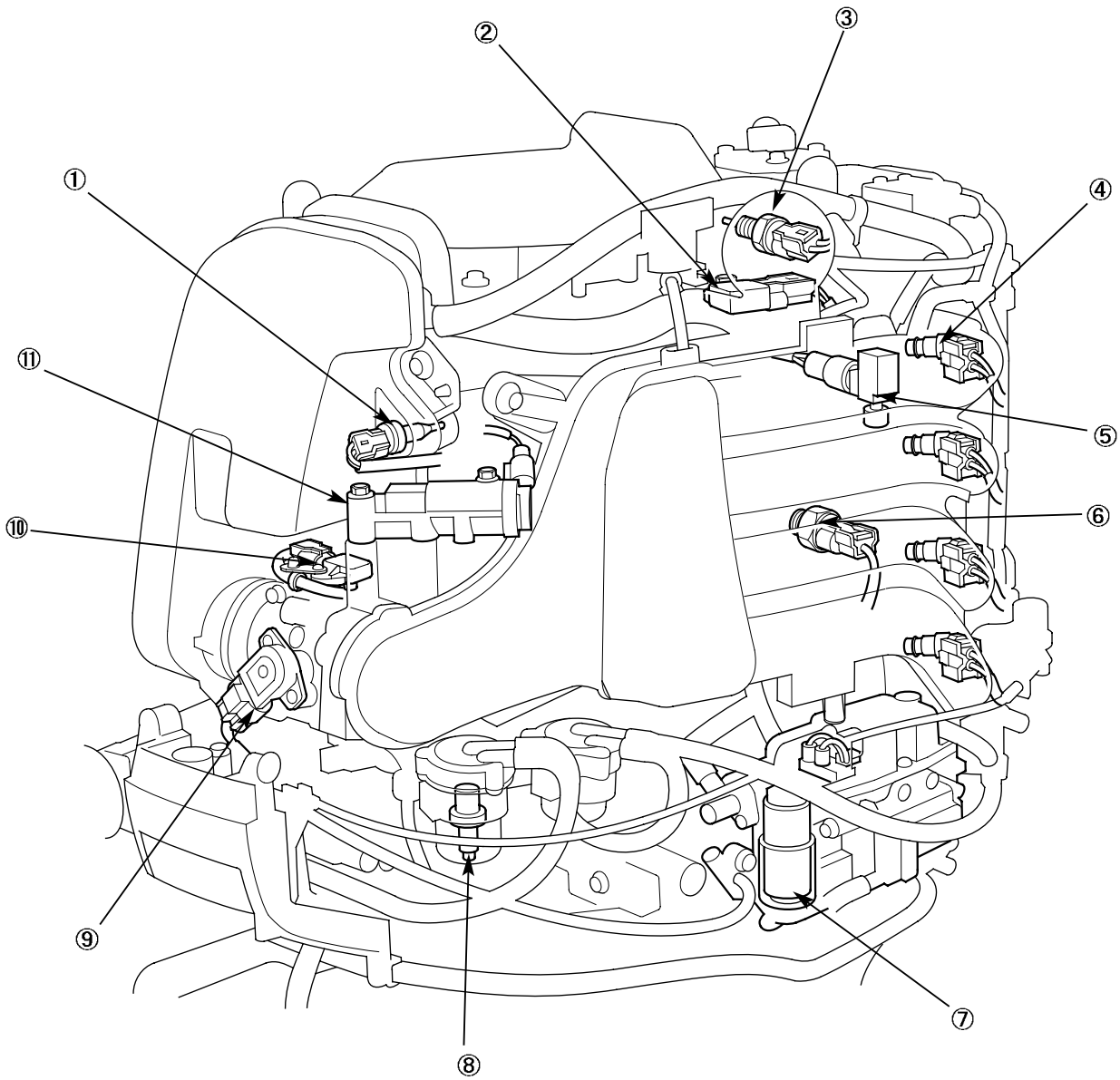
① A/F (AIR FUEL RATIO) SENSOR
② A/F (AIR FUEL RATIO) SENSOR RELAY
③ IAB (INTAKE AIR BYPASS) CONTROL VALVE
④ FUEL GAUGE
⑤ BUZZER
⑥ MIL
⑦ ACG INDICATOR LIGHT
⑧ IC REGULATOR (ALTERNATOR)
⑨ INDICATOR LIGHT
⑩ OVERHEAT INDICATOR LIGHT
⑪ OIL INDICATOR LIGHT
⑫ TACHOMETER PULSE CHECK CONNECTOR
⑬ TACHOMETER (OPTION)
⑭ DATA LINK CONNECTOR
⑮ EMERGENCY STOP SWITCH
⑯ TRIM METER (OPTION)
⑰ TRIM ANGLE SENSOR
⑱ EOP (ENGINE OIL PRESSURE) SWITCH (LOW PRESSURE SIDE)
⑲ WATER LEVEL SWITCH
⑳ NEUTRAL SWITCH

3. VACUUM CONNECTIONS

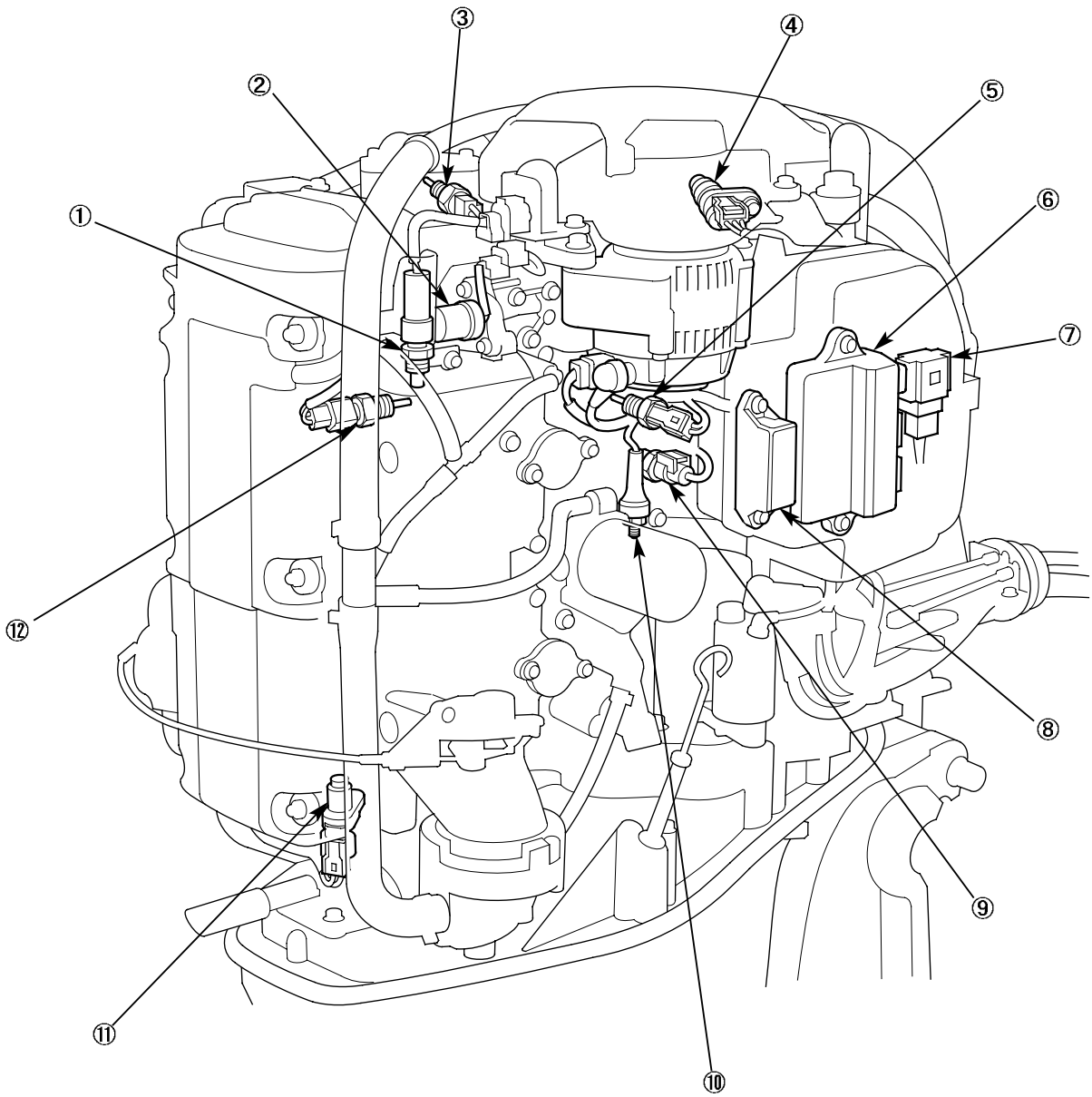


① VAPOR SEPARATOR
② FUEL PUMP
③ HIGH PRESSURE SIDE FUEL FILTER
④ VAPOR FILTER
⑤ SILENCER CASE
⑥ TP (THROTTLE POSITION) SENSOR
⑦ MAP (MANIFOLD ABSOLUTE PRESSURE) SENSOR
⑧ IAC (IDLE AIR CONTROL) VALVE
⑨ VACUUM TANK
⑩ IAB (INTAKE AIR BYPASS) CONTROL SOLENOID VALVE
⑪ DIAPHRAGM
⑫ INJECTOR
⑬ WATER SEPARATOR
⑭ FUEL STRAINER
⑮ BREATHER CHAMBER
⑯ FUEL PUMP (LOW PRESSURE SIDE)
⑰ PRESSURE REGULATOR

4. PARTS LOCATION/ECM TERMINAL LAYOUT



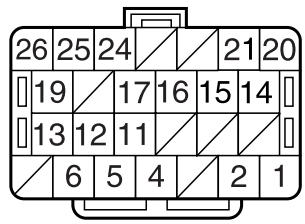
① IAT (INTAKE AIR TEMPERATURE) SENSOR
② BARO (BAROMETRIC PRESSURE) SENSOR
③ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 2
④ INJECTOR
⑤ IAB (INTAKE AIR BYPASS) CONTROL SOLENOID VALVE
⑥ KNOCK SENSOR
⑦ FUEL PUMP (HIGH PRESSURE SIDE)
⑧ WATER LEVEL SENSOR
⑨ TP (THROTTLE POSITION) SENSOR
⑩ MAP (MANIFOLD ABSOLUTE PRESSURE) SENSOR
⑪ IAC (IDLE AIR CONTROL) VALVE



① A/F (AIR FUEL RATIO) SENSOR
② VTEC SOLENOID VALVE
③ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 4
④ CKP (CRANKSHAFT POSITION) SENSOR
⑤ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 1
⑥ ECM (ENGINE CONTROL MODULE)
⑦ A/F (AIR FUEL RATIO) SENSOR RELAY
⑧ PGM-FI MAIN RELAY
⑨ EOP (ENGINE OIL PRESSURE) SWITCH (HIGH PRESSURE SIDE)
⑩ EOP (ENGINE OIL PRESSURE) SWITCH (LOW PRESSURE SIDE)
⑪ CMP (CAMSHAFT POSITION) SENSOR
⑫ ECT (ENGINE COOLANT TEMPERATURE) SENSOR 3

• ECM TERMINAL LAYOUT

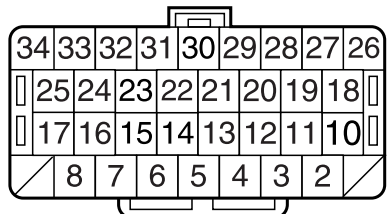
ECM CONNECTOR A



HARNESS SIDE CONNECTOR
VIEWED FROM THE TERMINAL SIDE

Terminal No.	Wire color	Terminal mark	Name	Content/Signal
1	G/W	LG2	Logic ground 2 (Common with B17)	
2	G/R	SG2	Sensor ground 2	
3	Not used			
4	W/Bl	AFV1	A/F sensor (V)	Power source for the A/F sensor
5	W/Bu	PA	BARO sensor	At ignition switch ON: Approx. 3V
6	R/G	TOH3	ECT sensor 4	Detects cylinder block temperature.
7	Not used			
8	Not used			
9	Not used			
10	Not used			
11	Br/W	VCC2	Sensor power 2	At ignition switch ON: Approx. 5V
12	Lg/Bl	VCC3	Sensor power 3	At ignition switch ON: Approx. 5V
13	Lg/R	FLR2	Fuel pump relay 2	
14	Bl/Y	AFC1	A/F sensor (C)	
15	R/Bu	KS	Knock sensor	
16	R	TOH2	ECT sensor 3	Detects exhaust port temperature.
17	Y/R	OPSH	EOP switch (High pressure side)	At switch ON: Approx. 0V At switch OFF: Battery voltage
18	Not used			
19	Br	EFD	Fuel filter water level switch	At switch ON (High water level): Approx. 0V At switch OFF: Battery voltage
20	G/Y	VTS	VTEC solenoid valve	Power to drive solenoid valve: High engine rpm (4,300 min^{-1}/rpm or above): ON
21	G	FUP	Fuel gauge	Power to drive fuel gauge
22	Not used			
23	Not used			
24	Bl/R	EMS2	Emergency stop switch 2	At switch ON: Approx. 0V At switch OFF: Battery voltage
25	G/O	LAFR	A/F sensor heater relay	Power to drive A/F sensor heater relay
26	Bl	SVS	IAB solenoid valve	Power to drive IAB solenoid valve High engine rpm (4,300 min^{-1}/rpm or above): ON

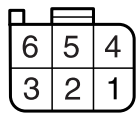
ECM CONNECTOR B



HARNESS SIDE CONNECTOR
VIEWED FROM THE TERMINAL SIDE

Terminal No.	Wire color	Terminal mark	Name	Content/Signal
1	Not used			
2	G	TDC	CMP sensor	CMP sensor signal
3	Bu	CRK	CKP sensor	CKP sensor signal
4	Br/Y	VCC1	Sensor power 1	Power for sensor (5V)
5	W/R	PB	MAP sensor	Detects vacuum at the intake manifold.
6	G/R	SG1	Sensor ground 1	
7	R/Bl	THL	TP sensor	Detects throttle position.
8	R/W	TE	ECT sensor 1	Detects cylinder block engine temperature.
9	Not used			
10	Lg/R	FLR1	Fuel pump relay 1	Power to drive fuel pump relay
11	R/Y	TA	IAT sensor	Detects intake air temperature.
12	R/Bl	TOH1	ECT sensor 2	Detects cylinder head temperature.
13	R/Bu	NTSW	Neutral switch	At switch ON (Neutral): Approx. 0V At switch OFF: Battery voltage
14	P	OPSL	EOP switch (Low pressure side)	At switch ON: Approx. 0V At switch OFF: Battery voltage
15	Bu	K-LINE	Communication signal	At ignition switch ON: Approx. 12V
16	Lg/W	SCS	Service check signal	
17	G/Bl	LG1	Logic ground 1	
18	Y/G	BUZZ	Buzzer	Power to sound buzzer
19	W/Bu	ACGL	Alternator indicator light	Inputs alternator indicator light ON signal.
20	Bl/R	EMS1	Emergency stop switch 1	At switch ON: Approx. 0V At switch OFF: Battery voltage
21	Br	INJ1	No. 1 injector	Power to drive No. 1 injector
22	Bu	IGN1	No. 1 ignition coil	Outputs No. 1 ignition signal.
23	R	INJ2	No. 2 injector	Power to drive No. 2 injector
24	Bu/Bl	IGN2	No. 2 ignition coil	Outputs No. 2 ignition signal.
25	R/Bu	WARNL	MIL	Power to turn MIL ON
26	G/W	EACVP	IAC valve (+)	Power to drive IAC valve (+)
27	Bu	INJ3	No. 3 injector	Power to drive No. 3 injector
28	W/G	IGN3	No. 3 ignition coil	Outputs No. 3 ignition signal
29	Y	INJ4	No. 4 injector	Power to drive No. 4 injector
30	Bu/R	IGN4	No. 4 ignition signal	Outputs No. 4 ignition signal
31	R	OHL	Overheat indicator light	Overheat indicator light ON line
32	Y	OPL	Oil pressure light	Oil indicator light ON line
33	Gr	TACHO	Tachometer pulse	Drives tachometer.
34	Bl	EACVM	IAC valve (–)	Power to drive IAC valve (–)

ECM CONNECTOR C



HARNESS SIDE CONNECTOR
VIEWED FROM THE TERMINAL SIDE

Terminal No.	Wire color	Terminal mark	Name	Content/Signal
1	Y/Bl	IGP1	ECM main power 1 (Common with C5)	At ignition switch ON: Battery voltage
2	G	PG1	Power ground 1 (Common with C6)	
3	Bl/W	AFHT	A/F sensor heater	
4	W	AFHT+	A/F sensor heater (+)	
5	Y/Bl	IGP2	ECM main power 2 (Common with C1)	At ignition switch ON: Battery voltage
6	G/R	PG2	Power ground 2 (Common with C2)	

5. TROUBLESHOOTING

The ECM (Engine Control Module) has the self-diagnosis function which memorizes the failure code and turns the MIL (Malfunction Indicator Light) ON when it detects an abnormality with the input/output system.

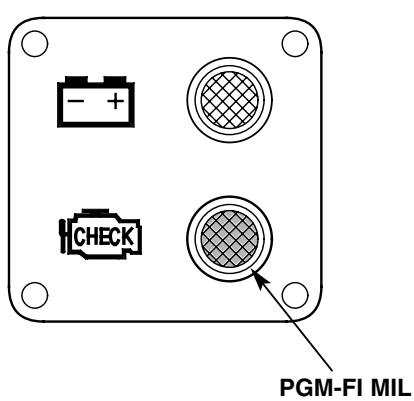
- If the MIL does not come ON but the engine failure (abnormality other than monitoring ECM) occurred, detect the probable problem part by referring to the Quick Reference Chart of Troubleshooting by System on page 5-12, and troubleshoot accordingly.

• HOW TO CARRY OUT TROUBLESHOOTING

When the MIL comes ON or blinks or any abnormality occurs during running, identify the problem detected by ECM according to the following procedure, and troubleshoot accordingly.

To troubleshoot, connect the tester probe to a commercially available digital circuit tester. Note that the tester probe must agree with the connector terminal of the digital circuit tester not to apply excessive force to the connector terminal.

1. Turn the ignition switch ON and check that the MIL comes ON.



2. When the MIL is ON or blinking, check the DTC (Diagnostic Trouble Code) using the HDS tester (P. 5-13).

   Or, use the short connector to blink the MIL and troubleshoot the problem indicated by the number of blinks of the MIL (P. 5-57).

3. Perform the troubleshooting by referring to the “Troubleshooting Guide by DTC” (P. 5-15) or “Troubleshooting Guide by No. of Blinks” (P. 5-59).

   Check each connector and wire harness for secure connection and damage before troubleshooting. Repair the connector and wire harness if necessary.

4. After troubleshooting, perform repairs as needed and perform the necessary work (P. 5-14 or 5-58).

• QUICK REFERENCE CHART OF TROUBLESHOOTING BY SYSTEM

When the MIL does not come ON but the engine becomes faulty, refer to the following troubleshooting chart and check the parts in the numbered order shown on the chart.

Idle Control System

Check point / Symptom / Ref. page	Idle adjusting screw	IAC valve	Neutral switch	Vacuum pipe
Ref. page	5-94	5-95	17-13	5-5
Engine does not start		2		1
Engine starts but stalls soon	1	2		3
Engine speed is higher than the specified idle speed after warm up.	3	2		1
Engine speed is higher than the specified trolling speed after warm up.	3	4	1	2
Engine speed is lower than the specified idle speed after warm up.	2	1		3
Engine speed is lower than the specified trolling speed after warm up.	2	1		3
Engine speed is not stable during idling and trolling.	2	1	4	3

Low Pressure Fuel Supply System

Check point / Symptom / Ref. page	Low pressure fuel line	Water separator	Low pressure fuel strainer	Low pressure fuel pump	Vapor separator
Ref. page	5-104	3-19	3-15	5-142	5-111
Engine does not start	3	1	2		4
Engine starts but stalls soon	3	1	2		4
Engine speed is not stable during idling and trolling, or engine stalls.		1	2		
Engine sometimes misfires or stalls soon	3	1	2		4
Engine stalls soon at hot restart of the engine.					1

High Pressure Fuel Supply System

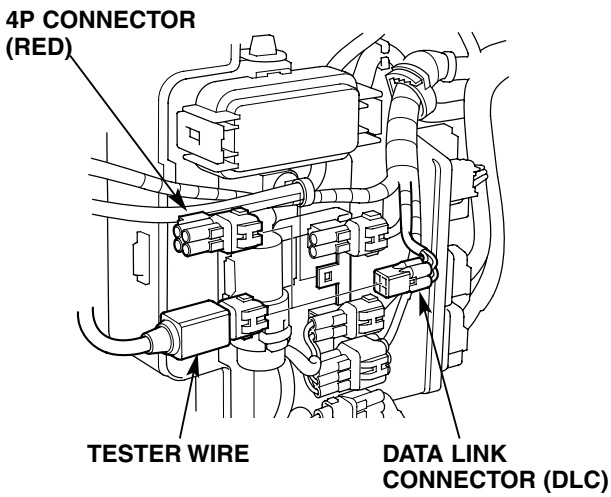
Check point / Symptom / Ref. page	High pressure fuel line	High pressure fuel pump	High pressure fuel strainer	Fuel injector	Pressure regulator
Ref. page	5-104	5-107	3-18	5-105	5-106
Engine does not start	1	2		3	
Engine starts but stalls soon	1	2		3	
Engine speed is not stable during idling and trolling, or engine stalls.	1			2	3
Engine speed does not rise	1	3	3	3	2
Engine sometimes misfires or stalls soon	1	3		2	3

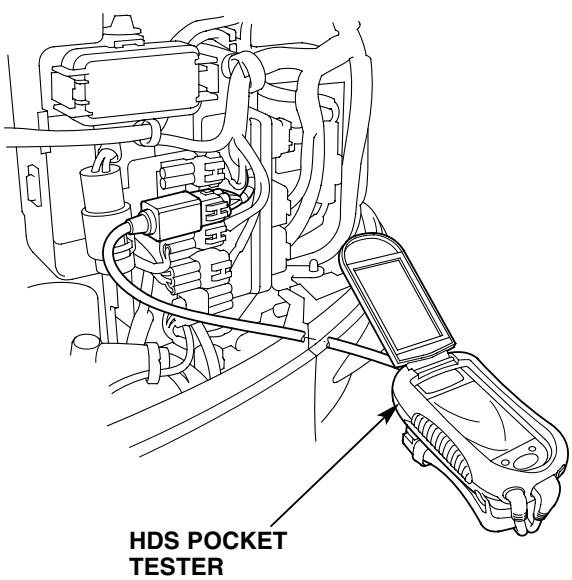
6. TROUBLESHOOTING WITH HDS TESTER

• DTC (DIAGNOSTIC TROUBLE CODE) CHECK

1. Remove the engine cover and the electric part cover (Section 4).

2. Disconnect the 4P (Red) connector and connect the HDS pocket tester to the data link connector (DLC).



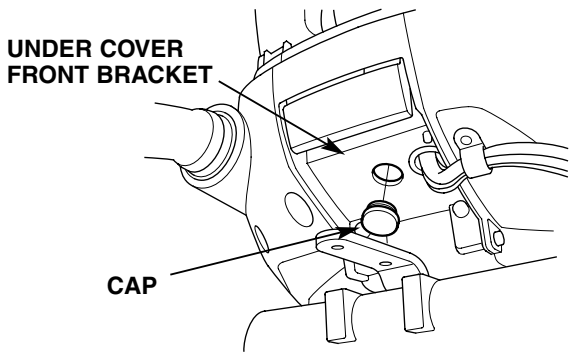


3. Turn the ignition switch ON and check the DTC shown on the HDS pocket tester.

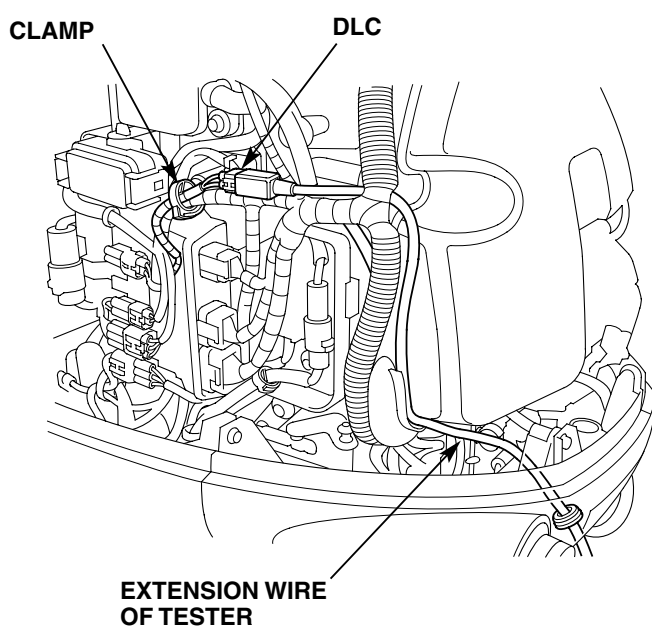
   Refer to the HDS pocket tester's operation manual for how to use the HDS pocket tester.

• WHEN USING HDS POCKET TESTER DURING CRUISING

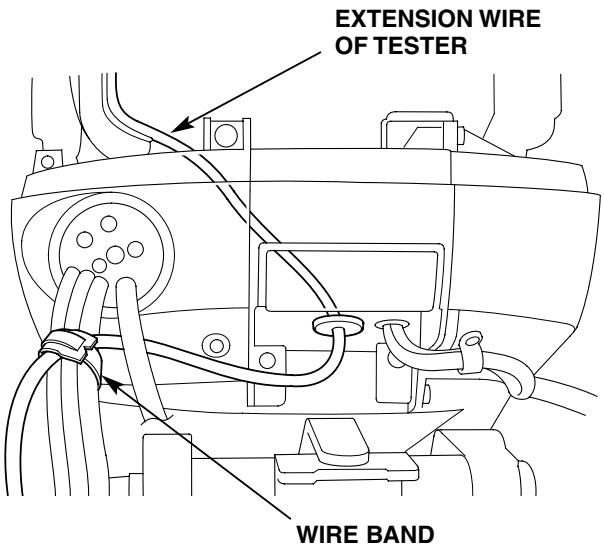
1. Remove the engine cover and the electric part cover (Section 4).
2. Remove the cap from the under cover front bracket. Route the extension wire in the HDS pocket tester kit through the front cover bracket.
   - Set the grommet on the under cover front bracket securely.



3. Disconnect the red 4P connector from the DLC (Data Link Connector) and secure the DLC wire as sown.
   - Route the extension wire of the tester in the position shown so that it does not interfere with the parts.
4. Connect the extension wire to the DLC.



5. Secure the extension wire as shown with the band.



6. Connect the extension wire to the HDS pocket tester.
7. Install the electric part cover and the engine cover in the reverse order of removal.

• TO CLEAR DTC

1. Remove the engine cover and the electric part cover.
2. Connect the HDS pocket tester to the data link connector (DLC).
3. Turn the ignition switch ON.
4. Clear the DTC using the HDS pocket tester.

   Refer to the HDS pocket tester's operation manual for how to use the HDS pocket tester.

   • When abnormality remains in the system, the DTC cannot be cleared as the ECM continues self-diagnosis.

• FINAL PROCEDURE (AFTER TROUBLESHOOTING)

1. Clear the DTC.
2. Disconnect the HDS pocket tester wire from the data link connector.
3. Install the cap on the under cover front bracket.
4. Install the electric part cover and the engine cover.

a. TROUBLESHOOTING GUIDE BY DTC

DTC	PGM-FI MIL	Detected unit	Probable problem part	Ref. page
– or 0-2, 0-5, 0-8	MIL does not come ON/blinks 	ECM	• Open circuit in MIL wire • Blown MIL bulb • Open circuit in ECM ground wire or poor grounding • Faulty ECM	5-18
– or 0-2, 0-5, 0-8	MIL stays ON 	ECM	• Open circuit in ECM power supply line • Short circuit in data link connector wire • Short circuit in MIL wire • Short circuit in sensor power supply line • Faulty ECM	5-21
3-1	MIL stays ON 	MAP sensor (Voltage too low)	• Short circuit in MAP sensor wire • Faulty MAP sensor • Faulty ECM	5-28
3-2	MIL stays ON 	MAP sensor (Voltage too high)	• Open circuit in MAP sensor wire • Faulty MAP sensor • Faulty ECM	5-29
4-1	MIL stays ON 	CKP sensor (No pulse)	• Open/short circuit in CKP sensor wire • CKP sensor • Faulty ECM	5-30
4-2	MIL stays ON 	CKP sensor (Abnormal pulse)	• Faulty CKP sensor • Faulty ECM	5-32
6-1	MIL stays ON 	ECT sensor 1 (Voltage too low)	• Short circuit in ECT sensor 1 • Faulty ECT sensor 1 • Faulty ECM	5-33
6-2	MIL stays ON 	ECT sensor 1 (Voltage too high)	• Open circuit in ECT sensor 1 wire • Faulty ECT sensor 1 • Faulty ECM	5-33
7-1	MIL stays ON 	TP sensor (Voltage too low)	• Open/short circuit in TP sensor wire • Faulty TP sensor • Faulty ECM	5-34
7-2	MIL stays ON 	TP sensor (Voltage too high)	• Open circuit in TP sensor wire • Faulty TP sensor • Faulty ECM	5-35
8-1	MIL stays ON 	CMP sensor (No pulse)	• Open/short circuit in CMP sensor • Faulty DC1 sensor • Faulty ECM	5-36
8-2	MIL stays ON 	CMP sensor (Abnormal pulse)	• Open/short circuit in CMP sensor • Faulty CMP sensor • Faulty ECM	5-37

–: DTC does not appear.

DTC	PGM-FI MIL	Detected unit	Probable problem part	Ref. page
10-1	MIL comes ON 	IAT sensor (Voltage too low)	• Short circuit in IAT sensor wire • Faulty IAT sensor • Faulty ECM	5-38
10-2	MIL comes ON 	IAT sensor (Voltage too high)	• Open circuit in IAT sensor wire • Faulty IAT sensor • Faulty ECM	5-38
13-1	MIL comes ON 	BARO sensor (Voltage too low)	• Short circuit in BARO sensor wire • Faulty BARO sensor • Faulty ECM	5-39
13-2	MIL comes ON 	BARO sensor (Voltage too high)	• Open circuit in BARO sensor wire • Faulty BARO sensor • Faulty ECM	5-40
14-1	MIL comes ON 	IAC valve (Abnormal current flow)	• Open/short circuit in IAC valve wire • Faulty IAC valve • Faulty ECM	5-41
21-1	MIL comes ON 	VTEC solenoid valve (Abnormal output)(BF150A only)	• Open/short circuit in VTEC solenoid valve • Faulty VTEC solenoid valve • Faulty ECM	5-42
23-1	MIL comes ON 	Knock sensor (Abnormal detection)	• Open/short circuit in knock sensor wire • Faulty knock sensor • Faulty ECM	5-43
41-3	MIL comes ON 	A/F sensor heater (Abnormal current flow)	• Open/short circuit in A/F sensor heater wire • Faulty A/F sensor heater • Faulty ECM	5-44
41-4	MIL comes ON 	A/F sensor heater (Abnormal current flow)	• Open/short circuit in A/F sensor heater wire • Faulty A/F sensor heater • Faulty ECM	5-46
48-5	MIL comes ON 	A/F sensor heater (Abnormal current flow)	• Open circuit in A/F sensor heater wire • Faulty A/F sensor • Faulty ECM	5-49
48-6	MIL comes ON 	A/F sensor heater (Abnormal current flow)	• Short circuit in A/F sensor wire C line • Faulty A/F sensor • Faulty ECM	5-50
48-7	MIL comes ON 	A/F sensor heater (Abnormal current flow)	• Short circuit in A/F sensor wire V line • Faulty A/F sensor • Faulty ECM	5-50

DTC	PGM-FI MIL	Detected unit	Probable problem part	Ref. page
140-1	MIL comes ON 	ECT sensor 2 (Voltage too low)	• Short circuit in ECT sensor 2 wire • Faulty ECT sensor 2 • Faulty ECM	5-51
140-2	MIL comes ON 	ECT sensor 2 (Voltage too high)	• Open circuit in ECT sensor 2 wire • Faulty ECT sensor 2 • Faulty ECM	5-51
141-1	MIL comes ON 	ECT sensor 3 (Voltage too low)	• Short circuit in ECT sensor 3 wire • Faulty ECT sensor 3 • Faulty ECM	5-52
141-2	MIL comes ON 	ECT sensor 3 (Voltage too high)	• Open circuit in ECT sensor 3 wire • Faulty ECT sensor 3 • Faulty ECM	5-53
142-1	MIL comes ON 	EOP switch (Abnormal signal)	• Open/short circuit in EOP switch wire • Faulty ECM	5-54
143-1	MIL comes ON 	ECT sensor 4 (Voltage too low)	• Short circuit in ECT sensor 4 wire • Faulty ECT sensor 3 • Faulty ECM	5-55
143-2	MIL comes ON 	ECT sensor 4 (Voltage too high)	• Open circuit in ECT sensor 4 wire • Faulty ECT sensor 4 • Faulty ECM	5-56

When multiple DTC's main codes are indicated:

DTC main codes	PGM-FI MIL	Detected unit	Probable problem part	Ref. page
7, 13	MIL comes ON 		• Open circuit in VCC line (power source for sensor)	—
6,7 10,13 48,140 141,143	MIL comes ON 		• Open circuit in SG (sensor ground) line	—

b. TROUBLESHOOTING

• MIL Does Not Come ON

1. Fuse check

-1. Turn the ignition switch ON and check that the warning buzzer sounds twice.

◆ Does the buzzer sound twice?
YES – Perform "6. Alternator indicator light check"
NO – Go to the step 2.

-2. Check the No. 4 (15A) fuse.

◆ Is the fuse normal?
YES – Go to the step 3.
NO – Repair open in the wire between the No. 4 fuse and the ECM, and between the No. 4 fuse and the injector. After repair, replace the No. 4 fuse.

-3. Check the No. 7 (30A) fuse.

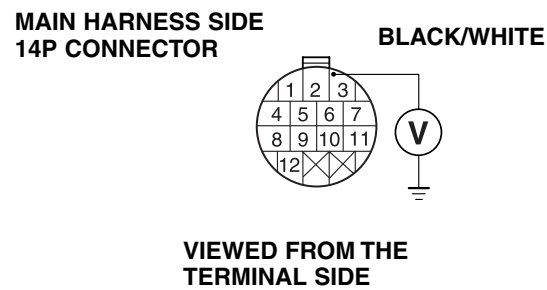
◆ Is the fuse normal?
YES – Go to the step 4.
NO – Repair short in the wire between the PGM-FI main relay and the fuse box, and between the PGM-FI main relay and the starter magnetic switch. After repair, replace the No. 7 fuse.

-4. Check the No. 3 (30A) fuse.

◆ Is the fuse normal?
YES – Perform "2. Main power line check".
NO – Repair short in the wire between the fuse box and the ignition switch, between the fuse box and the alternator, and between the fuse box and the power trim/tilt switch or power tilt switch. After repair, replace the No. 3 fuse.

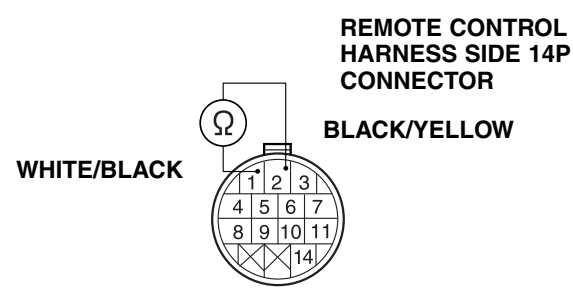
2. Main power line check

-1. Disconnect the remote control harness 14P connector.
-2. Measure the voltage between the No. 3 (White/Black) terminal of the main harness side 14P connector and the engine ground.
• Note that voltage is constantly applied to the White/Black terminal. Take care not to short-circuit the terminal.



◆ Is there the battery voltage?
YES – Go to the step 3.
NO – Repair open in the main harness.

-3. Turn the ignition switch ON. Check for continuity between the No. 1 (White/Black) terminal and the No. 2 (Black/Yellow) terminal of the remote control box harness side 14P connector.



◆ Is there the continuity?
YES – Perform "3. IGP power line check".
NO – Go to the step 4.

-4. Check the ignition switch (P. 16-9).

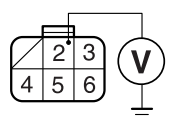
◆ Is the ignition switch normal?
YES – Repair open in the remote control box harness.
NO – The ignition switch is faulty.

3. IGP power line check

-1. Turn the ignition switch OFF. Disconnect the PGM-FI main relay 6P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Black/Yellow) terminal of the PGM-FI main relay harness side 6P connector and the engine ground.

PGM-FI MAIN RELAY HARNESS SIDE 6P CONNECTOR

BLACK/YELLOW

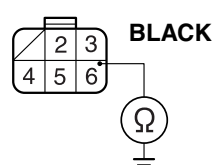


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 3.
NO – Repair open in the main harness.

-3. Turn the ignition switch OFF. Check for continuity between the No. 6 (Black) terminal of the PGM-FI main relay 6P connector and the engine ground.

PGM-FI MAIN RELAY HARNESS SIDE 6P CONNECTOR



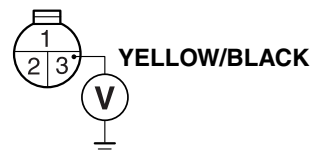
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "4. ECM power line check".
NO – Repair open in the main harness (Black).

4. ECM power line check

-1. Turn the ignition switch OFF and disconnect the fuse box 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (Yellow/Black) terminal of the fuse box side 3P connector and the engine ground.

FUSE BOX SIDE 3P CONNECTOR

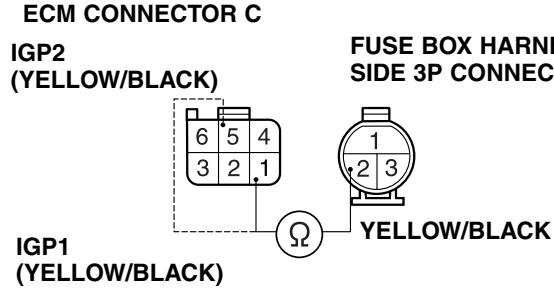


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 3.
NO – The PGM-FI main relay is faulty, or the fuse box is faulty.

-3. Turn the ignition switch OFF and disconnect the ECM connector C.
-4. Check for the continuity between the No. 2 (Yellow/Black) terminal of the fuse box harness side 3P connector and the respective terminals of the No. 1 (Yellow/Black) and No. 5 (Yellow/Black) terminals of the ECM connector C.

ECM CONNECTOR C



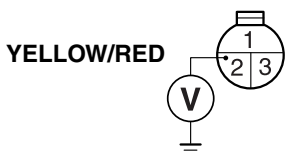
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "5. MIL power line check".
NO – Repair open in the wire of the main harness.

5. MIL power line check

-1. Turn the ignition switch OFF and disconnect the fuse box 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Yellow/Red) terminal of the fuse box side 3P connector and the engine ground

FUSE BOX SIDE 3P CONNECTOR

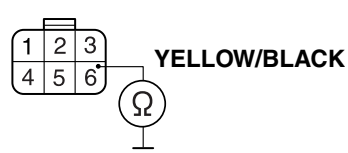


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 3.
NO – The PGM-FI main relay is faulty.

-3. Turn the ignition switch OFF and connect the fuse box 3P connector.
-4. Disconnect the MIL 6P connector.
-5. Turn the ignition switch ON. Measure the voltage between the No. 6 (Yellow/Black) terminal of the MIL 6P harness side connector and the engine ground.

MIL HARNESS SIDE 6P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform "6. Alternator indicator light check".
NO – Repair open in the main wire harness.

6. Alternator indicator light check

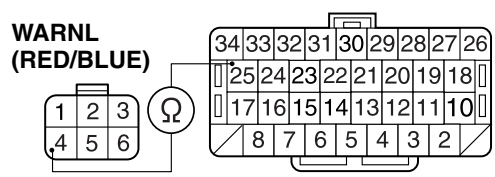
-1. Turn the ignition switch ON and check the alternator indicator light.

◆ Does the alternator indicator light come ON?
YES – Perform "8. Function test".
NO – Replace the MIL.

7. MIL line check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Disconnect the MIL 6P connector.
-3. Check for continuity between the No. 25 (Red/Blue) terminal of the ECM harness side connector B and the No. 4 (Red/Blue) terminal of the MIL harness side 6P connector.

MIL HARNESS SIDE 6P CONNECTOR **ECM CONNECTOR B**

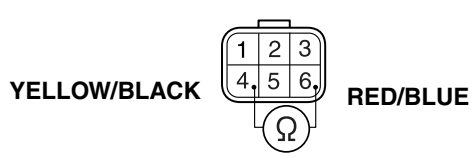


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Go to the step 4.
NO – Repair open in the main harness.

-4. Check for continuity between the No. 4 (Yellow/ Black) terminal and the No. 6 (Red/Blue) terminal of the MIL 6P connector.

MIL 6P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Substitute a known-good ECM and recheck.
NO – MIL is faulty or open circuit in the MIL harness wire.

8. Function test

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON and perform the function test. (See the HDS pocket tester's operation manual for the test procedure.)

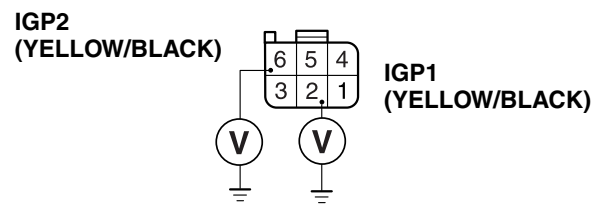
◆ Does the MIL blink?
YES – Substitute a known-good ECM and recheck.
NO – Check the MIL.
If the MIL is normal, repair the main wire harness (open in the Red/Blue wire between the MIL and ECM).

• MIL Comes ON but DTC Code Does Not Appear

1. ECM power line check

-1. Turn the ignition switch OFF and disconnect the ECM connector C.
-2. Turn the ignition switch ON. Measure the voltage between the respective terminals of the No. 2 (Yellow/Black) and No. 6 (Yellow/Black) terminals of the ECM connector C and the engine ground.

ECM CONNECTOR C



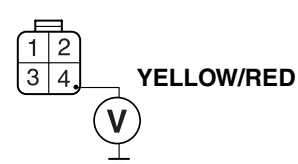
VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform “2. Data link connector check”.
NO – Repair open in the main harness.

2. Data link connector check

-1. Turn the ignition switch OFF and disconnect the HDS pocket tester.
-2. Turn the ignition switch ON. Measure the voltage between the No. 4 (Yellow/Red) terminal of the data link connector and the engine ground.

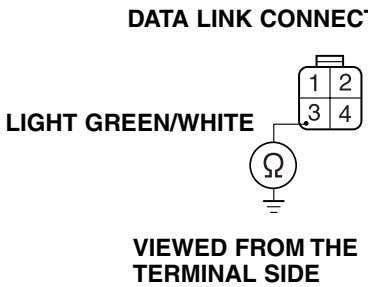
DATA LINK CONNECTOR



VIEWED FROM THE TERMINAL SIDE

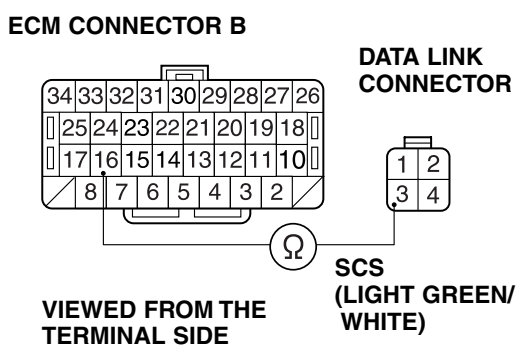
◆ Is there the battery voltage?
YES – Go to the step 3.
NO – Repair open in the main harness.

-3. Turn the ignition switch OFF and disconnect the ECM connector B.
-4. Check for the continuity between the No. 3 (Light green/White) terminal of the data link connector and the engine ground.



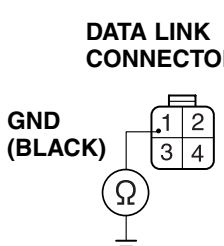
◆ Is there the continuity?
YES – Repair short in the main harness.
NO – Go to the step 5.

-5. Check for the continuity between the No. 3 (Light green/White) terminal of the data link connector and the No. 16 (Light green/White) terminal of the ECM harness side connector B.



◆ Is there the continuity?
YES – Go to the step 6.
NO – Repair open in the main harness.

-6. Check for the continuity between the service check connector No. 1 (Black) terminal and the engine ground.



◆ Is there the continuity?
YES – Perform "3. DTC recheck".
NO – Repair open in the main harness.

3. DTC recheck

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON and check the DTC with the HDS pocket tester.

◆ Is the main code 0 (either of 0-2, 0-5 or 0-8)?
YES – Substitute a known-good ECM and recheck.
NO – Troubleshoot the problem of the DTC.

• Alert System Initial Operation Is Faulty

1. Function test

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON and test the buzzer using the HDS pocket tester.

◆ Does the buzzer sound?
YES – Go to the step 3.
NO – Perform "2. Buzzer line check".

-3. Test the MIL using the HDS pocket tester.

◆ Does the MIL blink?
YES – Go to the step 4.
NO – Perform "3. MIL line check".

-4. Test the overheat indicator light using the HDS pocket tester.

◆ Does the overheat indicator light blink?
YES – Go to the step 5.
NO – Perform "4. Overheat indicator line check".

-5. Test the oil pressure indicator light using the HDS pocket tester.

◆ Does the oil pressure indicator light blink?
YES – End of the test
NO – Perform "5. Oil pressure indicator line check".

2. Buzzer line check

-1. Turn the ignition switch OFF and disconnect the Yellow/Green terminal from the buzzer.
-2. Connect the Yellow/Green terminal of the buzzer to the Black terminal with a jumper wire to short.
-3. Turn the ignition switch ON and check that the buzzer sounds.

◆ Does the buzzer sound?
YES – Repair open in the wire harness (wire between the buzzer and ECM).
NO – Go to the step 4.

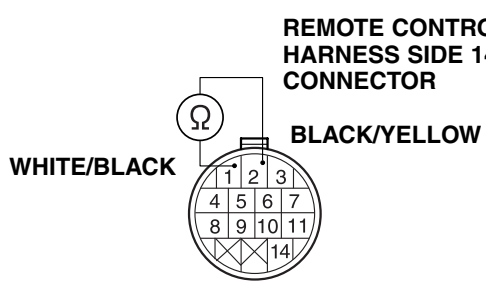
-4. Perform the unit check of the buzzer.

◆ Is the buzzer normal?
YES – Go to the step 5.
NO – The buzzer is faulty.

-5. Perform the unit check of the ignition switch (P. 16-9).

◆ Is the ignition switch normal?
YES – Go to the step 6.
NO – The ignition switch is faulty.

-6. Disconnect the remote control box harness side 14P connector.
-7. Turn the ignition switch ON. Check for the continuity between the No. 1 (White/Black) and the No. 2 (Black/Yellow) terminals of the remote control box harness side 14P connector.

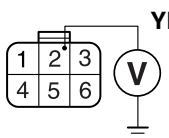


◆ Is there continuity?
YES – Repair open in the main harness.
NO – Repair open in the remote control box harness.

3. MIL line check

-1. Turn the ignition switch OFF and disconnect the MIL 6P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Yellow/Red) terminal of the MIL 6P main harness side connector and the engine ground.

MIL HARNESS SIDE 6P CONNECTOR

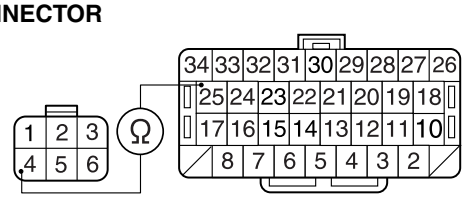


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 3.
NO – Repair open in the main wire harness.

-3. Turn the ignition switch OFF and disconnect the ECM connector B.
-4. Check for the continuity between the No. 25 (Red/Blue) terminal of the ECM harness side connector B and the No. 4 (Red/Blue) terminal of the MIL main harness side 6P connector.

MIL HARNESS SIDE 6P CONNECTOR **ECM CONNECTOR B**



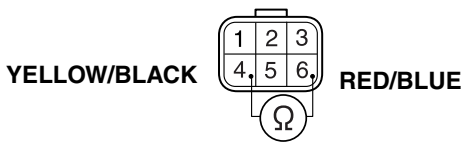
WHITE/BLACK

VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Go to the step 5.
NO – Repair open in the main harness.

-5. Check for continuity between the No. 4 (Yellow/ Black) terminal and the No. 6 (Red/Blue) terminal of the MIL 6P connector.

MIL 6P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Substitute a known-good ECM and recheck.
NO – The MIL is faulty or repair open in the MIL harness.

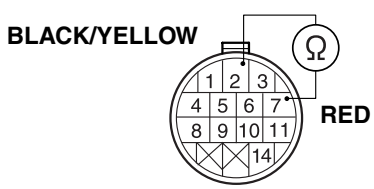
4. Overheat indicator line check

-1. Turn the ignition switch OFF. Disconnect the Red terminal of the indicator light and connect the Black terminal to short.
-2. Turn the ignition switch ON and check the overheat indicator light.

◆ Does the overheat indicator light come ON?
YES – Repair open in the wire harness (between the ECM and the indicator light).
NO – Go to the step 3.

-3. Turn the ignition switch OFF and connect the indicator light Red terminal.
-4. Disconnect the remote control harness 14P connector.
-5. Check for the continuity between the No. 7 (Red) terminal and the No. 2 (Black/Yellow) terminal of the remote control harness side 14P connector.

REMOTE CONTROL HARNESS SIDE 14P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair open in the wire of the main harness.
NO – The indicator light is faulty or repair open in the remote control harness.

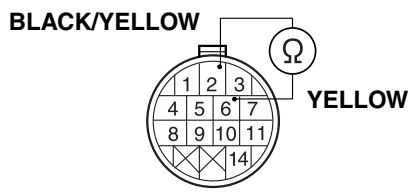
5. Oil pressure indicator line check

-1. Turn the ignition switch OFF. Disconnect the Yellow terminal of the indicator light and connect the Black terminal to short.
-2. Turn the ignition switch ON and check the oil pressure indicator light.

◆ Does the oil pressure indicator light come ON?
YES – Go to the step 3.
NO – Repair open in the wire harness (between the ECM and the indicator light).

-3. Turn the ignition switch OFF and connect the indicator light Yellow terminal.
-4. Disconnect the remote control harness 14P connector.
-5. Check for the continuity between the No. 6 (Yellow) and the No. 2 (Black/Yellow) terminals of the remote control harness side 14P connector.

REMOTE CONTROL HARNESS SIDE 14P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair open in the main harness.
NO – The indicator light is faulty or repair open in the remote control harness wire.

• Neutral Switch Malfunction

• Before following test, perform the neutral position check.

Engine speed does not increase in gears (BF150A only).

1. Switch condition check with the HDS pocket tester

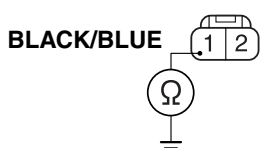
-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON and check the neutral switch condition using the HDS pocket tester.

◆ Does the switch position agree with the indication of the tester?
YES – Substitute a known-good ECM and recheck.
NO – Perform "2. Neutral switch line check".

2. Neutral switch line check

-1. Turn the neutral switch OFF and disconnect the neutral switch 2P connector.
-2. Check for the continuity between the No. 1 (Black/Blue) terminal of the neutral switch harness side 2P connector and the engine ground.

NEUTRAL SWITCH HARNESS SIDE 2P CONNECTOR

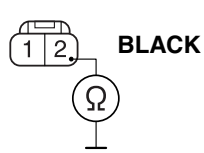


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire of the main harness.
NO – Go to the step 3.

-3. Check for the continuity between the No. 2 (Black) terminal of the neutral switch harness side 2P connector and the engine ground.

NEUTRAL SWITCH HARNESS SIDE 2P CONNECTOR

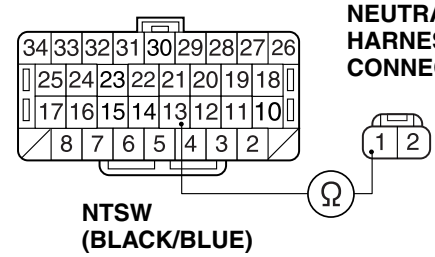


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Go to the step 4.
NO – Repair open in the main wire harness.

-4. Disconnect the ECM connector B.
-5. Check for the continuity between the No. 13 (Black/Blue) terminal of the ECM harness side connector B and the No. 1 (Black/Blue) terminal of the neutral switch harness side 2P connector.

ECM CONNECTOR B



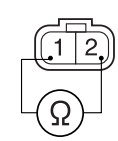
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "3. Neutral switch check".
NO – Repair open in the main harness.

3. Neutral switch check

-1. Turn the ignition switch OFF and disconnect the neutral switch 2P connector.
-2. Check for the continuity between the No. 1 (Black) terminal and the No. 2 (Black/Blue) terminal of the neutral switch side 2P connector.

NEUTRAL SWITCH SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity with the gear in Neutral and no continuity with the gear in other than Neutral?
YES – Substitute a known-good ECM and recheck.
NO – The neutral switch is faulty.

• Tachometer Malfunction

1. Engine speed check using the HDS pocket tester.

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Start the engine and check the engine speed with the HDS pocket tester.

◆ Do the tachometer and tester readings agree?
YES – Normal (Temporary problem has been removed.)
NO – Perform "2. Tachometer power line check".

*Tolerance of genuine Honda tachometer:
At 2,000 rpm: ±160 rpm
At 4,000 rpm: +200 rpm
–150 rpm
At 6,000 rpm: +200 rpm
–150 rpm

2. Tachometer power line check

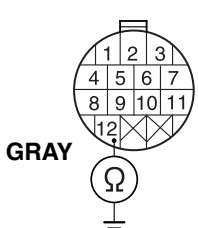
-1. Turn the ignition switch OFF and disconnect the Yellow/Black and the Black terminals of the tachometer.
-2. Turn the ignition switch ON and measure the voltage between the meter harness side Yellow/Black and the Black terminals.

◆ Is there the battery voltage?
YES – Perform "3. Tachometer pulse line check".
NO – Repair open in the wire of the meter harness.

3. Tachometer pulse line check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Disconnect the remote control harness 14P connector.
-3. Check for the continuity between the No. 12 (Gray) terminal of the main harness side 14P connector and the engine ground.

MAIN HARNESS SIDE 14P CONNECTOR

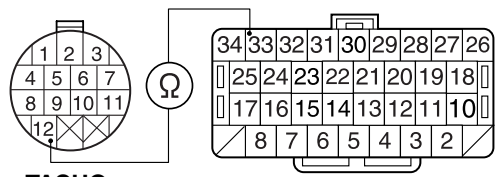


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the main harness.
NO – Go to the step 4.

-4. Check for the continuity between the No. 12 (Gray) terminal of the main harness side 14P connector and the No. 33 (Gray) terminal of the ECM harness side connector B.

MAIN HARNESS SIDE 14P CONNECTOR **ECM CONNECTOR B**



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Check for open in the remote control harness and meter harness wires. If the harnesses are normal, substitute a known-good ECM and recheck.
NO – Repair open in the wire of the main harness.

• ECM Troubleshooting

DTC 0-2, 0-5, 0-8: Inside of ECM is faulty

1. Symptom reproduction test

-1. Connect the HDS pocket tester.
-2. Turn the ignition switch ON and wait for 1 second or more.
-3. Clear the DTC once.
-4. Start the engine and check the DTC again.

◆ Does the DTC 0-2, 0-5, and/or 0-8 appear?
YES – Substitute a known-good ECM and recheck.
NO – Temporary failure inside ECM (Disappeared)

• MAP Sensor Troubleshooting

DTC 3-1: MAP sensor voltage is low

1. Symptom reproduction test

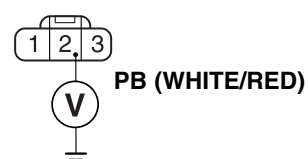
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Check the MAP sensor voltage using the HDS pocket tester.

◆ Is the measured voltage 0.22 to 3.15V?
YES – Temporary failure (Disappeared)
NO – Perform “2. MAP sensor signal line short-circuit test”.

2. MAP sensor signal line short-circuit test

-1. Turn the ignition switch OFF and disconnect the MAP sensor 3P connector.
-2. Disconnect the ECM connector A.
-3. Check for the continuity between the No. 2 (White/Red) terminal of the MAP sensor harness side 3P connector and the body ground.

MAP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the MAP sensor and ECM.
NO – Perform “3. MAP sensor check”.

3. MAP sensor check

-1. Connect the ECM connector A and the MAP sensor 3P connector.
-2. Turn the ignition switch ON and read the MAP sensor voltage using the HDS pocket tester.

◆ Is the voltage 2.76 – 2.96V?
YES – Substitute a known-good ECM and recheck.
NO – Replace the MAP sensor.

DTC 3-2: MAP sensor voltage is high

1. Symptom reproduction test

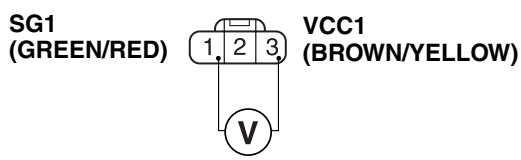
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Check PB voltage using the HDS pocket tester.

◆ Is the measured voltage 0.22 – 3.15V?
YES – Temporary failure (Disappeared)
NO – Perform "2. MAP sensor power line check".

2. MAP sensor power line check

-1. Turn the ignition switch OFF and disconnect the MAP sensor 3P connector.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No. 3 (Brown/Yellow) terminal and the No. 1 (Green/Red) terminal of the MAP sensor harness side 3P connector.

MAP SENSOR HARNESS SIDE 3P CONNECTOR



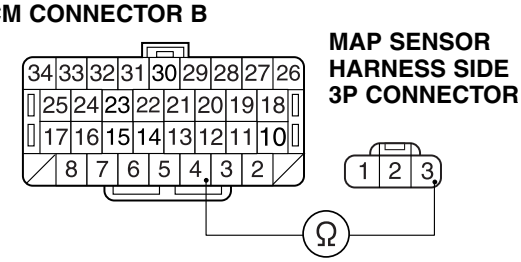
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "5. MAP sensor signal line open circuit check".
NO – Perform "3. MAP sensor power line open circuit check".

3. MAP sensor power line open circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 3 (Brown/Yellow) terminal of the MAP sensor harness side 3P connector and the No. 4 (Brown/Yellow) terminal of the ECM harness side connector B.

ECM CONNECTOR B

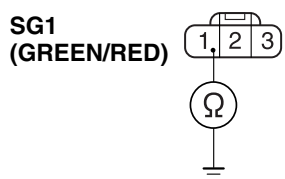


◆ Is there the continuity?
YES – Perform "4. MAP sensor ground line open circuit check".
NO – Repair open in the wire between the MAP sensor and the ECM.

4. MAP sensor ground line open circuit check

-1. Check for the continuity between the No. 1 (Green/Red) terminal of the MAP sensor harness side 3P connector and the body ground.

MAP SENSOR HARNESS SIDE 3P CONNECTOR



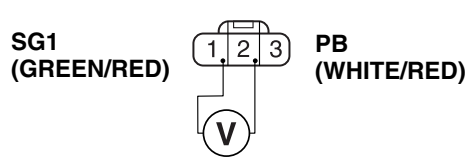
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "5. MAP sensor signal line open circuit check".
NO – Repair open in the wire between the MAP sensor and the ECM.

5. MAP sensor signal line open circuit check

-1. Connect the ECM connector A.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No. 2 (White/Red) terminal and the No. 1 (Green/Red) terminal of the MAP sensor harness side 3P connector.

MAP SENSOR HARNESS SIDE 3P CONNECTOR

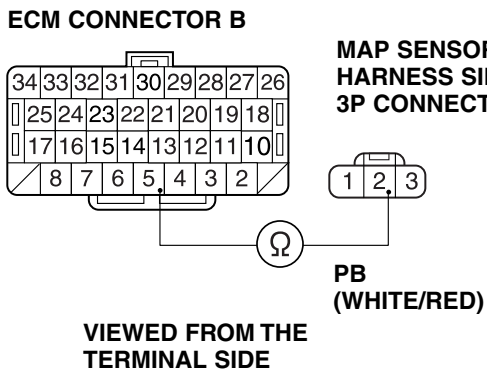


VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "7. MAP sensor check".
NO – Perform "6. MAP sensor signal line open circuit check".

6. MAP sensor signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 2 (White/Red) terminal of the MAP sensor harness side 3P connector and the No. 5 (White/Red) terminal of the ECM connector B.



◆ Is there the continuity?
YES – Perform "7. MAP sensor check".
NO – Repair open in the wire between the MAP sensor and ECM.

7. MAP sensor check

-1. Connect the ECM connector B and the MAP sensor 3P connector.
-2. Turn the ignition switch ON and read the PB voltage using the HDS pocket tester.

◆ Is the voltage 2.76 – 2.96V?
YES – Substitute a known-good ECM and recheck.
NO – Replace the MAP sensor.

• CKP Sensor Troubleshooting

DTC 4-1: No CKP pulse

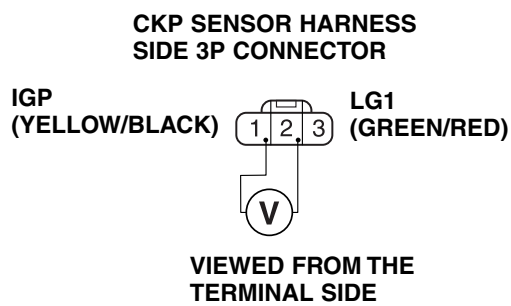
1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and let it run at idling under no load.
-3. Check the DTC using the HDS pocket tester.

◆ Does the DTC 4-1 appear?
YES – Perform "2. CKP sensor power line check".
NO – Temporary failure (Disappeared)

2. CKP sensor power line check

-1. Turn the ignition switch OFF and disconnect the CKP sensor 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 1 (Yellow/Black) terminal and the No. 2 (Green/Red) terminal of the CKP sensor harness side connector.

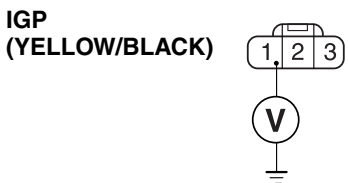


◆ Is there the battery voltage?
YES – Perform "4. CKP sensor signal line open circuit check".
NO – Perform "3. CKP sensor power line open circuit check".

3. CKP sensor power line open circuit check

-1. Turn the ignition switch ON and measure the voltage between the No. 1 (Yellow/Black) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?

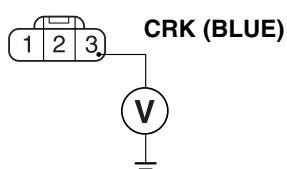
YES – Repair open in the CKP sensor ground line.

NO – Repair open in the wire between the No. 4 fuse and the CKP sensor.

4. CKP sensor signal line open circuit check

-1. Turn the ignition switch ON and measure the voltage between the No. 3 (Blue) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?

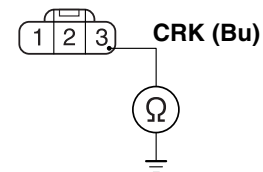
YES – Perform "5. CKP sensor signal line short circuit check".

NO – Repair open in the wire between the CKP sensor and the ECM.

5. CKP sensor signal line short circuit check

-1. Turn the ignition switch OFF. Check for continuity between the No. 3 (Blue) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

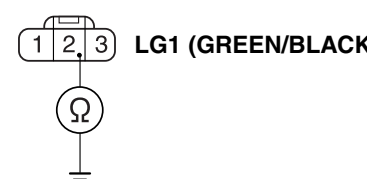
YES – Perform "6. CKP sensor ground line short circuit check".

NO – Repair open in the wire between the CKP sensor and the ECM.

6. CKP sensor ground line open circuit check

-1. Turn the ignition switch OFF. Check for continuity between the No. 2 (Green/Black) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

YES – Perform "7. CKP sensor check".

NO – Repair open in the wire between the CKP sensor and the ECM.

7. CKP sensor check

-1. Connect the HDS pocket tester and clear the DTC once.
-2. Start the engine and let it run at idling under no load. Check the DTC with the HDS pocket tester.

◆ Does the DTC 4-1 appear?

YES – Replace the CKP sensor and recheck. If the DTC 4-1 appears again, substitute a known-good ECM and recheck.

NO – End of the check

DTC 4-2: CKP pulse is abnormal

1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and let it run at idling under no load.
-3. Check the DTC with the HDS pocket tester.

◆ Does the DTC 4-2 appear?

YES – Check the crank pulse plate for deformation and damage. Replace the crank pulse plate with a new one if it is deformed or damaged, and check again. If abnormal, replace the CKP sensor and check. If the DTC 4-2 still appears, replace the ECM.

NO – Temporary failure (Disappeared)

• ECT Sensor 1 Troubleshooting

DTC 6-1: ECT sensor 1 voltage is low

1. Symptom reproduction test

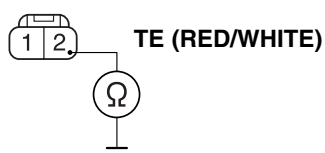
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Check the ECT sensor 1 voltage using the HDS pocket tester.

◆ Is the measurement 0.23 – 3.15V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 1 line short circuit check".

2. ECT sensor 1 line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 2 (Red/White) terminal of the ECT sensor 1 harness side 2P connector and the body ground.

ECT SENSOR 1 HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the ECT sensor 1.
NO – Perform "3. ECT sensor 1 check".

3. ECT sensor 1 check

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON. Check the engine coolant temperature with the HDS pocket tester.

◆ Is the engine coolant temperature normal?
YES – Substitute a known–good ECM and recheck.
NO – Replace the ECT sensor 1 and recheck.

DTC 6-2: ECT sensor 1 voltage is high

1. Symptom reproduction test

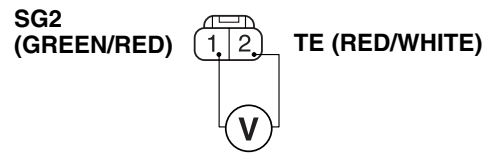
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the ECT sensor 1 voltage using the HDS pocket tester.

◆ Is the measurement 0.23 – 3.15V?
YES – Temporary failure (Disappeared)
NO – Go to the step 2.

2. ECT sensor 1 line check

-1. Turn the ignition switch OFF and disconnect the ECT sensor 1 connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Red/White) and the No. 1 (Green/Red) terminals of the ECT sensor 1 harness side 2P connector.

ECT SENSOR 1 HARNESS SIDE 2P CONNECTOR



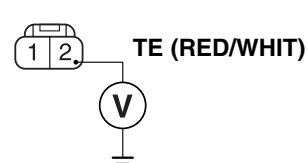
VIEWED FROM THE TERMINAL SIDE

◆ Is the measurement 4.30 – 5.25V?
YES – Perform "4. ECT sensor 1 check".
NO – Perform "3. ECT sensor 1 signal line open circuit check".

3. ECT sensor 1 line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 2 (Red/White) terminal of the ECT sensor 1 harness side 2P connector and the engine ground.

ECT SENSOR 1 HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is the measurement 4.30 – 5.25V?
YES – Repair open in the sensor ground line.
NO – Repair open in the wire between the ECM and the ECT sensor 1.

4. ECT sensor 1 check

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON and check the engine coolant temperature with the HDS pocket tester.

◆ Is the engine coolant temperature normal?
YES – Substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 1 and recheck.

• TP Sensor Troubleshooting

DTC 7-1: TP sensor voltage is low

1. Symptom reproduction test

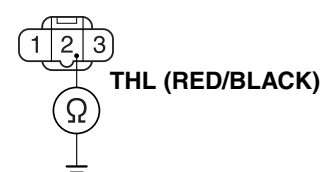
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the TP sensor voltage using the HDS pocket tester.

◆ Is the measurement 0.08 – 4.92V?
YES – Temporary failure (Disappeared)
NO – Perform "2. TP sensor signal line short circuit check".

2. TP sensor signal line short circuit check

-1. Turn the ignition switch OFF and disconnect the TP sensor connector.
-2. Disconnect the ECM connector B.
-3. Check for continuity between the No. 2 (Red/Black) terminal of the TP sensor harness side 3P connector and the engine ground.

TP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the TP sensor and the ECM.
NO – Perform "3. TP sensor check".

3. TP sensor check

-1. Connect the ECM connector B and the TP sensor 3P connector.
-2. Turn the ignition switch ON and measure the TP sensor voltage using the HDS pocket tester.

◆ Is the measurement voltage 4.49 – 4.85V at full open throttle and 0.44 – 0.56V at full close throttle?
YES – Substitute a known-good ECM and recheck.
NO – Replace the TP sensor.

DTC 7-2: TP sensor voltage is high

1. Symptom reproduction test

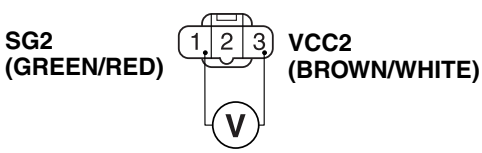
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the TP sensor voltage with the HDS pocket tester.

◆ Is the measurement 0.08 – 4.92V?
YES – Temporary failure (Disappeared)
NO – Perform "2. TP sensor power line check".

2. TP sensor power line check

-1. Turn the ignition switch OFF and disconnect the TP sensor 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (Brown/White) and the No. 1 (Green/Red) terminals of the TP sensor harness side 3P connector.

TP SENSOR HARNESS SIDE 3P CONNECTOR



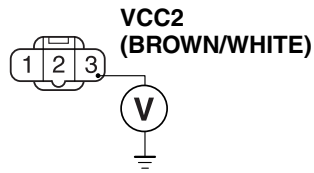
VIEWED FROM THE TERMINAL SIDE

◆ Is the measurement 4.75 – 5.25V?
YES – Perform "4. TP sensor signal line open circuit check".
NO – Perform "3. TP sensor power line open circuit check".

3. TP sensor power line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 3 (Brown/White) terminal of the TP sensor harness side 3P connector and the engine ground.

TP SENSOR HARNESS SIDE 3P CONNECTOR



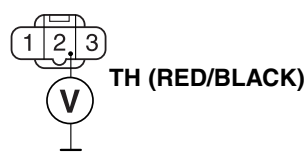
VIEWED FROM THE TERMINAL SIDE

◆ Is the measurement 4.75 – 5.25V?
YES – Repair open in the wire between the TP sensor and the engine ground.
NO – Repair open in the wire between the TP sensor and the ECM.

4. TP sensor signal line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 2 (Red/Black) terminal of the TP sensor harness side 3P connector and the engine ground.

TP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is the measurement 4.75 – 5.25V?
YES – Perform "5. TP sensor check".
NO – Repair open in the TP sensor and the ECM.

5. TP sensor check

-1. Turn the ignition switch OFF and connect the TP sensor 3P connector.
-2. Measure the TP sensor voltage using the HDS pocket tester.

◆ Is the measurement voltage 4.49 – 4.85V at full open throttle and 0.44 – 0.56V at full close throttle?
YES – Substitute a known-good ECM and recheck.
NO – Replace the TP sensor.

• CMP Sensor Troubleshooting

DTC 8-1: No CMP sensor pulse

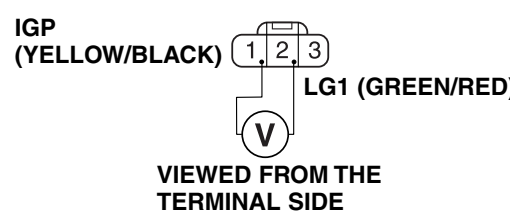
1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and let it run at idling under no load.
-3. Check the DTC using the HDS pocket tester.

◆ Does the DTC 8-1 appear?
YES – Check the pulse plate. If it is normal, perform "2. CMP sensor power line check". If it is abnormal, replace the pulse plate and recheck.
NO – Temporary failure (Disappeared)

2. CMP sensor power line check

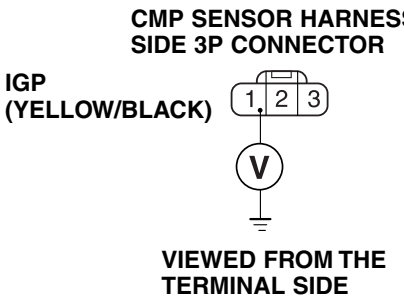
-1. Turn the ignition switch OFF and disconnect the CMP sensor 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 1 (Yellow/Black) terminal and the No. 2 (Green/Red) terminal of the CMP sensor harness side 3P connector.



◆ Is there the battery voltage?
YES – Perform "4. CMP sensor signal line open circuit check".
NO – Perform "3. CMP sensor power line open circuit check".

3. CMP sensor power line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 1 (Yellow/Black) terminal of the CMP sensor harness side 3P connector and the engine ground.



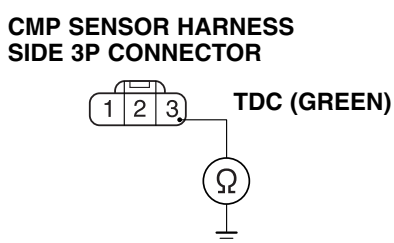
◆ Is there the battery voltage?

YES – Repair open in the CMP sensor ground line.

NO – Repair open in the wire between the No. 4 fuse and the CMP sensor.

4. CMP sensor signal line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 3 (Green) terminal of the CMP sensor harness side 3P connector and the engine ground.



◆ Is the measurement voltage 4.75 – 5.25V?

YES – Perform "5. CMP sensor check".

NO – Repair open in the wire between the CMP sensor and the ECM.

5. CMP sensor check

-1. Connect the HDS pocket tester and clear the DTC once.

-2. Start the engine and let it run at idling under no load. Check the DTC using the HDS pocket tester.

◆ Does the DTC 8-1 appear?

YES – Replace the CMP sensor and recheck. If the DTC 8-1 appears again, substitute a known-good ECM and recheck.

NO – End of the check

DTC 8-2: CMP sensor pulse is abnormal

1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.

-2. Start the engine and let it run at idling under no load.

-3. Check the DTC using the HDS pocket tester.

◆ Does the DTC 8-2 appear?

YES – Replace the CMP sensor and recheck. If the DTC 8-2 appears again, substitute a known-good ECM and recheck.

NO – Temporary failure (Disappeared)

• IAT Sensor Troubleshooting

DTC 10-1: IAT sensor voltage is low

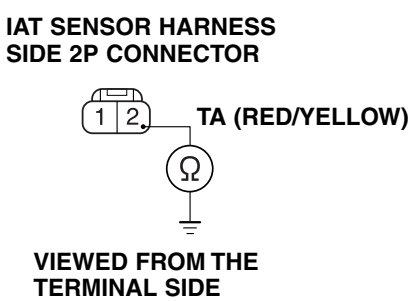
1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the IAT sensor (TA) voltage using the HDS pocket tester.

◆ Is the measurement voltage 0.08 – 4.92V?
YES – Temporary failure (Disappeared)
NO – Perform "2. IAT sensor line short circuit check".

2. IAT sensor line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 2 (Red/Yellow) terminal of the IAT sensor harness side 2P connector and the body ground.



◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the IAT sensor.
NO – Perform "3. IAT sensor check".

3. IAT sensor check

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON and check the intake air temperature using the HDS pocket tester.

◆ Does the measurement correspond to the ambient temperature?
YES – Substitute a known-good ECM and recheck.
NO – Replace the IAT sensor with a new one and recheck.

DTC 10-2: IAT sensor voltage is high

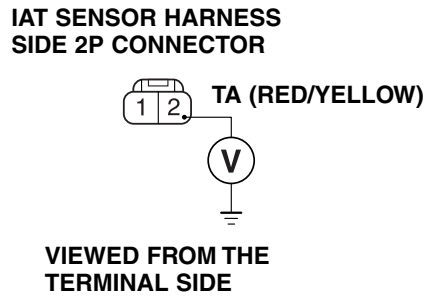
1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the IAT sensor (TA) voltage using the HDS pocket tester.

◆ Is the measured voltage 0.08 – 4.92V?
YES – Temporary failure (Disappeared)
NO – Perform "2. IAT sensor signal line open circuit check".

2. IAT sensor signal line open circuit check

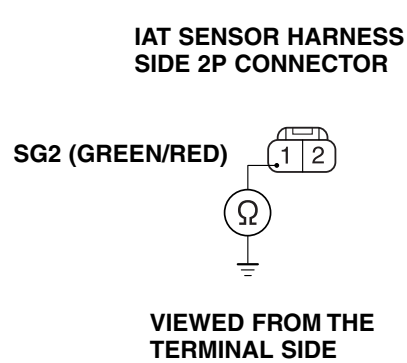
-1. Turn the ignition switch OFF and disconnect the IAT sensor 2P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Red/Yellow) terminal of the IAT sensor harness side 2P connector and the engine ground.



◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "3. IAT sensor ground line open circuit check".
NO – Repair open in the wire between the IAT sensor and the ECM.

3. IAT sensor ground line open circuit check

-1. Turn the ignition switch OFF.
-2. Check for the continuity between the No. 1 (Green/Red) terminal of the IAT sensor harness side 2P connector and the body ground.



◆ Is there the continuity?
YES – Perform “4. IAT sensor check”.
NO – Repair open in the wire between the IAT sensor and the engine ground.

4. IAT sensor check

-1. Turn the ignition switch OFF and connect the HDS pocket tester.
-2. Turn the ignition switch ON and check the intake air temperature using the HDS pocket tester.

◆ Does the measurement correspond to the ambient temperature?
YES – Substitute a known–good ECM and recheck.
NO – Substitute a known–good IAT sensor and recheck.

• BARO Sensor Troubleshooting

DTC 13-1: BARO sensor voltage is low

1. Symptom reproduction test

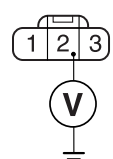
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the BARO sensor (PA) voltage using the HDS pocket tester.

◆ Is the measurement voltage 1.58 – 4.49V?
YES – Temporary failure (Disappeared)
NO – Perform “2. BARO sensor signal line short circuit check”.

2. BARO sensor signal line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 2 (White/Blue) terminal of the BARO sensor harness side 3P connector and the body ground.

BARO SENSOR HARNESS SIDE 3P CONNECTOR



PA (WHITE/BLUE)

VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the BARO sensor.
NO – Perform “3. BARO sensor check”.

3. BARO sensor check

-1. Turn the ignition switch OFF and connect the BARO sensor connector and the ECM connector B.
-2. Turn the ignition switch ON. Measure the BARO sensor voltage using the HDS pocket tester.

◆ Is the measurement voltage 2.76 – 2.96V?
YES – Substitute a known-good ECM and recheck.
NO – Replace the BARO sensor and recheck.

DTC 13-2: BARO sensor voltage is high

1. Symptom reproduction test

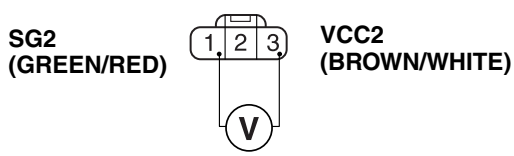
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the BARO sensor (PA) voltage using the HDS pocket tester.

◆ Is the measurement voltage 1.58 – 4.49V?
YES – Temporary failure (Disappeared)
NO – Perform "2. BARO sensor power line check".

2. BARO sensor power line check

-1. Turn the ignition switch OFF and disconnect the BARO sensor 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (Brown/White) and the No. 1 (Green/Red) terminals of the BARO sensor harness side 3P connector.

BARO SENSOR HARNESS SIDE 3P CONNECTOR



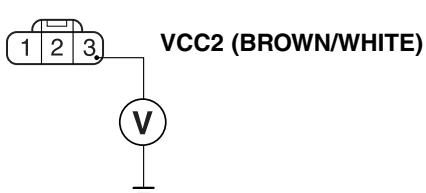
VIEWED FROM THE TERMINAL SIDE

◆ Is the measurement voltage 4.75 – 5.25V?
YES – Perform "4. BARO sensor signal line open circuit check".
NO – Perform "3. BARO sensor power line open circuit check".

3. BARO sensor power line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 3 (Brown/White) terminal of the BARO sensor harness side 3P connector and the engine ground.

BARO SENSOR HARNESS SIDE 3P CONNECTOR



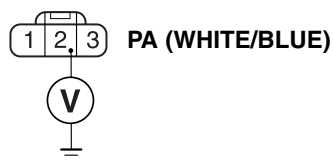
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Repair open in the wire between the BARO sensor and the engine ground.
NO – Repair open in the wire between the BARO sensor and the ECM.

4. BARO sensor signal line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 2 (White/Blue) terminal of the BARO sensor harness side 3P connector and the engine ground.

BARO SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "5. BARO sensor check".
NO – Repair open in the wire between the BARO sensor and the ECM.

5. BARO sensor check

-1. Turn the ignition switch OFF and connect the BARO sensor connector.
-2. Turn the ignition switch ON and measure the BARO sensor voltage using the HDS pocket tester.

◆ Is the measured voltage 2.76 – 2.96V?
YES – Substitute a known-good ECM and recheck.
NO – Replace the BARO sensor and recheck.

• IAC Valve Troubleshooting

DTC 14-1: IAC valve current is abnormal

1. Symptom reproduction test

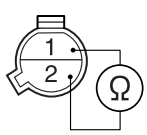
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and let it run at idling under no load.
-3. Measure the engine speed using the HDS pocket tester.

◆ Is the engine speed 650 min^{-1} (rpm) or above?
YES – Temporary failure (Disappeared)
NO – Perform "2. IAC valve open circuit check".

2. IAC valve open circuit check

-1. Turn the ignition switch OFF and disconnect the IAC valve 2P connector.
-2. Measure the resistance between the No. 1 and No. 2 terminals of the IAC valve.

IAC VALVE SIDE 2P CONNECTOR



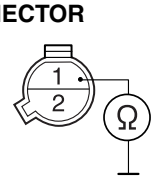
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured resistance 8 – 12Ω?
YES – Perform "3. IAC valve short circuit check".
NO – Replace the IAC valve.

3. IAC valve short circuit check

-1. Check for the continuity between the IAC valve No. 1 terminal and the body ground.

IAC VALVE SIDE 2P CONNECTOR

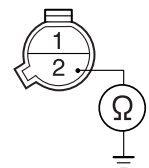


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Replace the IAC valve.
NO – Go to the step 2.

-2. Check for the continuity between the IAC valve No. 2 terminal and the body ground.

IAC VALVE SIDE 2P CONNECTOR



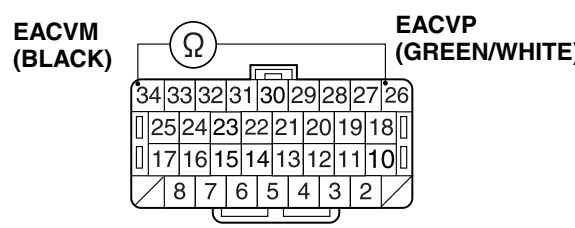
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Replace the IAC valve.
NO – Perform "4. IAC valve line open circuit check".

4. IAC valve line open circuit check

-1. Connect the IAC valve 2P connector.
-2. Disconnect the ECM connector B.
-3. Measure the resistance between the No. 26 (Green/White) and the No. 34 (Black) terminals of the ECM connector B.

ECM CONNECTOR B

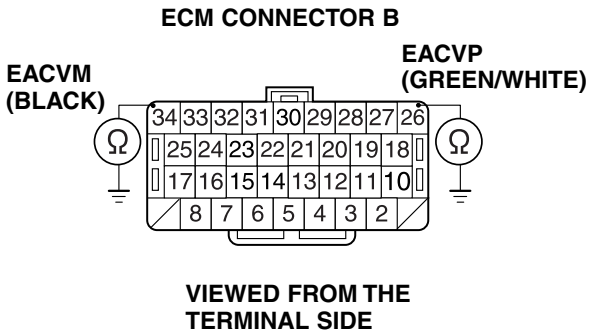


VIEWED FROM THE TERMINAL SIDE

◆ Is the measured resistance 10 – 13Ω?
YES – Perform "5. IAC valve line short circuit check".
NO – Repair open in the wire between the ECM and the IAC valve.

5. IAC valve line short circuit check

-1. Check for the continuity between the No. 26 (Green/White) terminal of the ECM connector B and the engine ground, and between the No. 34 (Black) terminal of the ECM connector B and the engine ground.



◆ Is there the continuity?

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

NO – Substitute a known-good ECM and recheck.

• VTEC Solenoid Valve Troubleshooting

DTC 21-1: VTEC solenoid valve output is abnormal

1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and warm it up for 5 minutes by running the engine at 3,000 min^{-1} (rpm) under no load.
-3. Disconnect the neutral switch 2P connector.
-4. Increase the engine speed gradually and run the engine at 4,500 min^{-1} (rpm) for a few seconds.
-5. Check the DTC again using the HDS pocket tester.

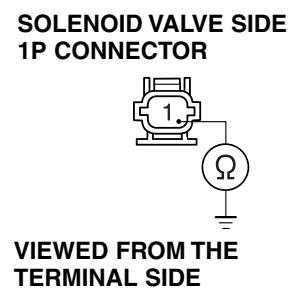
◆ Does the DTC 21-1 appear?

YES – Perform "2. Spool solenoid valve check".

NO – Temporary failure (Disappeared)

2. Spool solenoid valve check

-1. Turn the ignition switch OFF and disconnect the spool solenoid valve connector.
-2. Measure the resistance between the spool solenoid valve side 1P connector (Green/White) terminal and the body ground.



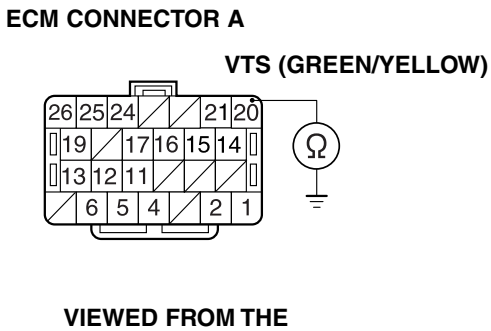
◆ Is the measured resistance 12 – 18 Ω?

YES – Perform "3. VTEC signal line short circuit check".

NO – Replace the spool solenoid valve.

3. VTEC signal line short circuit check

-1. Disconnect the ECM connector A.
-2. Check for the continuity between the No. 20 (Green/Yellow) terminal of the ECM connector A and the body ground.



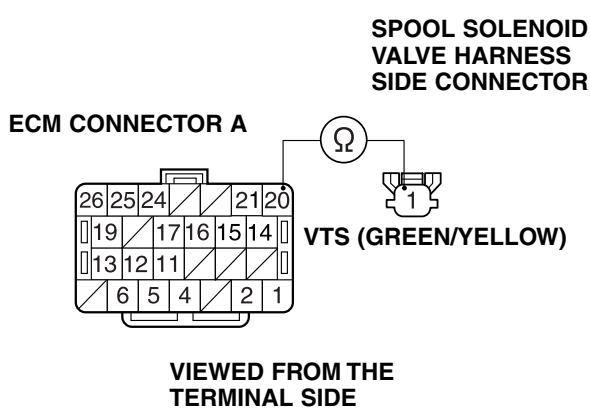
◆ Is there the continuity?

YES – Repair short in the wire between the ECM and the spool solenoid valve.

NO – Perform "4. VTEC signal line open circuit check".

4. VTEC signal line open circuit check

-1. Check for the continuity between the spool solenoid valve harness side connector terminal and the No. 20 (Green/Yellow) terminal of the ECM connector A.



◆ Is there the continuity?

YES – Substitute a known-good ECM and recheck.

NO – Repair open in the wire between the ECM and the spool solenoid valve.

• Knock Sensor Troubleshooting

DTC 23-1: Knock sensor detects failure

1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and warm it up for 5 minutes or more by running the engine at 5,000 min^{-1} (rpm) or more under no load.
-3. Check the DTC again with the HDS pocket tester.

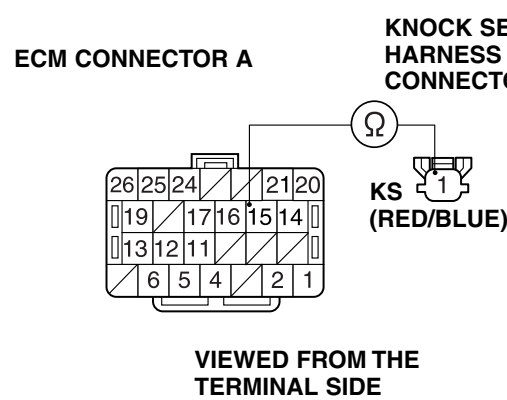
◆ Does the DTC 23-1 appear?

YES – Perform "2. Knock sensor signal line open circuit check".

NO – Temporary failure (Disappeared)

2. Knock sensor signal line open circuit check

-1. Turn the ignition switch OFF. Disconnect the knock sensor connector and the ECM connector A.
-2. Check for the continuity between the (Red/Blue) terminal of the knock sensor harness side connector and the No. 15 (Red/Blue) terminal of the ECM connector A.



◆ Is there the continuity?

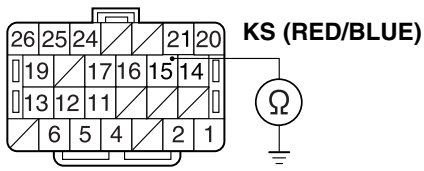
YES – Perform "3. Knock sensor signal line short circuit check".

NO – Repair open in the wire between the knock sensor and the ECM.

3. Knock sensor signal line short circuit test

-1. Check for the continuity between the No. 15 (Red/Blue) terminal of the ECM connector A and the body ground.

ECM CONNECTOR A



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

YES – Repair short in the wire between the ECM and the spool solenoid valve.

NO – Substitute a known-good ECM and recheck.

• A/F Heater Troubleshooting

DTC 41-3: A/F heater is abnormal

1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.

-2. Start the engine and warm it up 5 minutes or more by running the engine at 3,000 min^{-1} (rpm) under no load.

-3. Check the DTC again using the HDS pocket tester.

◆ Does the DTC 41-3 appear?

YES – Perform "2. A/F heater relay check".

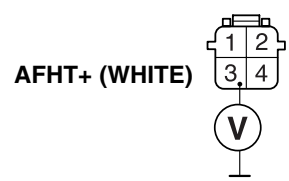
NO – Temporary failure (Disappeared)

2. A/F heater relay check

-1. Turn the ignition switch OFF and disconnect the A/F sensor 4P connector.

-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (White) terminal of the A/F sensor harness side 4P connector and the engine ground.

A/F SENSOR HARNESS SIDE 4P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?

YES – Perform "3. A/F sensor heater check".

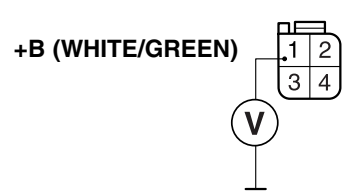
NO – Go to the step 3.

-3. Turn the ignition switch OFF and disconnect the A/F heater relay 4P connector.

-4. Measure the voltage between the No. 1 (White/ Green) terminal of the A/F heater relay harness side 4P connector and the engine ground.

• Note that the battery voltage is constantly applied to the White/Green terminal. Take care not to short-circuit the terminal.

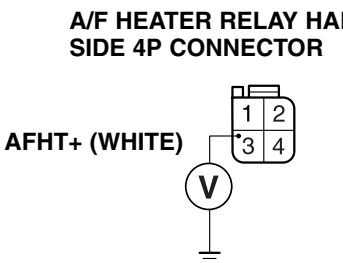
A/F HEATER RELAY HARNESS SIDE 4P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 5.
NO – Blown No. 1 fuse, or repair open in the wire between the A/F heater relay and the No. 1 fuse.

-5. Turn the ignition switch ON. Measure the voltage between the No. 3 (White) terminal of the A/F heater relay harness side 4P connector and the engine ground.

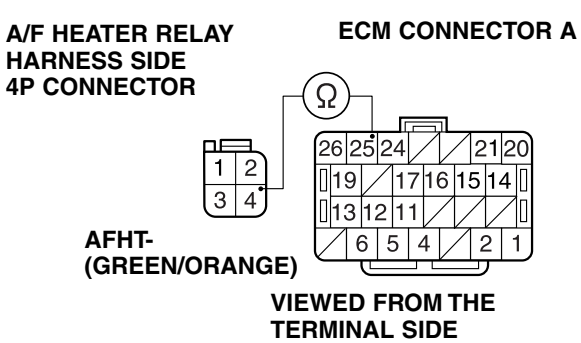


◆ Is there the battery voltage?
YES – Go to the step 6.
NO – Repair open in the wire between the A/F heater relay and the No. 5 fuse.

-6. Check the A/F heater relay (P. 18-20).

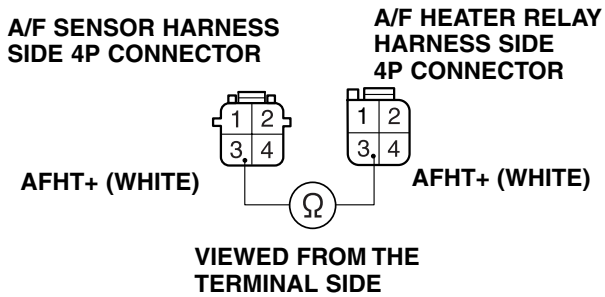
◆ Is the A/F heater relay normal?
YES – Go to the step 7.
NO – Replace the A/F heater relay.

-7. Turn the ignition switch OFF and disconnect the ECM connector A.
-8. Check for the continuity between the No. 4 (Green/Orange) terminal of the A/F heater relay harness side 4P connector and the No. 25 (Green/Orange) terminal of the ECM connector A.



◆ Is there the continuity?
YES – Go to the step 9.
NO – Repair open in the wire between the A/F heater relay and the ECM.

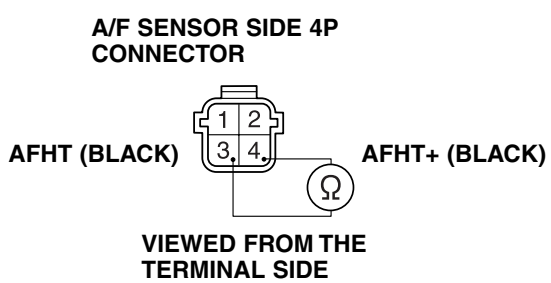
-9. Check for the continuity between the No. 3 (White) terminal of the A/F heater relay harness side 4P connector and the No. 3 (White) terminal of the A/F sensor harness side 4P connector.



◆ Is there the continuity?
YES – Perform "3. A/F sensor heater check".
NO – Repair open in the wire between the A/F heater relay and the A/F sensor.

3. A/F sensor heater check

-1. Turn the ignition switch OFF and disconnect the A/F sensor 4P connector.
-2. Measure the resistance between the No. 3 (Black) and the No. 4 (Black) terminals of the A/F sensor side 4P connector.

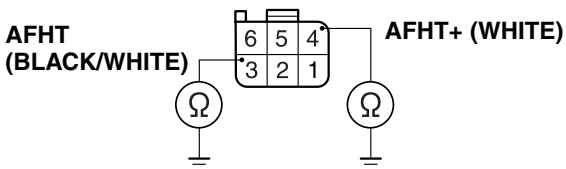


◆ Is the resistance 2 – 3Ω (at room temperature)?
YES – Perform "4. Heater line short circuit check".
NO – Replace the A/F sensor.

4. Heater line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector C.
-2. Check for the continuity between the No. 3 (Black/White) terminal of the ECM connector C and the engine ground, and between the No. 4 (White) terminal of the ECM connector C and the engine ground.

ECM CONNECTOR C

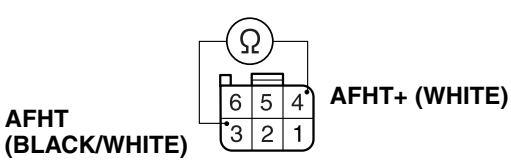


◆ Is there the continuity?
YES – Repair short in the wire between the A/F sensor and the ECM.
NO – Perform "5. Heater line open circuit check".

5. Heater line open circuit check

-1. Turn the ignition switch OFF and connect the A/F sensor 4P connector.
-2. Measure the resistance between the No. 3 (Black/White) and the No. 4 (White) terminals of the ECM connector C.

ECM CONNECTOR C



◆ Is the resistance 2 – 3Ω (at room temperature)?
YES – Replace the A/F sensor and recheck. If it is still abnormal, substitute a known-good ECM and recheck.
NO – Repair open in the wire between the A/F sensor and the ECM.

DTC 41-4: A/F sensor heater is abnormal

1. Symptom reproduction test

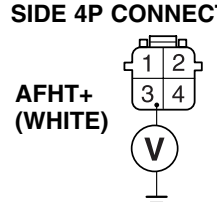
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and warm it up for 5 minutes or more by running the engine at 3,000 min^{-1} (rpm) under no load.
-3. Check the DTC again using the HDS pocket tester.

◆ Does the DTC 41-4 appear?
YES – Perform "2. A/F heater relay check".
NO – Temporary failure (Disappeared)

2. A/F heater relay check

-1. Turn the ignition switch OFF and disconnect the A/F sensor 4P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (White) terminal of the A/F sensor harness side 4P connector and the engine ground.

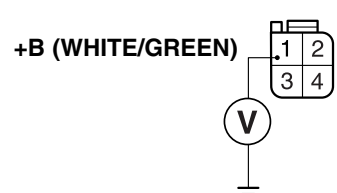
A/F SENSOR HARNESS SIDE 4P CONNECTOR



◆ Is there the battery voltage?
YES – Perform "3. A/F heater harness check".
NO – Go to the step 3.

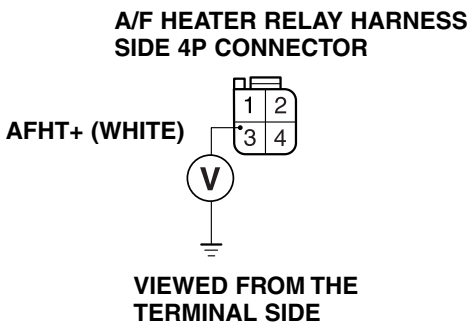
-3. Turn the ignition switch OFF and disconnect the A/F heater relay 4P connector.
-4. Measure the voltage between the No. 1 (White/ Green) terminal of the A/F heater relay harness side 4P connector and the engine ground.
• Note that the battery voltage is constantly applied to the White/Green terminal. Take care not to short-circuit the terminal.

A/F HEATER RELAY HARNESS SIDE 4P CONNECTOR



◆ Is there the battery voltage?
YES – Go to the step 5.
NO – Blown No. 1 fuse, or repair open in the wire between the A/F heater relay and the No. 1 fuse.

-5. Turn the ignition switch ON. Measure the voltage between the No. 3 (White) terminal of the A/F heater relay harness side 4P connector and the engine ground.

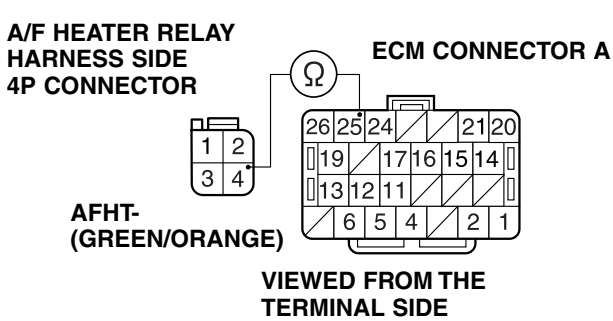


◆ Is there the battery voltage?
YES – Go to the step 6.
NO – Repair open in the wire between the A/F heater relay and the No. 5 fuse.

-6. Check the A/F heater relay (single unit check) (P. 18-24).

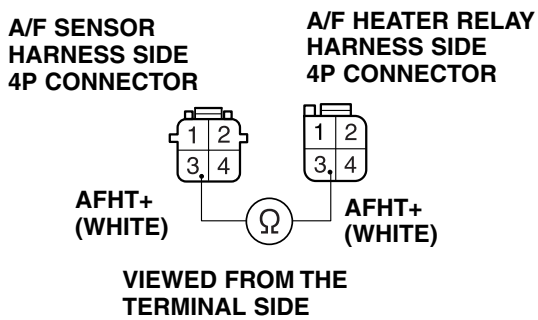
◆ Is the A/F heater relay normal?
YES – Go to the step 7.
NO – Replace the A/F heater relay.

-7. Turn the ignition switch OFF and disconnect the ECM connector A.
-8. Check for continuity between the No. 4 (Green/Orange) terminal of the A/F heater relay harness side 4P connector and the No. 25 (Green/Orange) terminal of the ECM connector A.



◆ Is there the continuity?
YES – Go to the step 9.
NO – Repair open in the wire between the A/F heater relay and the ECM.

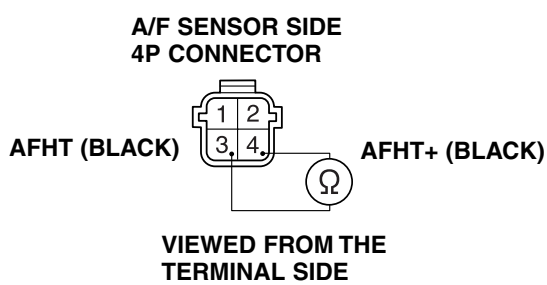
-9. Check for the continuity between the No. 3 (White) terminal of the A/F heater relay harness side 4P connector and the No. 3 (White) terminal of the A/F sensor harness side 4P connector.



◆ Is there the continuity?
YES – Perform "3. A/F heater check".
NO – Repair open in the wire between the A/F heater relay and the A/F sensor.

3. A/F heater check

-1. Turn the ignition switch OFF and disconnect the A/F sensor 4P connector.
-2. Measure the resistance between the No. 3 (Black) and the No. 4 (Black) terminals of the A/F sensor side 4P connector.

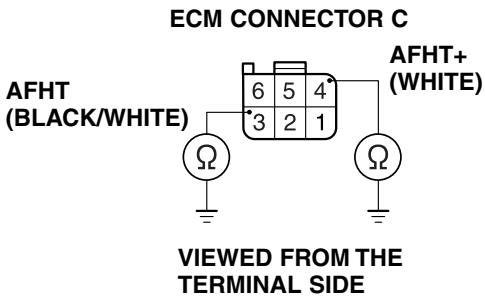


◆ Is the measured resistance 2 – 3Ω (at room temperature)?
YES – Perform "4. Heater line short circuit check".
NO – Replace the A/F sensor.

4. Heater line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector C.

-2. Check for the continuity between the No. 3 (Black/White) terminal of the ECM connector C and the engine ground, and between the No. 4 (White) terminal of the ECM connector C and the engine ground.



◆ Is there the continuity?

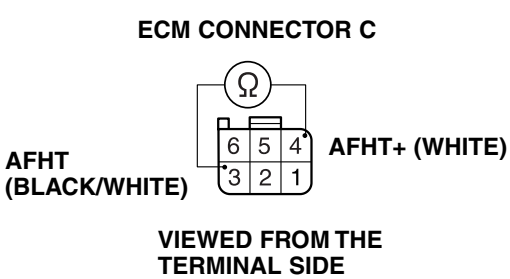
YES – Repair short in the wire between the A/F sensor and the ECM.

NO – Perform "5. Heater line open circuit check".

5. Heater line open circuit check

-1. Turn the ignition switch OFF and connect the A/F sensor 4P connector.

-2. Measure the resistance between the No. 3 (Black/White) terminal and the No. 4 (White) terminal of the ECM connector C.



◆ Is the resistance 2 – 3Ω (at room temperature)?

YES – Perform "6. Sensor line short circuit check".

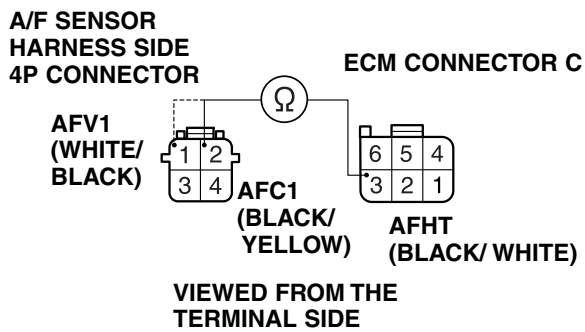
NO – Repair open in the wire between the A/F sensor and the ECM.

6. Sensor line short circuit check

-1. Disconnect the ECM connector B.

-2. Disconnect the A/F sensor 4P connector.

-3. Check for the continuity between the No. 3 (Black/White) terminal of the ECM connector C and the respective terminals of the No. 1 (White/Black) and the No. 2 (Black/Yellow) terminals of the A/F sensor harness side 4P connector.

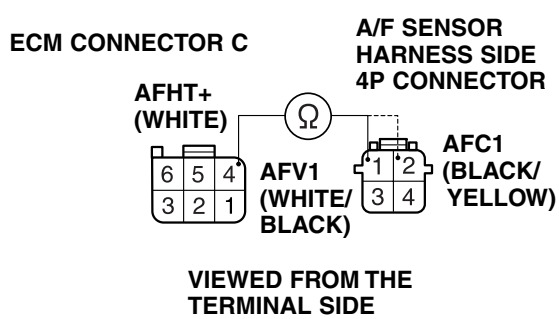


◆ Is there the continuity?

YES – Repair short in the wire between the A/F sensor and the ECM.

NO – Go to the step 4.

-4. Check for continuity between the No. 4 (White) terminal of the ECM connector C and the respective terminals of the No. 1 (White/Black) and the No. 2 (Black/Yellow) terminals of the A/F sensor harness side 4P connector.



◆ Is there the continuity?

YES – Repair short in the wire between the A/F sensor and the ECM.

NO – Replace the A/F sensor and recheck. If it is still abnormal, substitute a known-good ECM and recheck.

• A/F Sensor Troubleshooting

DTC 48-5: A/F sensor current is abnormal

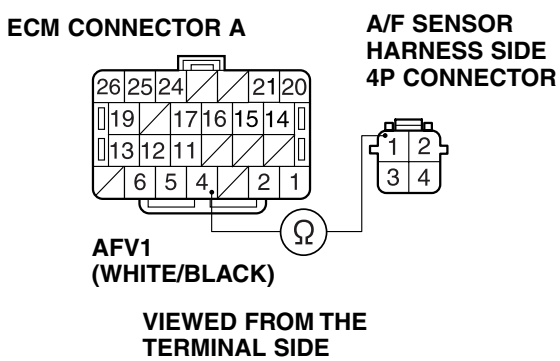
1. Symptom reproduction test

-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and warm it up for 5 minutes or more by running the engine at 3,000 min^{-1} (rpm) under no load.
-3. Check the DTC again using the HDS pocket tester.

◆ Does the DTC 48-5 appear?
YES – Perform "2. A/F sensor line open circuit check".
NO – Temporary failure (Disappears)

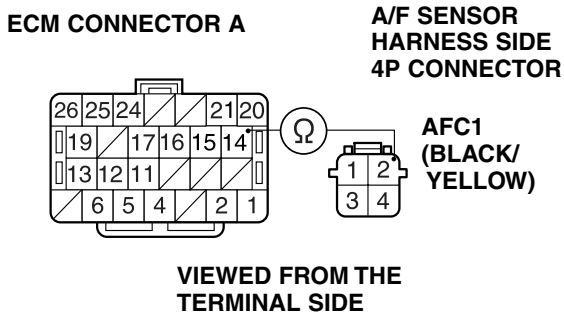
2. A/F sensor line open circuit check

-1. Turn the ignition switch OFF. Disconnect the A/F sensor connector and the ECM connector A.
-2. Check for the continuity between the No. 1 (White/Black) terminal of the A/F sensor harness side 4P connector and the No. 4 (White/Black) terminal of the ECM connector A.



◆ Is there the continuity?
YES – Go to the step 3.
NO – Repair open in the wire between the A/F sensor and the ECM.

-3. Check for the continuity between the No. 2 (Black/Yellow) terminal of the A/F sensor harness side 4P connector and the No. 14 (Black/Yellow) terminal of the ECM connector A.



◆ Is there the continuity?
YES – Replace the A/F sensor and recheck. If there is abnormality, substitute a known-good ECM and recheck.
NO – Repair open in the wire between the A/F sensor and the ECM.

DTC 48-6: A/F sensor V current is abnormal

1. Symptom reproduction test

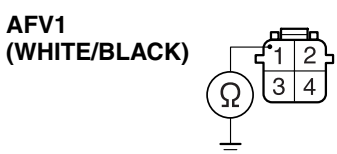
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and warm it up 5 minutes or more by running the engine at 3,000 min-1 (rpm) under no load.
-3. Check the DTC again using the HDS pocket tester.

◆ Does the DTC 48-6 appear?
YES – Perform "2. A/F sensor line short circuit check".
NO – Temporary failure (Disappeared)

2. A/F sensor line (V line) short circuit check

-1. Turn the ignition switch OFF. Disconnect the A/F sensor connector and the ECM connector A.
-2. Check for the continuity between the No. 1 (White/Black) terminal of the A/F sensor harness side 4P connector and the engine ground.

A/F SENSOR HARNESS SIDE 4P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the A/F sensor and the ECM.
NO – Replace the A/F sensor and recheck. If there is any abnormality, substitute a known-good ECM and recheck.

DTC 48-7: A/F sensor C current is abnormal

1. Symptom reproduction test

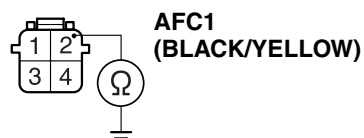
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Start the engine and warm it up for 5 minutes or more by running the engine at 3,000 min-1 (rpm) under no load.
-3. Check the DTC again using the HDS pocket tester.

◆ Does the DTC 48-7 appear?
YES – Perform "2. A/F sensor line short circuit check".
NO – Temporary failure (Disappeared)

2. A/F sensor line (C line) short circuit check

-1. Turn the ignition switch OFF. Disconnect the A/F sensor connector and the ECM connector A.
-2. Check for the continuity between the No. 2 (Black/Yellow) terminal of the A/F sensor harness side 4P connector and the engine ground.

A/F SENSOR HARNESS SIDE 4P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the A/F sensor and the ECM.
NO – Replace the A/F sensor and recheck. If it is abnormal, substitute a known-good ECM and recheck.

• ECT Sensor 2 Troubleshooting

DTC 140-1: ECT sensor 2 voltage is low

1. Symptom reproduction test

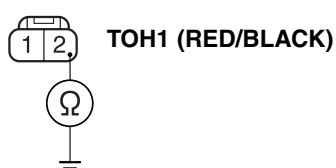
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the ECT sensor 2 voltage using the HDS pocket tester.

◆ Is the measured voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 2 signal line short circuit check".

2. ECT sensor 2 signal line short circuit check

-1. Turn the ignition switch OFF. Disconnect the ECT sensor 2 connector and the ECM connector B.
-2. Check for the continuity between the No. 2 (Red/Black) terminal of the ECT sensor 2 harness side 2P connector and the body ground.

ECT SENSOR 2 HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECT sensor 2 and the ECM.
NO – Perform "3. ECT sensor 2 check".

3. ECT sensor 2 check

-1. Turn the ignition switch OFF and connect the ECT sensor 2 2P connector.
-2. Turn the ignition switch ON and measure the ECT sensor 2 temperature using the HDS pocket tester.

◆ Does the measurement correspond to the engine coolant temperature?
YES – Substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 2.

DTC 140-2: ECT sensor 2 voltage is high

1. Symptom reproduction test

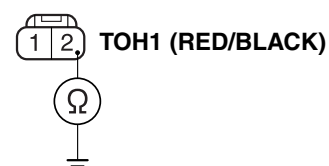
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the ECT sensor 2 voltage using the HDS pocket tester.

◆ Is the measured voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 2 signal line open circuit check".

2. ECT sensor 2 signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the 2P connector from the ECT sensor 2.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No. 2 (Red/Black) terminal of the ECT sensor 2 harness side 2P connector and the engine ground.

ECT SENSOR 2 HARNESS SIDE 2P CONNECTOR



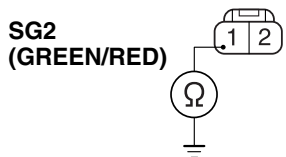
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "3. ECT sensor 2 ground line open circuit check".
NO – Repair open in the wire between the ECT sensor 2 and the ECM.

3. ECT sensor 2 ground line open circuit check

-1. Connect the ECM connector B.
-2. Check for the continuity between the No. 1 (Green/Red) terminal of the ECT sensor 2 harness side 2P connector and the body ground.

ECT SENSOR 2 HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "4. ECT sensor 2 check".
NO – Repair open in the wire between the ECT sensor 2 and the engine ground.

4. ECT sensor 2 check

-1. Turn the ignition switch OFF and connect all the connectors.
-2. Turn the ignition switch ON. Measure the ECT sensor 2 temperature using the HDS pocket tester.

◆ Does the measurement correspond to the engine coolant temperature?
YES – Substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 2.

• ECT Sensor 3 Troubleshooting

DTC 141-1: ECT sensor 3 voltage is low

1. Symptom reproduction test

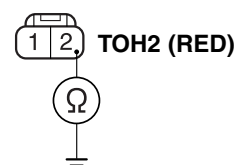
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the ECT sensor 3 voltage using the HDS pocket tester.

◆ Is the measured voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 3 signal line short circuit check".

2. ECT sensor 3 signal line short circuit check

-1. Turn the ignition switch OFF. Disconnect the ECT sensor 3 connector and the ECM connector B.
-2. Check for the continuity between the No. 2 terminal (Red) of the ECT sensor 3 harness side 2P connector and the body ground.

ECT SENSOR 3 HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECT sensor 3 and the ECM.
NO – Perform "3. ECT sensor 3 check".

3. ECT sensor 3 check

-1. Turn the ignition switch OFF and connect the ECT sensor 3 2P connector.
-2. Turn the ignition switch ON and measure the ECT sensor 3 temperature using the HDS pocket tester.

◆ Does the measurement agree with the engine coolant temperature?
YES – Substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 3.

DTC 141-2: ECT sensor 3 voltage is high

1. Symptom reproduction test

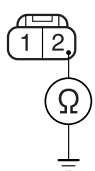
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the ECT sensor 3 voltage using the HDS pocket tester.

◆ Is the measured voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 3 signal line open circuit check".

2. ECT sensor 3 signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the 2P connector from the ECT sensor 3.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No. 2 (Red) terminal of the ECT sensor 3 harness side 2P connector and the engine ground.

ECT SENSOR 3 HARNESS SIDE 2P CONNECTOR



TOH2 (RED)

VIEWED FROM THE TERMINAL SIDE

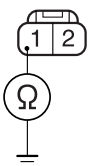
◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "3. ECT sensor 3 ground line open circuit check".
NO – Repair open in the wire between the ECT sensor 3 and the ECM.

3. ECT sensor 3 ground line open circuit check

-1. Connect the ECM connector B.
-2. Check for continuity between the No. 1 (Green/Red) terminal of the ECT sensor 3 harness side 2P connector and the body ground.

ECT SENSOR 3 HARNESS SIDE 2P CONNECTOR

SG2 (GREEN/RED)



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "4. ECT sensor 3 check".
NO – Repair open in the wire between the ECT sensor 3 and the engine ground.

4. ECT sensor 3 check

-1. Turn the ignition switch OFF and connect all the connectors.
-2. Turn the ignition switch ON and measure the ECT sensor 3 temperature using the HDS pocket tester.

◆ Does the measurement agree with the engine coolant temperature?
YES – When the DTC appears again, substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 3.

• EOP switch (High pressure side) Troubleshooting

DTC 142-1: EOP switch signal is abnormal

1. Symptom reproduction test

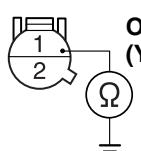
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Check the EOP switch signal using the HDS pocket tester.

◆ Is there the OFF signal?
YES – Temporary failure (Disappeared)
NO – Perform "2. EOP switch signal line open circuit check".

2. EOP switch signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the EOP switch 2P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 1 (Yellow/Red) terminal of the EOP switch harness side 2P connector and the body ground.

EOP SWITCH
HARNESS SIDE 2P CONNECTOR



OPSH
(YELLOW/RED)

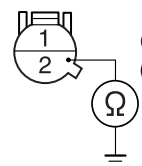
VIEWED FROM THE
TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform "3. EOP switch signal line short circuit check".
NO – Repair open in the wire between the EOP switch and the ECM.

3. EOP switch signal line short circuit check

-1. Turn the ignition switch OFF. Disconnect the EOP switch 2P connector and the ECM connector A.
-2. Check for the continuity between the No. 1 (Yellow/Red) terminal of the EOP switch harness side 2P connector and the body ground.

EOP SWITCH
HARNESS SIDE 2P CONNECTOR



OPSH
(YELLOW/RED)

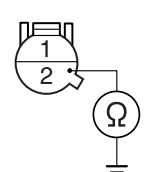
VIEWED FROM THE
TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the EOP switch and the ECM.
NO – Perform "4. EOP switch ground line open circuit check".

4. EOP switch ground line open circuit check

-1. Check for the continuity between the No. 2 (Green/Red) terminal of the EOP switch harness side 2P connector and the body ground.

EOP SWITCH
HARNESS SIDE 2P CONNECTOR



SG2
(GREEN/RED)

VIEWED FROM THE
TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "5. EOP switch check".
NO – Repair open in the wire between the EOP switch and the ECM.

5. EOP switch check

-1. Turn the ignition switch OFF and connect all the connectors.
-2. Turn the ignition switch ON and check the EOP switch using the HDS pocket tester.

◆ Does the tester shows the switch OFF?
YES – If the DTC appears again, substitute a known-good ECM and recheck.
NO – Replace the EOP switch.

• ECT Sensor 4 Troubleshooting

DTC 143-1: ECT sensor 4 voltage is low

1. Symptom reproduction test

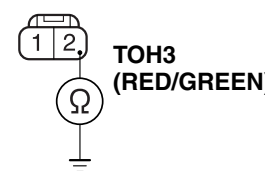
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the ECT sensor 4 voltage using the HDS pocket tester.

◆ Is the measured voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 4 signal line short circuit check".

2. ECT sensor 4 signal line short circuit check

-1. Turn the ignition switch OFF. Disconnect the ECT sensor 4 connector and the ECM connector B.
-2. Check for the continuity between the No. 2 (Red/Green) terminal of the ECT sensor 4 harness side connector and the body ground.

ECT SENSOR 4 HARNESS SIDE 2P CONNECTOR



TOH3 (RED/GREEN)

VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECT sensor 4 and the ECM.
NO – Perform "3. ECT sensor 4 check".

3. ECT sensor 4 check

-1. Turn the ignition switch OFF and connect the ECT sensor 4 2P connector.
-2. Turn the ignition switch ON. Measure the ECT sensor 4 temperature using the HDS pocket tester.

◆ Does the measurement correspond to the engine coolant temperature?
YES – If the DTC appears again, substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 4.

DTC 143-2: ECT sensor 4 voltage is high

1. Symptom reproduction test

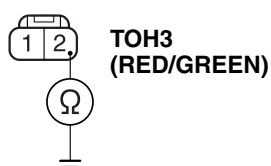
-1. Connect the HDS pocket tester and clear the DTC once. If the DTC can not be cleared, go on the troubleshooting.
-2. Turn the ignition switch ON.
-3. Measure the ECT sensor 4 voltage using the HDS pocket tester.

◆ Is the measured voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 4 signal line open circuit check".

2. ECT sensor 4 signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the 2P connector from the ECT sensor 4.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No. 2 (Red/Green) terminal of the ECT sensor 4 harness side 2P connector and the engine ground.

ECT SENSOR 4 HARNESS SIDE 2P CONNECTOR



TOH3 (RED/GREEN)

VIEWED FROM THE TERMINAL SIDE

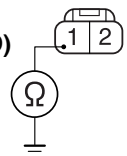
◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "3. ECT sensor 4 ground line open circuit check".
NO – Repair open in the wire between the ECT sensor 4 and the ECM.

3. ECT sensor 4 ground line open circuit check

-1. Connect the ECM connector B.
-2. Check for the continuity between the No. 1 (Green/Red) terminal of the ECT sensor 4 harness side 2P connector and the body ground.

ECT SENSOR 4 HARNESS SIDE 2P CONNECTOR

SG2 (GREEN/RED)



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "4. ECT sensor 4 check".
NO – Repair open in the wire between the ECT sensor 4 and the engine ground.

4. ECT sensor 4 check

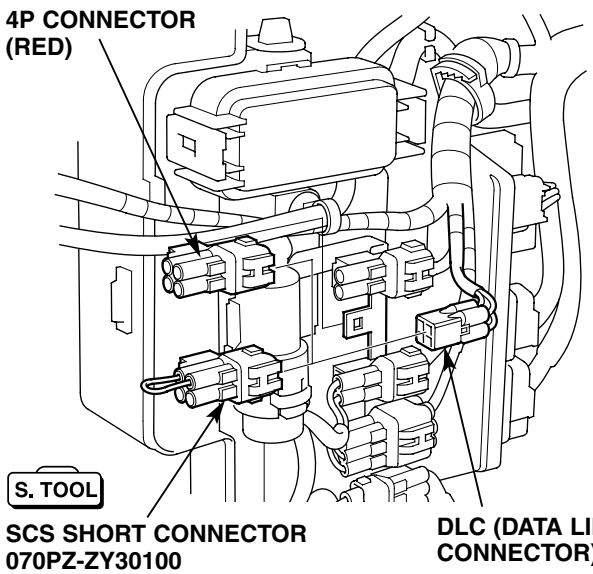
-1. Turn the ignition switch OFF and connect all the connectors.
-2. Turn the ignition switch ON and measure the ECT sensor 4 temperature using the HDS pocket tester.

◆ Does the measurement correspond to the engine coolant temperature?
YES – When the DTC appears again, substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 4.

7. TROUBLESHOOTING WITHOUT HDS TESTER

• Check of Number of Blinks of MIL

1. Remove the engine cover and the electric part cover (Section 4).
2. Disconnect the red 4P connector and connect (short-circuit) the SCS short connector to the DLC (Data Link Connector).



3. Check the number of blinks of the MIL.
   - 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.
   - When multiple problems occur simultaneously, the MIL repeatedly indicates them by blinking separate codes, one after another.

Separate problems:


See DTC 1.


See DTC 3.


See DTC 14.

Multiple problems:

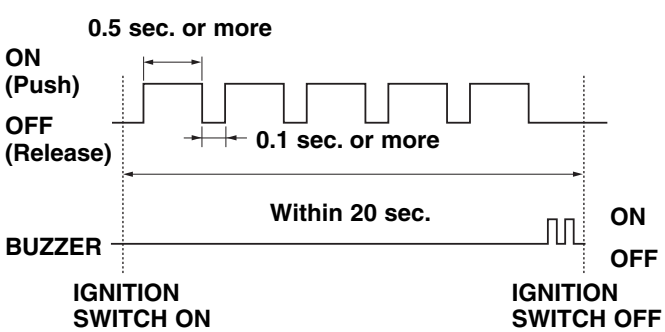

See DTC 1 and 3.


See DTC 3 and 4.


See DTC 1 and 14

• ECM Reset Procedure

1. Turn the ignition switch OFF.
2. Short-circuit the 4P (Red) data link connector located inside the electric part cover using the special tool (SCS short connector).
3. Turn the ignition switch ON.
4. Turn the emergency stop switch ON (push) and OFF (release). Repeat this procedure five times. (Repeat turning the switch ON for 0.5 sec. or more and turning it OFF for 0.1 sec. or more.)
5. Check that the buzzer sounds twice.
   - The MIL should stay ON.
6. Turn the ignition switch OFF. (ECM reset procedure completes.)
   - Perform the step 4 through the step 6 within 20 seconds.



• Final Procedure (After Troubleshooting)

1. Disconnect the SCS short connector from the data link connector.
   - Note that the MIL stays ON while the SCS short connector is connected to the data link connector.

2. Be sure to reset the ECM after troubleshooting.

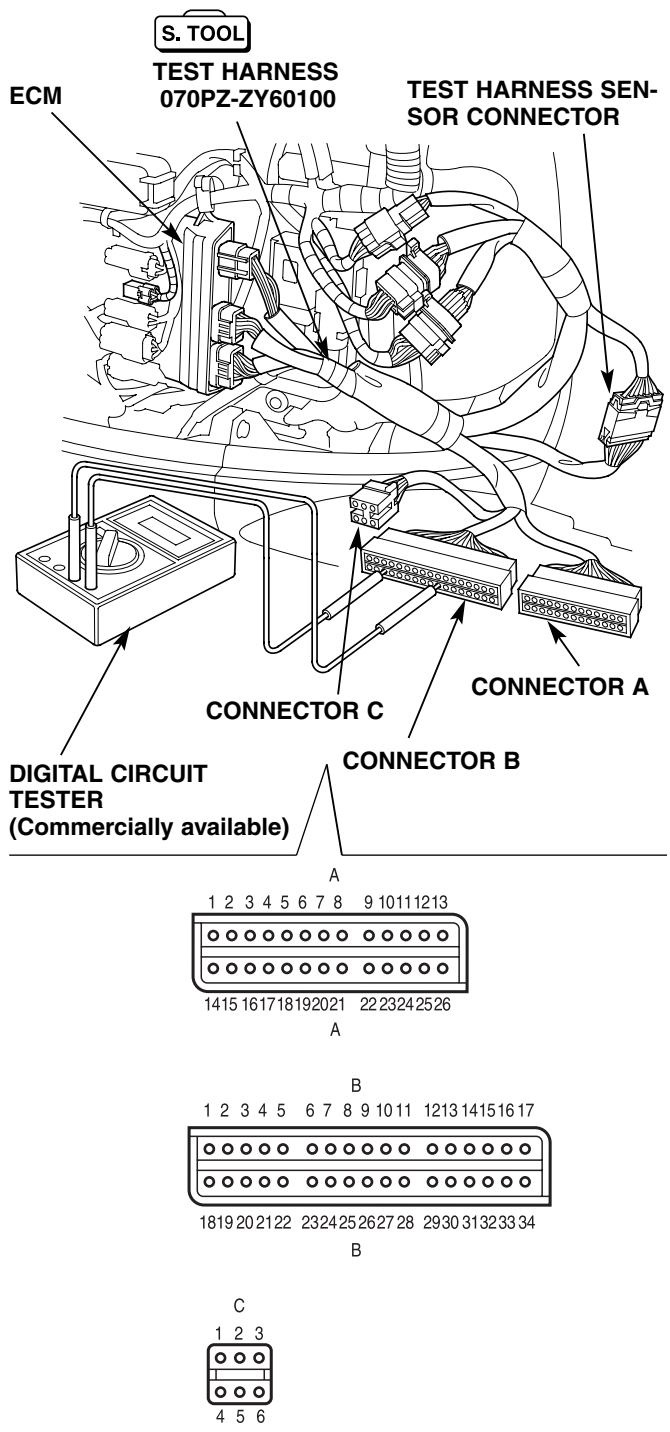
   The MIL can come ON or blink when the ECM detected poor or loose contact of a connector. If it is hard to identify the problem part by following the troubleshooting flow chart, check the three connectors of the ECM and the connector of the probable faulty part, and clean or repair the connector(s) if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

   If the problem cannot be identified by the above procedure, check by following the troubleshooting for the fuel supply system (P. 5-96).

• Connecting Test Harness

Use the test harness (special tool) and a commercially available digital circuit tester for troubleshooting.

Disconnect the test harness sensor connector if the instruction tells to do so for troubleshooting.



a. TROUBLESHOOTING GUIDE

MIL		Detected unit	Probable problem part	Ref. page
No. of blinks	MIL			
MIL does not come ON	OFF 	ECM	• Open circuit in MIL wire • Blown MIL bulb • Open circuit or poor grounding of ECM ground wire • Faulty ECM	5-61
Stays ON	ON 	ECM	• Open circuit in ECM power supply line • Short circuit in data link connector wire • Short circuit in MIL wire • Short circuit in sensor power supply line • Faulty ECM	5-64
3	ON 	MAP (Sensor voltage)	• Open or short circuit in MAP sensor line • Faulty MAP sensor • Faulty ECM	5-71
4	ON 	CKP sensor (Pulse)	• Open or short circuit in CKP sensor wire • Faulty CKP sensor • Faulty ECM	5-72
6	ON 	ECT sensor 1 (Sensor voltage)	• Open or short circuit in ECT sensor 1 wire • Faulty ECT sensor 1 • Faulty ECM	5-74
7	ON 	TP sensor (Sensor voltage)	• Open or short circuit in TP sensor wire • Faulty TP sensor • Faulty ECM	5-75
8	ON 	CMP sensor (Pulse)	• Open or short circuit in CMP sensor • Faulty CMP sensor • Faulty ECM	5-77
10	ON 	IAT sensor (Sensor voltage)	• Open or short circuit in IAT sensor wire • Faulty IAT sensor • Faulty ECM	5-78
13	ON 	BARO sensor (Sensor voltage)	• Short circuit in BARO sensor • Faulty BARO sensor • Faulty ECM	5-80
14	ON 	IAC valve (Input/output current)	• Open or short circuit in IAC valve wire • Faulty IAC valve • Faulty ECM	5-81
21	ON 	VTEC solenoid (Output current) (BF150A only)	• Open circuit or short circuit in VTEC solenoid wire • Faulty VTEC solenoid • Faulty ECM	5-82
23	ON 	Knock sensor (Sensor voltage)	• Open circuit or short circuit in knock sensor wire • Faulty knock sensor • Faulty ECM	5-83

MIL		Detected unit	Probable problem part	Ref. page
No. of blinks	MIL			
24	ON 	ECT sensor 2 (Low voltage)	• Open or short circuit in the ECT sensor 2 wire • Faulty ECT sensor 2 • Faulty ECM	5-84
25	ON 	ECT sensor 3 (Low voltage)	• Open or short circuit in the ECT sensor 3 wire • Faulty ECT sensor 3 • Faulty ECM	5-86
26	ON 	EOP switch (Current)	• Open or short circuit in the EOP switch wire • Faulty ECM	5-87
27	ON 	ECT sensor 4 (Sensor voltage)	• Open or short circuit in the ECT sensor 4 wire • Faulty ECT sensor 4 • Faulty ECM	5-89
41	ON 	A/F sensor heater (Current)	• Open or short circuit in the A/F sensor heater wire • Faulty A/F sensor heater • Faulty ECM	5-90
48	ON 	A/F sensor (Current)	• Open or short circuit in the A/F sensor wire • Faulty A/F sensor • Faulty ECM	5-92

When multiple DTC's main codes appear:

MIL		Detected unit	Probable problem part	Ref. page
No. of blinks	MIL			
7, 13	ON 	ECM (Sensor voltage)	• Open circuit in the VCC (sensor power supply) line	–
6, 7 10, 13 24, 25 27, 48	ON 	ECM (Sensor voltage)	• Open circuit in the SG (sensor ground) line	–

b. TROUBLESHOOTING

• MIL Does Not Come On

1. Fuse check

-1. Turn the ignition switch ON and check that the warning buzzer sounds twice.

◆ Does the buzzer sound twice?
YES – Perform "6. Alternator indictor light check".
NO – Go to the step 2.

-2. Check the No. 4 (15A) fuse.

◆ Is the fuse normal?
YES – Go to the step 3.
NO – Repair short in the wire between the No. 4 fuse and the ECM, and between the No. 4 fuse and the injector. After repair, replace the No. 4 fuse.

-3. Check the No. 7 (30A) fuse.

◆ Is the fuse normal?
YES – Go to the step 4.
NO – Repair short in the wire between the PGM-FI main relay and fuse box, and between the PGM-FI main relay and starter magnetic switch. After repair, replace the No. 7 fuse.

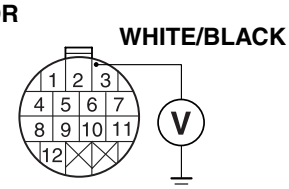
-4. Check the No. 3 (10A) fuse.

◆ Is the fuse normal?
YES – Perform "2. Main power supply line check".
NO – Repair short in the wire between the fuse box and ignition switch, between the fuse box and alternator, between the fuse box and power trim/tilt switch or the power tilt switch. After repair, replace the No. 3 fuse.

2. Main power supply line check

-1. Disconnect the remote control harness 14P connector.
-2. Measure the voltage between the No. 3 (White/ Black) terminal of the main harness side 14P connector and the engine ground.
• Note that the battery voltage is constantly applied to the White/Black terminal. Take care not to short-circuit the terminal.

MAIN HARNESS SIDE 14P CONNECTOR

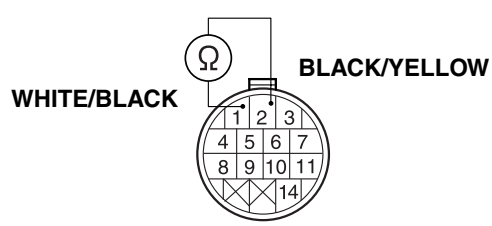


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 3.
NO – Repair open in the main harness wire.

-3. Turn the ignition switch ON. Check for the continuity between the No. 1 (White/Black) and the No. 2 (Black/Yellow) terminals of the remote control box harness side 14P connector.

REMOTE CONTROL HARNESS SIDE 14P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

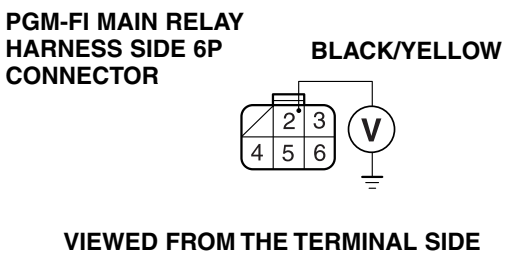
◆ Is there the continuity?
YES – Perform "3. IGP power supply line check".
NO – Go to the step 4.

-4. Check the ignition switch (P. 16-9).

◆ Is the ignition switch normal?
YES – Repair open in the remote control box harness.
NO – The ignition switch is faulty.

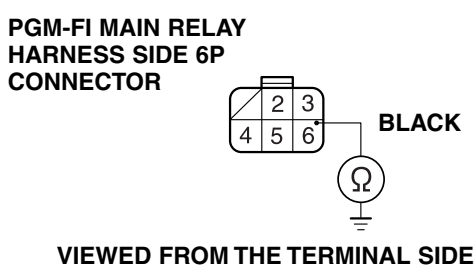
3. IGP power supply line check

-1. Turn the ignition switch OFF and disconnect the PGM-FI main relay 6P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Black/Yellow) terminal of the PGM-FI main relay harness side 6P connector and the engine ground.



◆ Is there the battery voltage?
YES – Go to the step 3.
NO – Repair open in the main harness wire.

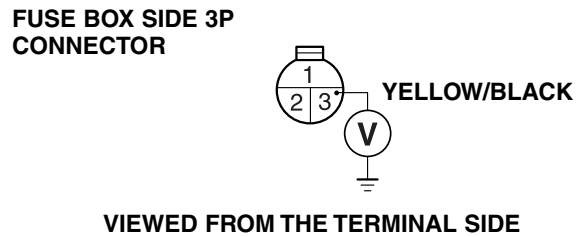
-3. Turn the ignition switch OFF. Check for the continuity between the No. 6 (Black) terminal of the PGM-FI main relay 6P connector and the engine ground.



◆ Is there the continuity?
YES – Perform "4. ECM power supply line check".
NO – Repair open in the main harness (Black) wire.

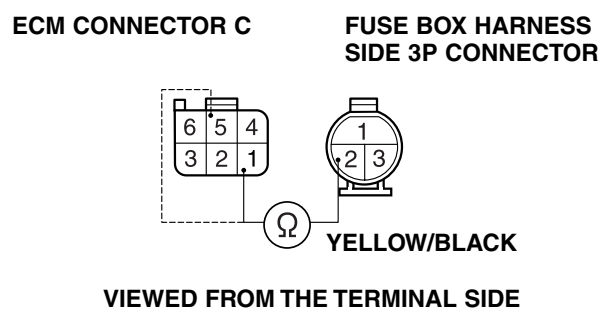
4. ECM power supply line check

-1. Turn the ignition switch OFF and disconnect the fuse box 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (Yellow/Black) terminal of the fuse box side 3P connector and the engine ground.



◆ Is there the battery voltage?
YES – Go to the step 3.
NO – PGM-FI main relay is faulty, or fuse box is faulty.

-3. Turn the ignition switch OFF and disconnect the ECM connector C.
-4. Check for the continuity between the No.2 (Yellow/Black) terminal of the fuse box harness side 3P connector and the respective terminals of the No. 1 (Yellow/Black) and the No. 5 (Yellow/Black) terminals of the ECM connector C.

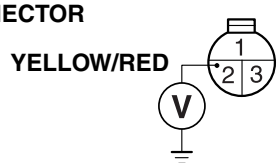


◆ Is there the continuity?
YES – Perform "5. MIL power supply line check".
NO – Repair open in the main harness wire.

5. MIL power supply line check

-1. Turn the ignition switch OFF and disconnect the fuse box 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Yellow/Red) terminal of the fuse box side 3P connector and the engine ground.

FUSE BOX SIDE 3P CONNECTOR

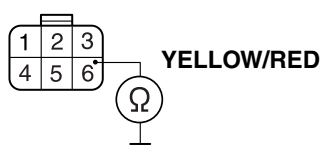


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 3.
NO – PGM-FI main relay is faulty.

-3. Turn the ignition switch OFF and connect the fuse box 3P connector.
-4. Disconnect the MIL 6P connector.
-5. Turn the ignition switch ON. Measure the voltage between the No. 6 (Yellow/Red) terminal of the MIL harness side 6P connector and the engine ground.

MIL HARNESS SIDE 6P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform "6. Alternator indicator light check".
NO – Repair open in the main wire harness.

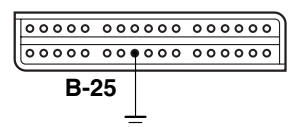
6. Alternator indicator light check

-1. Turn the ignition switch ON and check the alternator indicator light.

◆ Does the alternator indicator light come ON?
YES – Perform "7. MIL ON line check".
NO – Replace the MIL.

7. MIL ON line check

-1. Turn the ignition switch OFF and connect the test harness.
-2. Connect the test harness B-25 terminal to the engine ground to short-circuit. Turn the ignition switch ON and check the MIL.



◆ Does the MIL come ON?
YES – Substitute a known-good ECM and recheck.
NO – Repair open in the main harness wire between the MIL and the ECM.

• MIL ON but MIL Does Not Blink With SCS Circuit Shorted

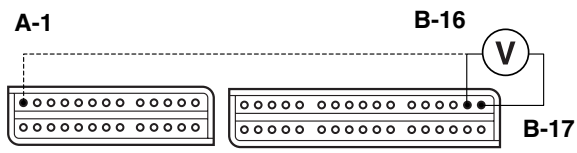
1. Engine start check

-1. Disconnect the SCS short connector and start the engine.

◆ Does the engine start?
YES – Perform "2. Data link connector line check".
NO – Perform "3. Sensor check".

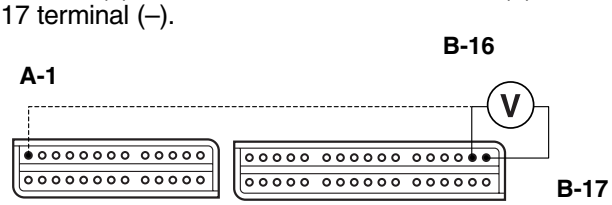
2. Data link connector line check

-1. Turn the ignition switch OFF and connect the test harness (P. 5-58).
-2. Disconnect the test harness sensor connector.
-3. Turn the ignition switch ON. Measure the voltage between the test harness B-16 terminal (+) and A-1 terminal (–), and between the B-16 terminal (+) and B-17 terminal (–).



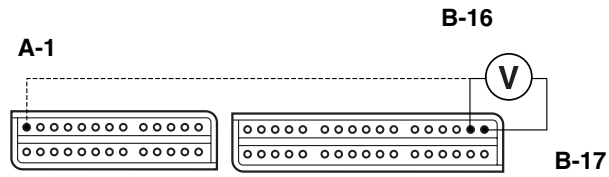
◆ Is the measured voltage 4.30 – 5.25V?
YES – Go to the step 4.
NO – Substitute a known-good ECM and recheck.

-4. Turn the ignition switch OFF and connect the test harness.
-5. Turn the ignition switch ON. Measure the voltage between the test harness B-16 terminal (+) and A-1 terminal (–), and between the B-16 terminal (+) and B-17 terminal (–).



◆ Is the measured voltage 4.30 – 5.25V?
YES – Repair open in the wire harness between the ECM and the data link connector.
NO – Go to the step 6.

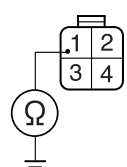
-6. Connect the SCS short connector to the data link connector to short-circuit.
-7. Measure the voltage between the test harness B-16 terminal (+) and A-1 (–) terminal, and between the B-16 terminal (+) and B-17 terminal (–).



◆ Is the measured voltage 4.30 – 5.25V?
YES – Go to the step 8.
NO – Go to the step 10.

-8. Disconnect the SCS short connector.
-9. Turn the ignition switch OFF. Check for the continuity between the data link connector No. 1 (Black) terminal and the engine ground.

DATA LINK CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair open in the main harness between the data link connector and the ECM.
NO – Repair open in the main harness between the data link connector and the engine ground.

-10. Disconnect the SCS short connector from the data link connector.
-11. Turn the ignition switch OFF and disconnect the ECM connector A.
-12. Turn the ignition switch ON and check that the MIL comes ON.

◆ Does the MIL come ON?
YES – Repair short in the main harness (Red/Blue) between the MIL and the ECM.
NO – Substitute a known-good ECM and recheck.

3. Sensor check

-1. Turn the ignition switch ON.
-2. Disconnect the MAP sensor 3P connector and check the MIL.

◆ Does the MIL go OFF?
YES – Replace the MAP sensor.
NO – Go to the step 3.

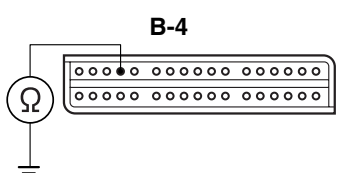
-3. Connect the MAP sensor 3P connector.
-4. Disconnect the TP sensor 3P connector and check the MIL.

◆ Does the MIL go OFF?
YES – Replace the TP sensor.
NO – Go to the step 5.

-5. Connect the TP sensor 3P connector.
-6. Disconnect the BARO sensor 3P connector and check the MIL.

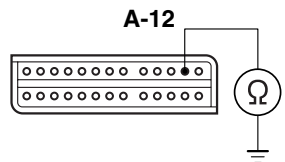
◆ Does the MIL go OFF?
YES – Replace the BARO sensor.
NO – Go to the step 7.

-7. Turn the ignition switch OFF and connect the test harness.
-8. Check for the continuity between the test harness B-4 terminal and the engine ground with the ECM connector A disconnected.



◆ Is there the continuity?
YES – Repair open in the main harness between the ECM and the MAP sensor.
NO – Go to the step 9.

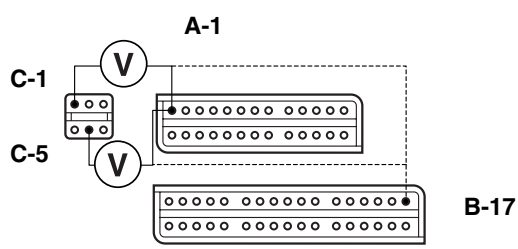
-9. With the ECU connector A disconnected, check for the continuity between the test harness A-12 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair open in the wire between the ECM and the BARO sensor.
NO – Perform "4. ECM main power supply line check".

4. ECM main power supply line check

-1. Connect the ECM connector A.
-2. Check for the continuity between the test harness C-1 terminal and the respective terminals of A-1 and B-17 terminals.
Measure the voltage between the test harness C-5 terminal and the respective terminals of A-1 and B-17 terminals.



◆ Is there the continuity?
YES – Substitute a known-good ECM and recheck.
NO – Check the PGM-FI main relay harness (P. 5-97).

• Alert System Initial Operation Is Faulty

1. Wire harness short-circuit check

-1. Turn the ignition switch OFF and connect the test harness.
-2. Disconnect the ECM connector A, B and C from the ECM.
-3. Turn the ignition switch ON and check whether the buzzer sounds.

◆ Does the buzzer sound?
YES – Repair short in the wire between the buzzer and the ECM.
NO – Go to the step 4.

-4. Check the oil pressure indicator light.

◆ Does the oil pressure indicator light come ON?
YES – Go to the step 5.
NO – Repair short in the wire between the oil pressure indicator light and the ECM.

-5. Check the overheat indicator light.

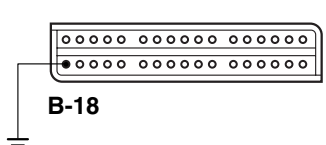
◆ Does the overheat indicator light come ON?
YES – Repair short in the wire between the overheat indicator light and the ECM.
NO – Go to the step 6.

-6. Check the MIL.

◆ Does the MIL come ON?
YES – Repair short in the wire between the MIL and the ECM.
NO – Perform "2. Buzzer line check".

2. Buzzer line check

-1. Connect the test harness B-18 terminal to the engine ground to short-circuit.
-2. Turn the ignition switch ON and check that the buzzer sounds.



◆ Does the buzzer sound?
YES – Perform “3. Overheat indicator line check”.
NO – Go to the step 3.

-3. Turn the ignition switch OFF and disconnect the Yellow/Green terminal from the buzzer.
-4. Connect the Yellow/Green terminal of the buzzer to the Black terminal with a jumper wire to short-circuit.
-5. Turn the ignition switch ON and check whether the buzzer sounds.

◆ Does the buzzer sound?
YES – Repair open in the wire between the buzzer and the ECM.
NO – Go to the step 6.

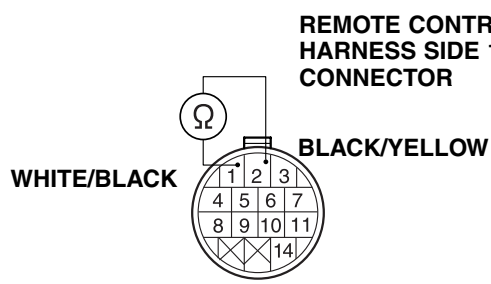
-6. Check the buzzer (single unit check).

◆ Is the buzzer normal?
YES – Go to the step 7.
NO – The buzzer is faulty.

-7. Check the ignition switch (single unit check) (P. 16-9).

◆ Is the ignition switch normal?
YES – Go to the step 8.
NO – The ignition switch is faulty.

-8. Disconnect the remote control box harness side 14P connector.
-9. Turn the ignition switch ON. Check for the continuity between the No. 1 (White/Black) and the No. 2 (Black/Yellow) terminals of the remote control box harness side 14P connector.

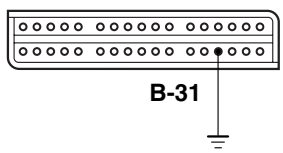


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair open in the main harness.
NO – Repair open in the remote control box harness.

3. Overheat indicator line check

-1. Connect the test harness B-31 terminal to the engine ground to short-circuit.
-2. Turn the ignition switch ON and check that the overheat indicator light comes ON.

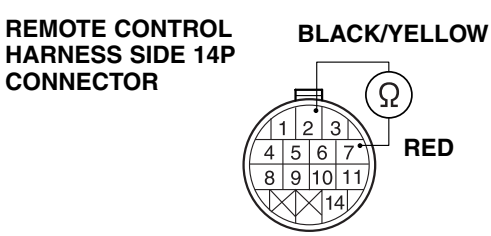


◆ Does the overheat indicator light come ON?
YES – Perform "4. Oil pressure indicator line check".
NO – Go to the step 3.

-3. Turn the ignition switch OFF. Disconnect the indicator light Red terminal and connect it to the Black terminal with a jumper wire to short-circuit.
-4. Turn the ignition switch ON and check the overheat indicator light.

◆ Does the overheat indicator light come ON?
YES – Repair open in the wire between the ECM and the indicator light.
NO – Go to the step 5.

-5. Turn the ignition switch OFF and connect the indicator light Red terminal.
-6. Disconnect the remote control harness 14P connector.
-7. Check for the continuity between the No. 7 (Red) and the No. 2 (Black/Yellow) terminals of the remote control harness side 14P connector.

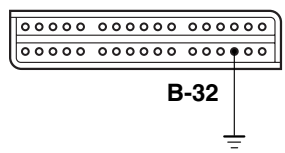


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair open in the main harness.
NO – The indicator light is faulty, or repair open in the remote control harness.

4. Oil pressure indicator line check

-1. Connect the test harness B-32 terminal to the engine ground to short-circuit.
-2. Turn the ignition switch ON and check the oil pressure indicator light.

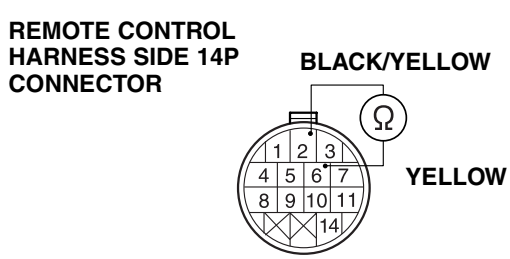


◆ Does the oil pressure indicator light come ON?
YES – Go to the step 3.
NO – Perform "5. MIL line check".

-3. Turn the ignition switch OFF. Disconnect the indicator light Yellow terminal and connect it to the Black terminal with a jumper wire to short-circuit.
-4. Turn the ignition switch ON and check the oil pressure indicator light.

◆ Does the oil pressure indicator light come ON?
YES – Go to the step 5.
NO – Repair open in the wire between the ECM and the indicator light.

-5. Turn the ignition switch OFF and connect the indicator light Yellow terminal.
-6. Disconnect the remote control harness 14P connector.
-7. Check for the continuity between the No. 6 (Yellow) and the No. 2 (Black/Yellow) terminals of the remote control harness side 14P connector.

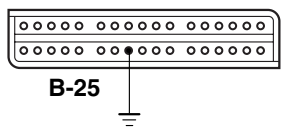


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair open in the main harness.
NO – The indicator light is faulty, or repair open in the remote control harness.

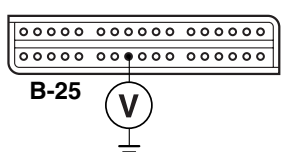
5. MIL line check

-1. Disconnect the ECM connector B and connect the test harness B-25 terminal to the engine ground to short-circuit.
-2. Turn the ignition switch ON and check the MIL.



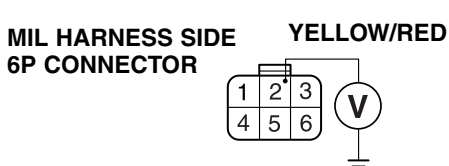
◆ Does the MIL come ON?
YES – Go to the step 3.
NO – Perform "6. Alternator indicator line check".

-3. Turn the ignition switch ON and measure the voltage between the test harness B-25 terminal and the engine ground.



◆ Is there the battery voltage?
YES – Repair open in the main harness between the ECM and the MIL.
NO – Go to the step 4.

-4. Turn the ignition switch OFF and disconnect the MIL 6P connector.
-5. Turn the ignition switch ON. Measure the No. 2 (Yellow/Red) terminal of the MIL 6P main harness side connector and the engine ground.

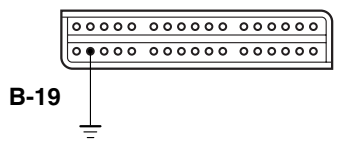


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Check the MIL. If it is normal, replace the MIL harness.
NO – Perform the troubleshooting of "MIL does not come ON" (P. 5-61).

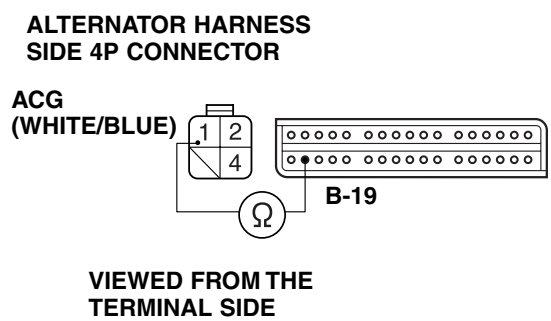
6. Alternator indicator line check

-1. Turn the ignition switch OFF and disconnect the alternator 4P connector.
-2. Check for the continuity between the test harness B-19 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the alternator.
NO – Go to the step 3.

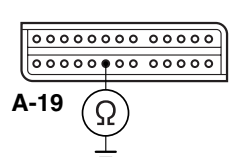
-3. Check for the continuity between the No. 1 (White/Blue) terminal of the alternator harness side 4P connector and the test harness B-19 terminal.



◆ Is there the continuity?
YES – Substitute a known-good ECM and recheck.
NO – Repair open in the wire between the ECM and the alternator.

7. Water level sensor line check

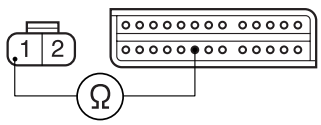
-1. Disconnect the water separator water level sensor 4P connector.
-2. Check for the continuity between the test harness A-19 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the main harness between the water level sensor and the ECM.
NO – Go to the step 3.

-3. Check for the continuity between the No. 1 (Brown) terminal of the water separator water level sensor harness side connector and the test harness A-19 terminal.

WATER LEVEL SENSOR HARNESS SIDE 2P CONNECTOR

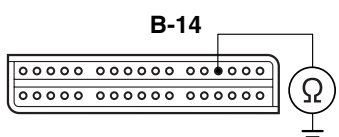


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "8. EOP switch (low pressure side) line check".
NO – Repair open in the main harness between the water level sensor and the ECM.

8. EOP switch (low pressure side) line check

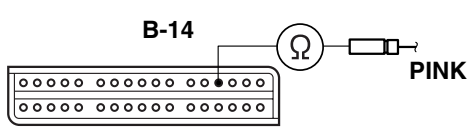
-1. Disconnect the low pressure side EOP switch wire.
-2. Check for the continuity between the test harness B-14 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the main harness between the low pressure side EOP switch and the ECM.
NO – Go to the step 3.

-3. Check for the continuity between the test harness B-14 terminal and the EOP switch harness side (Pink) terminal.

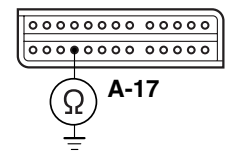
EOP SWITCH HARNESS SIDE TERMINAL



◆ Is there the continuity?
YES – Perform "9. EOP switch (high pressure side) line check".
NO – Repair open in the main harness between the low pressure side EOP switch and the ECM.

9. EOP switch (high pressure side) line check

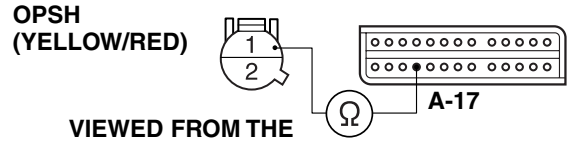
-1. Disconnect the high pressure side EOP switch 2P connector.
-2. Check for the continuity between the test harness A-17 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the main harness between the high pressure side EOP switch and the ECM.
NO – Go to the step 3.

-3. Check for the continuity between the test harness A-17 terminal and the No. 1 (Yellow/Red) terminal of the EOP switch harness side 2P connector.

EOP SWITCH (HIGH PRESSURE SIDE) HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Connect each connector and recheck. If there is any abnormality, substitute a known-good ECM and recheck.
NO – Repair open in the main harness between the high pressure side EOP switch and the ECM.

• Neutral Switch Malfunction

Engine speed does not increase in gear (BF150A only)

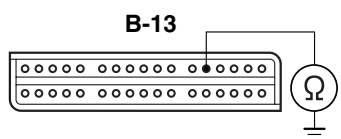
Perform neutral switch inspection (P. 17-13) and neutral position adjustment (P. 3-25) before troubleshooting.

1. Neutral switch line check

-1. Start the engine and warm it up with the gear in neutral.
-2. Disconnect the neutral switch 3P connector. Raise the engine speed slowly and check that the engine speed changes when it reaches approx. 4,500 rpm.

◆ Does the engine speed change (Does VTEC function)?
YES – Replace the neutral switch.
NO – Go to the step 3.

-3. Stop the engine and connect the test harness. Disconnect the ECM connector A, B and C.
-4. With the neutral switch 2P connector disconnected, check for the continuity between the test harness B-13 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the main harness between the ECM and the neutral switch.
NO – Substitute a known-good ECM and recheck.

• Tachometer Malfunction

Tachometer does not function so that it corresponds to the engine speed.

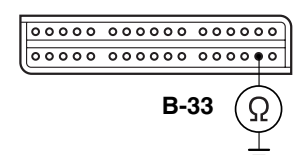
1. Tachometer power supply check

-1. Turn the ignition switch OFF and disconnect the tachometer's connecting terminal.
-2. Turn the ignition switch ON and measure the voltage between the harness side Black/Yellow terminal and the Black terminal.

◆ Is there the battery voltage?
YES – Perform "2. Tachometer pulse line check".
NO – Repair open in the meter harness.

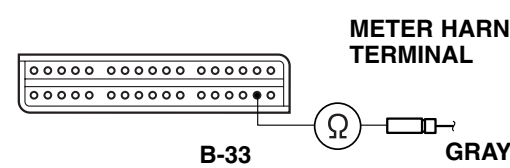
2. Tachometer pulse line check

-1. Turn the ignition switch OFF and connect the test harness.
Disconnect the ECM connector A, B and C.
-2. Check for the continuity between the test harness B-33 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the main harness between the tachometer and the ECM.
NO – Go to the step 3.

-3. Check for the continuity between the test harness B-33 terminal and the meter harness Gray terminal.



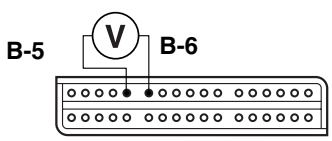
◆ Is there the continuity?
YES – Substitute a known-good ECM and recheck.
NO – Repair open in the main harness between the tachometer and the ECM.

• MAP Sensor Troubleshooting

MIL blinks 3 times.

1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness. Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the test harness B-5 terminal (+) and the B-6 terminal (–).

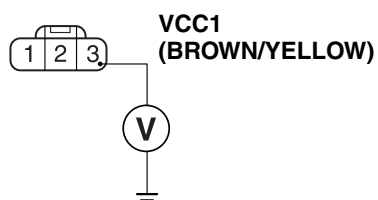


◆ Is the measured voltage 0.22 – 3.15V?
YES – Temporary failure (Disappeared)
NO – Perform "2. MAP sensor signal line short circuit check".

2. MAP sensor signal line short circuit check

-1. Turn the ignition switch OFF and disconnect the MAP sensor 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (Brown/Yellow) terminal of the MAP sensor harness side 3P connector and the engine ground.

MAP SENSOR HARNESS SIDE 3P CONNECTOR



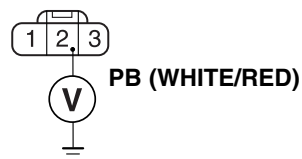
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "3. MAP sensor signal line open circuit check".
NO – Repair open in the wire between the ECM and the MAP sensor.

3. MAP sensor signal line open circuit check

-1. Connect the ECM connector A.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No. 2 (White/Red) terminal of the MAP sensor harness side 3P connector and the engine ground.

MAP SENSOR HARNESS SIDE 3P CONNECTOR



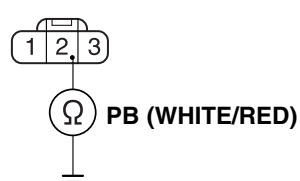
VIEWED FROM THE TERMINAL SIDE

◆ Is the measurement 4.75 – 5.25V?
YES – Perform "4. MAP sensor signal line short circuit check".
NO – Repair open in the wire between the ECM and the MAP sensor.

4. MAP sensor signal line short circuit check

-1. Check for the continuity between the No. 2 (White/Red) terminal of the MAP sensor harness side 3P connector and the body ground.

MAP SENSOR HARNESS SIDE 3P CONNECTOR



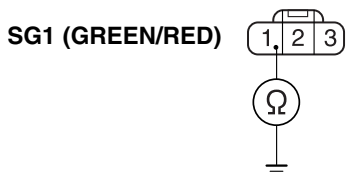
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the MAP sensor and the ECM.
NO – Perform “5. MAP sensor ground line open circuit check”.

5. MAP sensor ground line open circuit check

-1. Check for the continuity between the No. 1 (Green/Red) terminal of the MAP sensor harness side 3P connector and the body ground.

MAP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

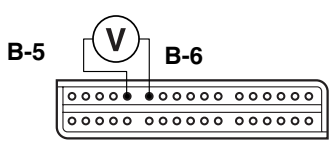
YES – Perform "6. MAP sensor check".

NO – Repair open in the wire between the MAP sensor and the ECM.

6. MAP sensor check

-1. Connect the MAP sensor 3P connector.

-2. Turn the ignition switch ON. Measure the voltage between the test harness B-5 terminal (+) and the B-6 terminal (–).



◆ Is the measurement 2.76 – 2.96V?

YES – Substitute a known-good ECM and recheck.

NO – Replace the MAP sensor.

• CKP Sensor Troubleshooting

MIL blinks 4 times.

1. Symptom reproduction test

-1. Reset the ECM.

-2. Start the engine and let it run at idling under no load.

-3. Check the MIL.

◆ Does the MIL come ON?

YES – Perform "2. CKP sensor power supply line open circuit check".

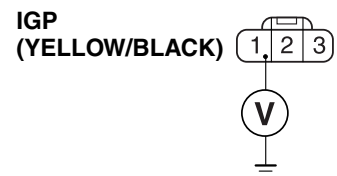
NO – Temporary failure (Disappeared)

2. CKP sensor power supply line open circuit check

-1. Turn the ignition switch OFF and disconnect the CKP sensor 3P connector.

-2. Turn the ignition switch ON and measure the voltage between the No. 1 (Yellow/Black) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?

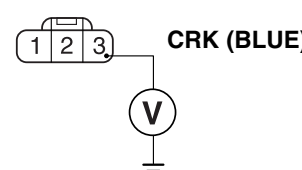
YES – Perform "3. CKP sensor signal line open circuit check".

NO – Repair open in the wire between the ECM and CKP sensor.

3. CKP sensor signal line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 3 (Blue) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



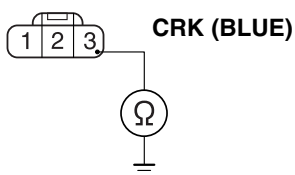
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "4. CKP sensor signal line short circuit check".
NO – Repair open in the wire between the CKP sensor and the ECM.

4. CKP sensor signal line short circuit check

-1. Turn the ignition switch OFF. Check for the continuity between the No. 3 (Blue) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



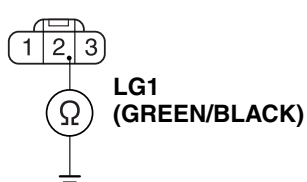
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "5. CKP sensor ground line open circuit check".
NO – Repair open in the wire between the CKP sensor and the ECM.

5. CKP sensor ground line open circuit check

-1. Check for the continuity between the No. 2 (Green/Black) terminal of the CKP sensor harness side 3P connector and the engine ground.

CKP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "6. CKP sensor check".
NO – Repair open in the wire between the CKP sensor and the ECM.

6. CKP sensor check

-1. Reset the ECM.
-2. Start the engine and let it run at idling under no load. Check the MIL.

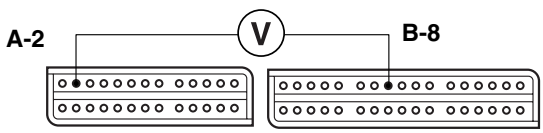
◆ Does the MIL come ON?
YES – Replace the CKP sensor and recheck. If the MIL comes ON again, substitute a known-good ECM and recheck.
NO – End of the check.

• ECT Sensor 1 Troubleshooting

MIL comes ON 6 times.

1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
    • Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the test harness B-8 terminal (+) and the A-2 terminal (–).

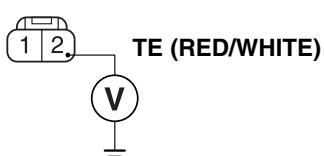


◆ Is the measured voltage 0.22 – 3.15V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 1 signal line open circuit check".

2. ECT sensor 1 signal line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 2 (Red/White) terminal of the ECT sensor 1 harness side 2P connector and the engine ground.

ECT SENSOR 1 HARNESS SIDE 2P CONNECTOR



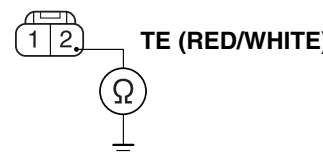
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.30 – 5.25V?
YES – Perform "3. ECT sensor 1 line short circuit check".
NO – Repair open in the wire between the ECM and ECT sensor 1.

3. ECT sensor 1 line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 2 (Red/White) terminal of the ECT sensor 1 harness side 2P connector and the body ground.

ECT SENSOR 1 HARNESS SIDE 2P CONNECTOR



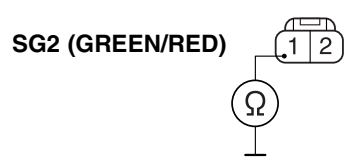
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the ECT sensor 1.
NO – Perform "4. ECT sensor 1 ground line short circuit check".

4. ECT sensor 1 ground line short circuit check

-1. Turn the ignition switch OFF. Check for the continuity between the No. 1 (Green/Red) terminal of the ECT sensor 1 harness side 2P connector and the engine ground.

ECT SENSOR 1 HARNESS SIDE 2P CONNECTOR



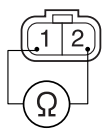
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform the 5. ECT sensor 1 check.
NO – Repair open in the wire between the ECM and the ECT sensor.

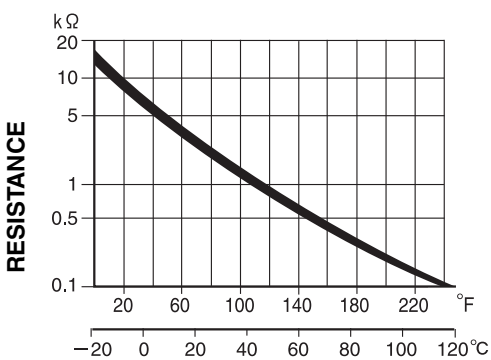
5. ECT sensor 1 check

-1. Turn the ignition switch OFF and disconnect the 2P connector of the ECT sensor 1.
-2. Measure the resistance between the No. 1 and the No. 2 terminals of the ECT sensor 1 side 2P connector.

ECT SENSOR 1 SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE



ENGINE COOLANT TEMPERATURE

◆ Is there the resistance corresponding to the engine coolant temperature?

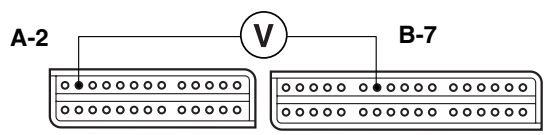
YES – Substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 1.

• TP Sensor Troubleshooting

MIL blinks 7 times.

1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the B-7 terminal (+) and the A-2 terminal (–) of the test harness.



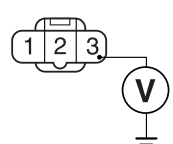
◆ Is the measured voltage 0.08 – 4.92V?

YES – Temporary failure (Disappeared)
NO – Perform "2. TP sensor power supply line open circuit check".

2. TP sensor power supply line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 3 (Brown/White) terminal of the TP sensor harness side 3P connector and the engine ground.

TP SENSOR HARNESS SIDE 3P CONNECTOR



VCC2 (BROWN/WHITE)

VIEWED FROM THE TERMINAL SIDE

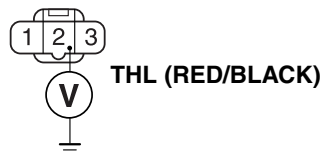
◆ Is the measured voltage 4.75 – 5.25V?

YES – Perform "3. TP sensor signal line open circuit check".
NO – Repair open in the wire between the TP sensor and the ECM.

3. TP sensor signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the TP sensor connector.
-2. Measure the voltage between the No. 2 (Red/Black) terminal of the TP sensor harness side 3P connector and the engine ground.

TP SENSOR HARNESS SIDE 3P CONNECTOR



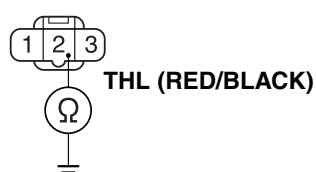
VIEWED FROM THE TERMINAL SIDE

◆ Is the measured voltage 4.75 – 5.25V?
YES – Perform "4. TP sensor signal line short circuit check".
NO – Repair open in the wire between the TP sensor and the ECM.

4. TP sensor signal line short circuit check

-1. Turn the ignition switch OFF and disconnect the TP sensor connector.
-2. Check for the continuity between the No. 2 (Red/Black) terminal of the TP sensor harness side 3P connector and the engine ground.

TP SENSOR HARNESS SIDE 3P CONNECTOR



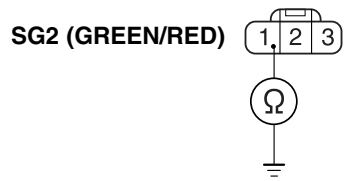
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the TP sensor and the ECM.
NO – Perform "5. TP sensor ground line open circuit check".

5. TP sensor ground line open circuit check

-1. Turn the ignition switch OFF and disconnect the TP sensor 3P connector.
-2. Check for the continuity between the No. 1 (Green/Red) terminal of the TP sensor harness side 3P connector and the engine ground.

TP SENSOR HARNESS SIDE 3P CONNECTOR

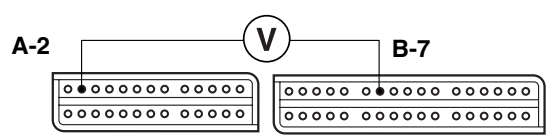


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "6. TP sensor check".
NO – Repair open in the wire between the TP sensor and the engine ground.

6. TP sensor check

-1. Turn the ignition switch OFF and connect the TP sensor 3P connector.
-2. Measure the voltage between the B-7 terminal and the A-2 terminal of the test harness.



◆ Is the voltage 4.49 – 4.85V when the throttle is fully open and 0.44 – 0.56V when the throttle is fully closed?
YES – Substitute a known-good ECM and recheck.
NO – Replace the TP sensor.

• CMP Sensor Troubleshooting

MIL blinks 8 times.

1. Symptom reproduction test

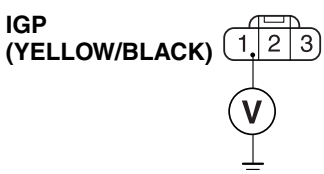
-1. Reset the ECM.
-2. Start the engine and let it run at idling under no load.
-3. Check the MIL.

◆ Does the MIL come ON?
YES – Check the pulse plate. If it is normal, perform "2. CMP sensor power supply line open circuit check". If it is abnormal, replace the pulse plate and recheck.
NO – Temporary failure (Disappeared)

2. CMP sensor power supply line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 1 (Yellow/Black) terminal of the CMP sensor harness side 3P connector and the engine ground.

CMP SENSOR HARNESS SIDE 3P CONNECTOR



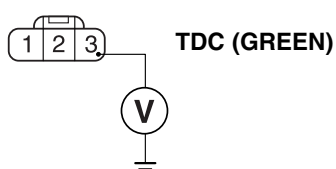
VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform "3. CMP sensor signal line open circuit check".
NO – Repair open in the wire between the No. 4 fuse and the CMP sensor.

3. CMP sensor signal line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 3 (Green) terminal of the CMP sensor harness side 3P connector and the engine ground.

CMP SENSOR HARNESS SIDE 3P CONNECTOR



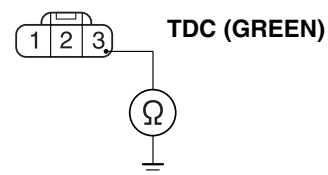
VIEWED FROM THE TERMINAL SIDE

◆ Is the voltage 4.75 – 5.25V?
YES – Perform "4. CMP sensor signal line short circuit check".
NO – Repair open in the wire between the CMP sensor and the ECM.

4. CMP sensor signal line short circuit check

-1. Turn the ignition switch OFF and disconnect the CMP sensor 3P connector.
-2. Check for the continuity between the No. 3 (Green) terminal of the CMP sensor harness side 3P connector and the engine ground.

CMP SENSOR HARNESS SIDE 3P CONNECTOR



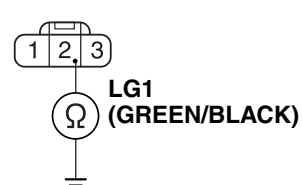
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the CMP sensor and the ECM.
NO – Perform "5. CMP sensor ground line open circuit check".

5. CMP sensor ground line open circuit check

-1. Turn the ignition switch OFF and disconnect the CMP sensor 3P connector.
-2. Check for the continuity between the No. 2 (Green/Black) terminal of the CMP sensor harness side 3P connector and the engine ground.

CMP SENSOR HARNESS SIDE 3P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform “6. CMP sensor check”.
NO – Repair open in the wire between the CMP sensor and the engine ground.

6. CMP sensor check

-1. Reset the ECM.
-2. Start the engine and let it run at idling under no load. Check the MIL.

◆ Does the MIL come ON?

YES – Replace the CMP sensor and recheck. If the MIL comes ON again, substitute a known-good ECM and recheck.

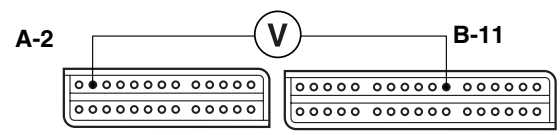
NO – End of the check

• IAT Sensor Troubleshooting

MIL blinks 10 times.

1. Symptom reproduction check

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
    - Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the B-11 terminal (+) and the A-2 terminal (-) of the test harness.



◆ Is the voltage 0.08 – 4.92V?

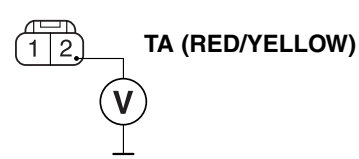
YES – Temporary failure (Disappeared)

NO – Perform "2. IAT sensor signal line open circuit check".

2. IAT sensor signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the IAT sensor 2P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 2 (Red/Yellow) terminal of the IAT sensor harness side 2P connector and the engine ground.

IAT SENSOR HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is the voltage 4.75 – 5.25V?

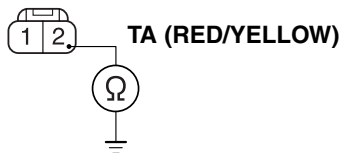
YES – Perform “3. IAT sensor signal line short circuit check”.

NO – Repair open in the wire between the IAT sensor and the ECM.

3. IAT sensor signal line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 2 (Red/Yellow) terminal of the IAT sensor harness side 2P connector and the body ground.

IAT SENSOR HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

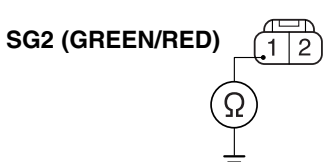
YES – Repair short in the wire between the IAT sensor and the ECM.

NO – Perform "4. IAT sensor ground line short circuit check".

4. IAT sensor ground line short circuit check

-1. Turn the ignition switch OFF.
-2. Check for the continuity between the No. 1 (Green/Red) terminal of the IAT sensor harness side 2P connector and the body ground.

IAT SENSOR HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

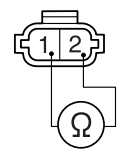
YES – Perform "5. IAT sensor check".

NO – Repair open in the wire between the IAT sensor and the engine ground.

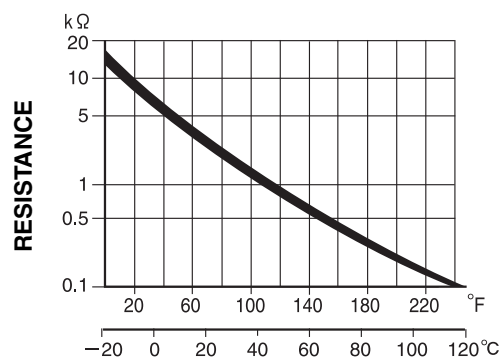
5. IAT sensor check

-1. Turn the ignition switch OFF and disconnect the IAT sensor 2P connector.
-2. Measure the resistance between the No. 1 and the No. 2 terminals of the IAT sensor side 2P connector.

IAT SENSOR SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE



INTAKE AIR TEMPERATURE

◆ Is there the resistance corresponding to the ambient temperature?

YES – Substitute a known-good ECM and recheck.

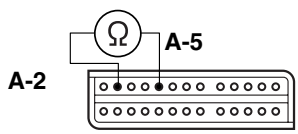
NO – Replace the IAT sensor and recheck.

• BARO Sensor Troubleshooting

MIL blinks 13 times.

1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
  • Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the A-5 terminal (+) and the A-2 terminal (–) of the test harness.

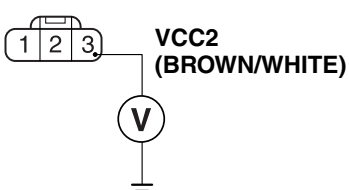


◆ Is there 1.58 – 4.49V?
YES – Temporary failure (Disappeared)
NO – Perform "2. BARO sensor power supply line open circuit check".

2. BARO sensor power supply line open circuit check

-1. Turn the ignition switch OFF and disconnect the BARO sensor 3P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No. 3 (Brown/White) terminal of the BARO sensor harness side 3P connector and the body ground.

BARO SENSOR HARNESS SIDE 3P CONNECTOR



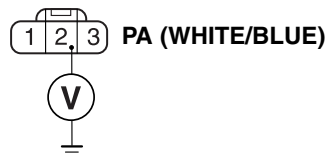
VIEWED FROM THE TERMINAL SIDE

◆ Is the voltage 4.75 – 5.25V?
YES – Perform "3. BARO sensor signal line open circuit check".
NO – Repair open in the wire between the BARO sensor and the ECM.

3. BARO sensor signal line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 2 (White/Blue) terminal of the BARO sensor harness side 3P connector and the body ground.

BARO SENSOR HARNESS SIDE 3P CONNECTOR



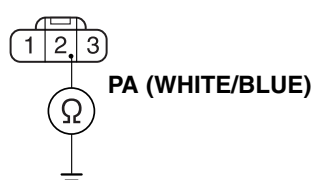
VIEWED FROM THE TERMINAL SIDE

◆ Is the voltage 4.75 – 5.25V?
YES – Perform "4. BARO sensor signal line short circuit check".
NO – Repair open in the wire between the BARO sensor and the ECM.

4. BARO sensor signal line short circuit check

-1. Turn the ignition switch OFF and disconnect the ECM connector B.
-2. Check for the continuity between the No. 2 (White/Blue) terminal of the BARO sensor harness side 3P connector and the body ground.

BARO SENSOR HARNESS SIDE 3P CONNECTOR



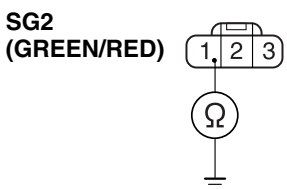
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the BARO sensor.
NO – Perform "5. BARO sensor ground line open circuit check".

5. BARO sensor ground line open circuit check

-1. Turn the ignition switch ON. Measure the voltage between the No. 1 (Green/Red) terminal of the BARO sensor harness side 3P connector and the engine ground.

BARO SENSOR HARNESS SIDE 3P CONNECTOR

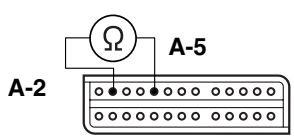


VIEWED FROM THE TERMINAL SIDE

◆Is there the continuity?
YES – Perform "6. BARO sensor check".
NO – Repair open in the wire between the BARO sensor and the engine ground.

6. BARO sensor check

-1. Turn the ignition switch ON.
-2. Measure the voltage between the A-5 terminal (+) and the A-2 terminal (–) of the test harness.



◆Is the measurement 2.76 – 2.96V?
YES – Substitute a known-good ECM and recheck.
NO – Replace the BARO sensor and recheck.

• IAC Valve Troubleshooting

MIL blinks 14 times

1. Symptom reproduction test

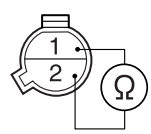
-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
• Hold the sensor connector connected.
-3. Start the engine. Check the engine speed during idling.

◆Is the engine speed 650 rpm or above?
YES – Temporary failure (Disappeared)
NO – Perform "2. IAC valve open circuit check".

2. IAC valve open circuit check

-1. Turn the ignition switch OFF and disconnect the IAC valve 2P connector.
-2. Measure the resistance between the IAC valve No. 1 and the No. 2 terminals.

IAC VALVE SIDE 2P CONNECTOR



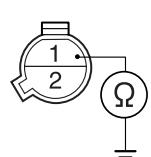
VIEWED FROM THE TERMINAL SIDE

◆Is the resistance 8 – 12Ω?
YES – Perform "3. IAC valve short circuit check".
NO – Replace the IAC valve.

3. IAC valve short circuit check

-1. Check for the continuity between the IAC valve No. 1 terminal and the body ground.

IAC VALVE SIDE 2P CONNECTOR

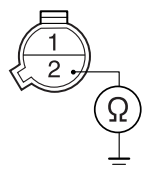


VIEWED FROM THE TERMINAL SIDE

◆Is there the continuity?
YES – Replace the IAC valve.
NO – Go to the step 2.

-2. Check for the continuity between the IAC valve No. 2 terminal and the body ground.

IAC VALVE SIDE 2P CONNECTOR

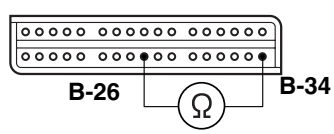


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Replace the IAC valve.
NO – Perform "4. IAC valve line open circuit check".

4. IAC valve line open circuit check

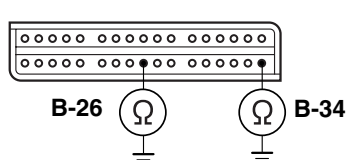
-1. Connect the IAC valve 2P connector.
-2. Disconnect the ECM connector B.
-3. Measure the resistance between the test harness B-26 terminal and the B-34 terminal.



◆ Is the resistance 10 – 13Ω?
YES – Perform "5. IAC valve line short circuit check".
NO – Check for open in the wire between the ECM and the IAC valve.

5. IAC valve line short circuit check

-1. Check for the continuity between the test harness B-26 terminal and the engine ground, and between the B-34 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the IAC valve.
NO – Substitute a known-good ECM and recheck.

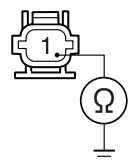
• VTEC Solenoid Valve Troubleshooting

MIL blinks 21 times

1. Spool solenoid valve check

-1. Turn the ignition switch OFF and disconnect the spool solenoid valve connector.
-2. Measure the resistance between the spool solenoid valve side 1P connector terminal (Green/White) and the body ground.

SPOOL SOLENOID VALVE SIDE 1P CONNECTOR

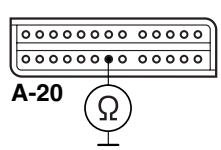


VIEWED FROM THE TERMINAL SIDE

◆ Is the measured resistance 12 – 18Ω?
YES – Perform "2. VTEC signal line short circuit check".
NO – Replace the spool solenoid valve.

2. VTEC signal line short circuit check

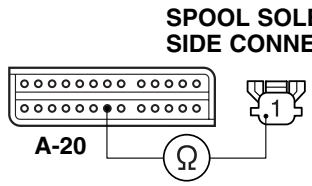
-1. Turn the ignition switch OFF and connect the test harness.
Hold the ECM connector A disconnected.
-2. Check for the continuity between the test harness A-20 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the spool solenoid valve.
NO – Perform “3. VTEC signal line open circuit check”.

3. VTEC signal line open circuit check

-1. Check for the continuity between the spool solenoid valve harness side connector terminal and A-20 terminal of the test harness.



◆ Is there the continuity?
YES – Perform "4. Symptom reproduction test".
NO – Repair open in the wire between the ECM and the spool solenoid valve.

4. Symptom reproduction test

-1. Disconnect the test harness and connect each connector securely.
-2. Reset the ECM.
-3. Start the engine and let it warm up by running the engine at 3,000 min^{-1} (rpm) for 5 minutes under no load.
-4. Disconnect the neutral switch 2P connector.
-5. Increase the engine speed gradually until it reaches 4,500 min^{-1} (rpm), and run the engine for a few seconds.
-6. If there is any abnormality, substitute a known-good ECM and recheck.

• KNOCK Sensor Troubleshooting

MIL blinks 23 times

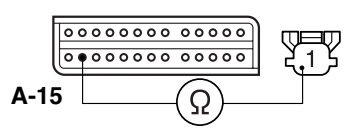
1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
• Hold the sensor connector connected.
-3. Start the engine and let it warm up by running the engine at 5,000 min^{-1} (rpm) or more for 5 minutes or more under no load.
-4. Check the MIL.

◆ Does the MIL come ON?
YES – Perform "2. Knock sensor signal line open circuit check".
NO – Temporary failure (Disappeared)

2. Knock sensor signal line open circuit check

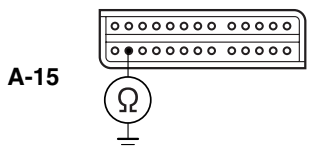
-1. Turn the ignition switch OFF and disconnect the knock sensor 1P connector.
-2. Check for the continuity between the knock sensor harness side connector (Red/Blue) terminal and the test harness A-15 terminal.



◆ Is there the continuity?
YES – Perform "3. Knock sensor signal line short circuit check".
NO – Repair open in the wire between knock sensor and the ECM.

3. Knock sensor signal line short circuit check

-1. Check for the continuity between the test harness A-15 terminal and the engine ground.



◆ Is there the continuity?

YES – Repair short in the wire between the ECM and the spool solenoid valve.

NO – Substitute a known-good ECM and recheck.

• ECT Sensor 2 Troubleshooting

MIL blinks 24 times

1. Symptom reproduction test

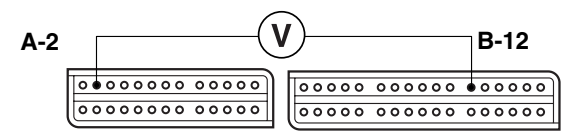
-1. Reset the ECM.

-2. Turn the ignition switch OFF and connect the test harness.

• Hold the sensor connector connected.

-3. Turn the ignition switch ON.

-4. Measure the voltage between the test harness B-12 terminal (+) and the A-2 terminal (–).



◆ Is the voltage 0.08 – 4.99V?

YES – Temporary failure (Disappeared)

NO – Perform "2. ECT sensor 2 signal line open circuit check".

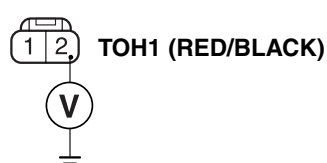
2. ECT sensor 2 signal line open circuit check

-1. Turn the ignition switch OFF. Disconnect the 2P connector from the ECT sensor 2.

-2. Turn the ignition switch ON.

-3. Measure the voltage between the No. 2 (Red/Black) terminal of the ECT sensor 2 harness side 2P connector and the engine ground.

ECT SENSOR 2 HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is the voltage 4.75 – 5.25V?

YES – Perform "3. ECT sensor 2 ground line short circuit check".

NO – Repair open in the wire between the ECT sensor 2 and the ECM.

3. ECT sensor 2 ground line short circuit check

-1. Turn the ignition switch OFF. Disconnect the ECT sensor 2 connector and the ECM connector B.
-2. Check for the continuity between the No. 2 (Red/Black) terminal of the ECT sensor 2 harness side 2P connector and the body ground.

ECT SENSOR 2 HARNESS SIDE 2P CONNECTOR

VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

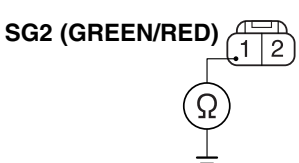
YES – Repair short in the wire between the ECT sensor 2 and the engine ground.

NO – Perform “4. ECT sensor 2 ground line open circuit check”.

4. ECT sensor 2 ground line open circuit check

-1. Reset the ECM connector B.
-2. Check for the continuity between the No. 1 (Green/Red) terminal of the ECT sensor 2 harness side 2P connector and the body ground.

ECT SENSOR 2 HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

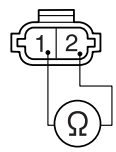
YES – Perform "5. ECT sensor 2 check".

NO – Repair open in the wire between the ECT sensor 2 and the engine ground.

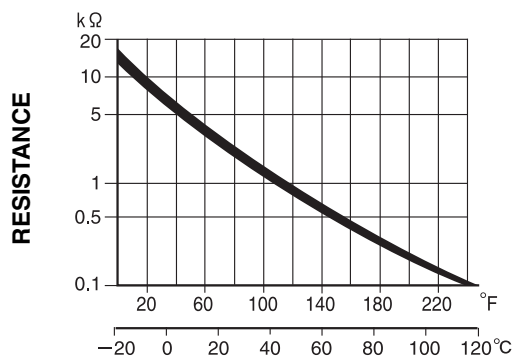
5. ECT sensor 2 check

-1. Turn the ignition switch OFF and disconnect the 2P connector of the ECT sensor 2 .
-2. Measure the resistance between the No. 1 and the No. 2 terminals of the ECT sensor 2 side 2P connector.

ECT SENSOR 2 SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE



ENGINE COOLANT TEMPERATURE

◆ Is there the resistance corresponding to the engine coolant temperature?

YES – Substitute a known-good ECM and recheck.

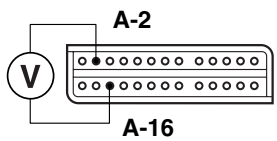
NO – Replace the ECT sensor 2.

• ECT Sensor 3 Troubleshooting

MIL blinks 25 times

1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
  • Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the test harness A-16 terminal (+) and the A-2 terminal (–).

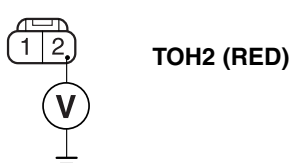


◆ Is the voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 3 signal line open circuit check".

2. ECT sensor 3 signal line open circuit check

-1. Turn the ignition switch OFF. Disconnect the 2P connector from the ECT sensor 3.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No. 2 (Red) terminal of the ECT sensor 3 harness side 2P connector and the engine ground.

ECT SENSOR 3 HARNESS SIDE 2P CONNECTOR



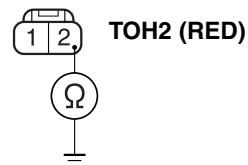
VIEWED FROM THE TERMINAL SIDE

◆ Is the voltage 4.75 – 5.25V?
YES – Perform "3. ECT sensor 3 signal line short circuit check".
NO – Repair open in the wire between the ECT sensor 3 and the ECM.

3. ECT sensor 3 signal line short circuit check

-1. Turn the ignition switch OFF. Disconnect the ECT sensor 3 connector and the ECM connector B.
-2. Check for the continuity between the No. 2 (Red) terminal of the ECT sensor 3 harness side 2P connector and the body ground.

ECT SENSOR 3 HARNESS SIDE 2P CONNECTOR



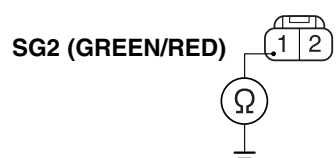
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECT sensor 3 and the engine ground.
NO – Perform "4. ECT sensor 3 ground line open circuit check".

4. ECT sensor 3 ground line open circuit check

-1. Connect the ECM connector B.
-2. Check for the continuity between the No. 1 (Green/Red) terminal of the ECT sensor 3 harness side 2P connector and the body ground.

ECT SENSOR 3 HARNESS SIDE 2P CONNECTOR



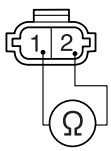
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "5. ECT sensor 3 check".
NO – Repair open in the wire between the ECT sensor 3 and the engine ground.

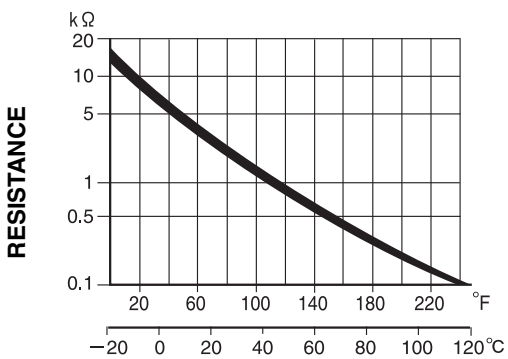
5. ECT sensor 3 check

-1. Turn the ignition switch OFF and disconnect the ECT sensor 3 2P connector.
-2. Measure the resistance between the No.1 and No.2 terminals of the ECT sensor 3 side 2P connector.

ECT SENSOR 3 SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE



ENGINE COOLANT TEMPERATURE

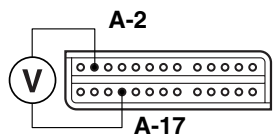
◆ Is there the resistance corresponding to the engine coolant temperature?
YES – Substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 3.

• EOP switch (High Pressure Side) Troubleshooting

MIL blinks 26 times

1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
  • Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the test harness A-17 terminal (+) and A-2 terminal (–).

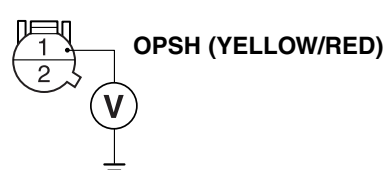


◆ Is the voltage 0V (OFF signal)?
YES – Temporary failure (Disappeared)
NO – Perform "2. EOP switch signal line open circuit check".

2. EOP switch signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the EOP switch 2P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No.1 (Yellow/Red) terminal of the EOP switch harness side 2P connector and the body ground.

EOP SWITCH HARNESS SIDE 2P CONNECTOR



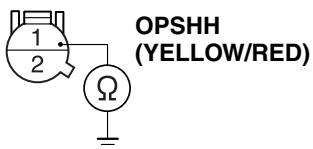
VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform "3. EOP switch signal line short circuit check".
NO – Repair open in the wire between the EOP switch and the ECM.

3. EOP switch signal line short circuit check

-1. Turn the ignition switch OFF. Disconnect the EOP switch 2P connector and the ECM connector A.
-2. Check for the continuity between the No.1 (Yellow/Red) terminal of the EOP switch harness side 2P connector and the body ground.

EOP SWITCH HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?

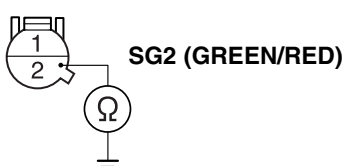
YES – Repair short in the wire between the EOP switch and the ECM.

NO – Perform “4. EOP switch ground line open circuit check”.

4. EOP switch ground line open circuit check

-1. Check for the continuity between the No.2 (Green/Red) terminal of the EOP switch harness side 2P connector and the body ground.

EOP SWITCH HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

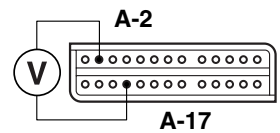
◆ Is there the continuity?

YES – Perform "5. EOP switch check".

NO – Repair open in the wire between the EOP switch and the ECM.

5. EOP switch check

-1. Turn the ignition switch OFF and connect each connector.
-2. Turn the ignition switch ON and measure the voltage between the test harness A-17 terminal (+) and the A-2 terminal.



◆ Is the voltage 0V (switch OFF)?

YES – Substitute a known-good ECM and recheck.

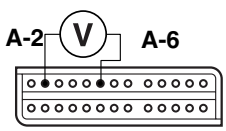
NO – Replace the EOP switch (high pressure side).

• ECT Sensor 4 Troubleshooting

MIL blinks 27 times

1. Symptom reproduction test

-1. Reset the ECM.
-2. Turn the ignition switch OFF and connect the test harness.
  • Hold the sensor connector connected.
-3. Turn the ignition switch ON.
-4. Measure the voltage between the test harness A-6 terminal (+) and the A-2 terminal (–).

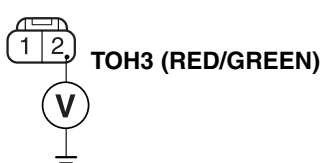


◆ Is the voltage 0.08 – 4.99V?
YES – Temporary failure (Disappeared)
NO – Perform "2. ECT sensor 4 signal line open circuit check".

2. ECT sensor 4 signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the 2P connector from the ECT sensor 4.
-2. Turn the ignition switch ON.
-3. Measure the voltage between the No.2 (Red/Green) terminal of the ECT sensor 4 harness side 2P connector and the engine ground.

ECT SENSOR 4 HARNESS SIDE 2P CONNECTOR



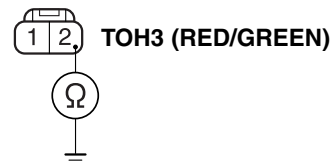
VIEWED FROM THE TERMINAL SIDE

◆ Is the voltage 4.75 – 5.25V?
YES – Perform "3. ECT sensor 4 signal line short circuit check".
NO – Repair open in the wire between the ECT sensor 4 and the ECM.

3. ECT sensor 4 signal line short circuit check

-1. Turn the ignition switch OFF. Disconnect the ECT sensor 4 connector and the ECM connector B.
-2. Check for the continuity between the No.2 (Red/Green) terminal of the ECT sensor 4 harness side 2P connector and the body ground.

ECT SENSOR 4 HARNESS SIDE 2P CONNECTOR



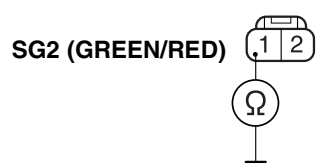
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECT sensor 4 and the engine ground.
NO – Perform “4. ECT sensor 4 ground line open circuit check”.

4. ECT sensor 4 ground line open circuit check

-1. Connect the ECM connector B.
-2. Check for the continuity between the No.1 (Green/Red) terminal of the ECT sensor 4 harness side 2P connector and the body ground.

ECT SENSOR 4 HARNESS SIDE 2P CONNECTOR



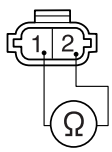
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Perform "5. ECT sensor 4 check".
NO – Repair open in the wire between the ECT sensor 4 and the engine ground.

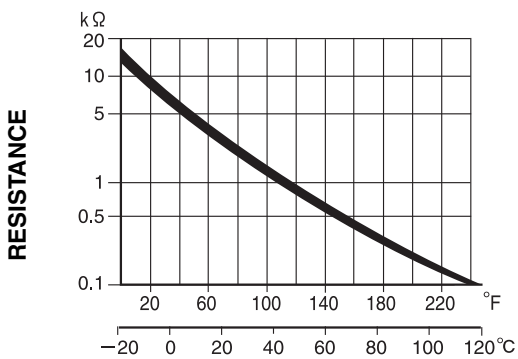
5. ECT sensor 4 check

-1. Turn the ignition switch OFF and disconnect the ECT sensor 4 2P connector.
-2. Measure the voltage between the No.1 and No.2 terminals of the ECT sensor 4 side 2P connector.

ECT SENSOR 4 SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE



ENGINE COOLANT TEMPERATURE

◆ Is there the resistance corresponding to the engine coolant temperature?
YES – Substitute a known-good ECM and recheck.
NO – Replace the ECT sensor 4.

• A/F Sensor Heater Troubleshooting

MIL blinks 41 times

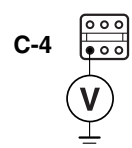
1. Symptom reproduction test

-1. Reset the ECM.
-2. Start the engine and run it at 3,000 rpm for 5 minutes or more to warm up.
-3. Check the MIL.

◆ Does the MIL come ON?
YES – Perform "2. A/F relay check".
NO – Temporary failure (Disappeared)

2. A/F relay check

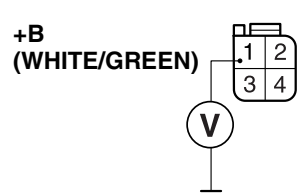
-1. Turn the ignition switch OFF and connect the test harness.
Hold the sensor connector connected.
-2. Disconnect the A/F sensor 4P connector.
-3. Turn the ignition switch ON. Measure the voltage between the test harness C-4 terminal and the engine ground.



◆ Is there the battery voltage?
YES – Perform "4. A/F heater check".
NO – Check the A/F relay and replace if necessary. If it is normal, go to the step 4.

-4. Turn the ignition switch OFF and disconnect the A/F relay 4P connector.
-5. Measure the voltage between the No.1 (White/ Green) terminal of the A/F relay harness side 4P connector and the engine ground.
• Note that the battery voltage is constantly applied to the White/Green terminal. Take care not to short-circuit the terminal.

A/F RELAY HARNESS SIDE 4P CONNECTOR

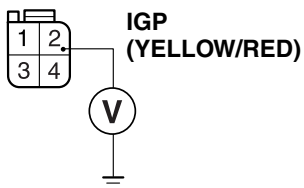


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 6.
NO – Blown No.1 (30A) fuse, or repair open in the wire between the A/F relay and the No.1 (10A) fuse.

-6. Turn the ignition switch ON. Measure the voltage between the No.2 (Yellow/Red) terminal of the A/F relay harness side 4P connector and the engine ground.

A/F RELAY HARNESS SIDE 4P CONNECTOR

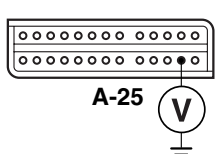


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform "3. A/F relay drive line check".
NO – Blown No.5 (10A) fuse, or repair open in the wire between the A/F relay and the No.5 fuse.

3. A/F relay drive line check

-1. Turn the ignition switch OFF and connect the A/F relay connector.
-2. Disconnect the ECM connector A.
-3. Turn the ignition switch ON and measure the voltage between the test harness A-25 and the engine ground.

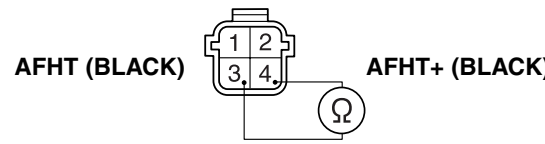


◆ Is there the battery voltage?
YES – Substitute a known-good ECM and recheck.
NO – Repair open in the A/F relay and the ECM.

4. A/F heater check

-1. Turn the ignition witch OFF and disconnect the A/F sensor 4P connector.
-2. Measure the resistance between the No.3 (Black) and No.4 (Black) terminals of the A/F sensor's sensor side 4P connector.

A/F SENSOR SIDE 4P CONNECTOR

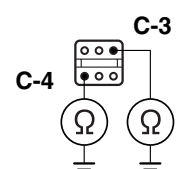


VIEWED FROM THE TERMINAL SIDE

◆ Is the resistance 2 – 3Ω?
YES – Perform "5. Heater line short circuit check".
NO – Replace the A/F sensor.

5. Heater line short circuit check

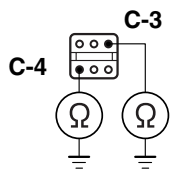
-1. Turn the ignition switch OFF and disconnect the ECM connector C.
-2. Check for the continuity between the test harness C-3 terminal and the engine ground, and between the C-4 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair short in the wire between the A/F sensor and the ECM.
NO – Perform "6. Heater line open circuit check".

6. Heater line open circuit check

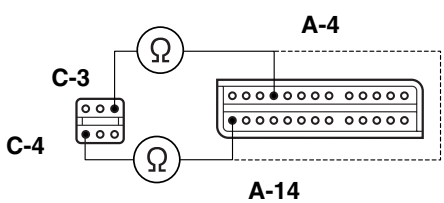
-1. Connect the No.3 (Black/White) and the No.4 (White) terminals of the A/F sensor harness side 4P connector respectively to the engine ground with the jumper wires.
-2. Check for the continuity between the test harness C-3 terminal and the engine ground, and between the C-4 terminal and the engine ground.



◆ Is there the continuity?
YES – Perform "7. Sensor line short circuit check".
NO – Repair open in the wire between the A/F sensor and the ECM.

7. Sensor line short circuit check

-1. Disconnect the ECM connector B.
-2. Disconnect the A/F sensor 4P connector.
-3. Check for the continuity between the test harness C-3 terminal and the respective terminals of A-4 and A-14 terminals, and between the C-4 terminal and the respective terminals of A-4 and A-14 terminals.



◆ Is there the continuity?
YES – Repair short in the wire between the A/F sensor and the ECM.
NO – Replace the A/F sensor and recheck. If it is still abnormal, substitute a known-good ECM and recheck.

• A/F Sensor Troubleshooting

MIL blinks 48 times

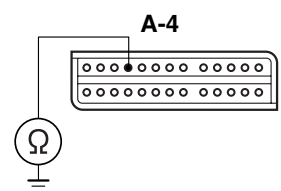
1. Symptom reproduction test

-1. Reset the ECM.
-2. Start the engine and let it warm up by running the engine at 3,000 rpm for 5 minutes or more under no load. Run the engine at idling for an additional one minute under no load.
-3. Check the MIL.

◆ Does the MIL come ON?
YES – Perform "2. A/F sensor line open circuit check".
NO – Temporary failure (Disappeared)

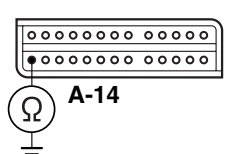
2. A/F sensor line open circuit check

-1. Turn the ignition switch OFF. Disconnect the A/F sensor connector and the ECM connector A.
-2. Connect the No.1 (White/Black) terminal of the A/F sensor harness side 4P connector to the engine ground to short using a jumper wire.
-3. Check for the continuity between the test harness A-4 terminal and the engine ground.



◆ Is there the continuity?
YES – Go to the step 4.
NO – Repair open in the wire between the A/F sensor and the ECM.

-4. Connect the No.2 (Black/Yellow) terminal of the A/F sensor harness side 4P connector to the engine ground to short using a jumper wire.
-5. Check for continuity between the test harness A-14 terminal and the engine ground.

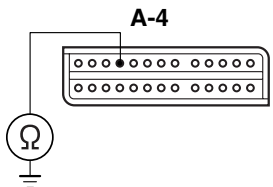


◆ Is there the continuity?
YES – Perform "3. A/F sensor line short circuit check".
NO – Repair open in the wire between the A/F sensor and the ECM.

3. A/F sensor line short circuit check

-1. Turn the ignition switch OFF. Disconnect the A/F sensor connector and the ECM connector A.

-2. Check for the continuity between the test harness A-4 terminal and the engine ground.

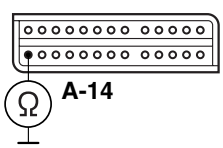


◆ Is there the continuity?

YES – Repair short in the wire between the A/F sensor and the ECM.

NO – Go to the step 3.

-3. Check for the continuity between the test harness A-14 terminal and the engine ground.



◆ Is there the continuity?

YES – Repair short in the wire between the A/F sensor and the ECM.

NO – Replace the A/F sensor and recheck. If there is any abnormality, substitute a known-good ECM and recheck.

8. IDLE CONTROL SYSTEM

• Troubleshooting

When the MIL does not come ON but an engine failure of either of the following symptoms occurs at the engine start or during idling, inspect the system(s) and part(s) in the numbered sequence.

• Hard to start

1. Vacuum line
2. IAC valve (P. 5-95)

• Engine starts but stalls soon.

1. Idle adjusting screw (P. 5-94)
2. IAC valve (P. 5-95)
3. Vacuum line

• Engine speed is higher than the specified idle speed after warming up.

1. Vacuum line
2. IAC valve (P. 5-95)
3. Idle adjusting screw (P. 5-94)

• Engine speed is higher than the specified trolling speed after warming up.

1. Neutral switch (P. 17-13)
2. Vacuum line
3. Idle adjusting screw (P. 5-94)
4. IAC valve (P. 5-95)

• Engine speed is lower than the specified idling or trolling speed after warming up.

1. IAC valve (P. 5-95)
2. Idle adjusting screw (P. 5-94)
3. Vacuum line

• Engine speed is not stable during idling and trolling.

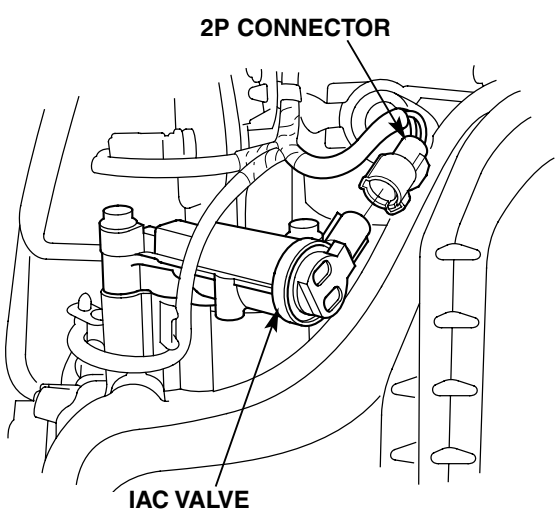
1. IAC valve (P. 5-95)
2. Idle adjusting screw (P. 5-94)
3. Vacuum line
4. Neutral switch (P. 17-13)

• Idle Adjusting Screw Adjustment

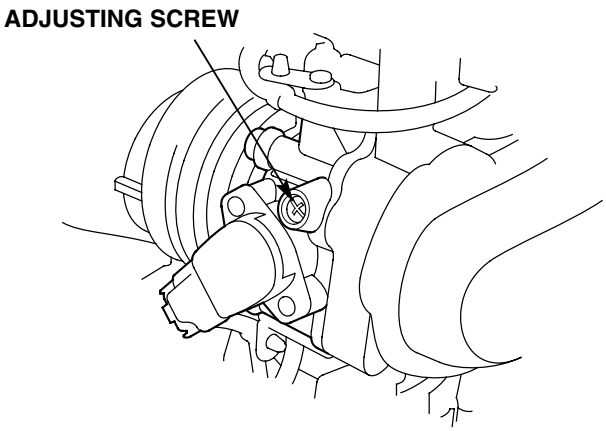
Check the following before adjustment.
- Idle speed inspection (P. 3-22)
- Spark plug (P. 3-6)
- MIL is OFF. (If it is ON, troubleshoot according to the chart on P. 5-15 or 5-59.)

1) Remove the propeller. Set the outboard motor in a test tank filled with water.
   - Fill the tank with water above the gear case.
2) Connect the HDS tester (P. 5-13).
   - If you do not have the HDS tester, connect a digital tachometer (P. 3-22).
3) Set the SCS mode using the HDS tester.
   - If you do not have the HDS tester, disconnect the red 4P connector and connect (short-circuit) the SCS short connector to the DLC . (P. 5-57).
4) Start the engine and let it warm up with the gear in neutral.
5) Disconnect the IAC valve 2P connector and check the idle speed.

Specified idle speed	575 ± 30 min^{-1} (rpm)



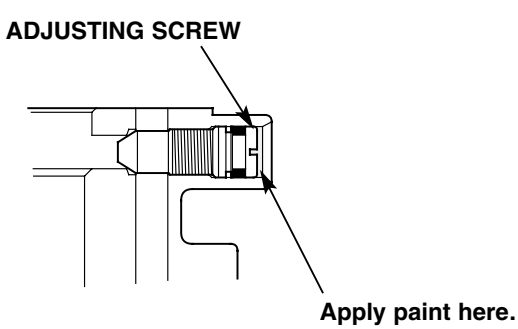
6) Adjust the idle speed by turning the adjusting screw.
   - If adjustment cannot be made, check each vacuum tube for disconnection and collapse, then check and clean the throttle body (P. 5-95).



7) After adjustment, connect the IAC valve 2P connector and clear the DTC (P. 5-14) or reset the ECM (P. 5-57).
8) Run the engine at idling for 5 minutes or more, then check the idle speed again.

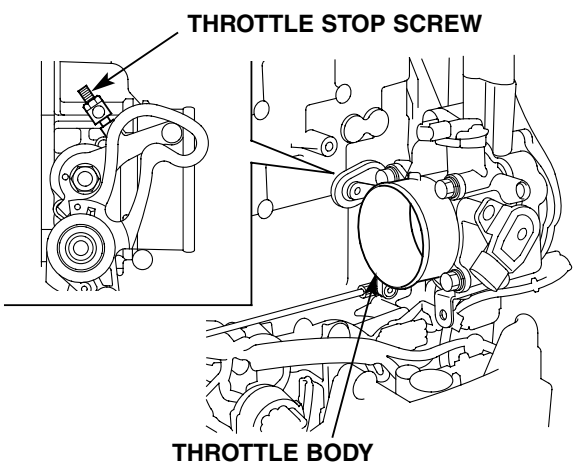
Specified idle speed	750 ± 50 min^{-1} (rpm)

9) If the idle speed is out of the specification, repeat the procedure from step 5) through step 8). If the idle speed is still out of the specification, replace the IAC valve. If the specified idle speed cannot be obtained yet, replace the ECM with a new one and recheck.
10) After adjustment, apply the paint (Nippon Paint Unipack #200 or equivalent) to the head of the adjusting screw.



• Throttle Body Inspection/Cleaning

1) Remove the engine cover.
2) Remove the intake air silencer (P. 5-128).
3) Turn the throttle cam and check the throttle valve for smooth movement and the throttle valve shaft for play.
4) Check that there is no gap between the throttle shaft stopper and the throttle stop screw.
   - The throttle stop screw cannot be adjusted. If it is faulty, replace the throttle body.

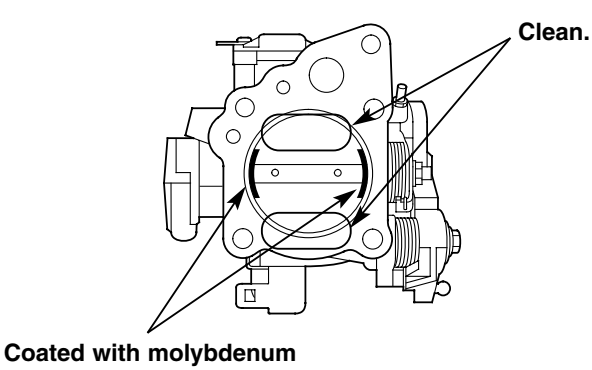


5) Check the throttle valve and bore for contamination. Clean if necessary.

NOTICE

- *Do not spray the carburetor cleaner directly to the throttle body.*
- *Use the genuine Honda carburetor cleaner.*
- *Do not wipe the throttle valve where is coated with the molybdenum (i.e. both ends of the throttle valve).*

6) Wipe the inner wall of the throttle bore and both ends of the throttle valve with a shop towel or equivalent material sprayed with the carburetor cleaner.



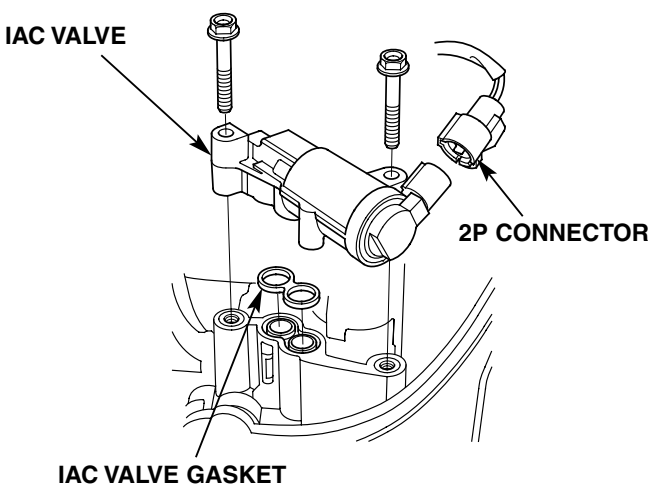
7) After cleaning, install the throttle rod and the silencer chamber (P. 5-135).

8) After assembly, check the idle speed and adjust if necessary (P. 5-94).

• IAC Valve Replacement

1) Remove the engine cover.

2) Turn the ignition switch OFF and disconnect the IAC valve 2P connector.



3) Apply the engine oil to the new IAC valve gasket and install it.

4) Install the IAC valve and tighten the 8 x 45 mm flange bolts securely.

5) Connect the IAC valve 2P connector securely.

6) Start the engine and let it warm up. Running the engine at idling, check the IAC valve for proper operation (idle speed inspection; see P. 3-22).

9. FUEL SUPPLY SYSTEM

• Troubleshooting

When the MIL does not come ON but an engine failure of either of the following symptoms occurs at the engine start or during idling, inspect the system(s) and part(s) in the numbered sequence.

Low pressure fuel supply system

• Hard to start

1. Water separator (P. 3-19)
2. Fuel strainer (low pressure side) (P. 3-15)
3. Fuel line (low pressure side) (P. 5-104)
4. Vapor separator (P. 5-111 thru. 5-127)

• Engine starts but stalls soon.

1. Water separator (P. 3-19)
2. Fuel strainer (low pressure side) (P. 3-15)
3. Fuel line (low pressure side) (P. 5-104)
4. Vapor separator (P. 5-111 thru. 5-127)

• Engine speed is not stable during idling and trolling, or engine stalls.

1. Water separator (P. 3-19)
2. Fuel strainer (low pressure side) (P. 3-15)

• Engine sometimes misfires or tends to stall.

1. Water separator (P. 3-19)
2. Fuel strainer (low pressure side) (P. 3-15)
3. Fuel line (low pressure side) (P. 5-104)
4. Fuel pump (low pressure side) (P. 5-142)

• Engine tends to stall at hot restart of the engine.

1. Vapor separator (P. 5-111 thru. 5-127)

High pressure fuel supply system

• Hard to start

1. Fuel line (high pressure side) (P. 5-104)
2. Fuel pump (high pressure side) (P. 5-107)
3. Fuel injector (P. 5-105)

• Engine starts but stalls soon.

1. Fuel line (high pressure side) (P. 5-104)
2. Fuel injector (P. 5-105)
3. Pressure regulator (P. 5-106)

• Engine speed is not stable during idling and trolling, or engine stalls.

1. Fuel line (high pressure side) (P. 5-104)
2. Fuel injector (P. 5-105)
3. Pressure regulator (P. 5-106)

• Engine speed does not increase

1. Fuel line (high pressure side) (P. 5-104)
2. Pressure regulator (P. 5-106)
3. Fuel pump (high pressure side) (P. 5-107)
4. Fuel strainer (high pressure side) (P. 3-18)
5. Fuel injector (P. 5-105)

• Engine sometimes misfires or tends to stall.

1. Water separator (P. 3-19)
2. Fuel injector (P. 5-105)
3. Fuel pump (high pressure side) (P. 5-107)
4. Pressure regulator (P. 5-106)

• PGM-FI Main Relay Harness Inspection

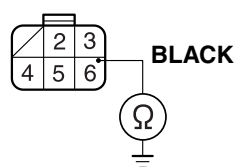
Check with test harness:

1. Turn the ignition switch OFF and disconnect each connector from the PGM-FI main relay.

2. Connect the test harness.
   • Disconnect the connector A, B and C from the ECM.

3. Check for the continuity between the No.6 (Black) terminal of the harness side 6P connector and the engine ground.

HARNESS SIDE 6P CONNECTOR

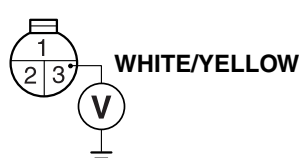


VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the PGM-FI main relay and the engine ground.
NO – Go to the step 4.

4. Measure the voltage between the No.3 (White/Yellow) terminal of the fuse box side 4P connector and the engine ground.

FUSE BOX SIDE 4P CONNECTOR



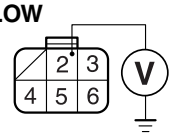
VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 5.
NO – Blown No.7 (30A) fuse, or open in the wire between the fuse box and the PGM-FI main relay.

5. Turn the ignition switch ON. Measure the voltage between the No.2 (Black/Yellow) terminal of the PGM-FI main relay harness side 6P connector and the engine ground.

PGM-FI MAN RELAY HARNESS SIDE 6P CONNECTOR

BLACK/YELLOW

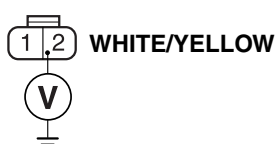


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 6.
NO – Blown No.3 (10A) fuse, or faulty ignition switch, or open in the wire between the PGM-FI main relay and the ignition switch.

6. Measure the voltage between the No.2 (White/Yellow) terminal of the harness side 2P connector and the engine ground.

PGM-FI MAIN RELAY HARNESS SIDE 2P CONNECTOR

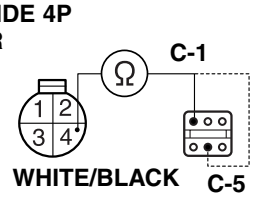


VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Go to the step 7.
NO – Blown No.3 (10A) fuse, or faulty ignition switch, or open in the wire between the PGM-FI main relay and the ignition switch.

7. Check for the continuity between the No.4 (White/Black) terminal of the fuse box side 4P connector and the respective terminals of the C-1 and C-5 terminals of the test harness.

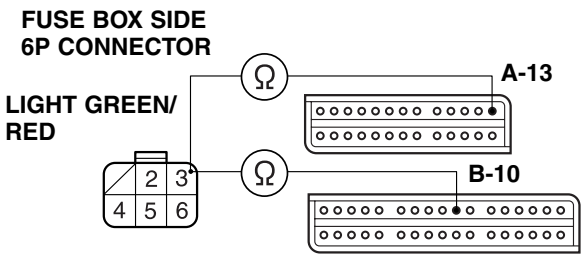
FUSE BOX SIDE 4P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

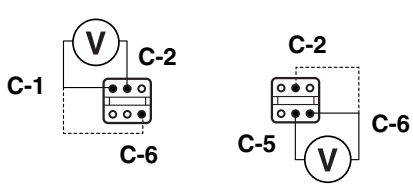
◆ Is there the continuity?
YES – Go to the step 8.
NO – Blown No.4 (15A) fuse, or open in the wire between the PGM-FI main relay and the No.4 (15A) fuse, or open in the wire between the No.4 (15A) fuse and the ECM.

8. Check for the continuity between the NO.3 (Light green/Red) terminal of the fuse box side 6P connector and the respective terminals of the test harness A-13 and B-10 terminals.



◆ Is there the continuity?
YES – Go to the step 9.
NO – Repair open in the wire between the PGM-FI main relay and the ECM.

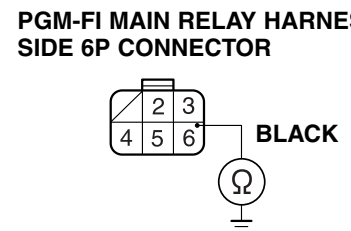
9. Turn the ignition switch ON. Measure the voltage between the test harness C-1 terminal (+) and the C-2/C-6 terminals (–), and between the C-5 terminal (+) and the C-2/C-6 (–) terminals.



◆ Is there the battery voltage?
YES – End of the check (Good)
NO – Replace the PGM-FI main relay.

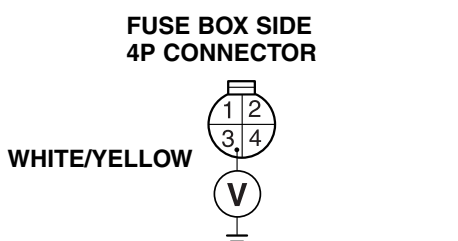
Check without test harness:

1. Turn the ignition switch OFF and disconnect each connector from the PGM-FI main relay.
2. Disconnect the ECM connectors A, B, and C.
3. Check for the continuity between the No.6 (Black) terminal of the harness side 6P connector and the engine ground.



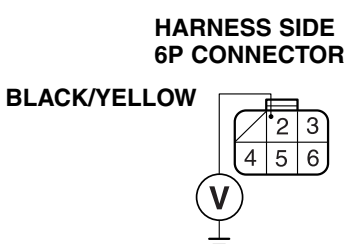
◆ Is there the continuity?
YES – Repair short in the wire between the PGM-FI main relay and the engine ground.
NO – Go to the step 4.

4. Measure the voltage between the No.3 (White/Yellow) terminal of the fuse box side 4P connector and the engine ground.



◆ Is there the battery voltage?
YES – Go to the step 5.
NO – Blown No.7 (30A) fuse, or open in the wire between the fuse box and the PGM-FI main relay.

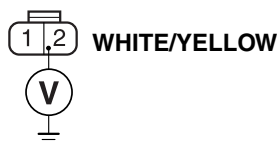
5. Turn the ignition switch ON. Measure the voltage between the No.2 (Black/Yellow) terminal of the harness side 6P connector and the engine ground.



◆ Is there the battery voltage?
YES – Go to the step 6.
NO – Blown No.3 (10A) fuse, or faulty ignition switch, or open in the wire between the PGM-FI main relay and the ignition switch.

6. Measure the voltage between the No.2 (White/Yellow) terminal of the harness side 2P connector and the engine ground.

HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

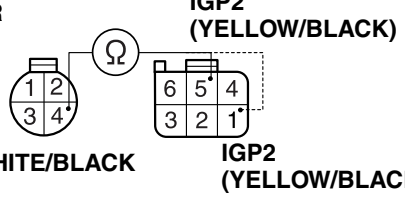
◆ Is there the battery voltage?
YES – Go to the step 7.
NO – Blown No.3 (10A) fuse, or faulty ignition switch, or open in the wire between the PGM-FI main relay and the ignition switch.

7. Check for the continuity between the fuse box side 4P connector and ECM connector terminals:

Fuse Box 4P connector		ECM connector C
No.4 (White/ Black)	—	No.1 (Yellow/Black)
No.4 (White/ Black)	—	No.5 (Yellow/Black)

ECM CONNECTOR C

FUSE BOX SIDE 4P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Go to the step 8.
NO – Blown No.4 (15A) fuse, or open in the wire between the PGM-FI main relay and the No.4 (15A) fuse, or open in the wire between the No.4 (15A) fuse and the ECM.

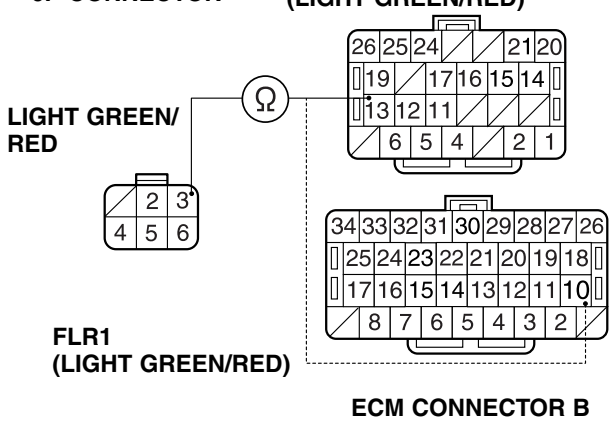
8. Check for the continuity between the terminals of the fuse box harness side 6P connector and ECM connectors A and B:

Fuse Box 6P connector		ECM connector A
No.3 (Light green/Red)	—	No.13 (Light green/Red)

Fuse Box 6P connector		ECM connector B
No.3 (Light green/Red)	—	No.10 (Light green/Red)

FUSE BOX HARNESS SIDE 6P CONNECTOR

ECM CONNECTOR A



ECM CONNECTOR B

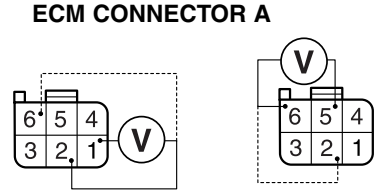
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Go to the step 9.
NO – Repair open in the wire between the PGM-FI main relay and the ECM.

9. Turn the ignition switch ON. Measure the voltage between the terminals of the ECM connector C:

No.1 (Yellow/Black) (+) — No. 2 (Green) (−)
No.1 (Yellow/Black) (+) — No. 6 (Green/red) (−)
No.5 (Yellow/Black) (+) — No. 2 (Green) (−)
No.5 (Yellow/Black) (+) — No. 6 (Green/Red) (−)

ECM CONNECTOR A



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – End of the check (Good)
NO – Replace the PGM-FI main relay.

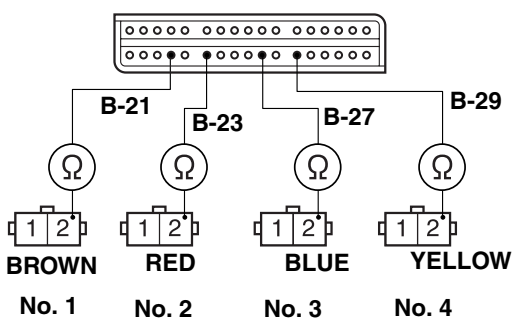
• Injector Harness Inspection

Check with test harness:

1. Turn the ignition switch OFF and disconnect each 2P connector from the respective injectors.

2. Connect the test harness.
   • Disconnect the connector A, B, and C from the ECM.

3. Check for the continuity between the test harness and each injector harness side 2P connector:
   B-21 — No.2 (Brown) of the No.1 injector
   B-23 — No.2 (Red) of the No.2 injector
   B-27 — No.2 (Blue) of the No.3 injector
   B-29 — No.2 (Yellow) of the No.4 injector

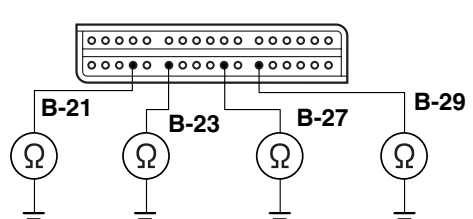


INJECTOR HARNESS SIDE 2P CONNECTORS

VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Go to the step 4.
NO – Repair open in the wire between the injector and ECM.

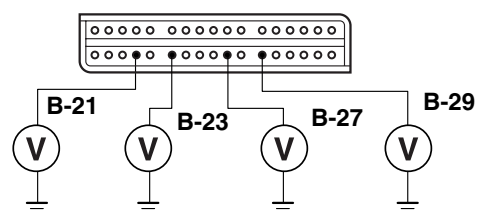
4. Check for the continuity between the test harness and engine ground:
   B-21 terminal and the engine ground,
   B-23 terminal and the engine ground
   B-27 terminal and the engine ground
   B-29 terminal and the engine ground.



◆ Is there the continuity?
YES – Repair open in the wire between the ECM and the injector
NO – Go to the step 5.

5. Connect each injector 2P connector.

6. Turn the ignition switch ON. Check for the voltage between the test harness and engine ground:
   B-21 terminal and the engine ground
   B-23 terminal and the engine ground
   B-27 terminal and the engine ground
   B-29 terminal and the engine ground



◆ Is there the battery voltage?
YES – End of the check (Good)
NO – Check the injector (P. 5-105). If it is normal, repair open in the wire between the No.4 (15A) fuse and the injector.

Check without test harness:

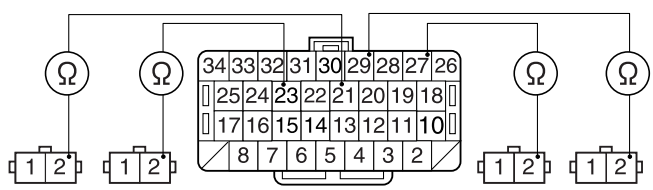
1. Turn the ignition switch OFF and disconnect the 2P connector from the respective injectors.

2. Disconnect the ECM connector B and C.

3. Check for the continuity between the ECM connector B and each injector harness side 2P connector:

   ECM connector B — Injector
   No.21 (Brown) — No.2 (Brown) of the No.1 injector
   No.23 (Red) — No.2 (Red) of the No.2 injector
   No.27 (Blue) — No.2 (Blue) of the No.3 injector
   No.29 (Yellow) — No.2 (Yellow) of the No.4 injector

ECM CONNECTOR B



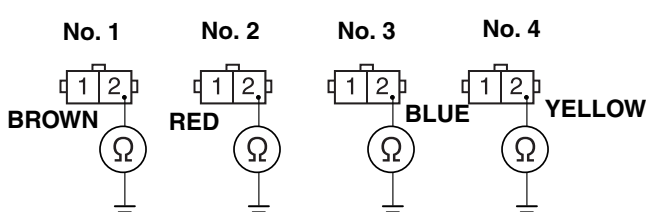
INJECTOR HARNESS SIDE 2P CONNECTORS

VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Go to the step 4.
NO – Repair open in the wire between the injector and the ECM.

4. Check for the continuity between the injector harness side 2P connector terminal and engine ground:
   No.2 (Brown) of No.1 injector and engine ground.
   No.2 (Red) of No.2 injector and engine ground.
   No.2 (Blue) of the No.3 injector and engine ground.
   No.2 (Yellow) of the No.4 injector and engine ground

INJECTOR HARNESS SIDE 2P CONNECTORS



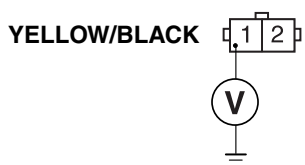
VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair open in the wire between the ECM and the injector.
NO – Go to the step 5.

5. Connect the injector 2P connector.

6. Turn the ignition switch ON. Measure the voltage between the No.1 (Yellow/Black) terminal of each injector harness side terminal and the engine ground.

INJECTOR HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – End of the check (Good)
NO – Check the injector (P. 5-105). If it is normal, repair open in the wire between the No.4 (15A) fuse and the injector.

• How To Relive Fuel Pressure

⚠WARNING

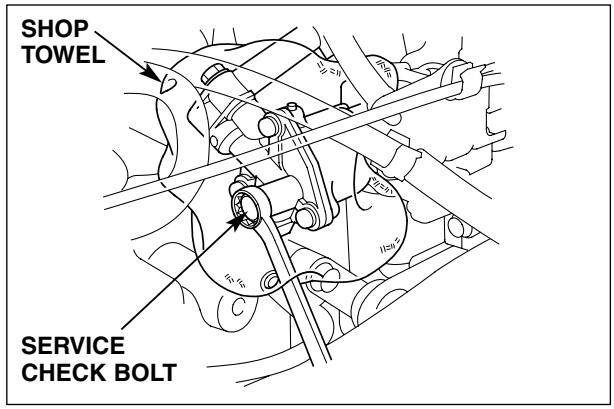
Gasoline is highly flammable and explosive.

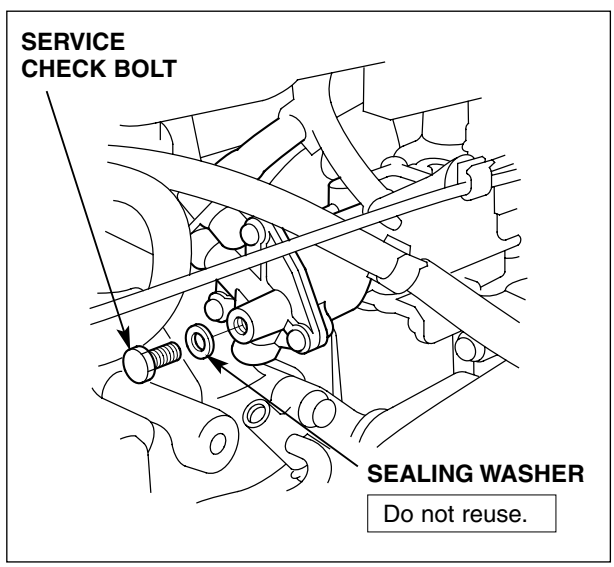
You can be burned or seriously injured when handling fuel.

- 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.

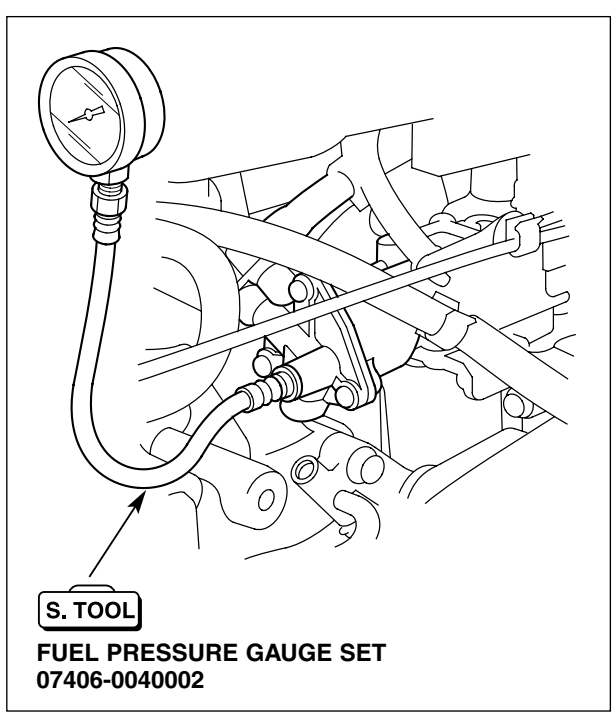
1) Remove the engine cover (P. 4-2).
2) Set an offset wrench on the 6 mm service check bolt of the vapor separator. Place a shop towel or equivalent material over the service check bolt.
3) Loosen the service check bolt approximately one turn slowly to relieve the fuel pressure.
4) After relieving the fuel pressure, remove the service check bolt and replace the 6 mm sealing washer with a new one.
5) 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 relive fuel pressure” explained above.
2) Remove the service check bolt and set the special tool (fuel pressure gauge set) in the threaded bolt hole.



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

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

Standard fuel pressure (At idle speed of 650 ± 50 min^{-1} /rpm)	270 – 320 kPa (2.8 – 3.3 kgf/cm^2, 39.8 – 46.9 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, collapse or restrictions.
- Check the pressure regulator for proper operation (Inspection: P. 5-106).

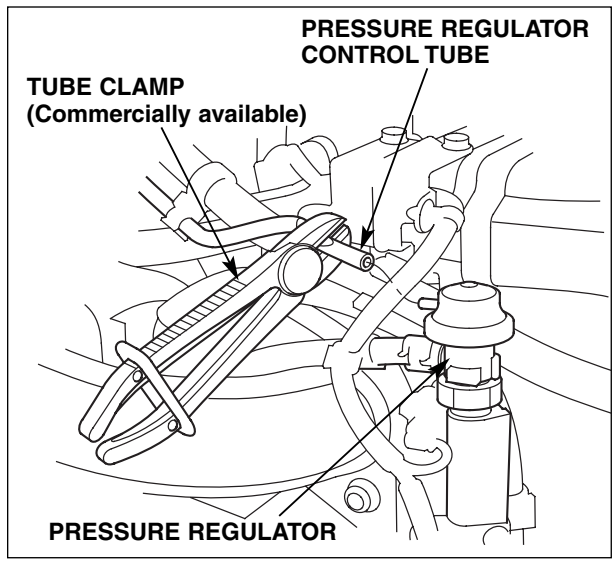
When the fuel pressure is lower than the standard pressure:

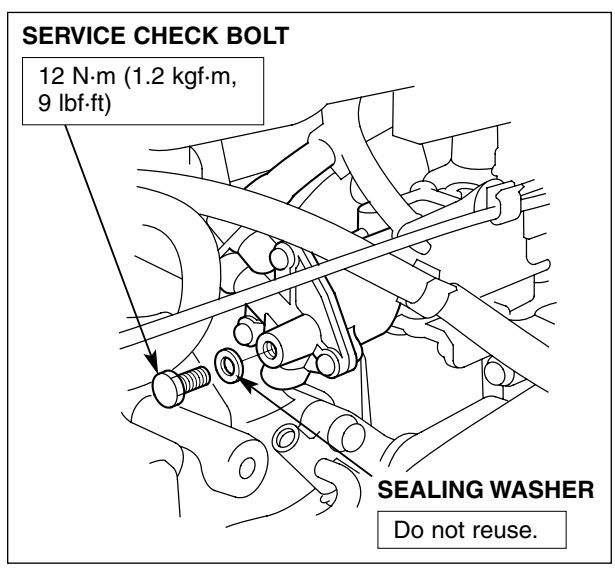
- Check the pressure regulator for proper operation (Inspection: P. 5-106).
- Check the high pressure side fuel strainer for clogging (Replacement: P.3-18).
- Check the high pressure side fuel pump for proper operation (Inspection: P. 5-107).

6) After check, replace the sealing washer with a new one and tighten the service check bolt to the specified torque.

TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

7) Connect the vacuum tube to the pressure regulator.





• Fuel Line Inspection

⚠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.

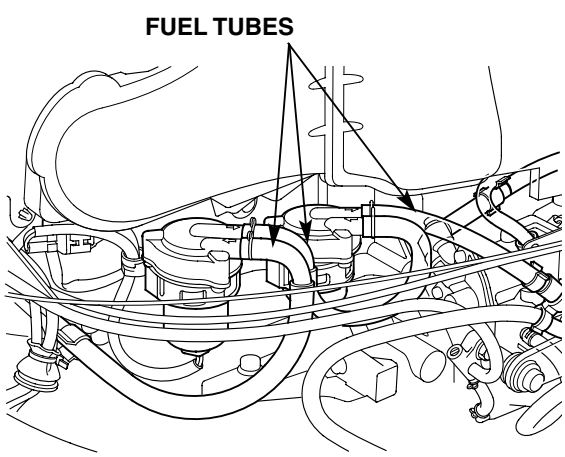
1) Check the fuel pipe, fuel hose, pressure regulator return hose and the fuel tube for damage, gasoline leakage, rust and other abnormalities.

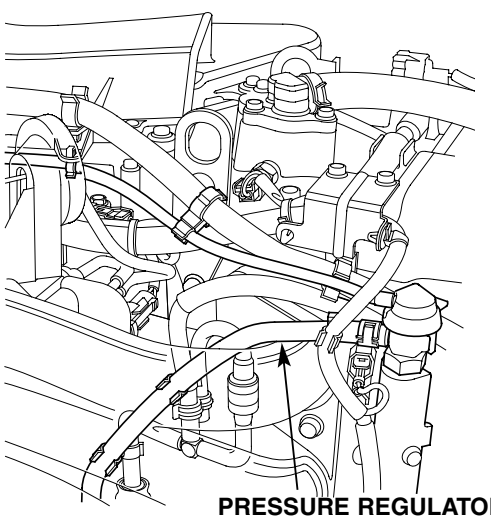
   Check that the hoses and tubes are not interfering with the neighboring pars.

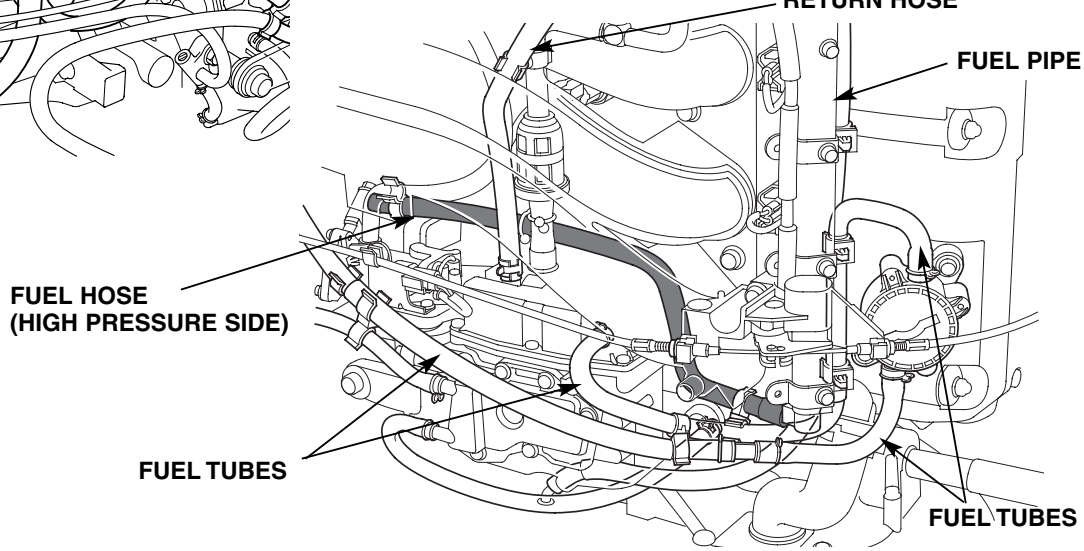
2) Replace the hose or tube if there is damage, gasoline leakage, rust, etc.

   Note the following on replacement.

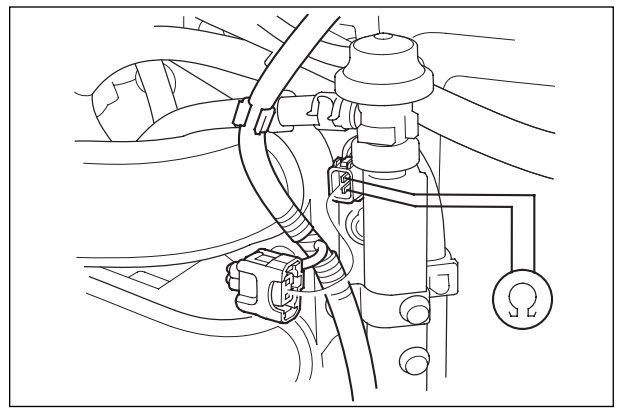
   - Relieve the fuel pressure according to "How to relive fuel pressure" (P. 5-102), then replace the fuel pipe, hoses and tube.
   - Replace the O-rings with the new ones. Apply the engine oil to the O-rings before installation.







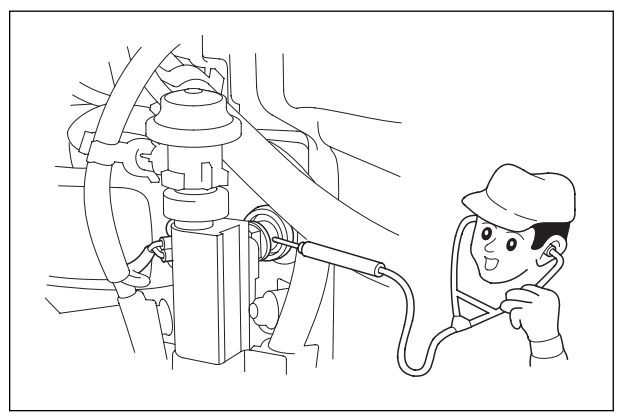
• Fuel Injector Inspection



When the engine is hard to start:

1) Disconnect the fuel injector connector and measure the resistance between the terminals.

2) If the fuel injector is normal, check the following
   - No.7 (10A) fuse
   - No.4 (15A) fuse
   - Open or short circuit in the injector harness (between ECM, injectors and No.4 fuse) (P. 5-100).



When the engine starts:

1) Start the engine and warm it up.

2) With the engine running at 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.

3) With the engine running at 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 with a new one and recheck.

4) If no abnormality is detected, replace the ECM.

• Pressure Regulator Inspection

⚠ 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 the fuel pressure is lower than the specified standard pressure, check the high pressure side fuel pump (P. 5-107), then check the pressure regulator.

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

2) Remove the service check bolt. Set the special tool (fuel pressure gauge set) in the threaded bolt hole.

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

4) With the engine idling, disconnect the pressure regulator control tube from the pressure regulator and clamp it.

5) Check the fuel pressure. It should be higher than the pressure measured with the vacuum tube connected.

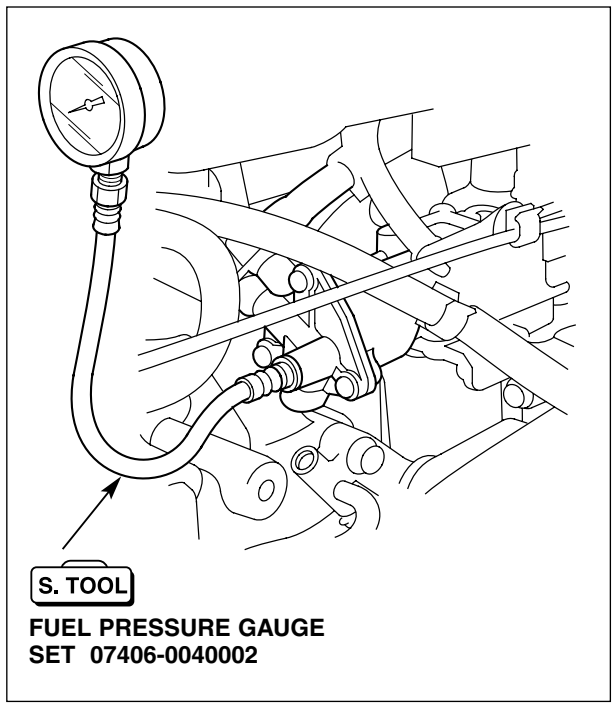
Standard fuel pressure (At idle speed of 650 ± 50 min^{-1} /rpm)	270 – 320 kPa (2.8 – 3.3 kgf/cm^2, 40 – 47 psi)

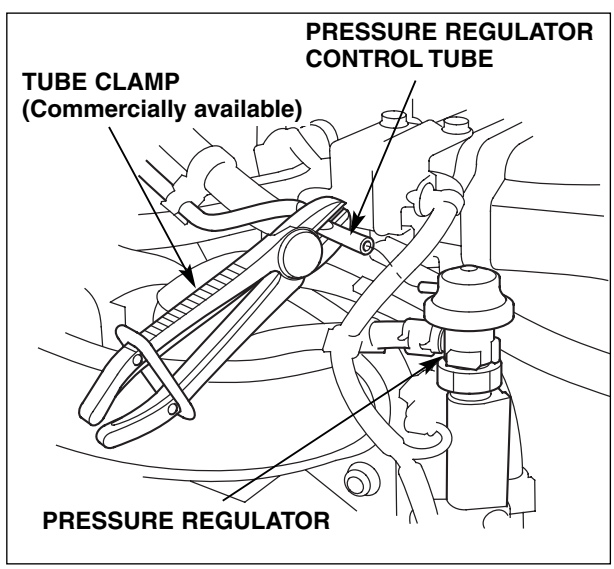
6) When the fuel pressure does not rise, connect the vacuum tube to the pressure regulator. Pinch the pressure regulator return hose that goes from the pressure regulator to the vapor separator a couple of times lightly, and measure the fuel pressure again.

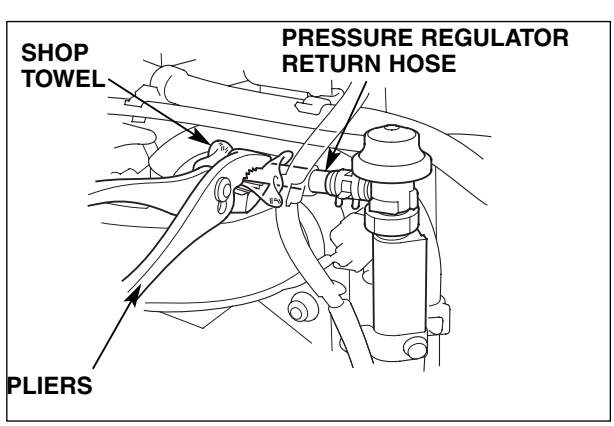
NOTICE

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

7) If the measurement is outside the specified standard pressure, replace the pressure regulator (P. 5-136).







• Fuel Pump (High pressure side) Inspection

⚠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.

- Turn the ignition switch OFF before disconnecting and connecting the connectors.
- Use a known-good battery.

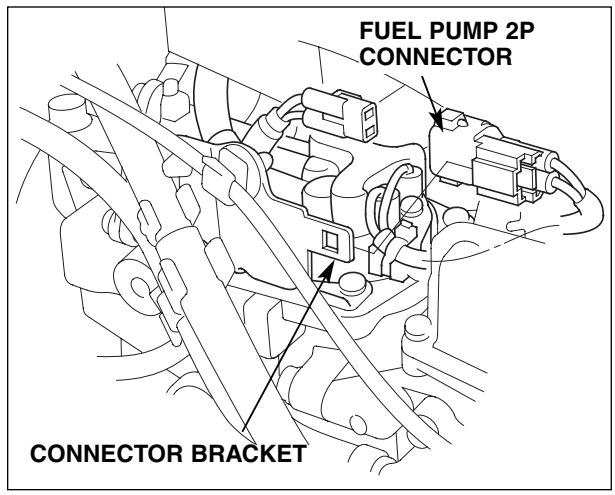
1) Remove the engine cover (P. 4-2).

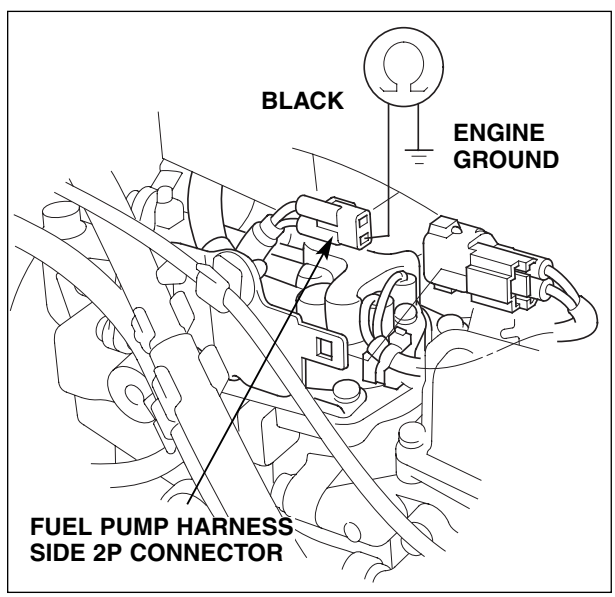
2) Turn the ignition switch ON. Check that the fuel pump operation sound can be heard for approximately 2 seconds.
   ◆ Is there the fuel pump operation sound?
   YES – Check the gasoline discharge volume.
   NO – Go to the step 3.

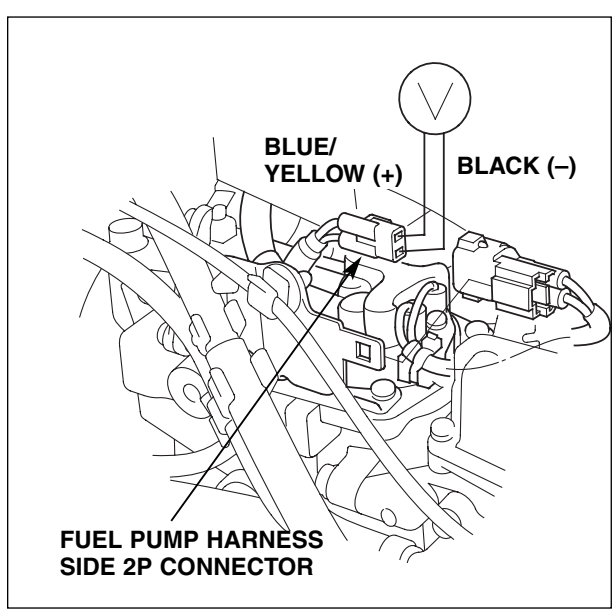
3) Remove the high pressure side fuel pump 2P connector from the connector bracket, and disconnect the connector.

4) Measure the voltage between the Black terminal of the harness side connector and the body ground.
   ◆ Is there the continuity?
   YES – Check the gasoline discharge volume.
   NO – Go to the step 5.

5) Attach the positive (+) tester lead to the Blue/Yellow (+) terminal and the negative (–) tester lead to the Black (–) terminal of the harness side connector. Turn the ignition switch ON and be sure that there is battery voltage for approximately 2 seconds.
   ◆ Is there the battery voltage?
   YES – Check the gasoline discharge volume (P. 5-108).
   NO – Check the PGM-FI main relay harness (P. 5-97).







• Discharge Volume Check

⚠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.

• Use a known-good battery for discharge volume check.

1) Turn the ignition switch OFF.

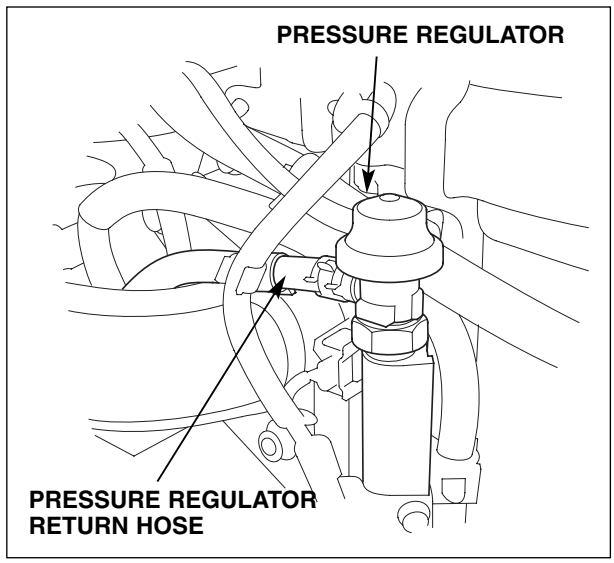
2) Disconnect the pressure regulator return hose from the pressure regulator, and connect a hose that is equivalent to the pressure regulator return hose to the pressure regulator.

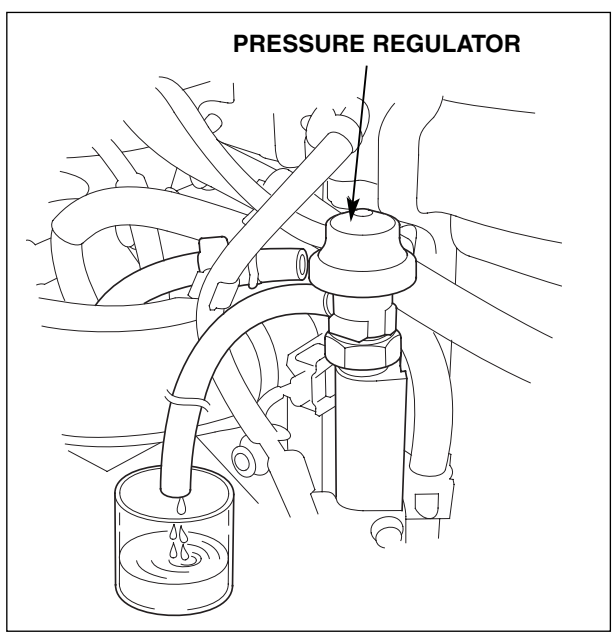
3) Turn the ignition switch ON. Operate the fuel pump for approximately 2 seconds and measure the gasoline discharge volume.

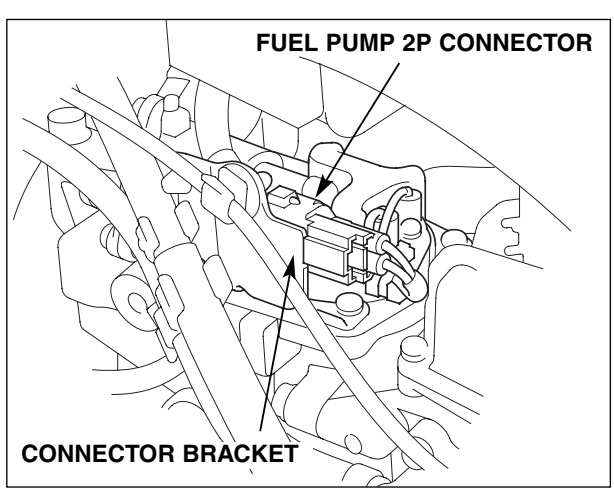
Standard discharge volume	45 cc (4.75 cu in) or more

4) If gasoline is not discharged or the discharge volume is too small, check the following and replace the fuel pump (P. 5-121).
   - Clogged high pressure side fuel filter
   - Clogged high pressure side fuel hose/pipe
   - Faulty pressure regulator

5) If the high pressure side fuel pump is normal, connect the 2P connector. Set the connector on the connector bracket.





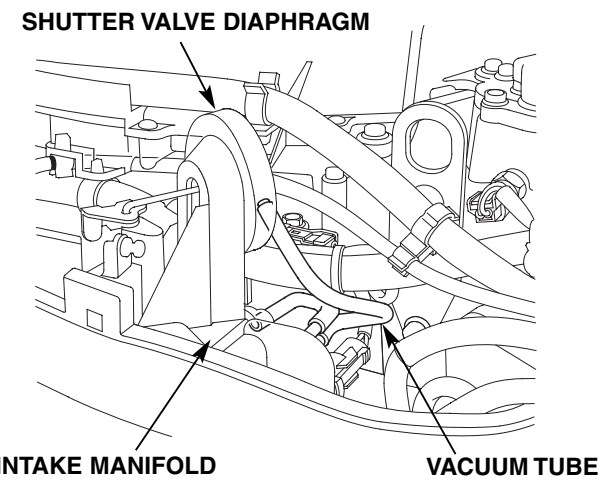


10. IAB (Intale Air Bypass) CONTROL SYSTEM

• IAB Control Valve Inspection

1. Vacuum line check

-1. Check the vacuum tubes between the shutter valve diaphragm and IAB control valve, and between the solenoid valve and intake manifold.



◆ Are the tubes disconnected, torn or clogged?
YES – Replace the vacuum tubes.
NO – Perform "2. Operation check at idling".

2. Operation check at idling

-1. Start the engine and let it warm up. Run the engine at idling.
-2. Disconnect the vacuum tube from the shutter valve diaphragm, and check the vacuum.

◆ Is there the vacuum?
YES – Perform “5. Operation check at engine stop and at high engine speed”.
NO – Go to the step 3.

-3. Disconnect the vacuum tube underside the IAB control valve, and check the vacuum.

◆ Is there the vacuum?
YES – Perform "3. IAB control valve check".
NO - • Faulty vacuum chamber
• Faulty check valve

3. IAB control valve check

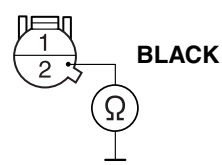
-1. Connect the vacuum tubes.
-2. Disconnect the IAB control valve 2P connector while running the engine at idling.
-3. Check the vacuum tube located above the IAB control valve for vacuum.

◆ Is there the vacuum?
YES – Perform "4. Ground line short circuit check".
NO – Replace the IAB control valve.

4. Ground line short circuit check

-1. Turn the ignition switch OFF. Disconnect the ECM connector A and the IAB control valve 2P connector.
-2. Check for the continuity between the No.2 (Black) terminal of the IAB control valve harness side 2P connector and the engine ground.

IAB CONTROL VALVE HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the continuity?
YES – Repair short in the wire between the ECM and the IAB control valve.
NO – Substitute a known-good ECM and recheck.

5. Operation check at engine stop and at high engine speed

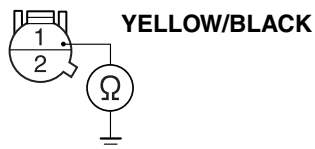
-1. Start the engine and run it at idling. Stop the engine and check the shutter valve diaphragm side vacuum tube for the vacuum.

◆ Is the vacuum removed?
YES – Perform shutter valve diaphragm check (P. 5-110).
NO – Perform "6. Signal line open circuit check".

6. Signal line open circuit check

-1. Turn the ignition switch OFF and disconnect the IAB control valve 2P connector.
-2. Turn the ignition switch ON. Measure the voltage between the No.1 (Yellow/Black) terminal of the IAB control valve harness side 2P connector and the engine ground.

IAB CONTROL VALVE HARNESS SIDE 2P CONNECTOR



VIEWED FROM THE TERMINAL SIDE

◆ Is there the battery voltage?
YES – Perform "7. IAB control valve check".
NO – Repair open in the wire between the ECM and the IAB control valve

7. IAB control valve check

-1. Turn the ignition switch OFF. Disconnect the IAB control valve 2P connector.
-2. Measure the resistance between the IAB control valve side 2P connector terminals.

◆ Is the resistance 37 – 44 Ω ?
YES – Substitute a known-good ECM and recheck.
NO – Replace the IAB control valve.

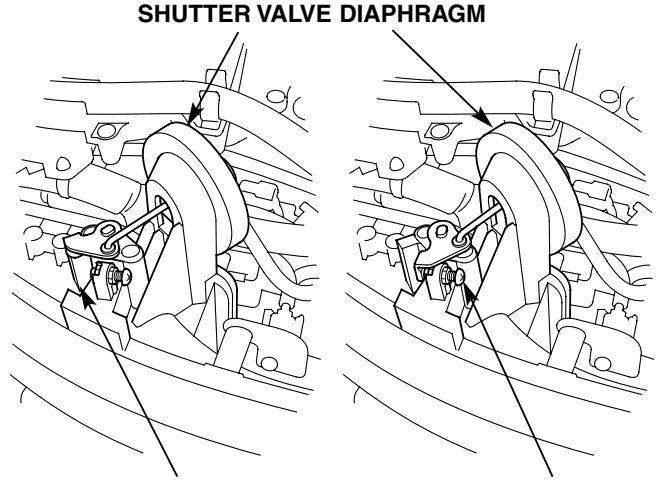
• Shutter Valve Diaphragm Inspection

NOTICE

- *Do not try to adjust the full close stop screw.*
- *Note that the shutter valve diaphragm must not be disassembled. If replacement is necessary, replace as an assembly of the intake manifold assembly.*

1) Check the following.
   - Check the shutter valve shaft for play and the stuck shaft.
   - Check the shutter valve for smooth movement from the full open to the full close positions.
   - Check there is no clearance between the full close screw and the full close stopper when the shutter valve is in the full close position.
   - Move the shutter valve to the full open position and check that the shutter valve contacts the full open stopper.

SHUTTER VALVE DIAPHRAGM



FULL OPEN STOPPER **STOP SCREW**

2) If there is any abnormality, clean the shutter valve diaphragm with a contact cleaner and recheck.
   If it is still abnormal, replace the intake manifold assembly.

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

a. REMOVAL

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

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

- Relieve the fuel pressure before removing the vapor separator.
- Disconnect the battery cable from the battery negative (–) terminal before relieving the fuel pressure.
- Replace the sealing washer with a new one whenever the service check bolt was loosened or removed.

1) Remove the engine cover and the L. engine under cover.

2) Relieve the fuel pressure (P. 5-102).

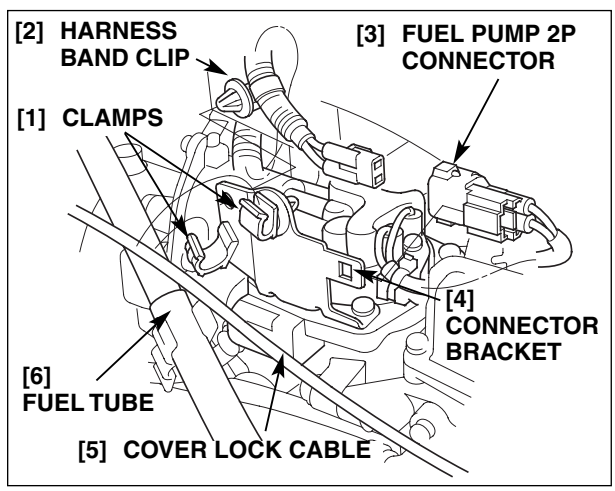
3) Remove the high pressure side fuel pump 2P connector from the connector bracket and disconnect the connector.

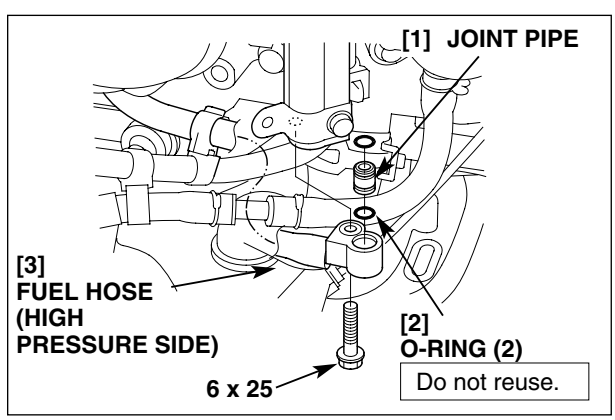
4) Remove the harness band clip from the connector bracket.

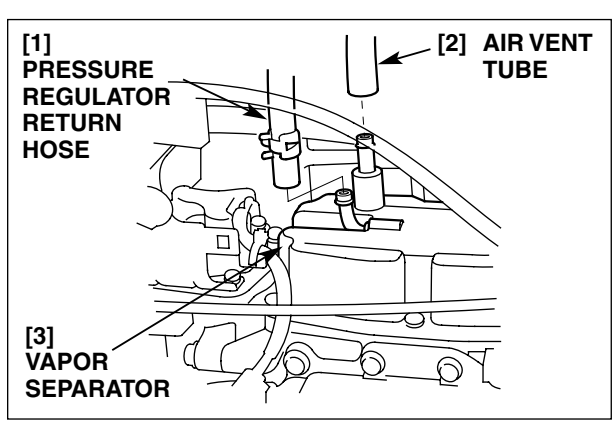
5) Unclamp the cover lock cable and the fuel tube.

6) Remove the 6 x 25 mm flange bolt and disconnect the high pressure side fuel hose. Remove the joint pipe and the O-ring.
   - Replace the O-ring with a new one.

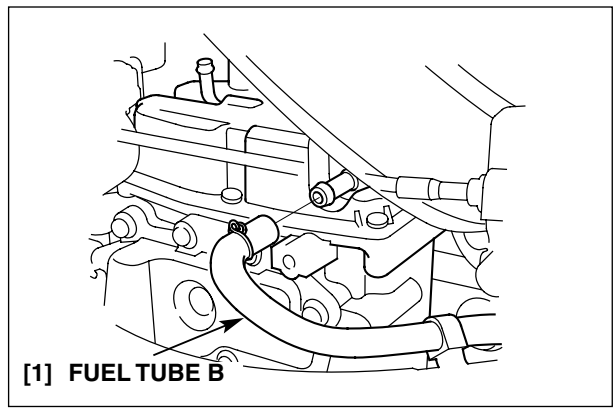
7) Disconnect the air vent tube and the pressure regulator return hose from the vapor separator.



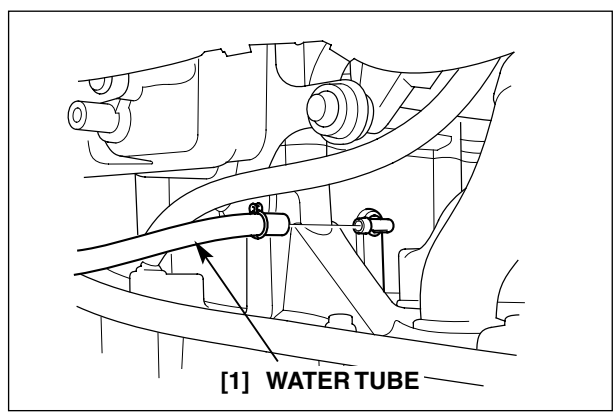




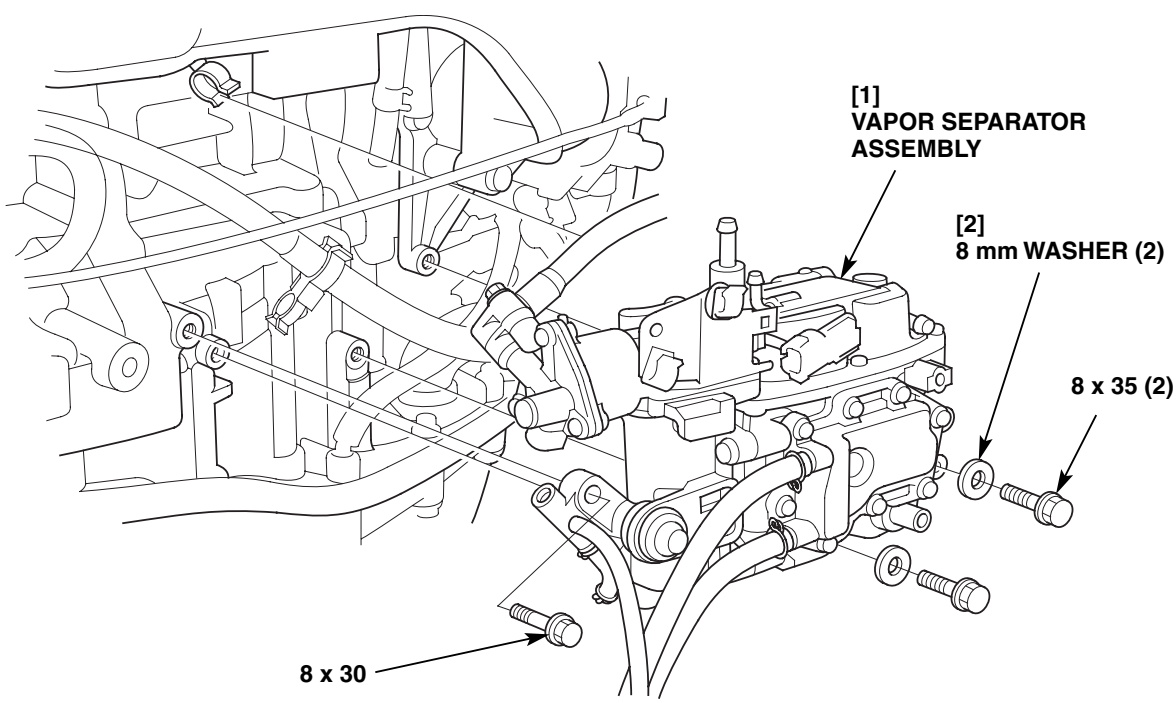
8) Disconnect the fuel tube B from the low pressure side fuel pump.



9) Disconnect the water tube from the crankcase.

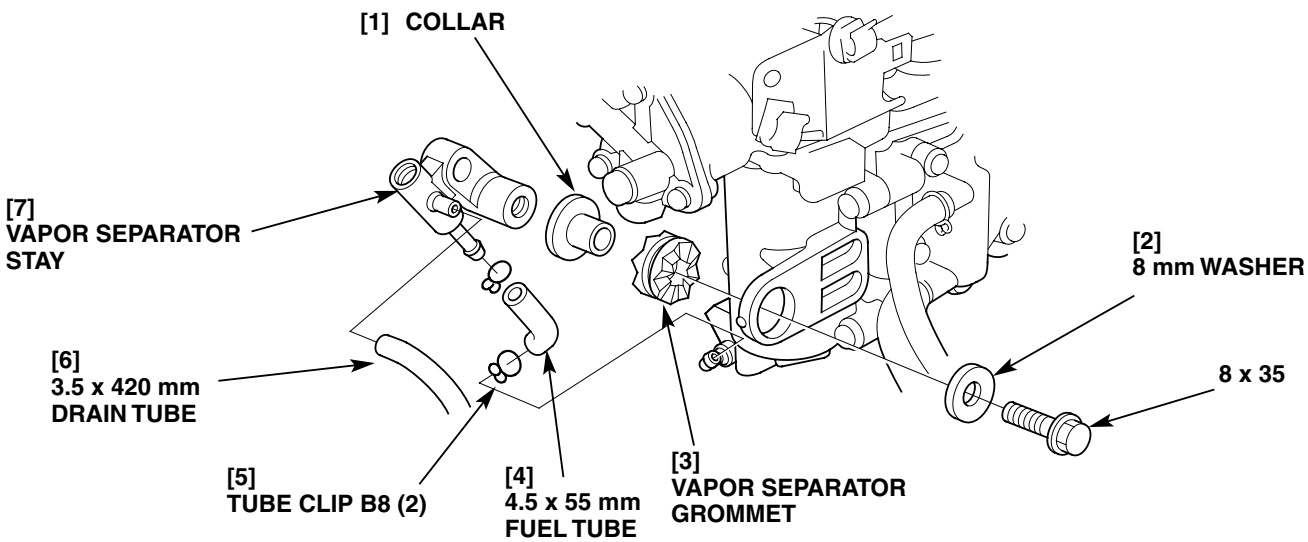


10) Remove the two 8 x 35 mm flange bolts, two 8 mm washers, and one 8 x 30 mm flange bolt. Remove the vapor separator assembly.

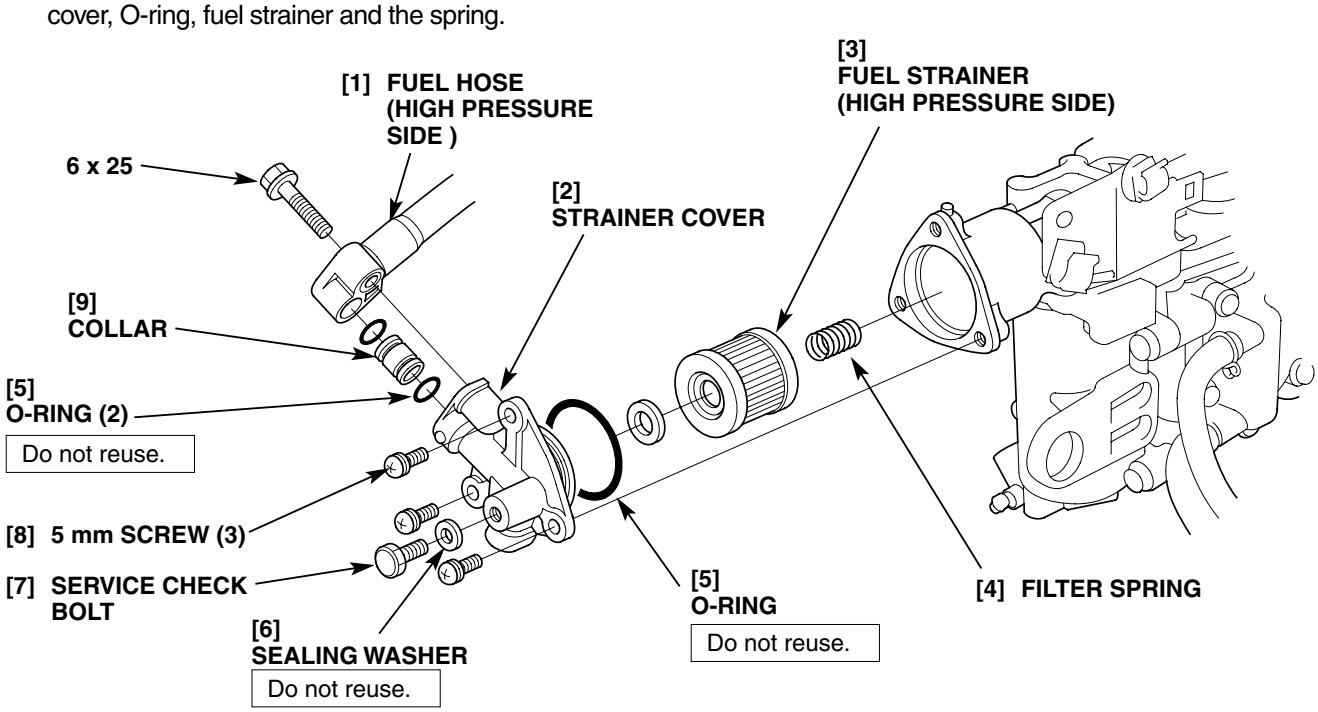


b. DISASSEMBLY

1) Disconnect the 4.5 x 55 mm fuel tube.
2) Remove the 8 x 35 mm flange bolt and the 8 mm washer. Remove the vapor separator stay.
3) Remove the collar and the vapor separator grommet.



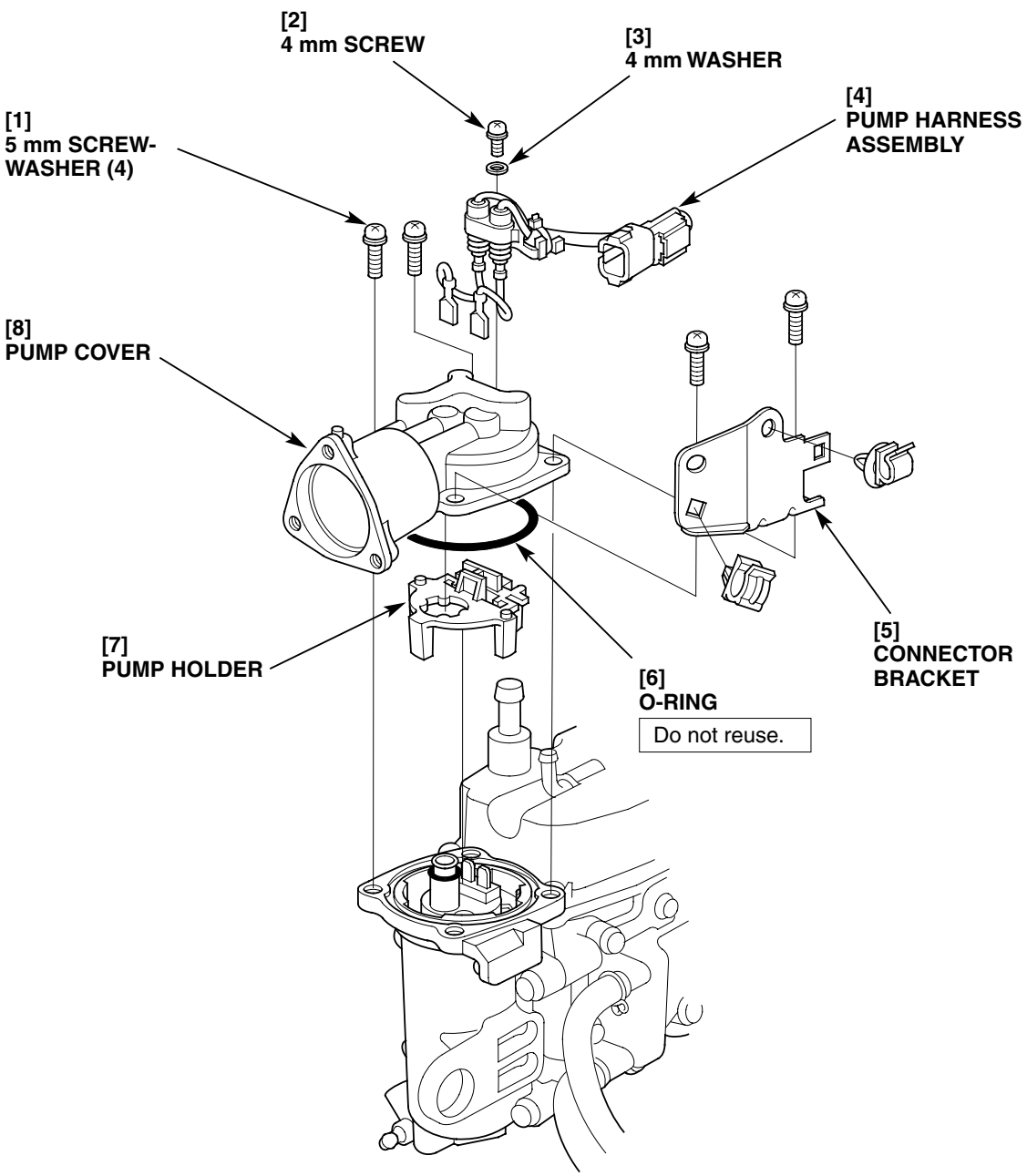
4) Remove the 6 x 25 mm flange bolt and remove the high pressure side fuel hose.
5) Remove the collar and the O-rings.
   Replace the O-rings on assembly.
6) Remove the three 5 mm screws and remove the strainer cover, O-ring, fuel strainer and the spring.



7) Remove the four 5 mm screw-washers. Remove the connector bracket and pump cover.
8) Remove the O-ring from the pump cover and discard it. Replace the O-ring with a new one on assembly.

9) Remove the pump holder.

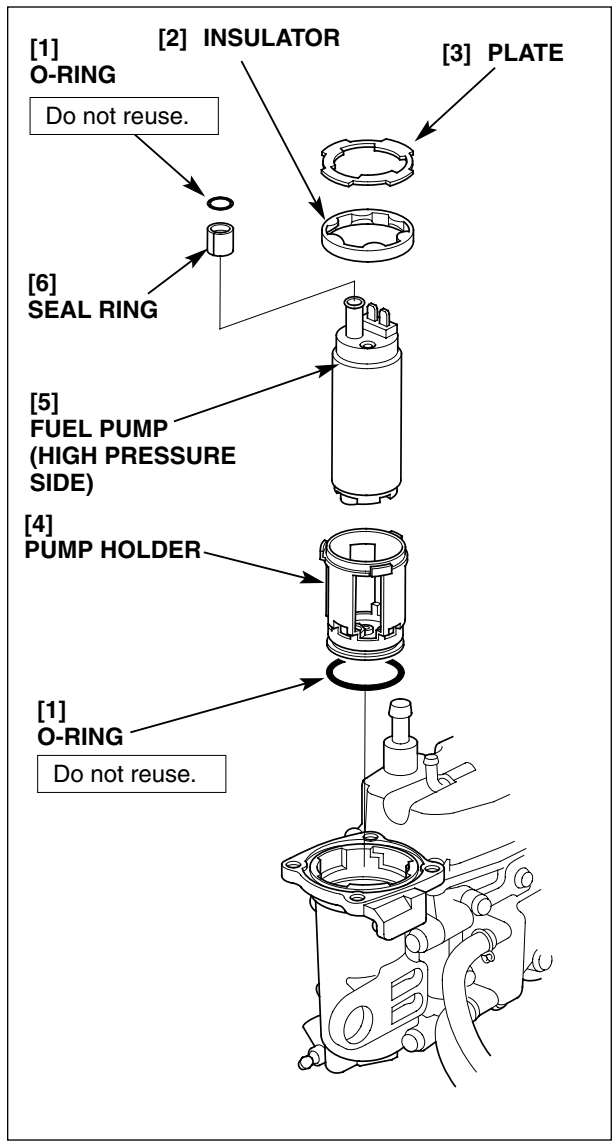
10) Remove the 4 mm screw and 4 mm washer, then remove the pump harness assembly.



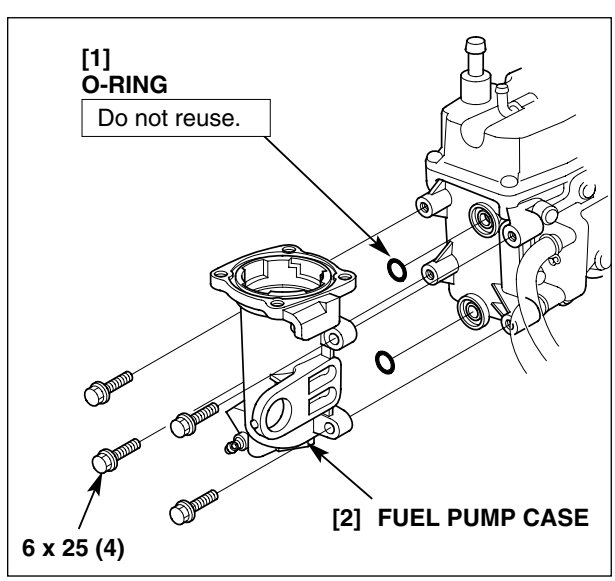
11) Remove the O-ring and the seal ring.
Replace the O-ring with a new one on assembly.

12) Remove the plate and the insulator.

13) Remove the high pressure side fuel pump, pump holder and the O-ring.
Replace the O-ring with a new one on assembly.

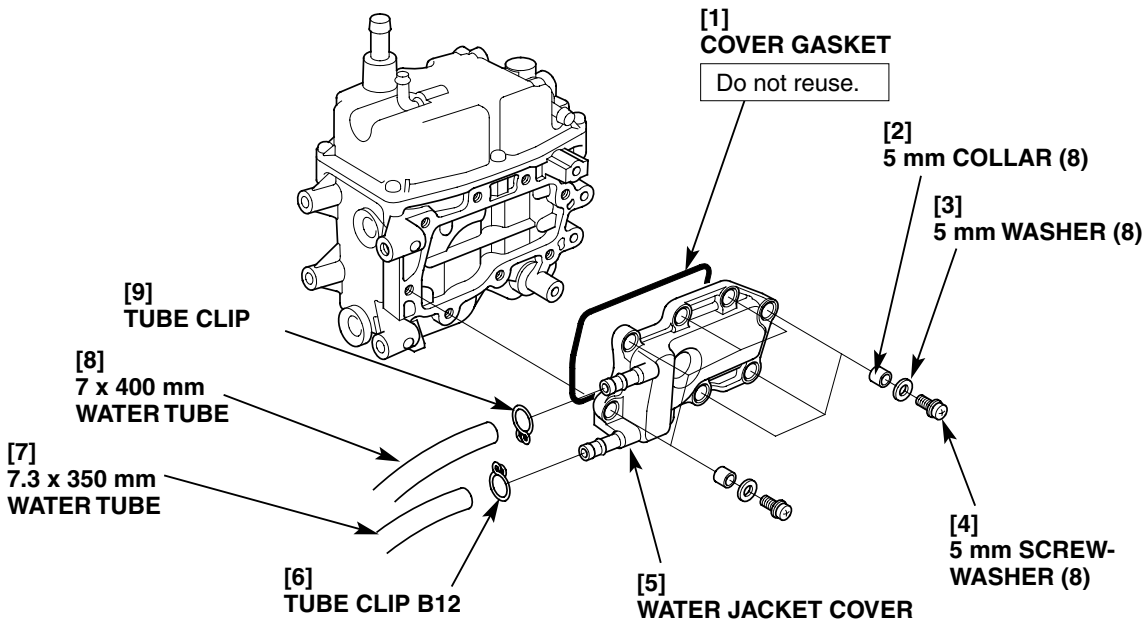


14) Remove the four 6 x 25 mm flange bolts. Remove the fuel pump case and the two O-rings.
Replace the O-rings with the new ones on assembly.



15) Remove the eight 5 mm screw-washers and the eight 6 mm washers. Remove the water jacket cover and the cover gasket.

Replace the cover gasket with a new one on assembly.

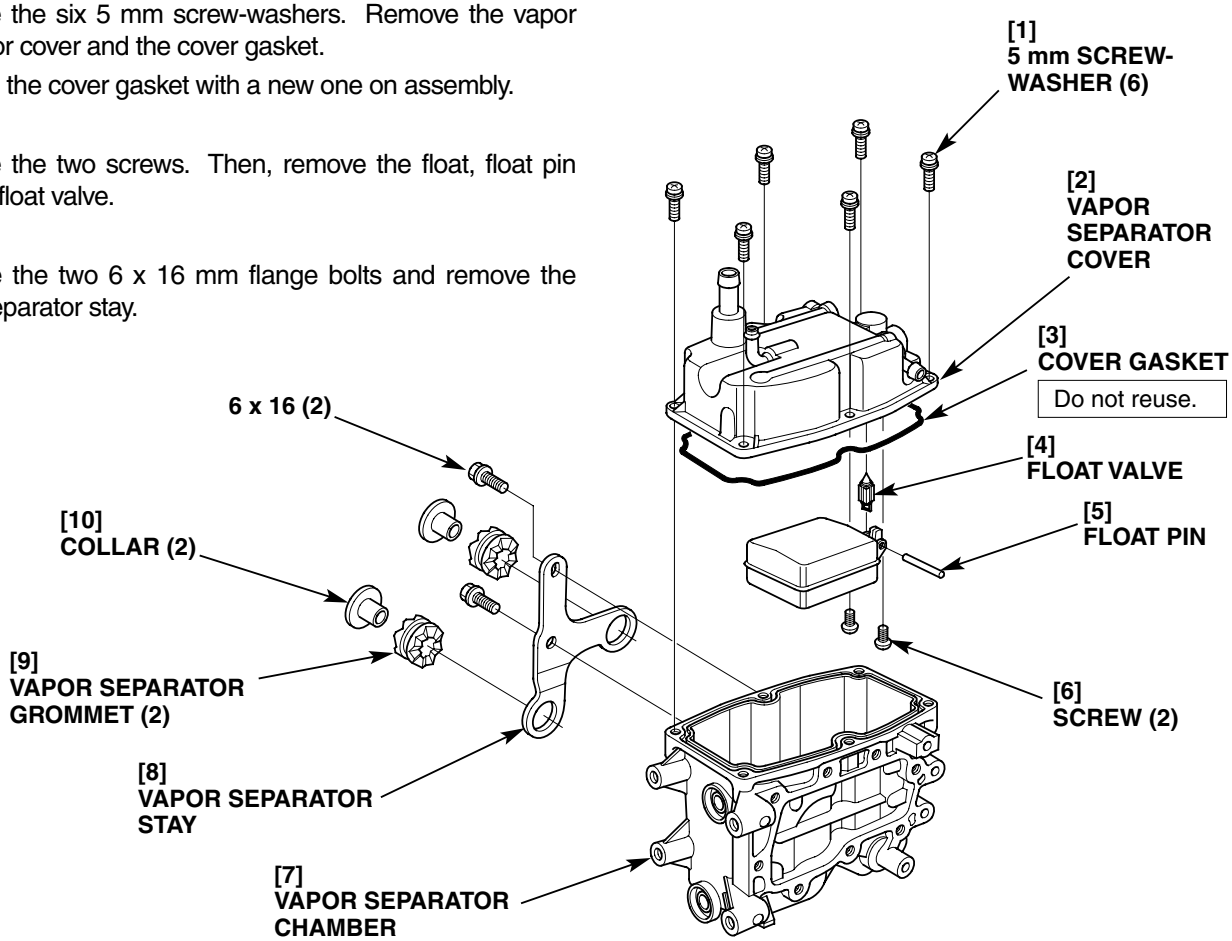


16) Remove the six 5 mm screw-washers. Remove the vapor separator cover and the cover gasket.

Replace the cover gasket with a new one on assembly.

17) Remove the two screws. Then, remove the float, float pin and the float valve.

18) Remove the two 6 x 16 mm flange bolts and remove the vapor separator stay.



c. INSPECTION

FLOAT HEIGHT

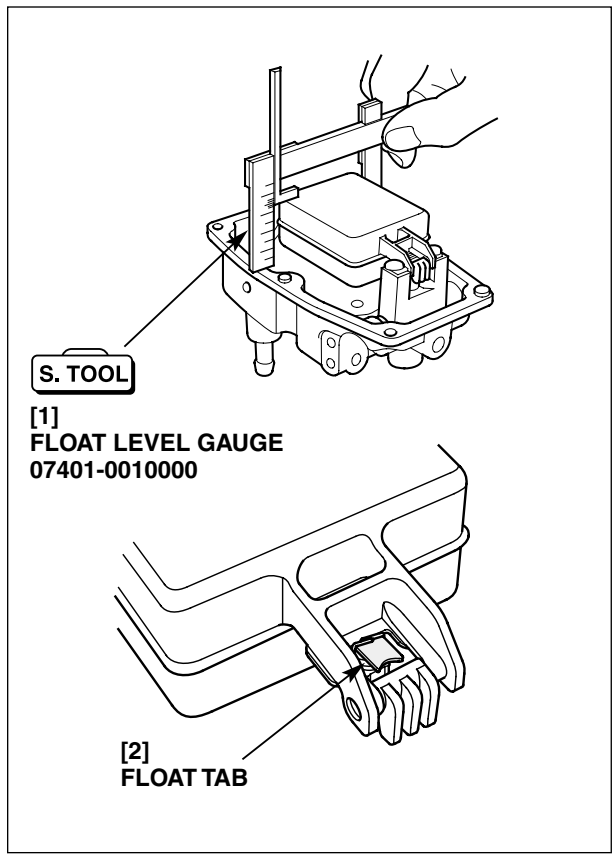
• Check the float height by installing the float properly.

1) Place the vapor separator cover as shown. Measure the distance between the float and vapor separator cover (i.e. float height).
   • Set the special tool at right angles to the float chamber mating surface and measure at the highest position of the float.

Float height	31 ± 2.5 mm (1.22 ± 0.10 in)

2) If the float height is out of the specification, check the float valve and valve seat for wear and damage.

3) If the float valve and valve seat are normal, adjust the float height by gently bending the brass float tab taking care not to damage the float.

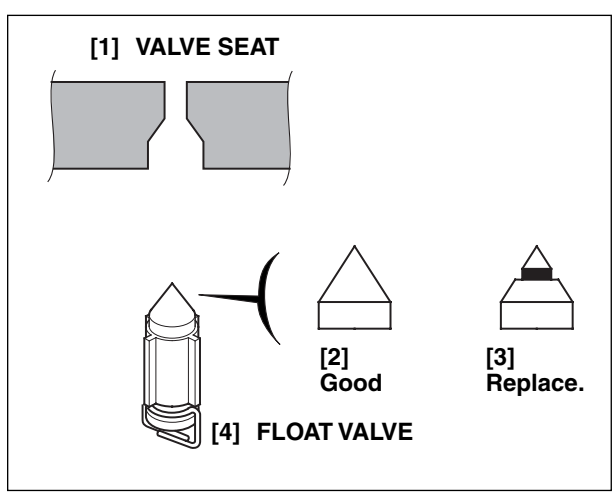


• FLOAT

Check the float for damage and deformation, and check for the gasoline in the float. Check the float for smooth movement.

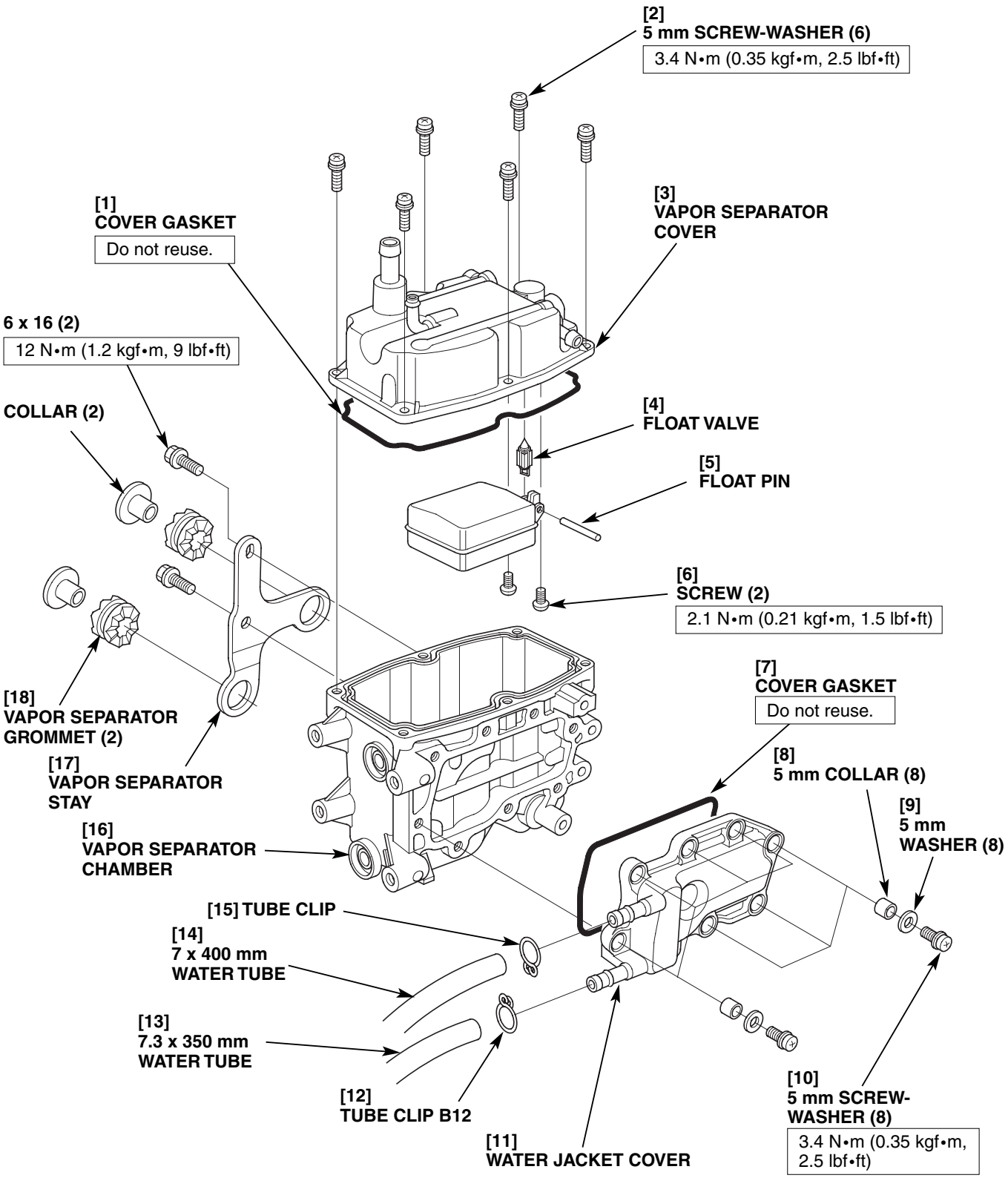
• FLOAT VALVE/VALVE SEAT

Check the float valve head and the float valve seat for scores, scratches, wear and damage.



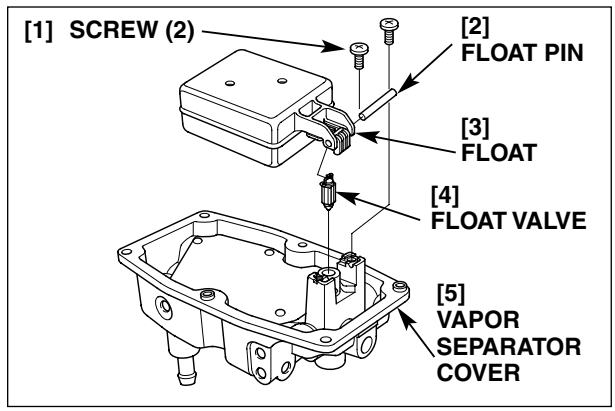
d. ASSEMBLY

• Vapor Separator Chamber



1) Install the float valve and float pin to the float.

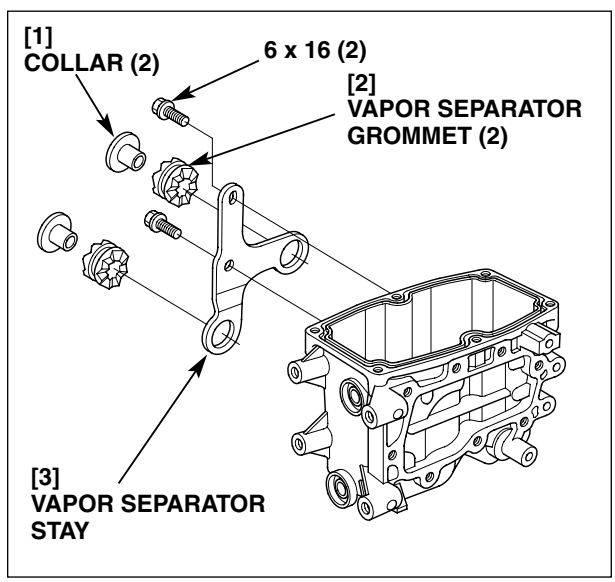
2) Set the float assembly on the vapor separator cover and tighten the two screws to the specified torque.
TORQUE: 2.1 N•m (0.21 kgf•m, 1.5 lbf•ft)



3) Install the vapor separator grommets on the vapor separator stay.

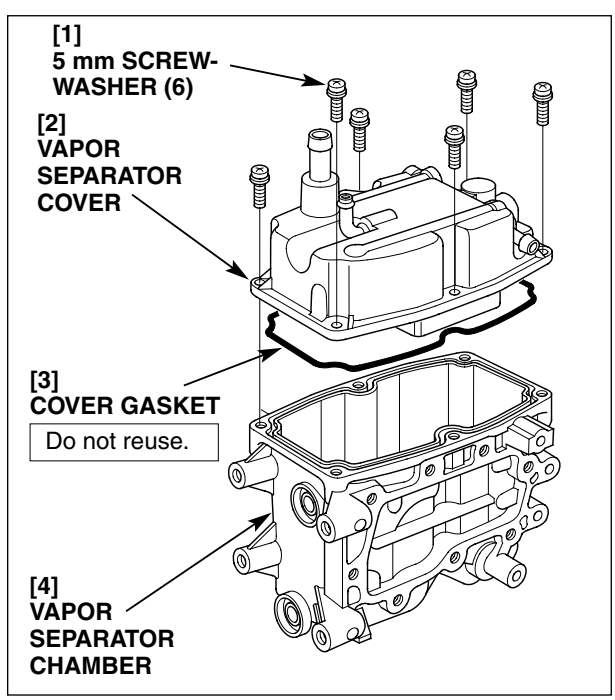
4) Install the vapor separator stay on the vapor separator chamber and tighten the two 6 x 16 mm flange bolts to the specified torque.
TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

5) Install the collars on the vapor separator grommet.



6) Apply a thin coat of the engine oil to the new cover gasket and install the gasket in the groove in the vapor separator chamber securely.

7) Install the vapor separator cover and tighten the 5 mm screw-washers to the specified torque.
TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)



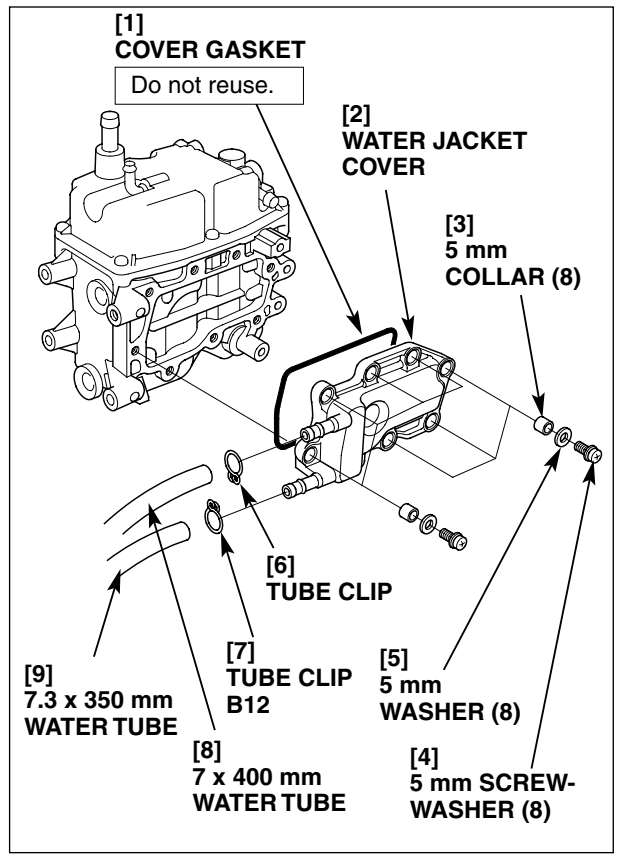
8) Apply a thin coat of the engine oil to a new cover gasket and install it on the water jacket cover.

9) Set the eight collars on the water jacket cover and install the water jacket cover on the vapor separator chamber.

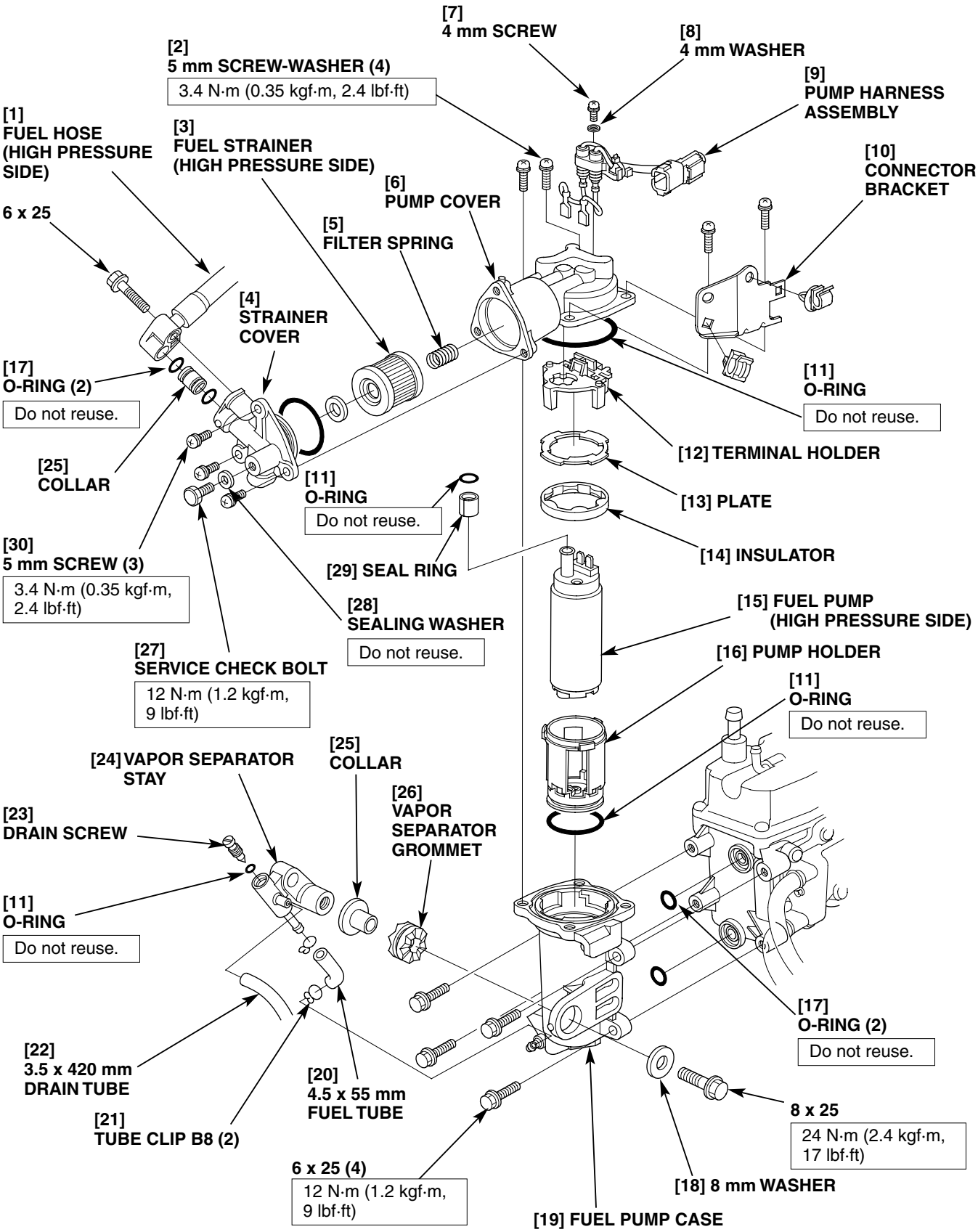
10) Set the eight 5 mm washers and the eight 5 mm screw-washers, then tighten the screws to the specified torque.
TORQUE: 3.4 N•m (0.35 kgf•m, 2.5 lbf•ft)

11) Connect the 7 x 400 mm water tube to the upper tube joint of the water jacket cover, and secure the connection of the tube with the tube clip.

12) Connect the 7.3 x 350 mm water tube to the lower tube joint of the water jacket cover, and secure the connection of the tube with the tube clip B12.



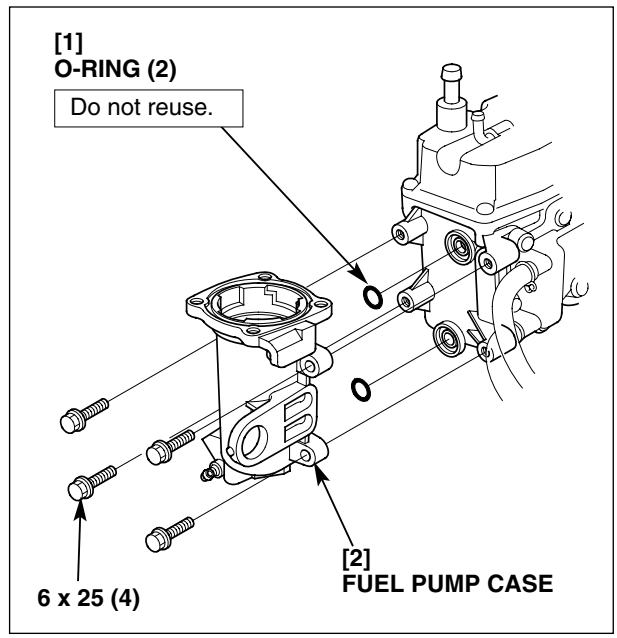
• Fuel Pump (High Pressure Side)



1) Apply a thin coat of the engine oil to the new O-rings and set them on the vapor separator chamber.

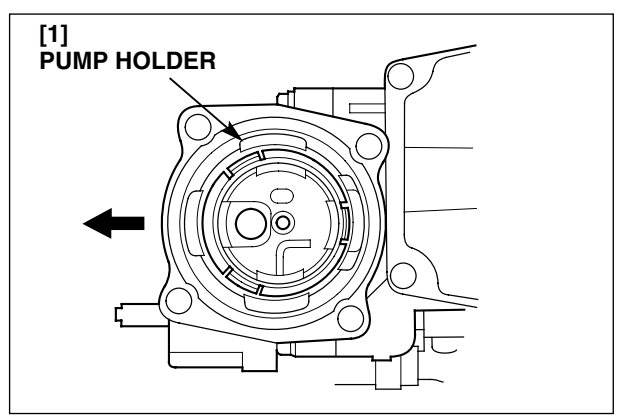
2) Install the pump case with care not to allow the O-rings to come out of position.

3) Tighten the 6 x 25 mm flange bolts.
TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

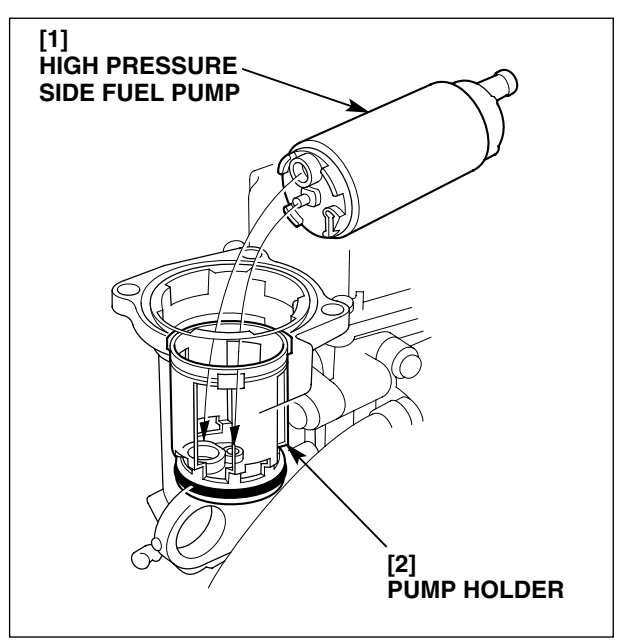


4) Apply a thin coat of the engine oil to the new O-ring and set it on the pump holder.

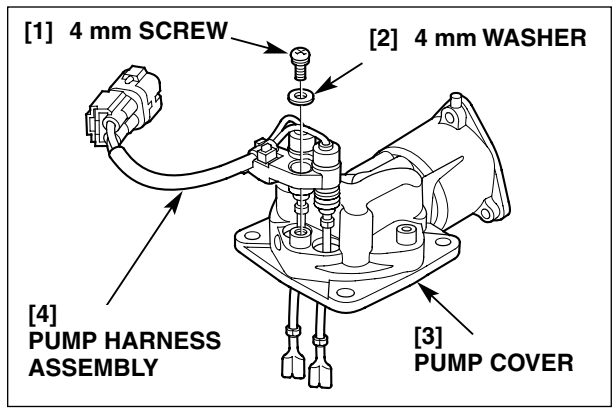
5) Install the pump holder on the pump case. Be sure to install it in the direction shown.



6) Install the high pressure side fuel pump on the pump case.
• Install by aligning the projection on the pump with the hole in the pump holder.

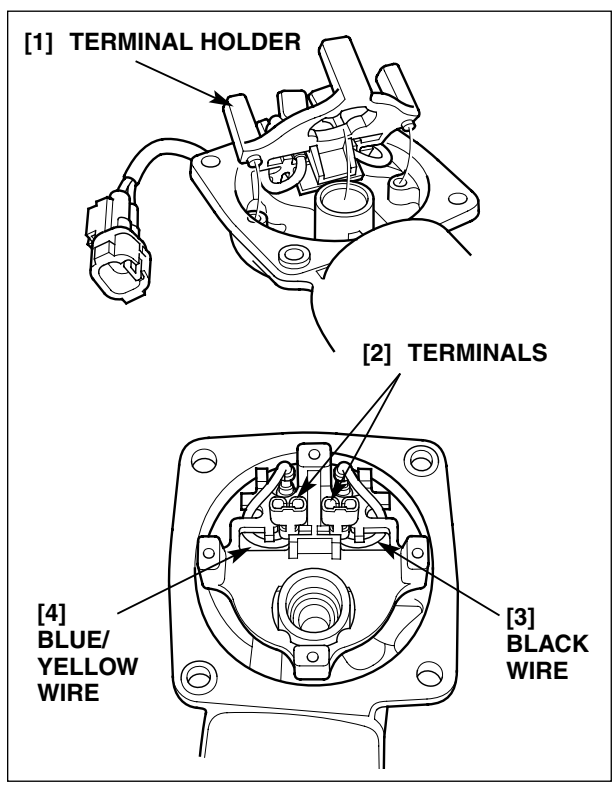


7) Install the pump harness assembly on the pump cover, and secure the pump harness assembly with the 4 mm screw.
TORQUE: 2.1 N•m (0.21 kgf•m, 1.5 lbf•ft)



8) Set the terminal holder on the pump cover and route each wire as shown.
• Align the bosses on the terminal holder with the holes in the pump cover.

9) Set the terminals in the positions shown.

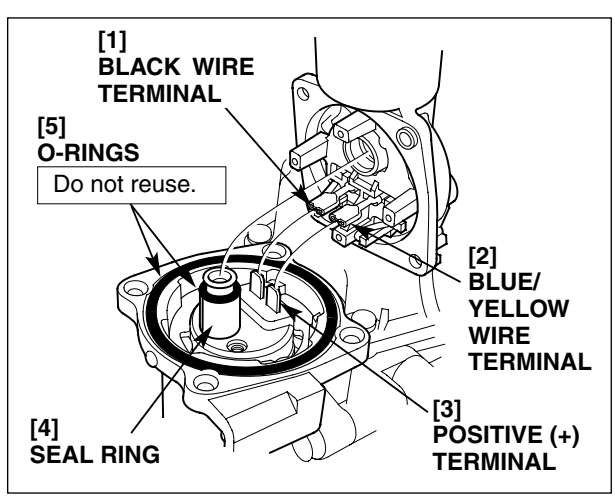


10) Apply a thin coat of engine oil to the new O-ring and install them on the oil case.

11) Set the seal ring at the discharge port of the pump.

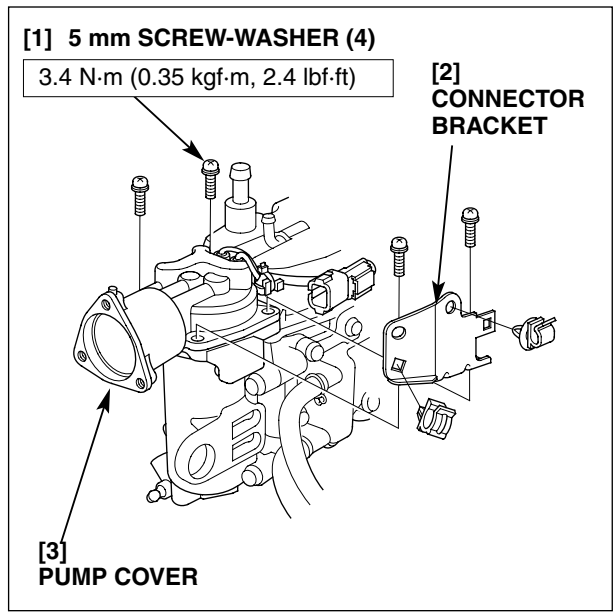
12) Apply a thin coat of the engine oil to the new O-ring and set it at the discharge port of the pump.

13) Connect the pump harness assembly terminals to the pump terminals as shown.
• Connect the Blue/Yellow wire terminal to the positive (+) terminal of the pump and the Black wire terminal to the negative (–) terminal of the pump.



14) Tighten the four 5 mm screw-washers securely.
- Install the connector bracket in the position shown and secure with the two 5 mm screw-washers.

TORQUE: 3.4 N•m (0.35 kgf•m, 2.4 lbf•ft)

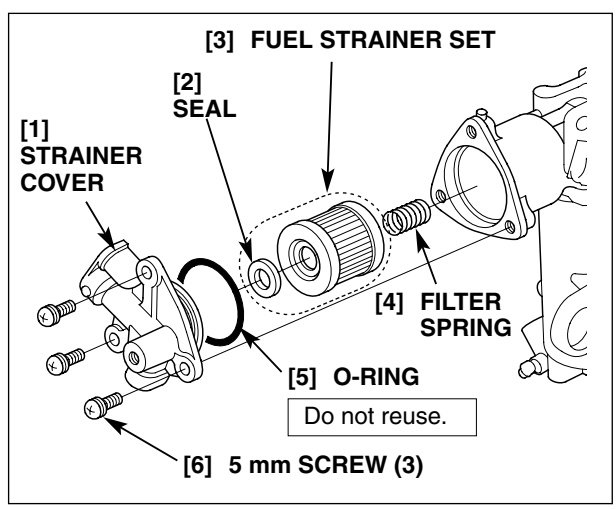


15) Apply the engine to the new O-ring and install it on the strainer cover.

16) Install the spring and the fuel strainer, and install the strainer cover.
- Install the fuel strainer in the direction shown.

17) Tighten the 5 mm washer screws securely.

TORQUE: 3.4 N•m (0.35 kgf•m, 2.4 lbf•ft)



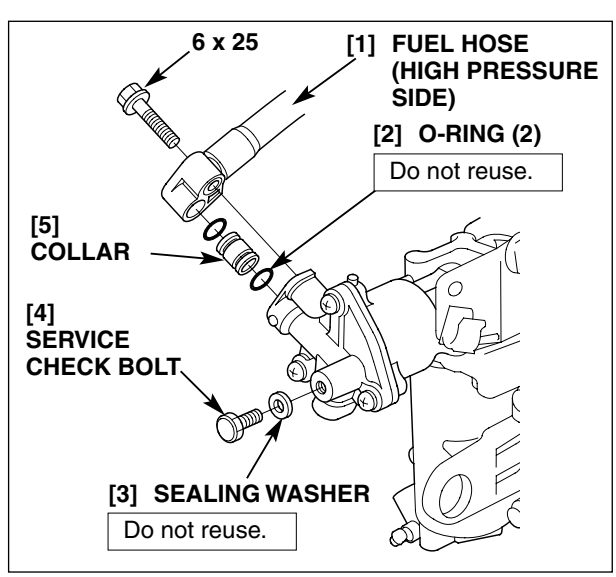
18) Apply the engine oil to the new O-rings and install them on the collar.

19) Install the collar on the strainer cover.

20) Set the fuel hose and secure it by tightening the 6 x 25 mm flange bolt.

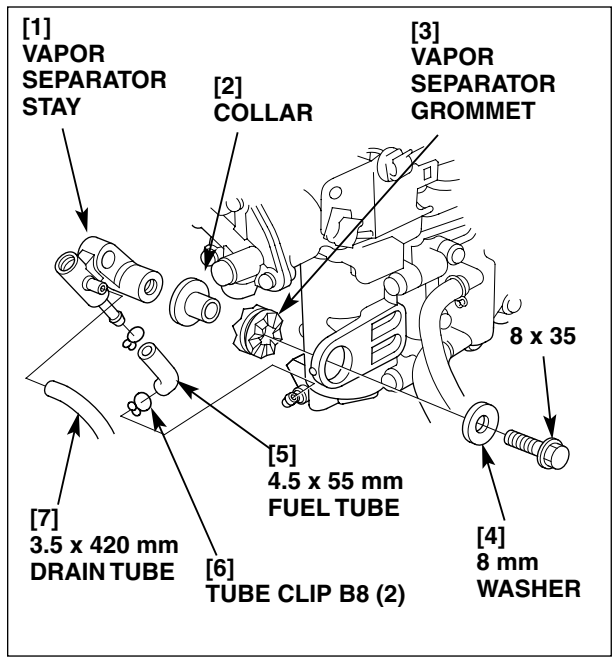
21) Using a new sealing washer, tighten the service check bolt to the specified torque.

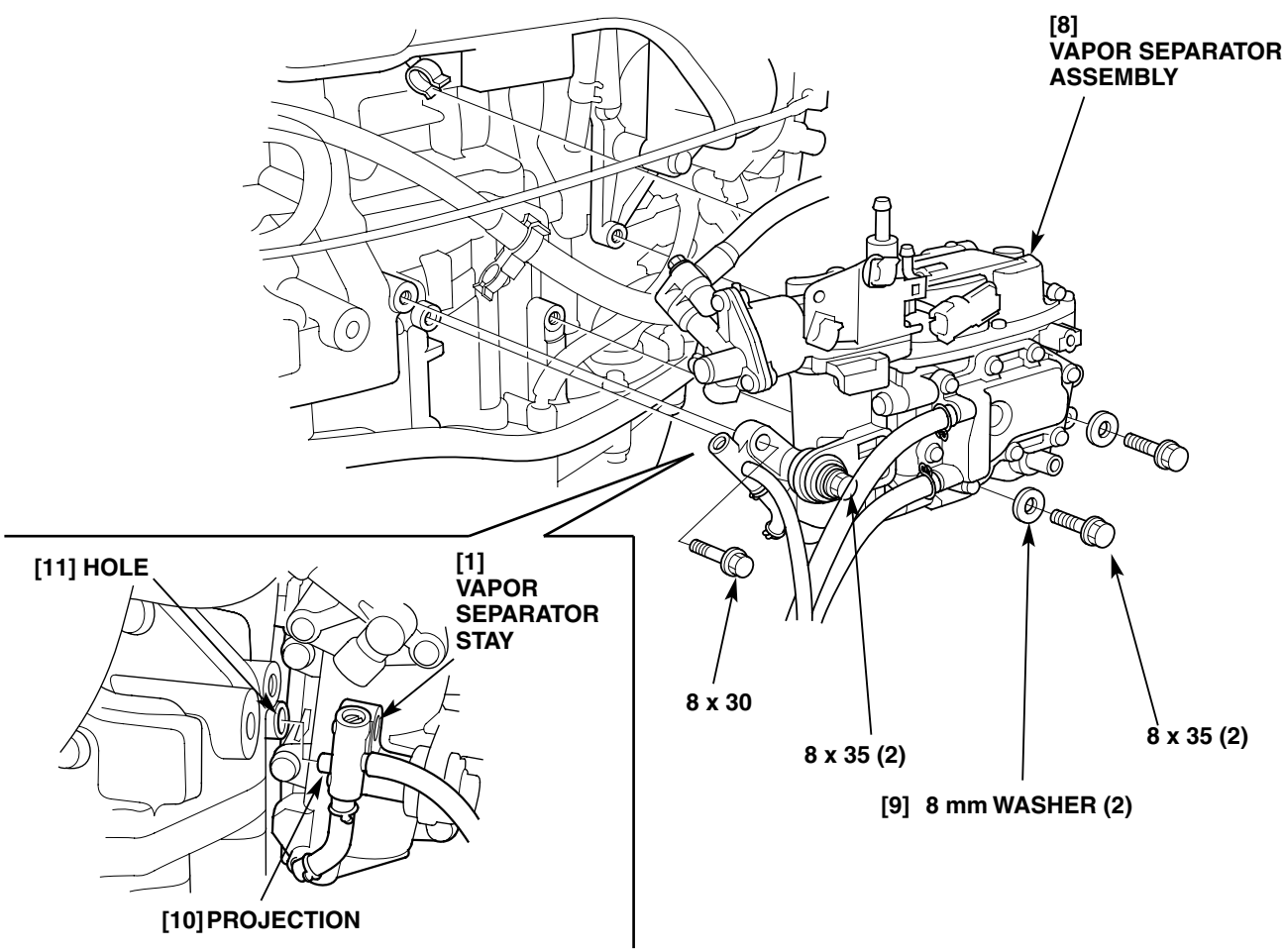
TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)



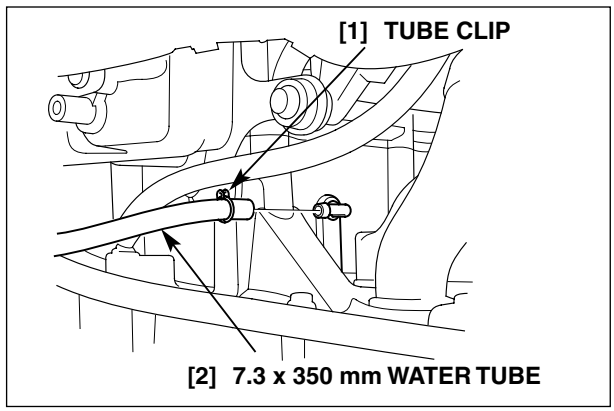
e. INSTALLATION

1) Install the vapor separator grommet and the collar on the fuel pump case.
2) Loosely tighten the vapor separator stay with the 8 mm washer and the 8 x 35 mm flange bolt.
   - Tighten the 8 x 35 mm flange bolt, after installing the vapor separator assembly on the engine.
3) Connect the 4.5 x 55 mm fuel tube and secure it with the tube clip B8.
4) Connect the 3.5 x 420 mm drain tube to the vapor separator stay.
5) Set the vapor separator assembly on the engine, and loosely tighten it with the two 8 mm washers, two 8 x 35 mm flange bolts and the one 8 x 30 mm flange bolt.
   - Align the projection of the vapor separator stay with the hole in the engine.
6) Tighten the three 8 x 35 mm flange bolts and one 8 x 30 mm flange bolt to the specified torque.
   TORQUE: 26 N•m (2.7 kgf•m, 20 lbf•ft)

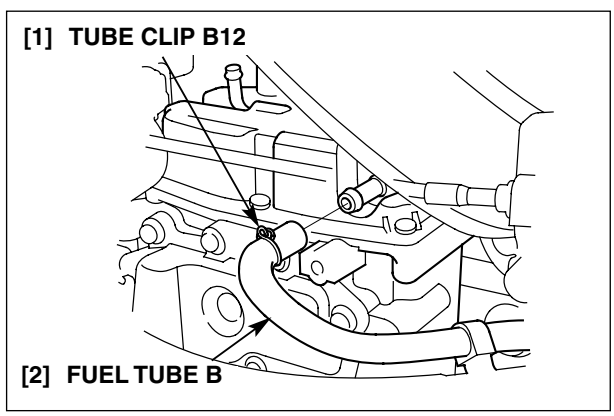




7) Connect the 7.3 x 350 mm water tube to the cylinder block and secure it with the tube clip.

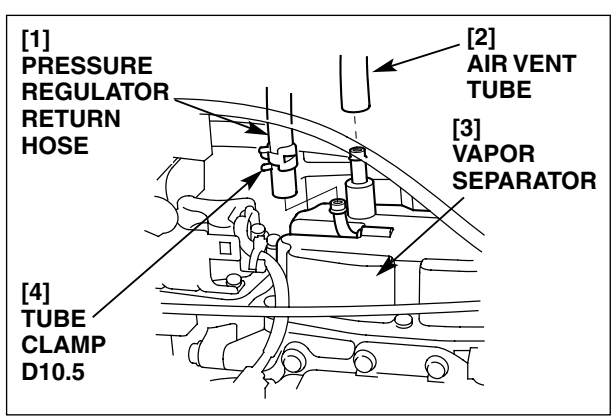


8) Connect the fuel tube B to the vapor separator and secure it with the tube clip B12.



9) Connect the pressure regulator return hose to the vapor separator, and secure it with the tube clamp D10.5.

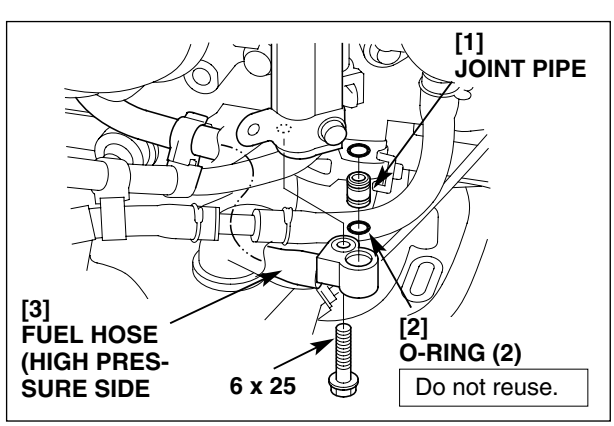
10) Connect the air vent tube to the vapor separator.



11) Apply the engine oil to the new O-ring and install it on the joint pipe.

12) Set the joint pipe in the fuel tube and install the fuel hose.

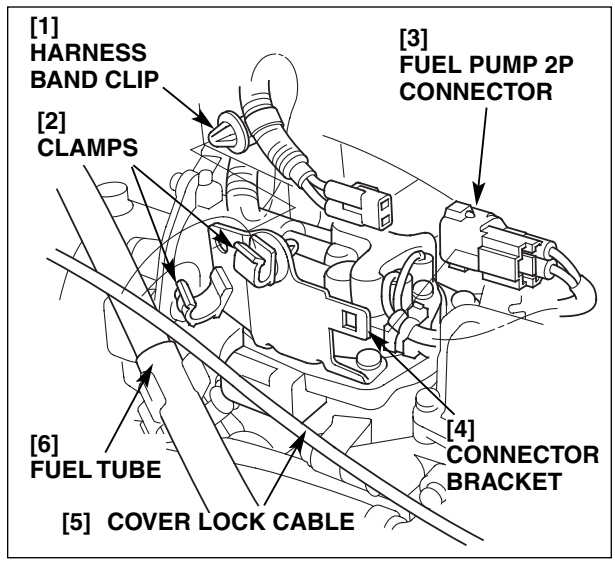
13) Tighten the 6 x 25 mm flange bolt to the specified torque.



14) Connect the fuel pump 2P connector and set the connector on the connector bracket.

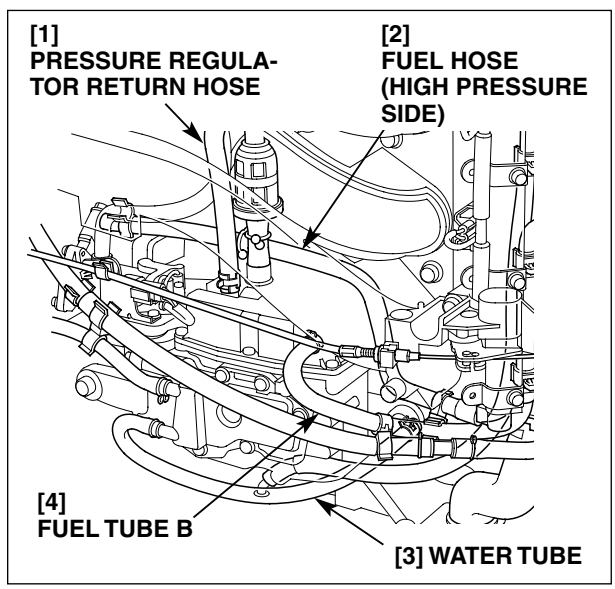
15) Install the harness band clip on the connector bracket in the position shown in the drawing.

16) Secure the cover lock cable and the fuel hose with the clamps.



17) After assembly, check each fuel tube and clamp and check that they are not interfering with the neighboring parts.

18) Turn the ignition switch ON. Check that the fuel pump turns for 2 seconds and that there is no fuel/water leakage.



12. SILENCER CASE/THROTTLE BODY/INTAKE MANIFOLD

a. SILENCER CASE REMOVAL

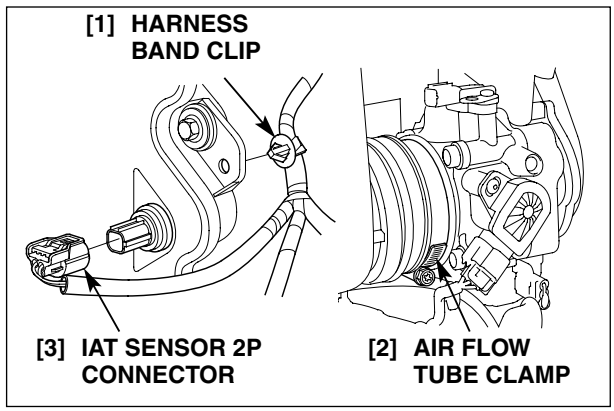
1) Remove the engine cover.

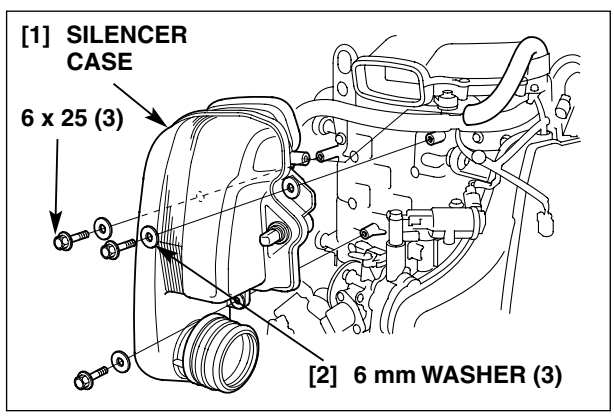
2) Disconnect the IAT sensor 2P connector and remove the harness band clip from the silencer case.

3) Loosen the air flow tube clamp.

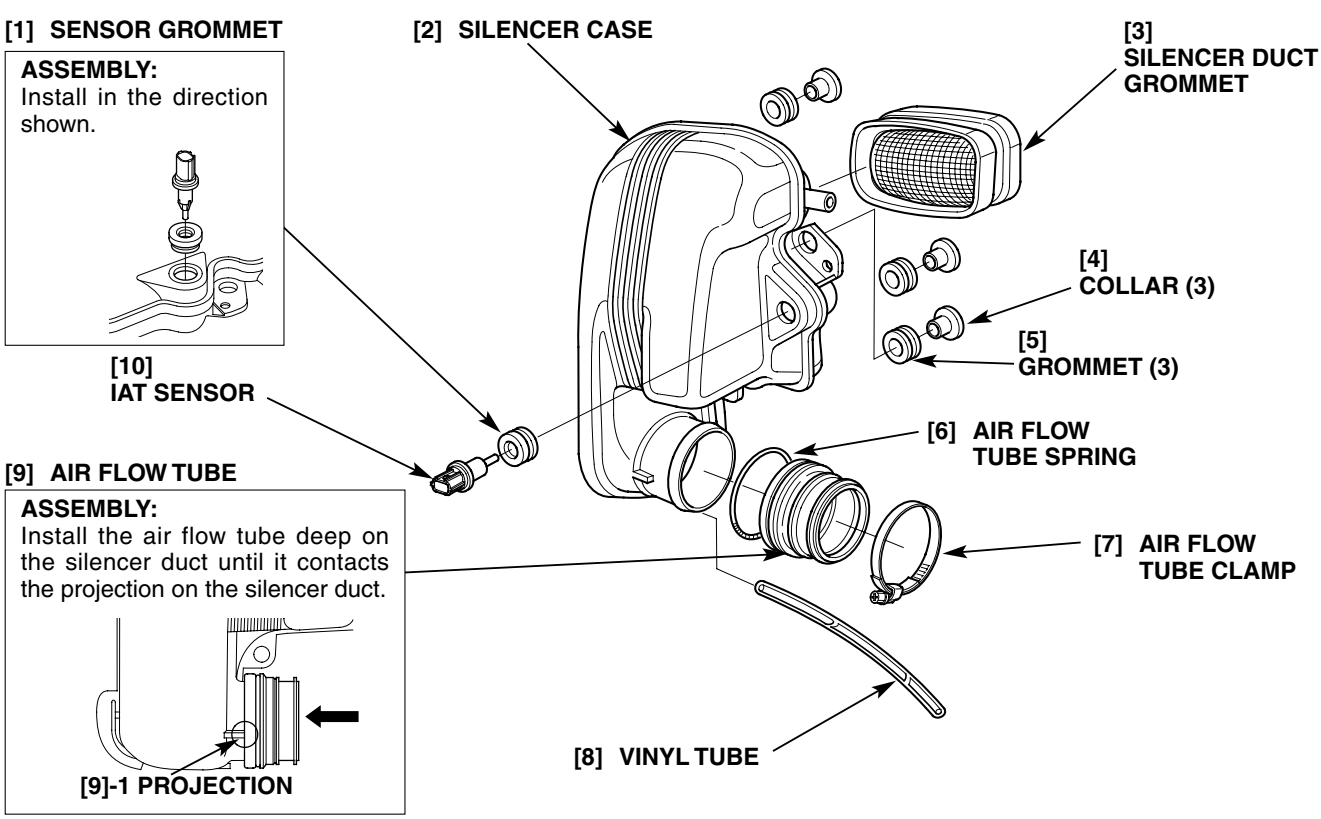
4) Disconnect the crankcase breather tube from the silencer case.

5) Remove the three 6 x 25 mm flange bolts and the three 6 mm washers. Remove the silencer case.





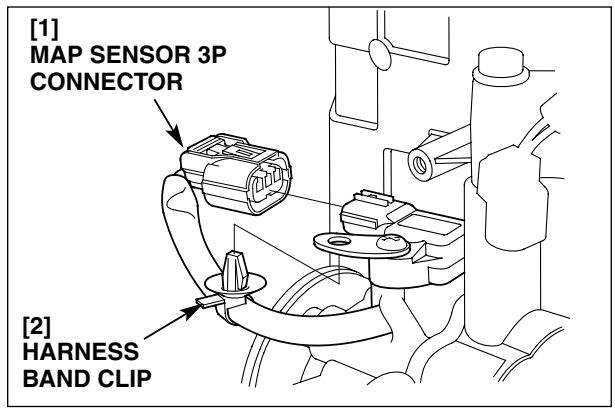
• SILENCER CASE DISASSEMBLY/ASSEMBLY



b. THROTTLE BODY/INTAKE MANIFOLD REMOVAL

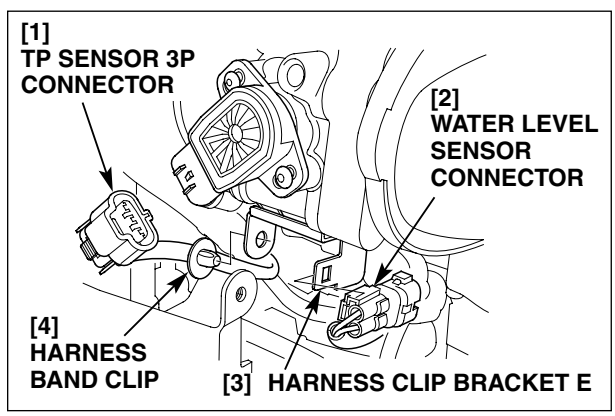
1) Remove the silencer case (P. 5-128).

2) Disconnect the MAP sensor 3P connector and remove the harness band clip.



3) Remove the water level sensor connector from the the harness clip bracket E.

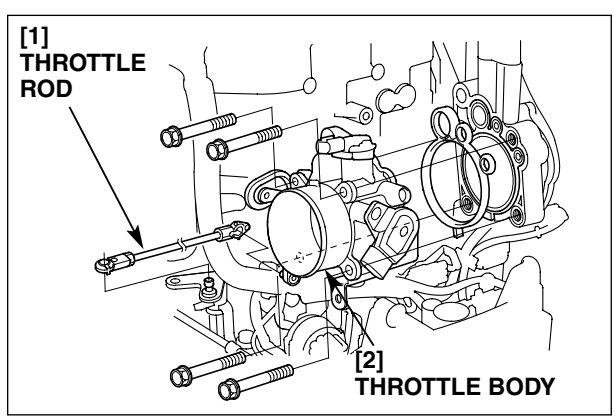
4) Disconnect the TP sensor 3P connector and remove the harness band clip from the harness clip bracket E.



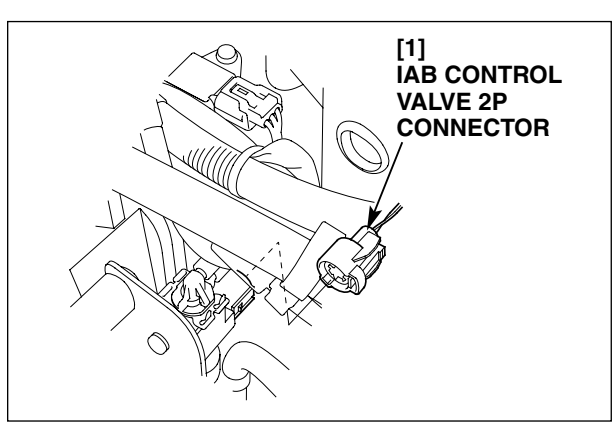
5) Remove the throttle rod.
   • Do not loosen the pivot lock nut.

6) Remove one 8 x 60 mm flange bolt and remove the throttle body.

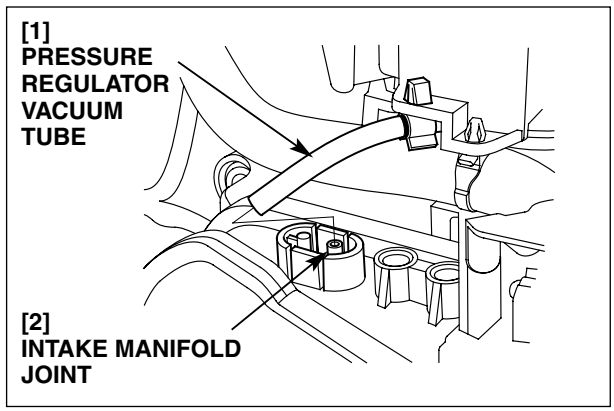
7) Remove the throttle body gasket.
   • Replace the throttle body gasket with a new one.
   • The intake manifold assembly can be removed by skipping the steps 6 and 7 (i.e. with the throttle body mounted).



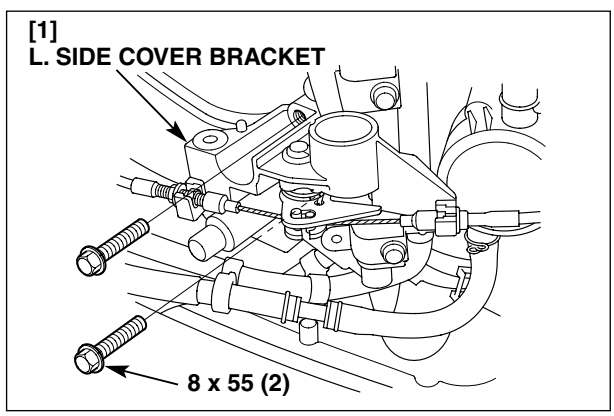
8) Disconnect the IAB control valve 2P connector.



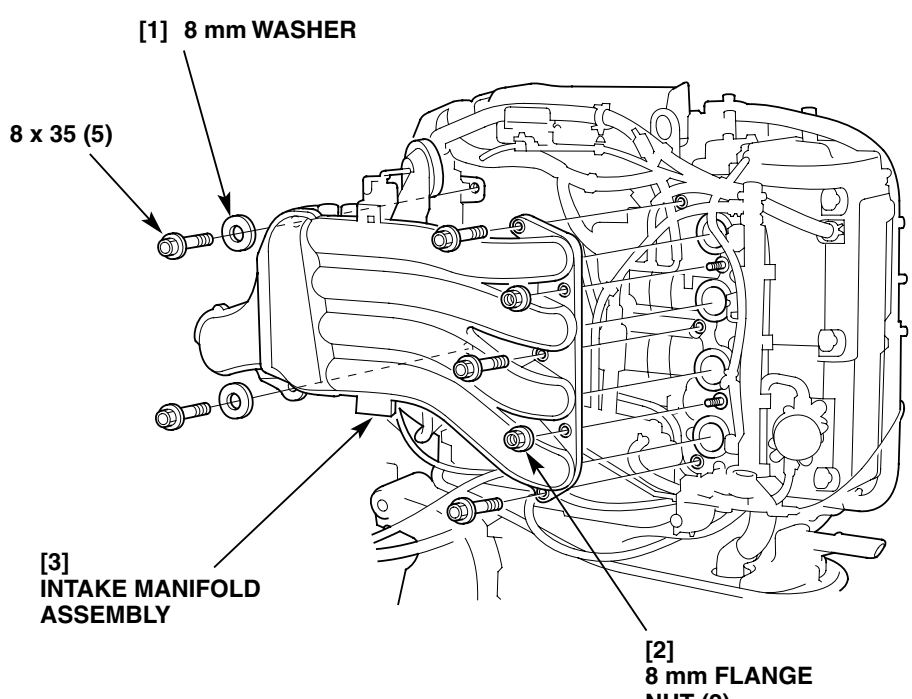
9) Disconnect the pressure regulator vacuum tube from the intake manifold joint.



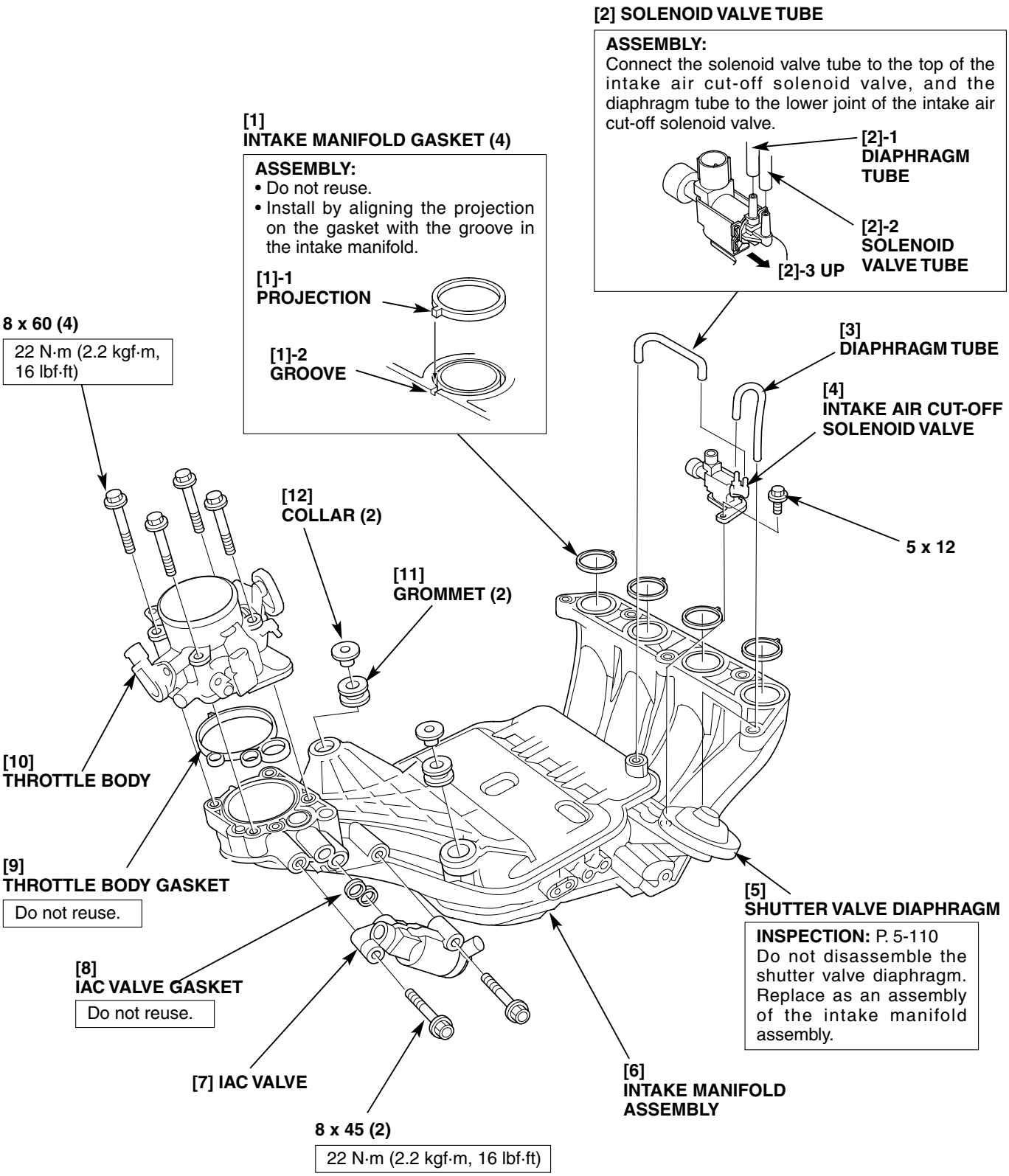
10) Remove the two 8 x 55 mm flange bolts and remove the L. side cover bracket.
   • The L. side cover bracket can be removed without disconnecting the cover lock cable.



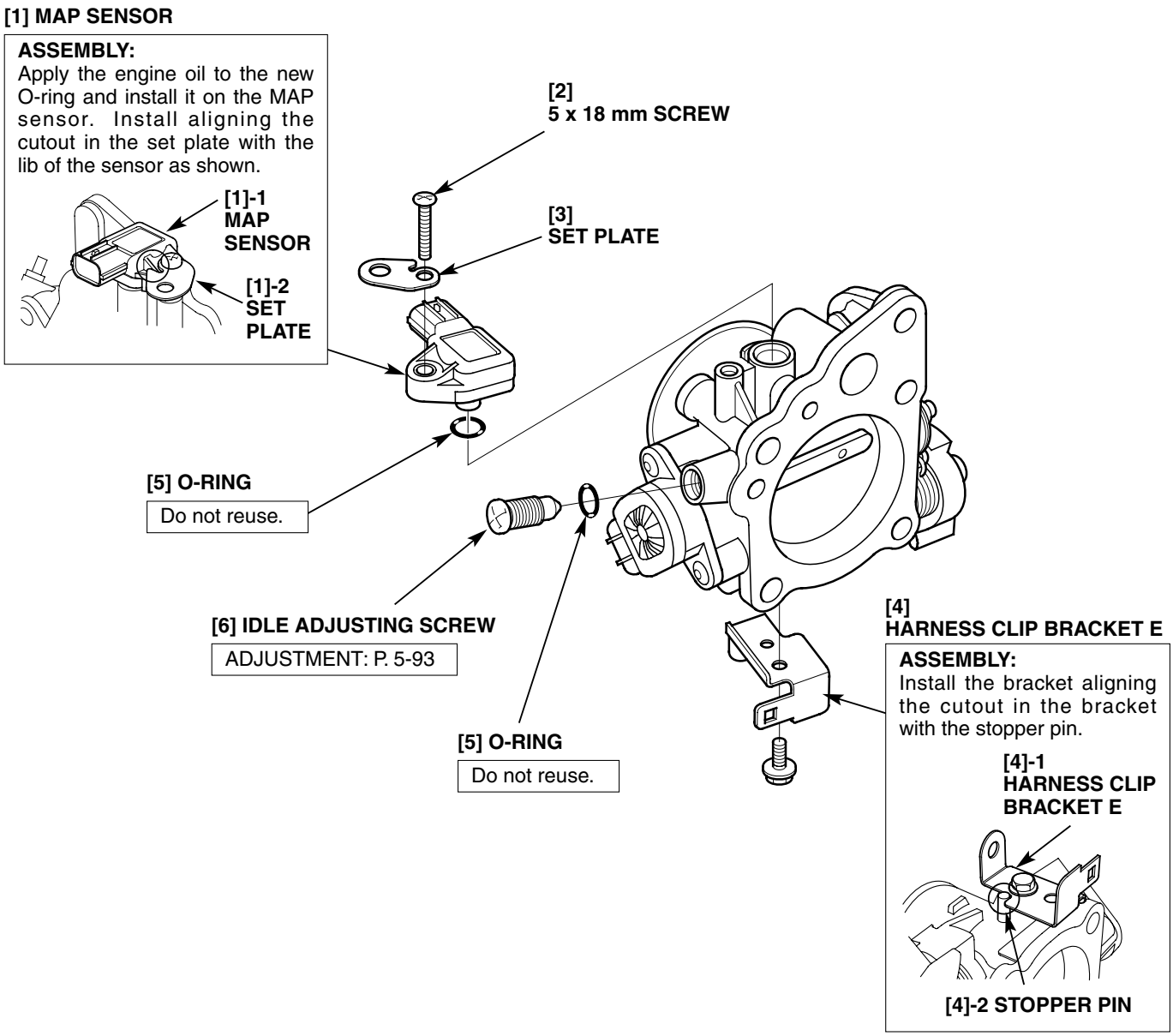
11) Remove the five 8 x 35 mm flange bolts, two 8 mm washers and the two 8 mm flange nuts. Remove the intake manifold assembly.



c. INTAKE MANIFOLD DISASSEMBLY/ASSEMBLY



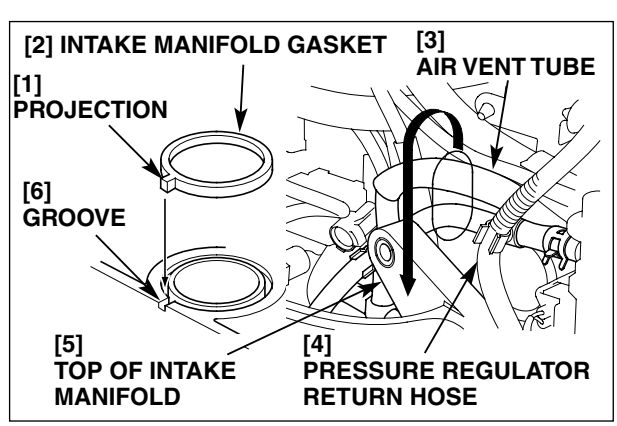
d. THROTTLE BODY DISASSEMBLY/REASSEMBLY



e. INTAKE MANIFOLD INSTALLATION

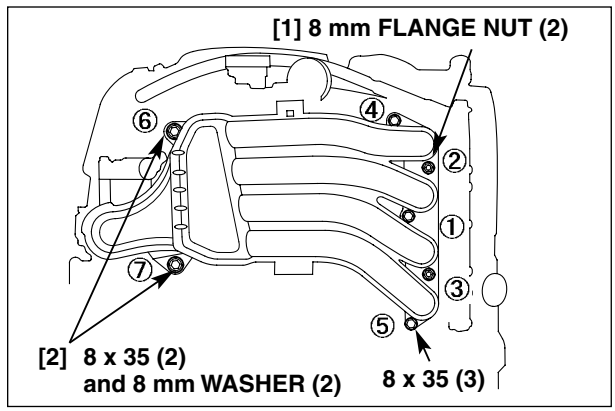
1) Install the new intake manifold gasket on the intake manifold assembly.
   - Install aligning the projection on the gasket with the groove in the intake manifold.

2) Install the intake manifold assembly on the engine.
   - Take care not to pinch the pressure regulator return hose and the air vent tube at the top of the intake manifold.



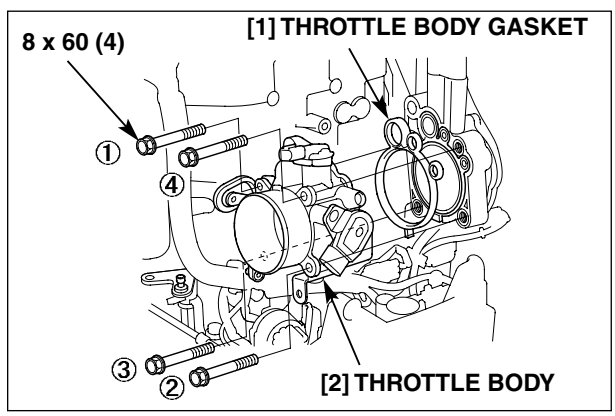
3) Set the five 8 x 35 mm flange bolts, two 8 mm washers and the two 8 mm flange nuts.

4) Tighten the 8 x 35 mm flange bolts and the 8 mm flange nuts in the numbered sequence in two or three steps to the specified torque.
TORQUE: 26 N•m (2.7 kgf•m, 20 lbf•ft)

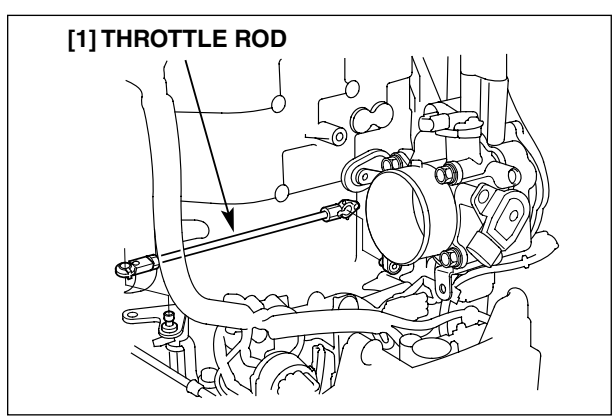


5) Install the new throttle body gasket on the intake manifold.

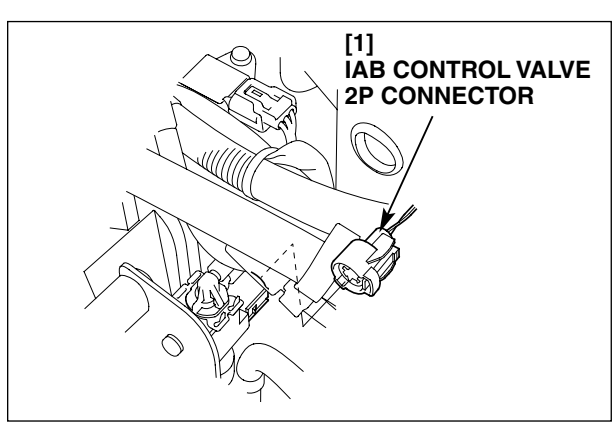
6) Install the throttle body and tighten the 8 x 60 mm flange bolts in the numbered sequence in two or three steps securely.
TORQUE: 22 N•m (2.2 kgf•m, 16 lbf•ft)



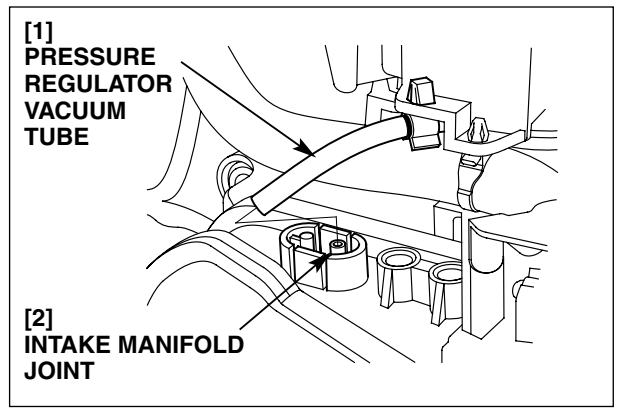
7) Install the throttle rod. Note the throttle rod installation direction. Don't loosen the lock nut of the throttle rod



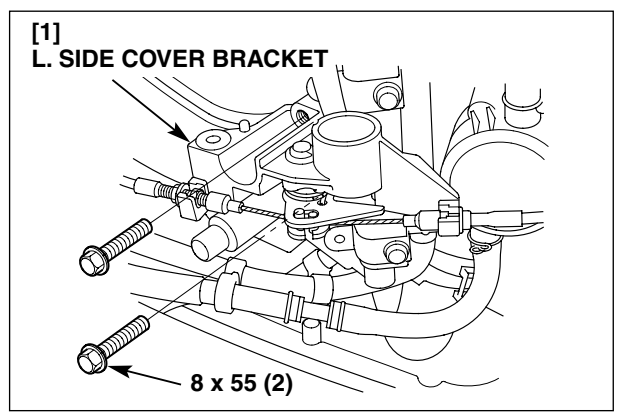
8) Connect the IAB control valve 2P connector.



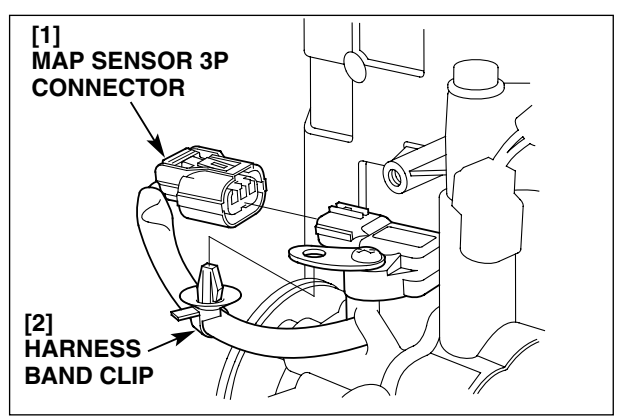
9) Connect the vacuum tube to the pressure regulator.



10) Install the L. side cover bracket assembly and tighten the two 8 x 55 mm flange bolts securely.

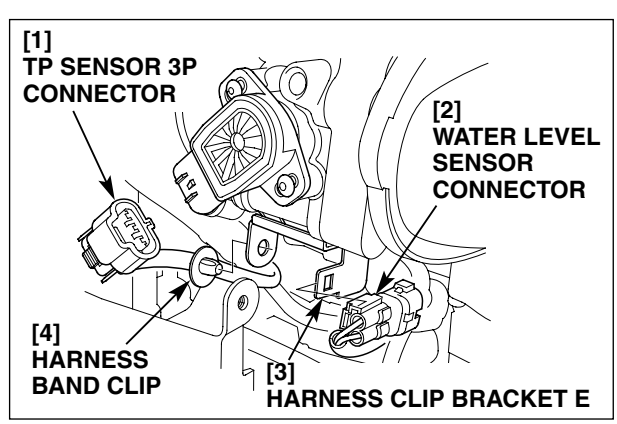


11) Connect the MAP sensor 3P connector and set the harness band clip in the hole in the sensor set plate.



12) Connect the TP sensor 3P connector and set the harness band clip in the hole in the harness clip bracket E.

13) Install the water level sensor connector on the harness clip bracket E.

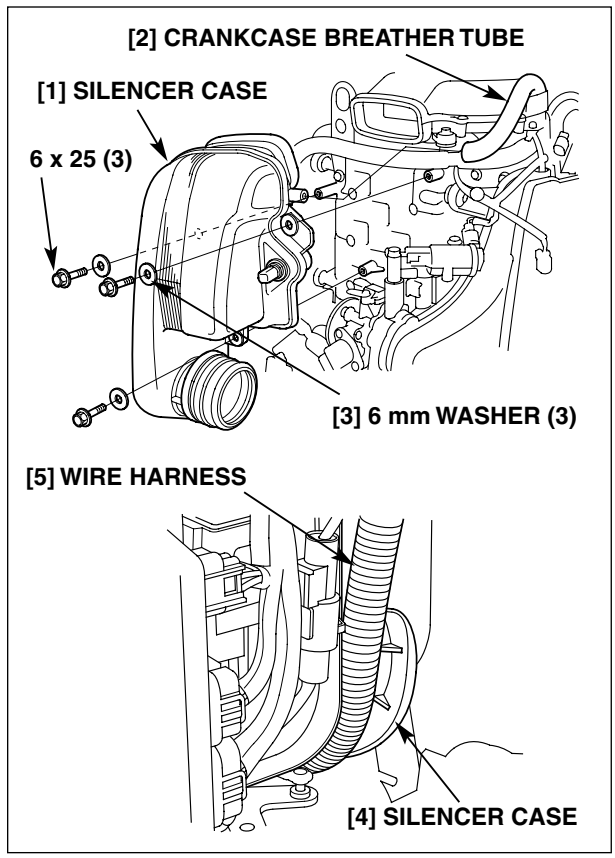


f. SILENCER CASE INSTALLATION

1) Install the silencer case and tighten the three 6 x 25 mm flange bolts and the three 6 mm washers.
   - Check that the wire harnesses are not pinched.
   - Set the main harness in the groove in the left lower section of the silencer case.

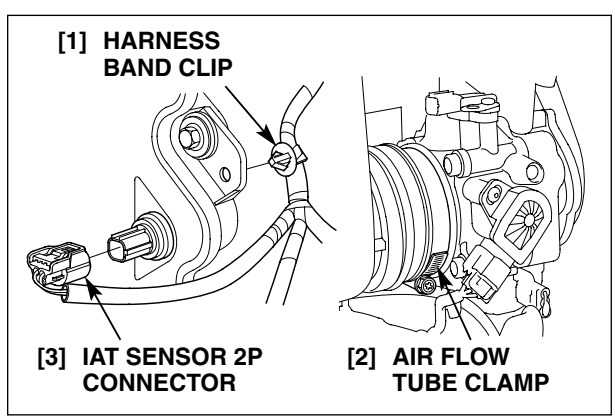
2) Tighten the three 6 x 25 mm flange bolts securely.

3) Connect the crankcase breather tube.



4) Fasten the air flow tube clamp securely.

5) Connect the IAT sensor 2P connector and secure the harness band clip in the hole in the silencer case.



13. FUEL INJECTOR/PRESSURE REGULATOR

a. FUEL LINE ASSEMBLY REMOVAL

⚠WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

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

- Relieve the fuel pressure before removing the fuel injectors.
- Disconnect the battery cable from the battery negative (–) terminal before relieving the fuel pressure.
- Replace the sealing washer with a new one when the service check bolt had been loosened or removed.

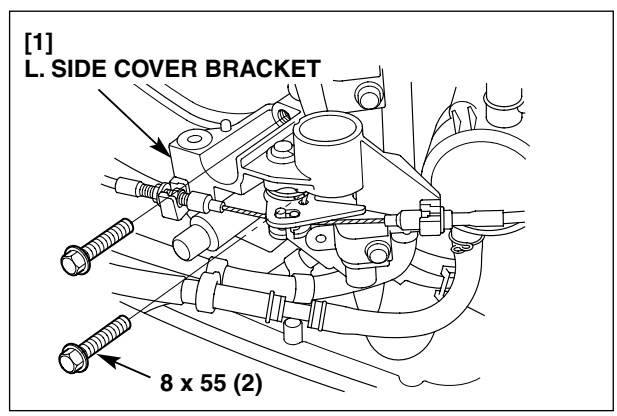
1) Remove the engine cover and the L. engine under cover.

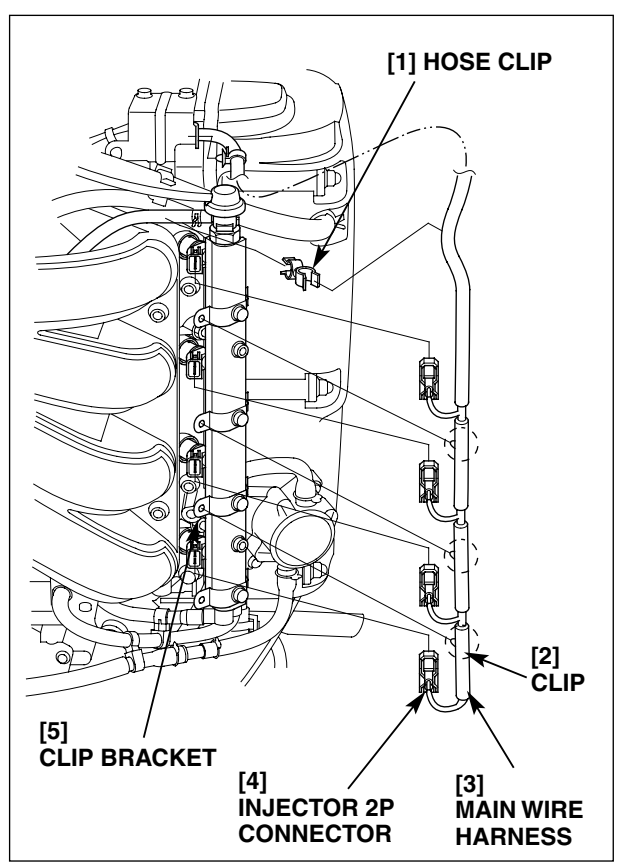
2) Relieve the fuel pressure according to “HOW TO RELIEVE FUEL PRESSURE” (P. 5-102).

3) Remove the two 8 x 55 mm flange bolts and move the L. side cover bracket out of position.
4) Remove the three main harness clips from the respective clip brackets.

5) Disconnect the connector from each injector.

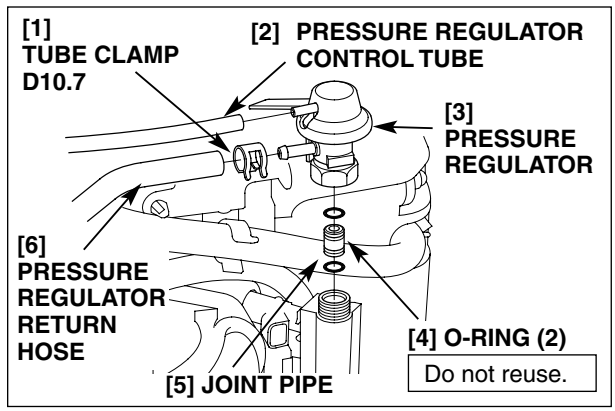
6) Remove the hose clip. Clamp the pressure regulator return hose and the main wire harness.





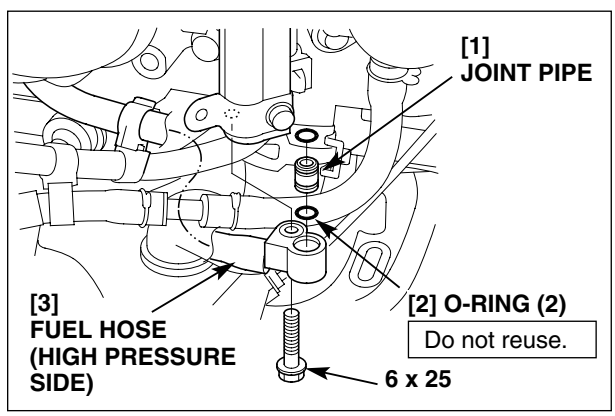
7) Disconnect the pressure regulator control tube and the pressure regulator return hose from the pressure regulator.

8) Remove the pressure regulator. Remove the joint pipe and the O-rings.
   • Replace the O-rings on assembly.



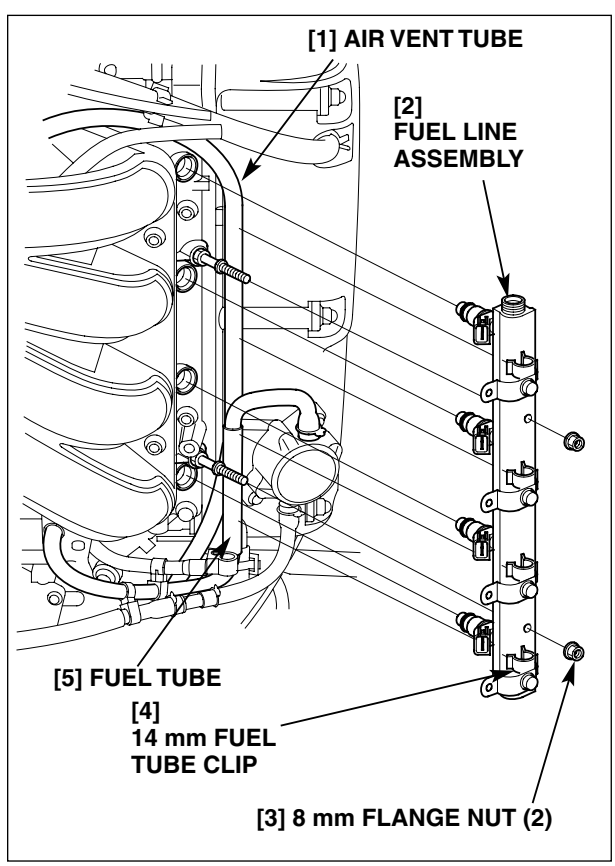
9) Remove the 6 x 25 mm flange bolt and remove the fuel hose (high pressure side).

10) Remove the joint pipe and the O-rings.
   • Replace the O-rings on assembly.



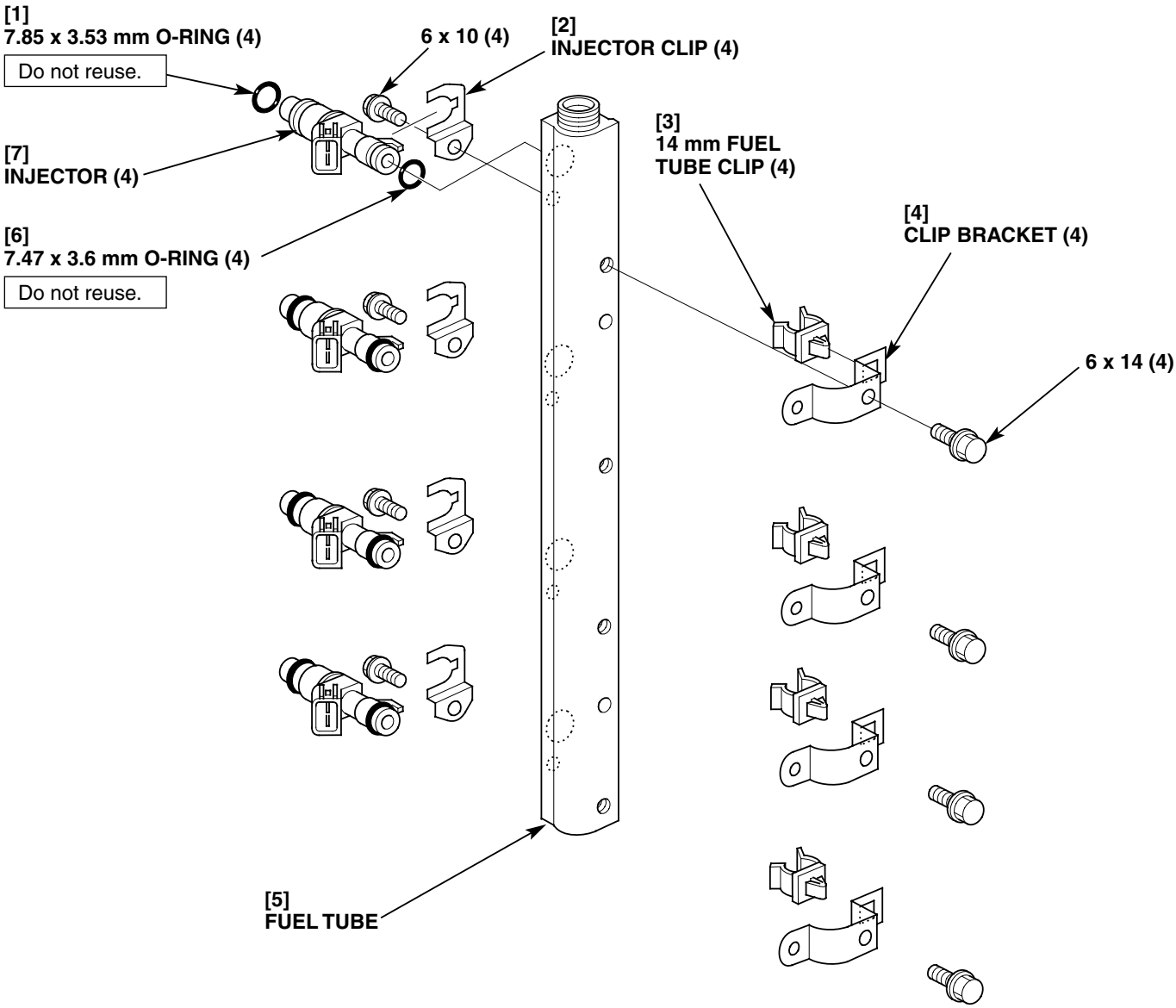
11) Release the fuel tube (2 places) and the air vent tube (2 places) from the 14 mm fuel tube clips.

12) Remove the two 6 mm flange nuts and remove the fuel line assembly.



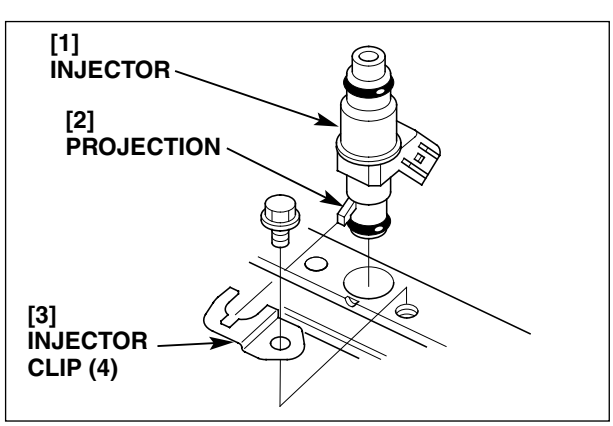
b. FUEL TUBE ASSEMBLY DISASSEMBLY/ASSEMBLY

• Replace the O-rings with the new ones and apply the engine oil to the new O-rings before installation.



• INJECTOR INSTALLATION

- Apply the engine oil to the new O-rings and install them on the respective injectors.
- Install the injectors aligning the projection with the groove in the fuel line.



c. INJECTOR BASE REMOVAL/INSTALLATION

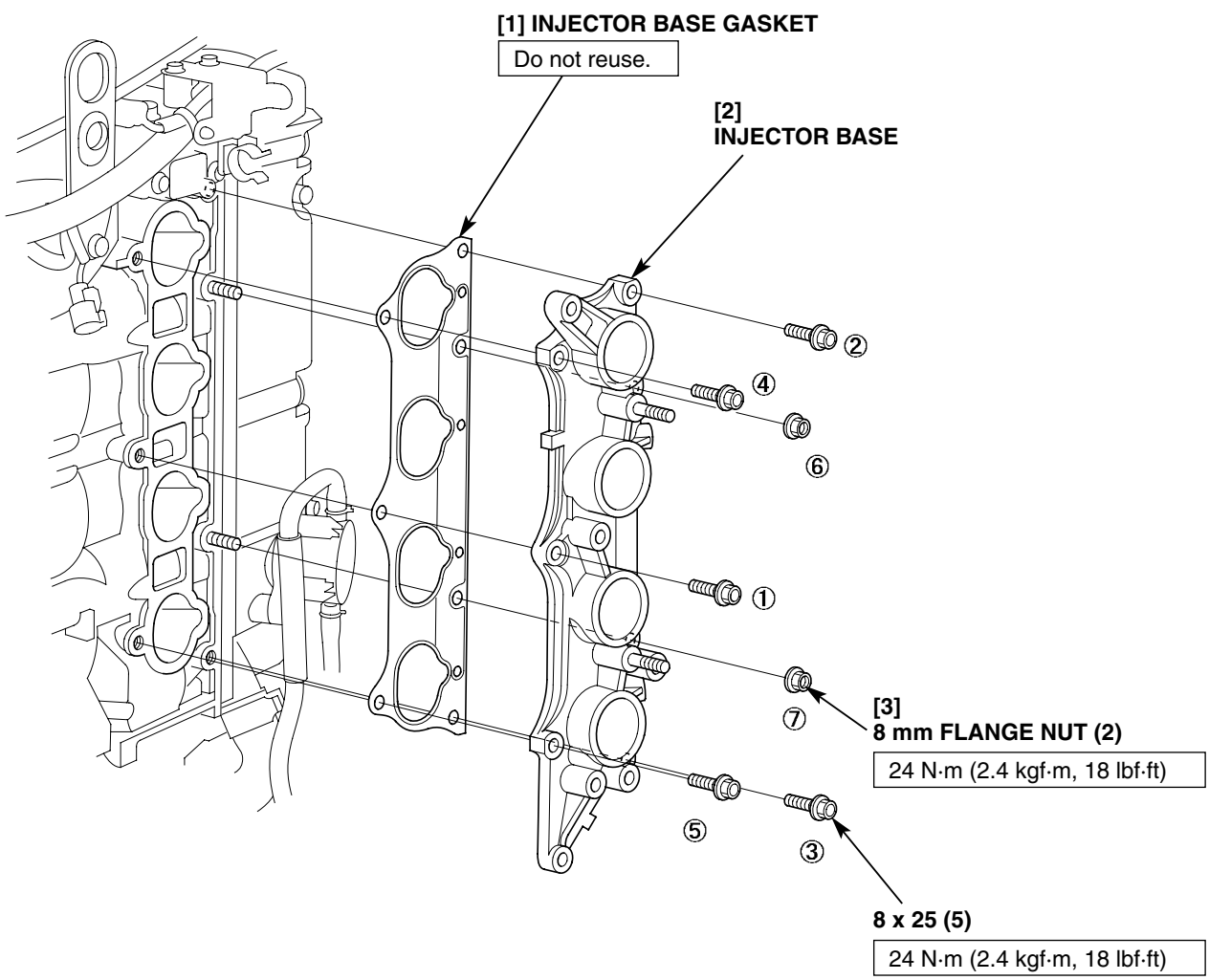
1) Remove the fuel injectors (P. 5-136).

2) Remove the silencer case (P. 5-128) and remove the intake manifold (P. 5-129).

3) Remove the five 8 x 25 mm flange bolts and the two 8 mm flange nuts, then remove the injector base and the injector base gasket.

4) Install the removed parts in the reverse order of removal.
   - Replace the injector base gasket on assembly.
   - Tighten the 8 x 25 mm flange bolts and the 8 mm flange nuts to the specified torque in the numbered sequence in a criss-cross pattern in two or three steps.

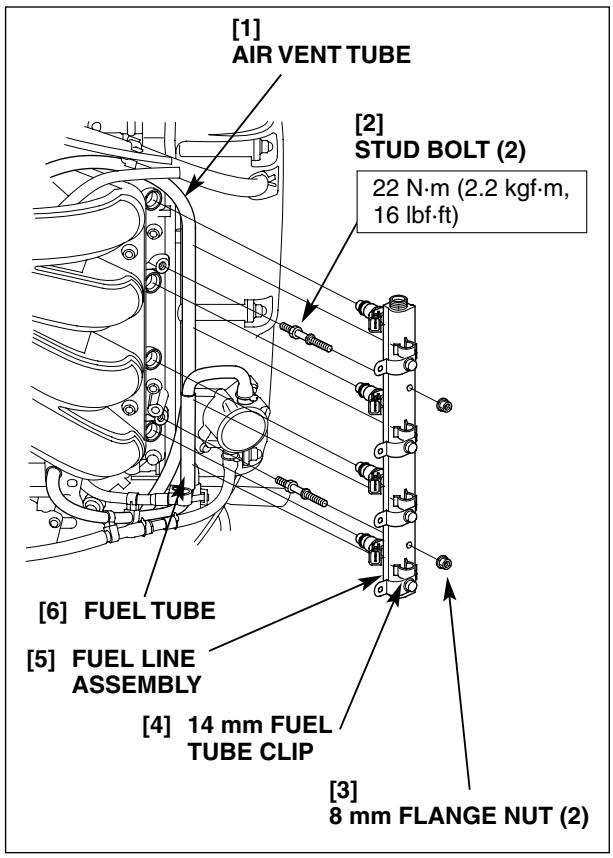
   TORQUE: 24 N•m (2.4 kgf•m, 18 lbf•ft)



d. FUEL TUBE ASSEMBLY INSTALLATION

1) Apply the engine oil to the O-rings on the injectors. Install the fuel line assembly and tighten the 8 mm flange nuts securely.
   • Replace the O-rings on assembly.

2) Set the air vent tube (2 places) and the fuel tube (2 places) on the 14 mm fuel tube clip.



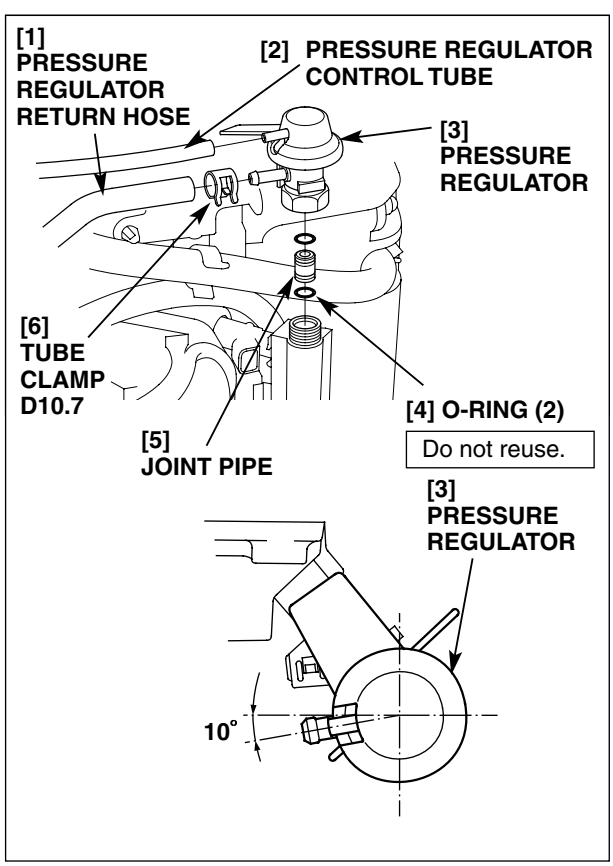
3) Apply the engine oil to the O-rings and install them on the joint pipe.

4) Install the joint pipe on the fuel line.

5) Install the pressure regulator and tighten the joint nut to the specified torque.
   • Install the pressure regulator in the direction shown.
   TORQUE: 27 N•m (2.8 kgf•m, 20 lbf•ft)

6) Connect the pressure regulator return hose and secure it with the tube clamp D10.7.

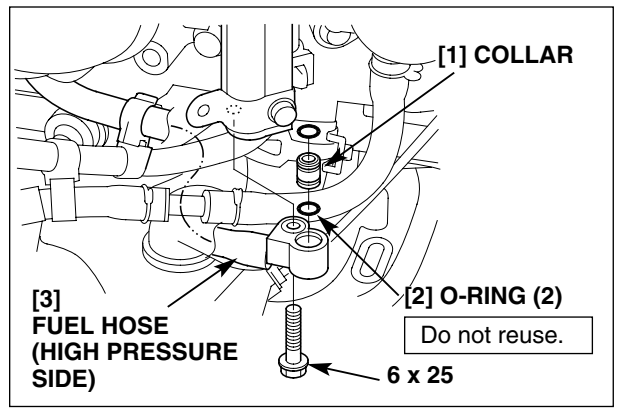
7) Connect the pressure regulator control tube.



8) Apply the engine oil to the O-rings and install them on the joint pipe.

9) Install the joint pipe on the fuel line.

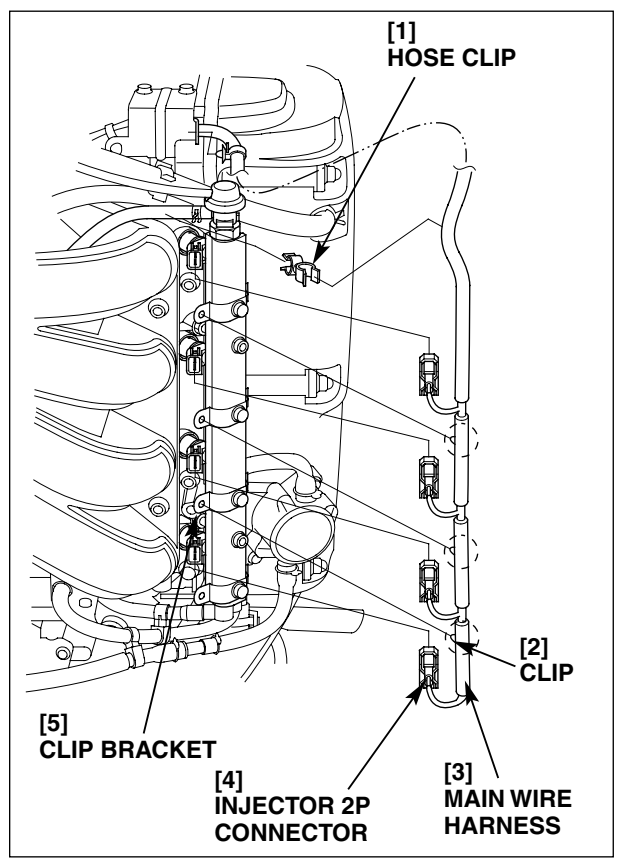
10) Connect the fuel hose (high pressure side) and tighten the 6 x 25 mm flange bolt securely.



11) Connect the 2P connector to each injector.

12) Set the three clips of the main harness on the clip brackets.

13) Clamp the pressure regulator return hose and the main wire harness with the hose clip.



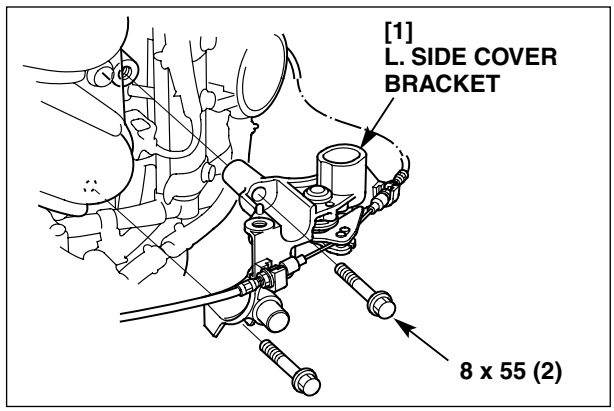
14. FUEL PUMP (LOW PRESSURE SIDE)

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

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

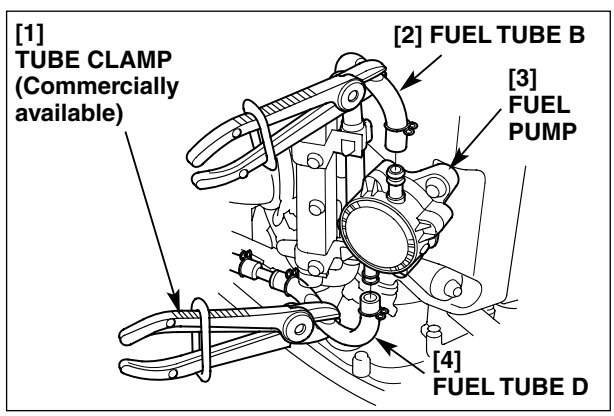


a. REMOVAL

1) Remove the engine cover and the L. engine under cover .

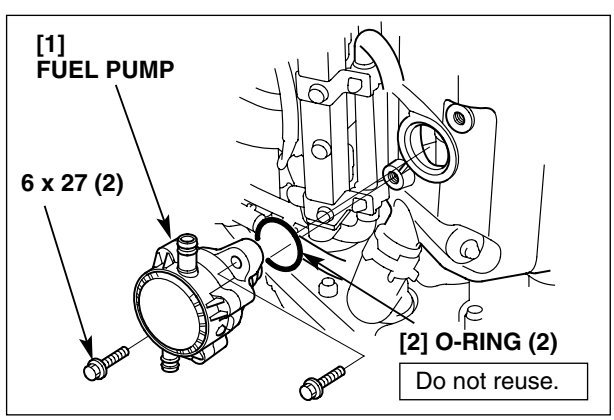
2) Remove the two 8 x 55 mm flange bolts and move the L. side cover bracket a side.

3) Clamp the fuel tubes with a commercially available tube clamps, then disconnect the fuel tubes from the fuel pump.



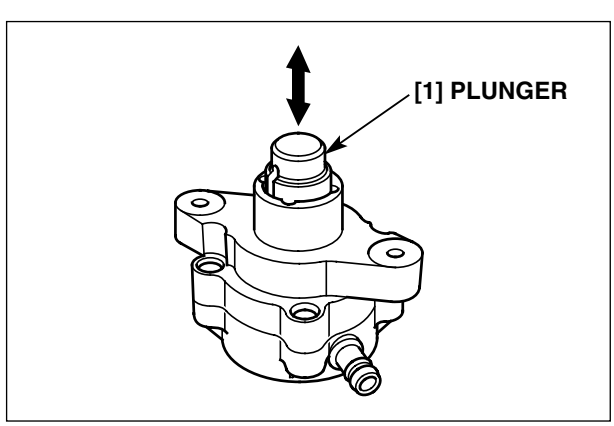
4) Remove the two 6 x 27 mm flange bolts and remove the fuel pump.

5) Remove the O-rings from the fuel pump.
   - Replace the O-rings with the new ones on assembly.

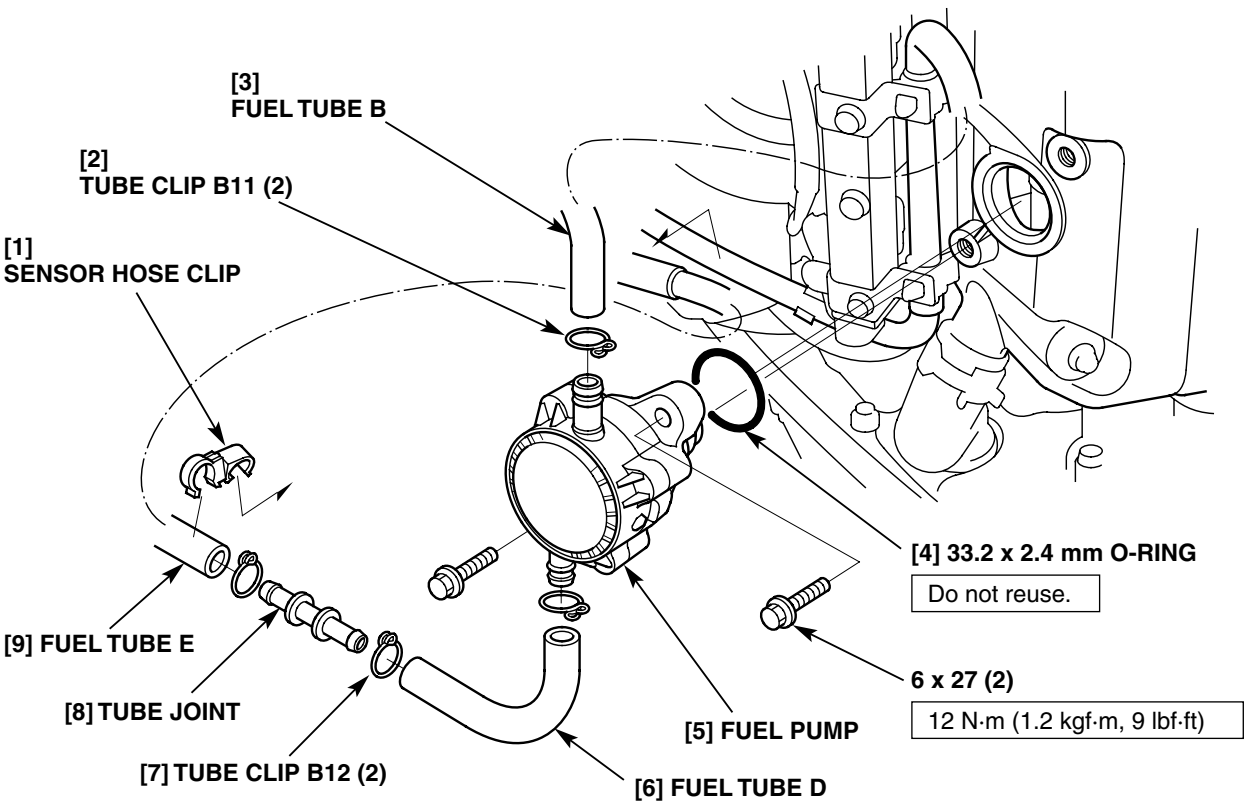


b. INSPECTION

Push the plunger to check for smooth operation.
Replace the plunger if it is faulty.

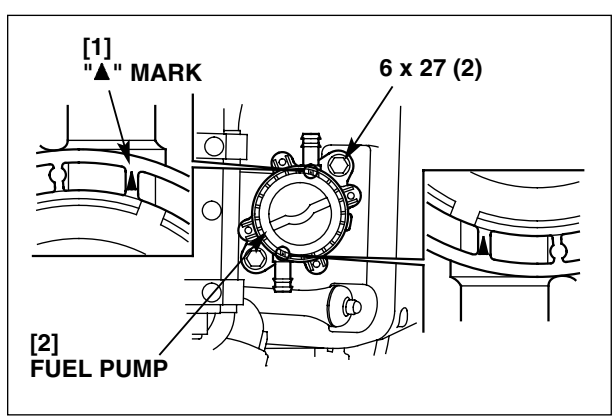


c. INSTALLATION



1) Apply the engine oil to the new O-ring and install it on the fuel pump.

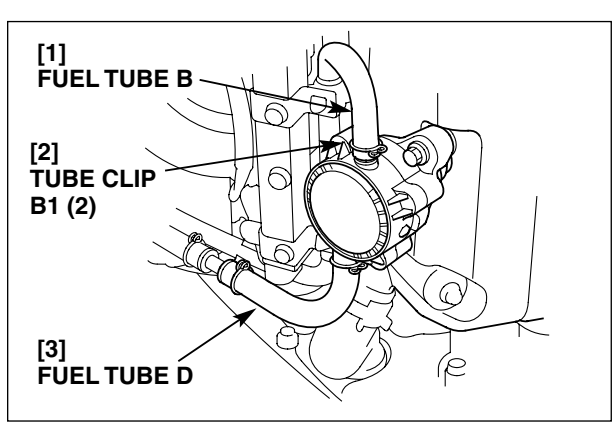
2) Install the fuel pump with the "▲" mark facing up and tighten the two 6 x 27 mm flange bolts to the specified torque.
   TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)



3) Connect the fuel tube B and D and secure them respectively with the tube clip B1s.

4) Install the L. side cover bracket and tighten the 8 x 55 mm flange bolt securely.

5) After assembly, start the engine and check for the gasoline leakage from the low pressure side fuel pump.



15. FUEL STRAINER (LOW PRESSURE SIDE)/WATER SEPARATOR

⚠ WARNING

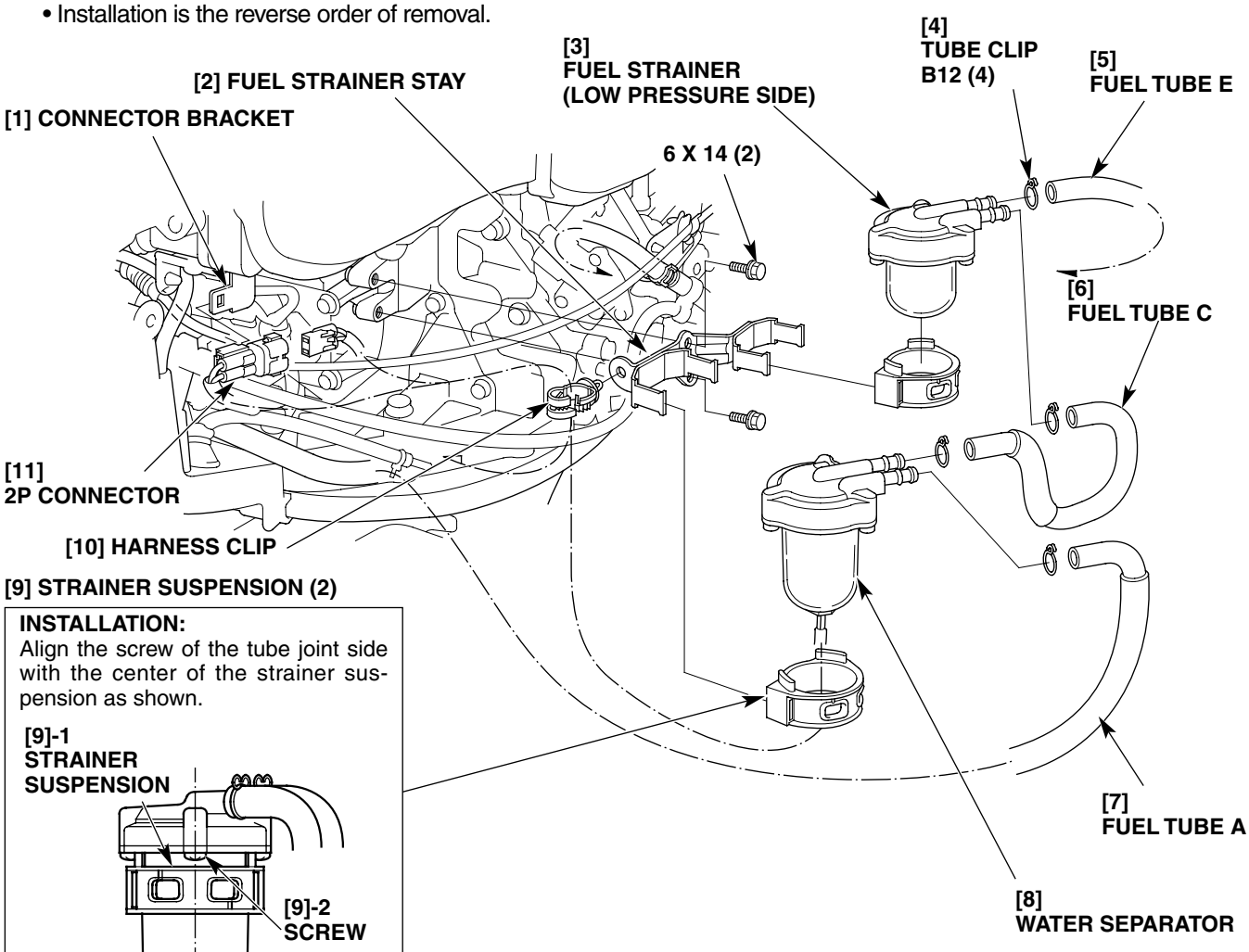
Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

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

a. REMOVAL/INSTALLATION

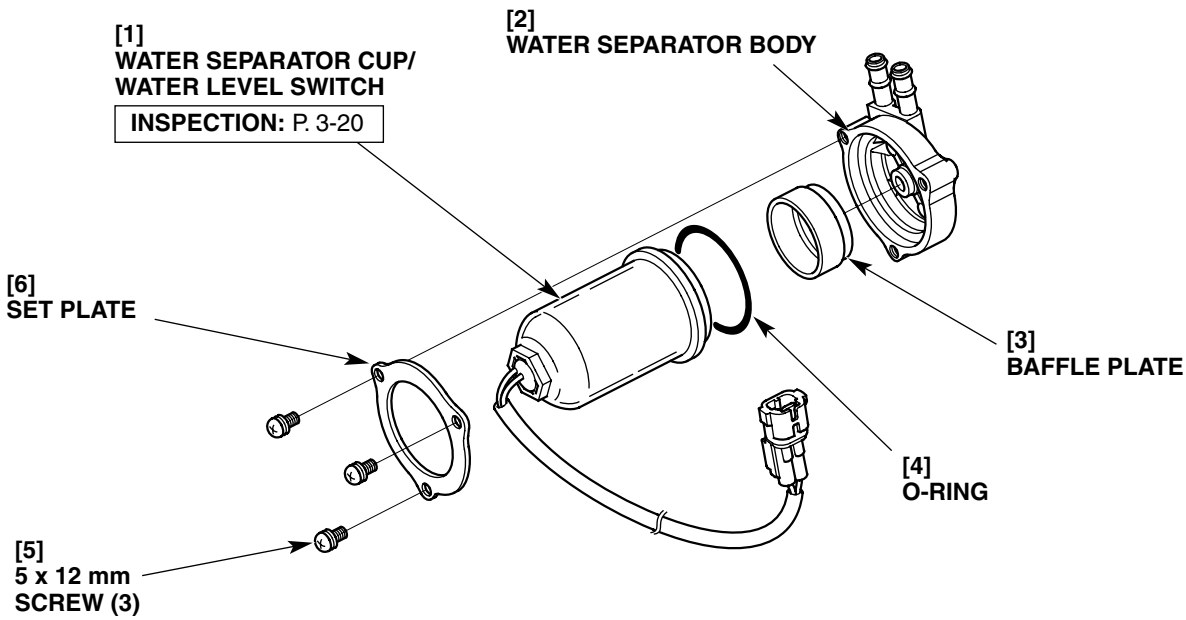
1) Remove the engine cover and the L. engine under cover .
2) Pinch the fuel tube A with the commercially available tube clip and disconnect the fuel tube A from the water separator.
3) Remove the water level sensor 2P connector from the connector bracket and disconnect the connector.
4) Pinch the fuel tube E with the commercially available tube clip and disconnect the fuel tube E from the fuel strainer (low pressure side).
5) Disconnect the fuel tube C from the water separator and fuel strainer.
6) Remove the fuel strainer and water separator.
7) Remove the 6 x 14 mm flange bolts and fuel strainer stay.
   - Installation is the reverse order of removal.



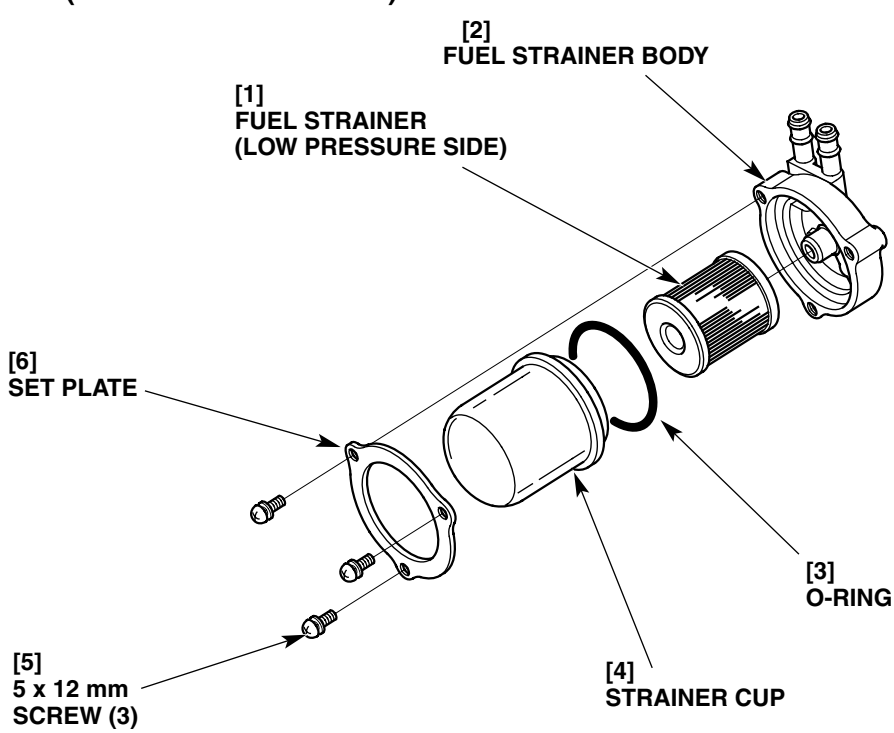
INSTALLATION:
Align the screw of the tube joint side with the center of the strainer suspension as shown.

b. DISASSEMBLY/REASSEMBLY

• WATER SEPARATOR



• FUEL STRAINER (LOW PRESSURE SIDE)

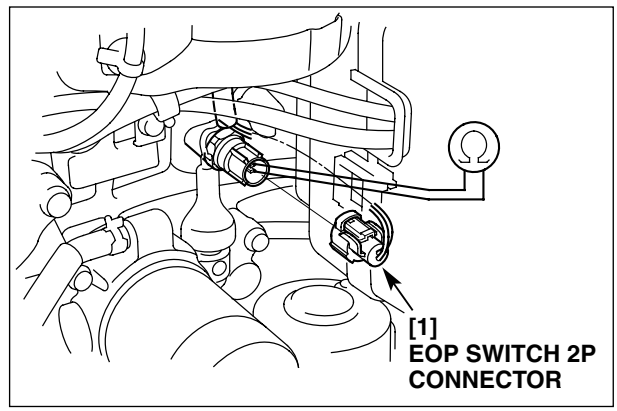


16. EOP (ENGINE OIL PRESSURE) SWITCH (HIGH PRESSURE SIDE)

a. INSPECTION

1) Disconnect the high pressure side EOP switch 2P connector.

2) Check for the continuity between the switch side 2P connector terminals.
   - The high pressure side EOP switch is normal if there is continuity.
   - Replace the high pressure side EOP switch if there is no continuity.



b. REPLACEMENT

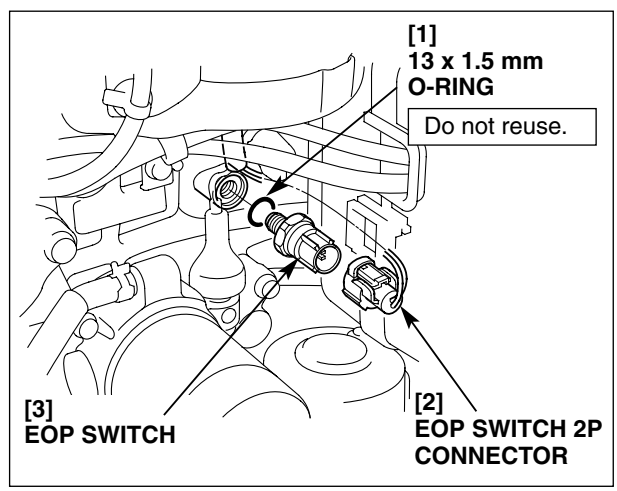
1) Disconnect the high pressure side EOP switch 2P connector.

2) Remove the EOP switch and the O-ring.
   - Replace the O-ring on assembly.

3) Apply the engine oil to the new O-ring and install it on the switch.

4) Tighten the EOP switch to the specified torque.
   TORQUE: 22 N•m (2.2 kgf•m, 16 lbf•ft)

5) After installation, connect the switch connector.

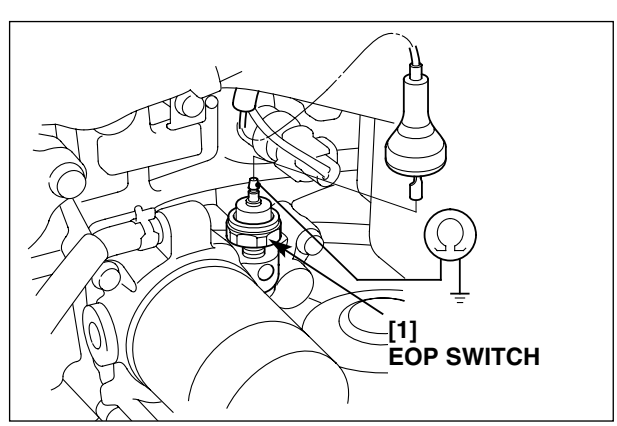


17. EOP (ENGINE OIL PRESSURE) SWITCH (LOW PRESSURE SIDE)

a. INSPECTION

1) Disconnect the low pressure side EOP switch terminal.

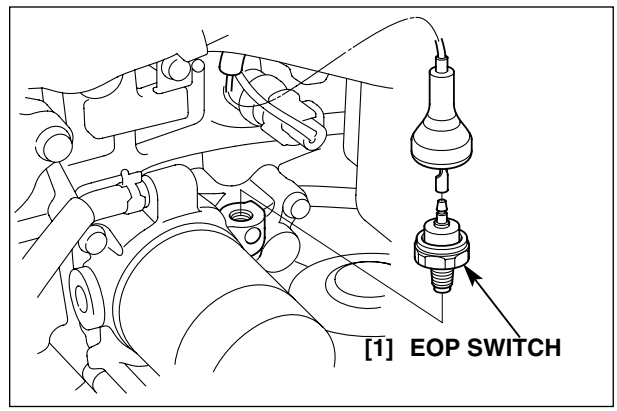
2) Check for the continuity between the switch terminal and the engine ground.
   - The low pressure side EOP switch is normal if there is continuity.
   - Replace the low pressure side EOP switch if there is no continuity.

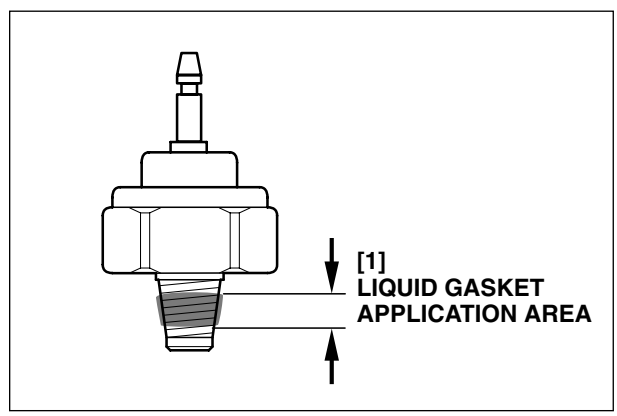


b. REPLACEMENT

1) Disconnect the low pressure side EOP switch terminal.
2) Remove the EOP switch.
3) Clean the EOP switch installation section in the crankcase.
4) Apply the liquid gasket (ThreeBond® #1215 or equivalent) to the indicated area of the threads of the new EOP switch.
5) Install and tighten the EOP switch to the specified torque.
   TORQUE: 8 N•m (0.8 kgf•m, 6 lbf•ft)

   NOTICE
   - *Be sure to use the torque wrench to tighten the EOP switch.*
   - *Do not exceed the specified torque when tightening the EOP switch. Overtightening will damage the cylinder block.*
6) Connect the EOP switch terminal.

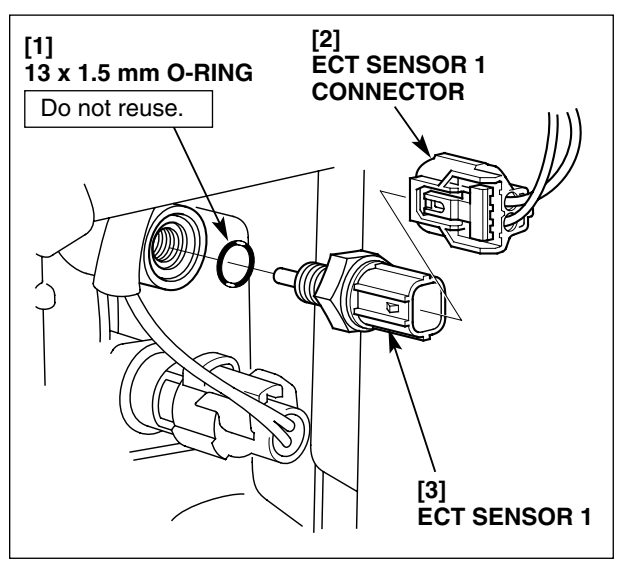




18. ECT (ENGINE COOLANT TEMPERATURE) SENSOR 1

a. REPLACEMENT

1) Disconnect the 2P connector of ECT sensor 1.
2) Remove the ECT sensor 1 and the O-ring.
   - Replace the O-ring on assembly.
3) Apply the engine oil to the new O-ring and install it on the ECT sensor 1.
4) Tighten the ECT sensor 1 to the specified torque.
   TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)
5) Connect the ECT sensor 1 connector.



19. ECT (ENGINE COOLANT TEMPERATURE) SENSOR 2, 3, 4

a. REPLACEMENT

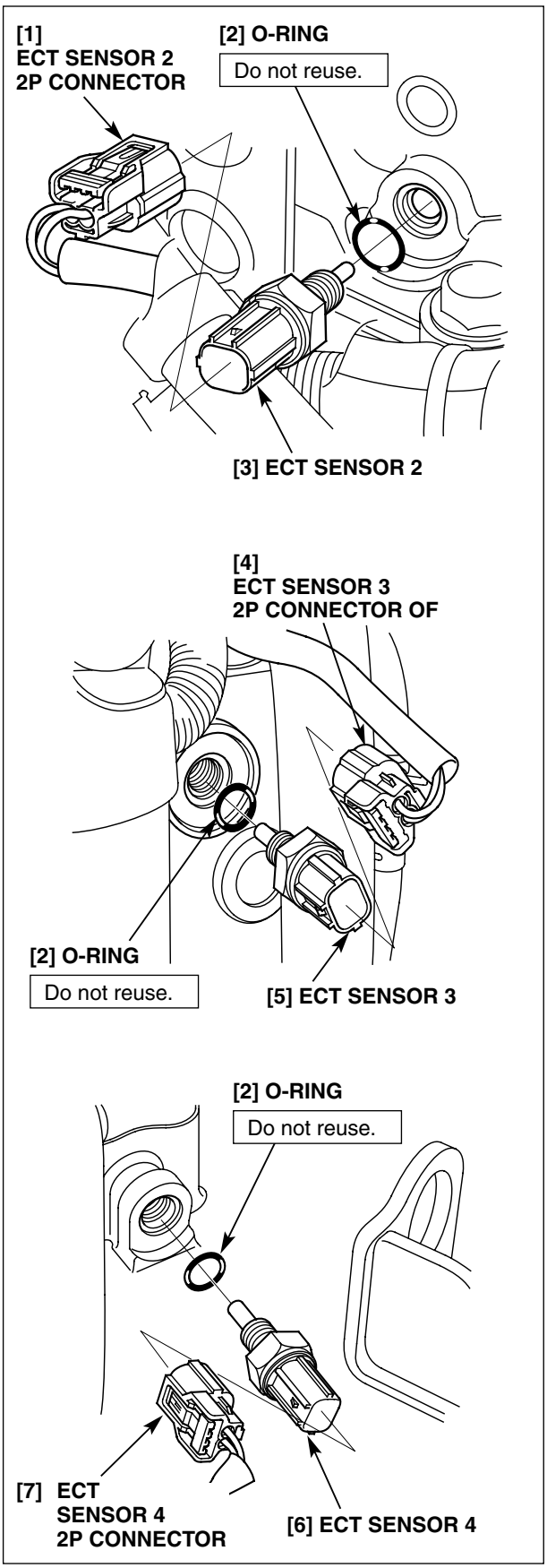
1) Disconnect the ECT sensor 2P connector.

2) Remove the ECT sensor and the O-ring.
   • Replace the O-ring with a new one on assembly.

3) Apply the engine oil to the new O-ring and install it on the ECT sensor.

4) Tighten the overheat sensor to the specified torque.
   TORQUE: 12 N•m (1.2 kgf•m, 9 lbf•ft)

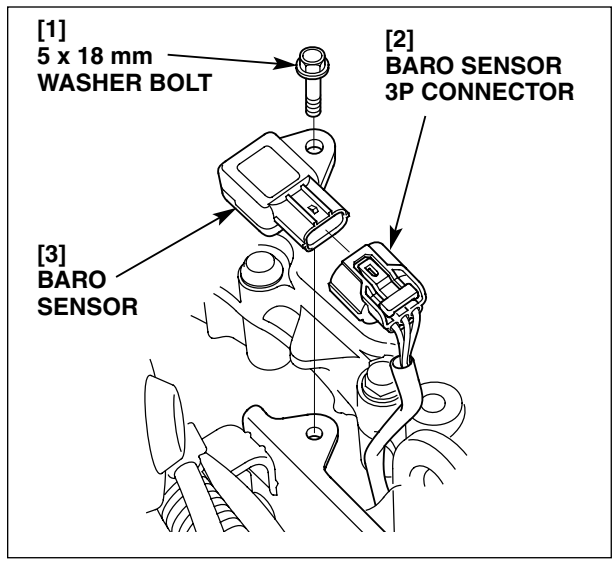
5) After installation, connect the ECT sensor 2P connector.



20. BARO (BAROMETRIC PRESSURE) SENSOR

a. REPLACEMENT

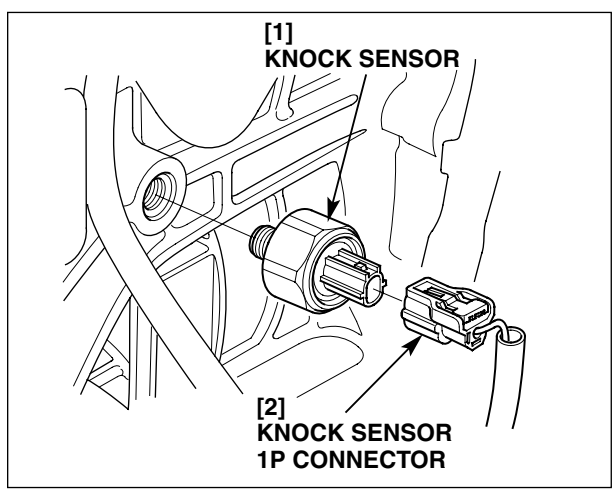
1) Disconnect the BARO sensor 3P connector.
2) Remove the 5 x 18 mm washer bolt and remove the BARO sensor.
3) Install the BARO sensor and tighten the 5 x 18 mm washer bolt securely.
4) After installation, connect the BARO sensor 3P connector.



21. KNOCK SENSOR

a. REPLACEMENT

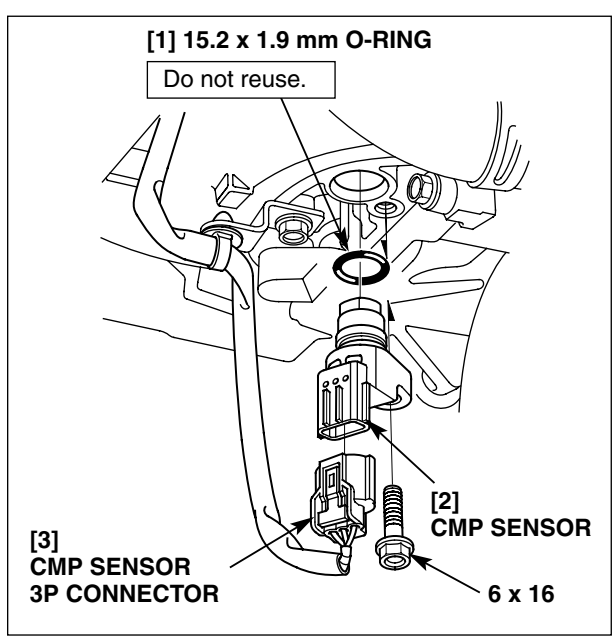
1) Disconnect the knock sensor 1P connector.
2) Remove the knock sensor.
3) Tighten the knock sensor to the specified torque.
   TORQUE: 31 N•m (3.1 kgf•m, 22 lbf•ft)
4) After installation, connect the knock sensor 1P connector.



22. CMP (CAMSHAFT POSITION) SENSOR

a. REPLACEMENT

1) Remove the R./L. side covers.
2) Disconnect the CMP sensor 3P connector.
3) Remove the 6 x 16 mm flange bolt and remove the CMP sensor and the O-ring.
   • Replace the O-ring on assembly.
4) Apply the engine oil to the new O-ring and install it on the CMP sensor.
5) Tighten the 6 x 16 mm flange bolt.
6) After installation, connect the CMP sensor 3P connector.
7) Install the removed parts in the reverse order of removal.



23. CKP (CRANKSHAFT POSITION) SENSOR

a. REPLACEMENT

1) Remove the silencer case (P. 5-128).

2) Disconnect the CKP sensor 3P connector.

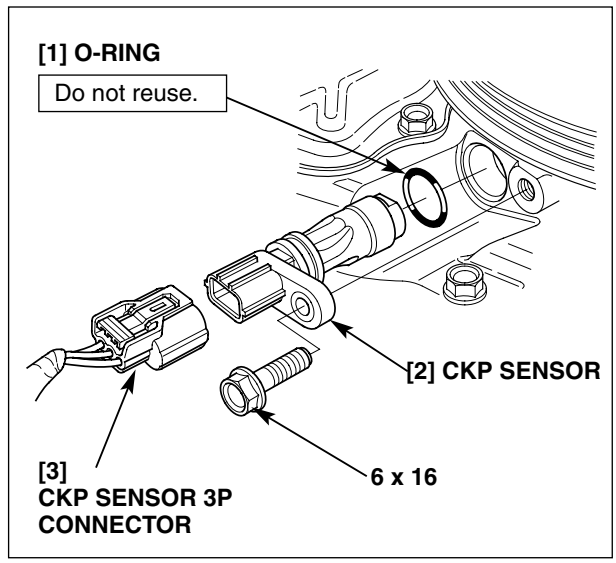
3) Remove the 6 x 16 mm flange bolt, and remove the CKP sensor and the O-ring.
   • Replace the O-ring on assembly.

4) Apply the engine oil to the new O-ring and install it on the CKP sensor.

5) Tighten the 6 x 16 mm flange bolt securely.

6) After installing the CKP sensor, connect the CKP sensor 3P connector.

7) Install the removed parts in the reverse order of removal.



24. VTEC SOLENOID VALVE (BF150A Only)

a. REPLACEMENT

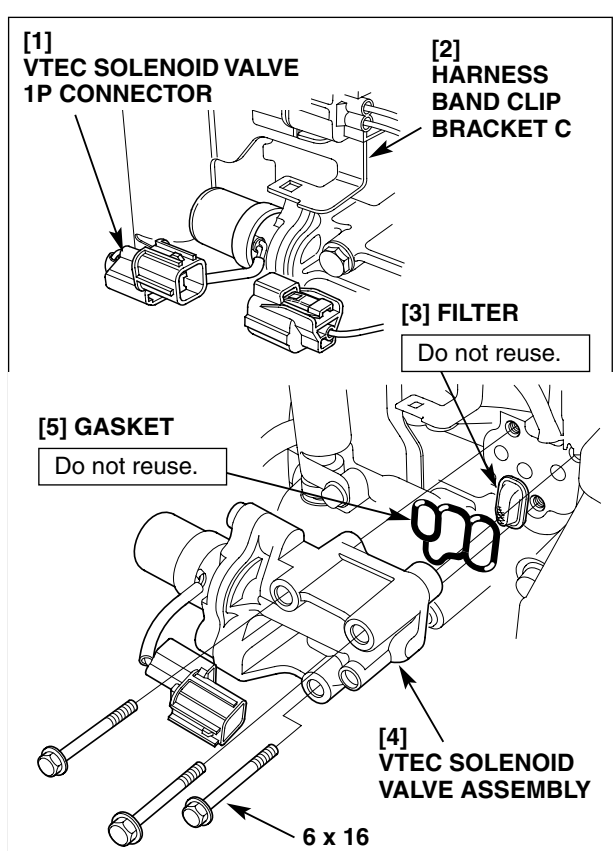
1) Disconnect the VTEC solenoid valve 1P connector and disconnect the connector from the harness band clip bracket C.

2) Remove the three 6 x 55 mm flange bolts. Remove the VTEC solenoid valve assembly, gasket and the filter.
   • Replace the gasket and filter as an assembly of the VTEC solenoid valve assembly.

3) Install the new gasket and filter on the VTEC solenoid valve.

4) Install the VTEC solenoid valve assembly and tighten the 6 x 55 mm flange bolts securely.

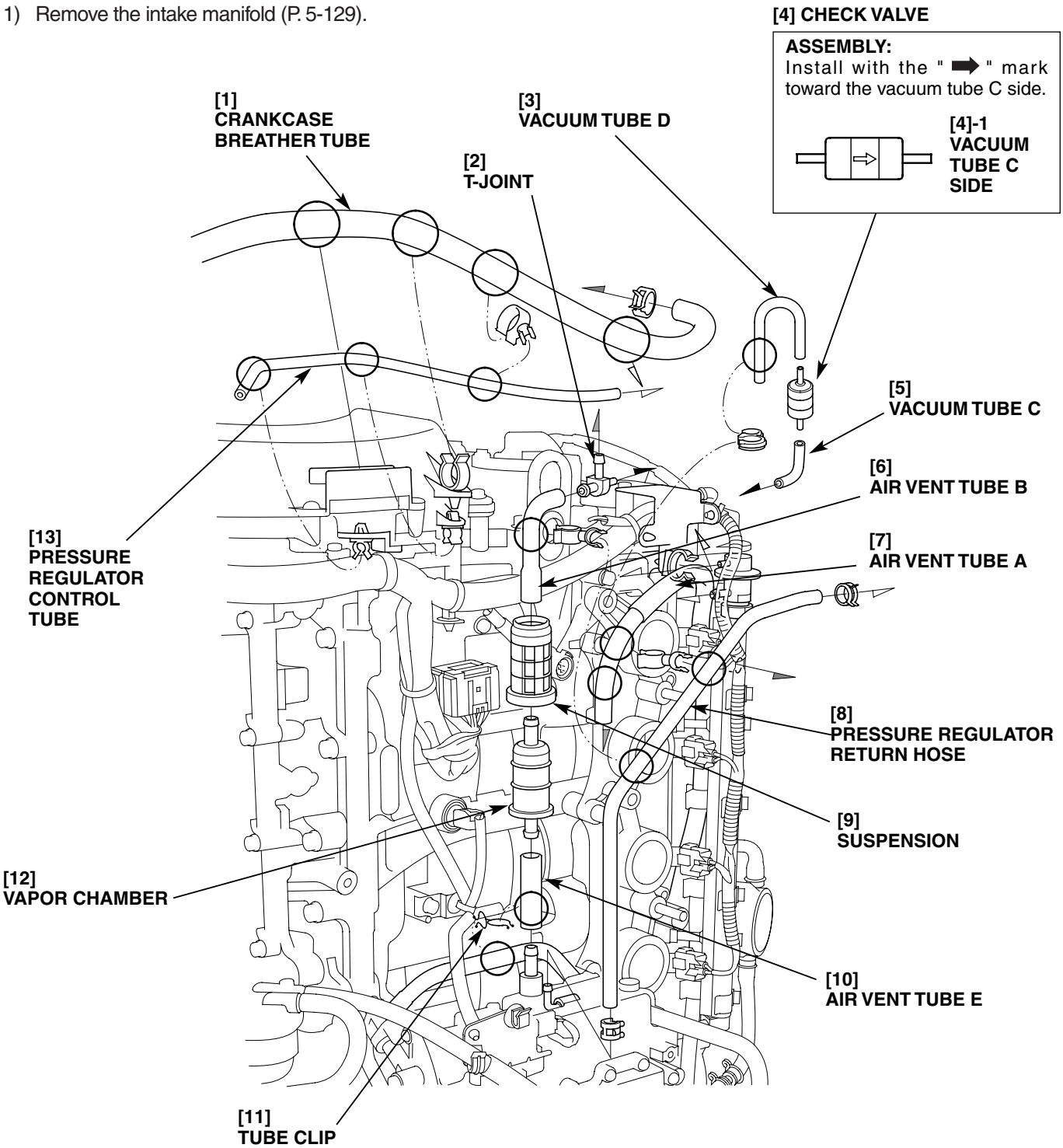
5) Connect the VTEC solenoid valve 3P connector and set it on the harness band clip bracket C.



25. VAPOR CHAMBER/CHECK VALVE

a. DISASSEMBLY/ASSEMBLY

1) Remove the intake manifold (P. 5-129).

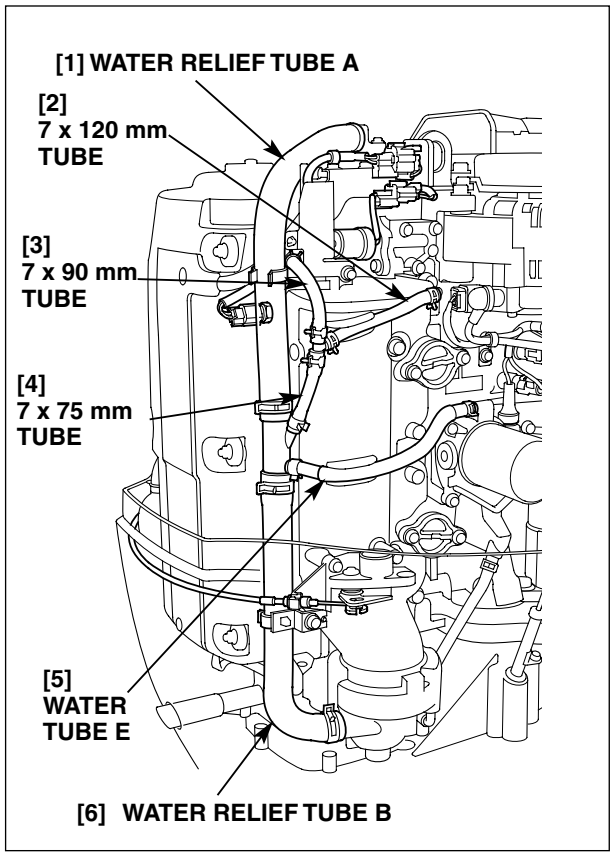


26. EXHAUST MANIFOLD

a. REMOVAL

1) Remove the engine cover and the L./R. engine under covers (P. 4-2 and 4-9).

2) Disconnect the following water hoses.
   - Water relief tube A/B
   - 7 x 90 mm tube
   - 7 x 75 mm tube
   - 7 x 120 mm tube
   - Water tube E

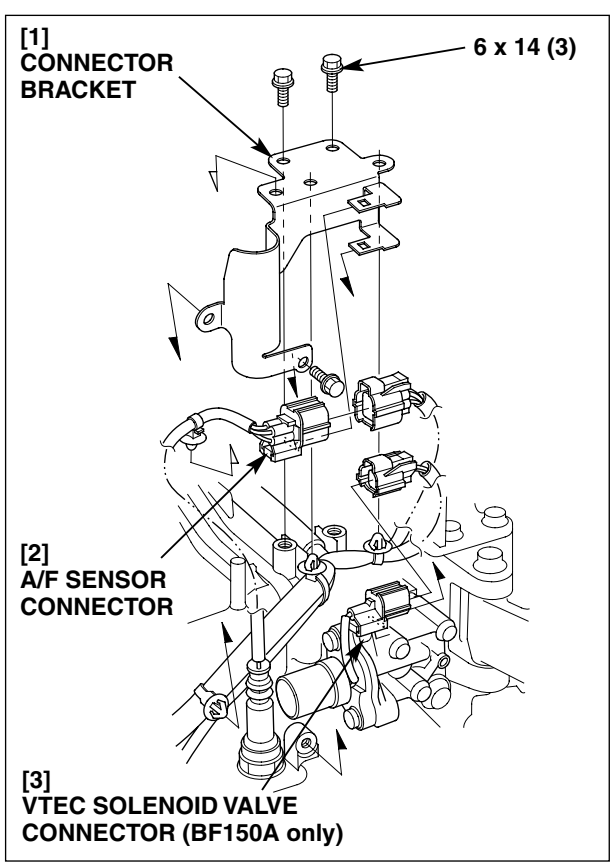


3) BF135A: Disconnect the A/F sensor connector and remove the connector from the harness band clip bracket.

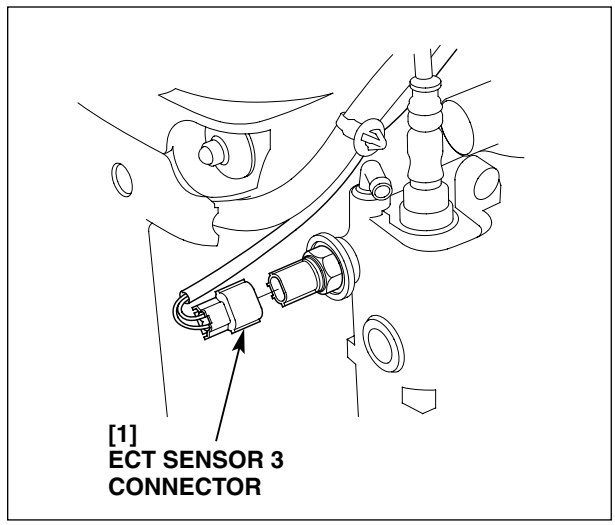
   BF150A: Disconnect the A/F sensor and VTEC solenoid valve connectors, and remove the connectors from the harness band clip bracket.

4) Remove the harness band clip from the connector bracket.

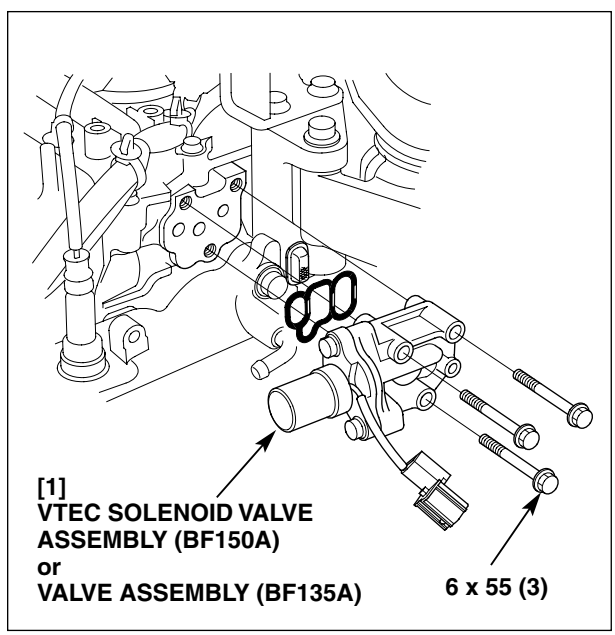
5) Remove the three 6 x 14 mm flange bolts and remove the connector bracket.



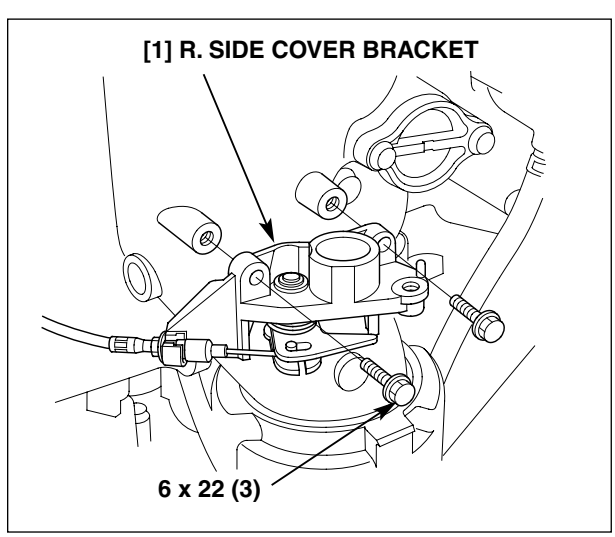
6) Disconnect the ECT sensor 3 connector.



7) Remove the 6 x 55 mm flange bolts and remove the valve assembly (BF135A) or the VTEC solenoid valve assembly (BF150A).

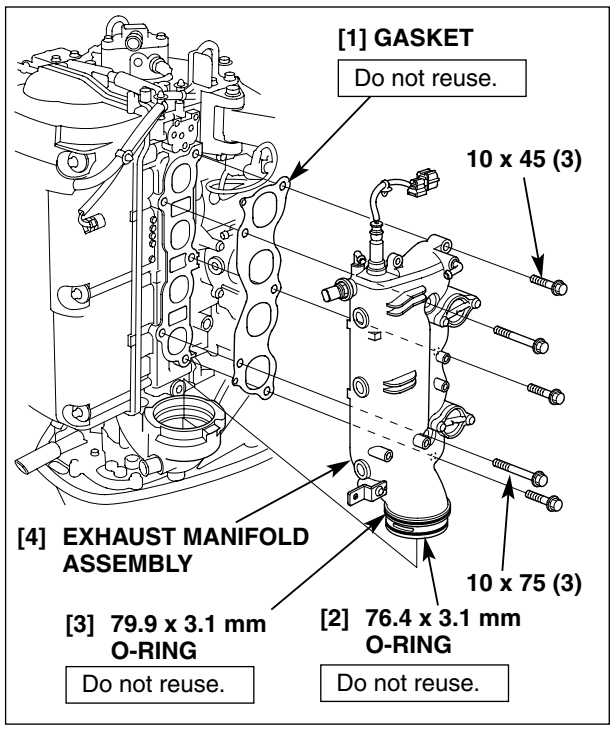


8) Remove the 6 x 22 mm flange bolts and remove the R. side cover bracket.

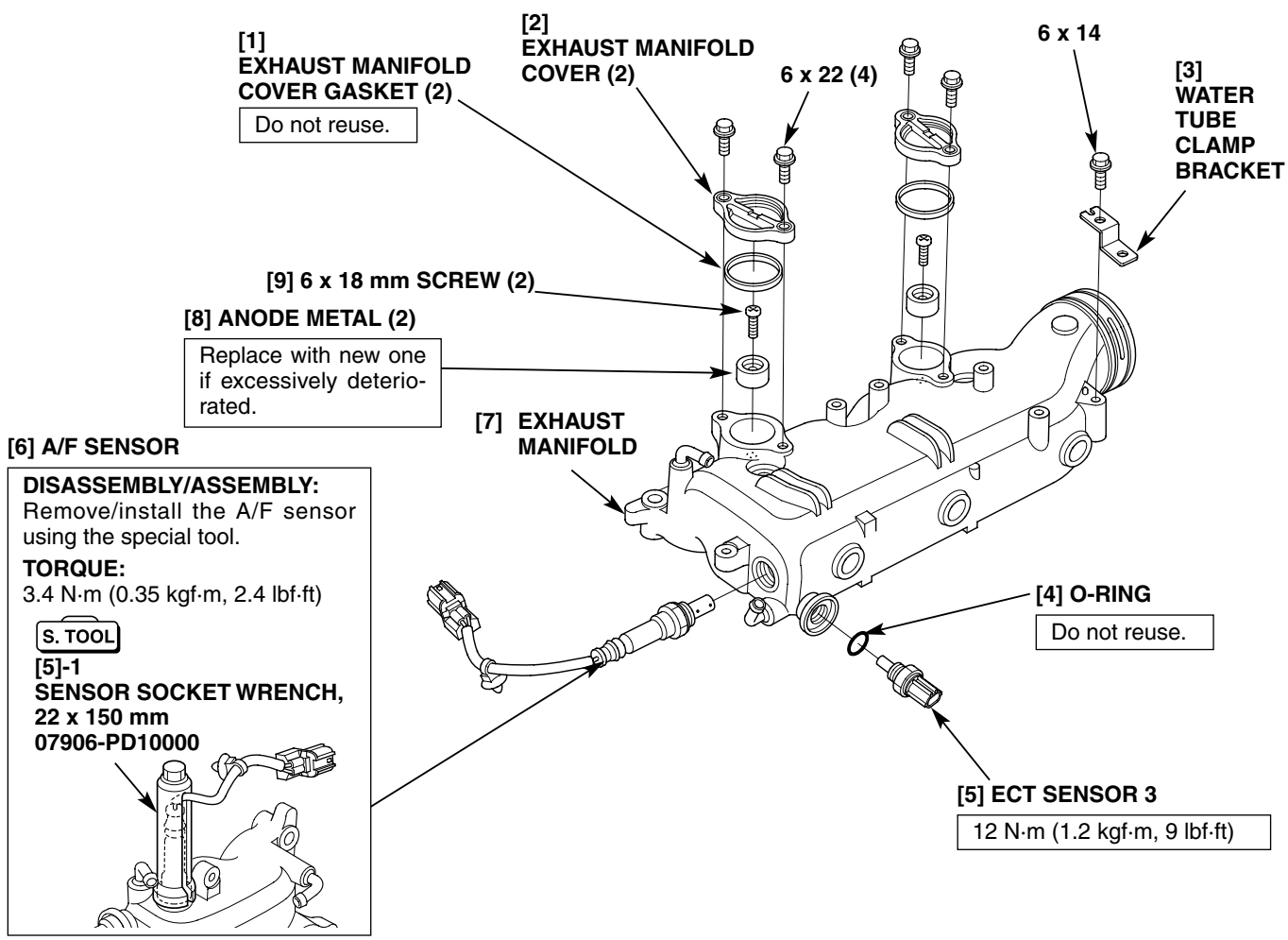


9) Remove the two 10 x 75 mm flange bolts and the three 10 x 45 mm flange bolts. Remove the exhaust manifold and the exhaust manifold gasket.
   • Replace the gasket on assembly.

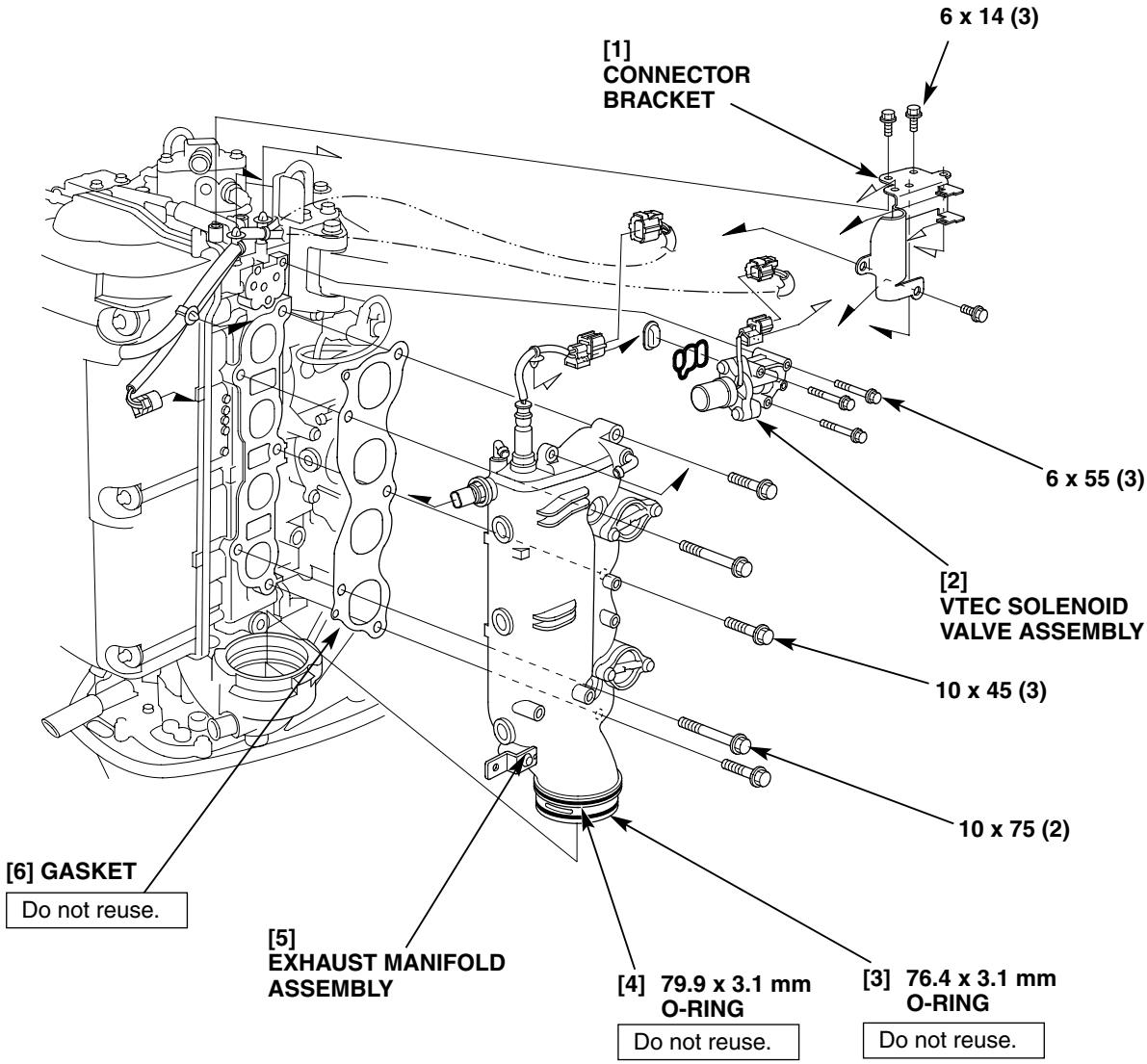
10) Remove the O-ring from the exhaust manifold.
   • Replace the O-ring on assembly.



b. DISASSEMBLY/ASSEMBLY



c. INSTALLATION

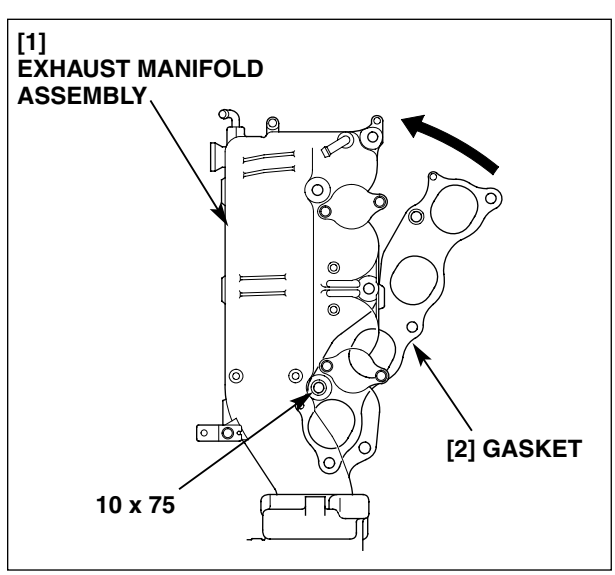


1) Apply the engine oil to the O-rings and install them on the exhaust manifold assembly.

2) Set the exhaust manifold assembly on the exhaust manifold guide.

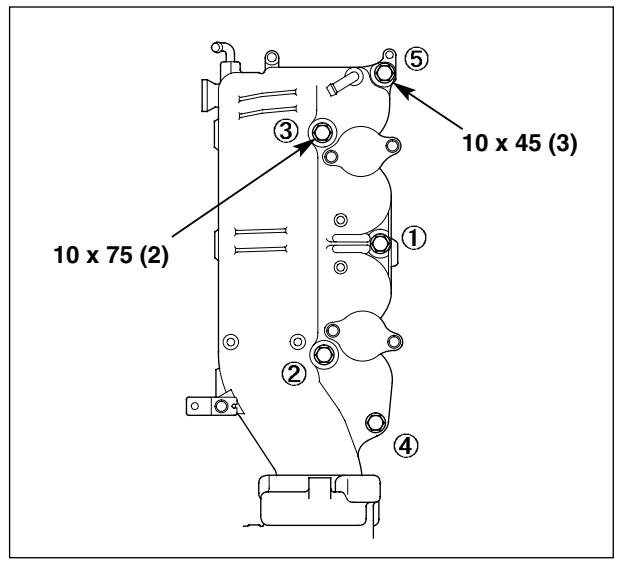
3) Set the new gasket. Align the holes located at the lower left side, and loosely tighten the 10 x 75 mm flange bolt as shown.

4) Align the bolt holes by turning the gasket in the direction shown with the arrow. Take care not to damage the gasket.

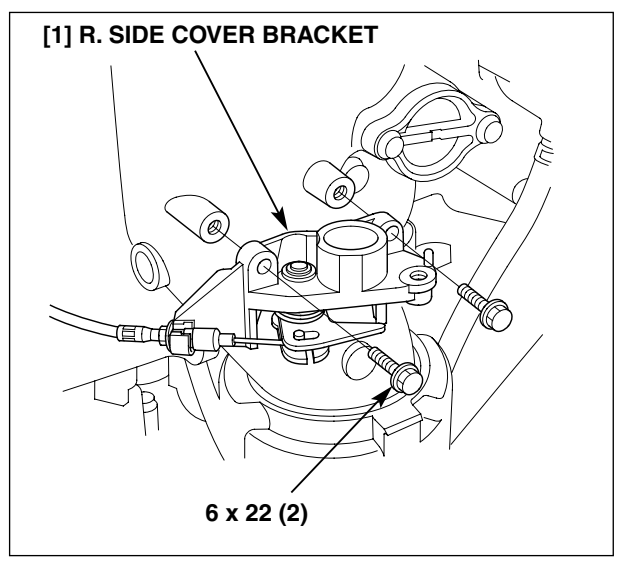


5) Tighten the two 10 x 75 mm flange bolts and the three 10 x 45 mm flange bolts to the specified torque in the numbered sequence in two or three steps.

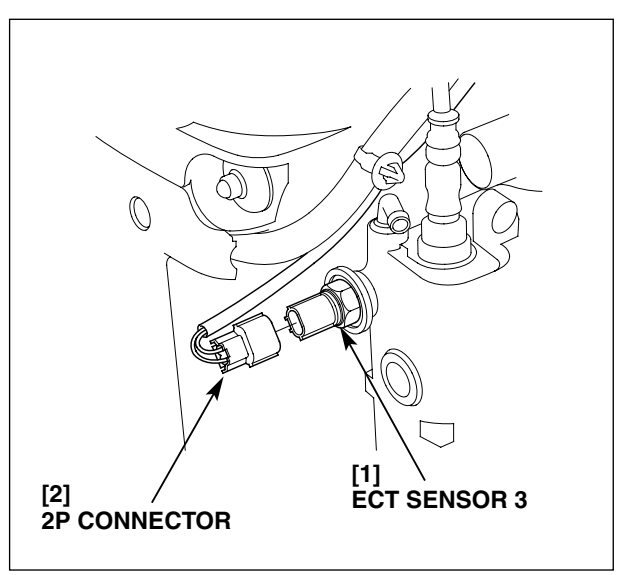
TORQUE: 39 N•m (4.0 kgf•m, 29 lbf•ft)



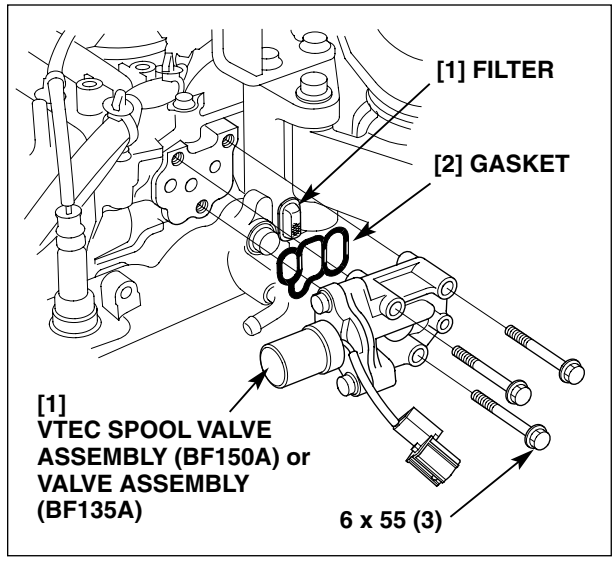
6) Install the R. side cover bracket and tighten the 6 x 22 mm flange bolts securely.



7) Connect the 2P connector to the ECT sensor 3.



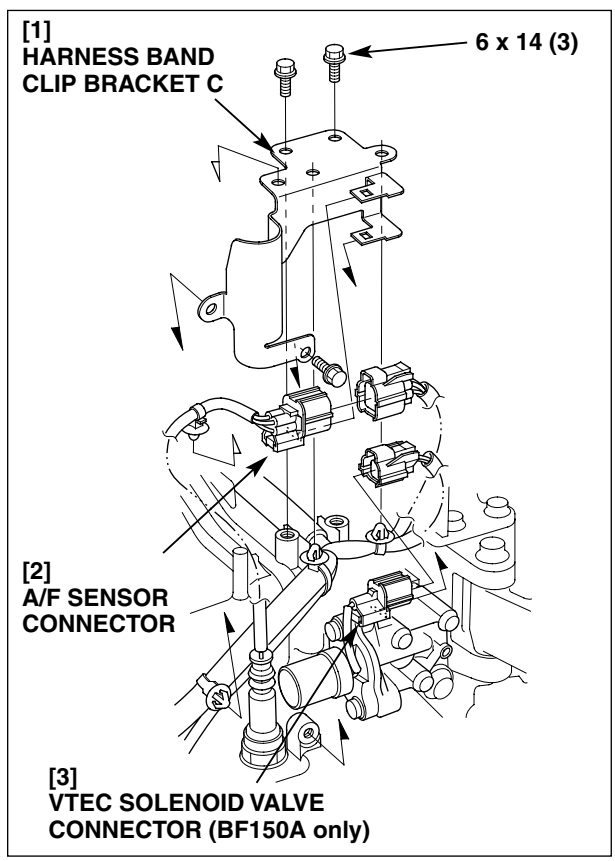
8) Install the VTEC spool valve assembly (BF150A) or valve assembly (BF135A) and tighten the 6 x 55 mm flange bolts securely.
   • Do not allow the gasket and filter to come out of position.



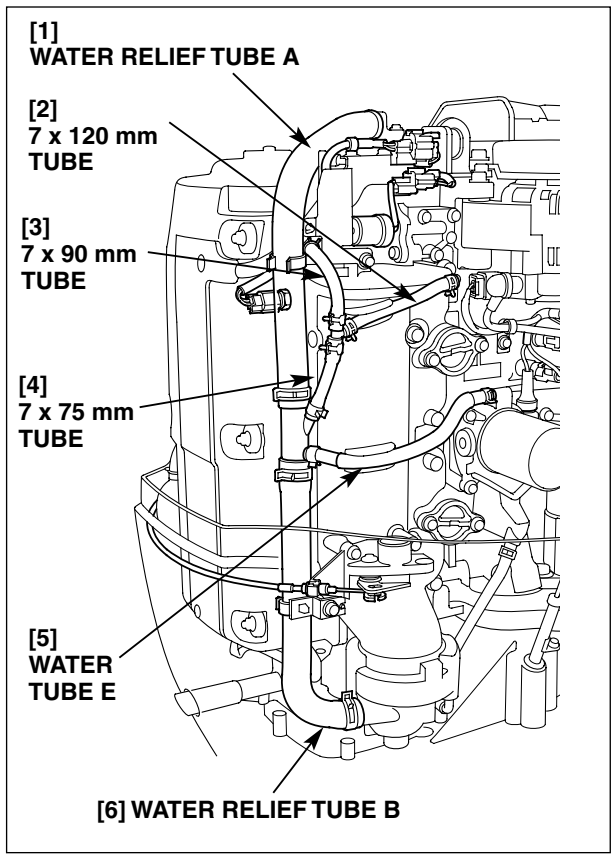
9) Install the harness band clip bracket C and tighten the three 6 x 14 mm flange bolts securely.

10) BF135A: Connect the A/F sensor connector and set the connector on the harness band clip bracket C.
    BF150A: Connect the A/F sensor and the VTEC solenoid valve connectors and set the connectors on the harness band clip bracket C.

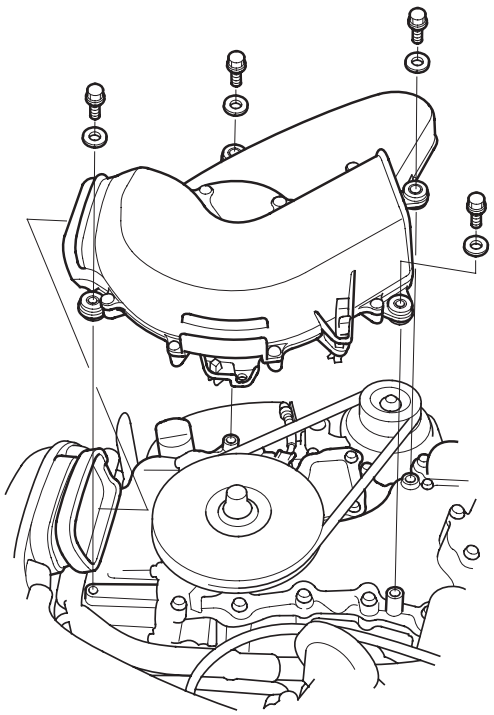
11) Set the harness band clip on the harness band clip bracket C.

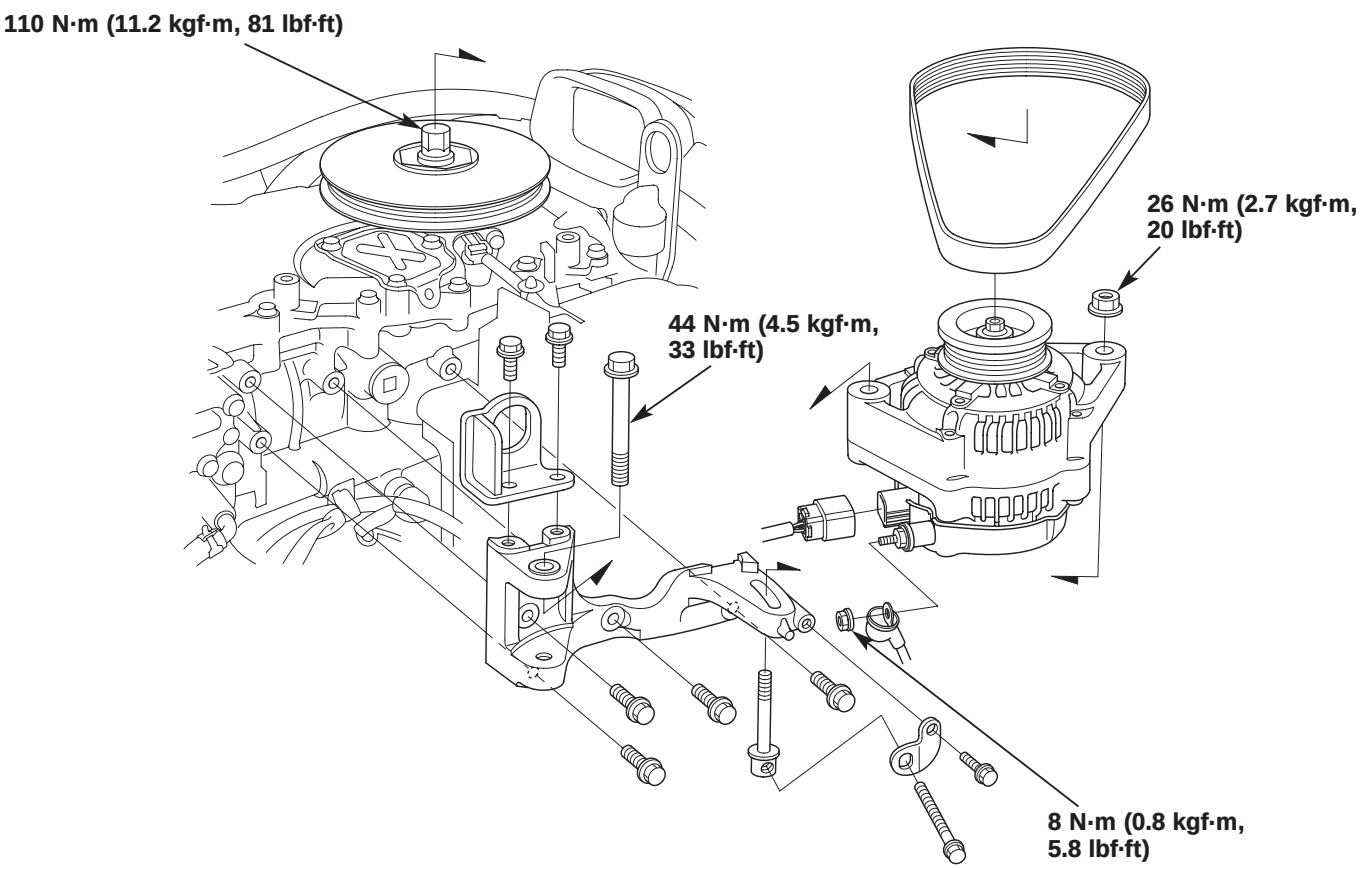


12) Connect the following water hoses.
- Water relief tube A/B
- 7 x 90 mm tube
- 7 x 75 mm tube
- 7 x 120 mm tube
- Water tube E



1. SILENCER DUCT	2. ALTERNATOR





1. SILENCER DUCT

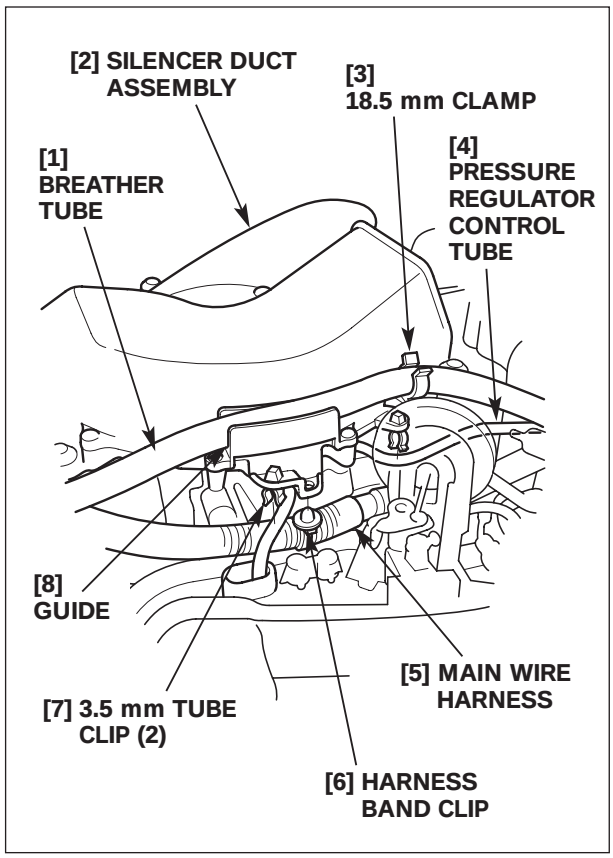
a. REMOVAL

1) Remove the engine cover (P. 4-2).

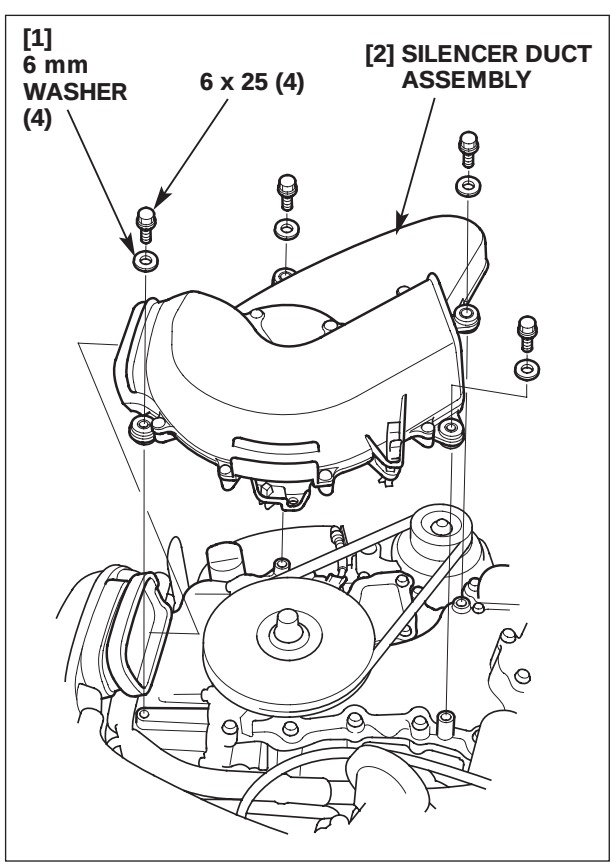
   Release the pressure regulator control tube from the two 3.5 mm tube clips of the silencer duct assembly.

   Remove the harness band clip, that secures the main wire harness, from the silencer duct assembly.

2) Release the breather tube from the 18.5 mm clamp and the guide of the silencer duct assembly.



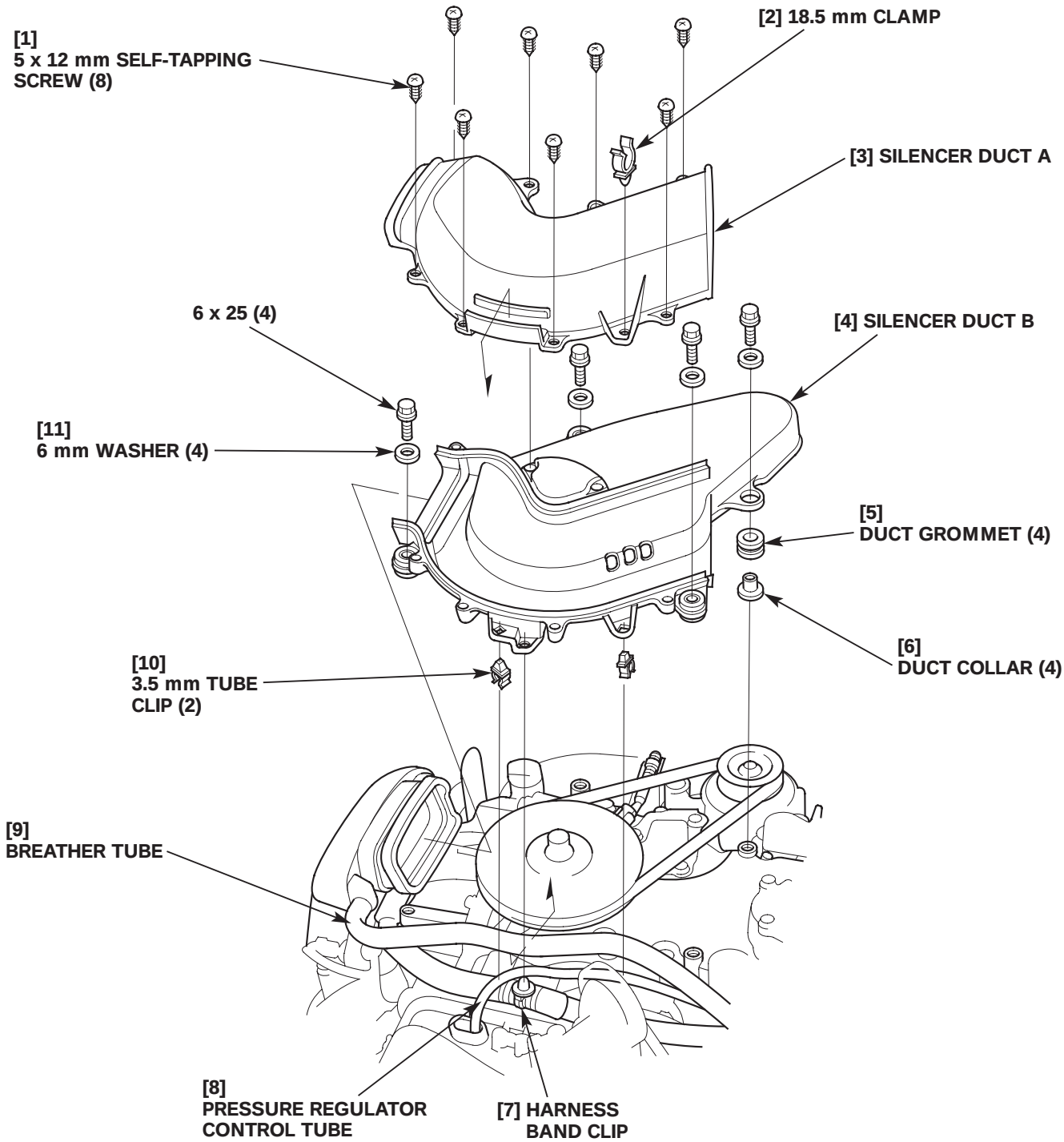
3) Remove the four 6 x 25 mm flange bolts and the four 6 mm washers, then remove the silencer duct assembly.



b. DISASSEMBLY

Remove the eight 5 x 12 mm self-tapping screws and remove the silencer duct A.

c. COMPONENTS DRAWING



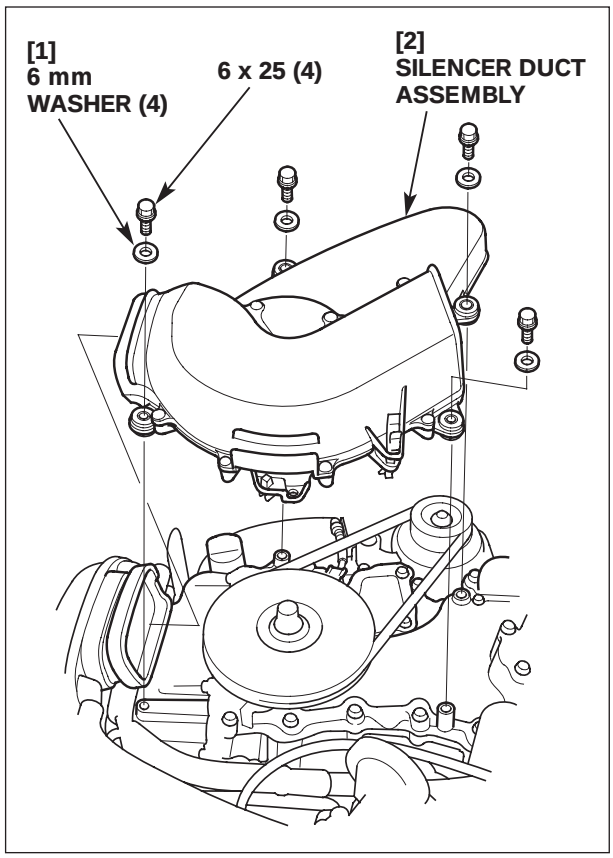
d. ASSEMBLY

Install the silencer duct A on the silencer duct B and tighten the eight 5 x 12 mm self-tapping screws securely.

e. INSTALLATION

1) Install the silencer duct assembly on the silencer case.

2) Set the four 6 mm washers and the four 6 x 25 mm flange bolts, then tighten the four 6 x 25 mm flange bolts securely.



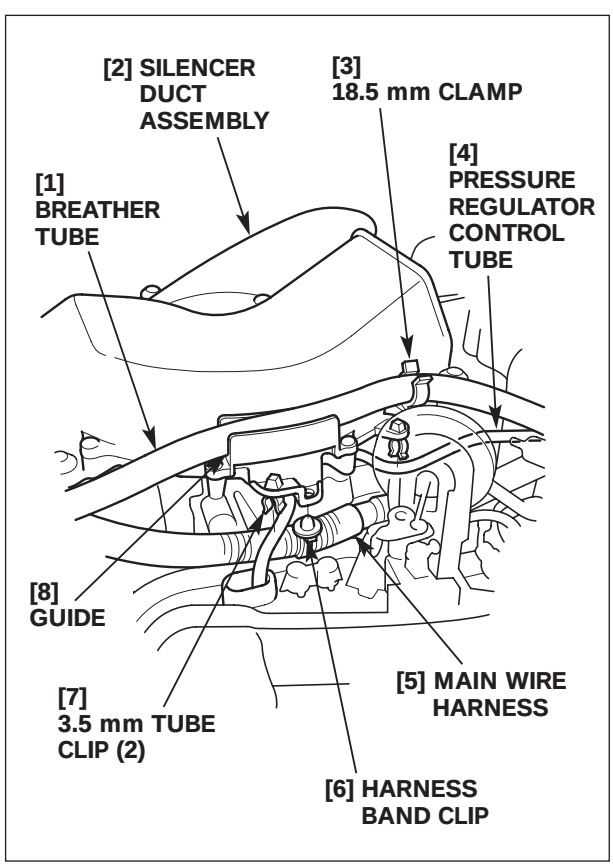
3) Set the breather tube in the 18.5 mm clamp and the guide of the silencer duct assembly.

4) Secure the pressure regulator control tube with the two 3.5 mm tube clips of the silencer duct assembly.

   Connect the pressure regulator control tube aligning the marked part on the tube with the end of the 3.5 mm tube clip (P. 2-71).

5) Install the main wire harness' harness band clip on the silencer duct assembly.

6) Install the engine cover (P. 4-2).



2. ALTERNATOR

a. ALTERNATOR ASSEMBLY INSPECTION (With the alternator assembly mounted on the outboard motor)

NOTICE

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

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

Check the following before starting the alternator assembly inspection.

– Battery condition and cable connection

– Alternator belt for looseness, cut and/or fraying (P. 3-28)

– Alternator 4P connector and alternator 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 the "ON" position and check that the alternator indictor light comes ON.

2) If the alternator indicator light does not come ON, disconnect the alternator 4P 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. 16-9)

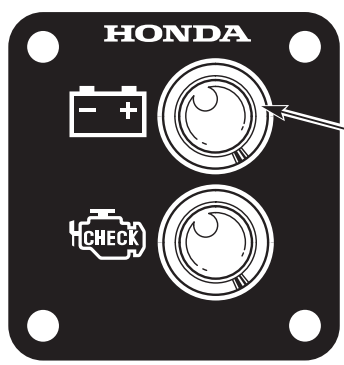
   – Main wire harness for open circuit

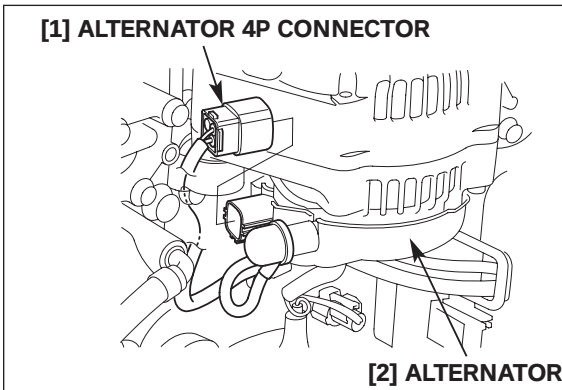
4) Start the engine and check that the alternator indicator light goes OFF.

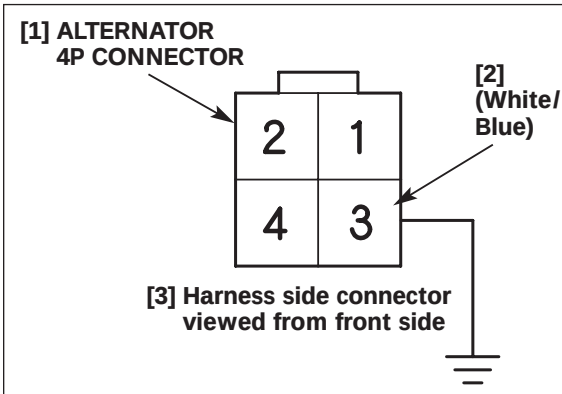
   – The alternator is normal when the light goes OFF.

   – If the indicator light is still ON, check each part of the alternator (P. 6-14) and repeat the above steps 2 and 3.

   - When the alert system functions while the alternator is in operation, the warning buzzer sounds intermittently.







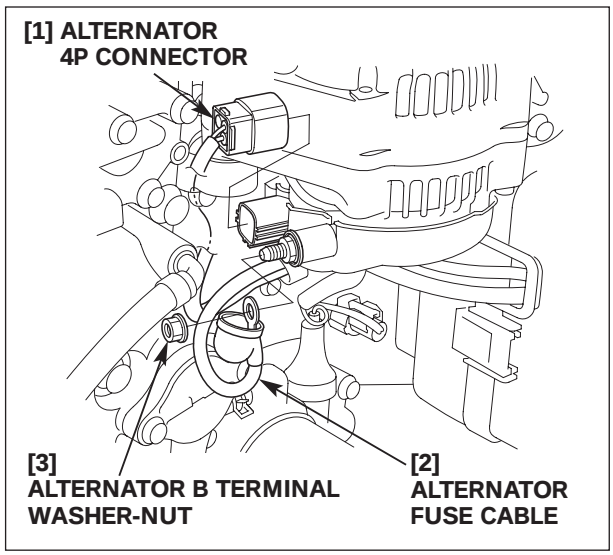
b. REMOVAL

Remove the following pars.
– Engine cover (P. 4-2)
– Silencer duct (P. 6-2)

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

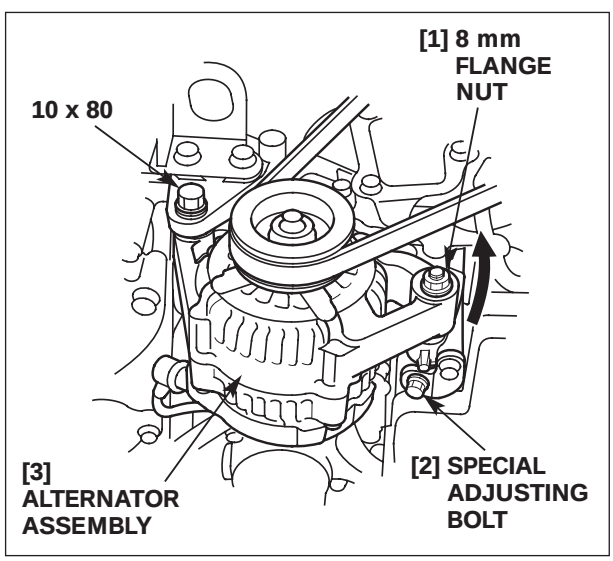
   Disconnect the alternator 4P connector.

   Disconnect the alternator fuse cable from the alternator assembly.



2) Loosen the 10 x 80 mm flange bolt and the 8 mm flange nut.

3) Loosen the special adjusting bolt and move the alternator assembly to the engine side as full as it goes.

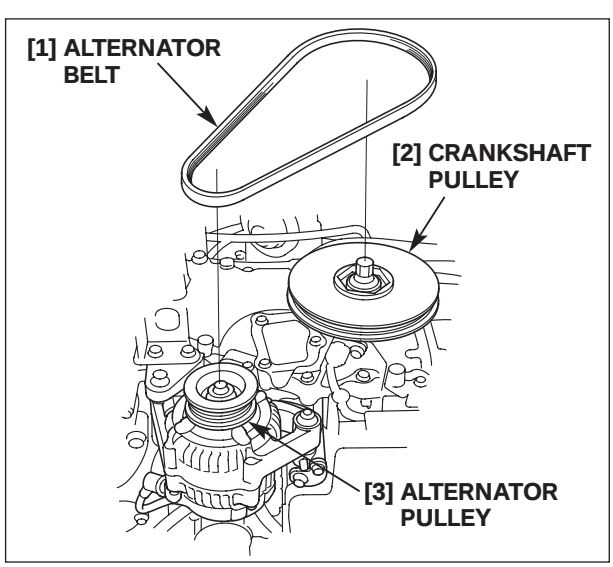


4) Detach the alternator belt from the alternator pulley first, then from the crankshaft pulley.

   Remove the alternator belt.

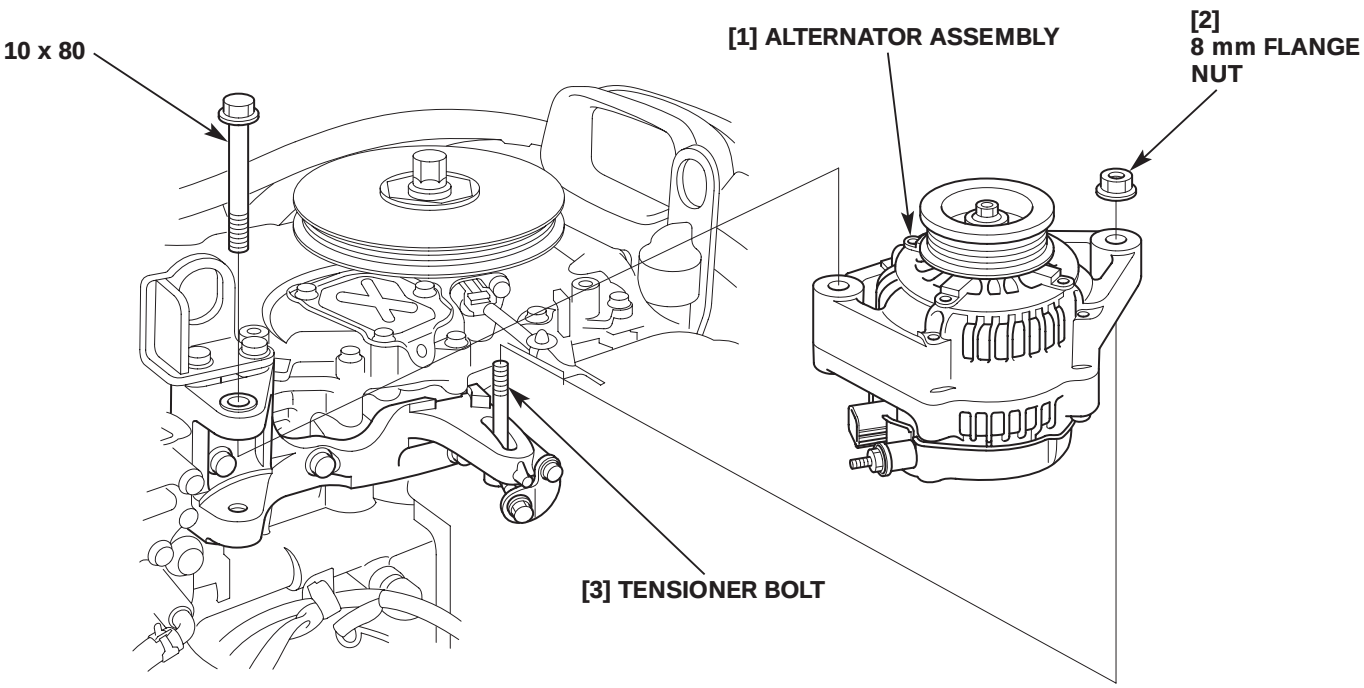
   • Do not contaminate the alternator belt with oil and grease after removal.

   • Do not bend the alternator belt. Store the belt by hanging it on the wall.



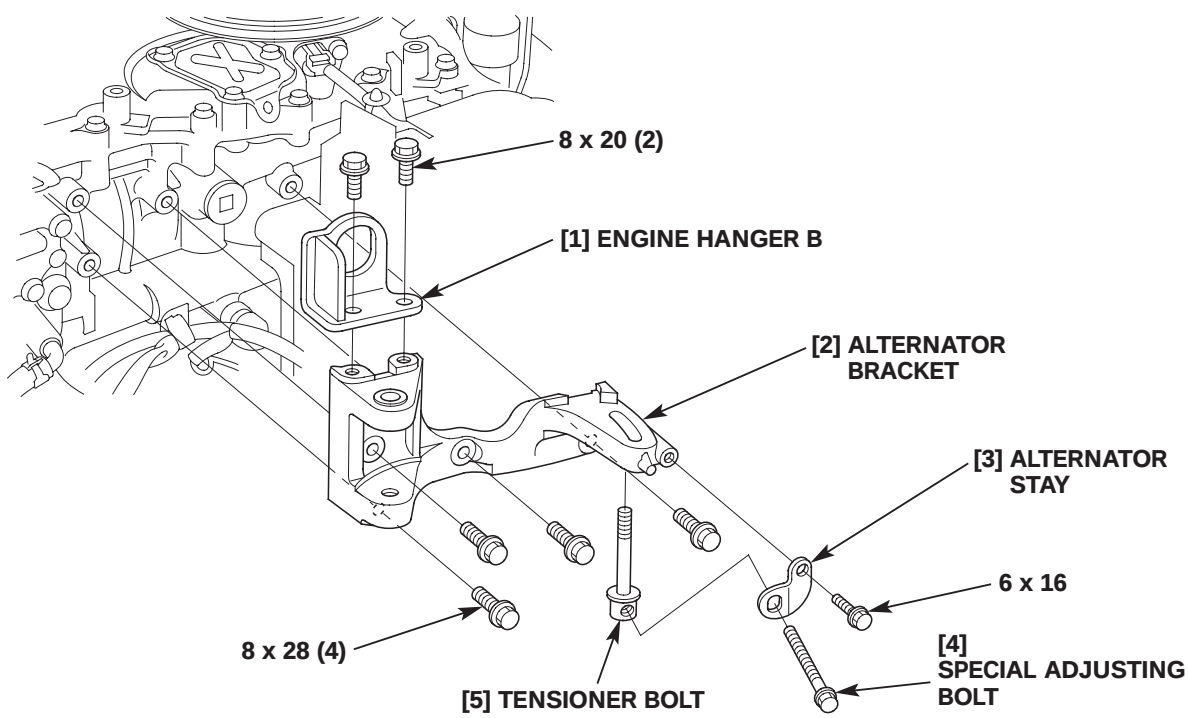
5) Remove the 10 x 80 mm flange bolt. Pull the alternator assembly toward you.

Remove the 8 mm flange nut and remove the alternator assembly from the tensioner bolt.

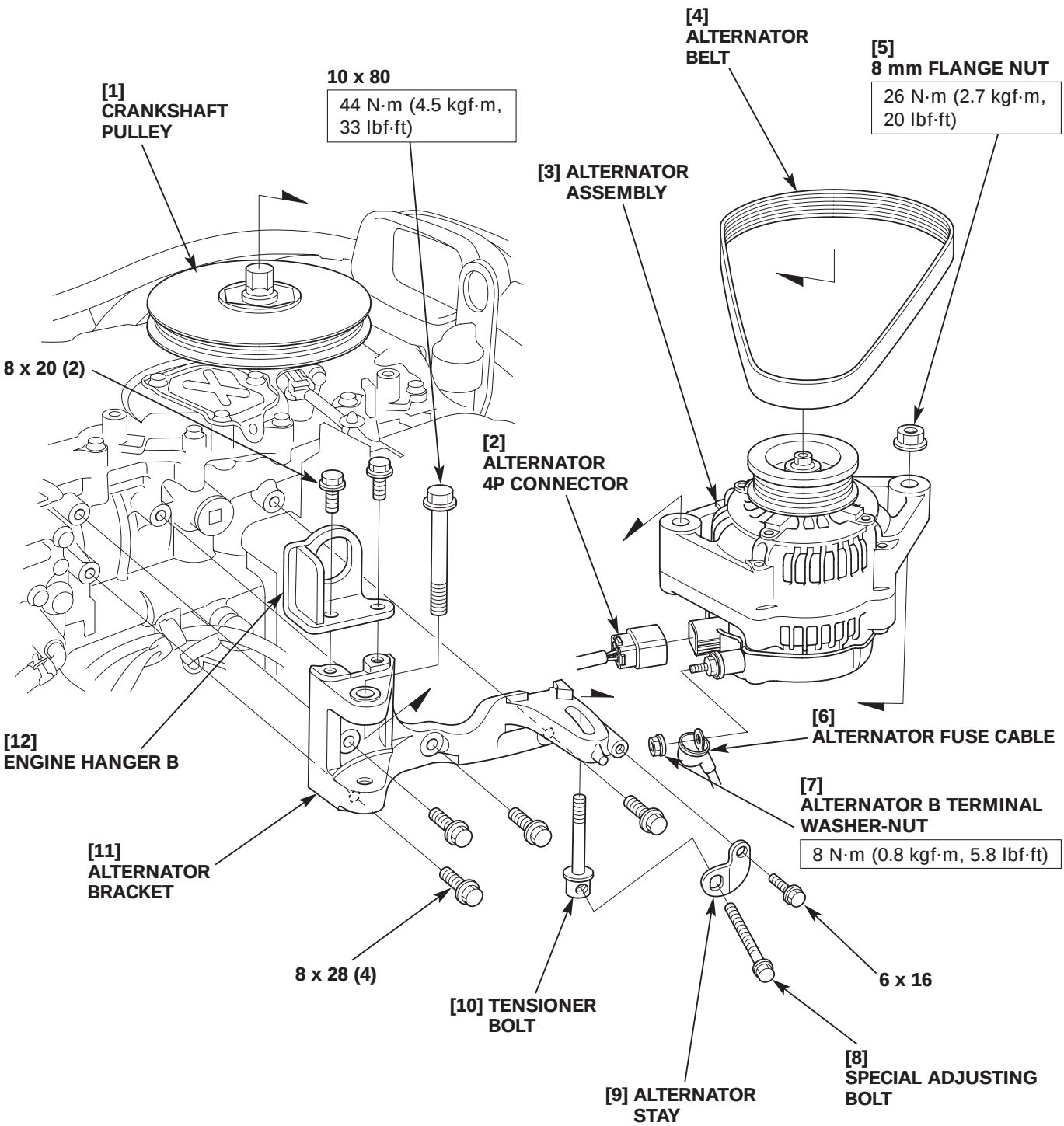


c. ALTERNATOR BRACKET DISASSEMBLY

1) Remove the four 8 x 28 mm flange bolts and remove the alternator bracket.
2) Remove the special adjusting bolt and remove the tensioner bolt.
3) Remove the 6 x 16 mm flange bolt and remove the alternator stay.
4) Remove the two 8 x 20 mm flange bolts and remove the engine hanger B.



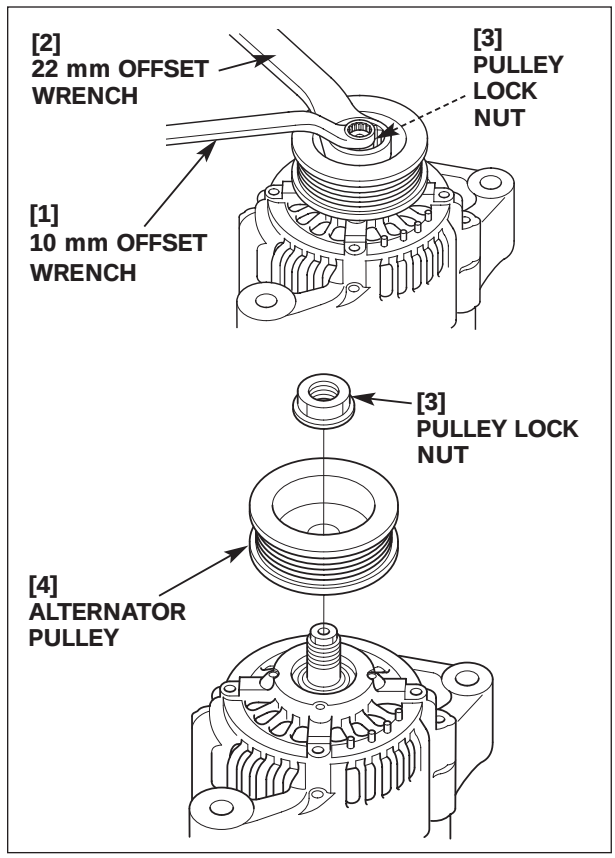
d. ALTERNATOR ASSEMBLY/ALTERNATOR BRACKET COMPONENTS DRAWING



e. ALTERNATOR ASSEMBLY DISASSEMBLY

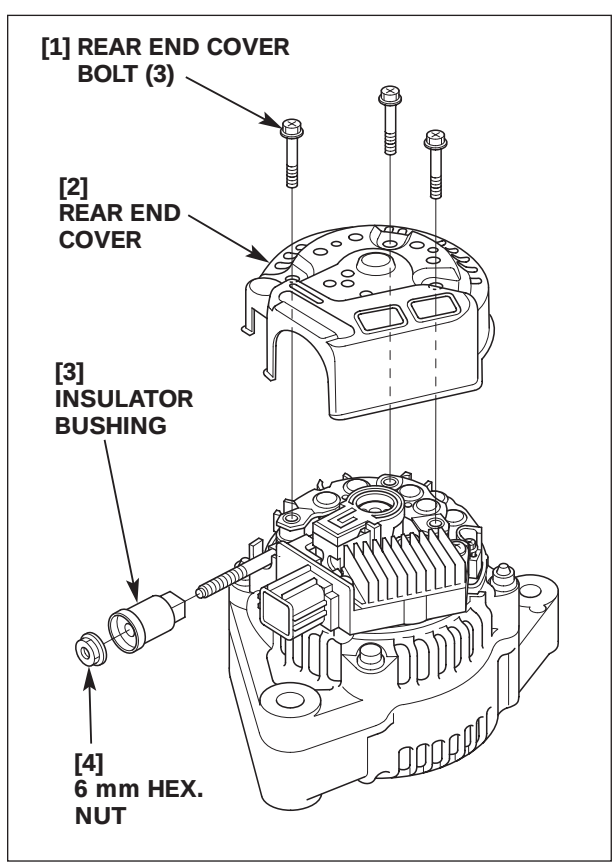
1) Loosen the pulley lock nut using a 22 mm offset wrench and a 10 mm offset wrench.

2) Remove the pulley lock nut and the alternator pulley.



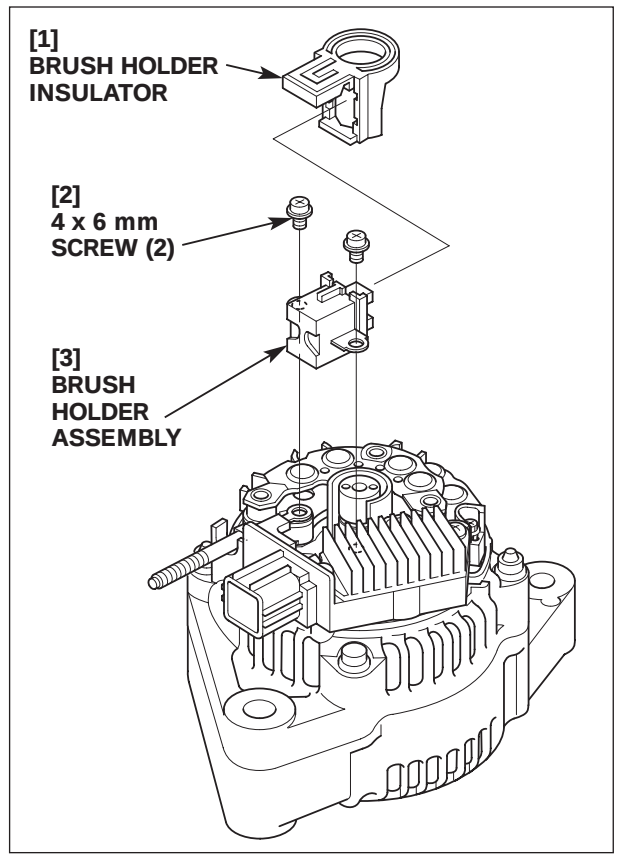
3) Remove the 6 mm hex. nut from the insulator bushing and remove the insulator bushing.

4) Remove the three rear end cover bolts and the rear end cover.

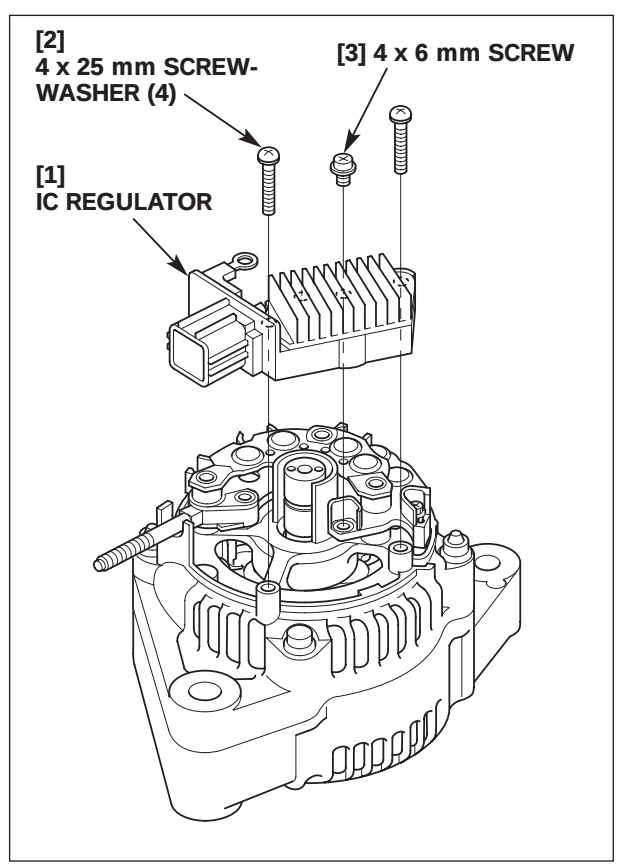


5) Remove the two 4 x 6 mm screws from the brush holder assembly and remove the brush holder assembly.

   Remove the brush holder insulator from the brush holder assembly.



6) Remove the two 4 x 25 mm screw-washers and the 4 x 6 mm screw from the IC regulator, then remove the IC regulator.

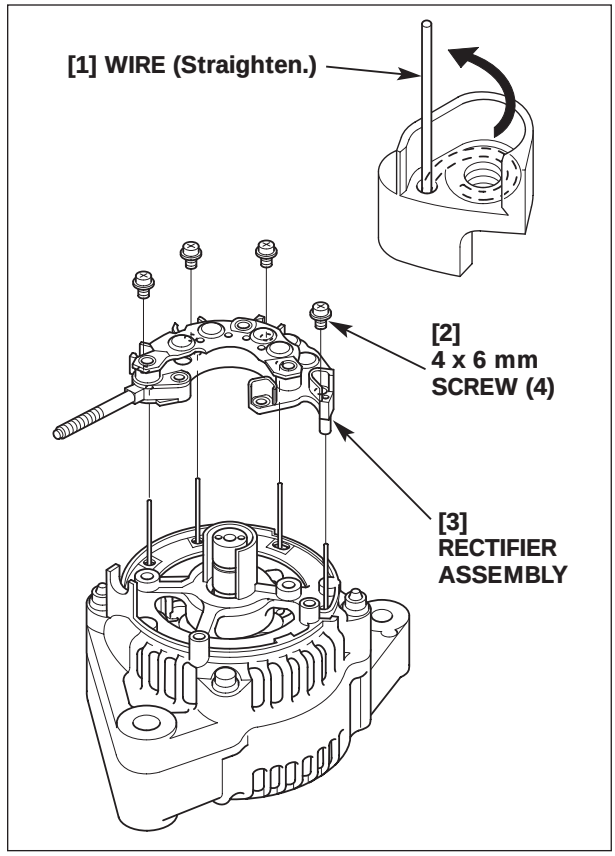


7) Remove the four 4 x 6 mm screws from the rectifier assembly.

8) Straighten the four wires as shown and remove the rectifier assembly.

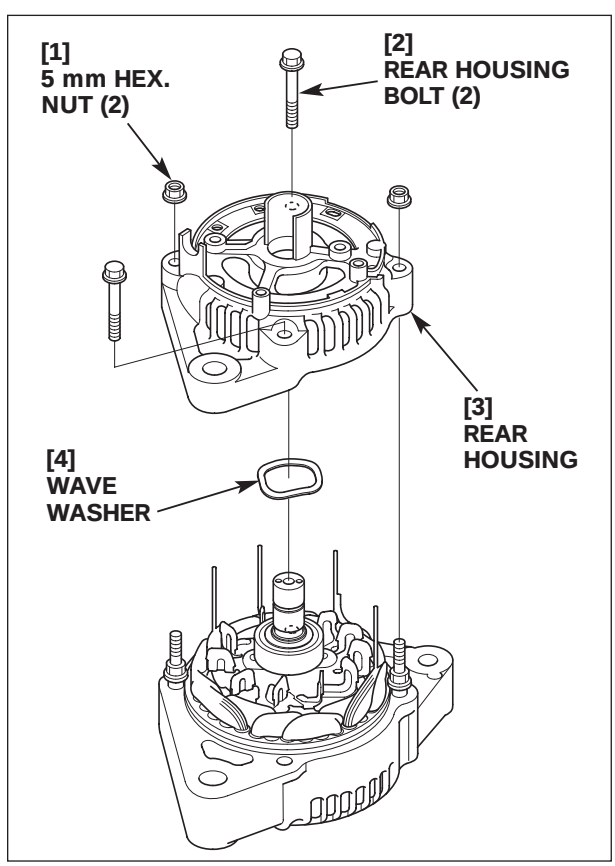
NOTICE

Replace the stator with a new one if a wire broke near the small hole in the rectifier assembly.



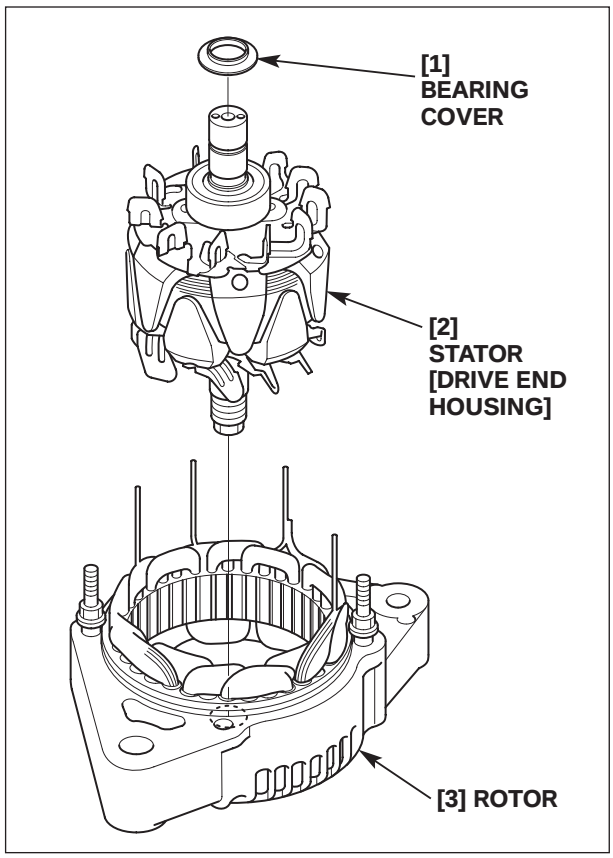
9) Remove the two 5 mm hex. nuts and the two rear housing bolts.
Remove the rear housing.

10) Remove the wave washer.



11) Remove the rotor from the stator (drive end housing).

Remove the bearing cover from the rotor shaft.

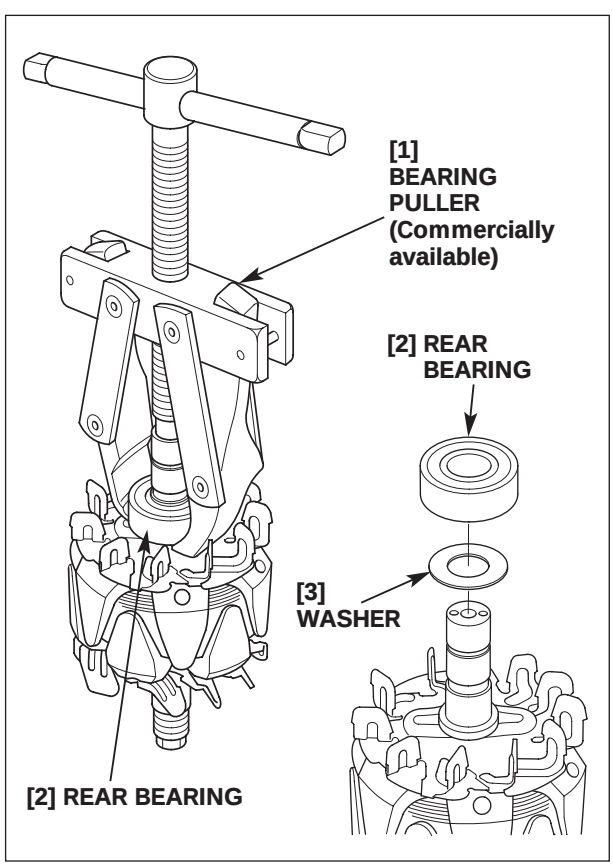


12) Check the rear bearing for abnormal sound and play before removal. Replace the rear bearing with a new one if there is abnormal sound or play.

13) Using a commercially available bearing puller as shown, remove the rear bearing and washer.
Replace the rear bearing with new one on assembly.

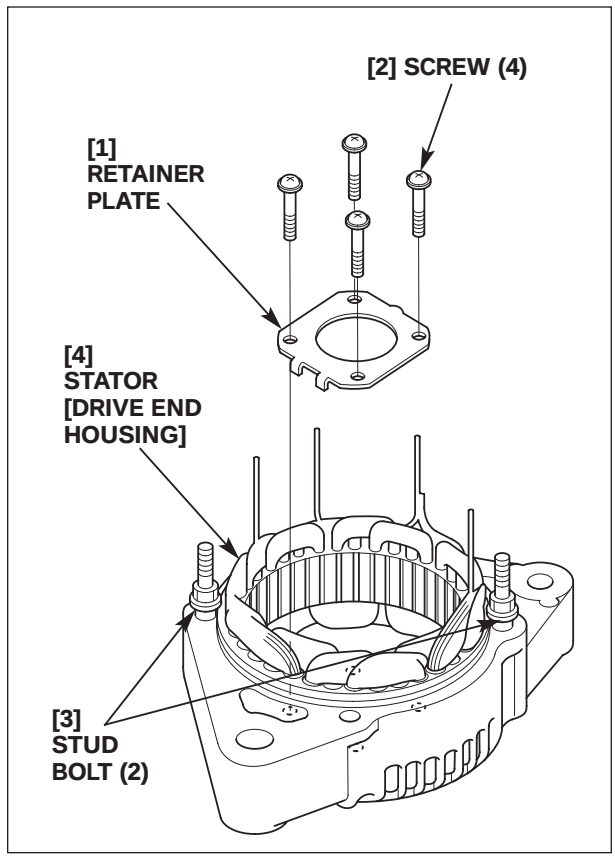
NOTICE

Install a commercially available bearing puller with care not to damage the rotor fins.



14) Remove the four screws and the retainer plate.

Remove the two stud bolts from the stator [drive end housing].



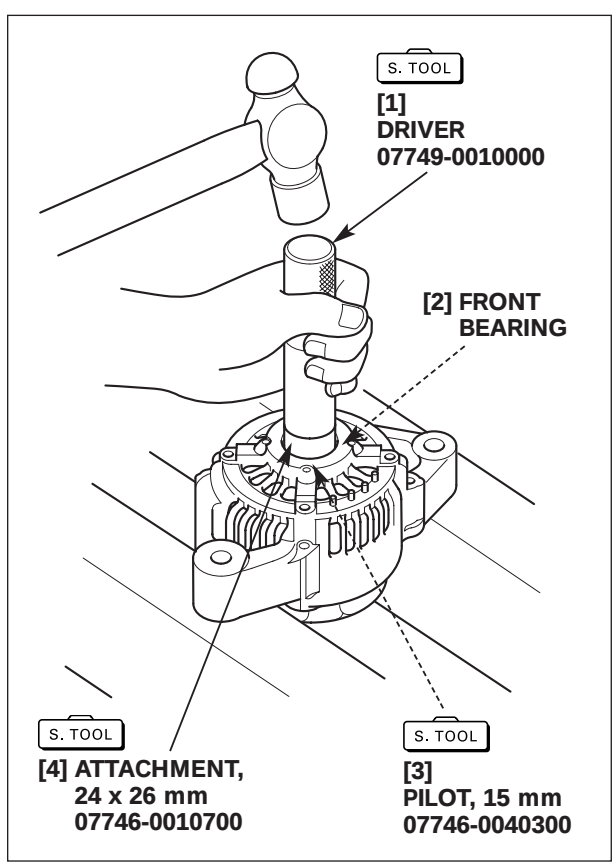
15) Check the front bearing for abnormal sound or play before removal.
Replace the front bearing if necessary.

16) Holding the stator [drive end housing] by attaching the wood blocks to both sides of the stator [drive end housing] as shown, remove the front bearing from the stator using the special tools.

Replace the front bearing with a new one on assembly.

TOOLS:

Driver	**07749-0010000**
Attachment, 24 x 26 mm	**07746-0010700**
Pilot, 15 mm	**07746-0040300**

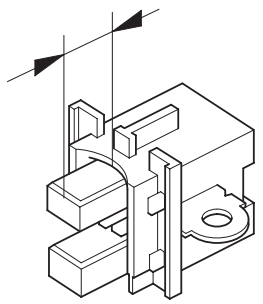


f. INSPECTION (Unit inspection)

• 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)

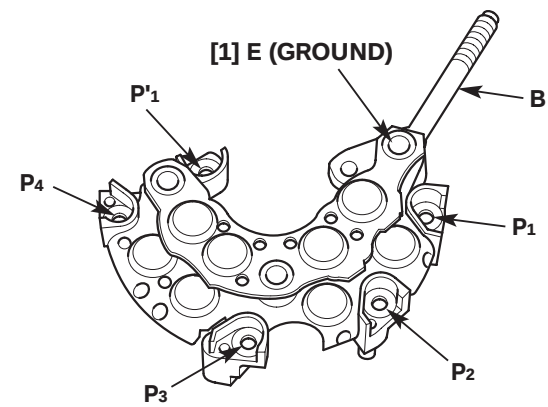


• RECTIFIER ASSEMBLY

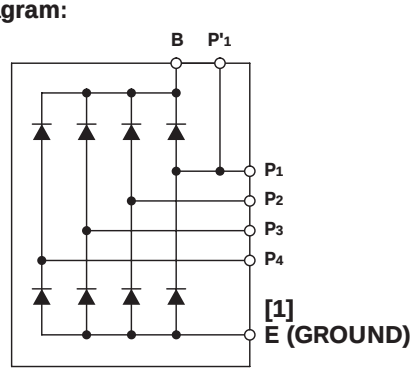
• Inspect the rectifier assembly by removing it from the outboard motor.

Check for continuity between the B terminal and the respective P terminals (P_1, P_2, P_3 and P_4), and between the E terminal and the respective P terminals (P_1, P_2, P_3 and P_4).
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.



[2] Circuit diagram:



• ROTOR

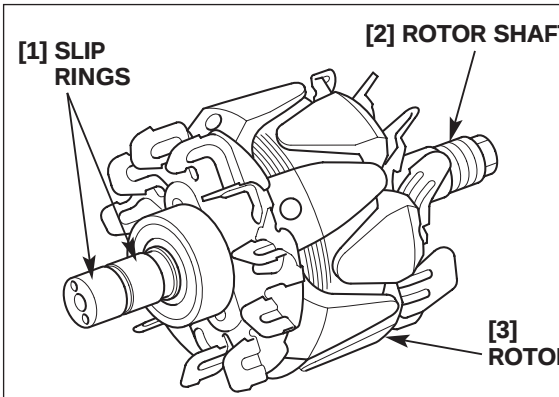
1) Check to be sure that there is continuity between the slip rings.

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.

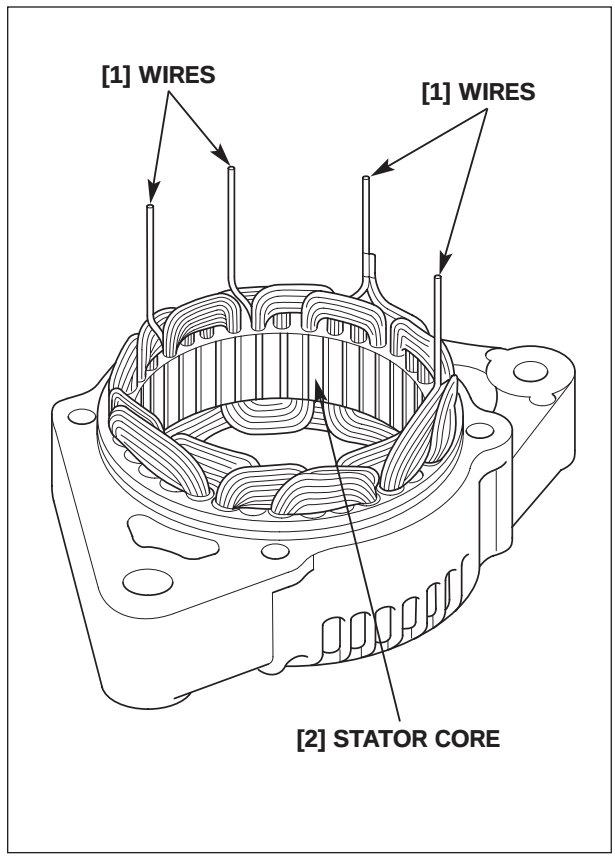


• STATOR [DRIVE END HOUSING]

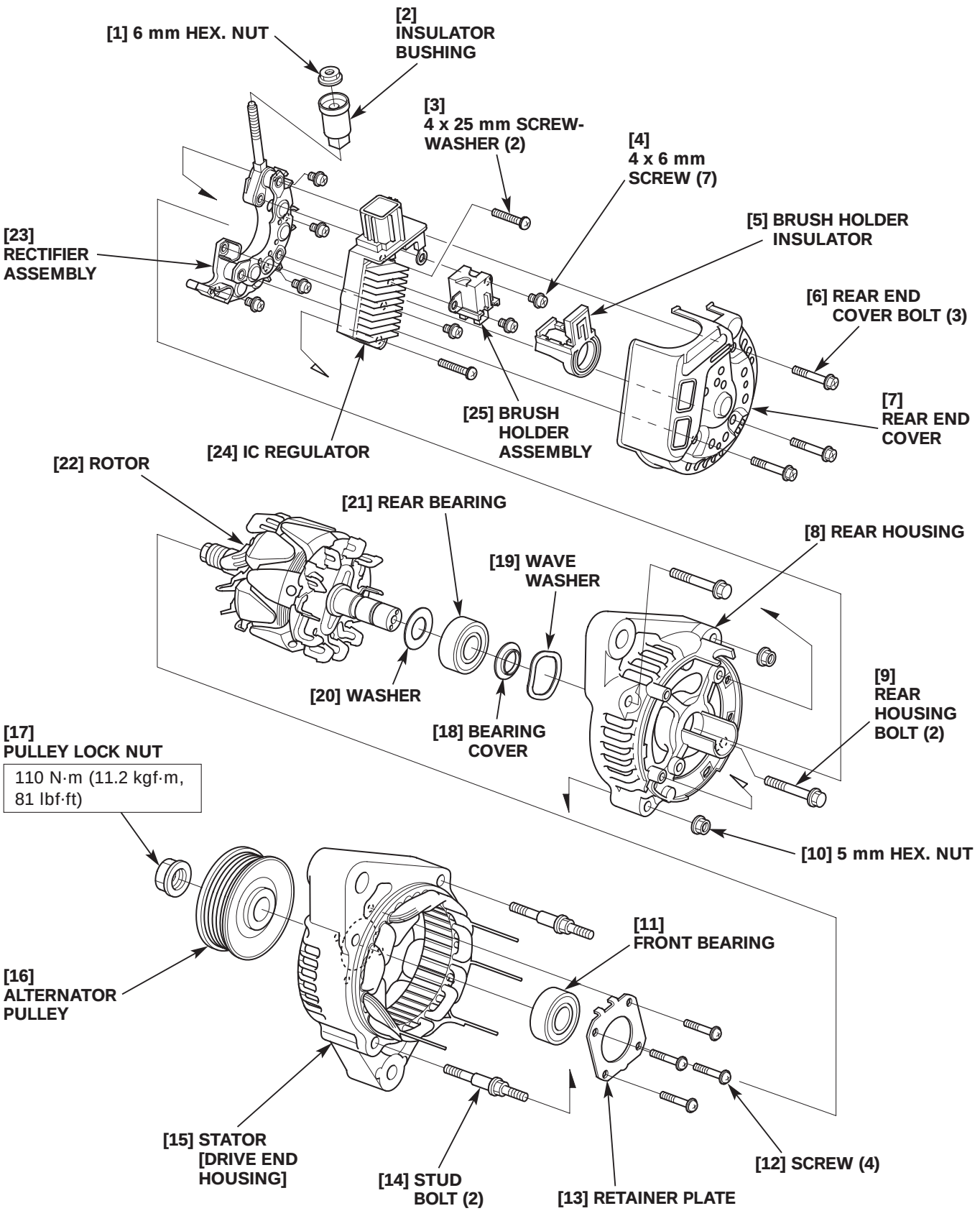
Inspect the stator by removing it from the outboard motor.

1) Check to see that there is continuity between the wires.

2) Check to see that there is no continuity between each wire and the stator core.



g. COMPONENTS DRAWING



h. ALTERNATOR ASSEMBLY ASSEMBLY

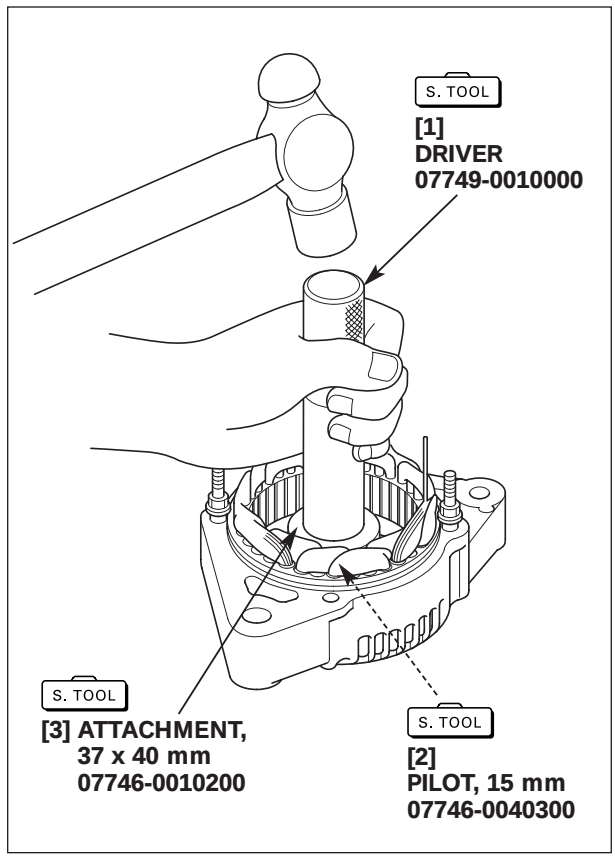
1) Tighten the two stud bolts on the stator.

2) Apply grease to the outer surface of a new front bearing.

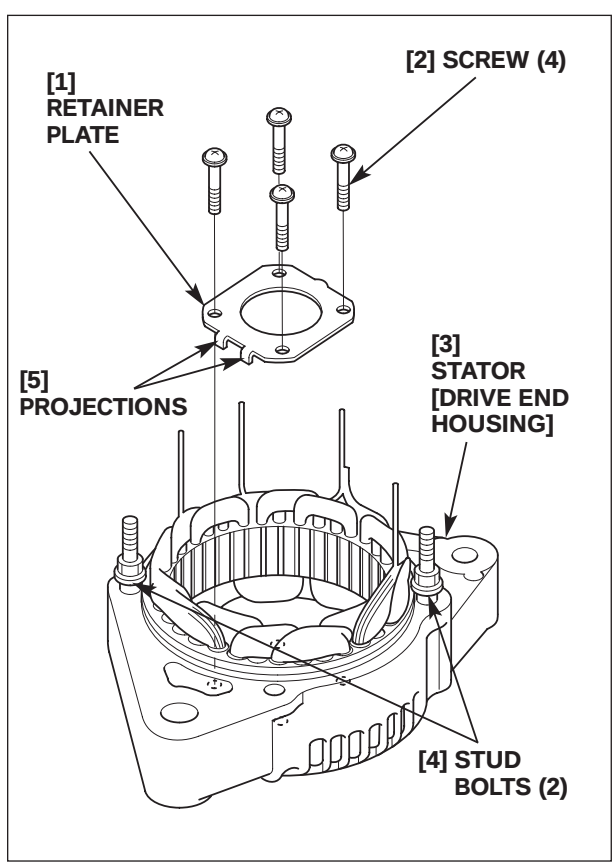
   Drive the front bearing into the stator using the special tools as shown.

   TOOLS:

Driver	**07749-0010000**
Attachment, 37 x 40 mm	**07746-0010200**
Pilot, 15 mm	**07746-0040300**

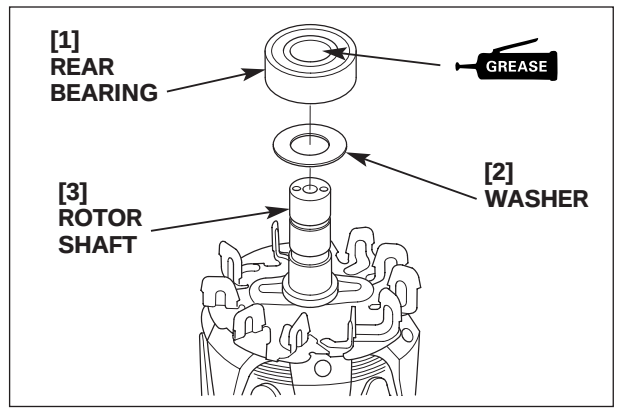


3) Install the retainer plate with the projections toward the front bearing and tighten it with the four screws.



4) Position a washer on the rotor shaft.

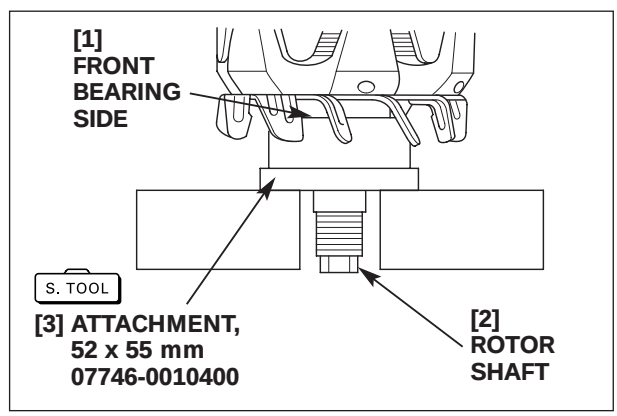
Apply grease to the inner wall of the new rear bearing and install it on the rotor shaft.



5) Attach the special tool to the front bearing side of the rotor shaft, and position the rotor on the hydraulic press.

TOOL:

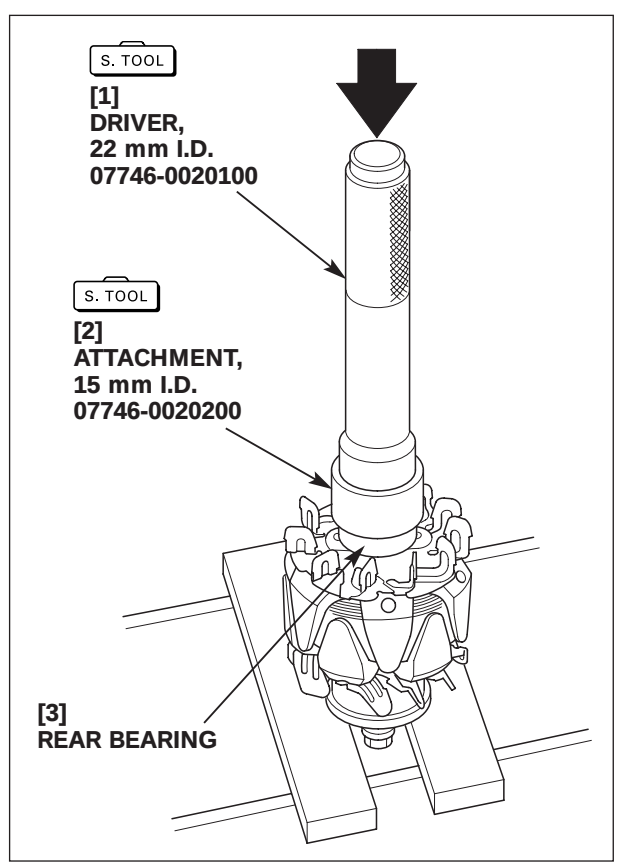
Attachment, 52 x 55 mm	**07746-0010400**



6) Attach the special tool to the rear bearing side and install the rear bearing on the rotor using the hydraulic press.

TOOLS:

Attachment, 52 x 55 mm	**07746-0010400**
Driver, 22 mm I.D.	**07746-0020100**
Attachment,15 mm I.D.	**07746-0020200**

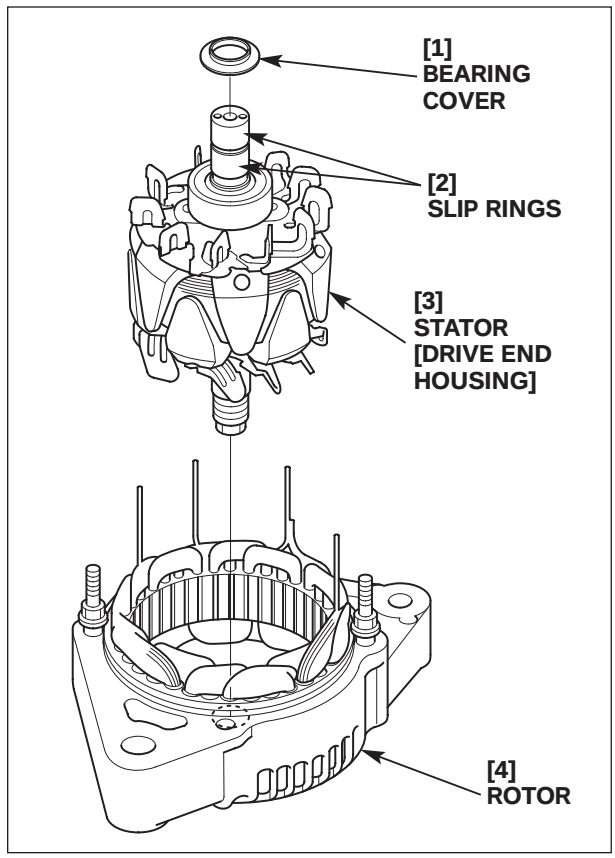


7) Check the rotor slip rings for contamination with grease.

   If it is contaminated with grease, wipe it off thoroughly with a clean cloth.

   Install the rotor on the stator [drive end housing].

   Install a bearing cover on the rotor shaft.

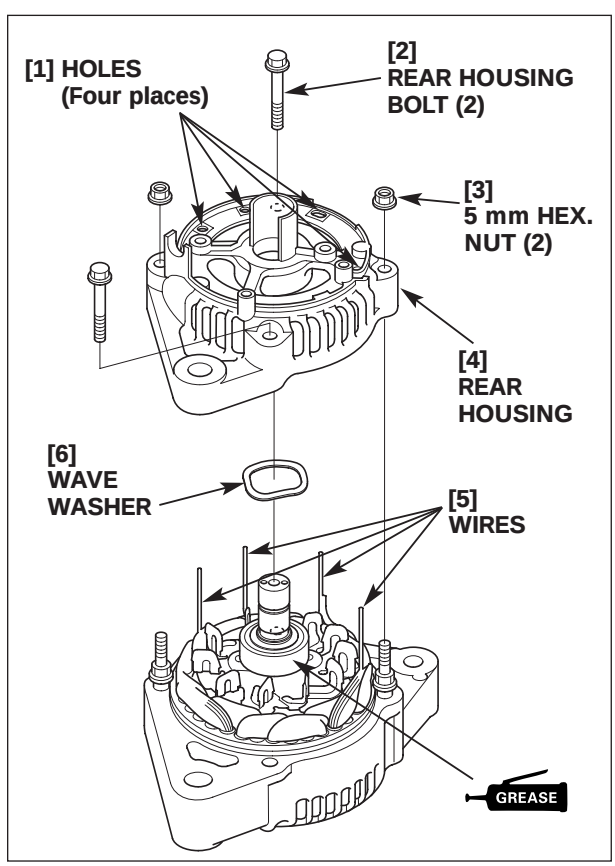


8) Apply grease to the surface of the rear bearing and install the wave washer.

9) Pass the wire through the respective four holes in the rear housing.

   Install the rear housing on the stator [drive end housing] and tighten the two 5 mm hex. nuts and the rear housing bolts securely.

   • Install the rear housing aligning the outer side of the wave washer with the outer side of the bearing.



10) Pass the four wires through the four holes at the projection on the reverse side of the rectifier assembly.

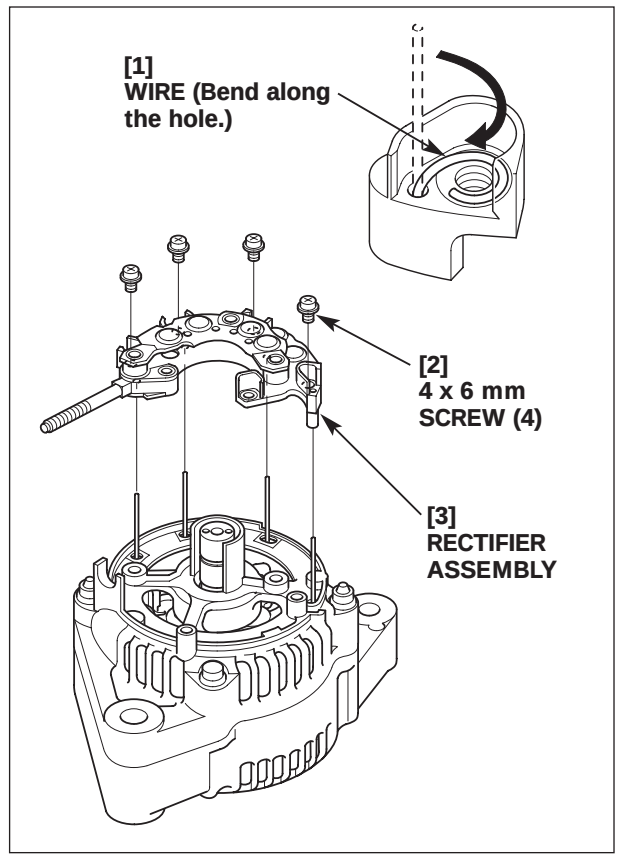
11) Bend each wire to the rectifier assembly side.

Bend each wire along the respective screw holes.

12) Tighten the four 4 x 6 mm screws securely.

NOTICE

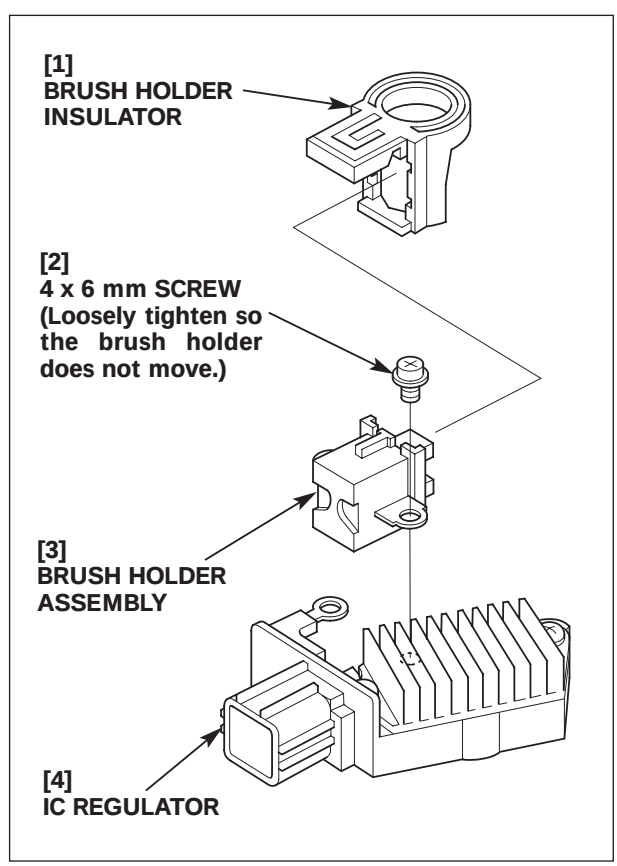
Replace the stator with a new one if a wire broke near the hole in the rectifier assembly.



13) Assemble the brush holder insulator with the brush holder assembly.

14) Position the brush holder assembly on the IC regulator and loosely tighten the 4 x 6 mm screw.

- Loosely tighten the 4 x 6 mm screw so that the brush holder does not move.

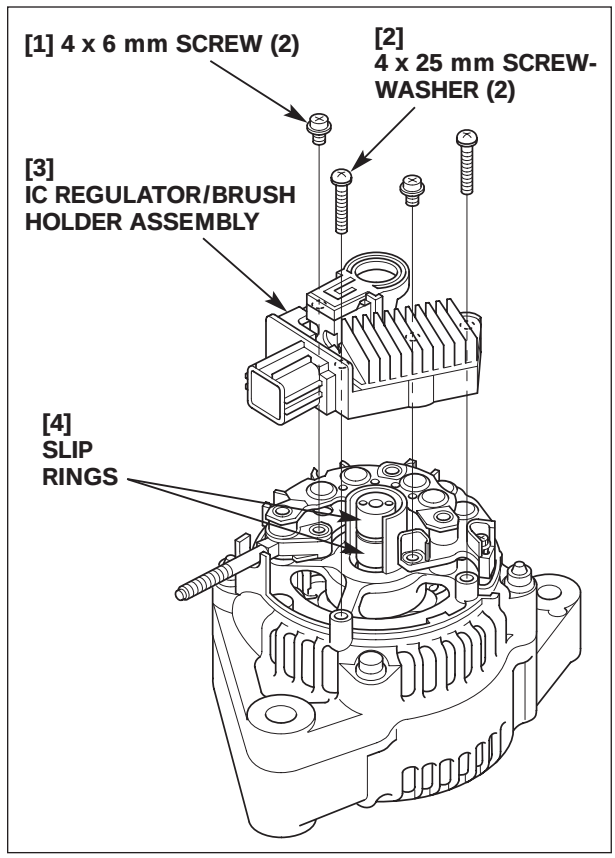


15) Tighten the two 4 x 25 mm screw-washers and the two 4 x 6 mm screws securely while pushing the brush of the IC regulator/brush holder assembly, assembled in step 14, lightly against the rotor shaft slip rings.

Tighten the 4 x 6 mm screw securely that has been tightened loosely in step 14.

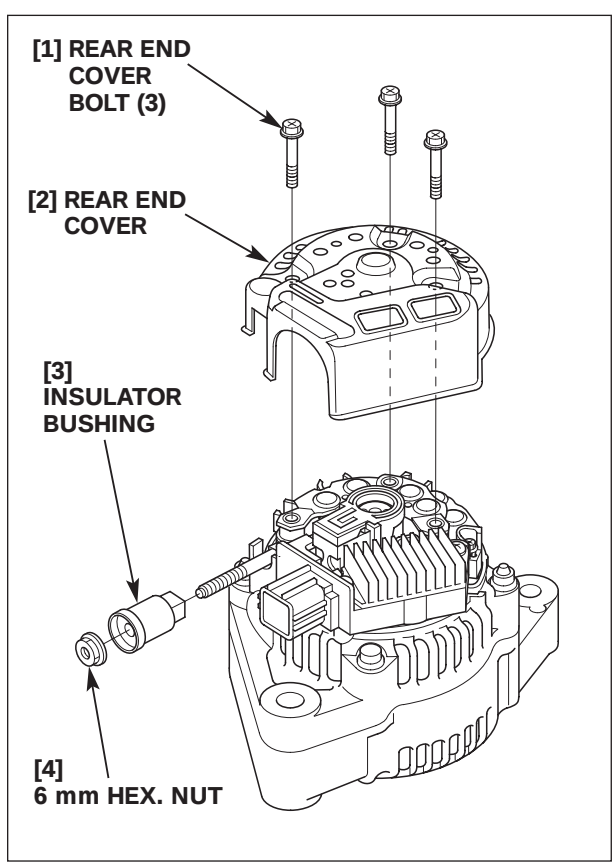
NOTICE

Take care not to damage the rotor shaft slip rings with the brush during installation.



16) Install the rear end cover and tighten the three rear end cover bolts securely.

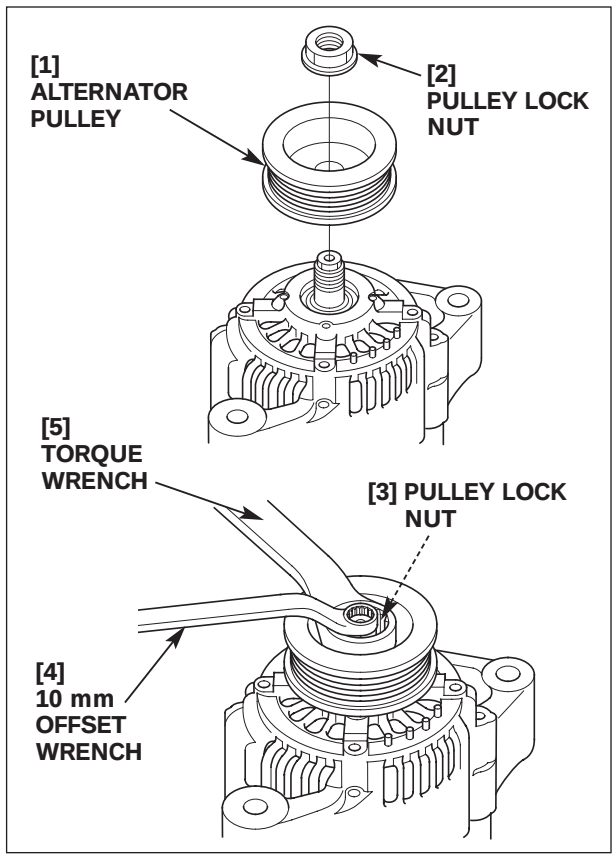
17) Install the insulator bushing and tighten the 6 mm hex. nut securely.



18) Position the alternator pulley on the rotor shaft and tighten the pulley lock nut.

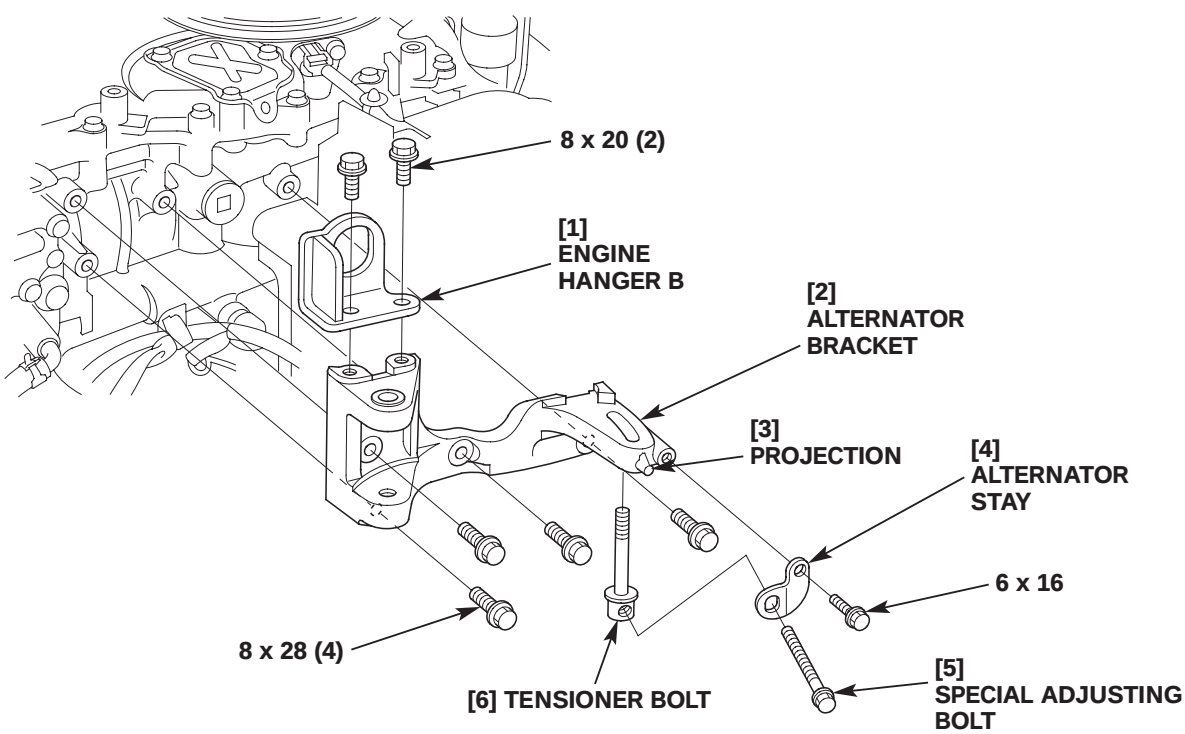
19) Tighten the pulley lock nut to the specified torque using a 10 mm offset wrench and a torque wrench.

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



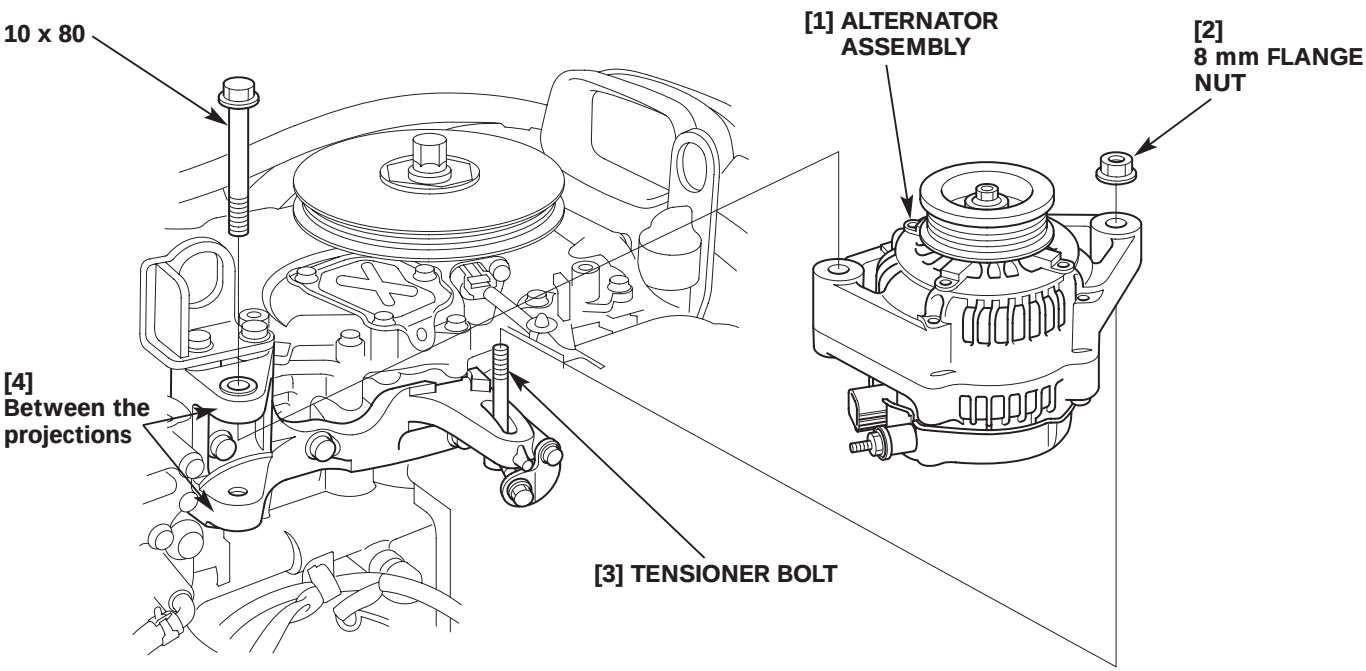
i. ALTERNATOR BRACKET ASSEMBLY

1) Tighten the alternator bracket with the four 8 x 28 mm flange bolts securely.
2) Tighten the 6 x 16 mm flange bolt securely while pushing the alternator stay against the projection on the alternator bracket.
3) Position the special adjusting bolt on the tensioner bolt.
4) Install the engine hanger B with the two 8 x 20 mm flange bolts.



j. INSTALLATION

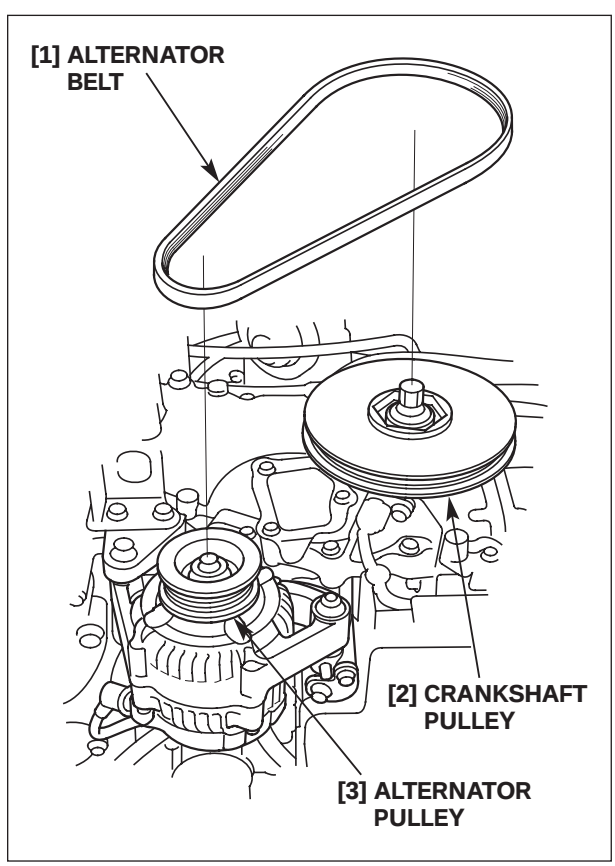
1) Position the alternator assembly over the tensioner bolt and loosely tighten the 8 mm flange nut.
2) Position the alternator assembly between the projections of the alternator bracket and loosely tighten the 10 x 80 mm flange bolt.



3) Install the alternator belt on the crankshaft pulley first, then on the alternator pulley.

NOTICE

Do nut turn the crankshaft pulley counterclockwise.



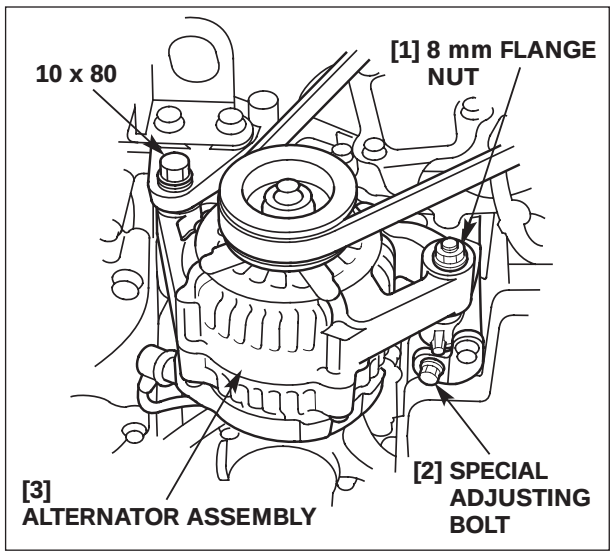
4) Tighten the special adjusting bolt.

   Inspect and adjust the alternator belt (P. 3-29).

5) After adjustment, tighten the 8 mm flange nut and 10 x 80 mm flange bolt in this order to the specified torque.

   TORQUE:
   8 mm flange nut: 26 N·m (2.7 kgf·m, 20 lbf·ft)
   10 x 80 mm flange bolt: 44 N·m (4.5 kgf·m, 33lbf·ft)

6) After tightening the nut and the bolt to the specified torque, check the alternator belt tension and deflection (P. 3-29).



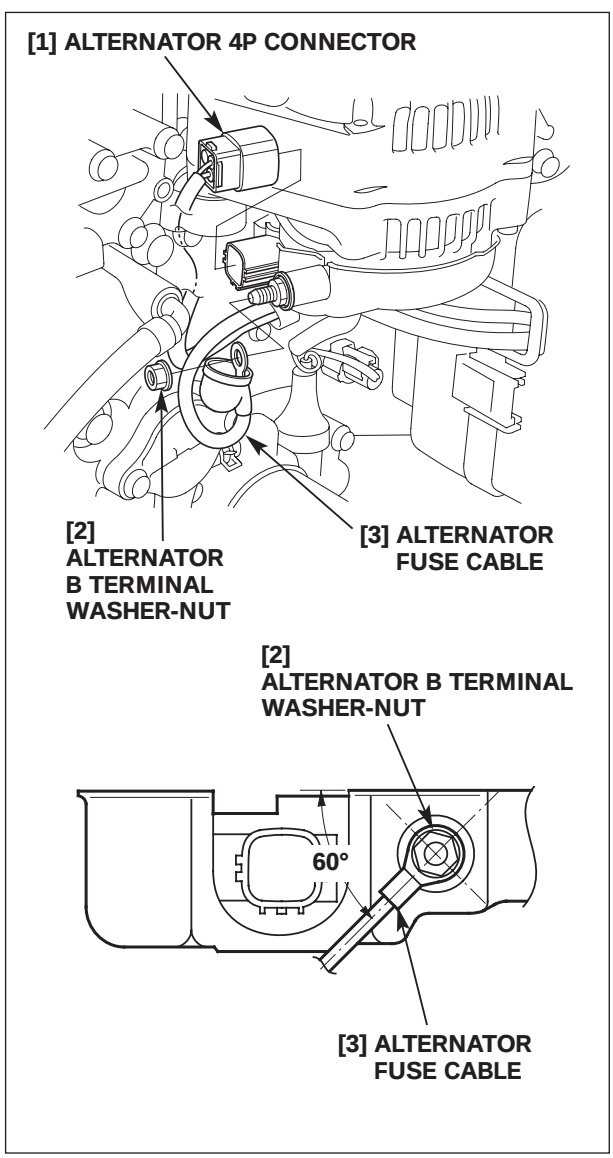
7) Connect the alternator 4P connector to the alternator assembly.

8) Connect the alternator fuse cable to the alternator assembly and loosely tighten the alternator B terminal washer-nut.

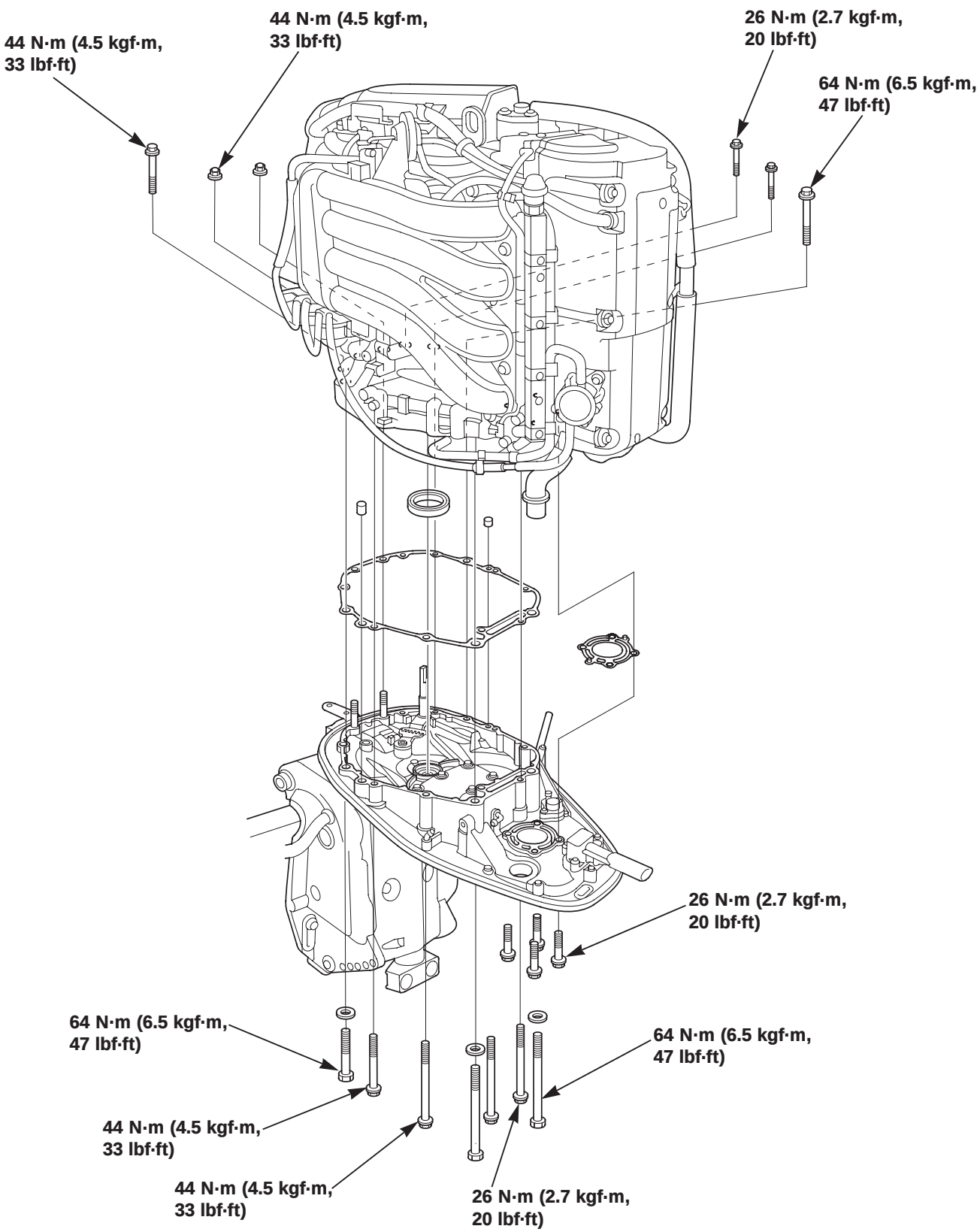
9) Tighten the alternator B terminal washer-nut to the specified torque so that the alternator fuse cable is connected at 60° from the horizontal line as shown.

   TORQUE: 8 N·m (0.8 kgf·m, 5.8 lbf·ft)

10) Install the following parts.
   – Silencer duct (P. 6-4)
   – Engine cover (P. 4-2)



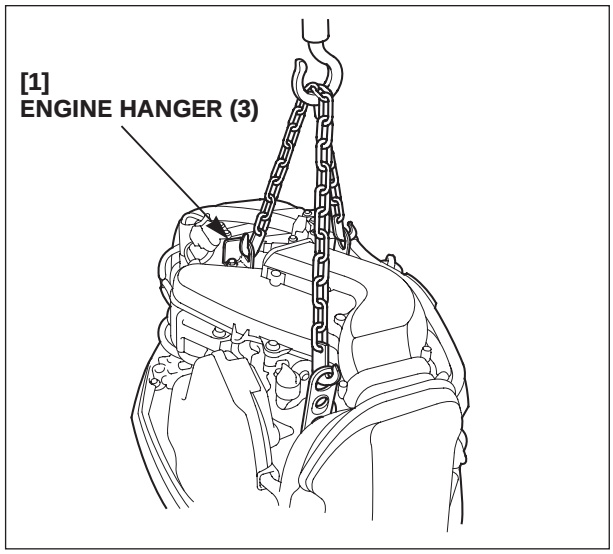
1. REMOVAL	2. INSTALLATION



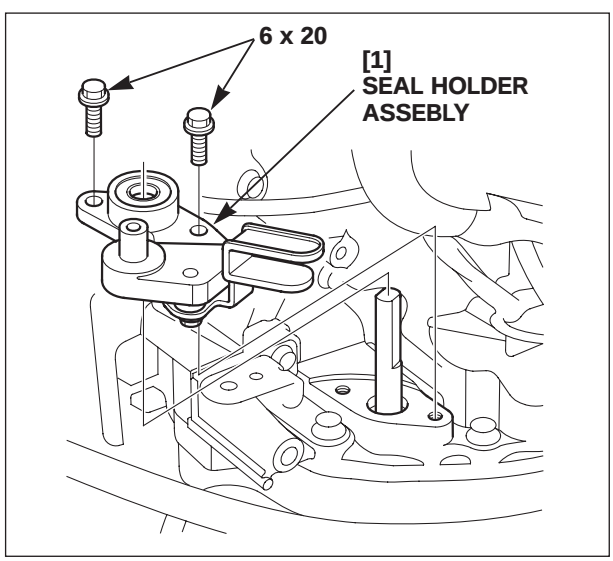
1. REMOVAL

Remove the following pars.
– Engine cover (P. 4-2).
– L./R. engine under covers (P. 4-9).
– Under cover front bracket/L./R. side cover brackets (P. 4-20).
– Vapor separator (P. 5-111).
– Gear case assembly (P. 14-3 and 42).

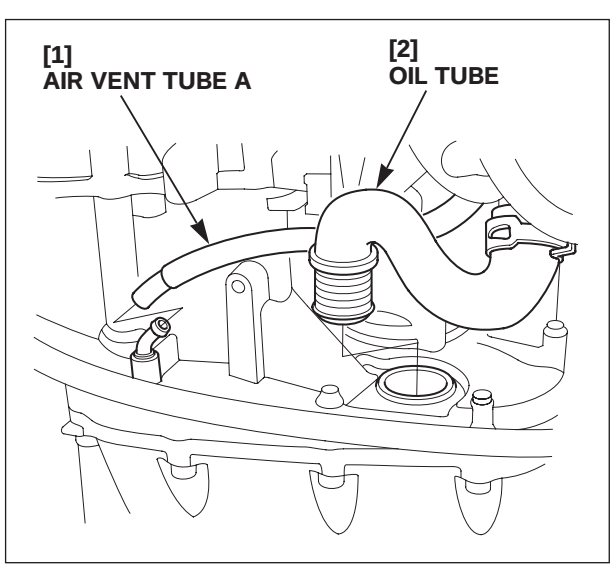
1) Hook the hoist hooks on the three engine hangers and secure the engine not to fall down.
   Remove the following parts.
   – Extension case/lower rubber mount (P. 14-89).
   – Oil case (P. 14-94).
2) Be sure that the engine is held vertically and remove the following parts.
   – Starter motor (P. 18-1).
   – Starter cable (P. 18-15).
   – Shift link bracket/neutral switch (P. 17-11).



3) Remove the two 6 x 20 mm flange bolts and remove the seal holder assembly from the engine assembly.

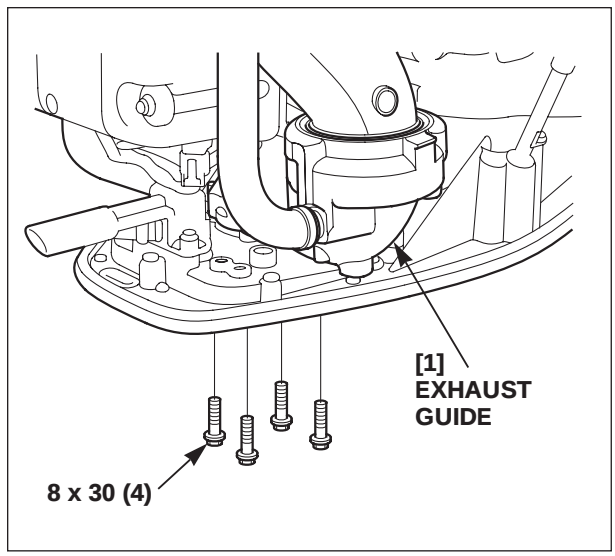


4) Disconnect the air vent tube A and the oil tube from the mounting case.

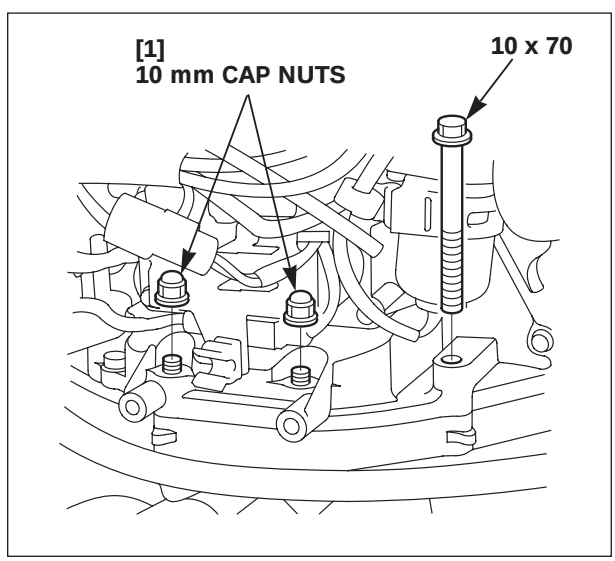


5) Remove the four 8 x 30 mm flange bolts that secure the exhaust guide from the underside of the mounting case.

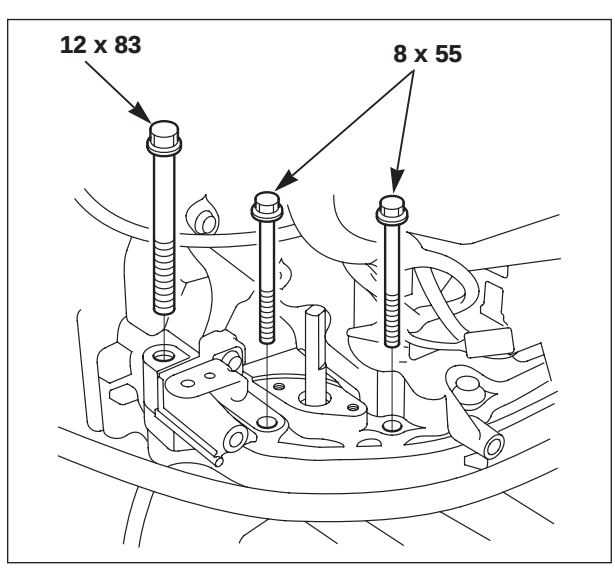
6) Disconnect the water relief tube C from the relief valve cover (P. 8-6).



7) Remove the two 10 mm cap nuts and the 10 x 70 mm flange bolt from the engine assembly.



8) Remove the two 8 x 55 mm flange bolts and the 12 x 83 mm flange bolt.



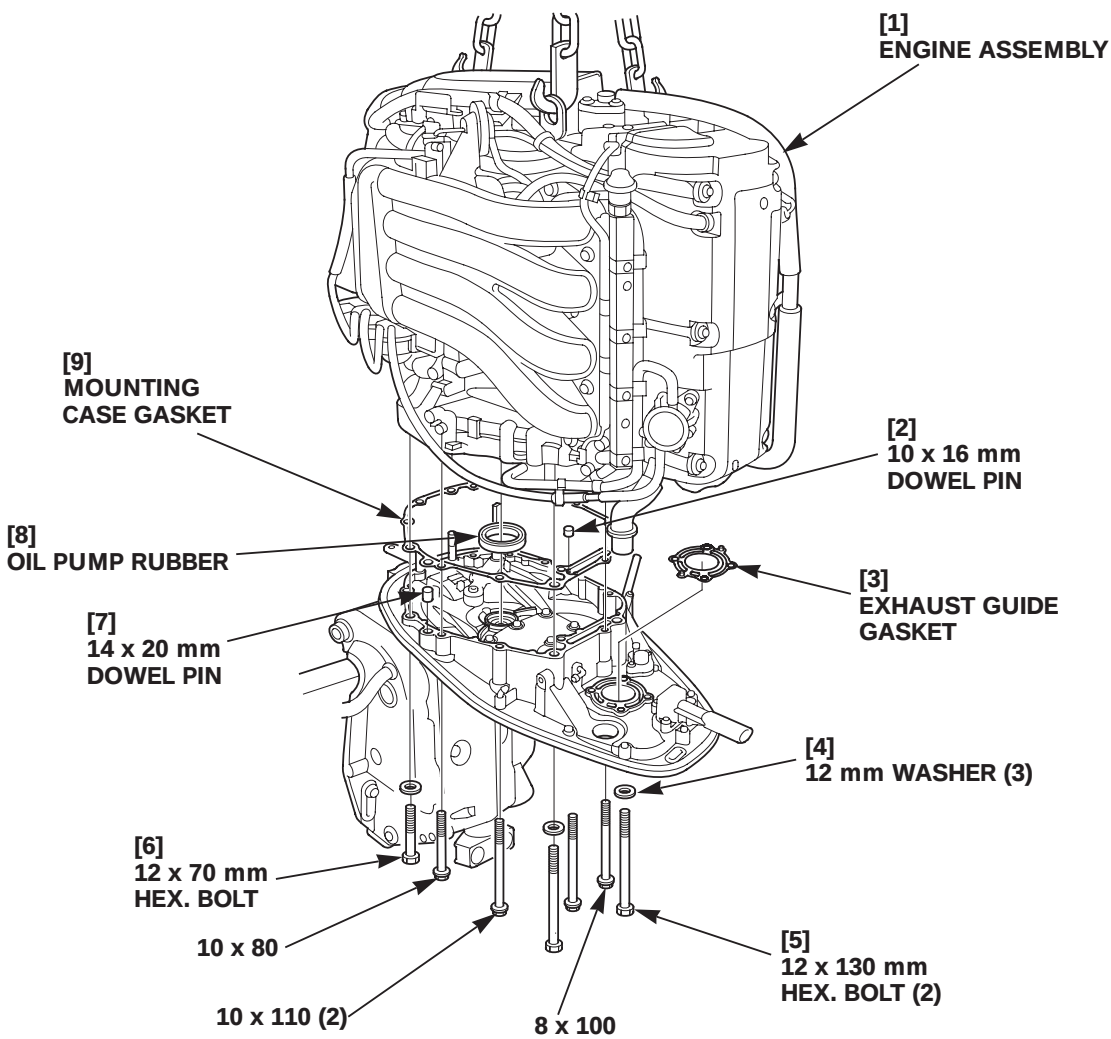
9) Remove the following bolts and washers from the underside of the mounting case.
   - 8 x 100 mm flange bolt (1)
   - 10 x 80 mm flange bolt (1)
   - 10 x 110 mm flange bolts (2)
   - 12 x 70 mm hex. bolt (1)
   - 12 x 130 mm hex. bolts (2)
   - 12 mm washers (3)

10) Lift up the engine assembly slowly and remove it from the mounting case.

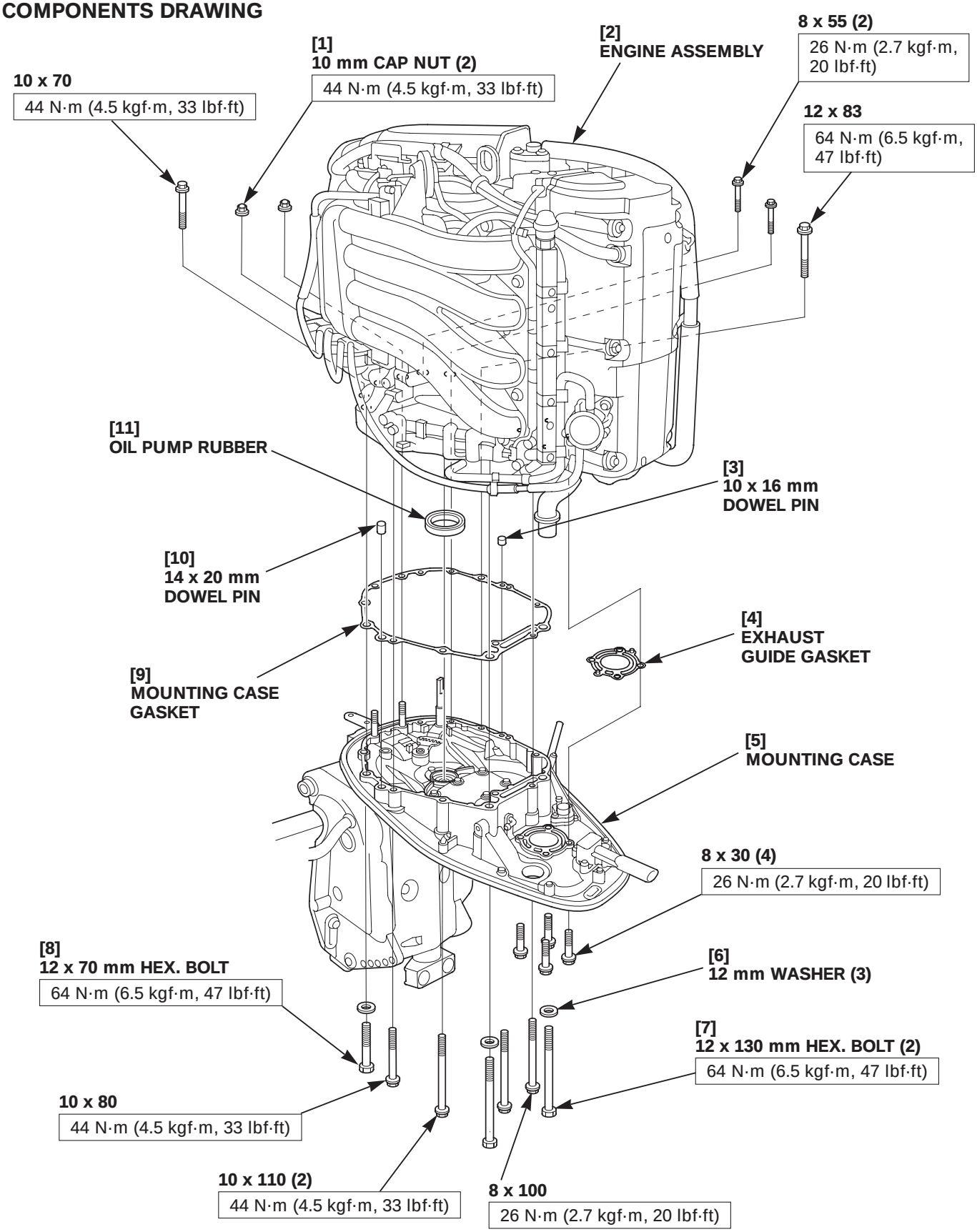
NOTICE

- *Be sure that the hoist hooks are set on the three engine hangers securely.*
- *Lift up the engine assembly while holding the engine vertically.*

11) Remove the two dowel pins, mounting case gasket, exhaust guide gasket and the oil pump rubber.



COMPONENTS DRAWING

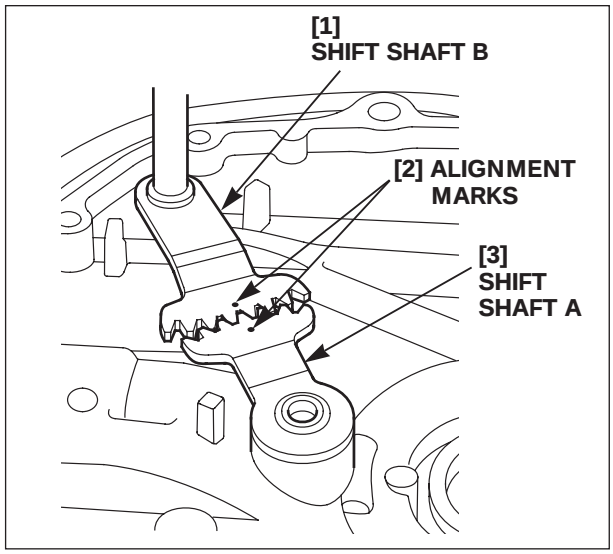


2. INSTALLATION

1) Align the punch mark on the shift shaft A with the punch mark on the shift shaft B before installing the engine assembly.

NOTICE

- *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.*

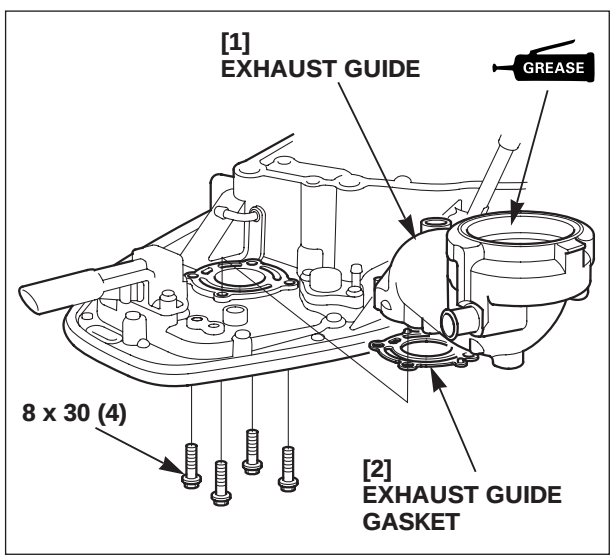


2) Disconnect the water relief tube B and the 7 x 40 mm tube from the exhaust guide (P. 8-5, 6).

3) Remove the exhaust guide from the exhaust manifold of the engine assembly.

4) Apply grease to the exhaust manifold of the engine assembly and to the sealing surface of the exhaust guide.

5) Install the exhaust guide gasket and the exhaust guide on the mounting case, and loosely tightem the four 8 x 30 mm flange bolts.

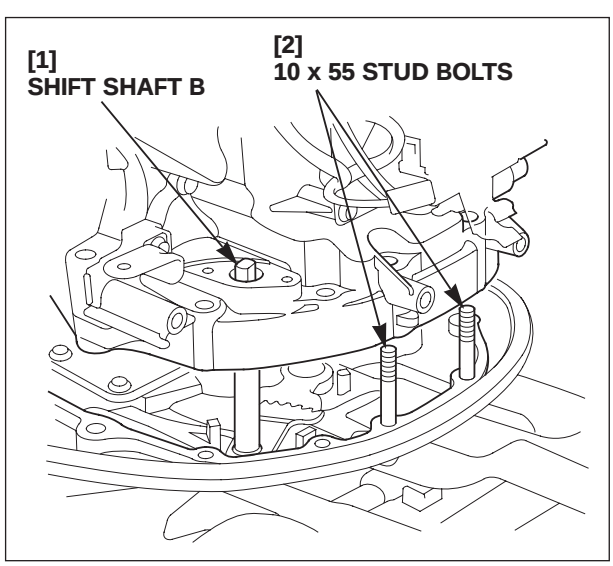


6) Install the 10 x 16 mm dowel pin, 14 x 20 mm dowel pin, mounting case gasket and the oil pump rubber on the mounting case.

7) Lower the engine assembly slowly while aligning the two 10 x 55 mm stud bolts and the shift shaft B with the respective installation holes in the engine assembly.

NOTICE

- *Take care not to ruin the stepped part of the shift shaft B and the threaded part of the 10 x 55 mm stud bolts.*
- *Do not allow the alignment marks on the shift shaft A and B come out of alignment. If they came out of alignment, perform the Shift Shaft A/B Alignment procedure explained for engine installation (P. 17-22).*
- *Lower the engine assembly slowly while holding the engine vertically.*

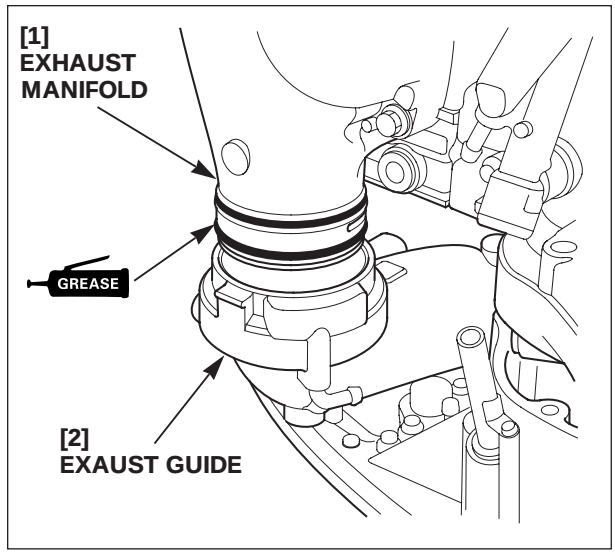


8) Lower the engine assembly slowly onto the mounting case while aliging the exhaust manifold of the engine assembly with the exhaust guide.

9) Connect the water relief tube B and the 7 x 40 mm tube, disconnected in step 2, to the exhaut guide (P. 8-7, 9).

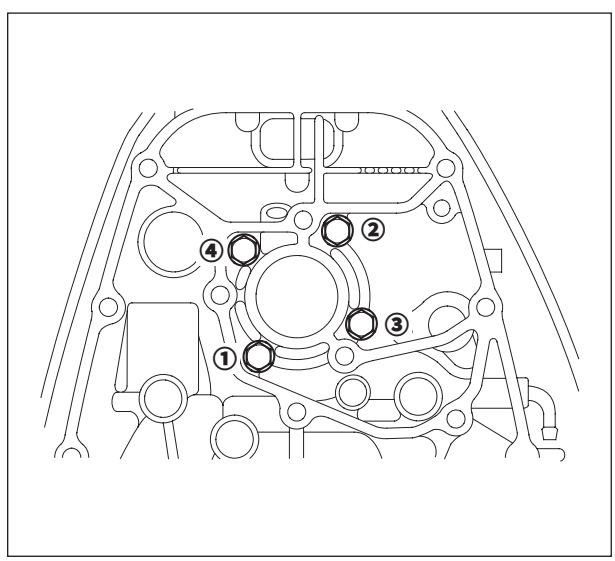
NOTICE

Lower the engine assembly onto the mounting case slowly while holding the engine vertically.



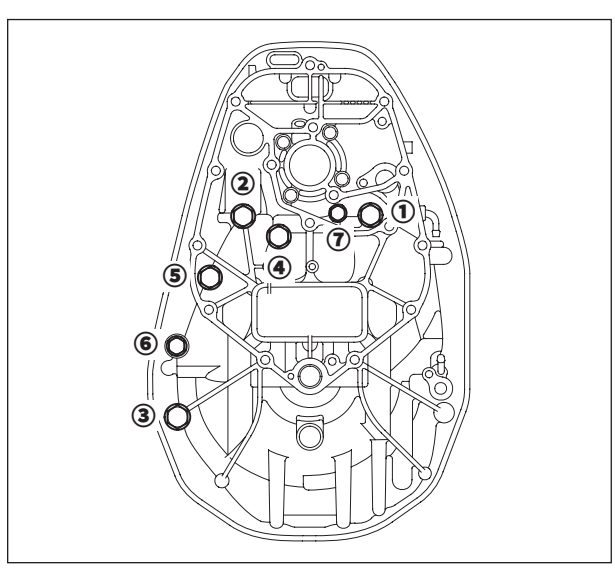
10) Tighten the four 8 x 30 mm flange bolts in the numbered sequence in two or three steps from the underside of the mounting case. Tighten to the specified torque.

TORQUE: 26 N·m (2.7 kgf·m, 20 lbf·ft)



11) Loosely tighten each bolt and washer at the designated places from the underside of the mounting case. Then, tighten them to the specified torque in the numbered sequence in two or three steps.

TORQUE:
12 x 70 mm hex. bolt,
12 x 130 mm hex. bolt: 64 N·m (6.5 kgf·m, 47 lbf·ft)
10 x 80 mm flange bolt,
10 x 110 mm flange bolt: 44 N·m (4.5 kgf·m, 33 lbf·ft)
8 x 100 mm flange bolt: 26 N·m (2.7 kgf·m, 20 lbf·ft)

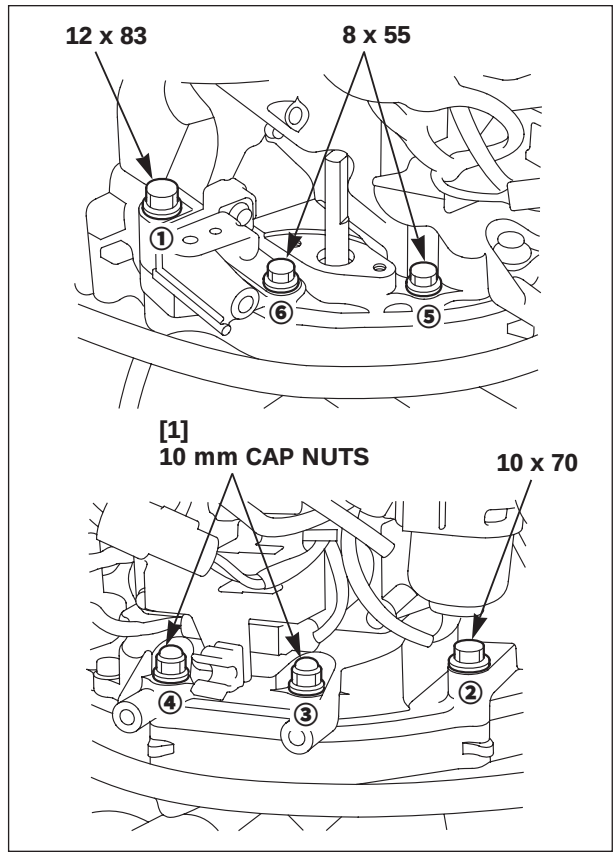


Tightening point	Part name	Q' ty
①, ②	12 x 130 mm hex. bolt, 12 mm washer	2
③	12 x 70 mm hex. bolt, 12 mm washer	1
④, ⑤	10 x 110 mm flange bolt	2
⑥	10 x 80 mm flange bolt	1
⑦	8 x 100 mm flange bolt	1

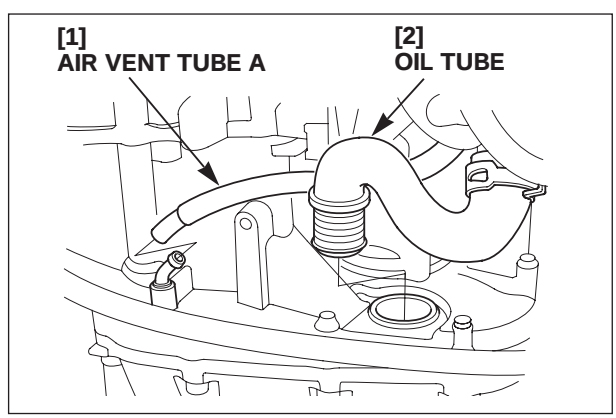
12) Loosely tighten the bolts and nuts at the designated places from the top of the engine assembly. Tighten the bolts and nuts to the specified torque in the numbered sequence in two or three steps.

TORQUE:
12 x 83 mm flange bolt: 64 N·m (6.5 kgf·m, 47 lbf·ft)
10 x 70 mm flange bolt: 44 N·m (4.5 kgf·m, 33 lbf·ft)
8 x 55 mm flange bolt: 26 N·m (2.7 kgf·m, 20 lbf·ft)
10 mm cap nut: 44 N·m (4.5 kgf·m, 33 lbf·ft)

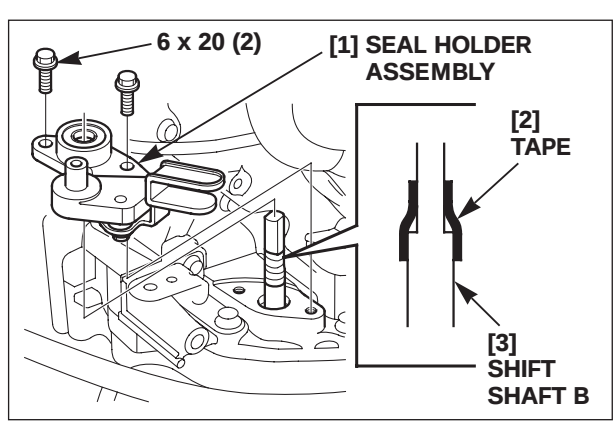
13) Connect the water relief tube C to the relief valve cover (P. 8-7).



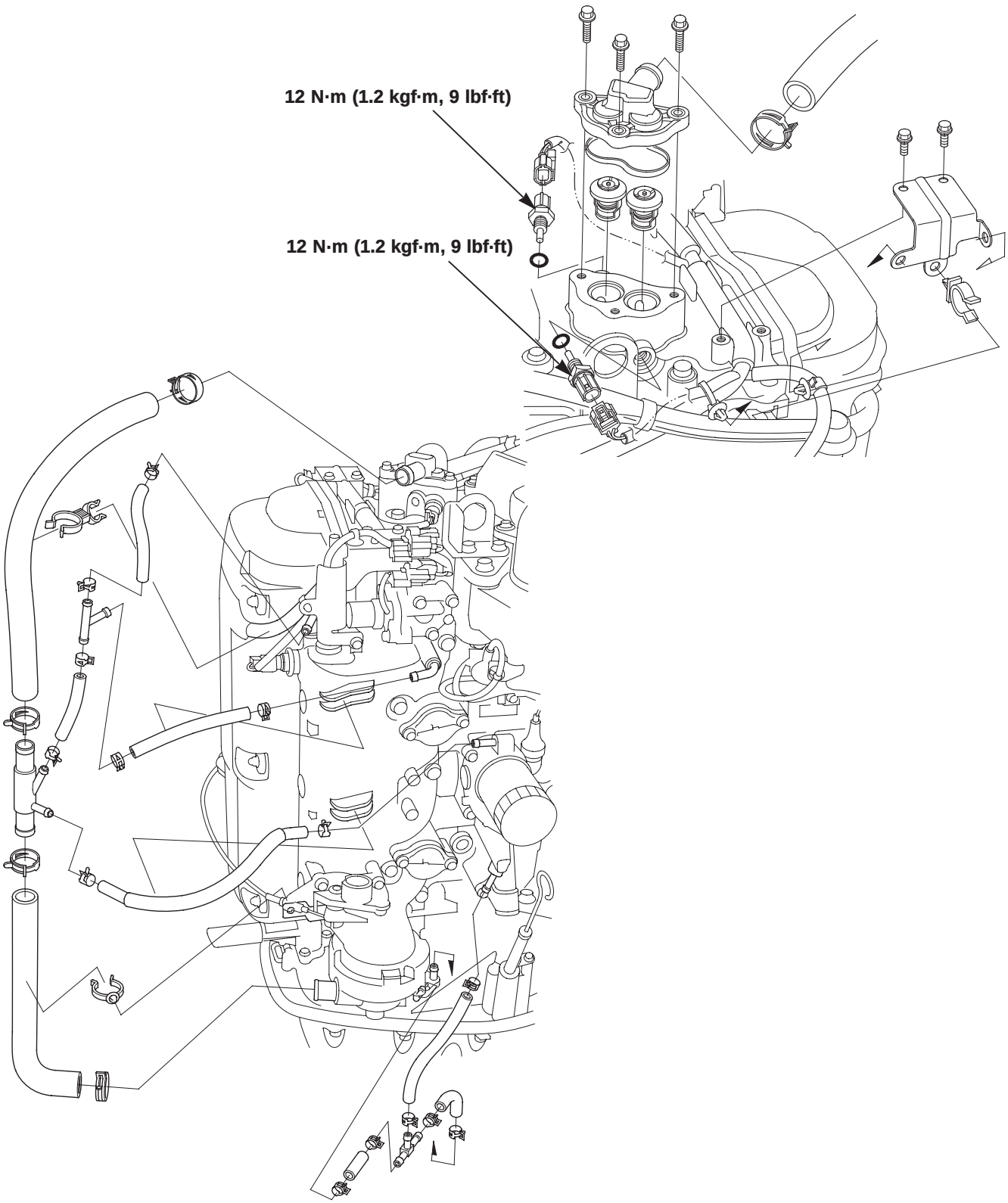
14) Connect the air vent tube A and the oil tube to the mounting case.



15) Tape around the stepped part of the shift shaft B to protect it.
16) Install the seal holder assembly on the engine assembly and tighten the two 6 x 20 mm flange bolts (P. 17-23).
Set the starter cable and the alternator fuse cable in the cable bracket A (P. 17-23).
17) Install the following parts.
– Shift link bracket/neutral switch (P. 17-17)
– Starter cable (P. 18-17)
– Starter motor (P. 18-14)
– Oil case (P. 14-95)
– Extension case/lower rubber mount (P. 14-91)
– Gear case assembly (P. 14-5 and 44)
– Vapor separator (P. 5-125)
– Under cover front bracket/L./R. side cover brackets (P. 4-30)
– L./R. engine under covers (P. 4-14)
– Engine cover (P. 4-2)



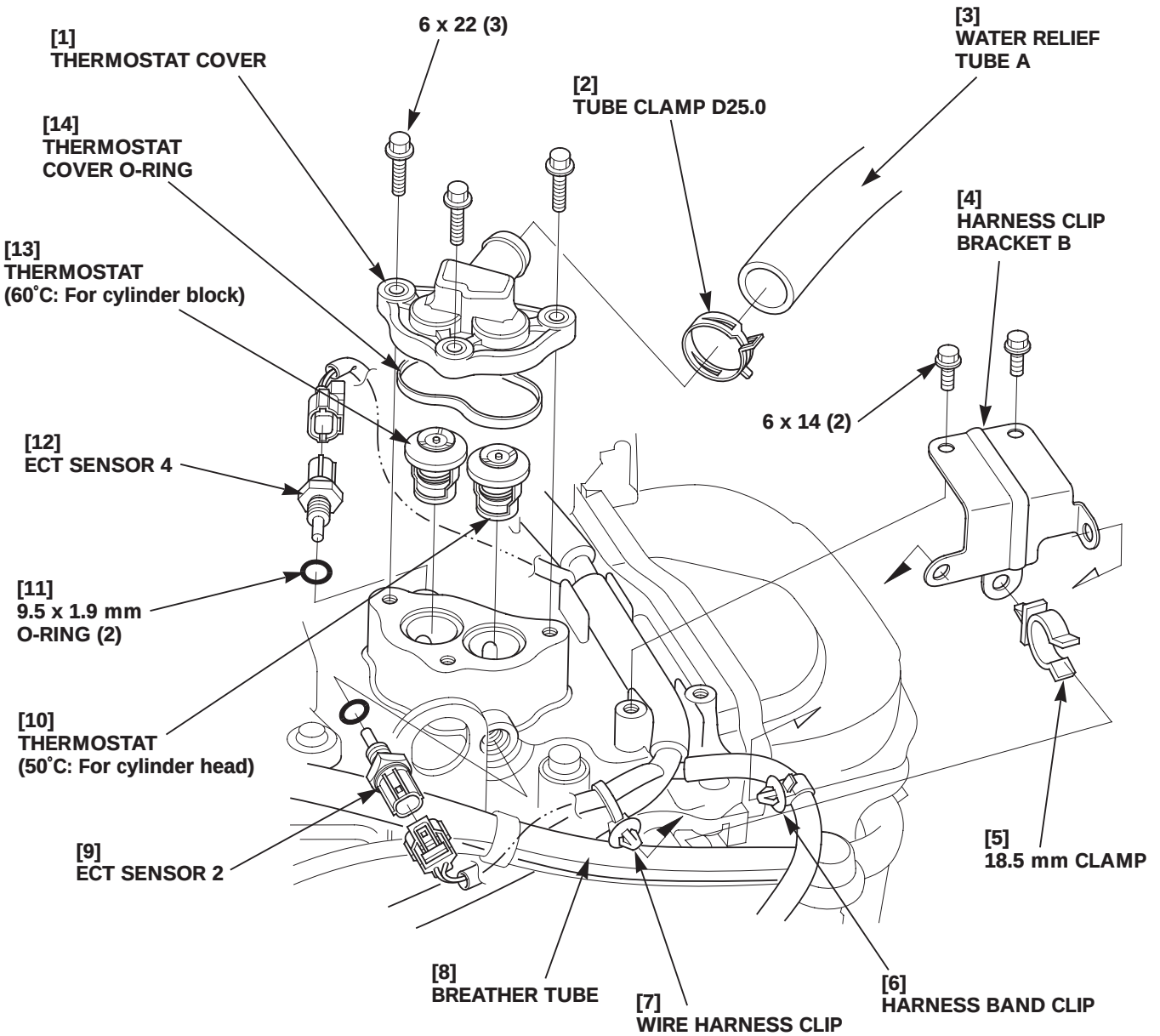
1. THERMOSTAT
2. WATER RELIEF TUBE/RELIEF VALVE
3. FLUSH VALVE



1. THERMOSTAT

a. DISASSEMBLY

1) Remove the engine cover (P. 4-2).
2) Disconnect the water relief tube A from the thermostat cover.
   Do not reuse the thermostat cover O-ring. Replace it with a new one on reassembly.
3) Remove the thermostat.
4) Disconnect the 2P connectors from the ECT sensor 2 and 4, and remove the ECT sensor 2 and 4.
   Do not reuse the 9.5 x 1.9 mm O-rings. Replace them with the new ones on reassembly.
5) Release the breather tube from the 18.5 mm clamp of the harness clip bracket B.
6) Remove the two 6 x 14 mm flange bolts from the harness clip bracket B. With the harness clip bracket B raised a little, remove the harness band clip and the wire harness clip from the harness clip bracket B.



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 to open.

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

Thermostat for cylinder head:

Start opening	48 – 52˚C (118 – 126˚F)
Fully open	60˚C (140 ˚F)

Thermostat for cylinder block:

Start opening	58 – 62˚C (136 – 144˚F)
Fully open	70˚C (158˚F)

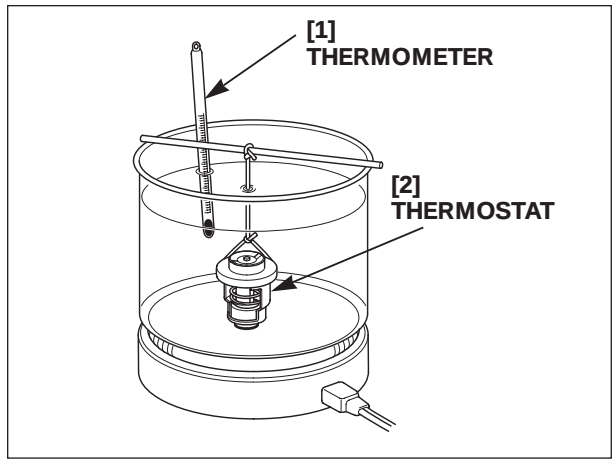
4) Measure the lift height when the thermostat is fully open.

Thermostat for cylinder head:

Lift height	More than 3.0 mm (0.12 in)

Thermostat for cylinder block:

Lift height	More than 3.0 mm (0.12 in)

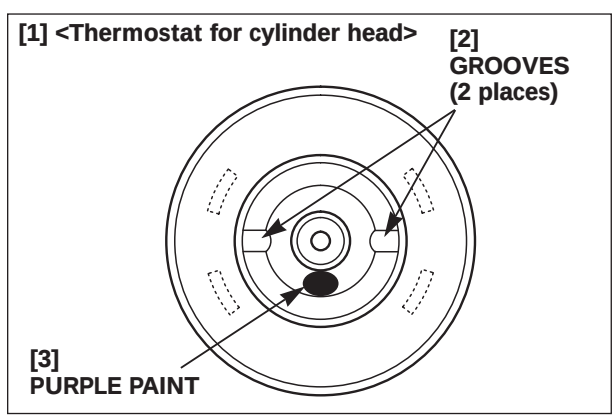


c. THERMOSTAT IDENTIFICATION

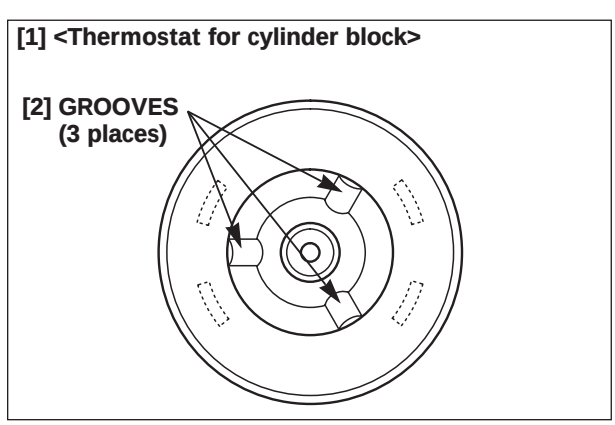
NOTICE

There are two types of thermostat; one for the cylinder head and the other for the cylinder block. Do not confuse them on assembly.

Thermostat for cylinder head:
The thermostat for the cylinder head can be identified with the purple paint (or two grooves) on the thermostat.



Thermostat for cylinder block:
The thermostat for the cylinder block can be identified with no paint (or three grooves) on the thermostat.

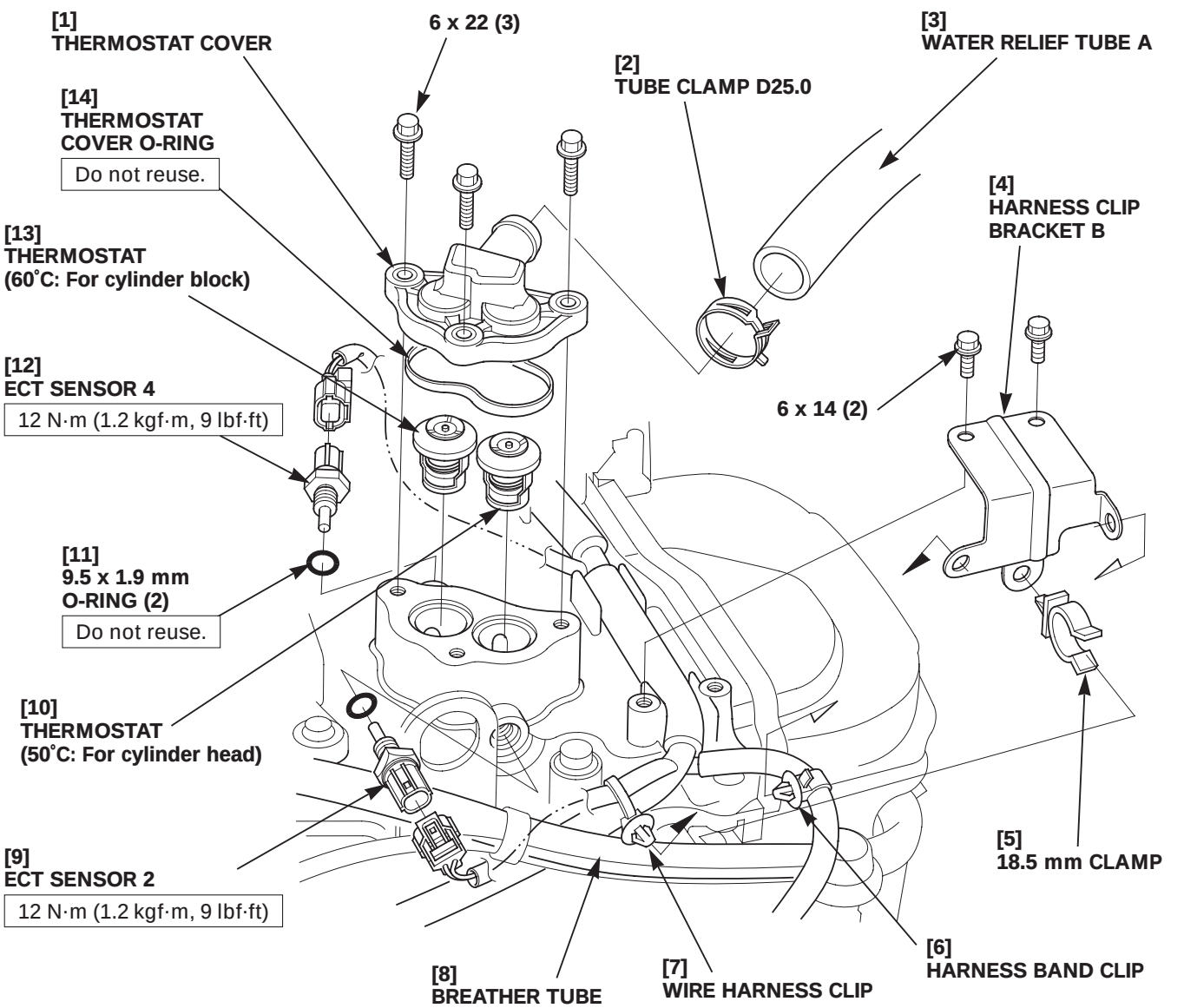


d. ASSEMBLY

1) Check the thermostats for the identification mark and install each of them in the proper position (P. 8-3).
   Install the thermostat for the cylinder head in the ECT sensor 2 installation hole side, and install the thermostat for the cylinder block in the ECTsensor 4 installation hole side.
2) Install a new thermostat cover O-ring on the thermostat cover, and tighten the thermostat cover with the three 6 x 22 mm flange bolts securely.
3) Set the tube clamp D25.0 on the water relief tube A, and insert the water relief tube A into the thermostat cover securely.
4) Position the tube clamp D25.0 so that its lugs are toward the direction shown.
5) Install a new 9.5 x 1.9 mm O-ring on the ECT sensor 2 and 4 respectively. Apply a liquid sealant (ThreeBond® #1201 or #1215 or equivalent) to the threads and seat of each sensor.
6) Install the ECT sensor 2 and 4, and tighten them to the specified torque.

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

7) Set the 18.5 mm clamp, harness band clip and the wire harness clip on the harness clip bracket B, and tighten the two 6 x 14 mm flange bolts.
8) Install the engine cover (P. 4-2).



2. WATER RELIEF TUBE/RELIEF VALVE

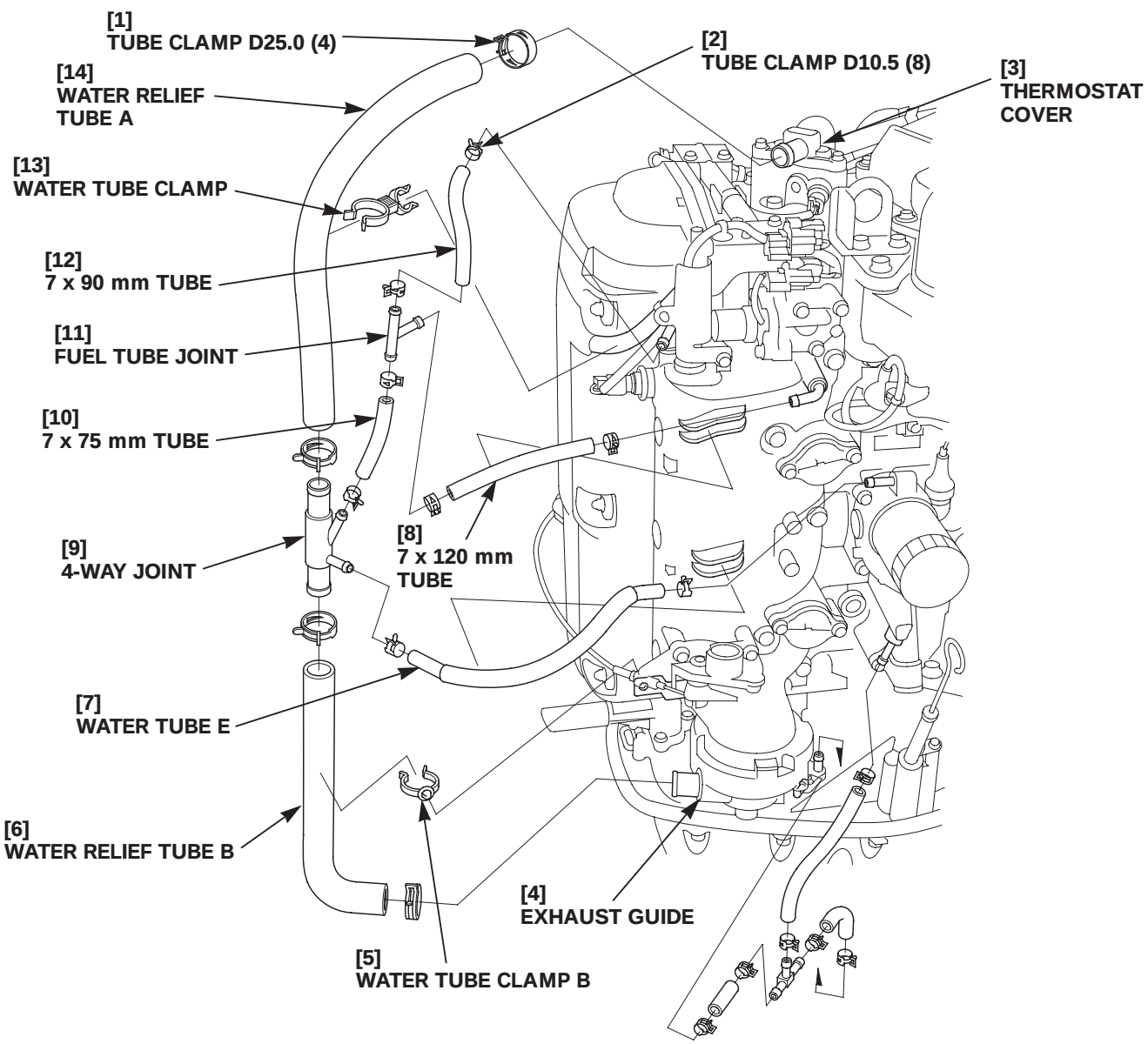
Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)

a. REMOVAL OF WATER RELIEF TUBE ASSEMBLY

1) Disconnect the water relief tube A from the thermostat cover.
   Remove the water tube clamp from the water relief tube A and the main wire harness.
2) Disconnect the 7 x 90 mm tube, 7 x 120 mm tube and the water tube E from the engine side.
   Disconnect the water relief tube B from the water tube clamp B.
3) Disconnect the water relief tube B from the exhaust guide.

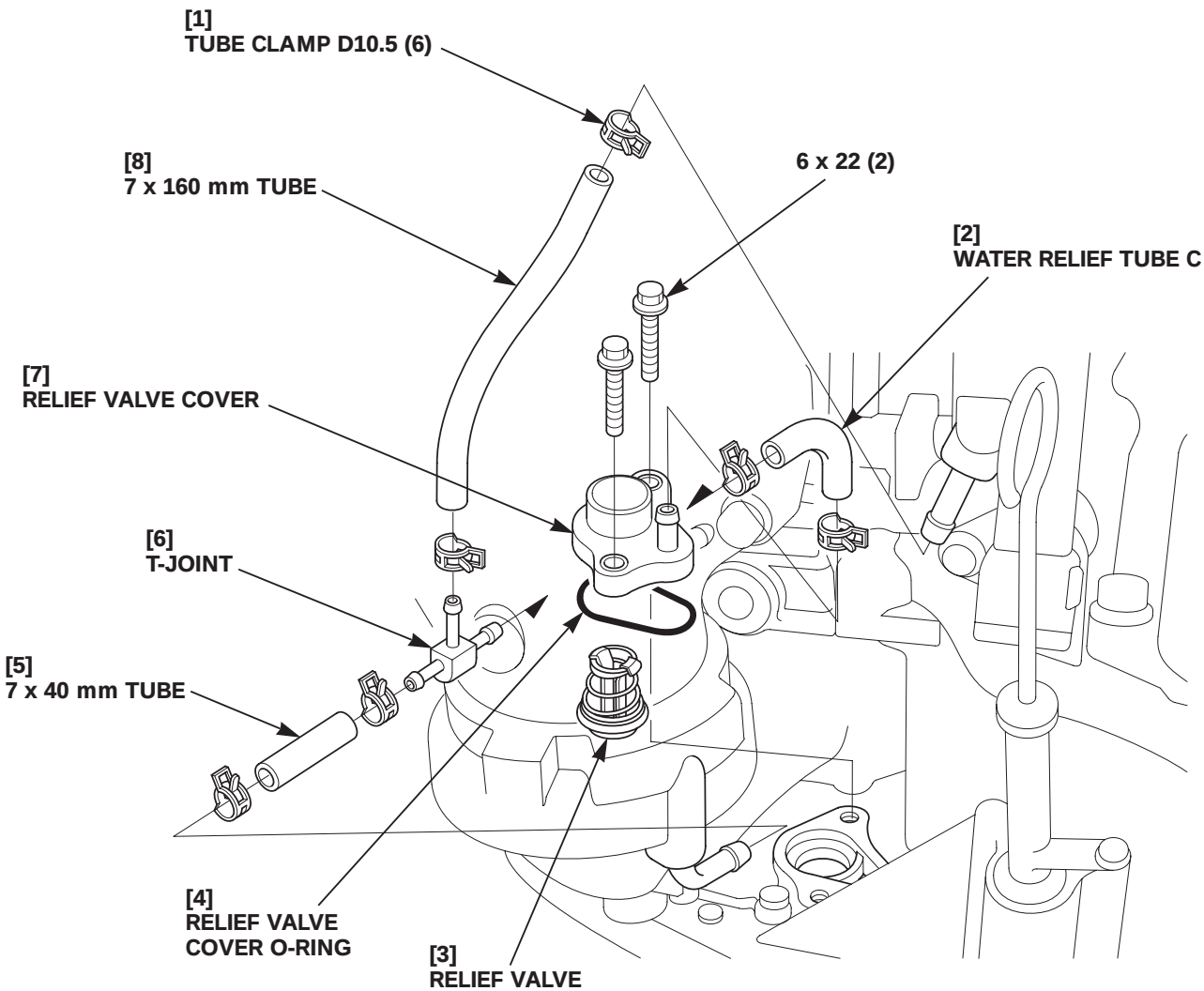
b. DISASSEMBLY OF WATER RELIEF TUBE ASSEMBLY

1) Disconnect the water relief tube A and B from the 4-way joint.
2) Disconnect the 7 x 90 mm tube and the 7 x 120 mm tube from the fuel tube joint.
3) Disconnect the fuel tube joint from the 7 x 75 mm tube.
4) Disconnect the 7 x 75 mm tube and the water tube E from the 4-way joint.



c. WATER RELIEF TUBE C/RELIEF VALVE DISASSEMBLY

1) Disconnect the 7 x 160 mm tube, 7 x 40 mm tube and the water relief tube C from the engine side.
2) Disconnect each tube from the T-joint.
3) Remove the two 6 x 22 mm flange bolts and remove the relief valve cover and the relief valve.
   Do not reuse the relief valve cover O-ring. Replace it with a new one on assembly.

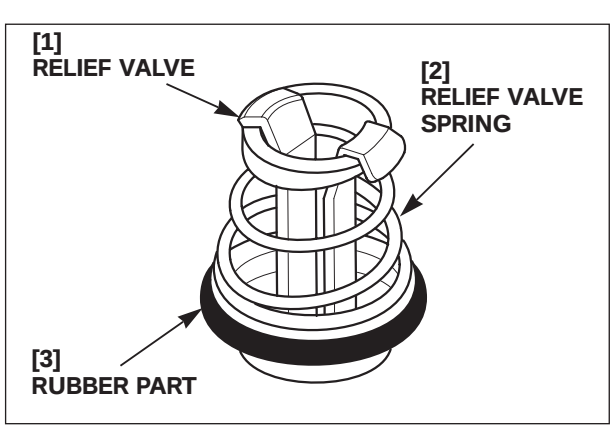


d. INSPECTION

• RELIEF VALVE

1) Check the rubber part of the relief valve for deterioration and cracks. Replace the relief valve with a new one if necessary.

2) Check the operation of the relief valve spring and replace the relief valve with a new one if necessary.

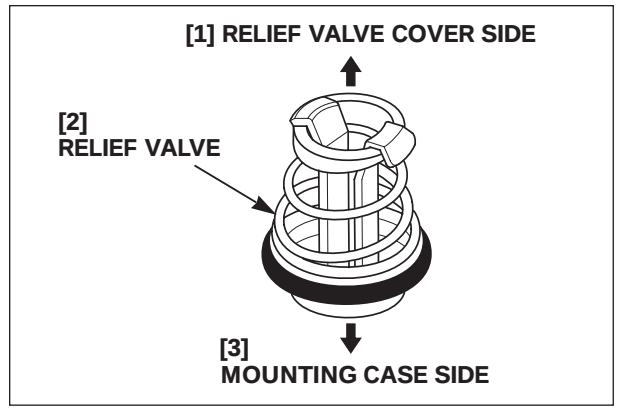


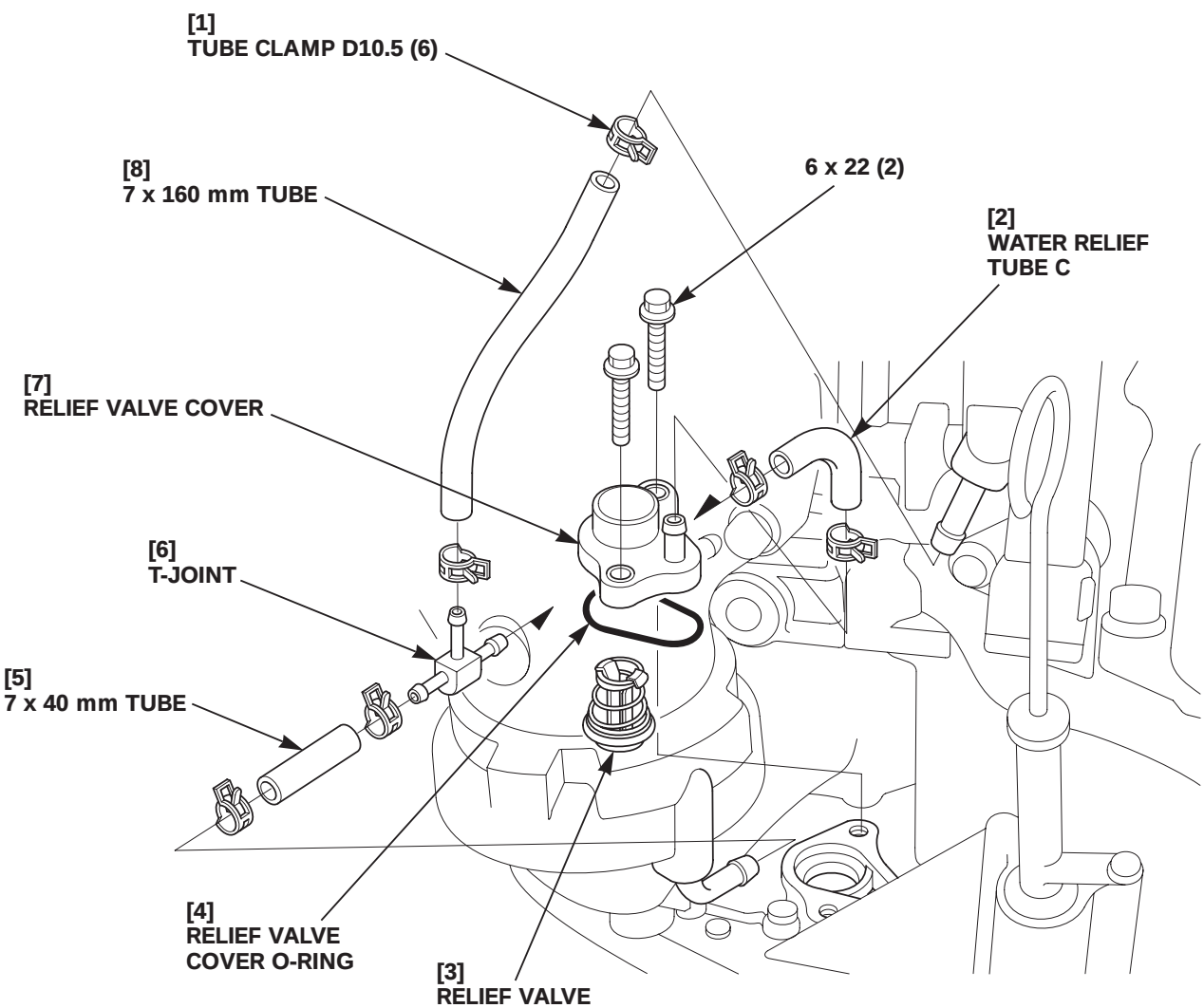
e. WATER RELIEF TUBE C/RELIEF VALVE ASSEMBLY

NOTICE

Check the tubes for deterioration and cracks before assembly. Replace if necessary.

1) Install the relief valve on the mount case noting the installation direction as shown.
2) Set a new relief valve cover O-ring on the relief valve cover, and install the relief valve cover with the two 6 x 22 mm flange bolts.
3) Connect the 7 x 160 mm tube, 7 x 40 mm tube and the water relief tube C to the T-joint, and clamp each tube with the tube clamp D10.5.
4) Set the tube clamp D10.5 on the side of each tube where is opposite to the other end connected to the T-joint, and connect each tube to the engine side.
   Clamp each tube with the tube clamp D10.5.





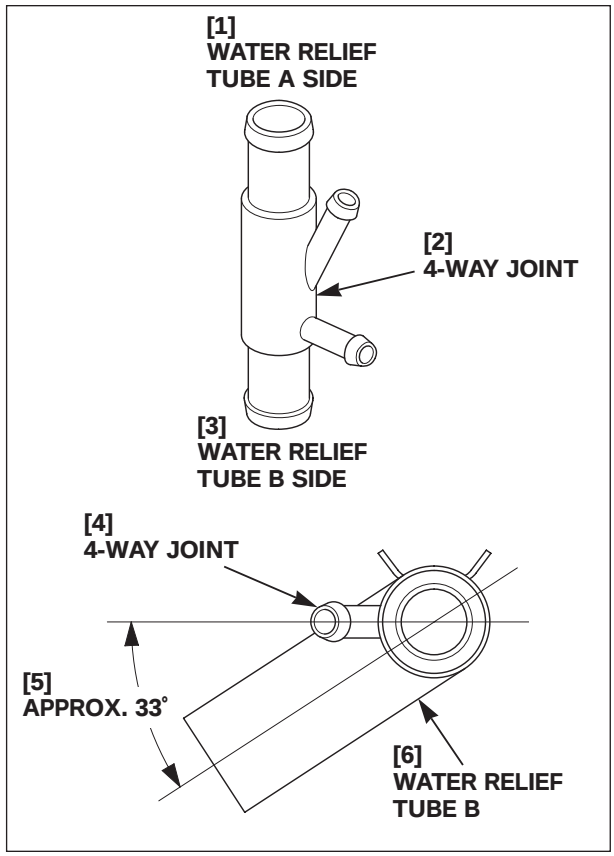
f. ASSEMBLY OF WATER RELIEF TUBE ASSEMBLY

NOTICE

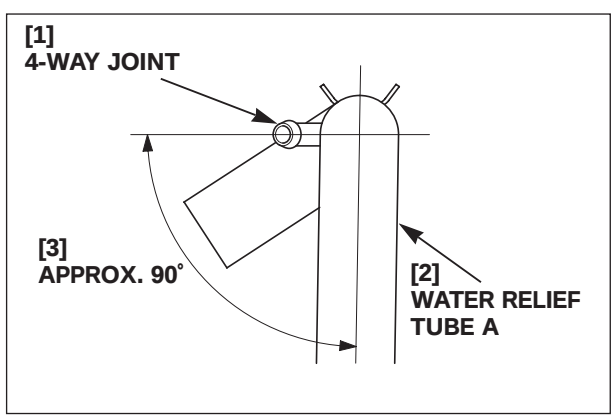
Check the tubes for deterioration and cracks before assembly. Replace if necessary.

1) Note the connection position of each tube to the 4-way joint as shown.

2) Connect the water relief tube B to the 4-way joint so that its installation angle is approximately 33˚ as shown.

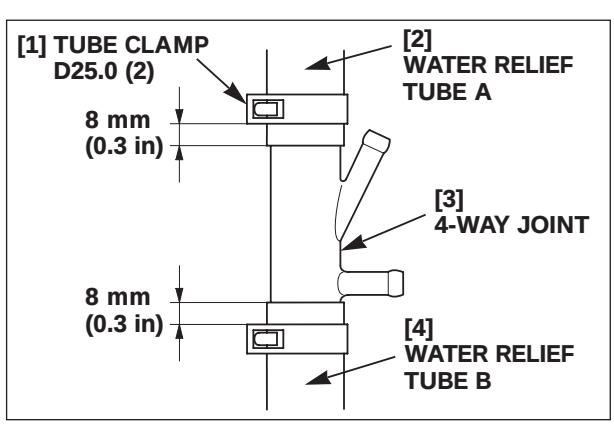


3) Connect the water relief tube A to the 4-way joint so that its installation angle is approximately 90˚ as shown.



4) Set the tube clamp D25.0s on the water relief tube A and B.

5) Set the tube clamp D25.0s in the position 8 mm from the end of each tube as shown.



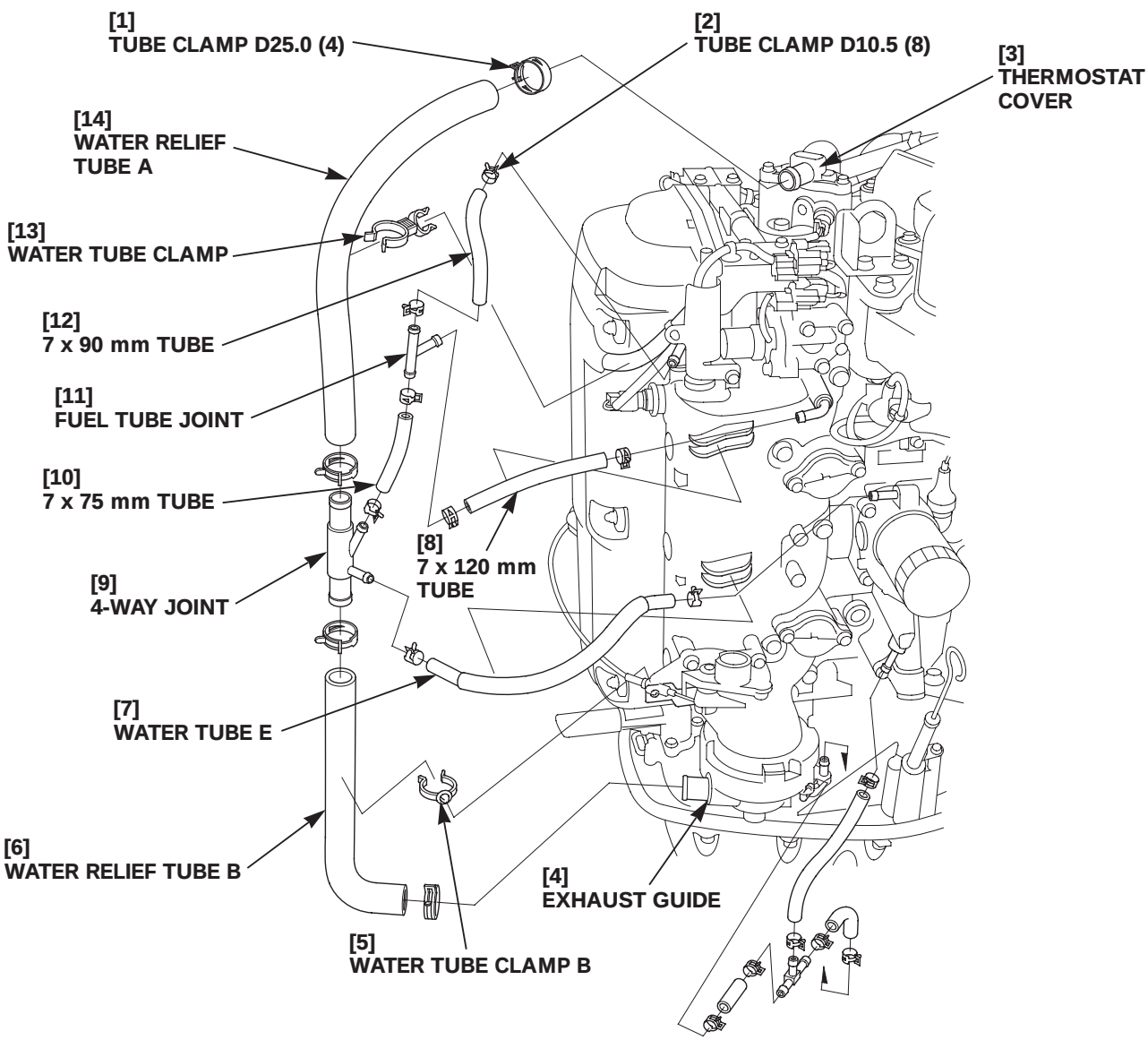
6) Connect the 7 x 75 mm tube and the water tube E to the 4-way joint.
7) Connect the 7 x 75 mm tube to the fuel tube joint.
8) Connect the 7 x 90 mm tube and the 7 x 120 mm tube to the fuel tube joint.
9) Connect the 7 x 120 mm tube with the lugs of the tube clamp D10.5s toward down.

g. INSTALLATION OF WATER RELIEF TUBE ASSEMBLY

1) Connect the water relief tube B to the exhaust guide.
   Clamp the water relief tube B with the water tube clamp B.
2) Connect the water relief tube A to the thermostat cover and set the tube clamp D25.0 with its lugs toward the direction shown (i.e. toward the intake manifold side).
   Clamp the water relief tube A and the main wire harness with the water tube clamp.
3) Connect the 7 x 90 mm tube and the water tube E to the engine side.
4) Connect the 7 x 120 mm tube to the engine side and set the tube clamp D10.5s with the lugs toward down.
5) Install the following parts.
   – L./R. engine under covers (P. 4-14)
   – Engine cover (P. 4-2)

NOTICE

Start the engine after connecting the tubes. Check that the water does not leak from each joint.



3. FLUSH VALVE

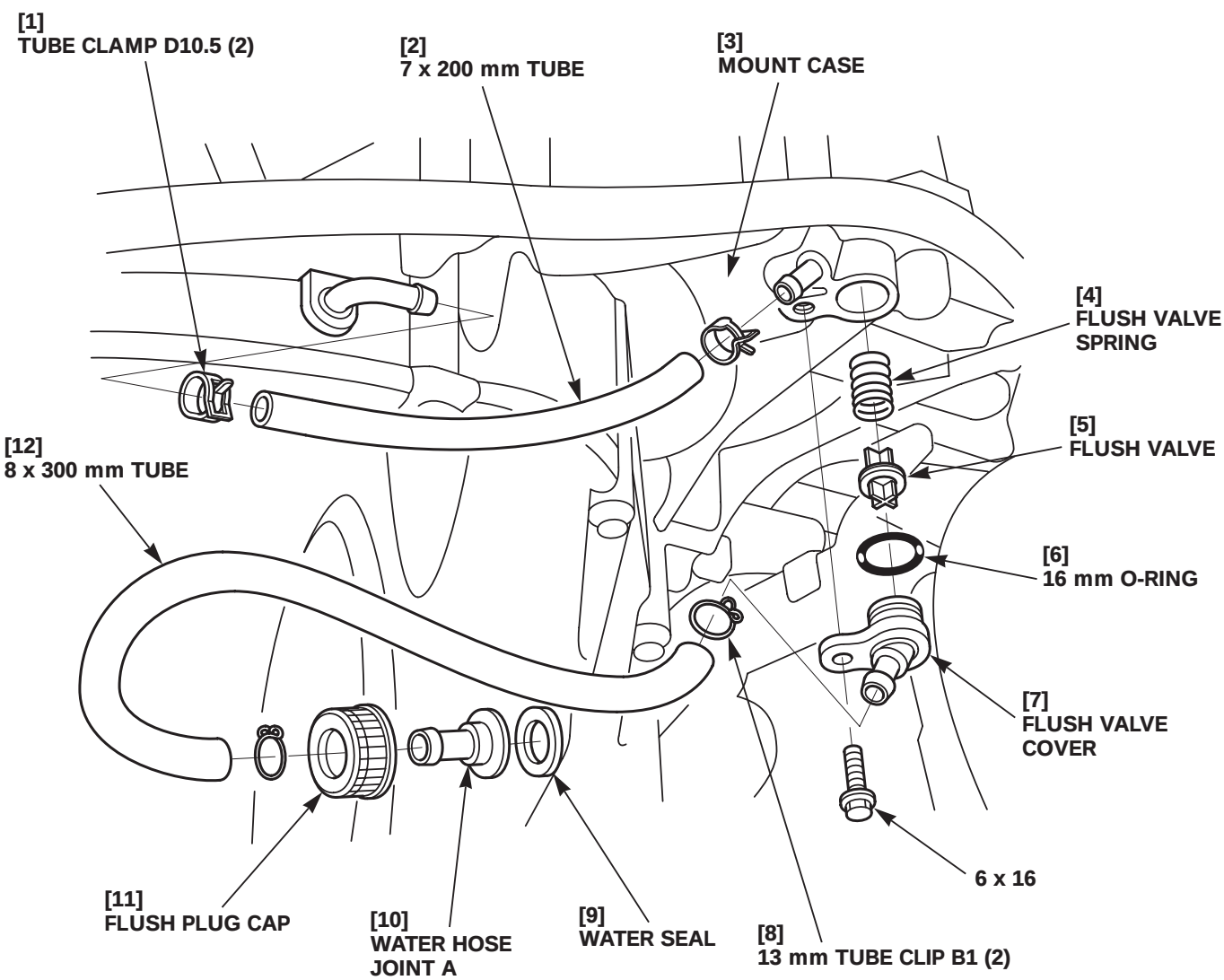
a. DISASSEMBLY

Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under cover (P. 4-9)

1) Disconnect the 7 x 200 mm tube from the mount case.

2) Disconnect the 8 x 300 mm tube from the flush valve cover.
Remove the water seal, water hose joint A and the flush plug cap from the 8 x 300 mm tube.

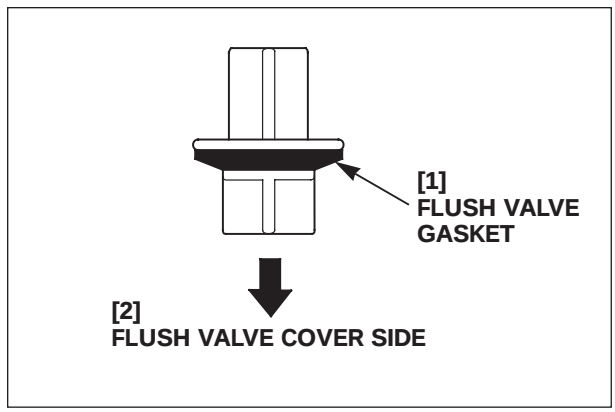
3) Remove the 6 x 16 mm flange bolt, then remove the flush valve cover, flush valve and the flush valve spring.
Do not reuse the 16 mm O-ring on the flush valve cover. Replace with a new one on assembly.



b. INSPECTION

• FLUSH VALVE

Check the flush valve gasket for deterioration and cracks, and replace the flush valve if necessary.

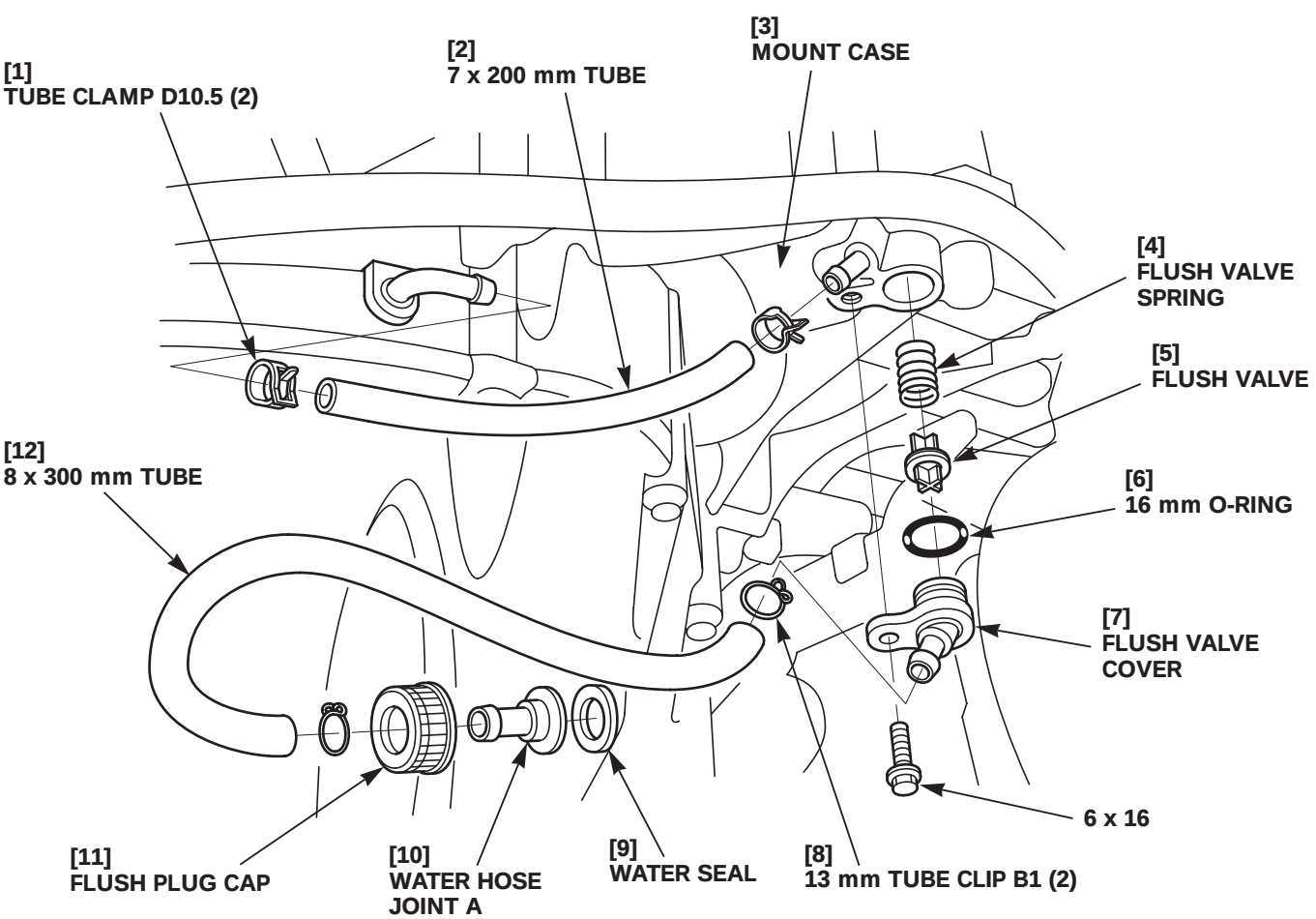


c. ASSEMBLY

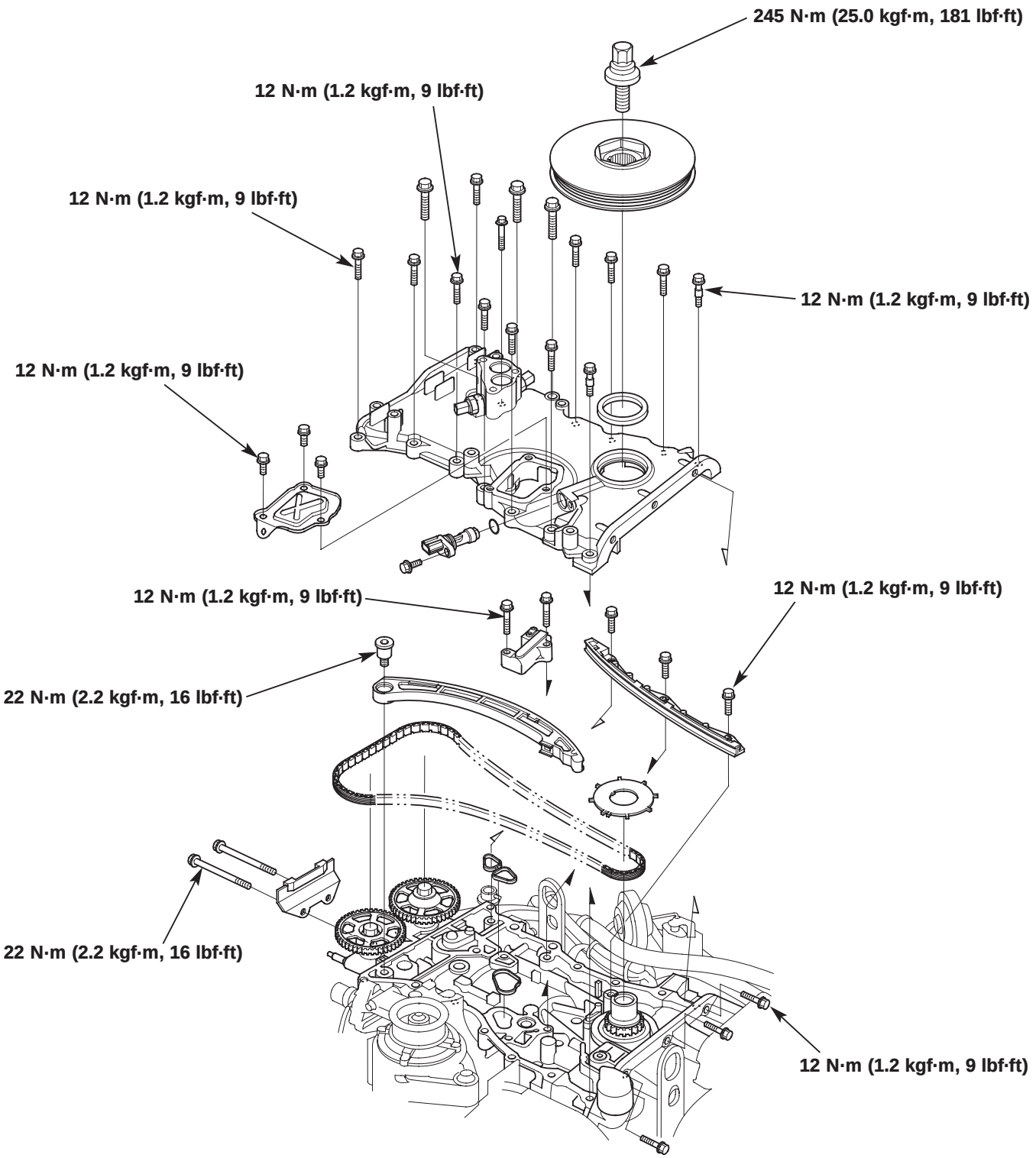
NOTICE

Check each tube for deterioration and cracks before assembly. Replace the tubes if necessary.

1) Install a new 16 mm O-ring on the flush valve cover.
2) Install the flush valve spring and the flush valve on the flush valve cover. Note the installation direction of the flush valve.
3) Tighten the flush valve cover with the 6 x 16 mm flange bolt securely.
4) Install the tube clip B12.5s, flush plug cap, water hose joint A and the water seal on the 8 x 300 mm tube. Connect the 8 x 300 mm tube to the flush valve cover and clamp the tube with the tube clip B12.5s.
5) Connect the 7 x 200 mm tube to the mount case.
6) Install the following parts.
   – L./R. engine under covers (P. 4-14)
   – Engine cover (P. 4-2)



1. DISASSEMBLY	2. ASSEMBLY



1. DISASSEMBLY

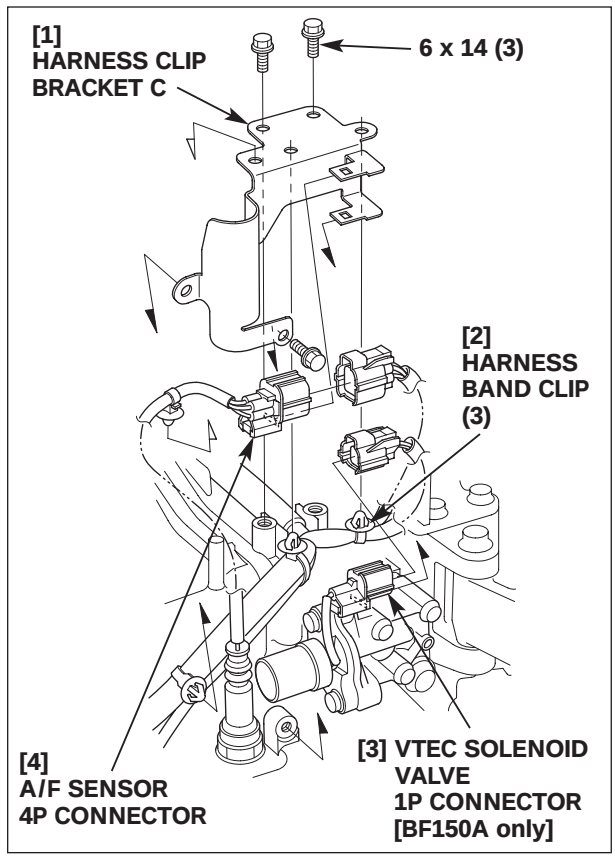
Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under cover (P. 4-9)
– Silencer duct (P. 6-2)
– Alternator belt (P. 3-29)
– Thermostat (P. 8-2)
– Cylinder head cover (P. 10-2)

Put the No.1 piston at the top dead center of its compression stroke before disassembly (P. 3-12 and 13).

1) Detach the A/F sensor 4P connector and the VTEC solenoid valve 1P connector [BF150A only] from the harness clip bracket C. Disconnect the connectors.

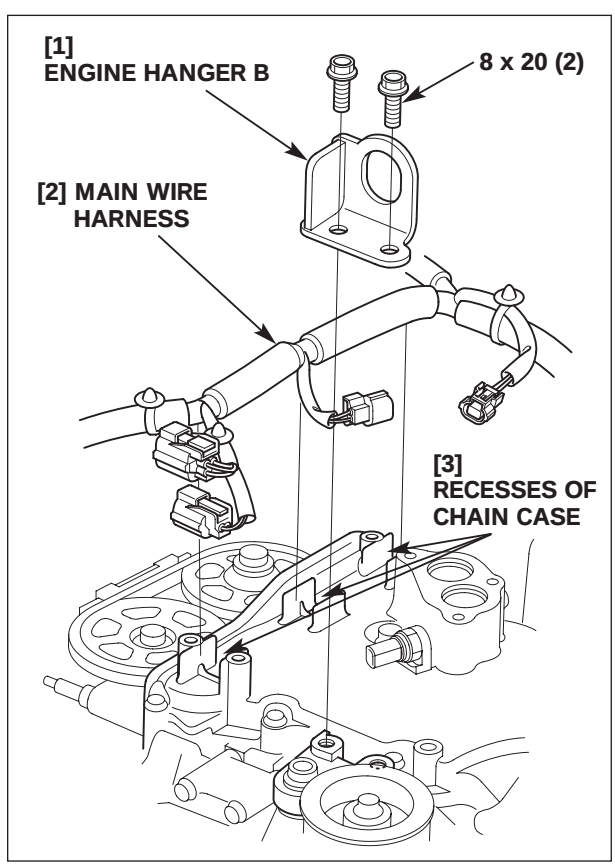
2) Remove the three harness band clips from the harness clip bracket C.

3) Remove the three 6 x 14 mm flange bolts from the harness clip bracket C and remove the harness clip bracket C.

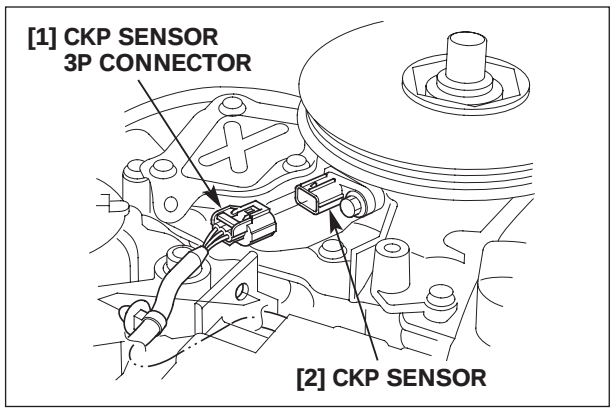


4) Remove the two 8 x 20 mm flange bolts from the engine hanger B and remove the engine hanger B.

5) Remove the main wire harness from the recesses of the chain case.



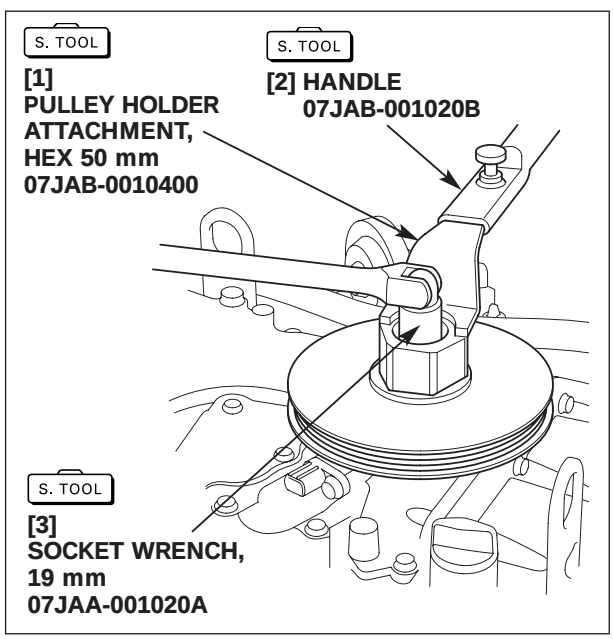
6) Disconnect the CKP sensor 3P connector from the CKP sensor.



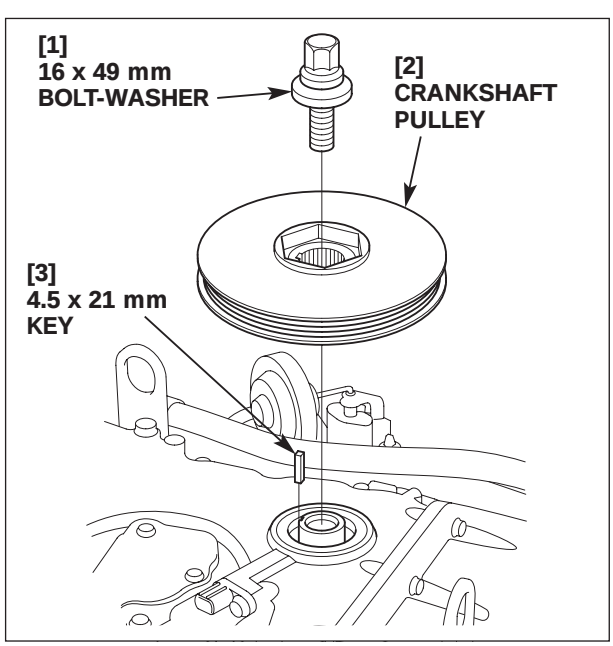
7) Loosen the 16 x 49 mm bolt-washer using the special tools as shown.

TOOLS:

Handle	**07JAB-001020B**
Pulley holder attachment, HEX 50 mm	**07JAB-0010400**
Socket wrench, 19 mm	**07JAA-001020A**

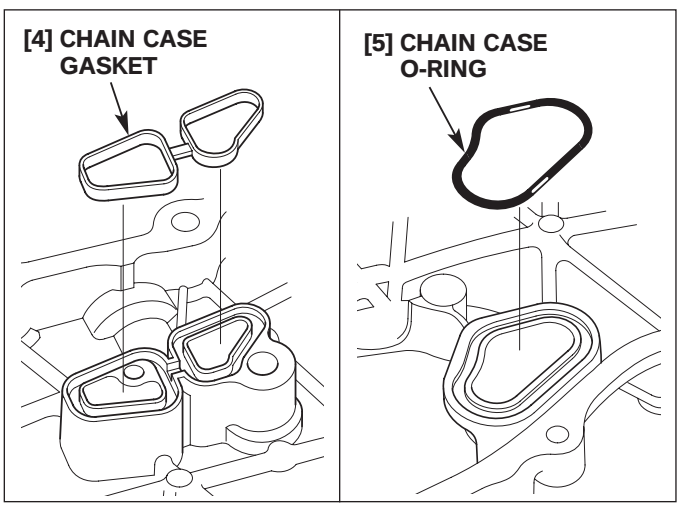


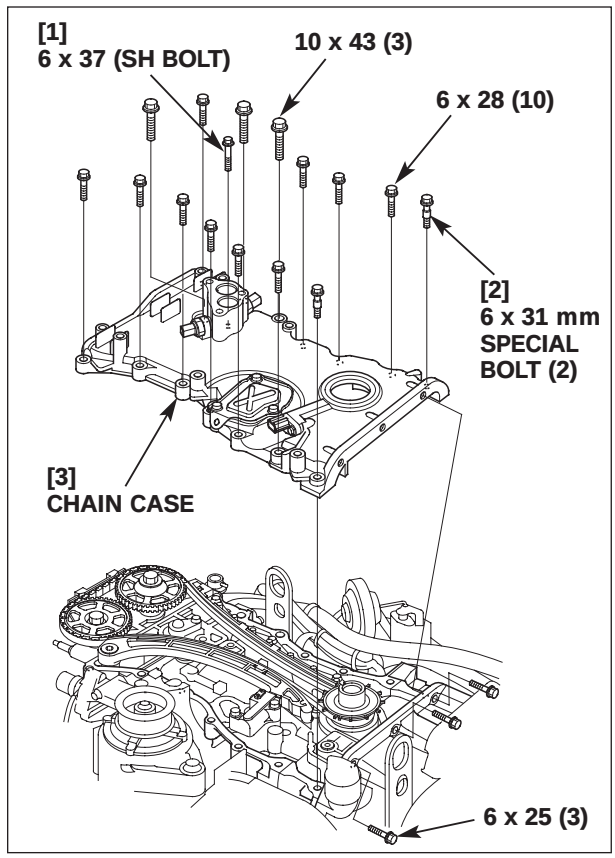
8) Remove the 16 x 49 mm bolt-washer and remove the crankshaft pulley and the 4.5 x 21 mm key.



9) Remove all bolts securing the chain case.
   - 10 x 43 mm flange bolts (3)
   - 6 x 38 mm (SH) flange bolt (1)
   - 6 x 28 mm flange bolts (10)
   - 6 x 31 mm special bolts (2)
   - 6 x 25 mm flange bolts (3)

10) Remove the chain case gasket and the chain case O-ring from the chain case.
    Replace the chain case gasket and the chain case O-ring with new ones on assembly.

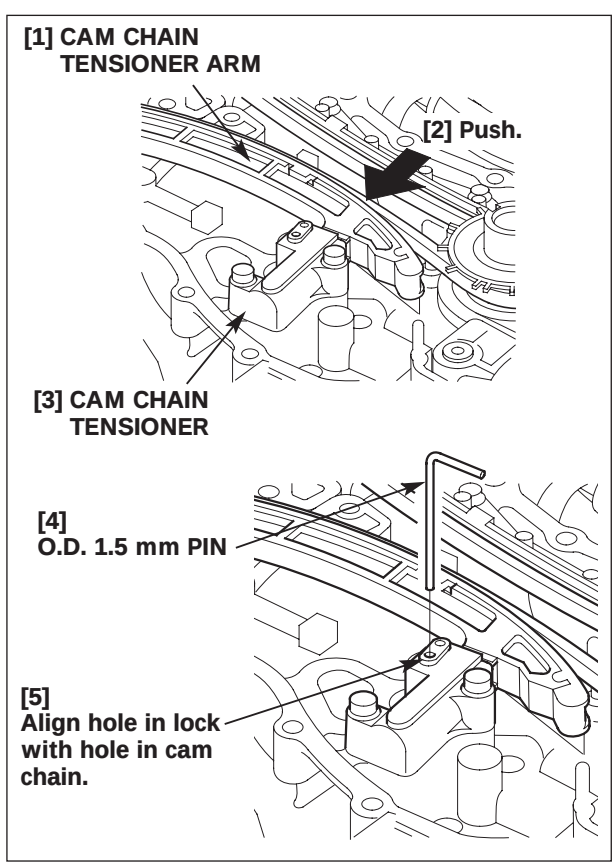




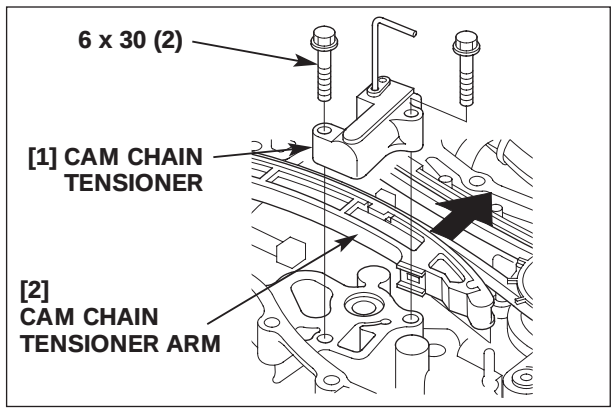
11) Pushing the cam chain tensioner arm toward the cam chain tensioner, align the hole in the lock with the hole in the cam chain and insert the pin of 1.5 mm in O.D. into the hole.

NOTICE

Do not remove the pin of 1.5 mm in O.D. from the cam chain tensioner before installing the cam chain tensioner.

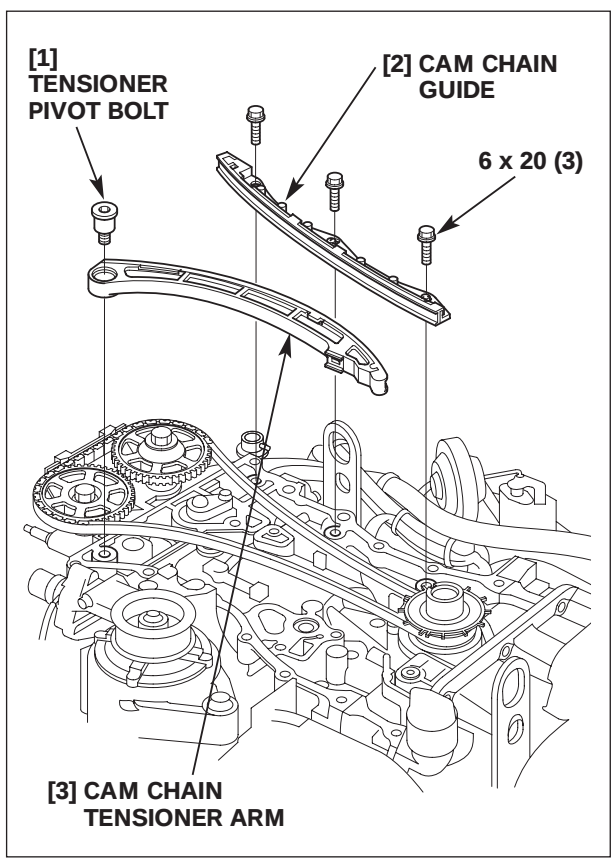


12) Remove the two 6 x 30 mm flange bolts and remove the cam chain tensioner while pushing the cam chain tensioner arm toward the cam chain (direction of arrow).

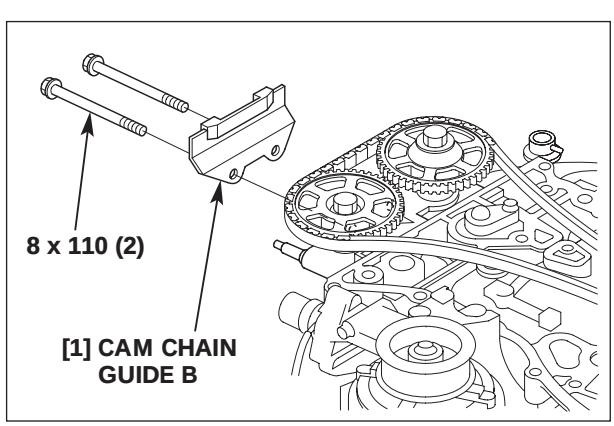


13) Remove the tensioner pivot bolt and the cam chain tensioner arm.

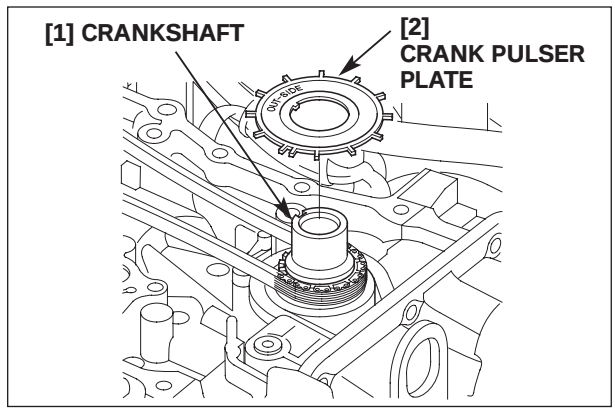
14) Remove the three 6 x 20 mm flange bolts and remove the cam chain guide.



15) Remove the two 8 x 110 mm flange bolts and remove the cam chain guide B.



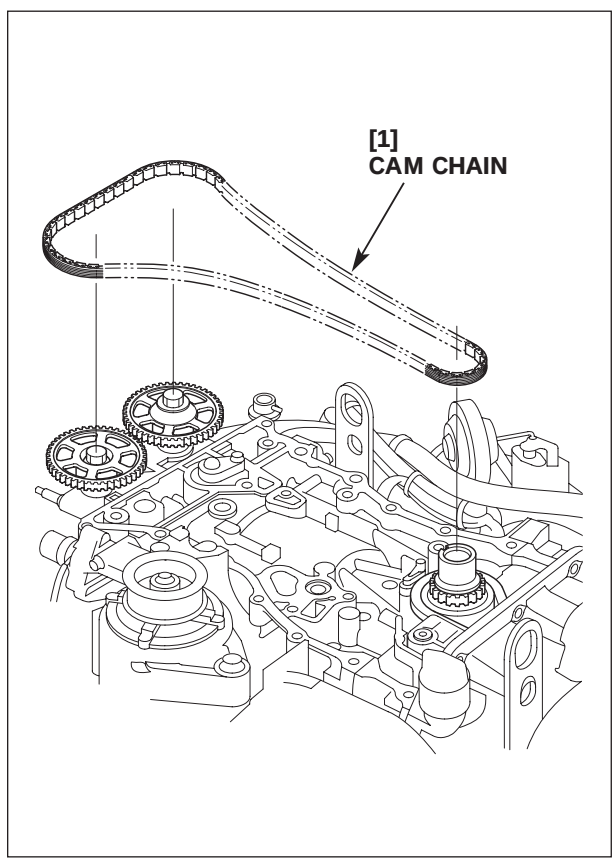
16) Remove the crank pulser plate from the crankshaft.



17) Remove the cam chain.

NOTICE

Keep the cam chin away from any magnetic parts and devices after removal.



CHAIN CASE DISASSEMBLY:

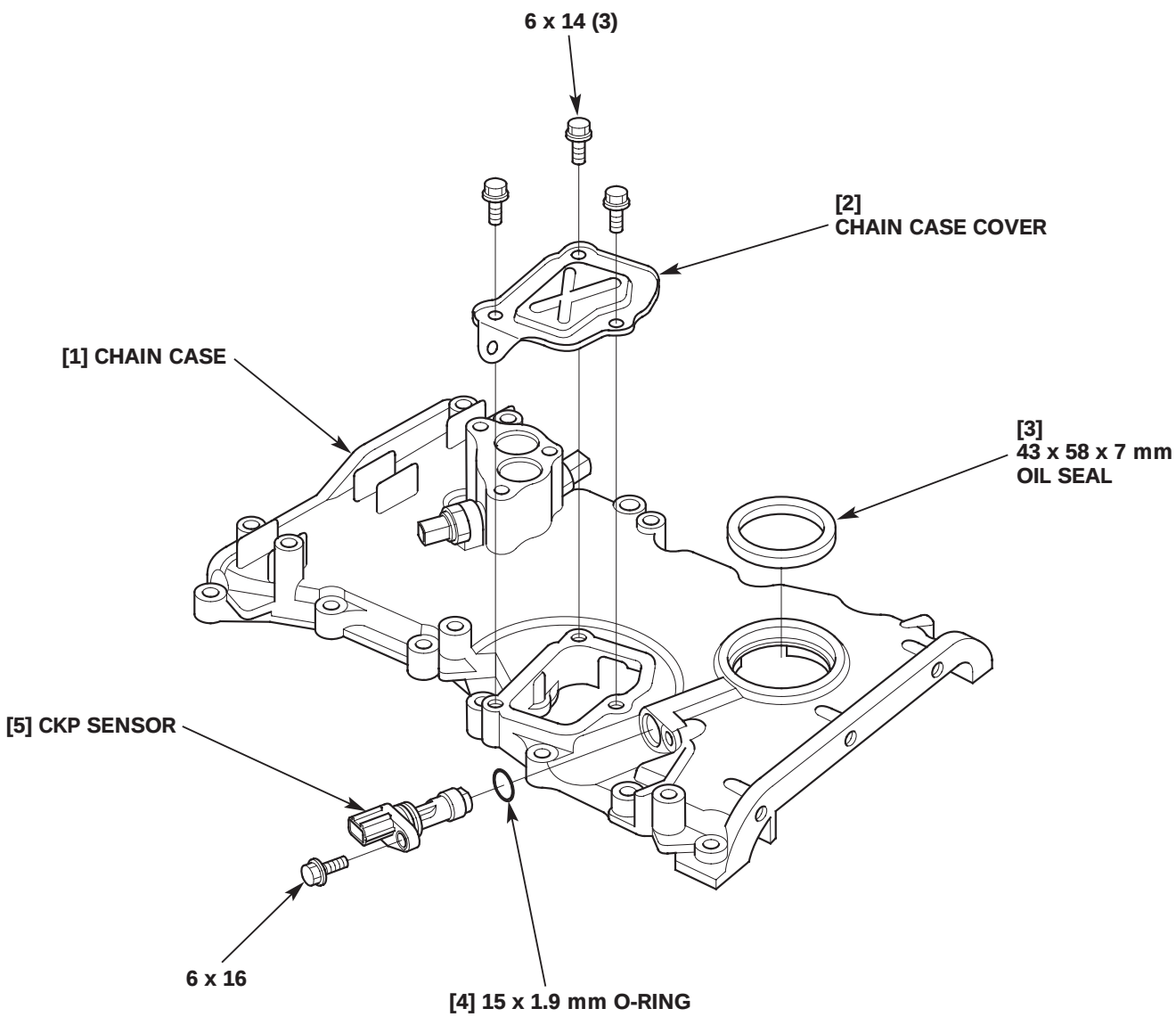
1) Check the 43 x 58 x 7 mm oil seal for cut and other damage and replace if necessary.

   Remove the 43 x 58 x 7 mm oil seal using a commercially available oil seal remover.

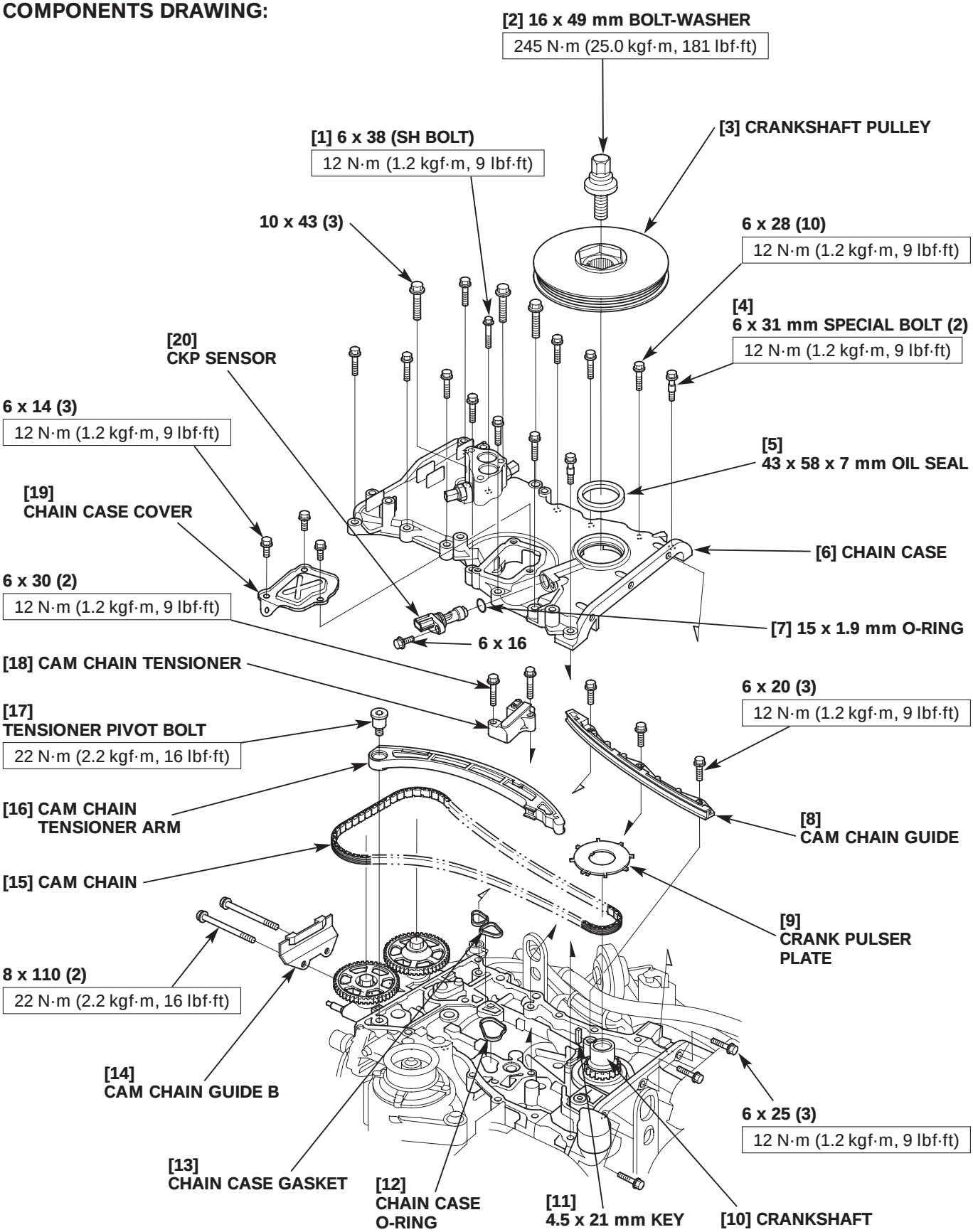
   Replace the 43 x 58 x 7 mm oil seal with a new one on assembly.

2) Remove the CKP sensor and the chain case cover from the chain case.

   Replace the CKP sensor at the 15 x 1.9 mm O-ring with a new one on assembly.



COMPONENTS DRAWING:



2. ASSEMBLY

CHAIN CASE ASSEMBLY:

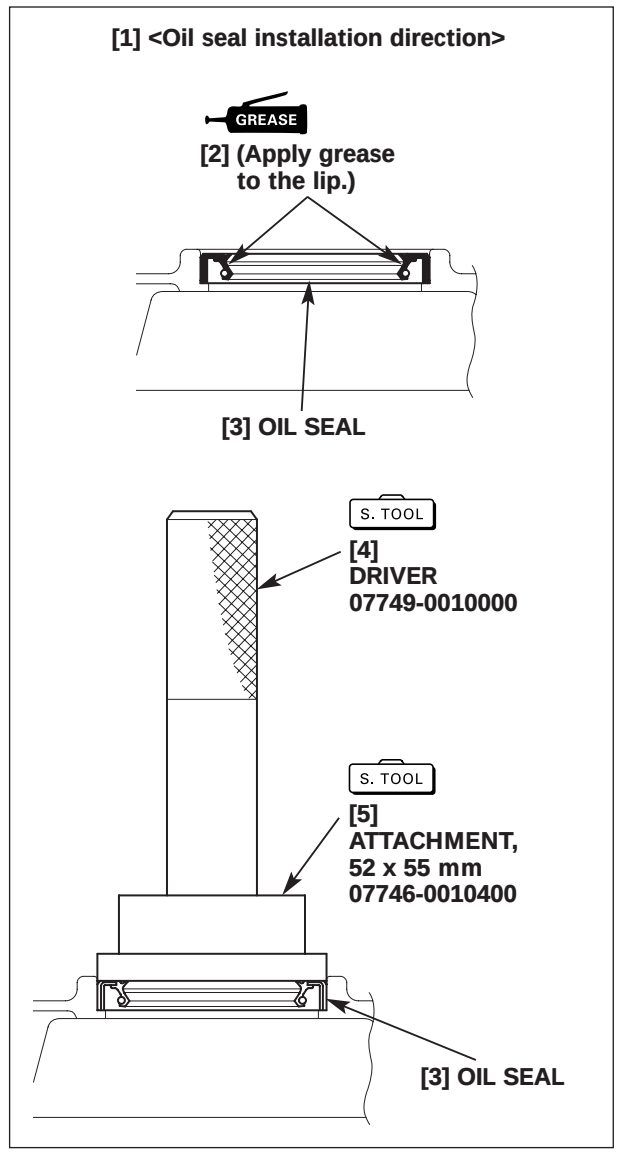
1) Apply soapy water to the outer surface of a new 43 x 58 x 7 mm oil seal.

   Using the special tools, drive in the 43 x 58 x 7 mm oil seal until it seats on the chain case as shown.

   After installation, apply grease to the oil seal lip.

   TOOLS:

Driver	**07749-0010000**
Attachment, 52 x 55 mm	**07746-0010400**

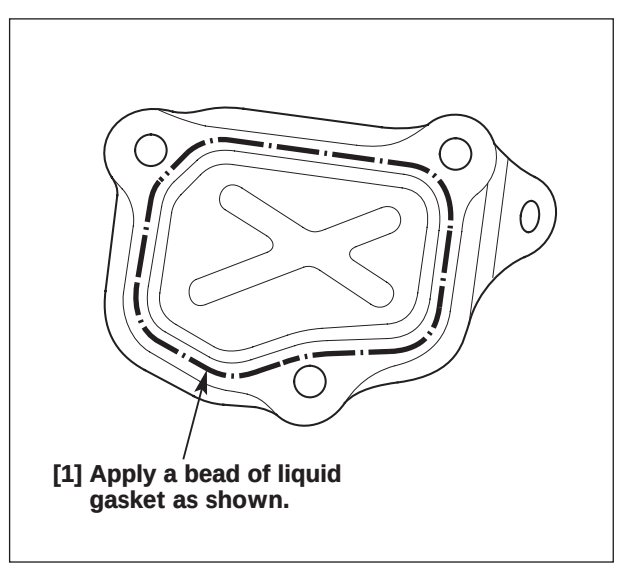


2) Remove the old liquid gasket, oil and contamination from the chain case cover and the chain case mating surfaces.

3) Apply a bead [ø2.0 – 3.0 mm (ø0.08 – 0.12 in)] of the liquid gasket (ThreeBond® #1280B or equivalent) to the indicated area of the chain case cover.

   NOTICE

   Assemble the chain case cover within 5 minutes after application of the liquid gasket. If it has been left for 5 minutes or longer, remove the old liquid gasket and apply the liquid gasket again before assembly.

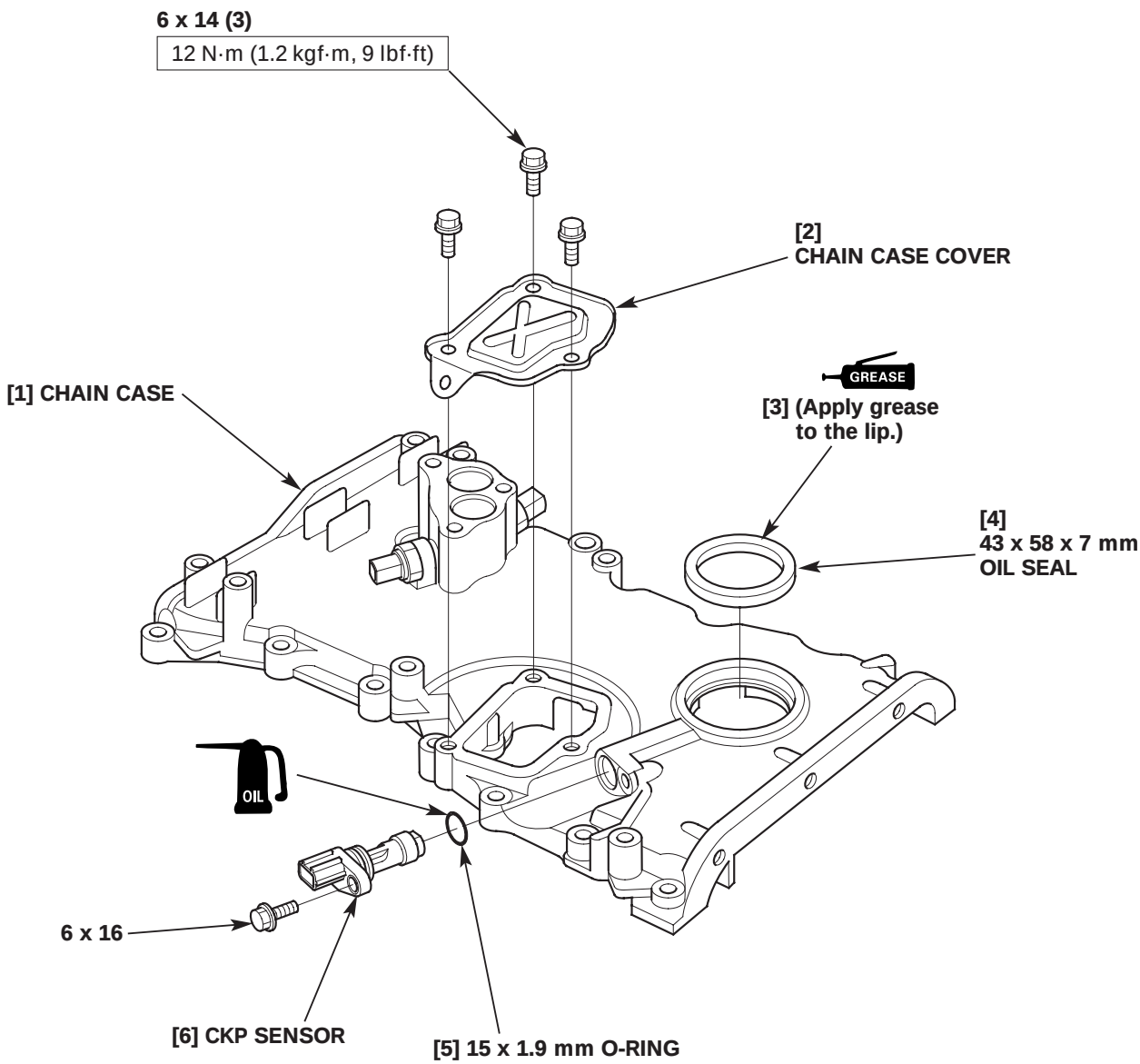


4) Install the chain case by tightening the three 6 x 14 mm flange bolts to the specified torque.

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

5) Position a new 15 x 1.9 mm O-ring on the CKP sensor and apply engine oil to the O-ring.

   Install the CKP sensor by tightening the 6 x 16 mm flange bolt securely.

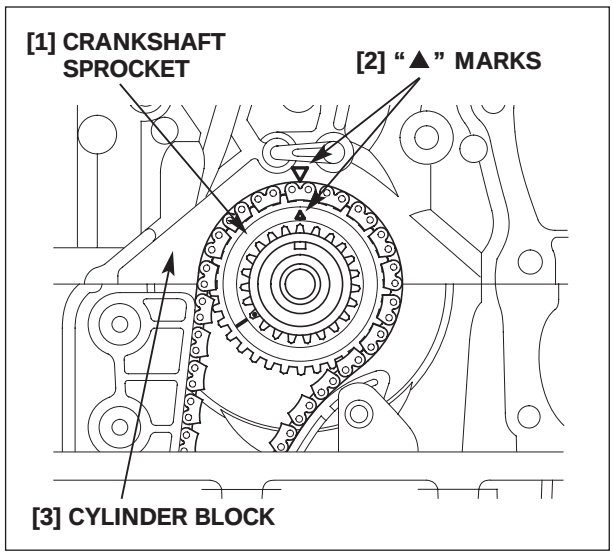


CAM CHAIN/CRANKSHAFT PULLEY ASSEMBLY:

NOTICE

Keep the cam chain away from any magnetic parts and devices.

1) Align the "▲" mark on the crankshaft sprocket with the "▲" mark on the cylinder block.

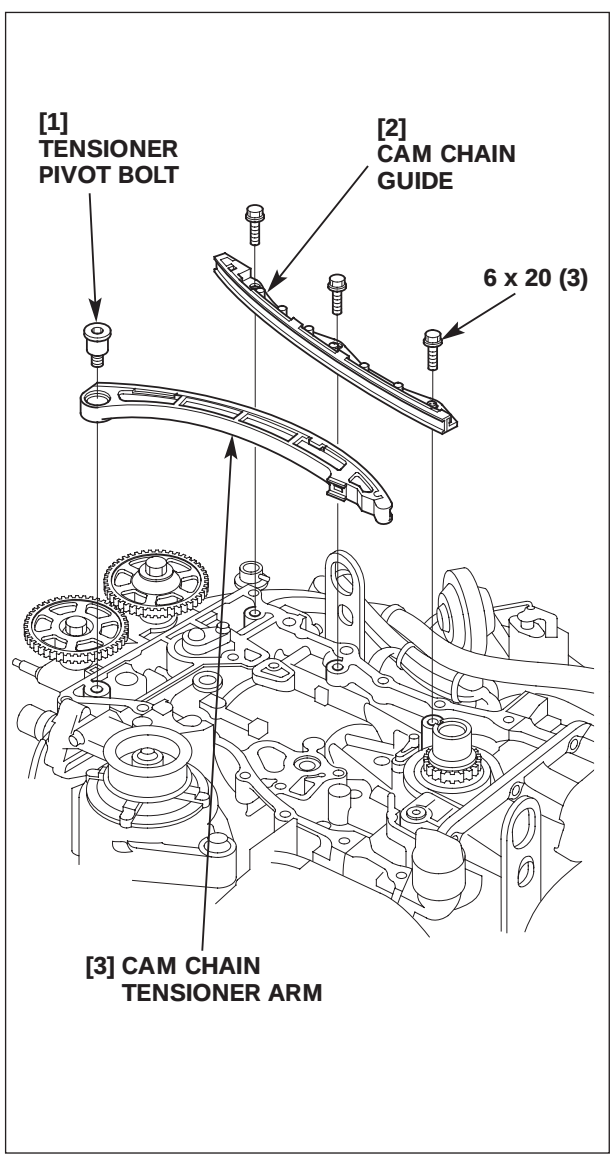


2) Install the cam chain guide and tighten the three 6 x 20 mm flange bolts to the specified torque.

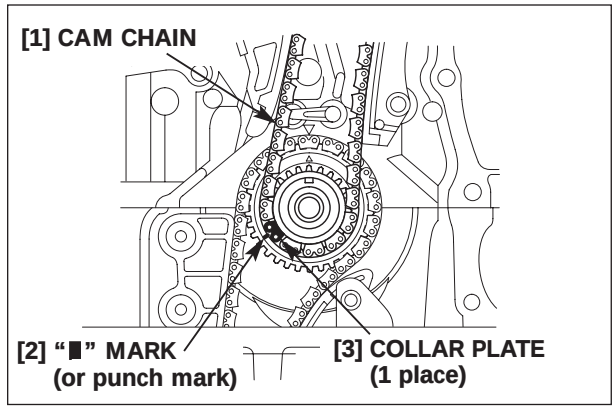
   TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

3) Install the cam chain tensioner arm and tighten the tensioner pivot bolt to the specified torque.

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



4) Install the cam chain aligning the color plate (one) with the "▮" mark (or punch mark) on the crankshaft sprocket as shown.



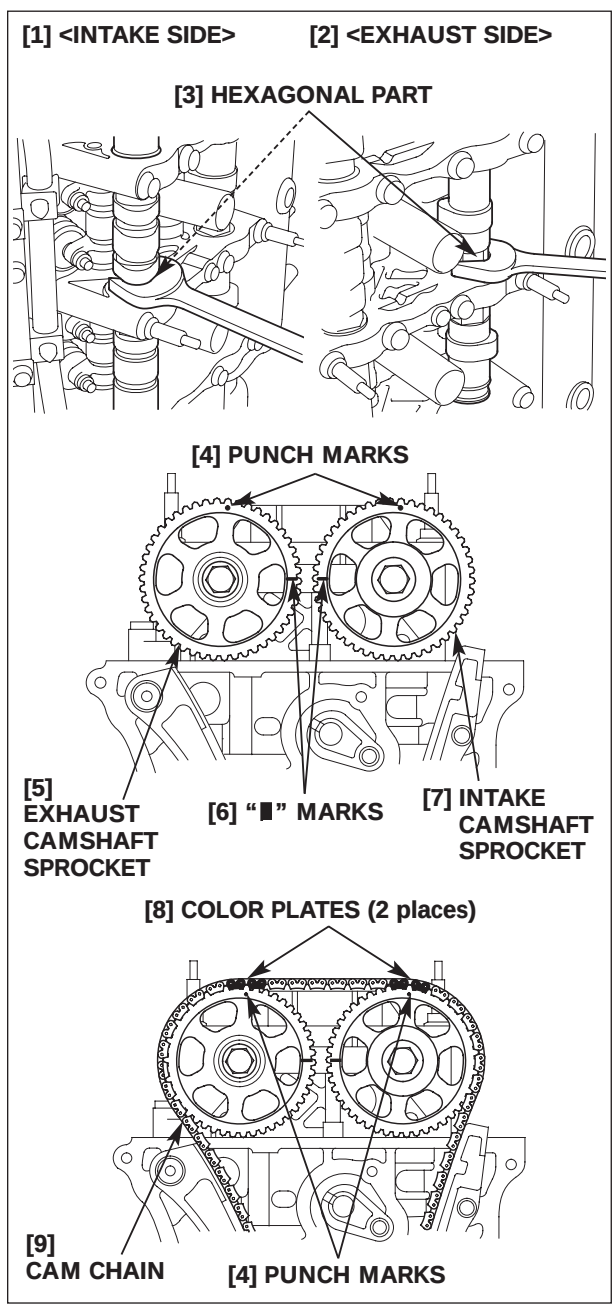
5) Holding the hexagonal part of both the intake and exhaust camshafts with the wrench or equivalent tool as shown, align the "▮" mark on the exhaust camshaft sprocket with the "▮" mark on the intake camshaft sprocket. (The No.1 piston is at the top dead center of its compression stroke.)

6) Check that the punch mark on the intake camshaft sprocket and the punch mark on the exhaust camshaft sprocket are in the position shown.

7) Holding the No.1 cylinder at the top dead center of its compression stroke and the punch marks in alignment as described in step 5, align each punch mark on the intake and exhaust camshaft sprockets with the mid point of the corresponding color plates (2 places) of the cam chain, and install the cam chain.

NOTICE

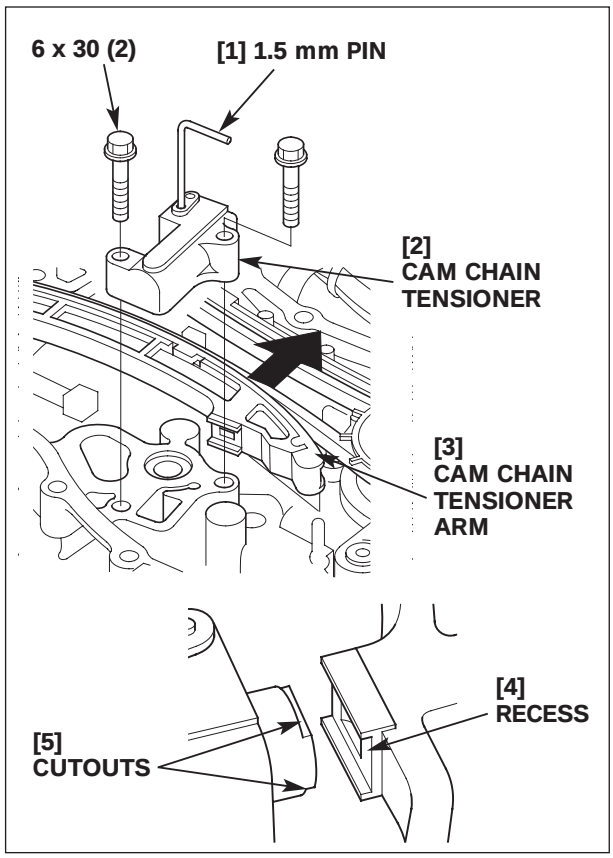
- *Turn the intake camshaft and the exhaust camshaft while holding the hexagonal part of the intake and exhaust camshafts with the wrench or equivalent tool and thereby aligning the alignment marks on both the intake and exhaust camshaft sprockets.*
- *Install the cam chain aligning the mid point of the two color plates with the punch mark on the intake/exhaust camshaft sprockets.*
- *Check that the color plate (one) of the crankshaft sprocket is not out of alignment.*
- *After installing the cam chain, check that the crankshaft sprocket and the camshaft sprocket are in alignment with the No.1 piston at the top dead center of its compression stroke.*



8) Pushing the cam chain tensioner arm toward the cam chain, install the cam chain tensioner by aligning the cutouts of the cam chain tensioner with the recess in the cam chain tensioner arm. Tighten the two 6 x 30 mm flange bolts to the specified torque.

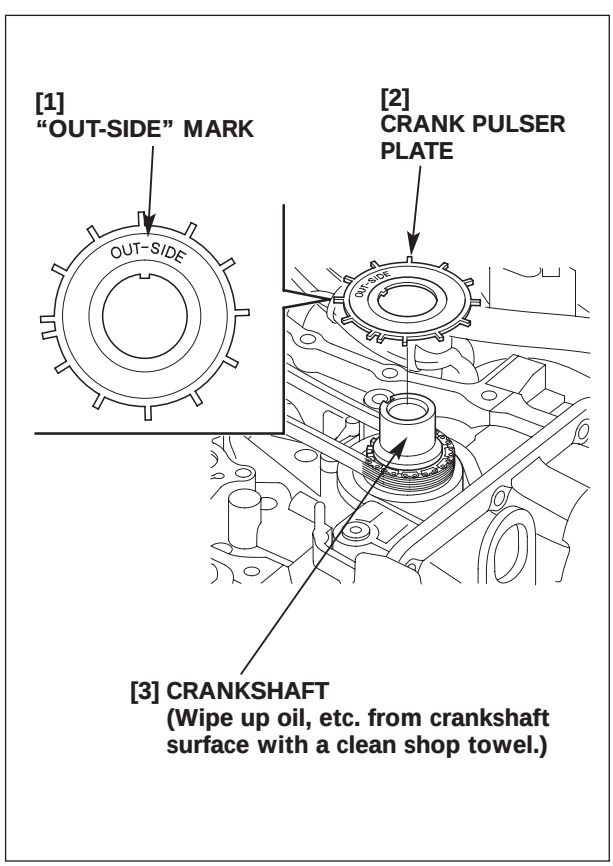
TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

Remove the 1.5 mm pin.



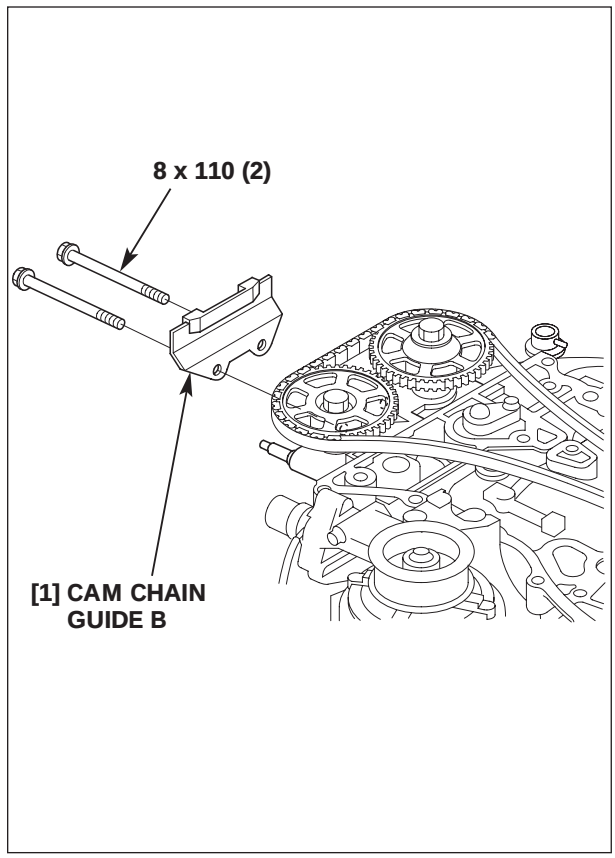
9) Wipe up oil, etc. from the crankshaft outer surface with a clean shop towel.

Install the crankshaft pulser plate on the crankshaft with the "OUT-SIDE" mark facing out.

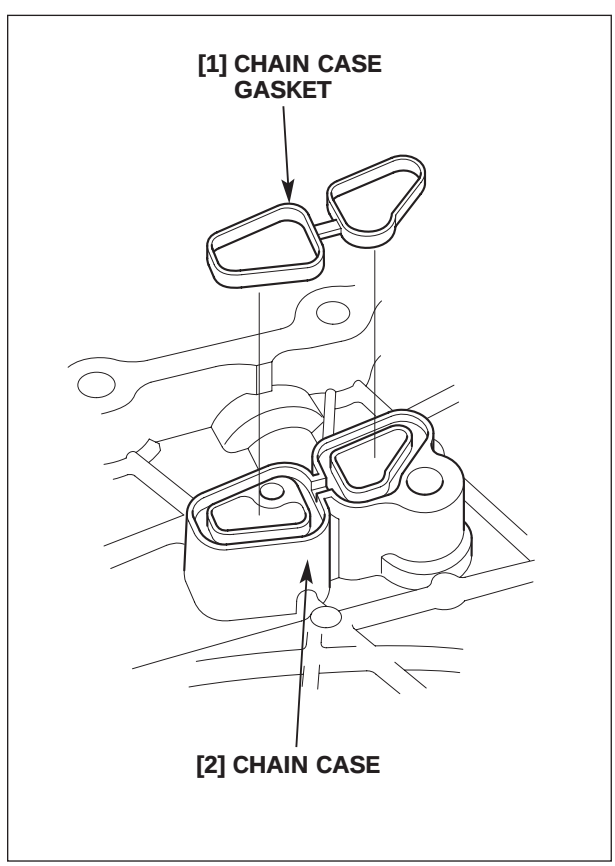


10) Install the cam chain guide B and tighten the two 8 x 110 mm flange bolts to the specified torque.

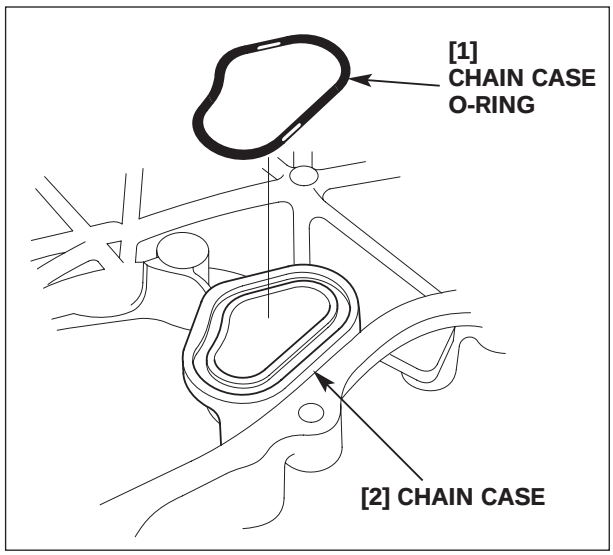
TORQUE: 22 N·m (2.2 kgf·m, 16 lbf·ft)



11) Install the new chain case gasket on the chain case.



12) Install the new chain case O-ring on the chain case.



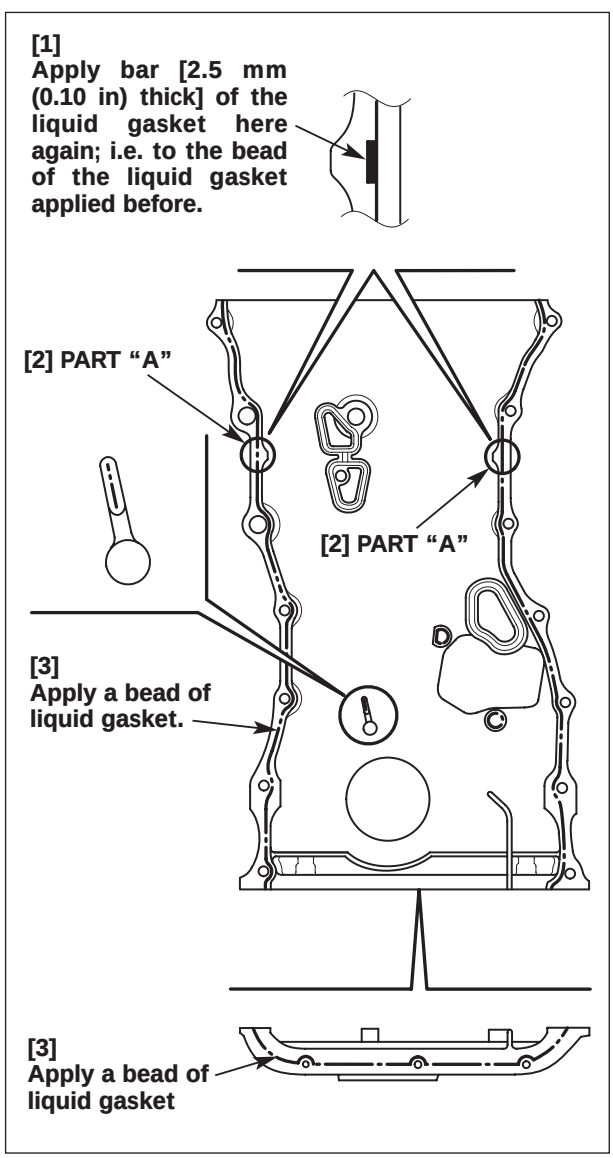
13) Remove the old liquid gasket, oil and the contamination from the cylinder block/cylinder head and chain case mating surfaces.

14) Apply a bead [ø2.0 – 3.0 mm (ø0.08 – 0.12 in)] of the liquid gasket (ThreeBond® #1280B or equivalent) to the indicated areas of the chain case.

Apply bead [2.5 mm (0.10 in) thick] of the liquid gasket again to the part "A" shown in the drawing; i.e. apply to the bead of the liquid gasket applied before.

NOTICE

Assemble the chain case within 5 minutes after applying the liquid gasket. If it has been left for 5 minutes or longer, remove the old liquid gasket and apply the liquid gasket again before assembly.



15) Install the chain case on the cylinder block aligning the end of the chain case at the crankcase side.

16) Loosely tighten the two 6 x 31 mm special bolts in the positions shown.

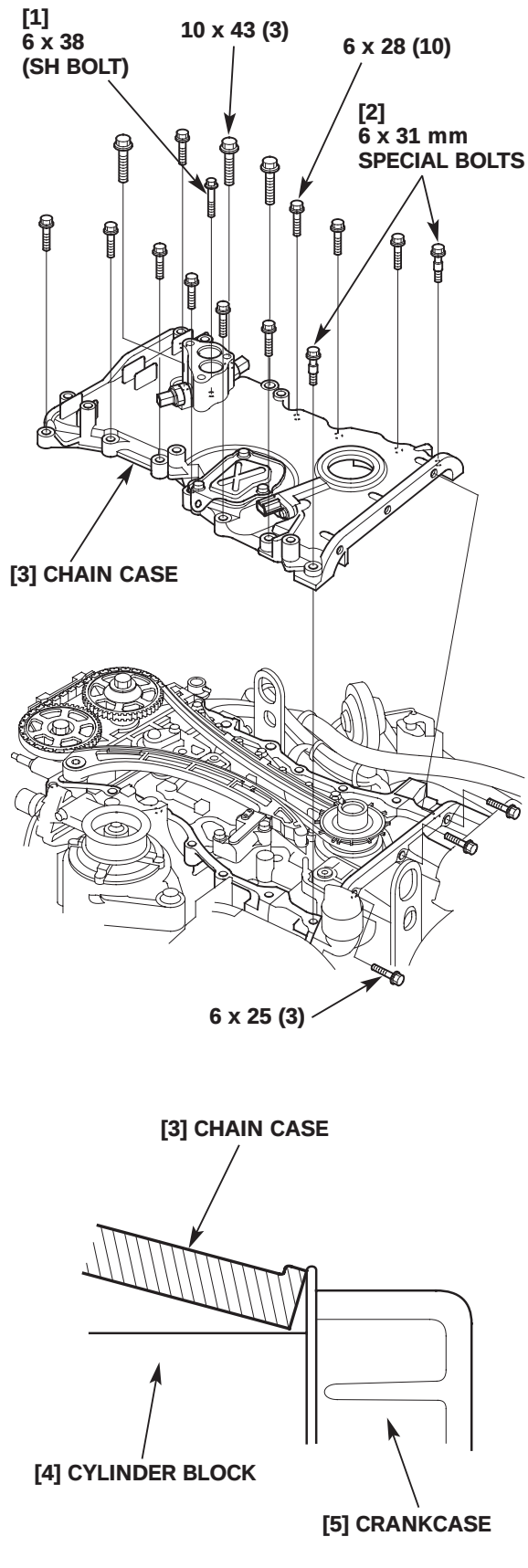
17) Loosely tighten all the chain case bolts but the two 6 x 31 mm special bolts, and tighten them to the specified torque in two or three steps in a criss-cross pattern. (Tighten the three 10 x 43 mm flange bolts to the standard torque.)

TORQUE:
6 x 38 mm (SH) flange bolt (1)/
6 x 28 mm flange bolts (10)/
6 x 31 mm special bolts (2)/
6 x 25 mm flange bolts (3): 12 N·m (1.2 kgf·m, 9 lbf·ft)

STANDARD TORQUE:
10 x 43 mm flange bolts (3): 39 N·m (40 kgf·m, 29 lbf·ft)

NOTICE

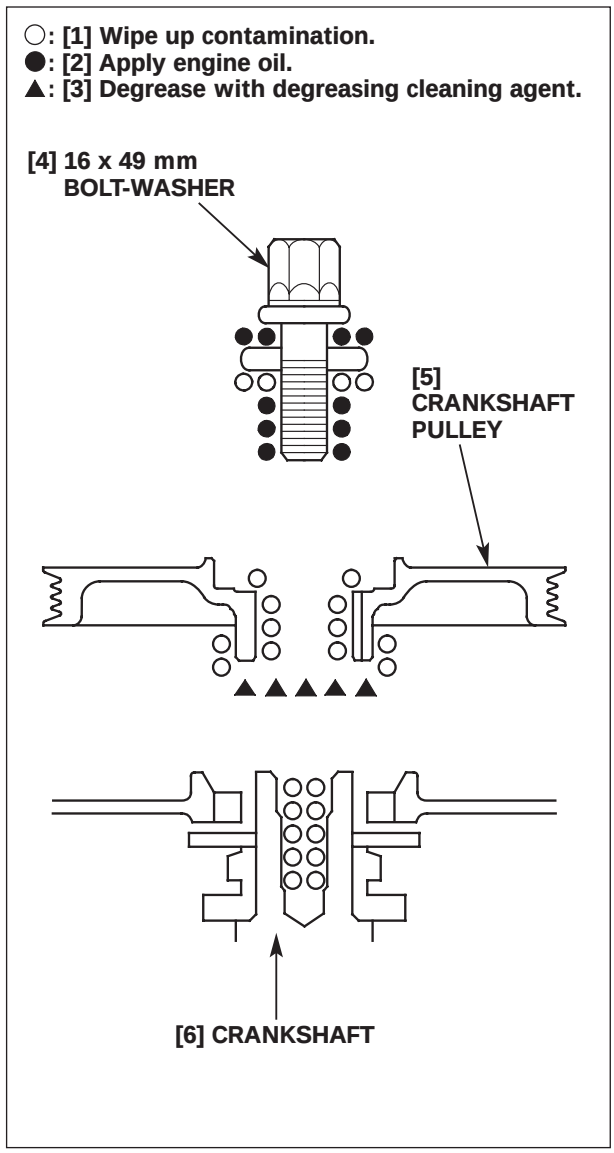
- *Do not touch the surfaces coated with the liquid gasket.*
- *Take care not to slide the chain case during installation as it makes the thickness of the liquid gasket uneven.*
- *Take care not to let the chain case gasket and O-ring come out of position.*



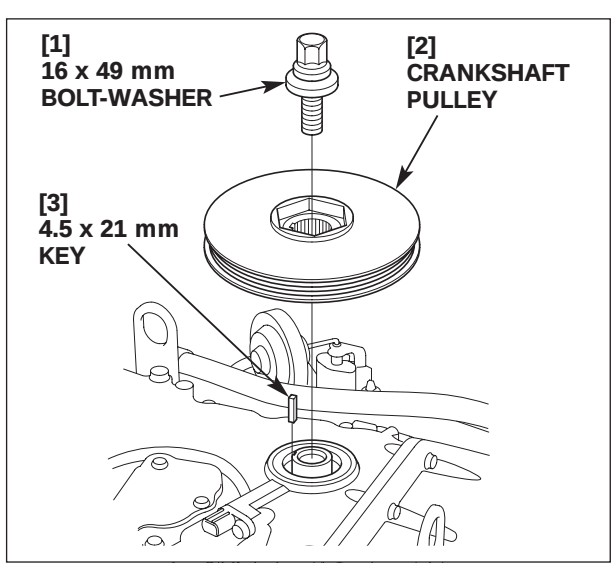
18) Wipe up oil thoroughly from the threaded part of the crankshaft where the 16 x 49 mm bolt-washer is tightened, and from the crankshaft pulley and the 16 x 49 mm bolt-washer with a clean shop towel.

19) Wipe up oil from the boss on the side of the crankshaft pulley with a clean shop towel sprayed with the degreasing cleaning agent.

20) Apply the engine oil to the threads and the seating surface of the 16 x 49 mm bolt-washer.



21) Position the 4.5 x 21 mm key and the crankshaft pulley on the crankshaft, then loosely tighten the 16 x 49 mm bolt-washer.

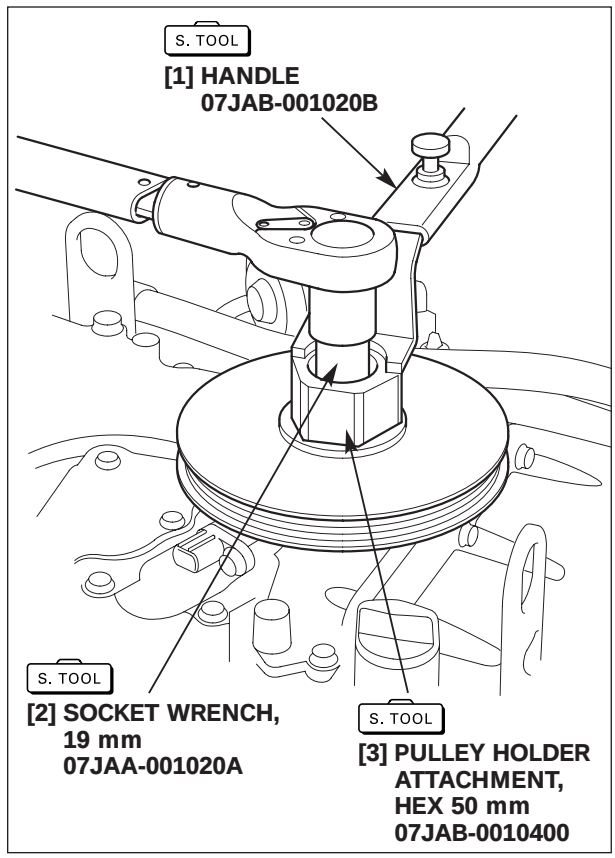


22) Tighten the 16 x 49 mm bolt-washer to the specified torque using the special tools as shown.

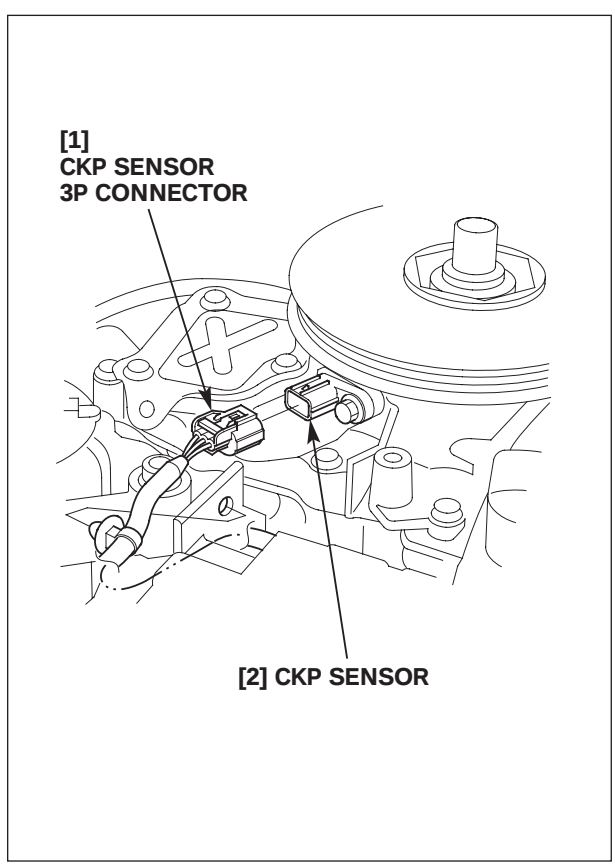
TOOLS:

Handle	**07JAB-001020B**
Pulley holder attachment, HEX 50 mm	**07JAB-0010400**
Socket wrench, 19 mm	**07JAA-001020A**

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

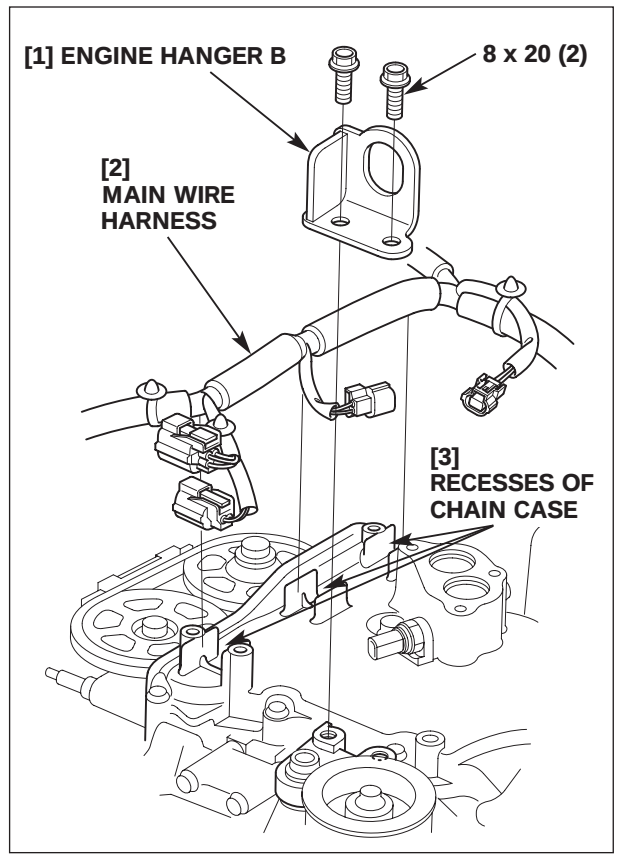


23) Connect the CKP sensor 3P connector to the CKP sensor.



24) Position the main wire harness in the recesses of the chain case.

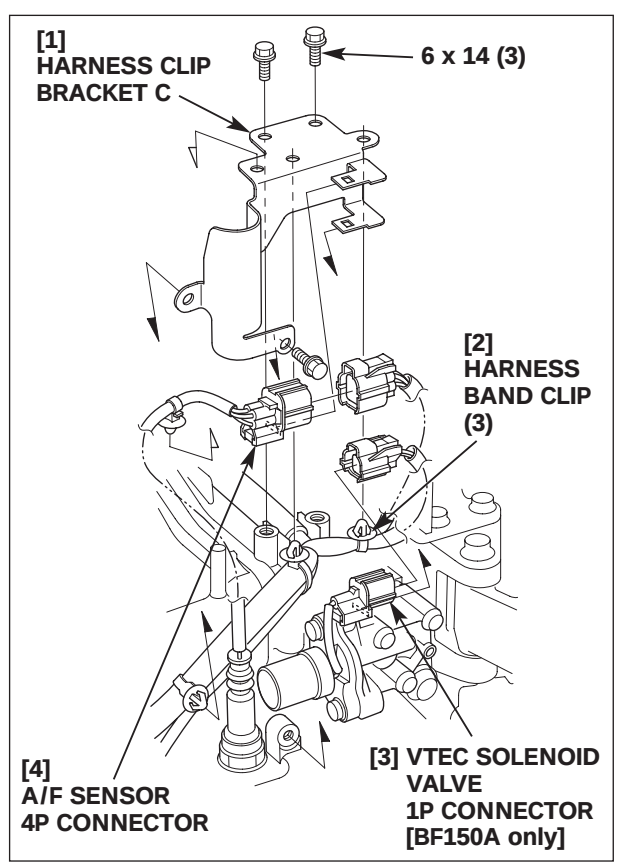
25) Tighten the engine hanger B with the two 8 x 20 mm flange bolts.

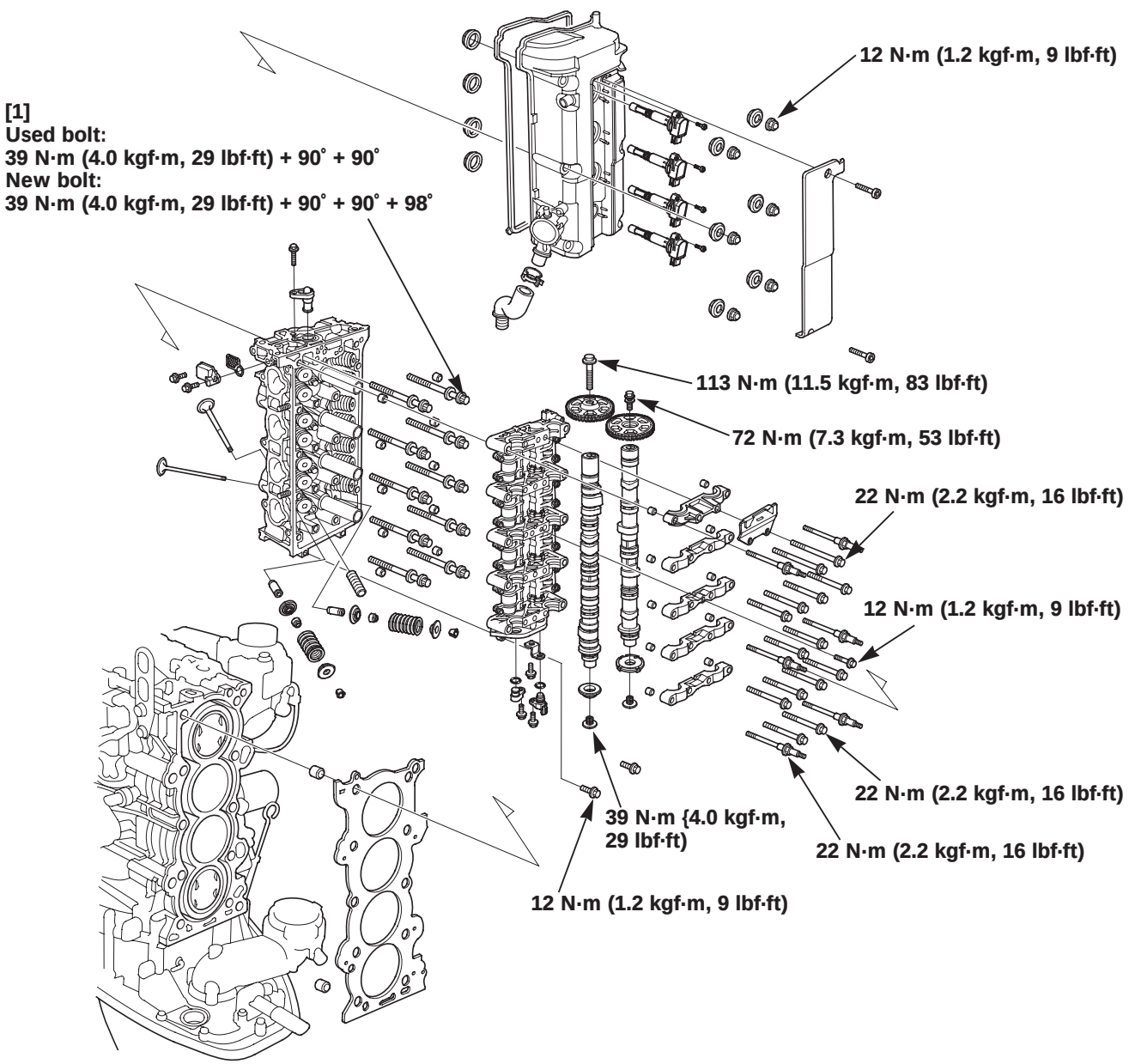


26) Position the three harness band clips on the harness clip bracket C.
Tighten the harness clip bracket C with the three 6 x 14 mm flange bolts securely.

27) Connect the A/F sensor 4P connector and the VTEC solenoid valve 1P connector [BF150A only], and install them on the harness clip bracket C.

28) Install the following parts.
– Cylinder head cover (P. 10-40)
– Thermostat (P. 8-4)
– Alternator belt (P. 3-30)
– Silencer duct (P. 6-4)
– L./R. engine under cover (P. 4-14)
– Engine cover (P. 4-2)

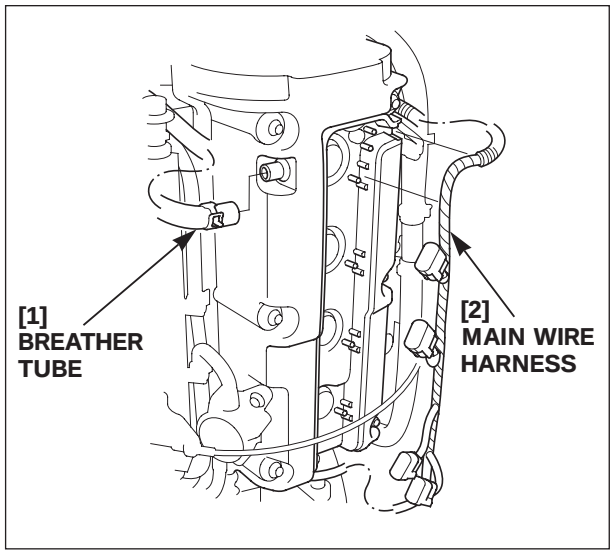




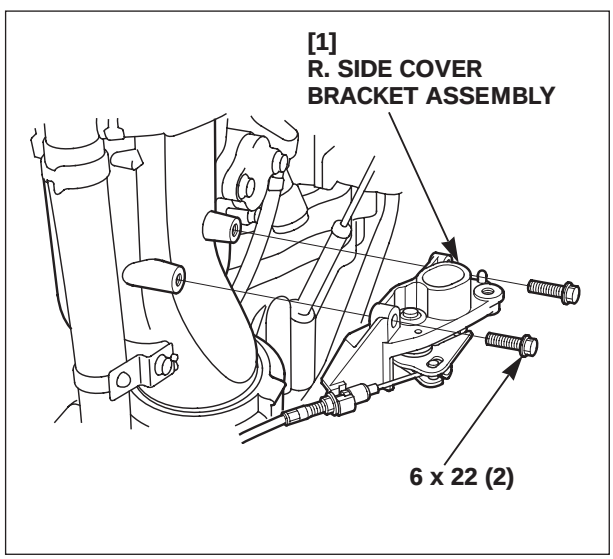
1. CYLINDER HEAD COVER REMOVAL

Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Ignition coil/spark plug (P. 3-6)

1) Disconnect the breather tube and the main wire harness from the cylinder head cover.



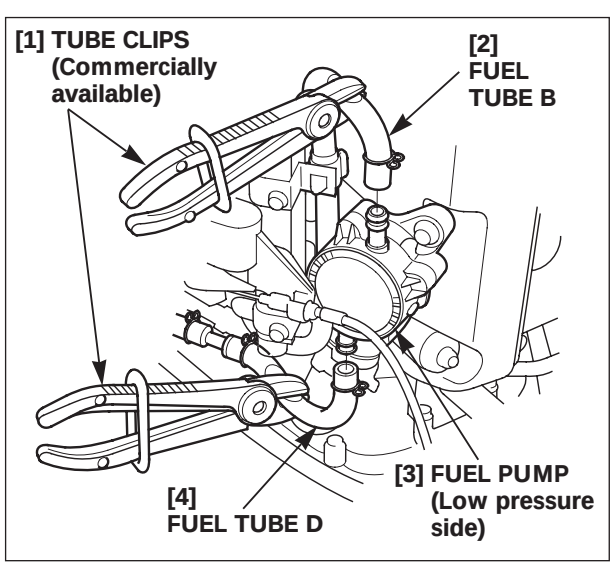
2) Remove the two 6 x 22 mm flange bolts, then remove the R. side cover bracket assembly from the engine assembly.



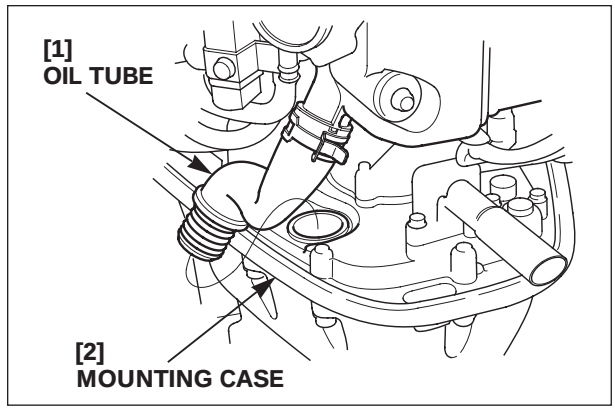
3) Disconnect the fuel tube B and the fuel tube D from the fuel pump (low pressure side).

NOTICE

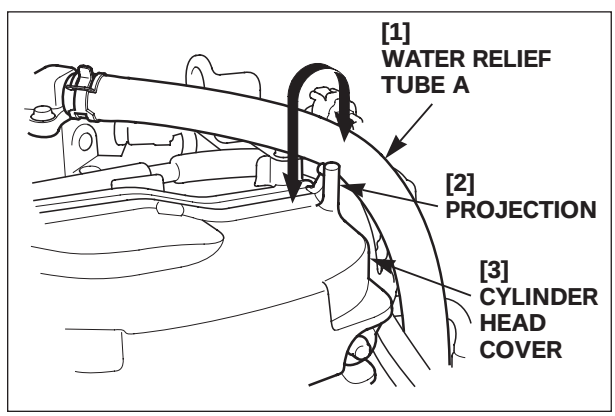
Before disconnecting the fuel tube B and the fuel tube D, clamp the fuel tubes with the tube clips to prevent gasoline leakage.



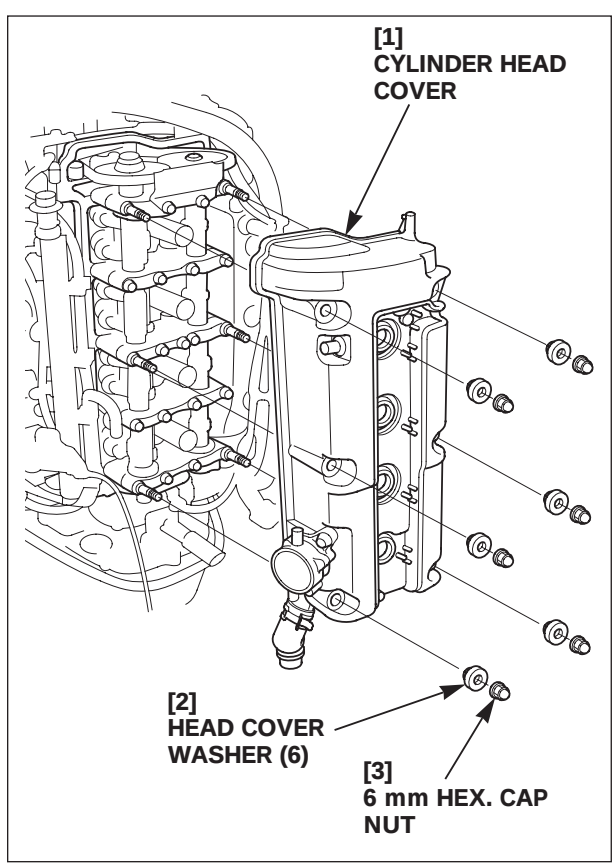
4) Disconnect the oil tube from the mounting case.



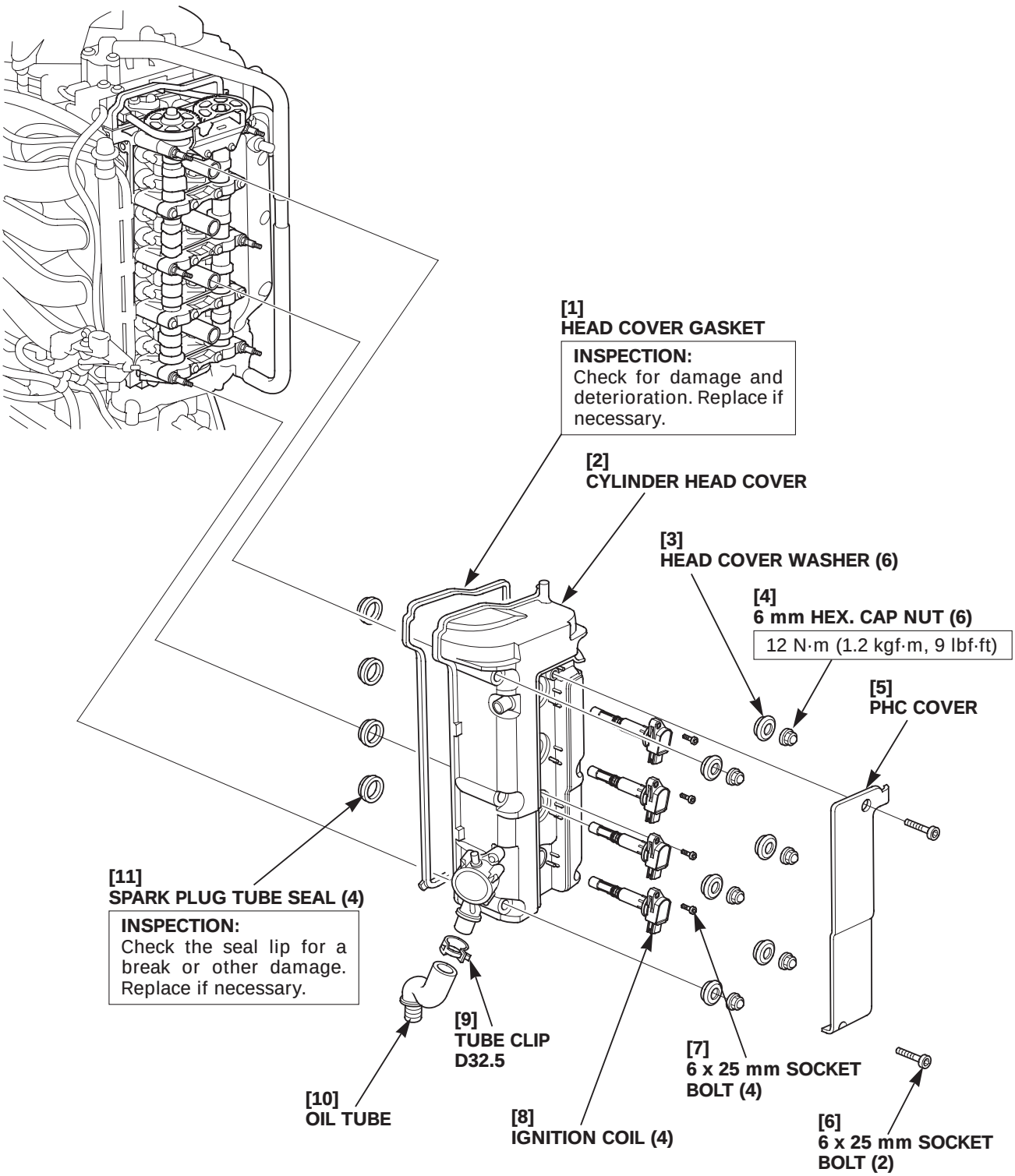
5) Move the water relief tube A from your side of the projection on the cylinder head cover to the other side.



6) Remove the six 6 mm hex. cap nuts and the six head cover washers, then remove the cylinder head cover.



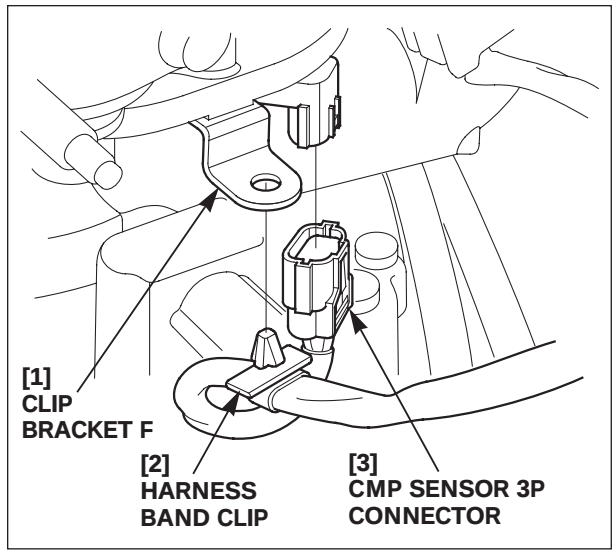
2. CYLINDER HEAD COVER DISASSEMBLY



3. CAMSHAFT/ROCKER ARM DISASSEMBLY

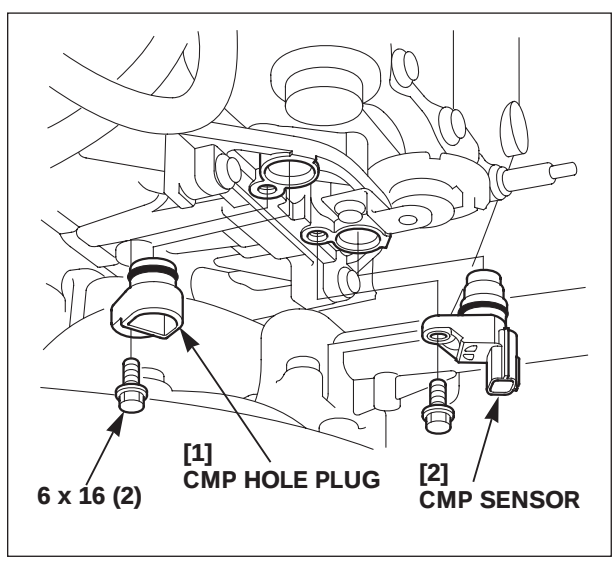
Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Ignition coil/spark plug (P. 3-6)
– Cylinder head cover (P. 10- 2)

1) Move the remote control lever to the "N" (Neutral) position.
2) Turn the crankshaft pulley clockwise until it sets the No.1 piston at the top dead center of its compression stroke (P. 3-12).
   Remove the following parts.
   – Crankshaft pulley/cam chain (P. 9-2)
3) Disconnect the CMP sensor 3P connector. Remove the harness band clip from the clip bracket F.

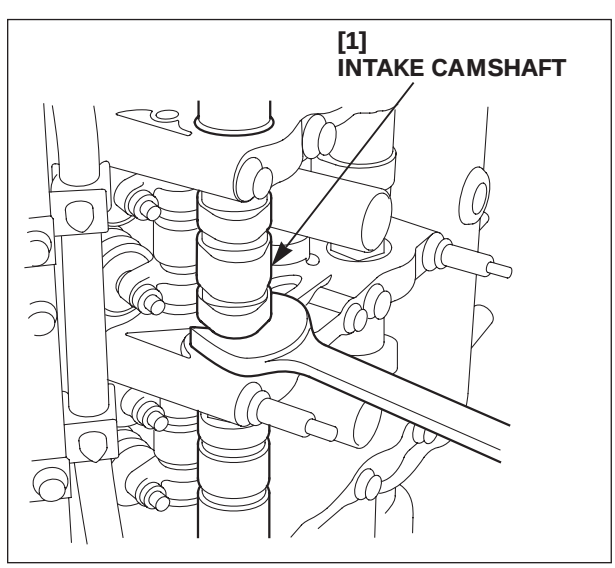


4) Remove the 6 x 16 mm flange bolts from the No.5 rocker shaft holder, then remove the CMP sensor and the CMP hole plug.

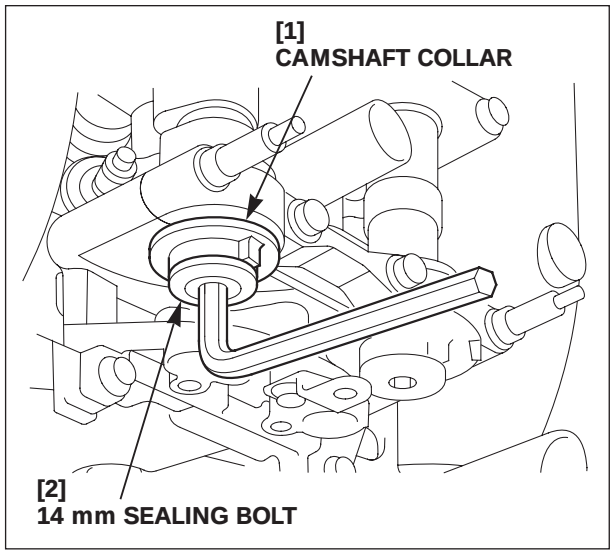
5) Remove the 15.2 x 1.9 mm O-rings from the CMP sensor and the CMP hole plug.
   Replace the O-rings with the new ones on assembly.



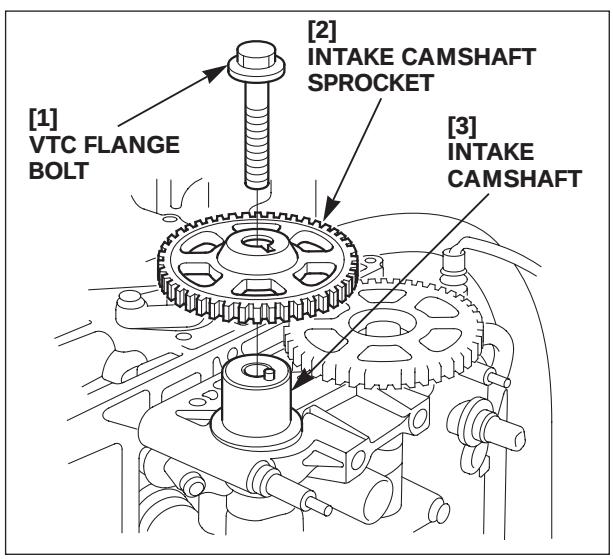
6) Secure the hex. part of the intake camshaft with a wrench or equivalent tool.



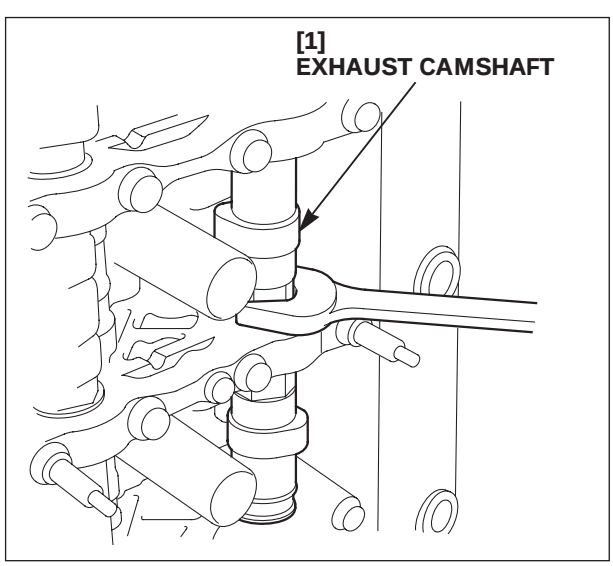
7) Using a hex. wrench, loosen the 14 mm sealing bolt that tightens the camshaft collar.



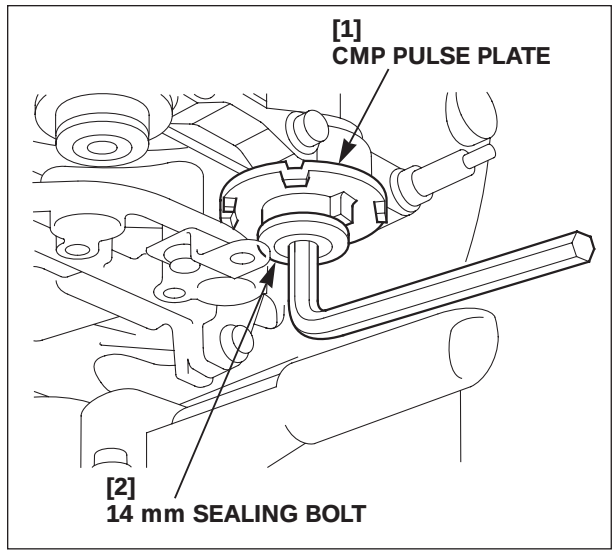
8) Remove the VTC flange bolt from the intake camshaft sprocket. Remove the intake camshaft sprocket from the intake camshaft.



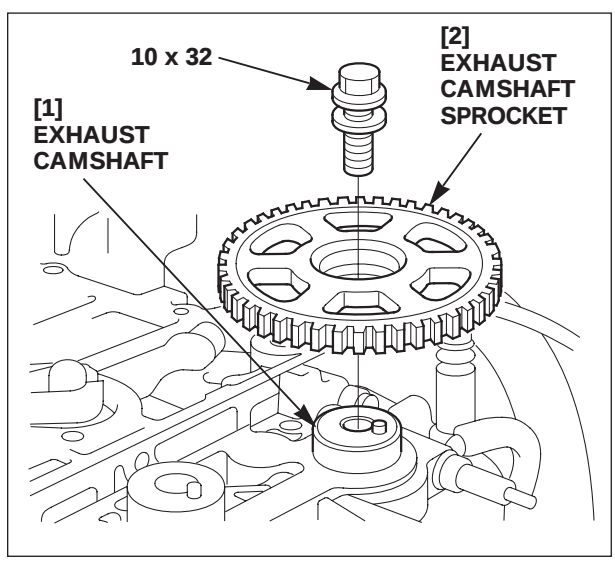
9) Secure the hex. part of the exhaust camshaft with a wrench or equivalent tool.



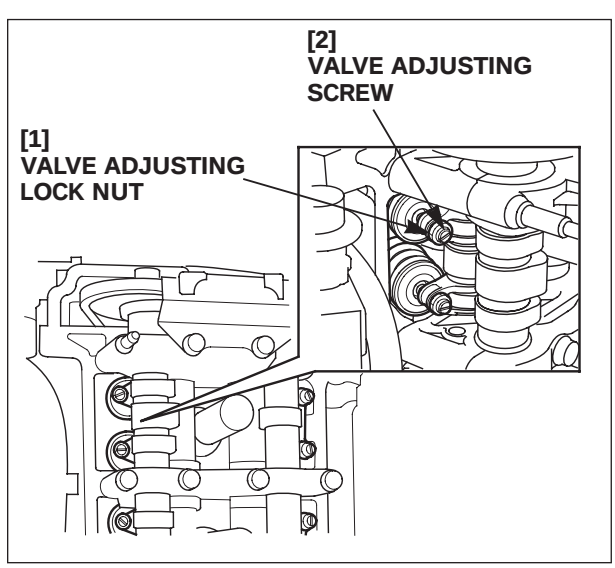
10) Using a hex. wrench, loosen the 14 mm sealing bolt that tightens the CMP pulse plate.



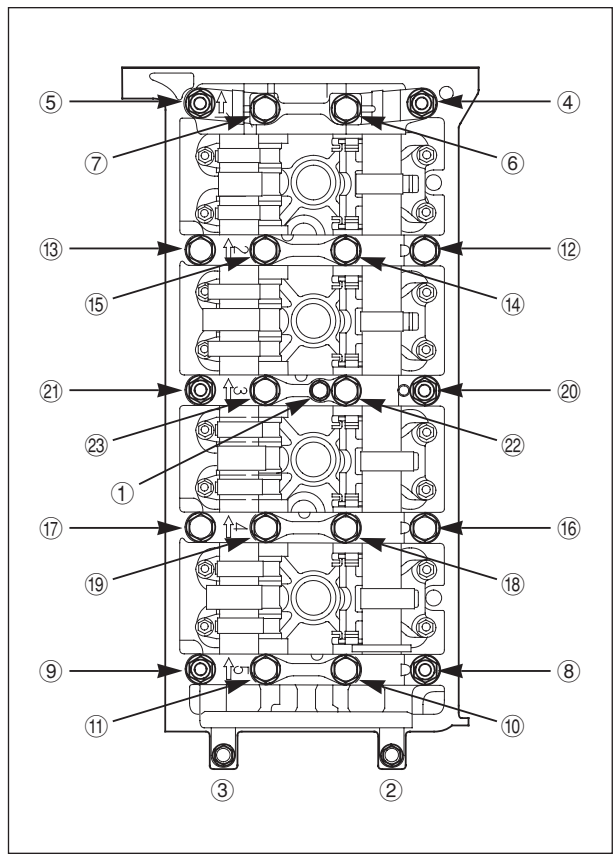
11) Remove the 10 x 32 mm flange bolt from the exhaust camshaft sprocket, then remove the exhaust camshaft sprocket from the exhaust camshaft.



12) Loosen the rocker arm's lock nut, then loosen the valve adjusting screw fully.

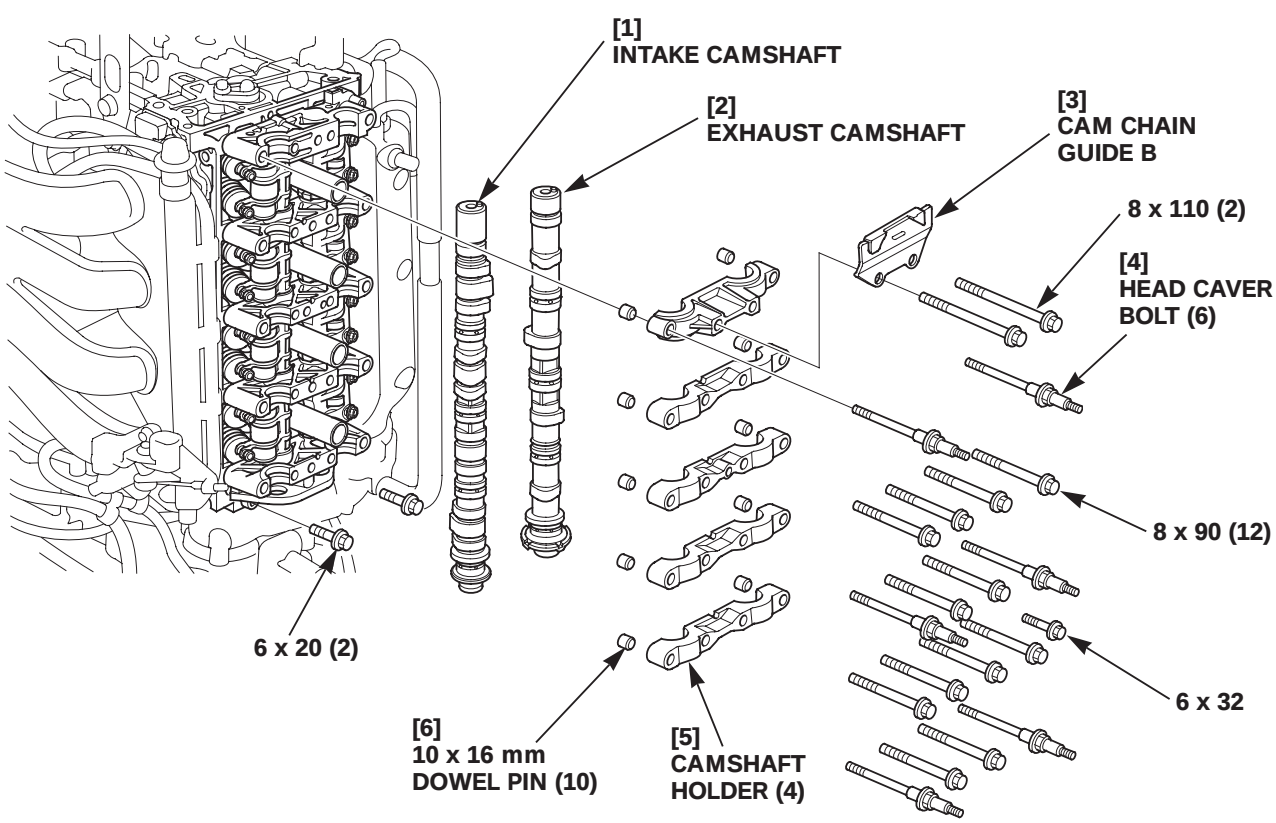


13) Loosen the camshaft holder bolts in the numbered sequence in two or three steps.

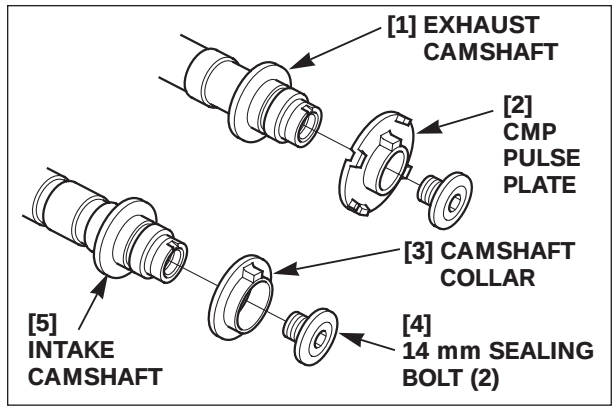


14) Remove the following bolts.
- Head cover bolts (6)
- 8 x 110 mm flange bolts (2)
- 8 x 90 mm flange bolts (12)
- 6 x 32 mm flange bolt (1)
- 6 x 20 mm flange bolts (2)

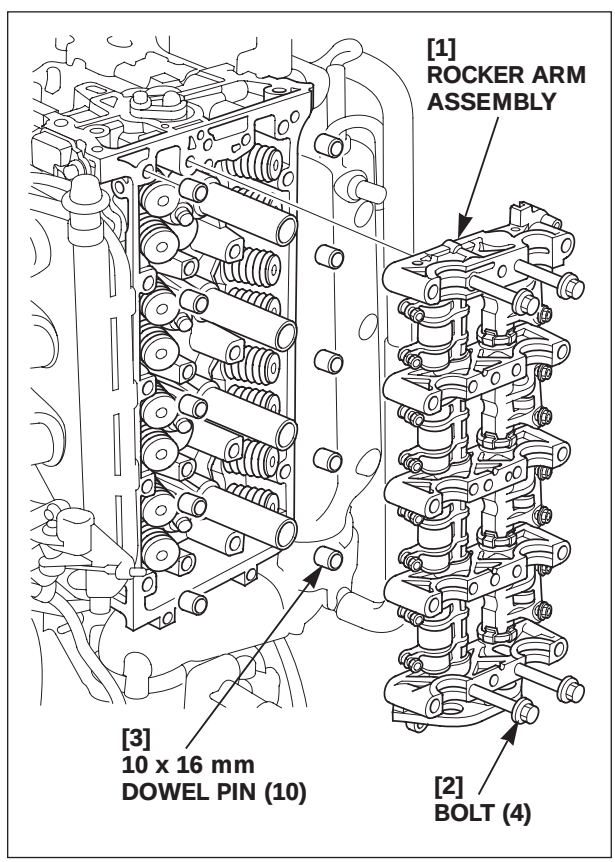
15) Remove the cam chain guide B, camshaft holder and the intake and exhaust camshafts.
Remove the 10 dowel pins.



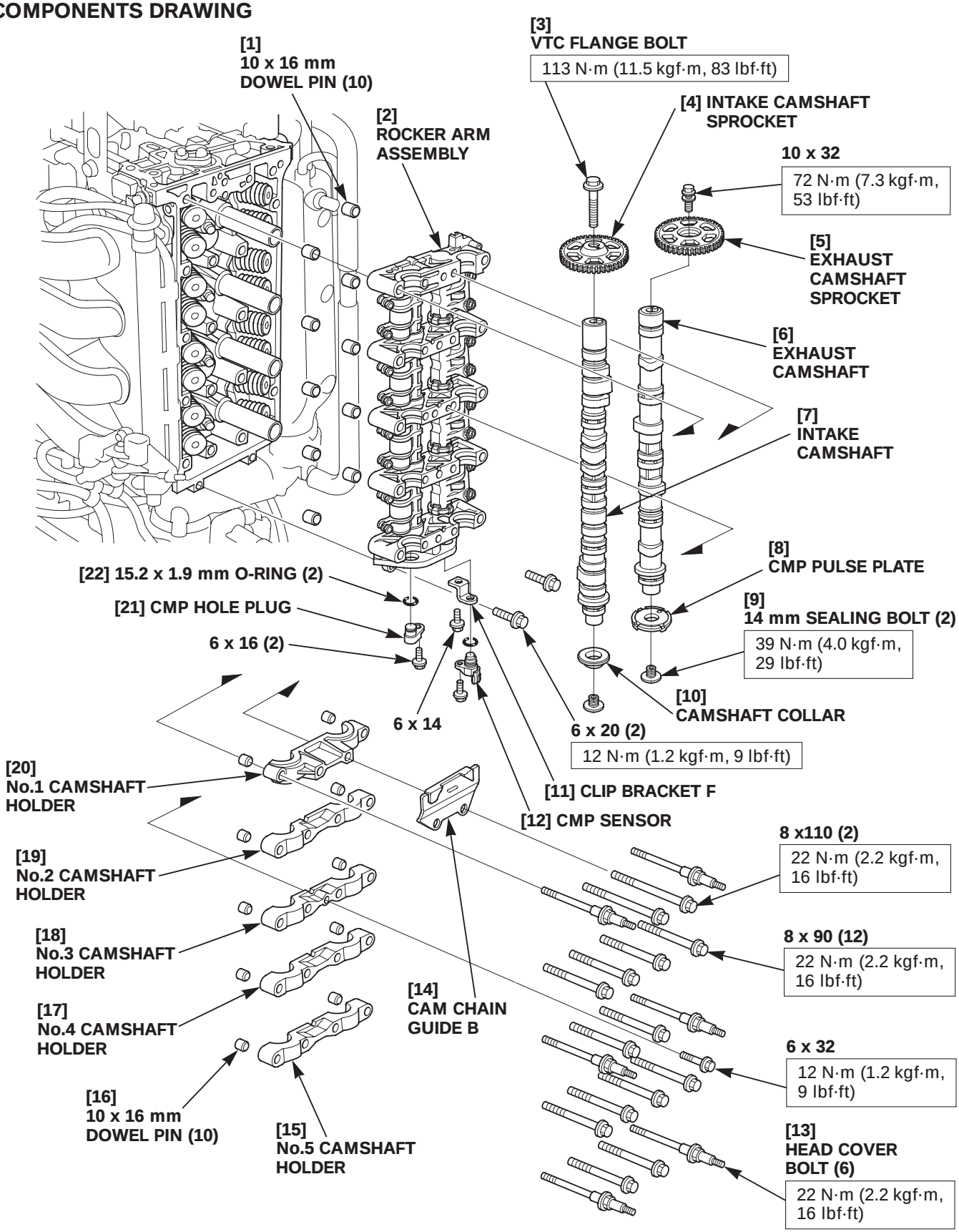
16) Remove the 14 mm sealing bolts from the intake/exhaust camshafts, then remove the camshaft collar and the CMP pulse plate.



17) Insert the bolts into the rocker shaft holders and remove the rocker arm assembly from the cylinder head assembly.



COMPONENTS DRAWING

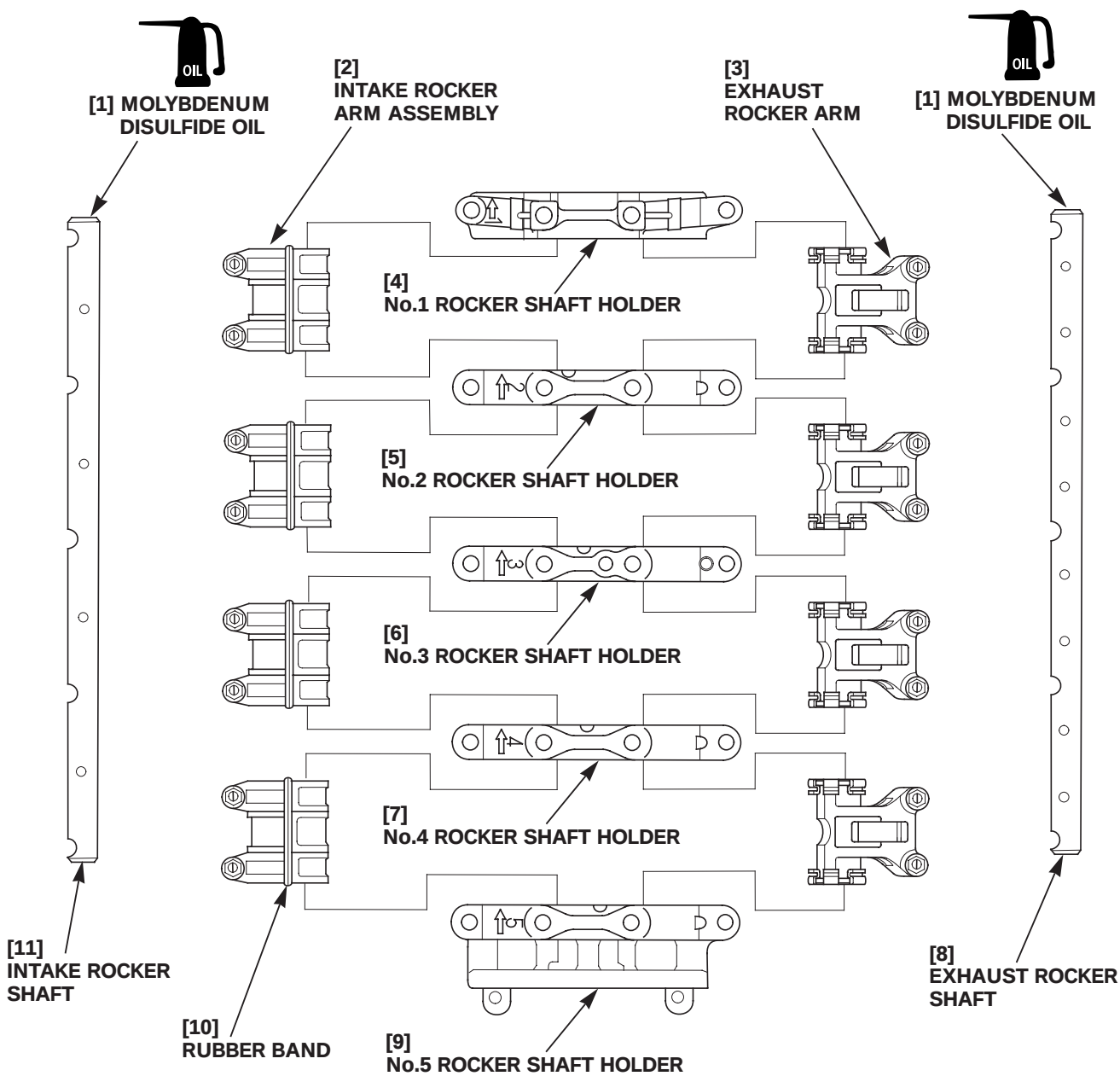


DISASSEMBLY OF ROCKER ARM ASSEMBLY
BF150A:

NOTICE

- *Note the location of each part before disassembly. Do not confuse the parts and install them in their original positions.*
- *Check the camshaft contact surface of each rocker arm for wear or damage.*
- *Insert the bolts in the rocker shaft holders before removing or installing the rocker arm assembly from/on the cylinder head.*

Apply molybdenum disulfide oil to the outer surface of the intake/exhaust rocker shafts on assembly.

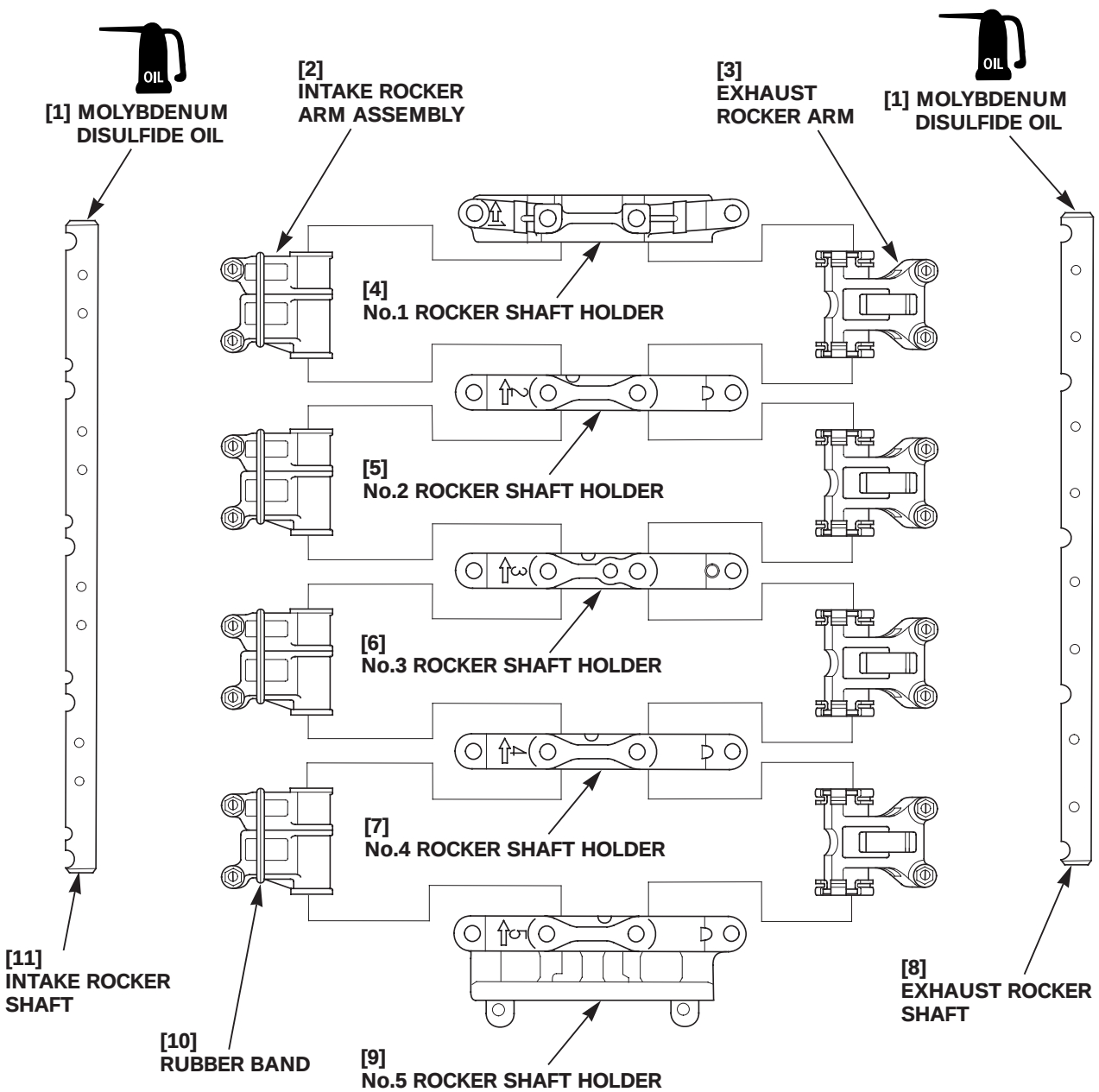


BF135A:

NOTICE

- *Note the location of each part before disassembly. Do not confuse the parts and install them in their original positions.*
- *Check the camshaft contact surface of each rocker arm for wear or damage.*
- *Insert the bolts in the rocker shaft holders before removing or installing the rocker arm assembly from/on the cylinder head.*

Apply molybdenum disulfide oil to the outer surface of the intake/exhaust rocker shafts on assembly.



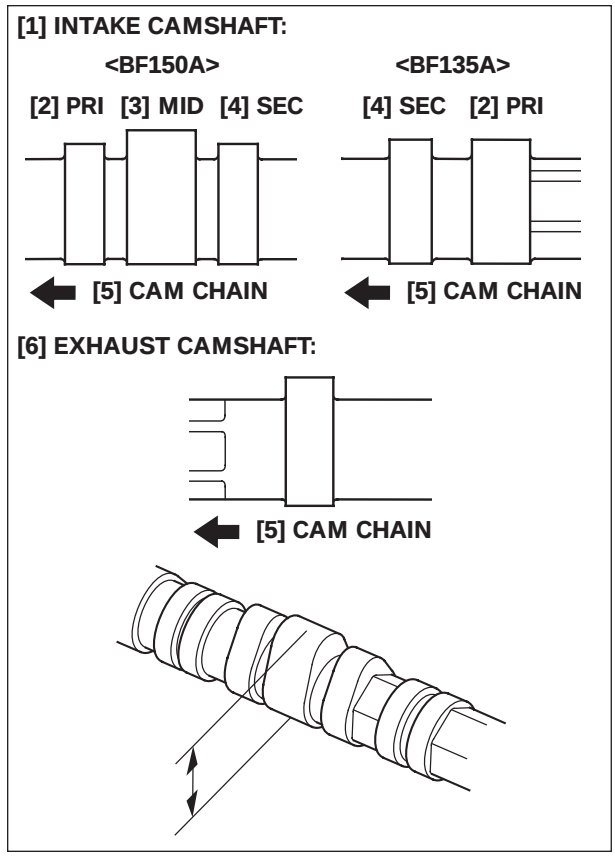
4. CAMSHAFT/ROCKER ARM INSPECTION

• CAM HEIGHT

Clean the camshaft and check the cam surface for wear and damage.

	STANDARD	SERVICE LIMIT
IN: PRI/SEC	32.626 – 32.931 mm (1.2845 – 1.2965 in)	———
IN: MID	35.369 – 35.654 mm (1.3925 – 1.4037 in)	———
EX	33.927 – 34.212 mm (1.3357 – 1.3469 in)	———

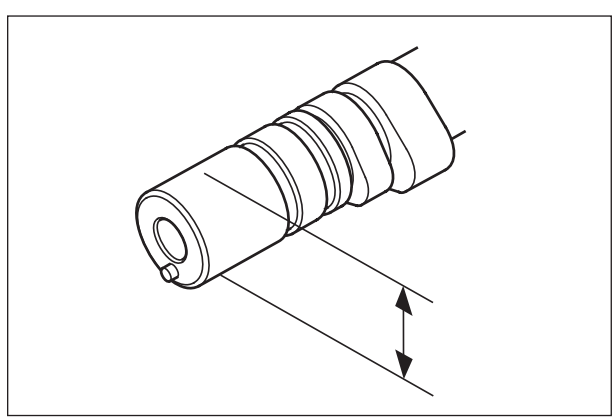
PRI: Primary MID: Mid SEC: Secondary



• CAMSHAFT JOURNAL O.D.

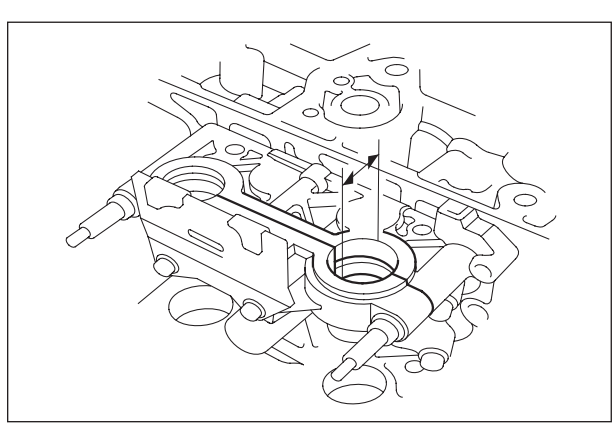
Clean the camshaft and check the journals for wear and damage.

	STANDARD	SERVICE LIMIT
No.1	28.955 – 28.970 mm (1.1400 – 1.1405 in)	———
No.2 – No.5	28.925 – 28.940 mm (1.1388 – 1.1394 in)	———



• CAMSHAFT JOURNAL I.D.

	STANDARD	SERVICE LIMIT
No.1 – No.5	29.000 – 29.024 mm (1.1417 – 1.1427 in)	———



• CAMSHAFT OIL CLEARANCE

1) Clean the camshaft and check the journals for wear and damage.

2) Clean the rocker shaft holder bearings and the camshaft holder bearings. Install the rocker shaft holders and the camshaft on the cylinder head assembly.

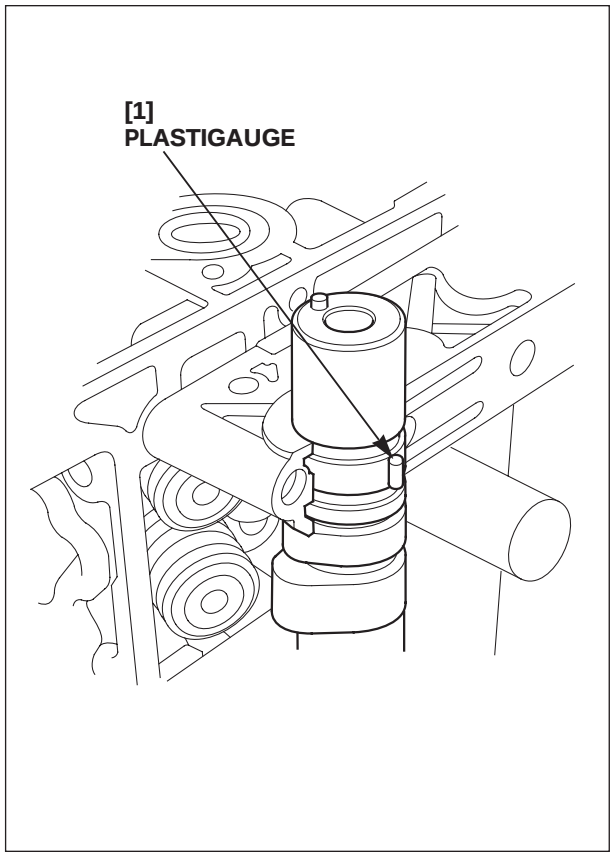
3) Set a plastigauge on each journal as shown.

NOTICE

- *Set a plastigauge in the axial direction on each journal.*
- *Do not turn the camshaft during the check.*

4) Install the camshaft holder on the rocker shaft holder and tighten the bolts to the specified torque (P. 10-35).

TORQUE:
Head cover bolt,
8 x 90 mm flange bolt,
8 x 110 mm flange bolt: 22 N·m (2.2 kgf·m, 16 lbf·ft)
6 x 20 mm flange bolt,
6 x 32 mm flange bolt: 12 N·m (1.2 kgf·m, 9 lbf·ft)



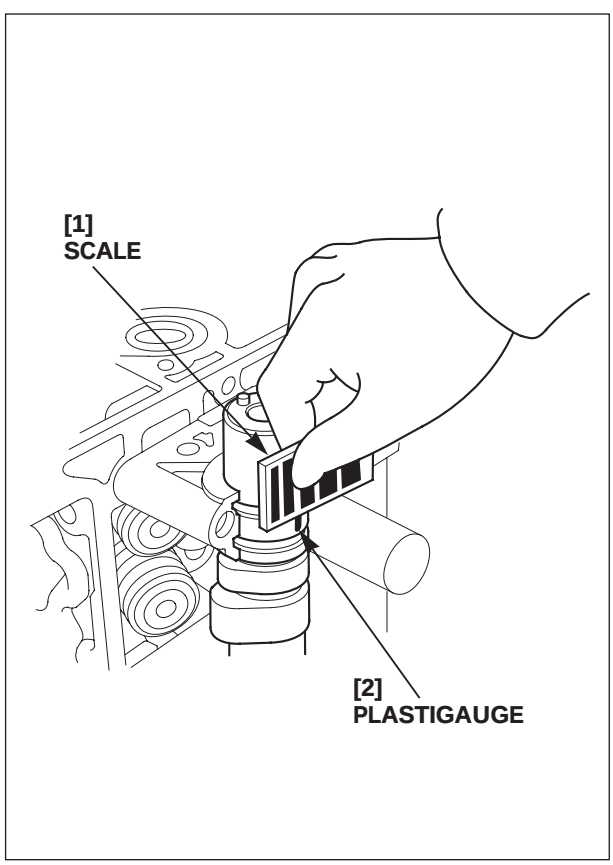
5) Remove the camshaft holder. Measure the width of the pressed part of the plastigauge using a scale printed on the bag of the plastigauge.

NOTICE

Measure the widest width on the plastigauge.

	STANDARD	SERVICE LIMIT
No.1	0.030 – 0.069 mm (0.0012 – 0.0027 in)	0.15 mm (0.006 in)
No.2 – No.5	0.060 – 0.099 mm (0.0024 – 0.0039 in)	0.15 mm (0.006 in)

6) If the measurement exceeds the service limit, replace the camshaft holder, rocker shaft holder and the cylinder head as a set. Recheck the camshaft oil clearance.
If the measurement still exceeds the service limit, replace the camshaft.

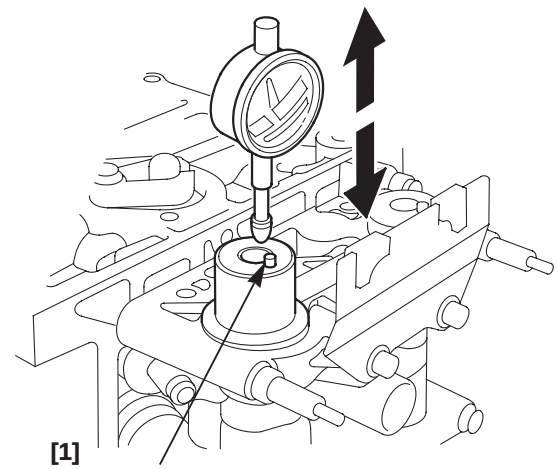


• CAMSHAFT AXIAL CLEARANCE

1) Install the rocker shaft holder, camshaft and the camshaft holder, and tighten the bolts to the specified torque (P. 10-35).
2) Put the camshaft at the top dead center of the compression stroke of the No.1 piston (with the dowel pin at your side). Install the dial indicator.
3) Check the camshaft axial play by pushing and pulling the camshaft of the opposite side from the indicator.

STANDARD	SERVICE LIMIT
0.05 – 0.20 mm (0.002 – 0.008 in)	0.4 mm (0.02 in)

4) If the measurement exceeds the service limit, replace the camshaft holder, rocker shaft holder and the cylinder head as a set, and recheck.
   If the measurement still exceeds the service limit, replace the camshaft.



[1]
Dowel pin is at your side.

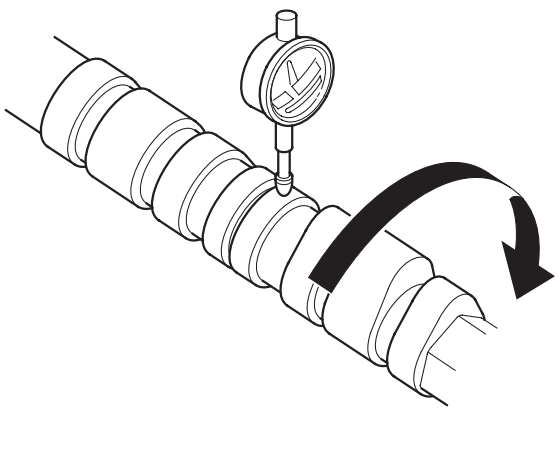
• CAMSHAFT RUNOUT

1) Place the V blocks or equivalent under the journal at both ends of the camshaft

2) Install the dial indicator and measure the camshaft runout by turning the camshaft.

STANDARD	SERVICE LIMIT
0.03 mm (0.001 in) Max.	0.4 mm (0.02 in)

3) Replace the camshaft if the measurement exceeds the service limit.

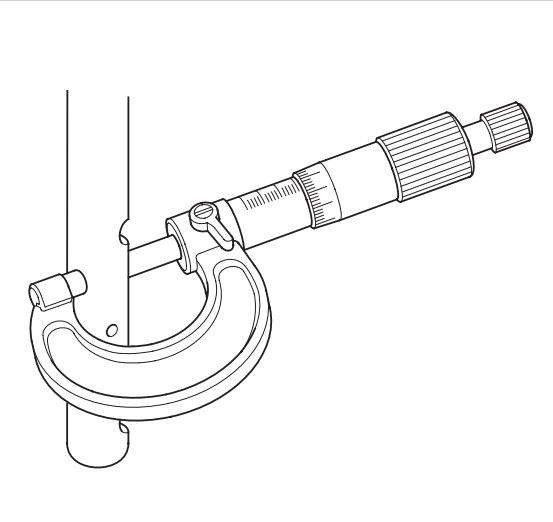


• ROCKER SHAFT O.D.

	STANDARD	SERVICE LIMIT
IN/EX	16.983 – 16.994 mm (0.6686 – 0.6690 in)	———

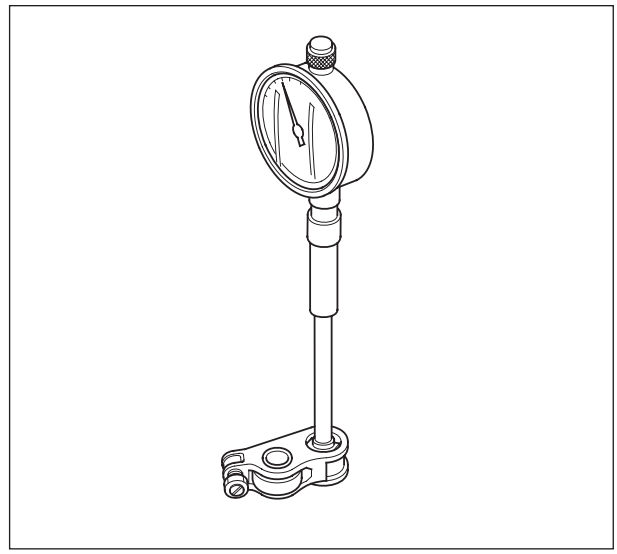
NOTICE

Measure the rocker shaft O.D. at the sliding part of the rocker arm.



• ROCKER ARM I.D.

	STANDARD	SERVICE LIMIT
IN	17.019 – 17.035 mm (0.6700 – 0.6707 in)	———
EX	17.012 – 17.039 mm (0.6698 – 0.6708 in)	———



• ROCKER ARM-TO-ROCKER SHAFT CLEARANCE

	STANDARD	SERVICE LIMIT
IN	0.025 – 0.052 mm (0.0010 – 0.0020 in)	0.08 mm (0.003 in)
EX	0.018 – 0.056 mm (0.0007 – 0.0022 in)	0.08 mm (0.003 in)

If the measurement exceeds the service limit, replace the rocker arm as an assembly and recheck.
If the measurement still exceeds the service limit, replace the rocker shaft.

• VTEC ROCKER ARM ASEMBLY INSPECTION (BF150A only)

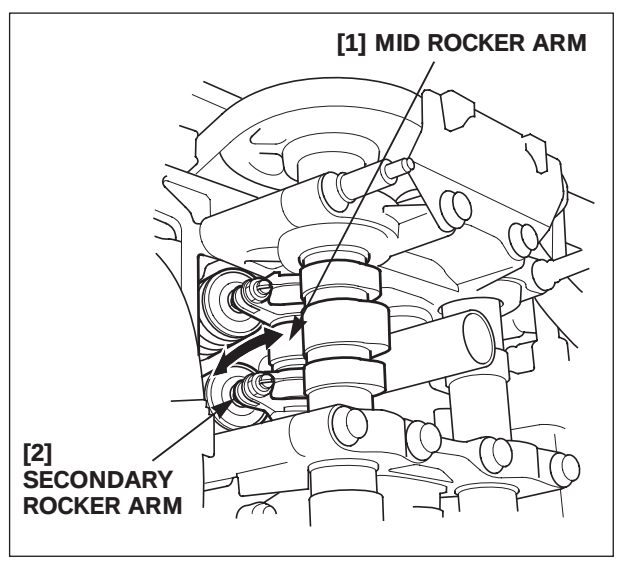
Check of stuck rocker arm assembly at high lift side:

1) Remove the cylinder head cover (P. 10-2).
2) Put the No.1 piston at the top dead center of the compression stroke (P. 3-12).
3) Move the secondary rocker arm of the No.1 cylinder up and down with a finger. Check that the secondary rocker arm moves independent from the mid rocker arm.

NOTICE

- *If it does not, remove and disassemble the rocker arm assembly to check (P. 10-18).*
- *If the rocker arm assembly is not normal, replace the rocker arm as an assembly.*

4) Repeat the step 2 and 3 on each cylinder to put the piston of each cylinder at the top dead center of its compression stroke. Check the secondary rocker arm.
5) Install the cylinder head cover (P. 10-40).



Check of stuck rocker arm assembly at low lift side:

NOTICE

- *Before performing inspection with the special tool(s), check that the secondary rocker arm moves independently. (See Check of stuck rocker arm assembly at high lift side.)*
- *Check with the special tool(s) can be made on the following conditions.*
  - *– At cylinder head disassembly*
  - *– Engine power drops significantly at high rpm but the cause of the problem cannot be identified by following the troubleshooting chart.*

1) Start the engine and let it warm up for five minutes.
2) Remove the cylinder head cover (P. 10-2).
3) Check the valve clearance (P. 3-9).

NOTICE

- *Check that the following conditions are met before using the air supply (special tool). The following conditions are essential for use of the air supply, as the specified air pressure of 290 kPa (3.0 kgf/cm², 43 psi) must be maintained at the gauge of the tool. Stop using the other air tools unless the specified air pressure is maintained.*
  - *– Check whether the air compressor tank is under the specified air pressure and the tank gauge shows the value of the set pressure.*
  - *– Connect the air supply to the air intake port located close to the compressor.*
  - *– Check as quickly as possible (within 6 seconds), or the air pressure drops possibly marking it hard to switch the valve timing to the high lift side.*
- *Check on each cylinder with the piston at the top dead center of its compression stroke.*
- *Oil can spurt out when the air pressure is applied. Adjust the air pressure with the regulator valve (special tool) and increase the air pressure gradually.*

4) Remove the 10 mm sealing bolt from the No.1 camshaft holder and install the air stopper (special tool).
5) Remove the two mounting bolts of the No.2 and No.3 camshaft holders (intake side), and install the special tool as shown.

TOOLS:

Air supply	**07LAJ-PR30102**
VTEC air adapter	**07ZAJ-PNA0101**
VTEC air stopper	**07ZAJ-PNA0200**
Air joint adapter	**07ZAJ-PNA0300**

NOTICE

Install the VTEC air adapter (special tool) and tighten it by hand.

6) Apply the specified air pressure and check that the valve timing switched to the high lift side.

Air pressure: 290 kPa (3.0 kgf/cm², 43 psi)

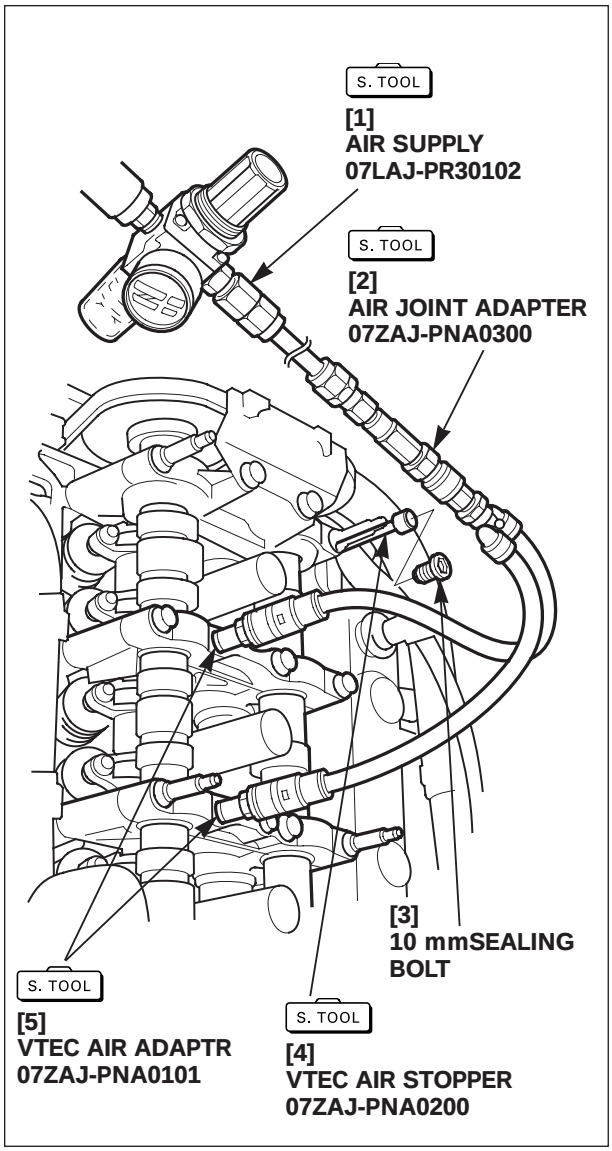
7) Check that the three intake rocker arms are interconnected by applying the specified amount of air pressure. Move the secondary rocker arm up and down with a finger and check that both the mid rocker arm and the primary rocker arm move up and down, too.
8) If there is abnormality in the rocker arm movement, replace the intake rocker arm as an assembly.
9) Remove the VTEC air adapter (special tool) and tighten the camshaft holder mounting bolts to the specified torque.

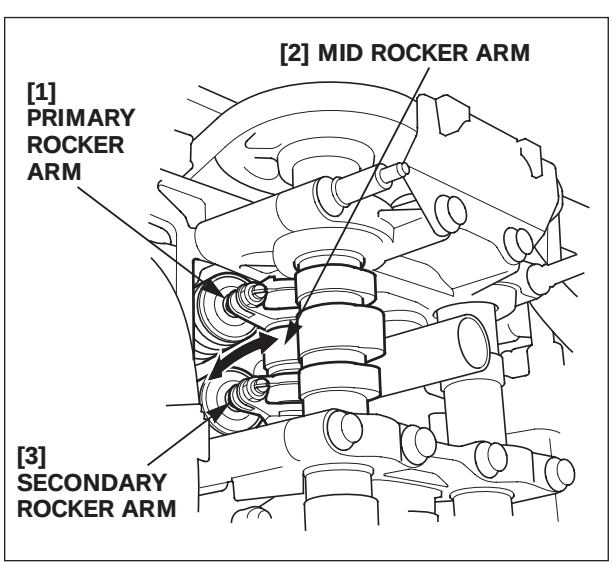
TORQUE: 22 N·m (2.2 kgf·m, 16 lbf·ft)

10) Remove the air stopper (special tool) from the No.1 camshaft holder, and tighten the 10 mm sealing bolt to the specified torque.

TORQUE: 20 N·m (2.0 kgf·m, 14 lbf·ft)

11) Install the cylinder head cover (P. 10-40).
12) Check that the MIL does not come ON.





• VTEC ROCKER ARM/ROCKER ARM INSPECTION

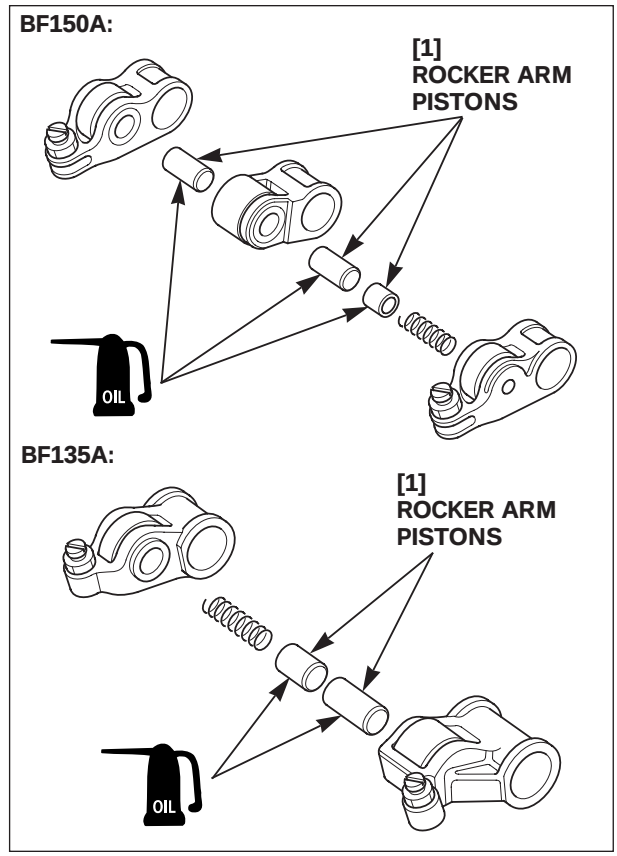
1) Disassemble the rocker arm assembly. Check that the rocker arm pistons move smoothly.

NOTICE

- *Remove the pistons from the primary rocker arm by applying low air pressure to the rocker arm. Take care not to apply excessive air pressure as the pistons can jump out of the rocker arm.*
- *After removing the rocker arm assembly, tie the assembly with a rubber band or equivalent to prevent each component of the assembly from missing. Note to remove the rubber band after installation.*

2) If the pistons do not move smoothly, replace the rocker arm as an assembly.

3) Apply the engine oil to the rocker arm pistons on assembly.



5. CYLINDER HEAD ASSEMBLY REMOVAL

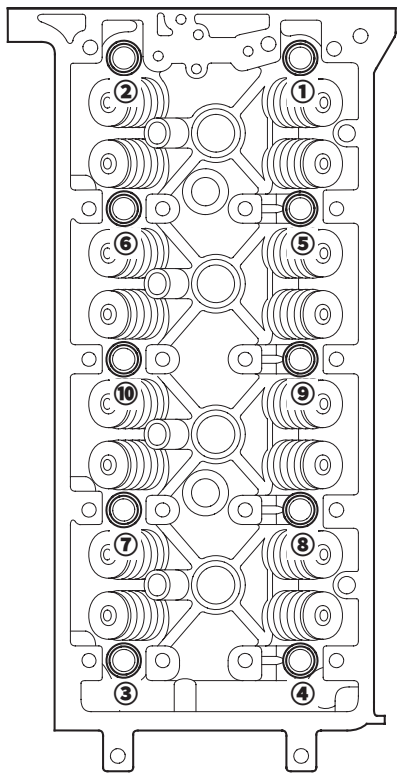
NOTICE

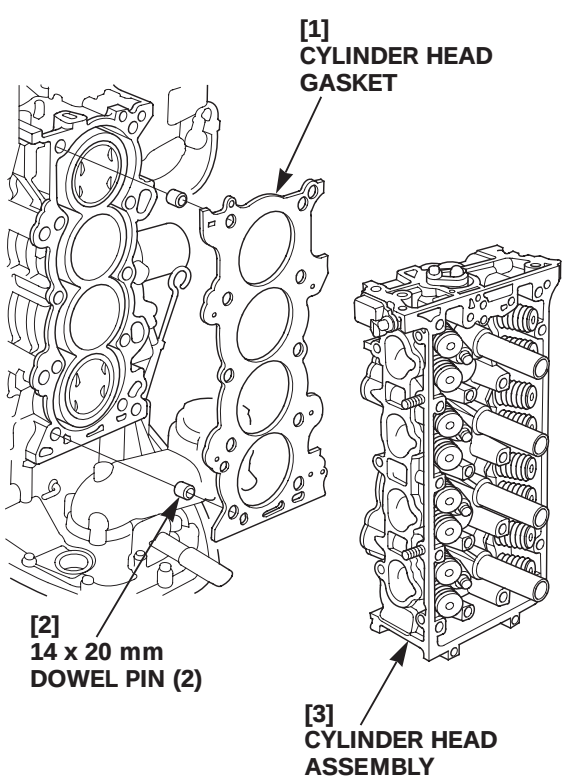
- *Removal of the cylinder head assembly must be made when the engine is cold (38˚C or below).*
- *Take care not to damage (scores or scratches) the gasket mating surfaces with the cylinder head and the cylinder block.*
- *Do not bend the cylinder head gaskets as they are the metal gaskets.*
- *Keep the cam chain away from the magnetic parts.*

Remove the following pars.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Ignition coil/spark plug (P. 3-6)
– L./R. side cover brackets (P. 4-24)
– Cylinder head cover (P. 10-2)

1) Move the remote control lever to the "N" (Neutral) position.
2) Turn the crankshaft pulley clockwise until it puts the No.1 piston at the top dead center of its compression stroke (P. 3-12).
   Remove the following pars.
   – Crankshaft pulley/cam chain (P. 9-2)
   – Camshaft/rocker arm (P. 10-5)
   – Throttle body/intake manifold (P. 5-129)
   – Fuel line assembly (P. 5-136)
   – Injector base (P. 5-139)
   – Exhaust manifold (P. 5-152)
3) Loosen the 11 x 155 mm bolt washers in the numbered sequence shown in two or three steps.
4) Remove the ten 11 x 155 mm bolt washers from the cylinder head assembly.

5) Remove the cylinder head assembly. Remove the cylinder head gasket and the two dowel pins.
   Replace the cylinder head gasket with a new one on assembly.



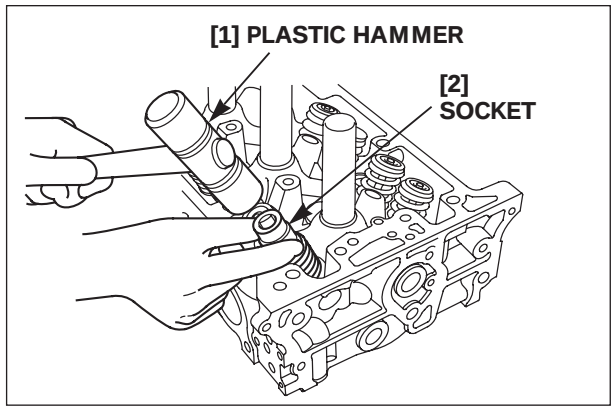


6. CYLINDER HEAD ASSEMBLY DISASSEMBLY

NOTICE

Mark each removed parts and store them securely classifying them into the groups of the intake side and the exhaust side of each cylinder. Install each part in the original position on assembly.

1) Use 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 valve keepers from the retainer.



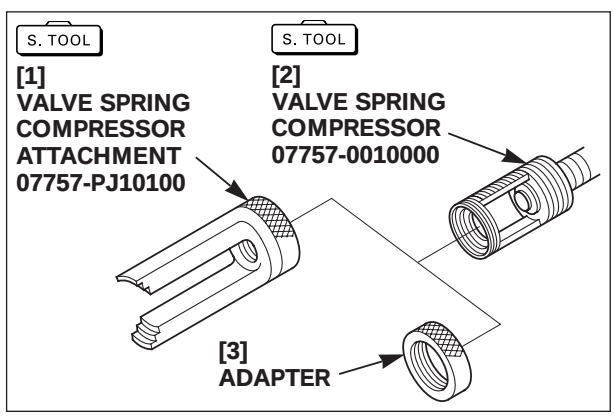
NOTICE

- *Tap at right angles with each valve stem head. Take care not to bend the valves.*
- *Support the cylinder head with a suitable material to prevent damage to the valve.*

2) Change the attachment of the special tool as shown.

TOOLS:

Valve spring compressor	**07757-0010000**
Valve spring compressor attachment	**07757-PJ10100**



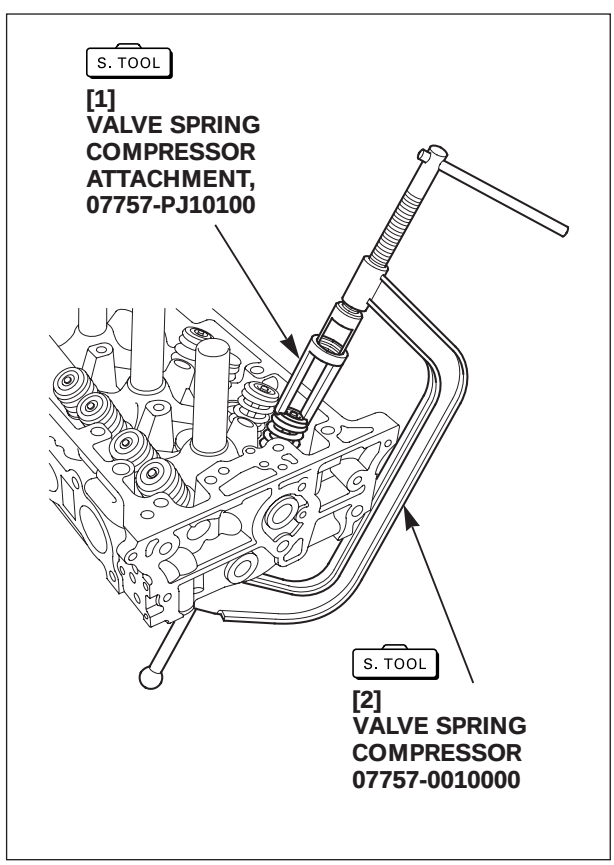
3) Compress the valve springs using the special tools as shown.

TOOLS:

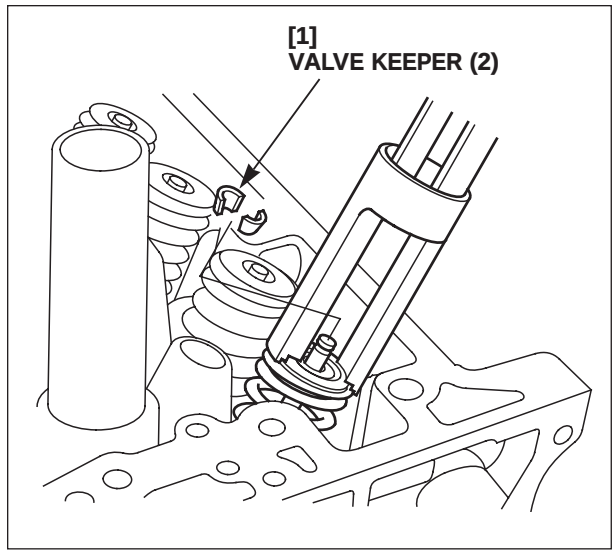
Valve spring compressor	**07757-0010000**
Valve spring compressor attachment	**07757-PJ10100**

NOTICE

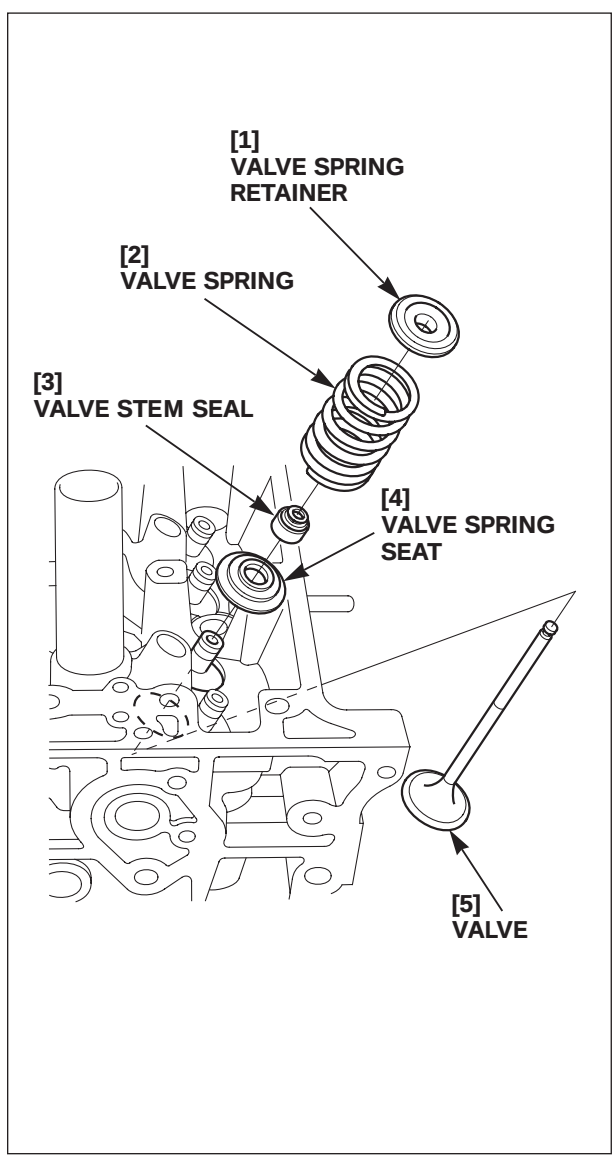
- *Take care not to let the special tools contact the cylinder head.*
- *Do not compress the valve springs more than necessary as it causes weak valve spring.*



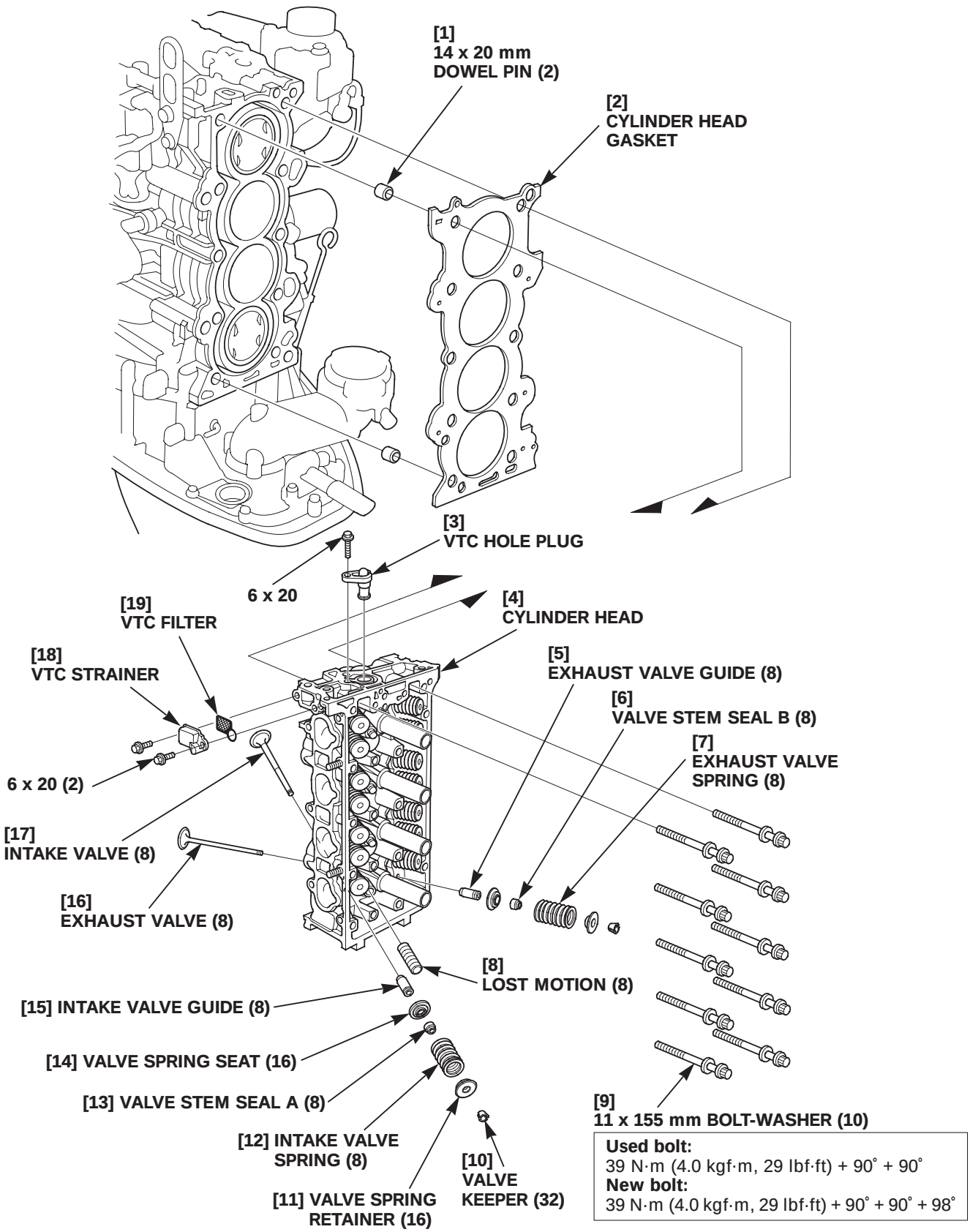
4) Remove the valve keeper from the groove in the valve stem.
5) Remove the remaining valve keepers.



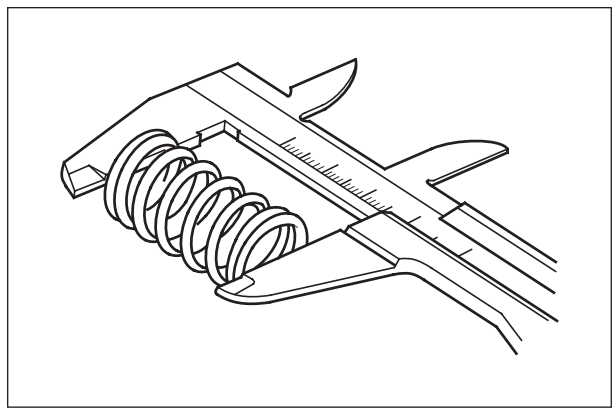
6) Remove the valve spring retainer, valve spring, valve, valve spring seat and the valve stem seal.
   Check the valve for chipping and excessive carbon deposits. Clean the valve if necessary.
   Replace the valve stem seal on assembly.



COMPONENTS DRAWING



7. CYLINDER HEAD ASSEMBLY INSPECTION



• VALVE SPRING FREE LENGTH

Measure the free length of the valve springs.

	STANDARD	SERVICE LIMIT
IN/EX	49.64 mm (1.954 in)	———

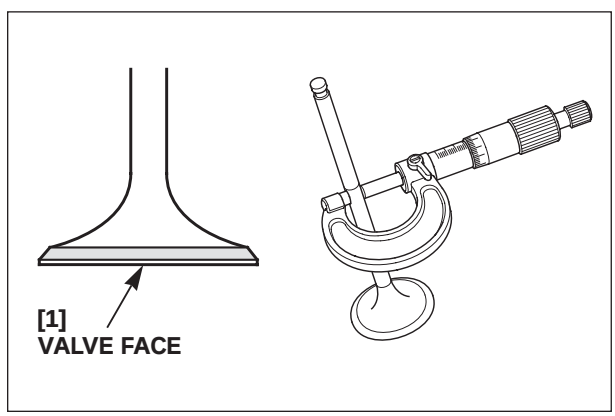
• VALVE FACE/VALVE STEM O.D.

<Valve face>

Inspect each valve face for pitting or wear irregularities. Inspect each valve face for even seat. Replace the valve if necessary.

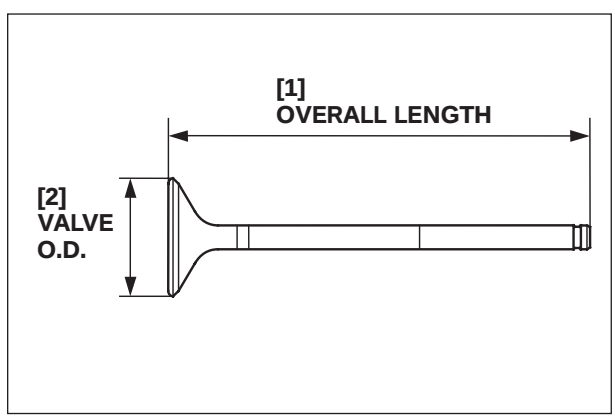
<Valve stem>

1) Check each valve for bend, seizure or damage.
2) Insert each valve into the corresponding valve guide to check the operation.
3) Measure the valve stem O.D. at the sliding surface of the valve guide.



	STANDARD	SERVICE LIMIT
IN	5.475 – 5.485 mm (0.2156 – 0.2159 in)	5.445 mm (0.2144 in)
EX	5.450 – 5.460 mm (0.2146 – 0.2150 in)	5.420 mm (0.2134 in)

• VALVE LENGTH/VALVE O.D.



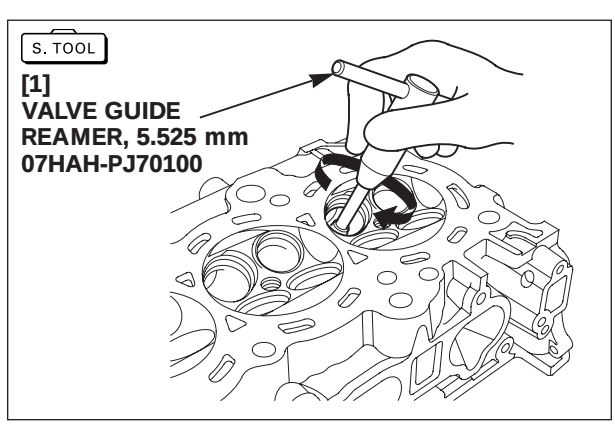
		STANDARD	SERVICE LIMIT
OVERALL LENGTH	IN	108.7 – 109.5 mm (4.28 – 4.31 in)	———
	EX	108.3 – 109.1 mm (4.26 – 4.30 in)	———
VALVE O.D.	IN	34.85 – 35.15 mm (1.372 – 1.384 in)	———
	EX	29.85 – 30.15 mm (1.175 – 1.187 in)	———

• VALVE GUIDE I.D.

Using the valve guide reamer, 5.525 mm (special tool), ream the valve guides to remove any carbon deposits before measuring. Measure and record each valve guide I.D.

NOTICE

Turn the valve guide reamer, 5.525 mm (special tool) clockwise and never turn it counterclockwise. Continue to turn the reamer as you lift it from the valve guide.



	STANDARD	SERVICE LIMIT
IN/EX	5.51 – 5.53 mm (0.217 – 0.218 in)	5.55 mm (0.219 in)

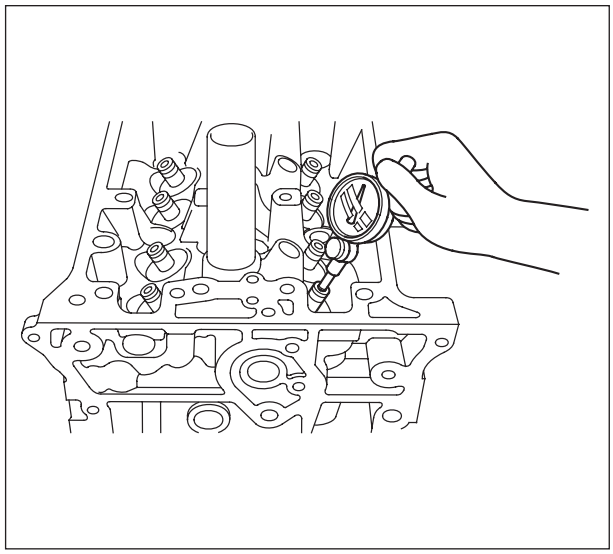
• VALVE STEM-TO-VALVE GUIDE CLEARANCE

	STANDARD	SERVICE LIMIT
IN	0.030 – 0.055 mm (0.0012 – 0.0022 in)	0.08 mm (0.003 in)
EX	0.055 – 0.080 mm (0.0022 – 0.0031 in)	0.11 mm (0.004 in)

If the stem-to-guide clearance exceeds the service limit, replace the valve and the valve guide as a set (P. 10-26).

NOTICE

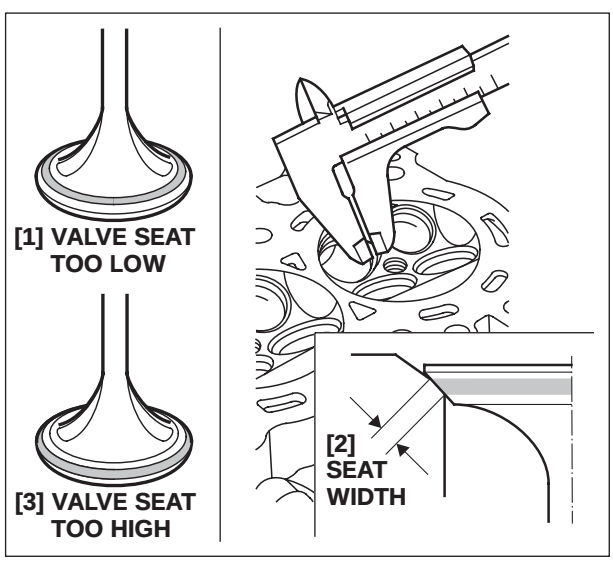
Recondition the valve seat whenever replacing the valve guide (P. 10-28).



• VALVE SEAT WIDTH

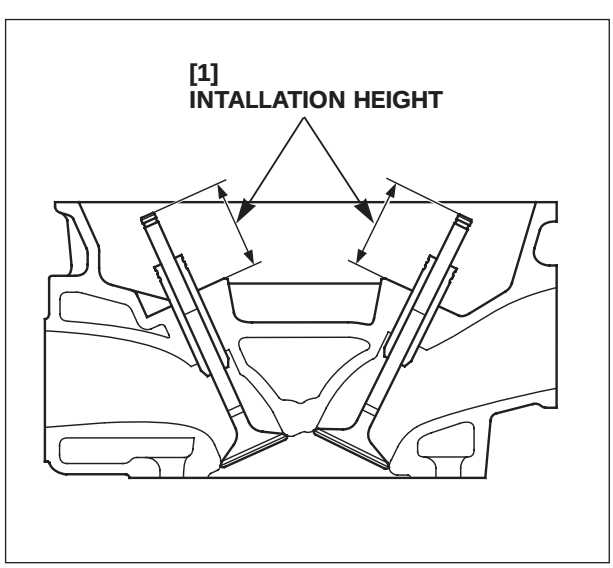
	STANDARD	SERVICE LIMIT
IN/EX	1.25 – 1.55 mm (0.049 – 0.061 in)	2.0 mm (0.08 in)

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. 10-28).



• VALVE INTALLATION HEIGHT

	STANDARD	SERVICE LIMIT
IN/EX	44.0 – 44.6 mm (1.73 – 1.76 in)	———



• 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) Min.

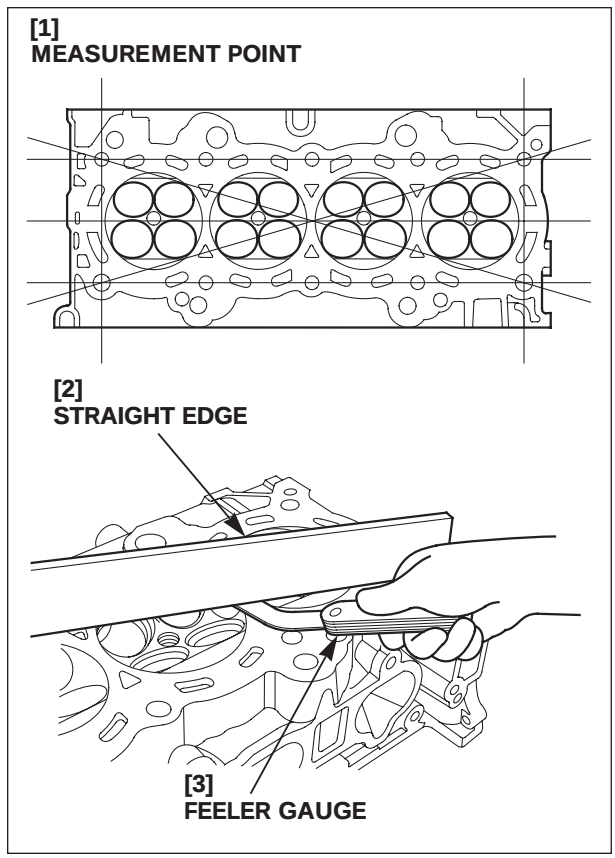
NOTICE

Take care not to damage (scores, scratches, etc.) the cylinder head at the mating surface with the gasket.

4) If the measurement exceeds the service limit, recondition.

NOTICE

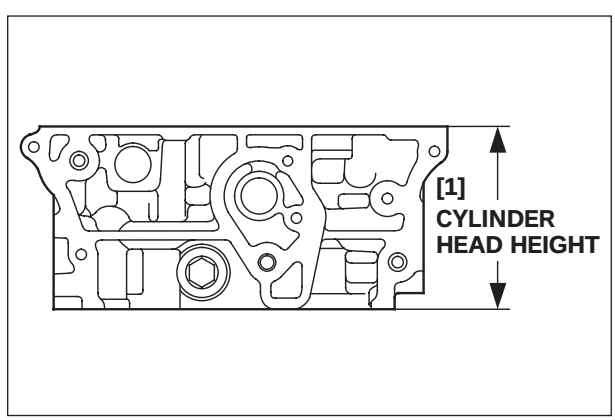
Reconditioning must be made within the standard value of the cylinder head height.



• CYLINDER HEAD HEIGHT

STANDARD	SERVICE LIMIT
103.95 – 104.05 mm (4.093 – 4.096 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.

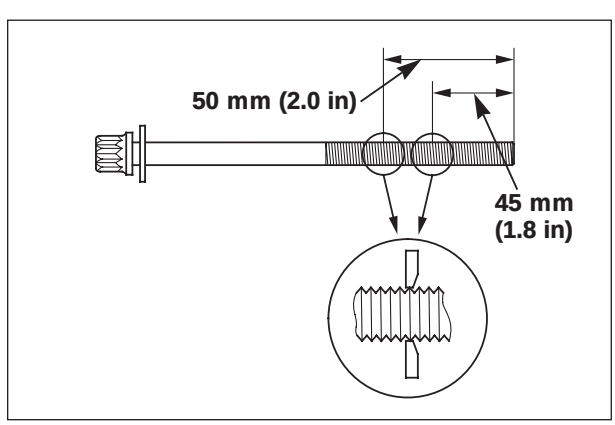


• 11 x 155 mm BOLT-WASHER (CYLINDER HEAD BOLT) O.D.

1) Measure the bolt O.D. at two points as shown.

SERVICE LIMIT	10.6 mm (0.42 in)

2) If the measurement is below the service limit, replace the bolt.



8. VALVE GUIDE REPLACEMENT

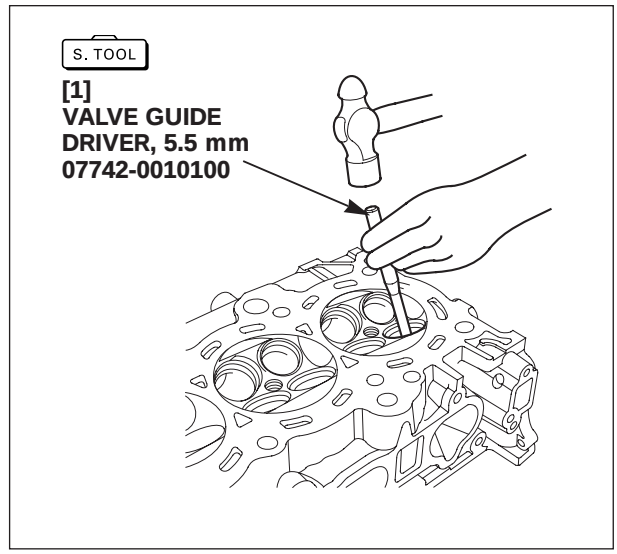
1) Chill the replacement valve guides in the freezer section of a refrigerator for about an hour.

2) Drive the valve guide out of the combustion chamber side using a special tools.

TOOL:
Valve guide driver, 5.5 mm **07742-0010100**

⚠CAUTION

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

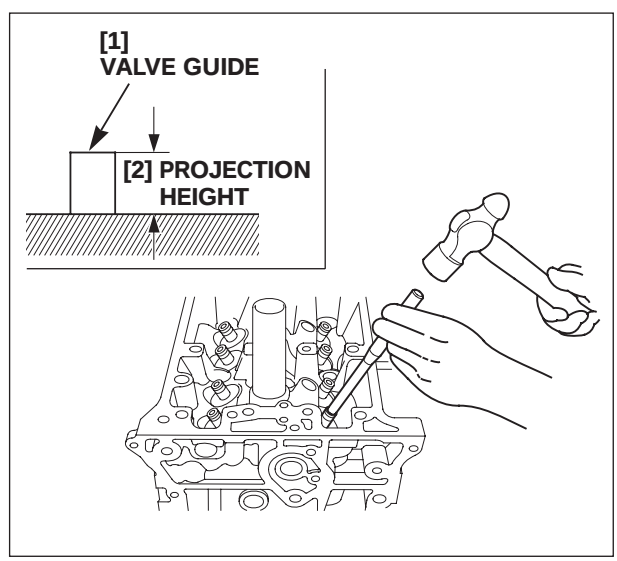


3) Remove the new valve guides from the refrigerator one at a time as needed.

4) Install the new valve guides from the valve spring side of the cylinder head. Drive each valve guide as shown.

Valve guide projection height	IN	15.2 – 16.2 mm (0.60 – 0.64 in)
	EX	15.5 – 16.5 mm (0.61 – 0.65 in)

5) After installation, inspect the valve guide for damage. Replace any damaged valve guide.



• VALVE GUIDE REAMING

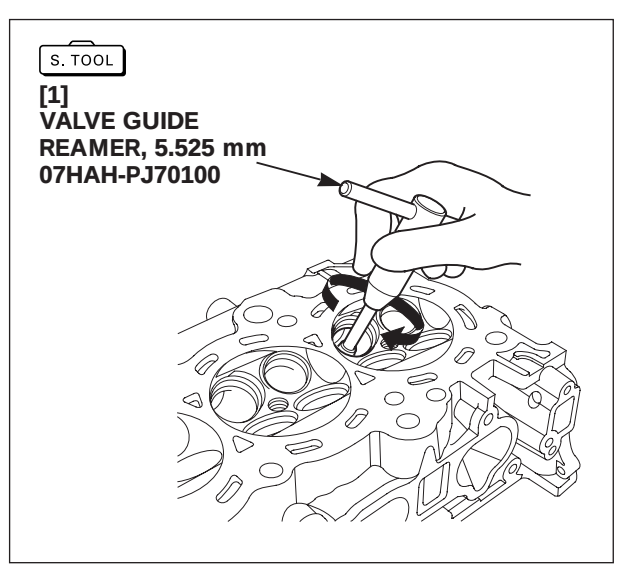
For best results, be sure the cylinder head is at room temperature before reaming valve guides.

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.

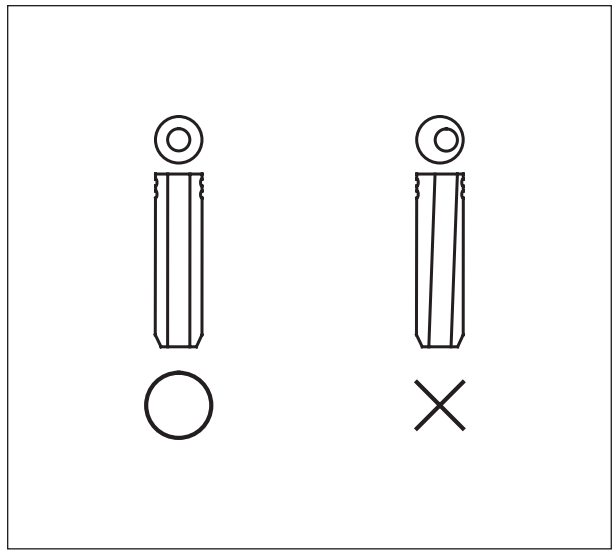
TOOL:
Valve guide reamer, 5.525 mm **07HAH-PJ70100**



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.

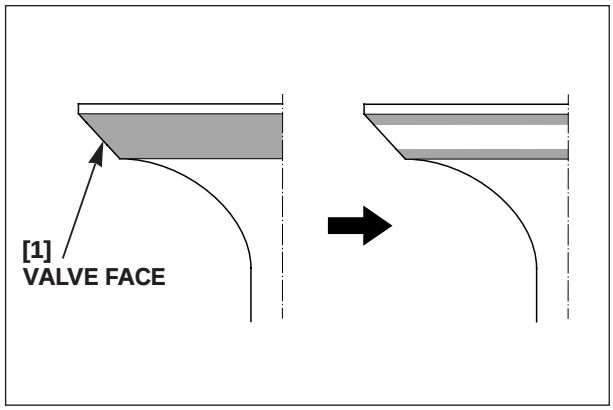
6) Check the Valve Stem-to-Valve Guide Clearance (P. 10-24).



9. 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 transfered marking compound will show any area of the seat that is not concentric.

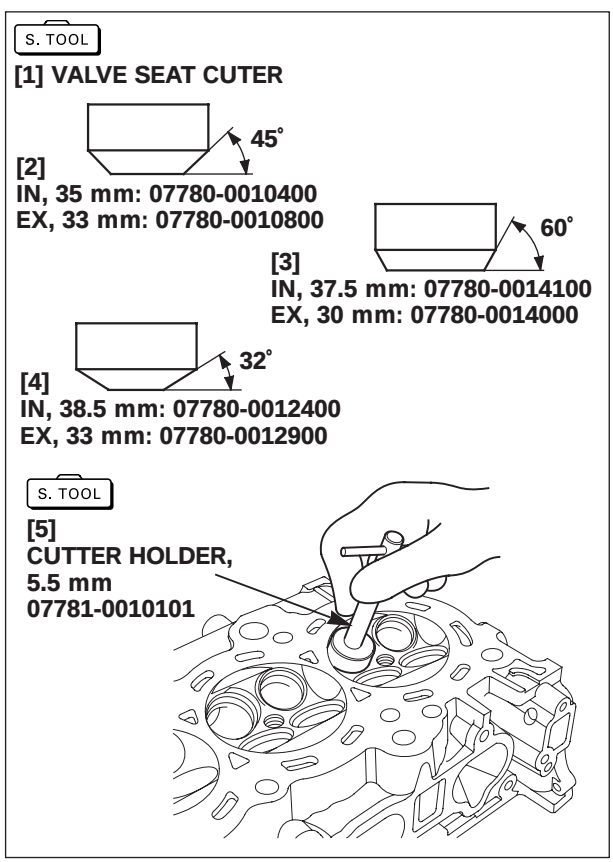


3) Using a 45˚ cutter, remove enough material to produce a smooth and concentric seat. Follow the Valve Seat Cutter Manufacturer's Instructions.

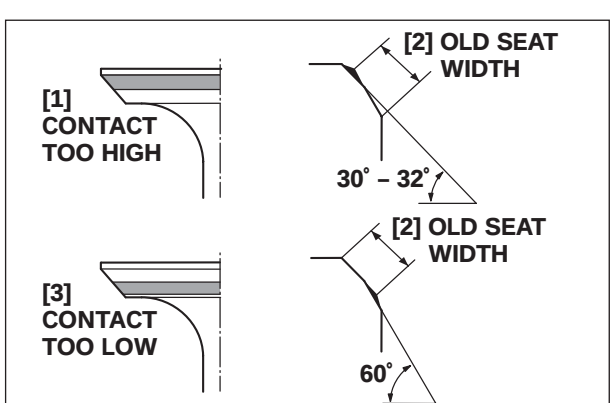
   Turn the cutter clockwise, never counterclockwise. Continue to turn the cutter as you lift it from the valve seat.

TOOLS:

Cutter holder, 5.5 mm	**07781-0010101**
Valve seat cutter, 45˚ 35 mm	**07780-0010400**
Valve seat cutter, 45˚ 33 mm	**07780-0010800**
Valve seat cutter, 32˚ 38.5 mm	**07780-0012400**
Valve seat cutter, 32˚ 33 mm	**07780-0012900**
Valve seat cutter, 60˚ 30 mm	**07780-0014000**
Valve seat cutter, 60˚ 37.5 mm	**07780-0014100**



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
IN/EX	1.25 – 1.55 mm (0.049 – 0.061 in)	2.0 mm (0.08 in)

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

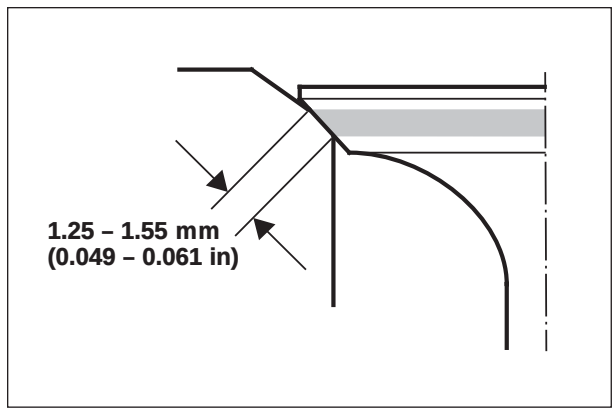
6) After resurfacing the seats, inspect for even valve seating. Apply Prussian Blue compound or erasable felt-tipped marker ink to the valve faces. Insert the valves, and then lift them and snap them closed against their seats several times. Be sure the valve does not rotate on teh seat. The seating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

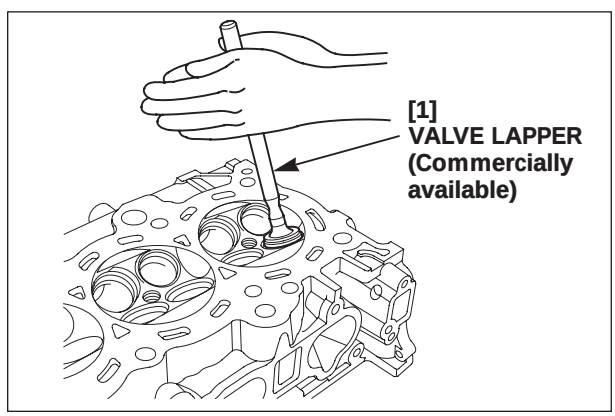
7) Lap the valves into their seats, using a hand valve lapper and lapping compound (commercially available).

NOTICE

To avoid severe engine damage, be sure to remove all lapping compound from the cylinder head before assembly.

8) Check valve clearance after assembly.





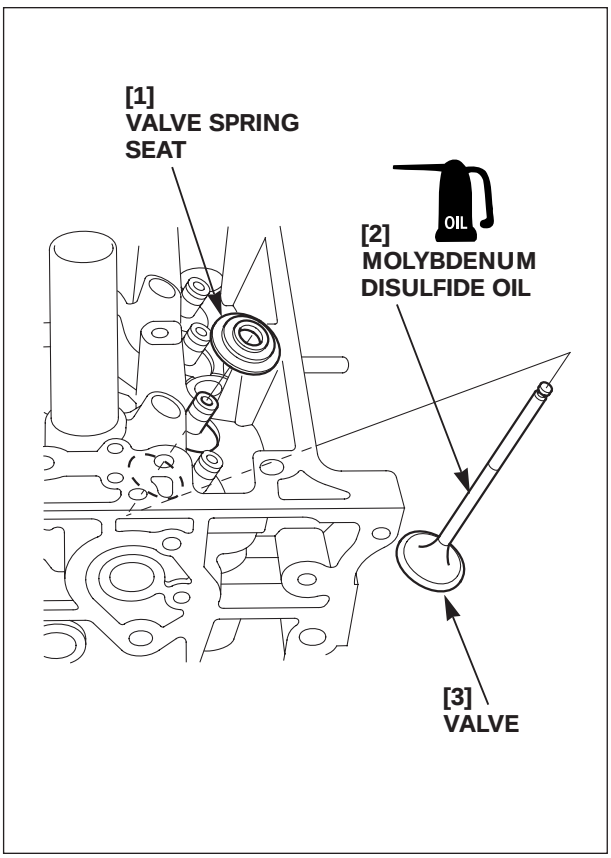
10. CYLINDER HEAD ASSEMBLY ASSEMBLY

1) Apply molybdenum disulfide oil to the valve stem sliding surface and insert the valve into the valve guide.
Check that the valve moves up and down smoothly.

NOTICE

Do not confuse the intake valve and the exhaust valve on assembly.

2) Install the valve spring seat.

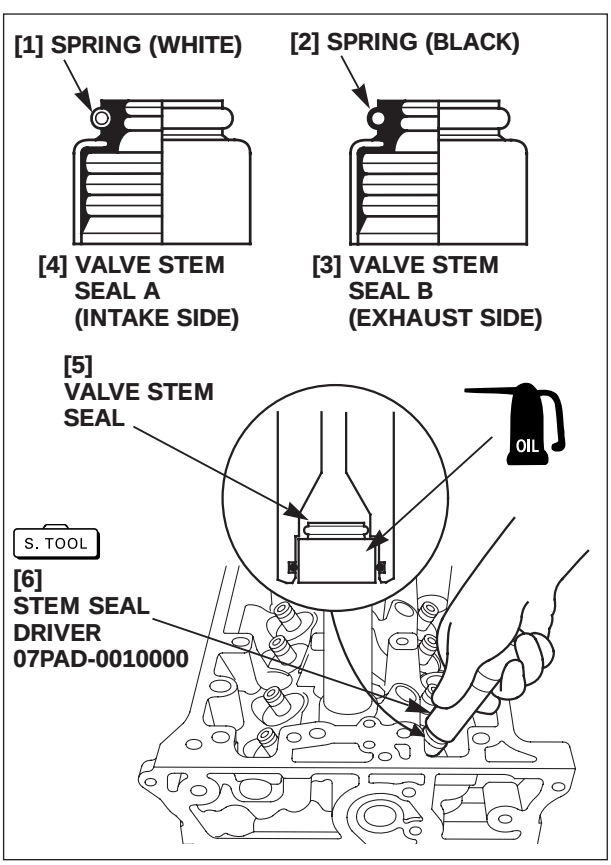


3) Apply engine oil to the inner wall of a new valve stem seal. Set the valve stem seal in the special tool, and push it straight into the valve guide by hand.

TOOL:
Stem seal driver **07PAD-0010000**

NOTICE

Note that the valve stem seal A (intake side) has the white spring and the valve stem seal B (exhaust side) has the black spring. Do not confuse them on assembly.



4) Install the valve spring and the valve spring retainer.

NOTICE

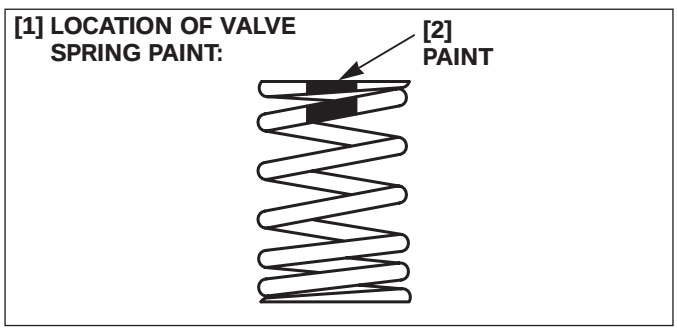
Do not confuse the intake valve spring and the exhaust valve spring.

<Identification>

The intake side can be identified with the pink paint on the spring. The exhaust side can be identified with the gray paint.

<Installation direction>

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



5) Using the same special tool as that used during disassembly, compress the valve springs and set the valve keepers in the groove in the respective valve stems securely.

TOOLS:

Valve spring compressor	**07757-0010000**
Valve spring compressor attachment	**07757-PJ10100**

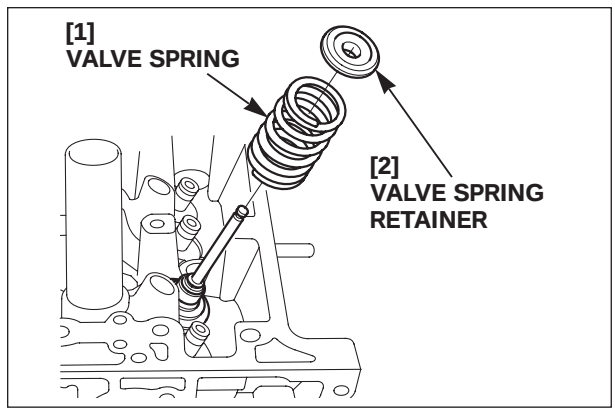
NOTICE

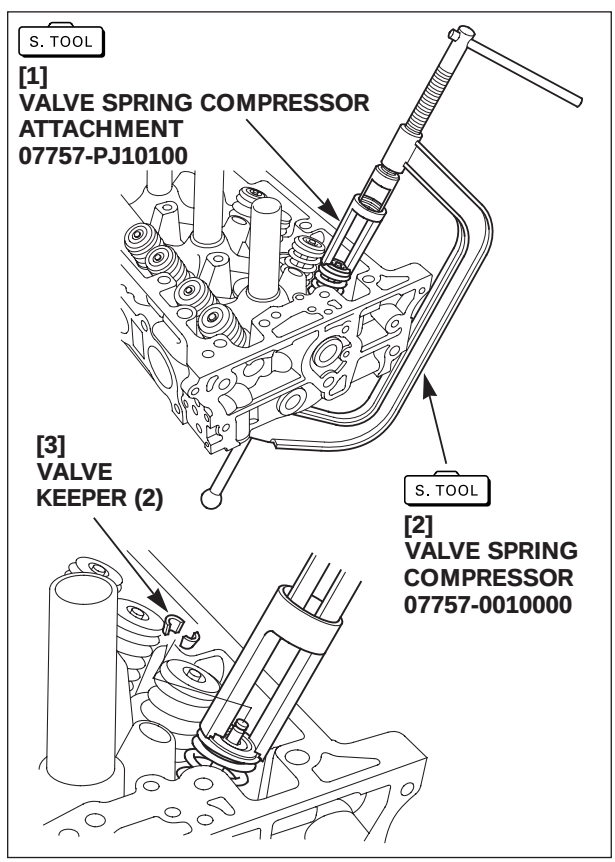
- *Take care not to let the special tools contact the cylinder head.*
- *Do not compress the valve springs more than necessary as it causes weak valve spring.*
- *The valve keepers can be installed in the groove in the valve stem by applying a small mount of grease to the valve keepers and adhering them to the groove in the valve stem.*

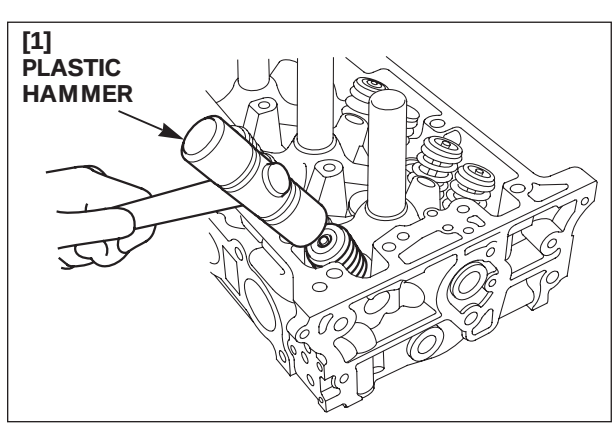
6) Tap on the valve stem head lightly with a plastic hammer two or three times and set the valve stem and keepers in the proper position securely.

NOTICE

- *Tap at right angles with each valve stem head. Take care not to bend the valve.*
- *Support the cylinder head with a suitable material to prevent damage to the valve.*





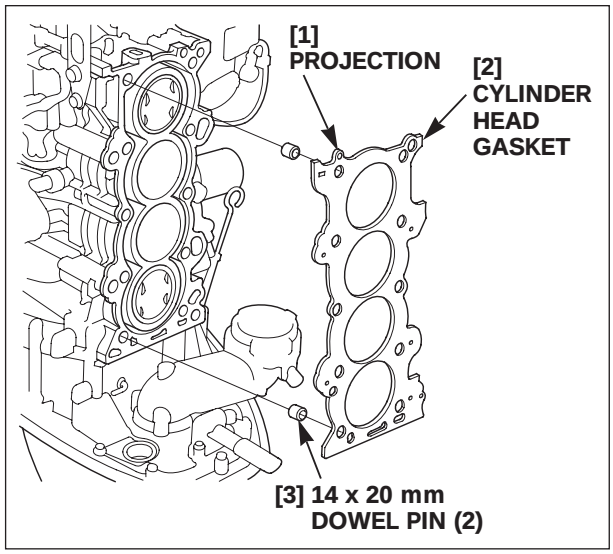


11. CYLINDER HEAD ASSEMBLY INSTALLATION

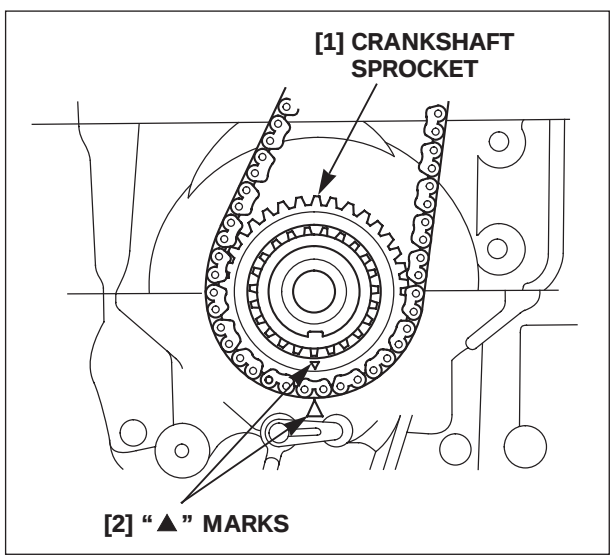
NOTICE

- *Do not let any foreign material enter the gap between the gasket, cylinder head and the cylinder block.*
- *Take care not to damage (scores, scratches, etc.) the cylinder head and the cylinder block at the mating surface with the gasket.*
- *Do not bend the cylinder head gaskets as they are the metal gaskets.*
- *Keep the cam chain away from the magnetic parts.*

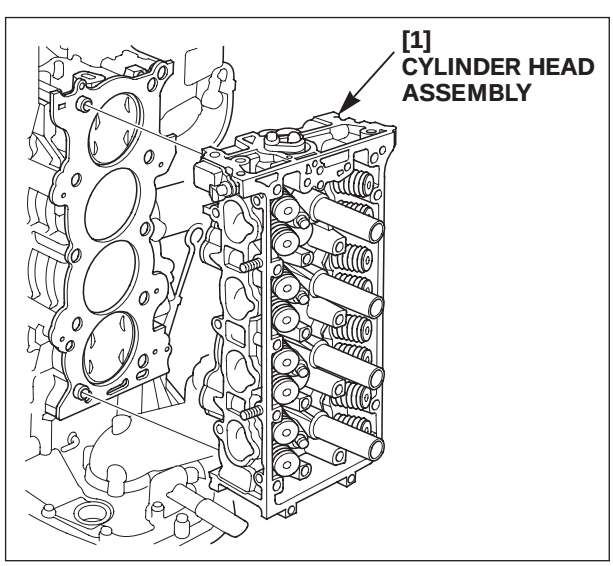
1) Clean the cylinder head and cylinder block mounting surfaces.
2) Install the two dowel pins on the cylinder block.
   Install a new cylinder head gasket on the cylinder block by setting the projection of the cylinder head gasket in the position shown.



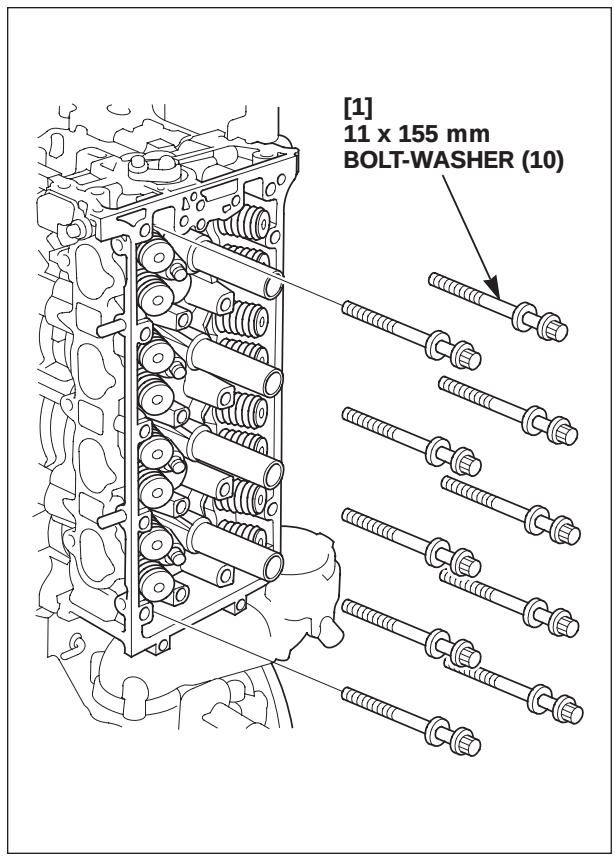
3) Align the "▲" mark on the crankshaft sprocket with the "▲" mark on the cylinder block.



4) Align the dowel pins on the cylinder block with the dowel pin installation positions of the cylinder head assembly as shown, and install the cylinder head assembly on the cylinder block.

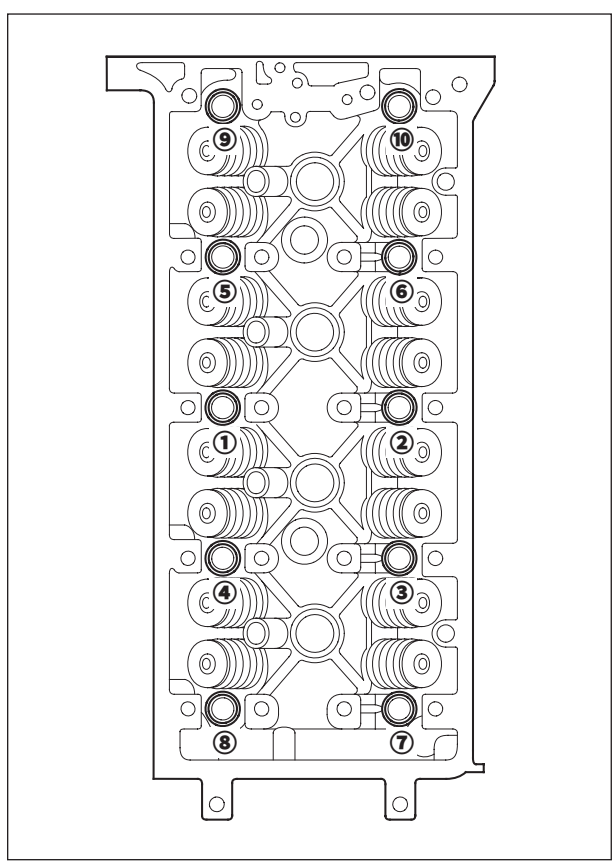


5) Apply engine oil to the threads and the washer seat of the ten 11 x 155 mm bolt-washers, and loosely tighten them on the cylinder head assembly.



6) Tighten the 11 x 155 mm bolt-washers to the specified torque in the numbered sequence in two or three steps.
After tightening to the specified torque, tighten each bolt in the numbered sequence twice in increments of 90˚.
When a bolt is replaced with a new one, tighten additionally to 98˚.

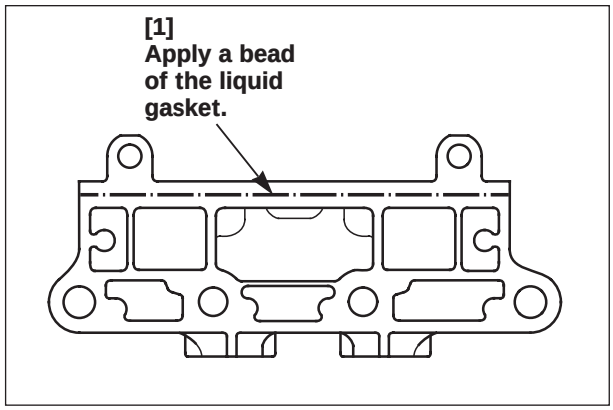
TORQUE:
Used bolt: 39 N·m (4.0 kgf·m, 29 lbf·ft) + 90˚ + 90˚
New bolt: 39 N·m (4.0 kgf·m, 29 lbf·ft) + 90˚ + 90˚ + 98˚



7) Install the following parts.
– Exhaust manifold (P. 5-155)
– Injector base (P. 5-139)
– Fuel line assembly (P. 5-140)
– Throttle body/intake manifold (P. 5-132)
– Camshaft/rocker arm (P. 10-34)
– Crankshaft pulley/cam chain (P. 9-11)
– Cylinder head cover (P. 10-40)
– L./R. side cover brackets (P. 4-30)
– Ignition coil/spark plug (P. 3-8)
– L./R. engine under covers (P. 4-14)
– Engine cover (P. 4-2)

12. CAMSHAFT/ROCKER ARM ASSEMBLY

1) Degrease the cylinder head mating surface of the No.5 rocker shaft holder with the degreasing cleaning agent.
2) Apply a bead [ø2.0 – 3.0 mm (ø0.08 – 0.12 in)] of the liquid gasket (ThreeBond® #1280B or equivalent) to the indicated area of the No.5 rocker shaft holder.

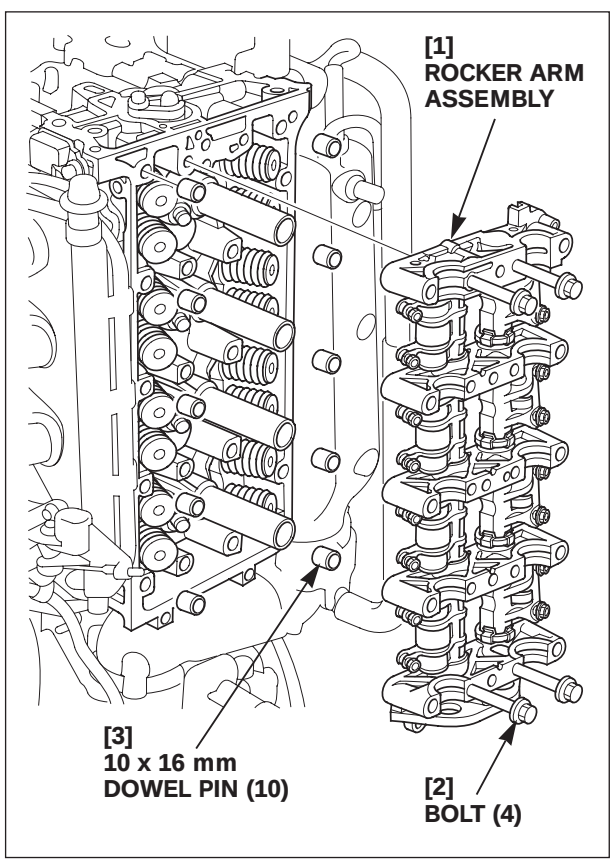


NOTICE

- *Assemble the No.5 rocker shaft holder within 5 minutes after application of the liquid gasket. If it has been left for 5 minutes or longer, remove the old liquid gasket and apply the liquid gasket again.*
- *Do not pour the engine oil in the oil tank at least 30 minutes after assembly.*

3) Set the ten dowel pins on the cylinder head assembly.

4) Insert the bolts into each of the rocker shaft holders and install the rocker arm assembly on the cylinder head assembly.

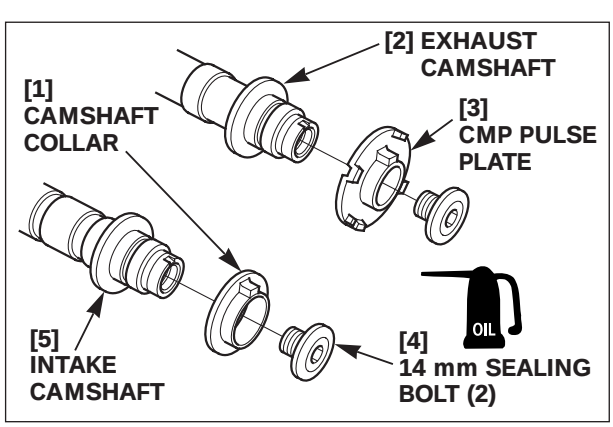


5) Apply engine oil to the threads and seat of the 14 mm sealing bolts.
Install the camshaft collar on the intake camshaft and the CMP pulse plate on the exhaust camshaft, then tighten the 14 mm sealing bolts to the specified torque.

TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)

NOTICE

- *Tighten the bolt while holding the hex. part of the camshaft with a wrench or equivalent tool.*
- *Do not damage (scores, scratches, etc.) the cams and journals of the camshaft journal.*



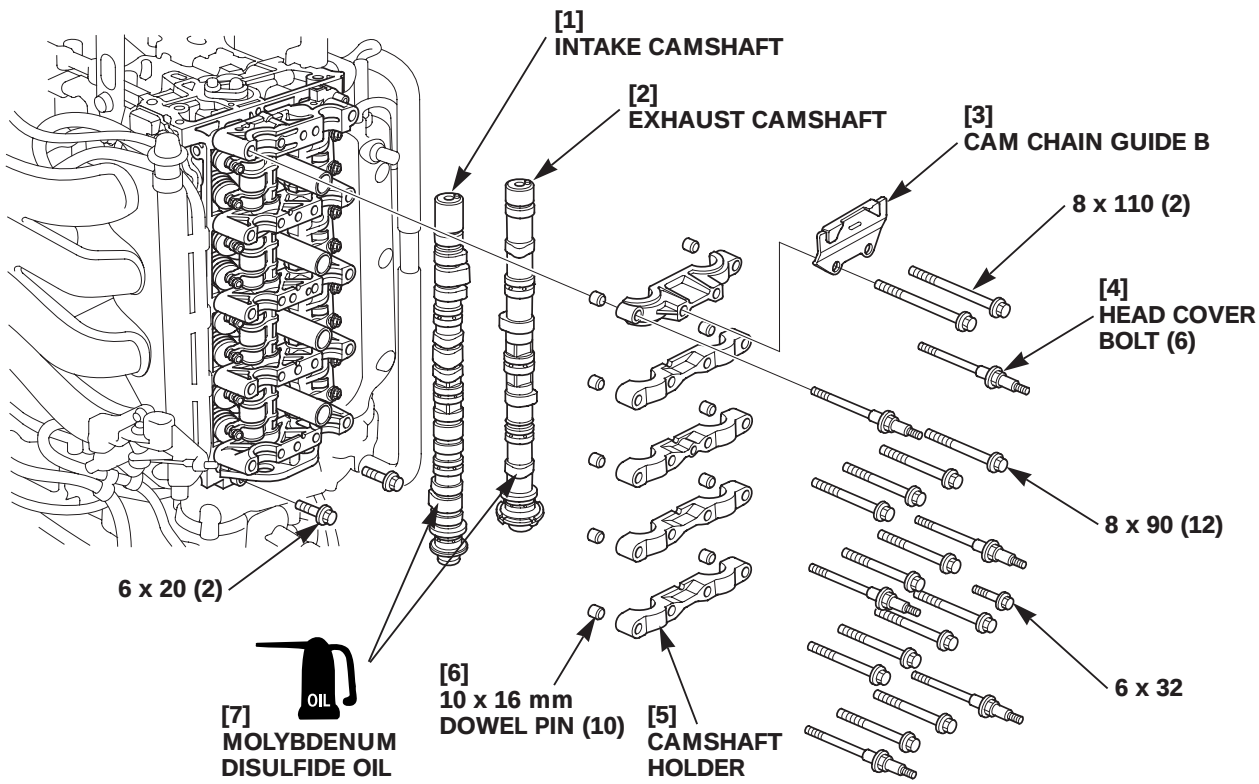
6) Apply molybdenum disulfide oil to the journals and cam surfaces of the camshafts.

7) Install the intake/exhaust camshafts, ten dowel pins, camshaft holders and the cam chain guide B.

NOTICE

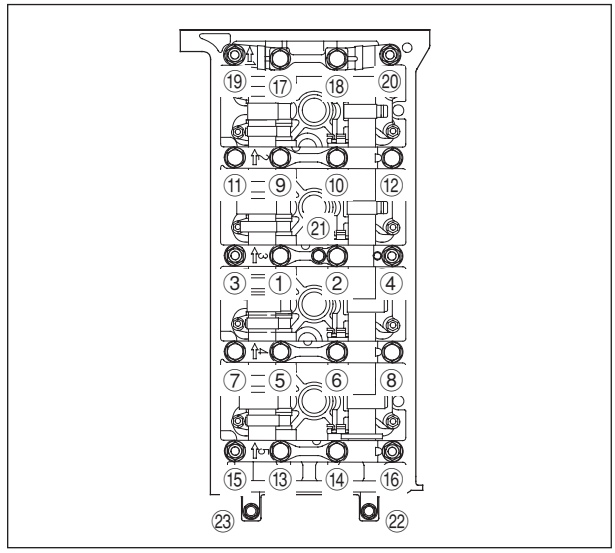
Install the camshafts with the No.1 piston at the top dead center of the compression stroke (i.e. dowel pin at your side).

8) Apply engine oil to the threads and seat of each bolt and loosely tighten to the designated position respectively.

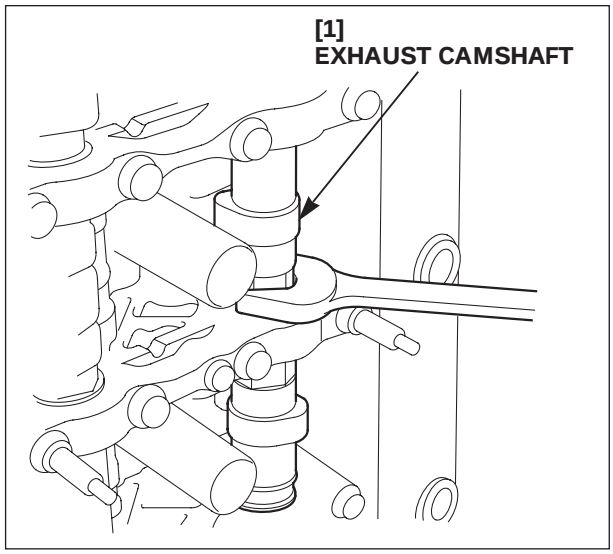


9) Tighten each bolt to the specified torque in the numbered sequence in two or three steps.

TORQUE:
Head cover bolt,
8 x 90 mm flange bolt,
8 x 110 mm flange bolt: 22 N·m (2.2 kgf·m, 16 lbf·ft)
6 x 20 mm flange bolt,
6 x 32 mm flange bolt: 12 N·m (1.2 kgf·m, 9 lbf·ft)

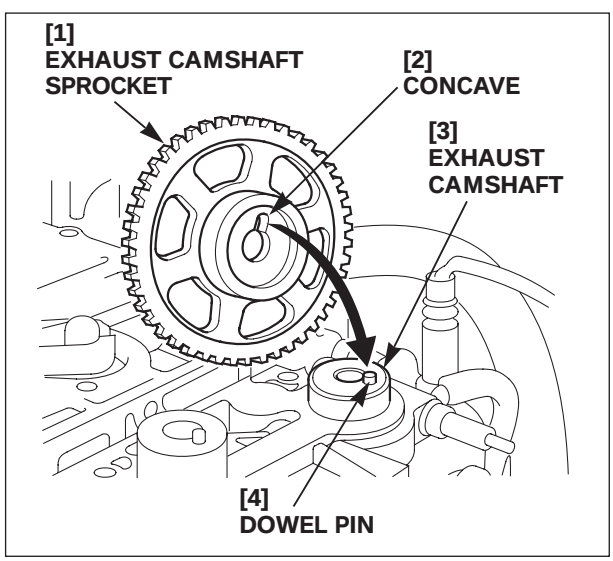


10) Secure the hex. part of the exhaust camshaft with a wrench or equivalent tool.

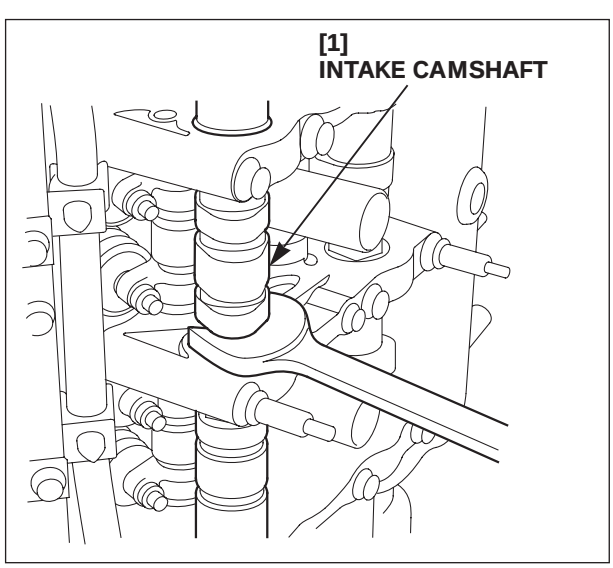


11) Install the exhaust camshaft sprocket on the exhaust camshaft by aligning the concave in the exhaust camshaft sprocket with the dowel pin on the exhaust camshaft. Tighten the 10 x 32 mm flange bolt on the exhaust camshaft to the specified torque.

TORQUE: 72 N·m (7.3 kgf·m, 53 lbf·ft)

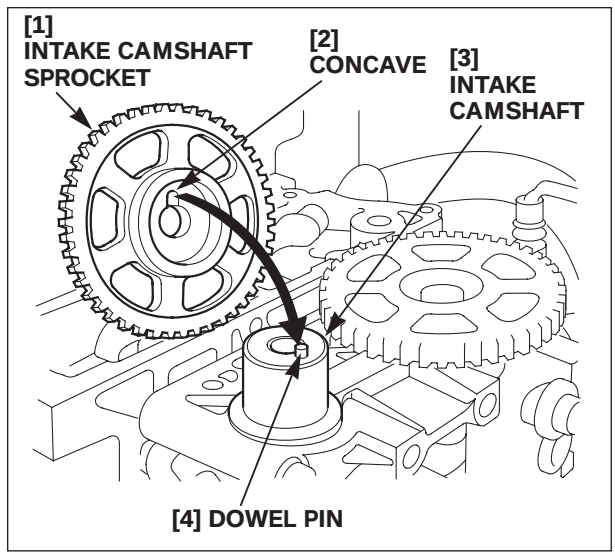


12) Secure the hex. part of the intake camshaft with a wrench or equivalent tool.



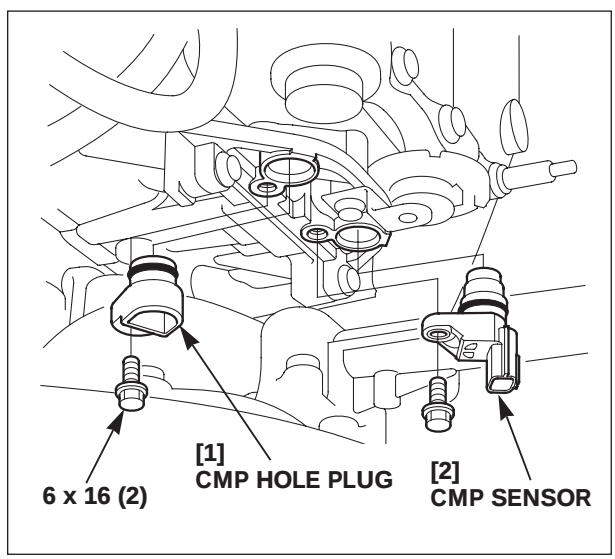
13) Install the intake camshaft sprocket on the intake camshaft by aligning the concave in the intake camshaft sprocket with the dowel pin on the intake camshaft.
Tighten the VTEC flange bolt on the intake camshaft to the specified torque.

TORQUE: 113 N·m (11.5 kgf·m, 83 lbf·ft)



14) Apply engine oil to the outer surface of the new 15.2 x 1.9 mm O-rings, and install the O-rings on the CMP sensor and CMP hole plug.

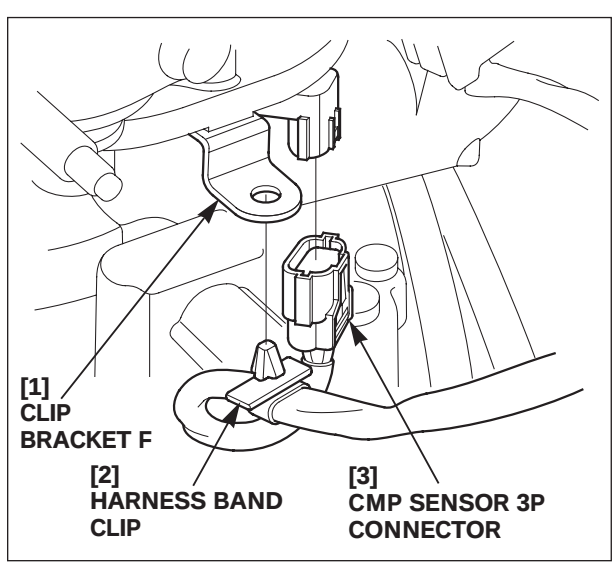
15) Install the CMP sensor (exhaust side) and the CMP hole plug (intake side) in the CMP sensor holes in the No.5 rocker shaft holder. Tighten the CMP sensor and CMP hole plug with the 6 x 16 mm flange bolts respectively.



16) Connect the CMP sensor 3P connector and set the harness band clip on the clip bracket F.

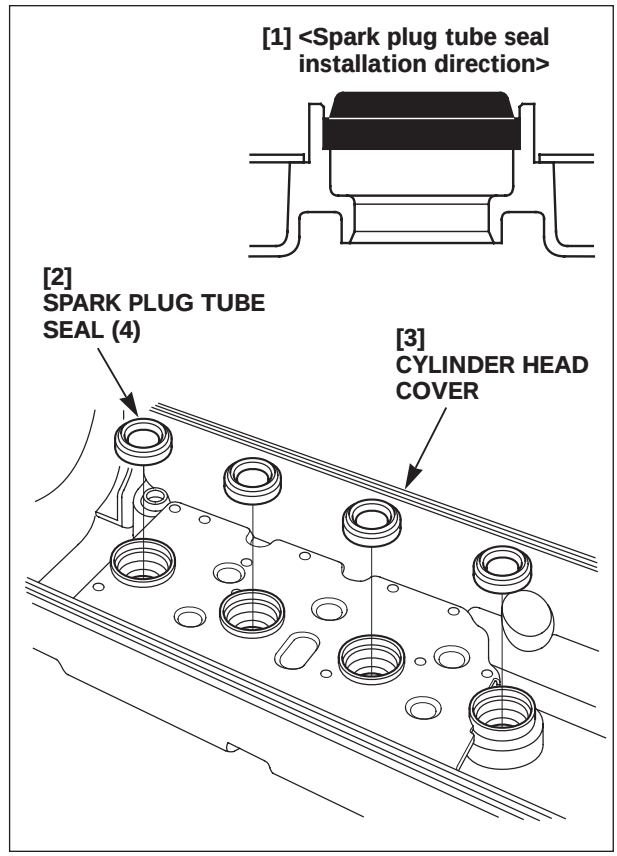
17) Install the crankshaft pulley/cam chain (P. 9-11) and adjust the valve clearance (P. 3-9).

18) Install the following parts.
– Cylinder head cover (P. 10-40)
– Ignition coil/spark plug (P. 3-8)
– L./R. engine under covers (P. 4-14)
– Engine cover (P. 4-2)



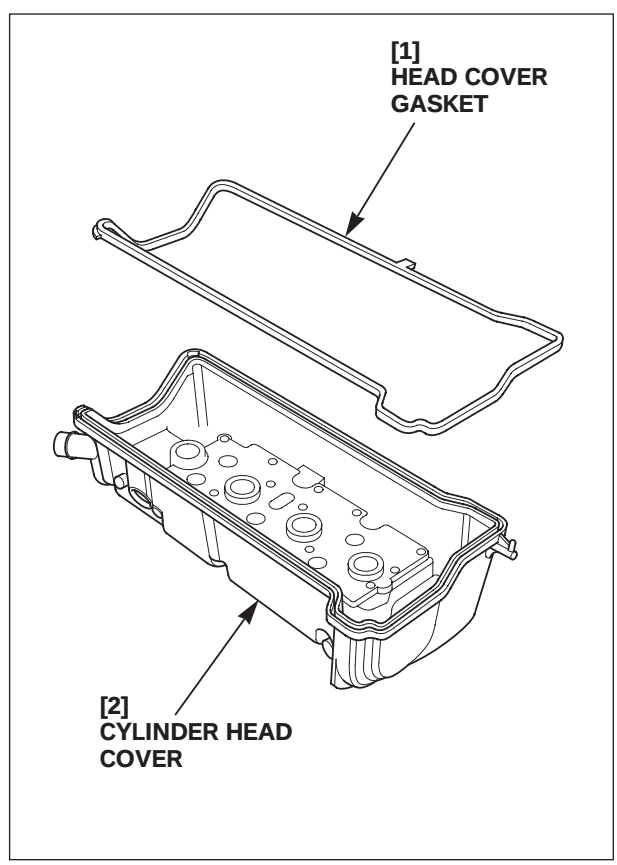
13. CYLINDER HEAD COVER ASSEMBLY

1) Install the spark plug tube seals on the cylinder head cover noting the installation direction of the seal.



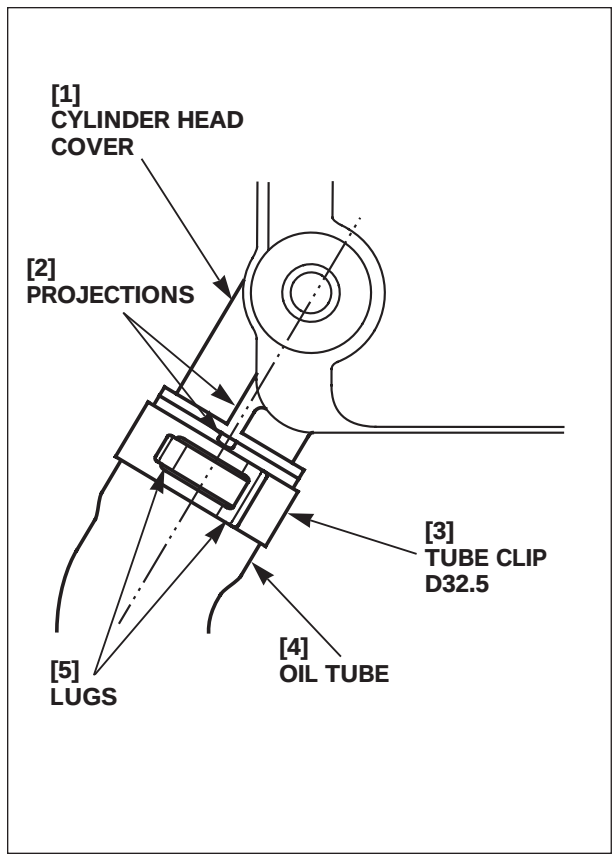
2) Clean the groove of the cylinder head cover and clean the head cover gasket.

3) Install the head cover gasket on the cylinder head cover.



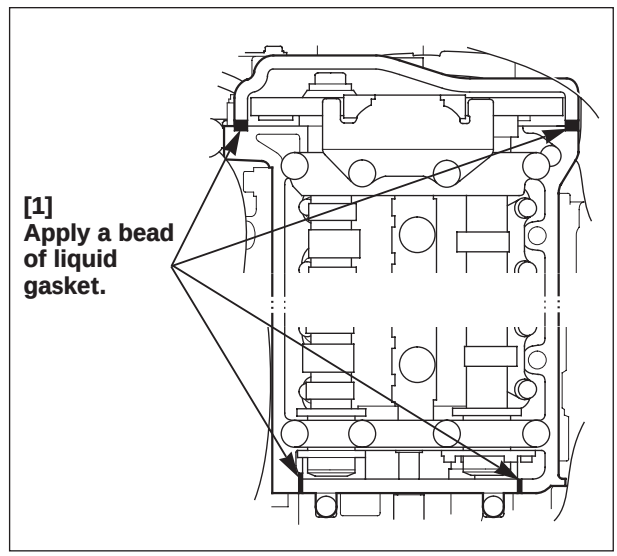
4) Connect the oil tube to the cylinder head cover by aligning the projection on the oil tube with the projection on the cylinder head cover.
   Check that the oil tube is inserted in the cylinder head cover securely.

5) Set the tube clip D32.5 with the lugs in the position shown.



14. CYLINDER HEAD COVER INSTALLATION

1) Thoroughly clean the cylinder head/cylinder head cover mating surfaces using a degreasing cleaning agent.
2) Apply a bead [ø2.0 – 3.0 mm (ø0.08 – 0.12 in)] of the liquid gasket (ThreeBond® #1280B or equivalent) to the cylinder head/chain case mating surfaces and to the No.5 rocker shaft holder as shown.



NOTICE

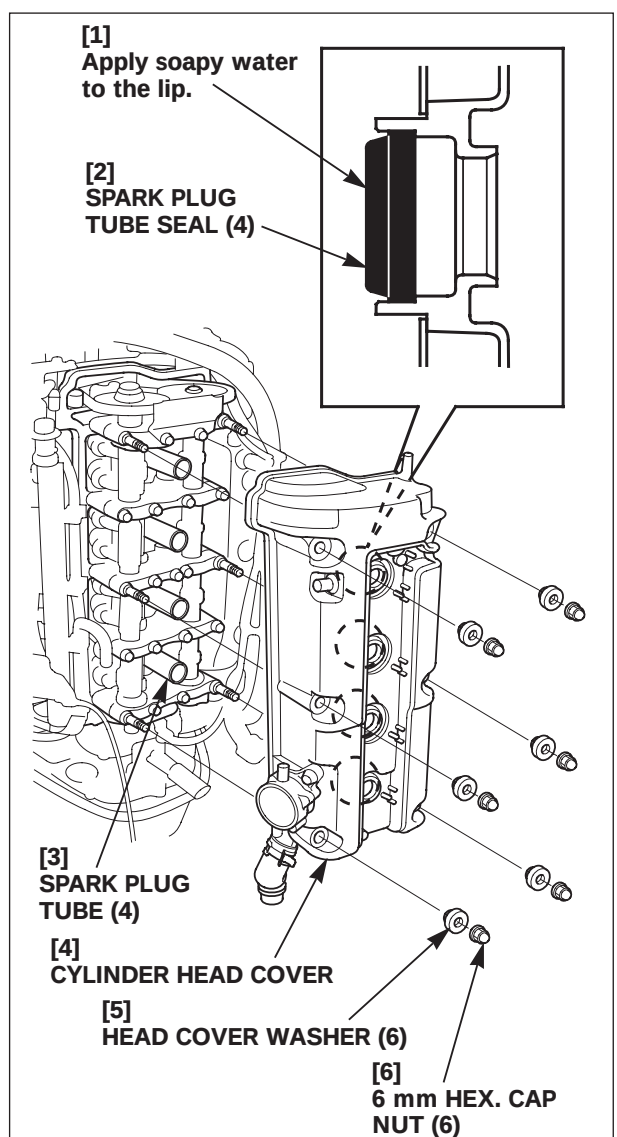
- *Assemble the cylinder head cover within 5 minutes after application of the liquid gasket. If it has been left for 5 minutes or longer, remove the old liquid gasket and apply the liquid gasket again.*
- *Do not pour the engine oil in the oil tank at least 30 minutes after assembly.*

3) Apply soapy water to the spark plug tube seal lip of the cylinder head cover.
4) Install the cylinder head cover on the cylinder head by aligning the spark plug tube with the spark plug tube seal.

NOTICE

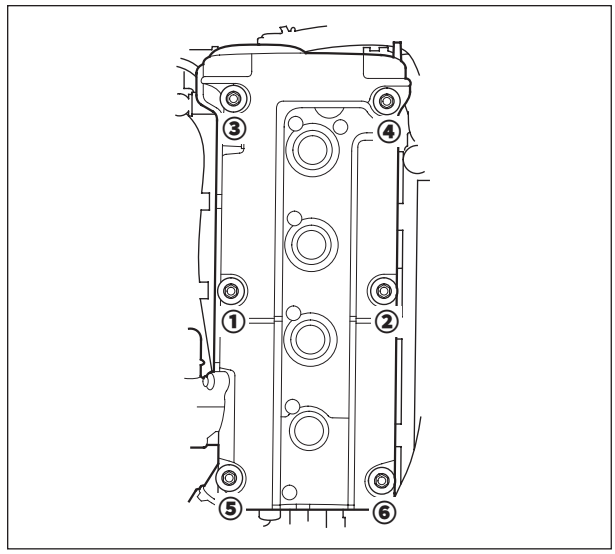
- *Check the spark plug tube seals for breakage and fatigue when installing the cylinder head cover.*
- *After installation, check that the spark plug tube seals are not turned up but they are set properly.*
- *Wipe up the oozing soapy water.*

5) After installation, swing the cylinder head cover lightly to make the head cover gasket fit on the cylinder head cover.
6) Install the six head cover washers and loosely tighten the six 6 mm hex. cap nuts.

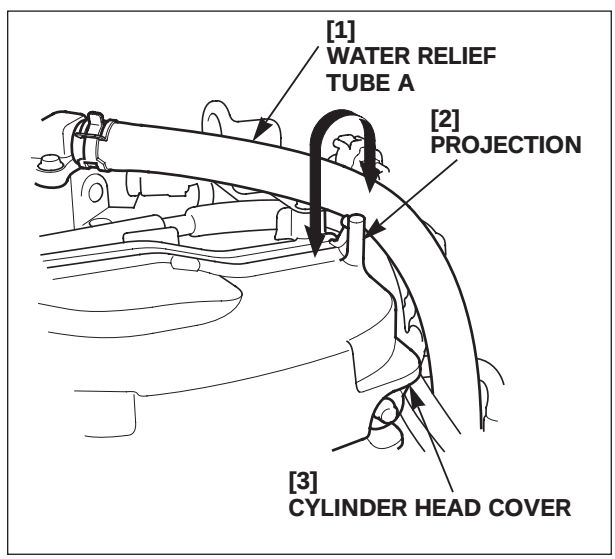


7) Tighten the 6 mm hex. cap nuts to the specified torque in the numbered sequence in two or three steps.

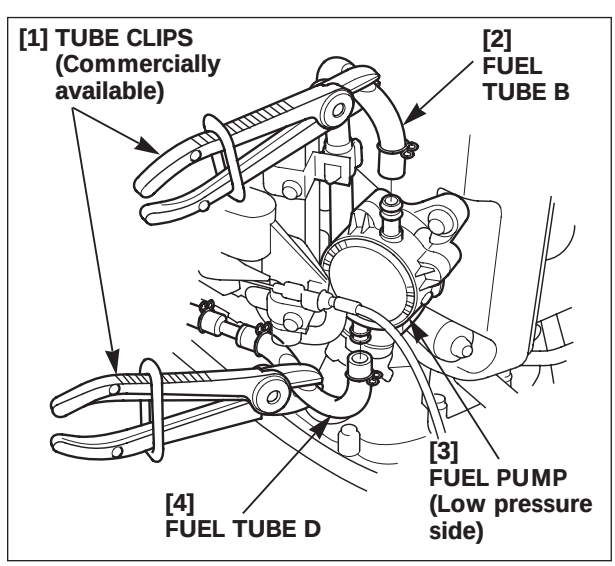
TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



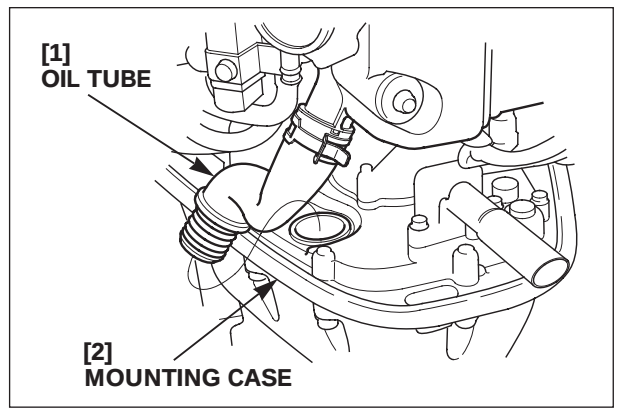
8) Move the water relief tube A from the other side of the projection on the cylinder head cover to your side.



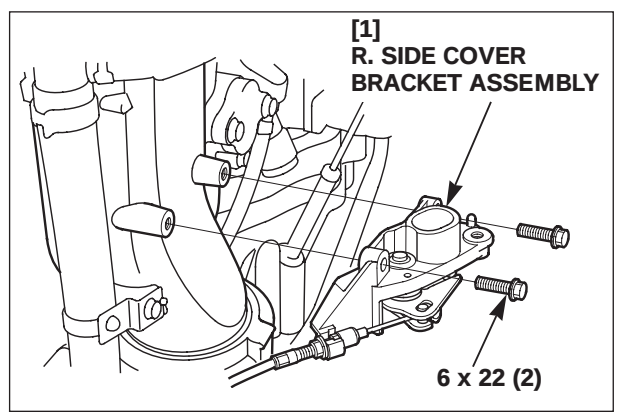
9) Connect the fuel tube B and D to the fuel pump (low pressure side).



10) Connect the oil tube to the mounting case.
After connection, check that the oil tube is inserted in the mounting case securely.



11) Install the R. side cover bracket assembly on the engine assembly and tighten the two 6 x 22 mm flange bolts.

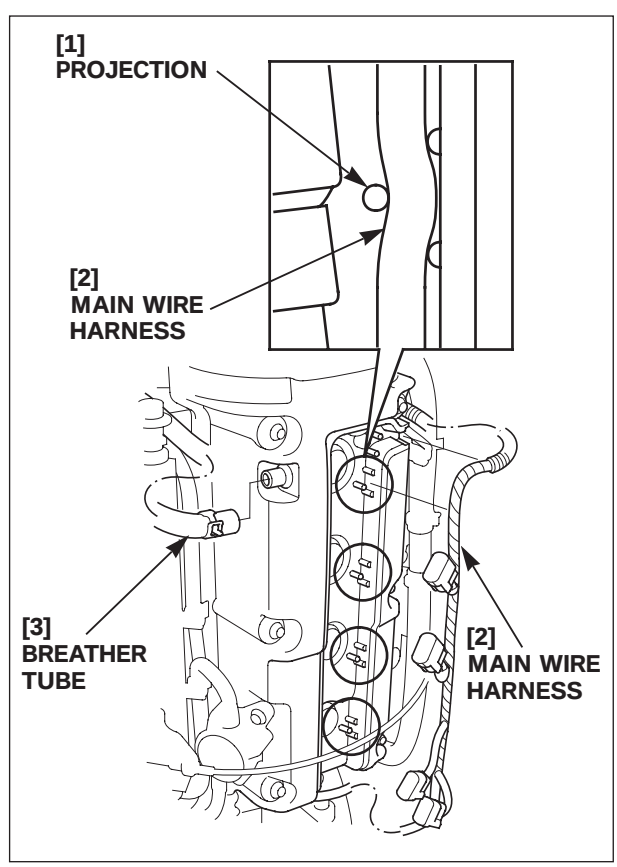


12) Connect the breather tube and the main wire harness to the cylinder head cover.

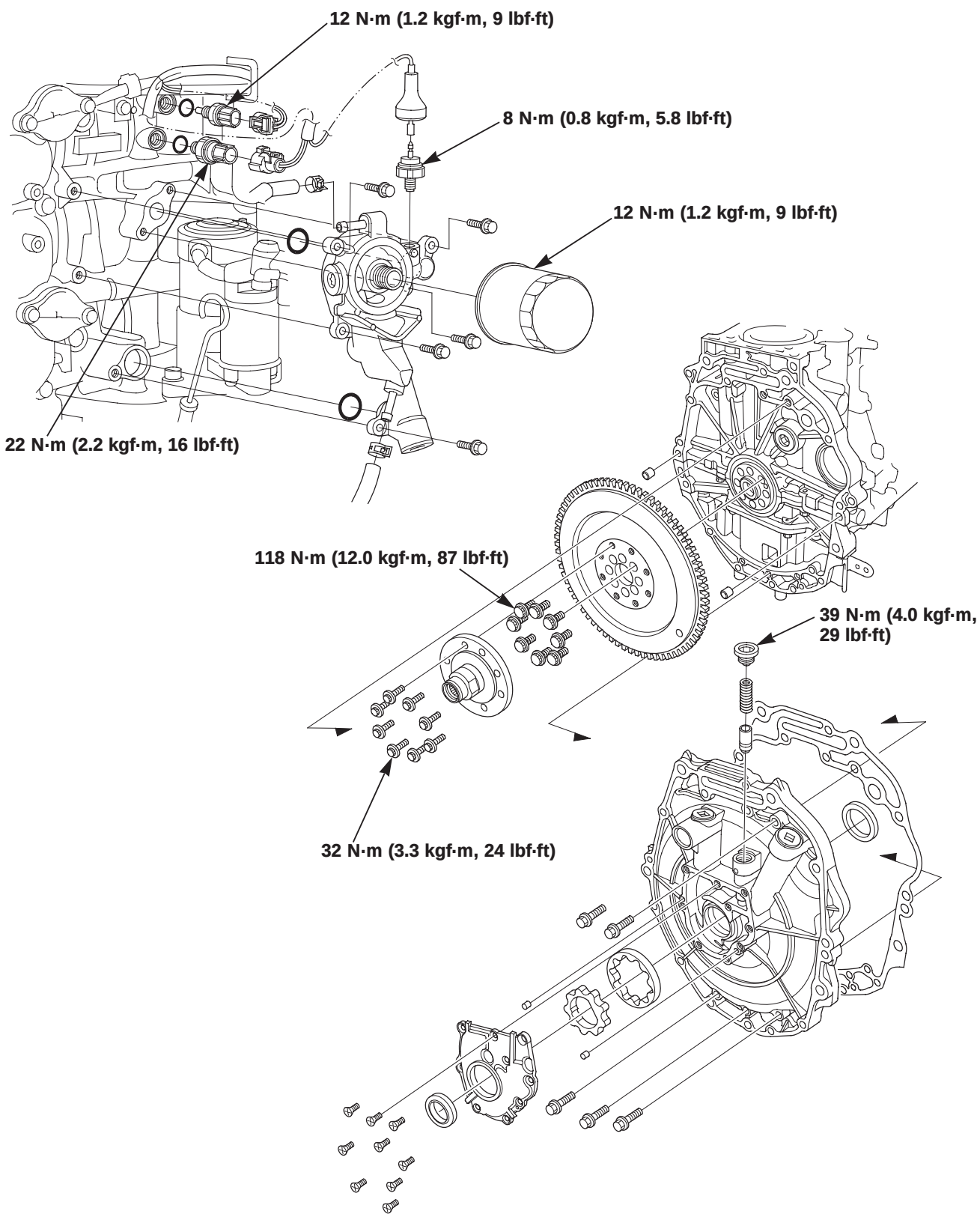
NOTICE

Route the main wire harness so it sets on the projections on the cylinder head cover securely.

13) Install the following parts.
– Ignition coil/spark plug (P. 3-8)
– L./R. engine under covers (P. 4-14)
– Engine cover (P. 4-2)



1. EOP SWITCH/OIL FILTER FLANGE	2. OIL PUMP
	3. FLYWHEEL



1. EOP SWITCH/OIL FILTER FLANGE

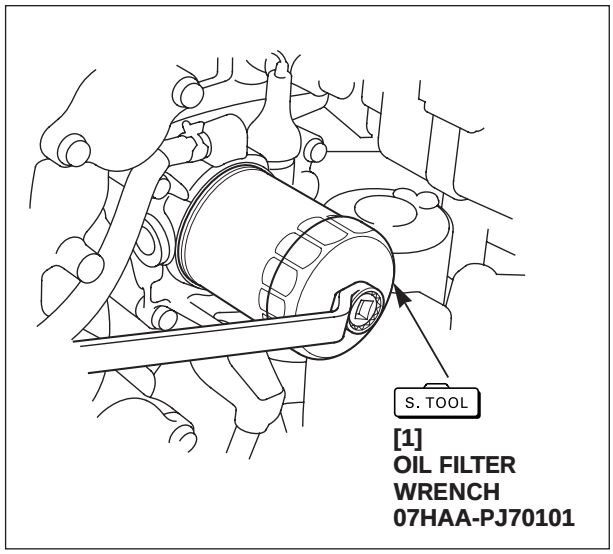
a. DISASSEMBLY

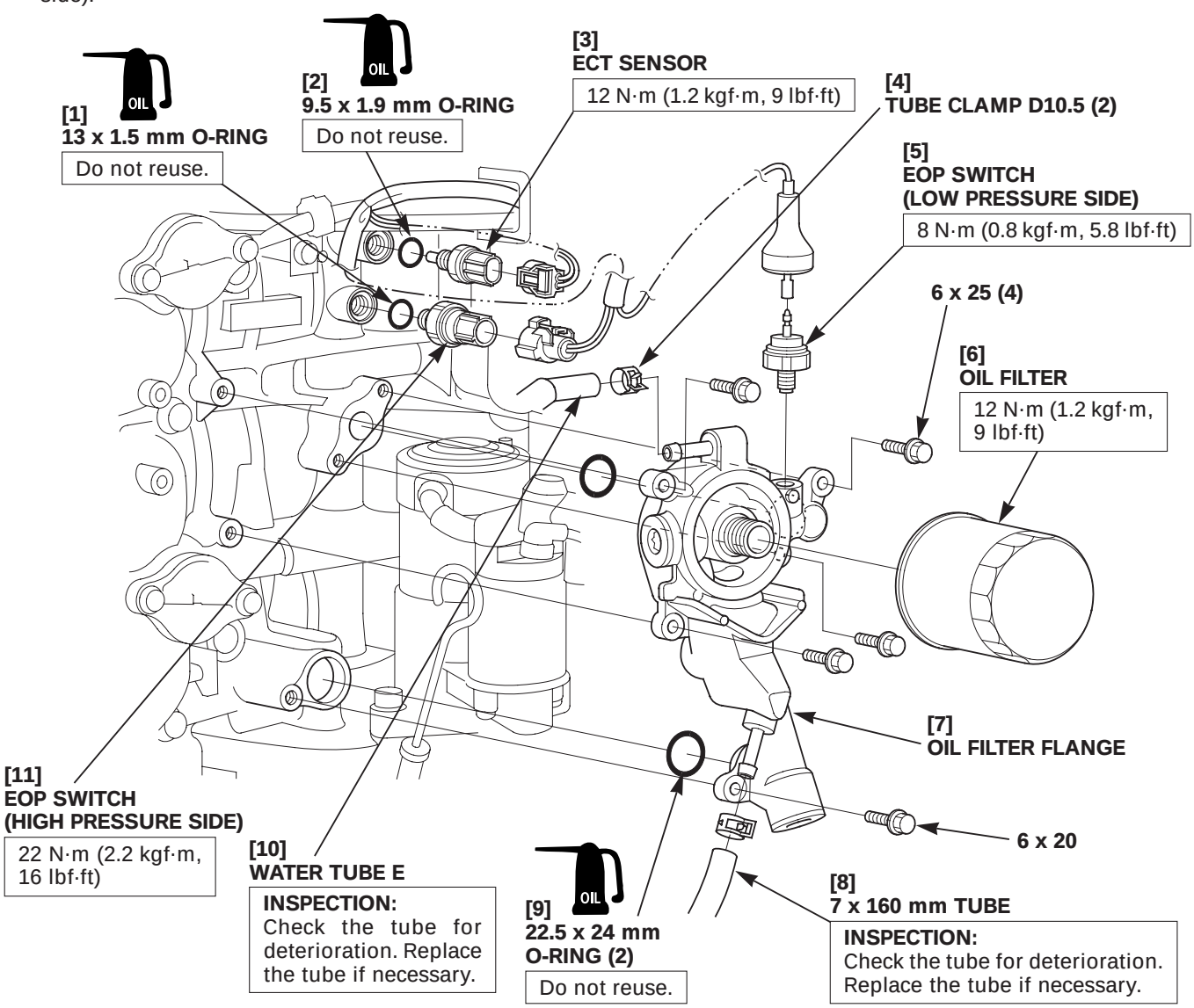
Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)

1) Drain the engine oil (P. 3-2) and remove the oil filter using the special tool as shown.

TOOL:
Oil filter wrench **07HAA-PJ70101**

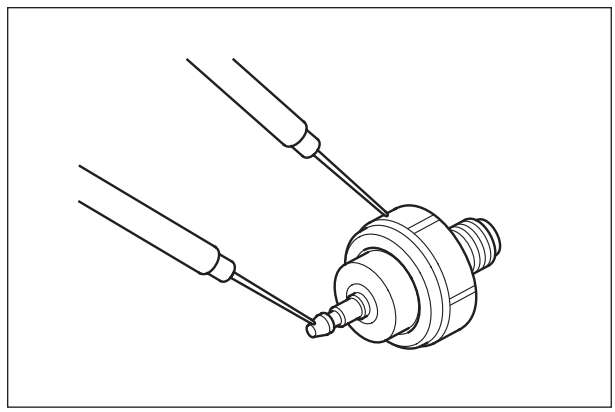
2) Remove the EOP switch (low pressure side).
3) Disconnect the water tube E and 7 x 160 mm tube from the oil filter flange.
4) Remove the oil filter flange.
5) Disconnect the ECT sensor 2P connector and the EOP switch (high pressure side) 2P connector.
Remove the ECT sensor and the EOP switch (high pressure side).





b. INSPECTION

Check for continuity between the terminal and body.
If there is no continuity, replace the EOP switch



c. ASSEMBLY

1) Apply engine oil to a new 13 x 1.5 mm O-ring and install it on the ECT sensor.

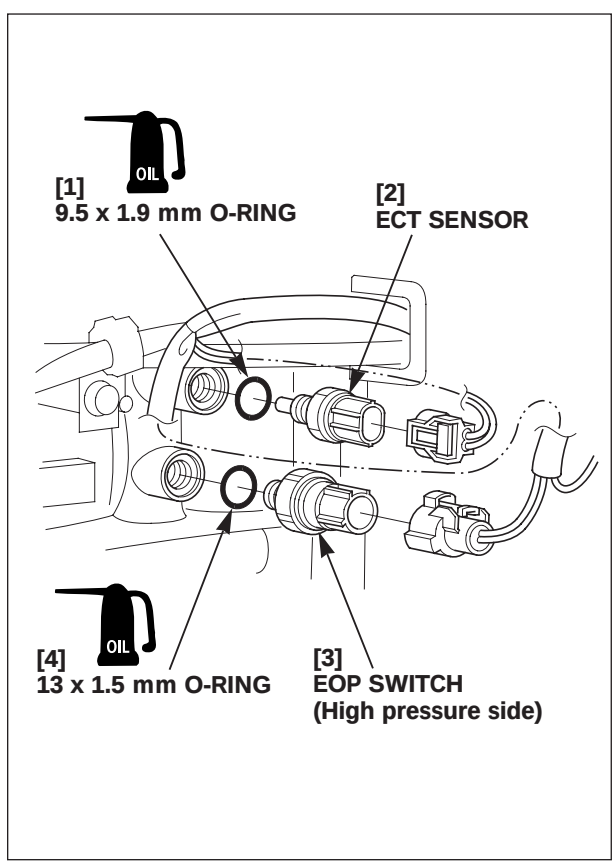
2) Tighten the ECT sensor to the specified torque and connect the ECT sensor 2P connector.

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

3) Apply engine oil to the 9.5 x 1.9 mm O-ring and install it on the EOP switch (high pressure side).

4) Tighten the EOP switch (high pressure side) to the specified torque and connect the EOP switch (high pressure side) 2P connector.

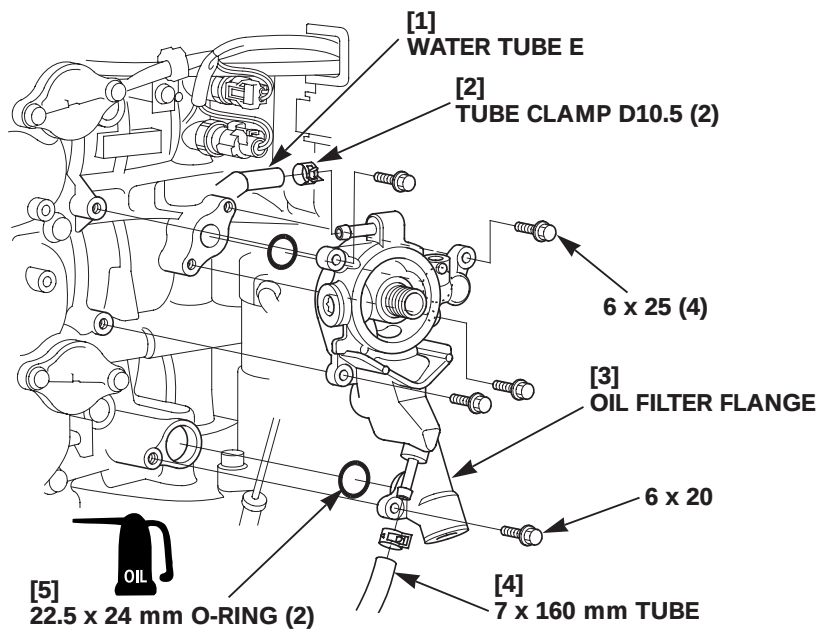
   TORQUE: 22 N·m (2.2 kgf·m, 16 lbf·ft)



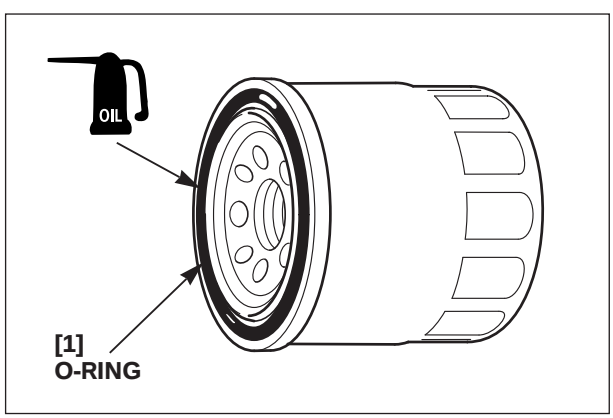
5) Apply engine oil to a new 22.5 x 24 mm O-ring and install it on the oil filter flange.

6) Install the oil filter flange and tighten the 6 x 20 mm flange bolt and the four 6 x 25 mm flange bolts securely.

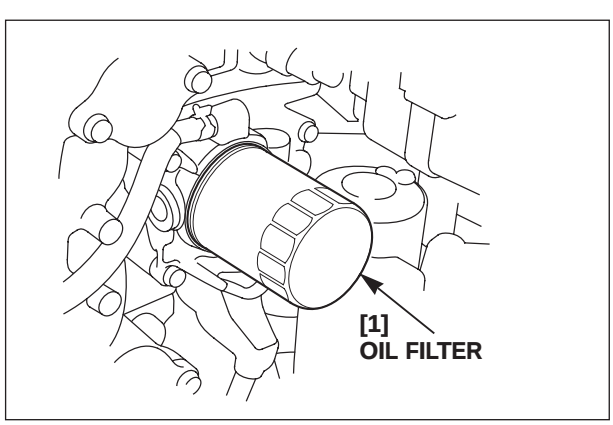
7) Connect the water tube E and the 7 x 160 mm tube to the oil filter flange, and clamp the tube with the tube clamp D10.5 securely.



8) Apply engine oil to the O-ring that is set in the new oil filter.



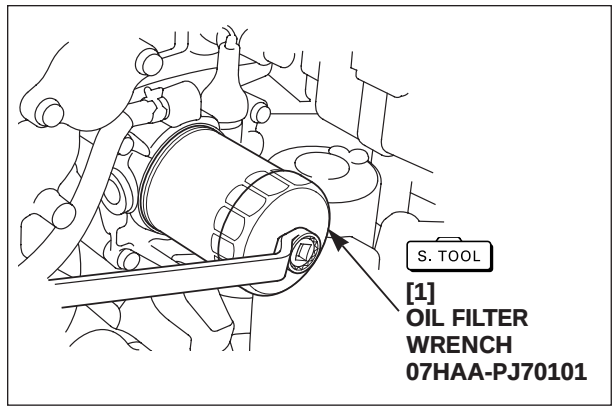
9) Clean the oil filter mounting part of the engine side oil filter flange and apply engine oil to the stud.
Tighten the oil filter by hand.



10) Then, tighten it to the specified torque using the same special tool as that used during disassembly.

TOOL:
Oil filter wrench **07HAA-PJ70101**

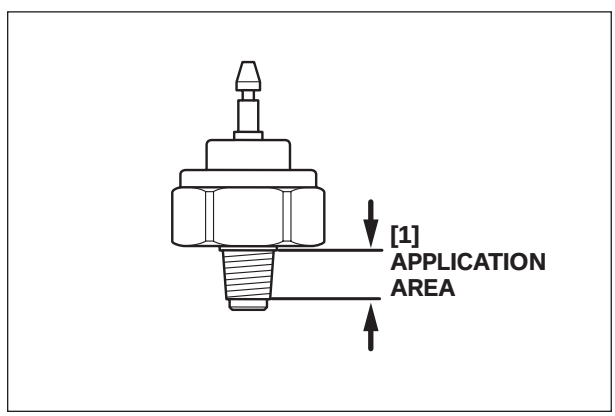
TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



11) Before installing the EOP switch (low pressure side), clean the switch and apply the liquid gasket (ThreeBond® #1215 or equivalent) to the area shown.

NOTICE

Take care not to put the liquid gasket on the switch end and the oil passage.



12) Tighten the EOP switch (low pressure side) to the specified torque using the torque wrench.

TORQUE: 8 N·m (0.8 kgf·m, 5.8 lbf·ft)

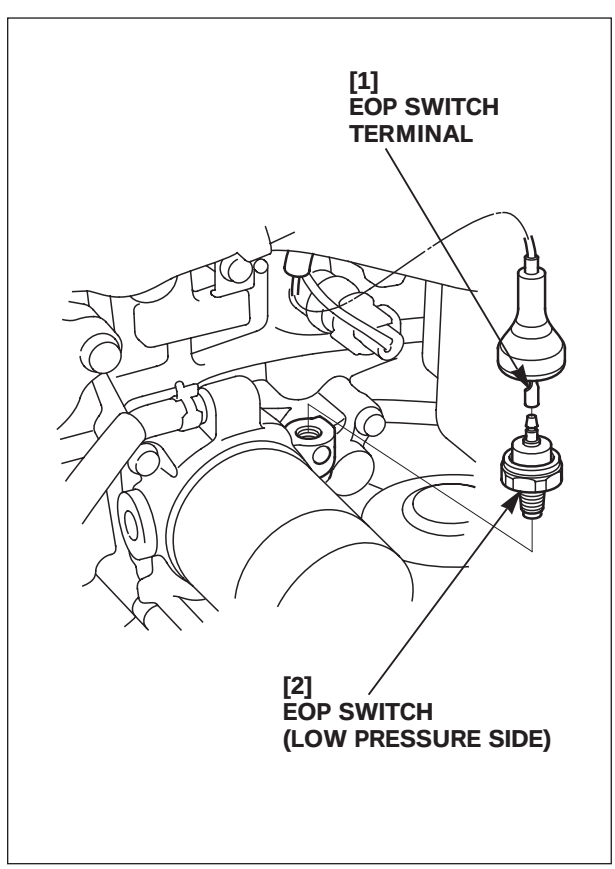
NOTICE

Use the torque wrench to tighten the EOP switch (low pressure side). Do not overtighten the EOP switch as it can damage the oil filter flange.

13) Connect the EOP switch terminal to the EOP switch (low pressure side).

14) Add the specified amount of the engine oil (P. 3-2).
After adding the oil, check each joint for oil leakage.

15) Install the following parts.
– L./R. engine under covers (P. 4-14)
– Engine cover (P. 4-2)

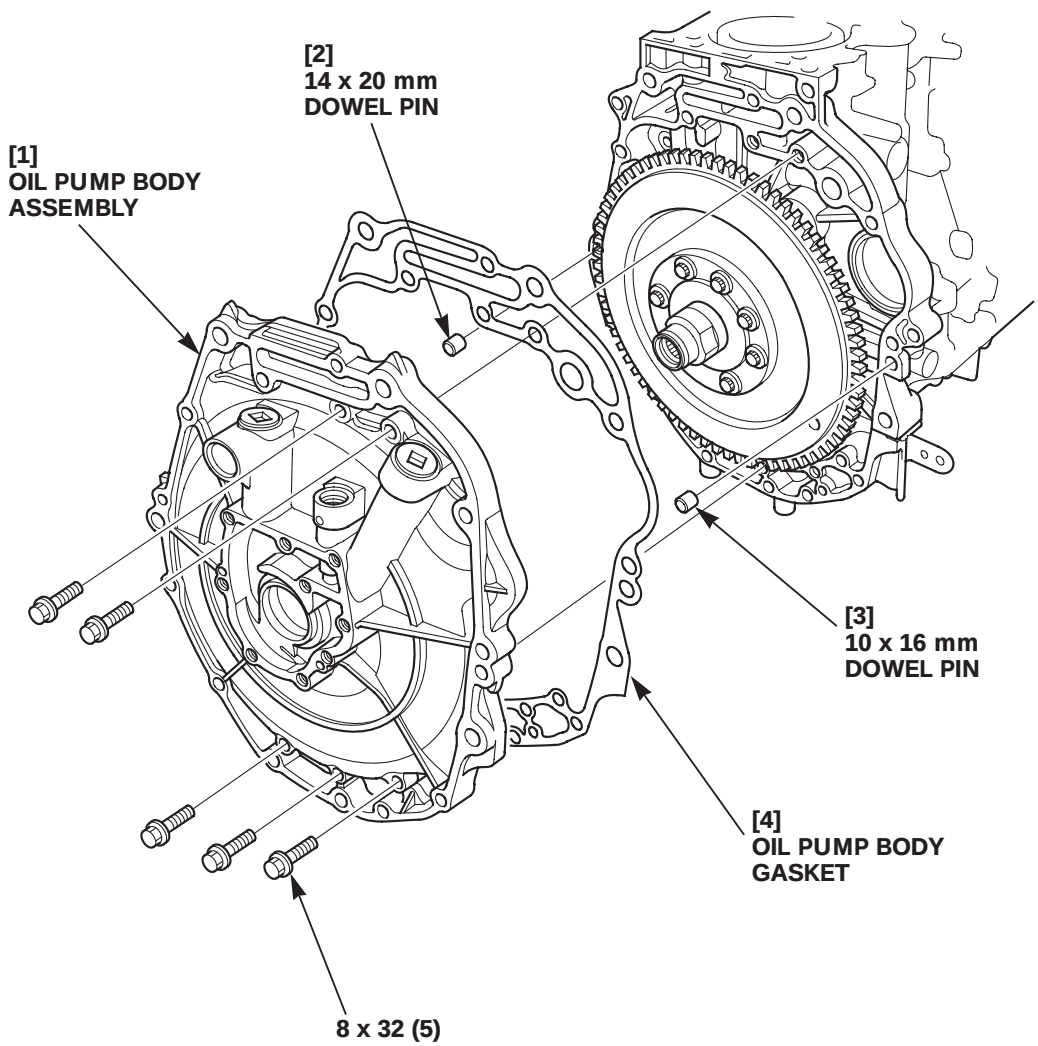


2. OIL PUMP

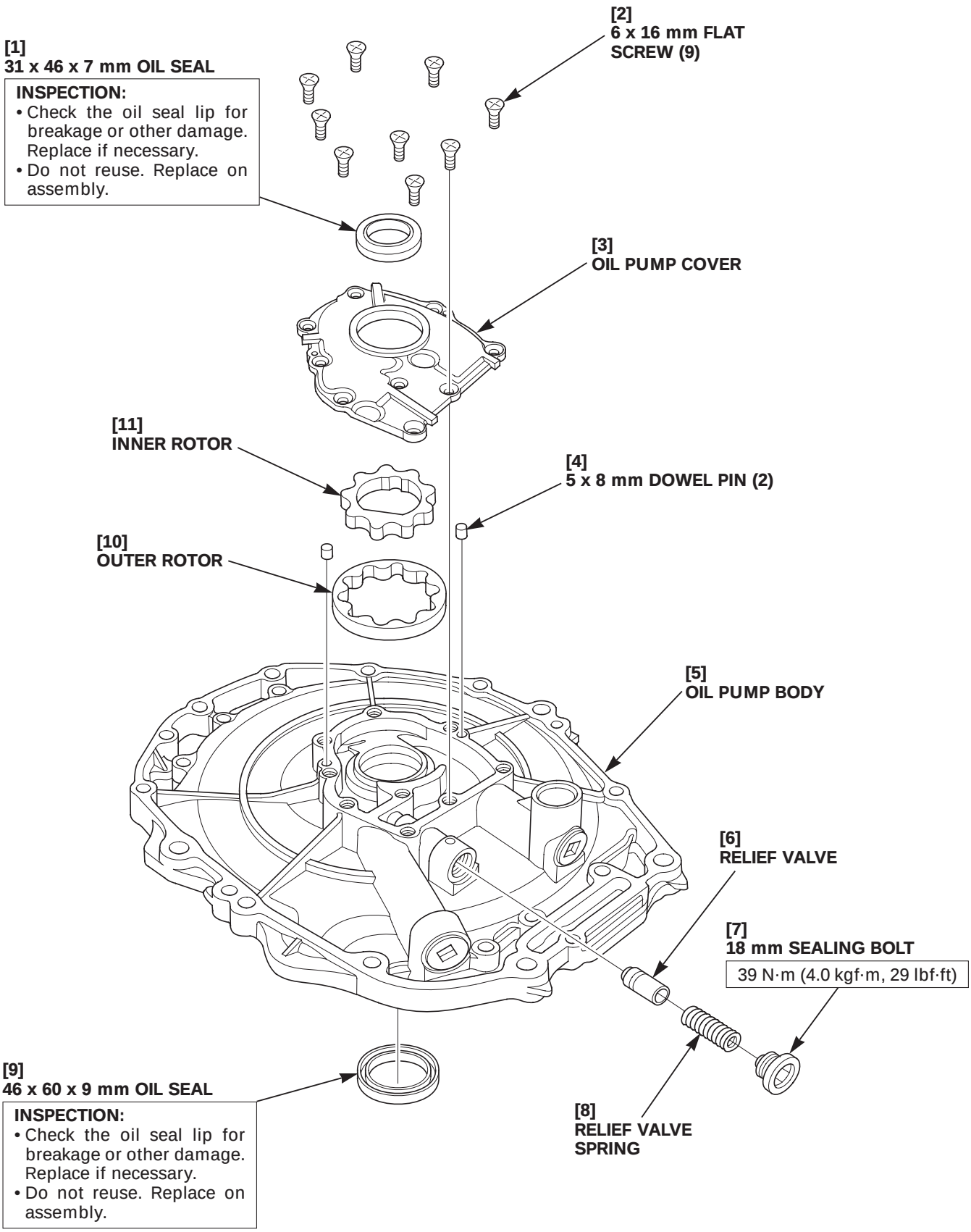
a. REMOVAL

1) Remove the engine from the outboard motor (P. 7-2).

2) Remove the five 8 x 32 mm flange bolts. Remove the oil pump body assembly, oil pump body gasket, 14 x 20 mm dowel pin and the 10 x 16 mm dowel pin.
Replace the oil pump body gasket with a new one on assembly.



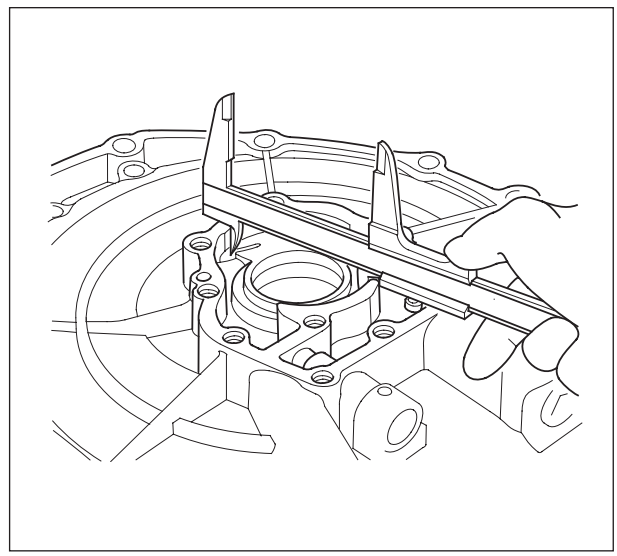
b. DISASSEMBLY



c. INSPECTION

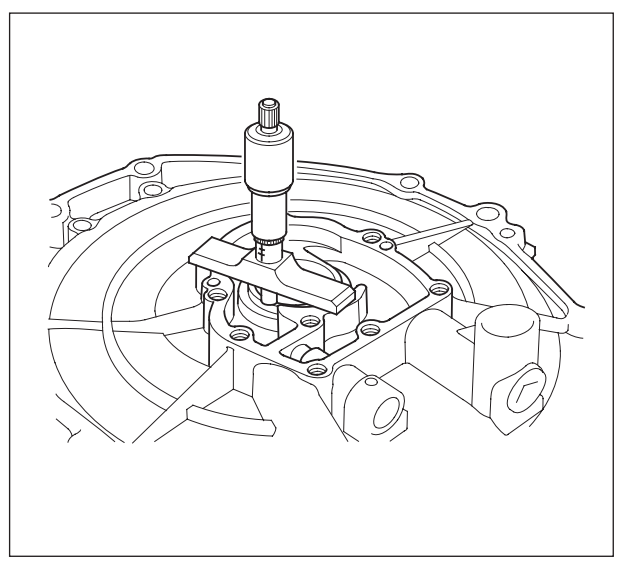
• OIL PUMP BODY I.D.

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



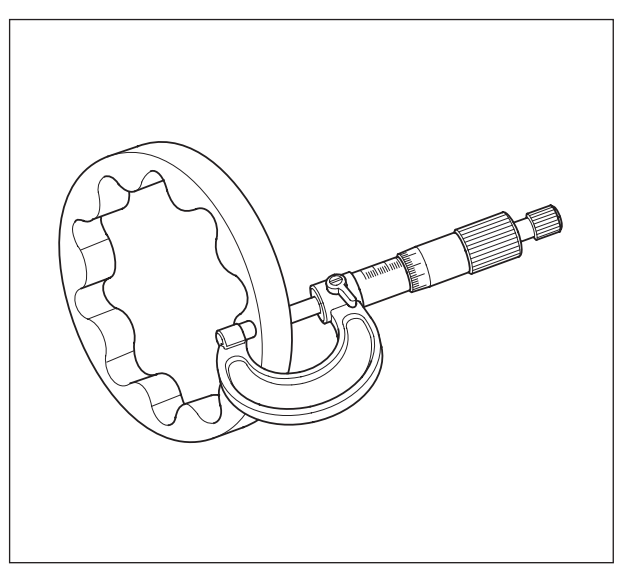
• OIL PUMP BODY DEPTH

STANDARD	SERVICE LIMIT
9.520 – 9.550 mm (0.3748 – 0.3760 in)	———



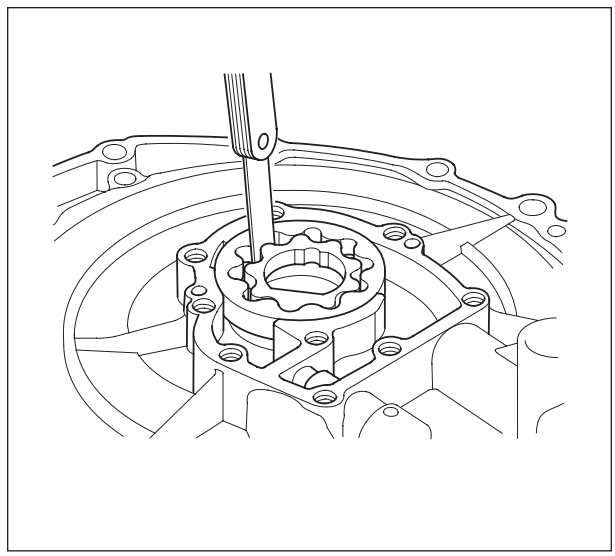
• OUTER ROTOR HEIGHT

STANDARD	SERVICE LIMIT
9.480 – 9.500 mm (0.3732 – 0.3740 in)	———



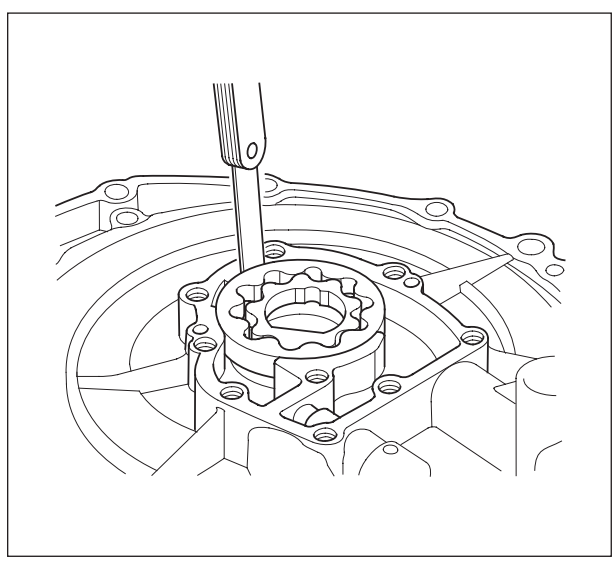
• INNER ROTOR-TO-OUTER ROTOR CLEARANCE

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



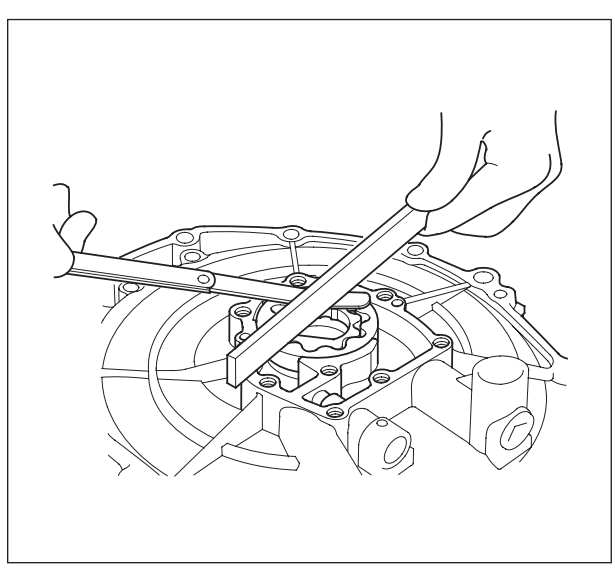
• OUTER ROTOR-TO-PUMP BODY CLEARANCE

STANDARD	SERVICE LIMIT
0.02 – 0.07 mm (0.001 – 0.003 in)	0.12 mm (0.005 in)



• OUTER ROTOR-TO-OIL PUMP BODY SIDE CLEARANCE

STANDARD	SERVICE LIMIT
0.14 – 0.19 mm (0.006 – 0.007 in)	0.20 mm (0.008 in)



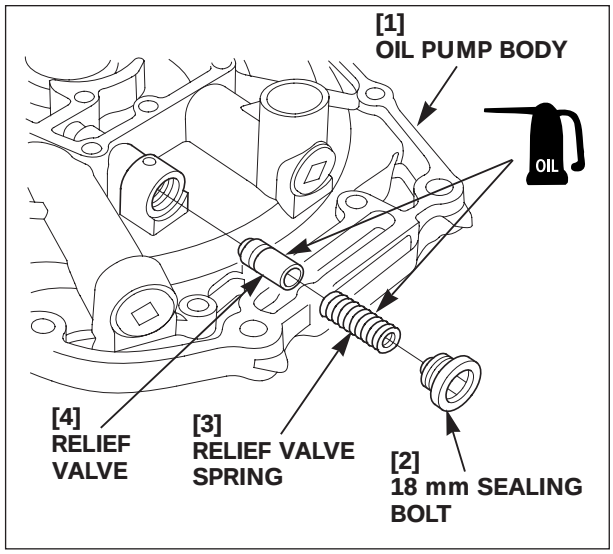
d. ASSEMBLY

1) Apply thread locking agent to the threads of the 18 mm sealing bolt.

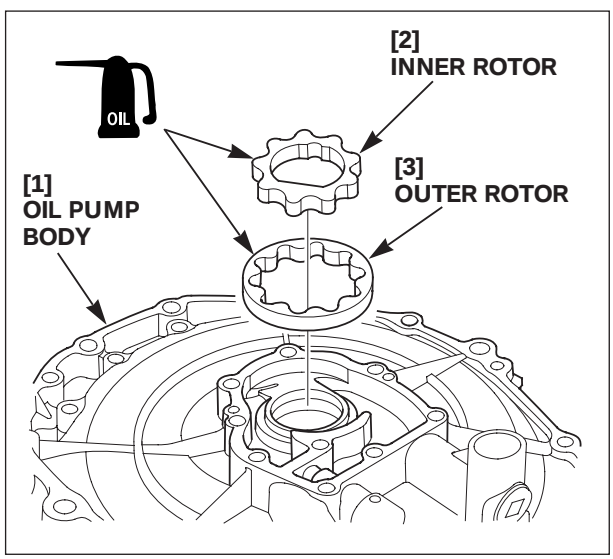
2) Check the relief valve surface for scores, scratches and other damage. Apply engine oil to the relief valve and the relief valve spring.

3) Install the relief valve and the relief valve spring in the oil pump body, and tighten the 18 mm sealing bolt to the specified torque.

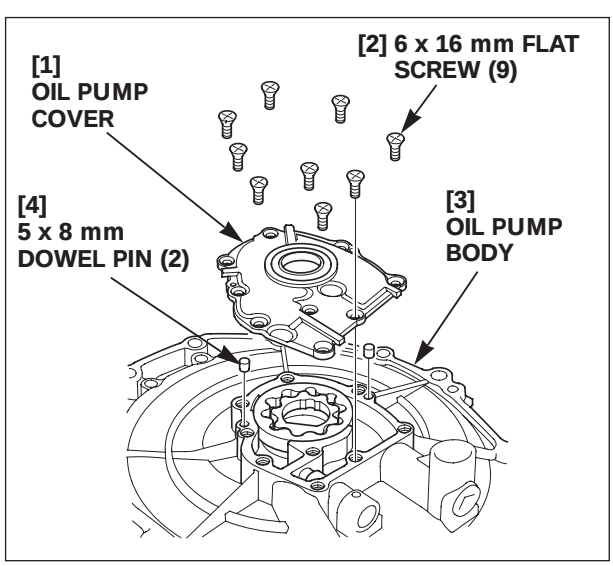
   TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)



4) Clean the inner rotor and the outer rotor thoroughly. Apply engine oil to the inner and outer rotors and install them on the oil pump body.
   Note to install the rotors in the same direction as the direction of the rotors noted on disassembly.



5) Install the two dowel pins and the oil pump cover on the oil pump body and tighten the nine 6 x 16 mm flat screws. Check that the rotors move smoothly.

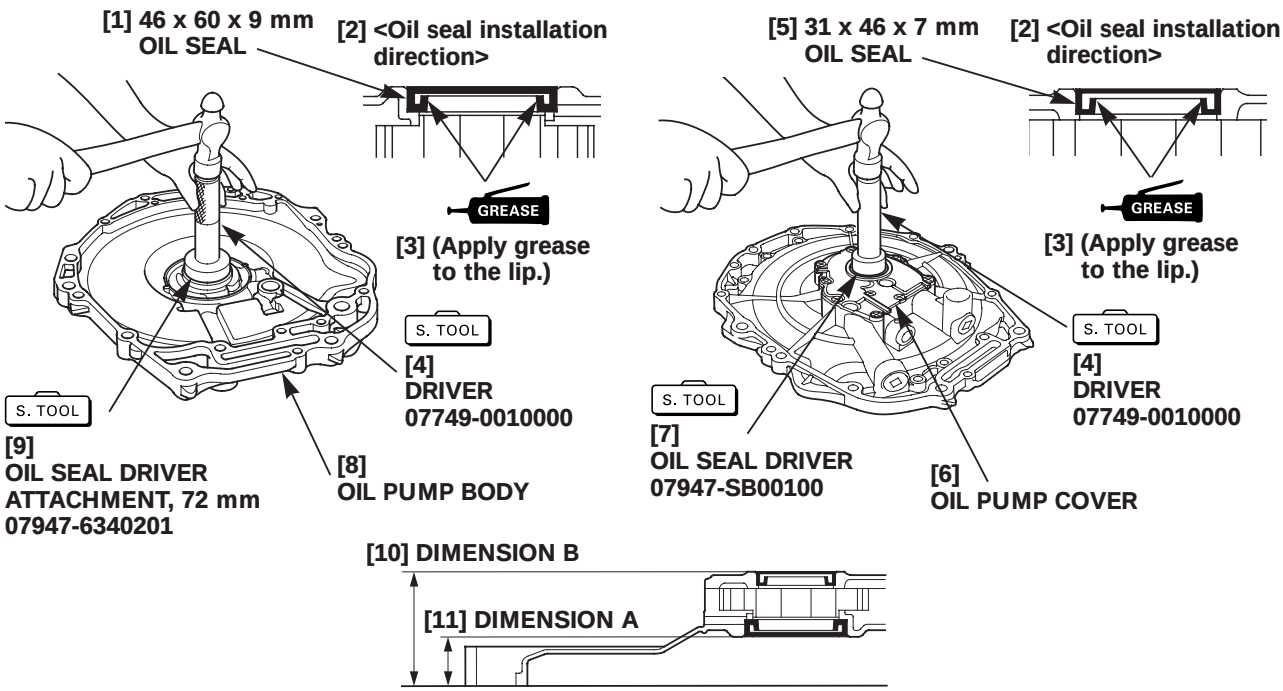


6) Apply soapy water to the outer surface of each new oil seal.
7) Using the special tools, drive the 46 x 60 x 9 mm oil seal into the oil pump body and the 31 x 46 x 7 mm oil seal into the oil pump cover so they set in the respective position of the dimensions shown.
   – Install the 46 x 60 x 9 mm oil seal so that the distance from the oil pump body end to the oil seal surface is 27.4 – 28.0 mm (1.08 – 1.10 in) (dimension A).
   – Install the 31 x 46 x 7 mm oil seal so that the distance from the oil pump body end to the oil seal surface is 63.9 – 64.5 mm (2.52 – 2.54 in) (dimension B) with the oil pump cover installed with the flat screws.

TOOLS:

Driver	**07749-0010000**
Oil seal driver attachment, 72 mm	**07947-6340201**
Oil seal driver	**07947-SB00100**

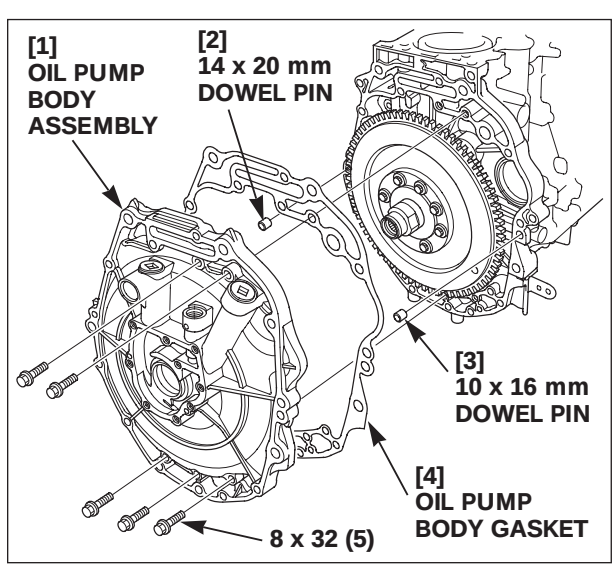
8) After installing the oil seals, apply grease to each oil seal lip.



e. INSTALLATION

1) Install the 14 x 20 mm dowel pin, 10 x 16 mm dowel pin, and the new oil pump body gasket on the engine side. Install the oil pump body and tighten the five 8 x 32 mm flange bolts.

2) Install the engine on the outboard motor (P. 7-6).



3. FLYWHEEL

a. REMOVAL

1) Remove the engine from the outboard motor (P. 7-2).

2) Remove the oil pump body assembly (P. 11-6).

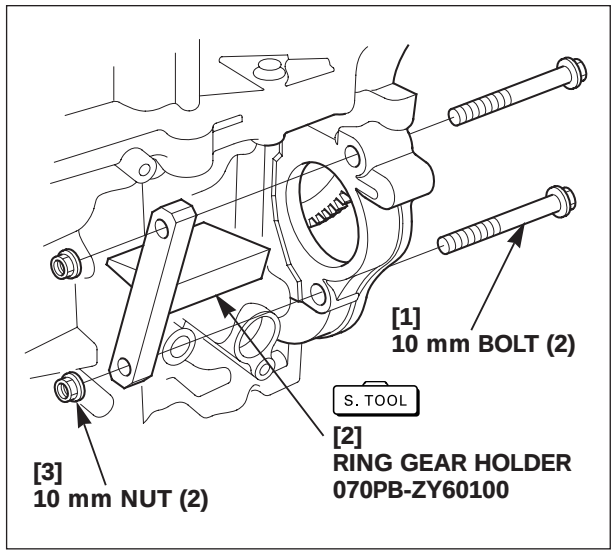
3) Set the special tool on the starter motor mounting part and temporarily tighten the special tool using the 10 mm bolts, 10 mm washers and the 10 mm nuts.

NOTICE

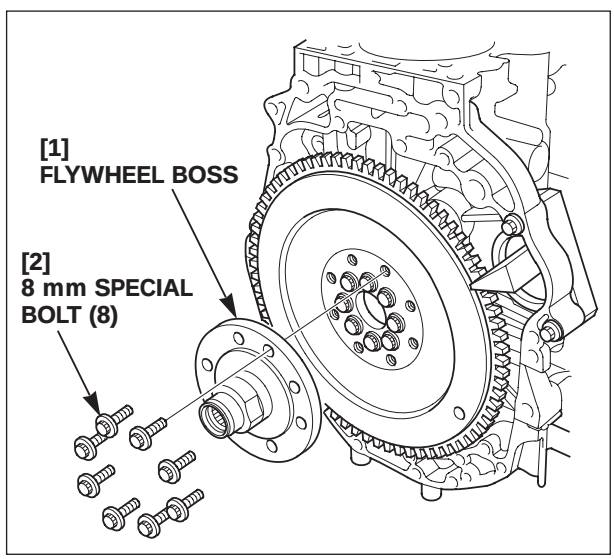
- *Do not damage the mating surface of the oil pump body gasket on the cylinder block.*
- *Check that the special tool is set on the ring gear securely.*

TOOL:

Ring gear holder	**070PB-ZY60100**

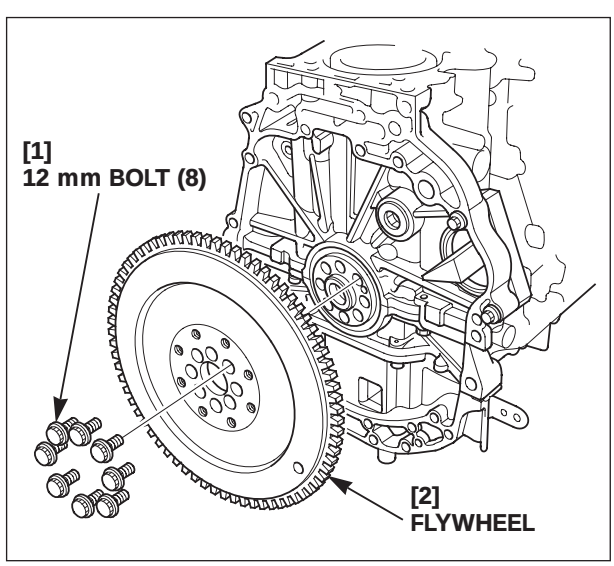


4) Remove the eight 8 mm special bolts and the flywheel boss.

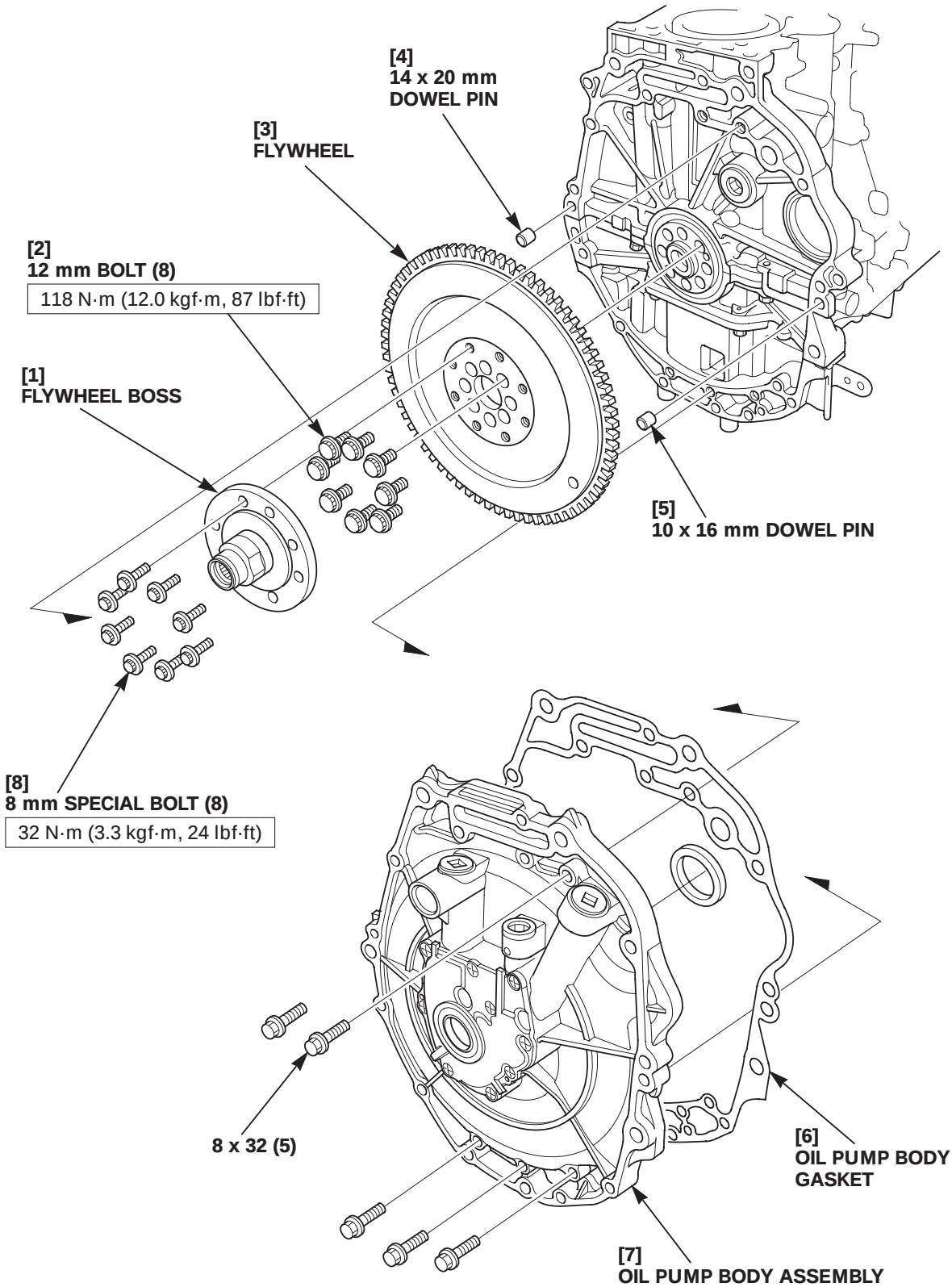


5) Remove the eight 12 mm bolts and the flywheel.

6) Remove the special tool.

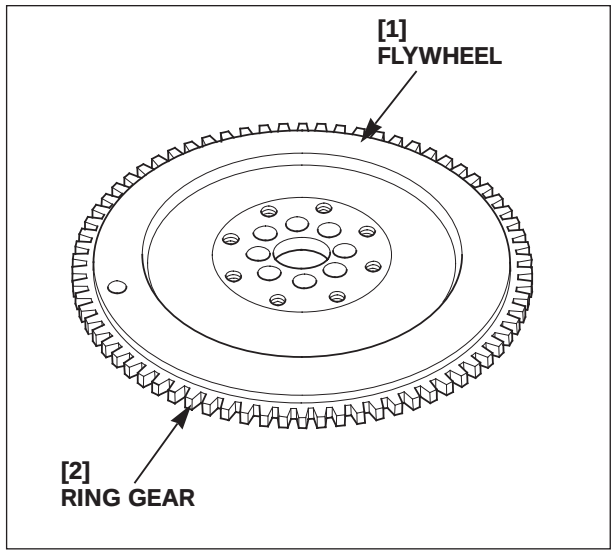


b. COMPONENTS DRAWING



c. INSPECTION

Check the ring gear for wear and damage. If it is worn or damaged, check the starter motor pinion gear.



d. INSTALLATION

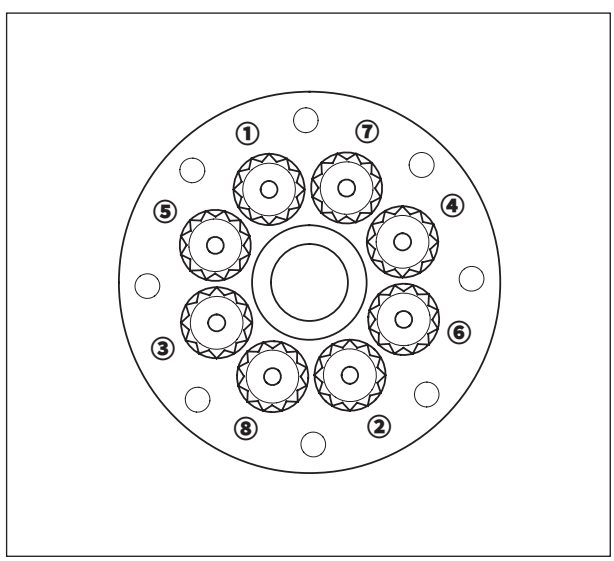
1) Clean the crankshaft and flywheel mating surfaces thoroughly with the degreasing cleaning agent.

2) Apply engine oil to the threads and seating surface of the 12 mm bolts.

3) Install the flywheel on the crankshaft and loosely tighten the eight 12 mm bolts. Install the special tool, that had been used for removal, on the starter motor mounting part (P. 11-12).

4) Tighten the 12 mm bolts to the specified torque in the numbered sequence in two or three steps.

   TORQUE: 118 N·m (12.0 kgf·m, 87 lbf·ft)



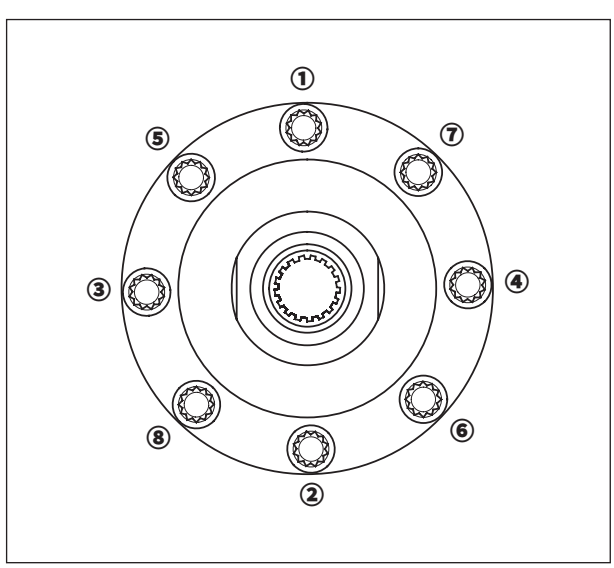
5) Clean the flywheel and flywheel boss mating surfaces thoroughly with the degreasing cleaning agent.
6) Apply engine oil to the threads and seating surface of the 8 mm special bolts.
7) Install the flywheel boss on the flywheel and loosely tighten the eight 8 mm special bolts.
8) Tighten the 8 mm special bolts to the specified torque in the numbered sequence in two to three steps.

   TORQUE: 32 N·m (3.3 kgf·m, 24 lbf·ft)

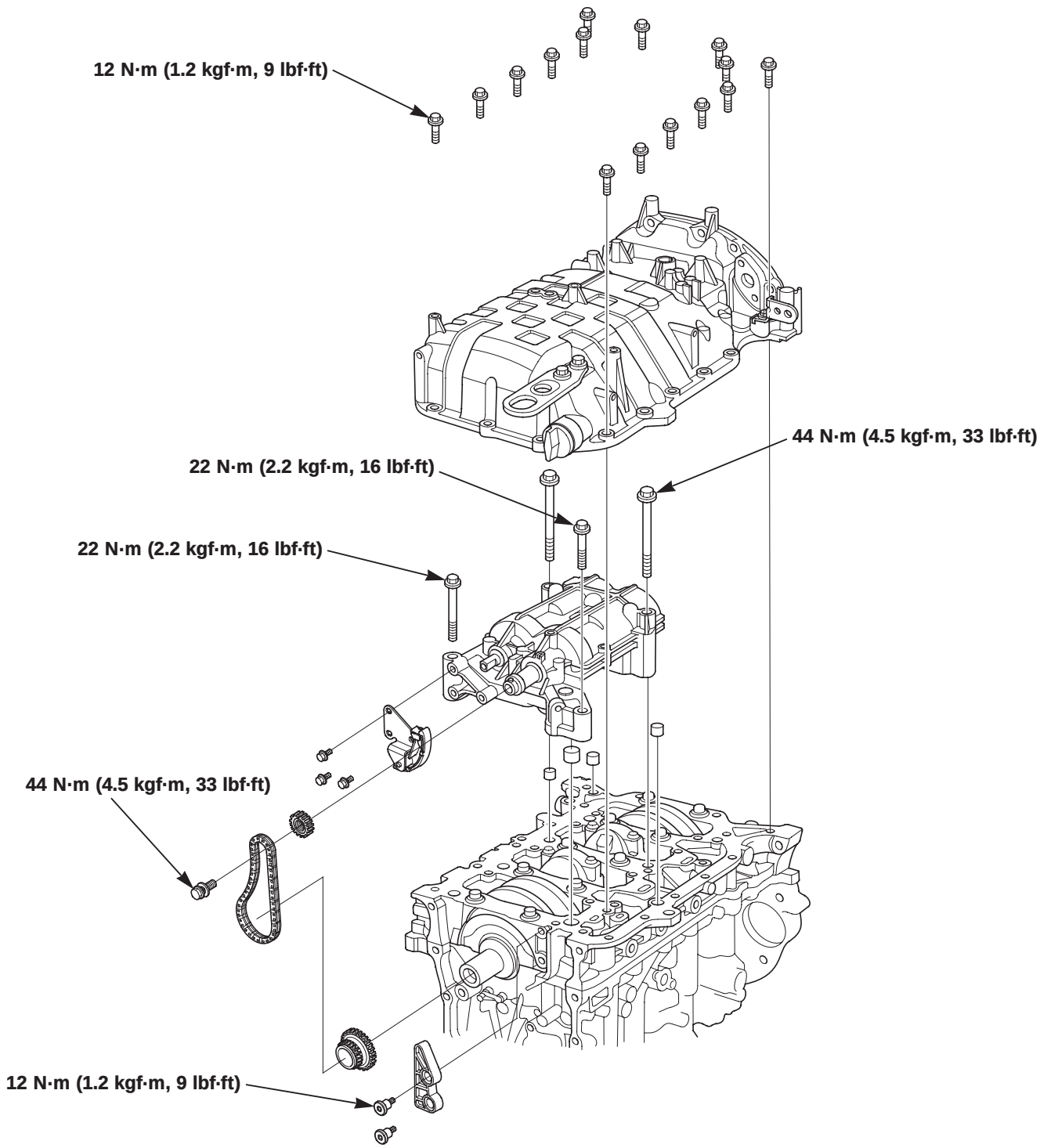
   NOTICE

   Be sure to clean the mating surfaces of the crankshaft, flywheel and the flywheel boss thoroughly with the degreasing cleaning agent.

9) Remove the special tool.
10) Install the oil pump body assembly (P. 11-11).
11) Install the engine on the outboard motor (P. 7-6).



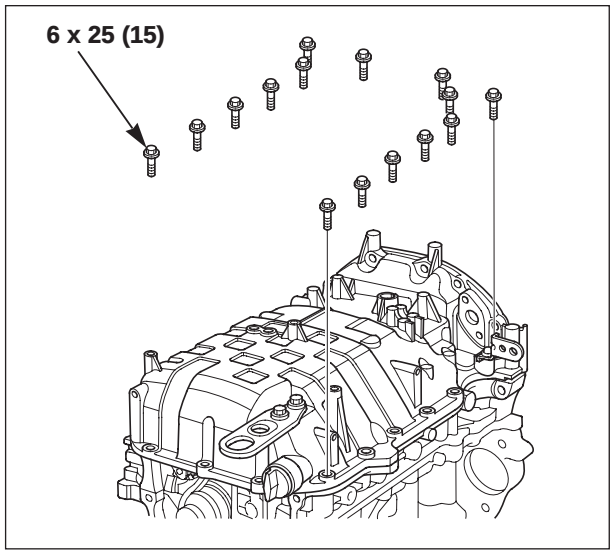
12. CRANKCASE/BALANCER



1. CRANKCASE/BALANCER CASE ASSEMBLY REMOVAL

Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Silencer case (P. 5-128)
– Throttle body/intake manifold (P. 5-129)
– Silencer duct (P. 6-2)
– Electric parts/main harness (P. 18-1, 15, 19 and 27)

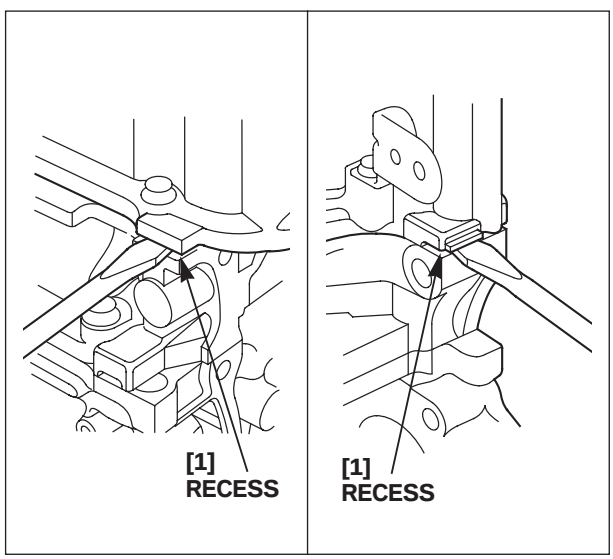
1) Move the remote control lever to the "N" (Neutral) position.
2) Turn the crankshaft pulley clockwise until it sets the No.1 piston at the top dead center of its compression stroke (P. 3-12).
   Remove the following parts.
   – Crankshaft pulley/cam chain (P. 9-2)
3) Remove the engine from the outboard motor (P. 7-2).
4) Remove the fifteen 6 x 25 mm flange bolts from the crankcase.



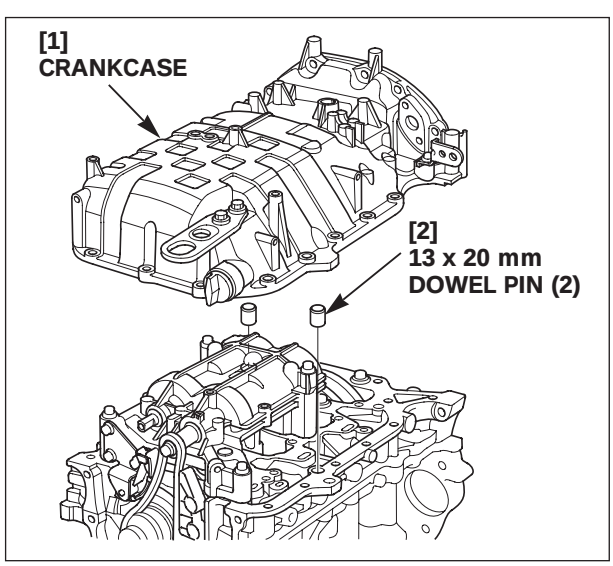
5) Insert the screwdriver into the recesses of the crankcase and raise the crankcase little by little.

NOTICE

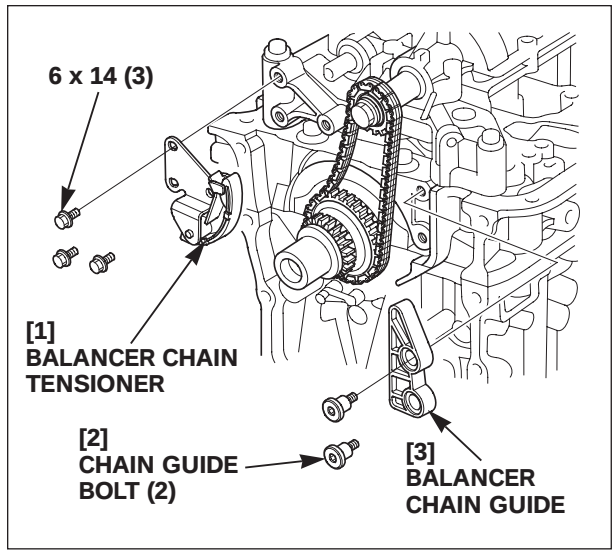
Take care not to damage the crankcase and lower block mating surfaces.



6) Remove the crankcase and the two dowel pins from the lower block.



7) Remove the two chain guide bolts and remove the balancer chain guide.
Remove the three 6 x 14 mm flange bolts and remove the balancer chain tensioner.

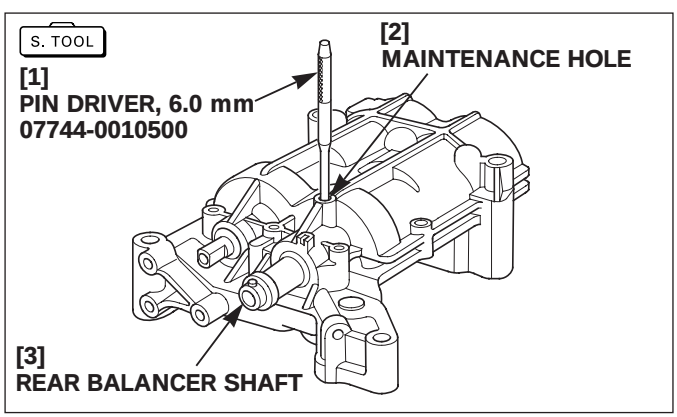


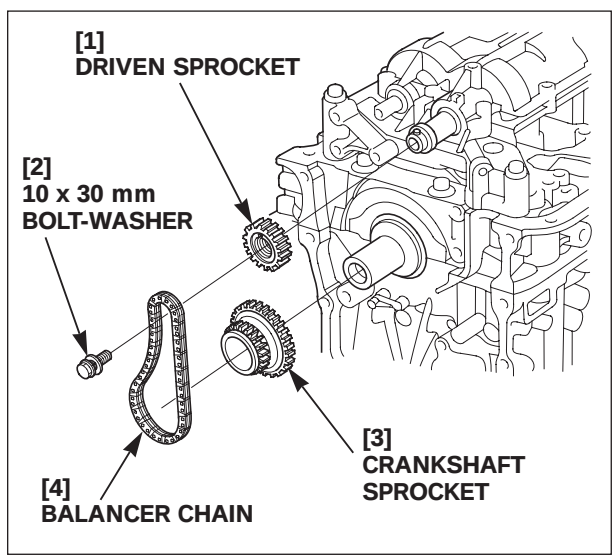
8) Hold the rear balancer shaft by inserting the special tool into the maintenance hole in the front balancer.
Remove the 10 x 30 mm bolt-washer and remove the crankshaft sprocket, driven sprocket and the balancer chain.

TOOL:
Pin driver, 6.0 mm **07744-0010500**

NOTICE

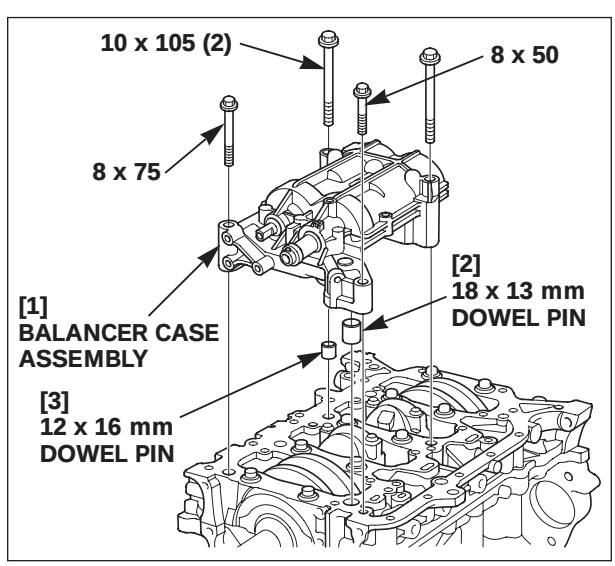
Check that the special tool is inserted in the balancer case assembly securely.



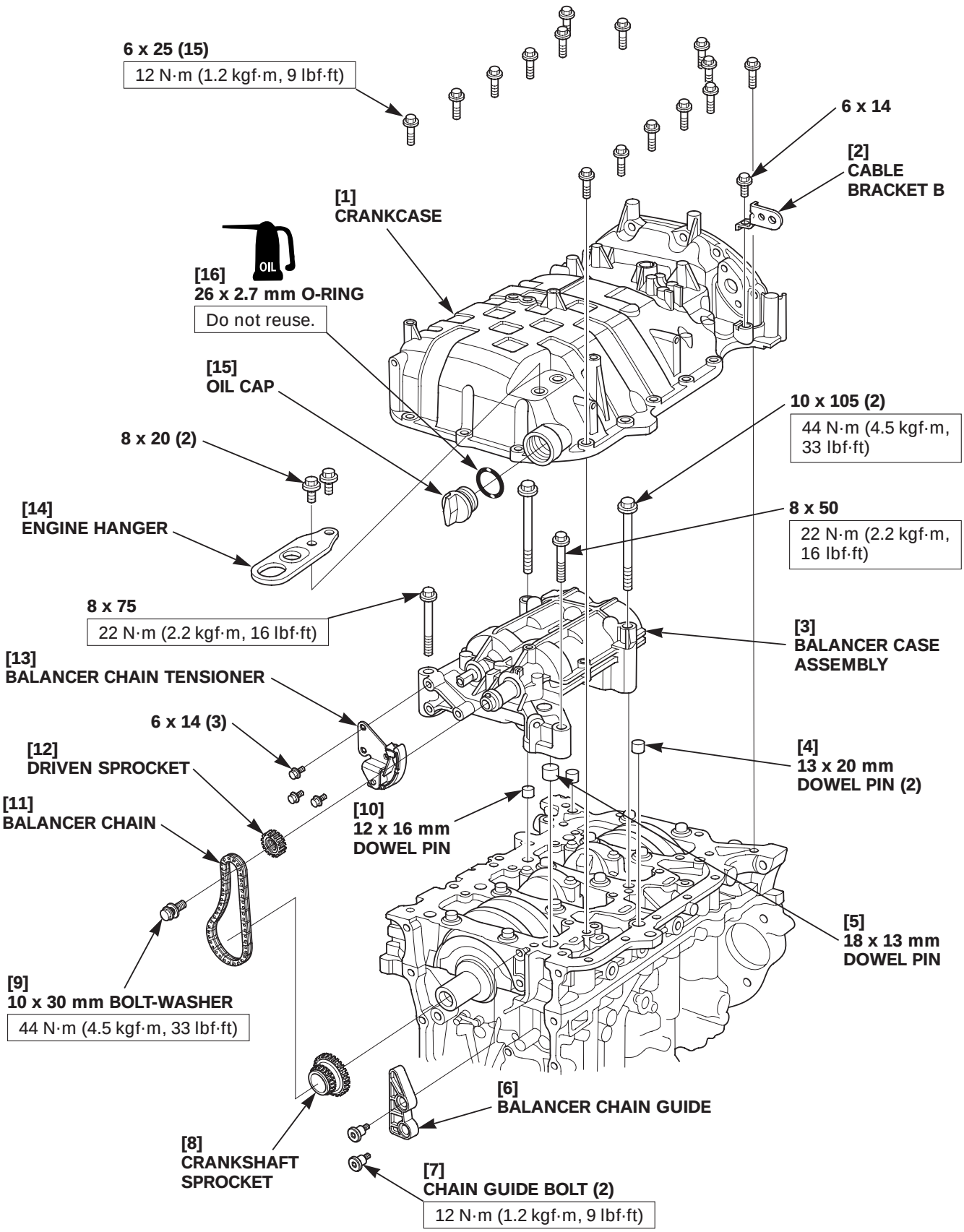


9) Remove the special tool from the balancer case assenbly.

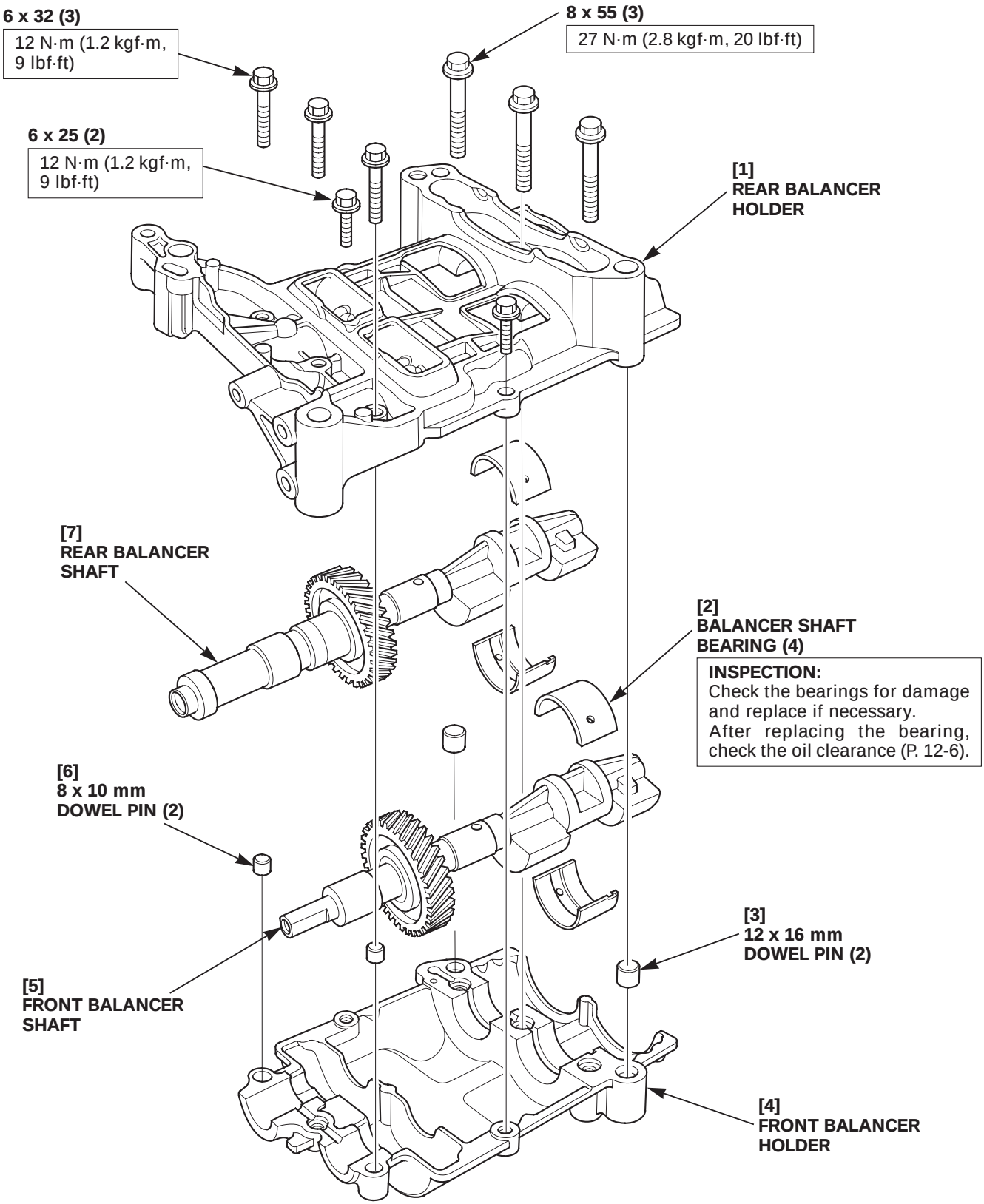
10) Remove the two 10 x 105 mm flange bolts, 8 x 75 mm flange bolt and the 8 x 50 mm flange bolt. Remove the balancer case assembly and the two dowel pins.



COMPONENTS DRAWING



2. BALANCER CASE ASSEMBLY DISASSEMBLY



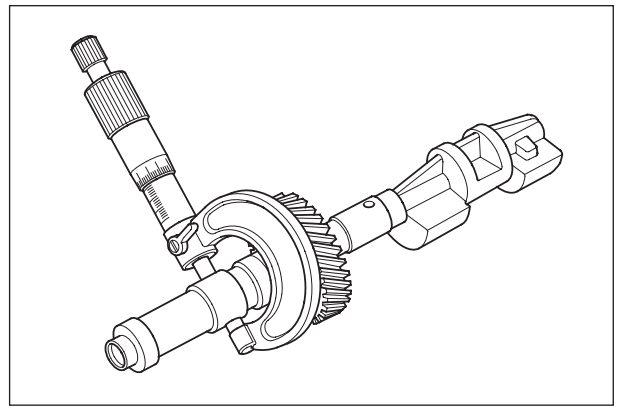
3. INSPECTION

• BALANCER SHAFT JOURNAL O.D.

Measure the O.D. of the balancer shaft No.1 journal.

	STANDARD	SERVICE LIMIT
Front	19.938 – 19.950 mm (0.7850 – 0.7854 in)	19.92 mm (0.784 in)
Rear	23.938 – 23.950 mm (0.9424 – 0.9429 in)	23.92 mm (0.942 in)

If the measurement exceeds the service limit, replace the balancer shaft.

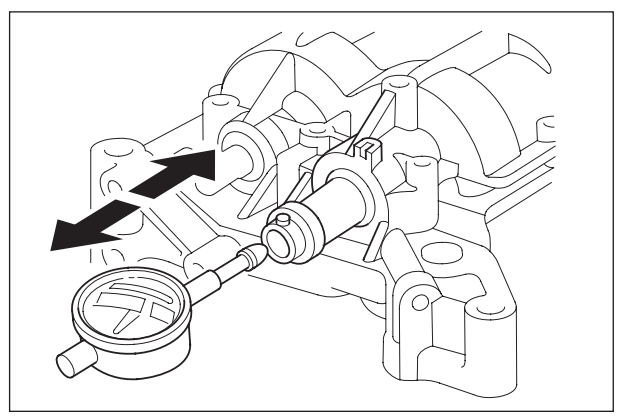


• BALANCER SHAFT AXIAL FREE PLAY

1) Assemble the balancer case assembly (P. 12-7).
2) Measure the balancer shaft axial play with the dial indicator by moving the balancer shaft back and force.

STANDARD	SERVICE LIMIT
0.060 – 0.140 mm (0.0024 – 0.0055 in)	0.15 mm (0.006 in)

3) If the measurement exceeds the service limit, replace the balancer case assembly.

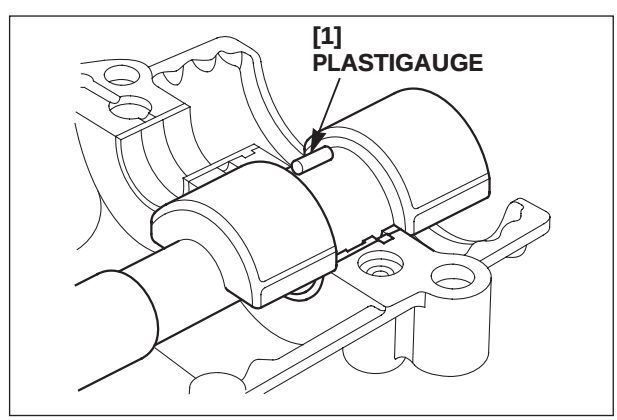


• BALANCER SHAFT OIL CLEARANCE

1) Clean the balancer shaft No.2 journal and the balancer holder bearing. Check the journal and the bearing for damage and wear.
2) Assemble the balancer case assembly (P. 12-7).
3) Remove the rear balancer holder. Set a plastigauge on the balancer shaft No.2 journal as shown.

NOTICE

- *Set the plastigauge in the axial direction on the balancer shaft No.2 journal.*
- *Do not turn the balancer shaft while checking oil clearance.*



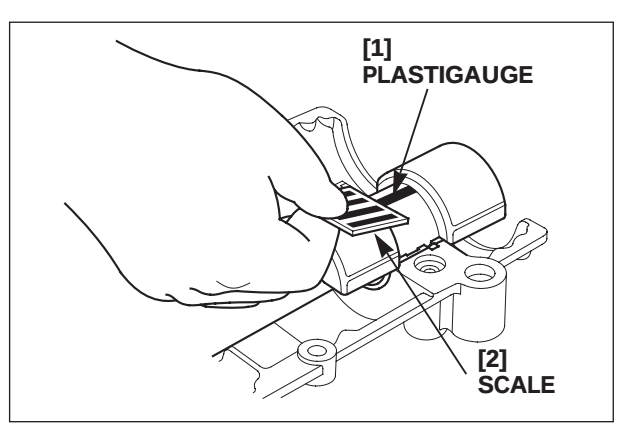
4) Reinstall the rear balancer holder and tighten the bolts to the specified torque (P. 12-7).

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

NOTICE

Measure the widest width on the plastigauge.

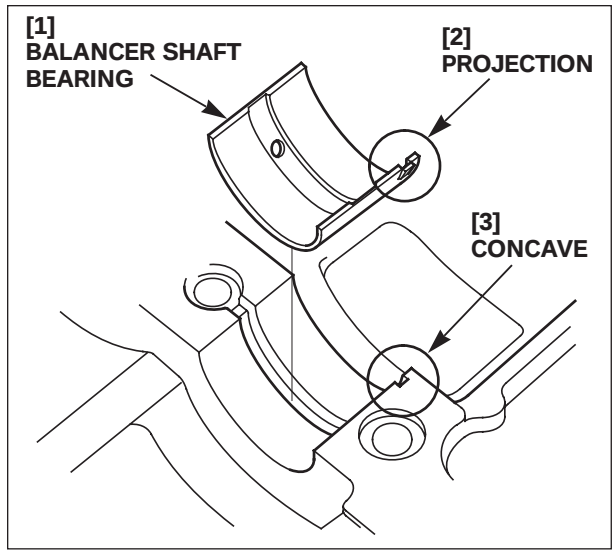
STANDARD	SERVICE LIMIT
0.060 – 0.120 mm (0.0024 – 0.0047 in)	0.15 mm (0.006 in)



6) If the measurement exceeds the service limit, replace the balancer shaft bearing and recheck the oil clearance.
If the measurement still exceeds the service limit, replace the balancer shaft.

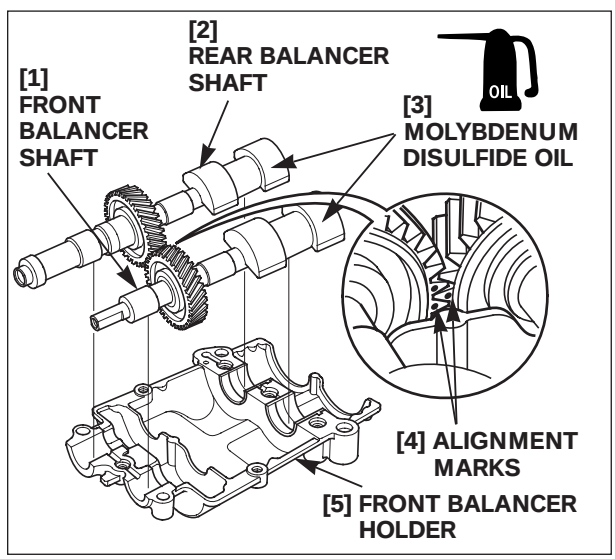
4. BALANCER CASE ASSEMBLY ASSEMBLY

1) Install the four balancer shaft bearings on the front/rear balancer holders by aligning the projection on each balancer shaft bearing with the concave at the corresponding bearing installation part of the front/rear balancer shaft.



2) Apply molybdenum disulfide oil to each journal of the balancer shaft.

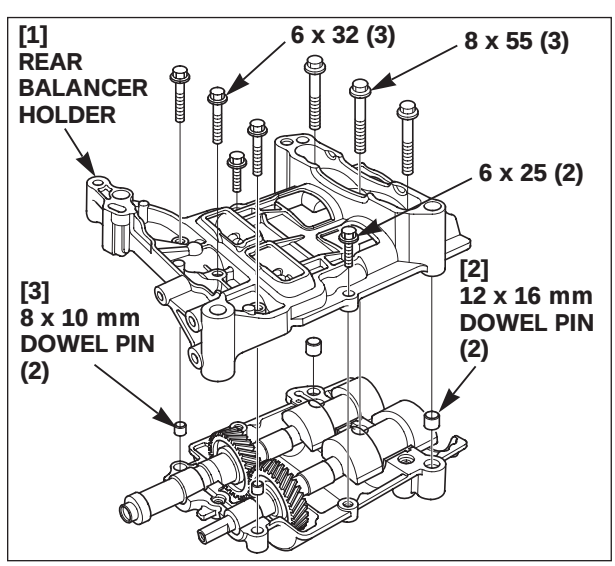
3) Install the front and rear balancer shafts on the front balancer holder while aligning the alignment marks on each of the front and rear balancer shaft gears as shown.



4) Apply engine oil to the threads and seat of the 8 x 55 mm flange bolts.

5) Install the four dowel pins and the rear balancer holder on the front balancer holder. Tighten the bolts to the specified torque.

TORQUE:
8 x 55 mm flange bolt: 27 N·m (2.8 kgf·m, 20 lbf·ft)
6 x 32 mm flange bolt,
6 x 25 mm flange bolt: 12 N·m (1.2 kgf·m, 9 lbf·ft)

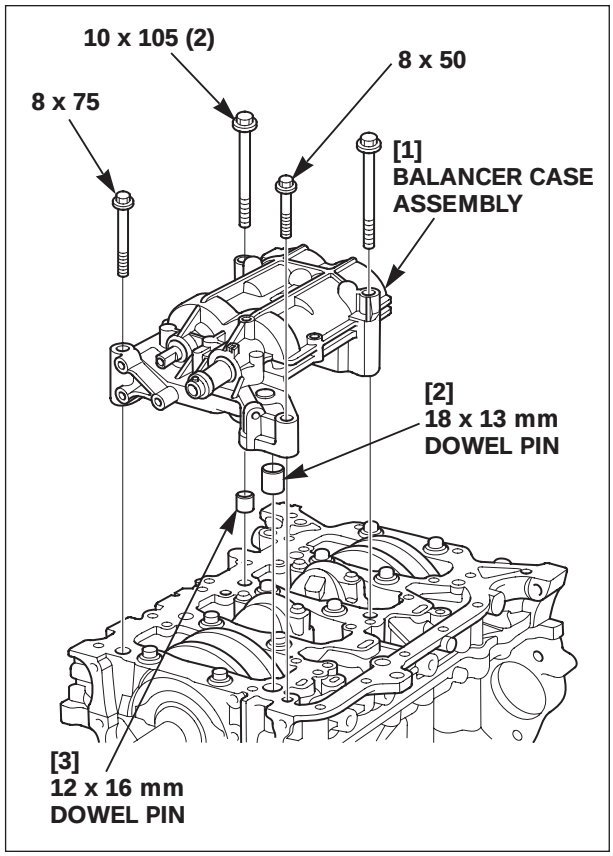


5. CRANKCASE/BALANCER CASE ASSEMBLY INSTALLATION

1) Apply engine oil to the threads and seat of each bolt.

2) Install the balancer case assembly and the two dowel pins on the lower block and tighten the bolts to the specified torque.

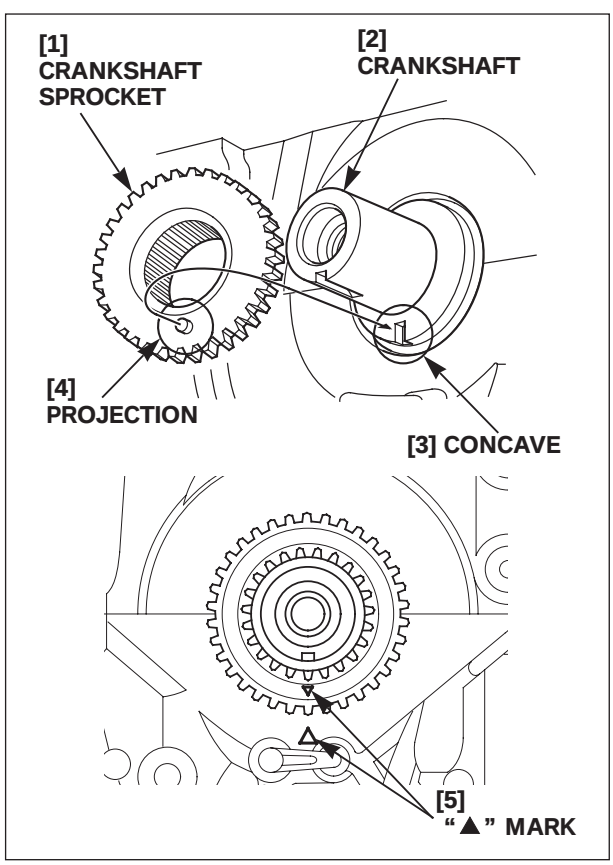
TORQUE:
10 x 105 mm flange bolt: 44 N·m (4.5 kgf·m, 33 lbf·ft)
8 x 75 mm flange bolt,
8 x 50 mm flange bolt: 22 N·m (2.2 kgf·m, 16 lbf·ft)



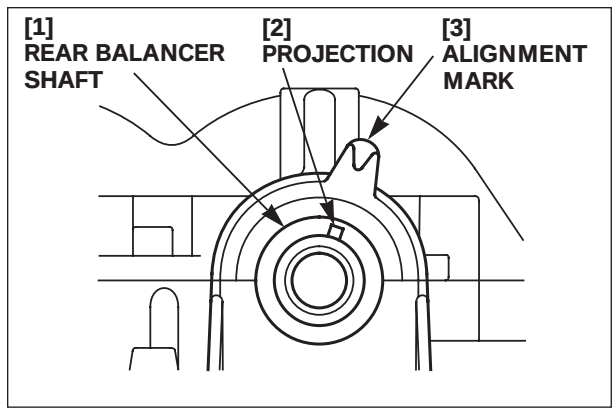
3) Install the crankshaft sprocket on the crankshaft aligning the projection on the crankshaft sprocket with the concave in the crankshaft.
After installation, check that the "▲" mark on the crankshaft sprocket aligns with the "▲" mark on the cylinder block.

NOTICE

The No.1 piston is at the top dead center of its compression stroke when the "▲" mark on the crankshaft sprocket aligns with the "▲" mark on the cylinder block.



4) Align the alignment mark on the front balancer holder with the projection on the rear balancer shaft.

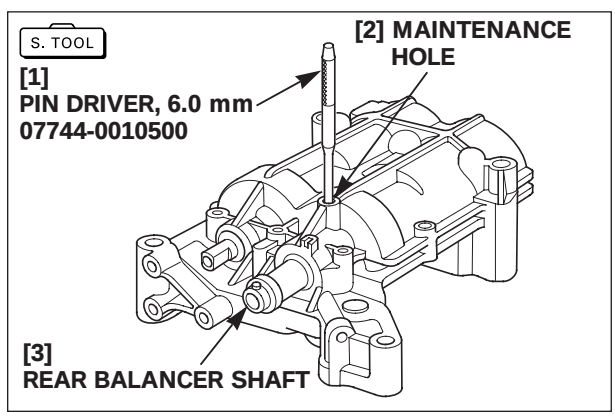


5) Hold the rear balancer shaft by inserting the special tool into the maintenance hole in the front balancer.

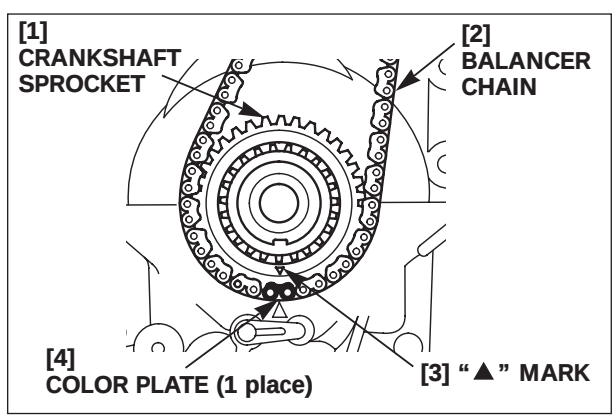
TOOL:
Pin driver, 6.0 mm **07744-0010500**

NOTICE

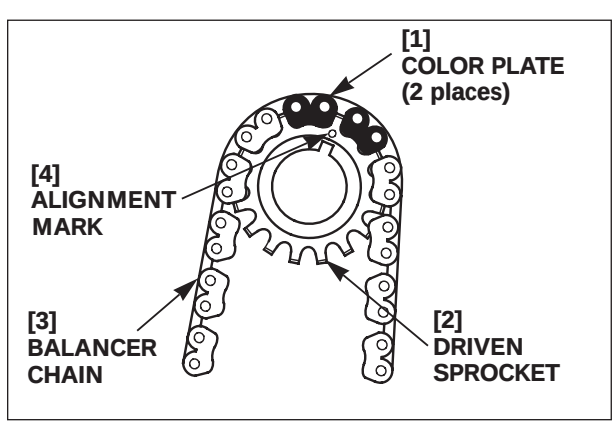
Check that the special tool is inserted in the balancer case assembly securely.



6) Install the balancer chain on the crankshaft sprocket while aligning the "▲" mark on the crankshaft sprocket with the color plate (1 place) of the balancer chain.



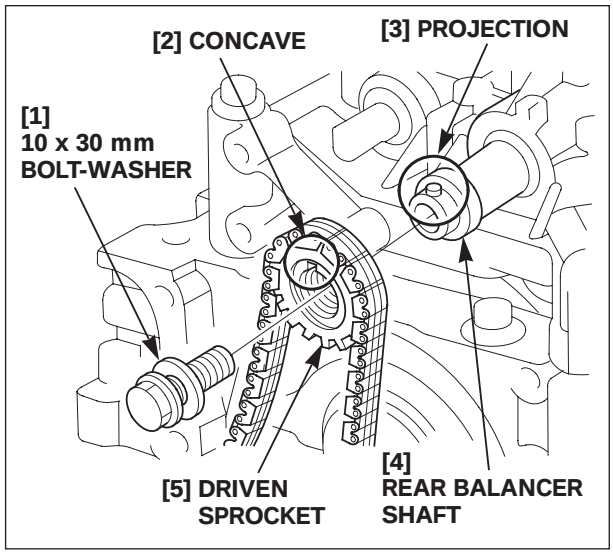
7) Install the driven sprocket on the balancer chain while aligning the alignment mark on the driven sprocket with the color plates (2 places) of the balancer chain.



8) Install the driven sprocket together with the balancer chain on the rear balancer shaft by aligning the concave in the driven sprocket with the projection on the rear balancer shaft.

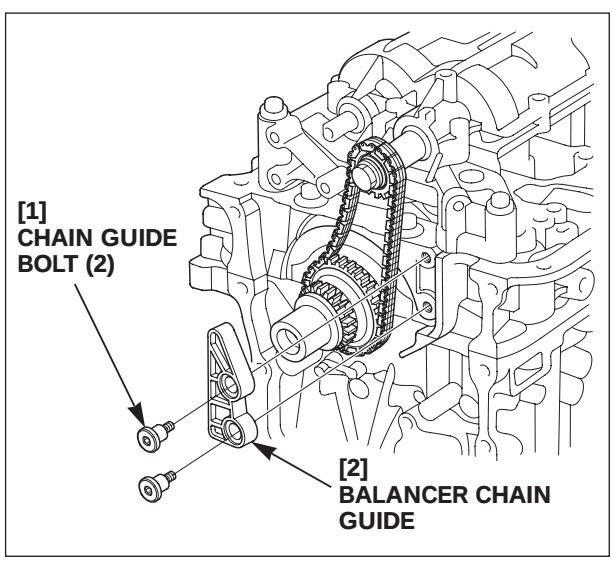
TORQUE: 44 N·m (4.5 kgf·m, 33 lbf·ft)

After installation, remove the special tool from the balancer case assembly.

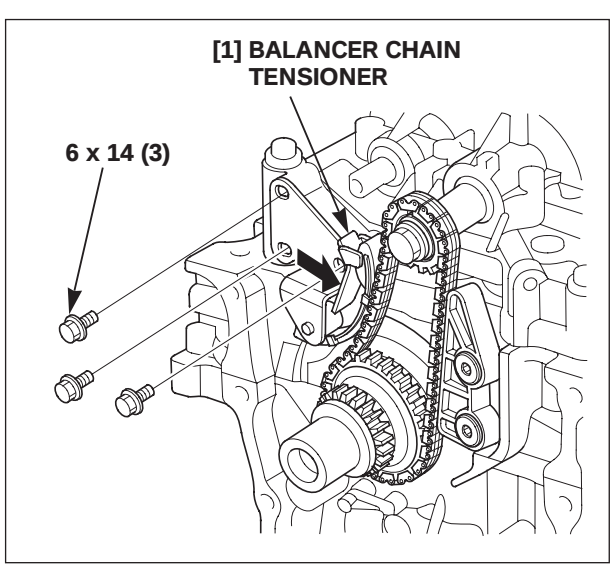


9) Install the balancer chain guide on the lower block and tighten the two chain guide bolts to the specified torque.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

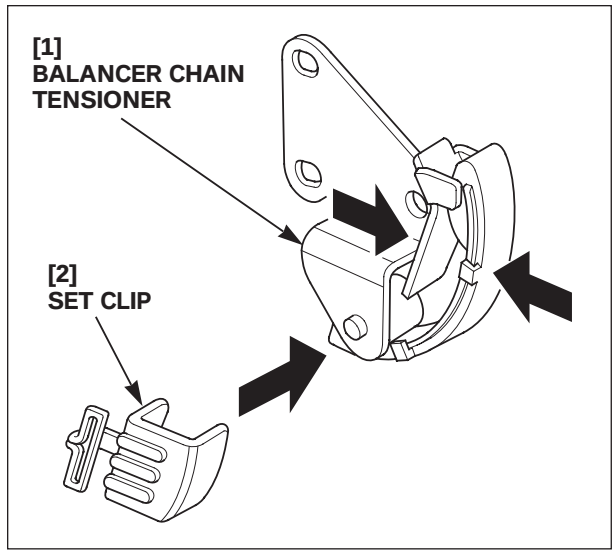


10) Pushing the balancer chain tensioner against the balancer chain, install the balancer chain tensioner on the balancer holder. Tighten the three 6 x 14 mm flange bolts.

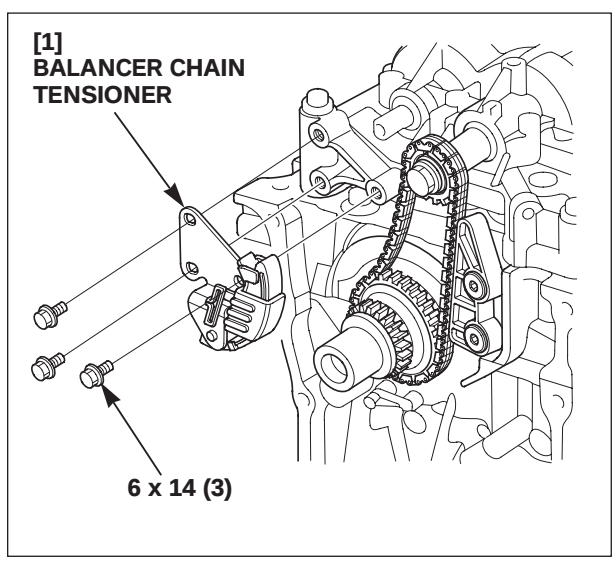


After replacing the balancer chain tensioner with new one:

11) Install the set clip, that came together with the new balancer chain tensioner, on the balancer chain tensioner.



12) Install the balancer chain tensioner assembled in step 10 on the rear balancer holder and tighten the three 6 x 14 mm flange bolts.
After installation, remove the set clip from the balancer chain tensioner.

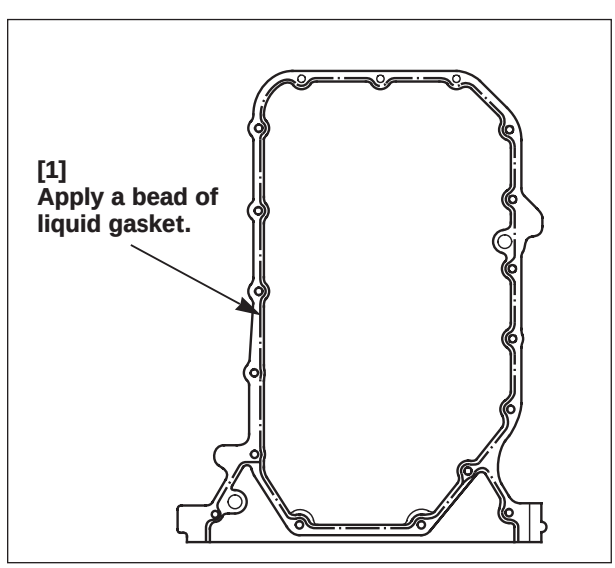


13) Install the crankshaft pulley/cam chain (P. 9-11).

NOTICE

- *Do not apply the liquid gasket to the chain case and crankcase mating surfaces.*
- *Do not tighten the three bolts of the chain case/crankcase mating side and do not install the crankshaft pulley.*

14) Clean the crankcase and lower block mating surfaces thoroughly with the degreasing cleaning agent.
15) Apply a bead [ø2.0 – 3.0 mm (ø0.08 – 0.12 in)] of the liquid gasket (ThreeBond® #1280B or equivalent) to the indicated area of the crankcase.

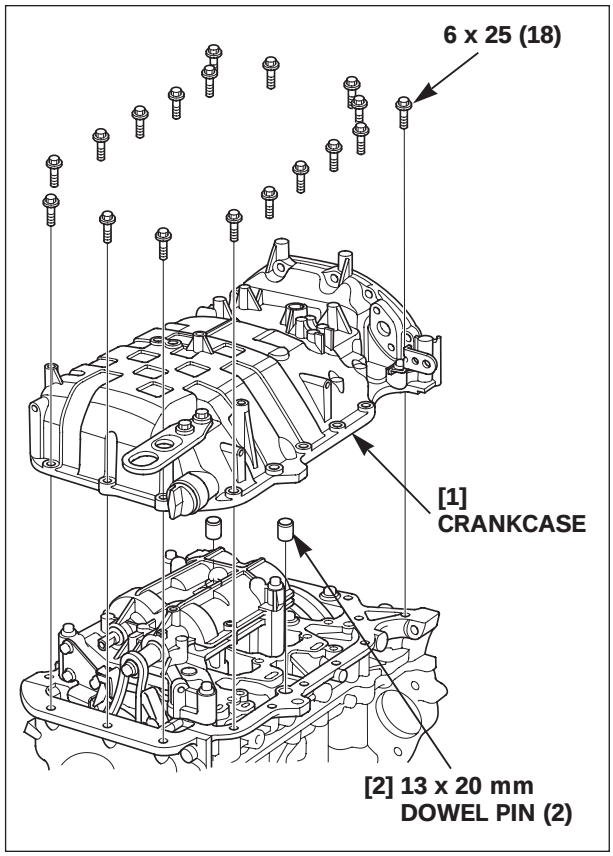


NOTICE

- *Assemble the crankcase within 5 minutes after applying the liquid gasket. If it has been left for 5 minutes or longer, remove the old liquid gasket and apply the liquid gasket again.*
- *Do not pour the engine oil in the oil tank at least 30 minutes after assembly.*

16) Apply engine oil to the threads and seat of the 6 x 25 mm flange bolts

17) Install the two dowel pins and crankcase on the lower block and loosely tighten the 6 x 25 mm flange bolts.

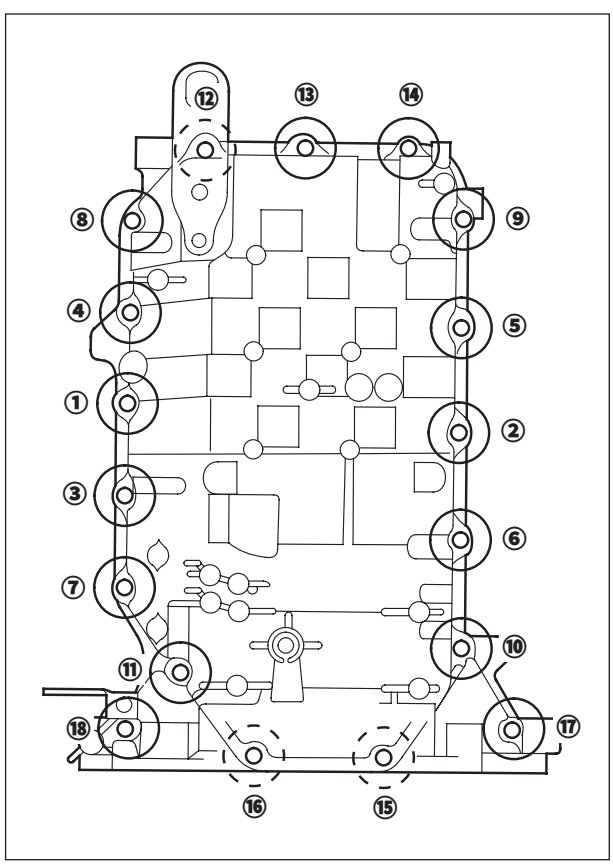


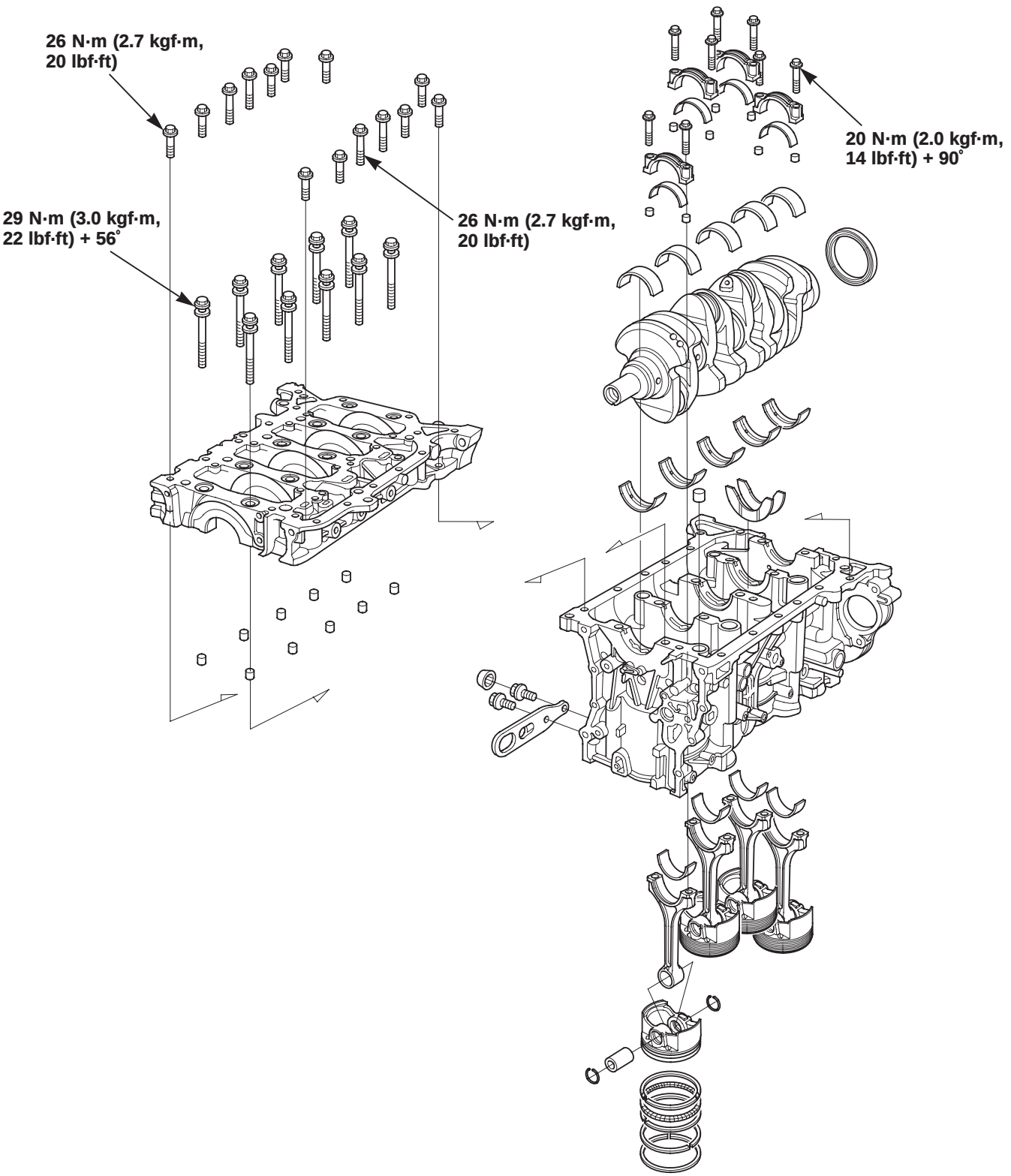
18) Tighten the 6 x 25 mm flange bolts to the specified torque in the numbered sequence in two to three steps.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

19) Install the engine on the outboard motor (P. 7-6).

20) Install the following parts.
- Crankshaft pulley (P. 9-17)
- Electric parts/main wire harness (P. 18-14, 17, 19 and 27)
- Silencer duct (P. 6-4)
- Throttle body/intake manifold (P. 5-132)
- Silencer case (P. 5-135)
- L./R. engine under covers (P. 4-14)
- Engine cover (P. 4-2)



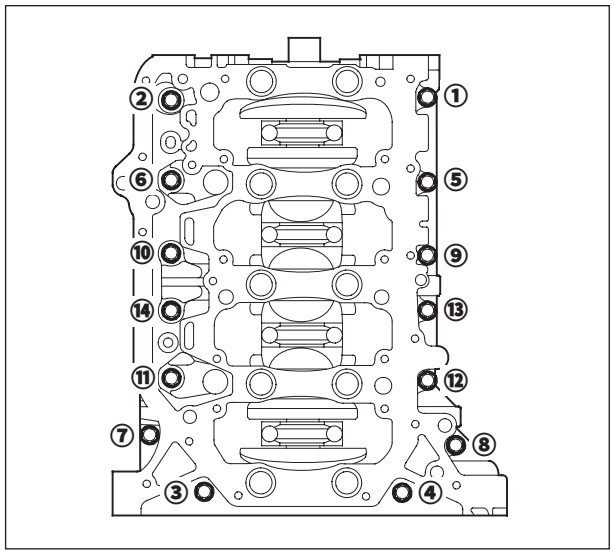


1. DISASSEMBLY

a. LOWER BLOCK/CRANKSHAFT/CYLINDER BLOCK

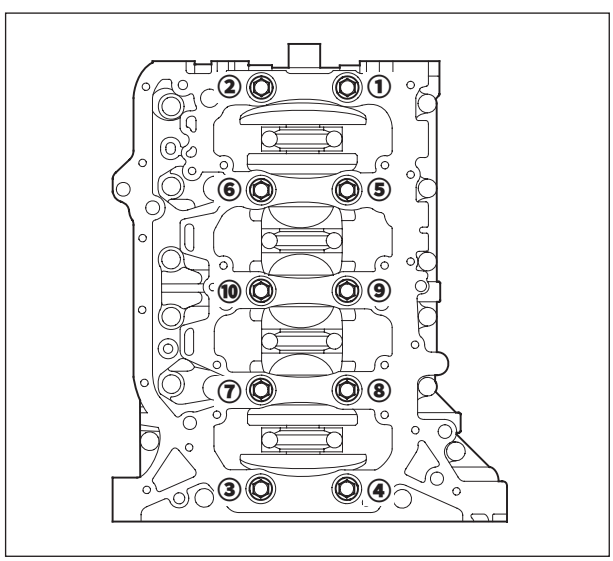
Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Cylinder head assembly (P. 10-19)
– Engine assembly (P. 7-2)
– Oil pump (P. 11-6)
– Flywheel (P. 11-12)
– Crankcase/balancer case assembly (P. 12-2)

1) Loosen the bolts in the numbered sequence in two or three steps.



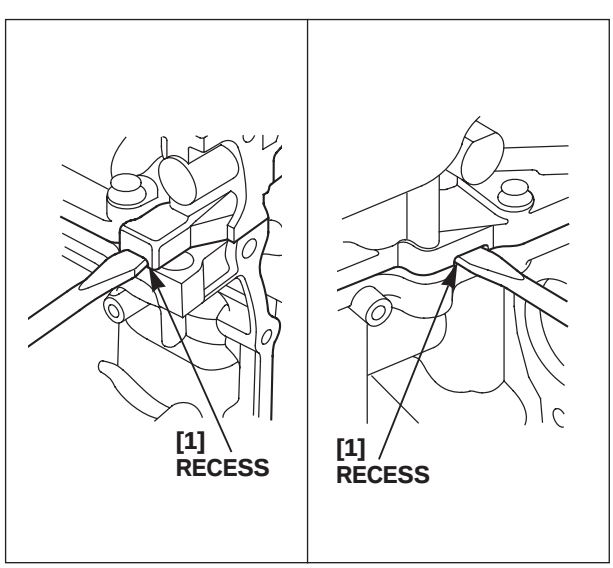
2) Remove the four 8 x 50 mm flange bolts and ten 8 x 35 mm flange bolts from the lower block.

3) Loosen the ten 11 x 95 mm washer bolts in the numbered sequence in two or three steps.

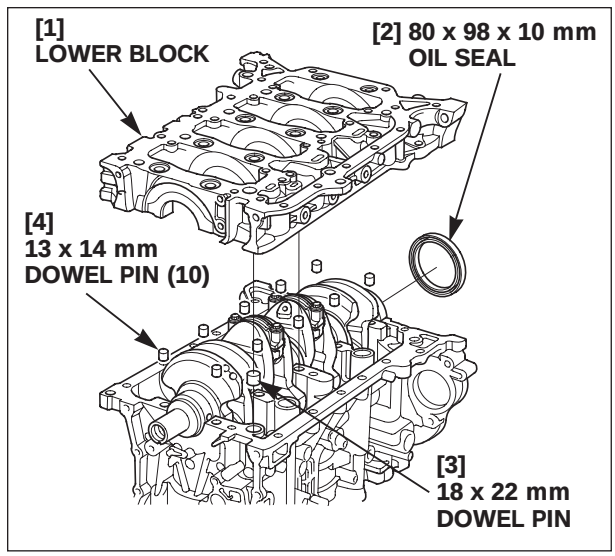


4) Remove the ten 11 x 95 mm washer bolts from the lower block.

5) Insert the screwdriver into the recesses of the lower block and raise the lower block little by little.



6) Remove the lower block, 80 x 98 x 10 mm oil seal and the eleven dowel pins from the cylinder block.
Replace the oil seal on assembly.



7) Check the lower main bearings for damage (scores, scratches, etc.) and replace if necessary.
8) Remove the five lower main bearings from the lower block.

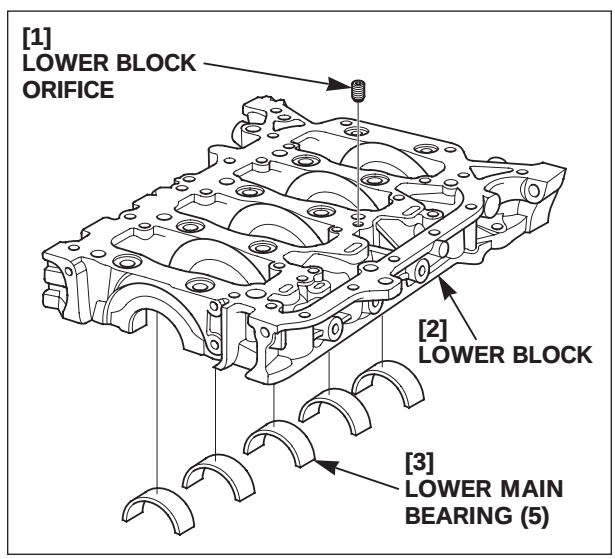
NOTICE

Store the removed lower main bearings separately for each journal.

9) Remove the lower block orifice from the lower block and check the lower block orifice for blockage.
If it is clogged, clean it with a cleaning solvent and remove the blockage by blowing the oil passage with the compressed air.
If the blockage cannot be removed by blowing with the compressed air, replace the lower block orifice with a new one.

NOTICE

Remove the blockage with care not to damage the oil passage of the lower block orifice.

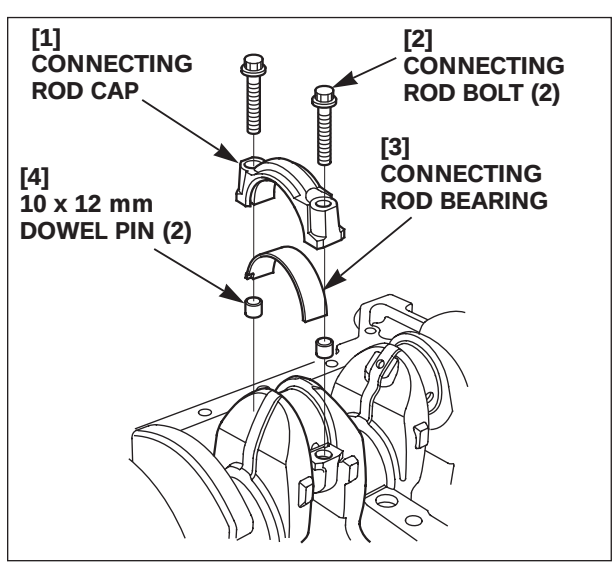


10) Check that the piston is at the bottom dead center of its stroke. If not, move the piston to the bottom dead center by turning the crankshaft.

11) Remove the connecting rod bolts, then remove the connecting rod cap, connecting rod bearing and the two dowel pins.

NOTICE

Store the removed connecting rod cap, connecting rod bearing and the dowel pins classifying them into each cylinder.



12) Remove the crankshaft from the cylinder block with care not to damage (scores, scratches, etc.) the journals.
Remove the two thrust washers.

13) Before removing the upper main bearings, check each bearing for damage (scores, scratches, etc.) and replace if necessary.

14) Remove the five upper main bearings from the cylinder block.

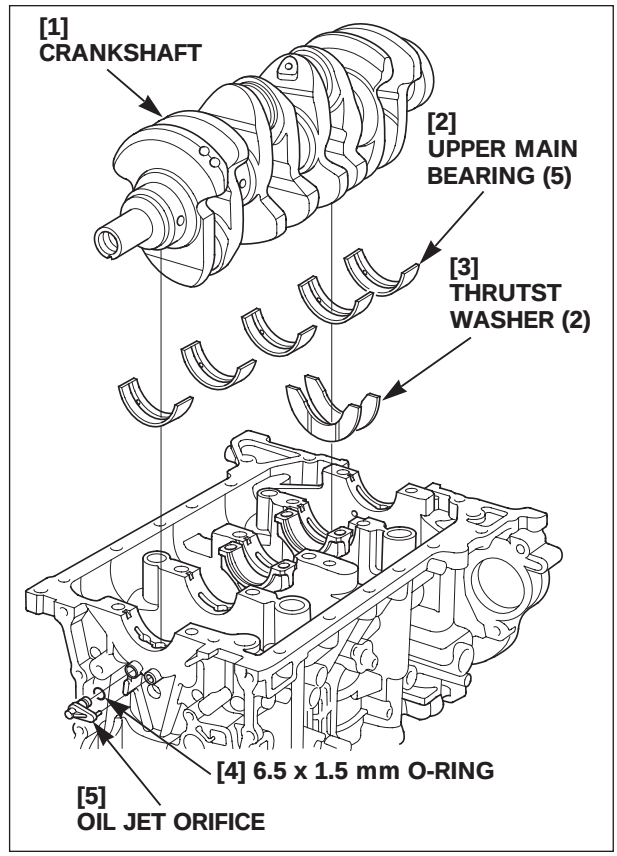
NOTICE

Store the upper main bearings separately for each journal.

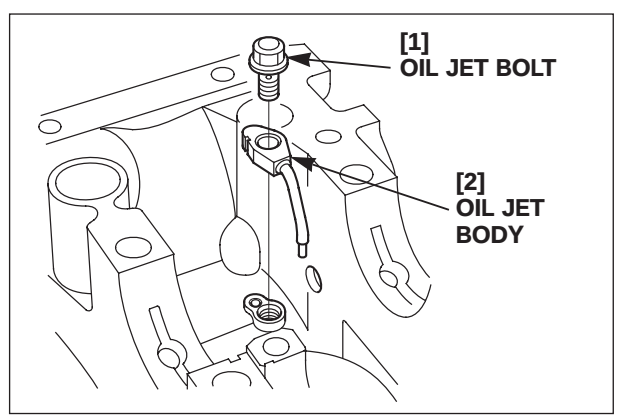
15) Remove the oil jet orifice and the 6.5 x 1.5 mm O-ring from the cylinder block, and check the oil jet orifice for blockage. If it is clogged, clean it with a cleaning solvent and remove the blockage by blowing the oil passage with the compressed air.
If the blockage cannot be removed by blowing with the compressed air, replace the oil jet orifice with a new one.

NOTICE

Remove the blockage with care not to damage the oil passage of the oil jet orifice.



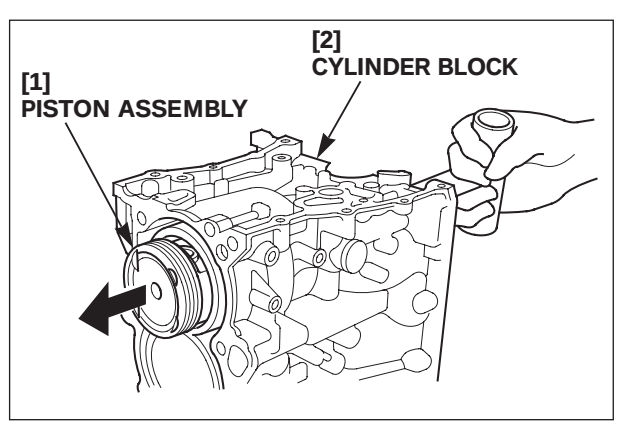
16) Remove the oil jet bolt from the No.1/No.2 cylinder of the cylinder block and remove the oil jet body.



17) Remove the piston assembly from the cylinder by pushing the piston assembly with the handle of a hammer as shown.

NOTICE

- *Before removing the piston assembly, remove the carbon deposits from the cylinder with care not to damage (scores, scratches, etc.) the piston.*
- *Do not damage the cylinder with the connecting rod.*
- *Store the removed piston assembly components separately for each cylinder.*

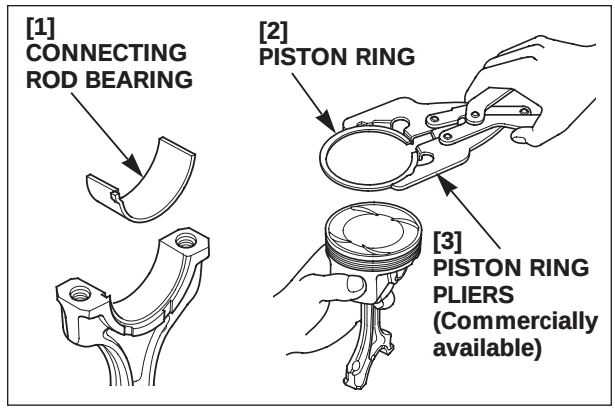


b. PISTON ASSEMBLY

1) Remove the connecting rod bearing and the piston ring from the piston assembly.

NOTICE

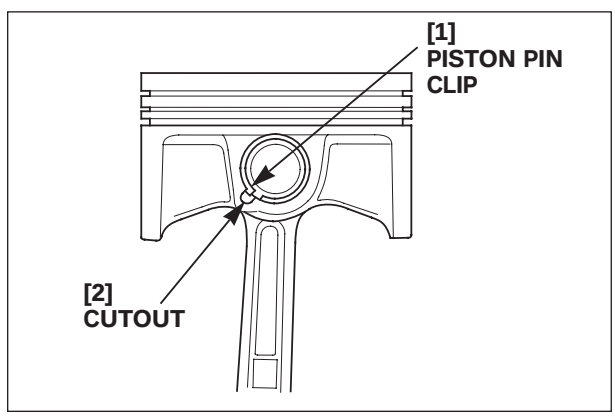
- *Do not apply excessive force to the piston ring as it can break the piston ring. Handle the piston ring with care.*
- *Store the removed connecting rod bearing and the piston ring separately for each piston.*



2) Apply oil to the piston pin clip. Align the piston pin clip end gap with the cutout in the piston pin hole.

NOTICE

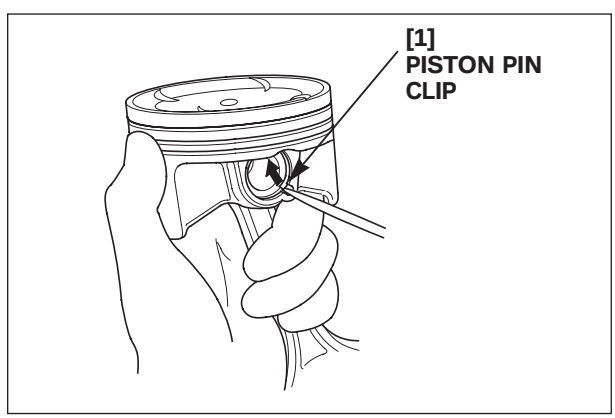
Do not damage the piston pin clip installation groove.



3) Remove the piston pin clips from the cut out at both sides of the piston.

NOTICE

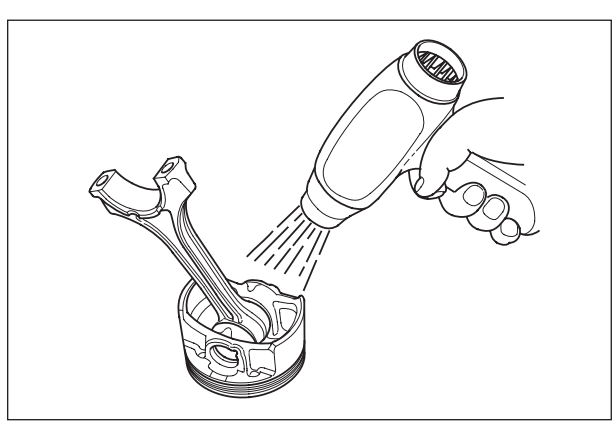
Remove the piston pin clips with care not to let them jump out of position.



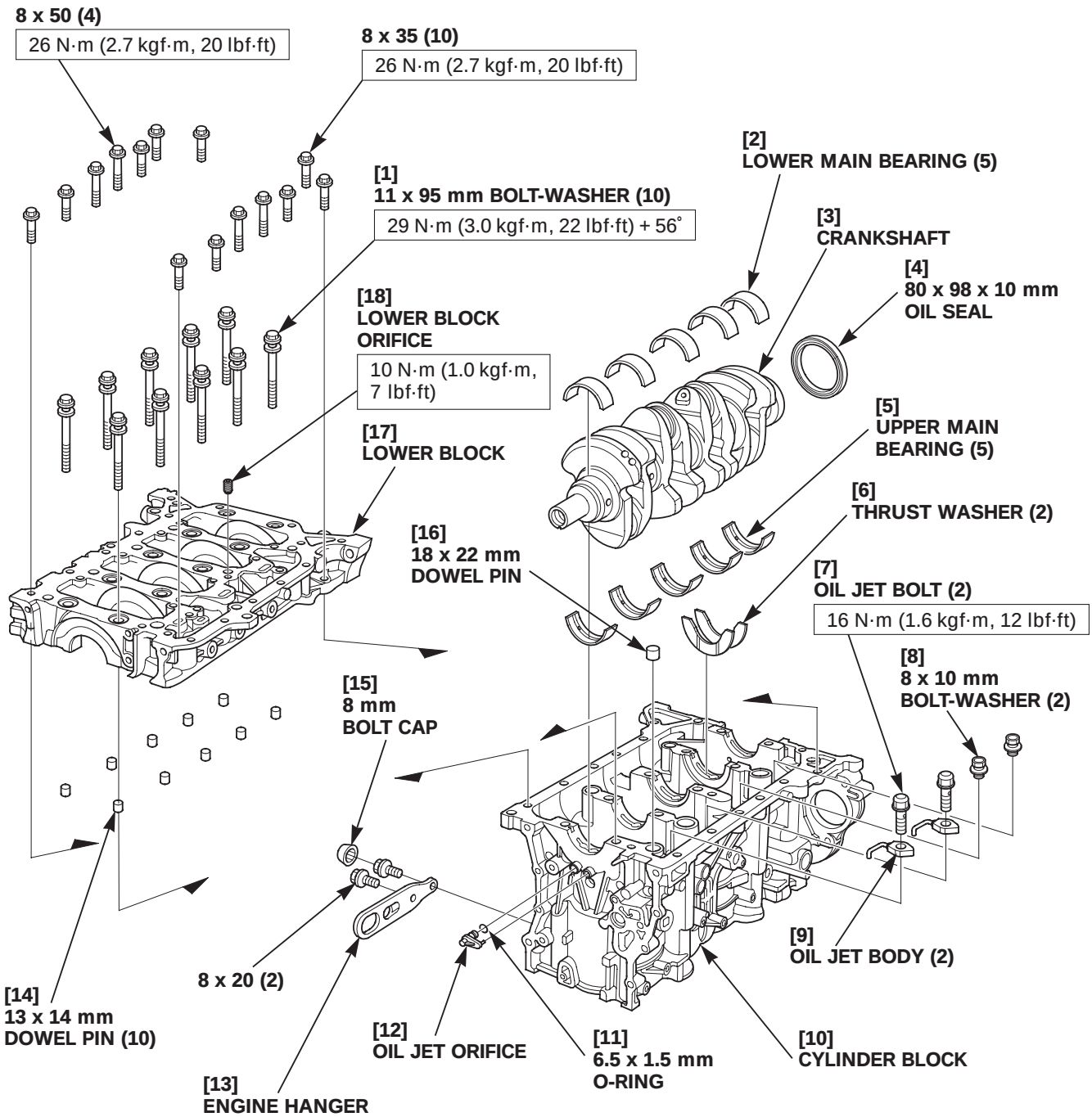
4) Warm up the piston assembly to approximately 70˚C (158˚F) and remove the piston pin.

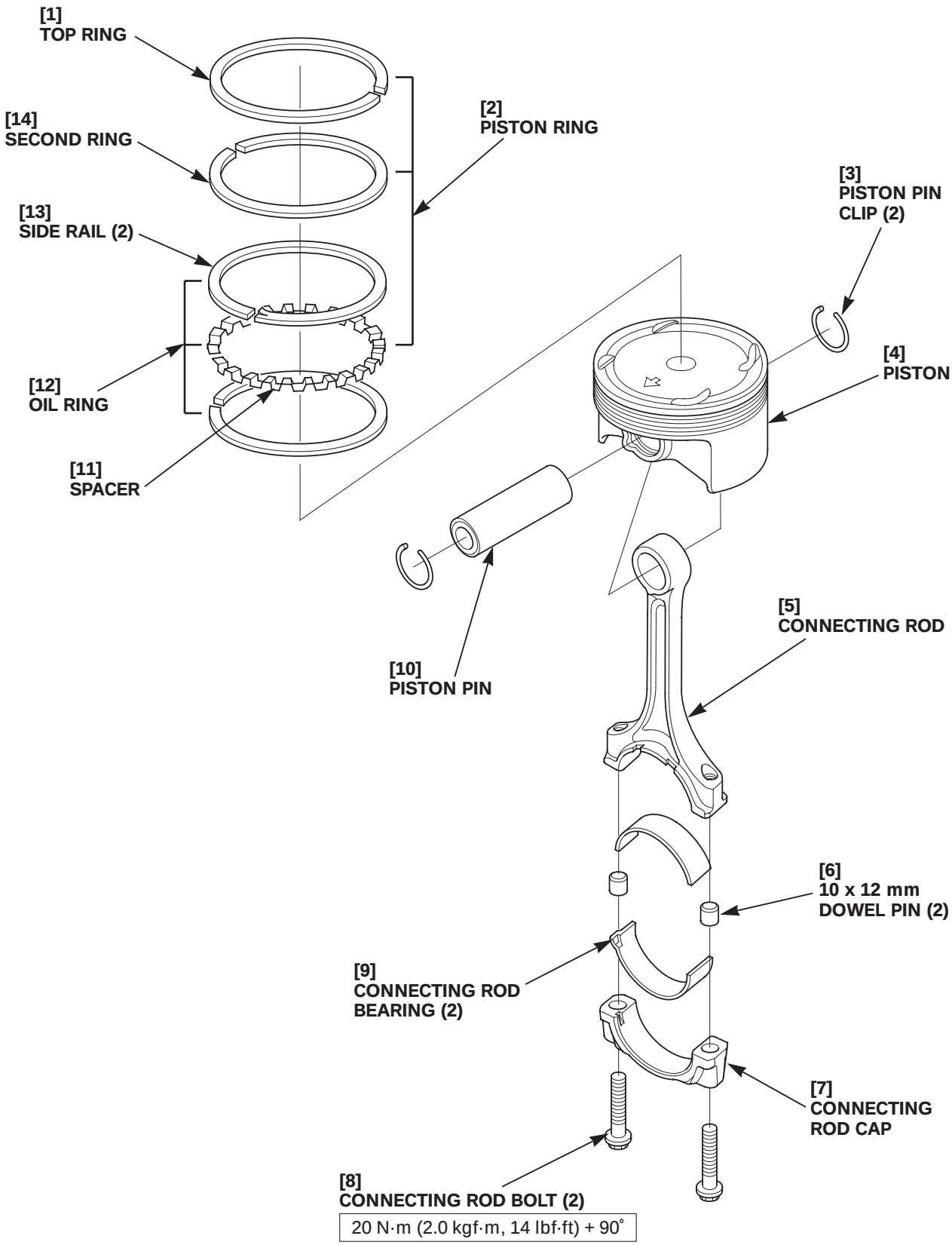
⚠CAUTION

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



c. COMPONENTS DRAWING




[1]
TOP RING
[14]
SECOND RING
[13]
SIDE RAIL (2)
[12]
OIL RING
[11]
SPACER
[2]
PISTON RING
[3]
PISTON PIN
CLIP (2)
[4]
PISTON
[10]
PISTON PIN
[5]
CONNECTING ROD
[6]
10 x 12 mm
DOWEL PIN (2)
[9]
CONNECTING ROD
BEARING (2)
[7]
CONNECTING
ROD CAP
[8]
CONNECTING ROD BOLT (2)
20 N·m (2.0 kgf·m, 14 lbf·ft) + 90˚

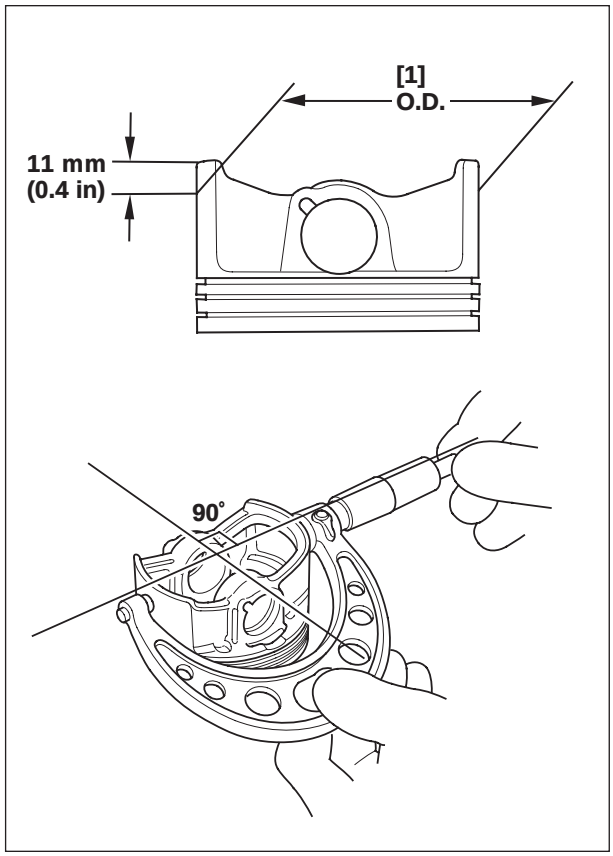
2. INSPECTION

• PISTON SKIRT O.D.

1) Check the piston outer surface for damage (scores, scratches, etc.). Check the piston for warpage and cracks.

2) Measure and record the piston O.D. at a point 11 mm from the bottom, and 90° to the piston pin bore.

	STANDARD	SERVICE LIMIT
A	86.98 – 86.99 mm (3.4244 – 3.4248 in)	86.93 mm (3.4224 in)
B	86.97 – 86.98 mm (3.4240 – 3.4244 in)	86.92 mm (3.4220 in)



• CYLNDER SLEEVE I.D.

1) Check the inner wall of the cylinder for damage (scores, scratches, etc.).

2) Measure and record the cylinder I.D. at three levels in both X and Y axis. Take the maximum reading to determine the cylinder I.D.

	STANDARD	SERVICE LIMIT
A or I	87.01 – 87.02 mm (3.4256 – 3.4260 in)	87.07 mm (3.4279 in)
B or II	87.00 – 87.01 mm (3.4252 – 3.4256 in)	87.07 mm (3.4279 in)

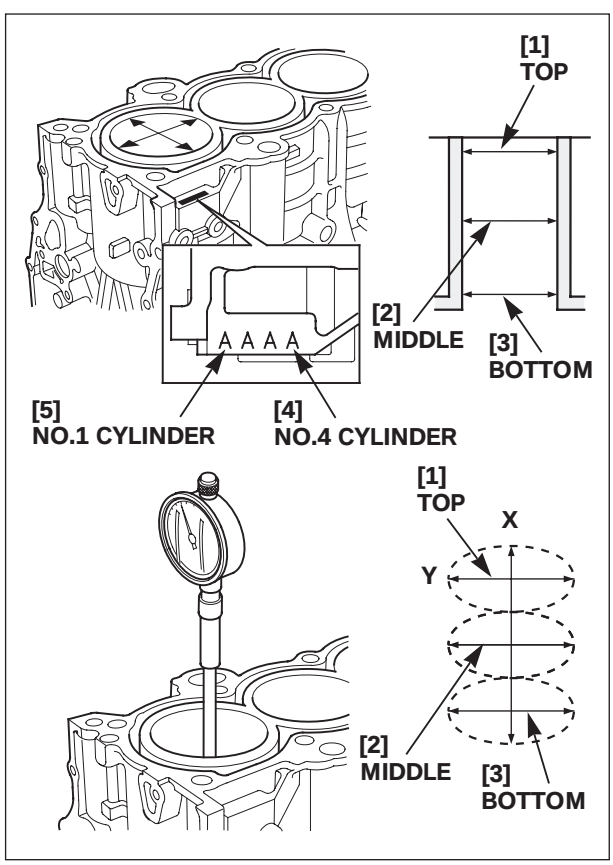
• PISTON-TO-CYLINDER CLEARANCE

STANDARD	SERVICE LIMIT
0.02 – 0.04 mm (0.001 – 0.002 in)	0.05 mm (0.002 in)

• CYLINDER SLEEVE I.D. GAP BETWEEN TOP AND BOTTOM

Determine the gap of the cylinder sleeve I.D. between the top and the bottom measurements.

SERVICE LIMIT	0.05 mm (0.002 in)

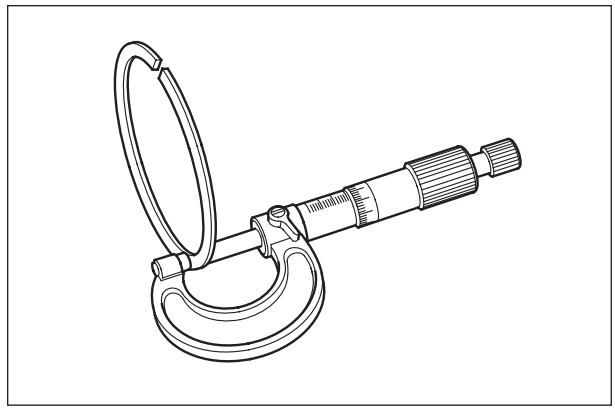


• PISTON RING THICKNESS

1) Check the piston ring for damage (scores, scratches, etc.).
2) Measure the piston ring thickness.

	STANDARD	SERVICE LIMIT
TOP	1.170 – 1.185 mm (0.0461 – 0.0467 in)	———
SECOND	1.175 – 1.190 mm (0.0463 – 0.0469 in)	———

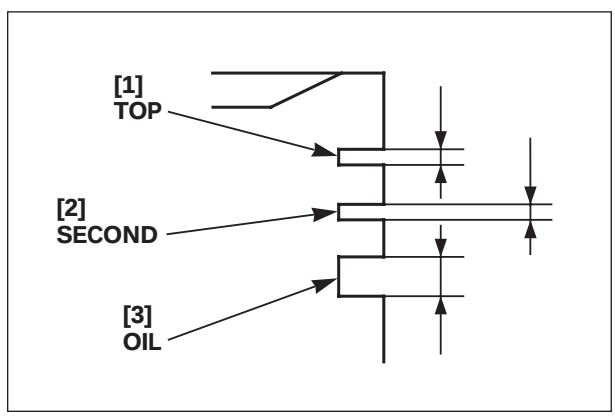
The oil rings are the combination rings. Replace the top ring, second ring and the oil rings as a set when either top or second ring needs replacement.



• PISTON RING GROOVE WIDTH

1) Check the piston ring grooves for uneven wear, damage and clogged oil hole.
2) Measure the piston ring groove width.

	STANDARD	SERVICE LIMIT
TOP	1.23 – 1.24 mm (0.0484 – 0.0488 in)	1.25 mm (0.0492 in)
SECOND	1.24 – 1.25 mm (0.0488 – 0.0492 in)	1.25 mm (0.0492 in)
OIL	2.005 – 2.025 mm (0.0789 – 0.0797 in)	2.05 mm (0.081 in)

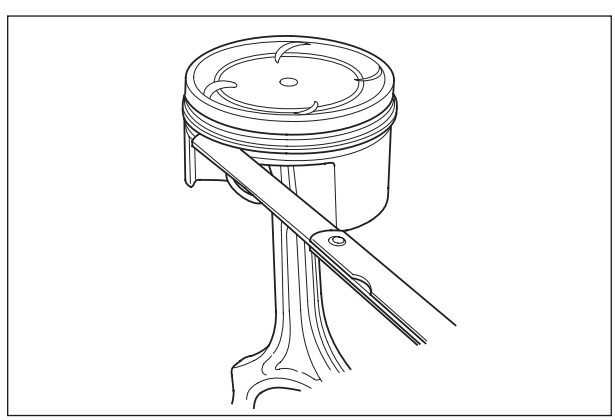


• PISTON RING SIDE CLEARANCE

Set the piston ring on the piston properly so it is almost flush with the piston outer surface. Measure the piston ring side clearance.

	STANDARD	SERVICE LIMIT
TOP	0.045 – 0.070 mm (0.0018 – 0.0028 in)	0.13 mm (0.005 in)
SECOND	0.040 – 0.065 mm (0.0016 – 0.0026 in)	0.13 mm (0.005 in)

The oil rings are the combination rings. Replace the top ring, second ring and the oil rings as a set when either top or second ring needs replacement.

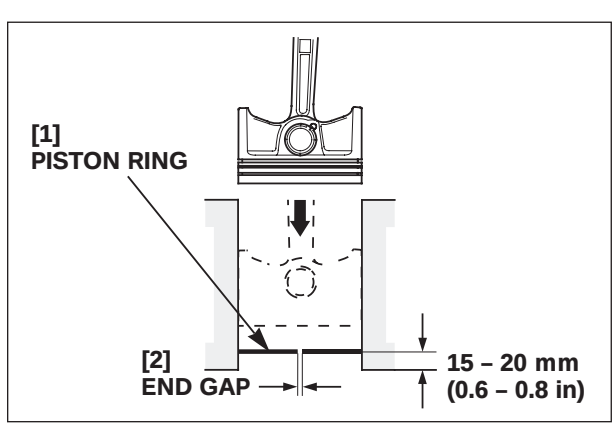


• PISTON RING END GAP

Use the piston to push the piston ring into the cylinder and position it horizontally at 15 to 20 mm from the bottom of the cylinder.

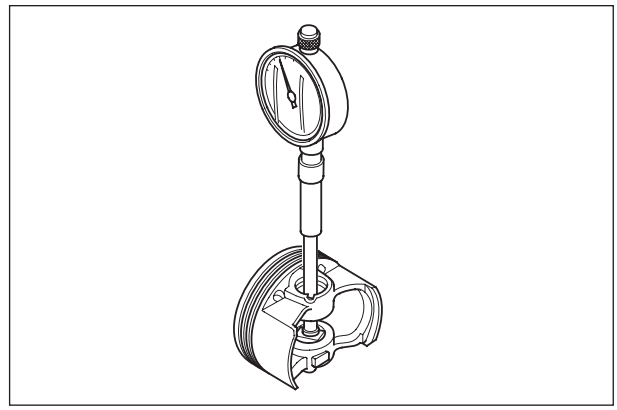
	STANDARD	SERVICE LIMIT
TOP	0.20 – 0.35 mm (0.008 – 0.014 in)	0.6 mm (0.02 in)
SECOND	0.50 – 0.65 mm (0.020 – 0.026 in)	0.75 mm (0.030 in)
OIL	0.20 – 0.70 mm (0.008 – 0.028 in)	0.8 mm (0.031 in)

If the end gap is larger than the service limit, install a new piston ring and recheck. Check the cylinder sleeve I.D. (P. 13-8).



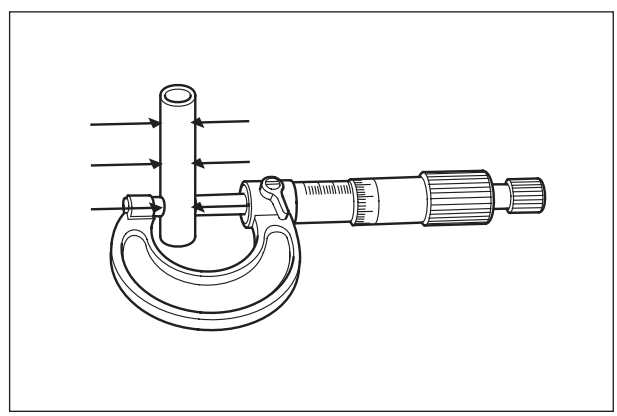
• PISTON PIN BORE I.D.

STANDARD	SERVICE LIMIT
21.960 – 21.963 mm (0.8646 – 0.8647 in)	———



• PISTON PIN O.D.

STANDARD	SERVICE LIMIT
21.961 – 21.965 mm (0.8646 – 0.8648 in)	21.953 mm (0.8643 in)

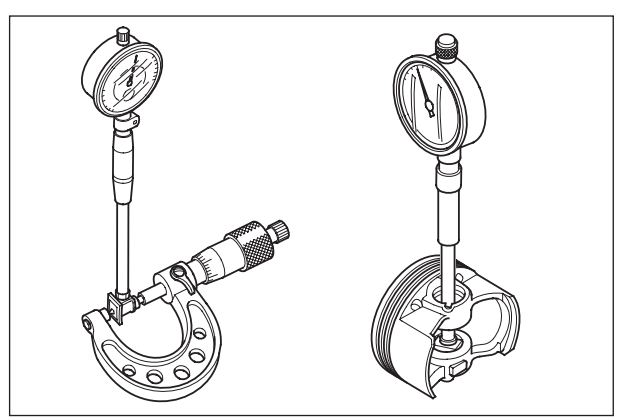


• PISTON PIN-TO-PIN BORE CLEARANCE

1) Set the cylinder gauge at the piston pin O.D. and zero the cylinder gauge.

2) Insert the cylinder gauge in the piston pin bore and measure the piston pin-to-pin bore clearance.

STANDARD	SERVICE LIMIT
–0.005 – +0.002 mm (–0.0002 – +0.0001 in)	0.005 mm (0.0002 in)

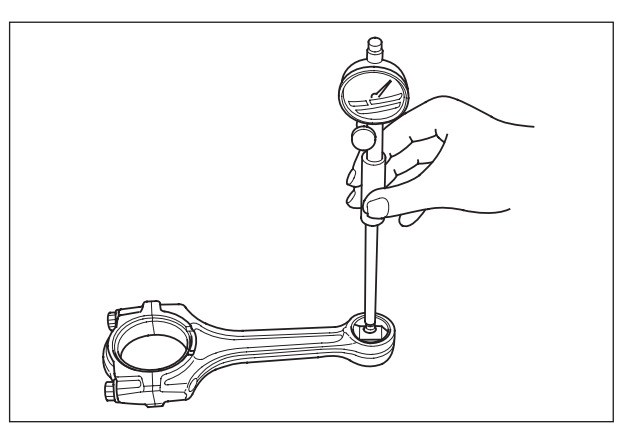


• CONNECTING ROD SMALL END I.D.

STANDARD	SERVICE LIMIT
23.969 – 23.982 mm (0.9437 – 0.9442 in)	———

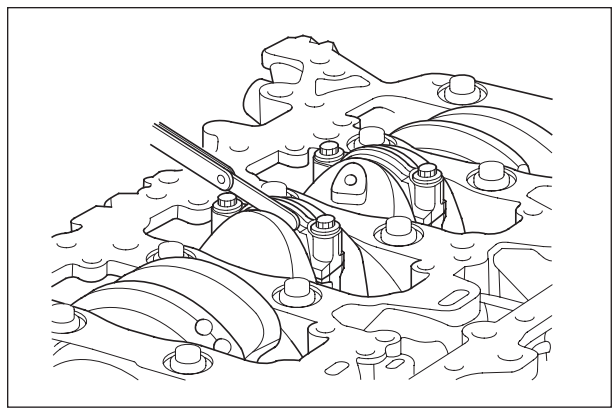
• CONNECTING ROD SMALL END-TO-PISTON PIN CLEARANCE

STANDARD	SERVICE LIMIT
0.005 – 0.015 mm (0.0002 – 0.0006 in)	0.02 mm (0.001 in)



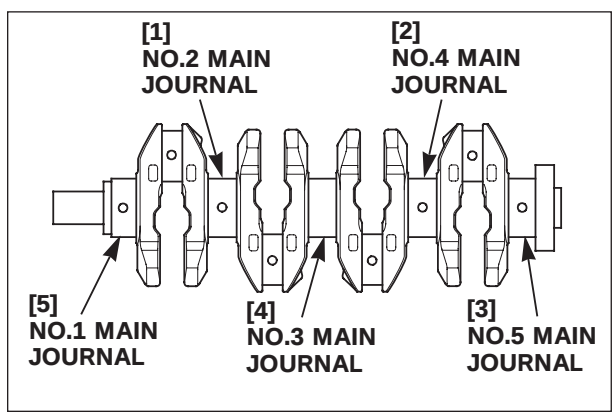
• CONNECTING ROD BIG END AXIAL CLEARANCE

STANDARD	SERVICE LIMIT
0.15 – 0.35 mm (0.006 – 0.014 in)	0.4 mm (0.02 in)



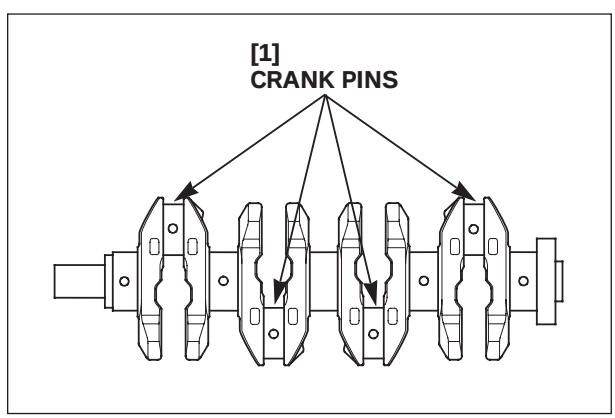
• CRANKSHAFT MAIN JOURNAL O.D.

	STANDARD	SERVICE LIMIT
No.1, 2, 4, 5,	54.984 – 54.992 mm (2.1647 – 2.1650 in)	———
No.3	54.976 – 55.000 mm (2.1644 – 2.1654 in)	———



• CRANK PIN JOURNAL O.D.

STANDARD	SERVICE LIMIT
47.976 – 48.000 mm (1.8888 – 1.8898 in)	———



• CRANKSHAFT JOURNAL (MAIN, PIN) ROUNDNESS

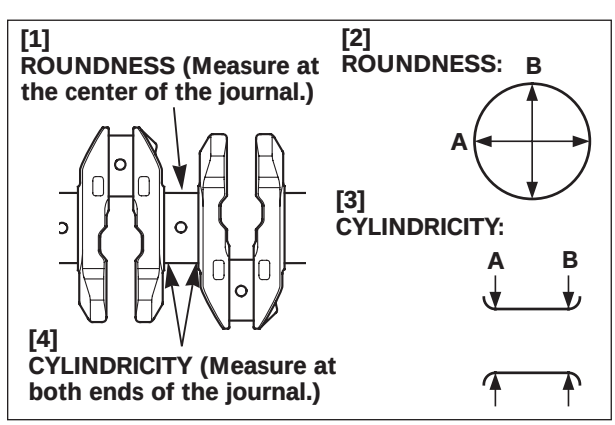
Measure the crankshaft main journal O.D. and the crank pin O.D. in the A and B directions. Calculate the gap between the measurements to determine the roundness.

STANDARD	SERVICE LIMIT
0.005 mm (0.0002 in) Max.	0.010 mm (0.0004 in)

• CRANKSHAFT JOURNAL (MAIN, PIN) CILINDRICITY

Measure the crankshaft main journal O.D. and the crank pin O.D. at the points A and B. Calculate the gap between the measurements to determine the cylindricity.

STANDARD	SERVICE LIMIT
0.005 mm (0.0002 in) Max.	0.010 mm (0.0004 in)

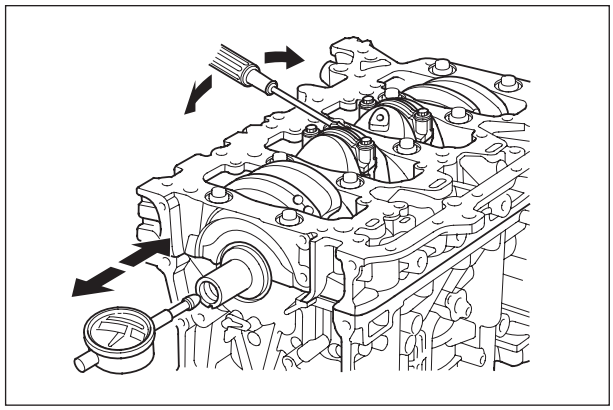


• CRANKSHAFT AXIAL CLEARANCE

Install the dial indicator as shown. Measure the crankshaft axial play by moving the crankshaft back and forth with a screwdriver.

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 cylinder block thrust surface. Replace the thrust washer and recheck.
If the measurement still exceeds the service limit, replace the crankshaft.

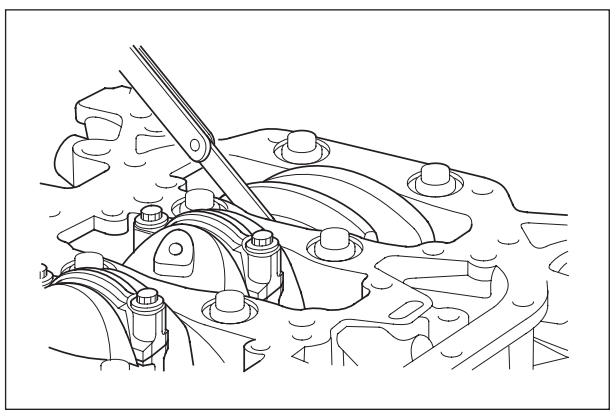


• THRUST METAL SIDE CLEARANCE

Measure the clearance between the No.4 main journal thrust washer and the crankshaft.

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 cylinder block thrust surface. Replace the thrust washer and recheck.
If the measurement still exceeds the service limit, replace the crankshaft.



• CRANKSHAFT RUNOUT

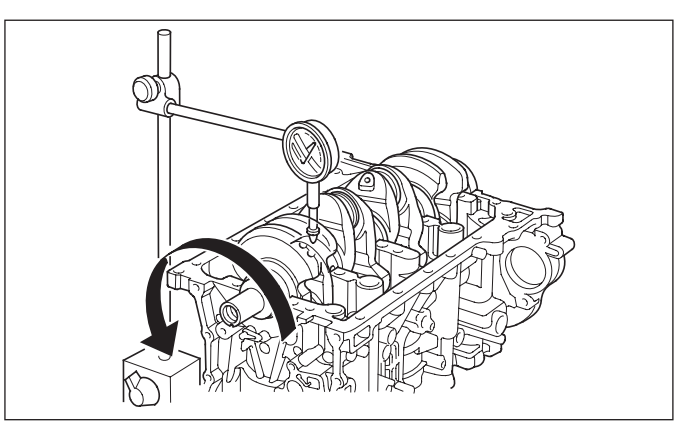
1) Install the No.1 and No.5 upper main bearings on the cylinder block.

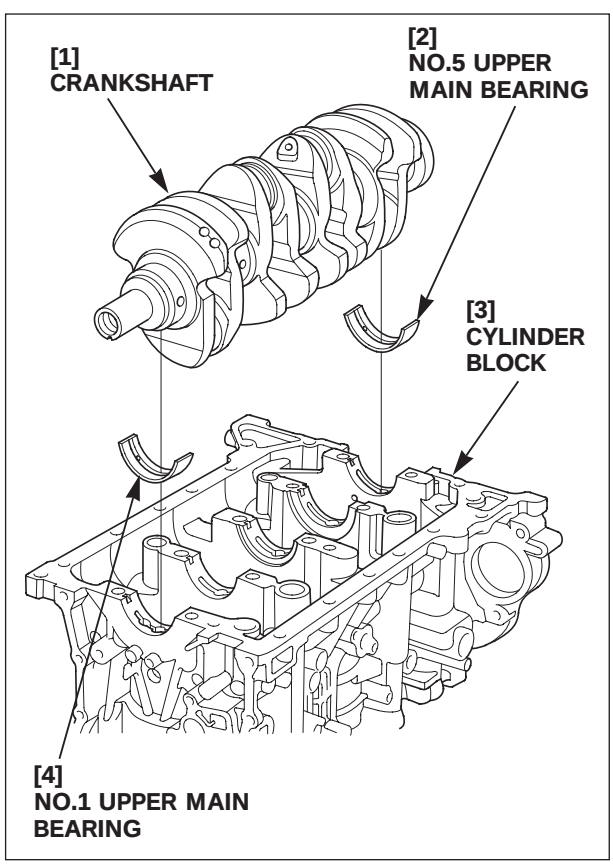
2) Install the crankshaft on the cylinder block.

3) Set the dial indicator on the crankshaft. Measure the crankshaft runout by turning the crankshaft.

STANDARD	SERVICE LIMIT
0.03 mm (0.001 in) Max.	0.04 mm (0.002 in)

4) If the measurement exceeds the service limit, replace the crankshaft.



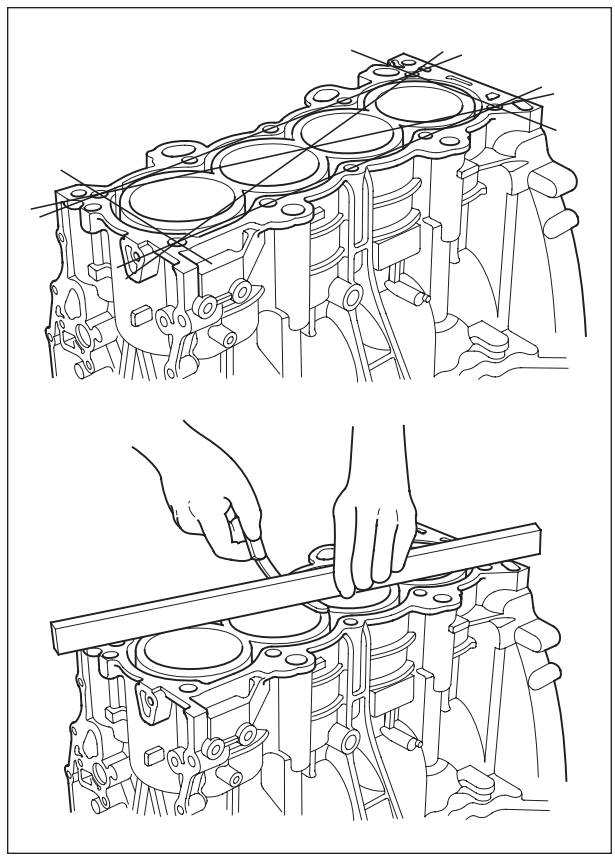


• CYLINDER HEAD SURFACE WARPAGE

1) Take care not to damage (score, scratches, etc.) the mating surface with the gasket.

2) Measure the surface warpage using a straight edge and a feeler gauge as shown.

STANDARD	SERVICE LIMIT
0.07 mm (0.003 in) Max.	0.10 mm (0.004 in)



• CONNECTING ROD BEARING OIL CLEARANCE

1) Clean the crank pin and the connecting rod bearing. Check the crank pin and the bearing for damage and wear.
2) Install the crankshaft on the cylinder block. Install the connecting rod cap on the connecting rod and tighten the connecting rod bolts to the specified torque (P. 13-22).
3) Remove the connecting rod cap. Set a plastigauge on the crank pin.

NOTICE

- *Set the plastigauge in the axial direction.*
- *Tighten the connecting rod bolts with care not to turn the crankshaft and connecting rod.*

4) Reinstall the connecting rod cap and tighten the connecting rod bolts to the specified torque (P. 13-22).

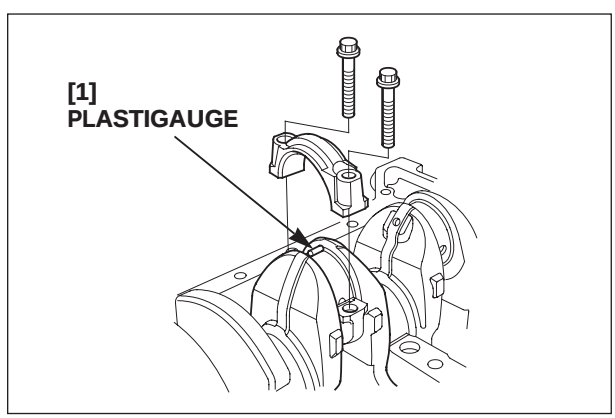
5) Remove the connecting rod cap. Measure the pressured width of the plastigauge using the scale printed on the bag of the plastigauge.

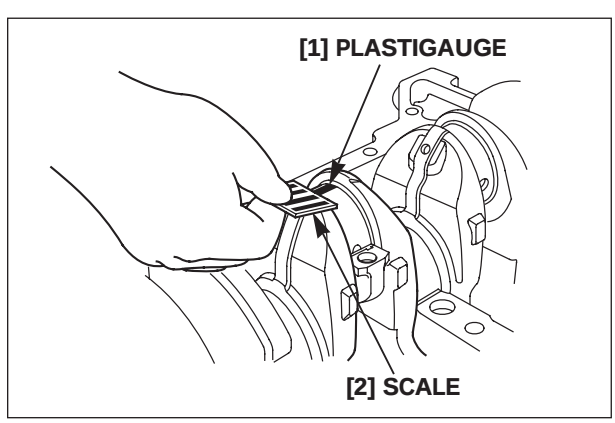
NOTICE

Measure the widest width on the plastigauge.

STANDARD	SERVICE LIMIT
0.032 – 0.066 mm (0.0013 – 0.0026 in)	0.077 mm (0.0030 in)

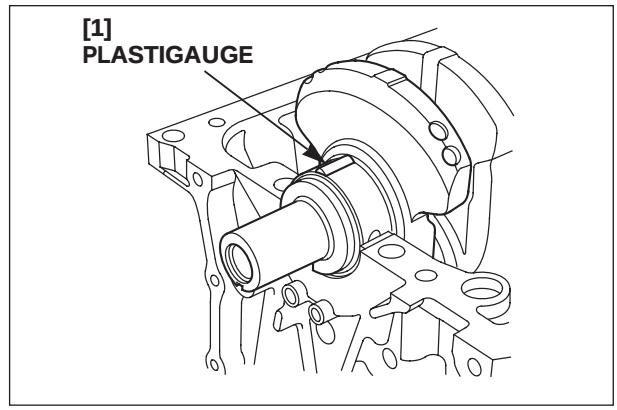
6) If the measurement exceeds the service limit, check the connecting rod big end I.D. and the crank pin O.D. If they are OK, replace with the undersize bearing by referring to the connecting rod bearing selection table (P. 13-16), and measure the oil clearance again.





• CRANKSHAFT MAIN BEARING OIL CLEARANCE

1) Clean the crankshaft main journals and the main bearings. Check the journals and the bearings for damage and wear.
2) Install the upper main bearings and the crankshaft on the cylinder block. Install the lower main bearings and the lower block and tighten the bolts to the specified torque (P. 13-24).
3) Remove the lower block and the lower main bearings. Set the plastigauge on each main journal of the crankshaft as shown.

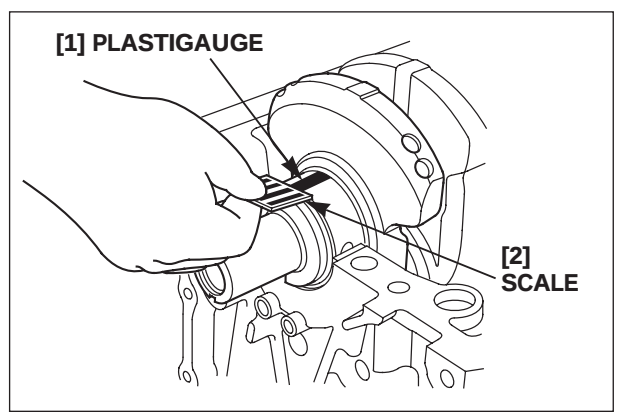


NOTICE

- *Set the plastgauges in the axial direction.*
- *Do not turn the crankshaft during this check.*

4) Reinstall the lower main bearings and the lower block. Tighten the bolts to the specified torque (P. 13-24).

5) Remove the lower block and the lower main bearings. Measure the pressured width of the plastigauge using the scale printed on the bag of the plastigauge.



NOTICE

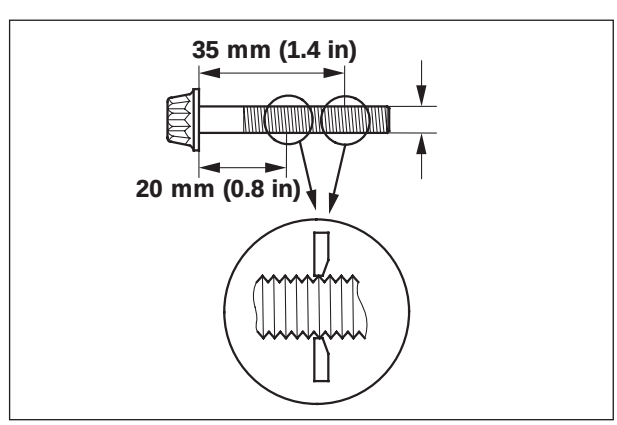
Measure the widest width on the plastigauge.

	STANDARD	SERVICE LIMIT
No.1, 2, 4, 5	0.017 – 0.041 mm (0.0007 – 0.0016 in)	0.05 mm (0.002 in)
No.3	0.025 – 0.049 mm (0.0010 – 0.0019 in)	0.055 mm (0.0022 in)

6) If the measurement exceeds the service limit, check the lower block and the cylinder block main bearing I.D. and the crankshaft main journal O.D. If they are OK, replace with the undersize bearing by referring to the connecting rod bearing selection table (P. 13-18), and measure the oil clearance again.

• CONNECTING ROD BOLT

1) Measure the O.D. of each connecting rod bolt at two points as shown, and calculate the gap between the measurements.



STANDARD	0 – 0.1 mm (0 – 0.004 in)

2) If the gap exceeds the standard value, replace the connecting rod bolt.

NOTICE

Measure the O.D. on each of the connecting rod bolt.

3. BEARING SELECTION

a. CONNECTING ROD BEARING

NOTICE

- *When replacing the connecting rod bearing, check the crank pin code letter and the connecting rod code number, and select the correct bearing by referring to the bearing selection table.*
- *If the code letters and/or numbers are not clear, clean the areas with a cleaning solvent and check again. Do not scrub with a stiff brush or driver to clean.*

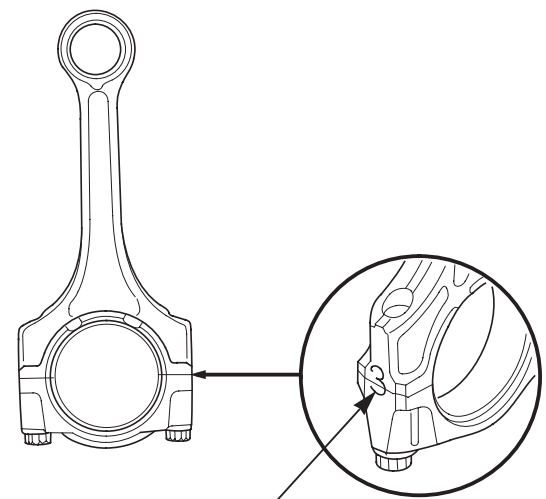
1) Check the connecting rod code numbers and record them.

NOTICE

The connecting rod code numbers are for the No.1 and the subsequent number journals when viewed from the crankshaft pulley side.

Connecting rod big end I.D.: 51 mm (2.0 in)

Code No.	Tolerance
1 or I	±0.000 – +0.006 mm (±0.0000 – +0.0002 in)
2 or II	+0.006 – +0.012 mm (+0.0002 – +0.0005 in)
3 or III	+0.012 – +0.018 mm (+0.0005 – +0.0007 in)
4 or IIII	+0.018 – +0.024 mm (+0.0007 – +0.0009 in)

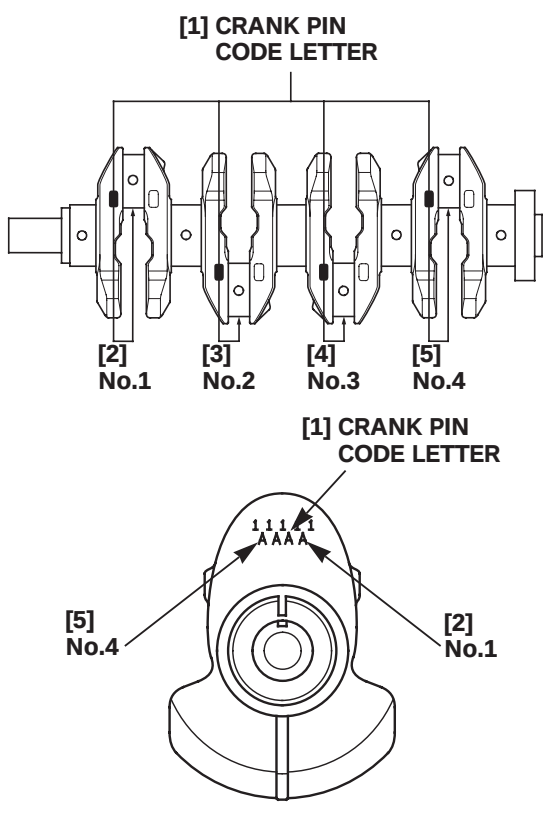


2) Check the crank pin code letters and record them.

NOTICE

The crank pin code letters are for the No.1 and the subsequent number journals when viewed from the right side of the position shown or from the crankshaft 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 identification color			
A	Red	Pink	Pink/ Yellow	Yellow
B	Pink	Yellow	Yellow/ Green	Green
C	Yellow	Green	Green/ Brown	Brown
D	Green	Brown	Brown/ Black	Black

Selection table:
Connecting rod bearing center thickness: 1.5 mm (0.06 in)

Mark	I.D. color	Tolerance
G	Red	–0.008 – –0.005 mm (–0.0003 – –0.0002 in)
F	Pink	–0.005 – –0.002 mm (–0.0002 – –0.0001 in)
E	Yellow	–0.002 – +0.001 mm (–0.0001 – +0.00004 in)
D	Green	+0.001 – +0.004 mm (+0.00004 – +0.0002 in)
C	Brown	+0.004 – +0.007 mm (+0.0002 – +0.0003 in)
B	Black	+0.007 – +0.010 mm (+0.0003 – +0.0004 in)
A	Blue	+0.010 – +0.013 mm (+0.0004 – +0.0005 in)

The connecting rod bearings are available in blue, black, brown, green, yellow, pink and red of the size identification color in this order in increments of 0.003 mm (0.0001 in).

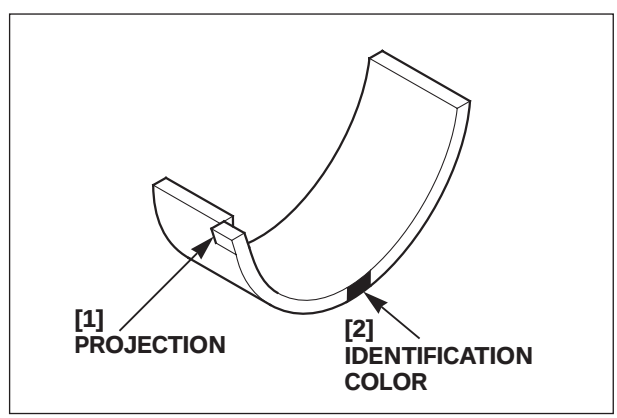
4) Note that the oil clearance is set taking the enlarged amount of the housing caused by crash into consideration. The bearings are selected so that the oil clearance is 0.032 – 0.066 mm (0.0013 – 0.0026 in).

5) Check the oil clearance after installing the selected bearing (P. 13-13).

6) Align the projection on the bearing with the cutout in the connecting rod or cap, and install with care not to damage the sliding surface.

NOTICE

- *Do not determine the bearing simply by referring to the selection table, but check the oil clearance.*
- *If the selection table shows two identification colors, use a pair of the bearing of each color for the upper and lower bearings.*



b. CRANKSHAFT MAIN BEARING

NOTICE

- *When replacing the main bearing, check the crankshaft main journal code number and the cylinder block I.D. code letter or number, and select the correct bearing by referring to the bearing selection table.*
- *If the code letter and/or number is not clear, clean the area with a cleaning solvent and check again. Do not scrub with a stiff wire brush or driver to clean.*

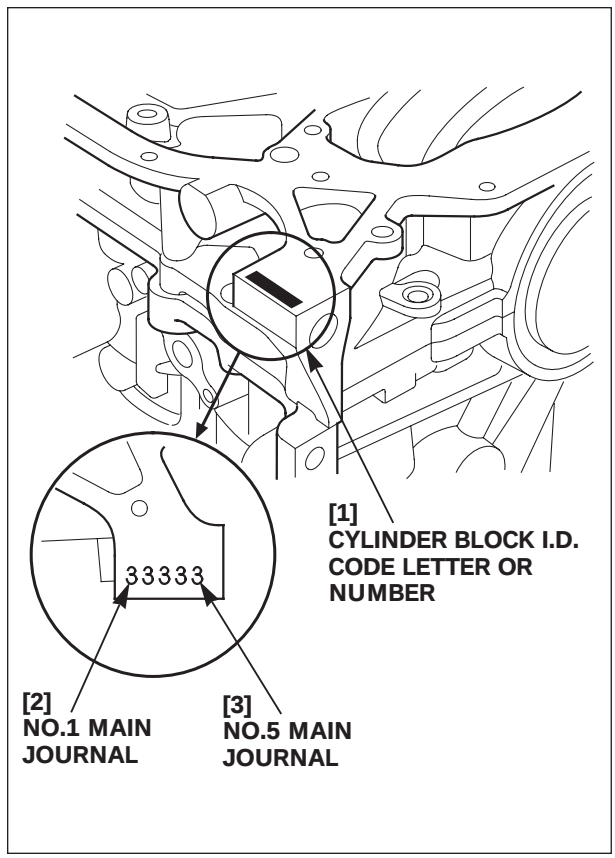
1) Check the cylinder block I.D. code letters or numbers and record them.

NOTICE

The cylinder block I.D. code letters or numbers are for the No.1 and the subsequent number journals when viewed from the left side.

Cylinder block I.D.: 59 mm (2.3 in)

Code No.	Tolerance
1 or A or I	±0.000 – +0.006 mm (±0.0000 – +0.0002 in)
2 or B or II	+0.006 – +0.012 mm (+0.0002 – +0.0005 in)
3 or C or III	+0.012 – +0.018 mm (+0.0005 – +0.0007 in)
4 or D or IIII	+0.018 – +0.024 mm (+0.0007 – +0.0009 in)

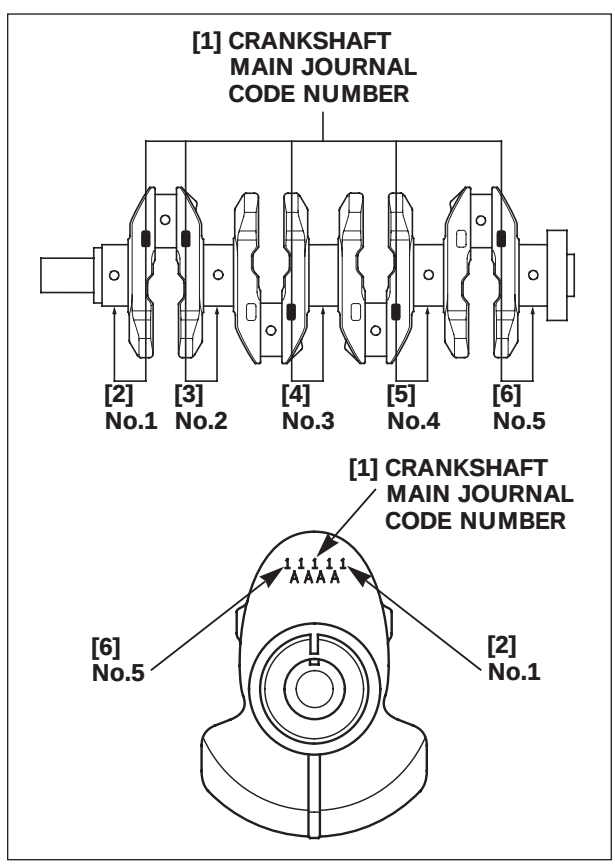


2) Check the crankshaft main journal code numbers and record them.

NOTICE

The crankshaft main journal code numbers are for the No.1 and the subsequent number journals when viewed from the right side of the position shown or from the crankshaft 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.



Crankshaft main bearing selection table:

Crankshaft main journal code number	Cylinder block I.D. code letter or number			
	1 or A or I	2 or B or II	3 or C or III	4 or D or IIII
	Bearing identification color			
1	Pink	Pink/ Yellow	Yellow	Green
2	Pink/ Yellow	Yellow	Green	Green/ Brown
3	Yellow	Green	Green/ Brown	Brown
4	Green	Green/ Brown	Brown	Black
5	Green/ Brown	Brown	Black	Black/ Blue
6	Brown	Black	Black/ Blue	Blue

Selection table:
Main bearing center thickness: 2.0 mm (0.08 in)

Mark	I.D. color	Tolerance
F	Pink	–0.006 – –0.003 mm (–0.0002 – –0.0001 in)
E	Yellow	–0.003 – ±0.000 mm (–0.0001 – ±0.0000 in)
D	Green	±0.000 – +0.003 mm (±0.0000 – +0.0001 in)
C	Brown	+0.003 – +0.006 mm (+0.0001 – +0.0002 in)
B	Black	+0.006 – +0.009 mm (+0.0002 – +0.0004 in)
A	Blue	+0.009 – +0.012 mm (+0.0004 – +0.0005 in)

The main bearings are available in blue, black, brown, green, yellow and pink of the size identification color in this order in increments of 0.003 mm (0.0001 in).

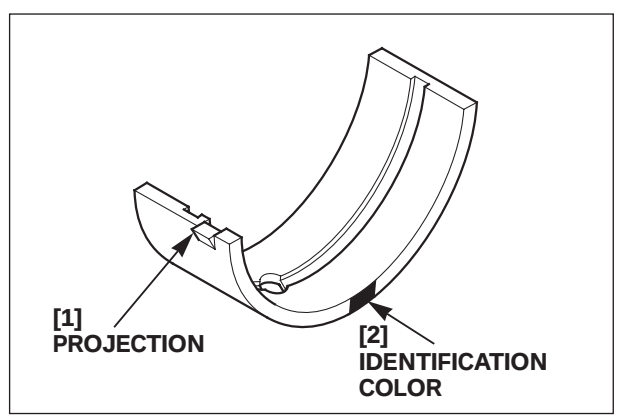
4) Note that the oil clearance is set taking the enlarged amount of the housing caused by crash into consideration. The bearings are selected so that the oil clearance for the No.1, 2, 4 and 5 journals is in the range of 0.017 – 0.041 mm (0.0007 – 0.0016 in), and the oil clearance for the No.3 journal is in the range of 0.025 – 0.049 mm (0.0010 – 0.0019 in).

5) Check the oil clearance after installing the selected bearing (P. 13-14).

6) Align the projection of the bearing with the cutout in the cylinder block or lower block, and install with care not to damage the sliding surface.

NOTICE

- *Do not determine the bearing simply by referring to the selection table, but check the oil clearance.*
- *If the selection table shows two identification colors, use a pair of the bearing of each color for the upper and lower bearings.*



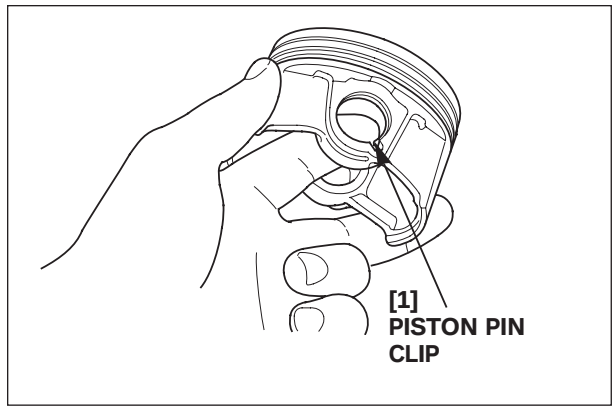
4. ASSEMBLY

a. PISTON ASSEMBLY

1) Install the piston pin clip only on one side of the piston.

NOTICE

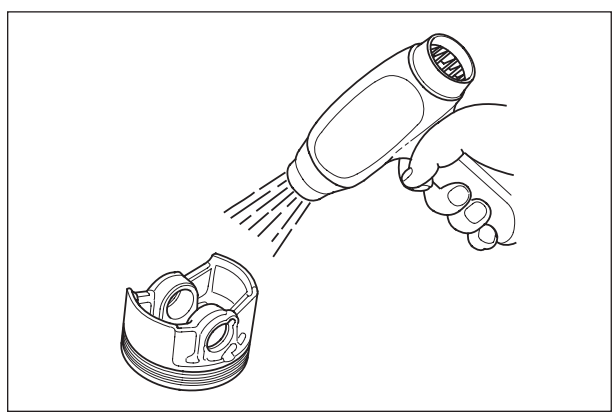
Take care not to let the piston pin clip jump out of position.



2) Warm up the piston to approximately 70˚C (158˚F).

⚠CAUTION

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



3) Apply molybdenum disulfide oil to the outer surface of the piston pin, inner wall of the piston pin hole in the piston and to the inner wall of the connecting rod small end. Install the connecting rod on the piston and install the piston pin.

NOTICE

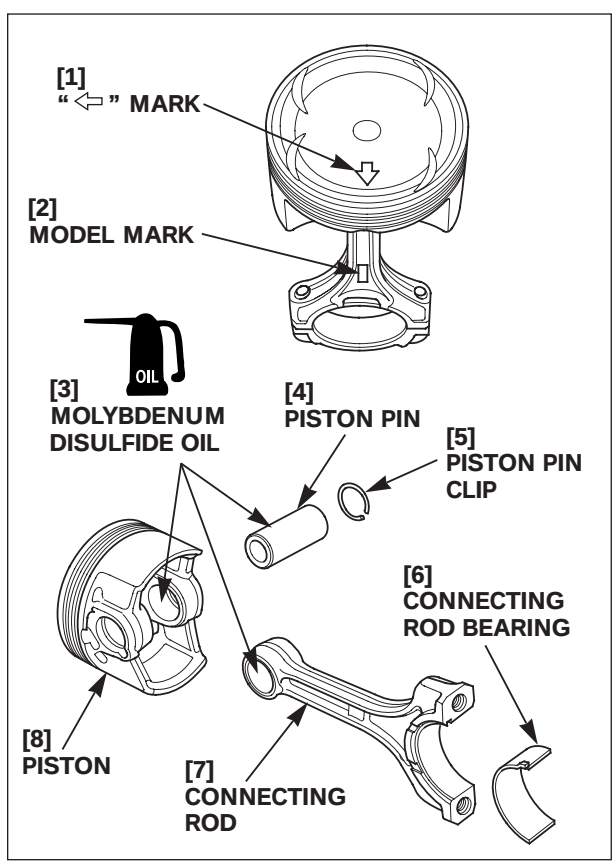
Install the piston pin so that the "⇦" mark on the piston head points to the model mark on the connecting rod.

4) Install the piston pin clip on the opposite side from where the piston pin clip was installed in step 3.

NOTICE

Take care not to let the piston pin clip jump out of position.

5) Install the connecting rod bearing on the connecting rod by aligning the projection on the bearing with the concave in the connecting rod.

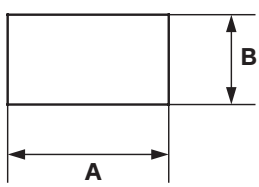


6) Install the piston rings in the ring grooves in the piston with the marker marks on the top ring and the second ring facing up.
Install the side rail (top side) by aligning the lug of the side rail (top side) with the positioning groove in the ring groove.

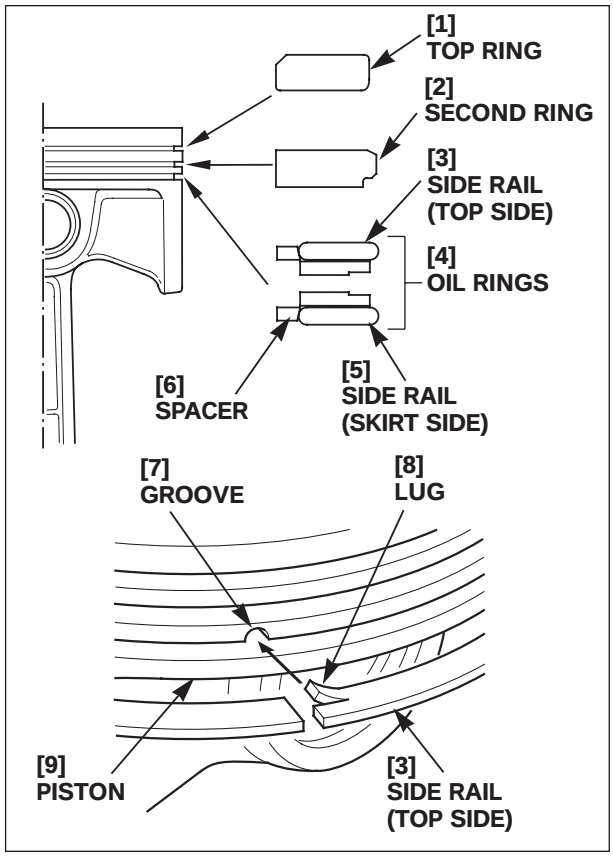
NOTICE

- *Clean the ring grooves thoroughly before installing the piston rings.*
- *Install the piston rings with care not to break the piston rings. Take care not to score or scratch the piston.*
- *Do not confuse the top ring and the second ring. The top ring is glossy while the second ring can be identified with the dark color.*
- *To install the oil rings, install the spacer first, then install the side rails.*
- *Be sure that the lug of the side rail (top side) sets in the positioning groove securely.*

[1] DIMENSIONS OF PISTON RING:



[2] TOP RING
A: 3.1 mm
B: 1.2 mm
SECOND RING
A: 3.4 mm
B: 1.2 mm

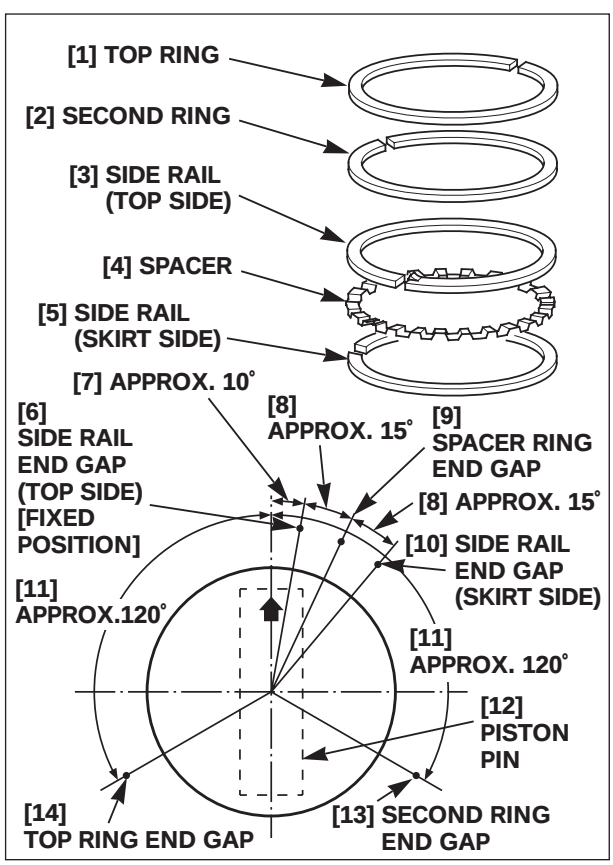


7) After installing the piston rings, check for smooth movement of each ring. [Except side rail (top side)]

8) Stagger the piston ring end gaps as shown.

NOTICE

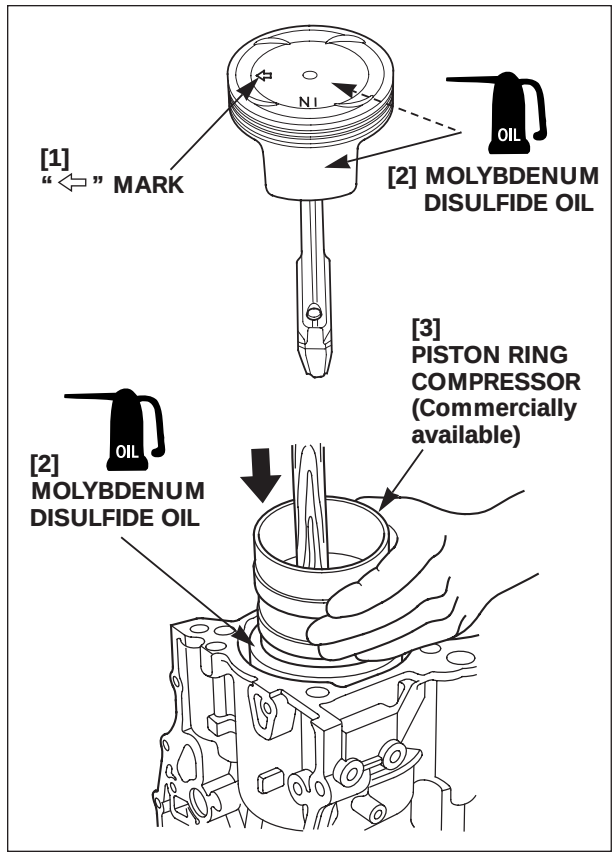
Do not align with the piston pin and avoid the direction that makes a right angle with the piston pin.



b. LOWER BLOCK/CRANKSHAFT/CYLINDER BLOCK

1) Apply molybdenum disulfide oil to the piston skirt and the inner wall of the cylinder sleeve.

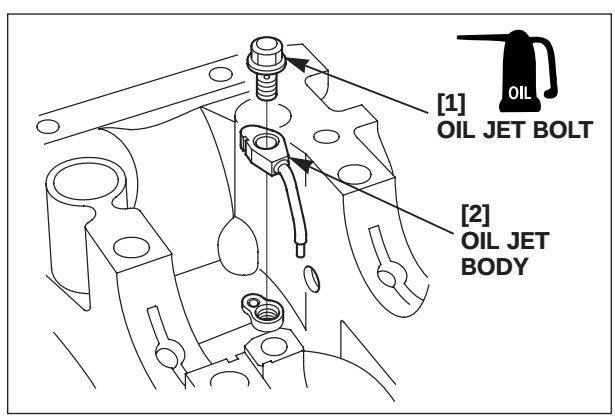
2) Using the handle of a hammer, drive the piston slowly into the cylinder block with the " ⇦ " mark on the piston toward the cam chain side.



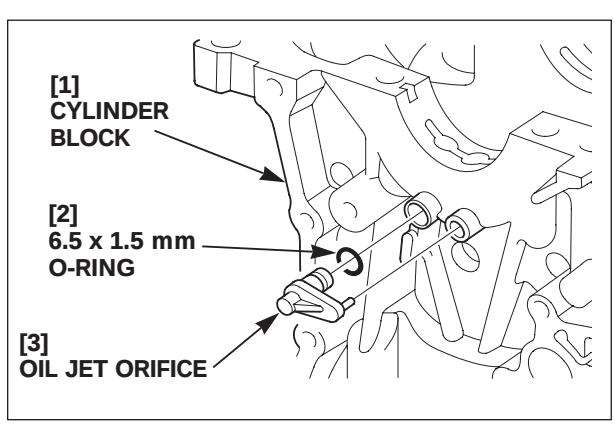
3) Apply engine oil to the threads and seat of the oil jet bolts.

4) Install the oil jet body on each of the No.1 and No.2 cylinder and tighten the oil jet bolts to the specified torque.

TORQUE: 16 N·m (1.6 kgf·m, 12 lbf·ft)



5) Apply engine oil to the new 6.5 x 1.5 mm O-ring and install it on the oil jet orifice.
Install the oil jet orifice on the cylinder block.



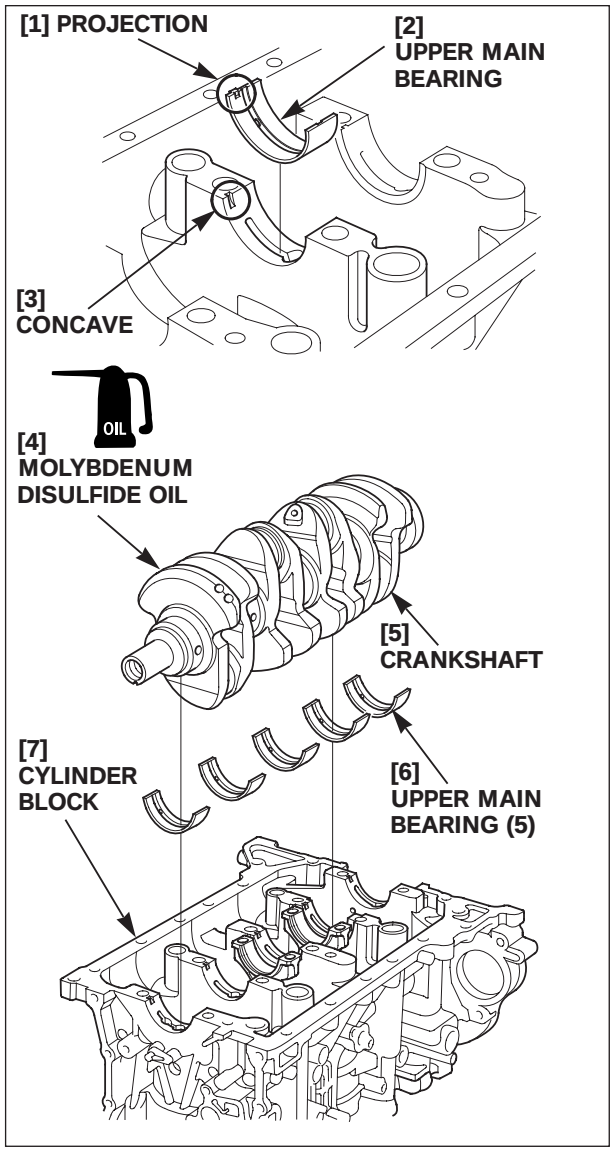
6) Install the upper main bearings on the cylinder block aligning the projection on the upper main bearing with the concave in the cylinder block.

7) Apply molybdenum disulfide oil to the crankshaft main journal, crank pin and the thrust washer mating surfaces.

8) Put the No.2 and No.3 pistons at the bottom dead center of their stroke. Install the crankshaft on the cylinder block while aligning it with the No.2 and No.3 connecting rods.

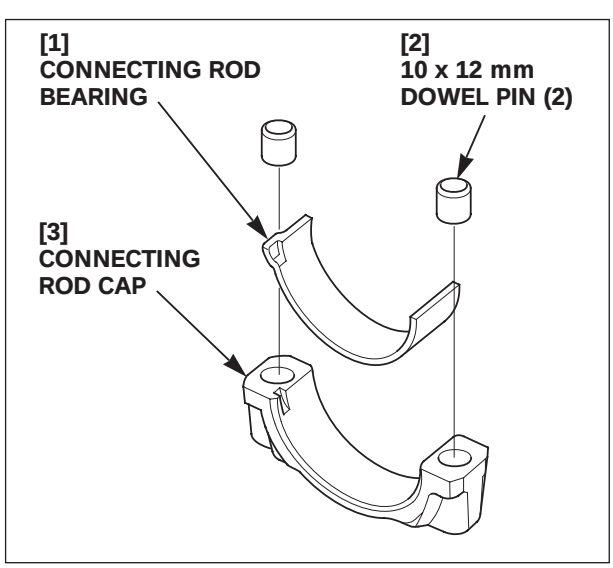
NOTICE

Install the crankshaft with care not to damage the journals.



9) Install the connecting rod bearing on the connecting rod cap aligning the projection on the connecting rod bearing with the concave in the connecting rod cap.

10) Install the two dowel pins on the connecting rod cap.

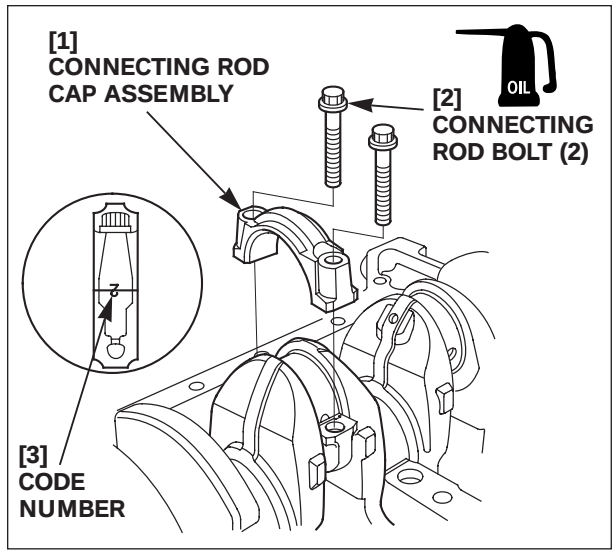


11) Apply engine oil to the threads and seat of the connecting rod bolts.
Install the connecting rod cap assembly on the connecting rod and tighten the two connecting rod bolts to the specified torque.
After tightening to the specified torque, tighten the bolts to an additional 90˚.

TORQUE: 20 N·m (2.0 kgf·m) + 90˚

NOTICE

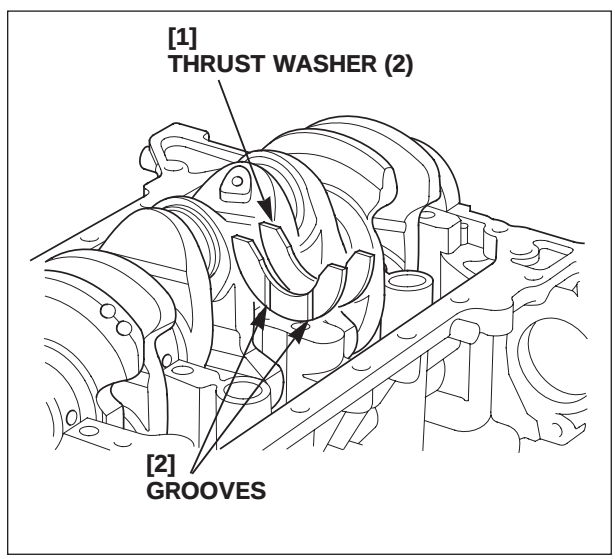
- *Install the connecting rod cap assembly aligning the code number with the number on the counter part.*
- *Check that the piston is at the bottom dead center of its stroke before tightening the bolts. It not, turn the crankshaft to bring the piston at the bottom dead center.*



12) Apply engine oil to the thrust washers and install them on the cylinder block No.4 journal.

NOTICE

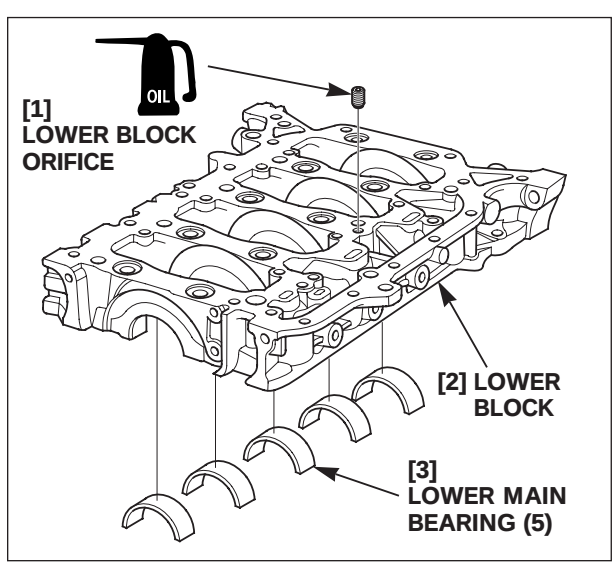
Install the thrust washers with the grooved side toward the crankshaft.



13) Install the lower main bearings on the cylinder block aligning the projection on the lower main bearing with the concave in the lower block.

14) Apply engine oil to the threads of the lower block orifice. Tighten the lower block orifice on the lower block to the specified torque.

TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)

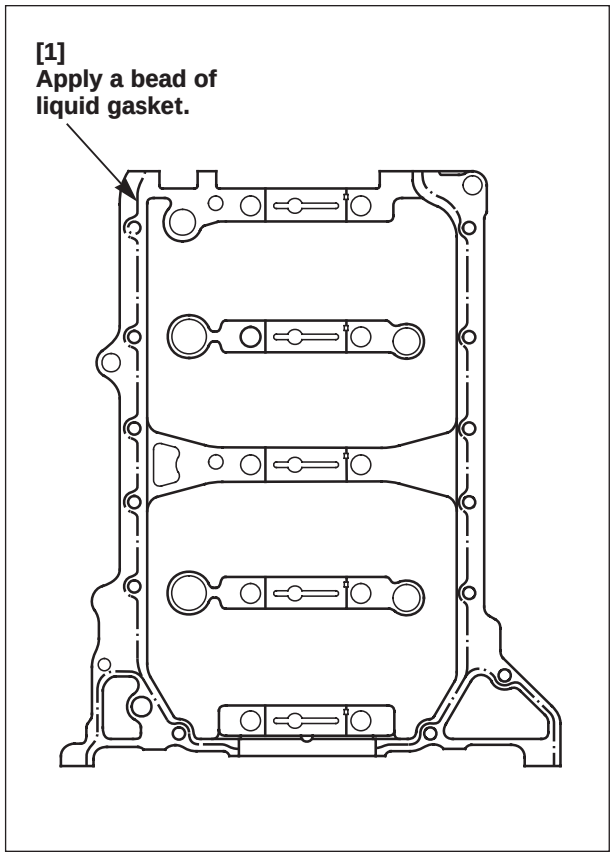


15) Clean the cylinder block and lower block mating surfaces thoroughly with the degreasing cleaning agent.

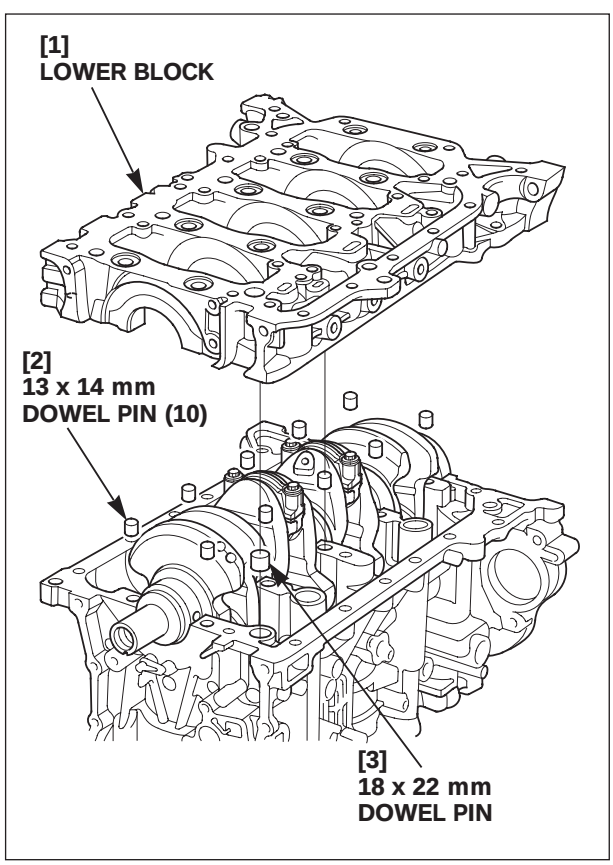
16) Apply a bead [ø2.0 – 3.0 mm (ø0.08 – 0.12 in.)] of the liquid gasket (ThreeBond® #1280B or equivalent) to the indicated area of the cylinder block.

NOTICE

- *Assemble the lower block within 5 minutes after applying the liquid gasket. If it has been left for 5 minutes or longer, remove the old liquid gasket and apply the liquid gasket again.*
- *Do not pour the engine oil in the oil tank at least 30 minutes after assembly.*



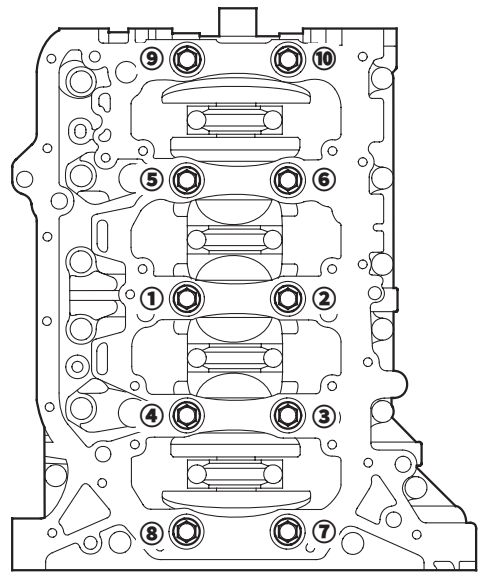
17) Install the eleven dowel pins and the lower block on the cylinder block.



18) Apply engine oil to the threads and the seating face of the washer of the 11 x 95 mm bolt-washers.

19) Loosely tighten the ten 11 x 95 mm bolt-washers on the lower block, then tighten the bolt-washers in the numbered sequence in two or three steps to the specified torque.
After tightening to the specified torque, tighten the bolt-washers to an additional 56° in the numbered order.

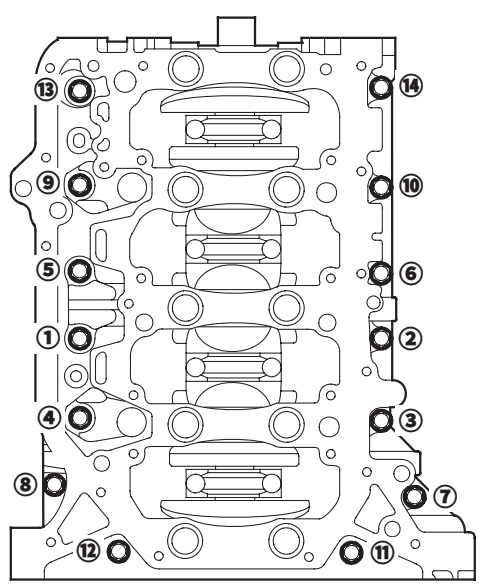
TORQUE: 29 N·m (3.0 kgf·m, 22 lbf·ft) + 56°



20) Apply engine oil to the threads and seating face of both the 8 x 50 mm flange bolts and the 8 x 35 mm flange bolts.

21) Loosely tighten the four 8 x 50 mm flange bolts and ten 8 x 35 mm flange bolts on the lower block. Tighten them to the specified torque in the numbered sequence in two or three steps.

TORQUE: 26 N·m (2.7 kgf·m, 20 lbf·ft)



22) Apply soapy water to the outer surface of the new 80 x 98 x 10 mm oil seal. Apply engine oil to the oil seal lip.

23) Using the special tools as shown, install the 80 x 98 x 10 mm oil seal on the crankshaft.
Drive in the oil seal so its upper side is 0.2 – 1.2 mm (0.01 – 0.05 in) deep from the surface.

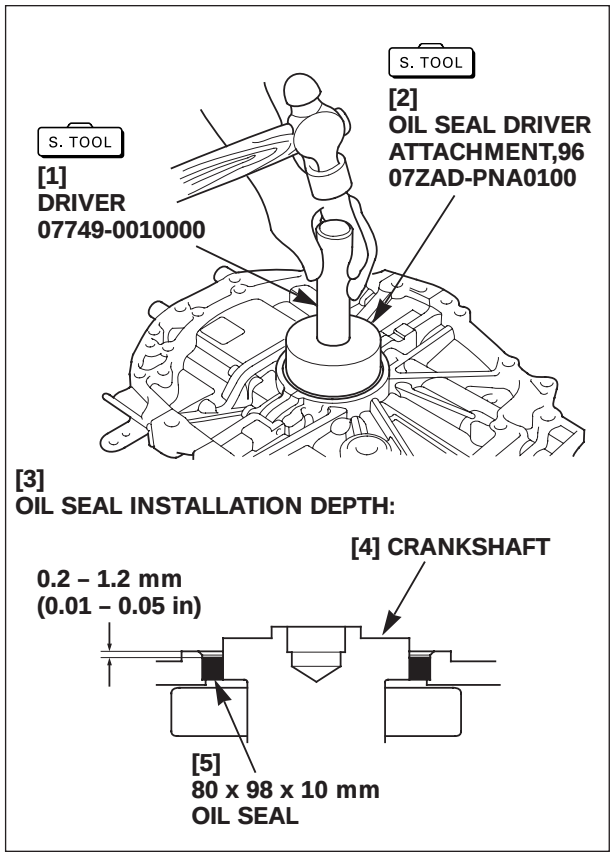
TOOLS:

Driver	**07749-0010000**
Oil seal driver attachment, 96	**07ZAD-PNA0100**

NOTICE

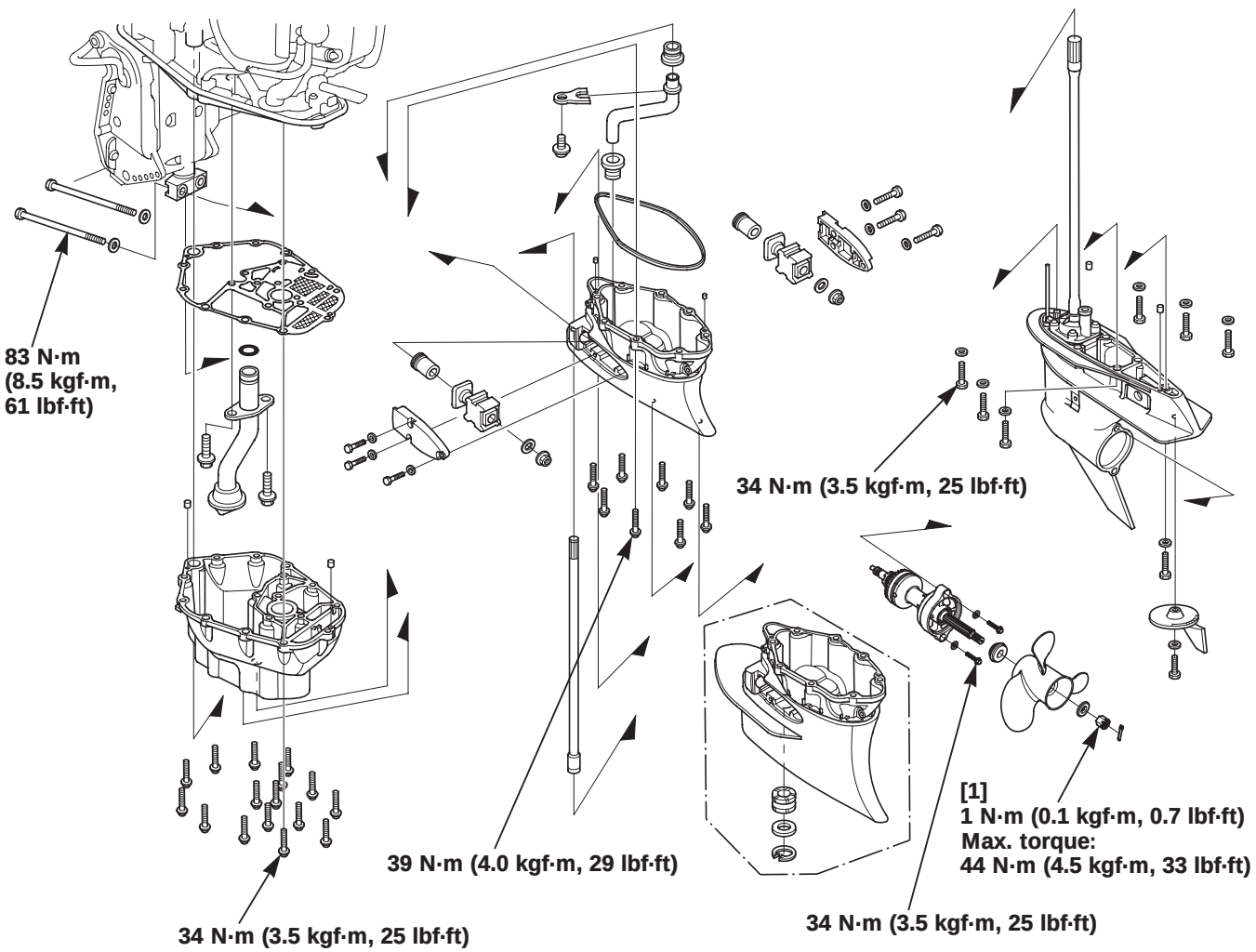
Drive in the oil seal with the part number on the oil seal toward out.

24) Install the following pars.
– Crankcase/balancer case assembly (P. 12-8)
– Flywheel (P. 11-14)
– Oil pump (P. 11-11)
– Engine assembly (P. 7-6)
– Cylinder head assembly (P. 10-32)
– L./R. engine under covers (P. 4-14)
– Engine cover (P. 4-2)



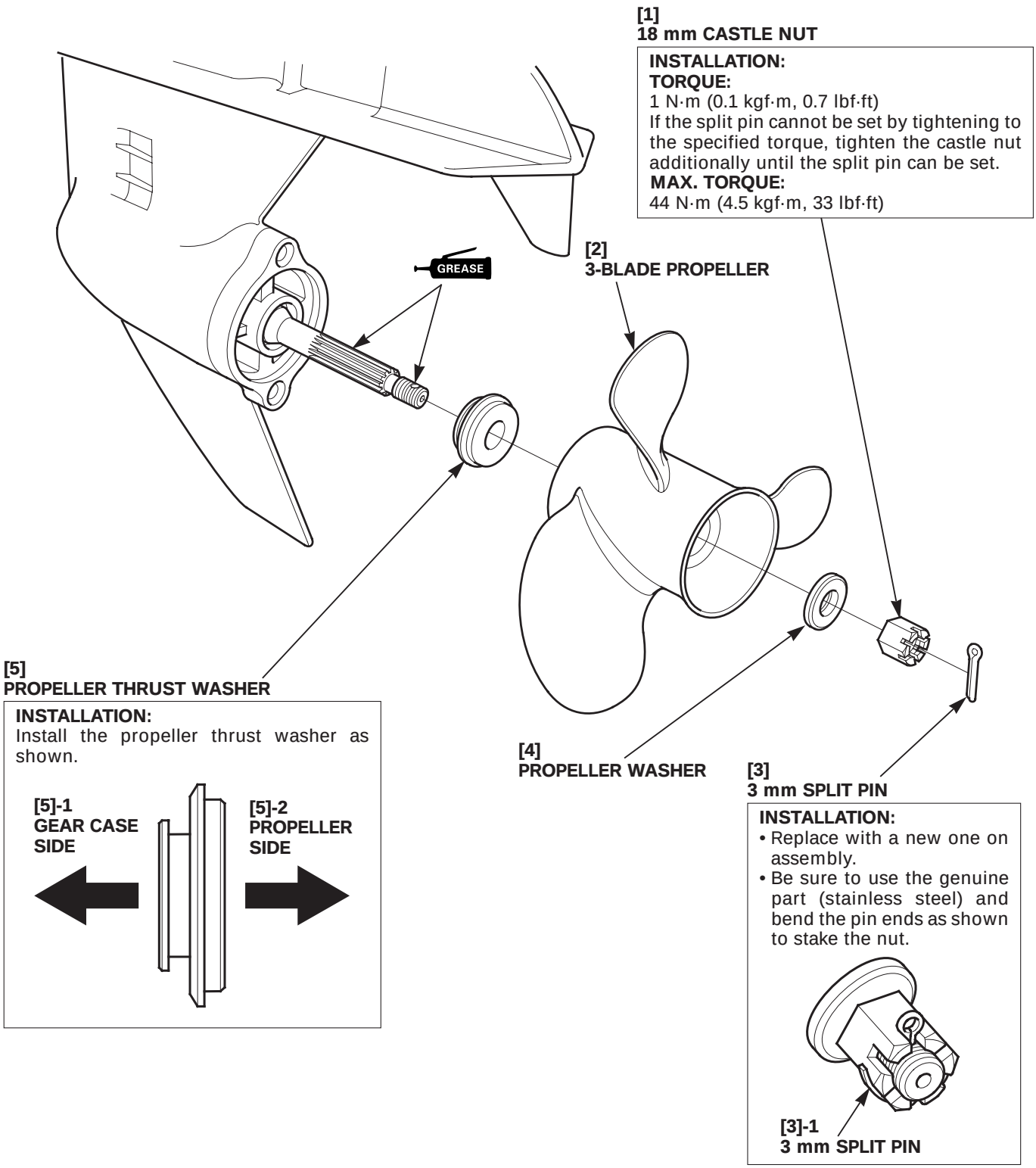
1. PROPELLER
2. GEAR CASE ASSEMBLY [*1]
3. WATER PUMP/SHIFT ROD [*1]
4. PROPELLER SHAFT HOLDER ASSEMBLY [*1]
5. PROPELLER SHAFT/PROPELLER SHAFT HOLDER [*1]
6. VERTICAL SHAFT/BEVEL GEAR [*1]
7. SHIM SELECTION [*1]
8. SHIM POSITION [*1]
9. BACKLASH ADJUSTMENT [*1]
10. GEAR CASE ASSEMBLY [*2]
11. WATER PUMP/SHIFT ROD [*2]
12. PROPELLER SHAFT HOLDER ASSEMBLY [*2]
13. PROPELLER SHAFT/PROPELLER SHAFT HOLDER [*2]
14. VERTICAL SHAFT/BEVEL GEAR [*2]
15. SHIM SELECTION [*2]
16. SHIM POSITION [*2]
17. BACKLASH ADJUSTMENT [*2]
18. ANODE METAL/WATER SCREEN
19. EXTENSION CASE/LOWER RUBBER MOUNT
20. OIL CASE

[*1]: LC, XC, LD and XD types [*2]: XCC, LCD and XCD types



1. PROPELLER

a. REMOVAL/INSTALLATION



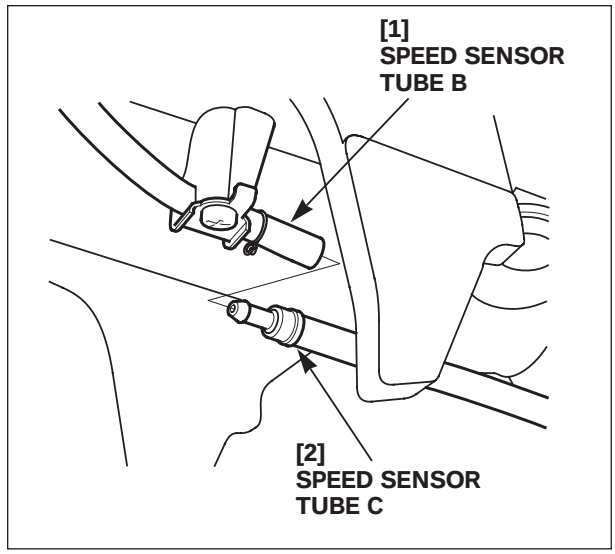
2. GEAR CASE ASSEMBLY [*1]

a. REMOVAL

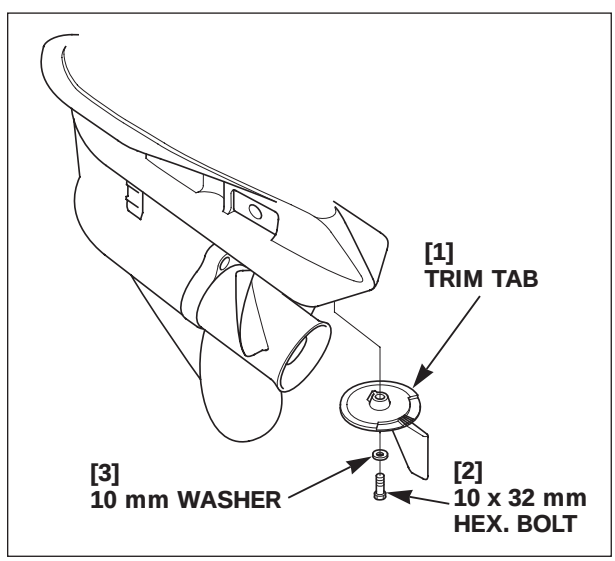
1) Place the remote control lever in the "N" (Neutral) position.

2) Tilt up the outboard motor to the uppermost position.

3) Disconnect the speed sensor tube B and the speed sensor tube C.

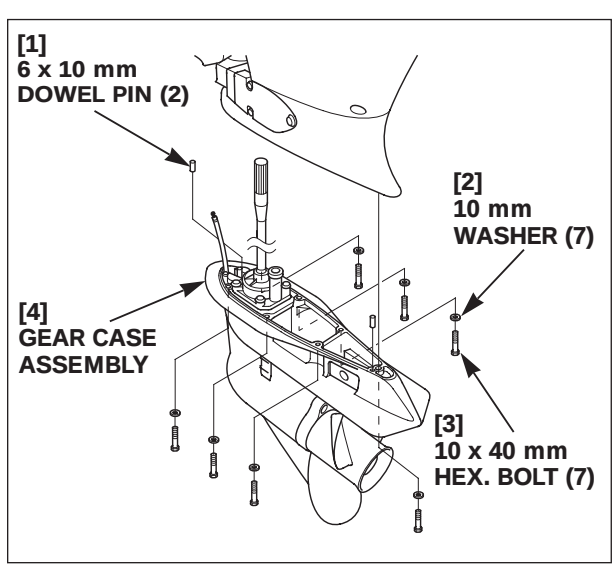


4) Remove the 10 x 32 mm hex. bolt and the 10 mm washer. Remove the trim tab from the gear case assembly.

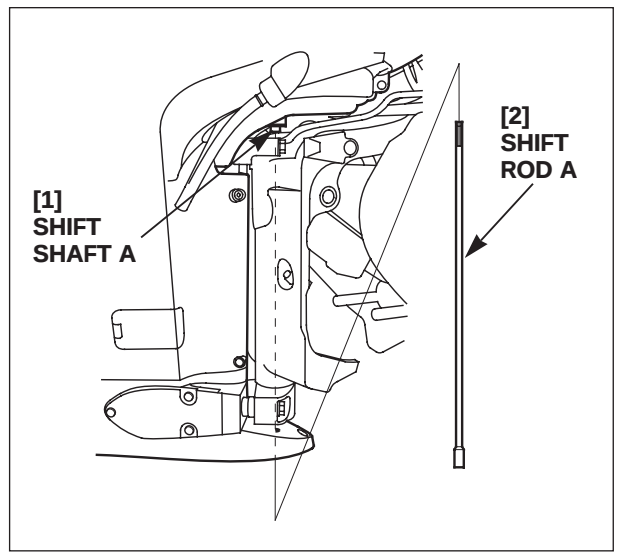


5) Remove the seven 10 x 40 mm hex. bolts and the seven 10 mm washers, then remove the gear case assembly from the outboard motor.
Remove the two dowel pins.

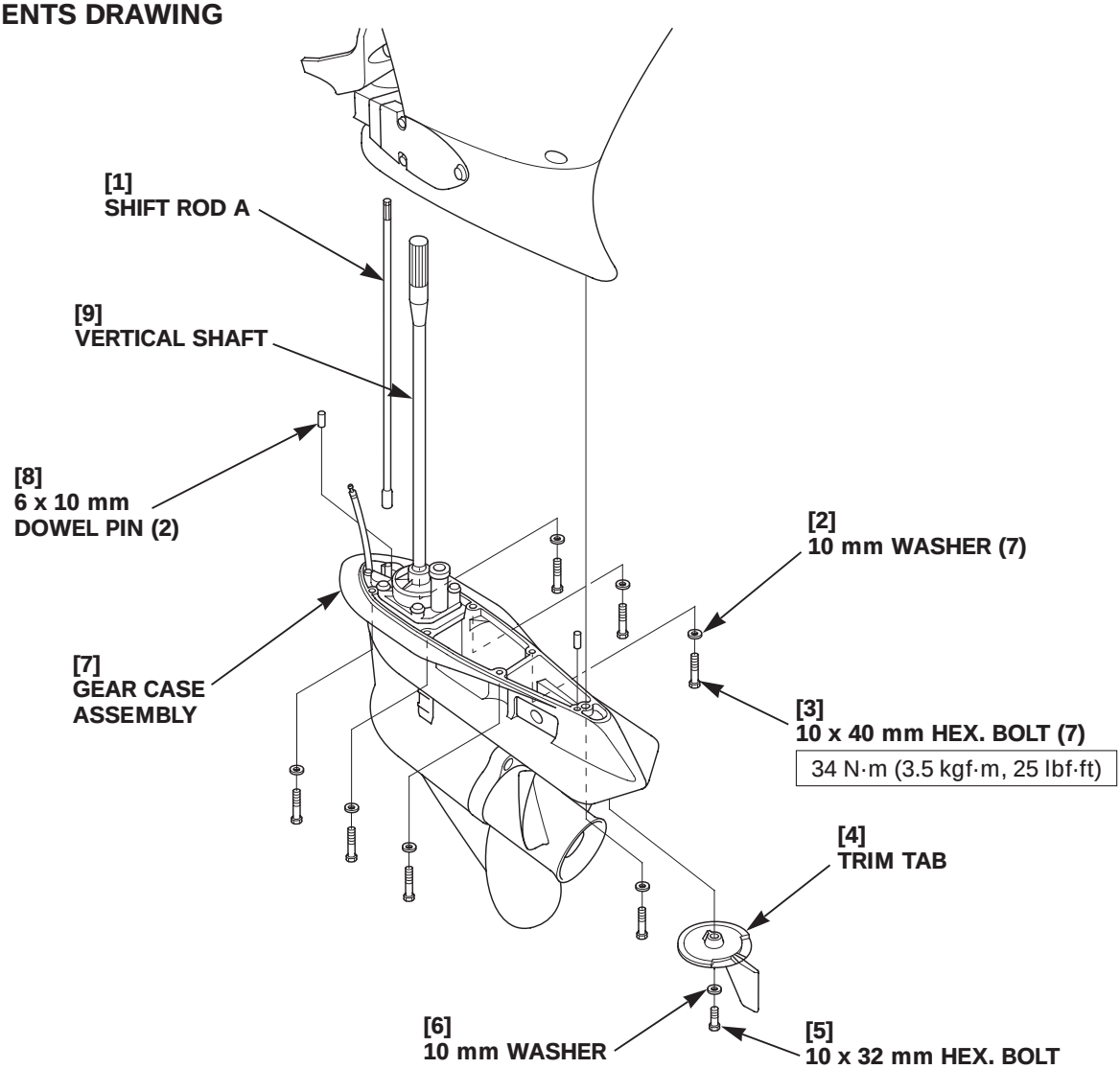
6) After removing the gear case assembly, lower the outboard motor to the lowermost position.



7) Remove the shift rod A from the shift shaft A.



b. COMPONENTS DRAWING

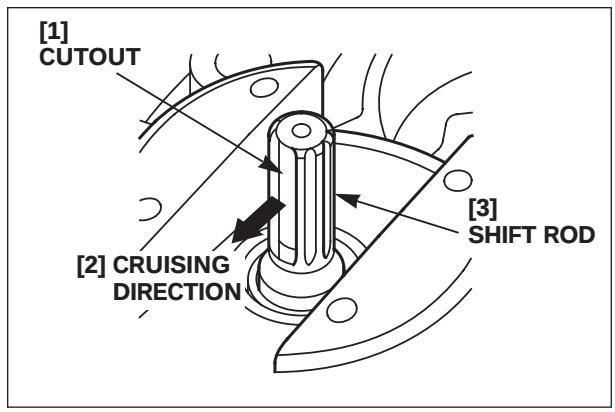


c. INSTALLATION

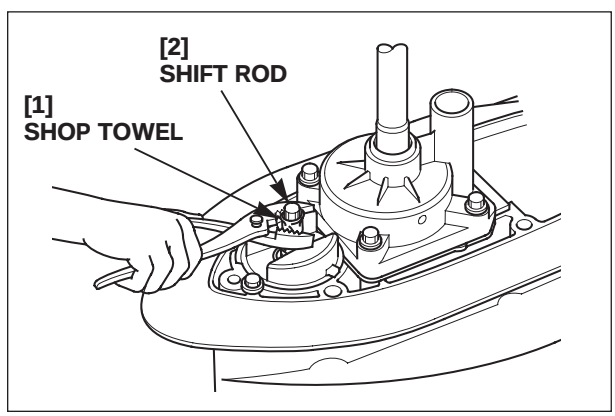
1) Place the remote control lever in the "N" (Neutral) position.

2) Check that the shift rod of the gear case is in the "N" (Neutral) position.

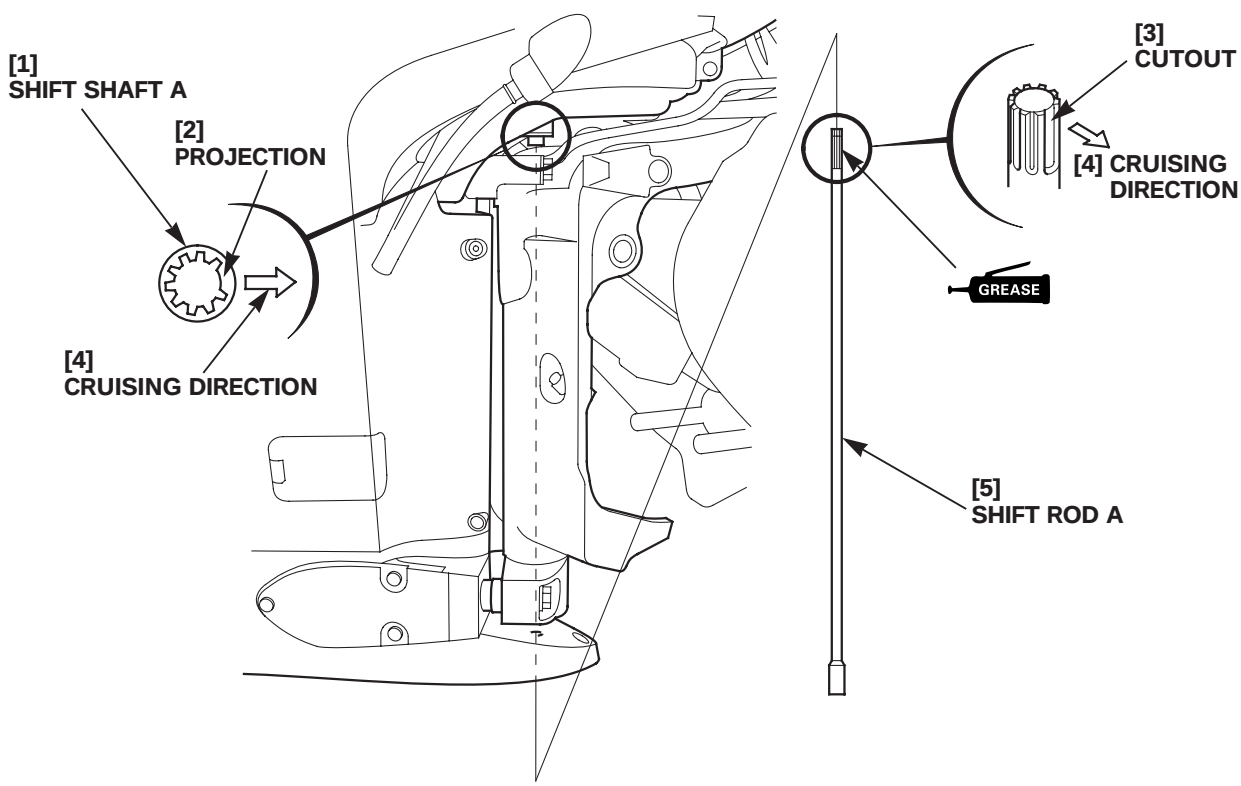
   To check:
   Check whether the cutout of the shift rod spline faces in the direction shown. [It indicates that the shift rod is in the "N" (Neutral) position.]



3) If the cutout of the spline is not in the direction 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.



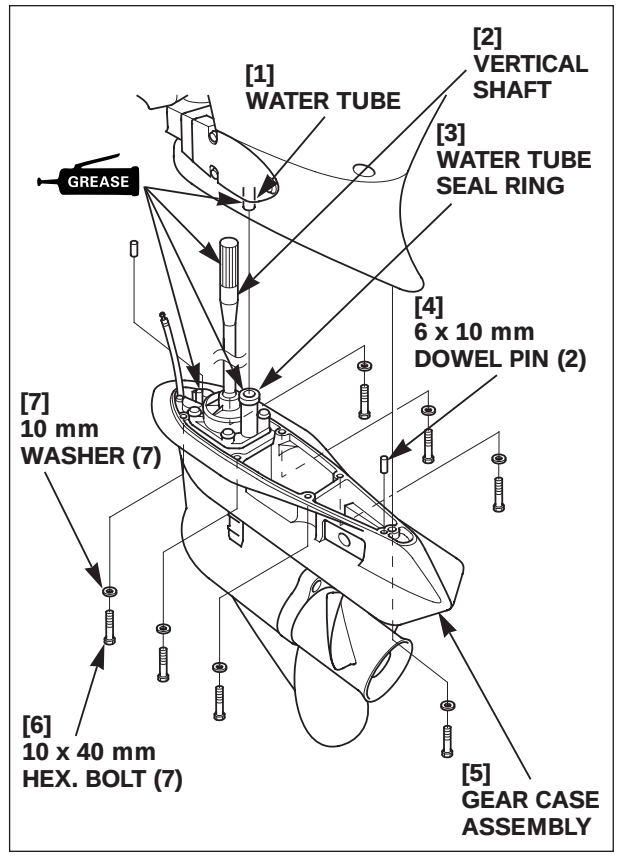
4) Tilt up the outboard motor to the uppermost position.
5) Apply grease to the spline of the shift rod A.
6) Install the shift rod A by aligning the projection of the shift shaft A with the cutout in the spline of the shift rod A. Check that the cutout in the spline of the shift rod A is toward the cruising direction.



7) Apply grease to the vertical shaft spline and the shift rod spline.
   Apply grease to the water tube insertion part and to the inner wall of the water tube seal ring of the impeller housing.
   Apply grease to the inner wall of the vertical shaft bushing [XC and XD types only] (P. 14-90).

8) Install the two dowel pins. Aligning the water tube with the water tube seal ring of the impeller housing, install the vertical shaft and the crankshaft. Install the shift rod and shift rod A, too, by aligning the splines.

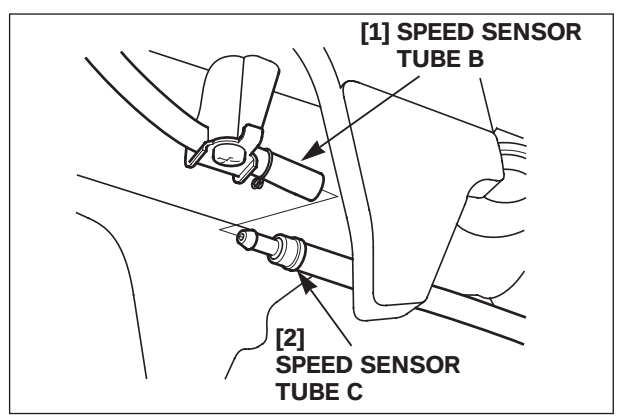
9) Install the gear case assembly on the outboard motor. Loosely tighten the seven 10 mm washers and the seven 10 x 40 mm hex. bolts.



10) Connect the speed sensor tube B and the speed sensor tube C.

11) Lower the outboard motor to the lowermost position and tighten the seven 10 x 40 mm hex. bolts to the specified torque.

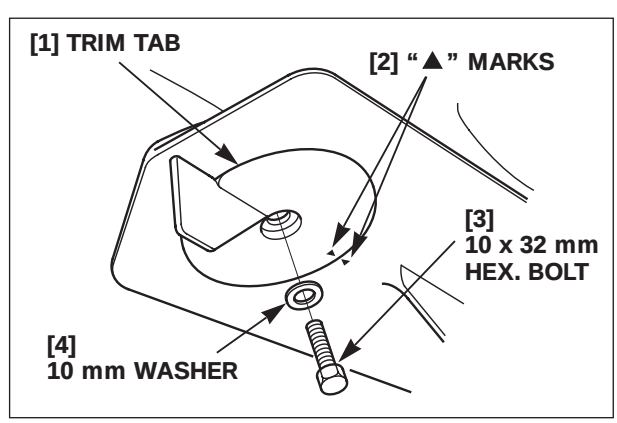
    TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)



12) Position the trim tab on the gear case assembly.

13) Install the trim tab on the gear case assembly aligning the "▲" mark on the trim tab with the "▲" mark on the gear case. Tighten the 10 mm washer and the 10 x 32 mm hex. bolt.

14) After installing the gear case assembly, adjust the shift control cable (P. 3-25).



3. WATER PUMP/SHIFT ROD [*1]

a. DISASSEMBLY

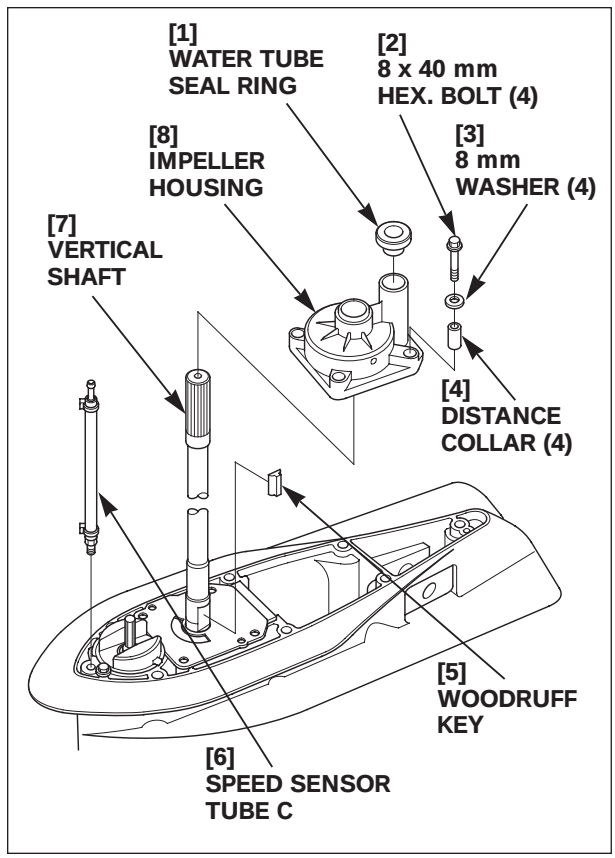
Remove the following parts.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-3)

1) Remove the speed sensor tube C.

2) Remove the water tube seal ring from the impeller housing.

3) Remove the four 8 x 40 mm hex. bolts and the four 8 mm washers from the impeller housing. Remove the impeller housing.
Remove the four distance collars from the impeller housing.

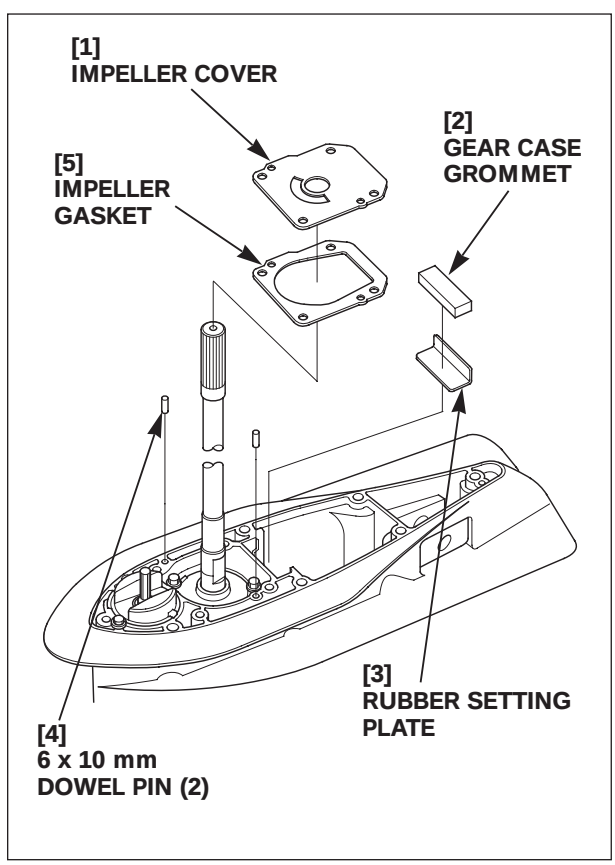
4) Remove the woodruff key from the vertical shaft.



5) Remove the impeller cover, impeller gasket, two dowel pins, gear case grommet and the rubber setting plate.

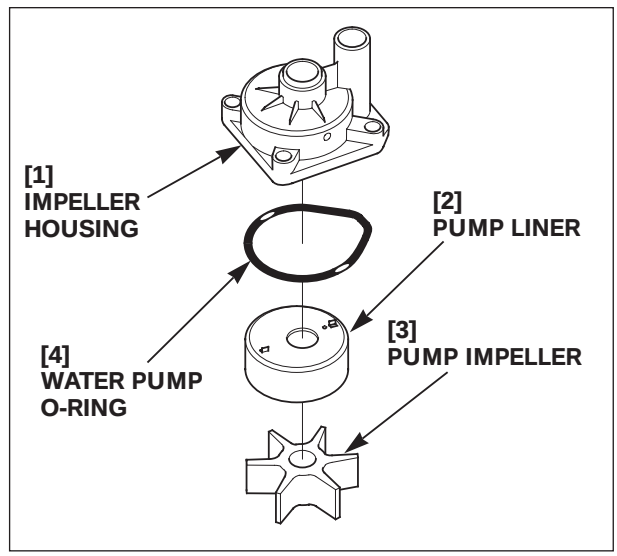
NOTICE

Replace the impeller gasket with a new one on assembly.



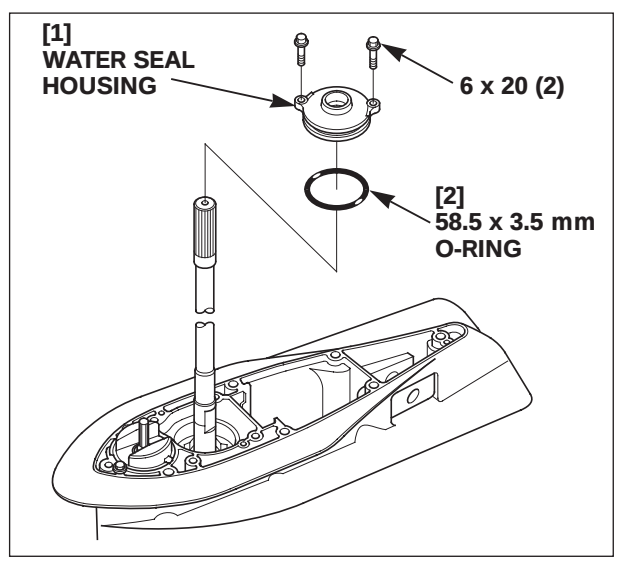
6) Check the pump impeller for cracks, wear or damage from overheating, and replace if necessary.

7) Remove the pump impeller, pump liner and the water pump O-ring from the impeller housing.
Replace the O-ring with a new one on assembly.



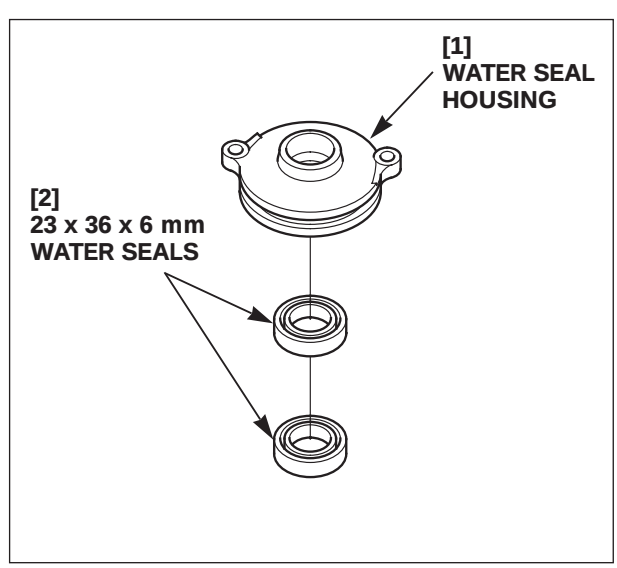
8) Remove the two 6 x 20 mm flange bolts and remove the water seal housing.

9) Remove the 58.5 x 3.5 mm O-ring from the water seal housing.
Replace the O-ring with a new one on assembly.

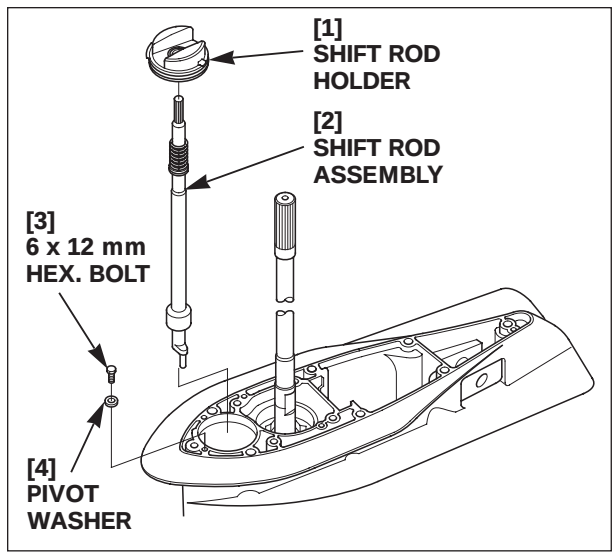


10) Before removing the 23 x 36 x 6 mm water seal, check the water seal lip for cut. Replace if necessary.

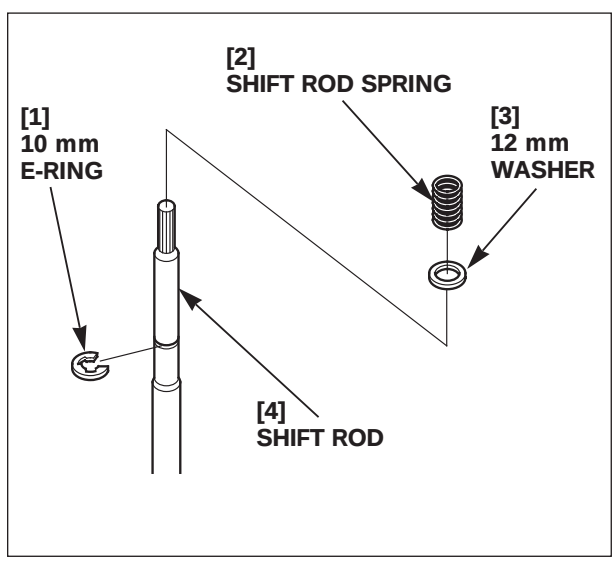
11) Remove the two 23 x 36 x 6 mm water seals from the water seal housing using a commercially available oil seal remover.
Replace the water seals with the new ones on assembly.



12) Remove the 6 x 12 mm hex. bolt and the pivot washer. Remove the shift rod holder and the shift rod assembly.



13) Remove the shift rod spring, 12 mm washer and the 10 mm E-ring from the shift rod.



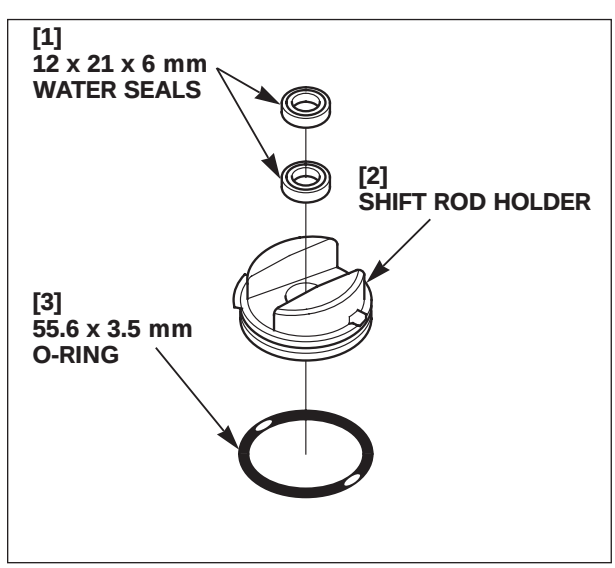
14) Check the 12 x 21 x 6 mm water seal lip for cut and replace if necessary.

15) Remove the two 12 x 21 x 6 mm water seals from the shift rod holder using a commercially available oil seal remover.

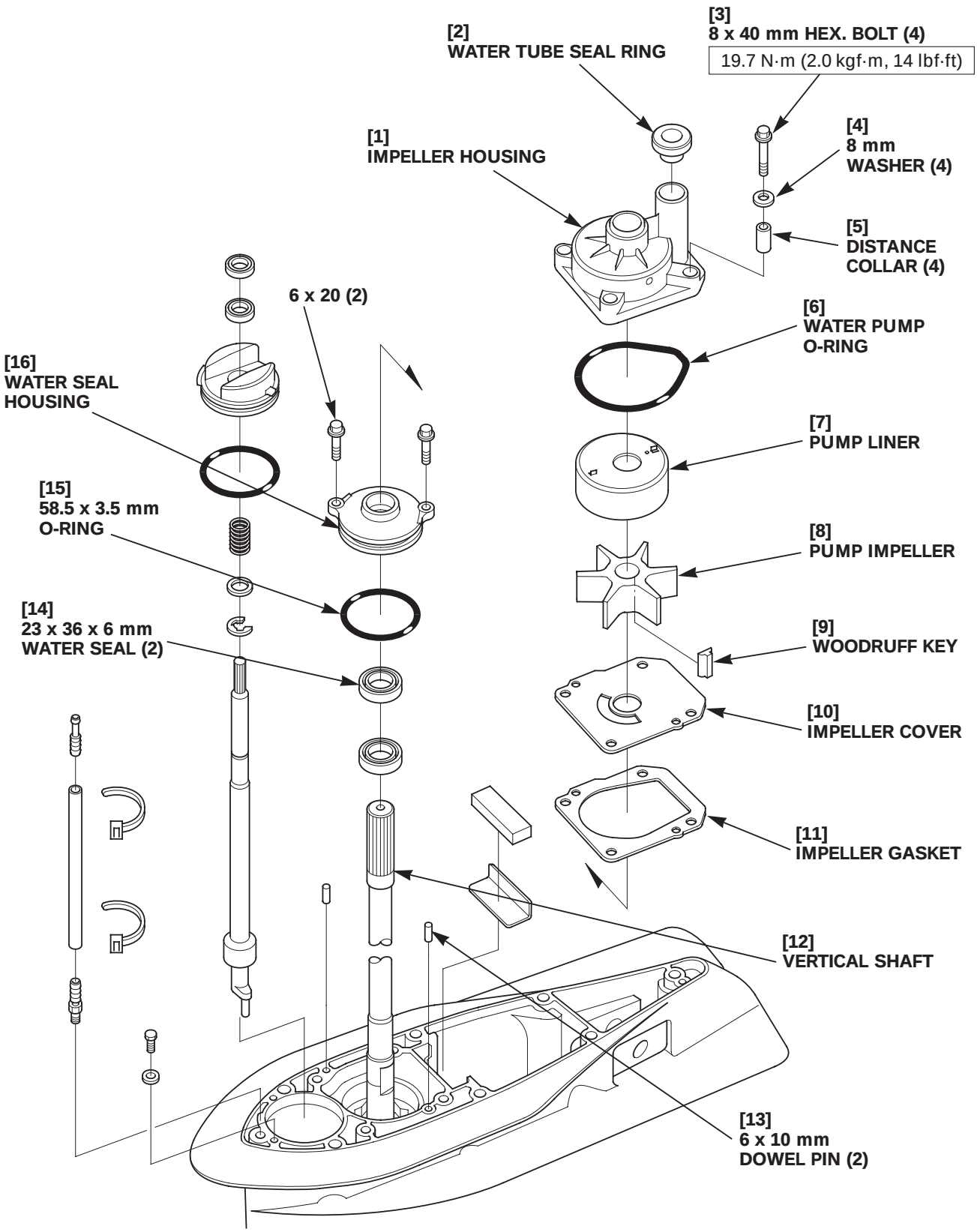
16) Remove the 55.6 x 3.5 mm O-ring from the shift rod holder.

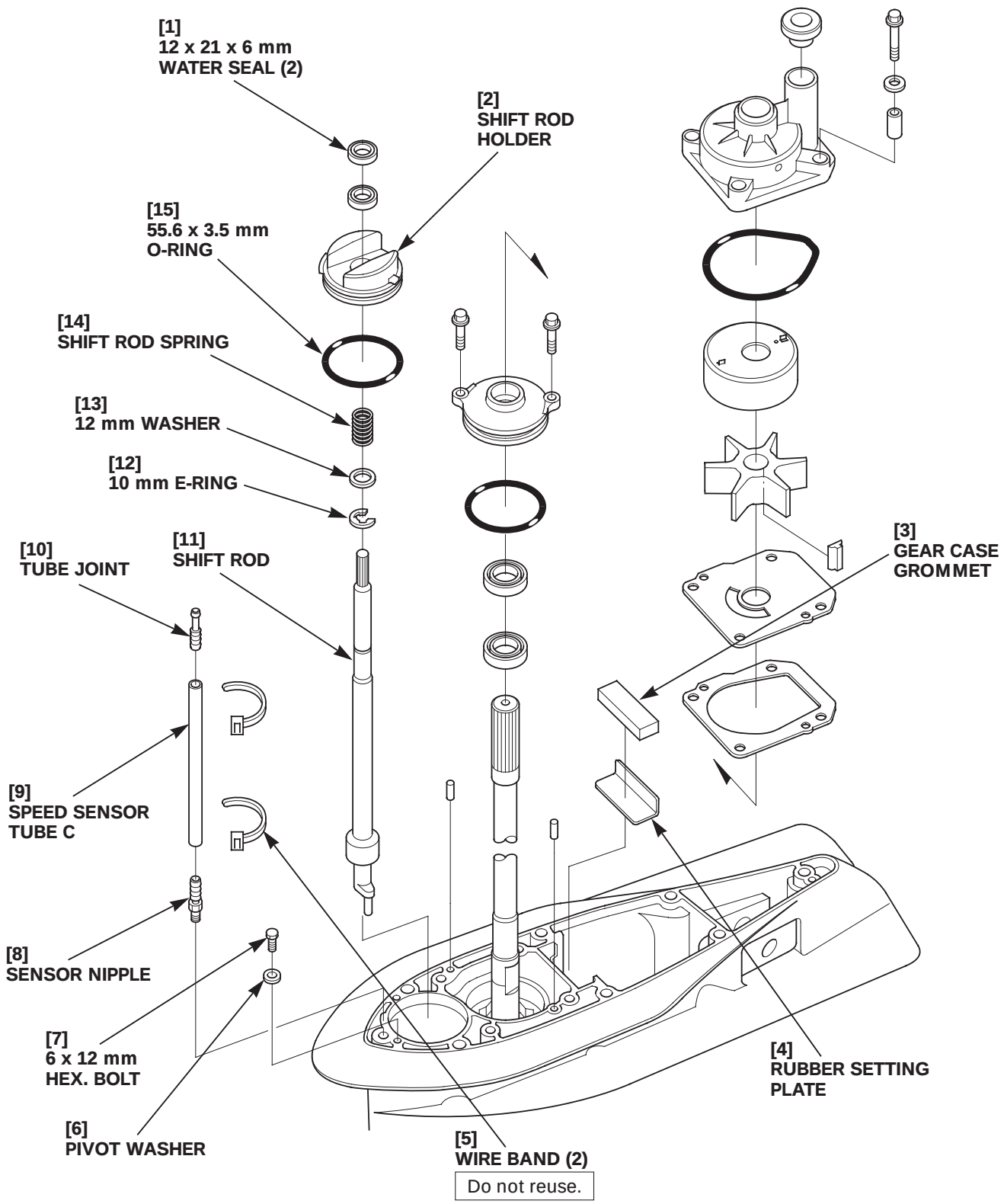
NOTICE

- *Replace the 12 x 21 x 6 mm water seals with the new ones on assembly.*
- *Replace the 55.6 x 3.5 mm O-ring with a new one on assembly.*



b. COMPONENTS DRAWING




[1]
12 x 21 x 6 mm
WATER SEAL (2)
[2]
SHIFT ROD
HOLDER
[15]
55.6 x 3.5 mm
O-RING
[14]
SHIFT ROD SPRING
[13]
12 mm WASHER
[12]
10 mm E-RING
[10]
TUBE JOINT
[11]
SHIFT ROD
[3]
GEAR CASE
GROMMET
[9]
SPEED SENSOR
TUBE C
[8]
SENSOR NIPPLE
[7]
6 x 12 mm
HEX. BOLT
[6]
PIVOT WASHER
[5]
WIRE BAND (2)
Do not reuse.
[4]
RUBBER SETTING
PLATE

c. ASSEMBLY

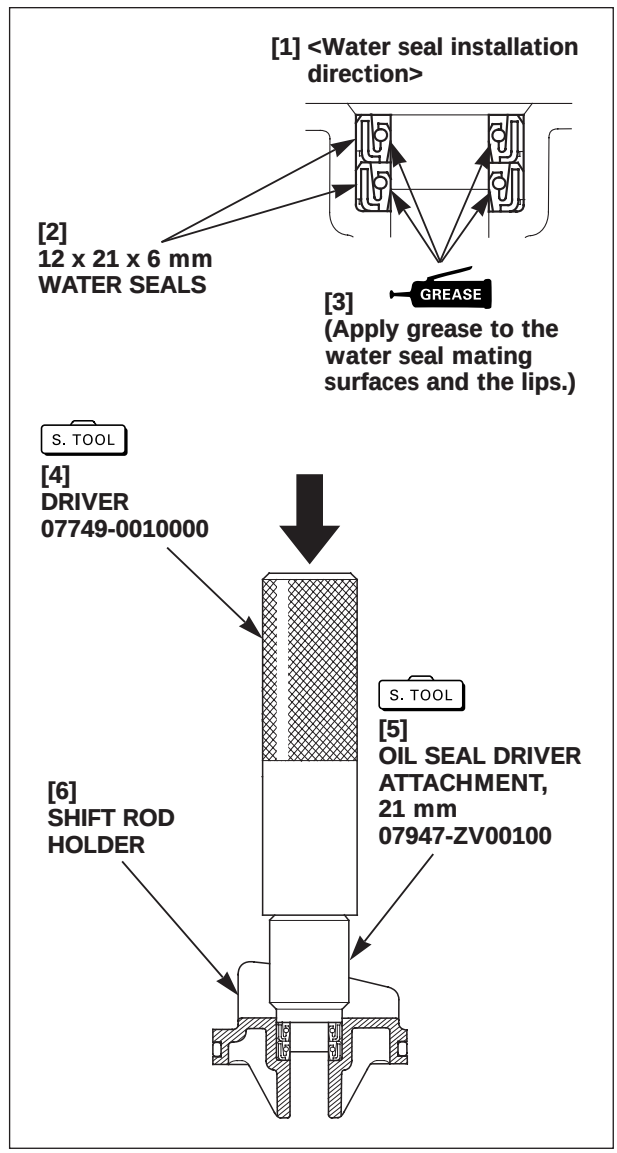
1) Apply soapy water to the circumference of the 12 x 21 x 6 mm water seals.

2) Drive the 12 x 21 x 6 mm water seals one by one in the shift rod holder using the special tools. Note the installation direction of the water seals.
Be sure to apply grease to the water seal mating surfaces before installation.

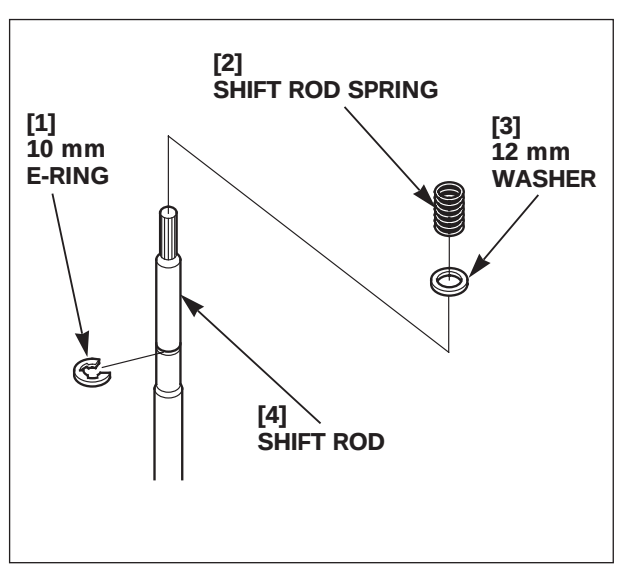
TOOLS:

Driver	**07749-0010000**
Oil seal driver attachment, 21 mm	**07947-ZV00100**

3) After installing the water seals, apply grease to the water seal lips.



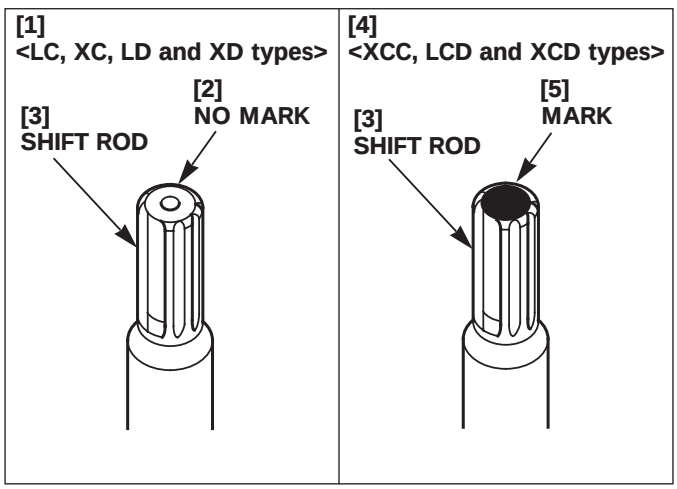
4) Position the 10 mm E-ring, 12 mm washer and the shift rod spring on the shift rod.

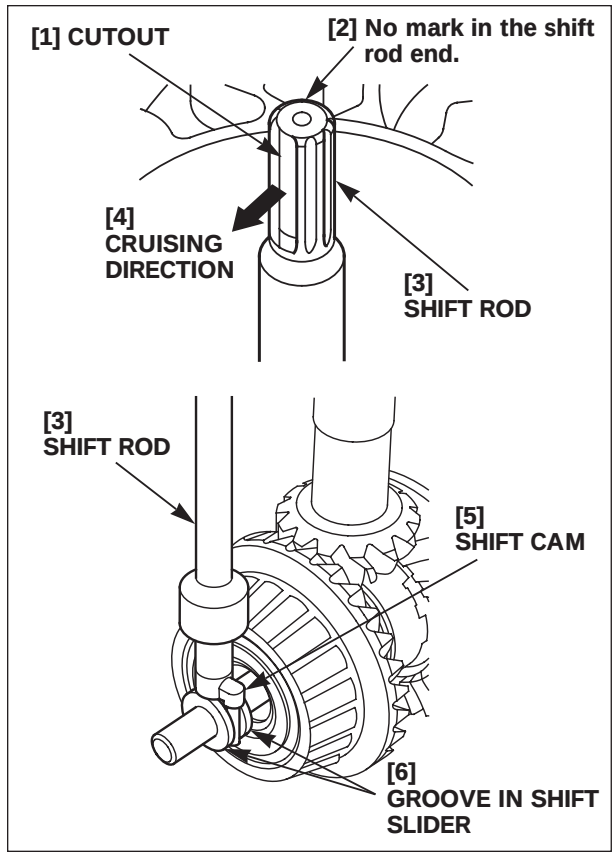


5) Install the shift rod by aligning the shift cam of the shift rod with the groove in the shift slider so that the cutout of the shift rod spline faces in the cruising direction.

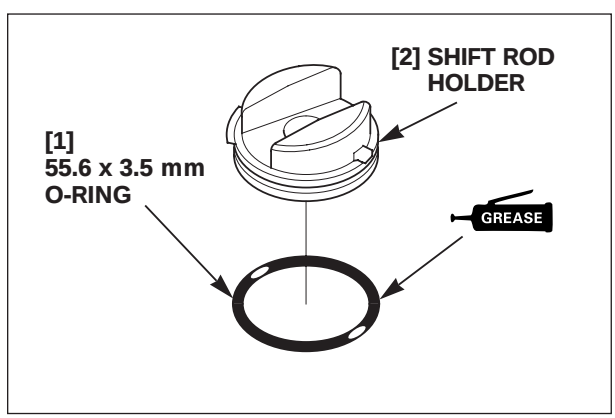
NOTICE

- *Check that there is no marking in the shift rod end.*
- *If the shift cam is in alignment with the groove in the shift slider but the cutout of the spline is not in the cruising direction, see the step 3 on page 14-5 and adjust accordingly.*

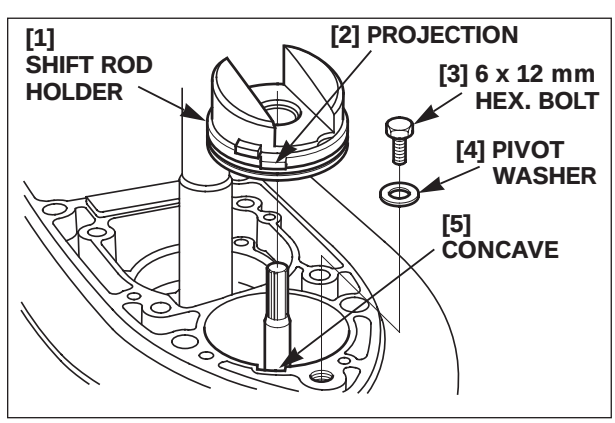




6) Apply grease to the circumference of the new 55.6 x 3.5 mm O-ring and install it on the shift rod holder.



7) Install the shift rod holder aligning the projection with the concave in the gear case and tighten with the pivot washer and the 6 x 12 mm hex. bolt.
After installation, check that the cutout of the shift rod spline faces in the cruising direction.



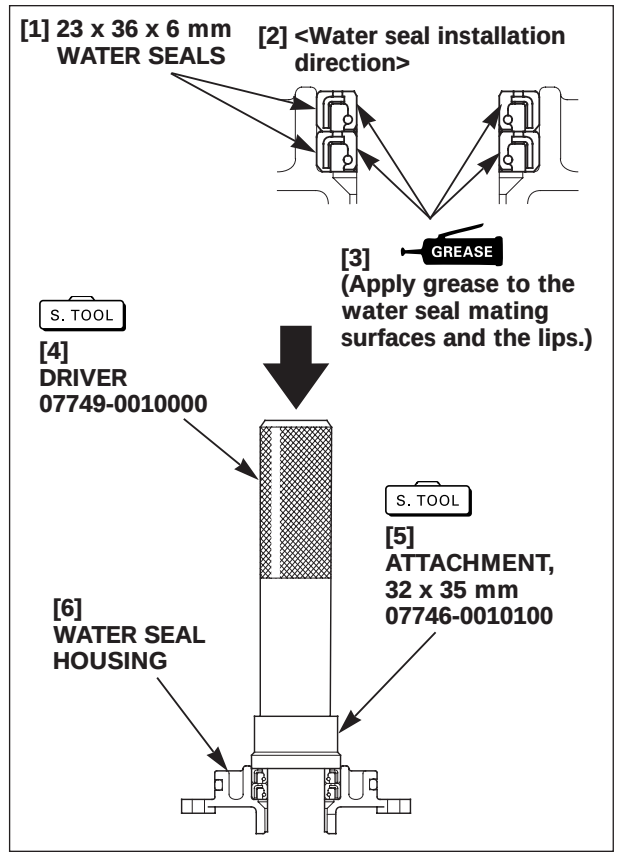
8) Apply soapy water to the circumference of the 23 x 36 x 6 mm water seals.

9) Drive the 23 x 36 x 6 mm water seals one by one in the water seal housing using the special tools. Note the installation direction of the water seals.
Be sure to apply grease to the water seal mating surfaces before installation.

TOOLS:

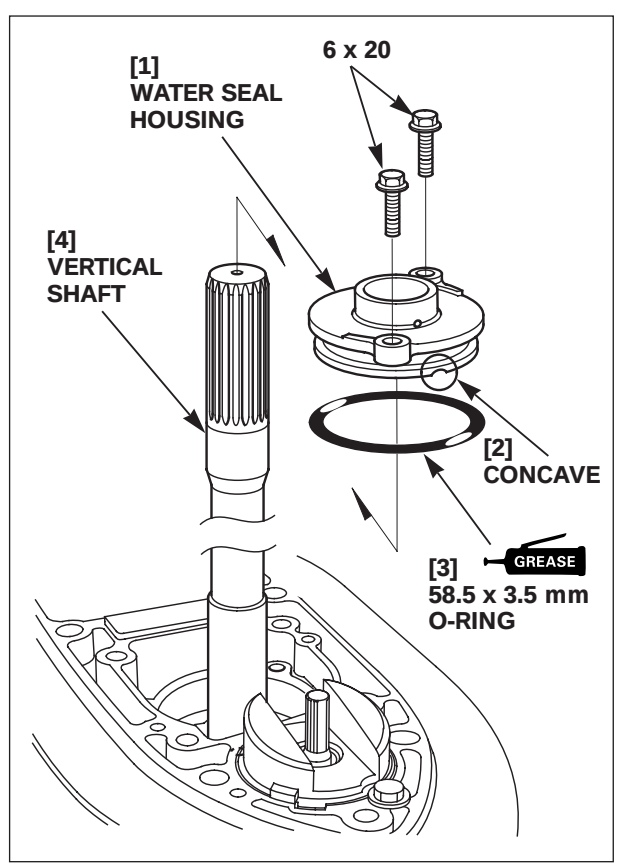
Driver	**07749-0010000**
Attachment, 32 x 35 mm	**07746-0010100**

10) After installing the water seals, apply grease to the water seal lips.

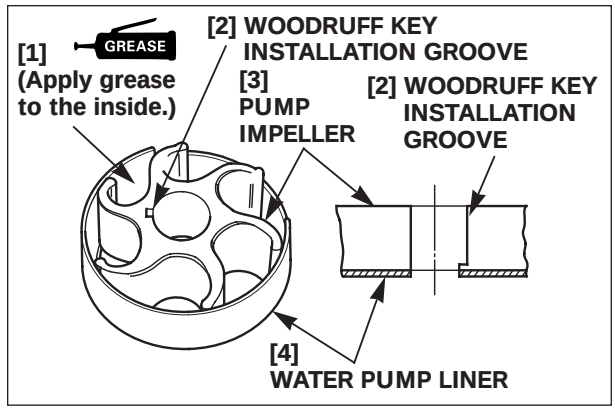


11) Apply grease to the circumference of the new 58.5 x 3.5 mm O-ring and position it on the water seal housing.

12) Install the water seal housing so that the concave faces in the cruising direction, and tighten it with the two 6 x 20 mm flange bolts.

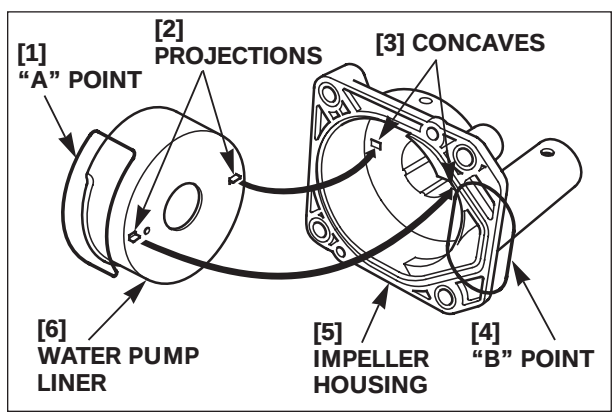


13) Apply grease to the inner wall of the water pump liner. Install the pump impeller in the water pump liner with the woodruff key installation groove facing up and the pump impeller fins in the direction shown.
Be sure to align the hole in the pump liner with the hole in the pump impeller.

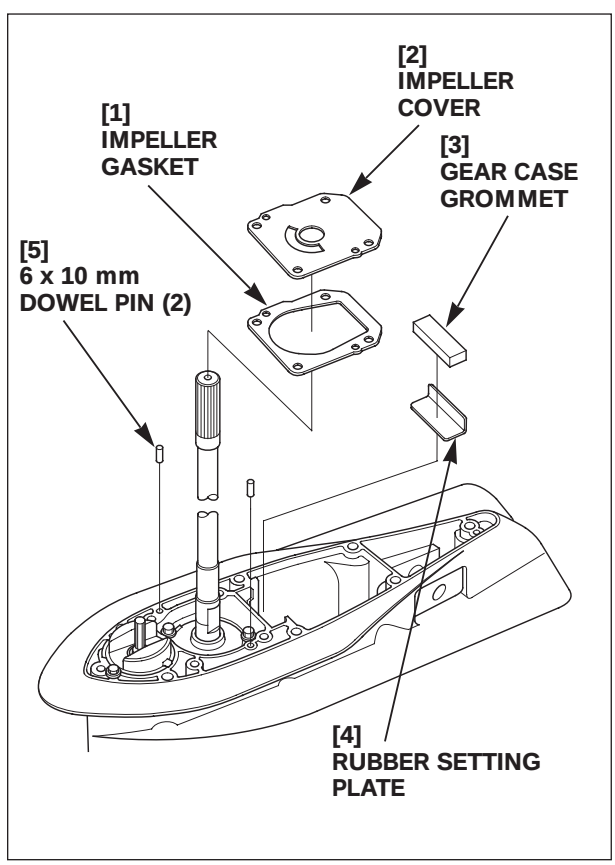


14) Install the water pump liner in the impeller housing by aligning the two projections on the pump liner with the two grooves inside the impeller housing.
Be sure that the part "A" of the water pump liner is in alignment with the part "B" of the impeller housing, too.

15) Apply grease to the circumference of the new water pump O-ring and install it on the impeller housing.



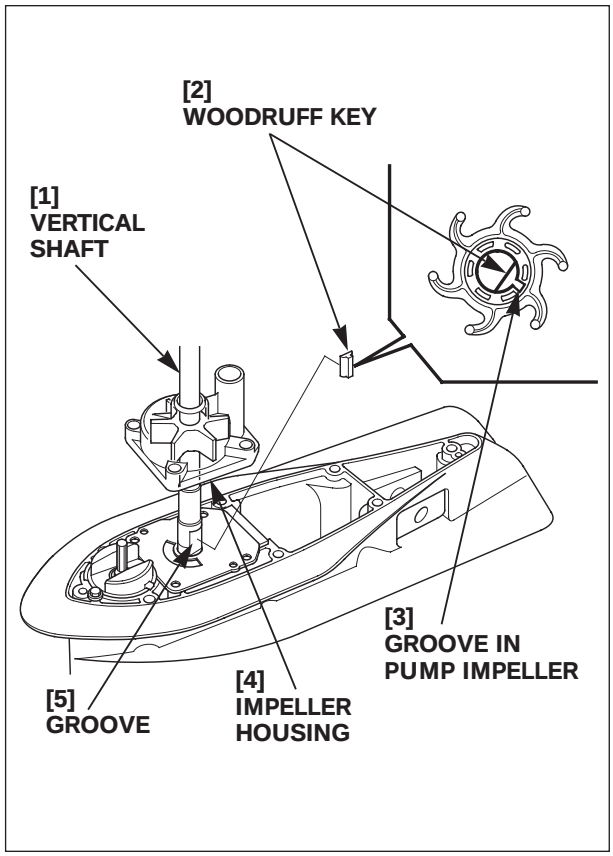
16) Install the rubber setting plate, gear case grommet, two dowel pins, new impeller gasket and the impeller cover.



17) Install the woodruff key in the groove in the vertical shaft. Align the groove in the pump impeller with the woodruff key and install the impeller housing by turning it clockwise.

NOTICE

- *Turn the impeller housing clockwise when it is turned with the pump impeller mounted.*
- *After installing the impeller housing, check that the impeller cover and the impeller gasket are set in the proper position.*



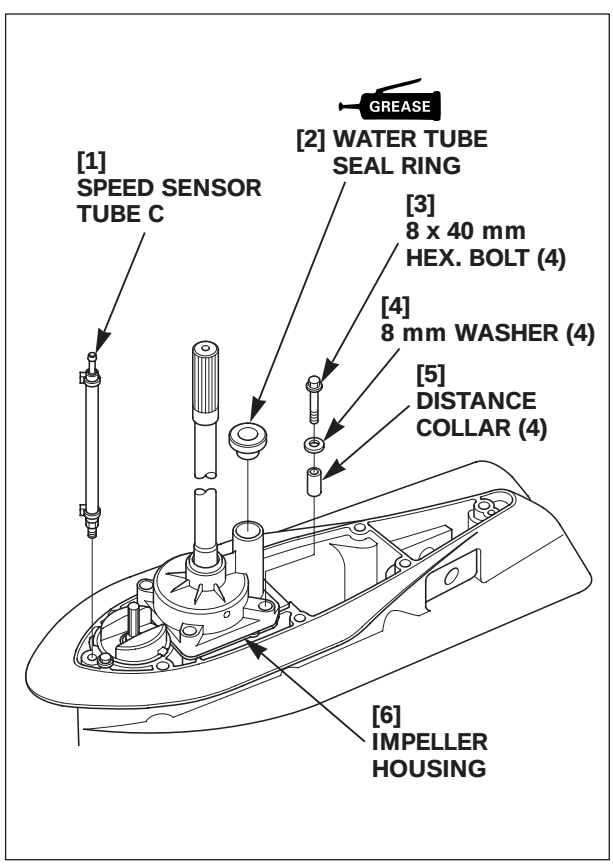
18) Install the four distance collars on the impeller housing, and tighten the four 8 mm washers and the four 8 x 40 mm hex. bolts to the specified torque.

TORQUE: 19.7 N·m (2.0 kgf·m, 14 lbf·ft)

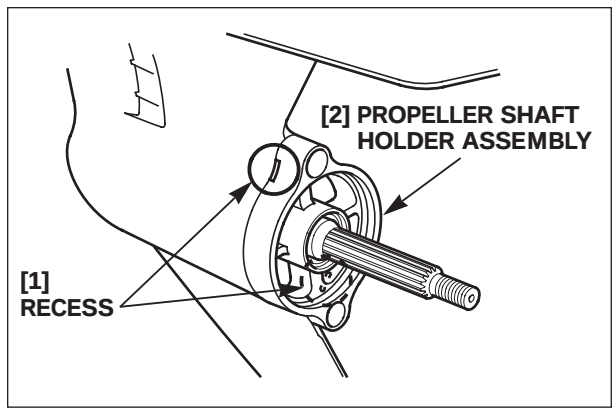
19) Apply grease to the inner wall of the water tube seal ring. Install the water tube seal ring aligning the projection with the hole in the housing.

20) Install the speed sensor tube C.

21) Install the following parts.
– Gear case assembly (P. 14-5)
– Propeller (14-2)



4. PROPELLER SHAFT HOLDER ASSEMBLY [*1]

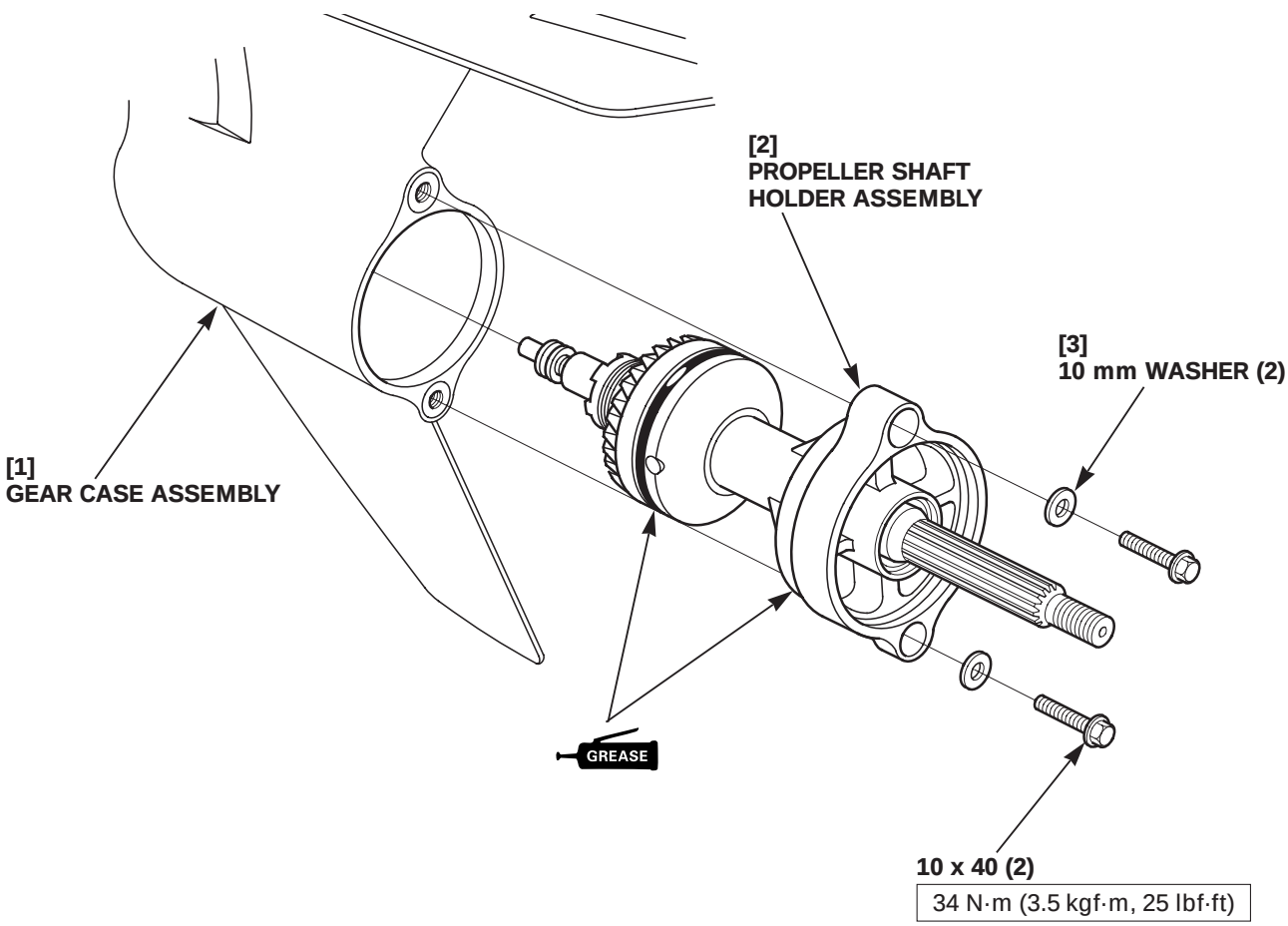


a. REMOVAL/INSTALLATION

Remove the following parts.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-3)
– Water pump/shift rod (P. 14-7)

1) Remove the two 10 mm washers and the two 10 x 40 mm flange bolts.
2) Insert a screwdriver or equivalent tool into the recess in the propeller shaft holder and remove the propeller shaft holder assembly from the gear case.

Installation is the reverse order of removal.

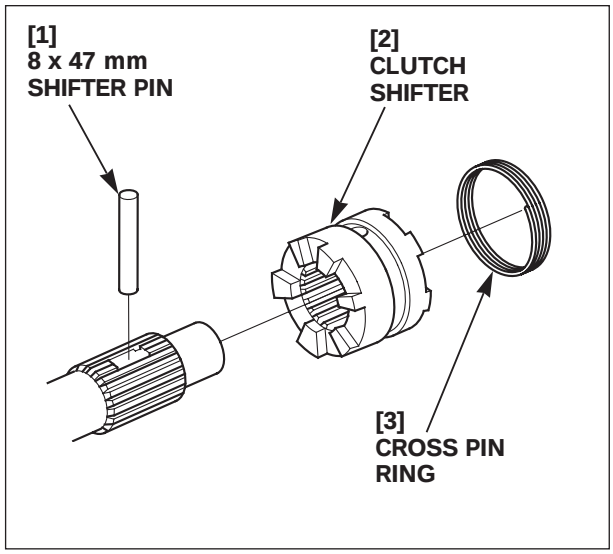


5. PROPELLER SHAFT/PROPELLER SHAFT HOLDER [*1]

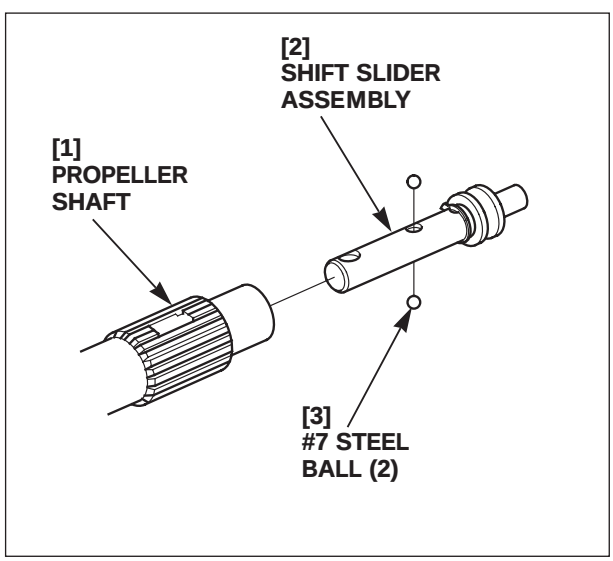
a. DISASSEMBLY

Remove the following parts.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-3)
– Water pump/shift rod (P. 14-7)
– Propeller shaft holder assembly (P. 14-17)

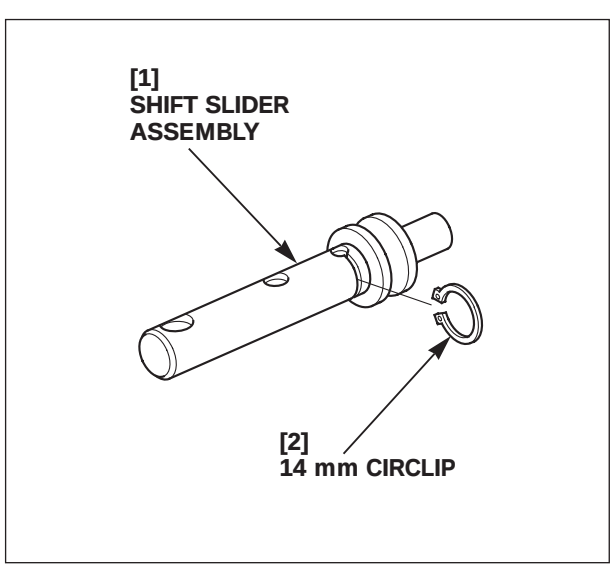
1) Remove the cross pin ring and the 8 x 47 mm shifter pin, then remove the clutch shifter.



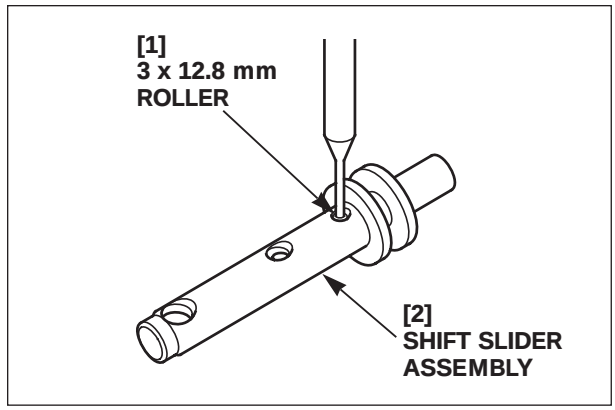
2) Remove the shift slider assembly and the two #7 steel balls from the propeller shaft. Take care not to lose the steel balls.



3) Remove the 14 mm circlip from the shift slider assembly.



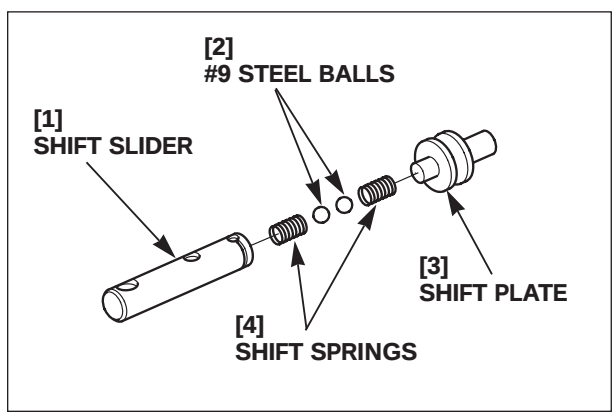
4) Remove the 3 x 12.8 mm roller from the shift slider assembly using a commercially available pin driver.



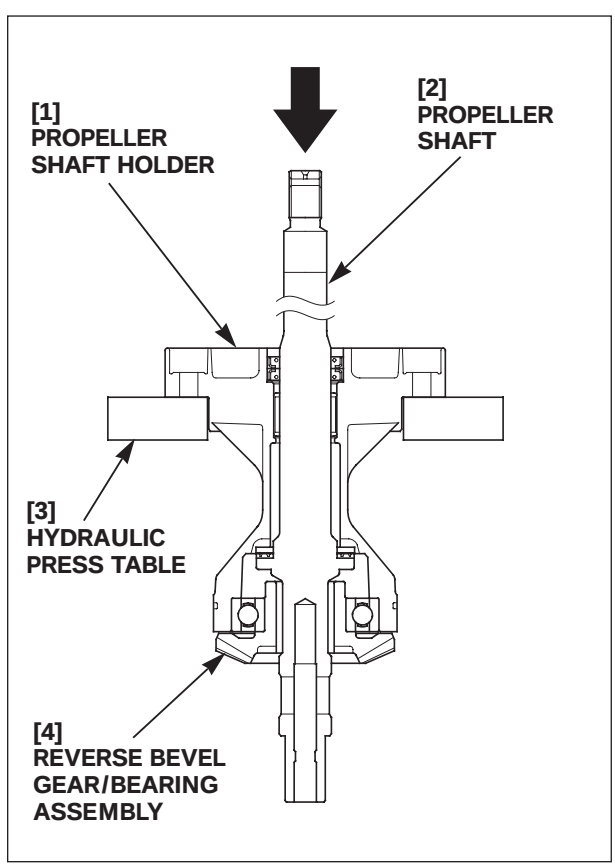
5) Remove the shift plate from the shift slider, then remove the two shift springs and the two #9 steel balls.

NOTICE

Take care not to let the shift springs and the #9 steel balls pop out of the shift slider during removal of the shift plate.



6) Remove the reverse bevel gear/bearing assembly and the propeller shaft from the propeller shaft holder using the hydraulic press as shown.



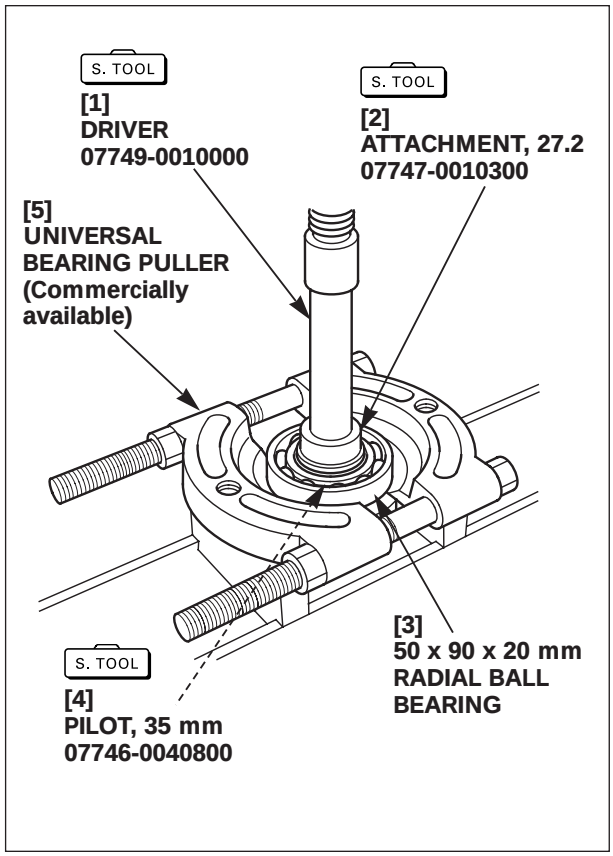
7) Before removing the bearing, check the bearing for abnormal sound and play. Replace if necessary.

8) Install a commercially available universal bearing puller between the reverse bevel gear and the bearing.

9) Remove the bearing from the reverse bevel gear using the special tools as shown.
Replace the bearing with a new one on assembly.

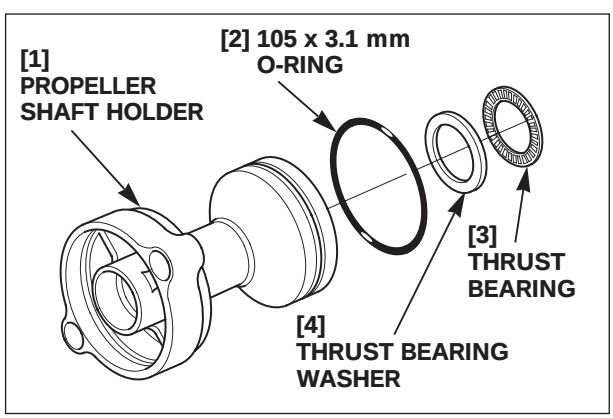
TOOLS:

Driver	**07749-0010000**
Attachment, 27.2	**07747-0010300**
Pilot, 35 mm	**07746-0040800**



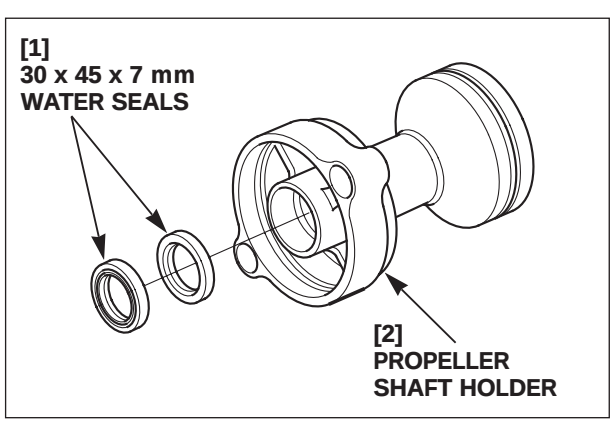
10) Check the thrust bearing for abnormal sound and play.
Replace if necessary.

11) Remove the thrust bearing, thrust bearing washer and the 105 x 3.1 mm O-ring from the propeller shaft holder.
Replace the O-ring with a new one on assembly.



12) Before removing the 30 x 45 x 7 mm water seals, check the water seal lips for cut and other damage. Replace the water seals if necessary.

13) Remove the two 30 x 45 x 7 mm water seals from the propeller shaft holder using a commercially available oil seal remover.
Replace the water seals with the new ones on assembly.

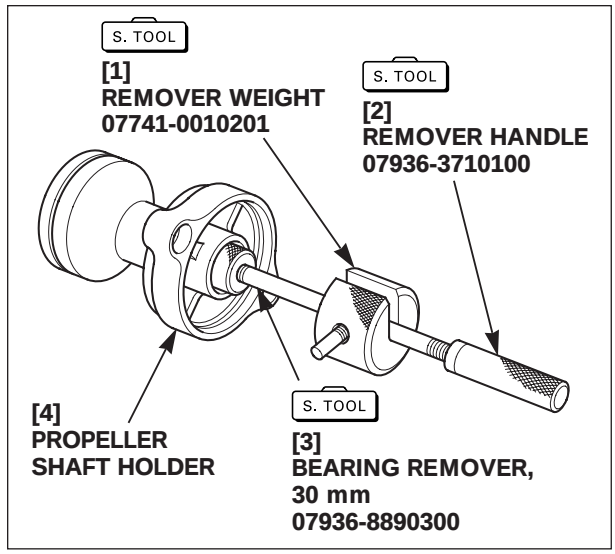


14) Check the needle bearing for abnormal sound and play before removal. Replace the needle bearing if necessary.

15) Remove the needle bearing from the propeller shaft holder using the special tools as shown.
Replace the needle bearing with a new one on assembly.

TOOLS:

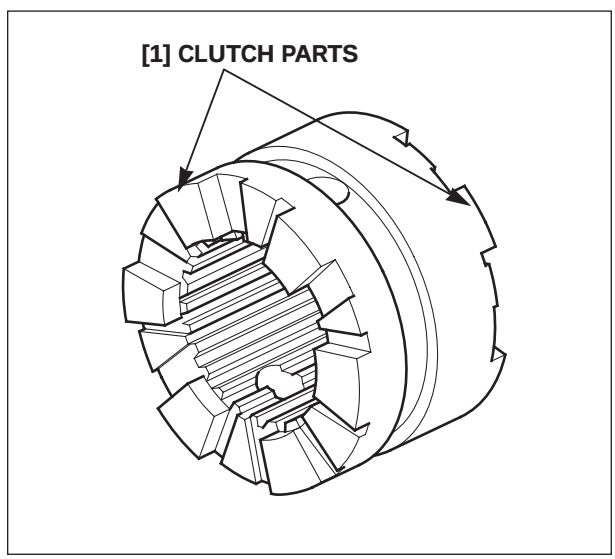
Remover weight	**07741-0010201**
Remover handle	**07936-3710100**
Bearing remover, 30 mm	**07936-8890300**



b. INSPECTION

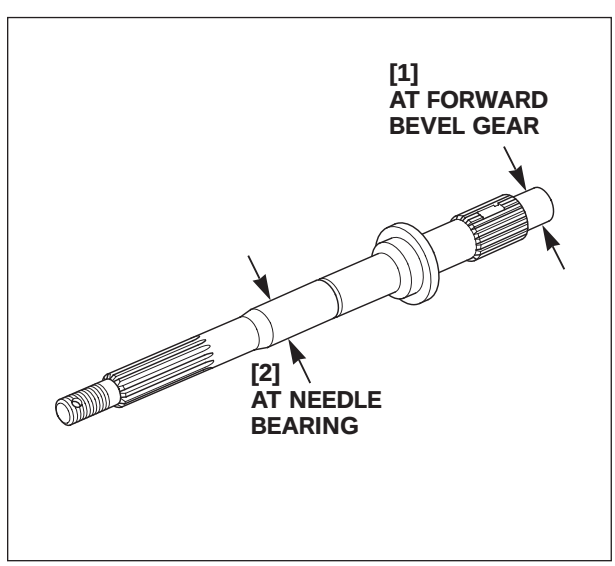
• CLUTCH SHIFTER

Check the clutch part of the forward and reverse sides for wear and damage.

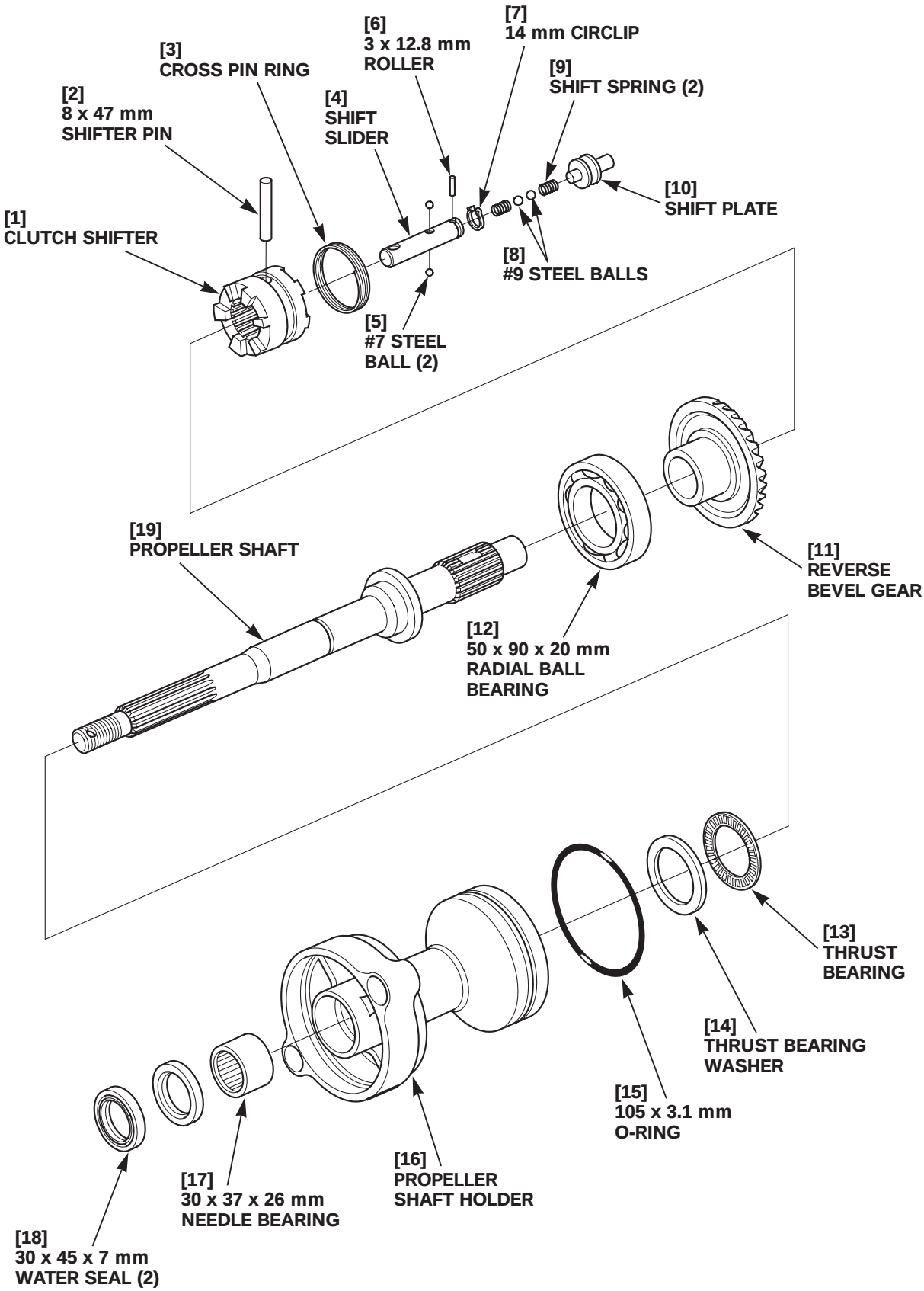


• PROPELLER SHAFT O.D.

	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)



c. COMPONENTS DRAWING



d. ASSEMBLY

1) Apply gear oil to the circumference of the new needle bearing.

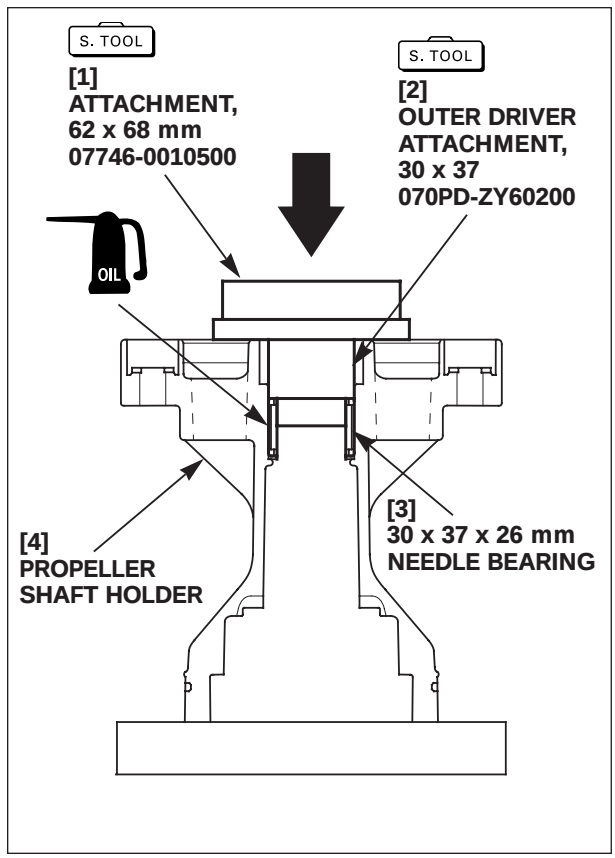
2) Install the needle bearing on the propeller shaft holder using the special tools and the hydraulic press.

TOOLS:

Attachment, 62 x 68 mm	**07746-0010500**
Outer driver attachment, 30 x 37	**070PD-ZY60200**

NOTICE

Install the needle bearing with the stamped side toward the special tools.



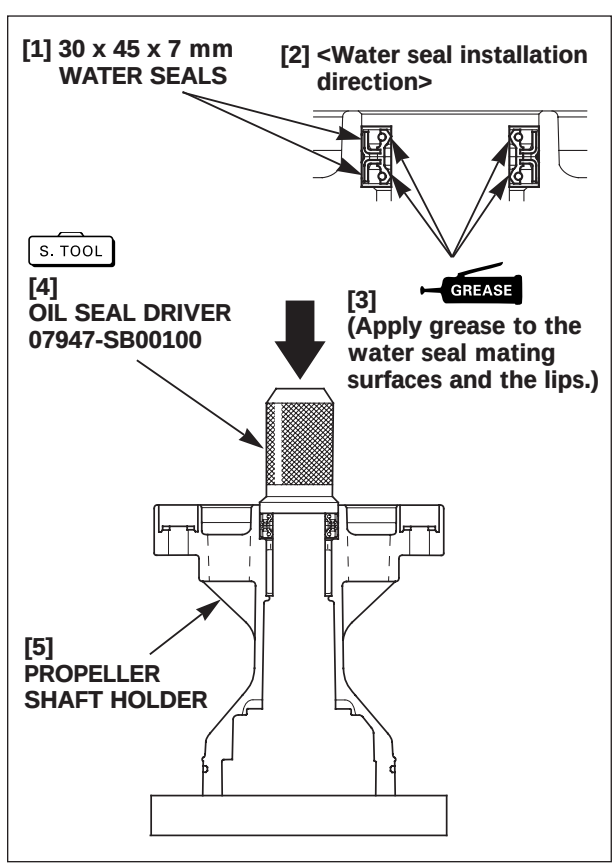
3) Apply soapy water to the circumference of the new 30 x 45 x 7 mm water seals.

4) Drive the 30 x 45 x 7 mm water seals one by one into the propeller shaft holder using the special tool. Note the installation direction of the water seals.
Apply grease to the water seal mating surfaces before installation.

TOOL:

Oil seal driver	**07947-SB00100**

5) After installation of the water seals, apply grease to the water seal lips.



6) Apply gear oil to the circumference of the new bearing.

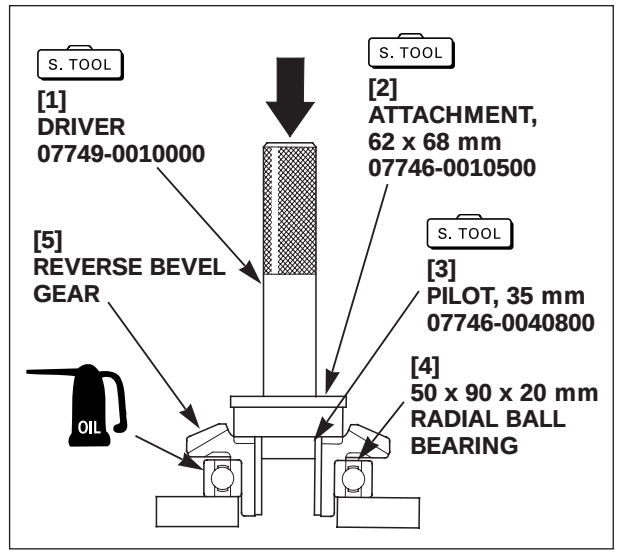
7) Install the bearing on the revere bevel gear using the special tools and the hydraulic press.

TOOLS:

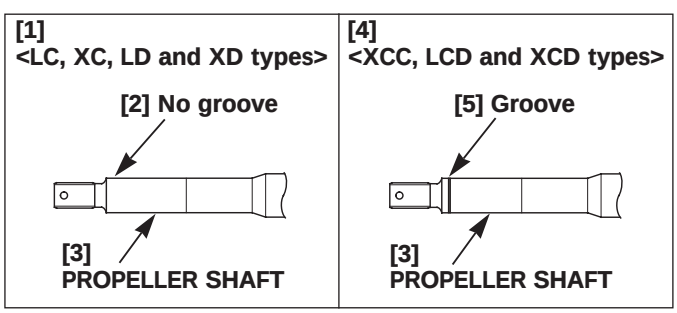
Driver	**07749-0010000**
Attachment, 62 x 68 mm	**07746-0010500**
Pilot, 35 mm	**07746-0040800**

NOTICE

Install the bearing holding the inner part of the bearing.



8) Apply gear oil to the circumference of the thrust bearing.
9) Soak the propeller shaft holder in the container filled with oil with the reverse bevel gear/bearing assembly installation side toward down.
10) Heat the oil to 80 – 90˚C (176 – 194˚F).
11) Check that there is no groove at the spline of the propeller installation side of the propeller shaft.



12) After the entire of the propeller shaft holder becomes hot, remove the holder from the container, and install the thrust bearing washer, thrust bearing, propeller shaft and the reverse bevel gear/bearing assembly in this order quickly on the propeller shaft holder.
Note to install the thrust bearing water with the chamfered side toward the holder.

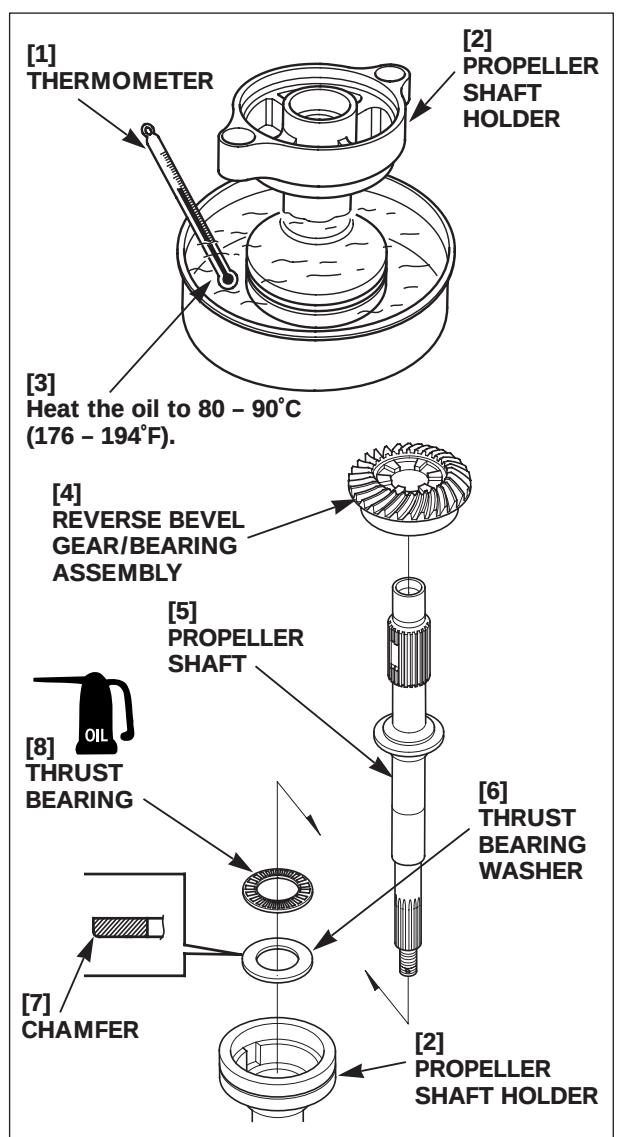
NOTICE

- *Do not heat the oil above 90˚C (194˚F).*
- *The entire holder becomes hot. Be sure to wear the gloves during the operation.*

13) Apply grease to the circumference of the new 105 x 3.1 mm O-ring and install it on the propeller shaft holder.

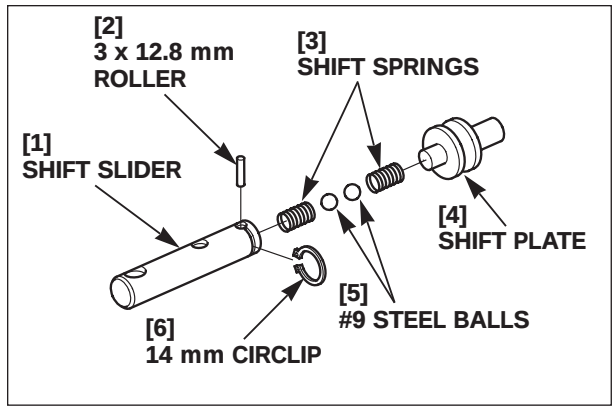
NOTICE

Wait until the propeller shaft holder cools down before installing the O-ring.



14) Install the shift spring, two #9 steel balls, shift spring and the shift plate in this order in the shift slider.

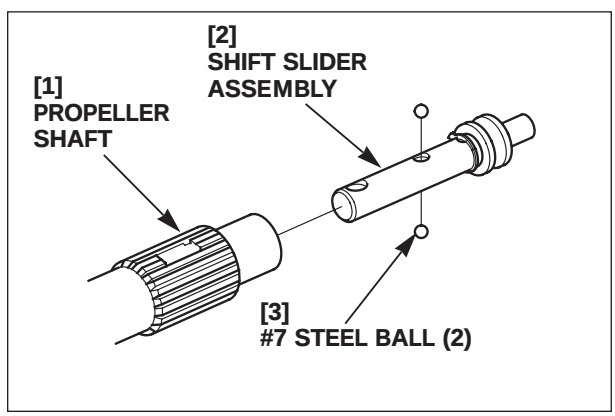
15) Install the 3 x 12.8 mm roller while aligning the hole in the shift slider with the hole in the shift plate, then install the 14 mm circlip.



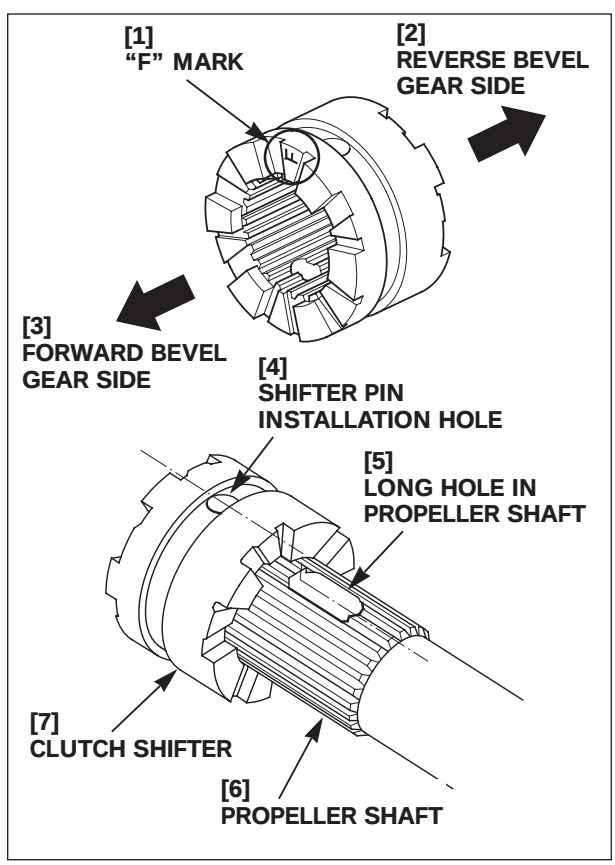
16) Set the #7 steel balls in the steel ball installation holes in the shift slider assembly, then push the shift slider assembly slowly into the propeller shaft.

NOTICE

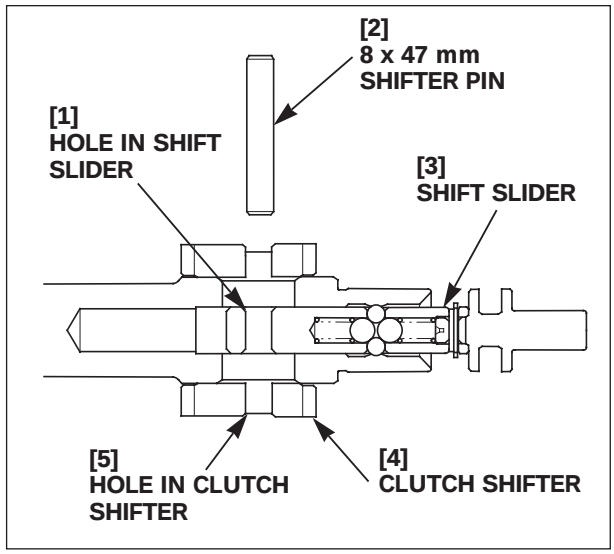
Push the shift slider assembly into the propeller shaft with care not to allow the #7 steel balls to pop out.



17) With the "F" mark on the clutch shifter toward the forward bevel gear (i.e. toward front), assemble the clutch shifter with the propeller shaft while aligning the 8 x 47 mm shifter pin installation hole with the long hole in the propeller shaft.



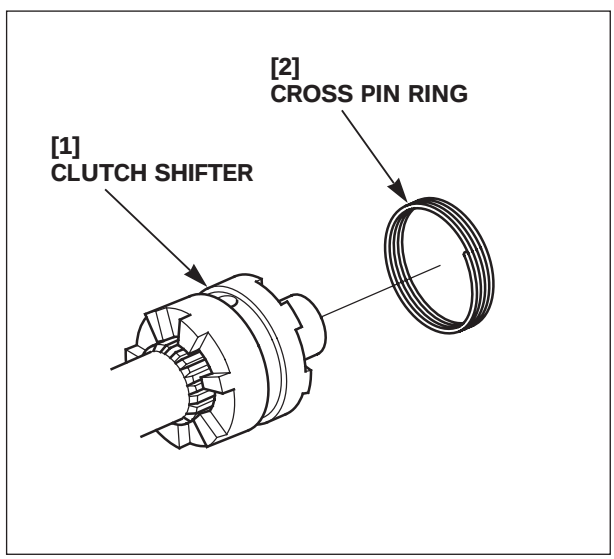
18) Install the 8 x 47 mm shifter pin while aligning the hole in the clutch shifter with the hole in the shift slider.



19) Install the cross pin ring on the clutch shifter.

NOTICE

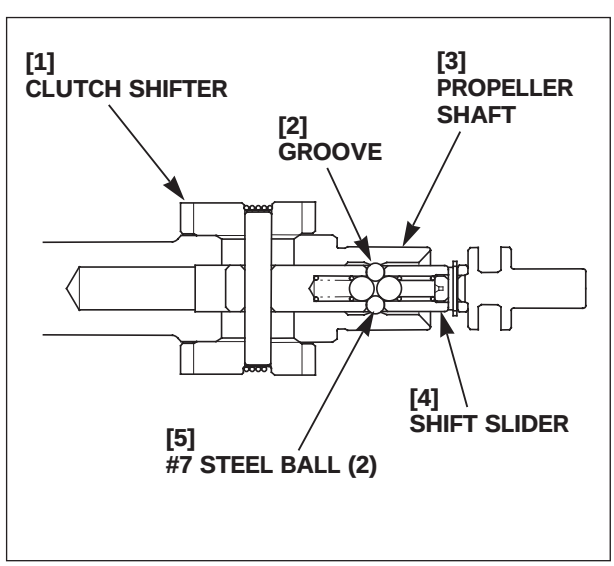
Check that the coils of the cross pin ring do not overlap each other.



20) Check that the #7 steel balls are set in the groove in the propeller shaft securely as shown.

Check procedure:

- Be sure that the clutch shifter is not at the reverse bevel gear installation side.
  If it is at the reverse bevel gear installation side, pull up the shift slider assembly slowly.
- Be sure that the #7 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 assembly slowly again.



21) Install the following parts.
- – Propeller shaft holder assembly (P. 14-17)
- – Water pump/shift rod (P. 14-12)
- – Gear case assembly (P. 14-5)
- – Propeller (P. 14-2)

6. VERTICAL SHAFT/BEVEL GEAR [*1]

a. DISASSEMBLY

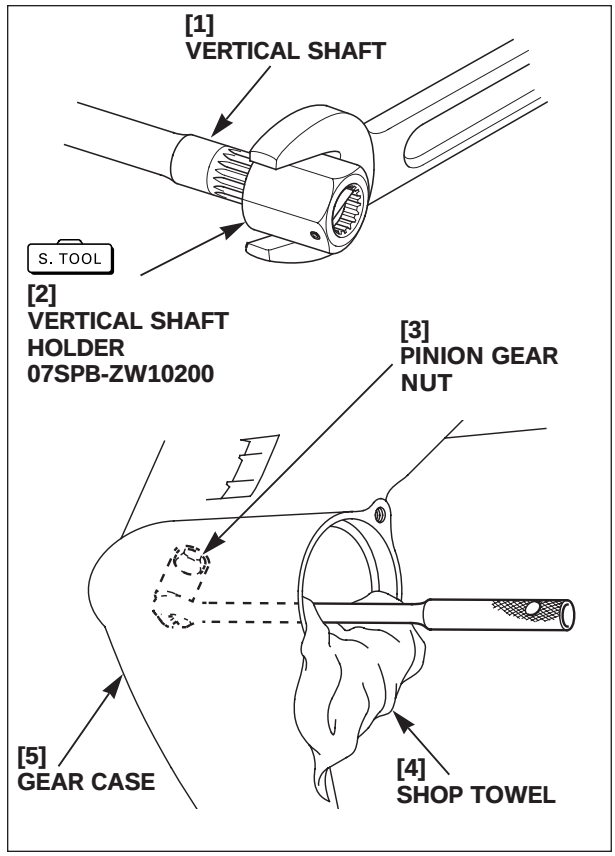
Remove the following parts.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-3)
– Water pump/shift rod (P. 14-7)
– Propeller shaft holder assembly (P. 14-17)

1) Attach the special tool to the end (crankshaft installation side) of the vertical shaft.

   TOOL:
   Vertical shaft holder **07SPB-ZW10200**

2) Place a shop towel or equivalent material as shown to protect the gear case.

3) Holding the special tool, remove the pinion gear nut and the pinion gear.



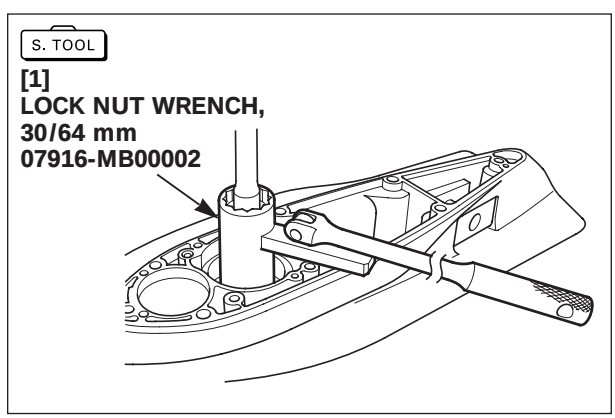
4) Remove the 64 mm lock nut using the special tool as shown.

   TOOL:
   Lock nut wrench, 30/64 mm **07916-MB00002**

5) Remove the vertical shaft assembly.

   NOTICE

   Take care not to drop the needle bearing (roller) when removing the vertical shaft assembly.

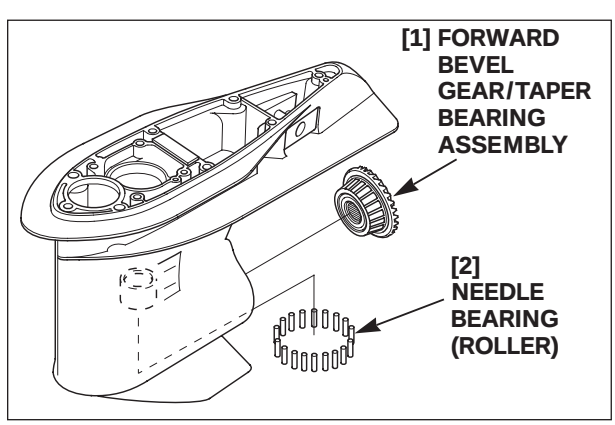


6) Check the needle bearing for abnormal sound and play. If there is abnormal sound and play, replace the roller and the outer race as a set.

7) Remove the needle bearing (roller).

8) Check the taper bearing (inner race) of the forward bevel gear/taper bearing assembly for noise, play and other abnormality. Replace together with the outer race as a set if necessary.

9) Remove the forward bevel gear/taper bearing assembly.



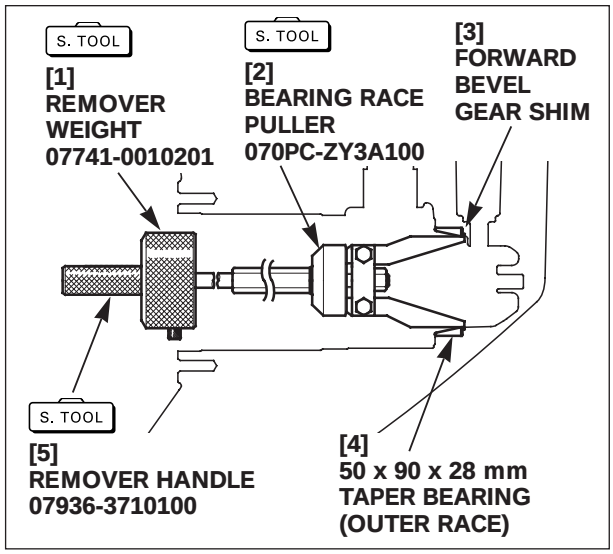
10) Check the taper bearing (outer race) for damage before removing it. Replace together with the inner race as a set if necessary.

11) Remove the taper bearing (outer race) using the special tools as shown.

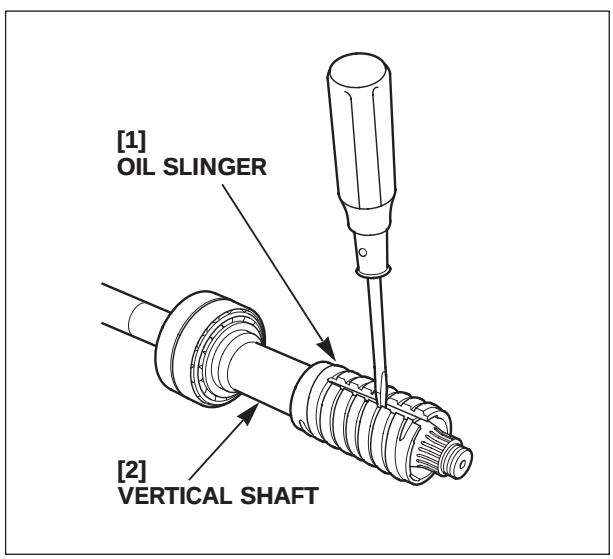
TOOLS:

Remover weight	**07741-0010201**
Remover handle	**07936-3710100**
Bearing race puller	**070PC-ZY3A100**

12) Remove the forward bevel gear shim from the gear case. Replace the forward bevel gear shim with a new one on assembly.



13) Remove the oil slinger from the vertical shaft by expanding the cut in the oil slinger with a screwdriver.

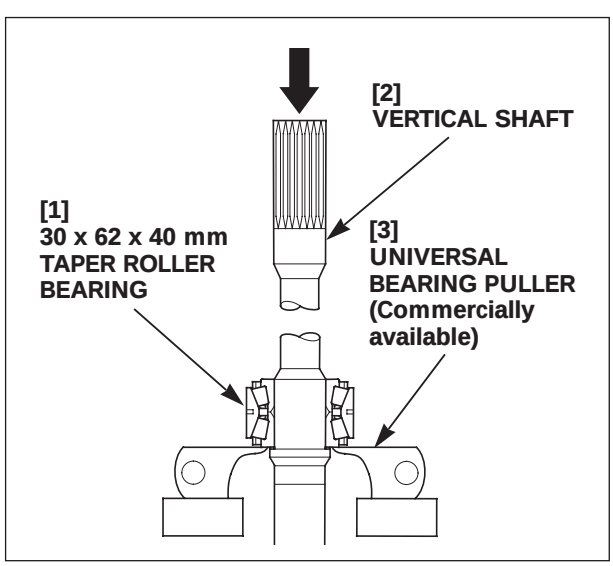


14) Check the taper roller bearing for noise, play and other abnormality before removing it. Replace the inner race and the outer race as a set if necessary.

15) Set a commercially available universal bearing puller on the taper roller bearing (inner race), and install the vertical shaft on the hydraulic press with the crankshaft installation side toward up.

16) Remove the taper roller bearing from the vertical shaft using the hydraulic press.

17) Remove the pinion gear shim from the vertical shaft. Replace the pinion gear shim with a new one on assembly.



18) Check the needle bearing (outer race) in the gear case for damage before removing it. Replace the needle bearing (outer race) if necessary.

19) Attach the special tools to the needle bearing (outer race) and place a shop towel or equivalent material under the needle bearing (outer race) as shown.

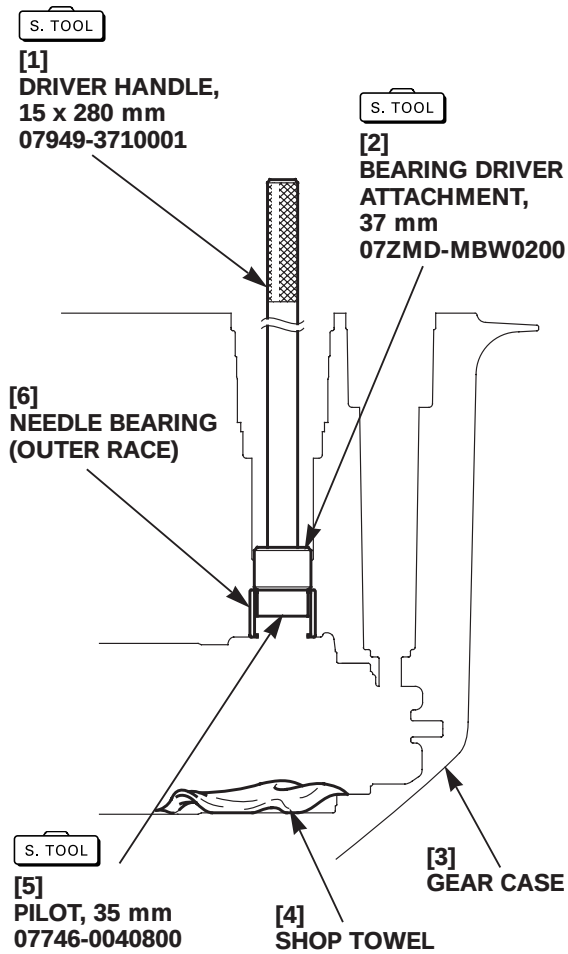
TOOLS:

Driver handle, 15 x 280 mm	**07949-3710001**
Bearing driver attachment, 37 mm	**07ZMD-MBW0200**
Pilot, 35 mm	**07746-0040800**

20) Remove the needle bearing (outer race) from the gear case using the special tools.

NOTICE

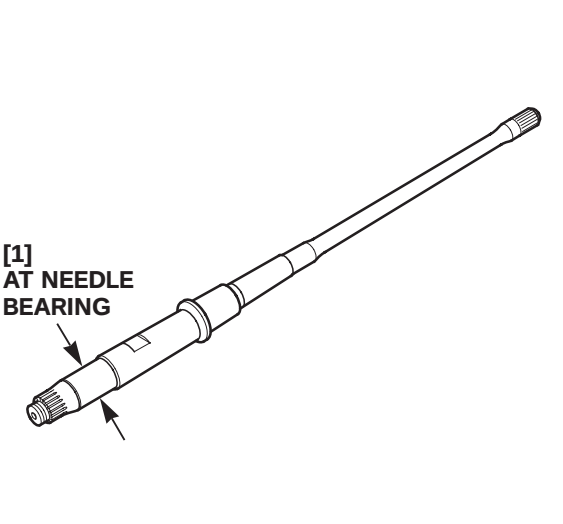
- *Remove the needle bearing (outer race) with care not to damage the gear case.*
- *Replace the needle bearing (outer race) and the roller as a set on assembly.*



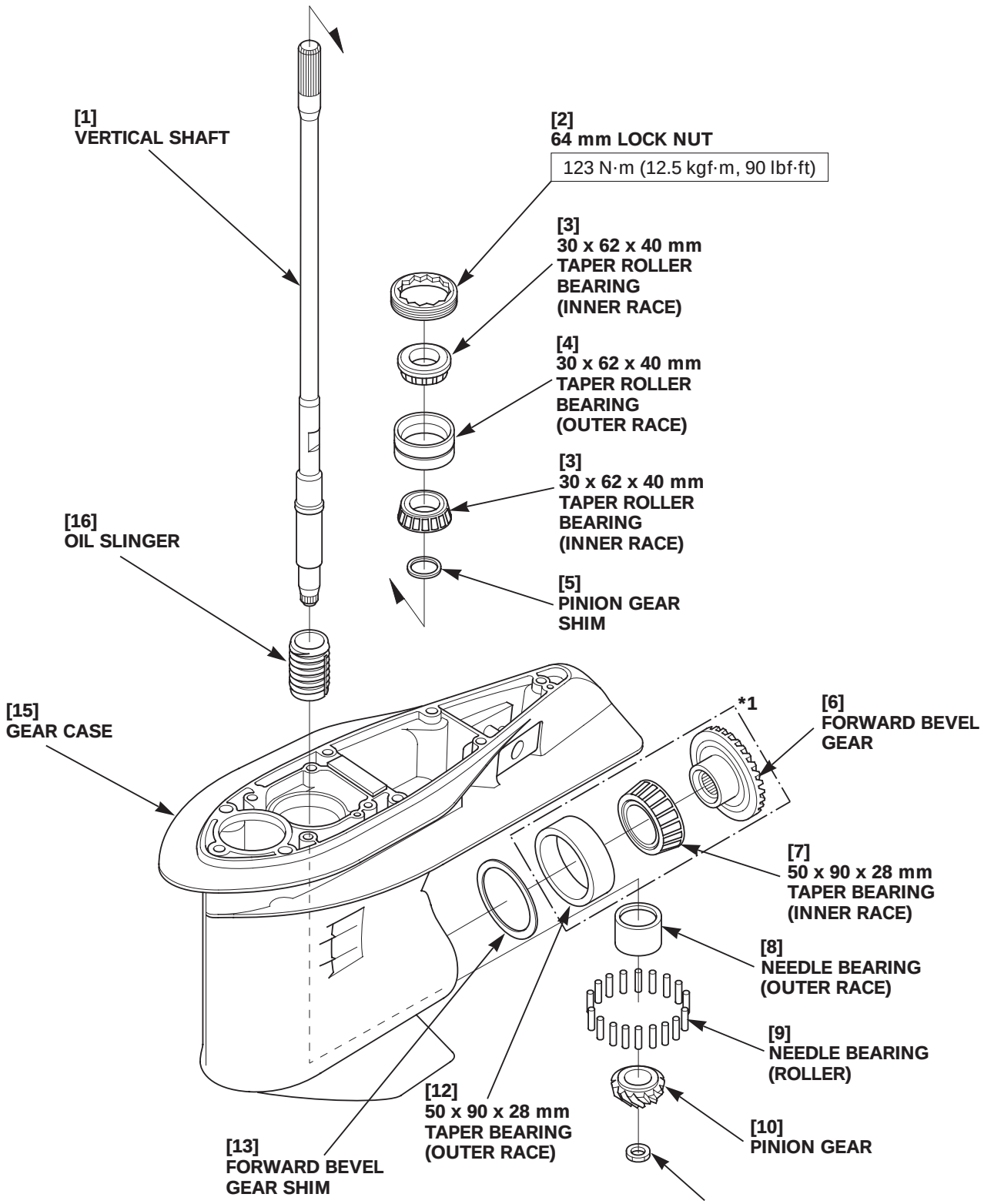
b. INSPECTION

• VERTICAL SHAFT O.D.

	STANDARD	SERVICE LIMIT
At needle bearing	28.556 – 28.575 mm (1.1242 – 1.1250 in)	28.545 mm (1.1238 in)



c. COMPONENTS DRAWING



[14]
*1: Replace the inner race and the outer race as a set after removing the taper bearing (inner race) from the forward bevel gear.

d. ASSEMBLY

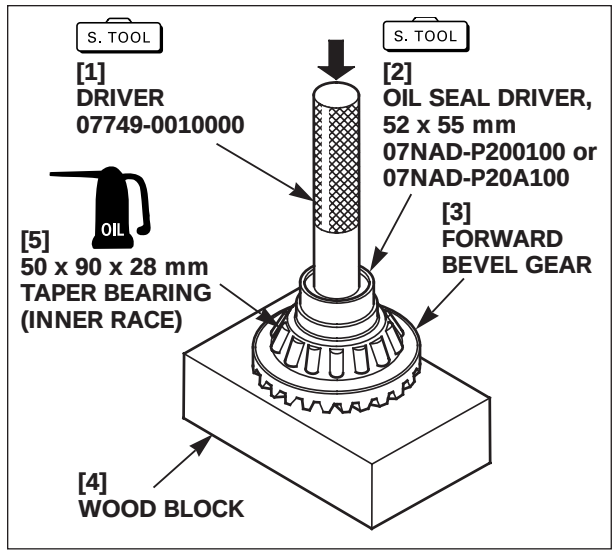
NOTICE

Measure the bearing height from the end of the taper bearing outer race to the end of the inner race and record the measurement before installing the 50 x 90 x 28 mm taper bearing on the forward bevel gear (P. 14-39).

1) Apply gear oil to the inner wall and the roller of the new taper bearing (inner race).
2) Position a wood block or equivalent material underside the forward bevel gear.
3) Install the taper bearing on the forward bevel gear using the special tools and the hydraulic press.

TOOLS:

Driver	**07749-0010000**
Oil seal driver, 52 x 55 mm	**07NAD-P200100 or 07NAD-P20A100**



4) Install the new forward bevel gear shim in the gear case.

5) Apply gear oil to the circumference of the taper bearing (outer race).

6) Install the taper bearing (outer race) in the gear case using the special tools as shown.

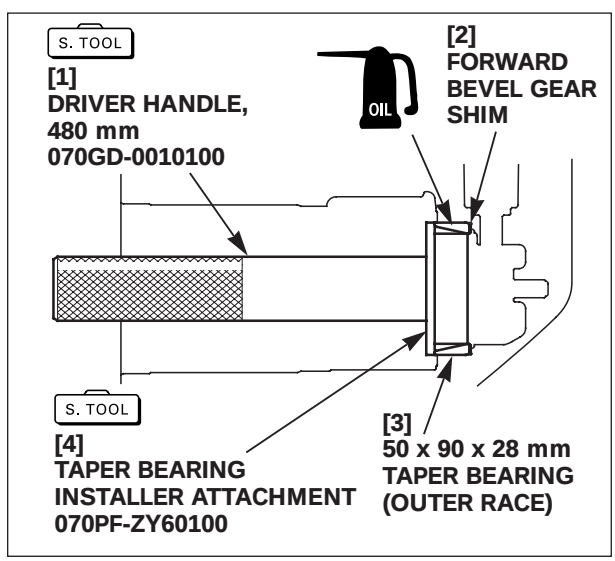
TOOLS:

Driver handle, 480 mm	**070GD-0010100**
Taper vearing installer attachment	**070PF-ZY60100**

NOTICE

Install the taper bearing (outer race) with the larger diameter side toward the forward bevel gear.

7) Install the forward bevel gear/taper bearing assembly in the gear case.



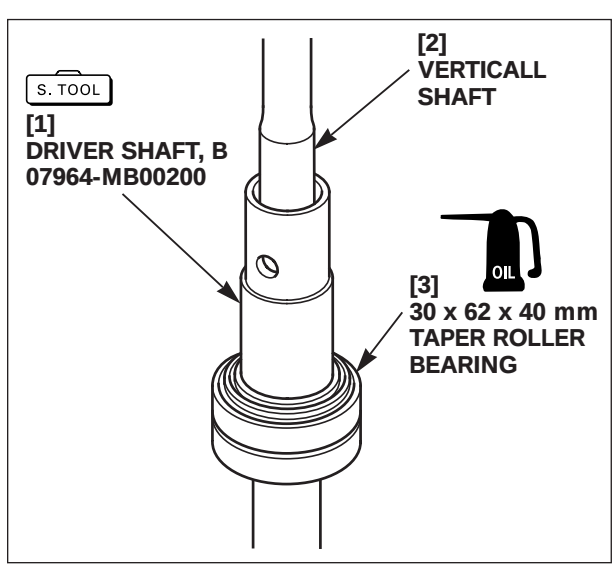
8) Install the pinion gear on the vertical shaft and loosely tighten the pinion gear nut by hand.

9) Apply gear oil to the inner wall of the inner race, roller and the circumference of the outer race of the taper roller bearings. Assemble the inner races and outer race.

10) Install the pinion gear shim, taper roller bearing and the special tool on the vertical shaft.

TOOL:

Driver shaft, B	**07964-MB00200**



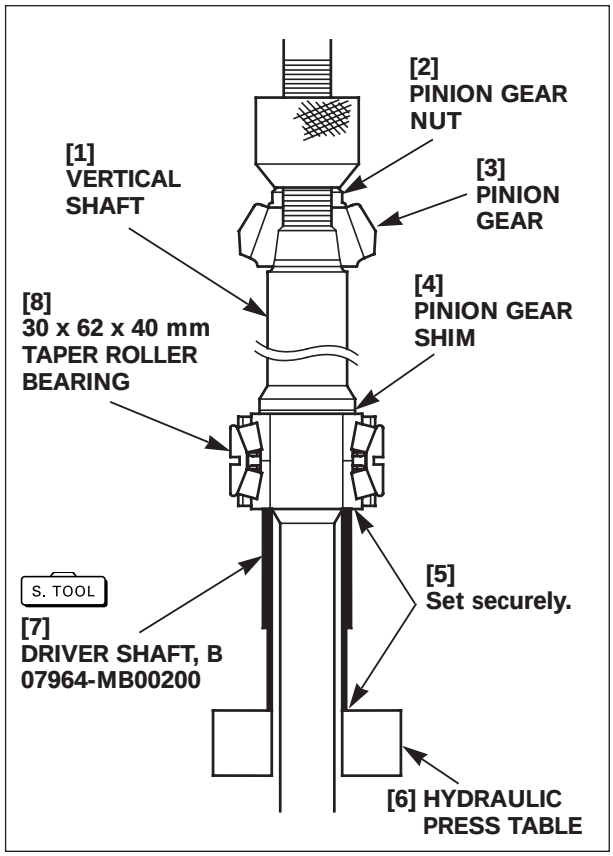
11) Position the vertical shaft on the hydraulic press with the pinion gear side facing up.

12) Install the taper roller bearing on the vertical shaft using the hydraulic press.

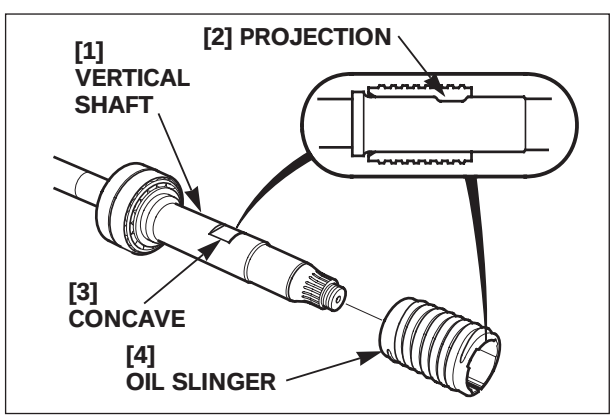
NOTICE

- *Check that the ends of the special tool are set on the taper roller bearing inner race and on the hydraulic press table securely.*
- *Do not ruin the threads at the end of the vertical shaft (pinion gear nut installation part).*

13) Remove the pinion gear nut and the pinion gear from the vertical shaft.

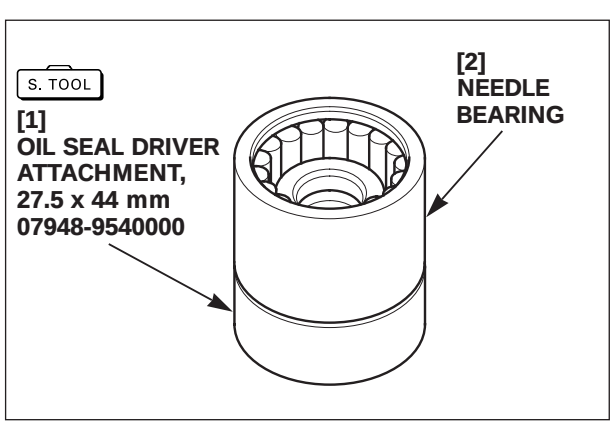


14) Install the oil slinger on the vertical shaft aligning the projection on the inside of the oil slinger with the concave of the pinion gear installation side of the vertical shaft.



15) Attach the special tool to the new needle bearing as shown. Install the needle bearing with the stamped side of the needle bearing (outer race) toward the special tool.

TOOL:
Oil seal driver attachment, 27.5 x 44 mm 07948-9540000

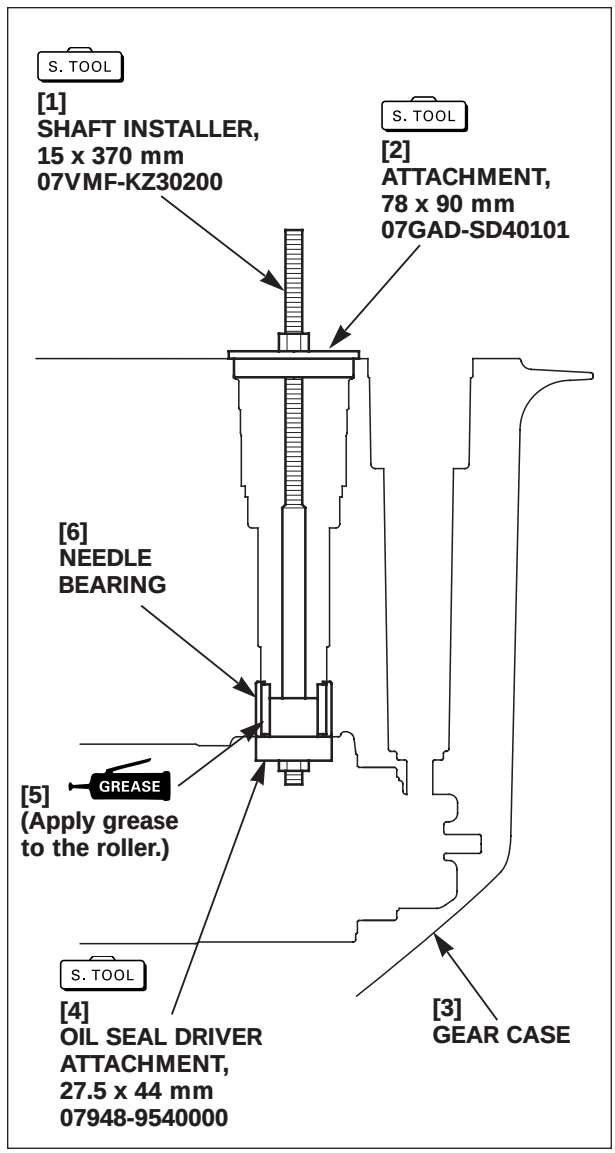


16) Install the needle bearing in the gear case using the special tools.

TOOLS:

Shaft installer, 15 x 370 mm	**07VMF-KZ30200**
Attachment, 78 x 90 mm	**07GAD-SD40101**
Oil seal driver attachment, 27.5 x 44 mm	**07948-9540000**

17) After installation, check that the bottom surface of the needle bearing is flush with the bottom of the gear case. Apply grease to the needle bearing roller.



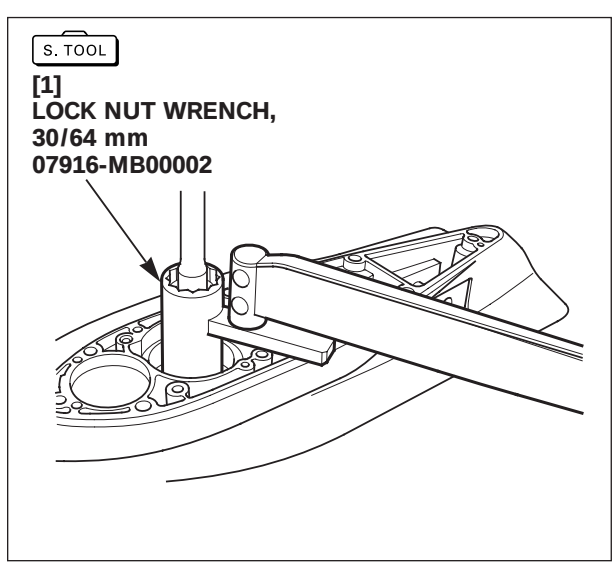
18) Install the vertical shaft assembly taking care not to bring the needle bearing roller out of position.

19) Apply the thread locking agent to the threads and seat of the 64 mm lock nut, and tighten the lock nut using the special tool.

TOOL:

Lock nut wrench, 30/64 mm	**07916-MB00002**

TORQUE: 123 N·m (12.5 kgf·m, 90 lbf·ft)



20) Wipe the tapered part of the vertical shaft and pinion gear with a shop towel and a degreasing cleaning solvent.

21) Attach the special tool to the end (crankshaft installation side) of the vertical shaft as shown.

TOOL:
Vertical shaft holder **07SPB-ZW10200**

22) Place a shop towel in the gear case as shown to protect the gear case.

23) Apply gear oil to the threads and seat of the pinion gear nut.

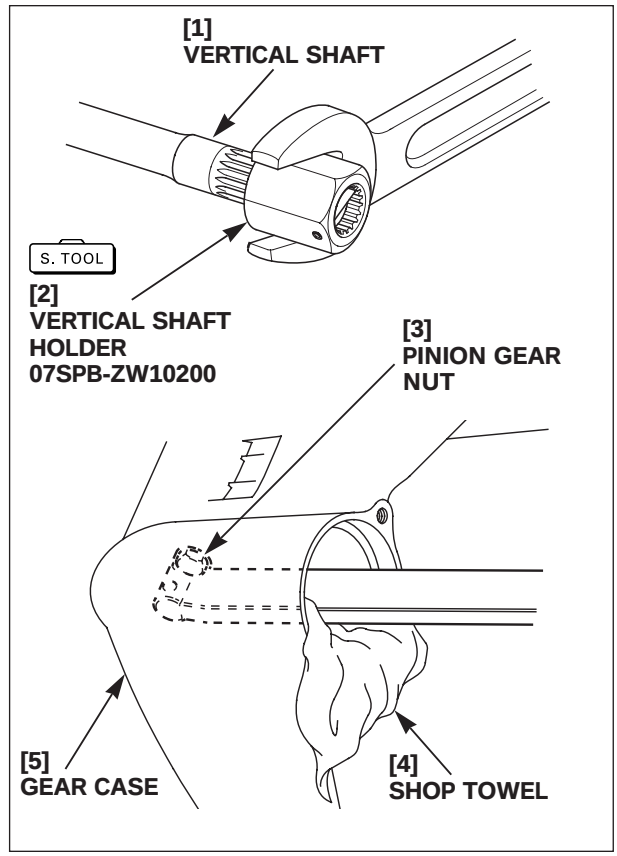
24) Install the pinion gear on the vertical shaft. Holding the special tool in the position, tighten the pinion gear nut to the specified torque.

TORQUE: 142 N·m (14.5 kgf·m, 105 lbf·ft)

NOTICE

Check that the forward bevel gear/taper bearing assembly is set properly.

25) Install the following parts.
– Propeller shaft holder assembly (P. 14-17)
– Water pump/shift rod (P. 14-12)
– Gear case assembly (P. 14-5)
– Propeller (P. 14-2)



7. SHIM SELECTION [*1]

NOTICE

Adjust the shim thickness after replacing the gear case, vertical shaft, bearing, taper bearing and the taper roller bearing.

a. PINION GEAR SHIM

Remove the taper roller bearing if it is mounted on the vertical shaft (P. 14-28).

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: 142 N·m (14.5 kgf·m, 105 lbf·ft)

NOTICE

- *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. 14-34).*

3) 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.

TOOL:
Gauge adapter, 110 mm **070PJ-ZY30100**

4) Holding the special tool with the side of the stamped tool number facing the opposite side from the pinion gear, be sure that the tool of the pinion gear nut side is not set on the nut.
Tighten the bolts by hand while pushing both tools toward the pinion gear side.

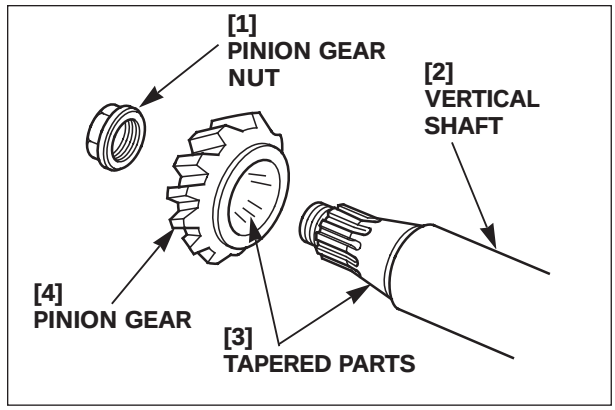
NOTICE

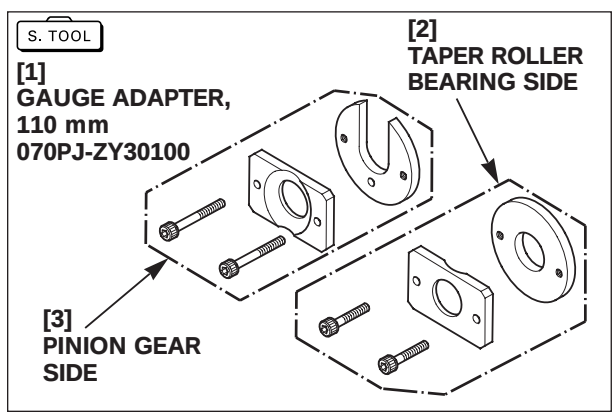
- *Do not tighten the bolts with a tool.*
- *There must be no wobbling in the special tool. It must securely set on the pinion gear.*

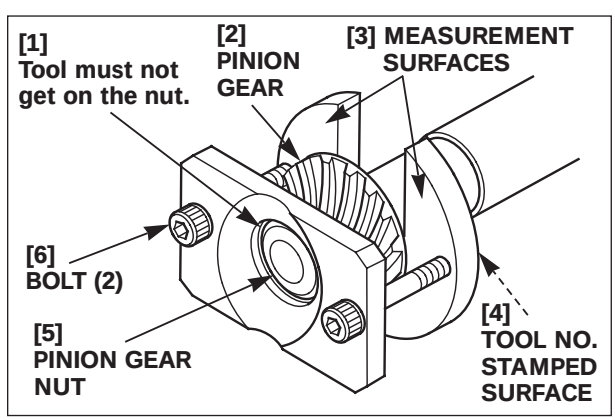
5) Set both tools on both sides of the flange of the vertical shaft with the side of the special tool stamped with the tool number and the tapered part facing the opposite side from the pinion gear as shown. Tighten the bolts by hand.

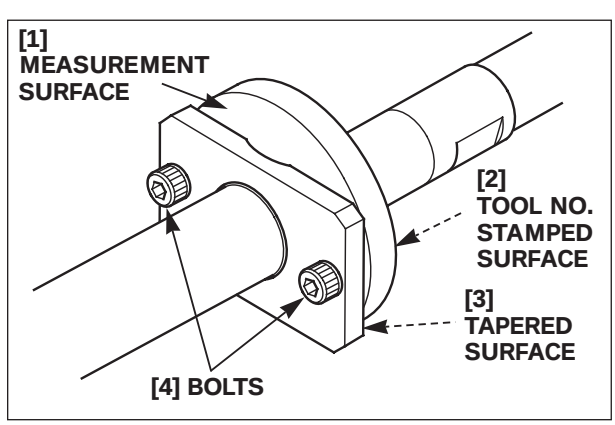
NOTICE

- *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.*



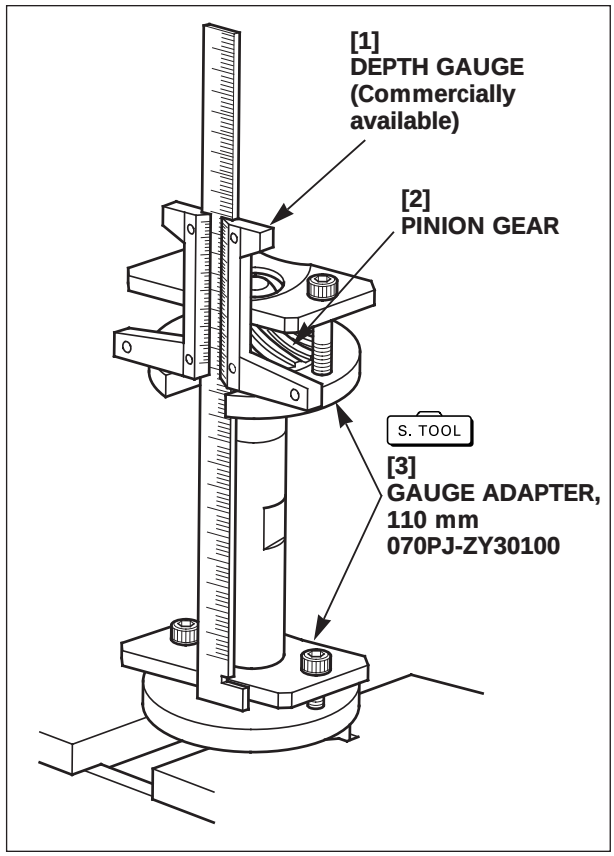






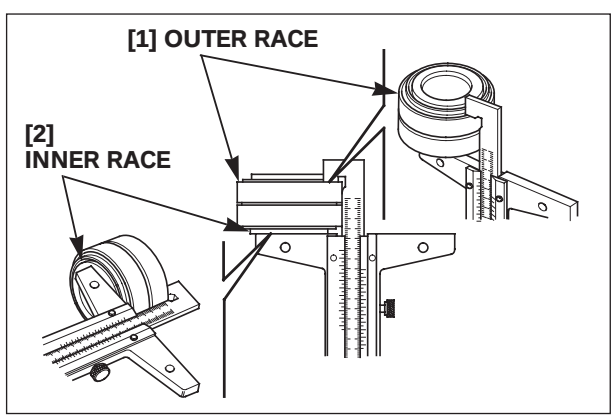
6) Hold the vertical shaft upright (with the pinion gear toward up) and secure the vertical shaft.

7) Set the commercially available depth gauge at the gauge adapter of the pinion gear side as shown. Measure the vertical shaft length (distance D) and record it.

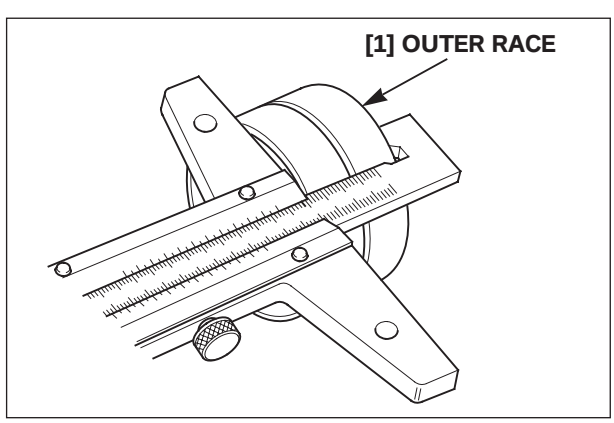


8) Assemble the outer race and the inner race of the 30 x 62 x 40 mm taper roller bearing, and turn the outer race two or three turns.

9) Measure the bearing height from the outer race end to the inner race end as shown, and record the measurement.



10) Measure the height of the taper roller bearing outer race and record it.



11) Calculate the gap (distance E) between the outer race and inner race using the measurements obtained in step 9 and 10 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 34.9 mm (1.37 in),
And, outer race height is 29.7 mm (1.17 in):

34.9 – 29.7 = 5.2

Therefore, the gap (distance E) is 5.2 mm (0.20 in).

12) Determine the calculation value using the vertical shaft length (distance D) obtained in step 7 and the gap (distance E) obtained in step 11 and the following formula.

Formula:
Vertical shaft length (distance D) + Gap (distance E) – 147.2 = Calculation value

Example:
When, vertical shaft length (distance D) is 141.8 mm (5.58 in),
And, gap (distance E) is 5.2 mm (0.20 in):

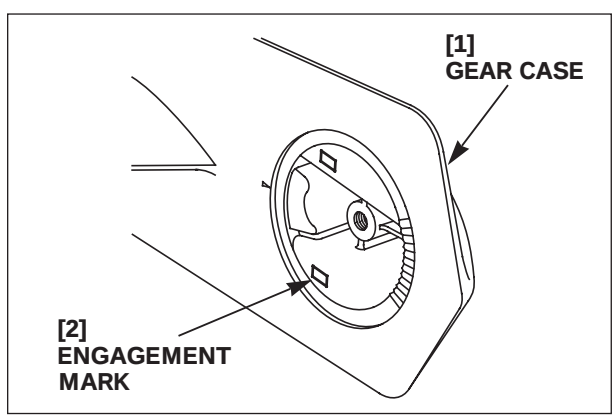
141.8 + 5.2 – 147.2= –0.20

Therefore, the calculation value is –0.20 mm (–0.008 in).

13) 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] Shim type	[2] Thickness
[3] Pinion gear shim A	0.10 mm (0.004 in)
[4] Pinion gear shim B	0.15 mm (0.006 in)
[5] Pinion gear shim C	0.30 mm (0.012 in)
[6] Pinion gear shim D	0.50 mm (0.020 in)



• Pinion gear shim selection table

[3] Unit: mm (in)

		[2] Calculation value						
		+0.41 (+0.0161) – +0.35 (+0.014)	+0.35 (+0.014) – +0.30 (+0.0118)	+0.30 (+0.0118) – +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	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)
	E	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)
	D	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)
	C	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)
	B	0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)
	A		0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)

[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) – –0.31 (–0.0122)
[1] Engagement mark on the gear case	F	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)
	E	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)
	D	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)
	C	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)
	B	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)
	A	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)

• How to read shim selection table

When the engagement mark on the gear case is E and the calculation value is –0.20 mm (–0.008 in) or more, the shim thickness is 0.80 mm (0.031 in).

When the calculation value is less than –0.20 mm (–0.008 in), the shim thickness is 0.85 mm (0.033 in). (See Shim selection table above.)

[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) – –0.31 (–0.0122)
[1] Engagement mark on the gear case	F	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)
	E	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)
	D	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)
	C	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)
	B	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)
	A	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)

• Shim combination

To obtain 0.75 mm (0.030 in) of shim thickness, combine three gear shim As and one gear shim B and one gear shim C, or combine one gear shim A, one gear shim B and one gear shim D by referring to the shim type table.

b. FORWARD BEVEL GEAR SHIM

1) Assemble the outer race and the inner race of the new 50 x 90 x 28 mm taper bearing, and turn the outer race two or three turns.

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.

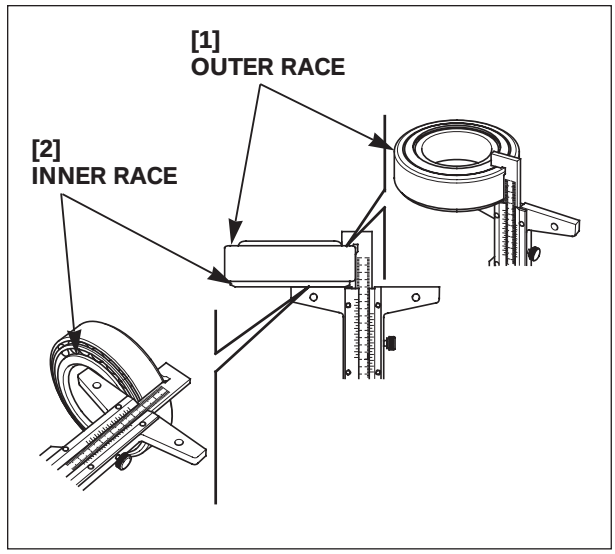
   Formula:
   Bearing height (distance F) – 28 = Calculation value

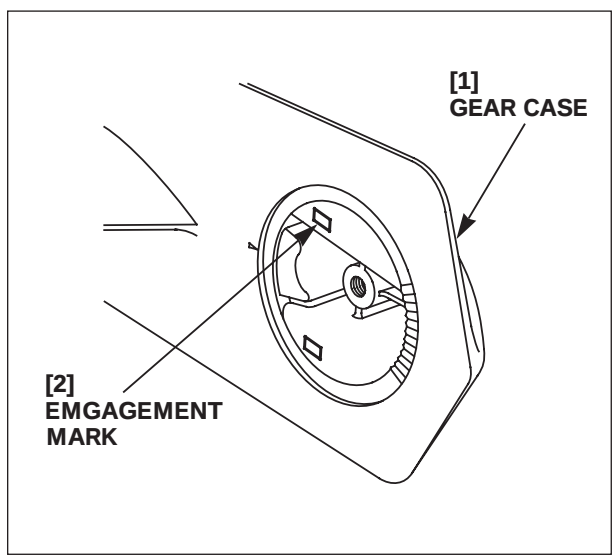
   Example:
   When bearing height (distance F) is 28.05 mm (1.104 in):

   28.05 – 28 = 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] Shim type	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.004 in)
[4] Forward bevel gear shim B	0.15 mm (0.006 in)
[5] Forward bevel gear shim C	0.30 mm (0.012 in)
[6] Forward bevel gear shim D	0.50 mm (0.020 in)

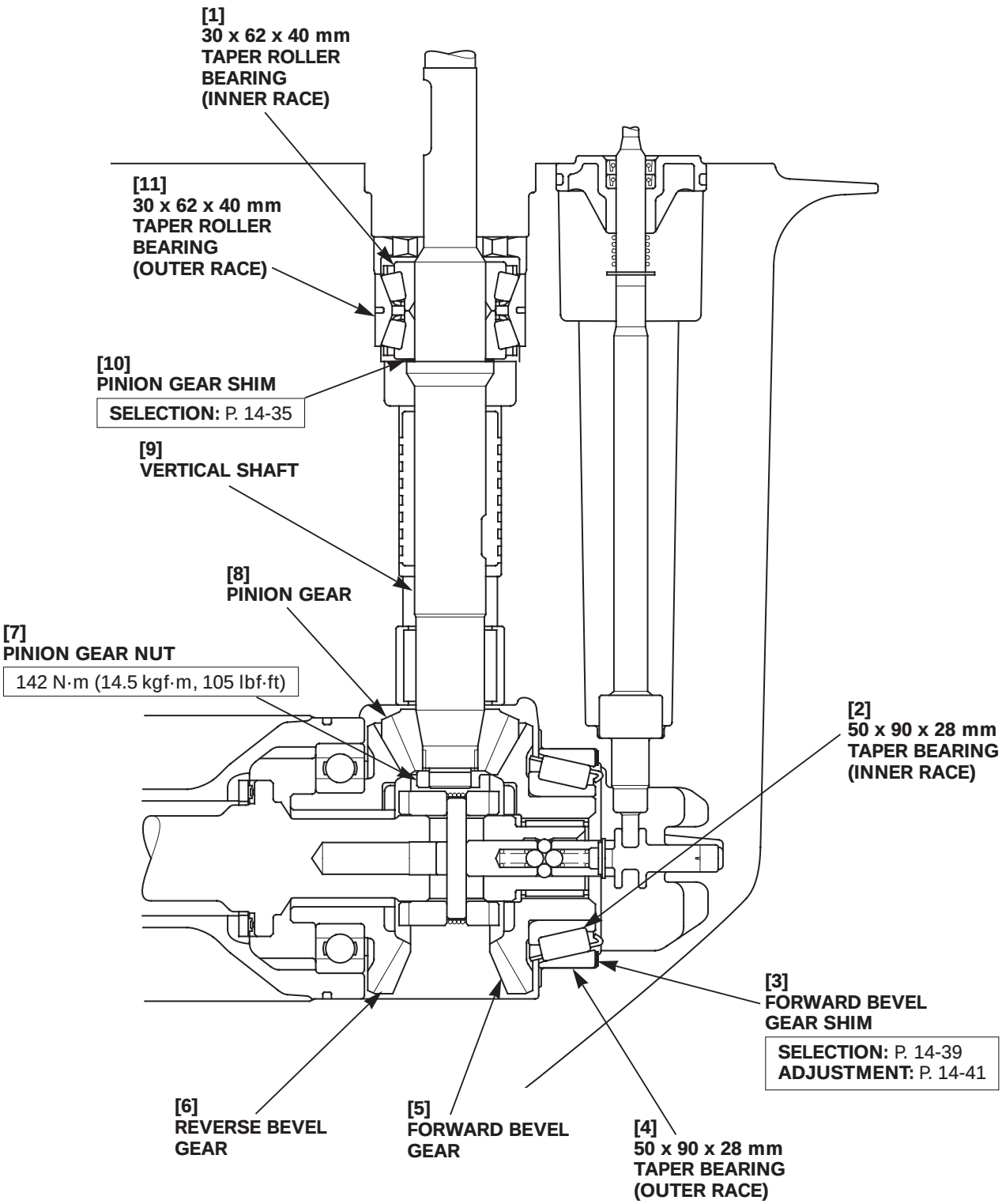
- **Pinion gear shim selection table**

[3] Unit: mm (in)

		[2] Calculation value	
		+0.10 (+0.004) – +0.05 (+0.002)	+0.05 (+0.002) – ±0 (±0.000)
[1] Engagement mark on the gear case	1	0.40 (0.016)	0.45 (0.018)
	2	0.35 (0.014)	0.40 (0.016)
	3	0.30 (0.012)	0.35 (0.014)
	4	0.25 (0.010)	0.30 (0.012)
	5	0.20 (0.008)	0.25 (0.010)
	6	0.15 (0.006)	0.20 (0.008)

Refer to page 14-38 for the information on how to read the shim selection table and shim combination.

8. SHIM POSITION [*1]



9. BACKLASH ADJUSTMENT [*1]

a. FORWARD BEVEL GEAR BACKLASH

Backlash adjustment must be made after adjustment of each gear shim (P. 14-35).
Install the parts except the water pump in the gear case (P. 14-12, 17 and 31).

1) Hold the propeller shaft securely with the special tool as shown, and tighten the puller bolt to the specified torque.

TOOLS:

Puller jaws	**07SPC-ZW0010Z**
Puller bolt	**07SPC-ZW0011Z**

TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)

Turn the vertical shaft five to ten turns clockwise to fit the bevel gear bearing.

2) Attach the special tool to the vertical shaft as shown, and adjust the dial indicator so its needle is at the line "2" of the special tool (backlash indicator tool).

TOOLS:

Backlash indicator tool	**07SPJ-ZW0030Z**
Backlash indicator attachment	**07SPK-ZW10100**

3) Turn the vertical shaft lightly right and left and record the dial indicator reading.
Measure the backlash at the four points (by turning the vertical shaft 90˚) in the same manner.

NOTICE

Do not turn the propeller shaft when turning the vertical shaft.

4) Obtain the forward bevel gear backlash using the dial indicator runout and the following formula.

Formula:
Dial indicator runout ÷ 0.86 = Backlash

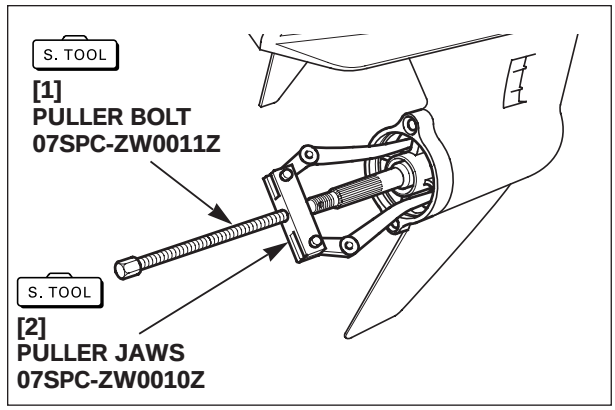
Example:
When dial indicator runout is 0.195 mm (0.0077 in):
0.195 ÷ 0.86 = 0.23
Therefore, the backlash is 0.23 mm (0.009 in).

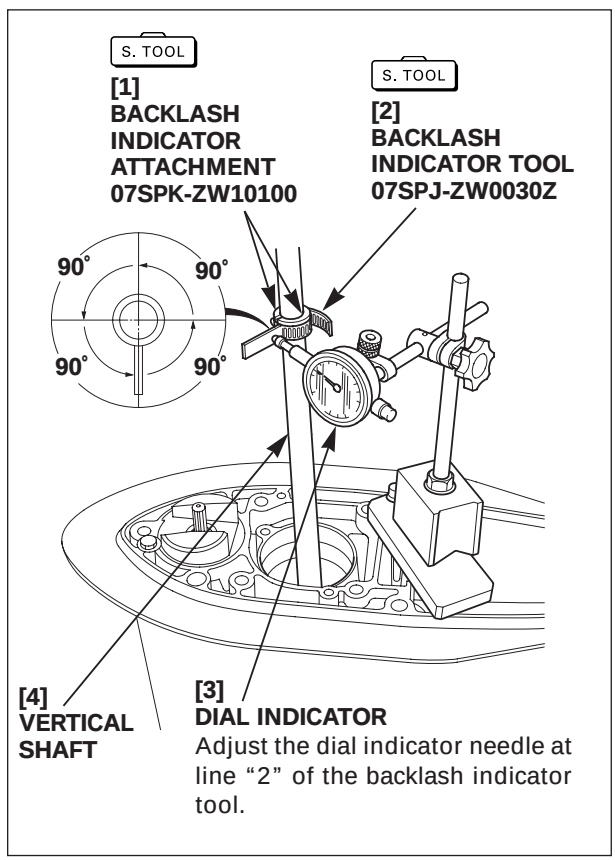
Standard value	0.10 – 0.30 mm (0.004 – 0.012 in)

5) If the backlash is too large, increase the forward bevel gear shim thickness and recheck the backlash.
If the backlash it too small, reduce the forward bevel gear shim thickness and recheck the backlash.

NOTICE

Use the special tool when 50 x 90 x 28 mm taper bearing outer race is removed to adjust the backlash again (P. 14-28).





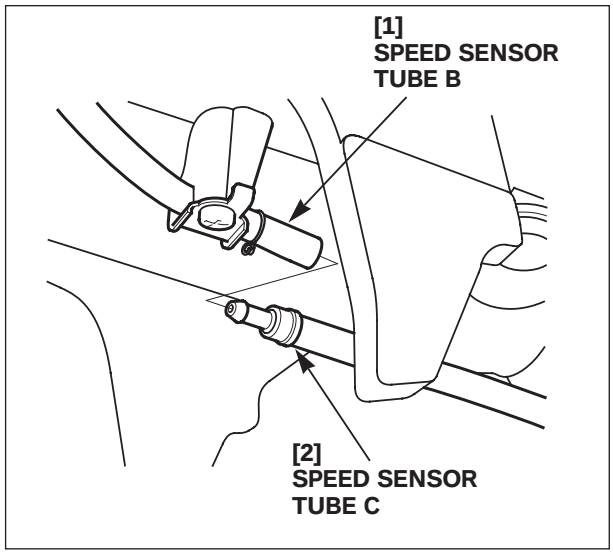
10. GEAR CASE ASSEMBLY [*2]

a. REMOVAL

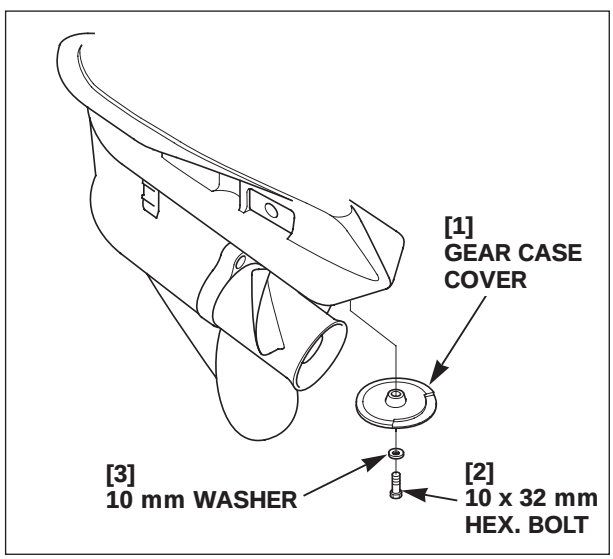
1) Place the remote control lever in the "N" (Neutral) position.

2) Tilt up the outboard motor to the uppermost position.

3) Disconnect the speed sensor tube B and the speed sensor tube C.

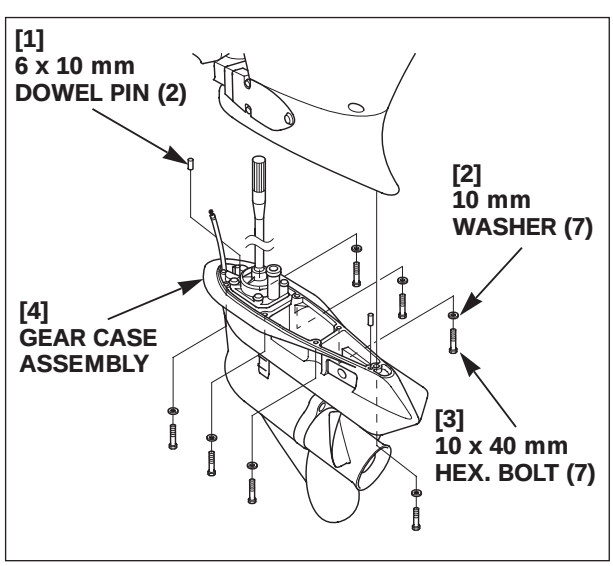


4) Remove the 10 x 32 mm hex. bolt and the 10 mm washer. Remove the gear case cover from the gear case assembly.

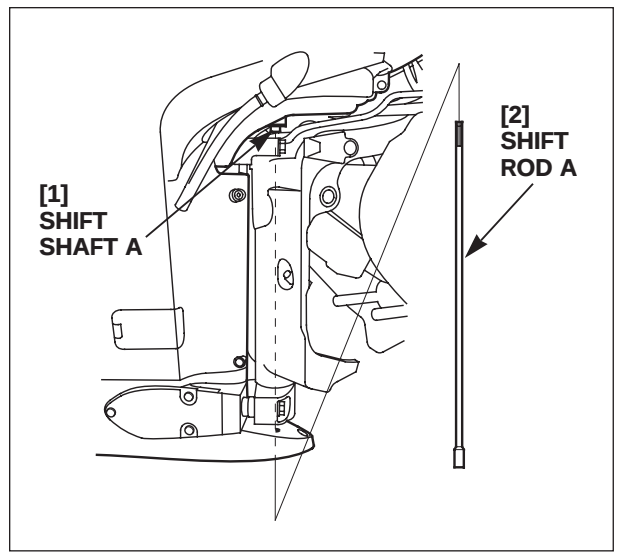


5) Remove the seven 10 x 40 mm hex. bolts and the seven 10 mm washers, then remove the gear case assembly from the outboard motor.

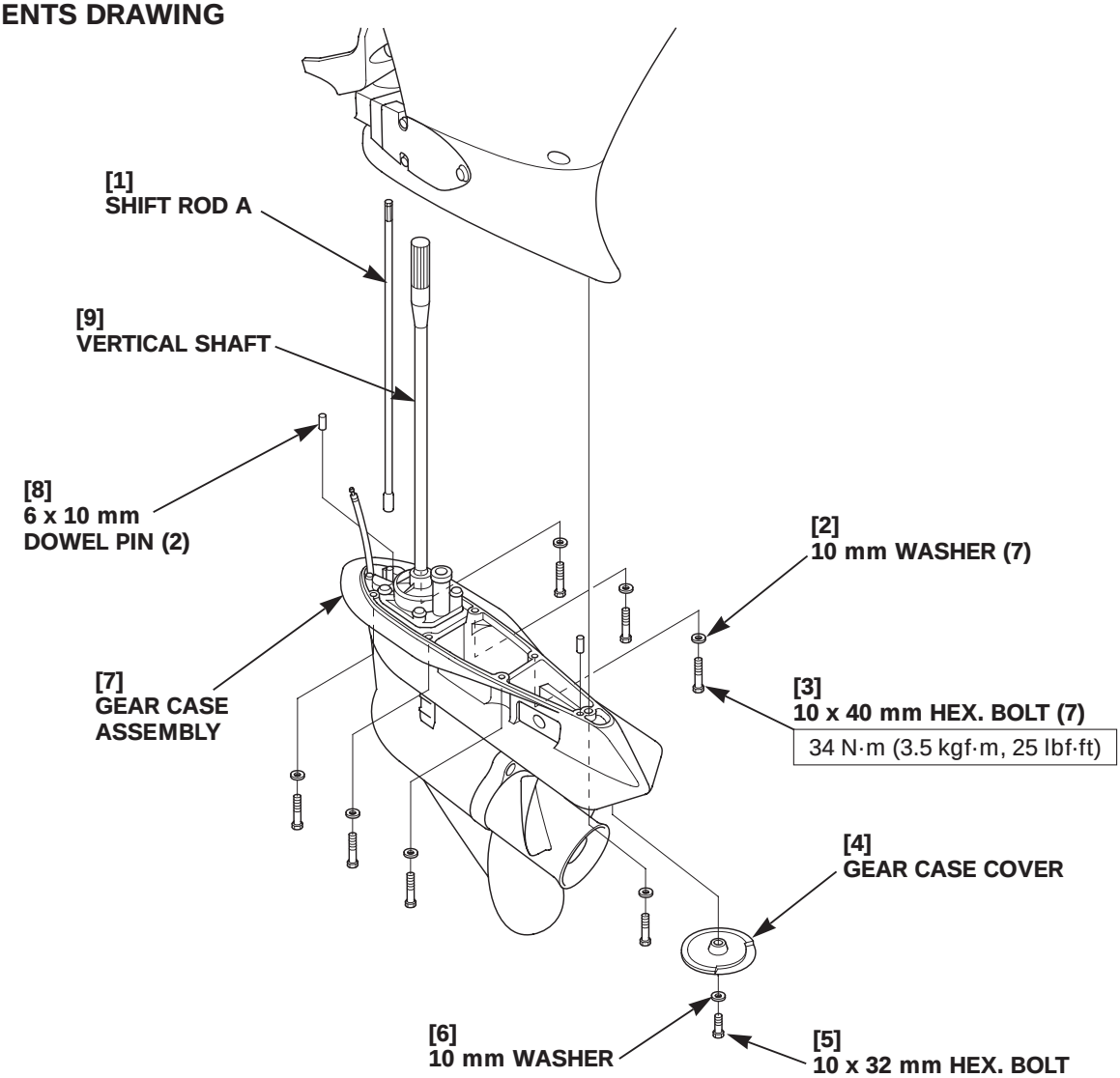
6) After removing the gear case assembly, lower the outboard motor to the lowermost position.



7) Remove the shift rod A from the shift shaft A.



b. COMPONENTS DRAWING

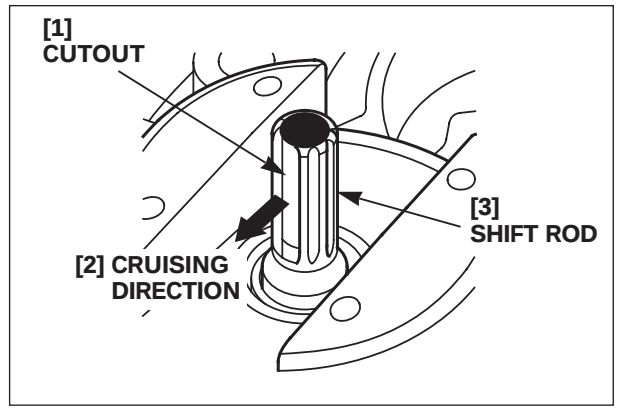


c. INSTALLATION

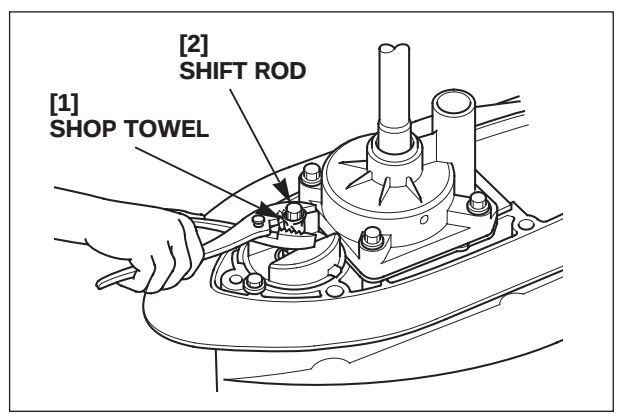
1) Place the remote control lever in the "N" (Neutral) position.

2) Check that the shift rod of the gear case is in the "N" (Neutral) position.

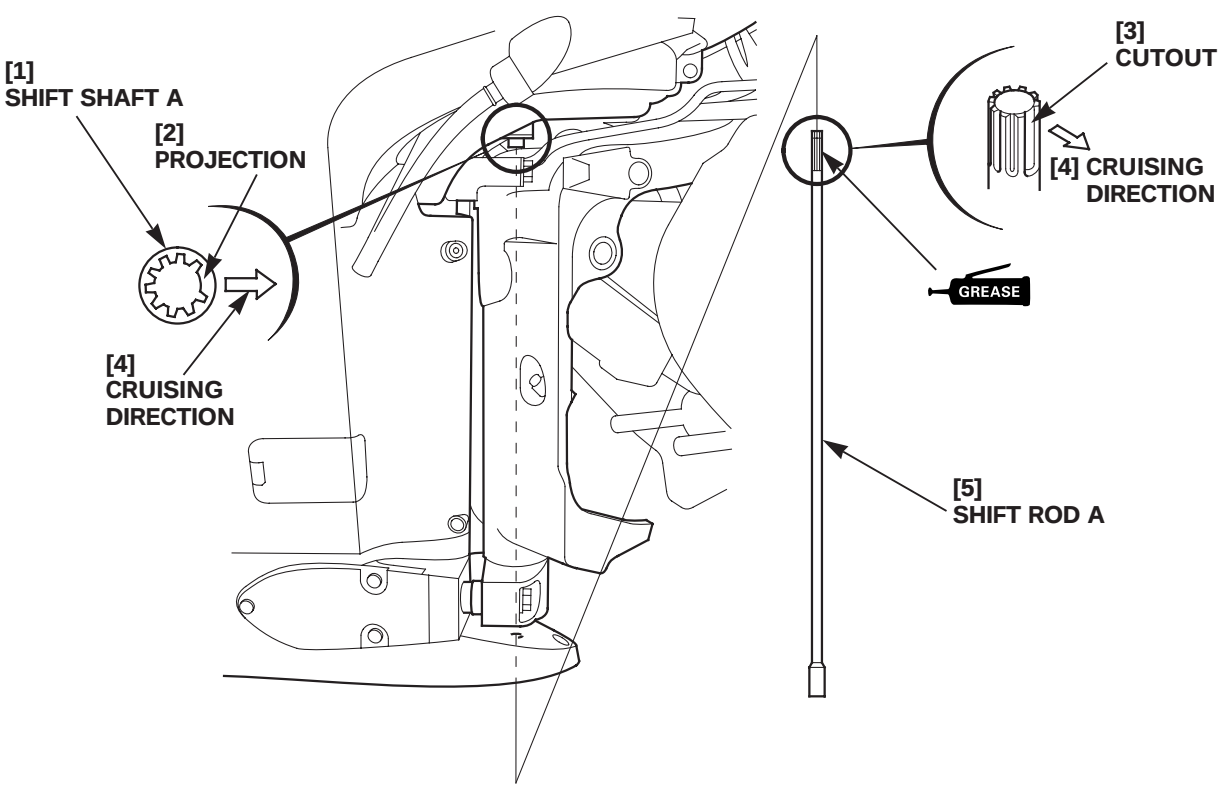
   To check:
   Check whether the cutout of the shift rod spline faces in the direction shown. [It indicates that the shift rod is in the "N" (Neutral) position.]



3) If the cutout of the spline is not in the direction 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.



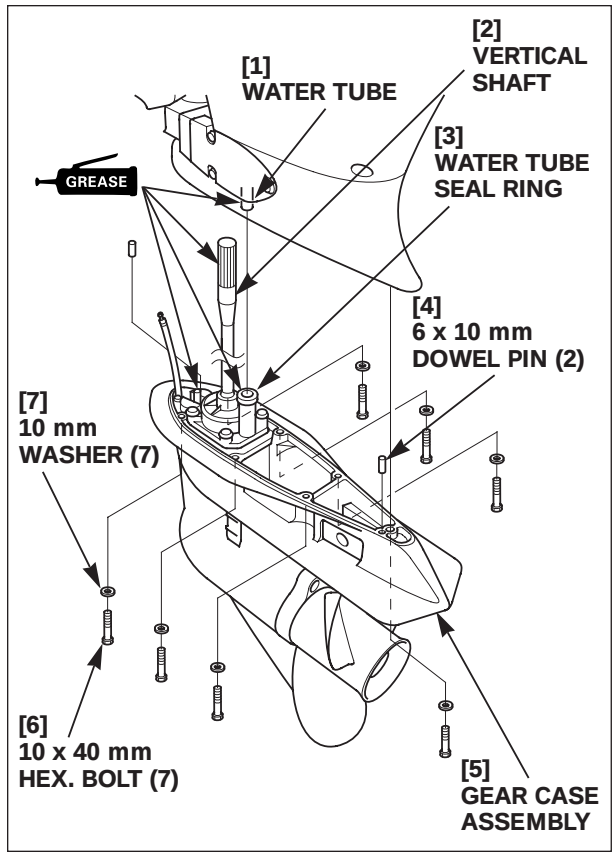
4) Tilt up the outboard motor to the uppermost position.
5) Apply grease to the spline of the shift rod A.
6) Install the shift rod A by aligning the projection of the shift shaft A with the cutout in the spline of the shift rod A. Check that the cutout in the spline of the shift rod A is toward the cruising direction.



7) Apply grease to the vertical shaft spline and the shift rod spline.
   Apply grease to the water tube insertion part and to the inner wall of the water tube seal ring of the impeller housing.
   Apply grease to the inner wall of the vertical shaft bushing [XCC and XCD types only] (P. 14-90).

8) Install the two dowel pins. Aligning the water tube with the water tube seal ring of the impeller housing, install the vertical shaft and the crankshaft. Install the shift rod and shift rod A, too, by aligning the splines.

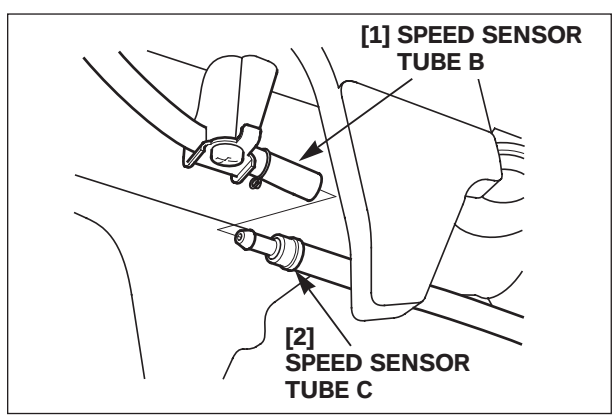
9) Install the gear case assembly on the outboard motor. Loosely tighten the seven 10 mm washers and the seven 10 x 40 mm hex. bolts.



10) Connect the speed sensor tube B and the speed sensor tube C.

11) Lower the outboard motor to the lowermost position and tighten the seven 10 x 40 mm hex. bolts to the specified torque.

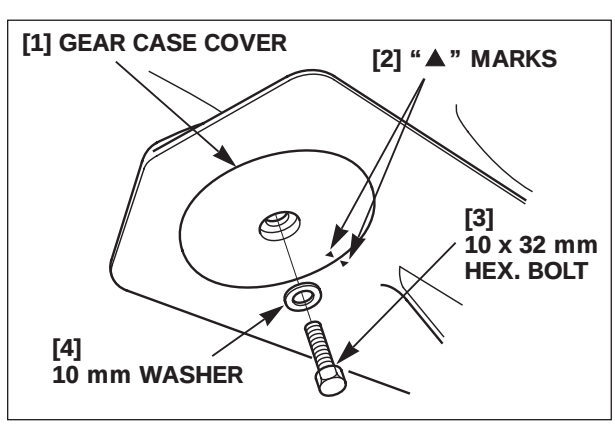
    TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)



12) Position the gear case cover on the gear case assembly.

13) Install the gear case cover aligning the "▲" mark on the gear case cover with the "▲" mark on the gear case. Tighten the 10 mm washer and the 10 x 32 mm hex. bolt.

14) After installing the gear case assembly, adjust the shift control cable (P. 3-25).



11. WATER PUMP/SHIFT ROD [*2]

a. DISASSEMBLY

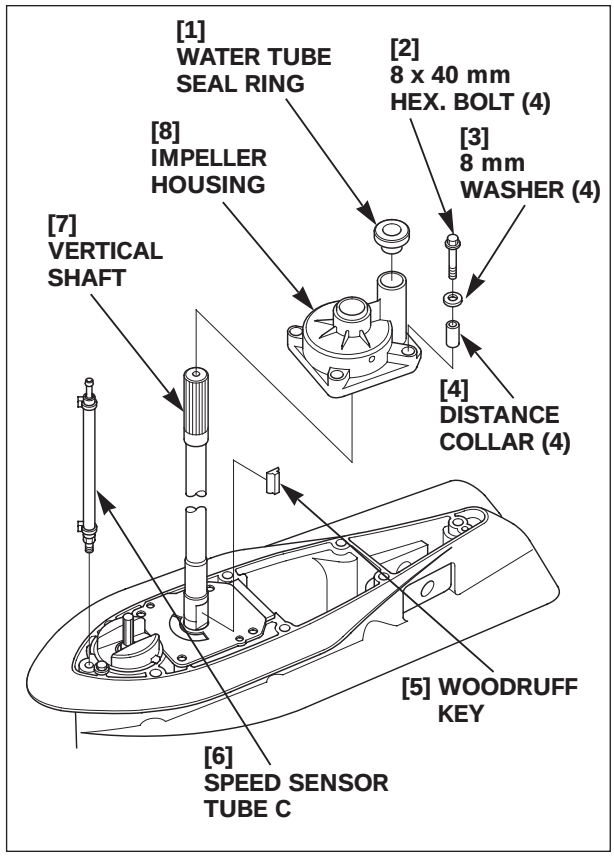
Remove the following parts.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-42)

1) Remove the speed sensor tube C.

2) Remove the water tube seal ring from the impeller housing.

3) Remove the four 8 x 40 mm hex. bolts and the four 8 mm washers from the impeller housing. Remove the impeller housing.
Remove the four distance collars from the impeller housing.

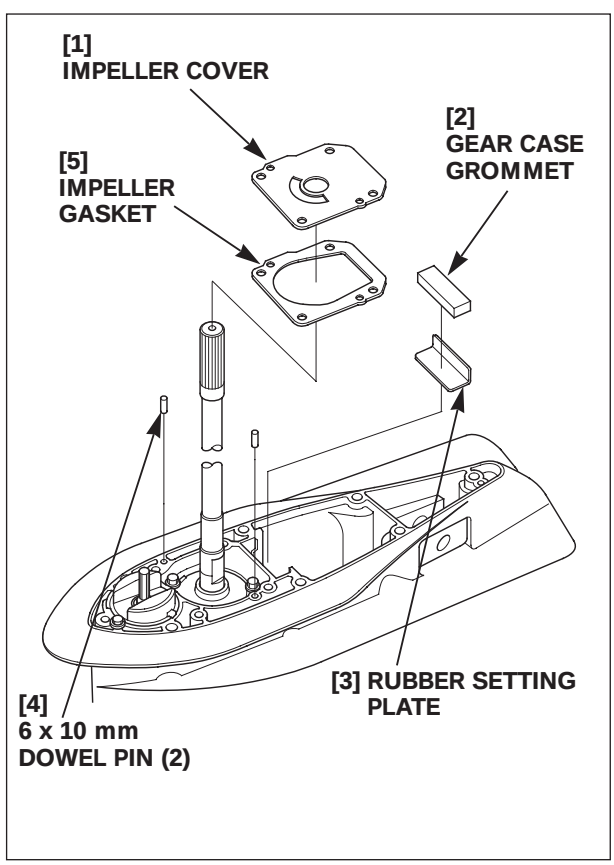
4) Remove the woodruff key from the vertical shaft.



5) Remove the impeller cover, impeller gasket, two dowel pins, gear case grommet and the rubber setting plate.

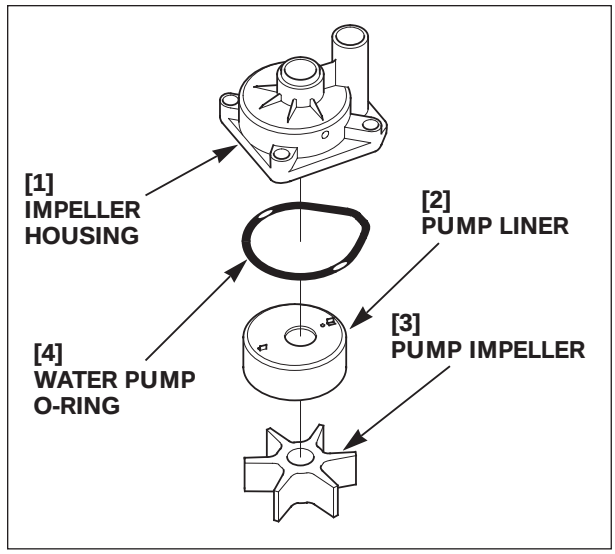
NOTICE

Replace the impeller gasket with a new one on assembly.



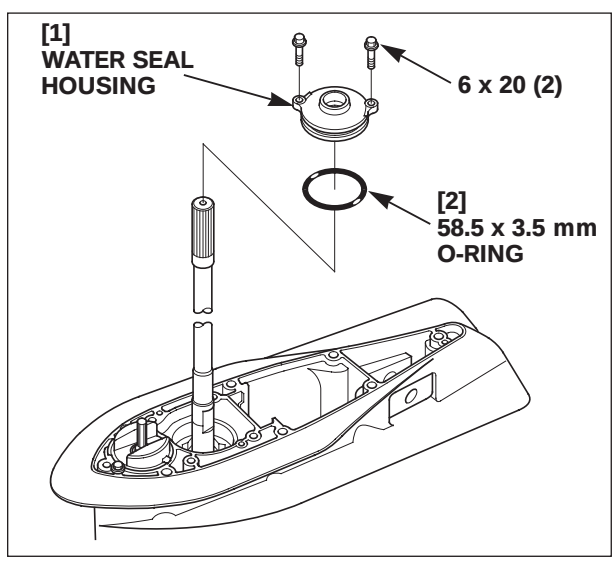
6) Check the pump impeller for cracks, wear or damage from overheating, and replace if necessary.

7) Remove the pump impeller, pump liner and the water pump O-ring from the impeller housing.
Replace the O-ring with a new one on assembly.



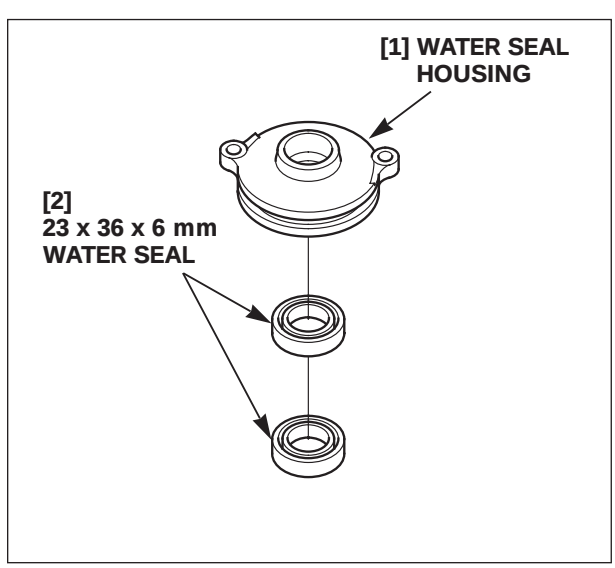
8) Remove the two 6 x 20 mm flange bolts and remove the water seal housing.

9) Remove the 58.5 x 3.5 mm O-ring from the water seal housing.
Replace the O-ring with a new one on assembly.

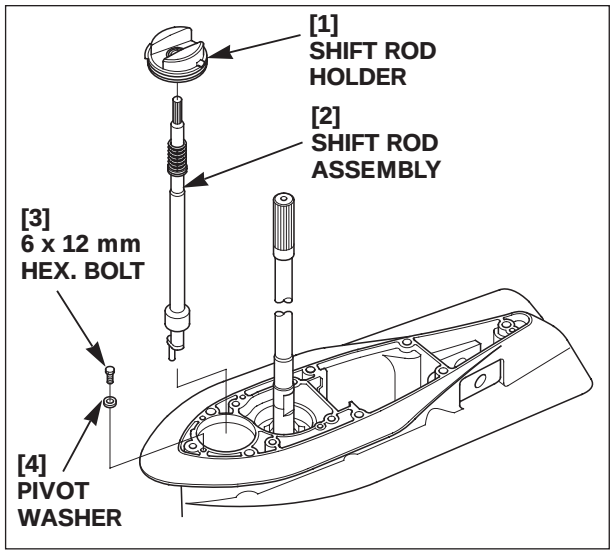


10) Before removing the 23 x 36 x 6 mm water seal, check the water seal lip for cut. Replace if necessary,

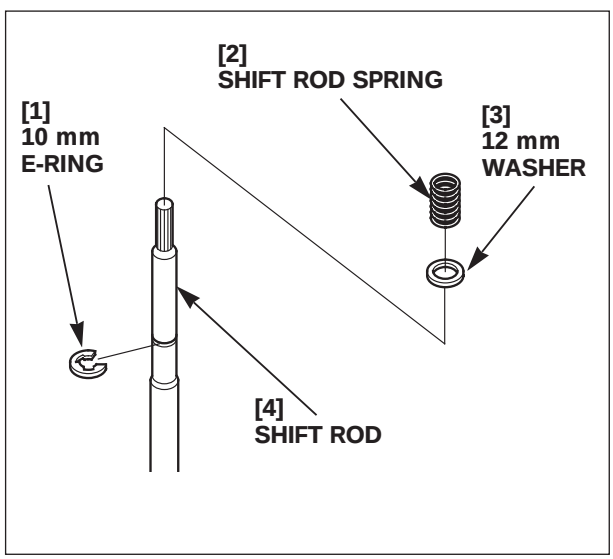
11) Remove the two 23 x 36 x 6 mm water seals from the water seal housing using a commercially available oil seal remover.
Replace the water seals with the new ones on assembly.



12) Remove the 6 x 12 mm hex. bolt and the pivot washer. Remove the shift rod holder and the shift rod assembly.



13) Remove the shift rod spring, 12 mm washer and the 10 mm E-ring from the shift rod.



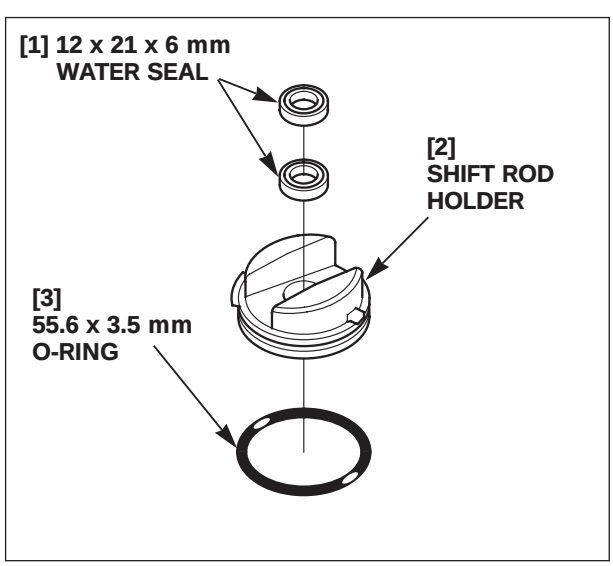
14) Check the 12 x 21 x 6 mm water seal lip for cut and replace if necessary.

15) Remove the two 12 x 21 x 6 mm water seals from the shift rod holder using a commercially available oil seal remover.

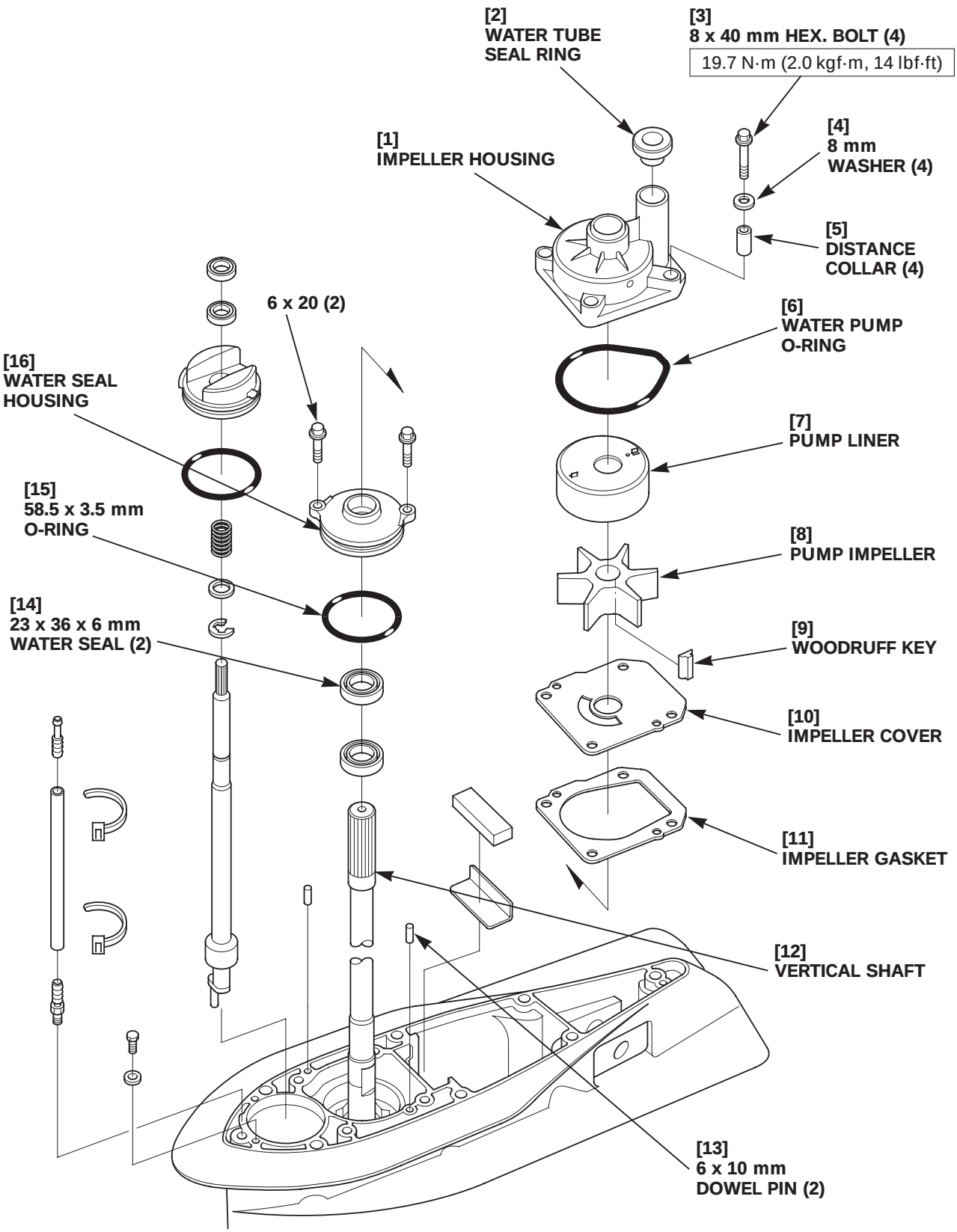
16) Remove the 55.6 x 3.5 mm O-ring from the shift rod holder.

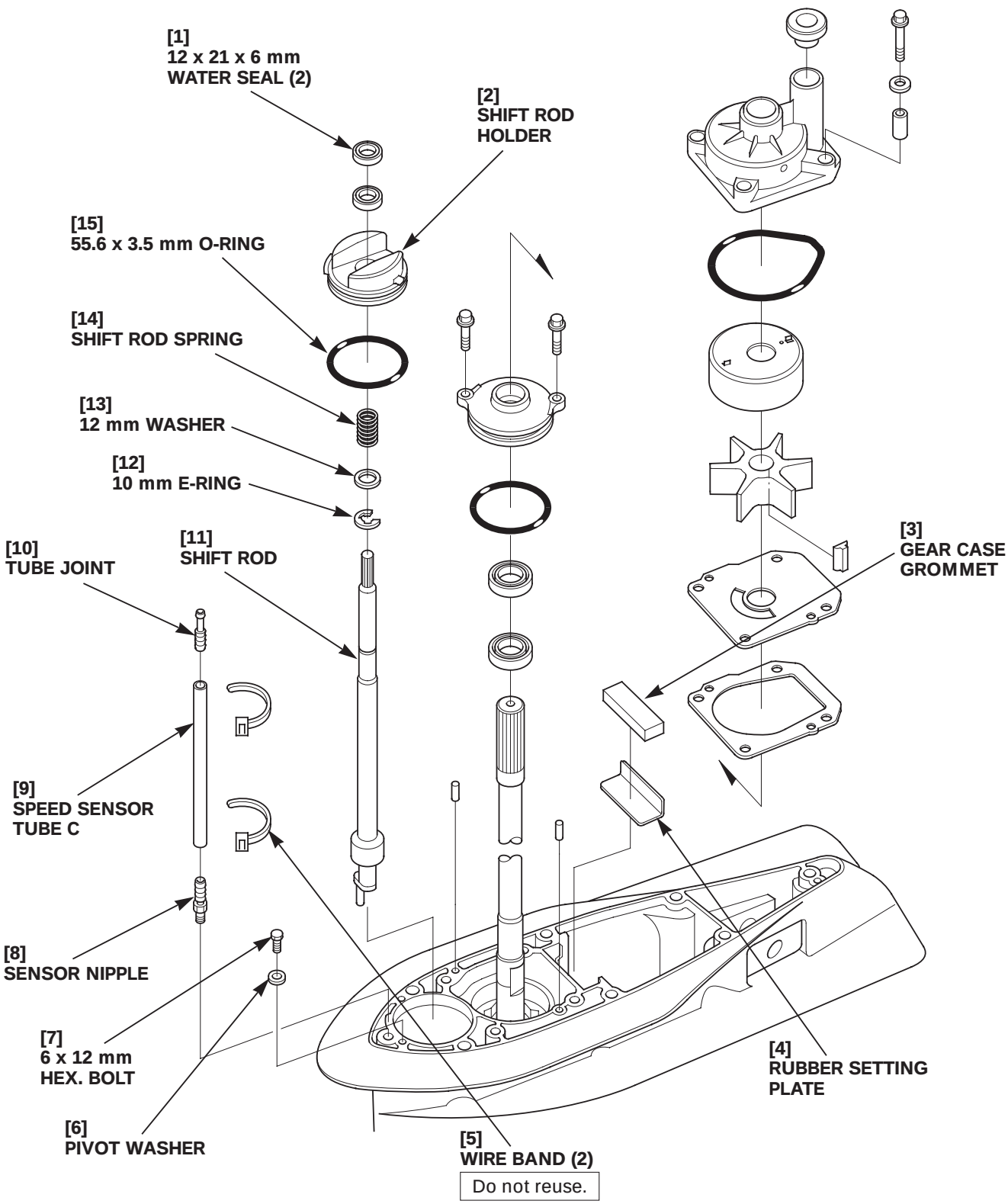
NOTICE

- *Replace the 12 x 21 x 6 mm water seals with the new ones on assembly.*
- *Replace the 55.6 x 3.5 mm O-ring with a new one on assembly.*



b. COMPONENTS DRAWING




[1]
12 x 21 x 6 mm
WATER SEAL (2)
[2]
SHIFT ROD
HOLDER
[15]
55.6 x 3.5 mm O-RING
[14]
SHIFT ROD SPRING
[13]
12 mm WASHER
[12]
10 mm E-RING
[10]
TUBE JOINT
[11]
SHIFT ROD
[3]
GEAR CASE
GROMMET
[9]
SPEED SENSOR
TUBE C
[8]
SENSOR NIPPLE
[7]
6 x 12 mm
HEX. BOLT
[6]
PIVOT WASHER
[5]
WIRE BAND (2)
Do not reuse.
[4]
RUBBER SETTING
PLATE

c. ASSEMBLY

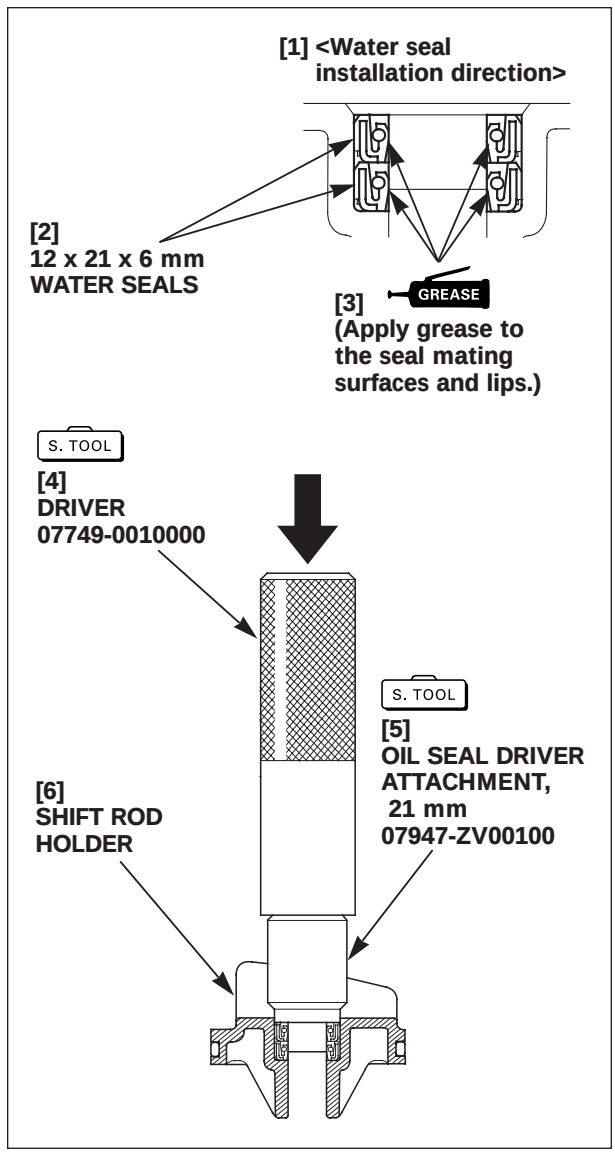
1) Apply soapy water to the circumference of the 12 x 21 x 6 mm water seals.

2) Drive the 12 x 21 x 6 mm water seals one by one in the shift rod holder using the special tools. Note the installation direction of the water seals.
Be sure to apply grease to the water seal mating surfaces before installation.

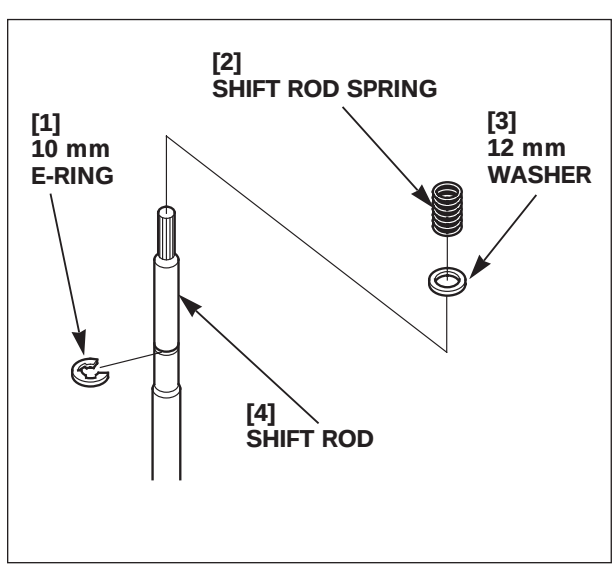
TOOLS:

Driver	**07749-0010000**
Oil seal driver attachment, 21 mm	**07947-ZV00100**

3) After installing the water seals, apply grease to the water seal lips.



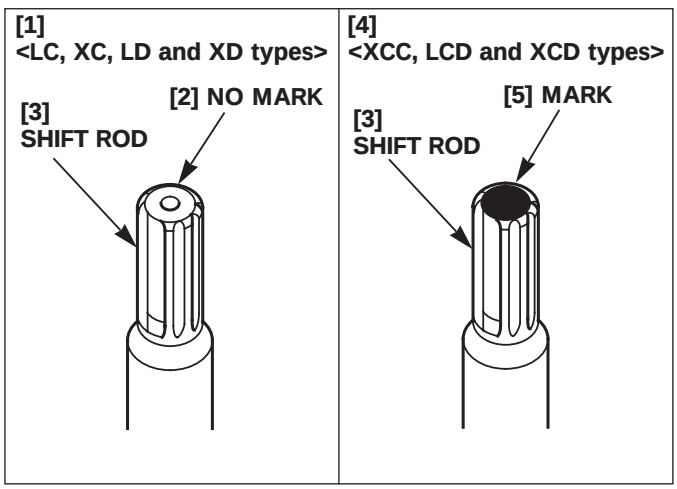
4) Position the 10 mm E-ring, 12 mm washer and the shift rod spring on the shift rod.

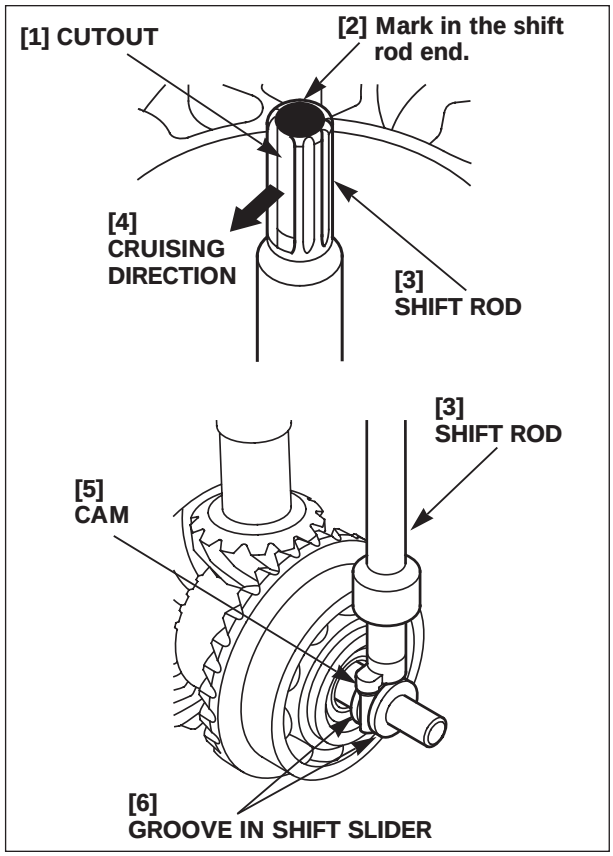


5) Install the shift rod by aligning the shift cam of the shift rod with the groove in the shift slider so that the cutout of the shift rod spline faces in the cruising direction.

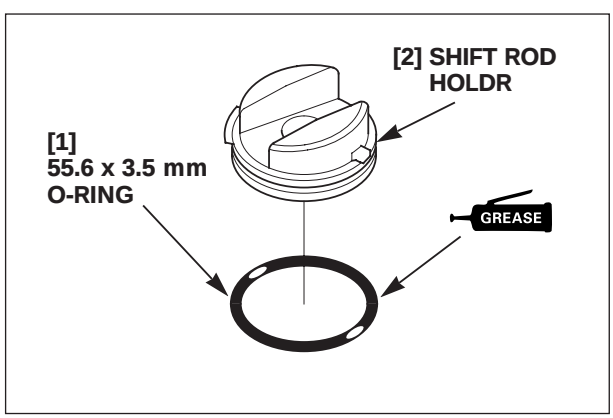
NOTICE

- *Check for marking in the end of the shift rod.*
- *If the shift cam is in alignment with the groove in the shift slider but the cutout of the spline is not in the cruising direction, see the step 3 on page 14-44 and adjust accordingly.*

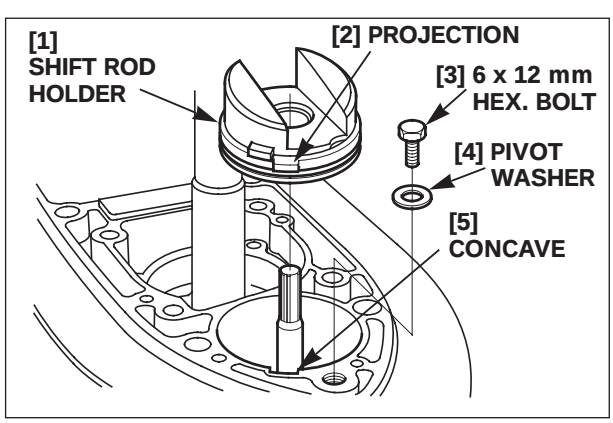




6) Apply grease to the circumference of the new 55.6 x 3.5 mm O-ring and install it on the shift rod holder.



7) Install the shift rod holder aligning the projection with the concave in the gear case and tighten it with the pivot washer and the 6 x 12 mm hex. bolt.
After installation, check that the cutout of the shift rod spline faces in the cruising direction.



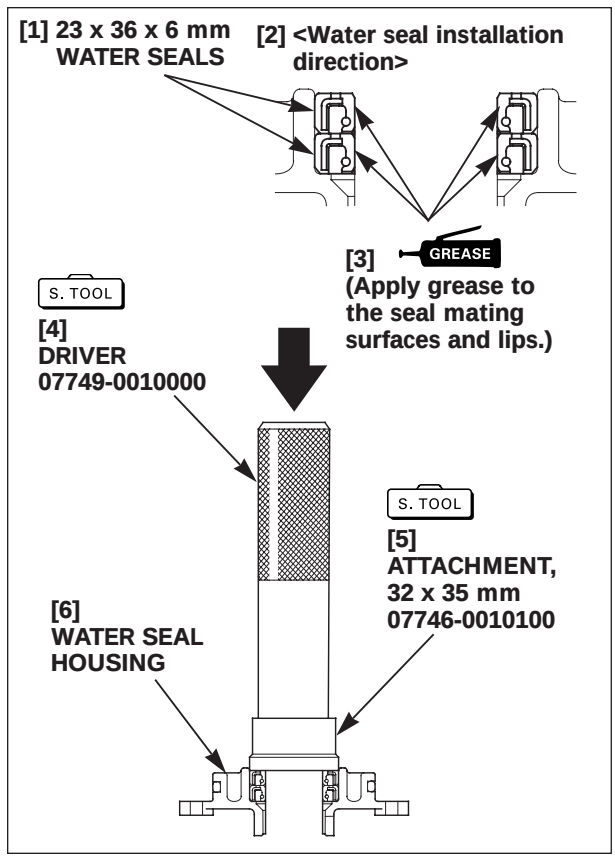
8) Apply soapy water to the circumference of the 23 x 36 x 6 mm water seals.

9) Drive the 23 x 36 x 6 mm water seals one by one in the water seal housing using the special tools. Note the installation direction of the water seals.
Be sure to apply grease to the water seal mating surfaces before installation.

TOOLS:

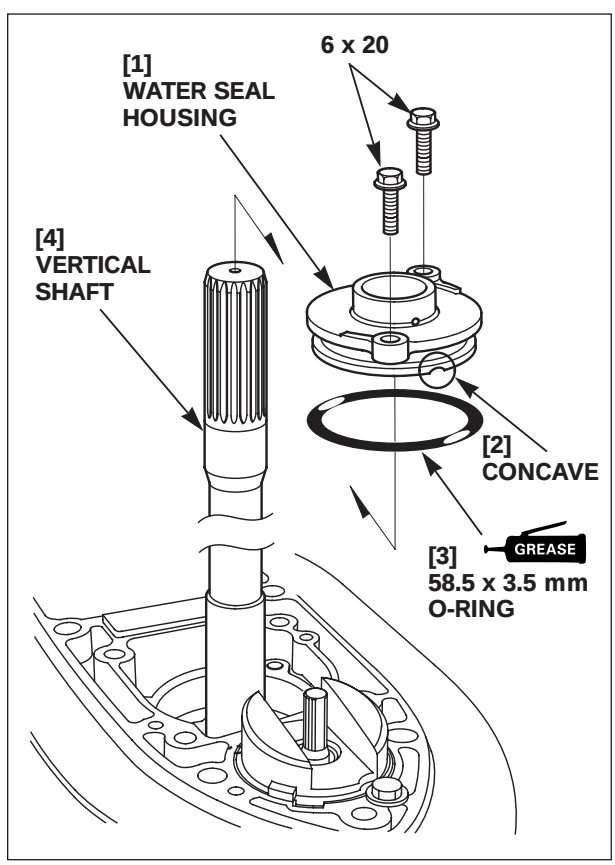
Driver	**07749-0010000**
Attachment, 32 x 35 mm	**07746-0010100**

10) After installing the water seals, apply grease to the water seal lips.

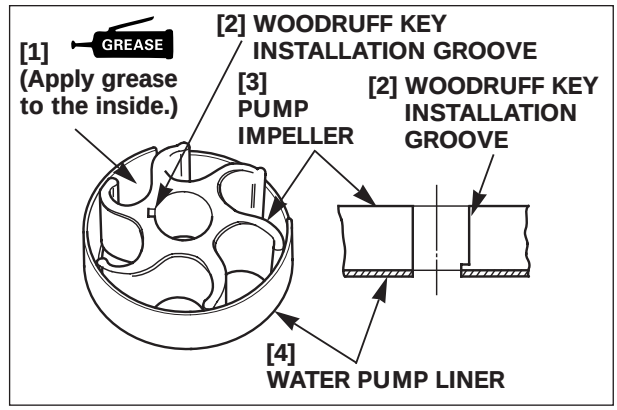


11) Apply grease to the circumference of the new 58.5 x 3.5 mm O-ring and position it on the water seal housing.

12) Install the water seal housing so that the concave faces in the cruising direction, and tighten it with the two 6 x 20 mm flange bolts.

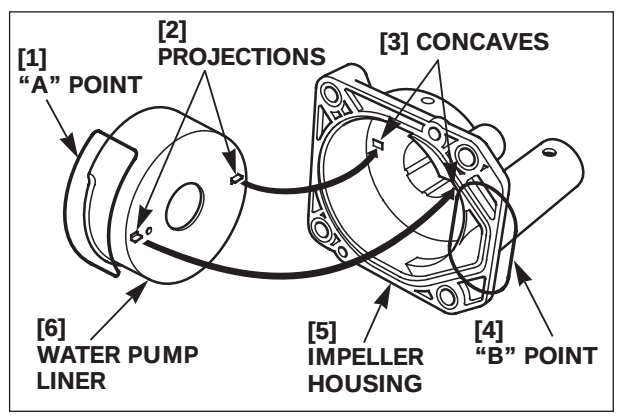


13) Apply grease to the inner wall of the water pump liner. Install the pump impeller in the water pump liner with the woodruff key installation groove facing up and the pump impeller fins in the direction shown.
Be sure to align the hole in the pump liner with the hole in the pump impeller.

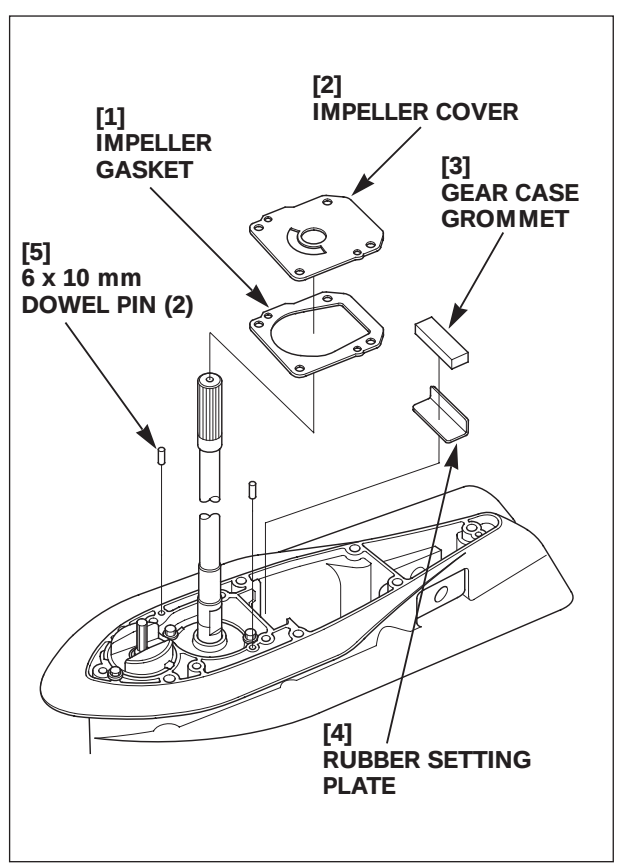


14) Install the water pump liner in the impeller housing by aligning the two projections on the pump liner with the two grooves inside the impeller housing.

15) Be sure that the part "A" of the water pump liner is in alignment with the part "B" of the impeller housing, too.



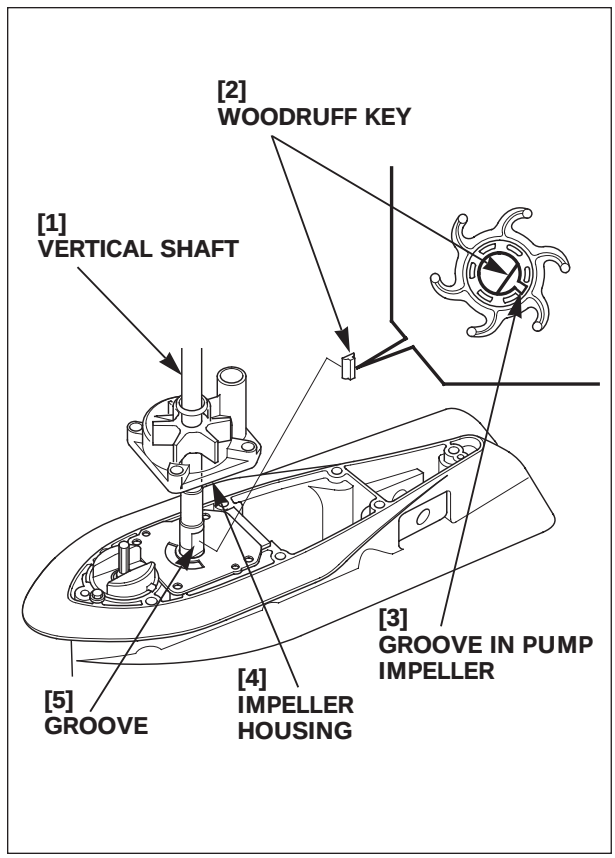
16) Install the rubber setting plate, gear case grommet, two dowel pins, new impeller gasket and the impeller cover.



17) Install the woodruff key in the groove in the vertical shaft. Align the groove in the pump impeller with the woodruff key and install the impeller housing by turning it clockwise.

NOTICE

- *Turn the impeller housing clockwise when it is turned with the pump impeller mounted.*
- *After installing the impeller housing, check that the impeller gasket is set in the proper position.*



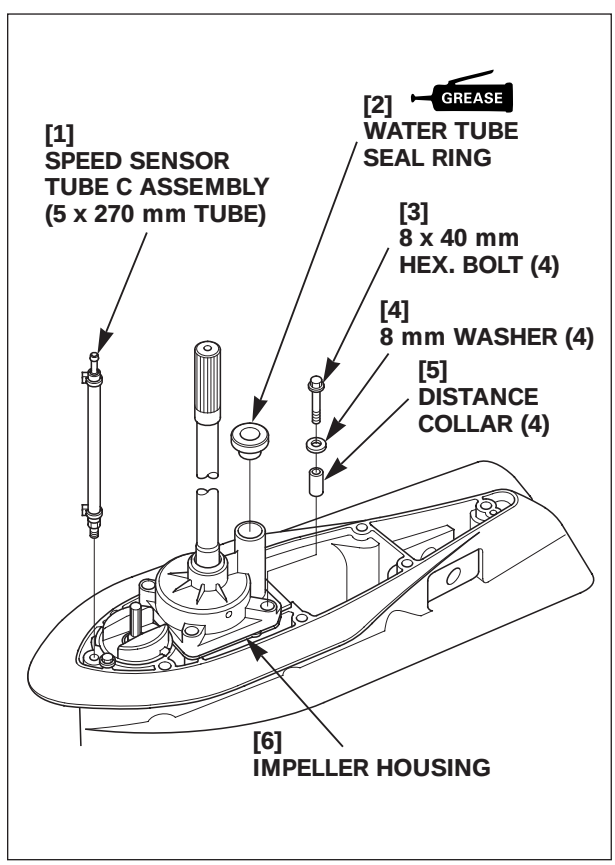
18) Improve the four distance collars on the impeller housing, and tighten the four 8 mm washers and the four 8 x 40 mm hex. bolts to the specified torque.

TORQUE: 19.7 N·m (2.0 kgf·m, 14 lbf·ft)

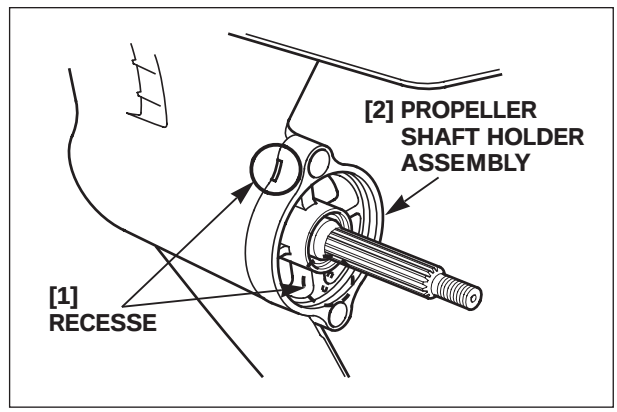
19) Apply grease to the inner wall of the water tube seal ring. Install the water tube seal ring aligning the projection with the hole in the housing.

20) Install the speed sensor tube C assembly (5 x 270 mm tube).

21) Install the following parts.
– Gear case assembly (P. 14-44)
– Propeller (P. 14-2)



12. PROPELLER SHAFT HOLDER ASSEMBLY [*2]

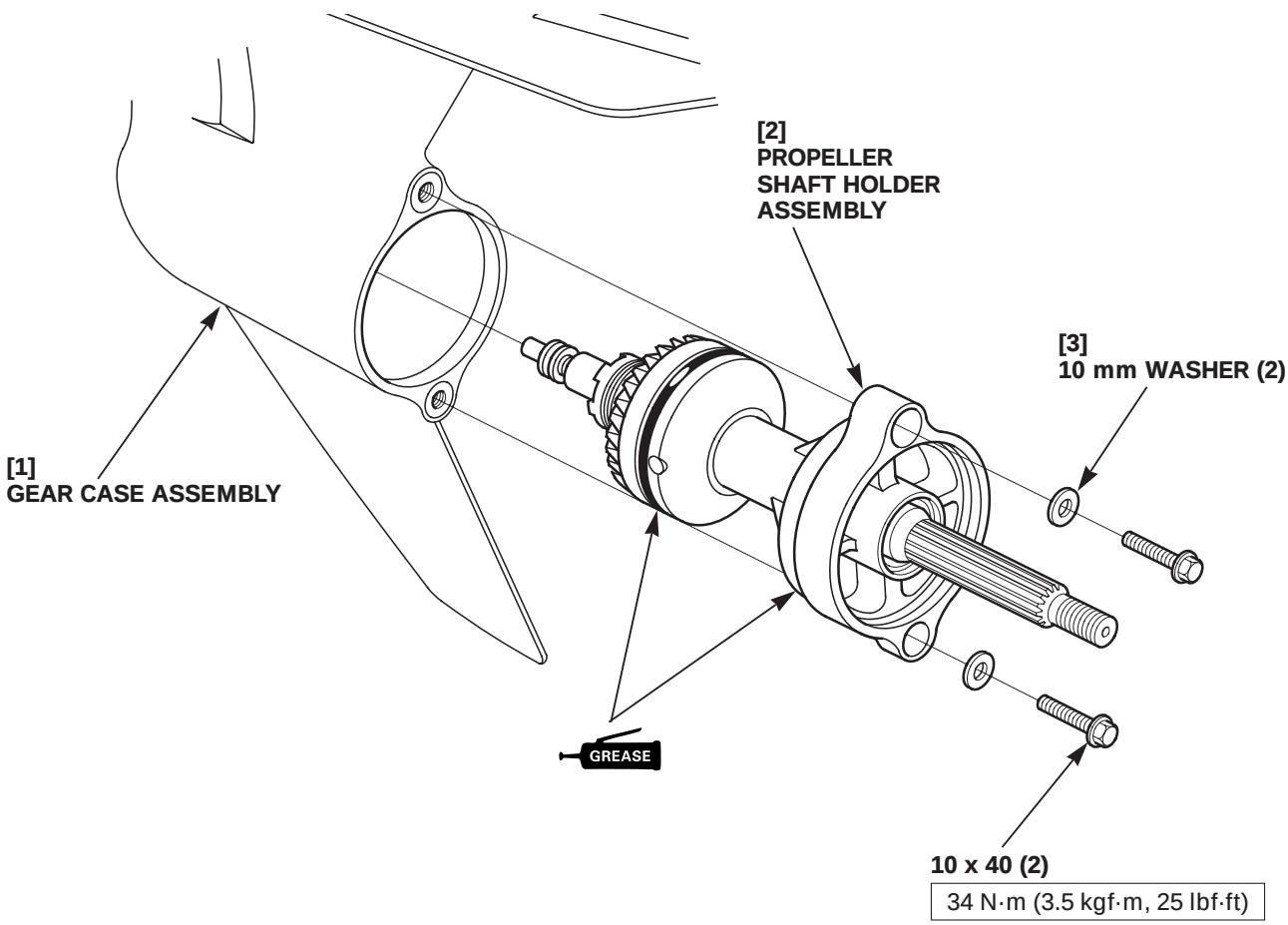


a. REMOVAL/INSTALLATION

Remove the following parts.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-42)
– Water pump/shift rod (P. 14-46)

1) Remove the two 10 mm washers and the two 10 x 40 mm flange bolts.
2) Insert a screwdriver or equivalent tool into the recess in the propeller shaft holder and remove the propeller shaft holder assembly from the gear case.

Installation is the reverse order of removal.

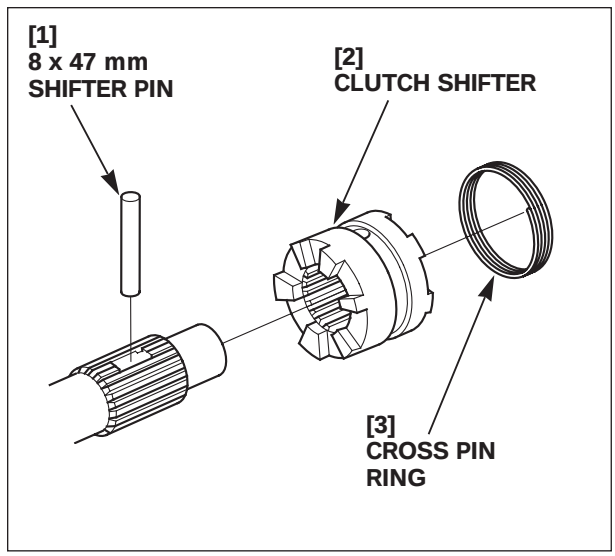


13. PROPELLER SHAFT/PROPELLER SHAFT HOLDER [*2]

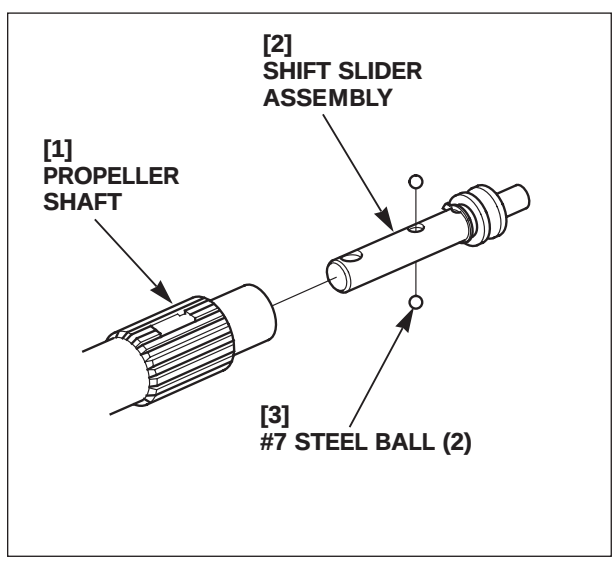
a. DISASSEMBLY

Remove the following parts.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-42)
– Water pump/shift rod (P. 14-46)
– Propeller shaft holder assembly (P. 14-56)

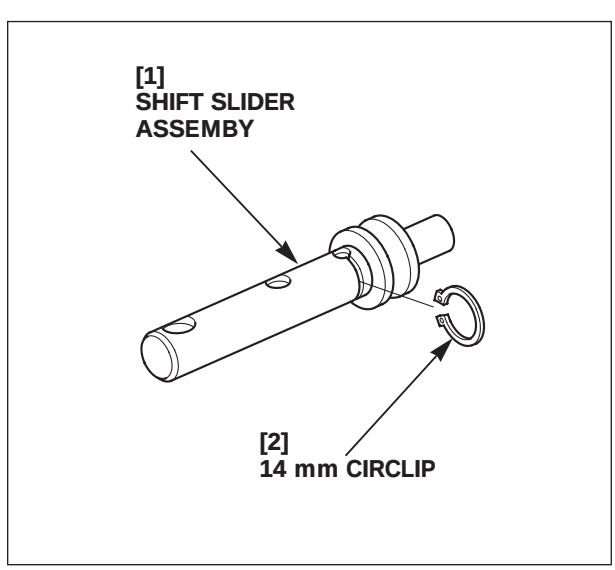
1) Remove the cross pin ring and the 8 x 47 mm shifter pin, then remove the clutch shifter.



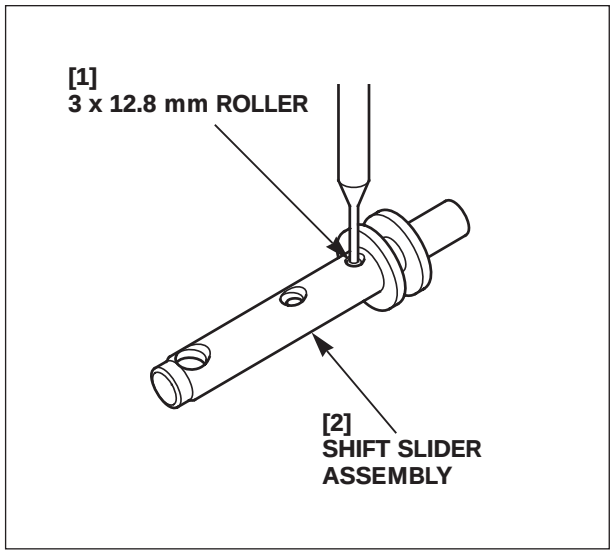
2) Remove the shift slider assembly and the two #7 steel balls from the propeller shaft. Take care not to lose the steel balls.



3) Remove the 14 mm circlip from the shift slider assembly.



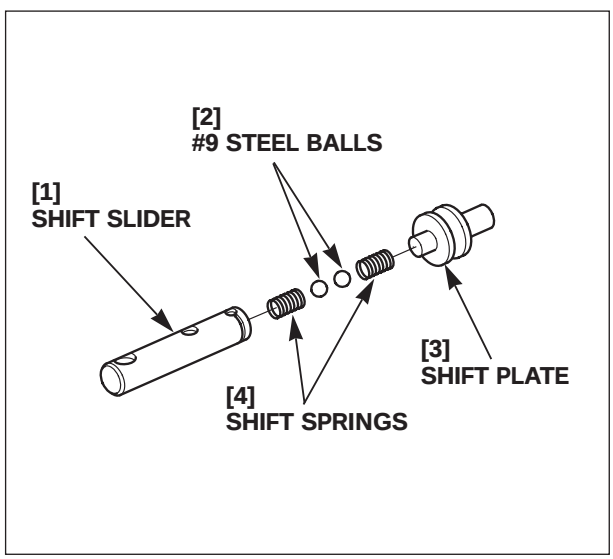
4) Remove the 3 x 12.8 mm roller from the shift slider assembly using a commercially available pin driver.



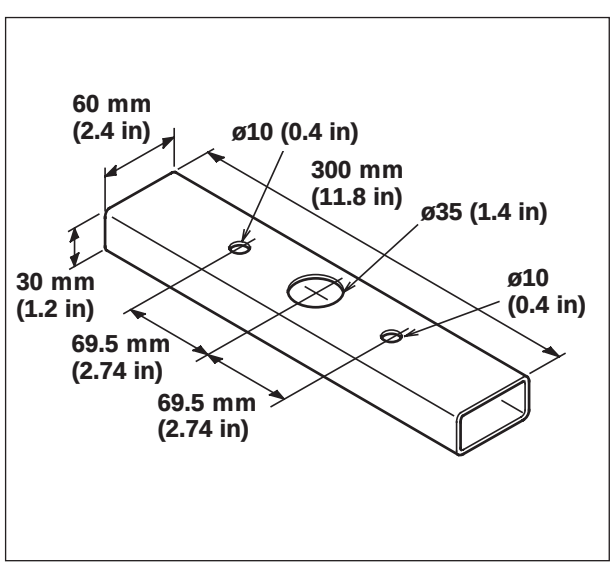
5) Remove the shift plate from the shift slider, then remove the two shift springs and the two #9 steel balls.

NOTICE

Take care not to let the shift springs and the #9 steel balls pop out of the shift slider during removal of the shift plate.



6) Prepare the fixing tool of the dimensions shown.



7) Position the propeller shaft holder assembly on the fixing tool and secure the holder assembly with the bolt.

8) Hold the fixing tool with a vise.

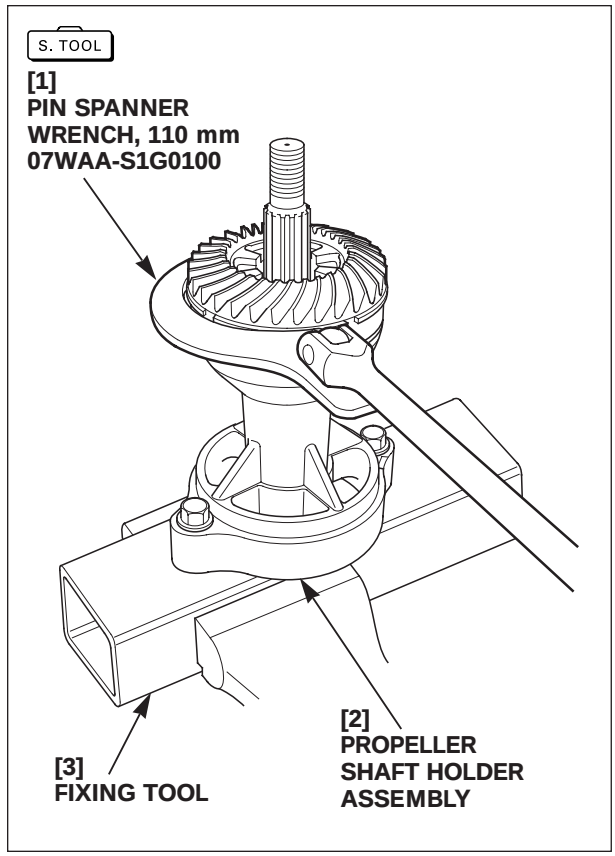
9) Loosen the bearing holder using the special tool as shown.

TOOL:
Pin spanner wrench, 110 mm 07WAA-S1G0100

10) Remove the bearing holder assembly from the propeller shaft holder.

NOTICE

Avoid holding the propeller shaft holder directly in a vise. Use the fixing tool to hold it in a vise.



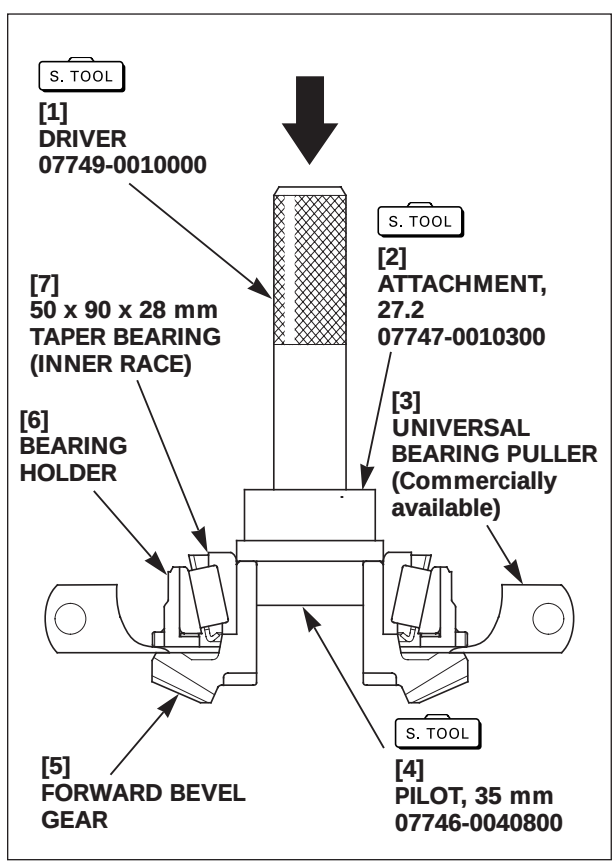
11) Before removing the taper bearing (inner race), check the inner race for abnormal sound and play. If there is any abnormal sound or play in the inner race, replace the inner race and the outer race as a set.

12) Attach a commercially available universal bearing puller between the bearing holder and the forward bevel gear.

13) Remove the forward bevel gear from the taper bearing (inner race) using the special tools and the hydraulic press.

TOOLS:

Driver	**07749-0010000**
Attachment, 27.2	**07747-0010300**
Pilot, 35 mm	**07746-0040800**



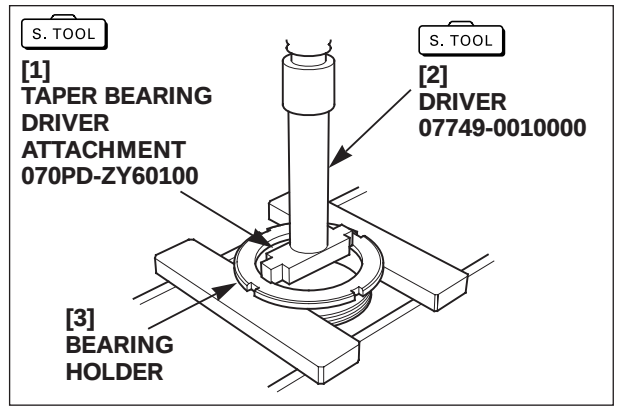
14) Before removing the taper bearing (outer race), check the outer race for damage. Replace the inner race and the outer race as a set if necessary.

15) Remove the taper bearing (outer race) from the bearing holder using the special tools and the hydraulic press.

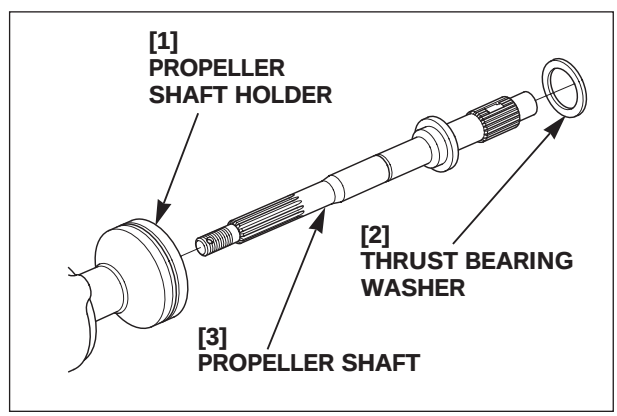
TOOLS:

Driver	**07749-0010000**
Taper vearing driver attachment	**070PD-ZY60100**

16) Remove the shim from the bearing holder.
Replace the shim with a new one on assembly.



17) Remove the thrust bearing washer and the propeller shaft from the propeller shaft holder.

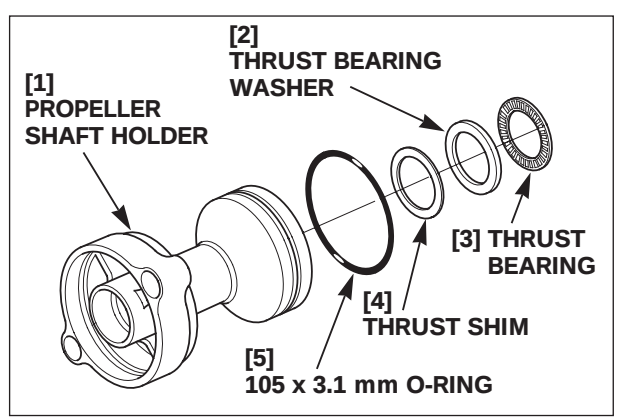


18) Check the thrust bearing for abnormal sound and play. Replace if necessary.

19) Remove the thrust bearing, thrust bearing washer, shim and the 105 x 3.1 mm O-ring from the propeller shaft holder.

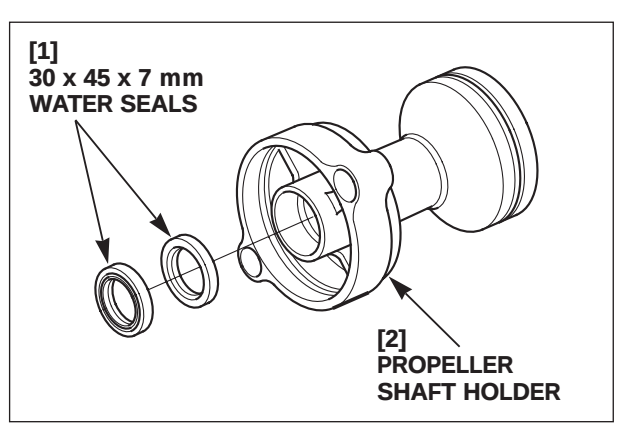
NOTICE

- *Replace the shim with a new one on assembly.*
- *Replace the 105 x 3.1 mm O-ring with a new one on assembly.*



20) Before removing the 30 x 45 x 7 mm water seals, check the water seal lips for cut and replace if necessary.

21) Remove the two 30 x 45 x 7 mm water seals from the propeller shaft holder using a commercially available oil seal remover.
Replace the water seals with the new ones on assembly.

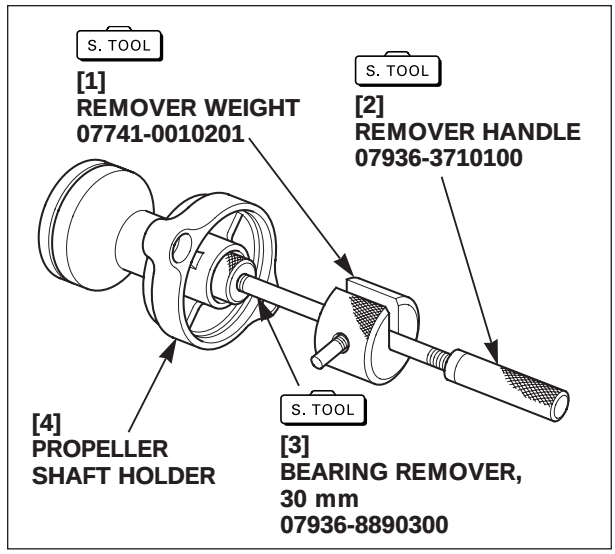


22) Check the needle bearing for abnormal sound and play before removal. Replace the needle bearing if necessary.

23) Remove the needle bearing from the propeller shaft using the special tools as shown.
Replace the needle bearing with a new one on assembly.

TOOLS:

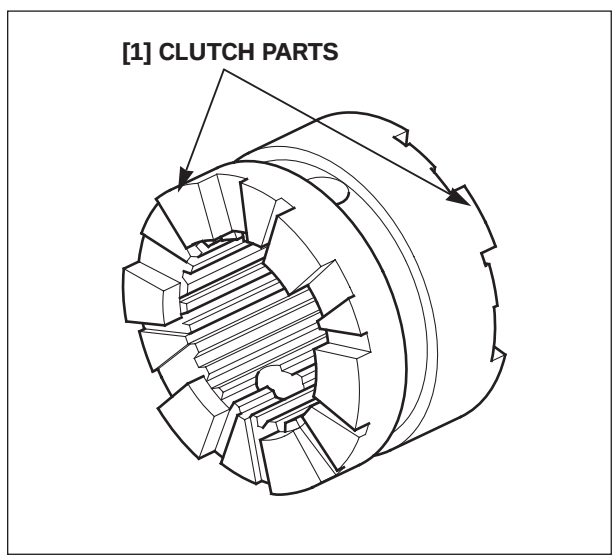
Remover weight	**07741-0010201**
Remover handle	**07936-3710100**
Bearing remover, 30 mm	**07936-8890300**



b. INSPECTION

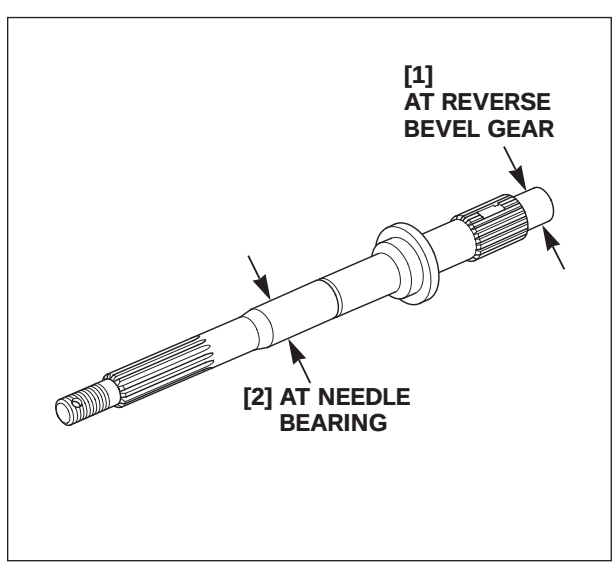
• CLUTCH SHIFTER

Check the clutch part of the forward and reverse sides for wear and damage

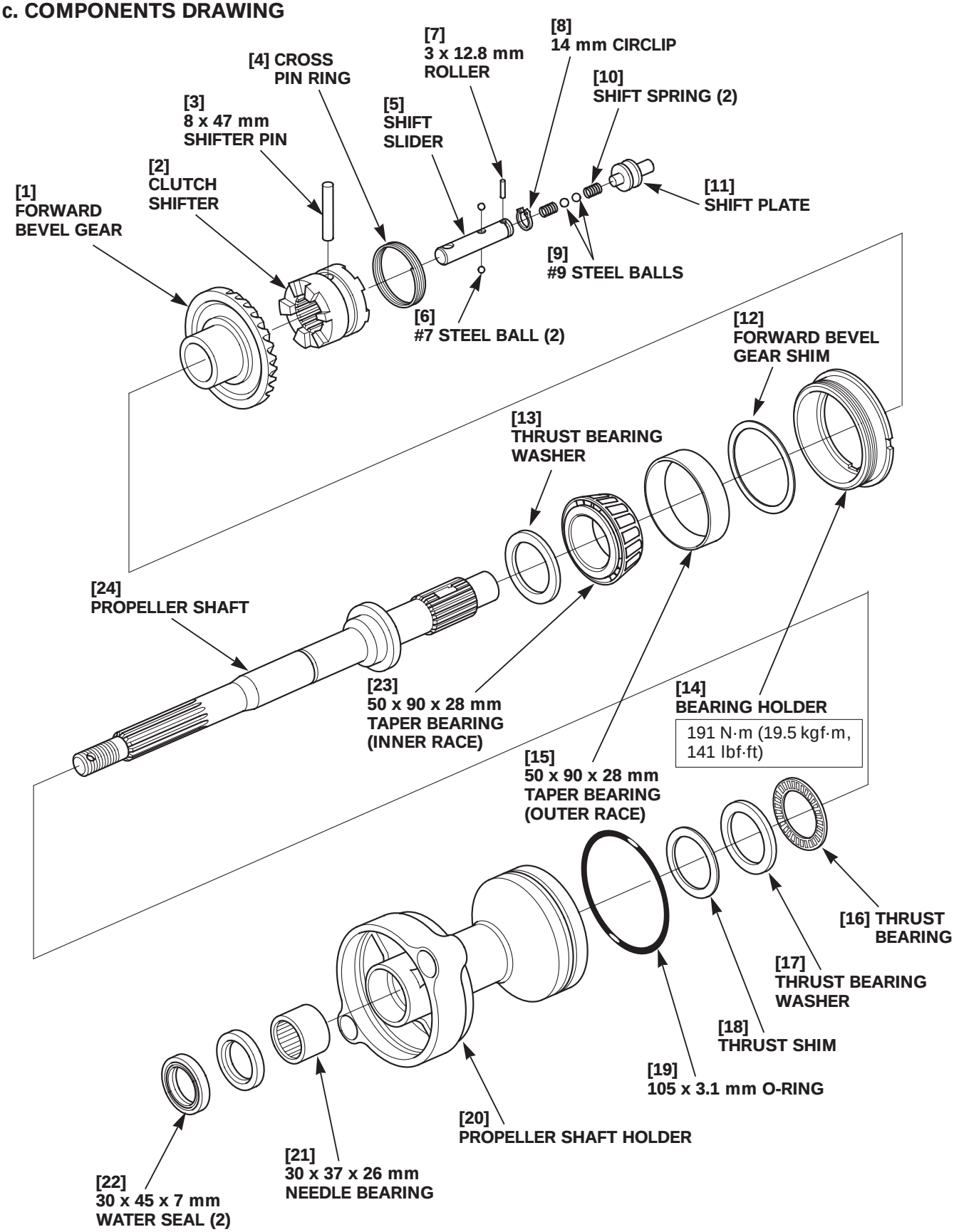


• PROPELLER SHAFT O.D.

	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)



c. COMPONENTS DRAWING



d. ASSEMBLY

1) Apply gear oil to the circumference of the new needle bearing.

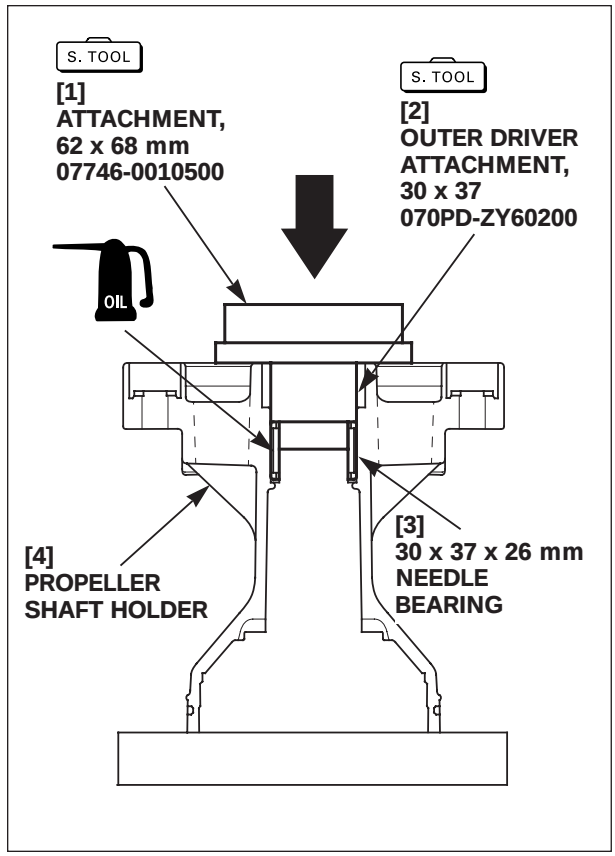
2) Install the needle bearing on the propeller shaft holder using the special tools and the hydraulic press.

TOOLS:

Attachment, 62 x 68 mm	**07746-0010500**
Outer driver attachment, 30 x 37	**070PD-ZY60200**

NOTICE

Install the needle bearing with the stamped side toward the special tools.



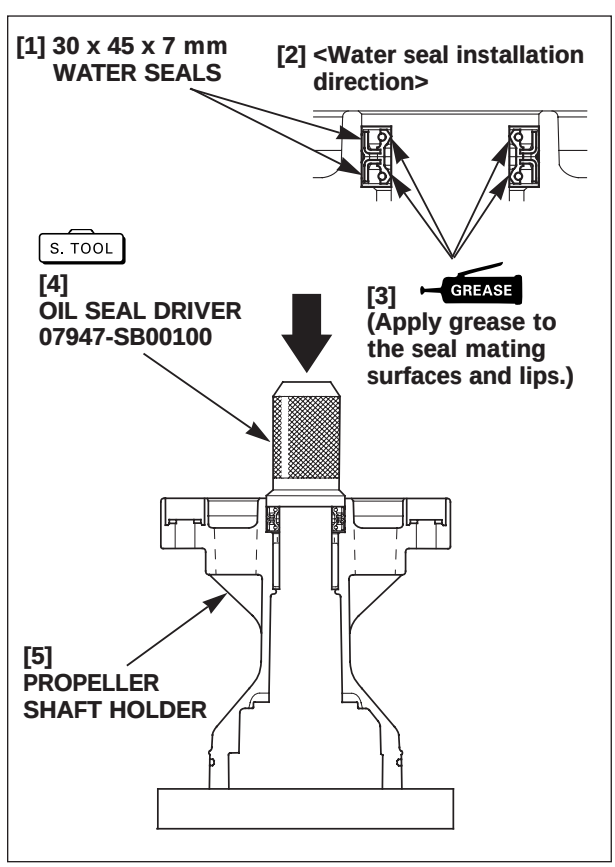
3) Apply soapy water to the circumference of the new 30 x 45 x 7 mm water seals.

4) Drive the 30 x 45 x 7 mm water seals one by one into the propeller shaft holder using the special tool. Note the installation direction of the water seals.
Apply grease to the water seal mating surfaces before installation.

TOOL:

Oil seal driver	**07947-SB00100**

5) After installation of the water seals, apply grease to the water seal lips.



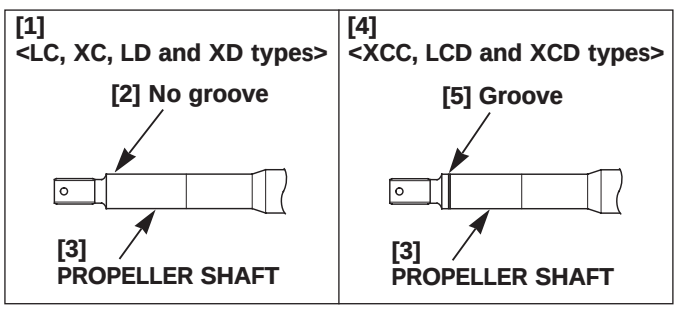
6) Apply gear oil to the circumference of the new 105 x 3.1 mm O-ring and install it on the propeller shaft holder.

7) Install the new thrust shim on the propeller shaft holder.

8) Install the thrust bearing washer with the chamfered side toward the thrust shim.

9) Apply gear oil to the circumference of the thrust bearing and install it on the thrust bearing washer.

10) Check that there is the groove at the spline of the propeller installation side of the propeller shaft.



11) Install the propeller shaft and the thrust bearing washer on the propeller shaft holder.
Install the thrust bearing washer with the chamfered side toward the flange of the propeller shaft.

12) Install the new shim on the bearing holder.

13) Apply gear oil to the circumference of the taper bearing (outer race) and install it on the bearing holder.

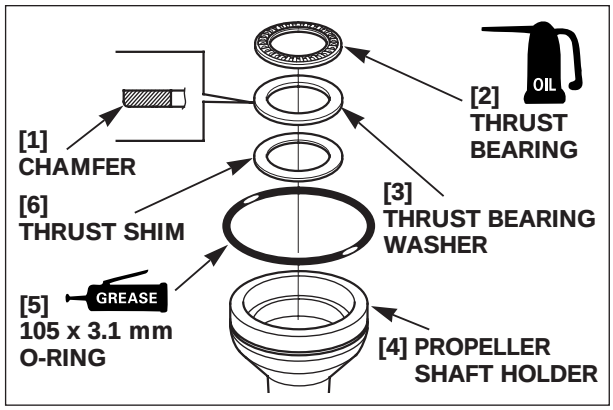
NOTICE

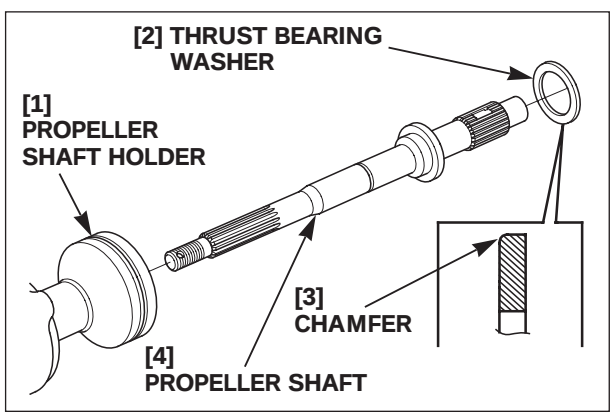
Install the taper bearing (outer race) with the smaller diameter side toward the shim.

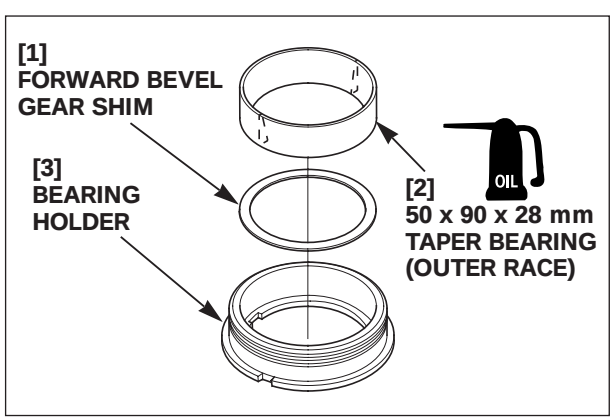
14) Install the taper bearing (outer race) on the bearing holder using the special tools and the hydraulic press as shown.

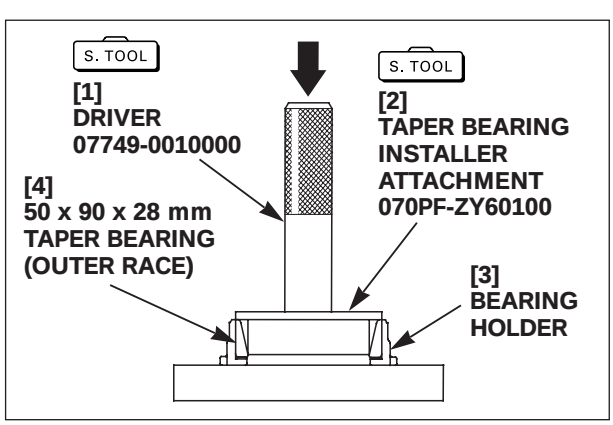
TOOLS:

Driver	**07749-0010000**
Taper bearing inataller attachment	**070PF-ZY60100**









15) Place the wood block under the forward bevel geaar.

16) Place the bearing holder assembly on the forward bevel gear.

17) Apply gear oil to the inner wall of the taper bearing inner race and position it in the forward bevel gear.

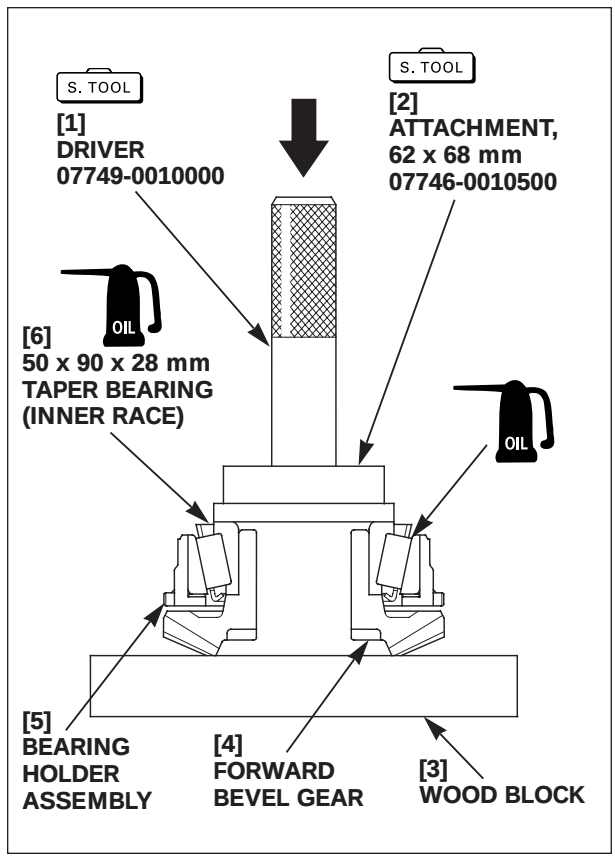
18) Install the taper bearing inner race on the forward bevel gear using the special tools and hydraulic press.

TOOLS:

Driver	**07749-0010000**
Attachment, 62 x 68 mm	**07746-0010500**

NOTICE

Install by applying gear oil between the inner and outer races of the taper bearing.



19) Apply gear oil to the threads and seat of the bearing holder assembly.

20) Position the bearing holder assembly on the propeller shaft.
Loosely tighten the bearing holder assembly by hands against the propeller shaft holder.

21) Attach the fixing tool, that had been used during propeller shaft/propeller shaft holder removal, on the propeller shaft holder assembly and secure with the bolt.

22) Tighten the bearing holder to the specified torque using the special tool as shown.

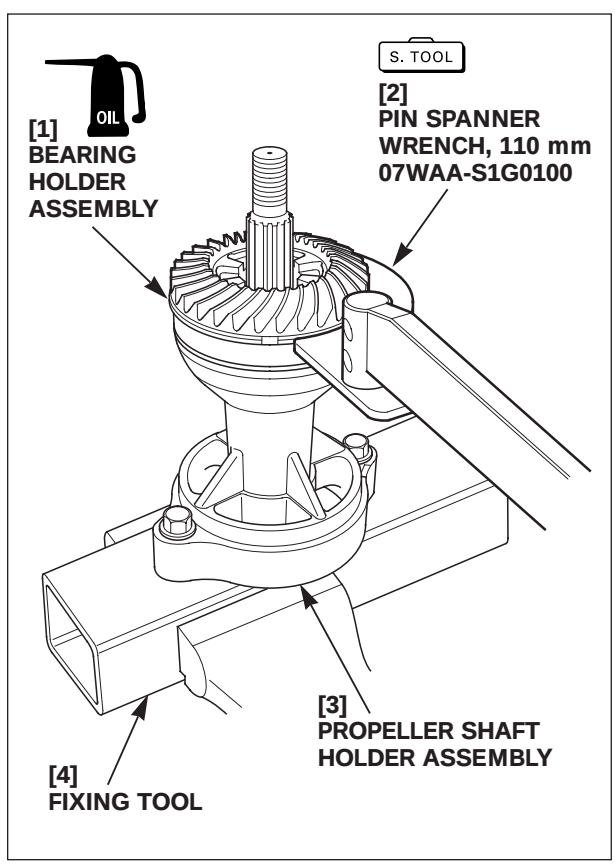
TOOL:

Pin spanner wrench, 110 mm	**07WAA-S1G0100**

TORQUE: 191 N·m (19.5 kgf·m, 141 lbf·ft)

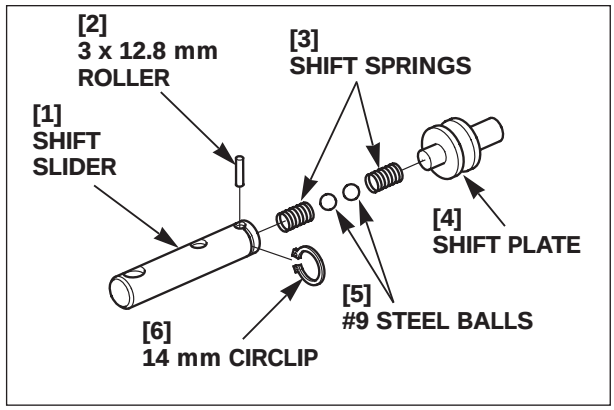
NOTICE

Avoid holding the propeller shaft holder directly in a vise. Use the fixing tool to hold it in a vise.



23) Install the shift spring, two #9 steel balls, shift spring and the shift plate in this order in the shift slider.

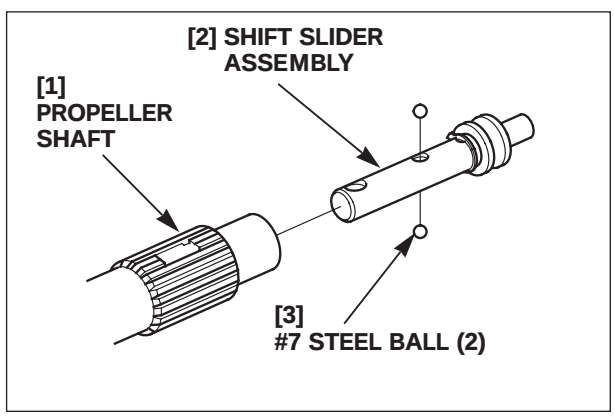
24) Install the 3 x 12.8 mm roller aligning the hole in the shift slider with the hole in the shift plate, then install the 14 mm circlip.



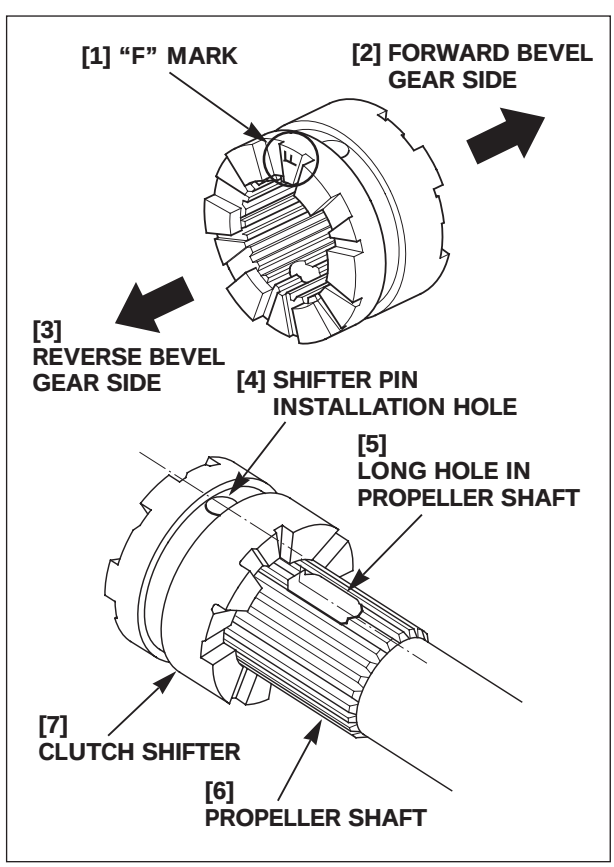
25) Set the #7 steel balls in the steel ball installation holes in the shift slider assembly, and push the shift slider assembly slowly into the propeller shaft.

NOTICE

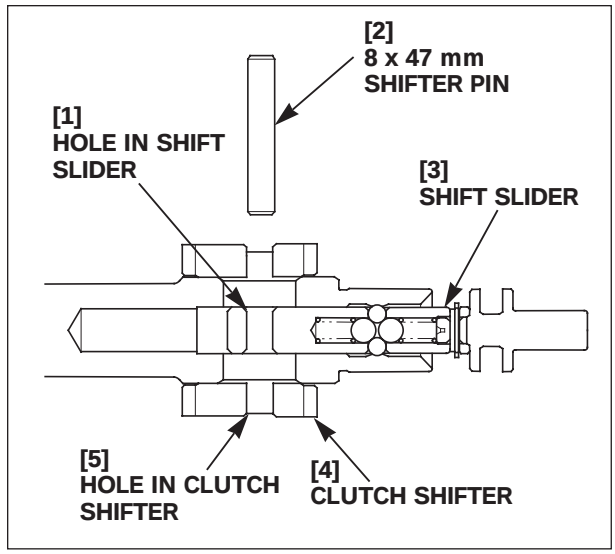
Push the shift slider assembly into the propeller shaft with care not to allow the #7 steel balls to pop out.



26) With the "F" mark on the clutch shifter toward the reverse bevel gear (i.e. toward front), assemble the clutch shifter with the propeller shaft while aligning the 8 x 47 mm shifter pin installation hole with the long hole in the propeller shaft.



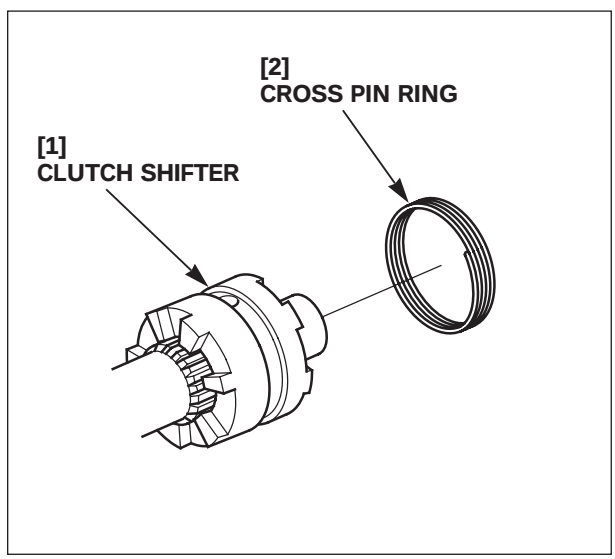
27) Install the 8 x 47 mm shifter pin while aligning the hole in the clutch shifter with the hole in the shift slider.



28) Install the cross pin ring on the clutch shifter.

NOTICE

Check that the coils of the cross pin ring do not overlap each other.

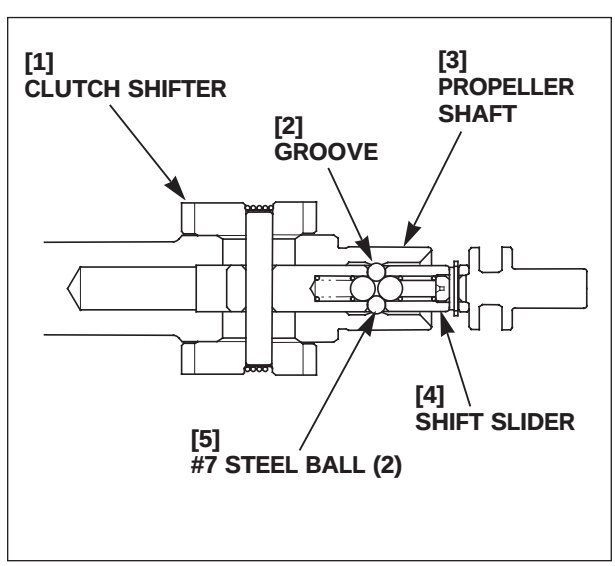


29) Check that the #7 steel balls are set in the groove in the propeller shaft securely as shown.

Check procedure:

- 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 assembly slowly.
- Be sure that the #7 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 assembly slowly again.

30) Install the following parts.
- Propeller shaft holder assembly (P. 14-56)
- Water pump/shift rod (P. 14-51)
- Gear case assembly (P. 14-44)
- Propeller (P. 14-2)



14. VERTICAL SHAFT/BEVEL GEAR [*2]

a. DISASSEMBLY

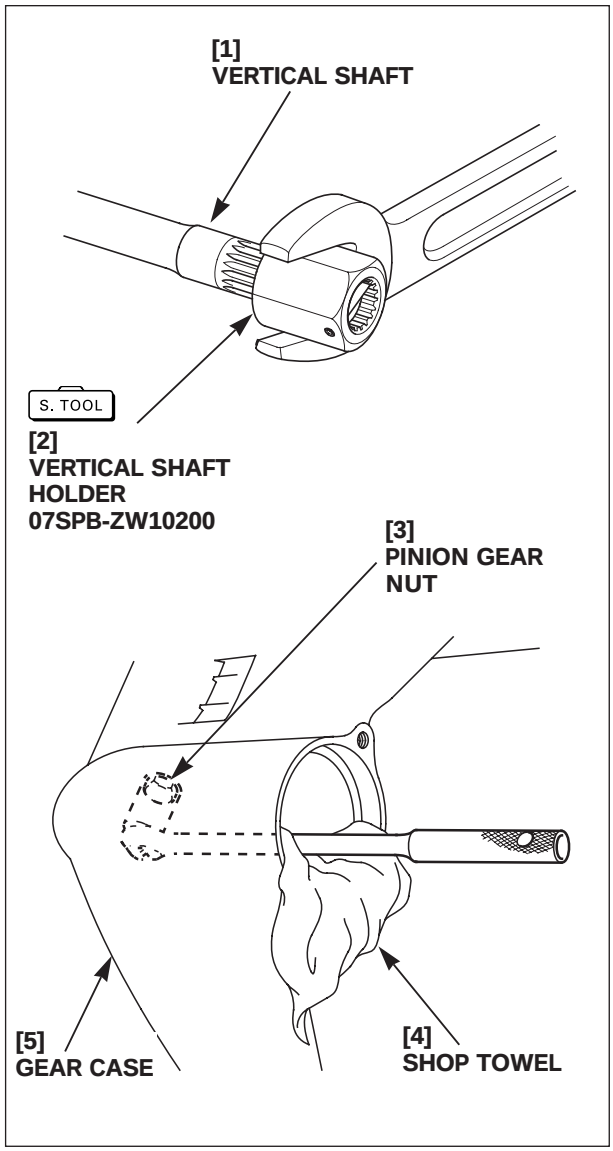
Remove the following pars.
– Propeller (P. 14-2)
– Gear case assembly (P. 14-42)
– Water pump/shift rod (P. 14-46)
– Propeller shaft holder assembly (P. 14-56)

1) Attach the special tool to the end (crankshaft installation side) of the vertical shaft.

TOOL:
Vertical shaft holder **07SPB-ZW10200**

2) Place a shop towel or equivalent material as shown to protect the gear case.

3) Holding the special tool, remove the pinion gear nut and the pinion gear.



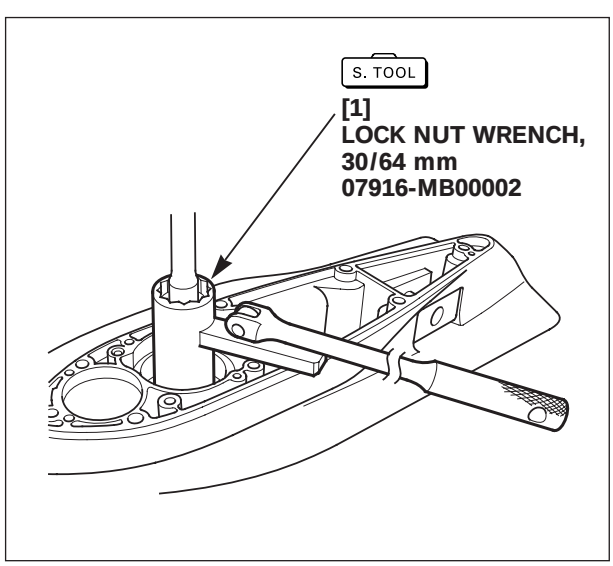
4) Remove the 64 mm lock nut using the special tool as shown.

TOOL:
Lock nut wrench, 30/64 mm **07916-MB00002**

5) Remove the vertical shaft assembly.

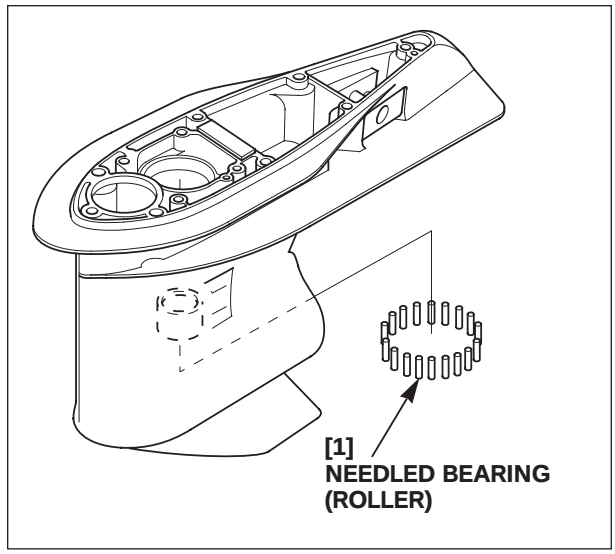
NOTICE

Take care not to drop the needle bearing (roller) when removing the vertical shaft assembly.



6) Check the needle bearing for abnormal sound and play. Replace the roller and the outer race as a set if necessary.

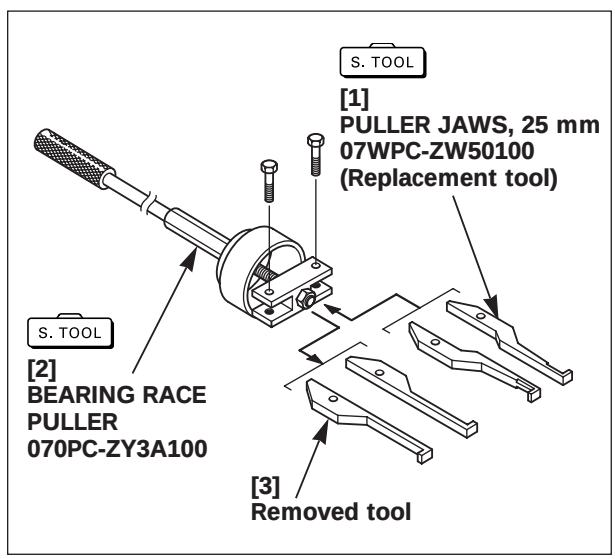
7) Remove the needle bearing (roller).



8) Replace the puller jaws of the special tool as shown.

TOOLS:

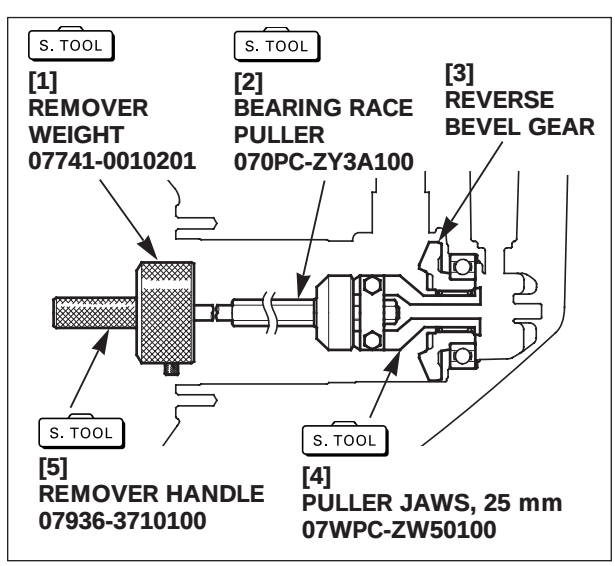
Bearing race puller	**070PC-ZY3A100**
Puller jaws, 25 mm	**07WPC-ZW50100**



9) Remove the reverse bevel gear using the special tools with the new puller jaws replaced in step 8 as shown.

TOOLS:

Remover weight	**07741-0010201**
Remover handle	**07936-3710100**
Bearing race puller	**070PC-ZY3A100**
Puller jaws, 25 mm	**07WPC-ZW50100**



10) Check the bearing for abnormal noise and play before removal. Replace if necessary.

11) Remove the 50 x 90 x 20 mm radial ball bearing using the special tools as shown.

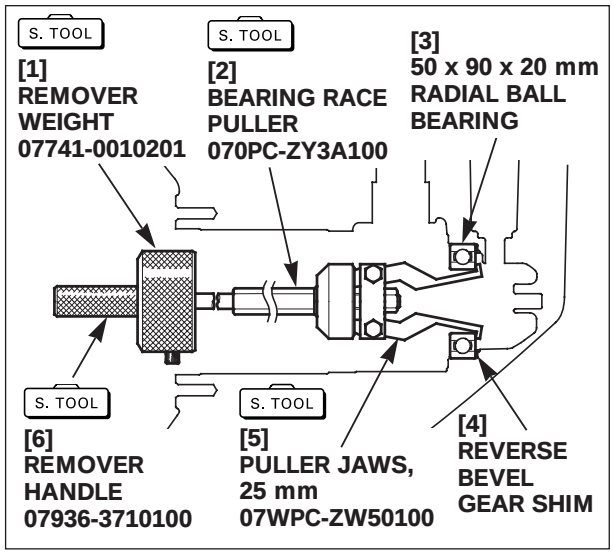
TOOLS:

Remover weight	**07741-0010201**
Remover handle	**07936-3710100**
Bearing race puller	**070PC-ZY3A100**
Puller jaws, 25 mm	**07WPC-ZW50100**

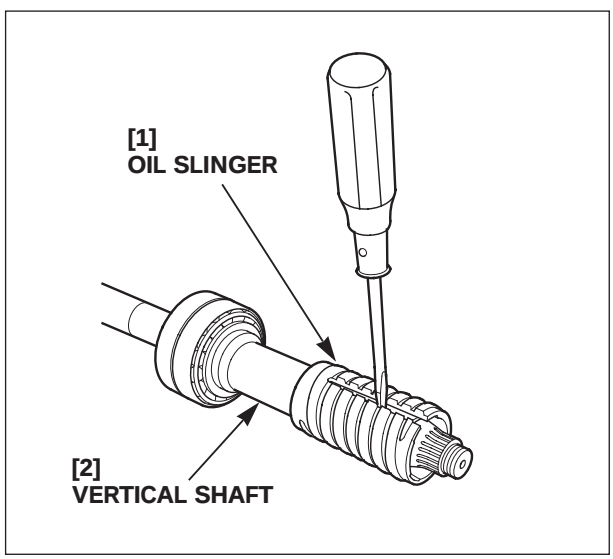
12) Remove the reverse bevel gear shim from the gear case.

NOTICE

- *Replace the 50 x 90 x 20 mm radial ball bearing with a new one on assembly.*
- *Replace the reverse bevel gear shim on assembly.*



13) Remove the oil slinger from the vertical shaft expanding the cut in the oil slinger using a screwdriver.

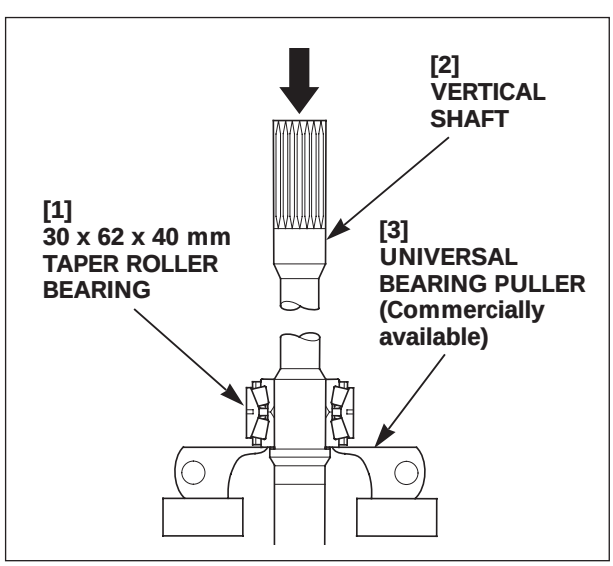


14) Check the taper roller bearing for noise, play and other abnormality before removing it. Replace the inner race and the outer race as a set if necessary.

15) Position a commercially available universal bearing puller on the taper roller bearing (inner race), and position the vertical shaft on the hydraulic press with the crankshaft installation side toward up.

16) Remove the taper roller bearing from the vertical shaft using the hydraulic press.

17) Remove the shim from the vertical shaft.
Replace the shim with a new one on assembly.



18) Check the needle bearing (outer race) for damage before removal. Replace if necessary.

19) Position the special tools on the needle bearing (outer race) and the shop towel under the needle bearing (outer race) as shown.

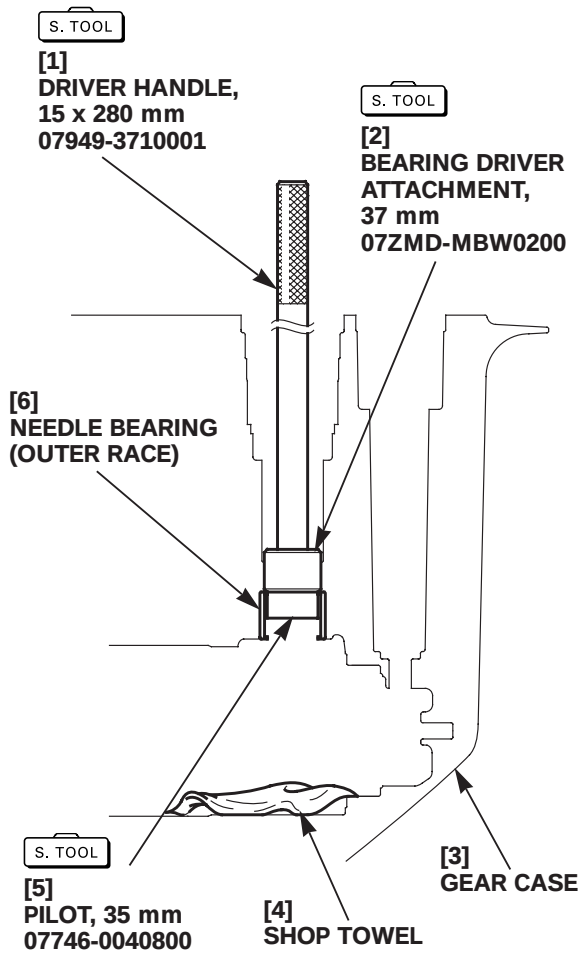
TOOLS:

Driver handle, 15 x 280 mm	**07949-3710001**
Bearing driver attachment, 37 mm	**07ZMD-MBW0200**
Pilot, 35 mm	**07746-0040800**

20) Remove the needle bearing (outer race) from the gear case using the special tools.

NOTICE

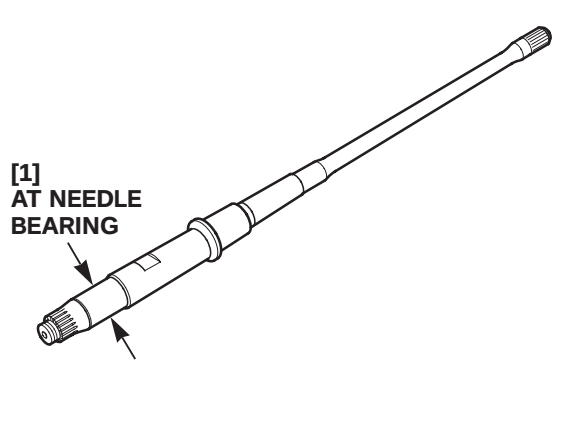
- *Remove the needle bearing (outer race) with care not to damage the gear case.*
- *Replace the needle bearing (outer race) and the roller as a set on assembly.*



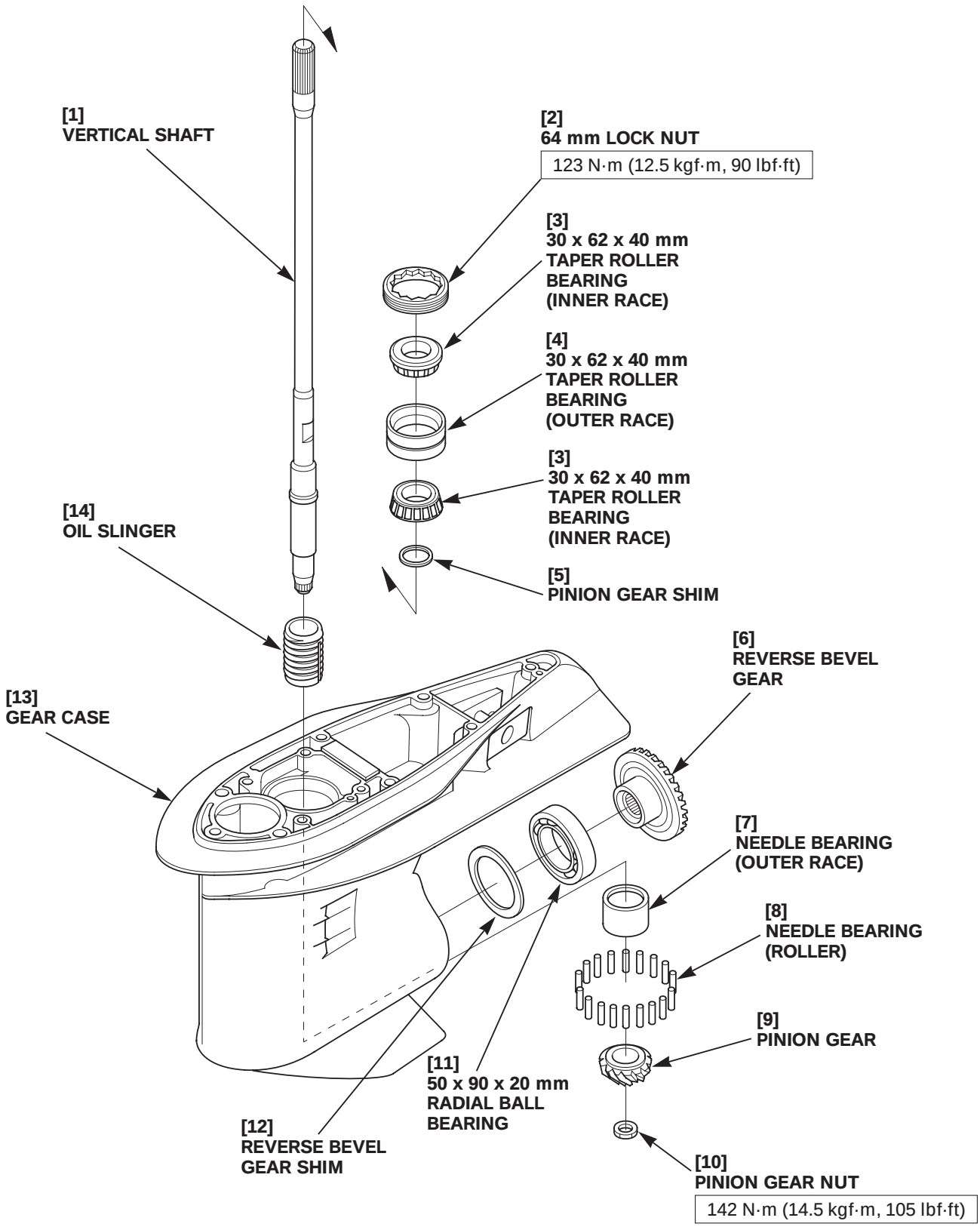
b. INSPECTION

• VERTICAL SHAFT O.D.

	STANDARD	SERVICE LIMIT
At needle bearing	28.556 – 28.575 mm (1.1242 – 1.1250 in)	28.545 mm (1.1238 in)



c. COMPONENTS DRAWING



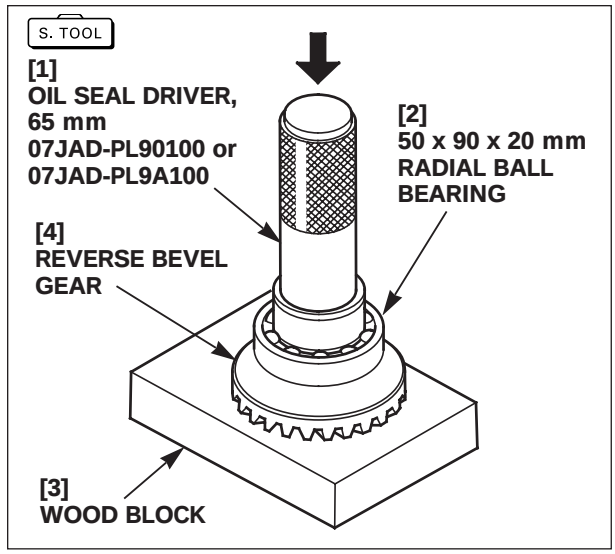
d. ASSEMBLY

1) Apply gear oil to the circumference of the new bearing.

2) Place a wood block under the reverse bevel gear.

3) Install the bearing on the reverse bevel gear using the special tool and the hydraulic press.

TOOL:
Oil seal driver, 65 mm **07JAD-PL90100 or 07JAD-PL9A100**



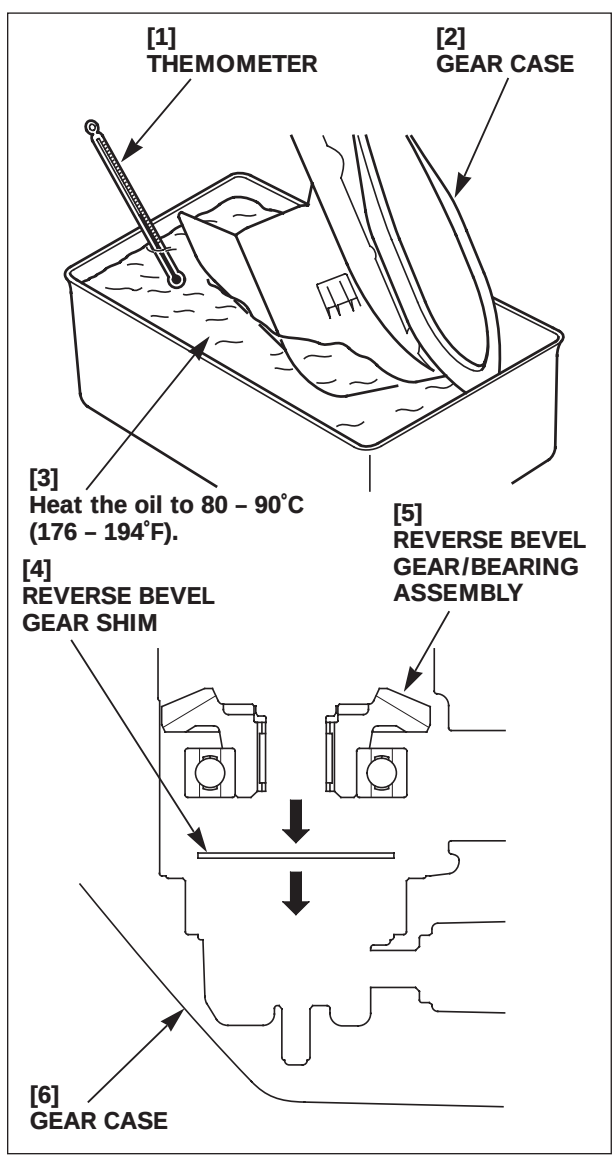
4) Soak the gear case in the container filled with oil with the bearing installation side toward down.

5) Heat the oil to 80 – 90˚C (176 – 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.

NOTICE

- *Do not heat the oil above 90˚C (194˚F).*
- *The entire gear case becomes hot. Be sure to wear the gloves during the operation.*
- *Do not apply the force of 8,829 N (900 kgf, 1984 lbf) or above during installation.*

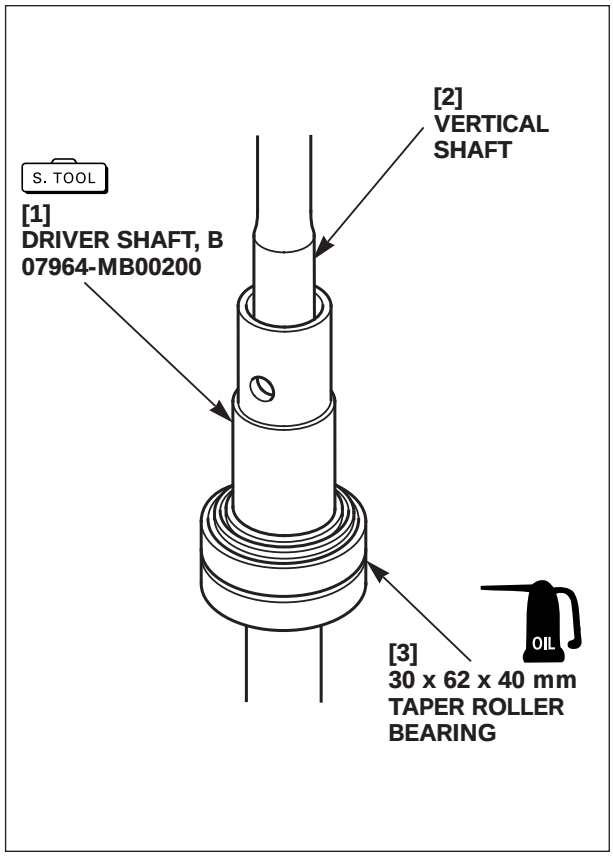


7) Position the pinion gear on the vertical shaft and loosely tighten the pinion gear nut by hand.

8) Apply gear oil to the inner wall of the inner race, roller and the circumference of the outer race of the taper roller bearings. Assemble the inner race and the outer race.

9) Position the shim, taper roller bearing and the special tool on the vertical shaft.

TOOL:
Driver shaft, B **07964-MB00200**



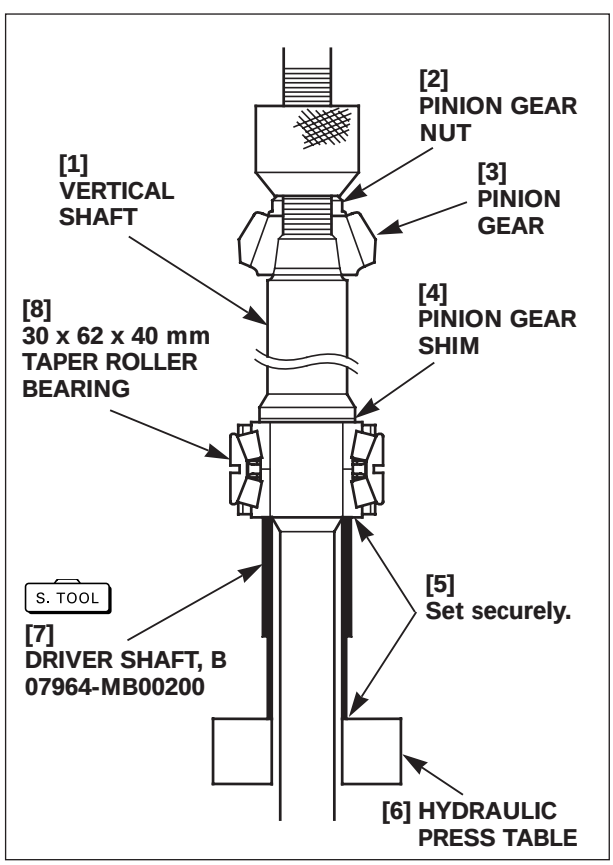
10) Position the vertical shaft on the hydraulic press with the pinion gear toward up as shown.

11) Install the taper roller bearing on the vertical shaft using the hydraulic press.

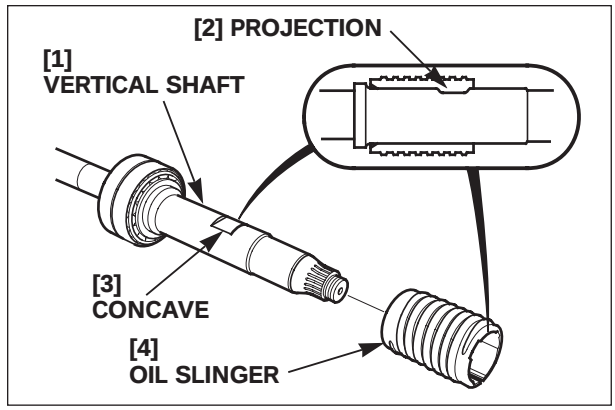
NOTICE

- *Check that the ends of the special tool are set on the taper roller bearing inner race and the hydraulic press table securely.*
- *Do not ruin the threads at the end of the vertical shaft (pinion gear nut installation part).*

12) Remove the pinion gear nut and the pinion gear from the vertical shaft.

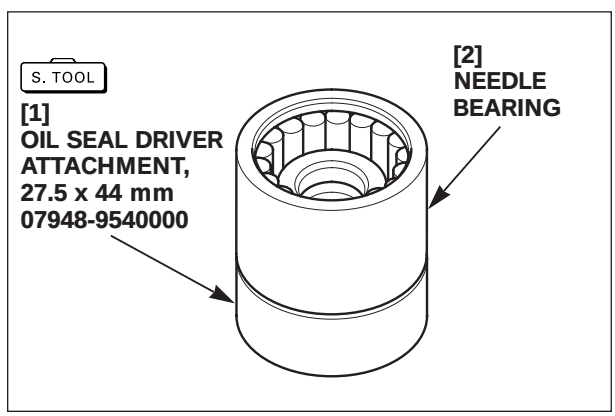


13) Install the oil slinger on the vertical shaft aligning the projection on the inside of the oil slinger with the recess of the pinion gear installation side of the vertical shaft.



14) Attach the special tool to the new needle bearing as shown. Install the needle bearing with the stamped side of the needle bearing (outer race) toward the special tool.

TOOL:
Oil seal driver attachment, 27.5 x 44 mm 07948-9540000

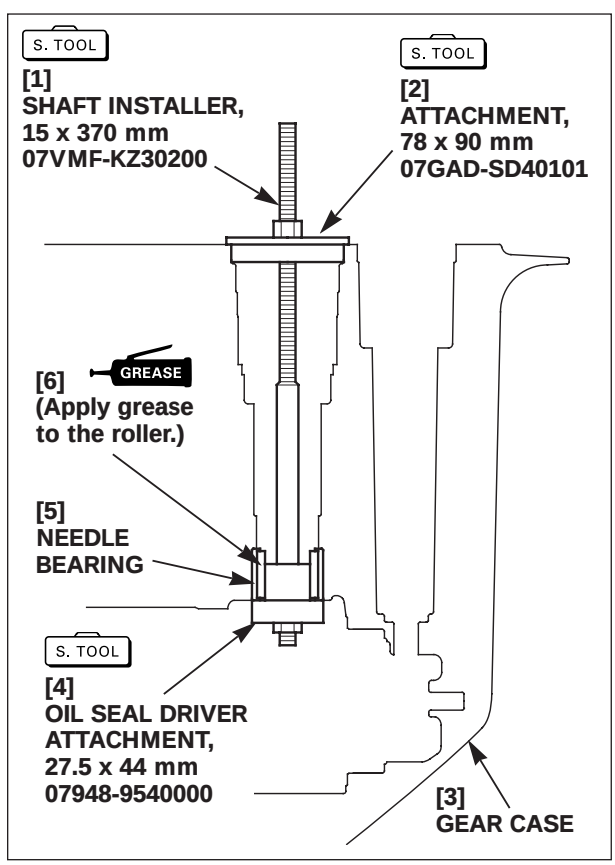


15) Install the needle bearing in the gear case using the special tools.

TOOLS:

Shaft installer, 15 x 370 mm	**07VMF-KZ30200**
Attachment, 78 x 90 mm	**07GAD-SD40101**
Oil seal driver attachment, 27.5 x 44 mm	**07948-9540000**

16) After installation, check that the bottom surface of the needle bearing is flush with the bottom of the gear case. Apply grease to the needle bearing roller.

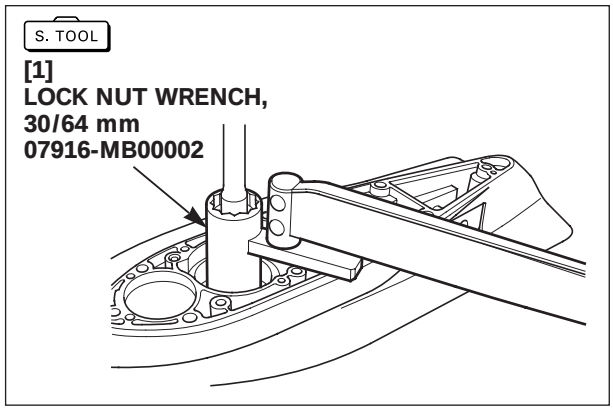


17) Install the vertical shaft assembly with care not to let the needle bearing roller come out of position.

18) Apply gear oil to the threads and seat of the 64 mm lock nut, and tighten the lock nut using the special tool.

TOOL:
Lock nut wrench, 30/64 mm 07916-MB00002

TORQUE: 123 N·m (12.5 kgf·m, 90 lbf·ft)



19) Wipe the tapered part of the vertical shaft and pinion gear with a shop towel and a degreasing cleaning solvent.

20) Attach the special tool to the end (crankshaft installation side) of the vertical shaft as shown.

TOOL:
Vertical shaft holder 07SPB-ZW10200

21) Place a shop towel in the gear case as shown to protect the gear case.

22) Apply gear oil to the threads and seat of the pinion gear nut.

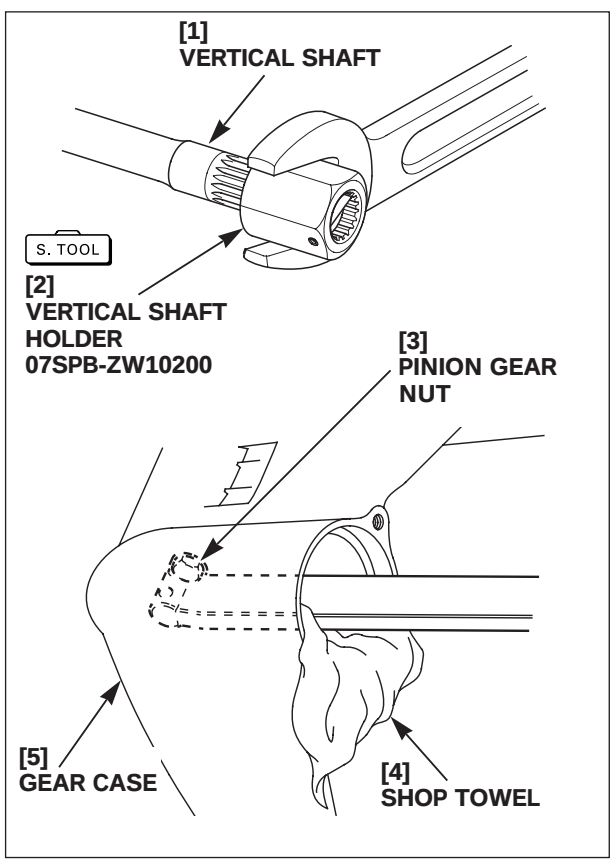
23) Tighten the pinion gear nut to the specified torque while installing the pinion gear on the vertical shaft and holding the special tool in position.

TORQUE: 142 N·m (14.5 kgf·m, 105 lbf·ft)

NOTICE

Check that the forward bevel gear/taper bearing assembly is set properly.

24) Install the following parts.
- Propeller shaft holder assembly (P. 14-56)
- Water pump/shift rod (P. 14-51)
- Gear case assembly (P. 14-44)
- Propeller (P. 14-2)



15. SHIM SELECTION [*2]

NOTICE

Adjust the shim thickness after replacing the gear case, vertical shaft, bearing, taper bearing and the taper roller bearing.

a. PINION GEAR SHIM

Remove the 30 x 62 x 40 mm taper roller bearing if it is mounted on the vertical shaft (P. 14-70).

1) Wipe the tapered part of the vertical shaft and the 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: 142 N·m (14.5 kgf·m, 105 lbf·ft)

NOTICE

- *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. 14-76).*

3) 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.

TOOL:
Gauge adapter, 110 mm **070PJ-ZY30100**

4) Holding the special tool with the side of the stamped tool number facing the opposite side from the pinion gear, be sure that the tool of the pinion gear nut side is not set on the nut.
   Tighten the bolts by hand while pushing both tools toward the pinion gear side.

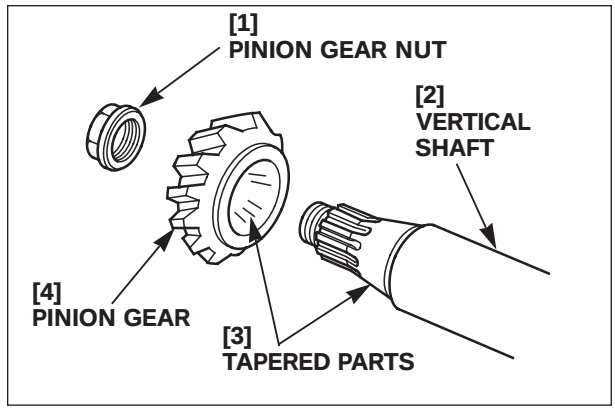
NOTICE

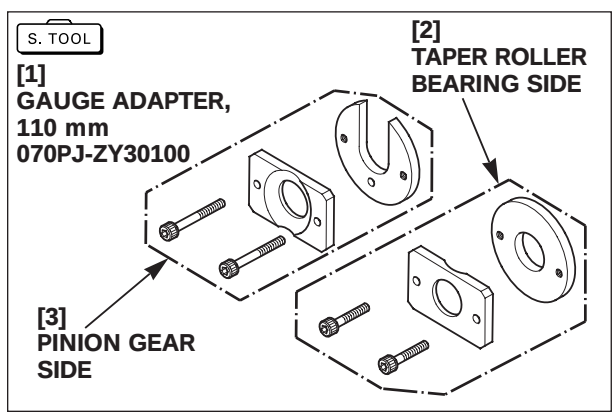
- *Do not tighten the bolts with a tool.*
- *There must be no wobbling in the special tool. It must securely set on the pinion gear.*

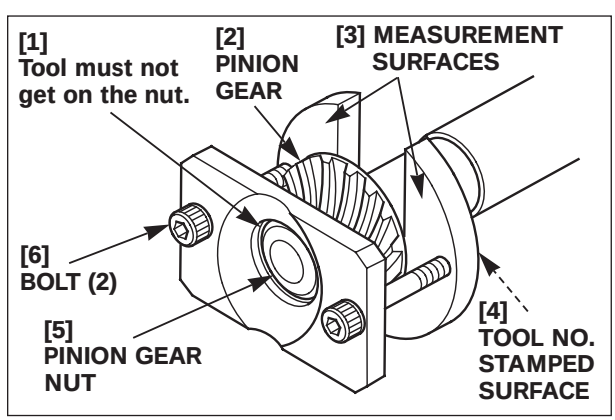
5) Set both tools on both sides of the flange of the vertical shaft with the side of the special tool, where is stamped with the tool number, and the tapered part facing the opposite side from the pinion gear as shown. Tighten the bolts by hand.

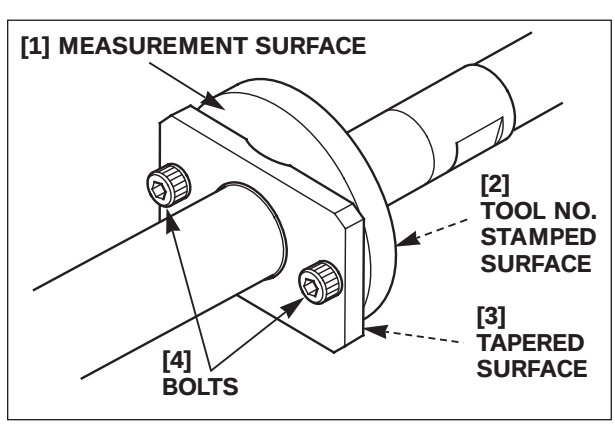
NOTICE

- *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.*



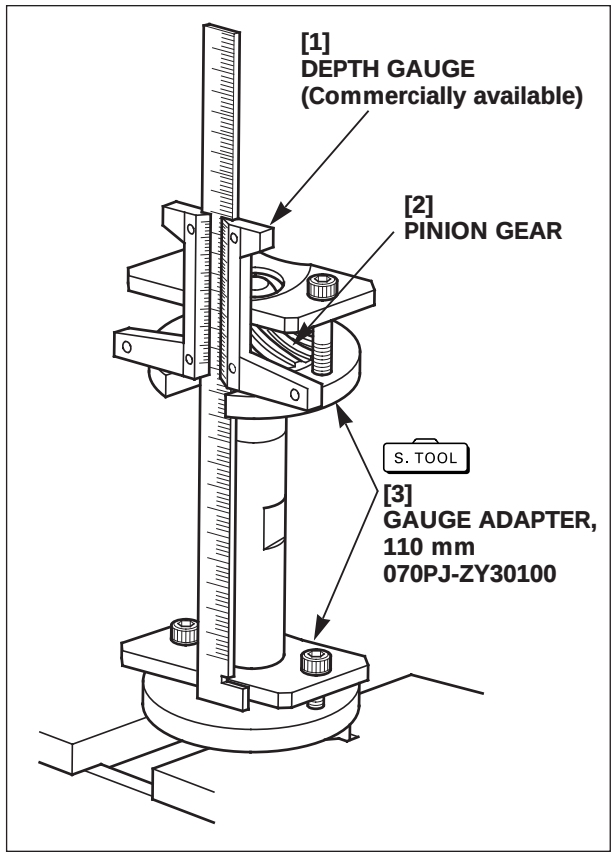






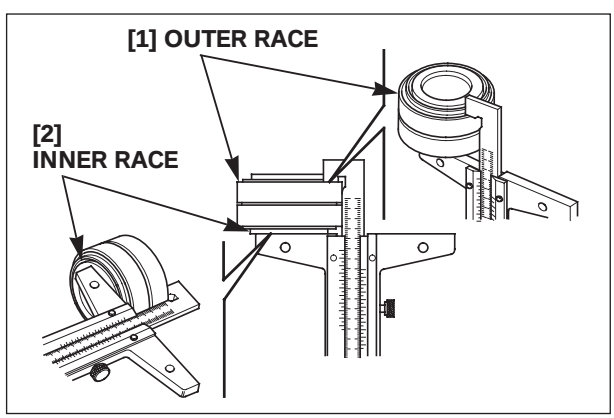
6) Hold the vertical shaft upright (with the pinion gear toward up) and secure the vertical shaft.

7) Set the commercially available depth gauge at the gauge adapter of the pinion gear side as shown. Measure the vertical shaft length (distance D) and record it.

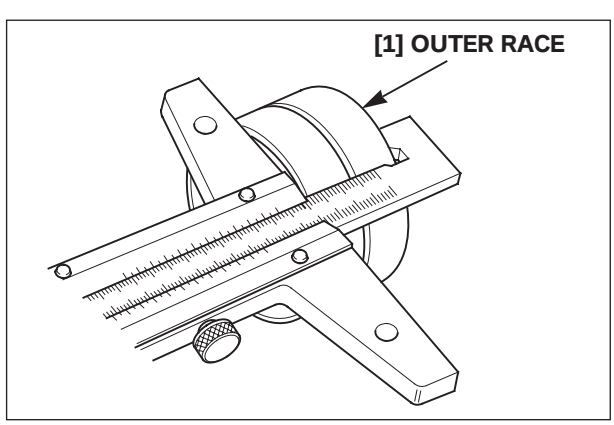


8) Assemble the outer race and the inner race of the 30 x 62 x 40 mm taper roller bearing, and turn the outer race two or three turns.

9) Measure the bearing height from the outer race end to the inner race end as shown, and record the measurement.



10) Measure the height of the taper roller bearing outer race and record it.



11) Calculate the gap (distance E) between the outer race and inner race using the measurements obtained in step 9 and 10 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 34.9 mm (1.37 in),
And, outer race height is 29.7 mm (1.17 in):

34.9 – 29.7 = 5.2

Therefore, the gap (distance E) is 5.2 mm (0.20 in).

12) Determine the calculation value using the vertical shaft length (distance D) obtained in step 7 and the gap (distance E) obtained in step 11 and the following formula.

Formula:
Vertical shaft length (distance D) + Gap (distance E) – 147.2 = Calculation value

Example:
When, vertical shaft length (distance D) is 141.8 mm (5.58 in),
And, gap (distance E) is 5.2 mm (0.20 in):

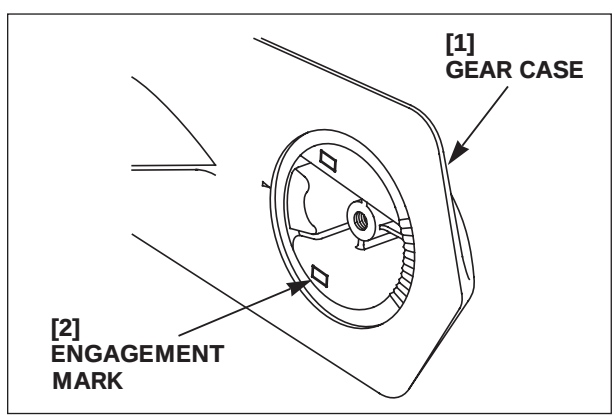
141.8 + 5.2 – 147.2 = –0.20

Therefore, the calculation value is –0.20 mm (–0.008 in).

13) 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] Shim type	[2] Thickness
[3] Pinion gear shim A	0.10 mm (0.004 in)
[4] Pinion gear shim B	0.15 mm (0.006 in)
[5] Pinion gear shim C	0.30 mm (0.012 in)
[6] Pinion gear shim D	0.50 mm (0.020 in)



• Pinion gear shim selection table

[3] Unit: mm (in)

[1] Engagement mark on the gear case	[2] Calculation value						
	+0.41 (+0.0161) – +0.35 (+0.014)	+0.35 (+0.014) – +0.30 (+0.0118)	+0.30 (+0.0118) – +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)
F	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)
E	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)
D	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)
C	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)	0.45 (0.018)
B	0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)	0.40 (0.0157)
A		0.10 (0.004)	0.15 (0.006)	0.20 (0.008)	0.25 (0.010)	0.30 (0.0118)	0.35 (0.014)

[3] Unit: mm (in)

[1] Engagement mark on the gear case	[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) – –0.31 (–0.0122)
F	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)
E	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)
D	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)
C	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)
B	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)
A	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)

• How to read shim selection table

When the engagement mark on the gear case is E and the calculation value is –0.20 mm (–0.008 in) or more, the shim thickness is 0.80 mm (0.031 in).

When the calculation value is less than –0.20 mm (–0.008 in), the shim thickness is 0.85 mm (0.033 in). (See Shim selection table above.)

[3] Unit: mm (in)

[1] Engagement mark on the gear case	[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) – –0.31 (–0.0122)
F	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)
E	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)
D	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)
C	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)
B	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)
A	0.40 (0.0157)	0.45 (0.018)	0.50 (0.020)	0.55 (0.022)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)

• Shim combination

To obtain 0.75 mm (0.030 in) of shim thickness, combine three gear shim As and one gear shim B and one gear shim C, or combine one gear shim A, one gear shim B and one gear shim D by referring to the shim type table.

b. FORWARD BEVEL GEAR SHIM

1) Assemble the outer race and the inner race of the 50 x 90 x 28 mm taper bearing, and turn the outer race two or three turns.

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 inner race height (distance K) as shown, and record the measurement.

4) Determine the calculation value using the bearing height (distance F), inner race height (distance K) and the following formula.

   Formula:
   Bearing height (distance F) – Inner race height (distance K) = Calculation value

   Example:
   When, bearing height (distance F) is 28.05 mm (1.104 in),
   And, inner race height (distance K) is 28.00 mm (1.102 in):

   28.05 – 28.00 = 0.05

   Therefore, the calculation value is 0.05 mm (0.002 in).

5) Check the calculation value and select the shim of the appropriate thickness from the shim selection table accordingly.

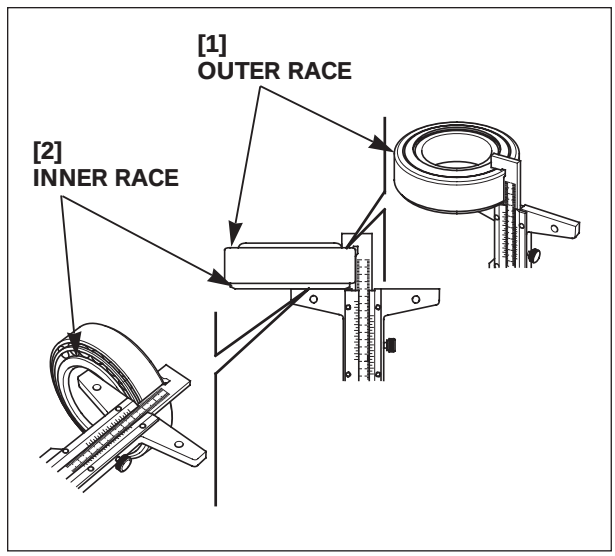
   • **Shim type table**

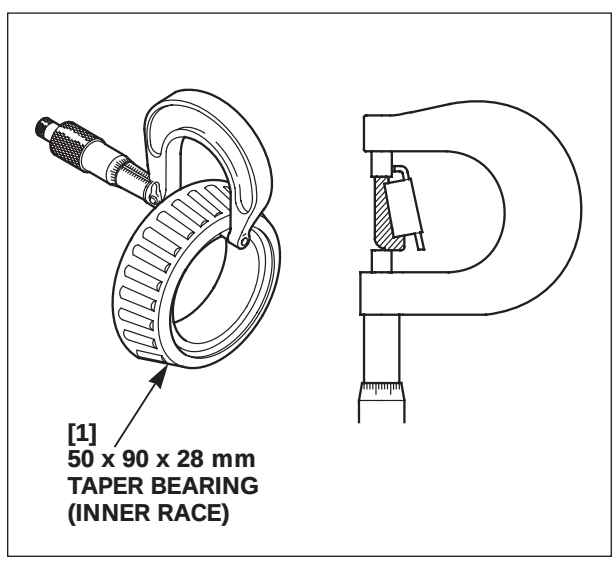
[1] Shim type	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.004 in)
[4] Forward bevel gear shim B	0.15 mm (0.006 in)
[5] Forward bevel gear shim C	0.30 mm (0.012 in)
[6] Forward bevel gear shim D	0.50 mm (0.020 in)

   • **Forward bevel gear shim selection table** [3] Unit: mm (in)

[1] Calculation value	[2] Shim thickness
+0.15 – +0.10 (+0.006 – +0.004)	0.35 (0.014)
+0.10 – +0.05 (+0.004 – +0.002)	0.40 (0.016)
+0.05 – ±0 (+0.002 – ±0.000)	0.45 (0.018)

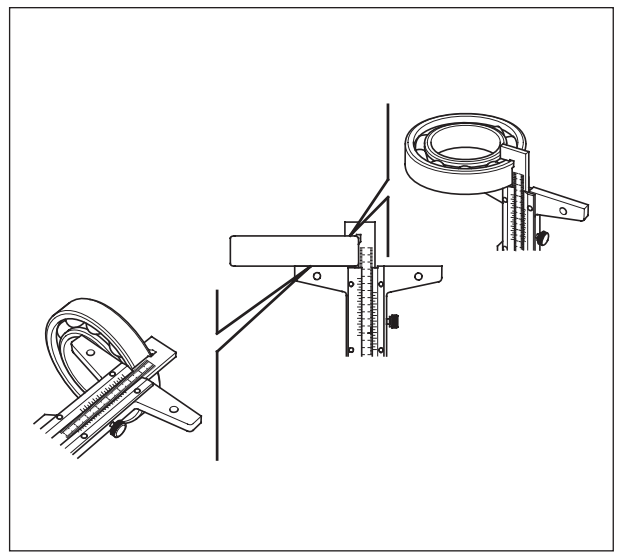
Refer to page 14-80 for information on shim combination.





c. REVERSE BEVEL GEAR SHIM

1) Measure the bearing height (distance H) of the new 50 x 90 x 20 mm radial ball bearing as shown, and record the measurement.



2) Determine the calculation value using the bearing height (distance H) and the following formula.

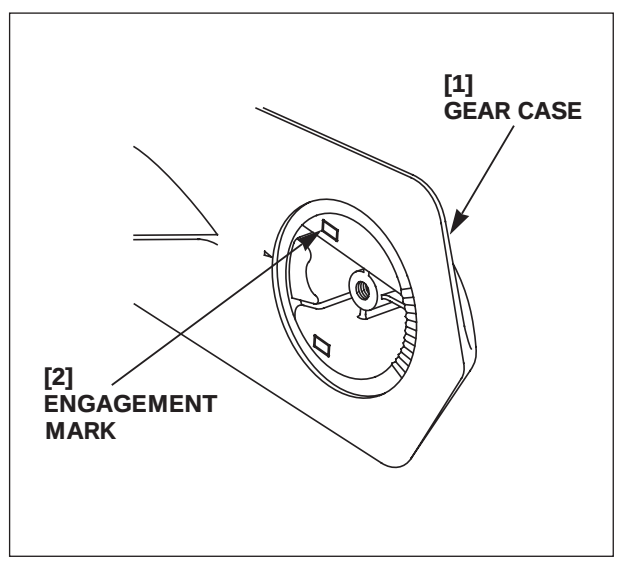
Formula:
Bearing height (distance H) – 20 = Calculation value

Example:
When, bearing height (distance H) is 19.95 mm (0.785 in):

19.95 – 20 = –0.05

Therefore, the calculation value is –0.05 mm (–0.002 in).

3) Cross reference the calculation value and the engagement mark located on the trim tab installation part of the gear case, and select the shim of the appropriate thickness from the shim selection table accordingly.



- **Shim type table**

[1] Shim type	[2] Thickness
[3] Forward bevel gear shim A	0.10 mm (0.004 in)
[4] Forward bevel gear shim B	0.15 mm (0.006 in)
[5] Forward bevel gear shim C	0.30 mm (0.012 in)
[6] Forward bevel gear shim D	0.50 mm (0.020 in)

- **Reverse bevel gear shim selection table** [3] Unit: mm (in)

		[2] Calculation value	
		±0 (±0.000) – –0.05 (–0.002)	–0.05 (–0.002) – –0.12 (–0.005)
[1] Engagement mark on the gear case	1	0.60 (0.024)	0.65 (0.026)
	2	0.55 (0.022)	0.60 (0.024)
	3	0.50 (0.020)	0.55 (0.022)
	4	0.45 (0.018)	0.50 (0.020)
	5	0.40 (0.016)	0.45 (0.018)
	6	0.35 (0.014)	0.40 (0.016)

Refer to page 14-80 for the information on how to read the shim selection table and shim combination.

d. THRUST SHIM

1) Assemble the outer race and inner race of the 50 x 90 x 28 mm taper bearing, and turn the outer race two or three turns.

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 inner race height (distance K) as shown, and record the measurement.

4) Determine the calculation value using the bearing height (distance F), inner race height (distance K) and the following formula.

   Formula:
   Bearing height (distance F) – Inner race height (distance K) = Calculation value

   Example:
   When, bearing height (distance F) is 28.05 mm (1.104 in),
   And, inner race height (distance K) is 28.00 mm (1.102 in):

   28.05 – 28.00 = 0.05

   Therefore, the calculation value is 0.05 mm (0.002 in).

5) Check the calculation value and the bearing height, and select the shim of the appropriate thickness from the shim selection table accordingly.

   • **Shim type table**

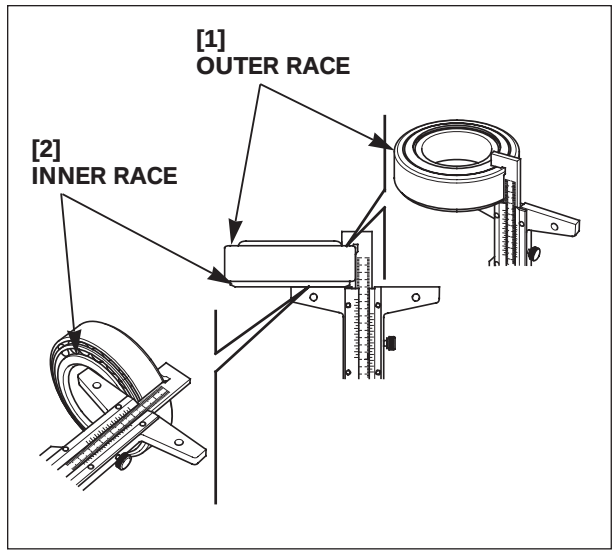
[1] Shim type	[2] Thickness
[3] Thrust shim A	0.10 mm (0.004 in)
[4] Thrust shim B	0.15 mm (0.006 in)
[5] Thrust shim C	0.30 mm (0.012 in)
[6] Thrust shim D	0.50 mm (0.020 in)

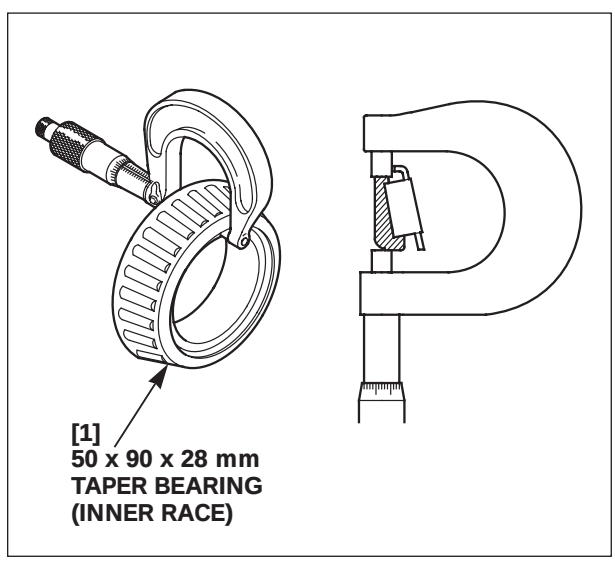
   • **Thrust shim selection table**

   [3] Unit: mm (in)

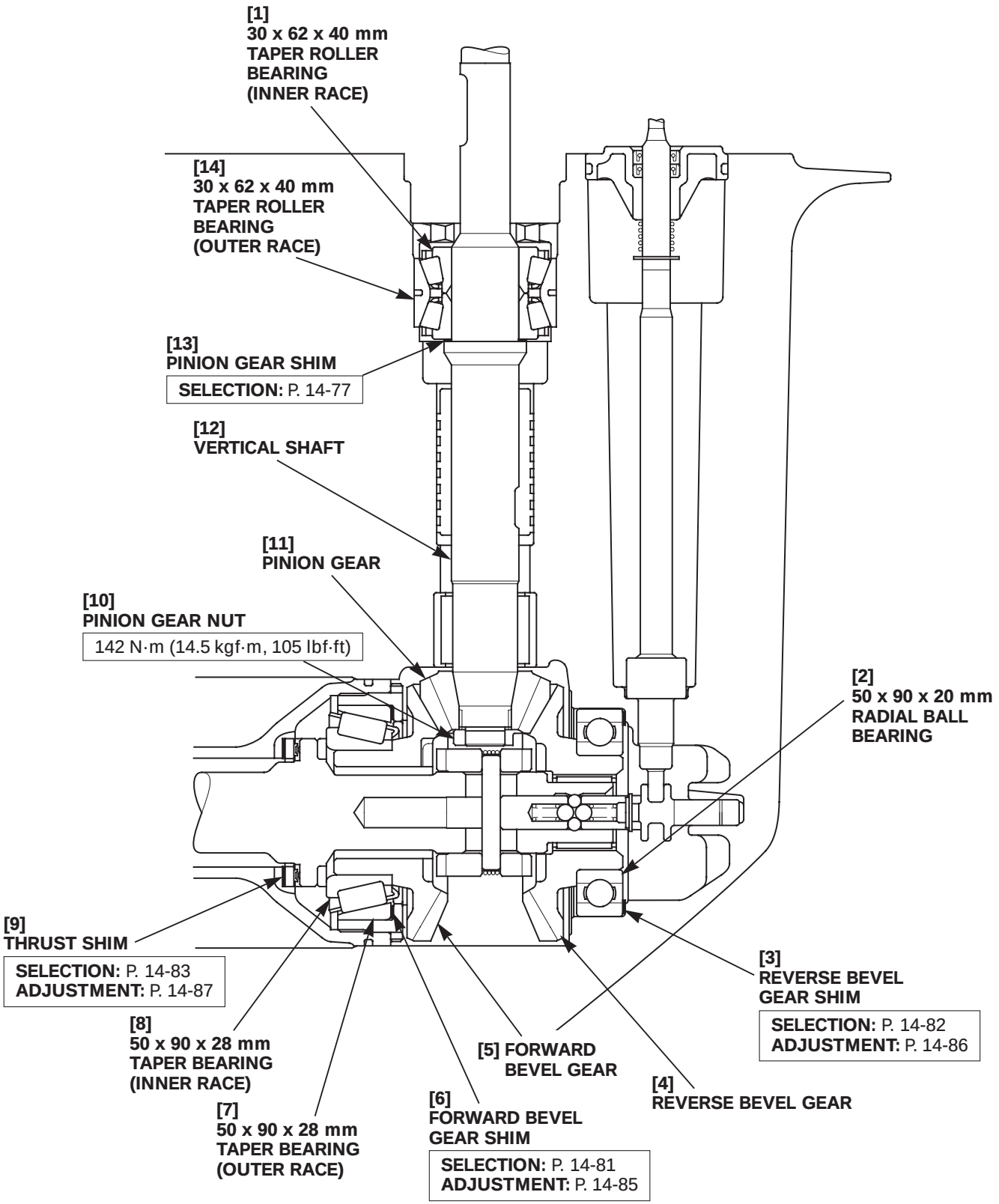
		[2] Calculation value		
		+0.15 (+0.006) – +0.10 (+0.004)	+0.10 (+0.004) – +0.05 (+0.002)	+0.05 (+0.002) – ±0 (±0.000)
[1] Bearing height	28.00 (1.102) – 28.05 (1.104)	0.65 (0.026)	0.70 (0.028)	0.75 (0.030)
	28.05 (1.104) – 28.10 (1.106)	0.60 (0.024)	0.65 (0.026)	0.70 (0.028)

Refer to page 14-80 for the information on how to read the shim selection table and shim combination.





16. SHIM POSITION [*2]



17. BACKLASH ADJUSTMENT [*2]

a. FORWARD BEVEL GEAR BACKLASH

Backlash adjustment must be made after adjustment of each gear shim (P. 14-77).
Install the parts except the water pump in the gear case (P. 14-51, 56 and 73).

1) Hold the propeller shaft securely with the special tool as shown, and tighten the puller bolt to the specified torque.

TOOLS:

Puller jaws	**07SPC-ZW0010Z**
Puller bolt	**07SPC-ZW0011Z**

TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)

Turn the vertical shaft five to ten turns clockwise to fit the bevel gear bearing.

2) Attach the special tool to the vertical shaft as shown, and adjust the dial indicator so its needle is at the line "2" of the special tool (backlash indicator tool).

TOOLS:

Backlash indicator tool	**07SPJ-ZW0030Z**
Backlash indicator attachment	**07SPK-ZW10100**

3) Turn the vertical shaft lightly right and left and record the dial indicator reading.
Measure the backlash at the four points (by turning the vertical shaft 90˚) in the same manner.

NOTICE

Do not turn the propeller shaft when turning the vertical shaft.

4) Obtain the forward bevel gear backlash using the dial indicator runout and the following formula.

Formula:
Dial indicator runout ÷ 0.86 = Backlash

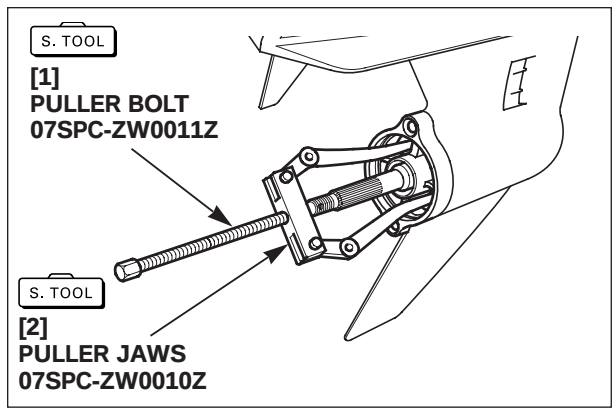
Example:
When dial indicator runout is 0.195 mm (0.0077 in):
0.195 ÷ 0.86 = 0.23
Therefore, the backlash is 0.23 mm (0.009 in).

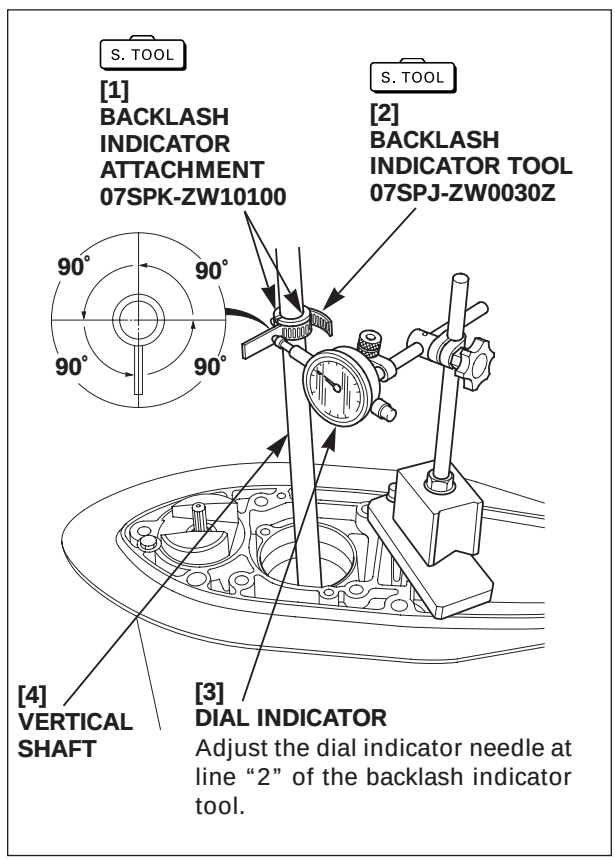
Standard value	0.10 – 0.30 mm (0.004 – 0.012 in)

5) 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.

NOTICE

Use the special tool when 50 x 90 x 28 mm taper bearing outer race is removed to adjust the backlash again (P. 14-60).





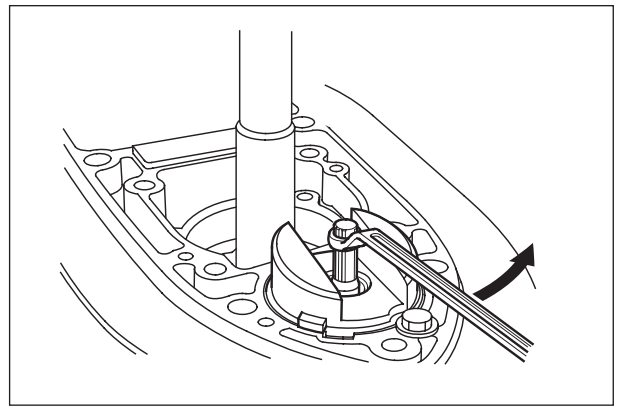
b. REVERSE BEVEL GEAR BACKLASH

1) Turn the vertical shaft five to ten turns clockwise for snug seat of the bevel gear taper roller bearing.

2) Using the wrench, turn the shift rod in the direction shown with the arrow and fix the propeller shaft.

NOTICE

If it is hard to fix the propeller shaft, turn the propeller shaft to change the phase of the shaft and fix it.



3) Attach the special tool to the vertical shaft as shown, and adjust the dial indicator so its needle is at the line "2" of the special tool (backlash indicator tool).

TOOLS:

Backlash indicator tool	**07SPJ-ZW0030Z**
Backlash indicator attachment	**07SPK-ZW10100**

4) Turn the vertical shaft lightly right and left and record the dial indicator reading.
Measure the backlash at the four points (by turning the vertical shaft 90˚) in the same manner.

NOTICE

Do not turn the propeller shaft when turning the vertical shaft.

5) Obtain the reverse bevel gear backlash using the dial indicator runout and the following formula.

Formula:
Dial indicator runout ÷ 0.86 = Backlash

Example:
When dial indicator runout is 0.195 mm (0.0077 in):

0.195 ÷ 0.86 = 0.23

Therefore, the backlash is 0.23 mm (0.009 in).

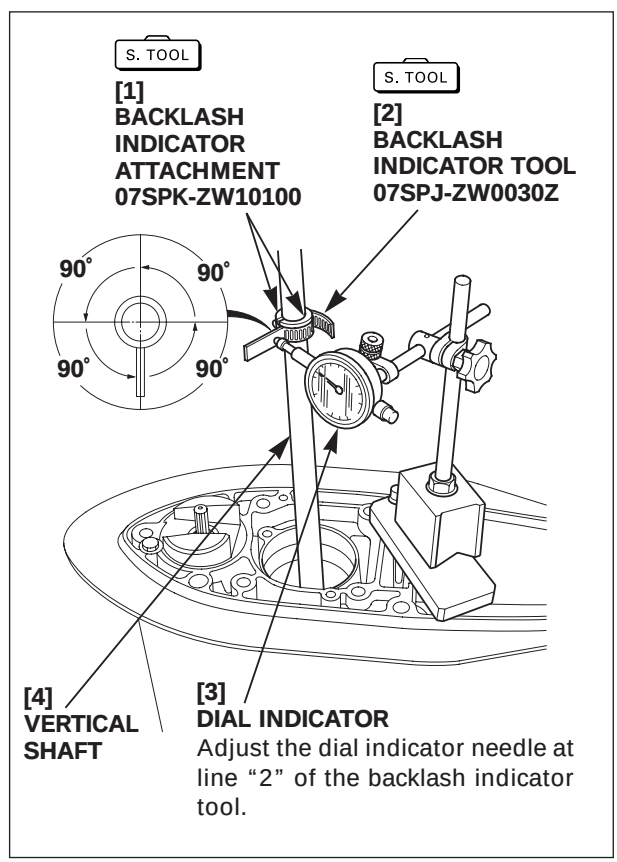
Standard value	0.10 – 0.35 mm (0.004 – 0.014 in)

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.

NOTICE

Use the special tool when 50 x 90 x 20 mm radial ball bearing is removed to adjust the backlash again (P. 14-69).

7) Adjust the thrust clearance after replacement of the forward bevel gear shim (P. 14-87).



c. THRUST CLEARANCE ADJUSTMENT

Adjust the thrust clearance after replacement of the forward bevel gear shim.

1) Check that the bearing holder assembly is securely tightened to the specified torque on the propeller shaft holder (P. 14-65).
   Check that the clutch shifter and the shift slider are not installed (P. 14-57).

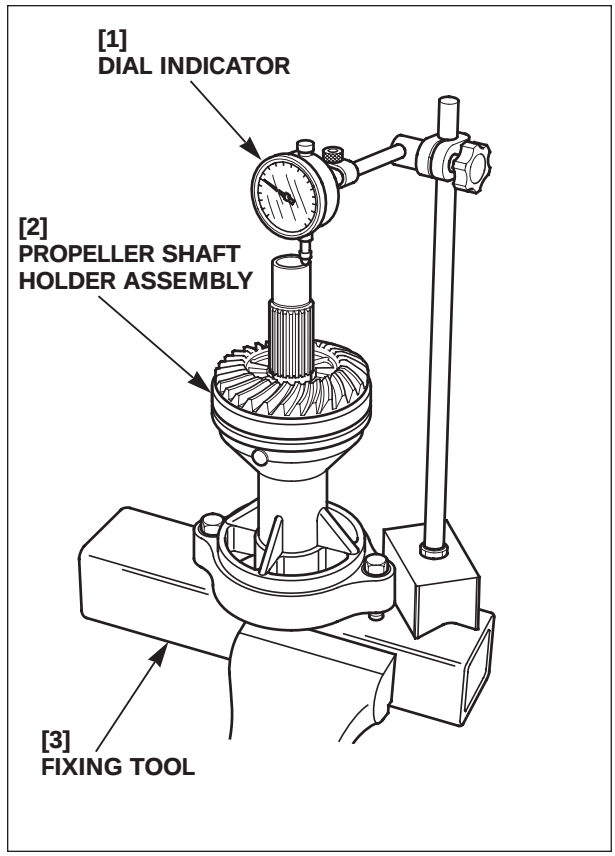
2) Fix the propeller shaft holder assembly on the fixing tool securely using the bolt as shown (P. 14-59).

3) Set the dial indicator perpendicularly so that its tip contacts the end of the propeller shaft.

4) Move the propeller shaft up and down and read the runout of the dial indicator. It must be within the specified range.

Standard value	0.2 – 0.4 mm (0.01 – 0.02 in)

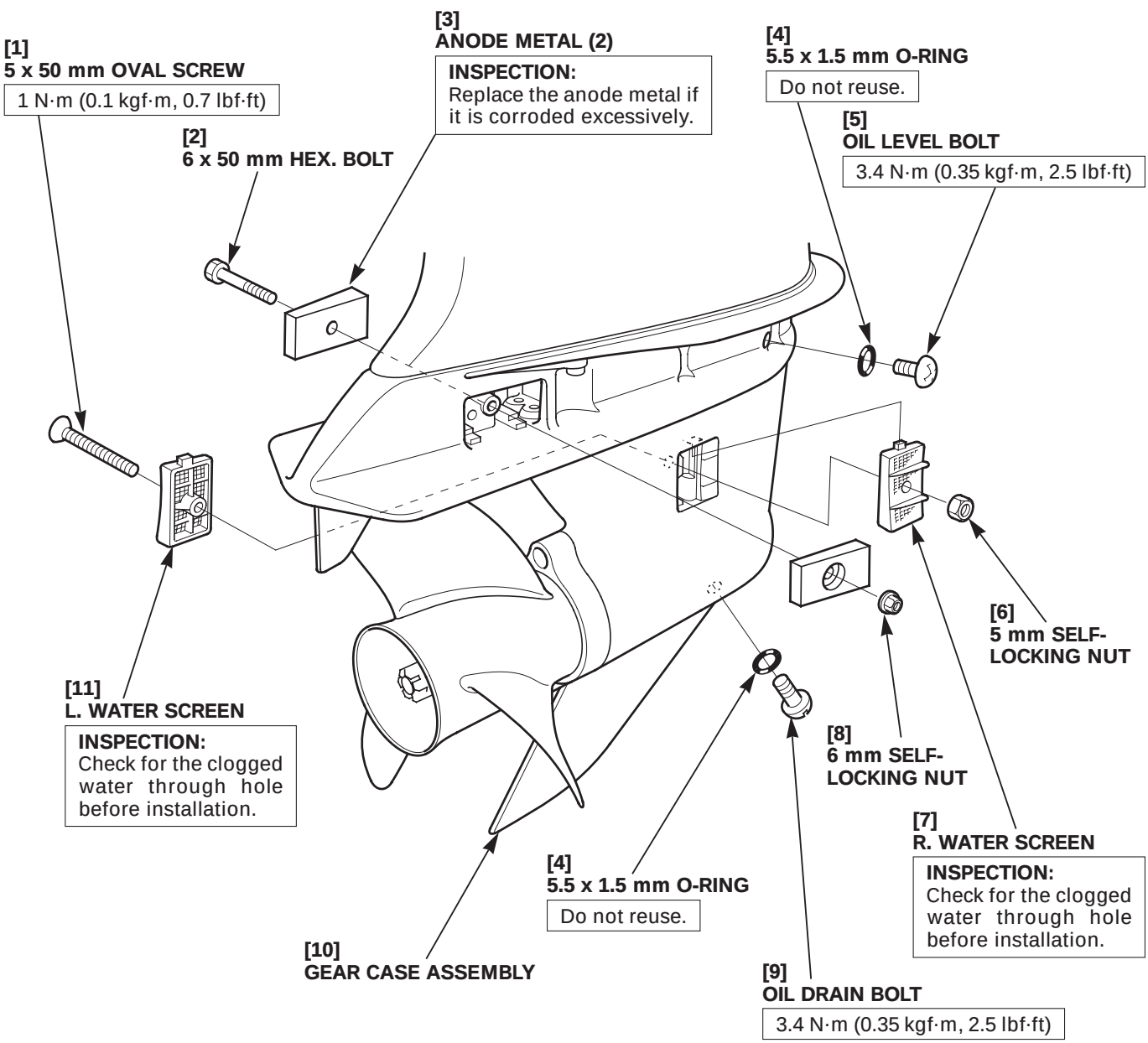
5) If the thrust clearance exceeds the specification, increase the thrust shim thickness and recheck the thrust clearance. If the thrust clearance is less than the specification, reduce the thrust shim thickness and recheck the thrust clearance.



18. ANODE METAL/WATER SCREEN

a. REMOVAL/INSTALLATION

Anode metal/water screen removal/installation can be made with the gear case mounted on the outboard motor.



19. EXTENSION CASE/LOWER RUBBER MOUNT

a. DISASSEMBY

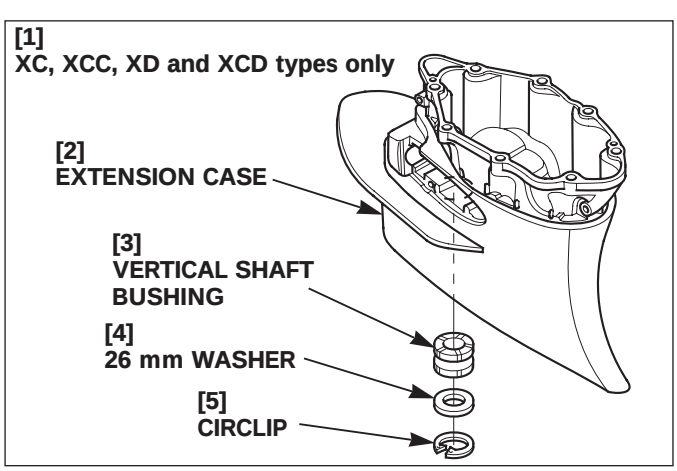
Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under cover (P. 4-9)
– Gear case assembly (P. 14-3 and 42)

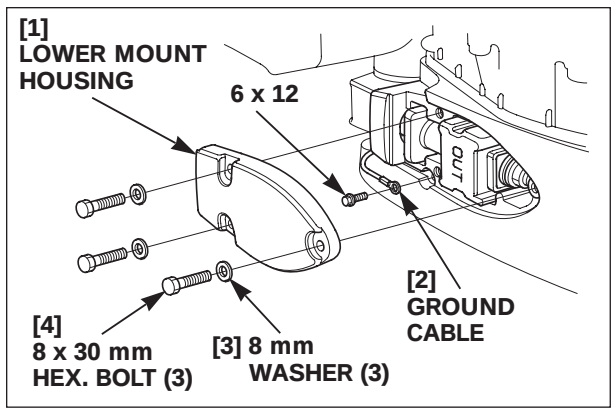
1) Tilt up the outboard motor and hold it in the position by hooking the hoist hook on each of the three engine hangers.
2) Remove the three 8 x 30 mm hex. bolts and the three 8 mm washers, then remove the lower mount housing from the extension case.
3) Remove the 6 x 12 mm flange bolt from the extension case and disconnect the ground cable.
4) Holding the 12 mm self-locking nut with a wrench, remove the 12 x 225 mm hex. bolt, 12 mm self-locking nut and the two 12 mm washers.
5) Remove the lower rubber mount and the lower mount collar from the extension case.
6) Remove the eight 10 x 40 mm flange bolts and remove the extension case from the outboard motor.
   Remove the two dowel pins.

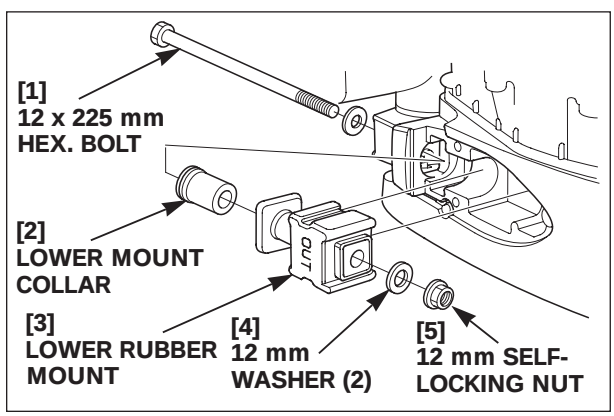
NOTICE

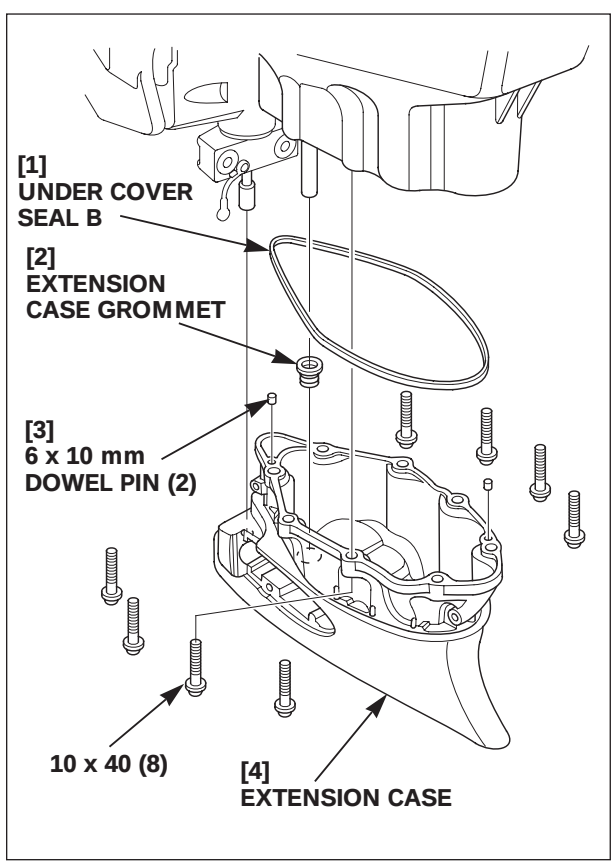
Remove the extension case with care not to drop it.

7) Remove the under cover seal B and the extension case grommet from the extension case.
8) Remove the circlip, and then remove the 26 mm washer and the vertical shaft bushing from the extension case (XC, XCC, XD and XCD types only).

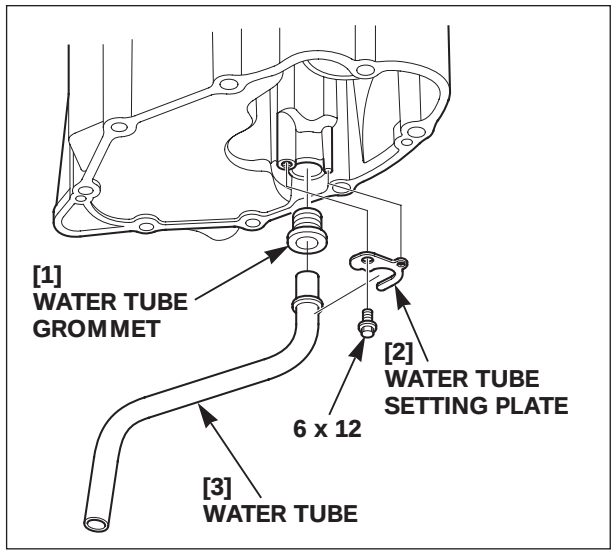




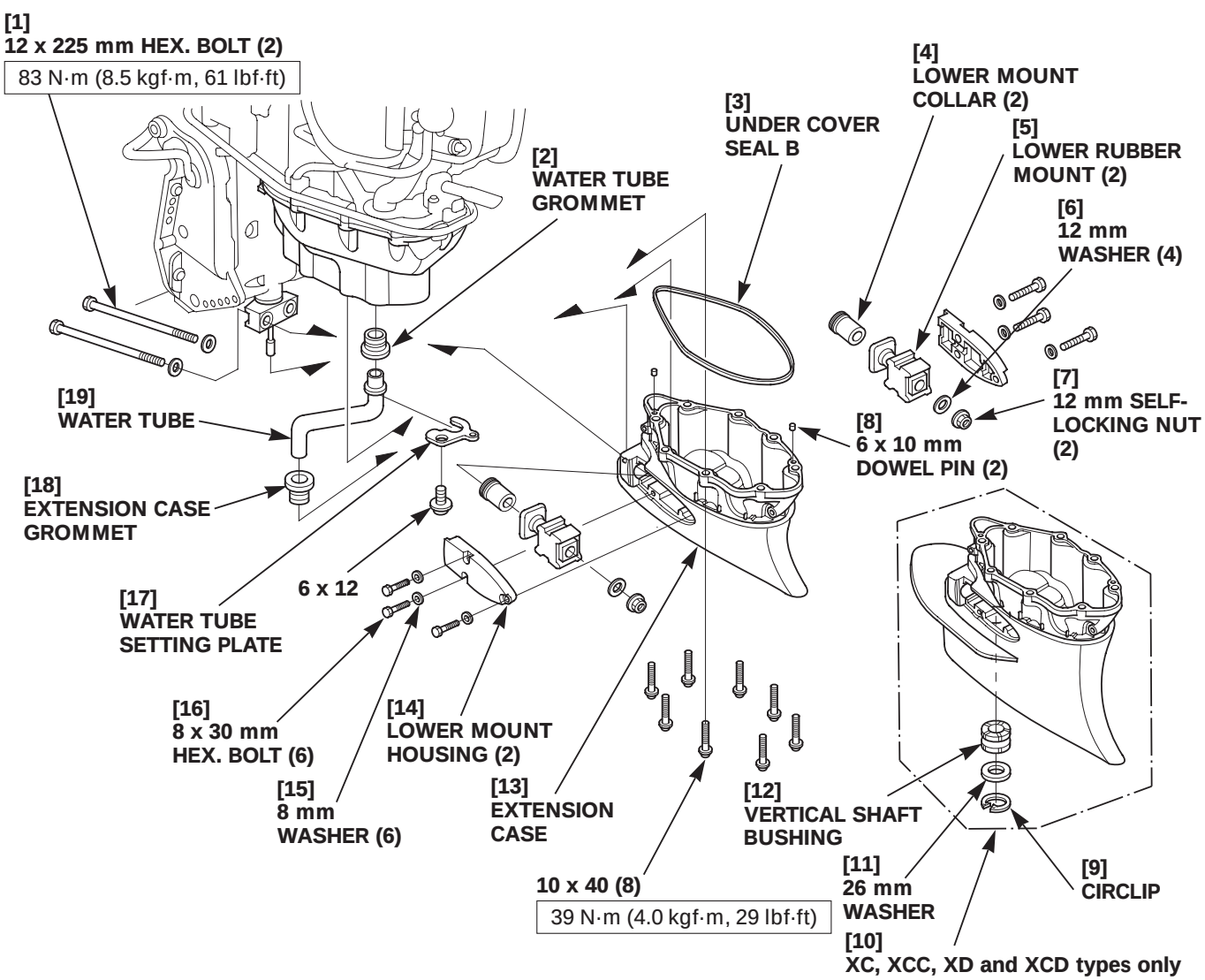




9) Remove the 6 x 12 mm flange bolt, and remove the water tube setting plate, water tube and the water tube grommet.



b. COMPONENTS DRAWING

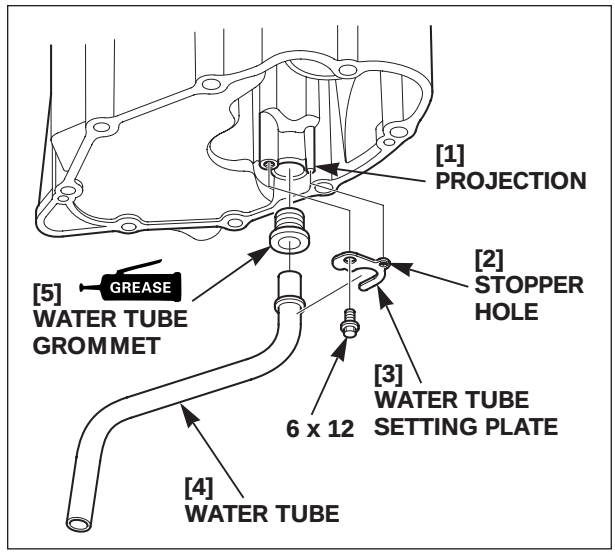


c. ASSEMBLY

1) Apply grease to the circumference of the water tube grommet and install it on the water tube.

2) Connect the water tube to the oil case noting the installation direction as shown.

3) Install the water tube set plate aligning the stopper hole of the water tube set plate with the projection on the oil case, and then tighten the 6 x 12 mm flange bolt.

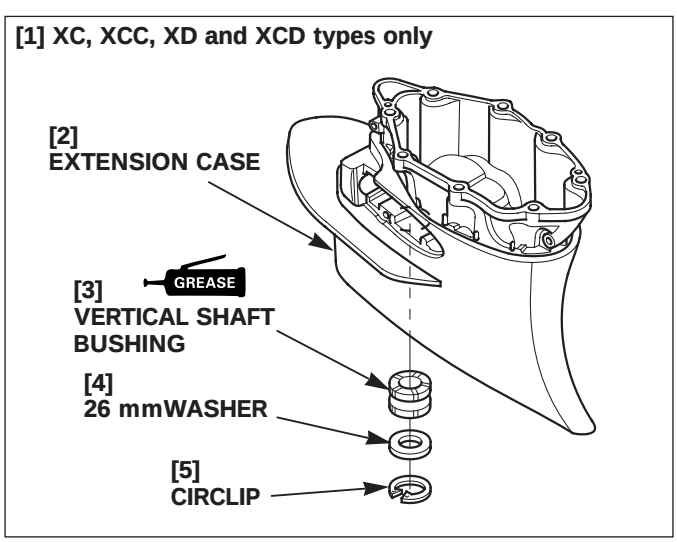


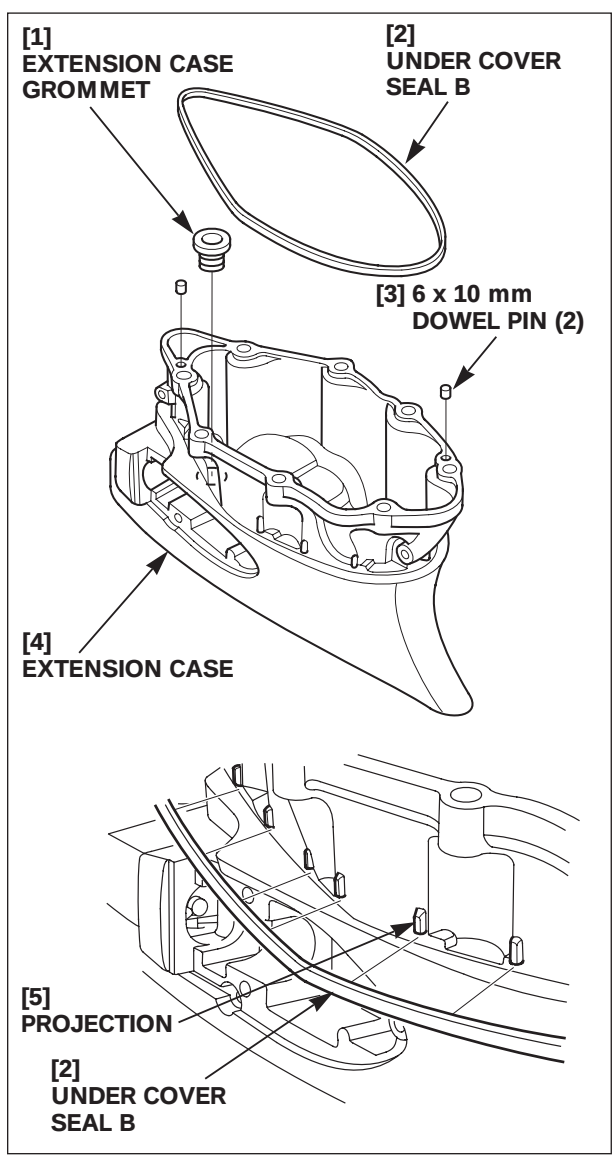
4) Install the under cover seal B, extension case grommet and the two dowel pins on the extension case.

NOTICE

Install the under cover seal B underside the projections of the extension case securely.

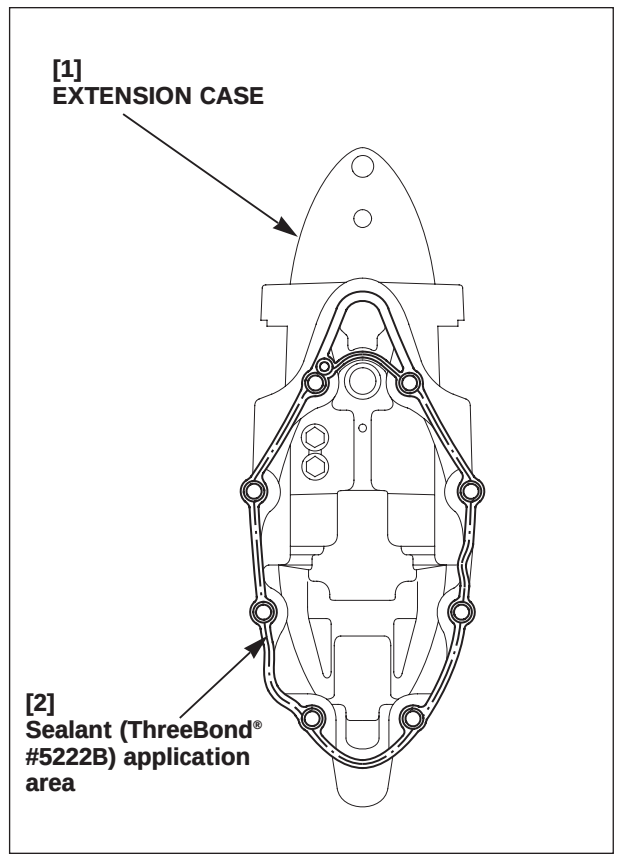
5) Apply grease to the inner wall of the vertical shaft bushing. Install the vertical shaft bushing, 26 mm washer and the circlip in the extension case (XC, XCC, XD and XCD types only).





6) Clean the extension case and oil case mating surfaces with a degreasing cleaning solvent and a shop towel.

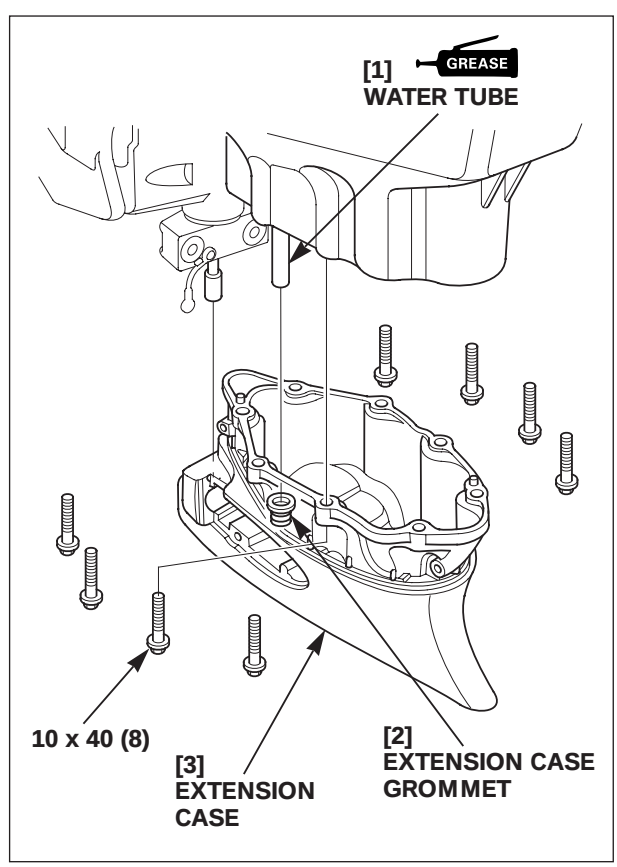
7) Apply sealant to the entire sealing surface of the oil case side of the extension case (ThreeBond® #5222B or equivalent).



8) Apply grease to the water tube end. Install the extension case on the outboard motor aligning the water tube with the extension case grommet.

9) Tighten the eight 10 x 40 mm flange bolts to the specified torque.

TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)



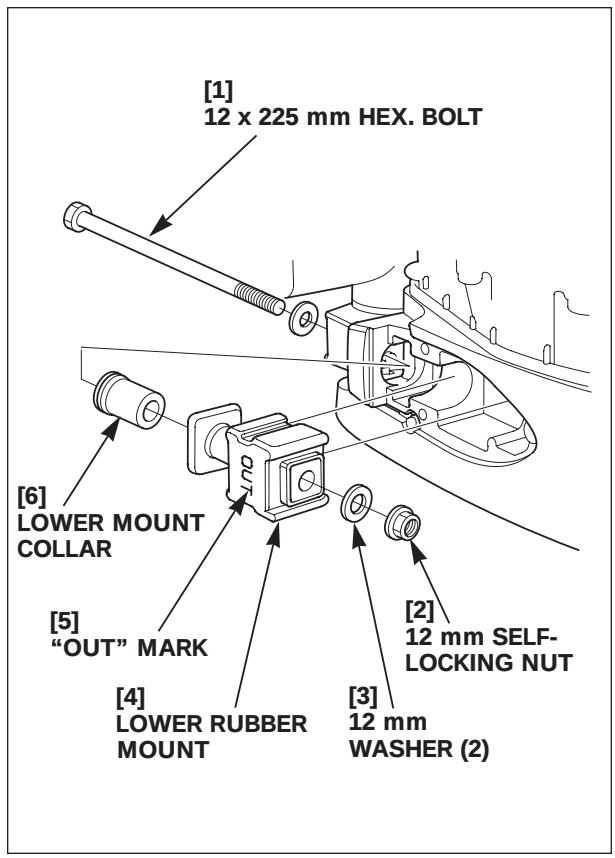
10) Install the lower mount collar and the lower rubber mount on the extension case.

NOTICE

- *Install the lower mount collar with the smaller diameter side toward the lower rubber mount.*
- *Install the lower rubber mount with the "OUT" mark toward out.*

11) Install the 12 x 225 mm hex. bolt, two 12 mm washers and the 12 mm self-locking nut. Holding the 12 mm self-locking nut with a wrench, tighten the 12 x 225 mm hex. bolt to the specified torque.

TORQUE: 83 N·m (8.5 kgf·m, 61 lbf·ft)

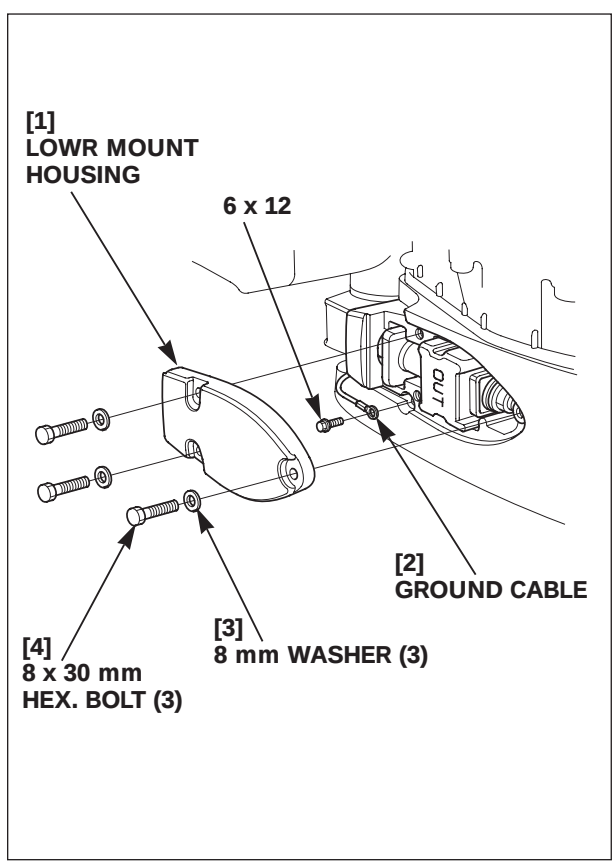


12) Connect the ground cable with the 6 x 12 mm flange bolt.

13) Install the lower mount housing on the extension case, and tighten the three 8 mm washers and the three 8 x 30 mm hex. bolts.

14) Remove the hoist hooks from the engine hangers and lower the outboard motor to the lowermost position.

15) Install the following pars.
- Gear case assembly (P. 14-5 and 44)
- L./R. engine under cover (P. 4-14)
- Engine cover (P. 4-2)

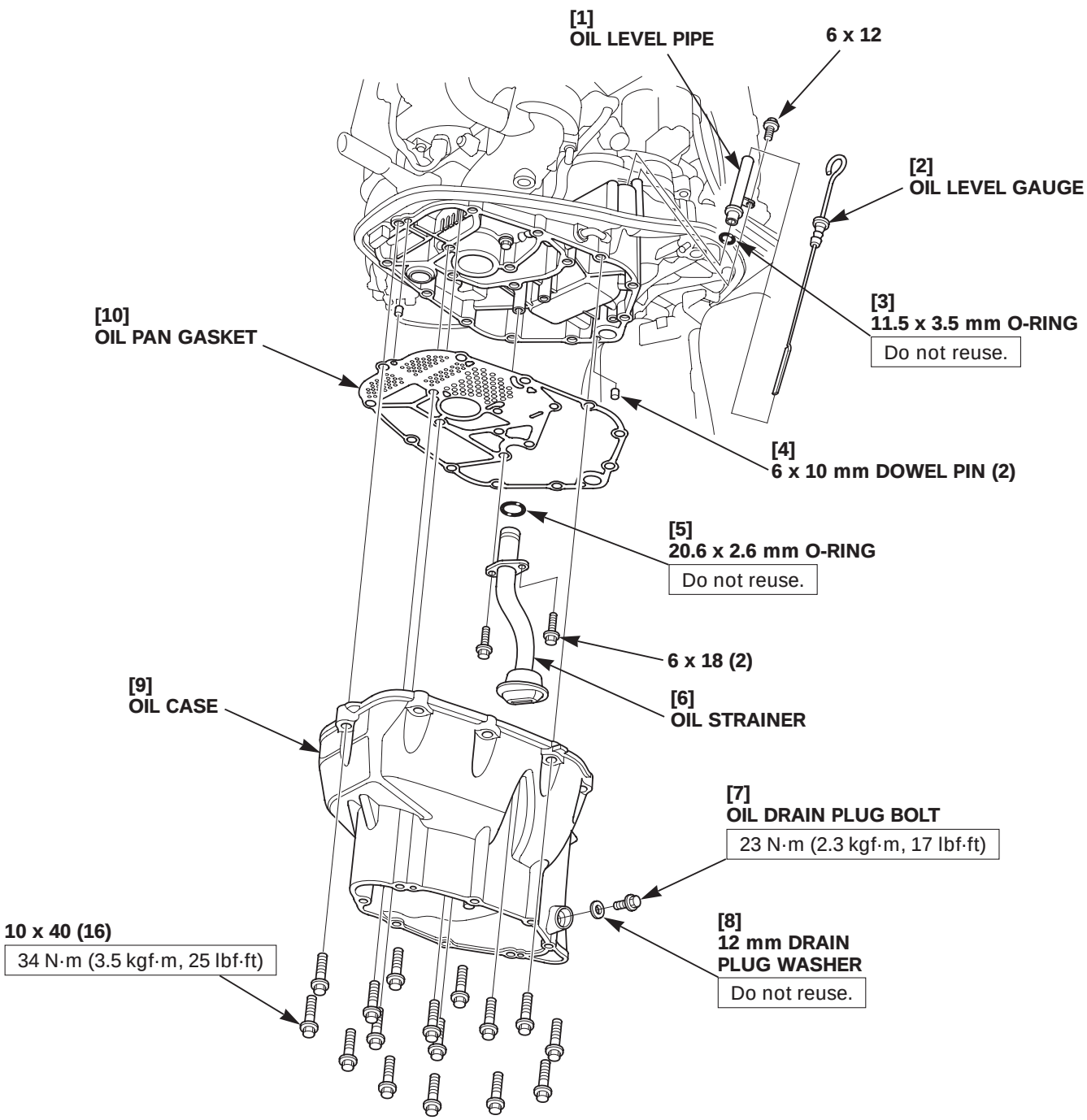


20. OIL CASE

a. REMOVAL

Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under cover (P. 4-9)
– Gear case assembly (P. 14-3 and 42)
– Extension case/lower rubber mount (P. 14-89)
1) Drain the engine oil from the oil case (P. 3-2).

2) Remove the sixteen 10 x 40 mm flange bolts and remove the oil case from the mount case.



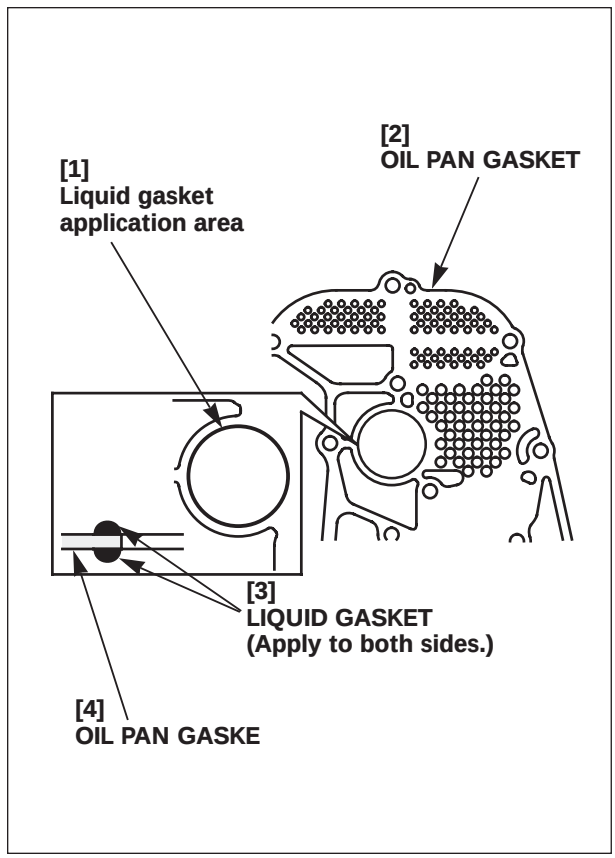
b. INSTALLATION

1) Clean the oil case and mount case mating surfaces and the both sides of the oil pan gasket with a cleaning solvent and a shop towel.

2) Apply bead [ø1.0 – 5.0 mm (ø0.04 – 0.20 in)] of the liquid gasket (ThreeBond® #1211 or equivalent) to the indicated area of the oil pan gasket.

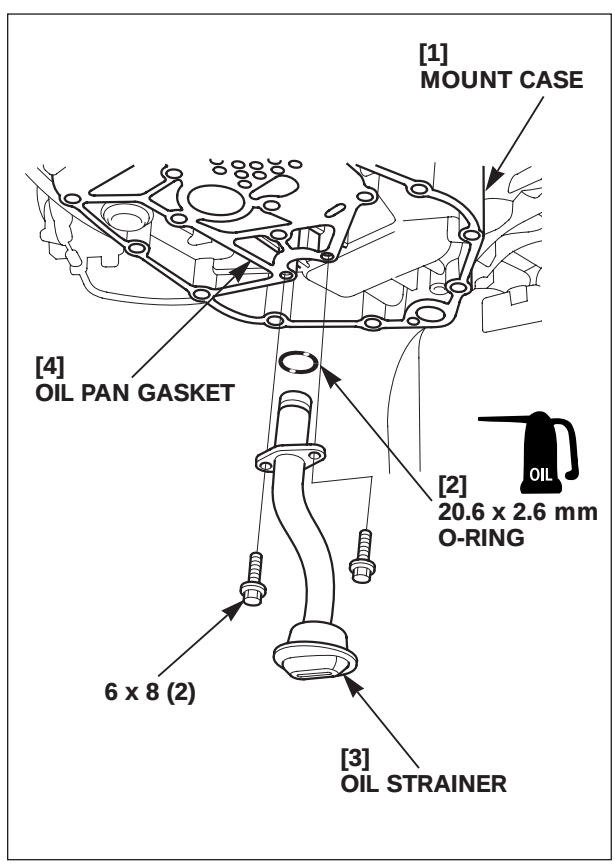
NOTICE

- *Assemble within 90 minutes after application of the liquid gasket. If the parts have been left unassembled for 90 minutes, remove the old gasket and apply a new gasket again.*
- *Do not fill in the oil case with the engine oil for 15 minutes after assembly.*



3) Apply engine oil to the circumference of the new 20.6 x 2.6 mm O-ring, and install it on the oil strainer.

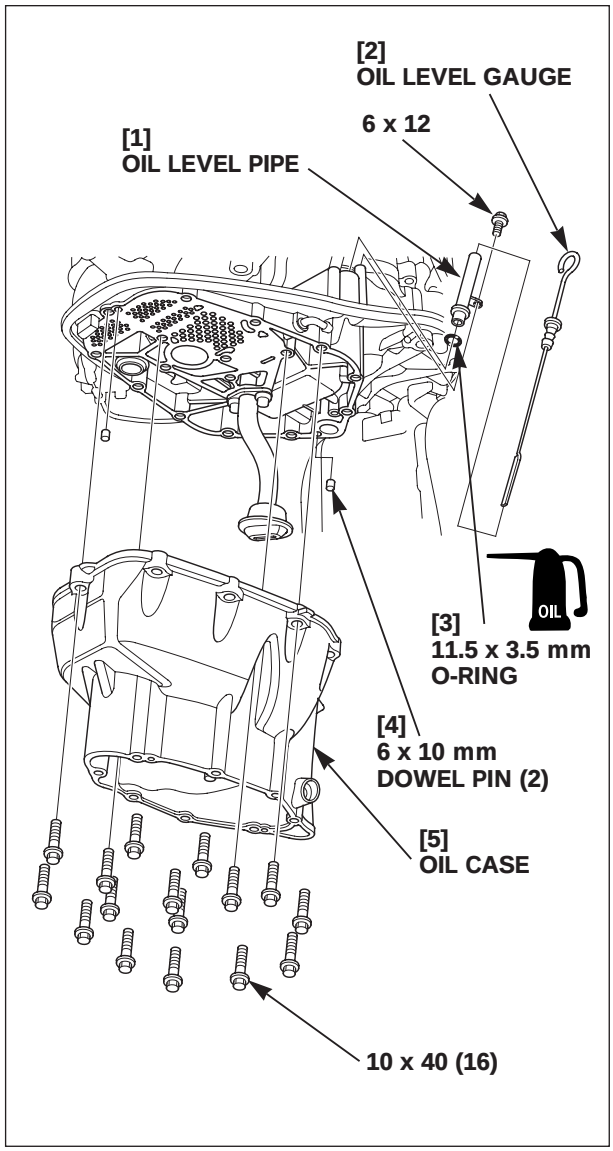
4) Install the oil pan gasket on the mount case. Install the oil strainer and tighten the two 6 x 18 mm flange bolts.



5) Apply the engine oil to the threads and seat of the sixteen 10 x 40 mm flange bolts.
   Install the two dowel pins and the oil case on the mount case, then loosely tighten the sixteen 10 x 40 mm flange bolts.

6) Apply engine oil to the new 11.5 x 3.5 mm O-ring, and install it on the oil level pipe.

7) Install the oil level pipe on the mount case and tighten the 6 x 12 mm flange bolts.
   Install the oil level gauge.



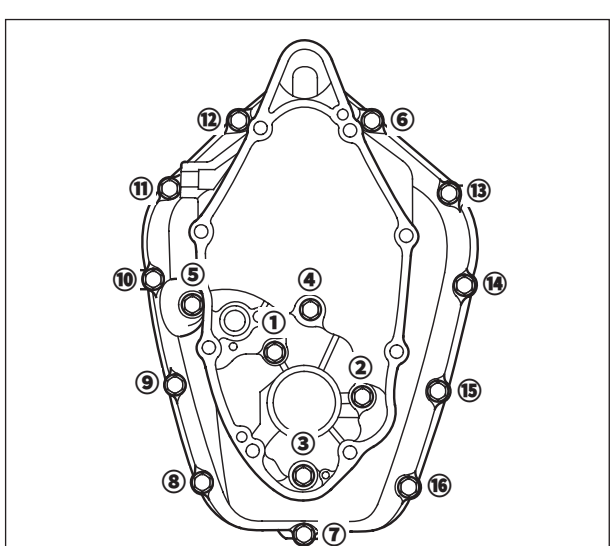
8) Tighten the 10 x 40 mm flange bolts to the specified torque in the numbered sequence in two or three steps.

   TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)

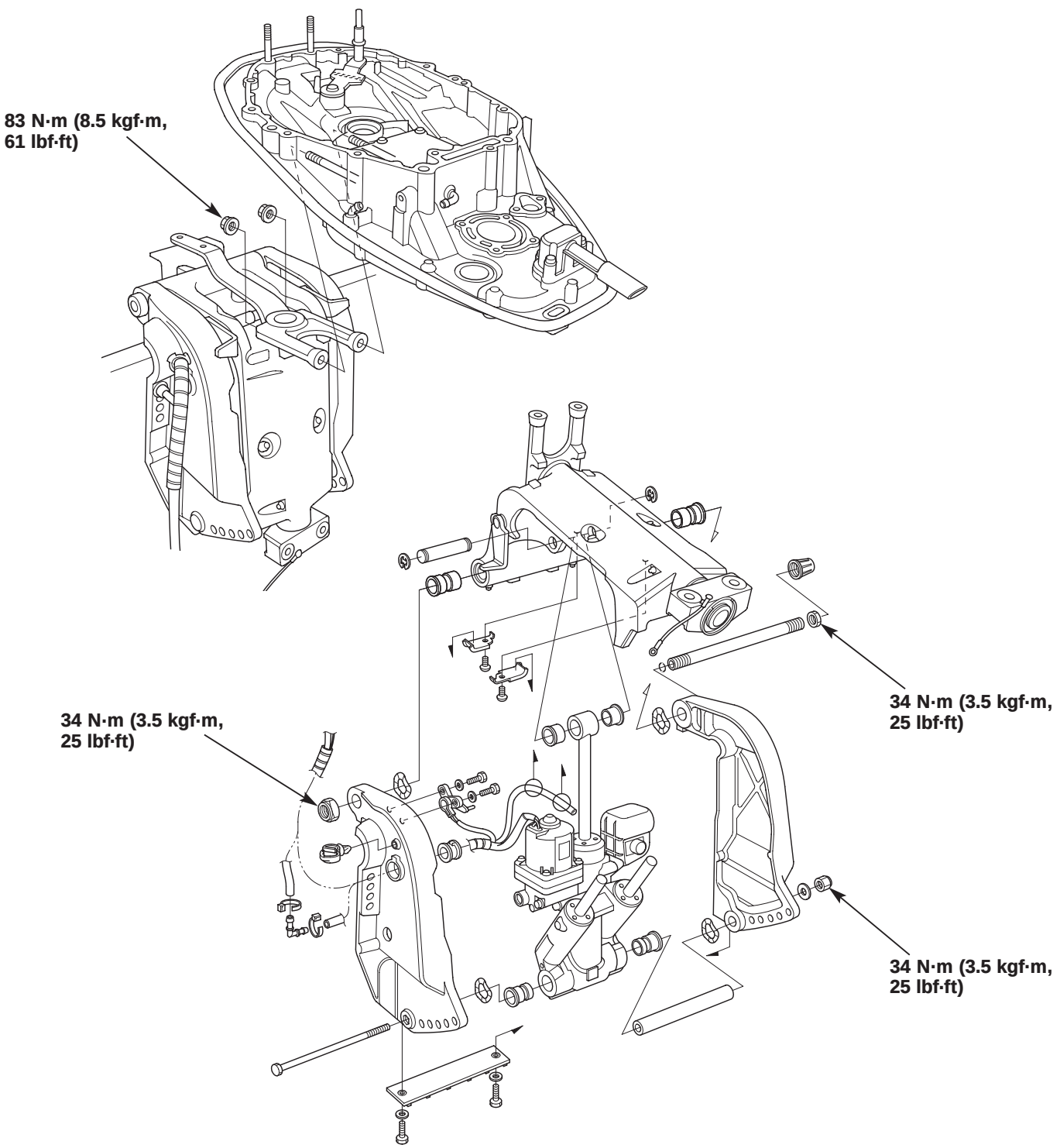
9) Tighten the 12 mm drain plug washer and the oil drain plug bolt on the oil case. Tighten them to the specified torque and add the engine oil.

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

10) Install the following parts.
   – Extension case/lower rubber mount (P. 14-91)
   – Gear case assembly (P. 14-5 and 44)
   – L./R. engine under cover (P. 4-14)
   – Engine cover (P. 4-2)



15. MOUNTING CASE/STERN BRACKET/SWIVEL CASE/POWER TRIM/TILT ASSEMBLY

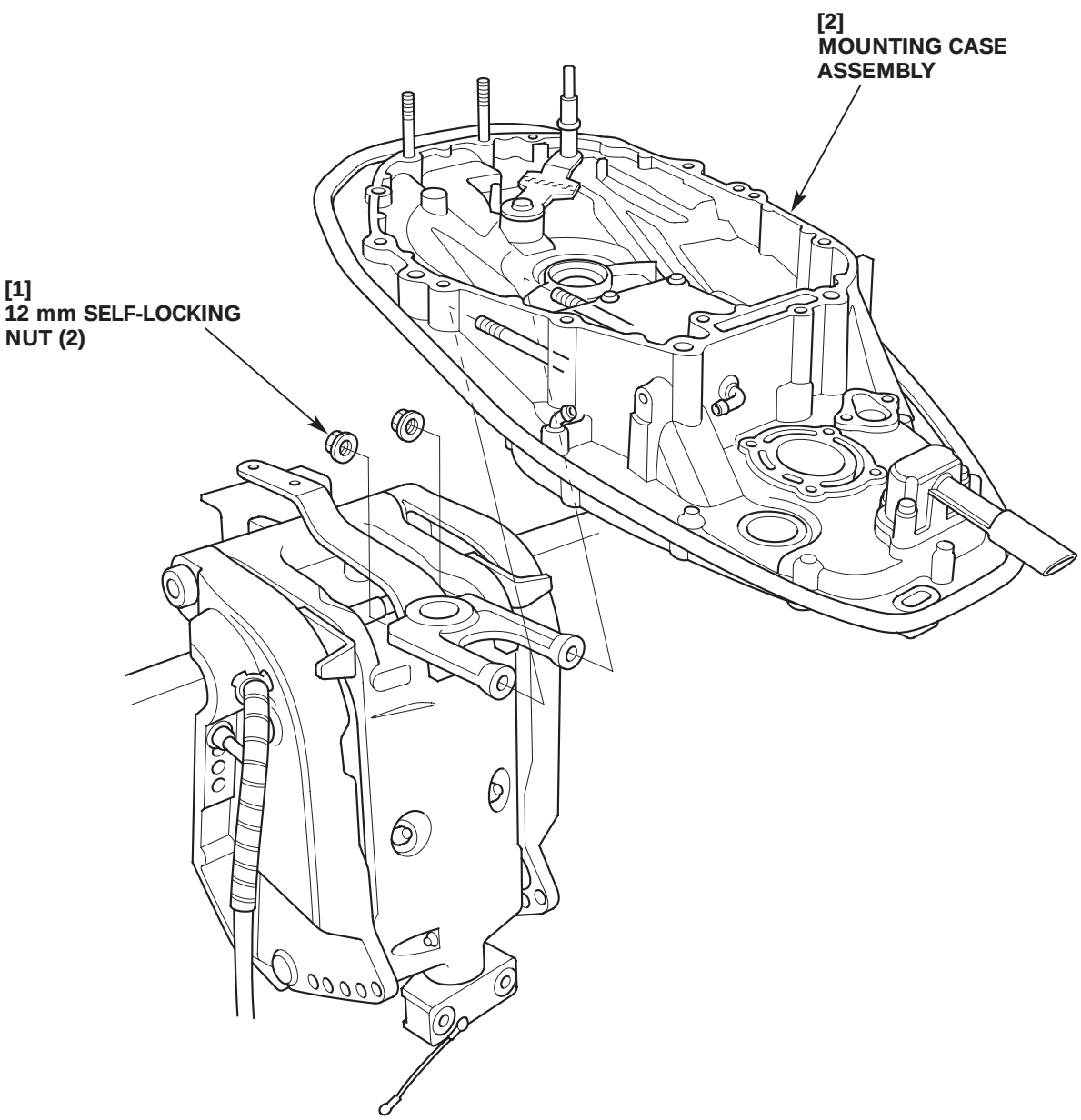


1. MOUNTING CASE

a. REMOVAL

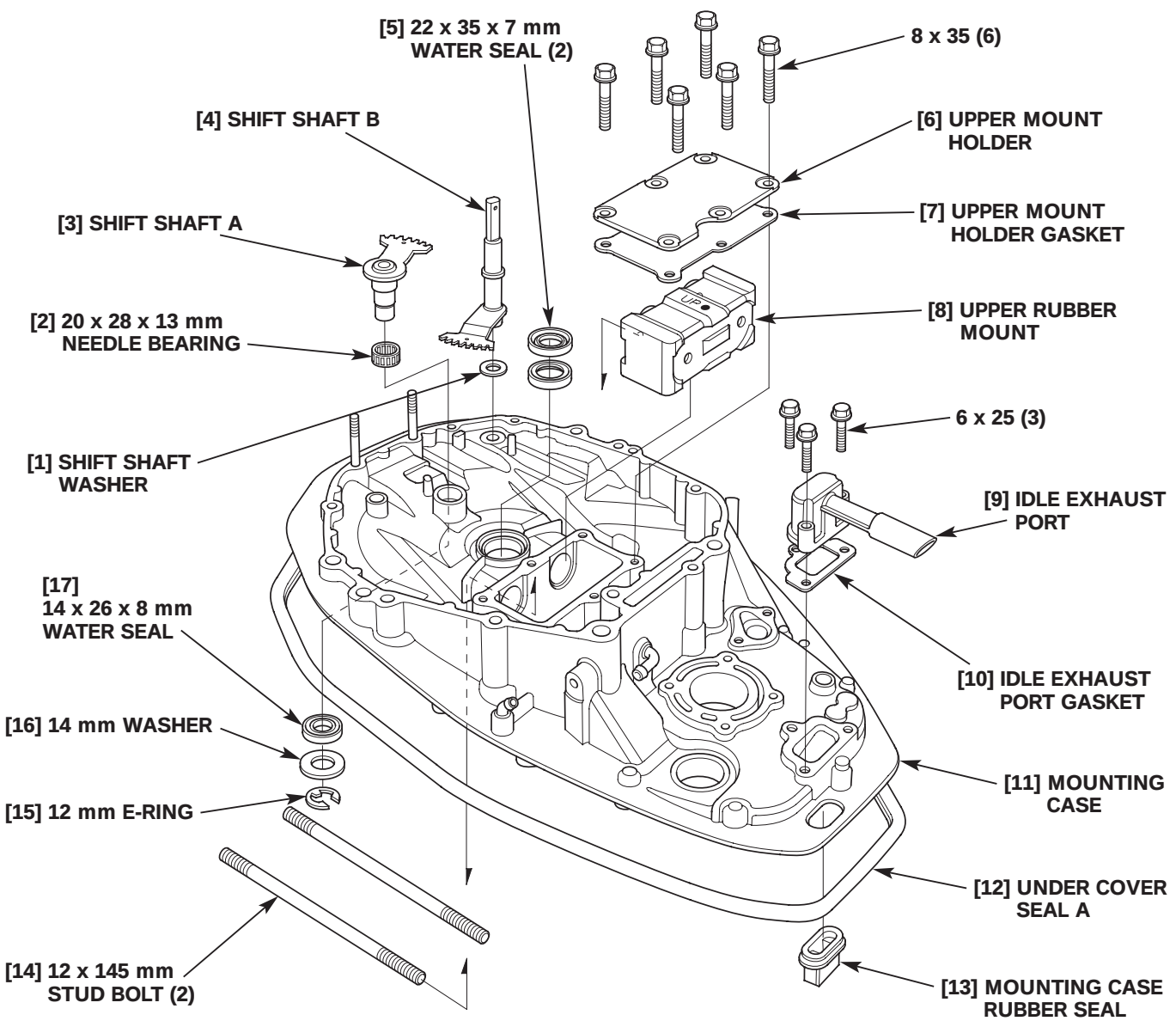
Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Under cover front bracket (P. 4-20)
– Water relief tube C (P. 8-6)
– Engine assembly (P. 7-2)

Remove the two 12 mm self-locking nuts and remove the mounting case assembly.



b. MOUNTING CASE DISASSEMBLY

1) Remove the under cover seal A and the mounting case rubber seal from the mounting case.
   Remove the shift shaft B and the shift shaft washer.
2) Remove the three 6 x 25 mm flange bolts and remove the idle exhaust port and the idle exhaust port gasket.
   Replace the gasket with a new one on assembly.
3) Check the 22 x 35 x 7 mm water seal lips for cut and replace if necessary before removal.
   Remove the two 22 x 35 x 7 mm water seals using a commercially available oil seal remover. Replace the oil seals with the new ones on assembly.
4) Remove the 12 mm E-ring from the shift shaft A and remove the 14 mm washer and the shift shaft A.
   Check the 14 x 26 x 8 mm water seal lip for cut and replace if necessary before removal. Remove the 14 x 26 x 8 mm water seal using a commercially available oil seal remover. Replace with a new one on assembly.
5) Remove the two 12 x 145 mm stud bolts from the upper rubber mount.
6) Remove the six 8 x 35 mm flange bolts and remove the upper mount holder, upper mount holder gasket and the upper rubber mount. Replace the gasket with a new one on assembly.
   Check the upper rubber mount for deterioration and cracks. Replace with a new one if necessary.



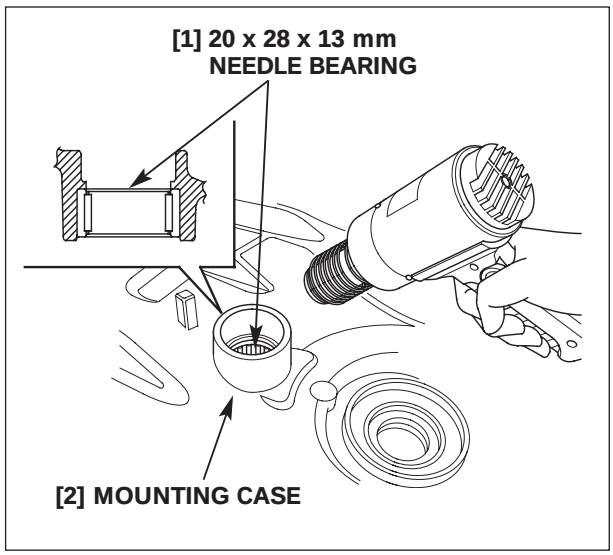
c. 20 x 28 x 13 mm NEEDLE BEARING REMOVAL

1) Remove all parts from the mounting case.

2) Warm up the 20 x 28 x 13 mm needle bearing of the mounting case and remove the needle bearing.

   Replace the 20 x 28 x 13 mm needle bearing with a new one on assembly.

   NOTICE
   Take care not to get burned during operation.



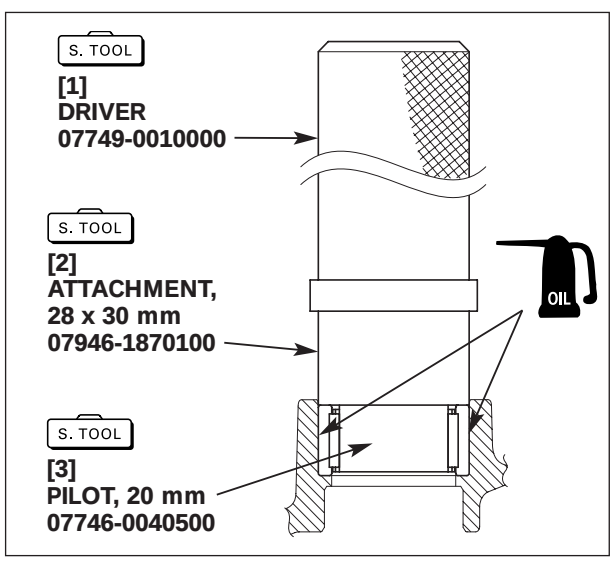
d. 20 x 28 x 13 mm NEEDLE BEARING INSTALLATION

1) Apply engine oil to the circumference of the new 20 x 28 x 13 mm needle bearing.

2) Install the 20 x 28 x 13 mm needle bearing in the mounting case using the special tools and the hydraulic press as shown.

TOOLS:

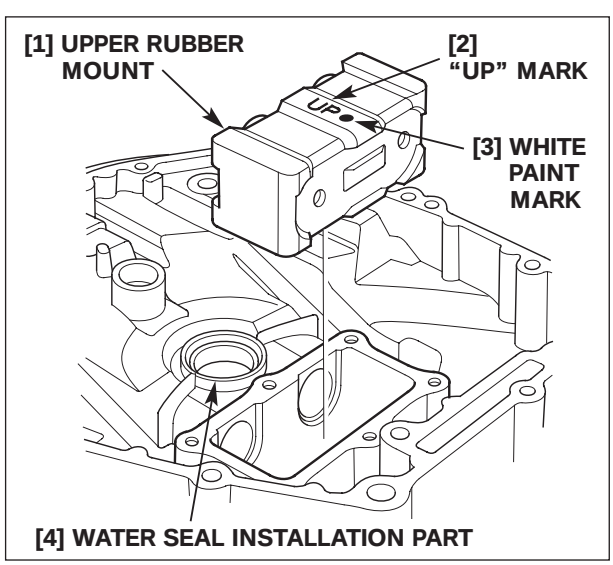
Driver	**07749-0010000**
Attachment, 28 x 30 mm	**07946-1870100**
Pilot, 20 mm	**07746-0040500**



e. MOUNTING CASE ASSEMBLY

1) Install the upper rubber mount in the mounting case with the "UP" mark on the upper rubber mount toward up and the white paint mark toward the opposite side from the water seal installation part.

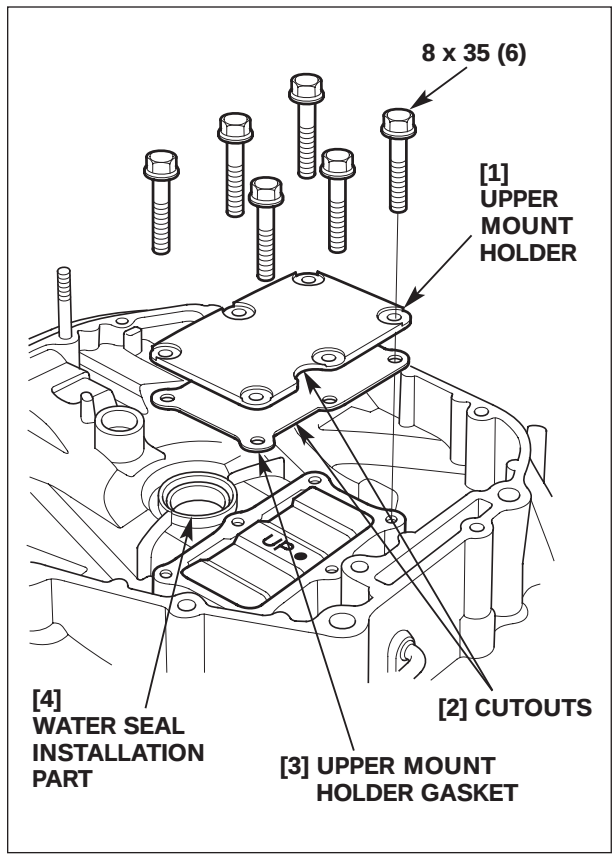
   Note the installation direction of the upper rubber mount.



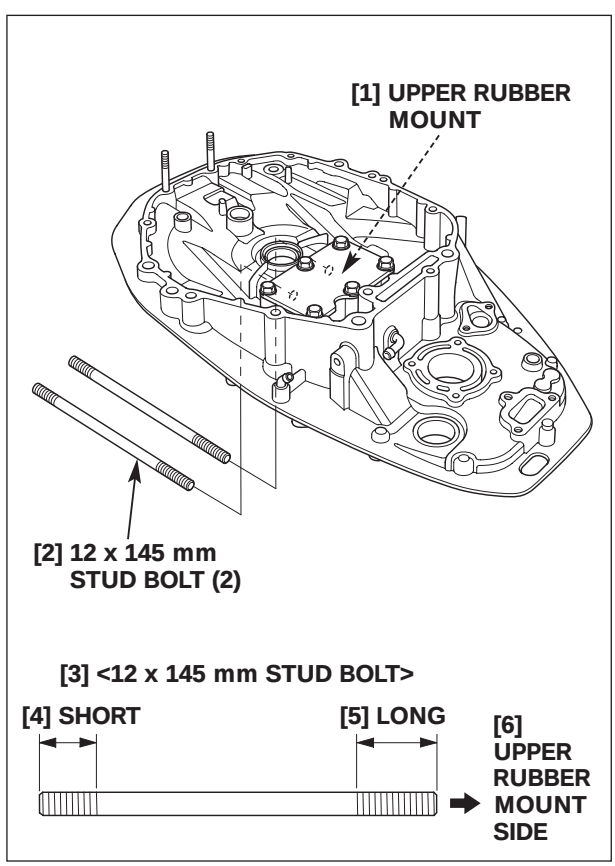
2) Install the new upper mount holder gasket and the upper mount holder on the upper rubber mount with the cutouts in the upper mount holder gasket and in the upper mount holder toward the opposite side from the water seal installation part.

   Note the installation direction.

3) Tighten the upper rubber mount securely with the six 8 x 35 mm flange bolts.



4) Tighten the two 12 x 145 mm stud bolts on the upper rubber mount securely with the longer threads of the stud bolts toward the upper rubber mount side.



5) Apply grease to the circumference and the mating surfaces of the two new 22 x 35 x 7 mm water seals.

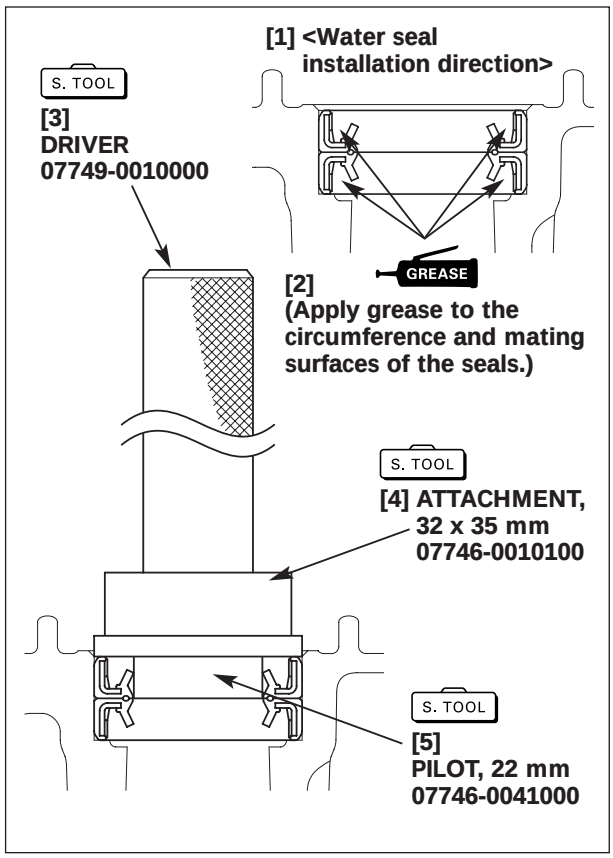
6) Install the 22 x 35 x 7 mm water seals one by one in the mounting case using the special tools as shown. Note the installation direction of the water seals.

7) After installing the water seals, apply 2 – 4 g (0.07 – 0.14 oz) of grease to the lip and the area around the lip of the water seals.

   • Note the installation direction of the water seals.

TOOLS:

Driver	**07749-0010000**
Attachment, 32 x 35 mm	**07746-0010100**
Pilot, 22 mm	**07746-0041000**



8) Apply grease to the circumference of the new 14 x 26 x 8 mm water seal.

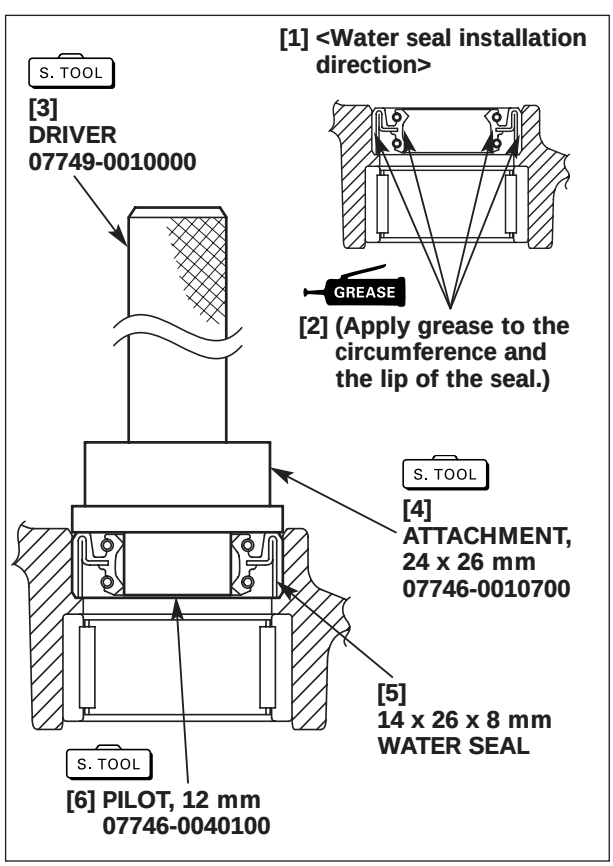
9) Install the water seal with the special tools as shown. Note the installation direction.

10) After installing the water seal, apply 2 – 4 g (0.07 – 0.14 oz) of grease to the lip and the area around the lip of the water seal.

   • Note the installation direction of the water seal.

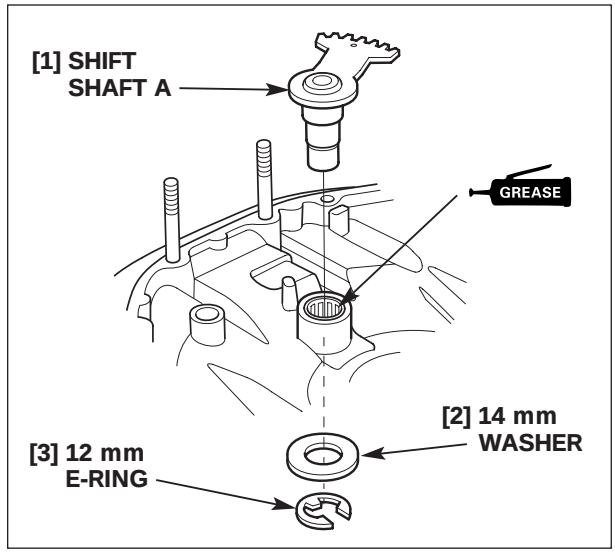
TOOLS:

Driver	**07749-0010000**
Attachment, 24 x 26 mm	**07746-0010700**
Pilot, 12 mm	**07746-0040100**



11) Apply grease to the shift shaft A installation part in the mounting case.

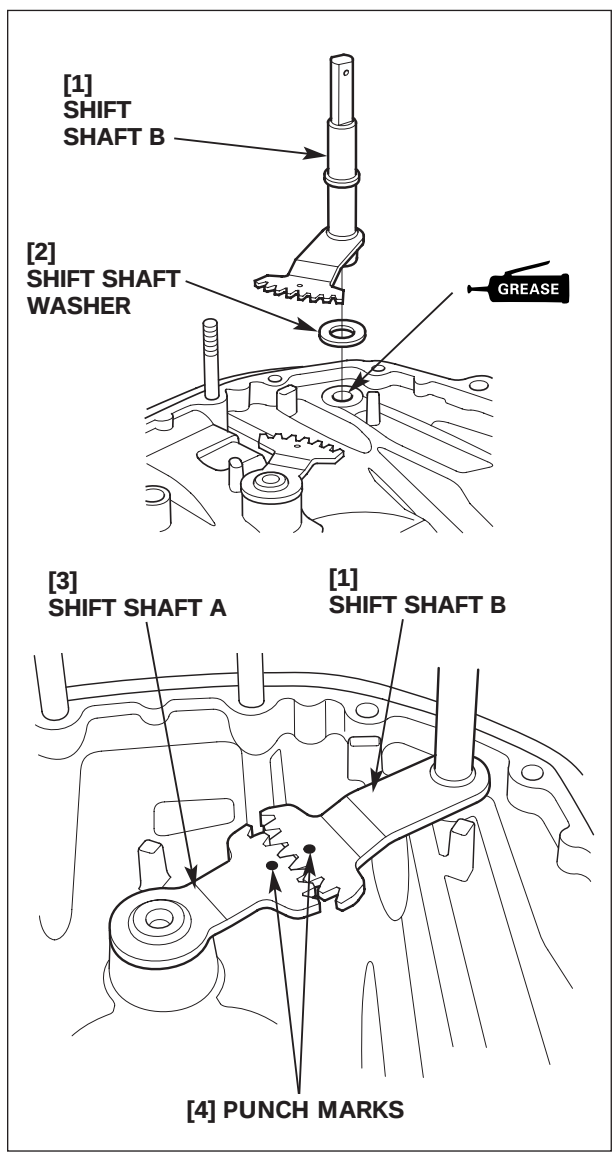
12) Set the shift shaft A on the mounting case and install the 14 mm washer and the 12 mm E-ring on the shift shaft A.



13) Install the shift shaft washer on the mounting case.

14) Apply grease to the shift shaft B installation part in the mounting case.

Install the shift shaft B on the mounting case aligning the punch mark on the shift shaft B with the punch mark on the shift shaft A as shown.



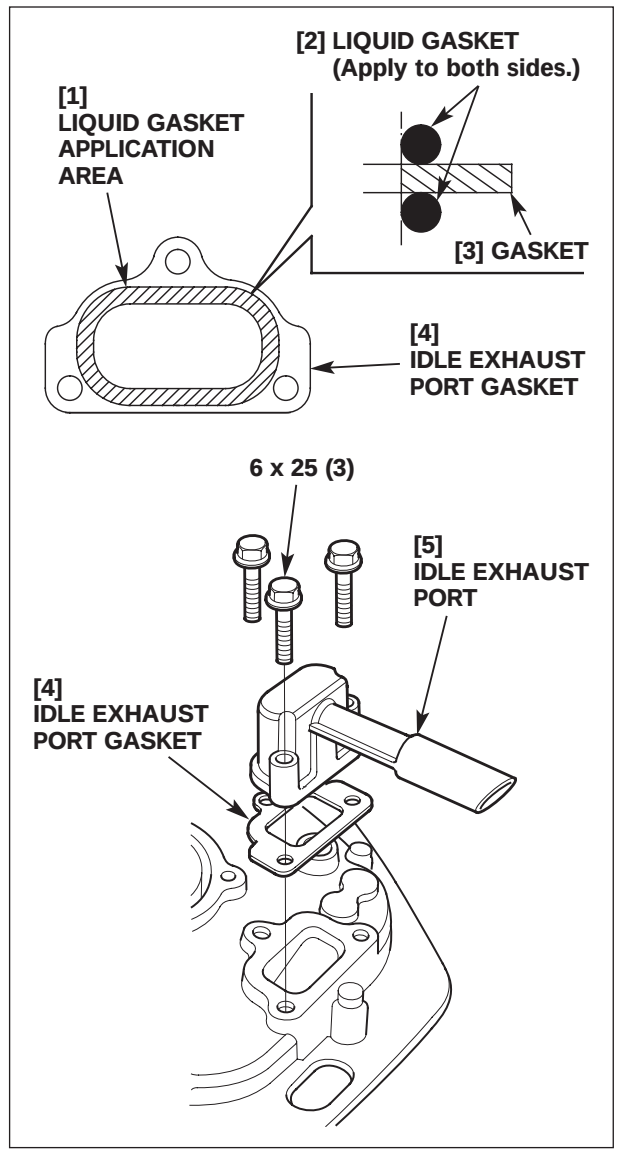
15) Clean the mounting case/idle exhaust port mating surfaces and the both sides of the idle exhaust port gasket thoroughly with a degreasing cleaning solvent and shop towel.

16) Apply a bead [ø1.0 – 5.0 mm (ø0.04 –0.20 in)] of the liquid gasket (ThreeBond® #1211 or equivalent) to the indicated area of the both sides of the idle exhaust port gasket.

NOTICE

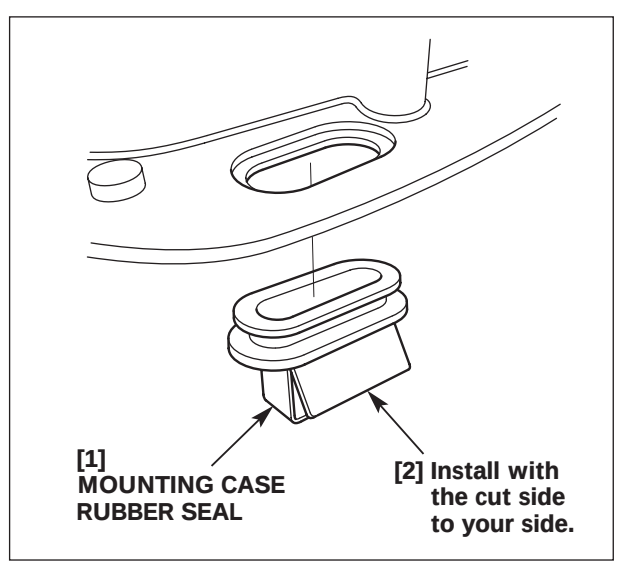
- *Install the idle exhaust gasket within 90 minutes after application of the liquid gasket.*
- *If it has been left for 90 minutes or longer, remove the old gasket and apply a liquid gasket again before installation.*

17) Install the idle exhaust port gasket on the mounting case and tighten the three 6 x 25 mm flange bolts securely.



18) Install the mounting case rubber seal on the mounting case with the cut side to your side.

19) Install the under cover seal A on the mounting case (P. 15-3).

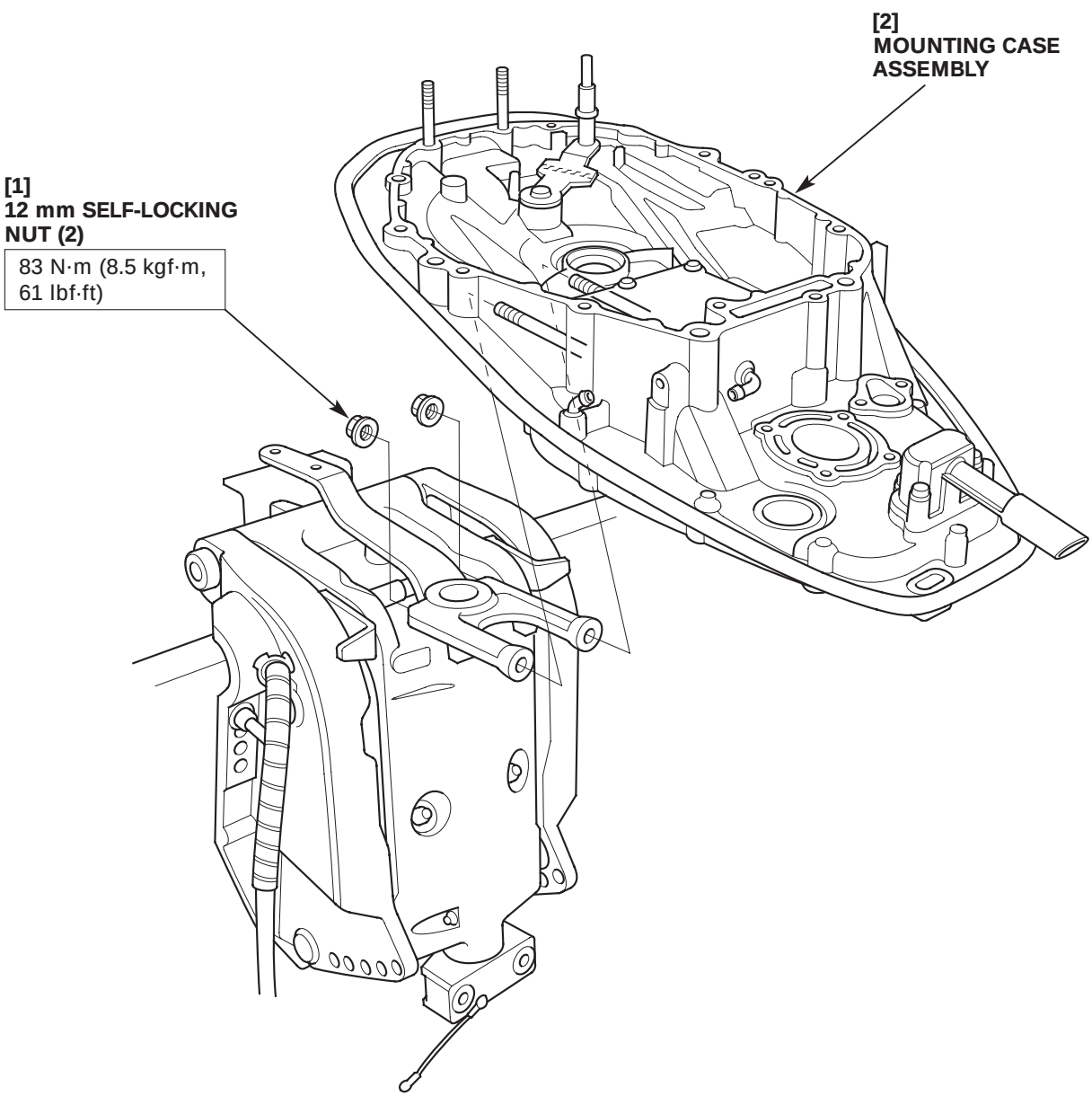


f. INSTALLATION

1) Set the mounting case assembly on the mount frame and tighten the two 12 mm self-locking nut to the specified torque.

   TORQUE: 83 N·m (8.5 kgf·m, 61 lbf·ft)

2) Remove the following parts.
   – Engine assembly (P. 7-6)
   – Water relief tube C (P. 8-7)
   – Under cover front bracket (P. 4-31)
   – L./R. engine under covers (P. 4-14)
   – Engine cover (P. 4-2)



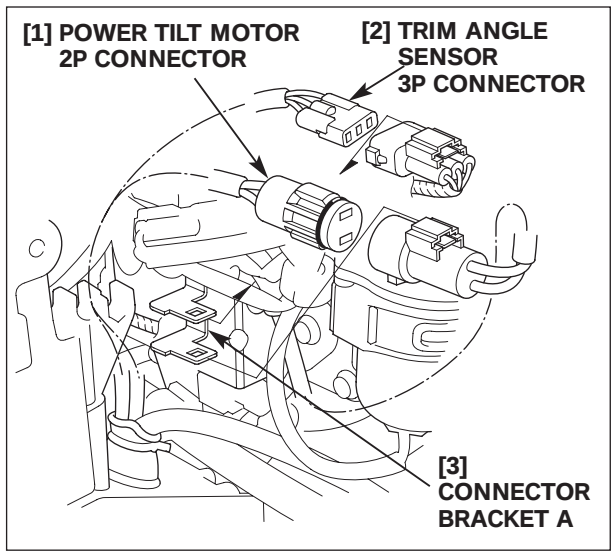
2. STERN BRACKET/SWIVEL CASE REMOVAL/INSTALLATION

a. REMOVAL

Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Gear case assembly (P. 14-3 and 42)
– Remote control cable/grommet (P. 17-2)
– Starter cable (P. 18-15)

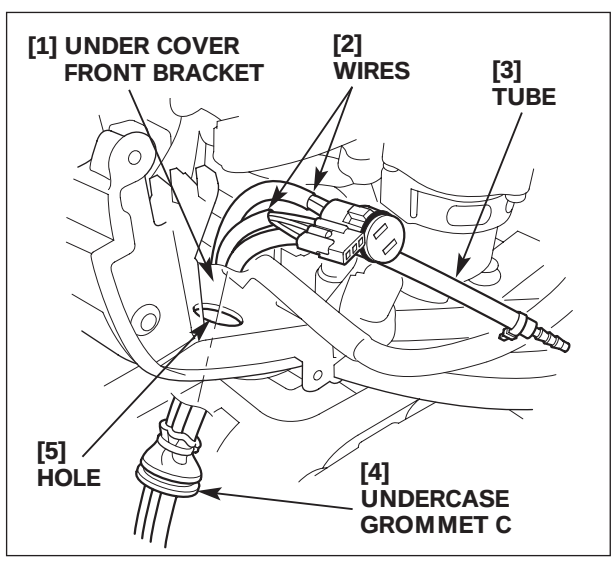
1) Place the outboard on a level surface (i.e. outboard motor in the vertical position).
2) Remove the trim angle sensor 3P connector and the power tilt motor 2P connector from the connector bracket A.

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



3) Remove the undercase grommet C outside the under cover front bracket.

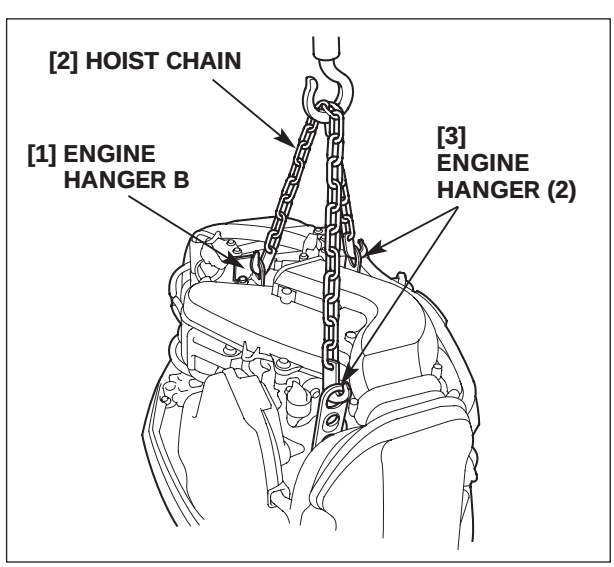
   Pull off the tube and wires through the hole in the under cover front bracket.



4) Hook the hoist hook on each of the three engine hangers.

   Remove the following part.
   – Lower rubber mount (P. 14-89)

   NOTICE
   Check that the outboard motor is not lifted off.



5) Swing the outboard motor right and left and remove the two 12 mm self-locking nuts.

6) Check that the engine assembly/mounting case mating surfaces are level to the ground.

   Holding the outboard motor with the hoist, remove the stern bracket/swivel case assembly mounted on the outboard motor stand from the outboard motor.

   If it is hard to remove the stern bracket/swivel case assembly, remove by raising and lowering the outboard motor slowly with the hoist.

NOTICE

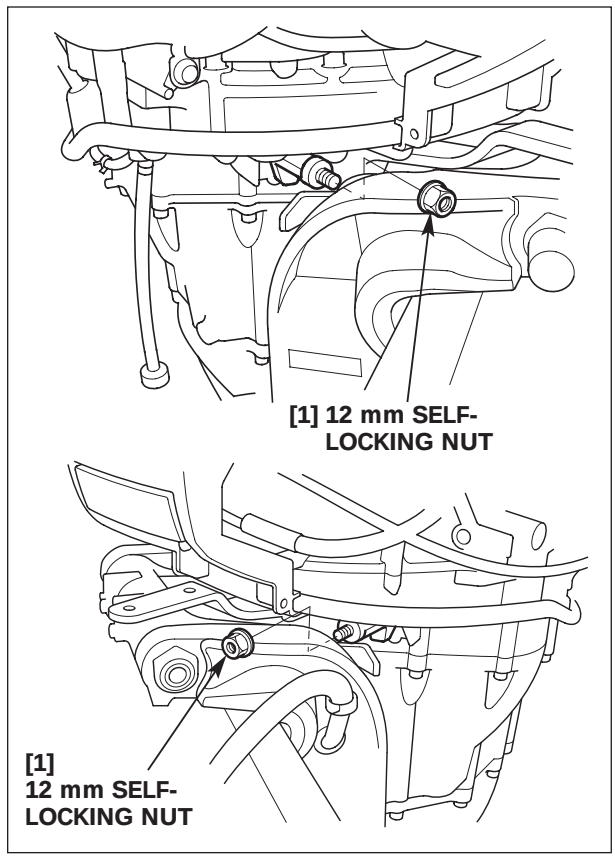
- *Do not raise the outboard motor stand off the ground while raising the outboard motor with the hoist.*
- *Remove the stern bracket/swivel case assembly with care not to damage the threads of the two 12 x 145 mm stud bolts.*

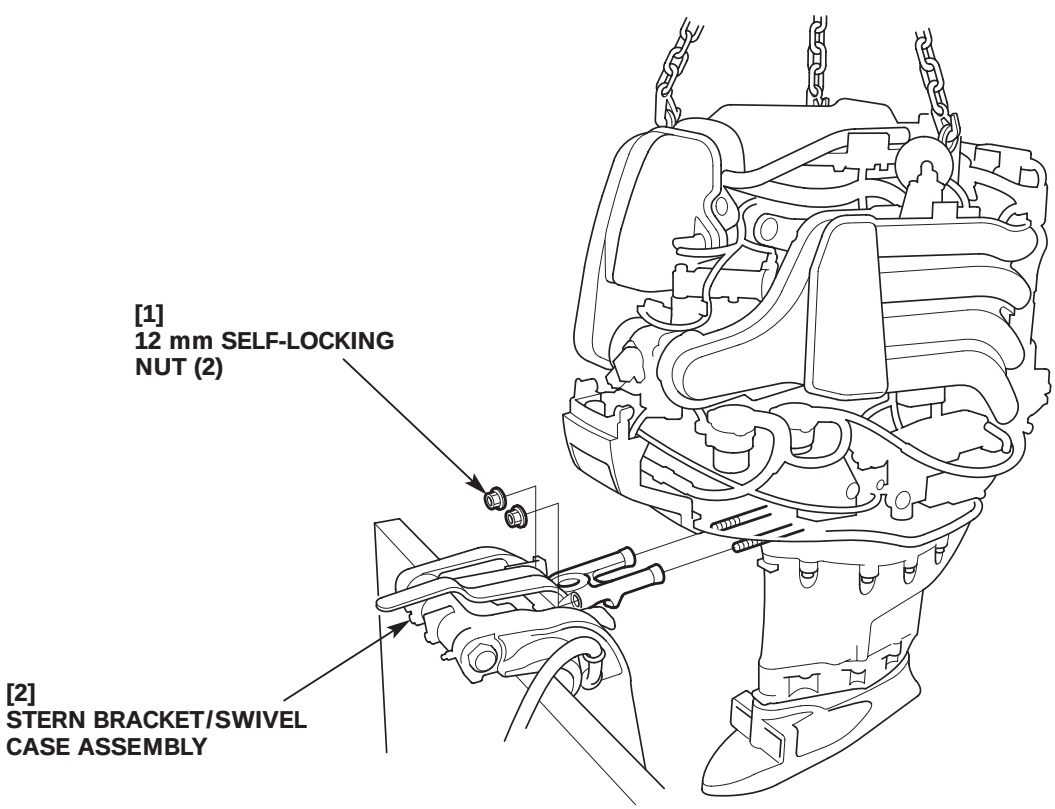
7) After removing the stern bracket/swivel case assembly, lower the outboard motor slowly.

   Store the outboard motor with the extension case set on the ground.

NOTICE

- *If it is necessary to store the outboard motor by laying it on its side, install the L./R. engine under covers (P. 4-14), drain the engine oil (P. 3-2) and drain the gasoline from the vapor separator.*
- *Then, lay the outboard motor on a urethane foam sheet or blanket with the intake manifold toward down.*



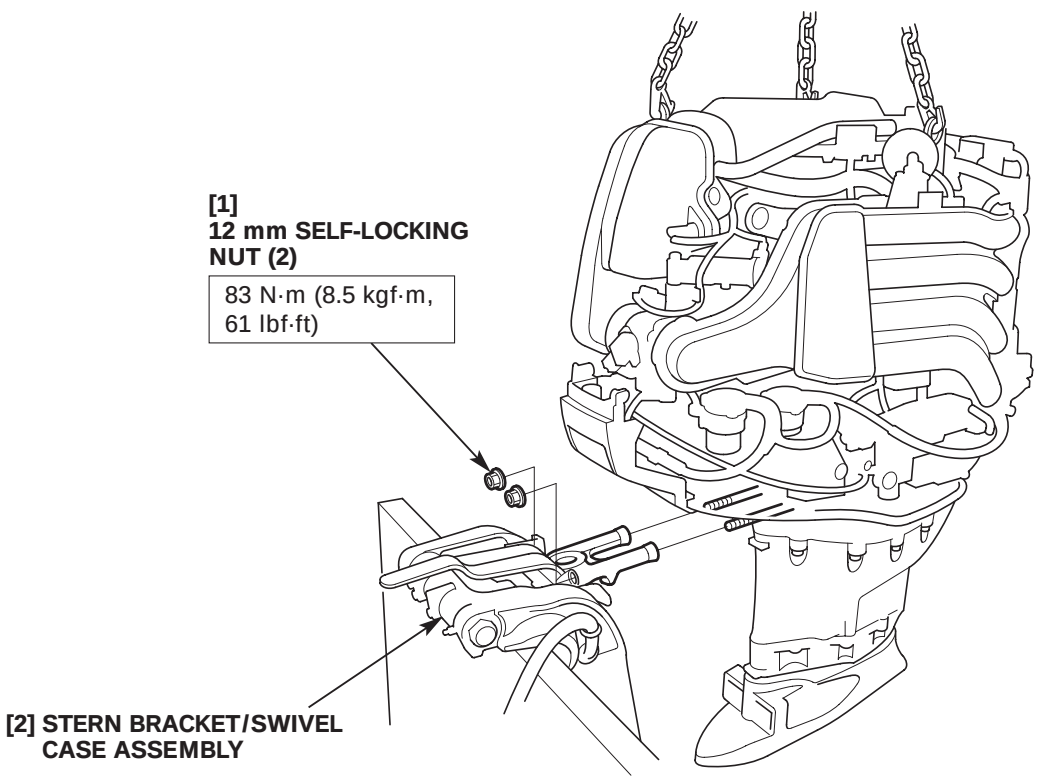


b. INSTALLATION

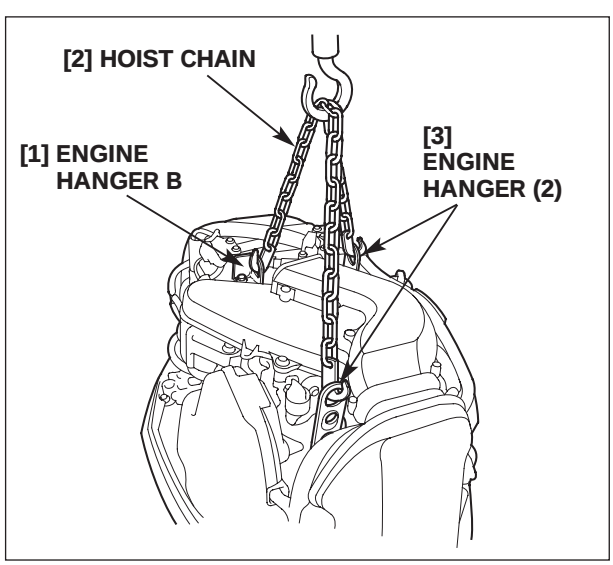
1) Lift up the outboard motor until the 12 x 145 mm stud bolts are flush with the holes in the mount frame of the stern bracket/swivel case assembly.
2) Holding the outboard motor with the hoist, move the stern bracket/swivel case assembly, that are attached to the outboard motor stand, slowly toward the outboard motor.

   Insert the 12 x 145 mm stud bolts into the mount frame and tighten the two 12 mm self-locking nuts to the specified torque.

   TORQUE: 83 N·m (8.5 kgf·m, 61 lbf·ft)



3) Install the lower rubber mount (P. 14-93).
4) Detach the hoist hooks from the three engine hangers.

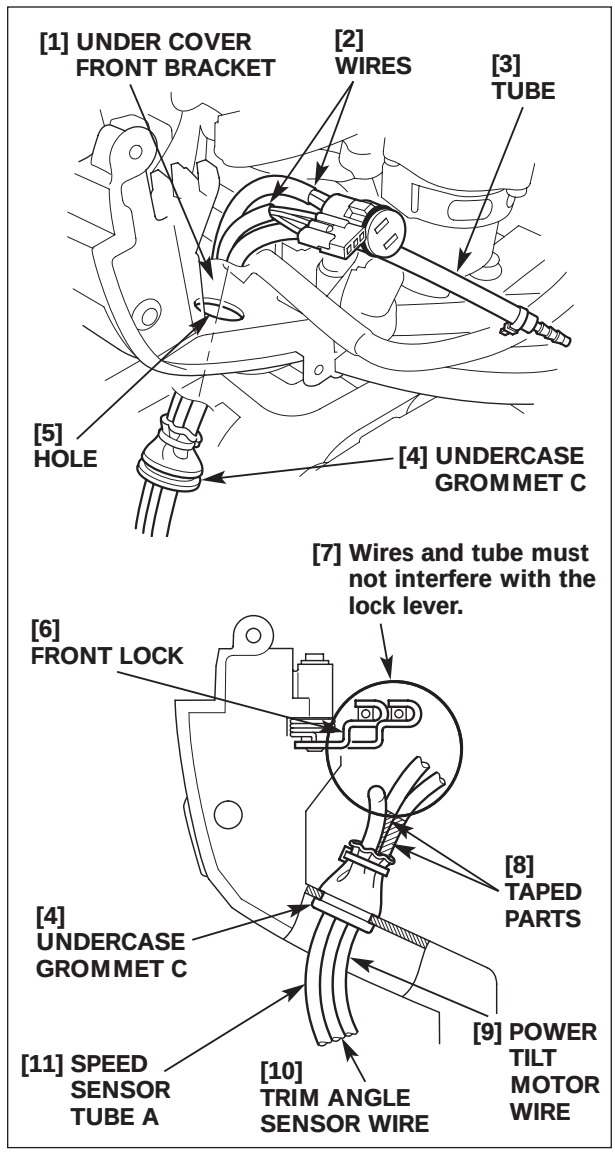


5) Pass the tube and wires through the hole in the under cover front bracket.

   Check that the taped ends of the power tilt motor wire and trim angle sensor wire are in alignment with the end of the undercase grommet C.

   Install the undercase grommet C on the under cover front bracket so they engage securely in the groove of the undercase grommet C.

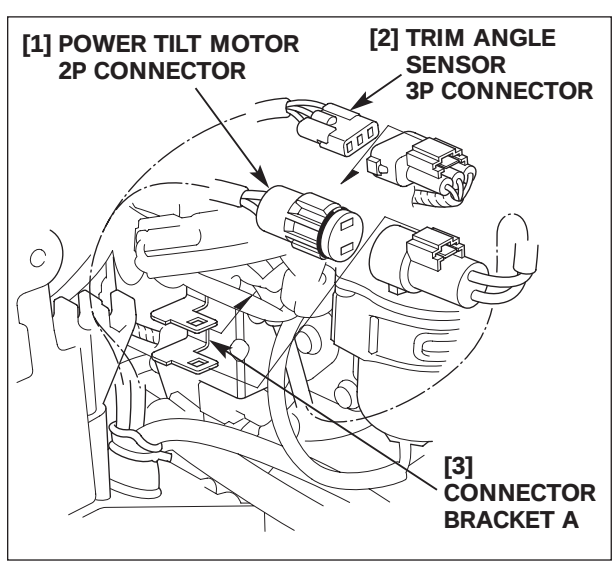
   Move the front lock with a hand and check that the wires and tube do not interfere with the front lock.



6) Connect the trim angle sensor 3P connector and the power tilt motor 2P connector.

   Install the power tilt motor 2P connector on the lower side of the connector bracket A and the trim angle sensor 3P connector on the upper side of the connector bracket A.

7) Install the following parts.
   – Starter cable (P. 18-17)
   – Remote control cable/grommet (P. 17-5)
   – Gear case assembly (P. 14-5 and 44)
   – L./R. engine under covers (P. 4-14)
   – Engine cover (P. 4-2)



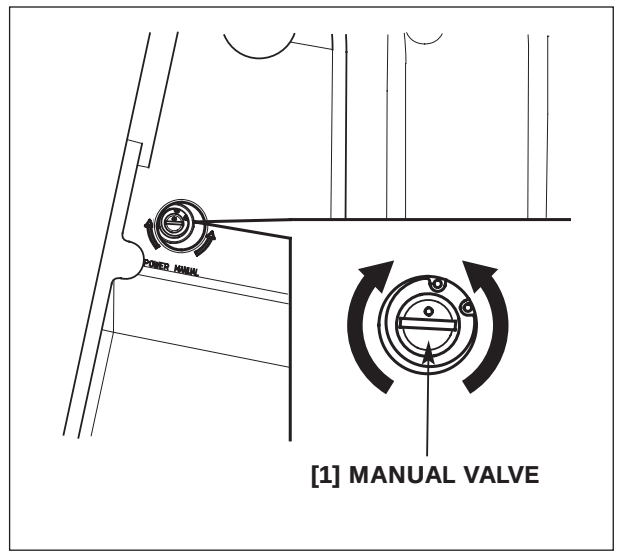
3. STERN BRACKET/SWIVEL CASE/ POWER TRIM/TILT ASSEMBLY

a. STERN BRACKET/SWIVEL CASE/POWER TRIM/ TILT ASSEMBLY REMOVAL

Remove the following parts.
– Engine cover (P. 4-2)
– L./R. engine under covers (P. 4-9)
– Gear case assembly (P. 14-3 and 42)
– Stern bracket/swivel case (P. 15-10)

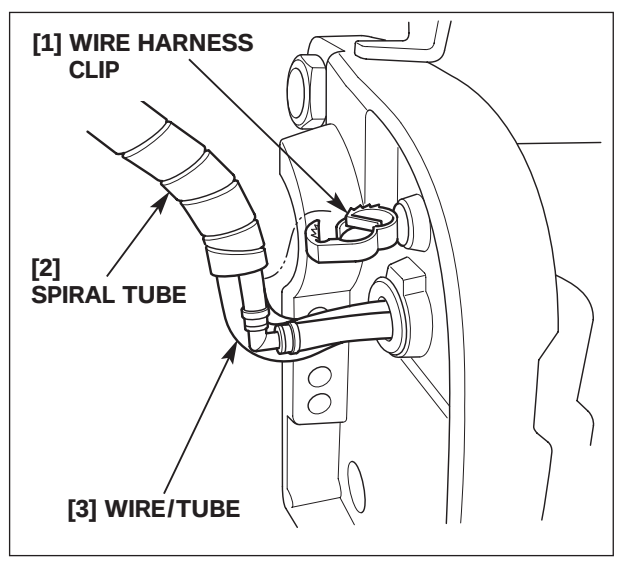
1) Loosen the manual valve fully and set the swivel case assembly in the uppermost position.

   After raising the swivel case assembly to the uppermost position, secure it in the position with the tilt stopper. Tighten the manual valve.



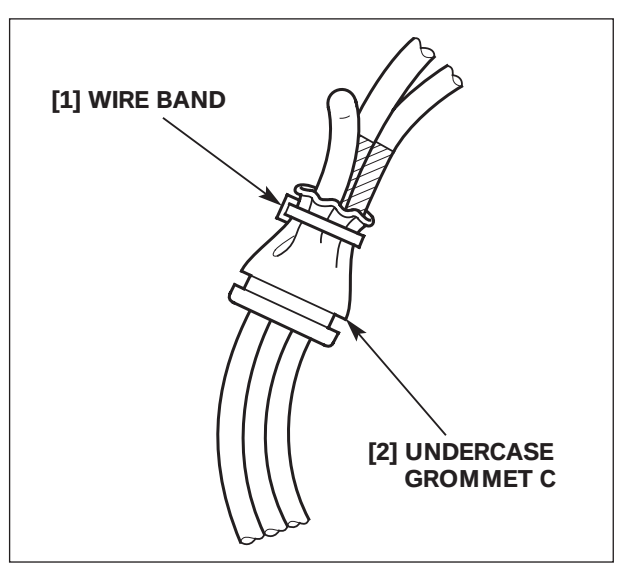
2) Open the wire harness clip and release the trim angle sensor wire, power tilt motor wire and the speed sensor tube A.

   Remove the spiral tube from the trim angle sensor wire, power tilt motor wire and the speed sensor tube A.



3) Remove the wire band from the undercase grommet C and release the trim angle sensor wire, power tilt motor wire and the speed sensor tube A.

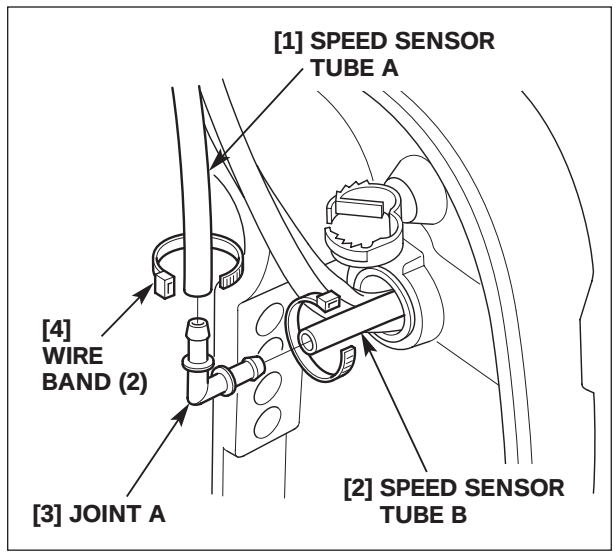
   Replace the tie wire with a new one on assembly.



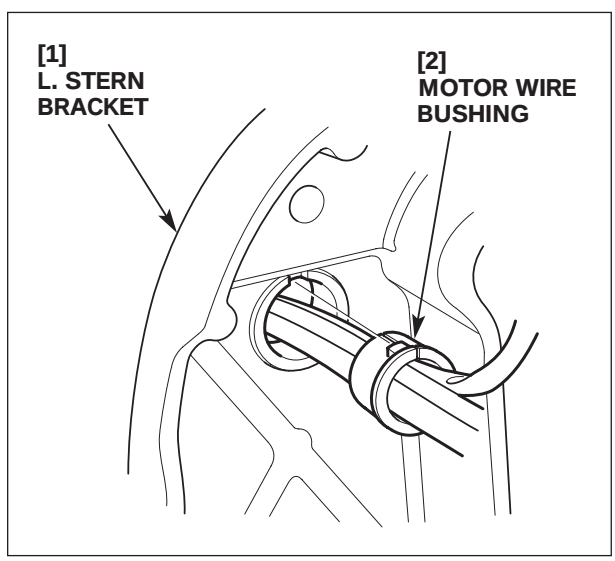
4) Open the two wire bands that secure the speed sensor tube A and B and disconnect the speed sensor tube A and B from the joint A.

   Replace the wire bands with the new ones on assembly.

   Check the speed sensor tube A for deterioration and cracks. Replace if necessary.

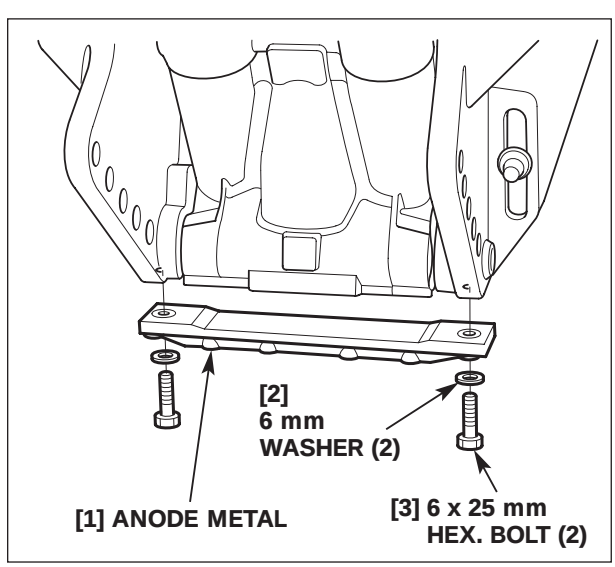


5) Remove the motor wire bushing from the L. stern bracket.



6) Remove the two 6 x 25 mm hex. bolts and the two 6 mm washers, and remove the anode metal.

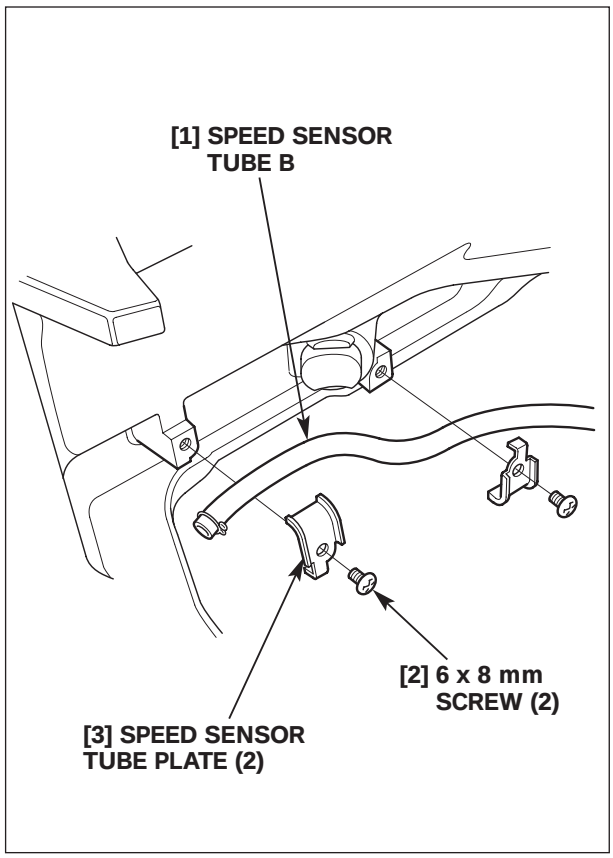
   Check the anode metal for corrosion. If it is corroded excessively, replace with a new one.



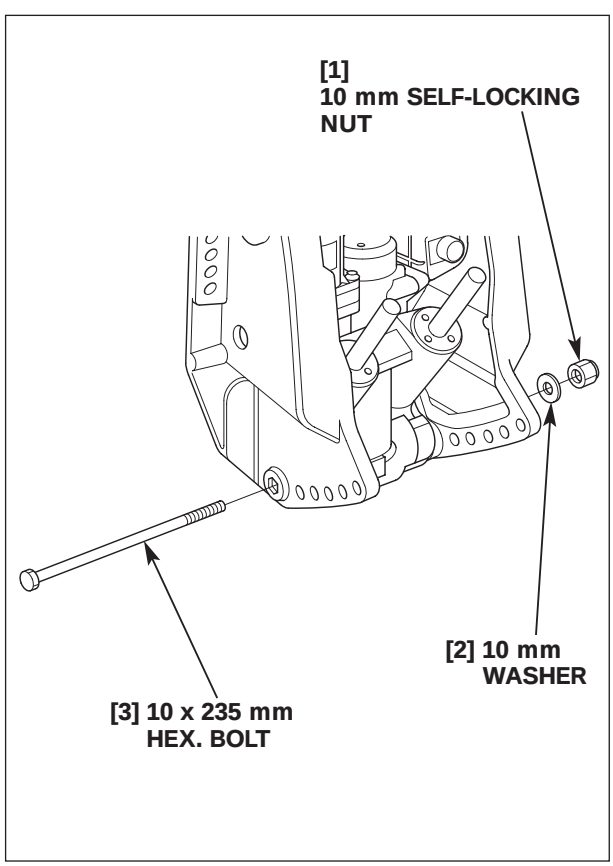
7) Remove the speed sensor tube plates that secure the speed sensor tube B.

   Remove the speed sensor tube B.

   Check the speed sensor tube B for deterioration and cracks. Replace if necessary.



8) Remove the 10 mm self-locking nut and 10 mm washer, and remove the 10 x 235 mm hex. bolt.

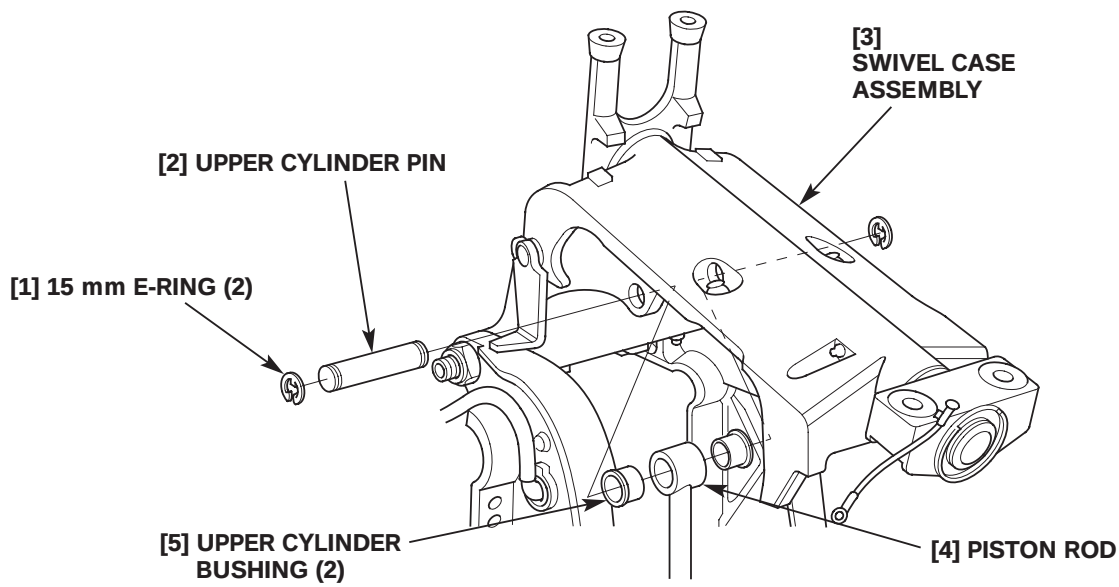


9) Remove the 15 mm E-ring from the upper cylinder pin. Remove the upper cylinder pin and the piston rod of the power trim/tilt assembly from the swivel case assembly.

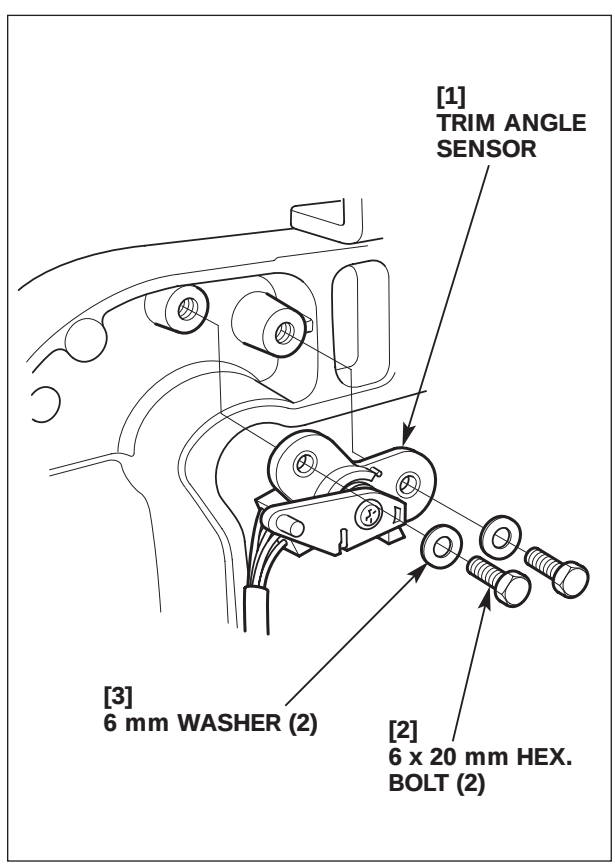
   Check the upper cylinder bushing mounted on the piston rod of the power trim/tilt assembly. If it is damaged, replace with a new one.

10) Remove the upper cylinder bushing.

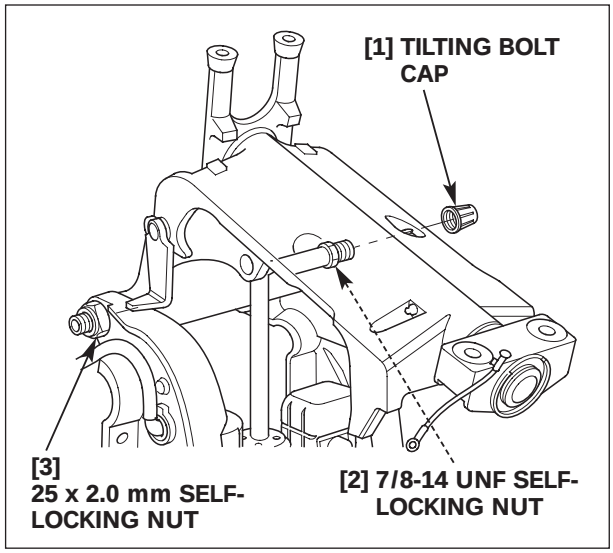
   Replace with a new one on assembly.



11) Remove the two 6 x 20 mm hex. bolts and the two 6 mm washers from the trim angle sensor, and remove the trim angle sensor.



12) Remove the tilting bolt cap and loosen the 25 x 2.0 mm self-locking nut or the 7/8-14 UNF self-locking nut.



13) Holding the power trim/tilt assembly with the hands, extend the L./R. stern brackets to the right and left and remove the lower cylinder collar and the two 32 mm wave washers.

14) Pull off the wires and tube through the hole in the L. stern bracket and remove the power trim/tilt assembly.

Check the lower cylinder bushings mounted on the power trim/tilt assembly for damage. Replace the bushings with the new ones if necessary.

15) Remove the lower cylinder bushings.

Replace the lower cylinder bushings with the new ones on assembly.

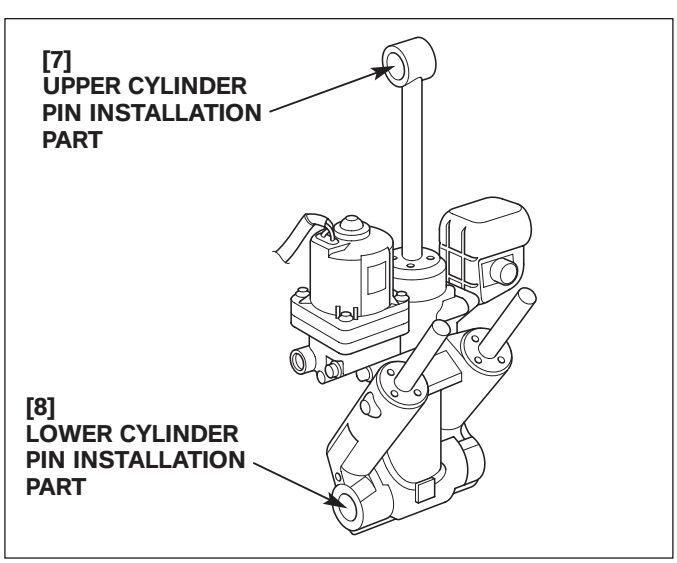
NOTICE

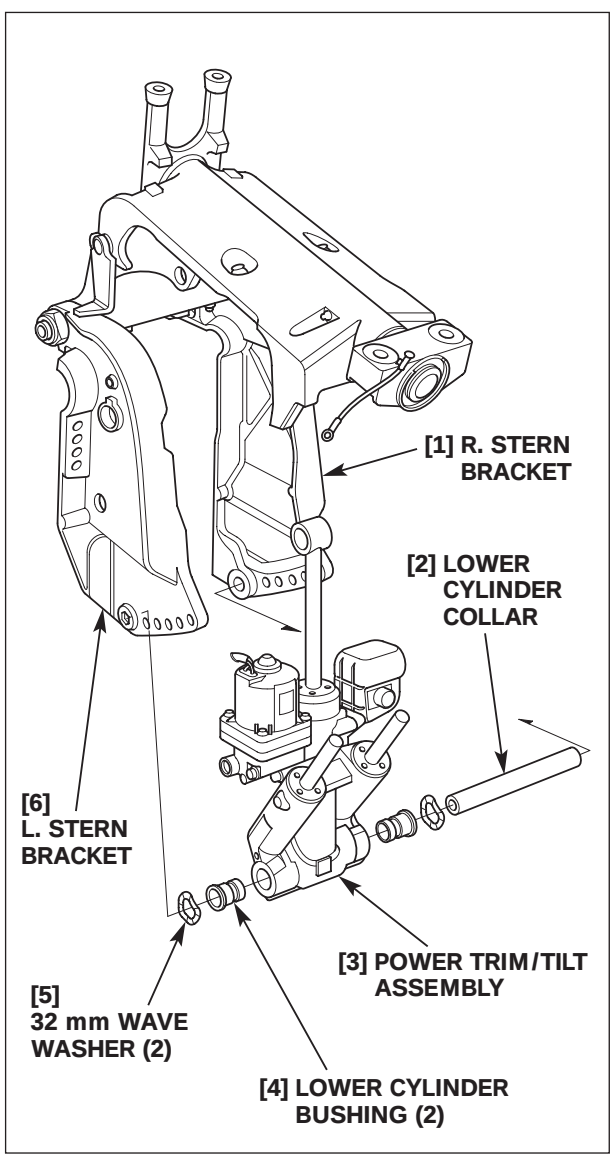
- *Do not push in the piston rod after removing the power trim/tilt assembly.*

  If the piston rod is pushed down, extend the piston rod fully and hold it in the position.

- *Store the power trim/tilt assembly vertically with the upper cylinder pin installation part facing up after removal. Never store the power trim/tilt assembly by laying it on its side or with the lower cylinder collar installation part facing up.*

- If it is hard to remove the lower cylinder collar, loosen the 25 x 2.0 mm self-locking nut again.



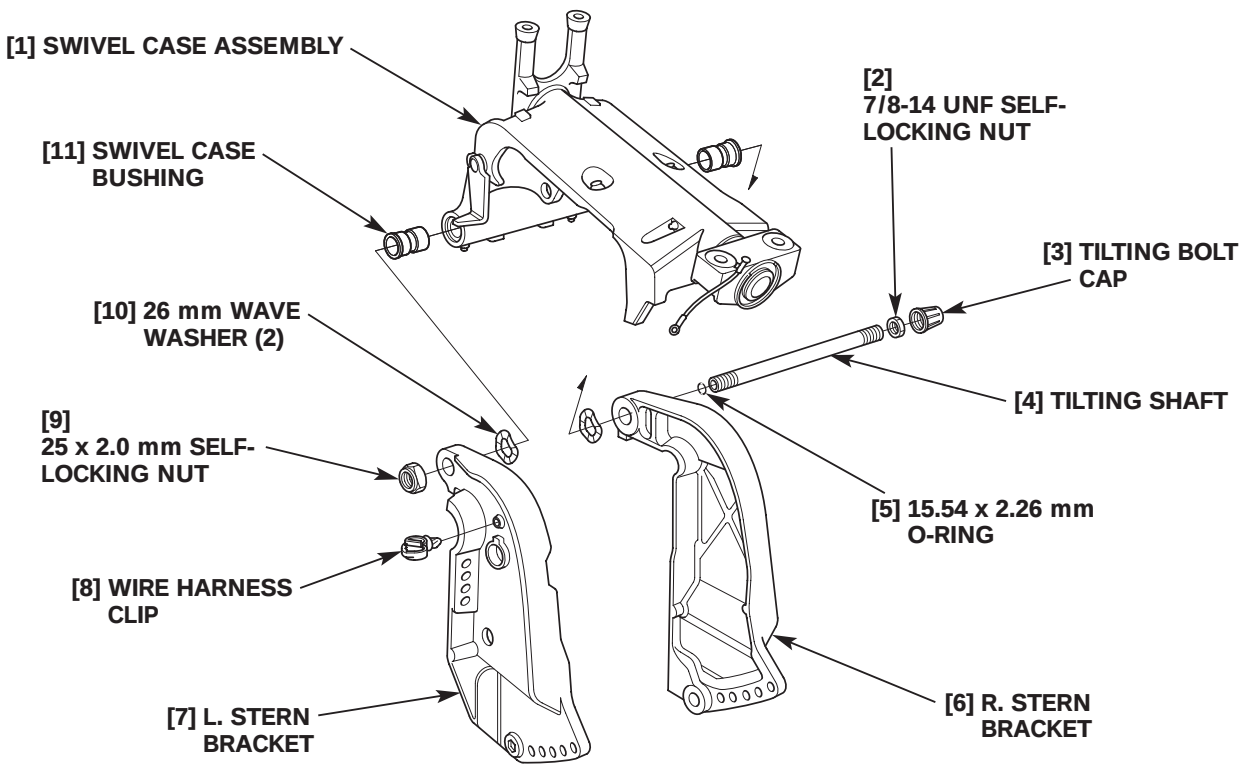


16) Remove the 25 x 2.0 mm self-locking nut or 7/8-14 UNF self-locking nut from the tilting shaft.
Replace the 25 x 2.0 mm self-locking nut or 7/8-14 UNF self-locking nut with a new one on assembly.

17) Remove the tilting shaft and remove the L./R. stern brackets, two 26 mm wave washers and the swivel case assembly.
Check the swivel case bushing that is mounted on the swivel case assembly.
Replace the swivel case bushing if it is damaged.

18) Remove the swivel case bushing.
Replace the swivel case bushing with a new one on assembly.

19) Remove the 15.54 x 2.26 mm O-ring from the tilting shaft.
Replace the O-ring with a new one on assembly.
Remove the wire harness clip from the L. stern bracket.

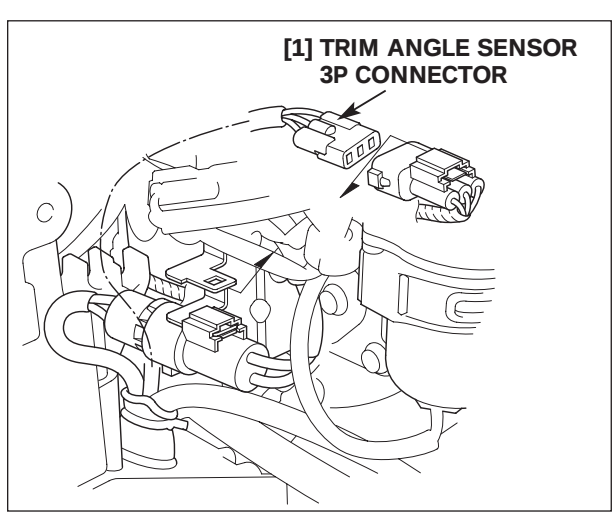


b. INSPECTION

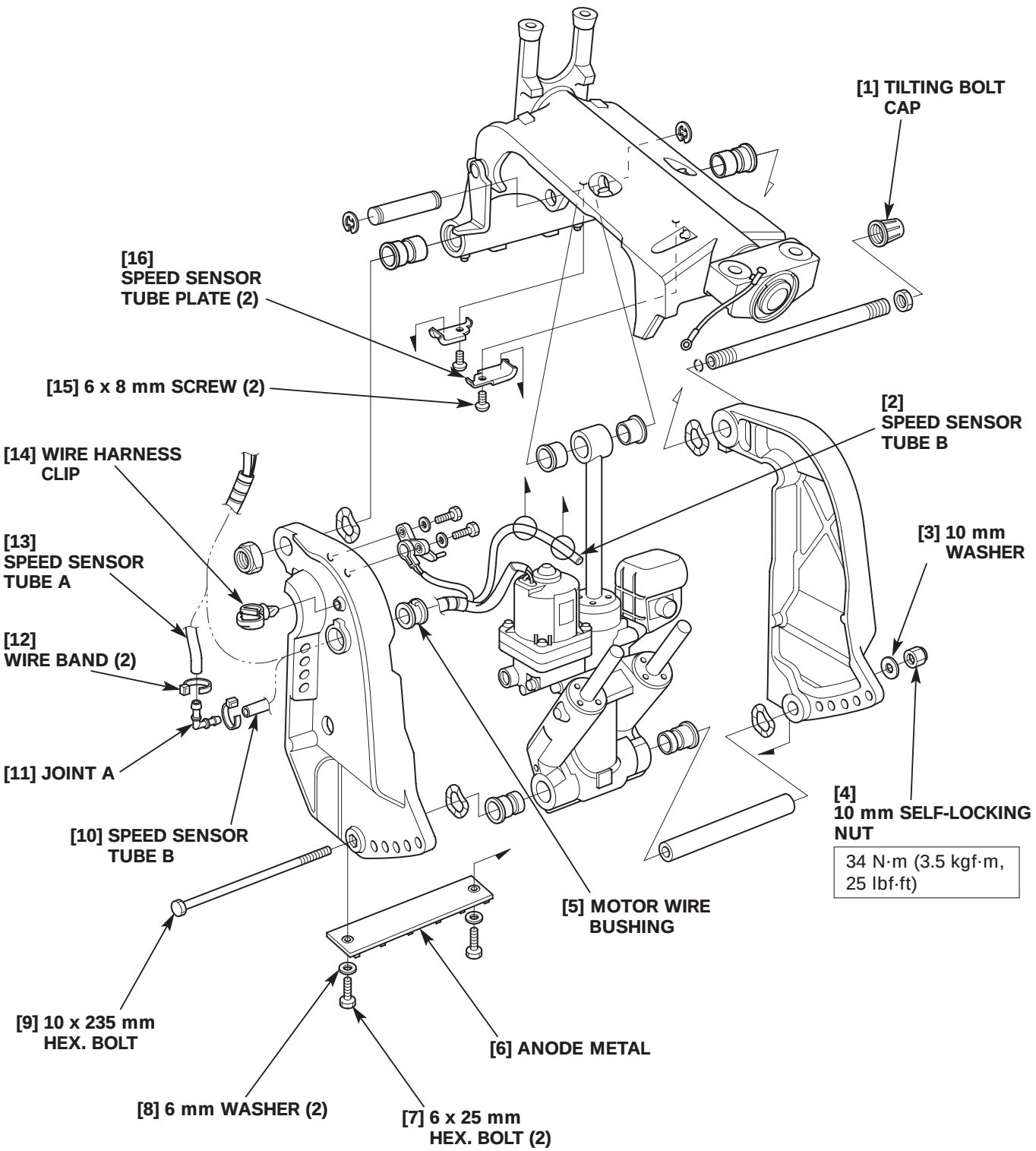
• TRIM ANGLE SENSOR

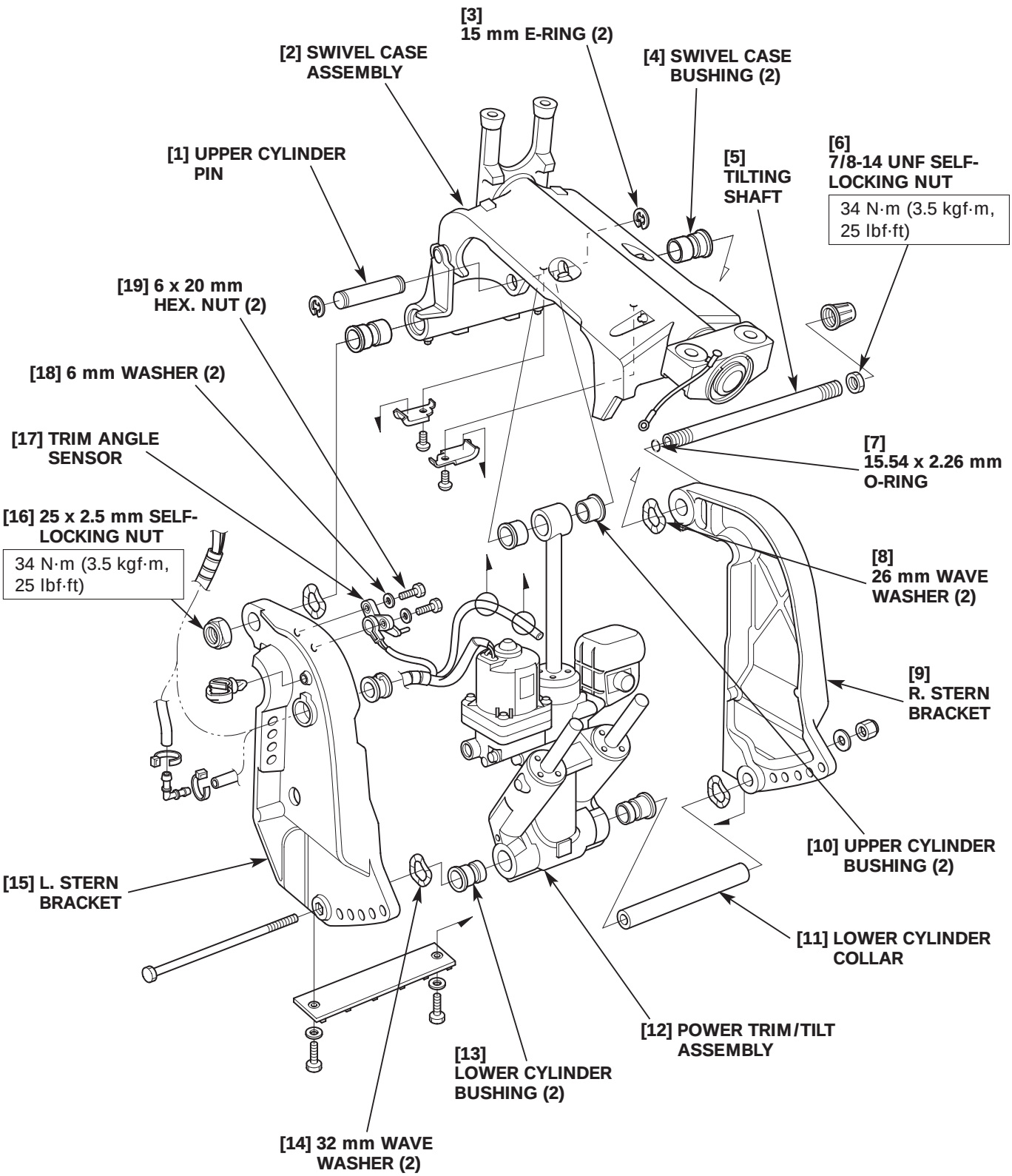
Attach the tester leads to the trim angle sensor connector and measure the resistance.

Resistance between Light green/black and Black	4 – 6 Ω
Resistance between Yellow/blue and Black	2.7 – 4.3 kΩ



c. COMPONENTS DRAWING

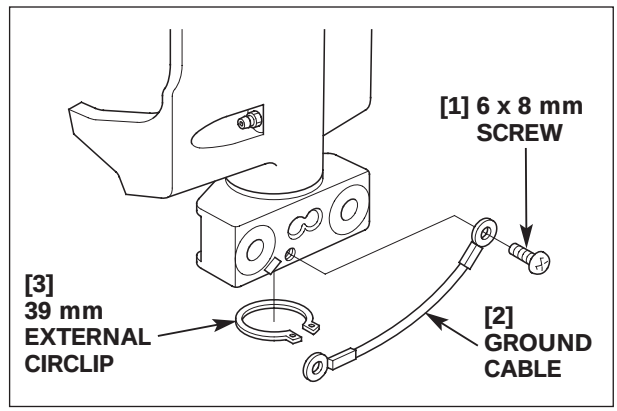



[3]
15 mm E-RING (2)
[2] SWIVEL CASE ASSEMBLY
[4] SWIVEL CASE BUSHING (2)
[1] UPPER CYLINDER PIN
[5] TILTING SHAFT
[6]
7/8-14 UNF SELF-LOCKING NUT
34 N·m (3.5 kgf·m, 25 lbf·ft)
[19] 6 x 20 mm HEX. NUT (2)
[18] 6 mm WASHER (2)
[17] TRIM ANGLE SENSOR
[7]
15.54 x 2.26 mm O-RING
[16] 25 x 2.5 mm SELF-LOCKING NUT
34 N·m (3.5 kgf·m, 25 lbf·ft)
[8]
26 mm WAVE WASHER (2)
[9]
R. STERN BRACKET
[10] UPPER CYLINDER BUSHING (2)
[15] L. STERN BRACKET
[11] LOWER CYLINDER COLLAR
[12] POWER TRIM/TILT ASSEMBLY
[13]
LOWER CYLINDER BUSHING (2)
[14] 32 mm WAVE WASHER (2)

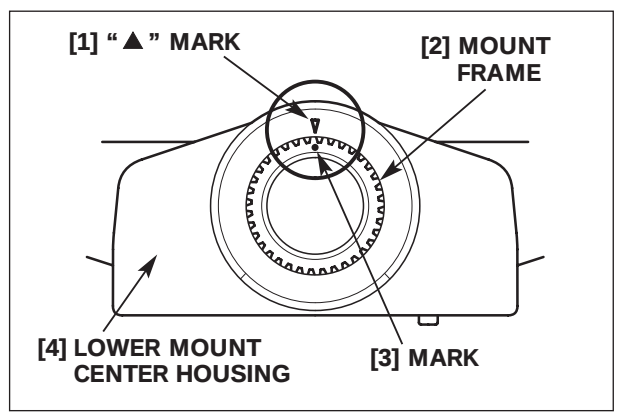
d. SWIVEL CASE ASSEMBLY DISASSEMBLY

1) Remove the 6 x 8 mm screw and the ground cable.

   Remove the 39 mm external circlip.



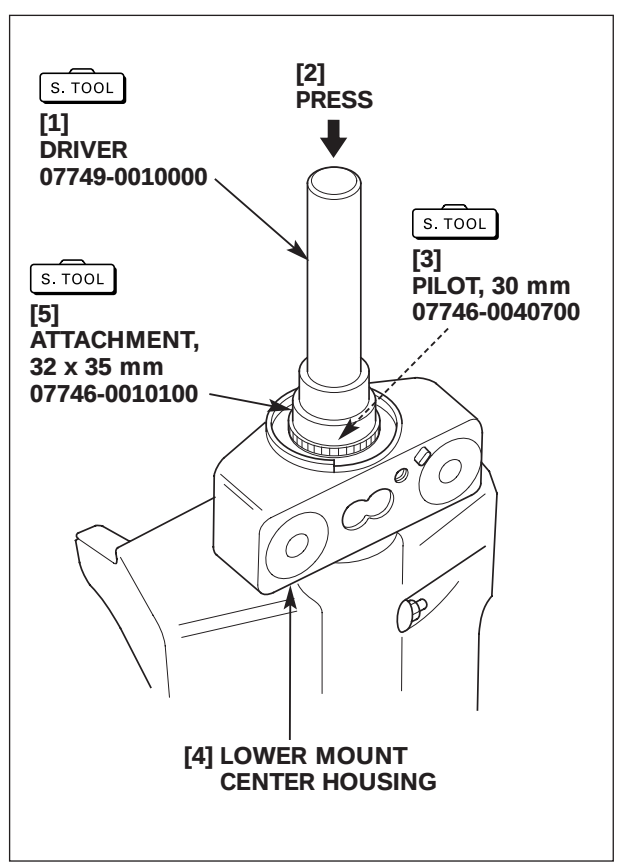
2) Put a mark on the mount frame so it aligns with the "▲" mark on the lower mount center housing.



3) Remove the lower mount center housing using a hydraulic press and the special tools as shown.

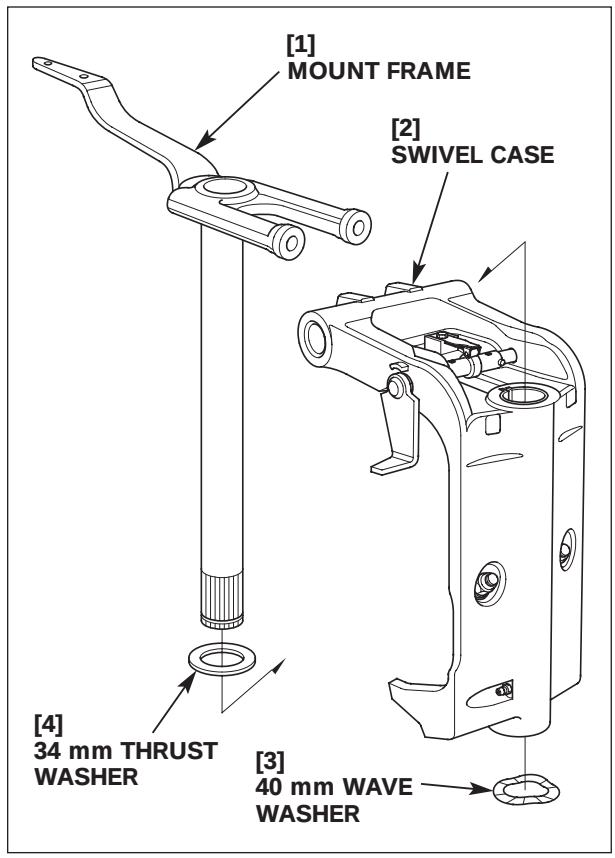
TOOLS:

Driver	**07749-0010000**
Attachment, 32 x 35 mm	**07746-0010100**
Pilot, 30 mm	**07746-0040700**



4) Remove the mount frame and the 34 mm thrust washer from the swivel case.

   Remove the 40 mm wave washer.

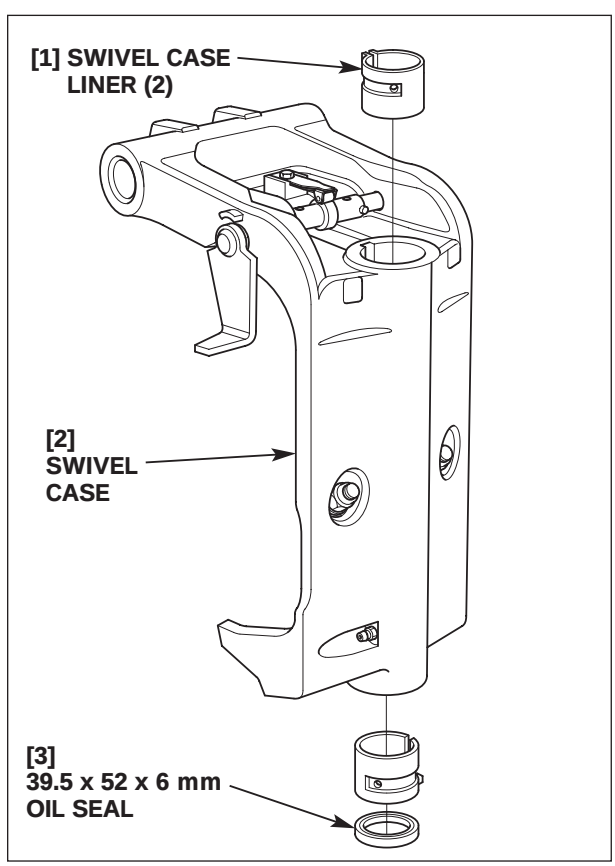


5) Check the 39.5 x 52 x 6 mm oil seal lip for cut and replace if necessary before removing the oil seal.

   Remove the 39.5 x 52 x 6 mm oil seal from the swivel case using a commercially available oil seal remover.

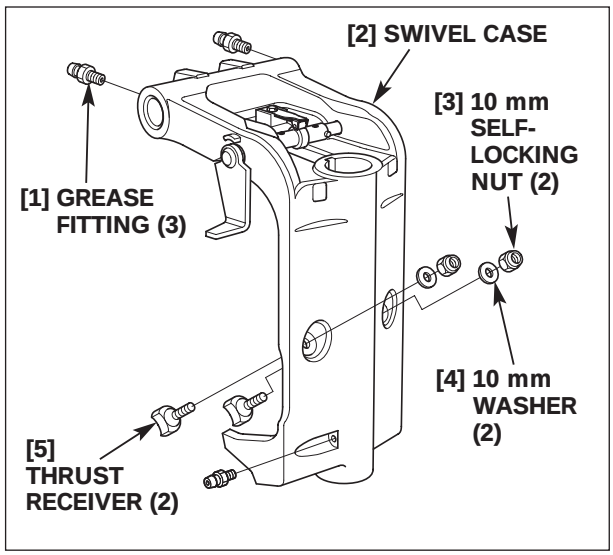
   Replace the oil seal with a new one on assembly.

6) Remove the two swivel case liners from the swivel case.



7) Remove the three grease fittings from the swivel case.

8) Remove the two 10 mm self-locking nuts and the two 10 mm washers, then remove the two thrust receivers.



9) Remove the 6 x 14 mm hex. bolt, and remove the detent assisted spring and the detent spring.

10) Using a commercially available 2.5 mm pin driver, drive out the 2.5 x 20 mm spring pin to the position where it does not interfere with the swivel case as shown.

Remove the driven-out 2.5 x 20 mm spring pin using the cutting pliers or equivalent tool.

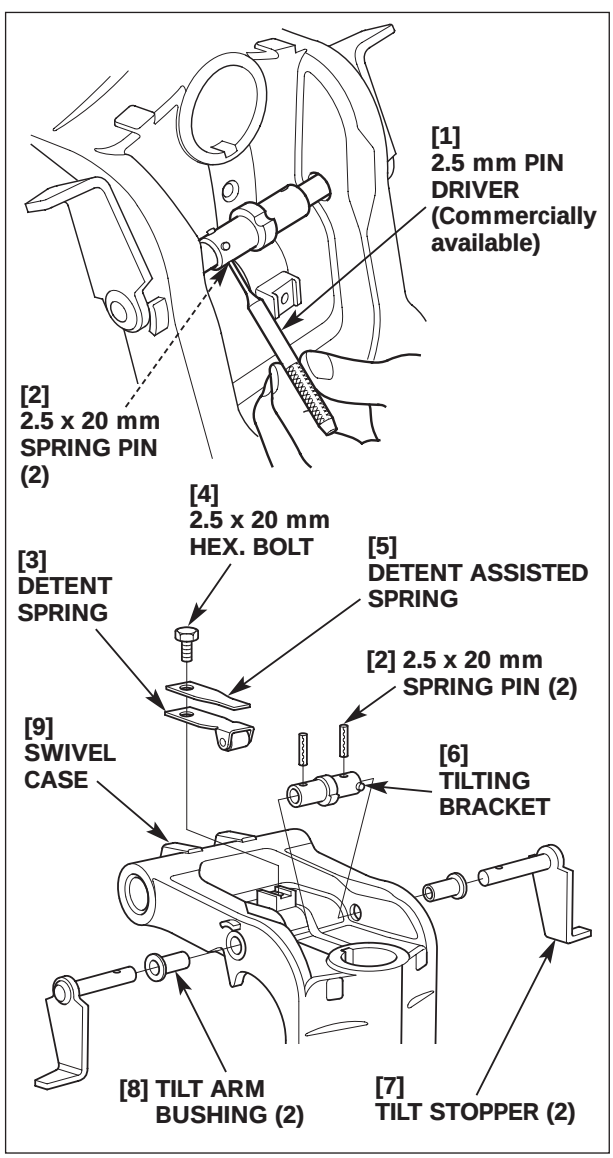
Remove the spring pin on the other side in the same manner.

11) Remove the two tilt stoppers and the tilting bracket.

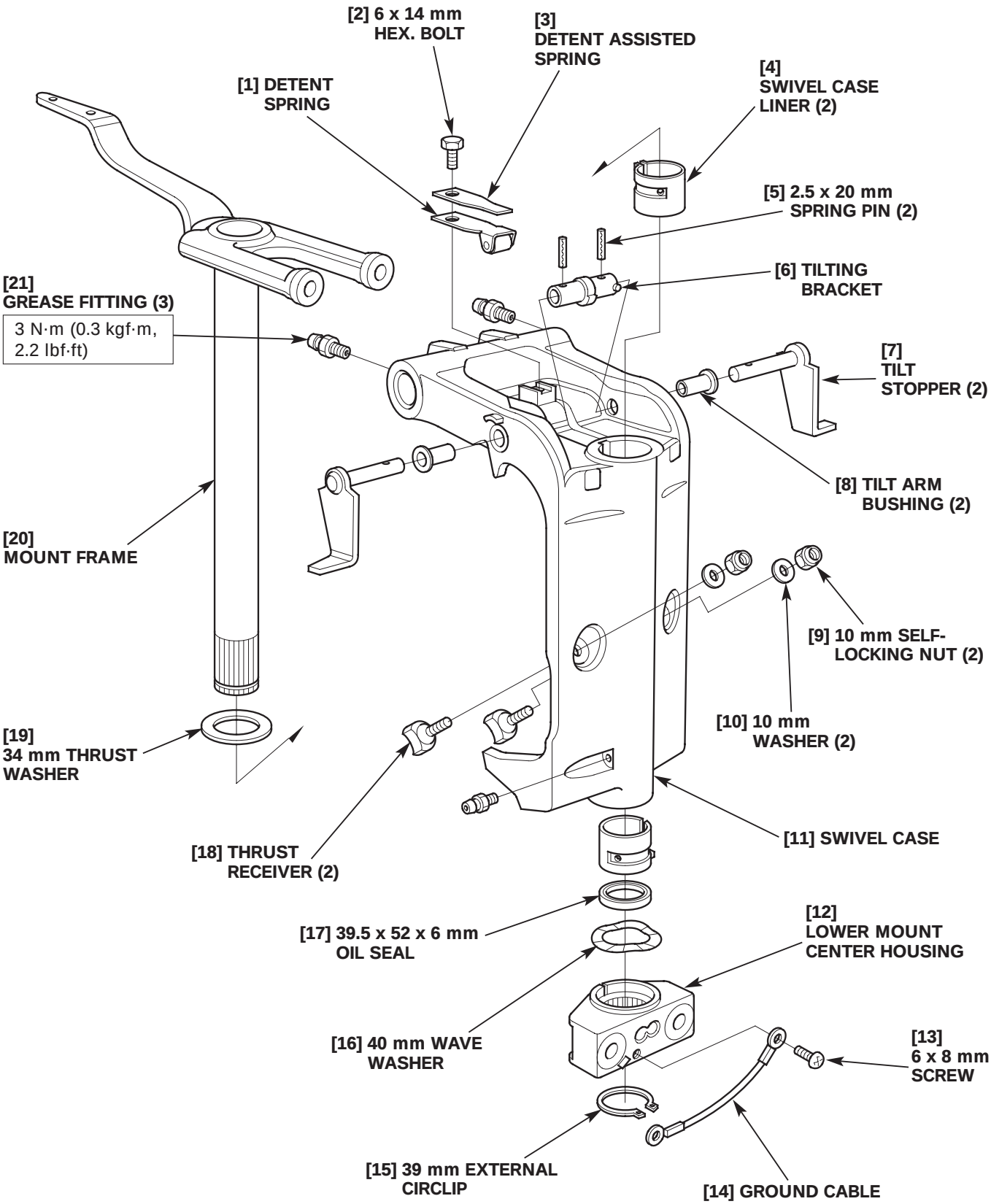
Check the tilt arm bushings mounted on the swivel case. Replace them with the new ones if they are damaged.

12) Remove the tilt arm bushings.

Replace the tilt arm bushings with the new ones on assembly.



e. COMPONENTS DRAWING



f. SWIVEL CASE ASSEMBLY ASSEMBLY

1) Apply grease to the circumference of the new tilt stopper bushings and install them on the swivel case.

2) Install the two tilt stoppers and the tilting bracket on the swivel case.

   Install the tilt stopper in the position shown.

   Check that the projection on the tilting bracket is in the position shown.

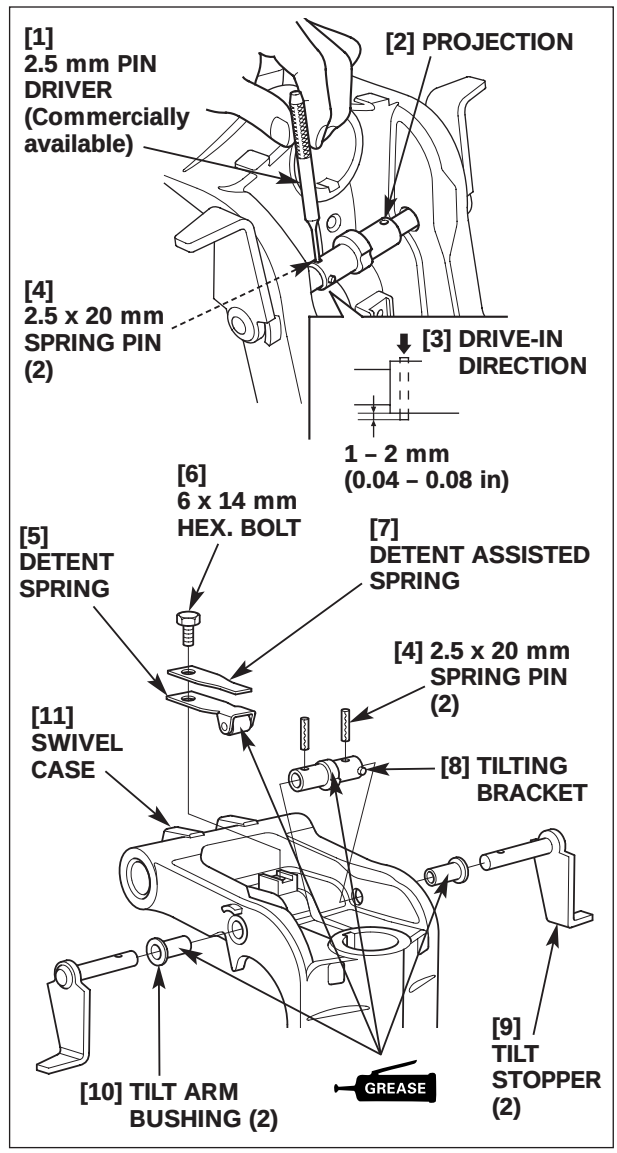
3) Drive the 2.5 x 20 mm spring pins into the tilting bracket using a commercially available 2.5 mm pin driver as shown.

   Check that 1 – 2 mm (0.04 – 0.08 in) of the spring pin end is out of the tilting bracket at the opposite side from the driving side.

   • Do not drive in the spring pins excessively. The tilt stopper cannot operate properly if the extrusion length of the pin is more than 1 – 2 mm (0.04 – 0.08 in).

4) Apply grease to the cam of the tilting bracket.

5) Apply grease to the detent spring roller. Secure the detent spring and the detent assisted spring with the 6 x 14 mm hex. bolt.



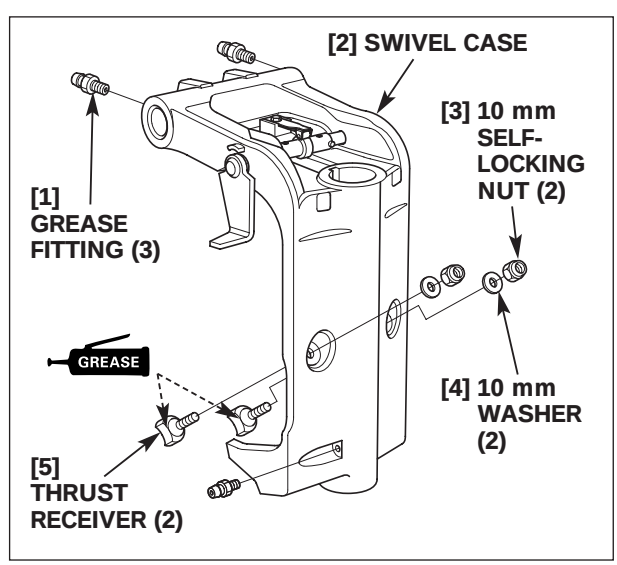
6) Install the two thrust receivers on the swivel case, then install the two 10 mm washers and the two 10 mm self-locking nuts.

   Tighten the 10 mm self-locking nuts securely.

   Apply grease to the sliding surface of the thrust receiver.

7) Set the three grease fittings on the swivel case, and tighten them to the specified torque.

   TORQUE: 3 N·m (0.3 kgf·m, 2.2 lbf·ft)



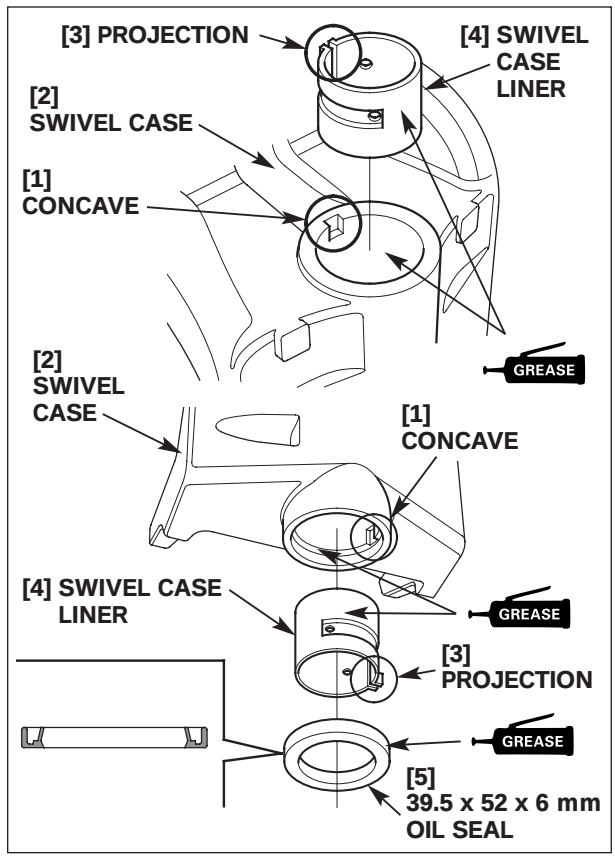
8) Apply grease to the outer surface of the swivel case liner.

   Install the swivel case liner aligning the projection on the swivel case liner with the concave in the swivel case.

9) Apply grease the circumference of the new 39.5 x 52 x 6 mm oil seal and install it in the bottom of the swivel case.

   Note the installation direction of the oil seal.

   Apply grease to the oil seal lip.

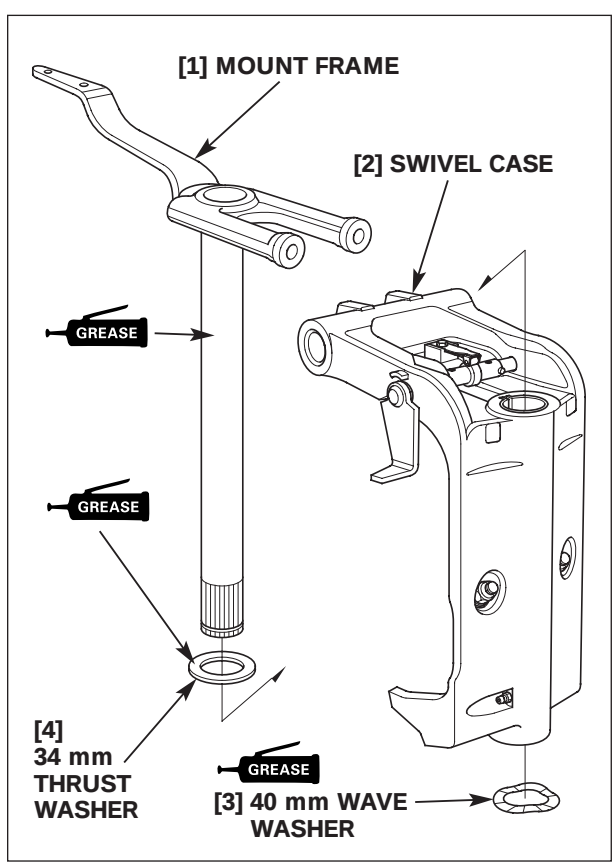


10) Apply grease to the surface of the 34 mm thrust washer and install it on the mount frame.

    Apply grease to the entire surface of the mount frame shaft and install the mount frame on the swivel case.

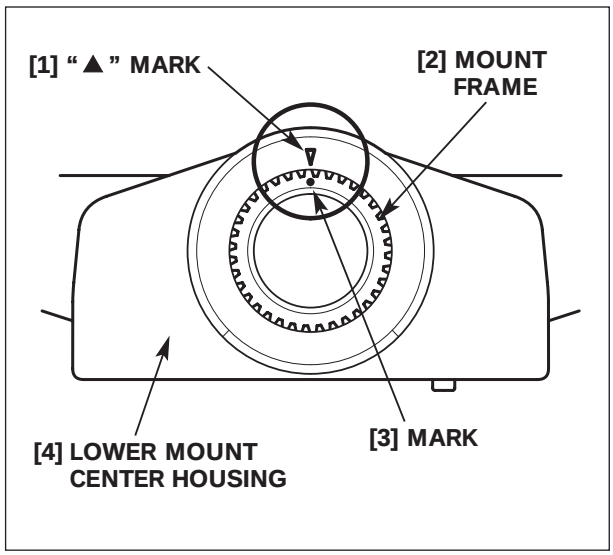
    • Install the mount frame with care not to push the swivel case liner out of the swivel case.

11) Apply grease to the surface of the 40 mm wave washer and install it on the mount frame.



12) Apply grease to the spline of the lower mount center housing.

Install the lower mount center housing on the mount frame aligning the "▲" mark on the lower center housing with the mark on the mount frame that had been put during disassembly.

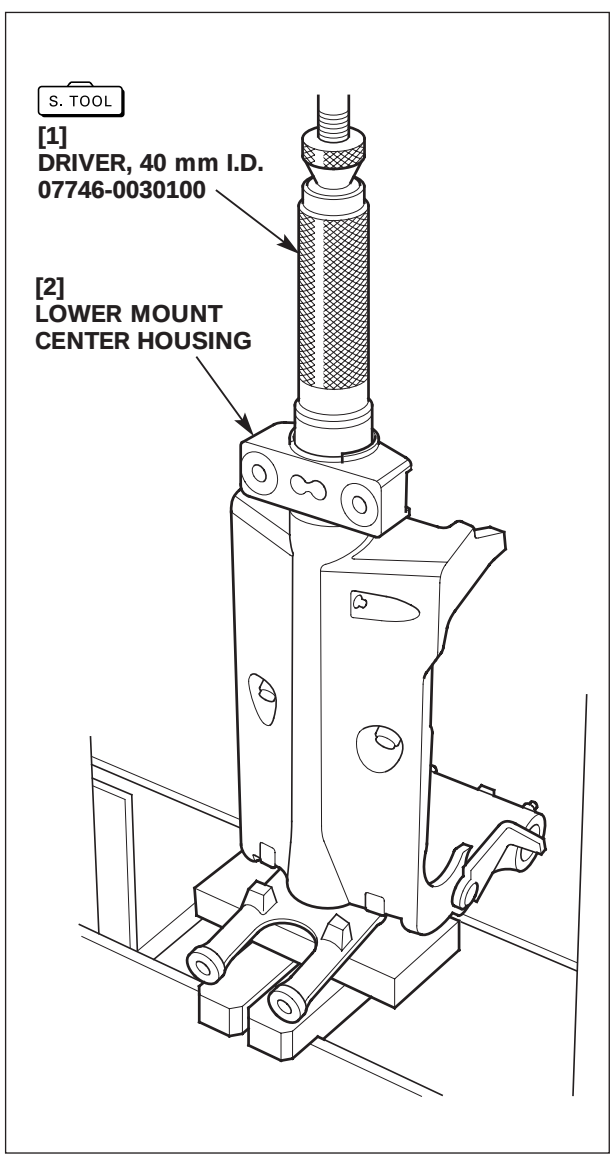


13) Position the swivel case/mount frame on the hydraulic press as shown.

14) Position the special tool on the lower mount center housing as shown.

Press fit the lower mount center housing until it contacts the swivel case (i.e. hydraulic pressure of the hydraulic press rises slightly).

TOOL:
Driver, 40 mm I.D. 07746-0030100



15) Remove the swivel case assembly and the special tool from the hydraulic press.

16) Check that the mount frame turns smoothly.
Check that the 39 mm external circlip sets in position smoothly.

<Mount frame turns smoothly and circlip can be installed>

Install the 39 mm external circlip and apply grease to the part "A" shown in the drawing.

<Circlip can be installed but the mount frame does not turn smoothly>

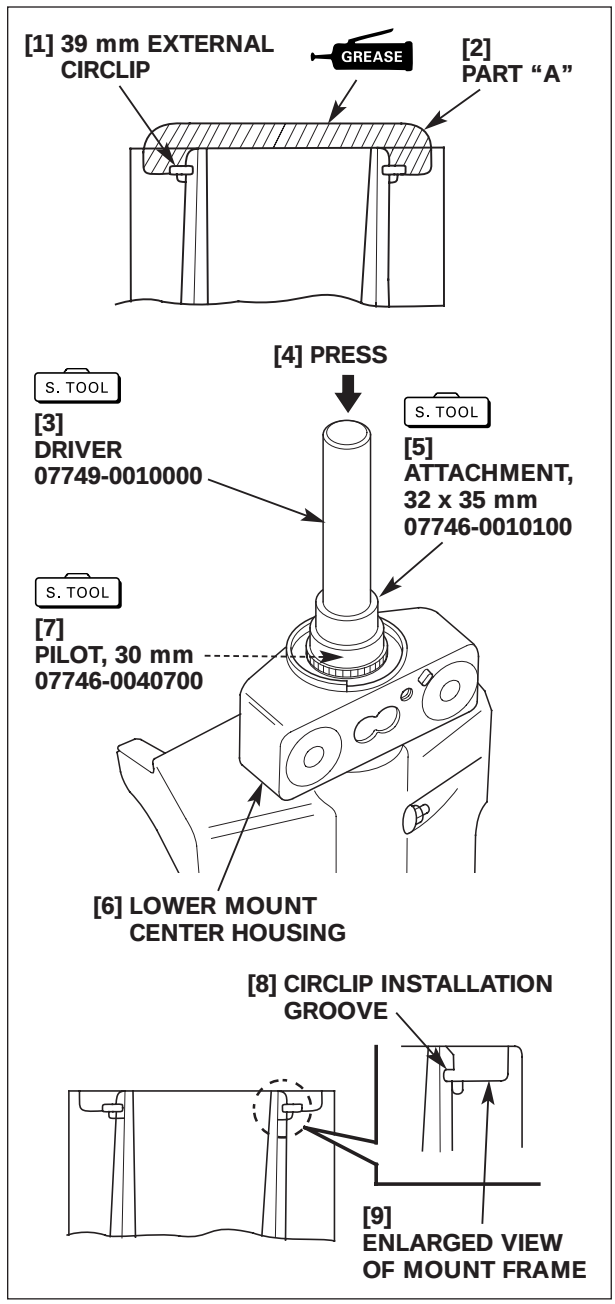
(1) Attach the special tools to the lower mount center housing.

TOOLS:

Driver	**07749-0010000**
Attachment, 32 x 35 mm	**07746-0010100**
Pilot, 30 mm	**07746-0040700**

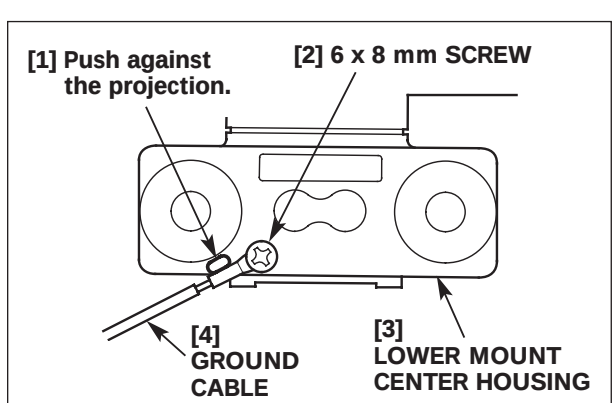
(2) Tighten the puller bolt and align the surface of the lower mount center housing with the circlip installation groove in the mount frame.
Remove the puller and the special tool.

(3) Install the 39 mm external circlip and apply grease to the part "A" shown in the drawing.



17) Tighten the 6 x 8 mm screw while pushing the ground cable against the projection of the lower mount center housing.

18) After assembling the swivel case, fill the grease fittings with the grease using a grease gun.



g. STERN BRACKET/SWIVEL CASE/POWER TRIM/ TILT ASSEMBLY INSTALLATION

• Check that the piston rod of the power trim/tilt assembly is in the fully extended position.

1) Apply grease to the inner wall and circumference of the new swivel case bushings. Install the new swivel case bushings on the swivel case.

2) Apply grease to the new 15.54 x 2.26 mm O-ring and install it in the groove in the tilting shaft.

   Apply grease to the threads and bearing of the tilting shaft.

   Apply grease to the shaft installation parts of the swivel case assembly and of the L./R. stern brackets.

3) Tighten the new 25 x 2.5 mm self-locking nut or the 7/8-14 UNF self-locking nut on the threads at either the right or left end of the tilting shaft.

4) Apply grease to the entire surface of the 26 mm wave washer. Install the stern bracket and the 26 mm wave washer on the end of the tilting shaft where the self-locking nut has been mounted.

   • When the 7/8-14 UNF self-locking nut has been tightened on the tilting shaft, insert the tilting shaft into the R. stern bracket.

5) Pass the tilting shaft through the swivel case assembly and install the 26 mm wave washer and the stern bracket.

6) Loosely tighten the new 25 x 2.0 mm self-locking nut or the 7/8-24 UNF self-locking nut on the tilting shaft. Move the L./R. stern brackets to the self-locking nut side.

   Raise the swivel case assembly to the uppermost position and hold it in the position with the tilt stopper.

   Install the wire harness clip on the L. stern bracket.

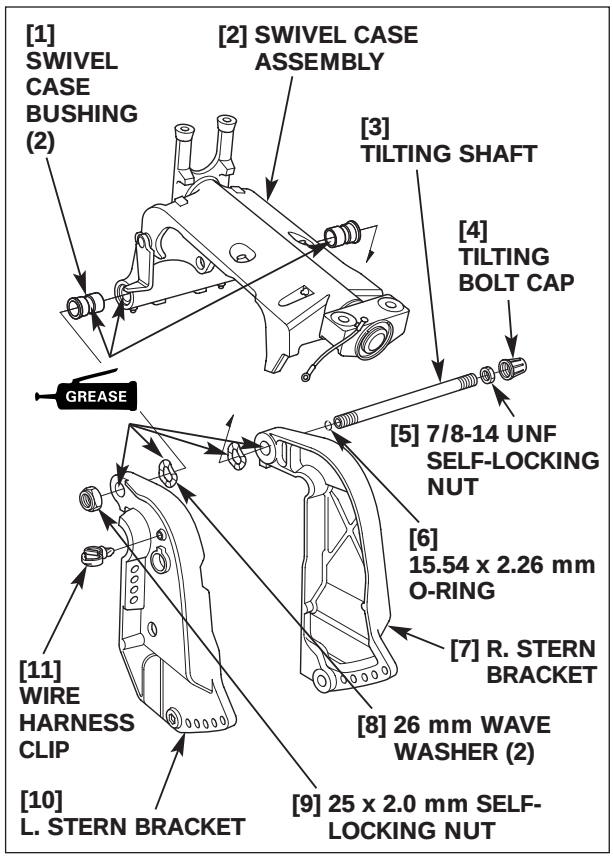
7) Apply grease to the inner wall and circumference of the new lower cylinder bushings and install them on the power trim/tilt assembly.

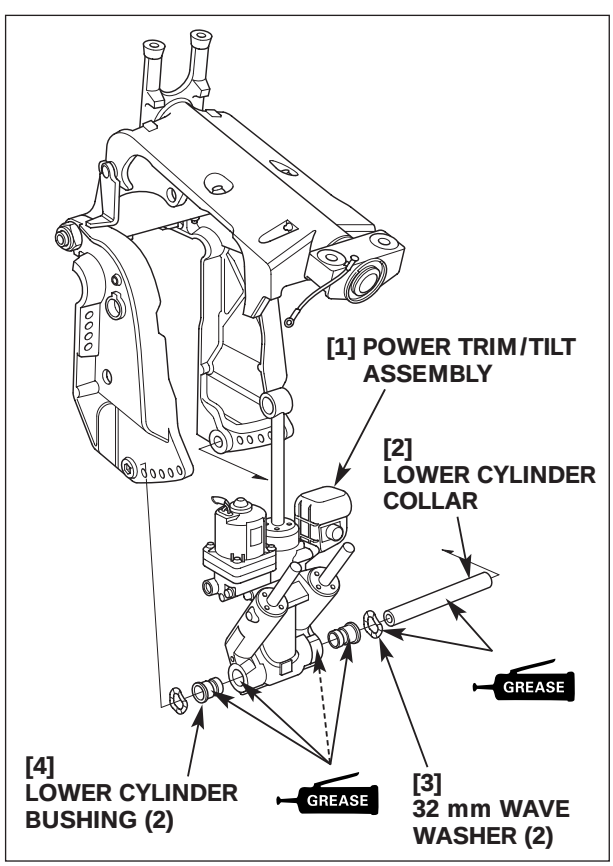
   Apply grease to the circumference of the lower cylinder collar and install it in the power trim/tilt assembly.

   Apply grease to the entire surface of the 26 mm wave washers and install them on the power trim/tilt assembly.

8) Pass the trim angle sensor wire, power tilt motor wire and the speed sensor tube B through the hole in the L. stern bracket.

9) Install the lower cylinder collar, that has been mounted in the power trim/tilt assembly, on the L./R. stern brackets.





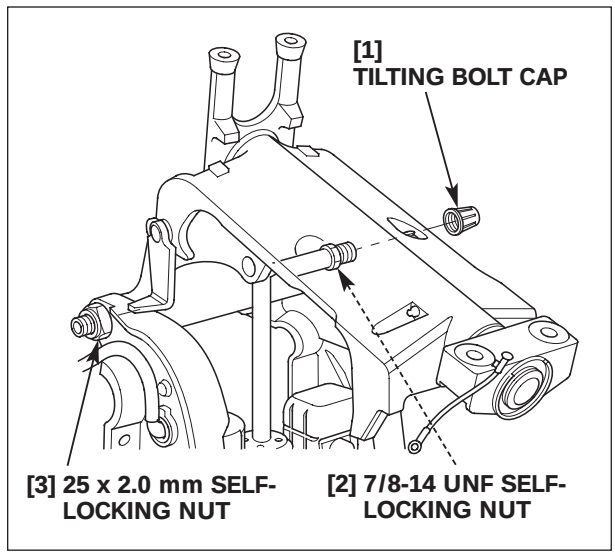
10) Tighten the 25 x 2.0 mm self-locking nut or the 7/8-14 UNF self-locking nut to the specified torque.

TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)

Tighten the 25 x 2.0 mm self-locking nut or the 7/8-14 UNF self-locking nut of the other side to the specified torque.

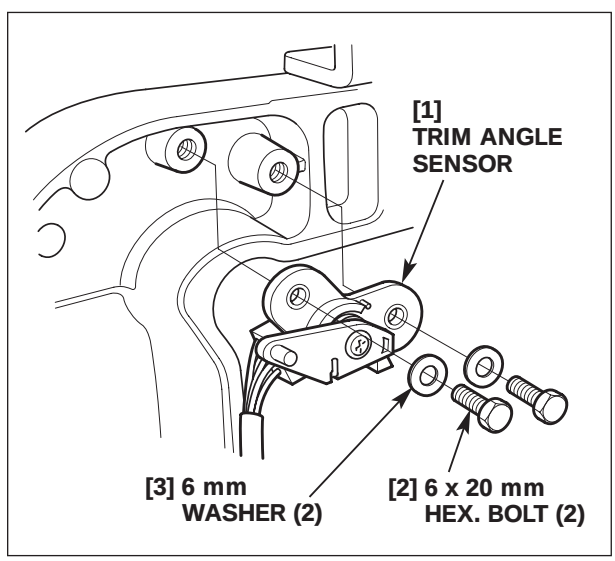
TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)

Tighten the tilting bolt cap on the 7/8-14 UNF self-locking nut.



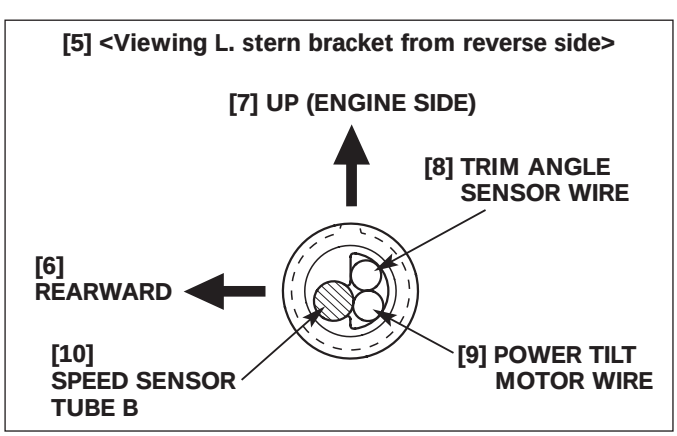
11) Set the two 6 x 20 mm hex. bolts and the two 6 mm washers on the trim angle sensor.

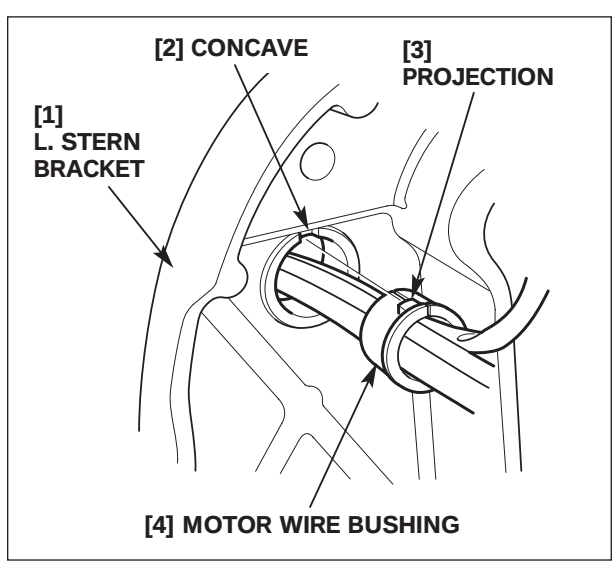
Tighten the two 6 x 20 mm hex. bolts securely.



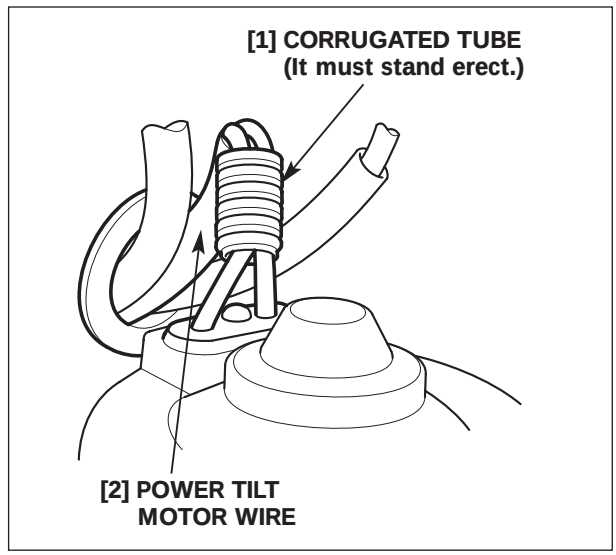
12) Pass the trim angle sensor wire, power tilt motor wire and the speed sensor tube B through the motor wire bushing. Install the motor wire bushing in the L. stern bracket aligning the projection on the motor wire bushing with the concave in the L. stern bracket.

- Check that the speed sensor tube B is at the rear side in the motor wire bushing, compared with the position of the trim angle sensor wire and the power tilt motor wire, by viewing the L. stern bracket from the reverse side.





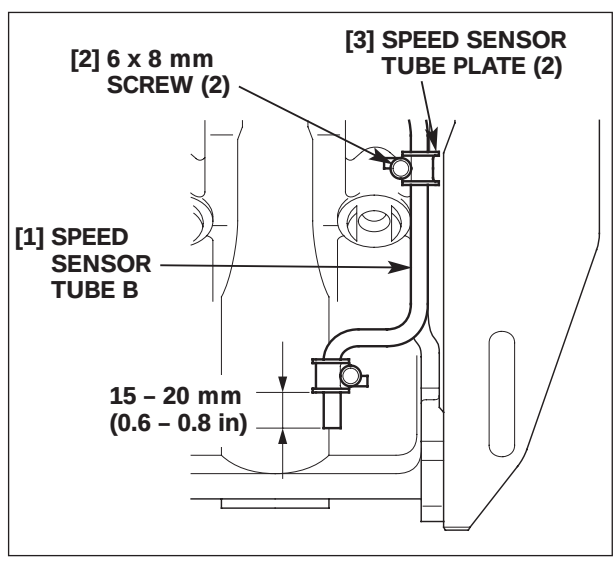
13) Check that the corrugated tube on the power tilt motor wire stands erect as shown.



14) Clamp the speed sensor tube B with the two speed sensor tube plates and loosely tighten the two 6 x 8 mm screws.

15) Tighten the 6 x 8 mm screw securely so that the distance from the gear case side speed sensor tube end to the end of the speed sensor tube plate is 15 – 20 mm (0.6 – 0.8 in) as shown.

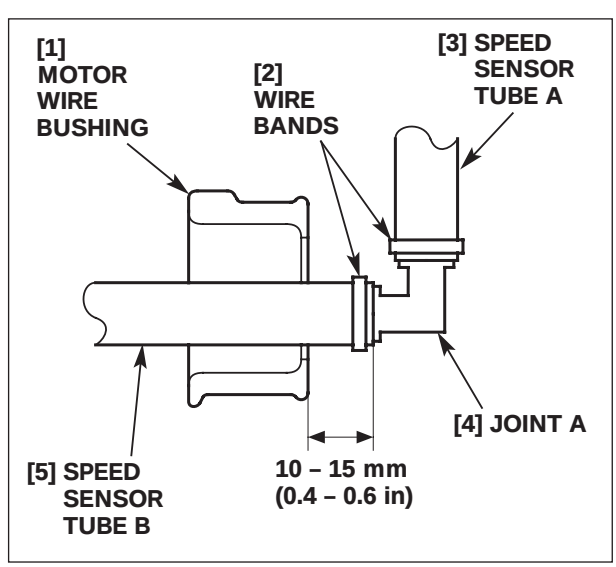
Route the speed sensor tube B on the L. stern bracket and tighten the 6 x 8 mm screw of the upper speed sensor tube plate securely.



16) Connect the speed sensor tube A to the joint A and fasten the new wire band on the speed sensor tube A.

Connect the speed sensor tube B to the joint A and fasten the new wire band on the speed sensor tube B.

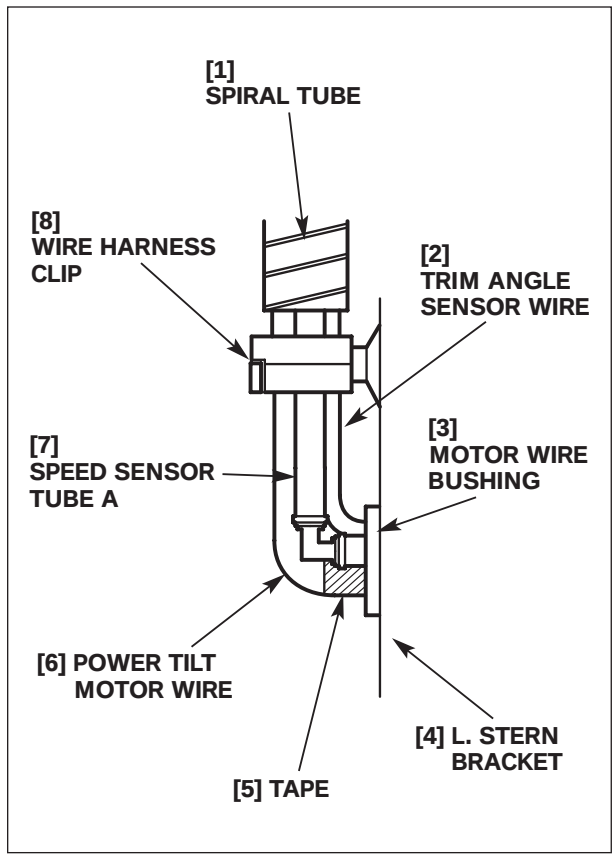
17) Adjust the distance from the end of the motor wire bushing to the end of the speed sensor tube B so that it is 10 – 15 mm (0.4 – 0.6 in) as shown.



18) Wind the spiral tube around the trim angle sensor wire, power tilt motor wire and the speed sensor tube A.

19) Align the taped end of the power tilt motor wire with the end of the motor wire bushing and install.

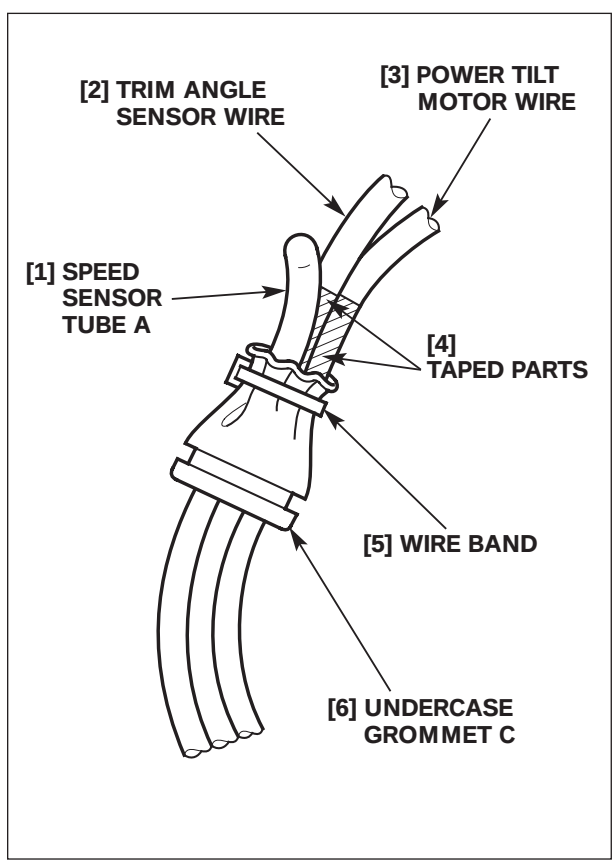
    Clamp the trim angle sensor wire, power tilt motor wire and the speed sensor tube A with the wire harness clip. Avoid clamping on the spiral tube.



20) Pass the trim angle sensor wire, power tilt motor wire and the speed sensor tube A through the undercase grommet C.

21) Align the taped ends of the trim angle sensor wire and the power tilt motor wire with the end of the undercase grommet C, and fasten the new wire band as shown.

    After fastening the wire band, cut the excess of the wire band so that the projected length is 5 – 10 mm (0.2 – 0.4 in) (P. 2-44).

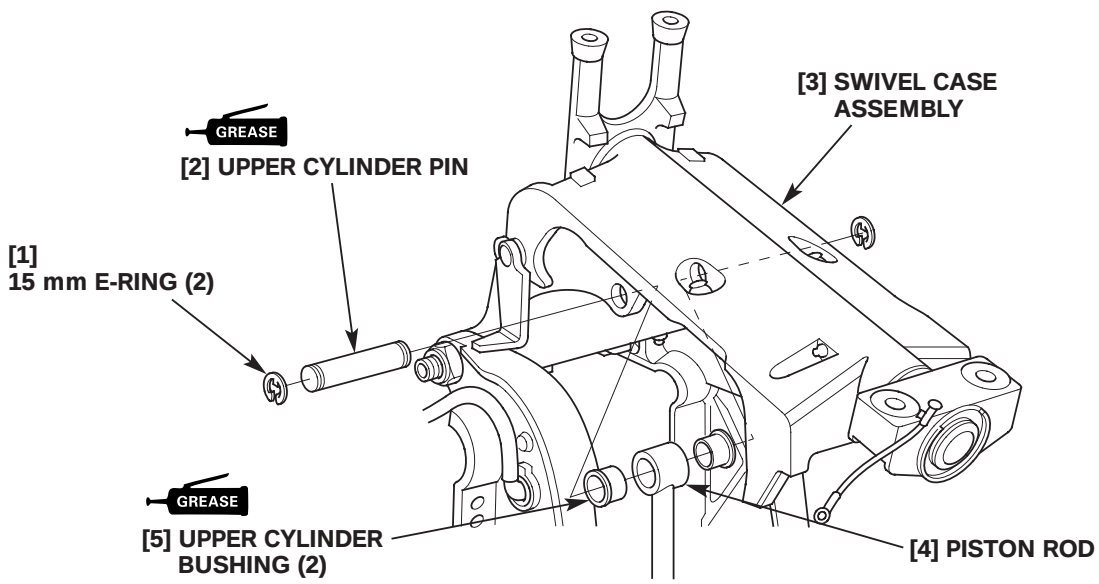


22) Apply grease to the inner wall and circumference of the new upper cylinder bushings and install them on the piston rod of the power trim/tilt assembly.

23) Apply grease to the circumference of the upper cylinder pin.

24) Align the hole in the piston rod with the hole in the swivel case assembly and insert the upper cylinder pin into the swivel case assembly.

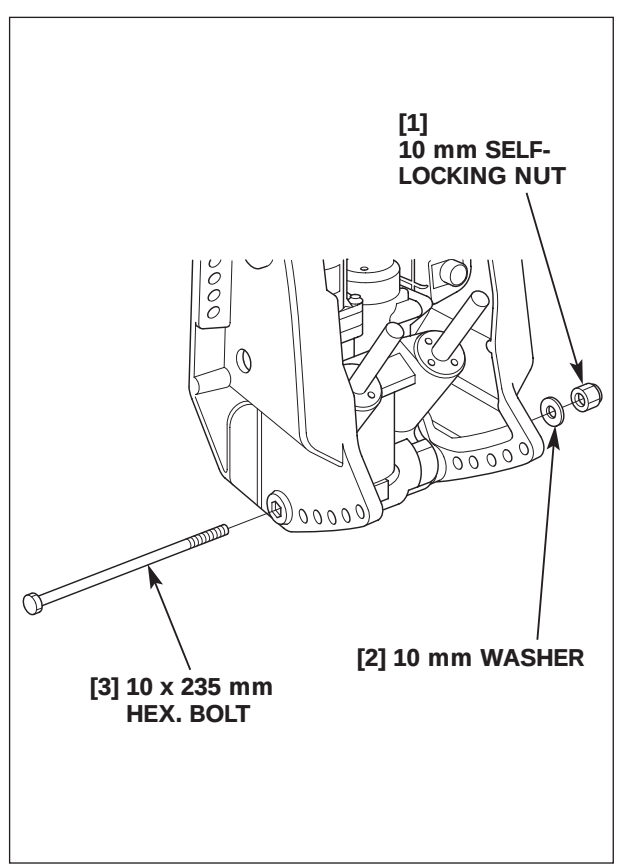
Install the two 15 mm E-rings on the upper cylinder pin.



25) Insert the 10 x 235 mm hex. bolt from the L. stern bracket side and set the 10 mm washer.

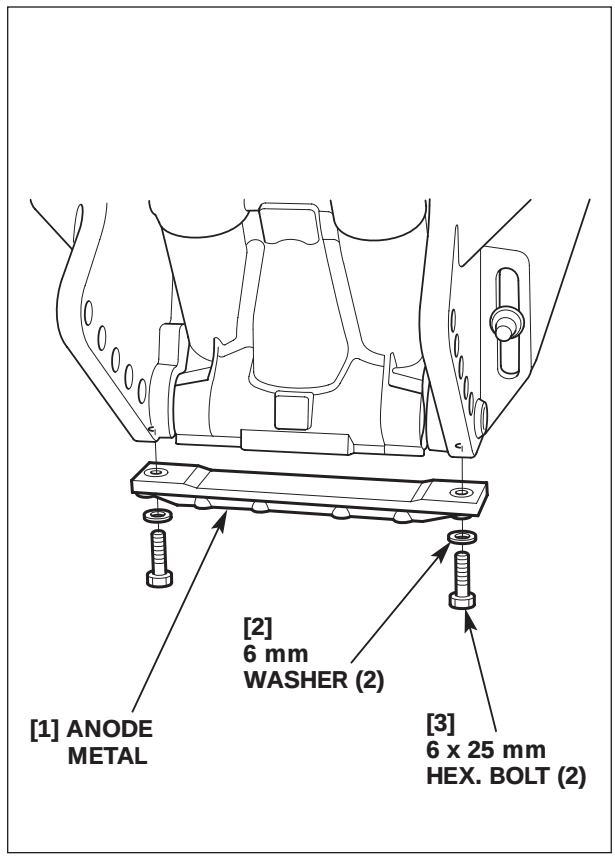
Tighten the 10 mm self-locking nut to the specified torque.

TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)



26) Check the anode metal for corrosion and replace with a new one if necessary.

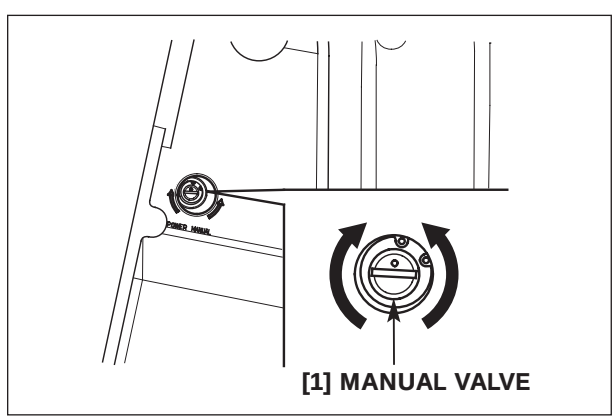
Tighten the anode metal with the two 6 x 25 mm hex. bolts securely.



27) If the manual valve is tightened, loosen it fully.

Raise the swivel case assembly a little, unlock the tilt stopper and lower the swivel case assembly to the lowermost position.

28) Remove the following parts.
- Stern bracket/swivel case (P. 15-12)
- Gear case assembly (P. 14-5 and 44)
- L./R. engine under covers (P. 4-14)
- Engine cover (P. 4-2)



4. POWER TRIM/TILT ASSEMBLY

a. REMOVAL

Remove the stern bracket, swivel case and the power trim/tilt assembly (P. 15-14).

b. DISASSEMBLY

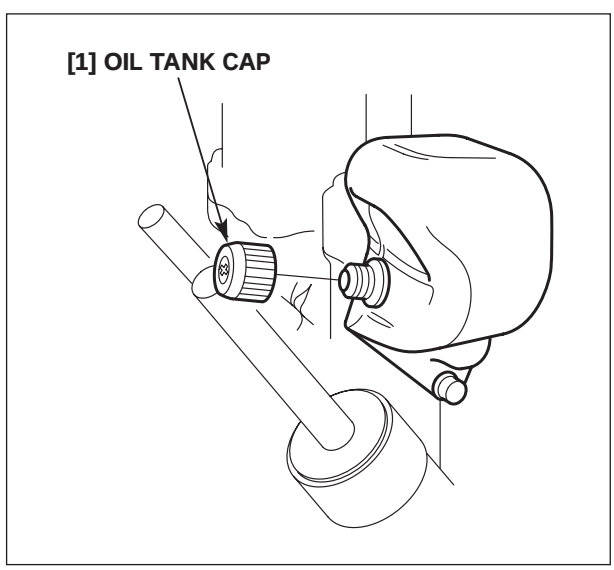
- Do not reuse the O-rings.
- Do not try to disassemble the pump assembly. Replace the pump assembly as an assembly if it is faulty.
- Do not use a shop towel or equivalent cloth, and do not wear the gloves during this operation.
- Do not reuse the drained Automatic Transmission Fluid (ATF).
- When the operation is made by holding the cylinder comp. in a vice, do not tighten the vice excessively. It can damage the cylinder comp.
- Clean the disassembled parts with the fresh Automatic Transmission Fluid (ATF) and blow the parts with compressed air to remove dust and dirt. Store the parts neatly keeping them off dust, dirt, oil/grease, etc.
- Remove the piston rod comp. and the piston rod B with care not to damage the sliding surface of the parts.

With the power trim/tilt assembly removed from the outboard motor, connect the power tilt motor 2P connector and operate the power tilt motor until the piston rod comp. and the piston rod B reach the fully extended position.

1) Remove the oil tank cap.

   Drain the Automatic Transmission Fluid (ATF) from the oil tank.

   - Do not drain the Automatic Transmission Fluid (ATF) by pushing the piston rod comp. in.



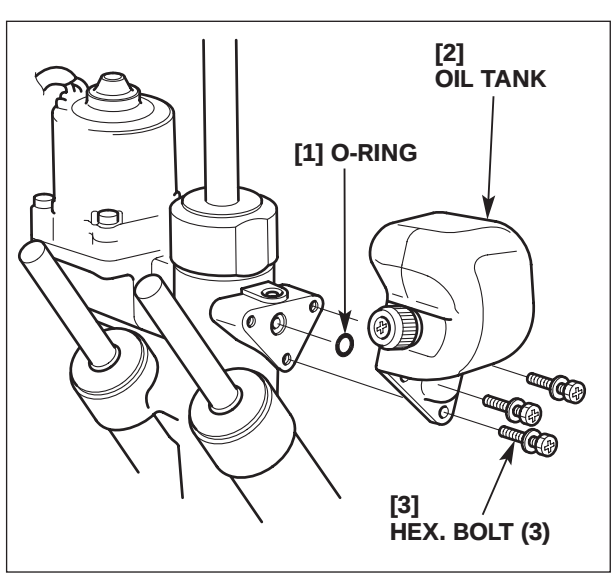
2) Loosely tighten the oil tank cap on the oil tank.

   Remove the three hex. bolts and remove the oil tank from the cylinder comp.

   Drain the Automatic Transmission Fluid (ATF) from the oil tank.

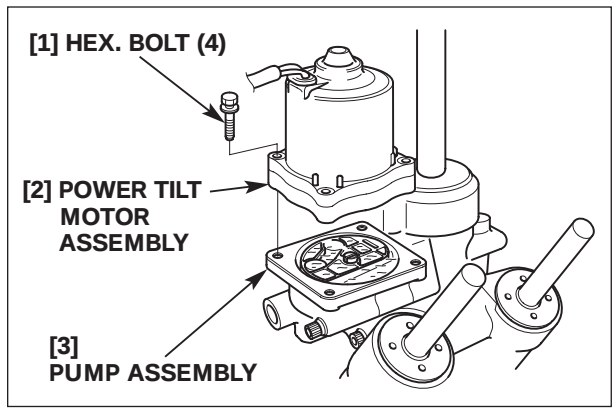
3) Remove the O-ring from the cylinder comp.

   Replace the O-ring with a new one on assembly.



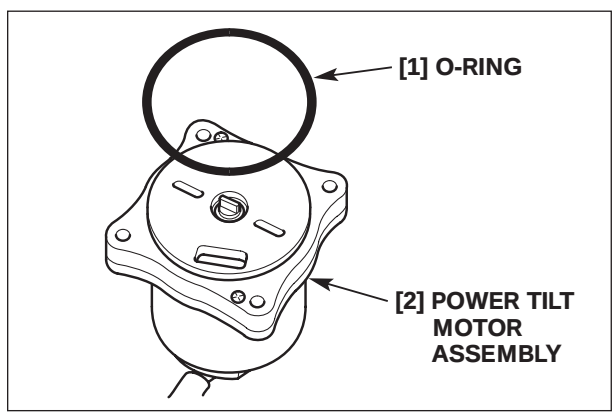
4) Remove the four hex. bolts and remove the power tilt motor assembly from the pump assembly.

   Drain the Automatic Transmission Fluid (ATF) from the pump assembly.



5) Remove the O-ring from the power tilt motor assembly.

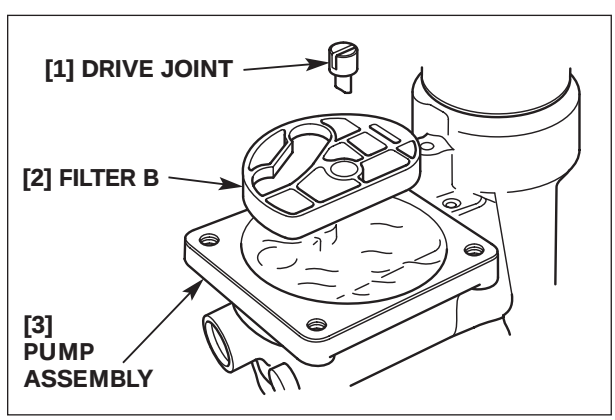
   Replace the O-ring with a new one on assembly.



6) Remove the drive joint and the filter B from the pump assembly.

   Check the mesh of the filter B for blockage and tear. If it is torn, replace the filter B with a new one. If it is clogged with dust and dirt, blow the mesh with air to remove the blockage. Take care not to damage the mesh.

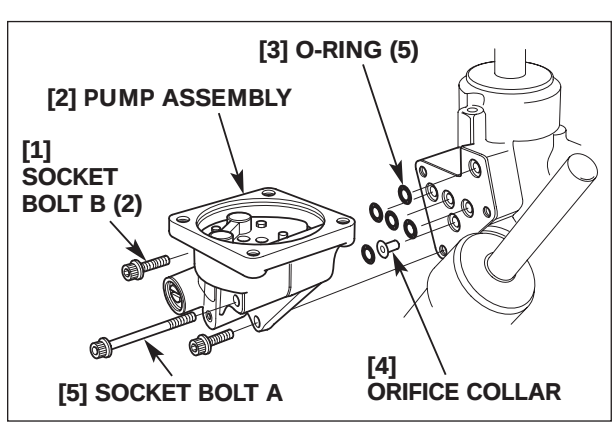
   Drain the residual Automatic Transmission Fluid (ATF) from the pump assembly.



7) Remove the socket bolt A and Bs, and remove the pump assembly from the cylinder comp.

   Remove the five O-rings and orifice collar from the cylinder comp.

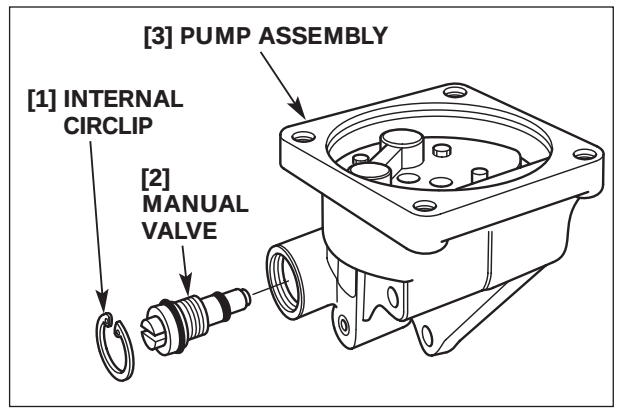
   Replace the O-rings with the new ones on assembly.



8) Remove the internal circlip and remove the manual valve from the pump assembly.

   Check the manual valve and the O-ring for deterioration, wear and damage. Replace them if necessary.

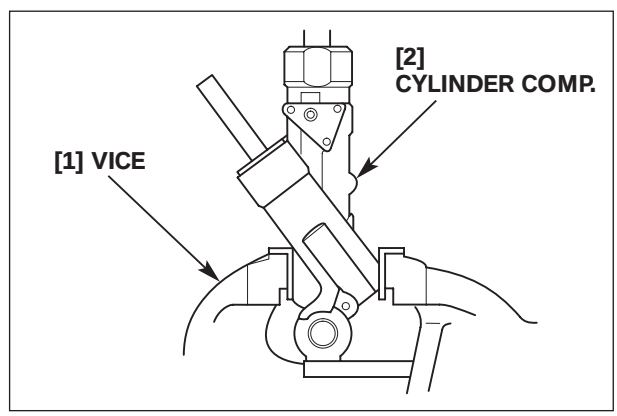
   Replace the manual valve with a new one on assembly.



9) Set the cylinder comp. in a vice as shown.

   NOTICE

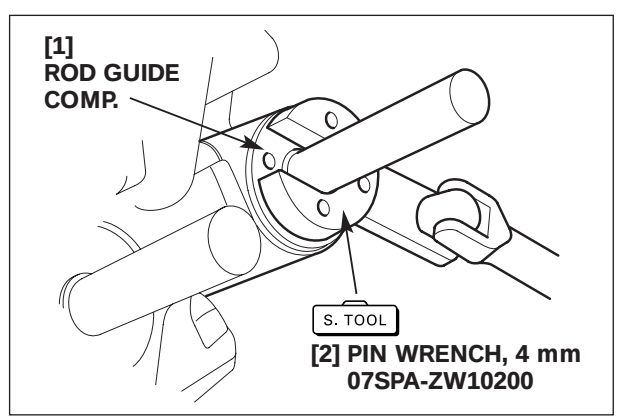
   Do not tighten the vice excessively, as it can damage the cylinder comp.



10) Check that the left and right piston rods are in the fully extended position.

11) Loosen the rod guide comp. fully using the special tool as shown.

   TOOL:
   Pin wrench, 4 mm **07SPA-ZW10200**

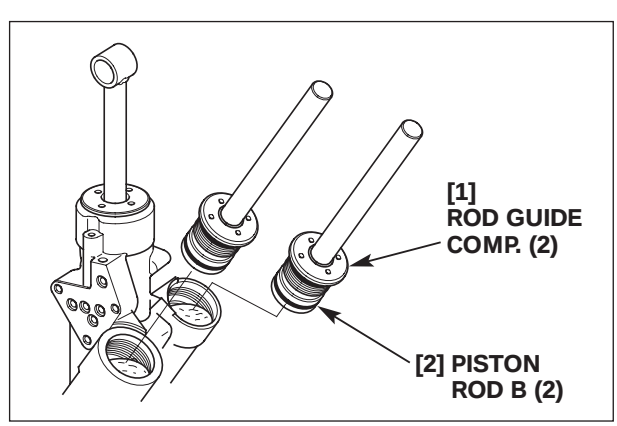


12) Remove the rod guide comp. and the piston rod Bs from the trim cylinders slowly.

   • Do not push the piston rod Bs into the trim cylinders.

13) Drain the Automatic Transmission Fluid (ATF) from the trim cylinders.

   Remove the rod guide comps from the piston rod B.



14) Remove the O-ring from the rod guide comp.

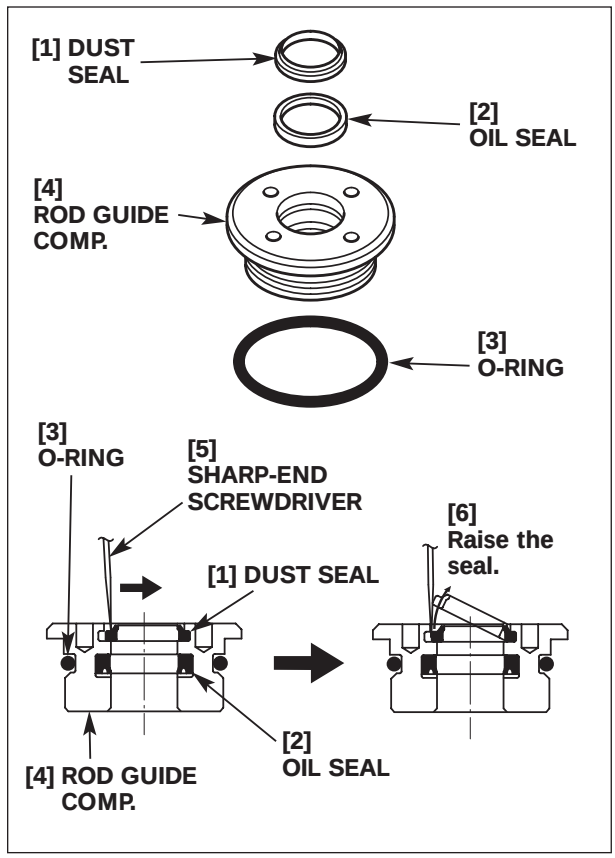
Replace the O-ring with a new one on assembly.

15) Insert a sharp-end screwdriver into the gap between the dust seal and the rod guide comp. Raise the dust seal and remove it from the rod guide comp.

Remove the oil seal in the rod guide comp. in the same manner.

Replace the dust seal and the oil seal with the new ones on assembly.

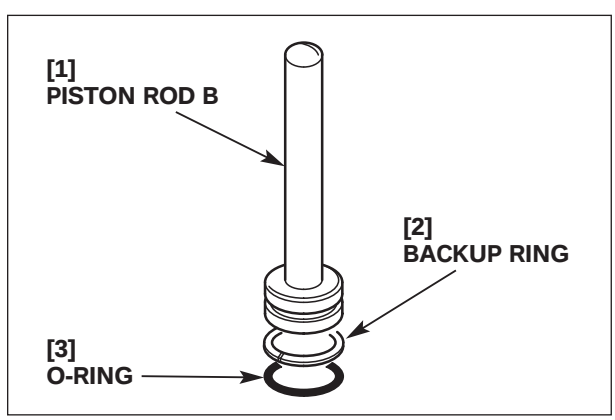
- Take care not to damage inside the rod guide comp. during this operation.



16) Remove the backup ring and the O-ring from the piston rod B.

Replace the backup ring and the O-ring with the new ones as a set on assembly.

17) Check the piston rod B. If it is scored or scratched, or if the rod is bent, replace the piston rod B with a new one.

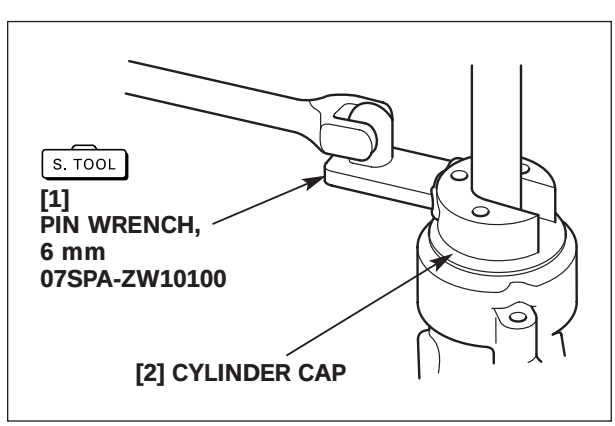


18) Hold the cylinder comp. in a vice (P. 15-38).

19) Check that the piston rod comp. is in the fully extended position.

20) Using the special tool, loosen the cylinder cap fully as shown.

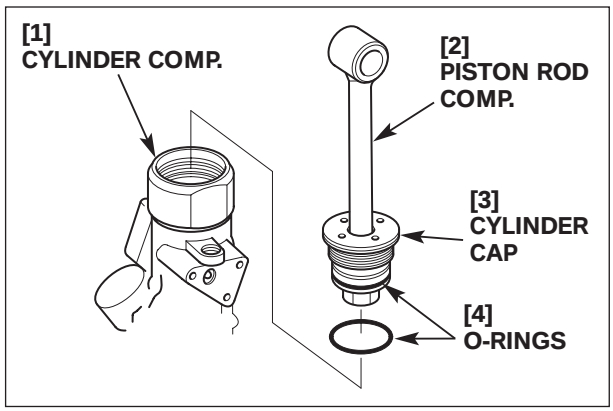
TOOL:
Pin wrench, 6 mm **07SPA-ZW10100**



21) Remove the piston rod comp. from the cylinder comp.

22) Remove the O-rings from the cylinder cap and the piston rod comp.

Replace the O-rings with the new ones on assembly.



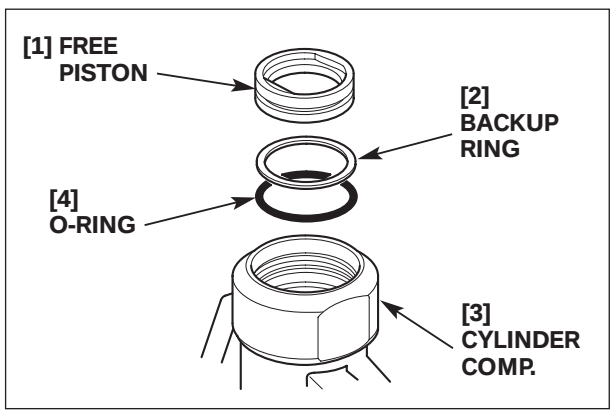
23) Remove the free piston from the cylinder comp.

Check the sliding surface of the free piston for wear and damage. Replace the free piston if necessary.

24) Remove the backup ring and the O-ring from the free piston.

Replace the backup ring and the O-ring as a set on assembly.

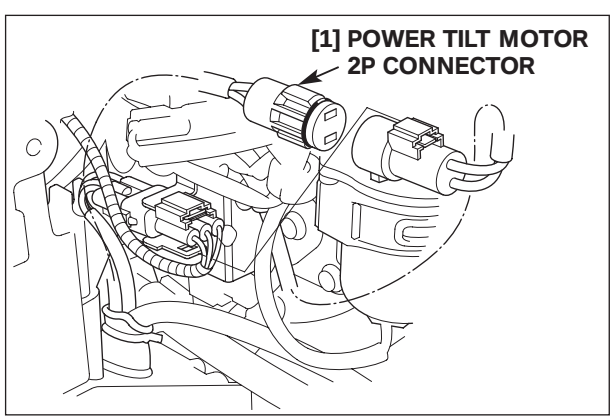
Drain the residual Automatic Transmission Fluid (ATF) from the cylinder comp.



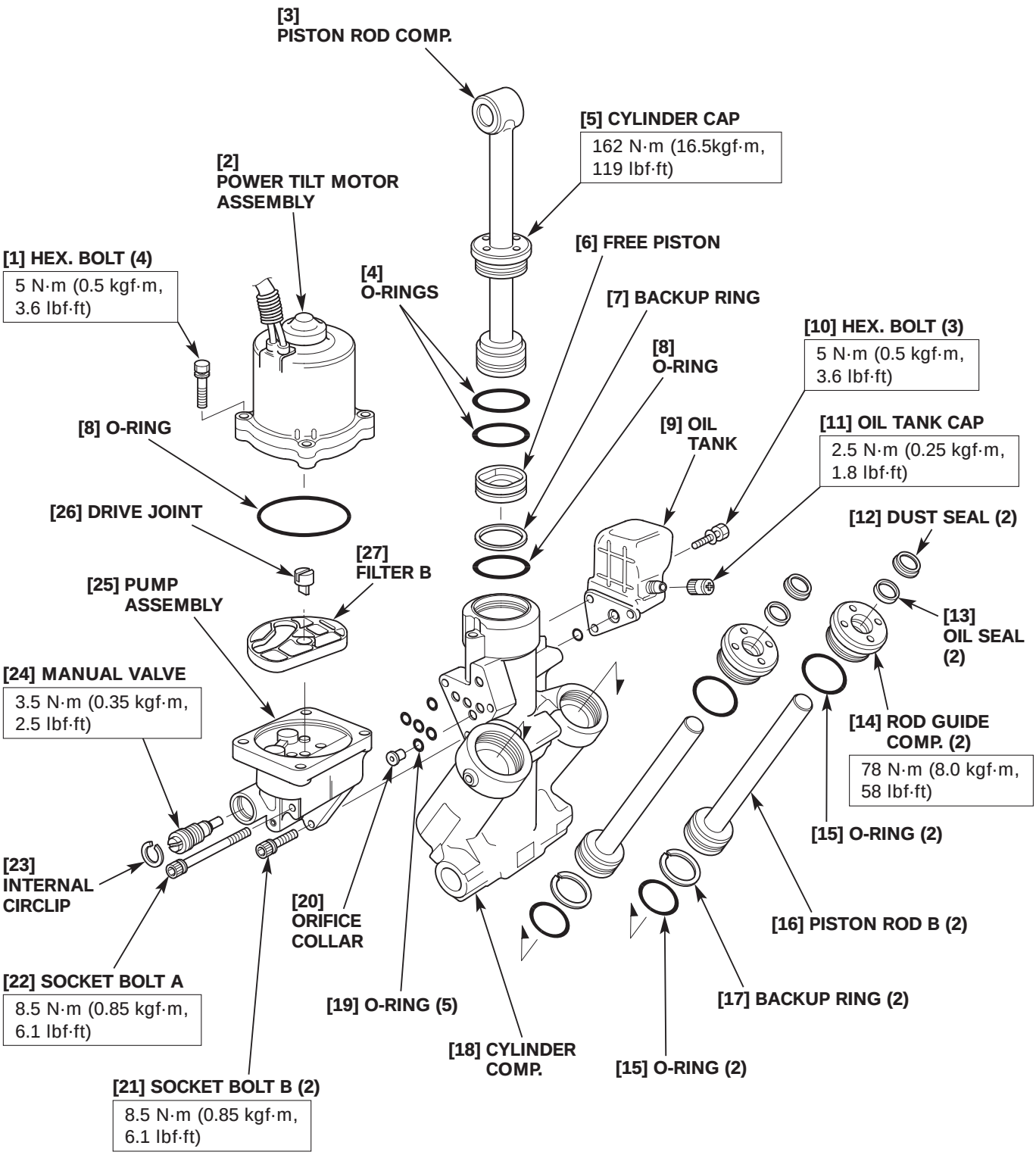
c. INSPECTION

• POWER TILT MOTOR

Check for continuity between the terminals.



d. COMPONENTS DRAWING



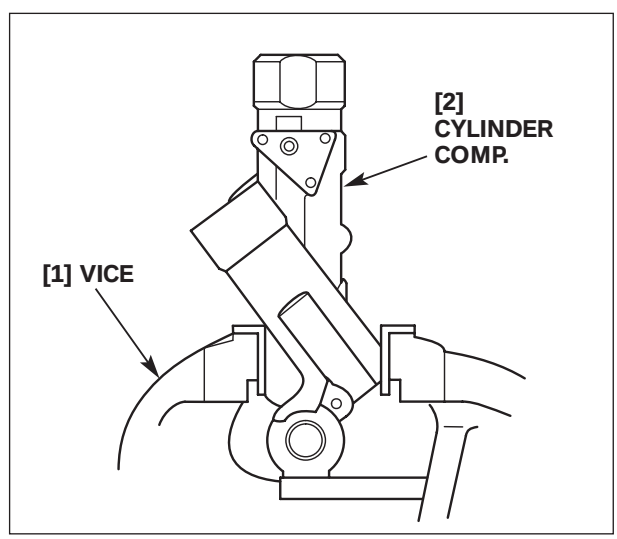
e. ASSEMBLY

- Do not reuse the O-rings.
- Do not use a shop towel or equivalent cloth, and do not wear the gloves during this operation.
- Do not reuse the drained Automatic Transmission Fluid (ATF).
- When the operation is made by holding the cylinder comp. in a vice, do not tighten the vice excessively. It can damage the cylinder comp.
- Add the Automatic Transmission Fluid (ATF) slowly.
- Assemble the power trim/tilt assembly with the piston rod comp. and the piston rod B fully extended. Do not push in the piston rod comp. and the piston rod B.
- Do not allow the dust, dirt and other foreign material enter the cylinder comp. and the pump assembly during assembly.
- Clean the parts with the fresh Automatic Transmission Fluid (ATF) and blow each port with compressed air to remove dust and dirt. Check that the parts are clean before assembly.
- 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. in a vice as shown.

NOTICE

Do not tighten the vice excessively as it can damage the cylinder comp.



2) Pour approximately 30 cm^3(1.0 fl oz.) of the Automatic Transmission Fluid (ATF) in the piston rod chamber of the cylinder comp.

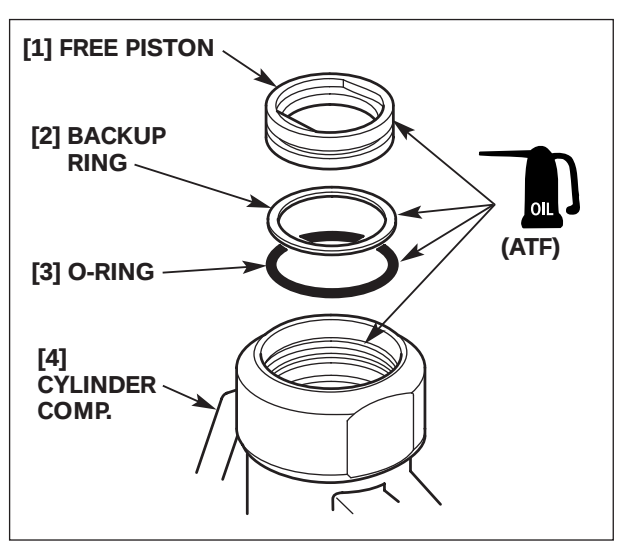
Recommended oil	Genuine Honda Automatic Transmission Fluid (ATF) DEXRON® or equivalent.

3) Apply Automatic Transmission Fluid (ATF) to the new O-ring and the backup ring. Install the O-ring and backup ring on the free piston.

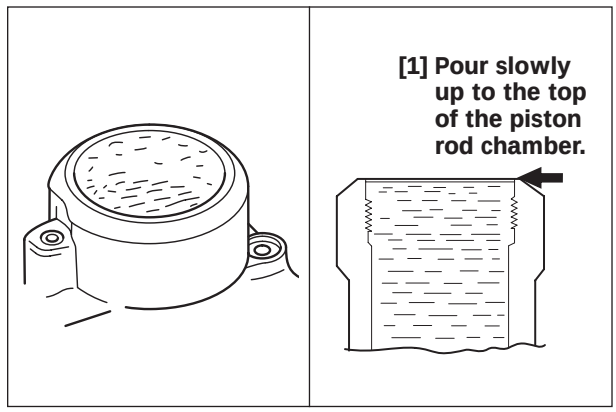
4) Apply Automatic Transmission Fluid (ATF) to the circumference of the free piston and push it in the piston rod chamber slowly until it bottoms out.

NOTICE

Install the backup ring on the free piston with care not to break it.



5) After installing the free piston, pour the fresh Automatic Transmission Fluid (ATF) slowly up to the top of the piston rod chamber of the cylinder comp.



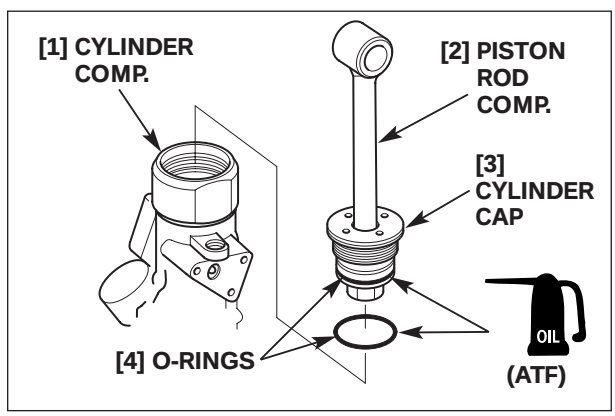
6) Apply Automatic Transmission Fluid (ATF) to the new O-ring and install it on the piston rod comp.

7) Apply Automatic Transmission Fluid (ATF) to the new O-ring and install it on the cylinder cap.

8) With the piston rod comp. fully extended, install the piston rod comp. slowly in the piston rod chamber of the cylinder comp.

   Loosely tighten the cylinder cap.

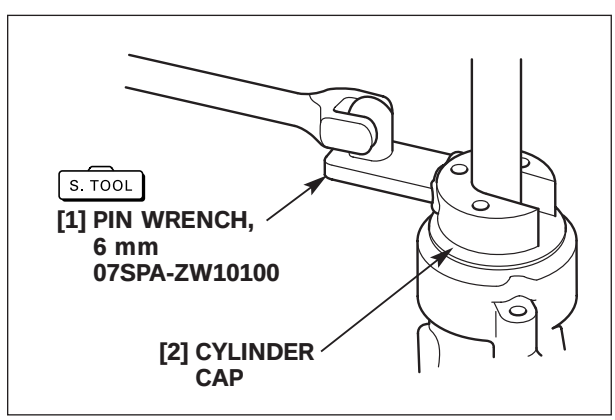
   • Do not install the piston rod comp. by pushing it in the piston rod chamber.



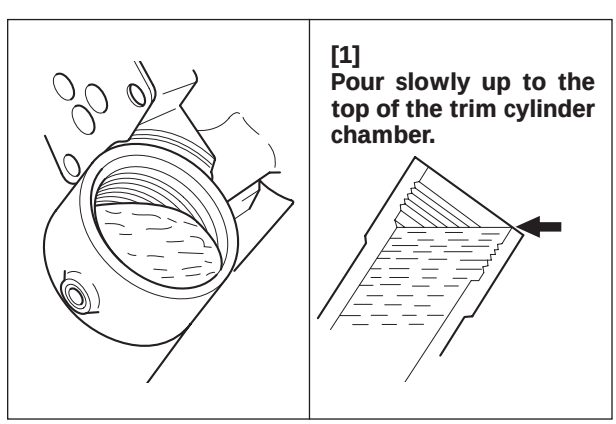
9) Tighten the cylinder cap to the specified torque using the special tool as shown.

TOOL:
Pin wrench, 6 mm **07SPA-ZW10100**

TORQUE: 162 N·m (16.5 kgf·m, 119 lbf·ft)

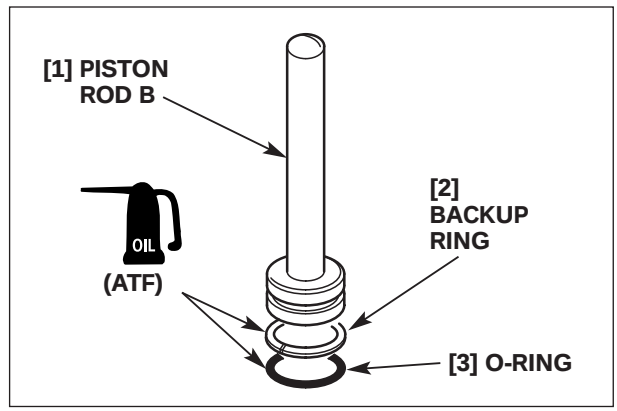


10) Pour the fresh Automatic Transmission Fluid (ATF) in the right and left trim cylinder chambers up to the top of the trim cylinder chamber.



11) Apply Automatic Transmission Fluid (ATF) to the new O-ring and the backup ring and install them on the piston rod comp.

- Install the backup ring on the free piston with care not to break it.



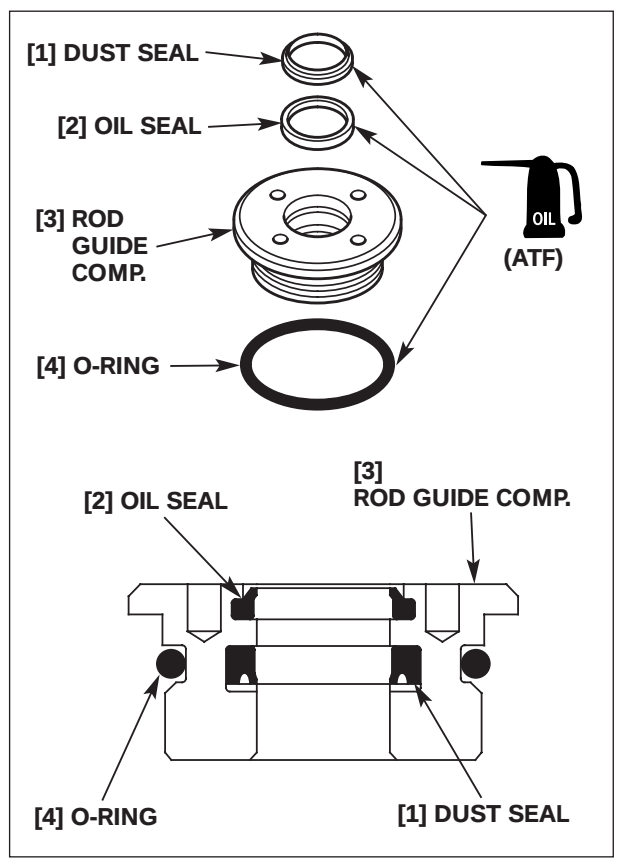
12) Apply Automatic Transmission Fluid (ATF) to the new oil seal.

Holding the oil seal in the shape of "U" with your fingers, install it in the lower groove in the rod guide comp.

13) Apply Automatic Transmission Fluid (ATF) to the new dust seal.

Holding the dust seal in the shape of "U" with your fingers, install it in the upper groove in the rod guide comp.

14) Apply Automatic Transmission Fluid (ATF) to the new O-ring and install it on the rod guide comp.

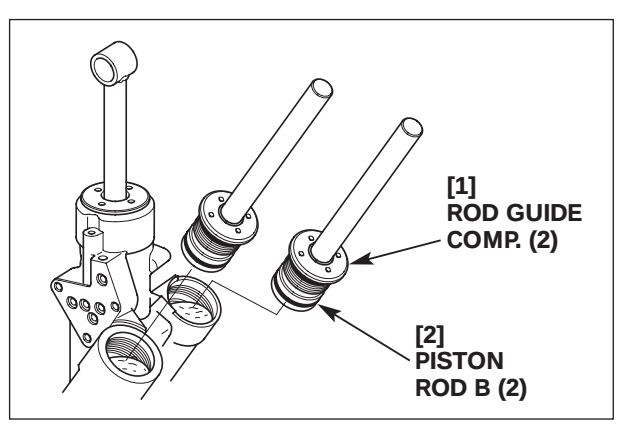


15) Install the rod guide comp. on the piston rod B.
Extend the piston rod fully and hold it in the position.

16) Holding the piston rod Bs aslant a little, set each of piston rod Bs in the left and right trim cylinder chambers.

- Do not install the piston rod Bs by pushing them into respective trim cylinders.

17) Install the piston rod B in the trim cylinder chamber slowly.



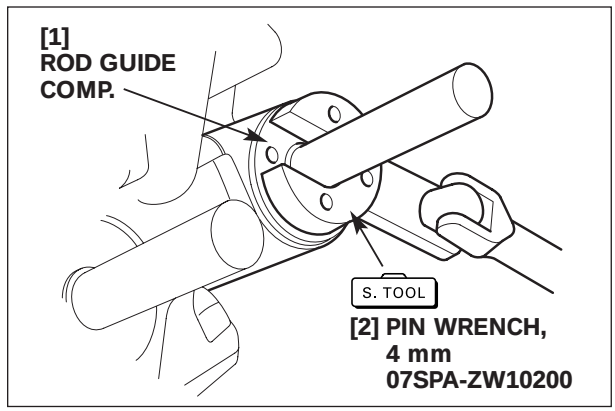
18) Holding the piston rod B in place, loosely tighten the rod guide comp. on the cylinder comp.

- Do not install the piston rod Bs by pushing them into respective trim cylinders.

19) Using the special tool, tighten the left and right rod guide comps. to the specified torque as shown.

TOOL:
Pin wrench, 4 mm **07SPA-ZW10200**

TORQUE: 78 N·m (8.0 kgf·m, 58 lbf·ft)



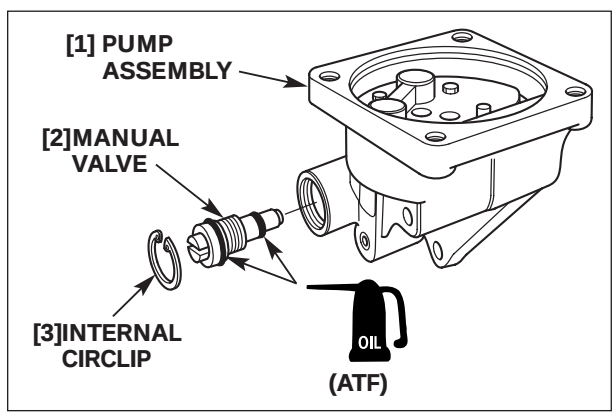
20) Check the manual valve and the O-ring for deterioration, wear and damage. Replace the manual valve with a new one if necessary.

21) Apply Automatic Transmission Fluid (ATF) to the manual valve O-ring.

Set the manual valve on the pump assembly and tighten it to the specified torque.

TORQUE: 3.5 N·m (0.35 kgf·m, 2.5 lbf·ft)

22) Install the internal circlip securely in the groove in the pump assembly.



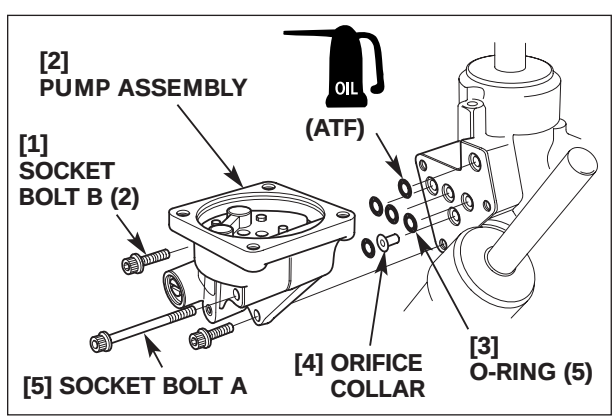
23) Apply Automatic Transmission Fluid (ATF) to the five new O-rings and the orifice collar.

Set the five O-rings and the orifice collar in the indicated position of the cylinder comp.

24) Install the pump assembly on the cylinder comp. with the socket bolt A and B.

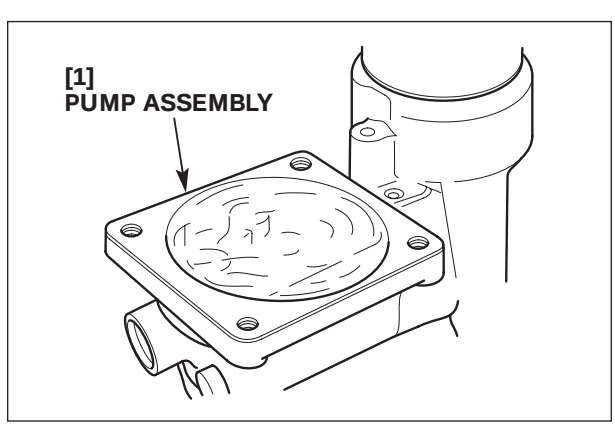
Tighten the socket bolt A and B to the specified torque.

TORQUE: 8.5 N·m (0.85 kgf·m, 6.1 lbf·ft)



25) Fill the pump assembly with the fresh Automatic Transmission Fluid (ATF).

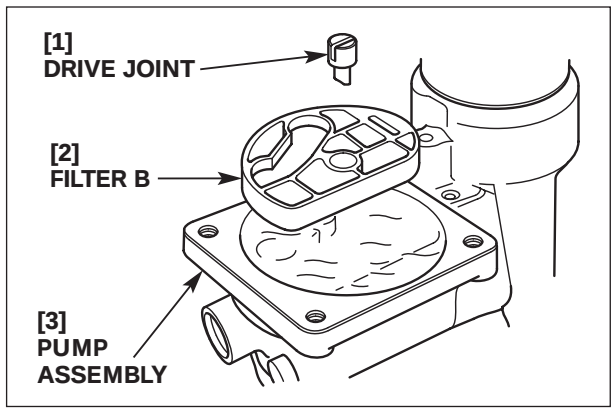
- Do not fill up the pump assembly quickly. Pour the Automatic Transmission Fluid (ATF) in the pump assembly slowly.



26) Check the filter B for blockage and damage. Replace the filter B if it is damaged.

Blow air through the filter B if it is clogged. Clean the filter B carefully to avoid damage.

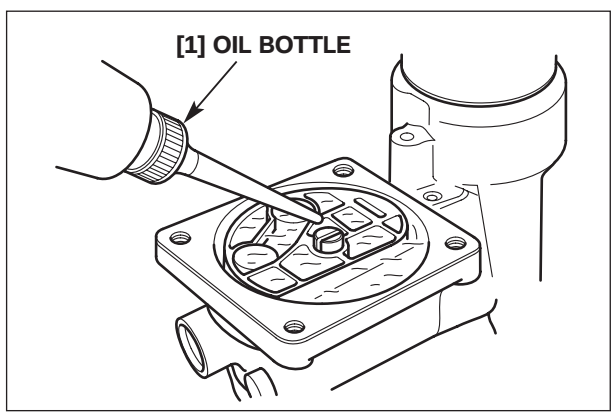
Install the filter B and the drive joint on the pump assembly.



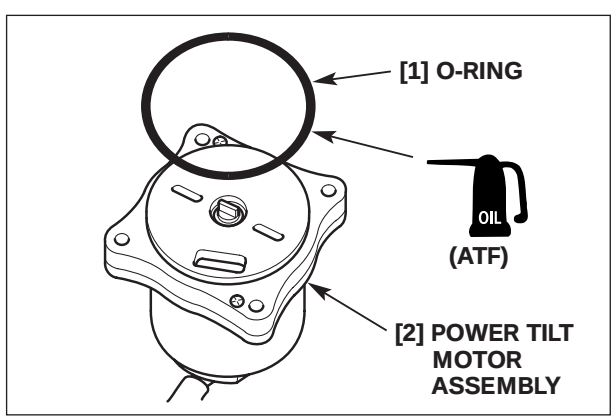
27) After installation, check the filter B for bubbles. Remove the bubbles with the oil bottle or equivalent tool if necessary.

- Be sure to remove the air bubbles, or it will cause air in the system.

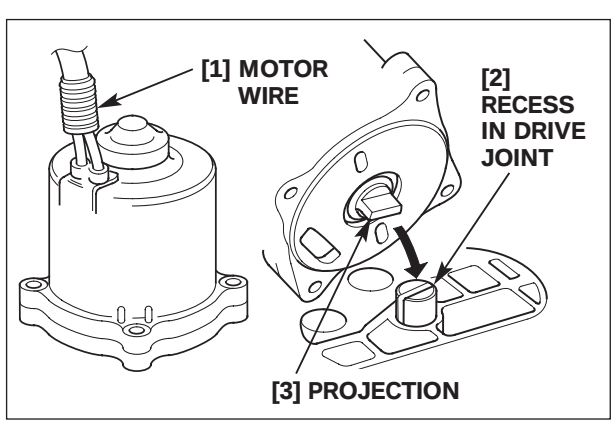
28) After removing the air bubbles, fill the pump assembly fully with the Automatic Transmission Fluid (ATF) again.



29) Apply Automatic Transmission Fluid (ATF) to the new O-ring and install it on the power tilt motor assembly.

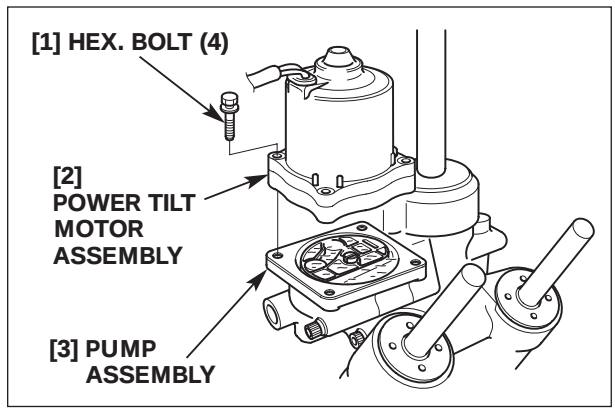


30) Install the power tilt motor assembly on the pump assembly aligning the projection on the power tilt motor assembly with the recess in the drive joint and with the motor wire of the power tilt motor assembly at the manual valve side.



31) Set the four hex. bolts on the power tilt motor assembly and tighten the bolts to the specified torque.

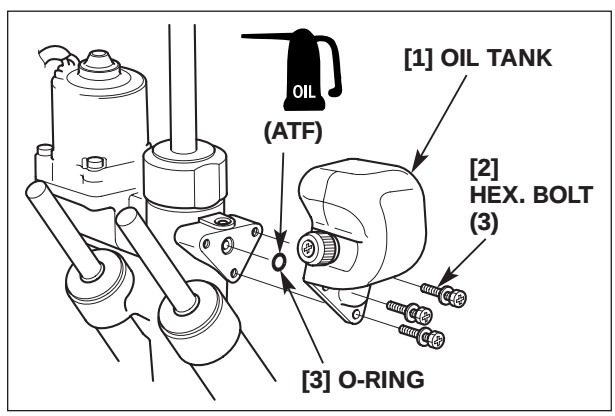
TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)



32) Apply Automatic Transmission Fluid (ATF) to the new O-ring and install it on the cylinder comp.

33) 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)



34) Remove the oil tank cap. Pour fresh Automatic Transmission Fluid (ATF) to the upper limit of the oil tank filler port.

Oil capacity	0.68R (0.72 US qt, 0.60 Imp qt)

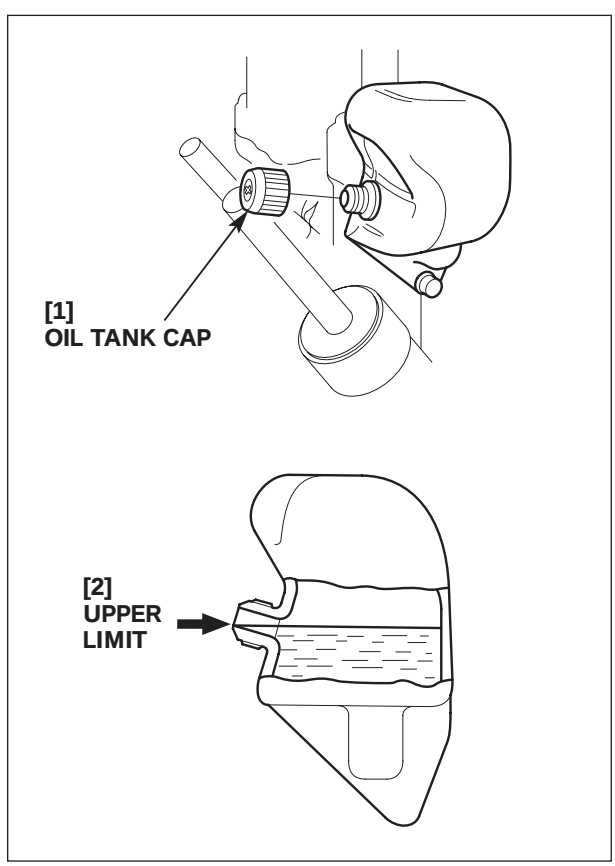
NOTICE

Do not overfill with Automatic Transmission Fluid (ATF). Pouring the Automatic Transmission Fluid (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.

35) After filling the oil tank with Automatic Transmission Fluid (ATF), bleed air from the power trim/tilt assembly <without mounting on the outboard motor> (P. 15-48).

36) Tighten the oil tank cap to the specified torque.

TORQUE: 2.5 N·m (0.25 kgf·m, 1.8 lbf·ft)



5. 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 air bleeding in the following order.
  Air bleeding without mounting the unit on the outboard motor; Check on blow pressure; Air bleeding after mounting the unit on the outboard motor.

Connect each cable to operate the power trim/tilt assembly.

– Connect the positive (+) and negative (–) starter cables.

– Connect the power tilt motor 2P connector to the power tilt relay.

– Be sure that the starter cables are 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 oil tank filler port.

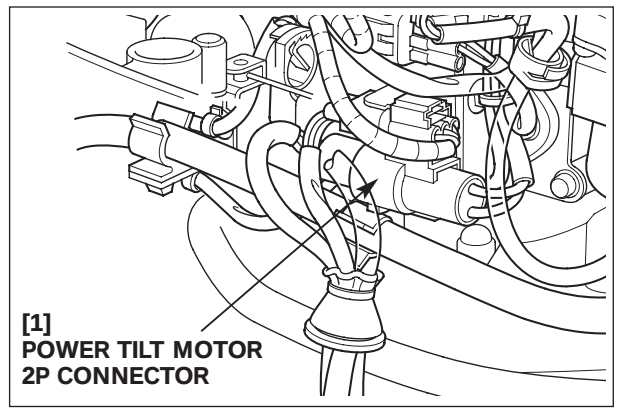
   If Automatic Transmission Fluid (ATF) does not flow out of the filler port, add Automatic Transmission Fluid (ATF) up to the upper limit of the filler port using a syringe or equivalent tool.

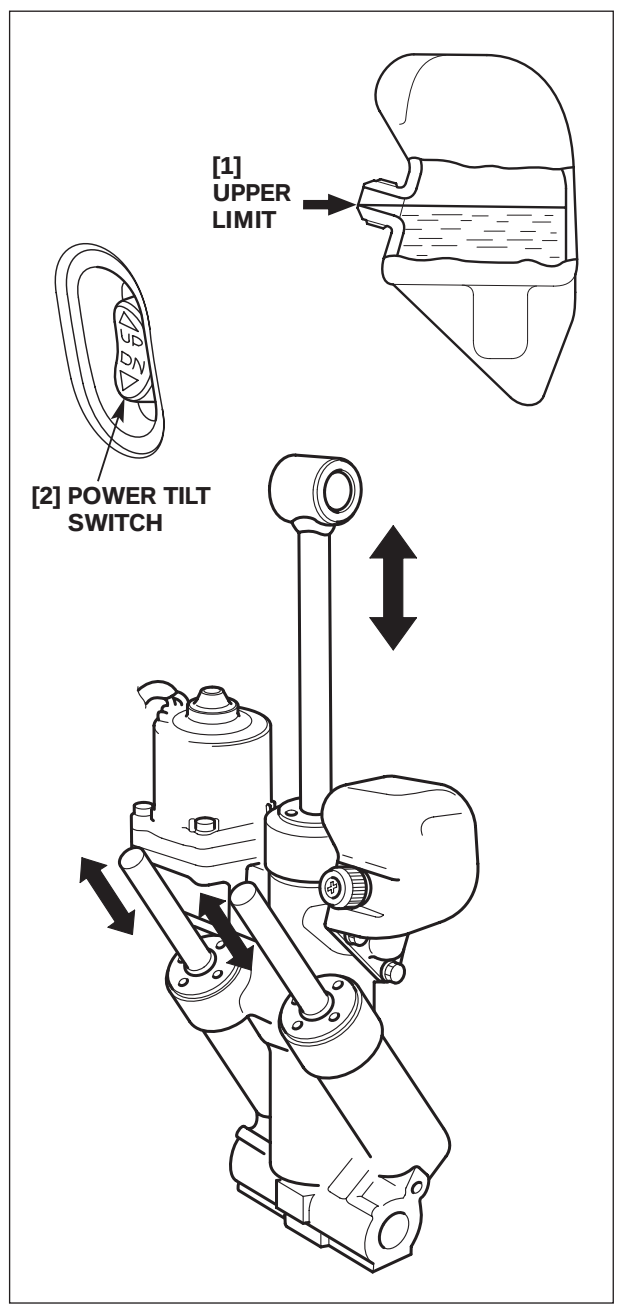
   - Check the fluid level with the rods fully extended.
     Note that Automatic Transmission Fluid (ATF) will spurt out when the oil tank cap is removed with the rods fully compressed.

5) After adding Automatic Transmission Fluid (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. 15-50) and air bleeding with the unit mounted on the outboard motor (P. 15-49).
   - When the rods do not compress fully, perform the procedure explained under <when the rods do not compress fully> (P. 15-49).





<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 inspection (P. 15-50).

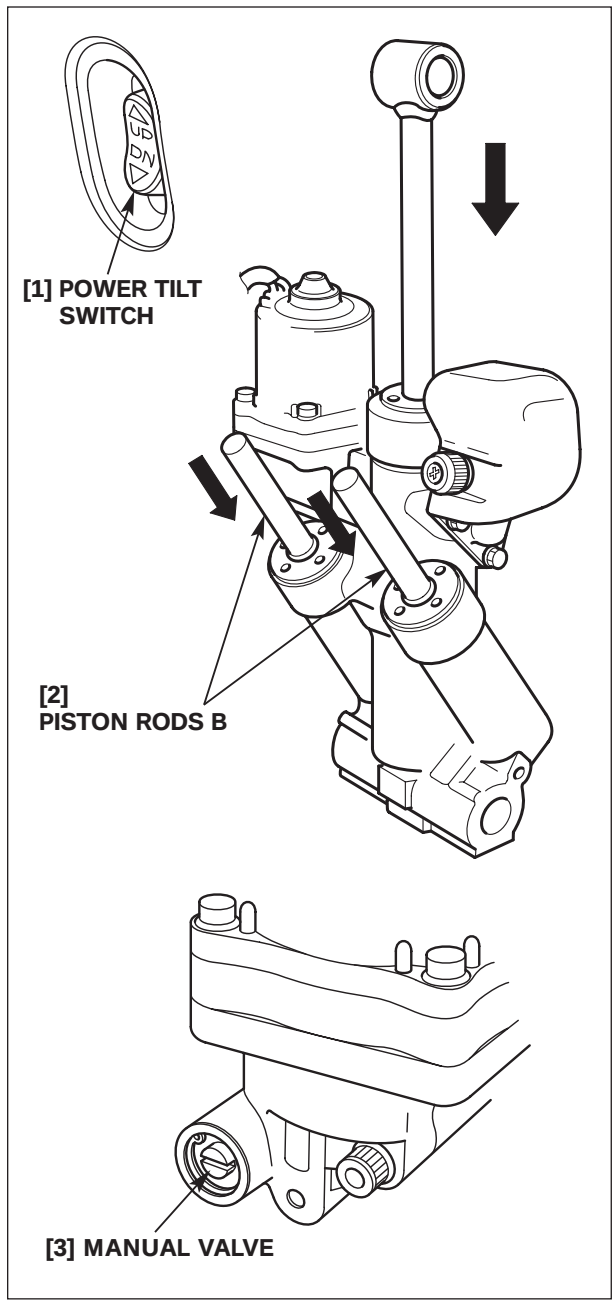
2) If the rods do not compress after the step 1 operation, push the "DN" side of the power tilt switch while pushing the piston rod B, and check whether the rods compress.

   If the rods compress fully, go to the blow pressure inspection (P. 15-50).

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 inspection (P. 15-50).

4) If the rods do not compress fully after the above operation, disassemble (P. 15-36) and reassemble (P. 15-42) the power trim/tilt assembly and bleed air with the power trim/tilt assembly not mounted on the outboard motor (P. 15-48).



<Air bleeding with power trim/tilt assembly mounted on the outboard motor>

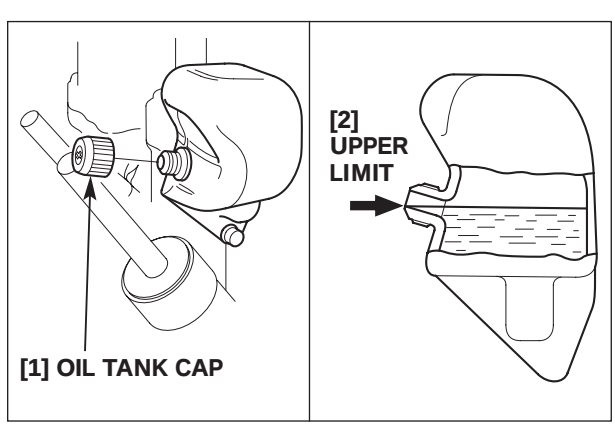
Perform the following procedure after bleeding air without mounting the power trim/tilt assembly on the outboard motor (P. 15-48) and after blow pressure inspection (P. 15-50).

1) Install the power trim/tilt assembly on the outboard motor securely (P. 15-30).

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 of the oil tank.

   If the Automatic Transmission Fluid (ATF) does not flow out of the oil filler port, add the Automatic Transmission Fluid (ATF) up to the upper limit of the oil filler port using a syringe or equivalent tool.



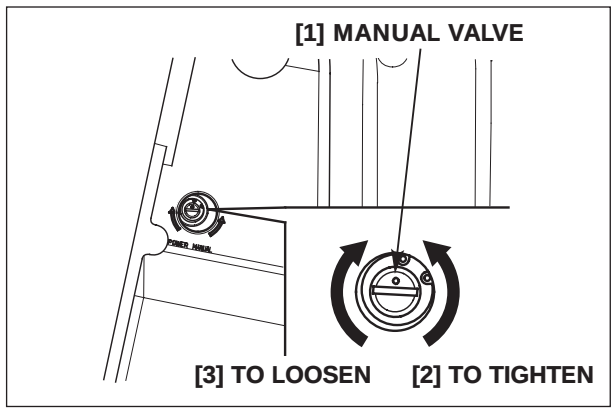
3) Lower the outboard motor slowly to the lowermost position by loosening the manual valve.

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 (P. 15-47).

7) Repeat the procedure from step 3 through 6 five times.



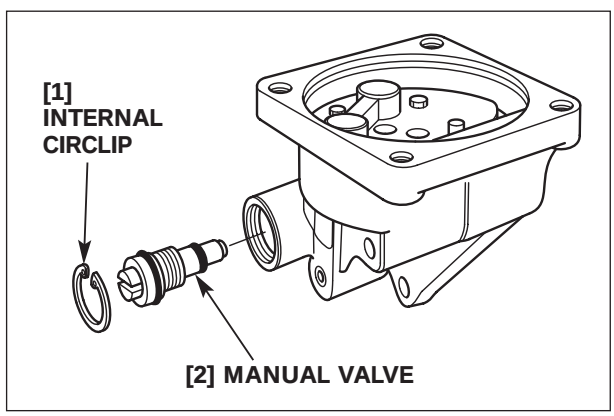
6. BLOW PRESSURE INSPECTION

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.

1) Operate each rod of the power trim/tilt assembly (i.e. move them up and down) several times and set the rods in the full extended position.

2) Check that the Automatic Transmission Fluid (ATF) is at the upper level in the oil tank (P. 15-47).

3) Using the special tools, check the blow pressure at the upper and lower chambers of the cylinder.



a. LOWER CHAMBER BLOW PRESSURE

1) Remove the internal circlip and manual valve from the power trim/tilt assembly.

   - Note that Automatic Transmission Fluid (ATF) will spurt out when the manual valve is removed without the rods fully extended. Move each rod to the fully extended position before removing the manual valve.
   - A small amount of the Automatic Transmission Fluid (ATF) will flow out when the manual valve is removed. Attach the special tools quickly.

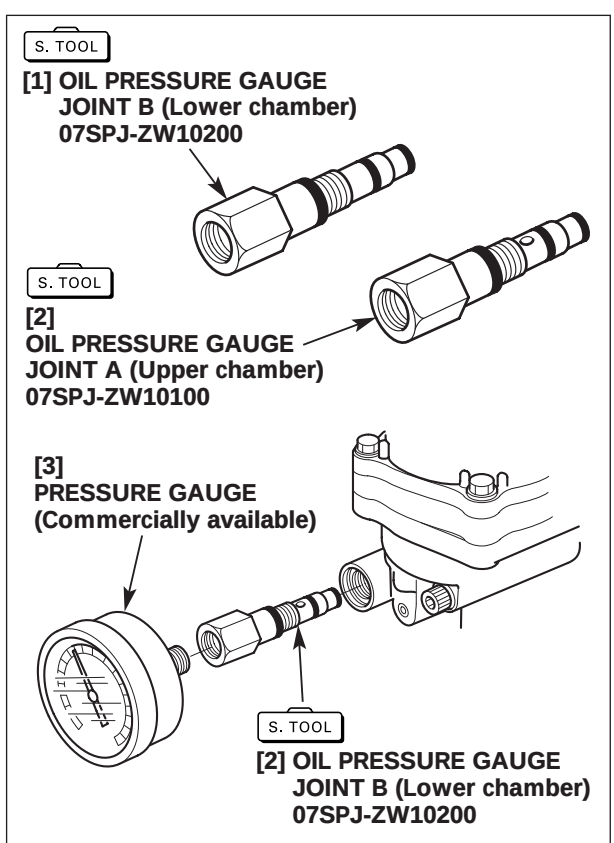
2) Attach the special tool (oil pressure gauge joint B) for measurement of lower chamber blow pressure to the manual valve installation section as shown.

   Tighten the special tool to the specified torque.

   TOOL:
   Oil pressure gauge joint B **07SPJ-ZW10200**

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

3) Attach a commercially available pressure gauge [P/T 1/4] which measures 14,710 kPa (150 kgf/cm^2, 2,133 psi) or above to the special tool (oil pressure gauge joint B).



4) Remove the oil tank cap. Check that Automatic Transmission Fluid (ATF) is at the upper limit of the filler port (P. 15-47).

5) Push the "DN" side of the power tilt switch to compress each rod fully.

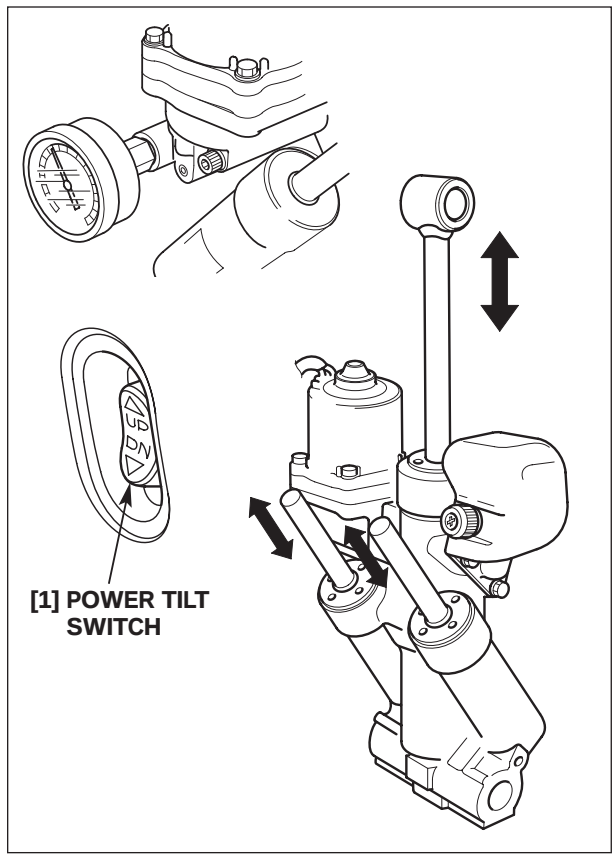
6) Push the "UP" side of the power tilt switch to extend each rod fully again. Read the pressure gauge to measure the lower chamber blow pressure.

Lower chamber blow pressure	8,826 – 11,768 kPa (90 – 120 kgf/cm², 1,280 – 1,707 psi)

7) If the blow pressure is lower than the specified pressure, check each part of the power trim/tilt assembly for oil leakage (P. 15-54).

8) If there is no oil leakage but the pressure dropped sharp below the specification, check the power tilt motor assembly for the damaged oil seal. Disassemble the power tilt motor assembly (P. 15-53) and inspect (P. 15-55), and measure the lower chamber blow pressure again (P. 15-50).

9) Measure the upper chamber blow pressure.



b. 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 from the pump assembly with each rod full extended.

   • Note that Automatic Transmission Fluid (ATF) will spurt out when the special tool is removed without the rods fully extended. Move each rod to the fully extended position before removing the special tool.

   • A small amount of the Automatic Transmission Fluid (ATF) will flow out when the special tool (oil pressure gauge joint B) is removed. Attach the special tool (oil pressure gauge joint A) quickly.

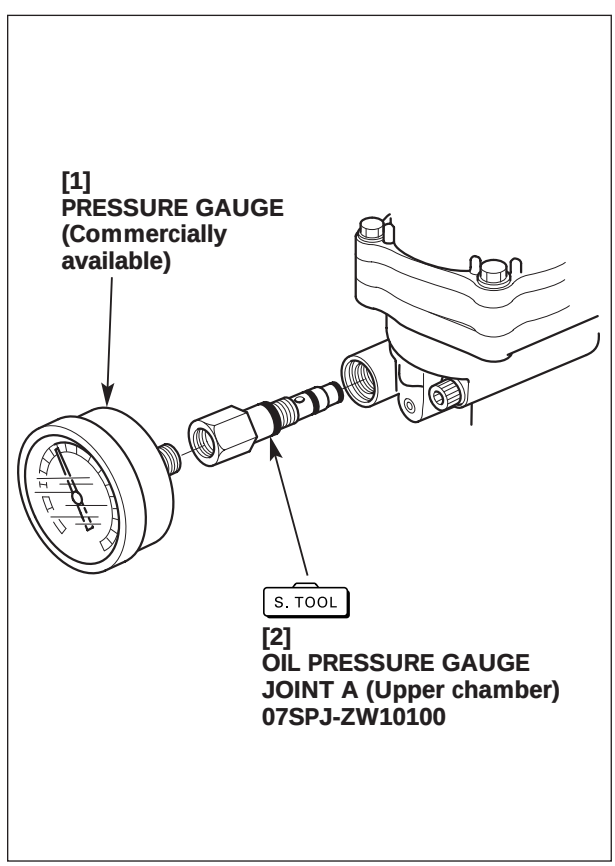
2) Attach the special tool (oil pressure gauge joint A) for measurement of upper chamber blow pressure to the manual valve installation section as shown.

   Tighten the special tool to the specified torque.

   TOOL:
   Oil pressure gauge joint A **07SPJ-ZW10100**

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

3) Attach a commercially available pressure gauge [P/T 1/4] which measures 14,710 kPa (150 kgf/cm², 2,133 psi) or above to the special tool (oil pressure gauge joint B).



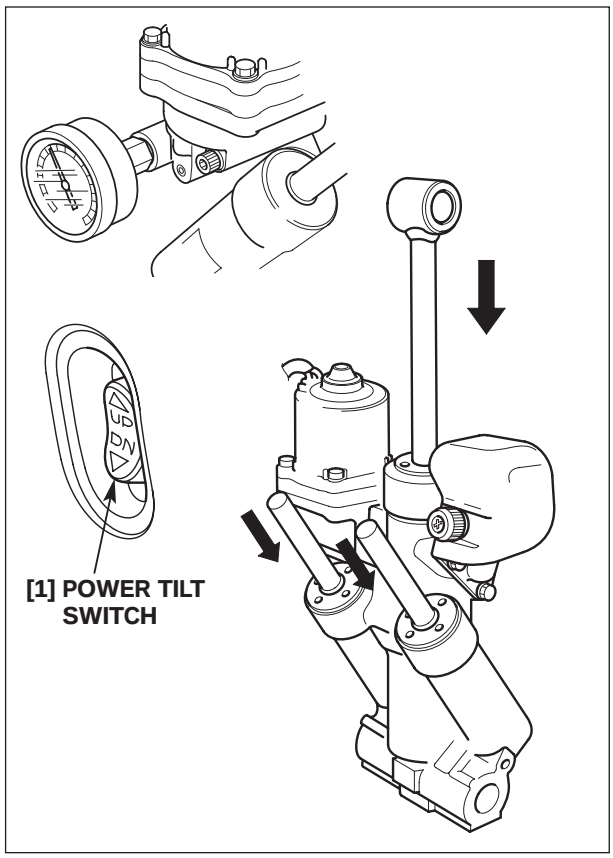
4) Remove the oil tank cap. Check that Automatic Transmission Fluid (ATF) is at the upper limit of the filler port (P. 15-47).

5) Push the "DN" side of the power tilt switch to compress each rod fully. Read the pressure gauge to measure the upper chamber blow pressure.

Upper chamber blow pressure	3,923 – 7.355 kPa (40 – 75 kgf/cm^2, 569 – 1,067 psi)

6) If the blow pressure is lower than the specified pressure, check each part of the power trim/tilt assembly for oil leakage.

7) If there is no oil leakage but the pressure dropped sharp below the specification, check the power tilt motor assembly for the damaged oil seal. Disassemble the power tilt motor assembly (P. 15-53) and inspect (P. 15-55), and measure the upper chamber blow pressure again (P. 15-50).



8) After checking, push the "UP" side of the power tilt switch and move each rod to the fully extended position.

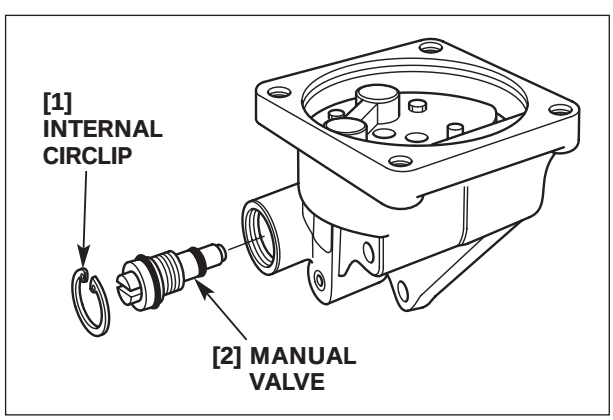
9) Remove the special tool (oil pressure gauge joint A) and the pressure gauge.

10) Tighten the manual valve to the specified torque.

TORQUE: 3.5 N·m (0.35 kgf·m, 2.5 lbf·ft)

11) With each rod in the fully extended position, remove the oil tank cap and check that the Automatic Transmission Fluid (ATF) is at the upper limit of the oil filler port (P. 15-47).

If the Automatic Transmission Fluid (ATF) does not flow out of the oil filler port, add the Automatic Transmission Fluid (ATF) up to the upper limit of the oil tank using a syringe or equivalent tool (P. 15-47).



7. POWER TILT MOTOR ASSEMBLY

a. DISASSEMBLY

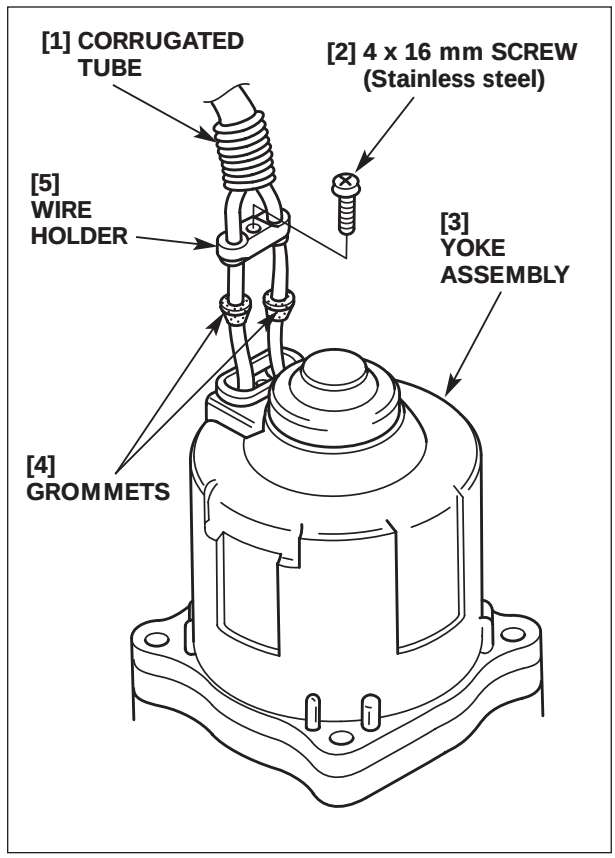
1) Untape the corrugated tube and pull the tube to the connector side.

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 corrugated tube side.

NOTICE

Pull out the grommets with care not to damage them.

3) Remove the two 4 x 16 mm screws.



4) Wrap the armature shaft with a shop towel or equivalent material to protect, and hold the shaft with pliers.

   Pushing the two motor wires toward the yoke assembly, remove the armature/front bracket assembly from the yoke assembly.

5) Remove the armature from the front bracket.

   • Do not allow the commutator to become contaminated with oil or grease.

6) Remove the two brush springs (P. 15-54).

7) Disconnect the motor wire (blue wire) terminal from the breaker assembly while holding the breaker assembly with a screwdriver.

NOTICE

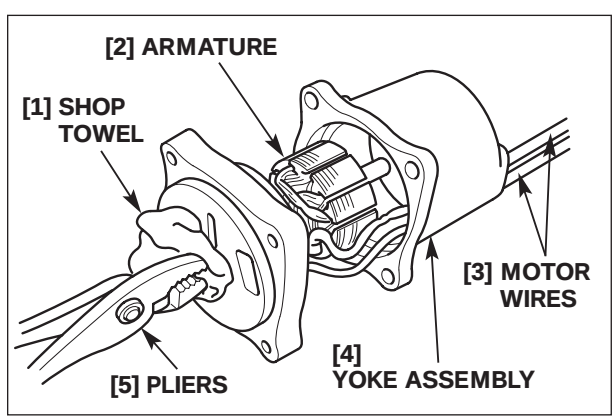
Do not disconnect the blue wire terminal without holding the breaker assembly, or it can cause damage to the brush holder B. Be sure to disconnect the terminal while holding the breaker assembly.

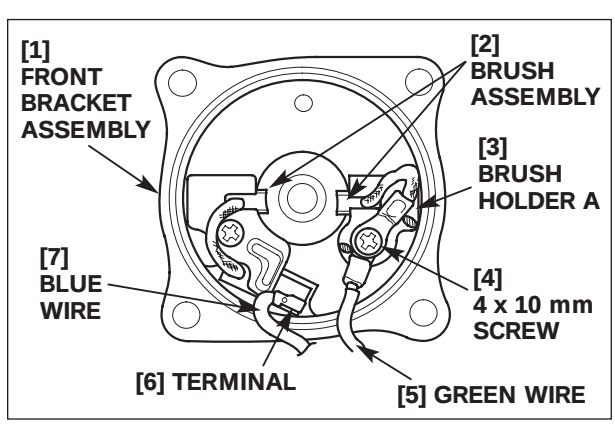
8) Remove the 4 x 10 mm screw from the brush holder A and remove the brush assembly.

   • Take care not to touch the bimetal part of the breaker assembly during removal.

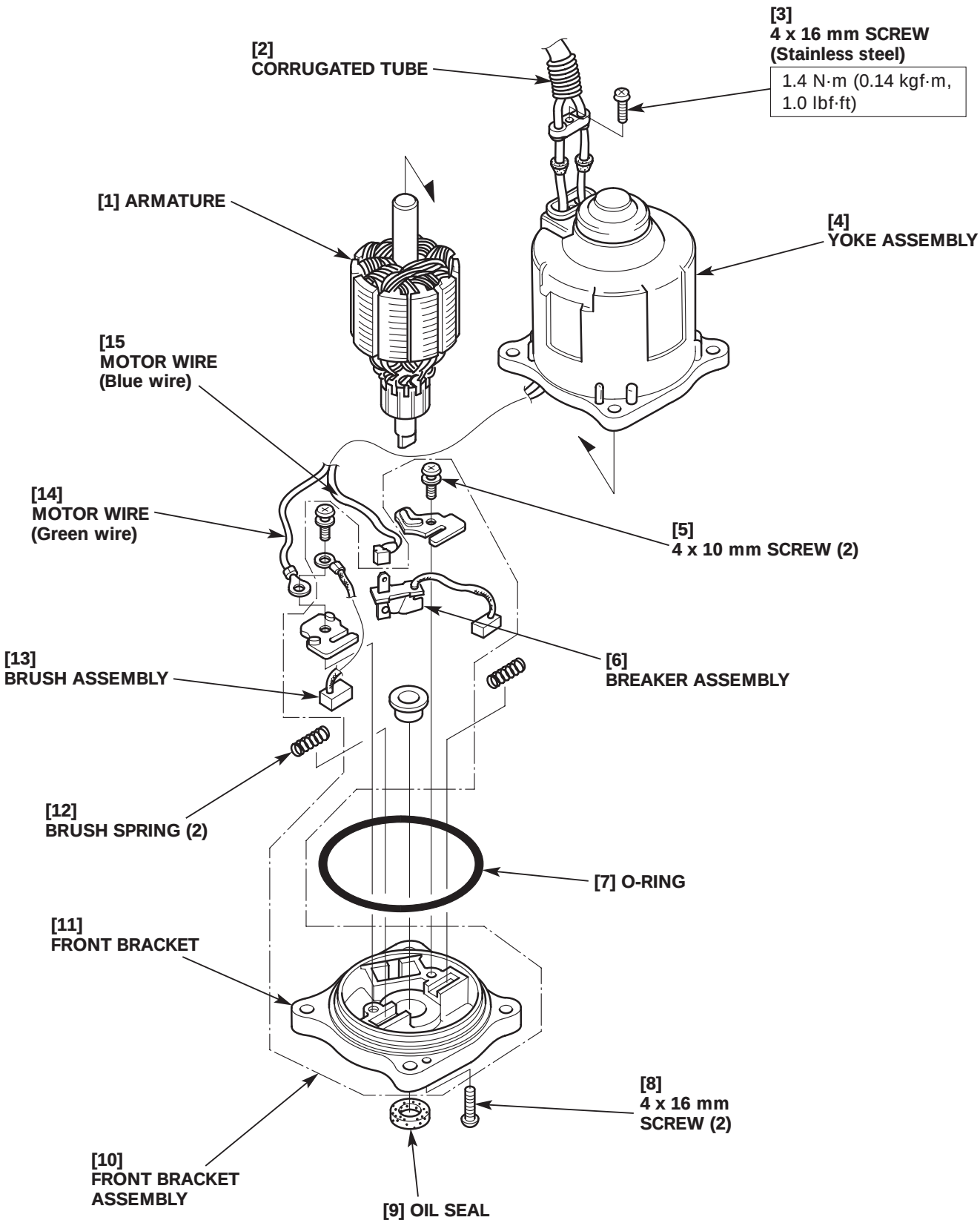
9) Remove the oil seal from the front bracket assembly (P. 15-54).

   Check the metal part of the front bracket assembly for damage and wear. Replace the front bracket assembly if necessary.





b. COMPONENTS DRAWING

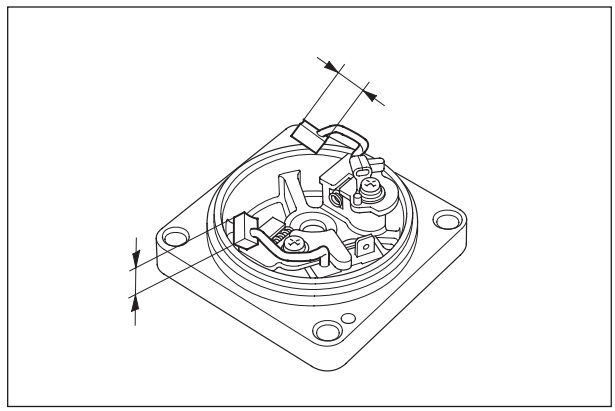


c. INSPECTION

• BRUSH LENGTH

Measure the brush length.
If the brush length is less than the service limit, replace the front bracket assembly.

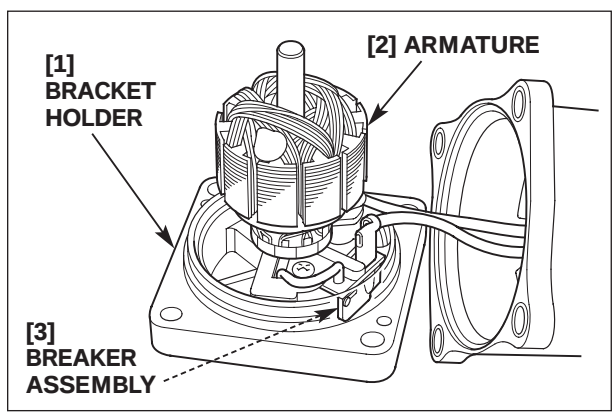
STANDARD	SERVICE LIMIT
9.8 mm (0.39 in)	4.8 mm (0.19 in)



• BREAKER ASSEMBLY

1) Install the armature on the front bracket assembly.
2) Connect the motor 2P connector to the outboard motor.
3) Operate the power tilt switch and check the breaker assembly for operation sound. The breaker is normal if there is operation sound from the breaker assembly.

   Replace the front bracket assembly if there is no operation sound from the breaker assembly.

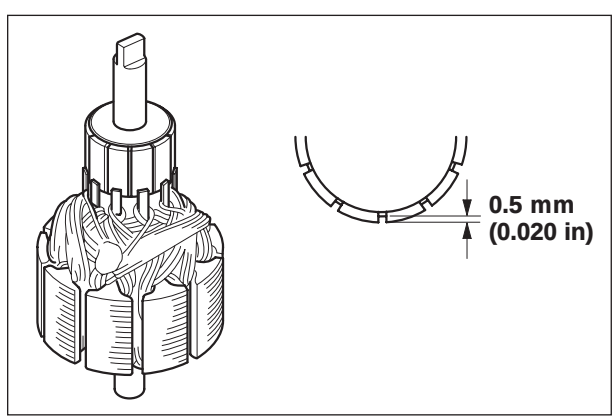


• MICA DEPTH

If the grooves are clogged or mica depth is less than the service limit, recut the groove using a hacksaw blade or a small file.

If the mica depth is still less than the service limit, replace the armature.

SERVICE LIMIT	0.5 mm (0.020 in)

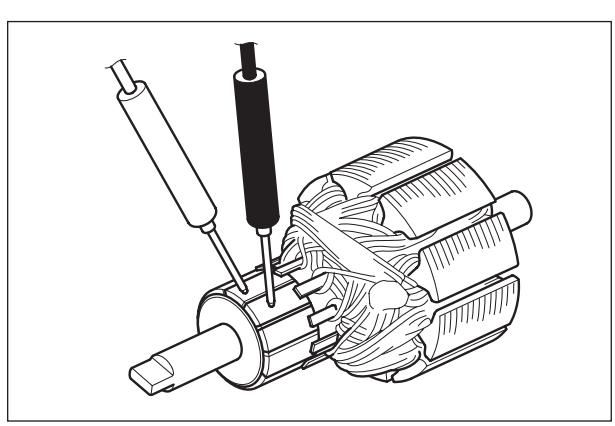


• ARMATURE

Use the armature tester if it is available.

• CONTINUITY CHECK – SEGMENTS

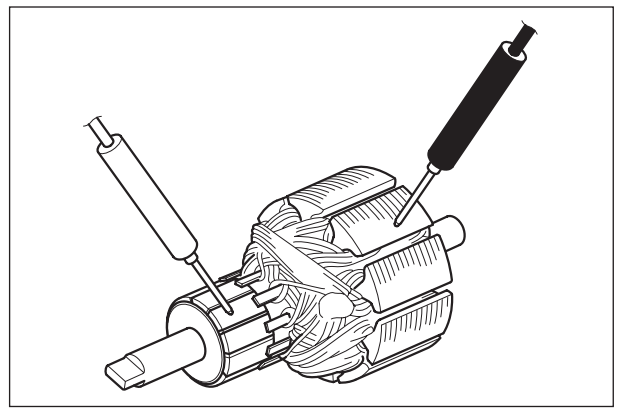
Check for continuity between the segments. If an open circuit exists between any two segments, replace the armature.



• SHORT CIRCUIT TEST – CORE-TO-COMMUTATOR

Check for continuity between the commutator and armature coil core.

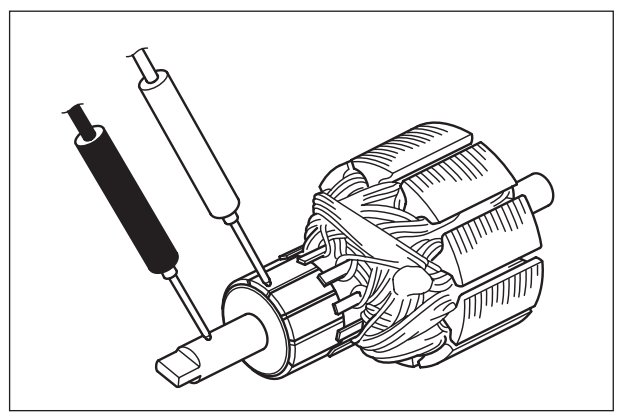
If continuity exists, replace the armature.



• SHORT CIRCUIT TEST – SHAFT-TO-COMMUTATOR

Check for continuity between the commutator and armature shaft.

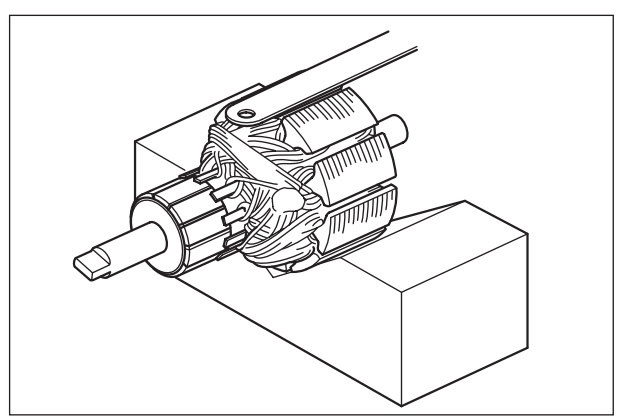
If there is continuity, replace the armature.



• SHORT CIRCUIT TEST – ARMATURE

Place the armature on an armature tester.

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.



d. ASSEMBLY

• When the front bracket assembly is replaced with the new one, remove the 4 x 10 mm screw that secures the brush holder B.

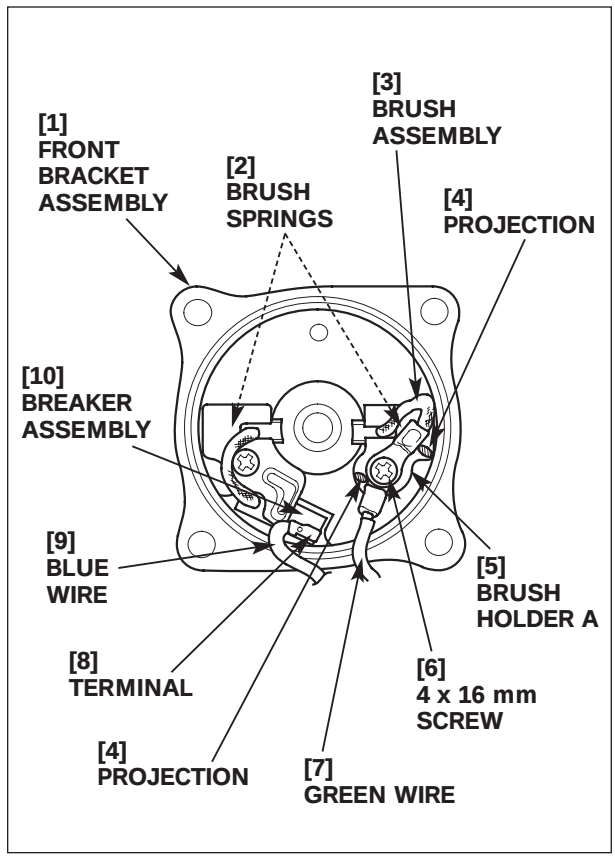
1) Install the new O-ring and the oil seal on the front bracket assembly (P. 15-54).

   Apply heat resisting grease to the oil seal lip.

2) Connect the motor wire (blue wire) terminal to the breaker assembly terminal.

3) Check the magnet in the yoke assembly for washer and other foreign material. There must be no washer, etc. on the magnet.

   Set the brush assembly terminal above the motor wire (green wire) terminal and loosely tighten the 4 x 10 mm screw. Be sure that the motor wire (green wire) terminal and the brush assembly wire terminal contact the respective projections on the brush holder A, then tighten the 4 x 10 mm screw securely.



4) Check that the commutator surface is not contaminated with oil and grease. Set the two brush springs on the front bracket assembly and install the armature on the front bracket with the brush terminal pushed in the holder.

5) Wrap the armature shaft with a shop towel or equivalent material and hold the shaft with the pliers.

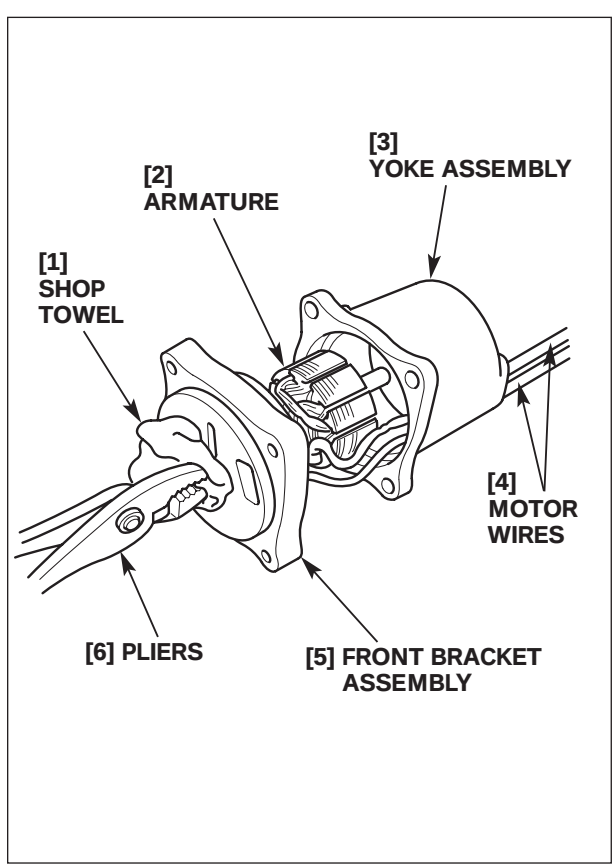
6) Pulling the two motor wires of the yoke assembly side slowly, install the armature/front bracket assembly on the yoke assembly.

   If it is hard to install the armature/front bracket assembly on the yoke assembly, check whether the metal of yoke assembly (i.e. where the armature shaft is installed) is out of position and repeat the procedure from step 4.

7) Check that the armature turns smoothly and tighten the two 4 x 16 mm screws.

   After tightening the two 4 x 16 mm screws, connect the power tilt motor 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 motor wire (blue wire) terminal is disconnected.



8) Install the two grommets and the wire holder on the yoke assembly.

   Tighten the 4 x 16 mm screw (stainless steel screw) to the specified torque. Take care not to overtighten it.

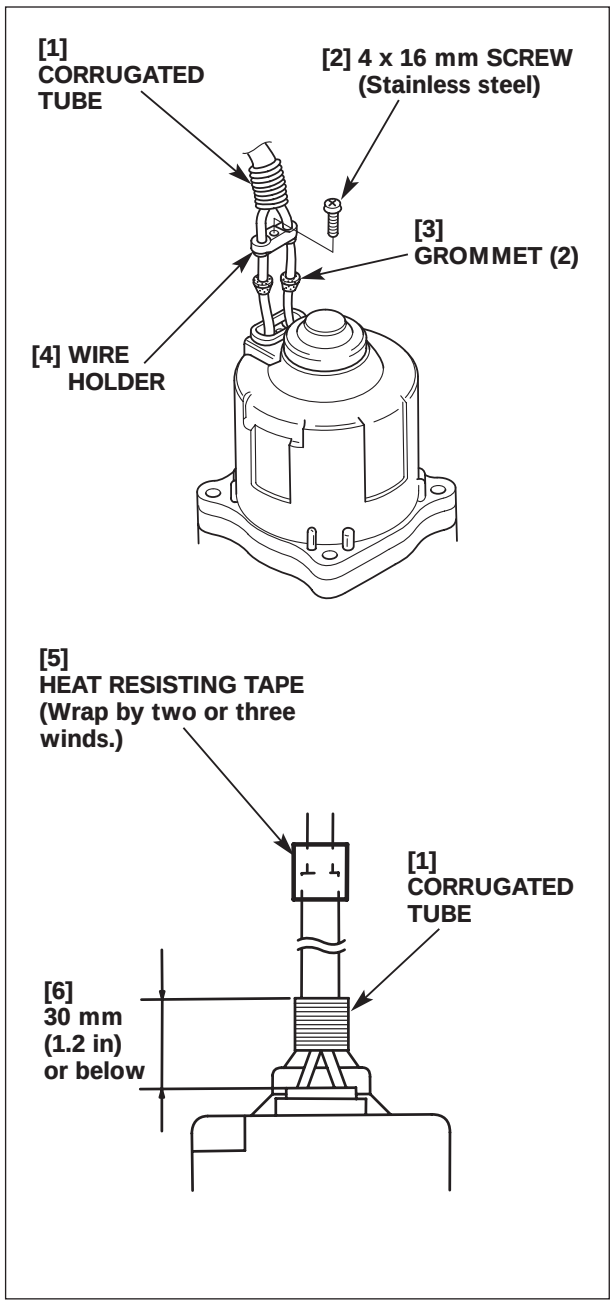
   TORQUE: 1.4 N·m (0.14 kgf·m, 1.0 lbf·ft)

9) Tape the corrugated tube with the heat resisting tape so that the distance from the wire holder end to the corrugated tube end is 30 mm (1.2 in) or less as shown.

10) Install the power tilt motor assembly on the power trim/tilt assembly (P. 15-46).

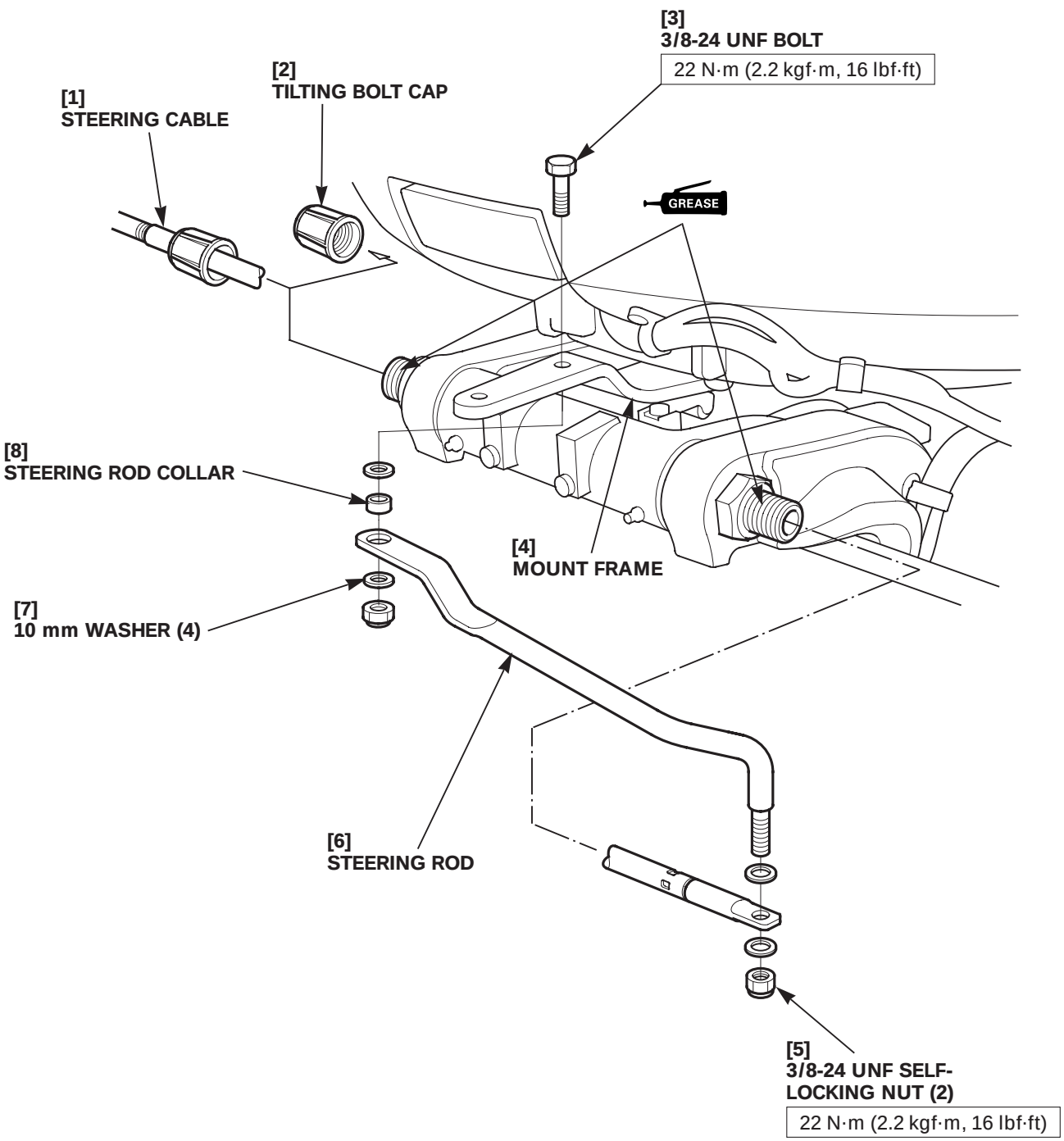
    Coat the joints or mating sections of the parts and the sections where the paint came off with rust preventive paint of the same color.

11) Bleed air from the power trim/tilt assembly without mounting on the outboard motor (P. 15-48).



1. STEERING ROD

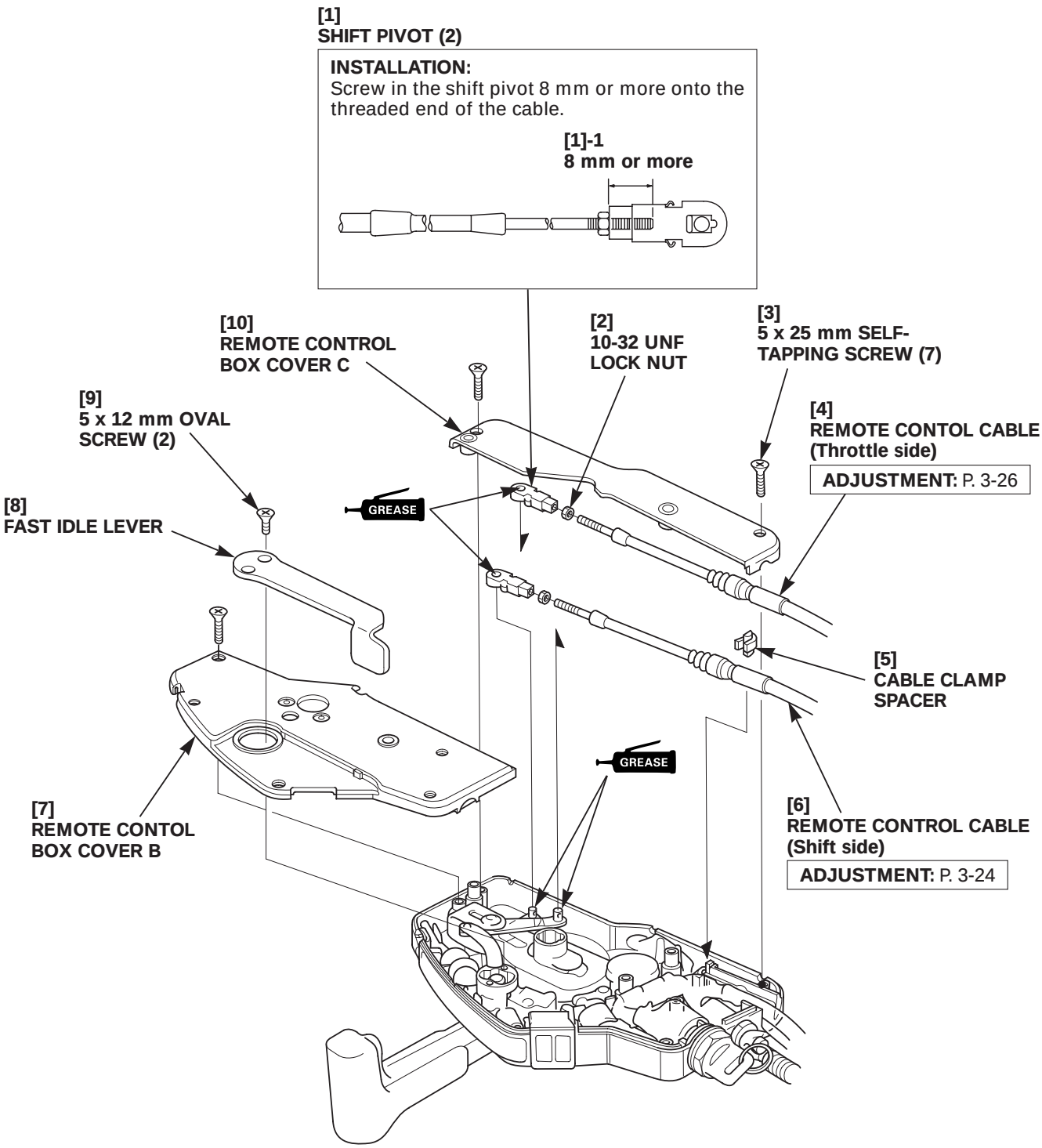
a. REMOVAL/INSTALLATION



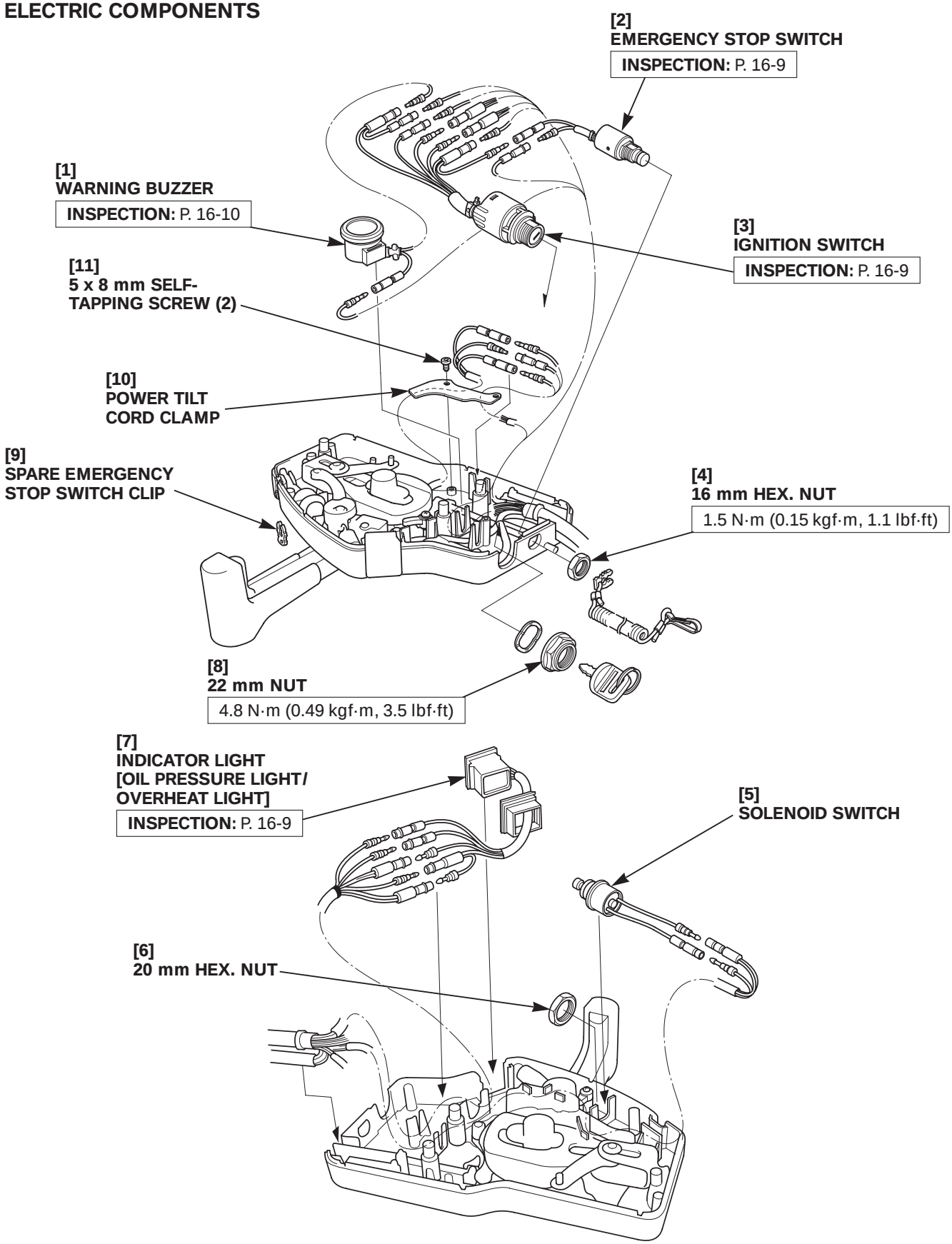
2. REMOTE CONTROL BOX (OPTIONAL PART)

a. DISASSEMBLY/ASSEMBLY

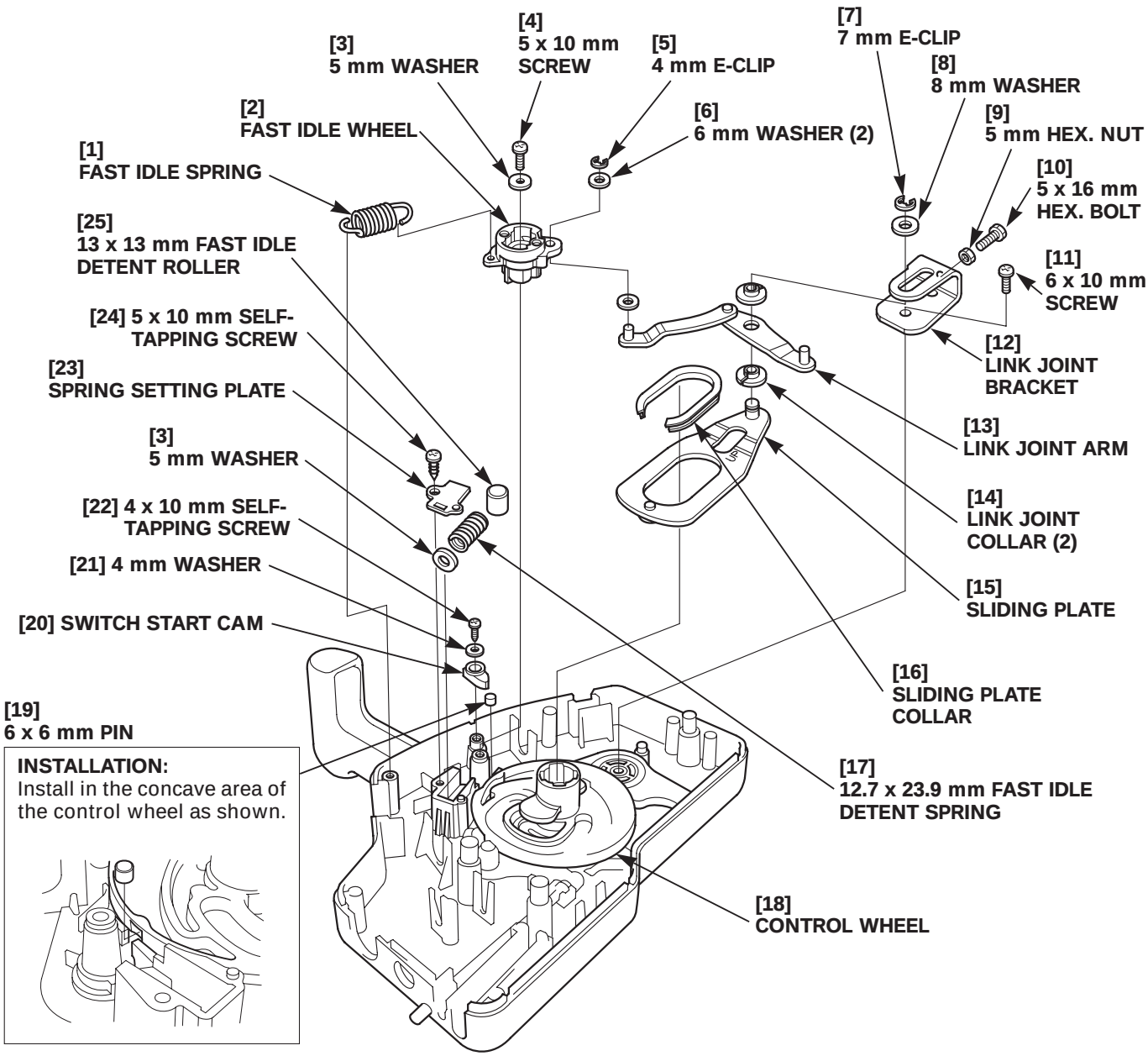
• REMOTE CONTROL CABLE



• ELECTRIC COMPONENTS



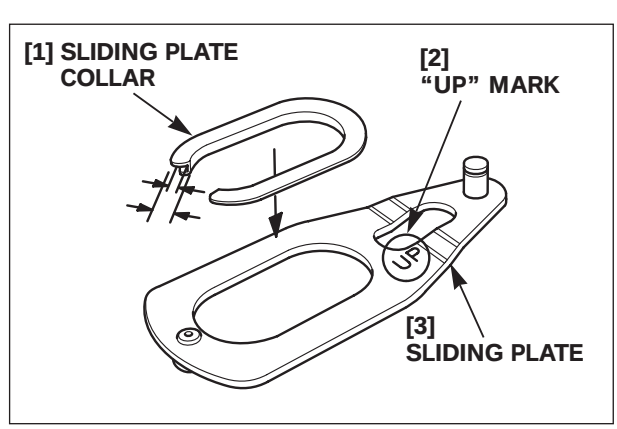
• SLIDING PLATE



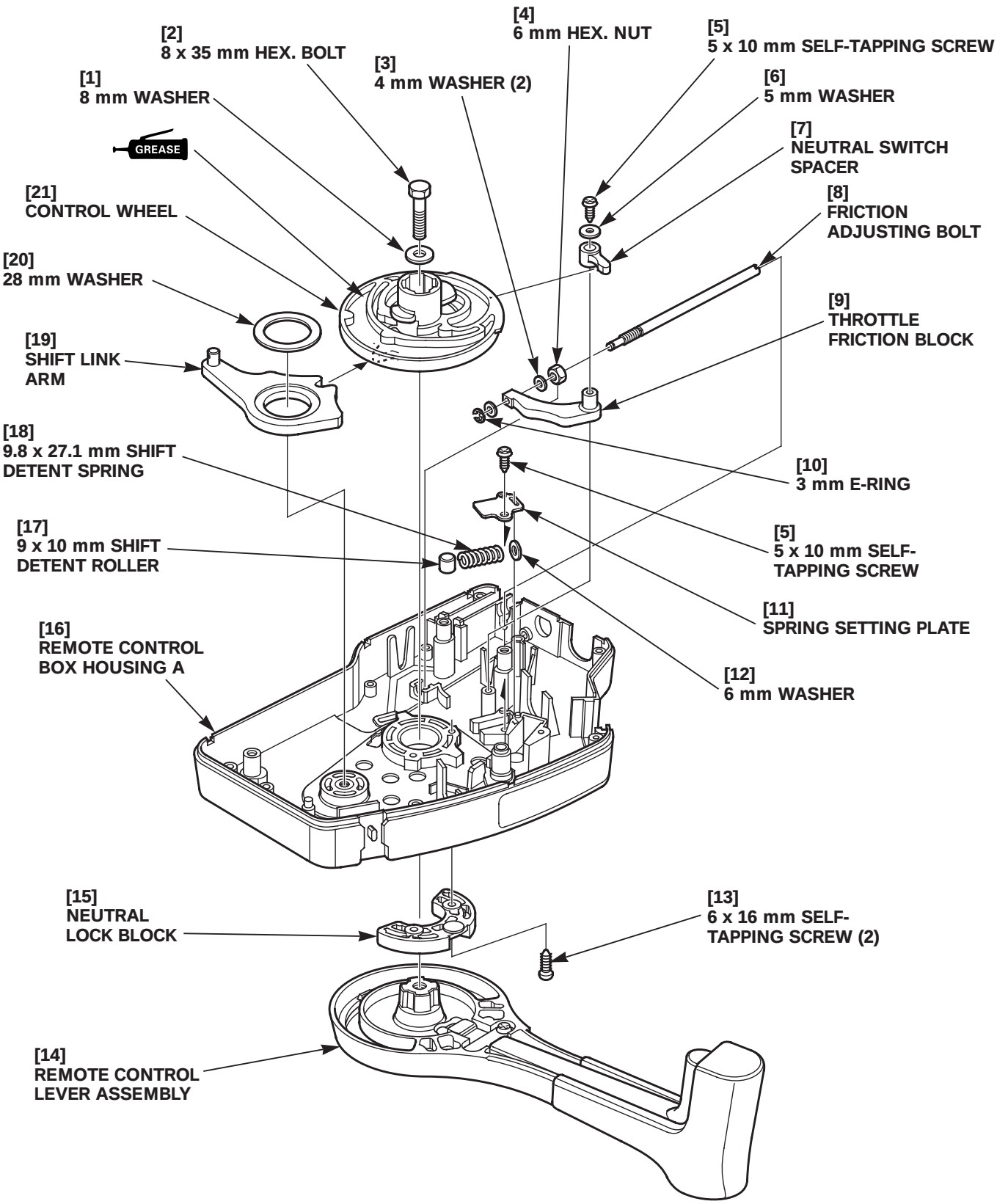
INSTALLATION:
Install in the concave area of the control wheel as shown.

• SLIDING PLATE/COLLAR

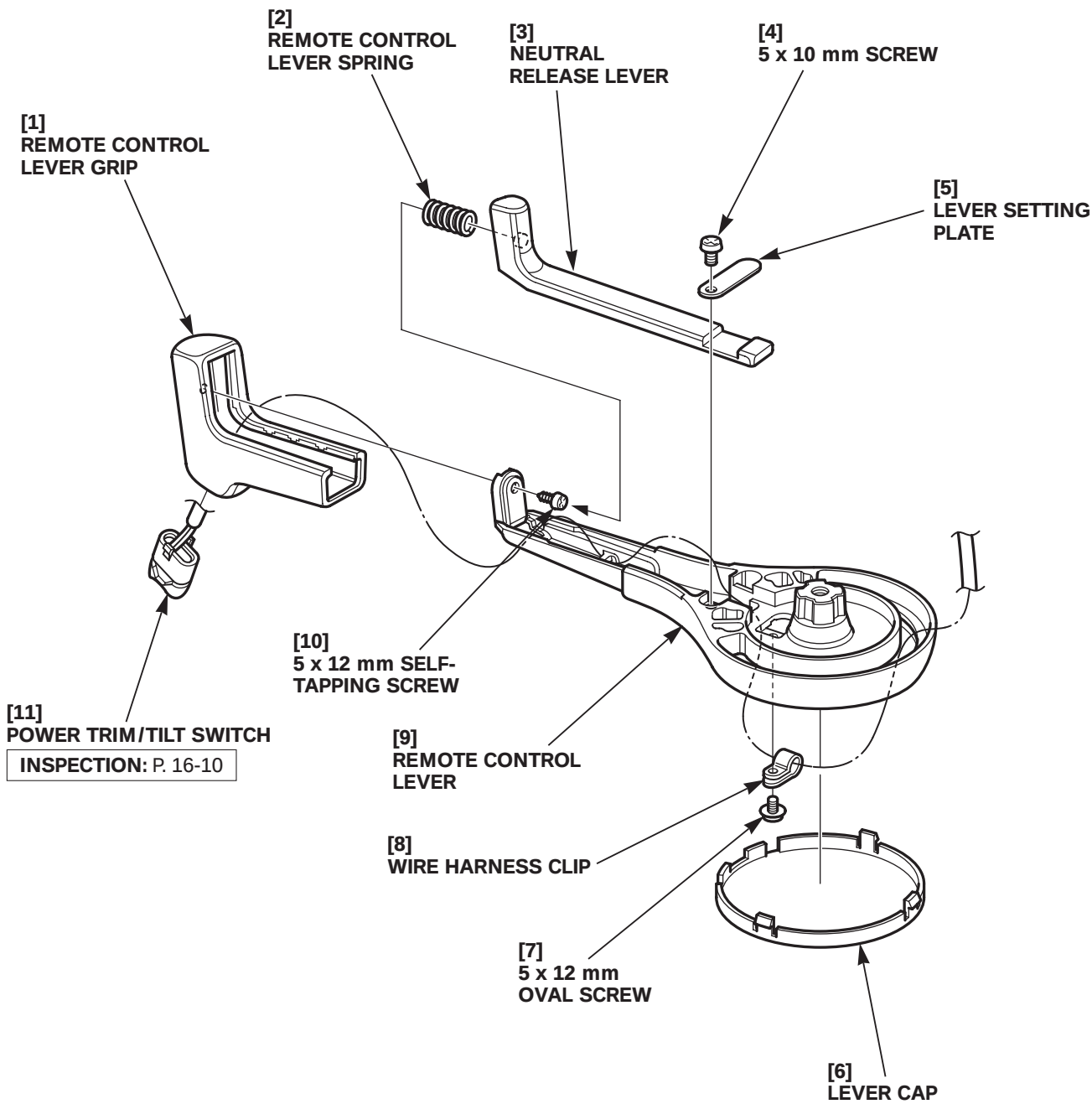
INSTALLATION:
Install the sliding plate with the "UP" mark facing up.
Attach the sliding plate collar to the sliding plate with its wider side toward the "UP" mark of the sliding plate.



• REMOTE CONTROL LEVER ASSEMBLY/CONTROL WHEEL

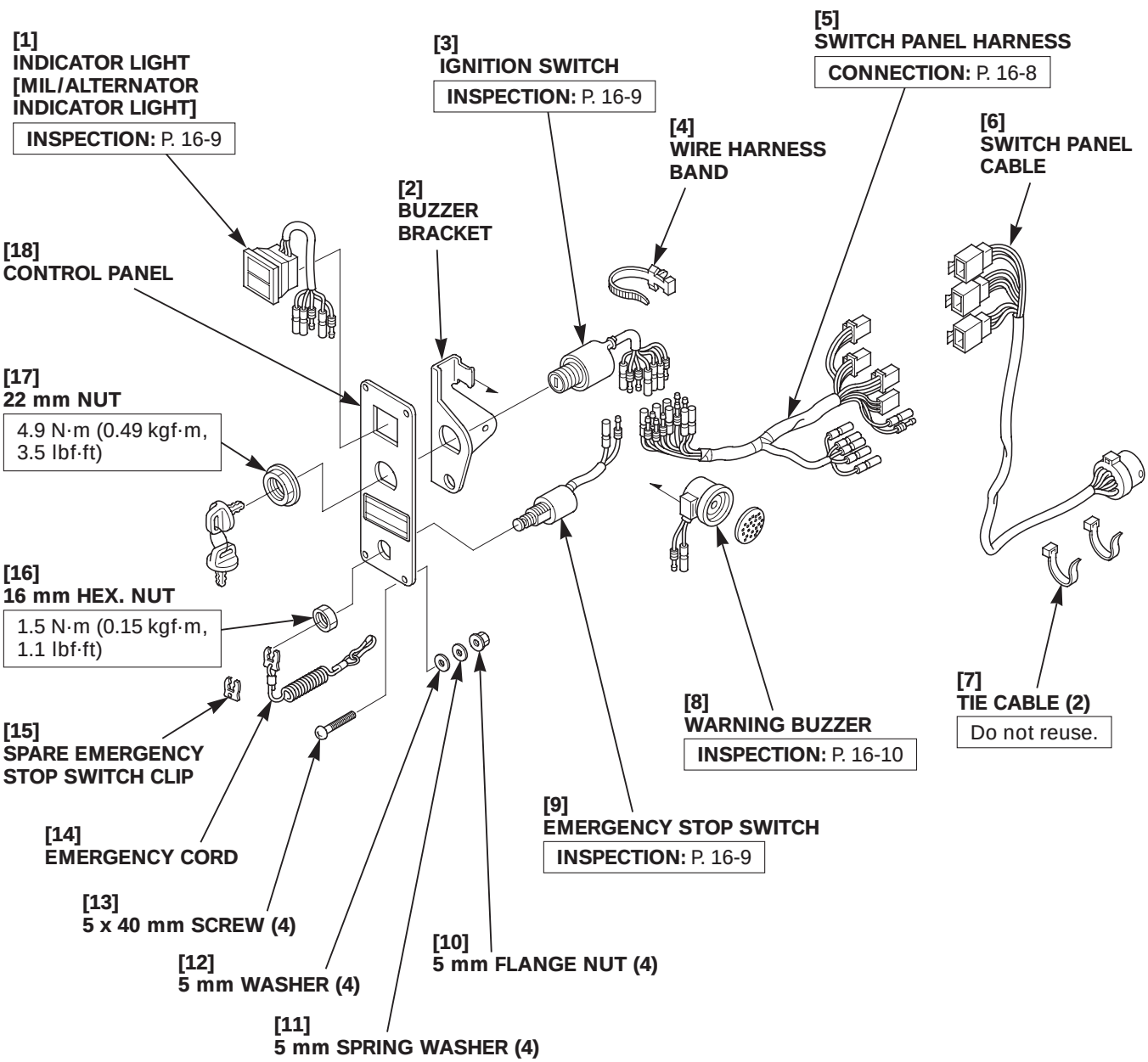


• **REMOTE CONTROL LEVER**



3. CONTROL PANEL (OPTIONAL PART)

a. DISASSEMBLY/ASSEMBLY

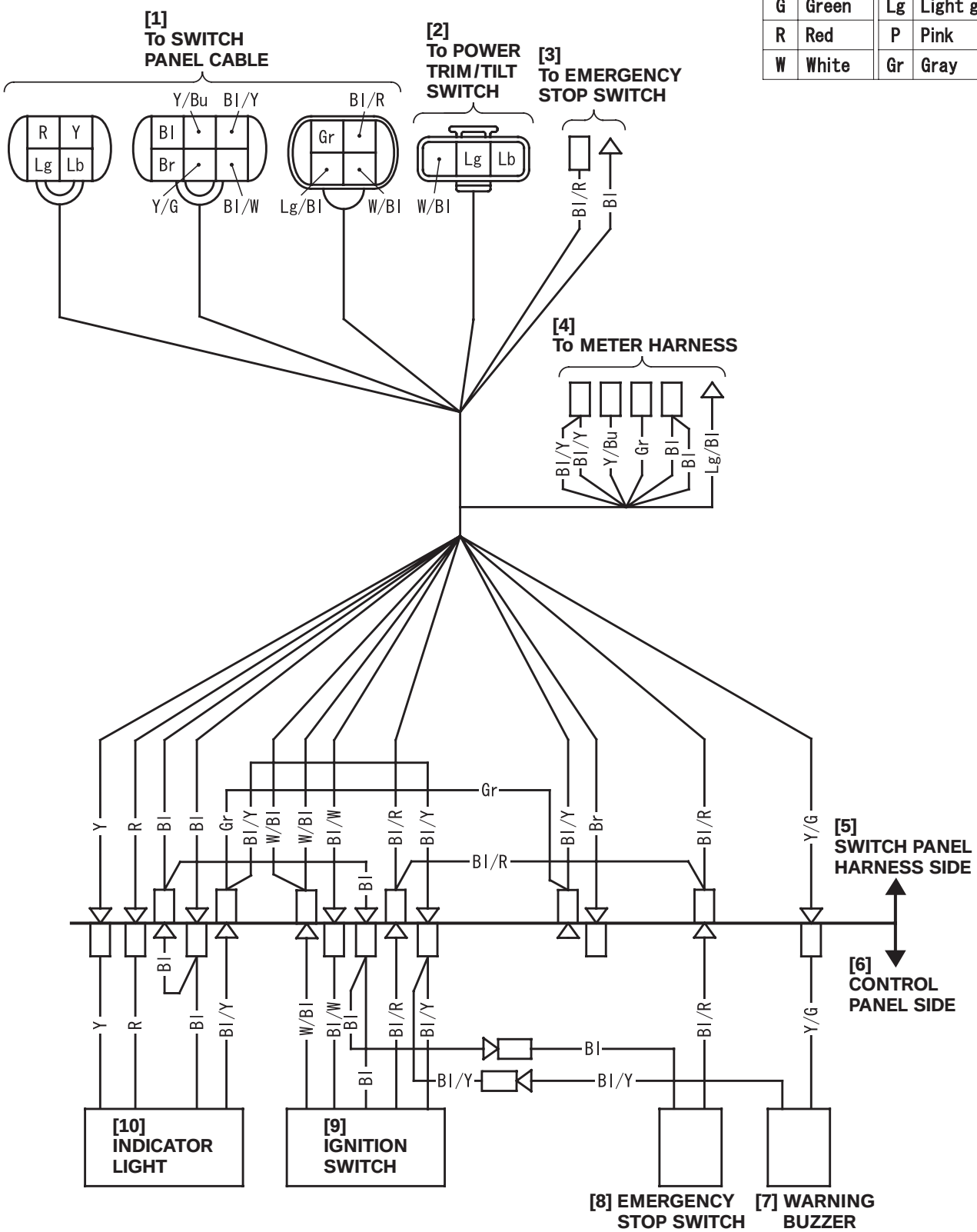


b. SWITCH PANEL HARNESS

CONNECTION:

Connect the switch panel harnesses to the respective switches as shown.

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



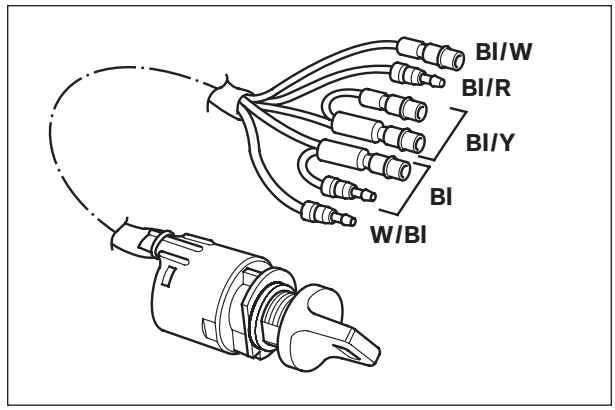
4. INSPECTION

• IGNITION SWITCH

Check for continuity between the terminals with the switch in each position.

Position \ Wire	E (Bl)	IG (Bl/R)	BAT (W/Bl)	LO (Bl/Y)	ST (Bl/W)
OFF (Stop)	○——○				
ON (Run)			○——○		
START (Start)			○——○	○——○	

○——○: Continuity Bl: Black R: Red W: White Y: Yellow

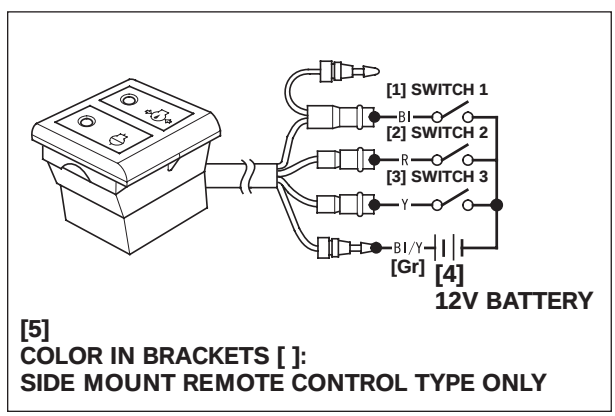


• INDICATOR LIGHT [OIL PRESSURE LIGHT/ OVERHEAT LIGHT]

NOTICE

Use a known-good battery.

Connect the black, red and yellow terminals to the switch 1, 2 and 3 respectively, and apply 12V battery voltage to the black/yellow [gray] terminal.
When the switch 1 is ON: Green light is ON.
When the switch 2 and 3 are ON: Green light is ON.
When the switch 2 is ON: Red light is ON.
Color in the brackets [ ] is for the side mount remote control type only.

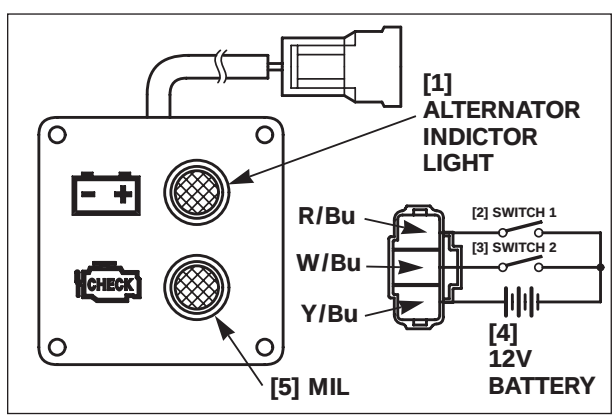


• INDICTOR LIGHT [MIL/ALTERNATOR INDICATOR LIGHT]

NOTICE

Use a known-good battery.

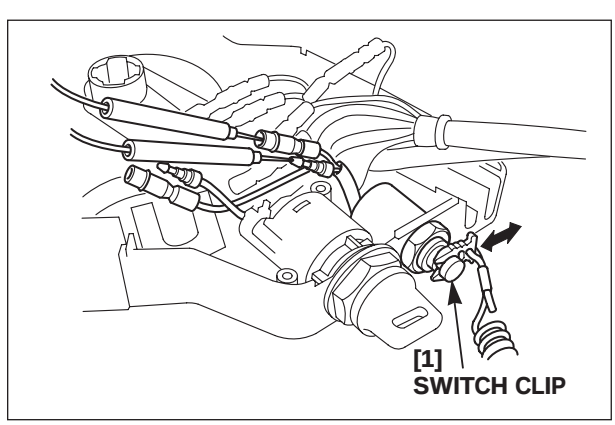
Connect the white/blue terminal to the switch 1, red/blue terminal to the switch 2, and apply 12V battery voltage as shown.
When the switch 1 is ON: Alternator indictor light is ON.
When the switch 2 is ON: MIL is ON.



• EMERGENCY STOP SWITCH

Attach the tester leads to the terminals and check for continuity.

Switch clip position	Continuity
Set	No
Not set	Yes
Switch is pushed with switch clip being set	Yes

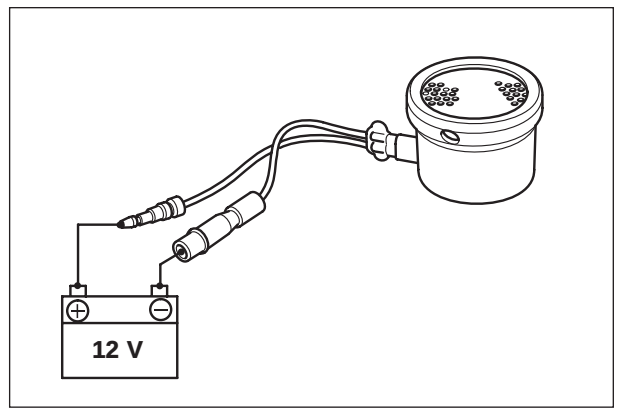


• WARNING BUZZER

NOTICE

Use a known-good battery.

Connect the black/yellow terminal of the warning buzzer to the battery positive (+) terminal, and the yellow/green terminal to the battery negative (–) terminal as shown. Check that the buzzer sounds this time.



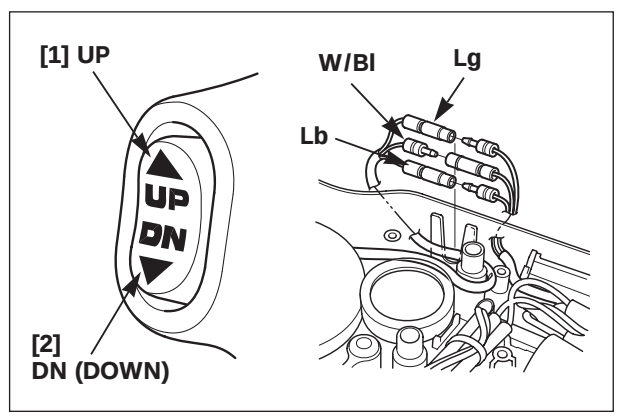
• POWER TRIM/TILT SWITCH (Side mount remote control type only)

Check for continuity between the terminals with the switch in each position.

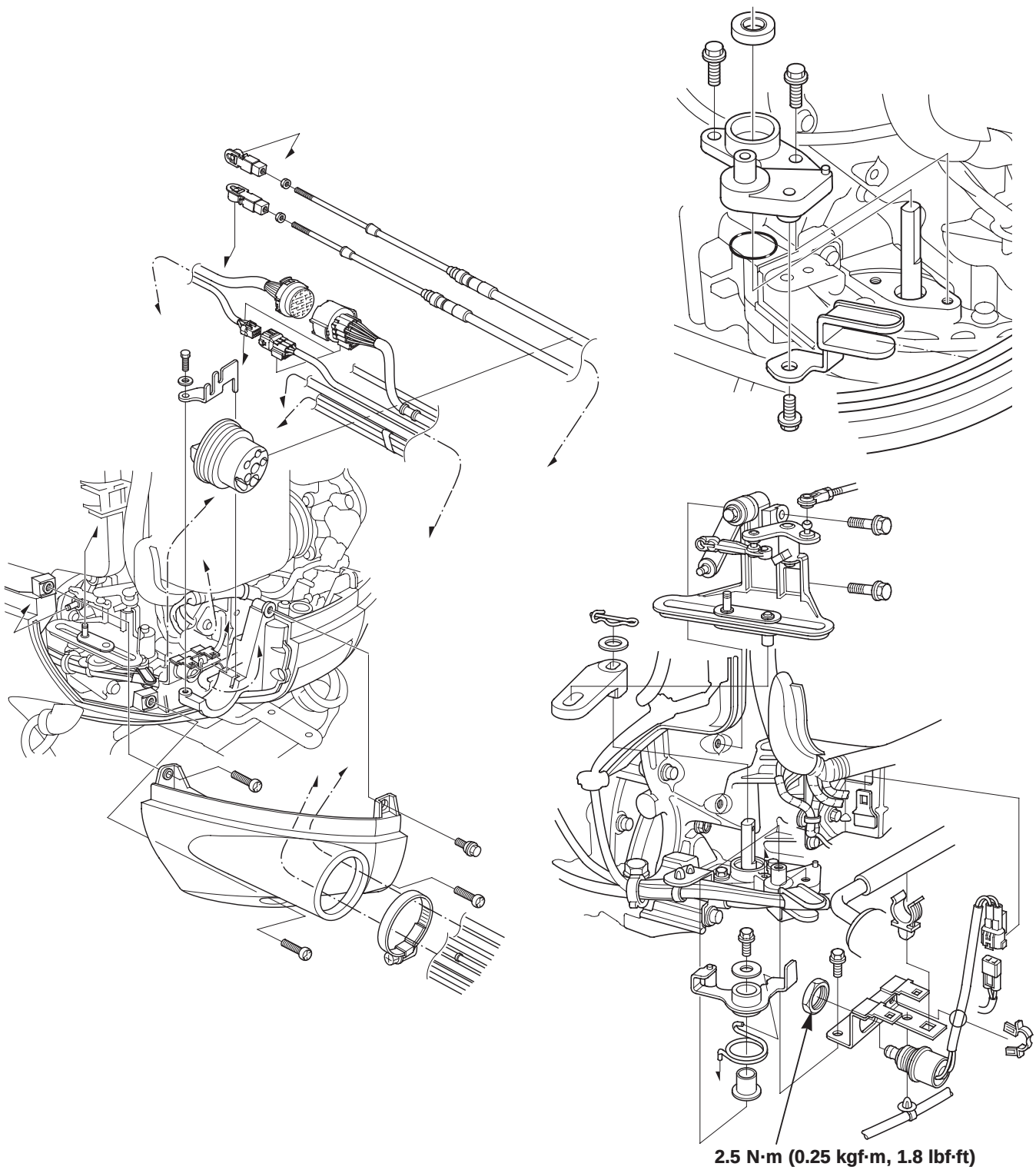
	Lb	W/Bl	Lg
UP	○———	———○	
DN (DOWN)		○———	———○

○———○: Continuity

Lb: Light blue W: White Bl: Black Lg: Light green



1. REMOTE CONTROL CABLE/ GROMMET
2. SHIFT LINK BRACKET/NEUTRAL SWITCH
3. SEAL HOLDER

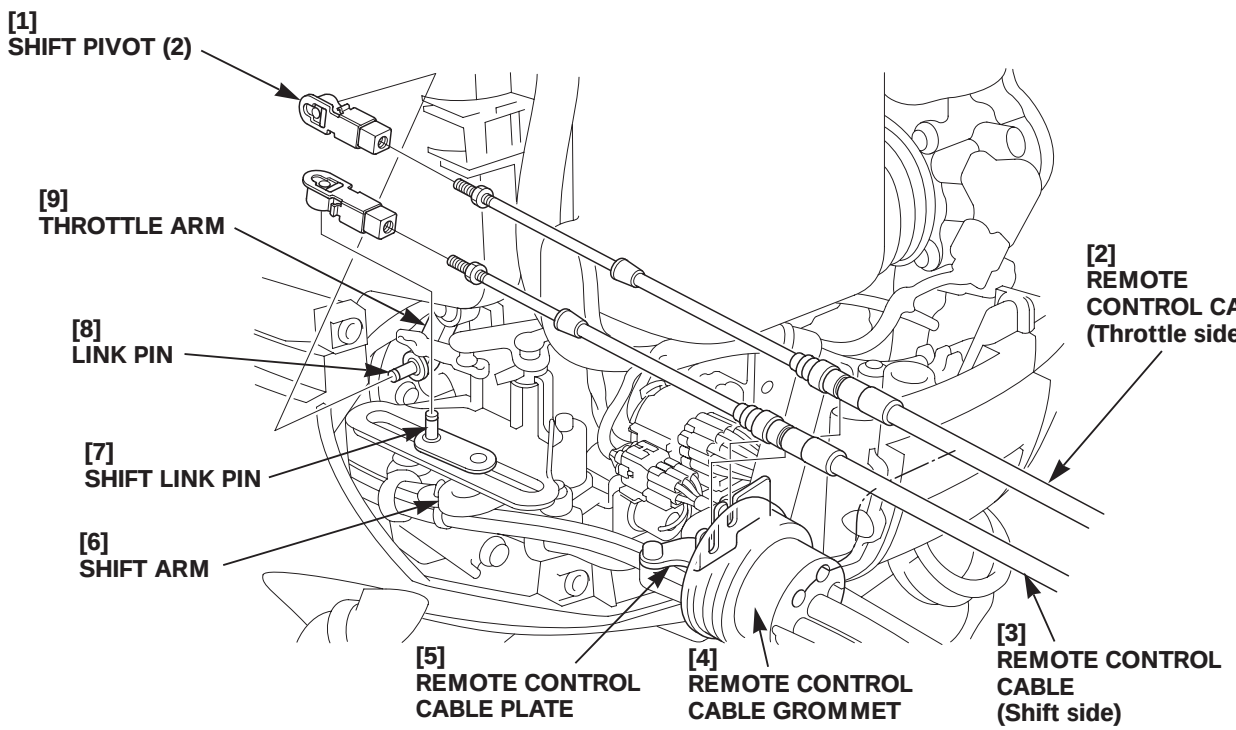


1. REMOTE CONTROL CABLE/GROMMET

a. REMOVAL

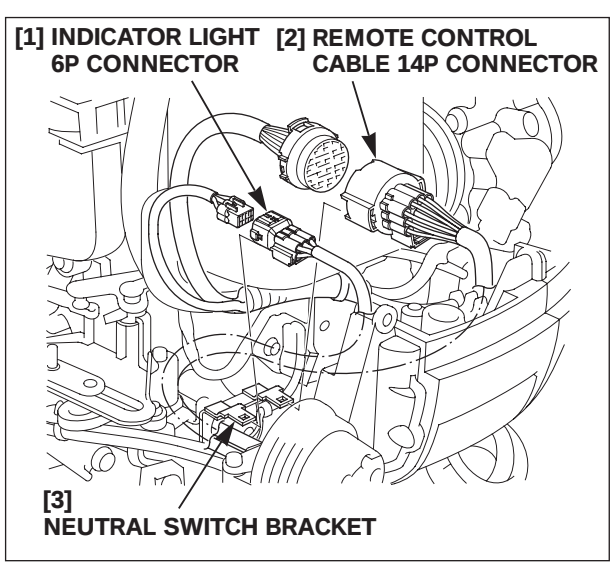
Remove the following parts.
– Engine cover (P. 4-2)
– Front separate cover (P. 4-7).

1) Remove the remote control cable (shift side) shift pivot from the shift arm shift link pin.
2) Remove the remote control cable (throttle side) shift pivot from the throttle arm link pin.
3) Remove the remote control cables (shift and throttle sides) from the remote control cable plate and the remote control cable grommet.

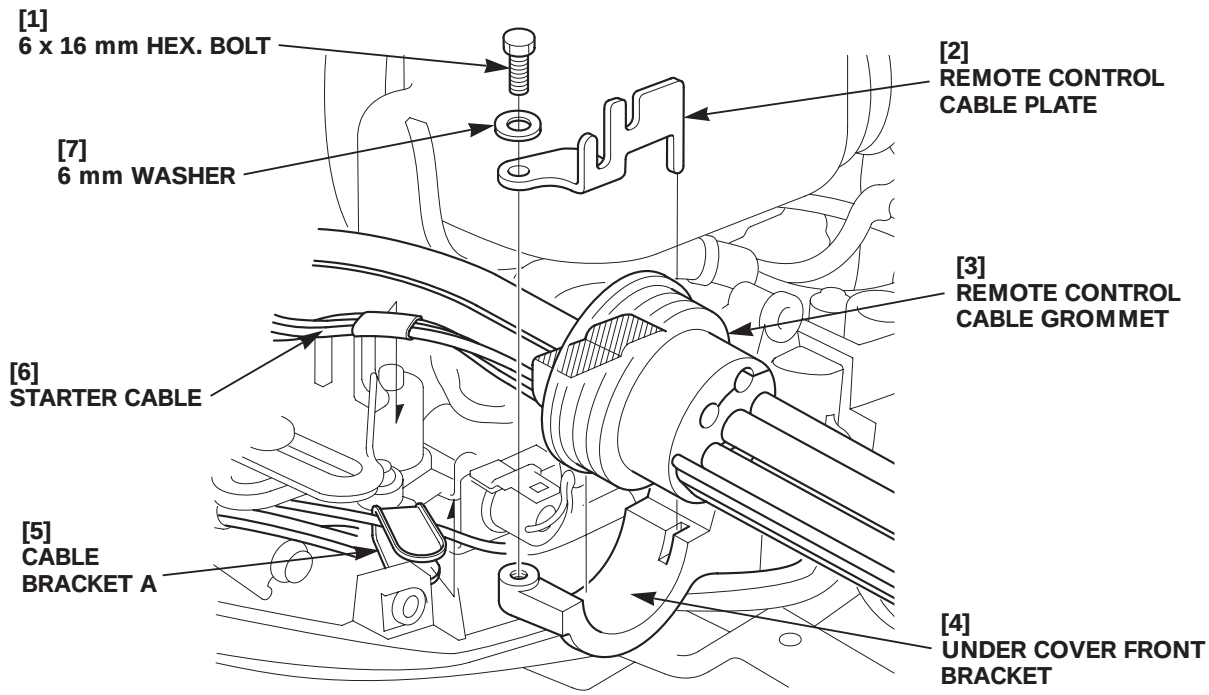


4) Release the indicator light 6P connector and the remote control cable 14P connector from the neutral switch bracket.

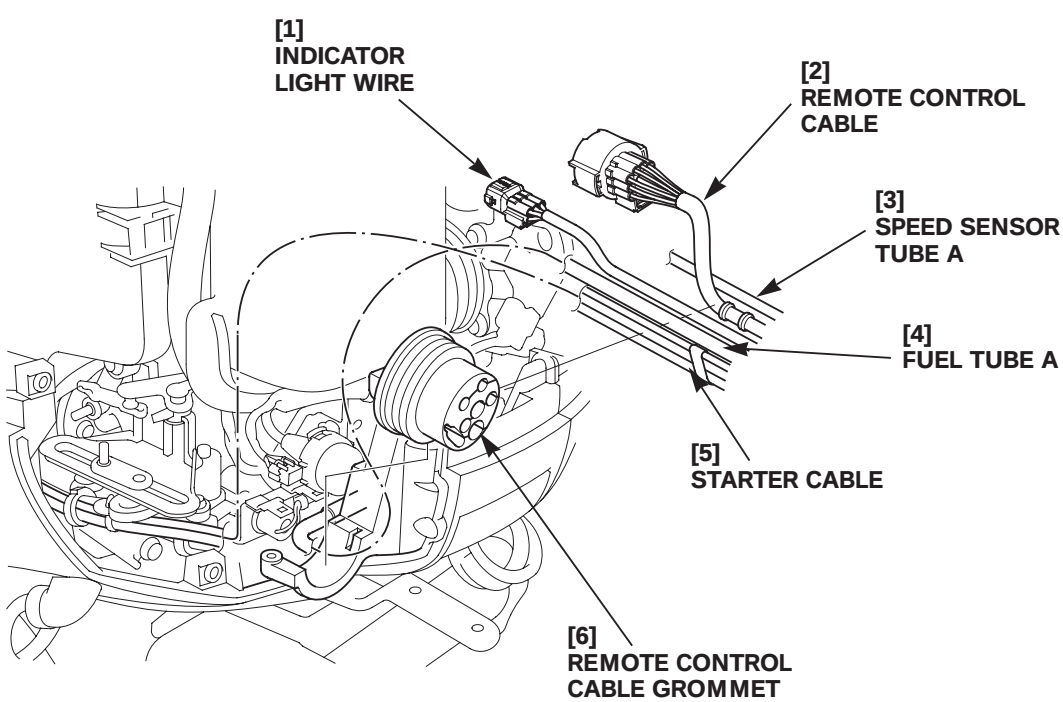
   Disconnect the indicator light 6P connector and the remote control cable 14P connector.



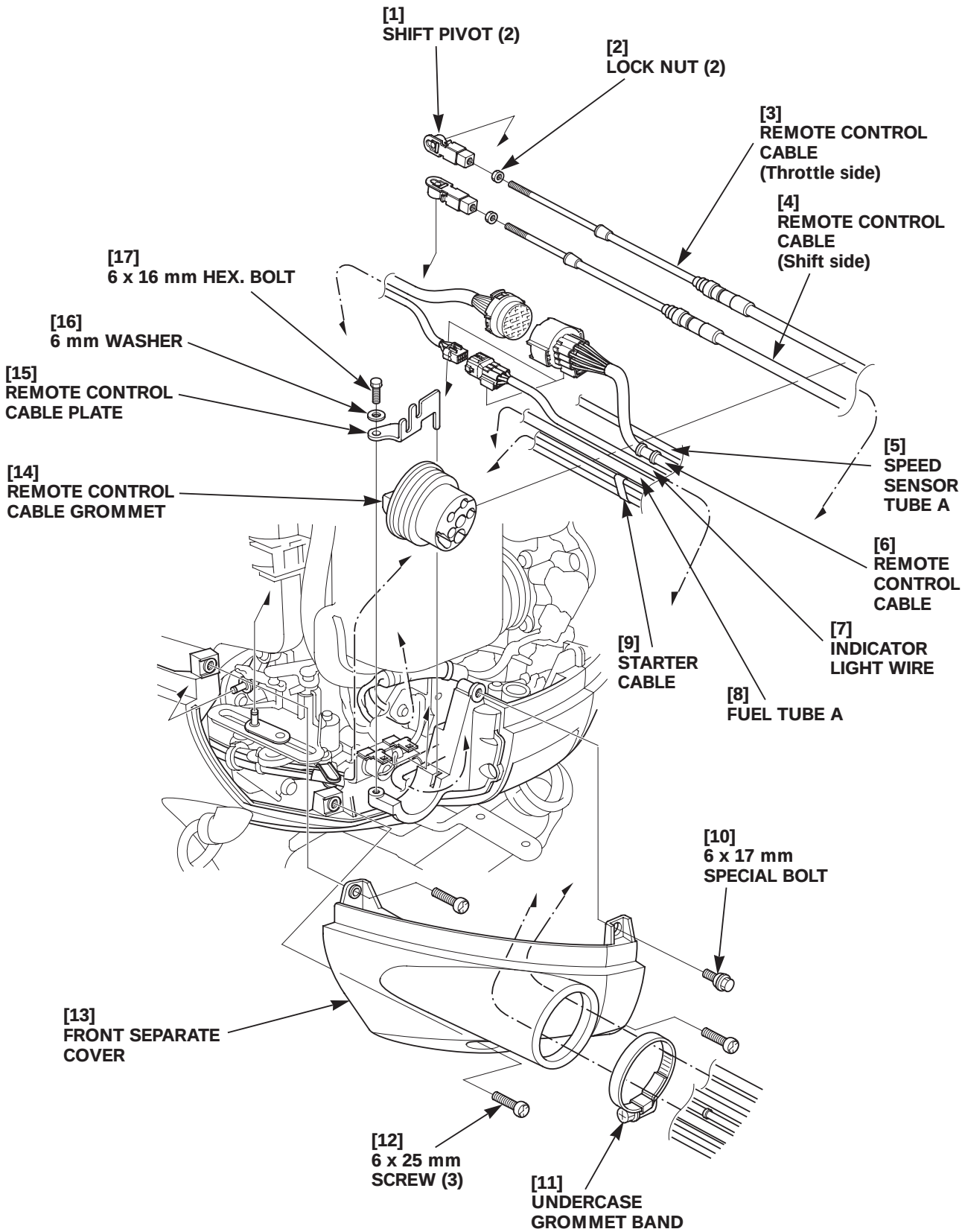
5) Remove the 6 x 16 mm hex. bolt and the 6 mm washer from the remote control cable plate, then remove the remote control cable plate.
Release the starter cable from the cable bracket A and remove the remote control cable grommet from the under cover front bracket.



6) Remove the speed sensor tube A, remote control cable, indicator light wire, starter cable and the fuel tube A from the remote control cable grommet. Remove the remote control cable grommet.



b. COMPONENTS DRAWING

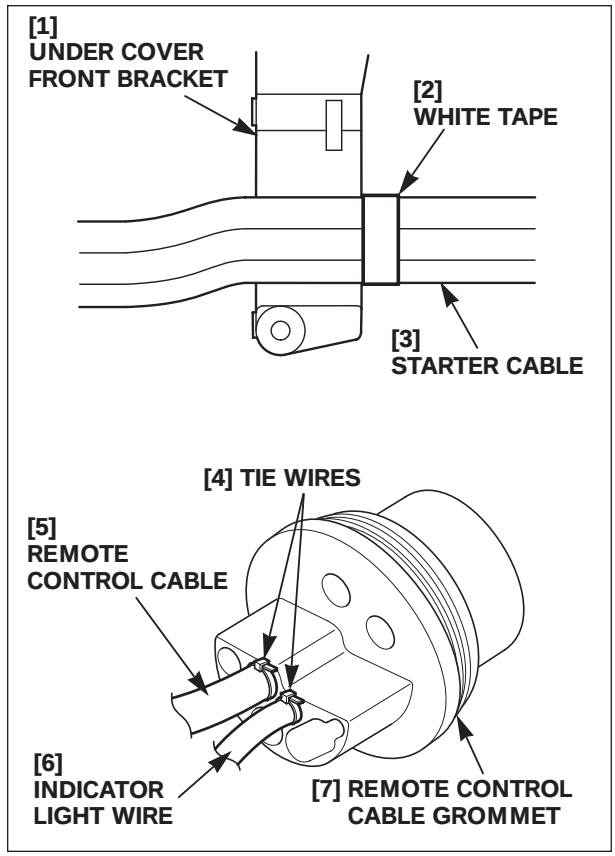


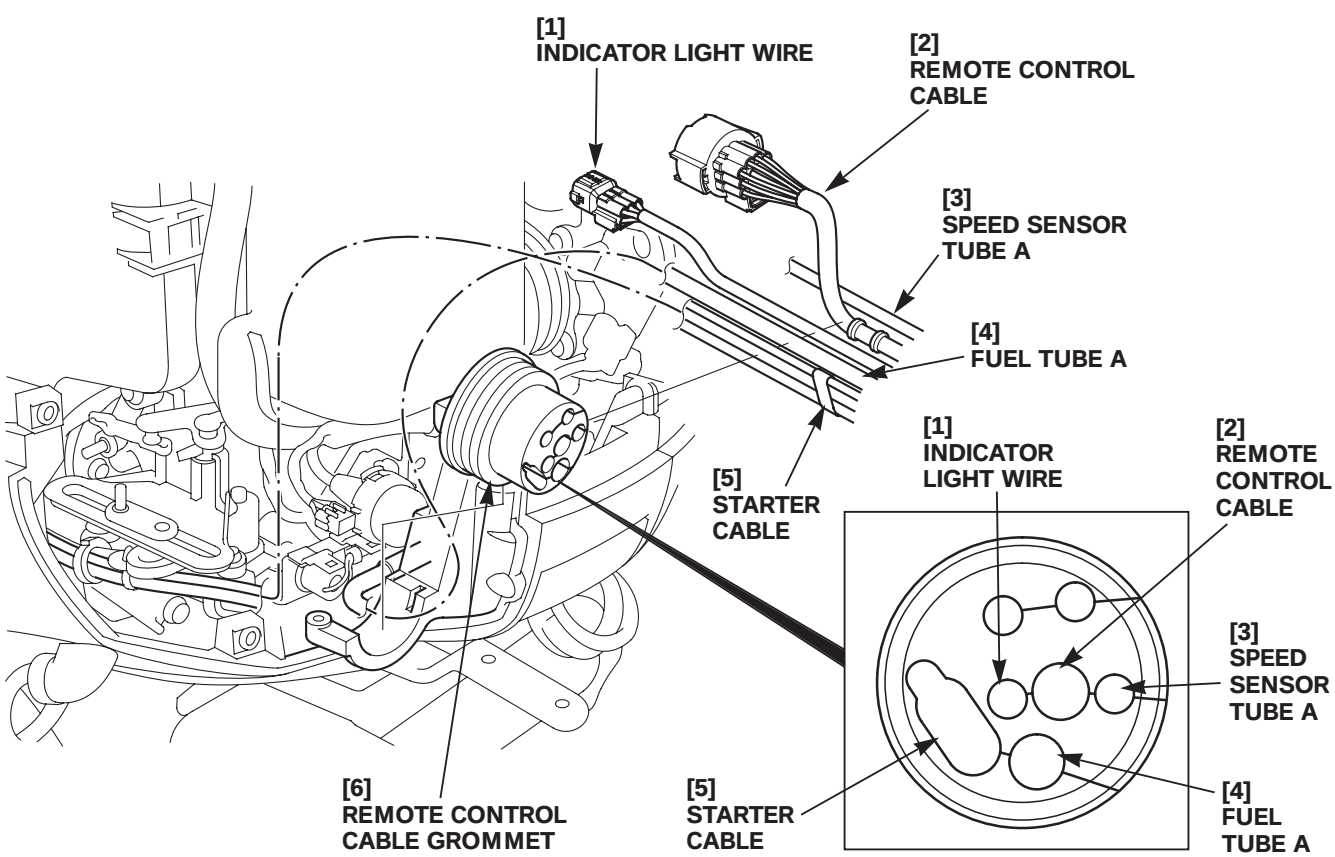
c. INSTALLATION

1) Set the indicator light wire and the remote control cable in the specified positions in the remote control cable grommet. Be sure that the tie wires on the indicator light wire and the remote control cable are set against the remote control cable grommet.

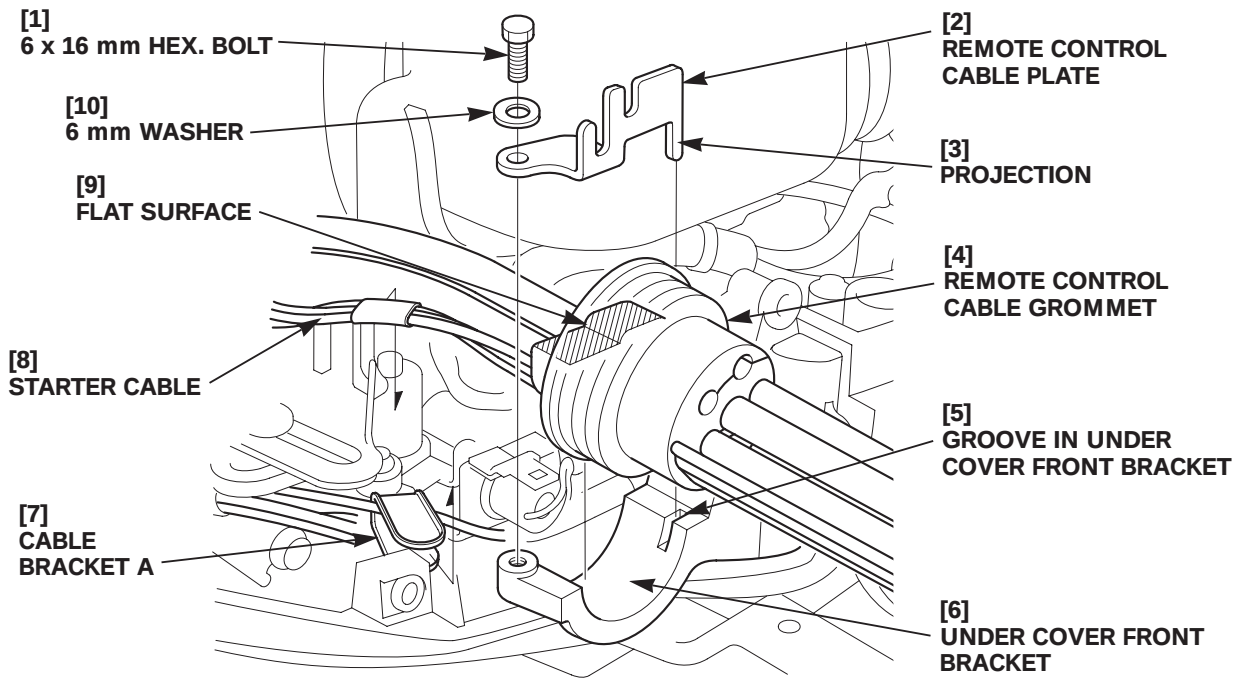
2) Set the starter cable in the specified position in the remote control cable grommet by aligning the end of the white tape on the starter cable with the end of the under cover front bracket as shown.

3) Set the fuel tube A and the speed sensor tube A in the specified positions of the remote control cable grommet.

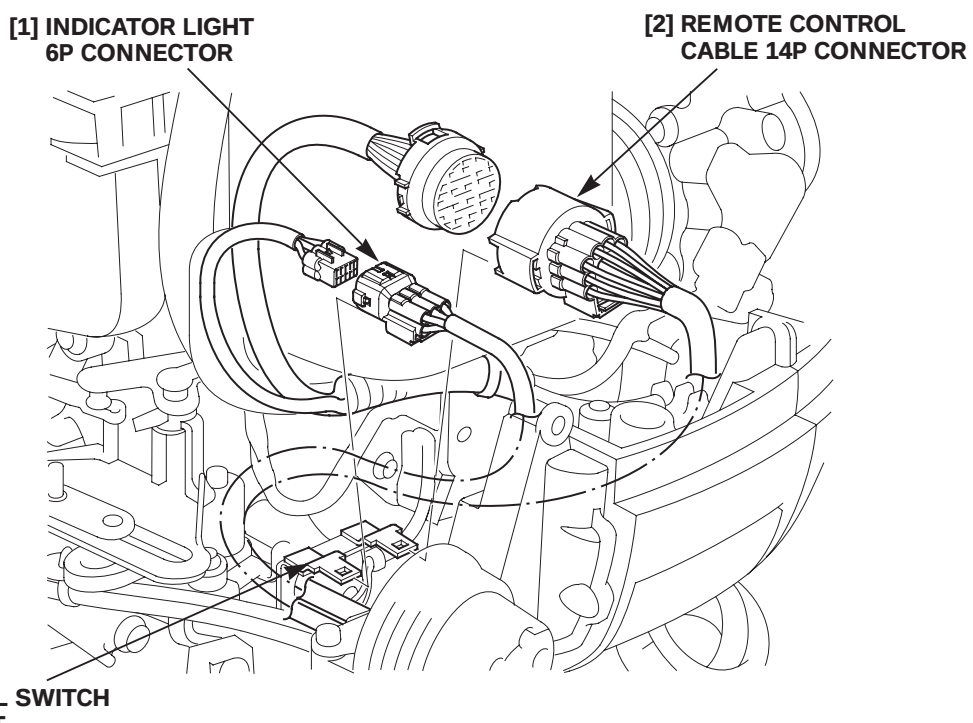




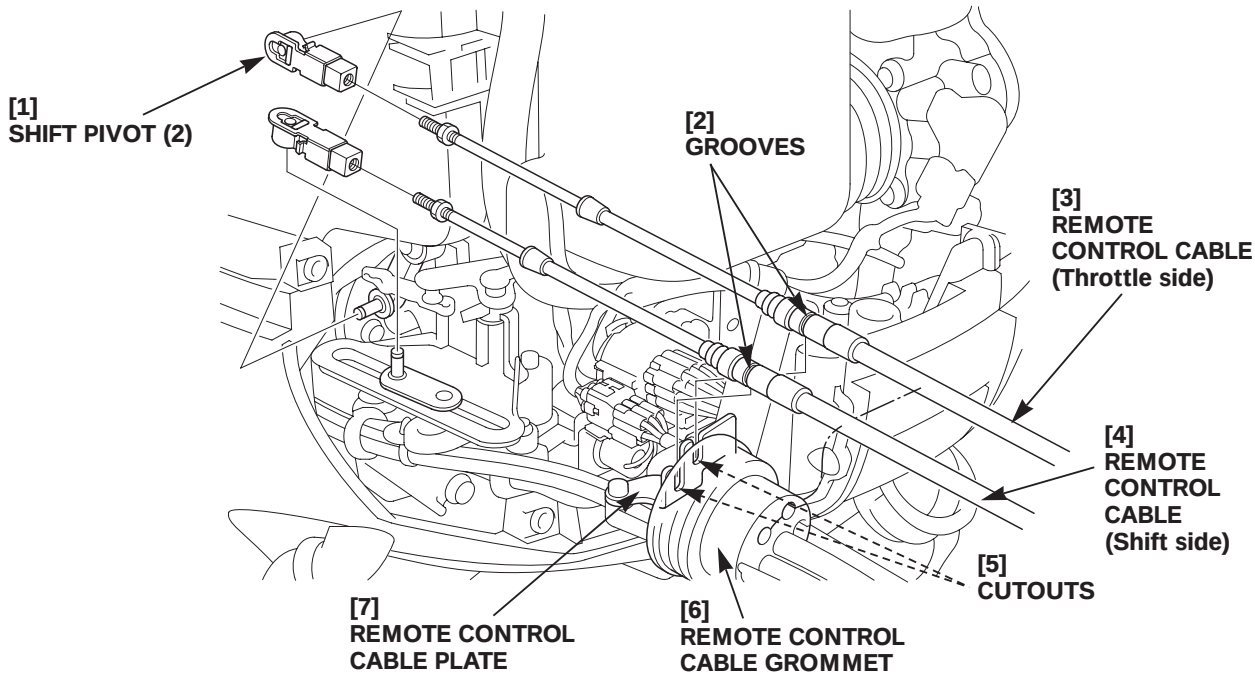
4) Install the remote control cable plate on the flat surface of the remote control cable grommet by aligning the projection on the remote control cable plate with the groove in the under cover front bracket. Take care not to move the alignments described in step 1 and 2 this time. Secure the remote control cable plate with the 6 x 16 mm hex. bolt.
Secure the starter cable with the cable bracket A.



5) Connect the indicator light 6P connector and the remote control cable 14P connector.
Install the indicator light 6P connector and the remote control cable 14P connector on the neutral switch bracket.



6) Install the lock nut and the shift pivot on each of the remote control cables.
Align the groove in each of the remote control cables (shift and throttle sides) with the cutouts in the remote control cable plate, and install the remote control cables on the remote control cable plate.
Fasten the undercase grommet band securely (P. 4-8).



d. REMOTE CONTROL CABLE (SHIFT SIDE) INSTALLATION

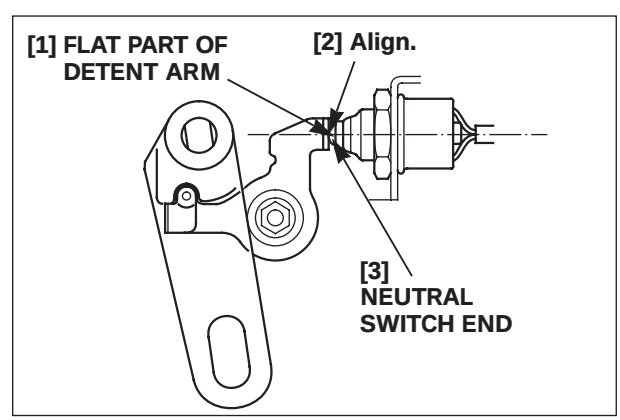
Check the following before installing the remote control cables on the outboard motor.

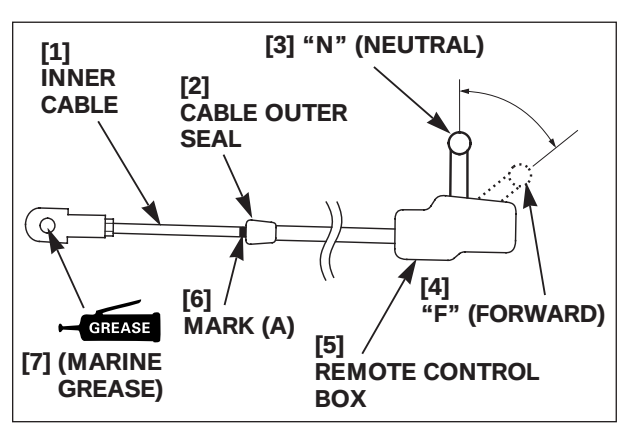
– Remote control cables are securely connected to the remote control box (P. 16-2).
– Shift arm is in the "N" (Neutral) position.
– Center of the neutral switch end is in line with the center of the flat part of the detent arm, and the detent arm roller is in the groove of the shift arm.
If the detent arm roller is in the groove of the shift arm but the center of the neutral switch end is not in line with the center of the flat part of the detent arm, check the detent arm. Replace the detent arm with a new one if it is deformed or damaged.

1) Install the shift pivot on the remove control cable (shift side).
Apply marine grease to the mounting part of the shift link pin on the shift pivot and to the shift link pin.

2) Check that the remote control cable (shift side) is detached from the shift link pin.
Move the remote control lever fully to "F" (Forward) position, then return it slowly to the "N" (Neutral) position.

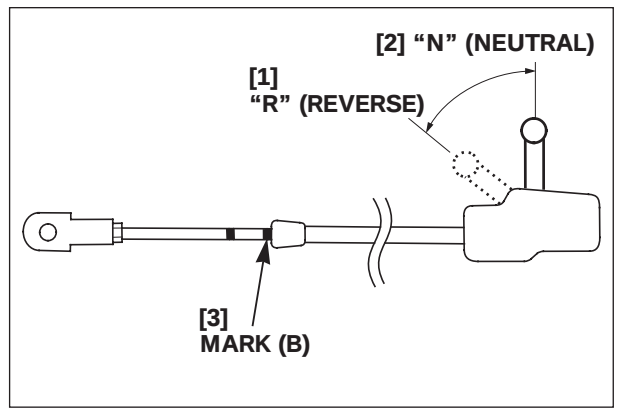
3) With the remote control lever in the position described in step 2, mark (A) at the end of the cable outer seal of the inner cable.



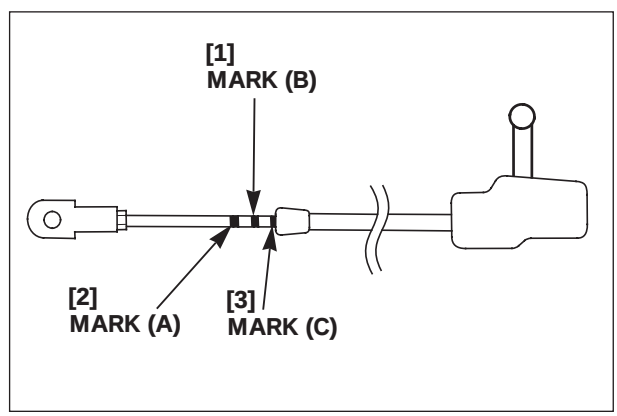


4) Move the remove control lever fully to the "R" (Reverse) position, then return it slowly to the "N" (Neutral) position.

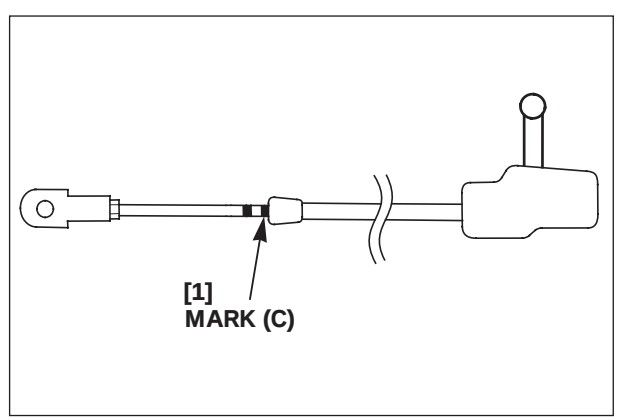
5) With the remote control lever in the position described in step 4, mark (B) at the end of the cable outer seal of the inner cable.



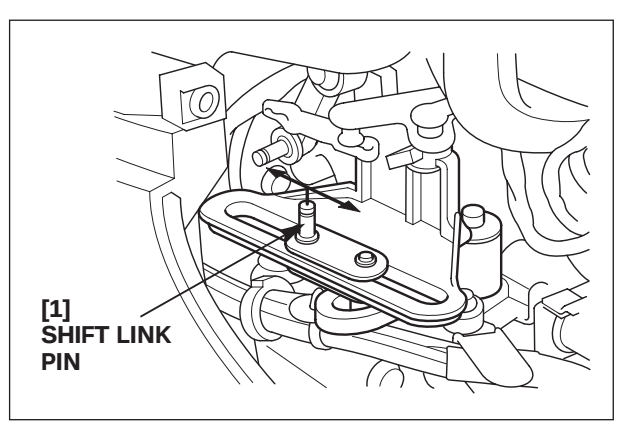
6) Mark (C) at the midpoint between the mark (A) and the mark (B).



7) Align the mark (C), marked in step 6, with the end of the cable outer seal.



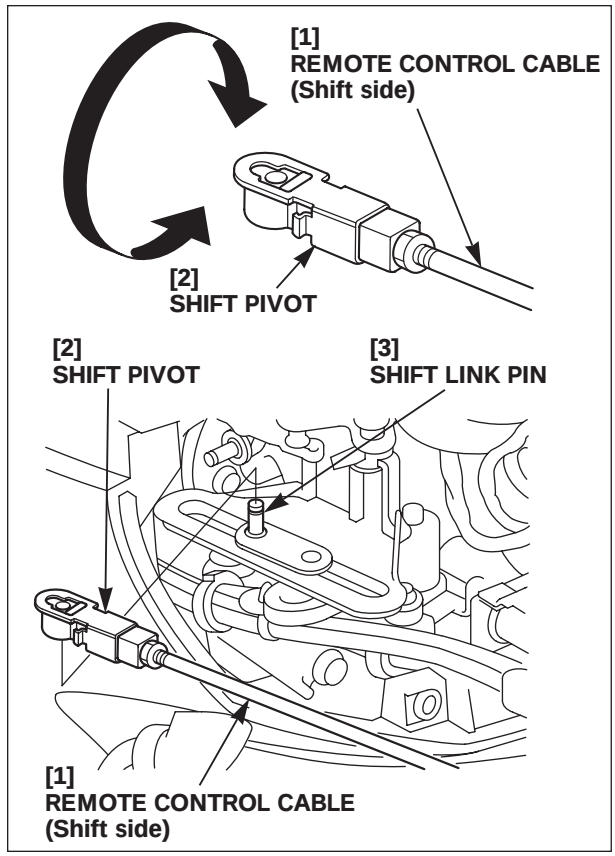
8) Move the shift link pin end lightly right and left. If the shift link pin has a free play, set the shift link pin at the center of the free play.



9) With the remote control cable (shift side) in the position described in step 7 (i.e. the mark (C) aligns with the cable outer seal end), adjust the shift side remote control cable length by turning the shift pivot so that the shift pivot sets on the shift link pin smoothly.

NOTICE

Take care not to move the mark (C) out of alignment. Set the shift pivot on the shift link pin with care not to move the shift link pin from the center of the free play.



10) After connecting the cable, move the remote control lever back and forth and check for shift.

NOTICE

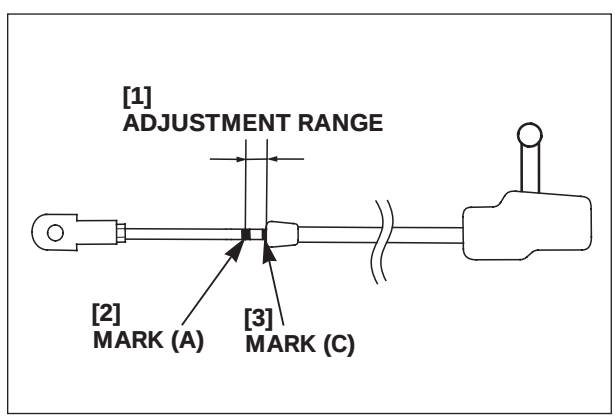
When it is hard to put the remote control lever in the "F" (Forward) or "R" (Reverse) position with the engine stopped, shift the gear while turning the propeller or propeller shaft. Do not shift the gear with force, or damage to the shift system can result.

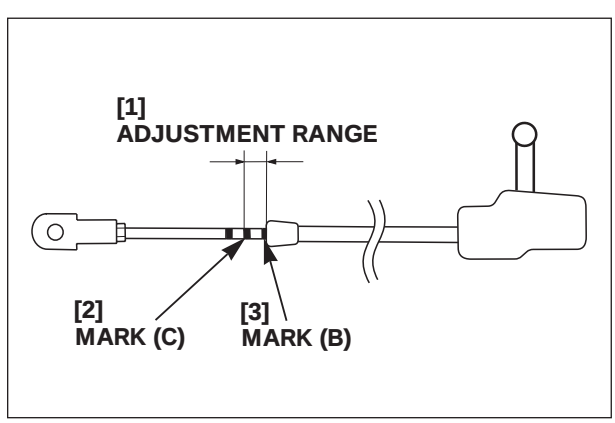
11) If the gear is not in neutral by moving the remote control lever from the "F" (Forward) to the "N" (Neutral) position, remove the shift side remote control cable from the shift link pin and move the inner cable toward the mark (A). Repeat the procedure from the step 8 (P. 17-8).

12) If the gear is not in neutral by moving the remote control lever from the "R" (Reverse) to the "N" (Neutral) position, remove the shift side remote control cable from the shift link pin and move the inner cable toward the mark (B). Repeat the procedure from the step 8 (P. 17-8).

13) After adjustment, set the remote control lever in each position and check for operation. If the gear is not in neutral securely, perform the step 11 or 12 again.

14) Adjust the shift side remote control cable after connection (P. 3-24).
Tighten the shift pivot lock nut securely.





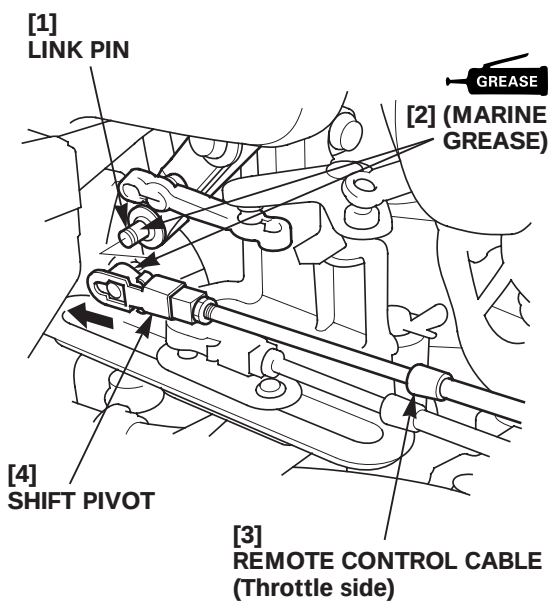
e. REMOTE CONTROL CABLE (THROTTLE SIDE) INSTALLATION

1) Apply marine grease to the link pin and the mounting part of the link pin on the shift pivot.

2) Set the remote control cable (throttle side) shift pivot on the throttle arm link pin.

3) Adjust the throttle control cable/throttle link (P. 3-26). Tighten the shift pivot lock nut securely.

4) Install the following parts.
   – Front separate cover (P. 4-7)
   – Engine cover (P. 4-2)



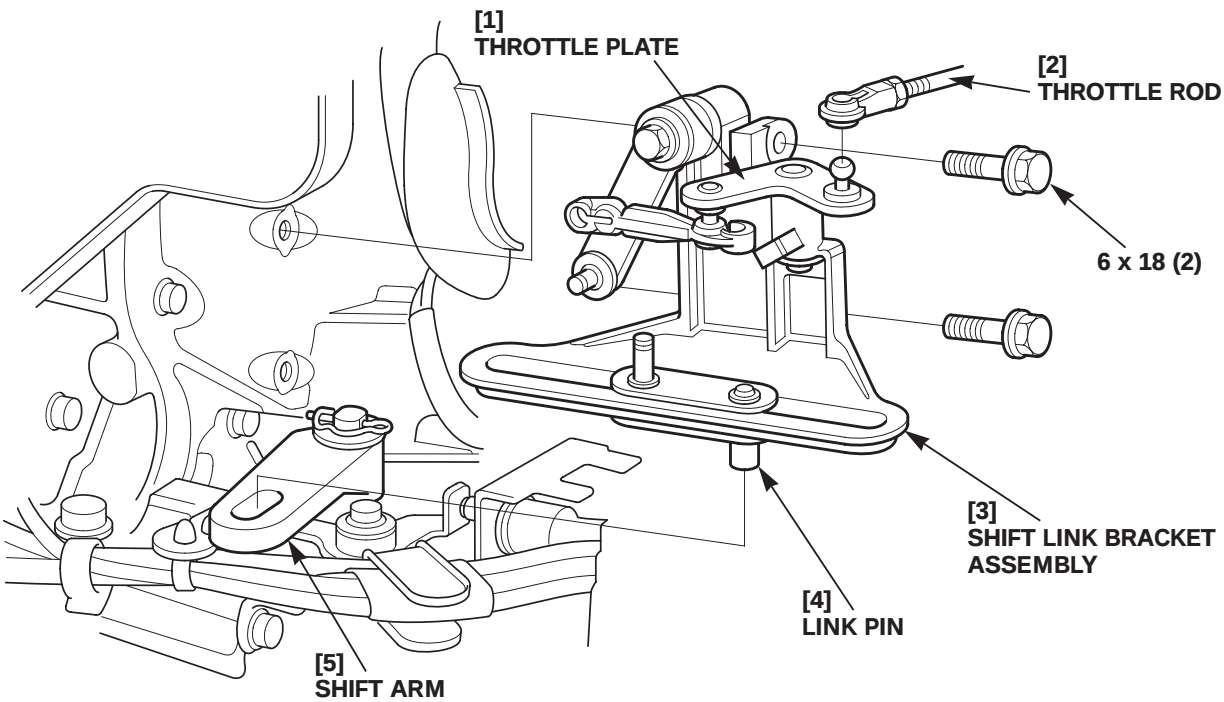
2. SHIFT LINK BRACKET/NEUTRAL SWITCH

a. REMOVAL

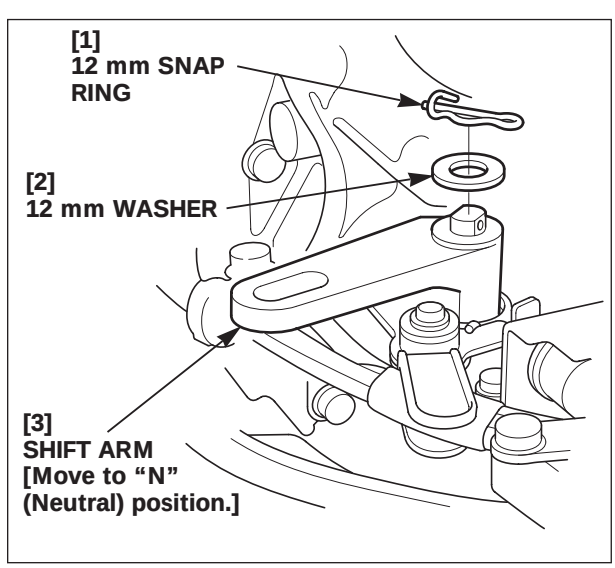
Remove the following parts.
– Engine cover (P. 4-2)
– Front separate cover (P. 4-7)
– L./R. engine under cover (P. 4-9)
– Remote control cable/grommet (P. 17-2)

1) Remove the throttle rod linkage pivot from the throttle plate.

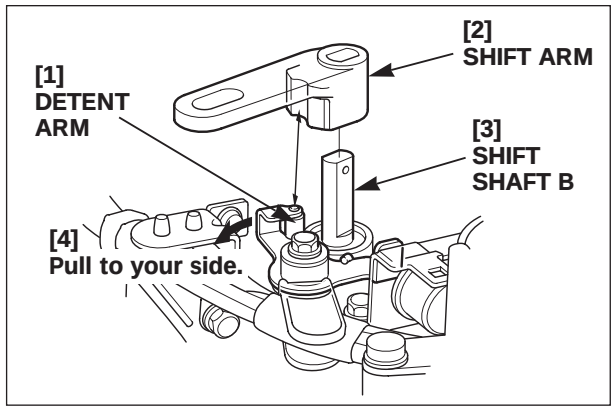
2) Remove the two 6 x 18 mm flange bolts from the shift link bracket assembly.
Remove the link pin of the shift link bracket assembly from the shift arm, and remove the shift link bracket assembly.



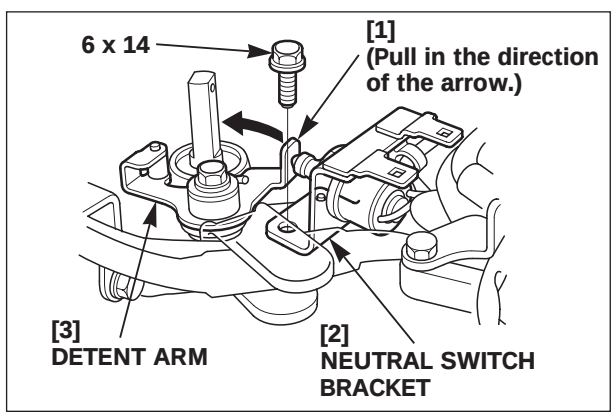
3) Move the shift arm to the "N" (Neutral) position. Remove the 12 mm snap ring and the 12 mm washer from the shift shaft B.



4) Remove the shift arm from the shift shaft B while pulling the detent arm to your side.



5) Remove the 6 x 14 mm flange bolt from the neutral switch bracket while pulling the detent arm toward you, then remove the neutral switch bracket.



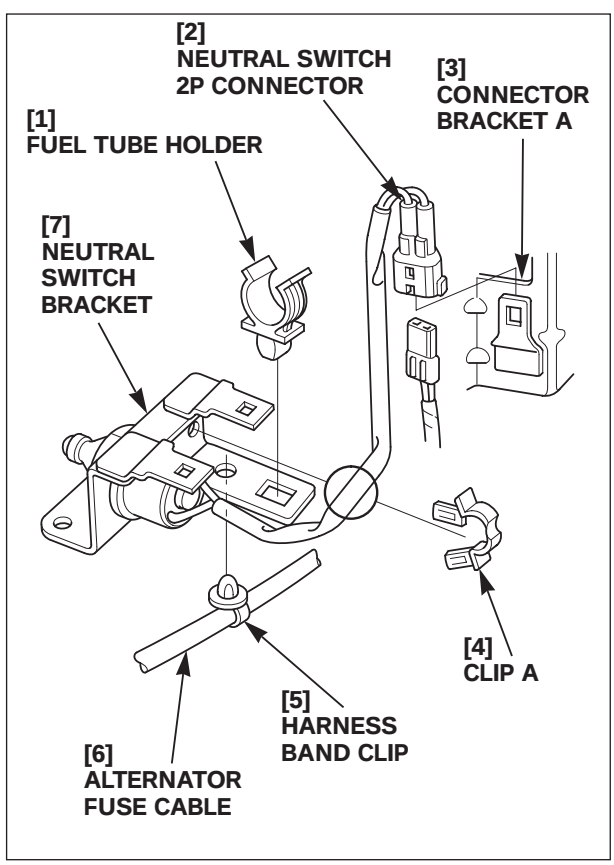
6) Release the fuel tube A from the fuel tube holder.

7) Remove the fuel tube holder from the neutral switch bracket.

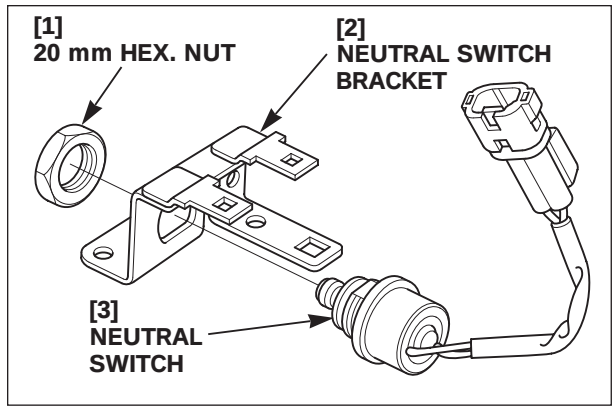
8) Remove the neutral switch 2P connector from the connector bracket A, then disconnect the connector.

9) Remove the harness band clip that secures the alternator fuse cable from the neutral switch bracket.

10) Remove the clip A from the neutral switch wire.



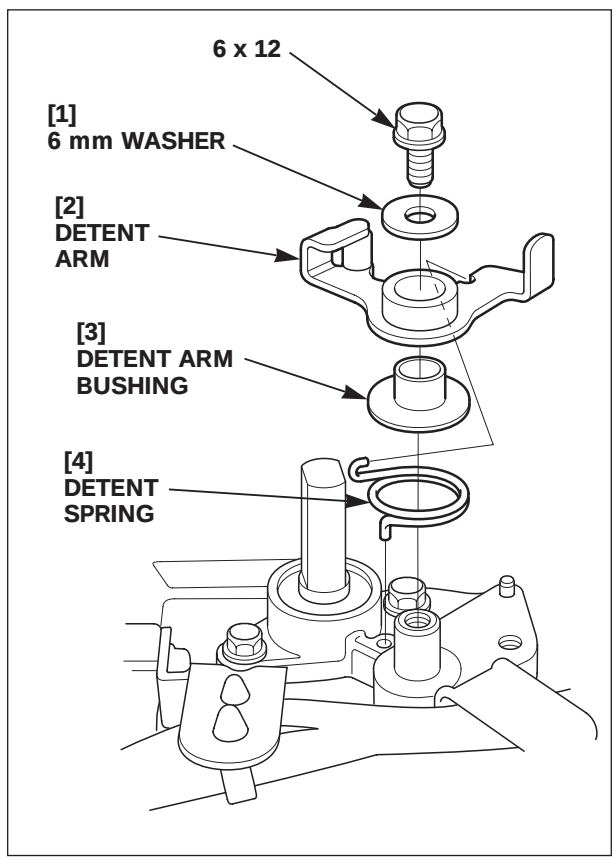
11) Remove the 20 mm hex. nut from the neutral switch, then remove the neutral switch from the neutral switch bracket.



12) Remove the 6 x 12 mm flange bolt from the detent arm, then remove the 6 mm washer, detent arm and the detent spring.

    Check the detent arm bushing on the detent arm. Replace the detent arm bushing if necessary.

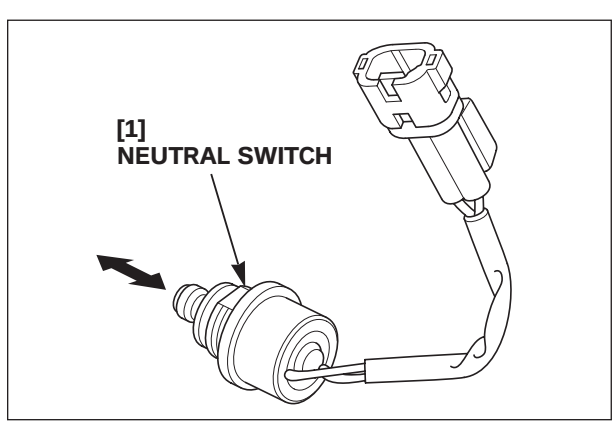
13) Remove the detent arm bushing from the detent arm. Replace the bushing with a new one on assembly.
    Check the detent arm for deformation or damage, and replace if necessary.



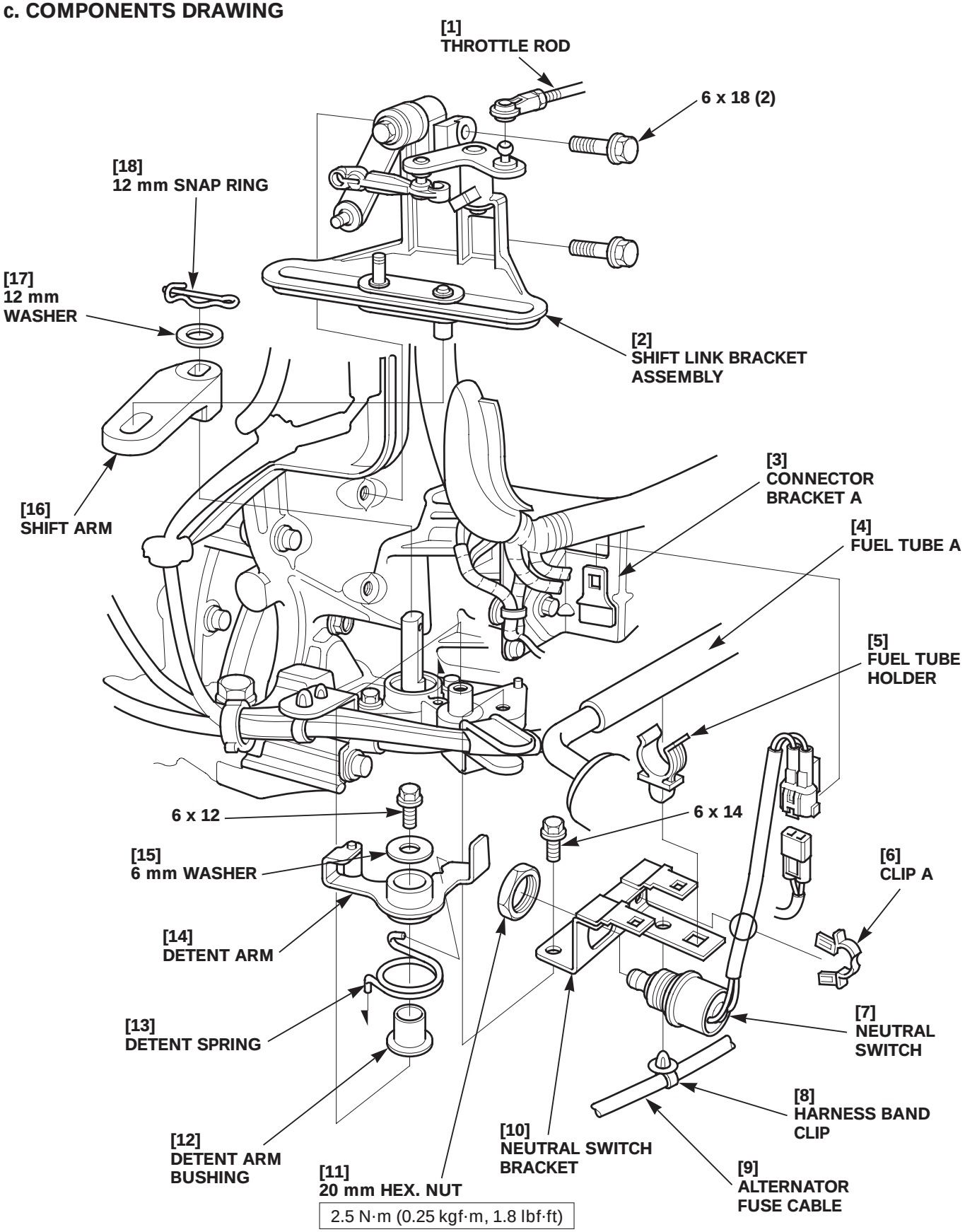
b. INSPECTION

• NEUTRAL SWITCH

Connect the tester between the terminals and push the switch knob. There must be continuity when the switch knob is pushed, and no continuity when the knob is released.



c. COMPONENTS DRAWING



d. DISASSEMBLY OF SHIFT LINK BRACKET ASSEMBLY

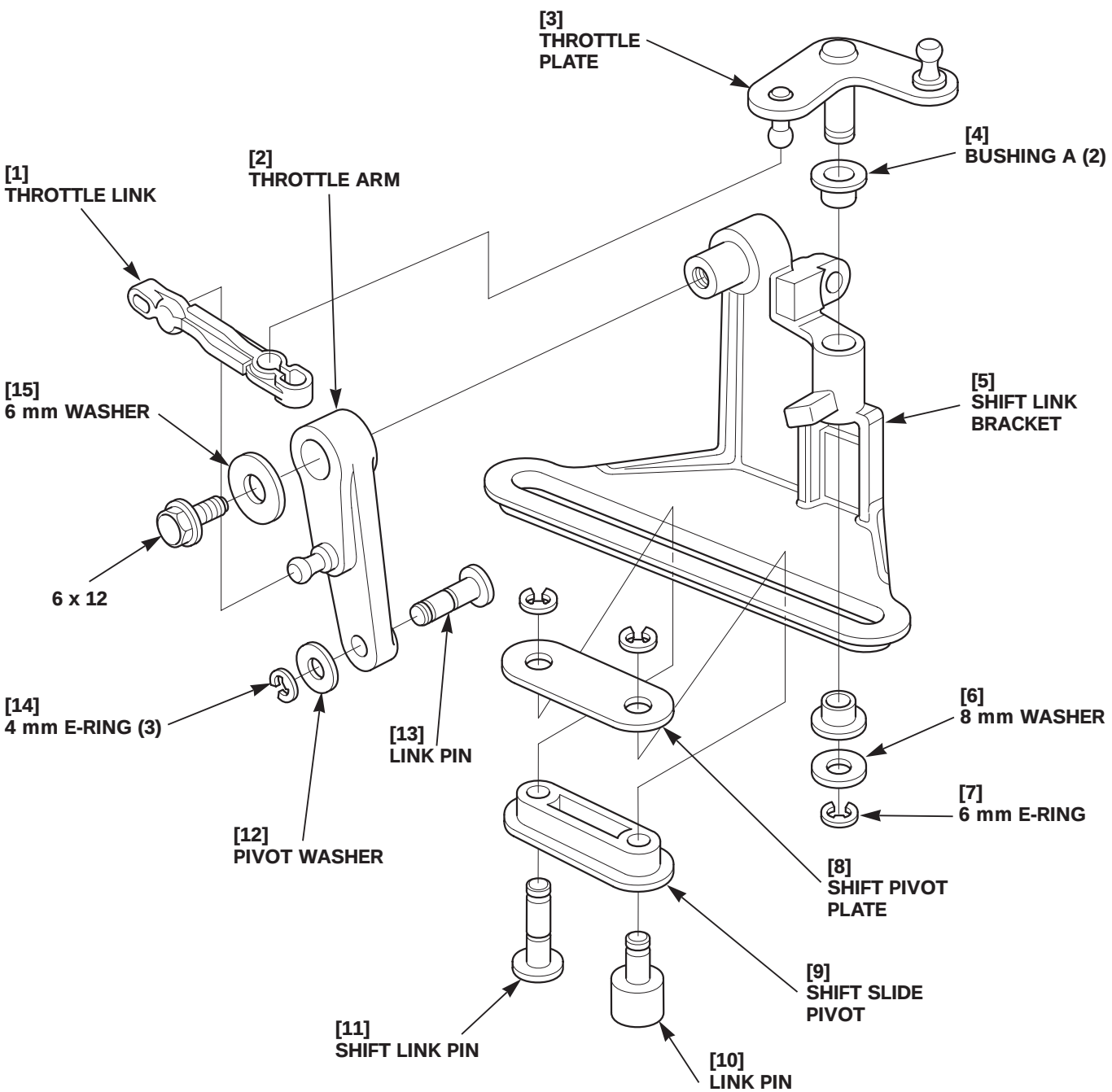
1) Remove the throttle link.

2) Remove the throttle arm and remove the link pin.

3) Remove the shift link pin, link pin, shift slide pivot and the shift pivot plate.

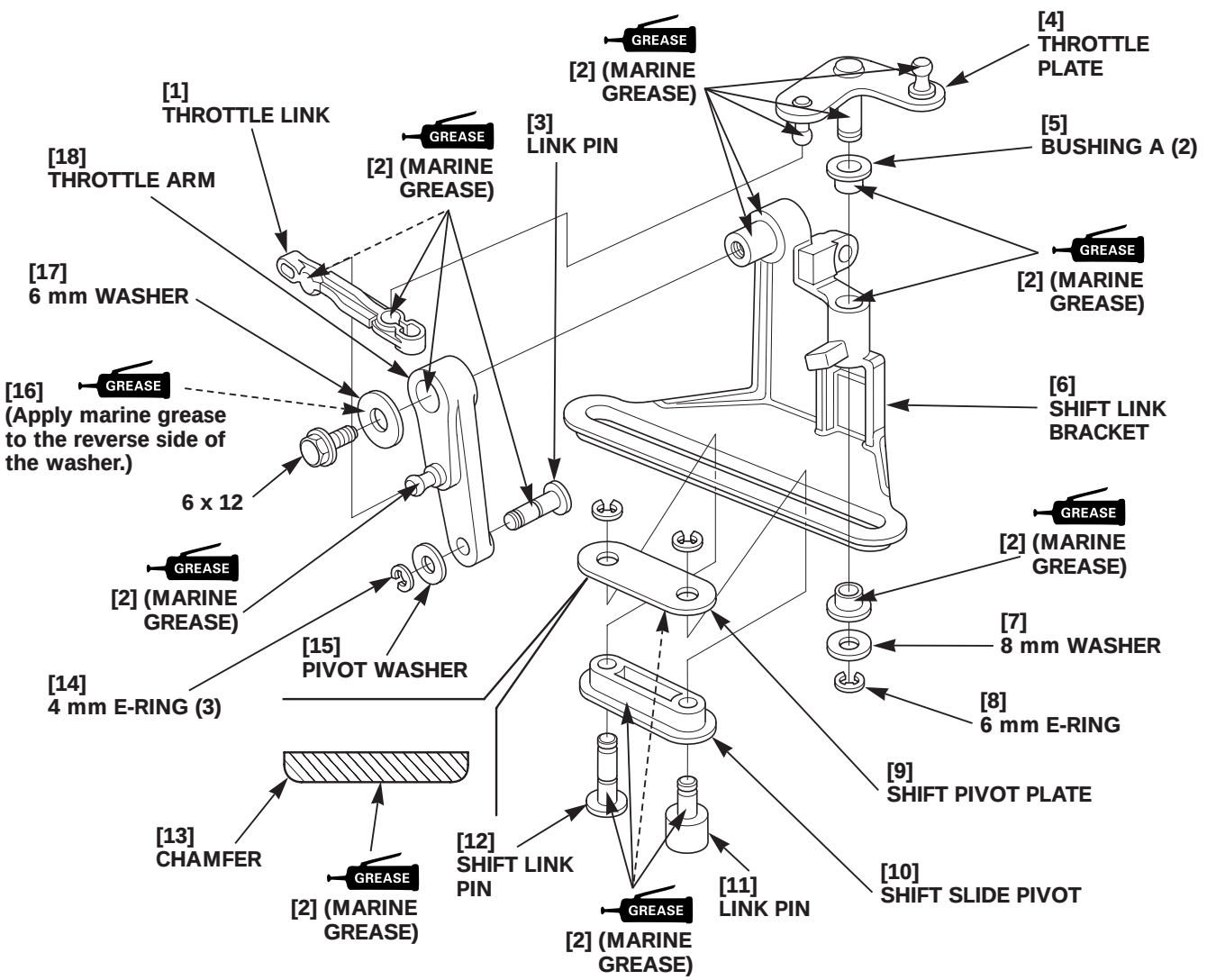
4) Remove the throttle plate.

5) Check the two bushing As from the shift link bracket. If they are damaged, remove them and replace with the new ones.



e. ASSEMBLY OF SHIFT LINK BRACKET ASSEMBLY

1) Apply marine grease to the outer surface of the two bushing As and the inner wall at the mounting part of the bushing A in the link bracket. Install the two bushing As in the shift link bracket.
2) Apply marine grease to the outer surface of the throttle plate shaft. Install the throttle plate on the shift link bracket. Set the 8 mm washer on the throttle plate, and set the 6 mm E-ring in the groove in the throttle plate securely.
3) Apply marine grease to the outer surface of the throttle arm link pin. Set the link pin on the throttle arm and secure with the pivot washer and the 4 mm E-ring.
4) Apply marine grease to the inner wall at the mounting part of the shift link bracket in the throttle arm.
   Apply marine grease to the throttle arm mating surfaces on the shift link bracket, and install the throttle arm on the shift link bracket.
5) Apply marine grease to the 6 mm washer and the throttle arm mating surfaces. Set the 6 mm washer on the throttle arm and tighten the 6 x 12 mm flange bolt securely.
6) Apply marine grease to the mounting part of the throttle arm and the mounting part of the throttle plate in the throttle link, then install the throttle link.
7) Apply marine grease to the shift slide pivot and the outer surface of the shift link pin. Apply marine grease to the entire surface of the link pin. Apply marine grease to the chamfered side of the shift pivot plate.
8) Set the shift link pin and the link pin on the shift slide pivot. Install the shift slide pivot on the shift link bracket.
9) Install the shift pivot plate with its chamfer toward the shift link bracket. Set the 4 mm E-rings in the grooves in the shift link pin and the link pin securely.



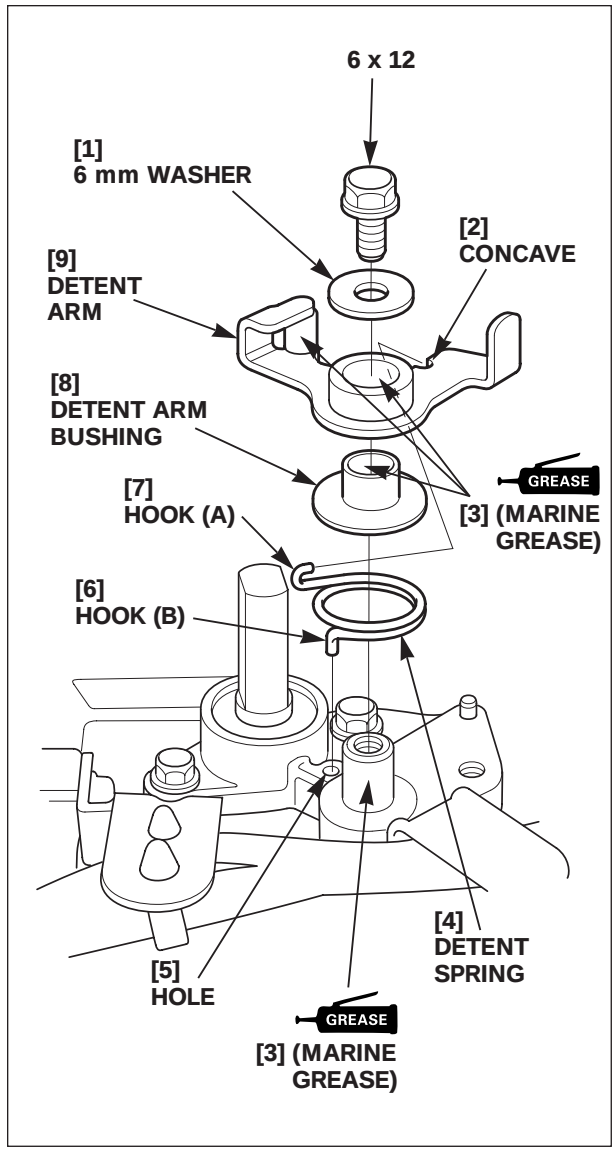
f. INSTALLATION

1) Apply marine grease to the inner wall of a new detent arm bushing. Set the detent arm bushing on the detent arm.

2) Apply marine grease to the seal holder shaft.
Apply marine grease to the roller area of the detent arm.

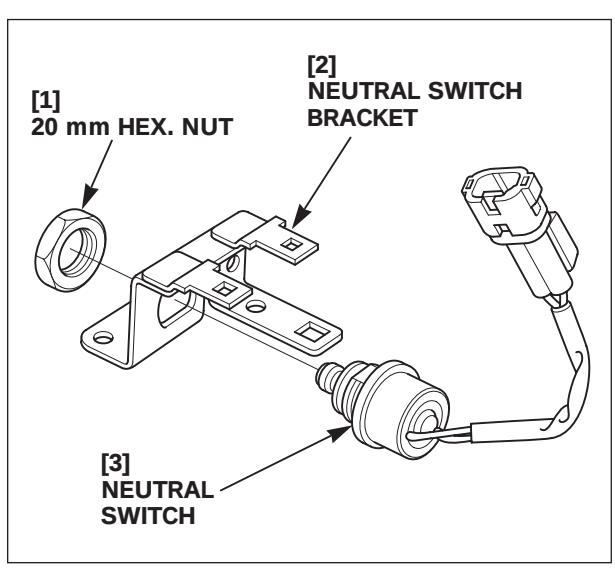
3) Align the hook (A) of the detent spring with the concave in the detent arm as shown.
Align the other hook (B) with the seal holder hole and install the detent spring.

4) Set the 6 mm washer on the detent arm and tighten the 6 x 12 mm flange bolt securely.



5) Set the neutral switch on the neutral switch bracket and tighten the 20 mm hex. nut to the specified torque.

TORQUE: 2.5 N·m (0.25 kgf·m, 1.8 lbf·ft)



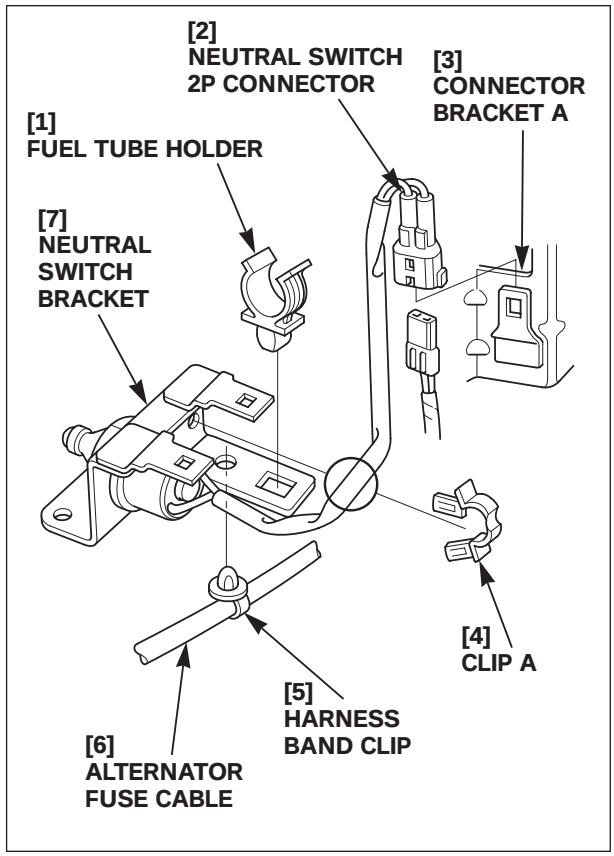
6) Clamp the neutral switch wire with the clip A and set the clip A on the neutral switch bracket.

7) Connect the neutral switch 2P connector and set the neutral switch 2P connector on the connector bracket A.

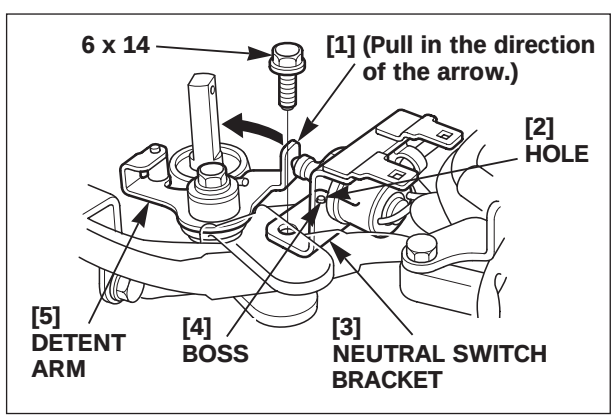
8) Set the fuel tube holder on the connector bracket A.

9) Clamp the fuel tube A on the connector bracket A.

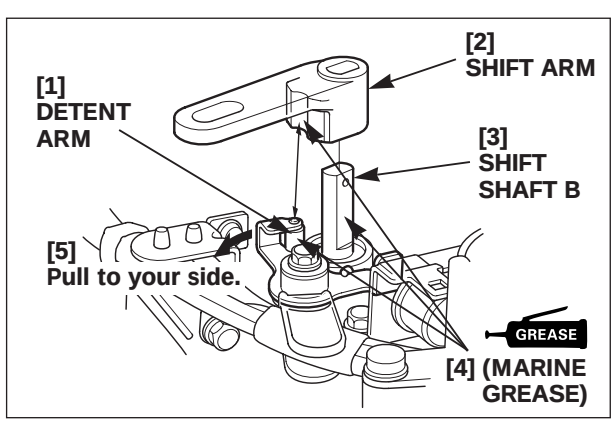
10) Set the harness band clip that clamps the alternator fuse cable on the neutral switch bracket.



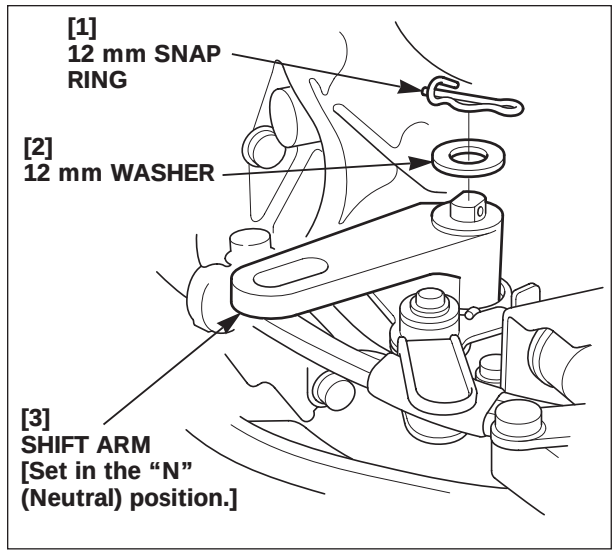
11) Install the neutral switch bracket by aligning a small hole in the neutral switch bracket with the boss on the seal holder while pulling the detent arm to your side. Tighten the 6 x 14 mm flange bolt securely.



12) Apply marine grease to the concave in the shift arm and to the shift shaft B.
Pulling the detent arm to your side, install the shift arm on the shift shaft B.



13) Set the 12 mm washer on the shift shaft B and secure with the 12 mm snap ring.



14) Apply marine grease to the outer surface of the link pin of the shift link bracket and to the long hole in the shift arm. Set the link pin aligning with the long hole in the shift arm.

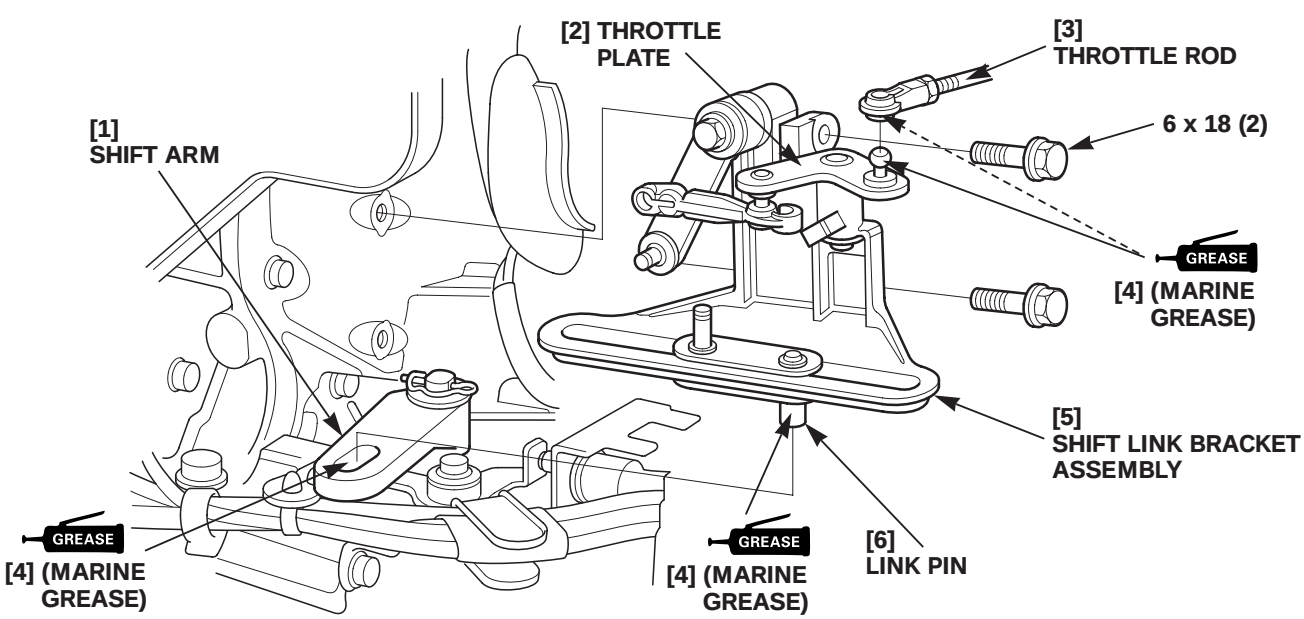
15) Tighten the shift link bracket assembly with the two 6 x 18 mm flange bolts securely.

16) Apply marine grease to the mounting part of the linkage pivot on the throttle plate and to the linkage pivot. Install the linkage pivot on the throttle plate.

17) Apply marine grease to the outer surface of the shift link pin and install the remote control cable (shift side) (P. 17-7).

18) Apply marine grease to the outer surface of the link pin and install the remote control cable (throttle side) (P.17-10).

19) Remove the following parts.
- Remote control cable/grommet (P. 17-5)
- L./R. engine under covers (P. 4-14)
- Front separate cover (P. 4-7)
- Engine cover (P. 4-2)



3. SEAL HOLDER

a. REMOVAL

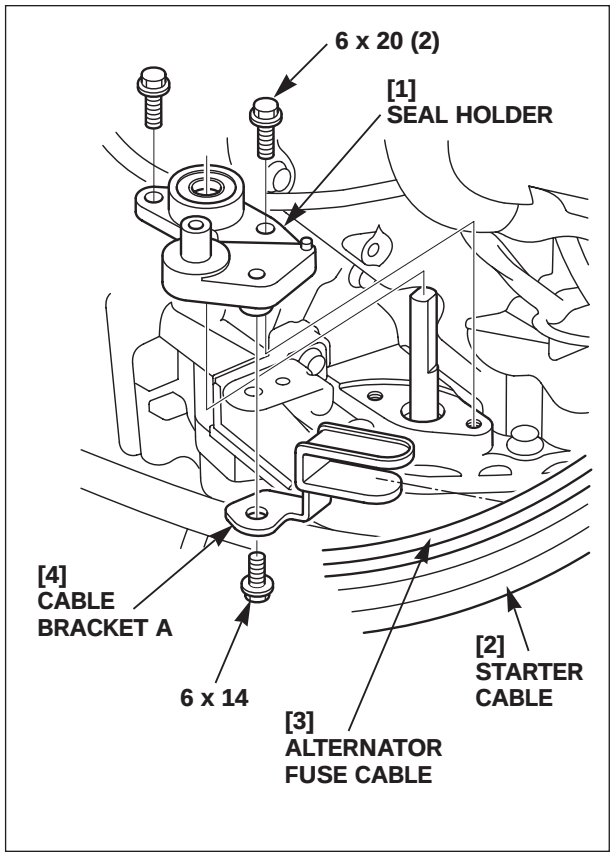
Remove the following pars.
– Engine cover (P. 4-2)
– Front separate cover (P. 4-7)
– R. engine under cover (P. 4-9)
– Remote control cable/bracket (P. 17-2)
– Shift link bracket/neutral switch (P. 17-11)

1) Remove the 6 x 14 mm flange bolt from the cable bracket A, and remove the cable bracket A.
Remove the starter cable and the alternator fuse cable from the cable bracket A.

2) Remove the two 6 x 20 mm flange bolts from the seal holder, and remove the seal holder.

NOTICE

- *Remove the seal holder with care not to raise the shift shaft B.*
- *Correct the shift shaft B if it is raised or if it is disengaged from the shift shaft A in the mounting case (P. 17-21).*
- *Note that assembly with the shift shaft A and B out of alignment will prevent proper shifting.*

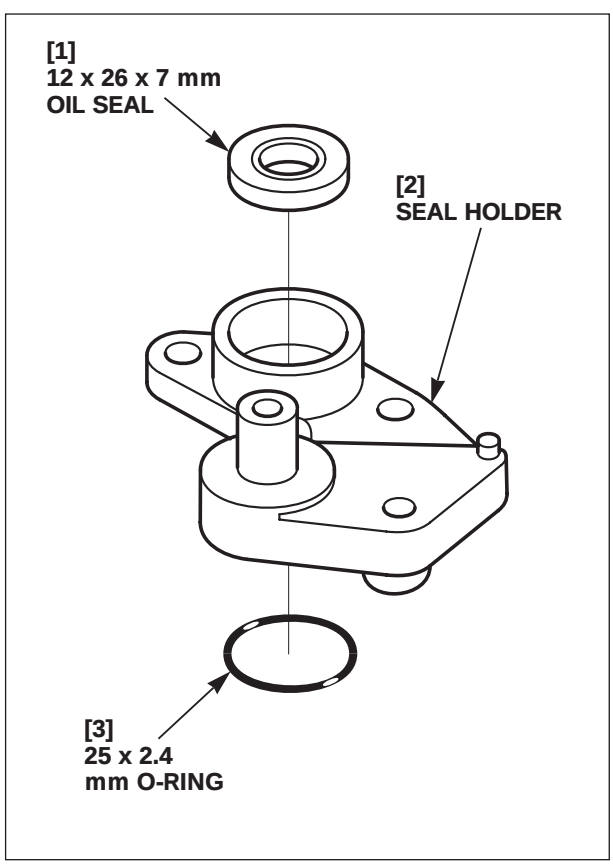


b. DISASSEMBLY

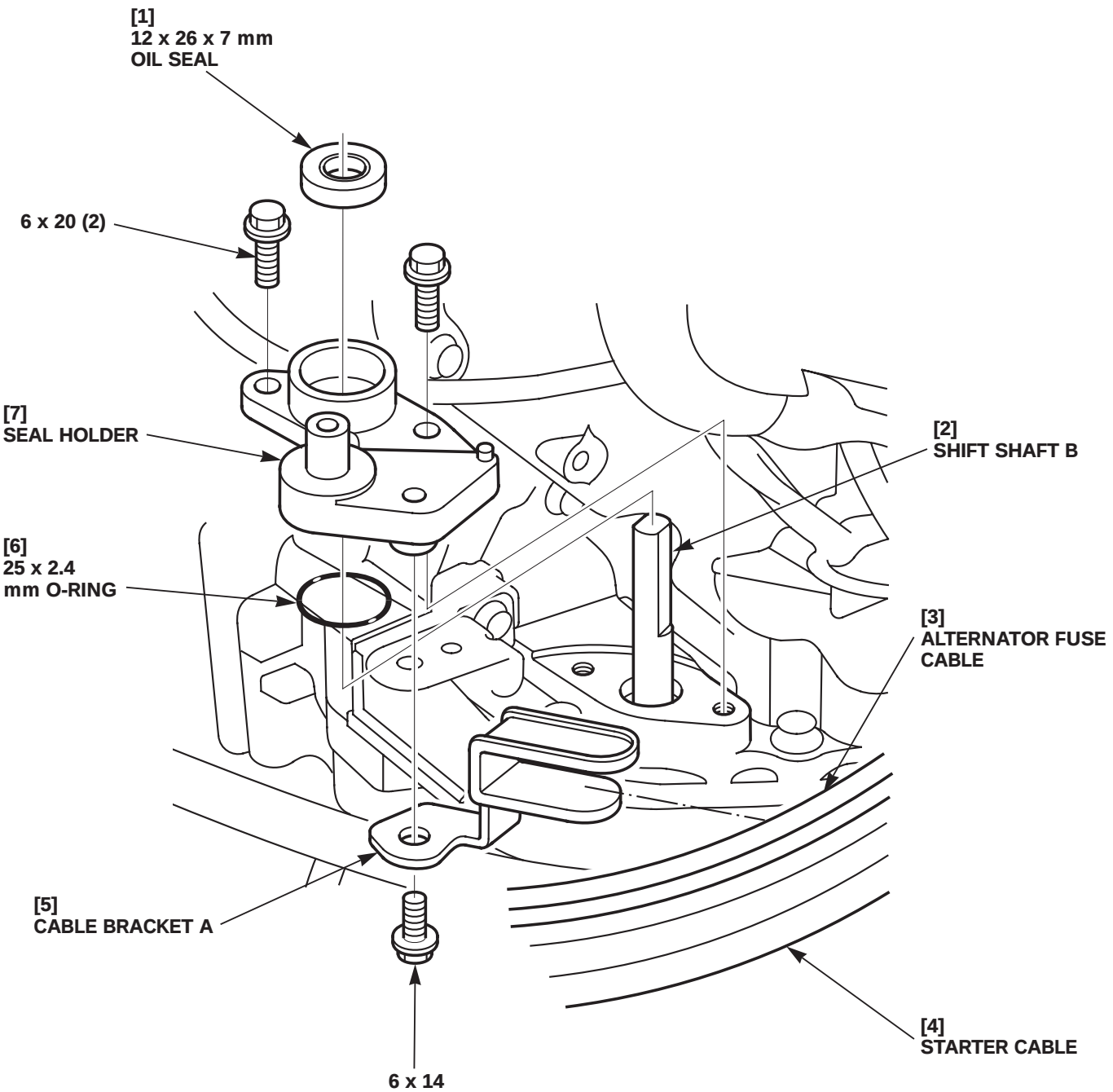
1) Before removing the 12 x 26 x 7 mm oil seal, check the oil seal lip for cut or other damage. Replace if necessary.

2) Remove the 12 x 26 x 7 mm oil seal from the seal holder using a commercially available oil seal remover.
Replace the oil seal with a new one on assembly.

3) Remove the 25 x 2.4 mm O-ring from the seal holder.
Replace the O-ring with a new one on assembly.



c. COMPONENTS DRAWING



d. SHIFT SHAFT B CORRECTION

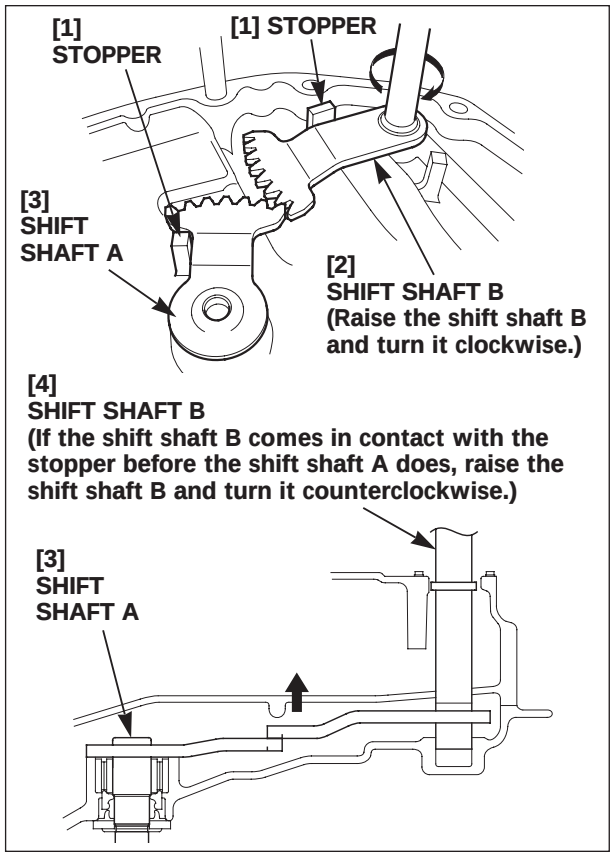
Correct the shift shaft B with the seal holder removed.
Correct the shift shaft B only when the shift shaft B is raised or when it is disengaged from the shift shaft A in the mounting case.

Remove the following pars before correction.
– Gear case assembly (P. 14-3, 42)

1) Turn the shift shaft B clockwise until the shift shaft A comes in contact with the stopper in the mounting case as shown.

NOTICE

If the shift shaft B comes in contact with the stopper before the shift shaft A does, raise the shift shaft B and turn it counterclockwise until it engages with the shift shaft A. Then turn the shift shaft B clockwise until the shift shaft A comes in contact with the stopper.



2) Raise the shift shaft B slowly while holding the shift shaft A in contact with the stopper in the mounting case.

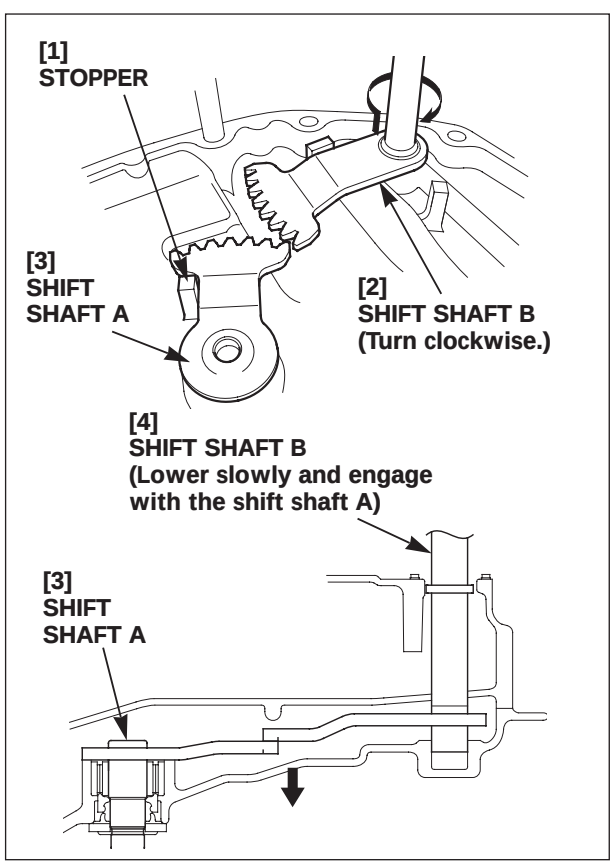
3) With the raised shift shaft B pushed against the stopper in the mounting case, lower the shift shaft B slowly and engage it with the shift shaft A.

NOTICE

Hold the shift shaft A not to move when engaging it with the shift shaft B.

4) After correction, check for proper shifting of the gear.

5) Install the seal holder (P. 17-23) and the gear case assembly (P. 14-5, 44).

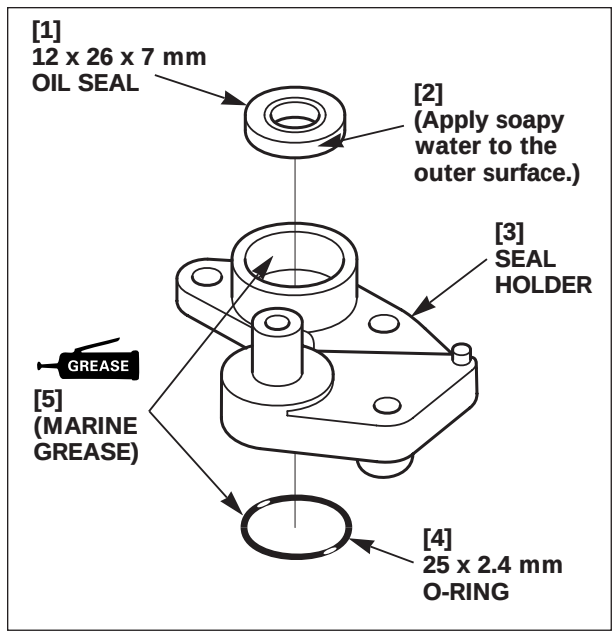


e. ASSEMBLY

1) Apply marine grease to a new 25 x 2.4 mm O-ring.
Apply soapy water to the outer surface of the 12 x 26 x 7 mm oil seal.

Apply marine grease to the mounting part of the O-ring on the seal holder.

2) Install the 12 x 26 x 7 mm oil seal and 25 x 2.4 mm O-ring on the seal holder.



f. INSTALLATION

1) Tighten the cable bracket A with the 6 x 14 mm flange bolt securely.

2) Protect the shift shaft B by taping around the stepped part of the shift shaft B.

3) Apply marine grease to the 12 x 26 x 7 mm oil seal lip mounted on the seal holder.

4) Install the seal holder over the shift shaft B slowly and tighten the seal holder with the two 6 x 20 mm flange bolts securely.

NOTICE

- *Install the seal holder with care not to raise the shift shaft B.*
- *Correct the shift shaft B if it is raised or if it is disengaged from the shift shaft A in the mounting case (P. 17-22).*
- *Note that assembly with the shift shaft A and B out of alignment will prevent proper shifting.*

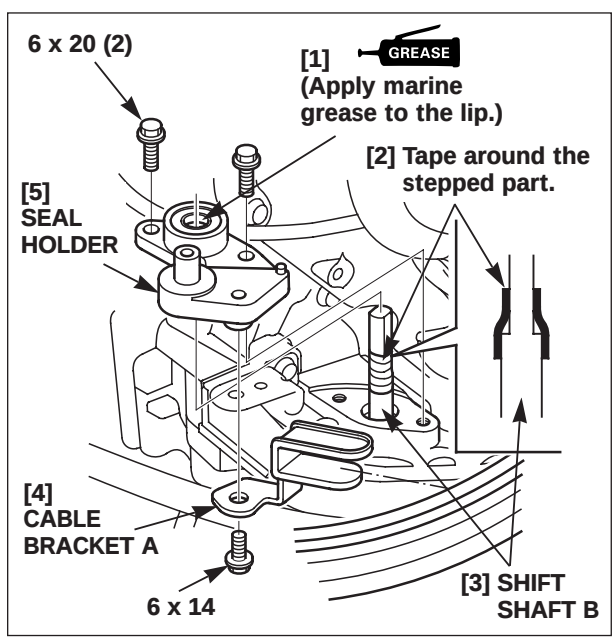
5) Remove the tape from the shift shaft B.

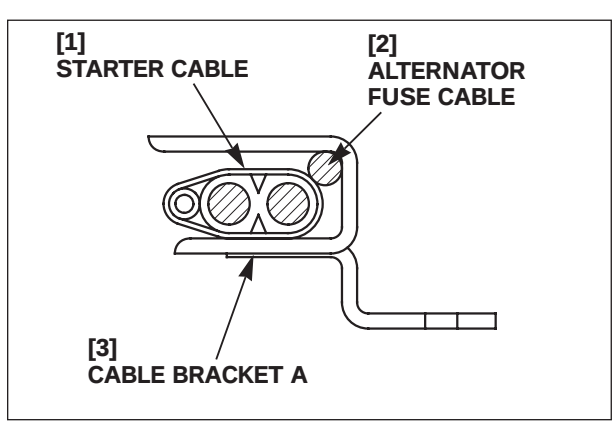
NOTICE

Check that the oil seal lip is not turned up during removal of the tape.

6) Set the starter cable and the alternator fuse cable in the cable bracket A as shown.

7) Install the following parts.
– Shift link bracket/neutral switch (P. 17-17)
– Remote control cable/grommet (P. 17-5)
– R. engine under covers (P. 4-15)
– Front separate cover (P. 4-7)
– Engine cover (P. 4-2)





1. STARTER MOTOR

a. REMOVAL

1) Disconnect the negative (–) cable from the battery negative terminal.

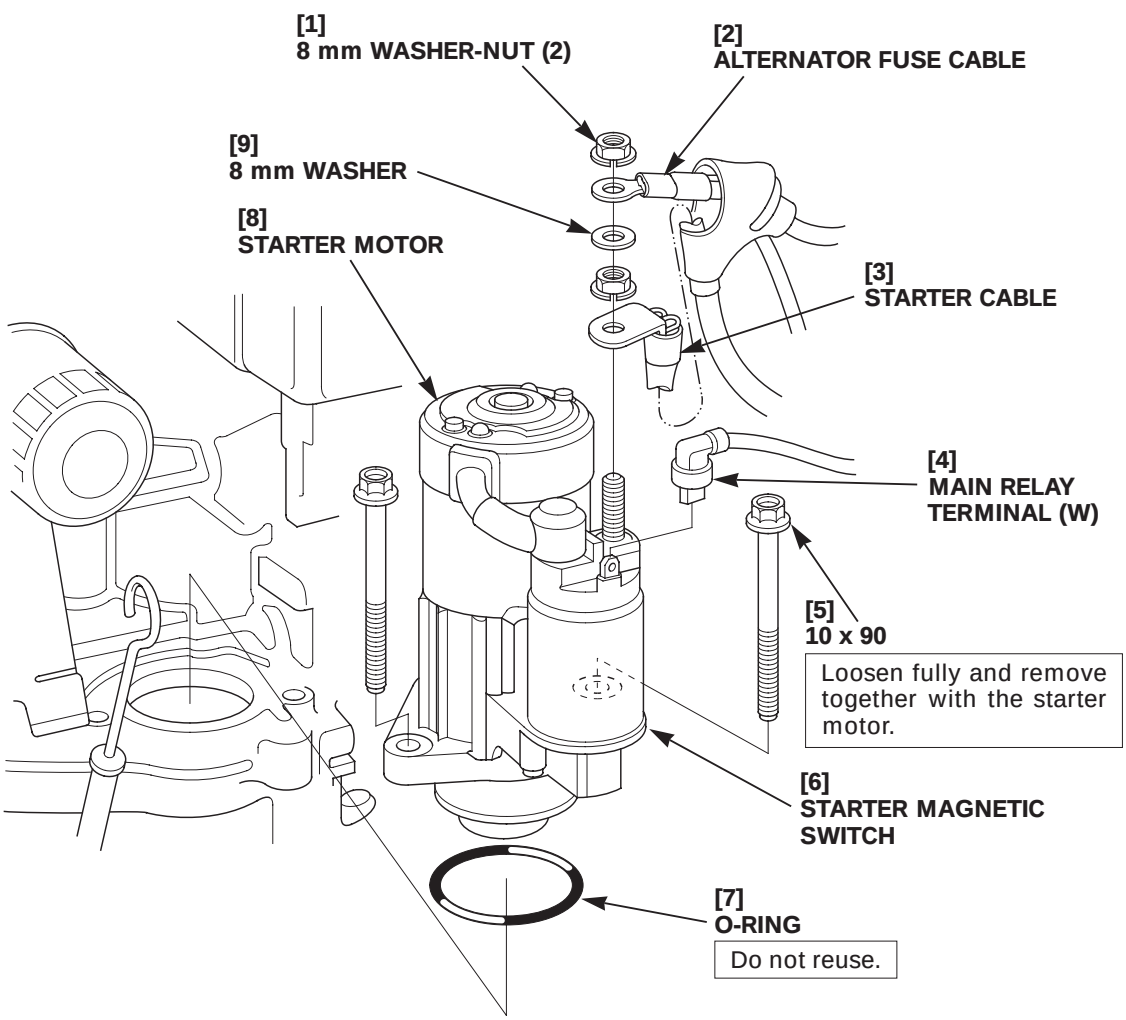
2) Disconnect the main relay (White) terminal from the magnetic switch.

3) Move the terminal cover aside and remove the 8 mm washer-nuts and the 8 mm washer. Disconnect the alternator fuse cable and the starter cable from the starter magnetic switch.

4) Loosen the 10 x 90 mm flange bolt fully.

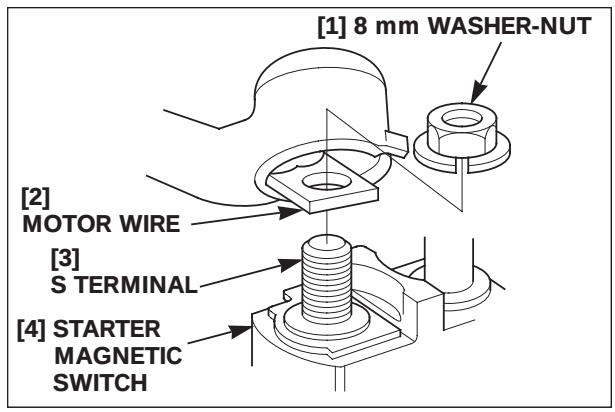
5) Remove the starter motor together with the 10 x 90 mm flange bolt.

6) Remove the O-ring from the starter motor.
   • Replace the O-ring.

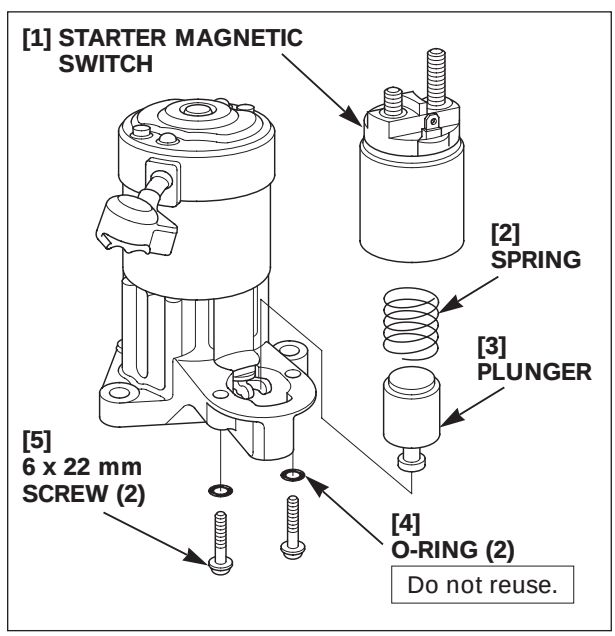


b. DISASSEMBLY

1) Move the terminal cover aside. Remove the 8 mm washer-nut and disconnect the motor wire from the S terminal.

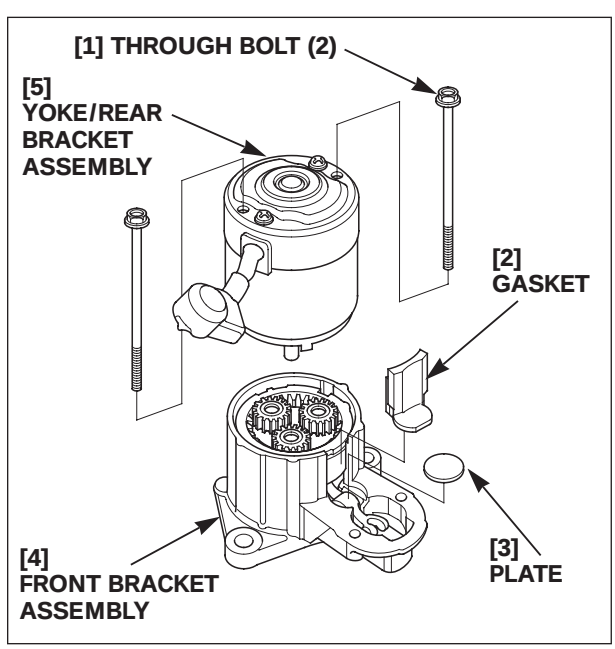


2) Remove the 6 x 22 mm washer screws and the O-rings. Remove the magnetic switch, spring and the plunger.

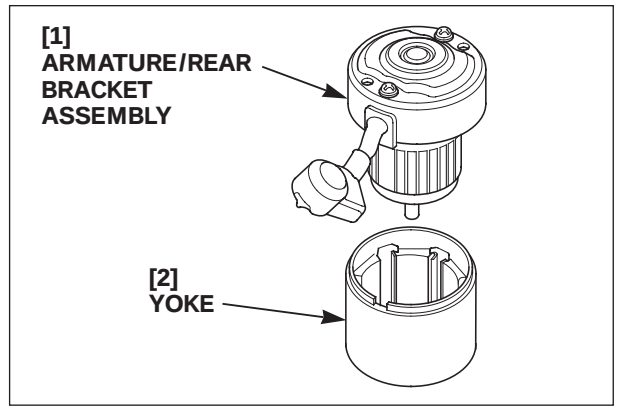


3) Remove the two through bolts and remove the yoke/rear bracket assembly.

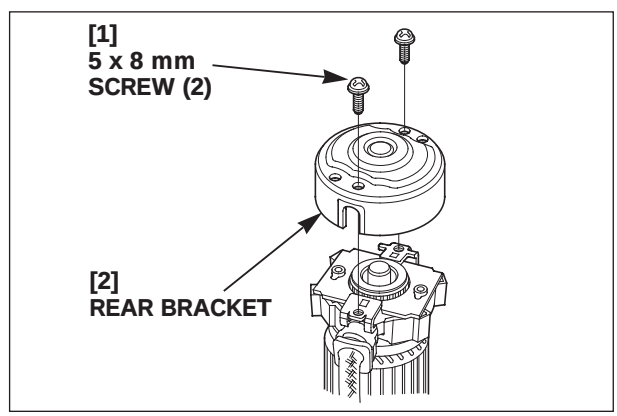
4) Remove the gasket and plate.



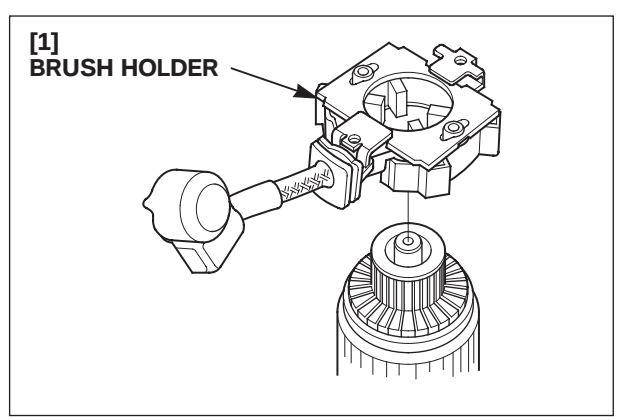
5) Remove the yoke from the armature/rear bracket assembly.



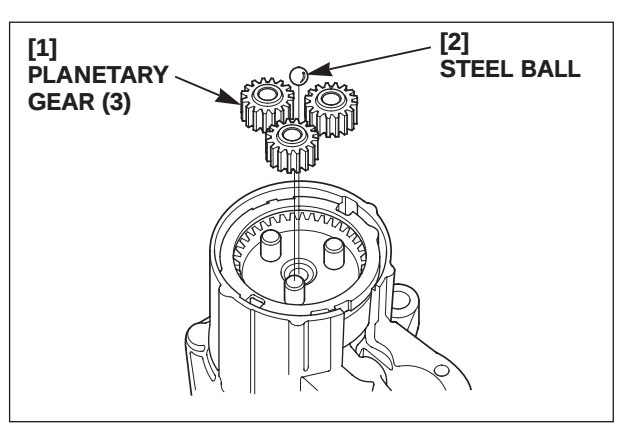
6) Remove the two 5 x 8 mm screws and remove the rear bracket.



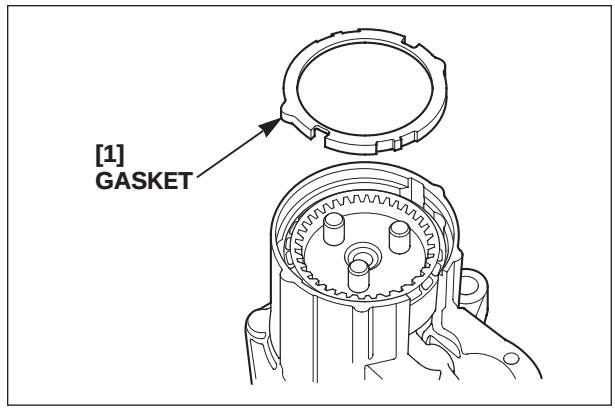
7) Remove the brush holder.



8) Remove the steel ball and planetary gear.

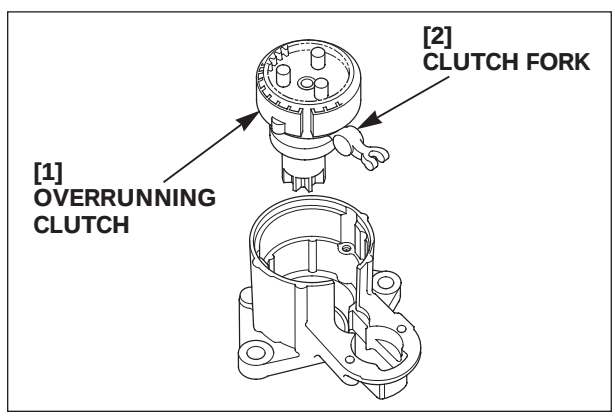


9) Remove the gasket.



10) Remove the overrunning clutch.

11) Remove the clutch fork.



• OVERRUNNING CLUTCH DISASSEMBLY

1) Secure the gear shaft by placing a wood block under the gear shaft assembly.

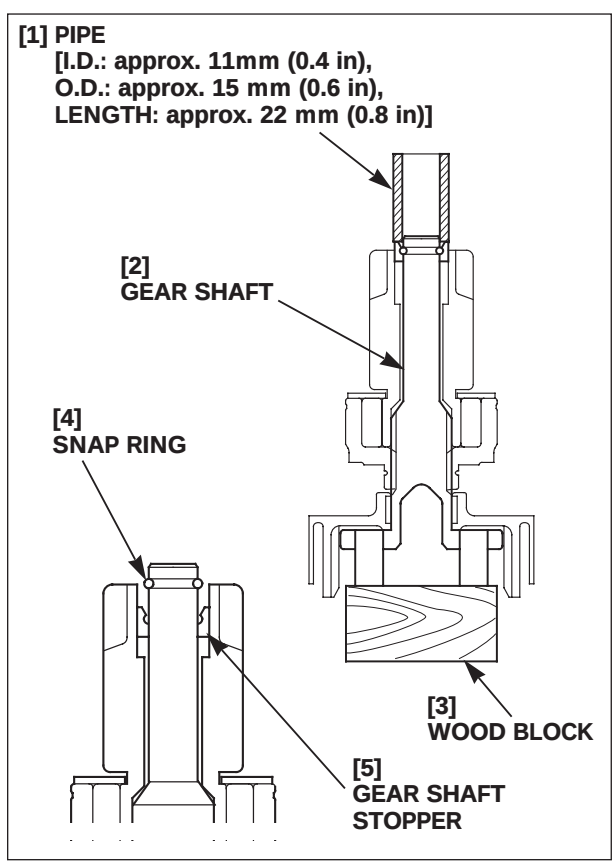
NOTICE

Secure the gear shaft assembly with care not to contact the internal gear.

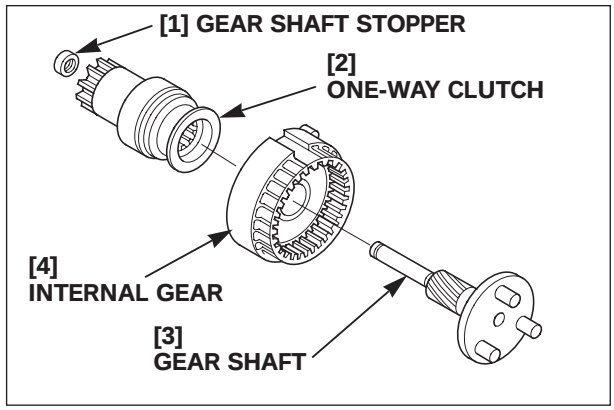
2) Prepare a pipe of the following dimensions.
   • I.D.: approx. 11 mm (0.4 in), O.D.: approx. 15 mm (0.6 in), LENGTH: approx. 20 mm (0.8 in)

3) Set the pipe on the gear shaft stopper and drop the gear shaft stopper by tapping on the pipe.

4) Remove the snap ring using a screwdriver or equivalent tool.



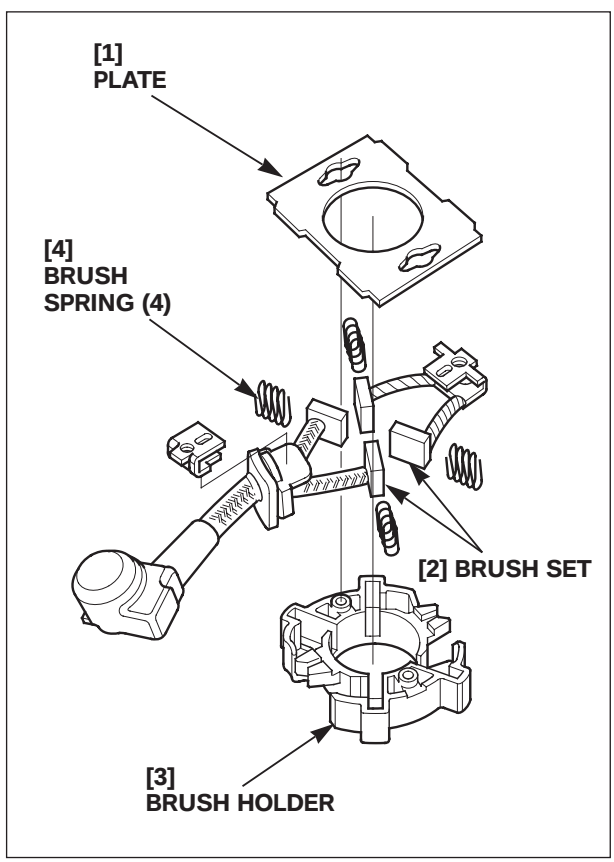
5) Remove the gear shaft and the gear shaft stopper. Remove the internal gear and the overrunning clutch.



• BRUSH HOLDER DISASSEMBLY

1) Remove the clip and the plate.

2) Remove the brush sets and the brush springs.

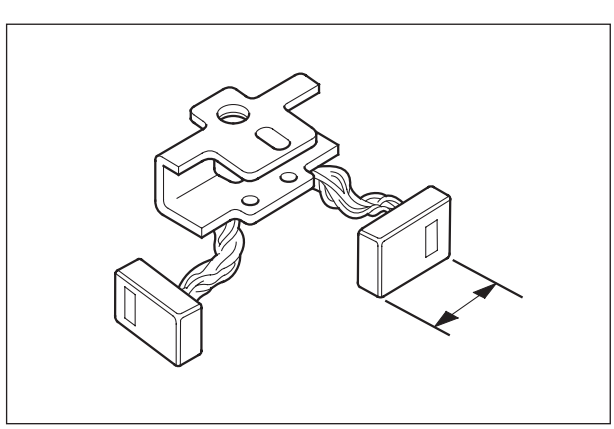


c. INSPECTION

• BRUSH LENGTH

Measure the brush length. Replace the brushes as a set if the measurement is less than the service limit.

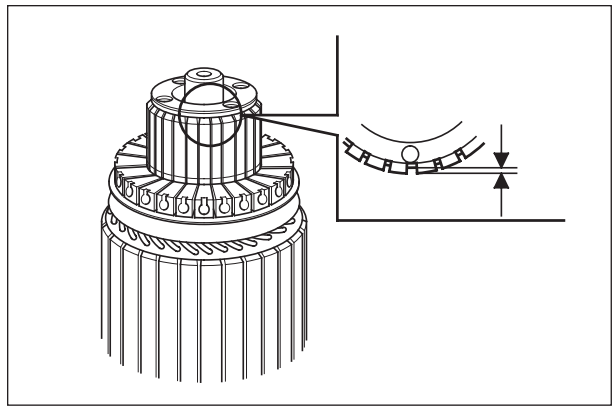
STANDARD	SERVICE LIMIT
12.3 mm (0.48 in)	7.0 mm (0.28 in)



• MICA DEPTH

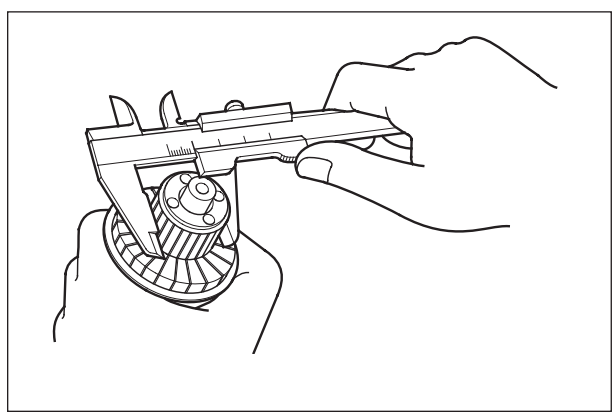
Measure the mica depth. If the grooves are clogged or mica depth is less than the service limit, recut the grooves using a hacksaw blade or a small file.

STANDARD	SERVICE LIMIT
0.4 – 0.5 mm (0.016 – 0.020 in)	0.2 mm (0.008 in)



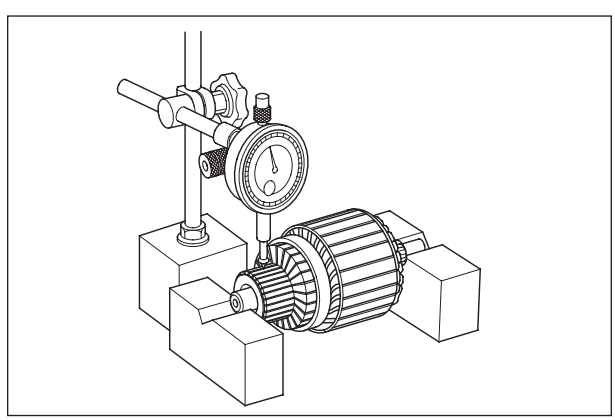
• COMMUTATOR

1) Measure the commutator O.D. If the measurement is less than the service limit, replace the armature with a new one.



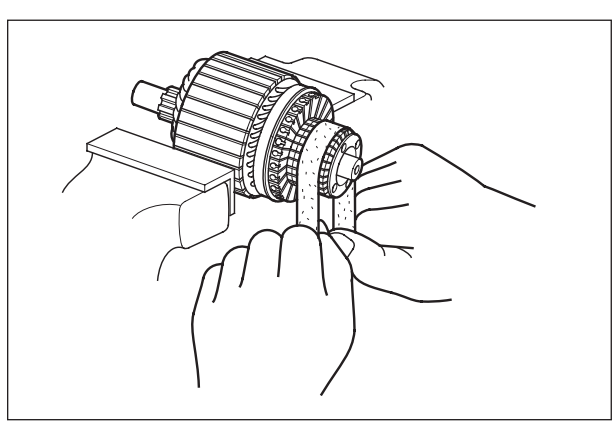
2) Measure the commutator runout using a dial gauge. If the measurement is more than the service limit, replace the armature with a new one.

STANDARD	SERVICE LIMIT
29.4 mm (1.16 in)	28.8 mm (1.13 in)



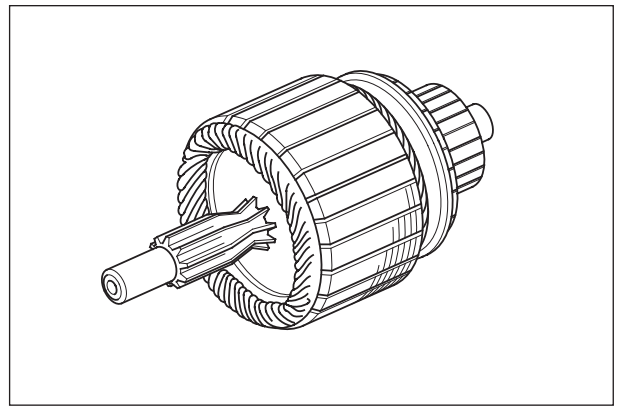
3) Check the commutator (insulaor) for damage, dust, dirt and metal particles.
If there is stain, irregularity and/or evidence of burning, clean with an emery paper #500 or #600.

STANDARD	0.1 mm (0.004 in)



• ARMATURE

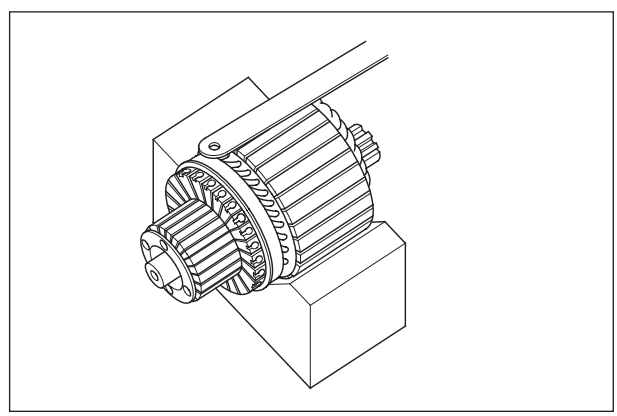
Check the armature and shaft gear for wear and damage.



• ARMATURE SHORT-CIRCUIT TEST

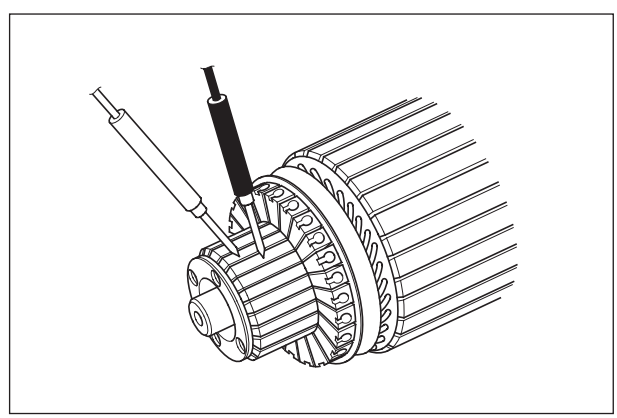
Place the armature in an armature tester (commercially available).

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.



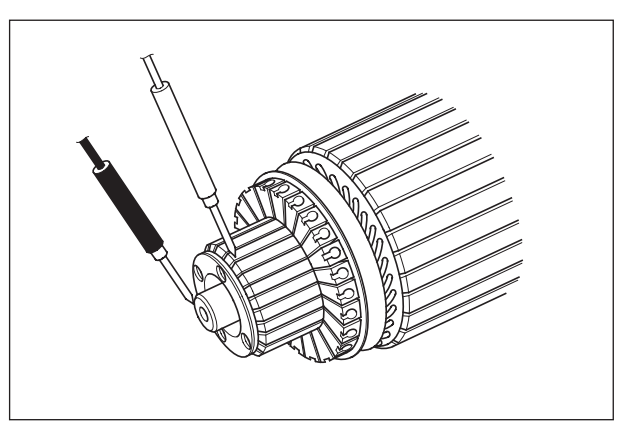
• CONTINUITY CHECK – SEGMENTS

Check for continuity between each segment.If an open circuit exists between any two segments, replace the armature.



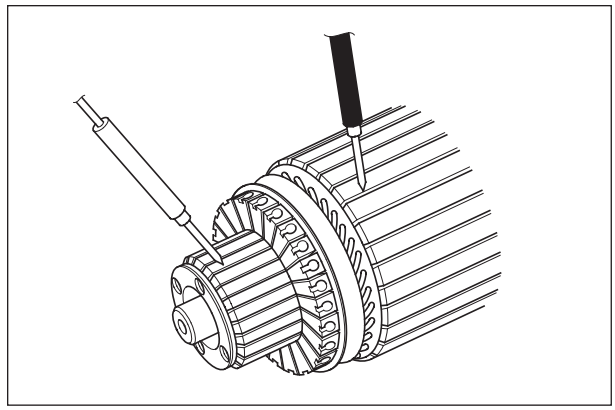
• SHORT-CIRCUIT TEST – SHAFT-TO-COMMUTATOR

Check for continuity between the commutator and armature shaft. If there is continuity, replace the armature.



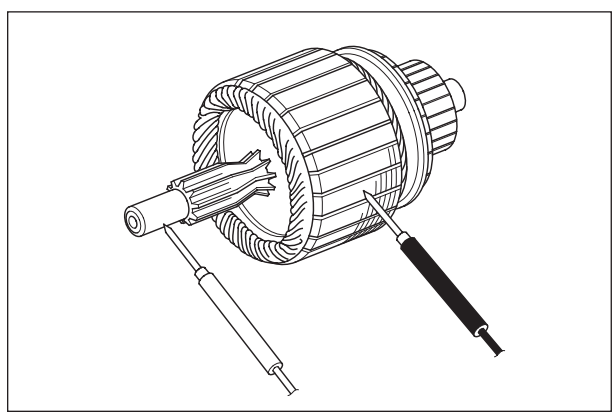
• SHORT-CIRCUIT TEST — CORE-TO-COMMUTATOR

Check for continuity between the commutator and armature coil core. If continuity exists, replace the armature.



• SHORT-CIRCUIT TEST — SHAFT-TO-ARMATURE

Check for continuity between the armature and armature shaft. If there is continuity, replace the armature.



• OVERRUNNING CLUTCH

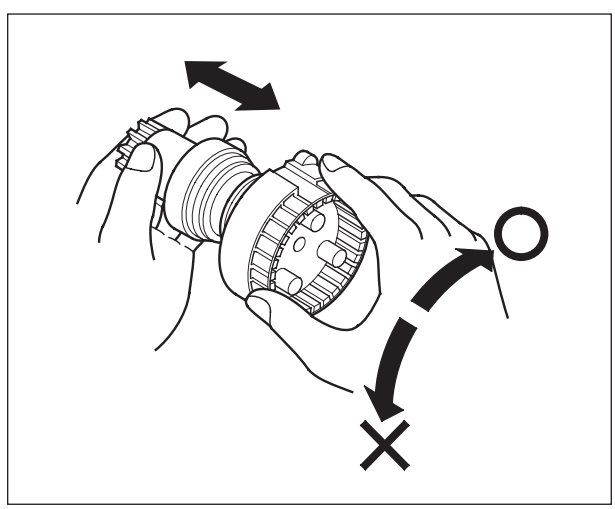
1) Check the overrunning clutch for smooth axial movement.
   If the overrunning clutch does not move smoothly, clean the spline and coat it with grease before recheck.
   If the overrunning clutch does not move smoothly after cleaning or coated with grease, replace the overrunning clutch assembly.

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.

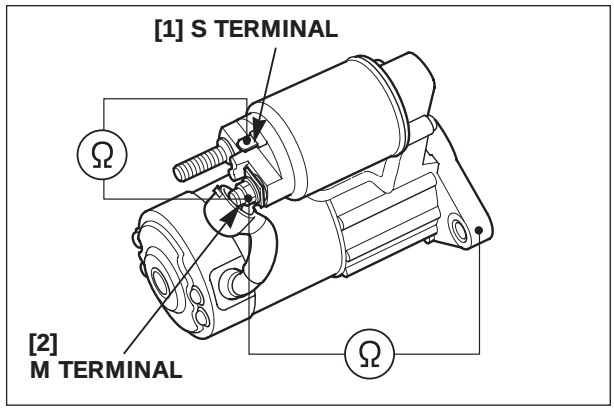
   NOTICE

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



• MAGNETIC SWITCH

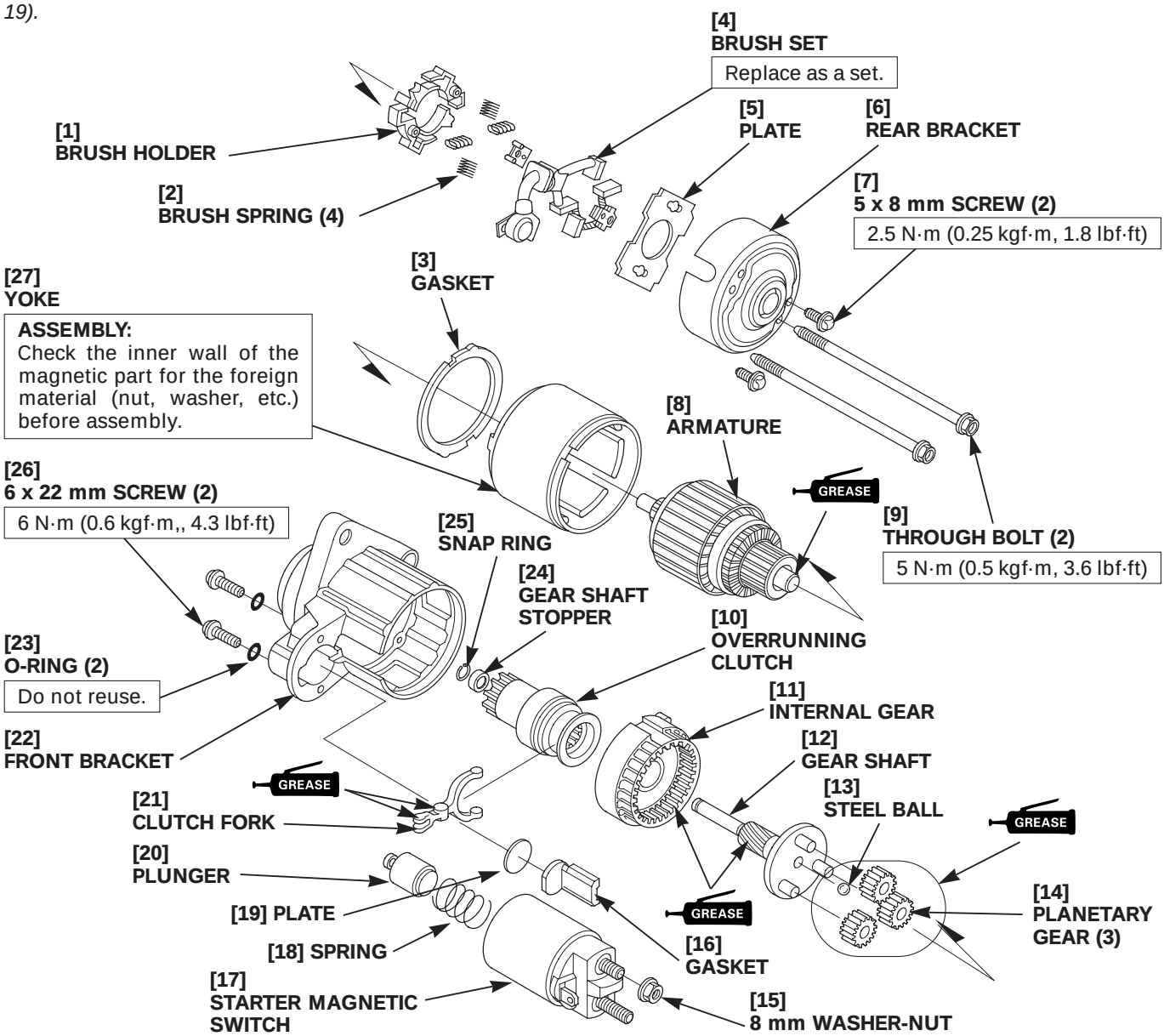
After assembly, check for continuity between the S terminal and the yoke (ground). Check for continuity between the S terminal and the M terminal.



d. ASSEMBLY

NOTICE

After assembling the starter motor, apply sufficient amount of the water resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the mating sections of each part (P. 17-19).



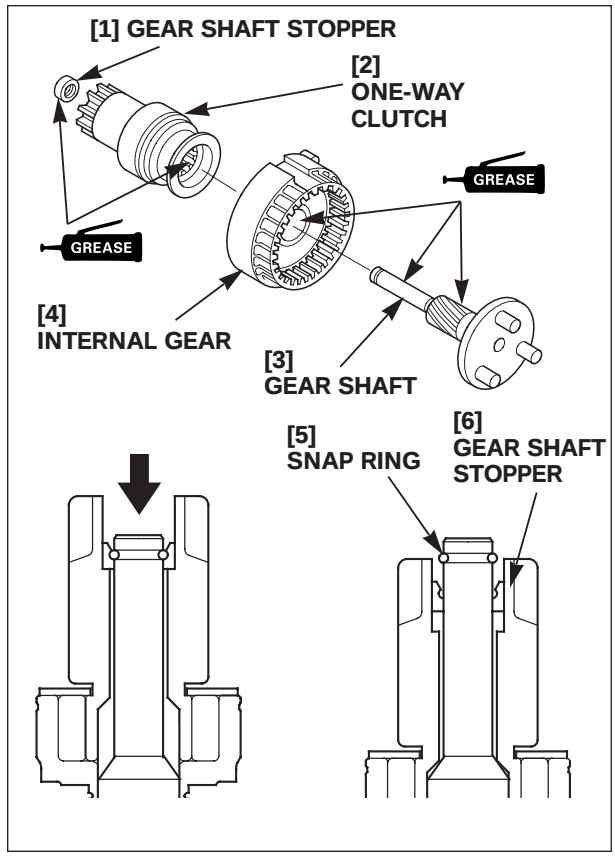
• OVERRUNNING CLUTCH ASSEMBLY

1) Apply grease to the internal gear, inner wall of the overrunning clutch, gear shaft sliding surface and the surface of the gear shaft stopper.

2) Assemble the overrunning clutch, gear shaft and the gear shaft stopper with the internal gear.

3) Install the new snap ring.

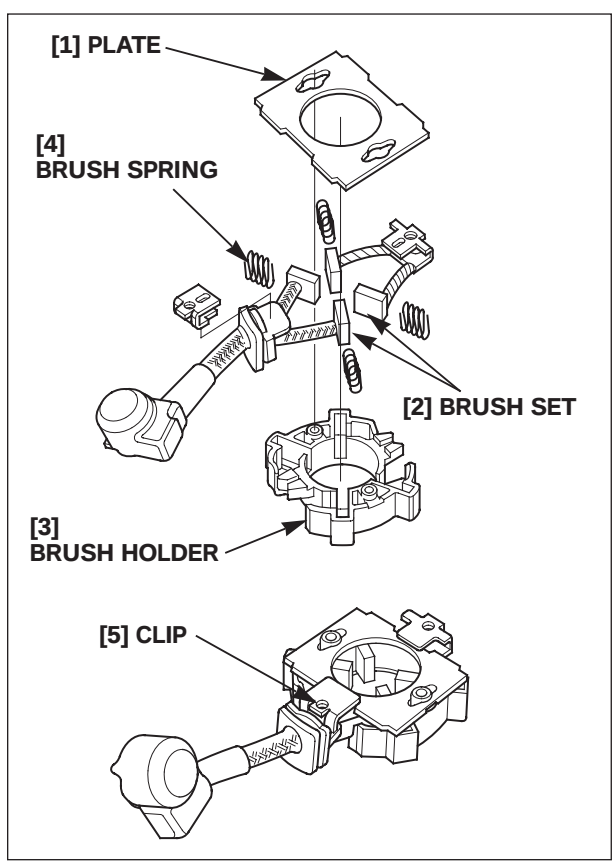
4) Holding the overrunning clutch, push the gear shaft into the overrunning clutch. Push the gear shaft stopper up to set the snap ring in the groove of the gear shaft stopper securely.



• BRUSH HOLDER ASSEMBLY

1) Install the brush springs and brushes on the brush holder. Install the plate on the brush holder.

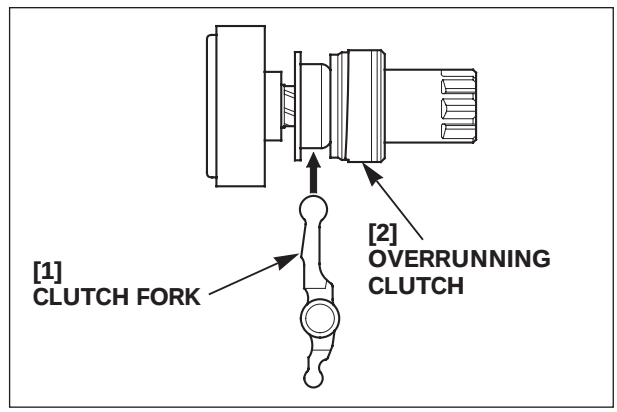
2) Secure the plate with the clip.



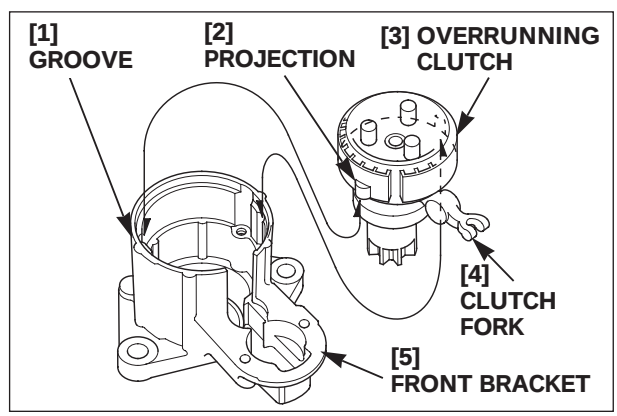
• FRONT BRACKET ASSEMBLY

1) Apply grease to the sliding surface of the clutch fork.

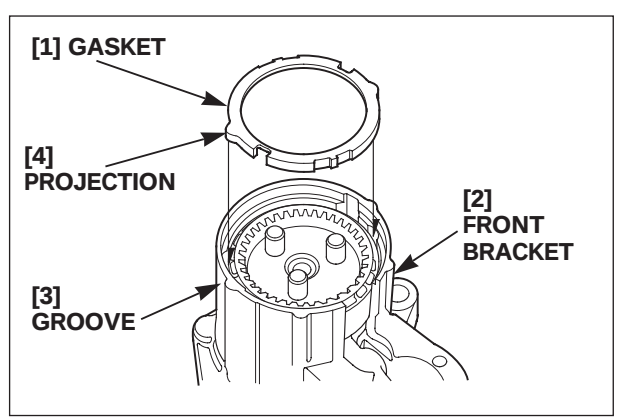
2) Set the clutch fork in the indicated position of the overrunning clutch.



3) Install the overrunning clutch assembly on the front bracket.
   • Install by aligning the projection on the outer surface of the ring gear with the groove in the front bracket.

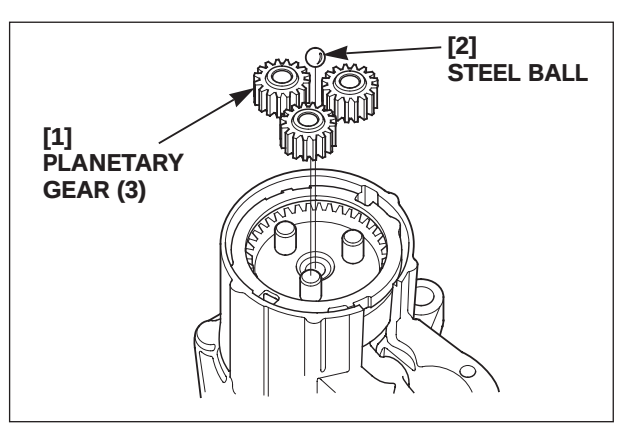


4) Install the gasket.
   • Install by aligning the projections on the gasket with the grooves in the front bracket.



5) Apply grease to the planetary gears, steel ball and the internal gear.

6) Install the planetary gears, steel ball and the internal gear.



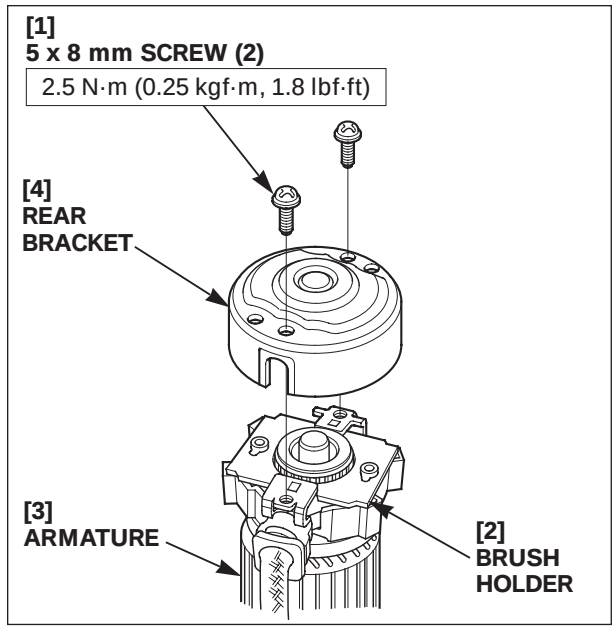
• REAR BRACKET/YOKE ASSEMBLY

1) Install the brush holder on the armature.

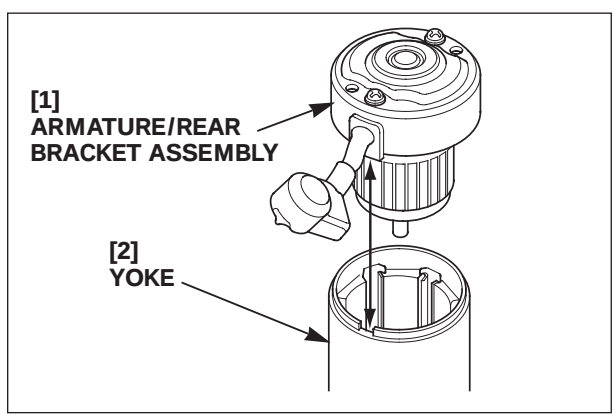
2) Apply grease to the armature shaft and install the gear bracket as shown.

3) Apply the water resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the seat of each 5 x 8 mm screw.
Tighten the 5 x 8 mm screws to the specified torque.

TORQUE: 2.5 N·m (0.25 kgf·m, 1.8 lbf·ft)



4) Check the inner wall of the yoke for foreign material and install the rear bracket/armature assembly.
   • Install the rear bracket/armature assembly by aligning the grommet with the cutout in the yoke.

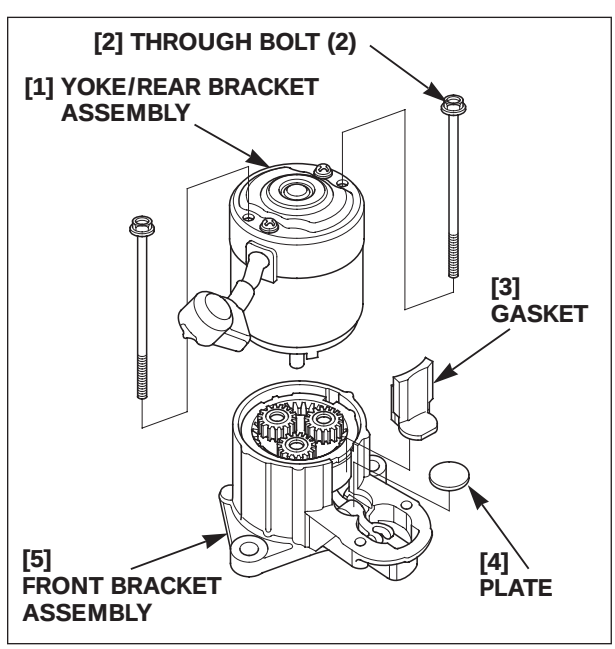


5) Install the plate and gasket on the front bracket.

6) Install the yoke/rear bracket assembly.
   • Install by aligning the projection on the yoke with the cutout in the front bracket.

7) Apply the water resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the seat of each through bolt.
Tighten the through bolts to the specified torque.

TORQUE: 5 N·m (0.5 kgf·m, 3.6 lbf·ft)



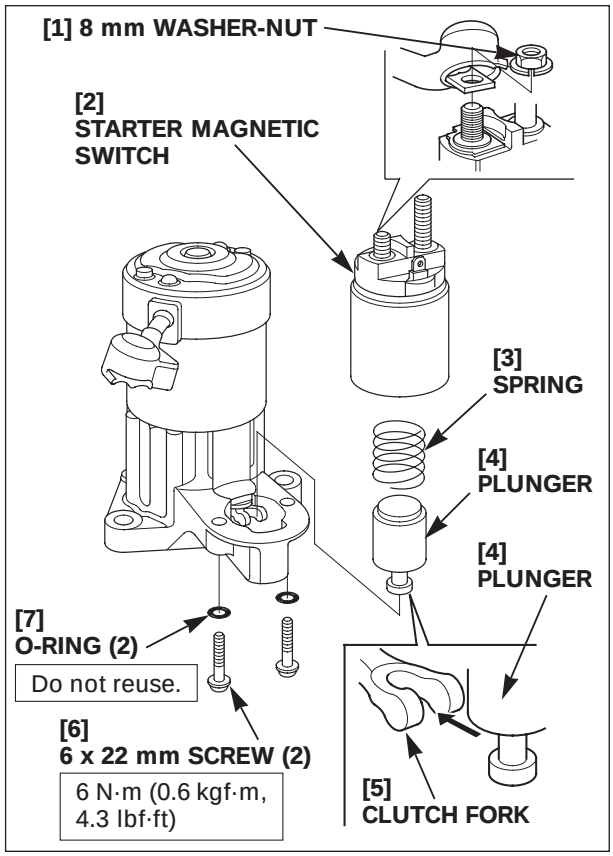
8) Apply the engine oil to the new O-rings and install the O-rings on the 6 x 22 mm screws.

9) Install the plunger, spring and the starter magnetic switch.
   • Assemble the plunger and the clutch fork as shown.

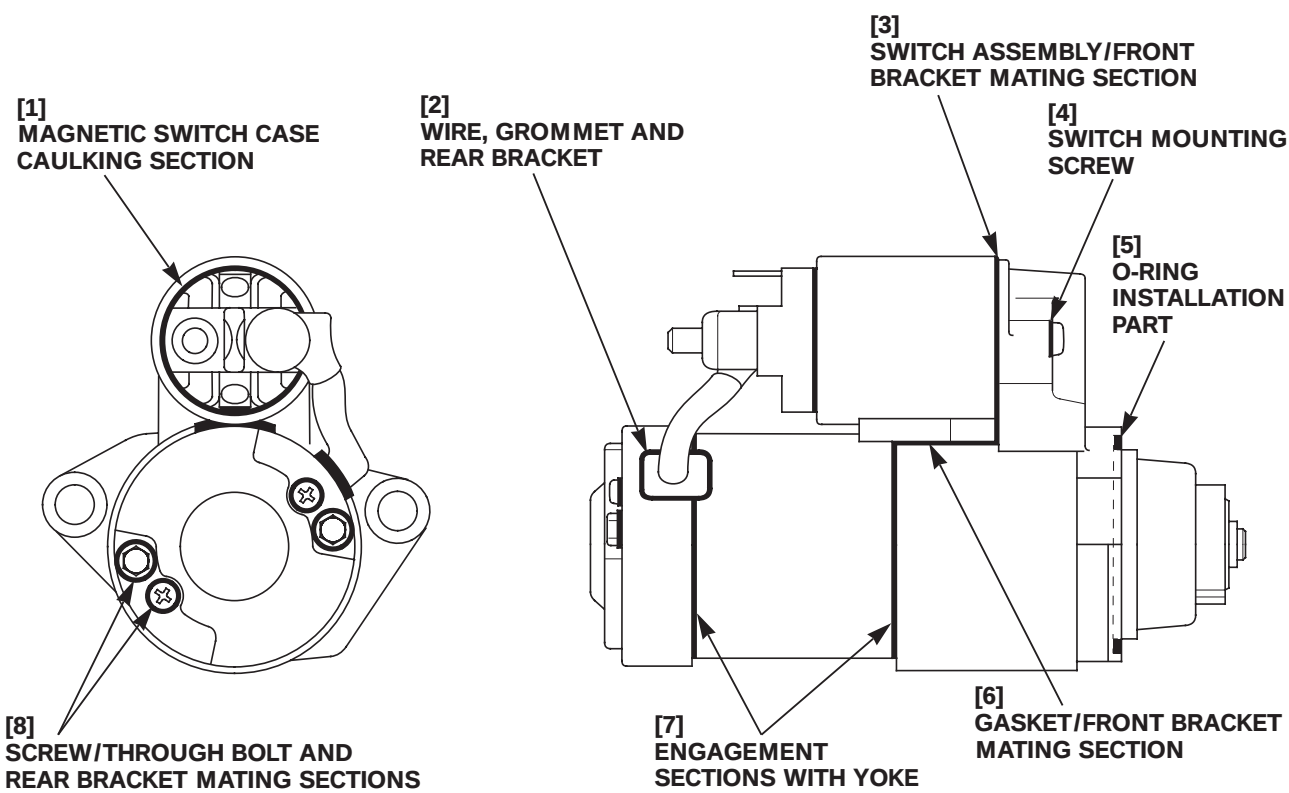
10) Tighten the 6 x 22 mm screws to the specified torque.

    TORQUE: 6 N·m (0.6 kgf·m, 4.3 lbf·ft)

11) Connect the brush terminal (M terminal) to the starter magnetic switch and tighten the 8 mm washer-nut securely.



12) After assembling the starter motor, apply sufficient amount of the water resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the following mating sections.



e. INSTALLATION

1) Apply the engine oil to the new O-ring.

2) Set the two 10 x 90 mm flange bolts on the starter motor, and install both the starter motor and the two 10 x 90 mm flange bolts on the engine.

3) Tighten the two 10 x 90 mm flange bolts to the specified torque.

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

4) Connect the starter cable to the starter magnetic switch and tighten the 8 mm washer-nut to the specified torque.

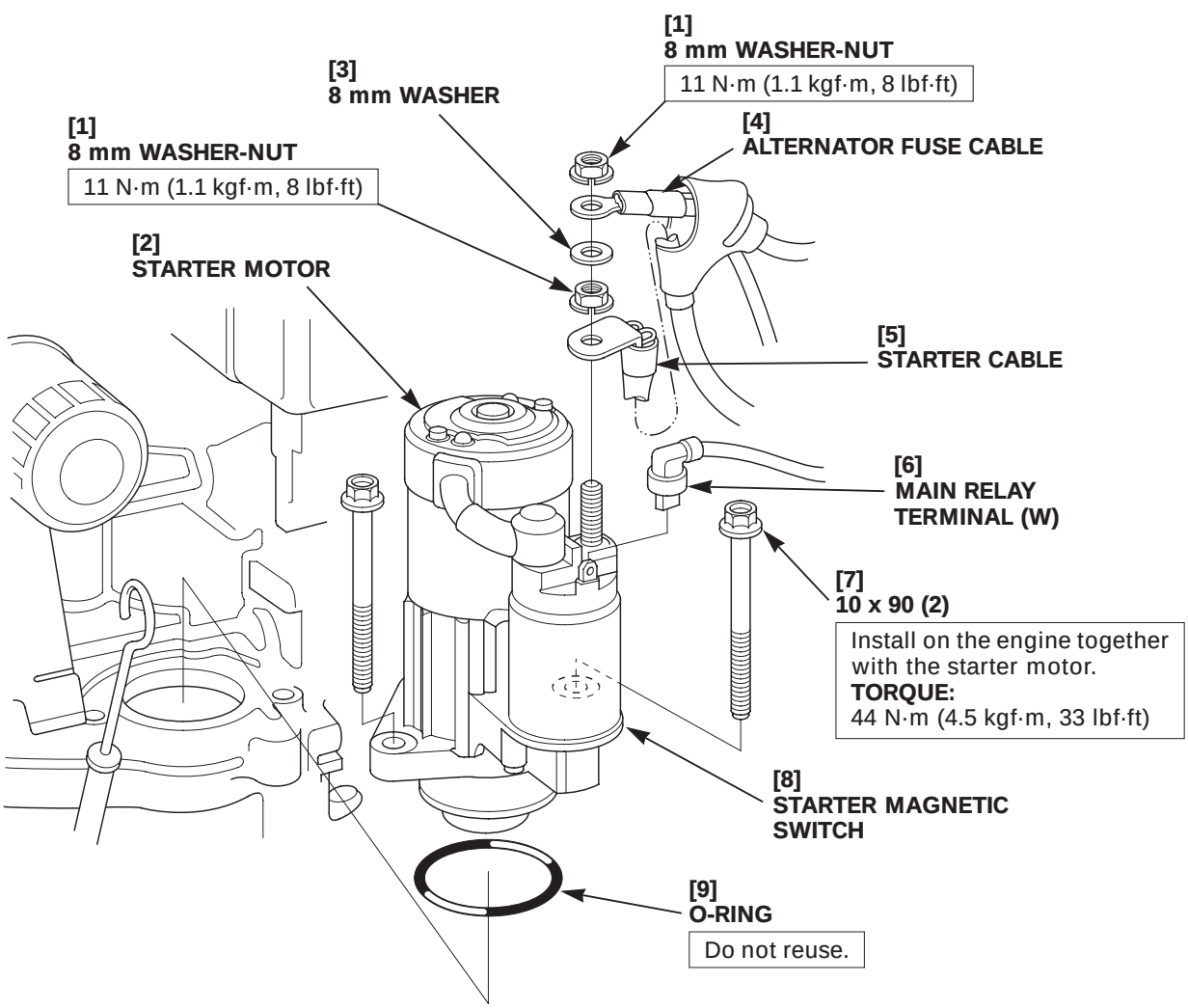
   TORQUE: 11 N·m (1.1 kgf·m, 8 lbf·ft)

5) Install the 8 mm washer and the alternator fuse cable on the starter magnetic switch and tighten the 8 mm washer-nut to the specified torque.

   TORQUE: 11 N·m (1.1 kgf·m, 8 lbf·ft)

6) Connect the main relay (White) terminal to the starter magnetic switch.

7) Install the terminal cover securely.



2. STARTER CABLE

a. REMOVAL

Remove the following parts.
– Engine cover (P. 4-2)
– Front separate cover (P. 4-7)

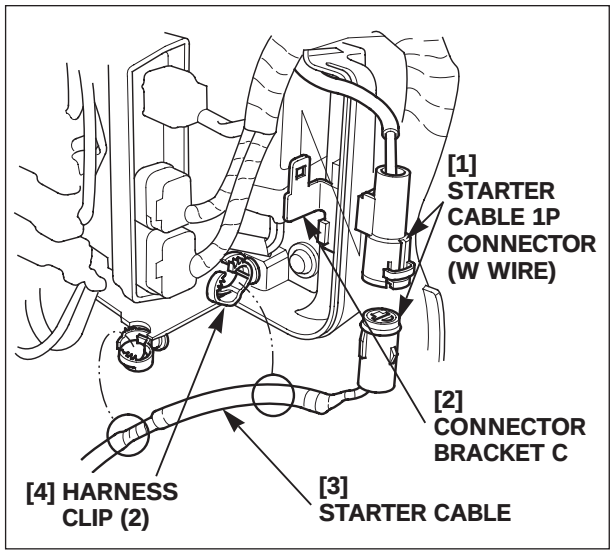
NOTICE

Disconnect the starter cable from the battery before disconnecting and connecting the starter cable.

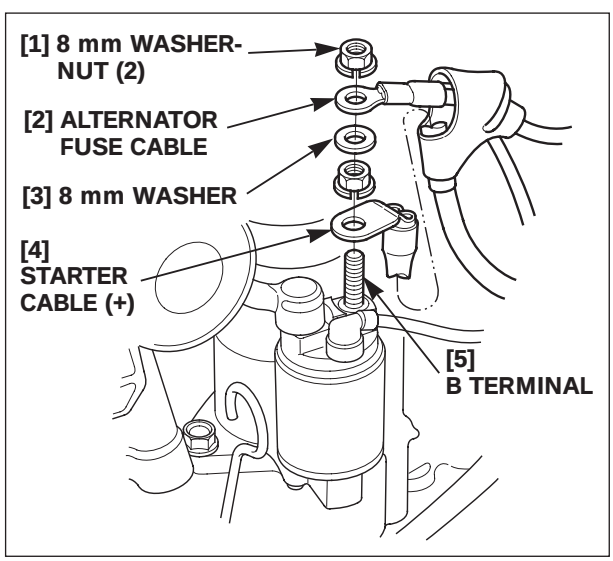
1) Release the starter cable from the two harness clips.

2) Release the starter cable 1P connector (White wire) from the connector bracket C.

3) Disconnect the starter cable 1P connector (White wire).

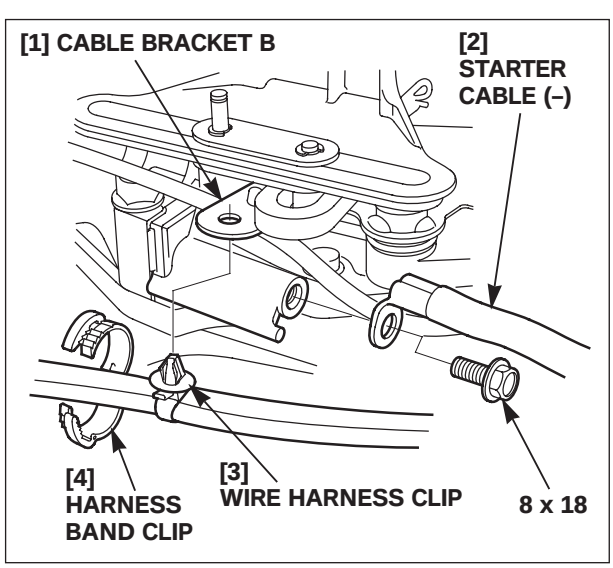


4) Remove and disconnect the two 8 mm washer-nuts, alternator fuse cable, 8 mm washer and the positive (+) starter cable from the magnetic switch B terminal.

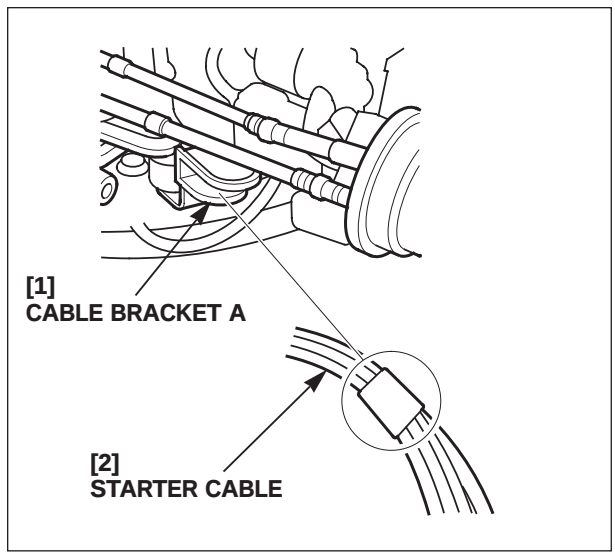


5) Remove the 8 x 18 mm flange bolt from the crankcase, then disconnect the negative (–) starter cable.

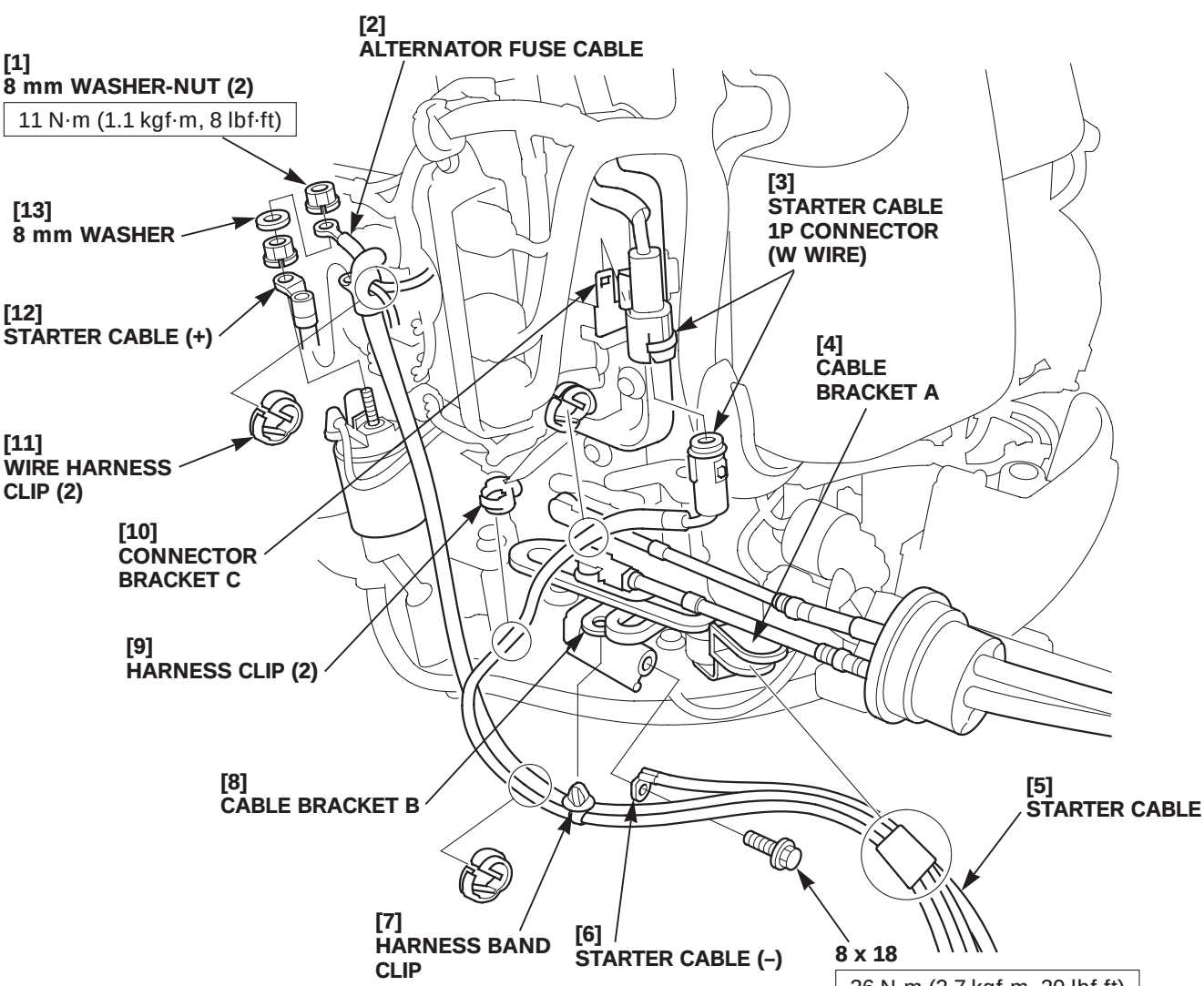
6) Remove the harness band clip that secures the starter cable from the cable bracket B.
Remove the wire harness clip.



7) Release the starter cable from the cable bracket A.

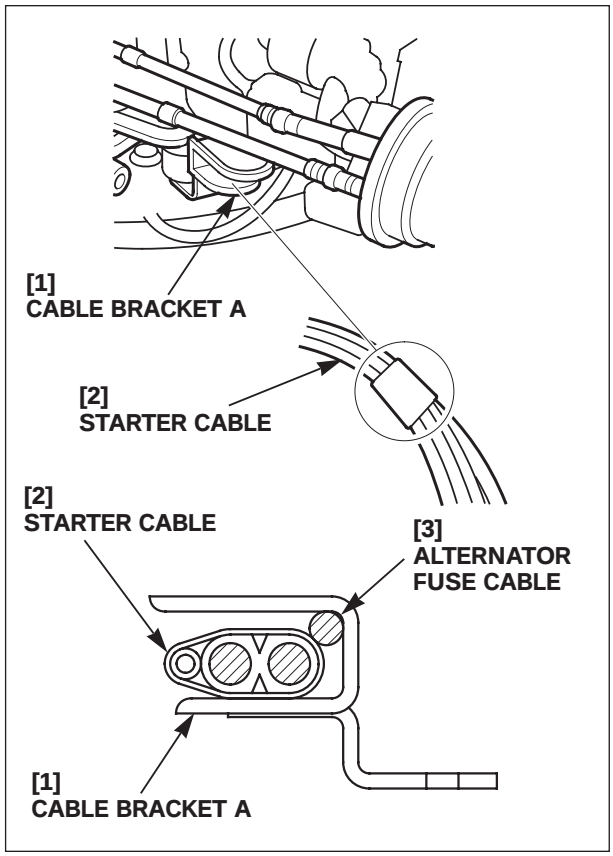


b. COMPONENTS LOCATION



c. INSTALLATION

1) Secure the alternator fuse cable and the starter cable with the cable bracket A as shown.



2) Tighten the 8 x 18 mm flange bolt to the specified torque while pushing the negative (–) starter cable against the projection on the crankcase.

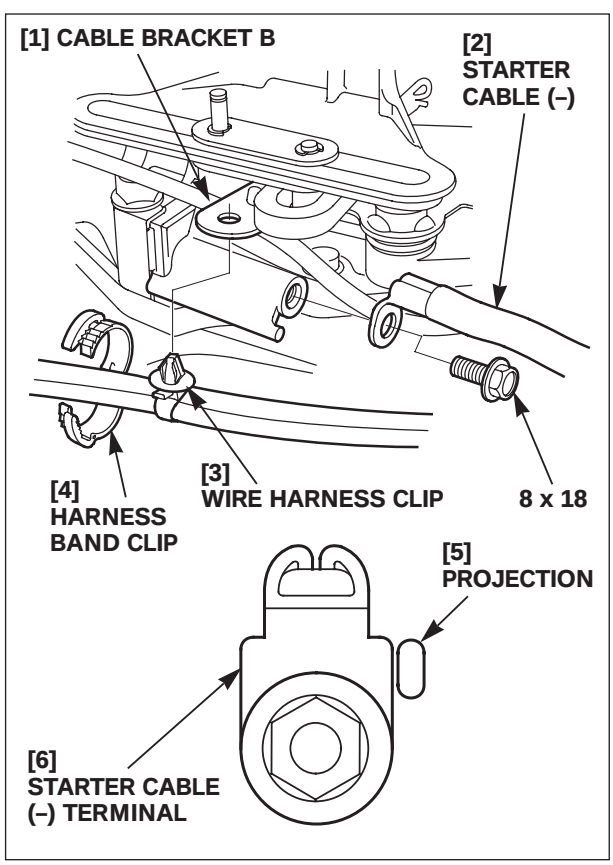
   TORQUE: 26 N·m (2.7 kgf·m, 20 lbf·ft)

3) Install the harness band clip, that clamps the starter cable, on the cable bracket B.

4) Clamp the alternator fuse cable and the starter cable with the wire harness clamp.

   NOTICE

   Check that the cables are not interfering with the shift arm.



5) Install the positive (+) starter cable on the magnetic switch B terminal at right angles to the vertical center line of the magnetic switch as shown. Tighten the 8 mm washer-nut to the specified torque.

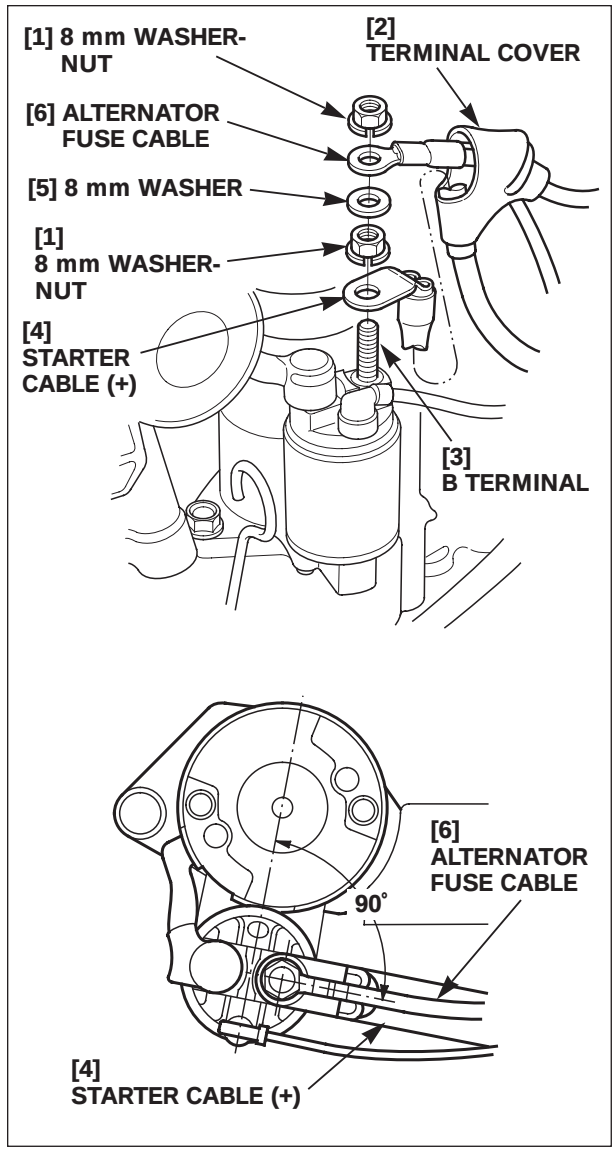
   TORQUE: 11 N·m (1.1 kgf·m, 8 lbf·ft)

   After tightening, set the 8 mm washer on the magnetic switch B terminal.

6) Install the alternator fuse cable on the magnetic switch B terminal at right angles to the vertical center line of the magnetic switch as shown. Tighten the 8 mm washer-nut to the specified torque.

   TORQUE: 11 N·m (1.1 kgf·m, 8 lbf·ft)

   After tightening, set the terminal cover on the magnetic switch B terminal.

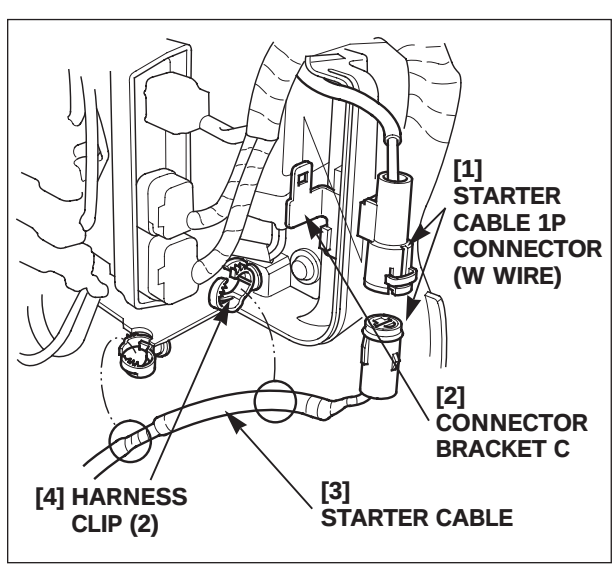


7) Connect the starter cable 1P connector (White wire).

8) Set the starter cable 1P connector (White wire) on the connector bracket C.

9) Secure the starter cable with the two harness clips.

10) Install the following parts.
   – Front separate cover (P. 4-7)
   – Engine cover (P. 4-2)

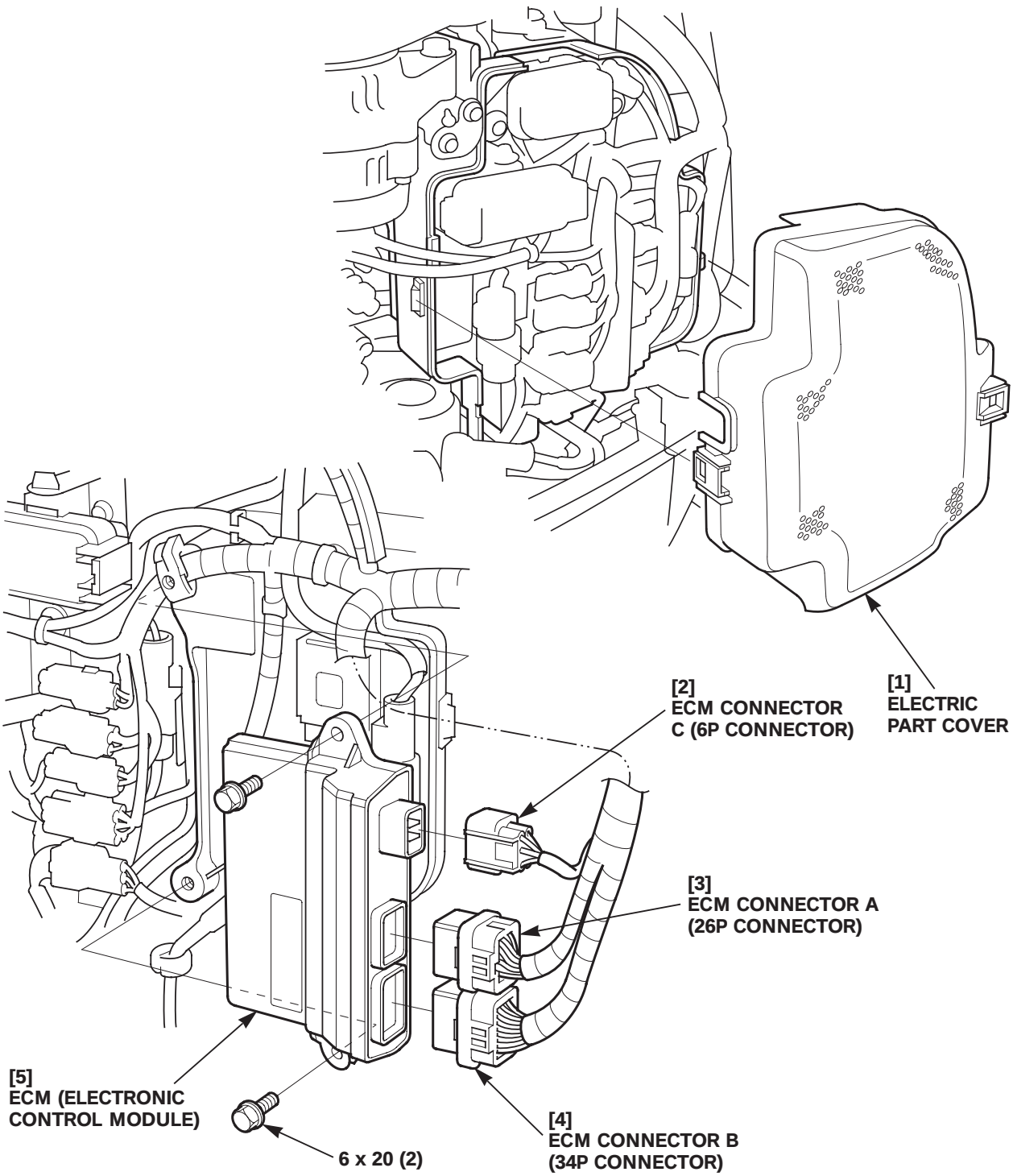


3. ECM/PGM-FI MAIN RELAY/FUSE BOX

a. ELECTRIC PART COVER/ECM REMOVAL/INSTALLATON

Remove the following parts.
– Engine cover (P. 4-2)
– R. engine under cover (P. 4-9)

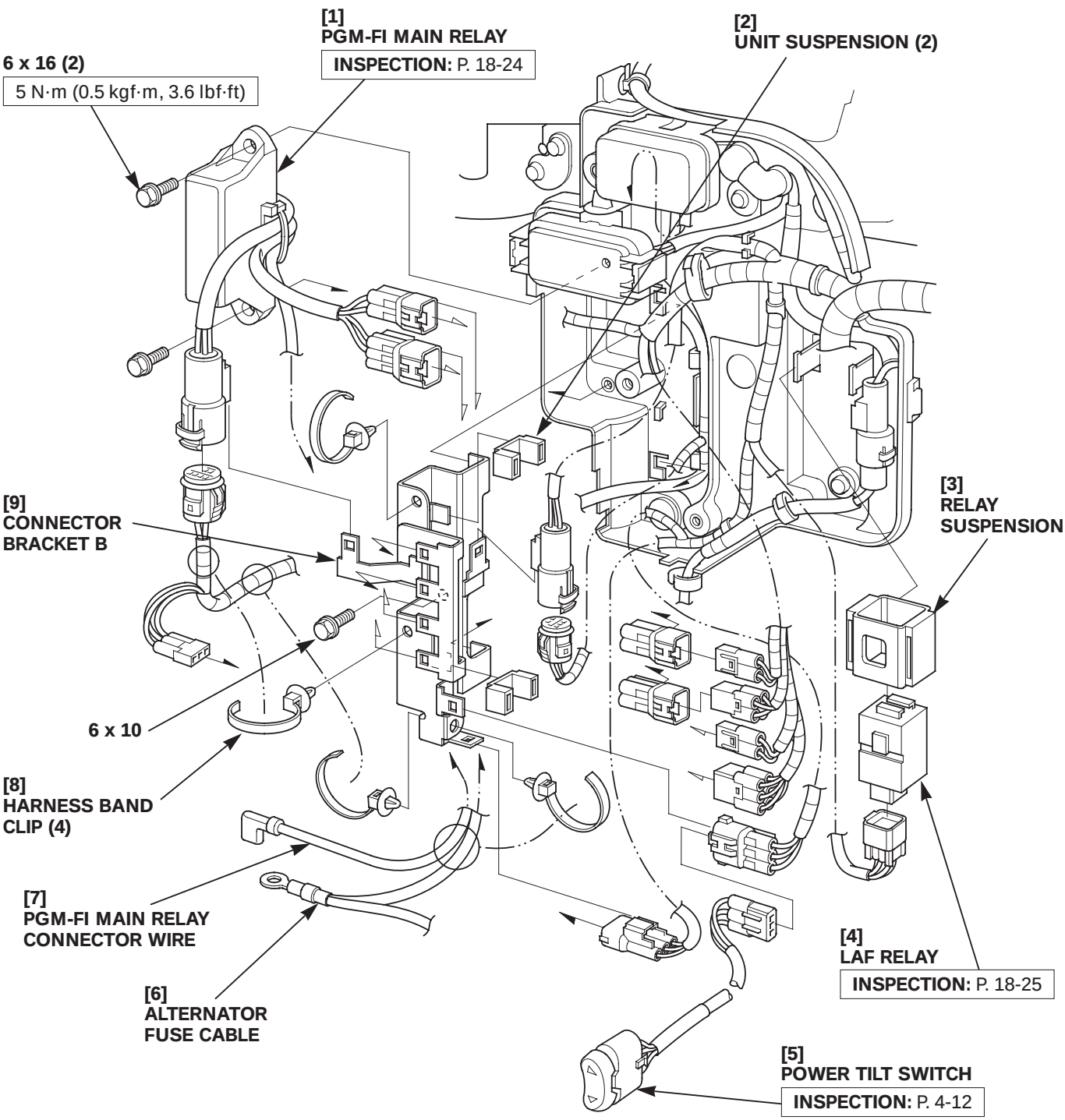
On installation, position each connector and harness in the proper position (P. 2-48).



b. PGM-FI MAIN RELAY/CONNECTOR BRACKET B REMOVAL/INSTALLATION

Remove the following parts.
– Engine cover (P. 4-2)
– R. engine under cover (P. 4-9)
– Electric part cover/ECM (P. 18-19)
Disconnect the PGM-FI main relay connector wire and the alternator fuse cable from the starter motor.

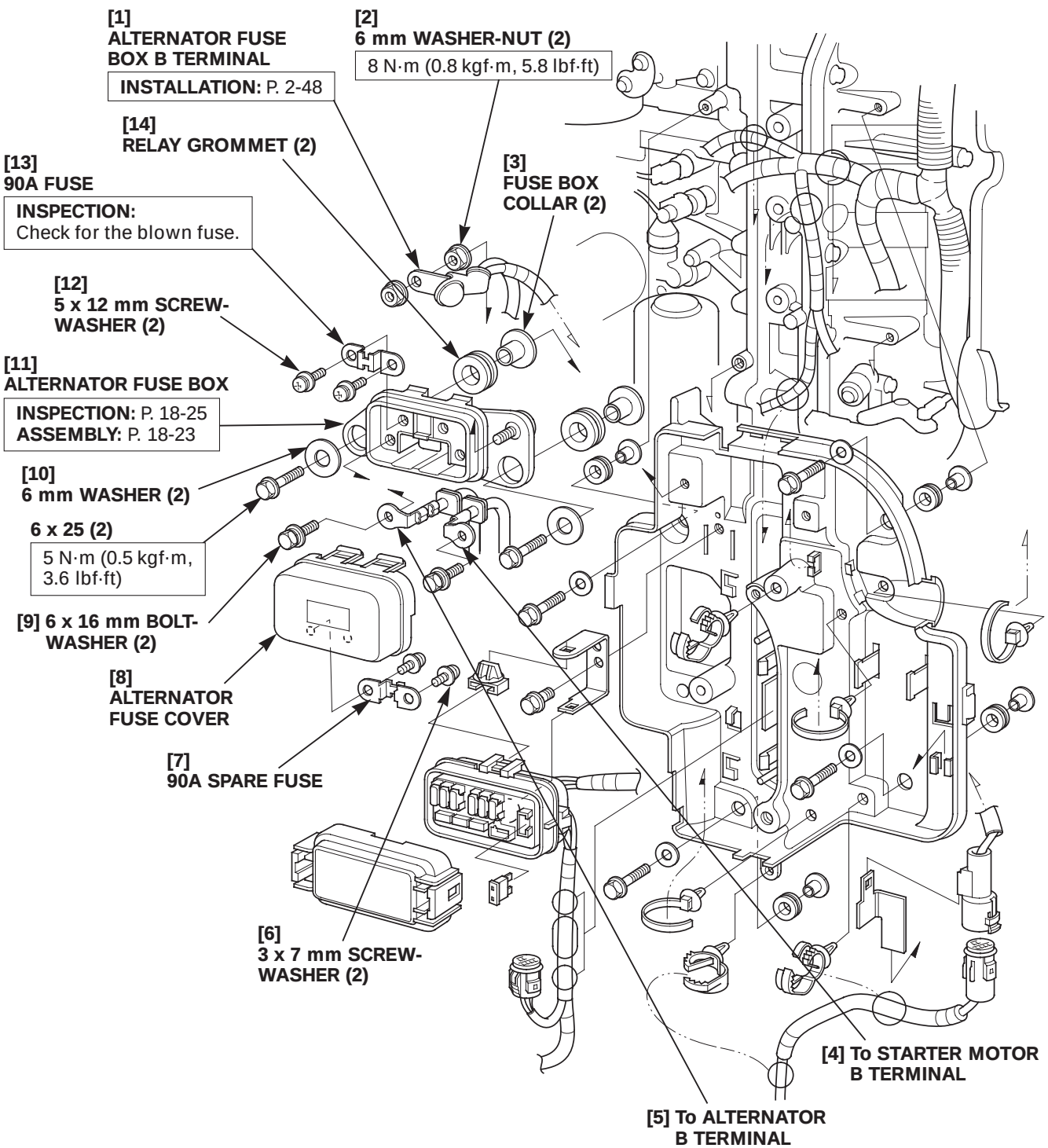
On installation, position each connector and harness in the proper position (P. 2-48 through P. 2-51).

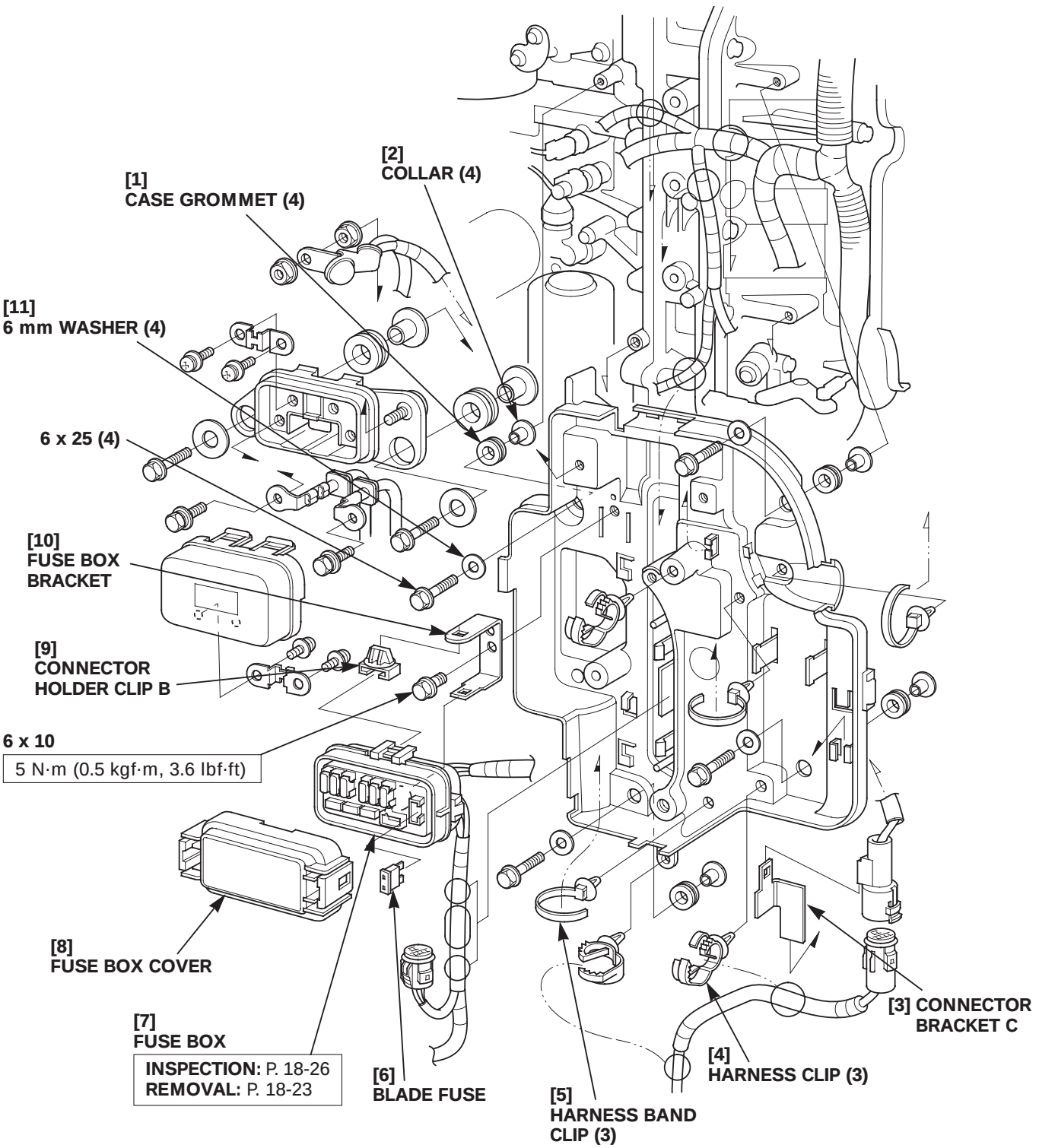


c. FUSE BOX/ALLTERNATOR FUSE BOX (90A) REMOVAL/INSTALLATION

Remove the following parts.
– Engine cover (P. 4-2)
– R. engine under cover (P. 4-9)
– Electric part cover/ECM (P. 18-19)
– PGM-FI main relay/connector bracket B (P. 18-20)

On installation, position each connector and harness in the proper position (P. 2-48 through P. 2-51).

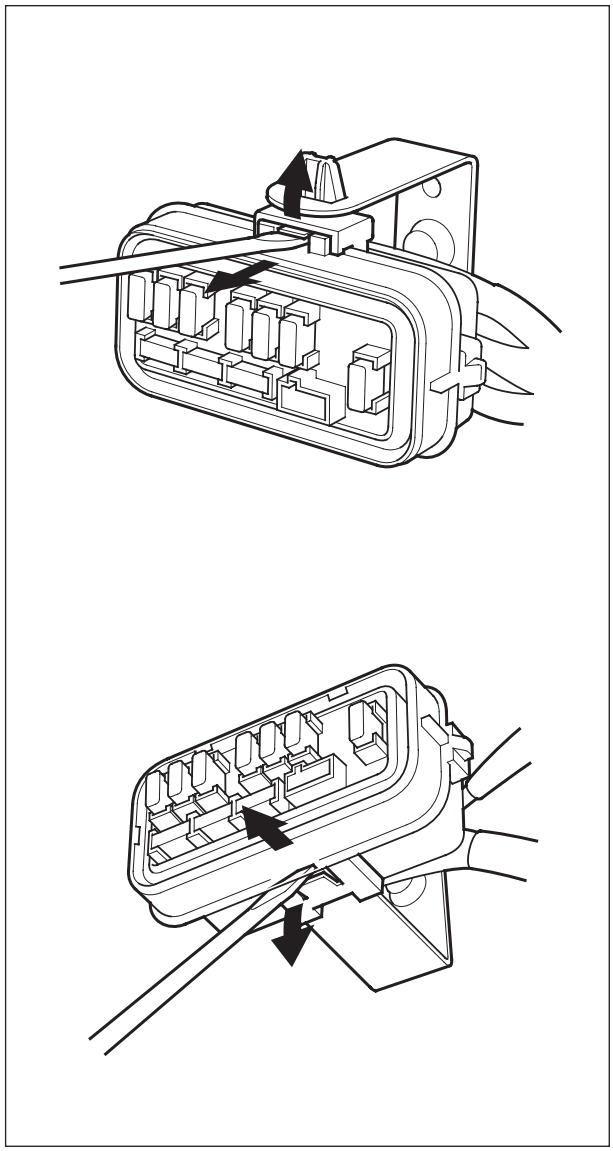



[1]
CASE GROMMET (4)
[2]
COLLAR (4)
[11]
6 mm WASHER (4)
6 x 25 (4)
[10]
FUSE BOX
BRACKET
[9]
CONNECTOR
HOLDER CLIP B
6 x 10
5 N·m (0.5 kgf·m, 3.6 lbf·ft)
[8]
FUSE BOX COVER
[7]
FUSE BOX
INSPECTION: P. 18-26
REMOVAL: P. 18-23
[6]
BLADE FUSE
[5]
HARNESS BAND
CLIP (3)
[4]
HARNESS CLIP (3)
[3] CONNECTOR
BRACKET C

• FUSE BOX

1) Insert a screwdriver or equivalent tool into the locking lugs on the top and underside of the fuse box, and unlock.

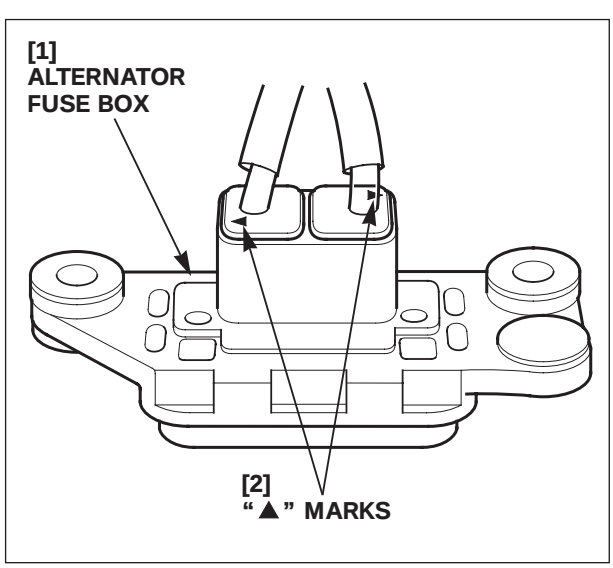
2) With the lock unlocked, pull the fuse box toward you and remove the fuse box from the fuse box bracket.



• ALTERNATOR FUSE BOX

ASSEMBLY:

Connect the alternator fuse cable (White wire) to the alternator fuse box from the reverse side. Connect so that the "▲" marks face the directions shown.



d. INSPECTION

NOTICE

- *Use a known-good battery.*
- *Do not connect the battery for more than 30 seconds. Wait for one minute or more before connecting the battery again.*

• PGM-FI MAIN RELAY

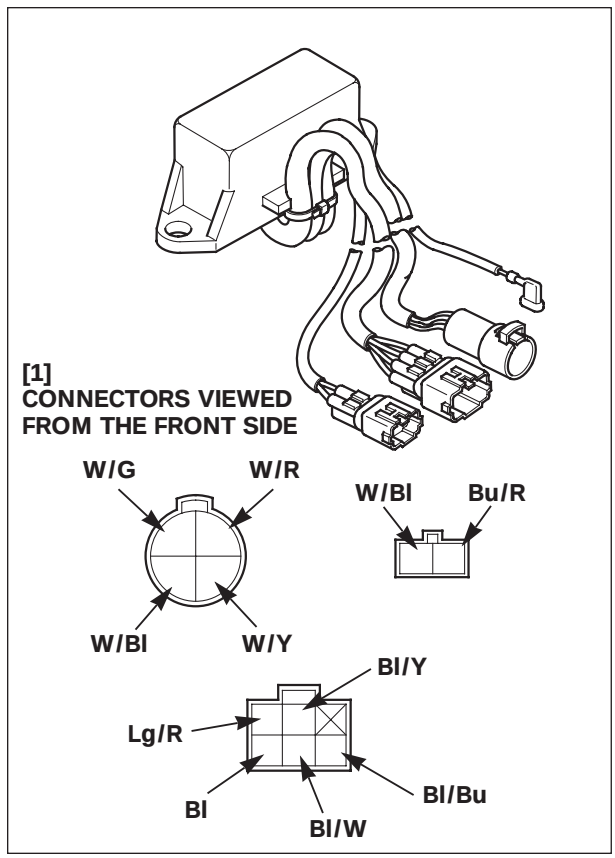
1) Connect the battery positive (+) terminal to the Black/Yellow terminal of the PGM-FI main relay 6P connector and the battery negative (–) terminal to the Black terminal. There must be the continuity between the following terminals of the 4P connector.
   - Between White/Yellow and White/Green terminals
   - Between White/Yellow and White/Red terminals
   - Between White/Yellow and White/Black terminals

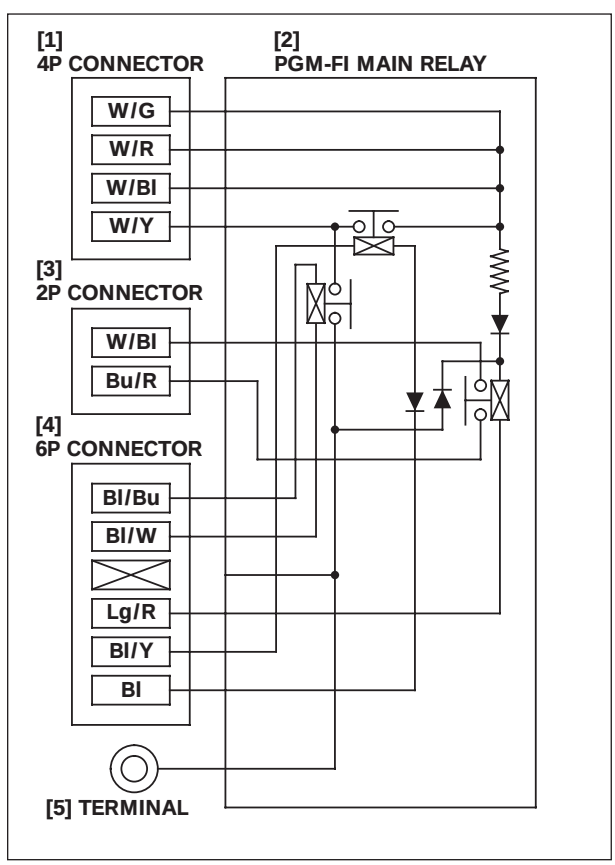
2) Connect the battery positive (+) terminal to the PGM-FI main relay terminal and the battery negative (–) terminal to the Light green/Red terminal. There must be the continuity between the White/Black and the Blue/Red terminals of the 2P connector.

3) Connect the battery positive (+) terminal to the Black/White terminal of the PGM-FI main relay 6P connector and the battery negative (–) terminal to the Black/Blue terminal. There must be continuity between the terminal and the White/Yellow terminal of the 4P connector.

4) Connect the battery positive (+) terminal to the White/Green terminal of the PGM-FI main relay 4P connector and the battery negative (–) terminal to the 6P connector Light green/Red terminal. There must be continuity between the White/Black and the Blue/Red terminals of the 2P connector.

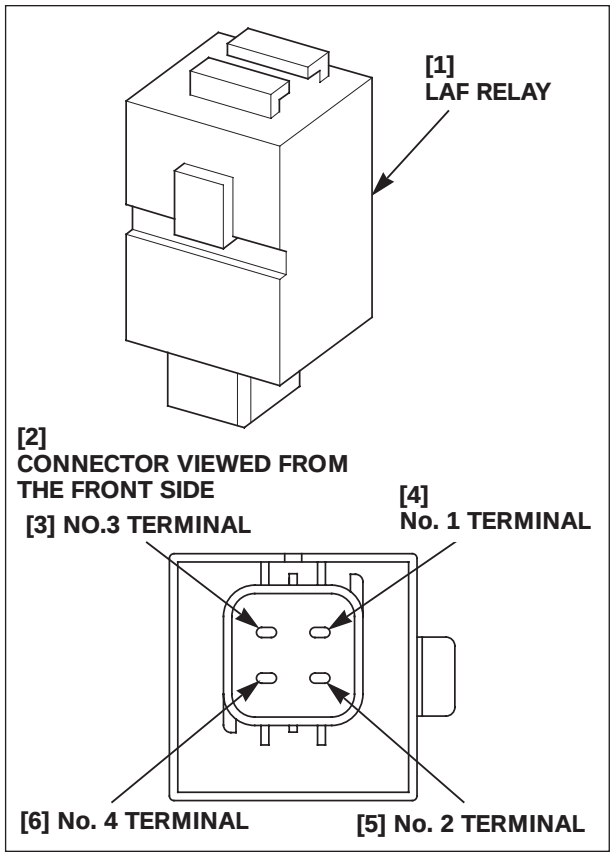
5) If there is no continuity, replace the PGM-FI main relay.





• LAF RRELAY

Connect the battery positive (+) terminal to the LAF relay No.3 terminal and the battery negative (–) terminal to the No.4 terminal. There must be continuity between the No.1 and No.2 terminal of the LAF relay.



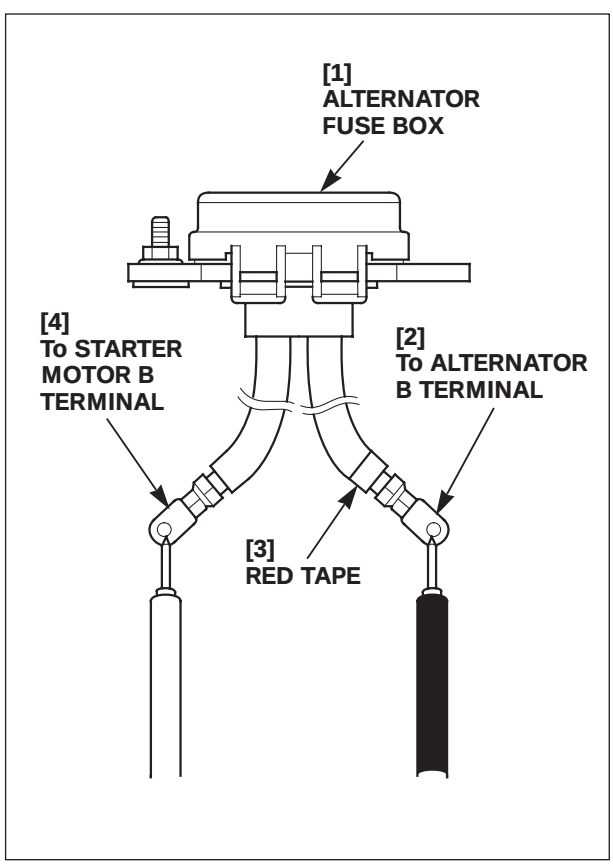
• ALTERNATOR FUSE BOX/FUSE

NOTICE

Disconnect the positive (+) and negative (–) starter cables from the battery before inspection and replacement of the alternator fuse box/fuse.

1) Check the 90A fuse for continuity.
   – If there is no continuity, replace the 90A fuse with the spare fuse.
   – If there is continuity, install the 90A fuse on the alternator fuse box and check for continuity between the cable terminals.

2) When installing the spare fuse on the reverse side of the cover, install so that the stamp of “90A” is at your side.



• FUSE BOX/FUSE

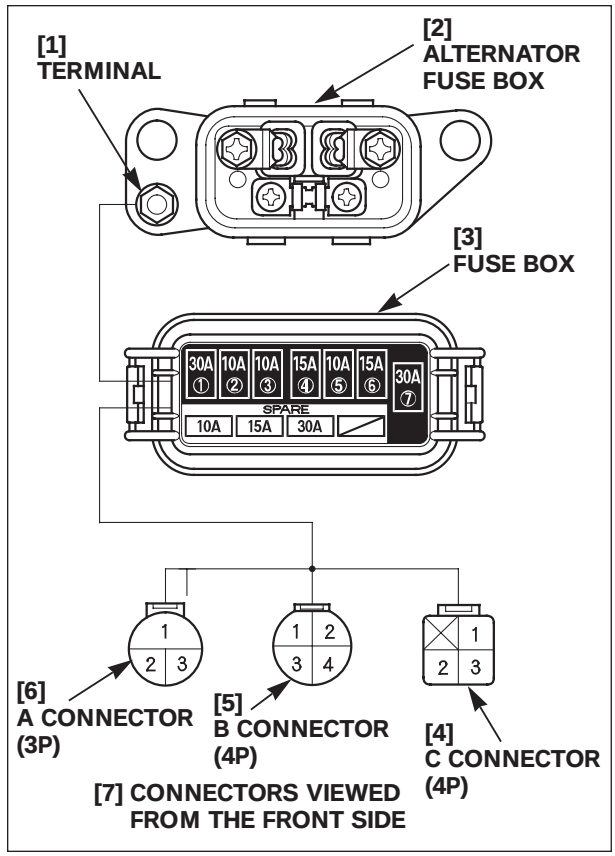
NOTICE

Disconnect the positive (+) and negative (–) starter cables from the battery before inspection and replacement of the fuse box/fuse.

1) Remove the fuses from the fuse box and check for blown fuse.

2) If the fuses are normal, install them in the fuse box and check for continuity between the terminals shown below.

Fuse No.	Check point
1	Between the terminal and the No.3 terminal of the C connector
2	Between the terminal and the No.2 terminal of the C connector
3	Between the terminal and the No.1 terminal of the C connector
4	Between the A connector No.3 terminal and the B connector No.4 terminal
5	Between the A connector No.2 terminal and the B connector No.1 terminal
6	Between the A connector No.1 terminal and the B connector No.2 terminal
7	Between the terminal and the No.3 terminal of the B connector

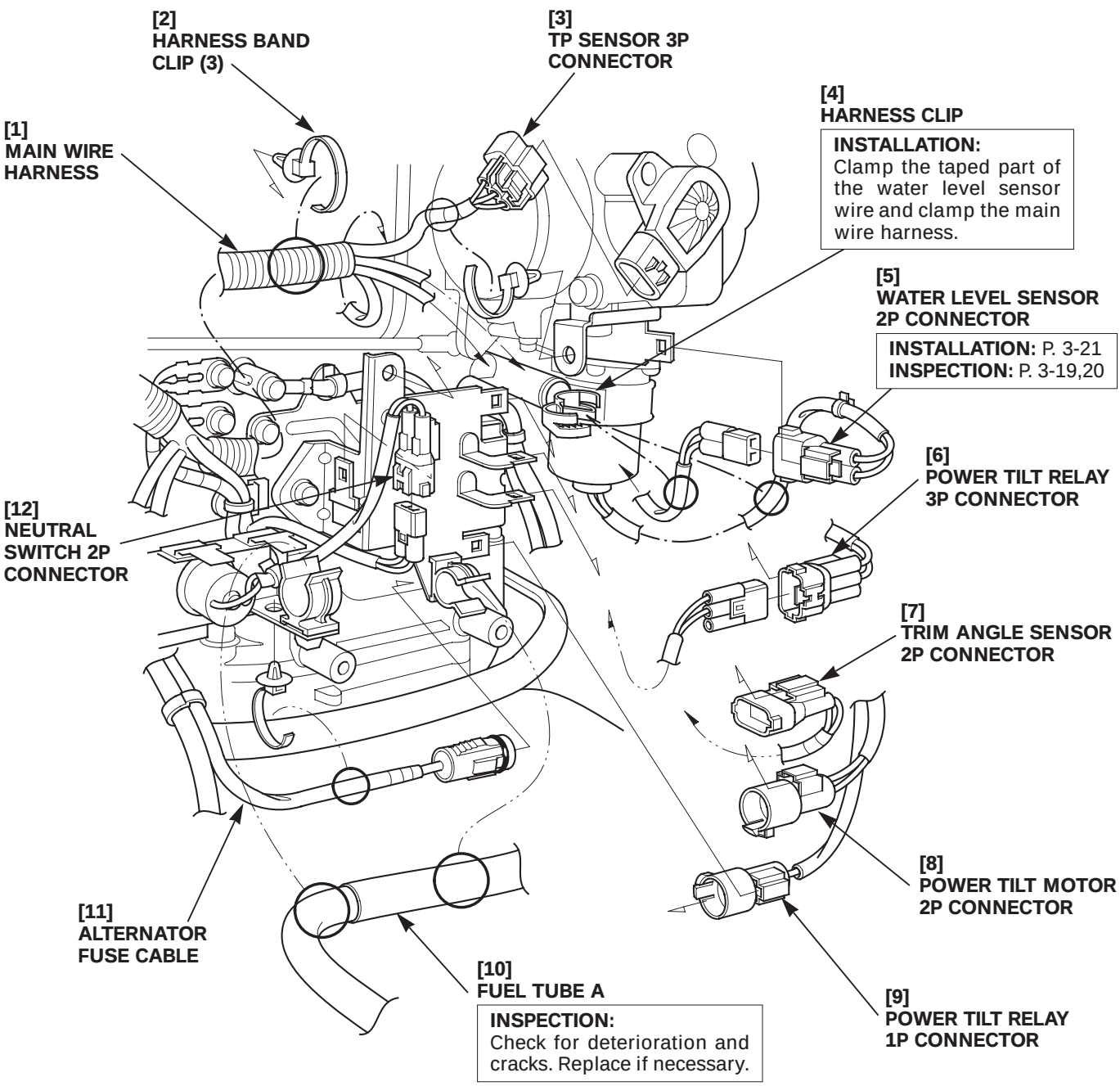


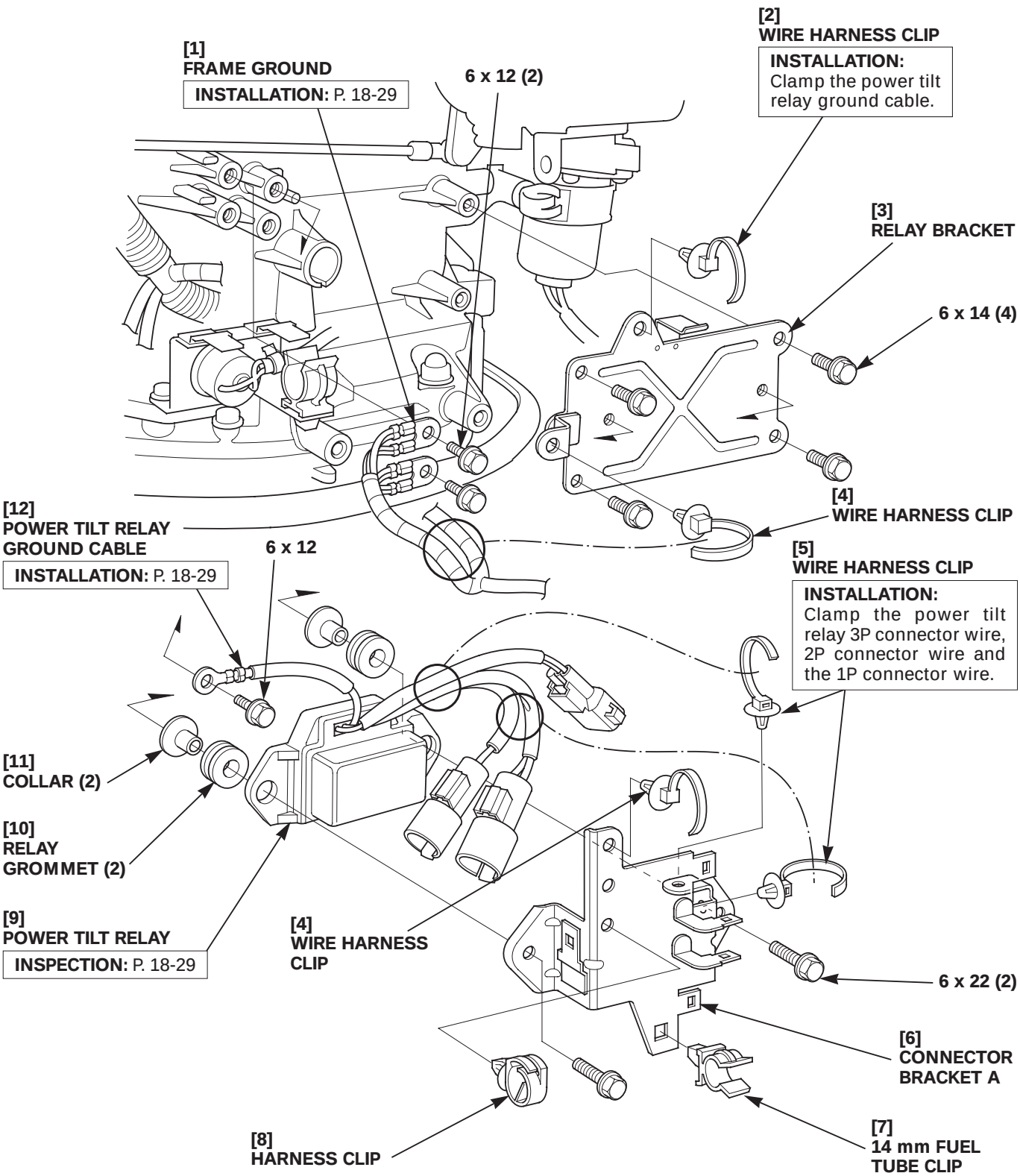
4. POWER TILT RELAY/CONNECTOR BRACKET A

a. REMOVAL/INSTALLATION

Remove the following parts.
– Engine cover (P 4-2)
– L./R. engine under covers (P. 4-9)
– Under cover front bracket (P. 4-20)
Remove each connector from the connector bracket A, then remove the connector bracket A and the power tilt relay.

On installation, position the connectors and harnesses in the proper position (P. 2-53 through P. 2-56).

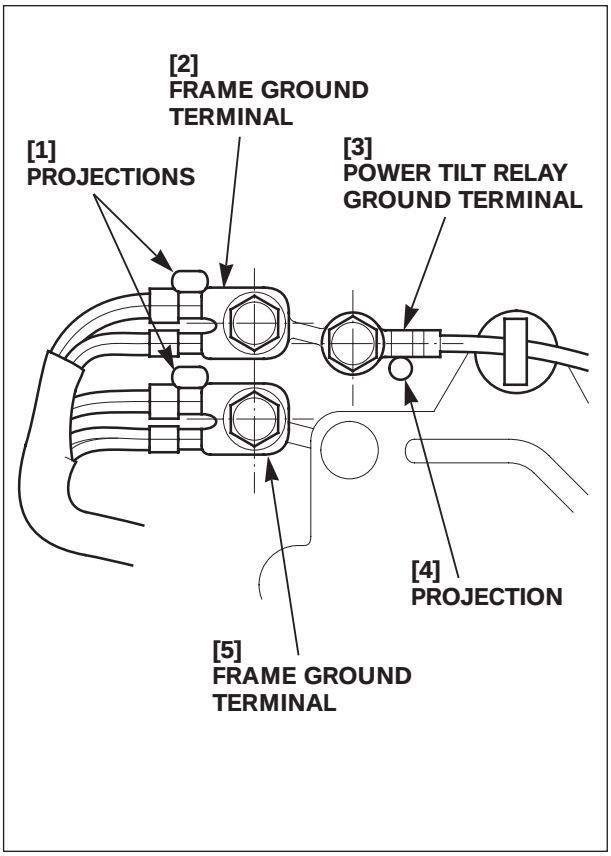



[1]
FRAME GROUND
INSTALLATION: P. 18-29
6 x 12 (2)
[2]
WIRE HARNESS CLIP
INSTALLATION:
Clamp the power tilt relay ground cable.
[3]
RELAY BRACKET
6 x 14 (4)
[4]
WIRE HARNESS CLIP
[12]
POWER TILT RELAY GROUND CABLE
INSTALLATION: P. 18-29
6 x 12
[5]
WIRE HARNESS CLIP
INSTALLATION:
Clamp the power tilt relay 3P connector wire, 2P connector wire and the 1P connector wire.
[11]
COLLAR (2)
[10]
RELAY GROMMET (2)
[9]
POWER TILT RELAY
INSPECTION: P. 18-29
[4]
WIRE HARNESS CLIP
6 x 22 (2)
[6]
CONNECTOR BRACKET A
[8]
HARNESS CLIP
[7]
14 mm FUEL TUBE CLIP

• FRAME GROUND

INSTALLATION:

Tighten the 6 x 12 mm flange bolts while pushing each ground terminal against the projection on the crankcase as shown.



• POWER TILT RELAY GROUND CABLE

INSTALLATION:

1) Connect the Black, Blue, Green/White wire side of the ground terminal to the upper connection, and the Green, Green/Black, Blue, Black/White wire side of the ground terminal to the lower connection as shown.

2) Tighten the 6 x 12 mm flange bolt while pushing each frame ground terminal against the projection on the crankcase.

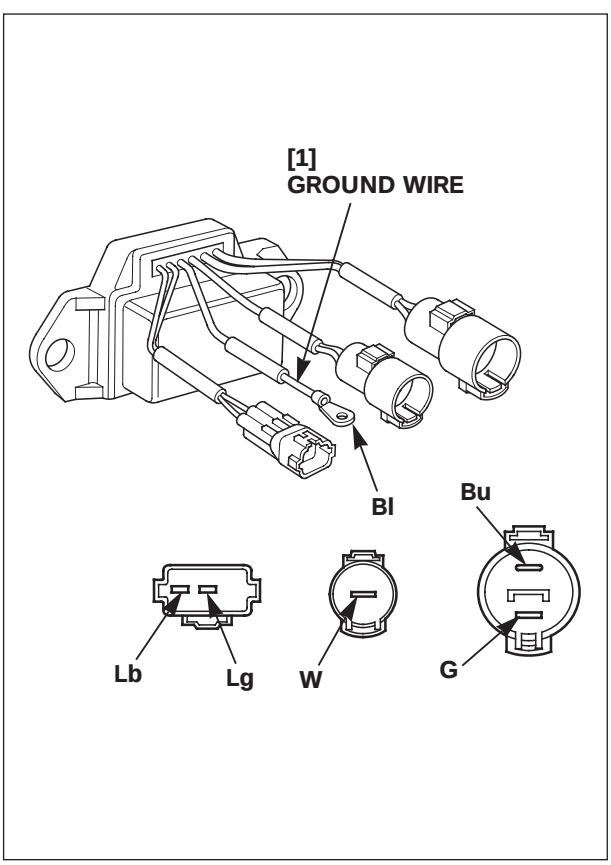
b. INSPECTION

• POWER TILT RELAY

Note that the power tilt relay inspection must be made on single unit of the power tilt relay.

1) Check for continuity between the terminals.

Green to Black terminals	Continuity
Blue to Black terminals	Continuity
Green to White terminals	No continuity
Blue to White terminals	No continuity



NOTICE

Use a known-good battery.

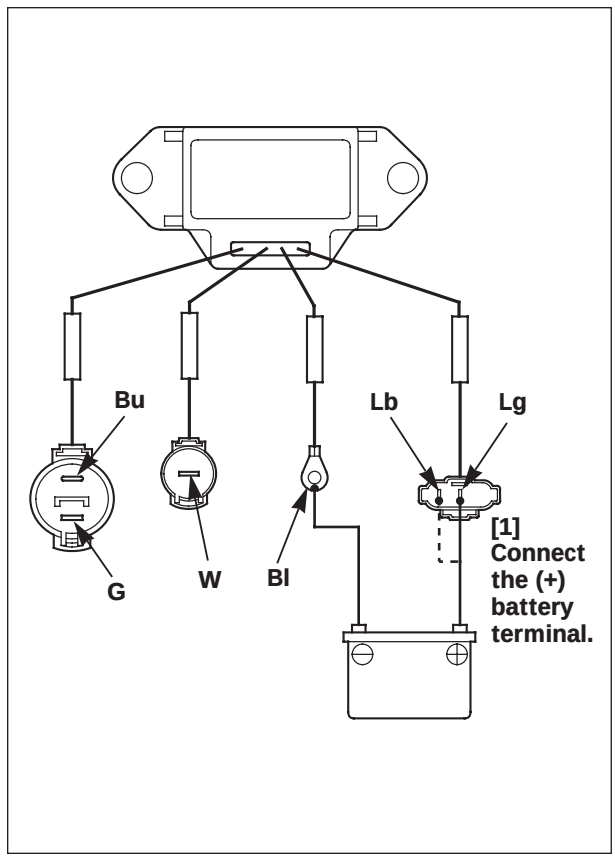
2) Connect the wires as shown, and check for continuity between the following terminals.

- **Connecting positive (+) battery terminal to Light green terminal:**

Green to Black terminals	No continuity
Blue to Black terminals	Continuity
Green to White terminals	Continuity
Blue to White terminals	No continuity

- **Connecting positive (+) battery terminal to Light blue terminal**:

Green to Black terminals	Continuity
Blue to Black terminals	No continuity
Green to White terminals	No continuity
Blue to White terminals	Continuity



1. DOHC (SWING ARM TYPE) + VTEC

STRUCTURE AND FEATURES

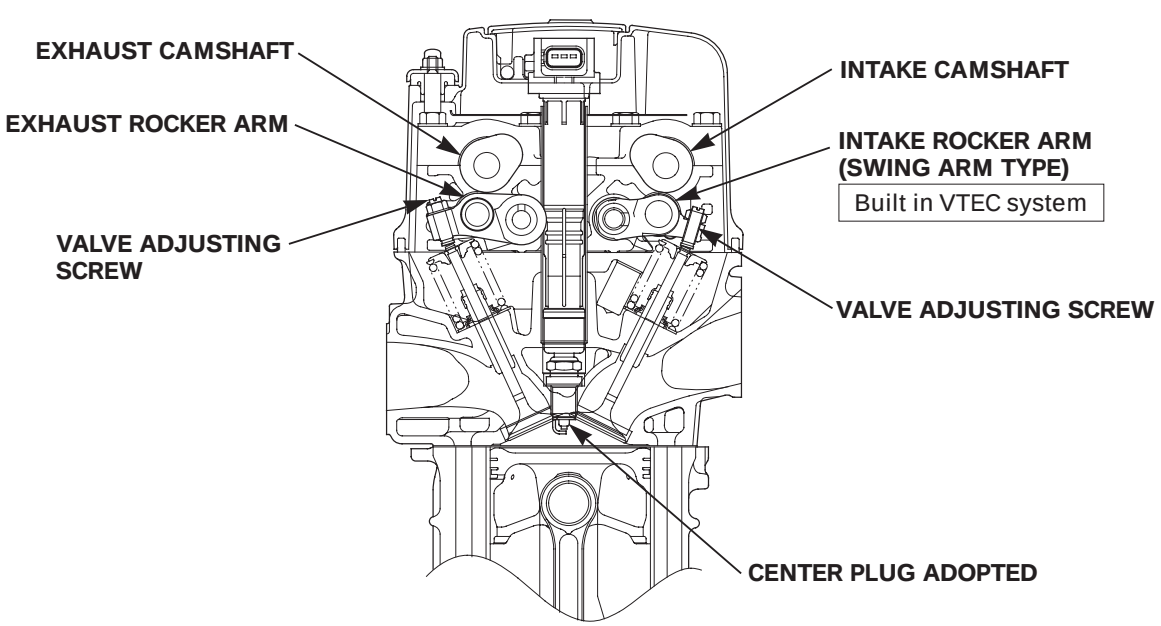
VTEC (BF150A only)

- The VTEC adapted on the BF150A outboard motors features the two cam profiles (for low and high engine speeds) and the corresponding three rocker arms to drive the intake valve.
- Receiving the signal from the ECM, the VTEC solenoid valve turns the hydraulic pressure ON and OFF, moving the rocker arm pistons built in the rocker arms and thereby combining and separating the three rocker arms to select either of the two modes and two valve timings that are suitable for the running conditions (e.g. engine speed, load, etc.).

  – When the engine speed is low [engine rpm is approx. 4,300 min^{-1} (rpm) or below], the rocker arm piston is retracted in the rocker arm. Each rocker arm is separate from the other making the independent movement. The center rocker arm, designed for the high engine speed, turns idle and the right and left rocker arms trace to the low engine speed cams. Therefore, the two intake side valves are driven in the low engine speed cam profile.
  Thus, improvement of the torque in full throttle low speed range was realized compared to the conventional fixed valve timing method.
  – When the engine speed is high [engine rpm is higher than approx. 4,300 min^{-1} (rpm)], the VTEC solenoid valve functions according to the signal from the ECM, extruding the rocker arm pistons from the rocker arm and combining the three rocker arms. As the center rocker arm, which is designed for the high engine speed, traces to the high speed cam, the two intake side valves are driven in the high engine speed cam profile.
  Thus, the two valves function in the valve timing that is specially designed for the high speed range, which assures improvement in engine horsepower.

DOHC

- The DOHC engine is adopted on these models, which realized center plug layout designed to contribute to improved fuel consumption efficiency.
- Though the engine is the DOHC type, it also adopted the swing arm rocker arm, which allows valve clearance adjustment with the adjusting screw and eliminated shim engagement that is poor in operationability.



2. CHAIN DRIVE CAM DRIVE SYSTEM

STRUCTURE AND FEATURES

The intake/exhaust cam drive method was changed from the existing cogged belt drive to the silent chain drive type. The chain tensioner was changed to the hydraulic type to make it maintenance free.

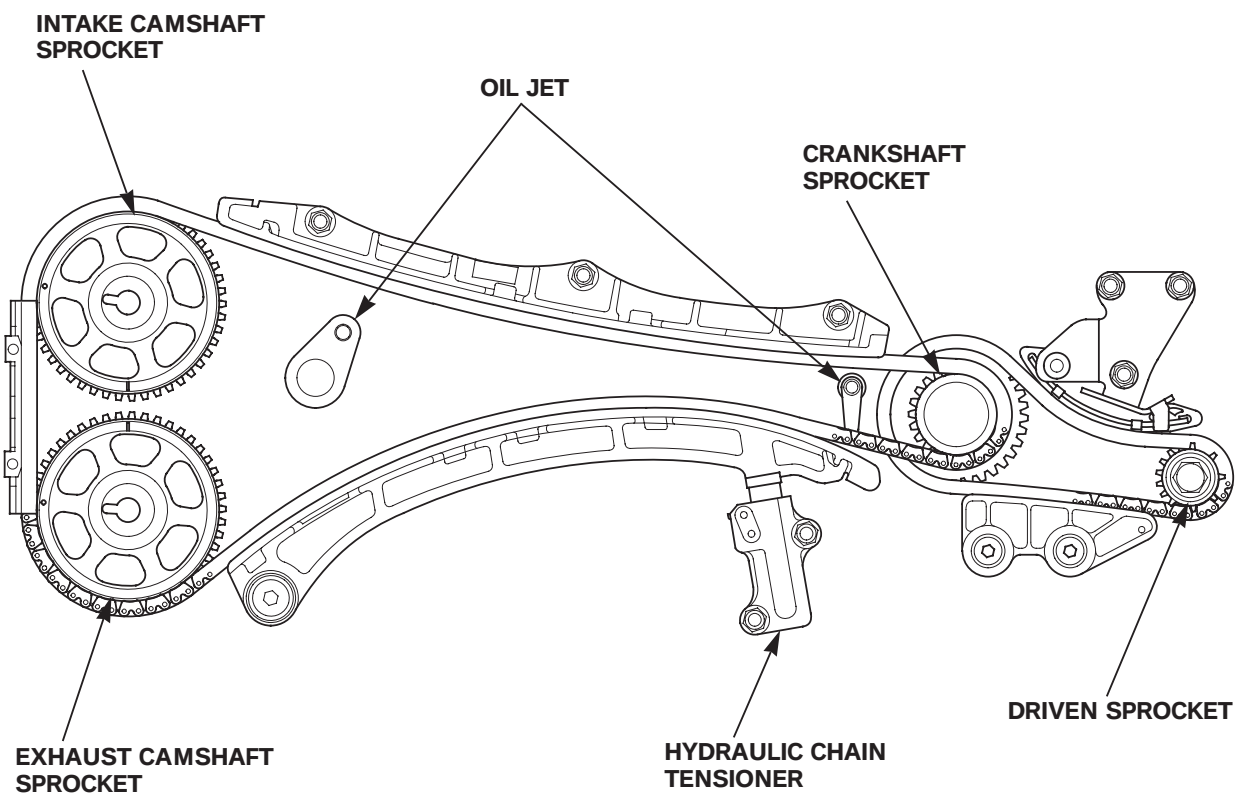
Structure:

As the basic structure of this chain drive cam drive system, the balancer is laid out in front of the crankshaft and the drive valve system is laid out behind the crankshaft.

- The balancer and intake/exhaust cam drive were changed from the two-cogged belt type (BF115A•130A) to the two-silent chain type.
- Cam chain tension adjustment was changed from the existing manual adjustment with spring to the automatic adjustment by drawing the main gallery oil pressure. This system is the same in structure as the system adopted on car.
- As the unique feature of these outboard motors, the dedicated chain lubrication oil jets are provided on the crankshaft sprocket, intake/exhaust camshaft sprocket and the driven sprocket. These oil jets feature the unique rib shape to collect the lubrication oil around the respective sprockets.

Effects:

- The chain guide is provided regulating 80% or more of the chain line. It thereby regulates deflection of the chain and eliminates wind noise of the chain.
- The existing spring type chain tensioner needs chain tension adjustment regularly (when chain sound was produced). These outboard motors are equipped on the hydraulic tensioner that has the adjustment mechanism (one-way lock mechanism) to maintain constant chain tension by means of the hydraulic pressure. It also adopted the unique lubrication system. Maintenance free during the service life of the chain tension was realized by adoption of these new features.



3. INDEPENDENT CYLINDER HEAD/CYLINDER BLOCK COOLING SYSTEM

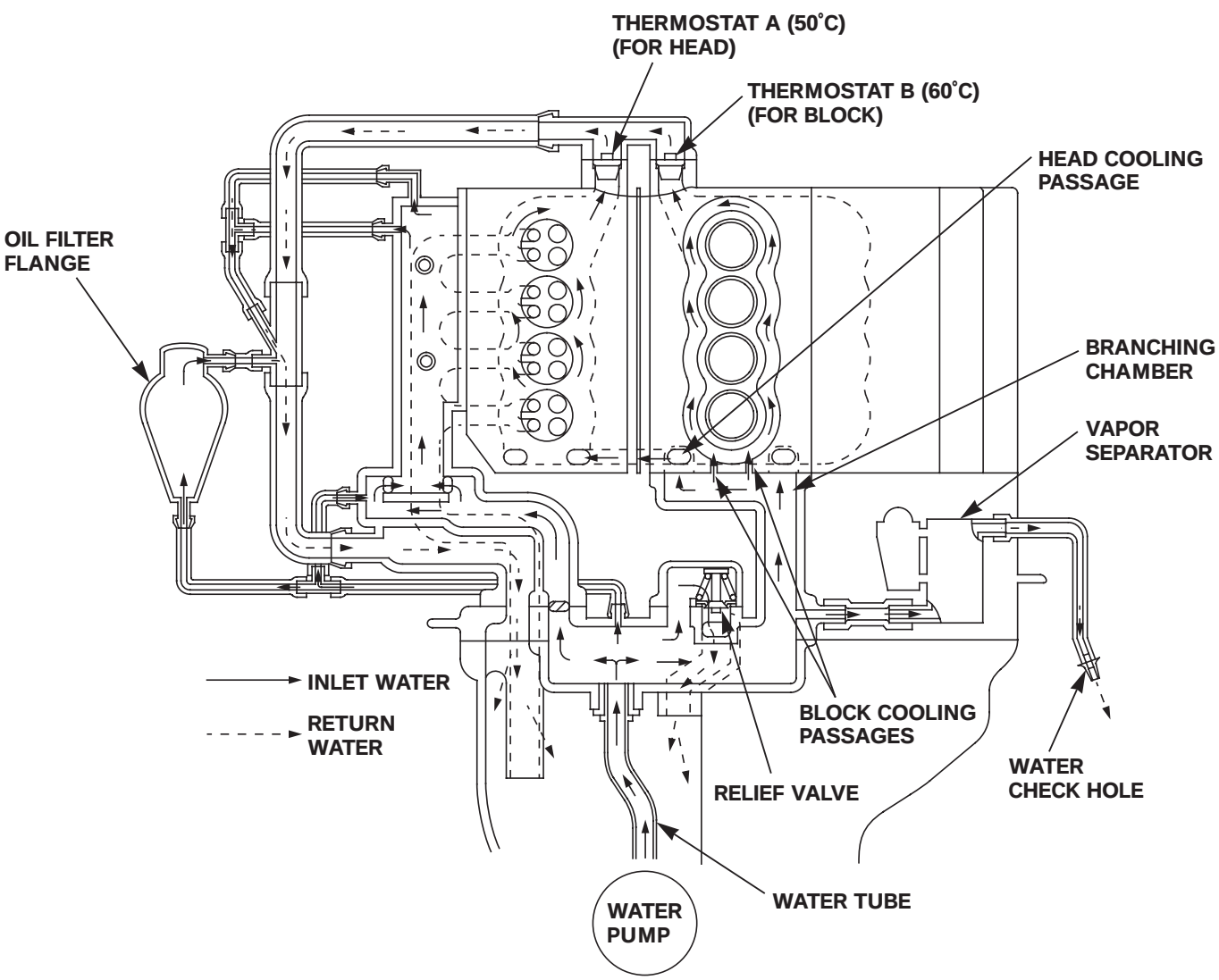
STRUCTURE AND FEATURES

The cylinder head and cylinder block cooling passages are laid out independently from each other, each of which is equipped with the thermostat to control the cooling water temperature of each passage.

Structure:

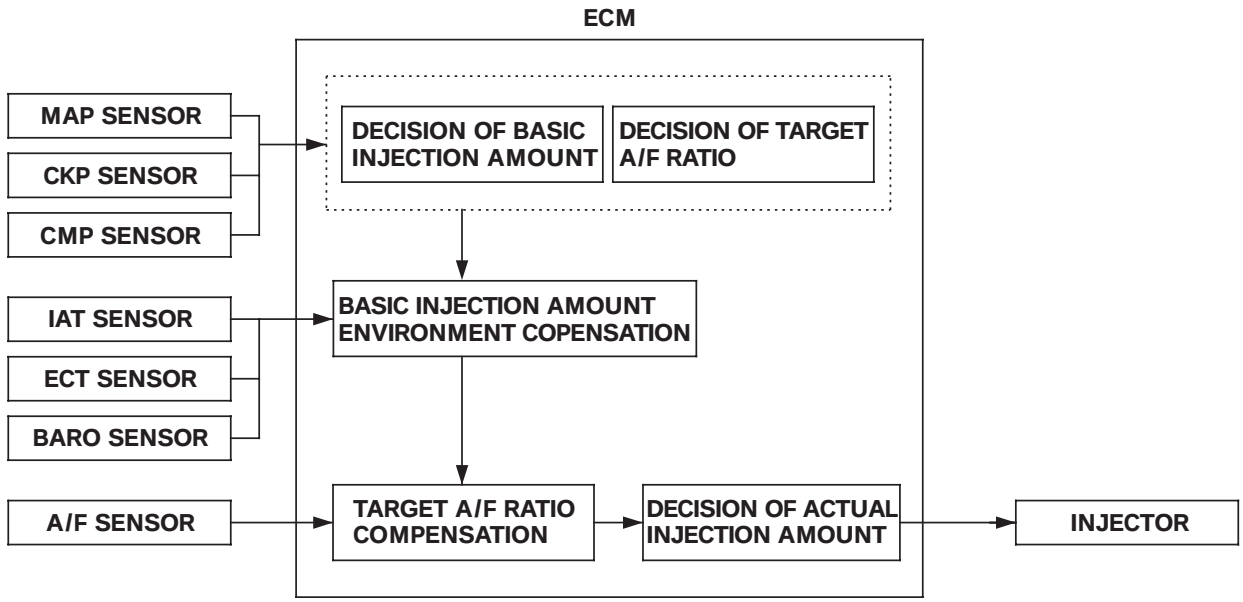
- The cooling water supplied from the water pump with force flows through the water tube and oil case, then it is drawn into the mounting case.
  In the mounting case, the cooling water separates into the two independent flows; one that goes to the cylinder head and the other that goes to the cylinder block.
  The cooling water temperature of each flow is regulated by the thermostat located at the outlet port of each passage.
- The thermostat valve open temperature for the cylinder head cooling water and for the cylinder block cooling water are set at different temperature from each other.
  At the cylinder block side, the thermostat valve open temperature is set at the optimum temperature (60˚C) to prevent oil dilution (over-cooling) during cruising at low speeds with extremely low load.
  At the cylinder head side, the thermostat valve open temperature is set at the temperature (50˚C) that can enhance the knocking limit by flushing the water more. Setting the valve open temperature in this way realized improvement in engine horsepower as well as toughness of the cylinder head against overheating.

COOLING CIRCUIT DIAGRAM



4. AIR/FUEL RATIO O_2 FEEDBACK CONTROL BY A/F SENSOR

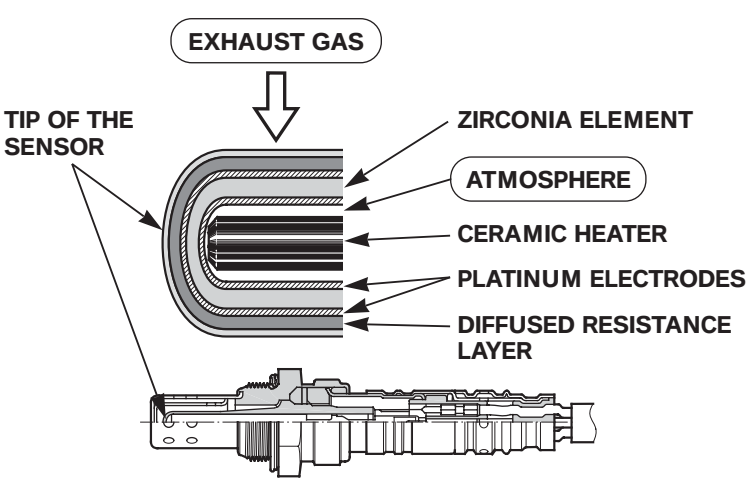
Receiving the current value signal from the A/F (Air Fuel Ratio) sensor, the ECM controls the fuel injection duration (fuel amount) so that the engine's suction air fuel mixture is at or near the target air/fuel ratio determined by the main CPU.



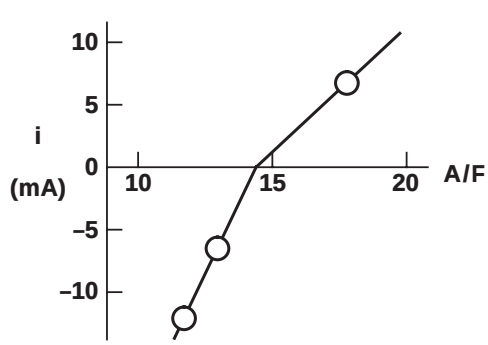
A/F (AIR FUEL RATIO) SENSOR

The A/F sensor, mounted on the exhaust manifold, detects the oxygen density in the exhaust gas. The A/F sensor has the built-in zirconia element coated with the platinum on the inner and outer surfaces and wrapped with the coarse diffused resistance layer. The sensor is structured so that its inner surface is exposed to the atmosphere and the outer surface to the exhaust gas.

When a given voltage is applied between the platinum electrodes, the current does not change by applying further voltage between the electrodes. However, the current value changes in accordance with the oxygen density in the exhaust gas that passed through the diffusion resistance layer. Utilizing this characteristic, the A/F sensor detects the change in oxygen density in the exhaust gas linearly, and thereby it realized very precise control of the air/fuel ratio.

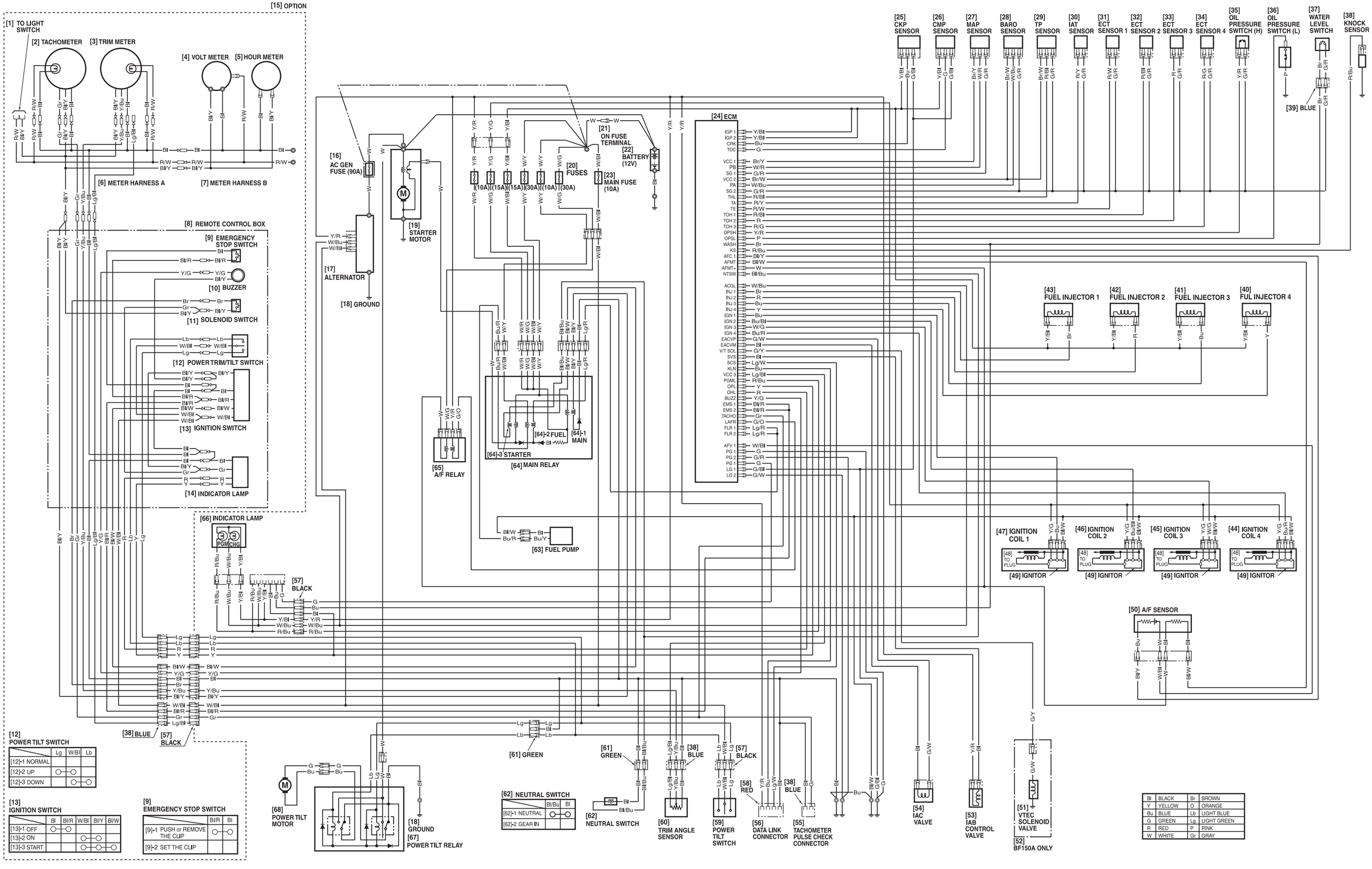


A/F SENSOR AIR FUEL RATIO/CURRENT CHARACTERISTIC CHART

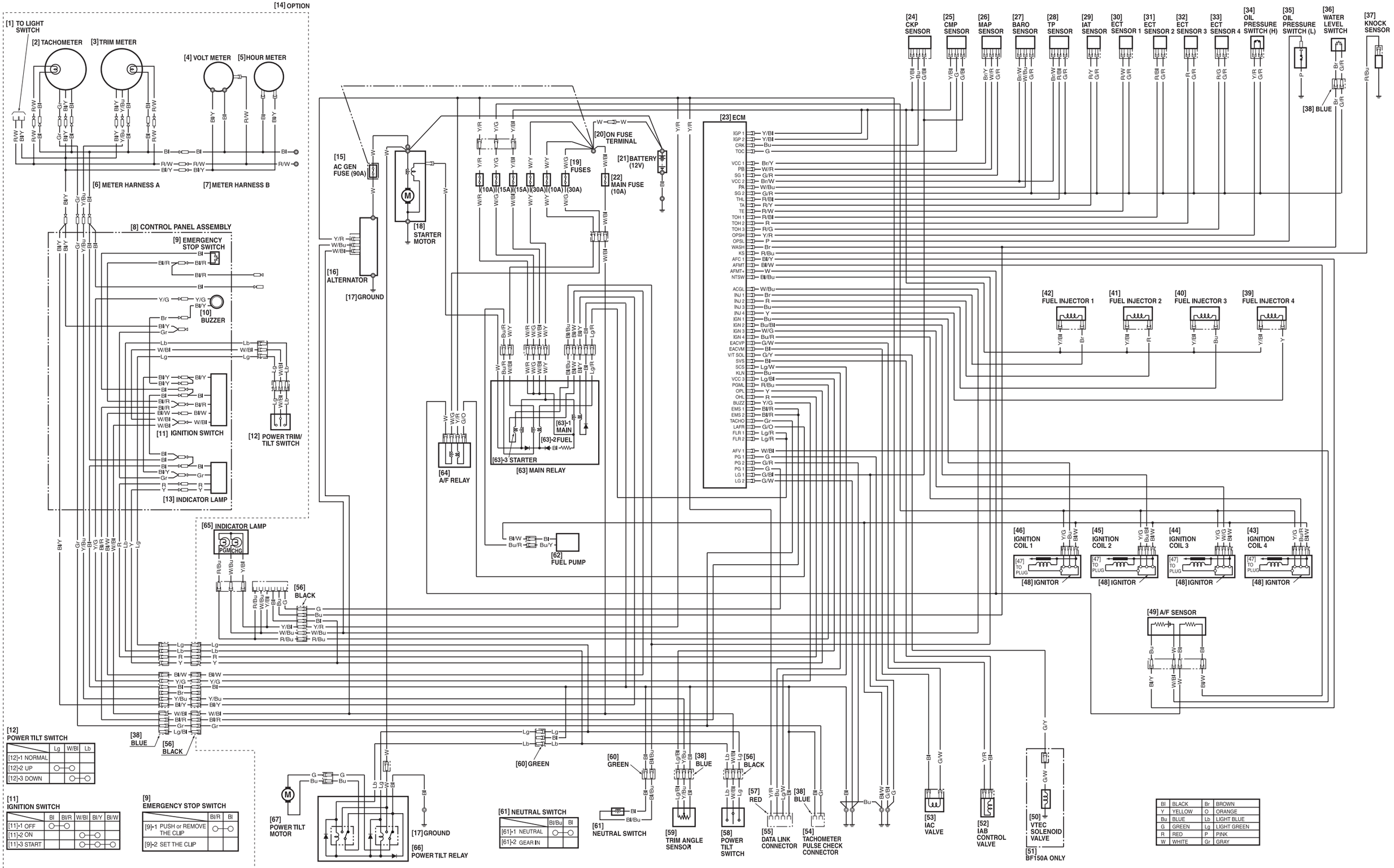


BF135A•BF150A

Side Mount Remote Control Type

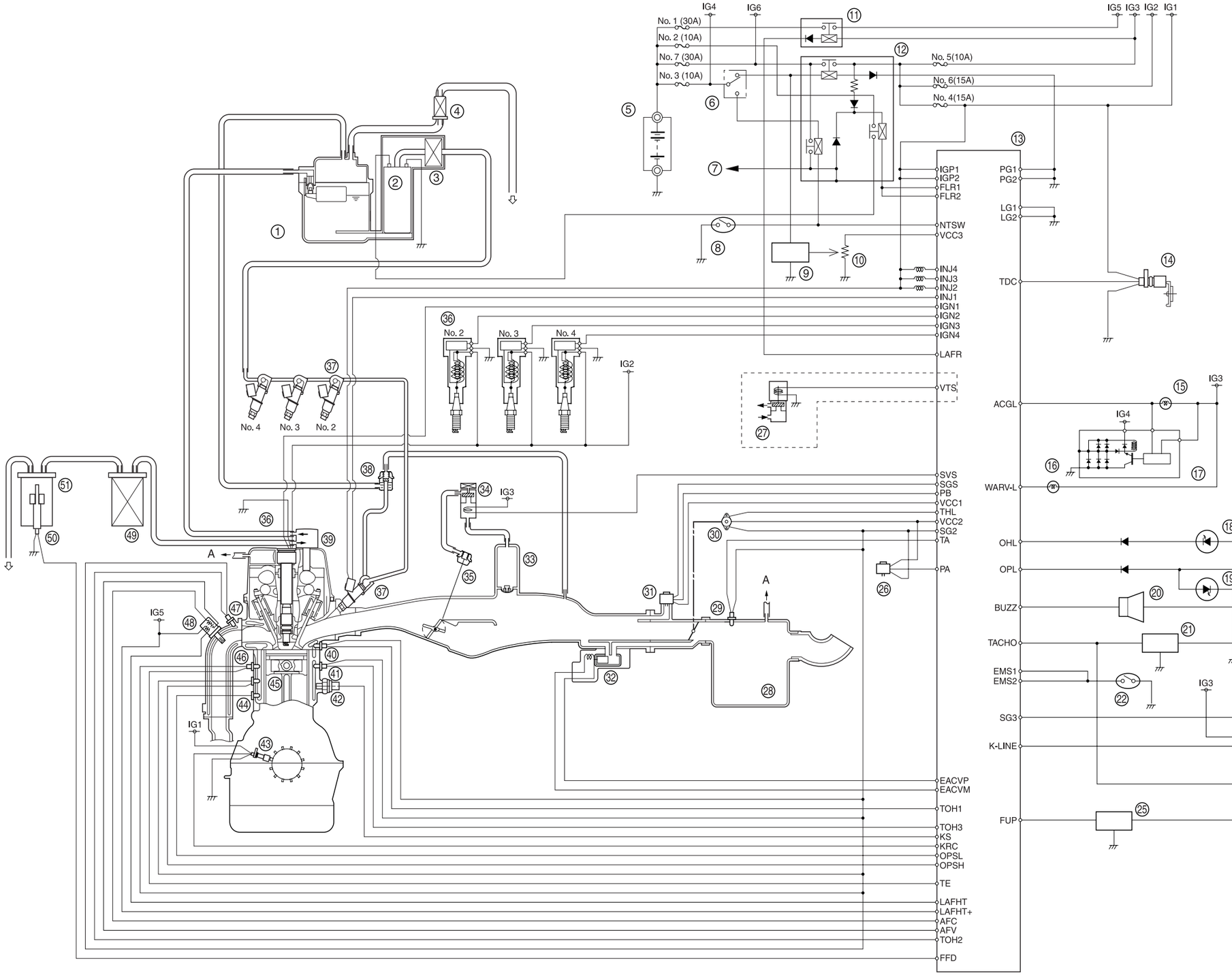


Top Mount Remote Control Type/Panel Mount Remote Control Type



BF135A•BF150A

PGM-FI System Diagram



① VAPOR SEPARATOR
② FUEL PUMP (HIGH PRESSURE SIDE)
③ FUEL STRAINER (HIGH PRESSURE SIDE)
④ VAPOR FILTER
⑤ BATTERY
⑥ IGNITION SWITCH
⑦ STARTER MOTOR
⑧ NEUTRAL SWITCH
⑨ TRIM METER (OPTION)
⑩ TRIM ANGLE SENSOR
⑪ A/F HEATER RELAY
⑫ PGM-FI MAIN RELAY
⑬ ECU
⑭ CMP SENSOR
⑮ ACG WARNING LIGHT
⑯ MIL
⑰ IC REGULATOR（AC GENERATOR）
⑱ OVERHEAT WARNING LIGHT
⑲ OIL INDICATOR LIGHT
⑳ WARNING BUZZER
㉑ TACHOMETER (OPTION)
㉒ EMERGENCY STOP SWITCH
㉓ DATA LINK CONNECTOR
㉔ TACHOMETER PULSE CHECK CONNECTOR
㉕ FUEL CONSUMPTION METER
㉖ BARO SENSOR
㉗ VTEC SOLENOID VALVE
㉘ SILENCER CASE
㉙ IAT SENSOR
㉚ TP SENSOR
㉛ MAP SENSOR
㉜ EACV
㉝ IAC VALVE
㉞ IAB CONTROL VALVE
㉟ DIAPHRAGM
㊱ IGNITION COIL
㊲ FUEL INJECTOR
㊳ PRESSURE REGULATOR
㊴ FUEL PUMP (HIGH PRESSURE SIDE
㊵ ECT SENSOR 2
㊶ ECT SENSOR 4
㊷ KNOCK SENSOR
㊸ CKP SENSOR
㊹ OIL PRESSURE SWITCH (LOW PRESSURE SIDE)
㊺ OIL PRESSURE SWITCH (HIGH PRESSURE SIDE)
㊻ ECT SENSOR 1
㊼ ECT SENSOR 3
㊽ A/F SENSOR
㊾ FUEL FILTER (LOW PRESSURE SIDE)
㊿ WATER LEVEL SWITCH
(51) WATER SEPARATOR

Note: Make sure to select Ó Shrink to fit in the printer dialog box when printing wiring diagrams.