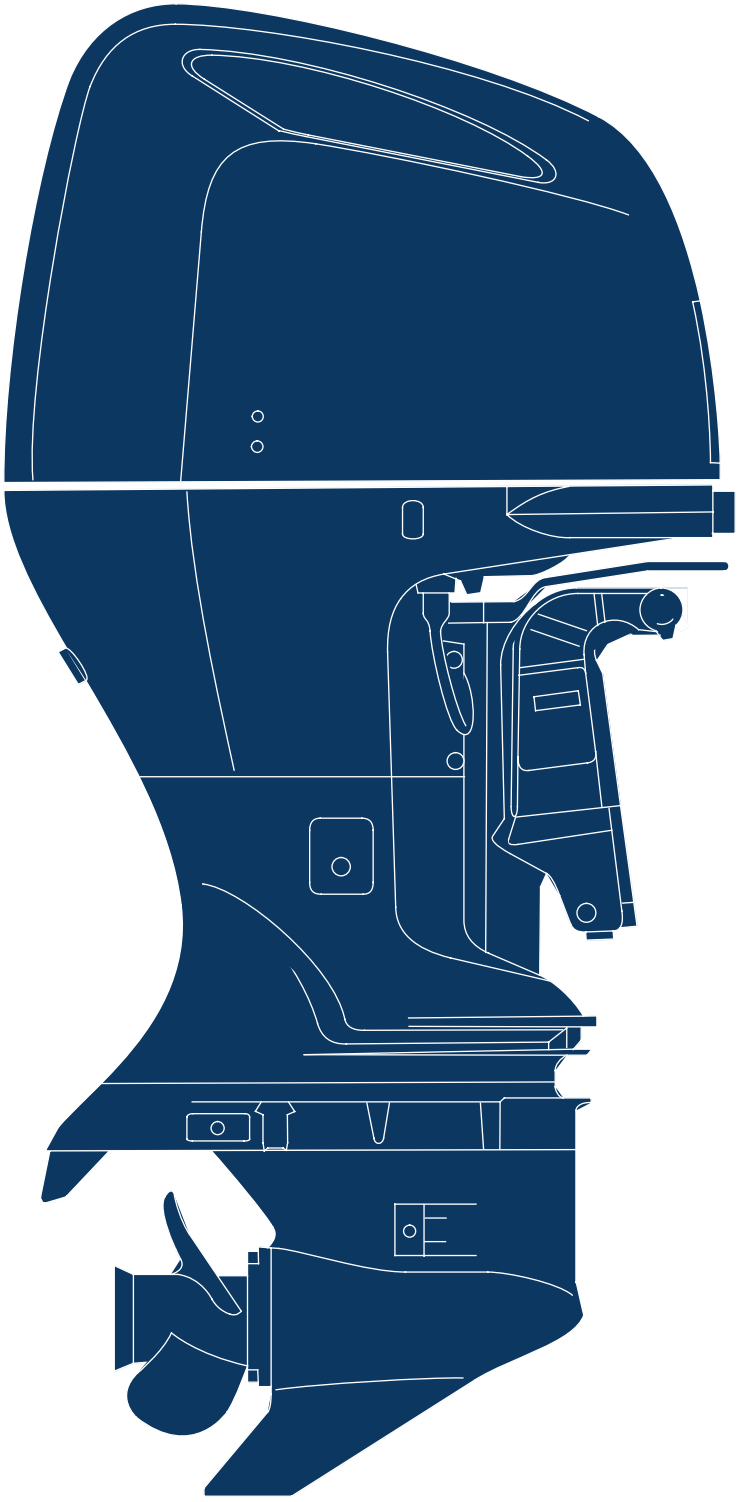
SERVICE MANUAL

TOHATSU
Outboards



4 Stroke
BFT 250A
Models

OB No.61ZX210
14-01 NB

Introduction

Before reading this manual

This service manual provides information that is needed for inspection, service and repair of applicable outboard motors. For our customers' safe and comfortable use of the products for long term, it is essential to maintain the performance and quality of the outboard motors. To ensure this, the maintenance and service have to be done properly by service technicians with fundamental knowledge and skills. This manual is utilized so that our customers can always use their outboard motor with full satisfaction.
As this document contains information from the Honda Motor's Service Manual, the document contains information about models that are not sold by our company. Additionally, the model names and part numbers of the special tools mentioned in this document are the names and numbers used by Honda Motor Co., Ltd. Please alter the model names and part numbers as follows.

Change model names with "BF" to "BFT".

Example: BF* -> BFT***

Add "HCO-" at the beginning of part numbers of special tools.

Example: 07GD-0010100-OS -> HCO-07GD-0010100-OS

Introduction

Avant de lire le présent manuel

Le présent manuel d'entretien fournit les informations nécessaires au contrôle, à l'utilisation et à la réparation des moteurs hors-bords concernés. Pour une utilisation de nos produits par nos clients, à long terme, en toute sécurité et tout confort, il est capital de veiller à maintenir les performances et la qualité du hors-bord. Pour garantir ce point, l'entretien et la maintenance doivent être assurés en bonne et due forme par des techniciens en entretien et réparation disposant des connaissances et compétences clés. Le présent manuel est prévu pour que nos clients puissent toujours utiliser leur moteur hors-bord pour leur plus grande satisfaction.
Ce document contient des informations provenant du manuel de réparation des moteurs Honda, mais il contient aussi des informations sur des modèles qui ne sont pas vendus par notre société. De plus, les noms de modèle et les numéros de pièce des outils spéciaux mentionnés dans ce document sont les noms et les numéros utilisés par Honda Motor Co., Ltd. Veuillez modifier les noms de modèles et les numéros de pièces de la façon suivante :

Changer les noms de modèle comprenant "BF" en "BFT".

Exemple: BF * -> BFT ***

Ajouter "HCO-" au début des numéros de pièce des outils spéciaux.

Exemple: 07GD-0010100-OS -> HCO-07GD-0010100-OS

Introducción

Antes de leer este manual

Este manual de servicio brinda la información que se requiere para la inspección, el servicio y la reparación de los correspondientes motores fuera de borda. Para que nuestros clientes puedan utilizar los productos durante largo tiempo de forma segura y cómoda, resulta fundamental mantener el desempeño y la calidad de los motores fuera de borda. Para garantizar esto, el mantenimiento y el servicio deben ser ejecutados correctamente por ténicos de mantenimiento con el conocimiento y las habilidades requeridas. La utilización de este manual permitirá a nuestros clientes utilizar siempre su motor fuera de borda con plena satisfacción.
Debido a que este documento contiene información extraía del manual de servicio de Honda Motor, el mismo contiene información acerca de modelos que no son vendidos por nuestra empresa. Adem s, los nombres de los modelos y los núeros de piezas de las herramientas especiales mencionadas en este documento son los nombres y núeros utilizados por Honda Motor Co., Ltd. Modifique los nombres de los modelos y los núeros de piezas como se indica a continuación.

Cambie los nombres de los modelos con "BF" a "BFT".

Ejemplo: BF * -> BFT *****

Añda "HCO-" al inicio de los núeros de piezas de las herramientas especiales.

Ejemplo: 07GD-0010100-OS -> HCO-07GD-0010100-OS

Einführung

Vor dem Durchlesen dieses Handbuchs

Dieses Service-Handbuch enthält die Information, die zur Inspektion, Service und Reparatur der jeweiligen Außenbordmotoren benötigt wird. Zur Sicherheit unserer Kunden und für eine komfortable, langfristige Benutzung der Produkte ist es unumgänglich, die Leistung und Qualität der Außenbordmotoren instand zu halten. Um dies zu gewährleisten, müssen Wartung und Service von Fachkräften mit dem entsprechenden Wissen und Fähigkeiten durchgeführt werden. Dieses Handbuch wird genutzt, damit unsere Kunden ihren Außenbordmotor zur vollen Zufriedenheit benutzen können.
Da dieses Dokument Information des Honda Motor Service-Handbuchs enthält, findet man auch Information über Modelle, die nicht von unserem Unternehmen verkauft werden. Des Weiteren werden die in diesem Dokument erwähnten Modellbezeichnungen und Teilenummern von Spezialwerkzeugen von Honda Motor Co., Ltd benutzt. Die Modellbezeichnungen und Teilenummern wie folgt abändern:

Modellbezeichnungen "BF" in "BFT" abändern.

Beispiel: BF* -> BFT***

"HCO" vor die Teilenummern der Spezialwerkzeuge setzen.

Beispiel: 07GD-0010100-OS -> HCO-07GD-0010100-OS

A Few Words About Safety

SERVICE INFORMATION

The service and repair information contained in this manual is intended for use by qualified, professional technicians. Attempting service or repairs without the proper training, tools, and equipment could cause injury to you and/or others. It could also damage this Honda product or create an unsafe condition.

This manual describes the proper methods and procedures for performing service, maintenance, and repairs. Some procedures require the use of special tools. Any person who intends to use a replacement part, service procedure, or a tool that is not recommended by Honda must determine the risks to their personal safety and the safe operation of this product.

If you need to replace a part, use Honda Genuine parts with the correct part number or an equivalent part. We strongly recommend that you do not use replacement parts of inferior quality.

For Your Customer's Safety

Proper service and maintenance are essential to the customer's safety and the reliability of this product. Any error or oversight while servicing this product can result in faulty operation, damage to the product, or injury to others.

⚠WARNING

Improper service or repairs can create an unsafe condition that can cause your customer or others to be seriously hurt or killed.

Follow the procedures and precautions in this manual and other service materials carefully.

For Your Safety

Because this manual is intended for the professional service technician, we do not provide warnings about many basic shop safety practices (e.g., Hot parts-wear gloves). If you have not received shop safety training or do not feel confident about your knowledge of safe servicing practices, we recommend that you do not attempt to perform the procedures described in this manual.

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

⚠WARNING

Failure to properly follow instructions and precautions can cause you to be seriously hurt or killed.

Follow the procedures and precautions in this manual carefully.

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 anytime you hammer, drill, grind, or work around pressurized air, pressurized liquids, 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 equipment hoisted in the air. Anytime you lift this product with a hoist, make sure that the hoist hook is securely attached to the product.

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 store gasoline in an open container.
- Keep all cigarettes, sparks, and flames away from the battery and all fuel-related parts.

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INTRODUCTION

This manual covers the service and repair procedures for the Honda BF250A outboard motor.

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.

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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 this Honda product, 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 products. You must use your own good judgement.

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

- Safety Labels – on the product.
- 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 these products correctly and safely.

ALL INFORMATION, ILLUSTRATIONS, DIRECTIONS, AND SPECIFICATIONS INCLUDED IN THIS PUBLICATION ARE BASED ON THE LATEST PRODUCT INFORMATION AVAILABLE AT THE TIME OF APPROVAL FOR PRINTING. Honda Motor Co., Ltd. RESERVES THE RIGHT TO MAKE CHANGES AT ANY TIME WITHOUT NOTICE AND WITHOUT INCURRING ANY OBLIGATION WHATSOEVER. NO PART OF THIS PUBLICATION MAY BE REPRODUCED WITHOUT WRITTEN PERMISSION. THIS MANUAL IS WRITTEN FOR PERSONS WHO HAVE ACQUIRED BASIC KNOWLEDGE OF MAINTENANCE ON Honda PRODUCTS.

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SERVICE PUBLICATION OFFICE

Date of Issue: @ 2012

SERVICE RULES

- Use Honda Genuine or Honda-recommended parts and lubricants or their equivalents. Parts that do not meet Honda's design specifications may damage the unit.
- Use the special tools designed for the product.
- Install new gaskets, O-rings, etc. when reassembling.
- 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.
- Clean parts in cleaning solvent upon disassembly. Lubricate any sliding surfaces before reassembly.
- After reassembly, check all parts for proper installation and operation.
- 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.

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.

SYMBOLS

The symbols used throughout this manual show specific service procedures. If supplementary information is required pertaining to these symbols, it will be explained specifically in the text without the use of the symbols.

	Replace the part(s) with new one(s) before assembly.
	Use the recommend engine oil, unless otherwise specified.
	Use molybdenum oil solution (mixture of the engine oil and molybdenum grease in a ratio of 1:1).
	Use multi-purpose grease (lithium based multi-purpose grease NLGI #2 or equivalent).
	Use marine grease (water resistant urea based grease).
	Apply a locking agent. Use a medium strength locking agent unless otherwise specified.
	Apply sealant.
	Use automatic transmission fluid.
(○ x ○) (○)	Indicates the diameter, length, and quantity of metric bolts used.
page 1-1	Indicates the reference page.

ABBREVIATIONS

Throughout this manual, the following abbreviations are used to identify the respective parts or systems.

Abbreviated term	Full term
ACG	Alternator
API	American Petroleum Institute
Approx.	Approximately
Assy.	Assembly
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATT	Attachment
BAT	Battery
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
BARO	Barometric Pressure
CKP	Crankshaft Position
Comp.	Complete
CMP	Camshaft Position
CYL	Cylinder
DLC	Data Link Connector
EBT	Engine Block Temperature
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EMT	Exhaust Manifold Temperature
EOP	Engine Oil Pressure
EX	Exhaust
F	Front or Forward
GND	Ground
HO2S	Heated Oxygen sensor
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
VTEC	Variable Valve Timing & Valve Lift Electronic Control

Bl	Black	G	Green	Br	Brown	Lg	Light green
Y	Yellow	R	Red	O	Orange	P	Pink
Bu	Blue	W	White	Lb	Light blue	Gr	Gray

1. GENERAL INFORMATION

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SERIAL NUMBER LOCATION

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





SPECIFICATIONS

TYPE DESCRIPTION

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

Model	BF250A				
Type	LA	XA	XCA	XXA	XXCA
Shaft Length type	L	XL	XL	XXL	XXL
Counter Rotation			○		○
Remote control	(○)	(○)	(○)	(○)	(○)
Power Trim/Tilt	○	○	○	○	○
Tachometer	(○)	(○)	(○)	(○)	(○)
Trim meter	(○)	(○)	(○)	(○)	(○)
XL: Extra long, XXL: Extra-extra long (○): Optional part					

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

DIMENSIONS AND WEIGHTS

Model	BF250A				
Description code	BBJJ				
Type	LA	XA	XCA	XXA	XXCA
Overall length	920 mm (36.2 in)				
Overall width	625 mm (24.6 in)				
Overall height	1,760 mm (69.3 in)	1,887 mm (74.3 in)		2,014 mm (79.3 in)	
Dry weight (*1)	278 kg (613 lbs)	284 kg (626 lbs)		288 kg (635 lbs)	
Operating weight (including oil)	291 kg (642 lbs)	297 kg (655 lbs)		301 kg (664 lbs)	
*1: With propeller mounted. Stainless type 6.0 kg (13.2 lbs)					

FRAME

Model	BF250A				
Type	LA	XA	XCA	XXA	XXCA
Transom height (*1)	508 mm (20.0 in)	635 mm (25.0 in)		762 mm (30.0 in)	
Tilting angle	68°				
Tilting stage	Stageless				
Trim angle (*1)	–4° to 16°				
Swivel angle	30° right and left				
*1: Transom angle is at 12°.					

ENGINE

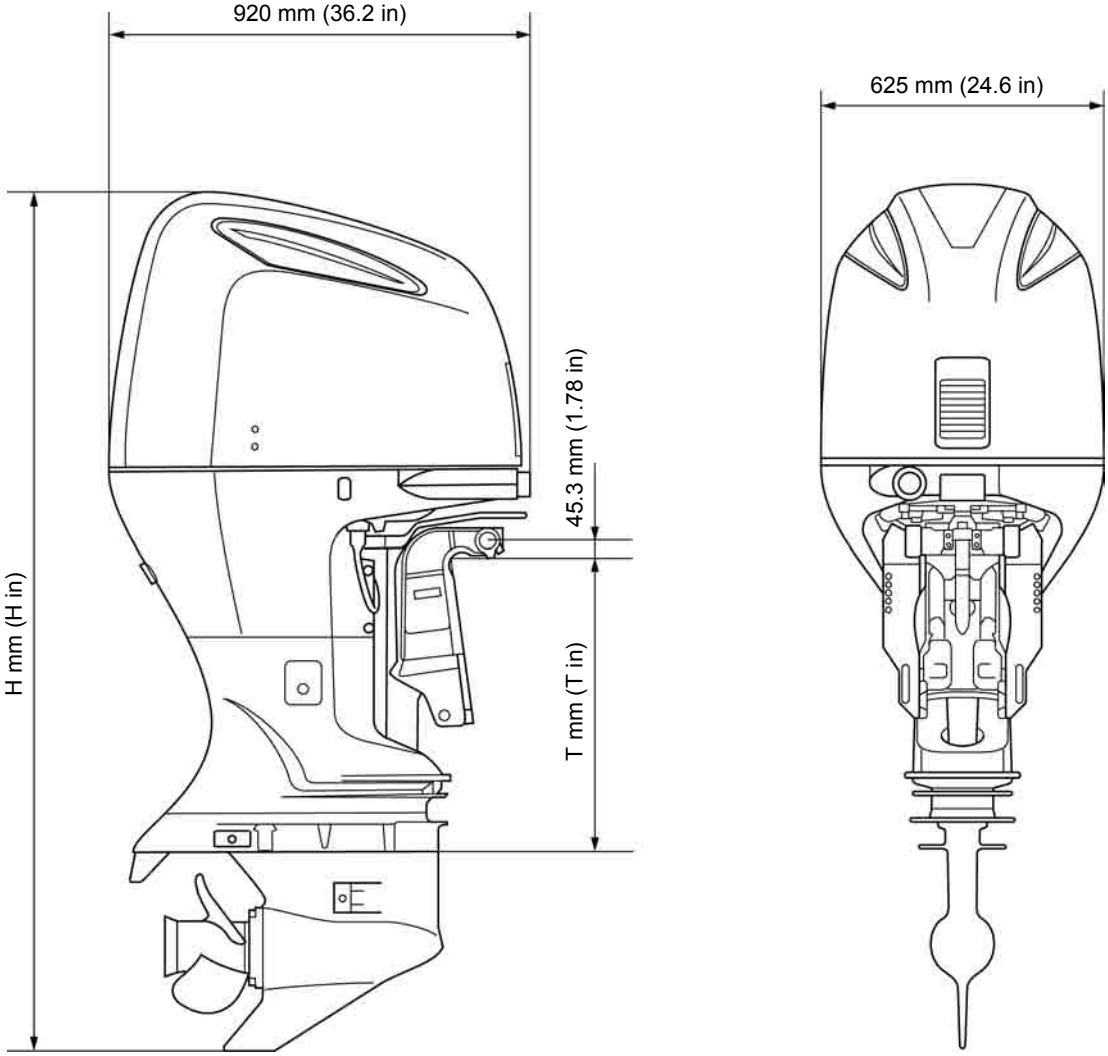
Model		BF250A
Description code		BEBJJ
Type		4-stroke, O.H.C., 6-cylinder
Displacement		3,583 cm^3 (218.6 cu in)
Bore x stroke		89.0 x 96.0 mm (3.50 x 3.78 in)
Rated power (*1)		186.4 kW (250 PS)
Maximum torque		320 N·m (32.6 kgf·m, 236 lbf·ft)
Compression ratio		10.0:1
Fuel consumption ratio (at rated power)		320 g/kW·h
Fuel consumption ratio (at continuous maximum power)		320 g/kW·h
Cooling system		Forced water circulation by impeller pump with thermostat
Ignition system		Fully transistorized, battery ignition
Ignition timing		0° at 650 min^{-1} (rpm) B.T.D.C.
Spark plug	Standard	ZFR6K-11E (NGK)
	Optional	IZFR6K-11E (NGK)
Fuel supply system		Programmed fuel injection
Fuel injection system		Electronic control
Fuel injection nozzle		Multi-point type
Fuel		Unleaded gasoline with a pump octane rating of 86 or higher
Fuel pump		Electric and mechanical plunger type
Lubrication system		Pressure lubrication by trochoid pump
Lubrication capacity		8.8 liters (9.3 US qt, 7.7 Imp qt) [Without oil filter replacement: 7.6 liter (8.03 US qt, 6.69 Imp qt)] [With oil filter replacement: 7.8 liter (8.24 US qt, 6.86 Imp qt)]
Starter system		Electric starter
Stopping system		Primary circuit ground
Exhaust system		Underwater type
*1: at 5,800 min^{-1} (rpm)		

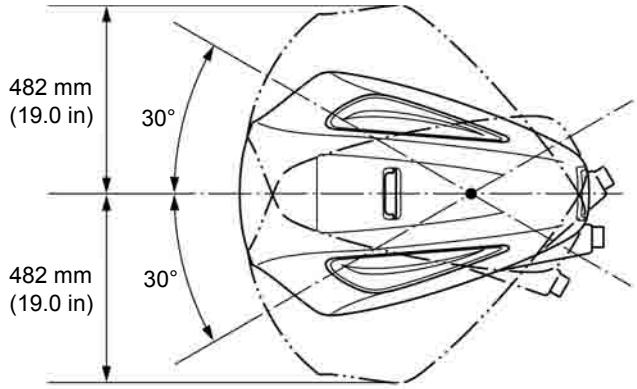
LOWER UNIT

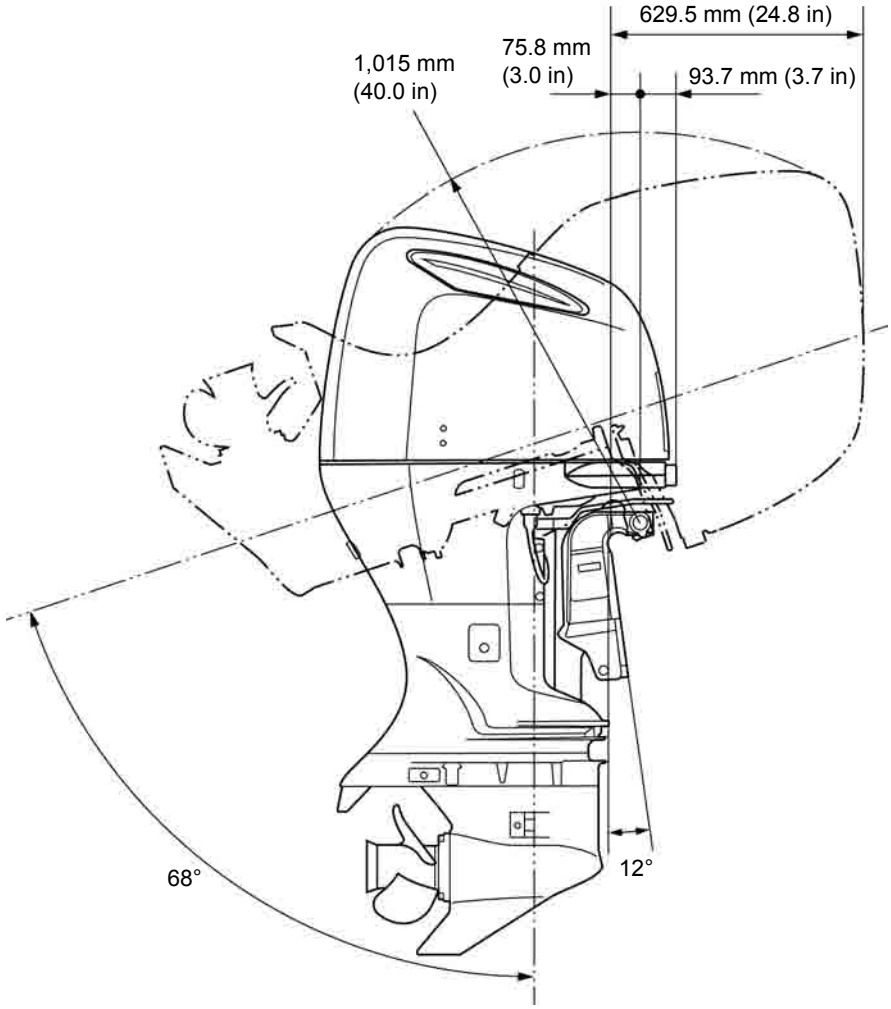
Clutch	Dog clutch (Forward – Neutral – Reverse)
Gear ratio	2.00 (24/12)
Reduction	Spiral bevel gear
Gear case oil capacity	1.47 liters (1.55 US qt, 1.29 Imp qt)
Propeller rotating direction	Clockwise (viewed from rear): LA, XA and XXA types Counterclockwise (viewed from rear): XCA and XXCA types

DIMENSIONAL DRAWING

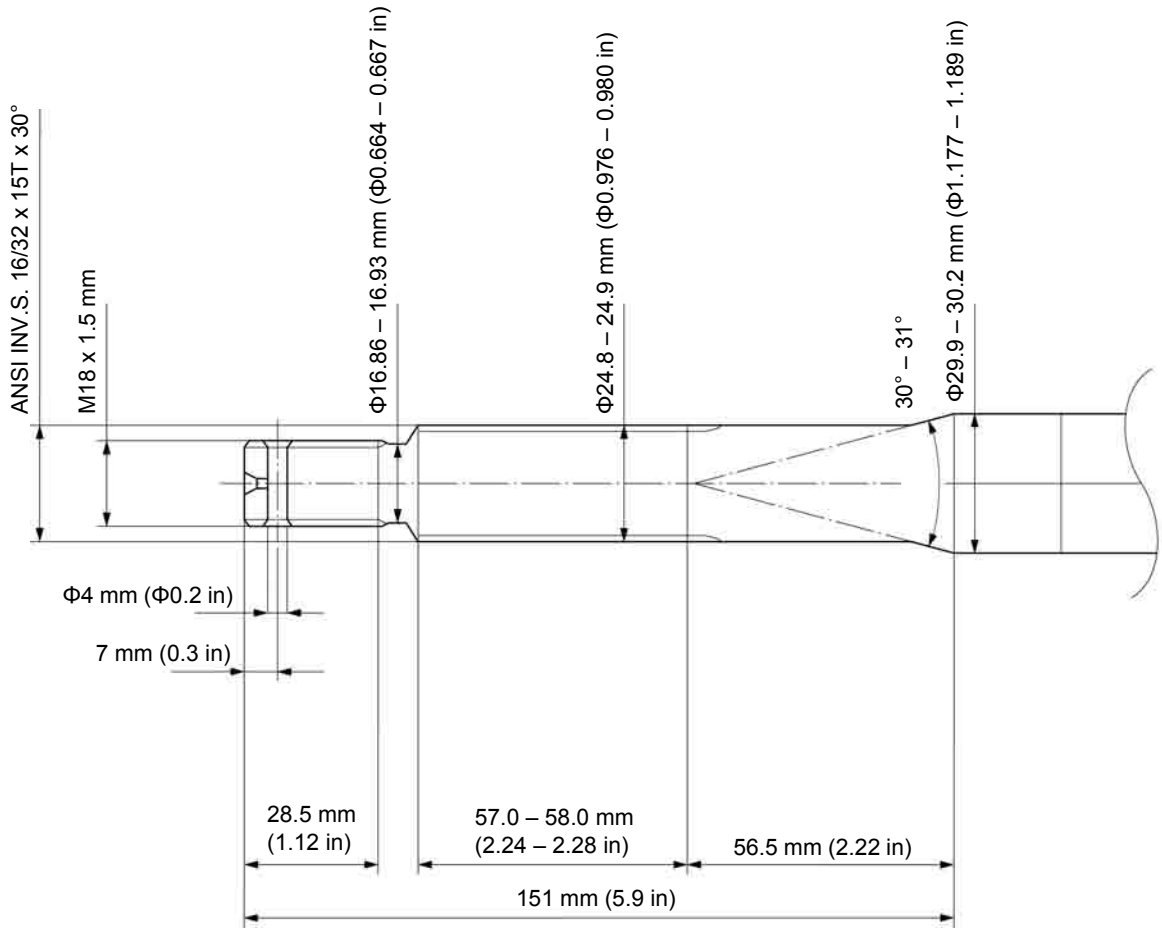
Transom	H	T
LA type	1,760 mm (69.3 in)	508 mm (20.0 in)
XA and XCA types	1,887 mm (74.3 in)	635 mm (25.0 in)
XXA and XXCA types	2,014 mm (79.3 in)	762 mm (30.0 in)




482 mm
(19.0 in)
30°
482 mm
(19.0 in)
30°


629.5 mm (24.8 in)
75.8 mm
(3.0 in)
93.7 mm (3.7 in)
1,015 mm
(40.0 in)
68°
12°

Propeller shaft



2. SERVICE INFORMATION

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MAINTENANCE STANDARDS

ENGINE

Unit: mm (in)

Part	Item		Standard	Service limit
Engine	Idle speed (in neutral)		650 ± 50 min^{-1} (rpm)	–
	Trolling speed		650 ± 50 min^{-1} (rpm)	–
	Cylinder compression		1,450 – 1,690 kPa (15 – 17 kgf/cm^2, 210 – 245 psi) at 200 min^{-1} (rpm)	–
Ignition timing	At idle		0° at 650 min^{-1} (rpm)	–
Spark plugs	Gap	Standard	1.00 – 1.10 (0.039 – 0.043)	–
		Optional	1.00 – 1.10 (0.039 – 0.043)	1.30 (0.051)
Valves	Valve clearance	IN	0.20 – 0.24 (0.008 – 0.009)	–
		EX	0.28 – 0.32 (0.011 – 0.013)	–
	Stem O.D.	IN	5.485 – 5.495 (0.2159 – 0.2163)	5.455 (0.2148)
		EX	5.450 – 5.460 (0.2146 – 0.2150)	5.420 (0.2134)
	Guide I.D.	IN/EX	5.515 – 5.530 (0.2171 – 0.2177)	5.55 (0.219)
	Guide extrusion amount	IN	21.20 – 22.20 (0.835 – 0.874)	–
		EX	20.63 – 21.63 (0.812 – 0.852)	–
	Stem-to-guide clearance	IN	0.020 – 0.045 (0.0008 – 0.0018)	0.080 (0.0032)
		EX	0.055 – 0.080 (0.0022 – 0.0032)	0.120 (0.0047)
	Seat width	IN/EX	1.25 – 1.55 (0.049 – 0.061)	2.0 (0.08)
	Seat installation height	IN	46.75 – 47.55 (1.841 – 1.872)	47.80 (1.882)
		EX	46.68 – 47.48 (1.838 – 1.869)	47.73 (1.879)
	Spring free length	IN	51.32 (2.020)	–
		EX	53.48 (2.106)	–
Rocker arms	Rocker arm I.D.	IN	20.019 – 20.039 (0.7881 – 0.7889)	–
		EX	20.019 – 20.049 (0.7881 – 0.7893)	–
	Rocker arm shaft O.D.	IN/EX	19.972 – 19.993 (0.7863 – 0.7871)	–
	Rocker arm-to-rocker arm shaft clearance	IN	0.026 – 0.067 (0.0010 – 0.0026)	0.067 (0.0026)
		EX	0.026 – 0.077 (0.0010 – 0.0030)	0.077 (0.0030)
Pistons	Skirt O.D.		88.974 – 88.984 (3.5029 – 3.5033)	88.964 (3.5025)
	Piston-to-cylinder clearance		0.016 – 0.041 (0.0006 – 0.0016)	0.080 (0.0032)
	Pin bore I.D.		21.960 – 21.963 (0.8646 – 0.8647)	–
	Pin O.D.		21.961 – 21.965 (0.8646 – 0.8648)	21.954 (0.8643)
	Pin-to-pin bore clearance		–0.005 – +0.002 (–0.0002 – +0.0001)	0.004 (0.0002)
	Ring groove width	Top/Second	1.220 – 1.230 (0.0480 – 0.0484)	1.25 (0.049)
		Oil	2.805 – 2.825 (0.1104 – 0.1112)	2.85 (0.112)
Piston rings	Ring side clearance	Top	0.035 – 0.060 (0.0014 – 0.0024)	0.13 (0.005)
		Second	0.030 – 0.055 (0.0012 – 0.0022)	0.13 (0.005)
	Ring end gap	Top	0.20 – 0.35 (0.008 – 0.014)	0.6 (0.02)
		Second	0.40 – 0.55 (0.016 – 0.022)	0.7 (0.03)
		Oil	0.20 – 0.70 (0.008 – 0.028)	0.8 (0.03)
	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)
	Camshaft journal I.D.		43.000 – 43.024 (1.6929 – 1.6939)	–
	Head height		120.95 – 121.05 (4.762 – 4.766)	–
	Cylinder head bolt/washer O.D.		11.3 (0.44)	–
Cylinder block	Cylinder sleeve I.D.		89.000 – 89.015 (3.5039 – 3.5045)	89.065 (3.5065)
	Warpage		0.07 (0.003) Max.	0.10 (0.004)
	Difference between upper and lower parts of sleeve I.D.		–	0.05 (0.002)
	Difference between upper and lower parts of connecting rod bolt O.D.		0 – 0.10 (0 – 0.004)	–
Connecting rods	Small end I.D.		21.970 – 21.976 (0.8650 – 0.8652)	–
	Small end-to-piston pin clearance		0.005 – 0.015 (0.0002 – 0.0006)	0.019 (0.0007)
	Big end axial clearance		0.15 – 0.35 (0.006 – 0.014)	0.45 (0.018)
	Connecting rod big end oil clearance		0.020 – 0.044 (0.0008 – 0.0017)	0.05 (0.002)

Part	Item			Standard	Service limit
Crankshaft	Journal O.D.		Main	71.976 – 72.000 (2.8337 – 2.8346)	–
			Pin	55.976 – 57.000 (2.2038 – 2.2441)	–
	Journal taper (Main/Pin)			0.005 (0.0002) Max.	0.010 (0.0004)
	Journal roundness (Main/Pin)			0.005 (0.0002) Max.	0.010 (0.0004)
	Crankshaft runout			0.025 (0.0010) Max.	0.030 (0.0012)
	Crankshaft main bearing oil clearance			0.020 – 0.046 (0.0008 – 0.0018)	0.05 (0.002)
	Crankshaft axial clearance			0.10 – 0.35 (0.004 – 0.014)	0.45 (0.018)
Camshaft	Camshaft axial clearance			0.05 – 0.20 (0.002 – 0.008)	0.2 (0.01)
	Camshaft runout			0.030 (0.0012) Max.	0.040 (0.0016)
	Journal O.D.			42.935 – 42.950 (1.6904 – 1.6909)	–
	Cam height	IN	PRI/SEC	34.88 – 34.98 (1.3732 – 1.3772)	–
			MID	36.227 – 36.421 (1.4263 – 1.4339)	–
		EX		36.289 – 36.474 (1.4287 – 1.4360)	–
	Camshaft oil clearance			0.050 – 0.089 (0.0020 – 0.0035)	0.15 (0.006)
Timing belt	Belt deflection Measured with 19.6 N (2 kgf, 4.4 lbf) of force applied to the mid point between the left side driven pulley and idle puller B.			8.8 – 9.7 (0.35 – 0.38)	–
Fuel injector	Resistance			11 – 13 Ω	–
Oil pump	Inner rotor-to-outer rotor clearance			0.04 – 0.16 (0.002 – 0.006)	0.20 (0.008)
	Outer rotor-to-oil pump body clearance			0.10 – 0.18 (0.004 – 0.007)	0.20 (0.008)
	Outer rotor-to-oil body side clearance			0.02 – 0.07 (0.001 – 0.003)	0.12 (0.005)
	Oil pressure			117 – 176 kPa (1.2 – 1.8 kgf/cm^2, 17 – 26 psi) at 650 ± 50 min^{-1} (rpm)	–
Fuel pump	Discharge volume (with pump operated for 2 sec.)			0.06 liter (2.0 US oz, 2.1 Imp oz) or more	–
	Fuel pressure			280 – 330 kPa (2.9 – 3.4 kgf/cm^2, 41 – 48 psi)	–
Vapor separator	Float height			28.5 – 33.5 (1.12 – 1.32)	–
Alternator	Brush length			10.5 (0.41)	9.0 (0.35)
	Slip ring O.D.			14.2 – 14.4 (0.56 – 0.57)	13.8 (0.54)
	Belt tension Measured between the pulleys with belt tension gauge.		Used belt	490 – 590 N (50 – 60 kgf, 110 – 133 lbf)	–
			New belt	880 – 980 N (90 – 100 kgf, 198 – 220 lbf) (*1)	–
				660 – 740 N (67 – 75 kgf, 148 – 166 lbf) (*2)	–
	Belt deflection Measured with 98 N (10 kgf, 22 lbf) of force applied to the center of belt between the pulleys.		Used belt	5.4 – 6.3 (0.21 – 0.25)	–
			New belt	3.20 – 3.40 (0.126 – 0.134) (*1)	–
				4.2 – 4.8 (0.17 – 0.19) (*2)	–
Starter motor	Brush length			12.3 (0.48)	7.0 (0.28)
	Insulation depth			0.40 – 0.50 (0.016 – 0.020)	0.20 (0.008)
	Commutator O.D.			29.4 (1.16)	28.8 (1.13)
	Commutator runout			–	0.10 (0.004)
Thermostat	Begin to open			58 – 62 °C (136 – 144 °F)	–
	Fully open			70 °C (158 °F)	–
	Valve lift			more than 4.3 (0.17)	–
CKP sensor	Resistance			1,850 – 2,450 Ω	–
CMP sensor	Resistance			1,850 – 2,450 Ω	–
IAB control solenoid valve	Resistance			37 – 44 Ω	–
EBT sensor	Resistance		40°C/104°F	1.0 – 1.3 kΩ	–
			100°C/212°F	0.1 – 0.2 kΩ	–

*1: With a new belt installed.

*2: After running engine for five minutes.

Part	Item		Standard	Service limit
EMT sensor	Resistance	40°C/104°F	1.0 – 1.3 kΩ	–
		100°C/212°F	0.1 – 0.2 kΩ	–
VTEC spool solenoid valve	Resistance		14.25 – 15.75 Ω	–
IAC valve	Resistance		8.7 – 10.5 Ω	–
HO2S heater	Resistance		4 – 30 Ω	–

FRAME

Unit: mm (in)

Part	Item		Standard	Service limit
Vertical shaft	Shaft O.D. (at needle bearing)		30.491 – 30.500 (1.2004 – 1.2008)	30.470 (1.1996)
	Runout	LA type	0.30 (0.012) or below	0.30 (0.012)
		XA and XCA types	0.35 (0.014) or below	0.35 (0.014)
		XXA and XXCA types	0.40 (0.016) or below	0.40 (0.016)
	Bushing I.D.		17.02 – 17.13 (0.670 – 0.674)	17.65 (0.695)
Propeller shaft	Shaft O.D. (at needle bearing)		32.007 – 32.020 (1.2601 – 1.2606)	31.990 (1.2594)
	Shaft O.D. (at bevel gear)		27.974 – 27.983 (1.1013 – 1.1017)	27.949 (1.1004)
	Runout		0.02 (0.001) or below	0.02 (0.001)
Propeller/gear case/extension case	Forward bevel gear backlash		0.30 – 0.54 (0.012 – 0.021)	–
	Reverse bevel gear backlash	Standard rotation	0.40 – 0.65 (0.016 – 0.026)	–
		Counter rotation	0.41 – 0.64 (0.016 – 0.025)	–
	Thrust clearance adjustment		0.20 – 0.40 (0.008 – 0.016)	–
Power trim/tilt assembly	Lower chamber blow pressure		8,826 – 11,768 kPa (90 – 120 kgf/cm^2, 1,280 – 1,707 psi)	–
	Upper chamber blow pressure		3,923 – 7,355 kPa (40 – 75 kgf/cm^2, 569 – 1,067 psi)	–
Power tilt motor assembly	Brush length		9.8 (0.39)	4.8 (0.19)
	Mica depth		–	0.50 (0.020)

ENGINE & FRAME TORQUE VALUES

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

ENGINE

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Bearing cap bolt (11 x 105 mm)	M11 x 1.5	–	–	–	See page 15-21
Side bolt (10 x 60 mm)	M10 x 1.25	49	5.0	36	
Side bolt (10 x 80 mm)	M10 x 1.25	49	5.0	36	
Side bolt (10 x 109 mm)	M10 x 1.25	49	5.0	36	
Timing belt back cover (CMP sensor) bolt	M5 x 0.8	3.9	0.40	2.9	
Cylinder head bolt/washer	M12 x 1.5	–	–	–	See page 14-24
Spark plug	M14 x 1.25	18	1.8	13	
Valve adjusting nut	M7 x 0.75	20	2.0	15	Apply engine oil to the threads and seating surface.
Connecting rod bolt	M8 x 0.75	–	–	–	See page 15-20
Crankshaft pulley bolt	M16 x 1.5	245	25.0	181	See page 14-14
Timing belt idler pulley A bolt	M12 x 1.25	83	8.5	61	
Timing belt idler pulley B bolt	M10 x 1.25	39	4.0	29	ALOC bolt; replace with a new one.
Timing belt tensioner bolt	M10 x 1.25	39	4.0	29	
Timing belt tensioner base bolt	M10 x 1.25	45	4.6	33	
Timing belt driven pulley bolt	M12 x 1.25	90	9.2	66	Apply engine oil to the threads and seating surface.
Rocker arm shaft (IN side) bolt	M8 x 1.25	24	2.4	18	
Rocker arm shaft (EX side) bolt	M8 x 1.25	24	2.4	18	Apply engine oil to the threads and seating surface.

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Oil filter cartridge	M20 x 1.5	12	1.2	9	
Oil pressure sealing bolt	M22 x 1.5	54	5.5	40	
Oil drain plug	M12 x 1.5	23	2.3	17	
Throttle body bolt	M8 x 1.25	22	2.2	16	
Mount case bolt	M10 x 1.25	44	4.5	32	See page 13-8
Mount case bolt	M12 x 1.25	75	7.6	55	See page 13-8
Mount case flange nut	M10 x 1.25	44	4.5	32	
Flywheel bolt	M12 x 1.0	118	12.0	87	Apply engine oil to the threads and seating surface.
Flywheel boss bolt	M8 x 1.25	32	3.3	24	Apply engine oil to the threads and seating surface.
Oil pump cover screw	M6 x 1.0	7.0	0.71	5.2	
Oil pump relief sealing bolt, 18 mm	M18 x 1.5	39	4.0	29	Apply locking agent to the threads.
Oil pump body sealing bolt	M22 x 1.5	49	5.0	36	
Terminal insulator nut	M6 x 1.0	7.8	0.80	5.8	
Alternator bolt	M10 x 1.25	44	4.5	32	
Alternator nut	M8 x 1.25	26	2.7	19	
Alternator pulley lock nut	–	110	11.2	81	
Starter motor bolt	M10 x 1.25	44	4.5	32	
EOP switch (Low pressure side)	(PT 1/8)	8.0	0.82	5.9	
EOP switch (High pressure side)	M10 x 1.25	22	2.2	16	
MAP sensor	M5 x 0.8	3.4	0.35	2.5	
IAT sensor	M12 x 1.5	18	1.8	13	
EBT sensor	M10 x 1.25	12	1.2	9	
EMT sensor	M10 x 1.25	12	1.2	9	
HO2S	M10 x 1.25	10	1.0	7	
Knock sensor	M12 x 1.25	32	3.3	24	
Throttle cable adjusting nut	M6 x 1.0	3.5	0.36	2.6	
Fuel pump strainer cover screw/washer	M5 x 0.8	3.4	0.35	2.5	
Fuel pump service check bolt	M6 x 1.0	12	1.2	9	
Vapor separator drain screw	–	1.5	0.15	1.1	
Fuel drain screw	–	1.5	0.15	1.1	
Vapor separator cover screw/washer	M5 x 0.8	3.4	0.35	2.5	
Fuel pump cover screw/washer	M5 x 0.8	3.4	0.35	2.5	
Fuel pump case bolt	M6 x 1.0	12	1.2	9	
Bracket B bolt	M6 x 1.0	12	1.2	9	
Fuel pump harness holder mounting screw	M4 x 0.7	2.1	0.21	1.5	
Vapor separator float screw	M4 x 0.7	2.1	0.21	1.5	
Vapor separator water jacket screw/washer	M5 x 0.8	3.4	0.35	2.5	
Oil jet mounting bolt	M8 x 0.75	16	1.6	12	Apply engine oil to the threads and seating surface.

OIL CASE

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Oil strainer bolt	M6 x 1.0	10	1.0	7	

GEAR CASE

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Gear case bolt (LA, XA and XCA types)	M10 x 1.25	37	3.8	27	
Gear case self-lock nut (XXA and XXCA types)	M10 x 1.25	37	3.8	27	
Gear case self-lock nut	M12 x 1.25	56	5.7	41	
Gear case stud bolt	M12 x 1.25	22	2.2	16	
Pinion gear nut	M18 x 1.0	196	20.0	145	Apply gear oil in to the threads and seating surface.
Gear oil check bolt	M8 x 1.25	6.5	0.66	4.8	
Bearing holder	M110 x 2.0	230	23.5	170	
Gear oil drain plug bolt	M8 x 1.25	6.5	0.66	4.8	
Impeller housing bolt/washer	M8 x 1.25	20	2.0	15	
Propeller castle nut (Standard rotation type)	M18 x 1.5	–	–	–	See page 16-6
Propeller castle nut (Counter rotation type)	M18 x 1.5	–	–	–	See page 17-5
68 mm lock nut	M68 x 1.5	132	13.5	97	Apply gear oil in to the threads and seating surface.
Water screen screw	M5 x 0.8	1.0	0.1	0.7	

EXTENSION/MOUNT

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Drain plug cover special screw	M6 x 1.0	6.4	0.65	4.7	
Lower rubber mount nut	M14 x 1.5	103	10.5	76	
Upper rubber mount nut	M12 x 1.25	83	8.5	61	
Lower mounting cover screw/ washer	M6 x 1.0	4.5	0.46	3.3	
Gear case stud bolt (LA, XA and XCA types)	M12 x 1.25	22	2.2	16	
Extension separator stud bolt (XXA and XXCA types)	M12 x 1.25	22	2.2	16	
Extension separator stud bolt (XXA and XXCA types)	M10 x 1.25	15	1.5	11	

STERN BRACKET

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Stern bracket nut	M25 x 2.0	34	3.5	25	
Stern bracket nut	(7/8-14UNF)	34	3.5	25	
Thrust receiver nut	M6 x 1.6	6.0	0.61	4.4	

POWER TRIM/TILT

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Manual valve	–	3.4	0.35	2.5	
Oil tank cap	–	2.5	0.25	1.8	
Socket bolt A and B	(3/8 x 18)	8.3	0.85	6.1	
Power tilt motor mounting bolt/ washer	M6 x 1.25	4.9	0.50	3.6	
Oil tank mounting bolt/washer	M6 x 1.25	4.9	0.50	3.6	
Power tilt motor wire holder screw	–	1.4	0.14	1.0	
Rod guide	–	140	14.3	103	
Cylinder cap	–	208	21.2	153	Apply grease to the threads.

OTHERS

Item	Thread Dia. and pitch	Torque values			Remarks
	mm (in)	N·m	kgf·m	lbf·ft	
Neutral switch nut	M20 x 1.0	2.5	0.25	1.8	
Grease fitting	M6 x 1.0	3.0	0.31	2.2	
Starter motor B terminal nut	M8 x 1.25	11	1.1	8	
Alternator terminal B terminal nut	M6 x 1.0	8.0	0.82	5.9	
Oil filter holder bolt	M22 x 1.5	49	5.0	36	
Lower mount cover screw	M6 x 1.0	4.5	0.46	3.3	
Cover locking cable adjusting nut	M6 x 1.0	3.5	0.36	2.6	
Water joint cap nut	M16 x 1.0	1.1	0.11	0.8	Apply locking agent to the seating surface.
Fuel strainer cup screw	–	3.4	0.35	2.5	
Water separator cover screw/ washer	M5 x 0.8	3.4	0.35	2.5	
Starter rear bracket screw	M5 x 0.8	2.5	0.25	1.8	
Starter rear bracket bolt screw	M5 x 0.8	5.0	0.51	3.7	
Power tilt relay mounting bolt/ washer	M6 x 1.0	5.0	0.51	3.7	
Fuse/relay junction box terminal bolt	M6 x 1.0	8.5	0.87	6.3	
Fuse/relay junction box mounting bolt	M6 x 1.0	5.0	0.51	3.7	
Connector holder mounting bolt	M6 x 1.0	5.0	0.51	3.7	
Block fuse screw/washer	M5 x 0.8	3.2	0.33	2.4	
Plug maintenance cover special bolt	M6 x 1.0	10	1.0	7	

STANDARD TORQUE VALUES

Item	Thread Dia. and pitch	Torque values		
	mm (in)	N·m	kgf·m	lbf·ft
Bolt and nut	5 mm	5.2	0.53	3.8
	6 mm	10	1.0	7
	8 mm	21.5	2.2	16
	10 mm	34	3.5	25
	12 mm	54	5.5	40
Flange bolt and nut	6 mm (SH bolt)	9.0	0.92	6.6
	6 mm (CT bolt)	12	1.2	9
	6 mm	12	1.2	9
	8 mm	26.5	2.7	20
	10 mm	39	4.0	29
Screw	5 mm	4.2	0.43	3.1
	6 mm	9.0	0.92	6.6

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

TOOLS

COMMERCIALLY AVAILABLE TOOLS

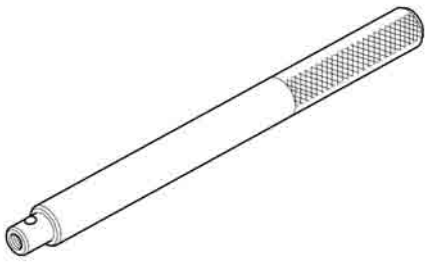
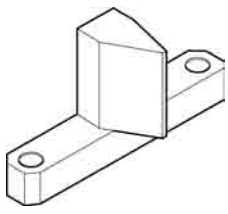
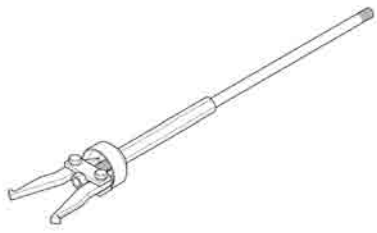
ORDERING INFORMATION

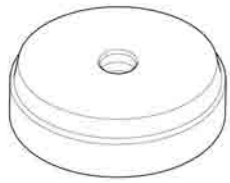
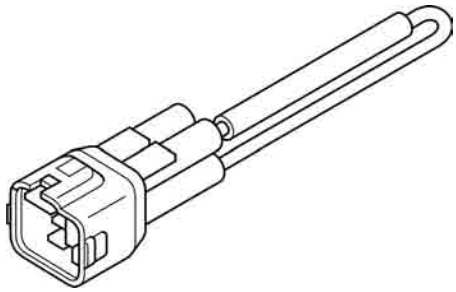
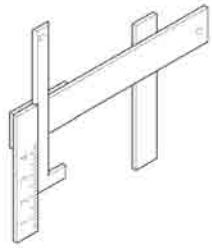
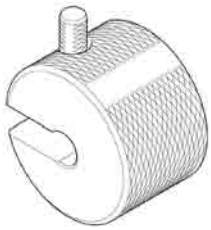
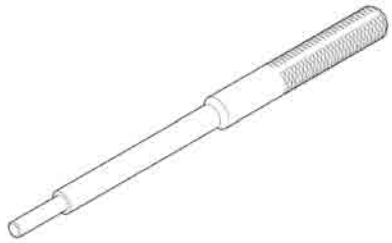
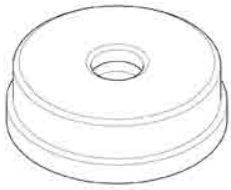
These tools are distinguished by the words (Commercially available). They are not available through the American Honda Parts Development. Most commercially available tools shown in this Shop Manual can be ordered through the Honda Marine Tool and Equipment Program by calling (888) 424-6857. Refer to the catalog for a complete tool listing.

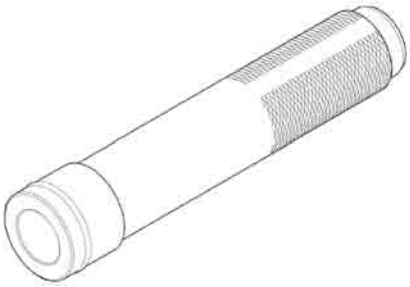
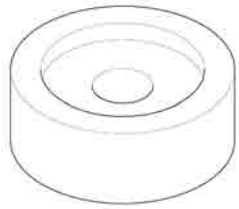
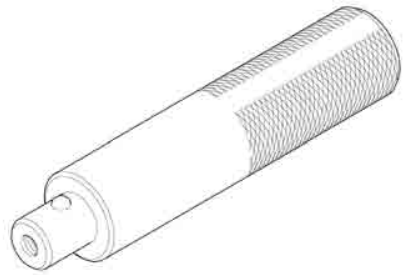
Tool name	Tool number	Application
Valve seat cutter, #115 30° Valve seat cutter, #122 45° Valve seat cutter, #111 60° Solid pilot bar, 5.5 mm T-wrench, #505 Accessory package, #246	NWY-CU607 NWY-CU608 NWY-CU270 NWY-140-5.5 NWY-TW505 NWY-KACC246	Valve seat reconditioning
Digital multimeter	FLU-88	Idle speed/electrical testing
Engine oil pressure gauge kit Engine oil pressure gauge	MT37A MT37AH	Cylinder leak oil pressure testing/inspection
Leak down tester	KLIAT1006M	Cylinder leak down
Compression gauge	EEPV303A	Cylinder compression testing
Puller, 2 jaw – Pins (2 required) – Pressure screw – Jaws – Tip – Yoke	see below CJ-105-11 CJ-105-3 CJ105-6 CJ-66-15-3 CJ-86-1	Prop shaft holding during backlash inspection
Gear case filler Adapter, 8 x 1.25 mm	STV-S33 STV-3334Y	Gear case filling
Pressure tester Adapter, 8 x 1.25 mm	STV-V34 STV-3334Y	Gear case pressure check
Clamps	HCP6	Water Separator removal/installation
Piston ring compressor	RC40C	Piston installation
Valve lapper	LIL-21100	Valve lapping
Torque angle gauge	TA360	Cylinder head torquing
O_2 sensor wrench	ANM14	HO2S removal/installation
Heat gun	ETB1600	Lower center housing removal/installation

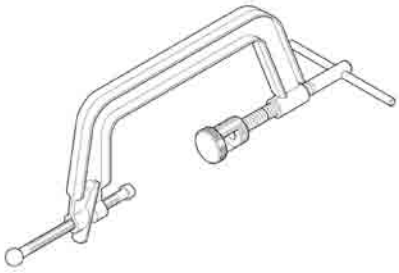
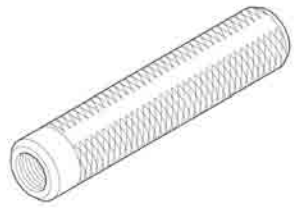
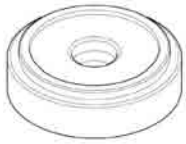
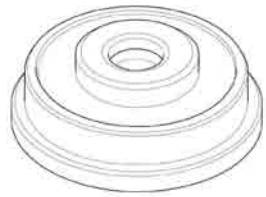
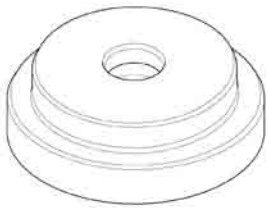
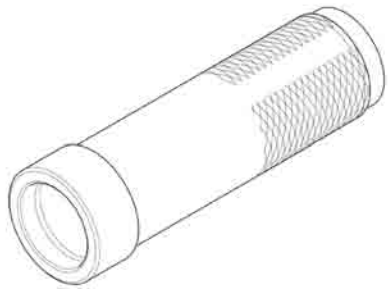
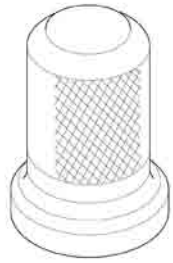
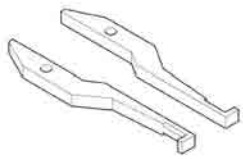
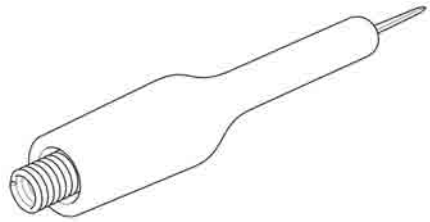
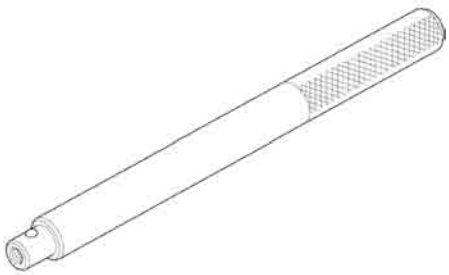
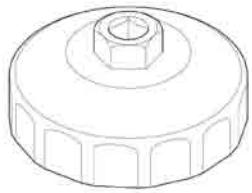
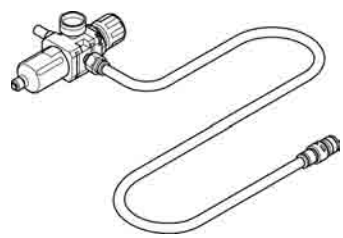
SPECIAL TOOLS

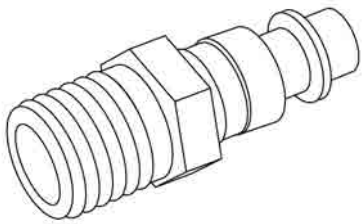
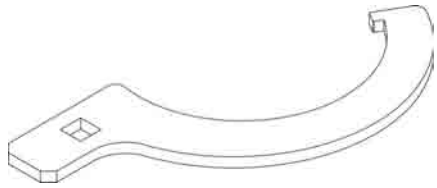
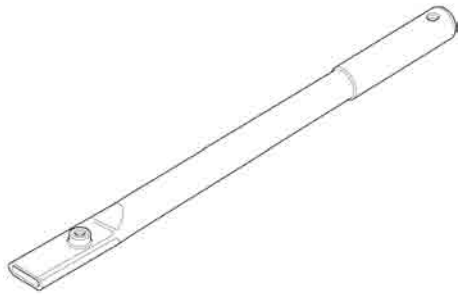
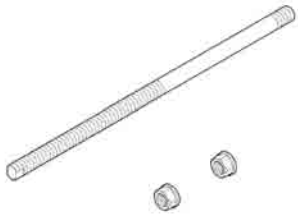
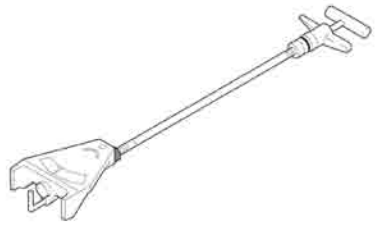
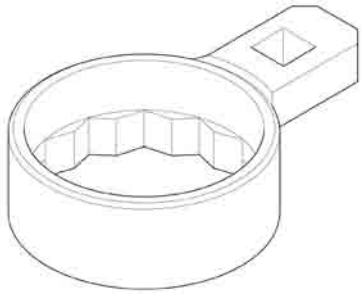
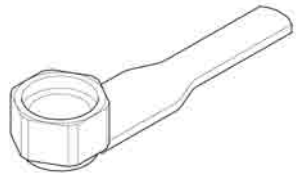
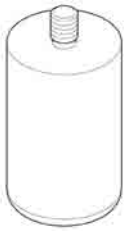
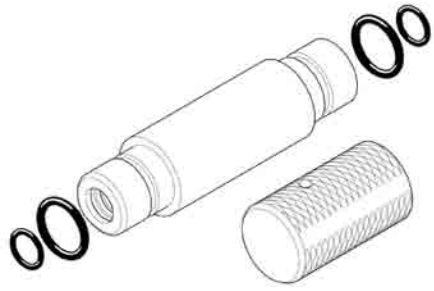
They are available through the American Honda Parts Department and ordered by using normal American Honda Parts ordering procedures.

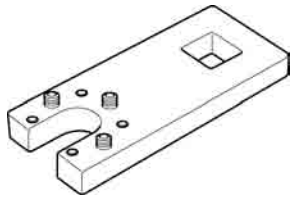
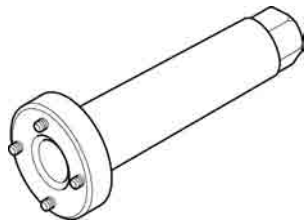
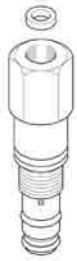
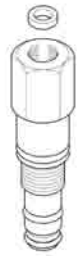
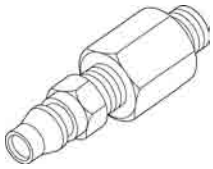
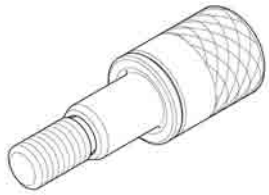
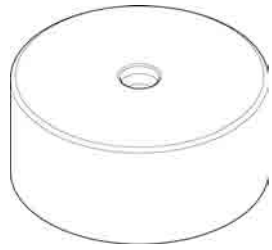
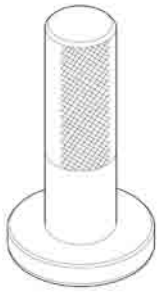
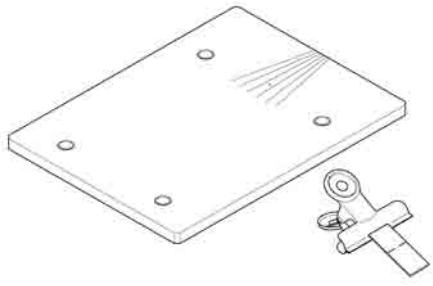
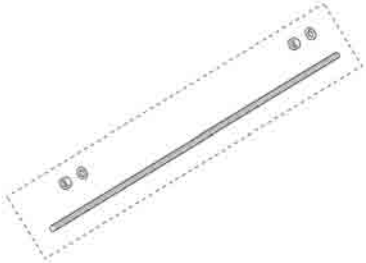
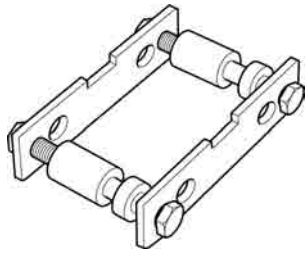
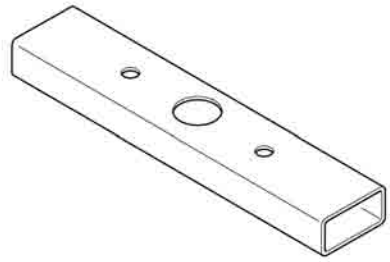
Driver, 480 mm 070GD-001A100 	Ring gear holder 070PB-ZY3A100 	Bearing race puller 070PC-ZY3A101 

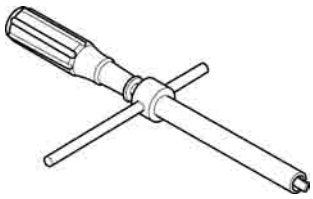
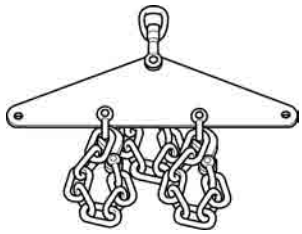
Attachment, 32 x 42 mm 070PD-ZY3A100 	Attachment, 30 x 37 mm 070PD-ZY6A200 	Taper bearing installer attachment, 90 mm 070PF-ZY3A100 
SCS service connector 070PZ-ZY30100 	Float level gauge 07401-0010000 	Fuel pressure gauge, 0 – 100 psi 07406-004000B 
Remover weight 07936-371020A or 07936-3710200 	Valve guide driver, 5.35 x 9.7 mm 07742-0010100 	Attachment, 32 x 35 mm 07746-0010100 
Attachment, 37 x 40 mm 07746-0010200 	Attachment, 42 x 47 mm 07746-0010300 	Attachment, 52 x 55 mm 07746-0010400 
Attachment, 62 x 68 mm 07746-0010500 	Attachment, 72 x 75 mm 07746-0010600 	Attachment, 24 x 26 mm 07746-0010700 

Driver, 22 mm I.D. 07746-0020100 	Attachment, 17 mm I.D. 07746-0020300 	Attachment, 50 mm 07APF-ZY3A100 
Attachment, 25 mm I.D. 07746-0030200 	Puller adapter 07APF-ZY3A200 	Pilot, 20 mm 07746-0040500 
Pilot, 35 mm 07746-0040800 	Pilot, 30 mm 07746-0040700 	Pilot, 25 mm 07746-0040600 
Pilot, 14 mm 07746-0041200 	Pilot, 22 mm 07746-0041000 	Pilot, 28 mm 07746-0041100 
Pilot, 17 mm 07746-0040400 	Fork seal driver attachment, 27.2 mm 07747-0010300 	Driver 07749-0010000 

Valve spring compressor 07757-0010000 	Lock nut wrench, 36 x 47.8 mm 07916-MB00002 	Remover handle 07936-3710100 
Bearing driver attachment, 44 x 49.5 mm 07945-3330300 	Oil seal driver attachment, 28 x 35 mm 07945-4150200 	Bearing driver attachment, 64 x 72 mm 07946-SB20000 
Oil seal driver attachment, 72 mm 07947-6340201 	Driver, 40 mm I.D. 07746-0030100 	Oil seal driver, 44.5 mm 07947-SB00100 
Oil seal driver attachment, 42 x 47 mm 07947-ZV00100 	Puller jaws, 25 mm 07WPC-ZW50100 	Test probe 07ZAJ-RDJA110 
Driver, 280 mm 07949-3710001 	Oil filter wrench, 65 mm 07HAA-PJ70101 or 07AAA-PLCA100 	Air supply 07AAJ-PNAA100 

Air quick connector 07AAZ-P8AA100 	Oil pressure adapter, 22 x 1.5 mm 07APJ-ZY3A101 	Pin type spanner, 128 mm 070PA-ZX20100 
Valve guide reamer, 5.5 mm 07HAH-PJ7A100 	Holder handle 07JAB-001020A 	Pilot, 28 mm 07JAD-PH80400 
Installer shaft, 15 x 370 mm 07VMF-KZ30200 	Oil seal driver, 65 mm 07JAD-PL9A100 	Belt tension gauge 07TGG-001000A or 07JGG-001010A 
Pressure gauge, 0 – 5,000 psi 07KPJ-VD6020B 	Lock nut wrench, 56 mm 07LPA-ZV30200 	Holder attachment, 50 mm 070PB-0010100 
Pilot, 32 x 50 mm 07MAD-PR90200 	Attachment, 52 x 55 mm 07NAD-P200100 	Stem seal driver 07PAD-0010000 

Pin wrench, 6 mm 07SPA-ZW1010A 	Pin wrench, 4 mm 07SPA-ZW1020A 	Vertical shaft holder 07SPB-ZW10200 
Backlash indicator tool 07SPJ-ZW0030B 	Oil pressure gauge joint A 07SPJ-ZW1010A 	Oil pressure gauge joint B 07SPJ-ZW1020A 
Air adapter 070AJ-0010101 	VTEC air stopper 070AJ-0030100 	Oil seal driver attachment, 80 x 96 mm 07ZAD-PNA0100 
Oil seal driver, 66 mm 07947-3710200 	Backlash inspection tool set 070PJ-ZX20200 	Air supply attachment 07VAJ-P8A010A 
Assembly shaft 07APF-ZY3A300 	Lower mount puller adapter 07APB-ZY3A200 	Prop shaft holder @@ 

Valve adjustment wrench, 10 mm 07908-5900000 	Engine hanger VSB02C000021 	Attachment, 27.5 x 44 mm 07948-9540000 

LUBRICATION & SEAL POINT

ENGINE

Material	Location	Remarks
Engine oil	Oil filter holder threads	
	Oil filter cartridge O-ring	
	Lost motion	
	Valve stem seal internal circumference	
	Valve adjusting screw threads	
	Oil pipe joint O-ring	
	Oil control orifice O-ring	
	Oil strainer O-ring	
	Oil pump rotor chamber	30 cc
	Mount case needle bearing outside circumference and inside	
	Oil pump rubber	
	Rocker arm piston	
	Starter motor O-ring (59.4 x 3.1 mm)	
	Oil pump relief valve and relief spring	
	EOP switch (High pressure side) O-ring	
	Fuel pump (Low pressure side) O-ring (37 x 2.4 mm)	
	MAP sensor O-ring	
	IAT sensor O-ring	
	EBT sensor O-ring	
	Camshaft thrust cover O-ring	
Use molybdenum oil solution (mixture of the engine oil and molybdenum grease in a ratio of 1:1)	Piston outer surface, pin holes and piston rings	
	Piston pin outer surface	
	Crankshaft main journal, crankpin, thrust washer contact surface	
	Camshaft journal and cam	
	Rocker arm shaft outer circumference	
	Inlet/exhaust valve stem sliding surface	
	Connecting rod small end inner surface	
	Connecting rod bearing crankshaft mating surface	
	Main bearing crankshaft mating surface	
	Thrust washer	
	Cylinder sleeve inner surface	
Engine oil or silicone oil (Shinetsu KF 96350 CS)	Fuel injector O-ring	
	Fuel hose A O-ring	
	Fuel joint hose O-ring	
Liquid sealant (Threebond® 1280B or equivalent)	Crankcase mating surface	See page 15-23
	Crankcase upper cover mating surface	See page 15-22
	Oil seal case mating surface	See page 15-21
Liquid sealant (Threebond® 1141H or Hondabond 4 or Hondabond HT or equivalent)	Oil filler extension mating surface	See page 12-5
Liquid sealant (Threebond® 1215 or Hondabond 4 or Hondabond HT or equivalent)	EOP switch (Low pressure side) threads	
Liquid sealant (Threebond® 1201 or 1215 or Hondabond 4 or Hondabond HT or equivalent)	EBT sensor threads and seating surface	
	EMT sensor threads and seating surface	
Liquid sealant (Threebond® 1211 or Hondabond 4 or Hondabond HT or equivalent)	Exhaust guide seal B installation section outer surface	See page 11-7
	Oil case gasket exhaust port sealing surface to oil case and mount case	See page 12-8
	Oil pump gasket water port sealing surface to cylinder block and oil pump	See page 12-9
Liquid sealant (Threebond® 1216 or Hondabond 4 or Hondabond HT equivalent)	Oil pump body sealing bolt	

Material	Location	Remarks
Industrial parts cleaner solution (mixture of the Threebond® 2720C and water in a ratio of 1:9)	Each oil seal and water seal outer surface	
Marine grease (water resistant urea based grease)	Each oil seal and water seal lip	
	Water tube grommet entire circumference	
	Exhaust manifold/water jacket cover O-ring	
	Exhaust guide/mount case O-ring and guide seal part	
	Flush valve cover O-ring	
	Mount case water seal (22 x 35 x 7 mm) lip and adjacent area	
	Relief valve spacer O-ring	

FRAME

GEAR CASE

Material	Location	Remarks
Marine grease (water resistant urea based grease)	Propeller shaft threads and spline	
	Propeller shaft water seal (30 x 45 x 7 mm) lip and between seals	
	Propeller shaft holder gear case seating surface and O-ring installation part	
	Propeller shaft holder O-ring circumference	
	Vertical shaft engine side spline	
	Vertical shaft water seal (26 x 42 x 7 mm) lip and mating surface	
	Water pump housing O-ring	
	O-ring (65.4 x 2.4 mm)	
	Thrust bearing (85 x 110 x 4 mm)	
	Water pump O-ring	
	Pump liner inner surface	
	Water tube seal ring inner wall	
	Extension case grommet inner surface	
	Water tube insertion part	
	Vertical shaft bushing inside	
	Shift rod water seal lip	
	Shift rod holder O-ring circumference	
Industrial parts cleaner solution (mixture of the Threebond® 2720C and water in a ratio of 1:9)	Propeller shaft water seal (30 x 45 x 7 mm) outer circumference	
	Vertical shaft water seal (26 x 42 x 7 mm) outer circumference	
	Shift rod water seal (12 x 21 x 6 mm) outer circumference	
Hypoid gear oil SAE #90	Bearing (32 x 65 x 26 mm)	
	Gear case	1,467 cc
	Bearing holder threads and seating surface	
	Needle bearing (30.5 x 47 x 37 mm) outer circumference	
	Taper bearing (60 x 100 x 30 mm) outer race, inner race inner surface, roller part	
	Taper bearing (32 x 66 x 49 mm) outer race inner surface, inner race inner surface, roller part	
	Ball bearing (55 x 100 x 21 mm) circumference	
	Needle bearing (32 x 42 x 30 mm) circumference	
	Drain plug bolt O-ring	
	Oil check bolt O-ring	
	Vertical shaft taper bearing insertion part	
	Thrust bearing (50 x 72 x 4.5 mm)	
	Thrust bearing F	

STERN BRACKET MOUNT

Material	Location	Remarks
Marine grease (water resistant urea based grease)	Lower cylinder collar outer surface	
	Lower cylinder bushing inner and outer surface	
	Mount frame shaft and spline	
	Thrust washer (34 mm)	
	Swivel case liner circumference	
	Oil seal (39.5 x 52 x 6 mm) lip and outer surface	
	Swivel case shaft sliding part	
	Swivel case tilting shaft sliding part	
	Swivel case thrust receiver part	
	Swivel case bushing inner and outer surface	
	Cylinder upper pin outer surface	
	Cylinder upper bushing inner and outer surface	
	Click spring roller	
	Tilting bracket cam part	
	Tilt arm bushing inner and outer surface	
	Tilting shaft bearing part and threads	
	Thrust receiver piston rod B sliding part	
	Thrust receiver shaft	
	Thrust receiver thrust sliding part	
	Thrust receiver bushing inner surface and thrust sliding part	
	External circlip installation area	See page 19-18
	Wave washer (40 mm)	
	Wave washer (26 mm)	
	Tilt stopper shaft	
	Lower mount center housing spline	

LINKAGE

Material	Location	Remarks
Marine grease (water resistant urea based grease)	Shift rod A spline	
	Shift shaft A water seal (14 x 26 x 8 mm) lip and outer circumference	
	Shift shaft A water seal contact surface and spline	
	Shift shaft B oil seal contact surface	
	O-ring (26.9 x 2.4 mm)	
	Seal holder O-ring groove and bearing part	
	Shift shaft B oil seal (14 x 26 x 6 mm) lip	
	Shift arm link rod insertion part and click part	
	Click spring roller	
	Link rod insertion part	
	Shift link bracket link rod insertion part and throttle arm insertion part	
	Throttle arm bearing part and shift pivot insertion part	
	Shift slider collar outer surface	
Industrial parts cleaner solution (mixture of the Threebond® 2720C and water in a ratio of 1:9)	Shift shaft B oil seal (14 x 26 x 6 mm) outer circumference	

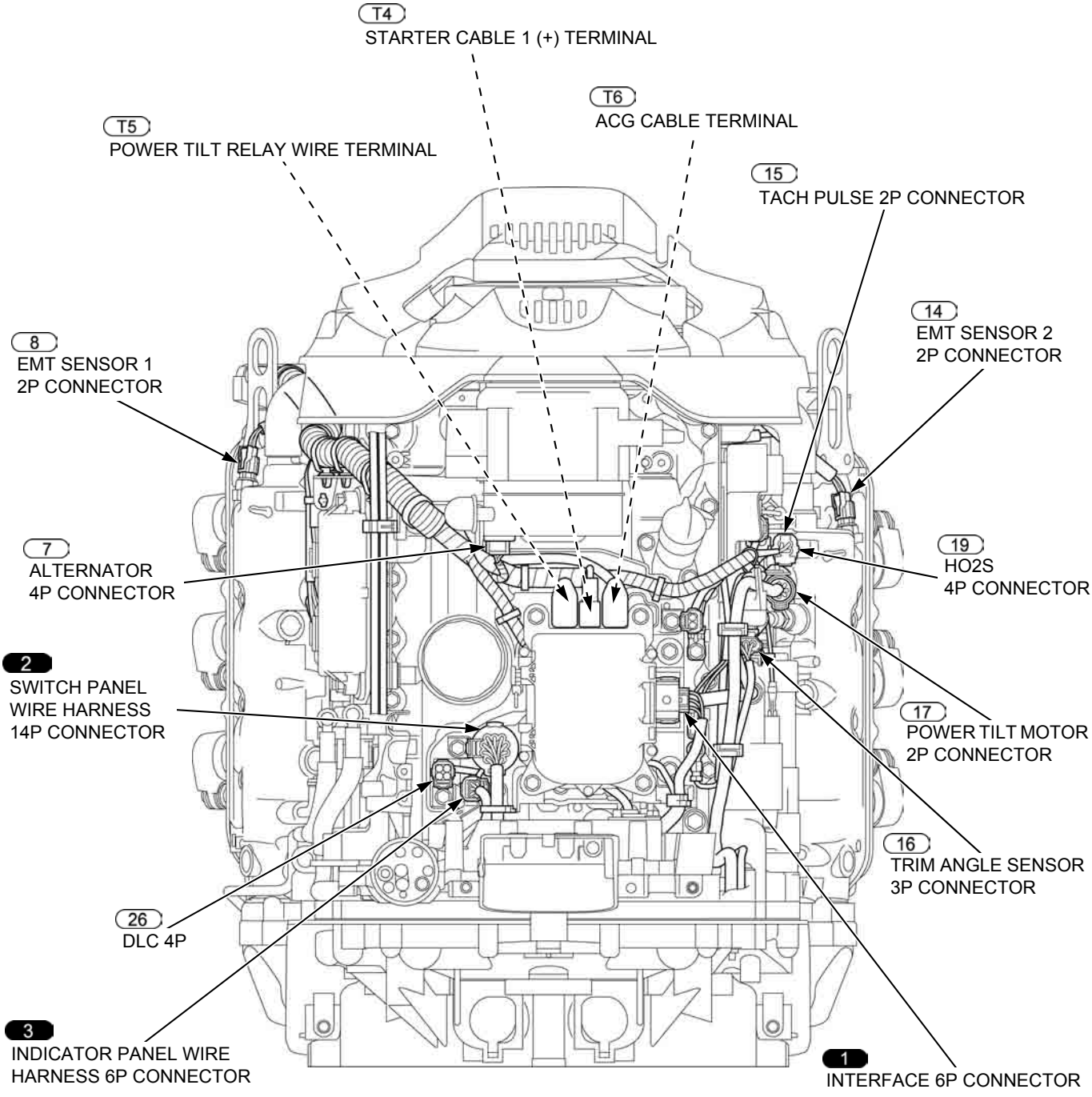
LOCKS

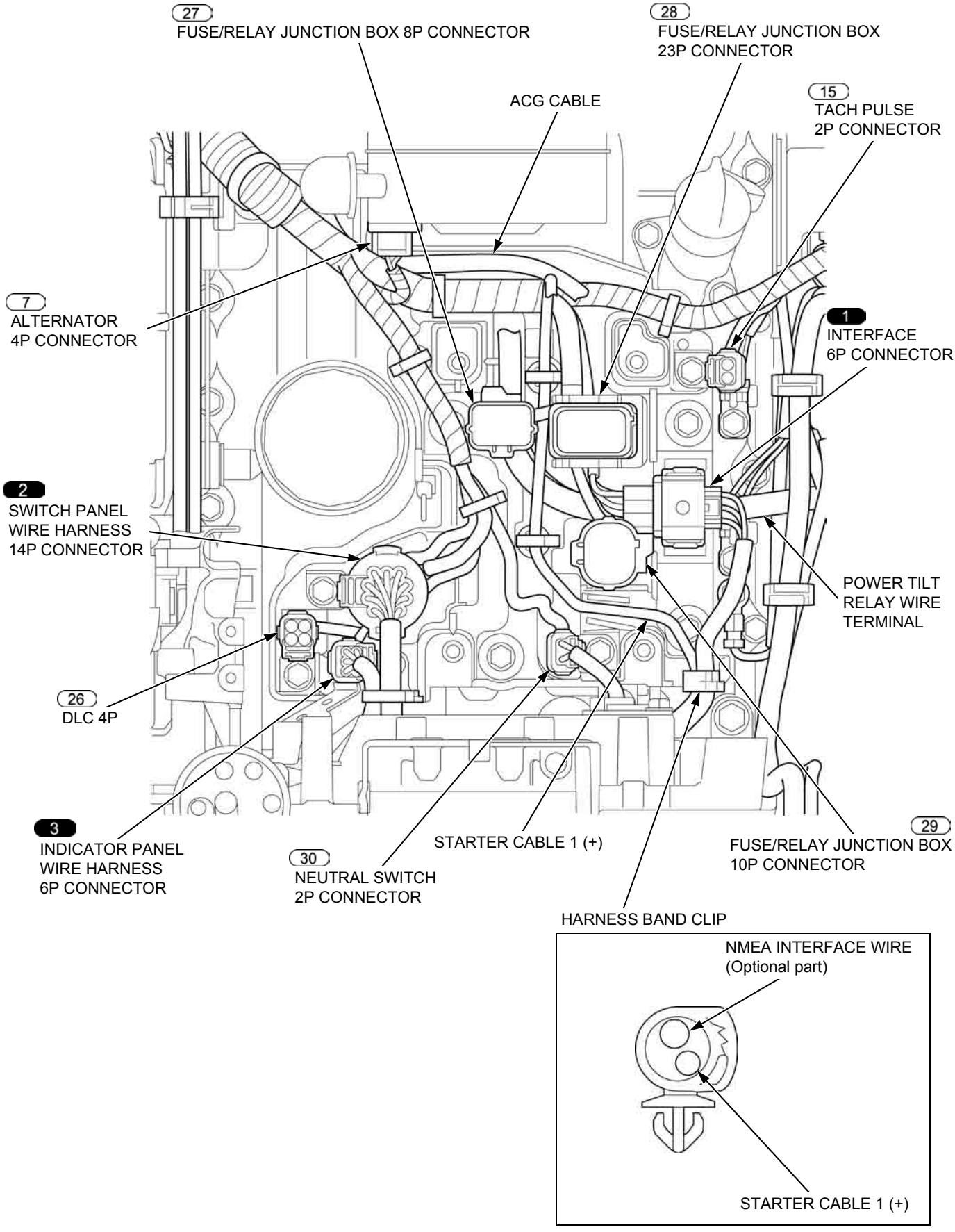
Material	Location	Remarks
Marine grease (water resistant urea based grease)	Cover lock lever-to-lever bushing contact part	
	Cover lock bushing A, B whole surface	
	Cover bracket lock damper insertion part	
	Front lock Assy. insertion part, locking part and cable end insertion part	
	Side lock insertion part, locking part and cable end insertion part	
	Cover lock bolt tapered part and bolt shaft	
	Lock cover shaft grease fitting	
	Front lock shaft sliding surface	
	Cover open shaft bearing part	

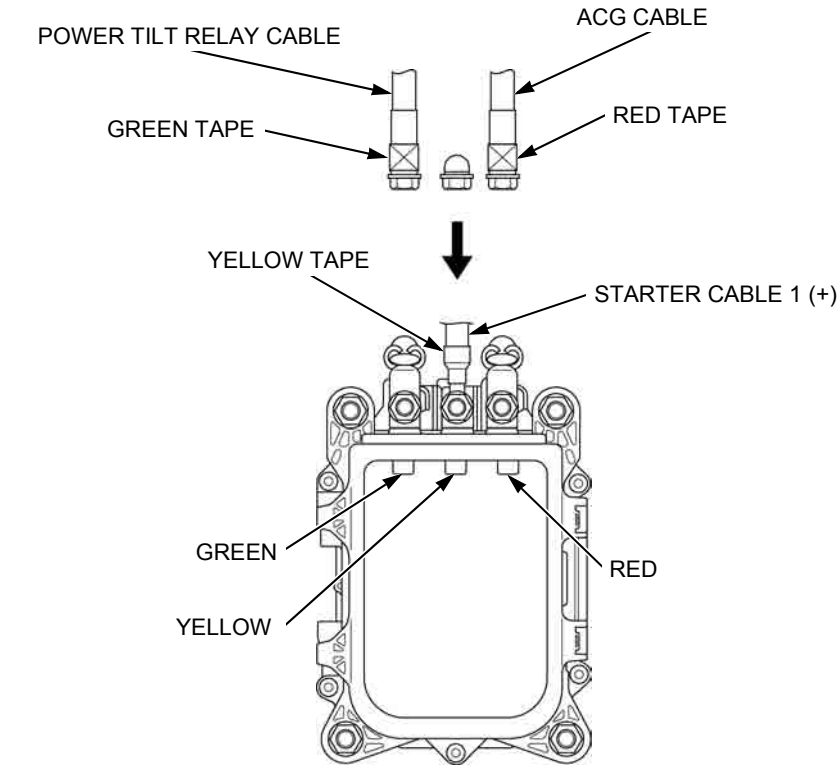
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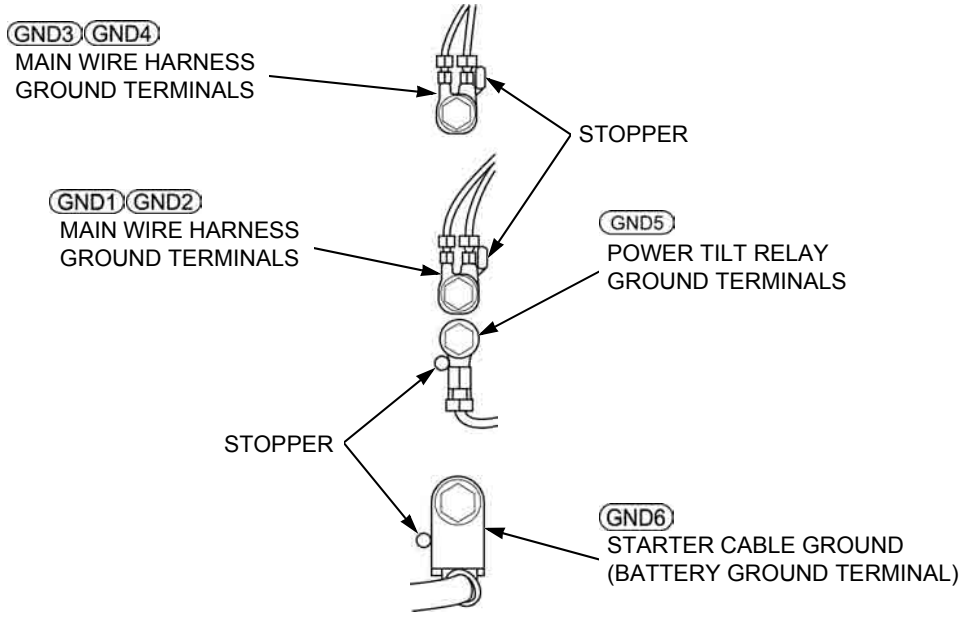
Material	Location	Remarks
Marine grease (water resistant urea based grease)	Drain plug rubber lip	
	Alternator front bearing outer surface	
	Alternator rear bearing inner surface	
	Throttle cam	
Loctite® PRISM 403	Water joint cap nut seating surface	

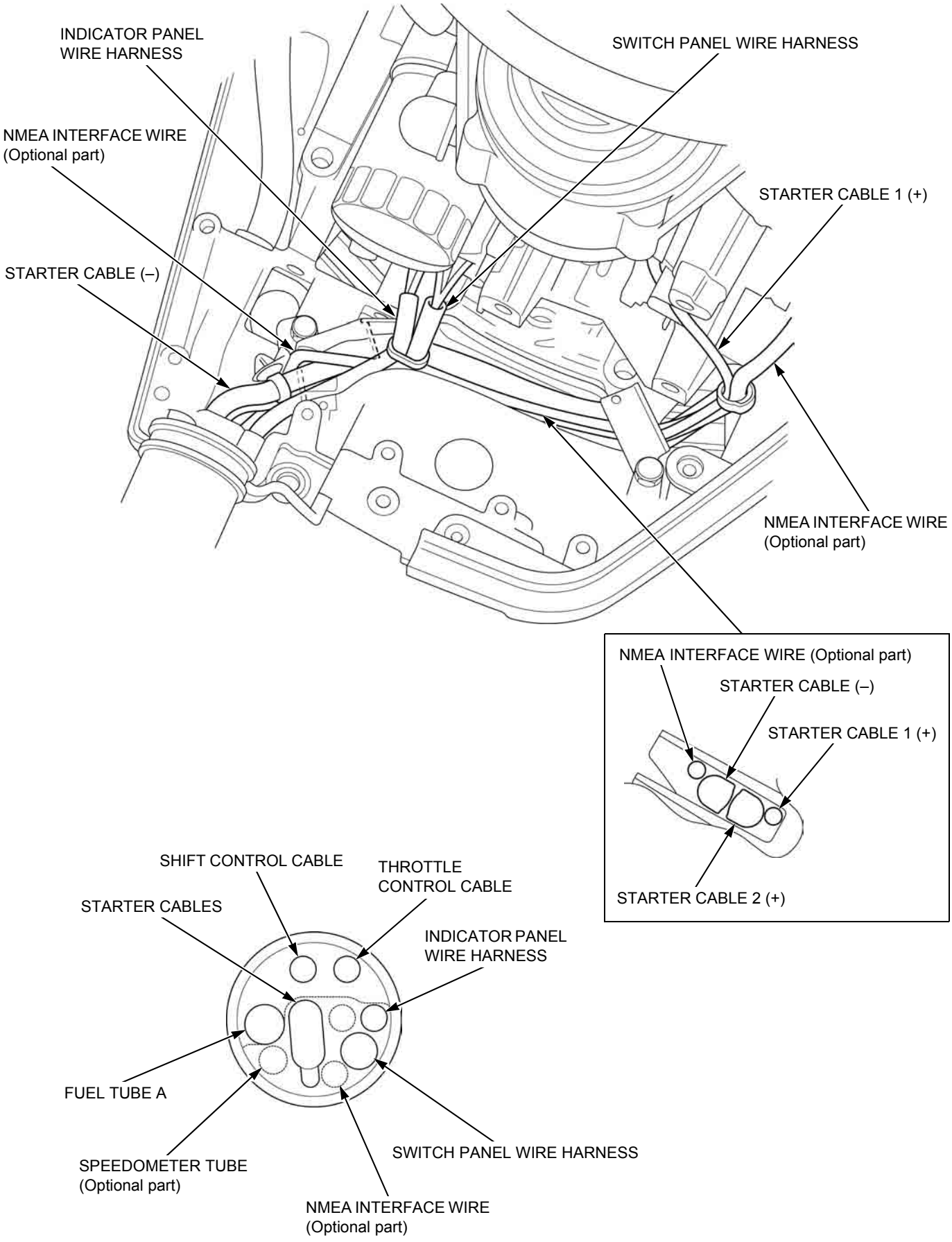
CABLE/HARNESS ROUTING




27
FUSE/RELAY JUNCTION BOX 8P CONNECTOR
28
FUSE/RELAY JUNCTION BOX
23P CONNECTOR
ACG CABLE
15
TACH PULSE
2P CONNECTOR
7
ALTERNATOR
4P CONNECTOR
1
INTERFACE
6P CONNECTOR
2
SWITCH PANEL
WIRE HARNESS
14P CONNECTOR
POWER TILT
RELAY WIRE
TERMINAL
26
DLC 4P
3
INDICATOR PANEL
WIRE HARNESS
6P CONNECTOR
30
NEUTRAL SWITCH
2P CONNECTOR
STARTER CABLE 1 (+)
29
FUSE/RELAY JUNCTION BOX
10P CONNECTOR
HARNESS BAND CLIP
NMEA INTERFACE WIRE
(Optional part)
STARTER CABLE 1 (+)

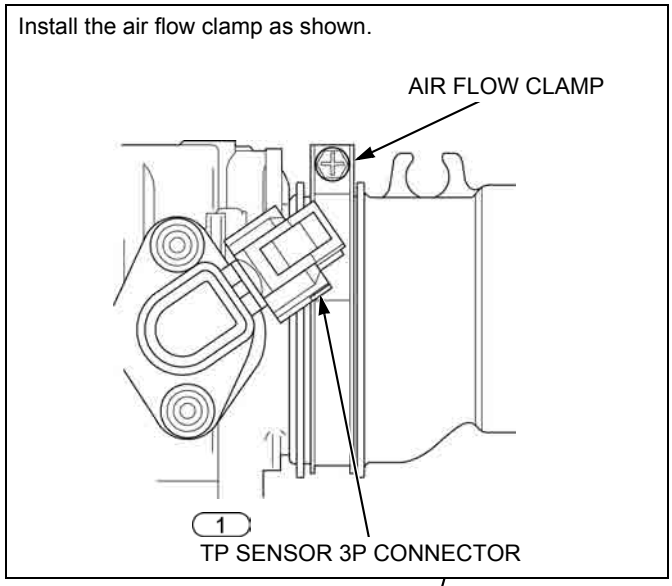

POWER TILT RELAY CABLE
ACG CABLE
GREEN TAPE
RED TAPE
YELLOW TAPE
STARTER CABLE 1 (+)
GREEN
RED
YELLOW

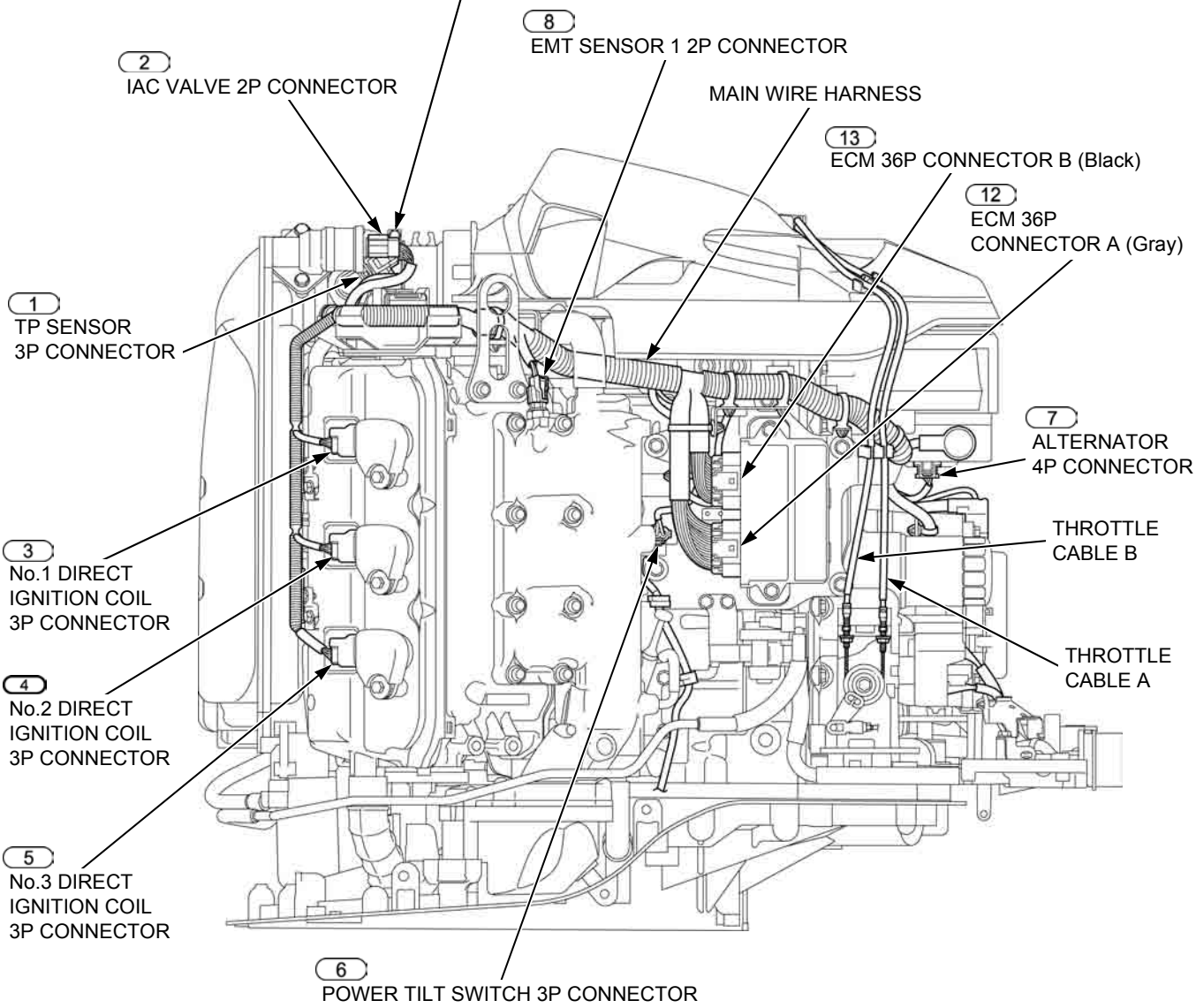

GND3 GND4
MAIN WIRE HARNESS
GROUND TERMINALS
STOPPER
GND1 GND2
MAIN WIRE HARNESS
GROUND TERMINALS
GND5
POWER TILT RELAY
GROUND TERMINALS
STOPPER
GND6
STARTER CABLE GROUND
(BATTERY GROUND TERMINAL)

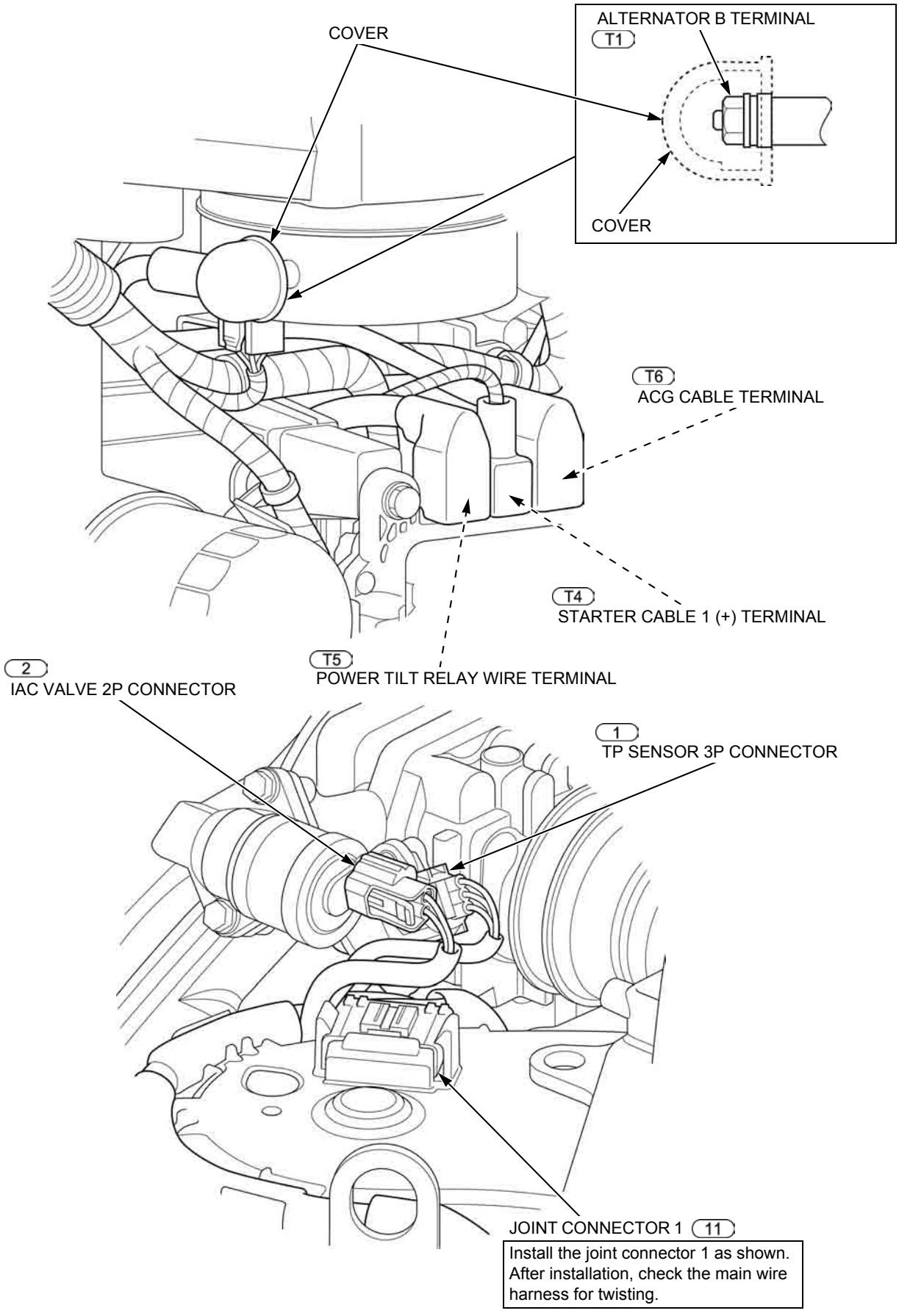

INDICATOR PANEL
WIRE HARNESS
SWITCH PANEL WIRE HARNESS
NMEA INTERFACE WIRE
(Optional part)
STARTER CABLE 1 (+)
STARTER CABLE (–)
NMEA INTERFACE WIRE
(Optional part)
NMEA INTERFACE WIRE (Optional part)
STARTER CABLE (–)
STARTER CABLE 1 (+)
STARTER CABLE 2 (+)
SHIFT CONTROL CABLE
THROTTLE
CONTROL CABLE
STARTER CABLES
INDICATOR PANEL
WIRE HARNESS
FUEL TUBE A
SPEEDOMETER TUBE
(Optional part)
SWITCH PANEL WIRE HARNESS
NMEA INTERFACE WIRE
(Optional part)

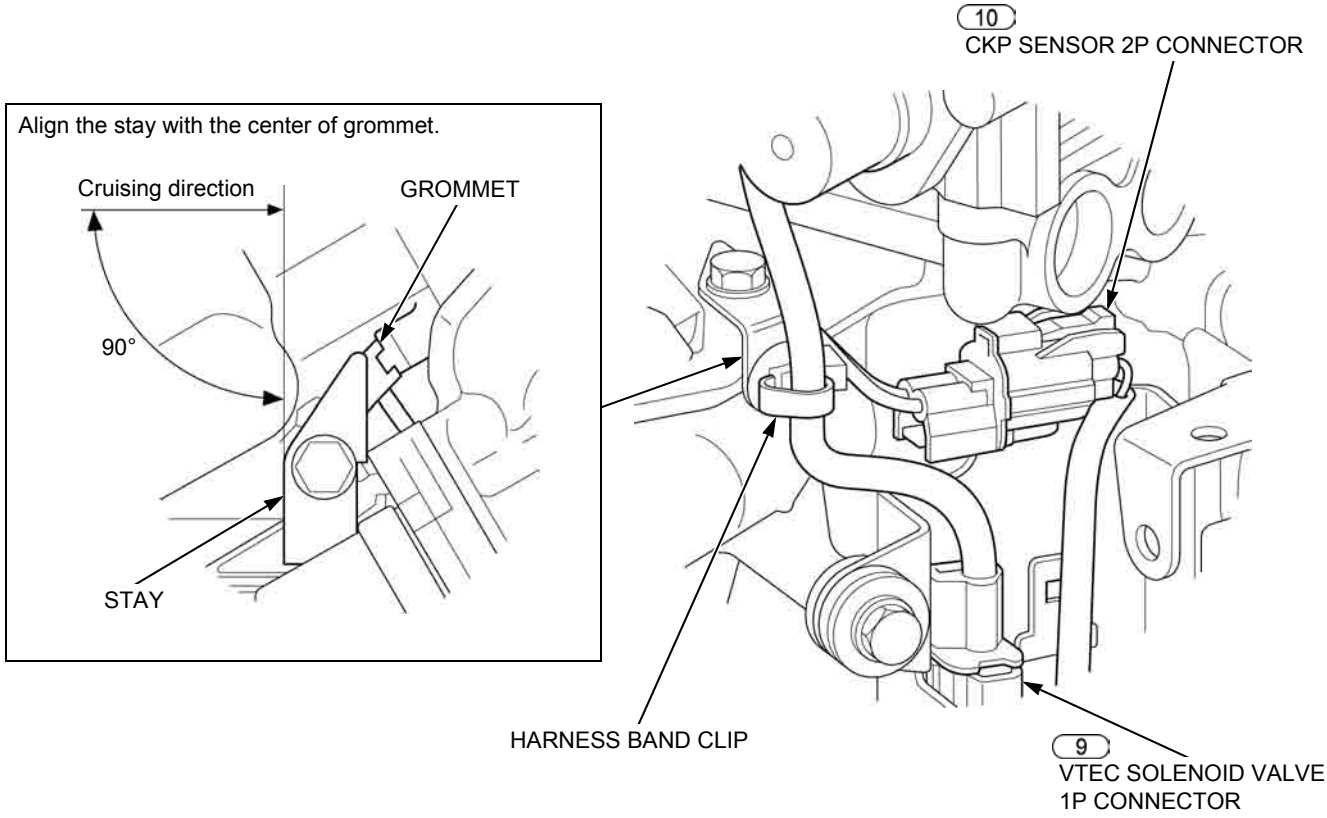
AIR FLOW CLAMP

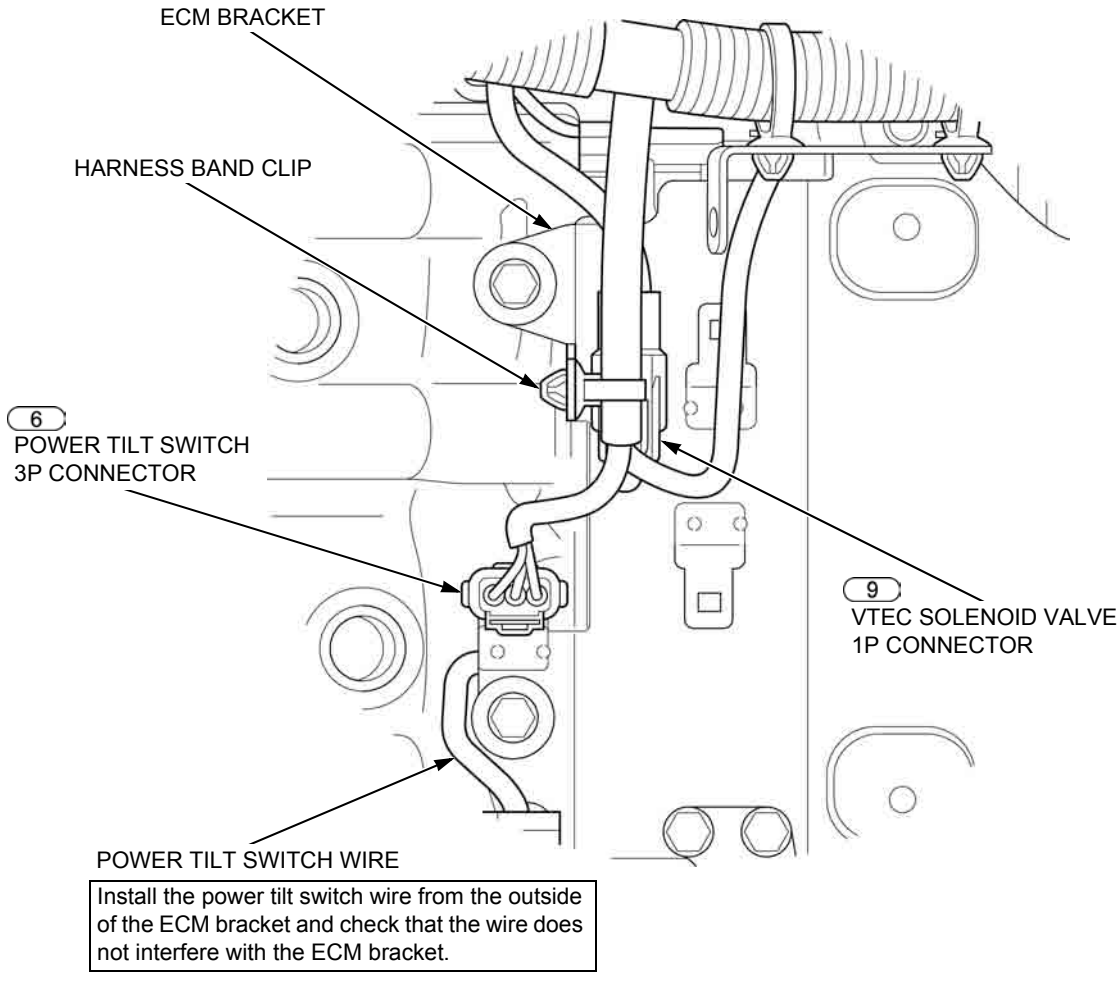
Install the air flow clamp as shown.

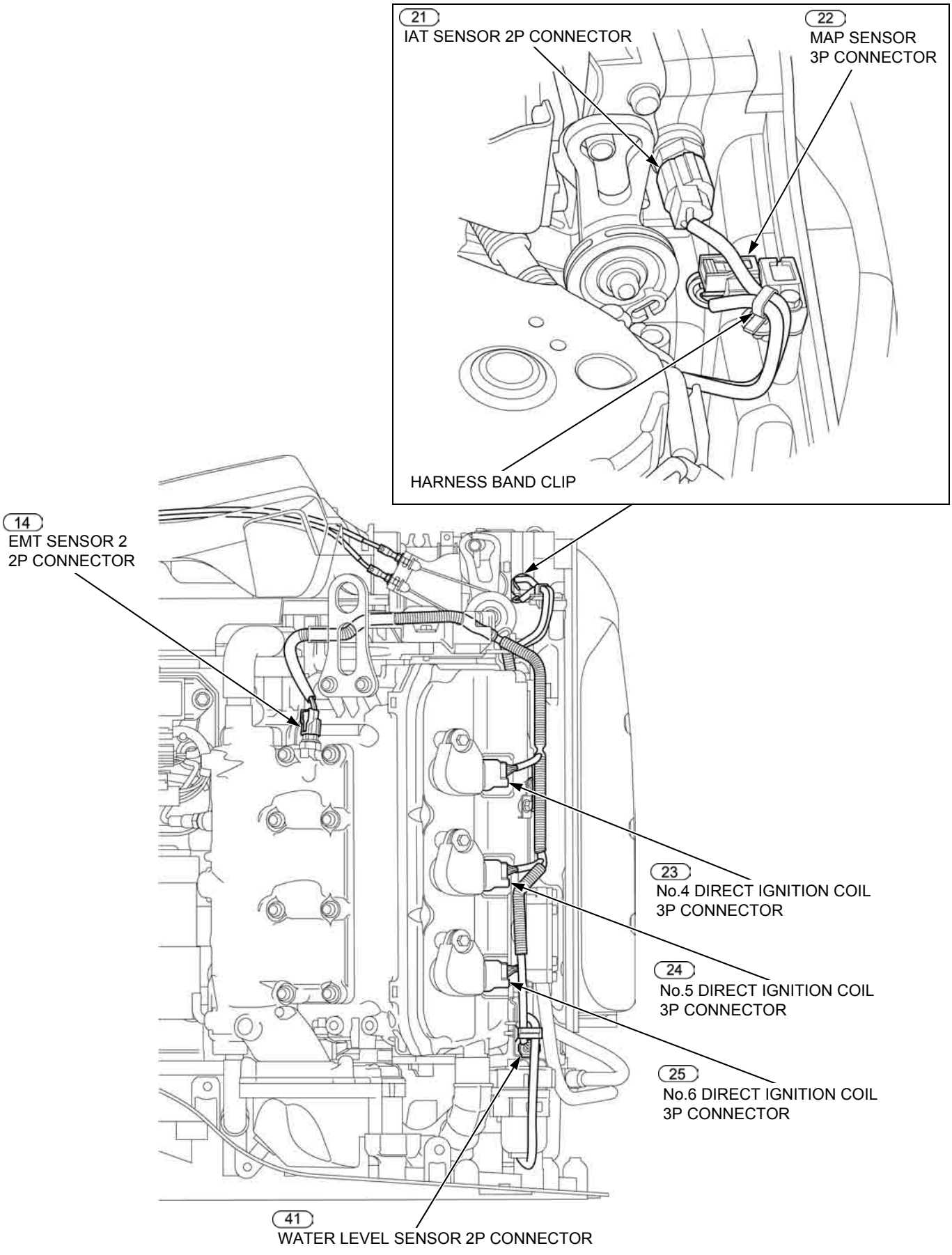


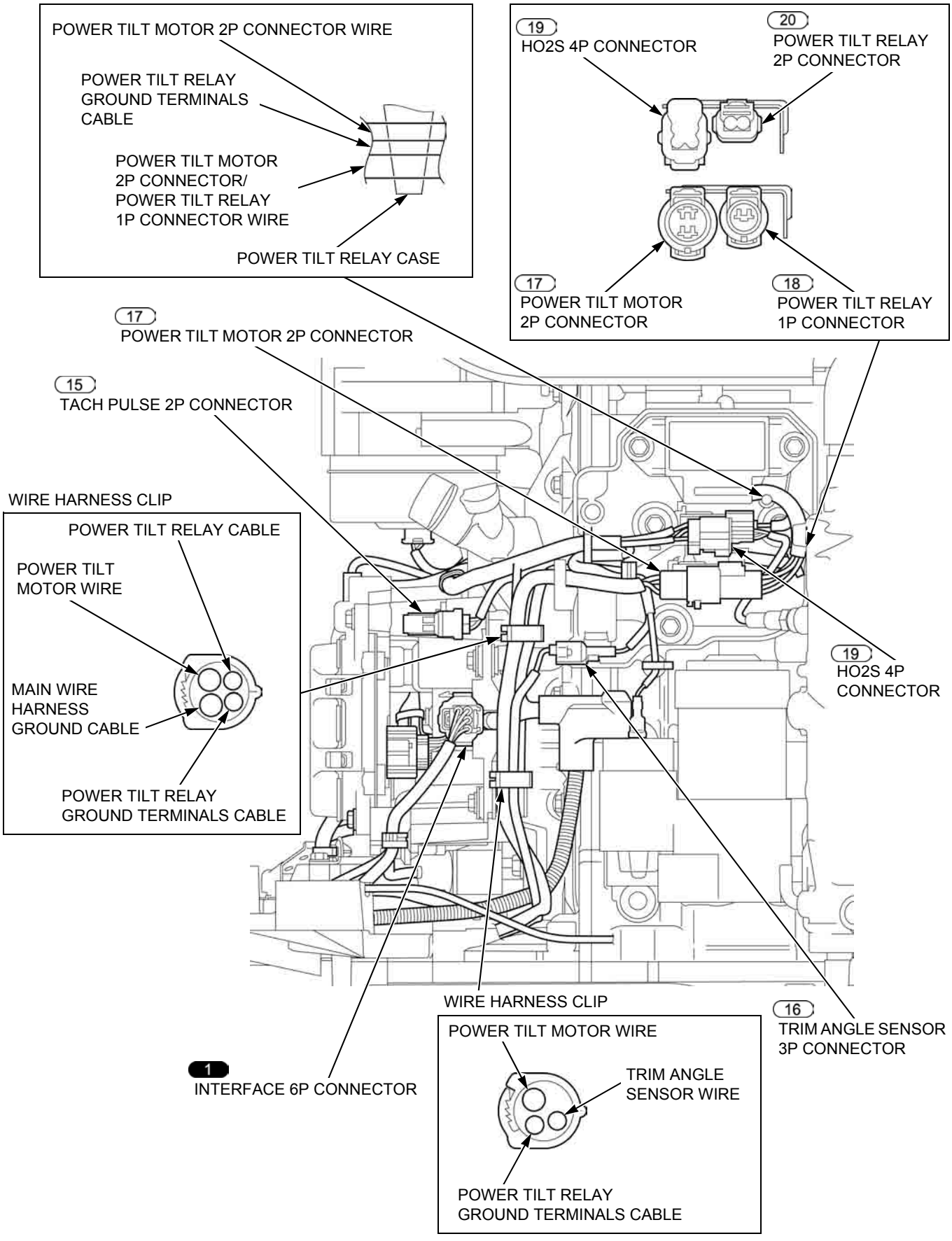


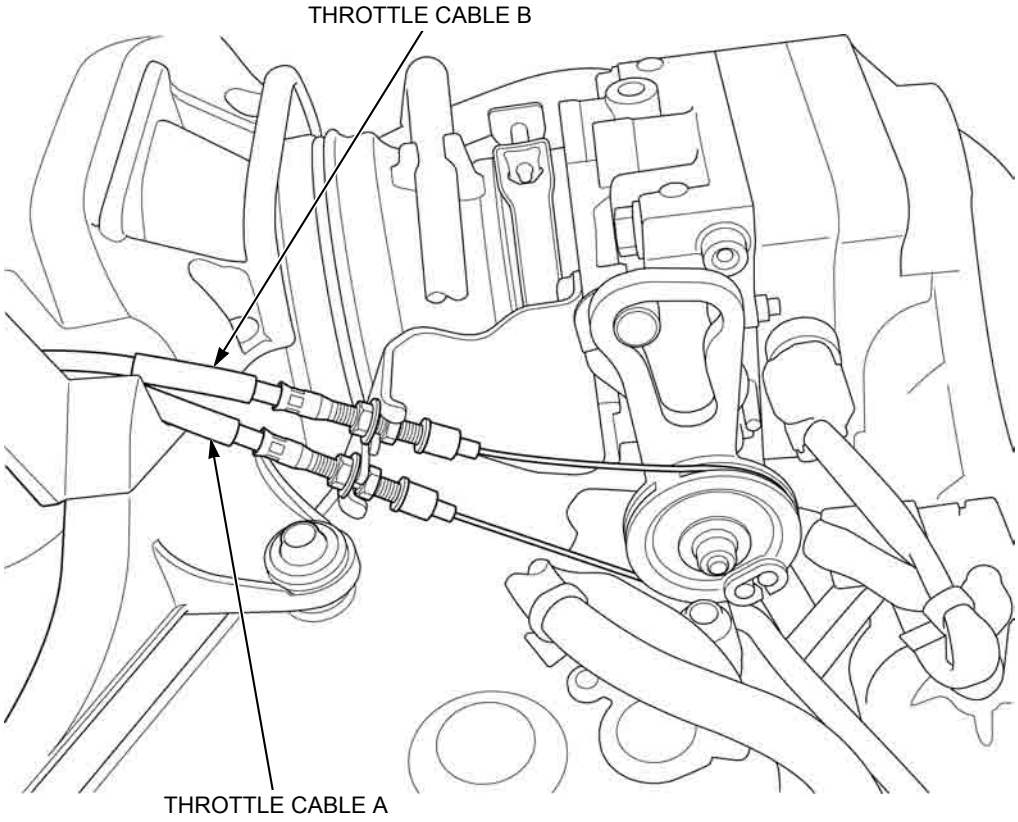

ALTERNATOR B TERMINAL
T1
COVER
COVER
T6
ACG CABLE TERMINAL
T4
STARTER CABLE 1 (+) TERMINAL
T5
POWER TILT RELAY WIRE TERMINAL
2
IAC VALVE 2P CONNECTOR
1
TP SENSOR 3P CONNECTOR
JOINT CONNECTOR 1 11
Install the joint connector 1 as shown. After installation, check the main wire harness for twisting.

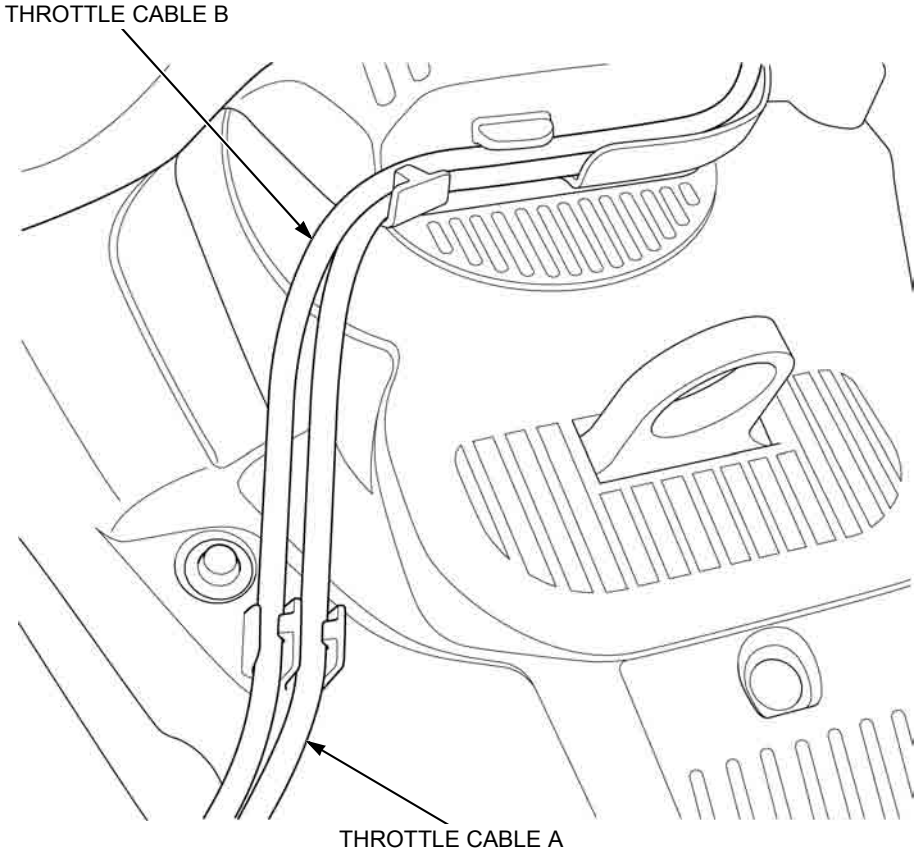

10
CKP SENSOR 2P CONNECTOR
Align the stay with the center of grommet.
Cruising direction
GROMMET
90°
STAY
HARNESS BAND CLIP
9
VTEC SOLENOID VALVE
1P CONNECTOR

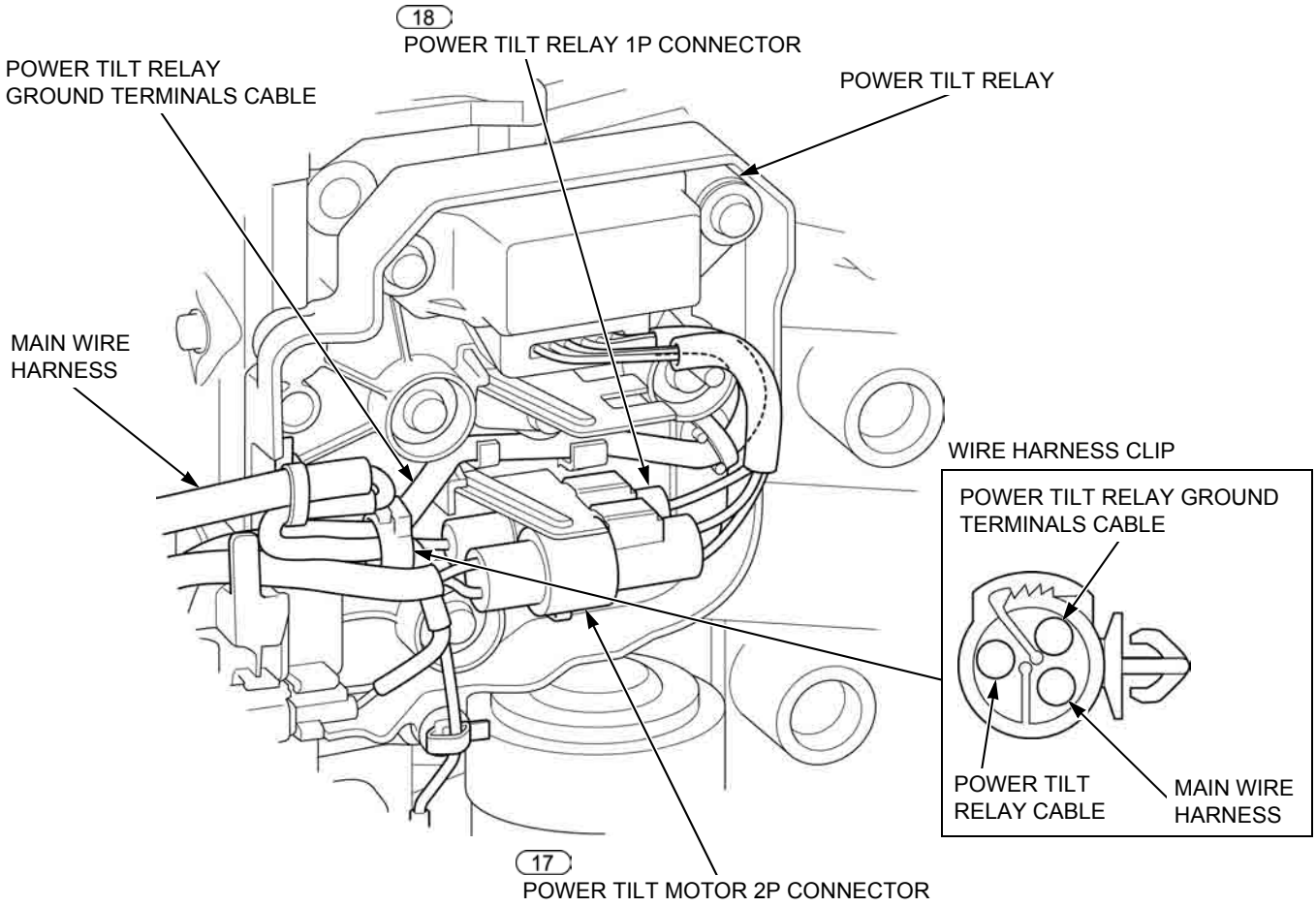

ECM BRACKET
HARNESS BAND CLIP
6
POWER TILT SWITCH
3P CONNECTOR
9
VTEC SOLENOID VALVE
1P CONNECTOR
POWER TILT SWITCH WIRE
Install the power tilt switch wire from the outside of the ECM bracket and check that the wire does not interfere with the ECM bracket.

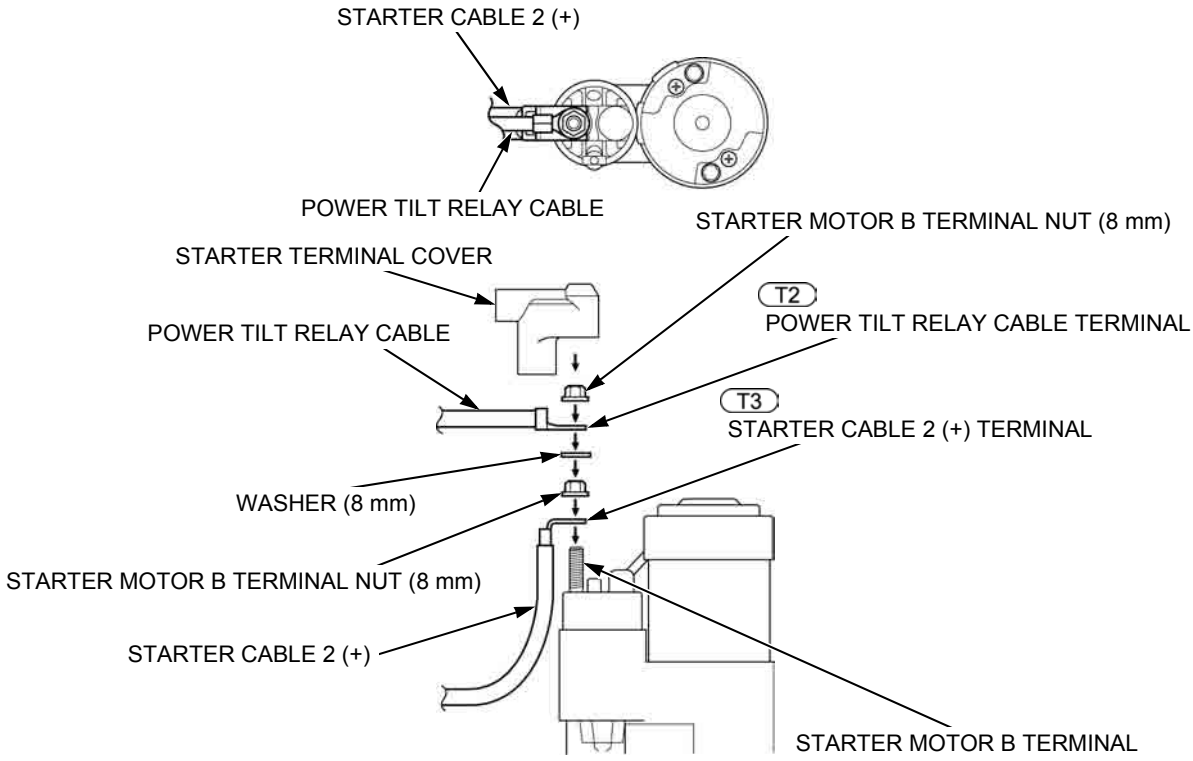

21
IAT SENSOR 2P CONNECTOR
22
MAP SENSOR
3P CONNECTOR
HARNESS BAND CLIP
14
EMT SENSOR 2
2P CONNECTOR
23
No.4 DIRECT IGNITION COIL
3P CONNECTOR
24
No.5 DIRECT IGNITION COIL
3P CONNECTOR
25
No.6 DIRECT IGNITION COIL
3P CONNECTOR
41
WATER LEVEL SENSOR 2P CONNECTOR

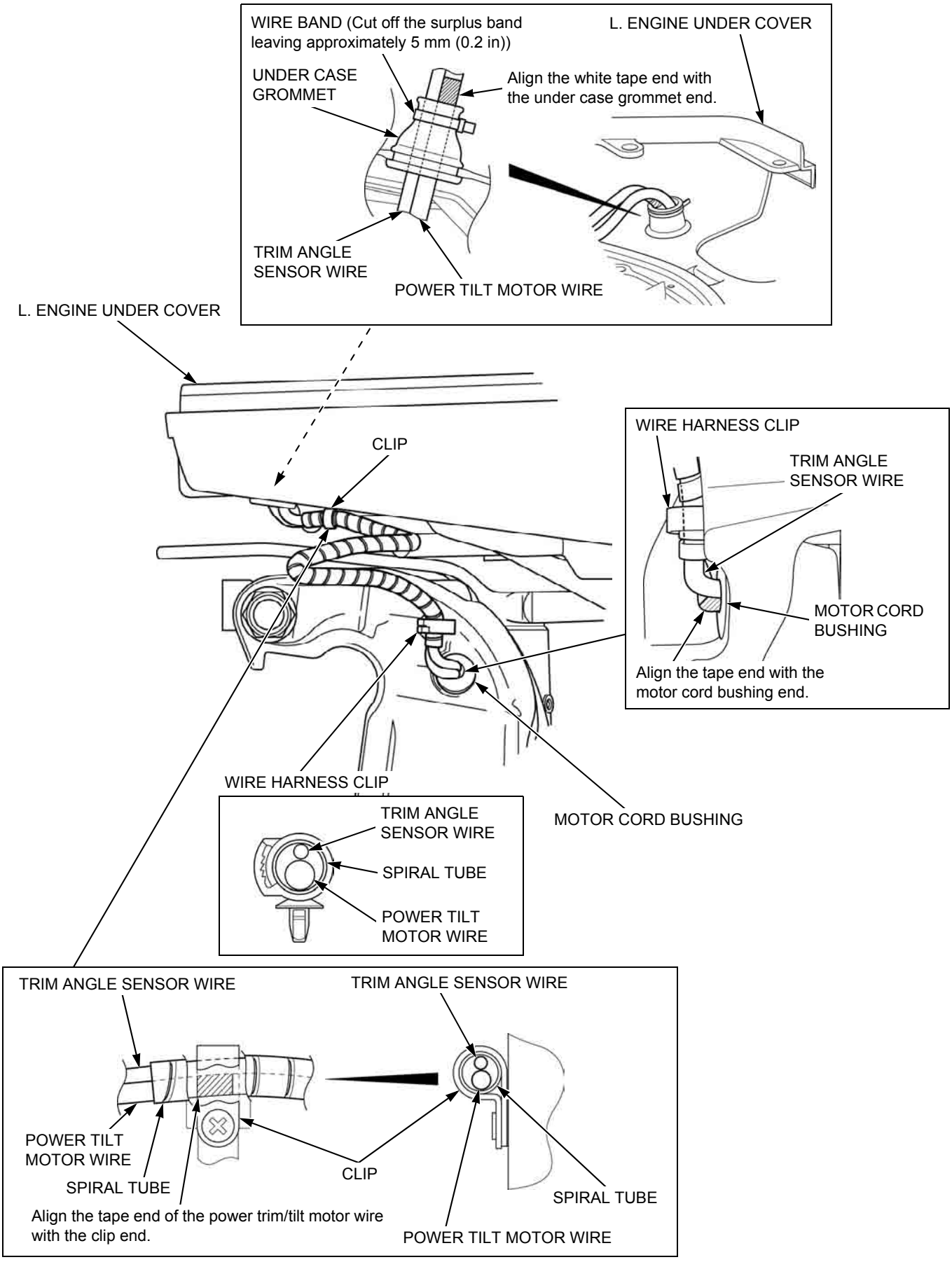

POWER TILT MOTOR 2P CONNECTOR WIRE
POWER TILT RELAY GROUND TERMINALS CABLE
POWER TILT MOTOR 2P CONNECTOR/ POWER TILT RELAY 1P CONNECTOR WIRE
POWER TILT RELAY CASE
19
HO2S 4P CONNECTOR
20
POWER TILT RELAY 2P CONNECTOR
17
POWER TILT MOTOR 2P CONNECTOR
18
POWER TILT RELAY 1P CONNECTOR
17
POWER TILT MOTOR 2P CONNECTOR
15
TACH PULSE 2P CONNECTOR
WIRE HARNESS CLIP
POWER TILT RELAY CABLE
POWER TILT MOTOR WIRE
MAIN WIRE HARNESS GROUND CABLE
POWER TILT RELAY GROUND TERMINALS CABLE
19
HO2S 4P CONNECTOR
WIRE HARNESS CLIP
16
TRIM ANGLE SENSOR 3P CONNECTOR
POWER TILT MOTOR WIRE
TRIM ANGLE SENSOR WIRE
POWER TILT RELAY GROUND TERMINALS CABLE
1
INTERFACE 6P CONNECTOR

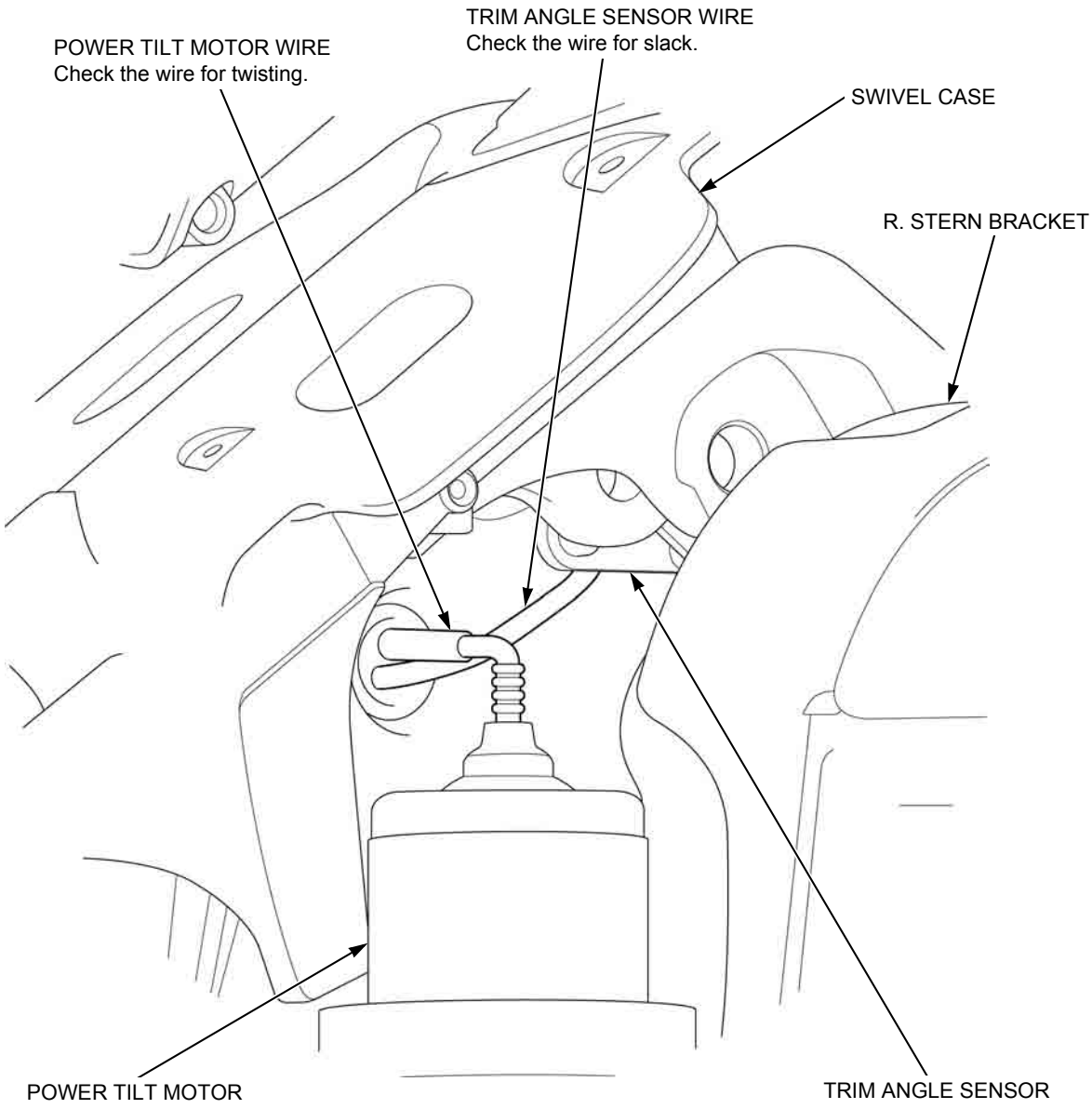

THROTTLE CABLE B
THROTTLE CABLE A

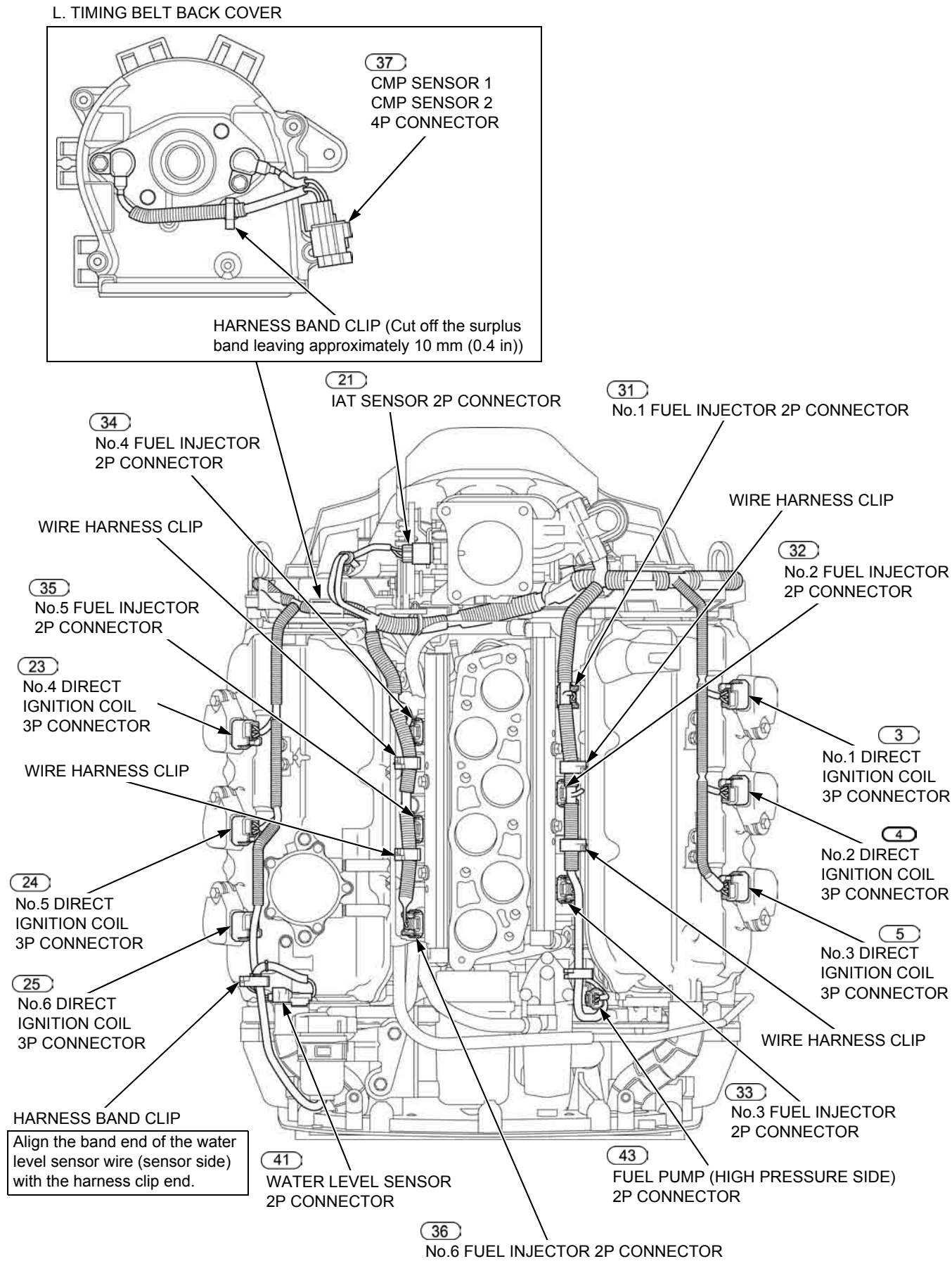

THROTTLE CABLE B
THROTTLE CABLE A

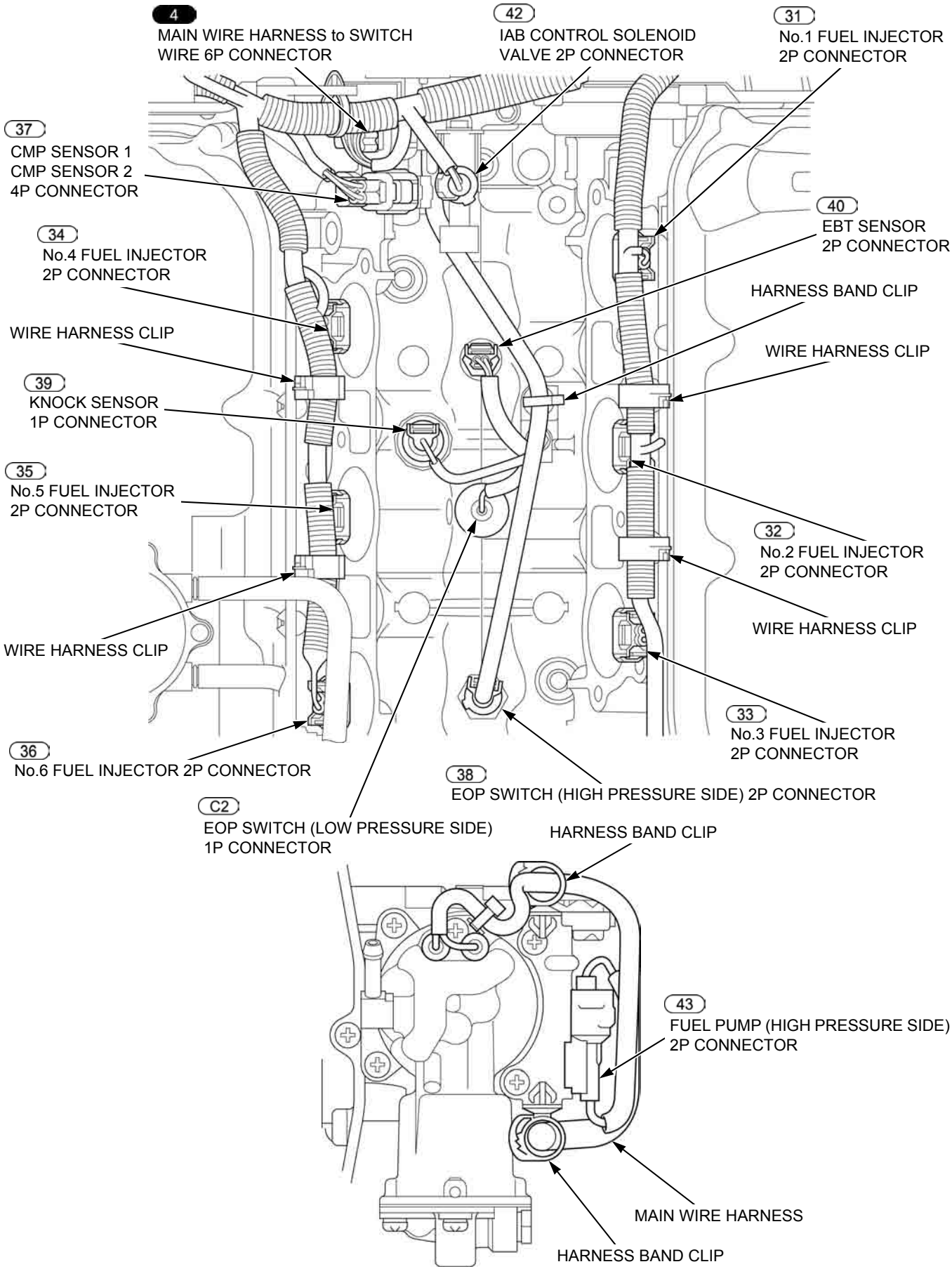

18
POWER TILT RELAY 1P CONNECTOR
POWER TILT RELAY
GROUND TERMINALS CABLE
MAIN WIRE
HARNESS
WIRE HARNESS CLIP
POWER TILT RELAY GROUND
TERMINALS CABLE
POWER TILT
RELAY CABLE
MAIN WIRE
HARNESS
17
POWER TILT MOTOR 2P CONNECTOR


STARTER CABLE 2 (+)
POWER TILT RELAY CABLE
STARTER MOTOR B TERMINAL NUT (8 mm)
STARTER TERMINAL COVER
T2
POWER TILT RELAY CABLE TERMINAL
POWER TILT RELAY CABLE
T3
STARTER CABLE 2 (+) TERMINAL
WASHER (8 mm)
STARTER MOTOR B TERMINAL NUT (8 mm)
STARTER CABLE 2 (+)
STARTER MOTOR B TERMINAL


WIRE BAND (Cut off the surplus band leaving approximately 5 mm (0.2 in))
L. ENGINE UNDER COVER
UNDER CASE GROMMET
Align the white tape end with the under case grommet end.
TRIM ANGLE SENSOR WIRE
POWER TILT MOTOR WIRE
L. ENGINE UNDER COVER
CLIP
WIRE HARNESS CLIP
TRIM ANGLE SENSOR WIRE
MOTOR CORD BUSHING
Align the tape end with the motor cord bushing end.
WIRE HARNESS CLIP
MOTOR CORD BUSHING
TRIM ANGLE SENSOR WIRE
SPIRAL TUBE
POWER TILT MOTOR WIRE
TRIM ANGLE SENSOR WIRE
TRIM ANGLE SENSOR WIRE
POWER TILT MOTOR WIRE
SPIRAL TUBE
CLIP
SPIRAL TUBE
Align the tape end of the power trim/tilt motor wire with the clip end.
POWER TILT MOTOR WIRE


POWER TILT MOTOR WIRE
Check the wire for twisting.
TRIM ANGLE SENSOR WIRE
Check the wire for slack.
SWIVEL CASE
R. STERN BRACKET
POWER TILT MOTOR
TRIM ANGLE SENSOR

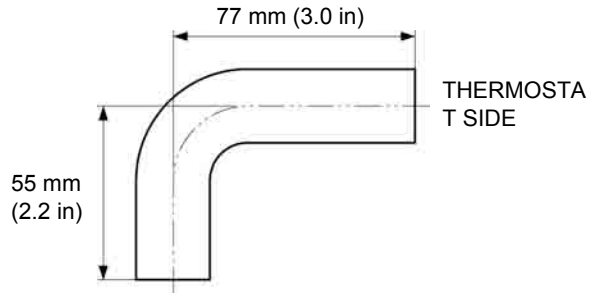

L. TIMING BELT BACK COVER
37
CMP SENSOR 1
CMP SENSOR 2
4P CONNECTOR
HARNESS BAND CLIP (Cut off the surplus band leaving approximately 10 mm (0.4 in))
21
IAT SENSOR 2P CONNECTOR
31
No.1 FUEL INJECTOR 2P CONNECTOR
34
No.4 FUEL INJECTOR 2P CONNECTOR
WIRE HARNESS CLIP
WIRE HARNESS CLIP
32
No.2 FUEL INJECTOR 2P CONNECTOR
35
No.5 FUEL INJECTOR 2P CONNECTOR
23
No.4 DIRECT IGNITION COIL 3P CONNECTOR
3
No.1 DIRECT IGNITION COIL 3P CONNECTOR
WIRE HARNESS CLIP
4
No.2 DIRECT IGNITION COIL 3P CONNECTOR
24
No.5 DIRECT IGNITION COIL 3P CONNECTOR
5
No.3 DIRECT IGNITION COIL 3P CONNECTOR
25
No.6 DIRECT IGNITION COIL 3P CONNECTOR
WIRE HARNESS CLIP
33
No.3 FUEL INJECTOR 2P CONNECTOR
HARNESS BAND CLIP
Align the band end of the water level sensor wire (sensor side) with the harness clip end.
41
WATER LEVEL SENSOR 2P CONNECTOR
43
FUEL PUMP (HIGH PRESSURE SIDE) 2P CONNECTOR
36
No.6 FUEL INJECTOR 2P CONNECTOR

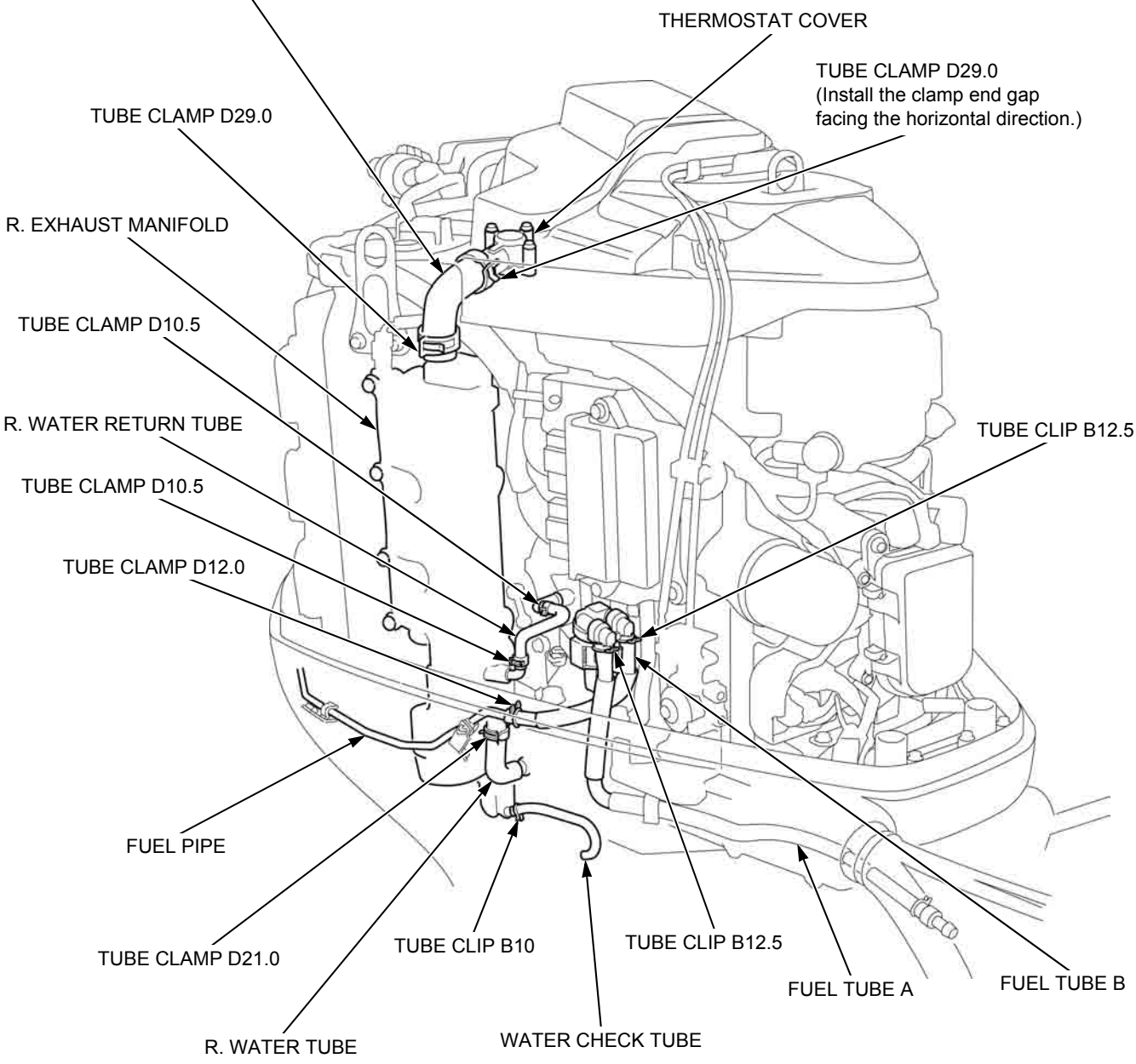

4
MAIN WIRE HARNESS to SWITCH WIRE 6P CONNECTOR
42
IAB CONTROL SOLENOID VALVE 2P CONNECTOR
31
No.1 FUEL INJECTOR 2P CONNECTOR
37
CMP SENSOR 1
CMP SENSOR 2
4P CONNECTOR
40
EBT SENSOR 2P CONNECTOR
34
No.4 FUEL INJECTOR 2P CONNECTOR
HARNESS BAND CLIP
WIRE HARNESS CLIP
WIRE HARNESS CLIP
39
KNOCK SENSOR 1P CONNECTOR
35
No.5 FUEL INJECTOR 2P CONNECTOR
32
No.2 FUEL INJECTOR 2P CONNECTOR
WIRE HARNESS CLIP
WIRE HARNESS CLIP
33
No.3 FUEL INJECTOR 2P CONNECTOR
36
No.6 FUEL INJECTOR 2P CONNECTOR
38
EOP SWITCH (HIGH PRESSURE SIDE) 2P CONNECTOR
C2
EOP SWITCH (LOW PRESSURE SIDE) 1P CONNECTOR
HARNESS BAND CLIP
43
FUEL PUMP (HIGH PRESSURE SIDE) 2P CONNECTOR
MAIN WIRE HARNESS
HARNESS BAND CLIP

TUBE ROUTING

R. WATER RELIEF TUBE

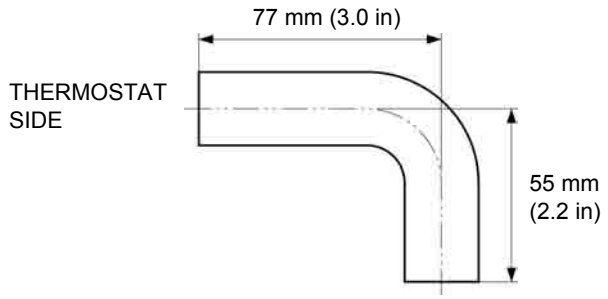
Install the longer side of the water relief tube into the thermostat. Install the shorter side of the water relief tube into the exhaust manifold. The tubes have a paint mark for the installation direction. The relief tube should be installed so that the paint mark is on the exhaust manifold.

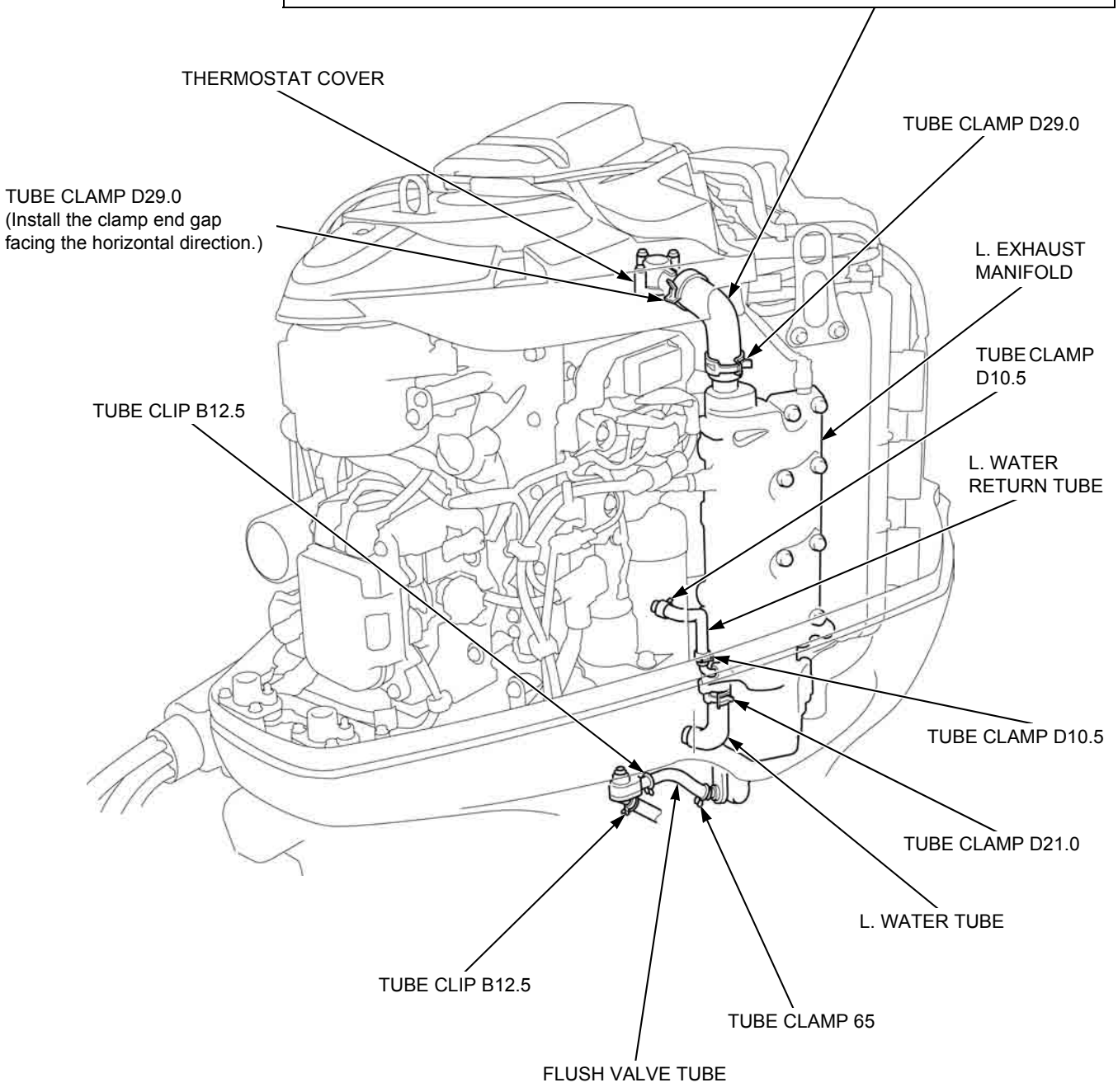


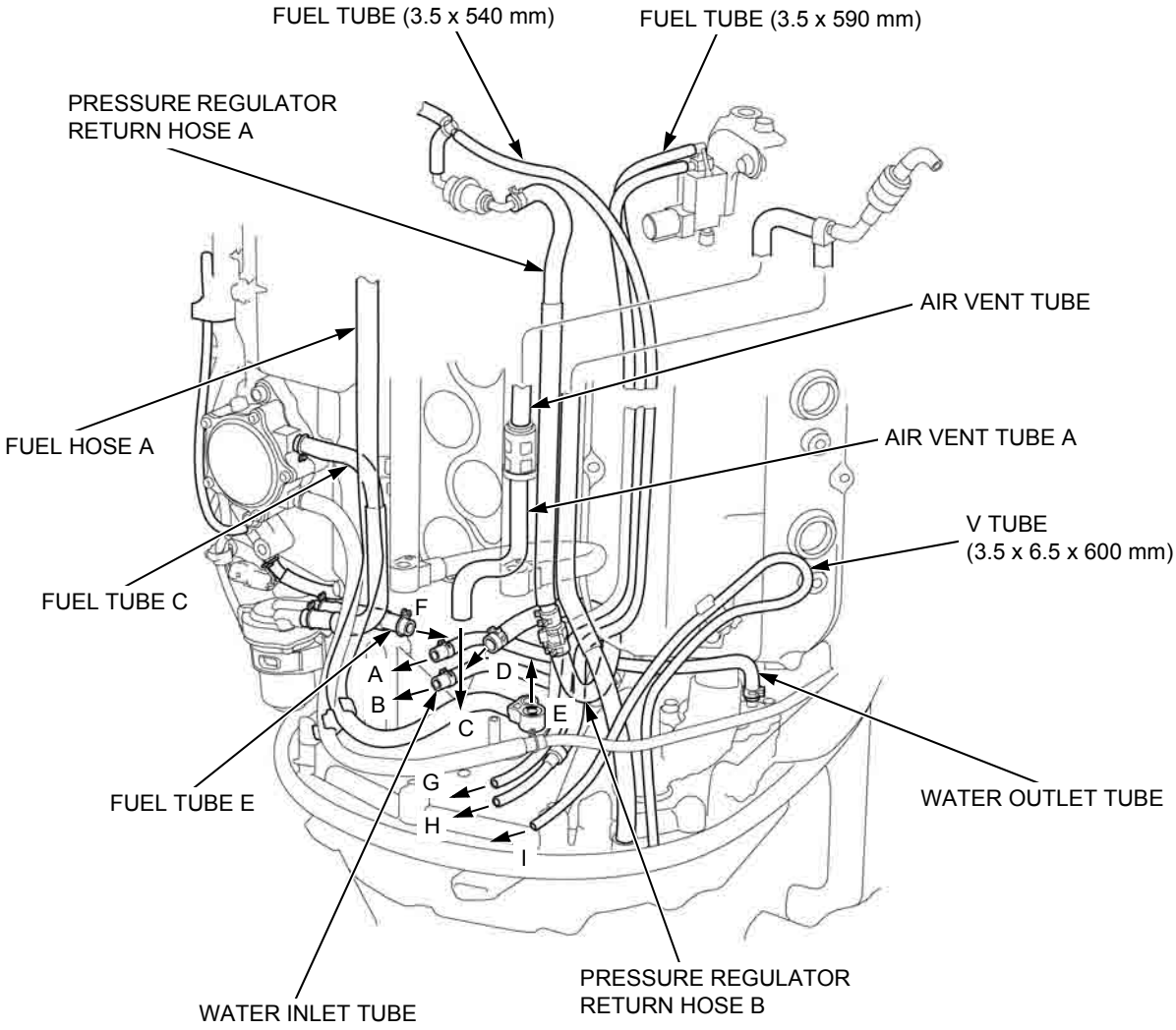


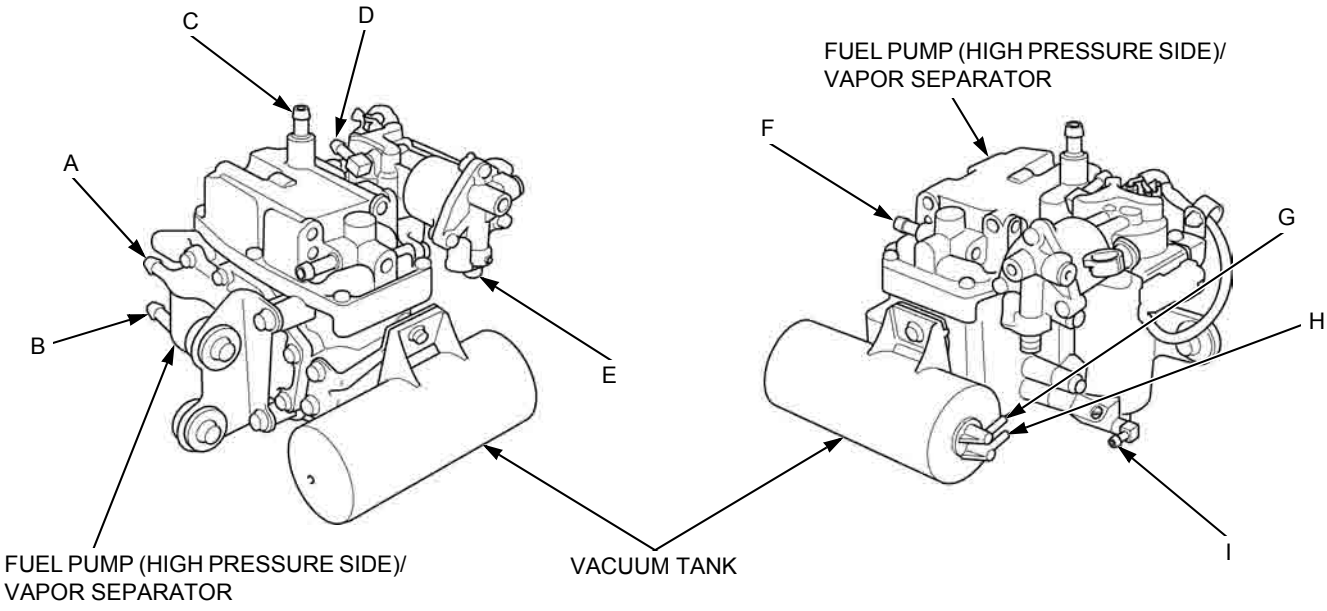
L. WATER RELIEF TUBE

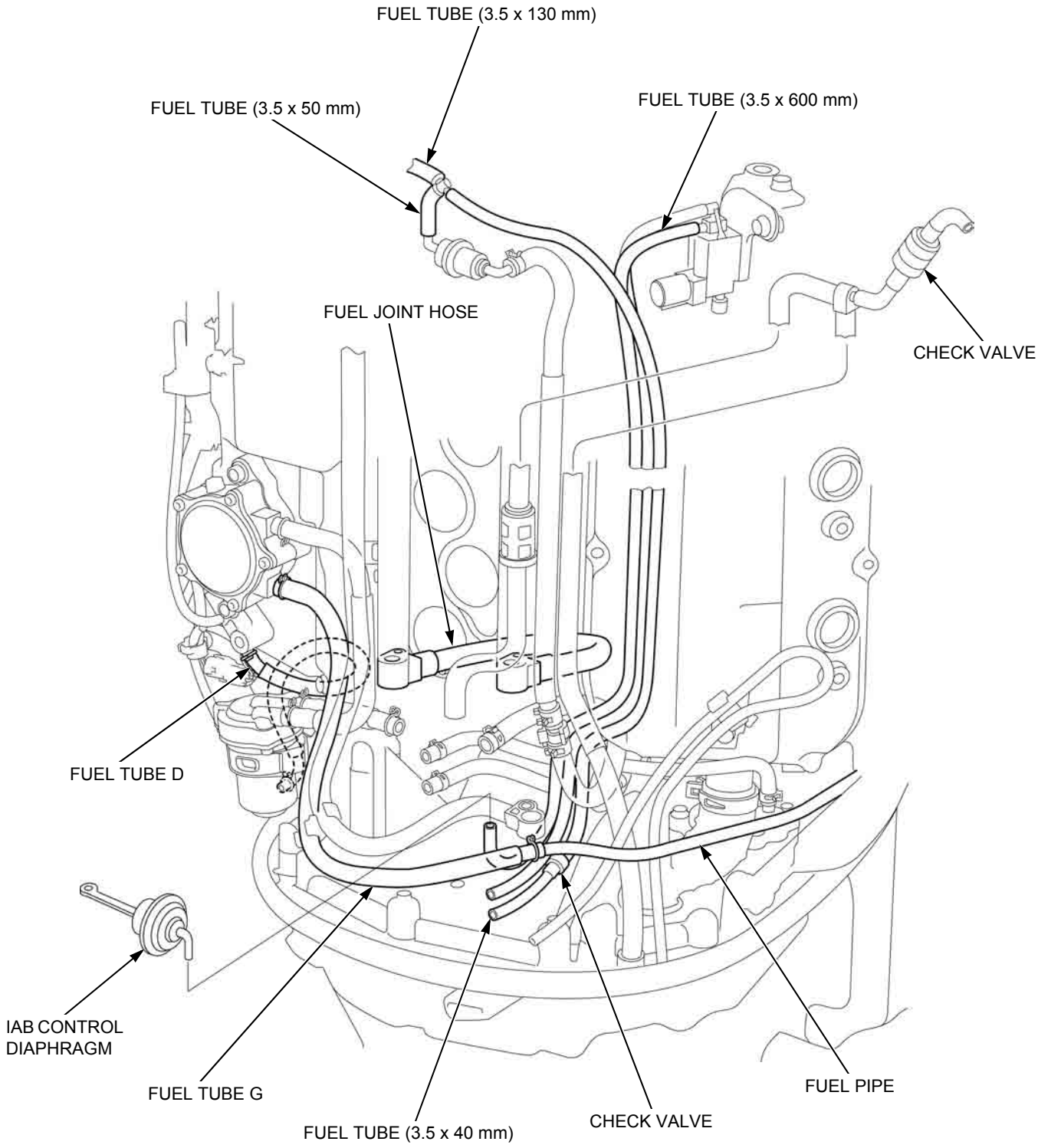
Install the longer side of the water relief tube into the thermostat. Install the shorter side of the water relief tube into the exhaust manifold. The tubes have a paint mark for the installation direction. The relief tube should be installed so that the paint mark is on the exhaust manifold.

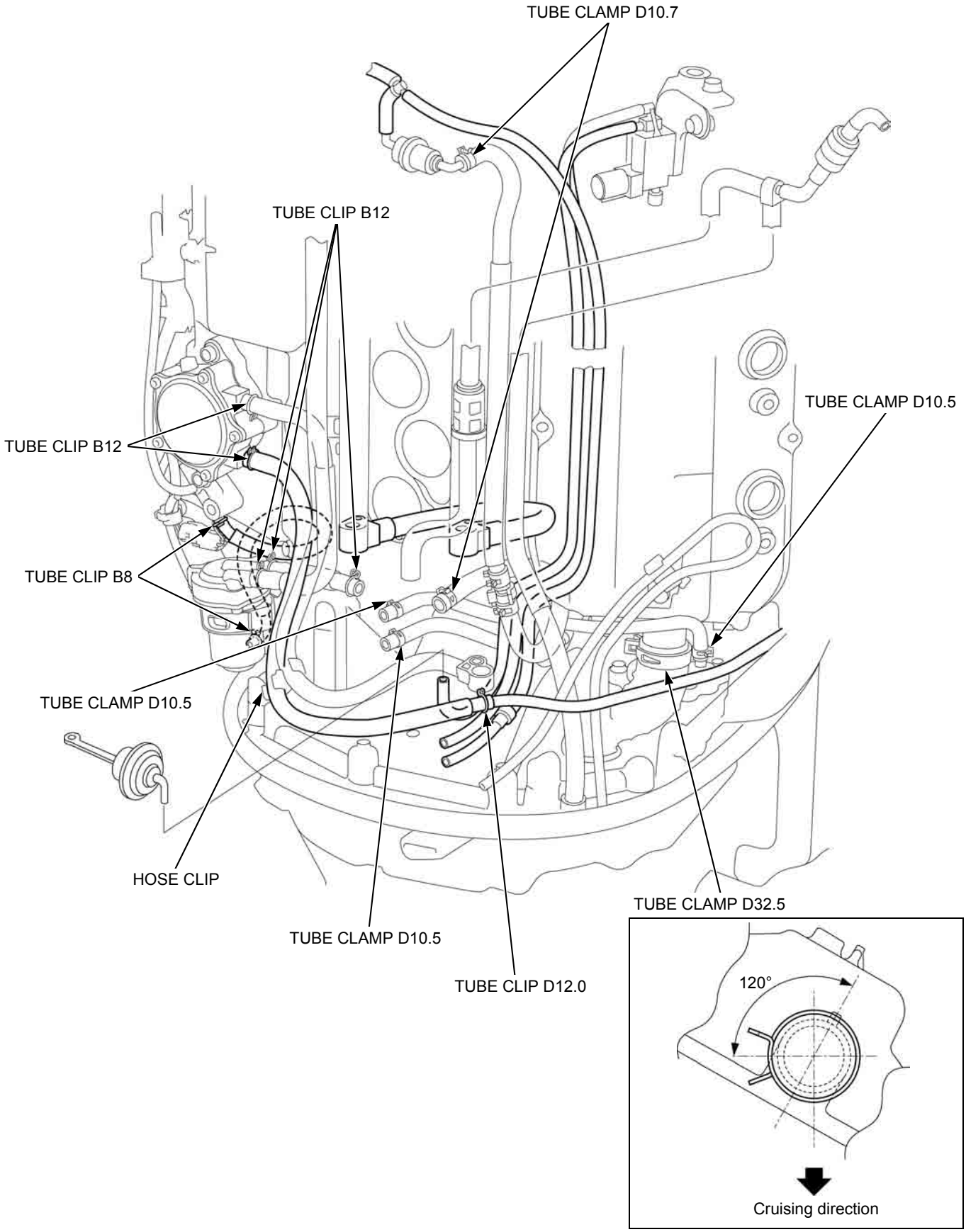


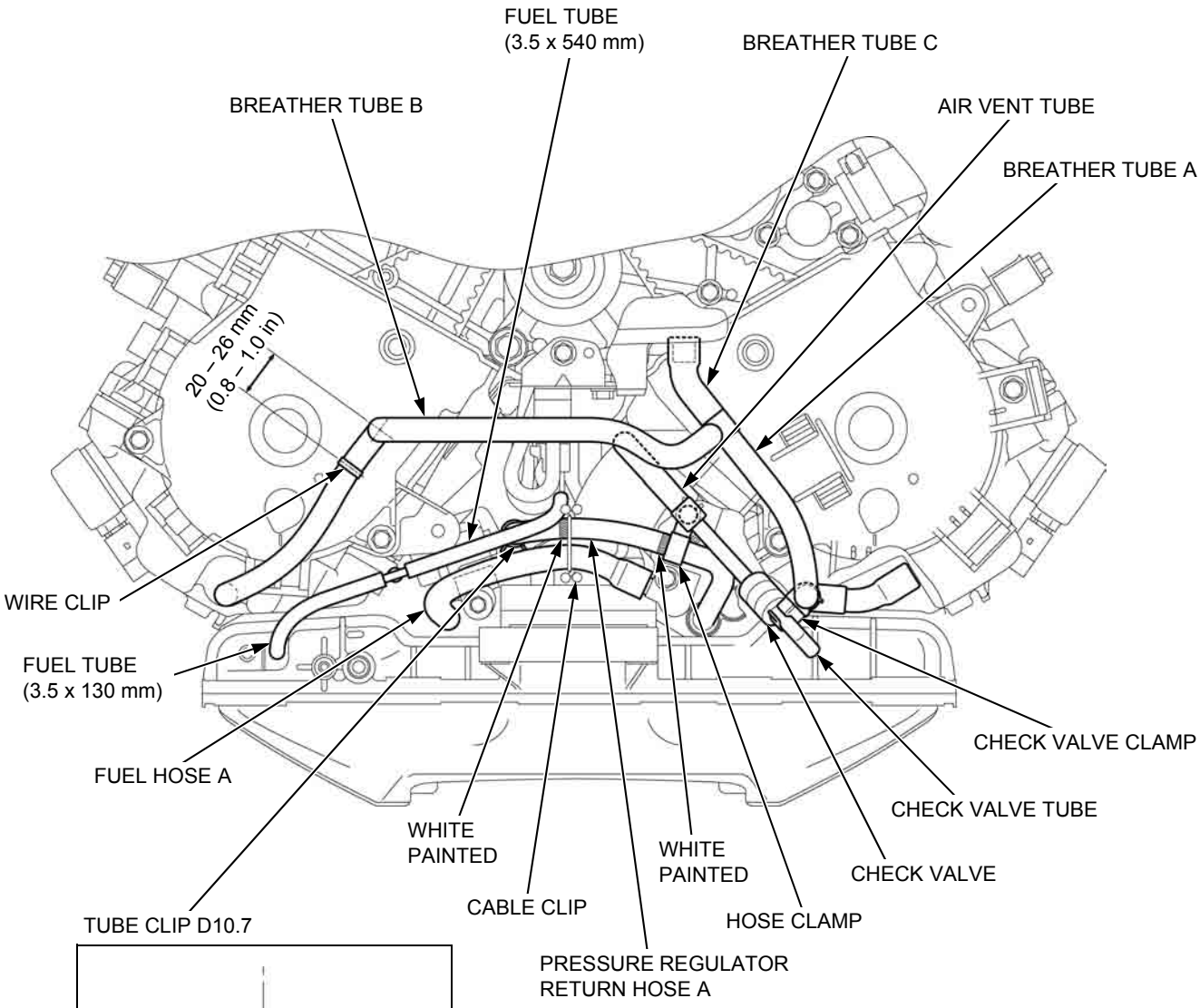


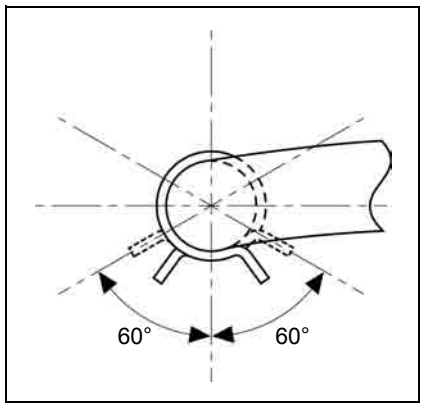

FUEL TUBE (3.5 x 540 mm)
FUEL TUBE (3.5 x 590 mm)
PRESSURE REGULATOR
RETURN HOSE A
AIR VENT TUBE
FUEL HOSE A
AIR VENT TUBE A
V TUBE
(3.5 x 6.5 x 600 mm)
FUEL TUBE C
F
A
D
B
E
C
G
FUEL TUBE E
H
I
WATER OUTLET TUBE
WATER INLET TUBE
PRESSURE REGULATOR
RETURN HOSE B

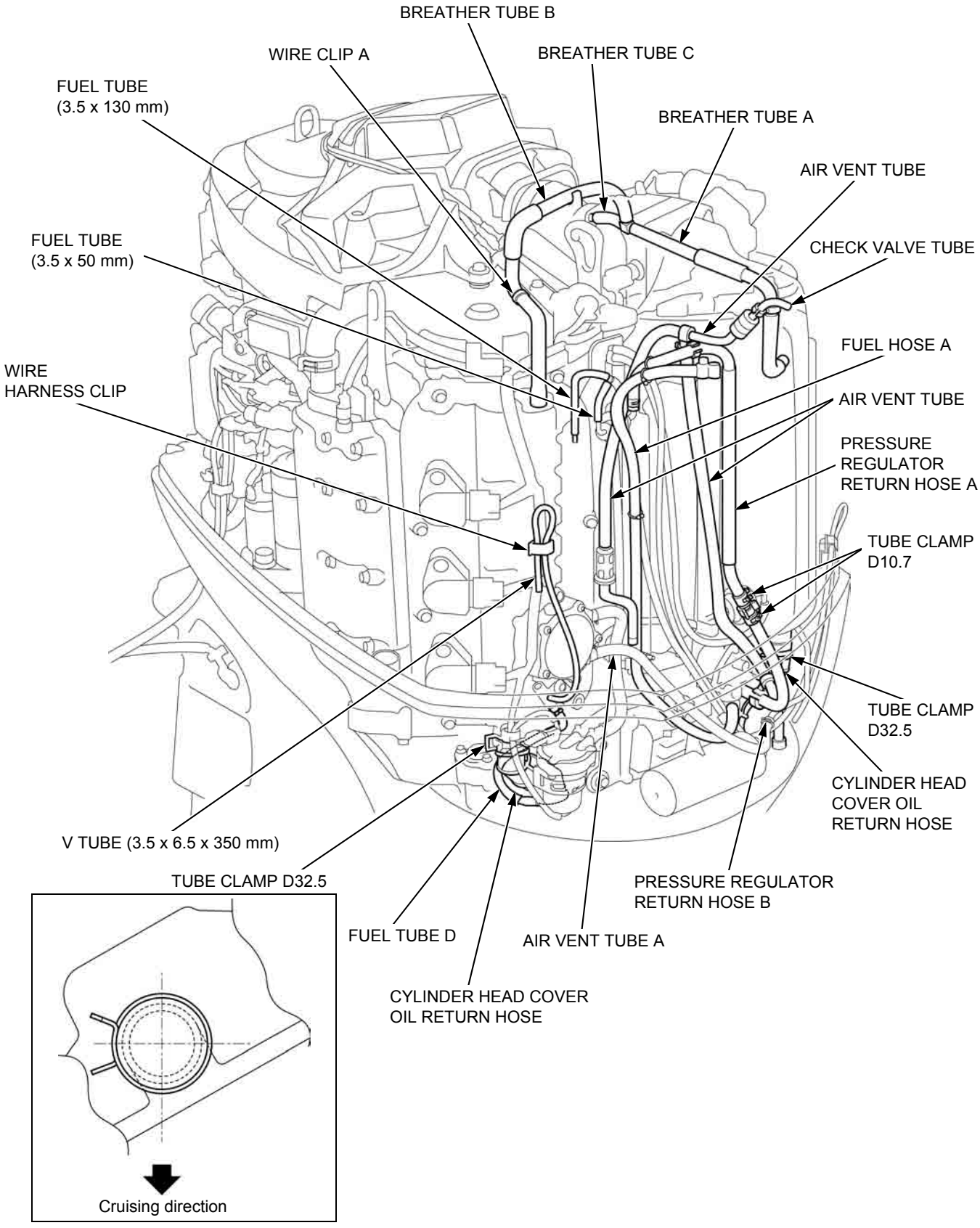

C
D
A
B
E
FUEL PUMP (HIGH PRESSURE SIDE)/
VAPOR SEPARATOR
F
G
H
I
FUEL PUMP (HIGH PRESSURE SIDE)/
VAPOR SEPARATOR
VACUUM TANK

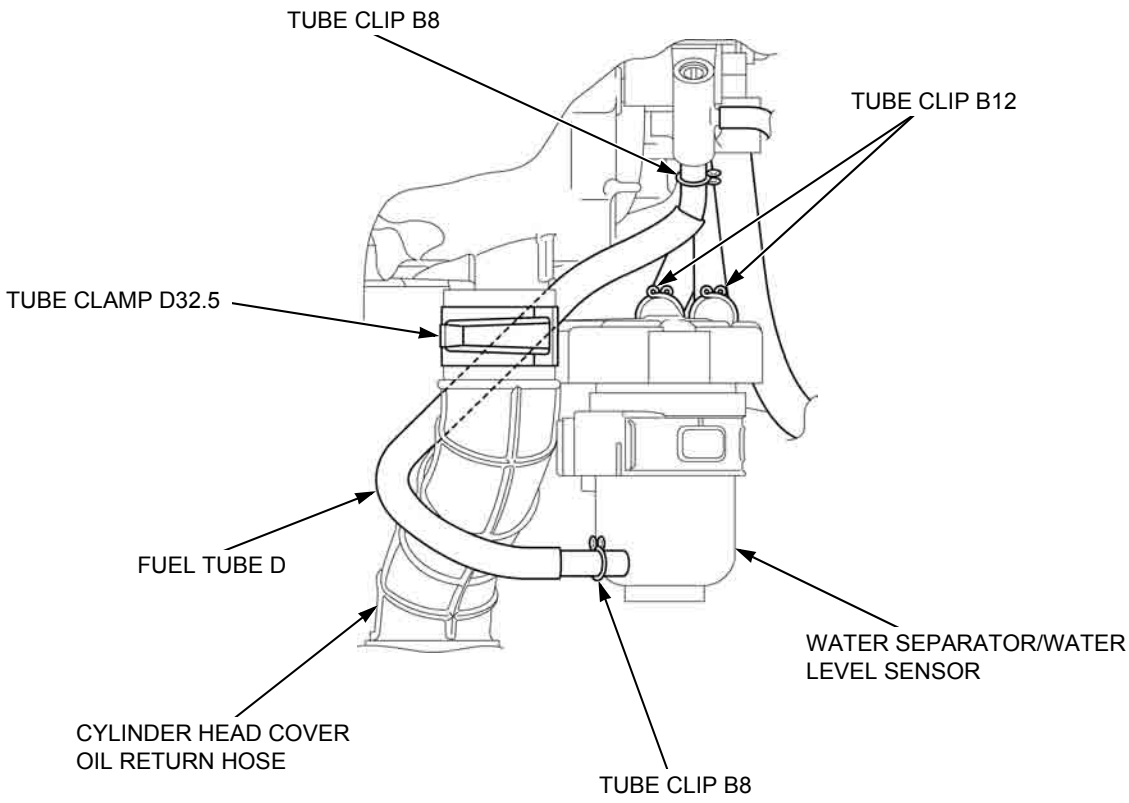

FUEL TUBE (3.5 x 130 mm)
FUEL TUBE (3.5 x 50 mm)
FUEL TUBE (3.5 x 600 mm)
FUEL JOINT HOSE
CHECK VALVE
FUEL TUBE D
IAB CONTROL DIAPHRAGM
FUEL TUBE G
FUEL TUBE (3.5 x 40 mm)
CHECK VALVE
FUEL PIPE

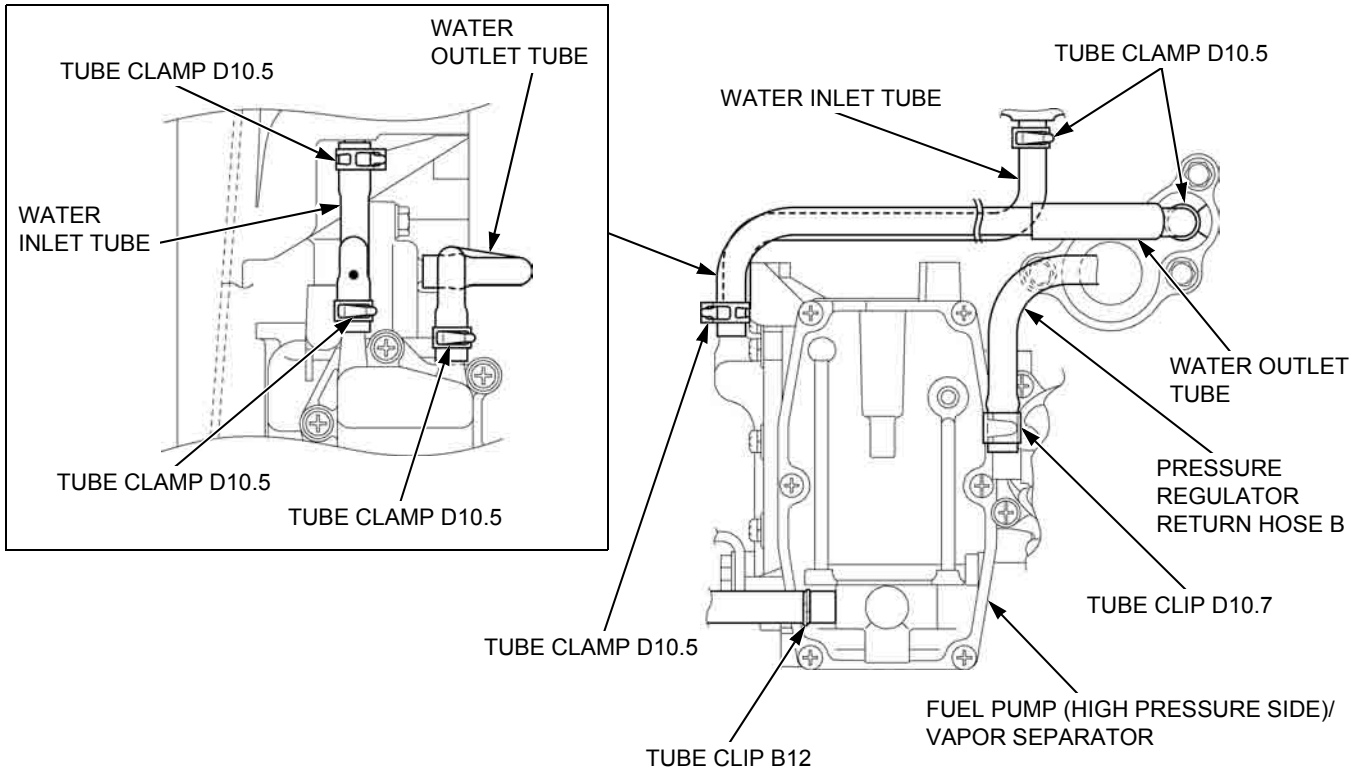

TUBE CLAMP D10.7
TUBE CLIP B12
TUBE CLIP B12
TUBE CLAMP D10.5
TUBE CLIP B8
TUBE CLAMP D10.5
HOSE CLIP
TUBE CLAMP D10.5
TUBE CLIP D12.0
TUBE CLAMP D32.5
120°
Cruising direction

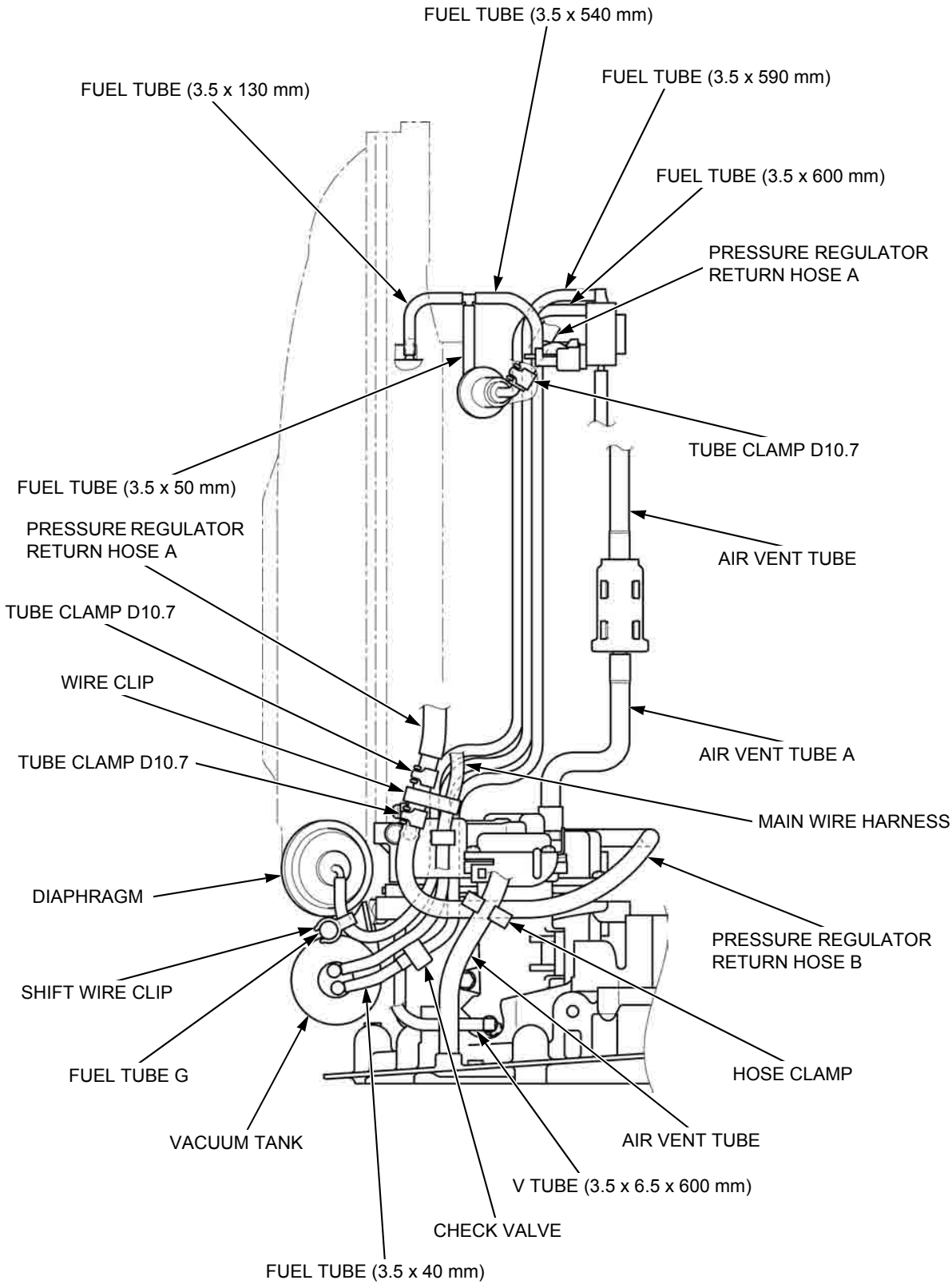

FUEL TUBE
(3.5 x 540 mm)
BREATHER TUBE C
BREATHER TUBE B
AIR VENT TUBE
BREATHER TUBE A
20 – 26 mm
(0.8 – 1.0 in)
WIRE CLIP
FUEL TUBE
(3.5 x 130 mm)
FUEL HOSE A
CHECK VALVE CLAMP
CHECK VALVE TUBE
WHITE
PAINTED
WHITE
PAINTED
CHECK VALVE
CABLE CLIP
HOSE CLAMP
TUBE CLIP D10.7
PRESSURE REGULATOR
RETURN HOSE A


60°
60°


BREATHER TUBE B
WIRE CLIP A
BREATHER TUBE C
FUEL TUBE
(3.5 x 130 mm)
BREATHER TUBE A
AIR VENT TUBE
FUEL TUBE
(3.5 x 50 mm)
CHECK VALVE TUBE
FUEL HOSE A
WIRE
HARNESS CLIP
AIR VENT TUBE
PRESSURE
REGULATOR
RETURN HOSE A
TUBE CLAMP
D10.7
TUBE CLAMP
D32.5
CYLINDER HEAD
COVER OIL
RETURN HOSE
V TUBE (3.5 x 6.5 x 350 mm)
TUBE CLAMP D32.5
PRESSURE REGULATOR
RETURN HOSE B
FUEL TUBE D
AIR VENT TUBE A
CYLINDER HEAD COVER
OIL RETURN HOSE
Cruising direction


TUBE CLIP B8
TUBE CLIP B12
TUBE CLAMP D32.5
FUEL TUBE D
WATER SEPARATOR/WATER LEVEL SENSOR
CYLINDER HEAD COVER OIL RETURN HOSE
TUBE CLIP B8


WATER OUTLET TUBE
TUBE CLAMP D10.5
WATER INLET TUBE
TUBE CLAMP D10.5
TUBE CLAMP D10.5
TUBE CLAMP D10.5
WATER INLET TUBE
TUBE CLAMP D10.5
WATER OUTLET TUBE
PRESSURE REGULATOR RETURN HOSE B
TUBE CLIP D10.7
TUBE CLAMP D10.5
FUEL PUMP (HIGH PRESSURE SIDE)/ VAPOR SEPARATOR
TUBE CLIP B12


FUEL TUBE (3.5 x 540 mm)
FUEL TUBE (3.5 x 590 mm)
FUEL TUBE (3.5 x 130 mm)
FUEL TUBE (3.5 x 600 mm)
PRESSURE REGULATOR
RETURN HOSE A
TUBE CLAMP D10.7
FUEL TUBE (3.5 x 50 mm)
AIR VENT TUBE
PRESSURE REGULATOR
RETURN HOSE A
TUBE CLAMP D10.7
WIRE CLIP
AIR VENT TUBE A
TUBE CLAMP D10.7
MAIN WIRE HARNESS
DIAPHRAGM
PRESSURE REGULATOR
RETURN HOSE B
SHIFT WIRE CLIP
FUEL TUBE G
HOSE CLAMP
VACUUM TANK
AIR VENT TUBE
V TUBE (3.5 x 6.5 x 600 mm)
CHECK VALVE
FUEL TUBE (3.5 x 40 mm)

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MAINTENANCE SCHEDULE

Item			REGULAR SERVICE PERIOD (2) Perform at every indicated month or operating hour interval, whichever comes first.							Refer to page
			Each use	After use	First month or 20 hrs.	Every 6 months or 100 hrs.	Every year or 200 hrs.	Every 2 years or 400 hrs.	Every 6 years or 1,200 hrs.	
Engine oil		Check level	○							3-4
		Change			○	○				3-5
Engine oil filter		Replace					○			3-6
Gear case oil		Change			○	○				3-7
Timing belt		Check-adjust					○			3-8
ACG belt		Check-adjust					○			3-9
Throttle linkage		Check-adjust			○	○				3-11
Valve clearance		Check-adjust					○			3-15
Spark plug	Standard	Check-Clean/ Replace				○				3-17
	Optional	Check					○			
		Replace						○		
Propeller and Cotter pin		Check	○							3-19
Anode metal (Outer side)		Check	○							3-19
Anode metal (Inner side) (5)		Check (*1)						○		3-20
		Check (*2)						○		3-21
		Replace (*3)							○	3-21
Idling speed		Check-adjust			○	○				3-22
Lubrication		Grease			○ (1)	○ (1)				3-25
Water separator		Check				○				3-27
Fuel filter (Low pressure side)		Check	○			○				3-27
		Replace						○		3-28
Fuel filter (High pressure side)		Check				○				3-29
		Replace						○		
Thermostat and thermostat cover		Check					○			11-19
Fuel line		Check	○ (6)							3-30
		Replace	Every 2 years (If necessary) (7)							
Battery and cable connection		Check level-tightness	○							3-31
Bolts and Nuts		Check-tightness			○	○				3-31
Crankcase breather tube		Check					○			3-31
Cooling water passages		Clean		○ (3)		○ (3)				3-32
Coolant leak		Check		○						–
Water pump		Check					○			3-32
Impeller housing		Check					○			3-32
Emergency stop switch		Check	○							3-33

Item		REGULAR SERVICE PERIOD (2) Perform at every indicated month or operating hour interval, whichever comes first.							Refer to page
		Each use	After use	First month or 20 hrs.	Every 6 months or 100 hrs.	Every year or 200 hrs.	Every 2 years or 400 hrs.	Every 6 years or 1,200 hrs.	
Engine oil leak	Check	○							–
Each operation part	Check	○							–
Engine condition (4)	Check	○							–
Power trim/tilt	Check				○				3-33
Shift control cable	Check-adjust				○				3-33

*1: Cylinder sleeve water jacket

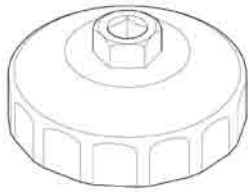
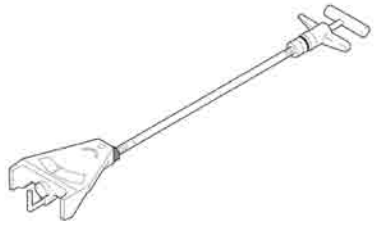
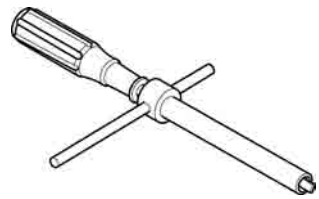
*2: Exhaust manifold

*3: Cylinder block

1. Lubricate more frequently when used in salt water.
2. For professional commercial use, log hours of operation to determine proper maintenance intervals.
3. When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.
4. Upon starting, check for unusual engine sounds and cooling water flowing freely from the check hole.
5. When there is 1/3 or more consumption, please exchange.
6. Check the fuel line for leaks, cracks, or damage. If it is leaking, cracked, or damaged, take it to your servicing dealer for replacement before using your outboard.
7. Check the fuel line for leaks, cracks, or damage. Replace the fuel line if there are signs of leaks, cracks, or damage.

TOOLS

LIST

Oil filter wrench, 65 mm 07HAA-PJ70101 or 07AAA-PLCA100	Belt tension gauge 07TGG-001000A or 07JGG-001010A	Valve adjust wrench, 10 mm 07908-5900000
		

ENGINE OIL LEVEL INSPECTION/OIL CHANGE

OIL LEVEL INSPECTION

Start the engine, let it warm up to the normal operating temperature, and stop the engine.

Place the outboard motor in the vertical position (with the engine level), and remove the engine cover.

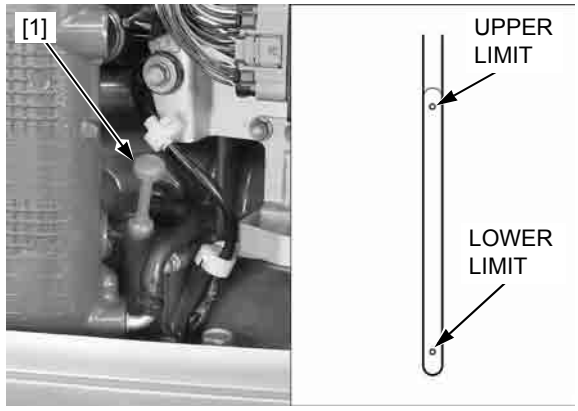
Remove the dipstick [1], and wipe it clean with a shop towel.

Insert the dipstick into the oil level pipe fully, then remove it and check the oil level.
Check whether the oil is dirty or has a milky color.

Replace the engine oil if it is dirty (page 3-5).

If the oil has a milky color, check the gaskets and replace them with new ones if necessary:

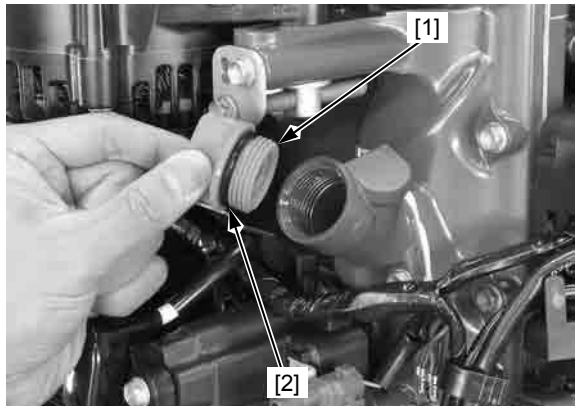
– Mount case gasket (page 13-4)
– Cylinder head gasket (page 14-22)
– Oil pump gasket (page 12-9)
– Oil case gasket (page 12-6)



If the oil level is low, remove the oil filler cap [1], and add the recommended oil to bring the oil level up to the upper level mark on the dipstick.

RECOMMENDED ENGINE OIL:
SAE 10W – 30
API Service classification SG, SH, or SJ

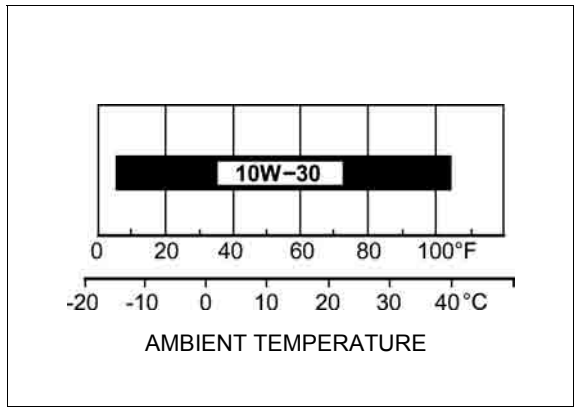
SUGGESTED ENGINE OIL:
Honda SAE 10W – 30 FC-W™



Check that the O-ring [2] is in good condition, replace it if necessary.

Install the oil filler cap and dipstick.

Install the engine cover.



OIL CHANGE

⚠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.

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

Place the outboard motor on a level surface and position the outboard motor vertically (with the engine level), and remove the engine cover.
Remove the oil filler cap.

Remove the special screw [1] and drain plug cover [2], and set the drain plug cover on the outboard motor as shown.

Place a suitable oil container next to the outboard motor.
Remove the oil drain plug bolt [3] and drain plug washer [4], and drain the engine oil.

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

After draining, set a new drain plug washer on 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)

Install the drain plug cover.
Tighten the special screw to the specified torque.

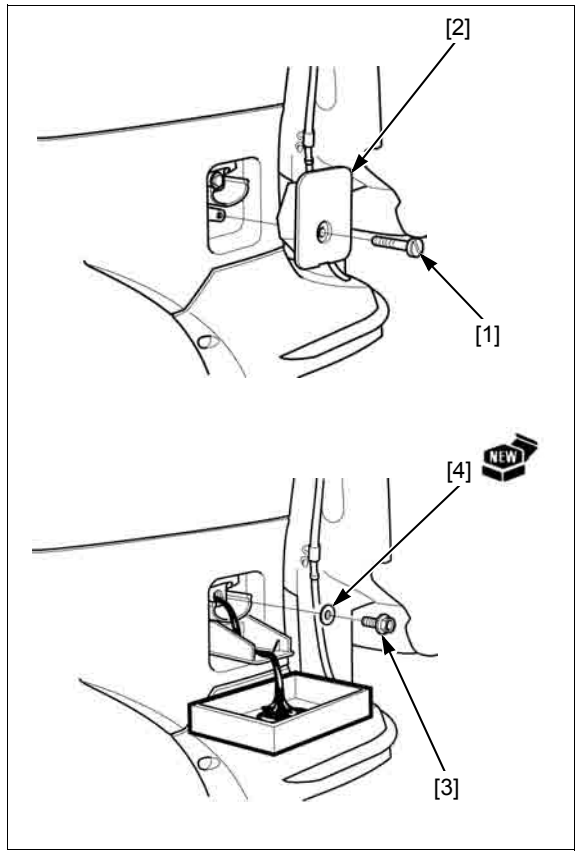
TORQUE: 6.4 N·m (0.65 kgf·m, 4.7 lbf·ft)

Refill with the recommended engine oil up to the upper level mark on the dipstick (page 3-4).

ENGINE OIL CAPACITY:
7.6 liters (8.0 US qt, 6.7 Imp qt)
With oil filter replacement:
7.8 liters (8.2 US qt, 6.9 Imp qt)

Install the oil filler cap and dipstick.

Install the engine cover.



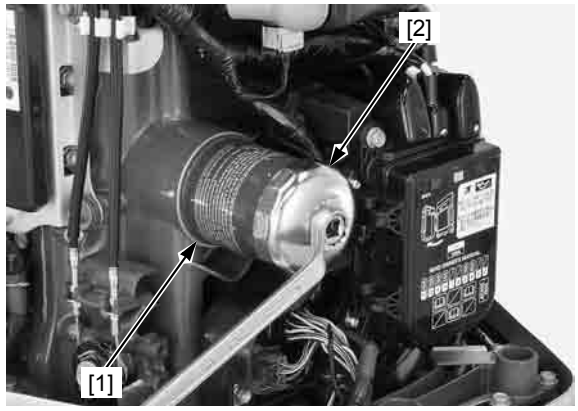
ENGINE OIL FILTER REPLACEMENT

Remove the engine cover.

Drain the engine oil as described in the oil change procedure (page 3-5).

Place a shop towel under the oil filter [1] to absorb any spilled oil, and then attach the special tool to the oil filter and remove it.

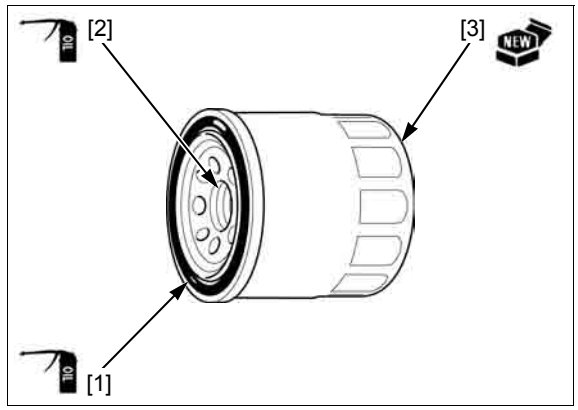
TOOL:
Oil filter wrench, 65 mm [2] 07HAA-PJ70101 or 07AAA-PLCA100



Apply clean engine oil to the O-ring [1] and threads [2] of a new oil filter [3].

Clean the filter mounting base, and coat the stud with clean engine oil.

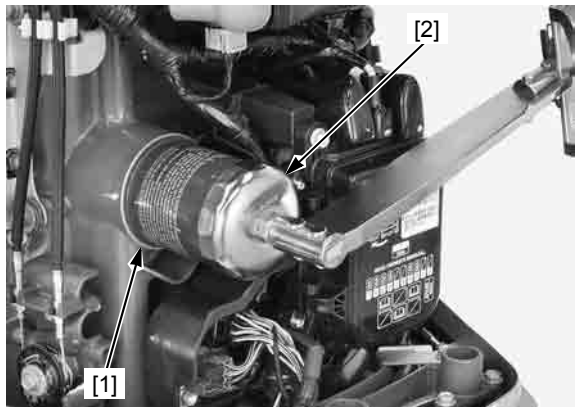
- Use only a Honda Genuine oil filter or a filter of equivalent quality specified for your model. Using the wrong Honda filter, or a non-Honda filter that is not of equivalent quality, may cause engine damage.



Screw on the filter [1] by hand first, and then screw it in to the specified torque using the special tool used for removing the filter.

TOOL:
Oil filter wrench, 65 mm [2] 07HAA-PJ70101 or 07AAA-PLCA100

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



Refill the engine with the specified amount of the recommended oil as described in the oil change procedure, and start the engine to warm it up to the normal operating temperature.

Stop the engine and check for leaks from the oil filter. Check the oil level (page 3-4).

Install the engine cover.

GEAR CASE OIL CHANGE

Place the outboard motor on a level surface and position the outboard motor vertically (with the engine level).
Tilt the outboard motor up slightly until the drain hole is at its lowest point.

Remove the oil drain plug bolt [1] and oil check bolt [2], then check for metal particles on the magnet end.

If there are metal particles on the magnet end of the drain plug bolt, disassemble and inspect the gear case assembly:

– Standard rotation type (page 16-8)
– Counter rotation type (page 17-7)

If there is water in the oil, the water will flow out first when the drain plug bolt is removed, or the oil will be a milky color. If water in the gear oil is detected, perform a gear case pressure check:

– Standard rotation type (page 16-45)
– Counter rotation type (page 17-42)

Tilt the outboard motor down until it is vertical.

Install an adapter (STV-334Y: commercially available) [3] and gear case filler (STV-S33: commercially available) [4] in the oil drain plug hole, and add gear oil until it flows out from the oil check bolt hole [5].

GEAR OIL CAPACITY:
1.47 liters (1.55 US qt, 1.29 Imp qt)

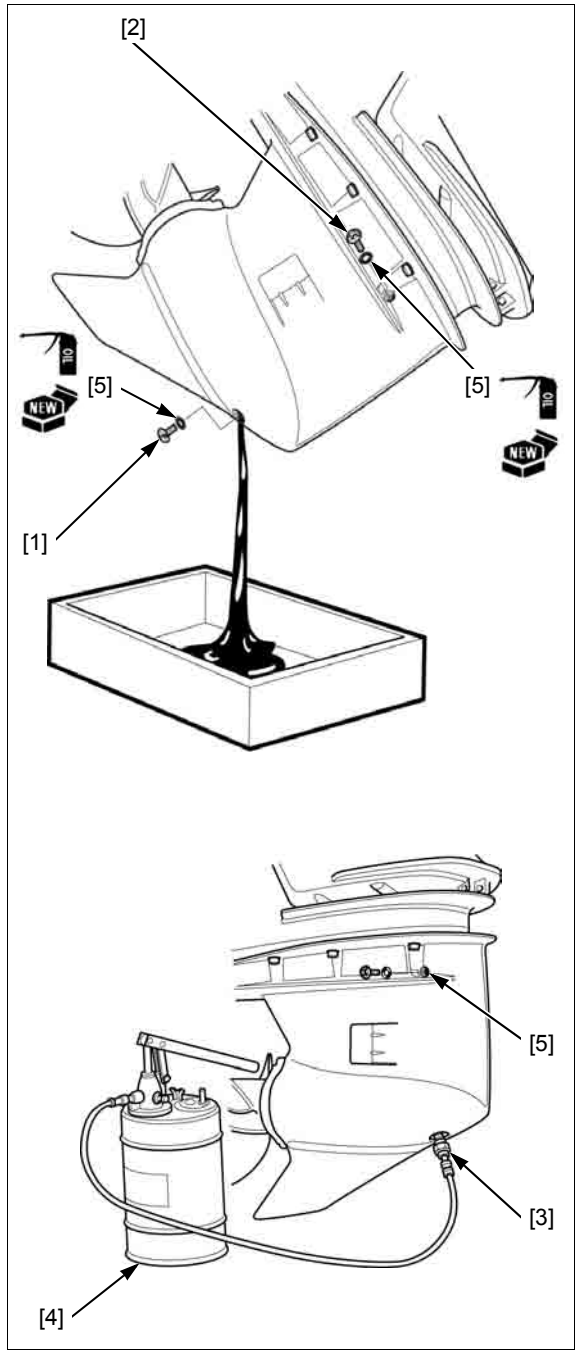
RECOMMENDED GEAR OIL:
MARINE SAE 90 Hypoid gear oil
API Service Classification (GL-4)

Apply gear oil to new O-rings [5] and install them on the oil level check bolt and drain plug bolt.

After adding gear oil, install the oil check bolt, and then remove the adapter and gear case filler.

Install and tighten the bolts to the specified torque.

TORQUE: 6.5 N·m (0.66 kgf·m, 4.8 lbf·ft)



TIMING BELT INSPECTION

INSPECTION

Remove the timing belt cover (page 14-6).

Check the timing belt [1] for wear and damage.
Replace the timing belt if it is worn or damaged.

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

Make any necessary repairs to eliminated the source of oil, grease, or coolant.

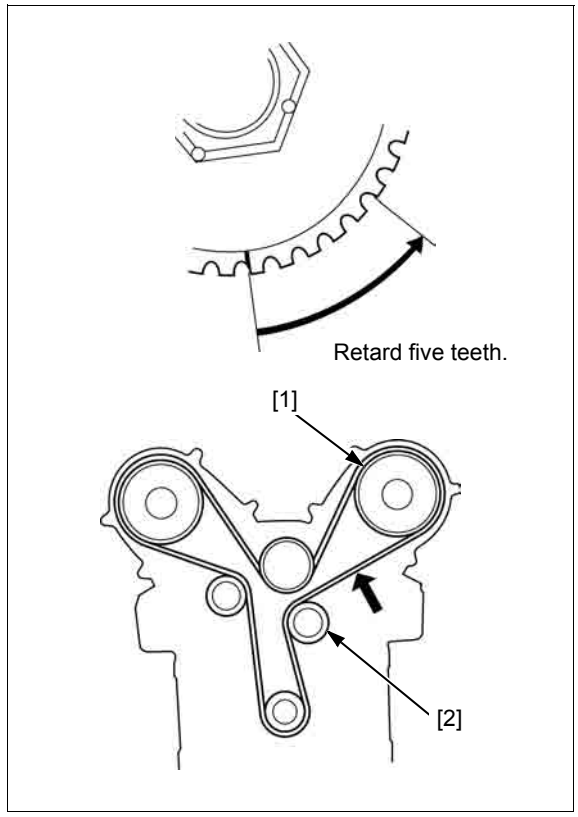


Turn the crankshaft clockwise to align the timing belt driven pulleys' No. 1 TDC marks with the marks of the timing belt back cover (page 3-15).

Slowly turn the crankshaft pulley counterclockwise five teeth of the timing belt driven pulley gear.

Apply a force of 19.6 N (2 kgf, 4.4 lbf), and measure the deflection at the mid point between the left side timing belt driven pulley [1] and idler pulley B [2].

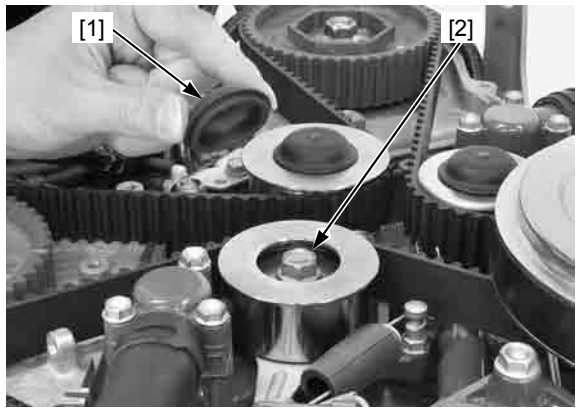
DEFLECTION: 8.8 – 9.7 mm (0.35 – 0.38 in)



ADJUSTMENT

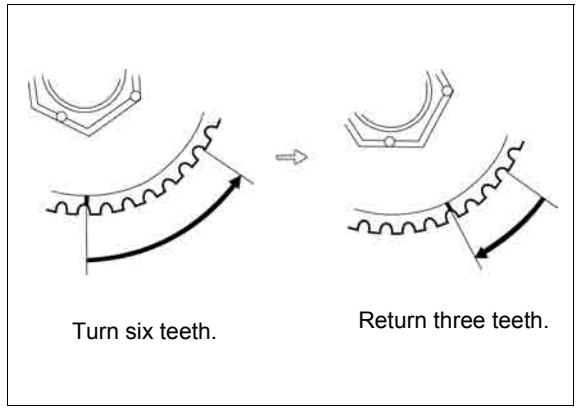
Turn the crankshaft clockwise to align the timing belt driven pulleys' No. 1 TDC marks with the marks of the timing belt back cover (page 3-15).

Remove the cap [1] and loosen the timing belt tensioner bolt [2] about one or one and a half turns.



Rotate the crankshaft pulley [1] counterclockwise by six teeth of the timing belt driven pulley gear, and then turn the crankshaft pulley clockwise by three teeth of the timing belt driven pulley gear.

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





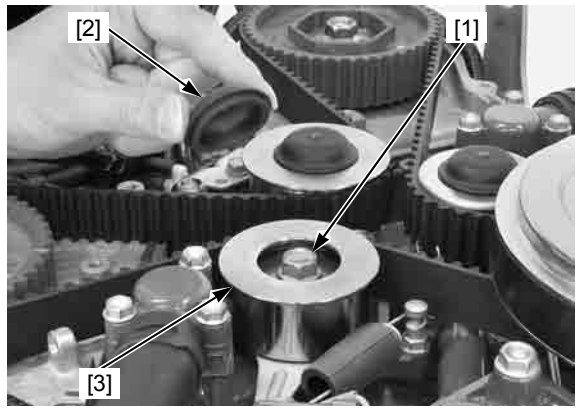
Tighten the timing belt tensioner bolt [1] to the specified torque.

TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)

Install the cap [2] on the timing belt tensioner pulley [3].

Check that the cap groove is installed securely.

Install the timing belt cover (page 14-18).



ALTERNATOR BELT INSPECTION

BELT INSPECTION

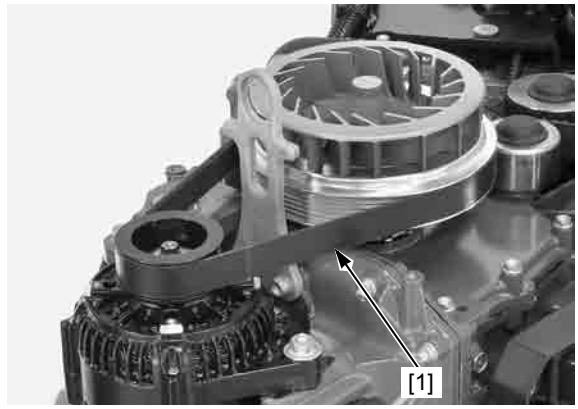
Remove the following:

– Engine cover
– Cooling fan cover (page 5-68)

Check the alternator belt [1] for wear and damage. Replace the belt if it is worn or damaged (page 7-5).

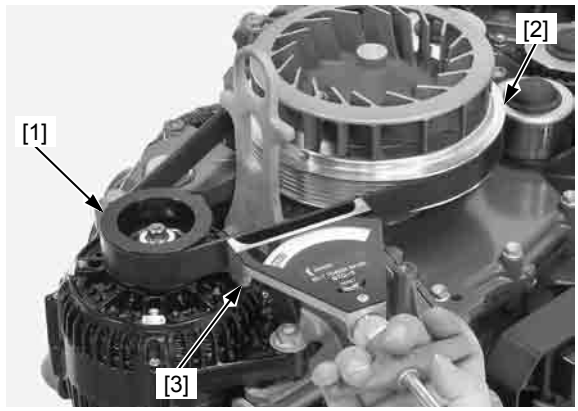
Check the alternator belt and the related parts for oil contamination, etc. If contaminated, clean the contaminated parts and replace the belt.

Check the alternator belt tension or deflection.



BELT TENSION INSPECTION USING BELT TENSION GAUGE

Set the special tool at the center between the alternator belt pulley [1] and the crankshaft pulley [2], and measure the belt tension.



TOOL:

Belt tension gauge [3]	**07TGG-001000A or 07JGG-001010A**

BELT TENSION:

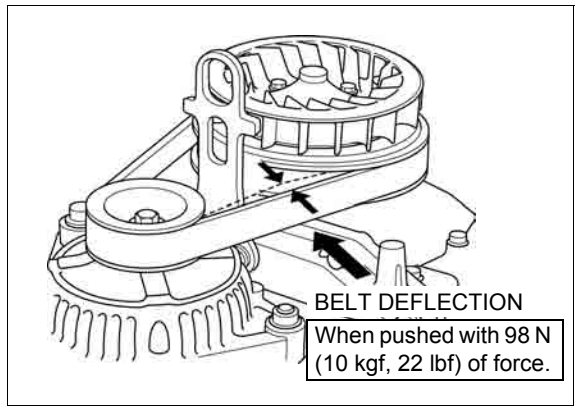
New belt*1 880 – 980 N (90 – 100 kgf, 198 – 220 lbf)
New belt*2 660 – 740 N (67 – 75 kgf, 148 – 166 lbf)
Used belt 490 – 590 N (50 – 60 kgf, 110 – 133 lbf)

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

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

BELT DEFLECTION INSPECTION

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:

New belt*1 3.20 – 3.40 mm (0.126 – 0.134 in)
New belt*2 4.2 – 4.8 mm (0.17 – 0.19 in)
Used belt 5.4 – 6.3 mm (0.21 – 0.25 in)

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

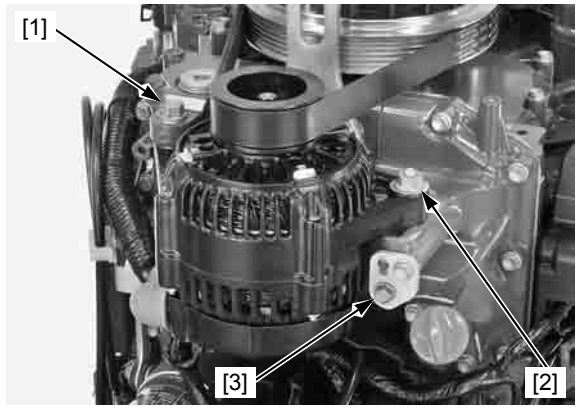
If the belt deflection is outside the specification, adjust the belt tension.

BELT TENSION ADJUSTMENT

1. If the belt tension or the belt deflection is out of the specification, loosen the alternator bolt [1] and alternator nut [2] and adjust the belt tension or deflection by turning the special adjuster bolt [3] right or left.
2. After adjustment, tighten the alternator bolt and the alternator nut in this order to the specified torque.

   TORQUE:
   Alternator bolt: 44 N·m (4.5 kgf·m, 32 lbf·ft)
   Alternator nut: 26 N·m (2.7 kgf·m, 19 lbf·ft)

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



THROTTLE LINKAGE INSPECTION/ ADJUSTMENT

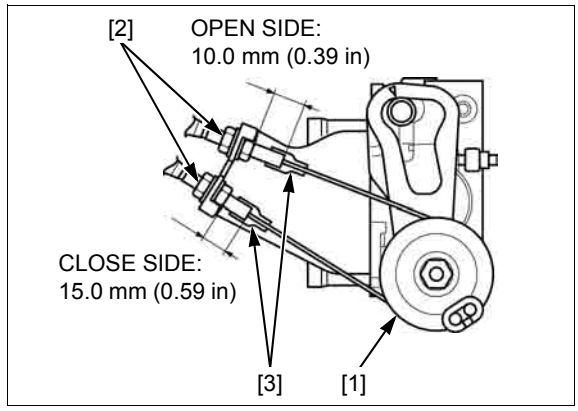
STANDARD INSPECTION/ ADJUSTMENT

1. Remove the engine cover.
2. Check the throttle cable length of the sections shown at the throttle cam [1] open side and the close side respectively.

   OPEN SIDE: 10.0 mm (0.39 in)
   CLOSE SIDE 15.0 mm (0.59 in)

3. If the measurement is above or below the specification, adjust by loosening the adjusting nut [2] at the throttle cam open side or the close side as needed.
   After adjusting, tighten the adjusting nut to specified torque.

   TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



NOTICE

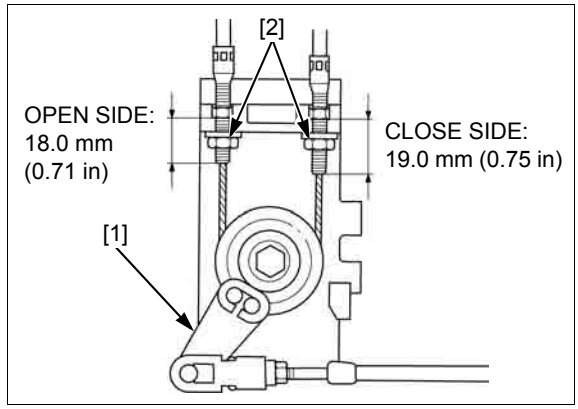
Install the water proof cap [3] securely after tightening the adjust nut.

4. Measure the throttle cable length from the end of the threaded part to the lock nut end.
   Measure at the throttle arm [1] open side and the close side respectively.

   OPEN SIDE: 18.0 mm (0.71 in)
   CLOSE SIDE 19.0 mm (0.75 in)

5. If the measurement is above or below the specification, adjust by loosening the adjusting nut [2] at the open side or the close side as needed.
   After adjusting, tighten the adjusting nut to specified torque.

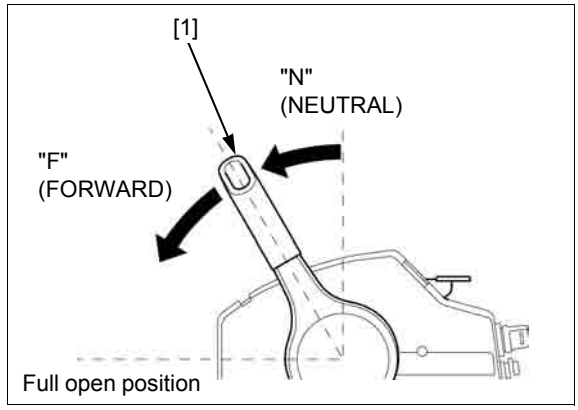
   TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



6. Move the remote control lever [1] to the "F" (Forward) full open position.
   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.

NOTICE

Do not move the remote control lever with force or damage to the gearshift system can result.

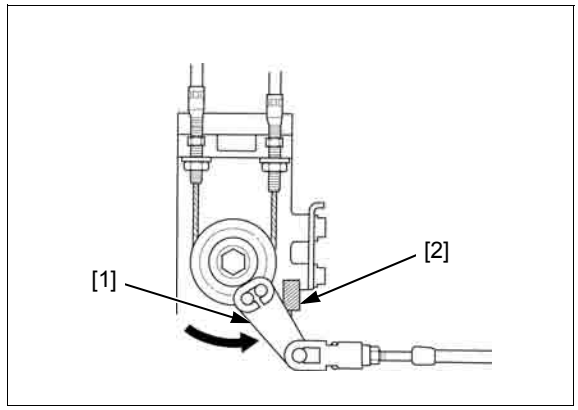


7. Check whether the throttle arm [1] is in contact with the full open position stopper [2].

   If it is not, adjust the throttle arm (page 3-13).

NOTE:

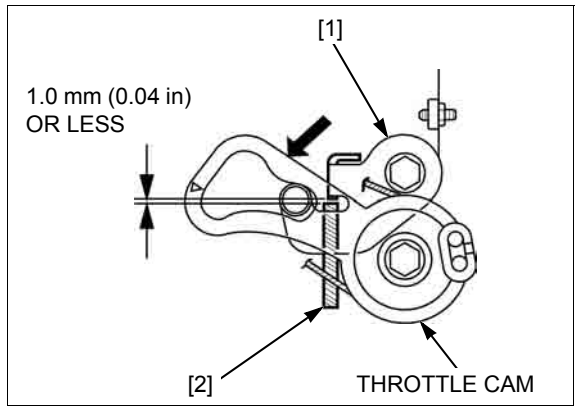
- Make sure the shift control cable is adjusted properly (page 20-10).



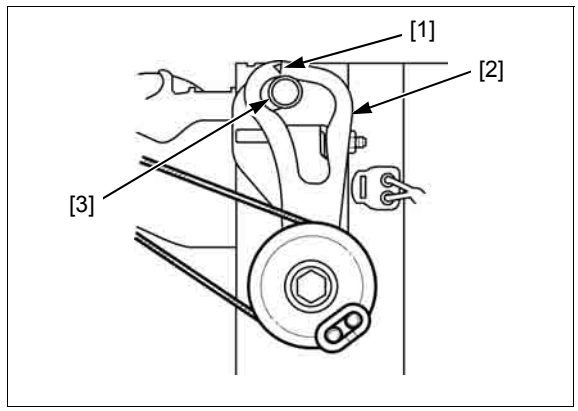
8. Check whether the throttle lever [1] of the throttle body is in the full open position.
9. With the throttle arm in contact with the full open position stopper, measure the clearance between the throttle lever of the throttle body assembly and the full open position stopper [2]. It should be 1.0 mm (0.04 in) or less.

   If adjustment is required, move the remote control lever to the full throttle position and loosen the OPEN and CLOSE side lower adjusting nuts.

   Move the OPEN side adjusting nuts up or down until a 1.0 mm (0.04 in) gap or less is obtained between the throttle lever and the full throttle stop with the remote control lever in the full throttle position.



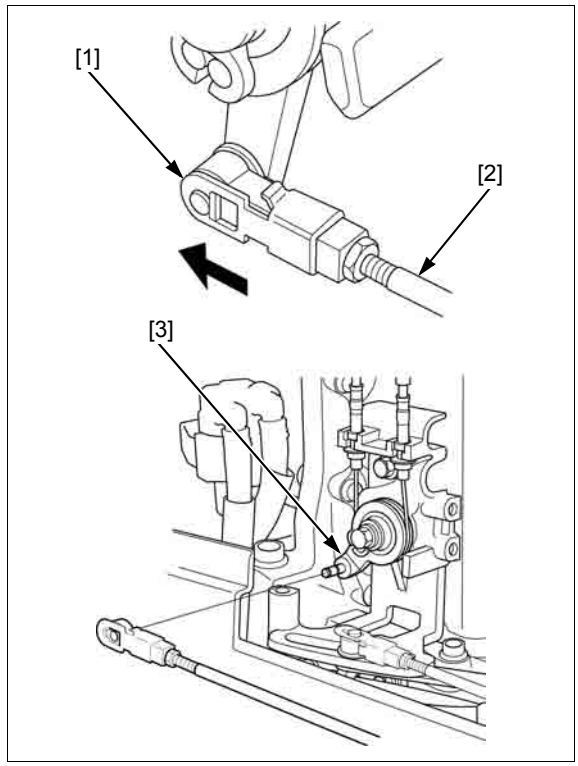
10. When you return the remote control lever to the "N" (Neutral) position, check whether the "△" mark [1] on the throttle cam [2] aligns with the center of the throttle cam roller [3].
    If it is not, adjust the throttle cam (page 3-14).



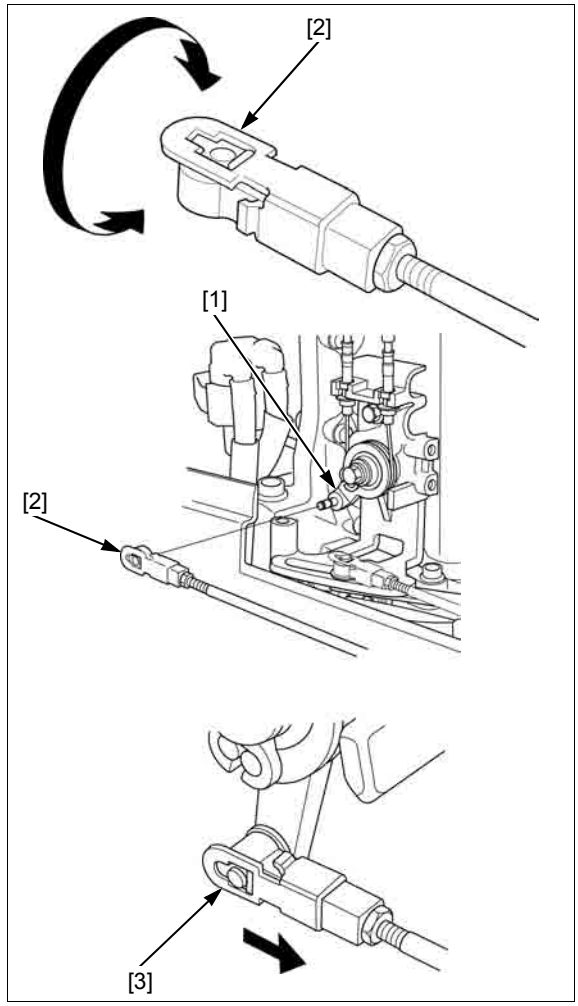
THROTTLE ARM ADJUSTMENT

If the throttle arm does not fully open

Slide the lock plate [1] backward and remove the throttle control cable [2] from the throttle arm [3].



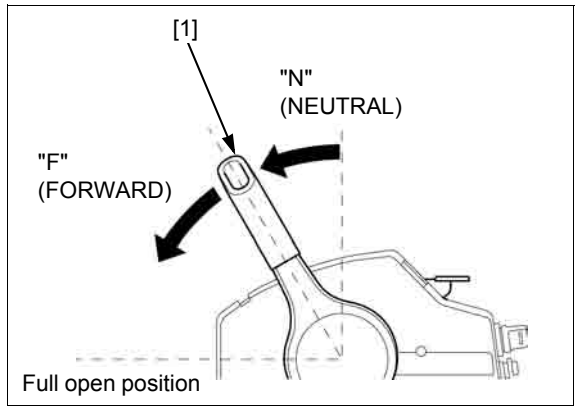
Move the remote control lever to the full throttle position.
Move the throttle arm [1] to the full throttle position and hold it there.
Twist the shift pivot [2] so it can be installed over the throttle arm easily.
Lock the lock plate [3] by sliding it to the groove of the shift link.



Move the remote control lever [1] to the "F" (Forward) full open position.

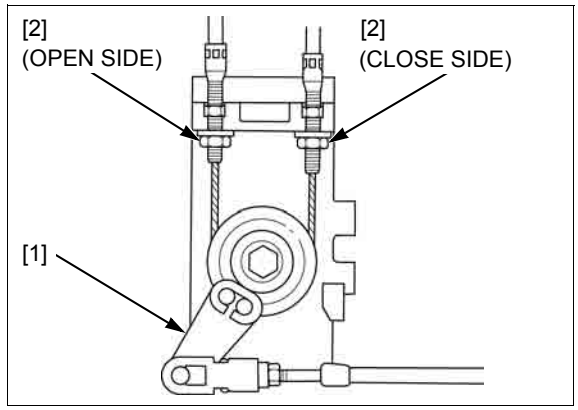
Check whether the throttle arm is in contact with the full open position stopper as shown on page 3-12.

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



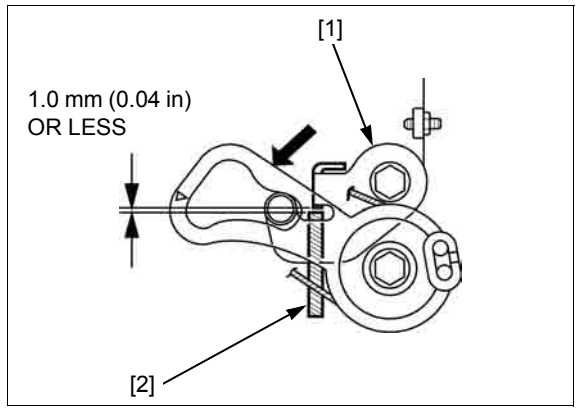
If the throttle cam does not fully open

At the throttle arm [1] side, loosen the adjusting nuts [2] of the throttle cables.



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

Turning the adjusting nut at the open side of the throttle cable in or out to adjust the gap between the throttle lever [1] of the throttle body assembly and the full open position stopper [2] to 1.0 mm (0.04 in) or less.

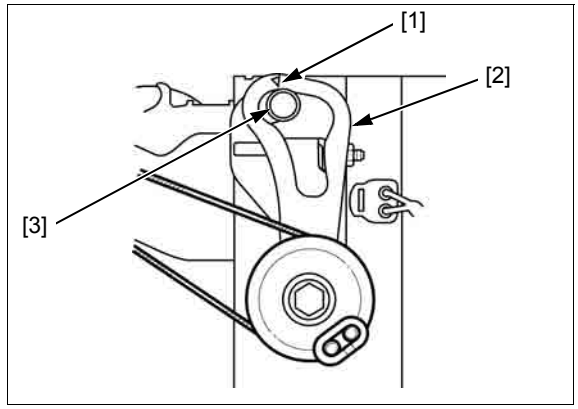


Move the remote control lever to the "N" (Neutral) position.

Check whether the "△" mark [1] on the throttle cam [2] aligns with the center of the throttle cam roller [3].
If the mark is out of alignment, adjust by turning the adjusting nut at the open side of the throttle cable.

After adjustment, tighten the adjusting nuts at the open side and the close side of the throttle cable to the specified torque.

TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



VALVE CLEARANCE

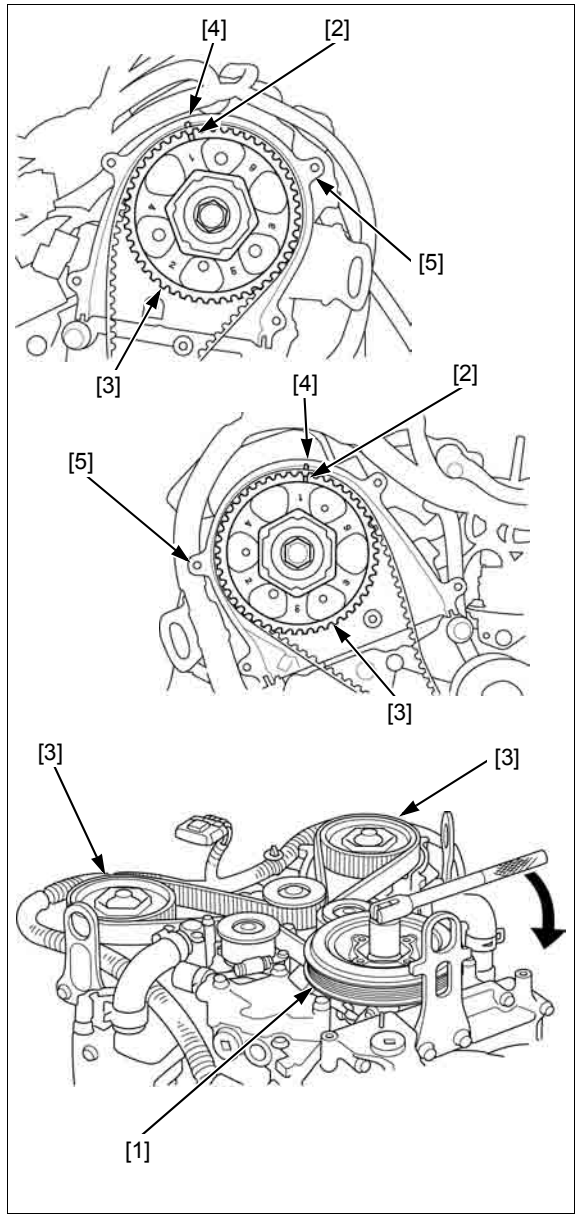
- Valve clearance inspection and adjustment must be performed with the engine cold.

1. Remove the following:

– Cylinder head cover (page 14-19)
– Timing belt covers (page 14-6)

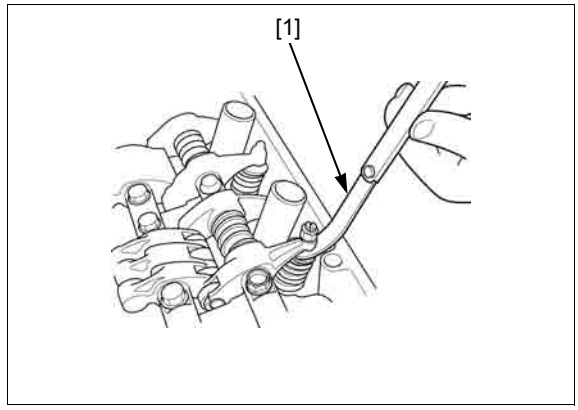
2. Manually turn the crankshaft pulley [1] clockwise, and align the No. 1 TDC (top dead center) marks [2] on both timing belt driven pulleys [3] with the marks [4] on the timing belt back covers [5].

- Do not turn the crankshaft pulley counterclockwise.



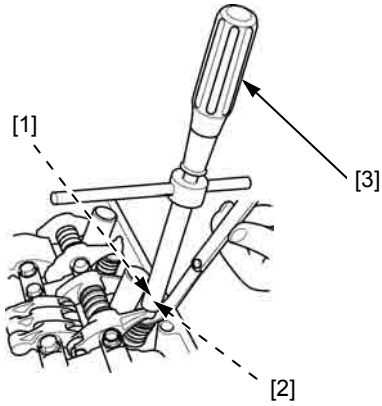
3. With the engine in the position described in step 2, check the intake and exhaust valve clearance on No. 1 cylinder with a feeler gauge [1] and adjust if necessary.

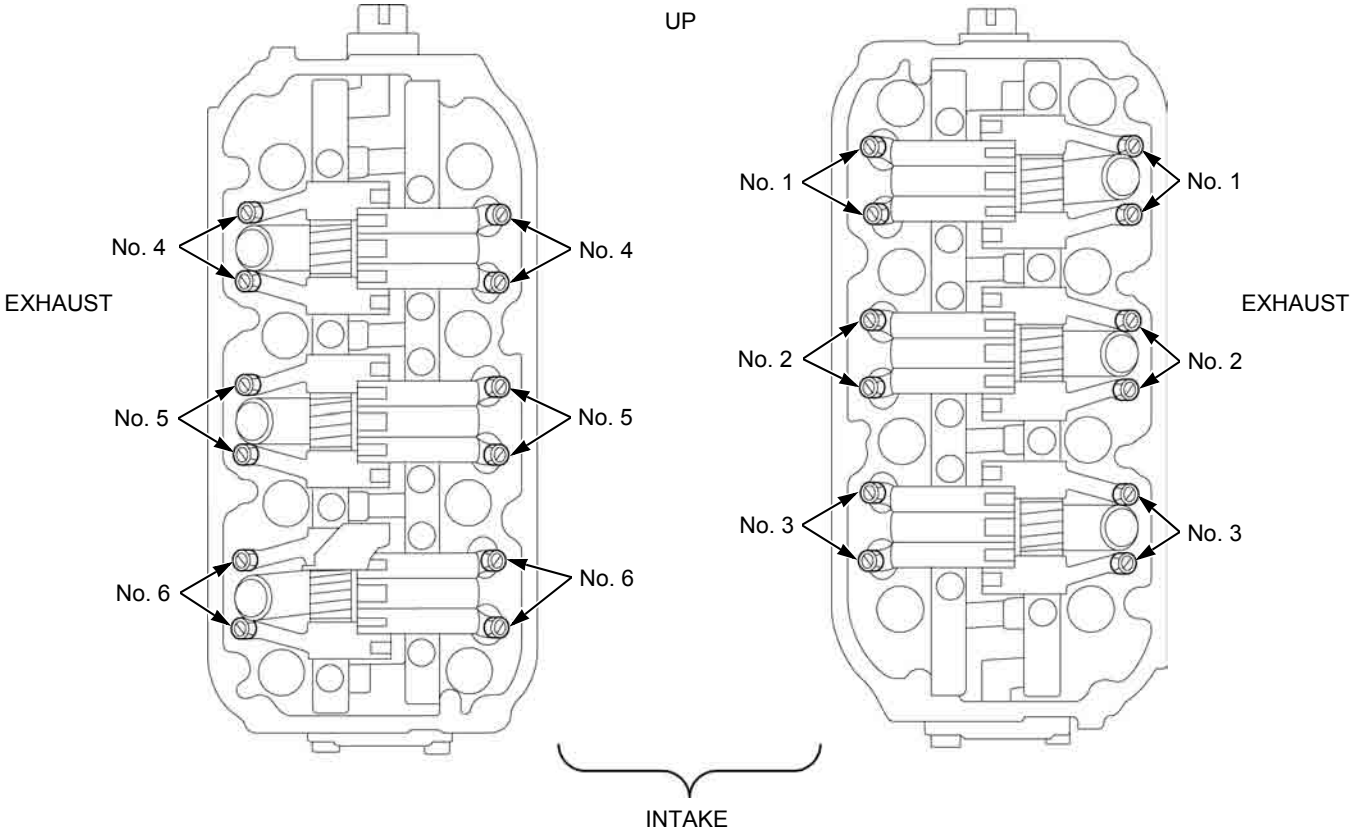
VALVE CLEARANCE:
IN: 0.20 – 0.24 mm (0.008 – 0.009 in)
EX: 0.28 – 0.32 mm (0.011 – 0.013 in)



4. If adjustment is necessary, loosen the valve adjusting lock nut [1] using the special tool, and adjust the intake and exhaust valve clearance by turning the valve adjusting screw [2] right or left.

TOOL:
Valve adjustment wrench, 07908-5900000
10 mm [3]

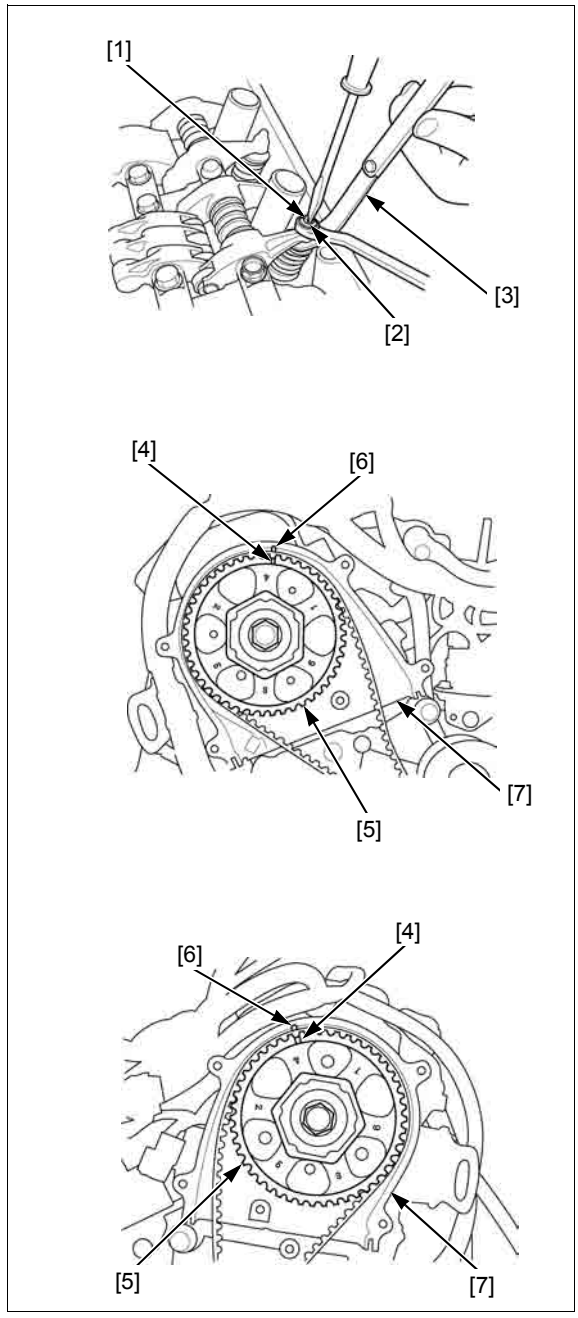




5. After adjustment, secure the adjusting screw [1] and loosely tighten the lock nut [2].
6. Recheck the valve clearances using a feeler gauge [3], and tighten the valve adjusting lock nut to the specified torque.

   TORQUE: 20 N·m (2.0 kgf·m, 15 lbf·ft)

7. After adjusting the intake and exhaust valve clearance of the No. 1 cylinder, turn the crankshaft pulley clockwise and align the No. 4 TDC marks [4] on the timing belt driven pulleys [5] with the marks [6] on the timing belt back covers [7].
   In this position, No. 4 piston is at TDC of its compression stroke. With the engine in this position, adjust the intake and exhaust valve clearance of the No. 4 cylinder.
8. After adjusting the intake and exhaust valve clearances of the No. 4 cylinder, adjust the intake and exhaust valve clearance of the No. 2, No. 5, No. 3, and No. 6 cylinders in this order using the same procedures from steps 2 through 6.



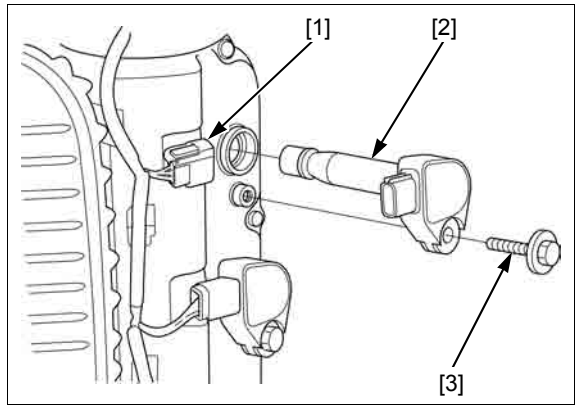
SPARK PLUG INSPECTION

Remove the engine cover.

Remove the plug maintenance cover (page 6-4).

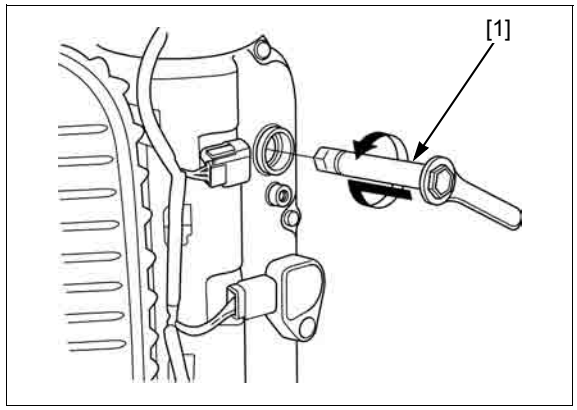
Disconnect the 3P connector [1] from the direct ignition coil [2].

Remove the bolt/washers [3] and direct ignition coils. Take care not to impact or drop the direct ignition coils. Replace the direct ignition coil if dropped.



Clean any dirt from around the spark plug bases.

Use a spark plug wrench [1] and remove the spark plugs.



Standard: If the spark plug is dirty, clean the spark plug using a spark plug cleaner.

Visually inspect the spark plug. Replace the plug if it is heavily fouled or the insulator [1] is cracked or chipped.

Check the following and replace if necessary.

– Insulator and sealing washer [2] for damage
– Center electrode [3] and side electrode [4] for wear
– Burning condition, coloration

RECOMMENDED SPARK PLUG:
Standard: ZFR6K-11E (NGK)
Optional Iridium: IZFR6K-11E (NGK)

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

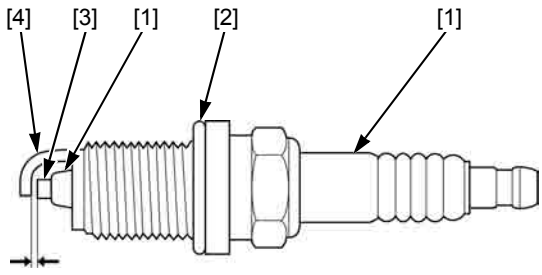
PLUG GAP: 1.00 – 1.10 mm (0.039 – 0.043 in)

SERVICE LIMIT:
Optional Iridium: 1.30 mm (0.051 in)

Standard: If the measurement is out of the specification, adjust by bending the side electrode.

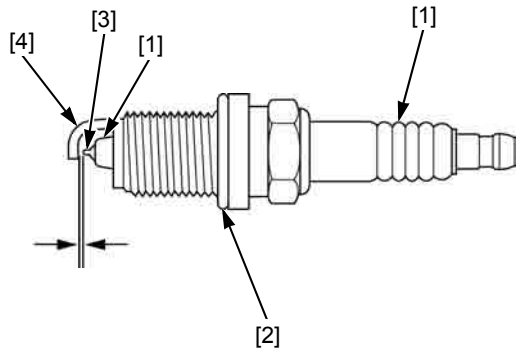
Optional Iridium: If the gap is out of specification, replace the plug. Do not adjust the plug gap.

Standard:



1.00 – 1.10 mm (0.039 – 0.043 in)

Optional Iridium:



NOTICE

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

Install and hand tighten the spark plugs to the cylinder head, then tighten the spark plugs to the specified torque.

TORQUE: 18 N·m (1.8 kgf·m, 13 lbf·ft)

Install the direct ignition coils and bolt/washers.

Connect the 3P connector to the direct ignition coil.

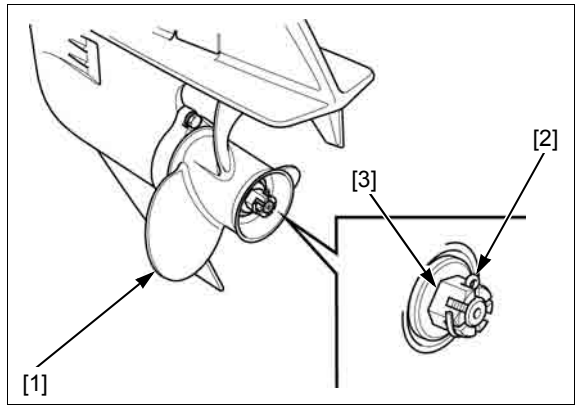
Install the plug maintenance cover (page 6-4) and engine cover.

PROPELLER AND COTTER PIN INSPECTION

Check the propeller [1] for bends or damage.
Make sure the split pin [2] ends are bent as shown to lock the castle nut [3].

Replace the propeller or split pin, if necessary:

– Standard rotation type (page 16-6)
– Counter rotation type (page 17-5)



ANODE INSPECTION (OUTER SIDE)

GEAR CASE

Check the anode [1] for excessive wear or corrosion.
Replace the anode with a new one if it is corroded excessively:

– Standard rotation type (page 16-7)
– Counter rotation type (page 17-6)



Remove the trim tab: Standard rotation type (page 16-8).

Remove the gear case cover: Counter rotation type (page 17-7).

Check the continuity between the anode [1] and gear case trim tab installation area [2].

Remove the corrosion as it prevents the continuity.

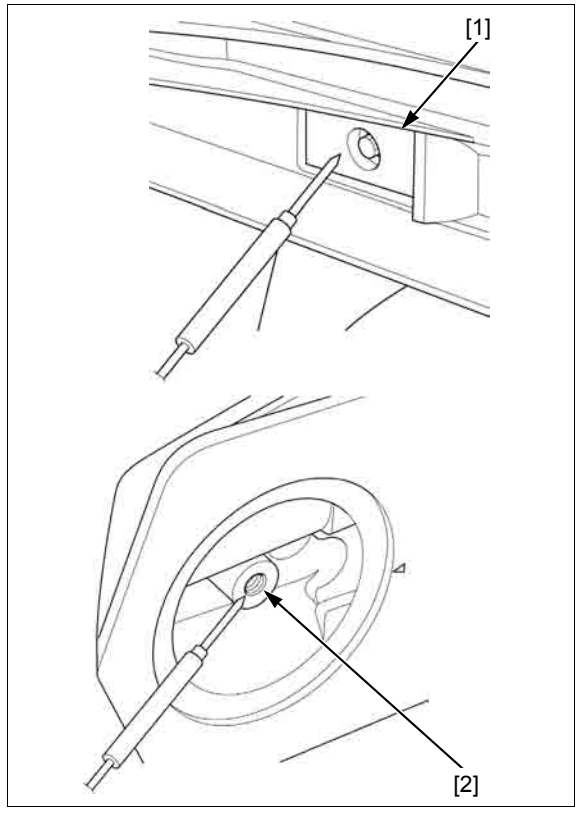
Perform continuity inspection between the anode metal surface without corrosion and the bare aluminum surface of the gear case trim tab installation area.

If there is no continuity, remove the anode metal:

– Standard rotation type (page 16-7)
– Counter rotation type (page 17-6)

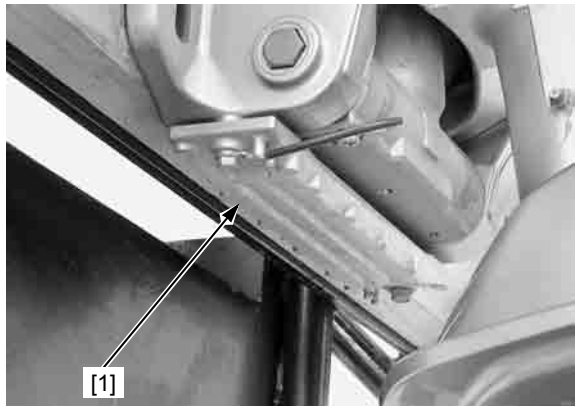
Remove the corrosion from the bolt, nut, anode metal, and anode metal installation surface.

Install the anode metal and recheck the continuity.
If there is no continuity, replace the anode metal with a new one and recheck.



STERN BRACKET

Check the anode [1] for excessive wear or corrosion. Replace the anode with a new one if it is corroded excessively (page 19-6).



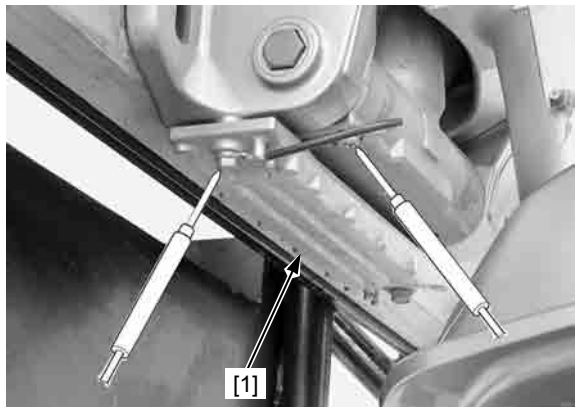
Check the continuity between the anode [1] and stern bracket or power trim/tilt.

Remove the corrosion as it prevents continuity.

Perform continuity inspection between the anode metal surface without corrosion and the bare aluminum surface of the stern bracket or the power trim/tilt.

If there is no continuity, remove the anode metal (page 19-6) and remove the corrosion from the bolt, anode metal, and anode metal installation surface.

Install the anode metal and recheck the continuity. If there is no continuity, replace the anode metal with a new one and recheck.



ANODE METAL INSPECTION (INNER SIDE)

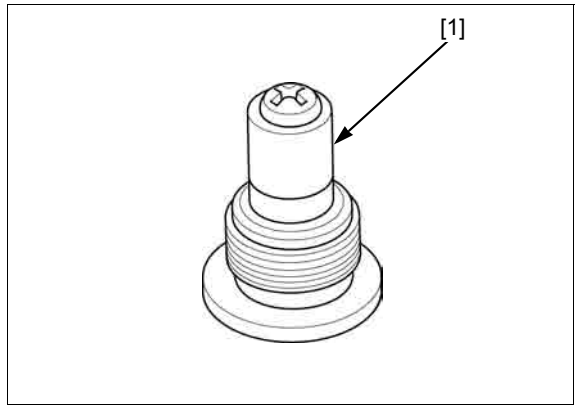
CYLINDER SLEEVE WATER JACKET

Remove the cylinder sleeve water jacket anode (page 11-15).

Check the anode [1] for excessive wear or corrosion.

If the anode is worn to less than 2/3 of its original length or the sealing bolt is rusty or damaged, replace the anode assembly as a set.

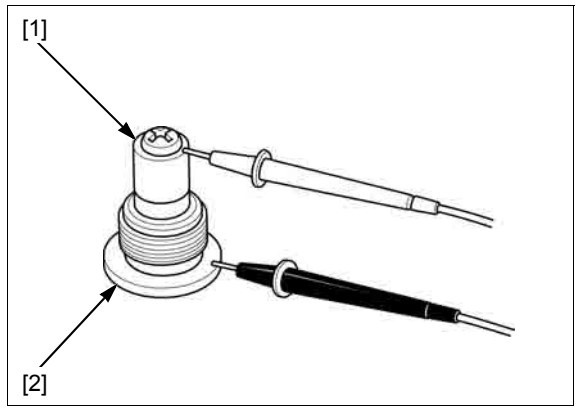
If the sealing bolt is rusty or damaged, replace the screw, anode metal and sealing bolt with new one as a set.



Check the continuity between the anode [1] and sealing bolt [2] surface.

Remove the corrosion and sealing tape as it prevents continuity. Use a soft resin brush or shop towel to clean the surface. Using a wire brush or sandpaper will damage the coating of the sealing bolt, resulting in corrosion.

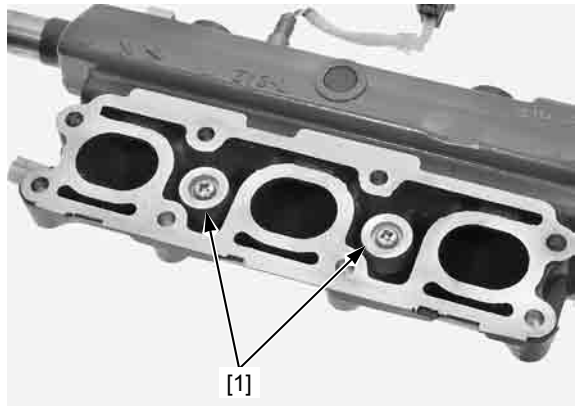
If there is continuity, reinstall the anode (page 11-15). If there is no continuity, replace the anode assembly as a set.



EXHAUST MANIFOLD

Remove the exhaust manifold (page 5-95).

Check the anode [1] for excessive wear or corrosion.



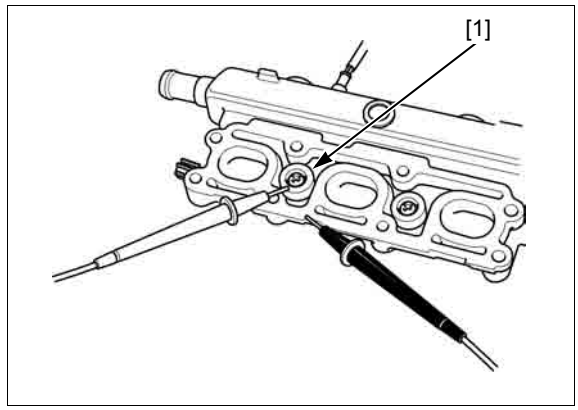
NOTICE

If the anode is worn to less than 2/3 of its original length, replace it with a new one.

Check the continuity between the anode [1] and exhaust manifold.

Remove the corrosion as it prevents continuity.

Perform the continuity inspection between the anode metal surface without corrosion and the bare aluminum surface of the exhaust manifold.

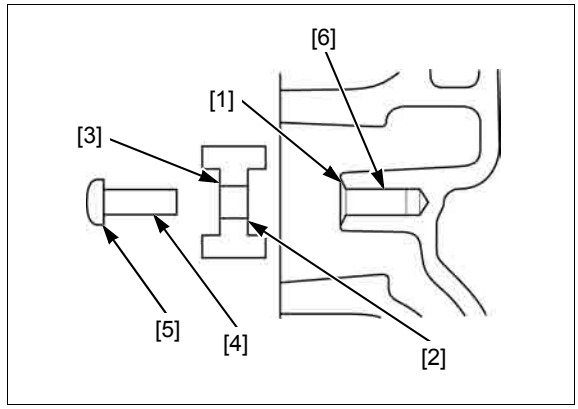


If there is no continuity, remove the anode metal and remove the corrosion of the following parts using sandpaper.

- Exhaust manifold (anode attaching area) [1]
- Anode metal (exhaust manifold attaching area) [2]
- Anode metal (screw head attaching area) [3]
- Screw (male screw area) [4]
- Screw (Anode metal attaching area) [5]

Clean the exhaust manifold (female nut area) [6] using an M6 x 1.0 tap.

Install the anode metal and recheck continuity.
If there is no continuity, replace the anode metal with a new one and recheck.



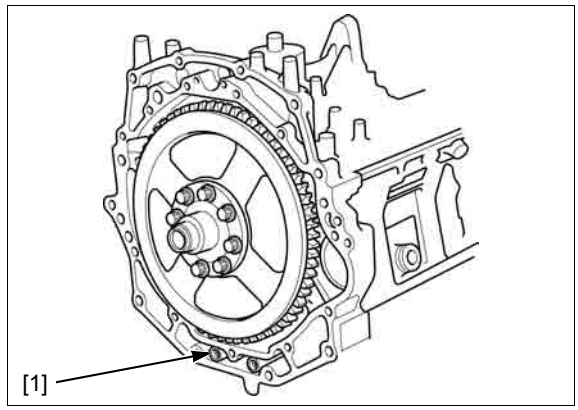
CYLINDER BLOCK

Remove the oil pump (page 12-9).

Check the anode [1] for excessive wear or corrosion.

NOTICE

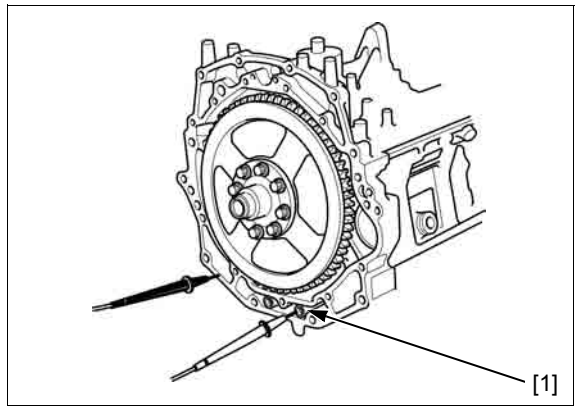
If the anode is worn to less than 2/3 of its original length, replace it with a new one.



Check the continuity between the anode [1] and cylinder block.

Remove the corrosion as it prevents continuity.

Perform continuity inspection between the anode metal surface without corrosion and the bare aluminum surface of the cylinder block.

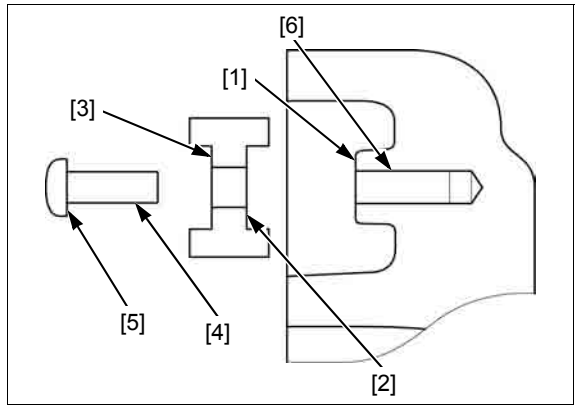


If there is no continuity, remove the anode metal (page 15-4) and remove the corrosion of the following parts using sandpaper.

– Cylinder block (anode attaching area) [1]
– Anode metal (cylinder block attaching area) [2]
– Anode metal (screw head attaching area) [3]
– Screw (male screw area) [4]
– Screw (Anode metal attaching area) [5]

Clean the cylinder block (female nut area) [6] using an M5 x 0.8 tap.

Install the anode metal (page 15-4) and recheck continuity.
If there is no continuity, replace the anode metal with a new one and recheck.



IDLE SPEED INSPECTION/ ADJUSTMENT

INSPECTION

Check the following before starting the idle speed inspection.

– Battery must be in good condition
– Boat equipment (electrical loads) must be removed
– Spark plug inspection (page 3-17)
– MIL must be OFF

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

Remove the engine cover.

Remove the propeller. Set the outboard motor gear case in a test tank filled with water.

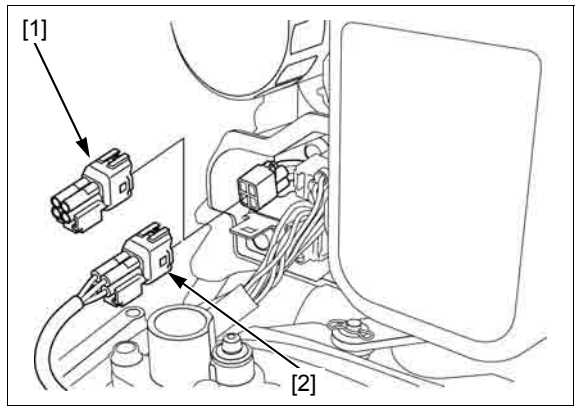
USING THE HDS

Remove the dummy connector [1] from the DLC and connect the HDS [2].

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

SPECIFIED IDLE SPEED (AT NEUTRAL):
650 ± 50 min^{-1} (rpm)

- If the idle speed is outside the specification, adjust it (page 3-23).



USING A COMMERCIALLY AVAILABLE DIGITAL MULTIMETER

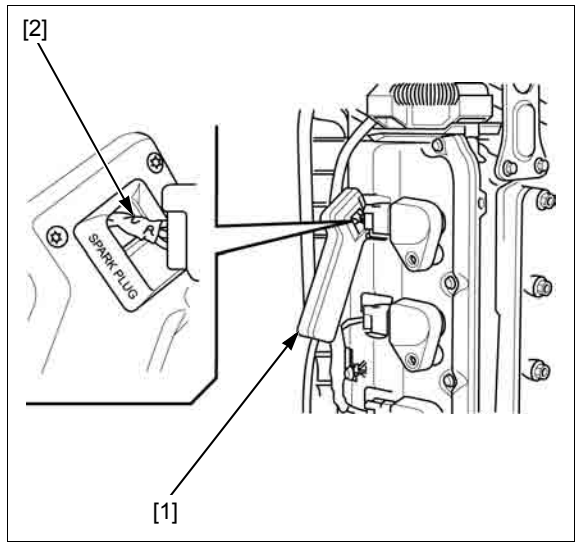
Install a commercially available digital multimeter with an inductive pickup (Fluke 88) [1].

Connect the inductive pickup to the No.1 ignition coil primary wire [2] with the "SPARK PLUG" side toward the spark plug as shown.

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

SPECIFIED IDLE SPEED (AT NEUTRAL):
650 ± 50 min^{-1} (rpm)

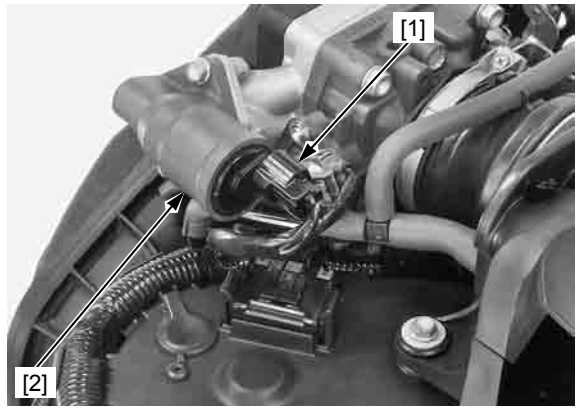
- If the idle speed is outside the specification, adjust it (page 3-23).

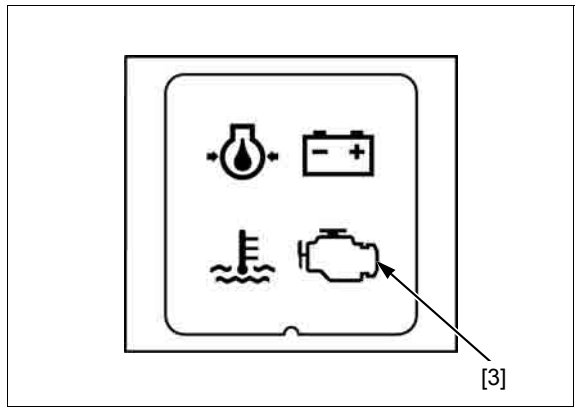


ADJUSTMENT

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

Disconnect the 2P connector [1] from the IAC valve [2]. The MIL [3] should come ON and the warning buzzer should sound (intermittent sound: long beep).

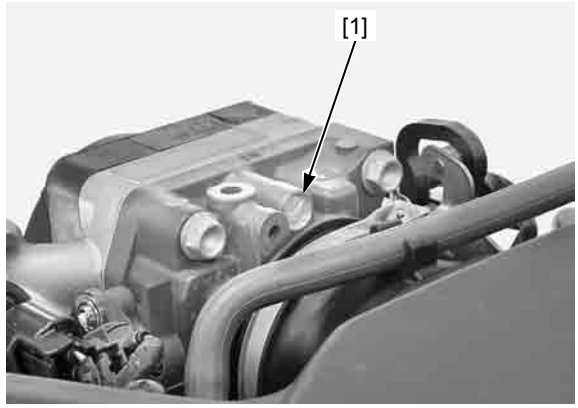




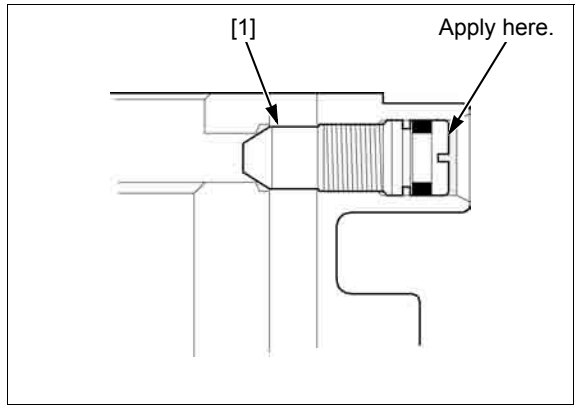
Wait until the engine speed stabilizes, and then check the idle speed.

If the idle speed is outside the specification, adjust by turning the idle adjusting screw [1] in or out.

BASE IDLE SPEED (AT NEUTRAL):
570 ± 30 min^{-1} (rpm) (with IAC valve connector disconnected)



After adjustment, stop the engine and apply Nippon Paint Uni-pack 200 or equivalent to the entire surface of the idle adjusting screw [1] head.



Connect the IAC valve 2P connector.

Reset the ECM (page 5-6).

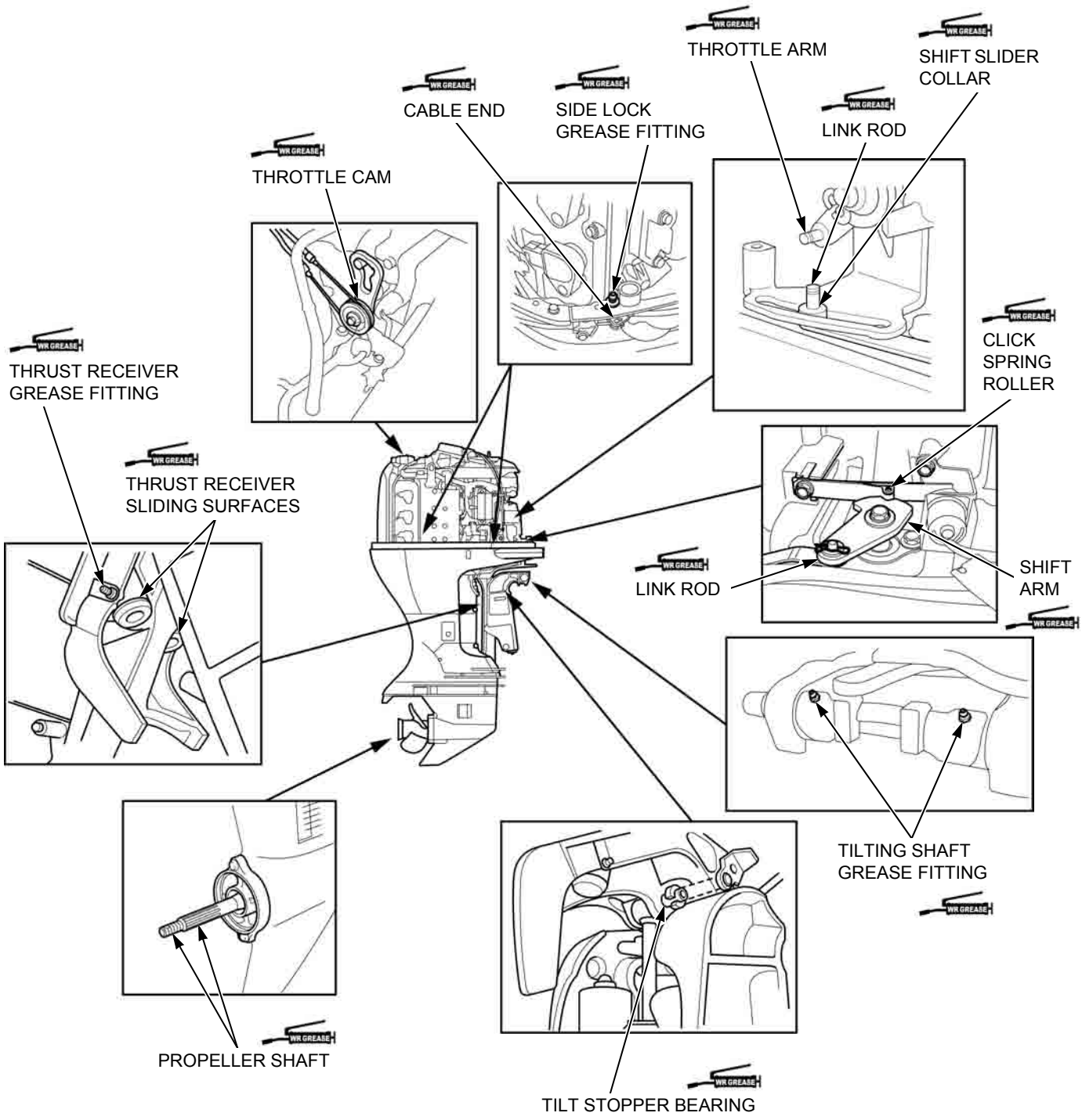
Start the engine. Wait until the engine speed stabilizes under no load, and recheck the idle speed.

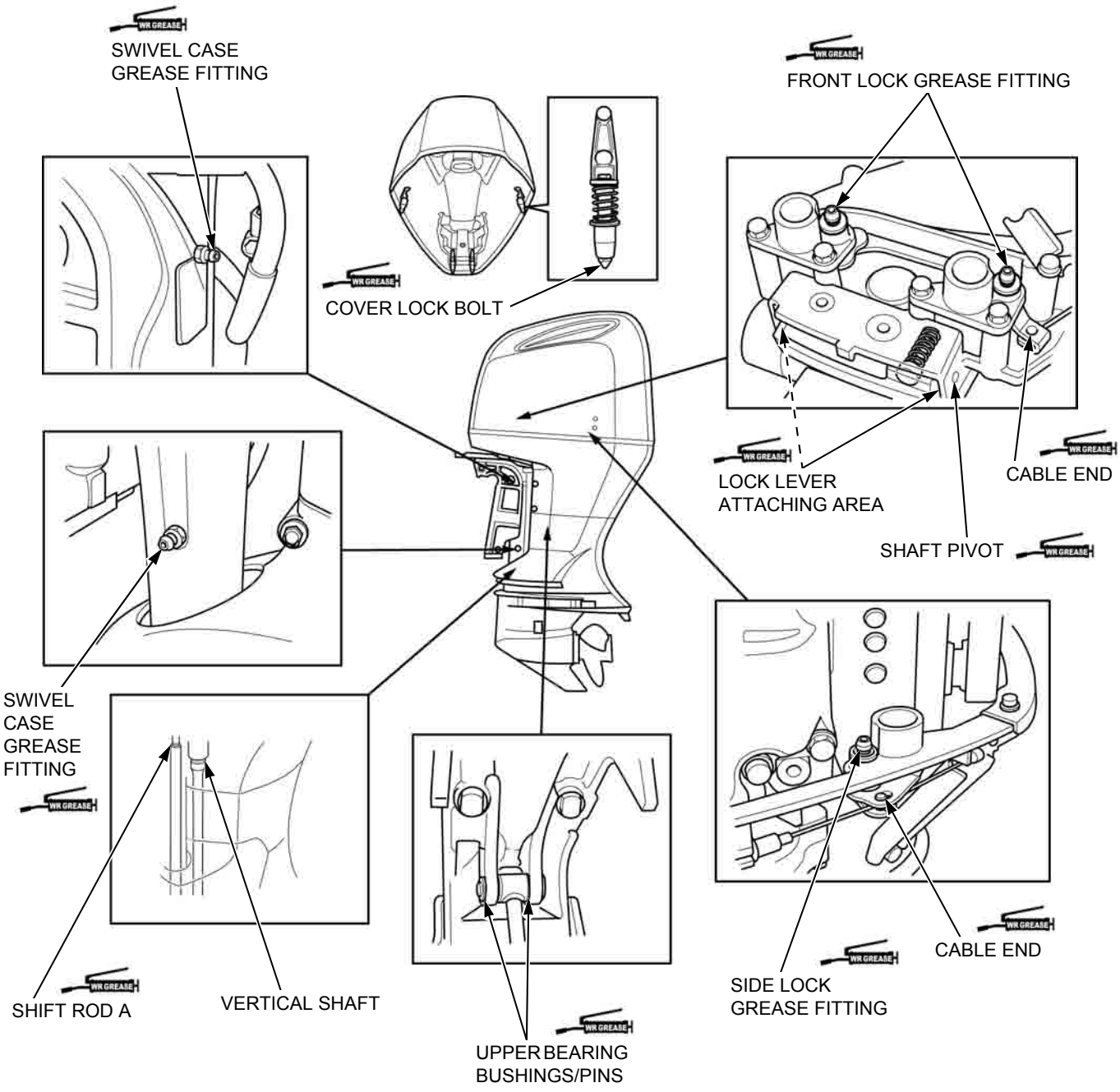
SPECIFIED IDLE SPEED (AT NEUTRAL):
650 ± 50 min^{-1} (rpm)

If the idle speed is outside the specification, inspect and troubleshoot the idle control system (page 4-6).

LUBRICATION

Apply marine grease to the following parts:



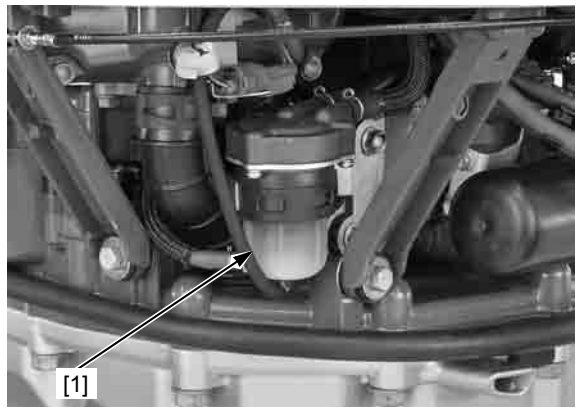

SWIVEL CASE
GREASE FITTING
COVER LOCK BOLT
FRONT LOCK GREASE FITTING
LOCK LEVER
ATTACHING AREA
CABLE END
SHAFT PIVOT
SWIVEL
CASE
GREASE
FITTING
SHIFT ROD A
VERTICAL SHAFT
UPPER BEARING
BUSHINGS/PINS
SIDE LOCK
GREASE FITTING
CABLE END

WATER SEPARATOR INSPECTION

Remove the L. engine under cover (page 6-4).

Check the water separator [1] for water accumulation or sediment. If water or sediment is found, or the warning buzzer sounds, disassemble and clean the water separator (page 5-93).

Install the L. engine under cover (page 6-4).



FUEL FILTER (LOW PRESSURE SIDE) INSPECTION/REPLACEMENT

⚠WARNING

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

INSPECTION

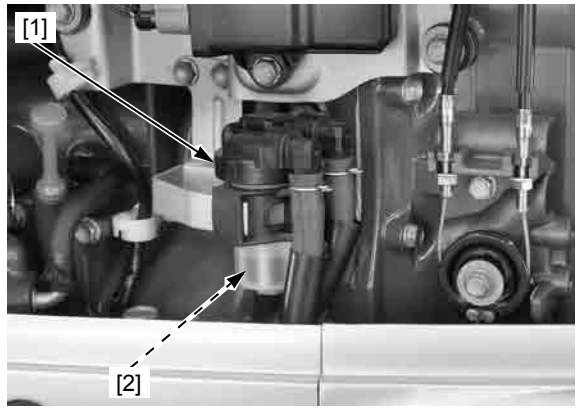
Remove the engine cover.

Check the fuel strainer [1] for water accumulation or sediment.

NOTE:
- If the float [2] is floating, water is present in the fuel strainer.

If sediment is found, disassemble and clean the fuel strainer (page 3-28).

If water is present in the fuel strainer, drain the water as follows.



DRAINING WATER FROM THE FUEL FILTER/ WATER SEPARATOR

Connect the primer bulb to fuel tube A.

Remove the V tube (3.5 x 6.5 x 350 mm) [1] and wire harness clip [2], and then place the tip of the tube into a suitable container.

Loosen the drain screw [3].

Squeeze the primer bulb to force water out of the V tube. Stop squeezing the primer bulb when gasoline starts to flow.

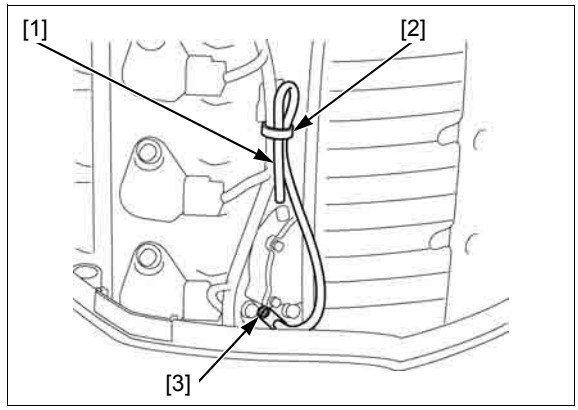
Tighten the drain screw to the specified torque.

TORQUE: 1.5 N·m (0.15 kgf·m, 1.1 lbf·ft)

Check for fuel leaks while squeezing the primer bulb.

Install the V tube (3.5 x 6.5 x 350 mm) and wire harness clip.

Disconnect the primer bulb from fuel tube A and install the engine cover.

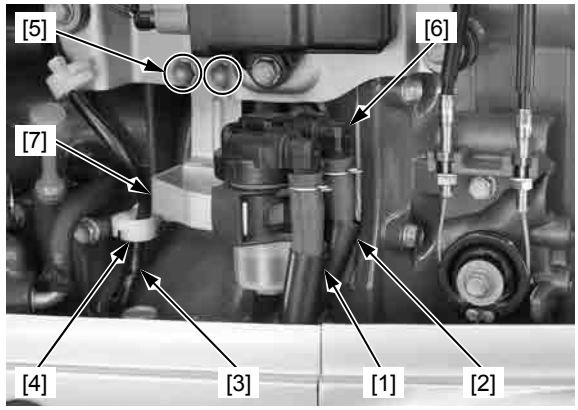


REPLACEMENT

Clamp fuel tubes A [1] and B [2] with hose clips, and then disconnect fuel tubes A and C from the strainer.

Release the power tilt switch wire [3] from the harness clip [4].

Remove the two bolts [5] and fuel strainer [6] with the strainer bracket [7].



Remove the harness clip [1], suspension [2], and fuel strainer from the strainer bracket [3].

Remove the following parts from the strainer body [4]:

– Cup [5]
– O-ring (32.2 x 2 mm) [6]
– Float [7]
– Fuel filter [8]
– O-ring (19.5 x 1.5 mm) [9]

Clean the water or sediment in the cup, and if necessary, replace the fuel filter.

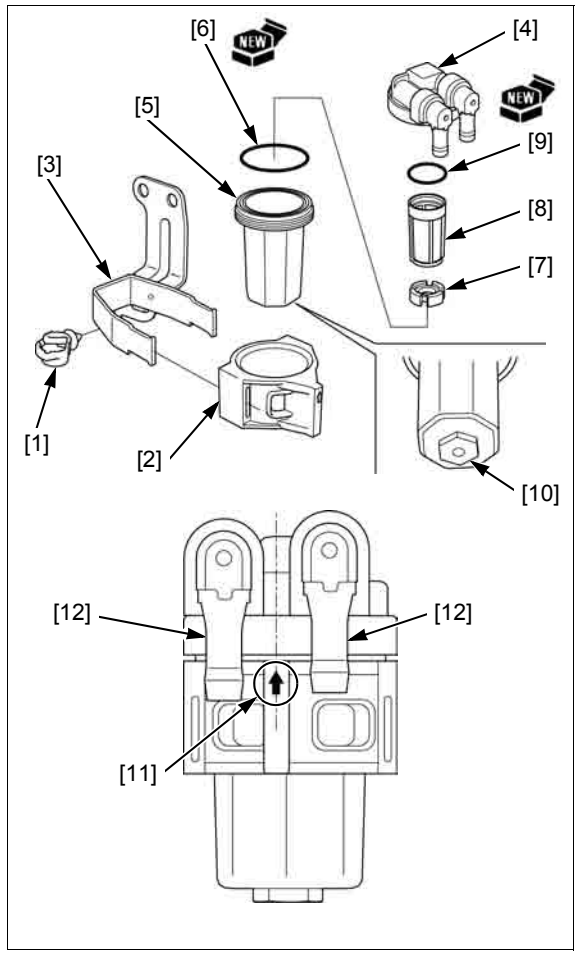
Installation is in the reverse order of removal.

NOTE:

- Do not reuse O-rings.
- Tighten the bottom surface [10] of the cup to the specified torque.

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

- Install the suspension with its arrow mark [11] facing up and between the fuel tube joints [12].



FUEL FILTER (HIGH PRESSURE SIDE) INSPECTION/REPLACEMENT

⚠WARNING

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

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

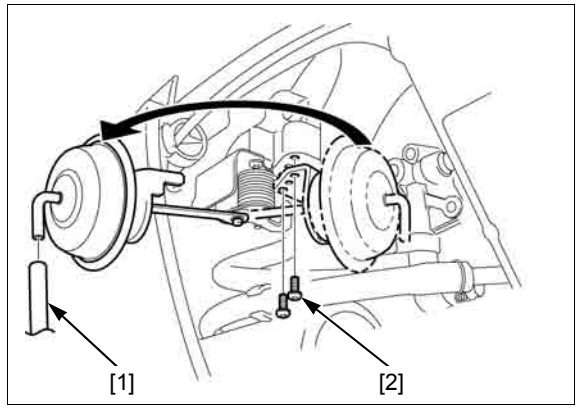
Replace the fuel filter (high pressure side) at the replacement interval shown or in the following case.

– Regular replacement period of every 2 years or 400 operating hours.
– When the fuel pressure does not reach 280 – 330 kPa (2.9 – 3.4 kgf/cm^2, 41 – 48 psi) with the pressure regulator vacuum tube connected, check the following.
  If the following items are normal, replace the fuel strainer (high pressure side).
  – Fuel pump (page 5-110)
  – Pressure regulator (page 5-111)

Remove the R. engine under cover (page 6-3).

Relieve the fuel pressure (page 5-66).

Disconnect the fuel tube [1] from the diaphragm.
Remove the screws [2] and swing the diaphragm to the side.



Place a rag or a shop towel over the strainer cover [1] and remove the three screw/washers [2] and the strainer cover.

Remove the fuel filter [3] and replace it if necessary.

Replace the O-ring [4] with a new one.

Install the fuel filter with the grommet [5] side facing out.

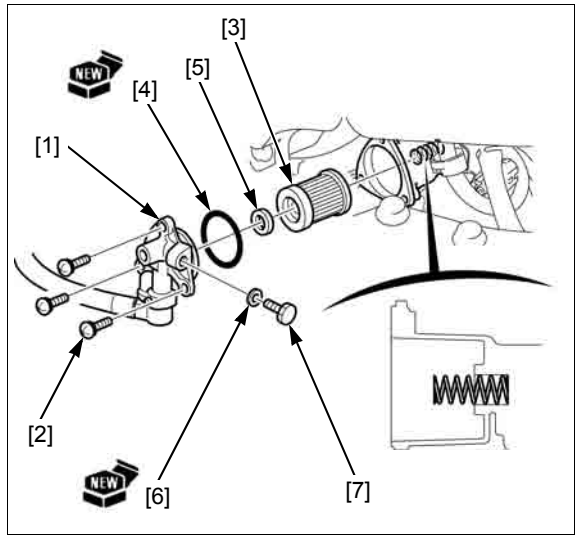
Install the strainer cover, screw/washers, and tighten them to the specified torque.

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

Replace the sealing washer [6], and tighten the service check bolt [7] to the specified torque.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

Install the removed parts in the reverse order of removal.



FUEL LINE INSPECTION/ REPLACEMENT

⚠WARNING

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

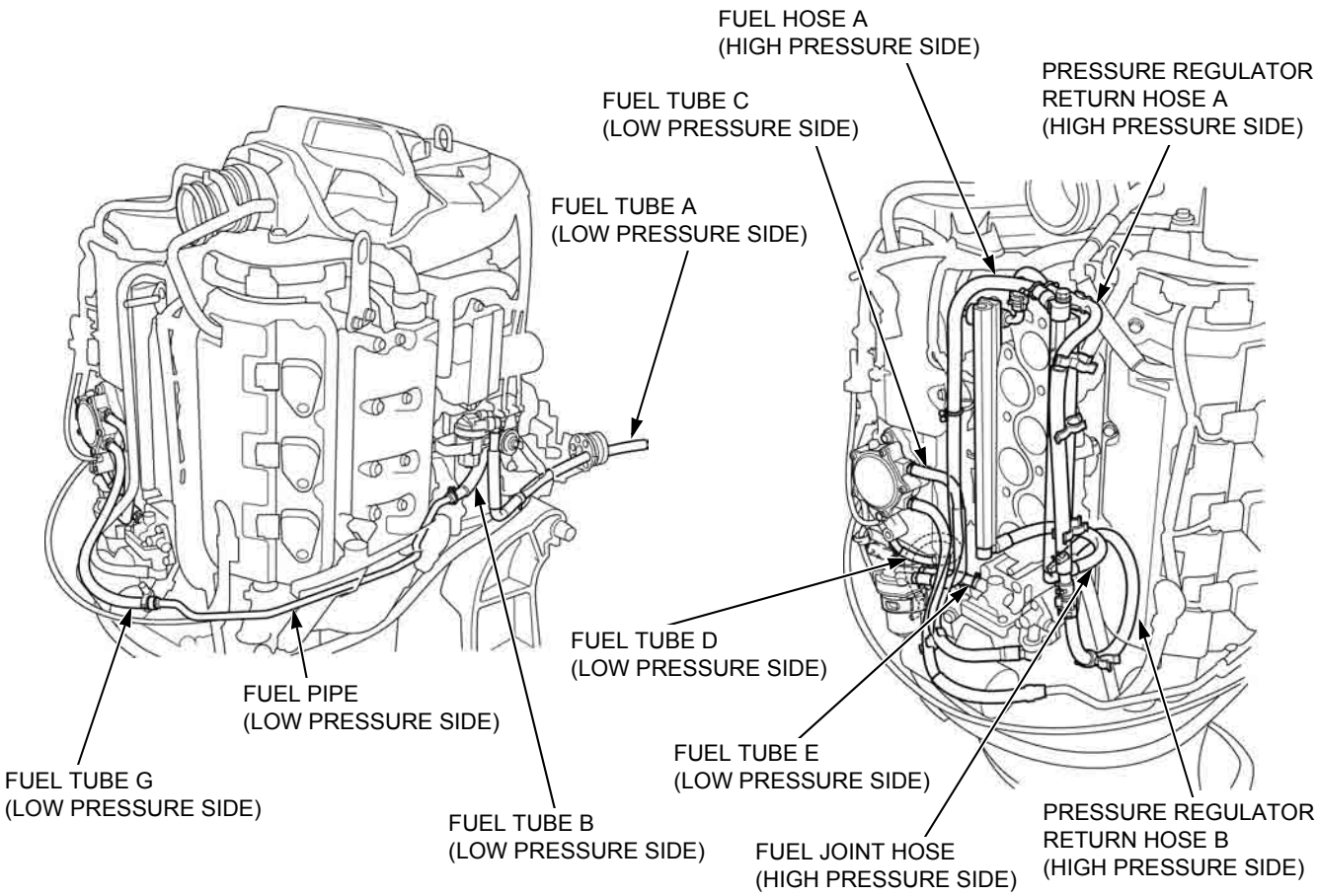
Check the fuel line, fuel hose, and the fuel tubes for damage, fuel leakage, corrosion, and other abnormalities. Check that the hoses and tubes are not interfering with the neighboring parts.

Turn the combination switch ON to operate the fuel pump (High pressure side) and check for fuel leakage.

Replace the hose or tube if there is damage, fuel leakage, corrosion, etc.

Replace the following fuel tube (or hose) as necessary:

– Fuel strainer line (page 3-27)
– Water separator line (page 5-93)
– Fuel pump (Low pressure side) tube (page 5-67)
– Fuel pump (High pressure side)/Vapor separator hose (page 5-86)
– Fuel injector/pressure regulator (page 5-78)



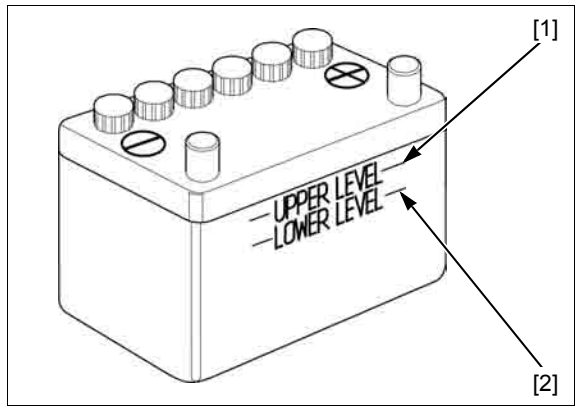
BATTERY AND CABLE CONNECTION

⚠WARNING

A battery can explode if you do not follow the proper procedure, causing serious injury to anyone nearby.
Follow all procedures carefully and keep sparks and open flames away from the battery.
The battery contains sulfuric acid electrolyte, which is highly corrosive and poisonous.
Getting electrolyte in your eyes or on your skin can cause serious burns.
Wear protective clothing and eye protection when working on or near a battery.
Swallowing electrolyte can cause fatal poisoning if immediate action is not taken.

- Battery handling differs according to the type of battery. Refer to the battery manufacturer's instructions.

Check whether the battery fluid is between the upper [1] and lower levels [2], and check the vent hole in each battery cap for clogging.
If the battery fluid is near or below the lower level, add distilled water to the upper level.



Check that the battery cables are connected securely.
If the battery terminals are contaminated or corroded, remove the battery cables and clean the terminals.

⚠WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds. When your hands after handling.

NUTS, BOLTS, FASTENERS

Check that all chassis nuts and bolts are tightened to their correct torque values (page 2-4).
Check that all safety clips, hose clamps, and cable stays are in place and properly secured.

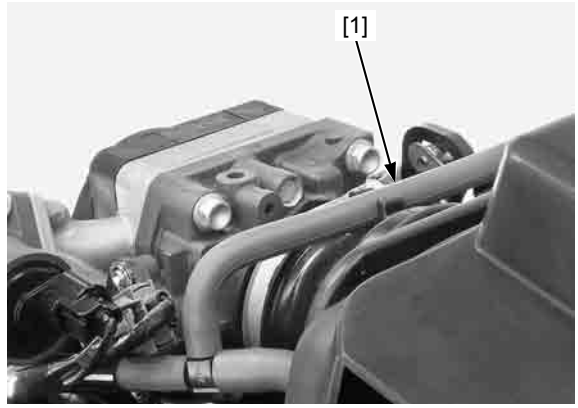
CRANKCASE BREATHER INSPECTION

Remove the engine cover.

Check if the crankcase breather tube [1] is bent or damaged.

Replace the crankcase breather tube if necessary.

Install the engine cover.



WATER PASSAGE CLEANING

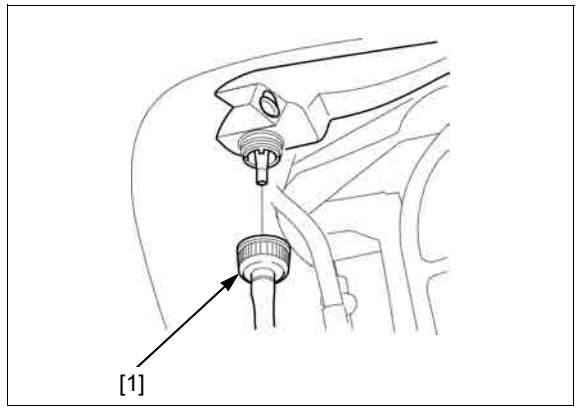
Flush the cooling system as follows.

NOTICE

Do not run the motor when flushing with a garden hose or the motor may be damaged.

For safety, remove the emergency stop switch clip so the engine cannot be started while you are standing near the propeller.

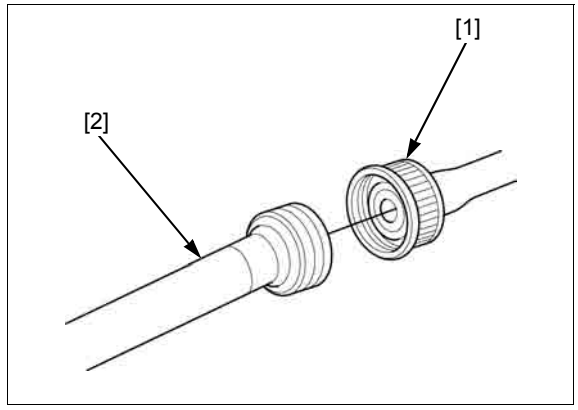
Disconnect the flush port connector [1].



Screw the flush port connector [1] onto the garden hose [2].

Turn on the fresh water supply and flush the outboard motor for at least 10 minutes.

After flushing, disconnect the garden hose and reconnect the flush port connector.

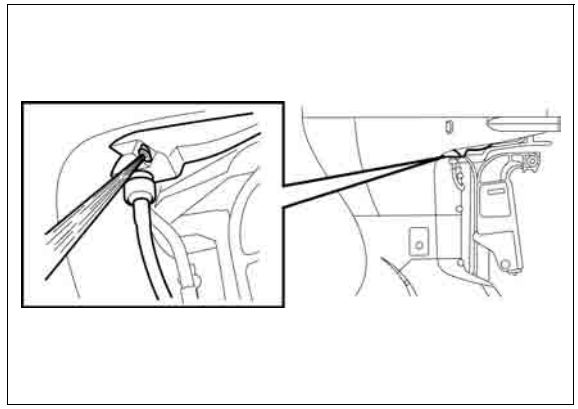


WATER PUMP INSPECTION

Place the outboard motor in a test tank or connect an external water supply to the water inlet.

Start the engine and idle the engine in neutral.
Water should flow from the cooling system indicator while the engine is running.

If water stops flowing while the engine is running, inspect the water pump and water passage (page 11-9).

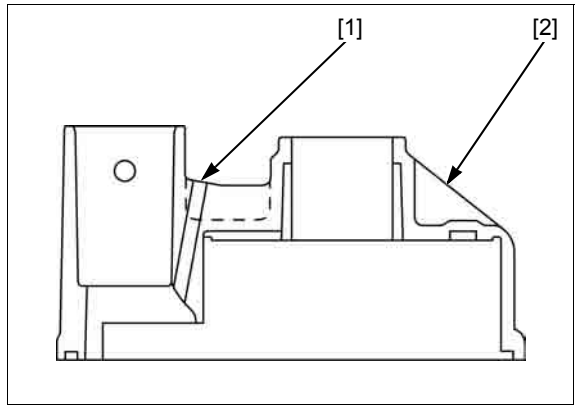


IMPELLER HOUSING INSPECTION

Remove the impeller housing (page 11-9).

Make sure that the vertical shaft bush cooling passage [1] of the impeller housing [2] is not clogged.

Inspect the cooling water passage of the vertical shaft.

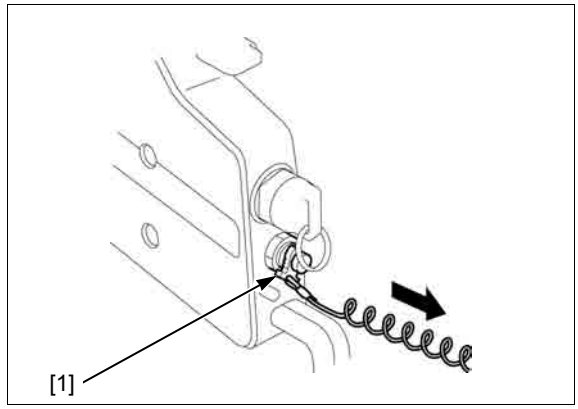


EMERGENCY STOP SWITCH INSPECTION

Make sure that the clip [1] is set at the emergency stop switch.

Start the engine and idle the engine in neutral.
The engine should stop when the clip is removed.

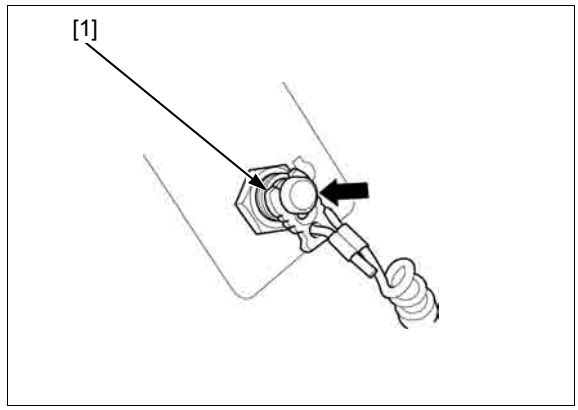
If it does not, replace the emergency stop switch.



Set the clip [1] to the emergency stop switch.

Start the engine and idle the engine in neutral.
The engine should stop when the switch is pushed.

If it does not, replace the emergency stop switch.



POWER TRIM/TILT INSPECTION

Set the swivel case to the uppermost position.

Make sure that the power trim/tilt has no ATF leaks.

If the ATF leaks, replace or repair the faulty part(s) (page 19-19).

SHIFT CONTROL CABLE INSPECTION/ ADJUSTMENT

Check the shift control cable for damage or corrosion.

Replace if necessary (page 20-3).

Check the shift control cable connected parts for damage or loose fitting.
Tighten the loose fitting or replace if necessary (page 20-3).

Start the engine.
Check the shift control cable for smooth operation.
Check that each gear shifts properly when the shift lever is moved to each position ("F" (Forward), "R" (Reverse), "N" (Neutral)).
Stop the engine.
Adjust or replace if necessary (page 20-3).

MEMO

4. TROUBLESHOOTING

BEFORE TROUBLESHOOTING 4-2

ENGINE TROUBLESHOOTING 4-2

FUSE/ELECTRIC POWER LINE TROUBLESHOOTING 4-15

ALERT SYSTEM/WARNING SYSTEM TROUBLESHOOTING 4-18

FRAME TROUBLESHOOTING 4-25

BEFORE TROUBLESHOOTING

- Use a known-good battery for troubleshooting.
- Disconnect the boat equipment (electrical loads)
- Check that the connectors are connected securely.
- Check for sufficient fresh fuel in the fuel tank.
- Check that the emergency stop switch clip is set securely.
- Read the circuit tester's operation instructions carefully, and observe the instructions during inspection.
- When a commercially available circuit tester is used for inspection, use the special tool [Tester probe (Male) 07ZAJ-RDJA110], and take care not to apply excessive force to the connector terminal.
- Switch the tester lead polarities to check the circuit, including the diode (see below). The circuit is normal if there is continuity in one direction but not the other. If there is continuity in both directions or in neither direction, the circuit is abnormal.
  – Indicator light
  – Fuse/relay junction box
  – Regulator/rectifier
  – Power tilt relay

ENGINE TROUBLESHOOTING

ENGINE DOES NOT START OR ENGINE STALLS

ENGINE DOES NOT START

1. Electrical power system inspection

Turn the combination switch ON.
Check the MIL and warning buzzer.

Does the MIL come ON for 2 seconds and warning buzzer sound twice?

YES – GO TO STEP 2.

NO – Perform fuse/electrical power system troubleshooting (page 4-15).

2. Alert system inspection

Check the warning buzzer sound.

Does the warning buzzer sound twice and then keep sounding?

YES – Perform alert/warning system troubleshooting (page 4-18).

NO – GO TO STEP 3.

3. Starting system inspection

Check that the starter motor operates properly.

Does the starter motor turn?

YES – GO TO STEP 4.

NO – Perform starting system troubleshooting (page 9-3).

4. Engine idle speed inspection

Adjust by turning the idle adjusting screw in or out.
Start the engine.

Engine starts?

YES – Improper idle adjusting screw. Adjust the idle speed (page 3-23).

NO – GO TO STEP 5.

5. Spark Test

Perform the spark test (page 8-4).

Is there weak or no spark?

YES – Perform ignition system troubleshooting (page 8-3).

NO – GO TO STEP 6.

6. Spark Plug Inspection

Remove and inspect spark plugs.

Is the spark plug wet?

YES – • Incorrect spark plug heat range
• Incorrect spark plug gap
• Restriction or blockage between the cooling fan cover and cylinder head
• Improper vapor separator float height

NO – GO TO STEP 7.

7. Vapor separator inspection

Loosen the vapor separator drain screw and check whether fuel flows out.

Does the fuel flow properly?

YES – GO TO STEP 8.

NO – • Closed fuel tank vent knob
• Faulty primer bulb
• Clogged or damaged fuel tube
• Clogged water separator (page 5-93)
• Clogged fuel strainer (Low pressure side) (page 3-27)
• Faulty fuel pump (Low pressure side)
• Clogged vapor separator air vent tube or filter
• Faulty vapor separator (page 5-115)

8. Fuel Pump Inspection

You should hear the pump hum when the combination switch is turned "ON".

Is the hum heard?

YES – GO TO STEP 9.

NO – Perform fuel pump system inspection (page 5-114)

9. Fuel Flow Inspection

Inspect the fuel flow (page 5-113).

Is the fuel flow within specification?

YES – GO TO STEP 10.

NO – • Clogged fuel strainer (High pressure side) (page 5-106)
• Clogged fuel feed hose
• Faulty fuel pump

10. Fuel injector inspection

Inspect the fuel injector (page 5-116).

Is the fuel injector normal?

YES – GO TO STEP 11.

NO – • Repair the open or short circuit in the fuel injector wire
• Faulty fuel injector

11. Cylinder Compression

Check the cylinder compression (page 14-33).

Is the compression low?

YES – Check the valve clearance and recheck. If compression is out of specification in one or more cylinders, perform a leak down test before removing components.

NO – GO TO STEP 12.

12. IAC valve inspection

Replace the IAC valve with a new one and start the engine.

Engine starts?

YES – Faulty original IAC valve.

NO – Replace the ECM with a new one and recheck.

ENGINE STARTS BUT STALLS SOON

1. **Alert system inspection**

   Turn the combination switch ON.
   Check the warning buzzer sound.

   Does the warning buzzer sound twice and then keep sounding?

   YES – Perform alert system/warning system troubleshooting (page 4-18).

   NO – GO TO STEP 2.

2. **Engine idle speed inspection**

   Adjust by turning the idle adjusting screw in or out.

   Does the engine stalls?

   YES – GO TO STEP 3.

   NO – Improper idle adjusting screw. Adjust the idle speed (page 3-23).

3. **Spark Test**

   Perform spark test (page 8-4) at all plugs.

   Is there weak or no spark?

   YES – Perform ignition system troubleshooting (page 8-3).

   NO – GO TO STEP 4.

4. **Spark Plug Inspection**

   Remove and inspect spark plugs.

   Is the spark plug wet?

   YES –
   - Incorrect spark plug gap
   - Incorrect spark plug heat range
   - Blockage between the cooling fan cover and cylinder head
   - Improper vapor separator float height

   NO – GO TO STEP 5.

5. **Intake air leak inspection**

   Check for secondary air in the system.

   Is there an air leak?

   YES –
   - Loose IAC valve and/or throttle body mounting bolt
   - Leaking or damaged throttle body and/or IAC valve gasket
   - Loose IAT sensor
   - Leaking or damaged IAT sensor O-ring
   - Loose intake manifold upper cover mounting bolt
   - Leaking or damaged intake manifold upper cover seal ring
   - Leaking or damaged intake manifold gasket
   - Leaking or damaged injector base gasket
   - Loose intake manifold and injector base mounting bolt
   - Leaking or damaged fuel injector seal ring

   NO – GO TO STEP 6.

6. **Fuel Flow Inspection**

   Inspect the fuel flow (page 5-113).

   Is the fuel flow within specification?

   YES – GO TO STEP 7.

   NO –
   - Clogged fuel strainer (Low pressure side) (page 3-27)
   - Clogged water separator (page 5-93)
   - Clogged or damaged fuel tube
   - Faulty fuel pump (Low pressure side)
   - Clogged vapor separator air vent tube or filter
   - Clogged fuel feed hose
   - Clogged fuel strainer (High pressure side) (page 5-106)
   - Faulty vapor separator (page 5-115)
   - Faulty fuel pump (high pressure side)

7. Pressure regulator inspection

Check the fuel pressure and record it (page 5-111).

Disconnect the pressure regulator vacuum tube.
Check the fuel pressure.

Is the fuel pressure higher with the vacuum tube disconnected?

YES – GO TO STEP 8.

NO – Faulty pressure regulator.

8. Fuel injector inspection

Inspect the fuel injector (page 5-116).

Is the fuel injector normal?

YES – GO TO STEP 9.

NO –
- Repair the open or short circuit fuel injector wire
- Faulty fuel injector

9. IAC valve inspection

Replace the IAC valve with a new one and start the engine.

Engine stalls?

YES – Replace the ECM with a new one and recheck.

NO – Faulty original IAC valve.

ENGINE SOMETIMES MISFIRES OR TENDS TO STALL

1. Spark Test

Perform spark test (page 8-4) at all plugs.

Is there weak or no spark?

YES – Perform ignition system troubleshooting (page 8-3).

NO – GO TO STEP 2.

2. Spark Plug Inspection

Remove and inspect the spark plugs.

Are the spark plugs wet?

YES –
- Incorrect spark plug gap
- Incorrect spark plug heat range
- Blockage between the cooling fan cover and cylinder head
- Improper vapor separator float height

NO – GO TO STEP 3.

3. Fuel Flow Inspection

Inspect the fuel flow (page 5-113).

Is the fuel flow within specification?

YES – GO TO STEP 4.

NO –
- Clogged fuel strainer (Low pressure side) (page 3-27)
- Clogged water separator (page 5-93)
- Clogged or damaged fuel tube
- Faulty fuel pump (Low pressure side)
- Clogged vapor separator air vent tube or filter
- Clogged fuel feed hose
- Clogged fuel strainer (High pressure side) (page 5-106)
- Faulty vapor separator (page 5-115)
- Faulty fuel pump (high pressure side)

4. Pressure regulator inspection

Inspect the fuel pressure and record it (page 5-111).

Disconnect the pressure regulator vacuum tube.
Inspect the fuel pressure.

Is the fuel pressure higher with the vacuum tube disconnected?

YES – GO TO STEP 5.

NO – Faulty pressure regulator.

5. Fuel injector inspection

Inspect the fuel injector (page 5-116).

Is the fuel injector normal?

YES – GO TO STEP 6.

NO – • Repair the open or short circuit in the fuel injection wire
• Faulty fuel injector

6. IAC valve inspection

Replace the IAC valve with a new one and start the engine.

Engine sometimes misfires or tends to stall?

YES – Replace the ECM with a new one and recheck.

NO – Faulty original IAC valve.

ENGINE DOES NOT RUN SMOOTHLY

ENGINE SPEED IS HIGHER THAN THE SPECIFIED IDLE SPEED AFTER WARMING UP

1. Alert system inspection

Turn the combination switch ON.
Check the warning buzzer sound.

Does the warning buzzer sound twice and then keep sounding?

YES – Perform alert/warning system troubleshooting (page 4-18).

NO – GO TO STEP 2.

2. Engine idle speed inspection

Adjust by turning the idle adjusting screw in or out.

Is the engine speed normal?

YES – Improper idle adjusting screw.

NO – GO TO STEP 3.

3. Pressure regulator inspection

Inspect the fuel pressure and record it (page 5-111).

Disconnect the pressure regulator vacuum tube.
Inspect the fuel pressure.

Is the fuel pressure higher with the vacuum tube disconnected?

YES – GO TO STEP 4.

NO – Faulty pressure regulator.

4. IAC valve inspection

Replace the IAC valve with a new one and start the engine.

Is the engine idle speed normal?

YES – Faulty original IAC valve.

NO – GO TO STEP 5.

5. Alternator F line inspection

Inspect the alternator F line (page 4-9).

Is the alternator F line normal?

YES – Replace the ECM with a new one and recheck.

NO – Replace the alternator with a new one and recheck.

ENGINE SPEED IS HIGHER THAN THE SPECIFIED TROLLING SPEED AFTER WARMING UP

1. Alert system inspection

Turn the combination switch ON.
Check the warning buzzer sound.

Does the warning buzzer sound twice and then keep sounding?

YES – Perform alert/warning system troubleshooting (page 4-18).

NO – GO TO STEP 2.

2. Engine idle speed inspection

Check the idle speed (page 3-22).

Is the idle speed normal?

YES – Improperly adjusted idle adjusting screw.

NO – GO TO STEP 3.

3. Neutral switch inspection

Inspect the neutral switch (page 9-20).

Is the neutral switch normal?

YES – GO TO STEP 4.

NO – Replace the neutral switch with a new one and recheck.

4. Pressure regulator inspection

Inspect the fuel pressure and record it (page 5-111).

Disconnect the pressure regulator vacuum tube.
Inspect the fuel pressure.

Is the fuel pressure higher with the vacuum tube disconnected?

YES – GO TO STEP 5.

NO – Faulty pressure regulator.

5. IAC valve inspection

Replace the IAC valve with a new one and start the engine.

Is the trolling speed normal?

YES – Faulty original IAC valve.

NO – Replace the ECM with a new one and recheck.

ENGINE SPEED IS LOWER THAN THE SPECIFIED IDLE SPEED OR TROLLING SPEED AFTER WARMING UP

1. Alert system inspection

Turn the combination switch ON.
Check the warning buzzer sound.

Does the warning buzzer sound twice and then keep sounding?

YES – Perform alert system/warning system troubleshooting (page 4-18).

NO – GO TO STEP 2.

2. Engine idle speed inspection

Check the idle speed (page 3-22).

Is the idle speed normal?

YES – Improperly adjusted idle adjusting screw.

NO – GO TO STEP 3.

3. Pressure regulator inspection

Inspect the fuel pressure and record it (page 5-111).

Disconnect the pressure regulator vacuum tube.
Inspect the fuel pressure.

Is the fuel pressure higher with the vacuum tube disconnected?

YES – GO TO STEP 4.

NO – Faulty pressure regulator.

4. IAC valve inspection

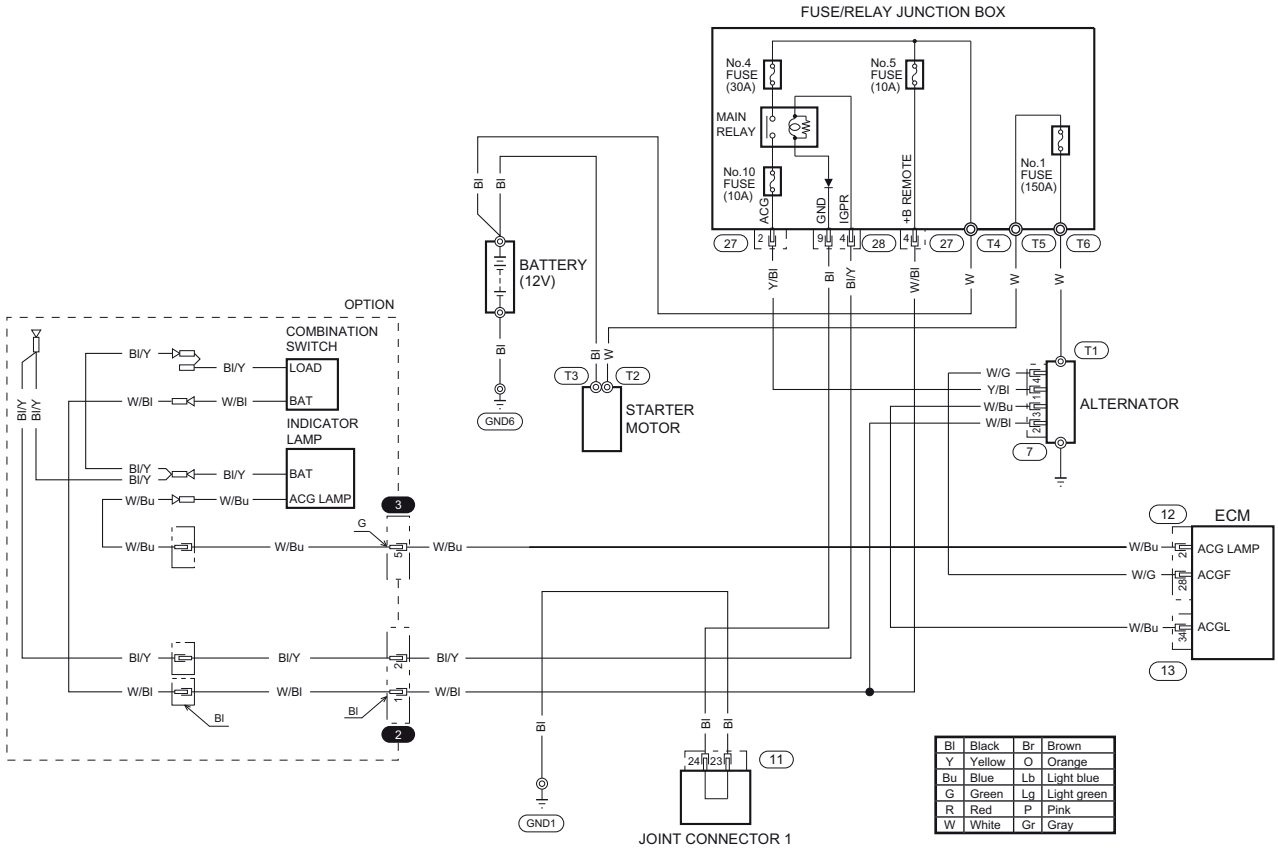
Replace the IAC valve with a new one and start the engine.

Is the trolling speed or engine idle speed normal?

YES – Faulty original IAC valve.

NO – Replace the ECM with a new one and recheck.

ENGINE SPEED IS HIGHER (750 min^{-1} (rpm)) THAN THE SPECIFIED IDLE SPEED WITH NORMAL ELECTRICAL LOAD AFTER WARMING UP



1. Battery test

Remove the battery.

Check the battery condition using the commercially available battery tester.

Is the battery in good condition?

YES – GO TO STEP 2.

NO – Faulty battery.

2. Alternator F line inspection

Turn the combination switch OFF.

Disconnect the alternator 4P connector (42).

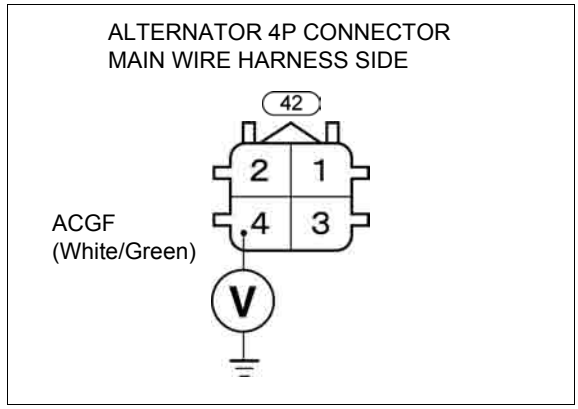
Turn the combination switch ON.

Measure the voltage between the alternator 4P connector (42) wire harness side No.4 terminal (White/Green) and engine ground.

Is there 4.30 – 5.25 V?

YES – Replace the alternator with a new one and recheck.

NO – Repair open or short circuit in the wire between the ECM and alternator. If wire harness is normal, replace the ECM with a new one and recheck.



ENGINE SPEED IS NOT STABLE DURING IDLE AND TROLLING

1. **Alert system inspection**

   Turn the combination switch ON.
   Check the warning buzzer sound.

   Does the warning buzzer sound twice and then keep sounding?

   YES – Perform alert system/warning system troubleshooting (page 4-18).

   NO – GO TO STEP 2.

2. **Engine idle speed inspection**

   Check the idle speed (page 3-22).

   Is the idle speed normal?

   YES – Improperly adjusted idle adjusting screw.

   NO – GO TO STEP 3.

3. **Spark Test**

   Perform spark test (page 8-4) at all plugs.

   Is there weak or no spark?

   YES – Perform ignition system troubleshooting (page 8-3).

   NO – GO TO STEP 4.

4. **Spark Plug Inspection**

   Remove and inspect spark plugs.

   Is the spark plug wet?

   YES –
   - Incorrect spark plug gap
   - Incorrect spark plug heat range
   - Blocked air cleaner

   NO – GO TO STEP 5.

5. **Fuel Flow Inspection**

   Inspect the fuel flow (page 5-113).

   Is the fuel flow within specification?

   YES – GO TO STEP 6.

   NO –
   - Clogged fuel strainer (Low pressure side) (page 3-27)
   - Clogged water separator (page 5-93)
   - Clogged or damaged fuel tube
   - Faulty fuel pump (Low pressure side)
   - Clogged vapor separator air vent tube or filter
   - Clogged fuel feed hose
   - Clogged fuel strainer (High pressure side) (page 5-106)
   - Faulty vapor separator (page 5-115)
   - Faulty fuel pump (high pressure side)

6. **Pressure regulator inspection**

   Inspect the fuel pressure and record it (page 5-111).

   Disconnect the pressure regulator vacuum tube.
   Inspect the fuel pressure.

   Is the fuel pressure higher with the vacuum tube disconnected?

   YES – GO TO STEP 7.

   NO – Faulty pressure regulator.

7. **Neutral switch inspection**

   Inspect the neutral switch (page 9-20).

   Is the neutral switch normal?

   YES – GO TO STEP 8.

   NO – Replace the neutral switch with a new one and recheck.

8. Fuel injector inspection

Inspect the fuel injector (page 5-116).

Is the fuel injector normal?

YES – GO TO STEP 9.

NO – • Repair the open or short circuit fuel injector wire
• Faulty fuel injector

9. IAC valve inspection

Replace the IAC valve with a new one and start the engine.

Is the engine speed stable during idle and trolling?

YES – Faulty original IAC valve.

NO – Replace the ECM with a new one and recheck.

ENGINE SPEED DOES NOT INCREASE

1. Throttle cable inspection

Inspect the throttle cable (page 3-11).

Is the throttle cable adjustment correct?

YES – GO TO STEP 2.

NO – Improper throttle cable adjustment (page 3-11).

2. Propeller inspection

Match the propeller.

Is the propeller correct?

YES – GO TO STEP 3.

NO – Propeller mismatched.

3. Fuel Flow Inspection

Inspect the fuel flow (page 5-113).

Is the fuel flow within specification?

YES – GO TO STEP 4.

NO – • Clogged fuel strainer (Low pressure side) (page 3-27)
• Clogged water separator (page 5-93)
• Clogged or damaged fuel tube
• Faulty fuel pump (Low pressure side)
• Clogged vapor separator air vent tube or filter
• Clogged fuel feed hose
• Clogged fuel strainer (High pressure side) (page 5-106)
• Faulty vapor separator (page 5-115)
• Faulty fuel pump (high pressure side)

4. Pressure regulator inspection

Inspect the fuel pressure and record it (page 5-111).

Disconnect the pressure regulator vacuum tube.
Inspect the fuel pressure.

Is the fuel pressure higher with the vacuum tube disconnected?

YES – GO TO STEP 5.

NO – Faulty pressure regulator.

5. Valve clearance inspection

Inspect the valve clearance (page 3-15).

Is the valve clearance correct?

YES – GO TO STEP 6.

NO – Improper valve clearance adjustment (page 3-15).

6. Neutral switch inspection

Inspect the neutral switch (page 9-20).

Is the neutral switch normal?

YES – GO TO STEP 7.

NO – Replace the neutral switch with a new one and recheck.

7. Fuel injector inspection

Inspect the fuel injector (page 5-116).

Is the fuel injector normal?

YES – GO TO STEP 8.

NO – • Repair the open or short circuit fuel injection wire
• Faulty fuel injector

8. VTEC system inspection

Inspect the following VTEC system:

– Solenoid valve (page 5-125)
– System operation (page 14-37)

Is the VTEC system operating properly?

YES – Replace the ECM with a new one and recheck.

NO – Faulty VTEC system.

ENGINE SPEED DOES NOT STABILIZE DURING RUNNING AT HIGH SPEED AND ENGINE SPEED IS NOT AS HIGH AS IT USED TO BE DURING RUNNING WITH THE THROTTLE FULLY OPEN

1. Throttle cable inspection

Inspect the throttle cable (page 3-11).

Is the throttle cable adjustment correct?

YES – GO TO STEP 2.

NO – Improper throttle cable adjustment (page 3-11).

2. Fuel Flow Inspection

Inspect the fuel flow (page 5-113).

Is the fuel flow within specification?

YES – GO TO STEP 3.

NO – • Clogged fuel strainer (Low pressure side) (page 3-27)
• Clogged water separator (page 5-93)
• Clogged or damaged fuel tube
• Faulty fuel pump (Low pressure side)
• Clogged vapor separator air vent tube or filter
• Clogged fuel feed hose
• Clogged fuel strainer (High pressure side) (page 5-106)
• Faulty vapor separator (page 5-115)
• Faulty fuel pump (high pressure side)

3. Fuel inspection

Check to see if the fuel deteriorated or contaminated.

Is the fuel deteriorated or contaminated?

YES – Refuel with fresh fuel with the correct octane rating.

NO – GO TO STEP 4.

4. Intake air system inspection

Check for restriction or blockage of the air intake system.

Is the intake airway restricted?

YES – Clear the restriction

NO – GO TO STEP 5.

5. IAB control solenoid valve inspection

Check operation of the IAB control solenoid valve (page 5-118).

Is the IAB system operating correctly?

YES – GO TO STEP 6.

NO – Faulty IAB control solenoid valve

6. VTEC system inspection

Inspect the following VTEC system:

– Solenoid valve (page 5-125)
– System operation (page 14-37)

Is the VTEC system operating properly?

YES – GO TO STEP 7.

NO – Faulty VTEC system.

7. Cylinder Compression

Check the cylinder compression (page 14-33).

Is the compression low?

YES – Check the valve clearance and recheck. If compression is out of specification in one or more cylinders, perform a leak down test before removing components.

NO – Replace the ECM with a new one and recheck.

ENGINE SPEED INCREASES EXCESSIVELY

1. Propeller inspection

Check the propeller.

Is the propeller correct?

YES – GO TO STEP 2.

NO –
- Propeller mismatched
- Faulty propeller

2. Outboard motor installation inspection

Inspect the outboard motor installation (Transom height/tilt angle).

Is the outboard motor installation correct?

NO – Faulty outboard motor installation.

ENGINE SPEED DOES NOT DECREASE

1. **Throttle cable inspection**

   Inspect the throttle cable (page 3-11).

   Is the throttle cable adjustment correct?

   YES – GO TO STEP 2.

   NO – Improper throttle cable adjustment (page 3-11).

2. **Throttle body inspection**

   Check the throttle shaft of the throttle body.

   Does the throttle shaft move smoothly?

   YES – GO TO STEP 3.

   NO – Check the throttle body and clean it (page 5-117).

3. **Engine idle speed inspection**

   Check the idle speed (page 3-22).

   Is the idle speed normal?

   YES – Improperly adjusted idle adjusting screw.

   NO – GO TO STEP 4.

4. **Intake air leak inspection**

   Check for a secondary air leak in the system.

   Is there an air leak?

   YES –
   - Loose IAC valve and/or throttle body mounting bolt
   - Leaking or damaged throttle body and/or IAC valve gasket
   - Loose IAT sensor.
   - Leaking or damaged IAT sensor O-ring
   - Loose intake manifold upper cover mounting bolt
   - Leaking or damaged intake manifold upper cover seal ring
   - Leaking or damaged intake manifold gasket
   - Leaking or damaged injector base gasket
   - Loose intake manifold and injector base mounting bolt
   - Leaking or damaged fuel injector seal ring

   NO – GO TO STEP 5.

5. **IAC valve inspection**

   Replace the IAC valve with a new one and start the engine.

   Does the engine speed decrease?

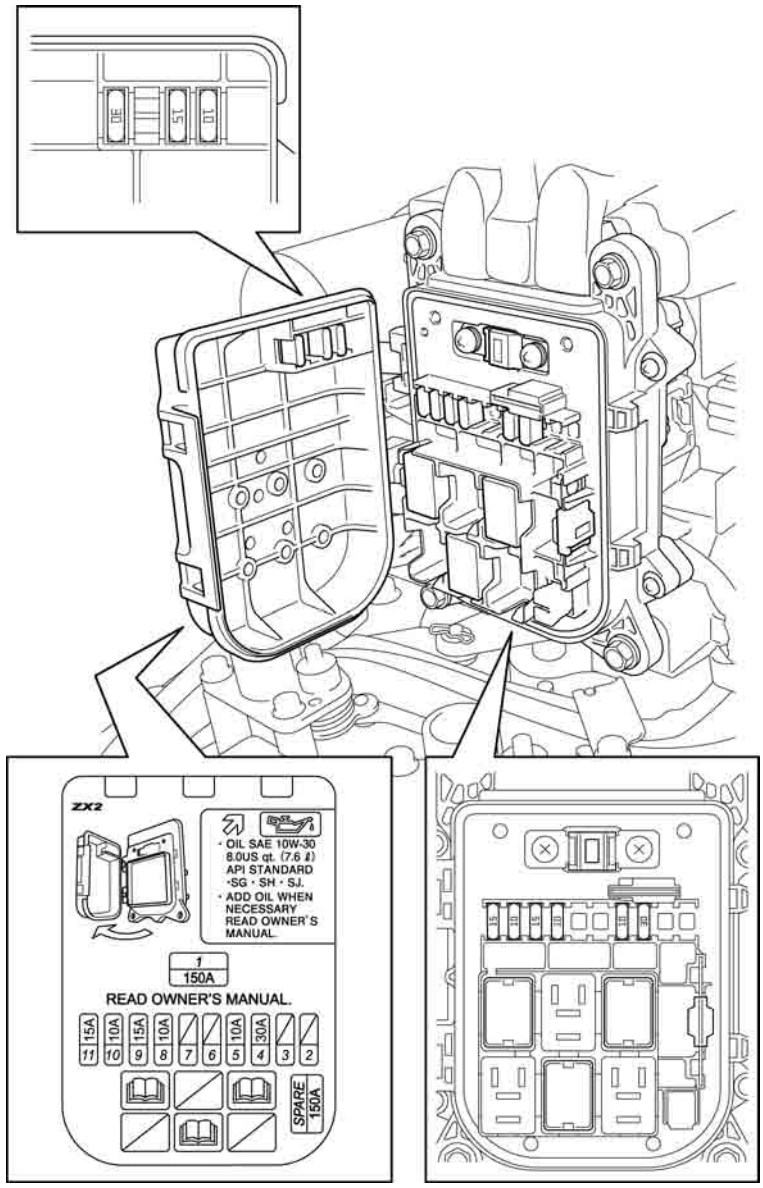
   YES – Faulty original IAC valve.

   NO – Replace the ECM with a new one and recheck.

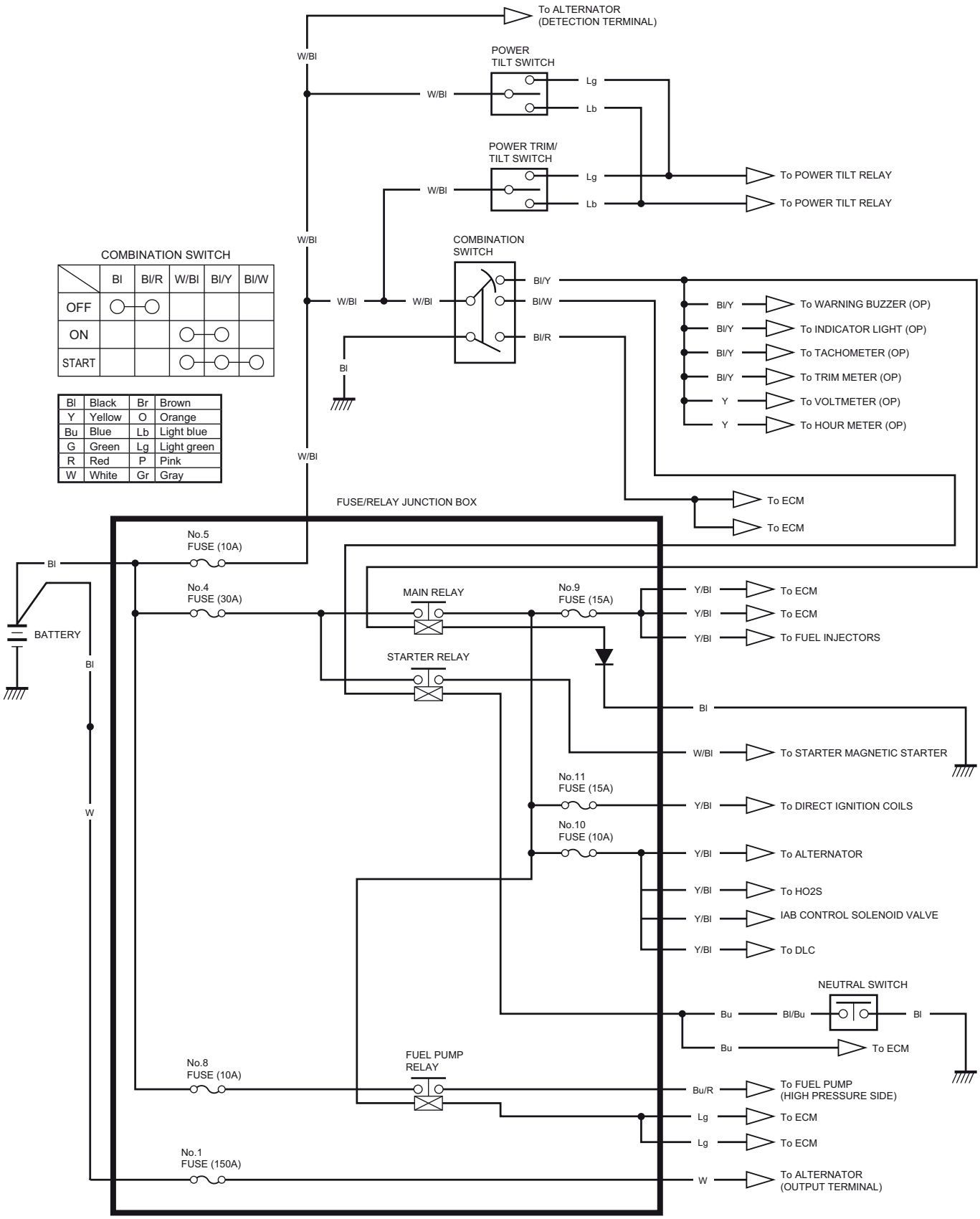
FUSE/ELECTRIC POWER LINE TROUBLESHOOTING

FUSE CONNECTION TABLE

Fuse No.	Amps.	Component(s) or Circuit(s) Protected
1	150 A	Alternator (Output terminal)
4	30 A	ECM (Power supply), Fuel injector, Alternator, DLC, O_2 sensor heater, IAB control solenoid valve, Direct ignition coil, Relay (Included in the junction box: Main relay, Starter relay, Fuel pump relay)
5	10 A	Alternator (Input terminal), Combination switch, Power tilt relay, Warning buzzer, Oil indicator light, Overheat indicator light, MIL, Alternator indicator light, tachometer, Trim meter, Hour meter, Volt meter, Relay (Included in the junction box: Main relay, Starter relay)
8	10 A	Fuel pump (High pressure side)
9	15 A	ECM (Power supply), Fuel injector
10	10 A	Alternator, O_2 sensor heater, IAB control solenoid valve, DLC
11	15 A	Direct ignition coil



FUSE LOAD CHART



MIL AND WARNING BUZZER DOES NOT OPERATE

1. Fuse inspection

Turn the combination switch OFF.

Check for blown No.4, No.5, and No.9 fuses.

Is the fuse blown?

YES – Replace the blown fuse and check for short in the main wire harness or incorrect load by referring to the fuse load chart (page 4-16).

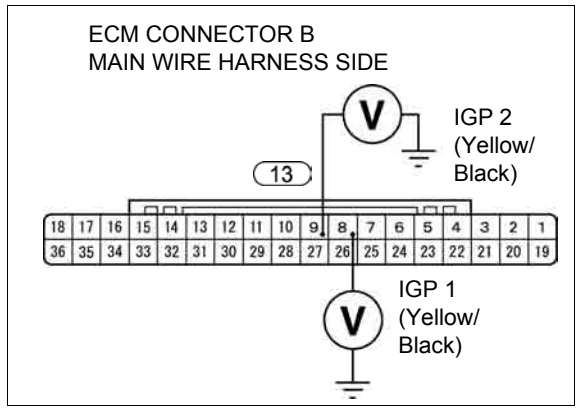
NO – GO TO STEP 2.

2. ECM power line inspection

Install the No.4, No.5 and No.9 fuses in the fuse/relay junction box.

Disconnect ECM connector B (13).

Turn the combination switch ON.
Measure the voltage between the main wire harness side No.8 (Yellow/Black) terminal of ECM connector B (13) and engine ground.
Measure the voltage between the main wire harness side No.9 (Yellow/Black) terminal of ECM connector B (13) and engine ground.



Is battery voltage present?

YES – GO TO STEP 3.

NO – GO TO STEP 4.

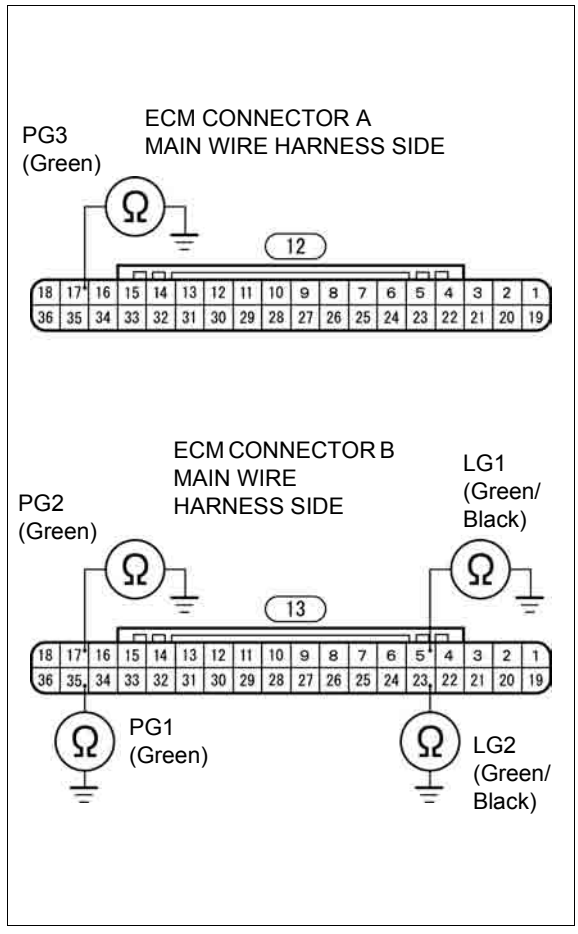
3. ECM ground line inspection

Turn the combination switch OFF.

Disconnect the ECM connector A (12).

Check for continuity between the ECM connector A (12) main wire harness side No.17 (Green) terminal and engine ground.

Check for continuity between the ECM connector B (13) main wire harness side No.5 (Green/Black) terminal, No.17 (Green) terminal, No.23 (Green/Black) terminal, No.35 (Green) terminal and engine ground.



Is there continuity?

YES – Replace the ECM with a new one and recheck.

NO – Repair the open circuit in the wire harness between the ECM and engine ground.

4. Main relay inspection

Inspect the main relay (page 10-11).

Is the main relay normal?

YES – GO TO STEP 5.

NO – Replace the main relay with a new one and recheck.

5. Fuse/relay junction box inspection

Inspect the main relay circuit into the fuse/relay junction box (page 10-13).

Is the fuse/relay junction box normal?

YES – Repair the open circuit in the main wire harness.

NO – Replace the fuse/relay junction box and recheck.

ALERT SYSTEM/WARNING SYSTEM TROUBLESHOOTING

- Perform the MIL initial check before starting the engine.
  The warning buzzer can sound when the starter motor speed is extremely low, but the alert system/warning system is normal if the buzzer stops sounding after starting the engine.
  When the warning buzzer keeps sounding after MIL initial check, refer to the following symptom chart and perform the necessary troubleshooting.
  If the symptom is not shown in the following symptom chart, perform a function test according to the following procedure:
  – FUNCTION TEST USING THE HDS (page 4-19)
  – FUNCTION TEST WITHOUT USING THE HDS (page 4-20)

SYMPTOM CHART

Condition	Indicator light				Warning buzzer
	Oil indicator light (Green)	Overheat indicator light (Red)	MIL (Red)	Alternator indicator light (Red)	
Combination switch ON (MIL initial check)	● (for 2 sec.)	● (for 2 sec.)	● (for 2 sec.)	●	Sounds twice
2 sec. after turning the combination switch ON	○	○	○	●	Stop
Normal operation	●	○	○	○	Stop
Low oil pressure (page 4-23)	○	○	○	○	Continuous sound
Overheat (page 4-22)	●	●	○	○	Continuous sound
MIL faulty (page 4-24)	●*1	○*2	●	○	Intermittent sound (Long beep)
Abnormal charging (page 4-24)	●	○	○	●	Intermittent sound (Long beep)
Water contamination (page 4-24)	●	○	○	○	Intermittent sound (Short beep)

● : ON ○ : OFF

When two or more problems occur the same time, the warnings for both problems are indicated together. The prolonged buzzer sound takes precedence over the short buzzer sound.
Example: When problems occur with overheat and abnormal charging at the same time, the oil indicator light, and the alternator indicator light all come on and the buzzer sounds continuously.
*1: The oil indicator light blinks when a problem with the EOP (High) switch occurs at the same time as a MIL malfunction.
*2: The overheat indicator light blinks when a problem with the EMT sensor occurs at the same time as a MIL malfunction.

FUNCTION TEST USING THE HDS

1. Fuse inspection

Turn the combination switch OFF.

Check the No.10 fuse in the fuse/relay junction box.

Is the fuse blown?

YES – Replace the blown fuse and check for short in the main wire harness or incorrect load by referring to the fuse load chart (page 4-16).

NO – GO TO STEP 2.

2. Buzzer inspection

Turn the combination switch OFF and connect the HDS (page 5-7).

Test the warning buzzer using the HDS.

Does the buzzer sound?

YES – GO TO STEP 3.

NO –
- Inspect the warning buzzer
- Inspect the combination switch
- Repair the open or short circuit in the main wire harness
- Replace the ECM with a new one and recheck

3. Alternator indicator light inspection

Test the alternator indicator light using the HDS.

Does the alternator indicator light blink?

YES – GO TO STEP 4.

NO –
- Inspect the indicator light
- Repair the open circuit in the main wire harness
- Replace the ECM with a new one and recheck

4. MIL inspection

Test the MIL using the HDS.

Does the MIL blink?

YES – GO TO STEP 5.

NO –
- Inspect the indicator light
- Repair the open or short circuit in the main wire harness
- Replace the ECM with a new one and recheck

5. Overheat indicator light inspection

Test the overheat indicator light using the HDS.

Does the overheat indicator light blink?

YES – GO TO STEP 6.

NO –
- Inspect the indicator light
- Repair the open or short circuit in the main wire harness
- Replace the ECM with a new one and recheck

6. Oil indicator light inspection

Test the oil indicator light using the HDS.

Does the oil indicator light blink?

YES – Indicator light/warning buzzer is normal.

NO –
- Inspect the indicator light
- Repair the open or short circuit in the main wire harness
- Replace the ECM with a new one and recheck

FUNCTION TEST WITHOUT USING THE HDS

1. Fuse inspection

Turn the combination switch OFF.

Check the No.10 fuse in the fuse/relay junction box.

Is the fuse blown?

YES – Replace the blown fuse and check for short in the main wire harness or incorrect load by referring to the fuse load chart (page 4-16).

NO – GO TO STEP 2.

2. Indicator light/buzzer short circuit inspection

Turn the combination switch OFF and disconnect the ECM connector A (12) and B (13).

Turn the combination switch ON.

Does the warning buzzer sound and/or indicator come ON?

YES – • Inspect the warning buzzer
• Inspect the indicator light
• Repair the short circuit in the main wire harness

NO – GO TO STEP 3.

3. Buzzer inspection

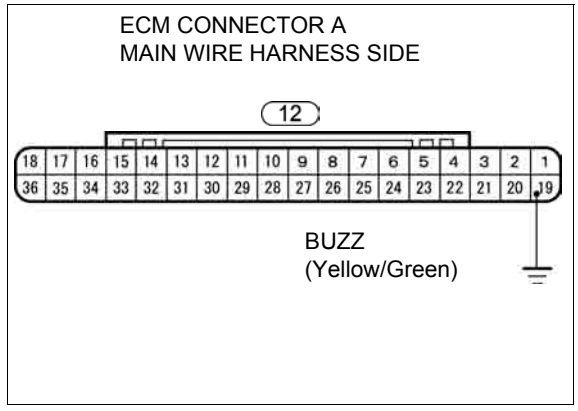
Turn the combination switch OFF.

Short the No.19 terminal (Yellow/Green) of the ECM connector A (12) main wire harness side 36P connector to engine ground using a jumper wire.
Turn the combination switch ON.

Does the warning buzzer sound?

YES – GO TO STEP 4.

NO – • Inspect the warning buzzer
• Inspect the combination switch
• Repair the open circuit in the main wire harness
• Replace the ECM with a new one and recheck



4. Alternator indicator light inspection

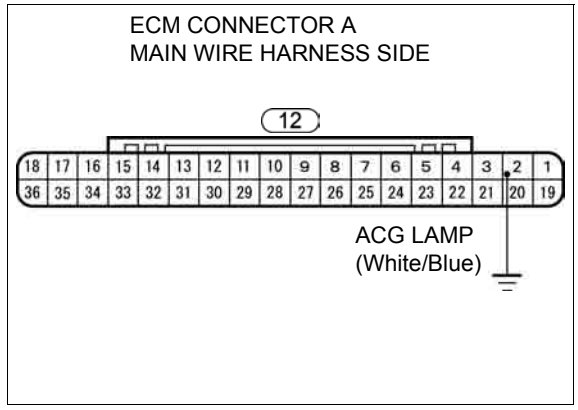
Turn the combination switch OFF.

Short the No.2 terminal (White/Blue) of the ECM connector A (12) main wire harness side 36P connector to engine ground using a jumper wire.
Turn the combination switch ON.

Does the alternator indicator light come ON?

YES – GO TO STEP 5.

NO – • Inspect the indicator light
• Repair the open circuit in the main wire harness
• Replace the ECM with a new one and recheck



5. MIL inspection

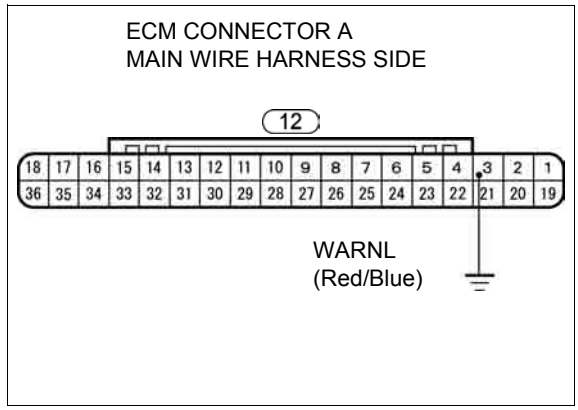
Turn the combination switch OFF.

Short the No.3 terminal (Red/Blue) of the ECM connector A (12) main wire harness side 36P connector to engine ground using a jumper wire.
Turn the combination switch ON.

Does the MIL come ON?

YES – GO TO STEP 6.

NO –
- Inspect the indicator light
- Repair the open circuit in the main wire harness
- Replace the ECM with a new one and recheck



6. Overheat indicator light inspection

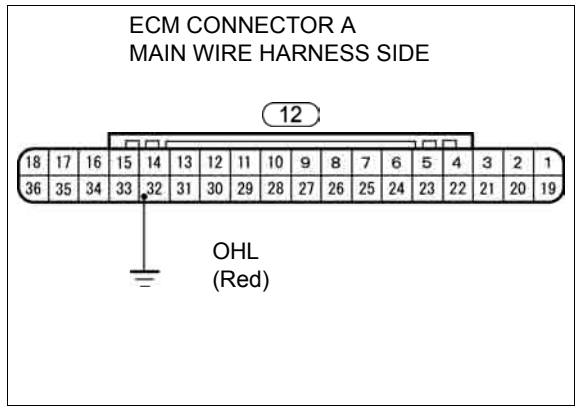
Turn the combination switch OFF.

Short the No.32 terminal (Red) of the ECM connector A (12) main wire harness side 36P connector to engine ground using a jumper wire.
Turn the combination switch ON.

Does the overheat indicator light come ON?

YES – GO TO STEP 7.

NO –
- Inspect the indicator light
- Repair the open circuit in the main wire harness
- Replace the ECM with a new one and recheck



7. Oil indicator light inspection

Turn the combination switch ON and check whether the oil indicator light comes ON.

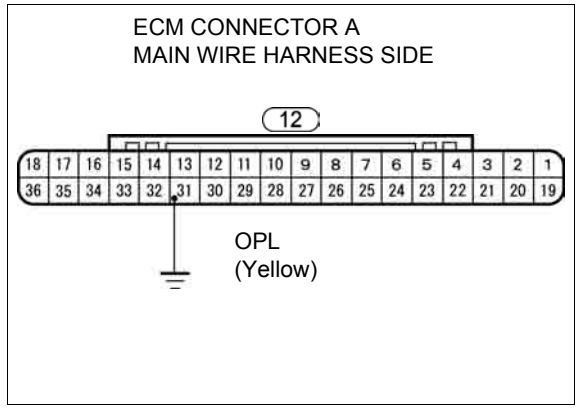
Turn the combination switch OFF.

Short the No.31 terminal (Yellow) of the ECM connector A (12) main wire harness side 36P connector to engine ground using a jumper wire.
Turn the combination switch ON.

Does the oil indicator light go off?

YES – Indicator light/warning buzzer is normal.

NO –
- Inspect the indicator light
- Repair the open circuit in the main wire harness
- Replace the ECM with a new one and recheck



WARNING BUZZER SOUNDS CONTINUOUSLY

- The warning buzzer can sound when the starter motor speed is extremely low, but the alert system/warning system is normal if the buzzer stops sounding after starting the engine.

THE OVERHEAT INDICATOR LIGHT COMES ON OR BLINKS

1. **MIL inspection**

   Check to see if the MIL stays on.

   Does the MIL stay ON?

   YES – Perform PGM-FI troubleshooting (page 5-6)

   NO – GO TO STEP 2.

2. **Outboard motor installation inspection**

   Inspect the outboard motor installation (transom height/tilt angle).

   Is the outboard motor installation correct?

   YES – GO TO STEP 3.

   NO – Faulty outboard motor installation.

3. **Water screen inspection**

   Stop the engine and check the water screen.

   Is it blocked with foreign material?

   YES – Remove the foreign material.

   NO – GO TO STEP 4.

4. **Cooling water inspection**

   Check the cooling water with the engine idling.

   Is the water flowing through the check port steadily?

   YES – GO TO STEP 5.

   NO – • Faulty water pump
   • Blocked or damaged water passage

5. **Engine cool down procedure**

   Put the outboard motor into gear for a few minutes and let the engine cool down at idle speed.

   Does the overheat indicator light go OFF and the buzzer stop sounding?

   YES – Temporary failure (disappears)

   NO – GO TO STEP 6.

6. **Thermostat inspection**

   Check the thermostat (page 11-19).

   Is the thermostat normal?

   YES – Replace the ECM with a new one and recheck.

   NO – Replace the thermostat with a new one and recheck.

THE OVERHEAT INDICATOR LIGHT GOES OFF AND OIL INDICATOR LIGHT GOES OFF OR BLINKS

1. **MIL inspection**

   Check to see if the MIL stays on.

   Does the MIL stay ON?

   YES – Perform PGM-FI troubleshooting (page 5-6)

   NO – GO TO STEP 2.

2. **Oil level inspection**

   Stop the engine and check the oil level.

   Is the oil level at the proper level?

   YES – GO TO STEP 3.

   NO – Adjust the oil level.

3. **Oil indicator light inspection 1**

   Let the engine idle.
   Check the oil indicator light and buzzer.

   Does the oil indicator light come ON and warning buzzer stop sounding?

   YES – GO TO STEP 4.

   NO – GO TO STEP 5.

4. **Oil indicator light inspection 2**

   Snap the engine (4,000 min^{-1} (rpm) or above under load) and check the oil indicator light and buzzer.

   Does the oil indicator light come ON and warning buzzer stop sounding?

   YES – Temporary failure (disappears)

   NO – GO TO STEP 5.

5. **Oil indicator light inspection 3**

   Disconnect the switch wire 6P connector 4.
   Turn the combination switch ON and check the oil indicator light and buzzer.

   Does the oil indicator light come ON and warning buzzer stop sounding?

   YES – GO TO STEP 6.

   NO – Short circuit in EOP switch (LOW) and ECM.

6. **Oil Pressure inspection**

   Turn the combination switch OFF and connect the switch wire 6P connector 4.
   Reset the ECM following:

   – Using the HDS (page 5-6)
   – Without using the HDS (page 5-6)

   Check the oil pressure (page 12-12).

   Is the oil pressure within specification?

   YES – GO TO STEP 7.

   NO –
   - Oil filter cartridge is clogged
   - Oil strainer is clogged
   - Faulty oil pump
   - Oil passage is clogged

7. **EOP (LOW) switch inspection**

   Replace the EOP (Low) switch.
   Check the oil indicator light and buzzer.

   Does the oil indicator light come ON and the buzzer stop sounding?

   YES – Faulty original EOP (Low) switch.

   NO – Replace the ECM with a new one and recheck.

THE OVERHEAT INDICATOR LIGHT GOES OFF AND OIL INDICATOR LIGHT COMES ON

1. Overheat indicator light and oil indicator light inspection

Check the overheat indicator light and oil indicator light as follows:

– Using the HDS (page 4-19)
– Without using the HDS (page 4-20)

Are they correct?

YES – Replace the ECM with a new one and recheck.

NO – Replace or repair the faulty part.

WARNING BUZZER SOUNDS INTERMITTENTLY (LONG BEEP)

1. MIL inspection

Check to see if the MIL stays on.

Does the MIL stay ON?

YES – Perform PGM-FI troubleshooting (page 5-6).

NO – GO TO STEP 2.

2. Alternator indicator light inspection

Check to see if the alternator indicator light stays on.

Does the alternator indicator light stay ON?

YES – Perform charging system troubleshooting (page 7-4).

NO – Check the indicator light:
- FUNCTION TEST USING THE HDS (page 4-19)
- FUNCTION TEST WITHOUT USING THE HDS (page 4-20)
- If indicator light is correct, replace the ECM with a new one and recheck

WARNING BUZZER SOUNDS INTERMITTENTLY (SHORT BEEP)

1. Water separator/fuel strainer inspection

Turn the combination switch OFF.
Check the water separator and the fuel strainer (low pressure side).

Is there water in the cup?

YES – Remove the water and clean the cup of the water separator and fuel strainer (page 3-27).

NO – GO TO STEP 2.

2. Water level sensor inspection

Disconnect the water level sensor 2P connector (41) and recheck.

Does the warning buzzer sound the intermittent short term sound?

YES – Repair the shorted wire between ECM and water level sensor. If the wires are correct, replace the ECM with a new one and recheck.

NO – Inspect the water level sensor (page 5-124).

FRAME TROUBLESHOOTING

HARD TO SHIFT

1. Control cable inspection

Check the remote control cable (engine side) for corrosion.

Is the control cable normal?

YES – GO TO STEP 2.

NO – Replace the remote control cable.

2. Shift control cable adjustment

Adjust the shift control cable (page 20-3).

Check the remote control lever of the remote control box for proper operation.

Is the remote control box operation proper?

YES – Improper cable adjustment.

NO – GO TO STEP 3.

3. Shift link/link rod inspection

Check the following to see if they are bent or deformed.

– Shift link
– Shift link rod

Are they normal?

YES – GO TO STEP 4.

NO – Replace the faulty part(s).

4. Shift shaft/shift shaft gear inspection

Check shift shaft A and B to see if they are bent or deformed.
Check shift shaft A and B gear teeth for wear or damage.

Are they normal?

YES – GO TO STEP 5.

NO – Replace the faulty part(s).

5. Shift rod inspection

Check the shift rod to see if it is bent or damaged.

Is it normal?

YES – Gear case problem (clutch shifter and propeller shaft are corroded).

NO – Replace the shift rod with a new one and recheck.

POWER TRIM/TILT DOES NOT MOVE

1. Power trim/tilt motor inspection

Turn the combination switch ON.
Operate the power trim/tilt switch and check the power tilt motor sound.

Do you hear the motor sound?

YES – GO TO STEP 2.

NO – Perform "POWER TRIM/TILT MOTOR DOES NOT OPERATE" troubleshooting (page 4-27).

2. Manual valve inspection

Check the manual valve tightness.

Is the manual valve tight?

YES – GO TO STEP 3.

NO – Tighten the manual valve to the specified torque: 3.4 N·m (0.35 kgf·m, 2.5 lbf·ft)

3. Oil leak inspection

Check for oil leakage from the power trim/tilt.

Is there oil leakage?

YES – Replace the O-ring and oil seal at the leaking point (if the manual valve O-ring or piston rod A (cylinder cap) oil seal is leaking, replace it as an assembly).

NO – GO TO STEP 4.

4. Oil level inspection

Check the oil level with each rod fully extended.

Is the oil level within the specification?

YES – GO TO STEP 5.

NO – Fill the oil to the specified level.

5. Air bleed inspection

Check for air in the system.

Air in the system?

YES – Bleed air from the system (page 19-31)

NO – Power trim/tilt faulty.
Repair the faulty part by referring to the "POWER TRIM/TILT QUICK REFERENCE CHART (page 4-28).

POWER TRIM/TILT DOES NOT HOLD POSITION

1. Manual valve inspection

Check the manual valve tightness.

Is the manual valve tight?

YES – GO TO STEP 2.

NO – Tighten the manual valve to the specified torque: 3.4 N·m (0.35 kgf·m, 2.5 lbf·ft)

2. Oil leak inspection

Check for oil leakage from the power trim/tilt.

Is there oil leakage?

YES – Replace the O-ring and oil seal at the leaking point (if the manual valve O-ring or piston rod A (cylinder cap) oil seal are leaking, replace it as an assembly).

NO – GO TO STEP 3.

3. Hydraulic pressure inspection

Check the hydraulic pressure (page 19-33).

Is the hydraulic pressure within the specification?

YES – GO TO STEP 4.

NO – Replace the pump (page 19-19).

4. Oil level inspection

Check the oil level with each rod fully extended.

Is the oil level within the specification?

YES – GO TO STEP 5.

NO – Fill the oil to the specified level.

5. Air bleed system inspection

Check for air in the system.

Air in the system?

YES – Bleed air from the system (page 19-31)

NO – Power trim/tilt faulty.
Repair the faulty part by referring to the "POWER TRIM/TILT QUICK REFERENCE CHART (page 4-28).

POWER TRIM/TILT MOTOR DOES NOT OPERATE

1. **Power trim/tilt motor inspection**

   Connect the battery to the power tilt motor and check whether the motor operates.

   Does the motor turn?

   YES – GO TO STEP 2.

   NO – GO TO STEP 4.

2. **Power tilt relay inspection**

   Check the power tilt relay (page 10-14)

   Is the power tilt relay normal?

   YES – GO TO STEP 3.

   NO – Replace the power tilt relay with a new one and recheck.

3. **Power tilt switch inspection**

   Check the power tilt switch (page 19-43)

   Is the power tilt switch normal?

   YES – Repair the main wire harness or replace it.

   NO – Replace the power tilt switch with a new one and recheck.

4. **Power trim/tilt motor continuity inspection**

   Check for continuity at the motor (page 19-41).

   Is there continuity?

   YES – GO TO STEP 5.

   NO – Repair or replace the motor.

5. **Overheat inspection**

   Check the motor for overheating.

   Is the motor overheated?

   YES – Cool down the motor.

   NO – GO TO STEP 6.

6. **Breaker inspection**

   Check the breaker inside the motor (page 19-41).

   Is the breaker normal?

   YES – GO TO STEP 7.

   NO – Replace the breaker (page 19-36).

7. **Oil leak inspection**

   Check for oil inside the motor (page 19-36).

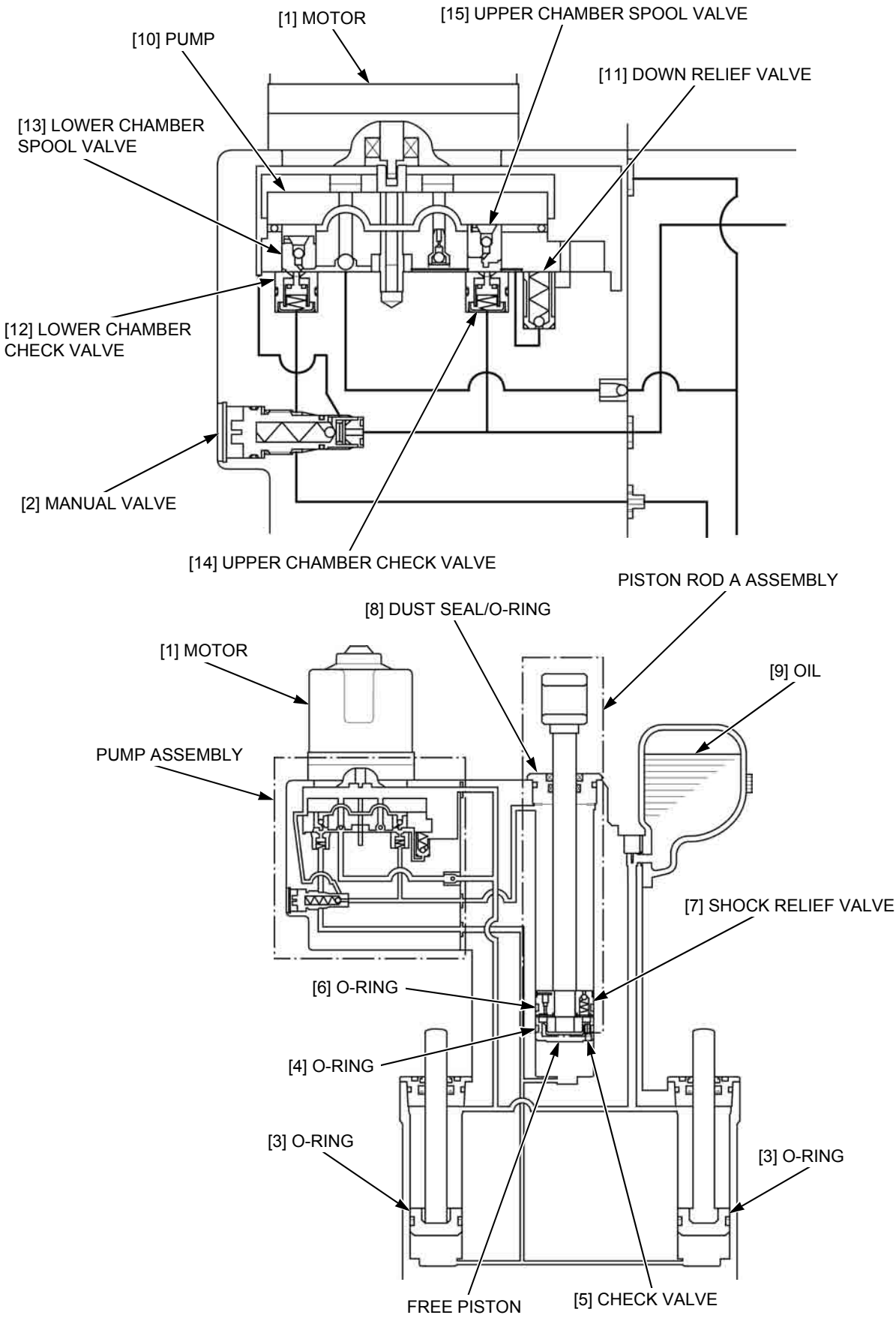
   Is oil inside?

   YES – Replace the motor with a new one and recheck.

   NO – Disassemble the motor and replace the faulty part.

POWER TRIM/TILT QUICK REFERENCE CHART

Symptom				Pressure check		Check point	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	Check according to the motor check procedure.
○	○	○	○	○	○	[2] manual valve	Check that the manual valve is installed securely. Replace if it is damaged. Check the O-ring for damage and replace if necessary. If there is no damage, clean the O-ring and install it on the manual valve properly.
○	○	○		○		[3] O-ring	Check the O-ring for damage and replace if necessary. If there is no damage, clean the O-ring and reinstall it properly.
○		○		○		[4] O-ring	
○		○		○		[5] Check valve	Check the ball seat for damage or foreign material. The check valve cannot be replaced as an individual part. Replace the free piston assembly if the check valve is defective.
	○		○		○	[6] O-ring	Check the O-ring for damage and replace if necessary. If there is no damage, clean the O-ring and reinstall it properly.
	○		○		○	[7] Shock relief valve	Check the ball seat for damage or foreign material. The shock valve cannot be replaced as an individual part. Replace the piston rod A assembly if the shock valve is defective.
	○		○		○	[8] Dust seal/ O-ring	Check the dust seal and O-ring for damage. The dust seal and O-ring cannot be replaced as individual parts. Replace the piston rod A assembly if the dust seal or O-ring are defective.
○	○					[9] Oil	Check the oil level and add the oil if necessary.
○	○			○	○	[10] Pump	Do not disassemble the pump assembly. If any of the following parts are defective, replace the pump assembly.
	○				○	[11] Down relief valve	
○	○	○		○		[12] Lower chamber check valve	
○	○	○		○		[13] Lower chamber spool valve	
○	○		○		○	[14] Upper chamber check valve	
○	○		○		○	[15] Upper chamber spool valve	

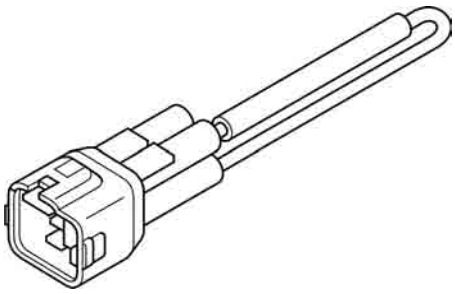
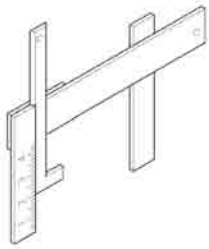
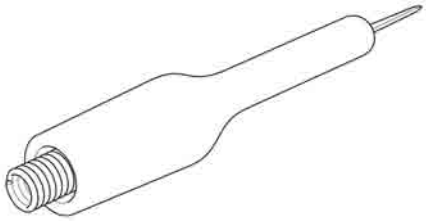

[1] MOTOR
[15] UPPER CHAMBER SPOOL VALVE
[10] PUMP
[11] DOWN RELIEF VALVE
[13] LOWER CHAMBER SPOOL VALVE
[12] LOWER CHAMBER CHECK VALVE
[2] MANUAL VALVE
[14] UPPER CHAMBER CHECK VALVE
PISTON ROD A ASSEMBLY
[8] DUST SEAL/O-RING
[1] MOTOR
[9] OIL
PUMP ASSEMBLY
[7] SHOCK RELIEF VALVE
[6] O-RING
[4] O-RING
[3] O-RING
[3] O-RING
FREE PISTON
[5] CHECK VALVE

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TOOLS

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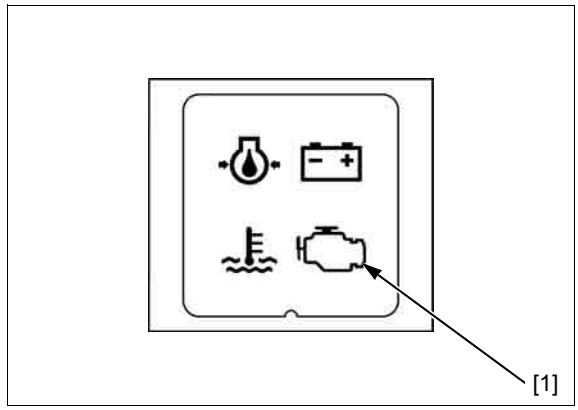
SCS service connector 070PZ-ZY30100 	Float level gauge 07401-0010000 	Fuel pressure gauge, 0 – 100 psi 07406-004000B 
Test probe 07ZAJ-RDJA110 		

SERVICE PRECAUTIONS

GENERAL TROUBLESHOOTING

Before troubleshooting

- First, check the MIL [1].
- Be sure to turn the combination switch OFF before disconnecting and connecting the connectors.
- Clear the DTCs and reset the ECM after inspection.
  – DTC (with the HDS: page 5-6)
  – MIL (without the HDS: page 5-6)



PERMANENT FAILURE

When there is a problem in the system, the MIL will blink and go off when the engine is turned off.
When there is a permanent failure, the MIL will blink again when the engine is started again, as the problem still exists.
Most permanent failures will be indicated when the combination switch is turned on and engine is started, while others are indicated only under certain conditions. MIL will blink consistently until the problem part is fixed or replaced.

INTERMITTENT FAILURE

When there is an intermittent failure, the MIL will not blink again when the engine is restarted.
The ECM stores the problem code in its memory.
An intermittent failure is often associated with a loose connector or poor contact in the circuit.

Opens and Shorts

An open or a short are common electrical terms. An open is a break in a wire or at a connection. A short is an accidental connection of a wire to ground or to another wire. This usually means something will not work at all. With an ECM, an open or short may cause something to work, just not the way it is supposed to.

FUEL LINE SERVICE

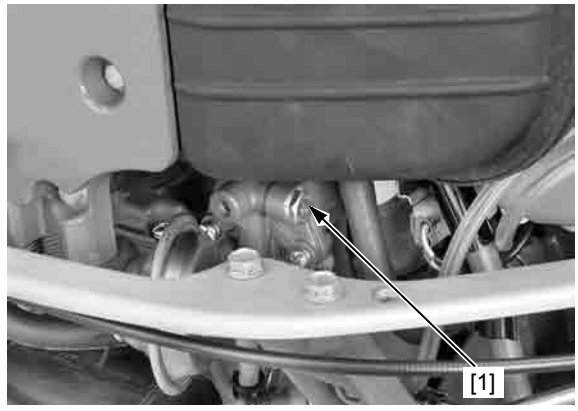
⚠WARNING

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

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 [1] of the high pressure side fuel strainer, as described in "FUEL PRESSURE RELIEVING" (page 5-66).

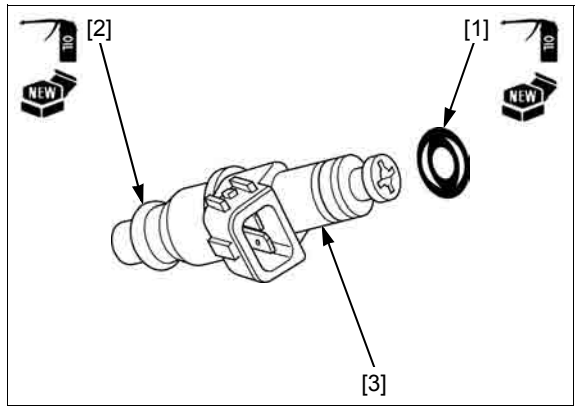
Replace the sealing washer [2] during reassembly.



Replace the O-rings (7.47 x 3.6 mm) [1] and seal rings (7.45 x 3.61 mm) [2] with new ones when the fuel line is removed/installed or replaced.

NOTE:

- Apply the recommended engine oil to the O-rings and seal rings before installing the fuel injector [3].
- Avoid using vegetable oil or alcohol based lubricants.
- Install the O-ring and seal ring in their proper locations.



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 combination switch ON (but do not turn the starter) after connecting the fuel lines. The fuel pump (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/D-GPS

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

SYSTEM DESCRIPTION

SELF-DIAGNOSIS SYSTEM

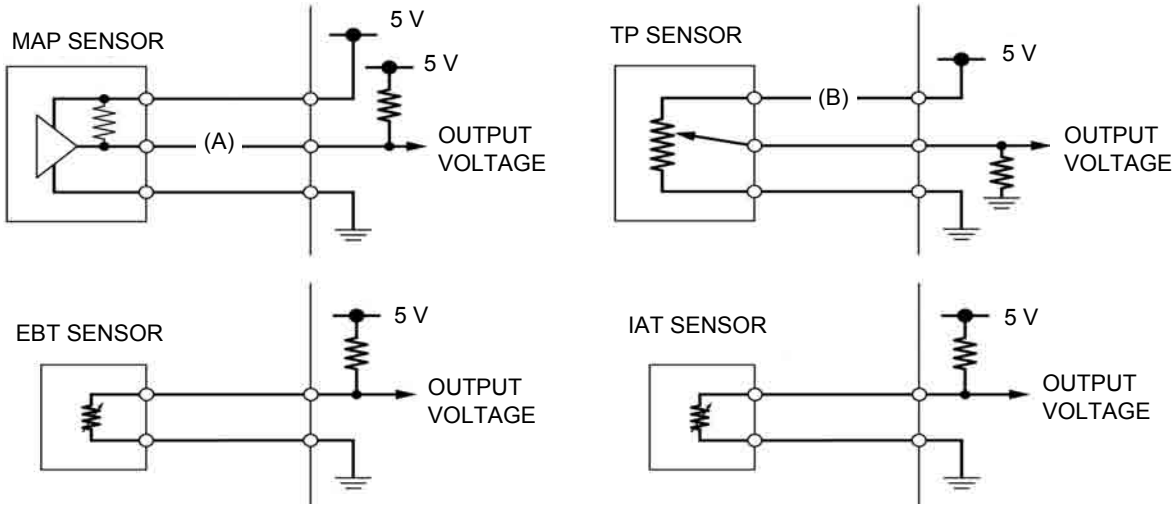
The ECM has a self-diagnosis function that memorizes the failure code and turns the MIL ON when it detects an abnormality with the input/output system.

FAIL-SAFE FUNCTION

The PGM-FI system is provided with a fail-safe function to provide minimum running capability even when there is trouble in the system. When any abnormality is detected by the self-diagnosis function, running capability is maintained by pre-programed value in the simulated program map. When any abnormality is detected in the MAP sensor or CKP sensor, the fail-safe function stops the engine to protect it from damage.

DTC (Diagnostic Trouble Code)

- The DTC is composed of a main code and a sub code and it is displayed as a hyphenated number when retrieved from the ECM with the HDS.
  The digits in front of the hyphen are the main code, they indicate the component of function failure.
  The digits behind the hyphen are the sub code, they detail the specific symptom of the component or function failure.
  For example, in the case of the TP sensor:
  – DTC 07 – 1 = (TP sensor voltage) – (lower than the specified value)
  – DTC 07 – 2 = (TP sensor voltage) – (higher than the specified value).
- The MAP, EBT, TP, and IAT sensor diagnosis will be made according to the voltage output of the affected sensor.
  If a failure occurs, the ECM determines the Function Failure, compares the sensor voltage output to the standard value, and then outputs the corresponding DTC to the HDS.
  For example:
  – If the input voltage line (A) on the MAP sensor is opened, the ECM detects the output voltage is about 5 V, then the DTC 3-2 (MAP sensor circuit high voltage) will be displayed.
  – If the input voltage line (B) on the TP sensor is opened, the ECM detects the output voltage is 0 V, then the DTC 7-1 (TP sensor circuit low voltage) will be displayed.



DTC READOUT

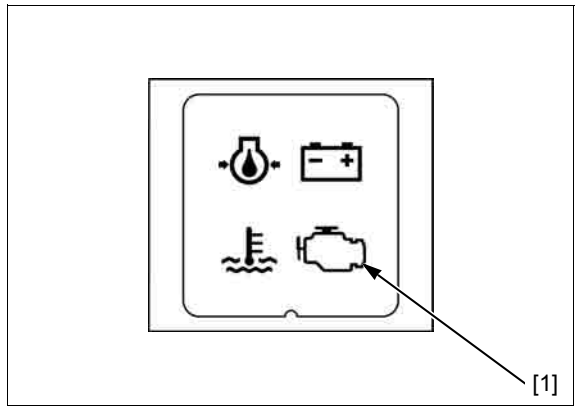
Turn the combination switch ON; the MIL [1] will stay on for a few seconds, then go off.

Start the engine and check the MIL.

- If the engine will not start, turn the starter motor for more than 10 seconds and check the MIL.

If the MIL stays on or blinks, read the following:

– DTC (with the HDS: page 5-7)
– MIL (without the HDS: page 5-7)



CLEARING DTC

How to clear the DTC with HDS

Connect the HDS to the DLC (page 5-7).

Clear the DTC with the HDS while the engine is stopped.

To clear the DTC without the HDS, refer to the following procedure.

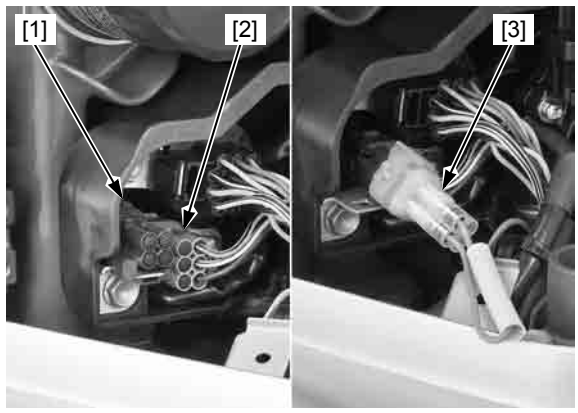
How to clear the DTC with SCS service connector

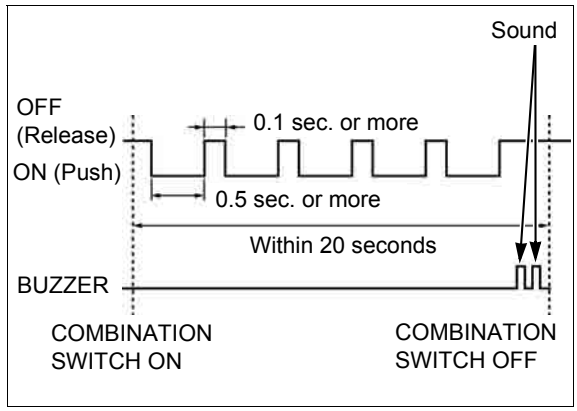
1. Turn the combination switch to OFF.
2. Remove the dummy connector [1] and short the Brown and Green wire terminals of the DLC [2] using the special tool.

   TOOL:
   SCS service connector [3] 070PZ-ZY30100
3. Push the combination switch to ON.

- Perform steps 4 though 6 within 20 seconds.

4. Push the emergency stop switch ON (push for 0.5 sec. or more) and OFF (release for 0.1 sec. or more).
   Repeat the procedure five times.
5. Check that the buzzer sounds twice.
   The MIL should stay ON.
6. Turn the combination switch OFF. (ECM reset procedure completes.)





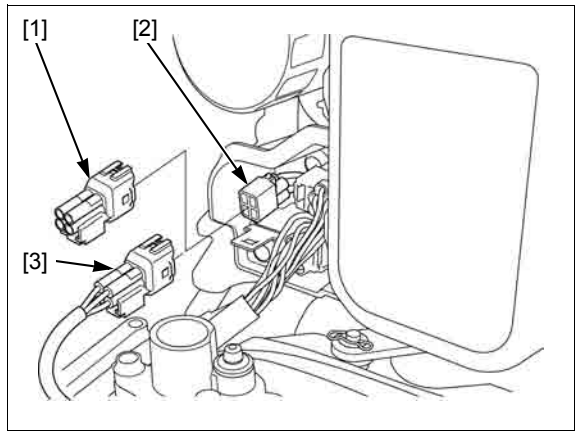
READING DTC WITH THE HDS

- The HDS can readout the DTC, freeze data, current data, and other ECM condition.

How to connect the HDS

Turn the combination switch to OFF.

Remove the dummy connector [1] from the DLC [2]. Connect the HDS [3] to the DLC.



Turn the combination switch ON and check the DTC and freeze data.

- Freeze data indicates the engine conditions when the first malfunction was detected.

Read the DTC and freeze data and follow the troubleshooting index (page 5-15).

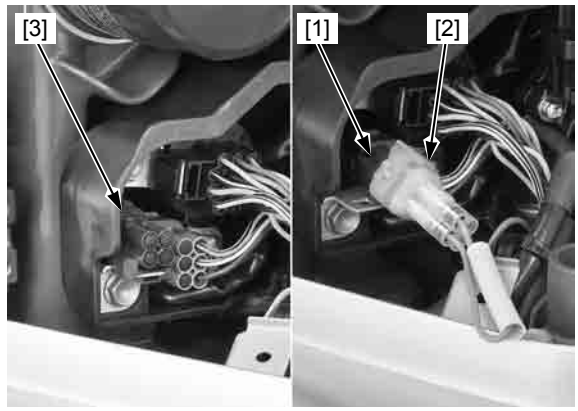
After troubleshooting, perform repairs as needed and perform the "FINAL PROCEDURE (AFTER TROUBLESHOOTING)" (page 5-8).

READING DTC WITH THE MIL

Turn the combination switch to OFF.

Remove the dummy connector [1] and short DLC terminals [2] using the special tool.

TOOL:
SCS service connector [3] 070PZ-ZY30100



Turn the combination switch ON, read, note the MIL blinks and refer to the troubleshooting index (page 5-45).

- If the ECM has any DTC in its memory, the MIL will start blinking.
- The MIL has two types of blinks, a long blink and short blink. One long blink is the equivalent of 10 short blinks. For example, when 1 long blink is followed by 4 short blinks, the MIL is 14 (1 long blinks = 10 blinks, plus 4 short blinks).
- When multiple problems occur simultaneously, the MIL repeatedly indicates them by blinking separate codes, one after another.

After troubleshooting, perform repairs as needed and perform the "FINAL PROCEDURE (AFTER TROUBLESHOOTING)" (page 5-8).

MIL CODES:

Single problem:







Multiple problems:



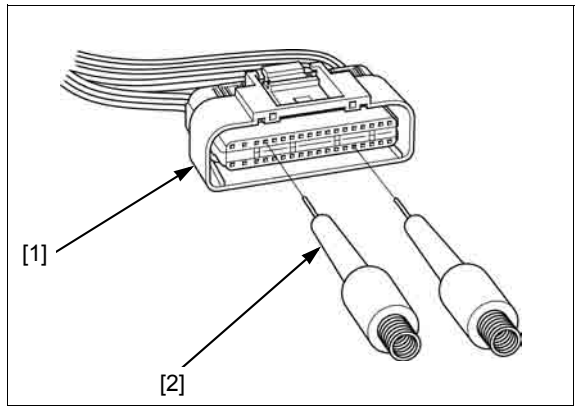




INSPECTION AT ECM CONNECTOR

- Always clean around and keep any foreign material away from the ECM [1] connector before disconnecting it.
- A faulty PGM-FI system is often related to poorly connected or corroded terminals. Check those connections before proceeding.
- In testing at the ECM connector (wire harness side) terminal, always use the test probe. Insert the test probe into the connector terminal, and then attach the digital multimeter probe to the test probe.

TOOL:
Test probe [2] **07ZAJ-RDJA110**

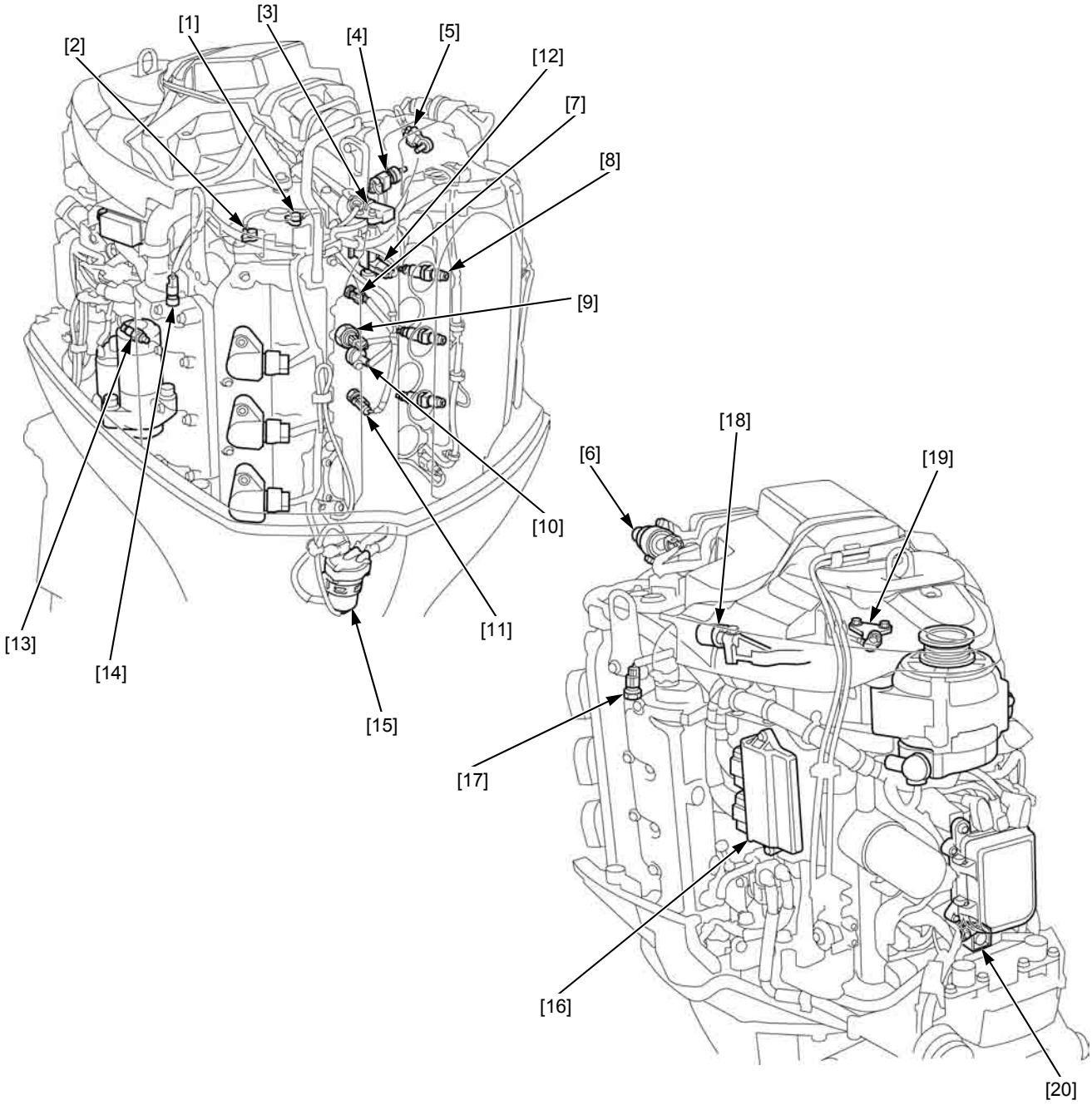


FINAL PROCEDURE (AFTER TROUBLESHOOTING)

Clear the DTCs from the ECM using the procedures shown on page 5-6.

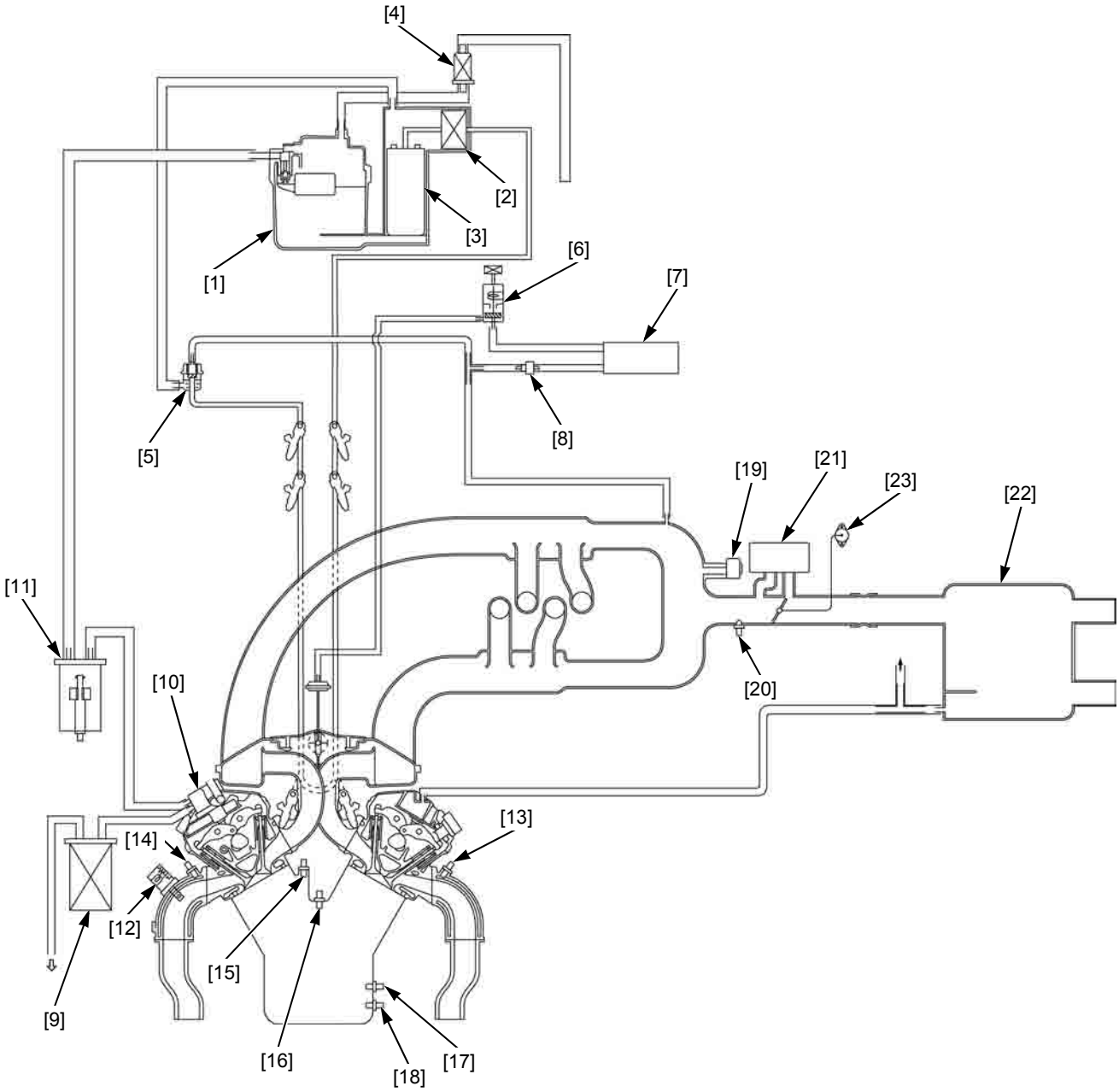
Disconnect the SCS service connector from the DLC and connect the dummy connector.
Note that the MIL stays ON while the SCS service connector is connected to the DLC.

SYSTEM LOCATION



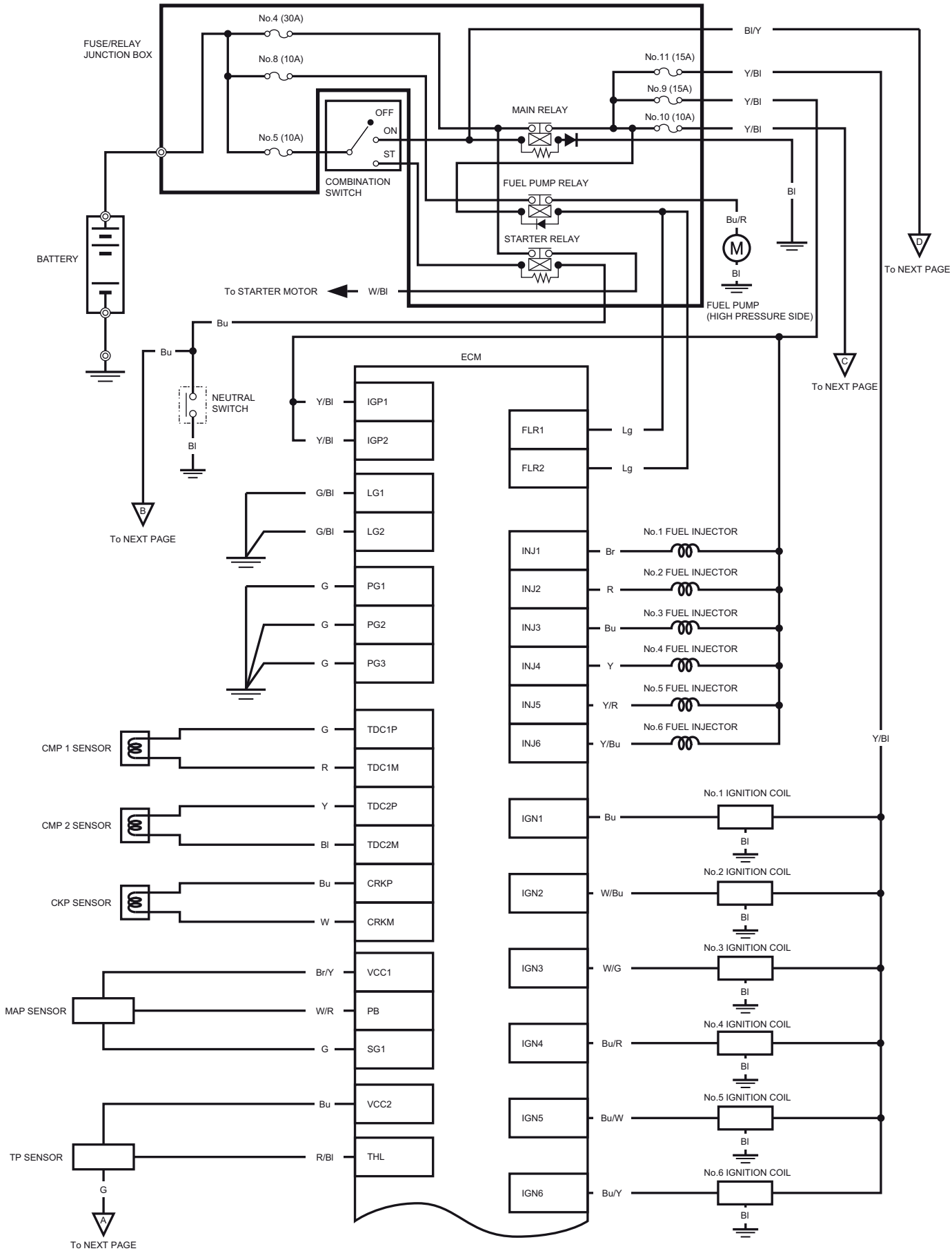
[1] CMP 1 sensor
[2] CMP 2 sensor
[3] MAP sensor
[4] IAT sensor
[5] TP sensor
[6] IAC valve
[7] EBT sensor
[8] Fuel injector
[9] Knock sensor
[10] EOP switch (Low pressure side)
[11] EOP switch (High pressure side)
[12] IAB control solenoid valve
[13] HO2S
[14] EMT sensor 2
[15] Water separator/water level sensor
[16] ECM
[17] EMT sensor 1
[18] VTEC solenoid valve
[19] CKP sensor
[20] Neutral switch

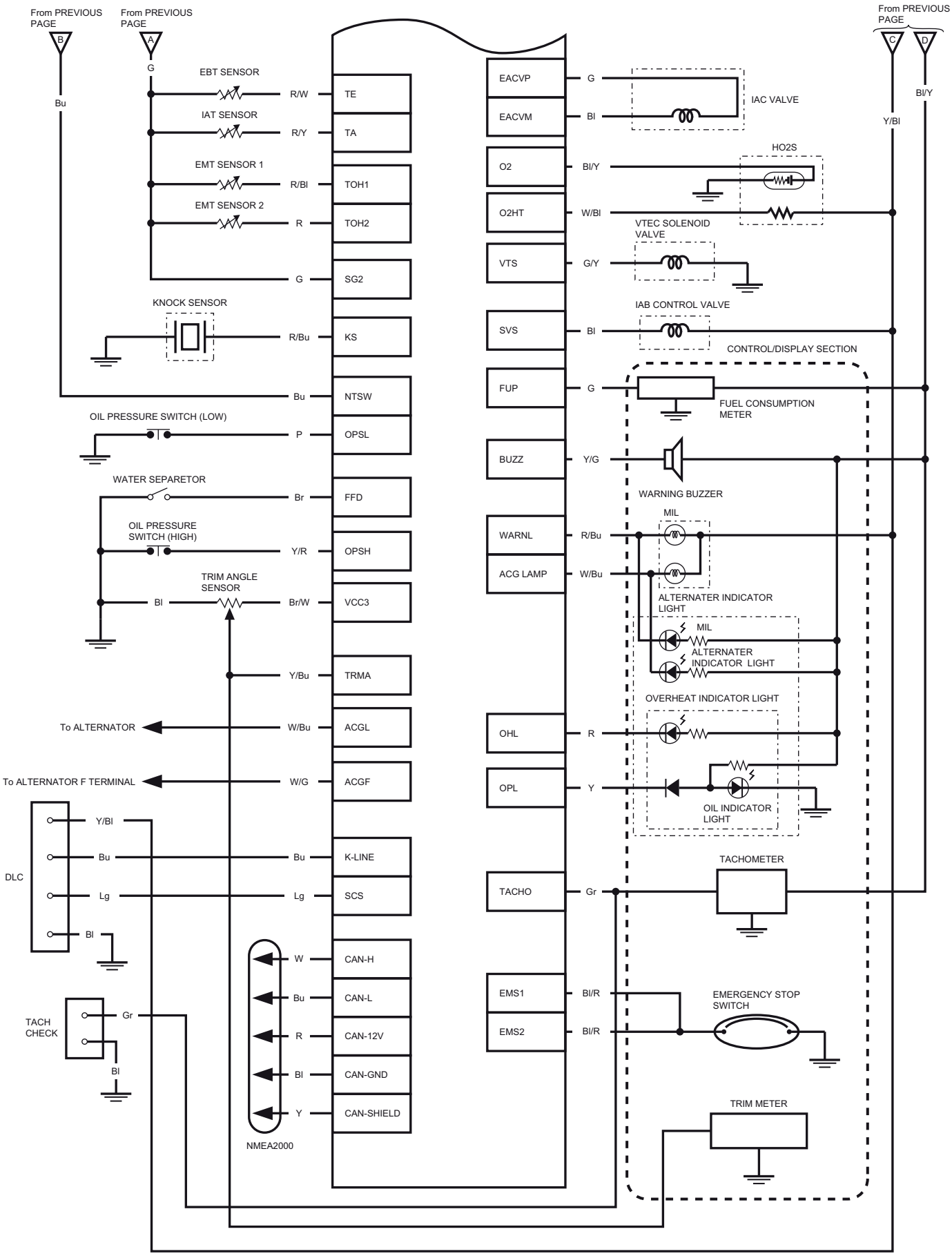
PIPING CONNECTIONS



[1] Vapor separator
[2] Fuel strainer (High pressure side)
[3] Fuel pump (High pressure side)
[4] Air vent strainer
[5] Pressure regulator
[6] IAB control solenoid valve
[7] Vacuum tank
[8] Check valve
[9] Fuel strainer (Low pressure side)
[10] Fuel pump (Low pressure side)
[11] Water separator (with water level sensor)
[12] HO2S
[13] EMT sensor 1
[14] EMT sensor 2
[15] Knock sensor
[16] EBT sensor
[17] EOP switch (High pressure side)
[18] EOP switch (Low pressure side)
[19] MAP sensor
[20] IAT sensor
[21] IAC valve
[22] Cooling fan cover
[23] TP sensor

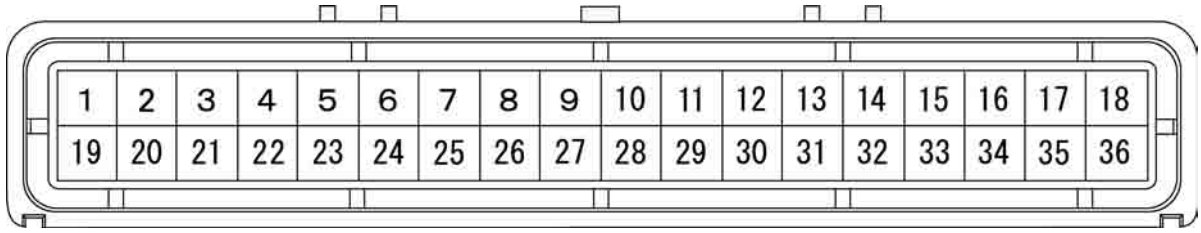
CIRCUIT DIAGRAM




From PREVIOUS PAGE
B
Bu
From PREVIOUS PAGE
A
G
EBT SENSOR
R/W
TE
IAT SENSOR
R/Y
TA
EMT SENSOR 1
R/Bl
TOH1
EMT SENSOR 2
R
TOH2
G
SG2
KNOCK SENSOR
R/Bu
KS
Bu
NTSW
OIL PRESSURE SWITCH (LOW)
P
OPSL
WATER SEPARETOR
Br
FFD
OIL PRESSURE SWITCH (HIGH)
Y/R
OPSH
TRIM ANGLE SENSOR
Bl
Br/W
VCC3
Y/Bu
TRMA
To ALTERNATOR
W/Bu
ACGL
To ALTERNATOR F TERMINAL
W/G
ACGF
DLC
Y/Bl
Bu
Lg
Bl
Bu
Lg
K-LINE
SCS
TACH CHECK
Gr
Bl
W
Bu
R
Bl
Y
CAN-H
CAN-L
CAN-12V
CAN-GND
CAN-SHIELD
NMEA2000
EACVP
EACVM
G
Bl
IAC VALVE
O2
Bl/Y
HO2S
O2HT
W/Bl
VTEC SOLENOID VALVE
VTS
G/Y
IAB CONTROL VALVE
SVS
Bl
CONTROL/DISPLAY SECTION
FUP
G
FUEL CONSUMPTION METER
BUZZ
Y/G
WARNING BUZZER
MIL
WARNL
R/Bu
ACG LAMP
W/Bu
ALTERNATER INDICATOR LIGHT
MIL
ALTERNATER INDICATOR LIGHT
OVERHEAT INDICATOR LIGHT
OHL
R
OPL
Y
OIL INDICATOR LIGHT
TACHOMETER
TACHO
Gr
EMS1
EMS2
Bl/R
Bl/R
EMERGENCY STOP SWITCH
TRIM METER
From PREVIOUS PAGE
C
D
Y/Bl
Bl/Y

ECM TERMINAL ARRANGEMENT

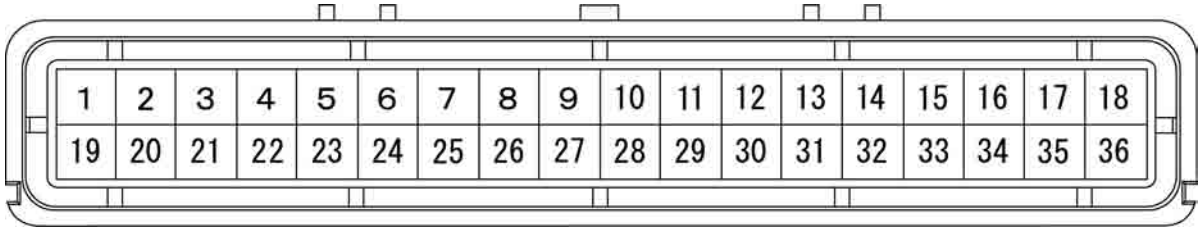
ECM CONNECTOR A (GRAY)



ECM side connector (viewed from the terminal side)

Terminal No.	Terminal mark	Name	Content/Signal
1	–	–	–
2	ACGLP	Alternator indicator lamp	Alternator indicator lamp output
3	WARNL	MIL	MIL output
4	TDC2P	CMP 2 sensor (+)	CMP 2 sensor (+) input
5	TDC2M	CMP 2 sensor (–)	CMP 2 sensor (–) input
6	TE	EBT sensor	EBT sensor input
7	THL	TP sensor	TP sensor input
8	PB	MAP sensor	MAP sensor input
9	–	–	–
10	TACHO	Tachometer	Tachometer pulse output
11	K-LINE	Communication signal	Tester communication signal input/output
12	SVS	IAB control solenoid	IAB control solenoid output
13	FLR1	Fuel pump relay 1	Fuel pump relay 1 output
14	FLR2	Fuel pump relay 2	Fuel pump relay 2 output
15	IGN6	No.6 direct ignition coil	No.6 ignition coil output
16	IGN4	No.4 direct ignition coil	No.4 ignition coil output
17	PG3	Power ground 3	Power ground 3
18	O2HT	O_2 sensor heater	O_2 sensor heater output
19	BUZZ	Warning buzzer	Warning buzzer output
20	CRKP	CKP sensor (+)	CKP sensor (+) input
21	CRKM	CKP sensor (–)	CKP sensor (–) input
22	TOH1	EMT sensor 1	EMT sensor 1 input
23	TA	IAT sensor	IAT sensor input
24	TDC1P	CMP 1 sensor (+)	CMP 1 sensor (+) input
25	TDC1M	CMP 1 sensor (–)	CMP 1 sensor (–) input
26	FUP	Fuel consumption meter	Fuel consumption volume output
27	O2	HO2S	HO2S input
28	ACGF	Alternator FR signal	Alternator FR signal input
29	TRMA	Trim angle sensor	Trim angle sensor input
30	TOH2	EMT sensor 2	EMT sensor 2 input
31	OPL	Oil indicator light	Oil indicator light output
32	OHL	Overheat indicator light	Overheat indicator light output
33	IGN5	No.5 direct ignition coil	No.5 ignition coil output
34	IGN3	No.3 direct ignition coil	No.3 ignition coil output
35	IGN2	No.2 direct ignition coil	No.2 ignition coil output
36	IGN1	No.1 direct ignition coil	No.1 ignition coil output

ECM CONNECTOR B (BLACK)



ECM side connector (viewed from the terminal side)

Terminal No.	Terminal mark	Name	Content/Signal
1	CAN1H	NMEA CAN HI	NMEA CAN HI output
2	CAN 12V	NMEA 12 V power source	NMEA 12 V power input
3	CAN GND	NMEA ground	NMEA ground
4	–	–	–
5	LG1	Logic ground 1	Logic ground 1
6	VCC1	Sensor power 1	Sensor power 5 V output 1
7	VCC2	Sensor power 2	Sensor power 5 V output 2
8	IGP1	Power source 1	Power 12 V input 1
9	IGP2	Power source 2	Power 12 V input 2
10	VTS	VTEC control solenoid	VTEC control solenoid output
11	INJ 6	No.6 injector	No.6 injector output
12	INJ 5	No.5 injector	No.5 injector output
13	INJ 4	No.4 injector	No.4 injector output
14	INJ 3	No.3 injector	No.3 injector output
15	INJ 2	No.2 injector	No.2 injector output
16	INJ 1	No.1 injector	No.1 injector output
17	PG2	Power ground 2	Power ground 2
18	EACVP	IAC valve (+)	IAC valve (+) output
19	CAN1L	NMEA CAN LO	NMEA CAN LO output
20	SHIELD	NMEA shield	NMEA shield
21	–	–	–
22	VCC3	Sensor power 3	Sensor power 5 V output 3
23	LG2	Logic ground 2	Logic ground 2
24	SG1	Sensor ground 1	Sensor ground 1
25	SG2	Sensor ground 2	Sensor ground 2
26	OPSL	EOP switch (Low pressure side)	EOP switch (Low pressure side) input
27	KS	Knock sensor	Knock sensor input
28	FFD	Water level sensor	Water level sensor input
29	NTSW	Neutral switch	Neutral switch input
30	EMS1	Emergency stop switch 1	Emergency stop switch input 1
31	EMS2	Emergency stop switch 2	Emergency stop switch input 2
32	OPSH	EOP switch (High pressure side)	EOP switch (High pressure side) input
33	SCS	Service check signal	Service check signal input
34	ACGL	Alternator indicator light	Alternator indicator light input
35	PG1	Power ground 1	Power ground 1
36	EACVM	IAC valve (–)	IAC valve (–) output

DTC TROUBLESHOOTING

DTC INDEX

DTC	MIL	Detected component	Probable cause	Ref. page
0 or does not communicate	MIL does not come ON/blink 	ECM	• Loose or poor contact of the connector • Faulty indicator light • Open circuit in MIL wire • Open circuit in ECM power/ ground cable • Faulty ECM	4-17
0 or does not communicate	MIL stay ON 	ECM	• SCS service connector activated • Short circuit in DLC wire • Short circuit in MIL wire • Short circuit in sensor power circuit • Faulty ECM	5-18
0-2	ON 	Internal failure of ECM	• Faulty ECM	5-20
1-4	ON 	HO2S	• Loose or poor contact of the connector • Open or short circuit in HO2S wire • Faulty fuel supply system • Faulty HO2S	5-21
3-1	ON 	MAP sensor (voltage too low)	• Loose or poor contact of the connector • Short circuit in MAP sensor wire • Faulty MAP sensor	5-22
3-2	ON 	MAP sensor (voltage too high)	• Loose or poor contact of the connector • Open circuit in MAP sensor wire • Faulty MAP sensor	5-23
4-1	ON 	CKP sensor (no pulse)	• Loose or poor contact of the connector • Open or short circuit in CKP sensor wire • Faulty CKP sensor	5-24
4-2	ON 	CKP sensor (abnormal pulse)	• Loose or poor contact of the connector • Faulty CKP sensor • Faulty Guide plate	5-25
6-1	ON 	ECT sensor 1 (EBT sensor) (voltage too low)	• Loose or poor contact of the connector • Short circuit in EBT sensor wire • Faulty EBT sensor	5-26
6-2	ON 	ECT sensor 1 (EBT sensor) (voltage too high)	• Loose or poor contact of the connector • Open circuit in EBT sensor wire • Faulty EBT sensor	5-27
7-1	ON 	TP sensor (voltage too low)	• Loose or poor contact of the connector • Open and short circuit in TP sensor wire • Faulty TP sensor	5-28
7-2	ON 	TP sensor (voltage too high)	• Loose or poor contact of the connector • Open circuit in TP sensor wire • Faulty TP sensor	5-29

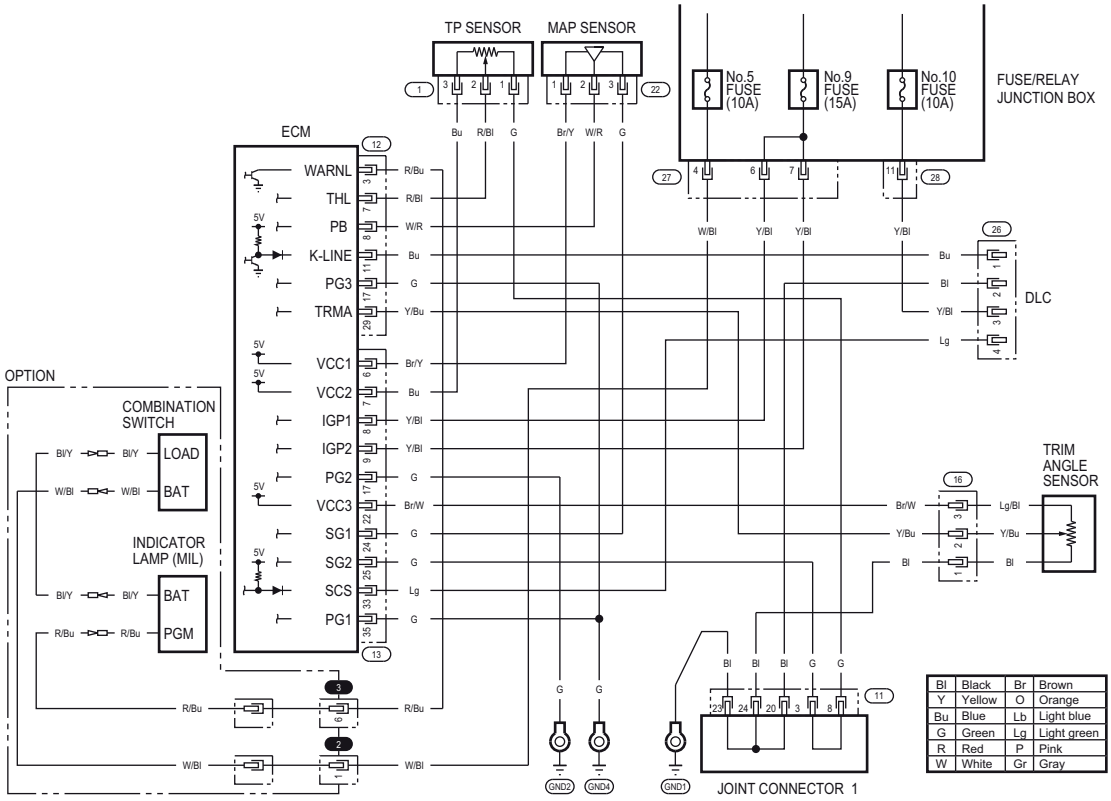
DTC	MIL	Detected component	Probable cause	Ref. page
8-1	ON 	CMP 1 sensor (no pulse)	• Loose or poor contact of the connector • Open or short circuit in CMP 1 sensor wire • Faulty CMP 1 sensor	5-30
8-2	ON 	CMP 1 sensor (abnormal pulse)	• Loose or poor contact of the connector • Faulty CMP 1 sensor	5-31
10-1	ON 	IAT sensor (voltage too low)	• Loose or poor contact of the connector • Short circuit in IAT sensor wire • Faulty IAT sensor	5-32
10-2	ON 	IAT sensor (voltage too high)	• Loose or poor contact of the connector • Open circuit in IAT sensor wire • Faulty IAT sensor	5-33
14-1	ON 	IAT valve (abnormal current)	• Loose or poor contact of the connector • Open or short circuit in IAC valve wire • Faulty IAC valve	5-34
21-1	ON 	VTEC spool solenoid valve	• Loose or poor contact of the connector • Open or short circuit in VTEC spool solenoid valve wire • Faulty VTEC spool solenoid valve	5-35
23-1	ON 	Knock sensor	• Loose or poor contact of the connector • Open or short circuit in knock sensor wire • Faulty knock sensor	5-36
41-2	ON 	HO2S heater (abnormal current)	• Loose or poor contact of the connector • Open or short circuit in HO2S heater wire • Faulty HO2S	5-37
58-1	ON 	CMP 2 sensor (no pulse)	• Loose or poor contact of the connector • Open or short circuit in CMP 2 sensor wire • Faulty CMP 2 sensor	5-38
58-2	ON 	CMP 2 sensor (abnormal pulse)	• Loose or poor contact of the connector • Faulty CMP 2 sensor	5-39
140-1	ON 	ECT sensor 2 (EMT sensor 1) (voltage too low)	• Loose or poor contact of the connector • Short circuit in EMT sensor 1 wire • Faulty EMT sensor 1	5-40
140-2	ON 	ECT sensor 2 (EMT sensor 1) (voltage too high)	• Loose or poor contact of the connector • Open circuit in EMT sensor 1 wire • Faulty EMT sensor 1	5-41

DTC	MIL	Detected component	Probable cause	Ref. page
141-1	ON 	ECT sensor 3 (EMT sensor 2) (voltage too low)	• Loose or poor contact of the connector • Short circuit in EMT sensor 2 wire • Faulty EMT sensor 2	5-42
141-2	ON 	ECT sensor 3 (EMT sensor 2) (voltage too high)	• Loose or poor contact of the connector • Open circuit in EMT sensor 2 wire • Faulty EMT sensor 2	5-43
142-1	ON 	EOP switch (high pressure side)	• Loose or poor contact of the connector • Open or short circuit in EOP switch (High pressure side) wire • Faulty EOP switch (high pressure side)	5-44

When multiple DTCs are shown

DTC	MIL	Detected component	Probable cause	Ref. page
1,6,7,10,13, 140,141, 142	ON 	SG (sensor ground) line	• Open circuit in SG (sensor ground) line	–

MIL IS ON BUT DTC IS 0 OR DOES NOT COMMUNICATE



1. DLC power/GND line open circuit inspection

Turn the combination switch OFF and disconnect the HDS.

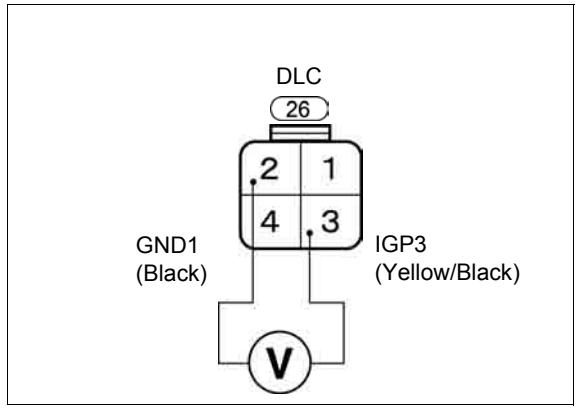
Turn the combination switch ON.

Measure the voltage at the DLC (26) No.3 (Yellow/Black) terminal and No.2 (Black) terminal.

Does battery voltage exit?

YES – GO TO STEP 2.

NO – • Repair open in the Yellow/Black wire between the No.10 fuse and DLC.
• Repair open in the Black wire between the ground cable (GND1) and DLC.
• If main wire harness is normal, inspect the No.10 fuse circuit in the fuse/relay junction box (page 10-13).



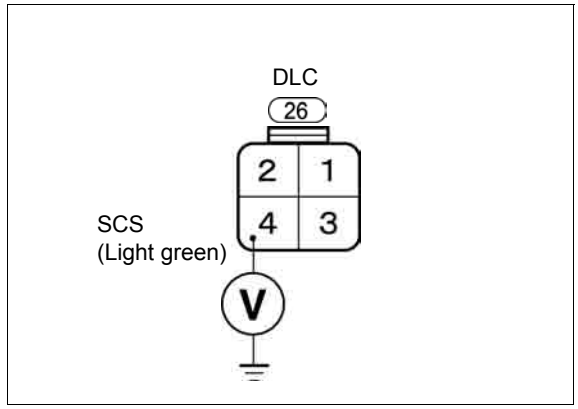
2. DLC signal line short circuit inspection

Measure the voltage between the DLC (26) No.4 (Light green) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 3.

NO – Repair short in the main wire harness between the ECM and the DLC.



3. MIL ON line short circuit inspection

Turn the combination switch OFF.
Disconnect ECM connector A (12).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – GO TO STEP 4.

NO – Repair short in the main wire harness between the ECM and the MIL.

4. MAP sensor power line short circuit inspection 1

Turn the combination switch OFF.
Connect ECM connector A (12).
Disconnect the MAP sensor 3P connector (22).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – Replace the MAP sensor.

NO – GO TO STEP 5.

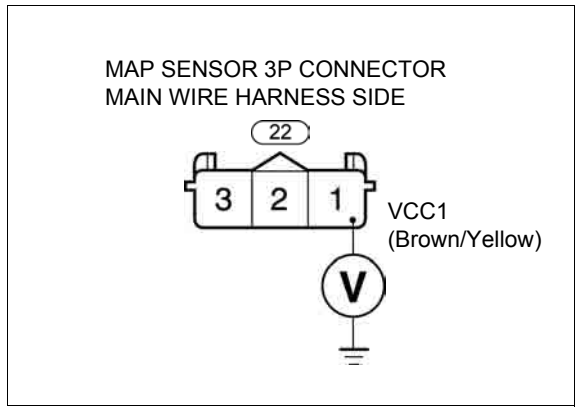
5. MAP sensor power line short circuit inspection 2

Measure the voltage between the MAP sensor 3P connector (22) main wire harness side No.1 (Brown/Yellow) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 6.

NO – Repair short in the main wire harness between the ECM and the MAP sensor.



6. TP sensor power line short circuit inspection 1

Turn the combination switch OFF.
Disconnect the TP sensor 3P connector (1).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – Replace the TP sensor.

NO – GO TO STEP 7.

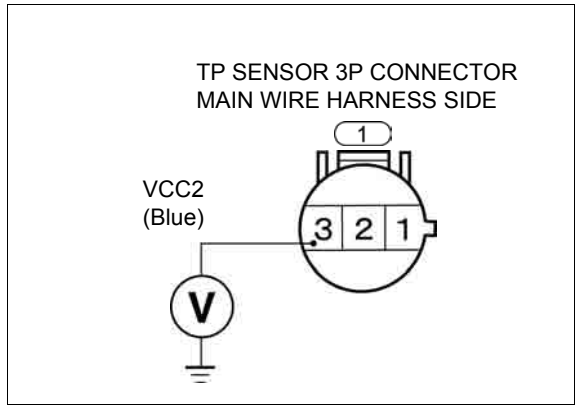
7. TP sensor power line short circuit inspection 2

Measure the voltage between the TP sensor 3P connector (1) main wire harness side No.3 (Blue) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 8.

NO – Repair short in the main wire harness between the ECM and the TP sensor.



8. Trim angle sensor power line short circuit inspection 1

Turn the combination switch OFF.
Disconnect the trim angle sensor 3P connector (16).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – Replace the trim angle sensor.

NO – GO TO STEP 9.

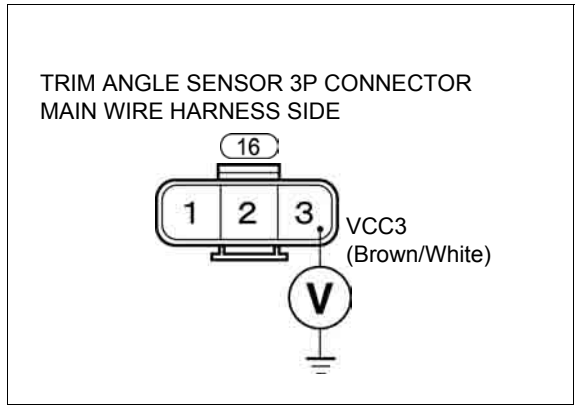
9. Trim angle sensor power line short circuit inspection 2

Measure the voltage between the trim angle sensor 3P connector (16) main wire harness side No.3 (Brown/White) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – Replace the ECM with a new one and recheck.

NO – Repair short in the main wire harness between the ECM and the trim angle sensor.



DTC 0-2 (INTERNAL FAILURE OF ECM)

1. Reappearance test

Turn the combination switch ON and wait for one second or more.

Clear the DTC (page 5-6).

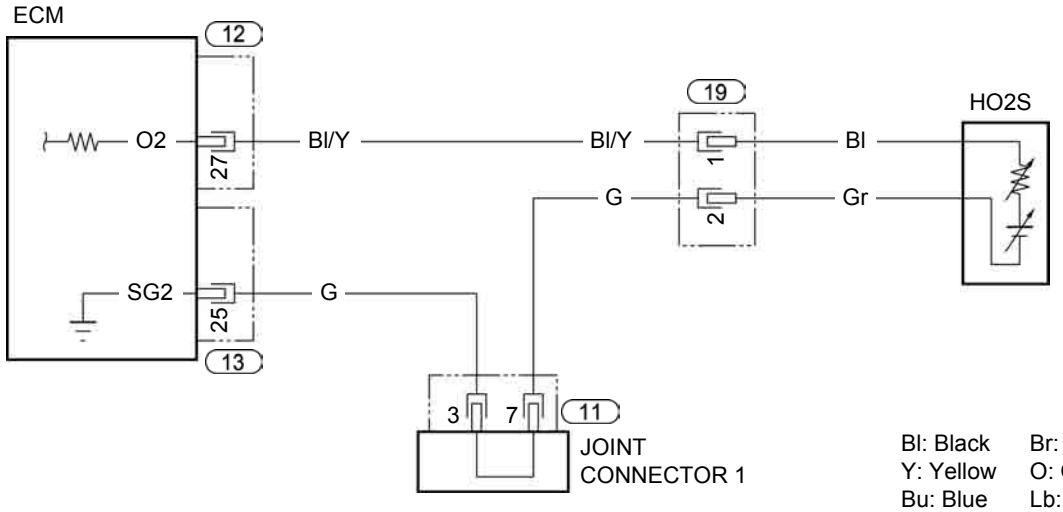
Start the engine and recheck the DTC using the HDS.

Does the DTC 0-2 appear?

YES – Replace the ECM with a new one and recheck

NO – Temporary failure (code does not reappear)

DTC 1-4 (ABNORMAL HO2S)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the HO2S 4P connector (19), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load.
Let the engine idle for 1 minute or more.

Check the DTC using the HDS.

Does the DTC 1-4 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. HO2S inspection

Turn the combination switch OFF and disconnect the HO2S 4P connector (19).

Inspect the HO2S (page 5-126).

Is the HO2S correct?

YES – GO TO STEP 3.

NO – Replace the HO2S with a new one and recheck.

3. Fuel supply system inspection

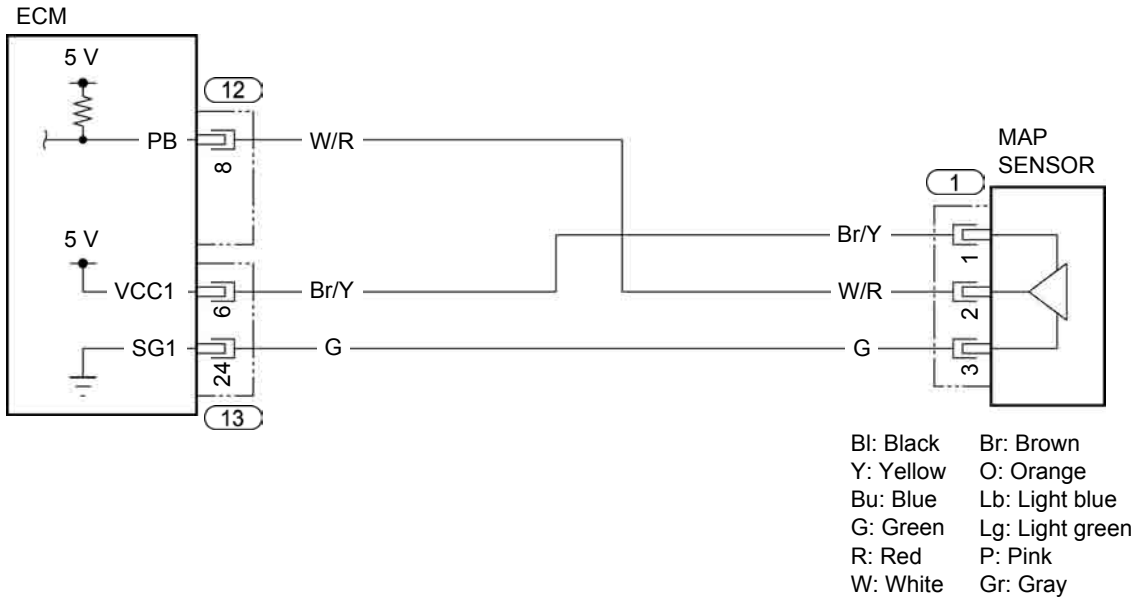
Measure the fuel pressure (page 5-110).

Is the fuel pressure normal?

YES – Repair open or short in the main wire harness between the ECM and HO2S. If the main wire harness is correct, replace the ECM with a new one, and recheck.

NO – Repair fuel supply system and recheck under normal fuel pressure.

DTC 3-1, 3-2 (MAP SENSOR VOLTAGE TOO LOW OR TOO HIGH)



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

DTC 3-1 (MAP SENSOR VOLTAGE IS TOO LOW)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the MAP sensor 3P connector (1), ECM connector A (12), ECM connector B (13) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the MAP sensor voltage using the HDS.

Is the measurement within 0.23 – 4.49 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

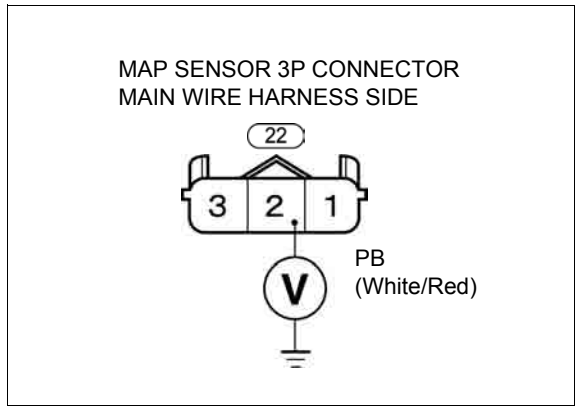
2. MAP sensor signal line short circuit inspection

Turn the combination switch OFF and disconnect the MAP sensor 3P connector (22).
Turn the combination switch ON.
Measure the voltage between the MAP sensor 3P connector (22) main wire harness side No.2 (White/Red) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – Replace the MAP sensor with a new one and recheck.

NO – Repair short in the main wire harness between the ECM and MAP sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



DTC 3-2 (MAP SENSOR VOLTAGE IS TOO HIGH)

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the MAP sensor 3P connector (22), ECM connector A (12), ECM connector B (13) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the MAP sensor voltage using the HDS.

Is the measurement within 0.23 – 4.49 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. MAP sensor power line open circuit inspection

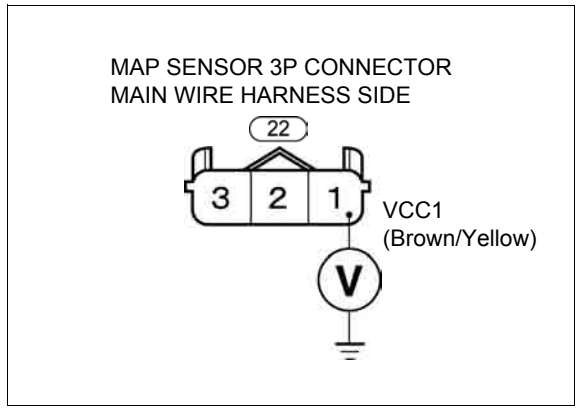
Turn the combination switch OFF and disconnect the MAP sensor 3P connector (22).

Turn the combination switch ON.
Measure the voltage between the MAP sensor 3P connector (22) main wire harness side No.1 (Brown/Yellow) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 3.

NO – Repair open in the main wire harness between the ECM and MAP sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



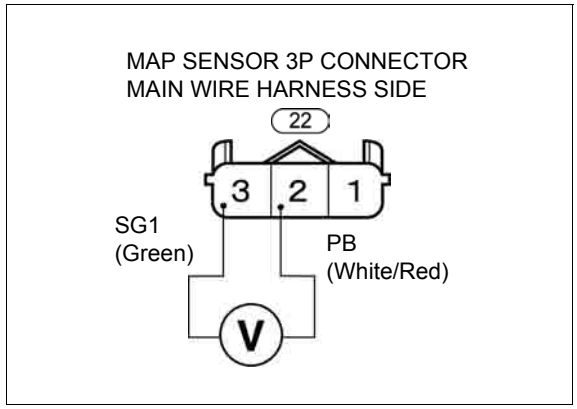
3. MAP sensor signal/GND line open circuit inspection

Measure the voltage between the MAP sensor 3P connector (22) main wire harness side No.2 (White/Red) terminal and No.3 (Green) terminal.

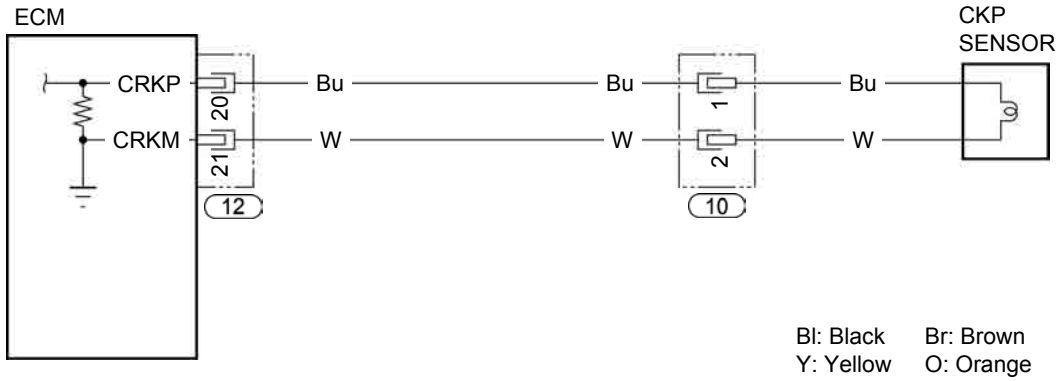
Is the measurement within 4.75 – 5.25 V?

YES – Replace the MAP sensor with a new one and recheck.

NO – • Repair open in the White/Red wire between the ECM and MAP sensor.
• Repair open in the Green wire between the ECM and MAP sensor.
• If the main wire harness is correct, replace the ECM with a new one, and recheck



DTC 4-1, 4-2 (NO CKP SENSOR PULSE OR ABNORMAL CKP SENSOR PULSE)



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

DTC 4-1 (NO CKP SENSOR PULSE)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CKP sensor 2P connector (10), ECM connector A (12) and then reconnect them.

Clear the DTC (page 5-6).

• Continue the procedure if the DTC does not clear.

Start the engine and check the DTC using the HDS.

Does the DTC 4-1 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CKP sensor inspection

Turn the combination switch OFF.

Inspect the CKP sensor (page 5-123).

Is the CKP sensor correct?

YES – Repair the open or short circuit in the CKP sensor harness between the CKP sensor and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the CKP sensor with a new one and recheck.

DTC 4-2 (ABNORMAL CKP SENSOR PULSE)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CKP sensor 2P connector (10), ECM connector A (12) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and check the DTC using the HDS.

Does the DTC 4-2 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CKP sensor installation inspection

Turn the combination switch OFF.

Inspect the CKP sensor installation (page 5-102).

Is the CKP sensor installed correctly?

YES – GO TO STEP 3.

NO – Install the CKP sensor correctly and recheck.

3. CKP sensor inspection

Replace the CKP sensor and connect the CKP sensor 2P connector (10).

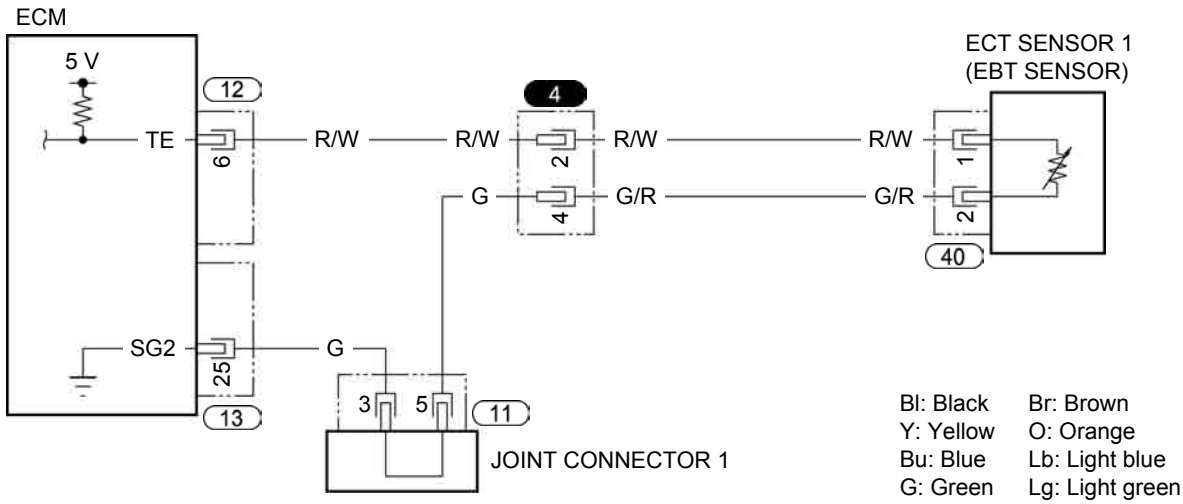
Start the engine and check the DTC using the HDS.

Does the DTC 4-2 appear?

YES – Replace the ECM with a new one and recheck.

NO – Faulty original CKP sensor.

DTC 6-1, 6-2 (ECT SENSOR 1 (EBT SENSOR) VOLTAGE IS TOO LOW OR TOO HIGH)



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

DTC 6-1 (ECT SENSOR 1 (EBT SENSOR) VOLTAGE IS TOO LOW)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the EBT sensor 2P connector (40), ECM connector A (12), ECM connector B (13), switch wire 6P connector (4), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the EBT sensor voltage using the HDS.

Is the measurement within 0.08 – 4.92 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. EBT sensor signal line short circuit inspection

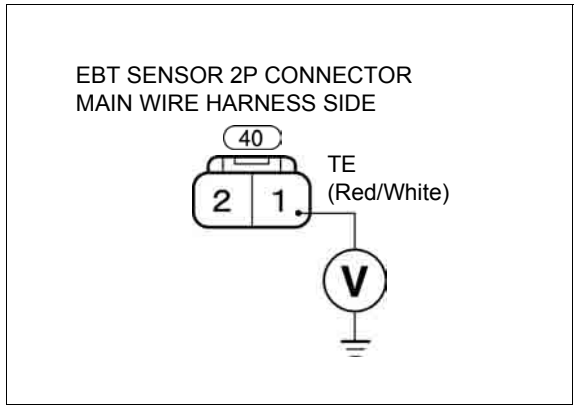
Turn the combination switch OFF and disconnect the EBT sensor 2P connector (40).

Turn the combination switch ON.
Measure the voltage between the EBT sensor 2P connector (40) main wire harness side No.1 (Red/White) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – Replace the EBT sensor with a new one and recheck.

NO – Repair short in the main wire harness between the ECM and EBT sensor. If the main wire is correct, replace the ECM with a new one and recheck.



DTC 6-2 (ECT SENSOR 1 (EBT SENSOR) VOLTAGE IS TOO HIGH)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the EBT sensor 2P connector (40), ECM connector A (12), ECM connector B (13), switch wire 6P connector (4) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the EBT sensor voltage using the HDS.

Is the measurement within 0.08 – 4.92 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. EBT sensor signal /GND line open circuit inspection

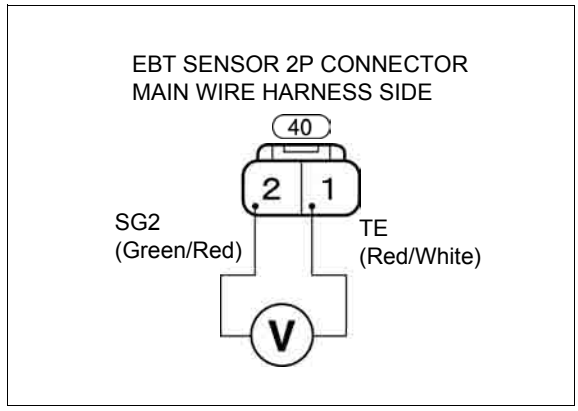
Turn the combination switch OFF and disconnect the EBT sensor 2P connector (40).

Turn the combination switch ON.
Measure the voltage between the EBT sensor 2P connector (40) main wire harness side No.1 (Red/White) terminal and No.2 (Green/Red) terminal.

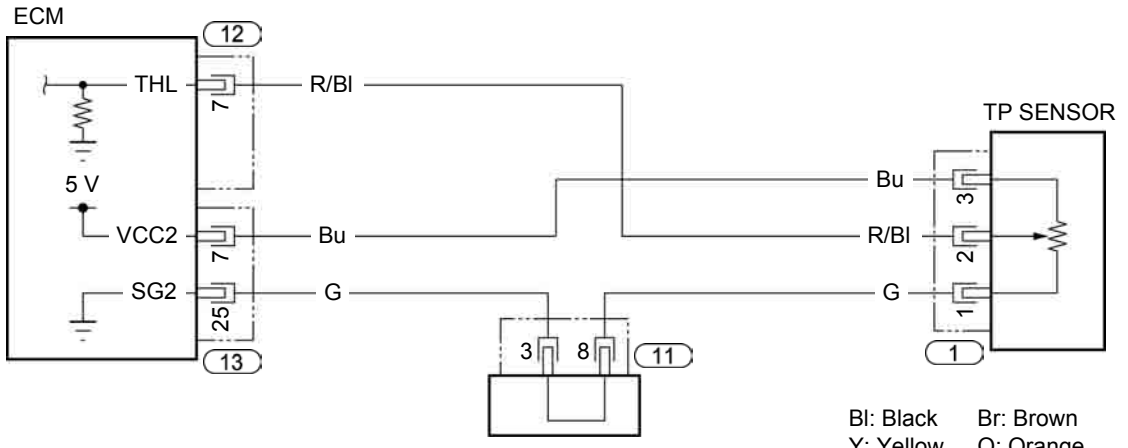
Is the measurement within 4.75 – 5.25 V?

YES – Replace the EBT sensor with a new one and recheck.

NO – Repair open in the Red/White or Green/Red wire harness between the ECM and EBT sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



DTC 7-1, 7-2 (TP SENSOR VOLTAGE IS TOO LOW OR TOO HIGH)



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

DTC 7-1 (TP SENSOR VOLTAGE IS TOO LOW)

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the TP sensor 3P connector (1), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the TP sensor voltage using the HDS.

Is the measurement within 0.23 – 4.89 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. TP sensor power/signal line open circuit inspection

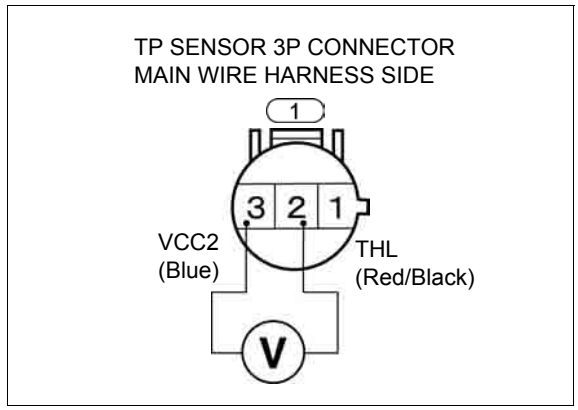
Turn the combination switch OFF and disconnect the TP sensor 3P connector (1).

Turn the combination switch ON.
Measure the voltage between the TP sensor 3P connector (1) main wire harness side No.3 (Blue) terminal and No.2 (Red/Black) terminal.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 3.

NO –
- Repair open in the Blue wire between the ECM and TP sensor
- Repair open in the Red/Black wire between the ECM and TP sensor
- If the main wire harness is correct, replace the ECM with a new one, and recheck



3. TP sensor signal line short circuit inspection

Turn the combination switch OFF.
Disconnect ECM connector A (12).

Check for continuity between the TP sensor 3P connector (1) main wire harness side No.2 (Red/Black) terminal and engine ground.

Is there continuity?

YES – Repair short in the main wire harness between the ECM and TP sensor.

NO – Replace the throttle body with a new one and recheck.

DTC 7-2 (TP SENSOR VOLTAGE IS TOO HIGH)

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the TP sensor 3P connector (1), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the TP sensor voltage using the HDS.

Is the measurement within 0.23 – 4.89 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. TP sensor inspection

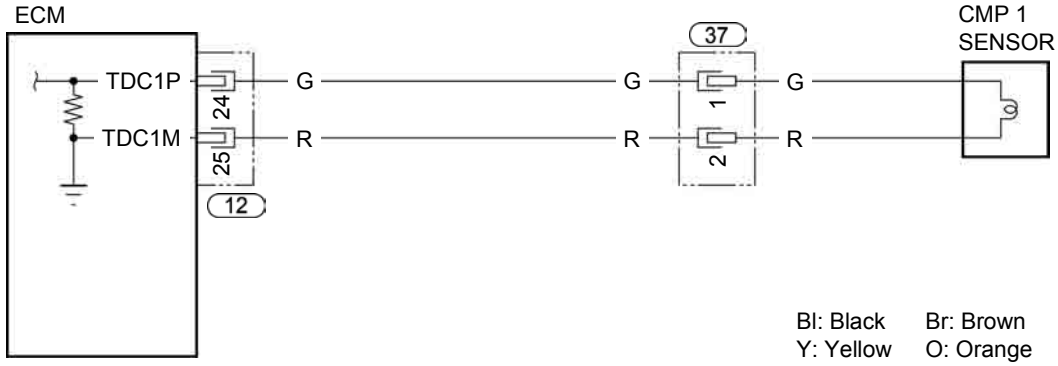
Turn the combination switch ON and measure the TP sensor voltage using the HDS.

Is the measurement within 4.49 – 4.85 V when the throttle is fully open and within 0.44 – 0.56 V when the throttle is fully closed?

YES – Replace the ECM with a new one and recheck.

NO – Repair the open circuit in the Green/Red wire between the TP sensor and the ECM. If the main wire harness is correct, replace the throttle body with a new one and recheck.

DTC 8-1, 8-2 (NO CMP 1 SENSOR PULSE OR ABNORMAL SENSOR PULSE)



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

DTC 8-1 (NO CMP 1 SENSOR PULSE)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CMP sensor 4P connector (37), ECM connector A (12) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and check the DTC using the HDS.

Does the DTC 8-1 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CMP sensor inspection

Turn the combination switch OFF.

Inspect the CMP 1 sensor (page 5-123).

Is the CMP 1 sensor correct?

YES – Repair the open or short circuit in the CMP 1 sensor harness between the CMP 1 sensor and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the CMP 1 sensor with a new one and recheck.

DTC 8-2 (ABNORMAL CMP 1 SENSOR PULSE)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CMP sensor 4P connector (37), ECM connector A (12) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and check the DTC using the HDS.

Does the DTC 8-2 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CMP 1 sensor installation inspection

Turn the combination switch OFF.

Inspect the CMP 1 sensor installation (page 5-103).

Is the CMP 1 sensor installed correctly?

YES – GO TO STEP 3.

NO – Install the CMP 1 sensor correctly and recheck.

3. CMP 1 sensor inspection

Replace the CMP sensor and connect the CMP sensor 4P connector (37).

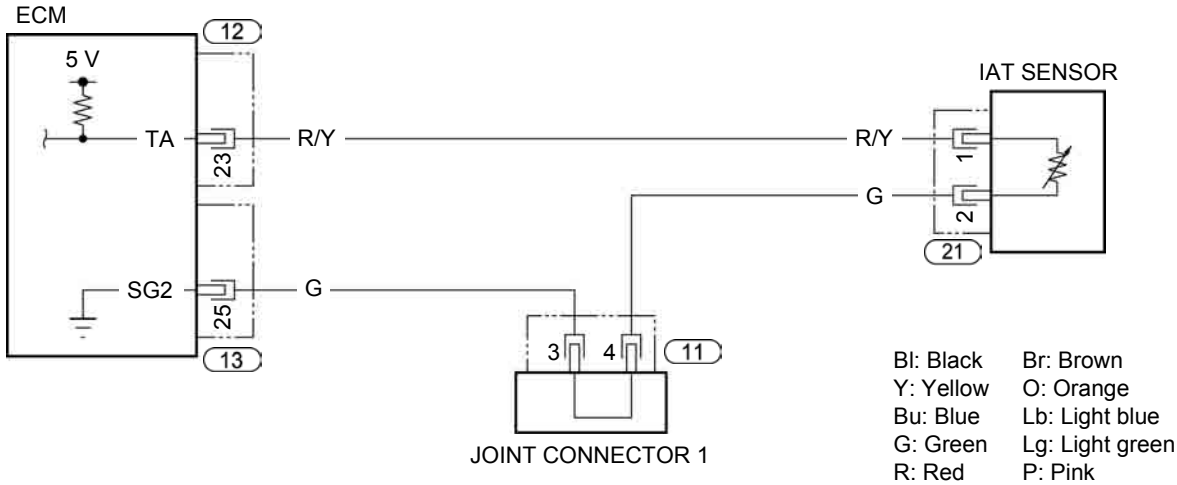
Start the engine and check the DTC using the HDS.

Does the DTC 8-2 appear?

YES – Replace the ECM with a new one and recheck.

NO – Faulty original CMP 1 sensor.

DTC 10-1, 10-2 (IAT SENSOR VOLTAGE IS TOO LOW OR TOO HIGH)



DTC 10-1 (IAT SENSOR VOLTAGE IS TOO LOW)

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the IAT sensor 2P connector (21), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the IAT sensor voltage using the HDS.

Is the measurement within 0.08 – 4.92 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. IAT sensor signal line short circuit inspection

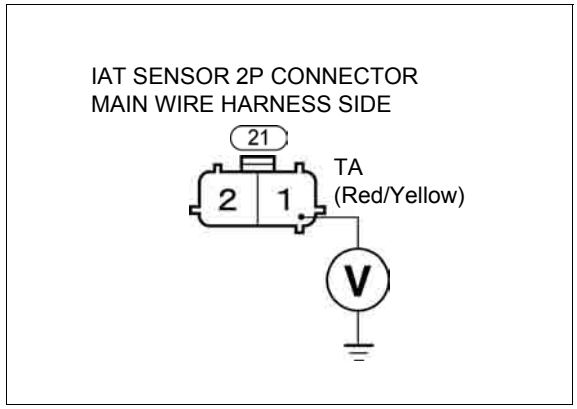
Turn the combination switch OFF and disconnect the IAT sensor 2P connector (21).

Turn the combination switch ON.
Measure the voltage between the IAT sensor 2P connector (21) main wire harness side No.1 (Red/Yellow) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – Replace the IAT sensor with a new one and recheck.

NO – Repair short in the main wire harness between the ECM and IAT sensor. If the main wire is correct, replace the ECM with a new one and recheck.



DTC 10-2 (IAT SENSOR VOLTAGE IS TOO HIGH)

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the IAT sensor 2P connector (21), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the IAT sensor voltage using the HDS.

Is the measurement within 0.08 – 4.92 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. IAT sensor signal line open circuit inspection

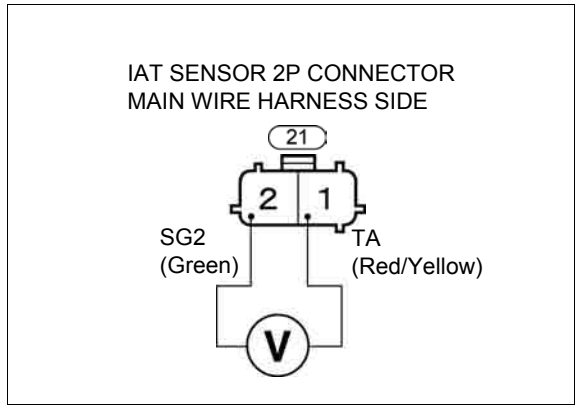
Turn the combination switch OFF and disconnect the IAT 2P connector (21).

Turn the combination switch ON.
Measure the voltage between the IAT sensor 2P connector (21) main wire harness side No.1 (Red/Yellow) terminal and No.2 (Green) terminal.

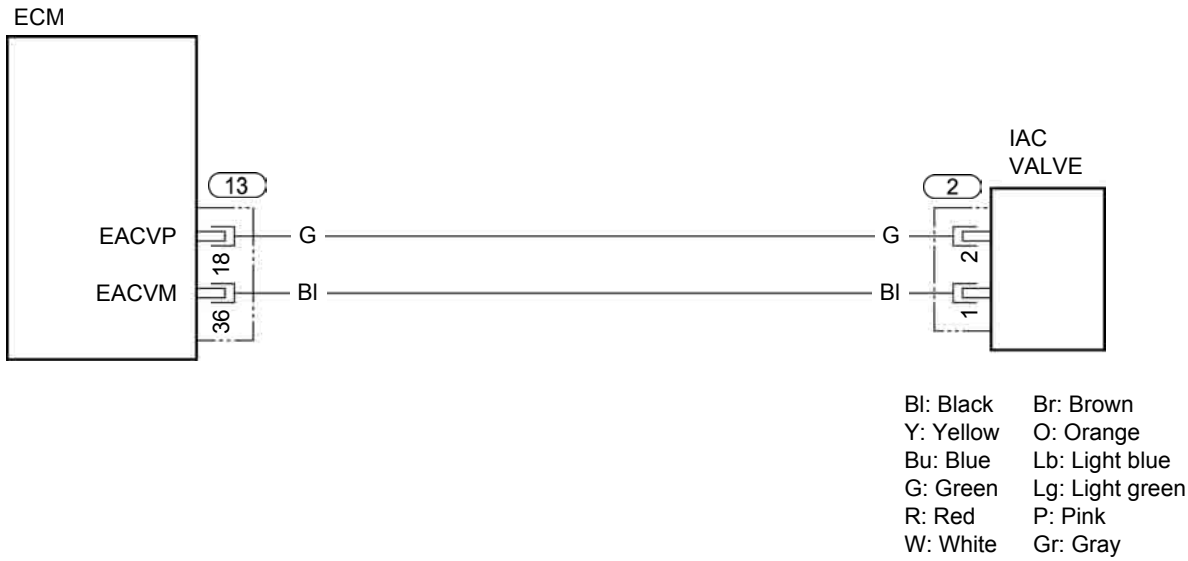
Is the measurement within 4.75 – 5.25 V?

YES – Replace the IAT sensor with a new one and recheck.

NO – Repair open in the Red/Yellow or Green/Red wire harness between the ECM and IAT sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



DTC 14-1 (ABNORMAL IAC VALVE)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the IAC valve 2P connector (2), ECM connector B (13) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and check the DTC using the HDS.

Does the DTC 14-1 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. IAC valve inspection

Turn the combination switch OFF and disconnect the IAC valve 2P connector (2).

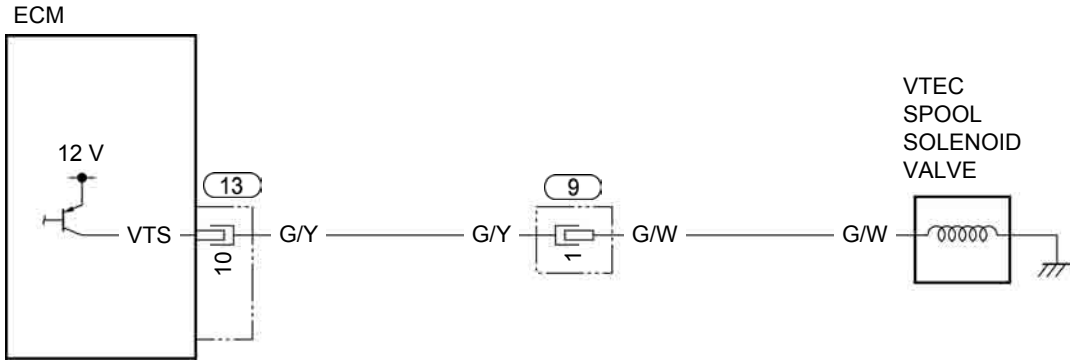
Inspect the IAC valve (page 5-125).

Is the IAC valve correct?

YES – Repair open or short in the main wire harness between the ECM and IAC valve. If main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the IAC valve with a new one and recheck.

DTC 21-1 (ABNORMAL OUTPUT OF VTEC SPOOL SOLENOID VALVE)



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. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the VTEC spool solenoid valve 1P connector (9), ECM connector B (13) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load.

Disconnect the neutral switch 2P connector (30).

Raise the engine speed slowly and let it run at 4,500 min^{-1} (rpm) for a few seconds.

Recheck the DTC with the HDS.

Does the DTC 21-1 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. VTEC spool solenoid valve inspection

Turn the combination switch OFF and disconnect the VTEC spool solenoid valve 1P connector (9).

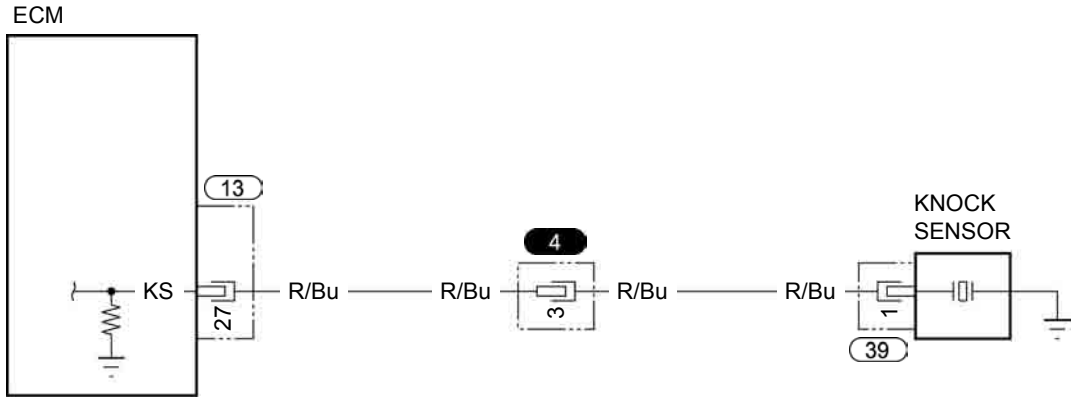
Inspect the VTEC spool solenoid valve (page 5-125).

Is the VTEC spool solenoid valve correct?

YES – Repair open in the main wire harness between the ECM and VTEC spool solenoid valve. If main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the VTEC spool solenoid valve with a new one and recheck.

DTC 23-1 (ABNORMAL OUTPUT OF KNOCK SENSOR)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the knock sensor 1P connector (39), ECM connector B (13), switch wire 6P connector (4) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load until the engine temperature is over 85 °C (185 °F).
Lower the engine speed gradually and run it at 3,000 – 4,000 min^{-1} (rpm) for 10 seconds.

Recheck the DTC with the HDS.

Does the DTC 23-1 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. Knock sensor line open or short circuit inspection

Turn the combination switch OFF.

Disconnect the knock sensor 1P connector (39) and ECM connector B (13).

Check the open and short in wire between the Knock sensor and ECM.

Is the knock sensor line correct?

YES – GO TO STEP 3.

NO – Repair open or short in the main wire harness between the ECM and knock sensor.

3. Knock sensor inspection

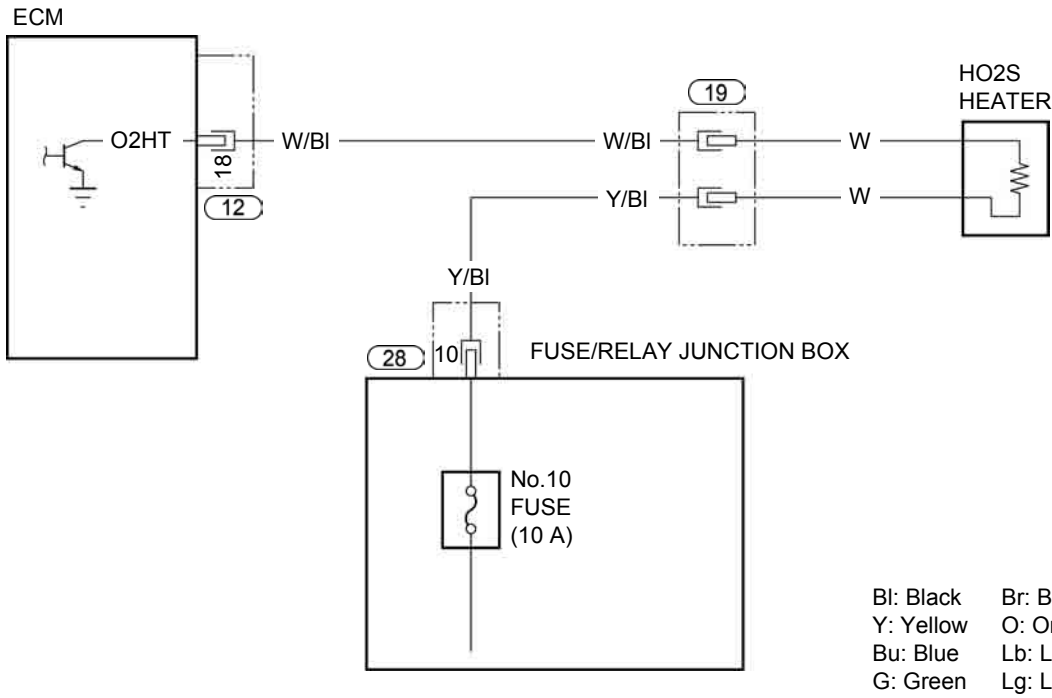
Replace the knock sensor with a new one and perform the knock sensor symptom reproduction test.

Does the DTC 23-1 appear?

YES – Replace the ECM with a new one and recheck.

NO – Faulty original knock sensor. End of inspection.

DTC 41-2 (ABNORMAL HO2S HEATER)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the HO2S 4P connector (19), ECM connector A (12), junction box 23P connector (28) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load.
Let the engine idle for a minute or more.

Check the DTC using the HDS.

Does the DTC 41-2 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. HO2S heater inspection

Turn the combination switch OFF.

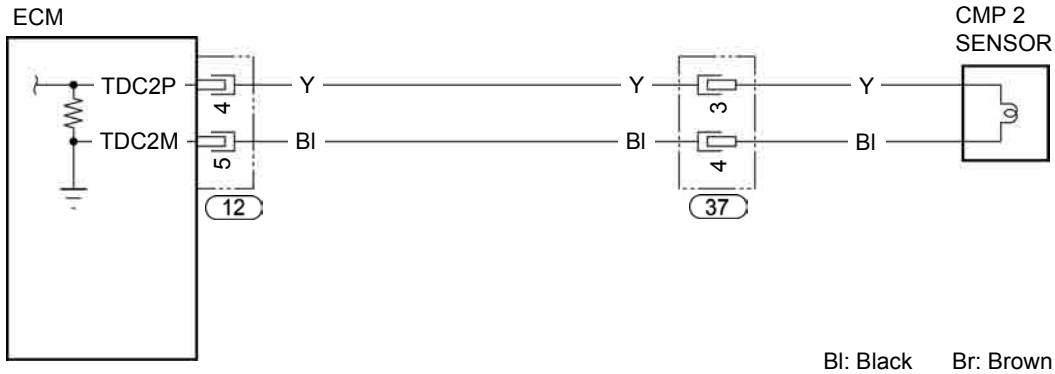
Inspect the HO2S heater (page 5-126).

Is the HO2S heater correct?

YES – Repair open in the main wire harness between the No.10 fuse and the HO2S or between the HO2S and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the HO2S with a new one and recheck.

DTC 58-1, 58-2 (NO CMP 2 SENSOR PULSE OR ABNORMAL SENSOR PULSE)



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

DTC 58-1 (NO CMP SENSOR PULSE)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CMP sensor 4P connector (37), ECM connector A (12) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and check the DTC using the HDS.

Does the DTC 58-1 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CMP sensor inspection

Turn the combination switch OFF.

Inspect the CMP 2 sensor (page 5-124).

Is the CMP sensor correct?

YES – Repair the open or short circuit in the CMP 2 sensor harness between the CMP 2 sensor and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the CMP 2 sensor with a new one and recheck.

DTC 58-2 (ABNORMAL CMP SENSOR PULSE)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CMP sensor 2P connector (37), ECM connector A (12) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Start the engine and check the DTC using the HDS.

Does the DTC 58-2 appear?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CMP sensor installation inspection

Turn the combination switch OFF.

Inspect the CMP 2 sensor installation (page 5-103).

Is the CKP sensor installed correctly?

YES – GO TO STEP 3.

NO – Install the CMP 2 sensor correctly and recheck.

3. CMP sensor inspection

Replace the CMP 2 sensor and connect the CMP sensor 4P connector (37).

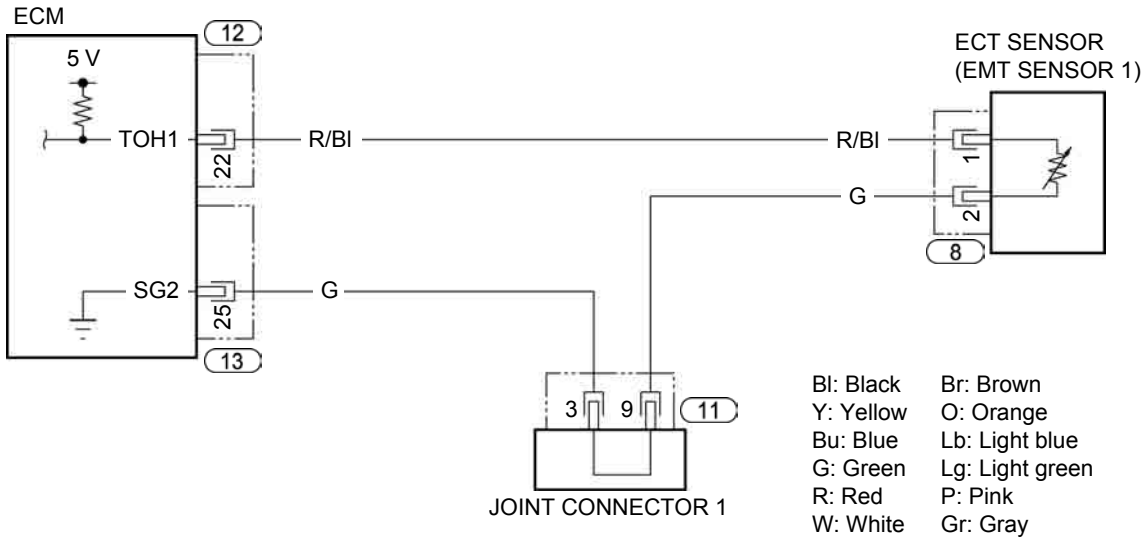
Start the engine and check the DTC using the HDS.

Does the DTC 58-2 appear?

YES – Replace the ECM with a new one and recheck.

NO – Faulty original CMP 2 sensor.

DTC 140-1, 140-2 (ECT SENSOR 2 (EMT SENSOR 1) VOLTAGE IS TOO LOW OR TOO HIGH)



DTC 140-1 (ECT SENSOR 2 (EMT SENSOR 1) VOLTAGE IS TOO LOW)

1. **Symptom reproduction test**

   Turn the combination switch OFF.
   Disconnect the EMT sensor 1 2P connector (8), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

   Clear the DTC (page 5-6).

   - Continue the procedure if the DTC does not clear.

   Turn the combination switch ON.
   Measure the EMT sensor 1 voltage using the HDS.

   Is the measurement within 0.08 – 4.92 V?

   YES – Temporary failure (code does not reappear).

   NO – GO TO STEP 2.

2. **EMT sensor 1 signal line short circuit inspection**

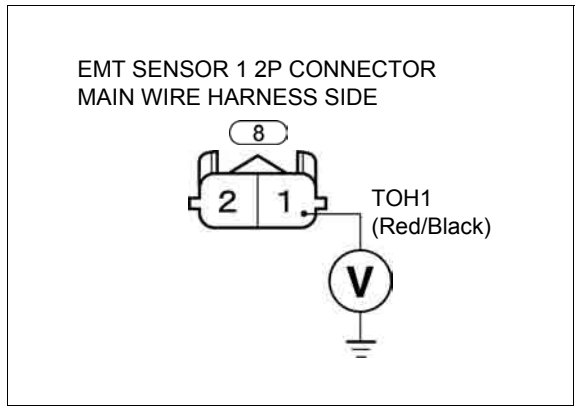
   Turn the combination switch OFF and disconnect the EMT sensor 1 2P connector (8).

   Turn the combination switch ON.
   Measure the voltage between the EMT sensor 1 2P connector (8) main wire harness side No.1 (Red/Black) terminal and engine ground.

   Is the measurement within 4.75 – 5.25 V?

   YES – Replace the EMT sensor 1 with a new one and recheck.

   NO – Repair short in the main wire harness between the ECM and EMT sensor 1. If the main wire is correct, replace the ECM with a new one and recheck.



DTC 140-2 (ECT SENSOR 2 (EMT SENSOR 1) VOLTAGE IS TOO HIGH)

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the EMT sensor 1 2P connector (8), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the EMT sensor 1 voltage using the HDS.

Is the measurement within 0.08 – 4.92 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. EMT sensor 1 signal /GND line open circuit inspection

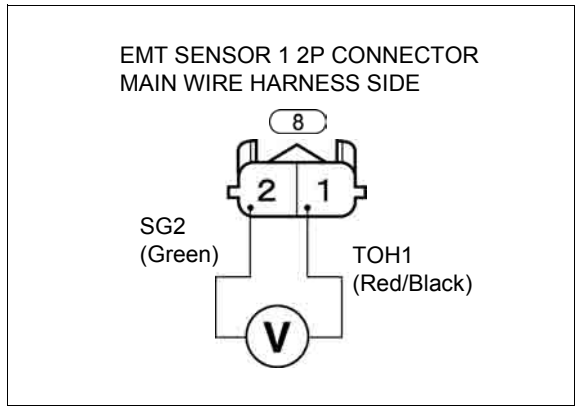
Turn the combination switch OFF and disconnect the EMT sensor 1 2P connector (8).

Turn the combination switch ON.
Measure the voltage between the EMT sensor 1 2P connector (8) main wire harness side No.1 (Red/Black) terminal and No.2 (Green) terminal.

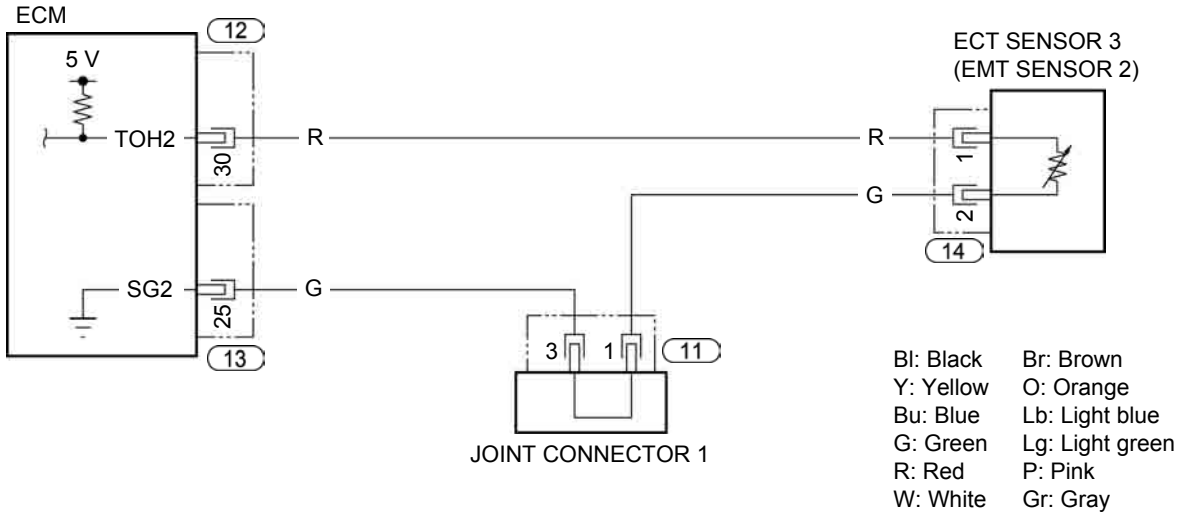
Is the measurement within 4.75 – 5.25 V?

YES – Replace the EMT sensor 1 with a new one and recheck.

NO – Repair open in the Red/Black or Green wire harness between the ECM and EMT sensor 1. If the main wire harness is correct, replace the ECM with a new one and recheck.



DTC 141-1, 141-2 (ECT SENSOR 3 (EMT SENSOR 2) VOLTAGE IS TOO LOW OR TOO HIGH)



DTC 141-1 (ECT SENSOR 3 (EMT SENSOR 2) VOLTAGE IS TOO LOW)

1. **Symptom reproduction test**

   Turn the combination switch OFF.
   Disconnect the EMT sensor 2 2P connector (14), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

   Clear the DTC (page 5-6).

   - Continue the procedure if the DTC does not clear.

   Turn the combination switch ON.
   Measure the EMT sensor 2 voltage using the HDS.

   Is the measurement within 0.08 – 4.92 V?

   YES – Temporary failure (code does not reappear).

   NO – GO TO STEP 2.

2. **EMT sensor 2 signal line short circuit inspection**

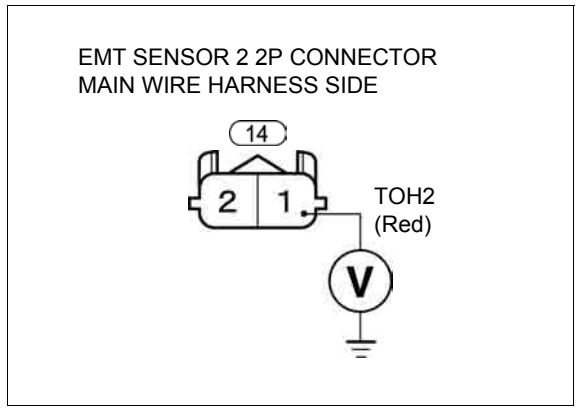
   Turn the combination switch OFF and disconnect the EMT sensor 2 2P connector (14).

   Turn the combination switch ON.
   Measure the voltage between the EMT sensor 2 2P connector (14) main wire harness side No.1 (Red) terminal and engine ground.

   Is the measurement within 4.75 – 5.25 V?

   YES – Replace EMT sensor 2 with a new one and recheck.

   NO – Repair short in the main wire harness between the ECM and EMT sensor 2. If the main wire is correct, replace the ECM with a new one and recheck.



DTC 141-2 (ECT SENSOR 3 (EMT SENSOR 2) VOLTAGE IS TOO HIGH)

1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the EMT sensor 2 2P connector (14), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Measure the EMT sensor 2 voltage using the HDS.

Is the measurement within 0.08 – 4.92 V?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. EMT sensor 2 signal/GND line open circuit inspection

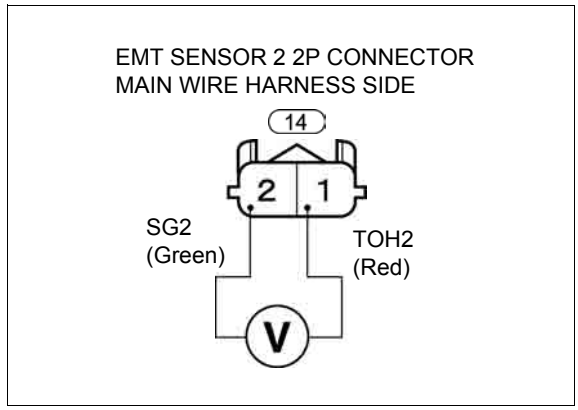
Turn the combination switch OFF and disconnect the EMT sensor 2 2P connector (14).

Turn the combination switch ON.
Measure the voltage between the EMT sensor 2 2P connector (14) main wire harness side No.1 (Red) terminal and No.2 (Green) terminal.

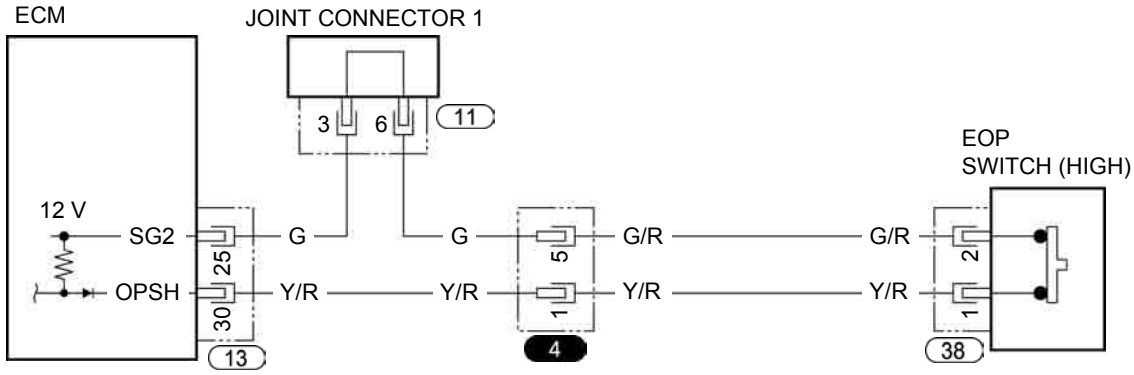
Is the measurement within 4.75 – 5.25 V?

YES – Replace EMT sensor 2 with a new one and recheck.

NO – Repair open in the Red or Green wire harness between the ECM and EMT sensor 2. If the main wire harness is correct, replace the ECM with a new one and recheck.



DTC 142-1 (ABNORMAL EOP SWITCH (HIGH PRESSURE SIDE))



Bl: Black	Br: Brown
Y: Yellow	O: Orange
Bu: Blue	Lb: Light blue
G: Green	Lg: Light green
R: Red	P: Pink
W: White	Gr: Gray

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the EOP switch (High pressure side) 2P connector (38), ECM connector B (13), switch wire 6P connector (4), joint connector 1 (11) and then reconnect them.

Clear the DTC (page 5-6).

- Continue the procedure if the DTC does not clear.

Turn the combination switch ON.
Check the EOP switch (high pressure side) signal with the HDS.

Is there the OFF signal?

YES – Temporary failure (code does not reappear).

NO – GO TO STEP 2.

2. EOP switch (high pressure side) line open circuit inspection

Turn the combination switch OFF and disconnect the EOP switch (high pressure side) 2P connector (38).

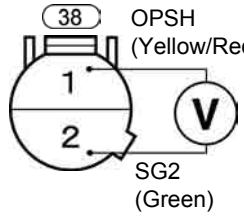
Turn the combination switch ON.
Measure the voltage between the EOP switch (high pressure side) 2P connector (38) main wire harness side No.1 (Yellow/Red) terminal and No.2 (Green) terminal.

Does battery voltage exist?

YES – Replace the EOP switch (high pressure side) with a new one and recheck.

NO – Repair open in the main wire harness between the ECM and EOP switch (high pressure side). If main wire harness is correct, replace the ECM with a new one and recheck.

EOP SWITCH (HIGH PRESSURE SIDE)
2P CONNECTOR MAIN WIRE HARNESS SIDE



MIL TROUBLESHOOTING

MIL INDEX

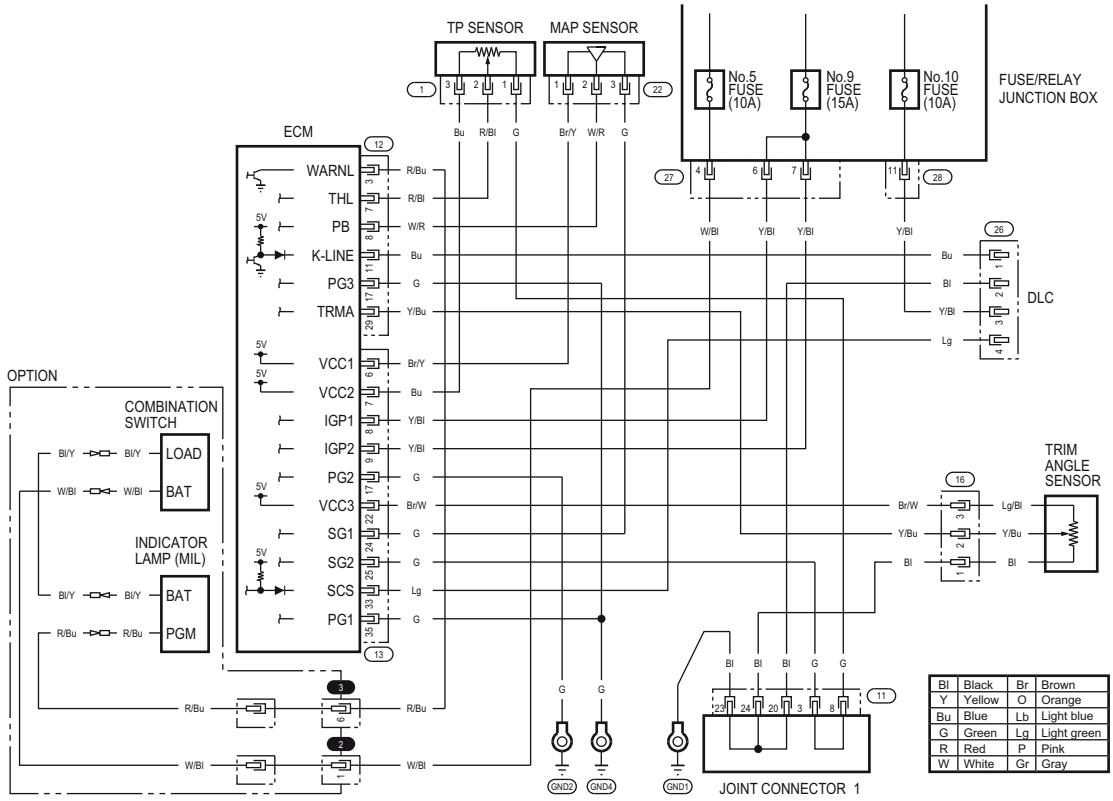
MIL		Detected component	Probable cause	Ref. page
No. of blinks	Condition			
MIL does not blink	Detected component 	ECM	• Loose or poor contact of the connector • Faulty indicator light • Open circuit in MIL wire • Open circuit in ECM power/ ground cable • Faulty ECM	4-16
Stays ON	ON 	ECM	Normal with the SCS service connector installed - If engine condition continues without the MIL blinking, check the following: • Short circuit in DLC wire • Short circuit in MIL wire • Short circuit in sensor power circuit • Faulty ECM	5-47
1	Blink 	HO2S	• Loose or poor contact of the connector • Open or short circuit in HO2S wire • Faulty fuel supply system • Faulty HO2S	5-49
3	Blink 	MAP sensor (sensor voltage)	• Loose or poor contact of the connector • Open or short circuit in MAP sensor wire • Faulty MAP sensor	5-50
4	Blink 	CKP sensor (pulse)	• Loose or poor contact of the connector • Open or short circuit in CKP sensor wire • Faulty CKP sensor • Faulty guide plate	5-52
6	Blink 	EBT sensor (sensor voltage)	• Loose or poor contact of the connector • Open or short circuit in EBT sensor wire • Faulty EBT sensor	5-53
7	Blink 	TP sensor (sensor voltage)	• Loose or poor contact of the connector • Open and short circuit in TP sensor wire • Faulty TP sensor	5-54
8	Blink 	CMP 1 sensor (pulse)	• Loose or poor contact of the connector • Open or short circuit in CMP 1 sensor wire • Faulty CMP 1 sensor	5-55
10	Blink 	IAT sensor (sensor voltage)	• Loose or poor contact of the connector • Open and short circuit in IAT sensor wire • Faulty IAT sensor	5-56
14	Blink 	IAC valve (abnormal current)	• Loose or poor contact of the connector • Open and short circuit in IAC valve wire • Faulty IAC valve	5-57

MIL		Detected component	Probable cause	Ref. page
No. of blinks	Condition			
21	Blink 	VTEC spool solenoid valve	• Loose or poor contact of the connector • Open and short circuit in VTEC spool solenoid valve wire • Faulty VTEC spool solenoid valve	5-58
23	Blink 	Knock sensor (abnormal output)	• Loose or poor contact of the connector • Open and short circuit in knock sensor wire • Faulty knock sensor	5-59
24	Blink 	EMT sensor 1 (sensor voltage)	• Loose or poor contact of the connector • Open and short circuit in EMT sensor 1 wire • Faulty EMT sensor 1	5-60
25	Blink 	EMT sensor 2 (sensor voltage)	• Loose or poor contact of the connector • Open and short circuit in EMT sensor 2 wire • Faulty EMT sensor 2	5-61
26	Blink 	EOP switch (high pressure side)	• Loose or poor contact of the connector • Open and short circuit in EOP switch (High pressure side) wire • Faulty EOP switch (High pressure side)	5-62
41	Blink 	HO2S heater (abnormal current)	• Loose or poor contact of the connector • Open and short circuit in HO2S heater wire • Faulty HO2S	5-64
58	Blink 	CMP 2 sensor (pulse)	• Loose or poor contact of the connector • Open and short circuit in CMP 2 sensor wire • Faulty CMP 2 sensor	5-65

When multiple DTCs are shown

MIL		Detected component	Probable cause	Ref. page
No. of blinks	Condition			
1,6,7,10,13, 24,25,26	Blink 	SG (sensor ground) line	• Open circuit in SG (sensor ground) line	–

MIL ON BUT DOES NOT BLINK OR INDICATE DTC CODE



1. DLC short circuit inspection

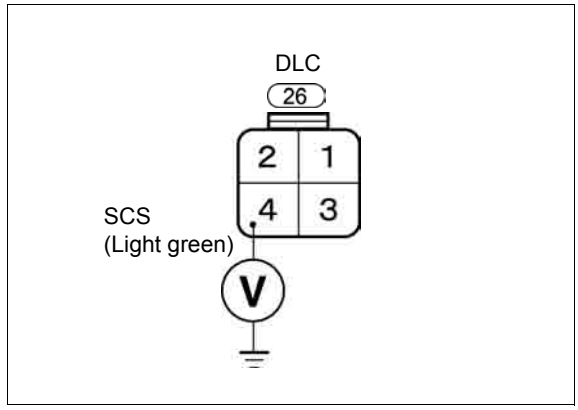
Turn the combination switch OFF.
Disconnect the dummy connector from the DLC (26).

Check for continuity between the DLC (26) No.4 (Light green) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 2.

NO – Repair short in the main wire harness between the ECM and the DLC.



2. MIL ON line short circuit inspection

Turn the combination switch OFF.
Disconnect the ECM connector A (12).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – GO TO STEP 3.

NO – Repair short in the main wire harness between the ECM and the MIL.

3. MAP sensor power line short circuit inspection 1

Turn the combination switch OFF.

Connect the ECM connector A (12) and disconnect the MAP sensor 3P connector (22).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – Replace the MAP sensor.

NO – GO TO STEP 4.

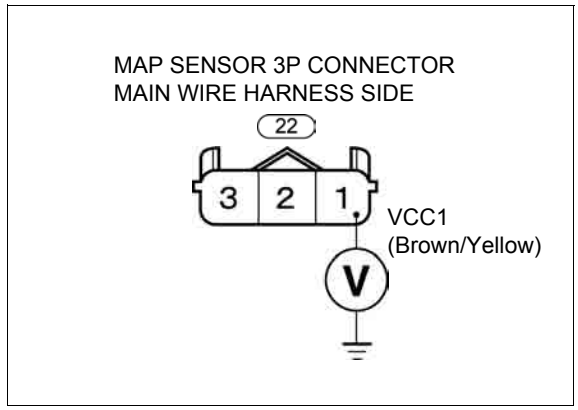
4. MAP sensor power line short circuit inspection 2

Measure the voltage between the MAP sensor 3P connector (22) main wire harness side No.1 (Brown/Yellow) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 5.

NO – Repair short in the main wire harness between the ECM and the MAP sensor.



5. TP sensor power line short circuit inspection 1

Turn the combination switch OFF.

Disconnect the TP sensor 3P connector (1).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – Replace the TP sensor.

NO – GO TO STEP 6.

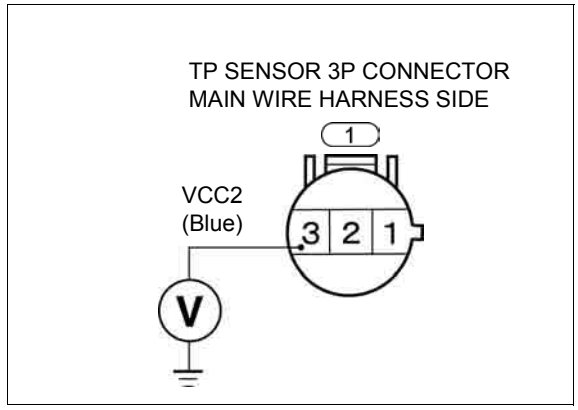
6. TP sensor power line short circuit inspection 2

Measure the voltage between the TP sensor 3P connector (1) main wire harness side No.3 (Blue) terminal and engine ground.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 7.

NO – Repair short in the main wire harness between the ECM and the TP sensor.



7. Trim angle sensor power line short circuit inspection 1

Disconnect the trim angle sensor 3P connector (16).

Turn the combination switch ON and check the MIL.

Does the MIL go OFF?

YES – Replace the trim angle sensor.

NO – GO TO STEP 8.

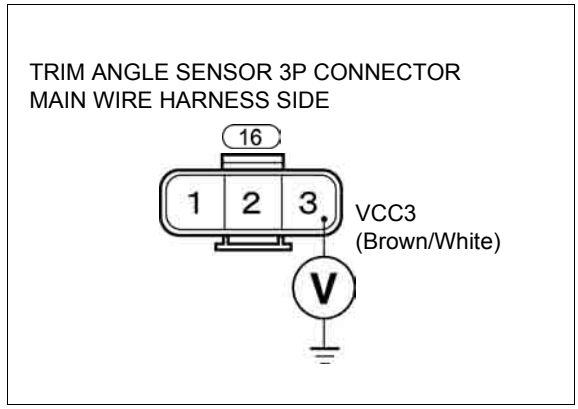
8. Trim angle sensor power line short circuit inspection 2

Measure the voltage between the trim angle sensor 3P connector (16) main wire harness side No.3 (Brown/White) terminal and engine ground.

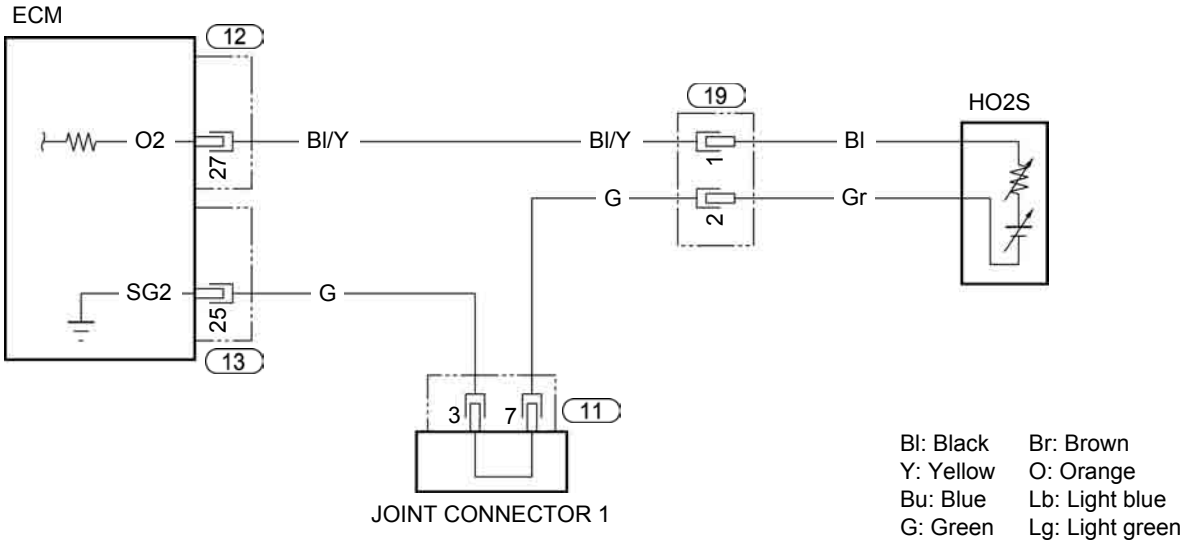
Is the measurement within 4.75 – 5.25 V?

YES – Replace the ECM with a new one and recheck.

NO – Repair short in the main wire harness between the ECM and the trim angle sensor.



MIL BLINKS ONCE (HO2S)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the HO2S 4P connector (19), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load.
Let the engine idle for 1 minute or more.

Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink once?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. HO2S inspection

Turn the combination switch OFF and disconnect the HO2S 4P connector (19).

Inspect the HO2S (page 5-126).

Is the HO2S correct?

YES – GO TO STEP 3.

NO – Replace the HO2S with a new one and recheck.

3. Fuel supply system inspection

Turn the combination switch OFF.

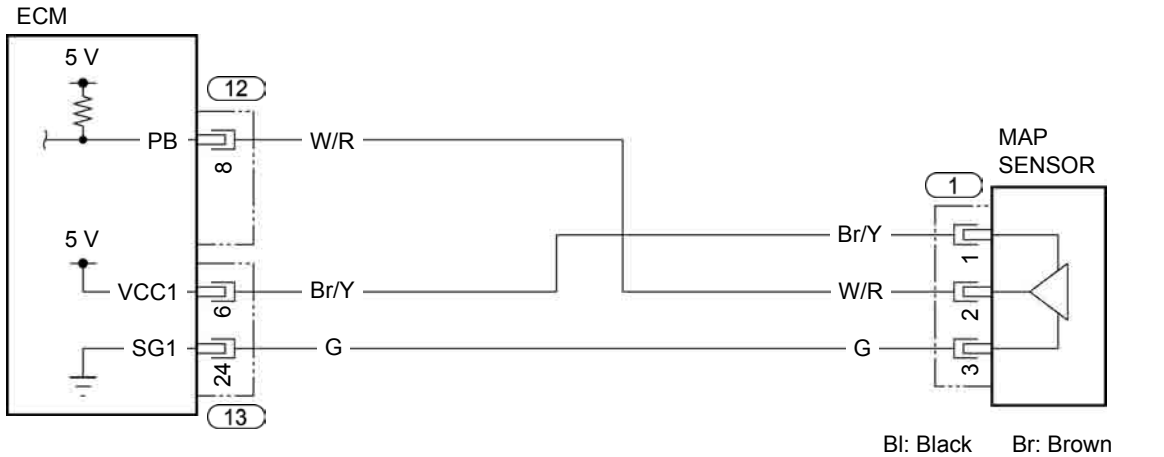
Measure the fuel pressure (page 5-110).

Is the fuel pressure normal?

YES – Repair open or short in the main wire harness between the ECM and HO2S. If the main wire harness is correct, replace the ECM with a new one, and recheck.

NO – Repair fuel supply system and recheck under normal fuel pressure.

MIL BLINKS 3 TIMES (MAP SENSOR)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the MAP sensor 3P connector (1), ECM connector A (12), ECM connector B (13) and then reconnect them.

Reset the ECM (page 5-6).

Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 3 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. MAP sensor power line open circuit inspection

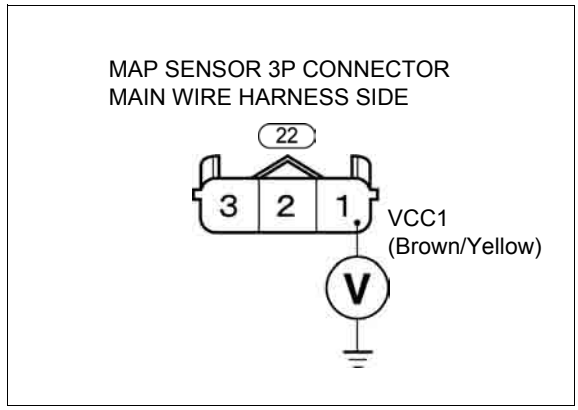
Turn the combination switch OFF and disconnect the MAP sensor 3P connector (22).

Turn the combination switch ON.
Measure the voltage between the MAP sensor 3P connector (22) main wire harness side No.1 (Brown/Yellow) terminal and engine ground.

Is the measurement within 4.75 - 5.25 V?

YES – GO TO STEP 3.

NO – Repair open in the main wire harness between the ECM and MAP sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



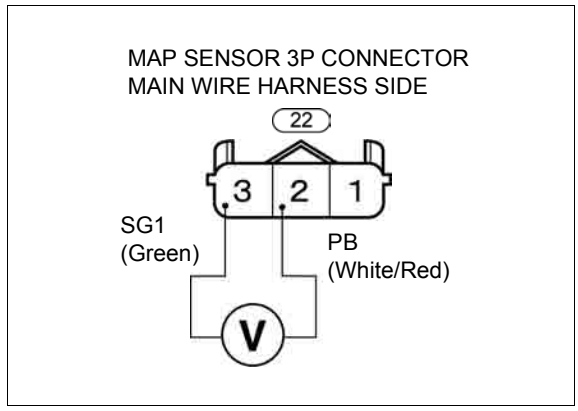
3. MAP sensor signal line open/short circuit inspection

Measure the voltage between the MAP sensor 3P connector (22) main wire harness side No.2 (White/Red) terminal and No.3 (Green) terminal.

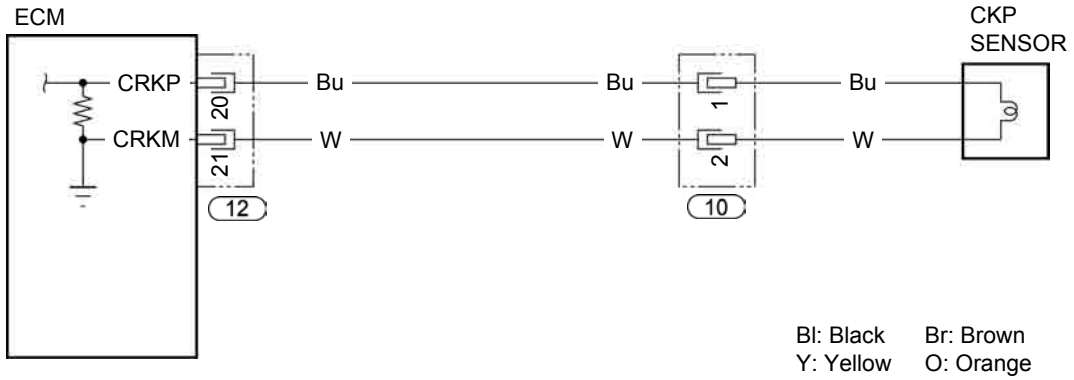
Is the measurement within 4.75 – 5.25 V?

YES – Replace the MAP sensor with a new one and recheck.

NO –
- Repair open or short in the White/Red wire between the ECM and MAP sensor.
- Repair open in the Green wire between the ECM and MAP sensor.
- If the main wire harness is correct, replace the ECM with a new one, and recheck



MIL BLINKS 4 TIMES (CKP SENSOR)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CKP sensor 2P connector (10), ECM connector A (12) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine.
Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 4 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear)

2. CKP sensor installation inspection

Turn the combination switch OFF.

Inspect the CKP sensor installation (page 5-102).

Is the CKP sensor installed correctly?

YES – GO TO STEP 3.

NO – Install the CKP sensor correctly and recheck.

3. CKP sensor inspection

Turn the combination switch OFF.

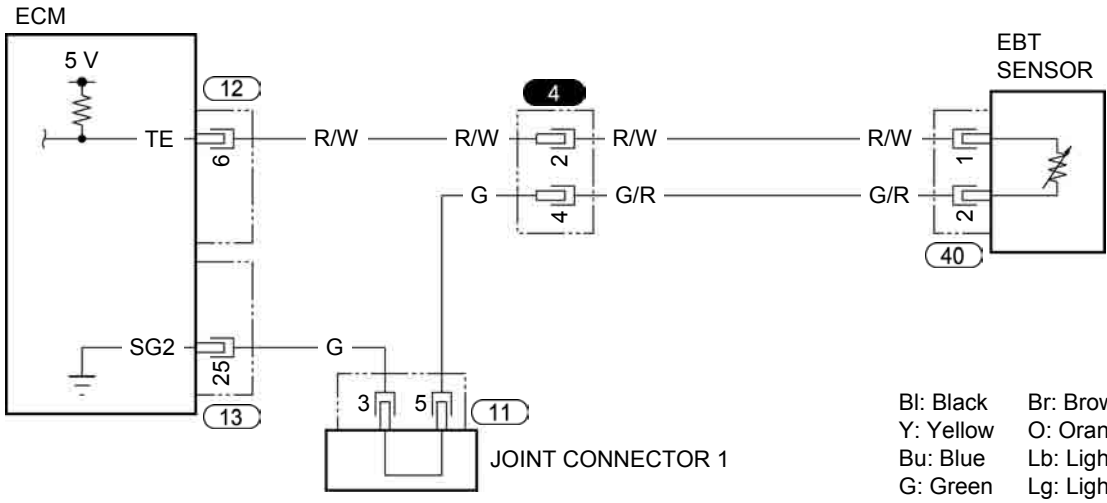
Inspect the CKP sensor (page 5-123).

Is the CKP sensor correct?

YES – Repair the open or short circuit in the CKP sensor harness between the CKP sensor and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the CKP sensor with a new one and recheck.

MIL BLINKS 6 TIMES (EBT SENSOR)



1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the EBT sensor 2P connector (40), ECM connector A (12), ECM connector B (13), switch wire 6P connector (4), joint connector 1 (11) and then reconnect them.

Reset the ECM (page 5-6).

Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 6 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. EBT sensor signal /GND line open/short circuit inspection

Turn the combination switch OFF and disconnect the EBT sensor 2P connector (40).

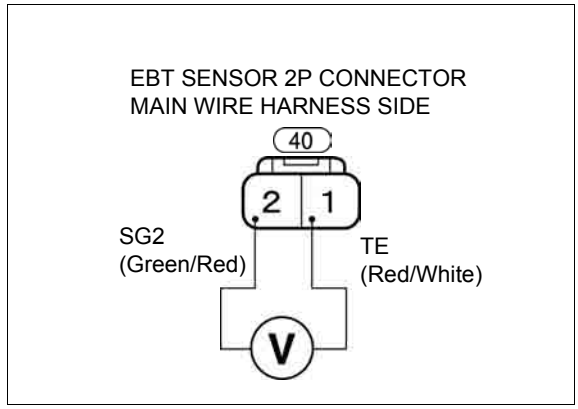
Turn the combination switch ON.

Measure the voltage between the EBT sensor 2P connector (40) main wire harness side No.1 (Red/White) terminal and No.2 (Green/Red) terminal.

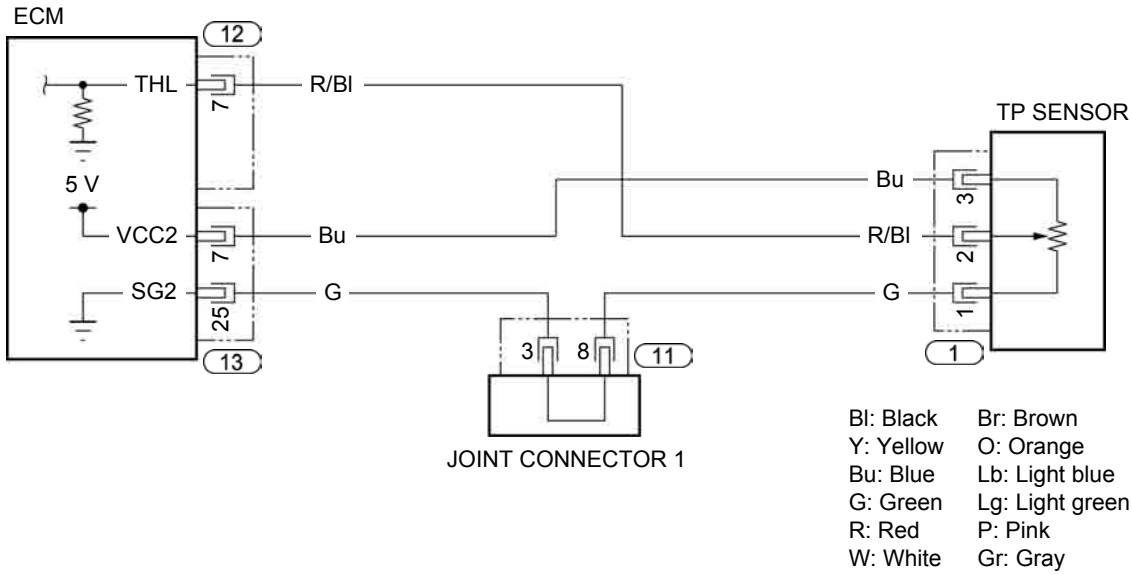
Is the measurement within 4.75 – 5.25 V?

YES – Replace the EBT sensor with a new one and recheck.

NO – Repair open or short in the Red/White or Green/Red wire harness between the ECM and EBT sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



MIL BLINKS 7 TIMES (TP SENSOR)



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the TP sensor 3P connector (1), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Reset the DTC (page 5-6).

Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 7 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. TP sensor power/ground line open circuit inspection

Turn the combination switch OFF and disconnect the TP sensor 3P connector (1).

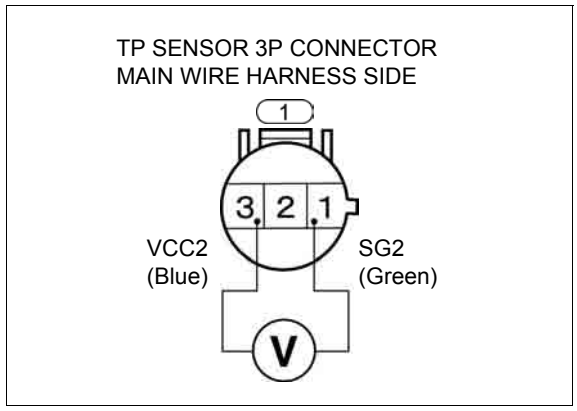
Turn the combination switch ON.

Measure the voltage between the TP sensor 3P connector (1) main wire harness side No.3 (Blue) terminal and No.1 (Green) terminal.

Is the measurement within 4.75 – 5.25 V?

YES – GO TO STEP 3.

NO – Repair open in the main wire harness between the ECM and TP sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



3. TP sensor signal line open/short circuit inspection

Turn the combination switch OFF.
Disconnect the ECM connector A (12).

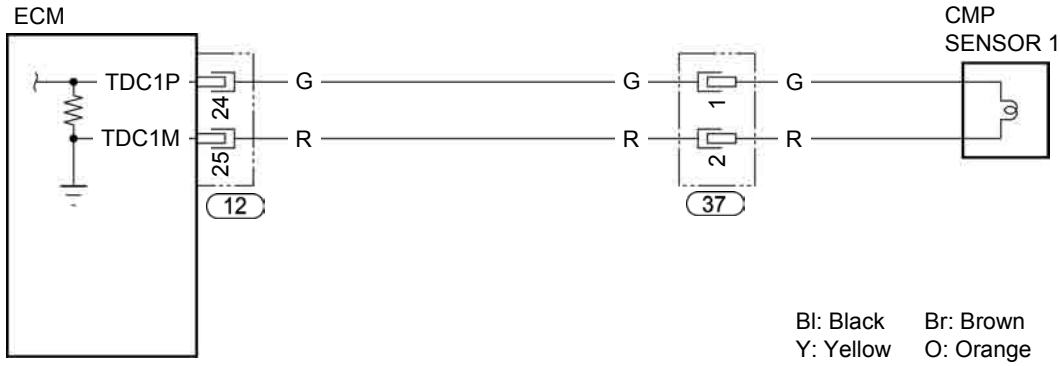
Check for an open or short in the wire between the TP sensor 3P connector (1) main wire harness side No.2 (Red/Black) terminal and ECM connector A (12) main wire harness side No.7 (Red/Black) terminal.

Is the signal line correct?

YES – Replace the throttle body with a new one and recheck.

NO – Repair open or short in the main wire harness between the ECM and TP sensor.

MIL BLINKS 8 TIMES (CMP 1 SENSOR)



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. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the CMP sensor 4P connector (37), ECM connector A (12) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine.
Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 8 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CMP 1 sensor installation inspection

Turn the combination switch OFF.

Inspect the CMP 1 sensor installation (page 5-103).

Is the CMP sensor installed correctly?

YES – GO TO STEP 3.

NO – Install the CMP 1 sensor correctly and recheck.

3. CMP sensor inspection

Turn the combination switch OFF.

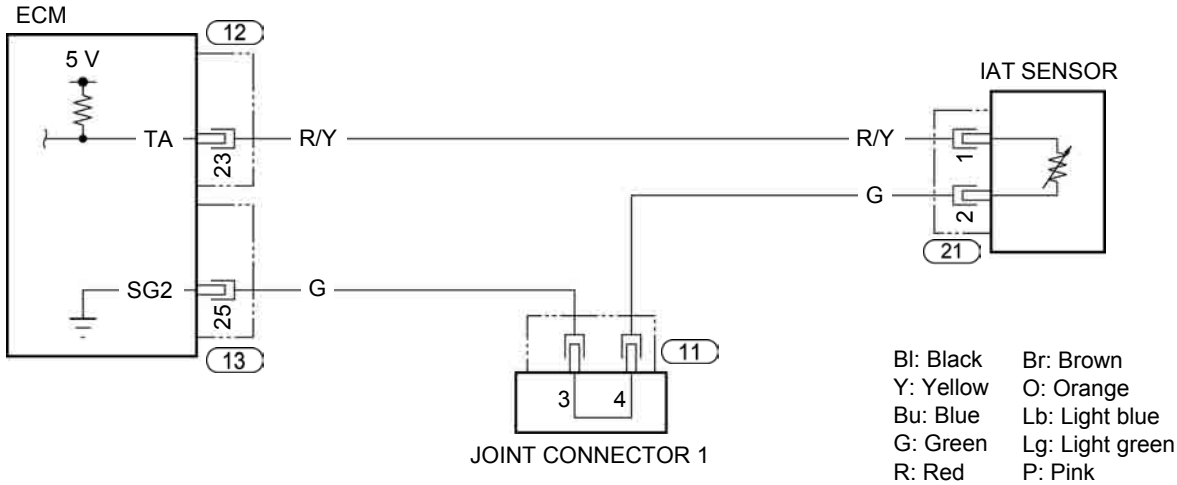
Inspect the CMP 1 sensor (page 5-123).

Is the CMP 1 sensor correct?

YES – Repair the open or short circuit in the CMP 1 sensor harness between the CMP 1 sensor and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the CMP 1 sensor with a new one and recheck.

MIL BLINKS 10 TIMES (ONE LONG BLINK AND NO SHORT BLINKS) IAT SENSOR



1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the IAT sensor 2P connector (21), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Reset the ECM (page 5-6).
Turn the combination switch OFF and connect the SCS service check connector.

Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 10 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. IAT sensor signal/GND line open/short circuit inspection

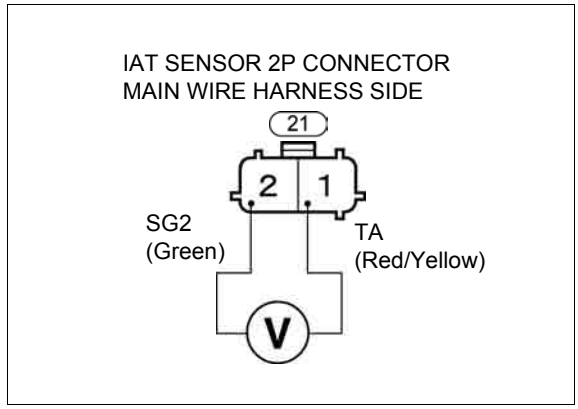
Turn the combination switch OFF and disconnect the IAT sensor 2P connector (21).

Turn the combination switch ON.
Measure the voltage between the IAT sensor 2P connector (21) main wire harness side No.1 (Red/Yellow) terminal and No.2 (Green) terminal.

Is the measurement within 4.75 – 5.25 V?

YES – Replace the IAT sensor with a new one and recheck.

NO – Repair open or short in the Red/Yellow or Green wire harness between the ECM and IAT sensor. If the main wire harness is correct, replace the ECM with a new one and recheck.



MIL BLINKS 14 TIMES (ONE LONG BLINK AND 4 SHORT BLINKS) IAC VALVE



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. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the IAC valve 2P connector (2), ECM connector B (13) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine.
Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 14 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. IAC valve inspection

Turn the combination switch OFF and disconnect the IAC valve 2P connector (2).

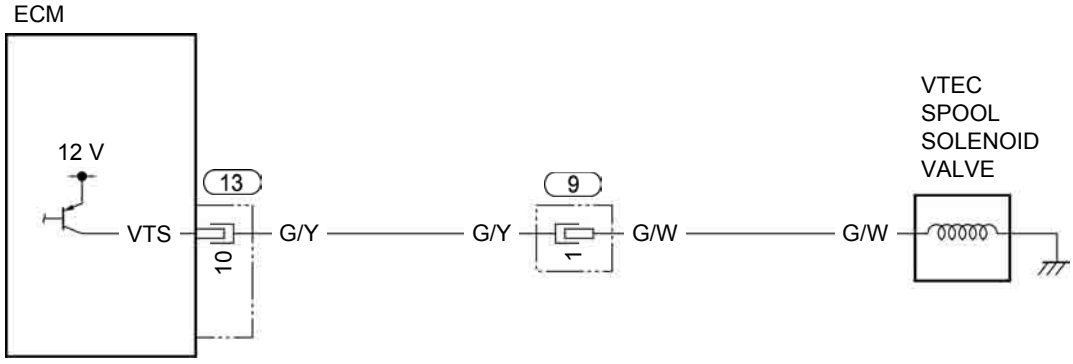
Inspect the IAC valve (page 5-125).

Is the IAC valve correct?

YES – Repair open or short in the main wire harness between the ECM and IAC valve. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the IAC valve with a new one and recheck.

MIL BLINKS 21 TIMES (2 LONG BLINKS AND ONE SHORT BLINK) VTEC SPOOL SOLENOID VALVE



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. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the VTEC spool solenoid valve 1P connector (9), ECM connector B (13) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load.

Disconnect the neutral switch 2P connector (30).

Raise the engine speed slowly and let it run at 4,500 min^{-1} (rpm) for a few seconds.

Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 21 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. VTEC spool solenoid valve inspection

Turn the combination switch OFF and disconnect the VTEC spool solenoid valve 1P connector (9).

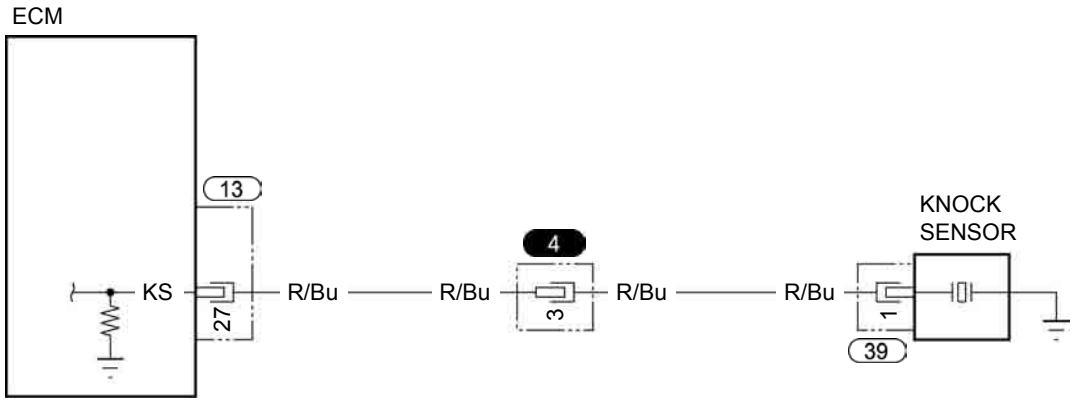
Inspect the VTEC spool solenoid valve (page 5-125).

Is the VTEC spool solenoid valve correct?

YES – Repair open or short in the main wire harness between the ECM and VTEC spool solenoid valve. If main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the VTEC spool solenoid valve with a new one and recheck.

MIL BLINKS 23 TIMES (2 LONG BLINKS AND 3 SHORT BLINKS) KNOCK SENSOR



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the knock sensor 1P connector (39), ECM connector B (13), switch wire 6P connector (4) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load until the engine temperature is over 85 °C (185 °F).
Lower the engine speed gradually and run it at 3,000 – 4,000 min^{-1} (rpm) for 10 seconds.

Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 23 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. Knock sensor line open or short circuit inspection

Turn the combination switch OFF.

Disconnect the knock sensor 1P connector (39) and ECM connector B (13).

Check for continuity through the Knock sensor wire.

Is the knock sensor line correct?

YES – GO TO STEP 3.

NO – Repair open or short in the main wire harness between the ECM and knock sensor.

3. Knock sensor inspection

Replace the knock sensor with a new one and connect the knock sensor 1P connector (39).

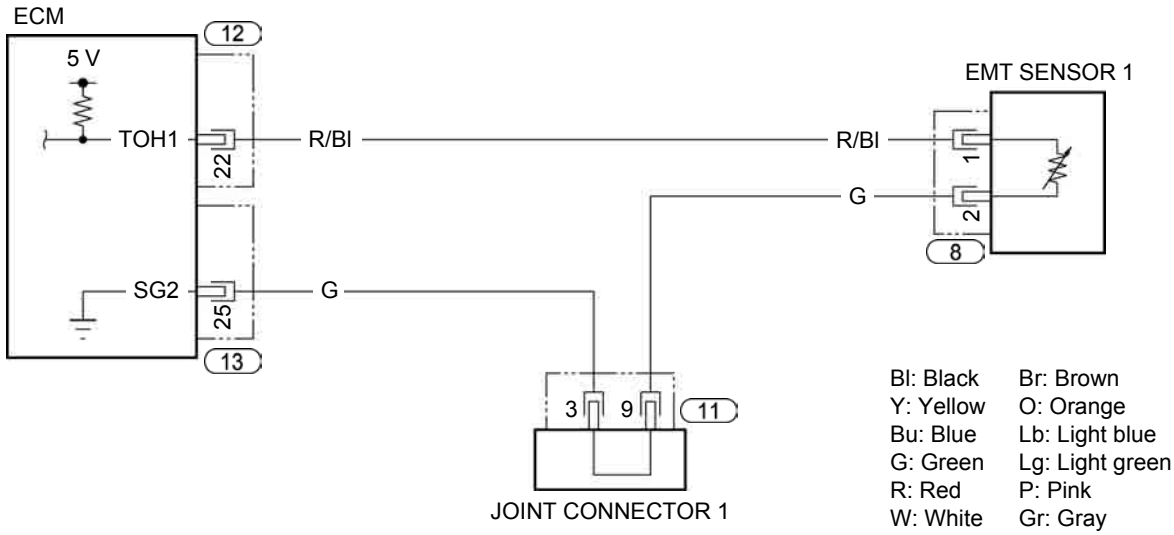
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blinks 23 times?

YES – Replace the ECM with a new one and recheck.

NO – Faulty original knock sensor. End of inspection.

MIL BLINKS 24 TIMES (2 LONG BLINKS AND 4 SHORT BLINKS) EMT SENSOR 1



1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the EMT sensor 1 2P connector (8), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Reset the ECM (page 5-6).

Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 24 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. EMT sensor 1 signal /GND line open circuit inspection

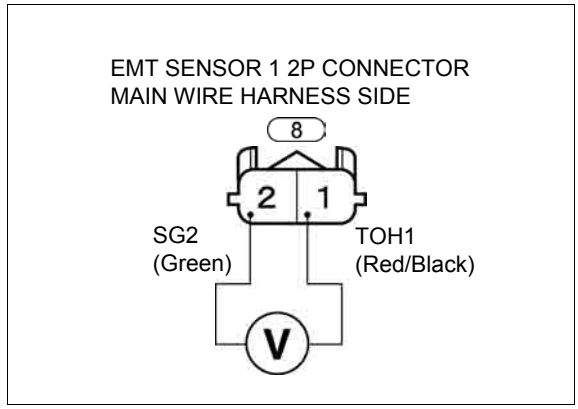
Turn the combination switch OFF and disconnect the EMT sensor 1 2P connector (8).

Turn the combination switch ON.
Measure the voltage between the EMT sensor 1 2P connector (8) main wire harness side No.1 (Red/Black) terminal and No.2 (Green) terminal.

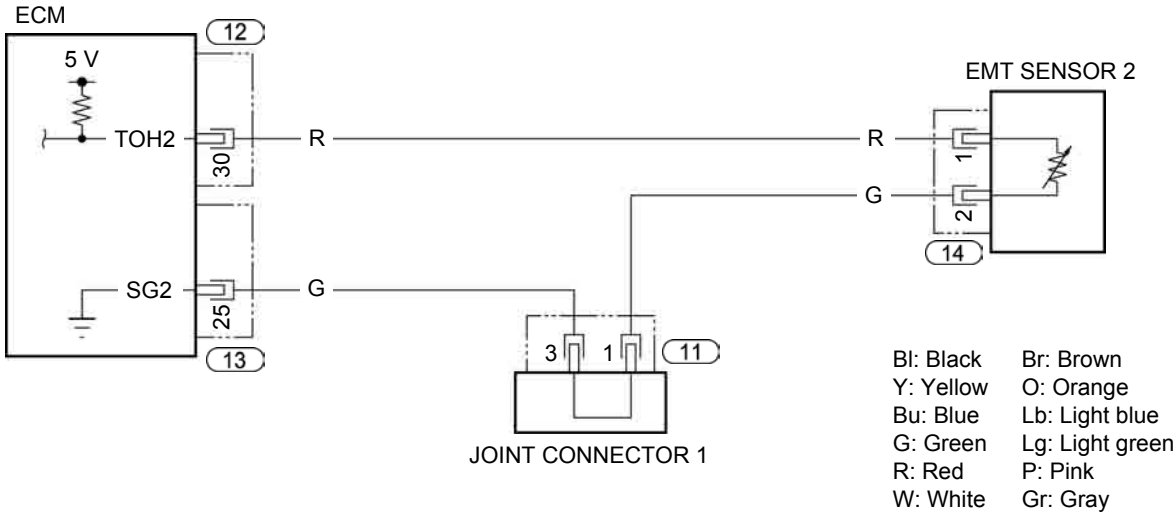
Is the measurement within 4.75 – 5.25 V?

YES – Replace the EMT sensor 1 with a new one and recheck.

NO – Repair open in the Red/Black or Green wire harness between the ECM and EMT sensor 1. If the main wire harness is correct, replace the ECM with a new one and recheck.



MIL BLINKS 25 TIMES (2 LONG BLINKS AND 5 SHORT BLINK) EMT SENSOR 2



1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the EMT sensor 2 2P connector (14), ECM connector A (12), ECM connector B (13), joint connector 1 (11) and then reconnect them.

Reset the ECM (page 5-6).

Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 25 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. EMT sensor 2 signal /GND line open circuit inspection

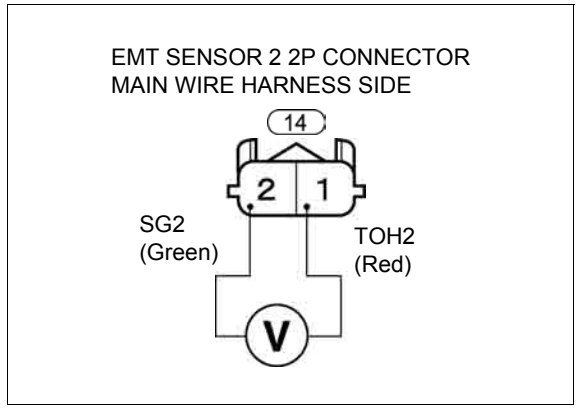
Turn the combination switch OFF and disconnect the EMT sensor 2 2P connector (14).

Turn the combination switch ON.
Measure the voltage between the EMT sensor 2 2P connector (14) main wire harness side No.1 (Red) terminal and No.2 (Green) terminal.

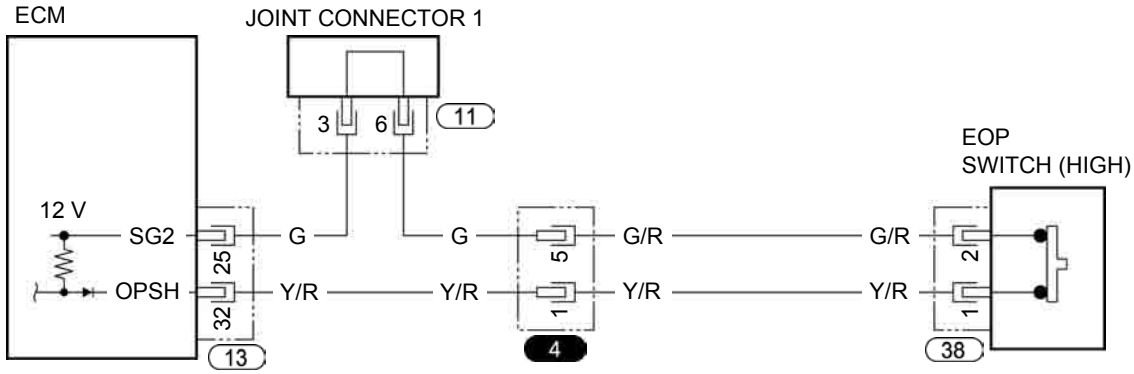
Is the measurement within 4.75 – 5.25 V?

YES – Replace the EMT sensor 2 with a new one and recheck.

NO – Repair open in the Red or Green wire harness between the ECM and EMT sensor 2. If the main wire harness is correct, replace the ECM with a new one and recheck.



MIL BLINKS 26 TIMES (2 LONG BLINKS AND 6 SHORT BLINKS) EOP SWITCH (HIGH PRESSURE SIDE)



Bl: Black	Br: Brown
Y: Yellow	O: Orange
Bu: Blue	Lb: Light blue
G: Green	Lg: Light green
R: Red	P: Pink
W: White	Gr: Gray

1. Symptom reproduction test

Turn the combination switch OFF.
Disconnect the EOP switch (High pressure side) 2P connector (38), ECM connector B (13), switch wire 6P connector (4), joint connector 1 (11) and then reconnect them.

Reset the ECM (page 5-6).

Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 26 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. EOP switch (High pressure side) line open circuit inspection

Turn the combination switch OFF and disconnect the EOP switch (High pressure side) 2P connector (38).

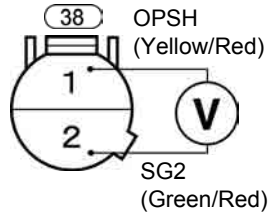
Turn the combination switch ON.
Measure the voltage between the EOP switch (High pressure side) 2P connector (38) main wire harness side No.1 (Yellow/Red) terminal and No.2 (Green/Red) terminal.

Does battery voltage exist?

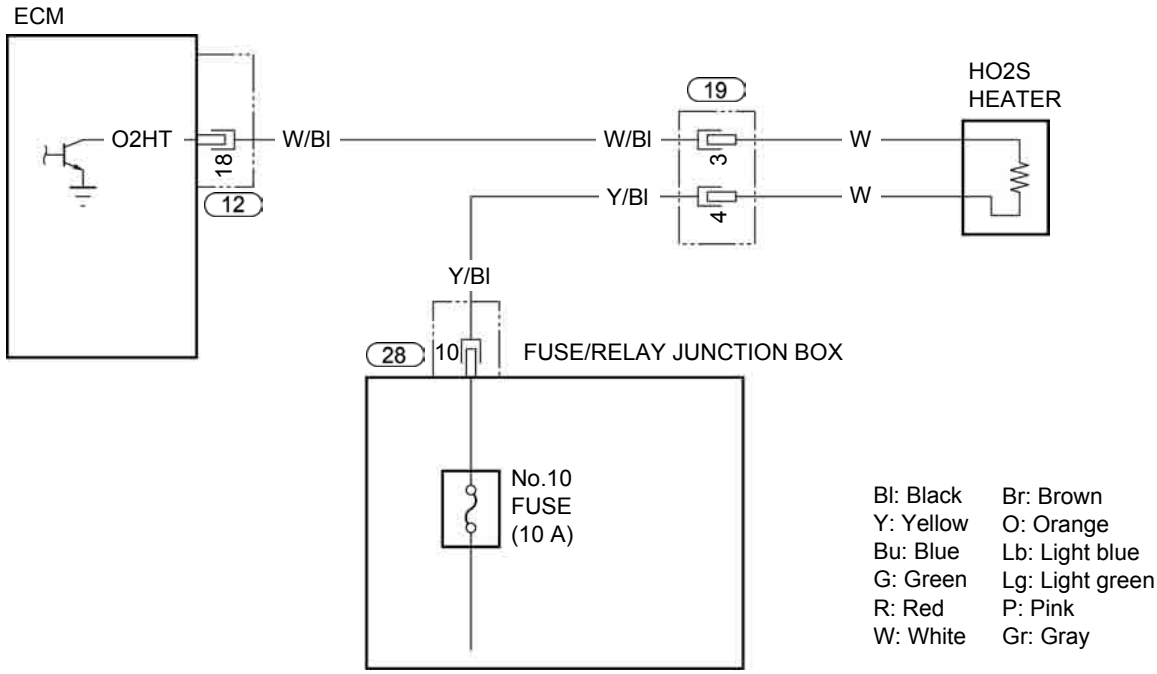
YES – Replace the EOP switch (High pressure side) with a new one and recheck.

NO – Repair open in the main wire harness between the ECM and EOP switch (High pressure side). If main wire harness is correct, replace the ECM with a new one and recheck.

EOP SWITCH (High pressure side)
2P CONNECTOR MAIN WIRE HARNESS SIDE



MIL BLINKS 41 TIMES (4 LONG BLINKS AND ONE SHORT BLINK) HO2S HEATER



1. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the HO2S 4P connector (19), ECM connector A (12), junction box 23P connector (28) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine and let it run at 3,000 min^{-1} (rpm) for 5 minutes or more under no load.
Let the engine idle for a minute or more.

Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 41 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. HO2S heater inspection

Turn the combination switch OFF.

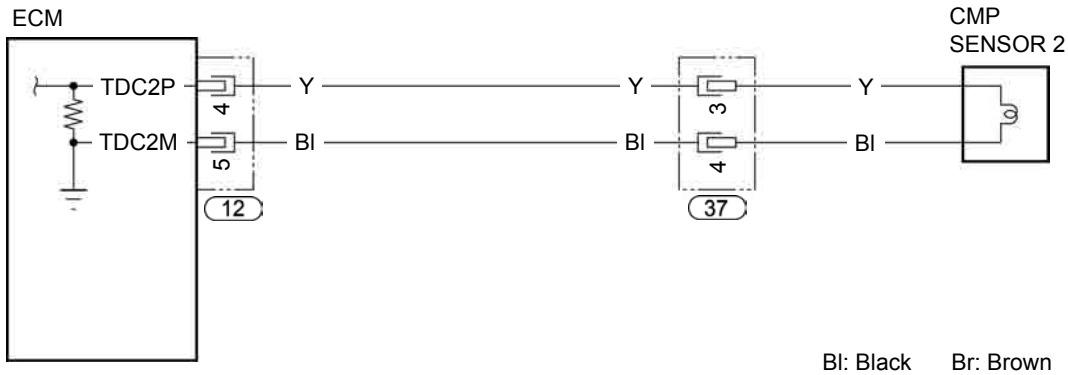
Inspect the HO2S heater (page 5-126).

Is the HO2S heater correct?

YES – Repair open in the main wire harness between the No.3 fuse and the HO2S or between the HO2S and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the HO2S with a new one and recheck.

MIL BLINKS 58 TIMES (5 LONG BLINKS AND 8 SHORT BLINKS) CMP 2 SENSOR



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. Symptom reproduction test

Turn the combination switch OFF.

Disconnect the CMP sensor 4P connector (37), ECM connector A (12) and then reconnect them.

Reset the ECM (page 5-6).

Start the engine.
Turn the combination switch OFF and connect the SCS service connector.
Turn the combination switch ON and check the number of blinks of the MIL.

Does the MIL blink 58 times?

YES – GO TO STEP 2.

NO – Temporary failure (code does not reappear).

2. CMP 2 sensor installation inspection

Turn the combination switch OFF.

Inspect the CMP 2 sensor installation (page 5-103).

Is the CMP 2 sensor installed correctly?

YES – GO TO STEP 3.

NO – Install the CMP 2 sensor correctly and recheck.

3. CMP sensor inspection

Turn the combination switch OFF.

Inspect the CMP 2 sensor (page 5-124).

Is the CMP sensor correct?

YES – Repair the open or short circuit in the CMP 2 sensor harness between the CMP 2 sensor and ECM. If the main wire harness is correct, replace the ECM with a new one and recheck.

NO – Replace the CMP 2 sensor with a new one and recheck.

FUEL PRESSURE RELIEVING

⚠WARNING

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

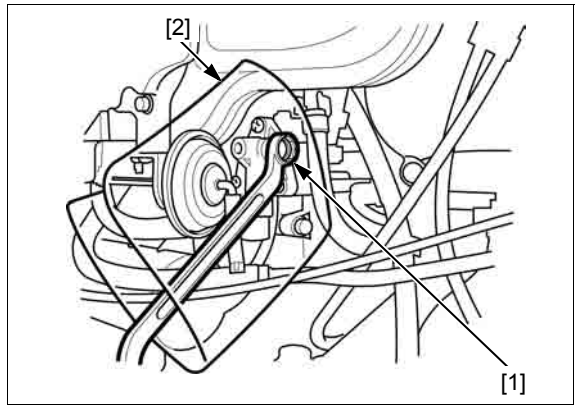
- Disconnect the battery cable from the battery negative (–) terminal before relieving the fuel pressure.
- Replace the sealing washer when the service check bolt is loosened or removed.

Remove the L./R. engine under cover (page 6-3).

Set a wrench on the service check bolt [1] beside of the fuel strainer (high pressure side).

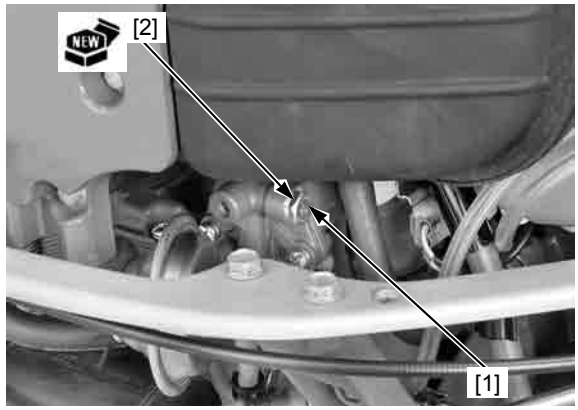
Place a shop towel or equivalent material [2] over the service check bolt.

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



After relieving the fuel pressure, remove the service check bolt [1] and replace the sealing washer with a new one [2]. Tighten the service check bolt to the specified torque.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



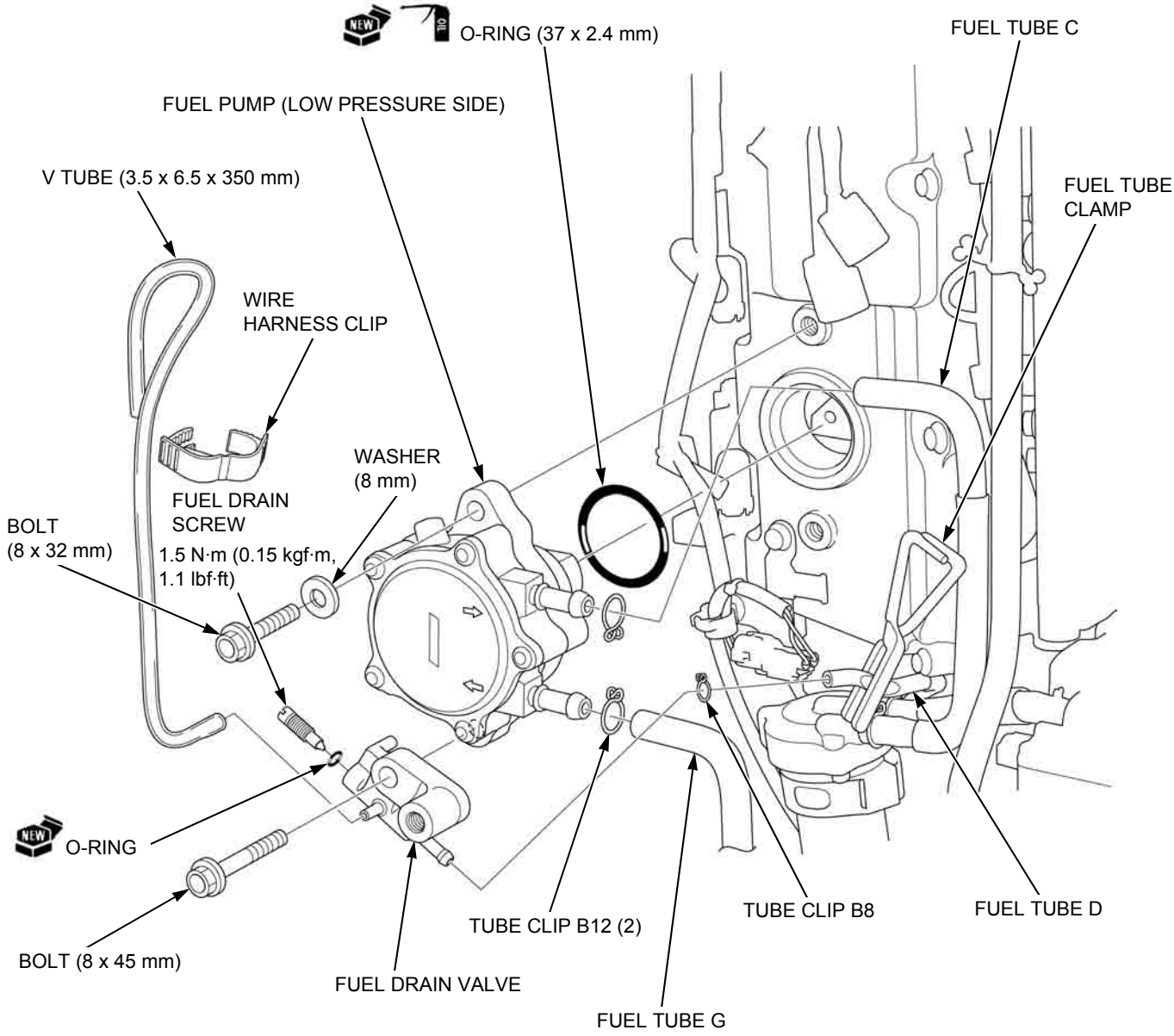
FUEL PUMP (LOW PRESSURE SIDE) REMOVAL/INSTALLATION

⚠WARNING

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

Remove the intake manifold (page 5-72).

Set a commercially available fuel tube clamp to fuel tube D.

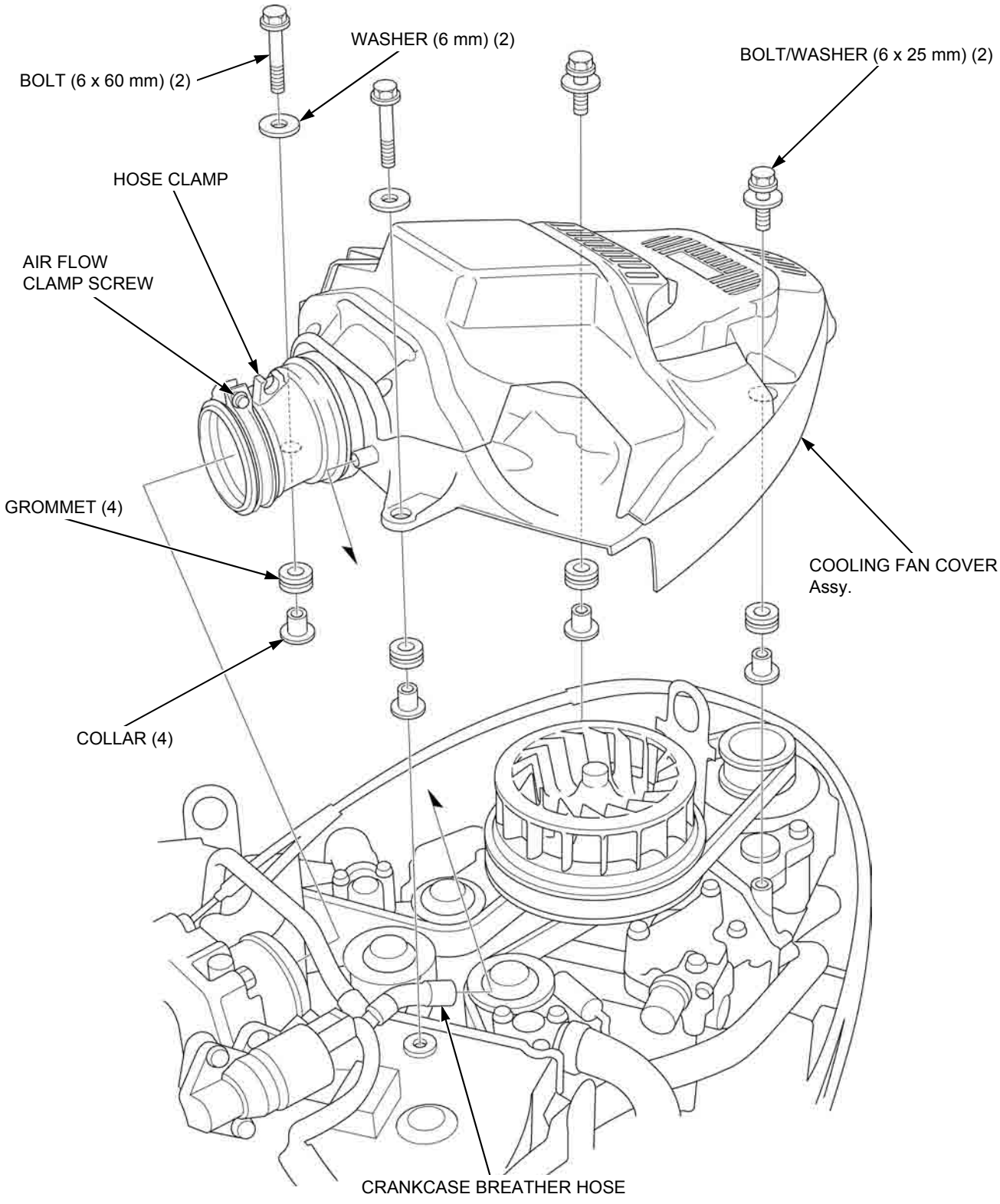


COOLING FAN COVER REMOVAL/ INSTALLATION

REMOVAL

NOTICE

- *Do not disassemble the cooling fan cover assembly.*

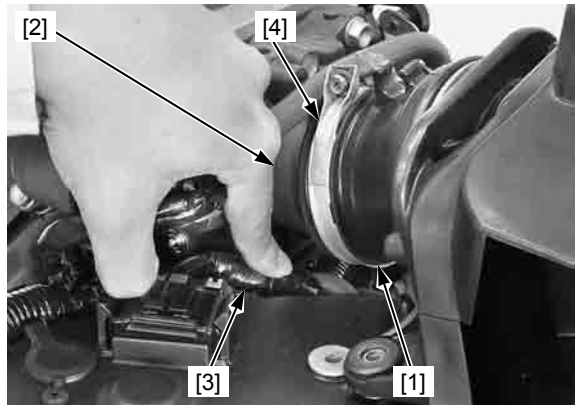


INSTALLATION

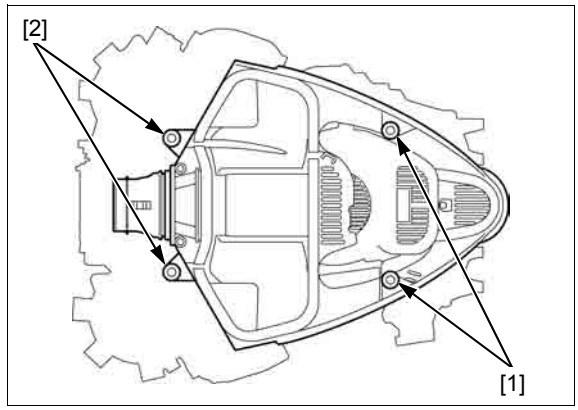
Connect the air flow tube [1] to the throttle body [2] securely while pushing the main harness [3] down.

NOTE:

- Take care that the main harness is not damaged by the air flow clamp [4].

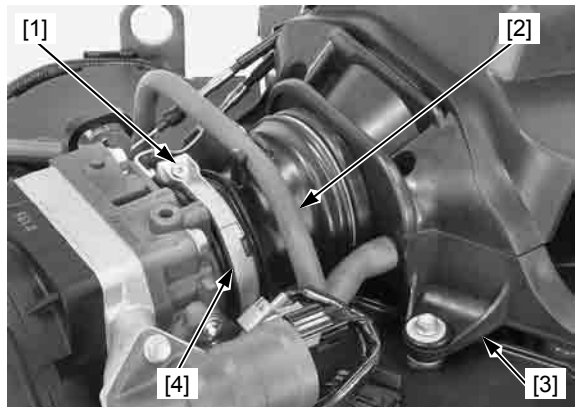


Install and tighten the two bolt/washers (6 x 25 mm) [2] and two bolts (6 x 60 mm) [3].

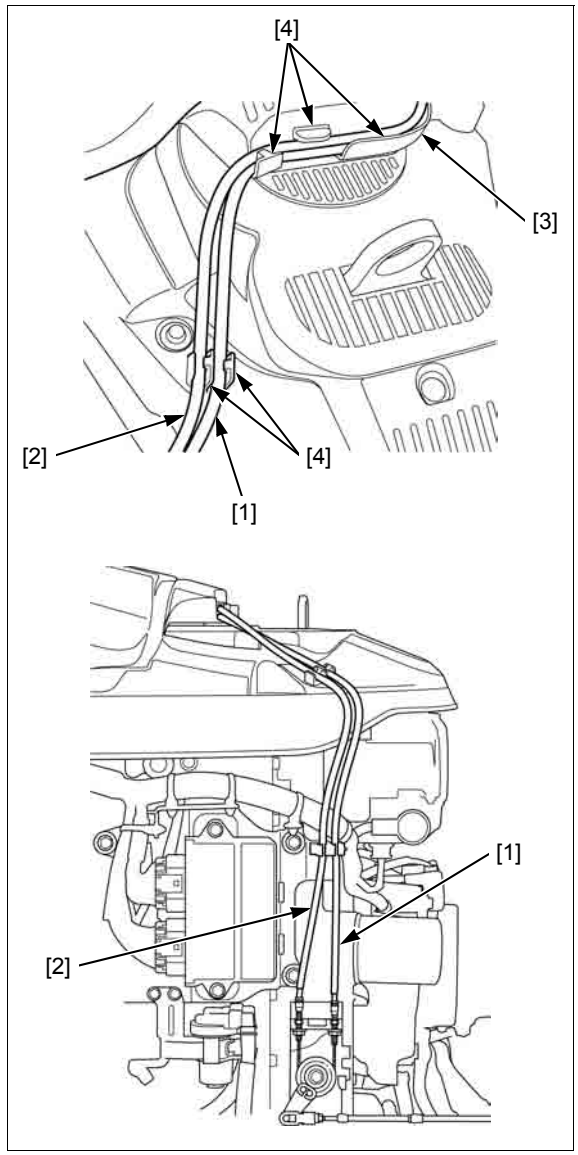


Tighten the air flow clamp screw [1] securely.

Connect the crankcase breather hose [2] to the cooling fan cover [3] and set it to the grommet clamp [4].



Put the throttle cable A [1] first, then put the throttle cable B [2] into the slit [3] of the cooling fan cover and hold them to the cable guides [4] of the cooling fan cover as shown.



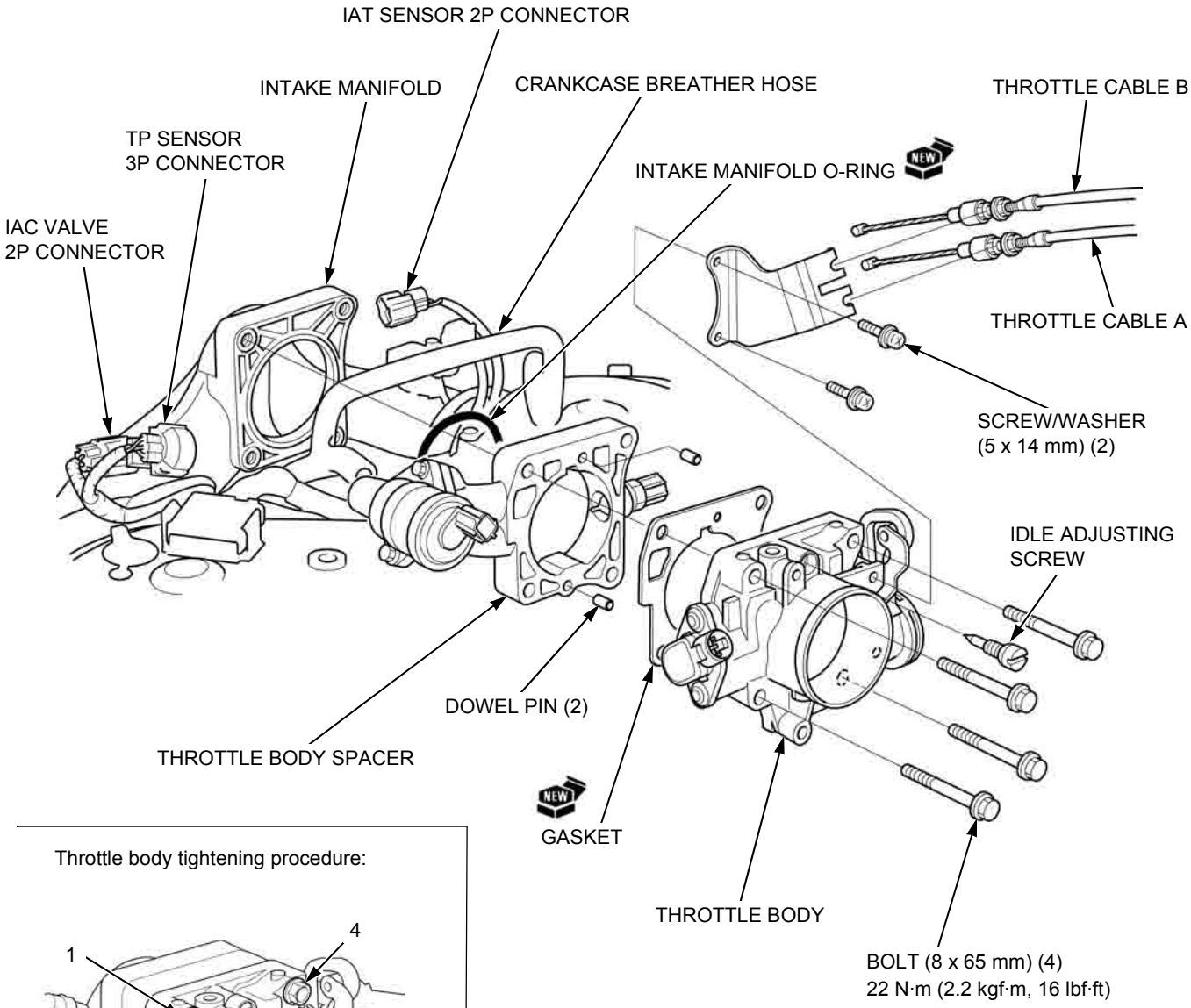
THROTTLE BODY REMOVAL/ INSTALLATION/CLEANING

REMOVAL/INSTALLATION

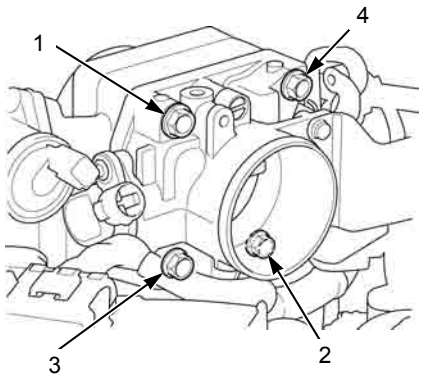
Remove the cooling fan cover (page 5-68).

NOTE:

- When assembling, route the throttle cables and crankcase breather hose properly (page 2-19).
- After assembly, adjust the throttle cables (page 3-11).



Throttle body tightening procedure:

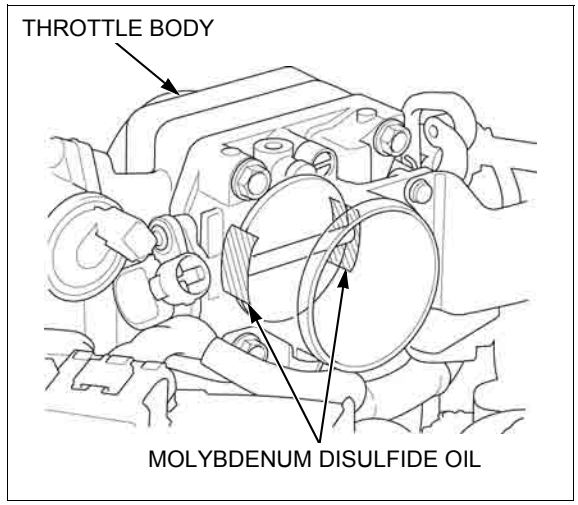


CLEANING

Wipe off carbon or any other dirt or stain with soft dry shop towels sprayed with carburetor cleaner, and clean the throttle valve and bore.

NOTICE

The inside of the throttle body is coated with molybdenum. Do not clean the throttle body excessively.



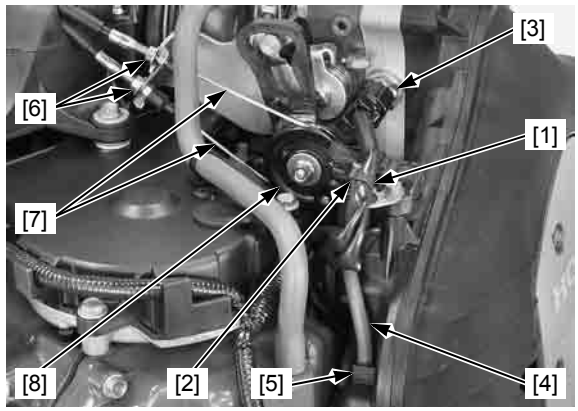
INTAKE MANIFOLD REMOVAL/ INSTALLATION

REMOVAL

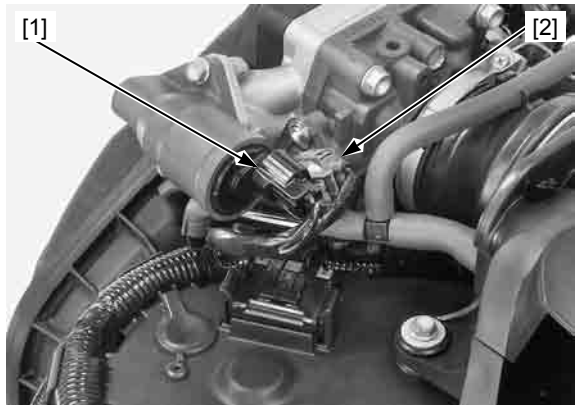
Release the harness clip [1] and disconnect the MAP sensor 3P connector [2].
Disconnect the IAT sensor 2P connector [3].

Disconnect the pressure regulator vacuum hose [4] from the intake manifold [5].

Loosen the throttle cable adjusting nuts [6] and disconnect the throttle cables [7] from the throttle cam [8].



Disconnect the IAC valve 2P connector [1] and TP sensor 3P connector [2].

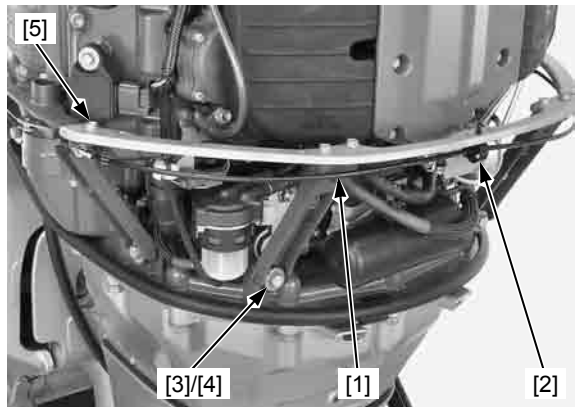


Loosen the air flow clamp screw [1].



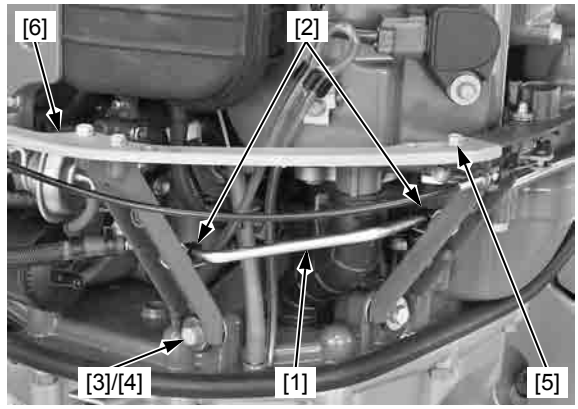
Release the cover locking cable [1] from the clamp [2].

Remove the bolt (8 x 35 mm) [3], washer (8 mm) [4], and bolt (6 x 12 mm) [5].

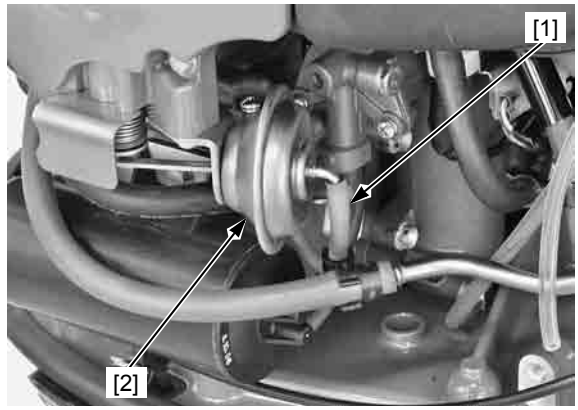


Release the fuel pipe [1] from the clamps [2].

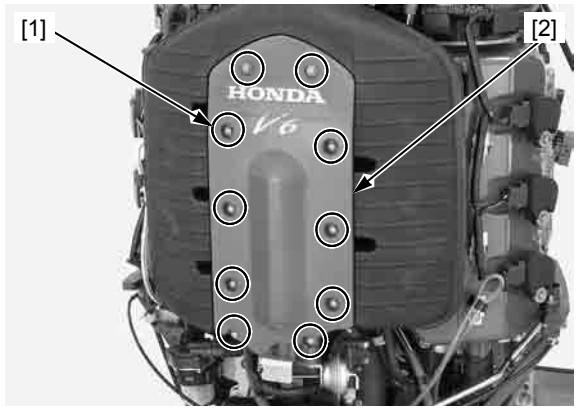
Remove the bolt (8 x 35 mm) [3], washer (8 mm) [4], bolt (6 x 12 mm) [5], and engine cover bracket [6].



Disconnect the vacuum tube [1] from the IAB control diaphragm [2].

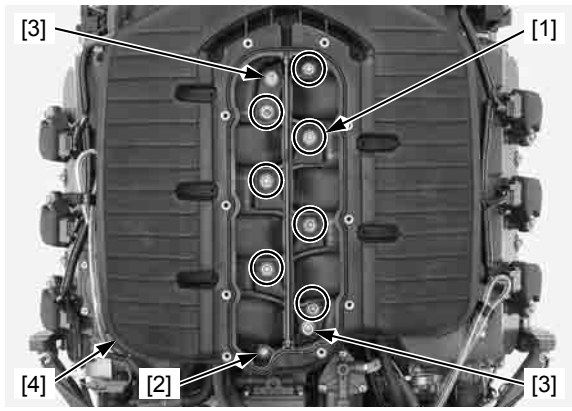


Remove the ten bolts (6 x 22 mm) [1] and intake manifold upper cover [2].



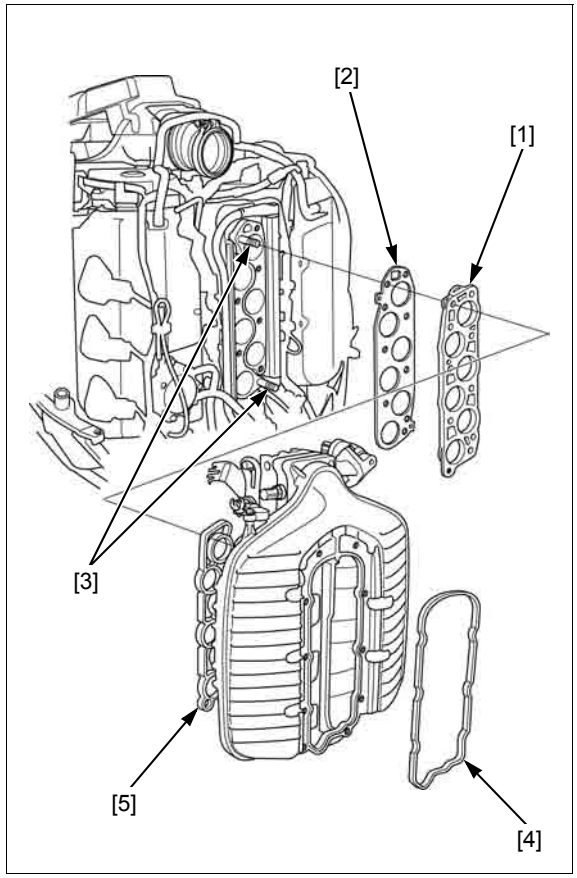
Remove the seven bolts (8 x 50 mm) [1], bolt (6 x 32 mm) [2], two nuts (8 mm) [3], and intake manifold [4].

- When loosening the stud bolt, tighten it and check that the length from the bolt head to the injector base surface is within specification (Specification length: 28 mm (1.1 in))

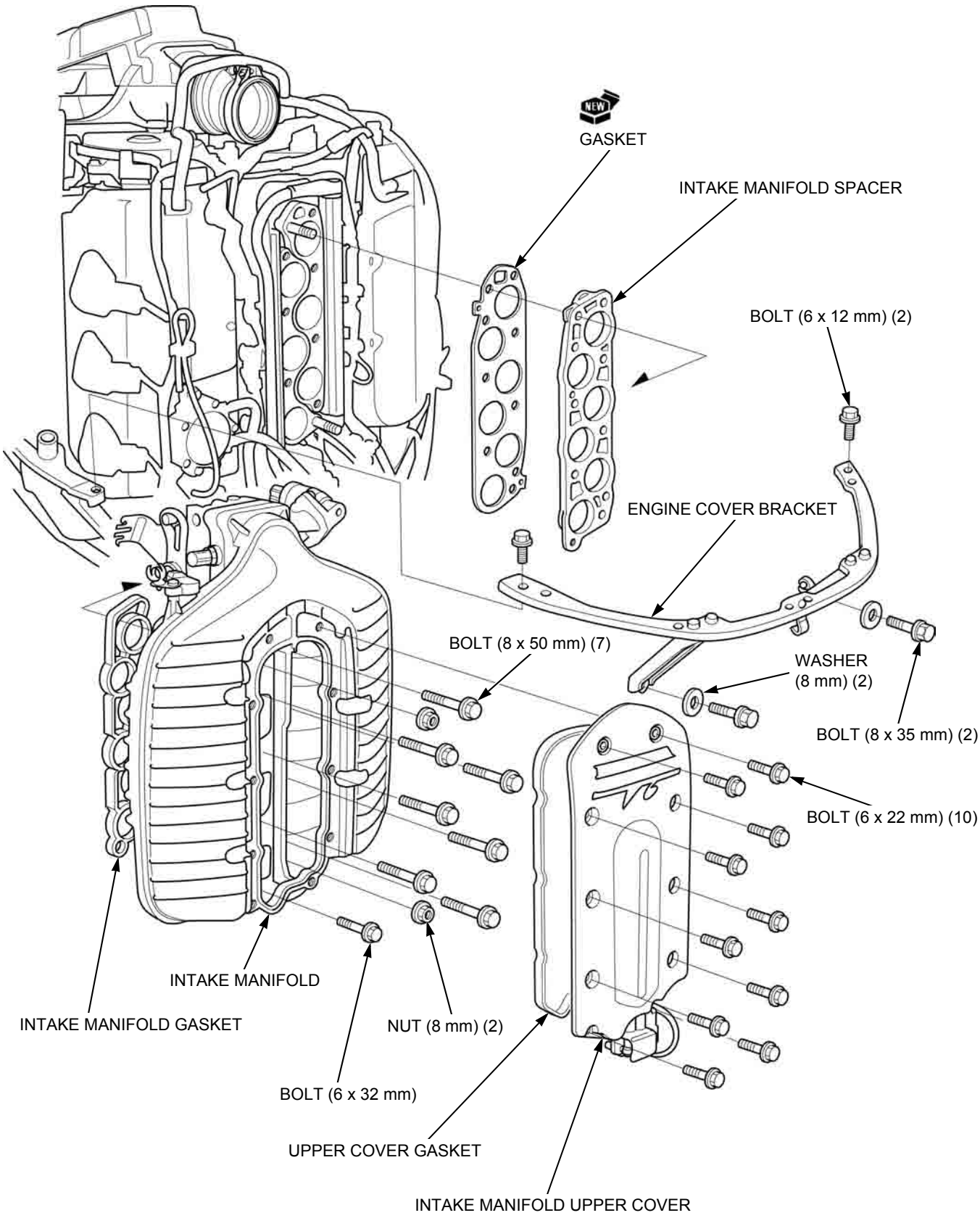


Remove the intake manifold spacer [1] and intake manifold gasket [2] from the stud bolts [3].

Check the upper cover gasket [4] and intake manifold gasket [5] for cracks and other damage. Replace if necessary.

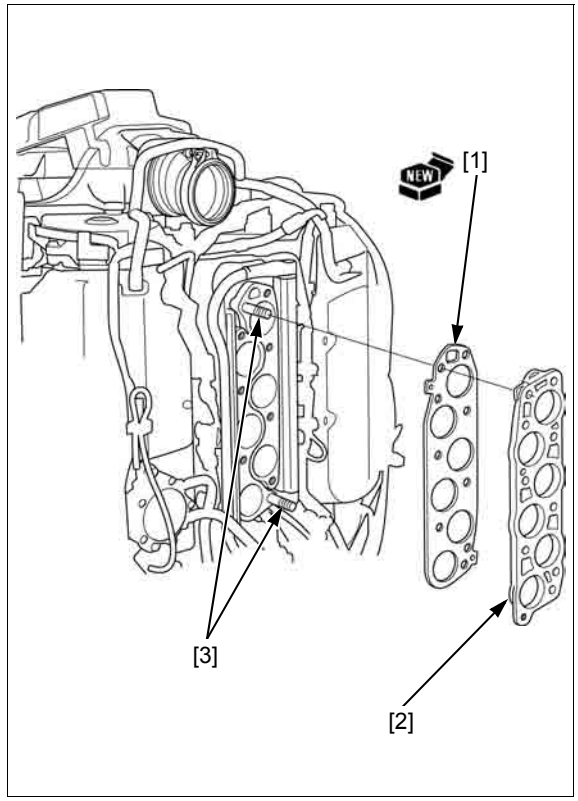


EXPLODED VIEW



INSTALLATION

Install a new intake manifold gasket [1] and the intake manifold spacer [2] to the stud bolts [3].

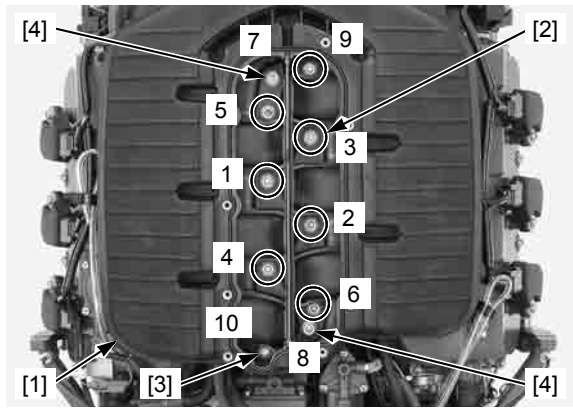


Install the intake manifold [1] to the studs and cooling fan cover grommet; do not turn the grommet inside out.

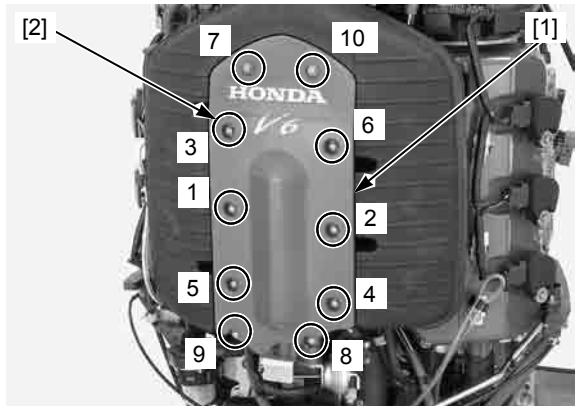
NOTICE

Be sure not to pinch the vacuum tube and fuel tube.

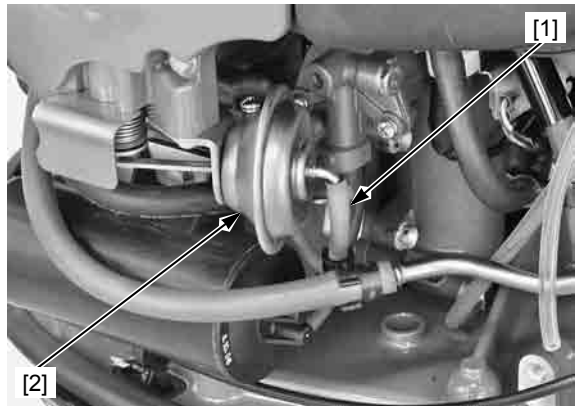
Install the seven bolts (8 x 50 mm) [2], bolt (6 x 32 mm) [3], two nuts (8 mm) [4], and tighten them in two or three steps.



Install the intake manifold upper cover [1] and tighten the bolts (6 x 22 mm) [2] in the numbered order. Be sure to tighten them in two or three steps.

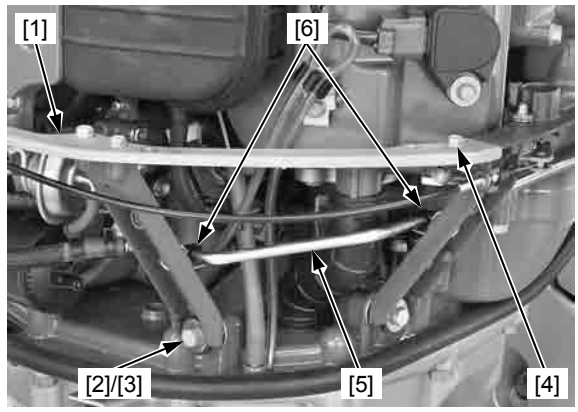


Connect the vacuum tube [1] to the IAB control diaphragm [2].



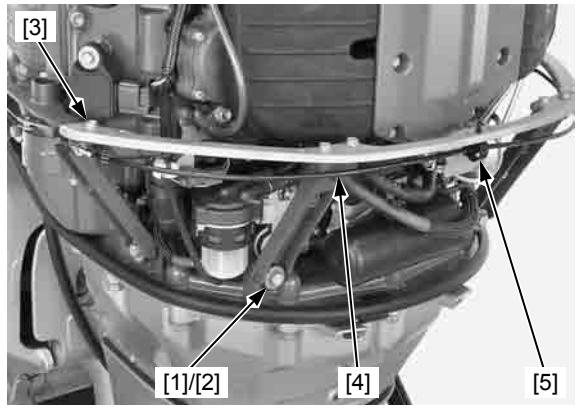
Install the engine cover bracket [1] and washer (8 mm) [2], and then tighten the bolt (8 x 35 mm) [3] and bolt (6 x 12 mm) [4] securely.

Install the fuel pipe [5] to the clamps [6].



Install the washer (8 mm) [1], bolt (8 x 35 mm) [2], bolt (6 x 12 mm) [3] and tighten them securely.

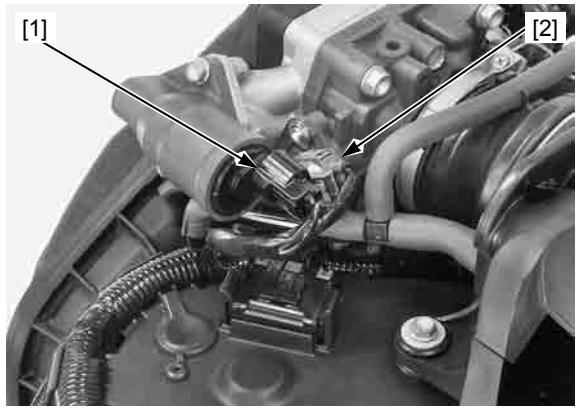
Clamp the cover locking cable [4] to the clamp [5].



Tighten the air flow clamp screw [1] securely.



Connect the IAC valve 2P connector [1] and TP sensor 3P connector [2].

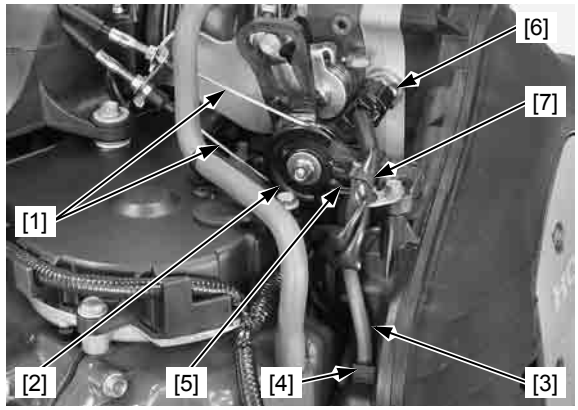


Connect the throttle cables [1] to the throttle cam [2].

Connect the pressure regulator vacuum hose [3] to the intake manifold [4].

Connect the MAP sensor 3P connector [5] and clamp it to the harness clip [6].
Connect the IAT sensor 2P connector [7].

Adjust the throttle cables (page 3-11).



FUEL INJECTORS/FUEL PRESSURE REGULATOR REMOVAL/ INSTALLATION

REMOVAL

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

⚠WARNING

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

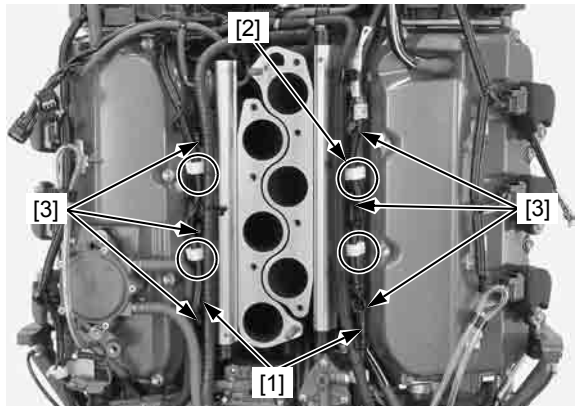
Relieve the fuel pressure (page 5-66).

- Always disconnect the fuel hose before removing the fuel rail.

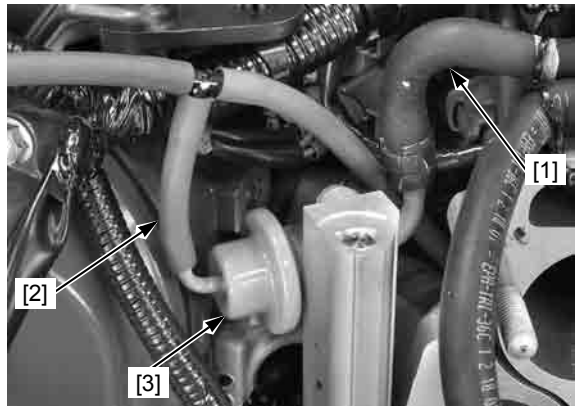
Remove the intake manifold (page 5-72).

Release the main harness [1] from the clamp [2].

Disconnect the 2P connectors [3] to the fuel injectors.

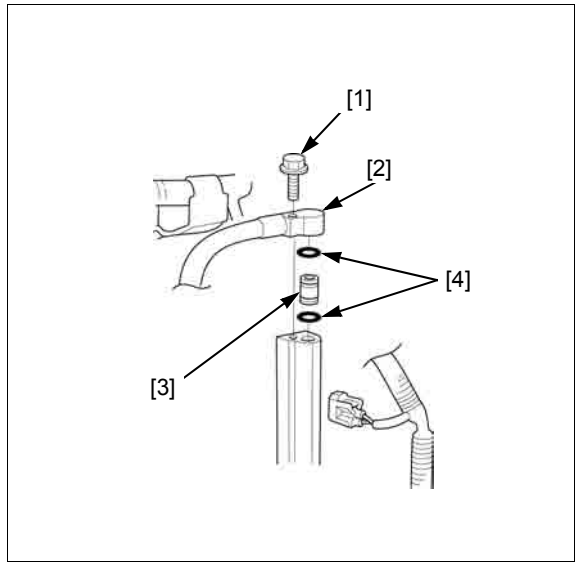


Disconnect the fuel return hose [1] and vacuum hose [2] from the pressure regulator [3].



Remove the bolt (6 x 25 mm) [1] and disconnect fuel hose A [2].

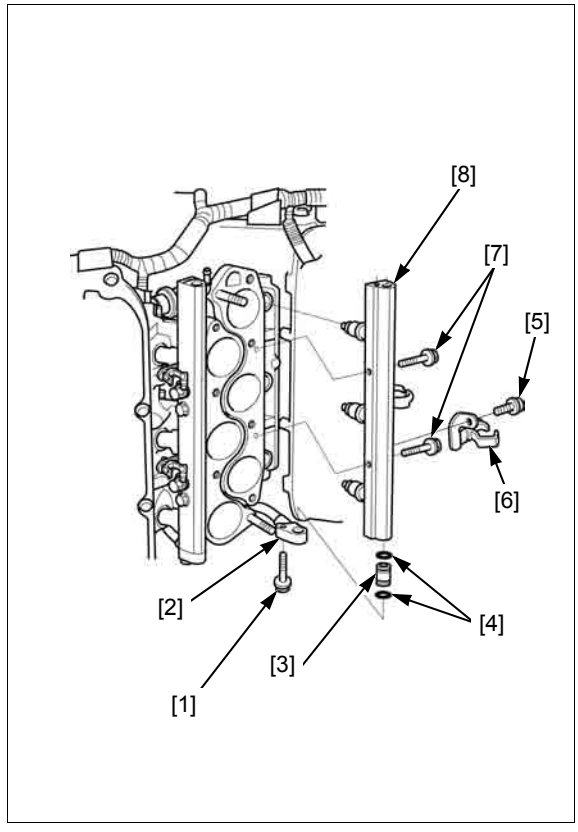
Disconnect the fuel pipe joint [3], and then remove the O-rings [4].



Remove the bolt (6 x 25 mm) [1] and disconnect the fuel joint hose [2].

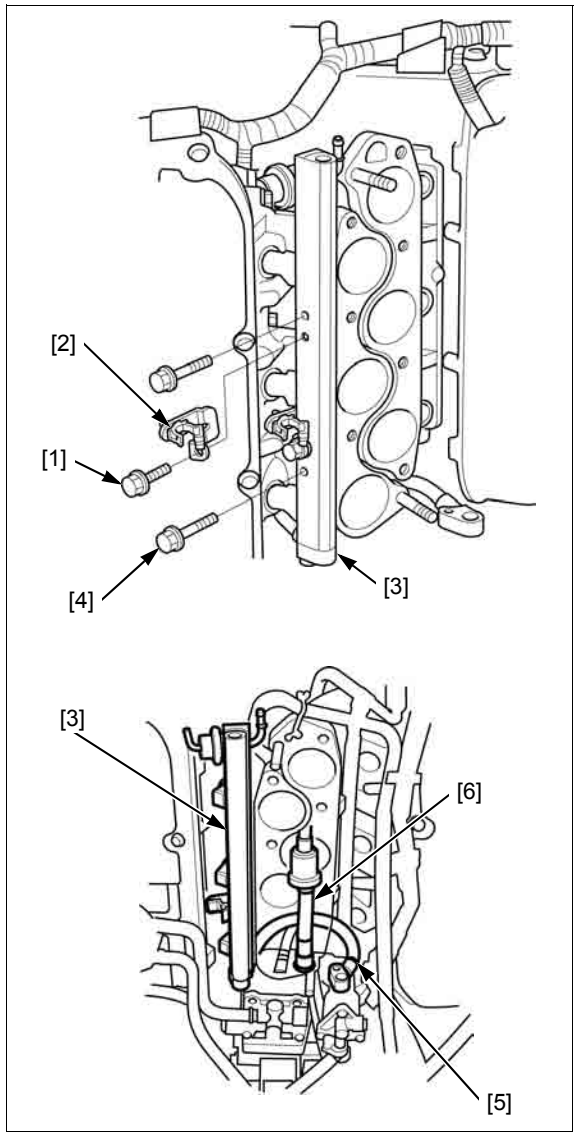
Disconnect the fuel pipe joint [3], and then remove the O-rings [4].

Remove the bolt (6 x 14 mm) [5] and release harness clip A [6] from the fuel pipe.
Remove the two bolts (6 x 35 mm) [7] and fuel pipe [8].



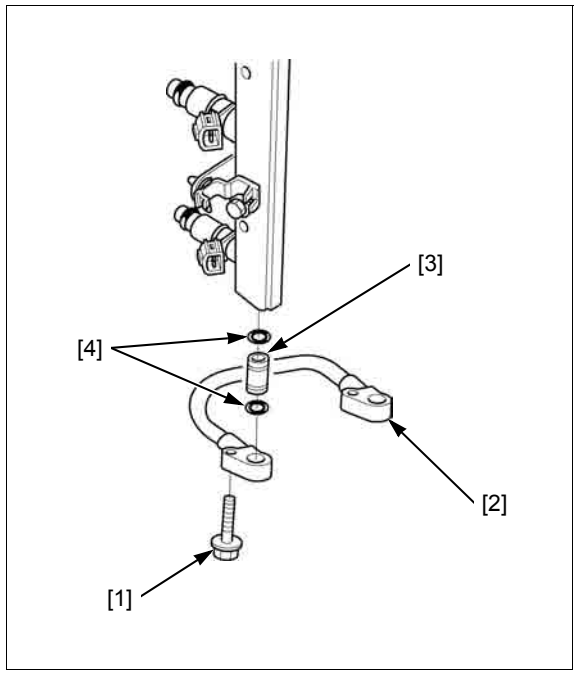
Remove the bolt (6 x 14 mm) [1] and release harness clip A [2] from the fuel pipe [3].
Remove the two bolts (6 x 35 mm) [4].

Remove the fuel pipe from the injector base by pulling the fuel joint hose [5] from the air vent hose [6] on the back side of the vapor separator.



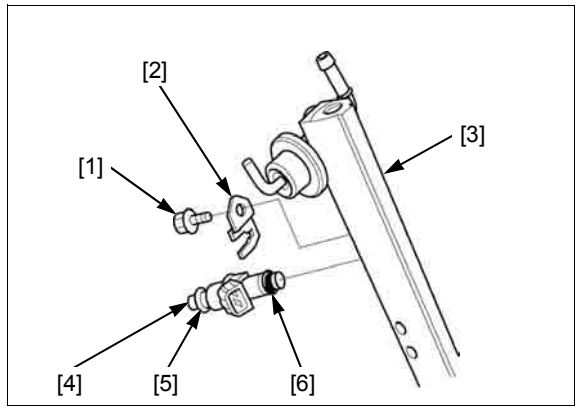
Remove the bolt (6 x 25 mm) [1] and disconnect the fuel joint hose [2].

Disconnect the fuel pipe joint [3], and then remove the O-rings [4].



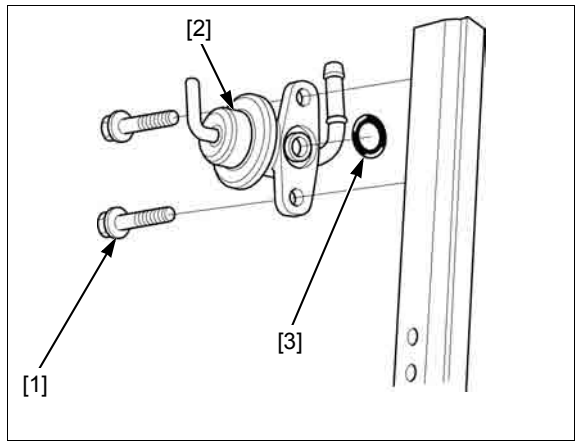
Remove the bolts (6 x 10 mm) [1] and injector clips A [2] from the fuel pipes [3].

Remove all injectors [4] from the fuel pipes.
Remove the O-ring [5] and seal ring [6].

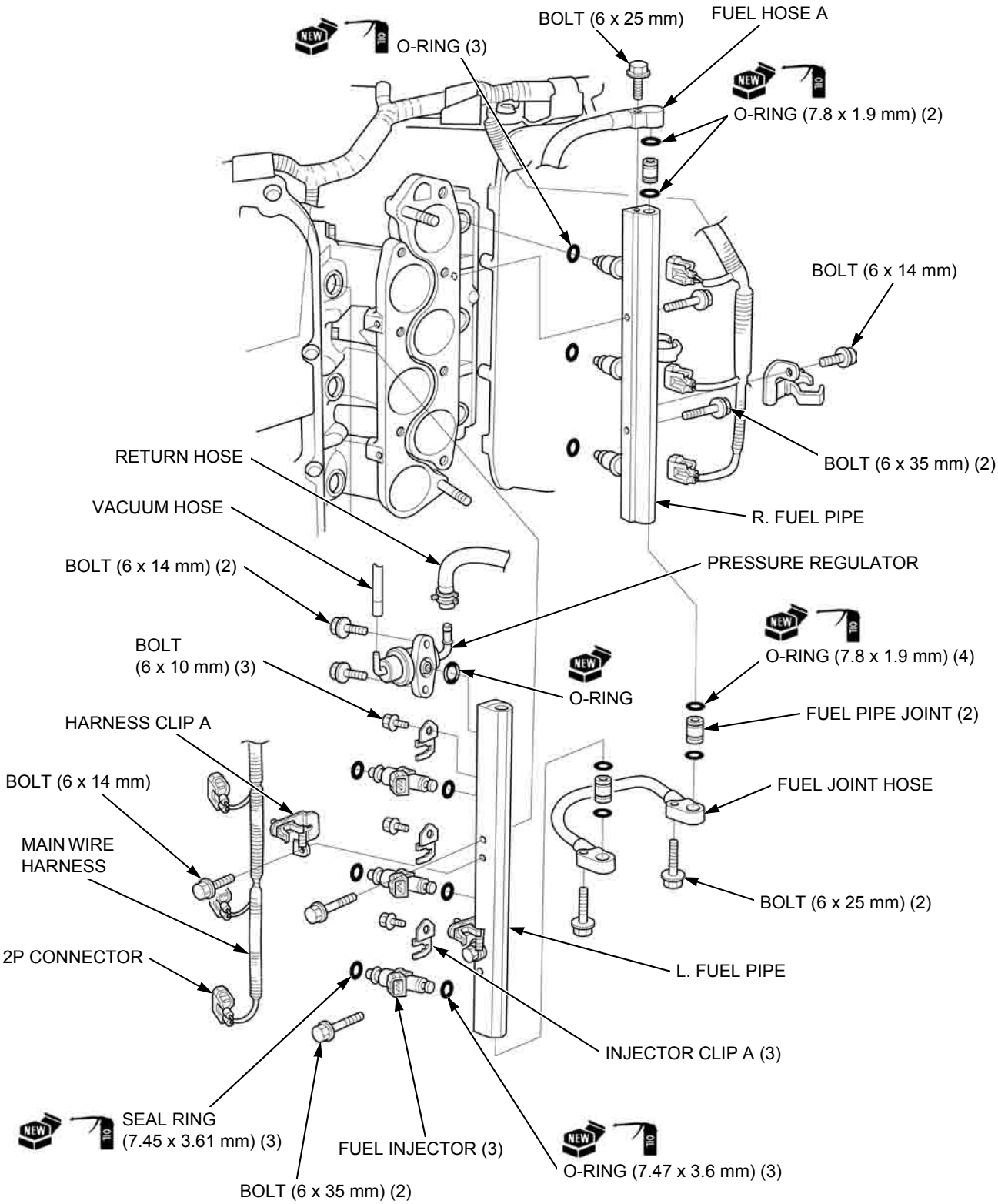


Remove the two bolts (6 x 14 mm) [1] and pressure regulator [2].

Remove the O-ring [3].

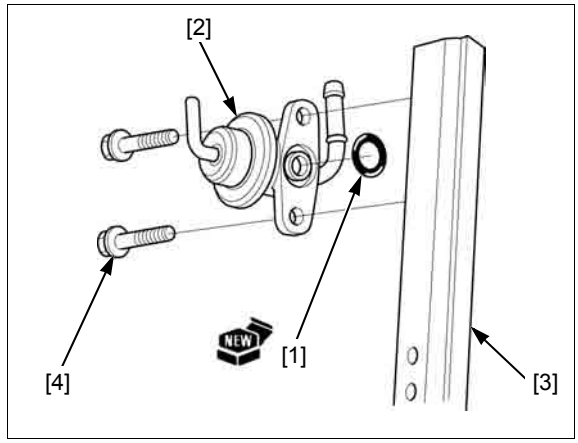


EXPLODED VIEW



INSTALLATION

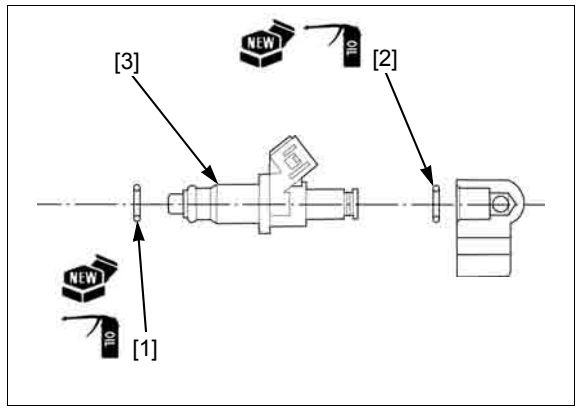
Replace the O-ring with a new one [1] and install the pressure regulator [2].
Install the pressure regulator to the L. fuel pipe [3] with two bolts [4].



Coat a new seal ring (7.45 x 3.61 mm) [1] and a new O-ring (7.47 x 3.6 mm) [2] with engine oil, and install them to the injector [3].

NOTE:

- Install the O-ring and seal ring in their proper locations.



Install all injectors [1] into the fuel pipes [2].

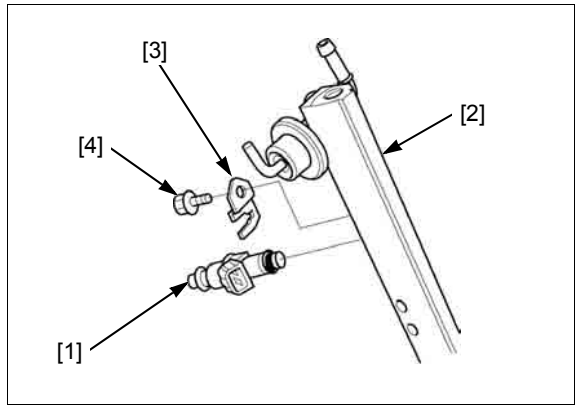
NOTICE

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

Install injector clips A [3] and tighten the bolts (6 x 10 mm) [4] to the fuel pipes.

NOTICE

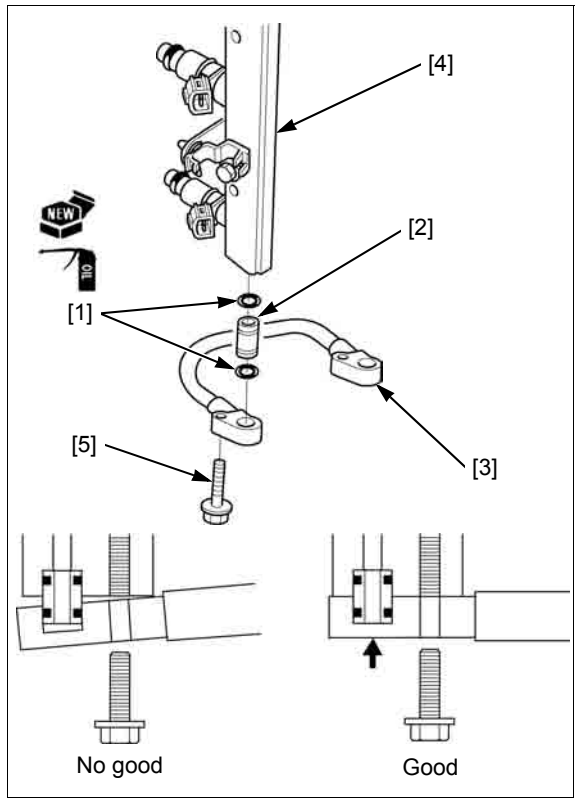
- *To prevent damage to the O-ring, install the injectors in the fuel pipe first, and then install them in the injector bases.*



Coat two O-rings [1] with engine oil and install them to the fuel pipe joint [2], and then install the fuel joint hose [3] to the fuel pipe [4] and tighten the bolt (6 x 25 mm) [5].

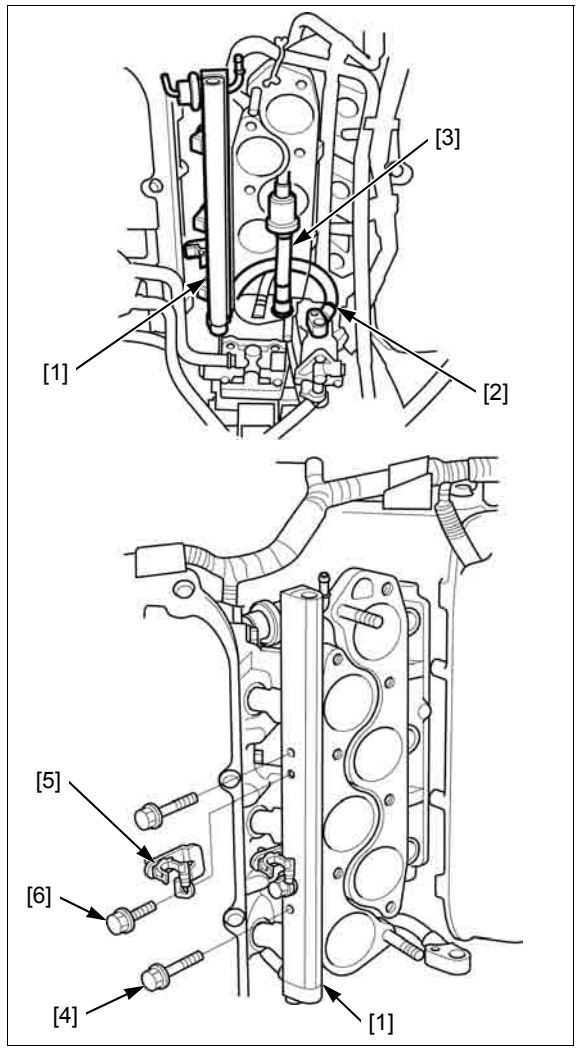
NOTICE

- *To prevent fuel leaks, make sure the fuel pipe joints and fuel joint hose are fixed to the fuel pipes securely before tightening the bolts.*



Install the fuel pipe [1] to the injector base by passing the fuel joint hose [2] to the vapor separator air vent hose [3] back side and tighten the two bolts (6 x 35 mm) [4].

Set harness clip A [5] and tighten the bolt (6 x 14 mm) [6].



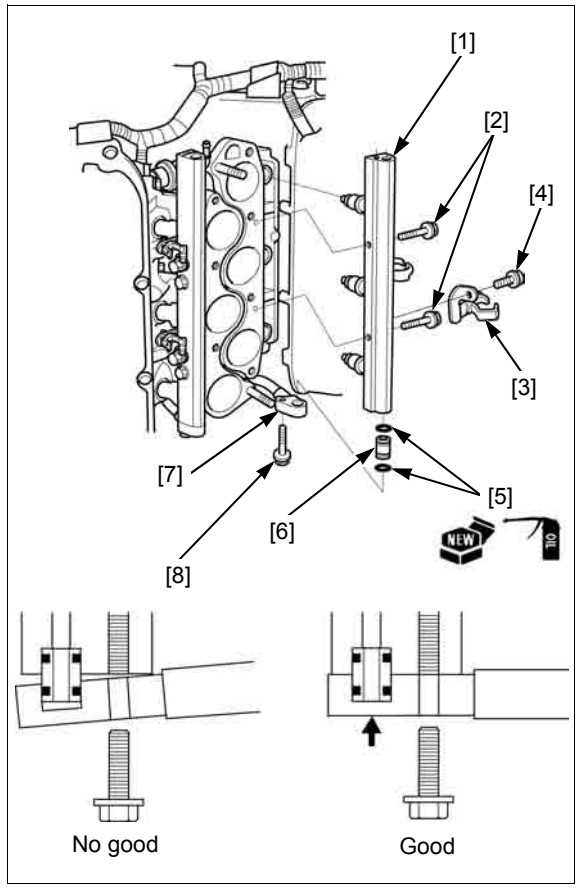
Install the fuel pipe [1] to the injector bases and tighten the two bolts (6 x 35 mm) [2].

Set harness clip A [3] and tighten the bolt (6 x 14 mm) [4].

Coat new O-rings [5] with engine oil and install them to the fuel pipe joint [6], and then install the fuel joint hose [7] to the fuel pipe and tighten the bolt (6 x 25 mm) [8].

NOTICE

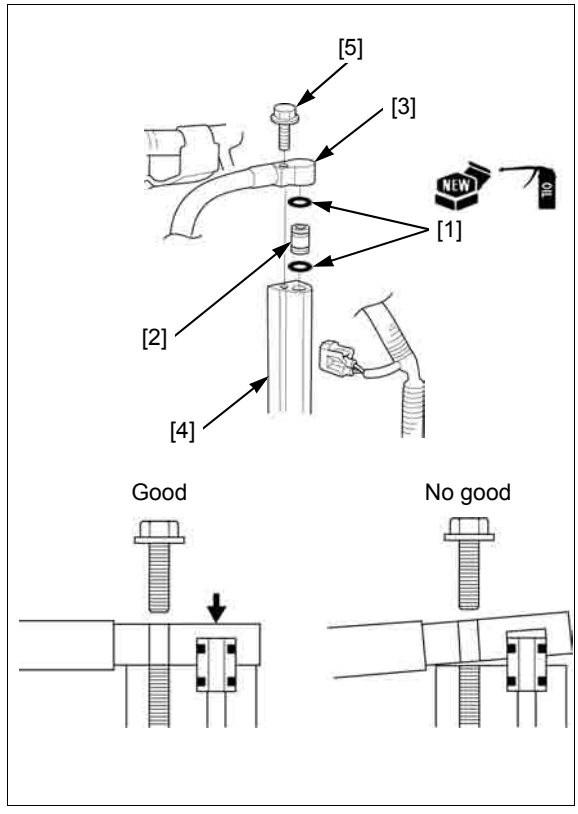
- *To prevent the fuel leaks, make sure the fuel pipe joints and fuel joint hose are fixed to the fuel pipes securely before tightening the bolts.*



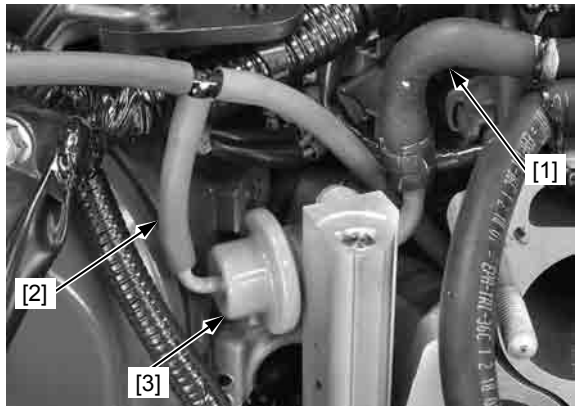
Coat new O-rings [1] with engine oil and install them to the fuel pipe joint [2], and then install the fuel joint hose [3] to the fuel pipe [4] and tighten the bolt [5].

NOTICE

- *To prevent the fuel leaks, make sure the fuel pipe joint and fuel hose A are fixed to the fuel pipe securely before tightening the bolt.*



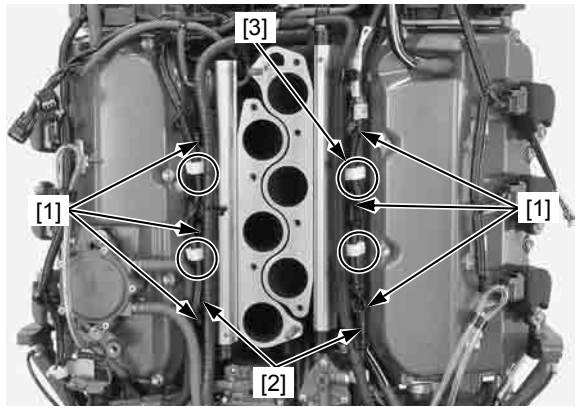
Connect the fuel return hose [1] and vacuum hose [2] to the pressure regulator [3].



Connect the 2P connectors [1] to the fuel injectors.

Clamp the main harness [2] to the tube clip [3].

Install the intake manifold (page 5-76).



FUEL PUMP (HIGH PRESSURE SIDE)/ VAPOR SEPARATOR REMOVAL/ INSTALLATION

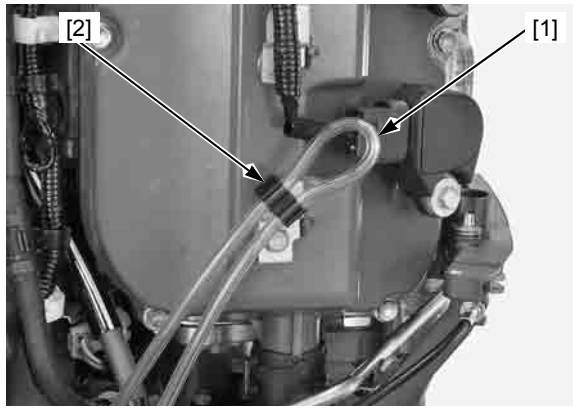
REMOVAL

Remove the intake manifold (page 5-72).

⚠WARNING

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

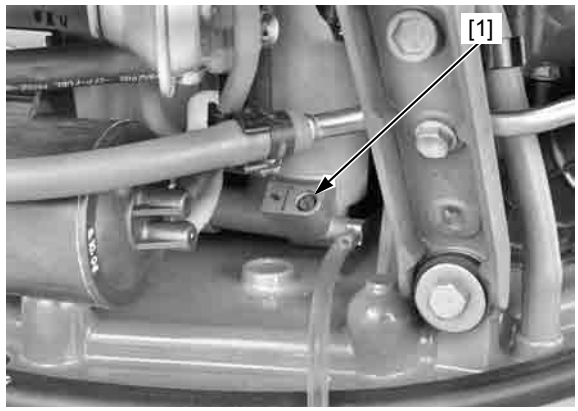
Release the V tube (3.5 x 6.5 x 600 mm) [1] from the tube clamp [2].



Loosen the vapor separator drain screw [1] and drain the fuel in a suitable container.

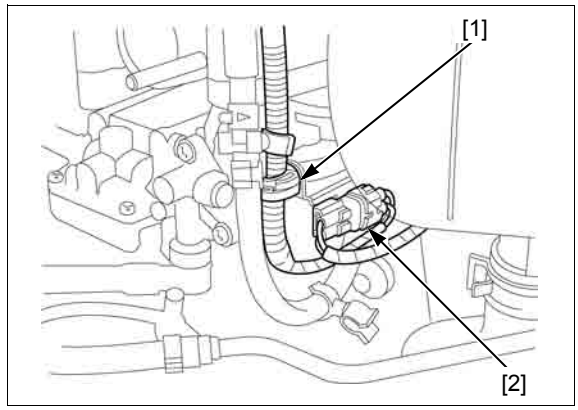
After draining, tighten the drain screw to the specified torque.

TORQUE: 1.5 N·m (0.15 kgf·m, 1.1 lbf·ft)

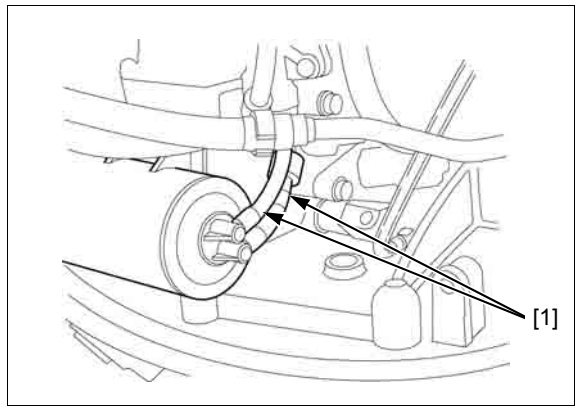


Release the wire harness from the clamp [1] of the fuel pump.

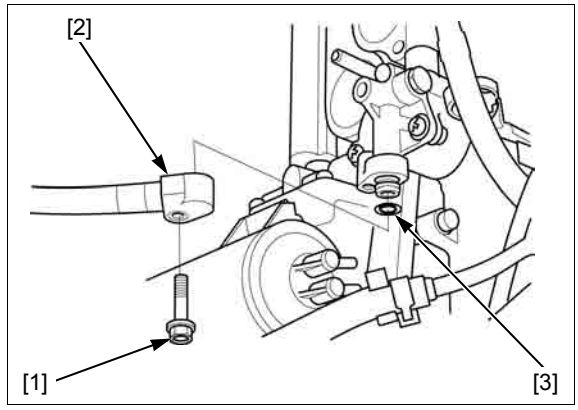
Disconnect the fuel pump (high pressure side) 2P connector [2] and release the connector from the connector holder of the fuel pump.



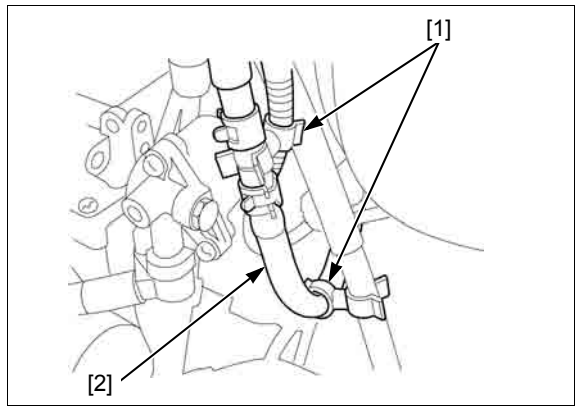
Disconnect the vacuum tubes [1] from the vacuum tank of the vapor separator.



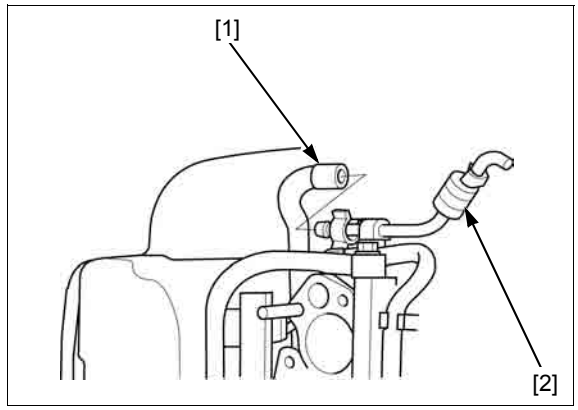
Remove the bolt (6 x 25 mm) [1] and disconnect fuel hose A [2] from the vapor separator.
Remove the O-ring [3].



Release the tube clamps [1] and disconnect the pressure regulator return hose [2].

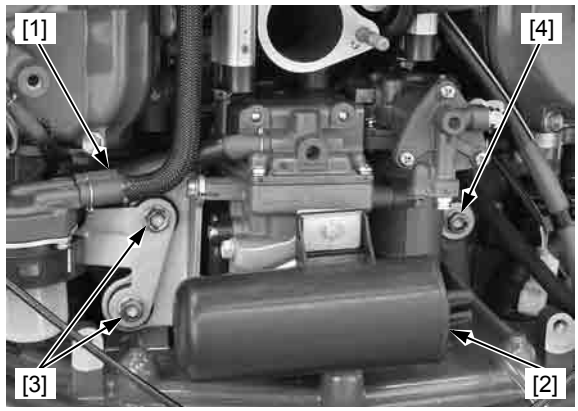


Disconnect the air vent tube [1] from the check valve [2].



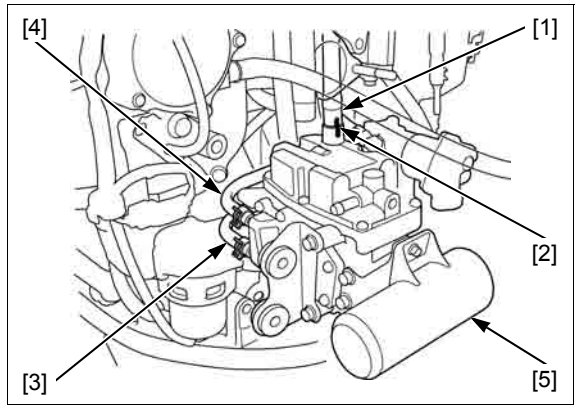
Disconnect the fuel tube E [1] from the vapor separator [2].

Remove the two bolts (8 x 35 mm) [3] and bolt/washer (8 x 35 mm) [4].

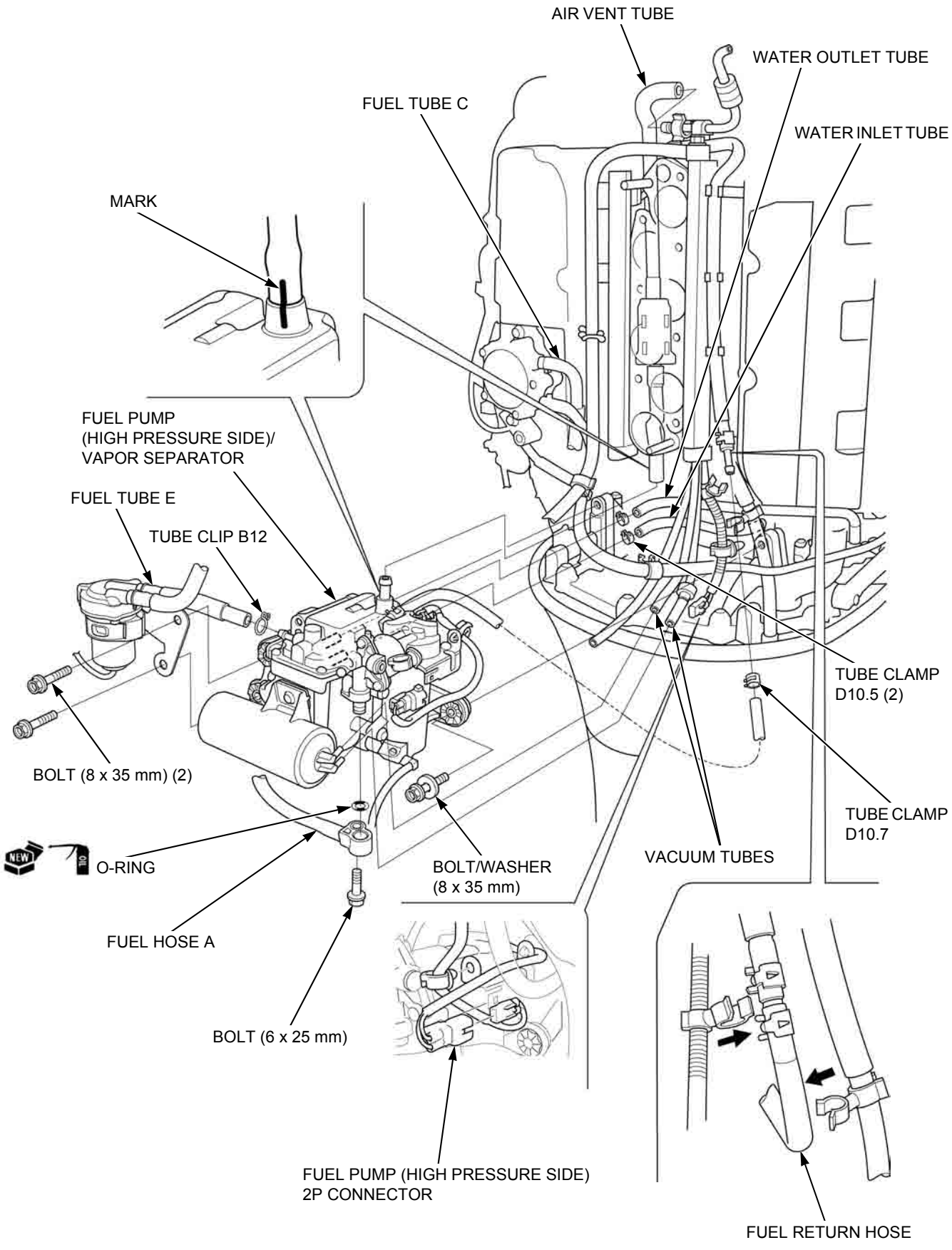


Before disconnecting the air vent tube [1], mark the air vent hose and hose joint of the vapor separator for proper position [2].

Disconnect the air vent tube, water inlet tube [3], and water outlet tube [4] from the vapor separator [5].



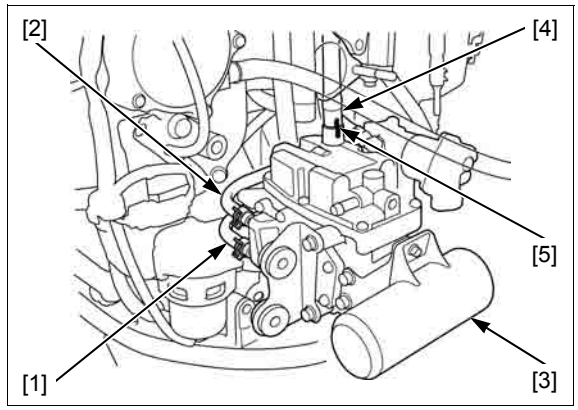
EXPLODED VIEW



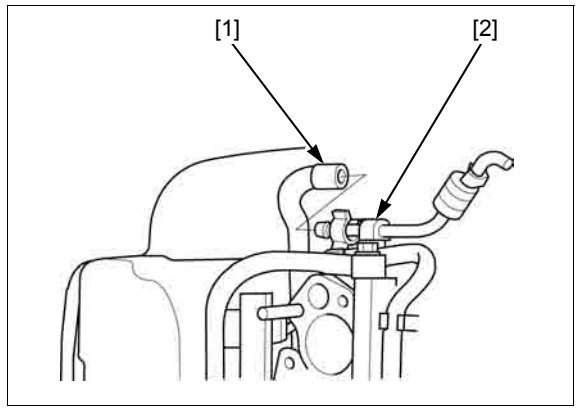
INSTALLATION

Connect the water inlet tube [1] and water outlet tube [2] to the vapor separator [3].

Connect the air vent tube [4] in its original position as marked during disconnection [5].

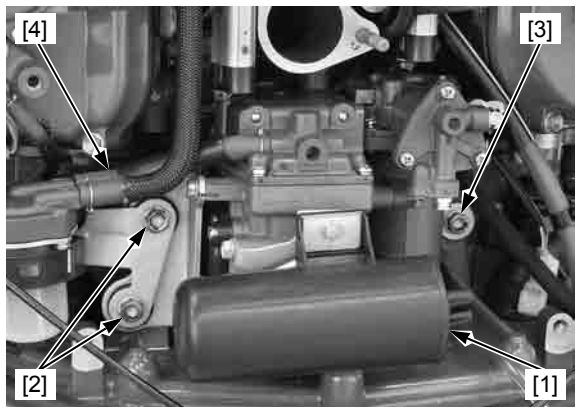


Connect the air vent tube [1] to the joint pipe [2].

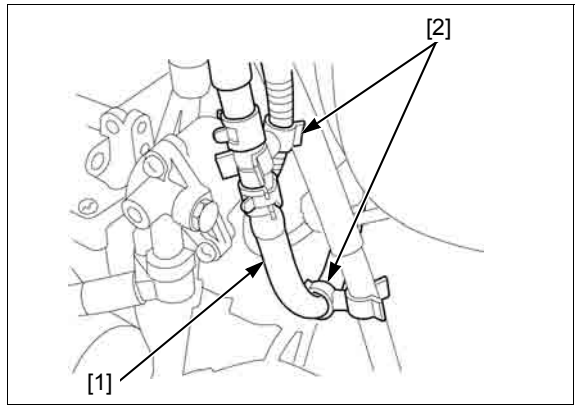


Install the vapor separator [1] and loosely tighten the two bolts (8 x 35 mm) [2] and bolt/washer (8 x 35 mm) [3].

Connect the fuel tube E [4] to the vapor separator.



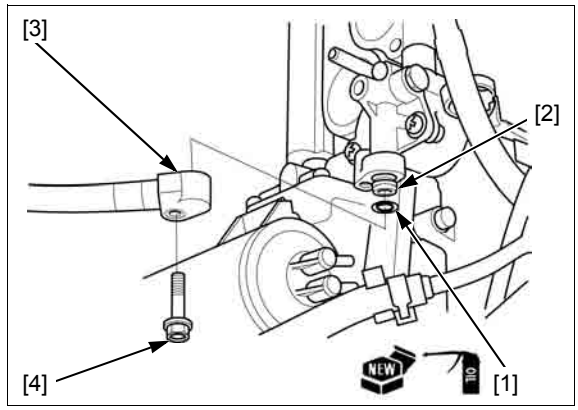
Connect the fuel return hose [1] and clamp the return hose to the hose clamps [2].



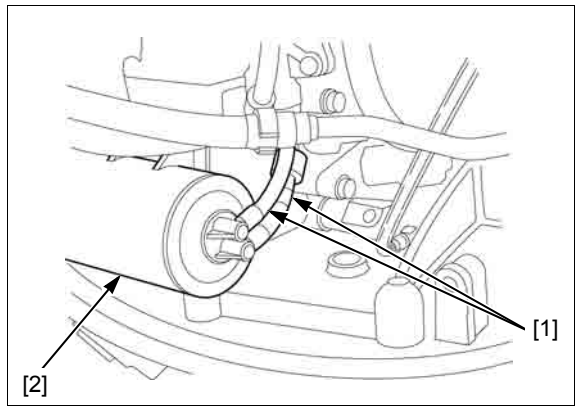
Apply engine oil to new O-ring [1].

Install the O-ring to the slit of fuel pipe joint [2].

Connect fuel hose A [3] to the vapor separator. Install and tighten the bolt (6 x 25 mm) [4].



Connect the vacuum tubes [1] to the vacuum tank [2] (the fuel tube with the check valve connects to the lower side of the vacuum tank joint.)



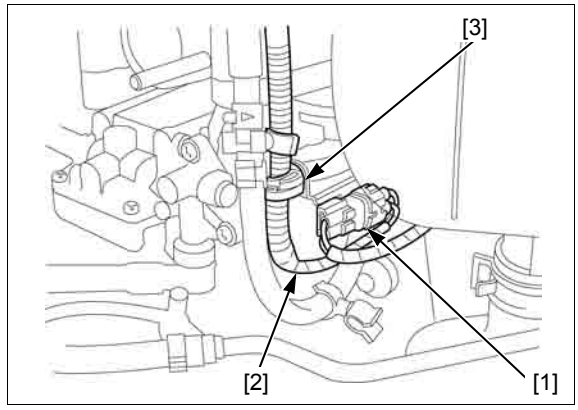
Make sure the tubes are connected properly (page 2-34).

After checking, tighten the vapor separator with the bolt/ washer (8 x 35 mm) and two bolts (8 x 35 mm) securely.

Connect the fuel pump (high pressure side) 2P connector [1] and set the connector to the connector holder of the fuel pump.

Clamp the main wire harness [2] to the harness clamp [3] of the fuel pump.

Install the intake manifold (page 5-76).



AIR VENT STRAINER/AIR VENT TUBE REMOVAL/INSTALLATION

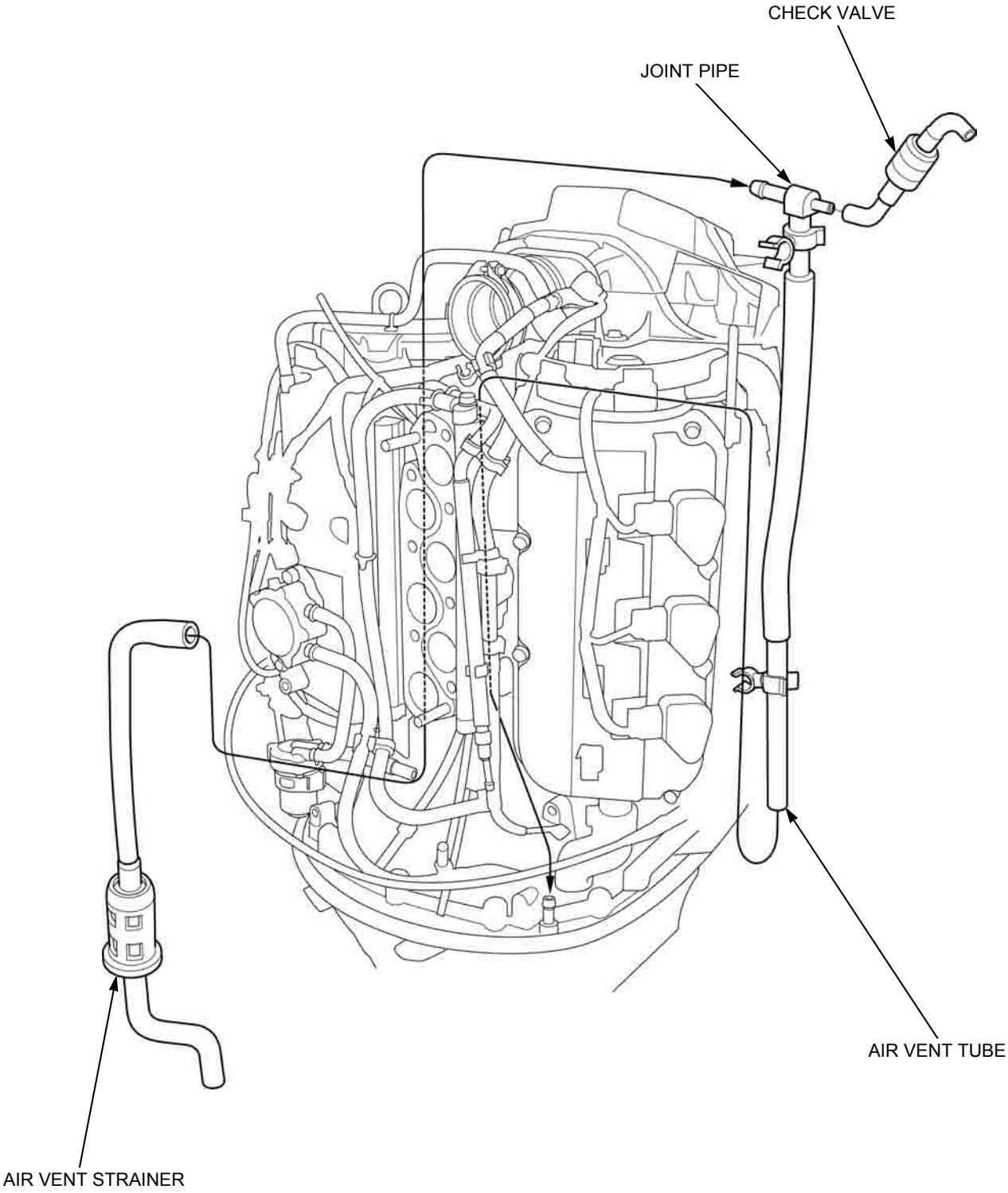
Remove the fuel pump (High pressure side)/vapor separator (page 5-86).

NOTICE

- *If there is a crack or deterioration, replace the tube.*

NOTE:

- When assembly, route the tube properly (page 2-34).



WATER SEPARATOR/WATER LEVEL SENSOR REMOVAL/INSTALLATION/ CLEANING

⚠WARNING

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

REMOVAL

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

Remove the L. engine under cover (page 6-4).

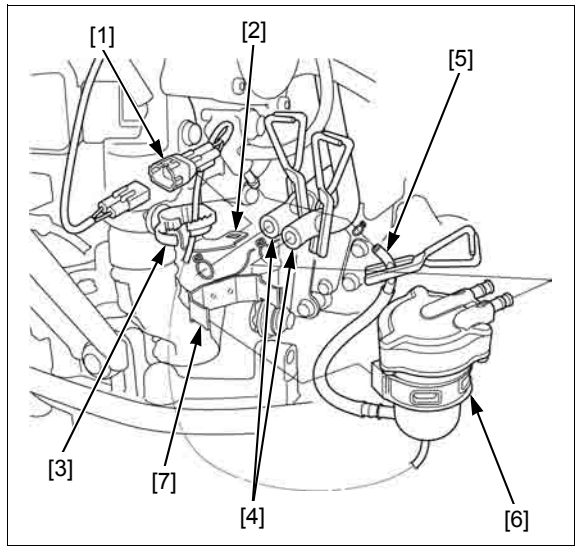
Remove the water separator/water level sensor 2P connector [1] from the stay [2].

Disconnect the 2P connector and release it from the harness clip [3].

Clamp the fuel tubes [4] and fuel tube D [5] with commercially available hose clamps.

Disconnect the fuel tubes and fuel tube D.

Remove the water separator Assy. [6] from the bracket [7].



DISASSEMBLY/ASSEMBLY/ CLEANING

Remove the suspension [1] from the water separator cup [2].

Remove the three screw/washers (5 x 12 mm) [3] and water separator cover [4], and then remove the plate [5] from the water separator cup.

Remove the float [6] from the separator cup.

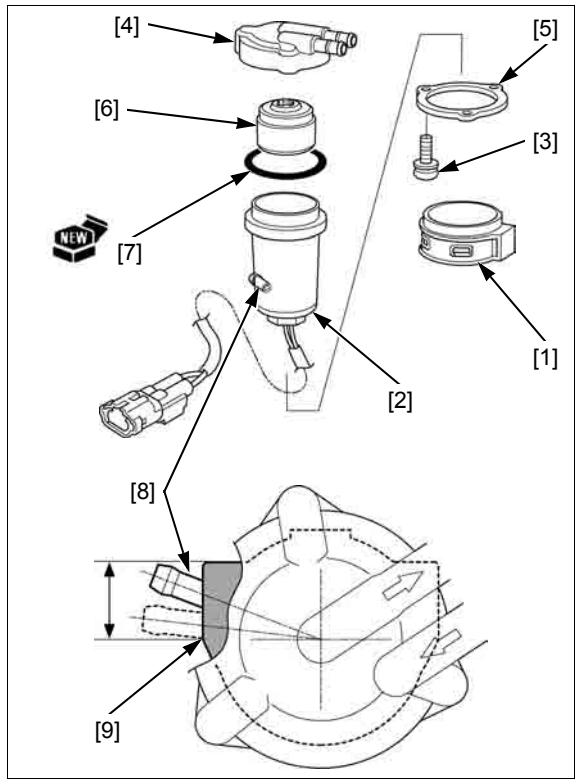
Clean the separator cup using low flash point solvent.

Install a new O-ring [7] to the separator cup.

Install the float to the separator cup.

Install the separator cover and plate to the separator cup and loosely tighten the three screw/washers.

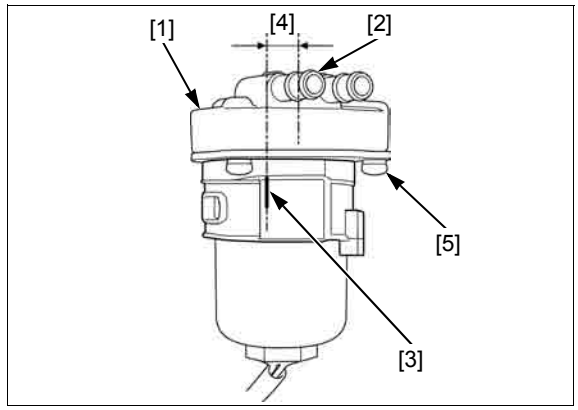
Install the suspension to the separator cup, and then position the drain joint [8] of separator cup on the side [9] of suspension as shown.



Turn the separator cover [1] and position the fuel tube inlet joint [2] with the "I" mark [3] on the suspension in the range [4] as shown.

Tighten the three separator cover screw/washers (5 x 12 mm) [5] to the specified torque.

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



INSTALLATION

Install the water separator [1] to the bracket [2].

Connect the fuel tubes [3] to the water separator securely.

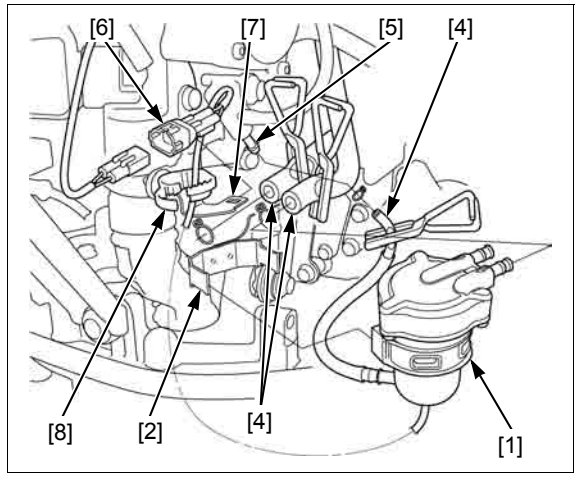
Connect the fuel tube D [4] to the fuel drain valve [5] securely.

Install the water separator/water level sensor 2P connector [6] to the stay [7].

Connect the 2P connector and clamp it with the harness clip [8].

Install the L. engine under cover (page 6-4).

Connect the battery positive (+) terminal and negative (–) terminal.

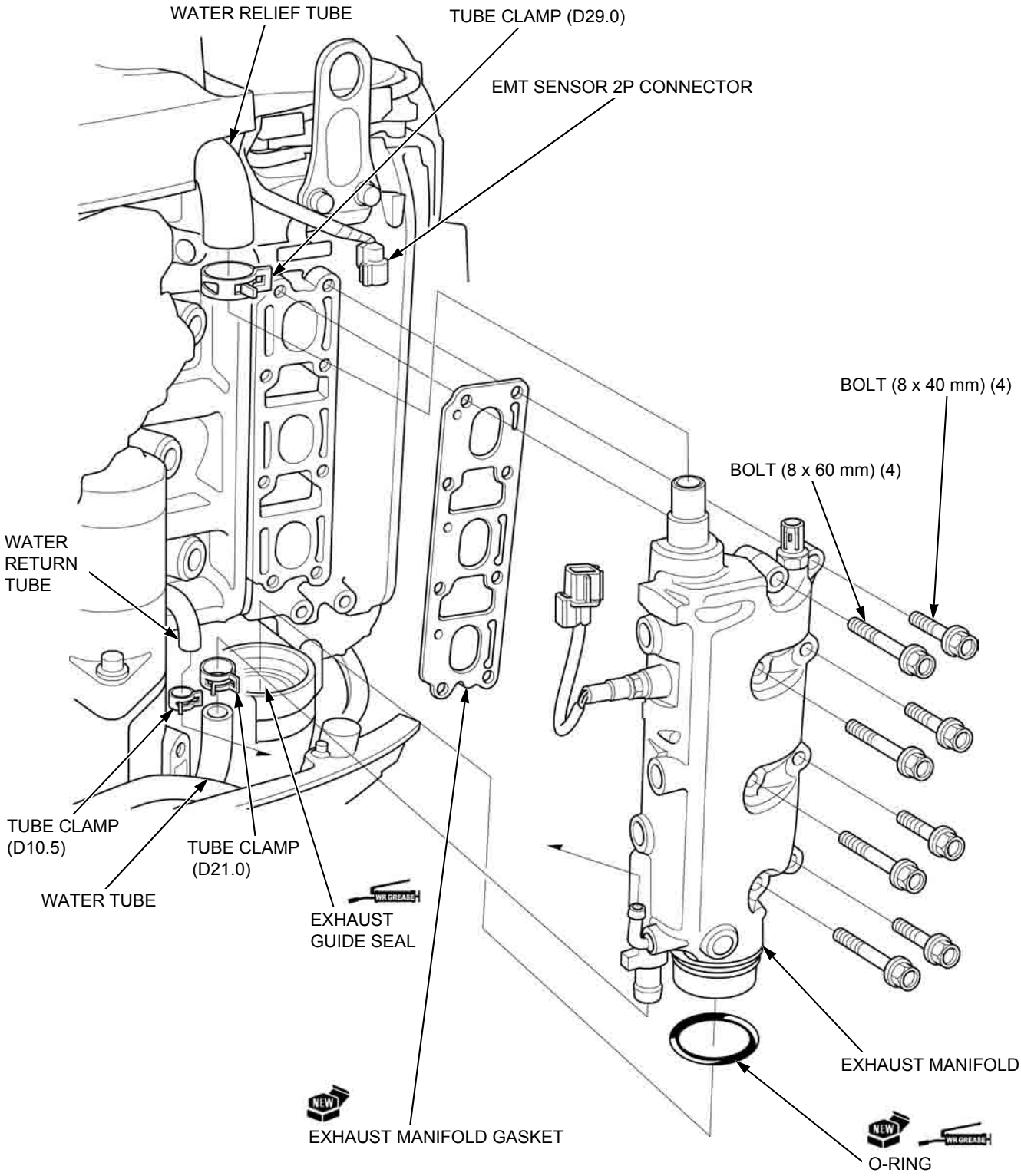


EXHAUST MANIFOLD REMOVAL/ INSTALLATION

REMOVAL

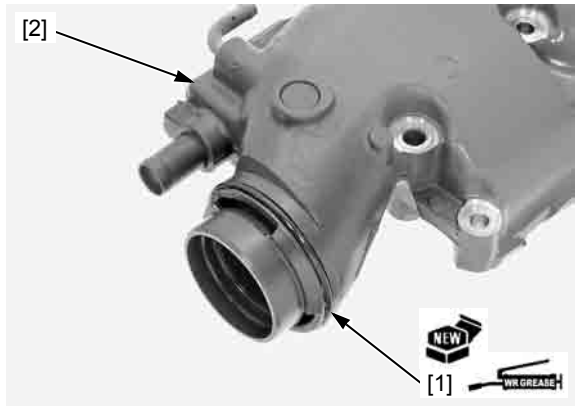
Remove the following:

– HO2S 4P connector (L. side only: page 10-6)
– engine cover bracket (page 6-9)



INSTALLATION

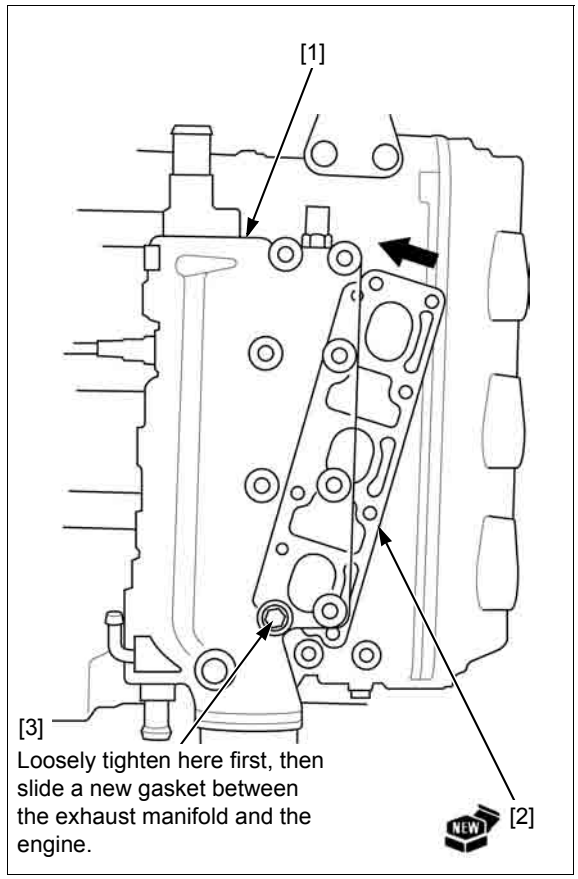
Apply marine grease to a new O-ring [1] and install it to the exhaust manifold [2].



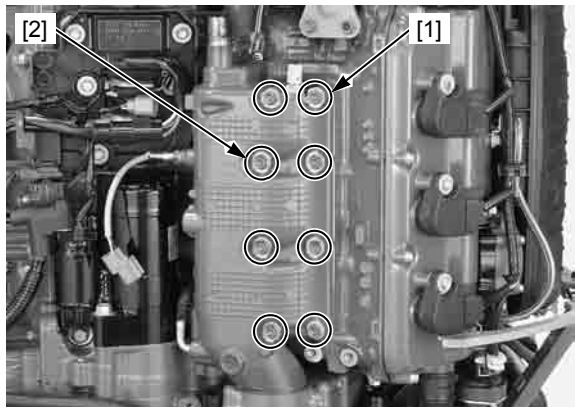
Install the exhaust manifold [1] into the exhaust guide water seal. Do not turn the grommet inside out.

Set a new gasket [2] to the exhaust manifold and loosely tighten the bolt (8 x 60 mm) [3] to the lower corner of the exhaust manifold.

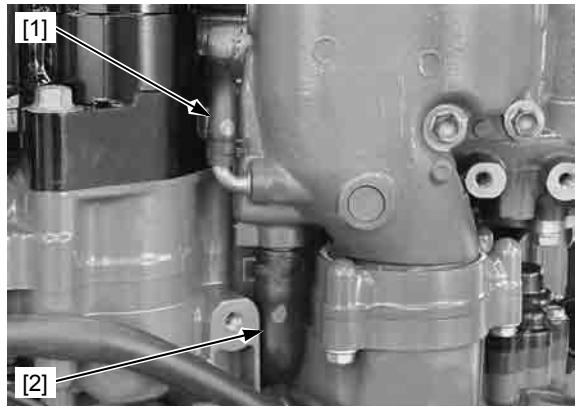
Slide the gasket as shown and install the exhaust manifold with the bolts (8 x 40 mm) and bolts (8 x 60 mm).



Install the exhaust manifold with the bolts (8 x 40 mm) [1] and bolts (8 x 60 mm) [2] and tighten them.



Connect the water return tube [1] and water tube [2] to the exhaust manifold.

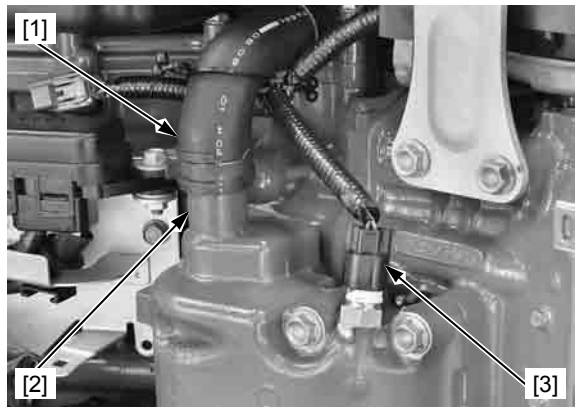


Connect the water relief tube [1] to the exhaust manifold [2].

Connect the EMT sensor 2P connector [3].

Install the following:

– HO2S 4P connector (L. side only: page 10-6)
– engine cover bracket (page 6-9)

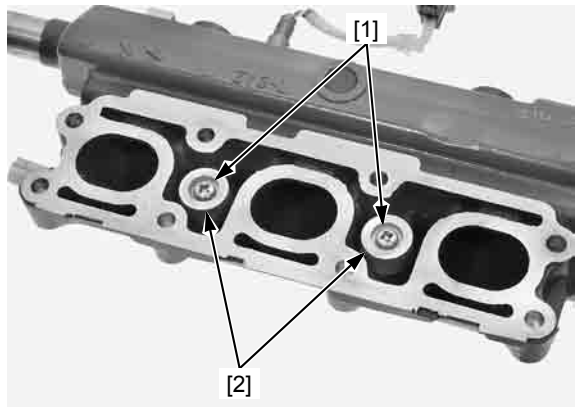


EXHAUST MANIFOLD ANODE REMOVAL/INSTALLATION

Remove the exhaust manifold (page 5-95).

Remove the screw [1] and anode metal [2].

Installation is in the reverse order of removal.



MAP SENSOR REMOVAL/ INSTALLATION

Remove the engine cover.

Disconnect the MAP sensor 3P connector [1].

Remove the bolt (5 x 18 mm) [2], MAP sensor [3], and wire band stay [4].

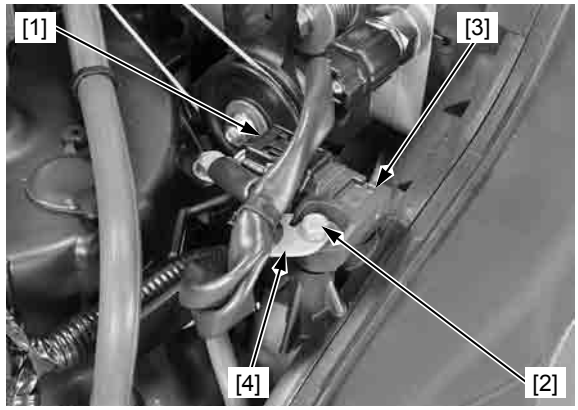
Replace the O-ring with new one [5] and coat it with engine oil.

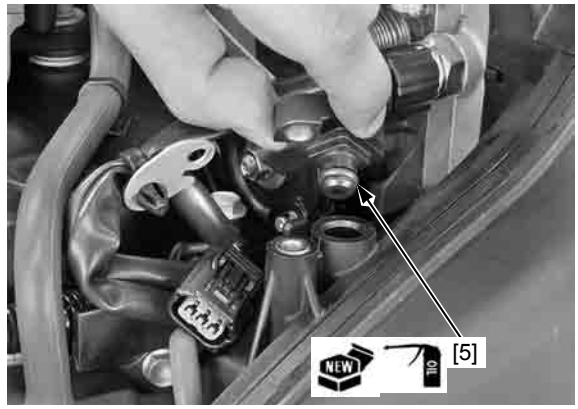
Install the MAP sensor and wire band stay, and tighten the bolt to the specified torque.

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

Connect the 3P connector to the MAP sensor.

Install the engine cover.





IAT SENSOR REMOVAL/ INSTALLATION

Remove the engine cover.

Disconnect the 2P connector [1] and remove the IAT sensor [2].

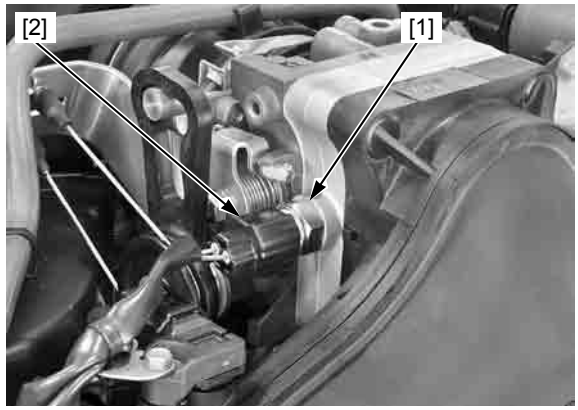
Replace the O-ring with new one [3] and coat it with engine oil.

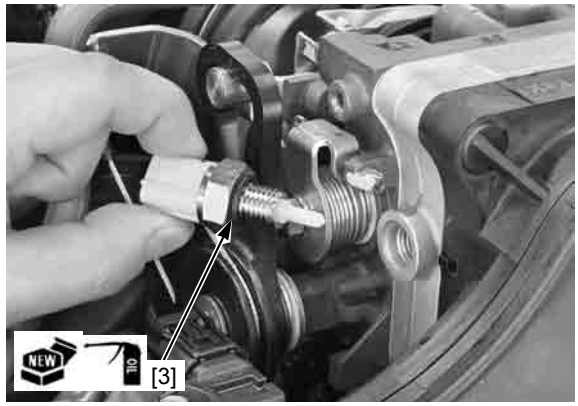
Install the IAT sensor to the specified torque.

TORQUE: 18 N·m (1.8 kgf·m, 13 lbf·ft)

Connect the 2P connector.

Install the engine cover.





IAC VALVE REMOVAL/INSTALLATION

Remove the engine cover.

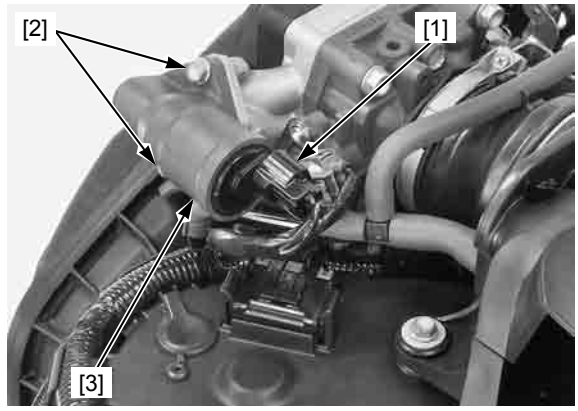
Disconnect the IAC valve 2P connector [1].

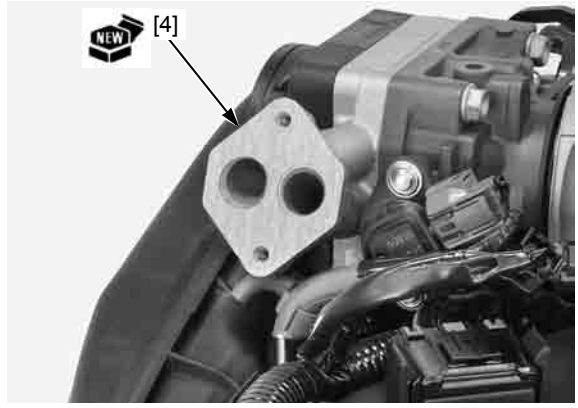
Remove the two bolts (6 x 22 mm) [2] and remove the IAC valve [3].

Install a new gasket [4] and IAC valve to the throttle body spacer and tighten the two bolts.

Connect the 2P connector.

Install the engine cover.





EMT SENSOR REMOVAL/ INSTALLATION

Remove the engine cover.

Disconnect the 2P connector [1] and remove the EMT sensor [2].

Replace the O-ring with a new one [3] and coat it with engine oil.

Apply liquid sealant (Threebond® #1201, #1215, Hondabond HT, Hondabond 4, or equivalent) to the threads and seating surface of the EMT sensor.

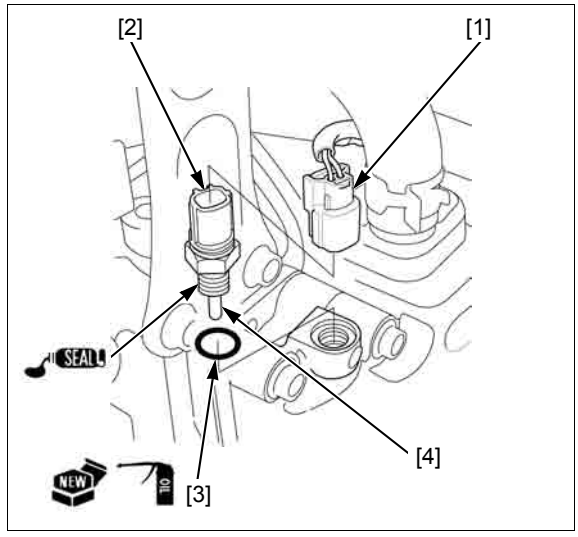
- Do not apply liquid sealant to the thermistor [4].

Install and tighten the EMT sensor to the specified torque.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

Connect the 2P connector.

Install the engine cover.

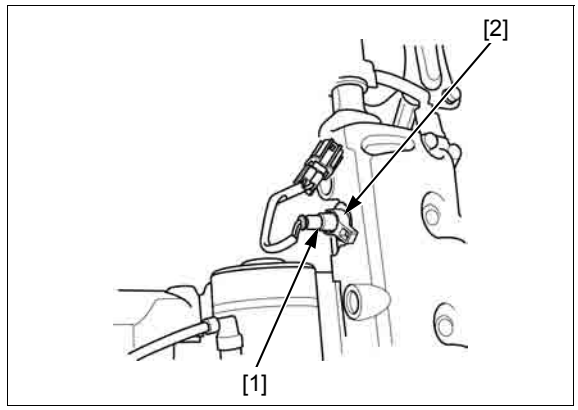


HO2S REMOVAL/INSTALLATION

REMOVAL

Remove the power tilt relay case (page 10-6).

Remove the HO2S [1] from the left exhaust manifold using a 14 mm crowfoot wrench, commercially available tool (ANM14) [2].



INSTALLATION

Install the HO2S [1] to the left exhaust manifold and tighten it using a 14 mm crowfoot wrench, commercially available tool (ANM14) [2] to the specified torque.

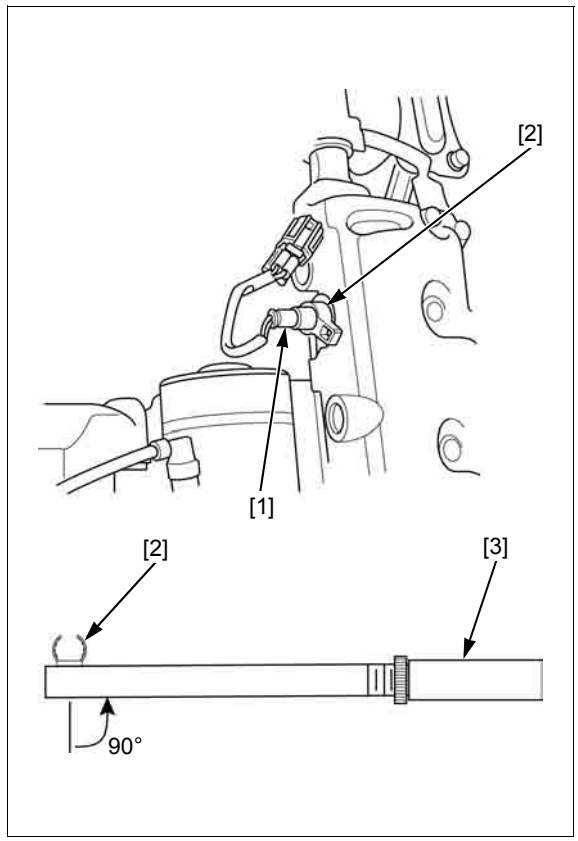
Attach the special tool at a 90° angle to the body of the torque wrench [3].

TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)

NOTICE

Make sure the torque wrench stays perpendicular to the special tool. If the torque wrench is not held 90 degrees to the tool, the torque reading will be incorrect.

Install the power tilt relay case (page 10-6).



VTEC SOLENOID VALVE REMOVAL/ INSTALLATION

Remove the following:

– Cooling fan cover (page 5-68)
– ECM (page 10-5)

Release the VTEC solenoid valve 1P connector [1] from the connector holder of the ECM bracket [2] and disconnect it.

Release the harness clip [3] from the VTEC solenoid valve wire harness.

Remove the bolt (8 x 50 mm) [4], bolts (8 x 75 mm) [5], and VTEC solenoid valve [6].

Replace the packing [7] with a new one and install the VTEC solenoid valve.

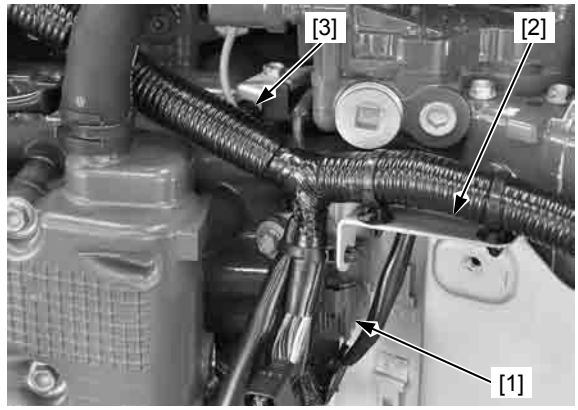
Install and tighten the bolt (8 x 50 mm) and bolts (8 x 75 mm).

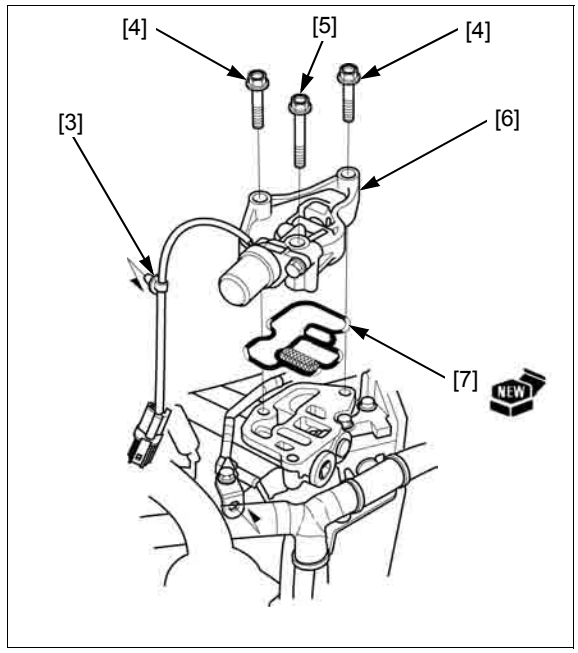
Set the harness clip from the VTEC solenoid valve wire harness.

Connect the VTEC solenoid valve 1P connector and set the connector to the connector holder of the ECM bracket.

Install the following:

– Cooling fan cover (page 5-69)
– ECM (page 10-5)





CKP SENSOR REMOVAL/ INSTALLATION

Disconnect the battery negative (–) terminal from the battery.

Remove the following:

– ECM (page 10-5)
– Timing belt drive pulley and timing belt (page 14-6)

Remove the bolt (6 x 14 mm) [1] and stay [2].

Disconnect the CKP sensor 2P connector [3] and release the connector from the connector holder of the ECM bracket [4].

Remove the bolt (6 x 16 mm) [5] and the CKP sensor [6].

Align the boss [7] of the CKP sensor with the hole [8] of the wire harness.
Install the CKP sensor by aligning its boss [9] with the hole [10] of the cylinder block.
Install and tighten the bolt securely.

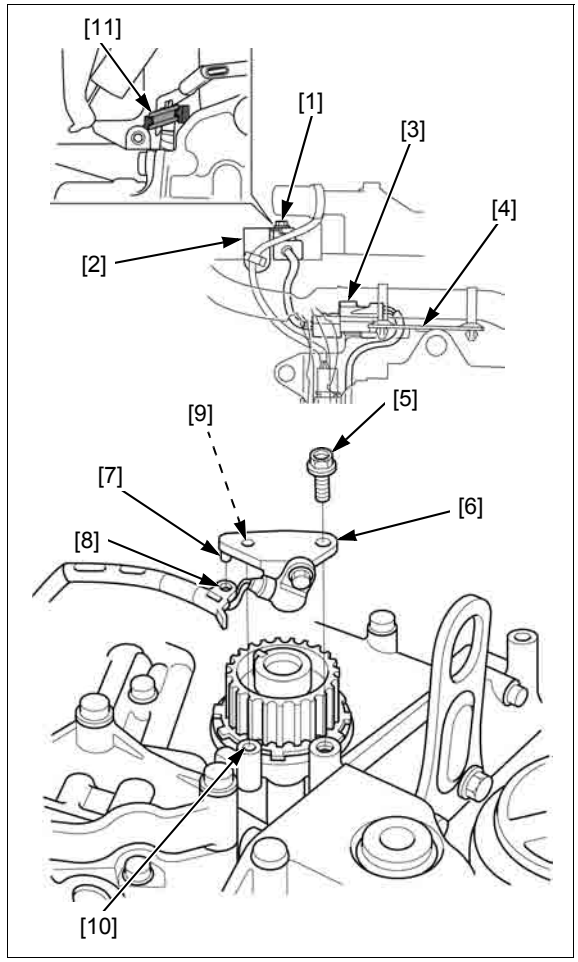
Install the grommet [11] as shown.

Install the stay and tighten the bolt securely.

Connect the CKP sensor 2P connector and set the connector to the connector holder of the ECM bracket.

Install the following:

– Timing belt drive pulley and timing belt (page 14-12)
– ECM (page 10-5)



IAB CONTROL SOLENOID VALVE REMOVAL/INSTALLATION

Remove the throttle body (page 5-71).

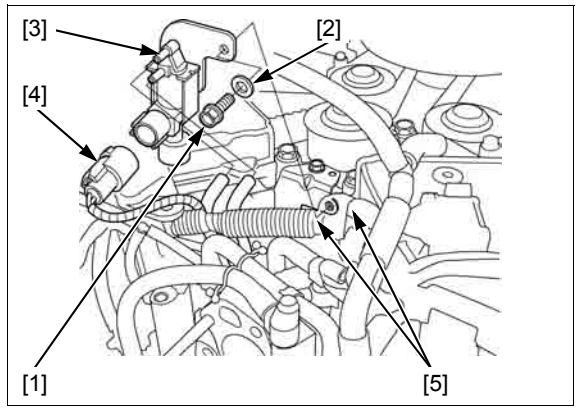
Remove the bolt (5 x 10 mm) [1], washer (5 mm) [2], and IAB control solenoid valve [3].

Disconnect the 2P connector [4] from the IAB control solenoid valve.
Disconnect the vacuum tubes [5] from the IAB control solenoid valve.

Connect the IAB control solenoid valve 2P connector.
Connect the vacuum tubes to the IAB control solenoid valve joint.

Install the IAB control solenoid valve and tighten the bolt.

Install the throttle body (page 5-71).



CMP SENSOR REMOVAL/ INSTALLATION

Remove the following:

– Throttle body (page 5-71).
– Left timing belt back cover (page 14-6)

Release the CMP sensor 4P connector [1] from the connector holder of the connector bracket [2] and disconnect it.

Remove the two bolts (5 x 14 mm) [3] and CMP 1 sensor/CMP 2 sensor [4] from the left side of the timing belt back cover [5] and release the harness clip band boss [6].

Install the CMP 1 sensor/CMP 2 sensor and tighten the two bolts to the specified torque.

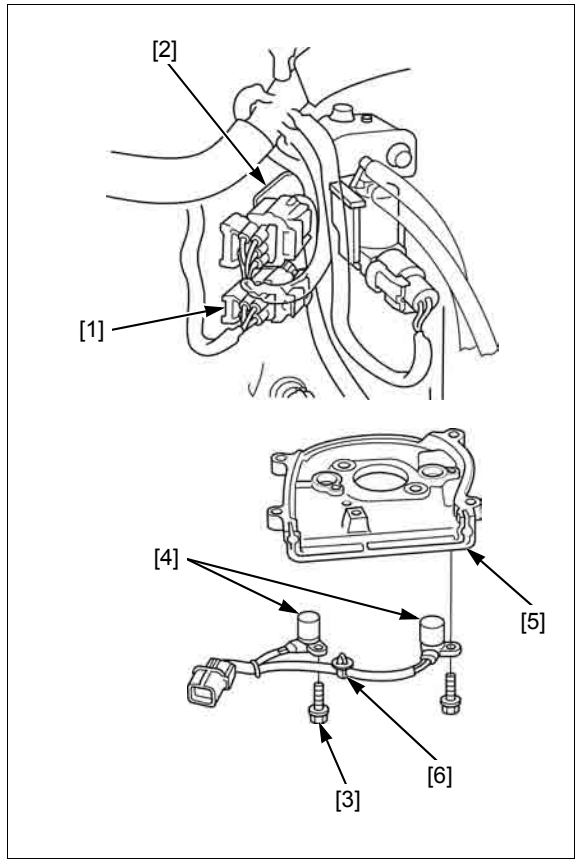
TORQUE: 3.9 N·m (0.40 kgf·m, 2.9 lbf·ft)

Set the harness clip band boss to the timing belt back cover.

After installing the CMP sensors, install the left timing belt back cover, timing belt driven pulley, and the timing belt (page 14-12).

Connect the CMP sensor 4P connector and set the connector to the connector holder of the connector bracket.

Install the throttle body (page 5-71).



EOP SWITCH (HIGH PRESSURE SIDE) REMOVAL/INSTALLATION

Remove the cylinder head (page 14-22).

Disconnect the 2P connector [1] and remove the EOP switch (High pressure side) [2].

Replace the O-ring with a new one [3] and coat it with engine oil.

Install and tighten the EOP switch to the specified torque.

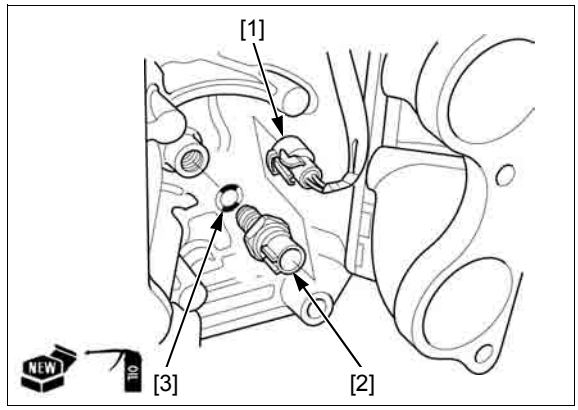
TORQUE: 22 N·m (2.2 kgf·m, 16 lbf·ft)

NOTICE

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

Connect the 2P connector to the EOP switch (High pressure side).

Install the cylinder head (page 14-24).



EOP SWITCH (LOW PRESSURE SIDE) REMOVAL/INSTALLATION

Remove the cylinder head (page 14-22).

Disconnect the 1P connector [1] and remove the EOP switch (Low pressure side) [2].

Clean the oil pressure switch threads and apply liquid sealant (Threebond® #1215, Hondabond HT, Hondabond 4, or equivalent) to the threads. Tighten the oil pressure switch to the specified torque.

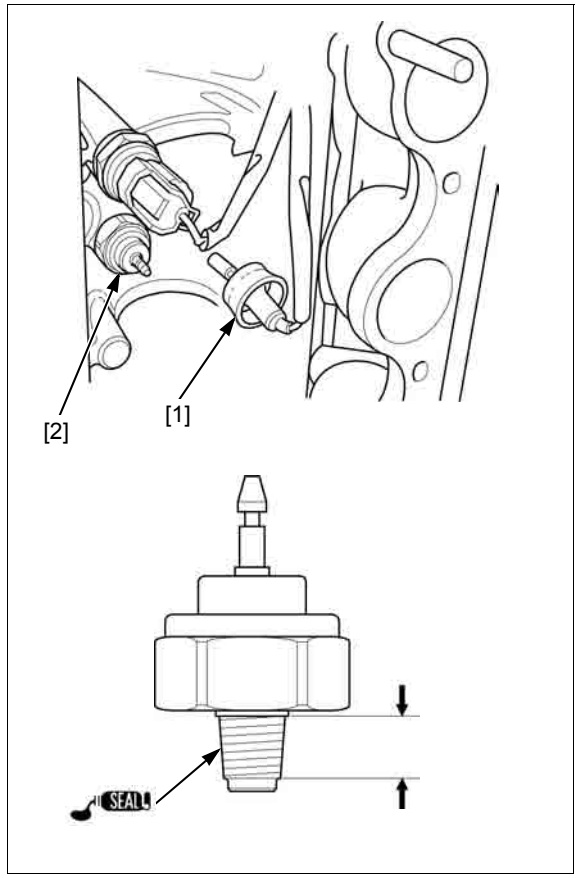
TORQUE: 8 N·m (0.82 kgf·m, 5.9 lbf·ft)

NOTICE

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

Connect the 1P connector to the EOP switch (Low pressure side).

Install the cylinder head (page 14-24).



KNOCK SENSOR REMOVAL/ INSTALLATION

Remove the cylinder head (page 14-22).

Disconnect the 1P connector [1] from the knock sensor [2].

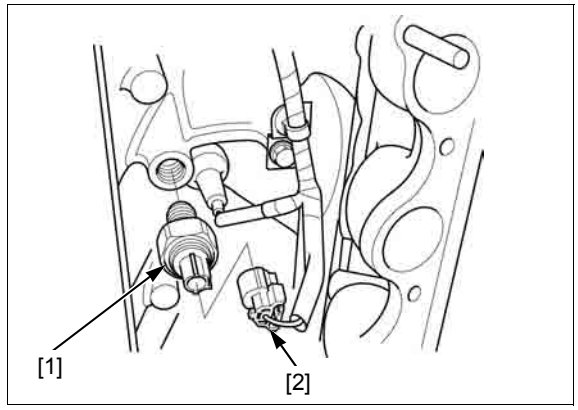
Remove the knock sensor.

Tighten the knock sensor to the specified torque.

TORQUE: 32 N·m (3.3 kgf·m, 24 lbf·ft)

Connect the 1P connector to the knock sensor.

Install the cylinder head (page 14-24).



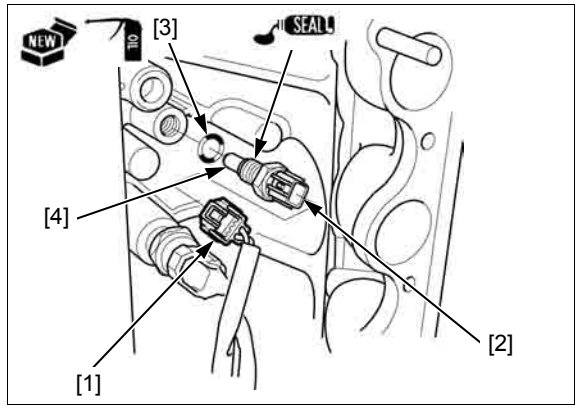
EBT SENSOR REMOVAL/ INSTALLATION

Remove the cylinder head (page 14-22).

Disconnect the 2P connector [1] and remove the EBT sensor [2].

Replace the O-ring with a new one [3] and coat it with engine oil.

Apply liquid sealant (Threebond® #1201 or #1215, Hondabond HT, Hondabond 4, or equivalent) to the threads and seating surface of the EBT sensor.



NOTICE

- *Do not apply liquid sealant to the thermistor [4].*

Install and tighten the EBT sensor to the specified torque.

TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)

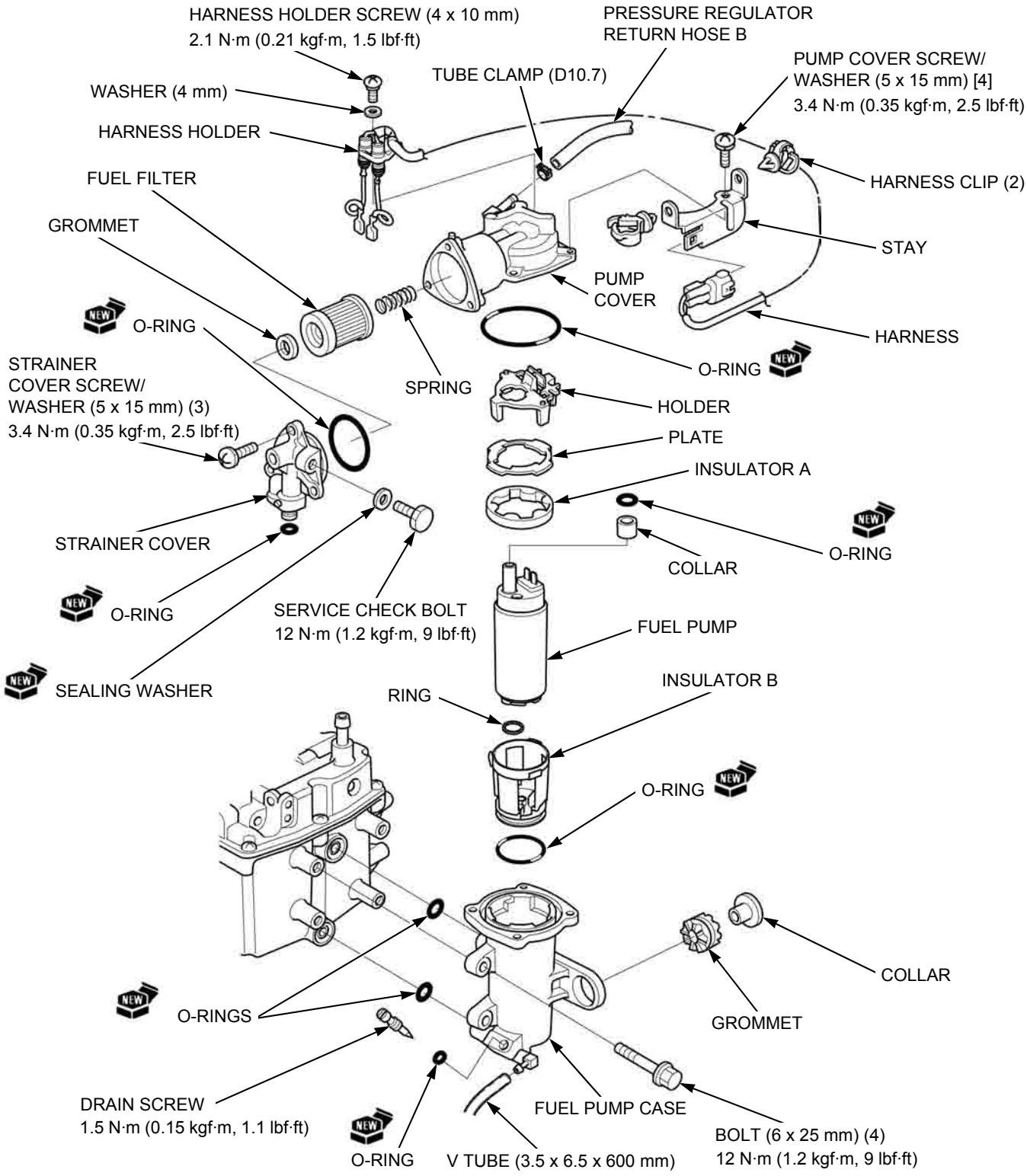
Connect the 2P connector to the EBT sensor.

Install the cylinder head (page 14-24).

FUEL PUMP (HIGH PRESSURE SIDE)/ FUEL FILTER DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

Remove the fuel pump (high pressure side)/vapor separator (page 5-86).



ASSEMBLY

Install a new O-ring [1] to the insulator A [2].

Install the ring [3] to the insulator A and install them to the fuel pump unit [4].

Install the fuel pump Assy. to the fuel pump case [5] securely.

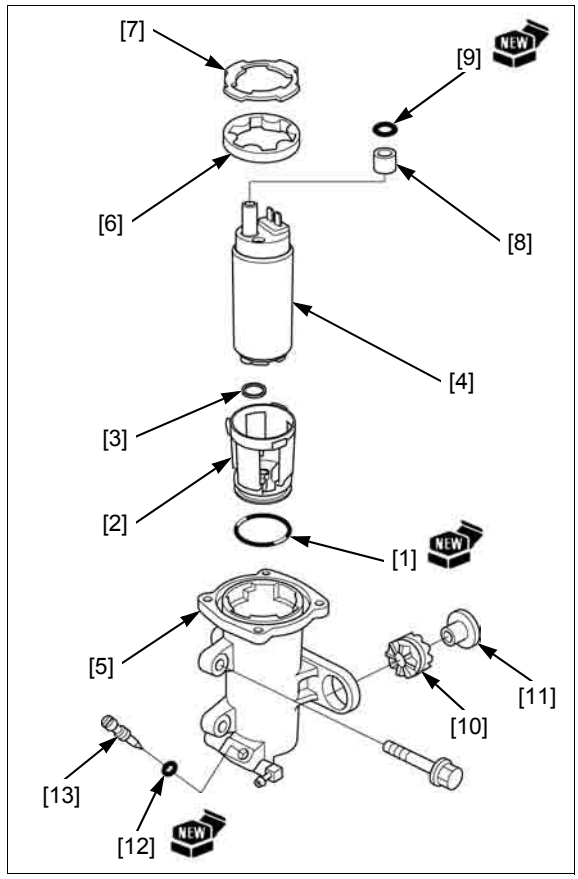
Install the insulator B [6] and plate [7] to the fuel pump Assy.

Install the collar [8] and a new O-ring [9] to the fuel pump Assy.

Install the grommet [10] and collar [11] to the fuel pump case.

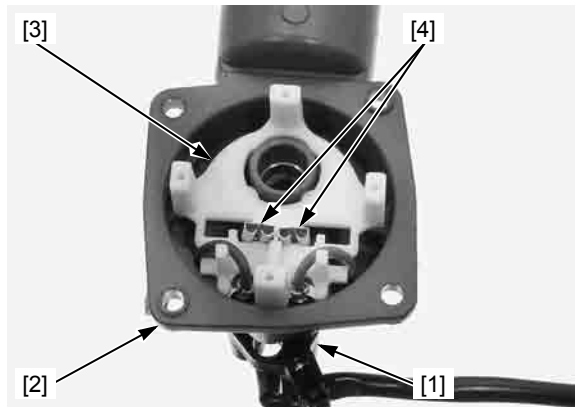
Install a new O-ring [12] to the drain screw [13] and tighten the screw to the specified torque.

TORQUE: 1.5 N·m (0.15 kgf·m, 1.1 lbf·ft)



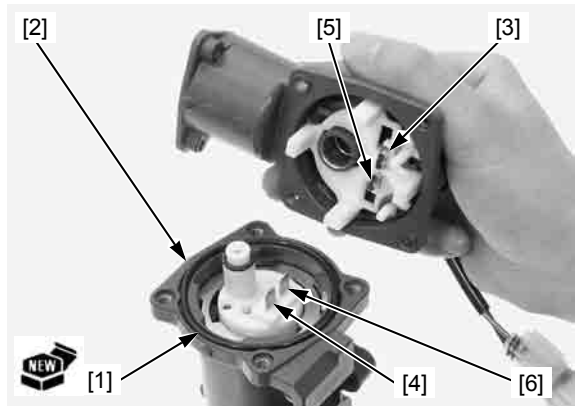
Install the harness holder [1] to the fuel pump cover [2].

Install the holder [3] to the fuel pump cover and set the two terminals [4] of the harness as shown.



Install a new O-ring [1] to the fuel pump case [2].

Connect the Blue/Yellow terminal [3] of the fuel pump cover side to the positive (+) terminal [4] of the fuel pump side.
Connect the Black terminal [5] of the fuel pump cover side to the negative (–) terminal [6] of the fuel pump side.

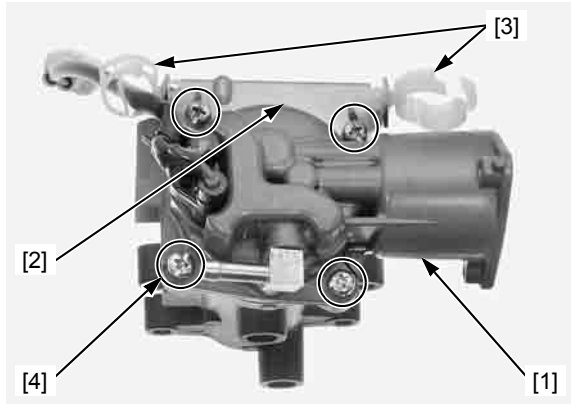


Install the fuel pump cover [1] with the connector holder [2].

Install the harness holder clips [3] to the connector holder as shown.

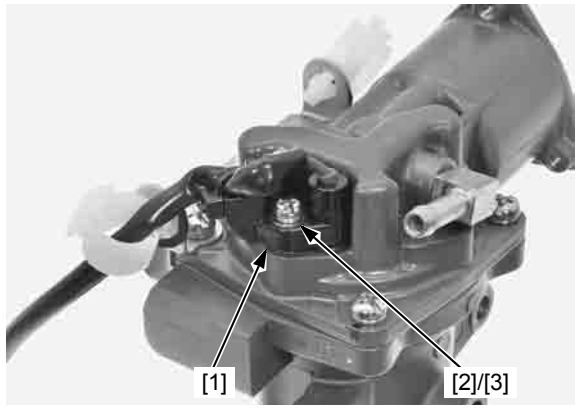
Install and tighten the four screw/washers (5 x 15 mm) [4] to the specified torque.

TORQUE: 3.4 N·m (0.35 kgf·m, 25 lbf·ft)



Set the harness holder [1] and washer (4 mm) [2], and tighten the harness holder screw (4 x 10 mm) [3].

TORQUE: 2.1 N·m (0.21 kgf·m, 1.5 lbf·ft)



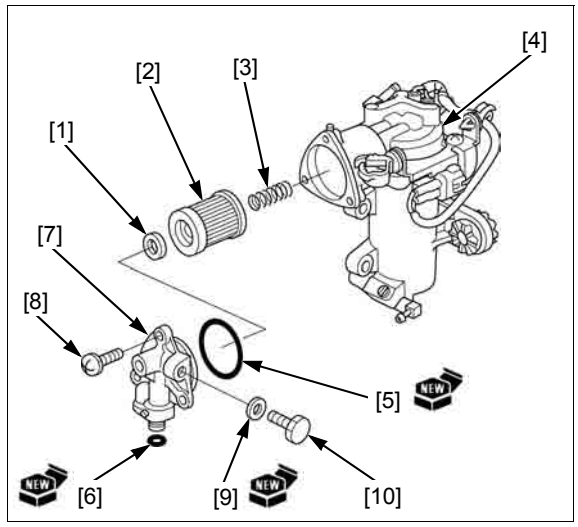
Install the grommet [1] to the fuel filter (high pressure side) [2], and then set the fuel filter and spring [3] to the fuel pump cover [4] as shown.

Install new O-ring rings [5]/[6] to the strainer cover [7] and tighten the three screw/washers (5 x 15 mm) [8] to the specified torque.

TORQUE: 3.4 N·m (0.35 kgf·m, 25 lbf·ft)

Replace the sealing washer with a new one [9] and tighten the service check bolt [10] to the specified torque.

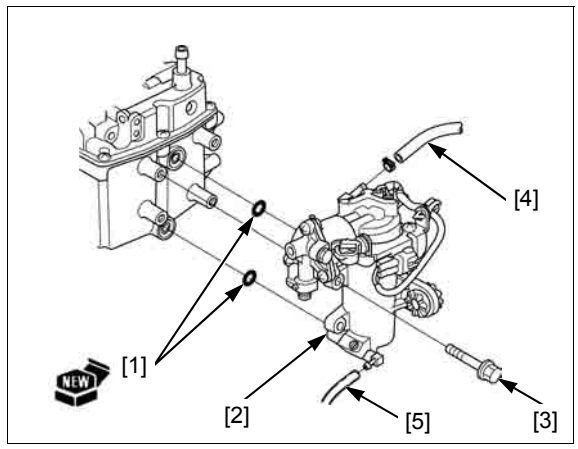
TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)



Replace the O-rings with new ones [1], install the fuel pump [2], and tighten the four bolts (6 x 25 mm) [3].

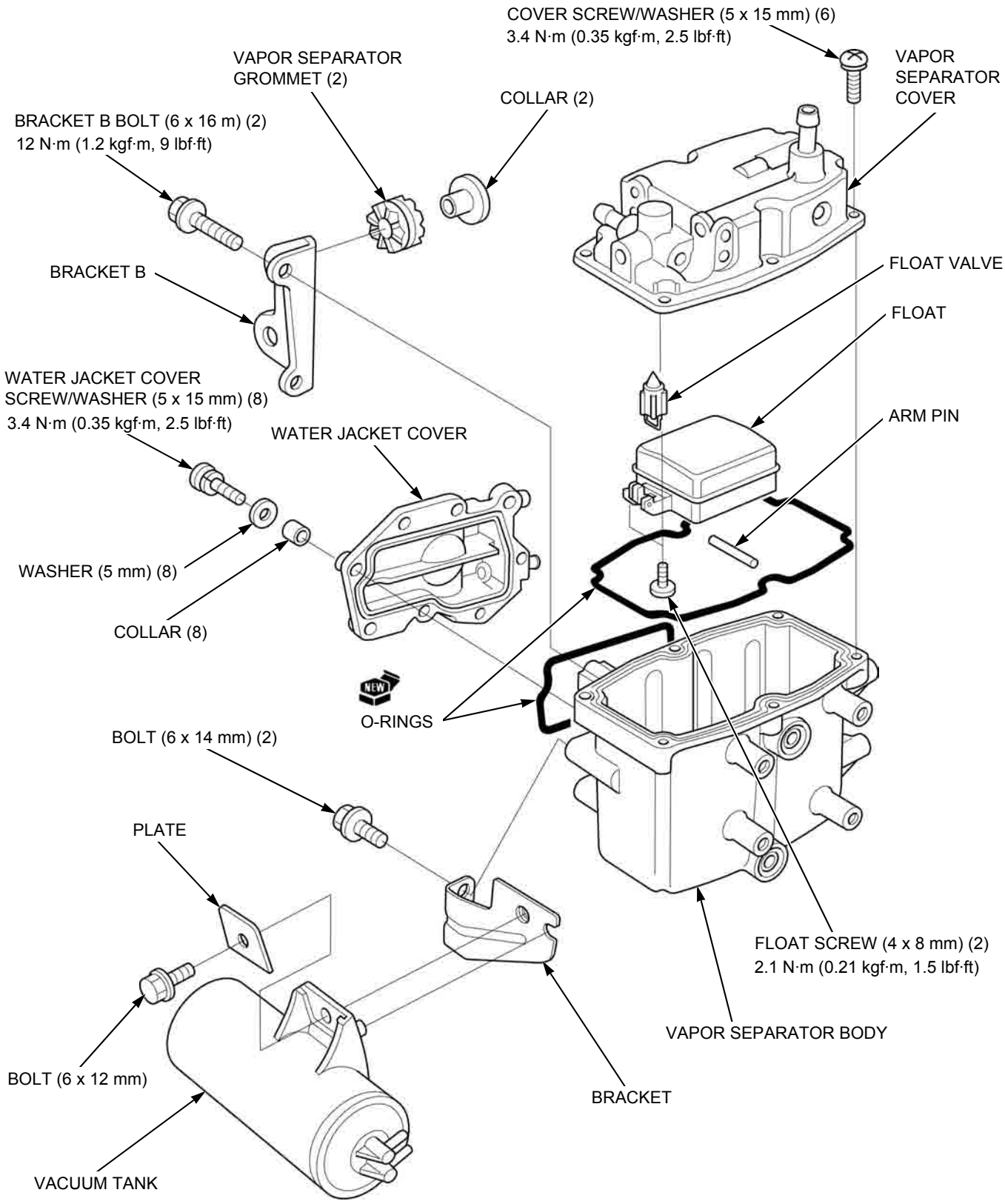
Connect the regulator return hose B [4] and V tube (3.5 x 6.5 x 600 mm) [5].

Install the fuel pump/vapor separator (page 5-90).



VAPOR SEPARATOR DISASSEMBLY/ ASSEMBLY

Remove the fuel pump (High pressure side) (page 5-106).



FUEL PRESSURE MEASUREMENT

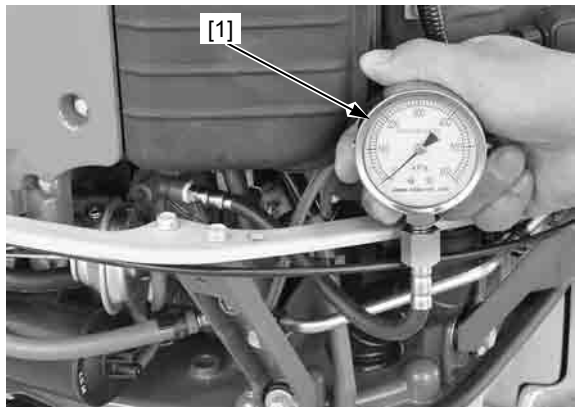
⚠WARNING

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

Relieve the fuel pressure (page 5-66).

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

TOOL:
Fuel pressure gauge, 0 – 100 psi [1] 07406-004000B



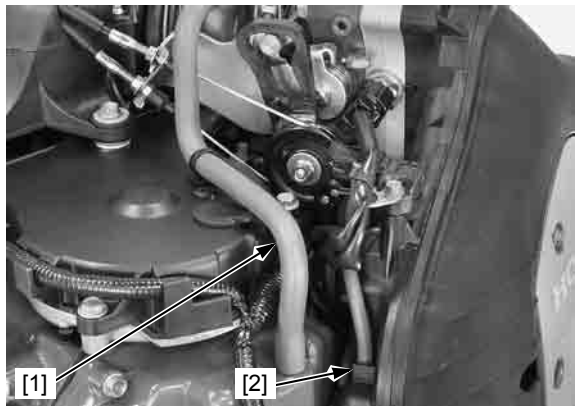
Disconnect the pressure regulator vacuum tube [1] from the intake manifold [2] and clamp the vacuum tube.

Remove the propeller:

– Standard rotation type (page 16-6)
– Counter rotation type (page 17-5)

Set the outboard motor gear case in a test tank filled with water. Start the engine and measure the fuel pressure at idle.

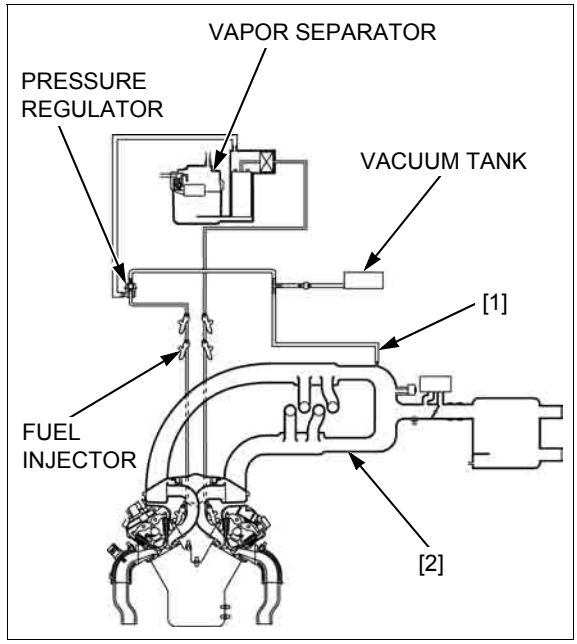
Standard fuel pressure
[At idle speed of 650 ± 50 min^{-1} (rpm)]:
280 – 330 kPa (2.9 – 3.4 kgf/cm^2, 41 – 48 psi)



When the fuel pressure is outside the specified standard pressure, check the following:

- When fuel pressure is higher than standard pressure:
  – Check fuel hose A, joint hose, and fuel pipe for clogging.
  – Check the high pressure side fuel pump for proper operation (page 5-113).
- When fuel pressure is lower than standard pressure:
  – Check the pressure regulator for proper operation (page 5-111)
  – Check the high pressure side fuel pump for proper operation (page 5-113).
  – Check fuel hose A, joint hose, and fuel pipe for leaking.
  – Check the high pressure side fuel filter for an obstruction (page 5-106).

After measuring fuel pressure, install the service check bolt (page 5-66).



FUEL PRESSURE REGULATOR INSPECTION

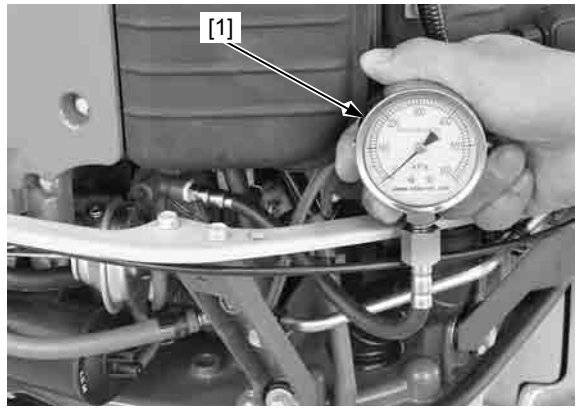
⚠ WARNING

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

Relieve the fuel pressure (page 5-66).

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

TOOL:
Fuel pressure gauge, 0 – 100 psi [1] 07406-004000B



Check that the pressure regulator vacuum tube [1] is not bent, disconnected, or damaged.

Remove the propeller:

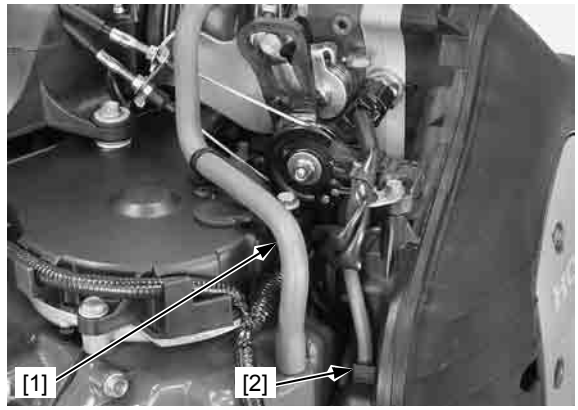
– Standard rotation type (page 16-6)
– Counter rotation type (page 17-5)

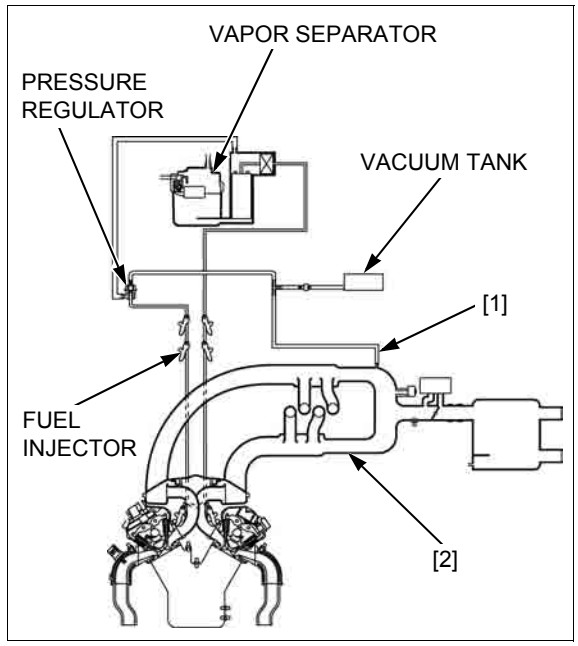
Set the gear case in a test tank filled with water and start the engine and then check the fuel pressure.

With the engine idling, disconnect the vacuum tube from the intake manifold [2] and clamp the vacuum tube.

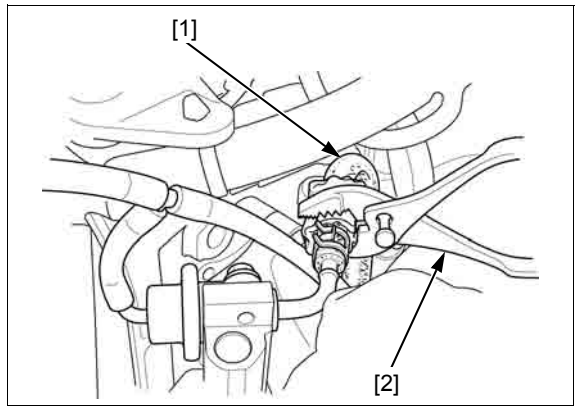
Check the fuel pressure. It should be higher than the pressure measured with the vacuum tube connected.

Standard fuel pressure
[At idle speed of 650 ± 50 min^{-1} (rpm)]:
280 – 330 kPa (2.9 – 3.4 kgf/cm^2, 41 – 48 psi)





If the fuel pressure does not rise, connect the vacuum tube to the pressure regulator. Pinch the pressure regulator return hose [1] that goes from the pressure regulator to the vapor separator 2 or 3 times lightly, and measure the fuel pressure again. If the measurement is outside the specified standard pressure, replace the pressure regulator.



NOTICE

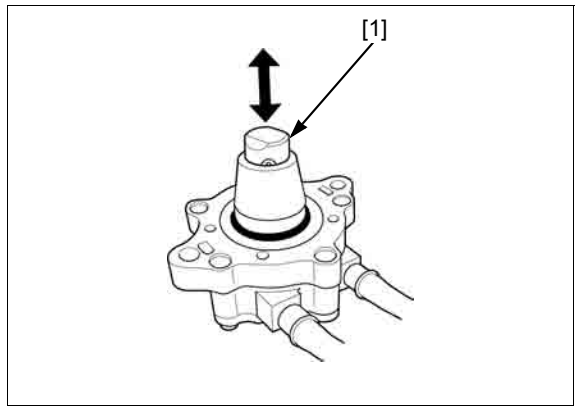
- *Protect the pressure regulator return hose by winding a shop towel or equivalent around the hose, and lightly pinch the hose with the pliers [2].*

FUEL PUMP (LOW PRESSURE SIDE) INSPECTION

Remove the fuel pump (low pressure side) (page 5-67).

Push the fuel pump plunger [1] and make sure the plunger moves smoothly.

If the plunger is stiff, replace the fuel pump (low pressure side).



FUEL PUMP (HIGH PRESSURE SIDE) INSPECTION

DISCHARGE VOLUME INSPECTION

⚠WARNING

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

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

Disconnect the pressure regulator return hose [1] and connect a hose [2] that is equivalent to the pressure regulator return hose to the pressure regulator.

Place a suitable container [3] under the hose as shown.

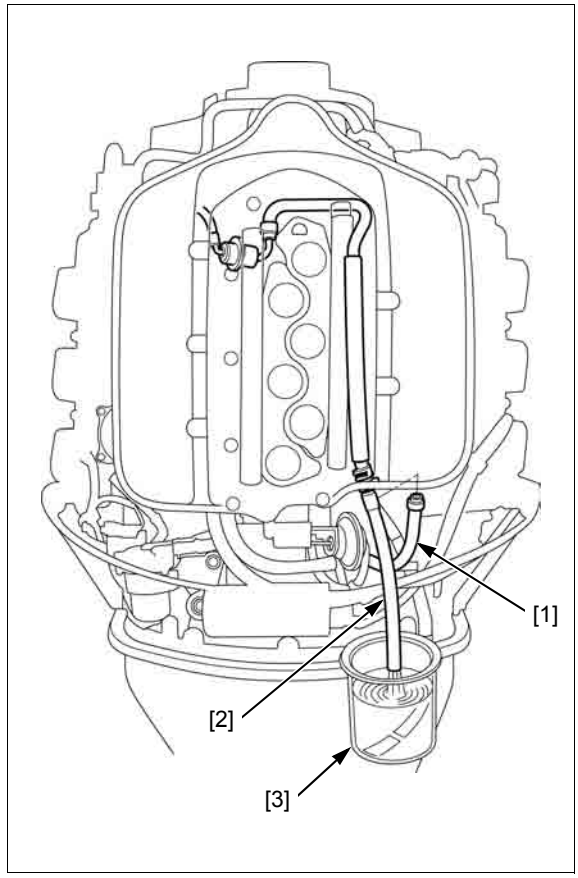
Turn the combination switch ON. Operate the fuel pump for approximately 2 seconds and measure the fuel discharge volume.

Discharge volume
0.06 liter (2.0 US oz, 2.1 Imp oz) or more

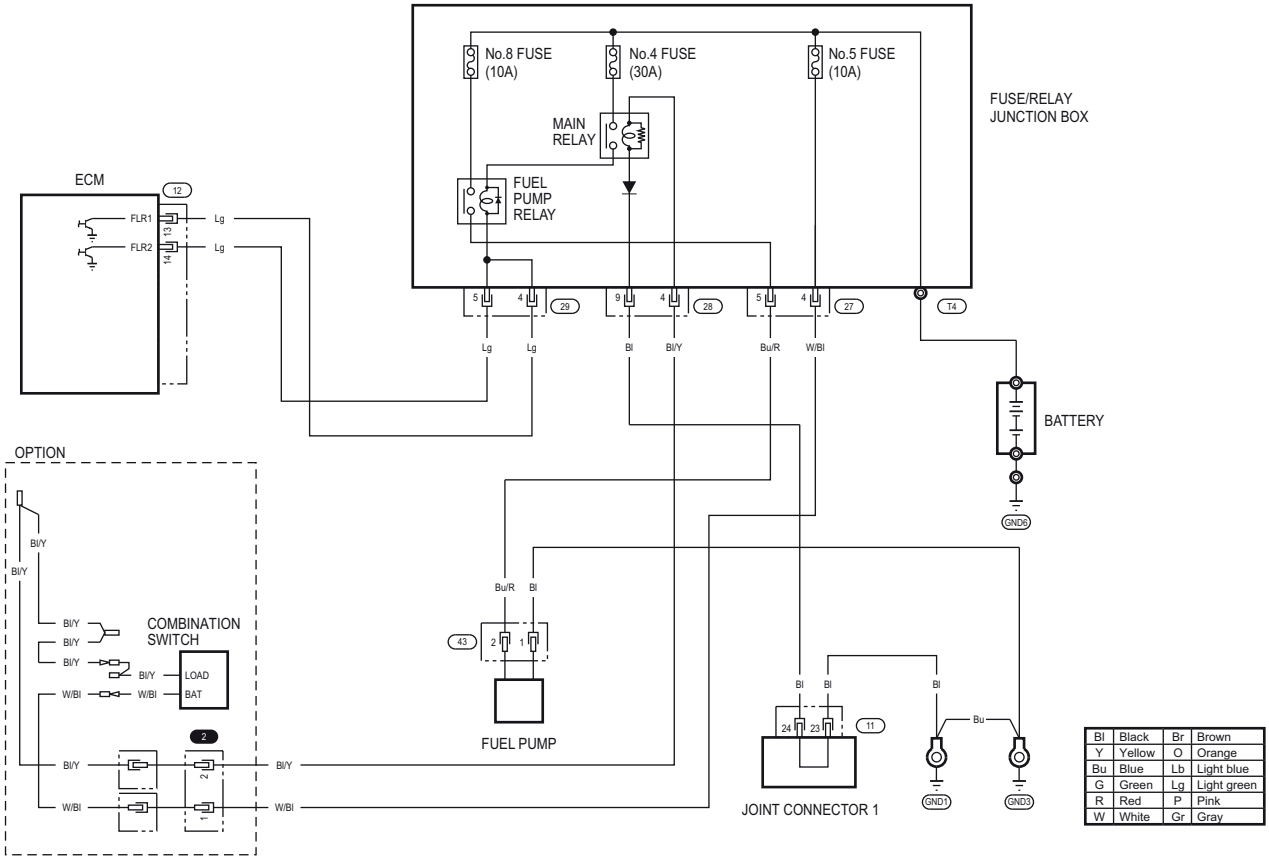
If the discharge volume is too small, check the following and replace the fuel pump (page 5-86).

– Open circuit or poor contact of the main wire harness
– Clogged fuel filter (high pressure side) or fuel hose/pipe
– Check the pressure regulator for proper operation (page 5-111).

If the fuel pump does not operate when the combination switch is turned ON, inspect the fuel pump circuit (page 5-114).



CIRCUIT INSPECTION



1. No.8 Fuse (10 A) inspection

Turn the combination switch OFF.

Check for blown No.8 fuse.

Is the fuse blown?

YES – Replace the blown fuse and check for short in the main wire harness or incorrect load by referring to the fuse load chart (page 4-16).

NO – GO TO STEP 2.

2. Fuel pump power/ground line open circuit inspection

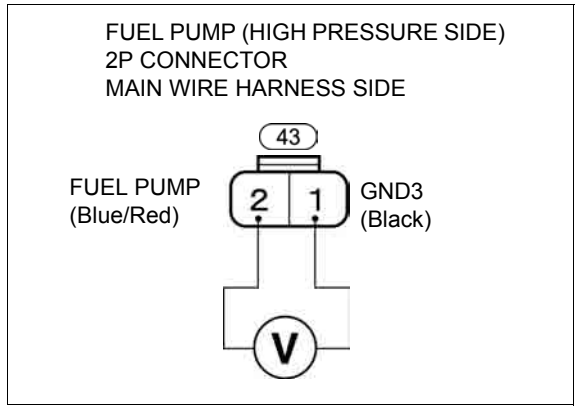
Turn the combination switch OFF and disconnect the fuel pump (High pressure side) 2P connector (43).

Turn the combination switch ON.
Measure the battery voltage between the fuel pump (High pressure side) 2P connector (43) main wire harness side No.2 (Blue/Red) terminal and No.1 (Black) terminal.

Is there battery voltage for a few seconds?

YES – Replace the fuel pump (High pressure side) with a new one and recheck.

NO – GO TO STEP 3.



3. Fuel pump relay, main relay Inspection

Turn the combination switch OFF.

Inspect the fuel pump relay (page 10-11).

Inspect the main relay (page 10-11).

Is the fuel pump relay normal?

YES – GO TO STEP 4.

NO – Replace the fuel pump relay or main relay with a new one and recheck.

4. Fuse/relay junction box inspection

Turn the combination switch OFF.

Inspect the fuel pump relay circuit in the fuse/relay junction box (page 10-13).

Is the fuse/relay junction box normal?

YES – GO TO STEP 5.

NO – Replace the fuse/relay junction box with a new one and recheck.

5. Fuel pump relay line Inspection

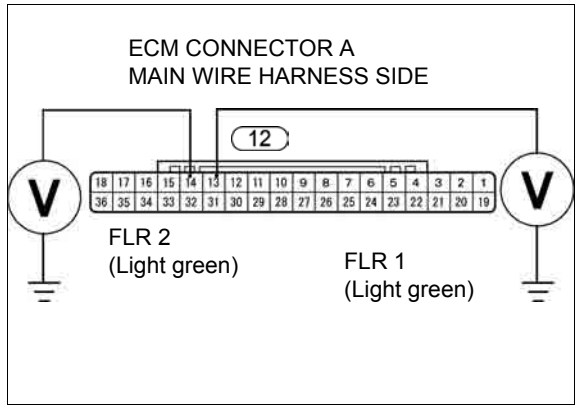
Install the fuel pump relay and fuse/relay junction box.

Disconnect the ECM connector A (12).

Turn the combination switch ON.

Measure the voltage as follows:

– ECM connector A (12) main wire harness side No.13 (Light green) terminal and engine ground
– ECM connector A (12) main wire harness side No.14 (Light green) terminal and engine ground



Is battery voltage present?

YES – • Repair the open in the Black and Blue wire harnesses between the fuse/relay junction box and fuel pump (High pressure side).
• If wire harness is normal, replace the ECM with a new one and recheck.

NO – Repair the open or short in the Light green wire.

VAPOR SEPARATOR INSPECTION

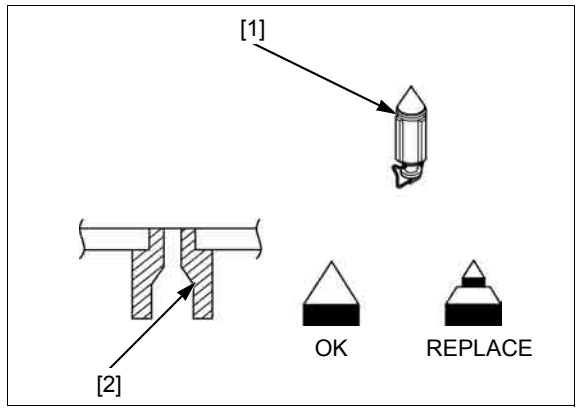
FLOAT VALVE

If gasoline overflows from the vapor separator, perform the following check.

Disassemble the vapor separator (page 5-109).

Remove the float valve [1] from the float.

Check the float valve tip and the valve seat [2] for wear and damage as shown. Replace the float valve or the vapor separator cover if necessary.



FLOAT HEIGHT

The float valve and the float must be installed on the cover properly.

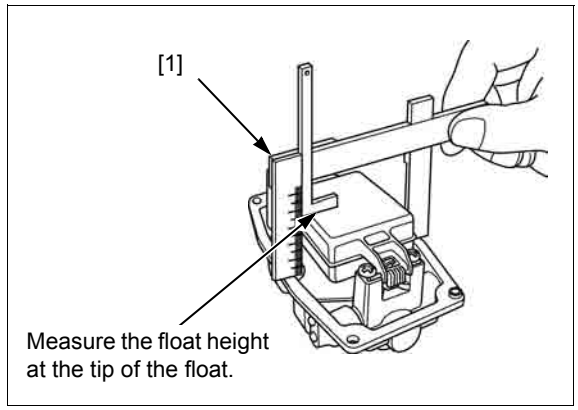
Place the cover as shown and measure the distance between the float and cover (i.e. float height) at the tip of the float.

TOOL:
Float level gauge [1] 07401-0010000

Float height: 28.5 – 33.5 mm (1.12 – 1.32 in)

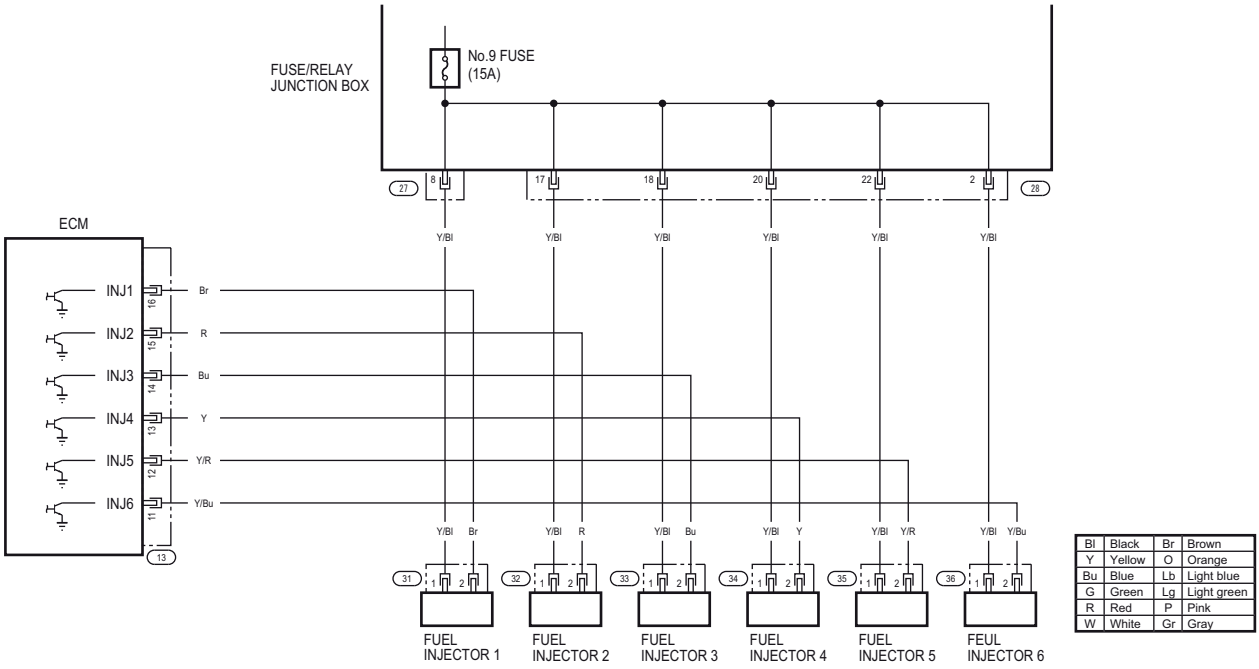
If the float height is outside the specification, adjust the float height by bending the brass float tab slowly with care not to damage the float.

Check float operation.



FUEL INJECTOR INSPECTION

CIRCUIT INSPECTION



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. Fuel injector power line open circuit inspection

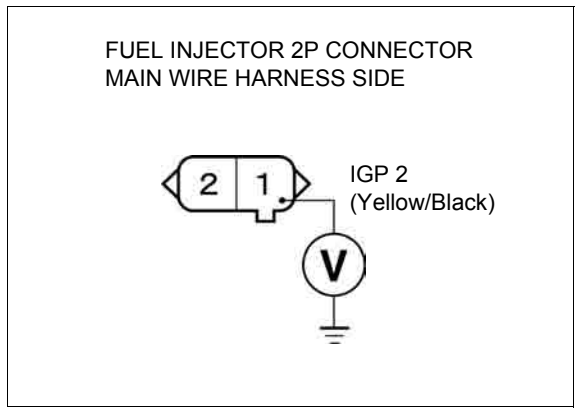
Turn the combination switch OFF and disconnect the injector 2P connectors (31), (32), (33), (34), (35) and (36).

Turn the combination switch ON.
Measure the battery voltage between each fuel injector 2P connector main wire harness side No.2 (Yellow/Black) terminal and ground.

Does battery voltage exist?

YES – GO TO STEP 2.

NO –
- Repair the open circuit in wire between the No.9 fuse and fuel injector.
- If the main harness wire is normal, inspect the No.9 fuse circuit in the fuse /relay junction box (page 10-13).



2. Fuel injector signal line open/short circuit Inspection

Turn the combination switch OFF.

Disconnect the ECM connector B (13).

Check for open or short circuit between each fuel injector 2P connector main wire harness side No.1 terminal and ECM connector B (13) main wire harness side terminal.

Is it normal?

YES – Circuit is normal.

NO – Repair the open or short circuit in wire between the fuel injector and ECM.

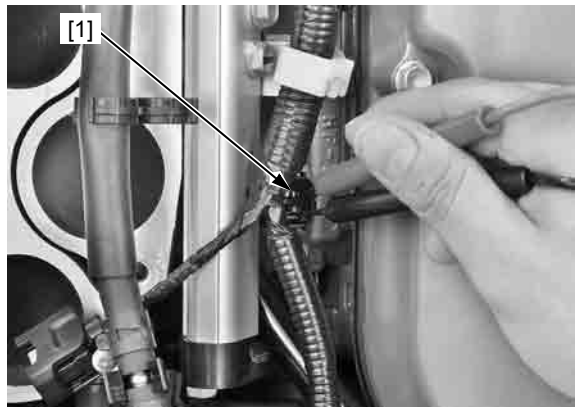
FUEL INJECTOR INSPECTION

Remove the intake manifold (page 5-72).

Turn the combination switch OFF and disconnect the fuel injector connectors.

Measure the resistance between the fuel injector [1] terminals.

Resistance: 11 – 13 Ω



THROTTLE BODY INSPECTION

NOTICE

- *Do not adjust the throttle stop screw [1].*

Check that the throttle valve turns smoothly when the throttle cam [2] is turned.

Check that there is no excessive wear on of the throttle valve shaft when the throttle valve lever [3] is turned.

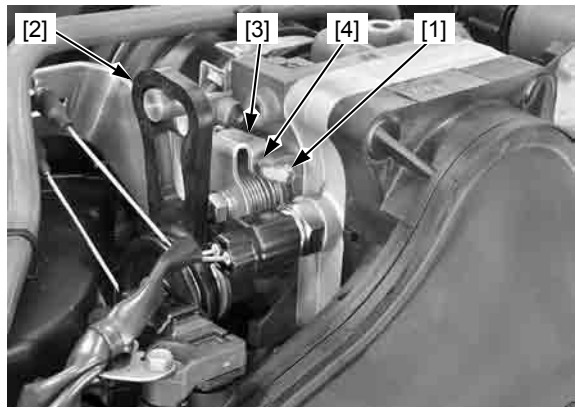
Make sure there is no clearance between the throttle stop screw and stopper [4] of the throttle valve lever.

Remove the throttle body (page 5-71).

Check for dirt or stains on the throttle valve and the throttle body bore.

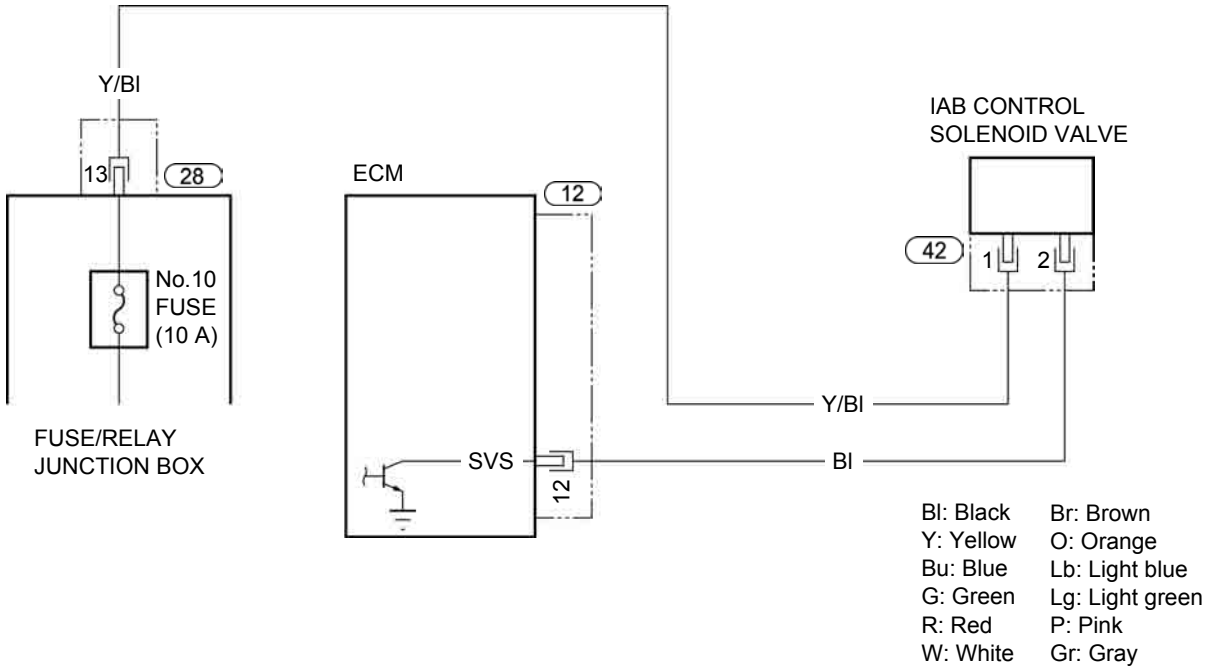
Install the throttle body (page 5-71).

If the throttle valve does not turn smoothly or the throttle valve shaft is worn out, replace the throttle body assembly. If the throttle valve and bore have dirt or stains, clean the throttle body (page 5-72).



IAB CONTROL SOLENOID VALVE INSPECTION

CIRCUIT INSPECTION



1. IAB control solenoid valve power/ground line open circuit inspection

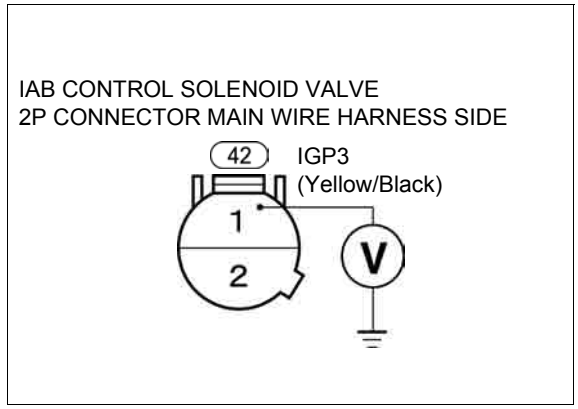
Turn the combination switch OFF and disconnect the IAB control solenoid valve 2P connector (42).

Turn the combination switch ON.
Measure the battery voltage between the IAB control solenoid valve 2P connector (42) main wire harness side No.1 (Yellow/Black) terminal and ground.

Does battery voltage exist?

YES – GO TO STEP 2.

NO – • Repair the open circuit in wire between the No.10 fuse and IAB control solenoid valve.
• If the main harness wire is normal, inspect the No.10 fuse circuit in the fuse /relay junction box (page 10-13).



2. IAB control solenoid valve signal line open/short circuit Inspection

Turn the combination switch OFF.
Disconnect the ECM connector A (12).

Check for open or short circuit between the IAB control solenoid valve 2P connector (42) main wire harness side No.2 (Black) terminal and ECM connector A (12) main wire harness side No.12 (Black) terminal.

Is it normal?

YES – Circuit is normal.

NO – Repair the open or short circuit in wire between the IAB control solenoid valve and ECM.

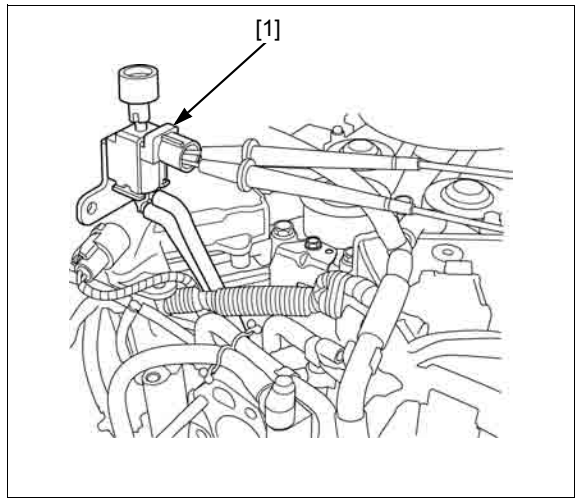
SOLENOID VALVE INSPECTION

Remove the IAB control solenoid valve (page 5-102).

Measure the resistance between the IAB control solenoid valve [1] terminals.

Resistance: 37 – 44 Ω

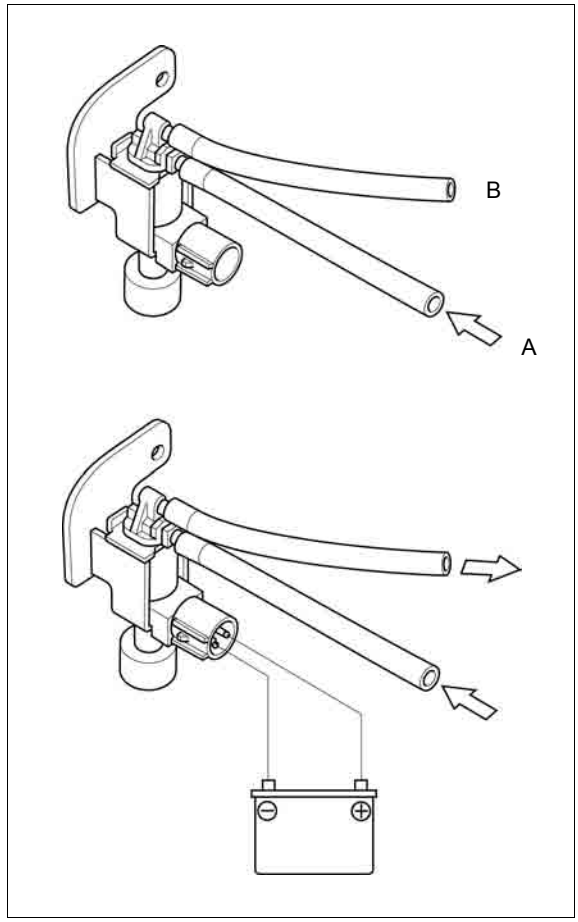
If the resistance is out of specification, replace the IAB control solenoid valve.



Check air flow from A to B. Air should not flow.

Connect the 12 V battery to the solenoid valve side 2P connector terminals.

Air should flow from A to B when the battery is connected.



VALVE OPERATION INSPECTION

NOTICE

- *Do not adjust the stop screw. It was preset at the factory.*

Check the IAB control valve [1] for smooth movement.

Check the IAB valve shaft for binding or sticking.

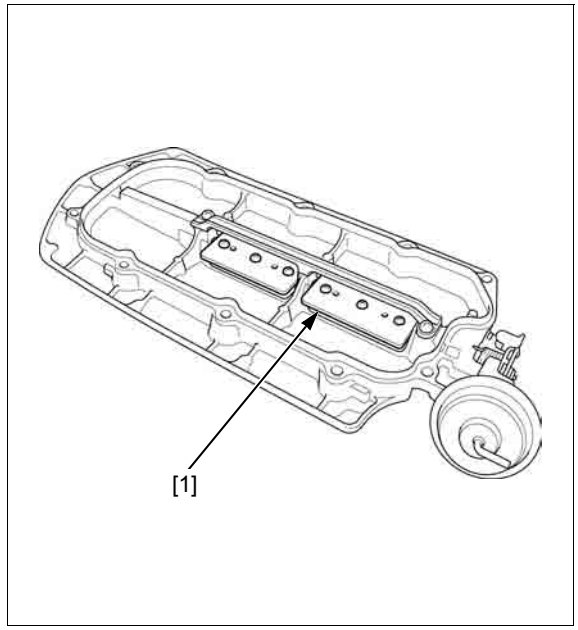
Check that there is no clearance between the stop screw and the fully closed position stopper when the IAB control valve is fully closed.

Check that there is no clearance between the IAB control valve and the fully opened position stopper when the IAB control valve is fully opened.

If the IAB control valve does not move smoothly, clean it with a carburetor cleaner.

NOTICE

- *Always use Honda Genuine Carburetor Cleaner.*
- *IAB control valve is molybdenum coated; do not clean the valve excessively.*
- *Do not spray carburetor cleaner directly to the shaft of the IAB control valve.*



EOP SWITCH (HIGH PRESSURE SIDE) INSPECTION

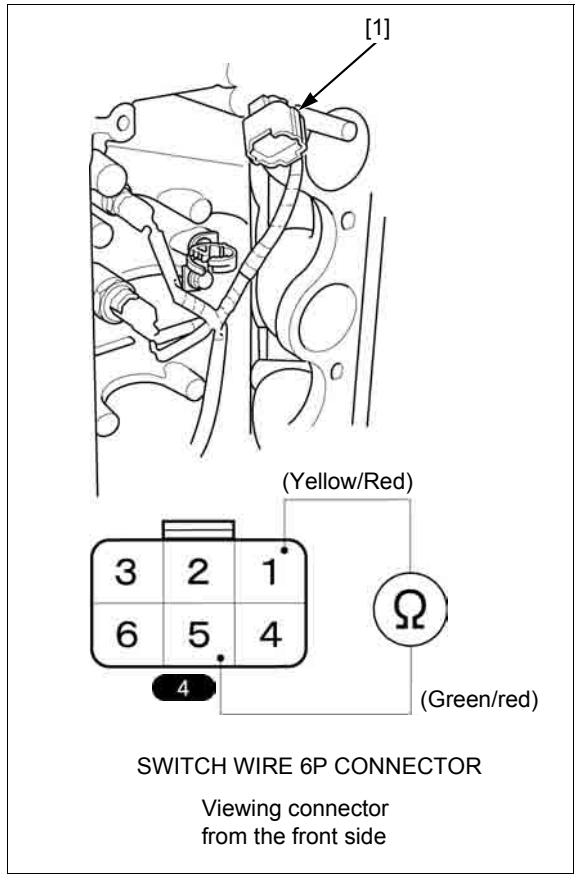
SWITCH WIRE HARNESS INSPECTION

Remove the cylinder head (page 14-22).

Disconnect the switch wire 6P connector 4 [1] from the main wire harness.

Check for continuity between the Yellow/Red and Green terminals of the switch wire 6P connector.

- If there is continuity, the switch wire harness is OK.
- If there is no continuity, check for an open in the wire.
  If the wire is OK, check the EOP switch (high pressure side).



SWITCH WIRE 6P CONNECTOR

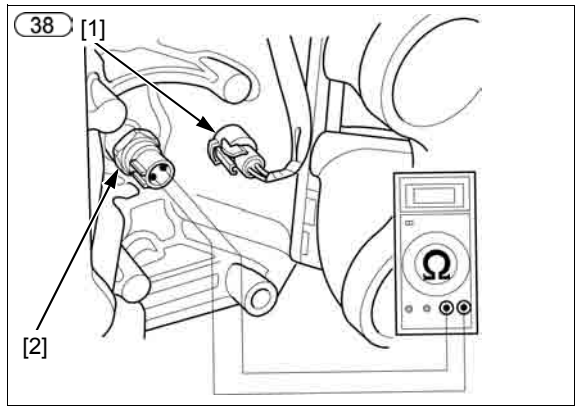
Viewing connector
from the front side

SWITCH INSPECTION

Disconnect the 2P connector (38) [1] from the EOP switch (High pressure side) [2].

Check for continuity between the EOP switch (High pressure side) terminals.

- If there is continuity, the EOP switch is OK.
- If there is no continuity, replace the EOP switch (high pressure side).



EOP SWITCH (LOW PRESSURE SIDE) INSPECTION

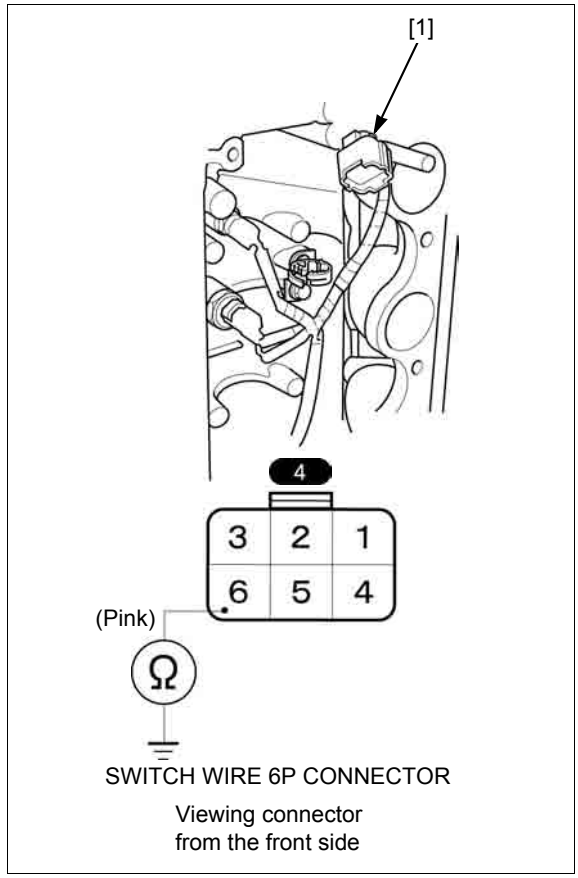
SWITCH WIRE HARNESS INSPECTION

Remove the cylinder head (page 14-22).

Disconnect the switch wire 6P connector 4 [1] from the main wire harness.

Check for continuity between the Pink wire terminal of the switch wire 6P connector and the engine ground.

- If there is continuity, the switch wire harness is OK.
- If there is no continuity, repair an open in the wire. If the wire is OK. Check the EOP (low pressure side) switch.



SWITCH WIRE 6P CONNECTOR

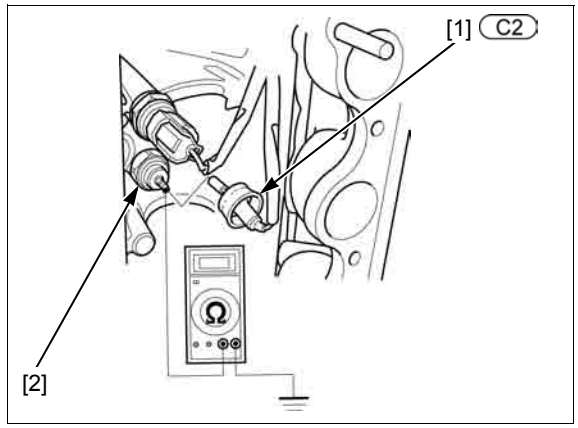
Viewing connector
from the front side

SWITCH INSPECTION

Disconnect the 1P connector (C2) [1] from the EOP switch (Low pressure side) [2].

Check for continuity between the EOP switch (low pressure side) terminal and engine ground.

- If there is continuity, the switch wire harness is OK.
- If there is no continuity, replace the EOP switch (low pressure side).



EBT/EMT SENSOR INSPECTION

Remove the following:

– EBT sensor (page 5-105)
– EMT sensor (page 5-99)

Heat the coolant with an electric heating element. Suspend the sensor [1] in heated coolant and check the continuity through the sensor as the coolant heats up.

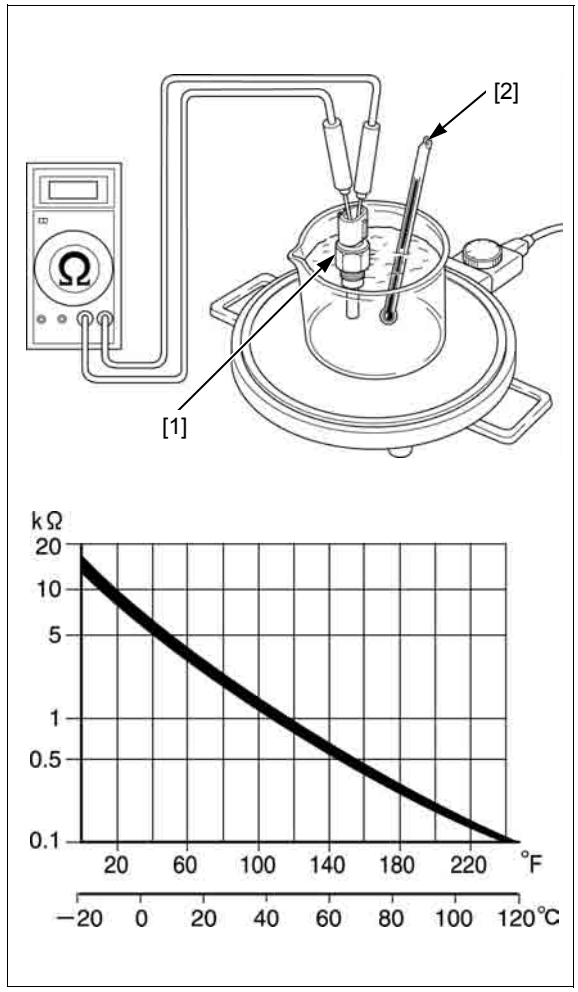
- Wear insulated gloves and adequate eye protection. Keep flammable materials away from the burner.
- Soak the sensor in coolant up to its threads with at least 40 mm (1.57 in) from the bottom of the pan to the bottom of the switch.
- Keep temperature constant for 3 minutes before testing. A sudden change of temperature will result in incorrect readings. Do not let the thermometer [2] or sensor touch the pan.

Temperature	40 °C (104 °F)	100 °C (212 °F)
Resistance	1.0 – 1.3 kΩ	0.1 – 0.2 kΩ

Replace the sensor if it is out of specifications.

Install the following:

– EBT sensor (page 5-105)
– EMT sensor (page 5-99)



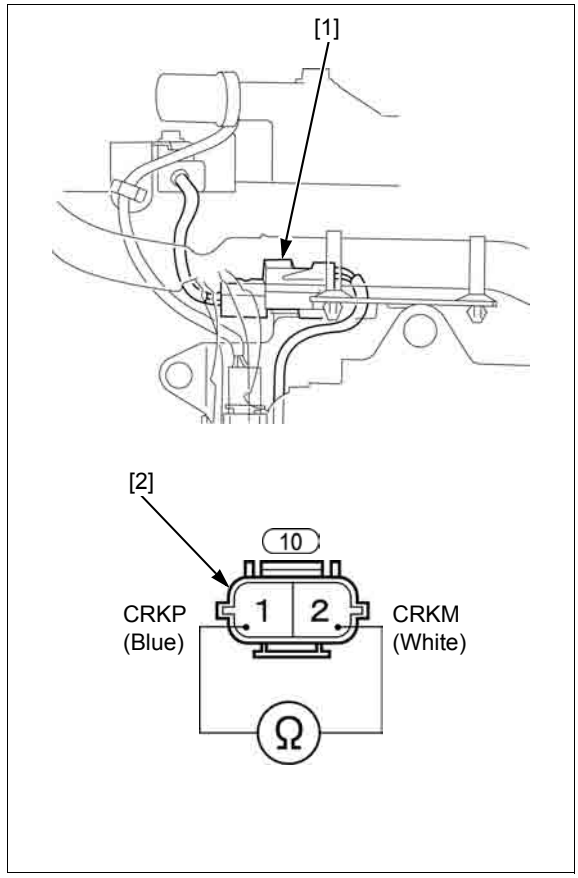
CKP SENSOR INSPECTION

Remove the ECM (page 10-5).

Disconnect the CKP sensor 2P connector (10) [1].

Measure the resistance between the CKP sensor 2P connector sensor side No. 1 (Blue) and No.2 (White) terminals.

Resistance: 1,850 – 2,450 Ω



CMP SENSOR INSPECTION

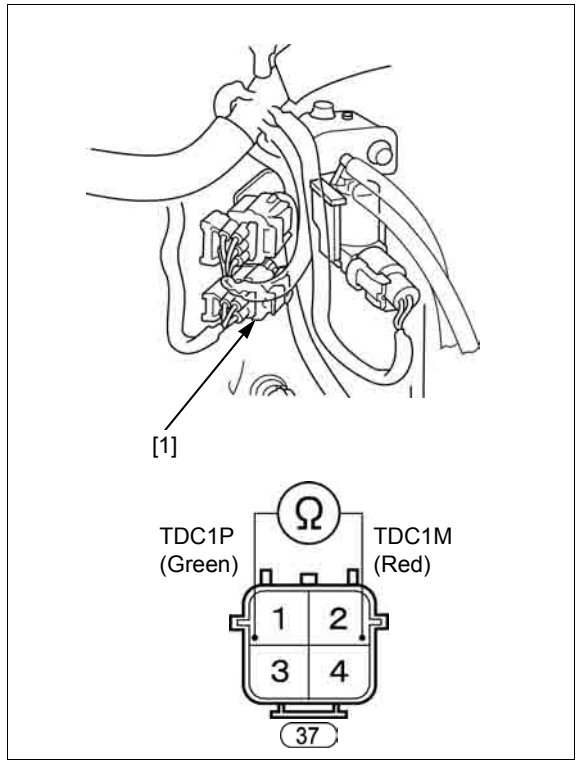
CMP 1 SENSOR PEAK VOLTAGE

Remove the throttle body (page 5-71).

Disconnect the CMP sensor 4P connector (37) [1].

Measure the resistance between the CMP 1 sensor No. 1 (Green) and No. 2 (Red) terminals of the sensor side.

Resistance: 1,850 – 2,450 Ω



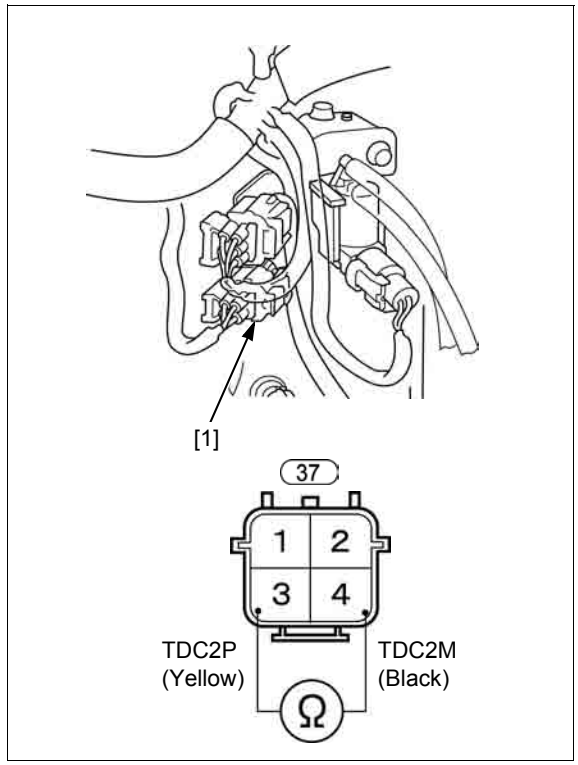
CMP 2 SENSOR PEAK VOLTAGE

Remove the throttle body (page 5-71).

Disconnect the CMP sensor 4P connector (37) [1].

Measure the resistance between the CMP sensor 4P connector sensor side No. 3 (Yellow) and No.4 (Black) terminals.

Resistance: 1,850 – 2,450 Ω



WATER LEVEL SENSOR INSPECTION

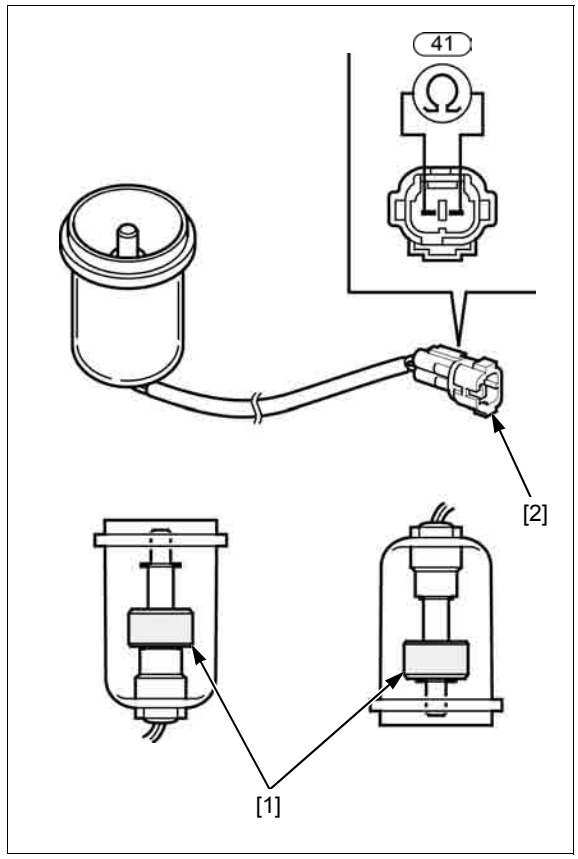
Disassemble the water separator (page 5-93).

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

Check for continuity between the water level sensor 2P connector (41) [2] terminals in each float position.

- There should be no continuity when the sensor is level (the float is down).
- There should be continuity when the sensor is upside down (the float is up).

If the water level sensor is faulty, replace the water separator.



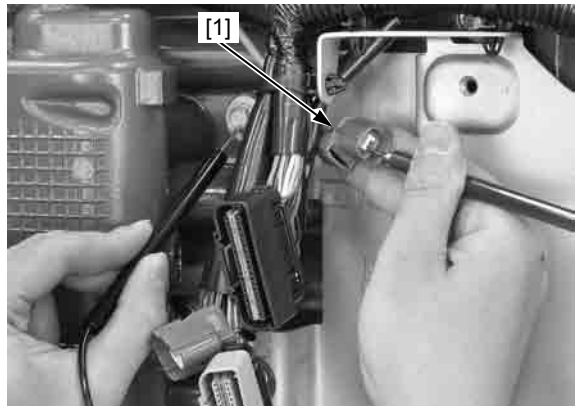
VTEC SPOOL SOLENOID VALVE INSPECTION

SOLENOID VALVE INSPECTION

- When checking the operation of the VTEC system, perform VTEC system inspection (page 14-37).

Remove the ECM (page 10-5).

Disconnect the VTEC solenoid valve 1P connector [1].



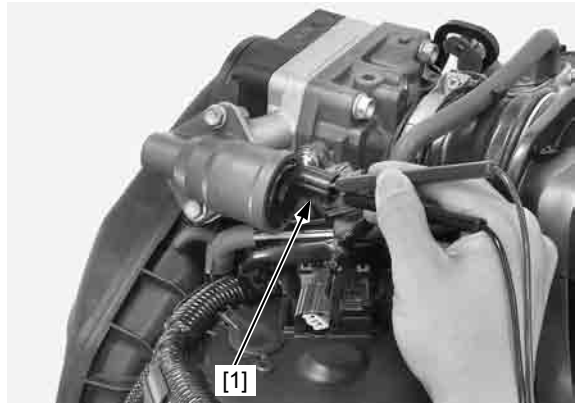
Measure the resistance between the 1P connector terminal and body ground.

Resistance: 14.25 – 15.75 Ω

If the resistance is not as specified, replace the VTEC solenoid valve (page 5-101).

IAC VALVE INSPECTION

Turn the combination switch OFF and disconnect the IAC valve 2P connector.



Measure the resistance between the IAC valve side No.1 terminal and No.2 terminal of the IAC valve 2P connector [1].

Resistance: 8.7 – 10.5 Ω

If the resistance is not as specified, replace the IAC valve (page 5-99).

HO2S INSPECTION

SYSTEM INSPECTION

OPERATION TEST

1. HO2S operation test 1

Turn the combination switch OFF and disconnect the HO2S 4P connector (19).

Connect the battery positive (+) cable to the sensor side No.4 (White) terminal and the battery negative cable (–) to the sensor side No.3 (White) terminal of the HO2S 4P connector respectively.

Start the engine and let it run at 3,000 min^{-1} (rpm) for 3 minutes or more under no load.

Snap the engine throttle with the engine speed in the range between idle speed and 4,000 ± 500 min^{-1} (rpm).

Let the engine idle for 1 minute or more.

Make sure that the voltage is above 0.6 V at the No.1 (Black) terminal and No.2 (Gray) terminal of the HO2S sensor side 4P connector.
If the voltage is temporarily below 0.6 V, recheck the above inspection after engine idle for 1 minute or more.

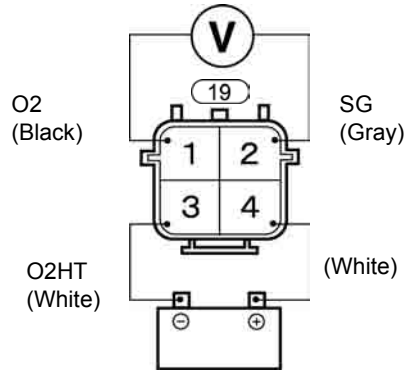
- The normal voltage at the idle speed is above 0.6 V.
  Depending on the condition of the warm-up, the voltage may become temporarily less than 0.6 V.

Does the voltage above 0.6 V exist?

YES – GO TO STEP 2.

NO – Faulty HO2S.

HO2S 4P CONNECTOR SENSOR SIDE



12V BATTERY

2. HO2S operation test 2

Snap the engine throttle with the engine speed in the range between idle speed and 4,000 ± 500 min^{-1} (rpm).
Or let it run at 4,000 ± 500 min^{-1} (rpm) under no load then quickly close the throttle valve.

Is the measurement above 0.6 V when the throttle is fully open and below 0.6 V when the throttle is fully closed?

YES – HO2S is normal.

NO – Faulty HO2S.

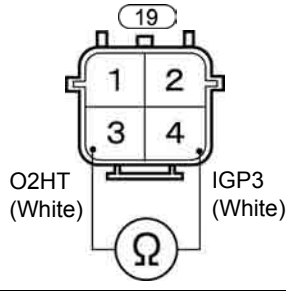
HO2S HEATER INSPECTION

Turn the combination switch OFF and disconnect the HO2S 4P connector (19) (page 10-6).

Measure the resistance between the No.3 (White) and No.4 (White) terminals of the HO2S sensor.

Resistance: 4 – 30 Ω

HO2S 4P CONNECTOR
SENSOR SIDE



INTAKE MANIFOLD STUD BOLT REPLACEMENT

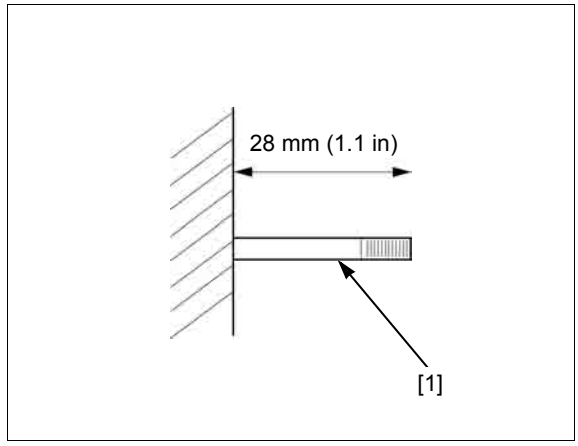
Remove the intake manifold (page 5-72).

Thread two nuts onto the stud [1] and tighten them together, and use a wrench on them to turn the stud bolt out.

Install new stud bolts into the injector base using the double nut procedure above and tighten them.

After intake manifold stud bolt installation, check that the length from the bolt head to the injector base surface is within specification.

SPECIFIED LENGTH: 28 mm (1.1 in)



MEMO

6. ENGINE COVER/COVER LOCK

COMPONENT LOCATION ····· 6-2

FRONT SEPARATE COVER REMOVAL/ INSTALLATION ····· 6-3

L./R. ENGINE UNDER COVER REMOVAL/ INSTALLATION ····· 6-3

COVER LOCKING CABLE REMOVAL/ INSTALLATION ····· 6-6

ENGINE COVER BRACKET REMOVAL/ INSTALLATION ····· 6-9

POWER TILT SWITCH REMOVAL/ INSTALLATION ····· 6-10

FRONT COVER BRACKET REMOVAL/ INSTALLATION ····· 6-10

DAMPER HOOK REMOVAL/ INSTALLATION ····· 6-12

SIDE COVER BRACKET DISASSEMBLY/ ASSEMBLY ····· 6-12

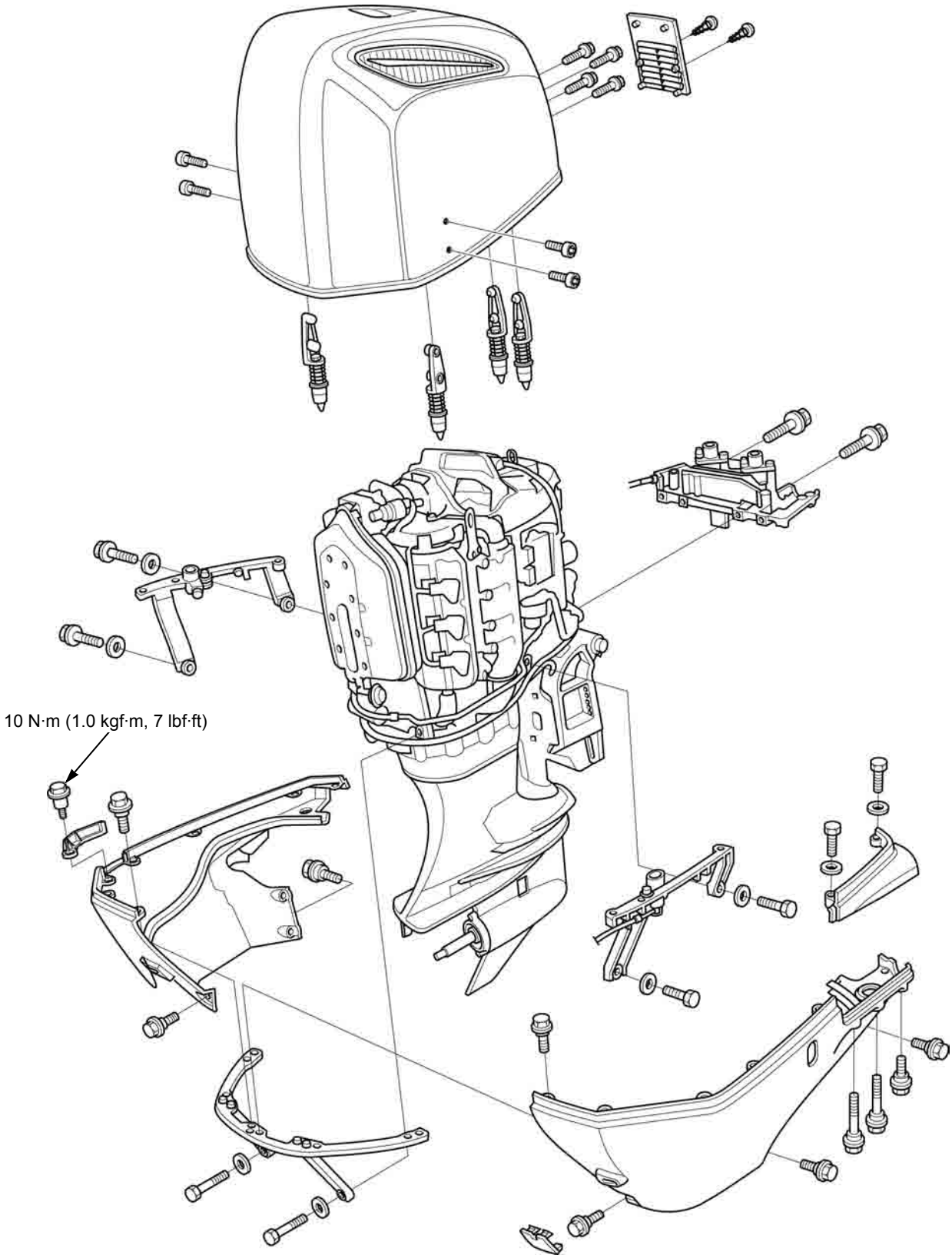
FRONT COVER BRACKET DISASSEMBLY/ ASSEMBLY ····· 6-13

DAMPER HOOK DISASSEMBLY/ ASSEMBLY ····· 6-15

DAMPER HOOK ADJUSTMENT ····· 6-16

UNDER COVER SEAL B REPLACEMENT ····· 6-16

COMPONENT LOCATION



FRONT SEPARATE COVER REMOVAL/ INSTALLATION

Remove the engine cover.

Remove the two bolt/washers (6 x 25 mm) [1], special bolt (6 x 17 mm) [2], two special bolts (6 x 37 mm) [3], and remove the front separate cover [4].

Install the front separate cover by sliding the tab [5] into the engine under cover.
Make sure that under case grommet A [6] is positioned in the grooves of the engine under cover and front separate cover.

Loosely tighten the bolt/washer (6 x 25 mm) on the front side.

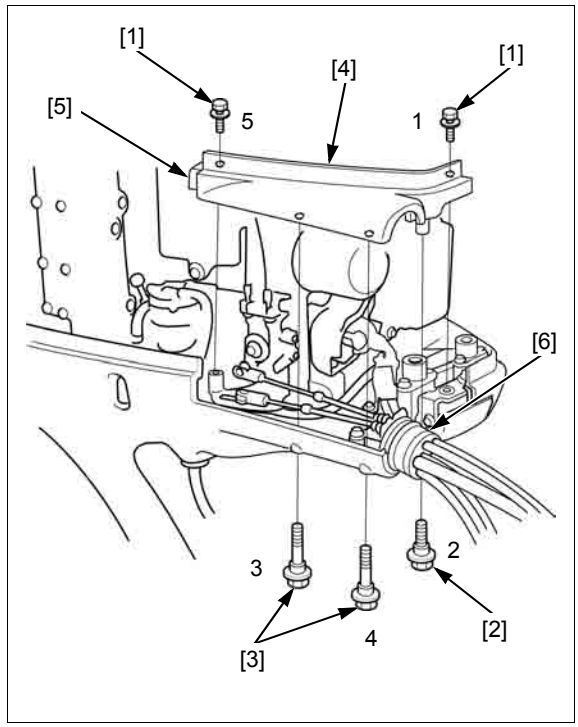
Loosely tighten the special bolt (6 x 17 mm) until the shoulder of the bolt is in the hole of the engine under cover.

Install and tighten the two special bolts (6 x 37 mm) and bolt/washer (6 x 25 mm) in the numbered order.

- Keep the remote control cable level.

Tighten the bolt (6 x 25 mm) on the front side and the special bolt (6 x 17 mm).

Install the engine cover.

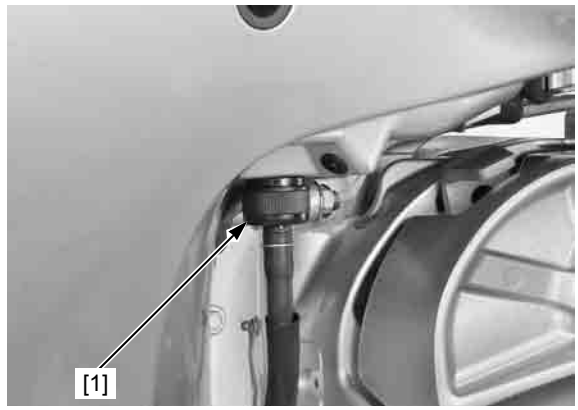


L./R. ENGINE UNDER COVER REMOVAL/INSTALLATION

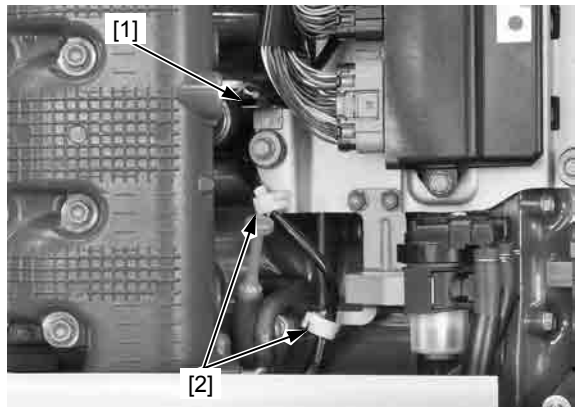
R. ENGINE UNDER COVER

Remove the front separate cover (page 6-3).

Disconnect the flush plug cap [1] from the R. engine under cover.



Disconnect the power tilt switch 3P connector [1], and release the wire from the harness clips [2].



Remove the under cover cap [1] and special bolt [2].

Remove the eight special bolts [3] from the R. engine under cover [4] and remove it halfway.
Disconnect the water check tube [5] from the water check grommet [6].

Remove the following parts from the R. engine under cover:

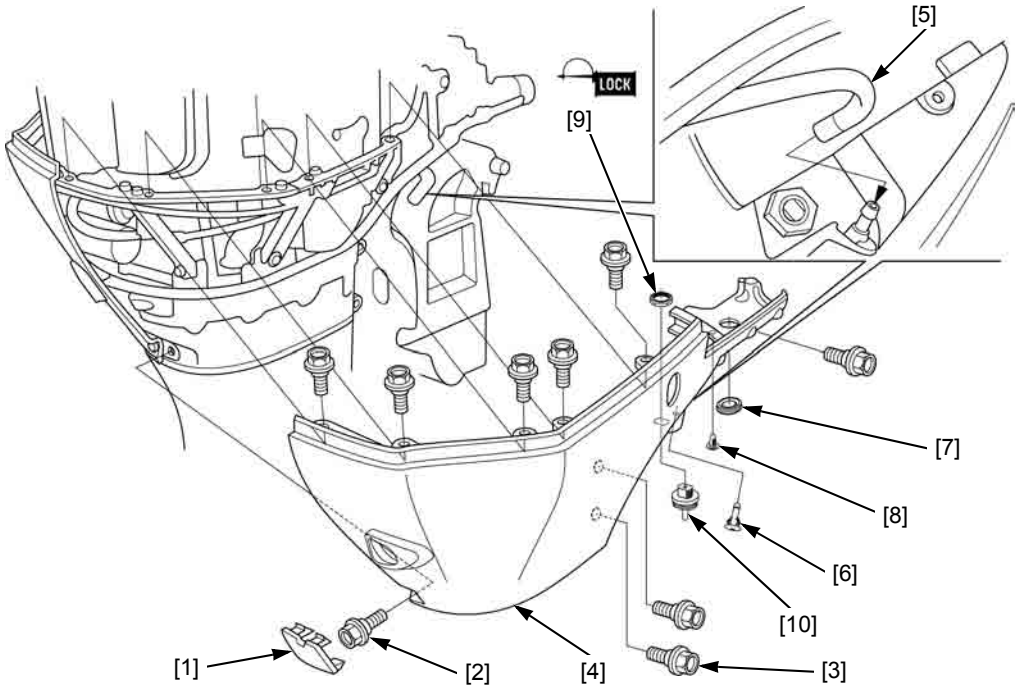
– Under case grommet C [7]
– Hole plug [8]
– Water check grommet
– Water joint cap nut [9]
– Water joint cap [10]

Installation is in the reverse order of removal.

NOTE:

• Apply locking agent (Loctite® PRISM 403 or equivalent) to the seating surface of the water joint cap nut.

TORQUE:
Water joint cap nut:
1.1 N·m (0.11 kgf·m, 0.8 lbf·ft)

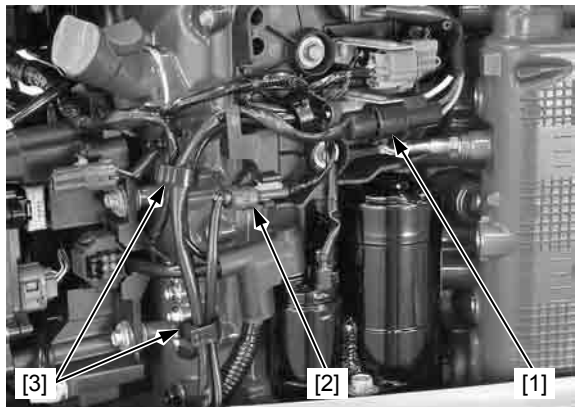


L. ENGINE UNDER COVER

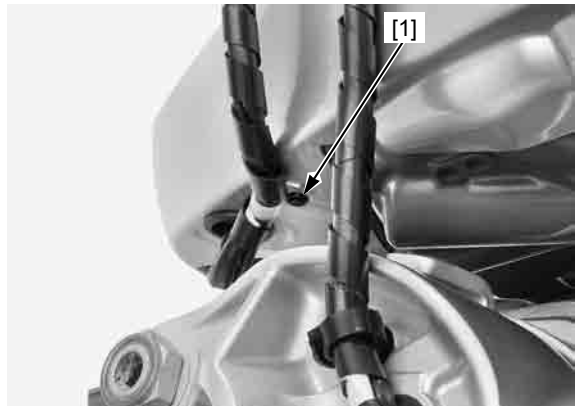
Remove the engine cover.

Disconnect the power tilt motor 2P connector [1] and the trim angle sensor 3P connector [2].

Open the harness clips [3] and release the power tilt motor wire and the trim angle sensor wire.



Remove the rivet screw [1] from the L. engine under cover.



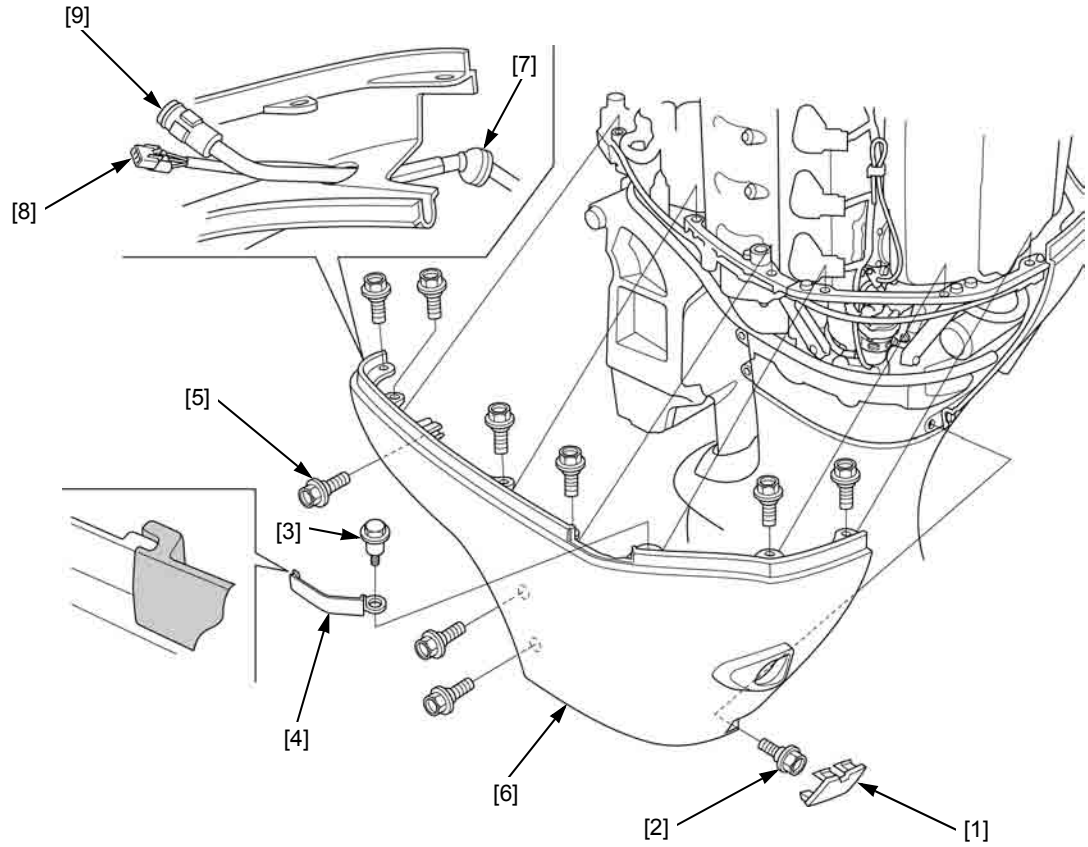
Remove the under cover cap [1] and special bolt [2].

Remove the plug maintenance cover special bolt [3] and plug maintenance cover [4].

Remove the nine special bolts [5] from the L. engine under cover [6] and remove it halfway.
Release the under case grommet [7] from the L. engine under cover.
Remove the trim angle sensor wire [8] and power tilt motor wire [9] from the hole in the L. engine under cover.

Installation is in the reverse order of removal.

TORQUE:
PLUG MAINTENANCE COVER SPECIAL BOLT:
10 N·m (1.0 kgf·m, 7 lbf·ft)

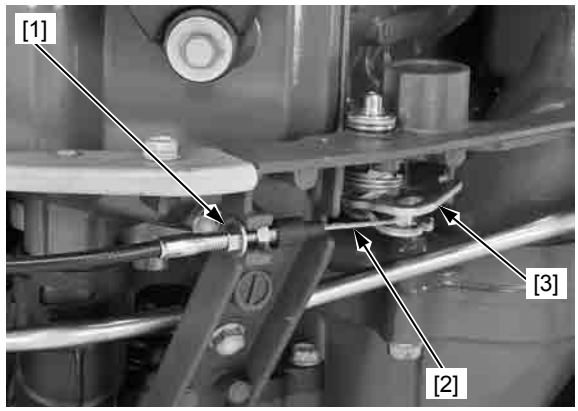


COVER LOCKING CABLE REMOVAL/ INSTALLATION

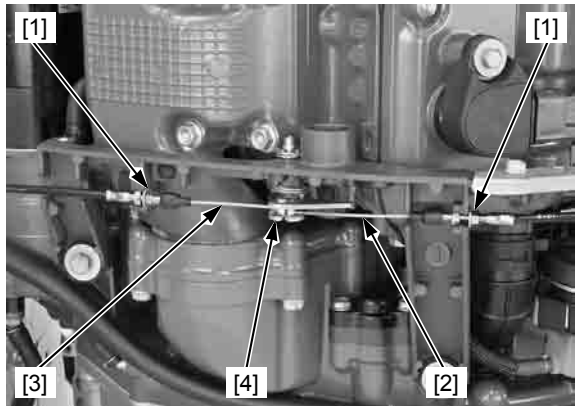
REMOVAL

Remove the L./R. engine under cover (page 6-3).

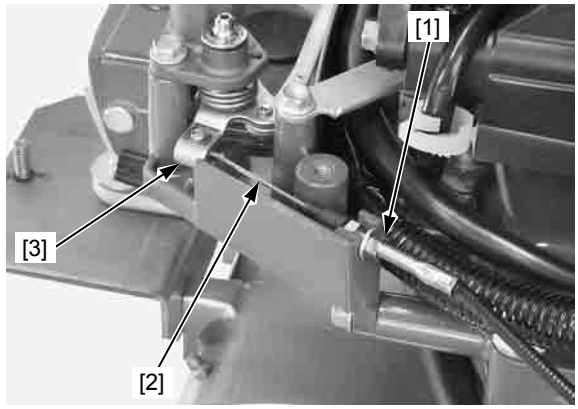
Loosen the washer side nut [1] of the cover locking cable A [2], and then disconnect the cable from the R. lock arm [3].



Loosen the washer side nuts [1] of the cover locking cable A [2] and cover locking cable B [3], and then disconnect the cables from the L. lock arm [4].

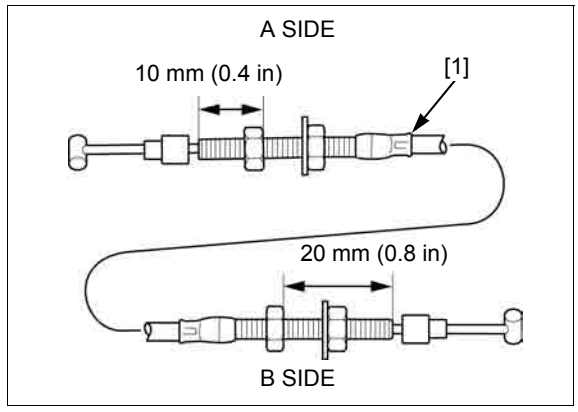


Loosen the washer side nuts [1] of the cover locking cable B [2], and then disconnect the cable from the front lock arm [3].



INSTALLATION/ADJUSTMENT

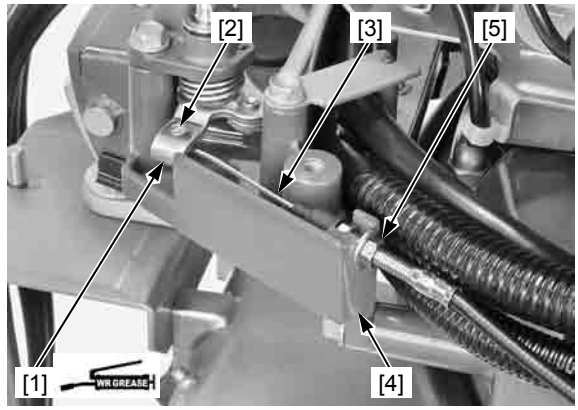
Set the adjusting nut position of cover locking cable B [1] (shorter cable) to the measurement as shown.



Apply marine grease to the front lock arm [1] cable end insertion part.

Insert the cable end (A side) [2] of cover locking cable B [3] into the front lock arm.
Install cover locking cable B so that the cable aligns with the groove of the front cover bracket [4], and tighten the washer side nut [5] to the specified torque.

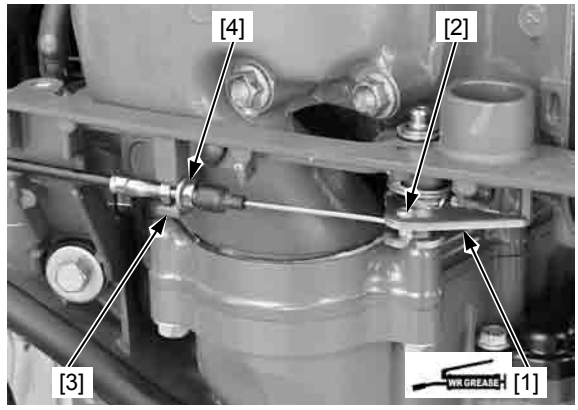
TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



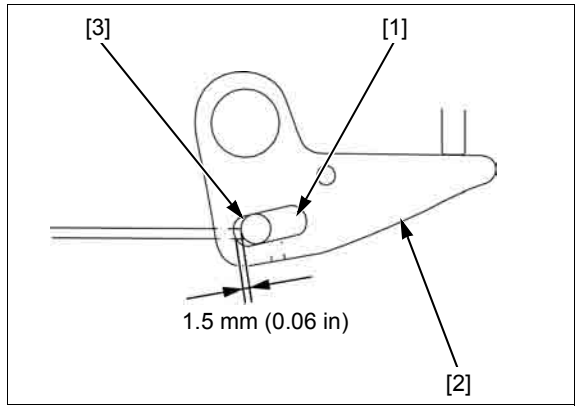
Apply marine grease to the L. lock arm [1] cable end insertion part.

Insert the cable end (B side) [2] of cover locking cable B into the L. lock arm.
Install cover locking cable B so that the cable aligns with the groove of the L. cover bracket [3], and tighten the washer side nut [4] to the specified torque.

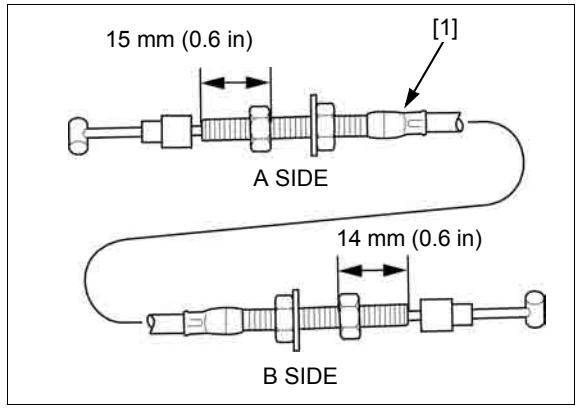
TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



There should be 1.5 mm (0.06 in) of clearance between the hole [1] of the L. lock arm [2] and the cable end [3]. Readjust if the clearance is out of specification.



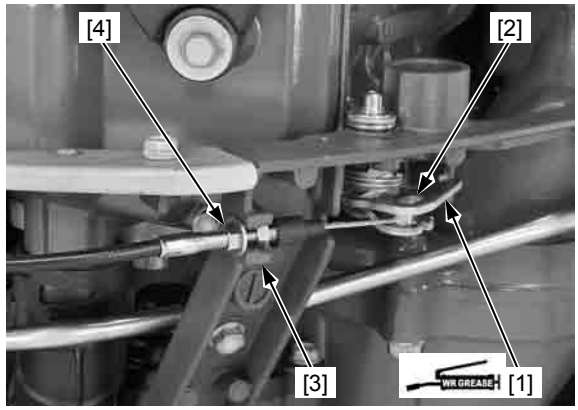
Set the adjusting nut position of cover locking cable A [1] (longer cable) to the measurement as shown.



Apply marine grease to the R. lock arm [1] cable end insertion part.

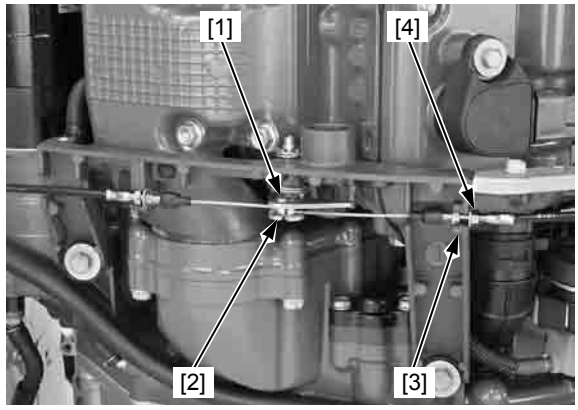
Insert the cable end (A side) [2] of cover locking cable A into the R. lock arm.
Install cover locking cable A so that the cable aligns with the groove of the R. cover bracket [3], and tighten the washer side nut [4] to the specified torque.

TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



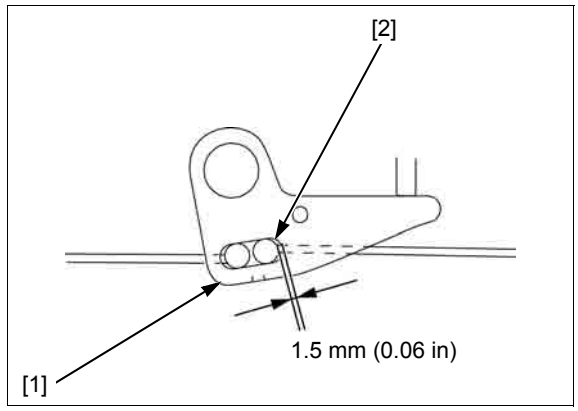
Insert the cable end (B side) [1] of cover locking cable A into the L. lock arm [2].
Install cover locking cable A so that the cable aligns with the groove of the L. cover bracket [3], and tighten the washer side nut [4] to the specified torque.

TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



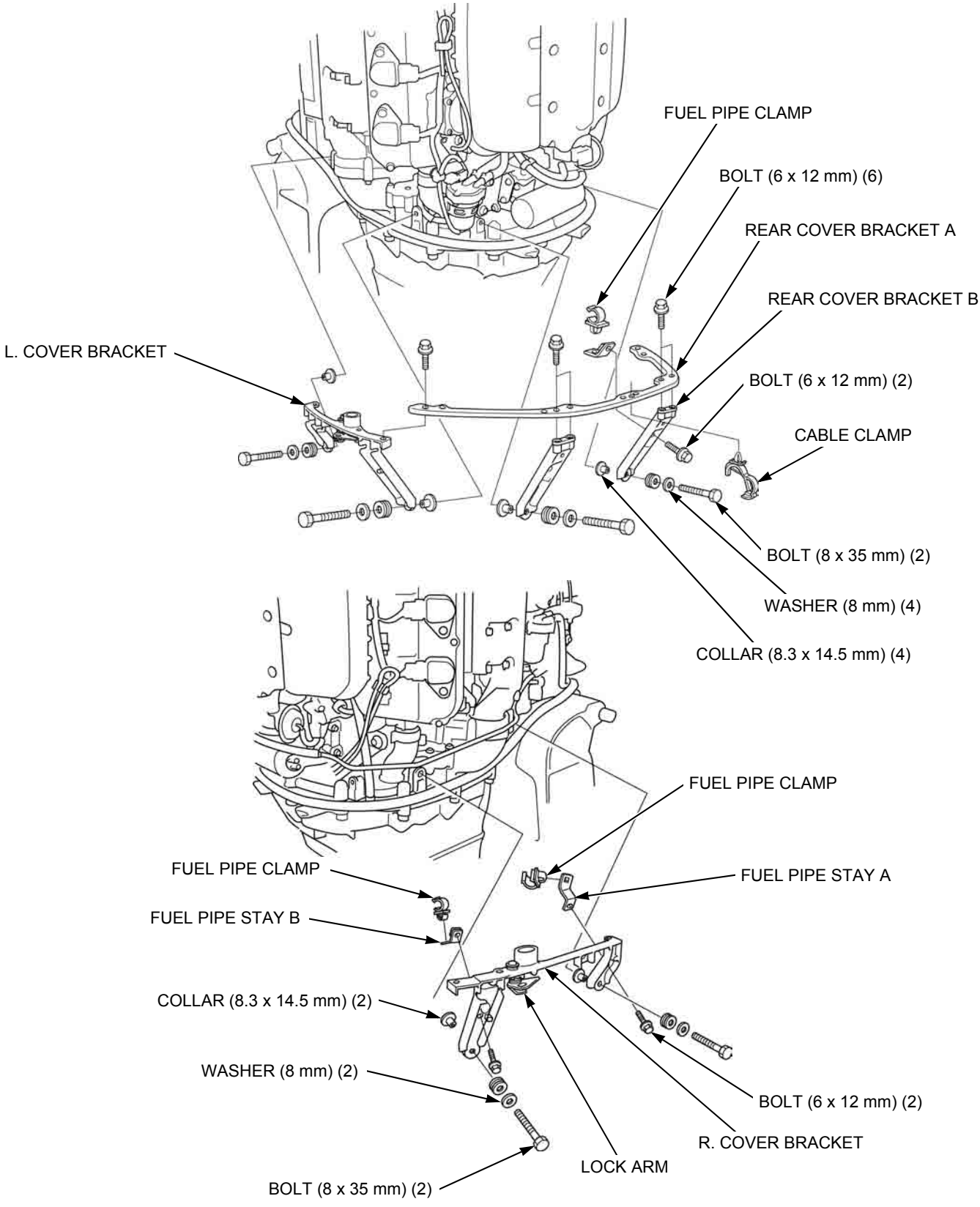
There should be 1.5 mm (0.06 in) of clearance between the hole of the L. lock arm [1] and the cable end [2].
Readjust the nut position of the L. cover bracket side if the clearance is out of specification.

Install the L./R. engine under cover (page 6-3).



ENGINE COVER BRACKET REMOVAL/ INSTALLATION

Remove the cover locking cable (page 6-6).

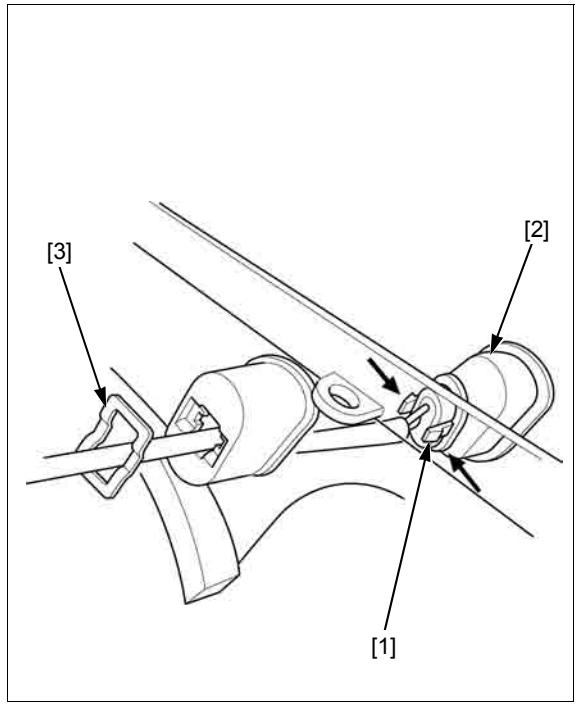


POWER TILT SWITCH REMOVAL/ INSTALLATION

Remove the R. engine under cover (page 6-3).

Release the hooks [1] of the power tilt switch [2] from the holder [3] and R. engine under cover [4] as shown. Remove the power tilt switch.

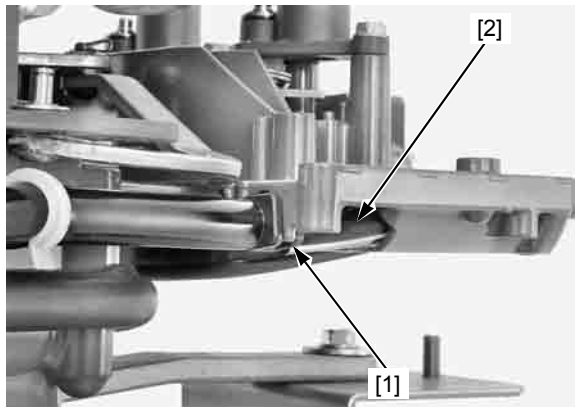
Installation is in the reverse order of removal.



FRONT COVER BRACKET REMOVAL/ INSTALLATION

Remove the switch panel/indicator wire harnesses (page 10-8).

Release the fuel hose grommet [1] from the front cover bracket groove and pull the fuel tube A [2] from the front cover bracket.



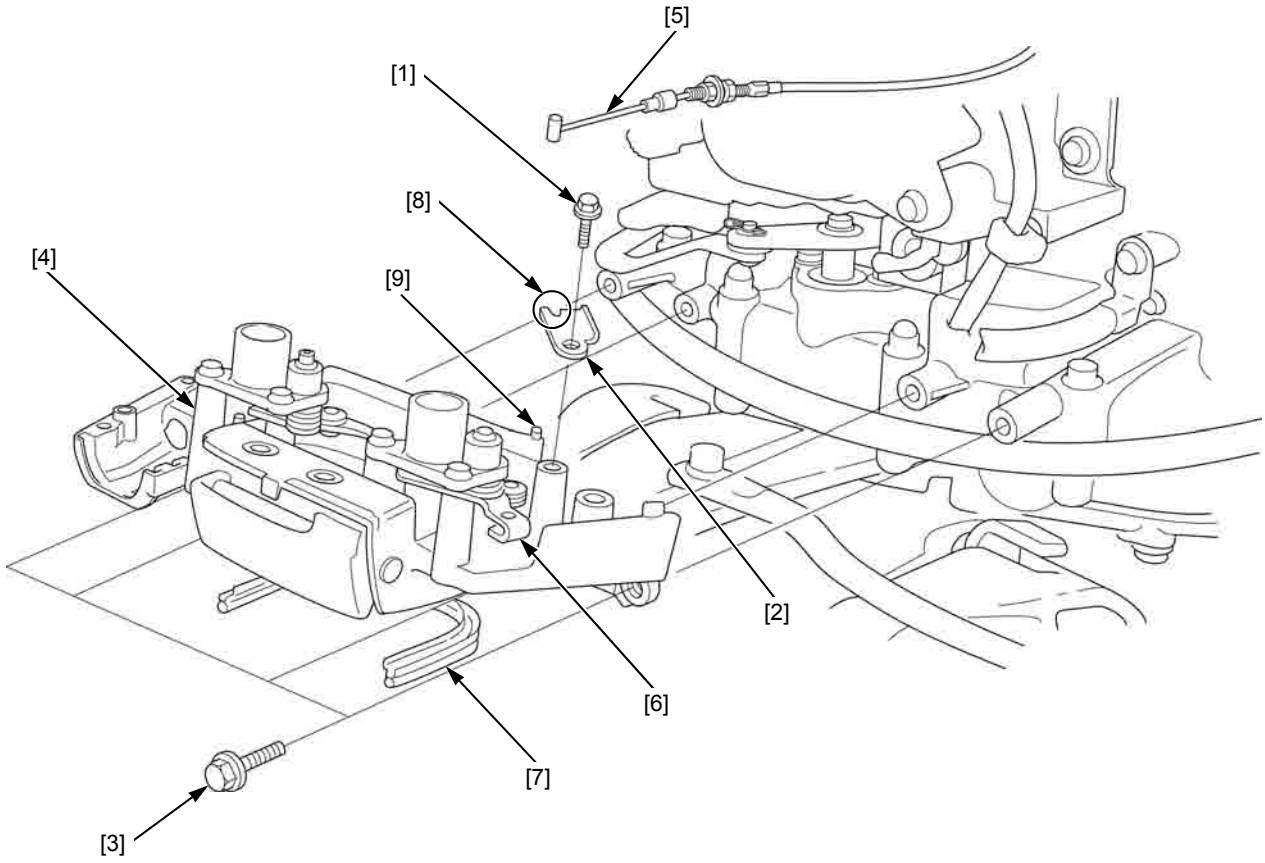
Remove the bolt (6 x 14 mm) [1] and cable holder [2], and release the starter cables from the front cover bracket groove.

Remove the four bolts (8 x 22 mm) [3] and the front cover bracket [4].
Disconnect cover locking cable B [5] then disconnect the cable from the R. lock arm [3].

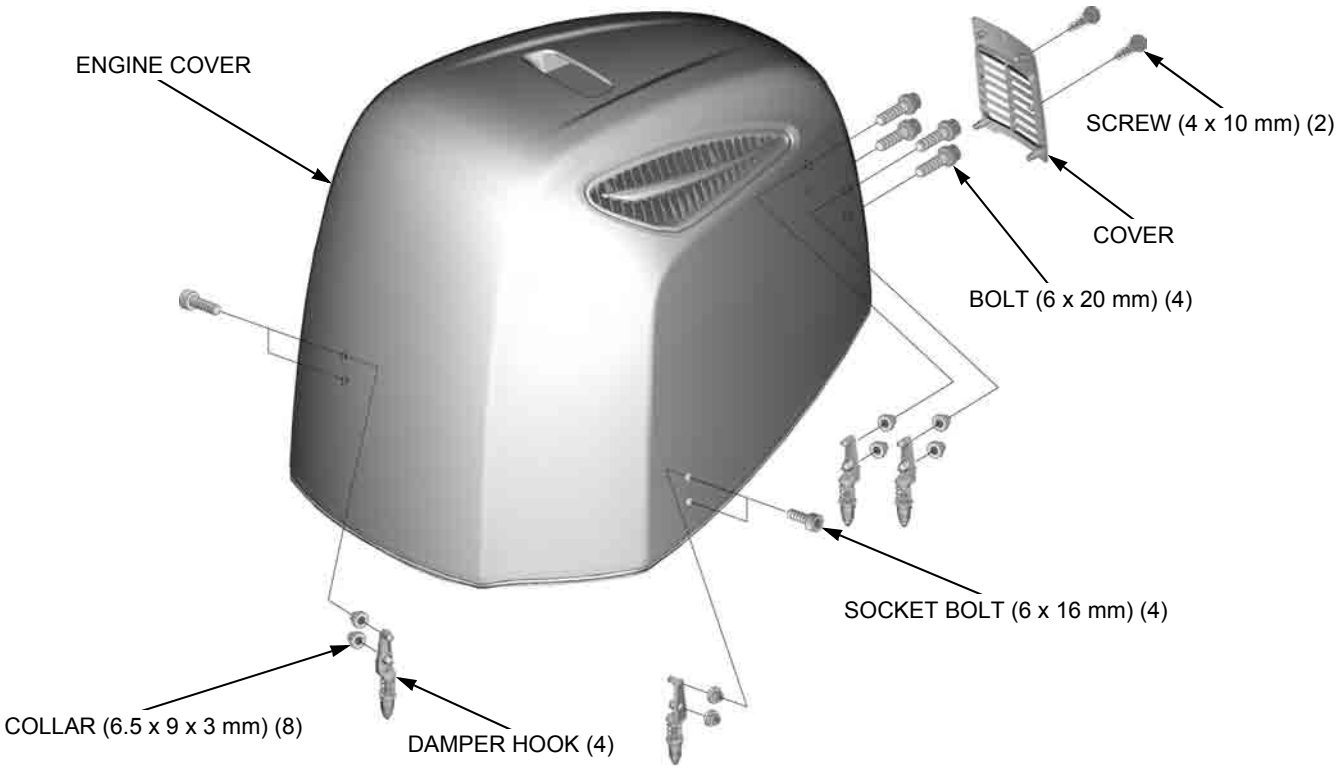
Replace the under cover seal D [7] if necessary.

Installation is in the reverse order of removal.

- Install the cable holder by aligning its cutout [8] with the boss [9] on the front cover bracket.



DAMPER HOOK REMOVAL/ INSTALLATION



SIDE COVER BRACKET DISASSEMBLY/ASSEMBLY

NOTE:

- The L. and R. cover bracket service procedures are the same.

Remove the cover bracket (page 6-9).

Remove the E-ring [1] two washers [2] and two wave washers [3] from the side lock [4].

Remove the side lock from the side cover bracket [5] by pulling down the side lock, while releasing the cover lock hook spring [6] from the side cover bracket hole.

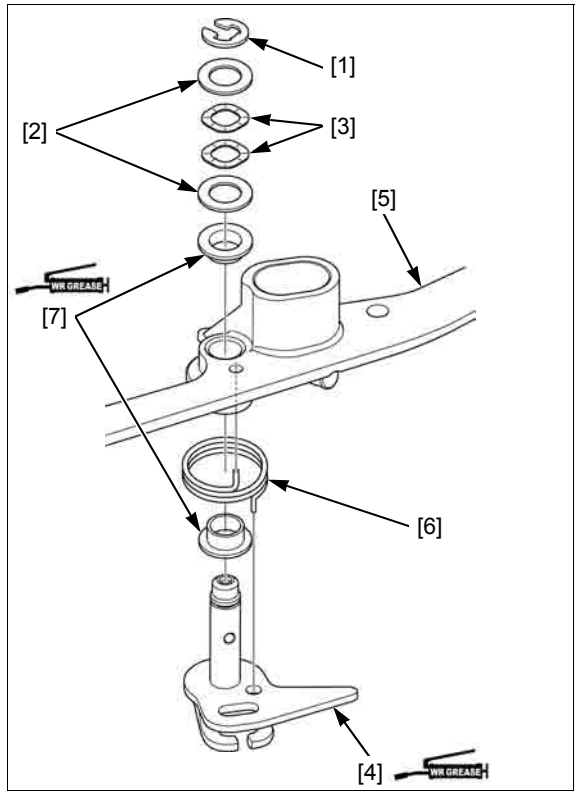
Remove the cover lock hook spring from the side lock.

Remove the two cover lock bushings A [7].

Check the cover lock bushings A for damage and replace them if necessary.

Apply marine grease to the cover lock bushings A whole surface and shaft area of the side lock.

Assembly is in the reverse order of disassembly.

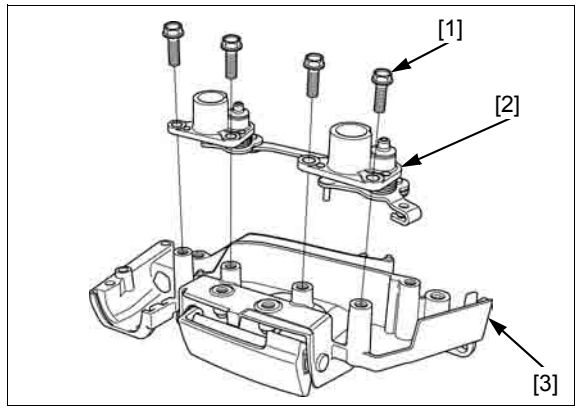


FRONT COVER BRACKET DISASSEMBLY/ASSEMBLY

DISASSEMBLY

Remove the front cover bracket (page 6-10).

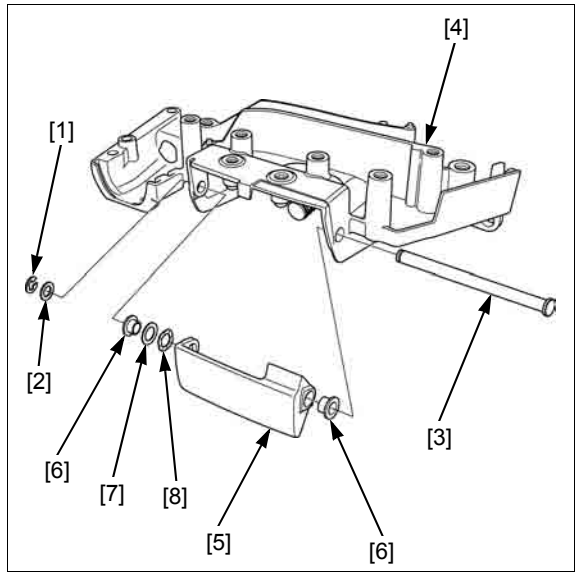
Remove the four bolts (6 x 20 mm) [1] and front lock [2] from the front cover bracket [3].



Remove the E-ring [1] and washer (8 mm) [2] from the front lock shaft [3].

Pull out the front lock shaft from the front cover bracket [4].

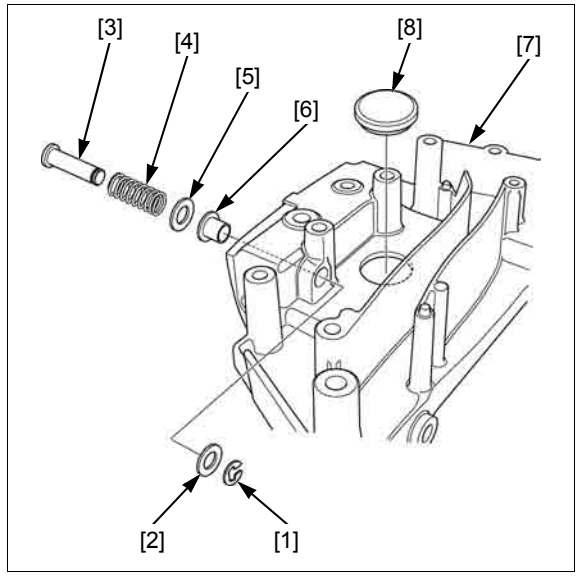
Remove the cover lock lever [5], two cover lock bushings A [6], washer (10 mm) [7] and wave washer [8].



Remove the E-ring [1] and washer (8 mm) [2] from the cover open shaft [3].

Remove the cover open shaft, lock lever return spring [4], washer (8 mm) [5] and cover lock bushing B [6] from the front cover bracket [7].

Remove the bracket cap [8].



FRONT LOCK DISASSEMBLY/ASSEMBLY

Remove the front lock (page 6-13).

Remove the E-ring [1] and washer [2] from the front lock assembly [3].

Release the cover lock spring [4] from the striker holder [5] hole, then remove the striker holder and cover lock spring.

Remove the two cover lock bushings A [6].

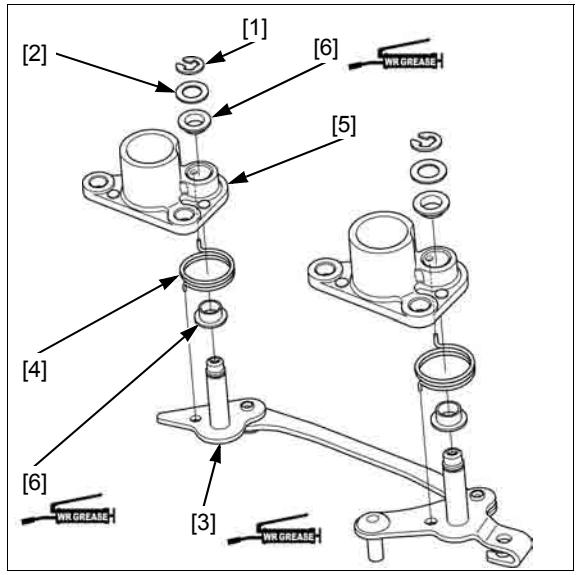
Disassemble the other side of the front lock in the same manner.

Check the cover lock bushings A for damage and replace them if necessary.

Apply marine grease to the cover lock bushings A whole surface and shaft area of the front lock assembly.

Assembly is in the reverse order of disassembly.

Install the front lock (page 6-15).

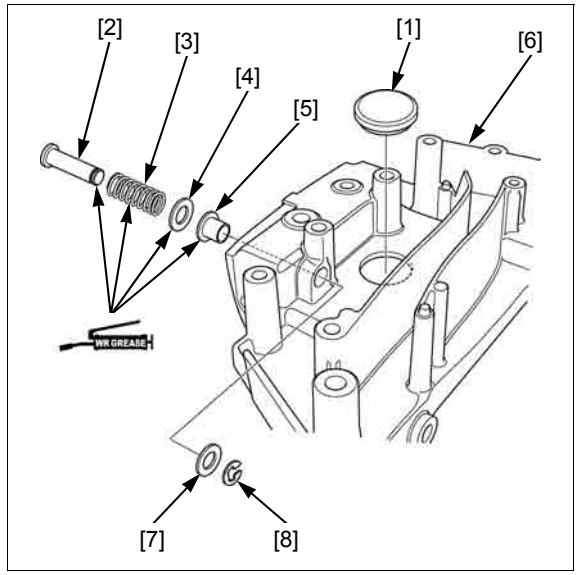


ASSEMBLY

Install the bracket cap [1].

Apply marine grease to the whole surface of cover open shaft [2], lock lever return spring [3], washer [4] and cover lock bushing B [5], then install them to the front cover bracket [6].

Install the washer [7] and E-ring [8] to the cover open shaft.

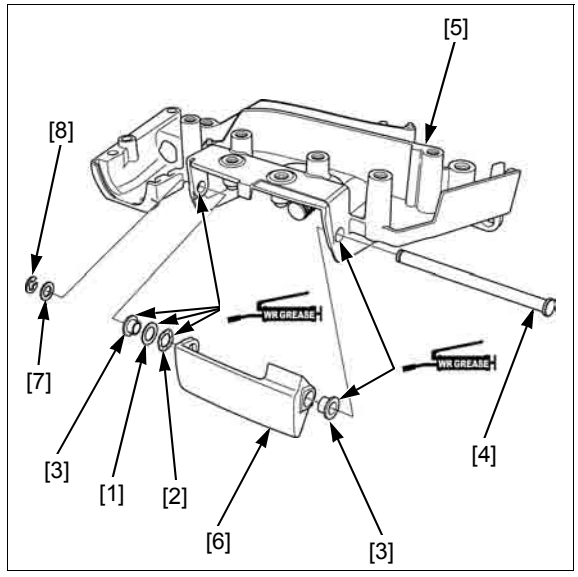


Apply marine grease to the whole surface of the washer (10 mm) [1], wave washer [2], two cover lock bushings A [3] and front lock shaft [4] sliding surface of front cover bracket [5].

Set the two cover lock bushings A, washer (10 mm) and wave washer to the cover lock lever [6] and install it to the front cover bracket.

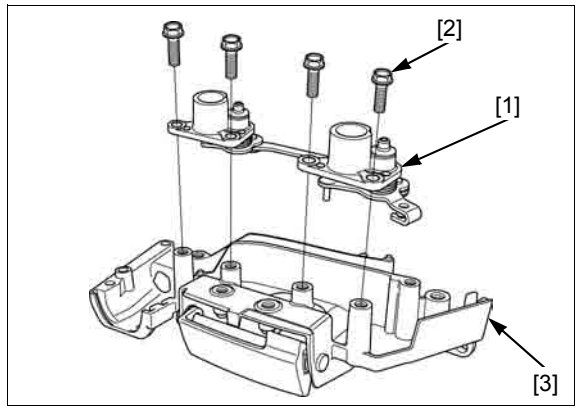
Install the front lock shaft.

Install the washer (8 mm) [7] and E-ring [8] to the front lock shaft.



Install the front lock [1] and four bolts (6 x 20 mm) [2] to the front cover bracket [3].

Install the front cover bracket (page 6-10).



DAMPER HOOK DISASSEMBLY/ ASSEMBLY

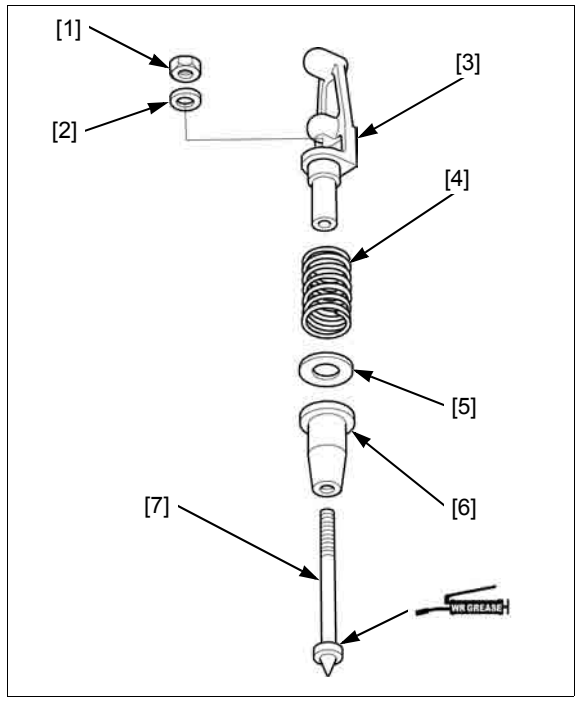
Remove the damper hook (page 6-12).

Disassemble the following:

– Nut [1]
– Washer (6 mm) [2]
– Hook bracket [3]
– Spring [4]
– Washer (12 mm) [5]
– Hook damper [6]
– Cover lock bolt [7]

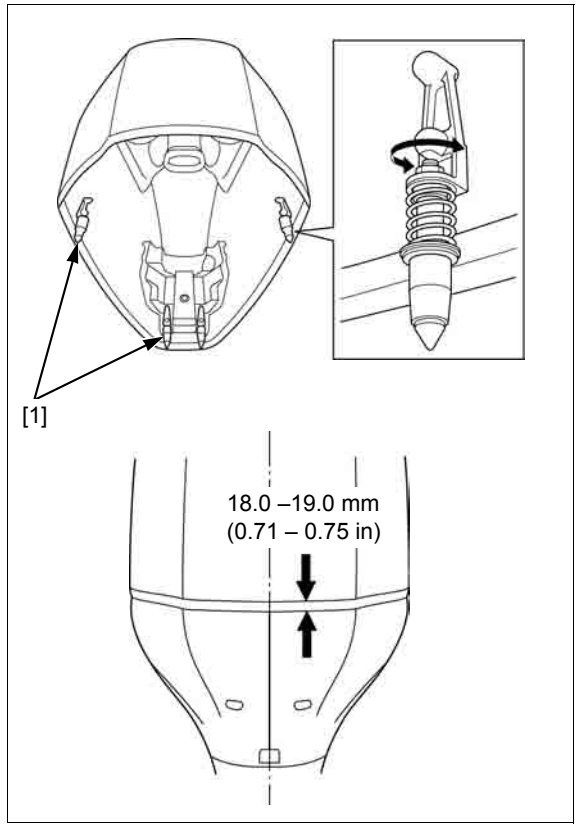
Apply marine grease to the tapered part and bolt shaft of the cover lock bolts.

Assembly is in the reverse order of disassembly.



DAMPER HOOK ADJUSTMENT

Adjust height of the damper [1] hook to be 18.0 – 19.0 mm (0.71 – 0.75 in) by tightening the nuts, and adjust for an even clearance between the engine cover and the undercover.



UNDER COVER SEAL B REPLACEMENT

Remove the extension case [1]:

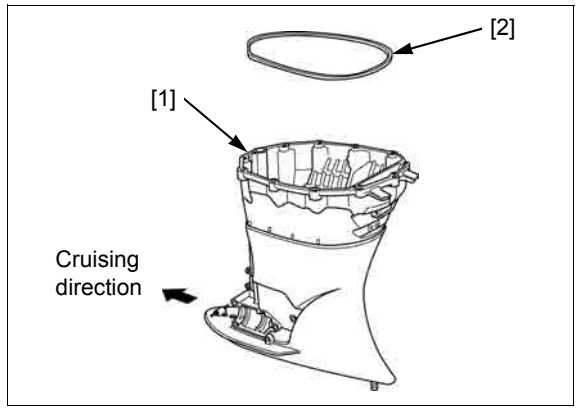
– Standard rotation type (page 16-11)
– Counter rotation type (page 17-9)

Remove the under cover seal B [2].

Check the under cover seal B for cracks and other damage. Replace if necessary.

Clean the under cover seal B area.

Install the under cover seal B.



7. CHARGING SYSTEM

SYSTEM LOCATION 7-2

SYSTEM DIAGRAM 7-2

TOOLS 7-3

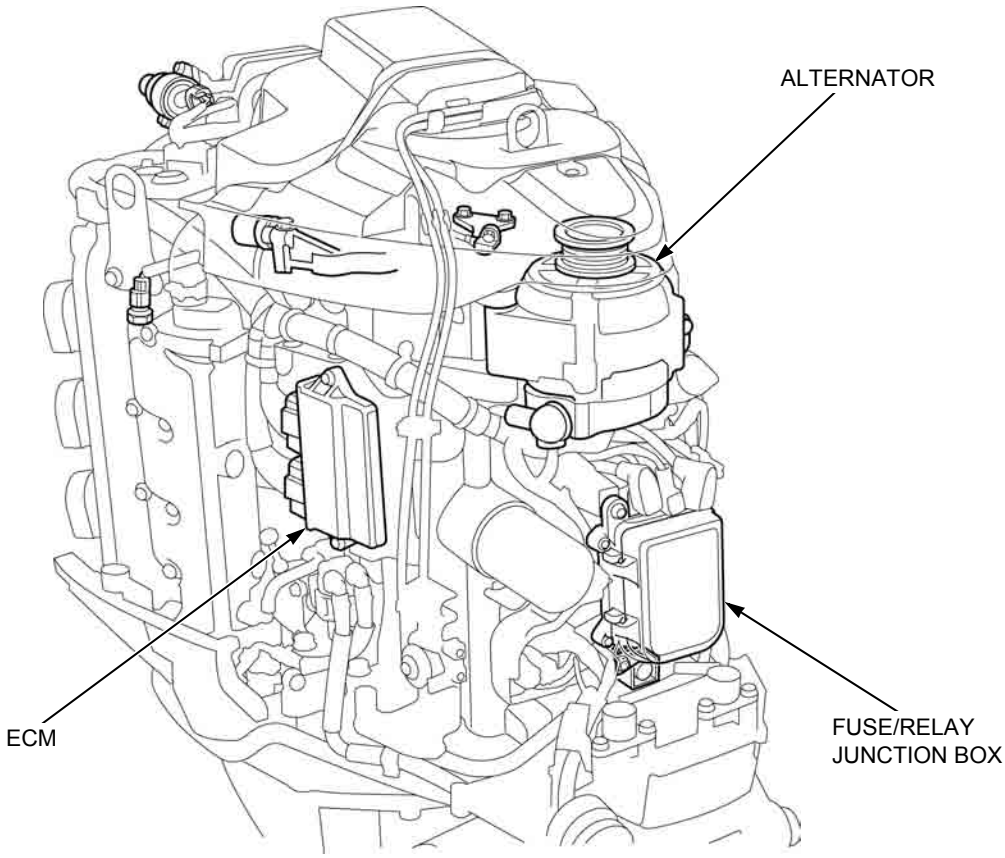
CHARGING SYSTEM TROUBLESHOOTING 7-4

ALTERNATOR REMOVAL/ INSTALLATION 7-5

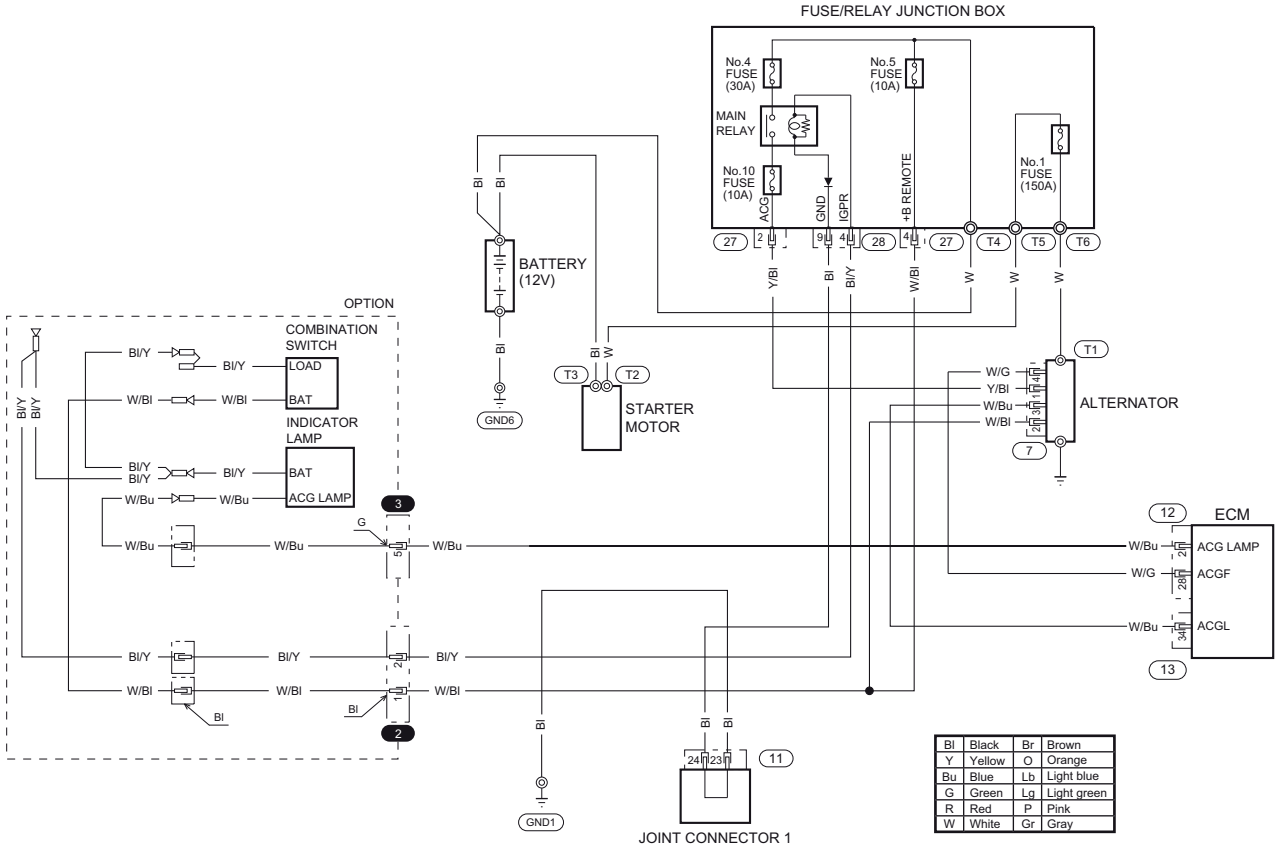
ALTERNATOR DISASSEMBLY/ ASSEMBLY 7-6

ALTERNATOR INSPECTION 7-15

SYSTEM LOCATION



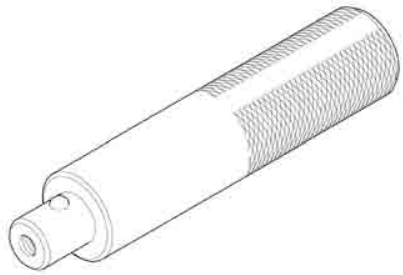
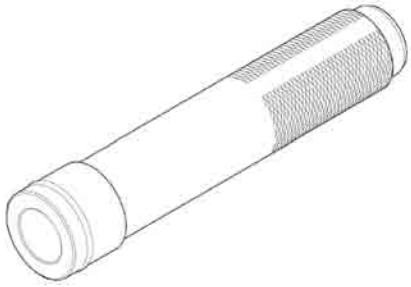
SYSTEM DIAGRAM



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

TOOLS

LIST

Driver 07749-0010000 	Attachment, 52 x 55 mm 07746-0010400 	Pilot, 17 mm 07746-0040400 
Driver, 22 mm I.D. 07746-0020100 	Attachment, 17 mm I.D. 07746-0020300 	Attachment, 25 mm I.D. 07746-0030200 

CHARGING SYSTEM TROUBLESHOOTING

BATTERY IS DAMAGED OR WEAK

1. Battery test

Remove the battery.

Check the battery condition using the commercially available battery tester.

Is the battery in good condition?

YES – GO TO STEP 2.

NO – Faulty battery.

2. Fuse inspection

Check for blown No.1 (150 A) fuse and No.10 fuse (10 A).

Is it normal?

YES – GO TO STEP 3.

NO – Battery connected incorrectly or reverse polarity.
- Check for short in the main wire harness
- Incorrect load by referring to the fuse load chart (page 4-16)
- Replace the blown fuse

3. Load Inspection

Check whether an excessive load is connected.

Is the load normal?

YES – GO TO STEP 4.

NO – Remove the load and recheck.

4. Alternator terminal inspection

Check the alternator B terminal and 4P connector (42) terminal for looseness and damage.

Is it normal?

YES – GO TO STEP 5.

NO – Connect the terminal and/or connector securely.

5. Alternator wire inspection

Check for open in the alternator wire.

Are they normal?

YES – GO TO STEP 6.

NO – Repair the open circuit in the alternator wire.

6. Alternator belt inspection

Check the alternator belt for looseness and damage (page 3-9).

Is it normal?

YES – GO TO STEP 7.

NO – Adjust or replace the alternator belt (page 3-9).

7. Alternator inspection

Inspect the following alternator parts:
– Blush (page 7-15)
– Rectifier (page 7-15)
– Rotor (page 7-16)
– Stator (page 7-16)

Are they normal?

YES – Replace the IC regulator with a new one and recheck.

NO – Replace the faulty part(s).

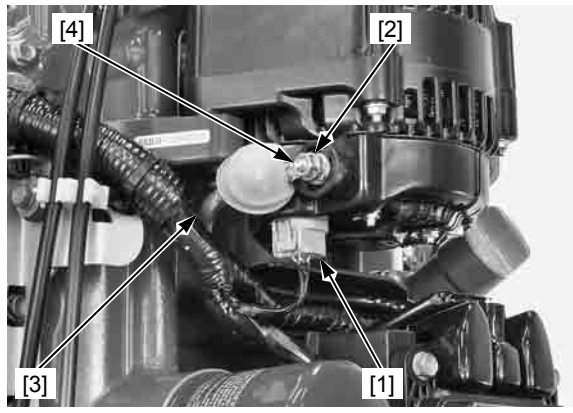
ALTERNATOR REMOVAL/ INSTALLATION

REMOVAL

Disconnect the battery negative (–) cable.
Remove the cooling fan cover (page 5-68).

Disconnect the 4P connector [1] from the alternator.

Remove the alternator B terminal nut [2] and ACG cable [3] from the alternator B terminal [4].

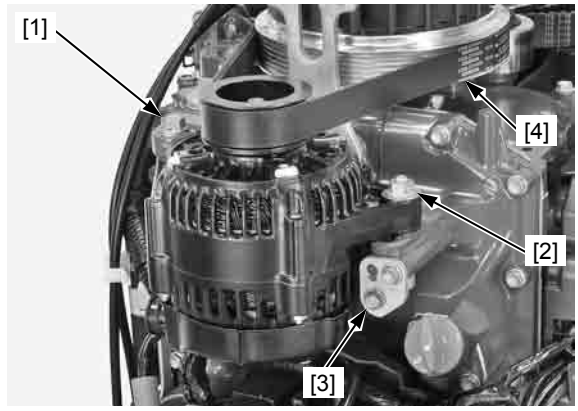


Loosen the alternator bolt [1] and nut [2].

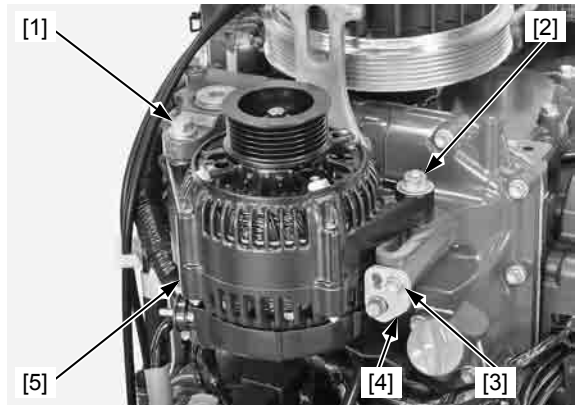
Loosen the special adjuster bolt [3].

Move the alternator to the engine side as far as it goes, and remove the alternator belt [4].

- 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.



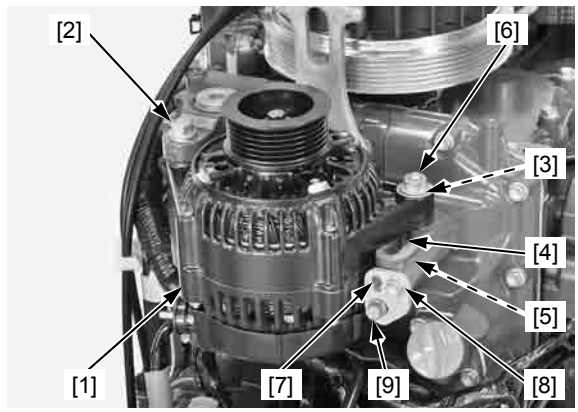
Remove the alternator bolt [1] and nut [2].
Remove the bolt (6 x 16 mm) [3], bracket [4], and remove the alternator [5].



INSTALLATION

Install the alternator [1] and loosely tighten the bolt [2].

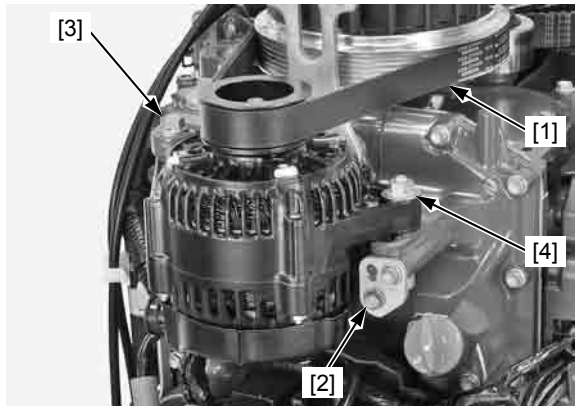
Install the alternator by aligning its hole [3] with the hole [4] of the alternator stay and then loosely tighten the tensioner bolt [5] and alternator nut [6].
Align the hole [7] of the bracket with the boss of the engine stay and tighten the bolt (6 x 16 mm) [8].
Loosely install the special adjuster bolt [9].



Install the alternator belt [1] to the alternator and adjust the belt tension by turning the special adjuster bolt [2]. Adjust the belt tension (page 3-9).

After adjusting the belt tension, tighten the alternator bolt [3], then the alternator nut [4] to the specified torque.

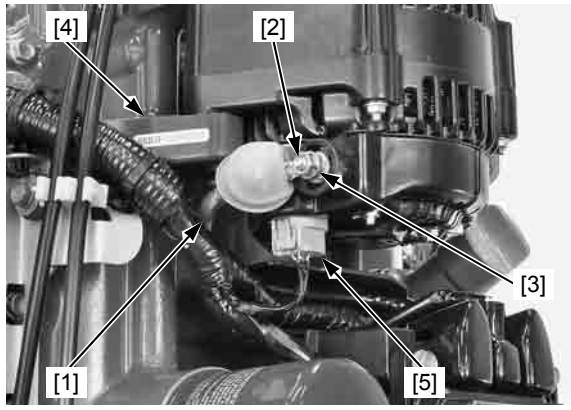
TORQUE:
Alternator bolt: 44 N·m (4.5 kgf·m, 32 lbf·ft)
Alternator nut: 26 N·m (2.7 kgf·m, 19 lbf·ft)



Connect the ACG cable [1] to the alternator B terminal [2] as shown.
Tighten the nut [3] to the specified torque so that the ACG cable does not to touch the bracket [4].

TORQUE: 8.0 N·m (0.82 kgf·m, 5.9 lbf·ft)

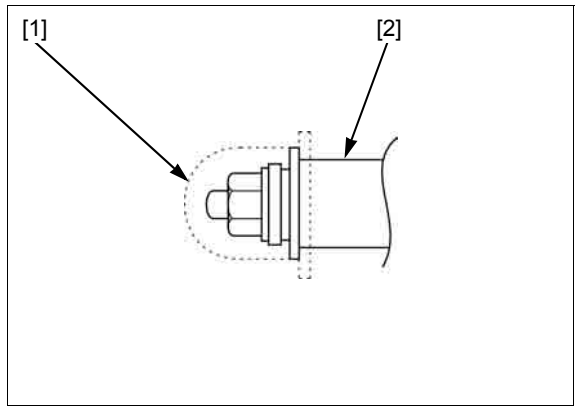
Connect the 4P connector [5] to the alternator.



After installation, place the cover [1] over the B terminal [2] securely.

Install the cooling fan cover (page 5-69).

Connect the battery negative (–) cable.

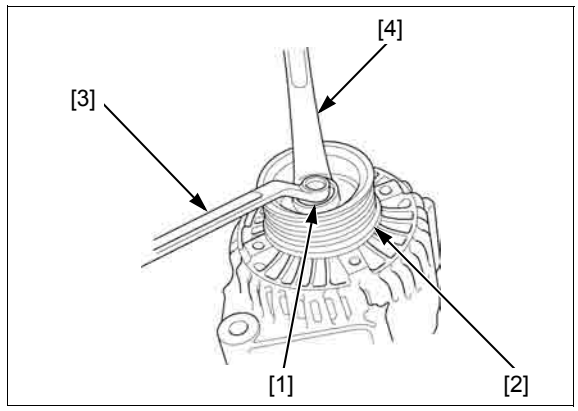


ALTERNATOR DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

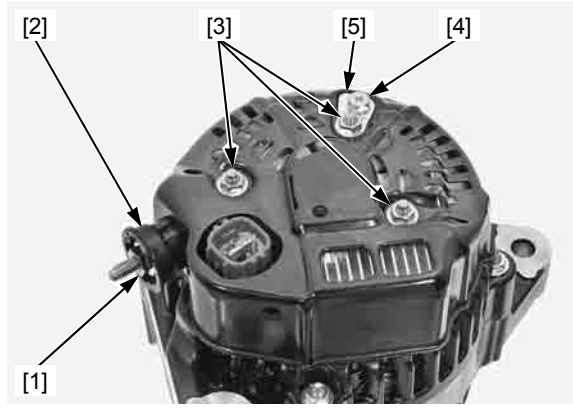
Remove the alternator (page 7-5).

Remove the pulley lock nut [1] and alternator pulley [2] using the two offset wrenches (10 mm [3] and 22 mm [4]) as shown.



Remove the nut [1] from the alternator B terminal and remove the insulator bushing [2].

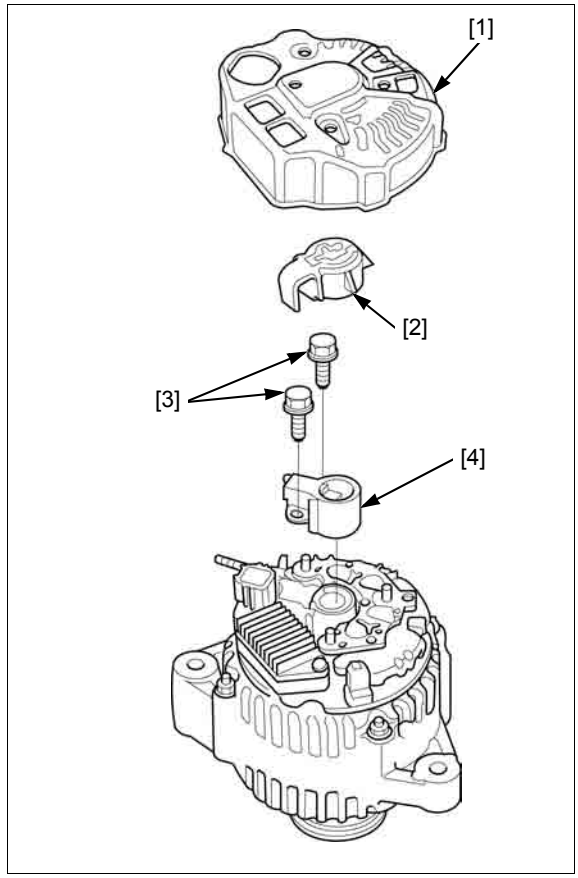
Remove the three nuts [3], screw (5 x 8 mm) [4], and plate [5].



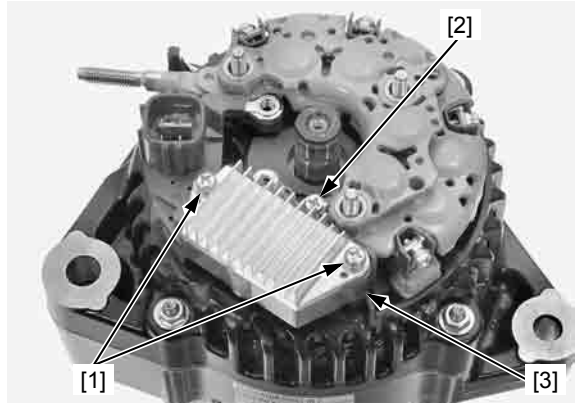
Remove the rear end cover [1].

Remove the brush holder insulator [2].

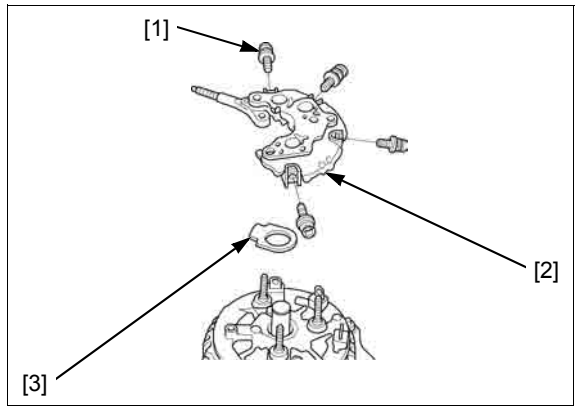
Remove the two screws (4 x 6 mm) [3] and the brush holder [4].



Remove the two screw/washers (4 x 25 mm) [1], screw (4 x 6 mm) [2], and IC regulator [3].

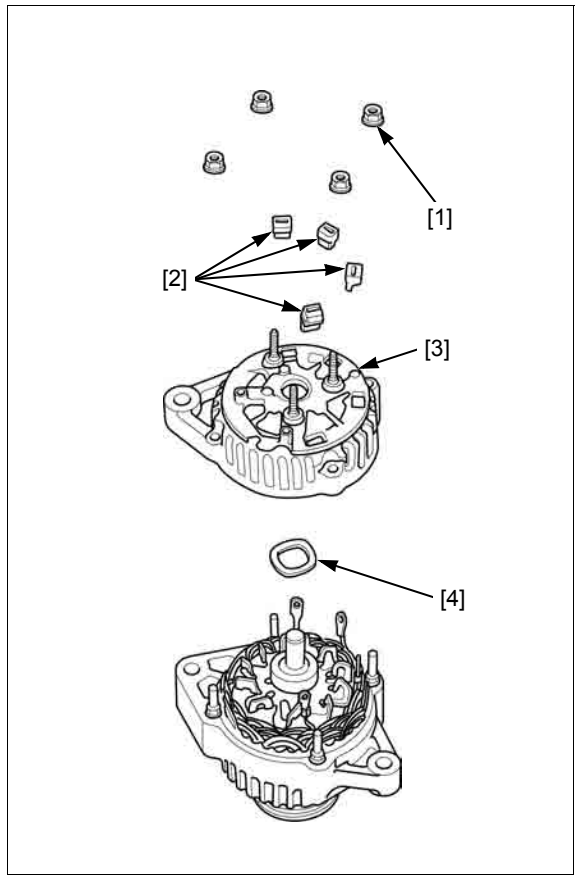


Remove the four screw/washers (4 x 7 mm) [1], rectifier [2], and seal ring [3].

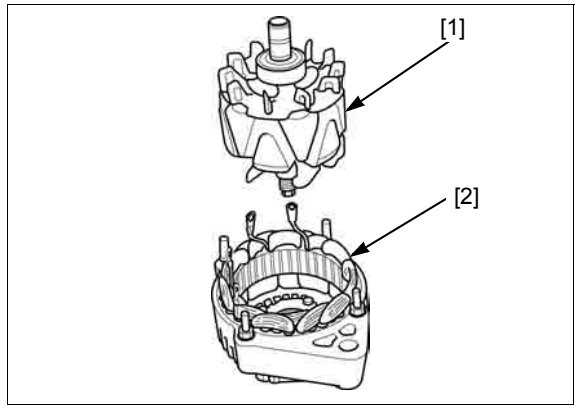


Remove the four nuts [1], insulators [2], and the rear housing [3].

Remove the washer [4].



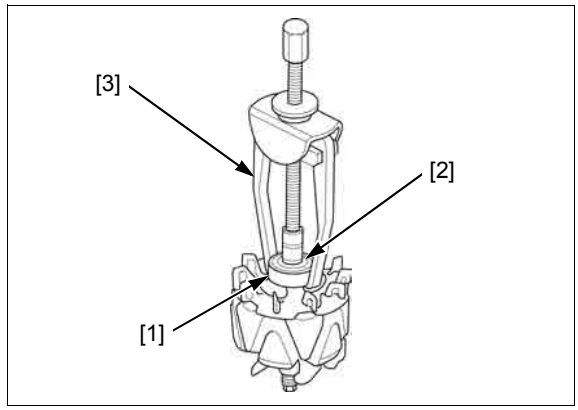
Remove the rotor [1] from the stator (drive end housing) [2].



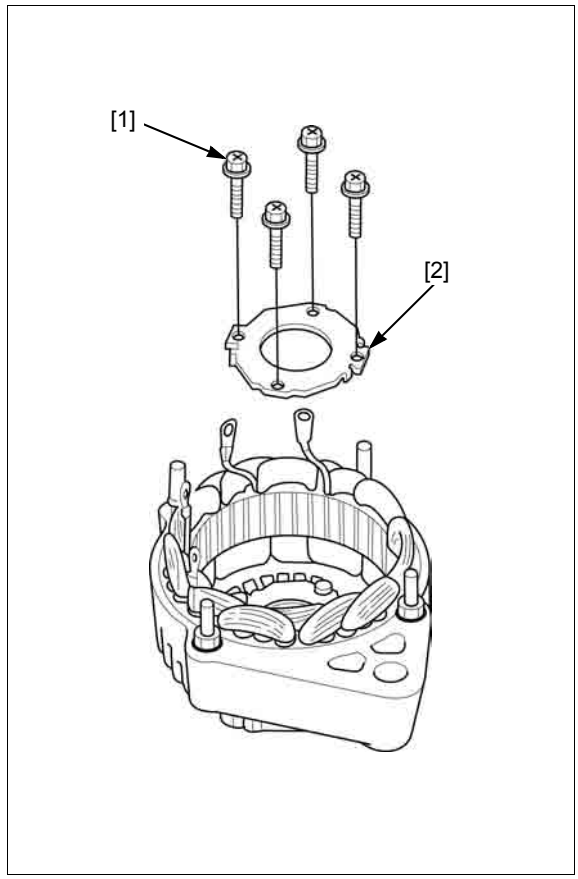
Remove the rear bearing [1] and bearing cover [2] from the rotor using a commercially available bearing puller [3].

NOTICE

Install a commercially available bearing puller with care not to damage the rotor shaft.

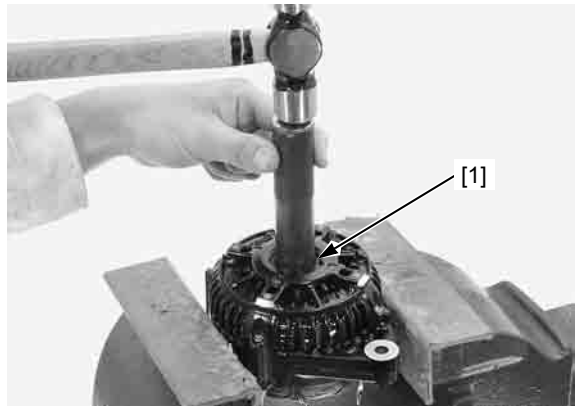


Remove the four screws (4.5 x 19 mm) [1] and bearing retainer [2].

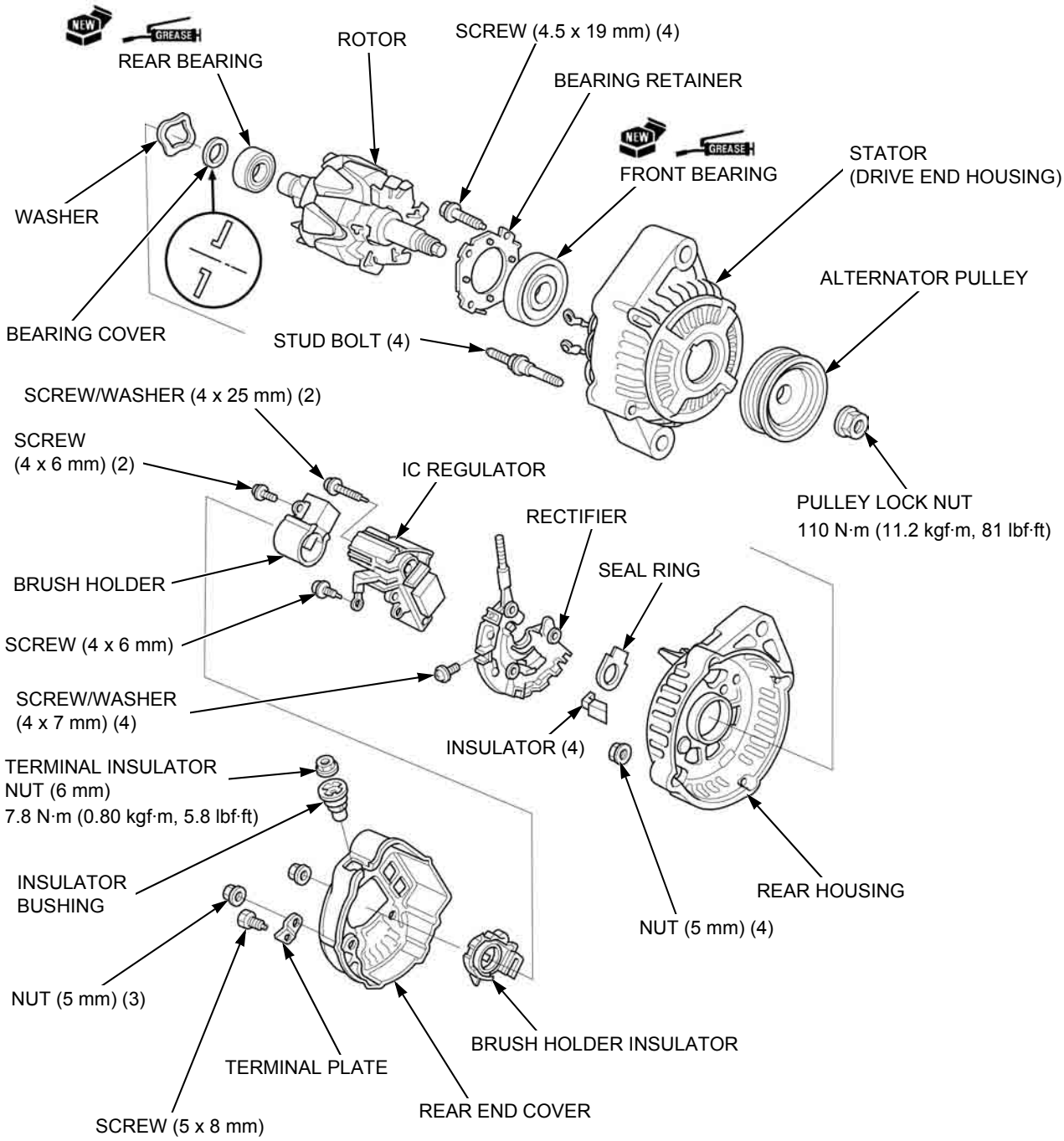


Support the stator housing in a vise, and drive out the front bearing [1] using a suitable tool.

Check the alternator parts (page 7-15).

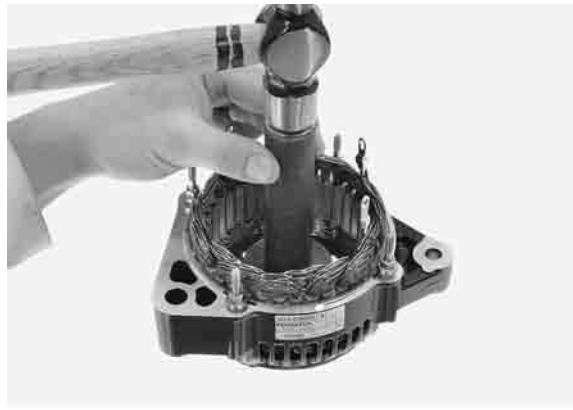


EXPLODED VIEW



ASSEMBLY

If the front bearing is removed, replace with a new bearing [1].

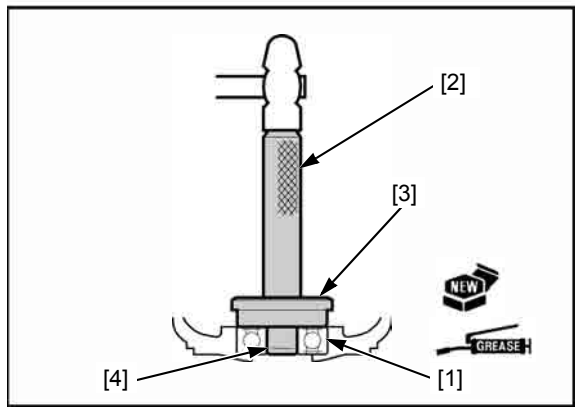


Apply grease to a new bearing outer surface.

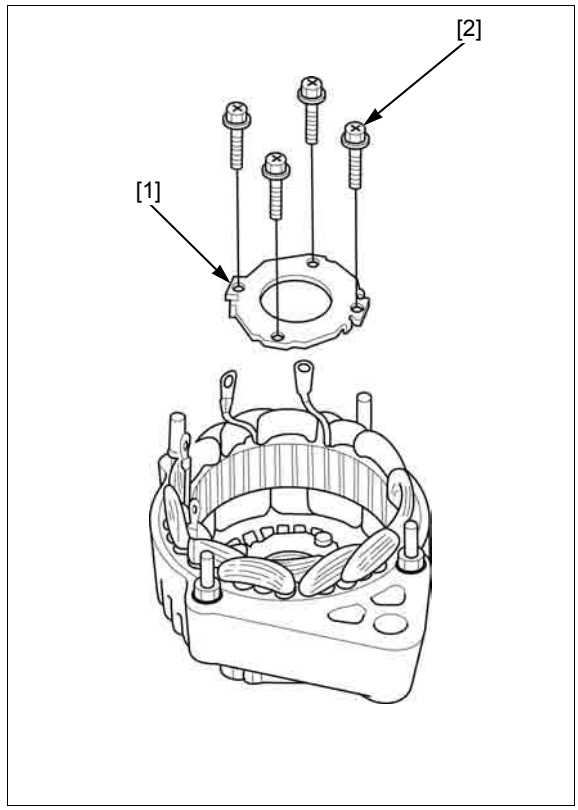
Install a new front bearing in the stator (drive end housing) using the special tool as shown.

TOOLS:

Driver [2]	**07749-0010000**
Attachment, 52 x 55 mm [3]	**07746-0010400**
Pilot, 17 mm [4]	**07746-0040400**



Install the front bearing retainer [1] and tighten the four screws (4.5 x 19 mm) [2].



If the rear bearing is removed, replace a new bearing [1].

Apply grease to a new bearing inner surface.

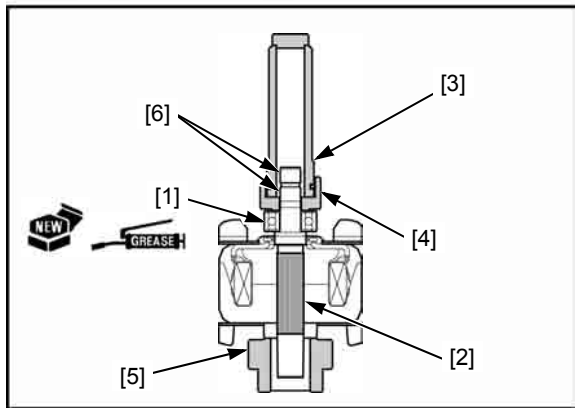
Install a new rear bearing on the rotor shaft [2] using the special tool as shown.

TOOLS:

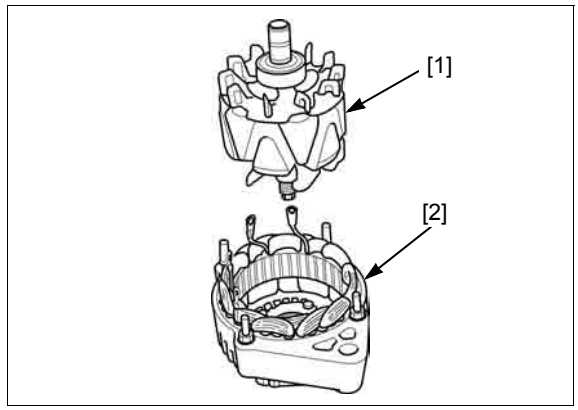
Driver, 22 mm I.D. [3]	**07746-0020100**
Attachment, 17 mm I.D. [4]	**07746-0020300**
Attachment, 25 mm I.D. [5]	**07746-0030200**

After installing the rear bearing, clean the rotor shaft and slip rings [6] with a degreasing cleaning agent.





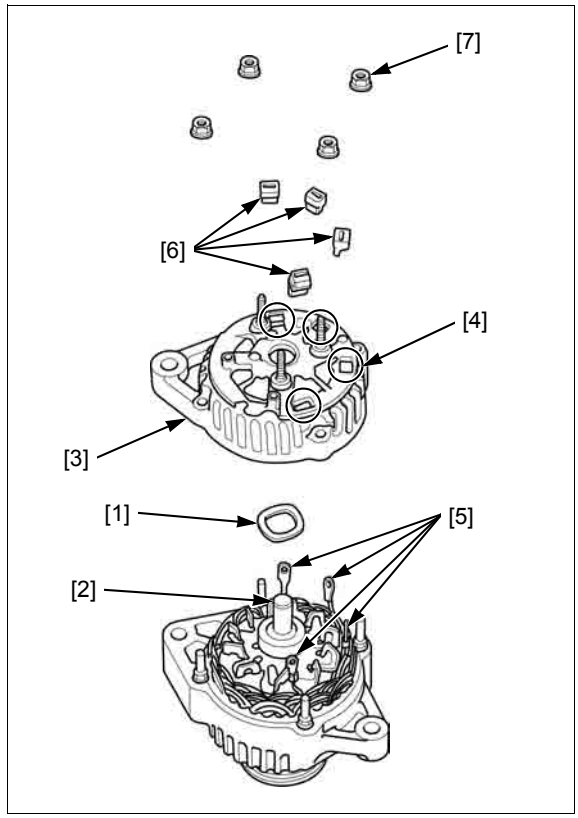
Install the rotor [1] to the stator (drive end housing) [2].



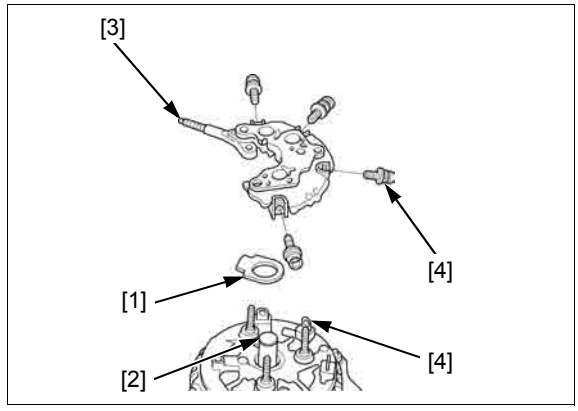
Install the washer [1] onto the rotor shaft [2].

- When installing the rear cover housing, be sure that the washer is positioned within the bearing circumference.

Install the rear housing [3] to the stator by aligning the holes [4] of the rear housing with the terminals [5] of the stator.
Install the insulators [6] to the terminals.
Install and tighten the four nuts [7].



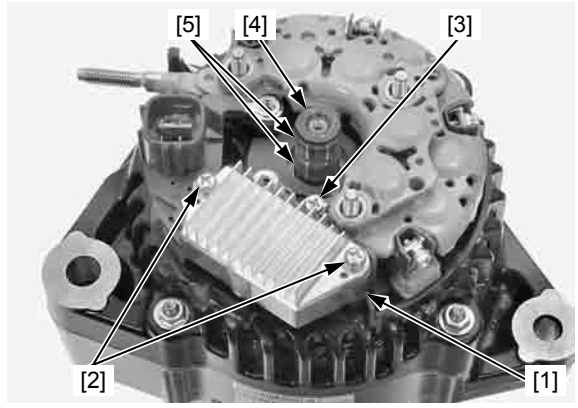
Install the seal ring [1] onto the rotor shaft [2].
Install the rectifier [3] by aligning the terminals of it with the stator terminals [4].
Install and tighten the four screw/washers (4 x 7 mm) [4].



Install the IC regulator [1] and tighten the two screws (4 x 25 mm) [2] and the screw (4 x 6 mm) [3].

NOTICE

- *Do not allow the rotor shaft [4] and slip rings [5] to become contaminated with oil or grease.*

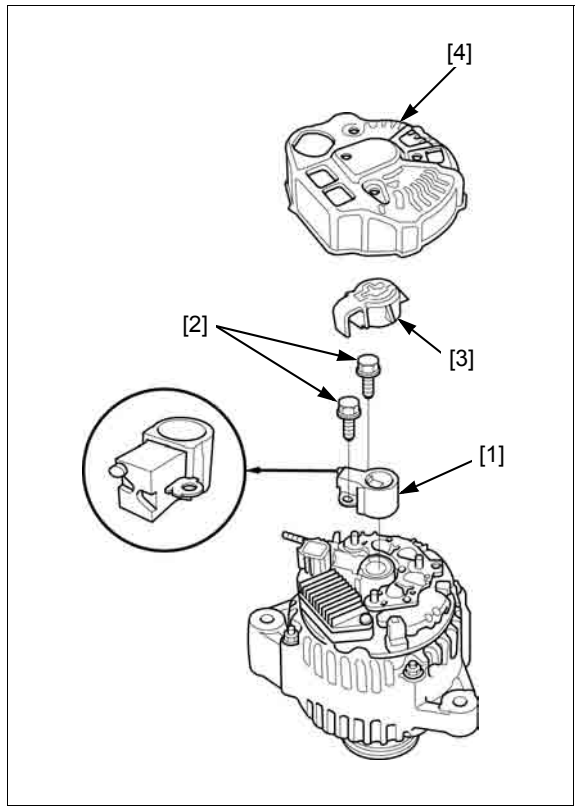


Install the brush holder [1] as shown and tighten the two screws (4 x 6 mm) [2].
Install the brush holder insulator [3].

NOTICE

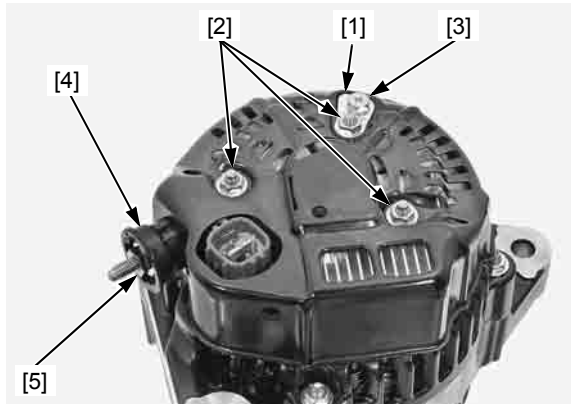
- *Take care not to damage the rotor shaft slip rings with the brush holder during installation.*

Install the rear end cover [4].



Install the terminal plate [1] and tighten the three nuts [2] and screw (5 x 8 mm) [3].
Install the insulator bushing [4] and tighten the nut [5] to the specified torque.

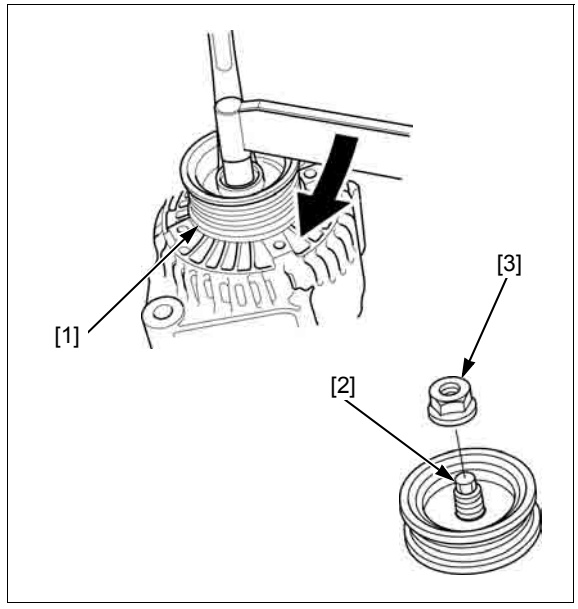
TORQUE: 7.8 N·m (0.80 kgf·m, 5.8 lbf·ft)



Install the alternator pulley [1] and tighten the alternator rotor shaft [2] by holding the pulley lock nut [3].

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

Install the alternator (page 7-5).

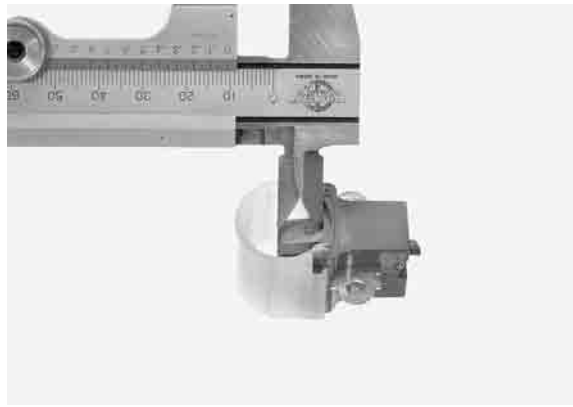


ALTERNATOR INSPECTION

BRUSH HOLDER ASSEMBLY

Measure the brush length.
If the measurement is less than the service limit, replace the brush holder assembly.

STANDARD: 10.5 mm (0.41 in)
SERVICE LIMIT: 9.0 mm (0.35 in)

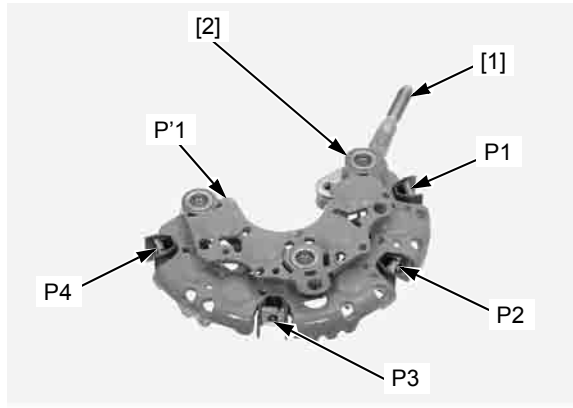


RECTIFIER ASSEMBLY

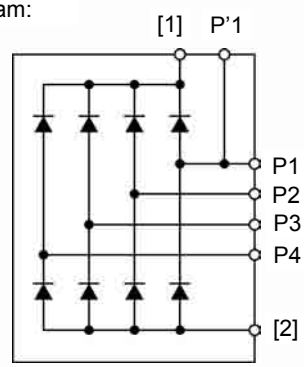
- Inspect the rectifier by removing it from the stator.

Check for continuity between the B terminal [1] and the respective P terminals (P1, P2, P3, and P4), and between the E terminal [2] and the respective P terminals (P1, P2, P3, and P4). Check for continuity in two directions by reversing the test leads.

There should be continuity only in one direction.
Replace the rectifier if necessary.



Circuit diagram:



ROTOR

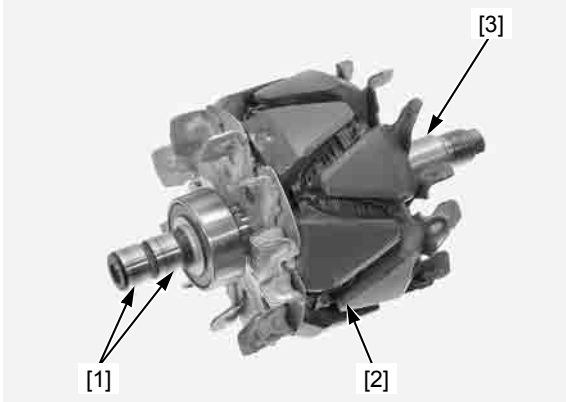
Check to be sure that there is continuity between the slip rings [1].

Check to see that there is no continuity between a slip ring and the rotor [2], and between a slip ring and the rotor shaft [3].

Measure the slip ring O.D.

STANDARD: 14.2 – 14.4 mm (0.56 – 0.57 in)
SERVICE LIMIT: 13.8 mm (0.54 in)

If the measurement is less than the service limit, replace the rotor.

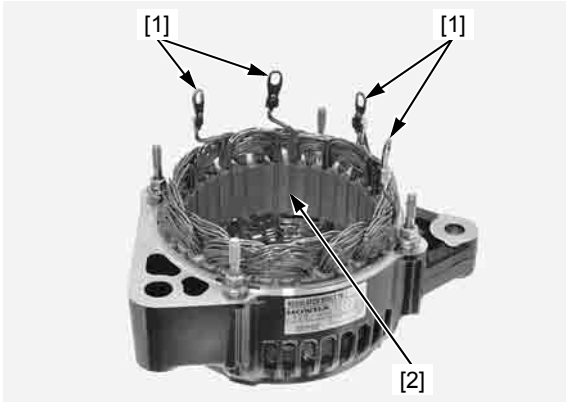


STATOR

- Inspect the stator by removing it from the alternator.

Verify there is continuity between the wires [1].

Verify there is no continuity between each wire and the stator core [2].



8. IGNITION SYSTEM

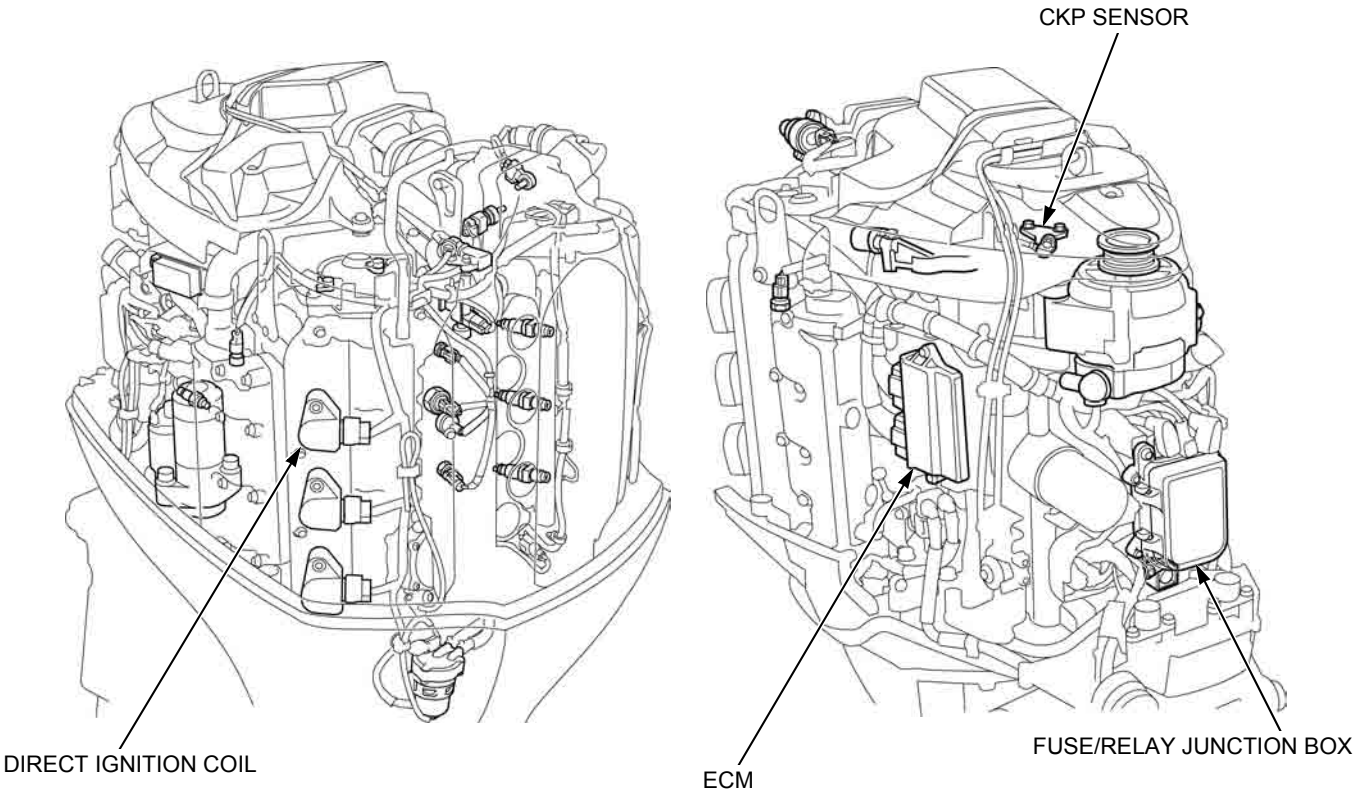
SYSTEM LOCATION 8-2

SYSTEM DIAGRAM 8-2

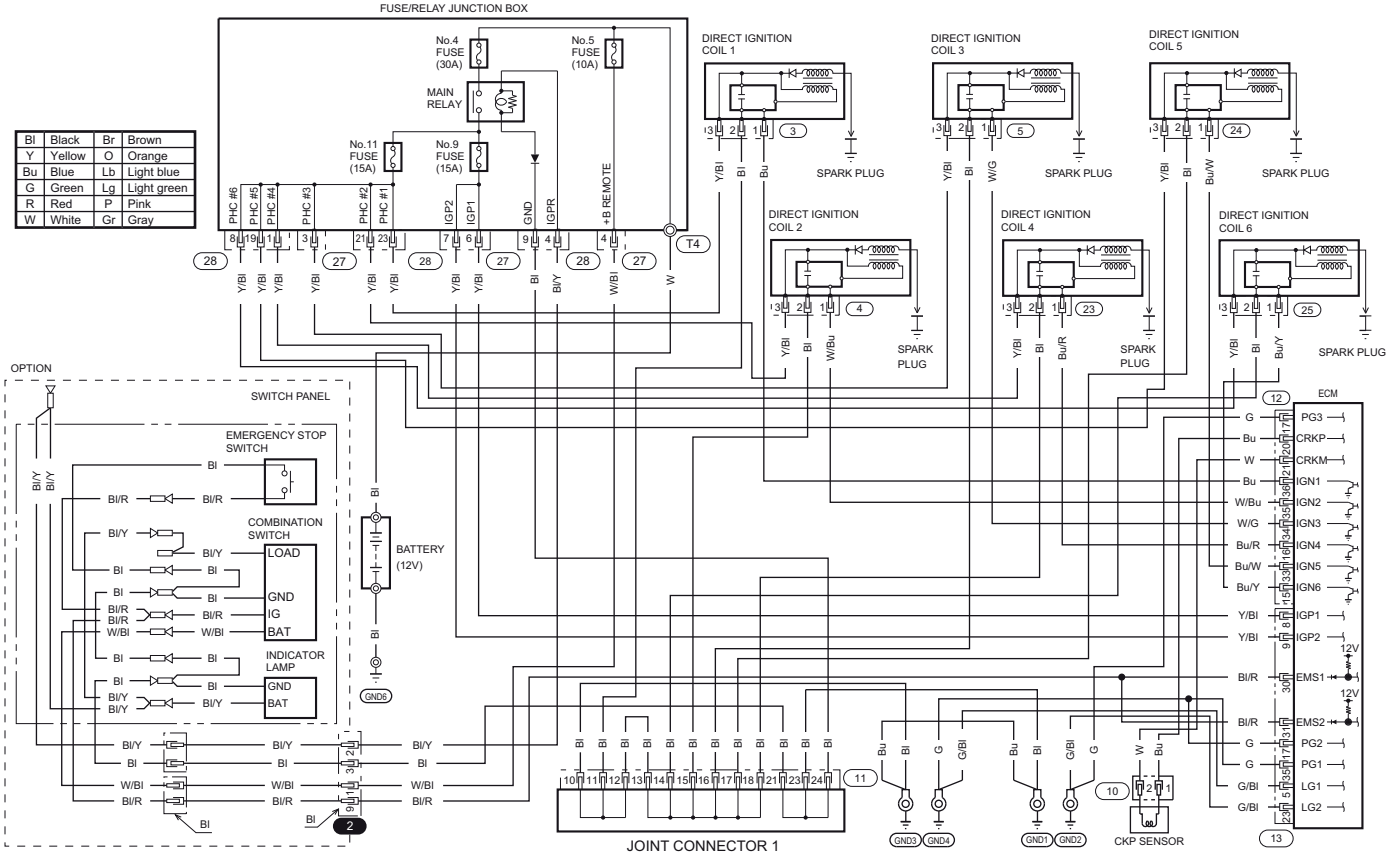
IGNITION SYSTEM TROUBLESHOOTING 8-3

SPARK TEST 8-4

SYSTEM LOCATION



SYSTEM DIAGRAM



IGNITION SYSTEM TROUBLESHOOTING

NO SPARK(S)

1. MIL inspection

Turn the combination switch ON and check that the MIL stays ON.

Does the MIL stay ON?

YES – PGM-FI troubleshooting (page 5-6)

NO – GO TO STEP 2.

2. Emergency stop switch clip inspection

Check the emergency stop switch clip.

Is the emergency stop switch clip connected?

YES – GO TO STEP 3.

NO – Set the clip securely.

3. Direct ignition coil inspection

Temporarily exchange the direct ignition coil with a known good direct ignition coil and perform the spark test.

Is there spark?

Sparks– Faulty original direct ignition coil.

One plug has no spark –GO TO STEP 4.

All plugs have no sparks –GO TO STEP 5.

4. Direct ignition coil signal line open circuit inspection

Turn the combination switch OFF.
Disconnect the ECM connector A (12).

Check for open or short circuit between the direct ignition coil 3P connector main wire harness side No.1 terminal and ECM connector A (12) terminal of the same colors.

Is the circuit normal?

YES – GO TO STEP 6.

NO – Repair open or short in the main wire harness between the ECM and direct ignition coil.

5. Fuse inspection

Check for a blown No.5 (15 A) fuse.

Is the fuse blown?

YES – Replace the blown fuse and check for short in the main wire harness or incorrect load by referring to the fuse load chart (page 4-16).

NO – GO TO STEP 6.

6. Direct ignition coil power/ground line open circuit inspection

Turn the combination switch OFF.
Disconnect the direct ignition coil 3P connector.

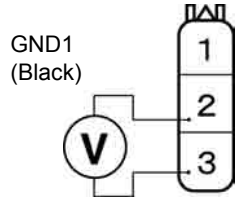
Turn the combination switch ON.
Measure the voltage at the direct ignition coil 3P connector main wire harness side No.2 terminal and No.3 terminal.

Does battery voltage exist?

YES – GO TO STEP 7.

NO – Repair open in the main wire harness between the ECM and direct ignition coil.

DIRECT IGNITION COIL 3P CONNECTOR
MAIN WIRE HARNESS SIDE



7. Timing belt driven pulley inspection

Check for proper installation of the timing belt driven pulley.

Is the timing belt driven pulley installed correctly?

YES – GO TO STEP 8.

NO – Correct the timing belt driven pulley installation

8. Emergency stop switch signal line short circuit inspection

Disconnect the ECM connector A (12) and B (13).

Disconnect the switch panel wire harness 14P connector 2.

Check for continuity between the ECM connector B (13) main wire harness side No.30 (Black/Red) terminal, No.31 (Black/Red) terminal and engine ground.

Is there continuity?

YES – Repair the short circuit in emergency stop switch wire.

NO – Replace the ECM with a new one and recheck

SPARK TEST

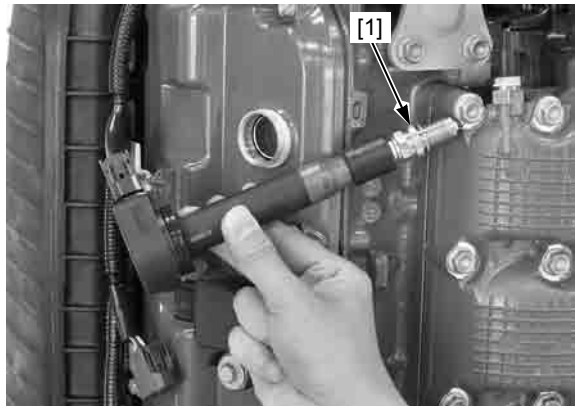
Inspect the following before doing a spark test.

– Spark plug
– Loose direct ignition coil 3P connector connection
– Water in the direct ignition coil (leaking the direct ignition coil secondary voltage)

Remove the direct ignition coil (page 3-17).
Connect the direct ignition coil 3P connector.

Connect a known-good spark plug [1] to the direct ignition coil and ground the spark plug to the engine.

Crank the engine with the starter motor and check whether sparks jump across the electrodes.



9. STARTING SYSTEM

SYSTEM LOCATION 9-2

SYSTEM DIAGRAM 9-2

STARTING SYSTEM TROUBLESHOOTING 9-3

STARTER MOTOR REMOVAL/ INSTALLATION 9-5

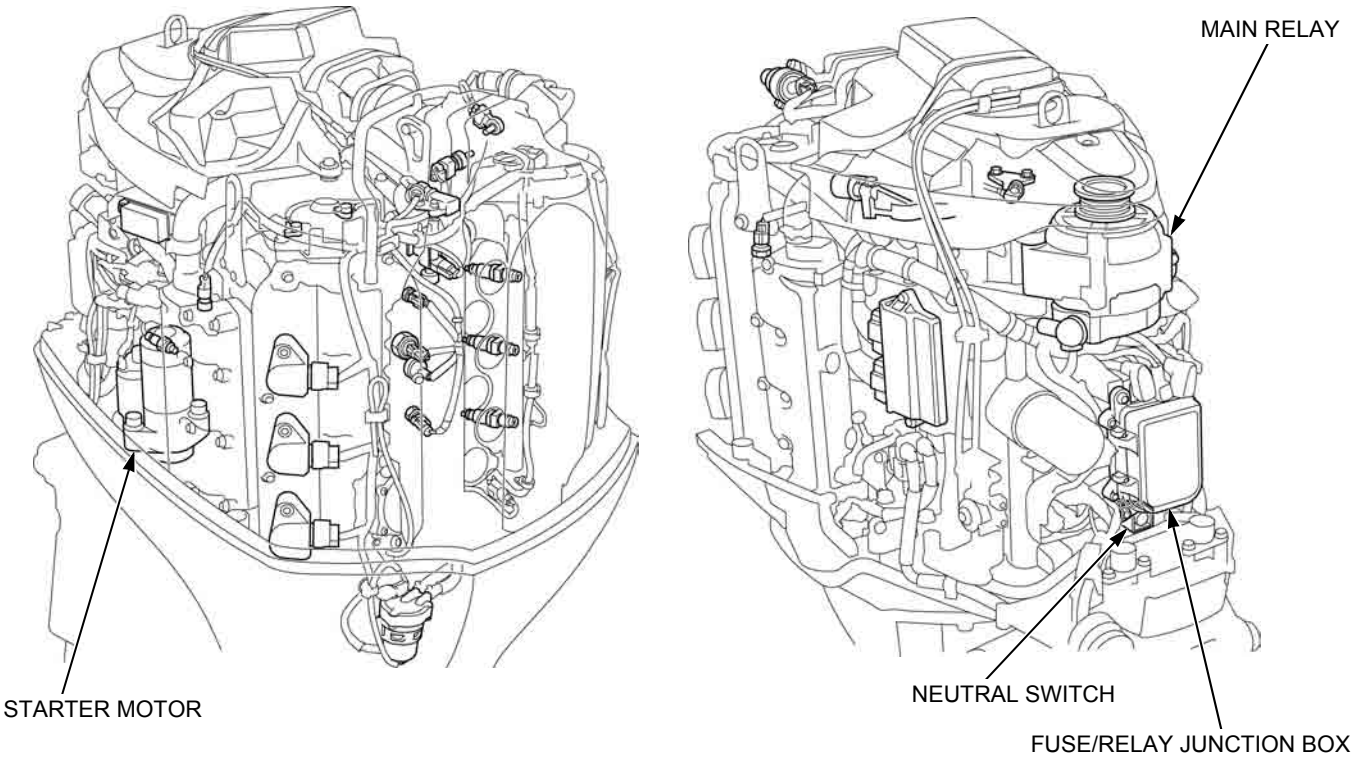
NEUTRAL SWITCH REMOVAL/ INSTALLATION 9-6

STARTER MOTOR DISASSEMBLY/ ASSEMBLY 9-6

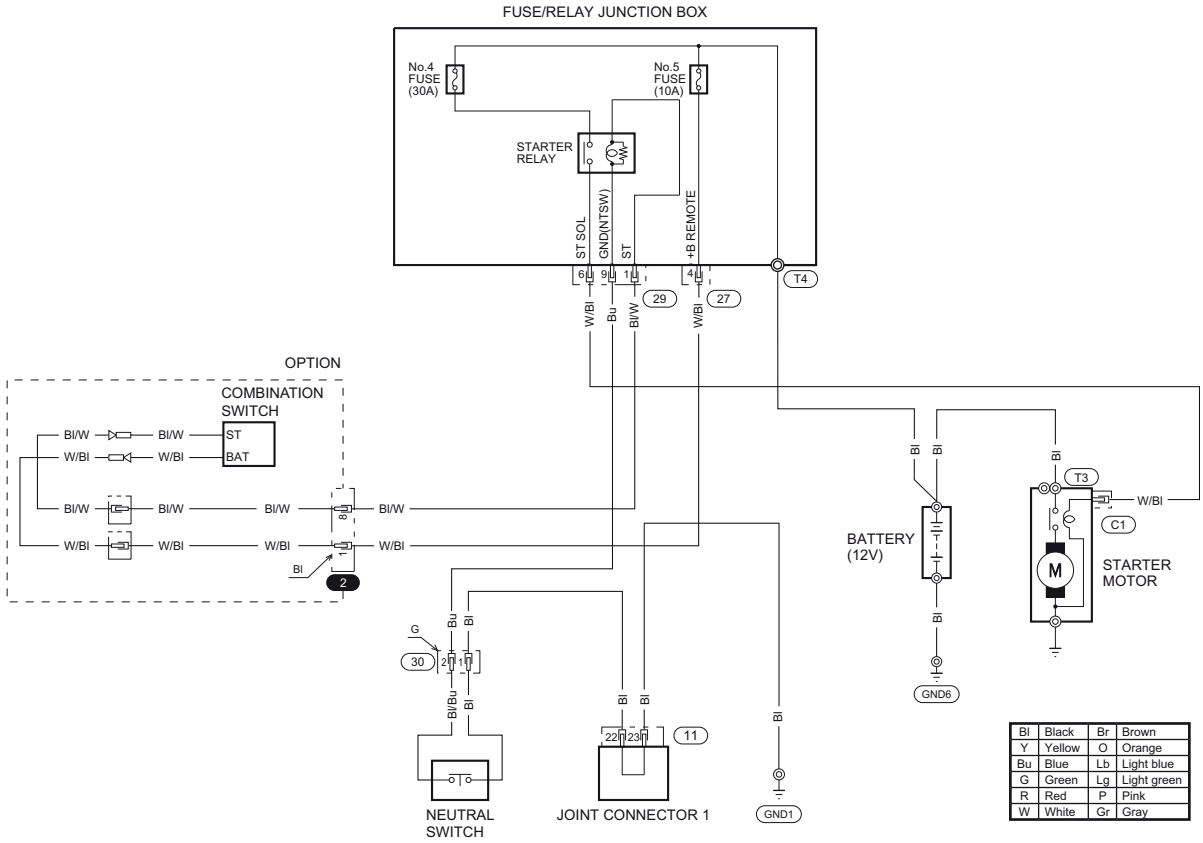
STARTER MOTOR INSPECTION 9-16

NEUTRAL SWITCH INSPECTION 9-20

SYSTEM LOCATION



SYSTEM DIAGRAM



STARTING SYSTEM TROUBLESHOOTING

STARTER MOTOR DOES NOT TURN

1. Standard inspection

Check the following:

– Battery condition
– Burned No. 4 (30 A) fuse
– Burned No. 5 (10 A) fuse

Are the above items in good condition?

YES – GO TO STEP 2.

NO – Replace or repair the malfunctioning part(s).

2. Starter switch operation inspection

Turn the combination switch to the START position.
Check the operation of the starter relay.

Does the starter relay click?

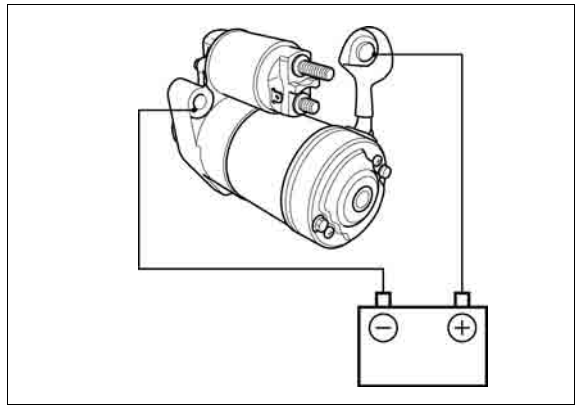
YES – GO TO STEP 3.

NO – GO TO STEP 5.

3. Starter motor inspection

Turn the combination switch OFF.
Remove the starter motor (page 9-5).

Apply battery voltage to the starter motor directly and check the operation (A large amount of current flows, so do not use a thin wire).



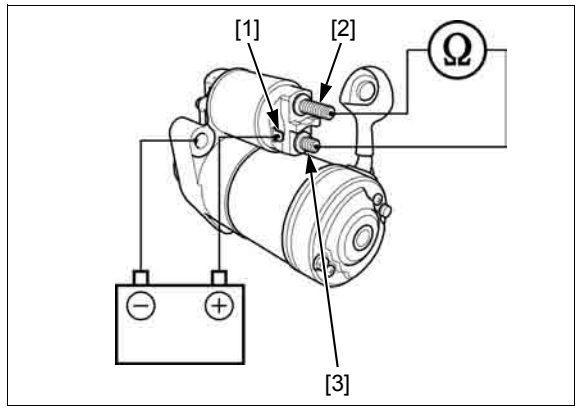
Does the starter motor turn?

YES – • Poorly connected starter motor cable
• Faulty starter magnetic switch

NO – GO TO STEP 4.

4. Starter magnetic switch inspection

Apply battery voltage to the starter solenoid S terminal [1] and starter motor body.
Check for continuity at the starter motor B terminal [2] and starter motor M terminal [3].



Is there continuity by connecting the battery?

YES – GO TO STEP 5.

NO – Faulty starter magnetic switch.

5. Starter relay coil line open circuit inspection

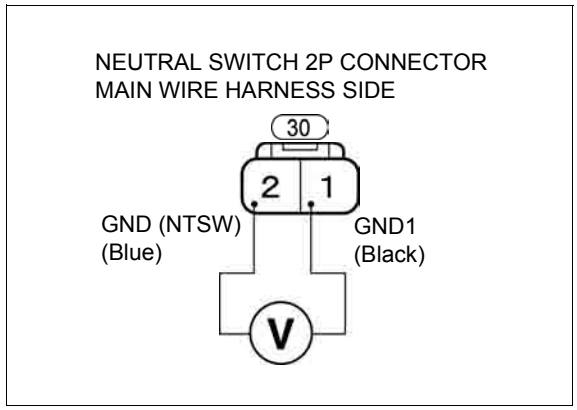
Disconnect the neutral switch 2P connector (30).

Turn the combination switch to the START position. Measure the voltage at the neutral switch 2P connector (30) main wire harness side No.2 (Blue) terminal and No.1 (Black) terminal.

Does battery voltage exist?

YES – Faulty neutral switch

NO – GO TO STEP 6.



6. Combination switch open circuit inspection

Turn the combination switch OFF.

Disconnect the switch panel wire harness 14P connector 2.

Turn the combination switch to START position.

Check for the continuity at the switch panel wire harness 14P connector 2 switch panel side No.1 (White/Black) terminal and No.8 (Black/White) terminal.

Is there continuity?

YES – GO TO STEP 7.

NO – • Repair the open circuit in the combination switch wire
• Replace the combination switch with a new one and recheck

7. Starter relay Inspection

Inspect the starter relay (page 10-11).

Is the starter relay normal?

YES – GO TO STEP 8.

NO – Replace the starter relay with a one and recheck.

8. Fuse/relay junction box inspection

Inspect the fuse/relay junction box starter relay circuit (page 10-13).

Is the fuse/relay junction box normal?

YES – • Repair the open circuit in the main wire harness.
• Poorly connected connector.

NO – Replace the fuse/relay junction box with a new one and recheck.

STARTER MOTOR TURNS SLOWLY

- Low battery voltage
- Poorly connected battery terminal cable
- Poorly connected starter motor cable
- Faulty starter motor
- Poorly connected battery ground cable
- Incorrect engine oil viscosity

STARTER MOTOR TURNS, BUT ENGINE DOES NOT TURN

- Starter motor is running backwards
  – Case assembled improperly
  – Terminals connected improperly
- Faulty starter overrunning clutch
- Damaged or faulty starter planetary gear

STARTER RELAY SWITCH "CLICKS", BUT ENGINE DOES NOT TURN OVER

- Crankshaft does not turn due to engine problems

STARTER MOTOR REMOVAL/ INSTALLATION

Disconnect the battery negative (–) terminal, then the positive (+) terminal from the battery.

Remove the engine cover.

Remove the three bolt/washers (6 x 27 mm) [1] and release the power tilt relay case [2] from cylinder block.

Disconnect the L. water return tube [3] from the L. exhaust manifold and remove the tube clamp (D10.5) [4].

Disconnect the starter motor S terminal [5].

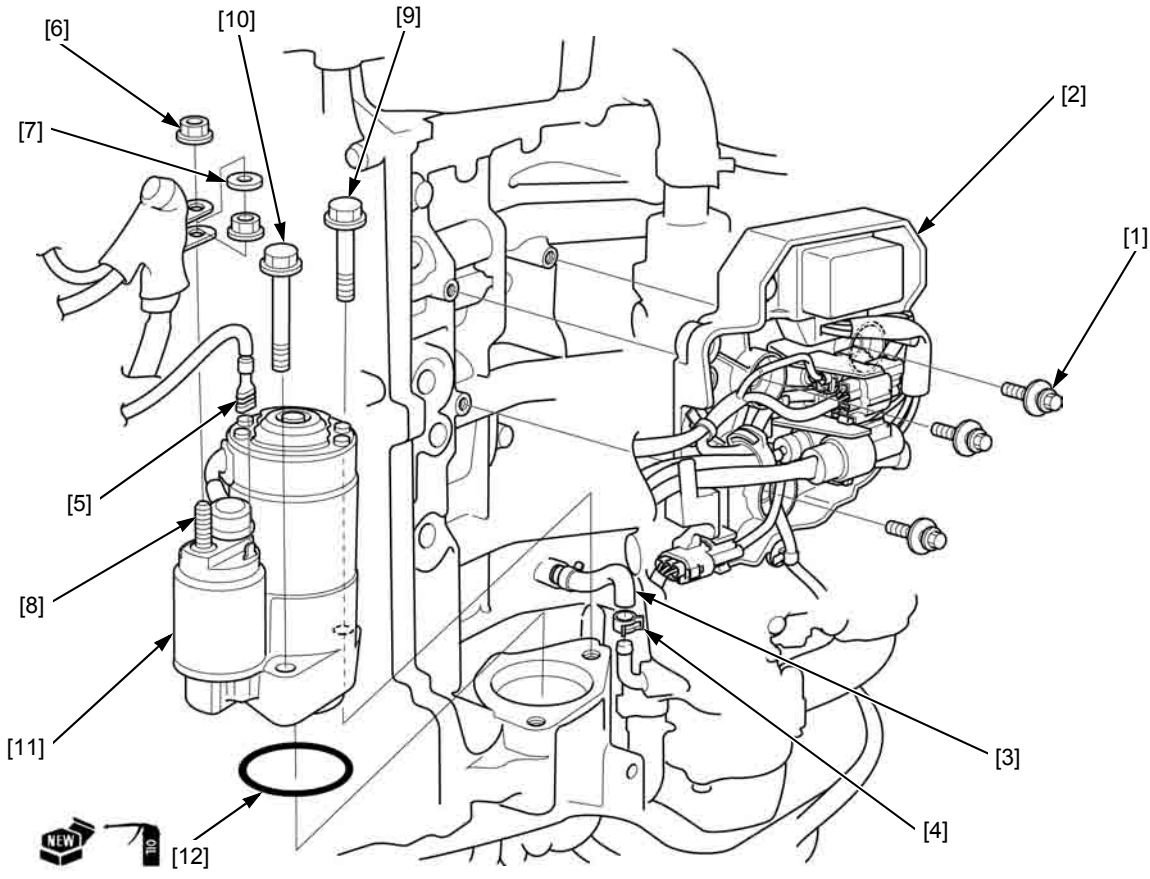
Remove the two nuts (8 mm) [6] and washer (8 mm) [7] and starter cable 2 (+) from the starter motor B terminal [8].

Remove the bolts (10 x 90 mm) [9], (10 x 110 mm) [10] and starter motor [11].

Installation is in the reverse order of removal.

TORQUE:
Starter motor bolt (10 x 90 mm):
44 N·m (4.5 kgf·m, 32 lbf·ft)
Starter motor bolt (10 x 110 mm):
44 N·m (4.5 kgf·m, 32 lbf·ft)
Starter motor B terminal nut:
11 N·m (1.1 kgf·m, 8 lbf·ft)

- Replace the O-ring (59.4 x 3.1 mm) [12] with a new one and coat it with engine oil.



NEUTRAL SWITCH REMOVAL/ INSTALLATION

Remove the electric parts case (page 10-4).

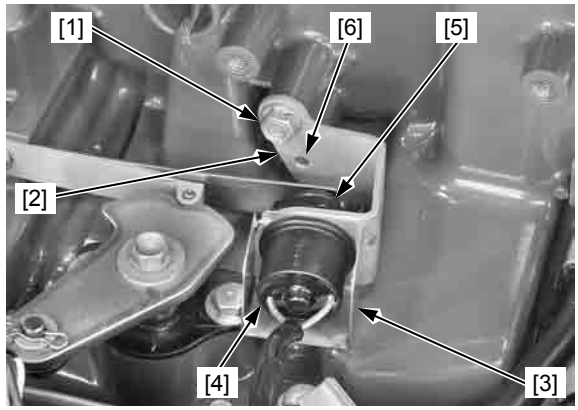
Remove the bolt (6 x 14 mm) [1] and neutral switch bracket [2] from the crankcase.

Remove the neutral switch plate [3] and neutral switch [4] from the bracket by removing the neutral switch nut (20 mm) [5].

Installation is in the reverse order of removal.

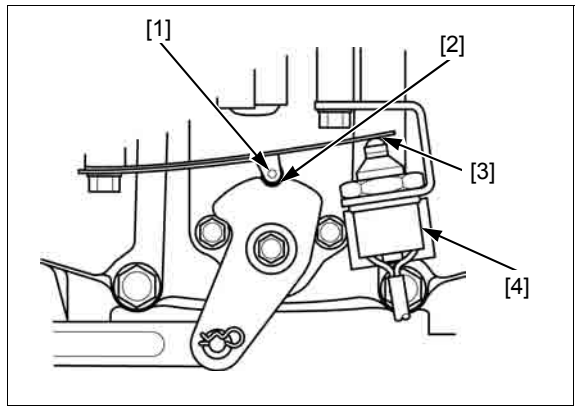
TORQUE:
Neutral switch nut:
2.5 N·m (0.26 kgf·m, 1.8 lbf·ft)

When installing the neutral switch bracket, align its hole [6] with the boss of the crankcase.



Make sure the click spring roller [1] is in the shift arm groove [2] and assist spring tip [3] is connecting the neutral switch [4] is pushed in with the shift lever in the neutral position.
Make sure the assist spring tip does not contact the neutral switch when the shift lever is in either forward or reverse.

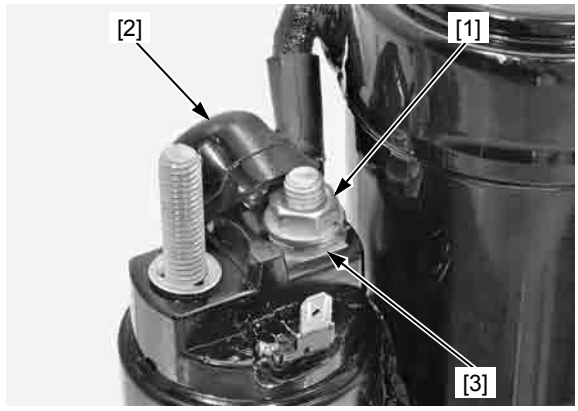
Install the electric parts case (page 10-4).



STARTER MOTOR DISASSEMBLY/ ASSEMBLY

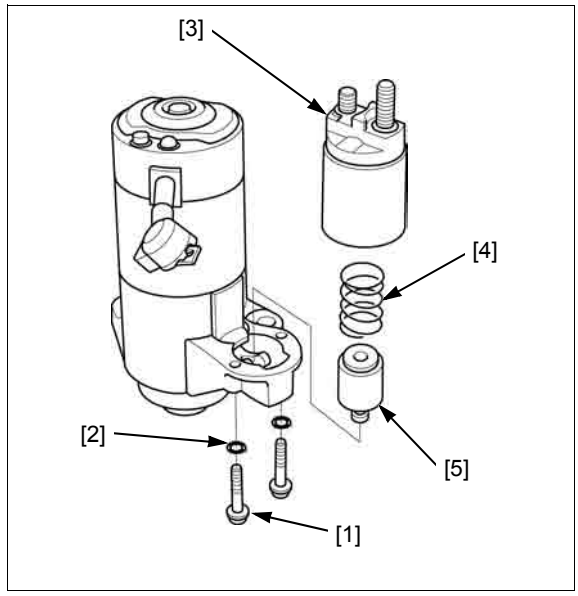
DISASSEMBLY

Remove the nut [1] by pulling off the terminal cover [2] and disconnect the motor wire [3] from the M terminal.



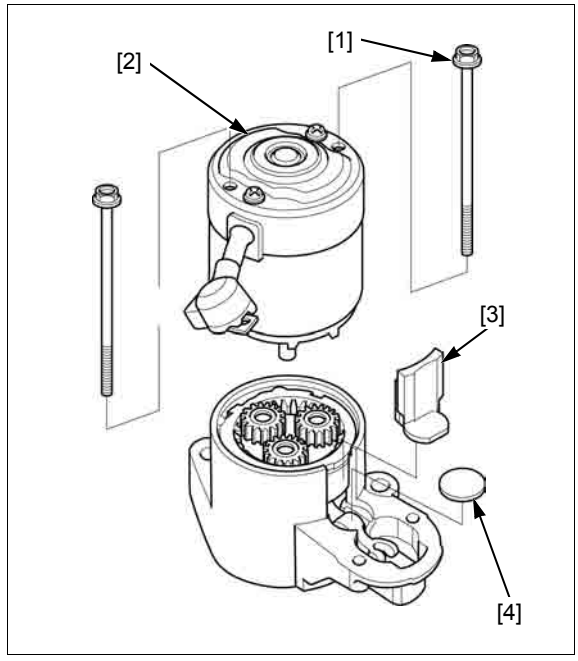
Remove the two screws (6 x 22 mm) [1] and the two O-rings [2].

Remove the starter magnetic switch [3], spring [4], and the plunger [5].

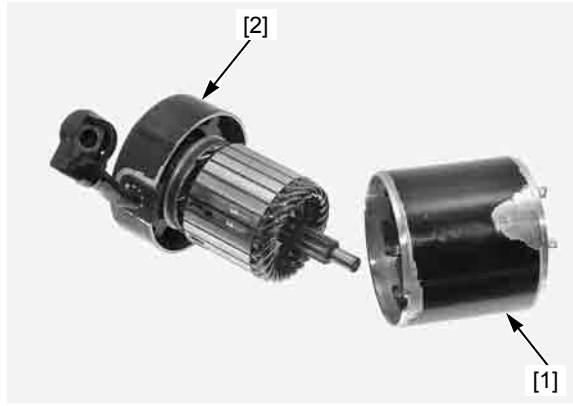


Remove the two bolt screws [1] and remove the yoke/rear bracket [2].

Remove the packing [3] and plate [4].



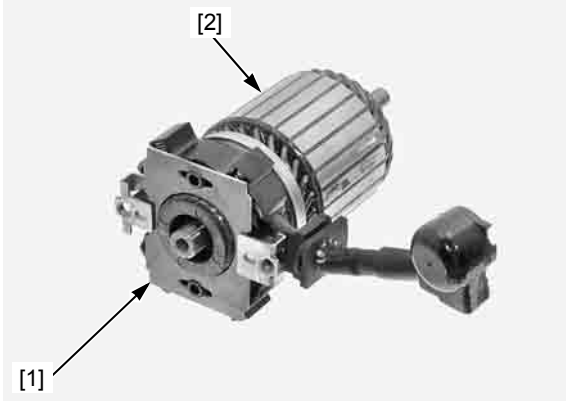
Remove the yoke [1] from the armature/rear bracket assembly [2].



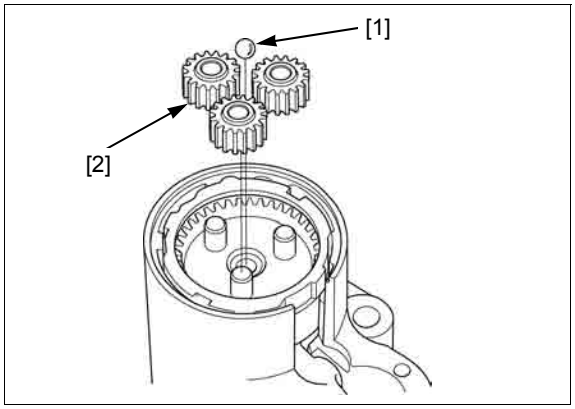
Remove the two screws (5 x 8 mm) [1] and rear bracket [2].



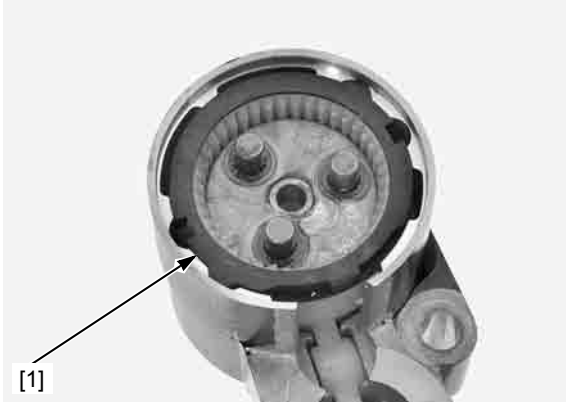
Remove the brush holder [1] from the armature [2].



Remove the steel ball [1] and three planetary gears [2].

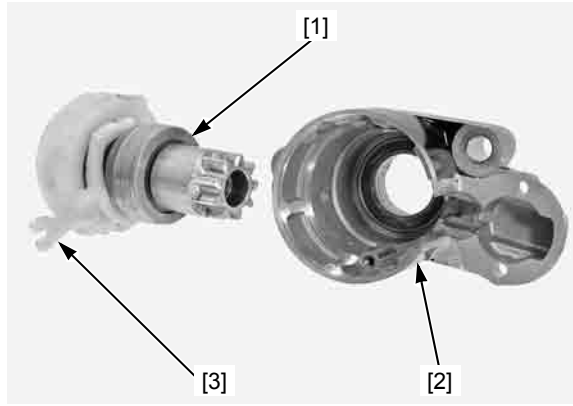


Remove the packing [1].



Remove the overrunning clutch [1] from the front bracket [2].

Remove the clutch fork [3] from the overrunning clutch.



Secure the gear shaft [1] by placing a wood block [2] under the gear shaft assembly.

NOTICE

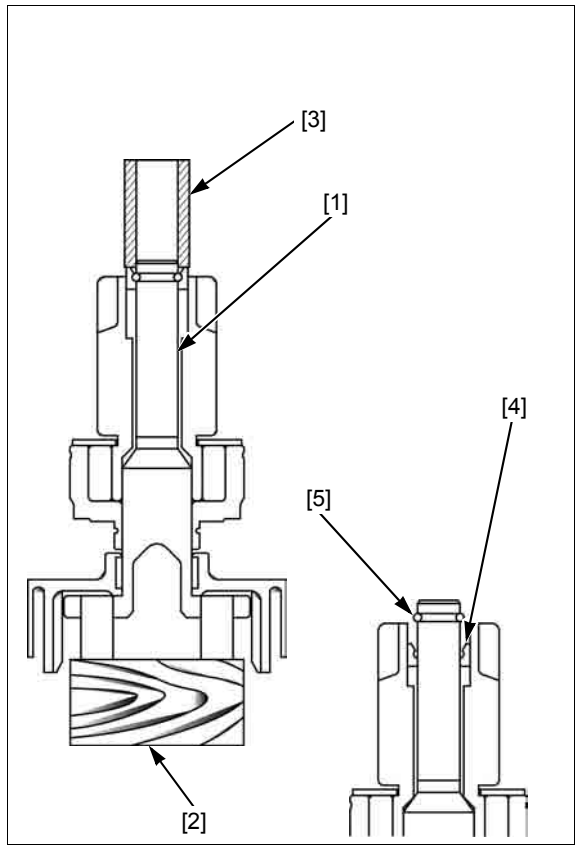
Secure the gear shaft assembly, being careful that the internal gear does not contact the wood block.

Prepare a pipe [3] 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)

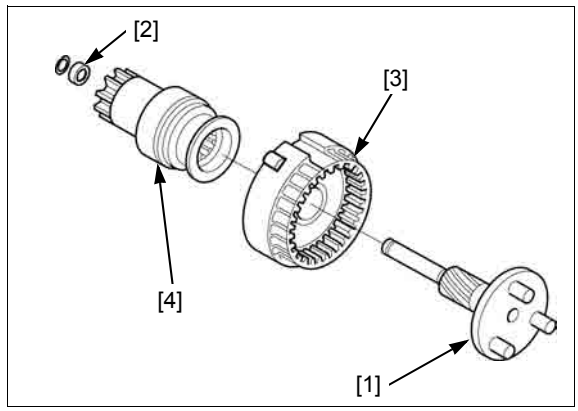
Set the pipe on the gear shaft stopper [4] and drop the gear shaft stopper by tapping on the pipe.

Remove the snap ring [5] using a screwdriver or equivalent tool.

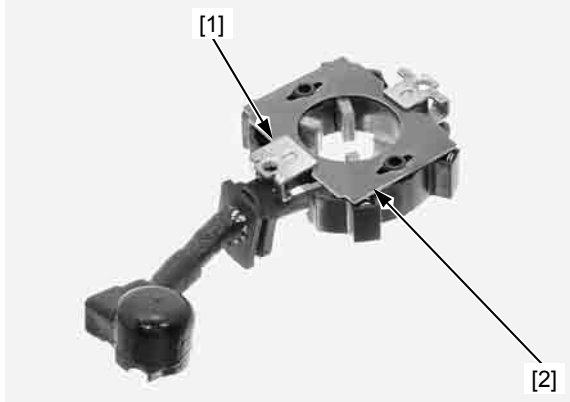


Remove the gear shaft [1] and gear shaft stopper [2].

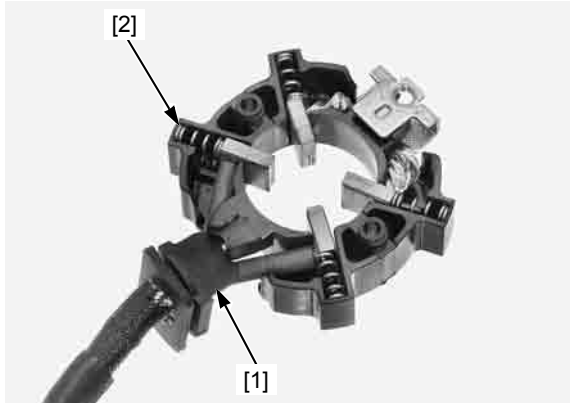
Remove the internal gear [3] and overrunning clutch [4].



Remove the clip [1] and plate [2].



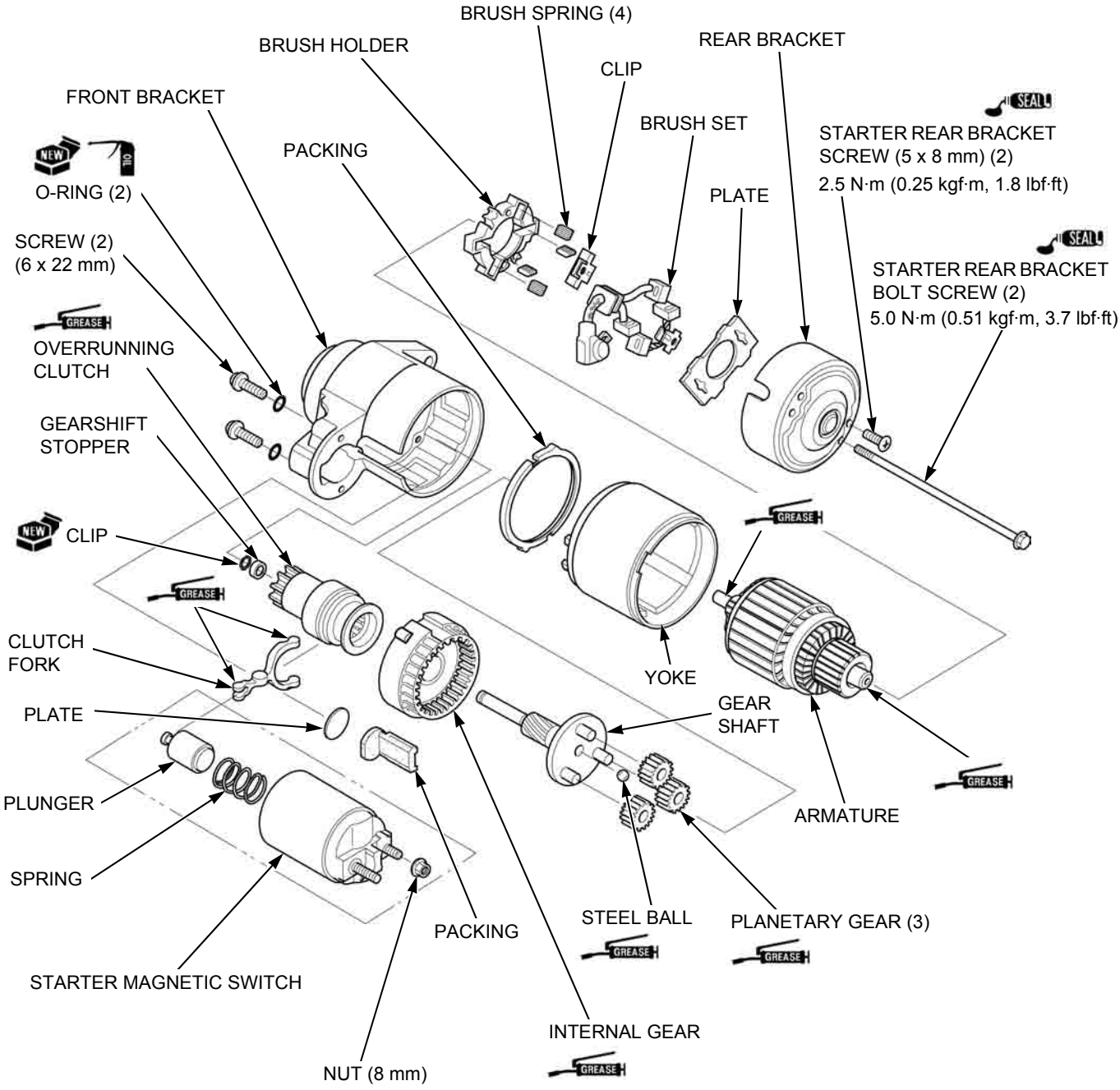
Remove the brush sets [1] and four brush springs [2].



EXPLODED VIEW

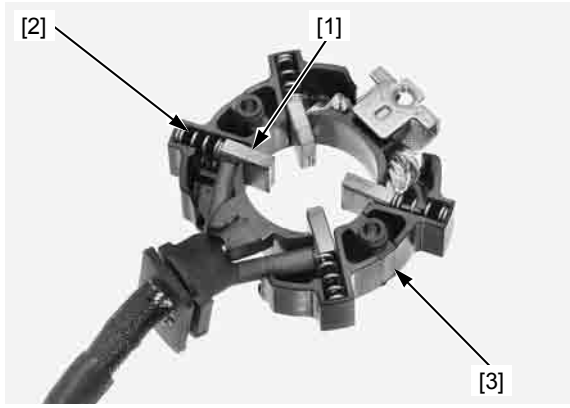
NOTICE

- *After assembling the starter motor, apply a sufficient amount of water resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the mating sections of each part (page 9-16).*



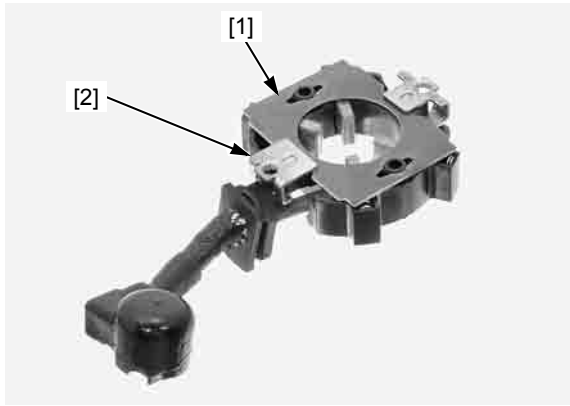
ASSEMBLY

Install the brushes [1] and four brush springs [2] on the brush holder [3].



Install the plate [1] on the brush holder.

Secure the plate with the clip [2].

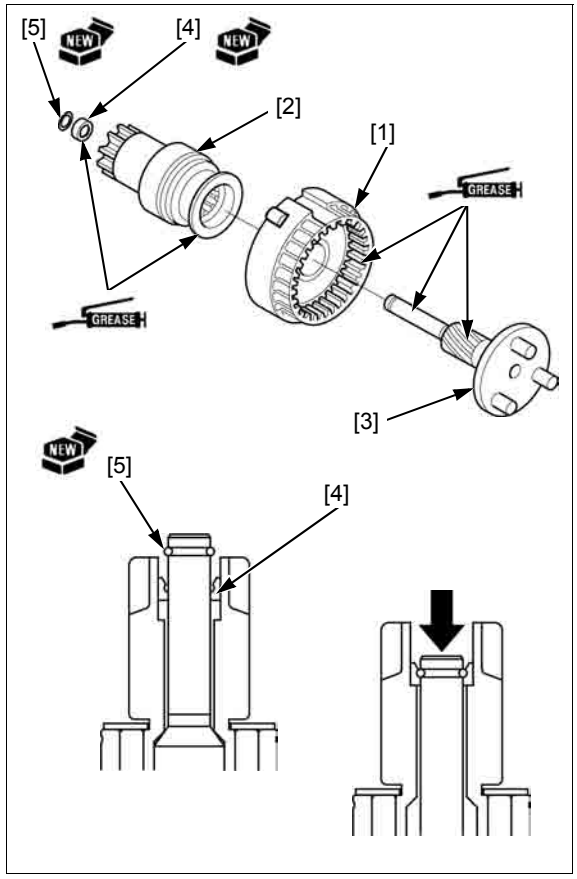


Apply grease to the internal gear [1], inner wall of the overrunning clutch [2], gear shaft [3] sliding surface, and the surface of a new gear shaft stopper [4].

Assemble the overrunning clutch, gear shaft, and the gear shaft stopper with the internal gear.

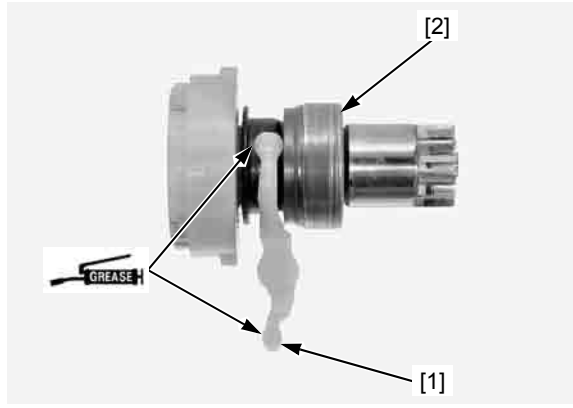
Install a new snap ring [5].

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.



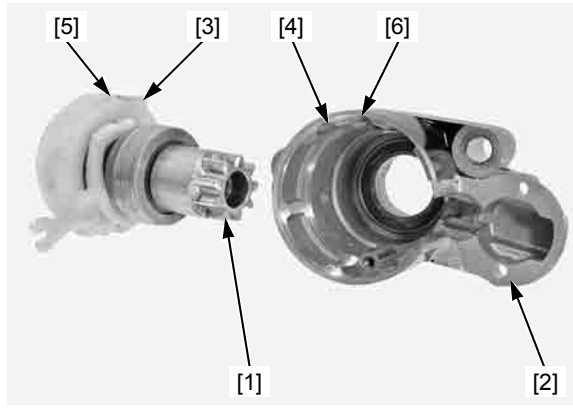
Apply grease to the sliding surface of the clutch fork [1].

Set the clutch fork in the indicated position of the overrunning clutch groove [2] as shown.



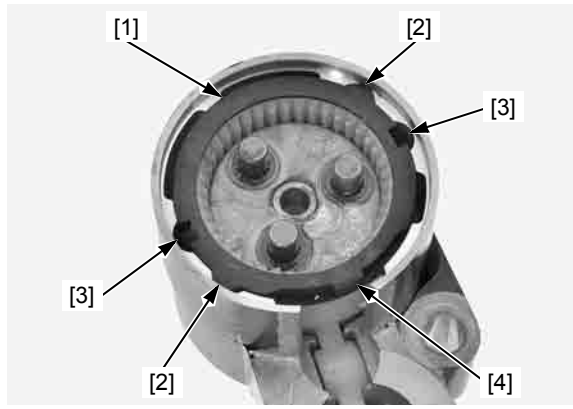
Install the overrunning clutch [1] assembly on the front bracket [2].

- Install the overrunning clutch by aligning the projection [3] on the outer surface of the internal gear with the groove [4] in the front bracket and groove [5] on the outer surface of the internal gear with the bolt hole groove [6] in the front bracket.



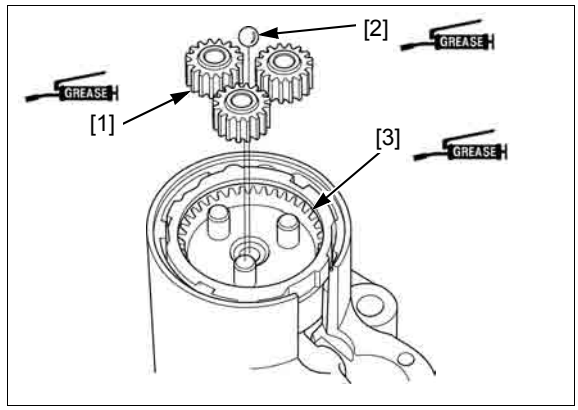
Install the packing [1].

- Install the packing by aligning the projections [2] on the packing with the grooves in the front bracket, and aligning the notches [3] on the packing with the bolt hole in the front bracket.
- Make sure the projection on the packing facing forward the clutch fork side.



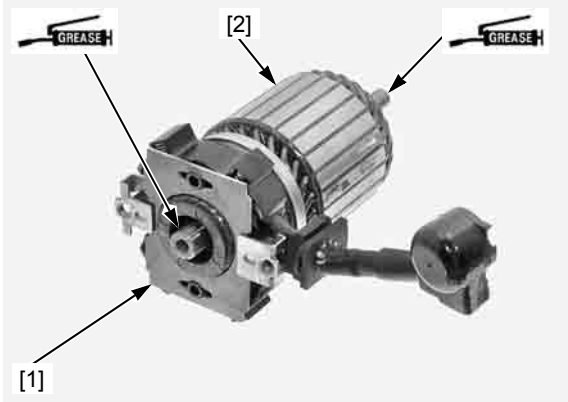
Apply grease to the planetary gears [1], steel ball [2], and the internal gear [3].

Install the three planetary gears and steel ball.



Install the brush holder [1] on the armature [2].

Apply grease to the armature shaft.



Install the rear bracket [1] as shown.

Apply the water resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the seat of each screw [2].

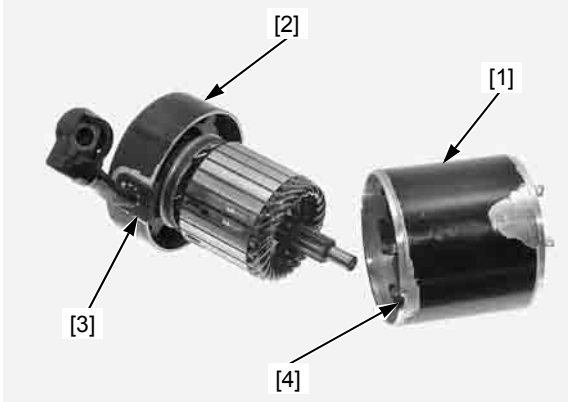
Install and tighten the screws (5 x 8 mm) to the specified torque.

TORQUE: 2.5 N·m (0.25 kgf·m, 1.8 lbf·ft)



Check the inner wall of the yoke [1] for foreign material and install the armature/rear bracket assembly [2] to the yoke.

- Install the armature/rear bracket assembly by aligning the grommet [3] with the cutout [4] in the yoke.



Install the plate [1] and packing [2] on the front bracket [3].

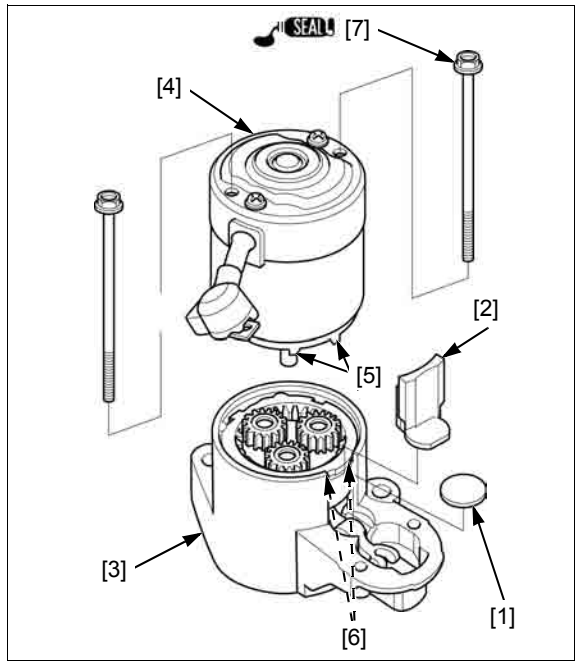
Install the yoke/rear bracket assembly [4].

- Install by aligning the projection [5] on the yoke with the cutout [6] in the front bracket.

Apply water resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the seat of each bolt [7].

Tighten the two bolt screws to the specified torque.

TORQUE: 5.0 N·m (0.51 kgf·m, 3.7 lbf·ft)



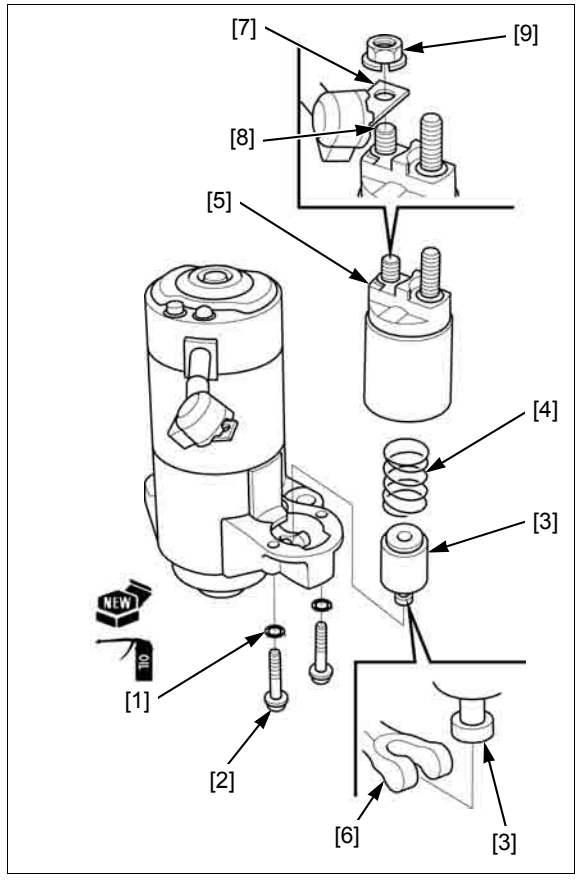
Apply engine oil to new O-rings [1] and install them on the screws (6 x 22 mm) [2].

Install the plunger [3], spring [4], and the starter magnetic switch [5].

- Assemble the plunger and clutch fork [6] as shown.

Install and tighten the two screws.

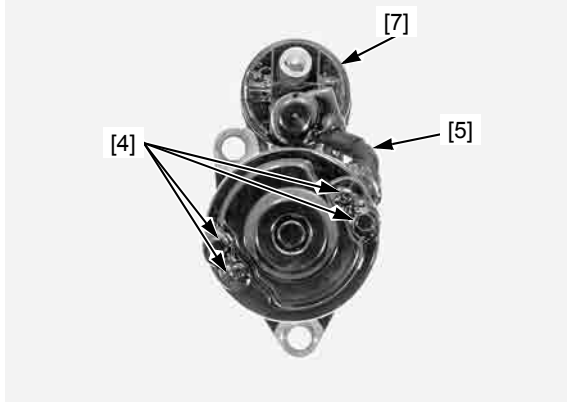
Connect the motor wire [7] to the brush terminal (M terminal [8]) and tighten the nut [9].

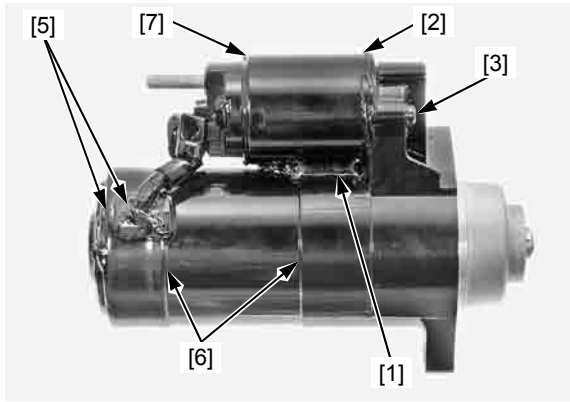


WATER RESISTING SEALANT APPLICATION POINTS

After the assembling the starter motor, apply a sufficient amount of water-resisting sealant (Sumitomo 3M Padding Sealer #8533 or equivalent) to the mating surfaces as shown.

– Packing/front bracket mating section [1]
– Switch assembly/front bracket mating section [2]
– Switch mounting screw [3]
– Screw/ bolt and rear bracket mating sections [4]
– Wire, grommet and rear bracket [5]
– Engagement sections with yoke [6]
– Magnetic switch case caulking section [7]



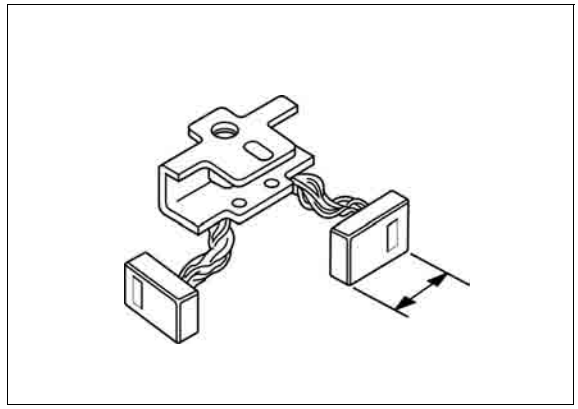


STARTER MOTOR INSPECTION

BRUSH LENGTH

Measure the brush length. If brush length is less than the service limit, replace the brushes as a set.

STANDARD: 12.3 mm (0.48 in)
SERVICE LIMIT: 7.0 mm (0.28 in)

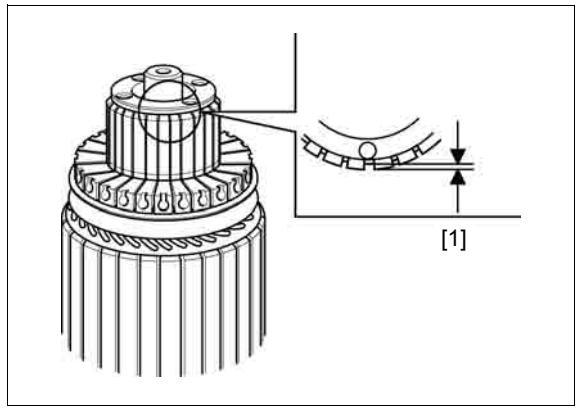


INSULATION DEPTH

Measure the mica depth [1].

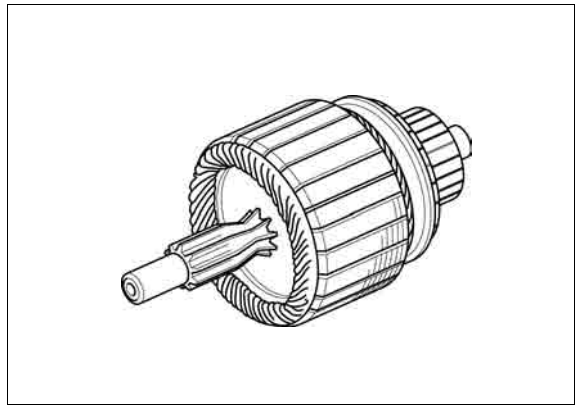
If the grooves are clogged or mica depth is less than the service limit, recut the grooves using a hacksaw blade or a small file.

STANDARD: 0.40 – 0.50 mm (0.016 – 0.020 in)
SERVICE LIMIT: 0.20 mm (0.008 in)



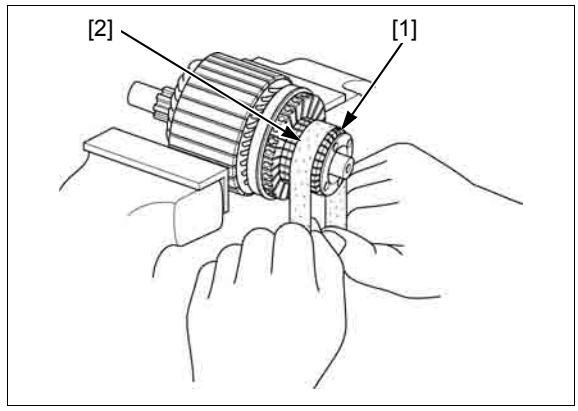
ARMATURE

Check the armature and shaft gear for wear and damage.



Check the commutator [1] for damage, dust, dirt, and metal particles.

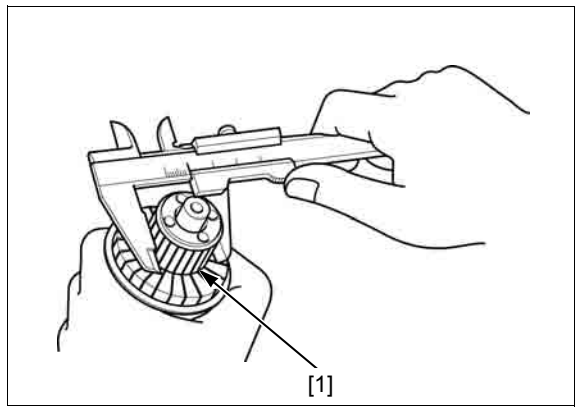
If there is stain, irregularity, and/or evidence of burning, clean with emery paper [2] #500 or #600.



Measure the commutator [1] O.D.

STANDARD: 29.4 mm (1.16 in)
SERVICE LIMIT: 28.8 mm (1.13 in)

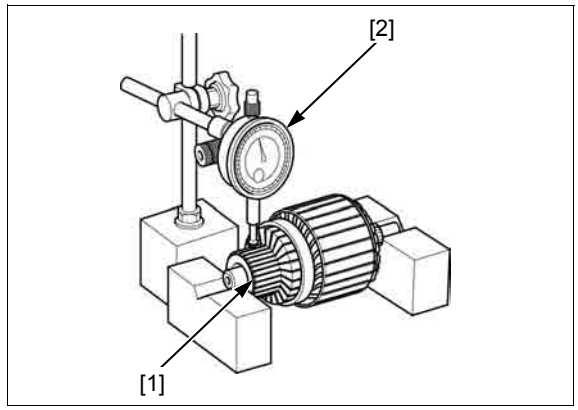
If the measurement is less than the service limit, replace the armature with a new one.



Measure commutator [1] runout using a dial gauge [2].

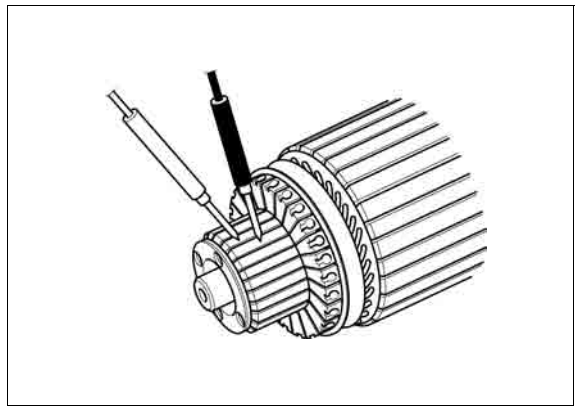
SERVICE LIMIT: 0.10 mm (0.004 in)

If the measurement is more than the service limit, replace the armature with a new one.



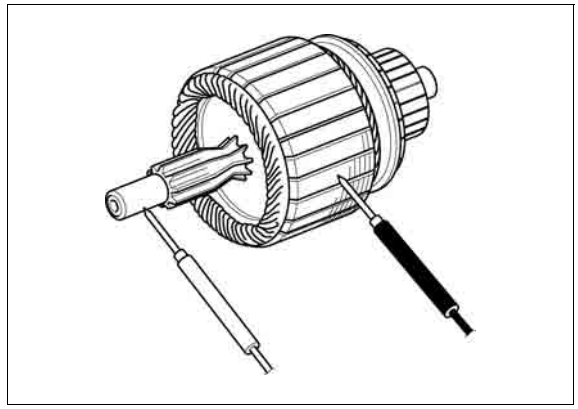
Check for continuity between each segment.

If an open circuit exists between any two segments, replace the armature.



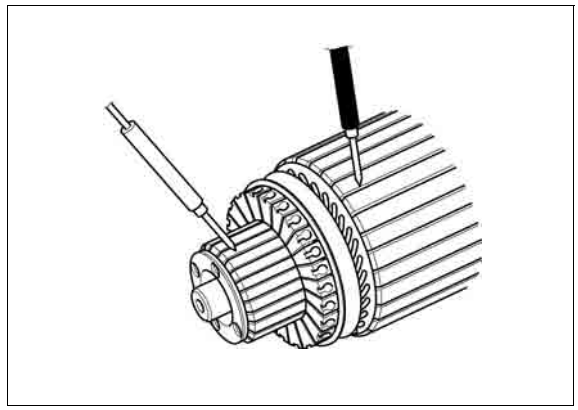
Check for continuity between the armature and armature shaft.

If there is continuity, replace the armature.



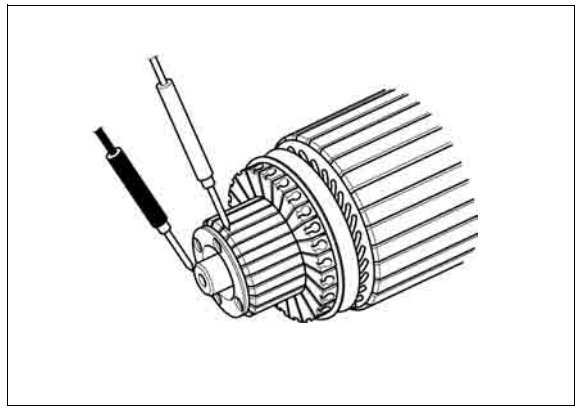
Check for continuity between the commutator and armature coil core.

If continuity exists, replace the armature.



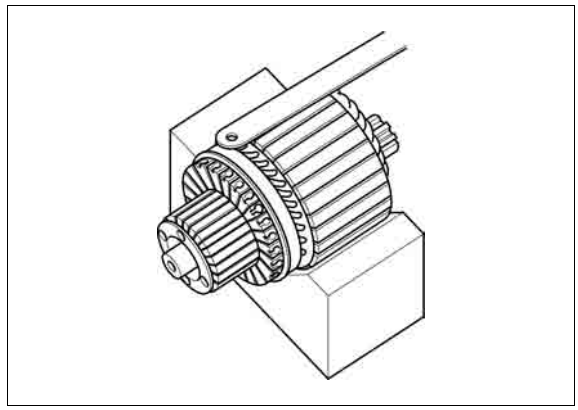
Check for continuity between the commutator and armature shaft.

If there is continuity, replace the armature.



Place the armature in an armature tester (commercially available).

Hold a hacksaw blade close to the armature core. If the blade is attracted to the core or vibrates when the core is turned, the armature is shorted. Replace the armature.

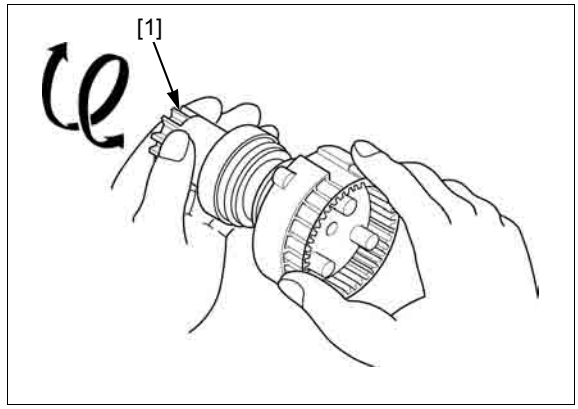


OVERRUNNING CLUTCH

Check the overrunning clutch [1] for smooth axial movement.

Clean or apply grease to the spline, if necessary.

If the overrunning clutch does not move smoothly after cleaning or coated with grease, replace the overrunning clutch or the gear shaft assembly.

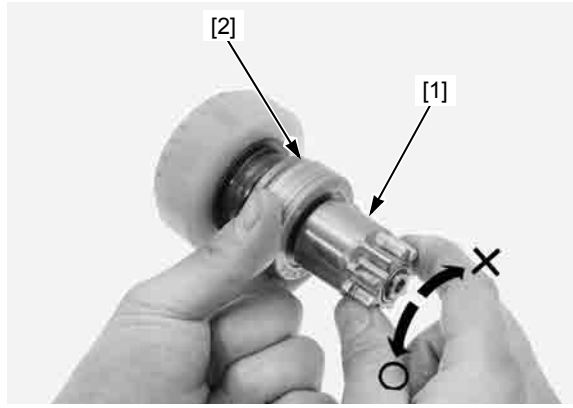


Turn the gear shaft assembly [1] by holding the overrunning clutch [2]. The gear shaft assembly should turn only counterclockwise.

If the clutch turns freely in both directions or if it does not turn at all, replace the overrunning clutch.

Check the pinion gear teeth for wear and damage and replace if necessary.

If the pinion gear is worn or damaged, the flywheel ring gear must be inspected (page 15-26).



NEUTRAL SWITCH INSPECTION

INSPECTION

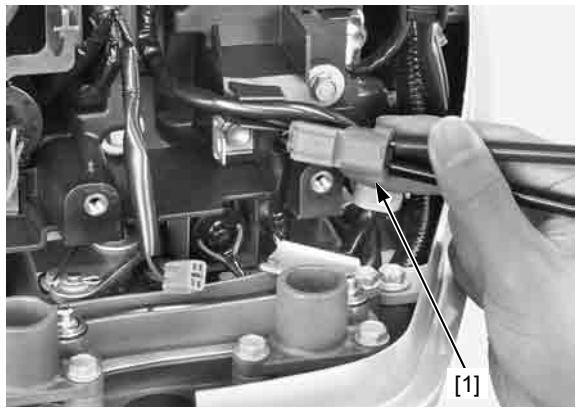
Remove the fuse/relay junction box (page 10-3).

Disconnect the neutral switch 2P connector [1] and release the connector from the connector holder.

Attach the tester leads to the two terminals at the neutral switch.

Continuity should exist at each position as follows:

SWITCH PUSHED (Shift lever in "N")	Continuity
SWITCH RELEASED (Shift lever in "F" or "R")	No continuity



SYSTEM LOCATION 10-2

FUSE RELAY JUNCTION BOX REMOVAL/ INSTALLATION 10-3

ELECTRIC PARTS CASE REMOVAL/ INSTALLATION 10-4

ECM REMOVAL/INSTALLATION 10-5

ECM BRACKET REMOVAL/ INSTALLATION 10-5

POWER TILT RELAY/POWER TILT RELAY CASE REMOVAL/INSTALLATION 10-6

SWITCH PANEL INDICATOR WIRE HARNESSES REMOVAL/ INSTALLATION 10-8

RELAY REMOVAL/INSTALLATION 10-10

MAIN/STARTER RELAY INSPECTION ... 10-11

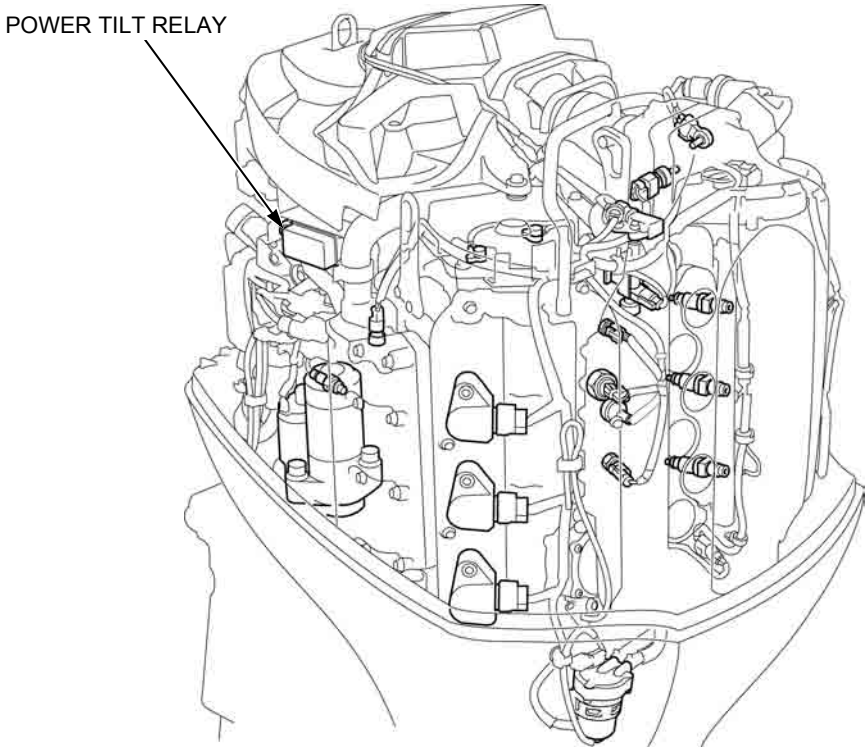
FUEL PUMP RELAY INSPECTION 10-11

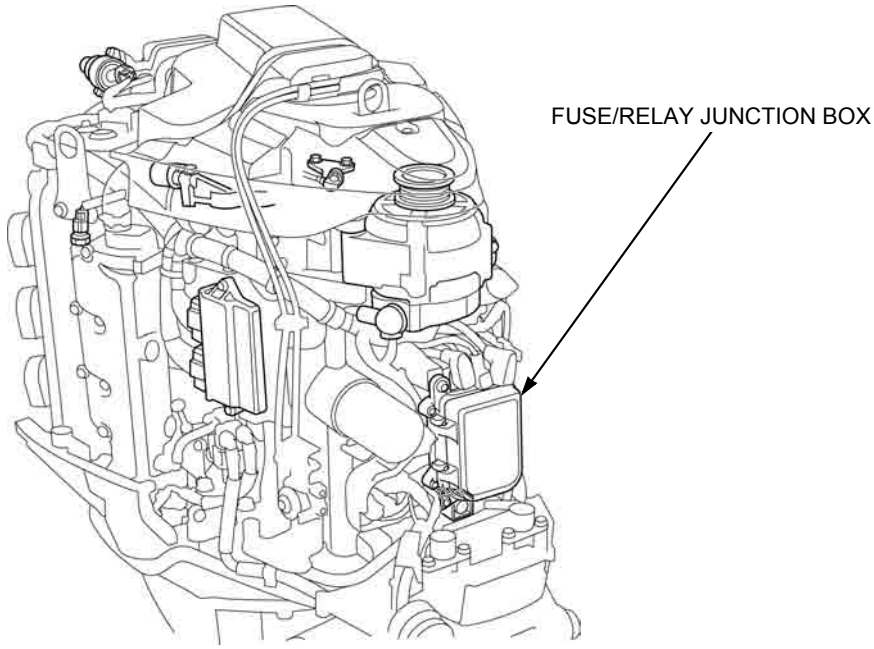
FUSE/RELAY JUNCTION BOX INSPECTION 10-12

POWER TILT RELAY INSPECTION 10-14

TRIM ANGLE SENSOR INSPECTION 10-15

SYSTEM LOCATION





FUSE RELAY JUNCTION BOX REMOVAL/INSTALLATION

REMOVAL

Disconnect the battery negative (–) cable, then the positive (+) cable from the battery.

Remove the engine cover.

Remove the following:

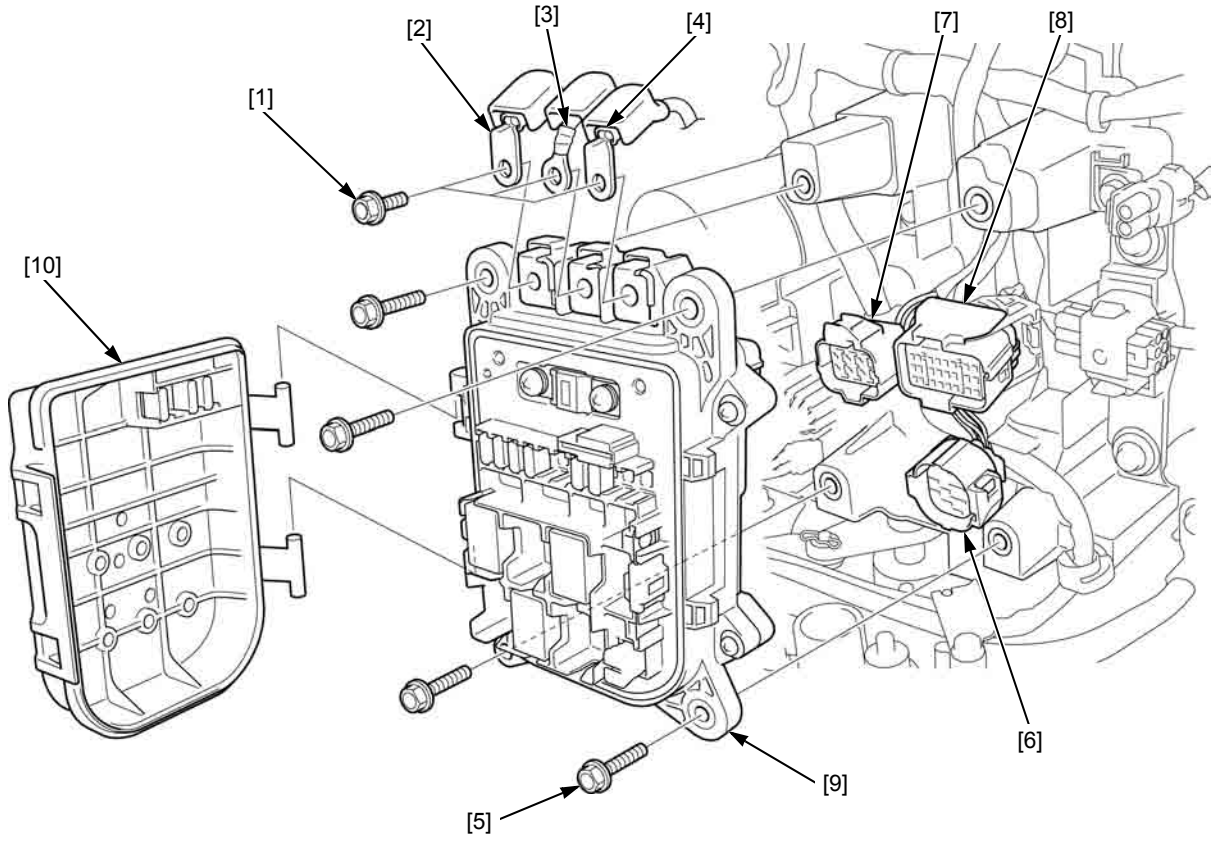
– Fuse/relay junction box terminal bolts (6 x 22 mm) [1] (three)
– Power tilt relay cable [2]
– Starter cable 1 (+) [3]
– ACG cable [4]
– Fuse/relay junction box mounting bolts (6 x 20 mm) [5] (four)
– Fuse/relay junction box 10P connector [6]
– Fuse/relay junction box 8P connector [7]
– Fuse/relay junction box 23P connector [8]
– Fuse/relay junction box [9]

Remove the fuse/relay junction box cover [10] from the fuse/relay junction box.

Installation is in the reverse order of removal.

TORQUE:
Fuse/relay junction box mounting bolt:
5.0 N·m (0.51 kgf·m, 3.7 lbf·ft)
Fuse/relay junction box terminal bolt:
8.5 N·m (0.87 kgf·m, 6.3 lbf·ft)

NOTE:
• Route the wire harness properly (page 2-19).

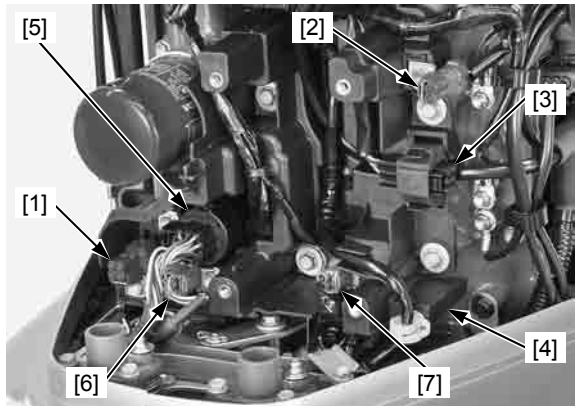


ELECTRIC PARTS CASE REMOVAL/ INSTALLATION

Remove the fuse/relay junction box (page 10-3).

Remove the DLC [1], tach pulse 2P connector [2] and interface 6P connector [3] from the electric parts case [4].

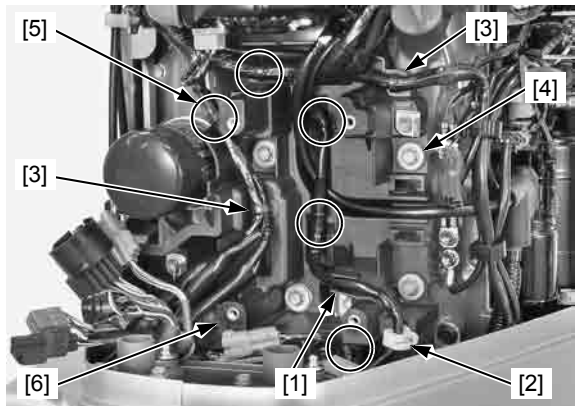
Disconnect the switch panel wire harness 14P connector [5], indicator wire harness 6P connector [6] and neutral switch 2P connector [7].



Release the starter cable 1 (+) [1] from the wire harness clip [2].

Remove the main wire harness from the two harness band clips [3]

Remove the four bolt/washers (6 x 26 mm) [4], the five harness band clips [5] and the electric parts case [6].



Remove the following parts from the electric parts case [1]:

– Connector holder mounting bolts (6 x 10 mm) [2] (five)
– Connector holders [3] (five)
– Collars [4] (four)
– Grommets [5] (four)
– Wire harness clip [6]
– Harness band clips [7] (two)

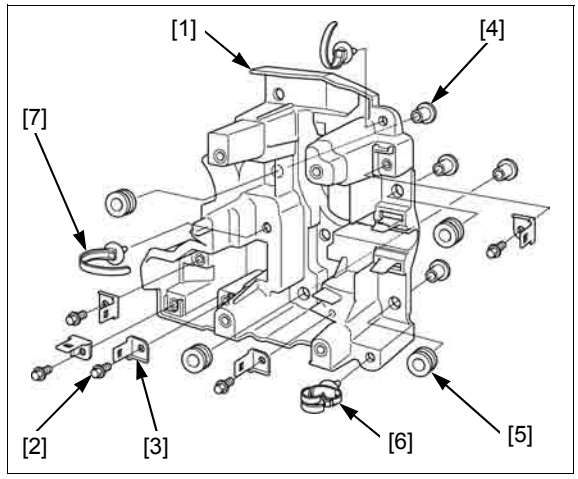
Installation is in the reverse order of removal.

NOTE:

• Route the wire harness properly (page 2-19).

TORQUE:

Connector holder mounting bolt:
5.0 N·m (0.51 kgf·m, 3.7 lbf·ft)



ECM REMOVAL/INSTALLATION

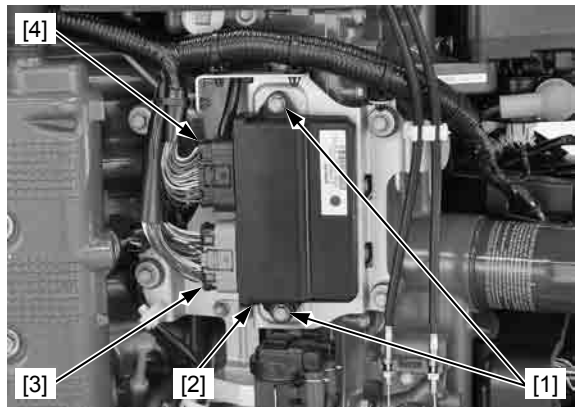
Disconnect the battery negative (–) cable, then the positive (+) cable from the battery.

Remove the engine cover.

Remove the two bolts (6 x 20 mm) [1] and the ECM [2].

Disconnect the ECM connector A [3] and B [4].

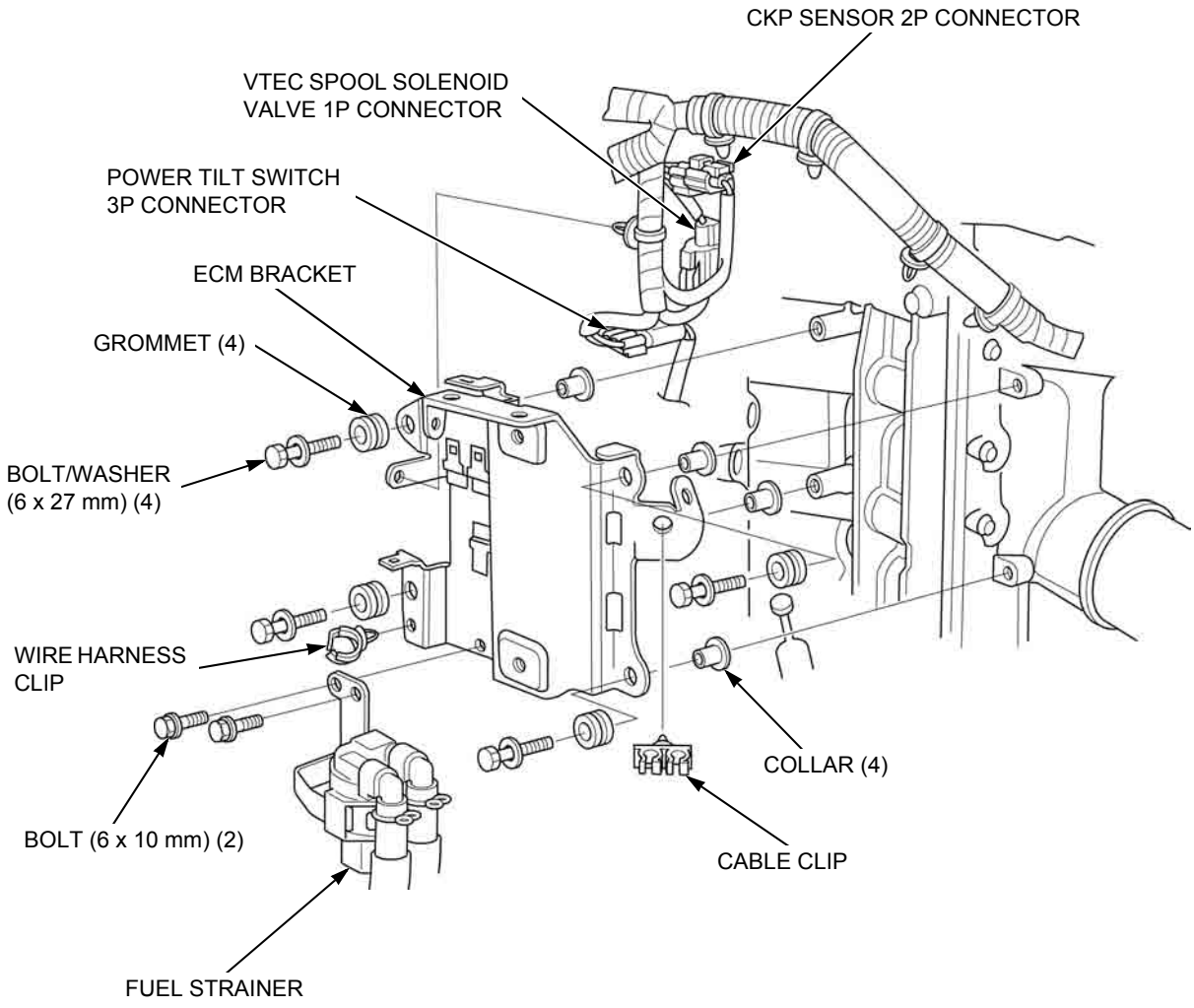
Installation is in the reverse order of removal.



ECM BRACKET REMOVAL/ INSTALLATION

Disconnect the battery negative (–) cable, then the positive (+) cable from the battery.

Remove the ECM (page 10-5).

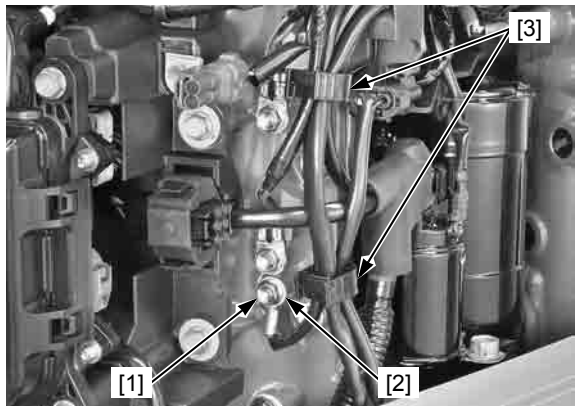


POWER TILT RELAY/POWER TILT RELAY CASE REMOVAL/ INSTALLATION

Disconnect the battery negative (–) cable, then the positive (+) cable from the battery.

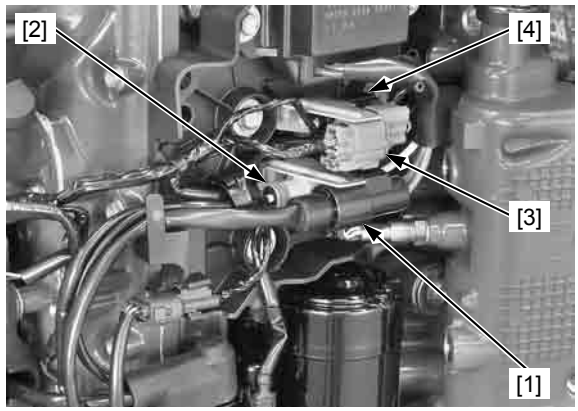
Remove the engine cover.

Remove the bolt (6 x 12 mm) [1], power tilt relay ground terminal [2] and two wire harness clips [3].

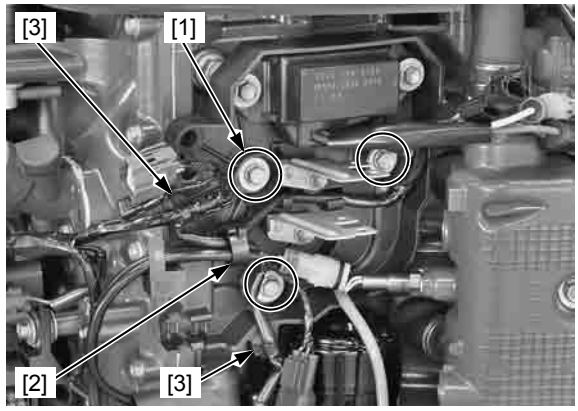


Disconnect the following:

– Power tilt motor 2P connector [1]
– Power tilt relay 1P connector [2]
– HO2S 4P connector [3]
– Power tilt relay 2P connector [4]



Remove the three bolt/washers (6 x 27 mm) [1], wire harness clip [2], and two harness band clips [3].



Remove the two power tilt relay mounting bolt/washers (6 x 25 mm) [1], harness band clip [2] and power tilt relay [3].

Remove the two collars [4] and two grommets [5] from the power tilt relay.

Remove the following parts from the power tilt relay case [6]:

– Connector bracket mounting bolts (6 x 10 mm) [7] (two)
– Connector brackets [8] (two)
– Collars [9] (three)
– Grommets [10] (three)

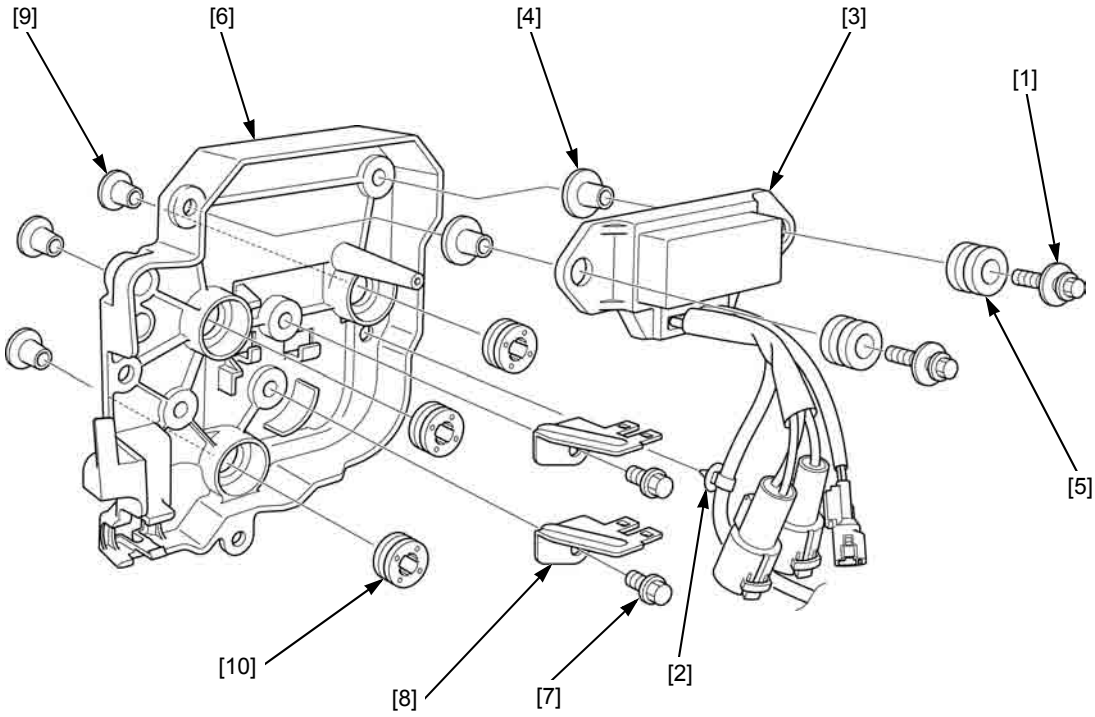
Installation is in the reverse order of removal.

NOTE:

• Route the wire harness properly (page 2-19).

TORQUE:

Connector bracket mounting bolt:
5.0 N·m (0.51 kgf·m, 3.7 lbf·ft)
Power tilt relay mounting bolt/washer:
5.0 N·m (0.51 kgf·m, 3.7 lbf·ft)



SWITCH PANEL INDICATOR WIRE HARNESSES REMOVAL/ INSTALLATION

REMOVAL

Remove the following:

– Front separate cover (page 6-3)
– Shift control cable pivot (page 20-3)
– Throttle control cable pivot (page 20-6)

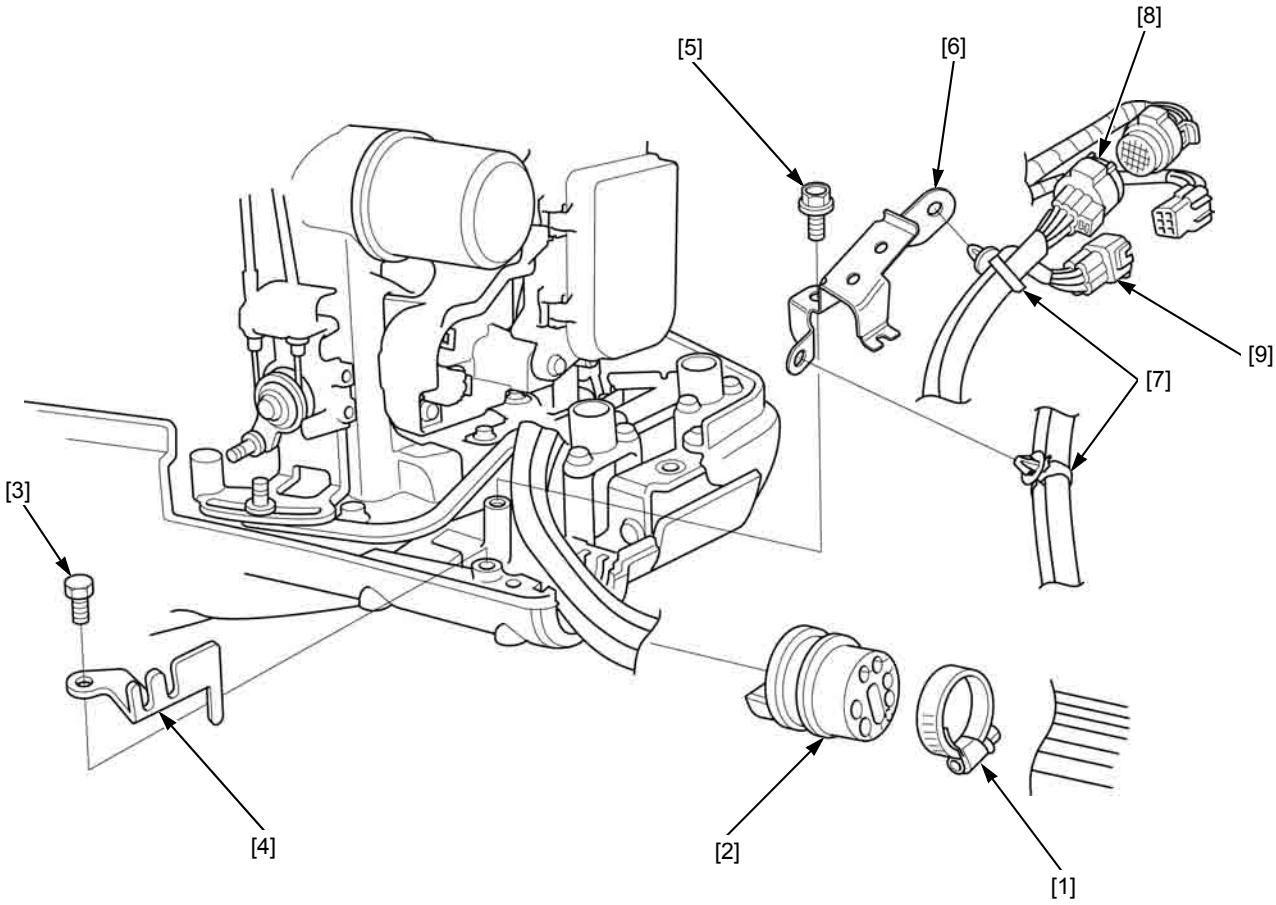
Loosen the screw and remove the grommet band [1], then remove the under case grommet A [2].

Remove the bolt (6 x 16 mm) [3] and remote control cable plate [4].

Be careful not to damage the starter cables by letting them fall: use a string or wire to hang the starter cables from the engine hanger bracket.

Remove the bolt (6 x 14 mm) [5] and harness bracket [6], and release the two harness band clips [7].

Disconnect the switch panel wire harness 14P connector [8] and indicator wire harness 6P connector [9].

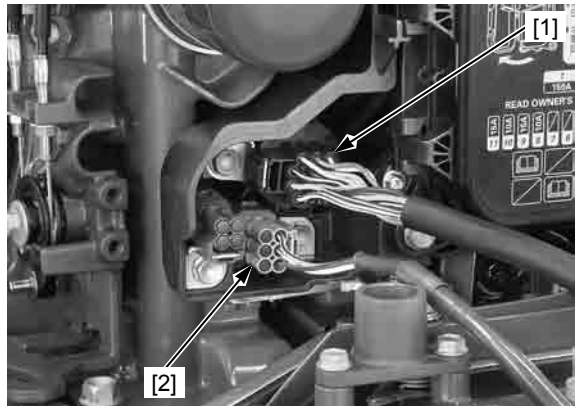


INSTALLATION

NOTE:

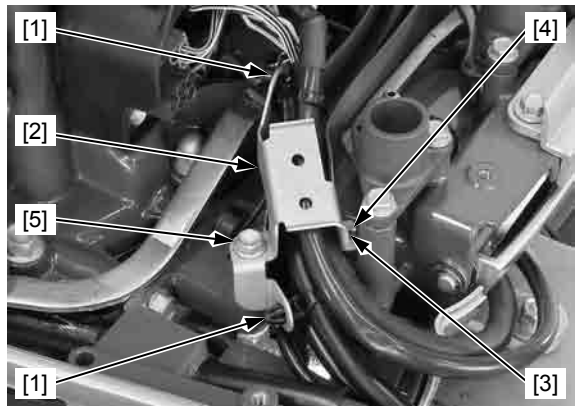
- Be careful not to press the fuel tube A with the under case grommet A.

Connect the switch panel wire harness connector 14P connector [1] and indicator panel wire harness 6P connector [2], and then attach them to the connector holders.



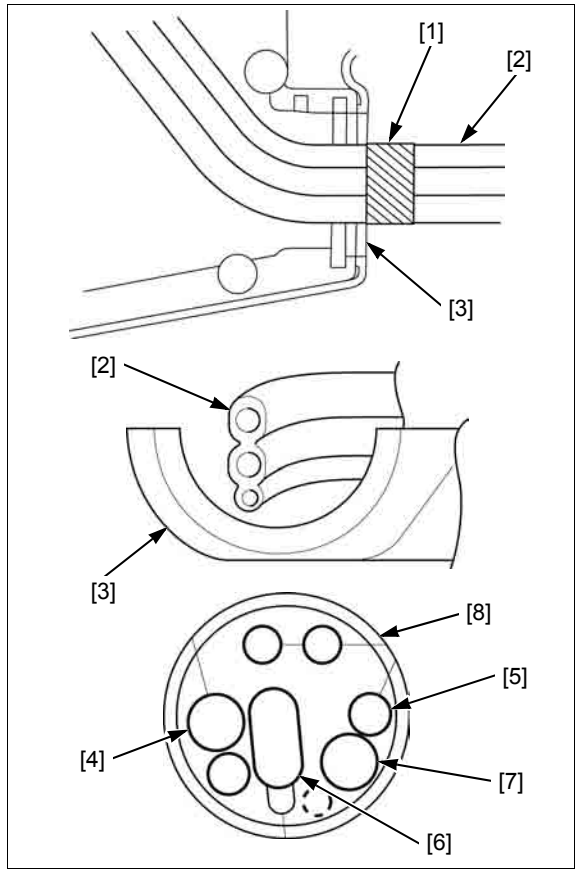
Set the switch panel wire harness into the crankcase groove.

Set the two wire harness clips [1] to the harness bracket [2].
Install the harness bracket by aligning its cutout [3] with the crankcase boss [4].
Install and tighten the bolt (6 x 14 mm) [5].



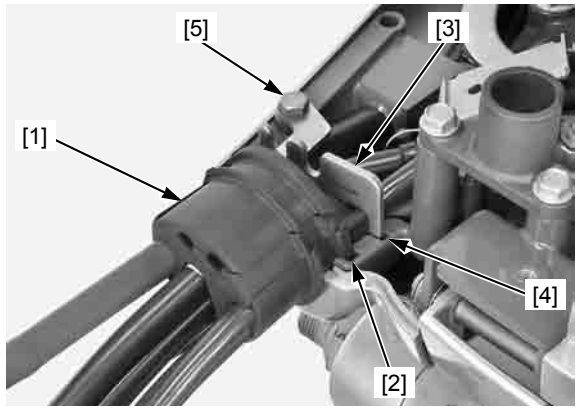
Make sure the white mark [1] on the starter cable [2] aligns with the edge of the front cover bracket [3].

Pass the fuel tube A [4], indicator panel wire harness [5], starter cables [6] and switch panel wire harness [7] through the under case grommet A [8].



Install the under case grommet A [1] to the groove [2] of the front cover bracket as shown.

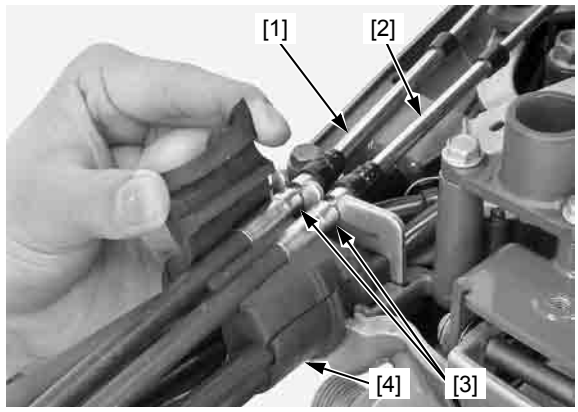
Install the remote control cable plate [3] to the groove [4] of the front cover bracket and tighten the bolt (6 x 16 mm) [5].



Install the following:

– Shift control cable pivot (page 20-3)
– Throttle control cable pivot (page 20-6)

Install the shift control cable [1] and throttle control cable [2] by aligning their grooves [3] with the grooves in the cable plate.
Put the remote control cables in under case grommet A [4].

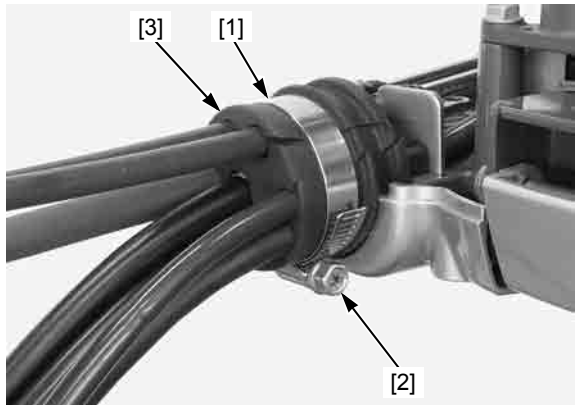


Set the grommet band [1] and tighten the screw [2]. Make sure the fuel tube A is not pinched by the under case grommet A [3].

Adjust the following:

– Throttle operation (page 3-11)
– Shift operation (page 20-3)

Install the front separate cover (page 6-3).



RELAY REMOVAL/INSTALLATION

Disconnect the battery negative (–) cable, then the positive (+) cable from the battery.

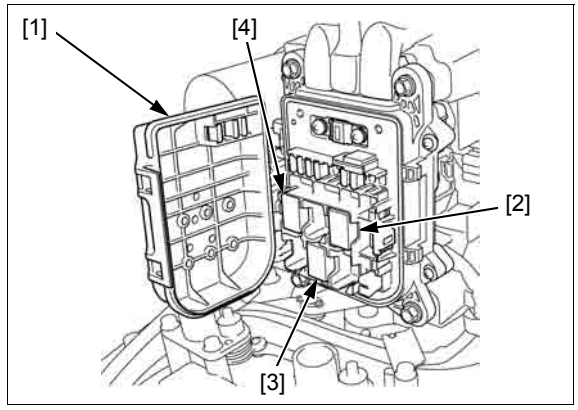
Remove the engine cover.

Open the fuse/relay junction box cover [1].

Remove the following:

– Main relay [2]
– Starter relay [3]
– Fuel pump relay [4]

Installation is in the reverse order of removal.



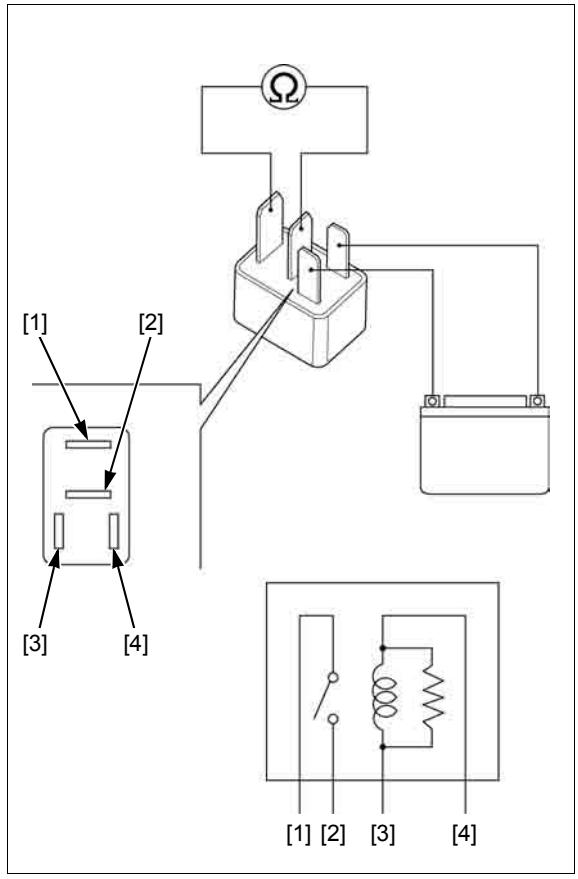
MAIN/STARTER RELAY INSPECTION

Remove the relay from the fuse/relay junction box (page 10-10).

Connect the ohmmeter to the relay terminal C [1] and terminal D [2].

Connect the battery positive (+) cable to the relay terminal A [3] and battery negative (–) cable to terminal B [4].

There should be continuity while the battery is connected to the relay terminals, and there should be no continuity while the battery is disconnected.



FUEL PUMP RELAY INSPECTION

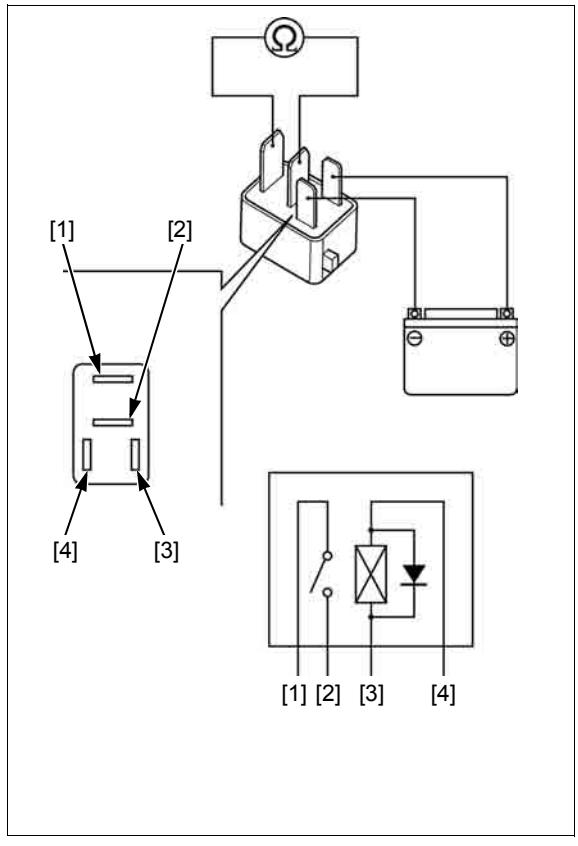
Remove the fuel pump relay from the fuse/relay junction box (page 10-10).

Connect the ohmmeter to the fuel pump relay terminal C [1] and terminal D [2].

Connect the battery positive (+) cable to the fuel pump relay terminal A [3] and battery negative (–) cable to terminal B [4].

- When connecting the fuel pump relay terminals, do not interchange the battery positive (+) cable and battery negative (–) cable.

There should be continuity while the battery is connected to the relay terminals, and there should be no continuity while the battery is disconnected.



FUSE/RELAY JUNCTION BOX INSPECTION

BLOCK FUSE INSPECTION

Disconnect the battery negative (–) cable, then the positive (+) cable from the battery.

Remove the engine cover.

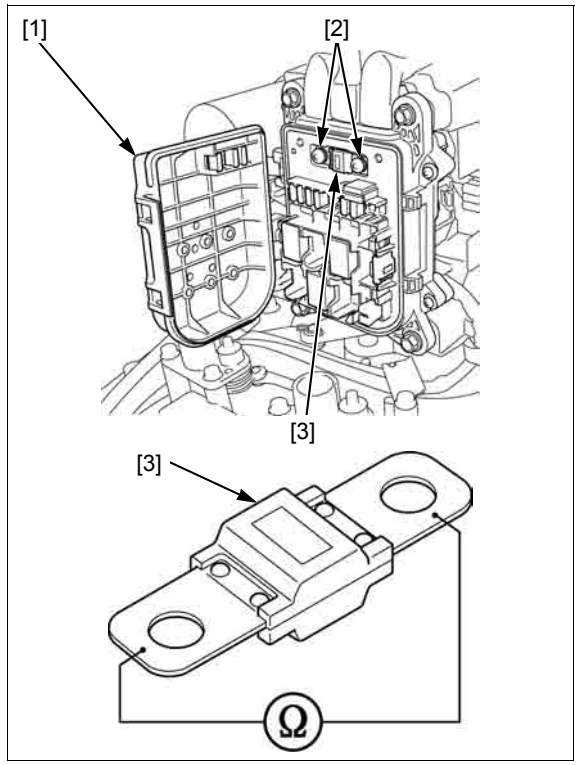
Open the fuse/relay junction box cover [1].

Remove the two block fuse screw/washers [2] and No.1 fuse [3] from fuse/relay junction box and check for continuity.

If there is no continuity, replace the No.1 fuse.

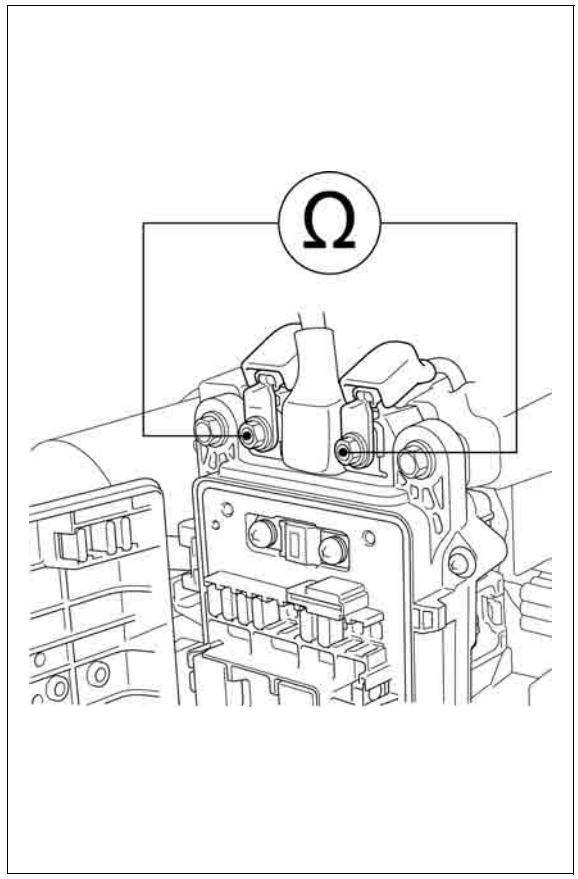
If there is continuity, install the No.1 fuse to fuse/relay junction box and tighten the two screw/washers to the specified torque.

TORQUE: 3.2 N·m (0.33 kgf·m, 2.4 lbf·ft)



Check for continuity between the (T6) terminal and (T5) terminal of fuse/relay junction box.

If the fuse is normal but there is no continuity between the terminals, replace the fuse/relay junction box with a new one.



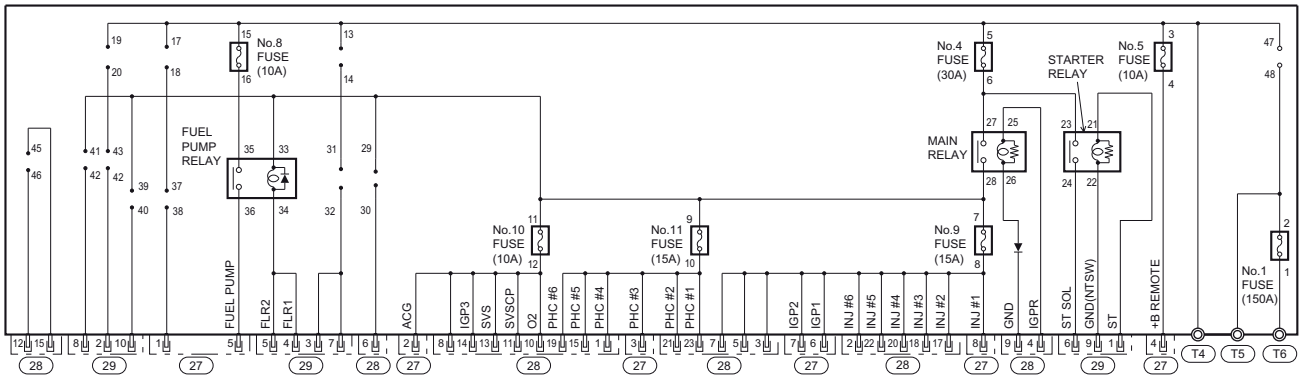
BLADE FUSE INSPECTION

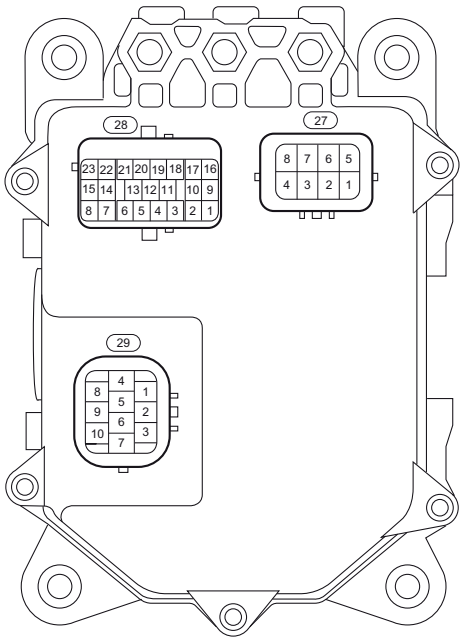
Remove the fuses from fuse/relay junction box and check for blown fuses.

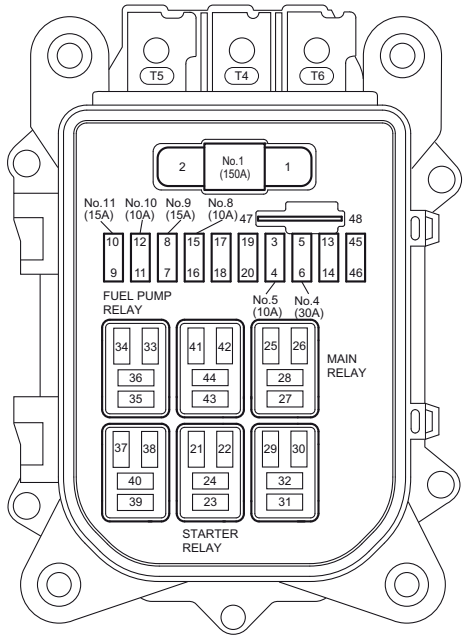
If the fuses are normal, install the fuses to fuse/relay junction box and check for continuity between the terminals in each connectors as shown in the table.

There should be continuity at all times.

FUSE/RELAY JUNCTION BOX







Check terminals
No.1 fuse (150 A) No.1 terminal and (T6) terminal
No.1 fuse (150 A) No.2 terminal and (T5) terminal
No.4 fuse (30 A) No.5 terminal and (T4) terminal
No.4 fuse (30 A) No.6 terminal and starter relay No.23 terminal
No.4 fuse (30 A) No.6 terminal and main relay No.27 terminal
No.5 fuse (10 A) No.3 terminal and (T4) terminal
No.5 fuse (10 A) No.4 terminal and fuse/relay junction box 8P connector (27) No.4 (+B REMOTE) terminal
No.8 fuse (10 A) No.15 terminal and (T4) terminal
No.8 fuse (10 A) No.16 terminal and fuel pump relay No.35 terminal
No.9 fuse (15 A) No.7 terminal and main relay No.28 terminal
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 8P connector (27) No.8 (INJ 1) terminal
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 23P connector (28) No.17 (INJ 2) terminal
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 23P connector (28) No.18 (INJ 3) terminal
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 23P connector (28) No.20 (INJ 4) terminal
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 23P connector (28) No.22 (INJ 5) terminal

Check terminals
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 23P connector (28) No.2 (INJ 6) terminal
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 8P connector (27) No.6 (IGP 1) terminal
No.9 fuse (15 A) No.8 terminal and fuse/relay junction box 8P connector (27) No.7 (IGP 2) terminal
No.10 fuse (10 A) No.11 terminal and main relay No.28 terminal
No.10 fuse (10 A) No.12 terminal and fuse/relay junction box 8P connector (27) No.2 (ACG) terminal
No.10 fuse (10 A) No.12 terminal and fuse/relay junction box 23P connector (28) No.10 (O2) terminal
No.10 fuse (10 A) No.12 terminal and fuse/relay junction box 23P connector (28) No.11 (SVSCP) terminal
No.10 fuse (10 A) No.12 terminal and fuse/relay junction box 23P connector (28) No.13 (SVS) terminal
No.10 fuse (10 A) No.12 terminal and fuse/relay junction box 23P connector (28) No.14 (IGP 3) terminal
No.11 fuse (15 A) No.9 terminal and main relay No.28 terminal
No.11 fuse (15 A) No.10 terminal and fuse/relay junction box 23P connector (28) No.23 (PHC 1) terminal
No.11 fuse (15 A) No.10 terminal and fuse/relay junction box 23P connector (28) No.21 (PHC 2) terminal
No.11 fuse (15 A) No.10 terminal and fuse/relay junction box 8P connector (27) No.3 (PHC 3) terminal
No.11 fuse (15 A) No.10 terminal and fuse/relay junction box 23P connector (28) No.1 (PHC 4) terminal
No.11 fuse (15 A) No.10 terminal and fuse/relay junction box 23P connector (28) No.15 (PHC 5) terminal
No.11 fuse (15 A) No.10 terminal and fuse/relay junction box 23P connector (28) No.19 (PHC 6) terminal
Starter relay No.21 terminal and fuse/relay junction box 10P connector (29) No.1 (ST) terminal
Starter relay No.22 terminal and fuse/relay junction box 10P connector (29) No.9 (GND (NTSW)) terminal
Starter relay No.24 terminal and fuse/relay junction box 10P connector (29) No.6 (ST SOL) terminal
Main relay No.25 terminal and fuse/relay junction box 23P connector (28) No.4 (IGPR) terminal
Main relay No.26 terminal and fuse/relay junction box 23P connector (28) No.9 (GND) terminal • Switch the tester lead polarities to check the circuit, including a diode. The circuit is normal if there is continuity in one direction but not the other. If there is continuity in both directions or in neither direction, the circuit is abnormal.
Main relay No.28 terminal and fuel pump relay No.33 terminal
Fuel pump relay No.34 terminal and fuse/relay junction box 10P connector (29) No.4 (FLR 1) terminal
Fuel pump relay No.34 terminal and fuse/relay junction box 10P connector (29) No.5 (FLR 2) terminal
Fuel pump relay No.36 terminal and fuse/relay junction box 8P connector (27) No.5 (FUEL PUMP) terminal

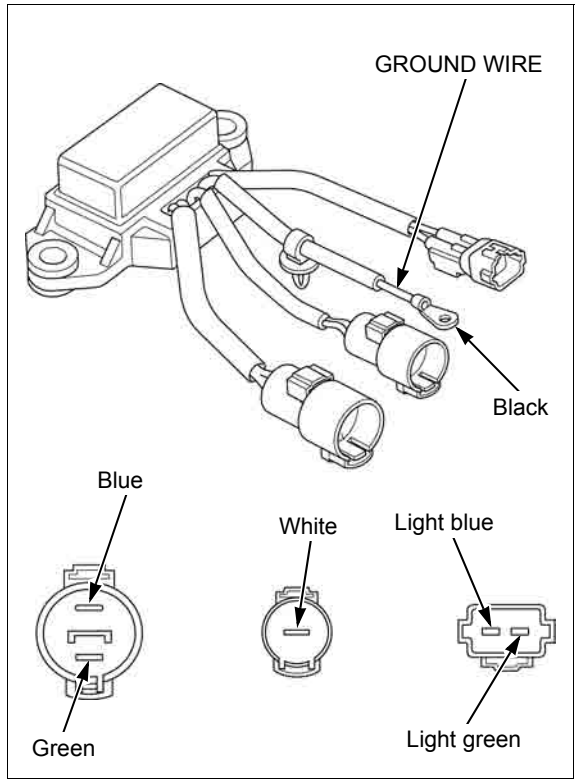
POWER TILT RELAY INSPECTION

- Disconnect the power tilt relay connectors, and remove the relay from the outboard motor to check.

Remove the power tilt relay (page 10-6).

Check for continuity between the following terminals.

Between Green and Black	Continuity
Between Blue and Black	Continuity
Between Green and White	No continuity
Between Blue and White	No continuity



Connect a battery as shown. There must be continuity/ no continuity between the terminals shown.

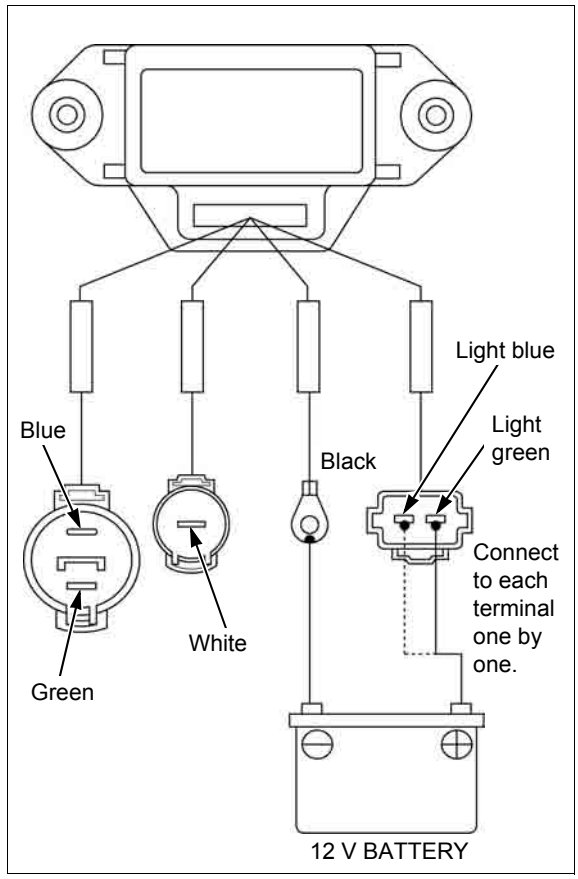
- Use a known-good battery for the test.

Positive (+) battery terminal connected to Light green terminal:

Between Green and Black	No continuity
Between Blue and Black	Continuity
Between Green and White	Continuity
Between Blue and White	No continuity

Positive (+) battery terminal connected to Light blue terminal:

Between Green and Black	Continuity
Between Blue and Black	No continuity
Between Green and White	No continuity
Between Blue and White	Continuity



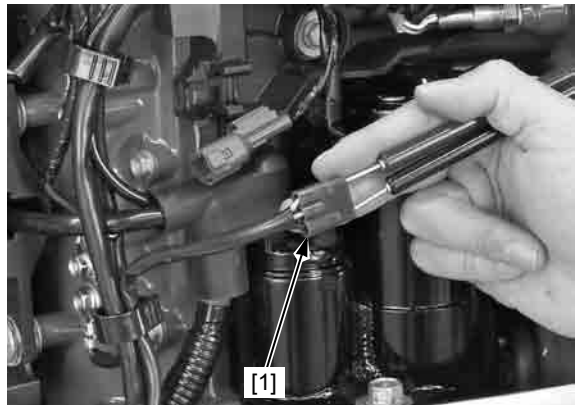
TRIM ANGLE SENSOR INSPECTION

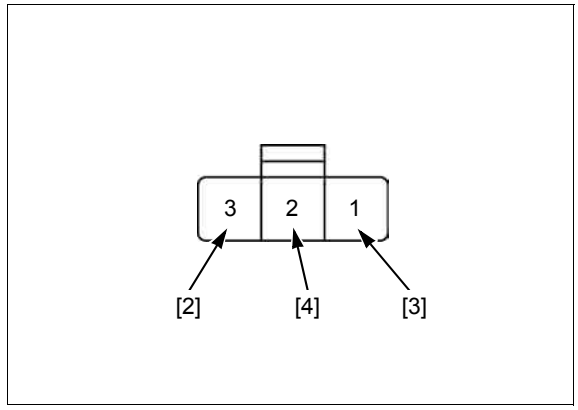
Remove the engine cover.

Disconnect the trim angle sensor 3P connector [1].

Measure the resistance between the trim angle sensor 3P connector sensor side terminals.

Between Light green/Black [2] and Black [3]	3.8 – 5.8 kΩ
Between Yellow/Blue [4] and Black	2.7 – 4.3 kΩ





MEMO

11. COOLING SYSTEM

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WATER PUMP REMOVAL/ INSTALLATION ····· 11-9

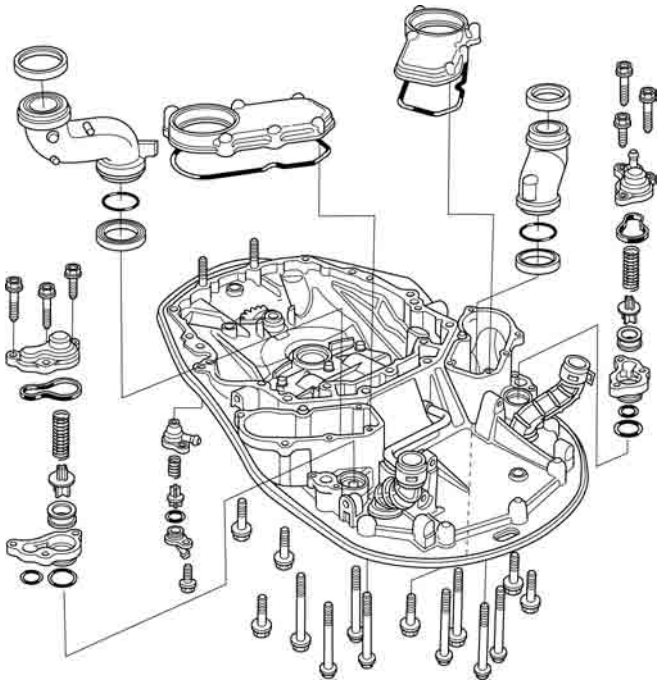
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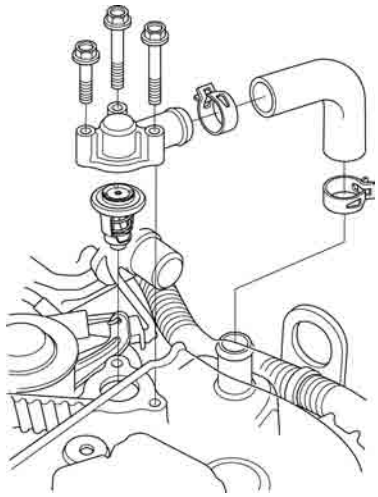
RELIEF VALVE DISASSEMBLY/ ASSEMBLY ····· 11-17

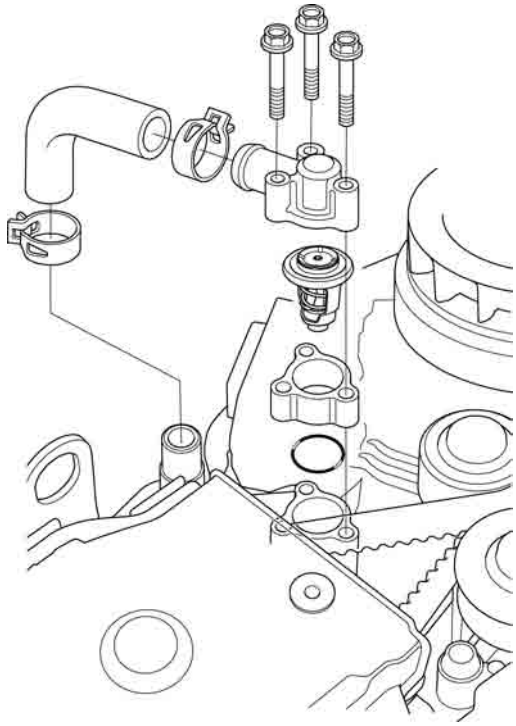
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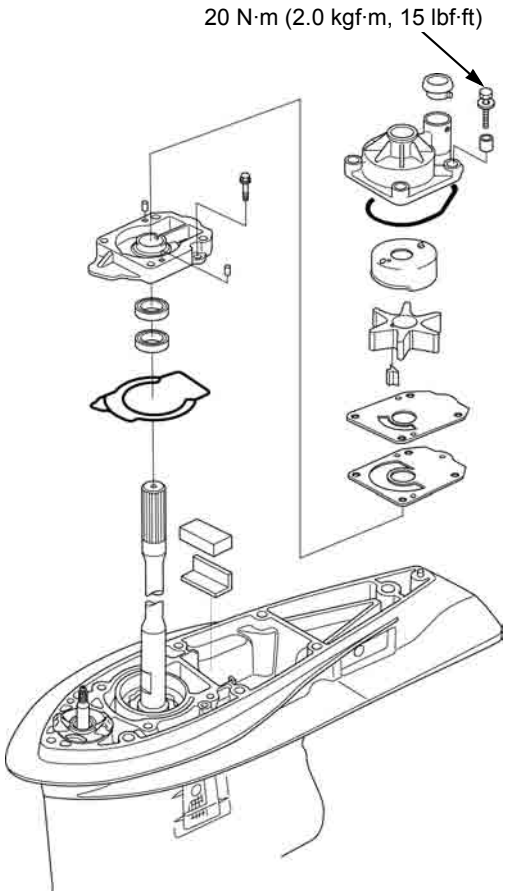
THERMOSTAT INSPECTION ····· 11-19

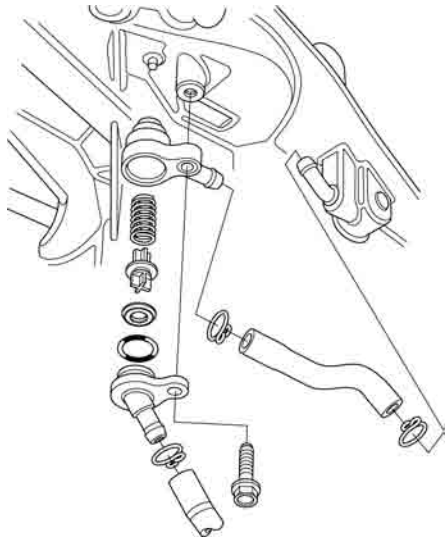
COMPONENT LOCATION





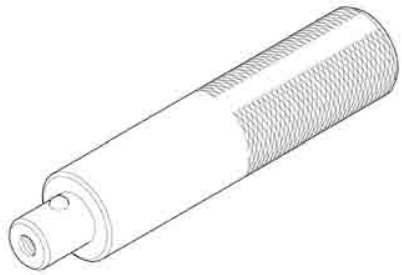




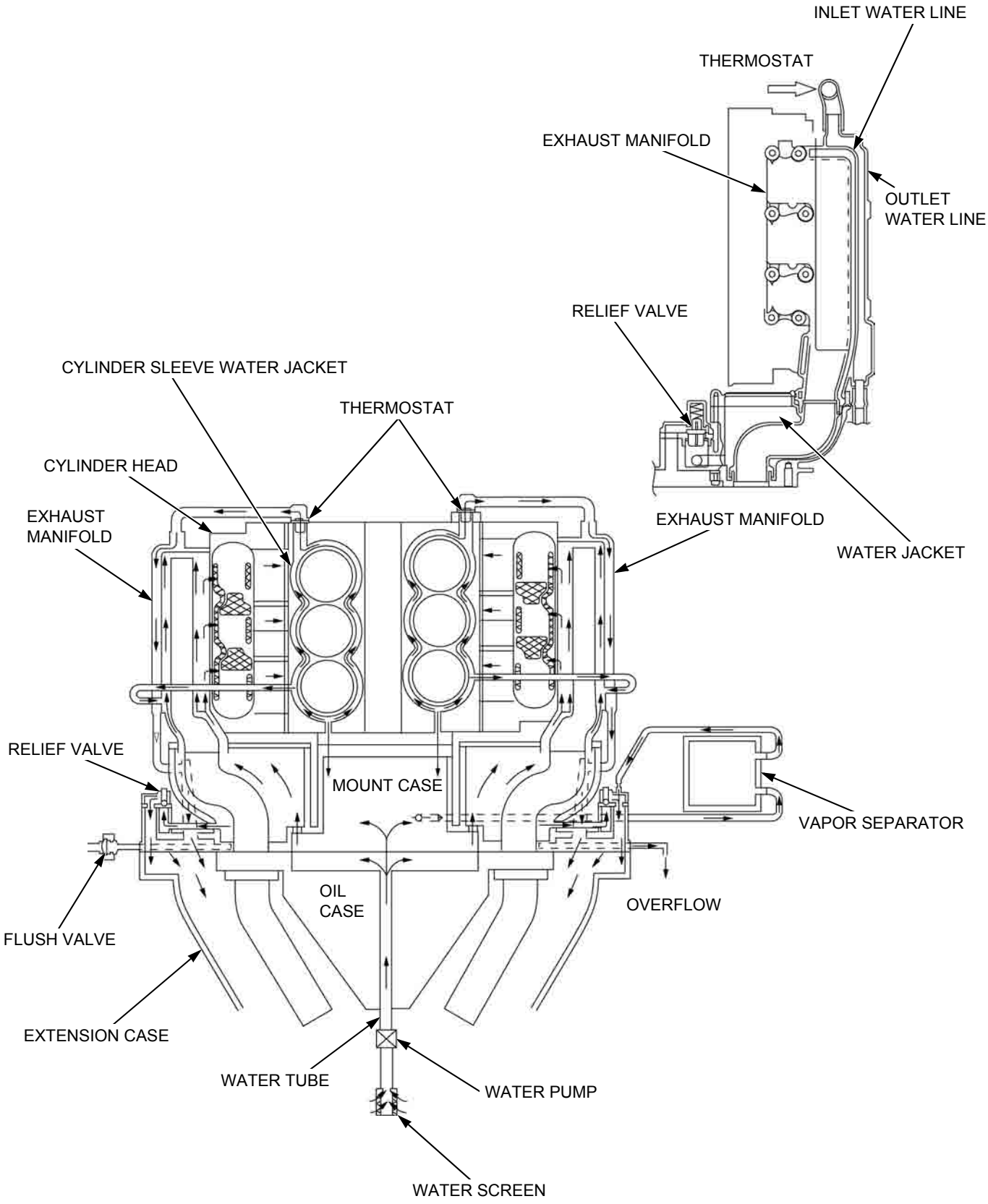


TOOLS

LIST

Attachment, 42 x 47 mm 07746-0010300 	Driver 07749-0010000 

WATER LINE DESCRIPTION



THERMOSTAT REMOVAL/ INSTALLATION

R. SIDE

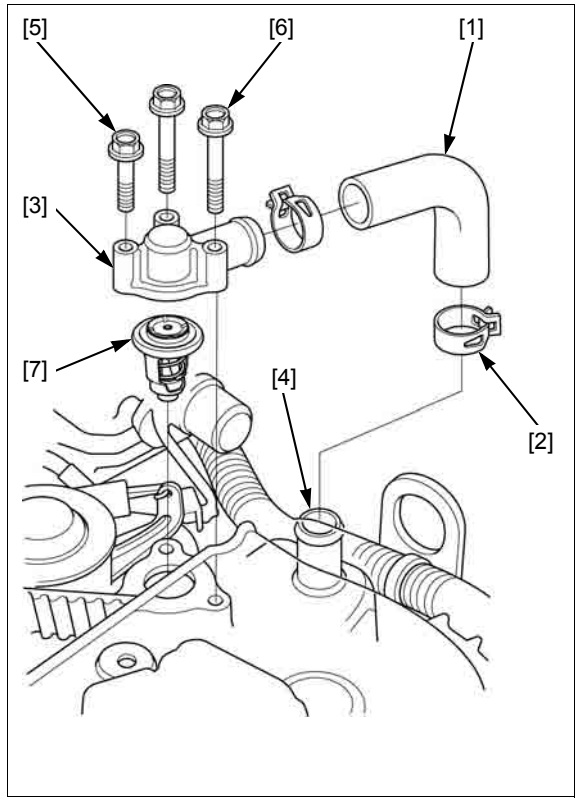
Remove the cooling fan cover (page 5-68).

Remove the water relief tube [1] and two tube clamps D29.0 [2] from the thermostat cover [3] and R. exhaust manifold [4].

Remove the bolt (6 x 35 mm) [5], two bolts (6 x 60 mm) [6], thermostat cover and thermostat [7] from the engine.

Installation is in the reverse order of removal.

NOTE:
After installation, check the tube and tube clamps for correct installation (page 2-34).



L. SIDE

Remove the cooling fan cover (page 5-68).

Remove the water relief tube [1] and two tube clamps D29.0 [2] from the thermostat cover [3] and L. exhaust manifold [4].

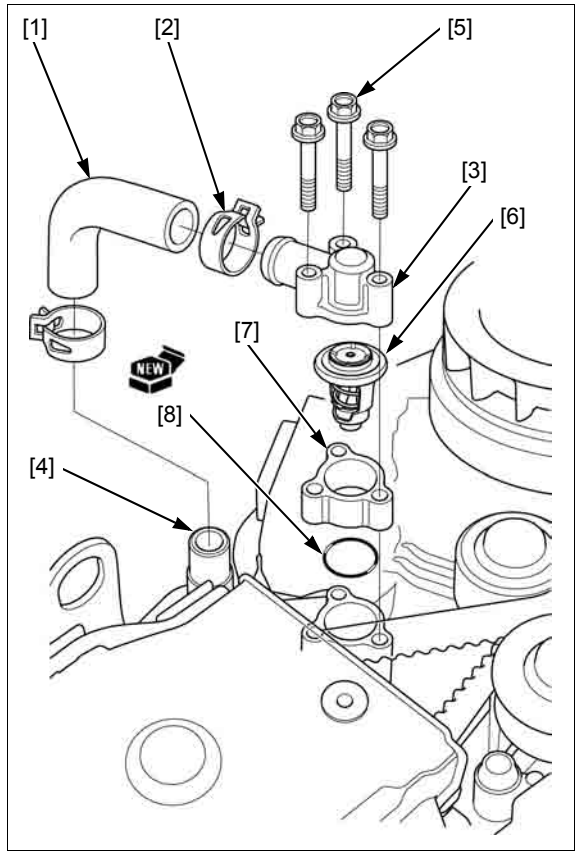
Remove the three bolts (6 x 60 mm) [5], thermostat cover, and thermostat [6].

Remove the thermostat spacer [7] and O-ring [8] from the engine.
Replace the O-ring with a new one.

Installation is in the reverse order of removal.

NOTE:

- After installation, check the tube and tube clamps for correct installation (page 2-34).



WATER JACKET REMOVAL/ INSTALLATION

REMOVAL

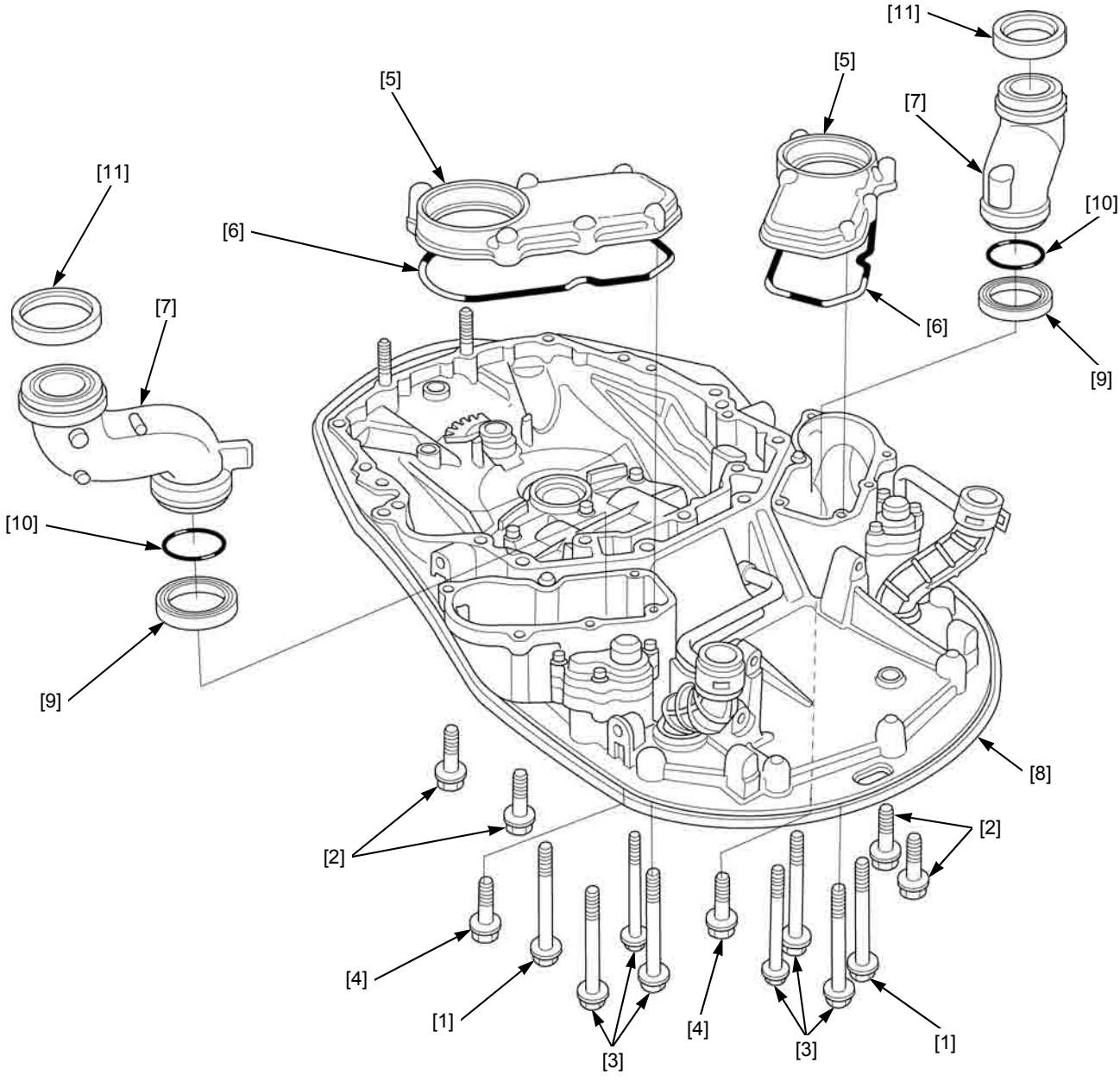
Remove the engine assembly (page 13-4).

Remove the following:

– Bolts (8 x 100 mm) [1] (two)
– Bolts (8 x 30 mm) [2] (four)
– Bolts (6 x 121 mm) [3] (six)
– Bolts (6 x 40 mm) [4] (two)

Remove the L./R. water jacket covers [5], two cover packings [6] and L./R. exhaust guides [7] from the mount case [8].

Remove the two exhaust guide seals [9], two O-rings [10] and two exhaust guide seals B [11] from the L./R. exhaust guides.



INSTALLATION

Apply a bead (Φ1.5 – 2.0 mm (0.06 – 0.08 in)) of liquid gasket (Threebond® #1211, Hondabond HT, Hondabond 4, or equivalent) to the exhaust guide seal B [1] installation section of the exhaust guide [2] as shown.

Install a new exhaust guide seal B to the upper side (exhaust manifold side) of the exhaust guide.

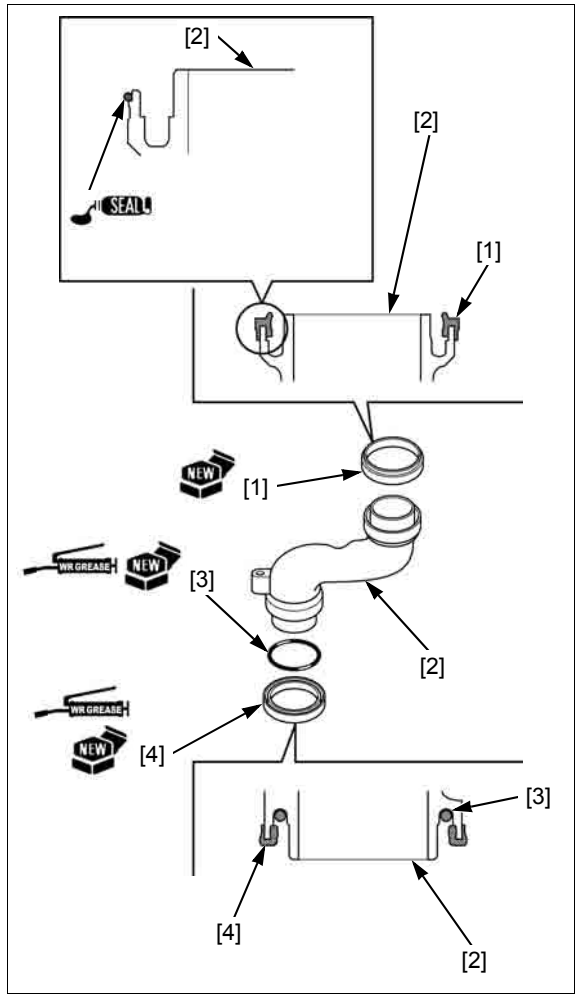
Apply marine grease to the O-ring [3] and install it to the lower side (mount case side) of exhaust guide.

Install a new exhaust guide seal [4] to the lower side (mount case side) of the exhaust guide, and then apply marine grease to it.

NOTICE

- *Do not interchange the exhaust guide seal B and exhaust guide seal.*
- *Be sure that the exhaust guide seal B is not lifted from the exhaust guide.*

Install and tighten the exhaust guide and bolt (6 x 40 mm) to the mount case.

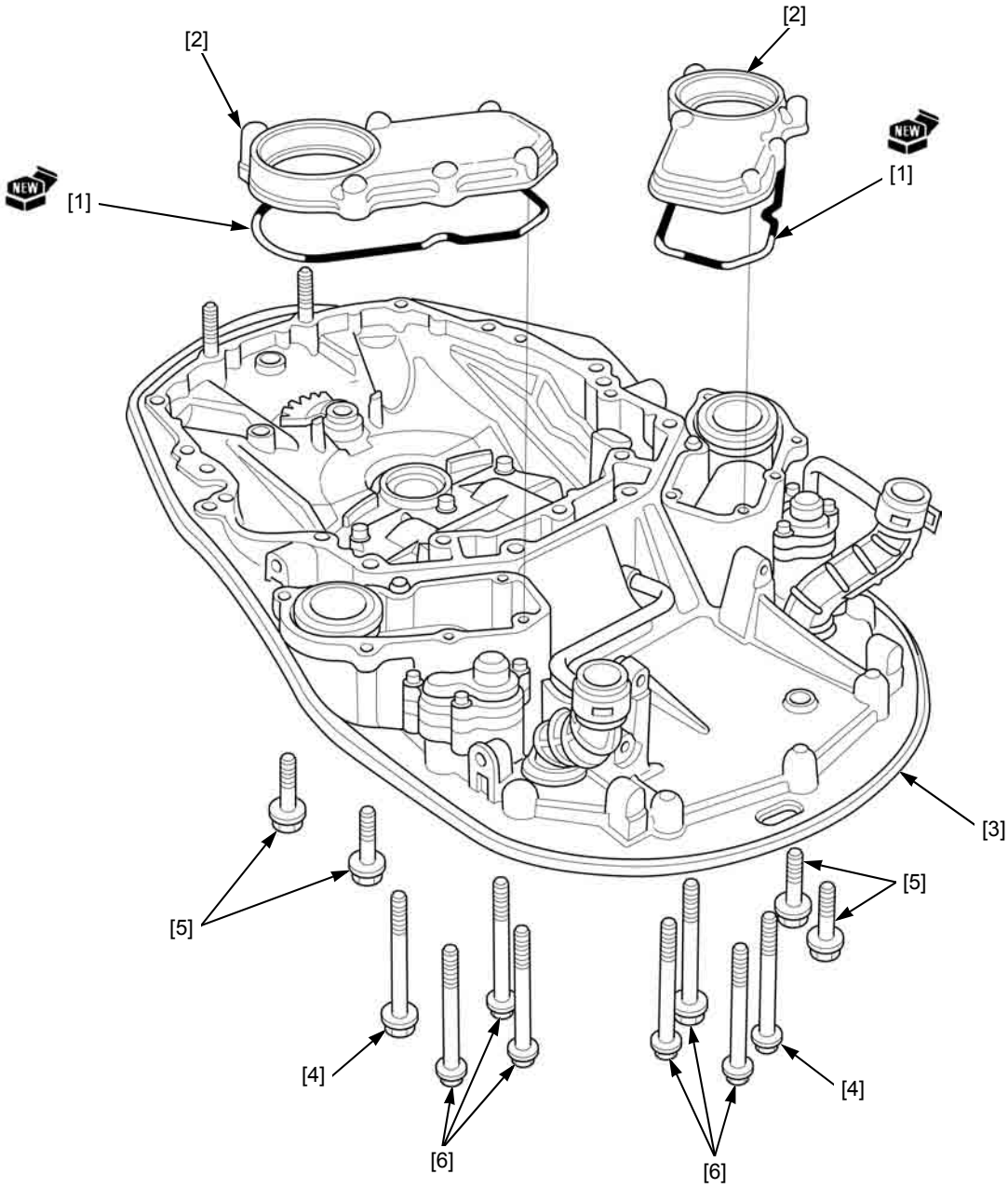


Install new cover packings [1] to the L./R. water jacket covers [2].
Install the water jacket cover to the engine mount case [3].

Install and tighten the following:

– Bolts (8 x 100 mm) [4] (two)
– Bolts (8 x 30 mm) [5] (four)
– Bolts (6 x 121 mm) [6] (six)

Install the engine assembly (page 13-6).



WATER PUMP REMOVAL/ INSTALLATION

REMOVAL

Remove the following:

Standard rotation type
– Propeller (page 16-6)
– Gear case (page 16-8)

Counter rotation type
– Propeller (page 17-5)
– Gear case (page 17-7)

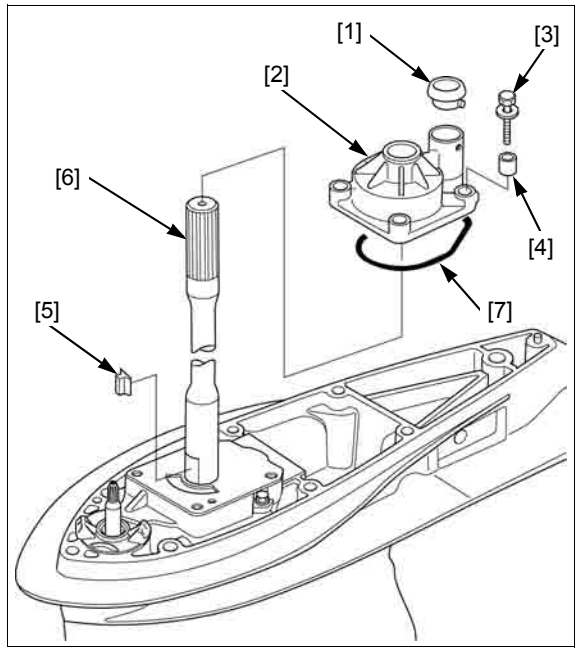
Remove the water tube seal ring [1] from the impeller housing [2].

Remove the four impeller housing bolt/washers (8 x 60 mm) [3], four distance collars [4], and impeller housing.

Remove the special key [5] from the vertical shaft [6].

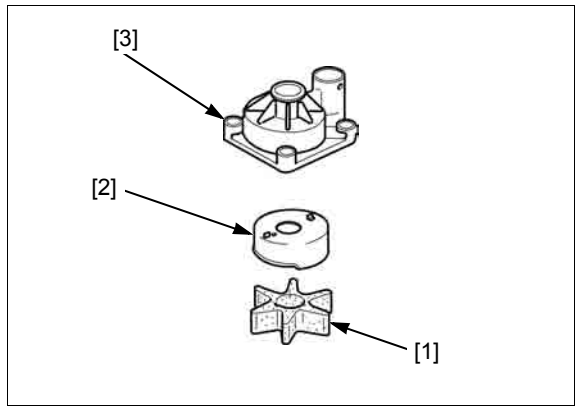
- Check the special key and key groove of the vertical shaft for wear; replace them if necessary.

Remove the water pump O-ring [7] from the impeller housing.

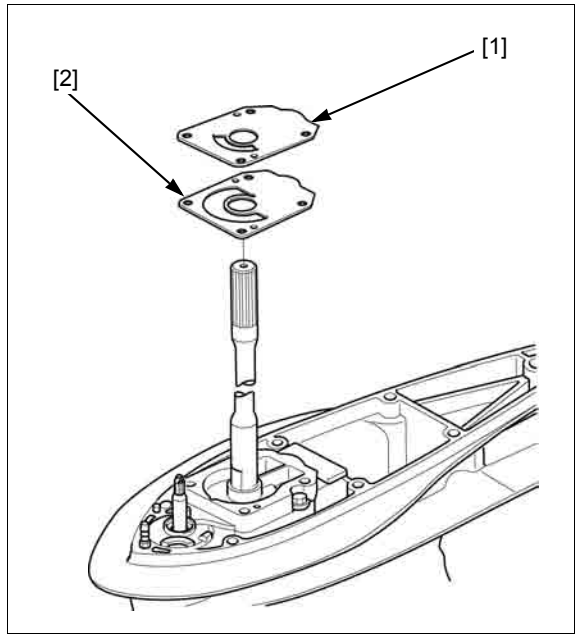


Remove the pump impeller [1] and pump liner [2] from the impeller housing [3].

Check the impeller for cracks, wear, or damage from overheating; replace them if necessary.
Check the pump liner for cracks or wear; replace it if necessary.
Check the impeller housing for deformation; replace it if necessary.



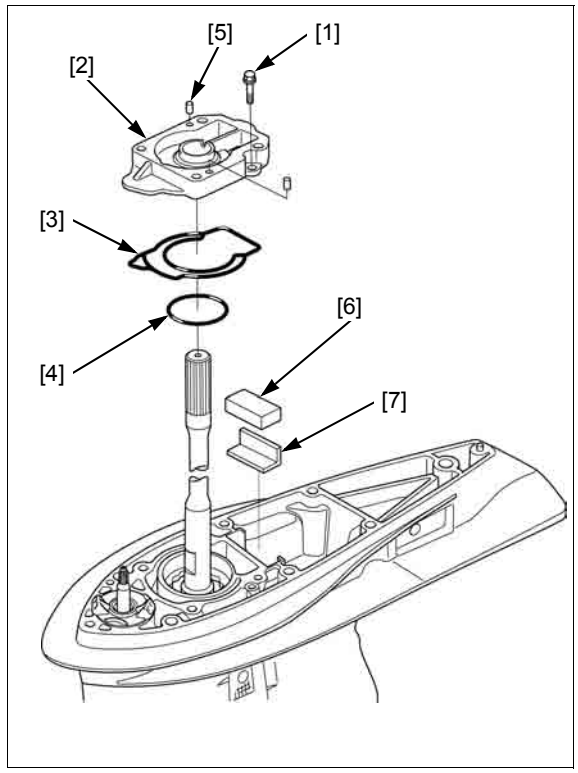
Remove the impeller cover [1] and the impeller gasket [2].



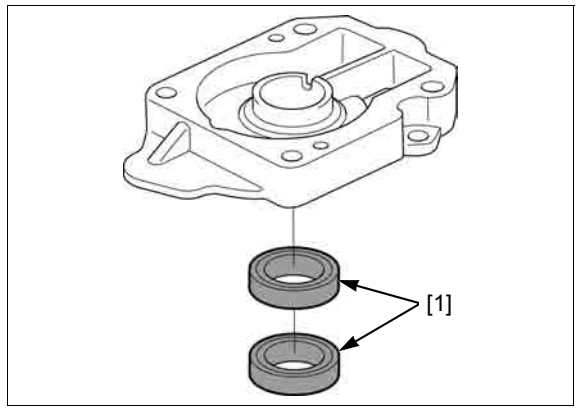
Remove the bolt (6 x 16 mm) [1] and water pump housing [2].

Remove the water pump housing O-ring [3], O-ring (65.4 x 2.4 mm) [4] and two dowel pins [5].

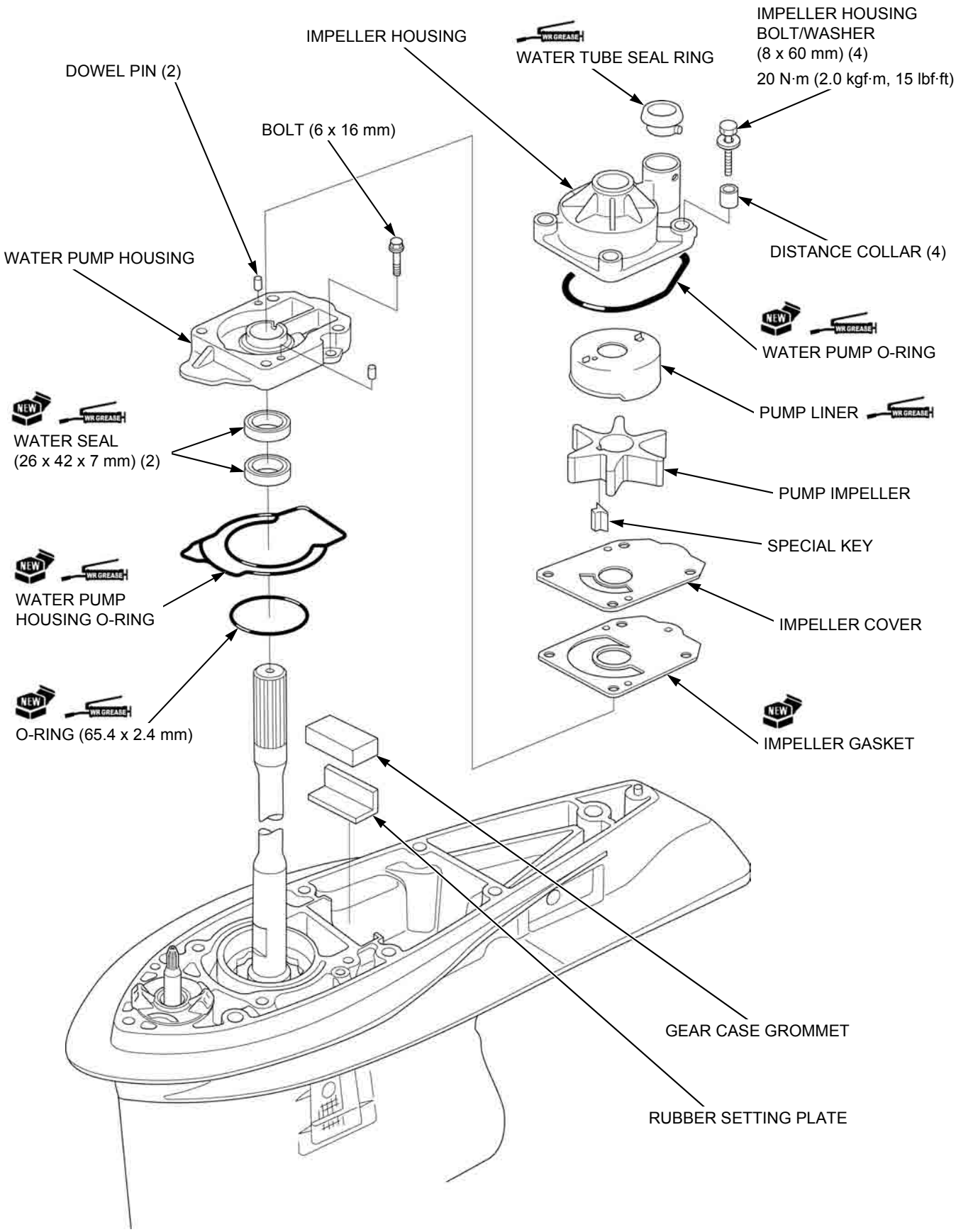
Remove the gear case grommet [6] and rubber setting plate [7] from the gear case.



Remove the two water seals (26 x 42 x 7 mm) [1] using a commercially available oil seal remover.



EXPLODED VIEW



INSTALLATION

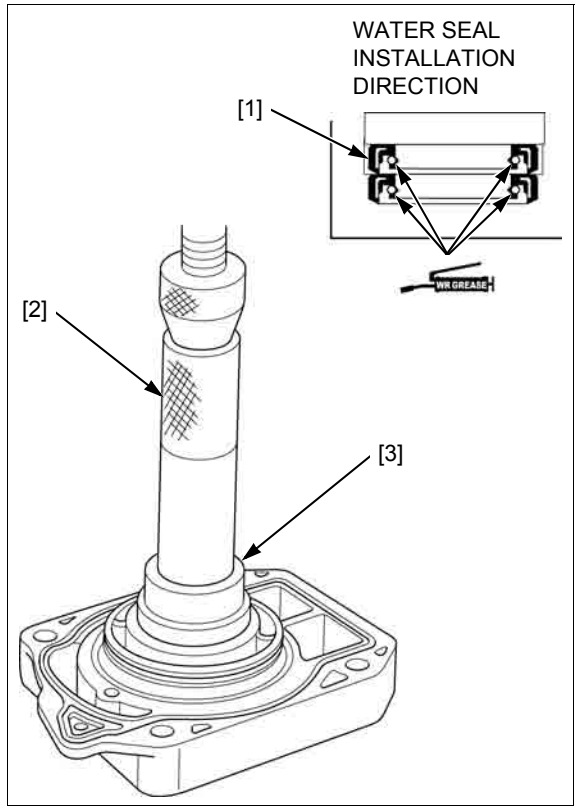
Apply soapy water to the outer circumference of the new water seals (26 x 42 x 7 mm) [1] and marine grease to the water seals mating surface.

Drive the water seals one by one into the water pump housing using the special tools.
Note the installation direction of the water seals.

TOOLS:

Driver [2]	**07749-0010000**
Attachment, 42 x 47 mm [3]	**07746-0010300**

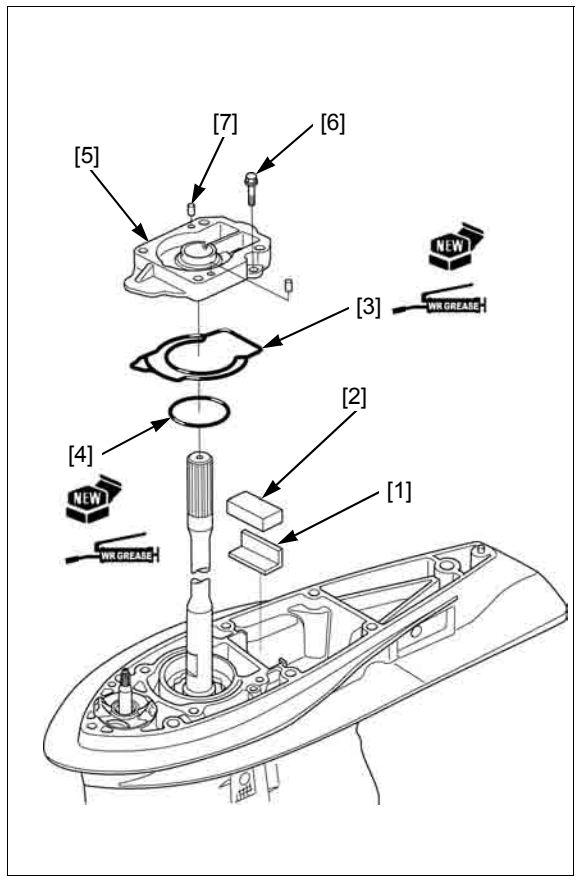
Apply marine grease to the water seal lips.



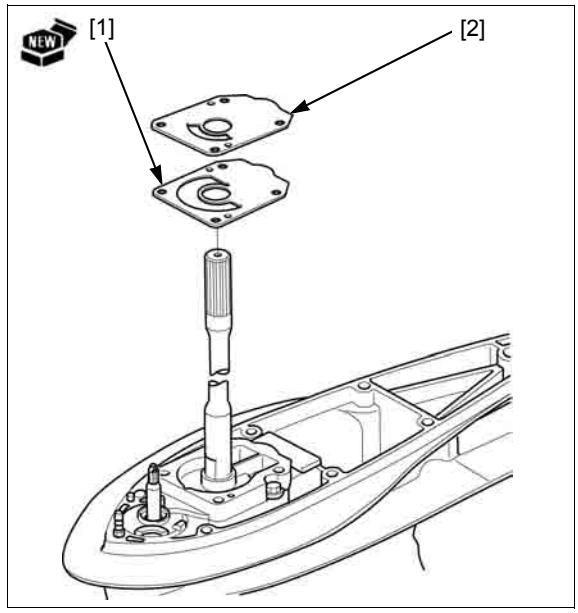
Install the rubber setting plate [1] and gear case grommet [2] in the gear case.

Apply marine grease to the circumference of new water pump housing O-ring [3], O-ring (65.4 x 2.4 mm) [4] and install it on the water pump housing [5].

Install the water pump housing on the gear case and loosely tighten the bolt (6 x 16 mm) [6].
Install the two dowel pins [7] in the water pump housing.



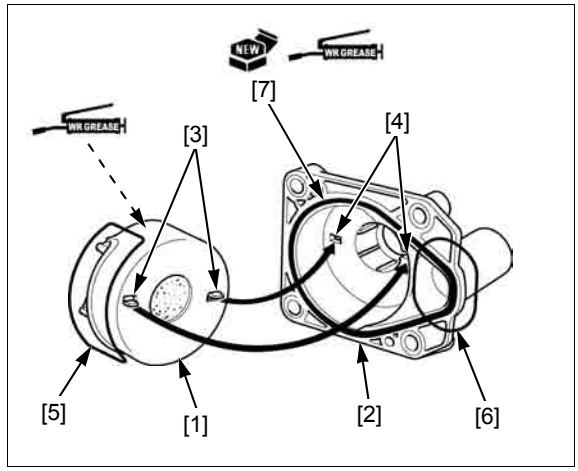
Install a new impeller gasket [1] and impeller cover [2].



Apply marine grease to the pump liner [1] inner surface.

Install the pump liner in the impeller housing [2] by aligning the two projections [3] on the pump liner with the two grooves [4] in the impeller housing.
Be sure that part "A" [5] of the pump liner is in alignment with part "B" [6] of the impeller housing.

Apply marine grease to a new water pump O-ring [1] and install it into the impeller housing [2].

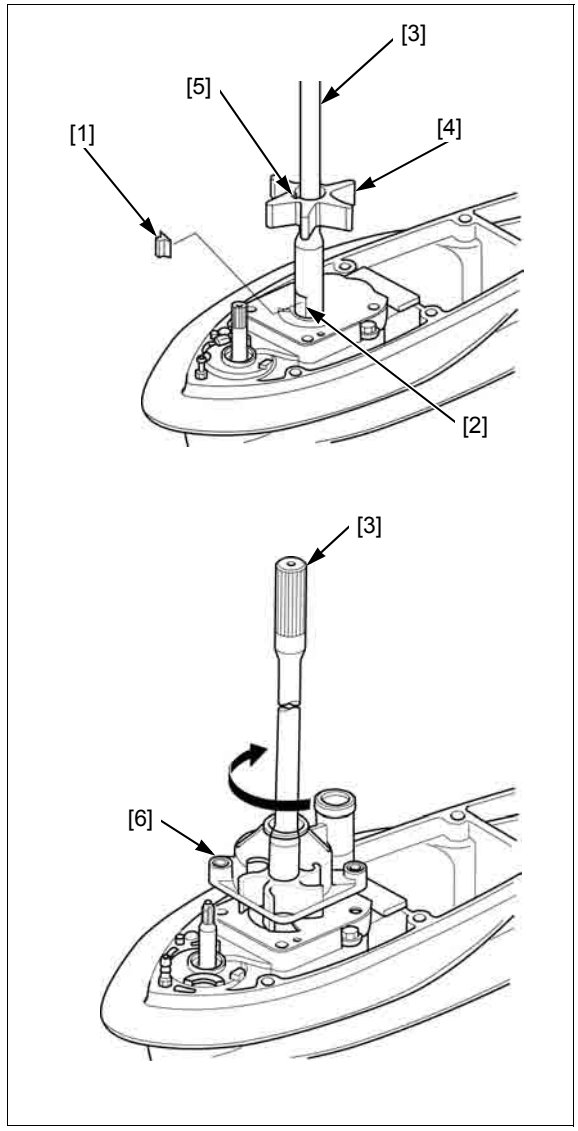


Set the special key [1] to the groove [2] in the vertical shaft [3].
Install the pump impeller [4], aligning the key groove [5] in the pump impeller with the special key.

Set the impeller housing [6] on the vertical shaft.
Install the impeller housing while turning the vertical shaft clockwise.

NOTICE

- *Be sure to turn the vertical shaft clockwise.*

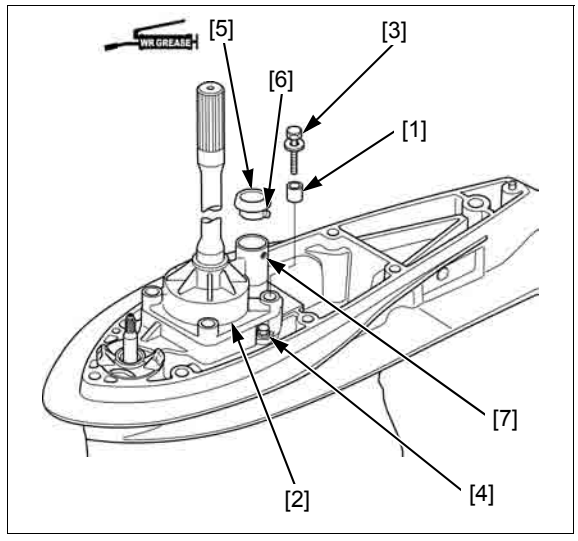


Install the four distance collars [1] on the impeller housing [2] and tighten the four impeller housing bolt/washers (8 x 60 mm) [3] to the specified torque.

TORQUE: 20 N·m (2.0 kgf·m, 15 lbf·ft)

After tightening the four bolts, tighten the bolt (6 x 16 mm) [4].

Apply marine grease to the inner wall of the water tube seal ring [5].
Install the water tube seal ring by aligning the projection [6] with the hole [7] in the housing.



Perform the gear case pressure check after assembly:

– Standard rotation type (page 16-45)
– Counter rotation type (page 17-42)

Install the following:

Standard rotation type
– Gear case (page 16-9)
– Propeller (page 16-6)

Counter rotation type
– Gear case (page 17-7)
– Propeller (page 17-5)

CYLINDER SLEEVE WATER JACKET ANODE REMOVAL/INSTALLATION

Remove the exhaust manifold (page 5-95).

Remove the sealing bolt [1] and washer [2] from the cylinder block.

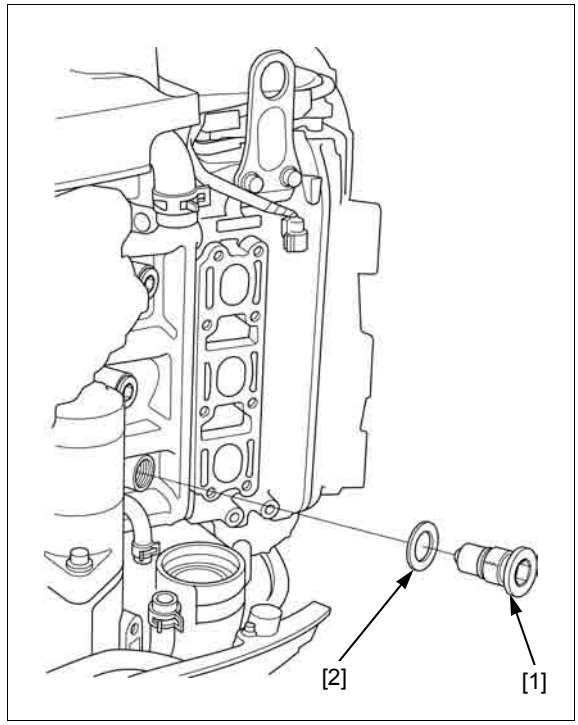
Remove corrosion and sealing tape from the sealing bolt.

- Use a soft resin brush or shop towel to clean the surface. Using a wire brush or sandpaper will damage the coating of the sealing bolt, resulting in corrosion.

If it is impossible to remove the corrosion and/or sealing tape, replace the sealing bolt with a new one.

- When replacing the sealing bolt, replace the screw and anode metal as a set.
- A new sealing bolt has threads coated with sealant. Do not apply sealant or sealing tape.

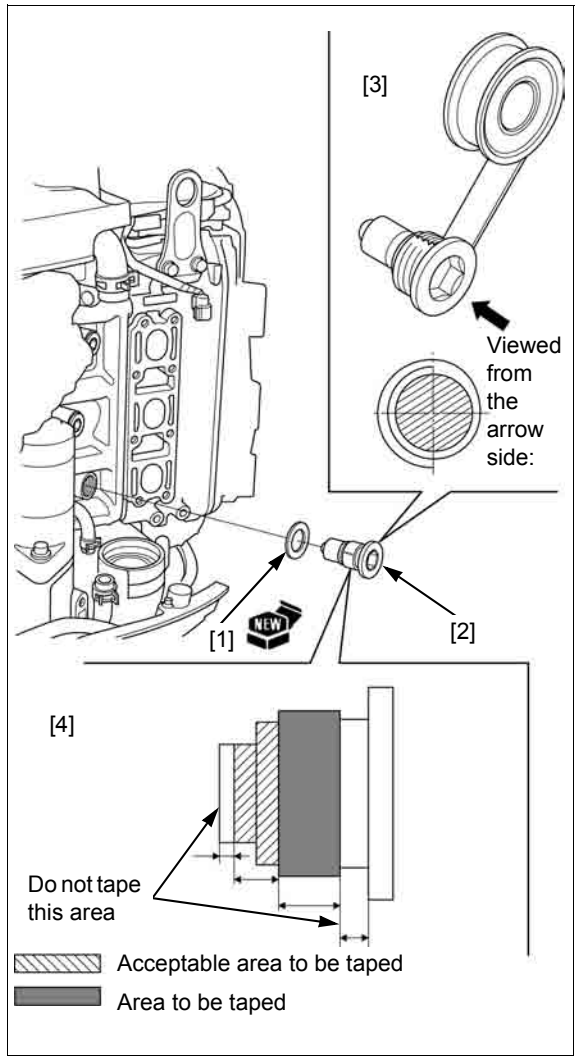
If the anode is worn to less than 2/3 of its original length, replace the anode assembly as set. See page 3-20 for inspection requirements.



Install a new sealing washer [1] to the sealing bolt [2]. Cover the sealing bolt threads with sealing tape. Starting from the top, wrap it counterclockwise 1-1/4 to 1-1/2 turn as shown [3].

- Do not use sealant, as it may protrude between anode metal and cylinder block, preventing continuity.
- Install sealing tape as shown [4]. Tape covering the sealing bolt flange will prevent continuity.

Install and tighten the sealing bolt.



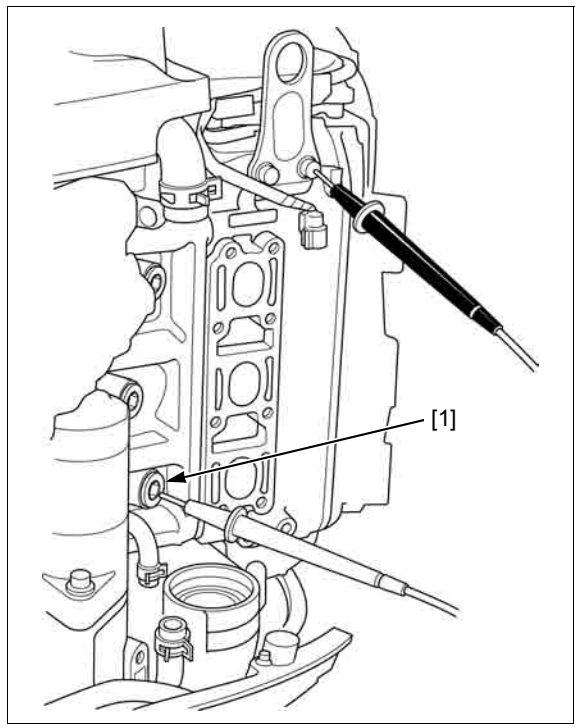
Check the continuity between the anode [1] and cylinder block.

Perform a continuity inspection between the anode metal surface without corrosion and the bare aluminum surface of the cylinder block or the bolt/nut.

If there is no continuity, remove the sealing bolt and sealing tape, and reinstall the sealing tape properly.

If there is no continuity, replace the screw, anode metal, sealing bolt with new one as a set.

Install the exhaust manifold (page 5-96).



RELIEF VALVE DISASSEMBLY/ ASSEMBLY

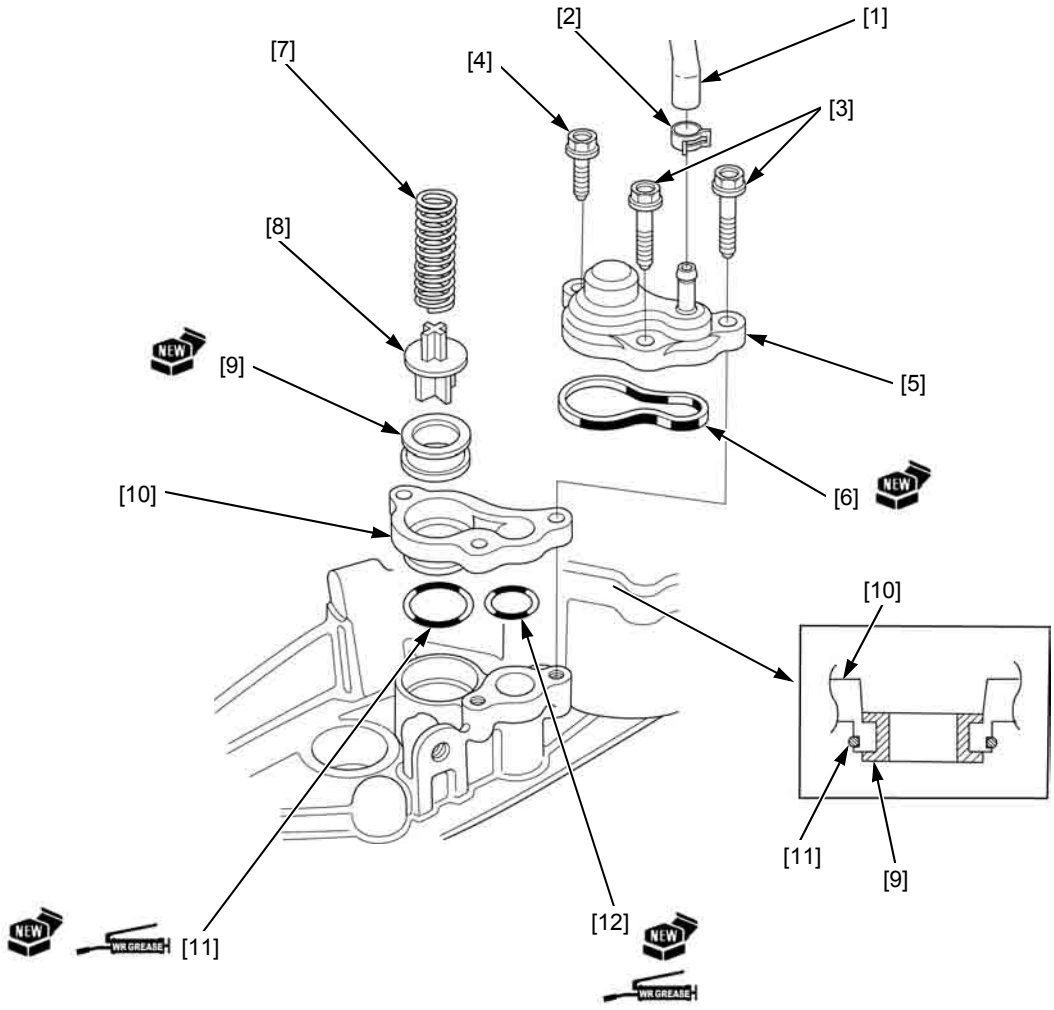
Remove the engine cover bracket (page 6-9).

Disconnect the water outlet tube [1] from the right relief valve and remove the tube clamp D10.5 [2].

Remove the following:

– Bolts (6 x 32 mm) [3] (two)
– Bolt (6 x 22 mm) [4]
– Relief valve cover [5]
– Cover packing [6]
– Relief spring [7]
– Relief valve [8]
– Packing [9]
– Relief valve spacer [10]
– O-ring (33.5 x 2 mm) [11]
– O-ring (23.5 x 2 mm) [12]

Always use a new packing when installing the relief valve.
Always use new O-rings and coat them with marine grease.
Installation is in the reverse order of removal.



FLUSH VALVE DISASSEMBLY/ ASSEMBLY

Remove the L. engine under cover (page 6-4).

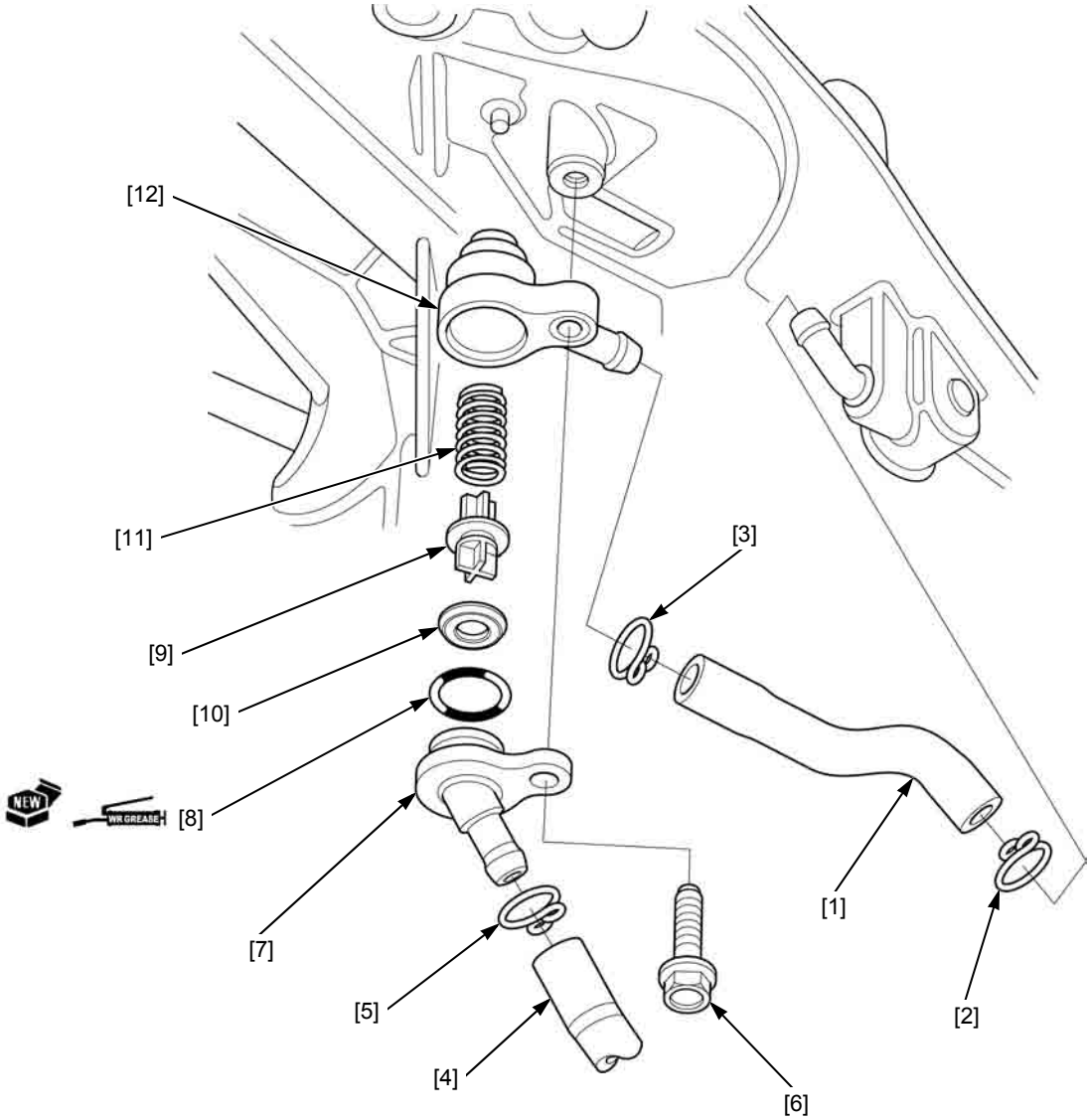
Disconnect the flush valve tube [1] and remove the tube clip 65 [2] and tube clip B12.5 [3].

Disconnect the water joint tube [4] and remove the tube clip B12.5 [5].

Remove the following:

- Bolt/washer (6 x 29 mm) [6]
- Flush valve cover [7]
- O-ring (16 mm) [8]
- Flush valve [9]
- Flush valve packing [10]
- Valve spring [11]
- Flash valve case [12]

Always use a new O-ring and coat it with marine grease.
Installation is in the reverse order of removal.



THERMOSTAT INSPECTION

Remove the thermostat (page 11-5).

Immerse the thermostat [1] in water.

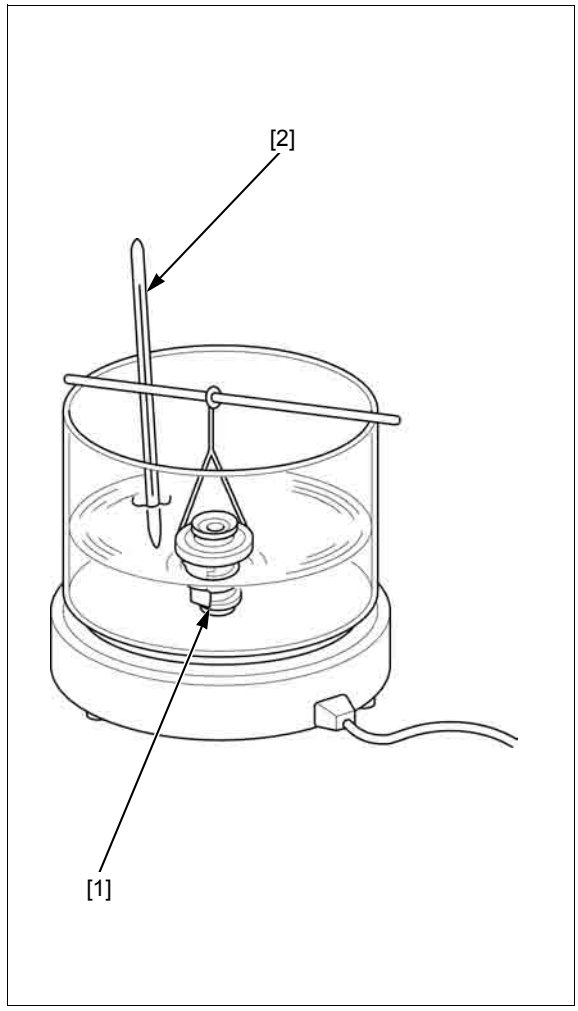
Heat the water and observe the operation of the thermostat as the water temperature increases.

Measure the water temperature when the thermostat starts opening.
Don't let the thermometer [2] or the thermostat touch the container; this may cause a false reading.

Measure the lift height when the thermostat is fully open.

START OPENING: 58 – 62°C (136 – 144°F)
FULLY OPEN: 70°C (158°F)

LIFT HEIGHT: More than 4.3 mm (0.17 in)



MEMO

12. LUBRICATION SYSTEM

COMPONENT LOCATION ····· 12-2

LUBRICATION SYSTEM DIAGRAM ····· 12-3

TOOLS ····· 12-4

OIL FILLER EXTENSION REMOVAL/ INSTALLATION ····· 12-5

OIL LEVEL GAUGE COVER REMOVAL/ INSTALLATION ····· 12-5

OIL CASE/EXHAUST PIPE/WATER TUBE REMOVAL/INSTALLATION ····· 12-6

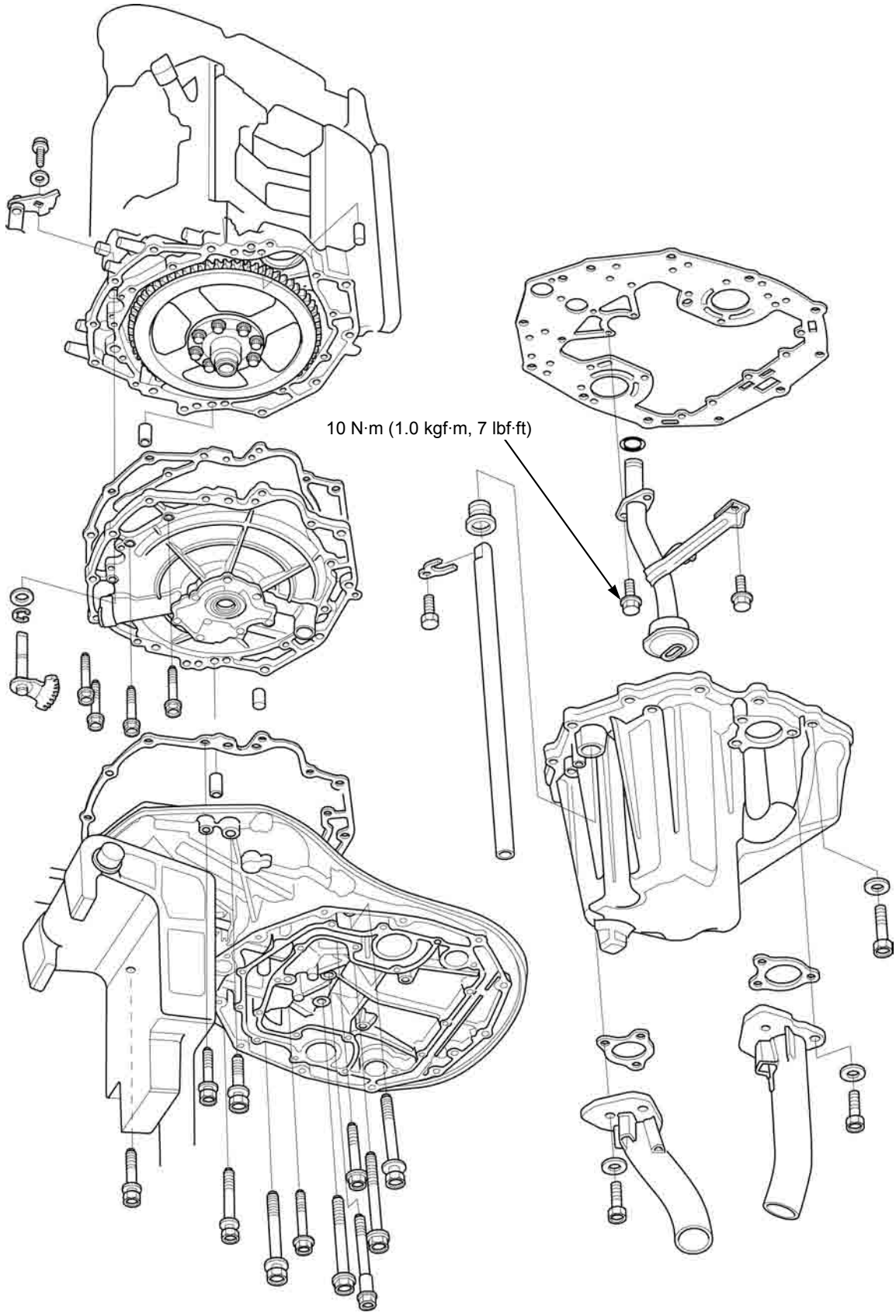
OIL PUMP REMOVAL/INSTALLATION ····· 12-9

OIL PUMP DISASSEMBLY/ ASSEMBLY ····· 12-10

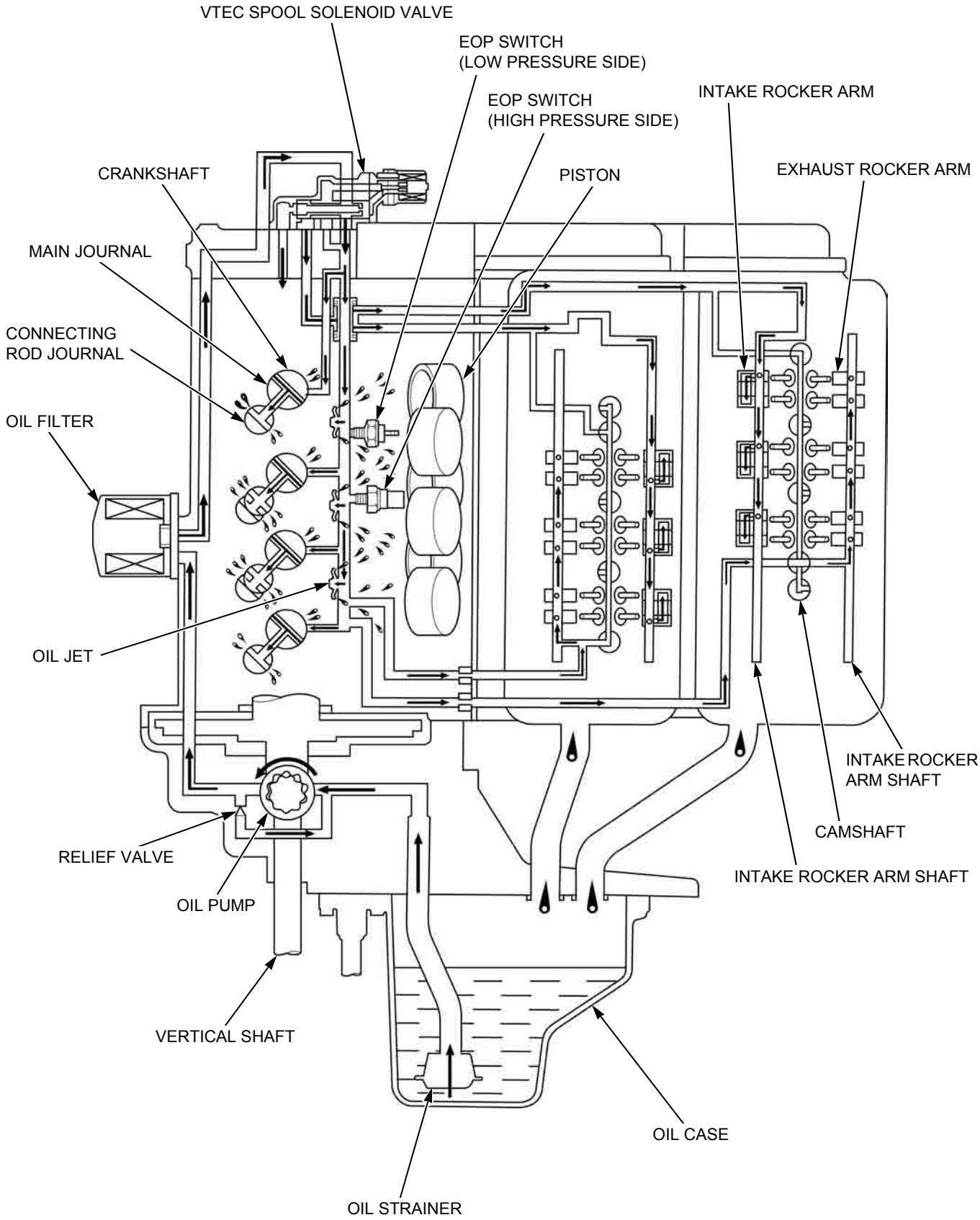
OIL PRESSURE TEST ····· 12-12

OIL PUMP INSPECTION ····· 12-13

COMPONENT LOCATION

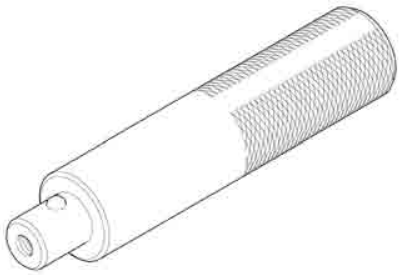
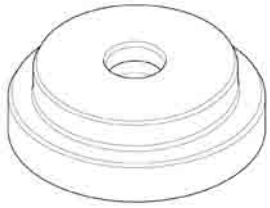
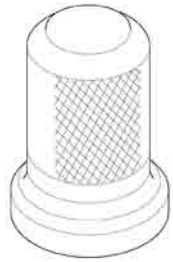


LUBRICATION SYSTEM DIAGRAM



TOOLS

LIST

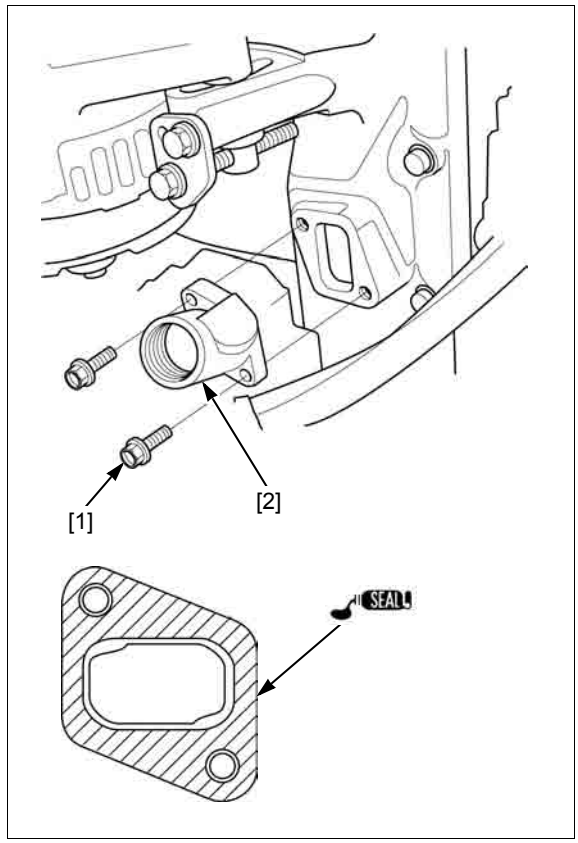
Driver 07749-0010000 	Oil seal driver attachment, 72 mm 07947-6340201 	Oil seal driver, 44.5 mm 07947-SB00100 
Oil pressure adapter, 22 x 1.5 mm 07APJ-ZY3A101 		

OIL FILLER EXTENSION REMOVAL/ INSTALLATION

Remove the two bolts (6 x 22 mm) [1] and the oil filler extension [2].

Apply liquid gasket (Threebond® #1141H, Hondabond HT, Hondabond 4, or equivalent) to the shaded part shown.

Install the oil filler extension and tighten the two bolts (6 x 22 mm).



OIL LEVEL GAUGE COVER REMOVAL/ INSTALLATION

Remove the R. exhaust manifold (page 5-95).

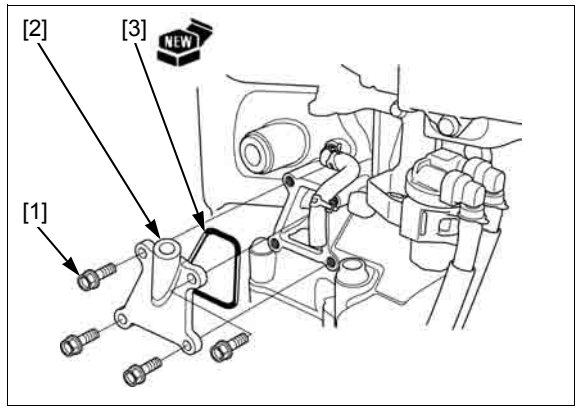
Remove the oil level gauge.

Remove the four bolts (6 x 18 mm) [1], oil level gauge cover [2], and O-ring [3].

Install a new O-ring onto the oil level gauge cover.
Install the oil level gauge cover and tighten the four bolts (6 x 18 mm).

Install the oil level gauge.

Install the R. exhaust manifold (page 5-96).



OIL CASE/EXHAUST PIPE/WATER TUBE REMOVAL/INSTALLATION

REMOVAL

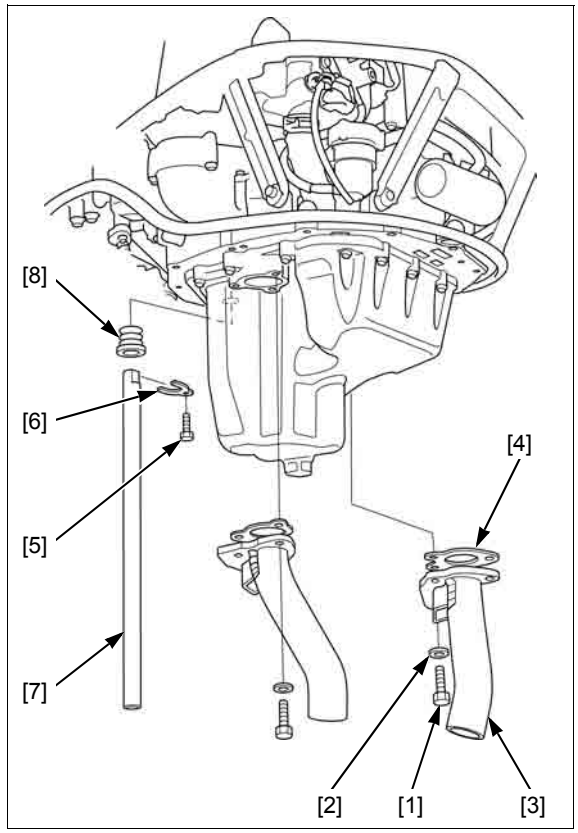
Drain the engine oil (page 3-4).

Remove the extension case:

– Standard rotation type (page 16-11)
– Counter rotation type (page 17-9)

Remove the six bolts (8 x 28 mm) [1], six washers (8 mm) [2], two exhaust pipes [3], and two exhaust pipe gaskets [4].

Remove the bolt (6 x 16 mm) [5], stopper plate [6], water tube [7], and water tube grommet [8].



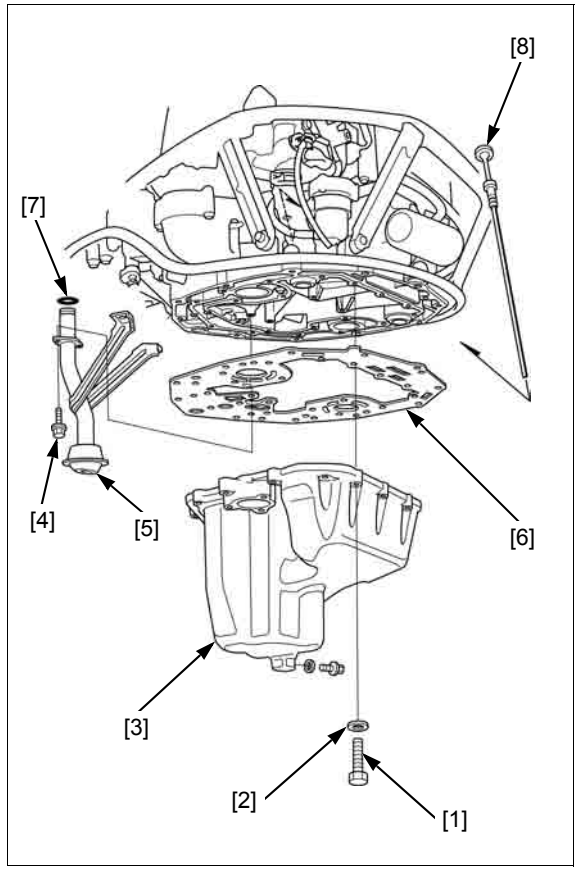
Remove the twenty-one bolts (8 x 35 mm) [1] and twenty-one washers (8 mm) [2], and remove the oil case [3].

Remove the four bolts (6 x 18 mm) [4], and remove the oil strainer [5] and oil case gasket [6].

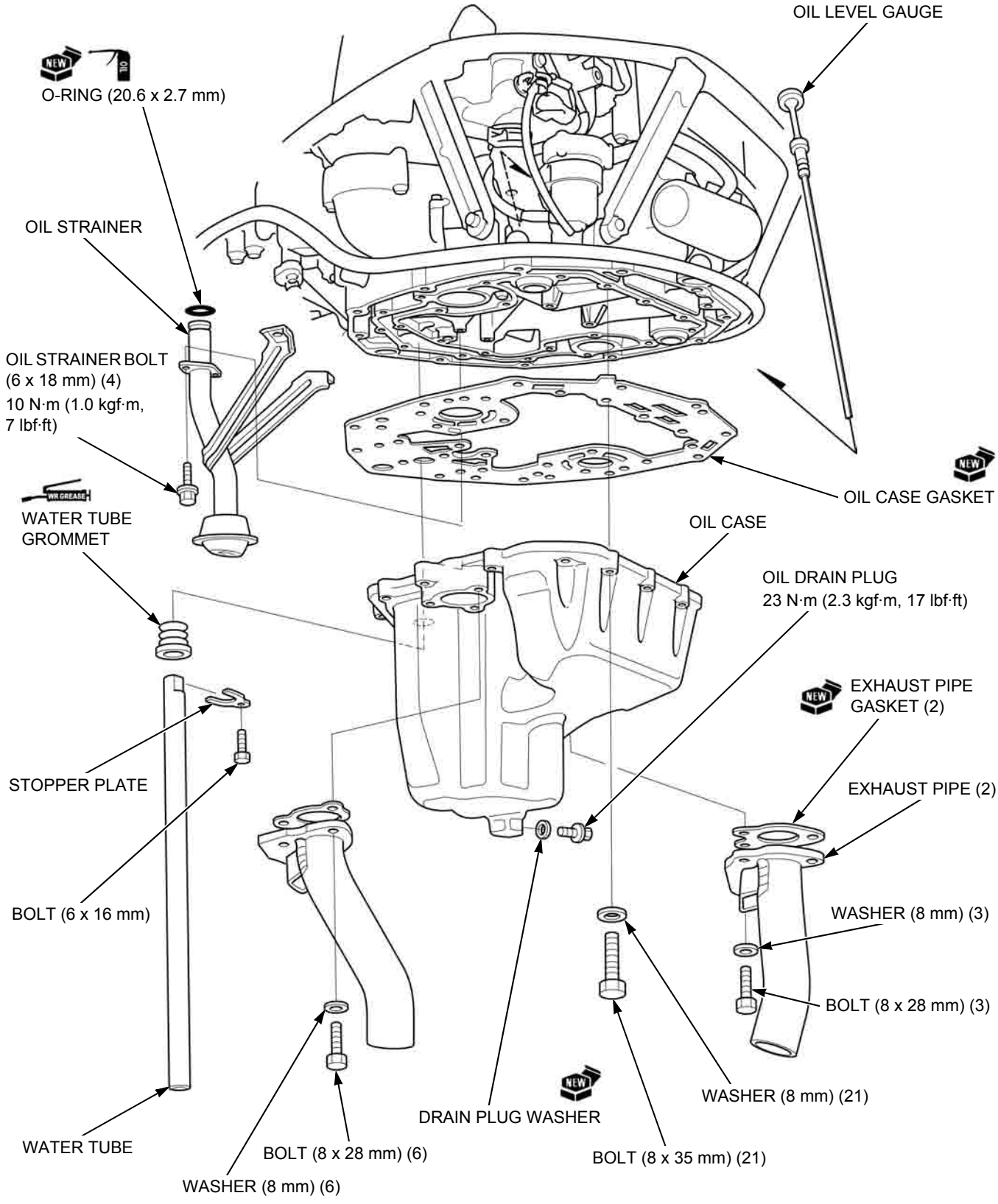
Clean the oil strainer screen with solvent and check the screen for damage, and replace if necessary.

Remove the O-ring [7] from the oil strainer.

Remove the oil level gauge [8].



EXPLODED VIEW



INSTALLATION

- Do not fill the engine with oil, or start the engine within 15 minutes after oil case installation.

Apply engine oil to a new O-ring [1], and install it to the oil strainer [2].

Apply a bead [Φ1.0 mm (0.04 in)] of the liquid gasket (Threebond® #1211, Hondabond HT, Hondabond 4, or equivalent) to the upper and lower area of the gasket [1] as shown.

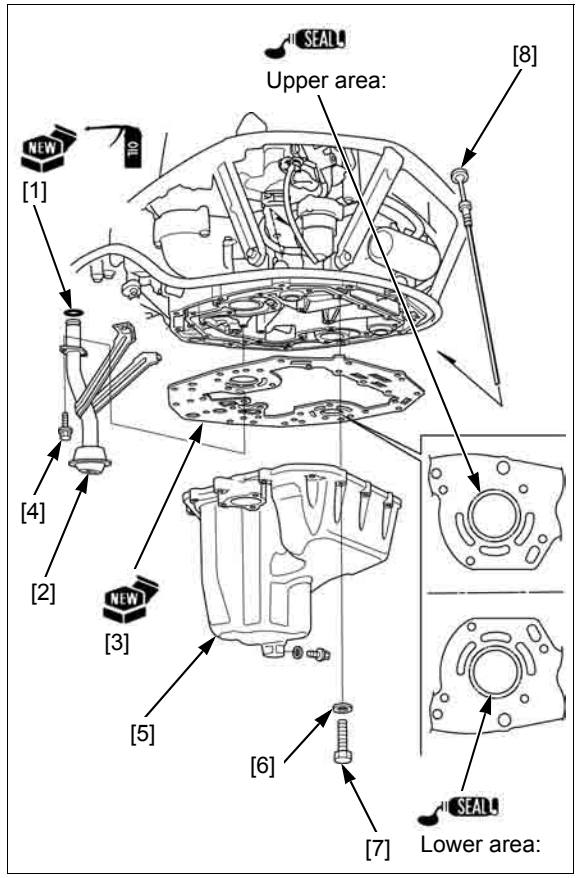
Install a new oil case gasket [3] and oil strainer and tighten the four bolts (6 x 18 mm) [4] to specified torque.

- Install the oil case gasket within 90 minutes after applying the sealant.

TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)

Set the oil case [5] to the mount case, and install the twenty-one washers (8 mm) [6] and twenty-one bolts (8 x 35 mm) [7].

Install the oil level gauge [8].



Apply marine grease to the entire circumference of the water tube grommet [1] and install it.

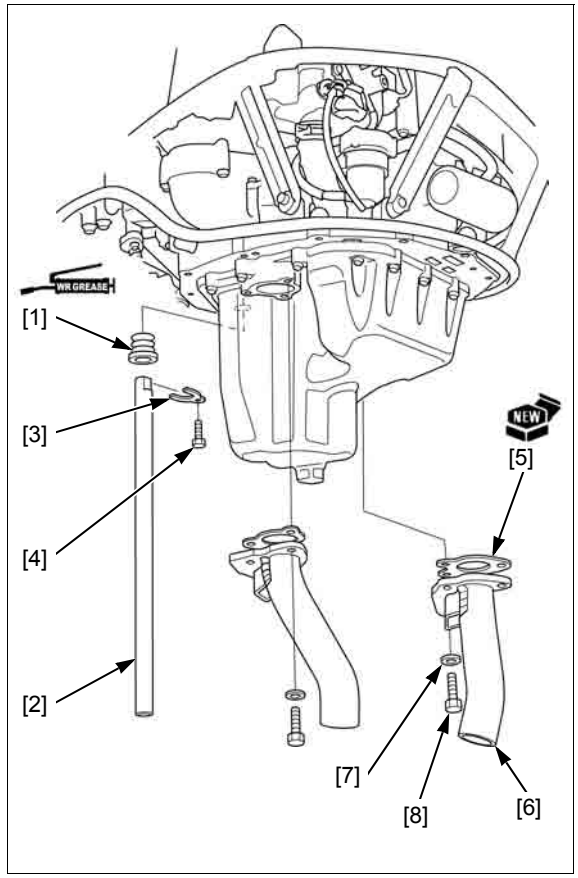
Set the water tube [2] and stopper plate [3] and tighten the bolt (6 x 16 mm) [4].

Set the two new exhaust pipe gaskets [5], exhaust pipes [6], and tighten the six washers (8 mm) [7] and six bolts (8 x 28 mm) [8].

Install the extension case:

– Standard rotation type (page 16-13)
– Counter rotation type (page 17-12)

Install the new drain plug washer and oil drain plug to the oil case and refill the engine oil (page 3-4).



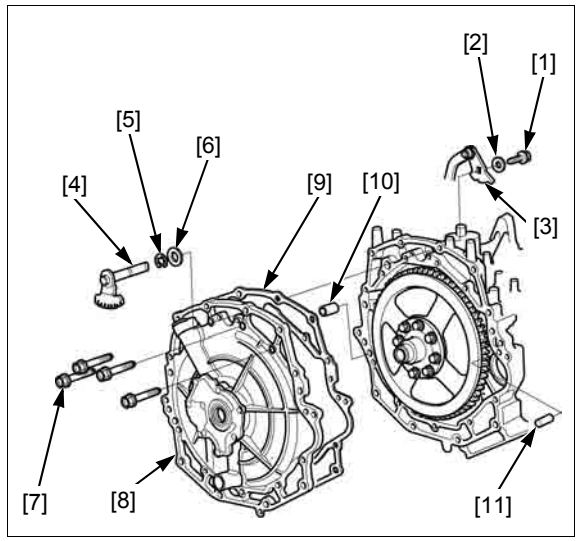
OIL PUMP REMOVAL/INSTALLATION

REMOVAL

Remove the engine (page 13-4).

Remove the bolt (6 x 16 mm) [1] and washer (6 mm) [2] from the shift arm [3].
Release the shift arm from shift shaft B [4].
Remove the E-ring [5], washer (14 mm) [6], and shift shaft B.

Remove the four bolts (8 x 30 mm) [7], oil pump [8], and gasket [9].
Remove the dowel pin (14 x 15 mm) [10] and dowel pin (10 x 16 mm) [11].



INSTALLATION

- Do not fill the engine with oil or start the engine within 15 minutes after oil pump installation.

Apply marine grease to the oil seal lips.

Install the dowel pin (10 x 16 mm) [1] and dowel pin (14 x 15 mm) [2].

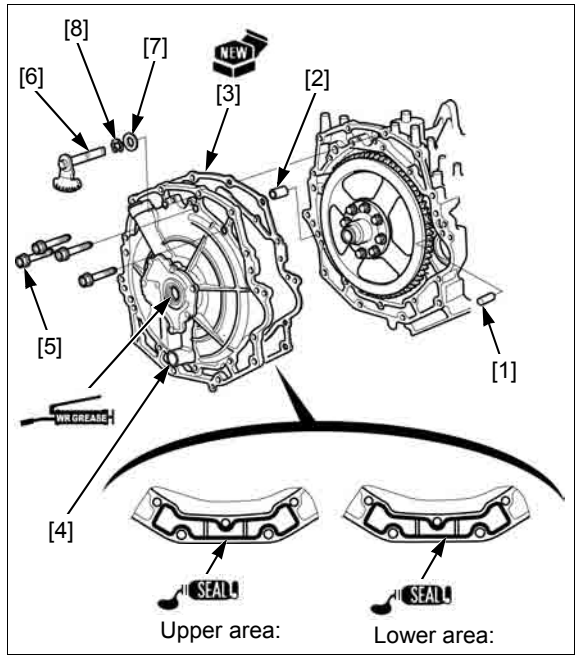
Apply a bead [Φ1.0 mm (0.04 in)] of the liquid gasket (Threebond® #1211, Hondabond HT, Hondabond 4, or equivalent) to the upper and lower area of a new oil pump gasket [3] as shown.

- Install the oil pump gasket within 90 minutes after applying the sealant.

Install the oil pump gasket and oil pump [4], and tighten the four bolts (8 x 30 mm) [5].

Install shift shaft B [6] and washer (14 mm) [7], and set the E-ring [8] to the shift shaft B groove properly.

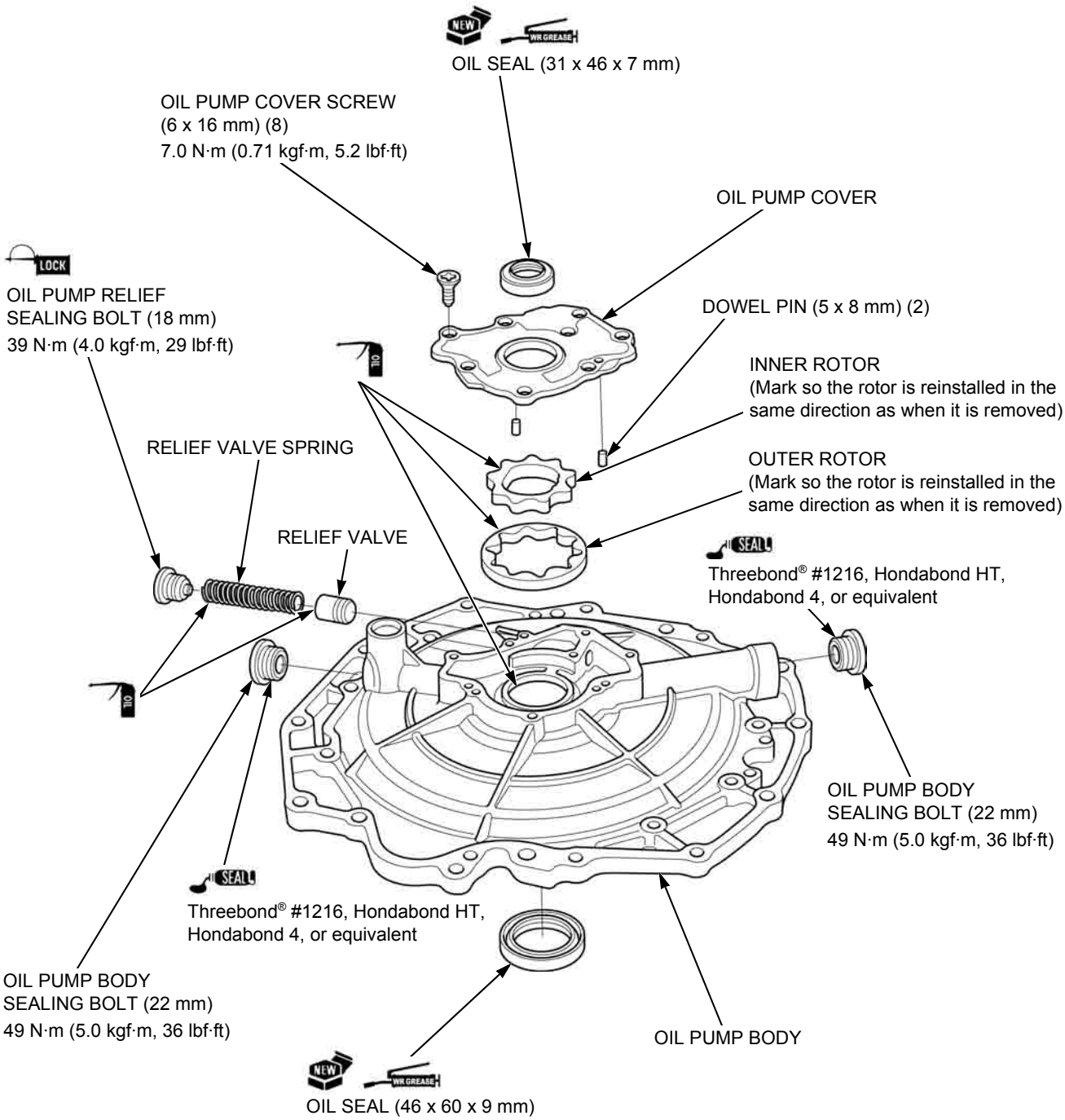
Install the engine (page 13-6).



OIL PUMP DISASSEMBLY/ASSEMBLY

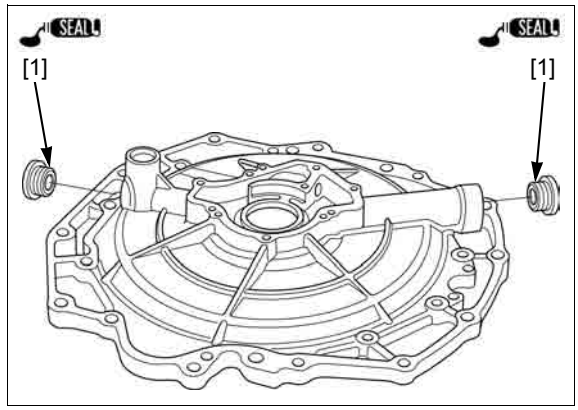
DISASSEMBLY

Remove the oil pump (page 12-9).



ASSEMBLY

Apply liquid sealant (Threebond® #1216 or equivalent) to the threads of the two sealing bolts [1].



NOTICE

- *To prevent leaks, do not install the parts if 5 minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the old residue.*
- *After assembly, wait at least 30 minutes before filling the engine with oil.*

Install and tighten the sealing bolts to the specified torque.

TORQUE: 49 N·m (5.0 kgf·m, 36 lbf·ft)

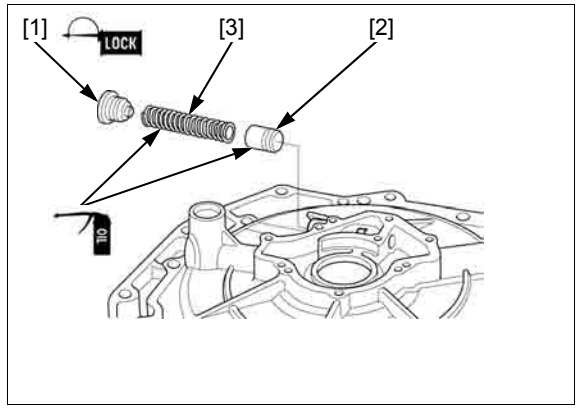
Apply a locking agent (Hondalock 2 or equivalent) to the threaded part of the oil pump sealing bolt [1].

Check the relief valve [2] surface for damage before installation.

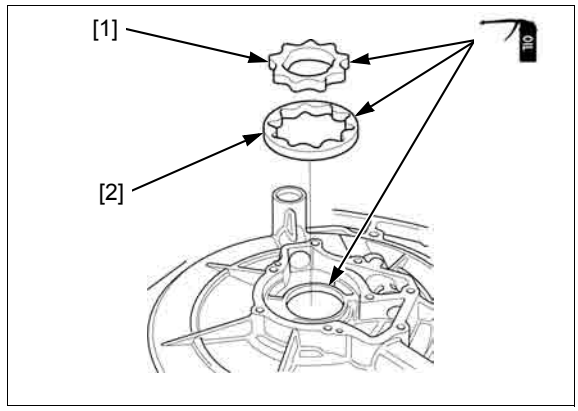
Apply engine oil to the relief valve and relief spring [3].

Install the relief valve and relief valve spring, and tighten the sealing bolt to the specified torque.

TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)



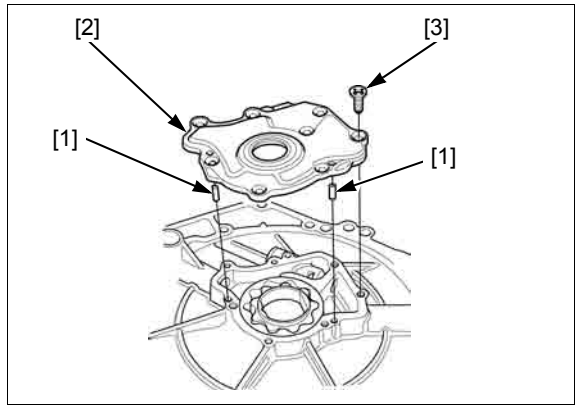
Clean the inner rotor [1] and outer rotor [2] thoroughly.
Apply engine oil to the inner rotor, outer rotor, and pump body, and set them to the oil pump body.
Install the rotors in the same direction as when they were removed.



Install the dowel pins [1] and oil pump cover [2], and tighten the eight flat screws (6 x 16 mm) [3] to the specified torque.

TORQUE: 7.0 N·m (0.71 kgf·m, 5.2 lbf·ft)

Make sure the rotor moves smoothly after reassembling.



Using the special tools or hydraulic press, install each oil seal to the position shown.

- Press-fit the oil seal (46 x 60 x 9 mm) [1] to the position 23.2 – 23.8 mm (0.24 – 0.27 in) [2] from the body end to the oil seal face.
- Press-fit the oil seal (31 x 46 x 7 mm) [3] to the position 8.7 – 9.3 mm (1.74 – 1.76 in) [4] from the body end to the oil seal face with the oil pump cover mounted with the flat screws.

Oil seal (46 x 60 x 9 mm):

TOOLS:

Driver [5]	**07749-0010000**
Oil seal driver attachment, 72 mm [6]	**07947-6340201**

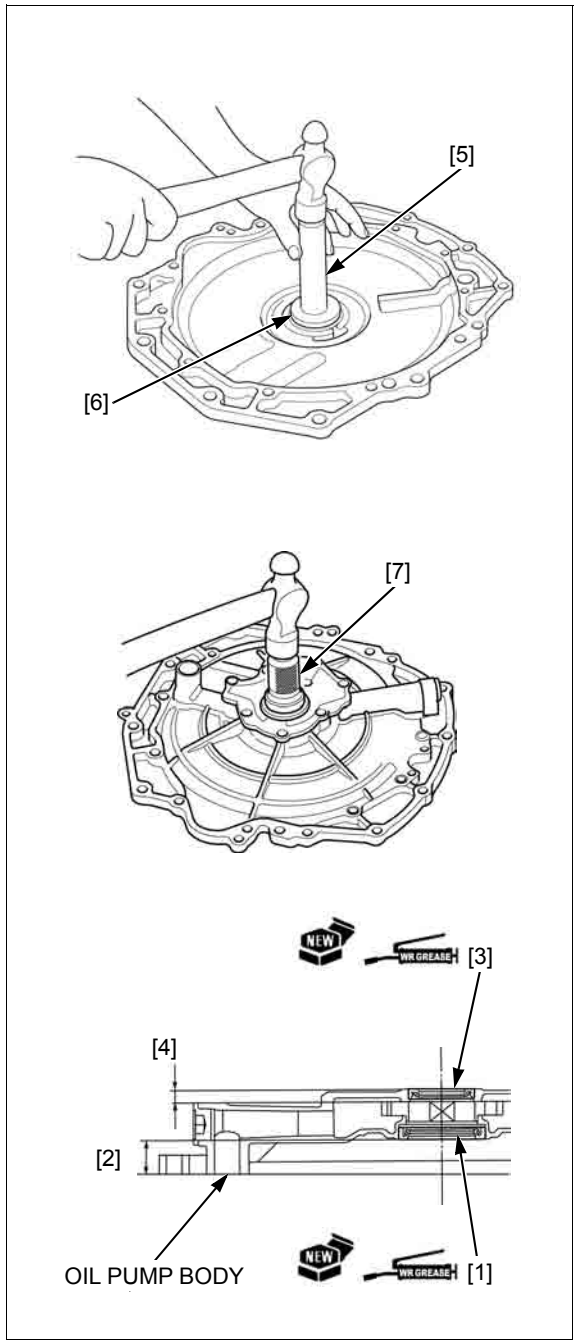
Oil seal (31 x 46 x 7 mm):

TOOL:

Oil seal driver, 44.5 mm [7]	**07947-SB00100**

Apply marine grease to the lips of each oil seal.

Install the oil pump (page 12-9).



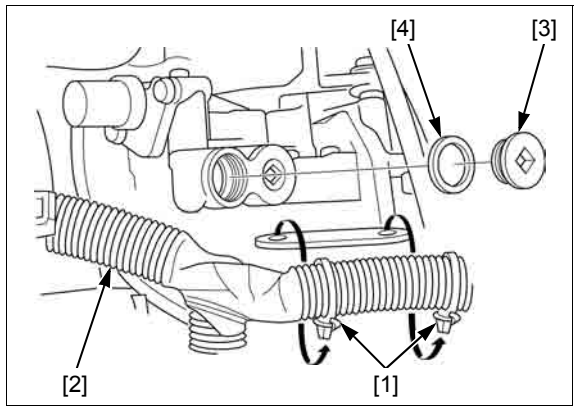
OIL PRESSURE TEST

Remove the cooling fan cover (page 5-68).

Check the engine oil level (page 3-4).

Release the two main wire harness band clips [1] located above the ECM, and pull the harness away from the engine.

Protect the main wire harness [2] with a shop towel or equivalent material.
Remove the oil pressure sealing bolt [3] and washer [4] from the crankcase upper cover.



Make sure the oil pressure adapter O-ring [1] is in good condition. Install and tighten the oil pressure adapter [2] to the specified torque.

TOOL:
Oil pressure adapter, 22 x 1.5 mm **07APJ-ZY3A101**

TORQUE: 9 N·m (0.9 kgf·m, 6.6 lbf·ft)

NOTICE

- *Over-tightening will damage the threads.*

Attach the oil pressure gauge, MT37A [3] to the quick disconnect, AT77AH [4].

TOOLS:

Oil pressure gauge MT37A	**Commercially available**
Quick disconnect, AT77AH	**Commercially available**

Remove the propeller:

– Standard rotation type (page 16-6)
– Counter rotation type (page 17-5)

Run the outboard in a test tank with the water level at least 4 inches above the anti-ventilation plate. Allow the engine to warm up to normal operating temperature, and then measure the oil pressure.

OIL PRESSURE (Pressure check at 650 ± 50 min^{-1} (rpm) in neutral:
117 – 176 kPa (1.2 – 1.8 kgf/cm^2, 17 – 26 psi)

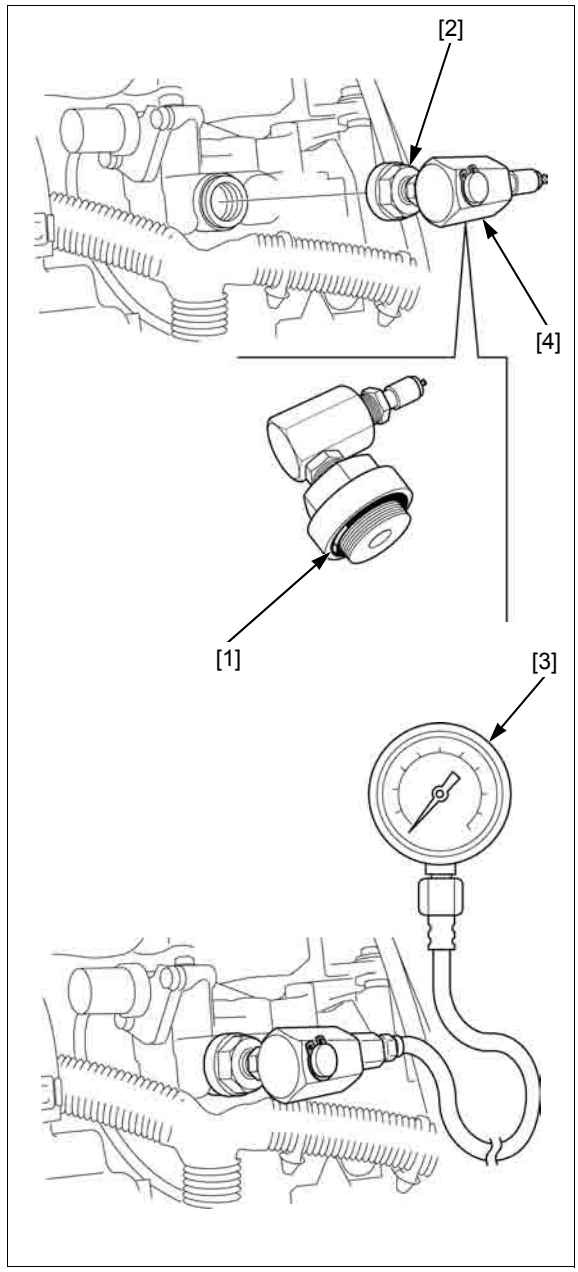
If the oil pressure is lower than specification, check the oil pump rotors and oil pump body for wear (page 12-13).

Remove the special tools.

Replace the sealing washer with a new one, and install the sealing bolt. Tighten the sealing bolt to the specified torque.

TORQUE: 54 N·m (5.5 kgf·m, 40 lbf·ft)

Install the removed parts in the reverse order of removal.

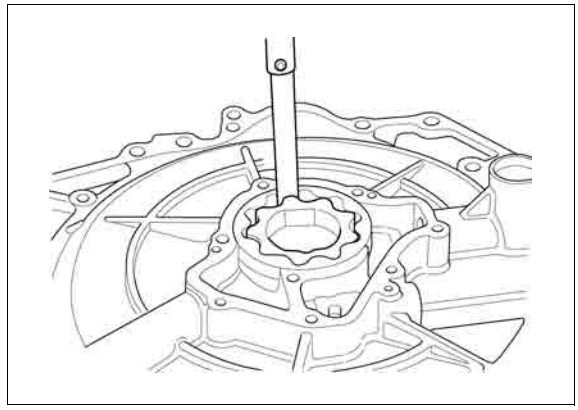


OIL PUMP INSPECTION

INNER ROTOR-TO-OUTER ROTOR CLEARANCE

Measure the inner rotor-to-outer rotor clearance.

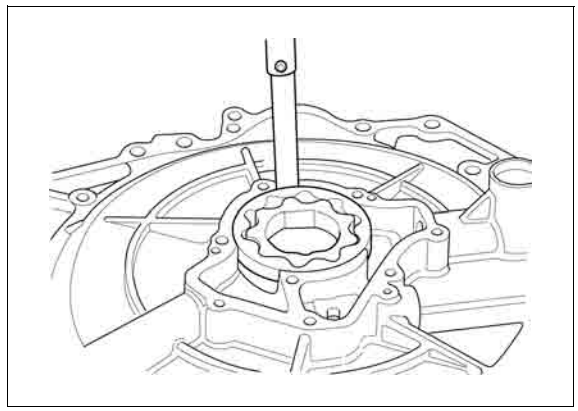
STANDARD:
0.04 – 0.16 mm (0.002 – 0.006 in)
SERVICE LIMIT:
0.20 mm (0.008 in)



OUTER ROTOR-TO-PUMP BODY CLEARANCE

Measure the outer rotor-to-pump body clearance.

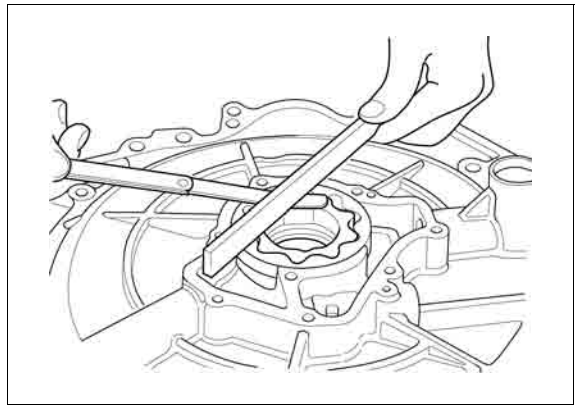
STANDARD:
0.10 – 0.18 mm (0.004 – 0.007 in)
SERVICE LIMIT:
0.20 mm (0.008 in)



OUTER ROTOR-TO-OIL PUMP BODY SIDE CLEARANCE

Measure the outer rotor-to-oil pump body side clearance.

STANDARD:
0.02 – 0.07 mm (0.001 – 0.003 in)
SERVICE LIMIT:
0.12 mm (0.005 in)



13. ENGINE REMOVAL/INSTALLATION

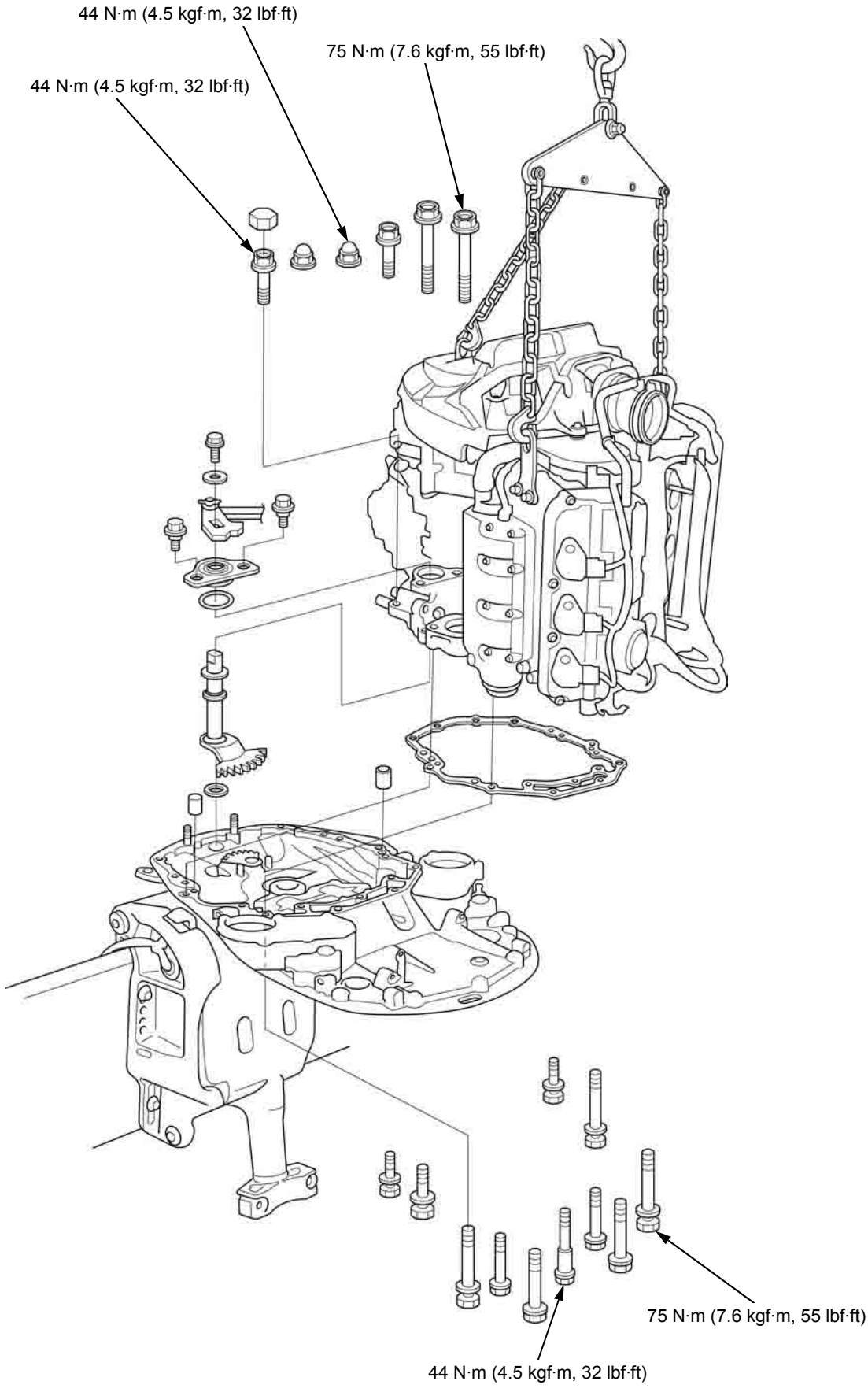
COMPONENT LOCATION ····· 13-2

TOOL ····· 13-3

ENGINE REMOVAL ····· 13-4

ENGINE INSTALLATION ····· 13-6

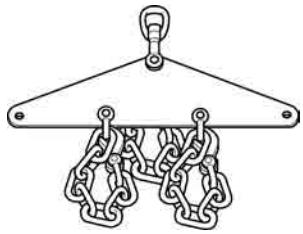
COMPONENT LOCATION



TOOL

LIST

Engine hanger
VSB02C000021



ENGINE REMOVAL

⚠WARNING

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

Disconnect the battery negative (–) cable, then positive (+) cable from the battery.

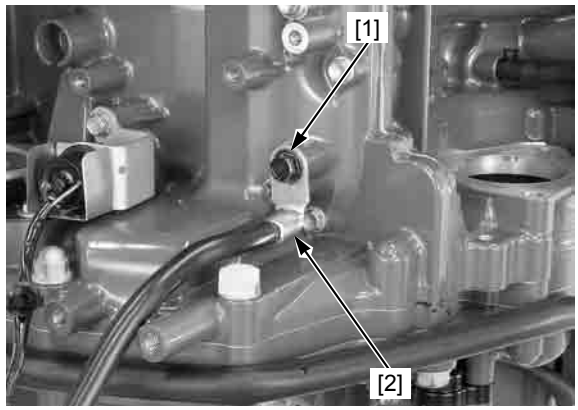
Shift the remote control lever to the N (neutral) position.

Relieve the fuel pressure (page 5-66).

Remove the following parts:

– Electric parts case (page 10-4)
– Power tilt relay case (page 10-6)
– Engine cover bracket (page 6-9)
– Front cover bracket (page 6-10)
– Water separator (page 5-93)
– Fuel pump (High pressure side)/Vapor separator (page 5-86)
– Oil case/Exhaust pipe/Water tube (page 12-6)
– Starter motor (page 9-5)

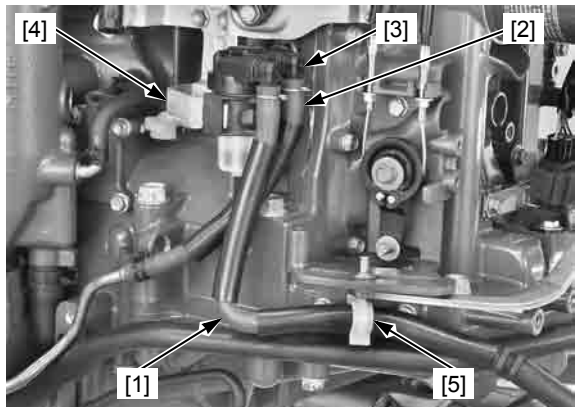
Remove the bolt (8 x 18 mm) [1] and starter cable (–) [2].



Disconnect fuel tube A [1] and B [2] from the fuel strainer [3].

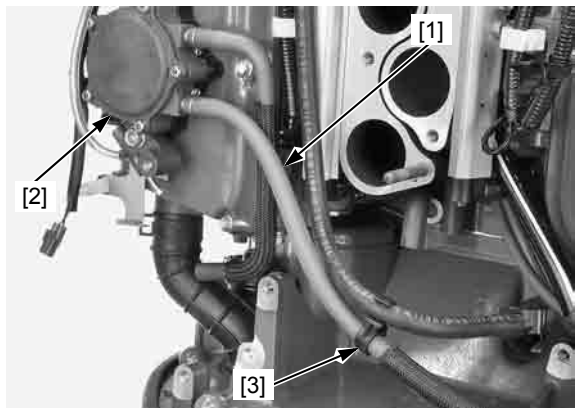
Remove the fuel strainer from the strainer bracket [4].

Release fuel tube A from the hose clamp [5].

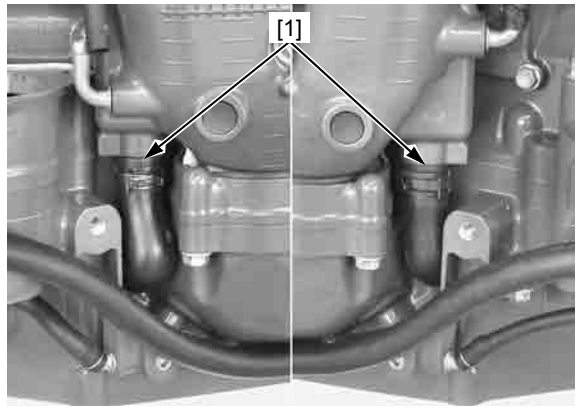


Disconnect fuel tube G [1] from the fuel pump (low pressure side) [2].

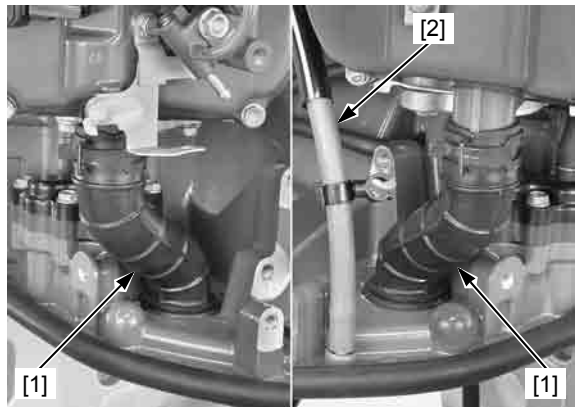
Release fuel tube G from the hose clip [3].



Disconnect the water tubes [1] from the exhaust manifolds.

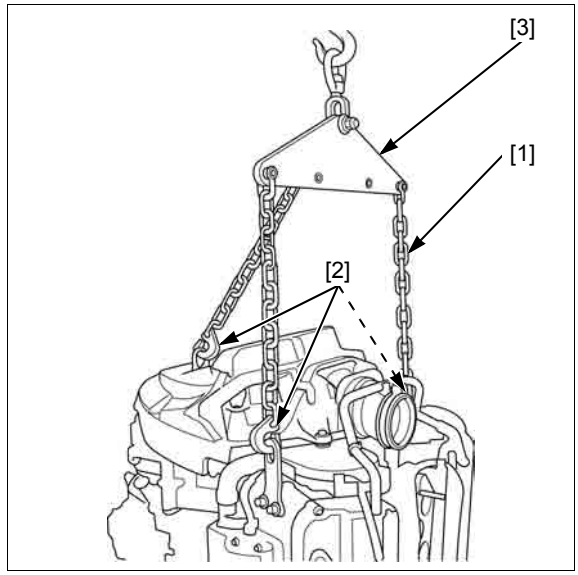


Disconnect the cylinder head cover oil return hoses [1] and air vent tube [2].



Attach the engine chains [1] to the engine hanger [2].

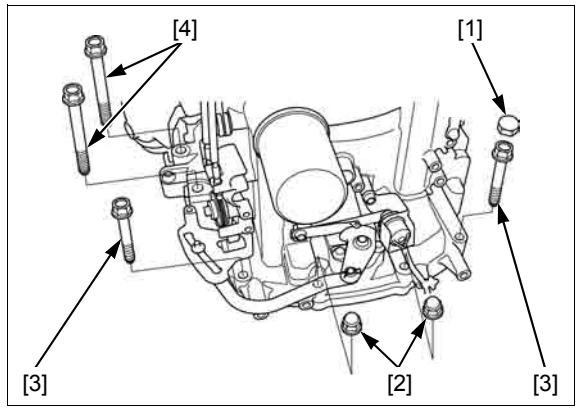
TOOL:
Engine hanger [3] VSB02C000021



Remove the cap [1], two mount case flange nuts [2], two flange bolts (10 x 55 mm) [3], and two flange bolts (12 x 95 mm) [4] from the engine assembly.

NOTICE

- *Be sure that the hanger chains are hooked on the three engine hangers securely.*



Remove the following bolts from the under side of the engine mounting case [1].

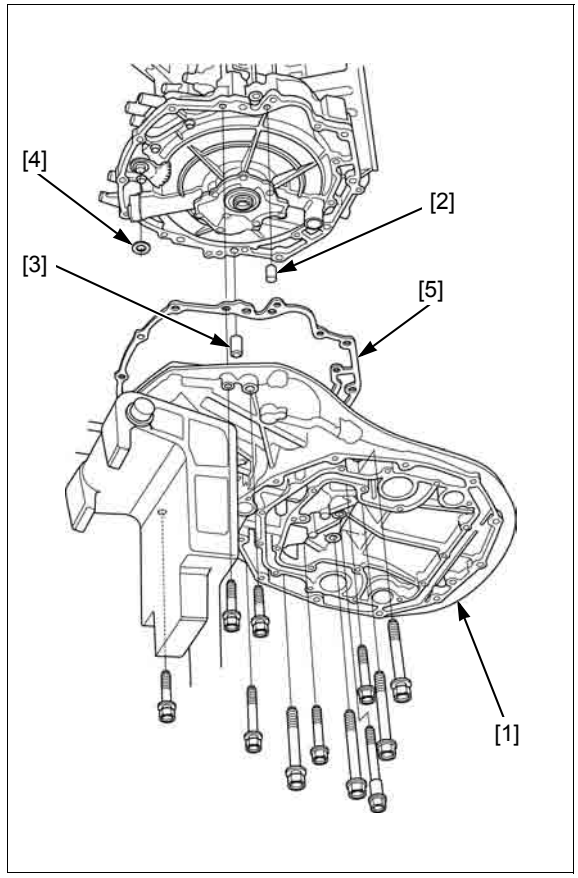
- bolts (10 x 60 mm) (two)
- bolt (10 x 85 mm) (one)
- bolt/washer (12 x 65 mm) (one)
- bolt/washers (12 x 120 mm) (two)
- flange bolts (10 x 70 mm) (two)
- flange bolt (10 x 120 mm) (one)
- flange bolts (12 x 120 mm) (two)

Lift up the engine assembly slowly with a hoist, and remove the engine from the engine mount case.

NOTICE

- *When lifting the engine assembly, take care to keep it level.*

Remove the dowel pin (10 x 16 mm) [2], dowel pin (14 x 15 mm) [3], washer (14 mm) [4] and the engine mounting case gasket [5].

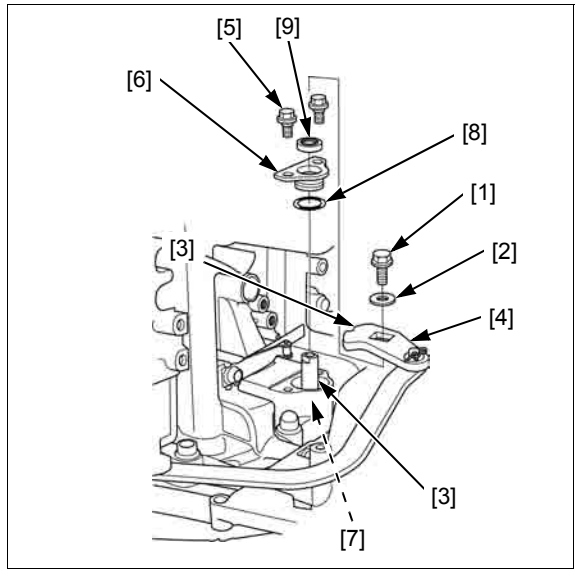


ENGINE INSTALLATION

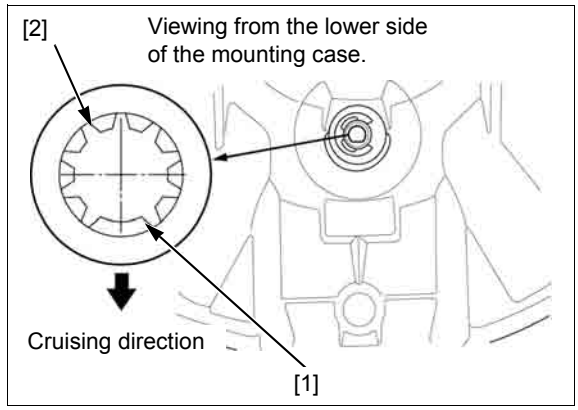
Remove the bolt (6 x 16 mm) [1], and washer (6 mm) [2] from sift shaft B [3], and remove the shift arm [4].

Remove the two bolts (6 x 11 mm) [5] and the seal holder [6].
Remove shift shaft B and washer (14 mm) [7] from the back side of the engine assembly.

Remove the O-ring (26.9 x 2.4 mm) [8] and oil seal [9] from the seal holder.



Turn shift shaft A [1] so that the cutout [2] is positioned as shown. (This position shows shift shaft A is in the neutral position.)

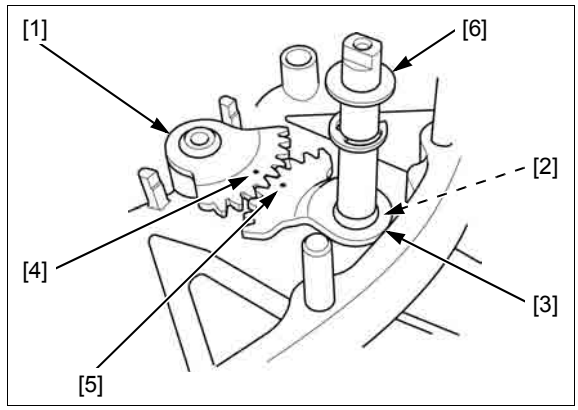


Install shift shaft A [1], washer [2] and shift shaft B [3] by aligning the punch mark [4] on shift shaft A with the punch mark [5] on shift shaft B.

NOTICE

- *Do not install the engine assembly without aligning the punch marks. Take care not to let the punch marks get out of alignment during the engine installation.*
- *Proper shifting cannot occur unless the punch marks are aligned.*

Install the washer (14 mm) [6] into the shift shaft B.

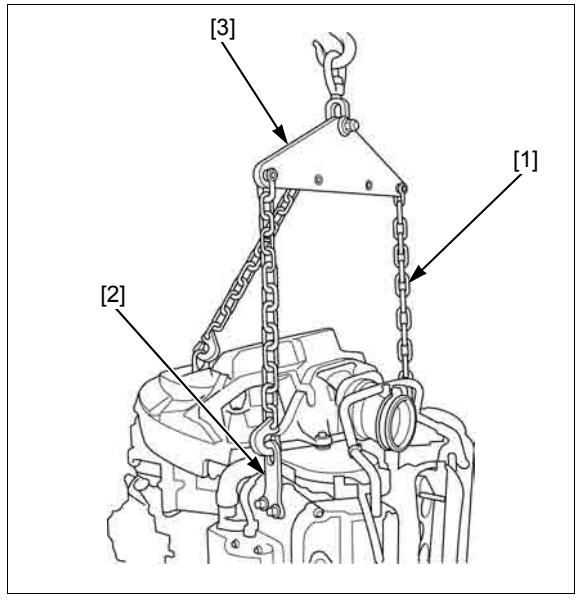


Attach the engine chains [1] to the engine hangers [2].

TOOL:
Engine hanger [3] VSB02C000021

NOTICE

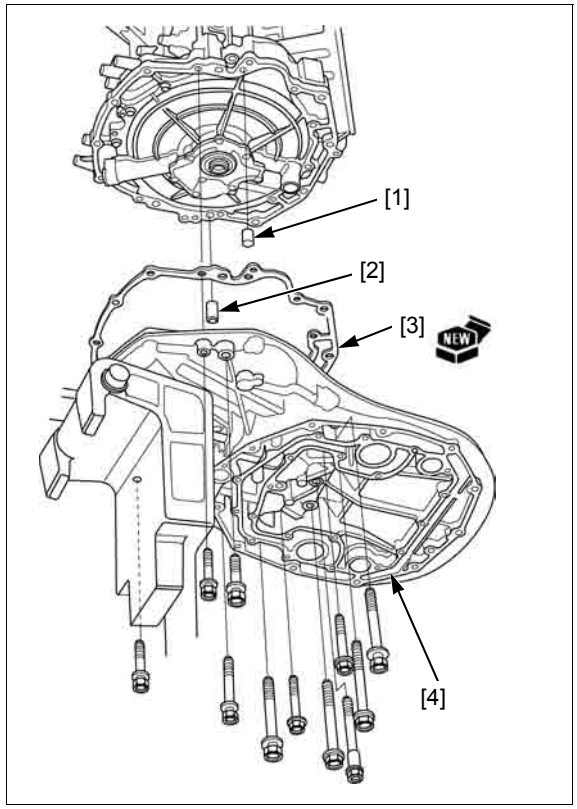
- *When lifting the engine assembly, take care to keep it level.*



Set the dowel pin (10 x 16 mm) [1] and dowel pin (14 x 15 mm) [2] to the mount case.

Install a new mount case gasket [3].

Slowly install the engine assembly on the engine mount case [4]. Be careful not to let the shift shaft B position come out of alignment.



Tighten the bolts from the under side of the mount case in the numbered order to the specified torque.

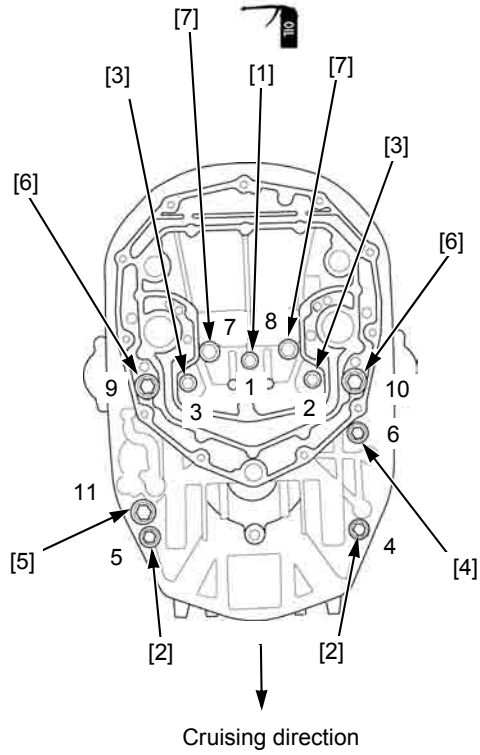
Before tightening the flange bolt (10 x 120 mm) [1], apply engine oil to their threads and seating surfaces.

TORQUE:

44 N·m (4.5 kgf·m, 32 lbf·ft):
- **bolts (10 x 60 mm) [2] (two)**
- **flange bolts (10 x 70 mm) [3] (two)**
- **bolt (10 x 85 mm) [4] (one)**
- **flange bolt (10 x 120 mm) (one)**

75 N·m (7.6 kgf·m, 55 lbf·ft):
- **bolt/washer (12 x 65 mm) [5] (one)**
- **bolt/washer (12 x 120 mm) [6] (two)**
- **flange bolts (12 x 120 mm) [7] (two)**

Viewing from the under side of the mount case.

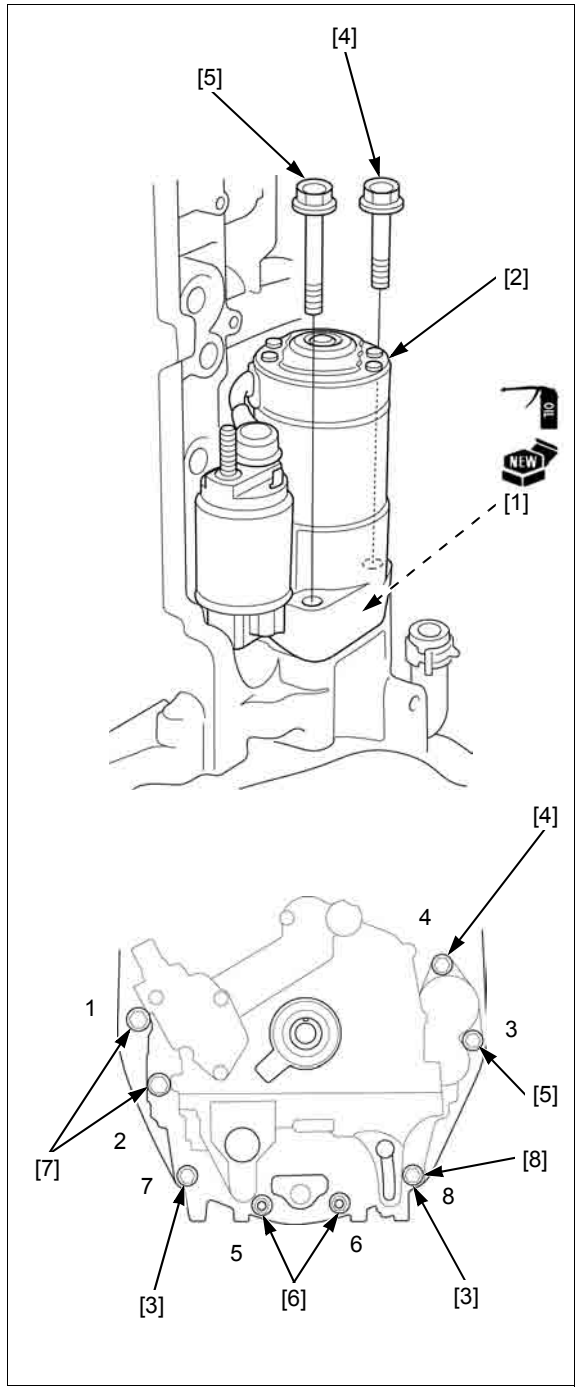


Apply engine oil to a new O-ring (59.4 x 3.1 mm) [1], and install it to the starter motor [2].

Install the starter motor, but do not tighten the starter motor bolts.
Tighten the bolts and nuts to the upper side of the engine assembly in the numbered order to the specified torque.

TORQUE:
- **44 N·m (4.5 kgf·m, 32 lbf·ft):**
  - **flange bolt (10 x 55 mm) [3] (two)**
  - **starter bolt (10 x 90 mm) [4] (one)**
  - **starter bolt (10 x 110 mm) [5] (one)**
  - **mount case flange nut (10 mm) [6]**
- **75 N·m (7.6 kgf·m, 55 lbf·ft):**
  - **flange bolts (12 x 95 mm) [7] (two)**

Install the cap [8] to the bolt (10 x 55 mm) of the L. side.



Apply marine grease to the seal holder [1] O-ring groove and bearing part.

Apply marine grease to a new O-ring (26.9 x 2.4 mm) [2], and install it to the seal holder.

Install the seal holder on shift shaft B [3] so that shift shaft B does not tilt on the mount case.
Install the two bolts (6 x 11 mm) [4] to the shift holder and tighten them.

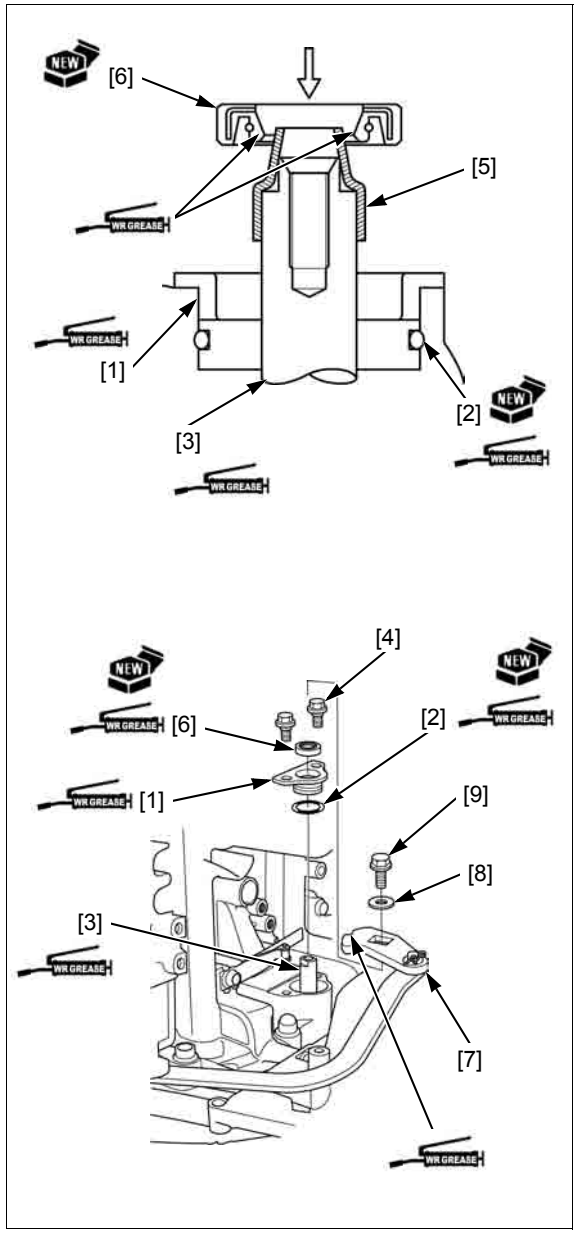
Tape [5] shift shaft B as shown.

Apply marine grease to the oil seal contact surface of the shift shaft B.

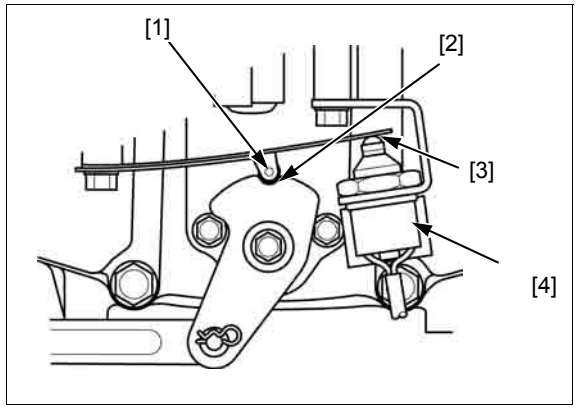
Apply marine grease to the lip part and soapy water to the outer circumference of a new oil seal [6], and install the oil seal to shift shaft B so that the oil seal lip part is toward the lower side.

Apply marine grease to the shift arm [7] click part.

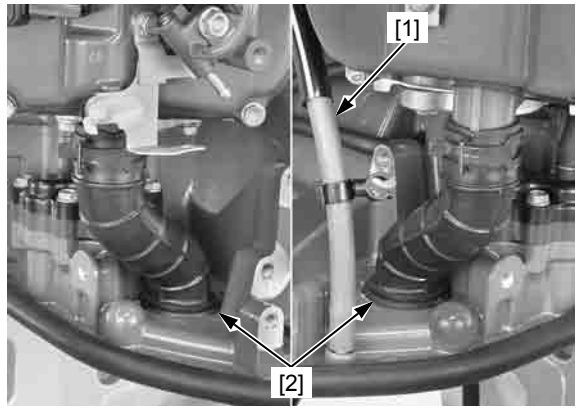
After installing the seal holder, install the shift arm to shift shaft B and tighten the washer (6 mm) [8] and bolt (6 x 16 mm) [9].



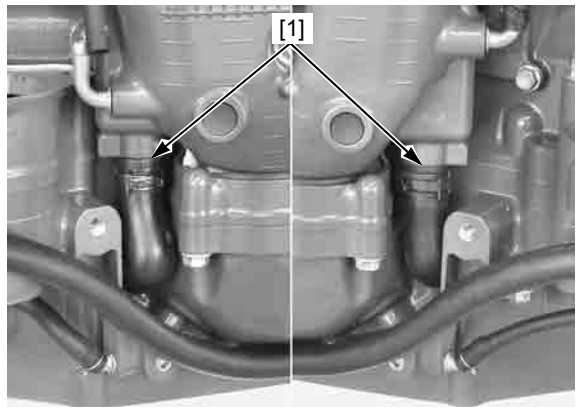
Make sure the click roller [1] is in the shift arm groove [2] and assist spring tip [3] is pushing the neutral switch [4].
Make sure the assist spring tip does not contact the neutral switch button when the shift lever is moved to either the forward or reverse positions.



Connect the cylinder head cover oil return hoses [1] and air vent tube [2].

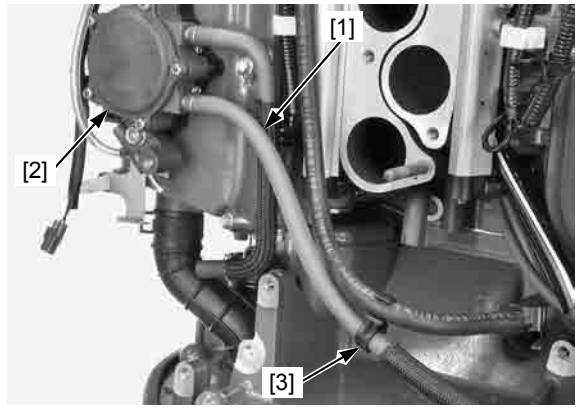


Connect the water tubes [1] to the exhaust manifolds.



Connect fuel tube G [1] to the fuel pump (low pressure side) [2].

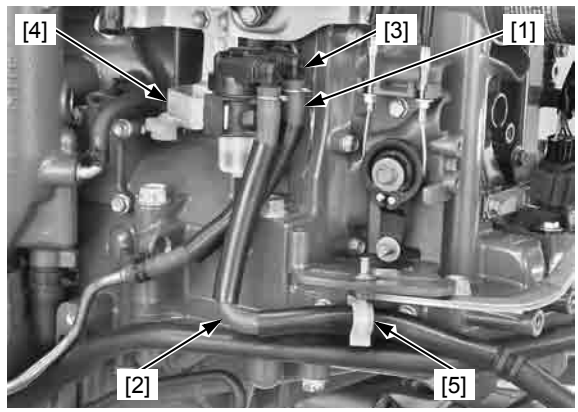
Install fuel tube G to the hose clip [3].



Connect fuel tube A [1] and B [2] to the fuel strainer [3].

Install the fuel strainer to the strainer bracket [4].

Install fuel tube A from the hose clamp [5].

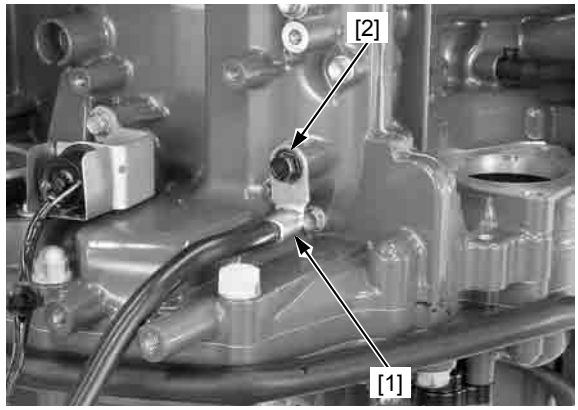


Install the starter cable (–) [1] and bolt (8 x 18 mm) [2].

Install the following parts:

– Oil case/Exhaust pipe/Water tube (page 12-8)
– Fuel pump (High pressure side)/Vapor separator (page 5-90)
– Water separator (page 5-94)
– Front cover bracket (page 6-10)
– Engine cover bracket (page 6-9)
– Electric parts case (page 10-4)
– Power tilt relay case (page 10-6)

Connect the battery positive (+) cable, then negative (–) cable to the battery.



14. CYLINDER HEAD

COMPONENT LOCATION ····· 14-2

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TIMING BELT DRIVE/DRIVEN PULLEY REMOVAL/INSTALLATION ····· 14-6

CYLINDER HEAD COVER REMOVAL/ INSTALLATION ····· 14-19

CYLINDER HEAD REMOVAL/ INSTALLATION ····· 14-22

CYLINDER HEAD DISASSEMBLY/ ASSEMBLY ····· 14-25

ROCKER ARMS/SHAFTS DISASSEMBLY/ ASSEMBLY ····· 14-31

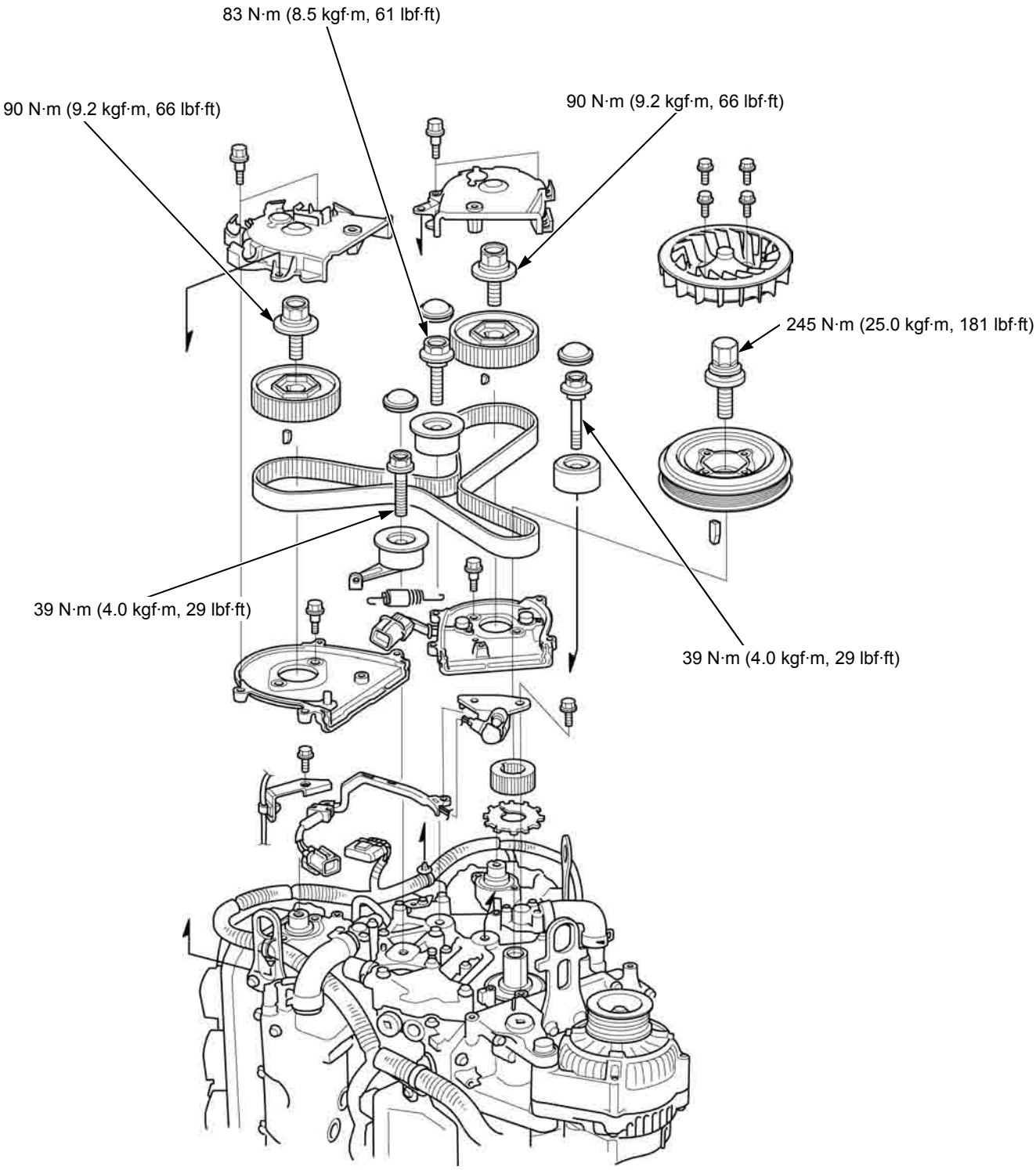
CYLINDER COMPRESSION TEST ····· 14-33

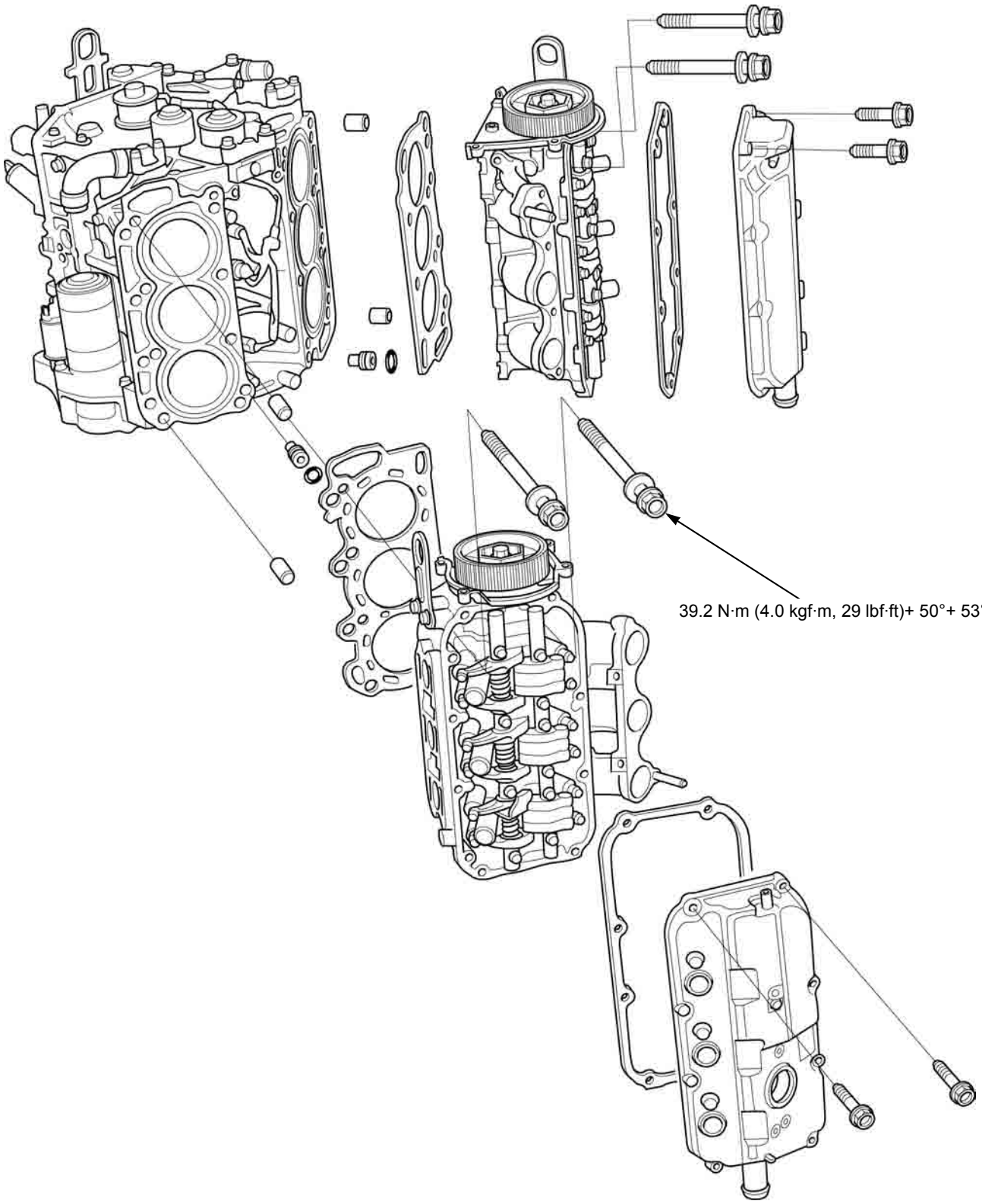
CYLINDER HEAD INSPECTION ····· 14-33

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VALVE SEAT RECONDITIONING ····· 14-44

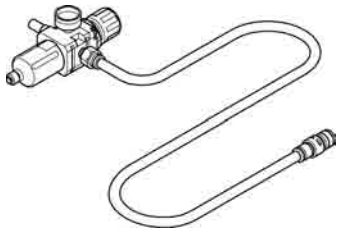
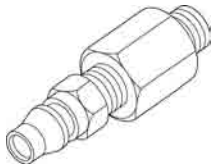
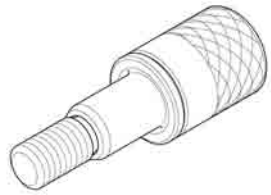
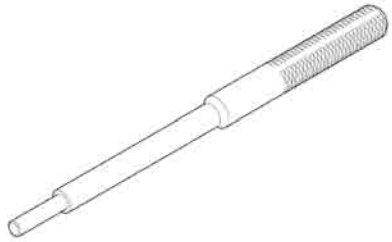
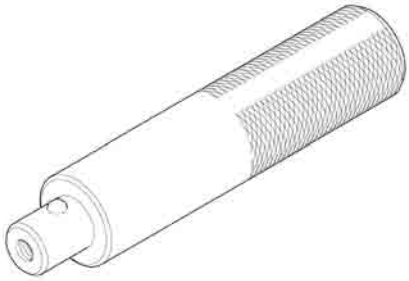
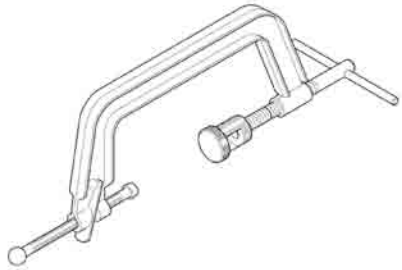
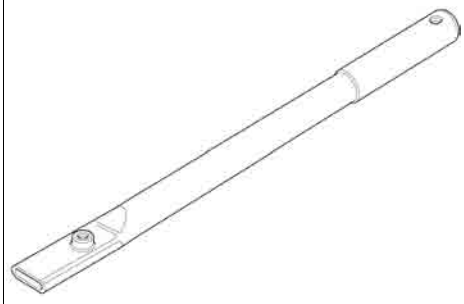
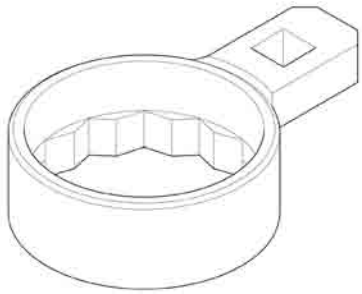
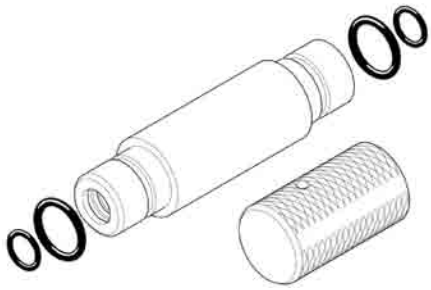
COMPONENT LOCATION




39.2 N·m (4.0 kgf·m, 29 lbf·ft)+ 50°+ 53°

TOOLS

LIST

Air supply 07AAJ-PNAA100 	Air adapter 070AJ-0010101 	VTEC air stopper 070AJ-0030100 
Valve guide reamer, 5.5 mm 07HAH-PJ7A100 	Valve guide driver, 5.35 x 9.7 mm 07742-0010100 	Attachment, 52 x 55 mm 07746-0010400 
Driver 07749-0010000 	Valve spring compressor 07757-0010000 	Holder handle 07JAB-001020A 
Lock nut wrench, 56 mm 07LPA-ZV30200 	Stem seal driver 07PAD-0010000 	Holder attachment, 50 mm 070PB-0010100 

Air supply attachment
07VAJ-P8A010A



TIMING BELT DRIVE/DRIVEN PULLEY REMOVAL/INSTALLATION

REMOVAL

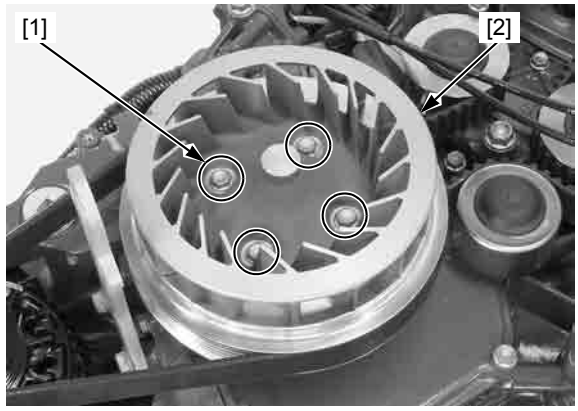
Disconnect the battery negative (–) cable.

Make sure the remote control lever is in "N" (neutral) position.

Remove the following:

– Engine cover
– Cooling fan cover (page 5-68)

Remove the four bolts (6 x 16 mm) [1] and cooling fan [2].



Check the cooling fan for wear or damage, replace it if necessary.

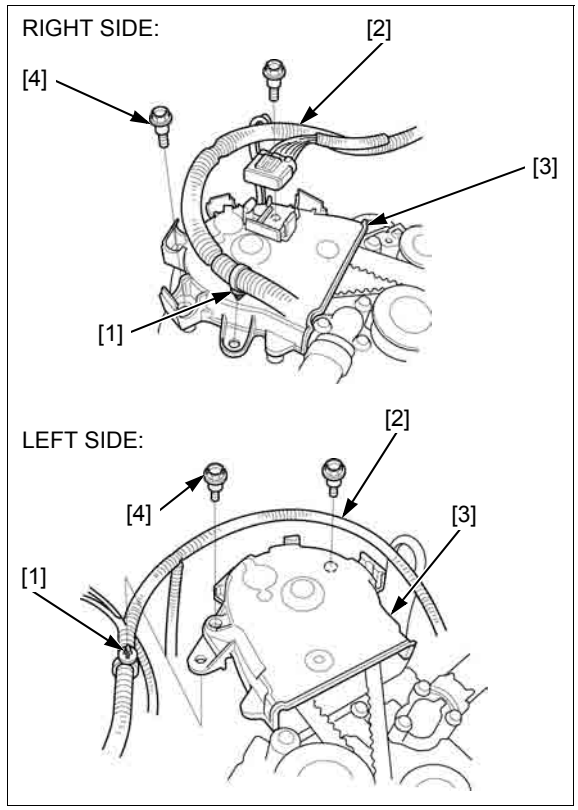
- Take care not to an impact or drop the cooling fan. Replace the cooling fan if dropped.

Remove the following:

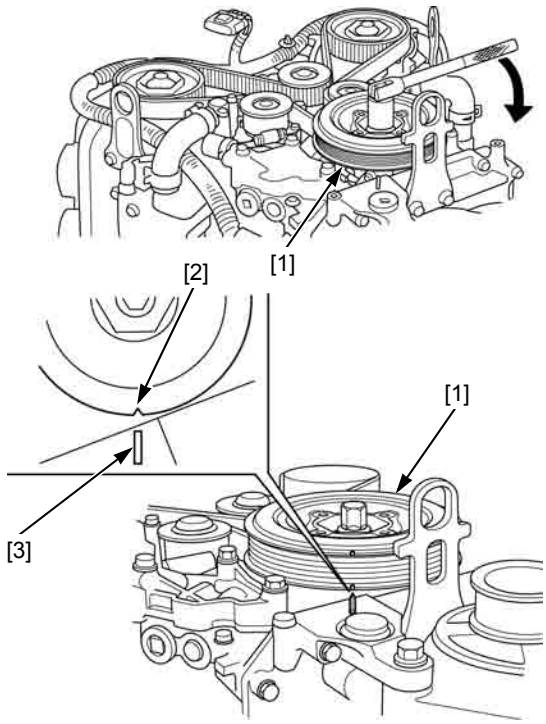
– Throttle body (page 5-71)
– Alternator belt (page 7-5)

Release the harness clip [1] and main wire harness [2] from the timing belt covers [3].

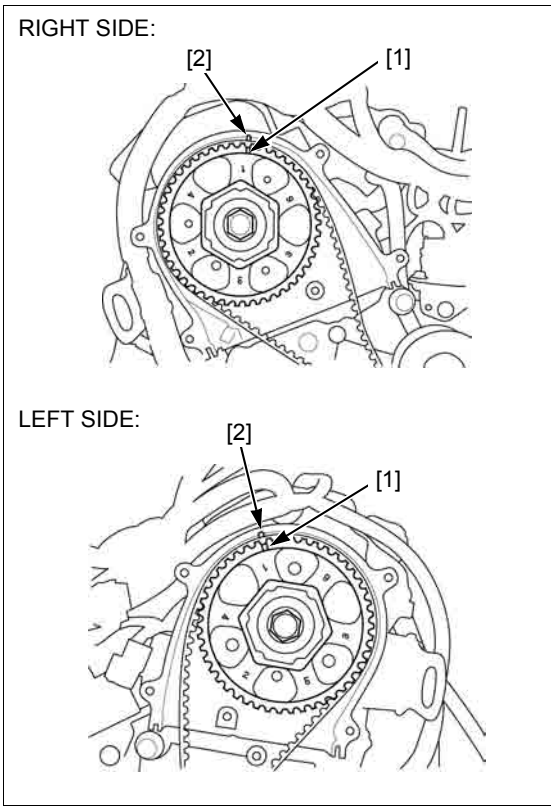
Remove the four timing belt cover bolts [4] and timing belt covers.



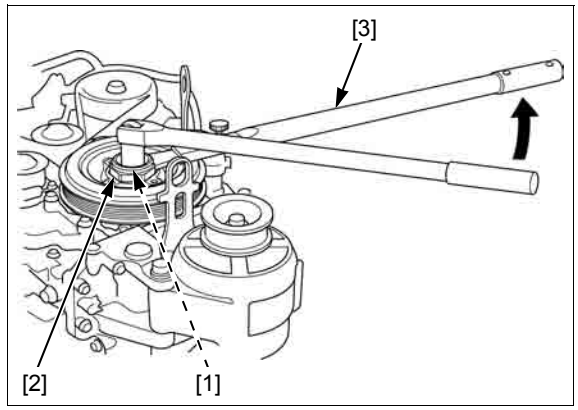
Turn the crankshaft pulley [1] clockwise so that the groove [2] of the crankshaft pulley lines up with the pointer [3].



Make sure both the right side and left side timing belt driven pulley NO. 1 TDC marks [1] align with the timing belt back cover pointers [2]. In this position, the No. 1 piston is at TDC.



Loosen the crankshaft pulley bolt [1] using the special tools as shown.



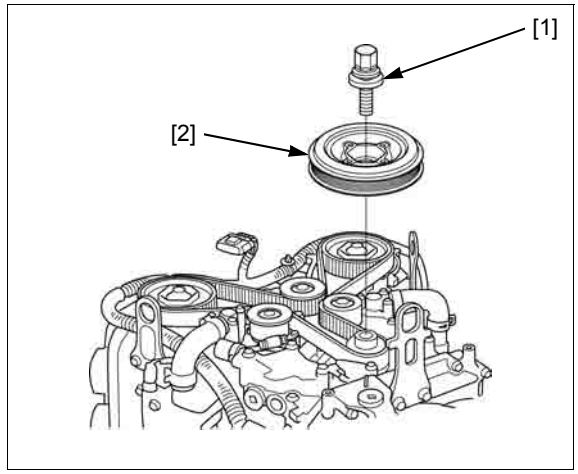
NOTICE

- *Do not use an impact wrench. Remove the bolt-washer while holding the crankshaft pulley with the special tool.*
- *Do not turn the crankshaft counterclockwise.*

TOOLS:

Holder attachment, 50 mm [2]	**070PB-0010100**
Holder handle [3]	**07JAB-001020A**

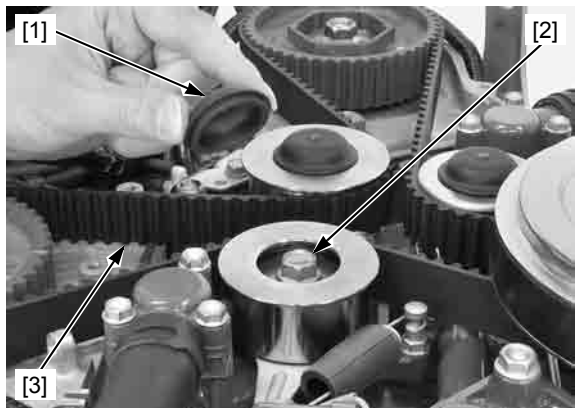
Remove the crankshaft pulley bolt [1] and crankshaft pulley [2].



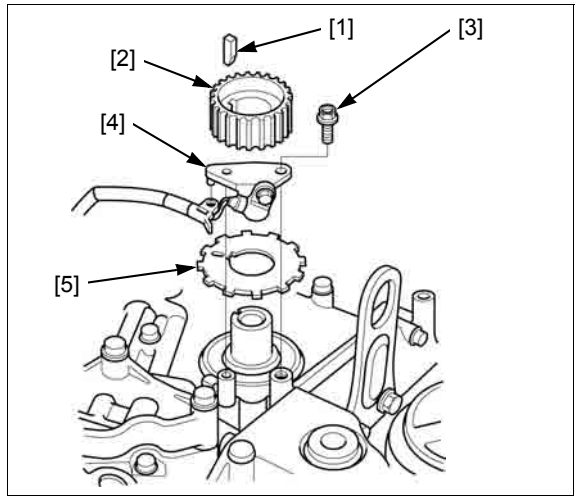
Remove the timing belt tensioner pulley cap [1].

Loosen the timing belt tensioner bolt [2] about one or one and half turns, push the tensioner pulley in the direction shown, tighten the tensioner bolt, and then remove the timing belt [3].

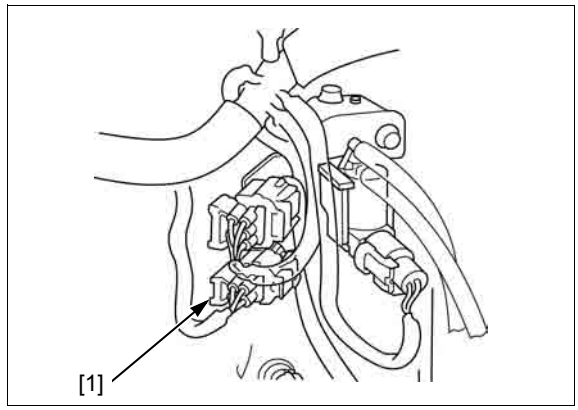
- Check the timing belt for damage or wear, and replace it with a new one if necessary.
- Do not remove the timing belt with force using a screwdriver.
- Take care not to contaminate the timing belt with oil or grease after removing it.
- Do not bend or distort the timing belt after removing it. Store the timing belt by hanging it on a wall.



Remove the key [1], and then remove the timing belt drive pulley [2].
Remove the bolt (6 x 16 mm) [3] and the CKP sensor [4].
Remove the timing guide plate [5].

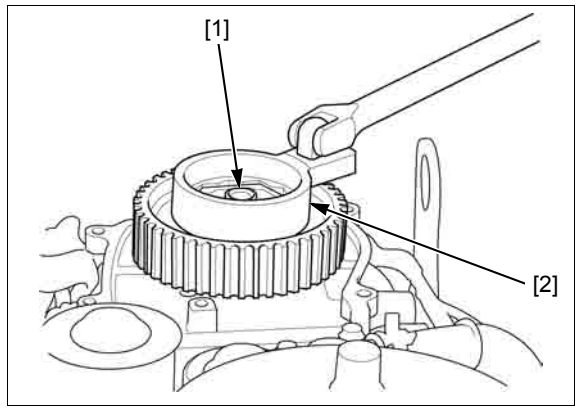


Disconnect the CMP sensor 4P connector [1].



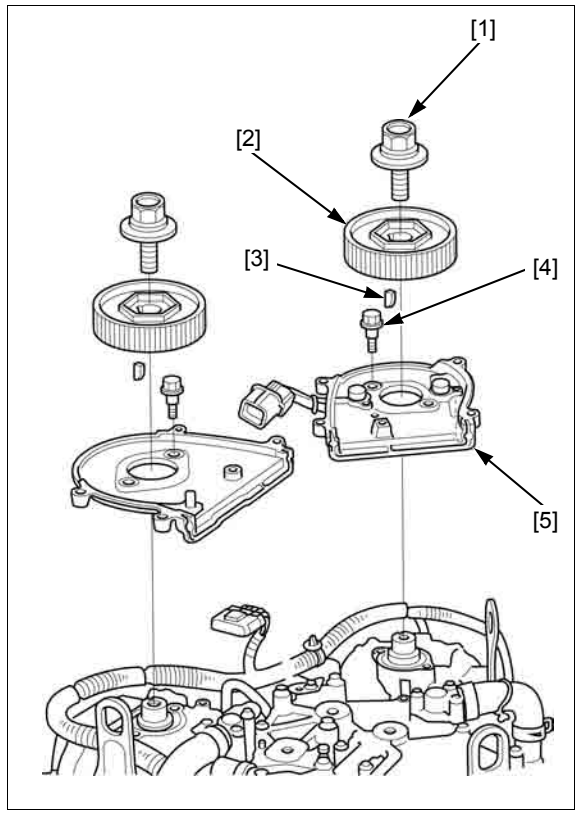
Using the special tool as shown, loosen the timing belt driven pulley bolt [1].

TOOL:
Lock nut wrench, 56 mm [2] 07LPA-ZV30200

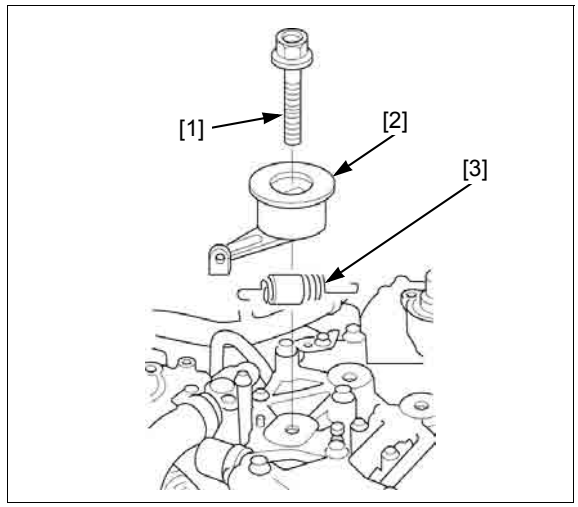


Remove the timing belt driven pulley bolt [1], timing belt driven pulley [2], and key [3] from the camshaft.

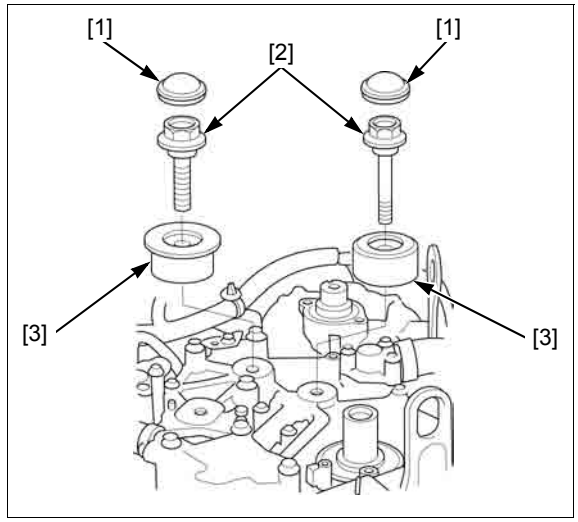
Remove the two special bolts (8 x 29 mm) [4] and timing belt back cover [5] from the cylinder head.



Remove the timing belt tensioner bolt [1] and timing belt tensioner pulley [2] and return spring [3].

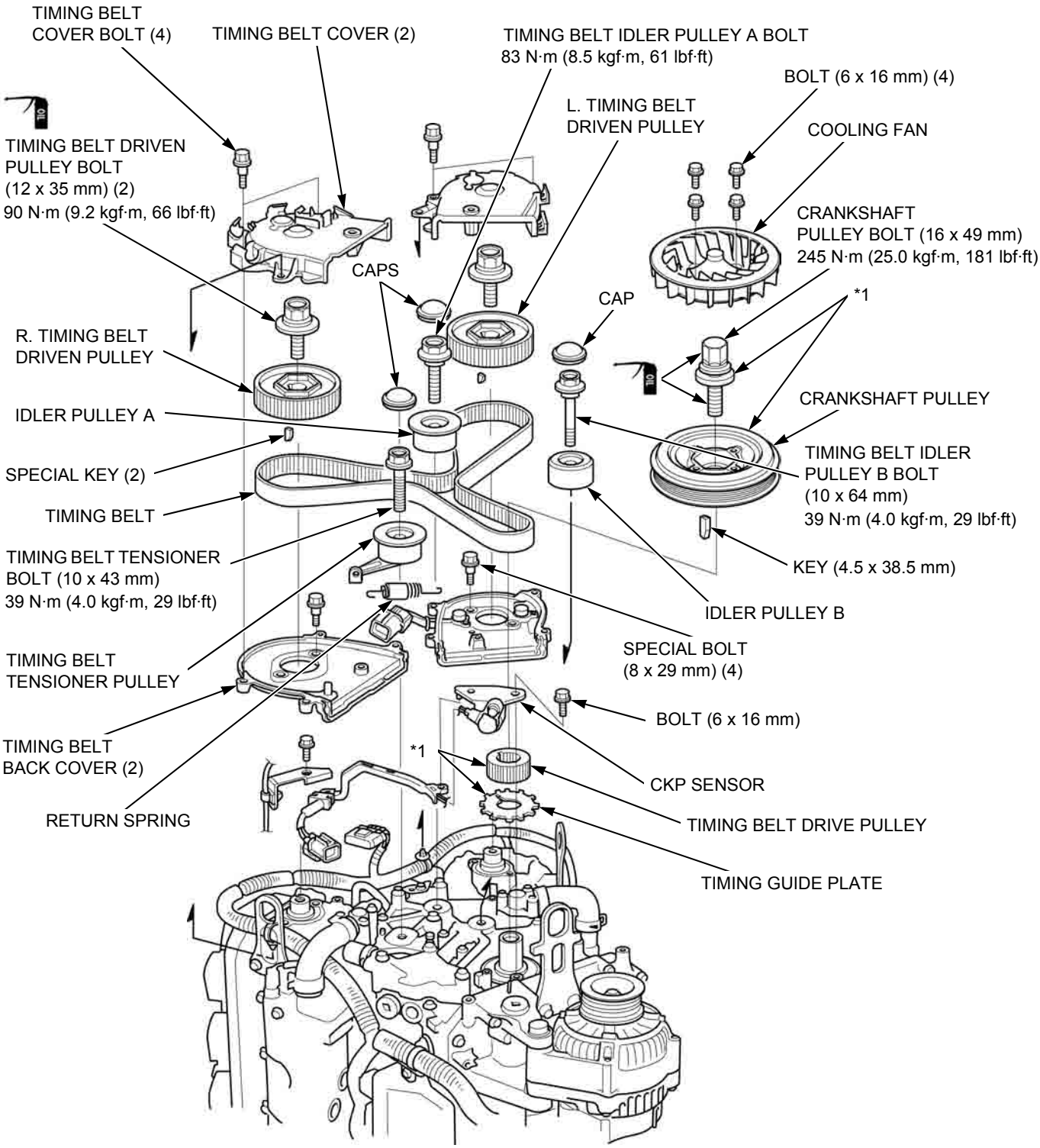


Remove the two caps [1] and idler pulley bolts [2], and then remove the idler pulleys [3].



EXPLODED VIEW

Degrease, clean and/or lubricate the parts marked with *1 according to the DEGREASING/CLEANING/ LUBRICATION instructions. Do not lubricate any part unless instructed to do so on page 14-14.

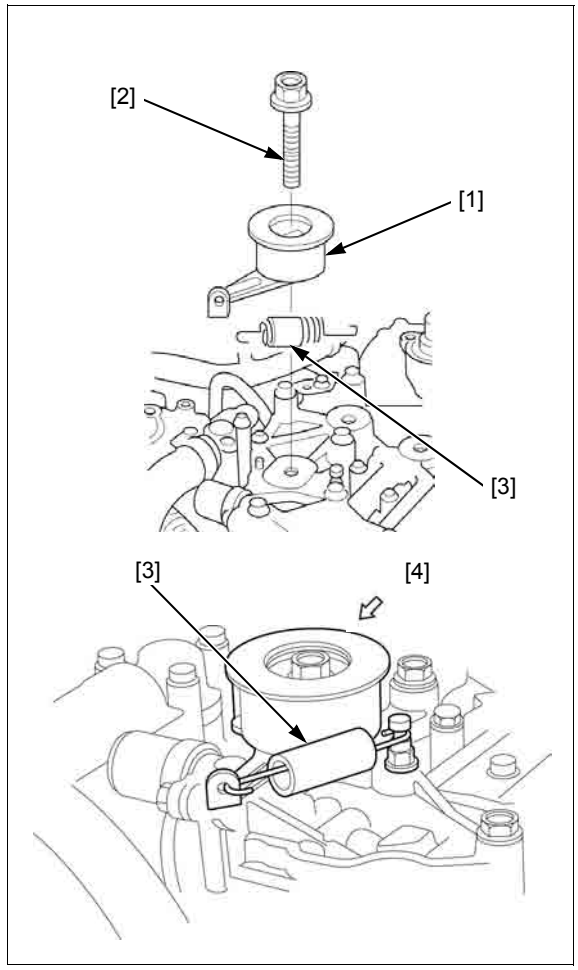


INSTALLATION

Install the timing belt tensioner pulley [1] and loosely tighten the timing belt tensioner bolt [2].

Install the return spring [3] as shown.

Push the tensioner pulley in the direction shown [4], and then tighten the tensioner bolt.



Install idler pulley A [1] and tighten the idler pulley A bolt [2] to the specified torque.

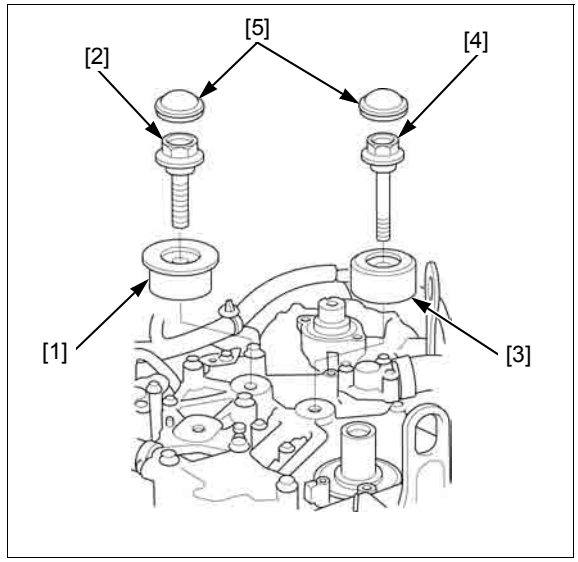
TORQUE: 83 N·m (8.5 kgf·m, 61 lbf·ft)

Install idler pulley B [3] and tighten the idler pulley B bolt [4] to the specified torque.

TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)

Install the caps [5] on the pulleys.

Check that the cap groove is installed securely.



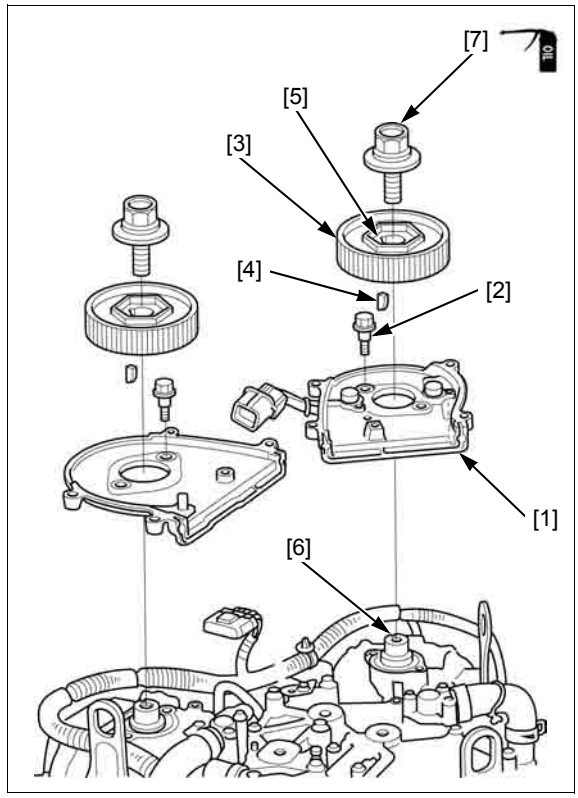
Install the timing belt back cover [1] to the cylinder head and tighten the two special bolts (8 x 29 mm) [2].

Install the timing belt driven pulley [3] and special key [4] to the camshaft by aligning the key groove [5] of the driven pulley with the key groove [6] of the camshaft.

Apply engine oil to the threaded part and seat of the timing belt driven pulley bolt [7] and install it.

NOTE:

- Install the L./R. timing belt driven pulleys in their proper locations.

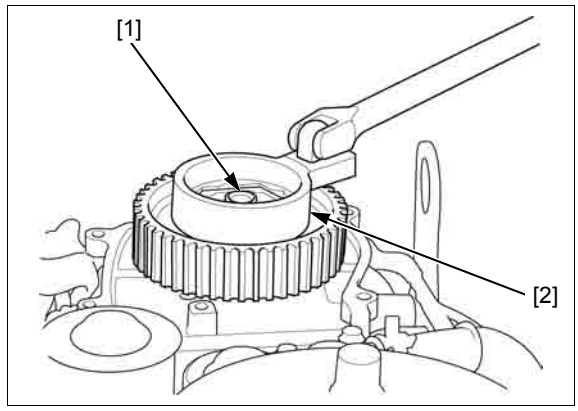


Using the special tool as shown, tighten the timing belt driven pulley bolt [1].

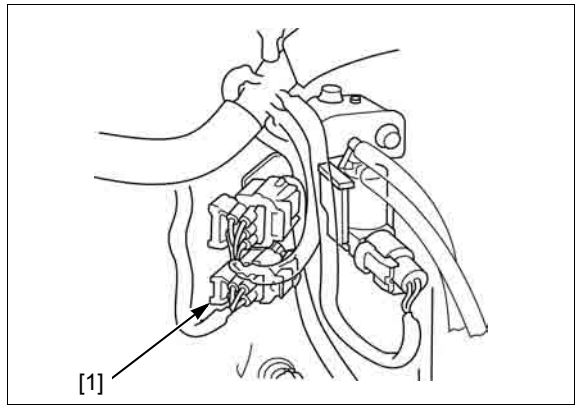
TOOL:
Lock nut wrench, 56 mm [2] 07LPA-ZV30200

TORQUE: 90 N·m (9.2 kgf·m, 66 lbf·ft)

- When tightening the timing belt driven pulley bolt, do not rotate the camshaft.



Connect the CMP sensor 4P connector [1].



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

Crankshaft pulley bolt [1]

- Degrease the entire surface of the bolt-washer (especially the washer and the crankshaft pulley mating surface) with a clean shop towel.
- Apply engine oil to the flanged part of the bolt and the washer mating surface.
- Apply engine oil to the threaded part of the bolt.
- Do not apply engine oil to the washer and the crankshaft pulley mating surface.

Crankshaft pulley [2]

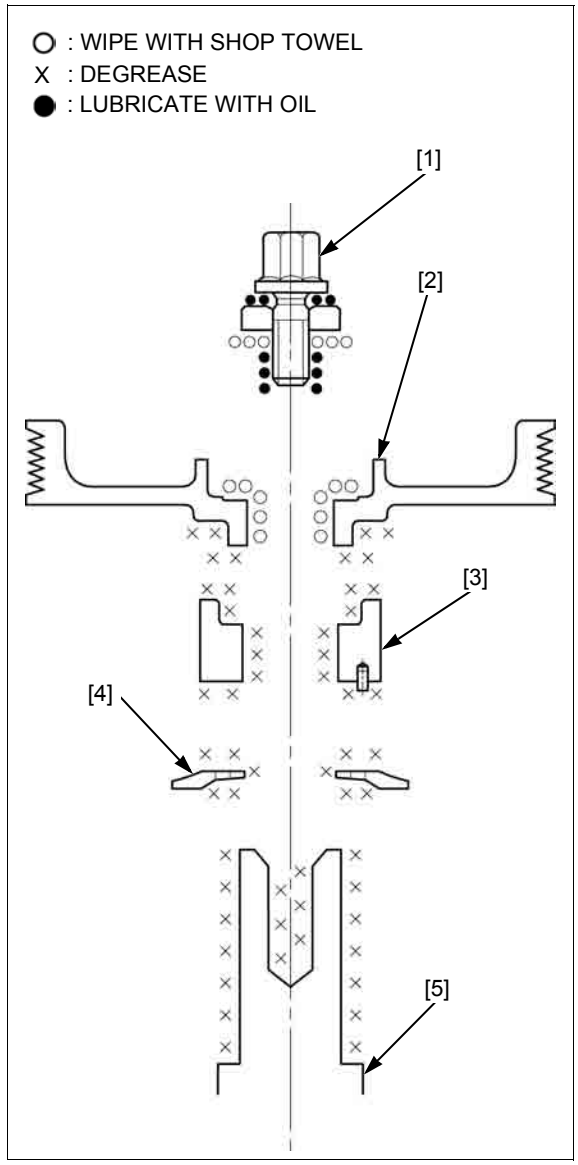
- Remove oil from the bottom of the crankshaft pulley boss using a degreasing cleaning agent.
- Degrease the bolt-washer mounting surface on the crankshaft pulley using a clean shop towel.
- Do not contaminate the belt installation parts with oil.

Timing belt drive pulley [3] /timing guide plate [4]

- Degrease the entire surface of the timing belt drive pulley and the timing belt guide plate using a degreasing cleaning agent.

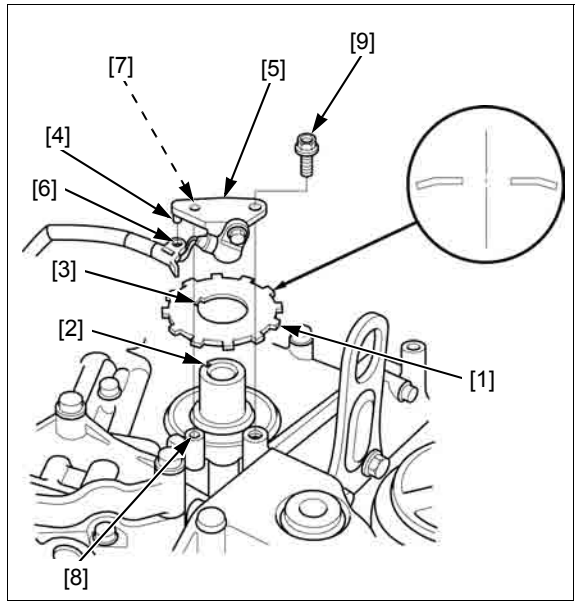
Crankshaft [5]

- Spray a degreasing cleaning agent over a clean shop towel, and wipe the entire surface of the crankshaft to remove oil thoroughly.
- Do not let the oil seals and other rubber parts get sprayed or contaminated with the degreasing cleaning agent.
- Do not spray the degreasing cleaning agent directly over the crankshaft. Be sure to wipe the crankshaft with a clean shop towel sprayed with the degreasing cleaning agent.



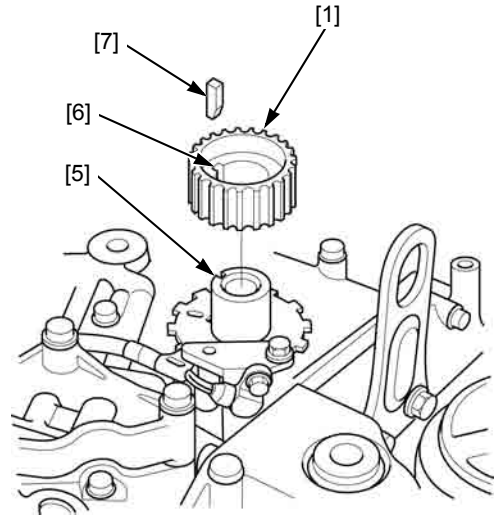
Install the timing guide plate [1] with its tapered side facing down by aligning the key groove [2] of the crankshaft and key groove [3] of the timing guide plate.

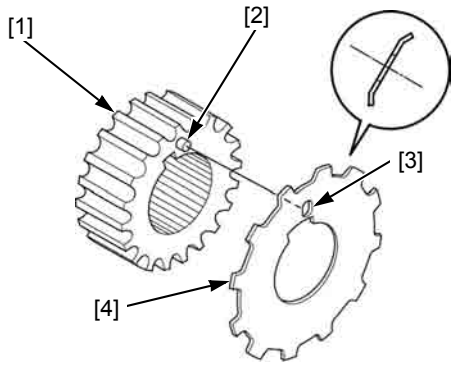
Align the boss [4] of the CKP sensor [5] with the hole [6] of the wire harness.
Install the CKP sensor by aligning the boss [7] of the CKP sensor with the hole [8] of the cylinder block.
Install and tighten the bolt (6 x 16 mm) [9].



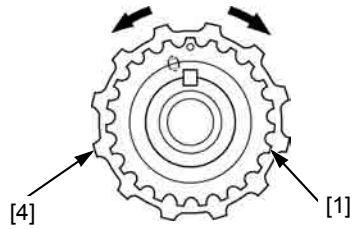
Install the timing belt drive pulley [1] by aligning the pin [2] of the pulley with the long hole [3] of the timing guide plate [4].

Align the key groove [5] of the crankshaft with the key groove [6] of the drive pulley, and install the key [7].





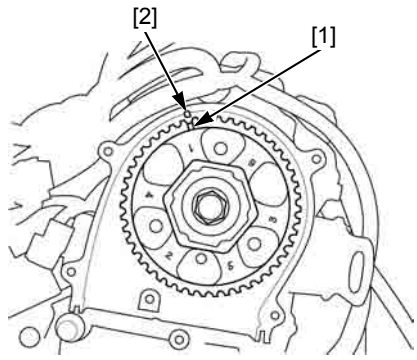
The guide plate must not turn more than the distance equal to the drive pulley pin moving in the long hole in the guide plate.



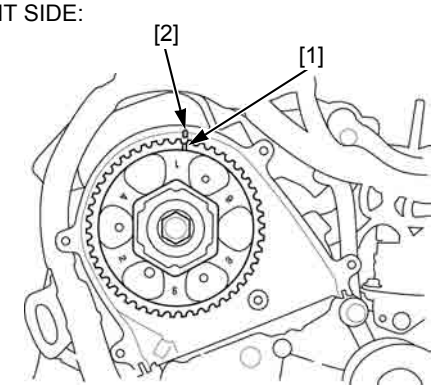
Clean the timing belt pulleys and the upper and lower covers.

Set the timing belt driven pulleys to No. 1 TDC by aligning the TDC marks [1] on the timing belt driven pulleys with the pointers [2] on the timing belt back cover.

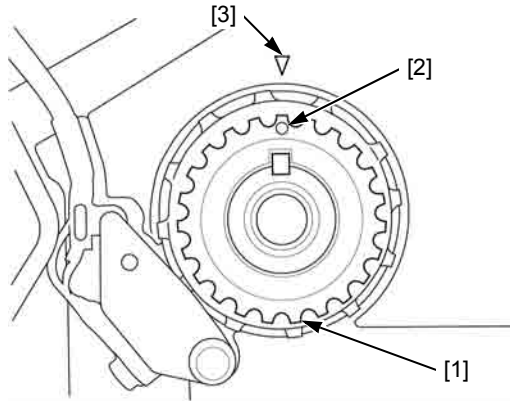
LEFT SIDE:



RIGHT SIDE:



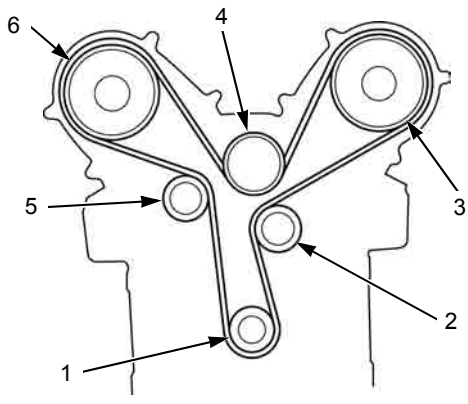
Set the timing belt drive pulley [1] to TDC by aligning the TDC mark [2] on the tooth of the timing belt drive pulley with the pointer [3] on the crankcase.



Install the timing belt in a counterclockwise sequence starting with the drive pulley. Take care not to damage the timing belt when installing the belt.

1. Drive pulley
2. Idler pulley B
3. Left timing belt driven pulley
4. Idler pulley A
5. Timing belt tensioner pulley
6. Right timing belt driven pulley

- Do not install the timing belt with force using a screwdriver
- Take care not to contaminate the timing belt with oil or grease after install it



Clean any oil off the inside face of the crankshaft pulley [1], and apply lubricant to the crankshaft pulley bolt [2] (page 14-14).

Install the crankshaft pulley by aligning the key groove of the crankshaft [3] and key groove of the pulley.

Install and tighten the crankshaft pulley bolt to the specified torque using the special tools.

TOOLS:

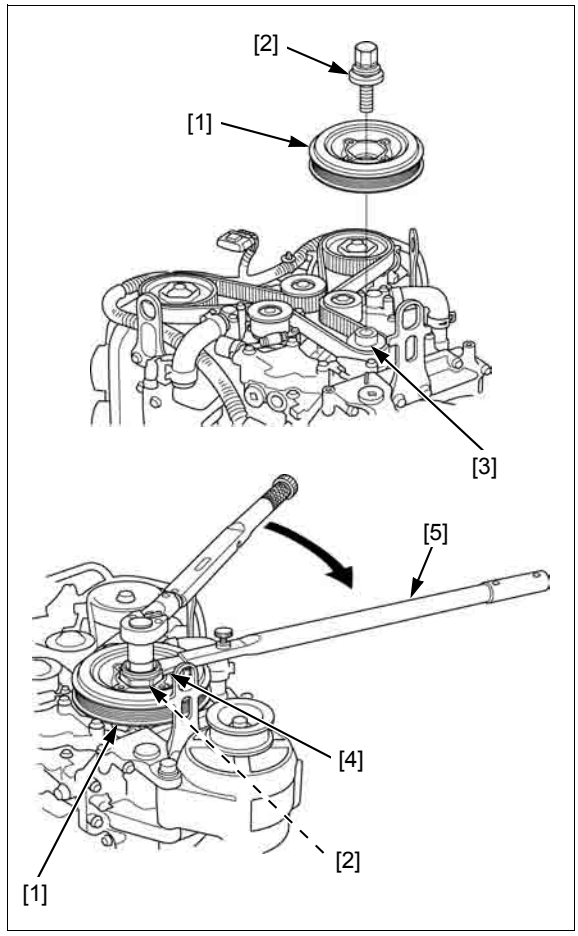
Holder attachment, 50 mm [4]	**070PB-0010100**
Holder handle [5]	**07JAB-001020A**

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

NOTICE

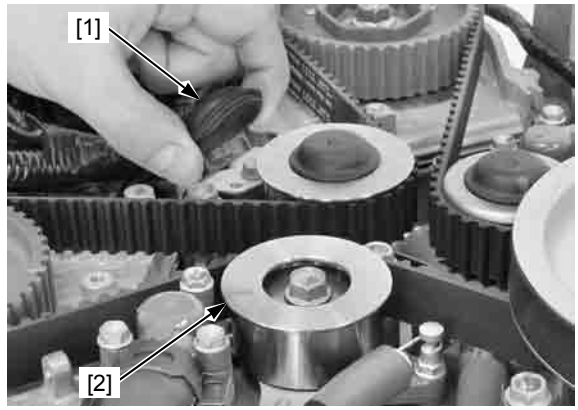
- *Do not use an impact wrench. Tighten the bolt-washer while holding the crankshaft pulley with the special tool.*
- *Do not turn the crankshaft counterclockwise.*

Adjust the timing belt (page 3-8)

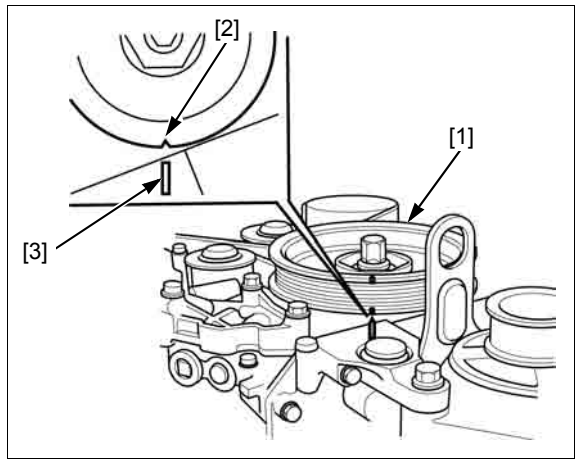


Install the cap [1] on the timing belt tensioner pulley [2].

Check that the cap groove is installed securely.



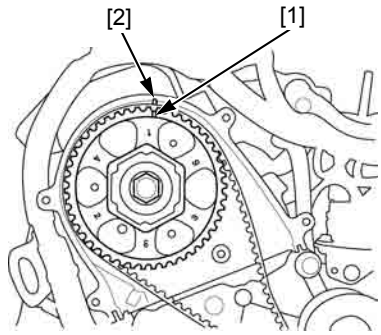
Turn the crankshaft pulley [1] five to six turns clockwise, and then align the groove [2] of the crankshaft pulley with the pointer [3].



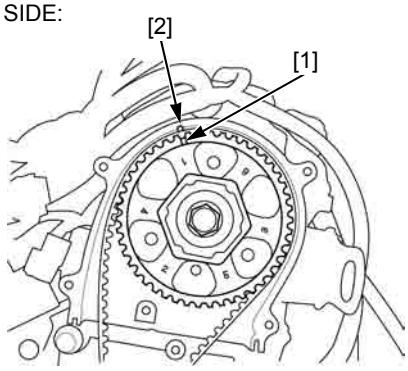
Make sure the No. 1 piston TDC marks [1] on both timing belt driven pulleys and the pointers [2] on the timing belt covers are aligned when the groove of the crankshaft pulley lines up with the pointer on the crankcase.

If the alignment marks do not align, remove the timing belt and repeat the timing belt installation steps.

RIGHT SIDE:



LEFT SIDE:



Install the timing belt covers [1] and tighten the four timing belt cover bolts [2].

Set the harness clip [3] and main wire harness [4] to the timing belt covers.

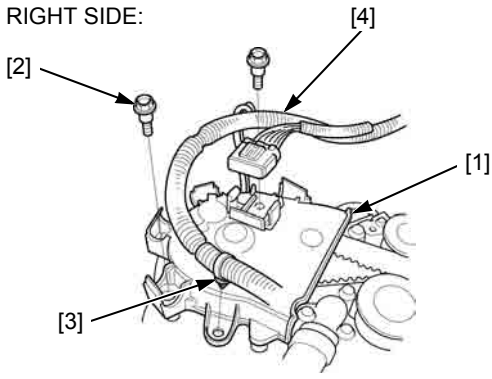
NOTE:

- Route the wire harness properly (page 2-19).

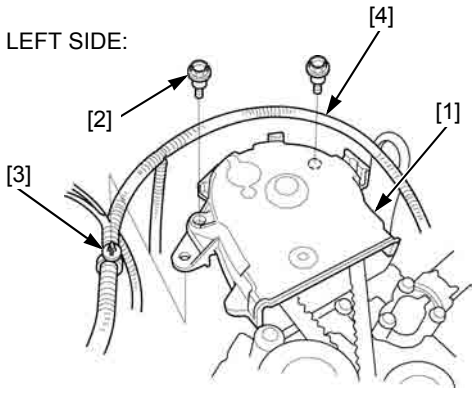
Install the following:

– Alternator belt (page 7-5)
– Throttle body (page 5-71)

RIGHT SIDE:



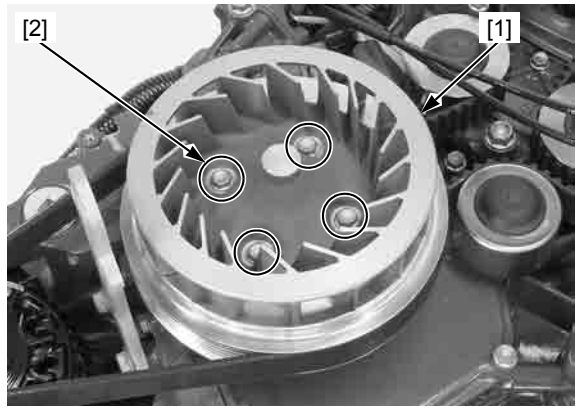
LEFT SIDE:



Install the cooling fan [1] and four bolts (6 x 16 mm) [2].

Install the following:

– Cooling fan cover (page 5-69)
– Engine cover



CYLINDER HEAD COVER REMOVAL/ INSTALLATION

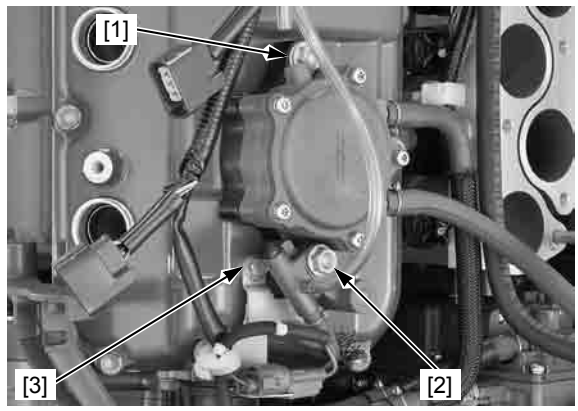
REMOVAL

Disconnect the battery negative (–) cable.
Shift the remote control lever in the N (neutral) position.

Remove the following:

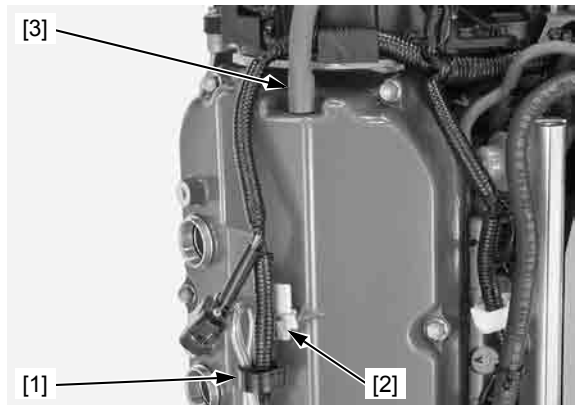
– Engine cover
– L./R. engine under cover (page 6-3)
– Intake manifold (page 5-72)
– Direct ignition coils (page 3-17)

Remove the fuel pump (Low pressure side) mounting bolt A (8 x 32 mm) [1] and mounting bolt B (8 x 45 mm).
Remove the water separator bracket mounting bolt (6 x 14 mm) [3].



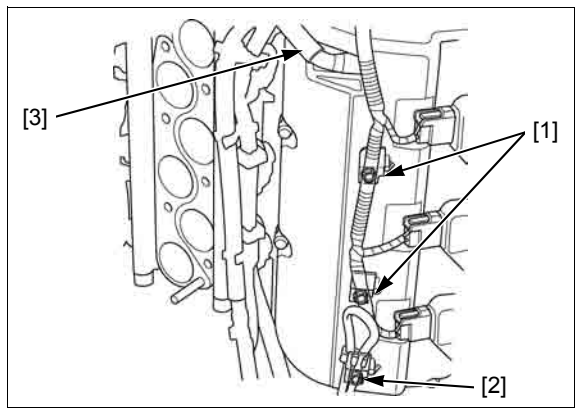
Remove the wire harness clip [1] and harness clamp bolt (6 x 14 mm) [2].

Disconnect the breather tube B [3].



Remove the two harness clamp bolts (6 x 14 mm) [1] and tube clamp bolt (6 x 14 mm) [2].

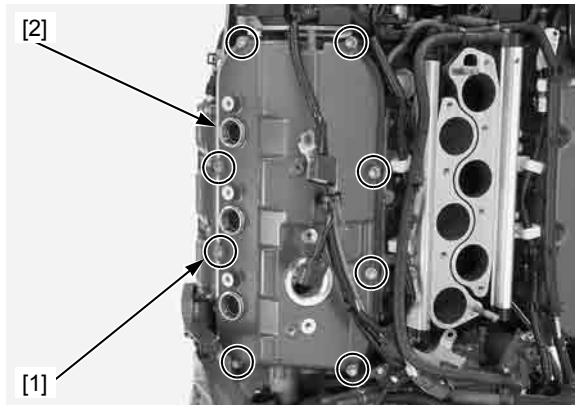
Disconnect breather tube A [3].



Disconnect the cylinder head cover oil return hose [1].



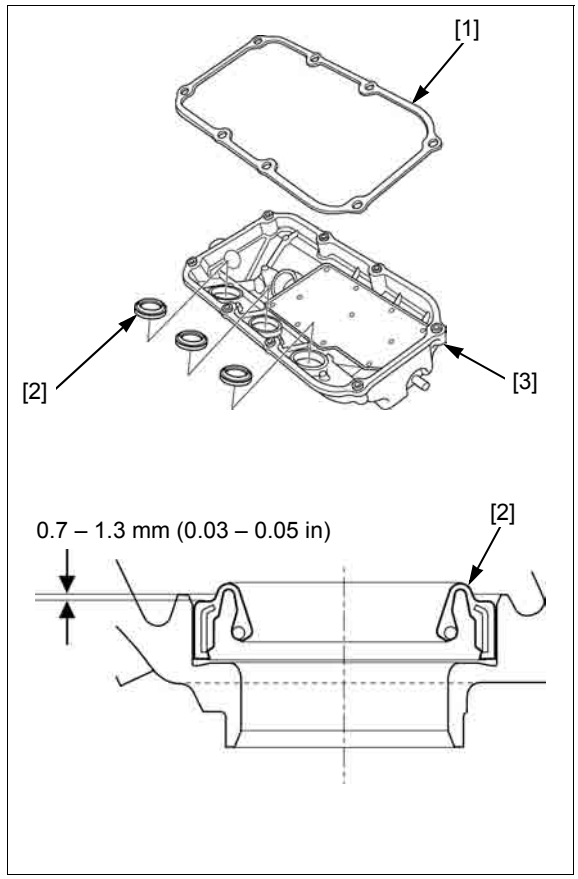
Remove the eight bolts (6 x 35 mm) [1] and cylinder head cover [2].



INSTALLATION

Check the cylinder head cover gasket [1] and spark plug tube seal [2], and replace them if necessary.

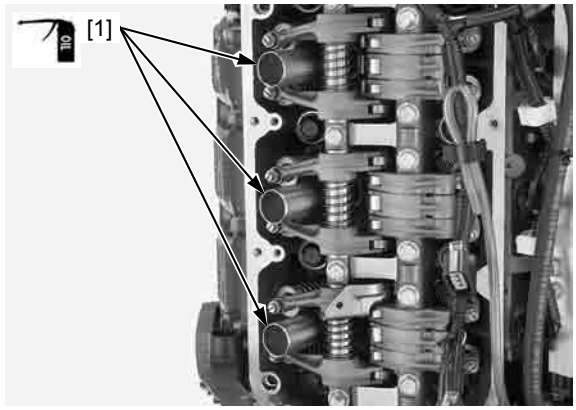
Install the spark plug tube seal to the cylinder head cover [3] in the direction as shown, until its upper surface is 0.7 – 1.3 mm (0.03 – 0.05 in) below the cylinder head cover top surface.



Apply engine oil to the spark plug tube [1].

Clean the cylinder head mating surfaces with a shop towel or equivalent material.

Install the cylinder head cover by aligning the spark plug tube seal with the spark plug tube.



Tighten the eight bolts (6 x 35 mm) in the numbered order in two steps.

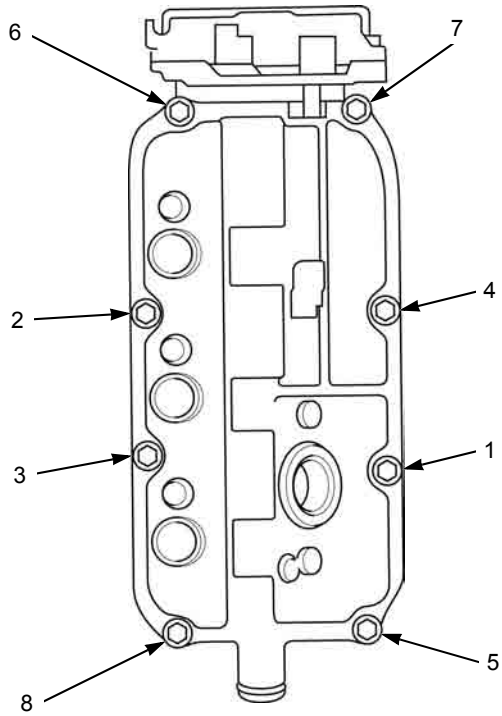
Install the removed parts in the reverse order of removal.

NOTE:

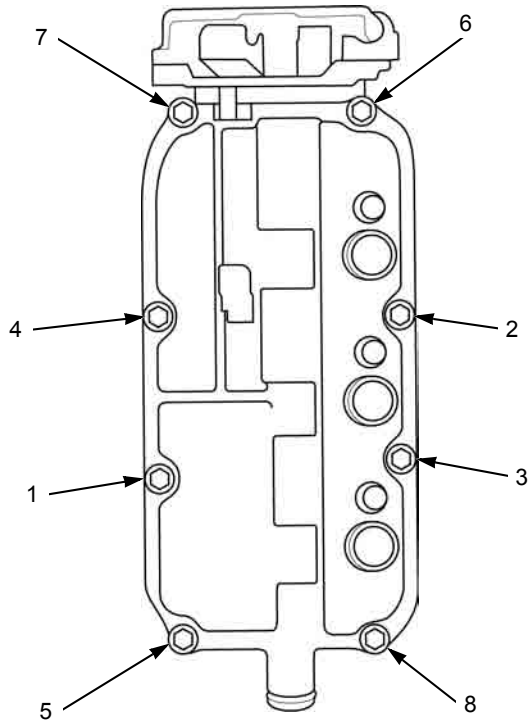
Route the wire harness properly (page 2-19).

Install the following:

– Direct ignition coils (page 3-17)
– Intake manifold (page 5-76)
– L./R. engine under cover (page 6-3)
– Engine cover



PORT HEAD



STARBOARD HEAD

CYLINDER HEAD REMOVAL/ INSTALLATION

REMOVAL

- Remove the cylinder head assembly while the engine is cold to prevent warpage.
- Take care not to damage the cylinder head and cylinder block mating surfaces.

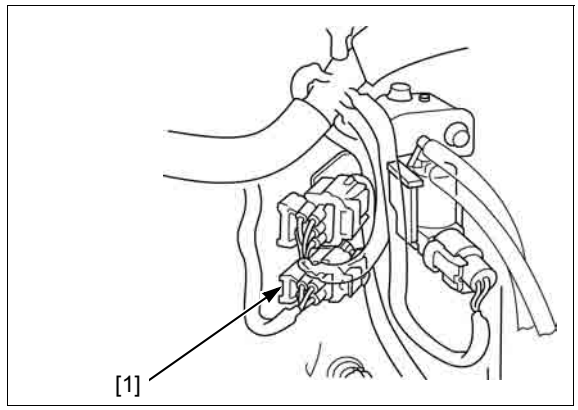
Set the timing belt driven pulley at top dead center of the compression stroke of the No.1 cylinder before removal/installation of the cylinder head assembly (page 14-6).

Disconnect the battery negative (–) cable.

Shift the remote control lever to the N (neutral) position.

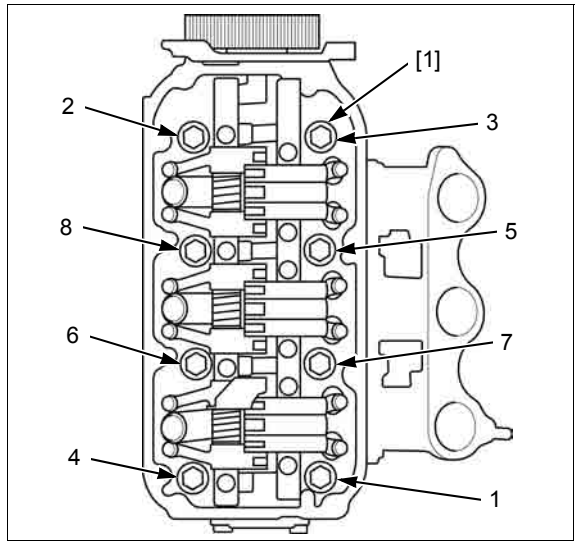
Remove the following:

– Engine cover
– Exhaust manifolds (page 5-95)
– Timing belt (page 14-6)
– Cylinder head covers (page 14-19)
– Fuel pump (High pressure side)/Vapor separator (page 5-86)
– Fuel pipe and injectors (page 5-78)



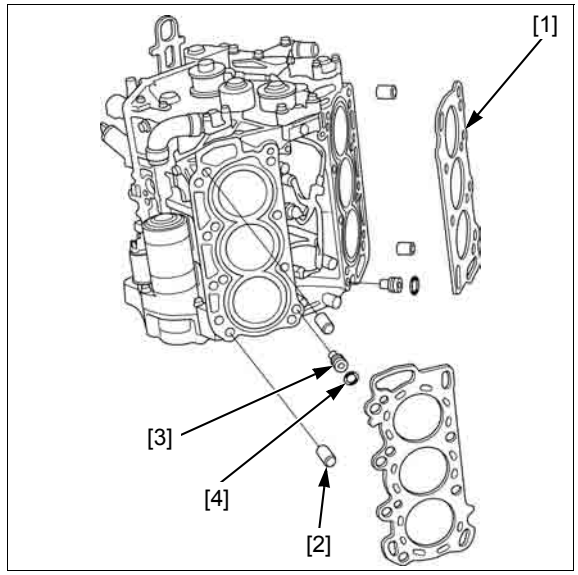
Disconnect the CMP sensor 4P connector [1].

Remove the eight cylinder head bolt/washers [1] in the numbered order in two or three steps.

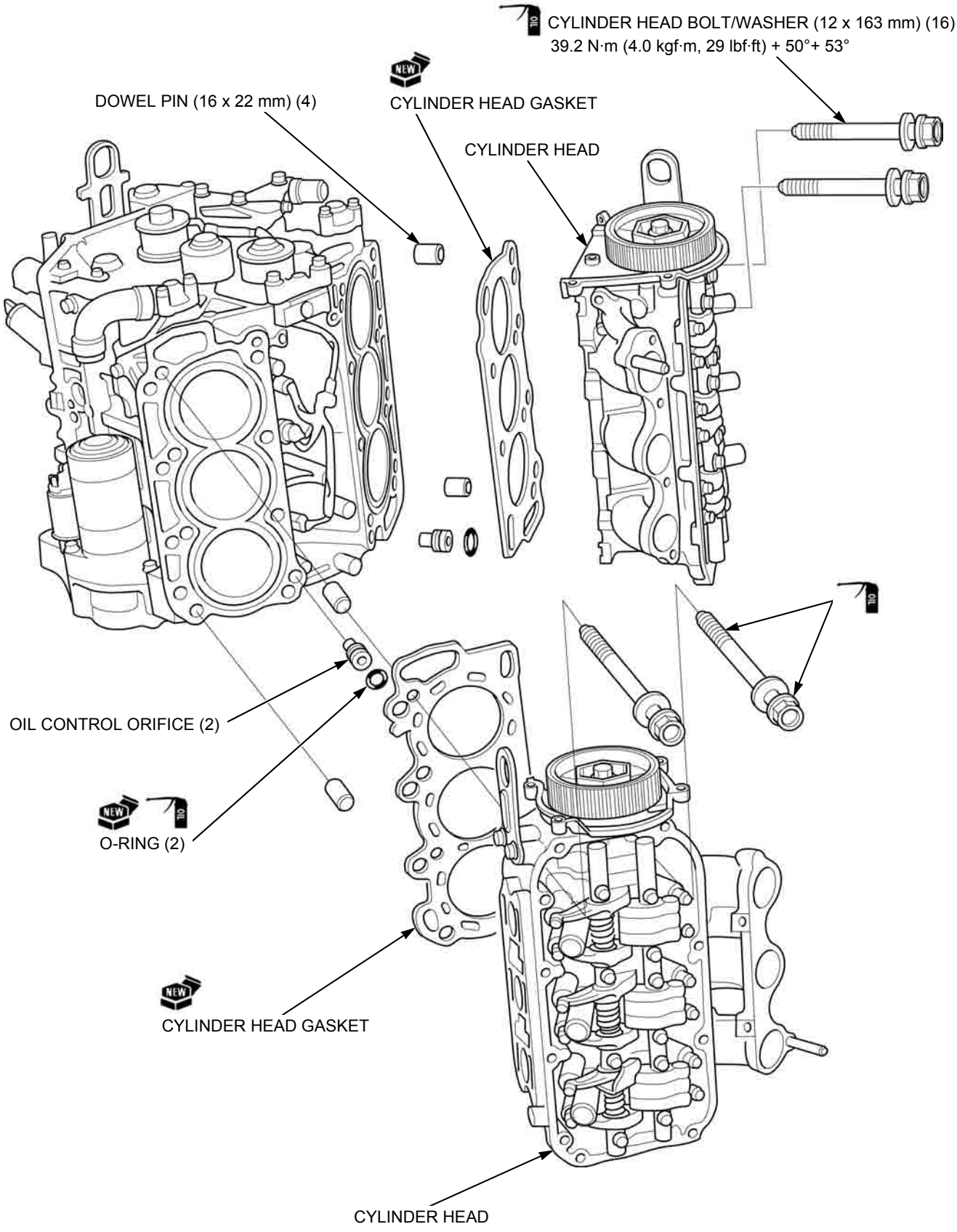


Remove the cylinder head assembly, and remove the cylinder head gasket [1] and four dowel pins [2].
Remove the two oil control orifices [3] and two O-rings [4].

- Take care not lose the oil control orifice.



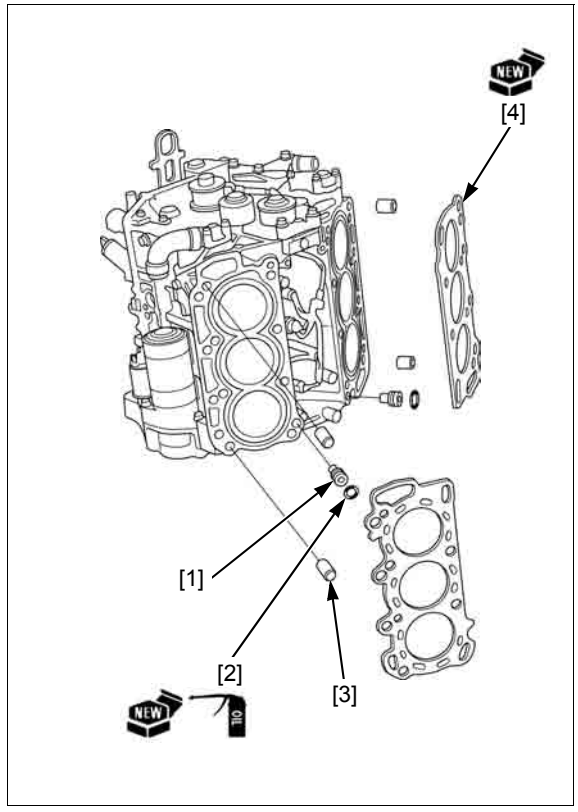
EXPLODED VIEW



INSTALLATION

Set the crankshaft drive pulley at top dead center of the compression stroke of the No.1 cylinder before installation of the cylinder head assembly (page 14-6).

Clean the cylinder head and cylinder block mating surfaces.
Clean the oil control orifice [1] and oil passage using pressurized air.
Coat a new O-ring [2] with engine oil and install it to the oil control orifice.
Install the dowel pins [3], oil control orifice, and new gaskets [4].



Install the cylinder head assembly.
Apply engine oil to the threaded section and the seating surface of each cylinder head bolt/washer [5], and loosely tighten the bolts against the cylinder head.
Tighten the bolts in the numbered order. Be sure to tighten them in two or three steps to the specified torque.

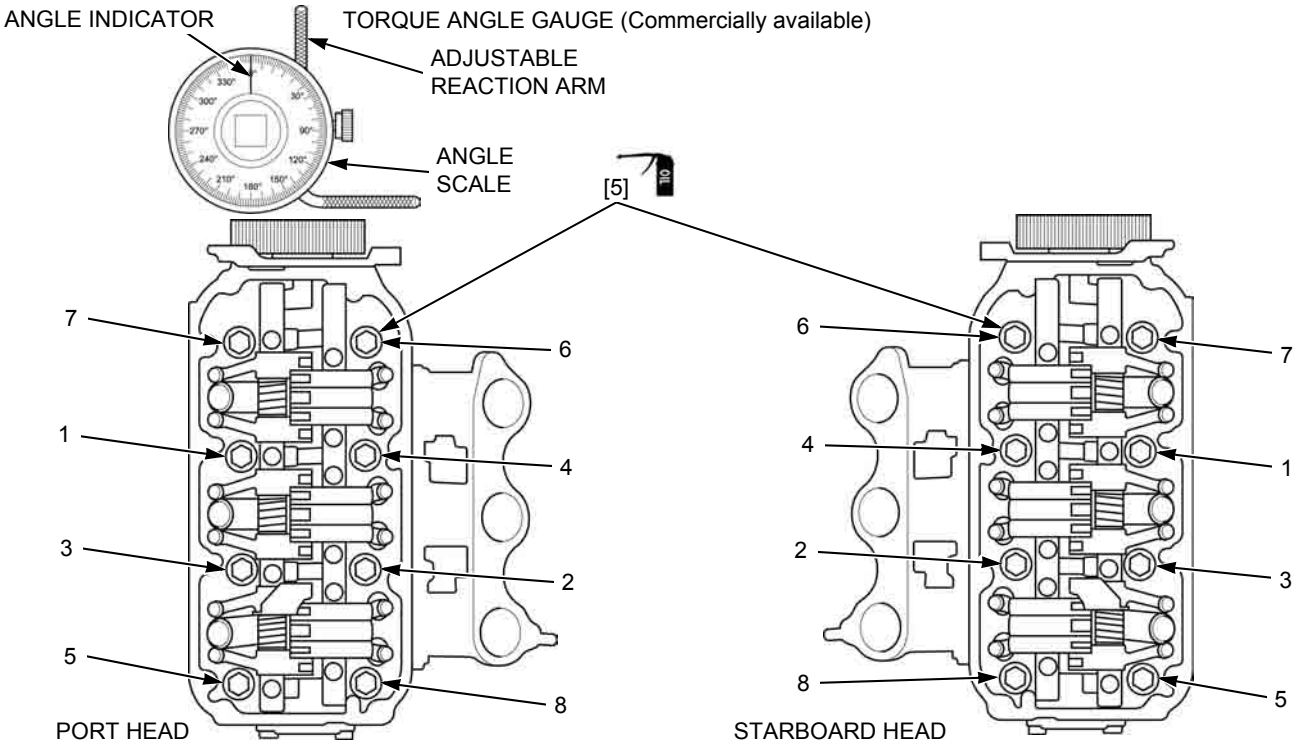
TORQUE: 39.2 N·m (4.0 kgf·m, 29 lbf·ft)

Using a torque angle gauge (TA360: commercially available), continue tightening the bolts in two more steps to the angles shown.

Step 1: + 50°
Step 2: + 53°

Install the following:

- Fuel pipe and injectors (page 5-83)
- Fuel pump (High pressure side)/Vapor separator (page 5-90)
- Cylinder head covers (page 14-20)
- Timing belt (page 14-12)
- Exhaust manifolds (page 5-96)
- Engine cover



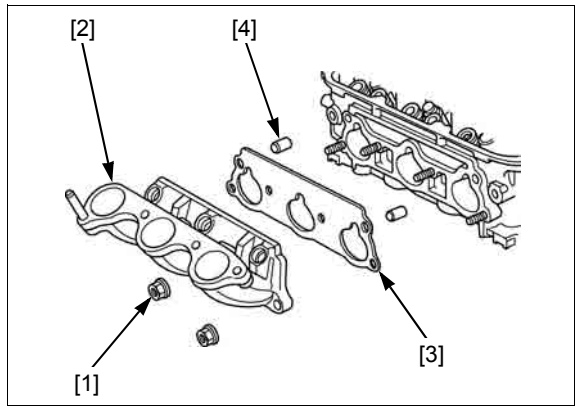
CYLINDER HEAD DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

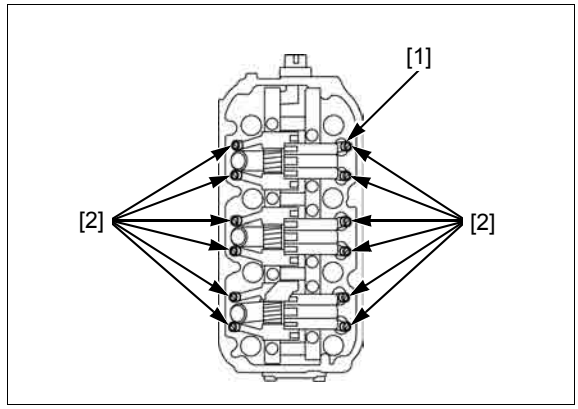
Remove the following:

– Cylinder head (page 14-22)
– Timing belt back cover (page 14-6)

Remove the four nuts [1], injector base [2], gasket [3], and the two dowel pins [4].

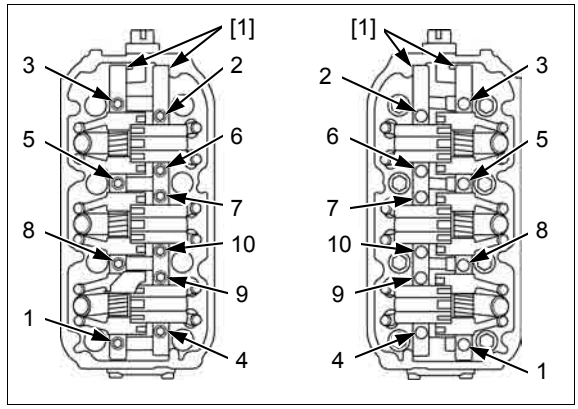


Loosen the twelve valve adjusting lock nuts [1] and twelve adjusting screws [2].



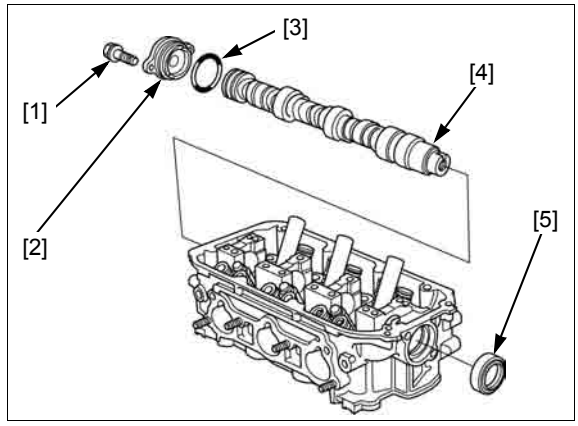
Loosen the ten bolts in the numbered order in two or three steps, and remove the rocker arm shafts [1].

- Identify parts as they are removed so they can be reinstalled in their original locations.
- When removing the rocker arm assembly, do not remove the rocker shaft mounting bolts. The bolts will keep the springs and rocker arms on the shaft.

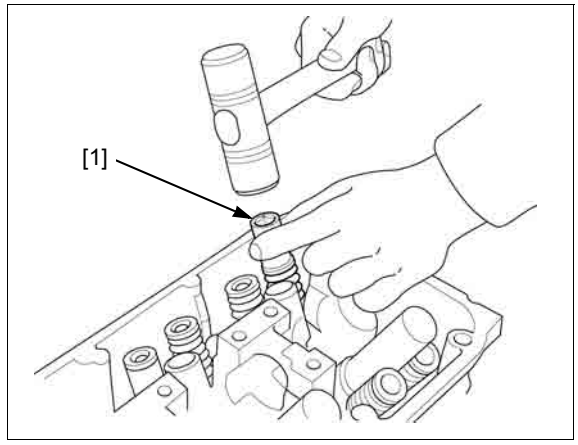


Remove the two bolts (8 x 28 mm) [1], and then remove the camshaft thrust cover [2], O-ring [3], and the camshaft [4].

Remove the oil seal [5] from the cylinder head.



Select a suitable tool [1] that matches the diameter of the valve spring retainer. Attach the tool to the retainer and lightly tap on the tool to separate the valve keepers and the retainer.

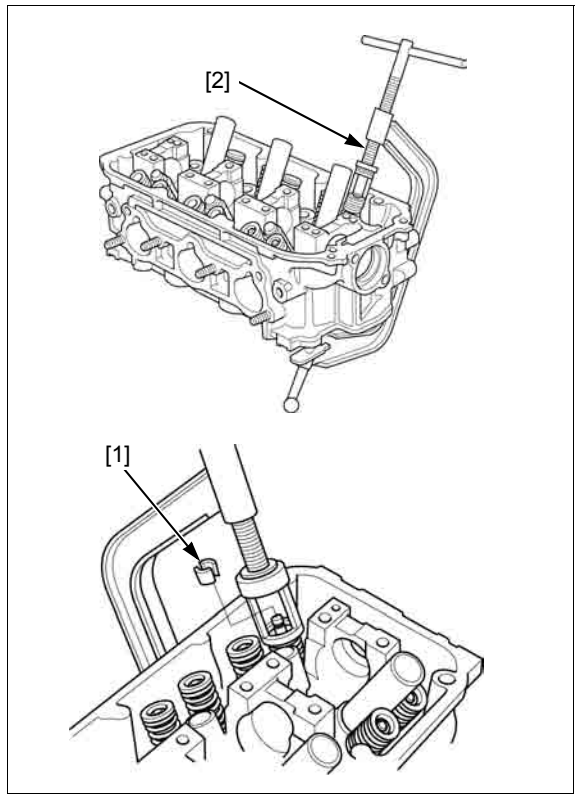


NOTICE

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

Using the special tool, compress the valve springs and remove the valve keepers [1].

TOOL:
Valve spring compressor [2] 07757-0010000

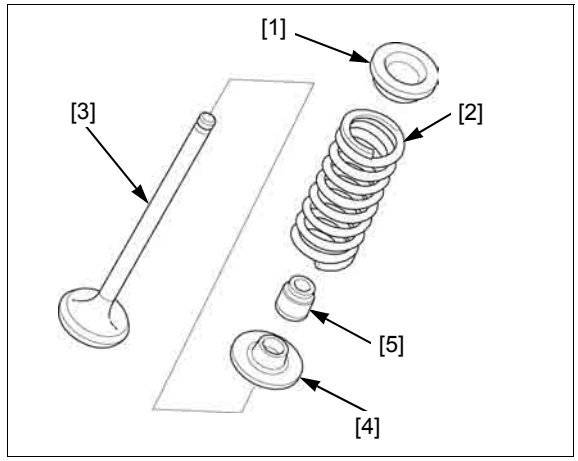


NOTICE

- *Take care not to hit the cylinder head with the special tool.*

Identify keepers as they are removed so they can be reinstalled in their original locations.

Remove the valve spring retainer [1], valve spring [2], valve [3], valve spring seat [4], and valve stem seal. [5]
Replace the valve stem seal when reassembling.
Check the valve head for nicks and carbon deposits before installation.



Identify parts as they are removed so they can be reinstalled in their original locations.

Check the cylinder head parts (page 14-33).

EXPLODED VIEW

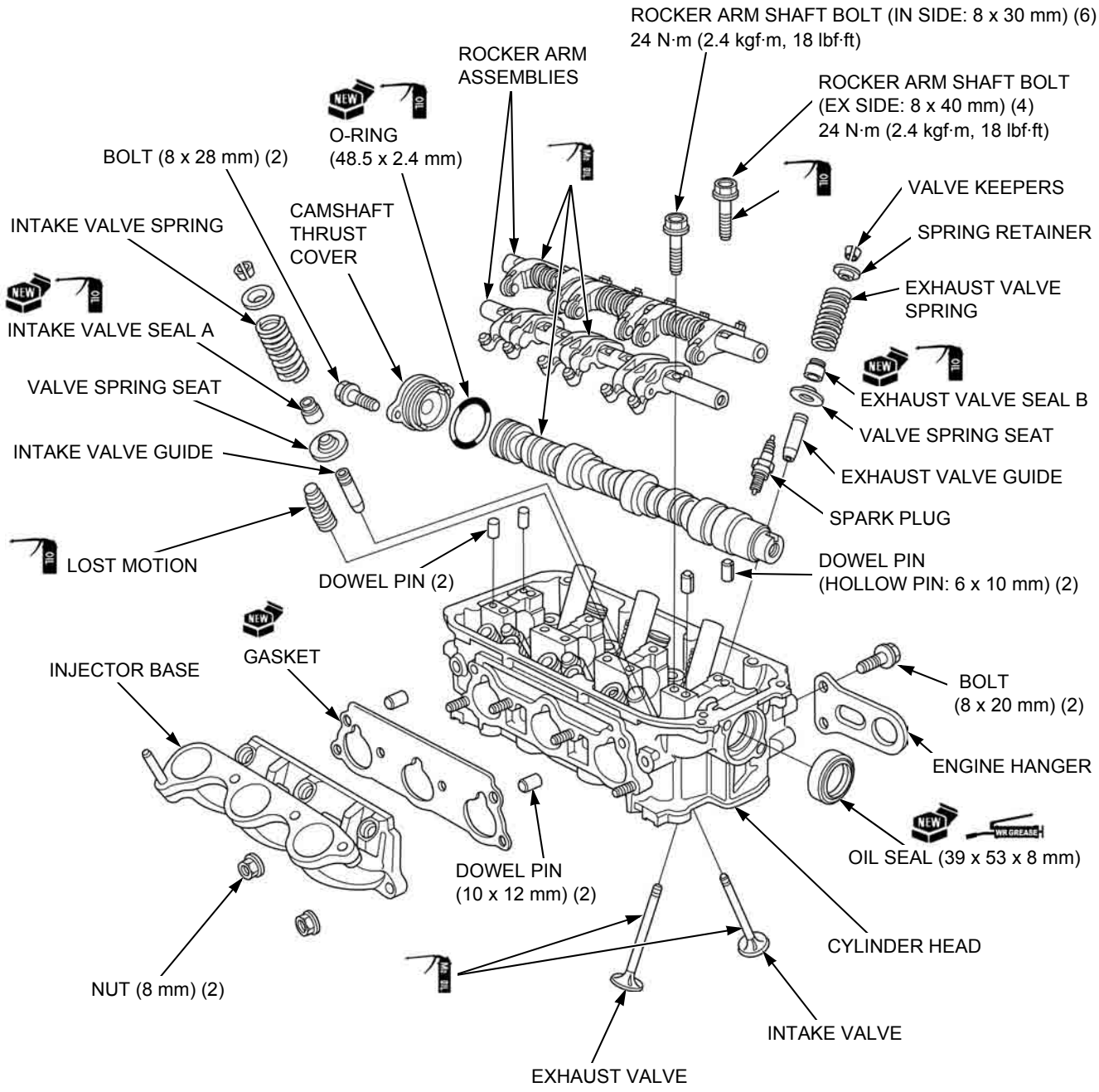
Apply oil to the following parts when reassembling.

Engine oil:

- Lost motion (full face)
- Exhaust rocker arm shaft bolt (threaded part and seat)
- Valve stem seal (internal circumference)
- Valve adjusting screw (threaded part)
- Valve adjusting lock nut (threaded part and seat)

Molybdenum disulfide oil:

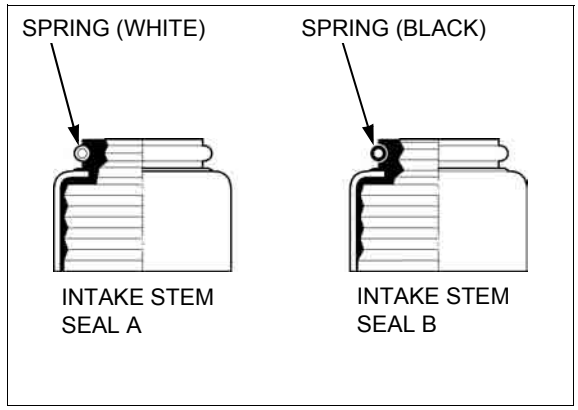
- Camshaft (journal and cam)
- Rocker arm shaft (outer circumference)
- Valve stem (sliding surface)



ASSEMBLY

Install the valve stem seals.

Note that valve stem seal A (intake side) and B (exhaust side) are different. Do not confuse them.



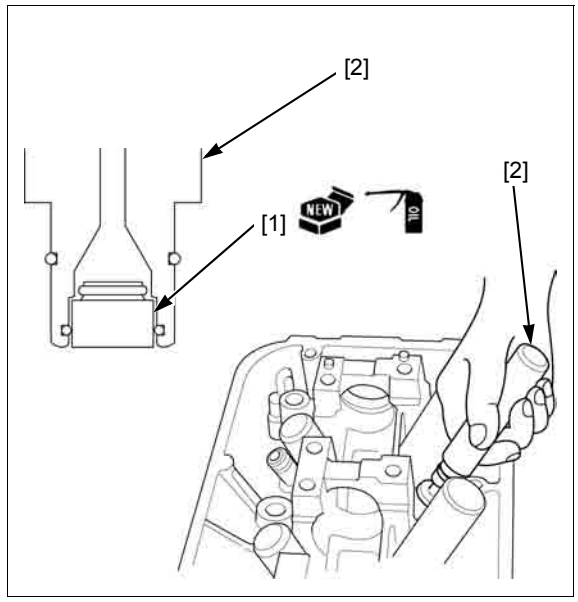
Install the valve spring seat.

Apply engine oil to the new valve stem seal [1] inner surface.

Install the new valve stem seals using the special tool.

TOOL:
Stem seal driver [2] 07PAD-0010000

NOTE:
- Use the 5.5 mm side of special tool.

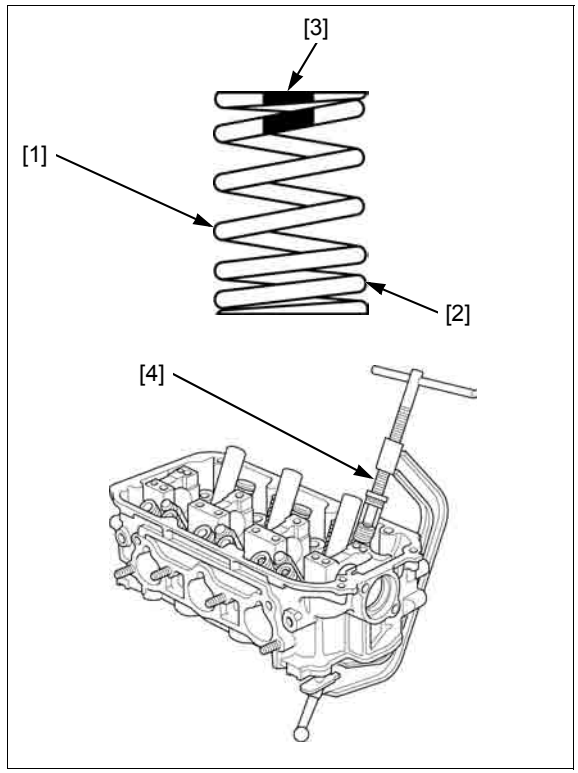


Install the valve spring [1] and valve spring retainer.

- Install the valve spring with its narrow pitched side [2] facing the valve spring seat and painted side [3] facing the retainer.
- Do not confuse the intake valve spring with the exhaust valve spring.

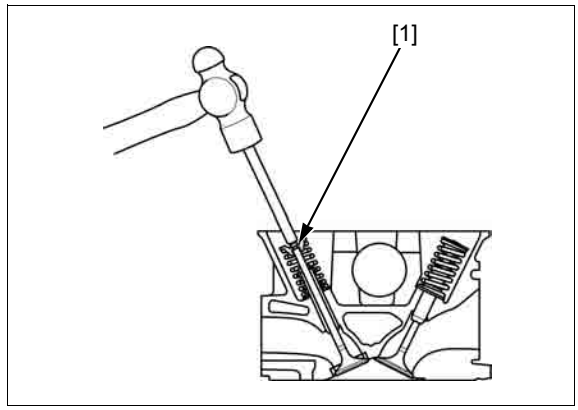
Using the special tools, compress the valve spring and set the two valve keepers in the groove in the valve stems securely.

TOOL:
Valve spring compressor [4] 07757-0010000



Lightly tap the end of each valve stem [1] two or three times with a plastic hammer to ensure proper seating of the valve and valve keepers.
Tap the valve stem only along its axis so you do not bend the stem.

- Support the cylinder head on an engine table or equivalent to prevent damage to the valve.

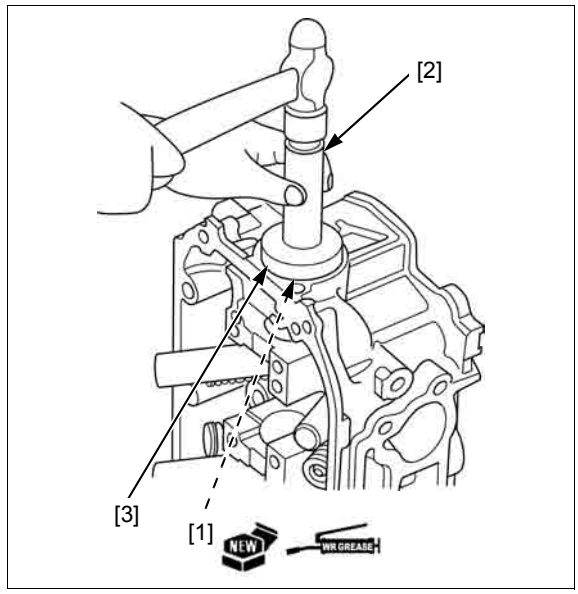


Apply marine grease to the new oil seal [1] lips.

Gently tap the camshaft oil seal into the cylinder head. Install the oil seal in the cylinder head about 0.5 – 1.5 mm (0.02 – 0.06 in.) from the surface of the cylinder head.

TOOLS:

Driver [2]	**07749-0010000**
Attachment, 52 x 55 mm [3]	**07746-0010400**

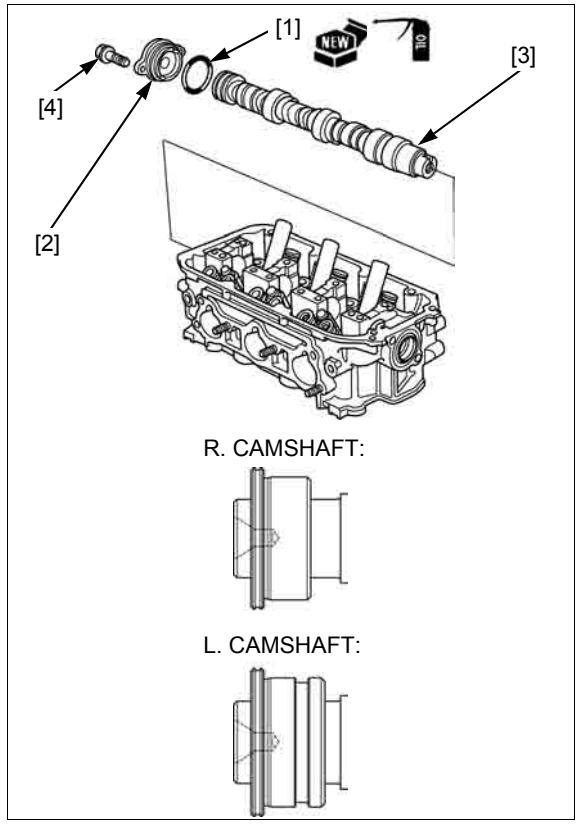


Coat a new O-ring [1] with engine oil and install it to the camshaft thrust cover [2].

Insert the camshaft [3] into the cylinder head, then install the camshaft thrust cover with the two bolts (8 x 28 mm) [4].

Note that R. camshaft and L. camshaft are different. Do not confuse them.

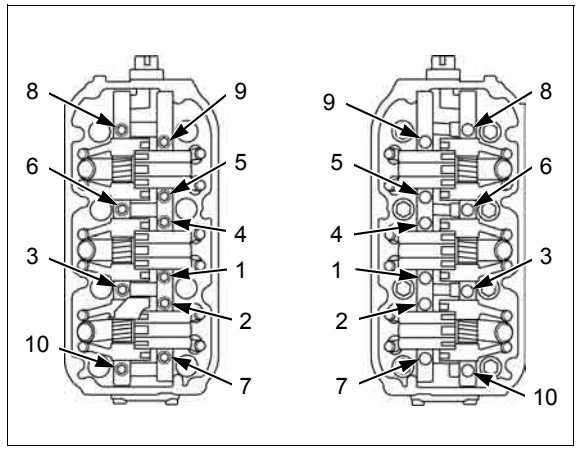
Check that the oil seal lips are not distorted.



Set the rocker arm assembly in place, and loosely install the bolts. Make sure that the rocker arms are properly positioned on the valve stems.

Apply engine oil to the threaded section and the seating surface of exhaust rocker arm shaft bolts, and tighten the bolts in the numbered order in two or three steps to the standard torque.

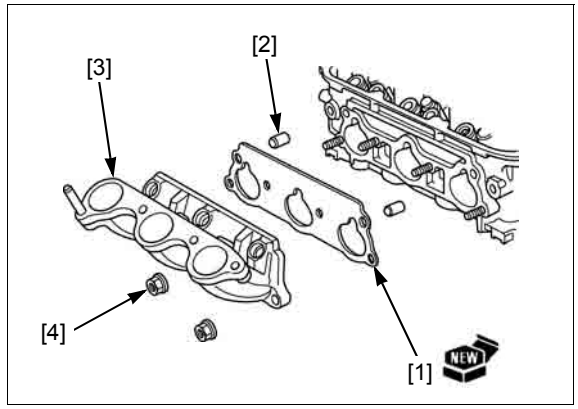
TORQUE: 24 N·m (2.4 kgf·m, 18 lbf·ft)



Set a new gasket [1] and the two dowel pins [2] and install the injector base [3] with the four nuts [4].

Install the following:

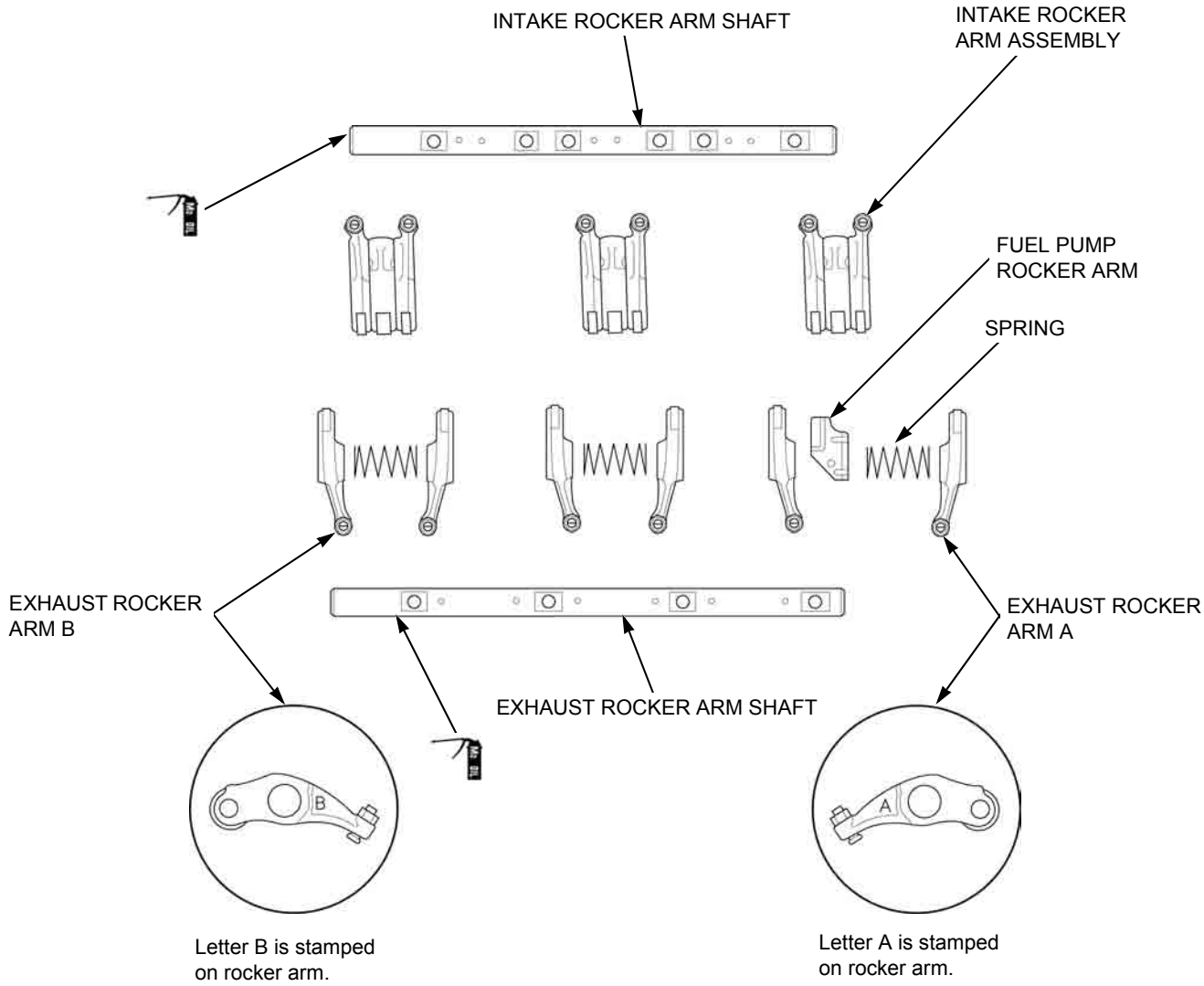
– Cylinder head (page 14-24)
– Timing belt back cover (page 14-12)



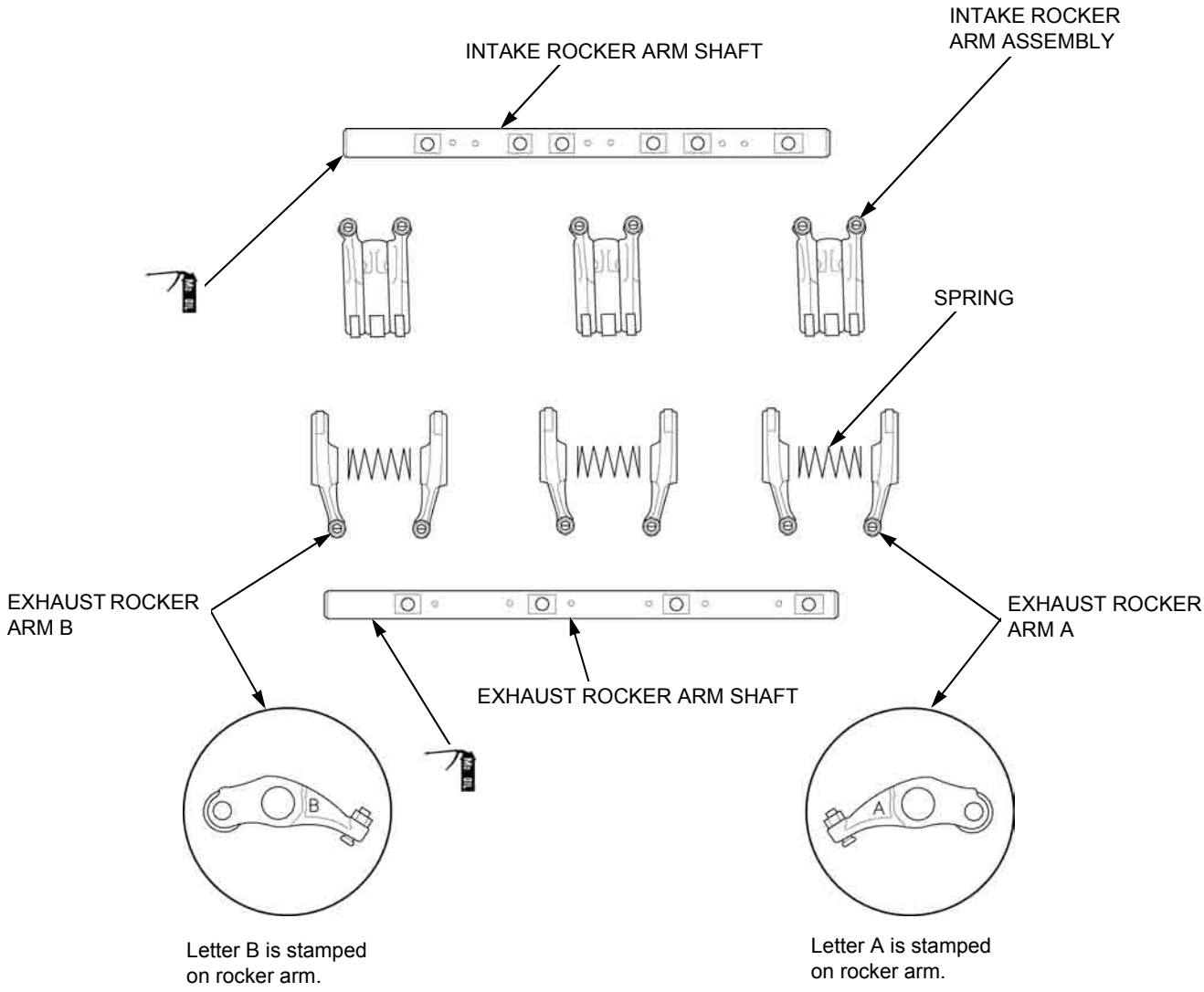
ROCKER ARMS/SHAFTS DISASSEMBLY/ASSEMBLY

- Identify parts as they are removed so they can be reinstalled in their original locations.
- Inspect the rocker arm shafts and rocker arms (page 14-33).
- Rocker arms must be installed in the same positions if reused.
- Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact points.

LEFT BANK:



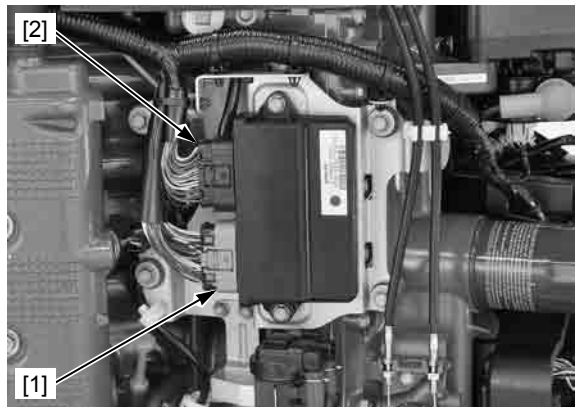
RIGHT BANK


INTAKE ROCKER ARM SHAFT
INTAKE ROCKER ARM ASSEMBLY
SPRING
EXHAUST ROCKER ARM B
EXHAUST ROCKER ARM A
EXHAUST ROCKER ARM SHAFT
B
A
Letter B is stamped on rocker arm.
Letter A is stamped on rocker arm.

CYLINDER COMPRESSION TEST

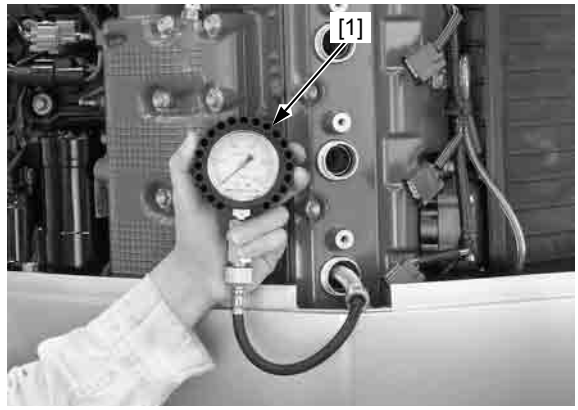
Set the remote control lever in the "N" (neutral) position.

Remove the engine cover and disconnect the ECM connector A [1] and B [2].



Remove the spark plugs (page 3-17).

Install a compression gauge (EEPV303A: commercially available) [1] in the No.1 plug hole.

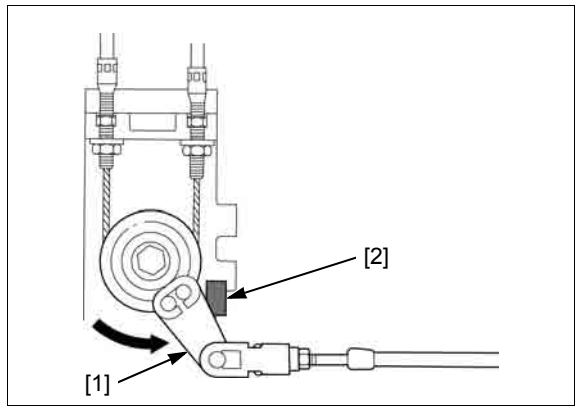


Set the throttle in the full throttle position by pulling the throttle arm [1] against the full throttle stopper [2] by hand as shown.

Set the combination switch in the START position and turn the starter motor until the maximum reading is obtained. Measure the cylinder compression.

CYLINDER COMPRESSION (Pressure check at 200 min^{-1} (rpm) with wide open throttle):
1,450 – 1,690 kPa (15 – 17 kgf/cm^2, 210 – 245 psi)

Check the compression on all cylinders.

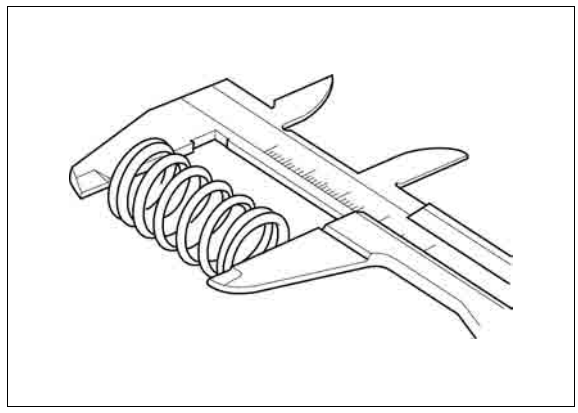


CYLINDER HEAD INSPECTION

VALVE SPRING FREE LENGTH

Measure the free length of the valve springs.

STANDARD:
IN: 51.32 mm (2.020 in)
EX: 53.48 mm (2.106 in)

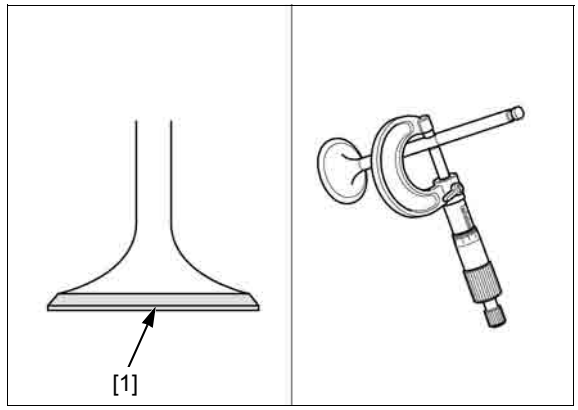


VALVE FACE/STEM O.D.

Inspect each valve face [1] for pitting, wear, or irregularities.
Inspect each valve stem for bending or abnormal stem wear. Replace the valve if necessary.
Measure and record each valve stem O.D.

STANDARD:
IN: 5.485 – 5.495 mm (0.2159 – 0.2163 in)
EX: 5.450 – 5.460 mm (0.2146 – 0.2150 in)
SERVICE LIMIT:
IN: 5.455 mm (0.2148 in)
EX: 5.420 mm (0.2134 in)

Replace the valves if their O.D. is smaller than the service limit.



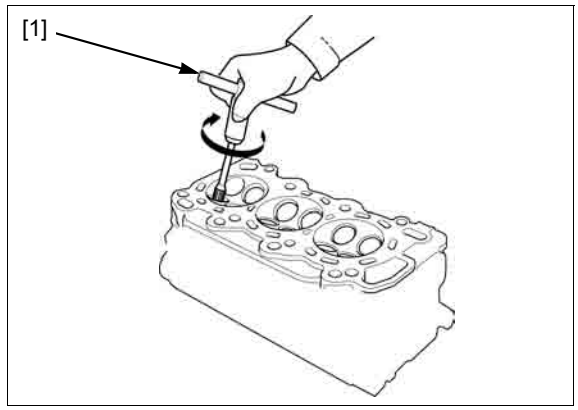
VALVE GUIDE I.D.

Using the valve guide reamer (special tool), ream the valve guides to remove any carbon deposits before measuring.

NOTICE

- *Turn the special tool (valve guide reamer, 5.5 mm) clockwise, never turn it counterclockwise. Continue to turn it clockwise as you lift it from the valve guide.*

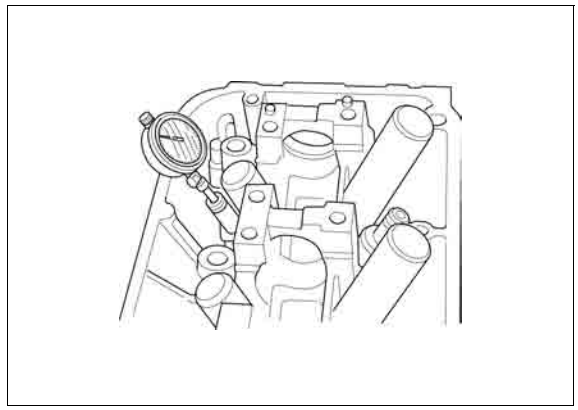
TOOL:
Valve guide reamer, 5.5 mm [1] 07HAH-PJ7A100



Measure and record each valve guide I.D.

STANDARD:
IN/EX: 5.515 – 5.530 mm (0.2171 – 0.2177 in)
SERVICE LIMIT:
IN/EX: 5.55 mm (0.219 in)

Replace the guides if they are over the service limit (page 14-42).



VALVE STEM-TO-VALVE GUIDE CLEARANCE

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

STANDARD:
IN: 0.020 – 0.045 mm (0.0008 – 0.0018 in)
EX: 0.055 – 0.080 mm (0.0022 – 0.0032 in)
SERVICE LIMIT:
IN: 0.080 mm (0.0032 in)
EX: 0.120 mm (0.0047 in)

If the stem-to-guide clearance exceeds the service limit, determine if the new guide with standard dimensions would bring the clearance within tolerance. If so, replace any guide as necessary and ream to fit. If the stem-to-guide clearance exceeds the service limit with new guides, replace the valves as well.

NOTICE

- *Recondition the valve seats whenever the valve guides are replaced (page 14-42).*

VALVE SEAT WIDTH

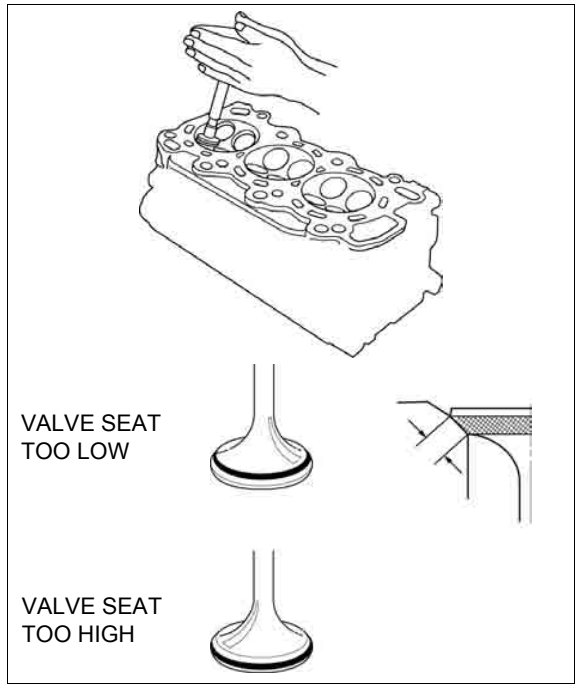
Thoroughly clean the combustion chambers and valve seats to remove carbon deposits. Apply a light coat of Prussian Blue compound or erasable felt-tipped marker ink to the valve faces.

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

Measure the valve seat width.

STANDARD:
IN/EX: 1.25 – 1.55 mm (0.049 – 0.061 in)
SERVICE LIMIT:
IN/EX: 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 (page 14-44).

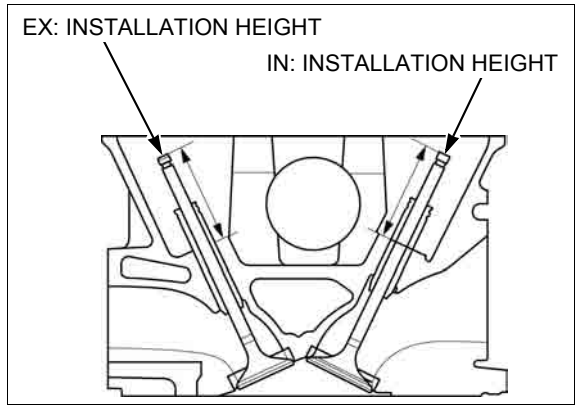


VALVE INSTALLATION HEIGHT

Measure the valve installation height.

STANDARD:
IN: 46.75 – 47.55 mm (1.841 – 1.872 in)
EX: 46.68 – 47.48 mm (1.838 – 1.869 in)
SERVICE LIMIT:
IN: 47.80 mm (1.882 in)
EX: 47.73 mm (1.879 in)

Replace the cylinder head if the measurement exceeds the service limit.



ROCKER ARM SHAFT O.D.

Measure and record the rocker arm shaft O.D.

STANDARD:
IN/EX: 19.972 – 19.993 mm (0.7863 – 0.7871 in)

Replace the rocker arm shaft if its O.D. is smaller than the service limit.



ROCKER ARM I.D.

Measure and record each rocker arm I.D.

STANDARD:
IN: 20.019 – 20.039 mm (0.7881 – 0.7889 in)
EX: 20.019 – 20.049 mm (0.7881 – 0.7893 in)

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

Also check the rocker arm-to-cam contact surface for any wear or scratches.



ROCKER ARM SHAFT-TO-ROCKER ARM CLEARANCE

Subtract each rocker arm shaft O.D. from the corresponding rocker arm I.D.

STANDARD:
IN: 0.026 – 0.067 mm (0.0010 – 0.0026 in)
EX: 0.026 – 0.077 mm (0.0010 – 0.0030 in)
SERVICE LIMIT:
IN: 0.067 mm (0.0026 in)
EX: 0.077 mm (0.0030 in)

If the rocker arm shaft-to-rocker arm clearance exceeds the service limit, replace the rocker arm and recheck.

If the rocker arm shaft-to-rocker arm clearance still exceeds the service limit, replace the rocker arm shaft.

VTEC ROCKER ARM TEST

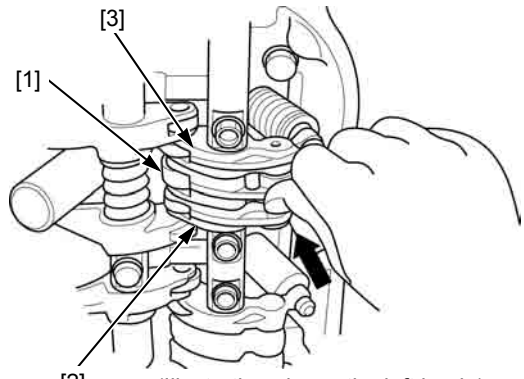
Remove the cylinder head covers (page 14-19).

Set the No. 1 piston at TDC (page 14-6).

Push on the intake mid rocker arm of the No.1 cylinder [1]. The mid rocker arm should move independently of the primary rocker arm [2] and secondary rocker arm [3].

Check for remaining intake mid rocker arms with each cylinder at each TDC as well.

- If the intake mid rocker arm does not move, remove the mid, primary, and secondary intake rocker arms as an assembly, and check that the pistons in the mid and primary rocker arms move smoothly (page 14-38).



(Illustration shows the left bank.)

Inspect the valve clearance (page 3-15).

Check that the air pressure on the shop air compressor gauge indicates over 690 kPa (7.0 kgf/cm^2, 100 psi).

Cover the timing belt with a shop towel to protect the belt.

Remove the two end intake rocker arm shaft mounting bolts, and then install and connect the special tools and an air pressure regulator with a 0 – 100 psi gauge as shown below

TOOLS:

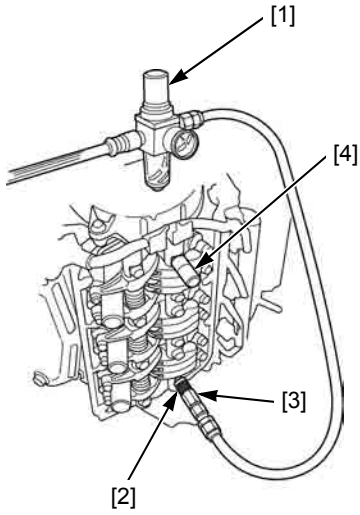
Air supply [1]	**07AAJ-PNAA100**
Air supply attachment [2]	**07VAJ-P8A010A**
Air adapter [3]	**070AJ-0010101**
VTEC air stopper [4]	**070AJ-0030100**

Loosen the valve on the regulator, and apply the specified air pressure.

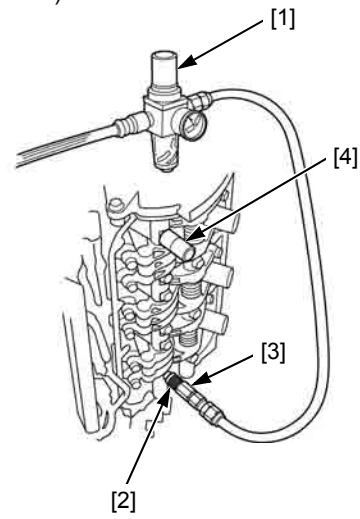
Specified Air Pressure:390 kPa (4.0 kgf/cm^2, 57 psi)

- If the synchronizing pistons do not move after applying air pressure, move the primary or secondary rocker arm up and down manually.

(LEFT BANK)

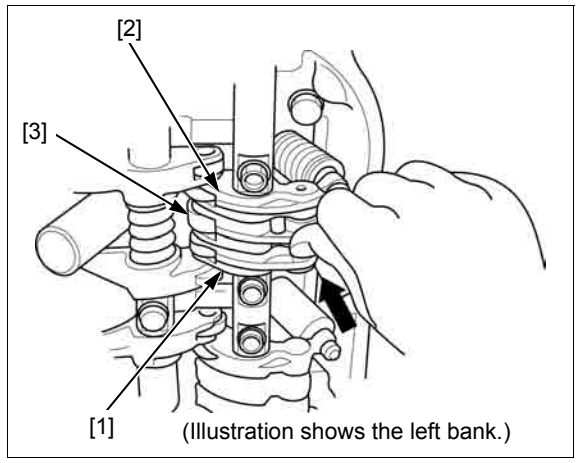


(RIGHT BANK)



Make sure that the intake primary rocker arm [1] and intake secondary rocker arm [2] are mechanically connected by the piston and that the mid rocker arm [3] does not move when pushed manually. If any intake mid rocker arm moves independently of the primary and secondary rocker arms, replace the rocker arms as a set.

After inspection, check that the MIL does not come on.

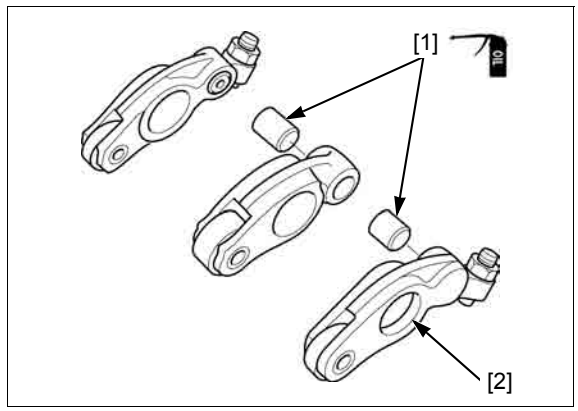


(Illustration shows the left bank.)

VTEC ROCKER ARM PISTONS INSPECTION

Disassemble the rocker arms and inspect the rocker arm pistons [1]. Push them manually. If they do not move smoothly, replace the rocker arm assembly.

- Apply engine oil to the pistons when reassembling.
- Do not mix up the pistons; they must go back in their original positions.



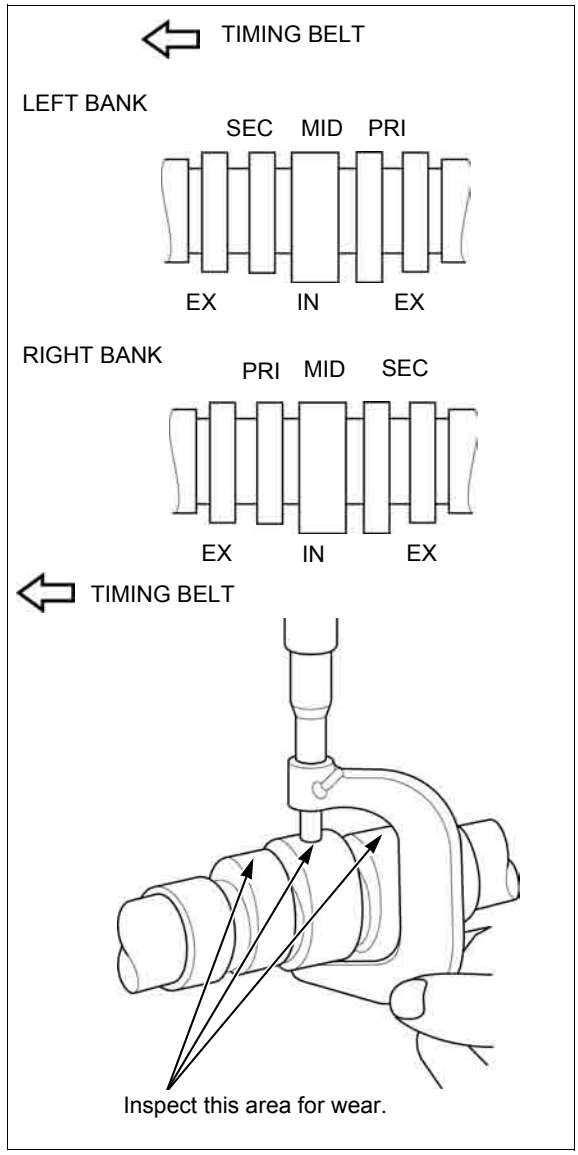
CAM LOBE HEIGHT

Wipe the camshaft clean, then inspect the lift ramps. Replace the camshaft if any lobes are pitted, scored or excessively worn.

Measure cam lobe height.

STANDARD:

IN/PRI: 34.88 – 34.98 mm (1.3732 – 1.3772 in)
IN/MID: 36.227 – 36.421 mm (1.4263 – 1.4339 in)
IN/SEC: 34.88 – 34.98 mm (1.3732 – 1.3772 in)
EX: 36.289 – 36.474 mm (1.4287 – 1.4360 in)



CAMSHAFT JOURNAL O.D.

Measure the camshaft journal O.D.

STANDARD:

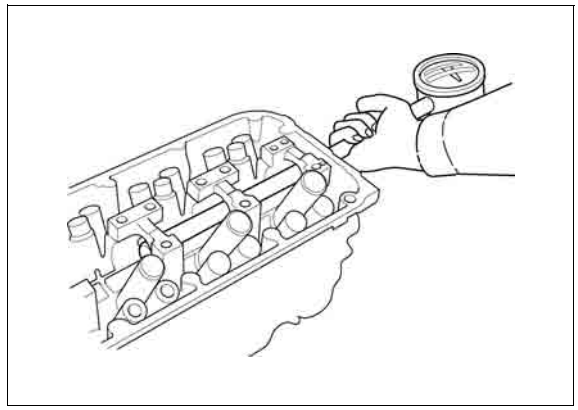
42.935 – 42.950 mm (1.6904 – 1.6909 in)



CAMSHAFT JOURNAL I.D.

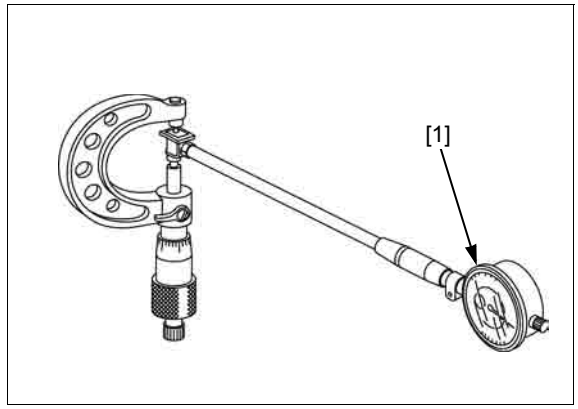
Measure the I.D. of each camshaft journal.

STANDARD:
43.000 – 43.024 mm (1.6929 – 1.6939 in)



CAMSHAFT OIL CLEARANCE

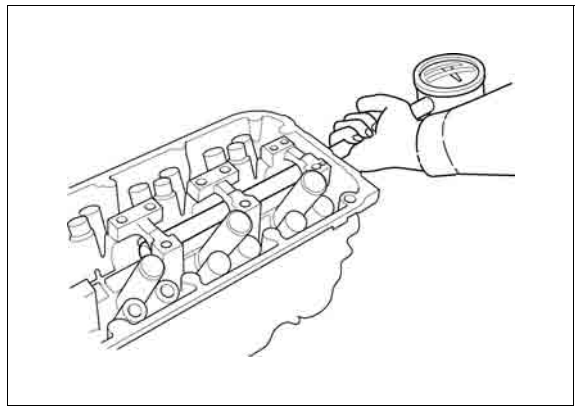
Zero the gauge to the camshaft journal O.D.



Clean the camshaft bearing surfaces in the cylinder head. Measure the inside diameter of each camshaft bearing surface, and check for an out-of-round condition.

STANDARD:
0.050 – 0.089 mm (0.0020 – 0.0035 in)
SERVICE LIMIT:
0.15 mm (0.006 in)

If the camshaft oil clearance is exceeds the service limit, replace the camshaft or cylinder head.



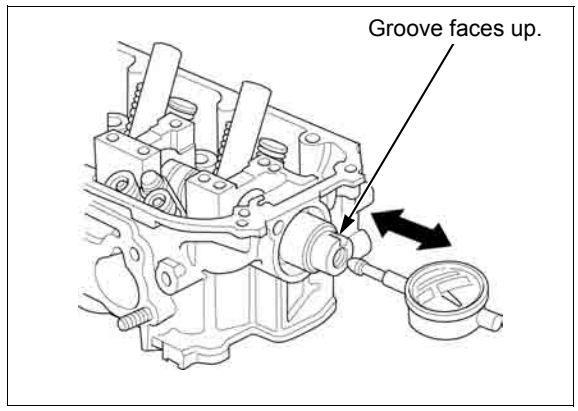
CAMSHAFT AXIAL CLEARANCE

Put the camshaft at top dead center of the compression stroke of the No. 1 piston (with the groove up). Check the camshaft axial play by pushing and pulling the camshaft as shown.

STANDARD:
0.05 – 0.20 mm (0.002 – 0.008 in)
SERVICE LIMIT:
0.2 mm (0.01 in)

If the measurement exceeds the service limit, replace the camshaft.

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

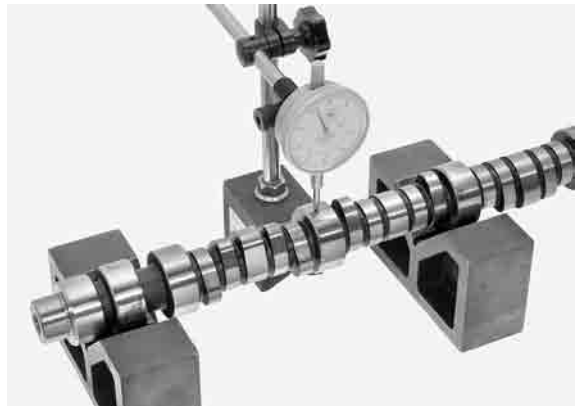


CAMSHAFT RUNOUT

Measure the camshaft runout.

STANDARD: 0.030 mm (0.0012 in) Max.
SERVICE LIMIT: 0.040 mm (0.0016 in)

Camshaft runout is half of maximum gauge reading.



CYLINDER HEAD WARPAGE

Remove carbon deposits from the combustion chamber.
Clean off any gasket material from the cylinder head surface.

Check the spark plug holes and valve areas for cracks.

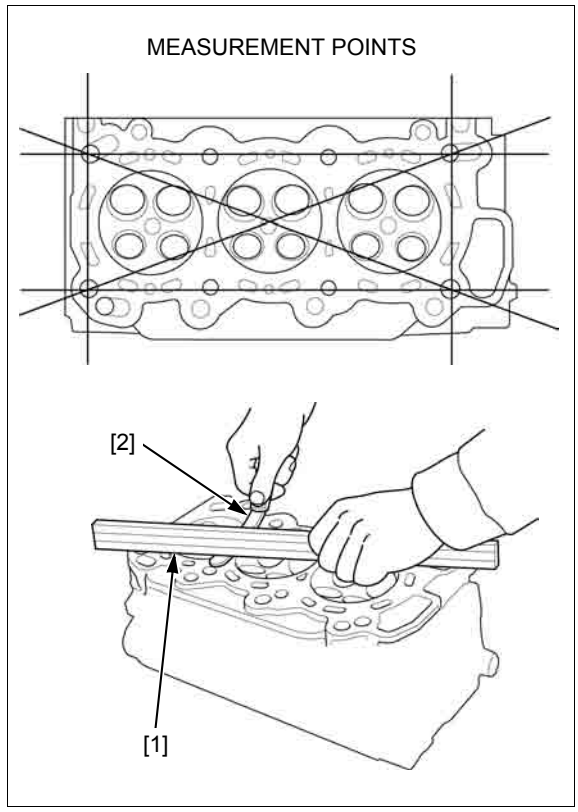
Check the cylinder head for warpage using a straight edge [1] and a feeler gauge [2].

SERVICE LIMIT: 0.05 mm (0.002 in)

If the measurement exceeds the service limit, recondition the cylinder head surface.
Reconditioning must be made within the standard value of the cylinder head height.

Cylinder head reconditioning procedure:

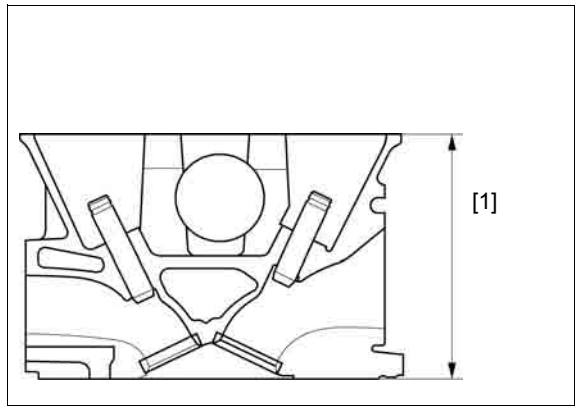
Apply Prussian blue compound to the level block to identify the warpage. Using a fine oil stone, grind the cylinder head in a figure "8" pattern with the warped part being the center of the ground part. Or use a lapping machine to recondition the cylinder head.



CYLINDER HEAD HEIGHT

Measure the cylinder head height [1].

STANDARD:
120.95 – 121.05 mm (4.762 – 4.766 in)



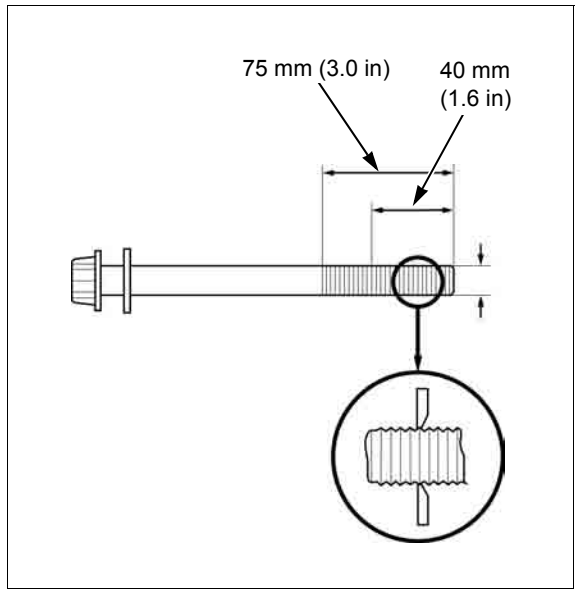
CYLINDER HEAD BOLT/WASHER

Measure the bolt O.D. at the two points as shown.

STANDARD: 11.3 mm (0.44 in)

Replace the cylinder head bolt/washer if its O.D. is smaller than the service limit.

Measure the O.D. of all cylinder head bolt/washers.



VALVE GUIDE REPLACEMENT

Chill the replacement valve guides in the freezer section of a refrigerator for about an hour.

Use a hot plate or oven to heat the cylinder evenly to 150°C (302°F). Check the temperature with a temperature indicating stick (available at a welding supply store) or equivalent.

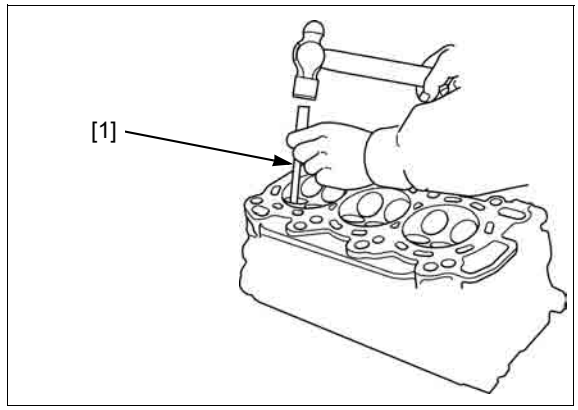
NOTICE

- *Do not use a torch to heat the cylinder head; warpage of the cylinder head may result.*
- *Do not get the head hotter than 150°C (302°F); excessive heat may loosen the valve seats.*

Remove the heated cylinder head from the hot plate, and support it with wooden blocks. Wear heavy gloves to protect your hands.

Drive the valve guide out of the combustion chamber side using a valve guide driver (special tool).

TOOL:
Valve guide driver, 5.35 x 9.7 mm [1] 07742-0010100



Allow the cylinder head to cool to room temperature. Clean and inspect the valve guide bores in the cylinder head.

Use a hot plate or oven to heat the cylinder head evenly to 150°C (302°F). Check the temperature with a temperature indicating stick or equivalent.

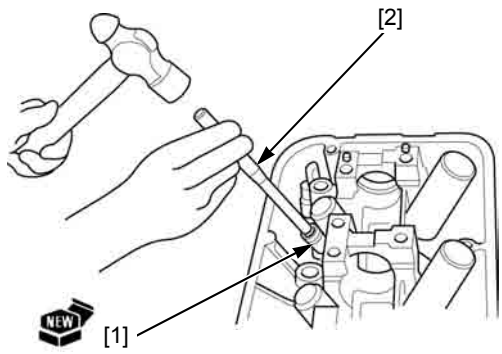
Install new valve guides [1] from the valve spring side of the cylinder head.
Remove new valve guides from the refrigerator one at a time as you install them, in order to keep them chilled.

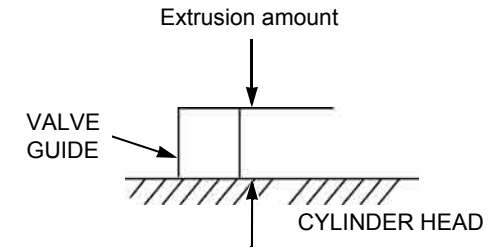
TOOL:
Valve guide driver, 5.35 x 9.7 mm [2] 07742-0010100

Drive each valve guide to the specified height, measured from the top of the valve guide to the cylinder head as shown.

Valve guide extrusion amount:
IN: 21.20 – 22.20 mm (0.835 – 0.874 in)
EX: 20.63 – 21.63 mm (0.812 – 0.852 in)

After installation, inspect the valve guide for damage. Replace any damaged valve guide.





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

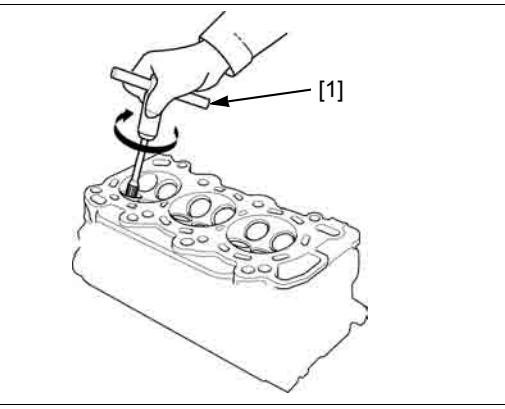
Coat the reamer and valve guide with cutting oil.

Rotate the reamer clockwise through the valve guide for the full length of the reamer.

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

NOTICE

- *Turn the special tool (valve guide reamer, 5.5 mm) clockwise, never turn it counterclockwise. Continue to turn it clockwise as you lift it from the valve guide.*

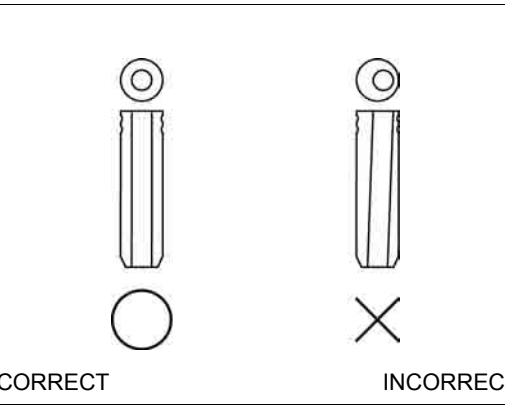


TOOL:
Valve guide reamer, 5.5 mm [1] 07HAH-PJ7A100

Thoroughly clean the cylinder head to remove any cutting residue.

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.

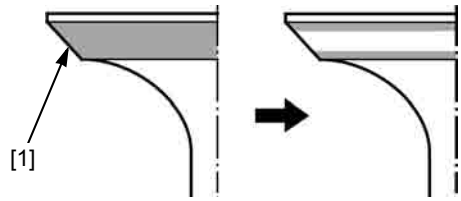
Check the Valve Stem-to-Valve Guide Clearance (page 14-35).



VALVE SEAT RECONDITIONING

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 [1].

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



Using a 45° cutter, remove enough material to produce a smooth and concentric seat. Follow the valve seat cutter manufacturer's instructions.

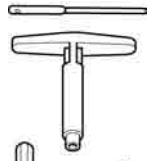
Turn the cutter clockwise, never counterclockwise. Continue to turn the cutter as you lift it from the valve seat.

VALVE SEAT RECONDITIONING TOOLS
(Commercially available)

Valve seat cutter, #607 30°
Valve seat cutter, #608 45°
Valve seat cutter, #270 60°



Solid pilot bar, 5.5 mm



T-wrench, #505



Accessory package, #246



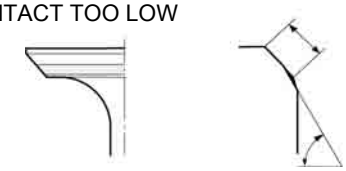
Use the 30° – 32° and 60° cutters to narrow and adjust the valve seat so that it contacts the middle of the valve face.

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.

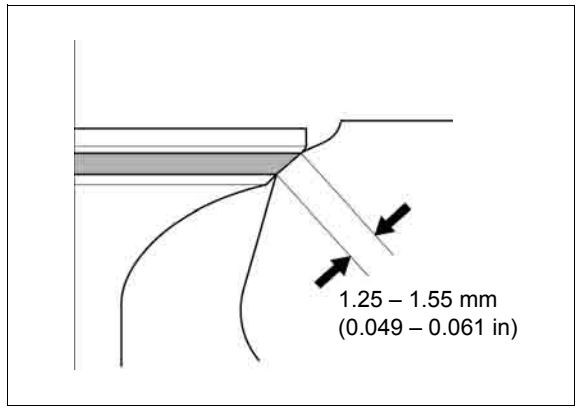
CONTACT TOO HIGH



CONTACT TOO LOW



Measure the valve set width.

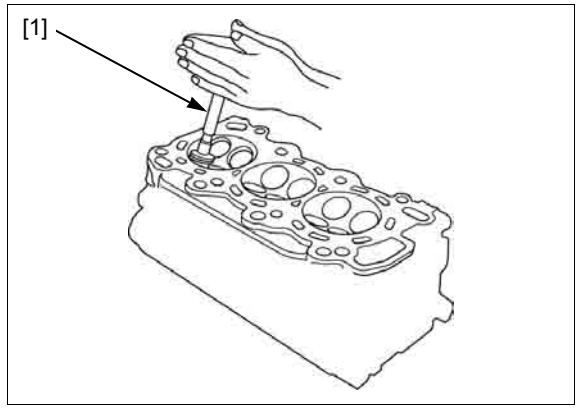


STANDARD:
1.25 – 1.55 mm (0.049 – 0.061 in)
SERVICE LIMIT:
2.0 mm (0.08 in)

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

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

Lap the valves into their seats, using a hand valve lapper (LIL-21100: commercially available) [1] and lapping compound.



NOTICE

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

Check valve clearance after assembly.

MEMO

15. CYLINDER BLOCK

COMPONENT LOCATION ····· 15-2

TOOLS ····· 15-3

CYLINDER BLOCK ANODE REMOVAL/ INSTALLATION ····· 15-4

FLYWHEEL REMOVAL/INSTALLATION ··· 15-4

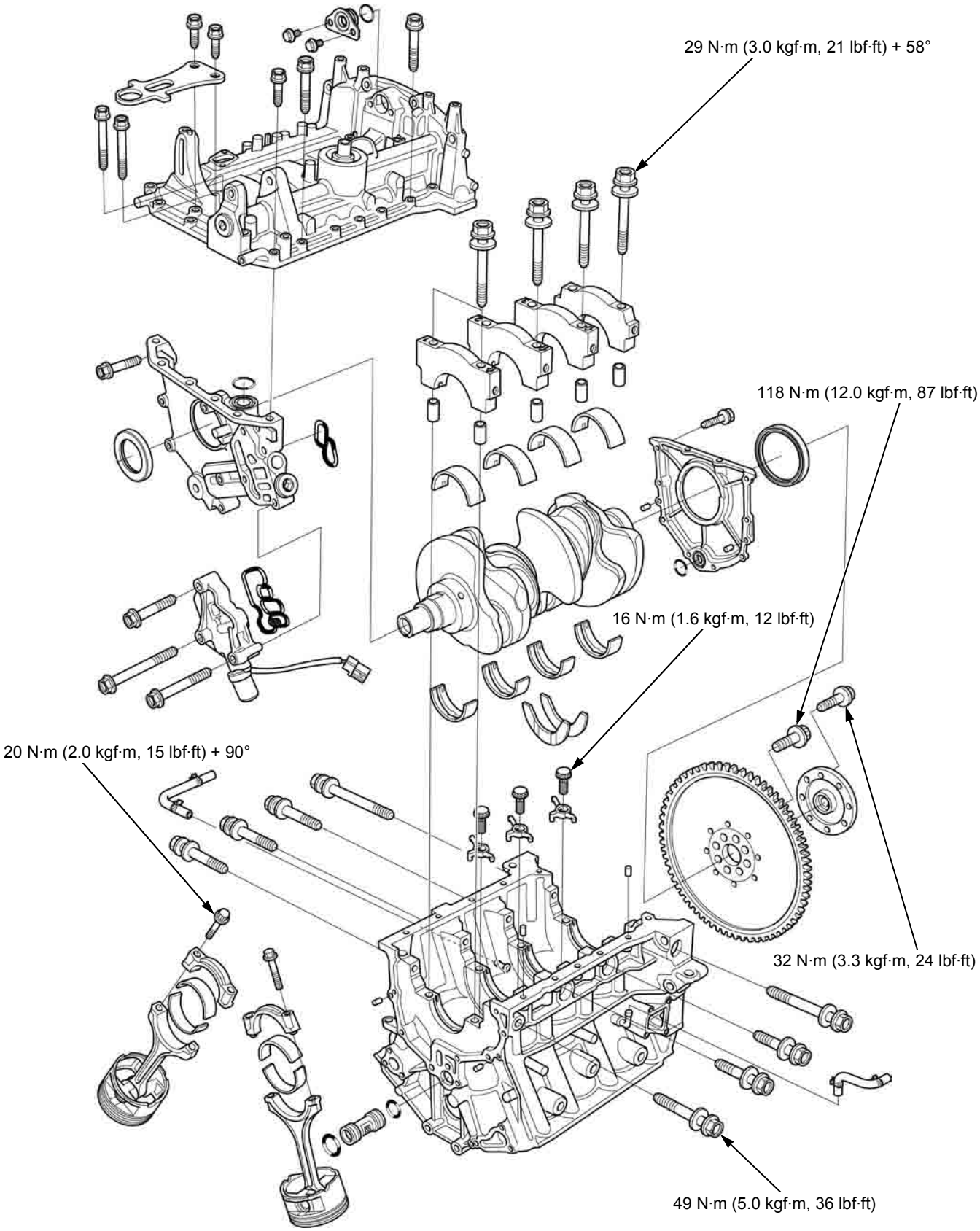
CRANKCASE COVER/CRANKSHAFT/PISTON DISASSEMBLY/ASSEMBLY ····· 15-7

FLYWHEEL INSPECTION ····· 15-26

CRANKSHAFT/PISTON/CYLINDER BLOCK INSPECTION ····· 15-27

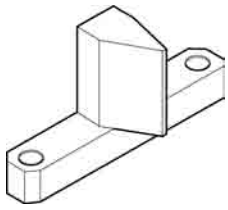
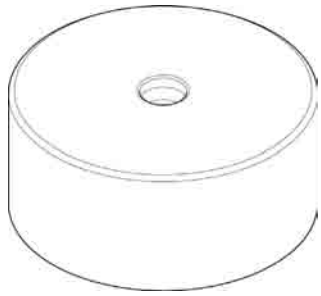
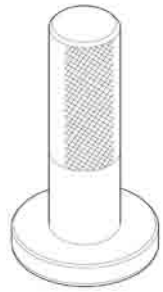
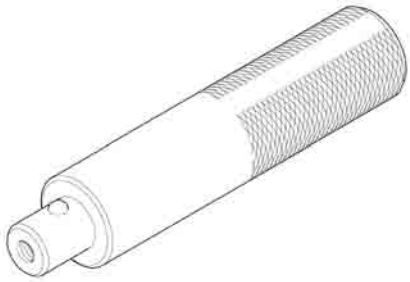
BEARING SELECTION ····· 15-36

COMPONENT LOCATION



TOOLS

LIST

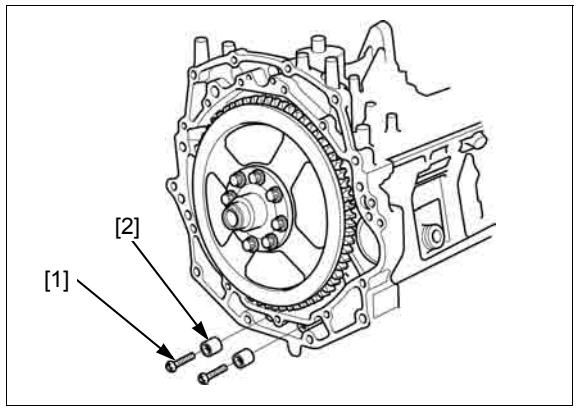
Ring gear holder 070PB-ZY3A100 	Oil seal driver attachment, 80 x 96 mm 07ZAD-PNA0100 	Oil seal driver, 66 mm 07947-3710200 
Driver 07749-0010000 		

CYLINDER BLOCK ANODE REMOVAL/ INSTALLATION

Remove the oil pump (page 12-9).

Remove the two screws (5 x 16 mm) [1] and two anode metals [2].

Installation is in the reverse order of removal.



FLYWHEEL REMOVAL/INSTALLATION

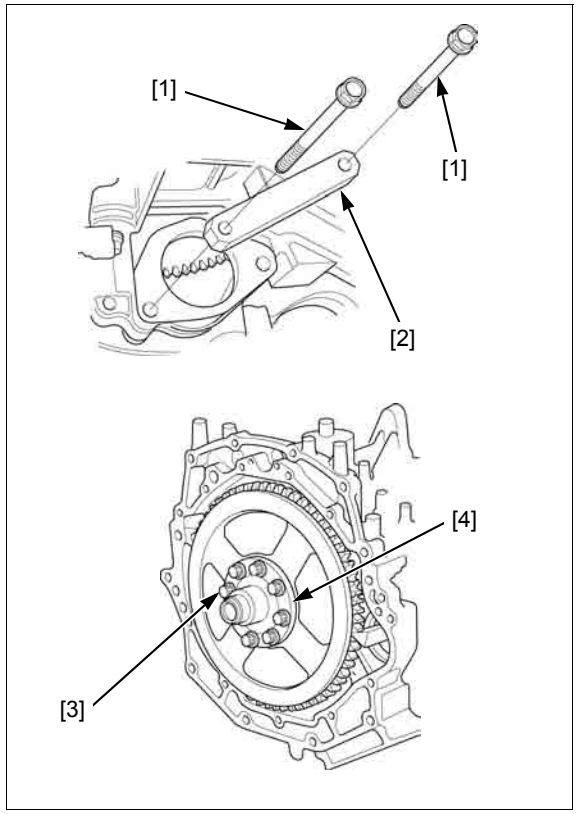
REMOVAL

Remove the oil pump (page 12-9).

Set the special tool on the starter motor mounting position and tighten the two suitable bolts [1].

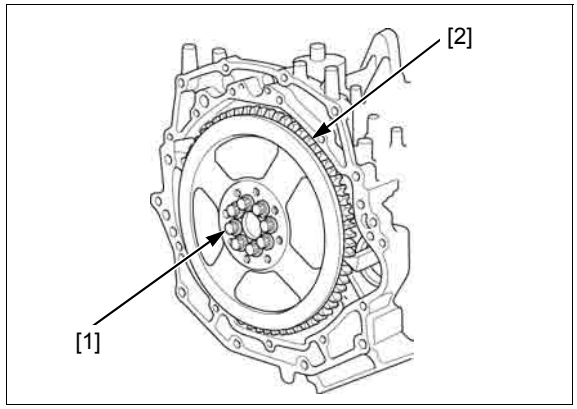
TOOL:
Ring gear holder [2] 070PB-ZY3A100

Remove the eight flywheel boss bolts [3] and remove the flywheel boss [4].



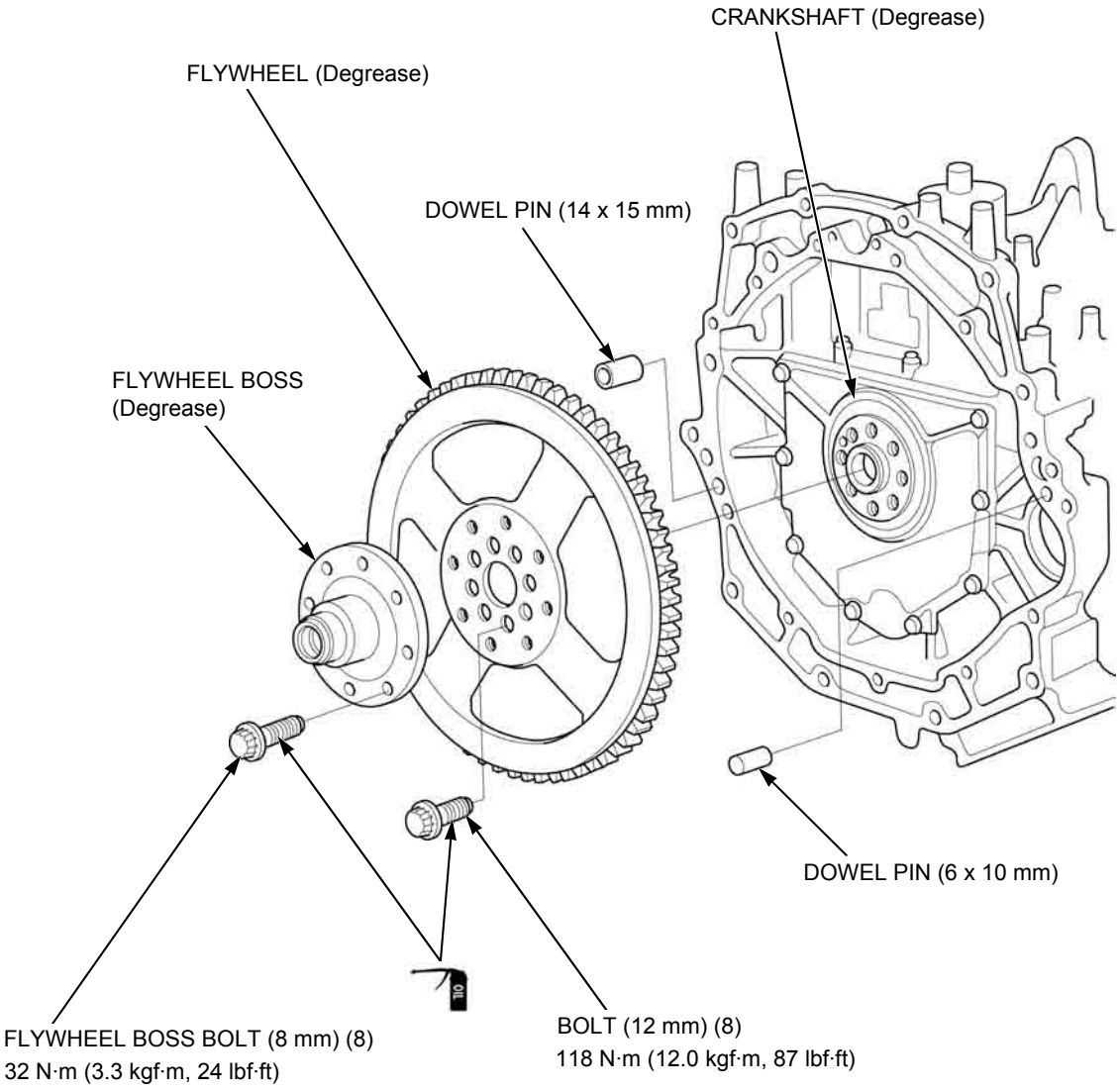
Remove the eight flywheel bolts [1] and the flywheel [2].

Check the flywheel (page 15-26).



EXPLODED VIEW

Remove oil from the mating surface between the crankshaft and the flywheel, and the mating surface between the flywheel and the flywheel boss, using a degreasing cleaning agent before installing the flywheel and the flywheel boss.



INSTALLATION

Clean the mating surfaces between the crankshaft and the flywheel [1] with a degreasing cleaning agent, and set the flywheel on the crankshaft.

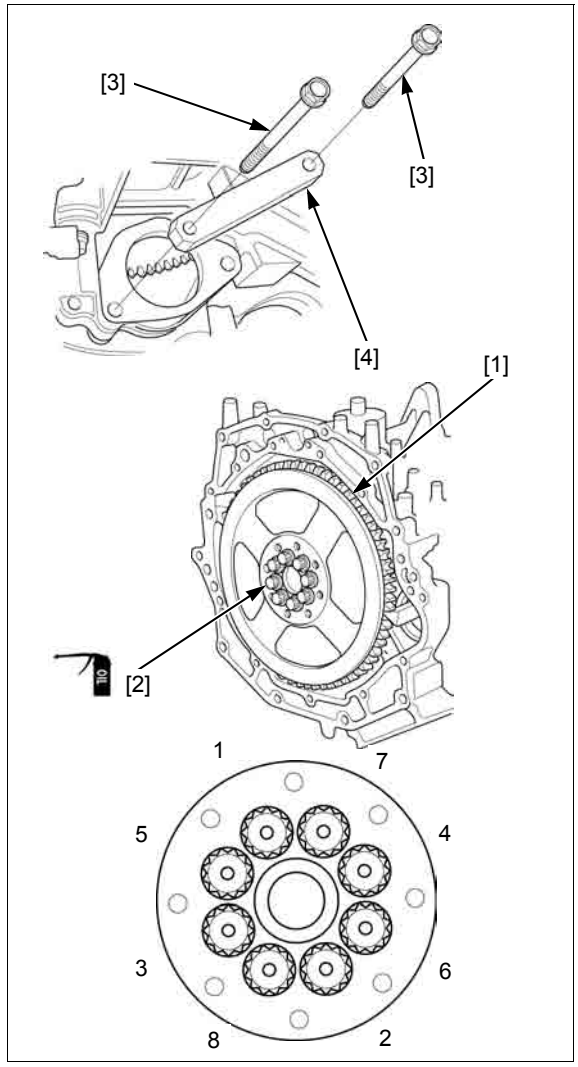
Apply engine oil to the seat and the threaded part of the flywheel bolts [2].

Hand tighten the eight bolts.
Install the special tool used for the flywheel boss/ flywheel removal on the starter motor mounting position and tighten the two suitable bolts [3].

TOOL:
Ring gear holder [4] 070PB-ZY3A100

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

TORQUE: 118 N·m (12.0 kgf·m, 87 lbf·ft)



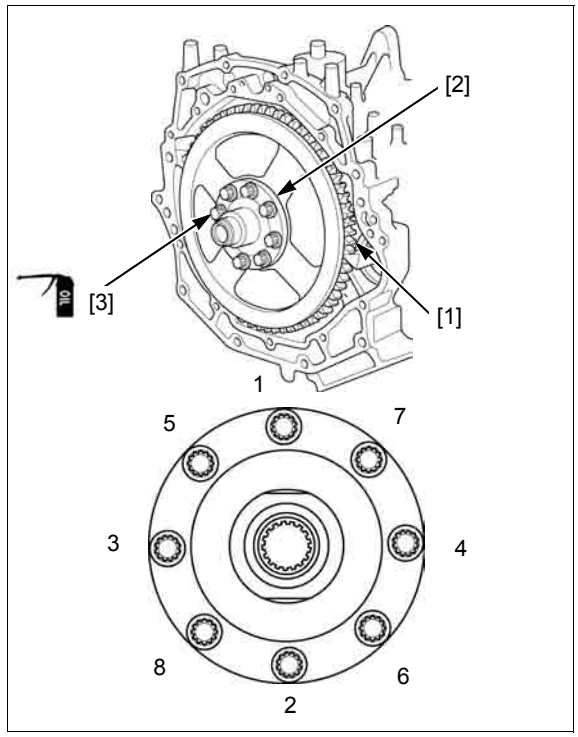
Clean the mating surfaces between the flywheel [1] and flywheel boss [2] with a degreasing cleaning agent, and set the flywheel boss on the flywheel.

Apply engine oil to the seat and the threaded part of the flywheel boss bolts [3].

Loosely tighten the eight bolts, then tighten them in the numbered sequence shown to the specified torque.

TORQUE: 32 N·m (3.2 kgf·m, 24 lbf·ft)

Install the oil pump (page 12-9).



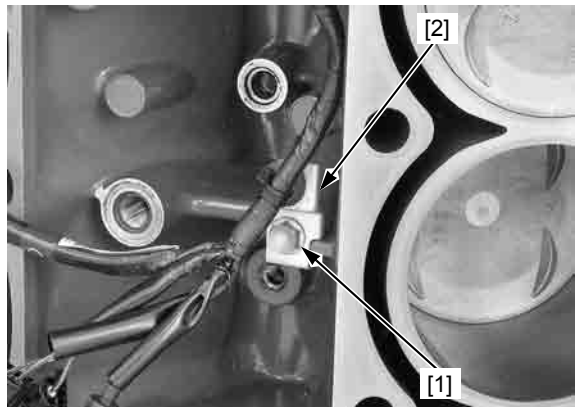
CRANKCASE COVER/CRANKSHAFT/ PISTON DISASSEMBLY/ASSEMBLY

CRANKCASE COVER/CRANKSHAFT DISASSEMBLY

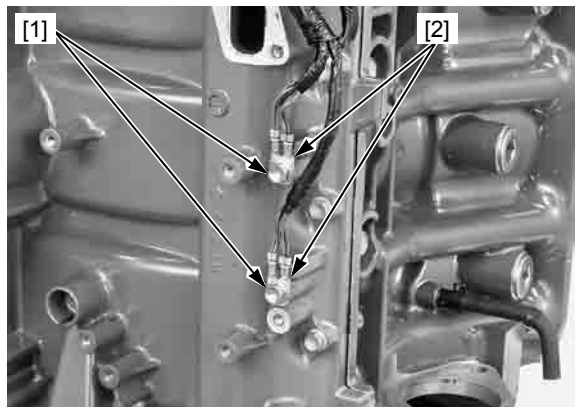
Remove the following parts:

– Engine assembly (page 13-4)
– Cylinder head (page 14-22)
– Oil filter (page 3-6)
– Thermostat (page 11-5)
– ECM bracket (page 10-5)
– Power tilt relay case (page 10-6)
– Alternator (page 7-5)
– Flywheel (page 15-4)
– EOP switch (High pressure side) (page 5-103)
– EOP switch (Low pressure side) (page 5-104)
– EBT sensor (page 5-105)
– Knock sensor (page 5-104)
– Oil filler extension (page 12-5)
– Oil level gauge cover (page 12-5)
– Neutral switch (page 9-6)
– Shift link bracket (page 20-7)
– Shift arm (page 20-9)

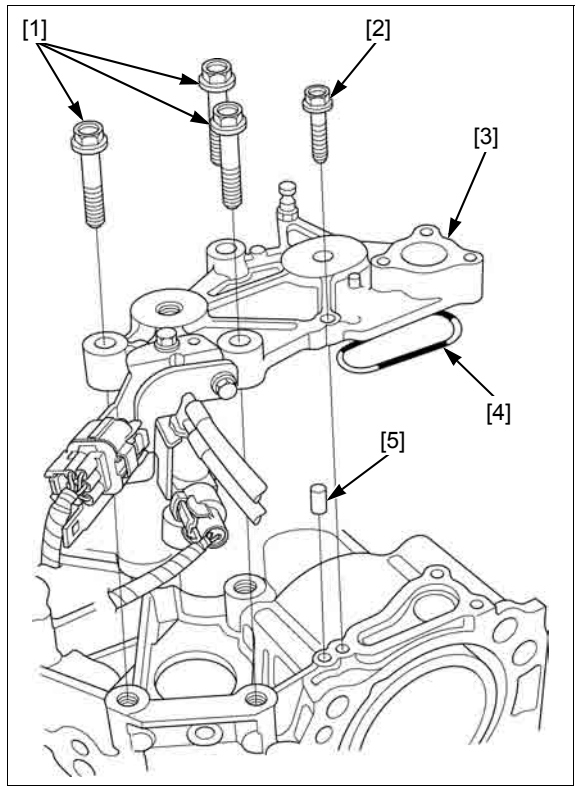
Remove the bolt (6 x 14 mm) [1] and harness clamp [2].



Remove the two bolts (6 x 12 mm) [1] and two main wire harness ground terminals [2].



Remove the three timing belt tensioner base bolts (10 x 40 mm) [1], bolt (6 x 22 mm) [2], timing belt tensioner base [3], and O-ring [4].
Remove the dowel pin [5].



Remove the two bolts (8 x 25 mm) [1] and engine hanger plate [2].

Remove the two bolts (6 x 11 mm) [3] and seal holder [4].

Remove the O-ring (26.9 x 2.4 mm) [5] from the seal holder.

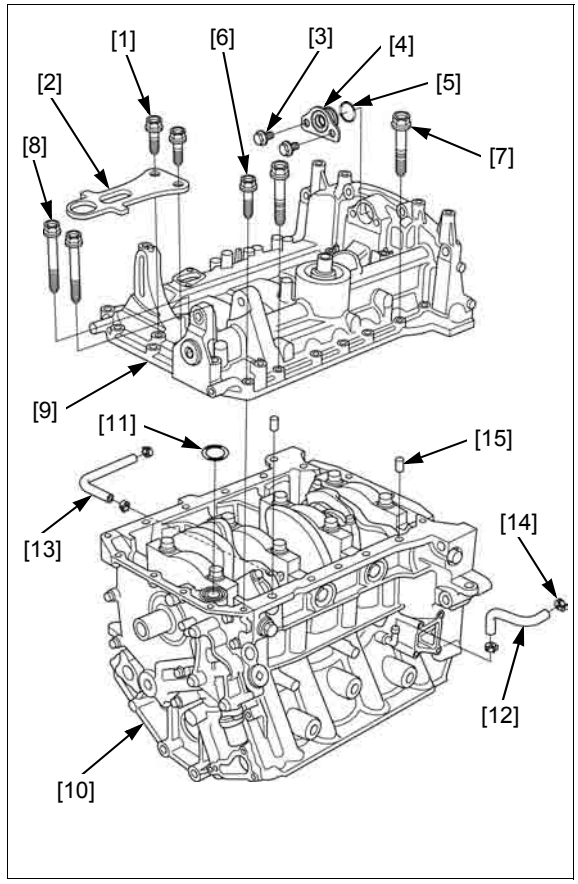
Remove the fifteen bolts (6 x 32 mm) [6], two bolts (6 x 37 mm) [7], and two bolts (6 x 55 mm) [8] from the crankcase [9].

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

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

Remove the following parts from the cylinder block [10].

– O-ring (25 x 2.4 mm) [11]
– L. water return tube [12]
– R. water return tube [13]
– Four tube clamps D10.5 [14]
– Two dowel pins [15]

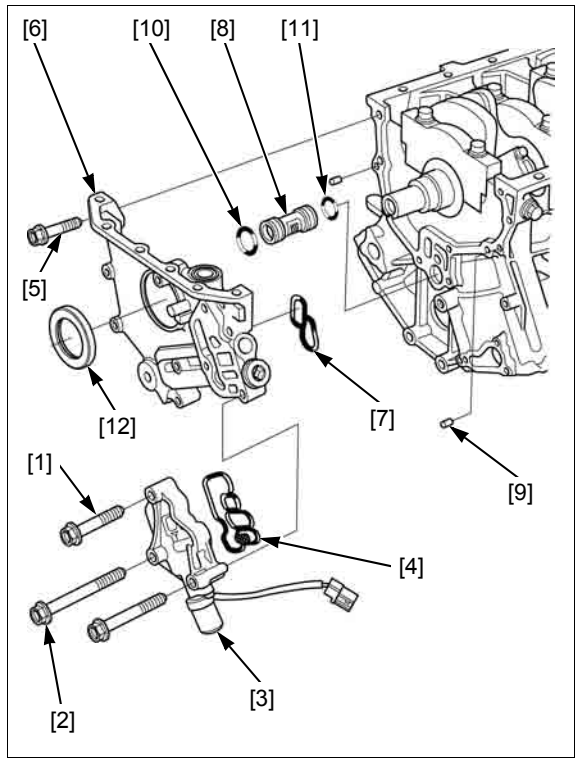


Remove the two bolts (8 x 50 mm) [1], bolt (8 x 75 mm) [2], VTEC spool valve [3], and VTEC spool valve filter [4].

Remove the seven bolts (6 x 35 mm) [5], crankcase upper cover [6], oil hole gasket [7], oil pipe joint [8] and two dowel pins [9].

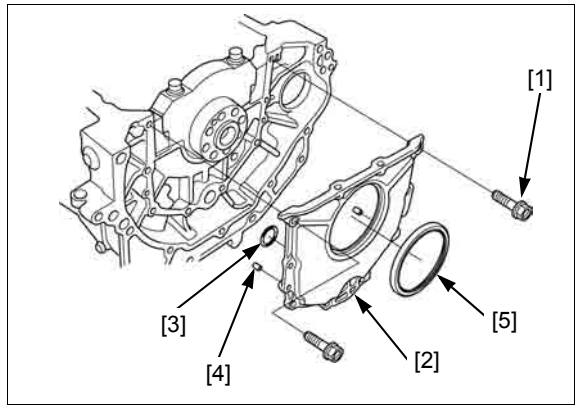
Remove the O-ring (18.3 x 3.5 mm) [10], O-ring (16.3 x 3.5 mm) [11] from the oil pipe joint.

Remove the oil seal [12] from the crankcase upper cover.



Remove the eight bolts (6 x 22 mm) [1], oil seal case [2], O-ring (26.2 x 2.4 mm) [3] and two dowel pins [4].

Remove the oil seal [5] from oil seal case.



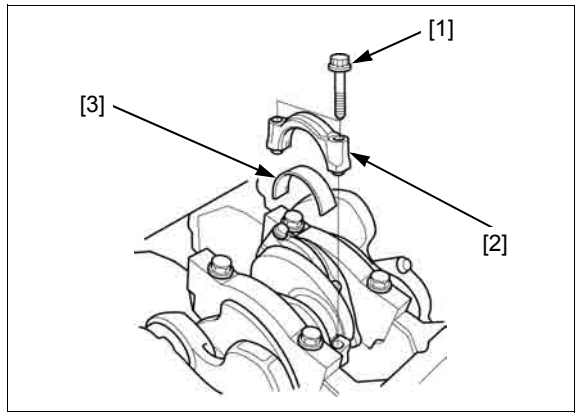
Set the piston at BDC for each cylinder.

Remove the two connecting rod bolts [1] and remove the connecting rod bearing cap [2].

NOTICE

- *To avoid mix up during reassembly, mark each piston/connecting rod assembly with its cylinder number.*
- *Check the connecting bearing for damage (scores, scratches, etc.) and replace it with a new one if necessary.*

Remove the connecting rod bearing [3].

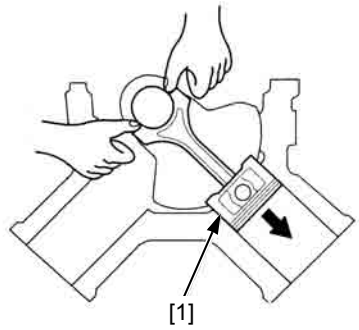


Remove the piston assembly [1] by pushing on the connecting rod.

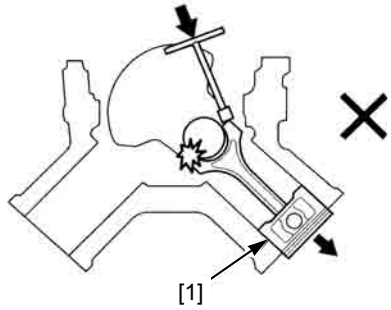
NOTICE

- *To avoid mix up during reassembly, mark each piston/connecting rod assembly with its cylinder number.*
- *Before removing the piston assembly, remove the carbon deposits from the cylinder. Be careful not to damage the piston.*

CORRECT

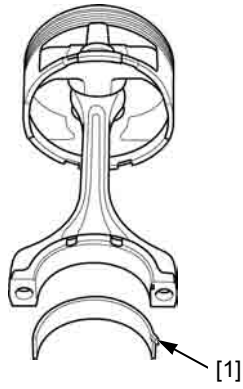


INCORRECT



Remove the connecting rod bearing [1] from the connecting rod.

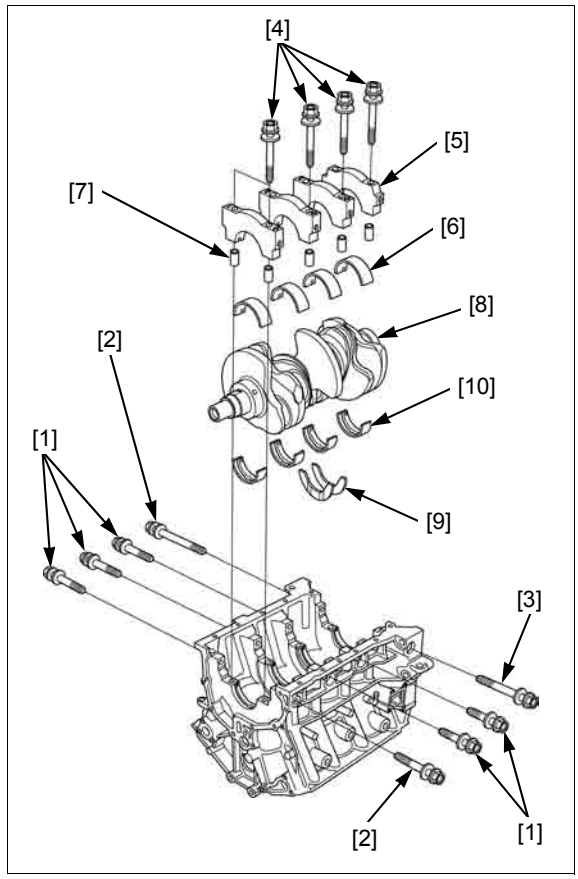
- Check the connecting rod bearing for damage (scores, scratches, etc.) and replace it with a new one if necessary.
- Check the mating surfaces of the connecting rod and connecting rod bearing cap for damage (scores, scratches, etc.).
  Replace the connecting rod and connecting rod bearing cap as a set, if damaged.



Remove the five side bolts (10 x 60 mm) [1], two side bolts (10 x 80 mm) [2], side bolt (10 x 109 mm) [3], eight bearing cap bolts [4], four bearing caps [5], four lower main bearings [6], and eight dowel pins [7].

- Check the main bearing for damage (scores, scratches, etc.) and replace it with a new one if necessary.

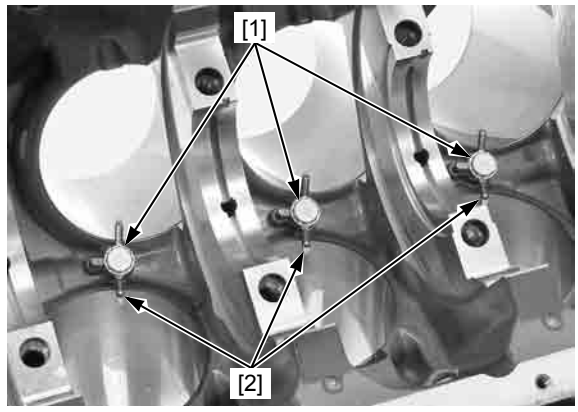
Remove the crankshaft [8], two thrust washers [9], and four upper main bearings [10], taking care not to damage the journal.



Remove the three oil jet bolts [1] and three oil jet bodies [2].

Check the oil jet bolt and oil jet body for clogs or damage.

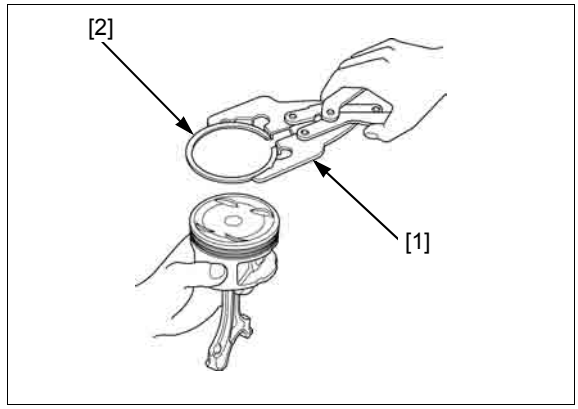
Check the crankshaft and cylinder block (page 15-27).



PISTON DISASSEMBLY

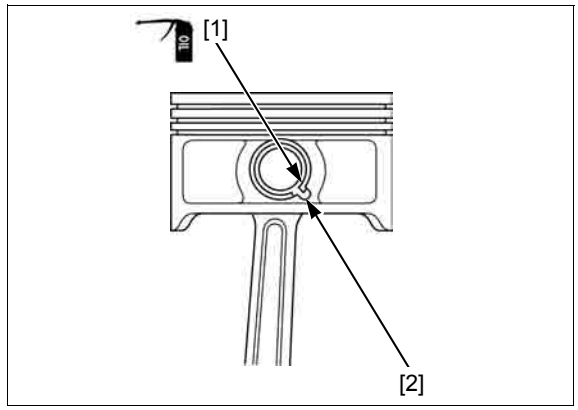
Remove the piston ring [2] using a piston ring expander (commercially available) [1].

- Store the removed connecting rod bearing and piston ring with its piston.
- Do not expand the piston ring excessively as it can break easily.
- Do not damage the piston with the piston ring.



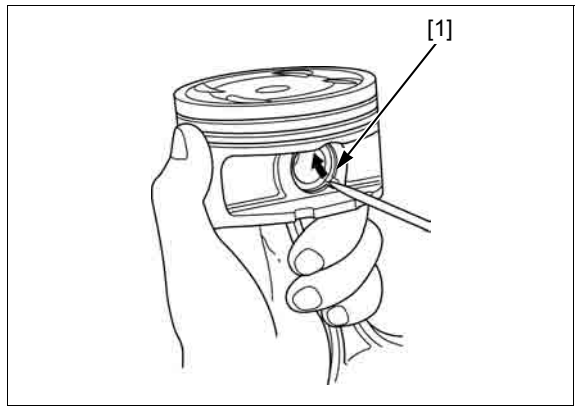
Apply engine oil to the piston pin clip [1] and turn them in the ring grooves until the end gaps are lined up with the cutouts [2] in the piston pin holes.

- Do not damage the piston pin clip installation groove.



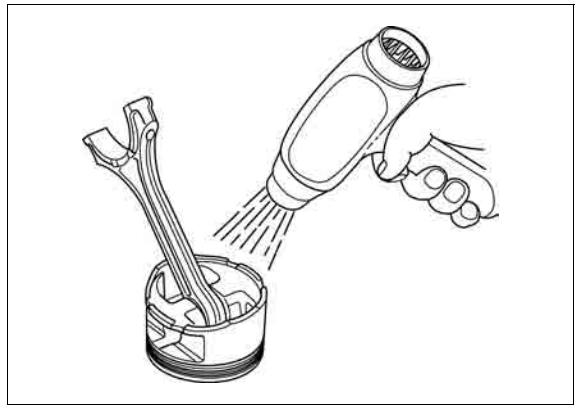
Remove both piston pin clips [1]. Start at the cutout in the piston pin holes.

Wear eye protection as the piston pin clips can pop out.

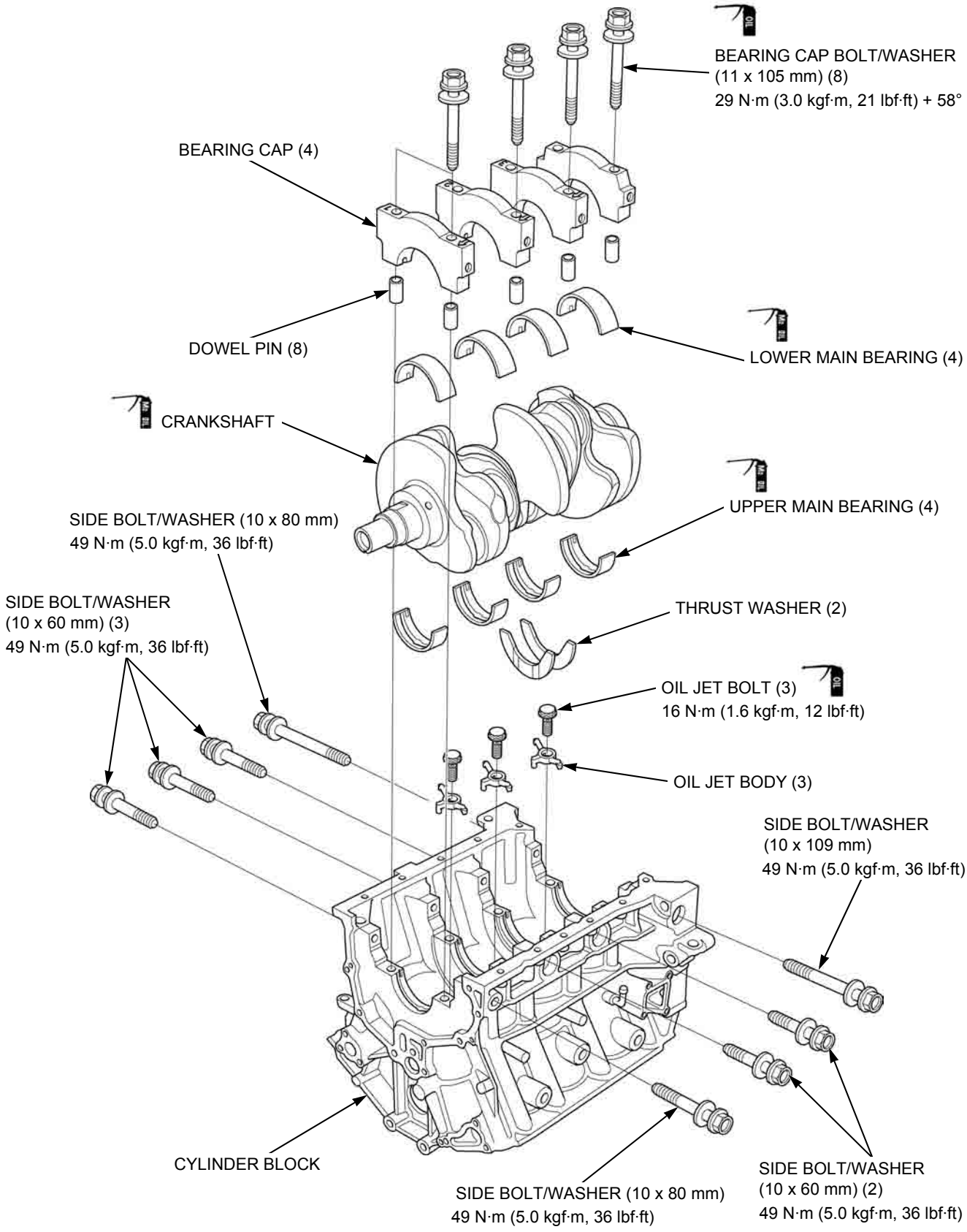


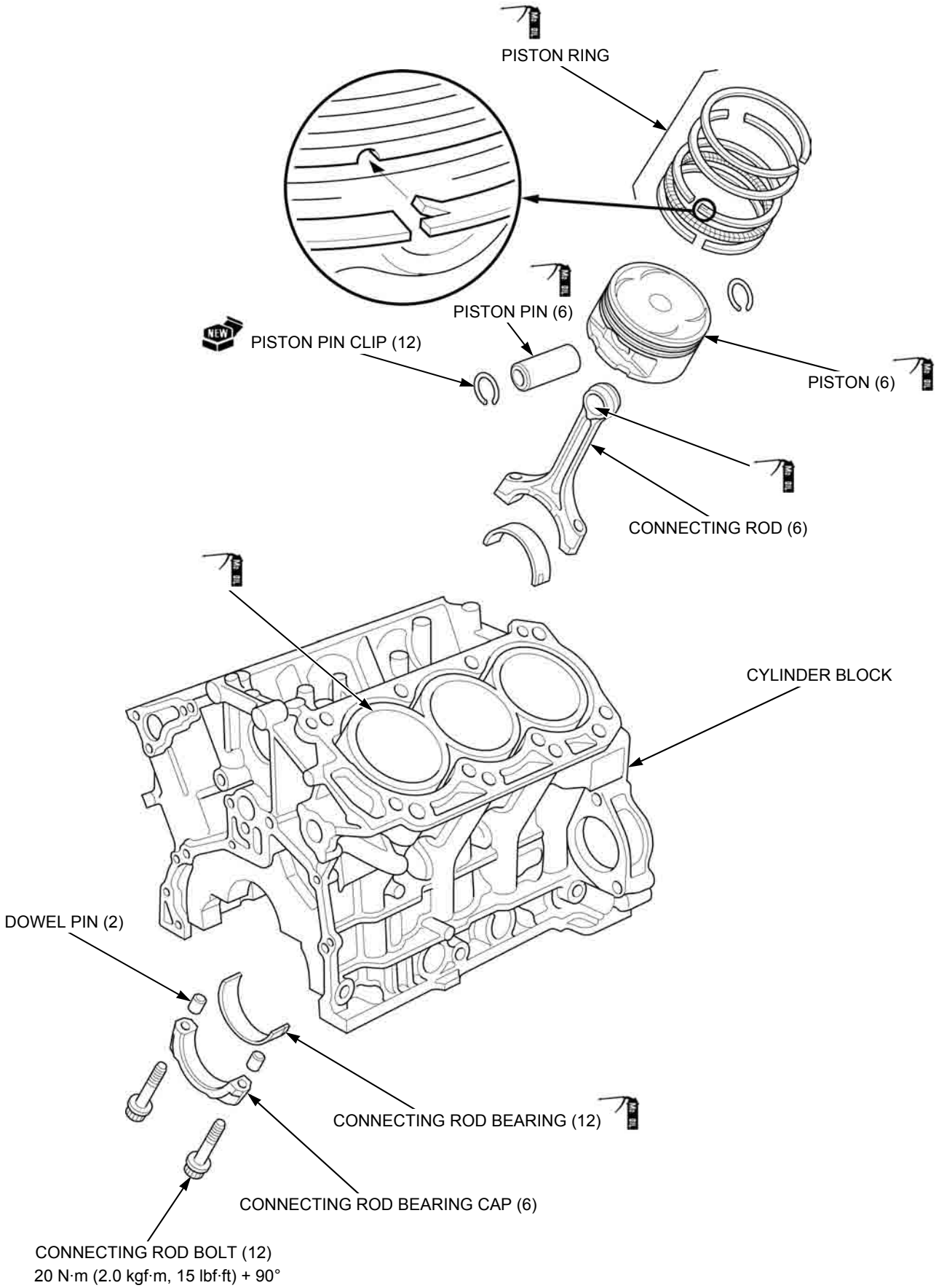
Wearing heavy gloves, heat the piston and connecting rod assembly to approximately 70 °C (158 °F), and then remove the piston pin.

Check the piston parts (page 15-27).



EXPLODED VIEW

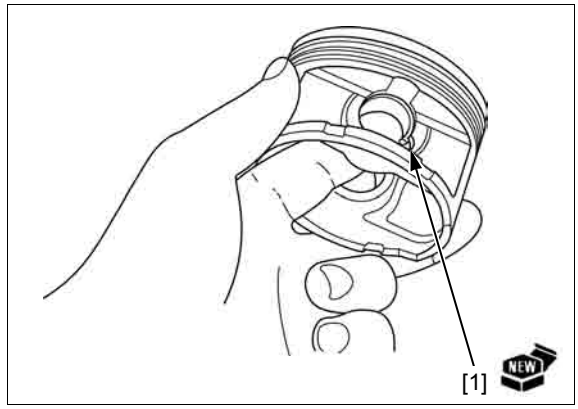



PISTON RING
PISTON PIN (6)
NEW
PISTON PIN CLIP (12)
PISTON (6)
CONNECTING ROD (6)
CYLINDER BLOCK
DOWEL PIN (2)
CONNECTING ROD BEARING (12)
CONNECTING ROD BEARING CAP (6)
CONNECTING ROD BOLT (12)
20 N·m (2.0 kgf·m, 15 lbf·ft) + 90°

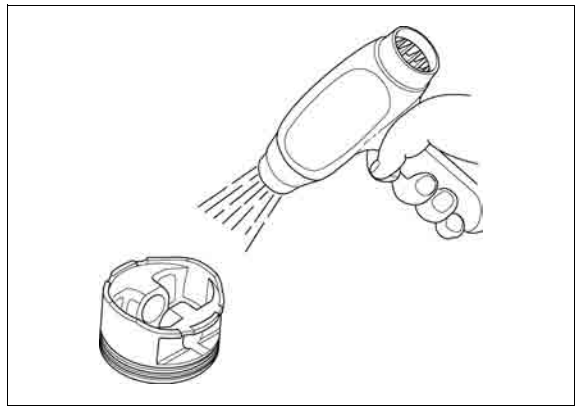
PISTON ASSEMBLY

Install a new piston pin clip [1] on one side only.

- Wear eye protection as the piston pin clips can pop out during installation.
- Make sure the piston pin clip does not align with the cutout in the piston pin bore.



Put on heavy gloves, then using a heat gun, heat the piston to approximately 158 °F (70 °C).

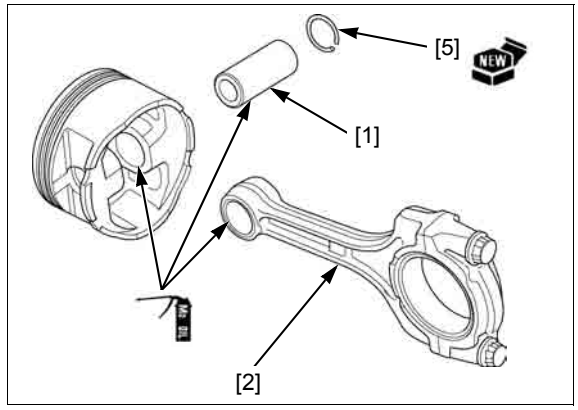


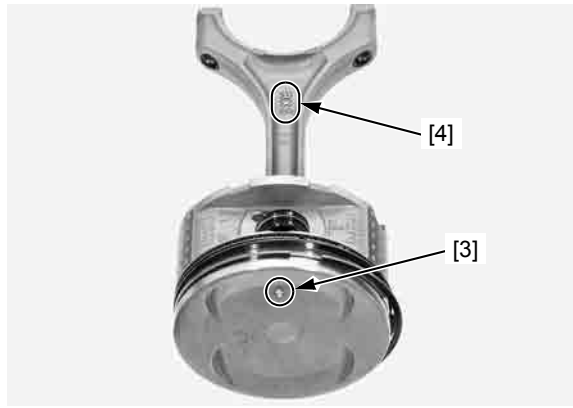
Apply molybdenum disulfide oil to the pin holes in the piston pin [1] outer surface, piston, and to the connecting rod [2] small end inner surface.

Install the piston pin so that the "△" mark [3] on the piston head points to the same direction as the model mark [4] on the connecting rod.

Install a new piston pin clip [5] to the opposite side.

- Wear eye protection as the piston pin clips can pop out.
- Make sure the piston pin clip does not align with the cutout in the piston pin bore.





Install the piston rings in the ring grooves of the piston [1] with the marks on the top ring [2] and the second ring [3] facing up.

NOTICE

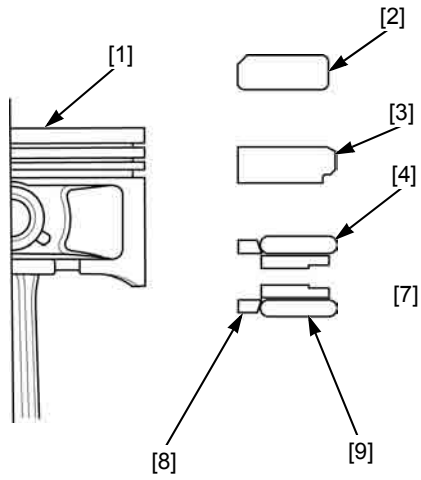
- *Clean the ring grooves thoroughly before installing the piston rings.*
- *Install the piston rings with care not to break the piston rings. Take care not to score or scratch the piston.*
- *Do not confuse the top ring and the second ring. The top ring is glossy while the second ring can be identified by its dark color.*

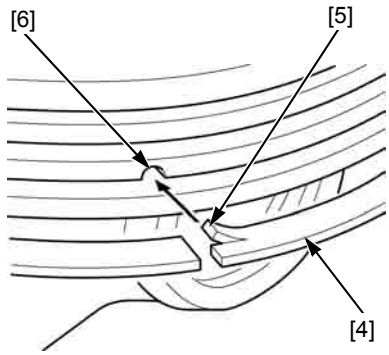
Install the side rail (top side) [4] by aligning the lug [5] of the side rail (top side) with the positioning groove [6] in the ring groove.

NOTICE

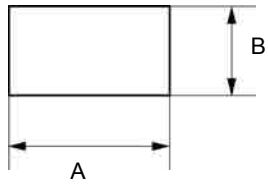
- *To install the oil rings [7], install the spacer [8] first, and then install the side rails (skirt side) [9].*
- *Be sure that the lug of the side rail (top side) sits in the positioning groove securely.*

After installing the piston rings, check for smooth movement of each ring. (except top side rail)





Dimensions of piston ring

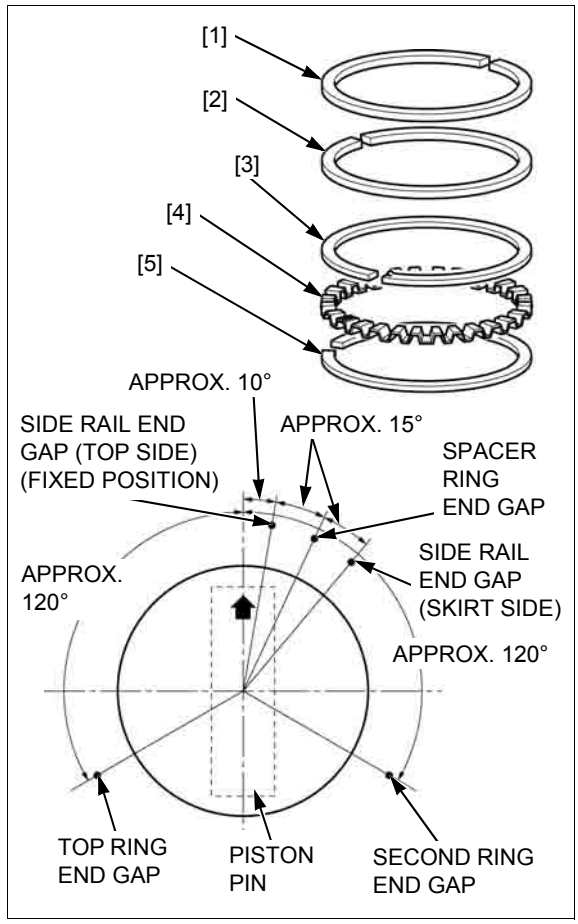


TOP RING
A: 3.1 mm (0.12 in)
B: 1.2 mm (0.05 in)
SECOND RING
A: 3.4 mm (0.13 in)
B: 1.2 mm (0.05 in)

Stagger the piston ring end gaps as shown (top ring [1], second ring [2], side rail (top side) [3], spacer [4], and side rail (skirt side) [5]).

NOTICE

- *Do not align with the piston pin, and avoid the direction that makes a right angle with the piston pin.*



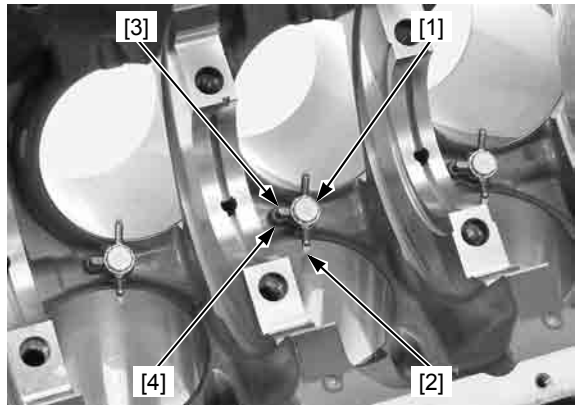
CRANKCASE COVER/CRANKSHAFT ASSEMBLY

Apply engine oil to the threads and seating surface of the oil jet bolt [1].

Install the three oil jet bodies [2] onto the cylinder block by aligning the tab [3] of the oil jet body with the hole [4] of the cylinder block.

Install and tighten the three oil jet bolts to the specified torque.

TORQUE: 16 N·m (1.6 kgf·m, 12 lbf·ft)



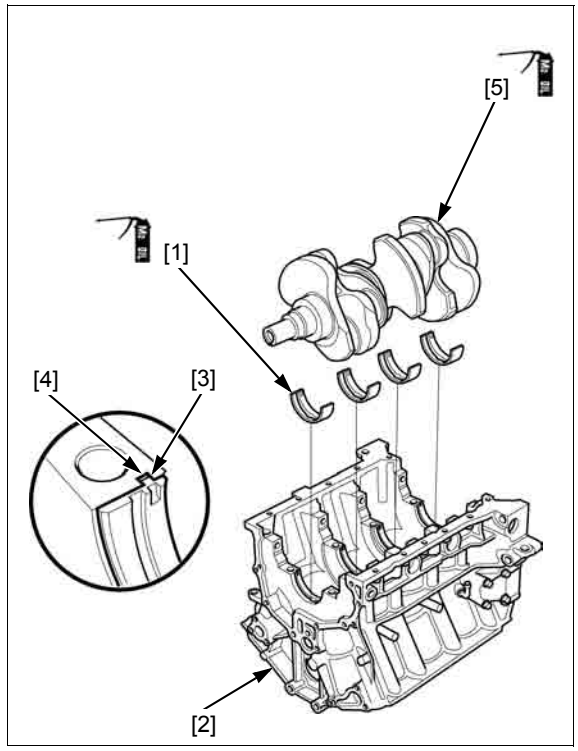
Clean the mating surfaces between the upper main bearing [1] and cylinder block [2] with a degreasing cleaning agent.

Apply molybdenum disulfide oil to the crankshaft mating surface of the upper main bearing.

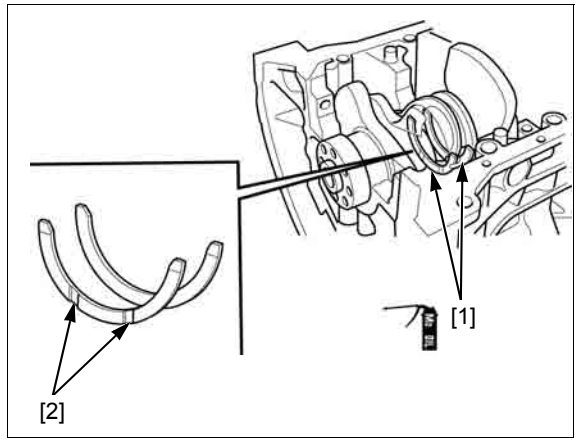
Install the four upper main bearings onto the cylinder block by aligning the tab [3] of the main bearing with the groove [4] of the cylinder block.

Apply molybdenum disulfide oil to the crankshaft [5] main bearing journal, crankpin, thrust washer contact surfaces.

Install the crankshaft [4] onto the main bearings.



Apply molybdenum disulfide oil and install the two thrust washers [1] in the No.3 journal so that the grooves [2] are facing out.



Clean the mating surfaces between the lower main bearing [1] and bearing cap [2] with a degreasing cleaning agent.

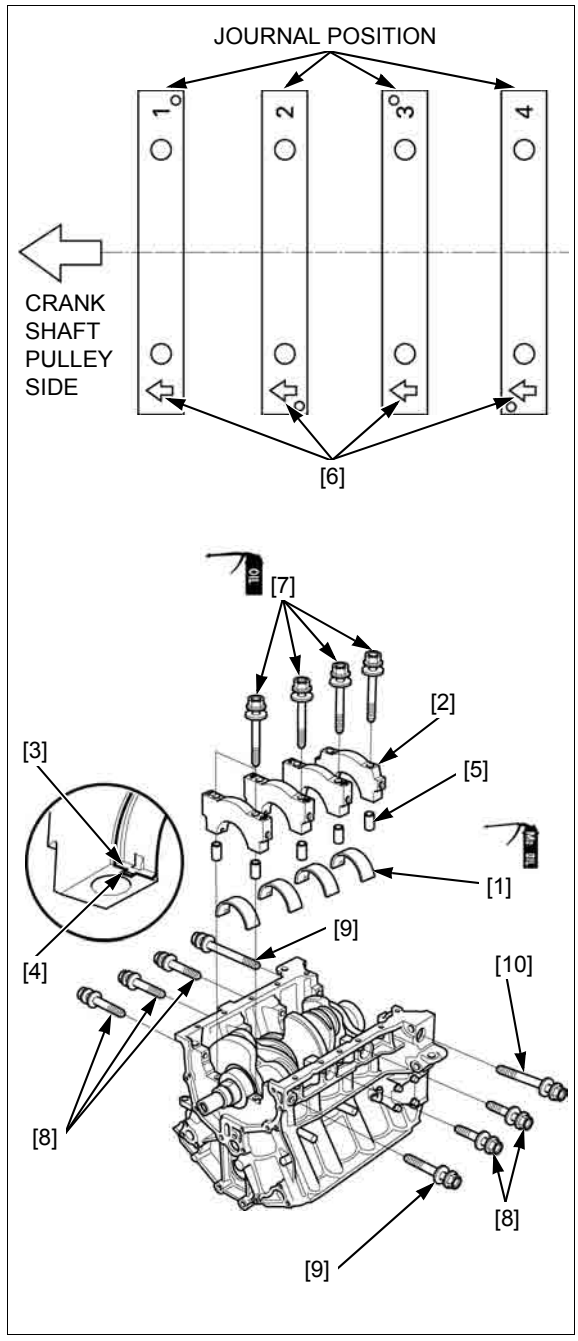
Apply molybdenum disulfide oil to the crankshaft mating surface of the lower main bearing.

Install the four lower main bearings onto the four bearing caps by aligning the tab [3] of the main bearing with groove [4] of the bearing caps.
Install the eight dowel pins [5] to the four bearing caps.

Install the bearing caps with the arrows [6] facing the crankshaft pulley side.

Apply engine oil to the eight bearing cap bolts (11 x 105 mm) [7] threads and seating surface, and then install them.

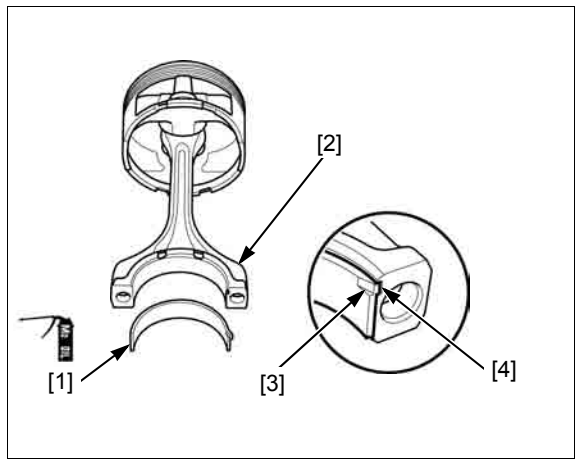
Install the five side bolts (10 x 60 mm) [8], two side bolts (10 x 80 mm) [9] and side bolt (10 x 109 mm) [10].



Clean the mating surfaces between the connecting rod bearing [1] and connecting rod [2] with a degreasing cleaning agent.

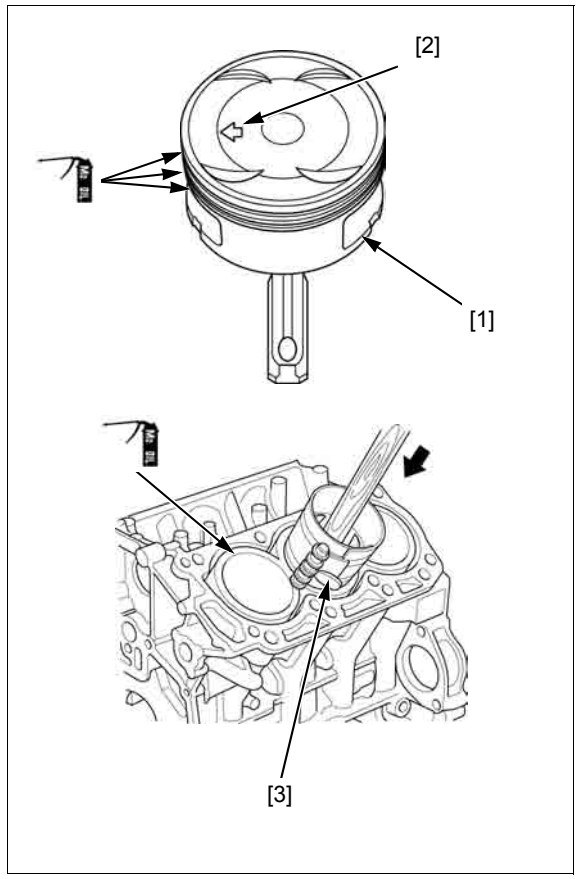
Apply molybdenum disulfide oil to the crankshaft mating surface of the connecting rod bearing.

Install the connecting rod bearing to the connecting rod by aligning the tab [3] of the connecting rod bearing with the groove [4] of the connecting rod.



Install the piston [1] with the arrow mark [2] facing the timing belt side of the engine. Using a piston ring compressor (RC40C: commercially available) [3], position the piston in the cylinder block, and tap it in using the wooden handle of a hammer.

- Apply the molybdenum disulfide oil to the piston rings, piston outer surface and cylinder sleeve inner surface.
- Insert the piston to BDC to install to the crankshaft.



Clean the mating surfaces between the connecting rod [1] and connecting rod bearing cap [2].

- Be careful not to damage the mating surface between the connecting rod and connecting rod bearing cap. Replace the connecting rod and connecting rod bearing cap as a set, if damaged.

Clean the mating surfaces between the connecting rod bearing [3] and connecting rod bearing cap with a degreasing cleaning agent.

Apply molybdenum disulfide oil to the crankshaft mating surface of the connecting rod bearing.

Install the connecting rod bearing to the connecting rod bearing cap by aligning the tab [4] of the main bearing with the groove [5] of the connecting rod.

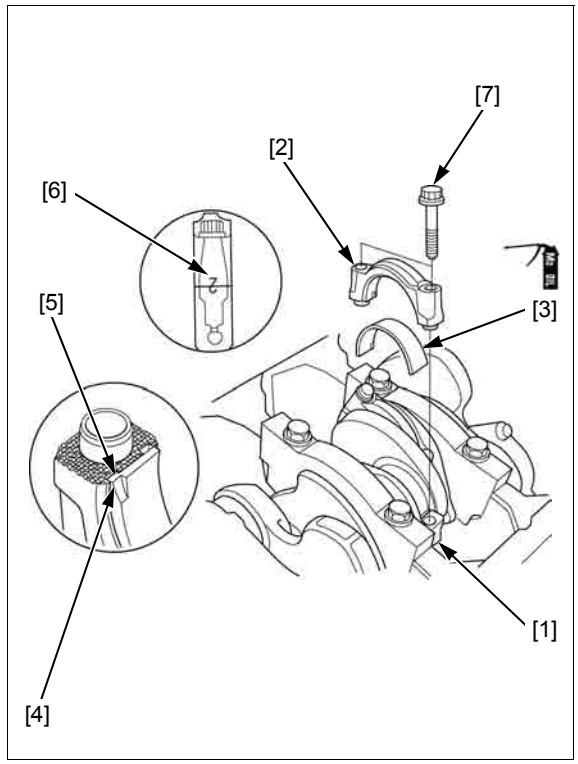
Line up the code number mark [6] on the connecting rod and cap, then install the cap.

Make sure that each connecting rod code number is matched as shown.

Tighten the two connecting rod bolts [7] to the specified torque, then tighten them to an additional 90°.

TORQUE: 20 N·m (2.0 kgf·m, 15 lbf·ft) + 90°

- Check that the piston is at the bottom dead center of its compression stroke before tightening the bolts. If not, turn the crankshaft to bring the piston to the bottom dead center of its compression stroke.
- Do not interchange the connecting rod bearing caps. Replace the connecting rod and connecting rod bearing cap as a set.



Tighten the eight bearing cap bolts [1] in the numbered sequence shown.

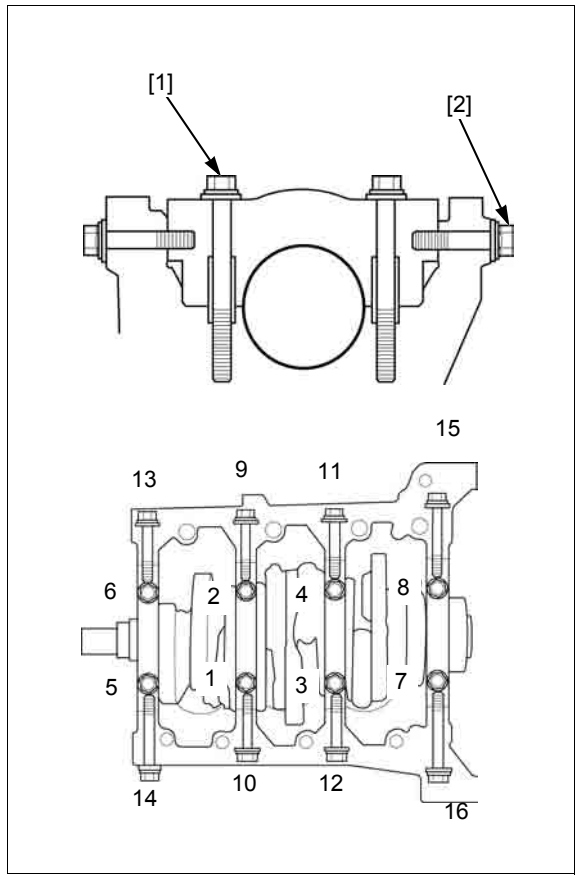
Tighten them to the specified torque, then tighten them to an additional 58°.

TORQUE: 29 N·m (3.0 kgf·m, 21 lbf·ft) + 58°

Tighten the five (10 x 60 mm), (10 x 109 mm), and two (10 x 80 mm) side bolts [2] in the numbered sequence shown.

Tighten them to the specified torque.

TORQUE: 49 N·m (5.0 kgf·m, 36 lbf·ft)

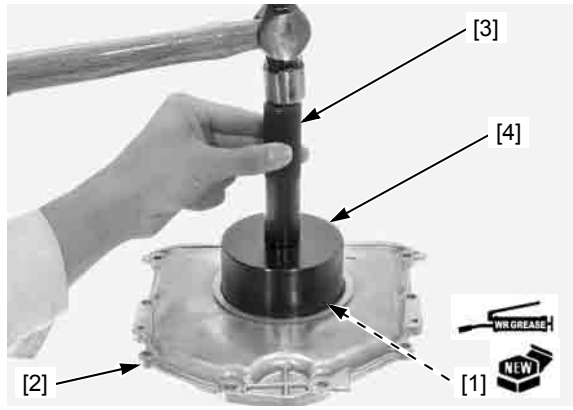


Apply marine grease to a new oil seal [1] lips.

Drive in the oil seal into the oil seal case [2] using the special tools.

TOOLS:

Driver [3]	**07749-0010000**
Oil seal driver attachment, 80 x 96 mm [4]	**07ZAD-PNA0100**

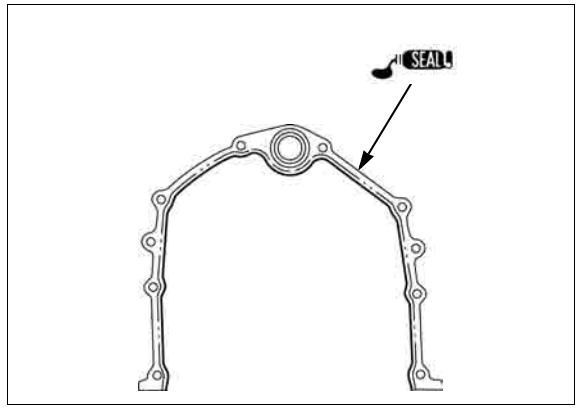


Wipe the oil off the mating surface of the cylinder block and oil seal case.

Before installing the oil seal case, apply a 1.5 -3.0 mm bead of liquid gasket (Threebond® #1280B or equivalent) to the shaded part as shown.

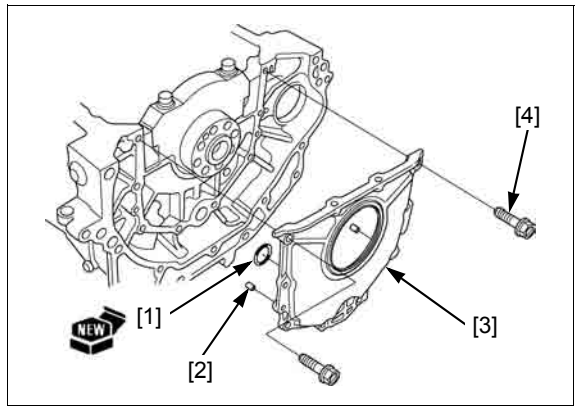
NOTICE

- *To prevent leaks, do not install the parts if 5 minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the old residue.*
- *After assembly, wait at least 30 minutes before filling the engine with oil.*
- *Do not apply liquid gasket to the O-ring groove.*



Install a new O-ring (26.2 x 2.4 mm) [1], two dowel pins [2] and oil seal case [3] to the cylinder block.

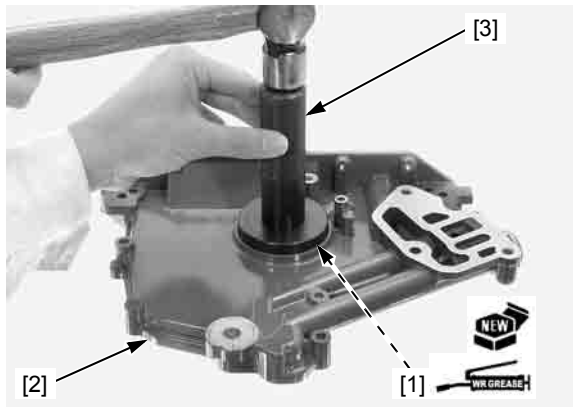
Tighten the eight bolts (6 x 22 mm) [4].



Apply marine grease to a new oil seal [1] lips.

Drive in the oil seal into the crankcase upper cover [2] using the special tool.

TOOL:
Oil seal driver, 66 mm [3] **07947-3710200**

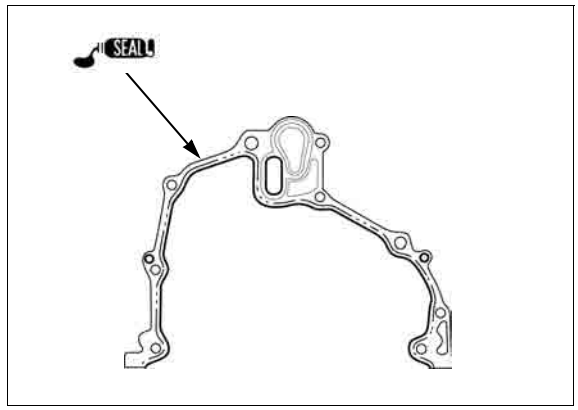


Wipe the oil off the mating surface of the cylinder block and the crankcase upper cover.

Before installing the crankcase upper cover, apply a 1.5 -3.0 mm bead of liquid gasket (Threebond® #1280B or equivalent) to the shaded part as shown.

NOTICE

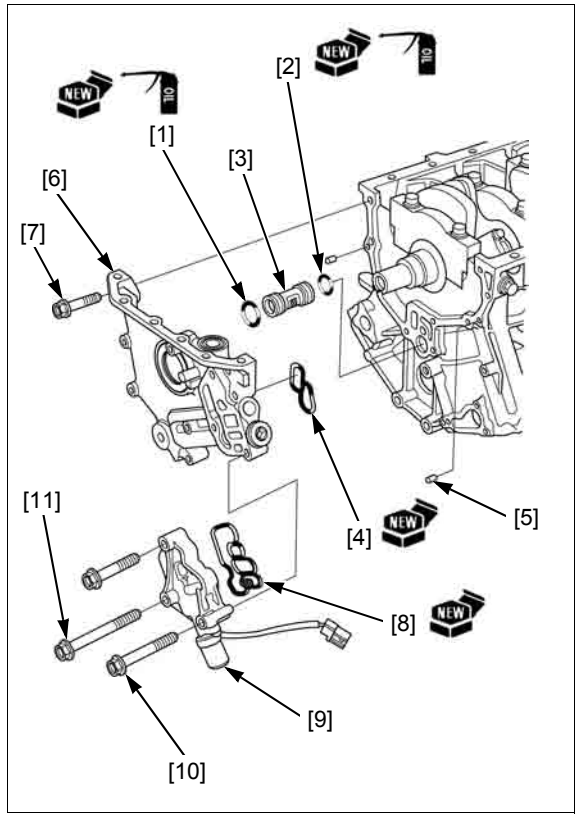
- *To prevent leaks, do not install the parts if 5 minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the old residue.*
- *After assembly, wait at least 30 minutes before filling the engine with oil.*
- *Do not apply liquid gasket to the O-ring groove.*



Coat new O-ring (18.3 x 3.5 mm) [1] and O-ring (16.3 x 3.5 mm) [2] with engine oil and install them to the oil pipe joint [3].
Install the oil pipe joint to the cylinder block.

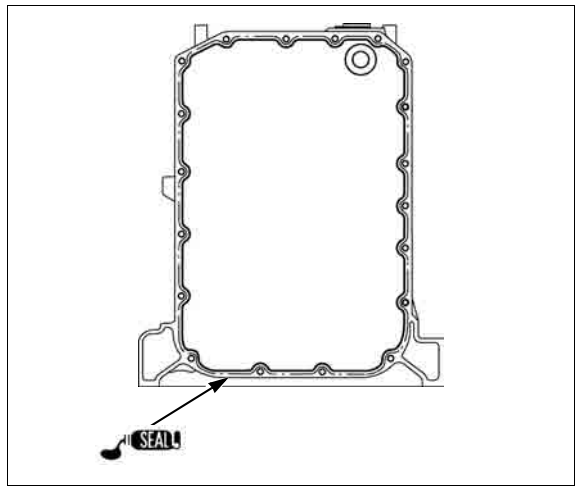
Install a new oil hole gasket [4], two dowel pins [5] and the crankcase upper cover [6] to the cylinder block with the seven bolts (6 x 35 mm) [7].

Install a new VTEC spool valve filter [8] and the VTEC spool valve [9] to the cylinder block with the two bolts (8 x 50 mm) [10] and bolt (8 x 75 mm) [11].



Wipe the oil off the mating surface of the cylinder block and the crankcase.

Before installing the crankcase cover, apply a 1.5 -3.0 mm bead of liquid gasket (Threebond® #1280B or equivalent) to the shaded part as shown.



NOTICE

- *To prevent leaks, do not install the parts if 5 minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the old residue.*
- *After assembly, wait at least 30 minutes before filling the engine with oil.*

Install a new O-ring (25 x 2.4 mm) [1], two dowel pins [2] and the crankcase [3] to the cylinder block [4].

Loosely tighten the fifteen bolts (6 x 32 mm) [5], two bolts (6 x 37 mm) [6], and two bolts (6 x 55 mm) [7] in the positions shown.

Tighten the bolts in the numbered sequence shown in two or three steps.

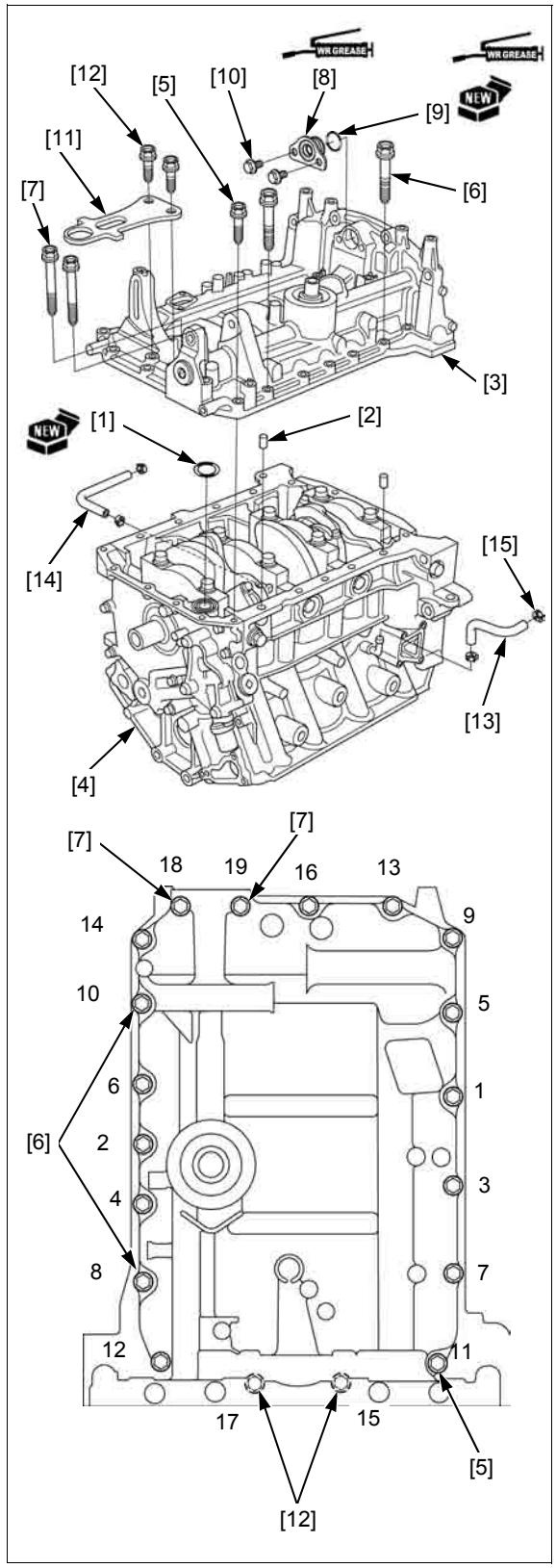
Apply marine grease to the seal holder [8] O-ring groove and bearing part.

Apply marine grease to a new O-ring (26.9 x 2.4 mm) [9], and install it to the seal holder.

Install the seal holder and tighten the two bolts (6 x 11 mm) [10].

Install the engine hanger plate [11] and tighten the two bolts (8 x 25 mm) [12].

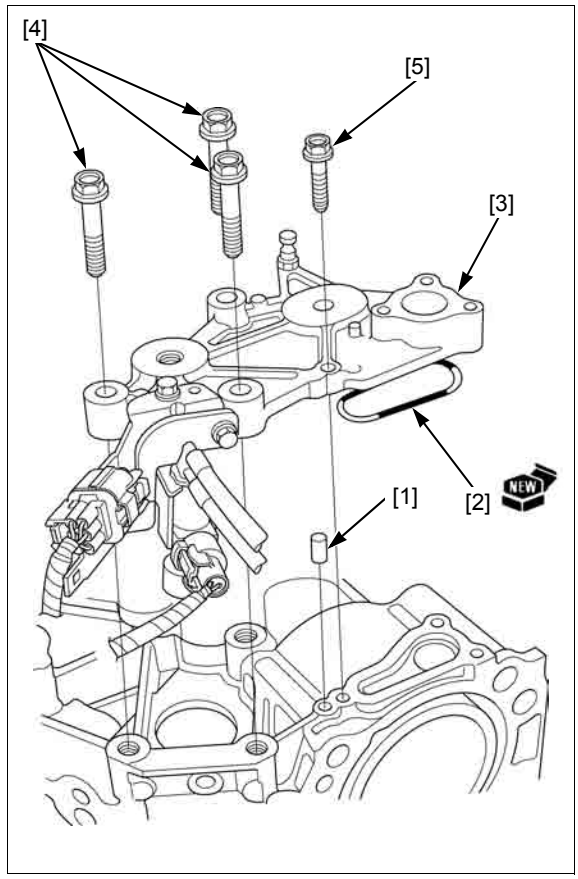
Install the L. water return tube [13], R. water return tube [14] and four tube clamps D10.5 [15].



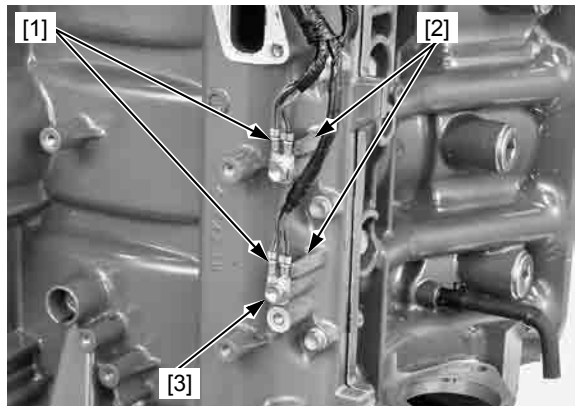
Install the dowel pin [1].
Align the dowel pin position, and install a new O-ring [2] and timing belt tensioner base [3].
Install and tighten the three timing belt tensioner base bolts (10 x 40 mm) [4] to the specified torque.

TORQUE: 45 N·m (4.6 kgf·m, 33 lbf·ft)

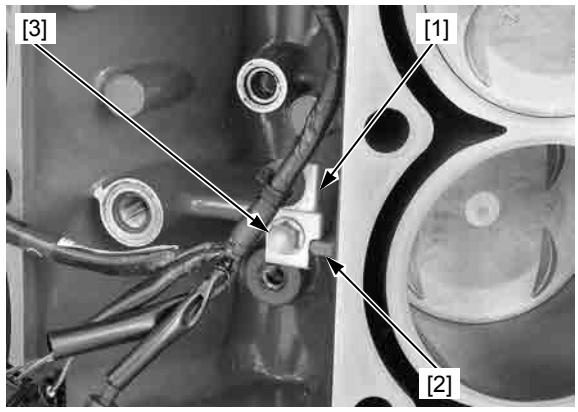
Install and tighten the bolt (6 x 22 mm) [5].



Position the two main wire harness ground terminals [1] against the stopper [2] of the crankcase, then install and tighten the two bolts (6 x 12 mm) [3].



Position the harness clamp [1] against the stopper [2] of the cylinder block, then install and tighten the bolt (6 x 14 mm) [3].

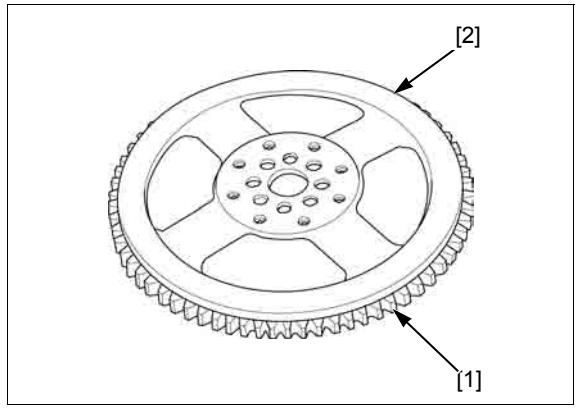


Install the following parts:

- Flywheel (page 15-6)
- EOP switch (High pressure side) (page 5-103)
- EOP switch (Low pressure side) (page 5-104)
- EBT sensor (page 5-105)
- Knock sensor (page 5-104)
- Oil filler extension (page 12-5)
- Oil level gauge cover (page 12-5)
- Neutral switch (page 9-6)
- Shift link bracket (page 20-8)
- Shift arm (page 20-10)
- Alternator (page 7-5)
- Power tilt relay case (page 10-6)
- ECM bracket (page 10-5)
- Thermostat (page 11-5)
- Oil filter (page 3-6)
- Cylinder head (page 14-24)
- Engine assembly (page 13-6)

FLYWHEEL INSPECTION

Check the ring gear [1] of the flywheel [2] for wear and damage. If the ring gear is worn or damaged, check the starter motor pinion gear as well (page 9-16).

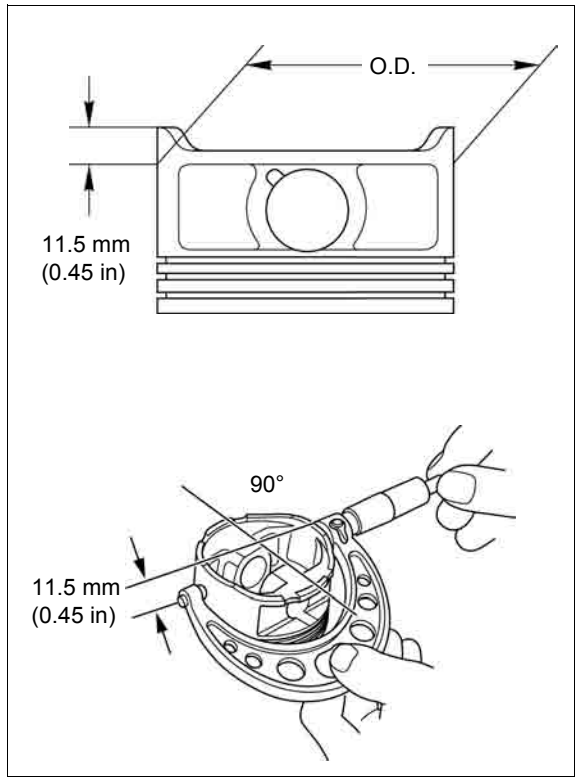


CRANKSHAFT/PISTON/CYLINDER BLOCK INSPECTION

PISTON SKIRT O.D.

Measure and record the piston O.D. at a point 11.5 mm (0.45 in) from the bottom, and 90° to the piston pin bore.

STANDARD:
88.974 – 88.984 mm (3.5029 – 3.5033 in)
SERVICE LIMIT:
88.964 mm (3.5025 in)



CYLINDER SLEEVE I.D.

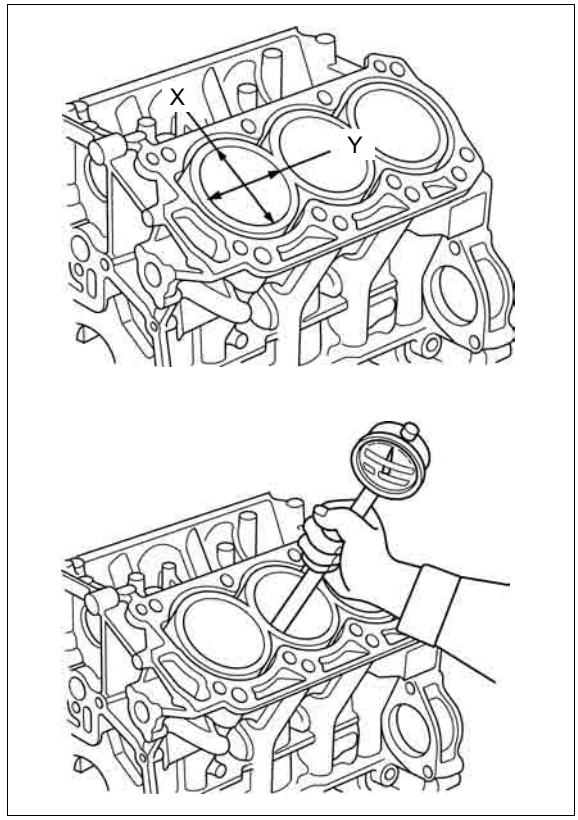
Measure and record the cylinder I.D. at three levels in both X and Y axis. Take the maximum reading to determine the cylinder wear.

STANDARD:
89.000 – 89.015 mm (3.5039 – 3.5045 in)
SERVICE LIMIT:
89.065 mm (3.5065 in)

DIFFERENCE BETWEEN UPPER AND LOWER PARTS OF SLEEVE I.D.

Measure and record the cylinder I.D. at three levels in both X and Y axis. Take the difference between upper and lower parts of sleeve I.D.

SERVICE LIMIT:
0.05 mm (0.002 in)



PISTON-TO-CYLINDER CLEARANCE

Subtract each piston skirt O.D. from the corresponding cylinder sleeve I.D.

STANDARD:
0.016 – 0.041 mm (0.0006 – 0.0016 in)
SERVICE LIMIT:
0.080 mm (0.0032 in)

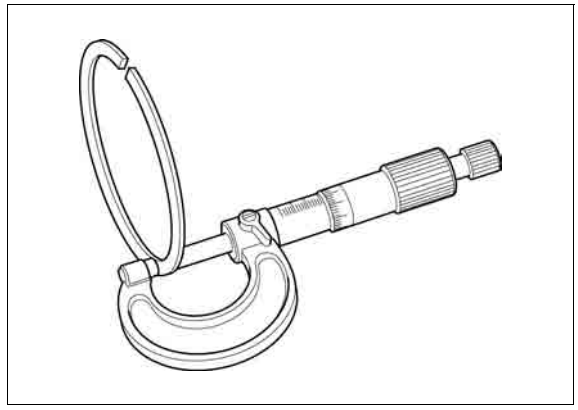
PISTON RING THICKNESS

Check the piston ring and oil ring for damage.
Always replace the oil ring spacer and side rails as a set.

Measure the piston ring thickness.

STANDARD:

TOP	**1.170 – 1.185 mm (0.0461 – 0.0467 in)**
SECOND	**1.175 – 1.190 mm (0.0463 – 0.0469 in)**



PISTON RING GROOVE WIDTH

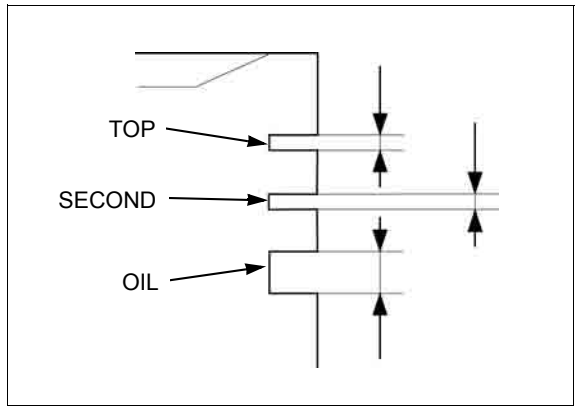
Measure the piston ring groove width.

STANDARD:

TOP/SECOND	**1.220 – 1.230 mm (0.0480 – 0.0484 in)**
OIL	**2.805 – 2.825 mm (0.1104 – 0.1112 in)**

SERVICE LIMIT:

TOP/SECOND	**1.25 mm (0.049 in)**
OIL	**2.85 mm (0.112 in)**



PISTON RING SIDE CLEARANCE

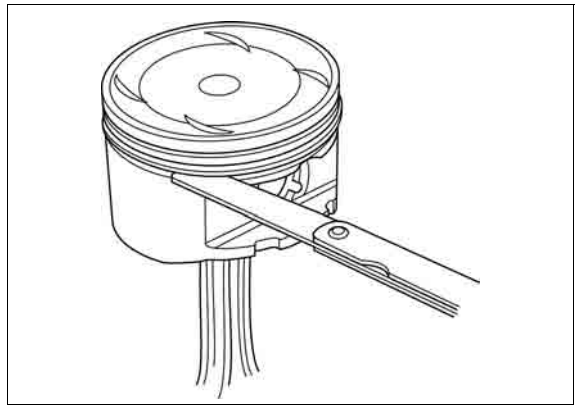
Measure the piston ring side clearance.

STANDARD:

TOP	**0.035 – 0.060 mm (0.0014 – 0.0024 in)**
SECOND	**0.030 – 0.055 mm (0.0012 – 0.0022 in)**

SERVICE LIMIT:

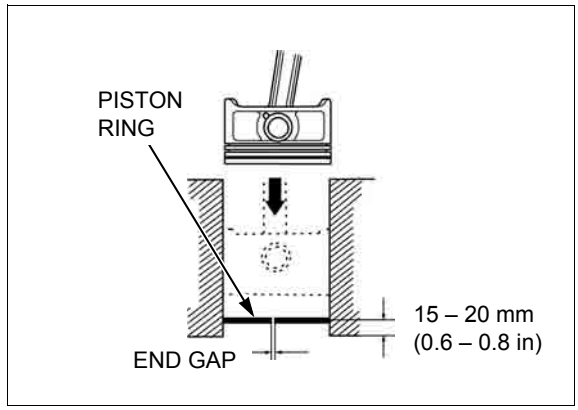
TOP/SECOND	**0.13 mm (0.005 in)**



PISTON RING END GAP

Measure the piston ring end gap 15 – 20 mm (0.6 – 0.8 in) from the cylinder bottom.

Before measurement, be sure to set the ring in the cylinder squarely using the piston.



STANDARD:

TOP	**0.20 – 0.35 mm (0.008 – 0.014 in)**
SECOND	**0.40 – 0.55 mm (0.016 – 0.022 in)**
OIL	**0.20 – 0.70 mm (0.008 – 0.028 in)**

SERVICE LIMIT:

TOP	**0.6 mm (0.02 in)**
SECOND	**0.7 mm (0.03 in)**
OIL	**0.8 mm (0.03 in)**

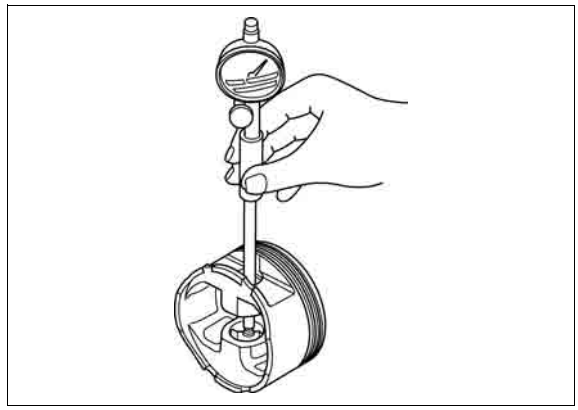
If the measurement is too large, install a new piston ring and measure again. Then, measure the cylinder sleeve I.D. (page 15-27).

PISTON PIN BORE I.D.

Check the piston pin for damage.

Measure the piston pin bore I.D.

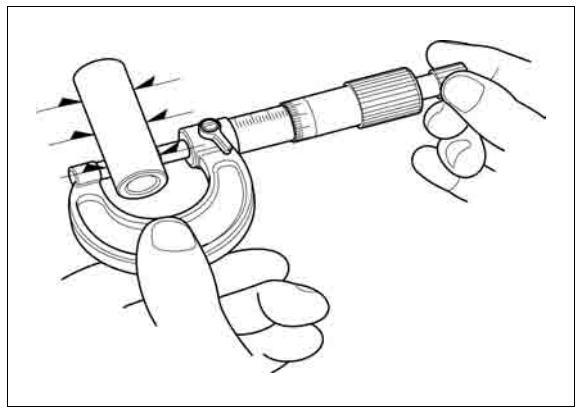
STANDARD:
21.960 – 21.963 mm (0.8646 – 0.8647 in)



PISTON PIN O.D.

Measure the piston pin O.D.

STANDARD:
21.961 – 21.965 mm (0.8646 – 0.8648 in)
SERVICE LIMIT:
21.954 mm (0.8643 in)

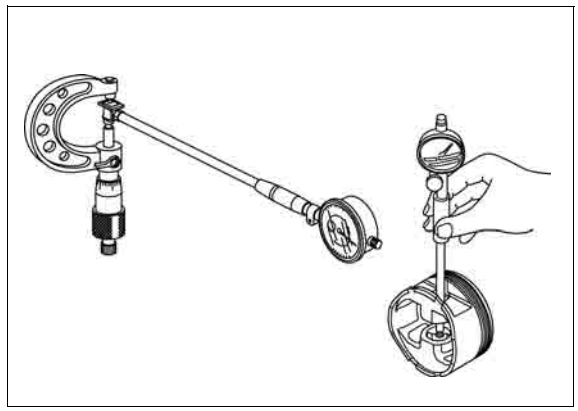


PISTON PIN-TO-PIN BORE CLEARANCE

Set the cylinder gauge at the piston pin O.D., and set the gauge needle at zero "0".

Set the cylinder gauge in the piston pin hole, and measure the piston pin-to-pin bore clearance.

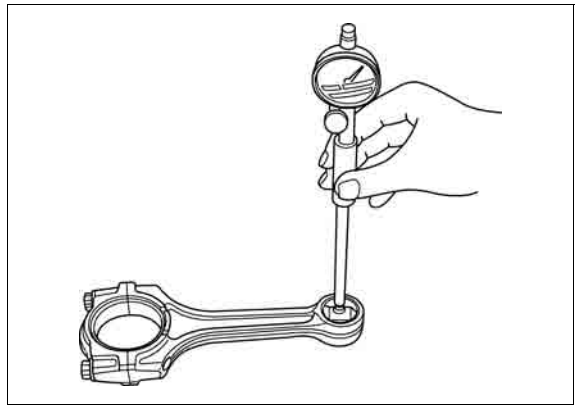
STANDARD:
–0.005 – +0.002 mm (–0.0002 – +0.0001 in)
SERVICE LIMIT:
0.004 mm (0.0002 in)



CONNECTING ROD SMALL END I.D.

Measure the connecting rod small end I.D.

STANDARD:
21.970 – 21.976 mm (0.8650 – 0.8652 in)



CONNECTING ROD SMALL END-TO-PISTON PIN CLEARANCE

Subtract each piston pin O.D. from the corresponding connecting rod small end I.D.

STANDARD:
0.005 – 0.015 mm (0.0002 – 0.0006 in)
SERVICE LIMIT:
0.019 mm (0.0007 in)

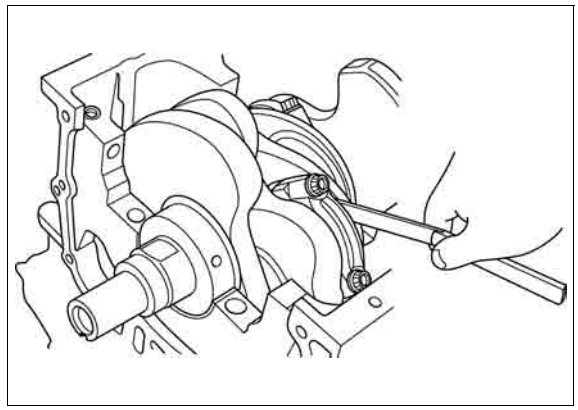
CONNECTING ROD BIG END AXIAL CLEARANCE

Measure the connecting rod big end axial clearance.

STANDARD:
0.15 – 0.35 mm (0.006 – 0.014 in)
SERVICE LIMIT:
0.45 mm (0.018 in)

If the clearance exceeds the service limit, replace the connecting rod and connecting rod cap with new ones as a set, and recheck.

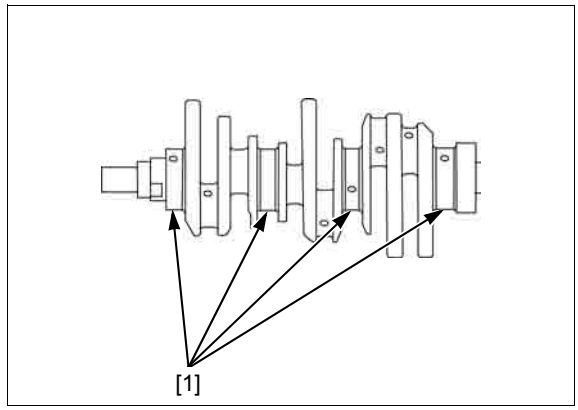
If the measurement still exceeds the service limit, replace the crankshaft with a new one.



CRANKSHAFT MAIN JOURNAL O.D.

Measure the crankshaft main journal [1] O.D.

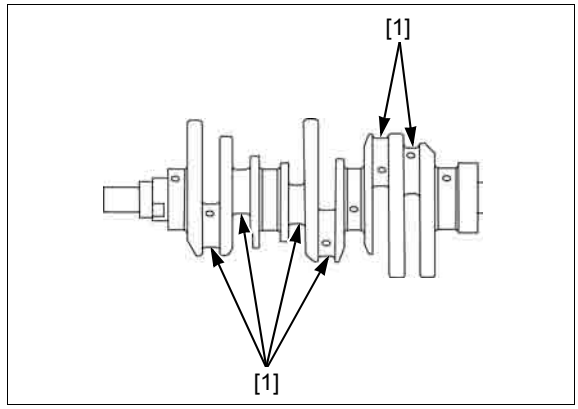
STANDARD:
71.976 – 72.000 mm (2.8337 – 2.8346 in)



CRANKPIN O.D.

Measure the crankpin [1] O.D.

STANDARD:
55.976 – 57.000 mm (2.2038 – 2.2441 in)



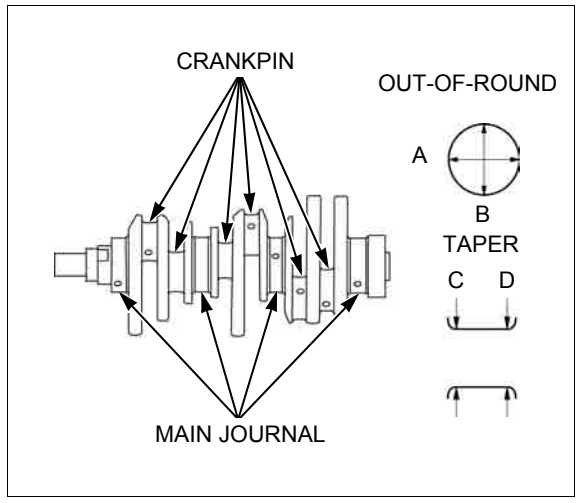
CRANKSHAFT JOURNAL ROUNDNESS (MAIN/CRANKPIN JOURNALS)

Measure out-of-round at the middle of each crankpin and main journal in two places. The difference between measurements on each journal must not be more than the service limit.

STANDARD:
0.005 mm (0.0002 in) Max.
SERVICE LIMIT:
0.010 mm (0.0004 in)

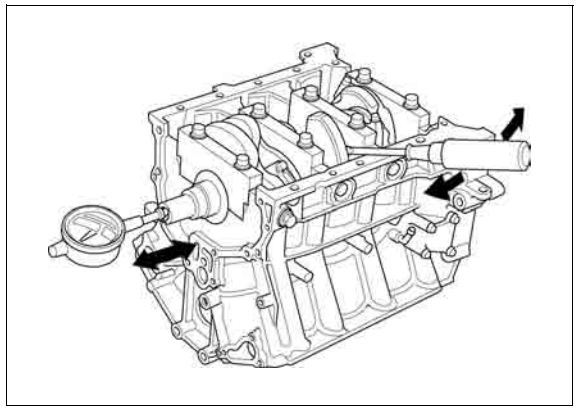
Measure taper at the edges of each crankpin and main journal. The difference between measurements on each journal must not be more than the service limit.

STANDARD:
0.005 mm (0.0002 in) Max.
SERVICE LIMIT:
0.010 mm (0.0004 in)



CRANKSHAFT AXIAL CLEARANCE

Measure the crankshaft axial clearance.



STANDARD:
0.10 – 0.35 mm (0.004 – 0.014 in)
SERVICE LIMIT:
0.45 mm (0.018 in)

If the measurement exceeds the service limit, check the thrust washers and the thrust surface of the crankshaft. Replace the thrust washers with new ones, and recheck.

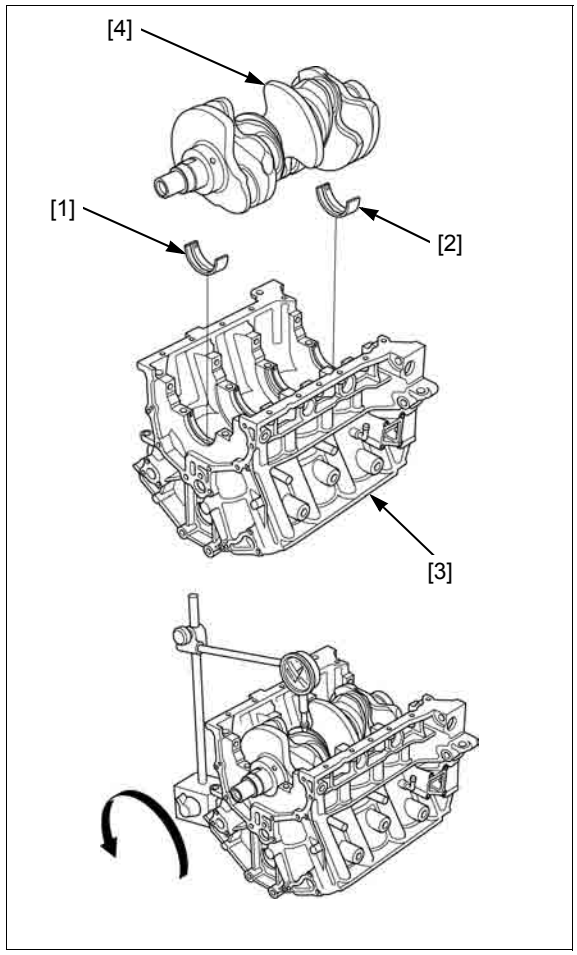
If the measurement still exceeds the service limit, replace the crankshaft.

CRANKSHAFT RUNOUT

Install the No.1 main bearing [1] and No.4 main bearing [2] to the cylinder block [3].

Install the crankshaft to the cylinder block [4].

Measure the crankshaft runout.



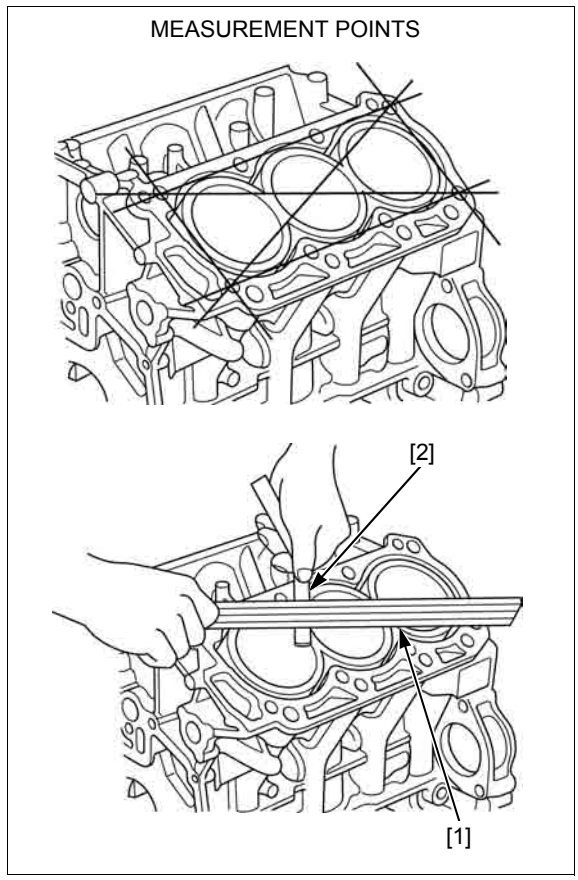
STANDARD:
0.025 mm (0.0010 in) Max.
SERVICE LIMIT:
0.030 mm (0.0012 in)

CYLINDER HEAD SURFACE WARPAGE

Take care not to damage (scores, scratches, etc.) the mating surface with the gasket.

Measure the surface warpage using a straight edge [1] and a feeler gauge [2] as shown.

STANDARD:
0.07 mm (0.003 in) Max.
SERVICE LIMIT:
0.10 mm (0.004 in)



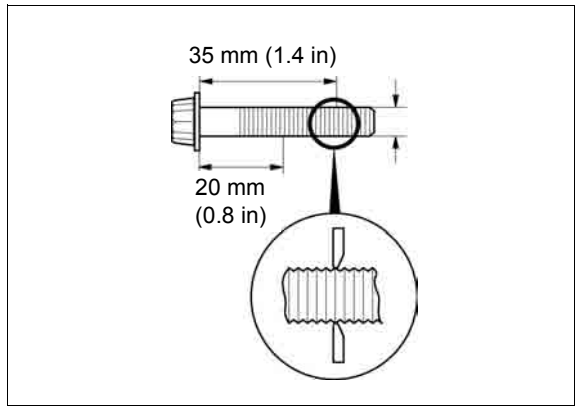
CONNECTING ROD BOLT

Measure the bolt O.D. at the two points as shown and calculate the difference between the measurements.

STANDARD:
0 – 0.10 mm (0 – 0.004 in)

If the difference exceeds the standard value, replace the connecting rod bolt.

Measure the O.D. of all connecting rod bolts.



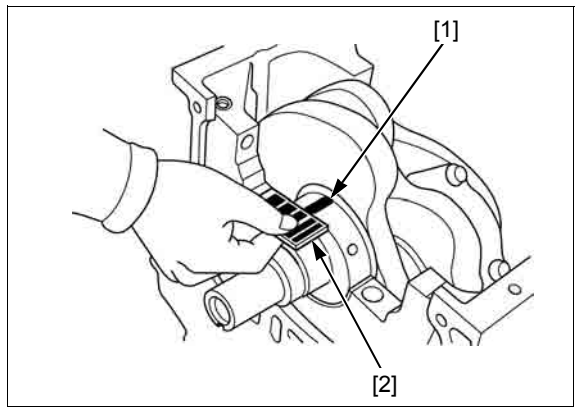
CRANKSHAFT MAIN BEARING OIL CLEARANCE

To check main bearing-to-journal oil clearance, remove the bearing caps, crankshaft, and main bearings (page 15-7).

Clean each main journal and main bearings with a clean shop towel.
Check each main journal, thrust washer contact surface, main bearing for scoring, scratches or damage.
Install the main bearings, crankshaft, and bearing caps, and tighten the cap bolts to the specified torque (page 15-17).

Remove the bearing caps and place one strip of plastigauge [1] across each main journal.

- Set the plastigauge in the axial direction.
- Avoid the oil passage in the bearing journal to set the plastigauge.



Reinstall the bearings and caps.

Tighten the bolts to the specified torque (page 15-17).

- Do not turn the crankshaft during this check.

Remove the bearing caps and measure the pressured width of the plastigauge using the scale [2] printed on the plastigauge's bag.

STANDARD:
0.020 – 0.046 mm (0.0008 – 0.0018 in)
SERVICE LIMIT:
0.05 mm (0.002 in)

- Take the widest width on the plastigauge.

If the measurement exceeds the service limit, replace the bearings by referring to crankshaft main bearing selection table (page 15-36) and measure the oil clearance again.
If the measurement still exceeds the service limit, replace the crankshaft with a new one and recheck.

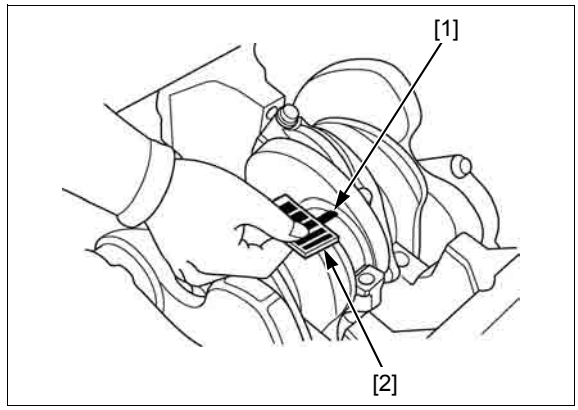
CONNECTING ROD BEARING OIL CLEARANCE

To check connecting rod bearing-to-crankpin oil clearance, remove the connecting rod bearing caps, crankshaft, and connecting rod bearings (page 15-7).

Clean each crankpin, connecting rod bearing cap, and connecting rod bearing with a clean shop towel.
Check each crankpin and connecting rod bearing for scoring, scratches or damage.
Install the connecting rod bearings, crankshaft, and connecting rod bearing caps.
Tighten the cap bolts to the specified torque (page 15-17).

Remove the bearing caps and place one strip of plastigauge [1] across each crankpin.

- Set the plastigauge in the axial direction.
- Avoid the oil passage in the crankpin when setting the plastigauge.



Reinstall the bearings and caps.

Tighten the bolts to the specified torque (page 15-17).

- Tighten the connecting rod bolt with care not to turn the crankshaft and/or the connecting rod.

Remove the bearing caps and measure the pressured width of the plastigauge using the scale [2] printed on the plastigauge's bag.

STANDARD:
0.020 – 0.044 mm (0.0008 – 0.0017 in)
SERVICE LIMIT:
0.05 mm (0.002 in)

- Take the widest width on the plastigauge.

If the measurement exceeds the service limit, replace the bearings by referring to connecting rod bearing selection table (page 15-38) and measure the oil clearance again.
If the measurement still exceeds the service limit, replace the crankshaft with a new one and recheck.

BEARING SELECTION

CRANKSHAFT MAIN BEARING

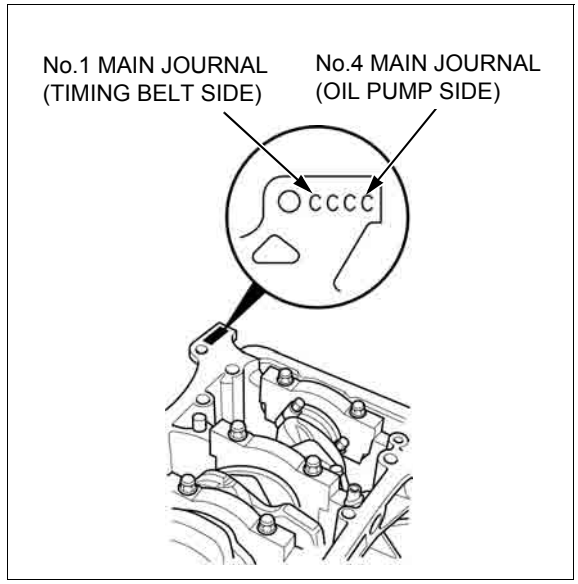
- When replacing the main bearing, check the crankshaft main journal code number and the cylinder block I.D. code letter or number, and select the correct bearing by referring to the bearing selection table.
- If the code letter and/or number is not clear, clean the area with a cleaning solvent and check again. Do not scrub with a stiff wire brush or scraper to clean.

Check the cylinder block I.D. code letters or numbers and record them.

The cylinder block I.D. code letters or numbers are for the No.1 and the subsequent number journals when viewed from the left side code.

Cylinder block I.D.: 77.00 mm (3.031 in)

Code number	Tolerance ranges
A or I	±0.000 – +0.006 mm (±0.0000 – +0.0002 in)
B or II	+0.006 – +0.012 mm (+0.0002 – +0.0005 in)
C or III	+0.012 – +0.018 mm (+0.0005 – +0.0007 in)
D or IIII	+0.018 – +0.024 mm (+0.0007 – +0.0009 in)

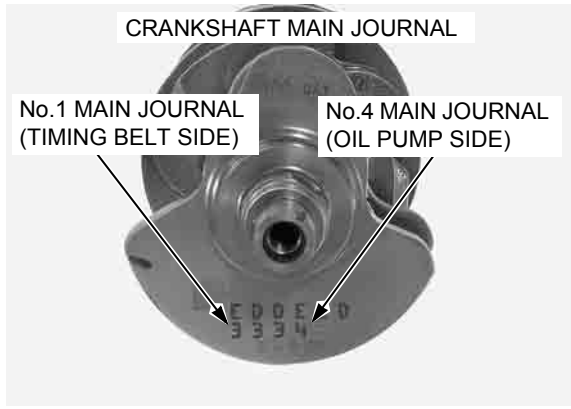


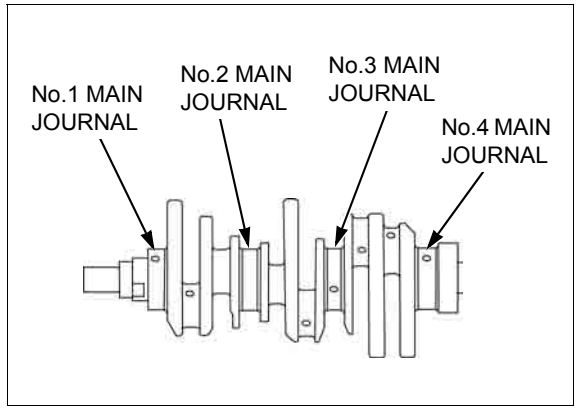
Check the crankshaft main journal code numbers and record them.

The crankshaft main journal code numbers are for the No.1 and subsequent number journals when viewed from the timing belt arrow-mark side.

Crankshaft main journal: 72.00 mm (2.835 in)

Code number	Tolerance ranges
6 or IIIIII	-0.024 – -0.020 mm (-0.0009 – -0.0008 in)
5 or IIIII	-0.020 – -0.016 mm (-0.0008 – -0.0006 in)
4 or IIII	-0.016 – -0.012 mm (-0.0006 – -0.0005 in)
3 or III	-0.012 – -0.008 mm (-0.0005 – -0.0003 in)
2 or II	-0.008 – -0.004 mm (-0.0003 – -0.0002 in)
1 or I	-0.004 – ±0.000 mm (-0.0002 – ±0.0000 in)





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 number or letter			
	A or I	B or II	C or III	D or IIII
	Bearing I.D. color			
1 or I	Pink	Pink/ Yellow	Yellow	Yellow/ Green
2 or II	Pink/ Yellow	Yellow	Yellow/ Green	Green
3 or III	Yellow	Yellow/ Green	Green	Green/ Brown
4 or IIII	Yellow/ Green	Green	Green/ Brown	Brown
5 or IIIII	Green	Green/ Brown	Brown	Brown/ Black
6 or IIIIII	Green/ Brown	Brown	Brown/ Black	Black

Main bearing identification table
Main bearing center thickness: 2.5 mm (0.10 in)

Number	I.D. color	Tolerance ranges
F	Red	–0.009 – –0.005 mm (–0.0004 – –0.0002 in)
E	Pink	–0.005 – –0.001 mm (–0.0002 – –0.0001 in)
D	Yellow	–0.001 – +0.003 mm (–0.0001 – +0.0001 in)
C	Green	+0.003 – +0.007 mm (+0.0001 – +0.0003 in)
B	Brown	+0.007 – +0.011 mm (+0.0003 – +0.0004 in)
A	Black	+0.011 – +0.015 mm (+0.0004 – +0.0006 in)

When using bearing halves of different colors, it does not matter which color is used in the top or bottom. Each rod falls into one of six tolerance ranges (from -0.009 mm (-0.0004 in) to 0.015 mm (0.0006 in)), in 0.004 mm (0.0002 in).

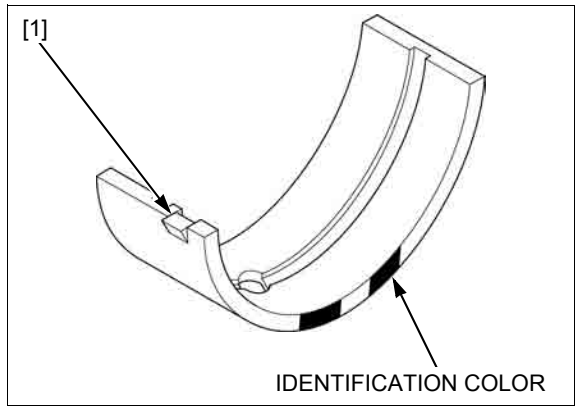
Note that the bearings are selected so that the oil clearance is in the range between 0.020 – 0.046 mm (0.0008 – 0.0018 in.)

After installing the selected bearing(s), measure the oil clearance (page 15-34).

Apply molybdenum disulfide oil to the crankshaft mating surface. Do not apply to the cylinder block and crankcase mating surfaces.

Align the bearing tab [1] with the grooves in the crankcase and cylinder block, and assemble carefully not to damage the sliding surface.

- Be sure to measure the main bearing oil clearance after selecting the bearing by referring to the selection table.
- If the two bearing I.D. colors are shown on the selection table, use a bearing of the respective colors.



CONNECTING ROD BEARING

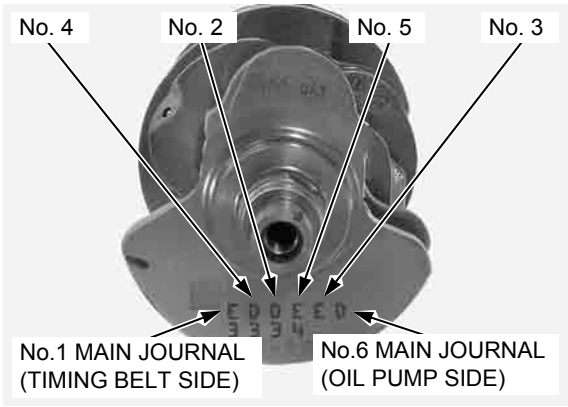
- When replacing the connecting rod bearing, check the crankpin code letter and the connecting rod code number, and select the correct bearing by referring to the bearing selection table.
- If the code letters and/or numbers are not clear, clean the areas with a cleaning solvent and check again. Do not scrub with a stiff wire brush or scraper to clean.

Check the crankpin code letters and record them.

The crankpin code letters are for the No.1 and the subsequent number journals when viewed from left side.

Crankpin: 57.00 mm (2.244 in)

Code number	Tolerance ranges
F or IIIIII	–0.024 – –0.020 mm (–0.0009 – –0.0008 in)
E or IIIII	–0.020 – –0.016 mm (–0.0008 – –0.0006 in)
D or IIII	–0.016 – –0.012 mm (–0.0006 – –0.0005 in)
C or III	–0.012 – –0.008 mm (–0.0005 – –0.0003 in)
B or II	–0.008 – –0.004 mm (–0.0003 – –0.0002 in)
A or I	–0.004 – ±0.000 mm (–0.0002 – ±0.0000 in)

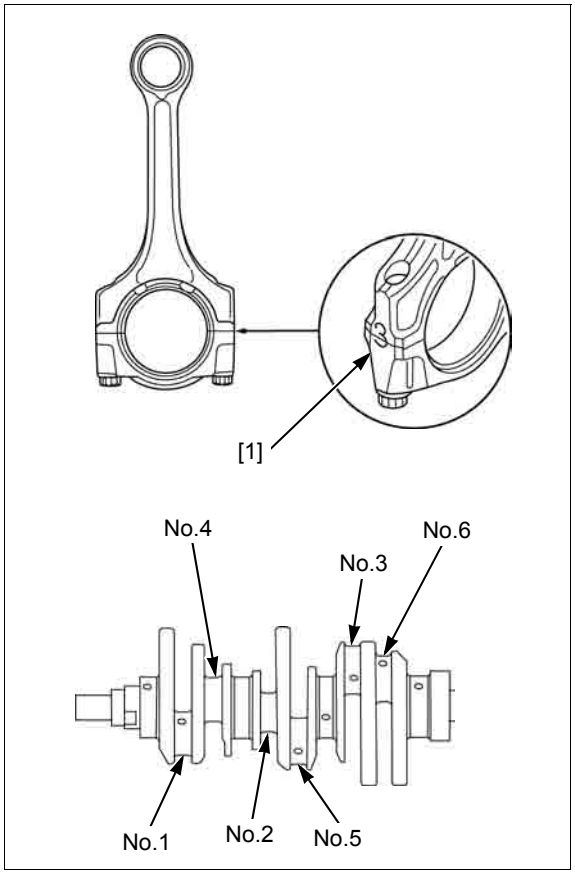


Check the connecting rod code numbers [1] and record them.

The connecting rod code numbers are for the No.1 and the subsequent number journals when viewed from the timing belt driven pulley side.

Connecting rod: 60.00 mm (2.362 in)

Code number	Tolerance ranges
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)



Select the correct bearing by referring to the crankpin code letter and the connecting rod code number.

Connecting rod bearing selection table

Crankpin code letter	Connecting rod code number			
	1 or I	2 or II	3 or III	4 or IIII
	Bearing I.D. color			
A or I	Pink	Pink/ Yellow	Yellow	Yellow/ Green
B or II	Pink/ Yellow	Yellow	Yellow/ Green	Green
C or III	Yellow	Yellow/ Green	Green	Green/ Brown
D or IIII	Yellow/ Green	Green	Green/ Brown	Brown
E or IIIII	Green	Green/ Brown	Brown	Brown/ Black
F or IIIIII	Green/ Brown	Brown	Brown/ Black	Black

Connecting rod bearing identification table
Connecting rod bearing center thickness: 1.5 mm (0.06 in)

Number	I.D. color	Tolerance ranges
E	Pink	–0.005 – –0.001 mm (–0.0002 – –0.00004 in)
D	Yellow	–0.001 – +0.003 mm (–0.00004 – +0.0001 in)
C	Green	+0.003 – +0.007 mm (+0.0001 – +0.0003 in)
B	Brown	+0.007 – +0.011 mm (+0.0003 – +0.0004 in)
A	Black	+0.011 – +0.015 mm (+0.0004 – +0.0006 in)

When using bearing halves of different colors, use one of each color. It does not matter which color is used in the top or bottom.

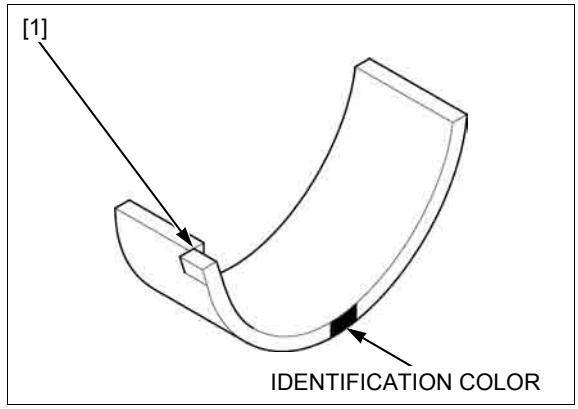
Note that the bearings are selected so that the oil clearance is in the range between 0.020 – 0.044 mm (0.0008 – 0.0017 in).

Be sure to measure the oil clearance after installing the selected bearing(s) (page 15-35).

Apply molybdenum disulfide oil to the crankshaft mating surface. Do not apply to the connecting rod and connecting rod cap mating surfaces.

Align the bearing tab [1] with the grooves in the connecting rod and cap, and install with care not to damage the sliding surface.

- Be sure to measure the connecting rod bearing oil clearance after selecting the bearing by referring to the selection table.
- If the two bearing I.D. colors are shown on the selection table, use a bearing of the respective colors.



MEMO

16. GEAR CASE (STANDARD ROTATION)

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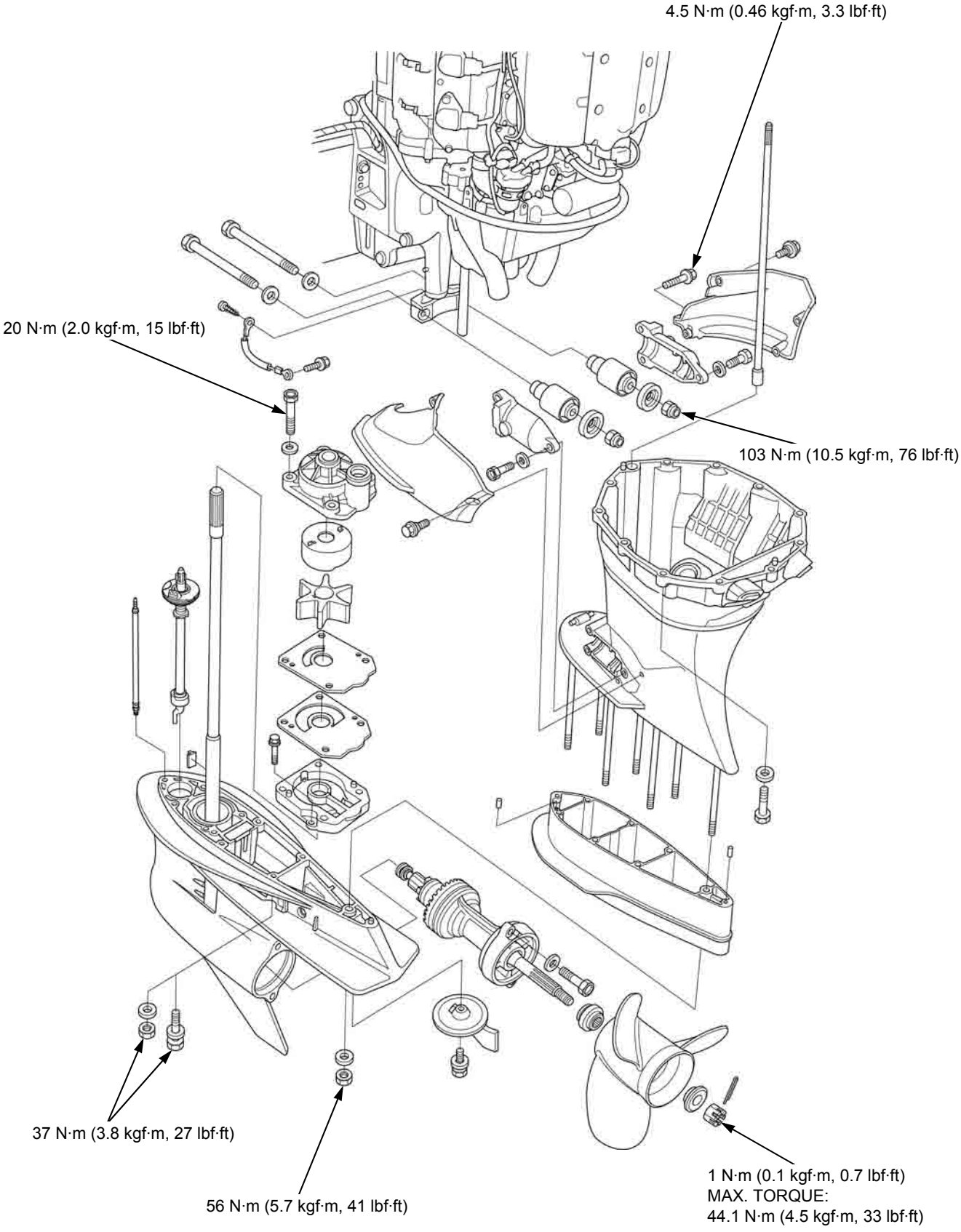
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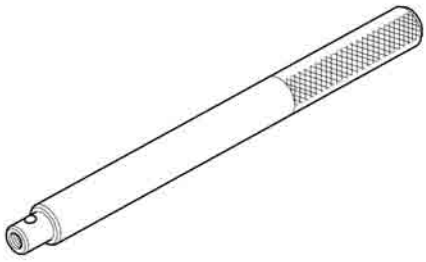
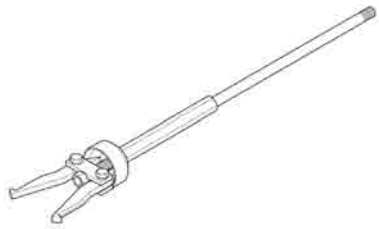
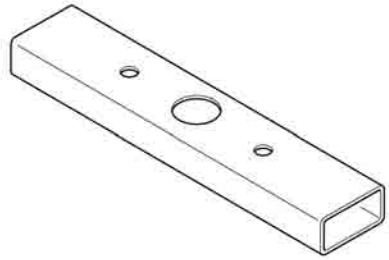
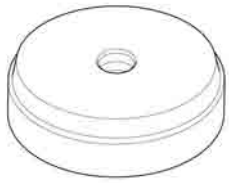
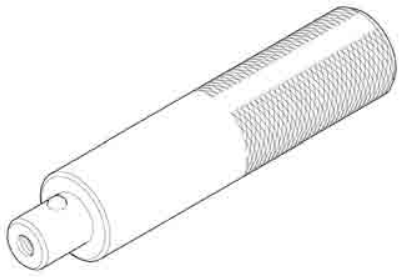
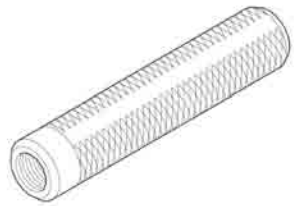
GEAR CASE NEEDLE BEARING REPLACEMENT ····· 16-49

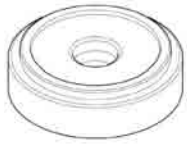
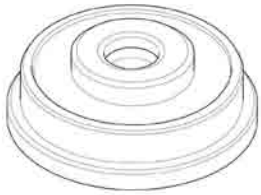
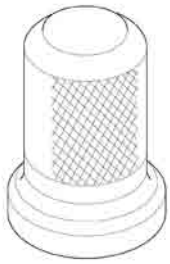
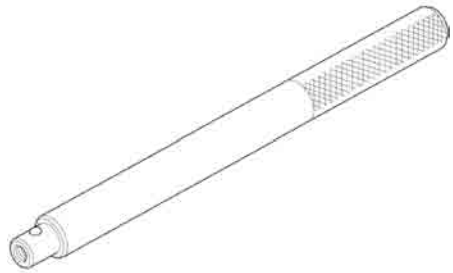
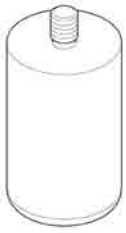
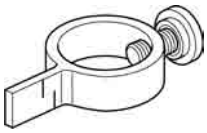
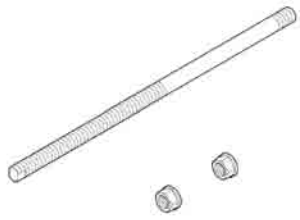
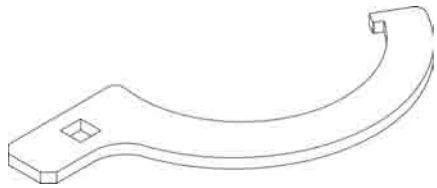
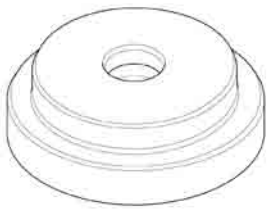
COMPONENT LOCATION

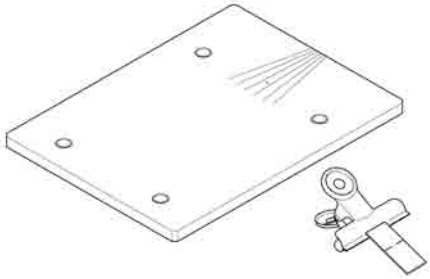


TOOLS

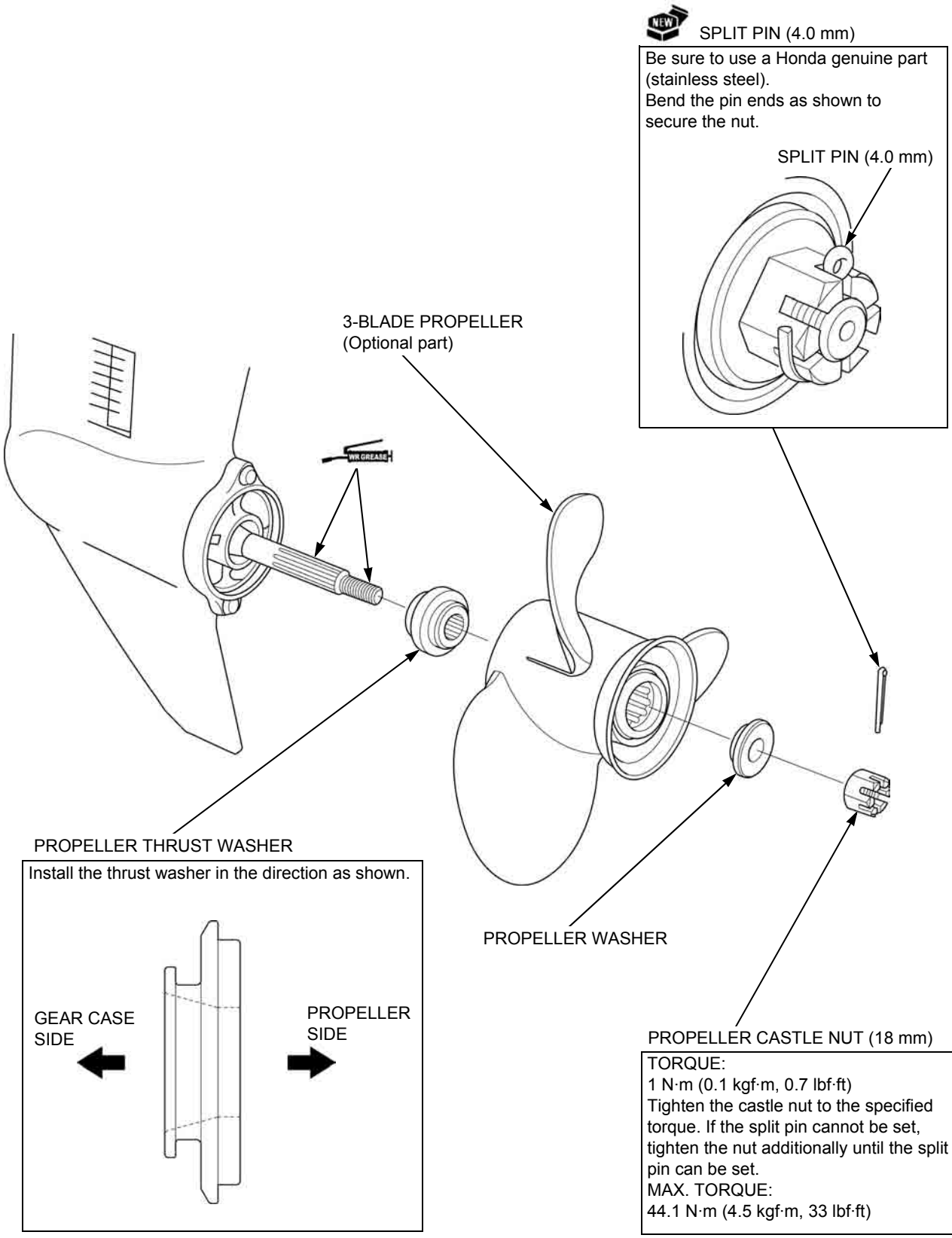
LIST

Driver, 480 mm 070GD-001A100 	Bearing race puller 070PC-ZY3A101 	Prop shaft holder @@ 
Attachment, 32 x 42 mm 070PD-ZY3A100 	Taper bearing installer attachment, 90 mm 070PF-ZY3A100 	Attachment, 37 x 40 mm 07746-0010200 
Pilot, 25 mm 07746-0040600 	Pilot, 28 mm 07746-0041100 	Fork seal driver attachment, 27.2 mm 07747-0010300 
Driver 07749-0010000 	Lock nut wrench, 36 x 47.8 mm 07916-MB00002 	Remover handle 07936-3710100 

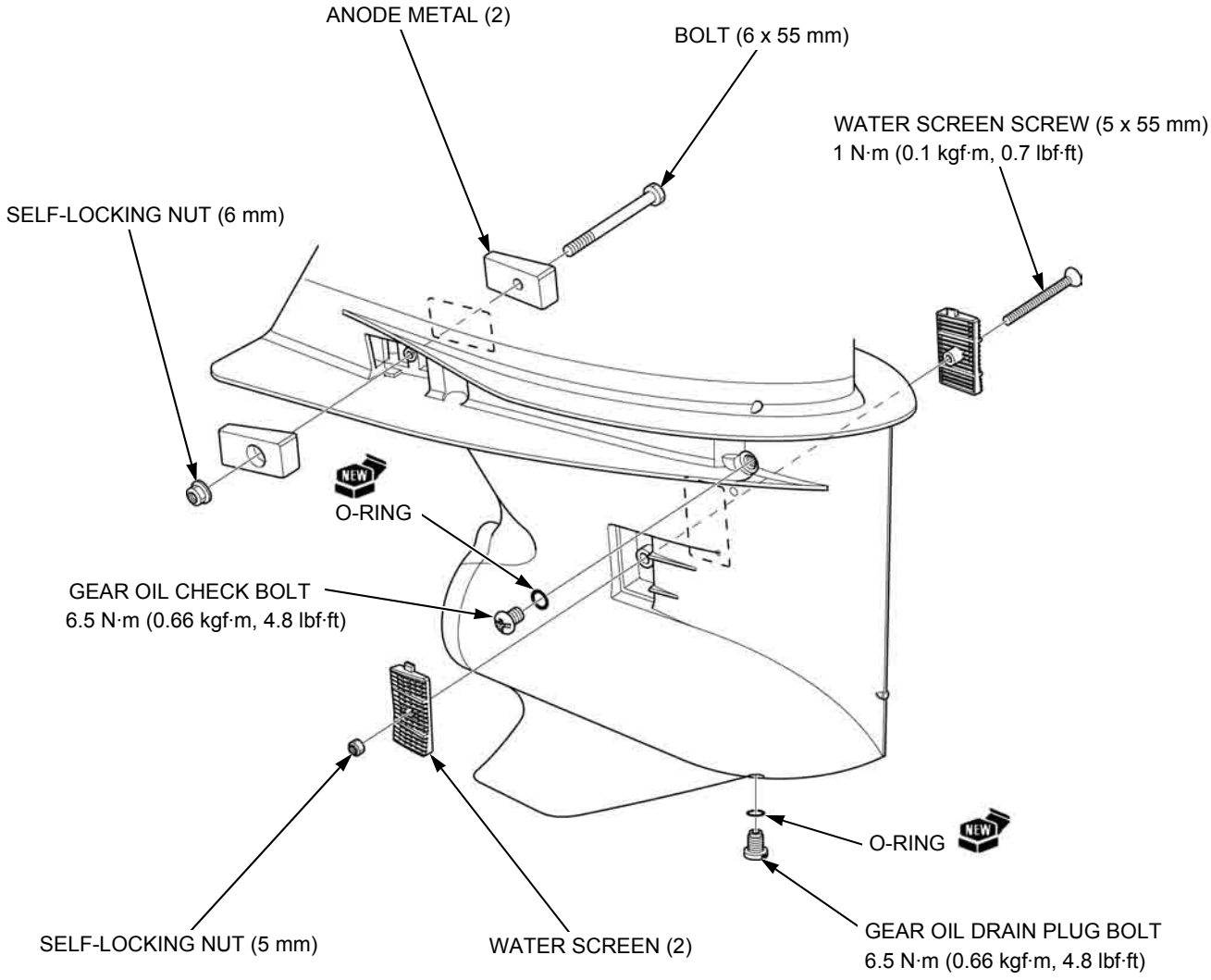
Remover weight 07936-371020A or 07936-3710200 	Bearing driver attachment, 44 x 49.5 mm 07945-3330300 	Oil seal driver attachment, 28 x 35 mm 07945-4150200 
Bearing driver attachment, 64 x 72 mm 07946-SB20000 	Oil seal driver, 44.5 mm 07947-SB00100 	Driver, 280 mm 07949-3710001 
Pilot, 32 x 50 mm 07MAD-PR90200 	Attachment, 52 x 55 mm 07NAD-P200100 	Vertical shaft holder 07SPB-ZW10200 
Backlash indicator tool 07SPJ-ZW0030B 	Installer shaft, 15 x 370 mm 07VMF-KZ30200 	Pin type spanner, 128 mm 070PA-ZX20100 
Oil seal driver attachment, 42 x 47 mm 07947-ZV00100 	Oil seal driver attachment, 72 mm 07947-6340201 	Oil seal driver attachment, 80 x 96 mm 07ZAD-PNA0100 

Backlash inspection tool set 070PJ-ZX20200 	Pilot, 30 mm 07746-0040700 	Attachment, 27.5 x 44 mm 07948-9540000 

PROPELLER REMOVAL/ INSTALLATION



ANODE METAL/WATER SCREEN REMOVAL/INSTALLATION



GEAR CASE/EXTENSION SEPARATOR (XXA type) REMOVAL/INSTALLATION

REMOVAL

Set the remote control lever in the "N" (Neutral) position.
Tilt up the motor to the uppermost position.

Remove the bolt/washer (10 x 32 mm) [1], and trim tab [2].
Remove the gear case nut (12 mm) [3] and washer (12 mm) [4].

LA, XA types: Hold the gear case [5] and remove the six bolt/washers (10 x 47 mm) [6] from the gear case.

XXA type: Hold the gear case and remove the six nuts (10 mm) [7] and six washer (10 mm) [8] from the gear case.

- When loosening the stud bolt, tighten it and check that the length from the bolt head to the extension case surface is within specification.
  – LA and XA types: page 16-48
  – XXA type: page 16-49

LA, XA types: Disconnect the speedometer tube [9] from the gear case.

Remove the gear case by sliding the vertical shaft [10] down.

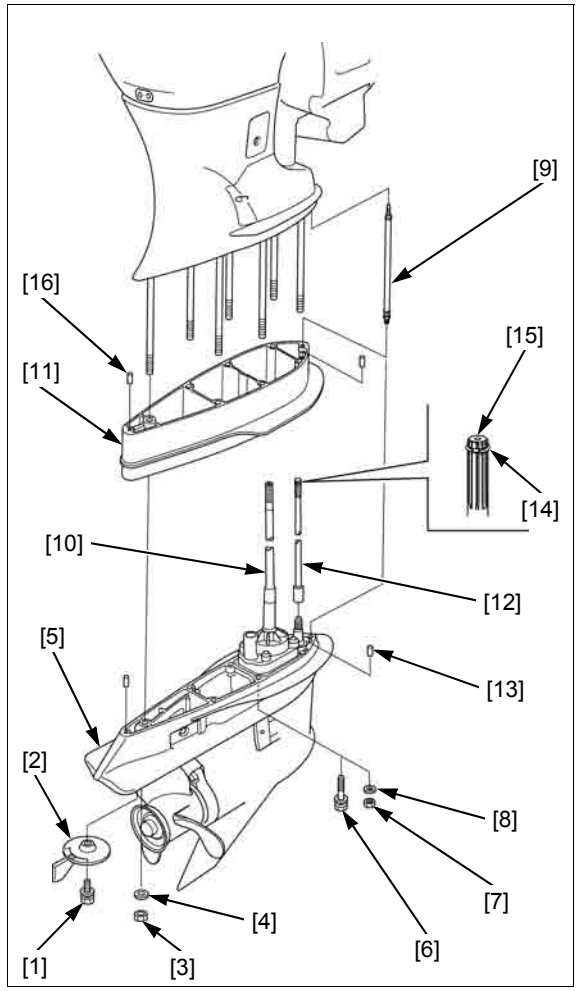
XXA type: Disconnect the speedometer tube, and remove the extension separator [11].
Remove the shift rod A [12] and two dowel pins [13].

- Joint clip [14] is fitted to the shift shaft A, so it is hard to remove the shift rod A [15].

Take care not to apply excessive force to the shift rod A.

XXA type: Remove the two dowel pins [16] from the extension separator.

After removing the gear case, tilt down the motor to the lowermost position.

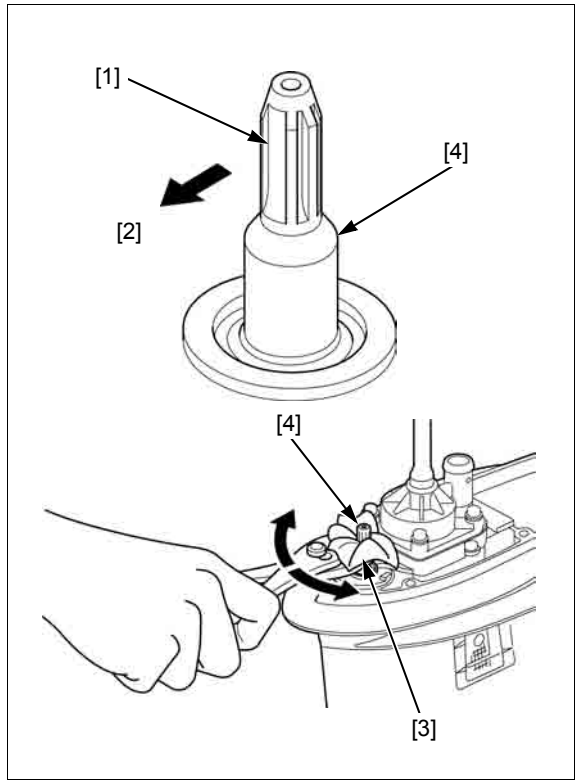


INSTALLATION

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

Check that the cutout [1] of the spline faces the cruising direction [2] (this position is "N" (Neutral)).

If the cutout of the spline is not in the direction shown, protect the spline with a shop towel [3] and turn the shift rod [4] right or left with a wrench until the cutout faces toward the specified direction.



Tilt up the motor to the uppermost position.

Install the two dowel pins [1] to the extension separator [2]. (XXA type)

Install the two dowel pins [3] to the gear case [4].

Install the shift rod A [5] by aligning the cutout [6] of the shift rod A spline with the projection [7] of the spline of shift shaft A [8].

Apply marine grease to the vertical shaft spline and inside of the water tube seal ring.

Install the extension separator, and connect the speedometer tube [9]. (XXA type)

Install the gear case halfway.
Connect the speedometer tube to the gear case (LA and XA types).
Install the shift rod A by aligning the projection [10] of the shift rod A spline [11] with the cutout [12] of the spline of the shift rod [13].

Loosely tighten six gear case bolt/washers (10 x 47 mm) [14]. (LA and XA types)
Loosely tighten six washers (10 mm) [15] and six gear case nuts (10 mm) [16]. (XXA type).

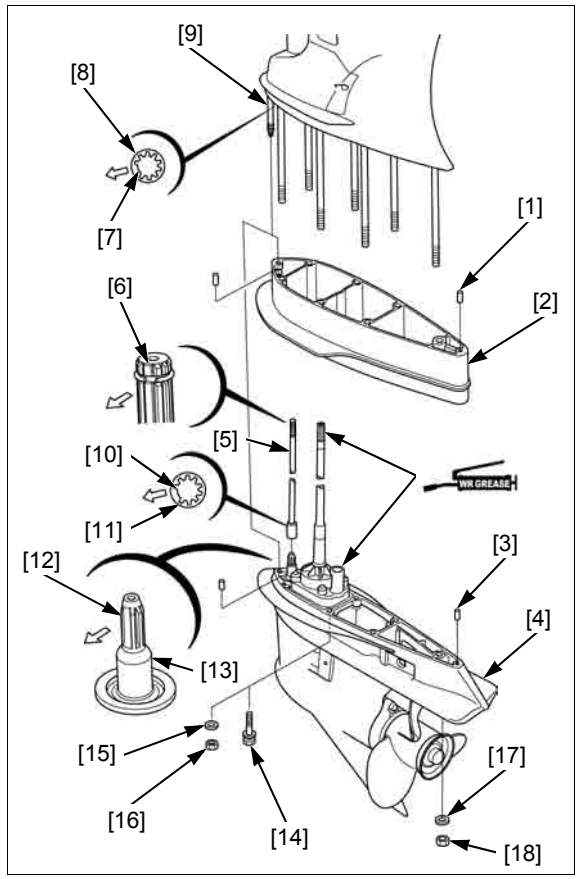
Tilt down the motor to the lowermost position.

Tighten the six gear case bolts (LA and XA types) or six gear case nuts (XXA type) to the specified torque.

TORQUE: 37 N·m (3.8 kgf·m, 27 lbf·ft)

Install the washer [17] and the gear case nut (12 mm) [18].

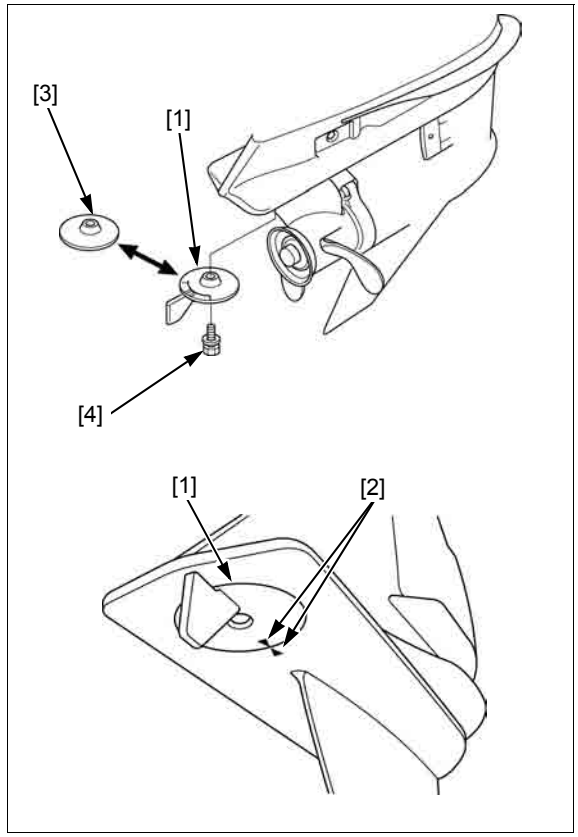
TORQUE: 56 N·m (5.7 kgf·m, 41 lbf·ft)



Install the trim tab [1] by aligning the "△" marks [2]. (single motor type)
Install the gear case cover [3]. (dual motor type)

Install and tighten the bolt/washer (10 x 32 mm) [4].

After installing the gear case, adjust the shift control cable (page 20-3).



VERTICAL SHAFT BUSHING REMOVAL/INSTALLATION (XA and XXA types)

Remove the gear case (page 16-8).
Remove the extension separator (XXA type: page 16-8).

Remove the internal circlip [1], washer (30 mm) [2], and vertical shaft bushing [3].

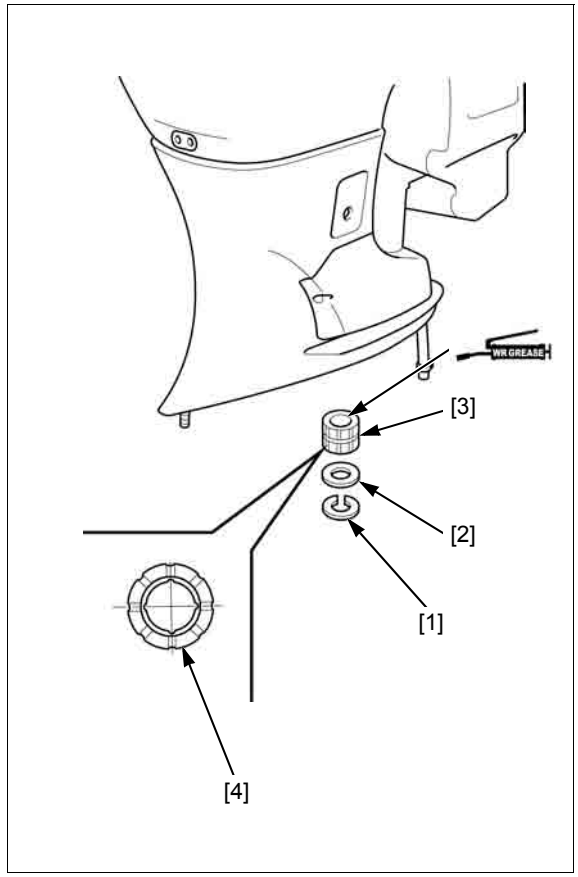
Inspect the vertical shaft bushing I.D. (page 16-48).
Replace the vertical shaft bushing if necessary.

Install the vertical shaft bushing to the extension case with the groove [4] facing the gear case side.

Apply marine grease to the inside of vertical shaft bushing.

Install the washer and set the internal circlip.

Install the extension separator (XXA type: page 16-9).
Install the gear case (page 16-9).



EXTENSION CASE REMOVAL/ INSTALLATION

REMOVAL

Remove the following:

– L./R. Engine under cover (page 6-3)
– Gear case (page 16-8)
– Extension separator (XXA type: page 16-8)

Remove the lower mounting cover screw/washer (6 x 40 mm) [1], six special bolts (6 x 17 mm) [2] and L./R. lower mounting covers [3].

Remove the bolt (6 x 12 mm) [4] and the ground terminal [5].

Remove the six bolts (10 x 35 mm) [6], six washers (10 mm) [7], and lower mount housing [8].

Remove the two lower rubber mount nuts [9].

Slightly move the extension case [10] and remove the two lower rubber mounts [11], two mount stoppers [12], two bolts (14 x 180 mm) [13], and two washers (14 mm) [14].

- Support the outboard motor securely in order to prevent the upper mount from being damaged when the lower rubber mount is removed from the extension case, which may cause an excessive load on the upper mount.

Remove the eleven bolts (12 x 50 mm) [15], eleven washers (12 mm) [16], and extension case.

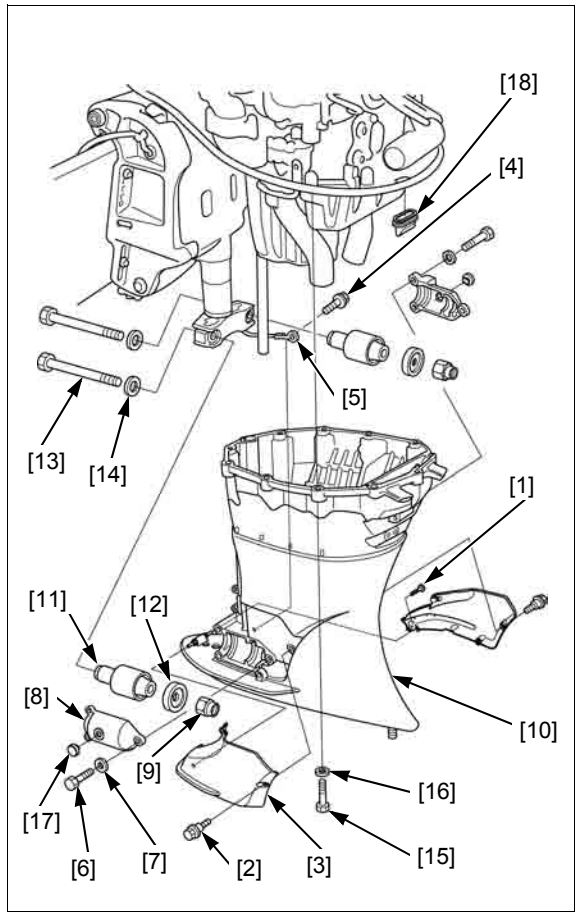
NOTICE

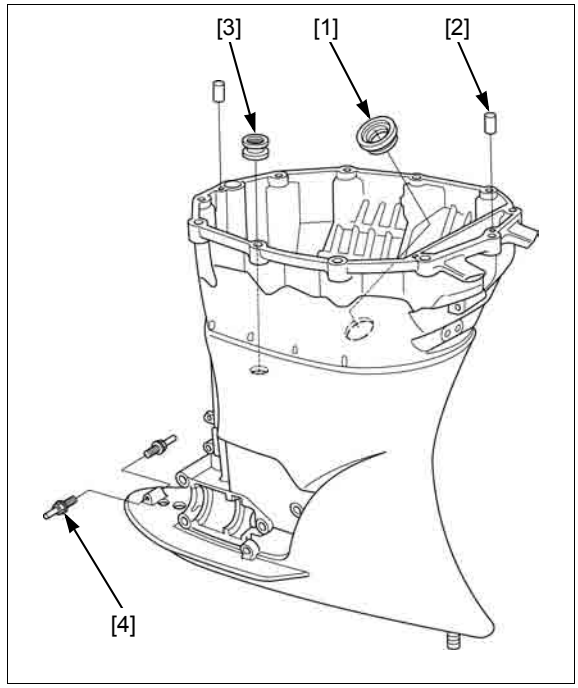
- *Take care not to drop the extension case.*

Remove the two rubbers [17] from the two lower mount housings.

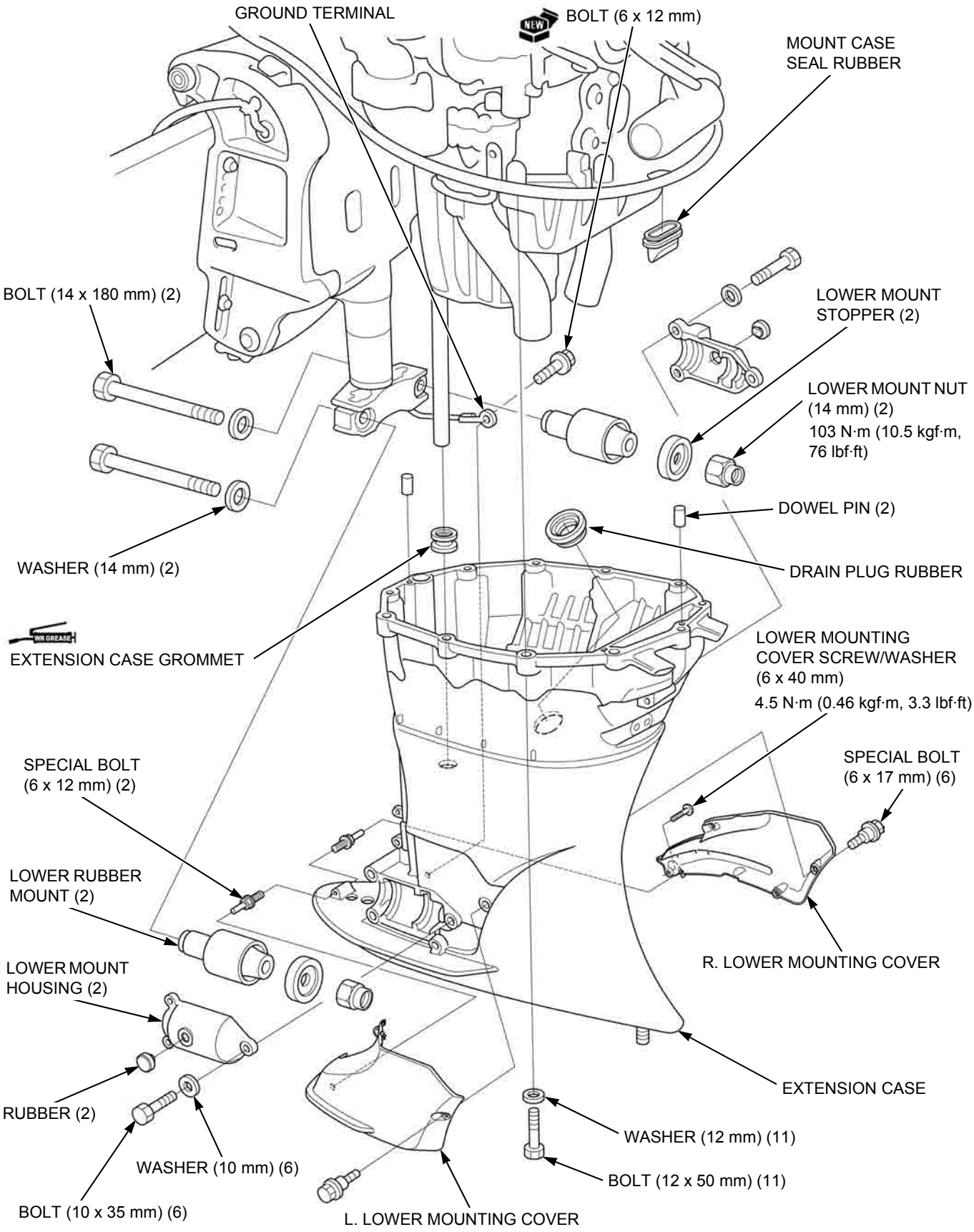
Remove the mount case seal rubber [18] from the mount case.

Remove the drain plug rubber [1], two dowel pins [2], extension case grommet [3] and two special bolts (6 x 12 mm) [4] from the extension case.





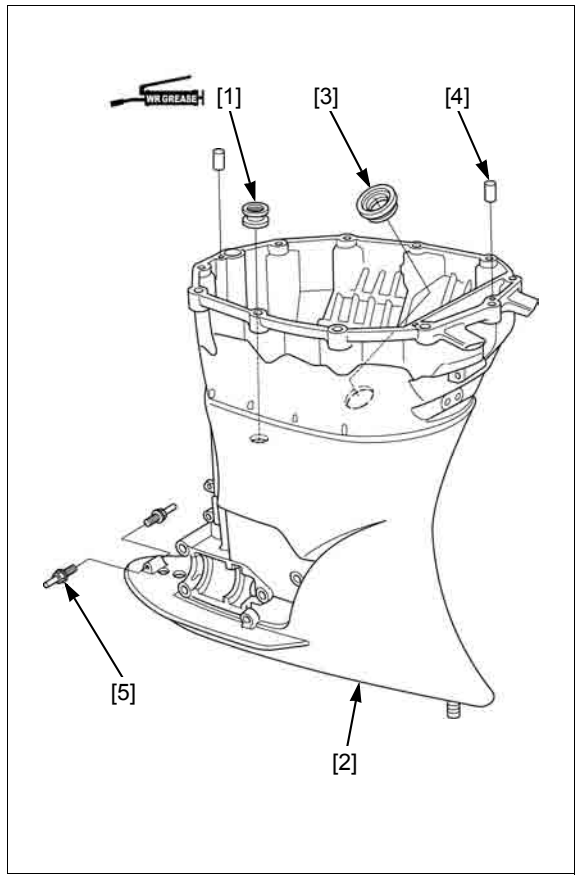
EXPLODED VIEW



INSTALLATION

Apply marine grease to the extension case grommet [1] inner surface and install it to the extension case [2].

Install the drain plug rubber [3], two dowel pins [4] and two special bolts (6 x 12 mm) [5] to the extension case.



Install the two rubbers [1] to the two lower mount housings [2].

Install the mount case seal rubber [3] to the mount case.

Install the extension case [4], eleven washers (12 mm) [5] and eleven bolts (12 x 50 mm) [6].

Install the two lower rubber mounts [1] and two lower mount stoppers [2] while holding the extension case.

Install the two bolts (14 x 180 mm) [3], two washers (14 mm) [4], and two lower mount nuts [5] and tighten them to the specified torque.

TORQUE: 103 N·m (10.5 kgf·m, 76 lbf·ft)

Install the two lower mount housing [6], six washers (12 mm) [7] and six bolts (10 x 35 mm) [8].

Set the ground terminal [11] and tighten the new bolt (6 x 12 mm) [12].

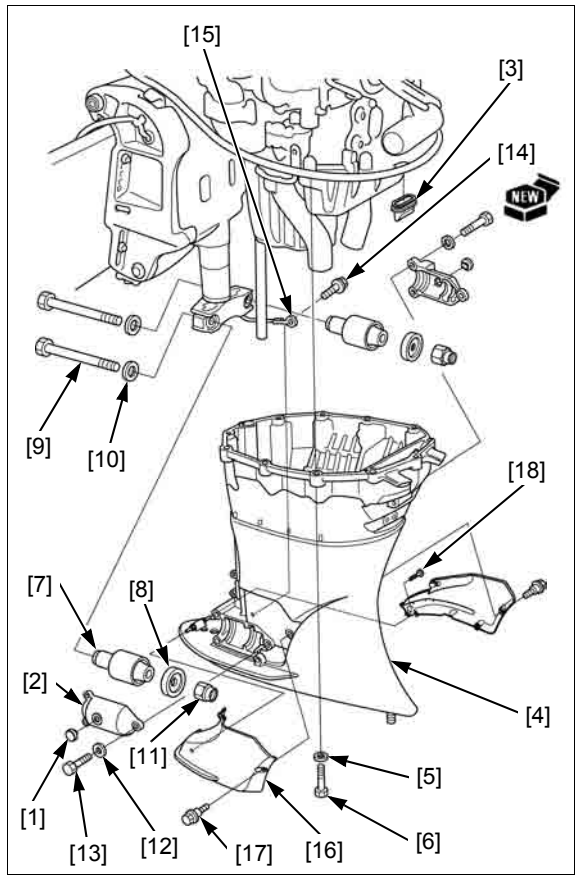
Install the L./R. lower mounting covers [9] and six special bolts (6 x 17 mm) [10].

Install and tighten the lower mounting cover screw/ washer (6 x 40 mm) [1] to the specified torque.

TORQUE: 4.5 N·m (0.46 kgf·m, 3.3 lbf·ft)

Install the following:

– Extension separator (XXA type: page 16-9)
– Gear case (page 16-9)
– L./R. engine under cover (page 6-3)

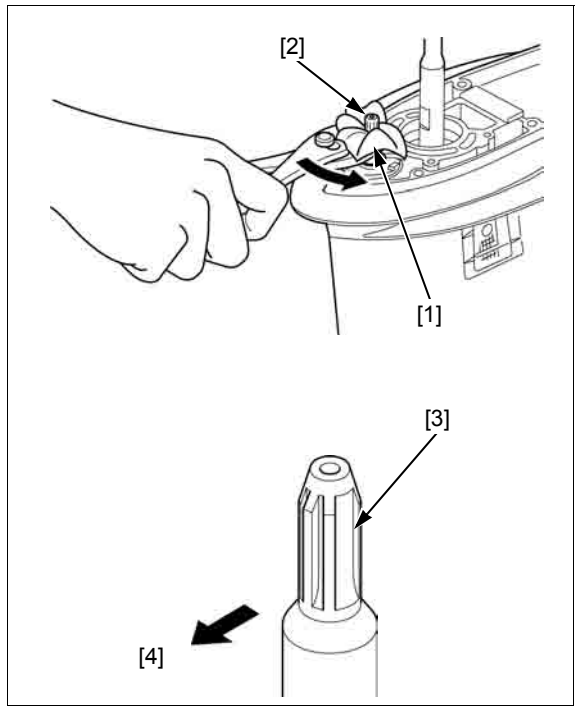


SHIFT ROD REMOVAL/INSTALLATION

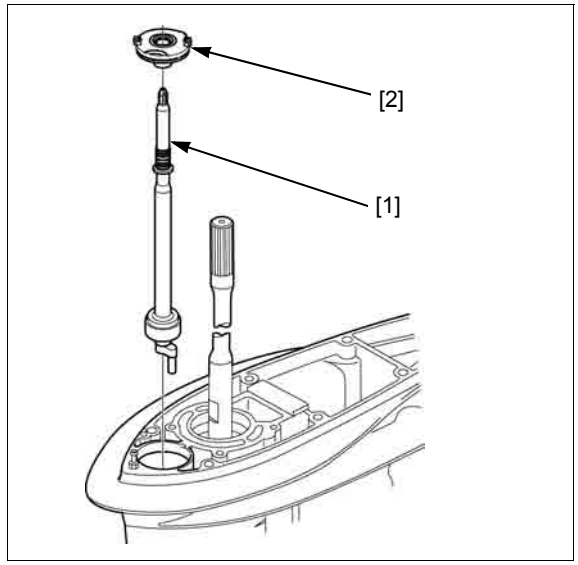
REMOVAL

Remove the water pump (page 11-9).

Wrap a shop towel [1] around the shift rod spline, and use pliers to turn the shift rod [2] in the direction shown (cutout of the shift rod spline [3] is toward the left side of the cruising direction [4]).

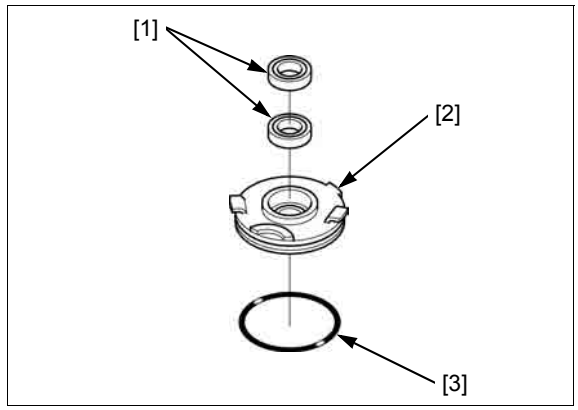


Remove the shift rod [1] and shift rod holder [2] from the gear case.

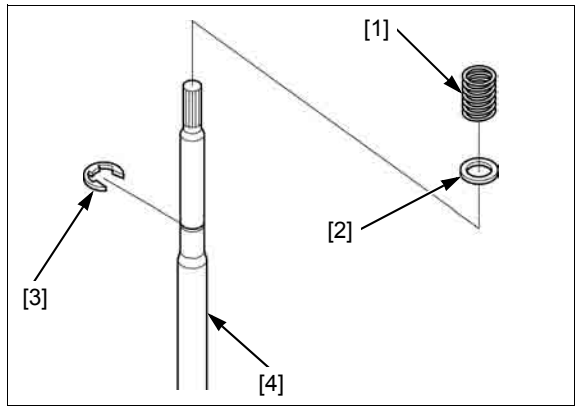


Remove the two water seals (12 x 21 x 6 mm) [1] from the shift rod holder [2] using a commercially available oil seal remover.

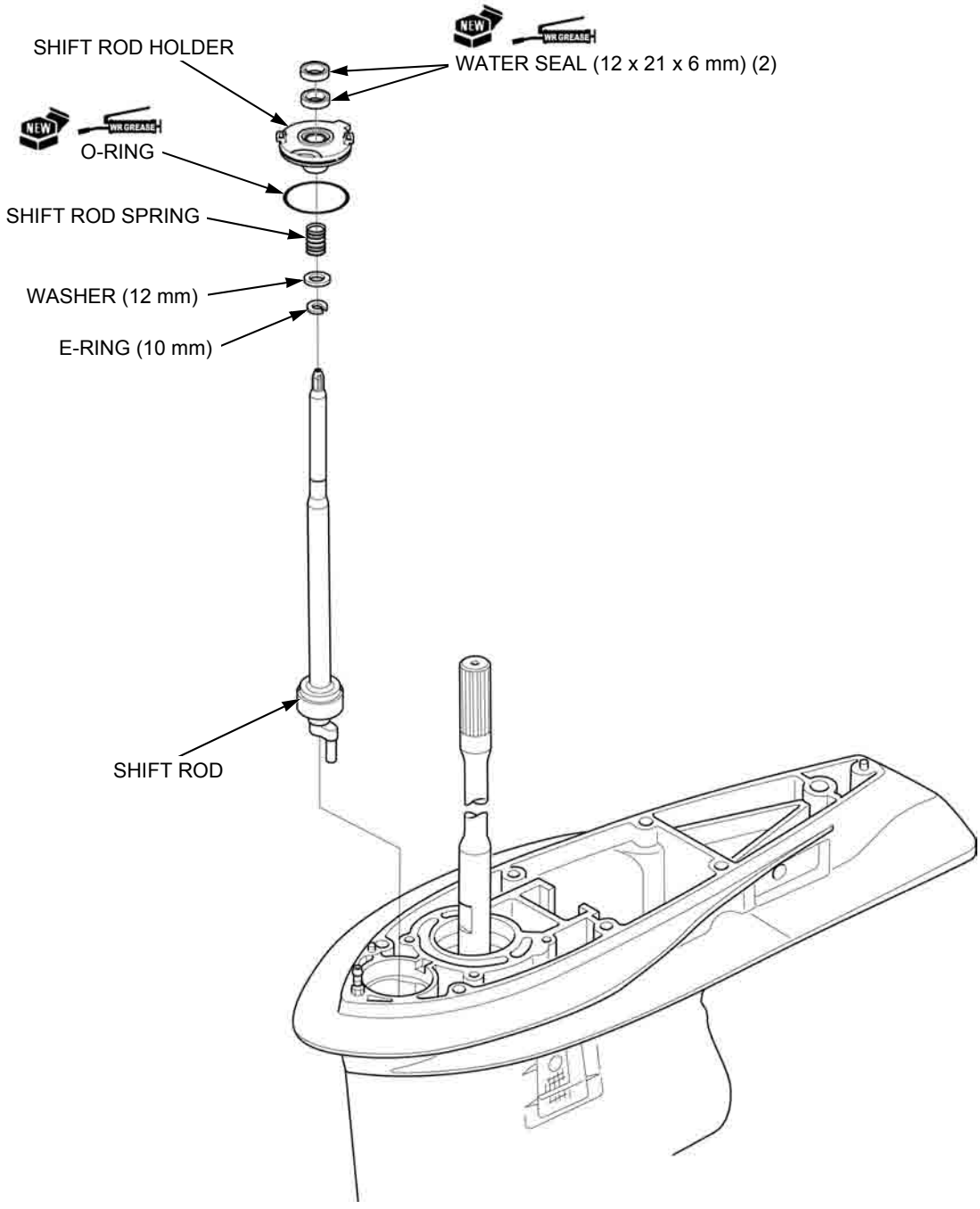
Remove the O-ring [3] from the shift rod holder.



Remove the shift rod spring [1], washer [2], and E-ring [3] from the shift rod [4].



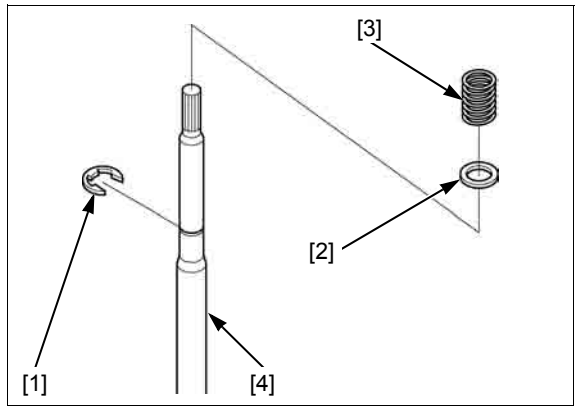
EXPLODED VIEW



INSTALLATION

Install the E-ring [1], washer [2], and shift rod spring [3] on the shift rod [4].

- Do not reuse the E-ring if it is deformed or deteriorated.
- Check that the E-ring is set in the groove in the shift rod securely.



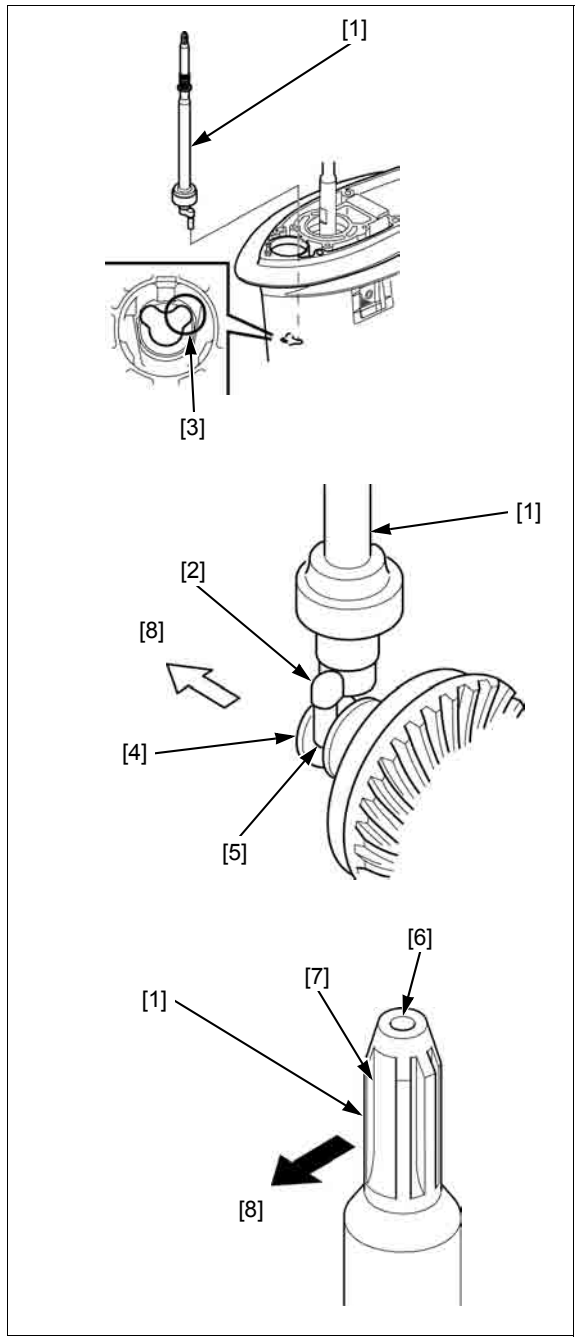
Insert the shift rod [1] into the gear case, aligning the cam [2] of the shift rod with the "A" point [3] of the gear case as shown.
Install the shift rod on the shift slider [4], aligning the cam of the shift rod with the groove [5] in the shift slider.

- Check that there is no marking [6] in the shift rod end.

After installing the shift rod, position the shift rod in the "N" (Neutral) position and check that the cutout in the spline [7] faces to the cruising direction [8].

NOTICE

- *If the cutout of the spline is not in the cruising direction, protect the spline with a shop towel and turn the shift rod right or left with a wrench until the cutout faces toward the cruising direction.*

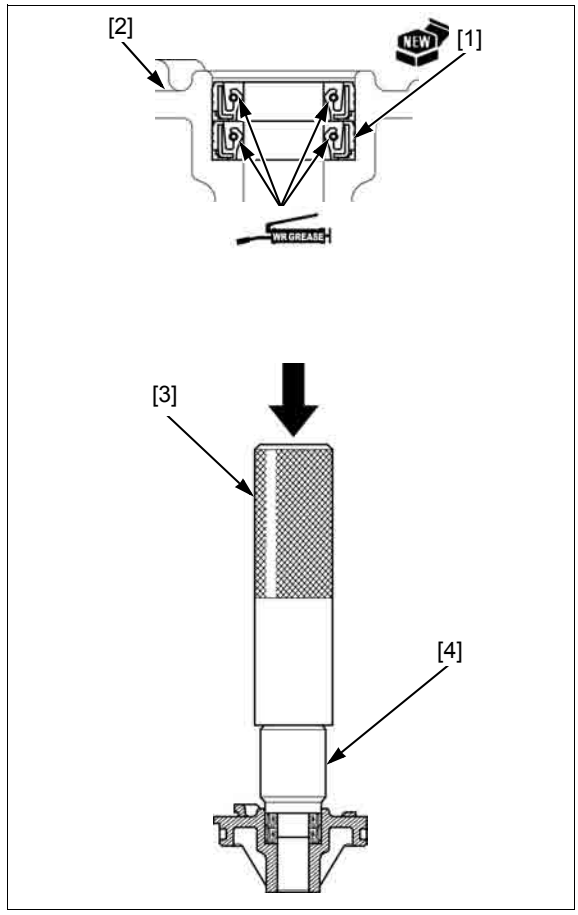


Apply marine grease to the lips and soapy water to the outer circumference of the new water seals (12 x 21 x 6 mm) [1].

With the lips facing up, drive the water seals (12 x 21 x 6 mm) into the shift rod holder [2].

TOOLS:

Driver [3]	**07749-0010000**
Oil seal driver attachment, 42 x 47 mm [4]	**07947-ZV00100**

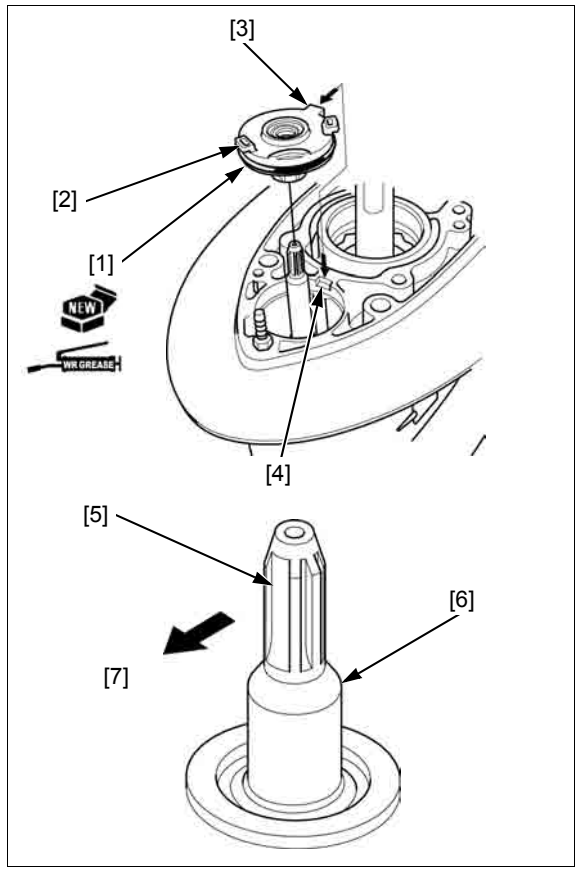


Apply marine grease to the circumference of a new O-ring [1], and install it on the shift rod holder [2].

Install the shift rod holder into the gear case by aligning the projection [3] of the shift rod holder with the recess [4] of the gear case.

After installation, check that the cutout [5] in the shift rod [6] splines is in the cruising direction [7].

Install the water pump (page 11-12).



PROPELLER SHAFT HOLDER REMOVAL/INSTALLATION

Drain the gear case oil (page 3-7).

Remove the following:

– Propeller (page 16-6)
– Gear case (page 16-8)
– Extension separator (XXA type: page 16-8)
– Shift rod (page 16-14)

Remove the two bolts (12 x 45 mm) [1], two washers (12 mm) [2].

Insert a screwdriver or equivalent tool into the recess [3] in the propeller shaft holder [4] and remove the propeller shaft holder from the gear case.

Remove the thrust shim [5].

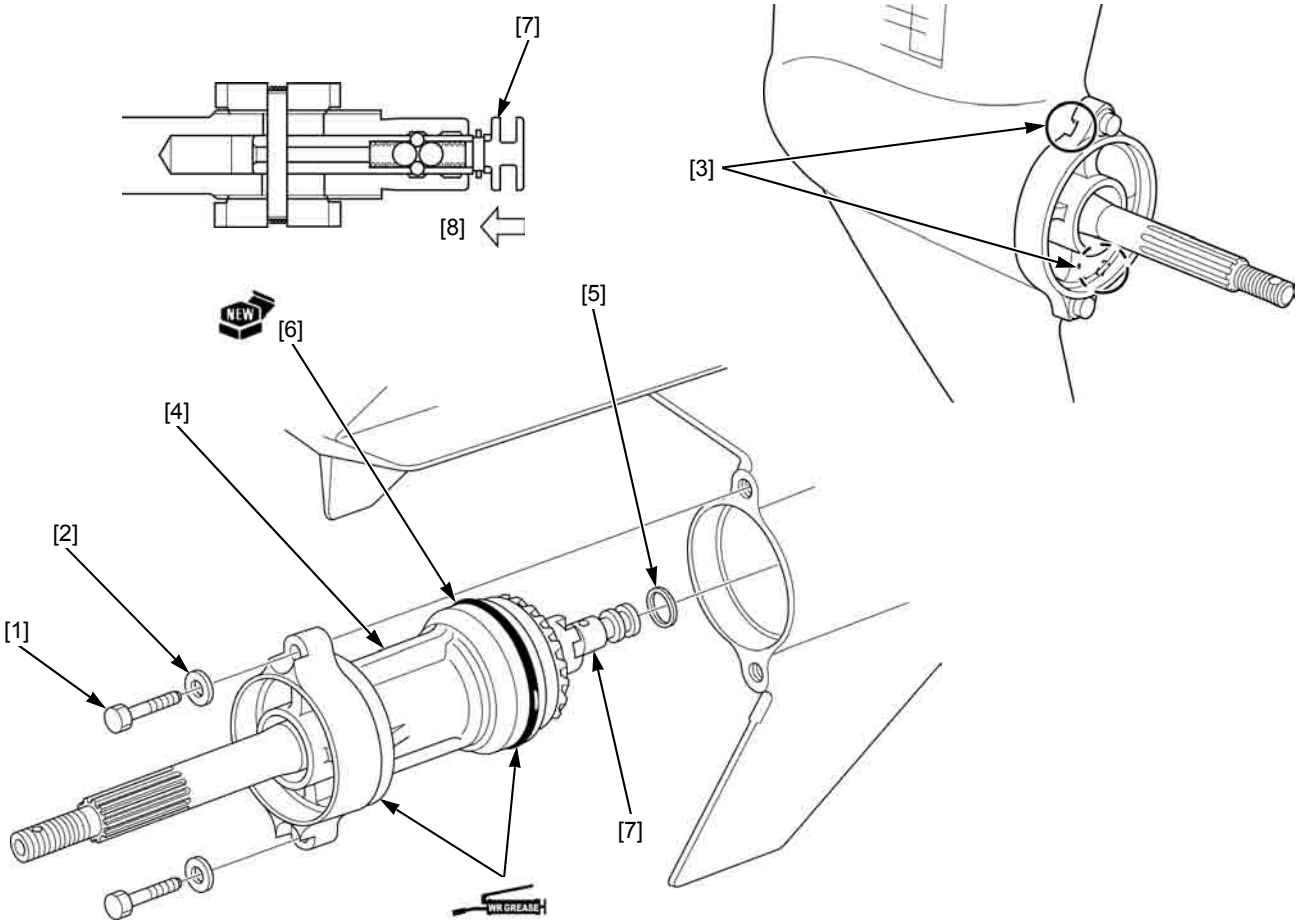
Replace the O-ring [6] with a new one and coat the O-ring with marine grease.

At installation, check that the shift slider [7] of the propeller shaft holder is set on the reverse bevel gear side [8].

Apply marine grease to the propeller shaft holder seating surface.

Installation is the reverse order of removal.

Perform the gear case pressure check (page 16-45).

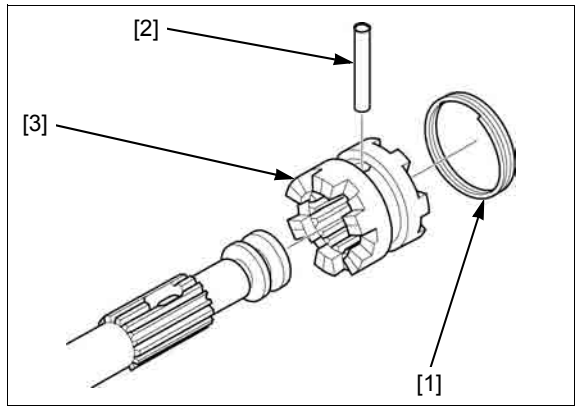


SHIFT SLIDER/PROPELLER SHAFT REMOVAL/INSTALLATION

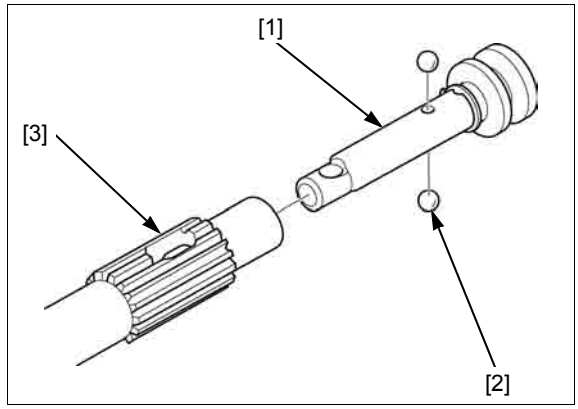
SHIFT SLIDER REMOVAL

Remove the propeller shaft holder (page 16-18).

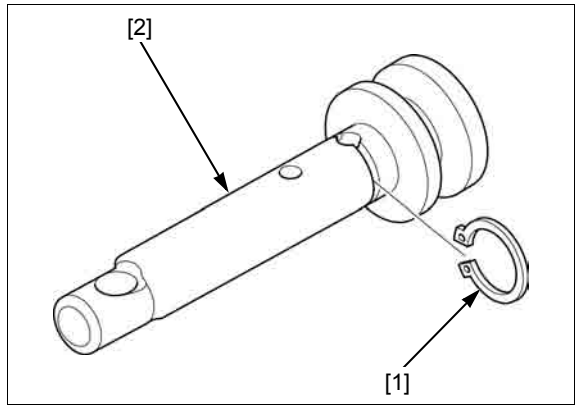
Remove the cross pin ring [1] and the shifter pin [2], and then remove the clutch shifter [3].



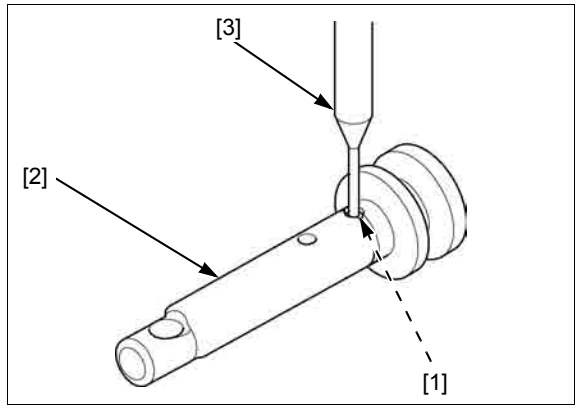
Remove the shift slider [1] and the two steel balls (#7) [2] from the propeller shaft [3]. Take care not to lose the steel balls.



Remove the circlip [1] from the shift slider [2].

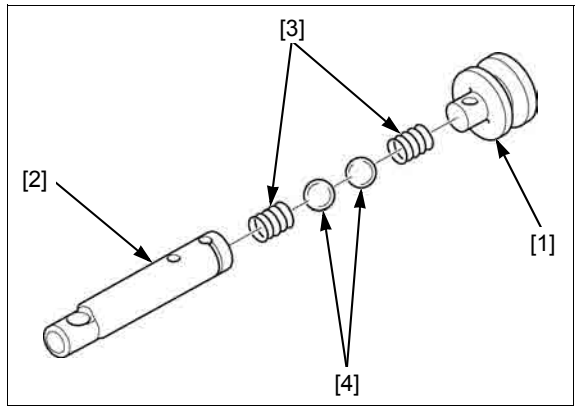


Remove the roller [1] from the shift slider [2] using a commercially available pin driver [3].



Remove the shift plate [1] from the shift slider [2], and then remove the two shift springs [3] and the two steel balls (#12) [4].

- Take care not to let the shift springs and the steel balls pop out of the shift slider during removal of the shift plate.

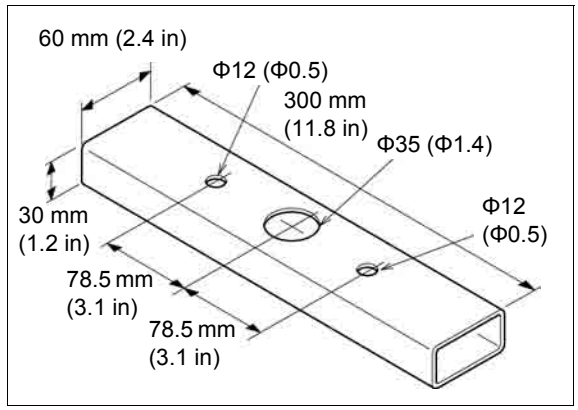


PROPELLER SHAFT REMOVAL

Remove the shift slider (page 16-19).

Prepare the fixing tool with the dimensions shown or use the special tool.

TOOL:
Prop shaft holder @@



Position the propeller shaft holder [1] on the fixing tool or special tool [2] and secure the holder with two bolts [3].

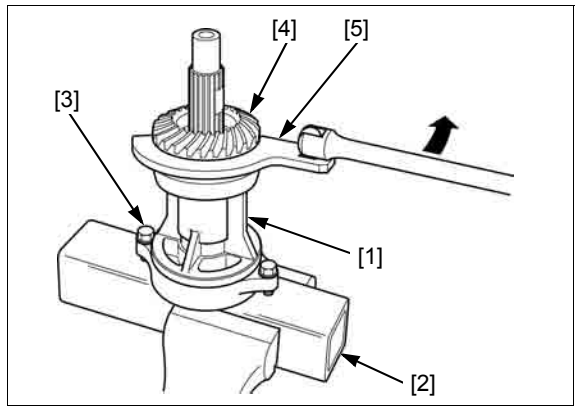
TOOL:
Prop shaft holder @@

Hold the fixing tool with a vise.

- Avoid holding the propeller shaft holder directly in a vise. Use the fixing tool to hold it in a vise.

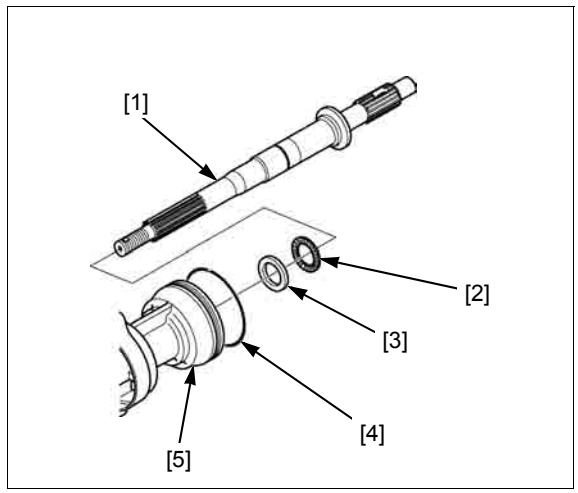
Loosen the bearing holder [4] using the special tool as shown.

TOOL:
Pin type spanner, 128 mm [5] 070PA-ZX20100

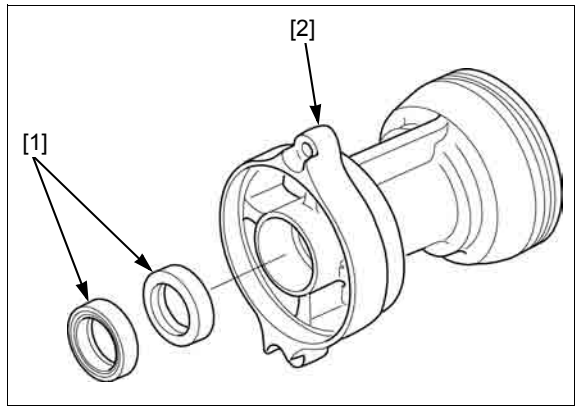


Remove the bearing holder from the propeller shaft holder.

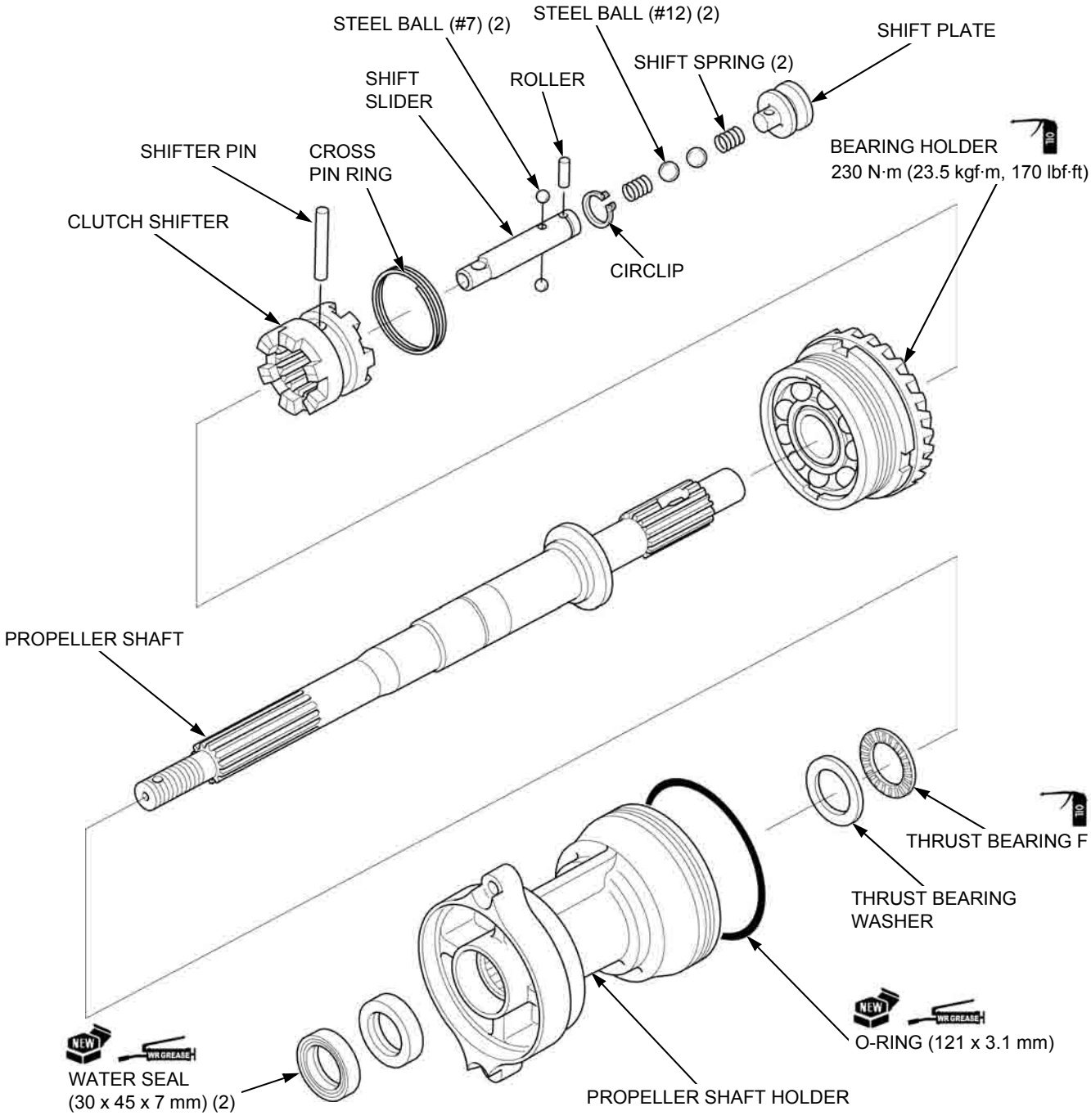
Remove the propeller shaft [1], thrust bearing F [2], thrust bearing washer [3], and O-ring [4] from the propeller shaft holder [5].



Remove the two water seals (30 x 45 x 7 mm) [1] from the propeller shaft holder [2] using a commercially available oil seal remover.



EXPLODED VIEW



PROPELLER SHAFT INSTALLATION

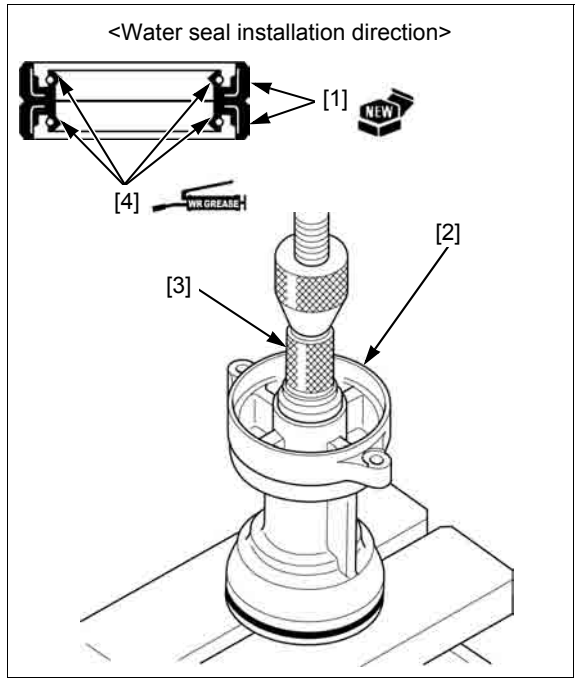
Apply soapy water to the outer circumference and marine grease to the mating surfaces of new water seals (30 x 45 x 7 mm) [1].

Drive the water seals one by one into the propeller shaft holder [2] using the special tool. Note the installation direction of the water seals.

- Replace the water seals with the new ones on assembly.

TOOL:
Oil seal driver, 44.5 mm [3] 07947-SB00100

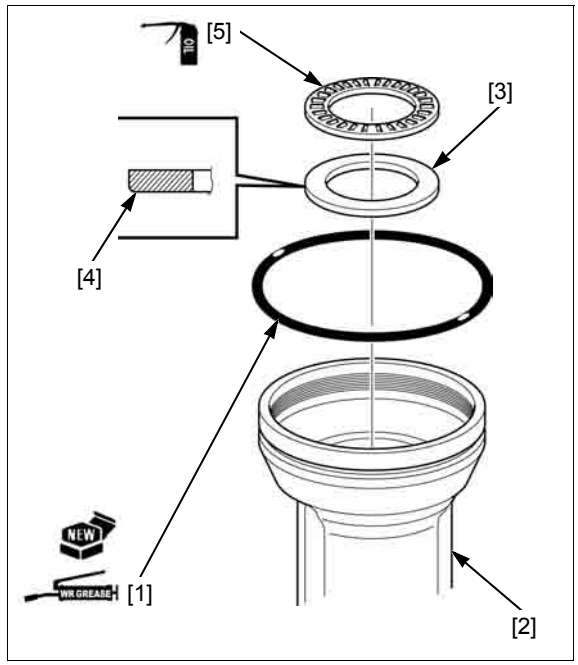
After installation of the water seals, apply marine grease to the water seal lips [4].



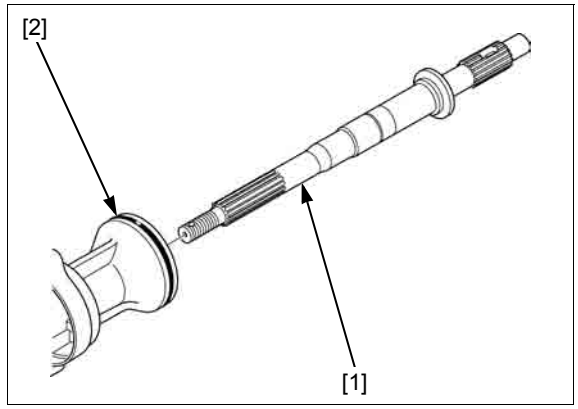
Apply marine grease to the circumference of the new O-ring [1], and install it on the propeller shaft holder [2].

Install the thrust bearing washer [3] with the chamfered [4] side toward the propeller shaft holder.

Apply gear oil to the thrust bearing F [5] and install it on the thrust bearing washer.



Install the propeller shaft [1] on the propeller shaft holder [2].



Apply gear oil to the threads and seating surface of the bearing holder [1].

Position the bearing holder on the propeller shaft. Loosely tighten the bearing holder by hand against the propeller shaft holder [2].

Attach the fixing tool or special tool [3] (page 16-20), on the propeller shaft holder and secure with two bolts [4].

TOOL:
Prop shaft holder [3] @@

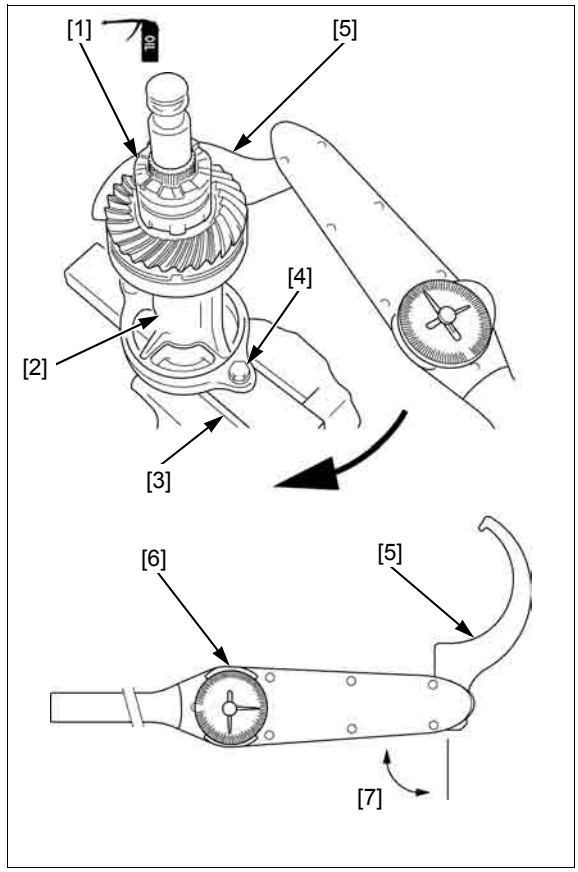
Hold the fixing tool with a vise.

- Avoid holding the propeller shaft holder directly in a vise. Use the fixing tool to hold it in a vise.

Tighten the bearing holder to the specified torque using the special tool as shown.

TOOL:
Pin type spanner, 128 mm [5] 070PA-ZX20100

TORQUE: 230 N·m (23.5 kgf·m, 170 lbf·ft)



NOTICE

- *Make sure the torque wrench [6] is mounted perpendicular [7] to the special tool. If the torque wrench is not held 90 degrees to the tool, the torque reading will be incorrect.*

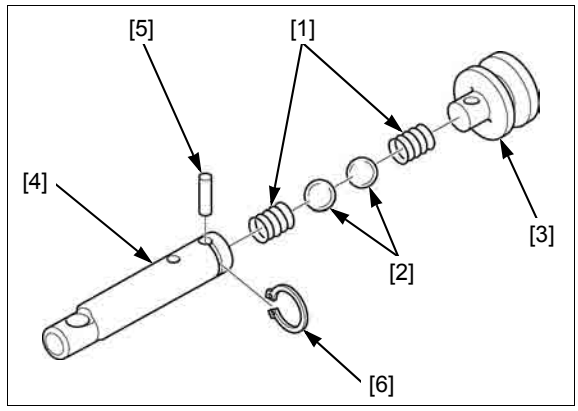
SHIFT SLIDER INSTALLATION

Install a shift spring [1], two steel balls (#12) [2], the other shift spring, and the shift plate [3] in this order in the shift slider [4].

Install the roller [5] by aligning the hole in the shift slider with the hole in the shift plate, and then install the circlip [6].

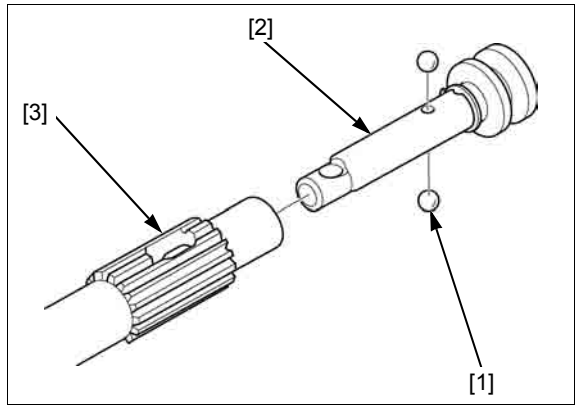
NOTE:

- Do not align the end gap of the circlip with the hole of the shift slider.



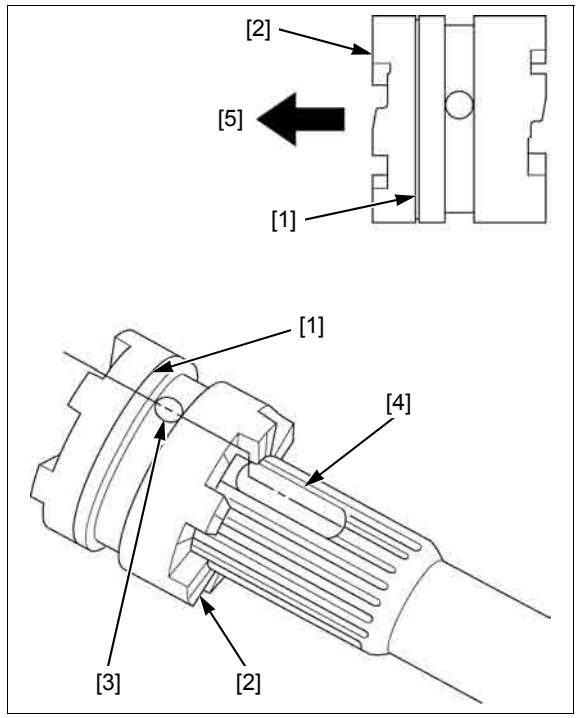
Set the two steel balls (#7) [1] in the steel ball installation holes in the shift slider [2], and push the shift slider slowly into the propeller shaft [3].

- Push the shift slider into the propeller shaft with care not to allow the steel balls to pop out.

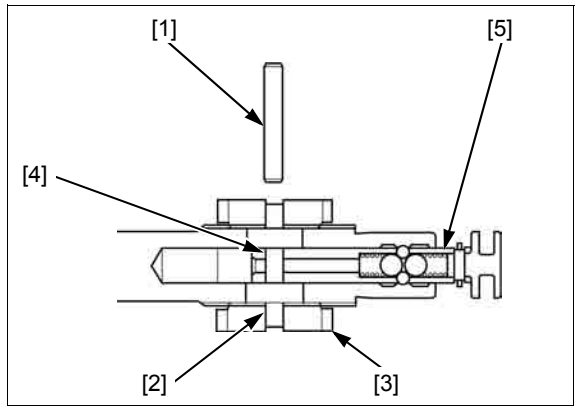


With the groove [1] on the clutch shifter [2] toward the forward bevel gear, assemble the clutch shifter on the propeller shaft while aligning the shifter pin installation hole [3] with the long hole [4] in the propeller shaft.

- The forward bevel gear is the cruising direction side [5].

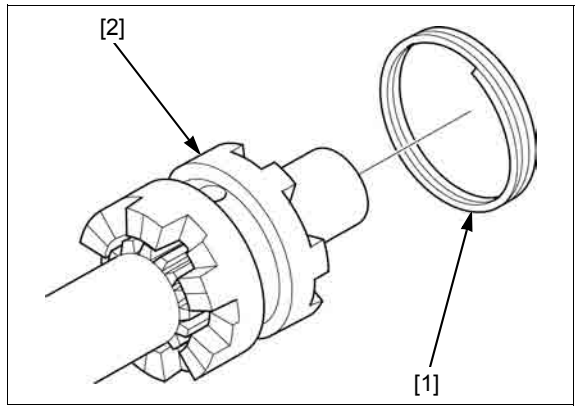


Install the shifter pin [1] while aligning the hole [2] in the clutch shifter [3] with the hole [4] in the shift slider [5].

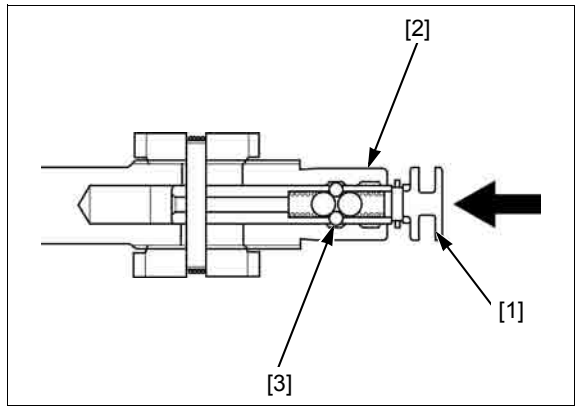


Install the cross pin ring [1] on the clutch shifter [2].

- Check that the coils of the cross pin ring do not overlap each other.



Push the shift slider [1] into the propeller shaft [2] slowly, and set the steel balls (#7) [3] in the positions shown.



NOTICE

- *Note that the shift rod cannot be installed unless the shift slider is on the reverse side. Set the shift slider on the reverse side securely.*

Install the propeller shaft holder (page 16-18).

VERTICAL SHAFT/REMOVAL/ INSTALLATION

REMOVAL

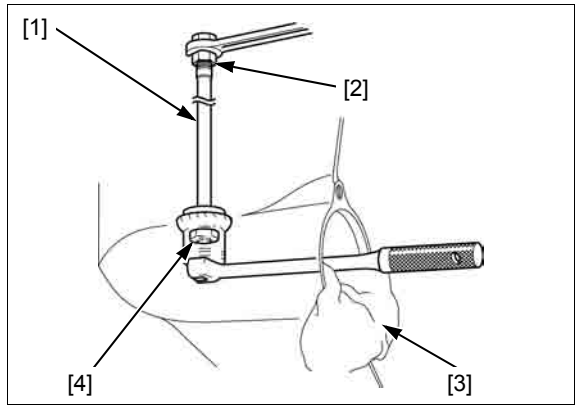
Remove the propeller shaft holder (page 16-18).

Attach the special tool to the vertical shaft end [1].

TOOL:
Vertical shaft holder [2] 07SPB-ZW10200

Place a shop towel [3] or equivalent material as shown to protect the gear case.

Holding the pinion gear nut [4] as shown, turn the vertical shaft and remove the pinion gear nut and pinion gear from the vertical shaft.

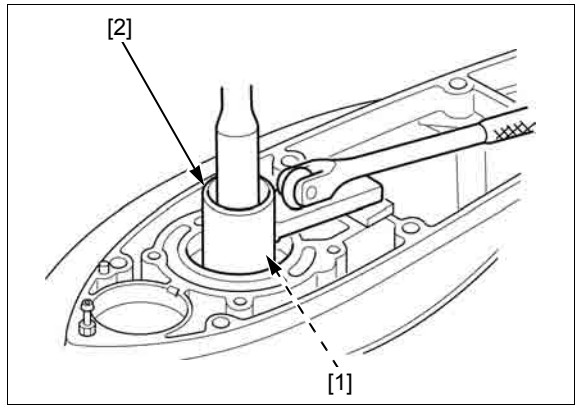


Remove the lock nut [1] using the special tool.

TOOL:
Lock nut wrench, 36 x 47.8 mm [2] 07916-MB00002

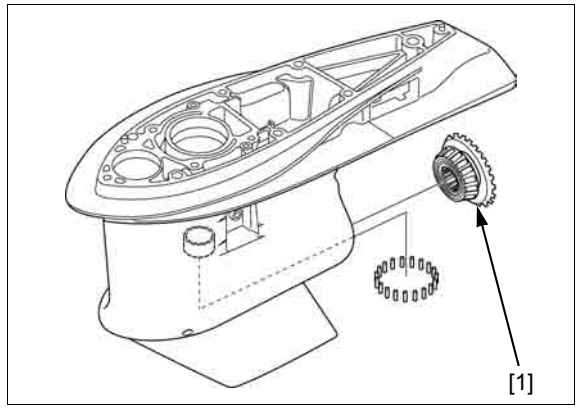
Remove the vertical shaft.

Take care not to drop the needle bearing when removing the vertical shaft.



Remove the forward bevel gear/taper bearing [1] from the gear case.

Remove the nineteen needle bearing rollers [2].

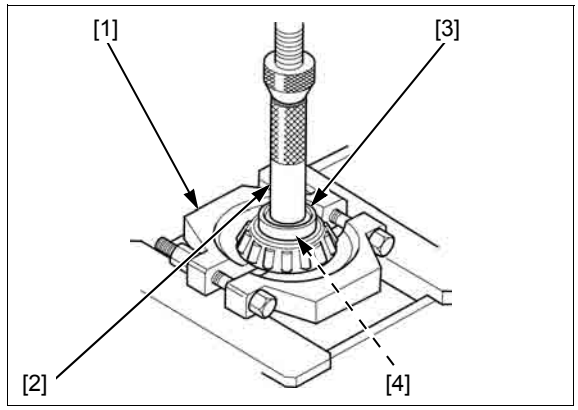


Set a commercially available universal bearing puller [1] between the taper bearing (inner race) and the forward bevel gear.

Drive the taper bearing (60 x 100 x 30 mm) (inner race) out of the forward bevel gear using the special tools and a hydraulic press as shown.

TOOLS:

Driver [2]	**07749-0010000**
Bearing driver attachment, 44 x 49.5 mm [3]	**07945-3330300**
Pilot, 28 mm [4]	**07746-0041100**

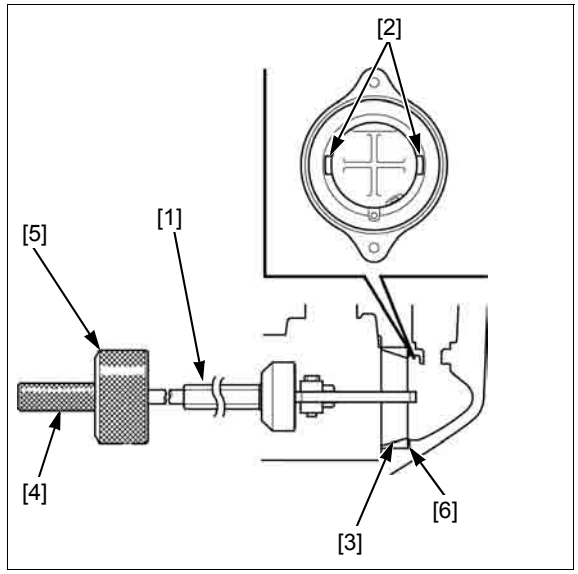


Set the bearing race puller (special tool) [1] in the cutouts [2] in the gear case as shown, and remove the taper bearing (60 x 100 x 30 mm) (outer race) [3].

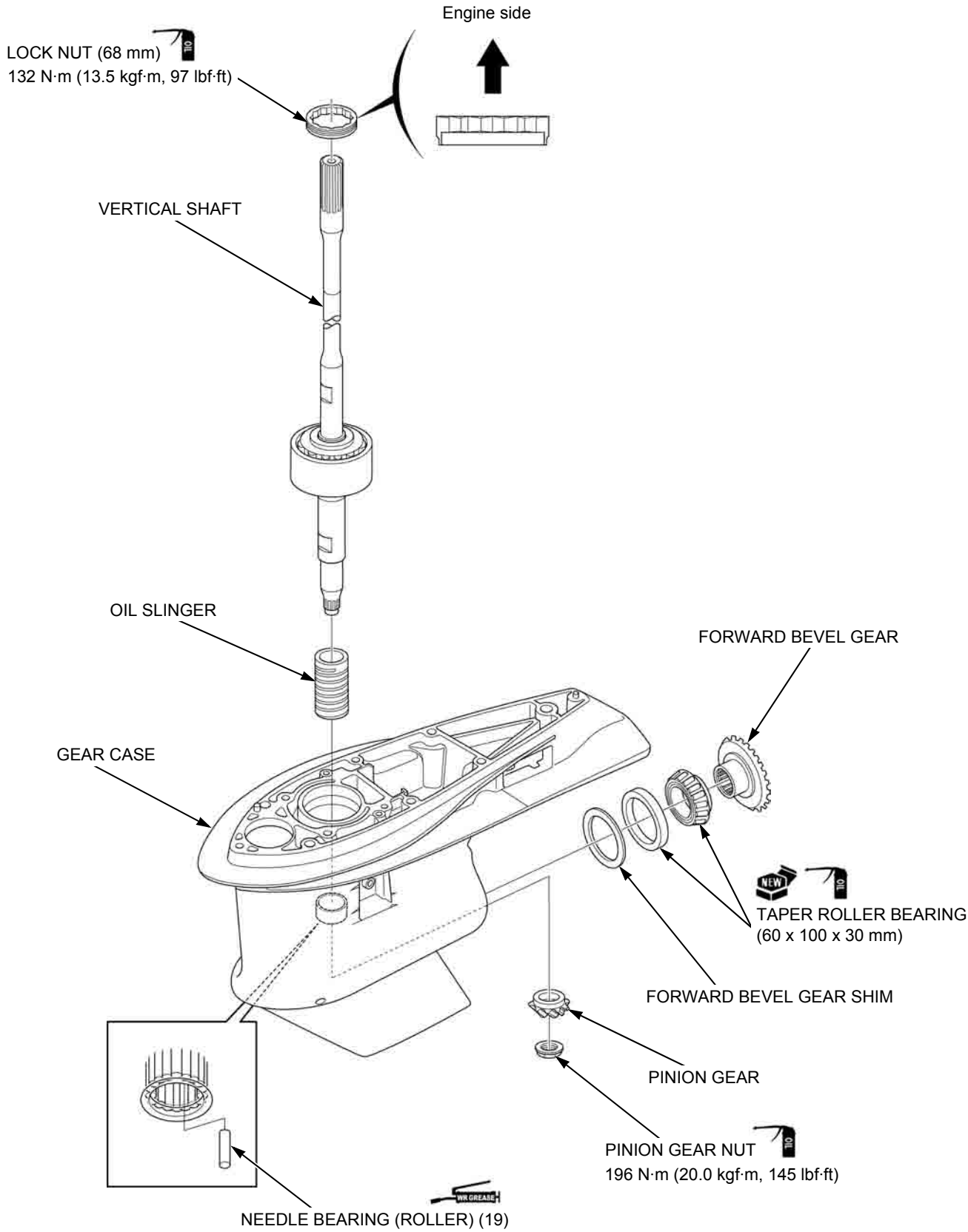
TOOLS:

Bearing race puller	**070PC-ZY3A101**
Remover handle [4]	**07936-3710100**
Remover weight [5]	**07936-371020A or 07936-3710200**

Remove the forward bevel gear shim [6] from the gear case.



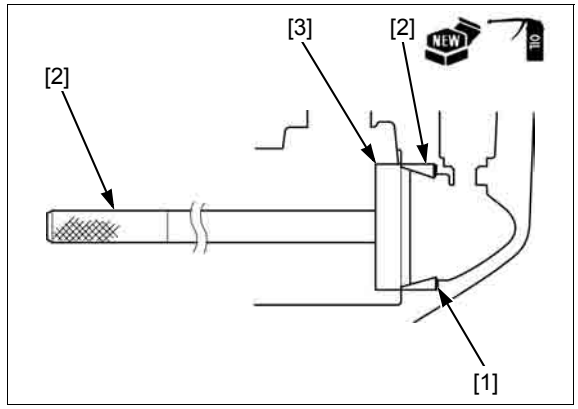
EXPLODED VIEW



INSTALLATION

Install the forward bevel gear shim [1] on the gear case.

- When the gear case, forward bevel gear, or the taper bearing have been replaced with new ones, perform shim adjustment and select the appropriate shim accordingly (page 16-35).



Apply gear oil to a new taper bearing (outer race) [2].

Install the taper bearing (60 x 100 x 30 mm) (outer race) on the gear case using the special tools as shown.

- Replace the taper bearing (outer race) and the inner race with new ones as a set on reassembly.
- Install the taper bearing (outer race) with the smaller I.D. side toward the shim.

TOOLS:

Driver, 480 mm [2]	**070GD-001A100**
Taper bearing installer attachment, 90 mm [3]	**070PF-ZY3A100**

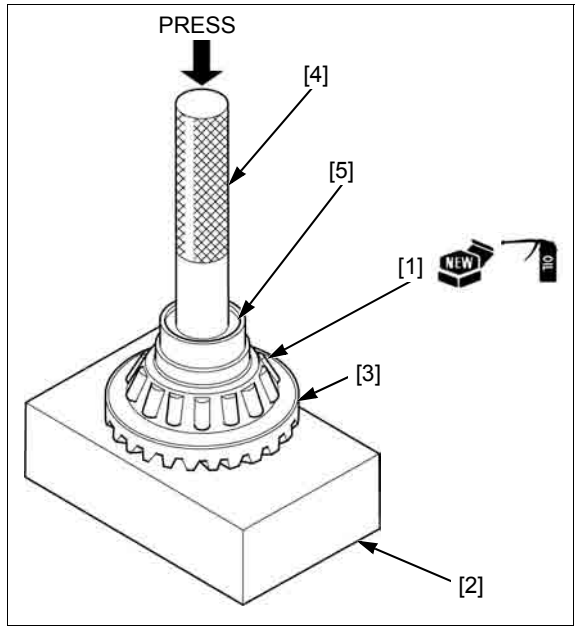
Apply gear oil to the inner surface and the rollers of a new taper bearing (inner race) [1].

Set a wood block [2] under the forward bevel gear [3].

Drive the taper bearing (60 x 100 x 30 mm) (inner race) into the forward bevel gear using the special tools and a hydraulic press.

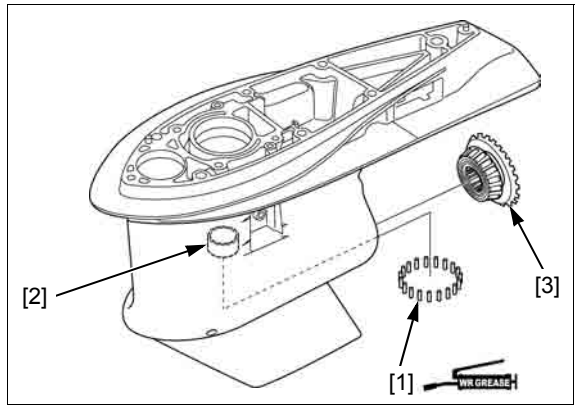
TOOLS:

Driver [4]	**07749-0010000**
Attachment, 52 x 55 mm [5]	**07NAD-P200100**



Apply marine grease to the nineteen needle bearing rollers [1] and install them into the needle bearing outer ring [2].

Install the forward bevel gear/taper bearing [3] into the gear case.



Wipe the tapered part [1] of the vertical shaft [2] and pinion gear [3] with a shop towel and degreasing cleaning solvent.

Apply gear oil to the threads and seating surface of the pinion gear nut [4].

Install the vertical shaft and pinion gear on the gear case, then loosely tighten the pinion gear nut.

Before installing the pinion gear, make sure that the forward bevel gear/taper bearing is positioned in the gear case correctly.

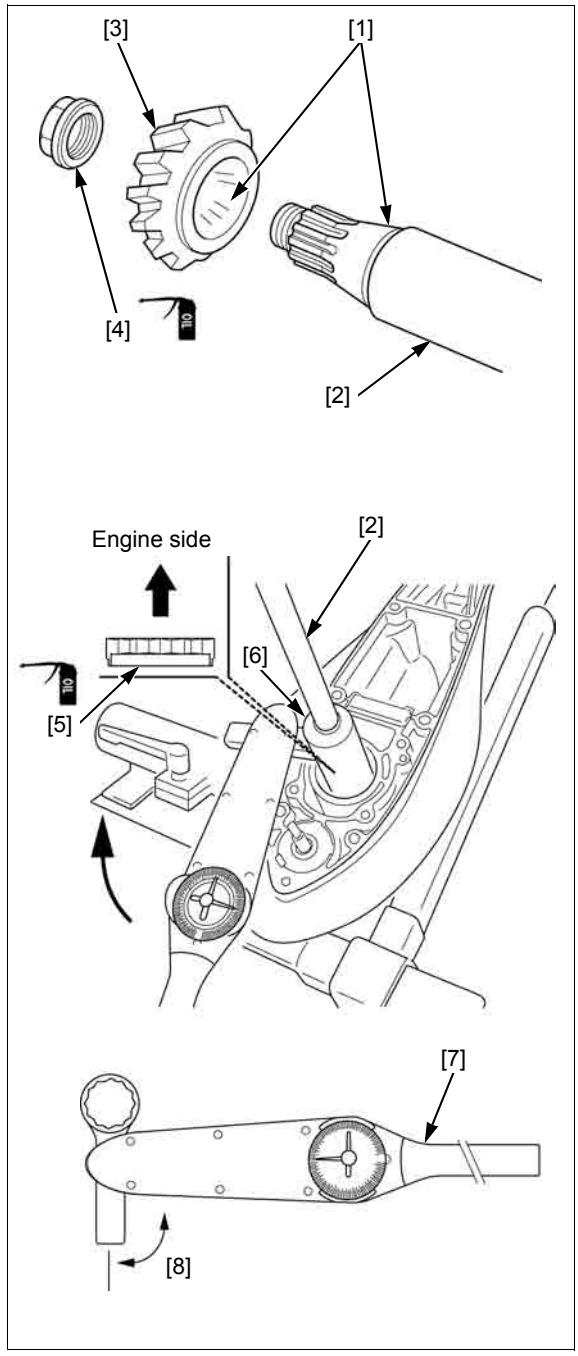
Apply gear oil to the threads and seat of the lock nut [5].

Install the lock nut as shown, noting the installation direction.

Tighten the lock nut to the specified torque using the special tool.

TOOL:
Lock nut wrench, 36 x 47.8 mm [6] 07916-MB00002

TORQUE: 132 N·m (13.5 kgf·m, 97 lbf·ft)



NOTICE

- *Make sure the torque wrench [7] is mounted perpendicular [8] to the special tool. If the torque wrench is not held 90 degrees to the tool, the torque reading will be incorrect.*

Attach the special tool to the end of the vertical shaft [1] as shown.

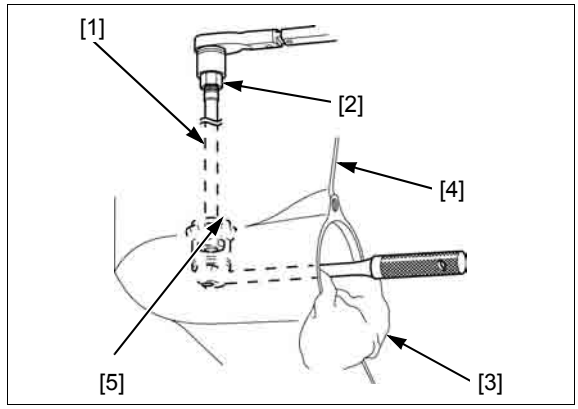
TOOL:
Vertical shaft holder [2] 07SPB-ZW10200

Place a shop towel [3] in the gear case [4] as shown to protect it.

Holding the pinion gear nut [5] as shown, turn the vertical shaft and tighten the pinion gear nut to the specified torque.

TORQUE: 196 N·m (20.0 kgf·m, 145 lbf·ft)

Install the propeller shaft holder (page 16-18).



BEARING HOLDER DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

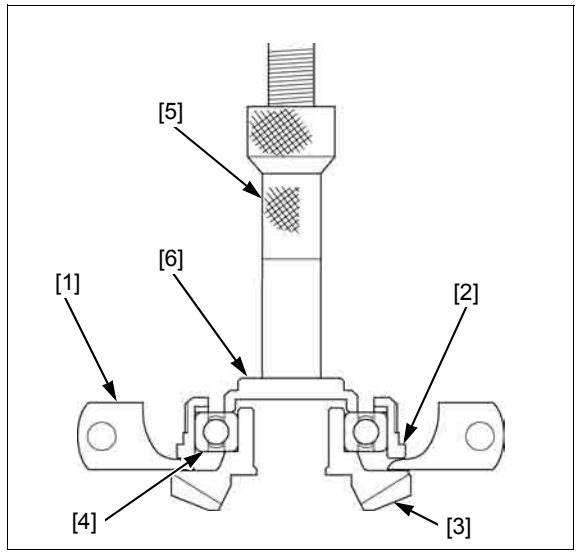
Attach a commercially available universal bearing puller [1] between the bearing holder [2] and the reverse bevel gear [3].

Remove the reverse bevel gear/bearing [4] from the bearing holder using the special tools and hydraulic press as shown.

TOOLS:

Driver [5]	**07749-0010000**
Oil seal driver attachment, 72 mm [6]	**07947-6340201**

Remove the reverse bevel gear shim [6] from the bearing holder.

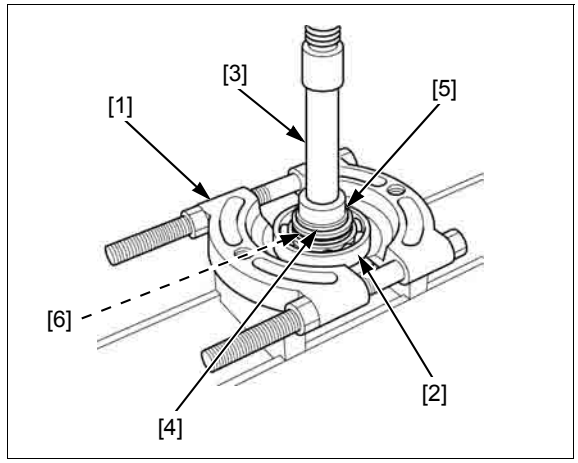


Attach a commercially available universal bearing puller [1] between the reverse bevel gear and the bearing.

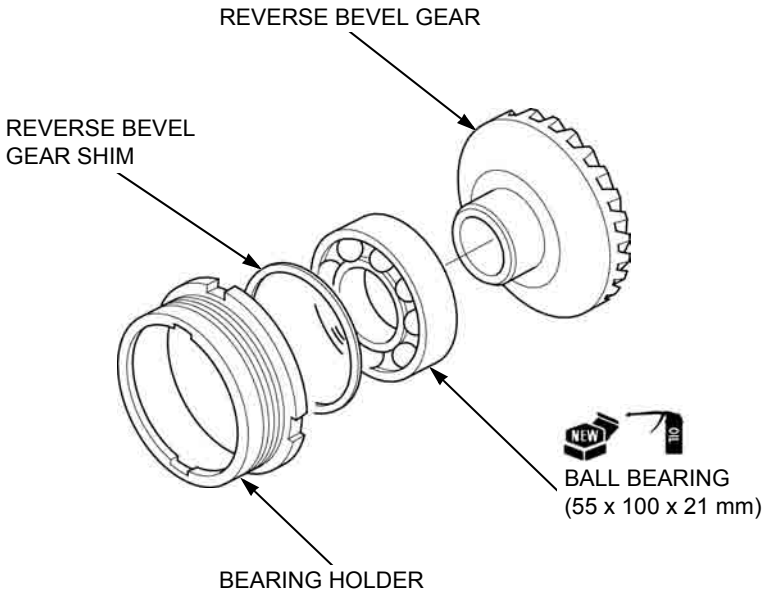
Remove the ball bearing [2] from the reverse bevel gear using the special tools and hydraulic press as shown.

TOOLS:

Driver [3]	**07749-0010000**
Fork seal driver attachment, 27.2 mm [4]	**07747-0010300**
Attachment, 37 x 40 mm [5]	**07746-0010200**
Pilot, 25 mm [6]	**07746-0040600**



EXPLODED VIEW



ASSEMBLY

Install the reverse bevel gear shim [1] on the bearing holder [2].

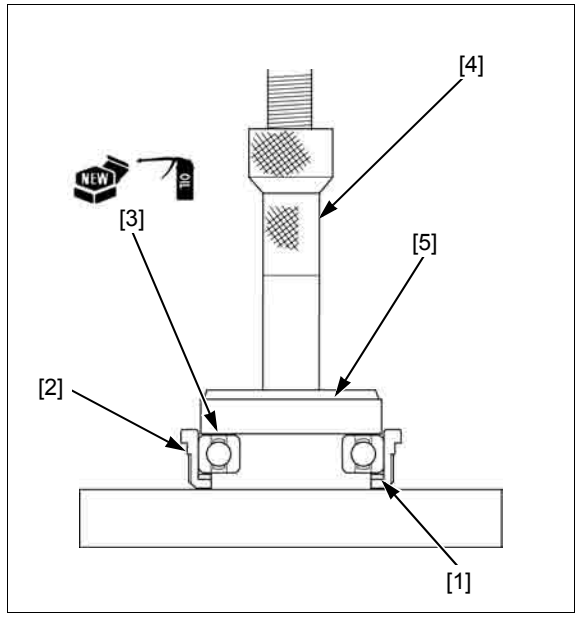
- When the gear case, reverse bevel gear or bearing is replaced with a new one, perform shim adjustment and select the appropriate shim accordingly (page 16-35).

Apply gear oil to the circumference of a new ball bearing (55 x 100 x 21 mm) [3].

Install the ball bearing in the bearing holder using the special tools and a hydraulic press as shown.

TOOLS:

Driver [4]	**07749-0010000**
Oil seal driver attachment, 80 x 96 mm [5]	**07ZAD-PNA0100**

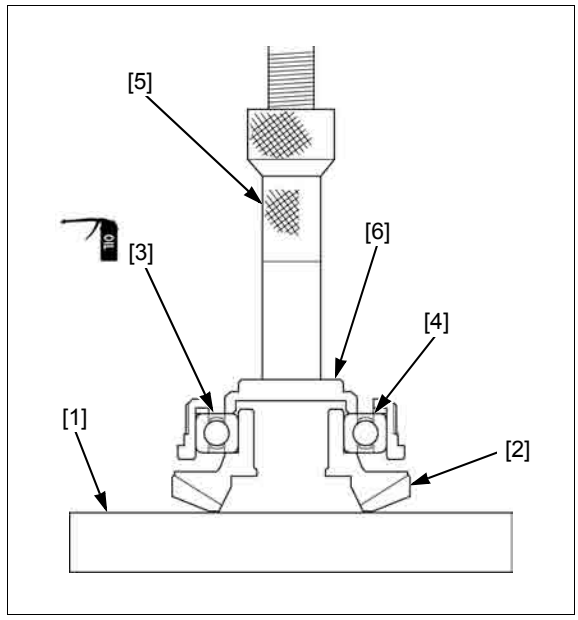


Place a wood block [1] under the reverse bevel gear [2].

Apply gear oil to the outer circumference of the bearing [3].
Install the reverse bevel gear on the bearing holder/ bearing [4] using the special tools and hydraulic press.

TOOLS:

Driver [5]	**07749-0010000**
Oil seal driver attachment, 72 mm [6]	**07947-6340201**



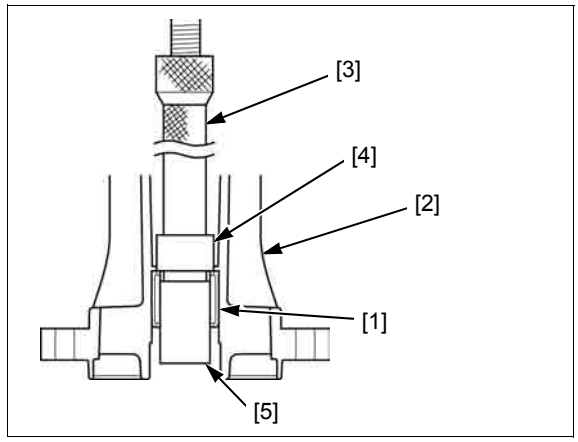
PROPELLER SHAFT HOLDER DISASSEMBLY/ASSEMBLY

DISASSEMBLY

Remove the needle bearing (32 x 42 x 30 mm) [1] from the propeller shaft holder [2] using the special tools and hydraulic press.

TOOLS:

Driver, 280 mm [3]	**07949-3710001**
Oil seal driver attachment, 28 x 35 mm [4]	**07945-4150200**
Pilot, 32 x 50 mm [5]	**07MAD-PR90200**



ASSEMBLY

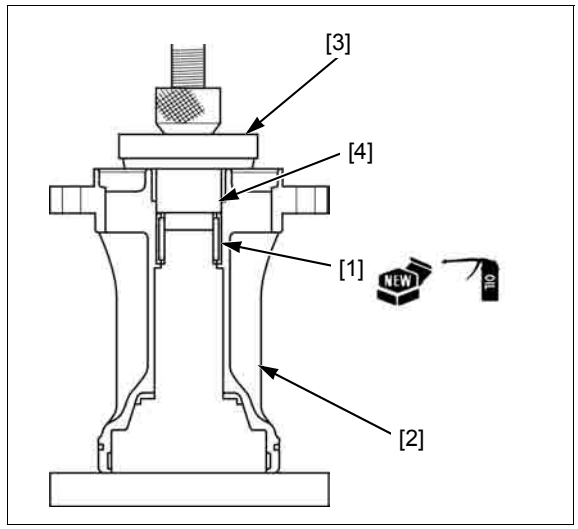
Apply gear oil to the circumference of a new needle bearing.

Drive the needle bearing (32 x 42 x 30 mm) [1] into the propeller shaft holder [2] using the special tools and a hydraulic press as shown.

- Install the needle bearing with the stamped end up (toward the special tool side).

TOOLS:

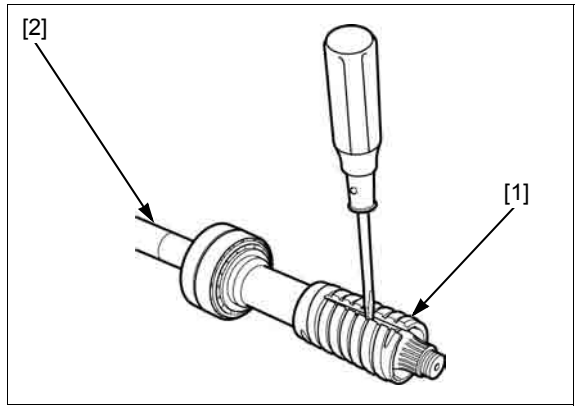
Taper bearing installer attachment, 90 mm [3]	**070PF-ZY3A100**
Attachment, 32 x 42 mm [4]	**070PD-ZY3A100**



VERTICAL SHAFT DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

Remove the oil slinger [1] from the vertical shaft [2] by expanding the cut in the oil slinger with a screwdriver.

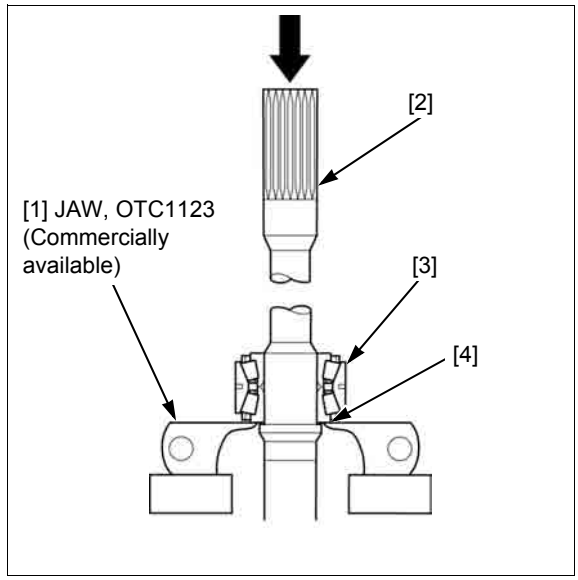


Check the taper roller bearing for abnormal sound and play.
Replace the inner race and outer race as a set if necessary.

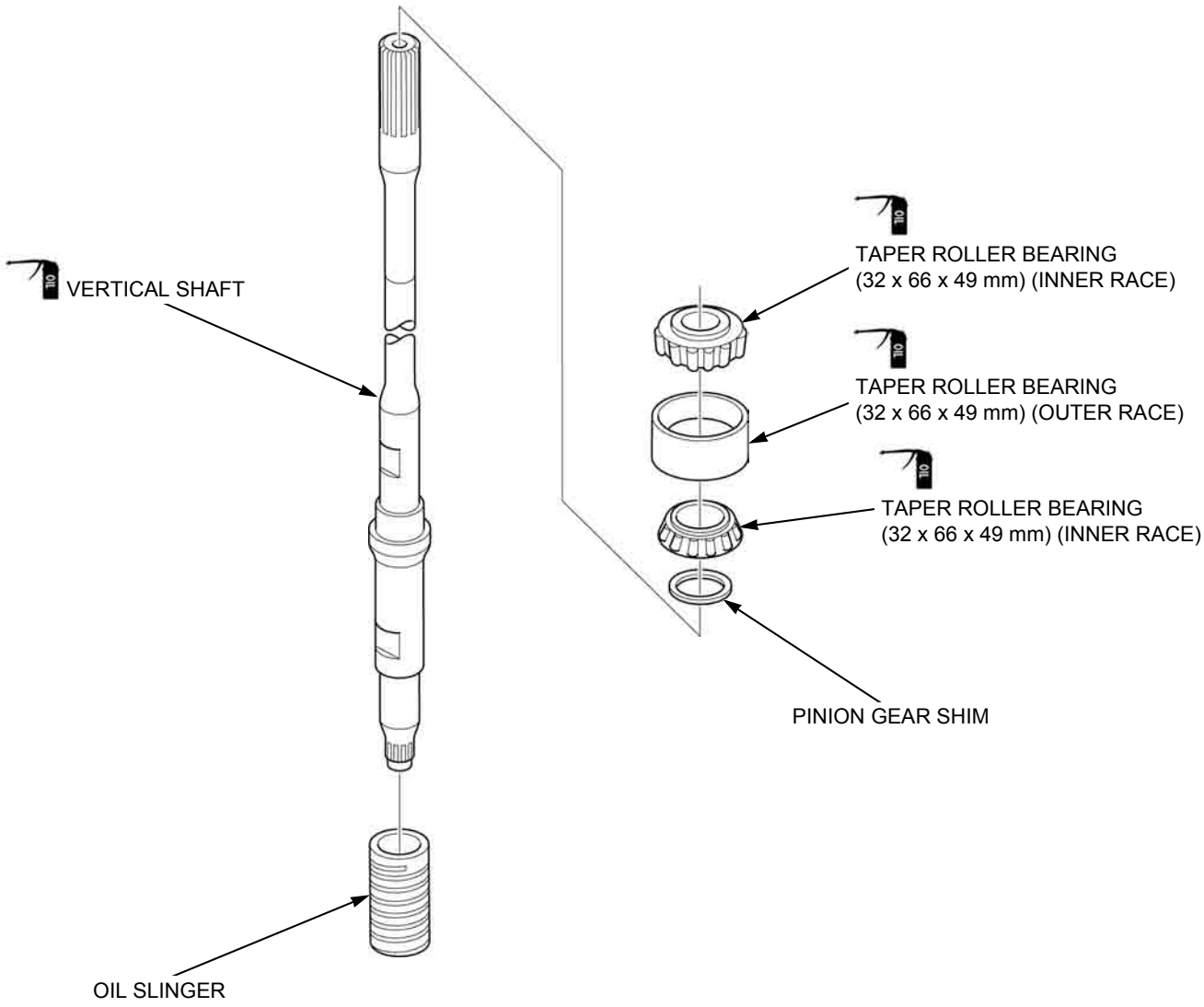
Set a commercially available universal bearing puller [1] on the taper roller bearing [inner race], and install the vertical shaft [2] on the hydraulic press with the flywheel boss installation side facing up.

Remove the taper roller bearing (32 x 66 x 49 mm) [3] from the vertical shaft using a hydraulic press.

Remove the pinion gear shim [4] from the vertical shaft.



EXPLODED VIEW



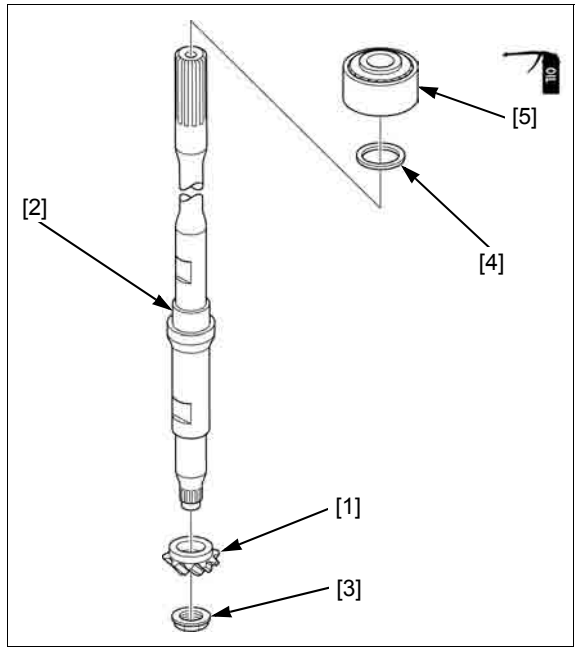
ASSEMBLY

Set the pinion gear [1] on the vertical shaft [2], and loosely tighten the pinion gear nut [3] by hand.

Apply gear oil to the inner surface of the taper roller bearing inner races, rollers, and the inner surface of the outer race. Assemble the inner races and the outer race.

Install the shim [4] and the taper roller bearing [5] on the vertical shaft.

- When the gear case, vertical shaft, pinion gear, or taper roller bearing is replaced with a new one, perform the shim adjustment and select the appropriate shim accordingly (page 16-35).
- Set the taper roller bearing with the side on which the "E" dimension was measured during shim adjustment toward the pinion gear.



Apply gear oil to the taper roller bearing insertion part of the vertical shaft [1].

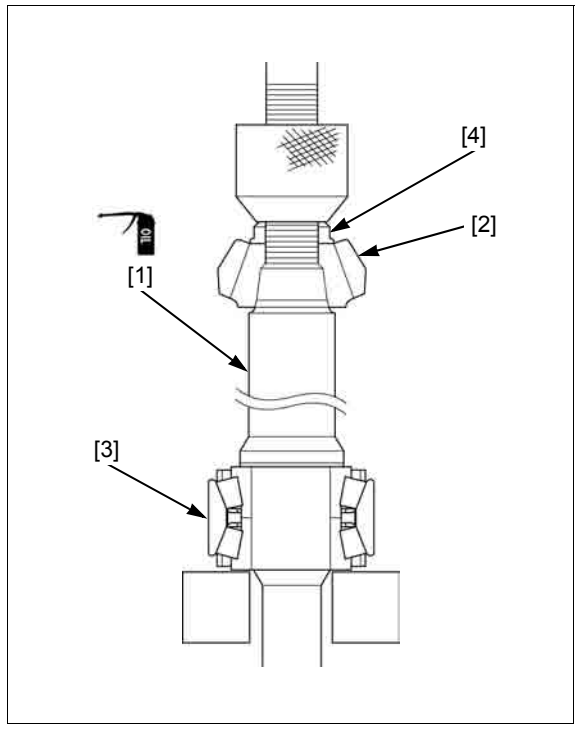
Set the vertical shaft on the hydraulic press with the pinion gear [2] side facing up as shown.

Install the taper roller bearing (32 x 66 x 49 mm) [3] on the vertical shaft using the hydraulic press.

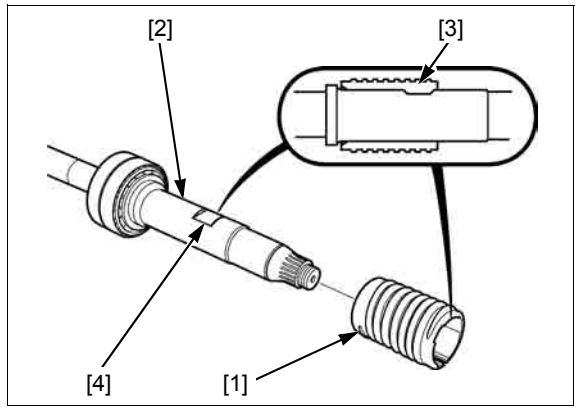
- Check that the taper roller bearing inner race is set on the hydraulic press table securely.
- Do not damage the threads at the end of the vertical shaft (pinion gear nut [4] installation part).

After installation, turn the outer race ten to twenty turns and check that the bearing turns smoothly.

Remove the pinion gear nut and the pinion gear from the vertical shaft.



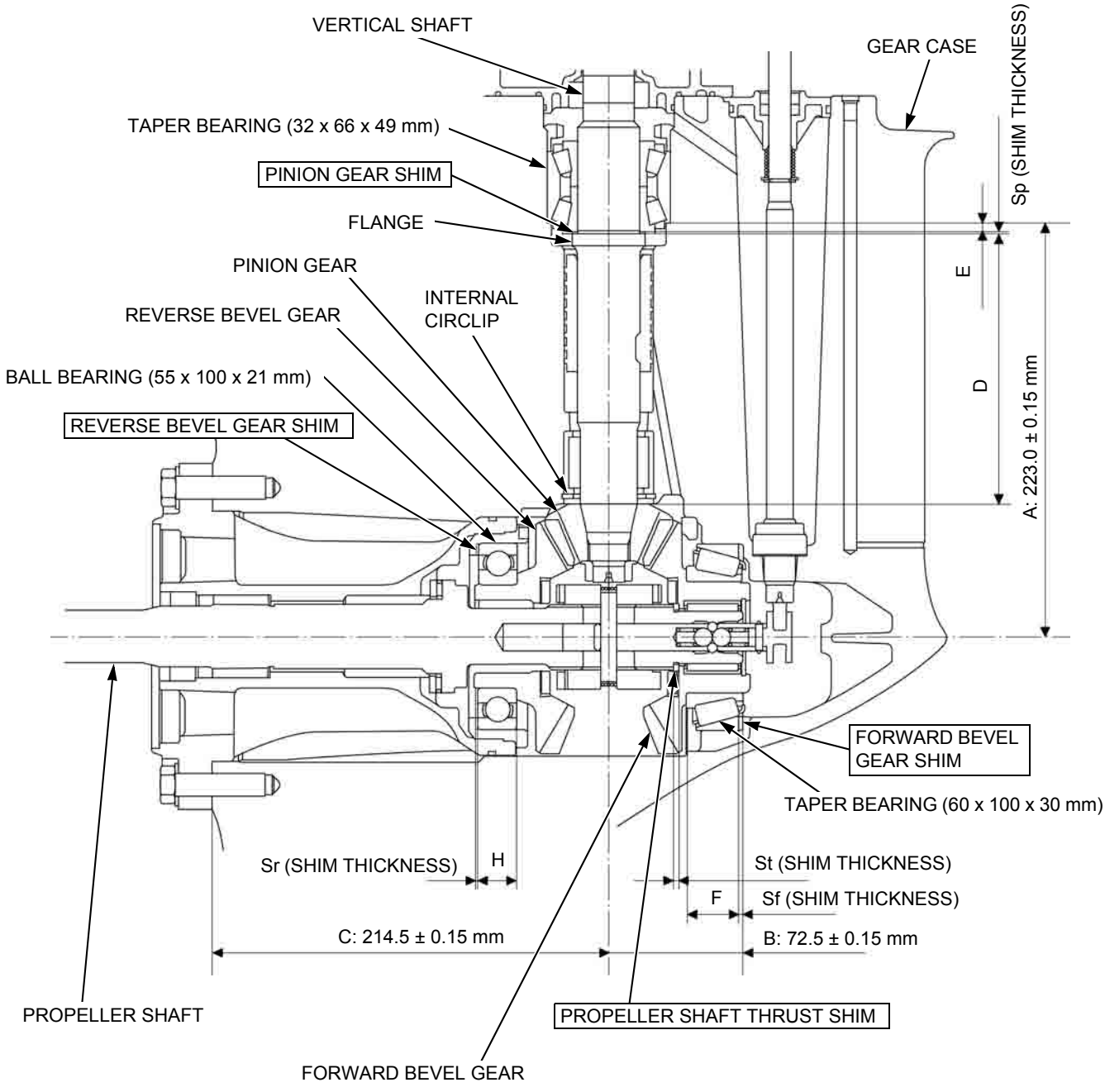
Install the oil slinger [1] on the vertical shaft [2] by aligning the projection [3] on the inside of the oil slinger with the recess [4] on the pinion gear installation side of the vertical shaft.



SHIM SELECTION

SHIM POSITION

- Use shims to adjust the position of each gear so that they engage properly. Perform shim adjustment if the backlash of a gear is outside the specification or after replacing the gear case, vertical shaft, propeller shaft, or bearing with a new one.



PINION GEAR SHIM

Remove the taper roller bearing (32 x 66 x 49 mm) if it is mounted on the vertical shaft [1] (page 16-32).

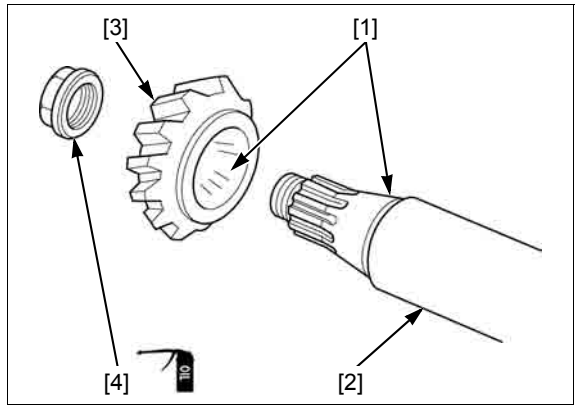
Clean the tapered surfaces [1] of the vertical shaft [2] and pinion gear [3] thoroughly using a shop towel and degreasing cleaning agent.

Apply gear oil to the threads and seating surface of the pinion gear nut [4].

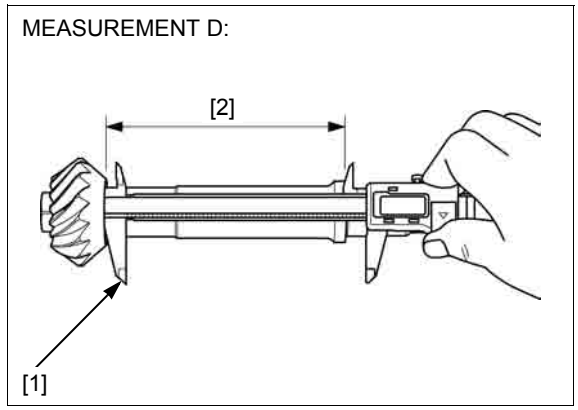
Install the pinion gear on the vertical shaft.
Tighten the pinion gear nut to the specified torque using the special tool.

TOOL:
Vertical shaft holder 07SPB-ZW10200

TORQUE: 196 N·m (20.0 kgf·m, 145 lbf·ft)

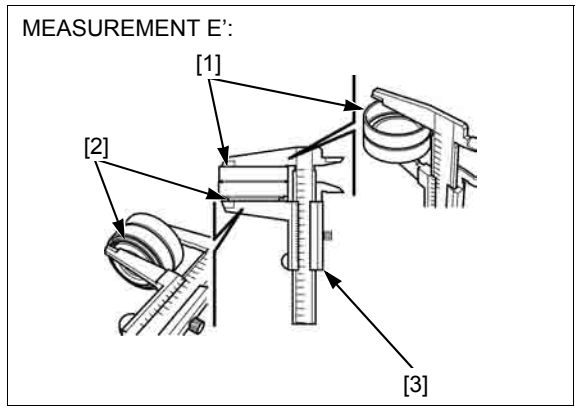


Use a vernier caliper [1] to measure distance (D) [2] from the end of the pinion gear to the end of the flange of the vertical shaft as shown. Record this measurement.



Assemble the outer race [1] and the inner race [2] of the taper roller bearing (32 x 66 x 49 mm), and turn the outer race two or three turns to fit the bearings.

Remove one side of the inner race and measure the bearing height (E') from the outer race end to the inner race end using a regular vernier caliper [3] as shown, and record the measurement.



Measure the height (E'') of the taper roller bearing (outer race [1]) using a regular vernier caliper [2], and record it.

Calculate the length from the inner race end to the outer race end (E) by determining the gap between the measurements E' and E'' using the following formula.

Formula: E= E' – E''

Example:
When measurement (E') from the outer race end to the inner race end is 34.90 mm (1.374 in), and outer race height (E'') is 29.70 mm (1.169 in):

E= 34.90 – 29.70 = 5.20
The gap (E) from the inner race end to the outer race end is 5.20 mm (0.205 in).

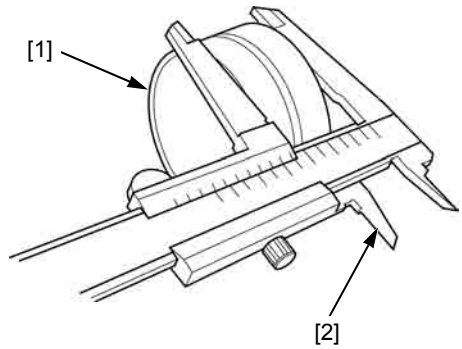
Determine the tolerance and record it using the measurement (D), calculation (E) and the following formula.

Formula: Tolerance = D + E – 152.50

Example:
When measurement (D) from the pinion gear end to the end of the vertical shaft collar is 147.10 mm (5.791 in), and calculation (E) from the inner race end to the outer race end is 5.20 mm (0.205 in):

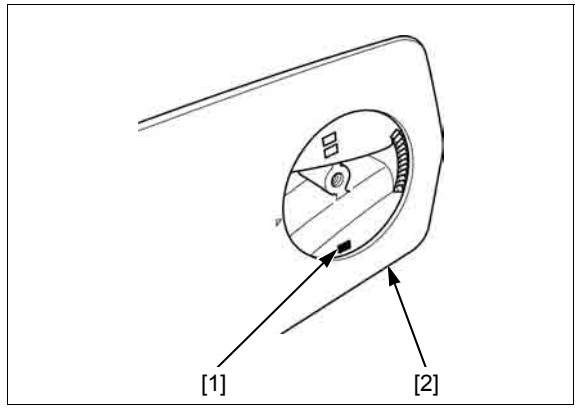
147.10 + 5.20 – 152.50 = –0.20
The tolerance is –0.20 mm (–0.008 in).

MEASUREMENT E'':



Remove the trim tab from the gear case (page 16-8).

Cross reference the engagement mark [1] located on the trim tab installation part of the gear case [2] and the tolerance calculated in the previous step, and refer to the pinion gear shim selection table to determine the required thickness of the shim (Sp).



Pinion gear shim selection table

Unit: mm

		Calculation value													
		–0.37 – –0.25	–0.25 – –0.20	–0.20 – –0.15	–0.15 – –0.10	–0.10 – –0.05	–0.05 – 0	0 – +0.05	+0.05 – +0.10	+0.10 – +0.15	+0.15 – +0.20	+0.20 – +0.25	+0.25 – +0.30	+0.30 – +0.35	+0.35 – +0.43
Gear case engagement mark	A	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20	0.15
	B	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20
	C	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25
	D	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30
	E	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35
	F	1.05	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40

Select the shims from the pinion gear shims of different thickness to obtain the required thickness (Sp) by combining the shims.

Shim type table

Shim type	Thickness
Shim A	0.10 mm
Shim B	0.15 mm
Shim C	0.30 mm
Shim D	0.50 mm

Install the trim tab on the gear case (page 16-9).

After shim selection, inspect the forward bevel gear backlash (page 16-41).

HOW TO READ SHIM SELECTION TABLE

When the engagement mark on the gear case housing is E and the tolerance is –0.20 mm (–0.008 in), the shim selection table shows that the required shim thickness is 0.90 mm (0.035 in). (See the table shown below).

Pinion gear shim selection table

Unit: mm

		Calculation value													
		–0.37 – –0.25	–0.25 – –0.20	–0.20 – –0.15	–0.15 – –0.10	–0.10 – –0.05	–0.05 – 0	0 – +0.05	+0.05 – +0.10	+0.10 – +0.15	+0.15 – +0.20	+0.20 – +0.25	+0.25 – +0.30	+0.30 – +0.35	+0.35 – +0.43
Gear case engagement mark	A	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20	0.15
	B	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20
	C	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25
	D	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30
	E	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35
	F	1.05	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40

HOW TO SELECT SHIM COMBINATION

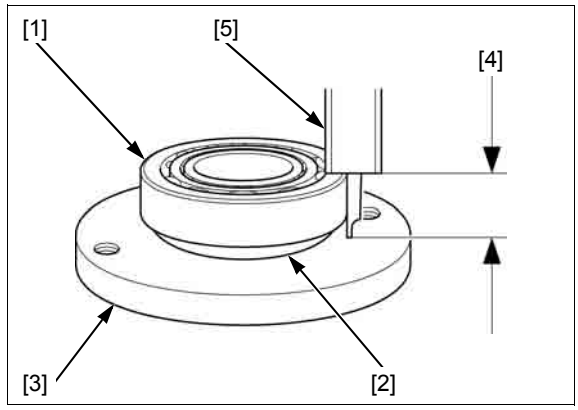
To obtain 0.90 mm (0.035 in) of shim thickness, combine one gear shim A, one gear shim C, and one gear shim D, or combine four gear shim A and one gear shim D.

FORWARD BEVEL GEAR SHIM

Assemble the outer race [1] and the inner race [2] of a new taper bearing (60 x 100 x 30 mm), and turn the outer race two or three turns.

Place the bearing assembly on a flat surface [3] with its tapered side facing down.

Press the outer race down over the inner race and measure the bearing height (F) [4] from the outer race end to the inner race end using a regular vernier caliper [5] as shown, and record the measurement.



Calculate the tolerance using the measurement F obtained in the previous step and the following formula.

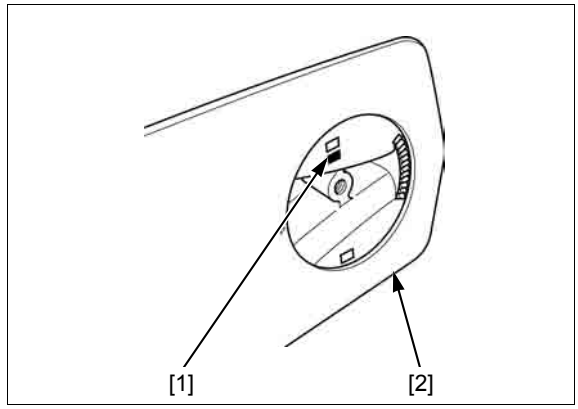
Formula: Tolerance = F – 30.5

Example:
When measurement (F) from the outer race end to the inner race end is 30.55 mm (1.203 in):

Tolerance = 30.55 – 30.5 = 0.05
The tolerance is 0.05 mm (0.002 in).

Remove the trim tab from the gear case (page 16-8).

Cross reference the engagement mark [1] located on the trim tab installation part of the gear case [2] and the tolerance calculated in the previous step, and refer to the forward bevel gear shim selection table to determine the required thickness of the shim (Sf).



Forward bevel gear shim selection table

Unit: mm

		Calculation value			
		0 – +0.05	+0.05 – +0.10	+0.10 – +0.15	+0.15 – +0.20
Gear case engagement mark	1	0.40	0.35	0.30	0.25
	2	0.35	0.30	0.25	0.20
	3	0.30	0.25	0.20	0.15
	4	0.25	0.20	0.15	0.10
	5	0.20	0.15	0.10	–
	6	0.15	0.10	–	–

Refer to page 16-38 for information on how to read the shim selection table and shim combination.

Select the shims from the forward bevel gear shims of different thickness to obtain the required thickness (Sf) by combining the shims.

Shim type table

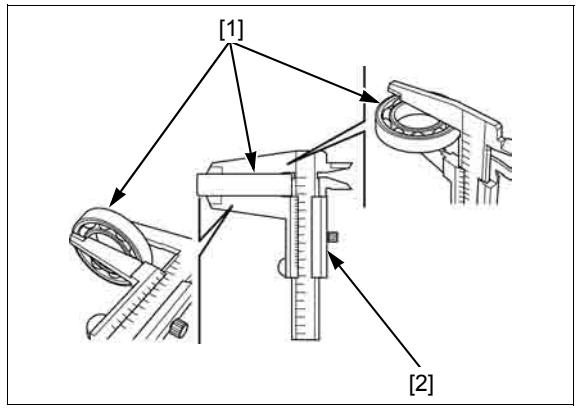
Shim type	Thickness
Shim A	0.10 mm
Shim B	0.15 mm
Shim C	0.30 mm
Shim D	0.50 mm

Install the trim tab on the gear case (page 16-9).

After shim selection, inspect the forward bevel gear backlash (page 16-41).

REVERSE BEVEL GEAR SHIM

Measure the bearing height (H) of a new ball bearing (55 x 100 x 21 mm) [1] using a regular vernier caliper [2] as shown, and record the measurement.



Calculate the tolerance using the measurement H obtained in the previous step and the following formula.

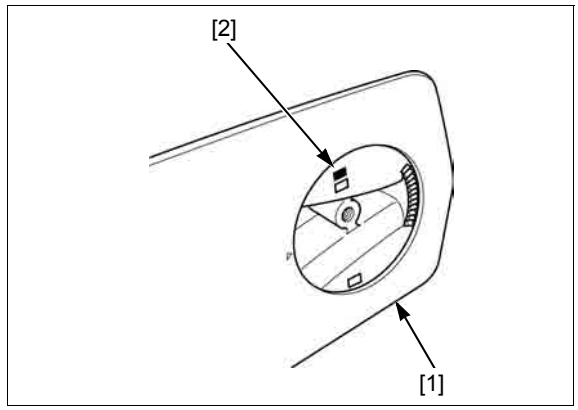
Formula: Tolerance = H – 21.5

Example:
When measurement (H) is 21.45 mm (0.844 in):

Tolerance = 21.45 – 21.5 = –0.05
The tolerance is –0.05 mm (–0.002 in).

Remove the trim tab from the gear case (page 16-8).

Cross reference the engagement mark [1] located on the trim tab installation part of the gear case [2] and the tolerance, and refer to the reverse bevel gear shim selection table to determine the required thickness of the shim (Sr).



Reverse bevel gear shim selection table

Unit: mm

		Calculation value					
		–0.29 – –0.25	–0.25 – –0.20	–0.20 – –0.15	–0.15 – –0.10	–0.10 – –0.05	–0.05 – 0
Gear case engagement mark	A	0.40	0.35	0.30	0.25	0.20	0.15
	B	0.45	0.40	0.35	0.30	0.25	0.20
	C	0.50	0.45	0.40	0.35	0.30	0.25
	D	0.55	0.50	0.45	0.40	0.35	0.30
	E	0.60	0.55	0.50	0.45	0.40	0.35
	F	0.65	0.60	0.55	0.50	0.45	0.40

Refer to page 16-38 for information on how to read the shim selection table and shim combination.

Select the shims from the reverse bevel gear shims of different thickness to obtain the required thickness (Sr) by combining the shims.

Shim type table

Shim type	Thickness
Shim A	0.10 mm
Shim B	0.15 mm
Shim C	0.30 mm
Shim D	0.50 mm

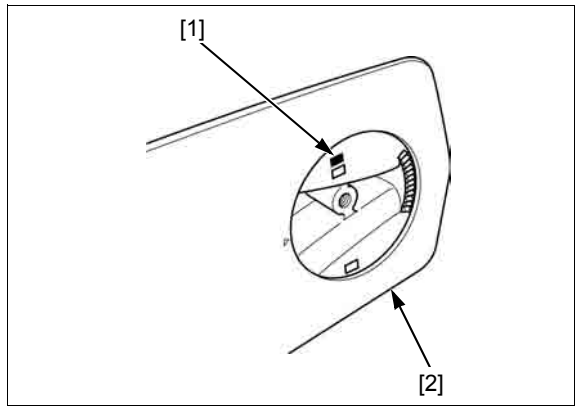
Install the trim tab on the gear case (page 16-9).

After shim selection, inspect the reverse bevel gear backlash (page 16-43).

THRUST SHIM

Remove the trim tab from the gear case (page 16-8).

Cross reference the engagement mark [1] located on the trim tab installation part of the gear case [2] and refer to the shim selection table to determine the required thickness of the shim (St).



Shim selection table Unit: mm

		Thickness	Trust shim name
Gear case engagement mark	A	2.85	Trust shim C
	B	2.90	Trust shim D
	C	2.95	Trust shim E
	D	3.00	Trust shim F
	E	3.05	Trust shim G
	F	3.10	Trust shim H

Select the shims from the thrust shims of different thickness, and install the shim.

Install the trim tab on the gear case (page 16-9).

After shim selection, inspect the propeller shaft thrust clearance (page 16-44).

BACKLASH INSPECTION

FORWARD BEVEL GEAR BACKLASH

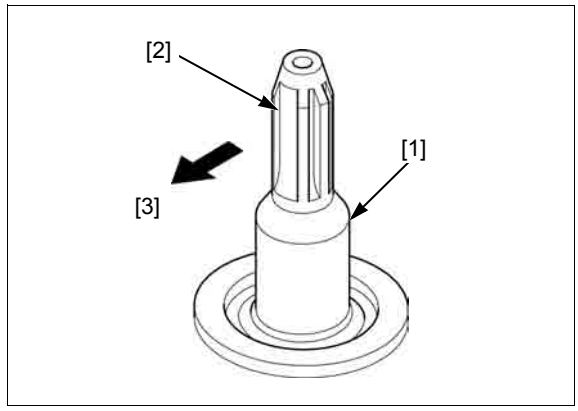
Backlash adjustment must be made after adjustment of each gear shim (page 16-35).

Install the following parts except the water pump.

– Vertical shaft/forward bevel gear (page 16-28)
– Propeller shaft holder (page 16-18)
– Shift rod (page 16-16)

Check that the shift rod [1] in the gear case is in the "N" (Neutral) position.

- The shift rod is in the "N" (Neutral) position if the cutout [2] in the shift rod spline is in the cruising direction [3].

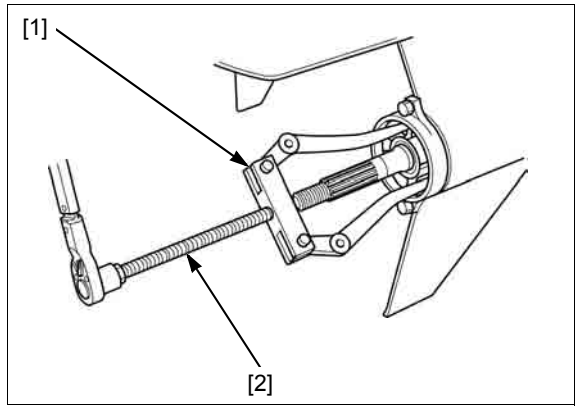


Hold the propeller shaft securely with the 2 jaw puller (commercially available) [1] as shown, and tighten the puller to the specified torque.

TOOLS (commercially available):
Puller, 2 jaw

Pins (2 required)	**CJ-105-11**
Pressure screw	**CJ-105-3**
Jaws	**CJ-105-6**
Tip	**CJ-66-15-3**
Yoke	**CJ-86-1**

TORQUE: 5 N·m (0.51 kgf·m, 3.7 lbf·ft)

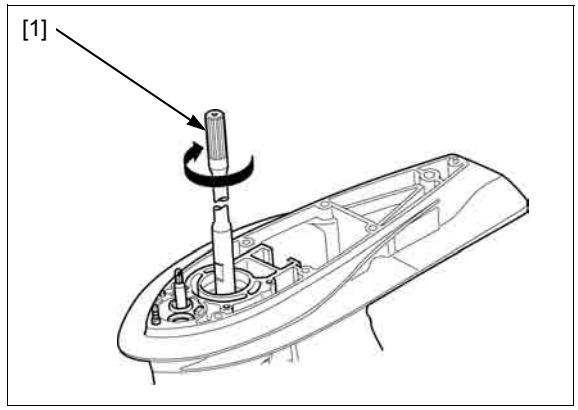


Turn the vertical shaft [1] five to ten turns clockwise to fit the taper bearing.

Retighten the puller bolt to the specified torque.

TORQUE: 5 N·m (0.51 kgf·m, 3.7 lbf·ft)

Repeat the procedure several times.

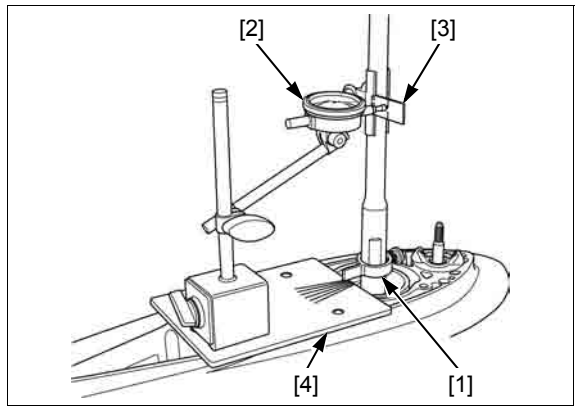


Set the special tools as shown.

TOOLS:

Backlash indicator tool [1]	**07SPJ-ZW0030B**
Backlash inspection tool set	**070PJ-ZX20200**

- Adjust the dial indicator [2] so its needle is at the line of the indicator clip [3].
- Align the backlash indicator tool with line of the base plate [4]



Turn the vertical shaft lightly right and left and record the dial indicator reading.

Measure the backlash at six lines of the base plate.

Turn the vertical shaft 180° and measure the backlash in the same manner.

- Retighten the puller bolt to the specified torque before each measurement.
- When measuring the backlash, do not turn the propeller shaft by turning the vertical shaft.

Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

Formula:
Backlash = Dial gauge runout ÷ 0.806

Example:
When dial gauge runout is 0.285 mm (0.0112 in),
Backlash =
0.285 mm (0.0112 in) ÷ 0.806 = 0.35 mm (0.014 in)

STANDARD VALUE:
0.30 – 0.54 mm (0.012 – 0.021 in)

If the backlash is too large compared to the standard value, increase the forward bevel gear shim thickness and recheck the backlash.

If the backlash is too small compared to the standard value, reduce the forward bevel gear shim thickness and recheck the backlash.

- Use the special tool when taper bearing (60 x 100 x 30 mm) [outer race] is removed to adjust the backlash again.
- Inspect the reverse bevel gear backlash after adjustment of the pinion gear shim (page 16-43).
- Inspect the propeller shaft thrust clearance after adjustment of the forward bevel gear shim (page 16-44).

REVERSE BEVEL GEAR BACKLASH

Backlash adjustment must be made after adjustment of each gear shim (page 16-35).

Install the following parts except the water pump.

– Vertical shaft/forward bevel gear (page 16-28)
– Propeller shaft holder (page 16-18)
– Shift rod (page 16-16)

Wrap a shop towel [1] around the shift rod spline [2], and use pliers to turn the shift rod in the direction shown (cutout of the shift rod spline [3] is toward the left side of the cruising direction [4]).

Set the special tools as shown.

TOOLS:

Backlash indicator tool [5]	**07SPJ-ZW0030B**
Backlash inspection tool set	**070PJ-ZX20200**

- Adjust the dial indicator [6] so its needle is at the line of the indicator clip [7].
- Align the backlash indicator tool with line of the base plate [8]

Turn the vertical shaft lightly right and left and record the dial indicator reading.
Measure the backlash at six lines of the base plate.
Turn the vertical shaft 180° and measure the backlash in the same manner.

When measuring the backlash, do not turn the propeller shaft by turning the vertical shaft.

Obtain the reverse bevel gear backlash using the dial indicator runout and the following formula.

Formula:
Backlash = Dial gauge runout ÷ 0.806

Example:
When dial gauge runout is 0.285 mm (0.0112 in),
Backlash =
0.285 mm (0.0112 in) ÷ 0.806 = 0.35 mm (0.014 in)

STANDARD VALUE:
0.40 – 0.65 mm (0.016 – 0.026 in)

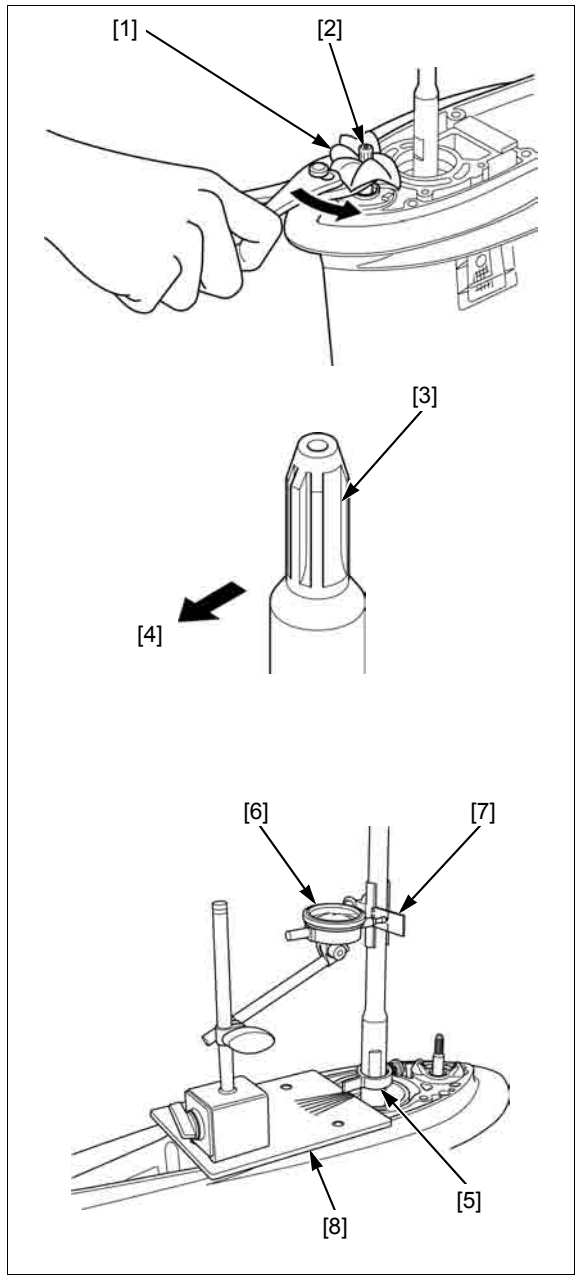
If the backlash is too large compared to the standard value, increase the reverse bevel gear shim thickness and recheck the backlash.

If the backlash is too small compared to the standard value, reduce the reverse bevel gear shim thickness and recheck the backlash.

- Use the special tool when reverse bevel gear/ bearing is removed to adjust the backlash again.
- Inspect the propeller shaft thrust clearance after adjustment of the pinion gear shim (page 16-44).

Install the water pump (page 11-12).

After installation, inspect the gear case pressure (page 16-45)



PROPELLER SHAFT THRUST CLEARANCE INSPECTION

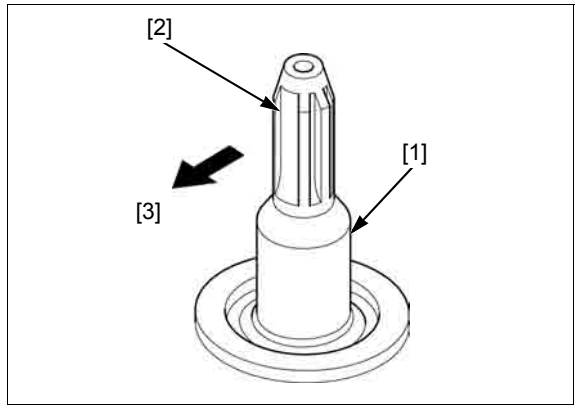
Adjust the propeller shaft thrust clearance after inspection of the backlash.

Install the following parts except the water pump.

– Vertical shaft/forward bevel gear (page 16-28)
– Propeller shaft holder (page 16-18)
– Shift rod (page 16-16)

Check that the shift rod [1] in the gear case is in the "N" (Neutral) position.

- The shift rod is in the "N" (Neutral) position if the cutout [2] in the shift rod spline is in the cruising direction [3].



Set the gear case so that the propeller shaft is in the vertical position and secure the gear case.

Install the castle nut [1] to the propeller shaft.

Hold the propeller shaft securely with the 2 jaw puller (commercially available) [2] as shown.

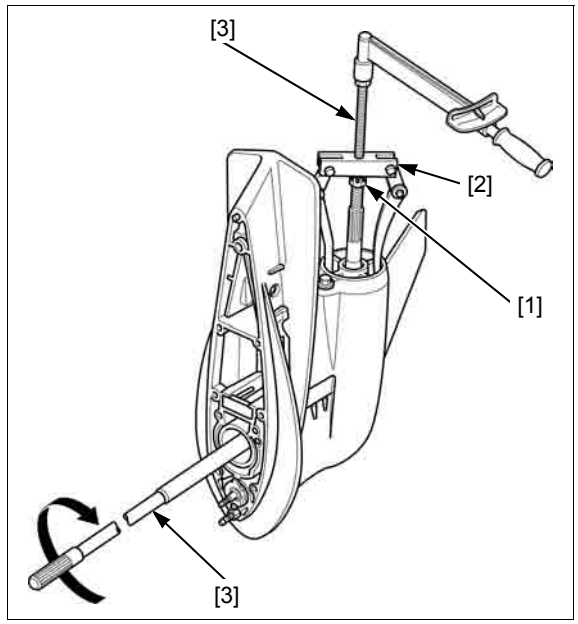
TOOLS (commercially available):
Puller, 2 jaw

Pins (2 required)	**CJ-105-11**
Pressure screw	**CJ-105-3**
Jaws	**CJ-105-6**
Tip	**CJ-66-15-3**
Yoke	**CJ-86-1**

Tighten the puller bolt to the specified torque while turning the vertical shaft [3] five to ten turns clockwise.

- Be sure to turn the vertical shaft while maintaining the specified torque in order to stabilize the taper bearing in fully seated position.

TORQUE: 5 N·m (0.51 kgf·m, 3.7 lbf·ft)

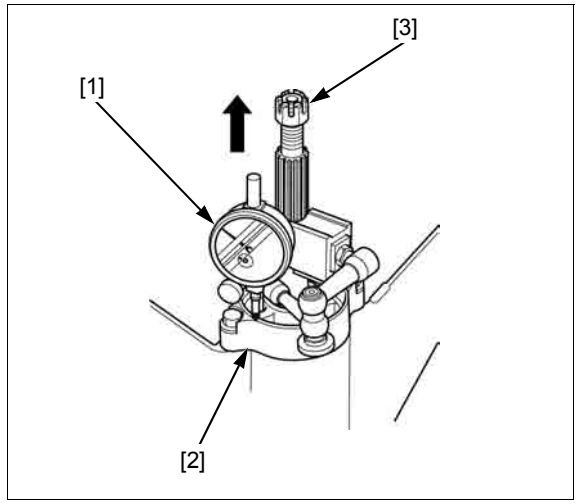


Remove the 2 jaw puller.

Set the dial indicator [1] on the propeller shaft and bring the tip of the gauge in contact with the rib of the propeller shaft holder [2] perpendicularly.
Hold the castle nut [3] and pull the propeller shaft up in the direction shown and note the first measurement of the propeller shaft thrust clearance.

Thrust clearance 0.20 – 0.40 mm (0.008 – 0.016 in)

- The clearance must be measured at the first attempt. If you pull up the shaft more than once, measurement will be inaccurate as it affects the relative position of taper roller bearing inner/outer race.
- If you have to recheck the clearance, remove the dial indicator and reinstall the special tools to reposition the bearing races.



If the clearance is too large, increase the thrust shim thickness and recheck the clearance.
If the clearance is too small, reduce the thrust shim thickness and recheck the clearance.

Install the water pump (page 11-12).

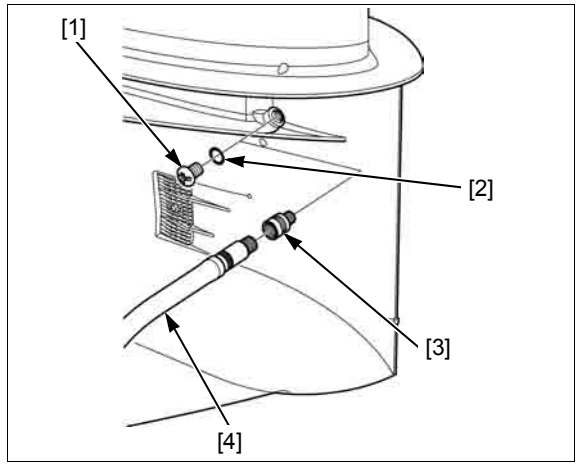
After installation, inspect the gear case pressure (page 16-45)

GEAR CASE PRESSURE INSPECTION

- Perform the gear case pressure check and check for pressure leakage after disassembling and reassembling the gear case.
- In principle, the pressure check should be made on the gear case before filling it with gear oil and before installing it on the outboard motor. However, the check can be made with the gear case filled with gear oil.

Remove the oil check bolt [1] and the O-ring [2].

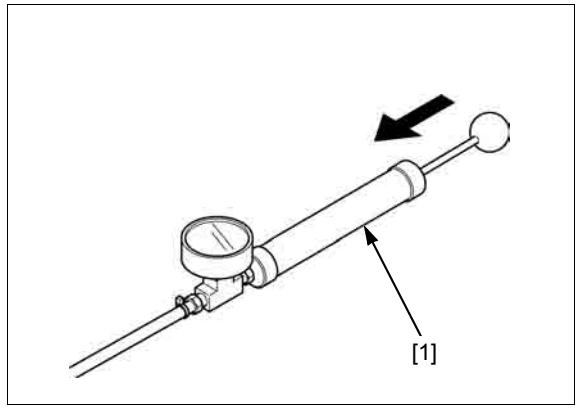
Install the adapter (STV-3334Y: commercially available) [3] in the oil check bolt hole.
Attach the hose end of the pressure tester (STV-V34: commercially available) [4] to the adapter.
Do not screw in the adapter and the hose end with force.



While watching pressure tester gauge [1], apply the specified air pressure to the gear case by pumping the handle slowly.

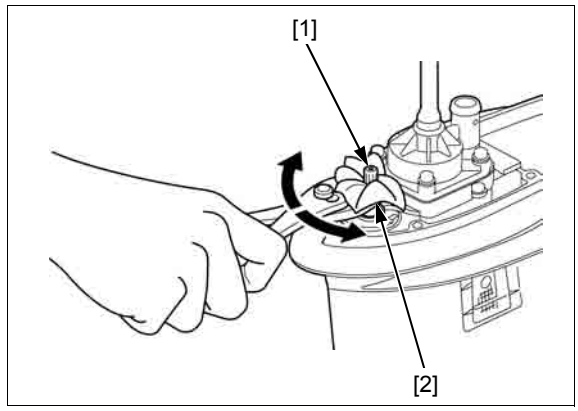
Do not apply excessive air pressure.

AIR PRESSURE:
29 kPa (0.3 kgf/cm^2, 4.3 psi)



While applying the specified air pressure to the gear case, move the shift rod [1] right and left five or six times using pliers.

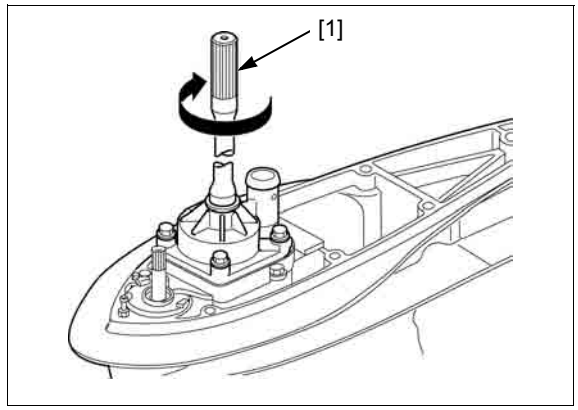
Wrap a shop towel [2] around the shift rod spline to move the shift rod with pliers.



While applying the specified air pressure to the gear case, turn the vertical shaft [1] five or six turns clockwise.

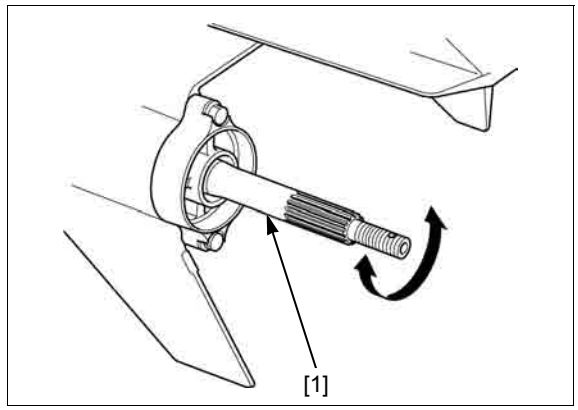
NOTICE

- *Be sure to turn the vertical shaft clockwise, or damage to the water pump impeller can occur.*



While applying the specified air pressure to the gear case, turn the propeller shaft [1] right and left two or three turns.

Leave the gear case for five minutes, and then check that the air pressure is maintained.



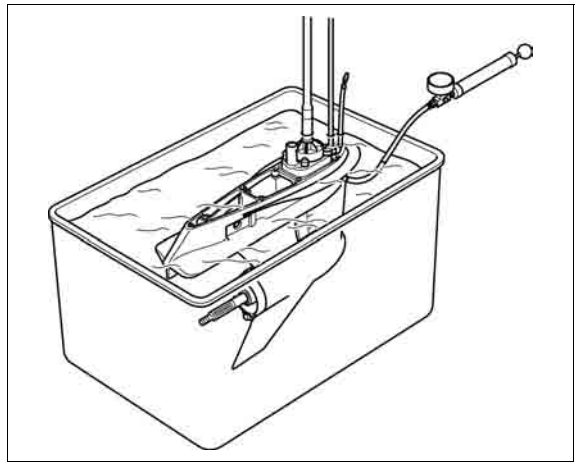
If the air pressure drops, place the gear case in a container filled with a water. Apply the specified air pressure to the gear case again, move the shift rod, vertical shaft and the propeller shaft, and locate the point where the air is leaking.

Remove the gear case from the water and replace the water seal or O-ring where the air is leaking.

After replacing the water seal or O-ring, perform the pressure check again and be sure that air is not leaking.

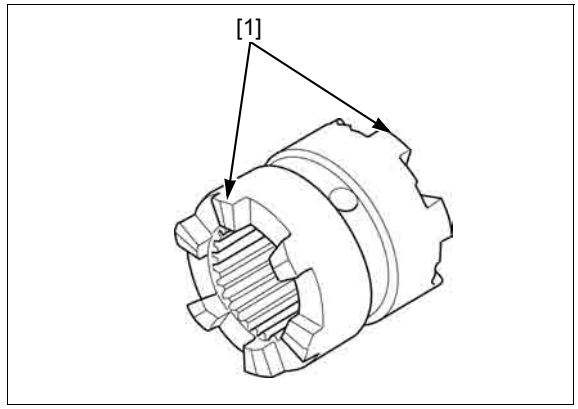
Remove the gear case pressure tester and the adapter from the gear case.
Install a new O-ring on the oil check bolt, and tighten the oil check bolt to the specified torque.

TORQUE: 6.5 N·m (0.66 kgf·m, 4.8 lbf·ft)



CLUTCH SHIFTER INSPECTION

Check the clutch parts [1] on both the forward and reverse sides for wear and damage.



PROPELLER SHAFT INSPECTION

PROPELLER SHAFT O.D.

Measure the O.D. of the propeller shaft where the bearings ride.

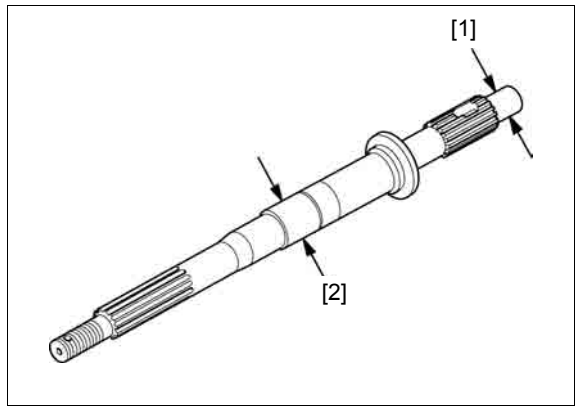
STANDARD:

At bevel gear [1]:	**27.974 – 27.983 mm (1.1013 – 1.1017 in)**
At needle bearing [2]:	**32.007 – 32.020 mm (1.2601 – 1.2606 in)**

SERVICE LIMIT:

At bevel gear:	**27.949 mm (1.1004 in)**
At needle bearing:	**31.990 mm (1.2594 in)**

If the measurement is less than the service limit, replace the propeller shaft with a new one on assembly.



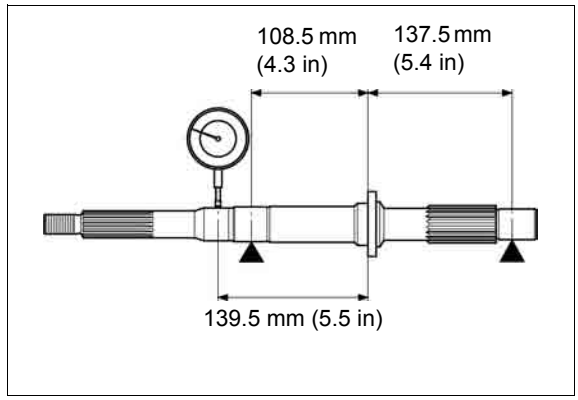
PROPELLER SHAFT RUNOUT

Support each journal with V-blocks as shown.

Set the dial indicator and measure the propeller shaft runout while turning the shaft.

STANDARD: 0.02 mm (0.001 in) or below
SERVICE LIMIT: 0.02 mm (0.001 in)

If the measurement is more than the service limit, replace the propeller shaft with a new one on assembly.



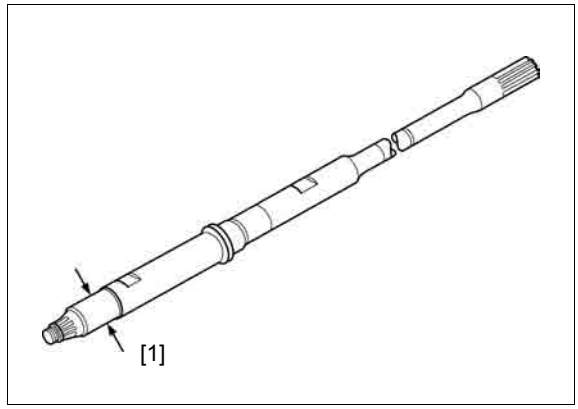
VERTICAL SHAFT INSPECTION

VERTICAL SHAFT O.D. (At needle bearing)

Measure the O.D. of the vertical shaft where the needle bearing [1] rides.

STANDARD: 30.491 – 30.500 mm (1.2004 – 1.2008 in)
SERVICE LIMIT: 30.470 mm (1.1996 in)

If the measurement is less than the service limit, replace the vertical shaft with a new one on assembly.



VERTICAL SHAFT RUNOUT

Support each journal with V-blocks as shown.

Set the dial indicator and measure the vertical shaft runout while turning the shaft.

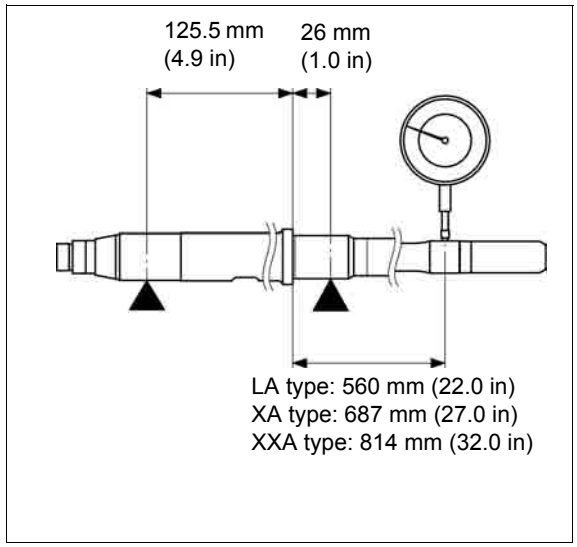
STANDARD:

LA type	**0.30 mm (0.012 in) or below**
XA type	**0.35 mm (0.014 in) or below**
XXA type	**0.40 mm (0.016 in) or below**

SERVICE LIMIT:

LA type	**0.30 mm (0.012 in)**
XA type	**0.35 mm (0.014 in)**
XXA type	**0.40 mm (0.016 in)**

If the measurement exceeds the service limit, replace the vertical shaft with a new one.



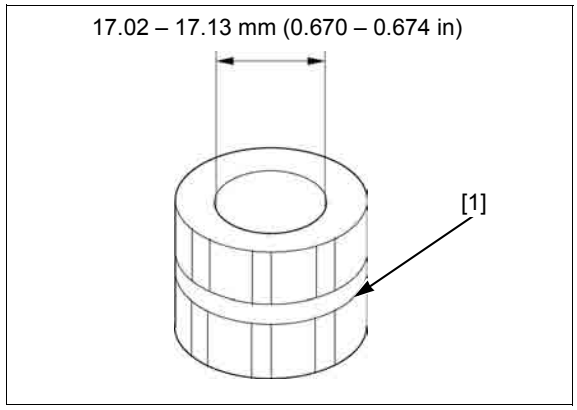
VERTICAL SHAFT BUSH INSPECTION (Except LA type)

VERTICAL SHAFT BUSH I.D.

Measure the vertical shaft bush [1] I.D.

STANDARD: 17.02 – 17.13 mm (0.670 – 0.674 in)
SERVICE LIMIT: 17.65 mm (0.695 in)

If the measurement exceeds the service limit, replace the vertical shaft bush with a new one.



GEAR CASE STUD BOLT REPLACEMENT (LA and XA types)

Remove the gear case (page 16-8).

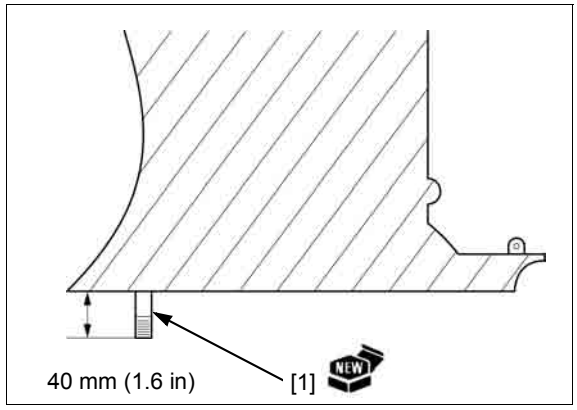
Thread two nuts onto the stud [1] and tighten them together. Use a wrench to turn the stud bolt (12 x 40 mm) out.

Install a new stud bolt into the extension case and tighten them to the specified torque.

TORQUE: 22 N·m (2.2 kgf·m, 16 lbf·ft)

After gear case stud bolt installation, check that the length from the bolt head to the extension case surface is within specification.

SPECIFIED LENGTH: 40 mm (1.6 in)



EXTENSION SEPARATOR STUD BOLT REPLACEMENT (XXA type)

Remove the extension separator (page 16-8).

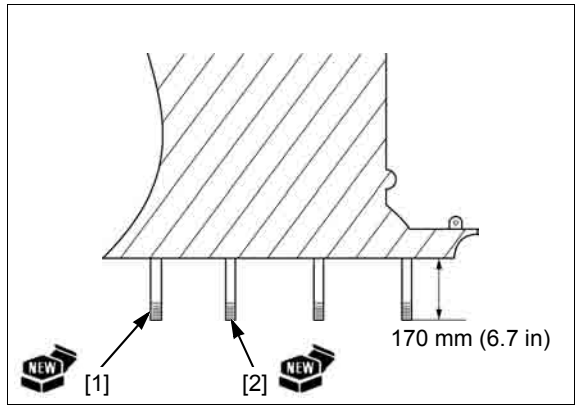
Thread two nuts onto the stud bolt (12 x 170 mm) [1] and six stud bolts (10 x 170 mm) [2], and tighten them together. Use a wrench to turn the stud bolt out.

Install new stud bolts into the extension case and tighten them to the specified torque.

TORQUE:
STUD BOLT (12 x 170 mm):
22 N·m (2.2 kgf·m, 16 lbf·ft)
STUD BOLT (10 x 170 mm):
15 N·m (1.5 kgf·m, 11 lbf·ft)

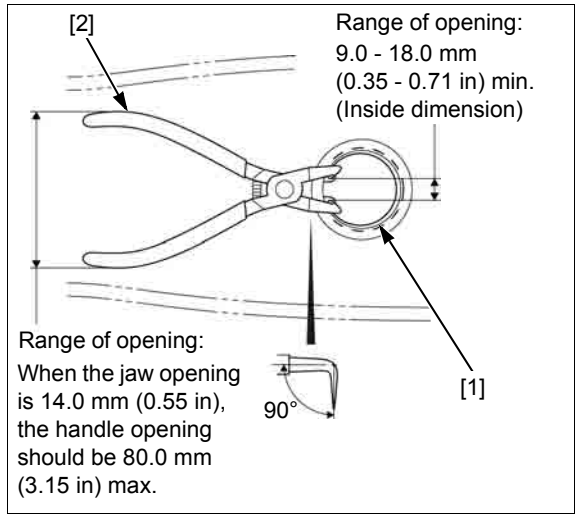
After extension separator stud bolt installation, check that the length from the bolt head to the extension case surface is within specification.

SPECIFIED LENGTH: 170 mm (6.7 in)



GEAR CASE NEEDLE BEARING REPLACEMENT

Remove the internal circlip [1] using suitable commercially available pliers [2] as shown.



Set the special tools on the needle bearing [1], and place a shop towel [2] or equivalent material under the needle bearing as shown.

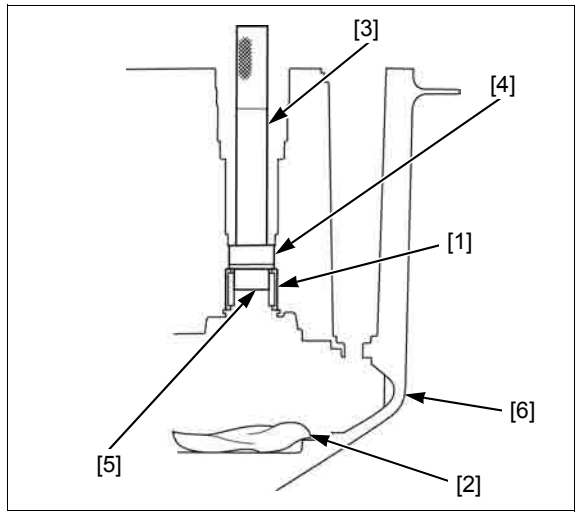
TOOLS:

Driver, 280 mm [3]	**07949-3710001**
Attachment, 37 x 40 mm [4]	**07746-0010200**
Pilot, 30 mm [5]	**07746-0040700**

Remove the needle bearing (30.5 x 47 x 37 mm) from the gear case [6] using the special tools.

NOTICE

- *Remove the needle bearing with care not to damage the gear case.*



Apply gear oil to the outer circumference of a new needle bearing [1].

Install the needle bearing (30.5 x 47 x 37 mm) in the gear case [2] using the special tools, until it is fully seated.

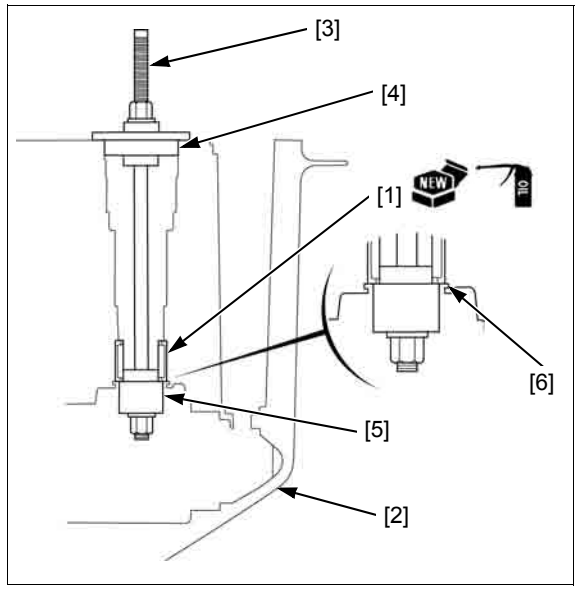
NOTICE

- *Install the needle bearing with the stamped end facing down (toward the pinion gear side) or severe gear case damage will occur.*

TOOLS:

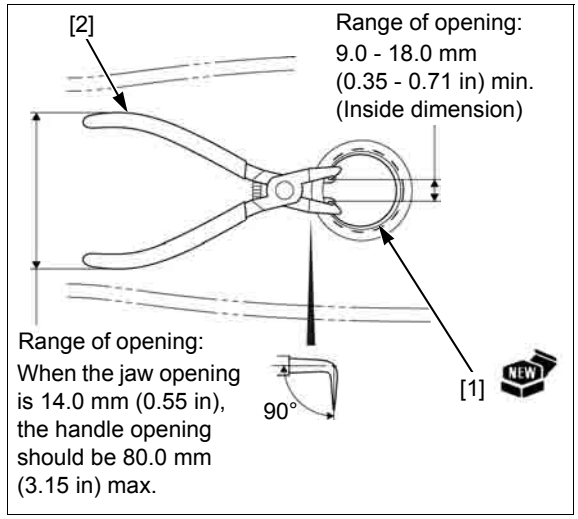
Installer shaft, 15 x 370 mm [3]	**07VMF-KZ30200**
Bearing driver attachment, 64 x 72 mm [4]	**07946-SB20000**
Attachment, 27.5 x 44 mm [5]	**07948-9540000**

After installation, check that the bottom surface of the needle bearing is above the groove [6] of the gear case.



Install a new internal circlip [1] using suitable commercially available pliers [2] as shown.

- Install the internal circlip with the sharp side facing the pinion gear side.
- Check that the internal circlip is seated in the gear case groove.
- Avoid the internal circlip damage during installation (Do not close the pliers nose narrower than 9.0 mm (0.35 in)).



17. GEAR CASE (COUNTER ROTATION)

COMPONENT LOCATION ····· 17-2

TOOLS ····· 17-3

PROPELLER REMOVAL/ INSTALLATION ····· 17-5

ANODE METAL/WATER SCREEN REMOVAL/ INSTALLATION ····· 17-6

GEAR CASE/EXTENSION SEPARATOR (XXCA type) REMOVAL/ INSTALLATION ····· 17-7

VERTICAL SHAFT BUSHING REMOVAL/ INSTALLATION ····· 17-9

EXTENSION CASE REMOVAL/ INSTALLATION ····· 17-9

SHIFT ROD REMOVAL/ INSTALLATION ····· 17-13

PROPELLER SHAFT HOLDER REMOVAL/ INSTALLATION ····· 17-17

SHIFT SLIDER/PROPELLER SHAFT REMOVAL/INSTALLATION ····· 17-18

VERTICAL SHAFT/REMOVAL/ INSTALLATION ····· 17-25

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CLUTCH SHIFTER INSPECTION ····· 17-43

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VERTICAL SHAFT INSPECTION ····· 17-44

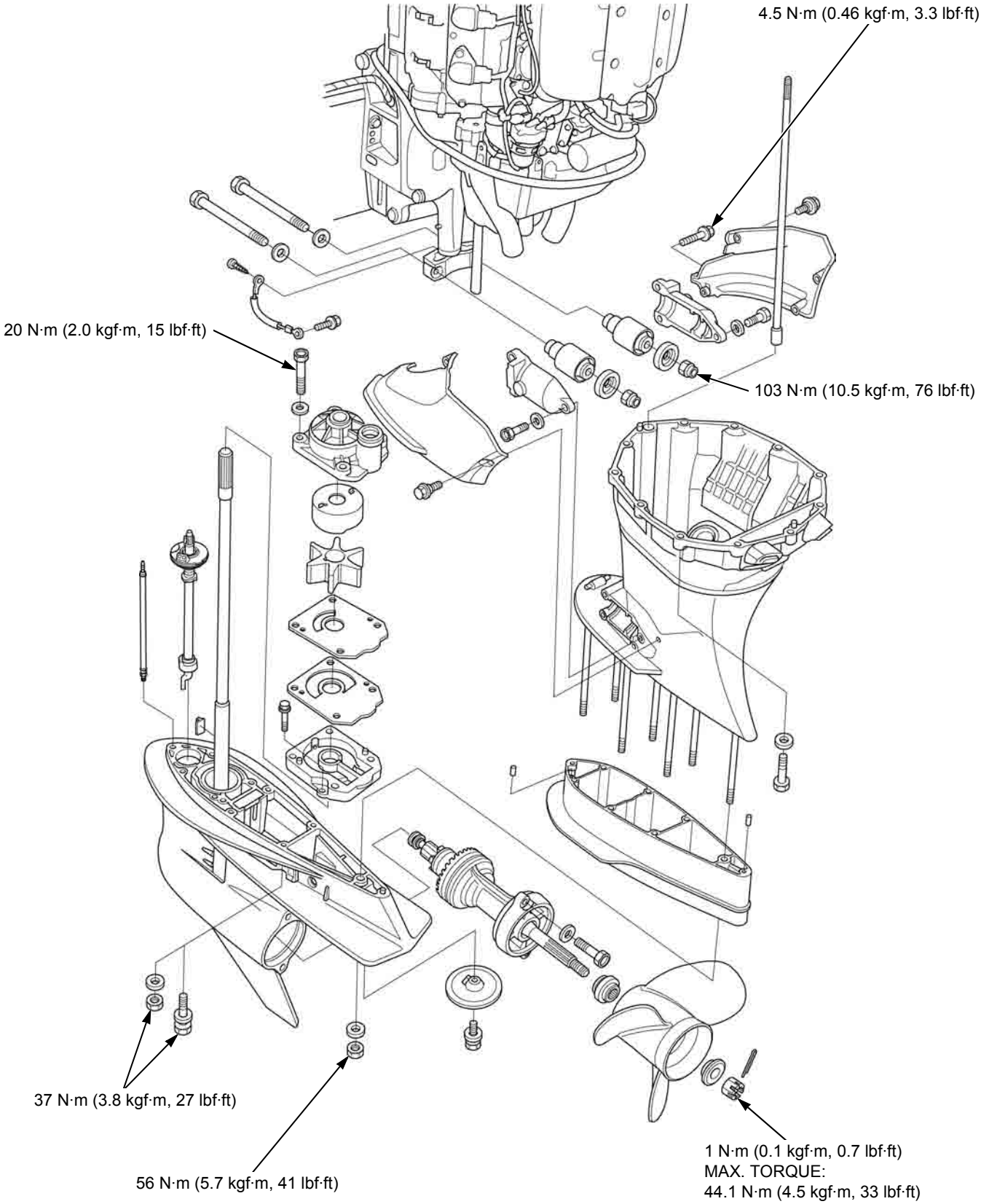
VERTICAL SHAFT BUSH INSPECTION ····· 17-45

GEAR CASE STUD BOLT REPLACEMENT (XCA type) ····· 17-45

EXTENSION SEPARATOR STUD BOLT REPLACEMENT (XXCA type) ····· 17-46

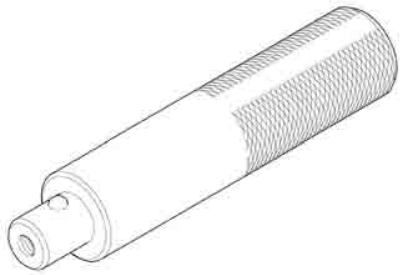
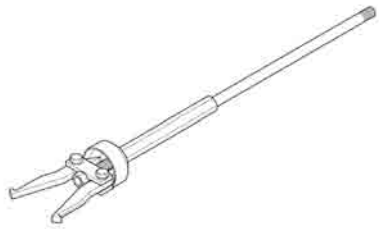
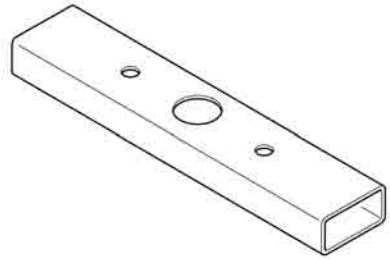
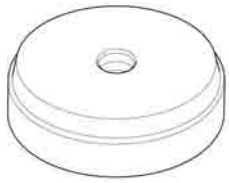
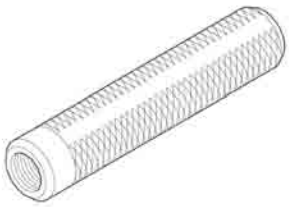
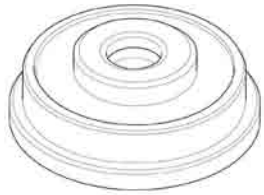
GEAR CASE NEEDLE BEARING REPLACEMENT ····· 17-46

COMPONENT LOCATION

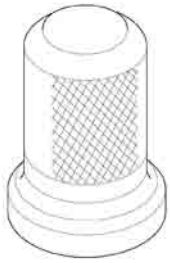


TOOLS

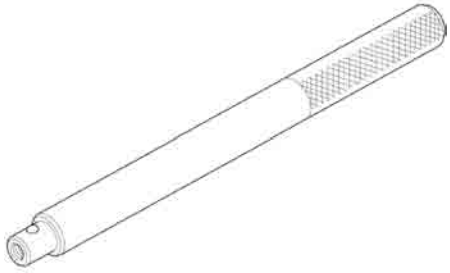
LIST

Driver 07749-0010000 	Bearing race puller 070PC-ZY3A101 	Prop shaft holder @@ 
Attachment, 32 x 42 mm 070PD-ZY3A100 	Taper bearing installer attachment, 90 mm 070PF-ZY3A100 	Oil seal driver attachment, 42 x 47 mm 07947-ZV00100 
Attachment, 37 x 40 mm 07746-0010200 	Oil seal driver attachment, 28 x 35 mm 07945-4150200 	Lock nut wrench, 36 x 47.8 mm 07916-MB00002 
Remover handle 07936-3710100 	Remover weight 07936-371020A or 07936-3710200 	Bearing driver attachment, 64 x 72 mm 07946-SB20000 

Oil seal driver, 44.5 mm
07947-SB00100



Driver, 280 mm
07949-3710001



Pilot, 28 mm
07JAD-PH80400



Pilot, 32 x 50 mm
07MAD-PR90200



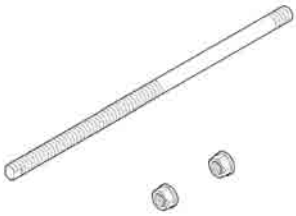
Vertical shaft holder
07SPB-ZW10200



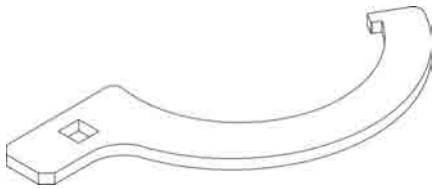
Backlash indicator tool
07SPJ-ZW0030B



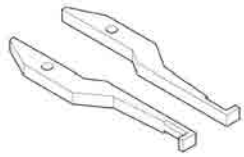
Installer shaft, 15 x 370 mm
07VMF-KZ30200



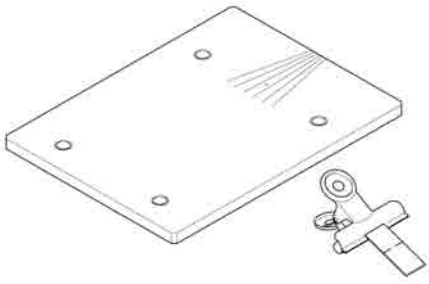
Pin type spanner, 128 mm
070PA-ZX20100



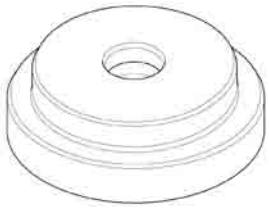
Puller jaws, 25 mm
07WPC-ZW50100



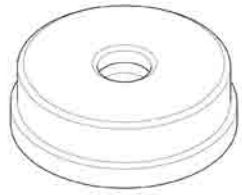
Backlash inspection tool set
070PJ-ZX20200



Oil seal driver attachment, 72 mm
07947-6340201



Attachment, 62 x 68 mm
07746-0010500



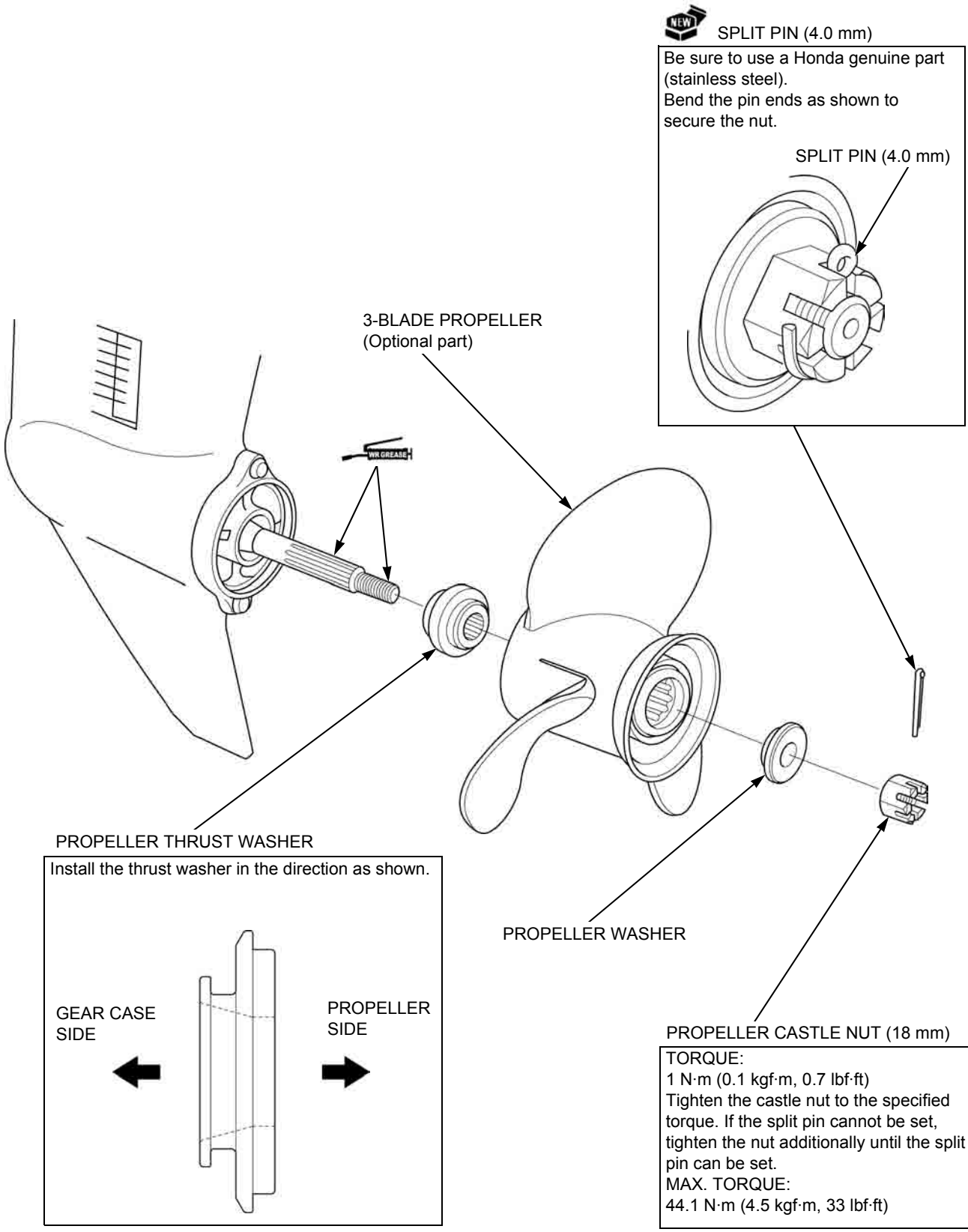
Pilot, 30 mm
07746-0040700



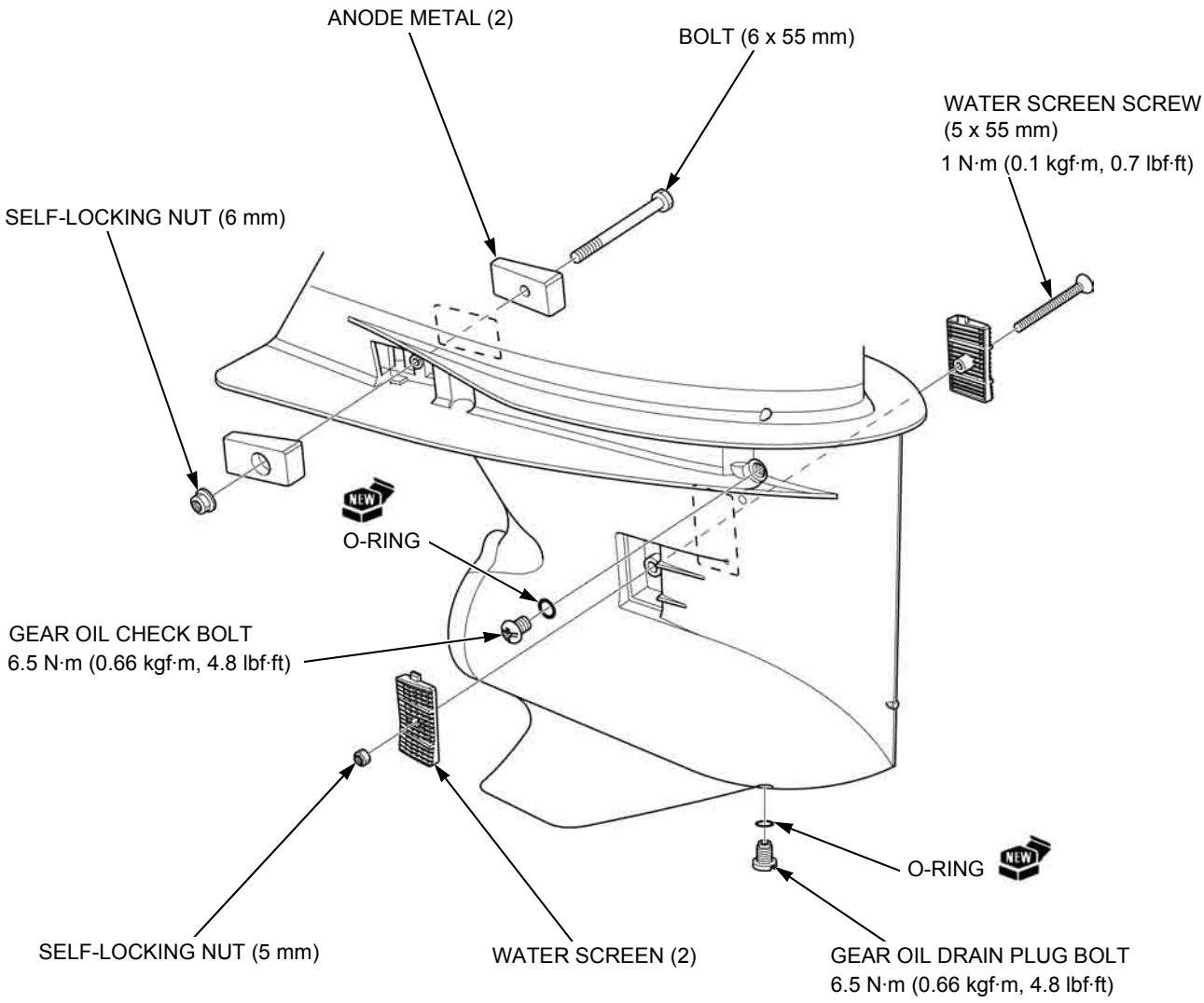
Attachment, 27.5 x 44 mm
07948-9540000



PROPELLER REMOVAL/ INSTALLATION



ANODE METAL/WATER SCREEN REMOVAL/INSTALLATION



GEAR CASE/EXTENSION SEPARATOR (XXCA type) REMOVAL/INSTALLATION

REMOVAL

Set the remote control lever in the "N" (Neutral) position.
Tilt up the motor to the uppermost position.

Remove the bolt/washer (10 x 32 mm) [1], and gear case cover [2].
Remove the gear case nut (12 mm) [3] and washer (12 mm) [4].

XCA type: Hold the gear case [5] and remove the six bolt/washers (10 x 47 mm) [6] from the gear case.

XXCA type: Hold the gear case and remove the six nuts (10 mm) [7] and six washer (10 mm) [8] from the gear case.

- When loosening the stud bolt, tighten it and check that the length from the bolt head to the extension case surface is within specification.
  – XCA type: (page 17-45)
  – XXCA type: (page 17-46)

XCA type: Disconnect the speedometer tube [9] from the gear case.

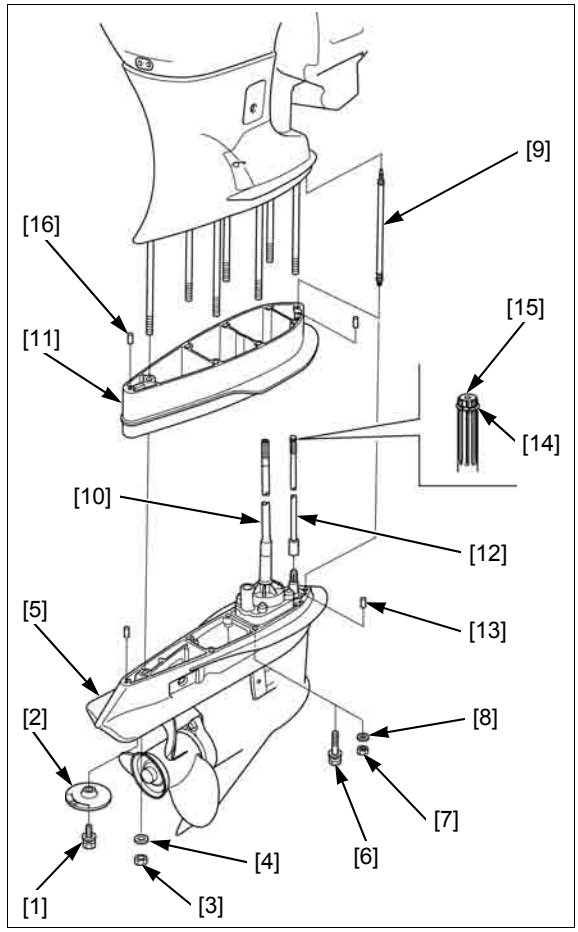
Remove the gear case by sliding the vertical shaft [10] down.

XXCA type: Disconnect the speedometer tube, and remove the extension separator [11].
Remove the shift rod A [12] and two dowel pins [13].

- Joint clip [14] is fitted to the shift shaft A securely, so it is hard to remove the shift rod A [15].
  Take care not to apply excessive force to the shift rod A.

XXCA type: Remove the two dowel pins [16] from the extension separator.

After removing the gear case, tilt down the motor to the lowermost position.

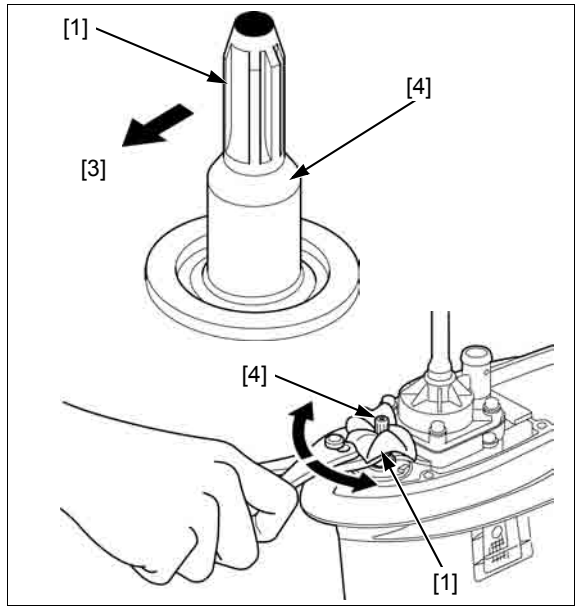


INSTALLATION

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

Check that the cutout [1] of the spline faces the cruising direction [2] (this position is "N" (Neutral)).

If the cutout of the spline is not in the direction shown, protect the spline with a shop towel [3] and turn the shift rod [4] right or left with a wrench until the cutout faces toward the specified direction.



Tilt up the motor to the uppermost position.

Install the two dowel pins [1] to the extension separator [2]. (XXCA type)

Install the two dowel pins [3] to the gear case [4].

Install the shift rod A [5] by aligning the cutout [6] of the shift rod A spline with the projection [7] of the spline of shift shaft A [8].

Apply marine grease to the vertical shaft spline and inside of the water tube seal ring.

Install the extension separator, and connect the speedometer tube [9]. (XXCA type)

Install the gear case halfway.
Connect the speedometer tube to the gear case (XCA type).
Install the shift rod A by aligning the projection [10] of the shift rod A spline [11] with the cutout [12] of the spline of the shift rod [13].

Loosely tighten six gear case bolt/washers (10 x 47 mm) [14]. (XCA type)
Loosely tighten six washers (10 mm) [15] and six gear case nuts (10 mm) [16]. (XXCA type).

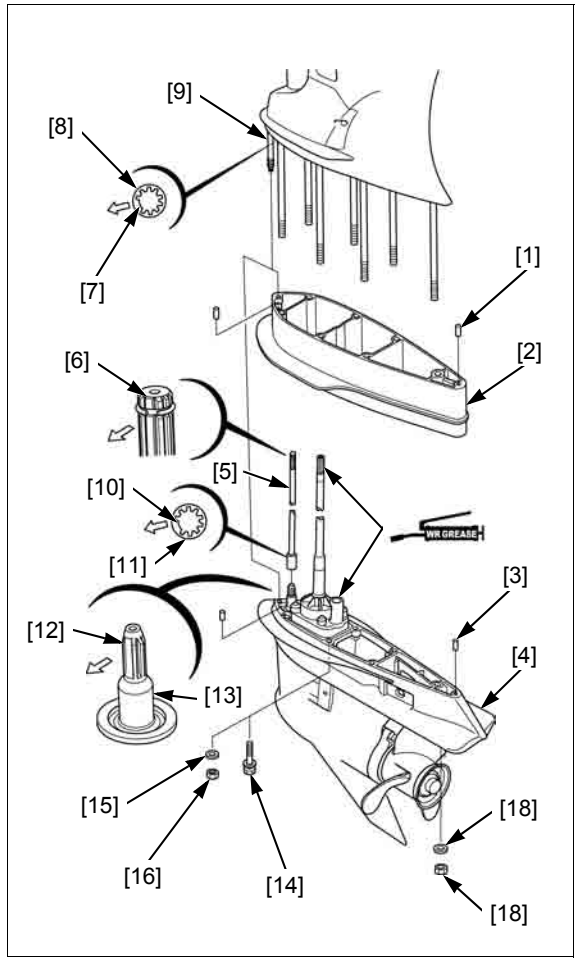
Tilt down the motor to the lowermost position.

Tighten the six gear case bolts (XCA type) or six gear case nuts (XXCA type) to the specified torque.

TORQUE: 37 N·m (3.8 kgf·m, 27 lbf·ft)

Install the washer [17] and the gear case nut (12 mm) [18].

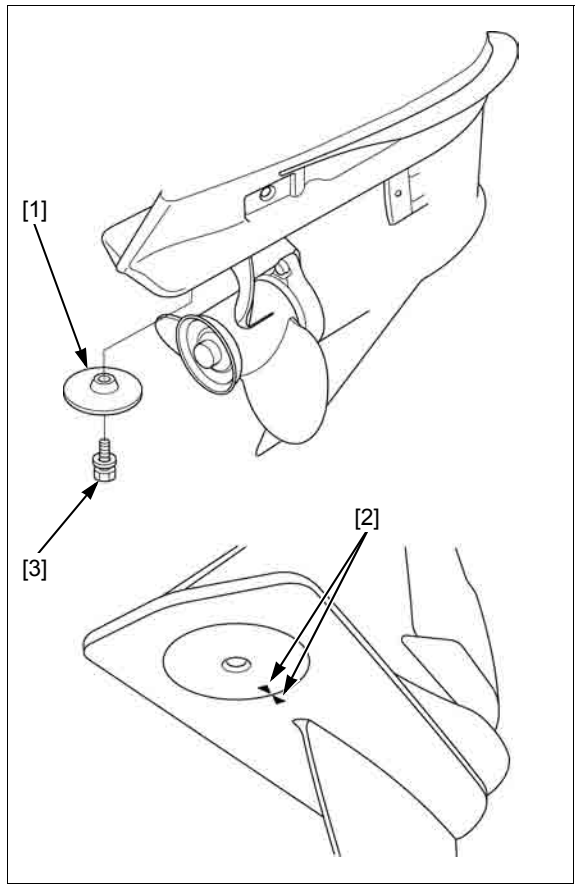
TORQUE: 56 N·m (5.7 kgf·m, 41 lbf·ft)



Install the gear case cover [1] by aligning the "△" marks [2].

Install and tighten the bolt/washer (10 x 32 mm) [3].

After installing the gear case, adjust the shift control cable (page 20-3).



VERTICAL SHAFT BUSHING REMOVAL/INSTALLATION

Remove the gear case (page 17-7).
Remove the extension separator (XXCA type: page 17-7).

Remove the internal circlip [1], washer (30 mm) [2], and vertical shaft bushing [3].

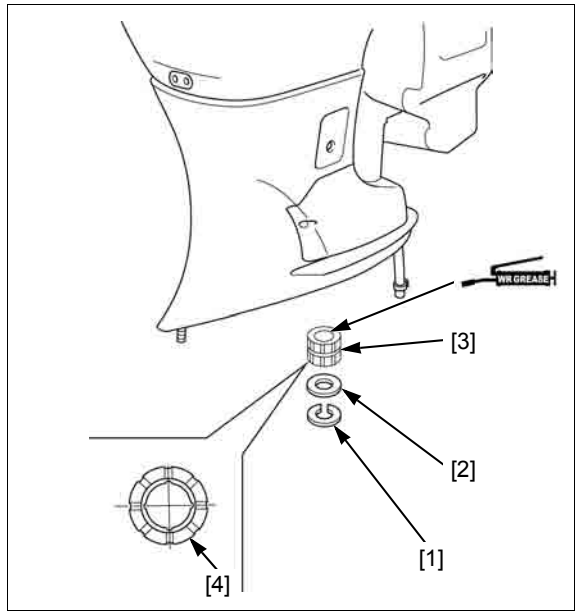
Inspect the vertical shaft bushing I.D. (page 17-45). Replace the vertical shaft bushing if necessary.

Install the vertical shaft bushing to the extension case with the groove [4] facing the gear case side.

Apply marine grease to the inside of vertical shaft bushing.

Install the washer and set the internal circlip.

Install the extension separator (XXCA type: page 17-7).
Install the gear case (page 17-7).



EXTENSION CASE REMOVAL/ INSTALLATION

REMOVAL

Remove the following:

– L./R. Engine under cover (page 6-3)
– Gear case (page 17-7)
– Extension separator (XXCA type: page 17-7)

Remove the lower mounting cover screw/washer (6 x 40 mm) [1], six special bolts (6 x 17 mm) [2] and L./R. lower mounting covers [3].

Remove the bolt (6 x 12 mm) [4] and the ground terminal [5].

Remove the six bolts (10 x 35 mm) [6], six washers (10 mm) [7], and lower mount housing [8].

Remove the two lower rubber mount nuts [9].

Slightly move the extension case [10] and remove the two lower rubber mounts [11], two mount stoppers [12], two bolts (14 x 180 mm) [13] and two washers (14 mm) [14].

- Support the outboard motor securely in order to prevent the upper mount from being damaged when the lower rubber mount is removed from the extension case, which may cause an excessive load on the upper mount.

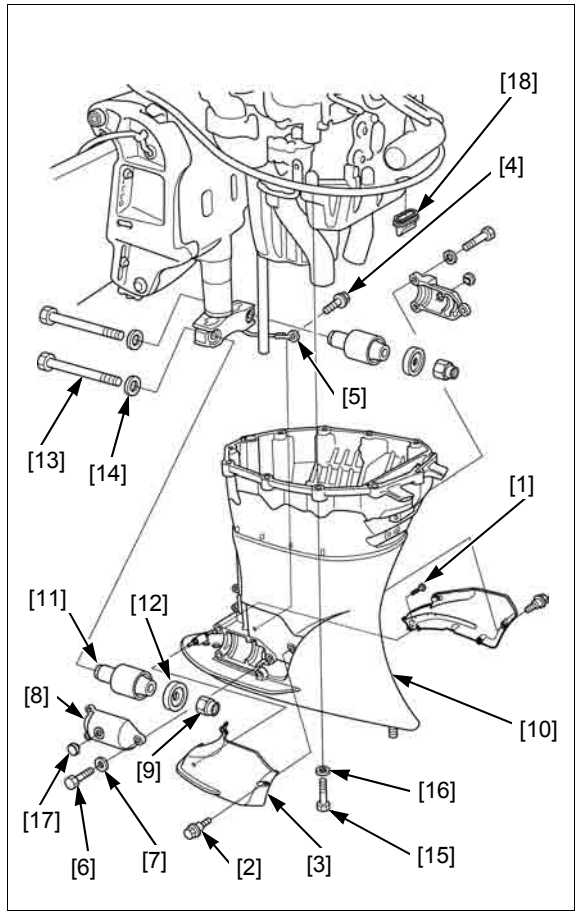
Remove the eleven bolts (12 x 50 mm) [15], eleven washers (12 mm) [16], and extension case.

NOTICE

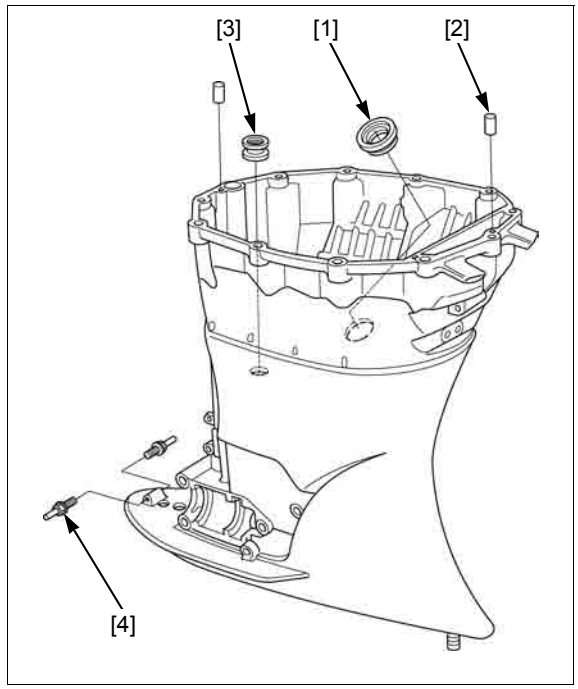
- *Take care not to drop the extension case.*

Remove the two rubbers [17] from the two lower mount housings.

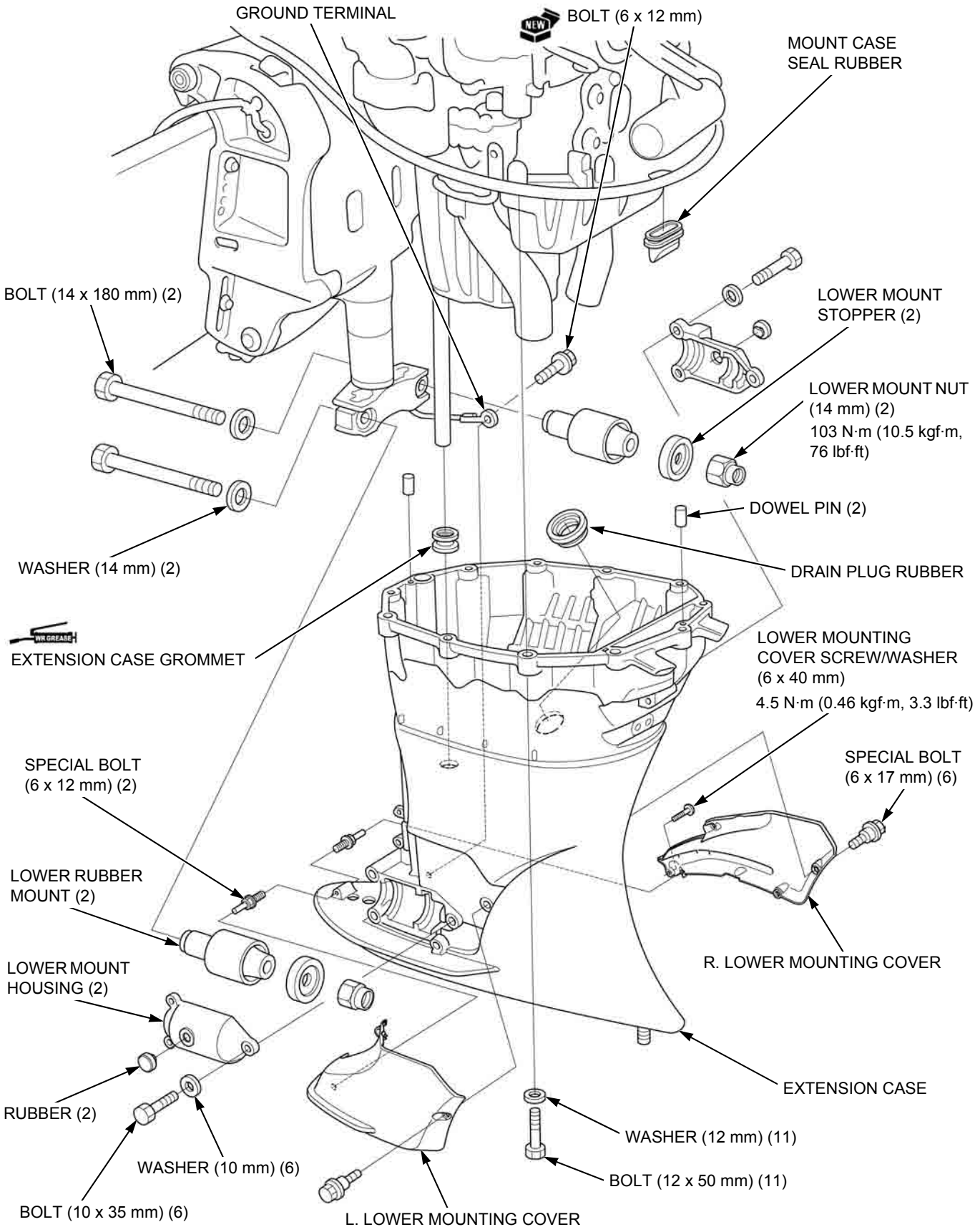
Remove the mount case seal rubber [18] from the mount case.



Remove the drain plug rubber [1], two dowel pins [2], extension case grommet [3] and two special bolts (6 x 12 mm) [4] from the extension case.



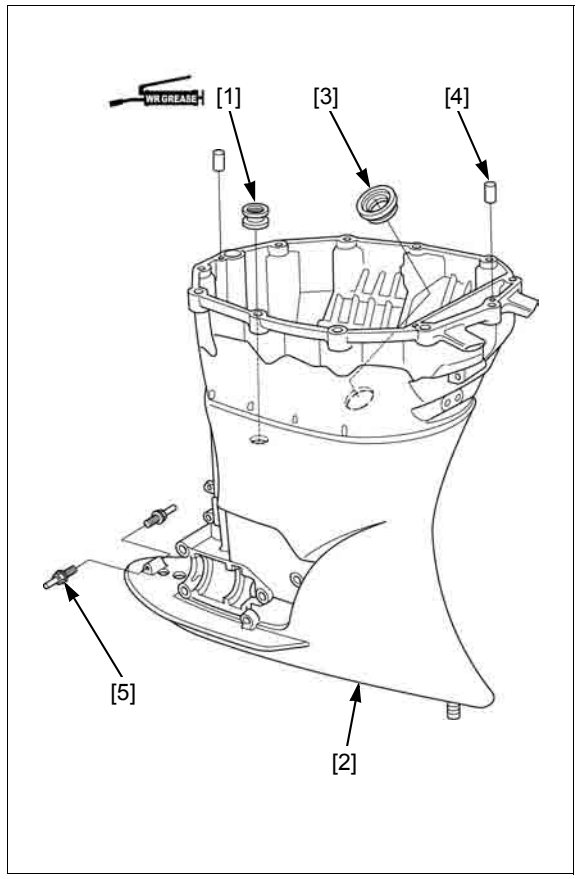
EXPLODED VIEW



INSTALLATION

Apply marine grease to the extension case grommet [1] inner surface and install it to the extension case [2].

Install the drain plug rubber [3], two dowel pins [4] and two special bolts (6 x 12 mm) [5] to the extension case.



Install the two rubbers [1] to the two lower mount housings [2].

Install the mount case seal rubber [3] to the mount case.

Install the extension case [4], eleven washers (12 mm) [5] and eleven bolts (12 x 50 mm) [6].

Install the two lower rubber mounts [1] and two lower mount stoppers [2] while holding the extension case.

Install the two bolts (14 x 180 mm) [3], two washers (14 mm) [4] and two lower mount nuts [5] and tighten them to the specified torque.

TORQUE: 103 N·m (10.5 kgf·m, 76 lbf·ft)

Install the two lower mount housing [6], six washers (12 mm) [7] and six bolts (10 x 35 mm) [8].

Set the ground terminal [11] and tighten the new bolt (6 x 12 mm) [12].

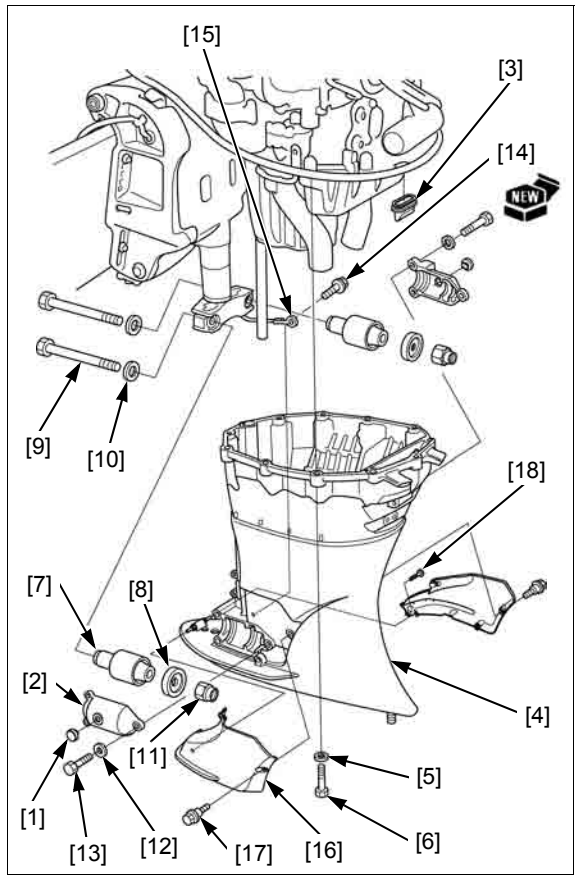
Install the L./R. lower mounting covers [9] and six special bolts (6 x 17 mm) [10].

Install and tighten the lower mounting cover screw/ washer (6 x 40 mm) [1] to the specified torque.

TORQUE: 4.5 N·m (0.46 kgf·m, 3.3 lbf·ft)

Install the following:

– Extension separator (XXCA type: page 17-7)
– Gear case (page 17-7)
– L./R. engine under cover (page 6-3)

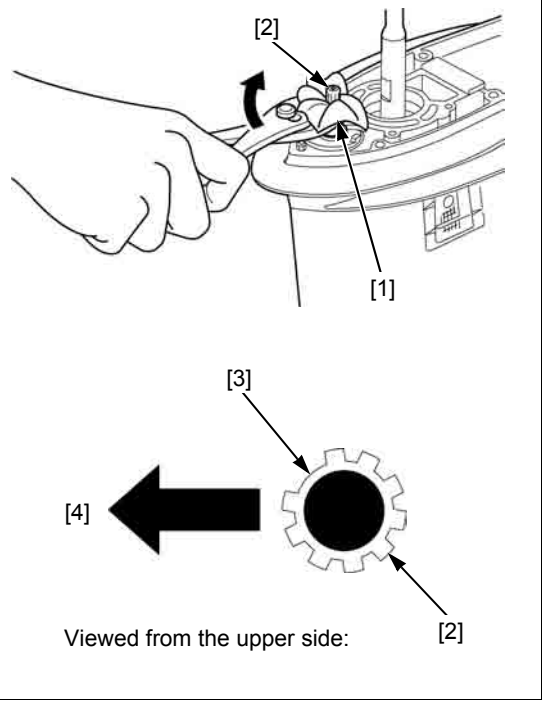


SHIFT ROD REMOVAL/INSTALLATION

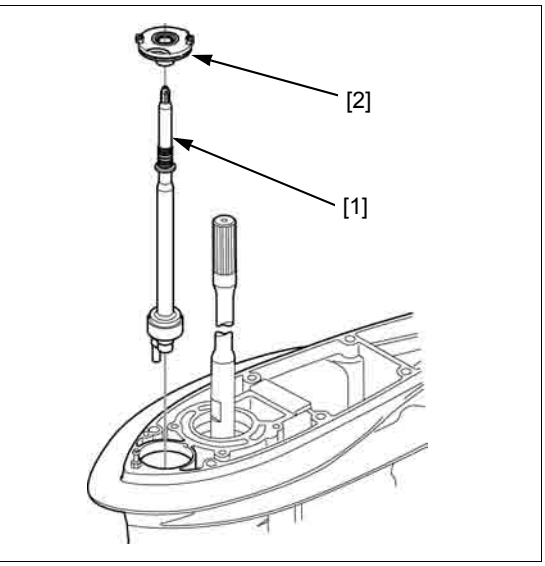
REMOVAL

Remove the water pump (page 11-9).

Wrap a shop towel [1] around the shift rod spline, and use pliers to turn the shift rod [2] in the direction shown (Cutout of the shift rod spindle [3] is toward the right side of the cruising direction [4]).

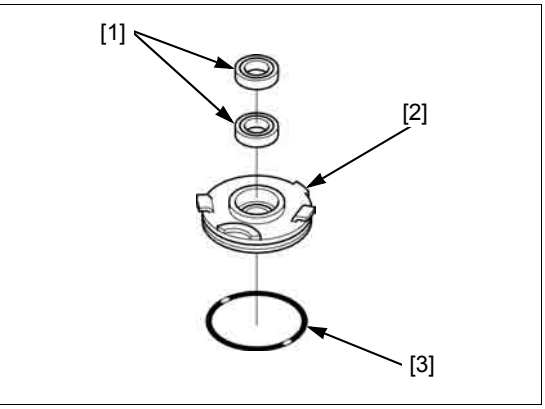


Remove the shift rod [1] and shift rod holder [2] from the gear case.

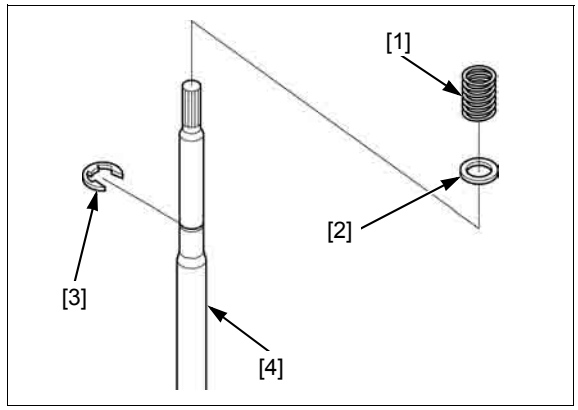


Remove the two water seals (12 x 21 x 6 mm) [1] from the shift rod holder [2] using a commercially available oil seal remover.

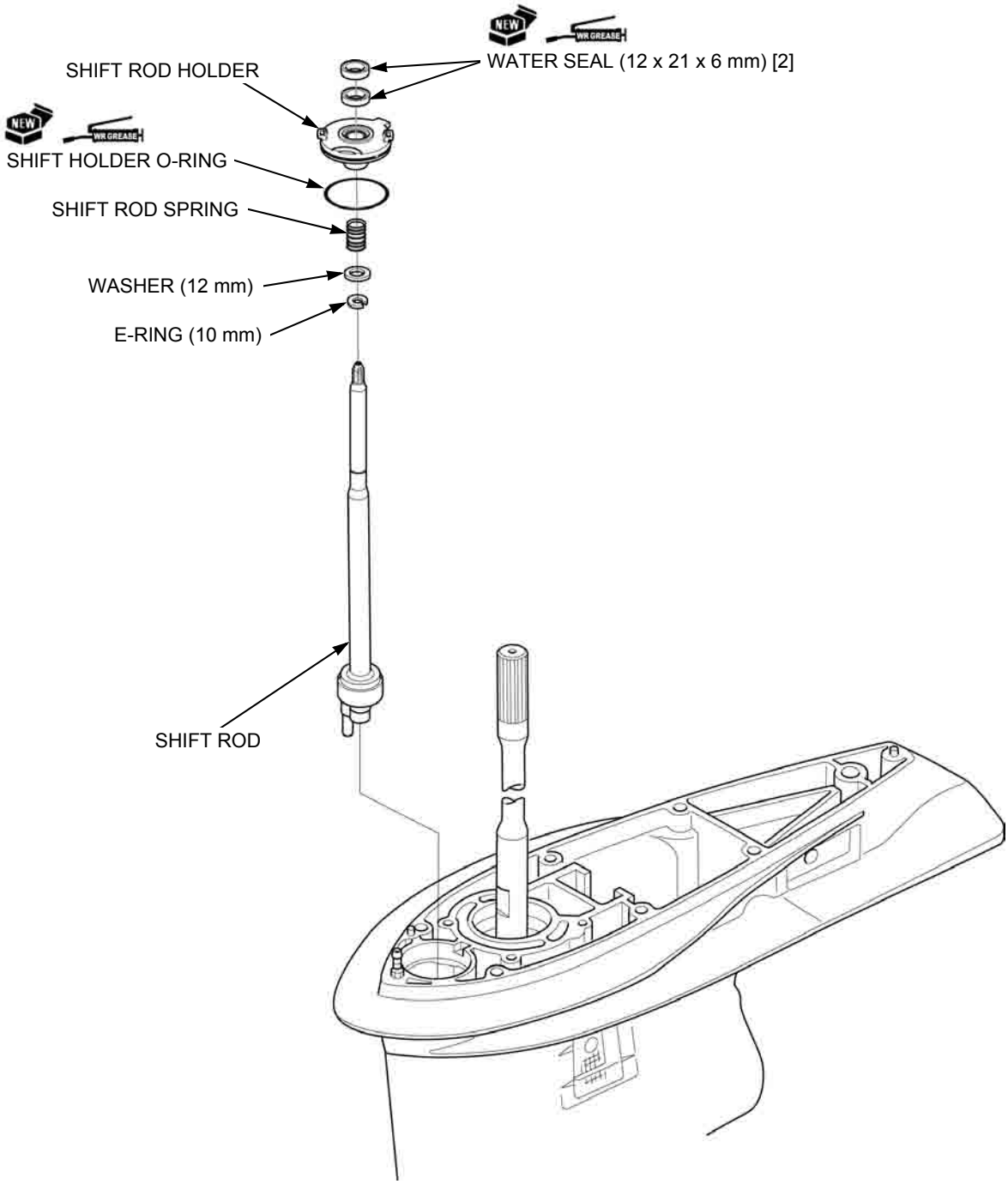
Remove the O-ring [3] from the shift rod holder.



Remove the shift rod spring [1], washer [2], and E-ring [3] from the shift rod [4].



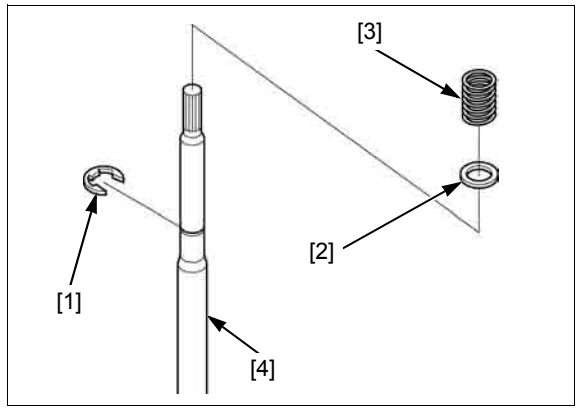
EXPLODED VIEW



INSTALLATION

Install the E-ring [1], washer [2], and shift rod spring [3] on the shift rod [4].

- Do not reuse the E-ring if it is deformed or deteriorated.
- Check that the E-ring is set in the groove in the shift rod securely.



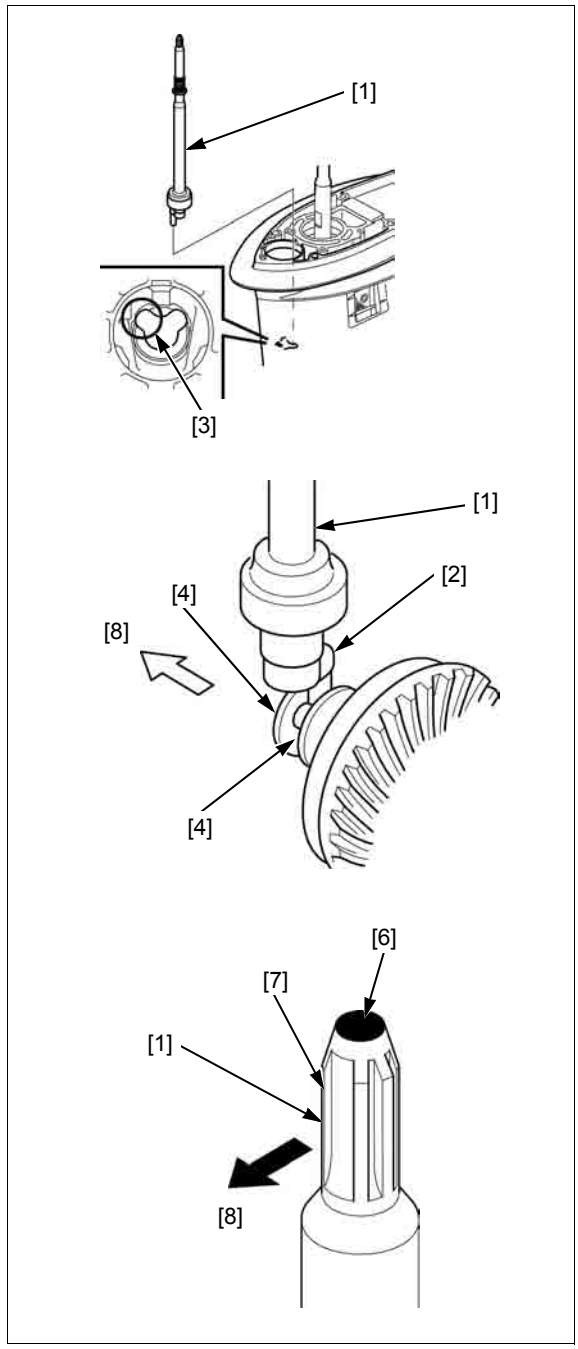
Insert the shift rod [1] into the gear case, aligning the cam [2] of the shift rod with the "A" point [3] of the gear case as shown.
Install the shift rod on the shift slider [4], aligning the cam of the shift rod with the groove [5] in the shift slider.

- Check that there is a marking [6] in the shift rod end.

After installing the shift rod, position the shift rod in the "N" (Neutral) position and check that the cutout in the spline [7] faces to the cruising direction [8].

NOTICE

- *If the cutout of the spline is not in the cruising direction, protect the spline with a shop towel and turn the shift rod right or left with a wrench until the cutout faces toward the cruising direction.*

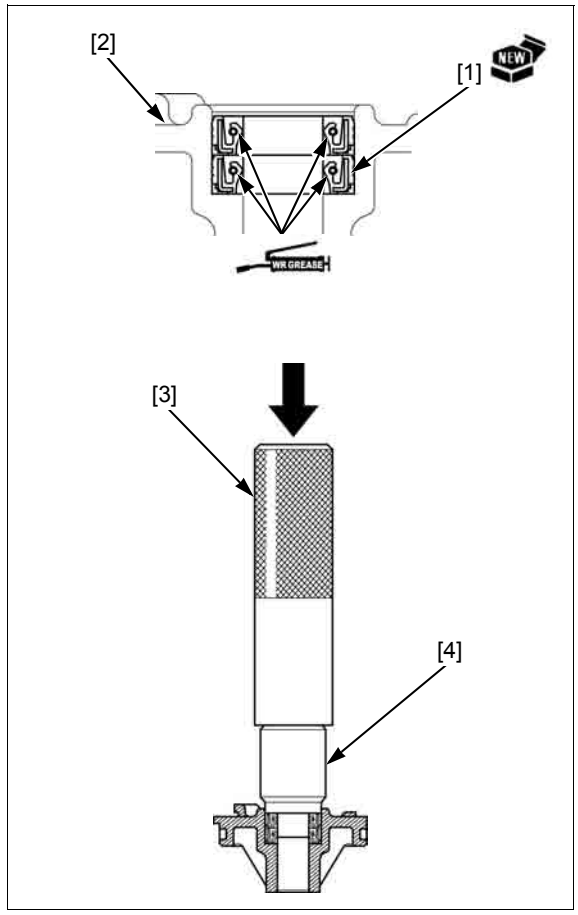


Apply marine grease to the lips and soapy water to the outer circumference of the new water seals (12 x 21 x 6 mm) [1].

With the lips facing up, drive the water seals (12 x 21 x 6 mm) into the shift rod holder [2].

TOOLS:

Driver [3]	**07749-0010000**
Oil seal driver attachment, 42 x 47 mm [4]	**07947-ZV00100**

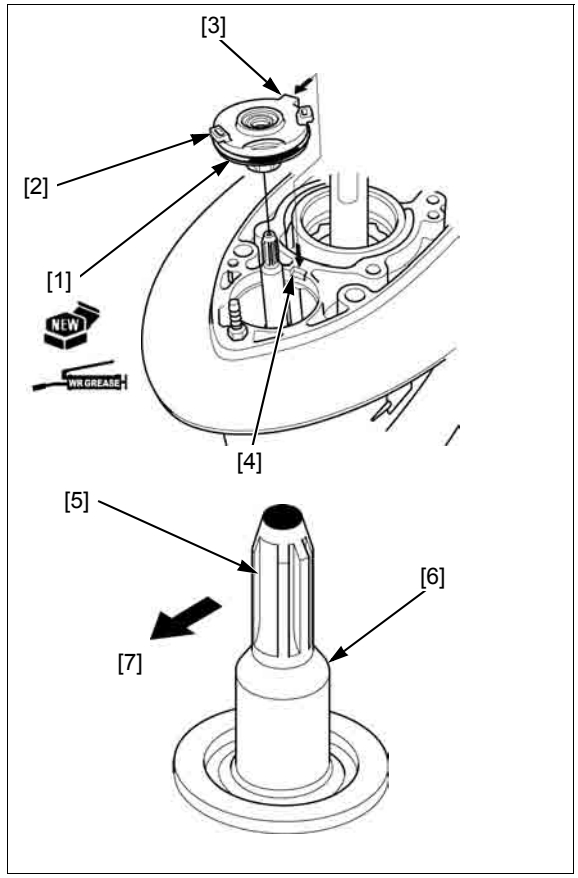


Apply marine grease to the circumference of a new O-ring [1], and install it on the shift rod holder [2].

Install the shift rod holder into the gear case by aligning the projection [3] of the shift rod holder with the recess [4] of the gear case.

After installation, check that the cutout [5] in the shift rod [6] splines is in the cruising direction [7].

Install the water pump (page 11-12).



PROPELLER SHAFT HOLDER REMOVAL/INSTALLATION

Drain the gear case oil (page 3-7).

Remove the following:

– Propeller (page 17-5)
– Gear case (page 17-7)
– Extension separator (XXCA types: page 17-7)
– Shift rod (page 17-13)

Remove the two bolts (12 x 45 mm) [1], two washers (12 mm) [2].

Insert a screwdriver or equivalent tool into the recess [3] in the propeller shaft holder [4] and remove the propeller shaft holder from the gear case.

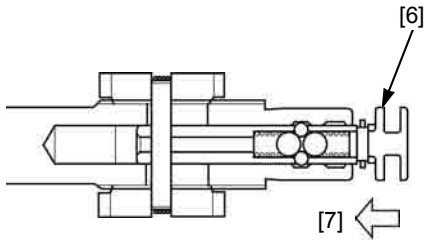
Replace the O-ring [5] with a new one and coat the O-ring with marine grease.

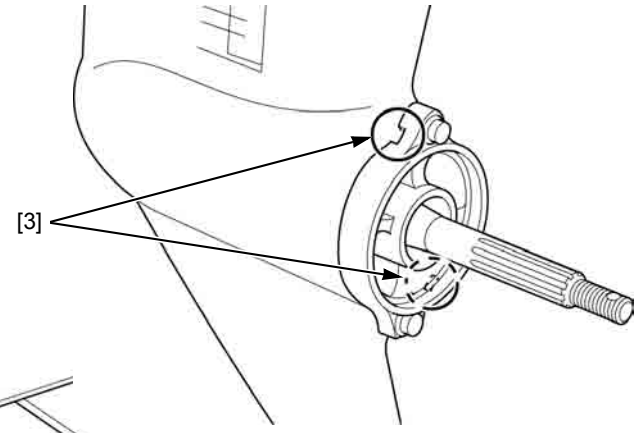
At installation, check that the shift slider [6] of the propeller shaft holder is set on the reverse bevel gear side [7].

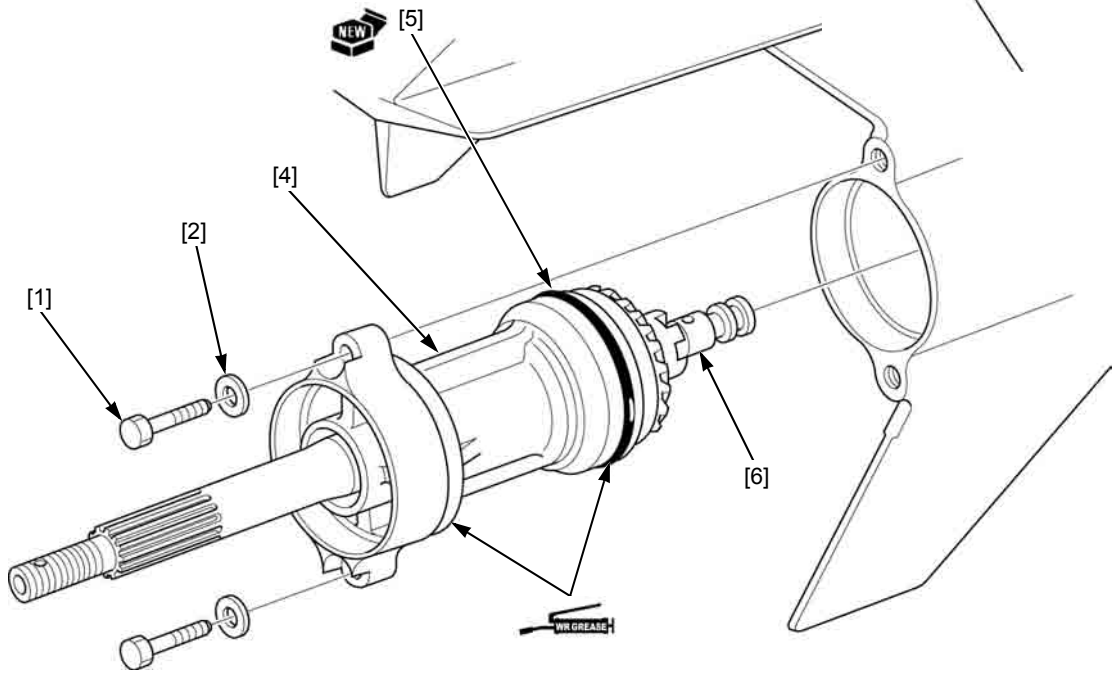
Apply marine grease to the propeller shaft holder seating surface.

Installation is the reverse order of removal.

Perform the gear case pressure check (page 17-42).





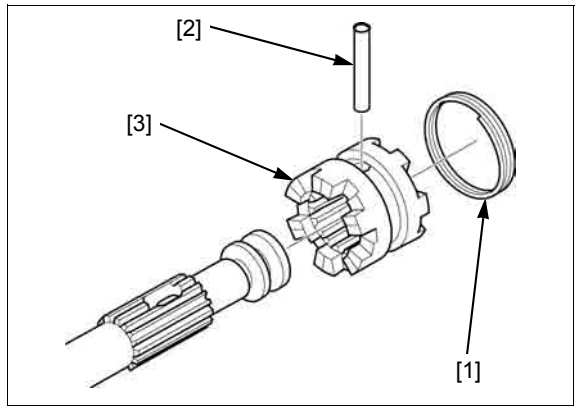


SHIFT SLIDER/PROPELLER SHAFT REMOVAL/INSTALLATION

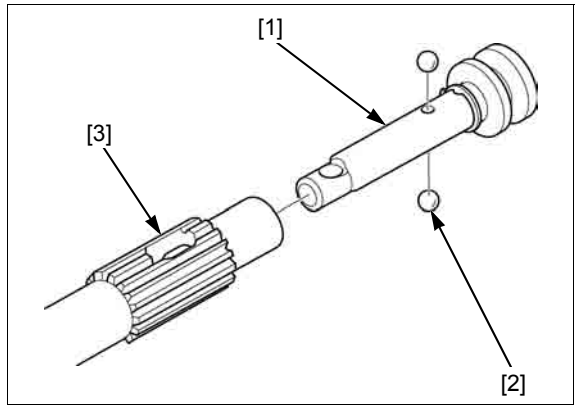
SHIFT SLIDER REMOVAL

Remove the propeller shaft holder (page 17-17)

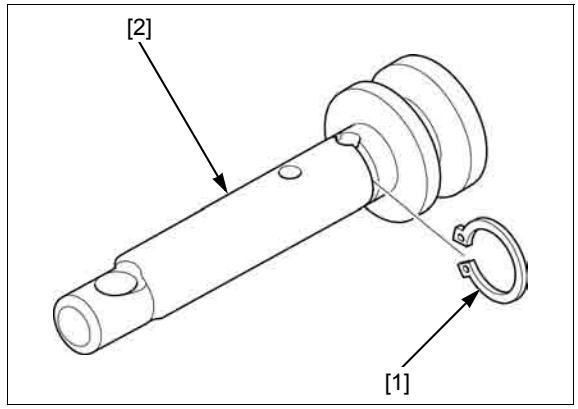
Remove the cross pin ring [1] and the shifter pin [2], and then remove the clutch shifter [3].



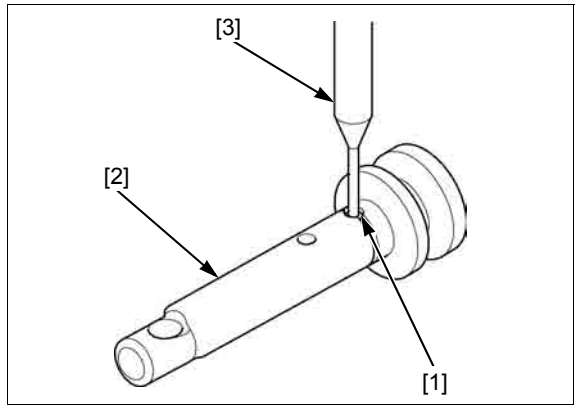
Remove the shift slider [1] and the two steel balls (#7) [2] from the propeller shaft [3]. Take care not to lose the steel balls.



Remove the circlip [1] from the shift slider [2].

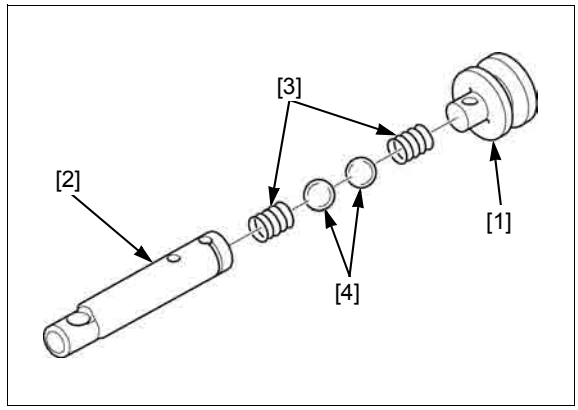


Remove the roller [1] from the shift slider [2] using a commercially available pin driver [3].



Remove the shift plate [1] from the shift slider [2], and then remove the two shift springs [3] and the two steel balls (#12) [4].

- Take care not to let the shift springs and the steel balls pop out of the shift slider during removal of the shift plate.

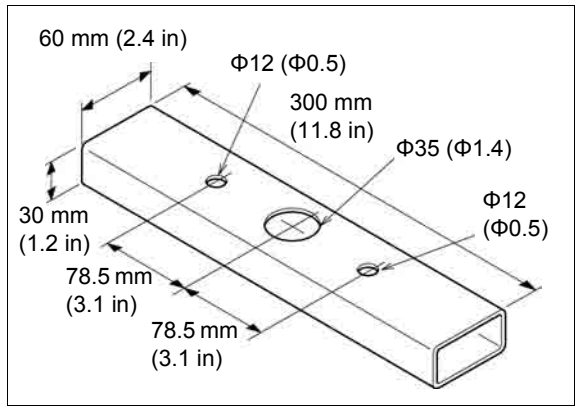


PROPELLER SHAFT REMOVAL

Remove the shift slider (page 17-18).

Prepare the fixing tool with the dimensions shown or use the special tool.

TOOL:
Prop shaft holder @@



Position the propeller shaft holder [1] on the fixing tool or special tool [2] and secure the holder with bolts [3].

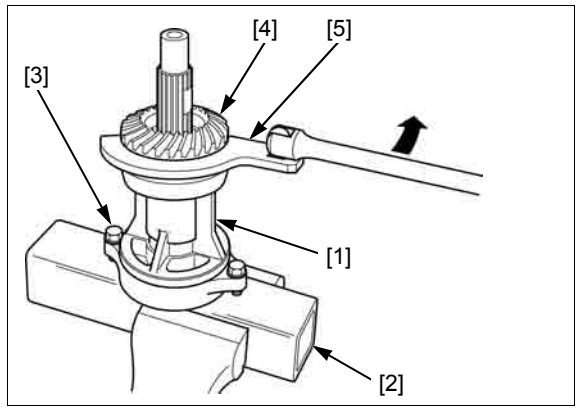
TOOL:
Prop shaft holder @@

Hold the fixing tool with a vise.

- Avoid holding the propeller shaft holder directly in a vise. Use the fixing tool to hold it in a vise.

Loosen the bearing holder [4] using the special tool as shown.

TOOL:
Pin type spanner, 128 mm [4] 070PA-ZX20100

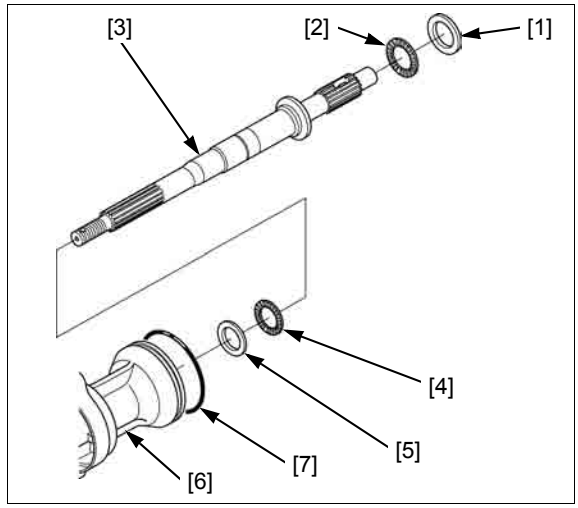


Remove the bearing holder from the propeller shaft holder.

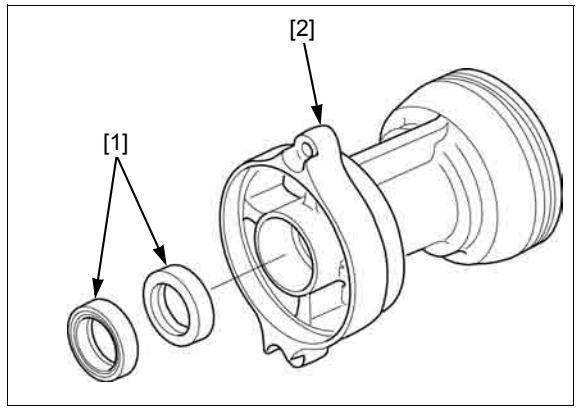
Remove the thrust bearing washer (48 x 74 x 3 mm) [1], thrust bearing (50 x 72 x 4.5 mm) [2] from the propeller shaft [3].

Remove the propeller shaft, thrust bearing F [4], thrust bearing washer [5] from the propeller shaft holder [6].

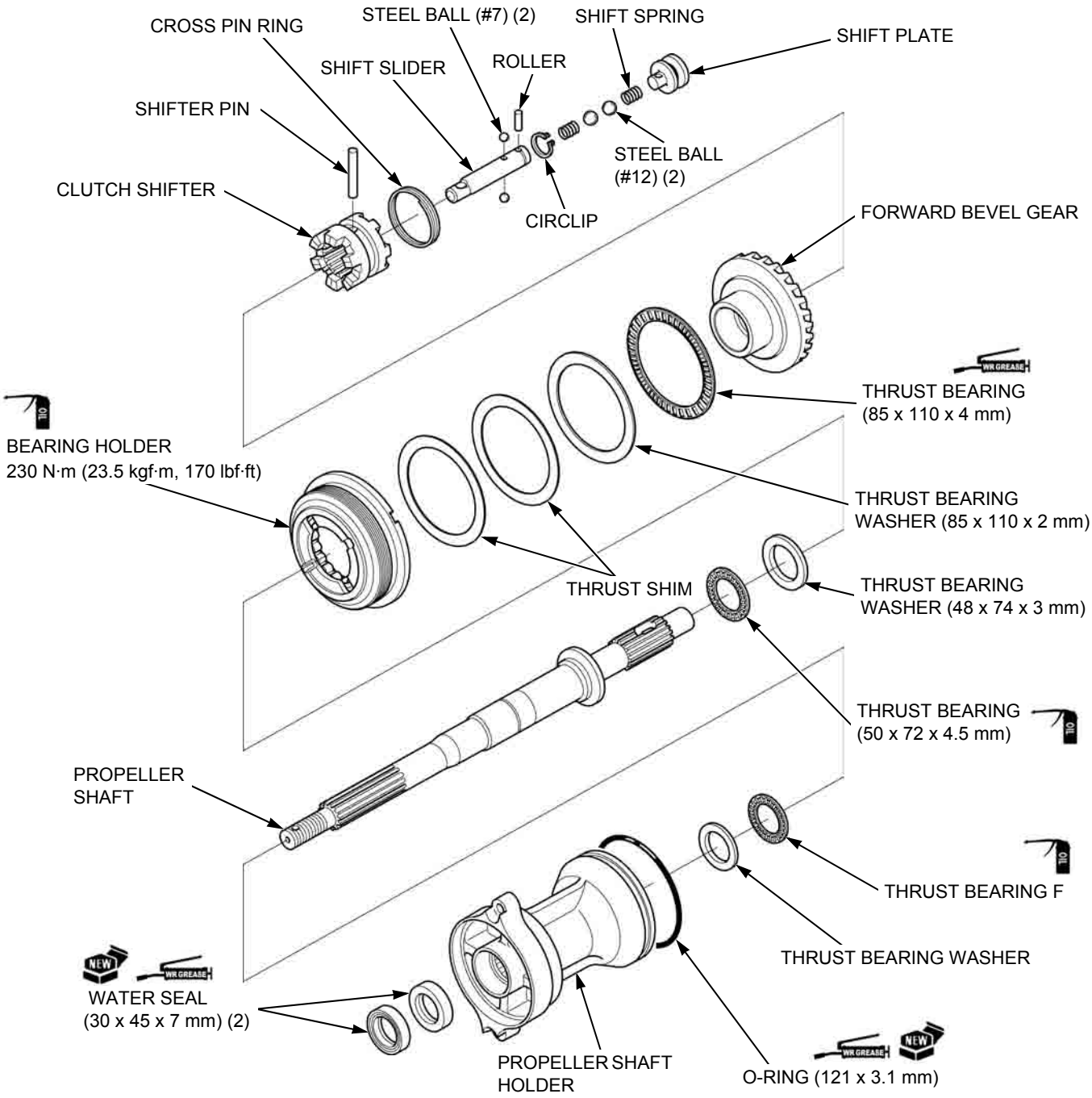
Remove the O-ring [7] from the propeller shaft holder.



Remove the two water seals (30 x 45 x 7 mm) [1] from the propeller shaft holder [2] using a commercially available oil seal remover.



EXPLODED VIEW



PROPELLER SHAFT INSTALLATION

Apply soapy water to the outer circumference of new water seals (30 x 45 x 7 mm) [1].

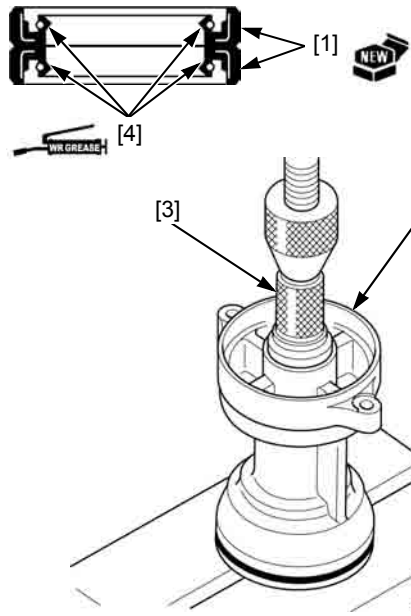
Drive the water seals one by one into the propeller shaft holder [2] using the special tool. Note the installation direction of the water seals.

- Replace the water seals with the new ones on assembly.

TOOL:
Oil seal driver, 44.5 mm [3] 07947-SB00100

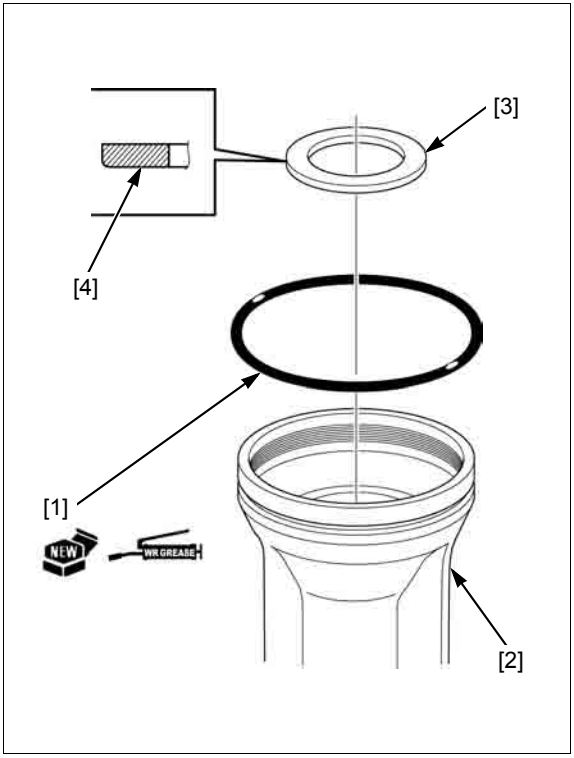
After installation of the water seals, apply marine grease to the water seal lips [4].

<Water seal installation direction>



Apply marine grease to the circumference of a new O-ring [1], and install it on the propeller shaft holder [2].

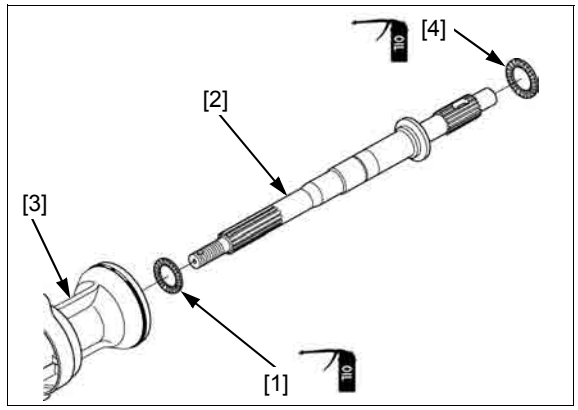
Install the thrust bearing washer [3] with the chamfered side [4] toward the propeller shaft holder.



Apply gear oil to the thrust bearing F [1] and install it to the propeller shaft [2].

Install the propeller shaft on the propeller shaft holder [3].

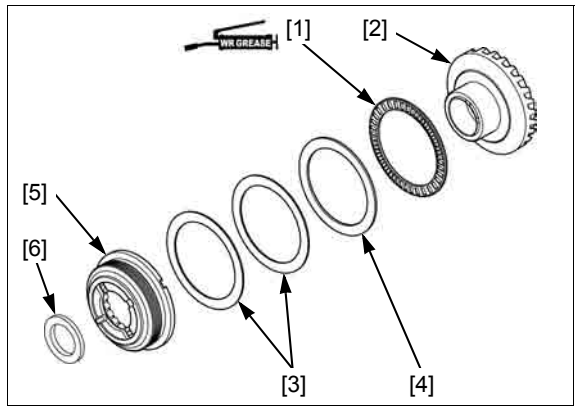
Apply gear oil to the thrust bearing (50 x 72 x 4.5 mm) [4] and install it to the propeller shaft.



Apply marine grease to the thrust bearing (85 x 110 x 4 mm) [1] to avoid falling from the forward bevel gear [2].

Install the thrust shim [3], thrust bearing washer (85 x 110 x 2 mm) [4], thrust bearing (85 x 110 x 4 mm) and forward bevel gear to the bearing holder [5].

Install the thrust bearing washer (48 x 74 x 3 mm) [6] to the bearing holder.



BEARING HOLDER INSTALLATION

Apply gear oil to the threads and seating surface of the bearing holder [1].

Position the bearing holder on the propeller shaft. Loosely tighten the bearing holder by hand against the propeller shaft holder [2].

Attach the fixing tool or special tool [3] (page 17-19), on the propeller shaft holder and secure with two bolts [4].

TOOL:
Prop shaft holder [3] @@

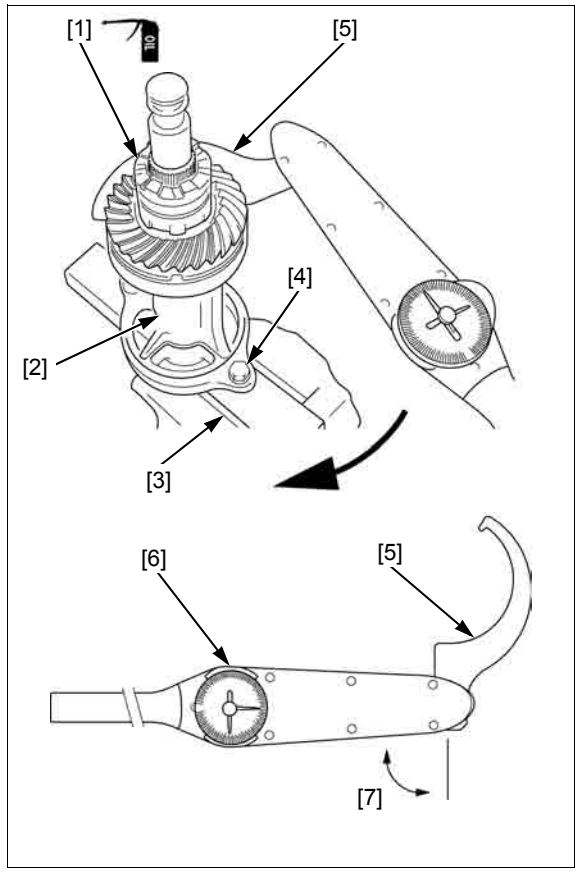
Hold the fixing tool with a vise.

- When tightening, check the thrust bearing washer (48 x 74 x 3 mm) for falling from the propeller shaft holder.
- Avoid holding the propeller shaft holder directly in a vise. Use the fixing tool to hold it in a vise.

Tighten the bearing holder to the specified torque using the special tool as shown.

TOOL:
Pin type spanner, 128 mm [5] 070PA-ZX20100

TORQUE: 230 N·m (23.5 kgf·m, 170 lbf·ft)



NOTICE

- *Make sure the torque wrench [6] is mounted perpendicular [7] to the special tool. If the torque wrench is not held 90 degrees to the tool, the torque reading will be incorrect.*

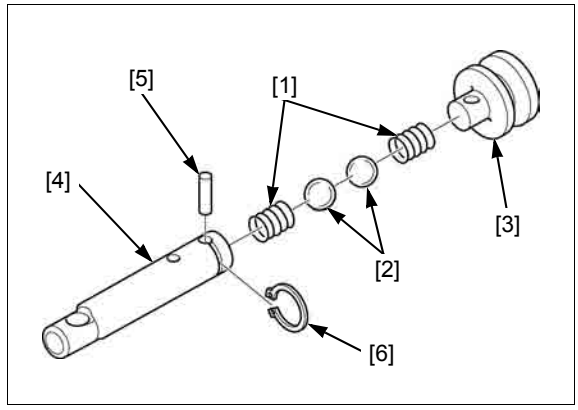
SHIFT SLIDER INSTALLATION

Install a shift spring [1], two steel balls (#12) [2], the other shift spring, and the shift plate [3] in this order in the shift slider [4].

Install the roller [5] aligning the hole in the shift slider with the hole in the shift plate, and then install the circlip [6].

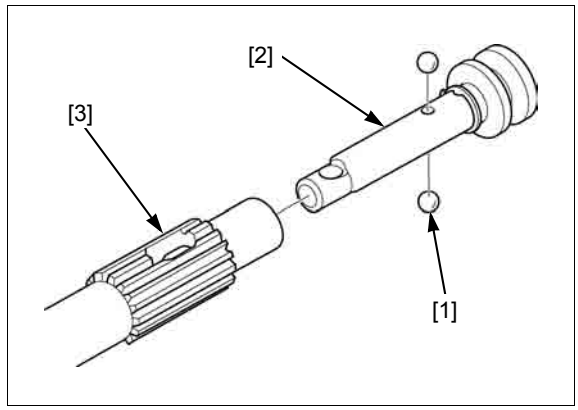
NOTE:

- Do not align the end gap of the circlip with the hole of the shift slider.



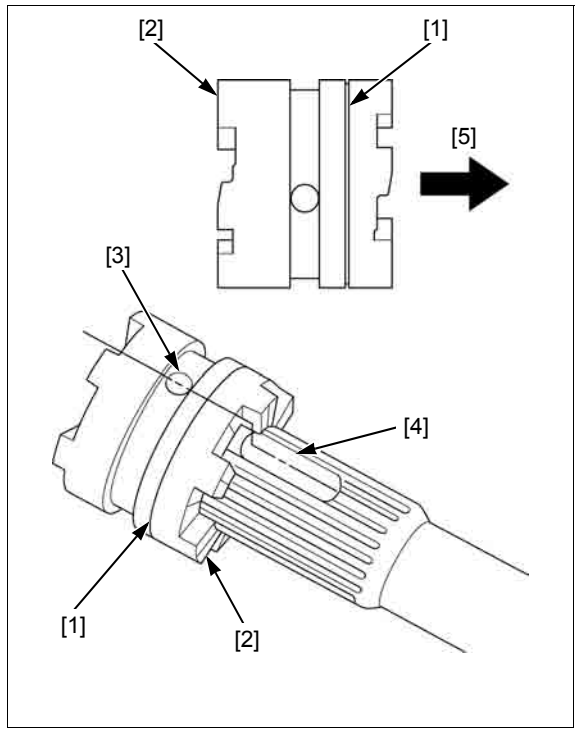
Set the steel balls (#7) [1] in the steel ball installation holes in the shift slider [2], and push the shift slider slowly into the propeller shaft [3].

- Push the shift slider into the propeller shaft with care not to allow the steel balls to pop out.

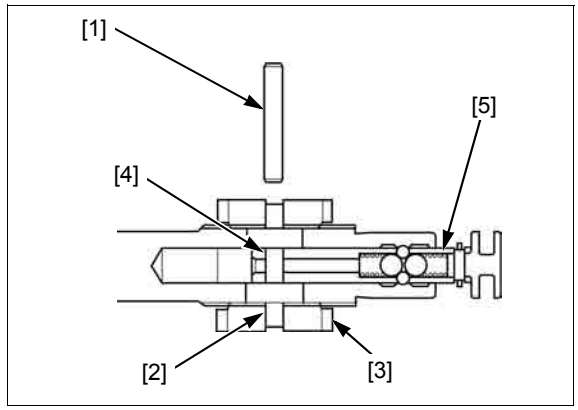


With the groove [1] on the clutch shifter [2] toward the forward bevel gear, assemble the clutch shifter on the propeller shaft while aligning the shifter pin installation hole [3] with the long hole [4] in the propeller shaft.

- The forward bevel gear is opposite the side of the cruising direction [5].

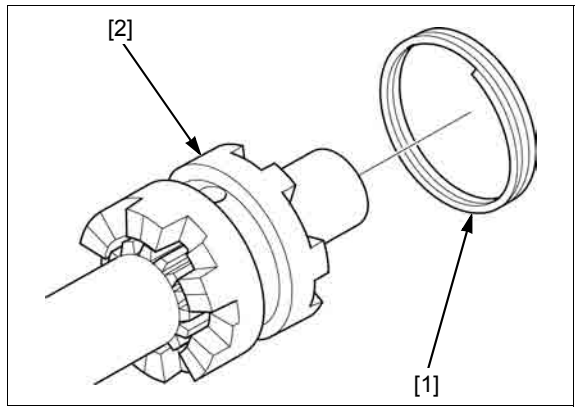


Install the shifter pin [1] while aligning the hole [2] in the clutch shifter [3] with the hole [4] in the shift slider [5].

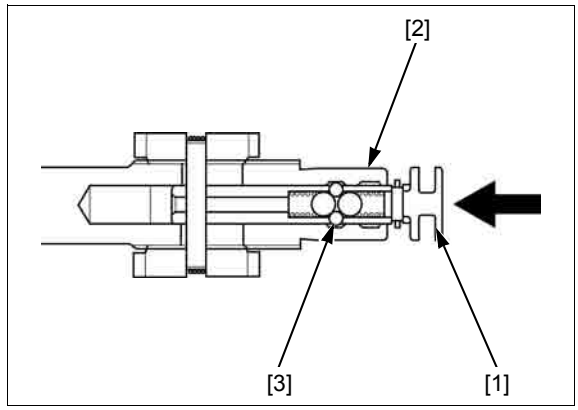


Install the cross pin ring [1] on the clutch shifter [2].

- Check that the coils of the cross pin ring do not overlap each other.



Push the shift slider [1] into the propeller shaft [2] slowly, and set the steel balls (#7) [3] in the positions shown.



NOTICE

- *Note that the shift rod cannot be installed unless the shift slider is on the forward side. Set the shift slider on the forward side securely.*

Install the propeller shaft holder (page 17-17).

VERTICAL SHAFT/REMOVAL/ INSTALLATION

REMOVAL

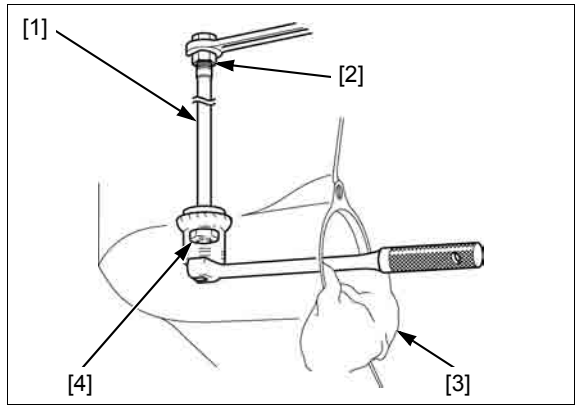
Remove the propeller shaft holder (page 17-17).

Attach the special tool to the vertical shaft end [1].

TOOL:
Vertical shaft holder [2] 07SPB-ZW10200

Place a shop towel [3] or equivalent material as shown to protect the gear case.

Holding the pinion gear nut [4] as shown, turn the vertical shaft and remove the pinion gear nut and pinion gear from the vertical shaft.

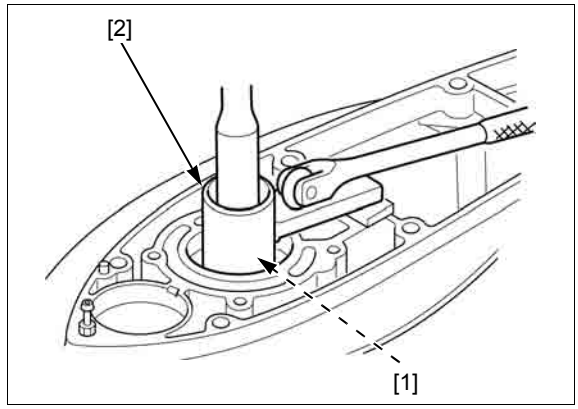


Remove the lock nut [1] using the special tool.

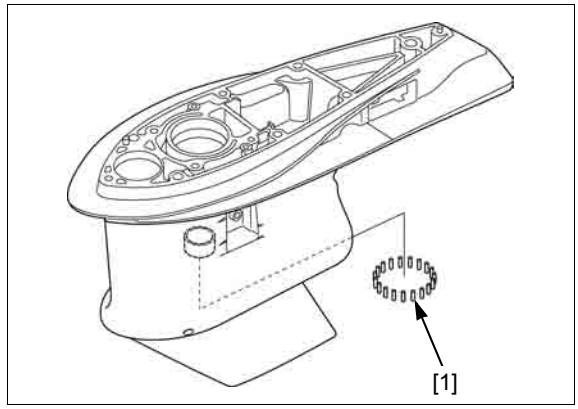
TOOL:
Lock nut wrench, 36 x 47.8 mm [2] 07916-MB00002

Remove the vertical shaft.

- Take care not to drop the needle bearing when removing the vertical shaft.



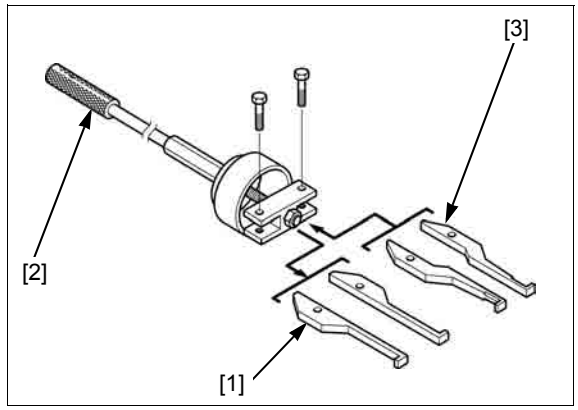
Remove the nineteen needle bearing rollers [1].



Replace the puller jaws [1] of the special tools as shown.

TOOLS:

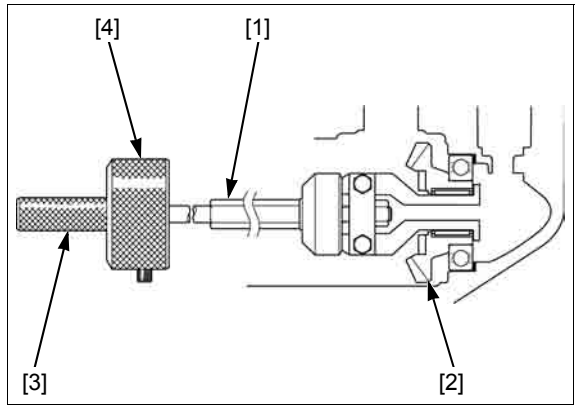
Bearing race puller [2]	**070PC-ZY3A101**
Puller jaws, 25 mm [3]	**07WPC-ZW50100**



Remove the reverse bevel gear [1] using the special tools as shown.

TOOLS:

Bearing race puller [2]	**070PC-ZY3A101**
Remover handle [3]	**07936-3710100**
Puller jaws, 25 mm [4]	**07WPC-ZW50100**
Remover weight [5]	**07936-371020A or 07936-3710200**



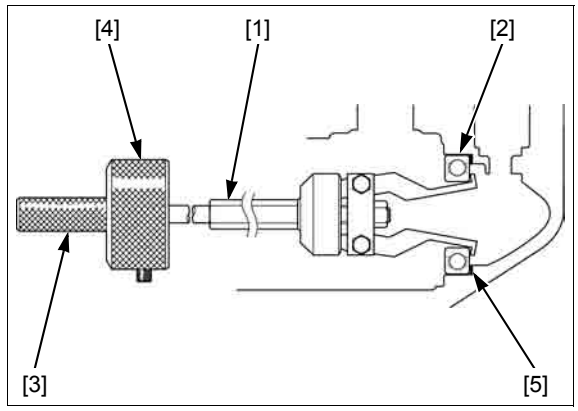
Reinstall the removed jaws of the special tools.

Remove the radial ball bearing [1] using the special tools.

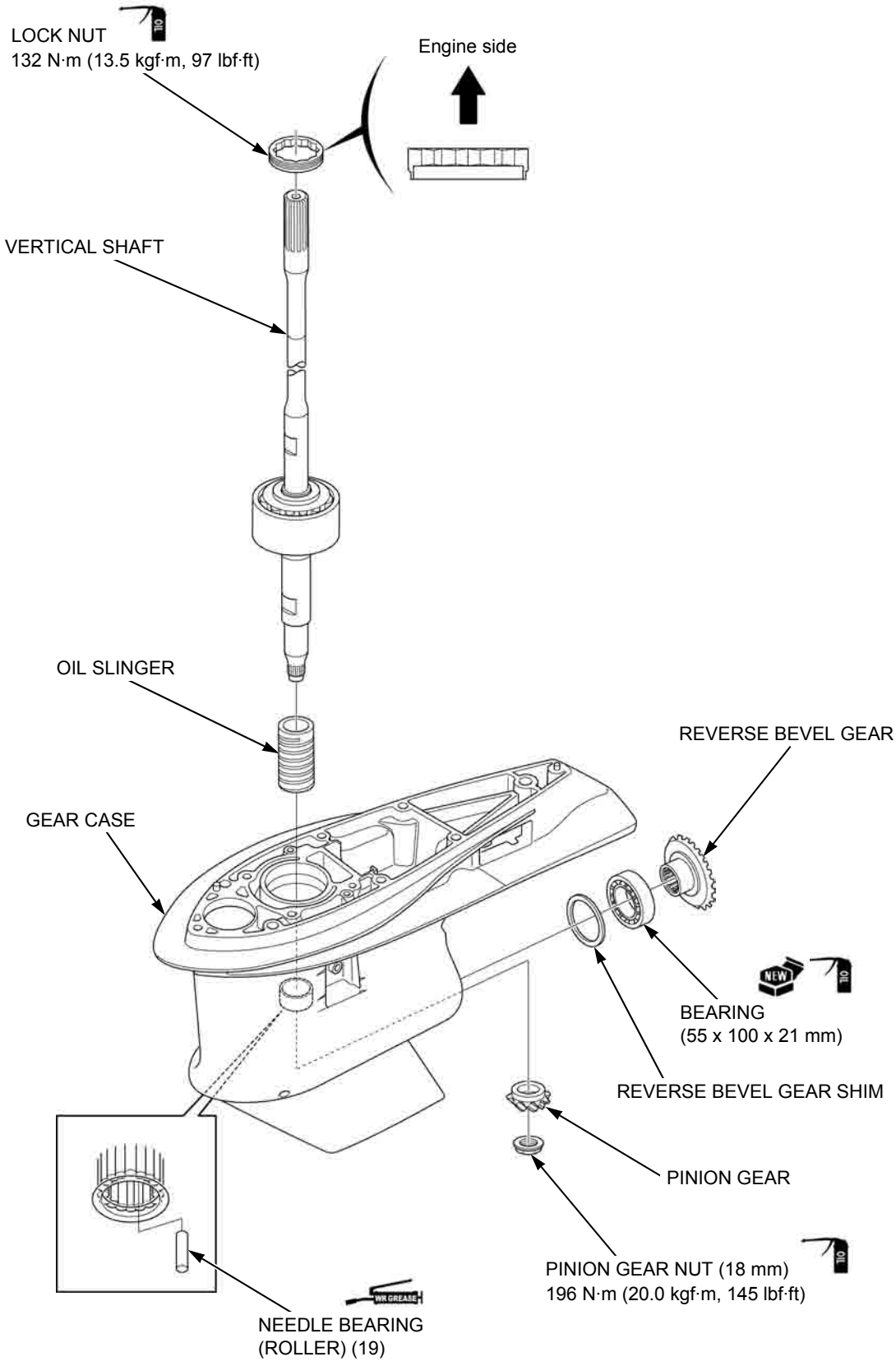
TOOLS:

Bearing race puller [2]	**070PC-ZY3A101**
Remover handle [3]	**07936-3710100**
Remover weight [4]	**07936-371020A or 07936-3710200**

Remove the reverse bevel gear shim [5] from the gear case.



EXPLODED VIEW



INSTALLATION

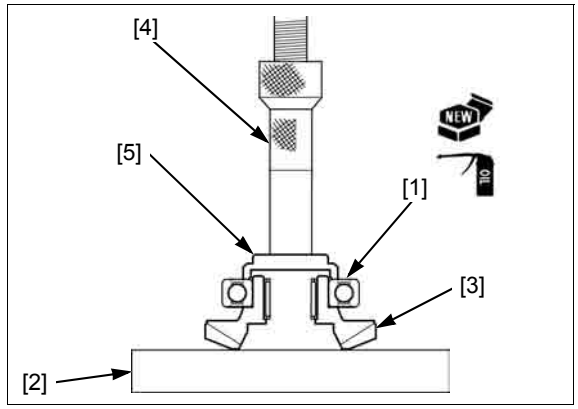
Apply gear oil to the circumference of a new ball bearing [1].

Place a wood block [2] under the reverse bevel gear [3].

Drive the ball bearing (55 x 100 x 21 mm) into the reverse bevel gear using the special tool and a hydraulic press as shown.

TOOLS:

Driver [4]	**07749-0010000**
Oil seal driver attachment, 72 mm [5]	**07947-6340201**



Soak the gear case [1] in the container [2] filled with oil with the bearing installation side down.

Heat the oil to 80 °C – 90 °C (176 °F – 194 °F).

NOTICE

- *Do not heat the oil above 90 °C (194 °F).*

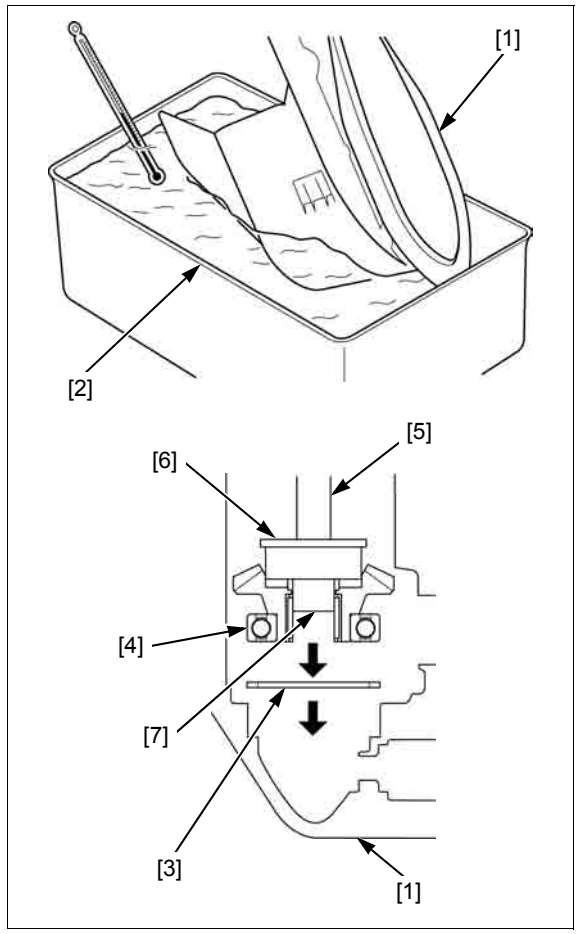
After the entire of bearing installation side of the gear case becomes hot, remove the gear case from the container and install the bevel gear shim [3] on the gear case.
Install the reverse bevel gear/bearing [4] on the gear case using the special tool as shown.

NOTICE

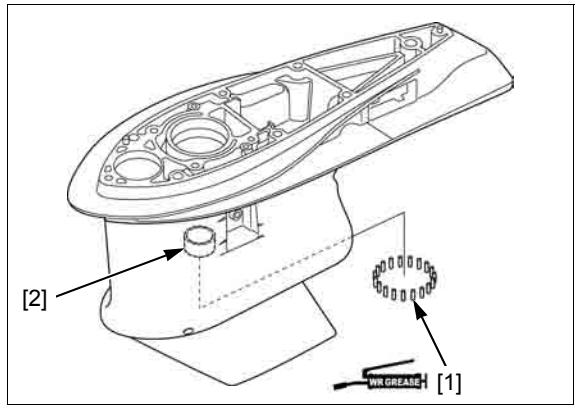
- *Do not apply the force of 9,000 N (917 kgf, 2022 lbf) or above during installation.*
- The entire gear case becomes hot. Be sure to wear the gloves during the operation.
- When the gear case, reverse bevel gear or bearing is replaced with a new one, perform shim adjustment and select the appropriate shim accordingly (page 17-34).
- Install the reverse bevel gear/bearing assembly while the gear case is hot.

TOOLS:

Driver, 280 mm [5]	**07949-3710001**
Attachment, 62 x 68 mm [6]	**07746-0010500**
Pilot, 28 mm [7]	**07JAD-PH80400**



Apply marine grease to the nineteen needle bearing rollers [1] and install them into the needle bearing outer ring [2].



Wipe the tapered part [1] of the vertical shaft [2] and pinion gear [3] with a shop towel and degreasing cleaning solvent.

Apply gear oil to the threads and seating surface of the pinion gear nut [4].

Install the vertical shaft and pinion gear on the gear case, then loosely tighten the pinion gear nut.

Before installing the pinion gear, make sure that the forward bevel gear/taper bearing is positioned in the gear case correctly.

Apply gear oil to the threads and seat of the lock nut [5].

Install the lock nut as shown, noting the installation direction.

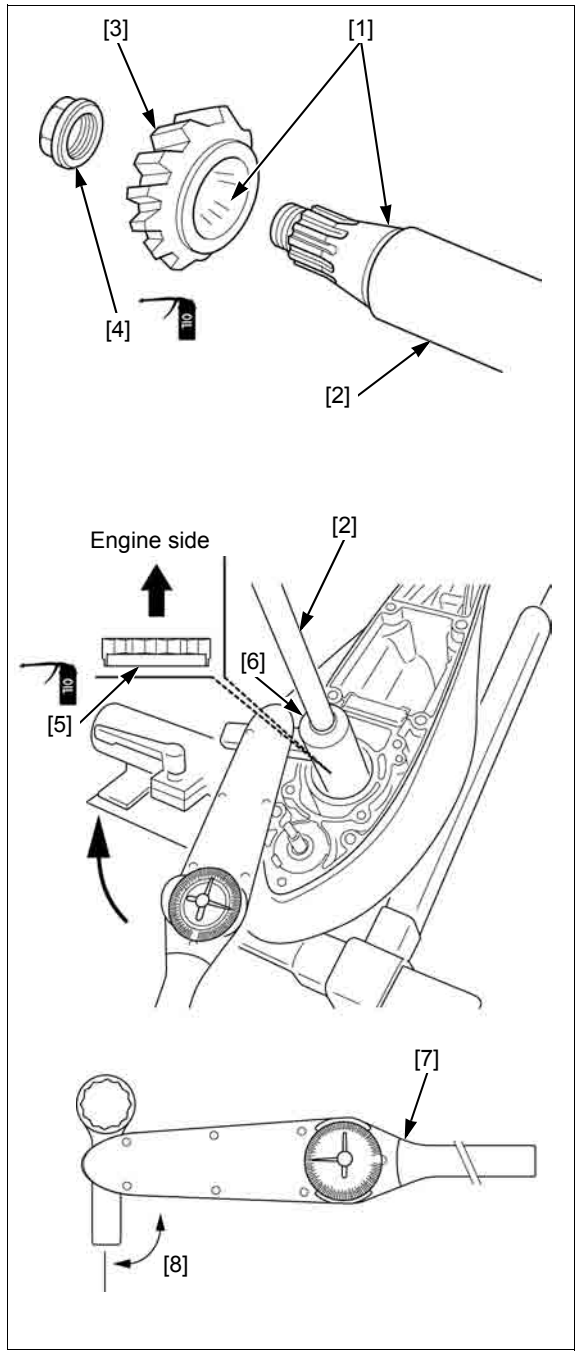
Tighten the lock nut to the specified torque using the special tool.

TOOL:
Lock nut wrench, 36 x 47.8 mm [6] 07916-MB00002

TORQUE: 132 N·m (13.5 kgf·m, 97 lbf·ft)

NOTICE

- *Make sure the torque wrench [7] is mounted perpendicular [8] to the special tool. If the torque wrench is not held 90 degrees to the tool, the torque reading will be incorrect.*



Attach the special tool to the end of the vertical shaft [1] as shown.

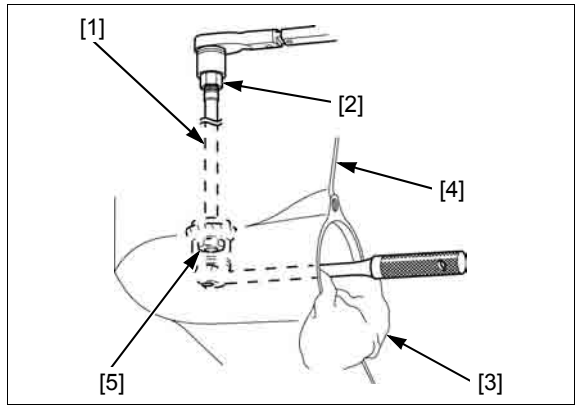
TOOL:
Vertical shaft holder [2] 07SPB-ZW10200

Place a shop towel [3] in the gear case [4] as shown to protect it.

Holding the pinion gear nut [5] as shown, turn the vertical shaft and tighten the pinion gear nut to the specified torque.

TORQUE: 196 N·m (20.0 kgf·m, 145 lbf·ft)

Install the propeller shaft holder (page 17-17).



REVERSE BEVEL GEAR NEEDLE BEARING (28 x 39 x 30 mm) REPLACEMENT

Remove the reverse bevel gear (page 17-25).

Drive out the needle bearing (28 x 39 x 30 mm).

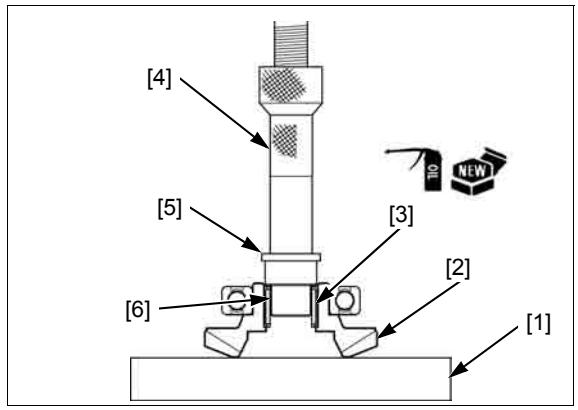
Place a wood block [1] under the reverse bevel gear [2].

Apply gear oil to the outer circumference of a new needle bearing [3].

Install the needle bearing in the reverse bevel gear using the special tools and a hydraulic press as shown.

TOOLS:

Driver [4]	**07749-0010000**
Attachment, 37 x 40 mm [5]	**07746-0010200**
Pilot, 28 mm [6]	**07JAD-PH80400**



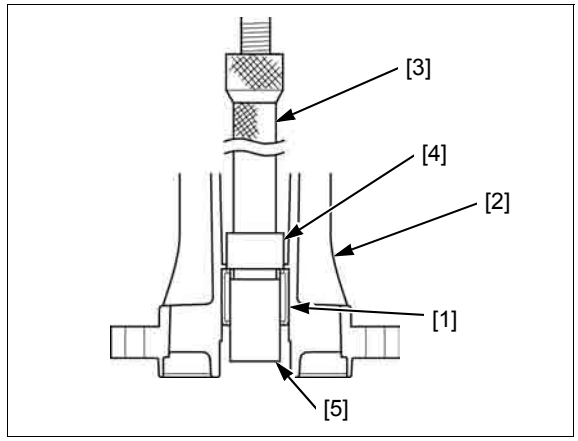
PROPELLER SHAFT HOLDER DISASSEMBLY/ASSEMBLY

DISASSEMBLY

Remove the needle bearing (32 x 42 x 30 mm) [1] from the propeller shaft holder [2] using the special tools and hydraulic press.

TOOLS:

Driver, 280 mm [3]	**07949-3710001**
Oil seal driver attachment, 28 x 35 mm [4]	**07945-4150200**
Pilot, 32 x 50 mm [5]	**07MAD-PR90200**



ASSEMBLY

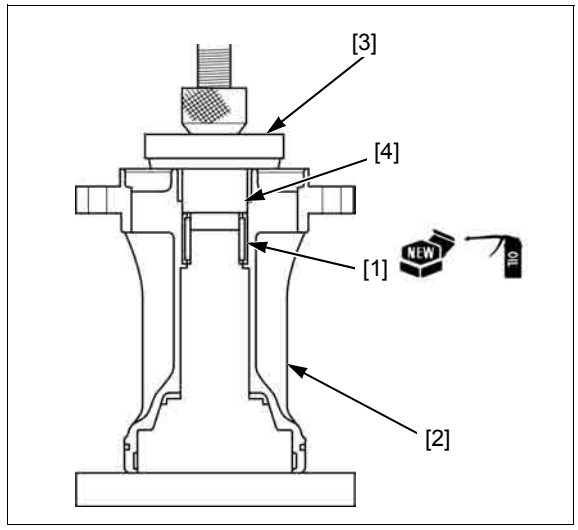
Apply gear oil to the circumference of a new needle bearing.

Drive the needle bearing (32 x 42 x 30 mm) [1] into the propeller shaft holder [2] using the special tools and a hydraulic press as shown.

- Install the needle bearing with the stamped end up (toward the special tool side).

TOOLS:

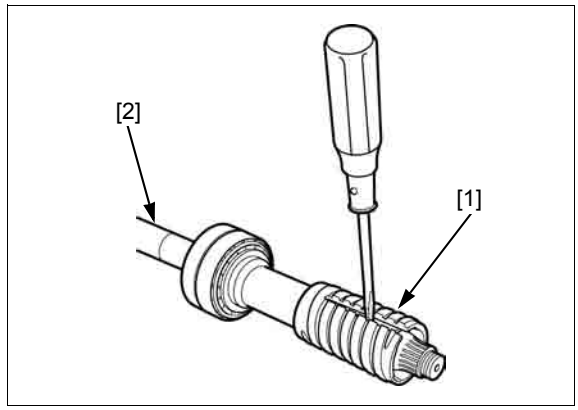
Taper bearing installer attachment, 90 mm [3]	**070PF-ZY3A100**
Attachment, 32 x 42 mm [4]	**070PD-ZY3A100**



VERTICAL SHAFT DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

Remove the oil slinger [1] from the vertical shaft [2] by expanding the cut in the oil slinger with a screwdriver.

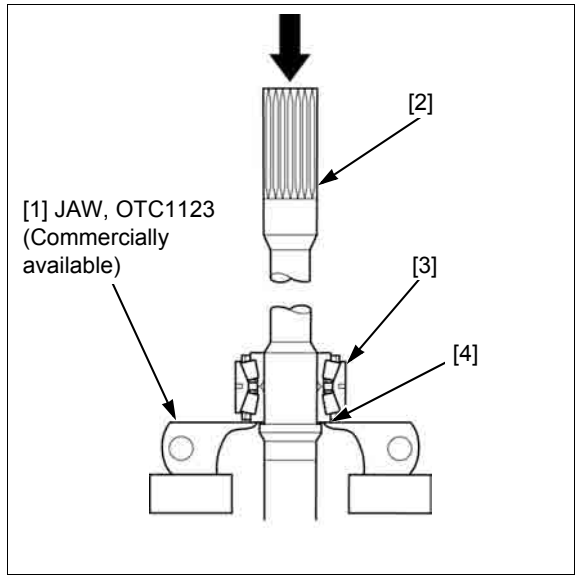


Check the taper roller bearing for abnormal sound and play.
Replace the inner race and outer race as a set if necessary.

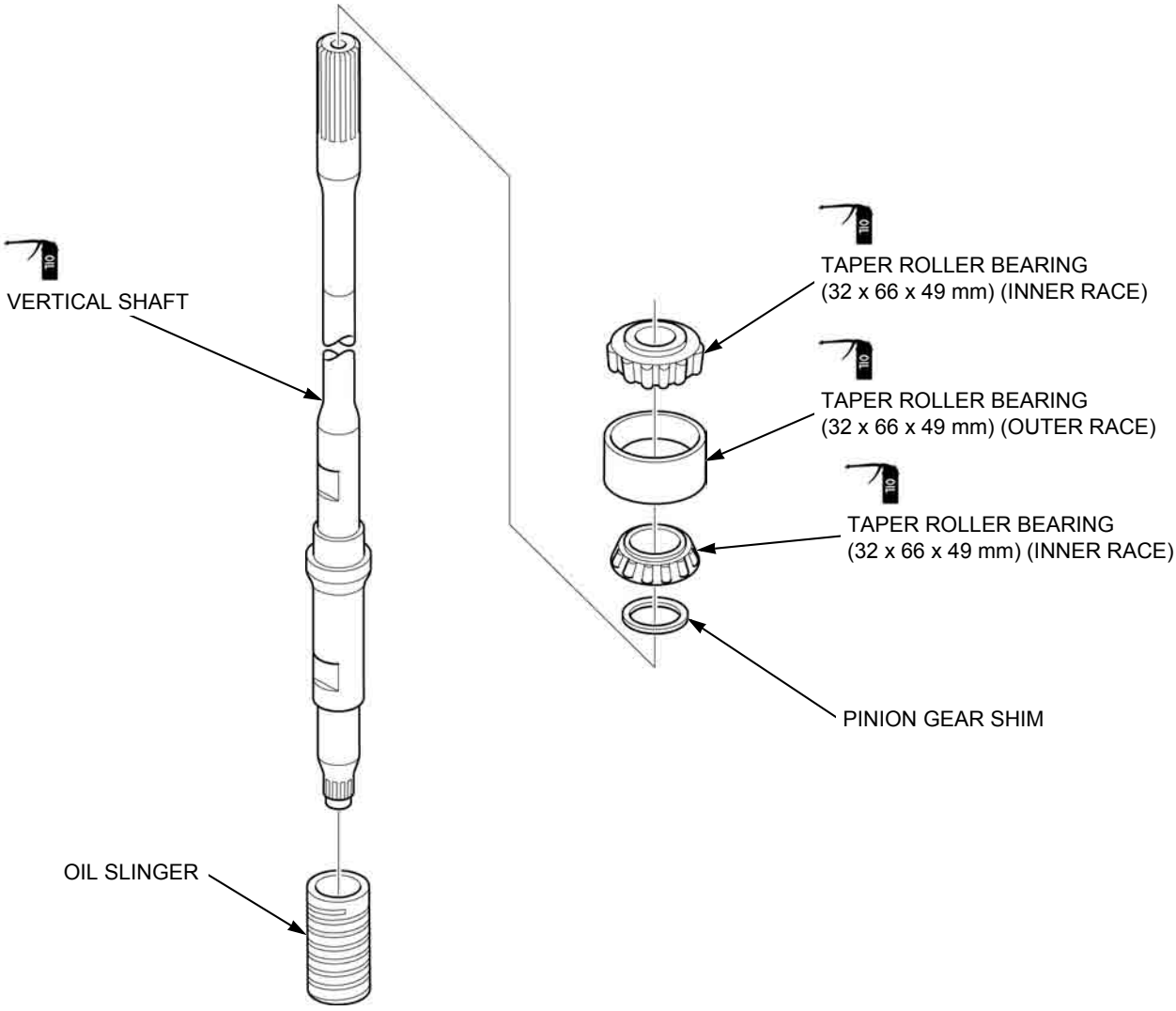
Set a commercially available universal bearing puller [1] on the taper roller bearing [inner race], and install the vertical shaft [2] on the hydraulic press with the flywheel boss installation side facing up.

Remove the taper roller bearing (32 x 66 x 49 mm) [3] from the vertical shaft using a hydraulic press.

Remove the pinion gear shim [4] from the vertical shaft.



EXPLODED VIEW



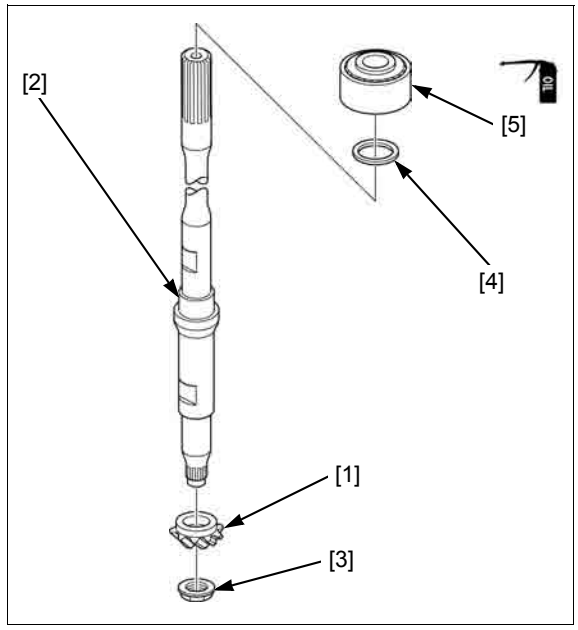
ASSEMBLY

Set the pinion gear [1] on the vertical shaft [2], and loosely tighten the pinion gear nut [3] by hand.

Apply gear oil to the inner surface of the taper roller bearing inner races, rollers, and the inner surface of the outer race. Assemble the inner races and the outer race.

Install the shim [4] and the taper roller bearing [5] on the vertical shaft.

- When the gear case, vertical shaft, pinion gear, or taper roller bearing is replaced with a new one, perform the shim adjustment and select the appropriate shim accordingly (page 17-34).
- Set the taper roller bearing with the side on which the "E" dimension was measured during shim adjustment toward the pinion gear.



Apply gear oil to the taper roller bearing insertion part of the vertical shaft [1].

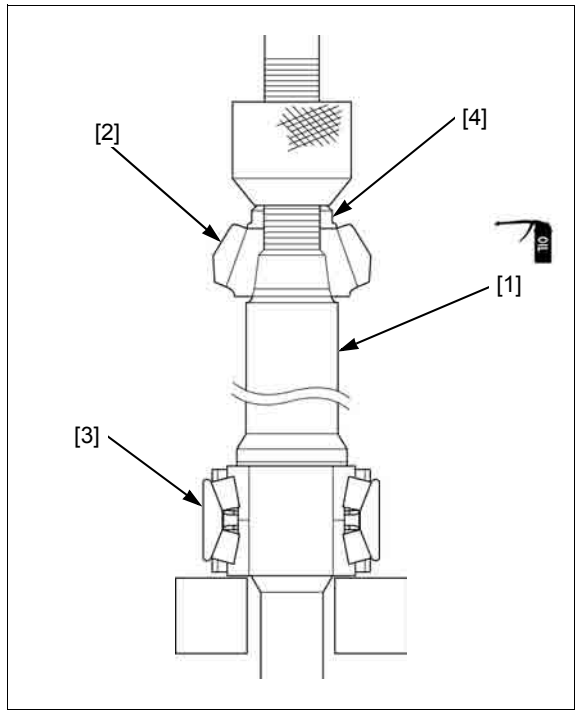
Set the vertical shaft on the hydraulic press with the pinion gear [2] side facing up as shown.

Install the taper roller bearing (32 x 66 x 49 mm) [3] on the vertical shaft using the hydraulic press.

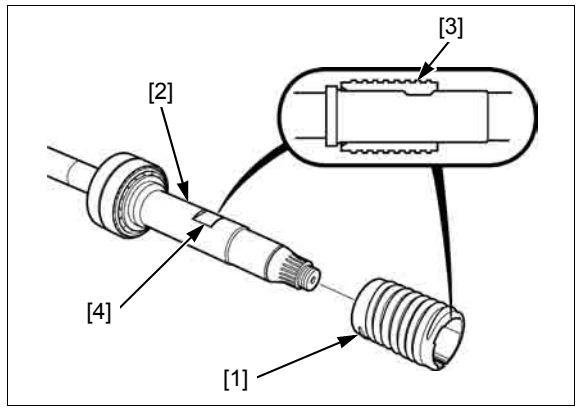
- Check that the taper roller bearing inner race is set on the hydraulic press table securely.
- Do not damage the threads at the end of the vertical shaft (pinion gear nut [4] installation part).

After installation, turn the outer race ten to twenty turns and check that the bearing turns smoothly.

Remove the pinion gear nut and the pinion gear from the vertical shaft.



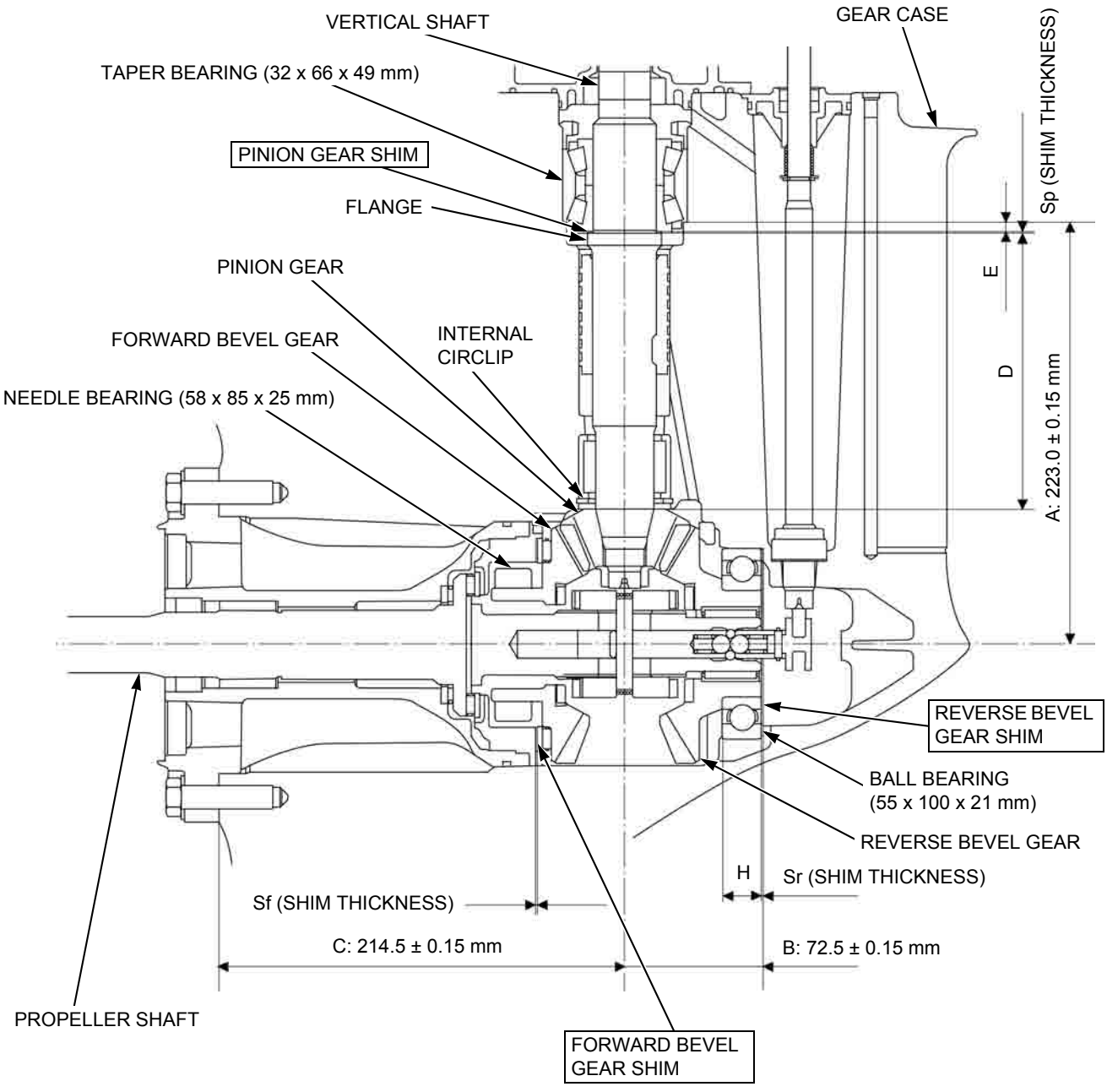
Install the oil slinger [1] on the vertical shaft [2] by aligning the projection [3] on the inside of the oil slinger with the recess [4] on the pinion gear installation side of the vertical shaft.



SHIM SELECTION

SHIM POSITION

- Use shims to adjust the position of each gear so that they engage properly. Perform shim adjustment if the backlash of a gear is outside the specification or after replacing the gear case, vertical shaft, or bearing with a new one.



PINION GEAR SHIM

Remove the taper roller bearing (32 x 66 x 49 mm) if it is mounted on the vertical shaft [1] (page 17-31).

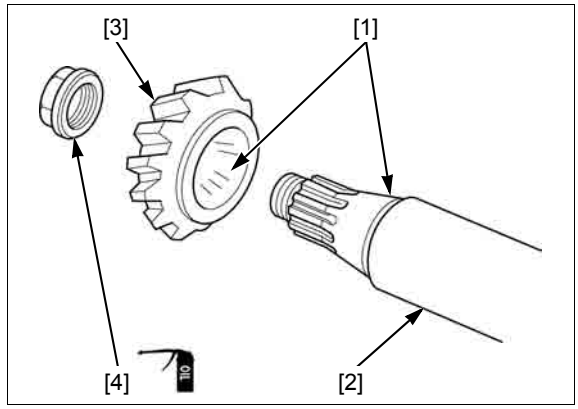
Clean the tapered surfaces [1] of the vertical shaft [2] and pinion gear [3] thoroughly using a shop towel and degreasing cleaning agent.

Apply gear oil to the threads and seating surface of the pinion gear nut [4].

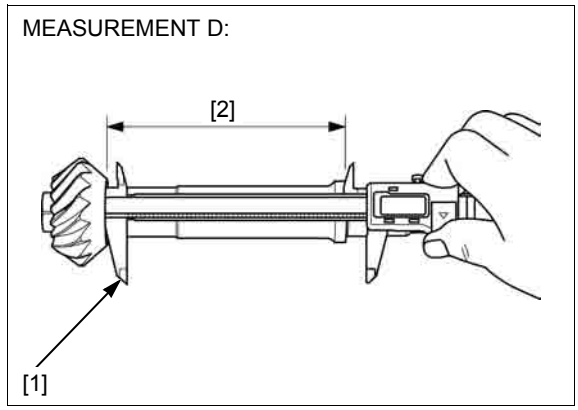
Install the pinion gear on the vertical shaft.
Tighten the pinion gear nut to the specified torque using the special tool.

TOOL:
Vertical shaft holder 07SPB-ZW10200

TORQUE: 196 N·m (20.0 kgf·m, 145 lbf·ft)

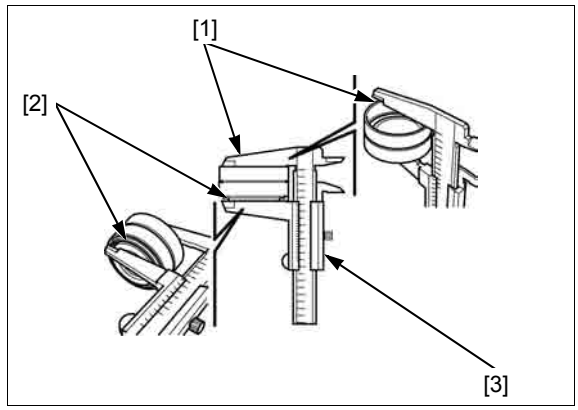


Use a vernier caliper [1] to measure distance (D) [2] from the end of the pinion gear to the end of the flange of the vertical shaft as shown. Record this measurement.

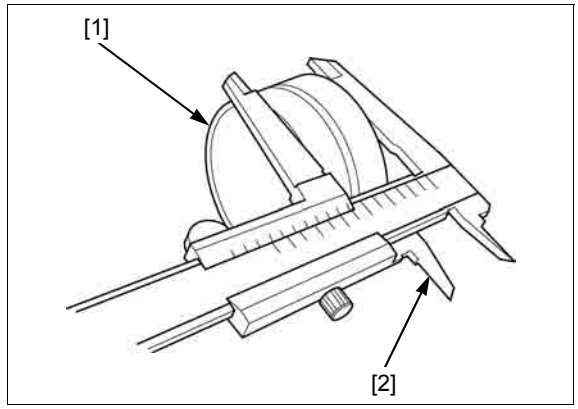


Assemble the outer race [1] and the inner race [2] of the taper roller bearing (32 x 66 x 49 mm), and turn the outer race two or three turns to fit the bearings.

Remove one side of the inner race and measure the bearing height (E') from the outer race end to the inner race end using a regular vernier caliper [3] as shown, and record the measurement.



Measure the height (E'') of the taper roller bearing (outer race [1]) using a regular vernier caliper [2], and record it.



Calculate the length from the inner race end to the outer race end (E) by determining the gap between the measurements E' and E'' using the following formula.

Formula: E= E' – E''

Example:
When measurement (E') from the outer race end to the inner race end is 34.90 mm (1.374 in), and outer race height (E'') is 29.70 mm (1.169 in):

E= 34.90 – 29.70 = 5.20
The gap (E) from the inner race end to the outer race end is 5.20 mm (0.205 in).

Determine the tolerance and record it using the measurement (D), calculation (E) and the following formula.

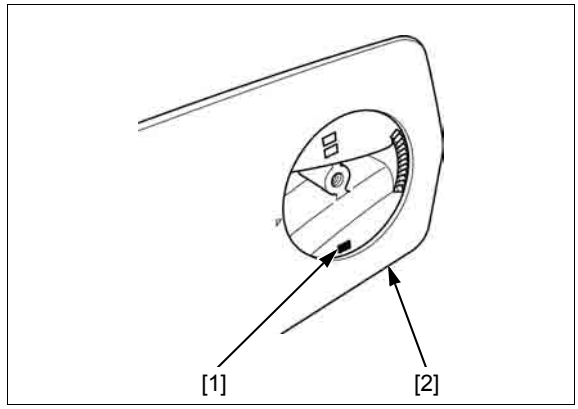
Formula: Tolerance = D + E – 152.50

Example:
When measurement (D) from the pinion gear end to the end of the vertical shaft collar is 147.10 mm (5.791 in), and calculation (E) from the inner race end to the outer race end is 5.20 mm (0.205 in):

147.10 + 5.20 – 152.50 = –0.20
The tolerance is –0.20 mm (–0.008 in).

Remove the gear case cover from the gear case (page 17-7).

Cross reference the engagement mark [1] located on the trim tab installation part of the gear case [2] and the tolerance calculated in the previous step, and refer to the pinion gear shim selection table to determine the required thickness of the shim (Sp).



Pinion gear shim selection table

Unit: mm

		Calculation value													
		–0.37 – –0.25	–0.25 – –0.20	–0.20 – –0.15	–0.15 – –0.10	–0.10 – –0.05	–0.05 – 0	0 – +0.05	+0.05 – +0.10	+0.10 – +0.15	+0.15 – +0.20	+0.20 – +0.25	+0.25 – +0.30	+0.30 – +0.35	+0.35 – +0.43
Gear case engagement mark	A	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20	0.15
	B	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20
	C	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25
	D	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30
	E	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35
	F	1.05	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40

Select the shims from the pinion gear shims of different thickness to obtain the required thickness (Sp) by combining the shims.

Shim type table

Shim type	Thickness
Shim A	0.10 mm
Shim B	0.15 mm
Shim C	0.30 mm
Shim D	0.50 mm

Install the gear case cover on the gear case (page 17-7).

After shim selection, inspect the forward bevel gear backlash (page 17-40)

HOW TO READ SHIM SELECTION TABLE

When the engagement mark on the gear case housing is E and the tolerance is –0.20 mm (–0.008 in), the shim selection table shows that the required shim thickness is 0.90 mm (0.035 in). (See the table shown below).

Pinion gear shim selection table

Unit: mm

		Calculation value													
		–0.37 – –0.25	–0.25 – –0.20	–0.20 – –0.15	–0.15 – –0.10	–0.10 – –0.05	–0.05 – 0	0 – +0.05	+0.05 – +0.10	+0.10 – +0.15	+0.15 – +0.20	+0.20 – +0.25	+0.25 – +0.30	+0.30 – +0.35	+0.35 – +0.43
Gear case engagement mark	A	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20	0.15
	B	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20
	C	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25
	D	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30
	E	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40	0.35
	F	1.05	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	0.50	0.45	0.40

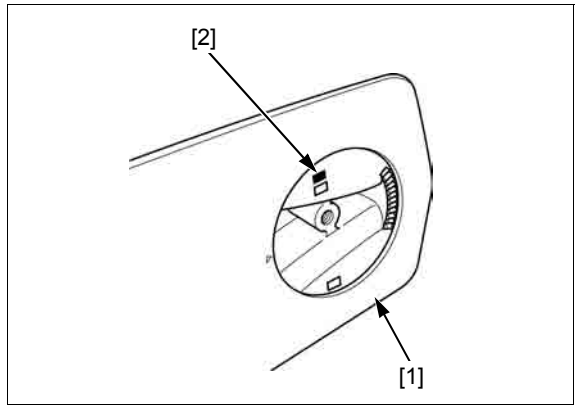
HOW TO SELECT SHIM COMBINATION

To obtain 0.90 mm (0.035 in) of shim thickness, combine one gear shim A, one gear shim C, and one gear shim D, or combine four gear shim A and one gear shim D.

FORWARD BEVEL GEAR SHIM

Remove the gear case cover from the gear case (page 17-7).

Cross reference the engagement mark [1] located on the gear case cover installation part of the gear case [2] and the tolerance calculated in the previous step, and refer to the forward bevel gear shim selection table to determine the required thickness of the shim (Sf).



Forward bevel gear shim selection table

Unit: mm

	Thickness	
Gear case engagement mark	A	0.10
	B	0.15
	C	0.20
	D	0.25
	E	0.30
	F	0.35

Select the shims from the forward bevel gear shims of different thickness to obtain the required thickness (Sf) by combining the shims.

Shim type table

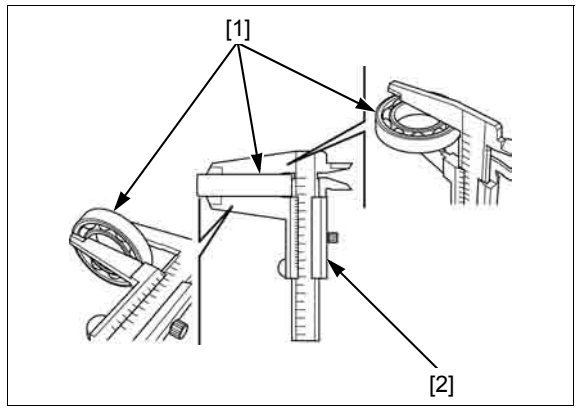
Shim type	Thickness
Shim A	0.10 mm
Shim B	0.15 mm
Shim C	0.30 mm
Shim D	0.50 mm

Install the gear case cover on the gear case (page 17-7).

After shim selection, inspect the forward bevel gear backlash (page 17-40)

REVERSE BEVEL GEAR SHIM

Measure the bearing height (H) of a new ball bearing (55 x 100 x 21 mm) [1] using a regular vernier caliper [2] as shown, and record the measurement.



Calculate the tolerance using the measurement H obtained in the previous step and the following formula.

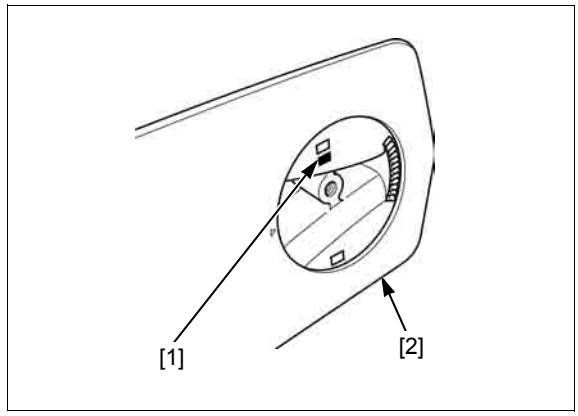
Formula: Tolerance = H – 21.5

Example:
When measurement (H) is 21.45 mm (0.844 in):

Tolerance = 21.45 – 21.5 = –0.05
The tolerance is –0.05 mm (–0.002 in).

Remove the gear case cover from the gear case (page 17-7).

Cross reference the engagement mark [1] located on the gear case cover installation part of the gear case [2] and the tolerance, and refer to the reverse bevel gear shim selection table to determine the required thickness of the shim (Sr).



Reverse bevel gear shim selection table

Unit: mm

		Calculation value					
		–0.29 – –0.25	–0.25 – –0.20	–0.20 – –0.15	–0.15 – –0.10	–0.10 – –0.05	–0.05 – 0
Gear case engagement mark	1	0.70	0.65	0.60	0.55	0.50	0.45
	2	0.65	0.60	0.55	0.50	0.45	0.40
	3	0.60	0.55	0.50	0.45	0.40	0.35
	4	0.55	0.50	0.45	0.40	0.35	0.30
	5	0.50	0.45	0.40	0.35	0.30	0.25
	6	0.45	0.40	0.35	0.30	0.25	0.20

Refer to 17-37 for information on how to read the shim selection table and shim combination.

Select the shims from the reverse bevel gear shims of different thickness to obtain the required thickness (Sr) by combining the shims.

Shim type table

Shim type	Thickness
Shim A	0.10 mm
Shim B	0.15 mm
Shim C	0.30 mm
Shim D	0.50 mm

Install the gear case cover on the gear case (page 17-7).

After shim selection, inspect the reverse bevel gear backlash (page 17-41).

BACKLASH INSPECTION

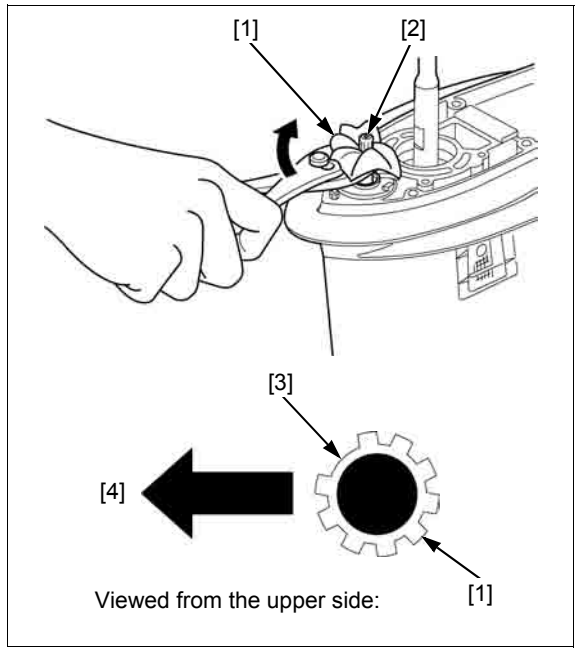
FORWARD BEVEL GEAR BACKLASH

Backlash adjustment must be made after adjustment of each gear shim (page 17-34).

Install the following parts except the water pump.

– Vertical shaft/forward bevel gear (page 17-28)
– Propeller shaft holder (page 17-17)
– Shift rod (page 17-15)

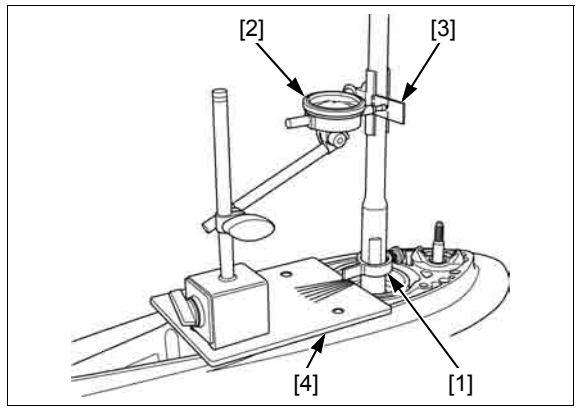
Wrap a shop towel [1] around the shift rod spline [2], and use pliers to turn the shift rod in the direction shown (cutout of the shift rod spline [3] is toward the right side of the cruising direction [4]).



Set the special tools as shown.

TOOLS:

Backlash indicator tool [1]	**07SPJ-ZW0030B**
Backlash inspection tool set	**070PJ-ZX20200**



- Adjust the dial indicator [2] so its needle is at the line of the indicator clip [3].
- Align the backlash indicator tool with line of the base plate [4]

Turn the vertical shaft lightly right and left and record the dial indicator reading.

Measure the backlash at six lines of the base plate.

Turn the vertical shaft 180° and measure the backlash in the same manner.

When measuring the backlash, do not turn the propeller shaft by turning the vertical shaft.

Obtain the forward bevel gear backlash using the dial gauge runout and the following formula.

Formula:
Backlash = Dial gauge runout ÷ 0.806

Example:
When dial gauge runout is 0.285 mm (0.0112 in),
Backlash =
0.285 mm (0.0112 in) ÷ 0.806 = 0.35 mm (0.014 in)

STANDARD VALUE:
0.40 – 0.65 mm (0.016 – 0.026 in)

If the backlash is too large compared to the standard value, increase the forward bevel gear shim thickness and recheck the backlash.

If the backlash is too small compared to the standard value, reduce the forward bevel gear shim thickness and recheck the backlash.

- Inspect the reverse bevel gear backlash after adjustment of the pinion gear shim (page 17-41).

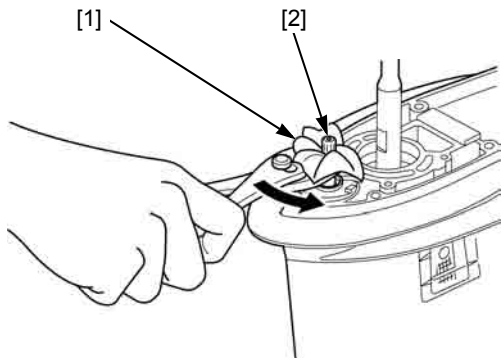
REVERSE BEVEL GEAR BACKLASH

Backlash adjustment must be made after adjustment of each gear shim (page 17-34).

Install the following parts except the water pump.

– Vertical shaft/forward bevel gear (page 17-28)
– Propeller shaft holder (page 17-17)
– Shift rod (page 17-15)

Wrap a shop towel [1] around the shift rod spline [2], and use pliers to turn the shift rod in the direction shown (cutout of the shift rod spline [3] is toward the left side of the cruising direction [4]).

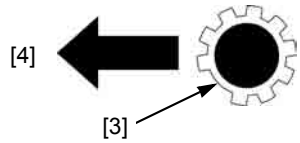


Set the special tools as shown.

TOOLS:

Backlash indicator tool [5]	**07SPJ-ZW0030B**
Backlash inspection tool set	**070PJ-ZX20200**

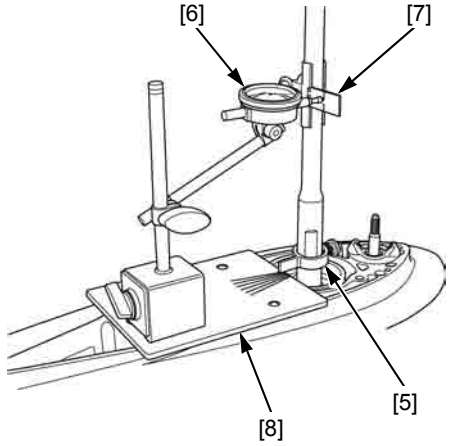
- Adjust the dial indicator [6] so its needle is at the line of the indicator clip [7].
- Align the backlash indicator tool with line of the base plate [8]



Viewed from the upper side:

Turn the vertical shaft lightly right and left and record the dial indicator reading.
Measure the backlash at six lines of the base plate.
Turn the vertical shaft 180° and measure the backlash in the same manner.

When measuring the backlash, do not turn the propeller shaft by turning the vertical shaft.



Obtain the reverse bevel gear backlash using the dial indicator runout and the following formula.

Formula:
Backlash = Dial gauge runout ÷ 0.806

Example:
When dial gauge runout is 0.285 mm (0.0112 in),
Backlash =
0.285 mm (0.0112 in) ÷ 0.806 = 0.35 mm (0.014 in)

STANDARD VALUE:
0.41 – 0.64 mm (0.016 – 0.025 in)

If the backlash is too large compared to the standard value, increase the reverse bevel gear shim thickness and recheck the backlash.

If the backlash is too small compared to the standard value, reduce the reverse bevel gear shim thickness and recheck the backlash.

- Use the special tool when reverse bevel gear/ bearing is removed to adjust the backlash again.

Install the water pump (page 11-12).

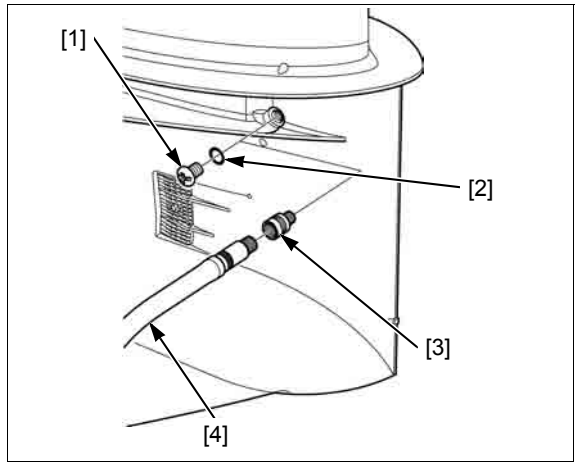
After installation, inspect the gear case pressure (page 17-42).

GEAR CASE PRESSURE INSPECTION

- Perform the gear case pressure check and check for pressure leakage after disassembling and reassembling the gear case.
- In principle, the pressure check should be made on the gear case before filling it with gear oil and before installing it on the outboard motor. However, the check can be made with the gear case filled with gear oil.

Remove the gear oil check bolt [1] and the O-ring [2].

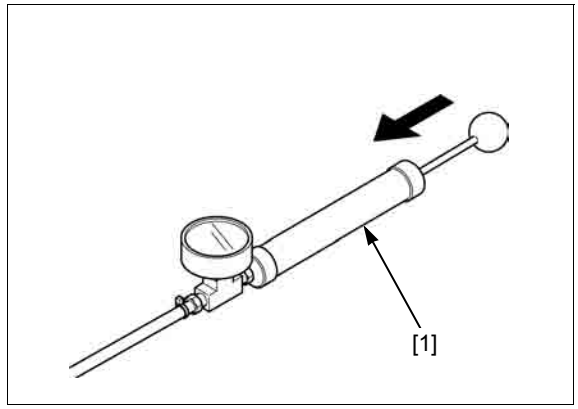
Install the adapter (STV-3334Y: commercially available) [3] in the oil check bolt hole.
Attach the hose end of the pressure tester (STV-V34: commercially available) [4] to the adapter.
Do not screw in the adapter and the hose end with force.



While watching pressure tester gauge [1], apply the specified air pressure to the gear case by pumping the handle slowly.

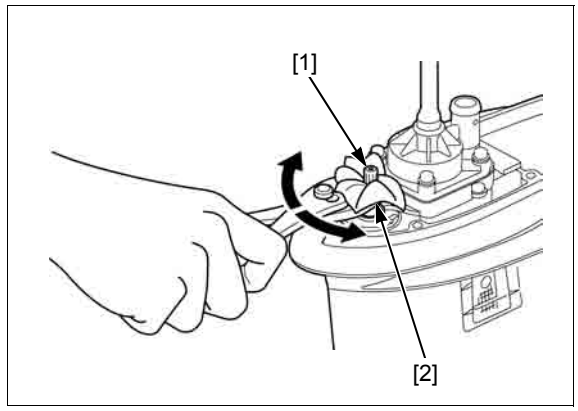
Do not apply excessive air pressure.

AIR PRESSURE:
29 kPa (0.3 kgf/cm^2, 4.3 psi)

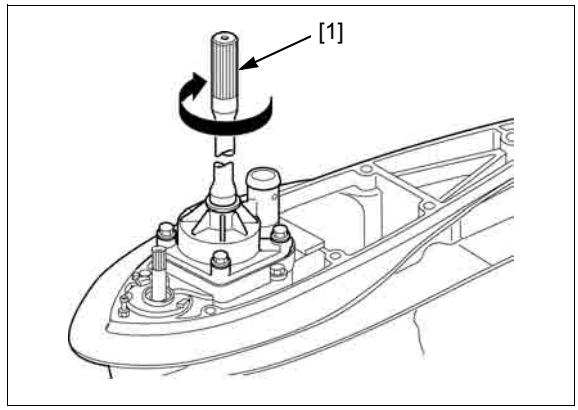


While applying the specified air pressure to the gear case, move the shift rod [1] right and left five or six times using pliers.

Wrap a shop towel [2] around the shift rod spline to move the shift rod with pliers.



While applying the specified air pressure to the gear case, turn the vertical shaft [1] five or six turns clockwise.

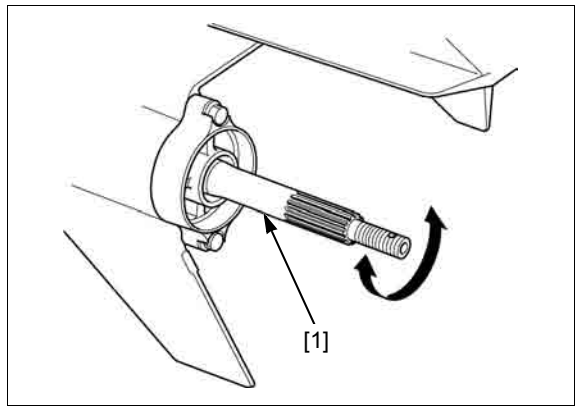


NOTICE

- *Be sure to turn the vertical shaft clockwise, or damage to the water pump impeller can occur.*

While applying the specified air pressure to the gear case, turn the propeller shaft [1] right and left two or three turns.

Leave the gear case for five minutes, and then check that the air pressure is maintained.



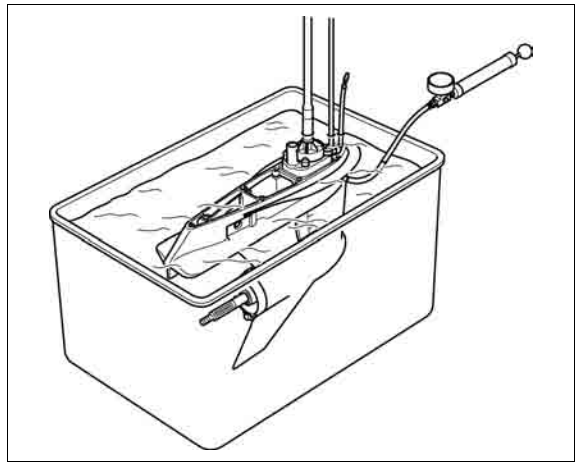
If the air pressure drops, place the gear case in a container filled with a water. Apply the specified air pressure to the gear case again, move the shift rod, vertical shaft, and the propeller shaft, and locate the point where the air is leaking.

Remove the gear case from the water and replace the water seal or O-ring where the air is leaking.

After replacing the water seal or O-ring, perform the pressure check again and be sure that air is not leaking.

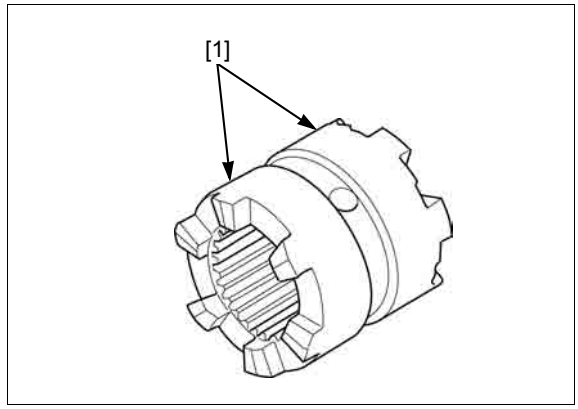
Remove the gear case pressure tester and the adapter from the gear case.
Install a new O-ring on the oil check bolt, and tighten the gear oil check bolt to the specified torque.

TORQUE: 6.5 N·m (0.66 kgf·m, 4.8 lbf·ft)



CLUTCH SHIFTER INSPECTION

Check the clutch parts [1] on both the forward and reverse sides for wear and damage.



PROPELLER SHAFT INSPECTION

PROPELLER SHAFT O.D.

Measure the O.D. of the propeller shaft where the bearings ride.

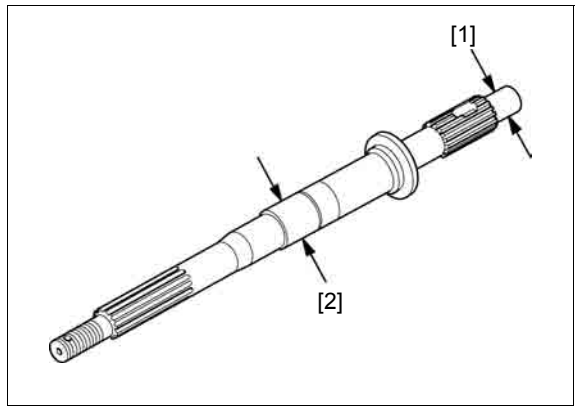
STANDARD:

At bevel gear [1]:	**27.974 – 27.983 mm (1.1013 – 1.1017 in)**
At needle bearing [2]:	**32.007 – 32.020 mm (1.2601 – 1.2606 in)**

SERVICE LIMIT:

At bevel gear:	**27.949 mm (1.1004 in)**
At needle bearing:	**31.990 mm (1.2594 in)**

If the measurement is less than the service limit, replace the propeller shaft with a new one on assembly.



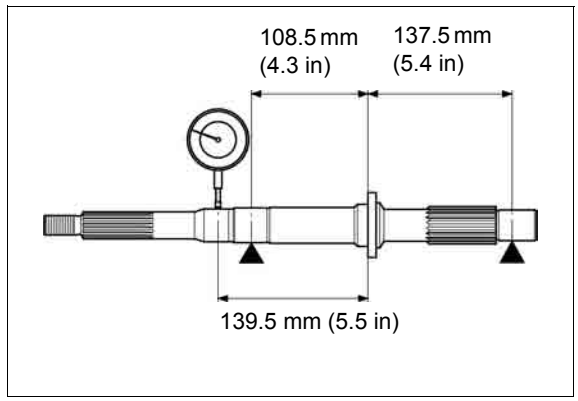
PROPELLER SHAFT RUNOUT

Support each journal with V-blocks as shown.

Set the dial indicator and measure the propeller shaft runout while turning the shaft.

STANDARD: 0.02 mm (0.001 in) or below
SERVICE LIMIT: 0.02 mm (0.001 in)

If the measurement is more than the service limit, replace the propeller shaft with a new one on assembly.



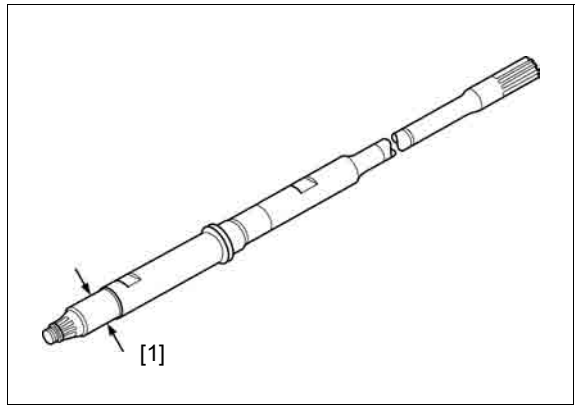
VERTICAL SHAFT INSPECTION

VERTICAL SHAFT O.D. (At needle bearing)

Measure the O.D. of the vertical shaft where the needle bearing [1] rides.

STANDARD: 30.491 – 30.500 mm (1.2004 – 1.2008 in)
SERVICE LIMIT: 30.470 mm (1.1996 in)

If the measurement is less than the service limit, replace the vertical shaft with a new one on assembly.



VERTICAL SHAFT RUNOUT

Support each journal with V-blocks as shown.

Set the dial indicator and measure the vertical shaft runout while turning the shaft.

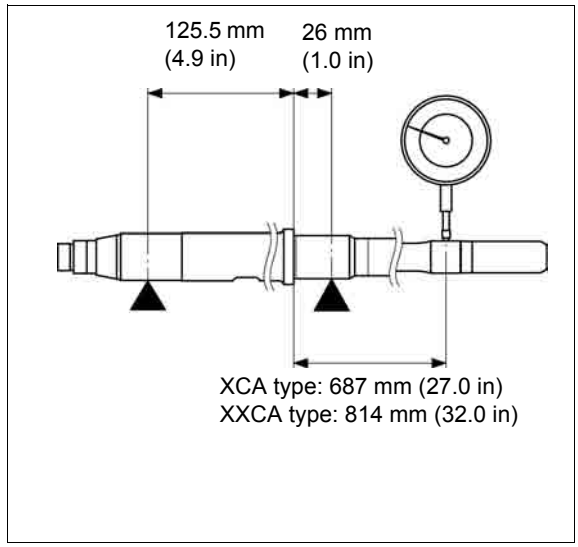
STANDARD:

XCA type	**0.35 mm (0.014 in) or below**
XXCA type	**0.40 mm (0.016 in) or below**

SERVICE LIMIT:

XCA type	**0.35 mm (0.014 in)**
XXCA type	**0.40 mm (0.016 in)**

If the measurement exceeds the service limit, replace the vertical shaft with a new one.



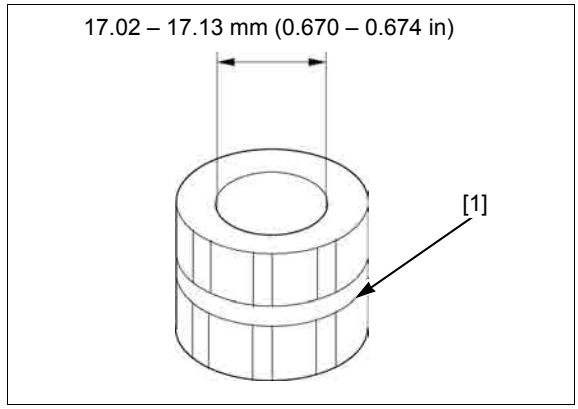
VERTICAL SHAFT BUSH INSPECTION

VERTICAL SHAFT BUSH I.D.

Measure the vertical shaft bush [1] I.D.

STANDARD: 17.02 – 17.13 mm (0.670 – 0.674 in)
SERVICE LIMIT: 17.65 mm (0.695 in)

If the measurement exceeds the service limit, replace the vertical shaft bush with a new one.



GEAR CASE STUD BOLT REPLACEMENT (XCA type)

Remove the gear case (page 17-7).

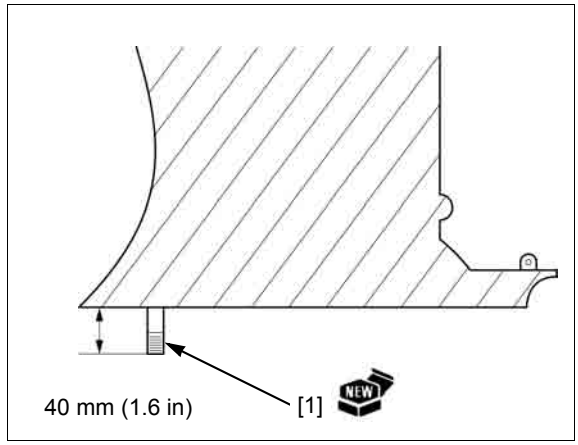
Thread two nuts onto the stud [1] and tighten them together. Use a wrench to turn the stud bolt out.

Install new stud bolt into the extension case and tighten them to the specified torque.

TORQUE: 22 N·m (2.2 kgf·m, 16 lbf·ft)

After gear case stud bolt installation, check that the length from the bolt head to the extension case surface is within specification.

SPECIFIED LENGTH: 40 mm (1.6 in)



EXTENSION SEPARATOR STUD BOLT REPLACEMENT (XXCA type)

Remove the extension separator (page 17-7).

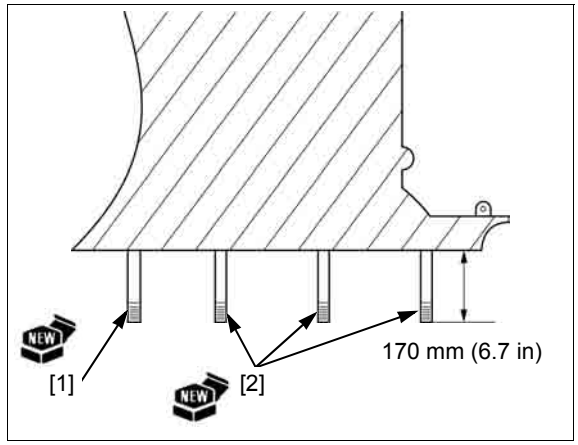
Thread two nuts onto the stud bolt (12 x 170 mm) [1] and six stud bolts (10 x 170 mm) [2], and tighten them together. Use a wrench to turn the stud bolt out.

Install new stud bolts into the extension case and tighten them to the specified torque.

TORQUE:
STUD BOLT (12 x 170 mm):
22 N·m (2.2 kgf·m, 16 lbf·ft)
STUD BOLT (10 x 170 mm):
15 N·m (1.5 kgf·m, 11 lbf·ft)

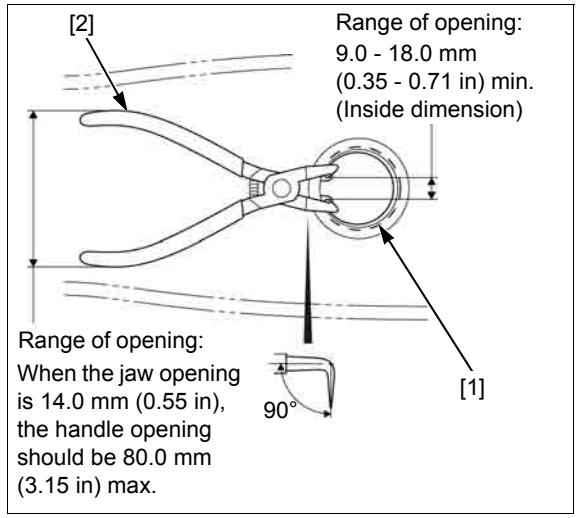
After extension separator stud bolt installation, check that the length from the bolt head to the extension case surface is within specification.

SPECIFIED LENGTH: 170 mm (6.7 in)



GEAR CASE NEEDLE BEARING REPLACEMENT

Remove the internal circlip [1] using suitable commercially available pliers [2] as shown.



Set the special tools on the needle bearing [1], and place a shop towel [2] or equivalent material under the needle bearing as shown.

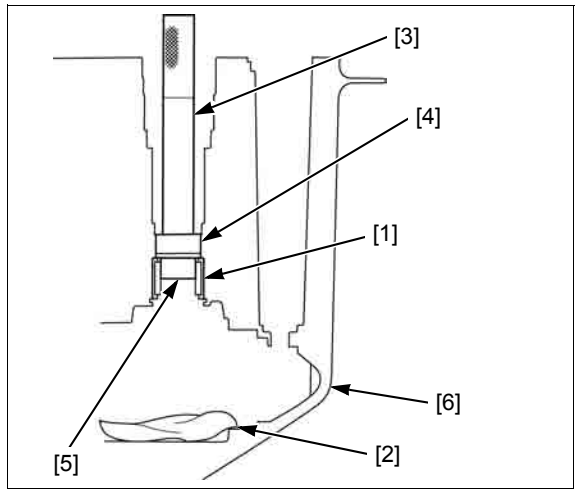
TOOLS:

Driver, 280 mm [3]	**07949-3710001**
Attachment, 37 x 40 mm [4]	**07746-0010200**
Pilot, 30 mm [5]	**07746-0040700**

Remove the needle bearing (30.5 x 47 x 37 mm) from the gear case [6] using the special tools.

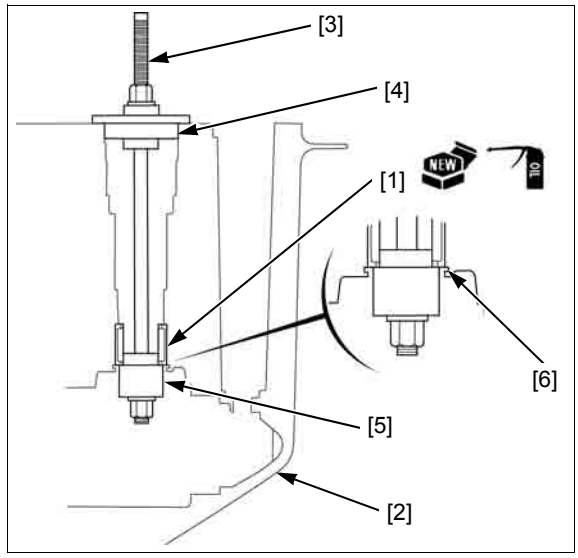
NOTICE

- *Remove the needle bearing with care not to damage the gear case.*



Apply gear oil to the outer circumference of a new needle bearing [1].

Install the needle bearing (30.5 x 47 x 37 mm) in the gear case [2] using the special tools, until it is fully seated.



NOTICE

- *Install the needle bearing with the stamped end facing down (toward the pinion gear side) or severe gear case damage will occur.*

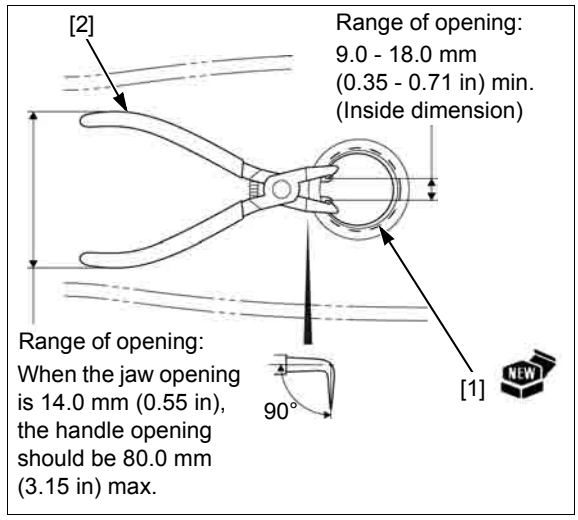
TOOLS:

Installer shaft, 15 x 370 mm [3]	**07VMF-KZ30200**
Bearing driver attachment, 64 x 72 mm [4]	**07946-SB20000**
Attachment, 27.5 x 44 mm [5]	**07948-9540000**

After installation, check that the bottom surface of the needle bearing is above the groove [6] of the gear case.

Install a new internal circlip [1] using suitable commercially available pliers [2] as shown.

- Install the internal circlip with the sharp side facing the pinion gear side.
- Check that the internal circlip is seated in the gear case groove.
- Avoid the internal circlip damage during installation (Do not close the pliers nose narrower than 9.0 mm (0.35 in)).



MEMO

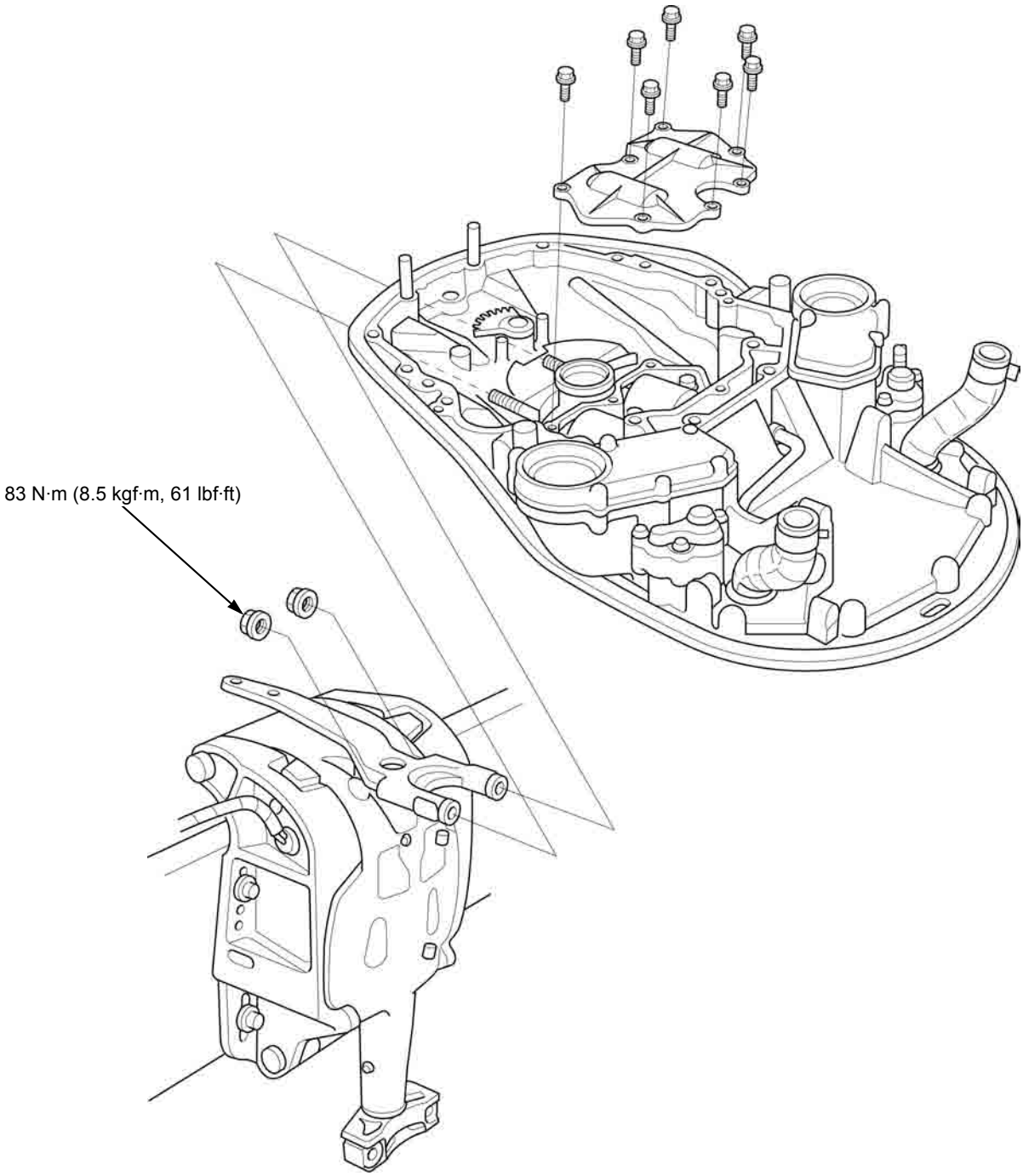
COMPONENT LOCATION ····· 18-2

TOOLS ····· 18-3

MOUNT CASE REMOVAL/ INSTALLATION ····· 18-4

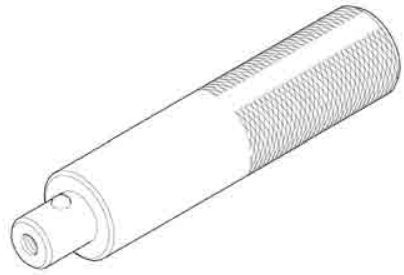
MOUNT CASE DISASSEMBLY/ ASSEMBLY ····· 18-5

COMPONENT LOCATION



TOOLS

LIST

Attachment, 32 x 35 mm 07746-0010100 	Attachment, 24 x 26 mm 07746-0010700 	Pilot, 20 mm 07746-0040500 
Pilot, 22 mm 07746-0041000 	Pilot, 14 mm 07746-0041200 	Driver 07749-0010000 

MOUNT CASE REMOVAL/ INSTALLATION

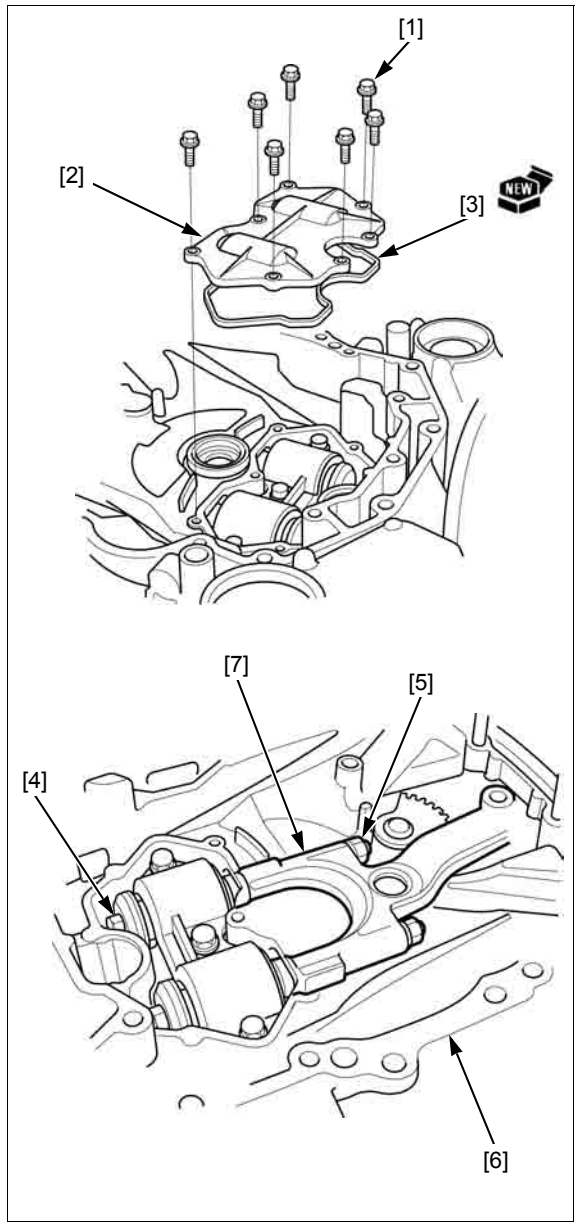
Remove the engine (page 13-4).

Remove the seven bolts (6 x 20 mm) [1], mount rubber cover [2] and mount rubber cover seal [3].
Hold the two bolts (12 x 200 mm) [4] and remove the two upper rubber mount nuts [5].
Remove the mount case [6] from the swivel case/stern bracket [7]

Replace a mount rubber cover seal with new one.

Installation is in the reverse order of removal.

TORQUE:
Upper rubber mount nut:
83 N·m (8.5 kgf·m, 61 lbf·ft)



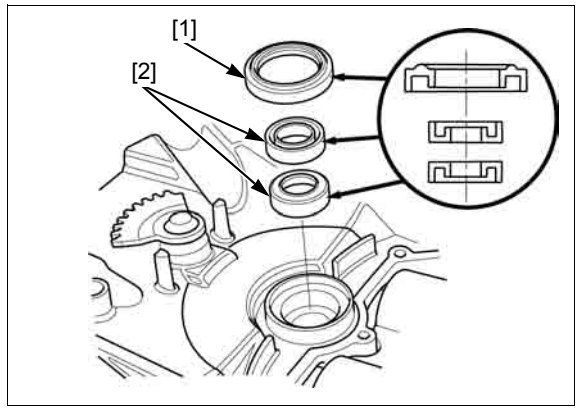
MOUNT CASE DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

Remove the mount case (page 18-4).

Remove the oil pump rubber [1] from the mount case.

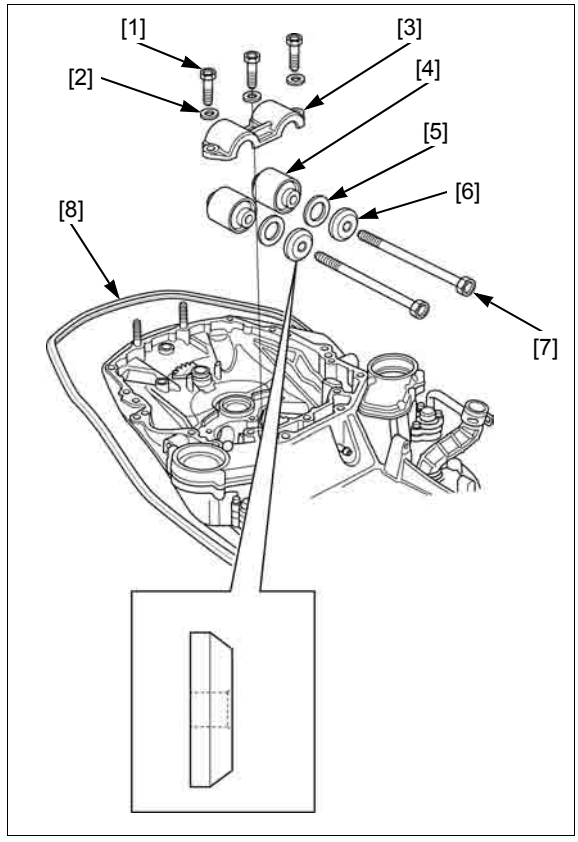
Remove the two water seals (22 x 35 x 7 mm) [2] from the mount case.



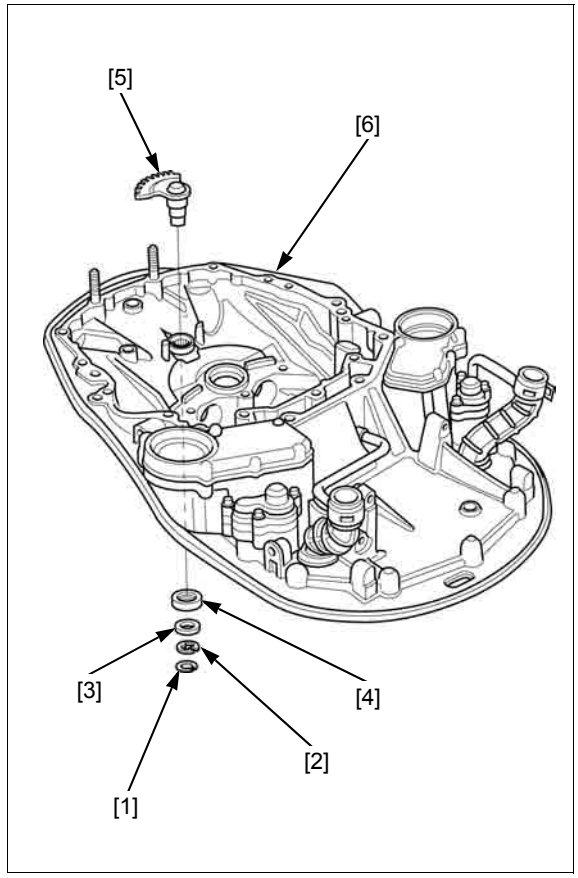
Remove the three bolts (10 x 32 mm) [1], three washers (10 mm) [2], and mount rubber holder [3].

Remove the two mount rubbers [4], two rubber spacers [5], two upper mount stopper washers [6], two bolts (12 x 200 mm) [7] and under cover seal A [8] from the mount case.

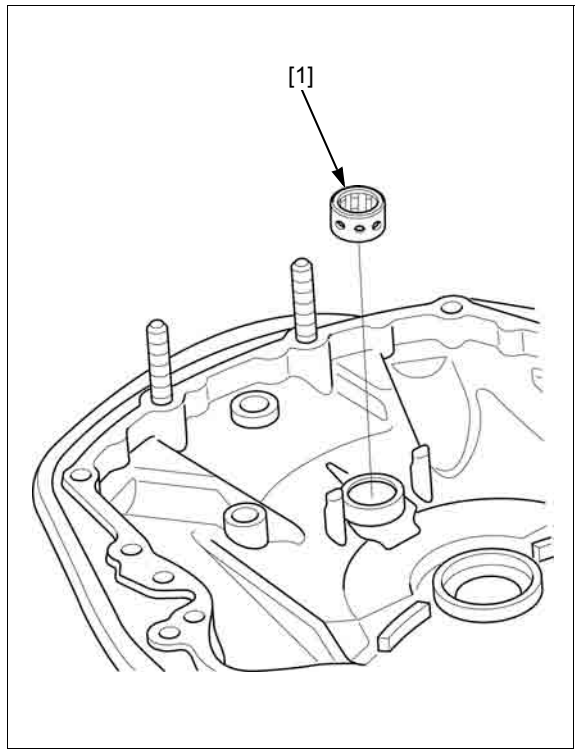
Check the under cover seal A deterioration or damage, and replace it if necessary.



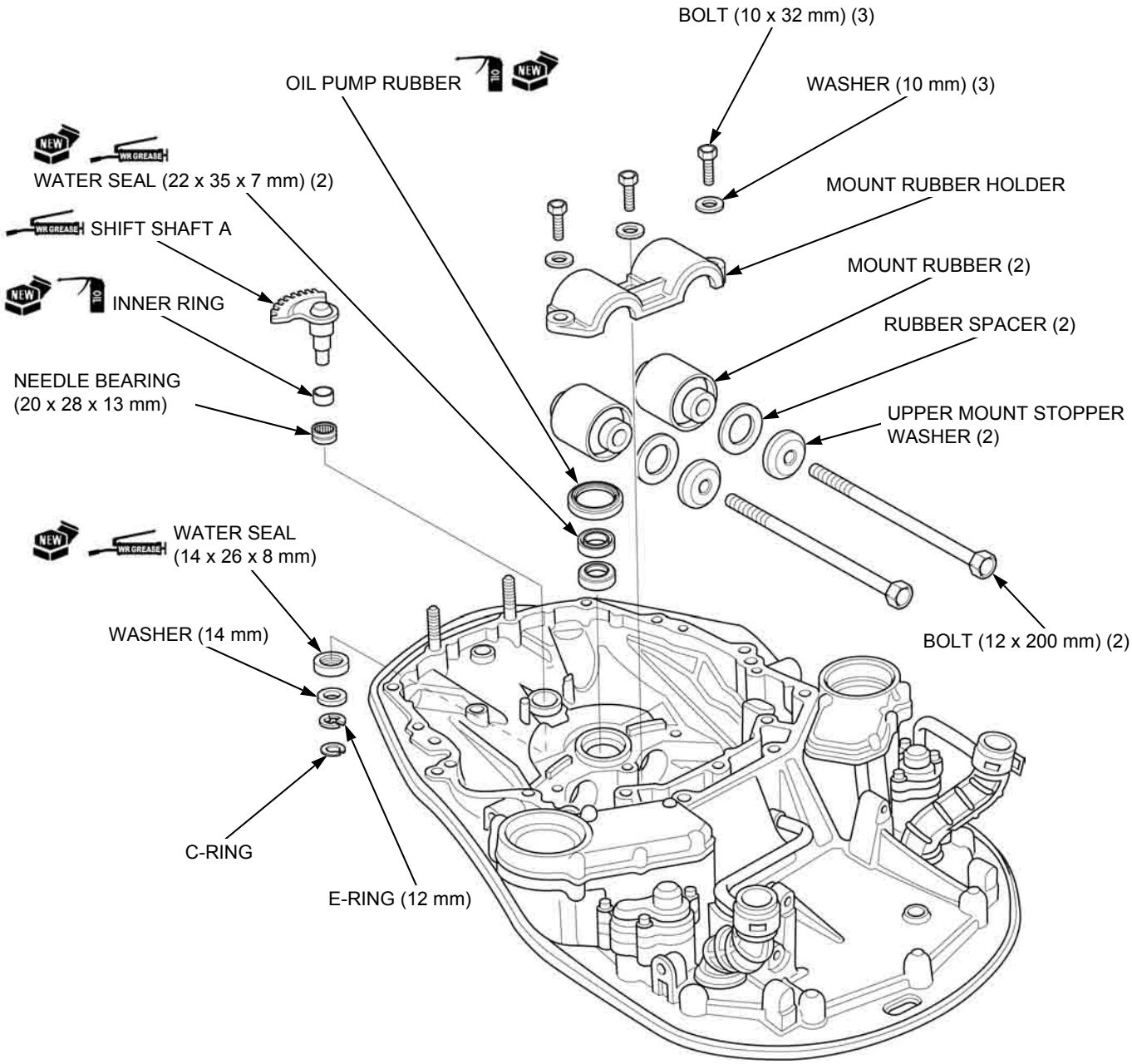
Remove the C-ring [1], E-ring [2], washer (14 mm) [3], water seal (14 x 26 x 8 mm) [4], and shift shaft A [5] from the mount case [6].



Remove the needle bearing (20 x 28 x 13 mm) [1] from the mount case.



EXPLODED VIEW



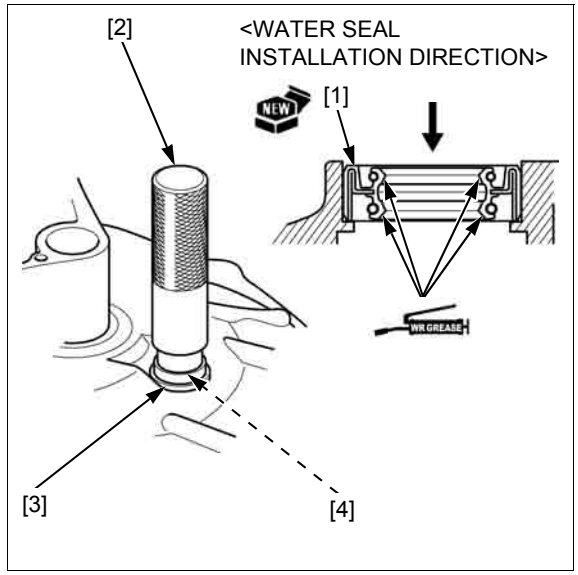
ASSEMBLY

Apply marine grease to the lips and outer circumference of a new shift shaft A water seal [1].

Turn the mount case over and install the shift shaft A water seal into the mount case using the special tools as shown, noting the installation direction.

TOOLS:

Driver [2]	**07749-0010000**
Attachment, 24 x 26 mm [3]	**07746-0010700**
Pilot, 14 mm [4]	**07746-0041200**

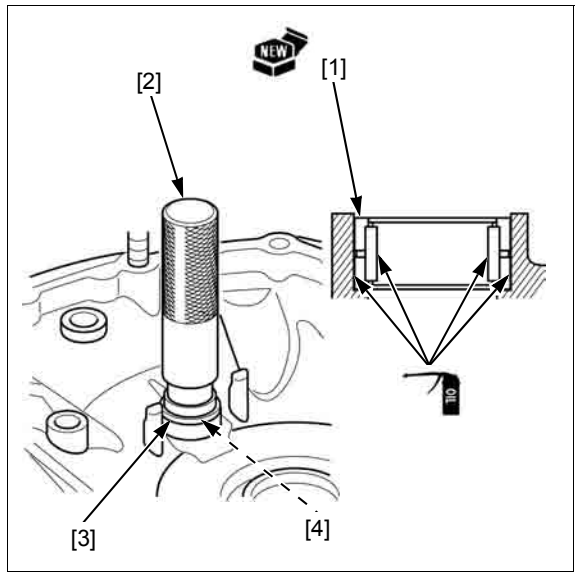


Apply engine oil to the outside circumference and the inside of a new needle bearing [1].

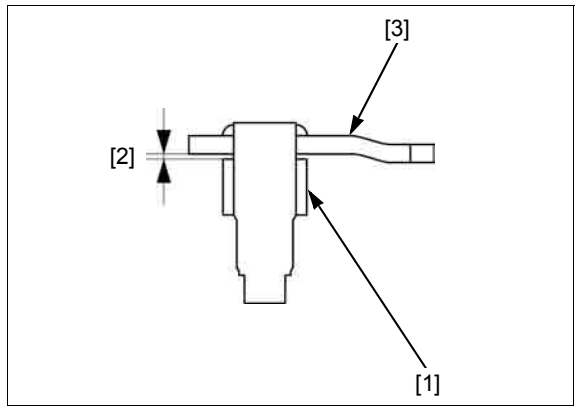
Install the needle bearing in the mount case using the special tools as shown.

TOOLS:

Driver [2]	**07749-0010000**
Attachment, 24 x 26 mm [3]	**07746-0010700**
Pilot, 20 mm [4]	**07746-0040500**

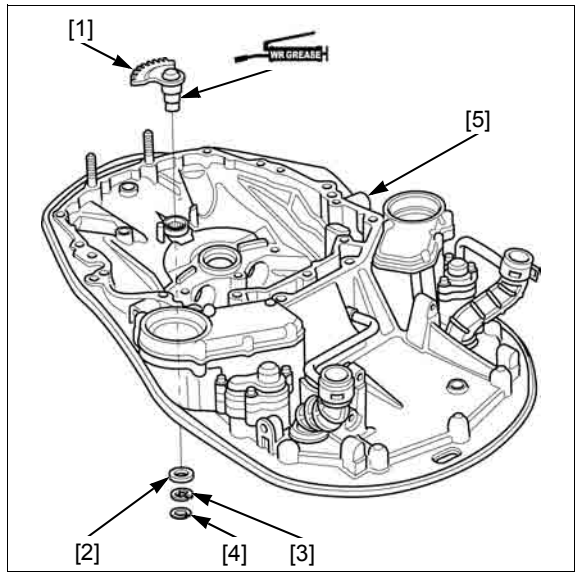


Using a press, install the inner race [1] to the position shown so that the inner race face is 1.0 mm (0.04 in) [2] from shift shaft A [3] when it is removed.



Apply marine grease to the water seal contact surface and spline of the shift shaft A [1].

Install the washer (14 mm) [2], E-ring [3], C-ring [4], and shift shaft A to the mount case [5].

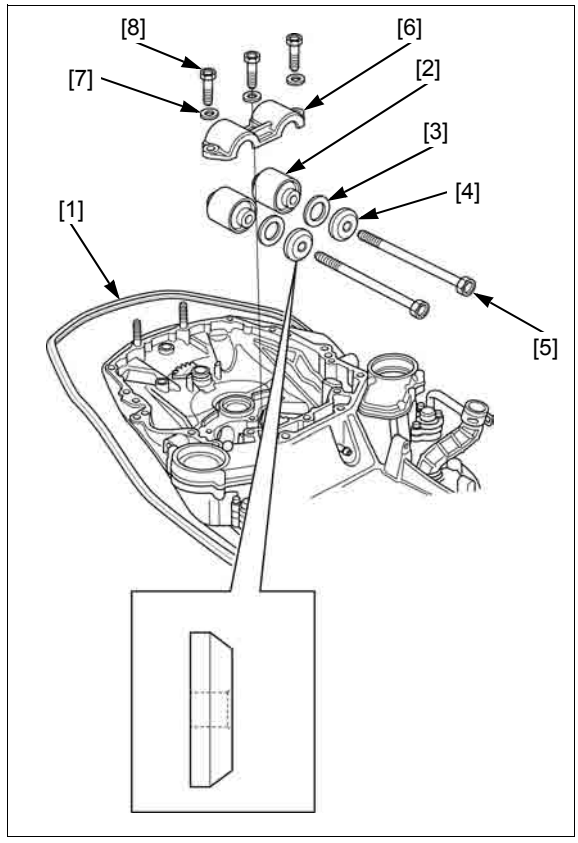


Install the under cover seal A [1], two mount rubbers [2], two rubber spacers [3], two upper mount stopper washers [4], and two bolts (12 x 200 mm) [5] into the mount case.

NOTICE

Note the installation direction of the upper mount stopper washer.

Install the mount rubber holder [6], three washers (10 mm) [7], and three bolts (10 x 32 mm) [8], and tighten the bolts.



Apply soapy water to the outer circumference of a new mount case water seals [1].

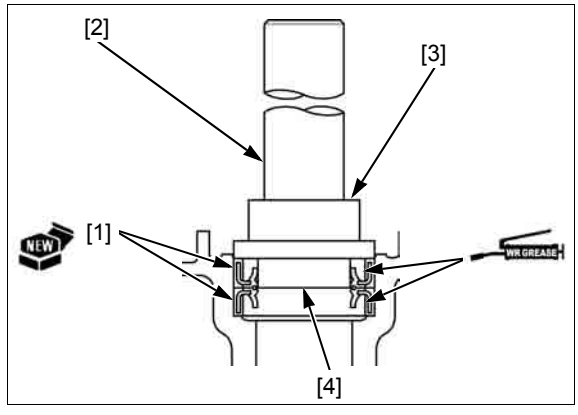
Drive the water seals one by one into the mount case using the special tools.

Note the installation direction of the water seals.

TOOLS:

Driver [2]	**07749-0010000**
Attachment, 32 x 35 mm [3]	**07746-0010100**
Pilot, 22 mm [4]	**07746-0041000**

After installing the water seals, apply 2 – 4 g (0.07 – 0.14 oz) of water resistant molybdenum disulfide grease to the seal lips and the adjacent areas.

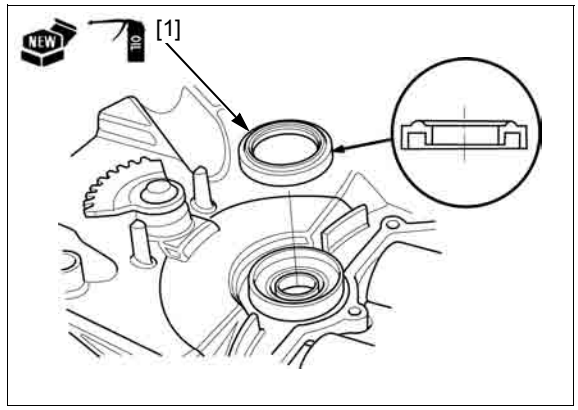


Apply engine oil to a new oil pump rubber [1].

Install the oil pump rubber to the mount case.

Note the installation direction of the oil pump rubber.

Install the mount case (page 18-4).



COMPONENT LOCATION ····· 19-2

ATF LINE DESCRIPTION ····· 19-3

TOOLS ····· 19-5

POWER TRIM/TILT/SWIVEL CASE REMOVAL/ INSTALLATION ····· 19-6

SWIVEL CASE/MOUNT FRAME DISASSEMBLY/ASSEMBLY ····· 19-11

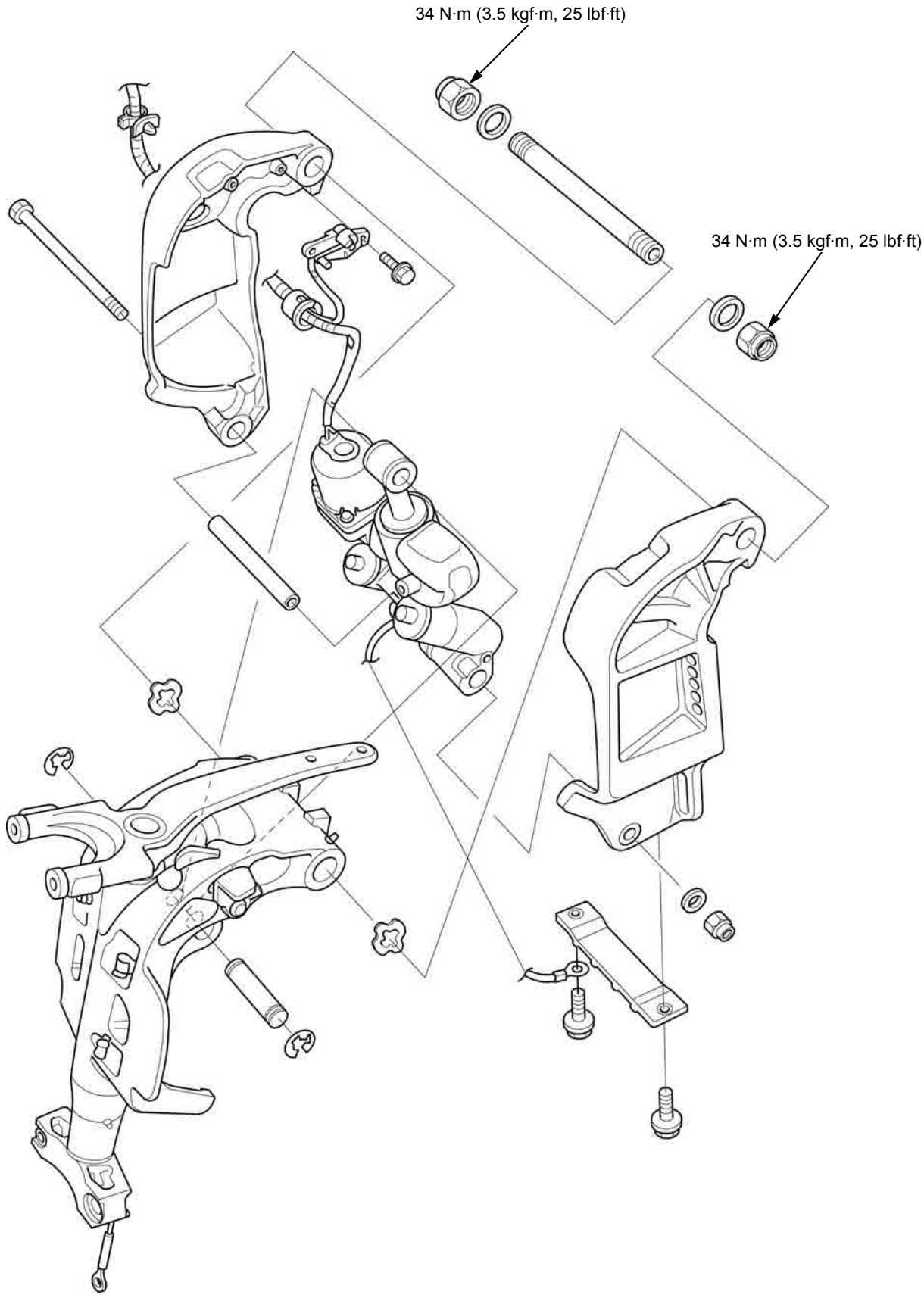
POWER TRIM/TILT DISASSEMBLY/ ASSEMBLY ····· 19-19

POWER TILT MOTOR DISASSEMBLY/ ASSEMBLY ····· 19-36

POWER TILT MOTOR INSPECTION ····· 19-41

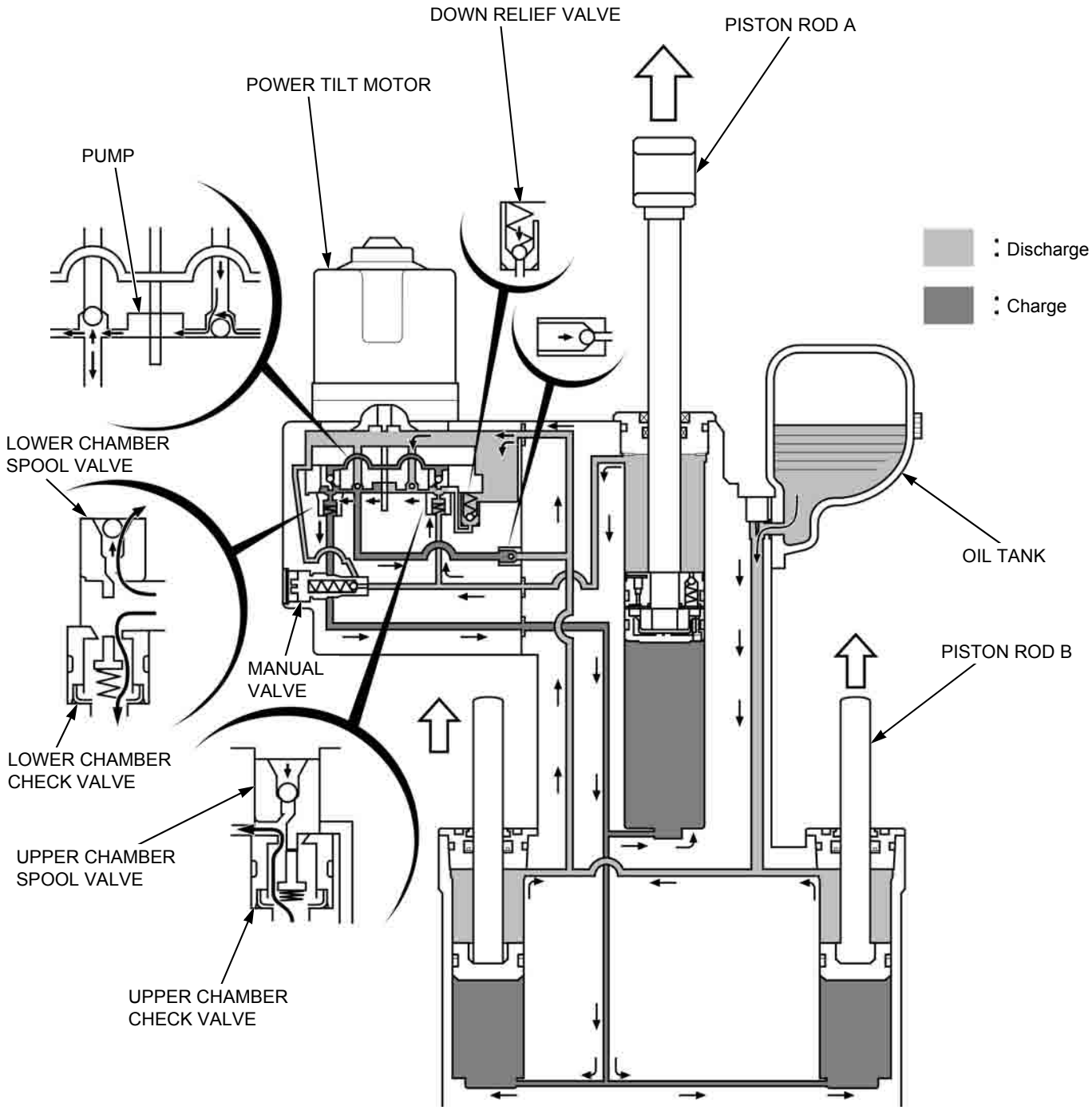
POWER TILT SWITCH INSPECTION ····· 19-43

COMPONENT LOCATION

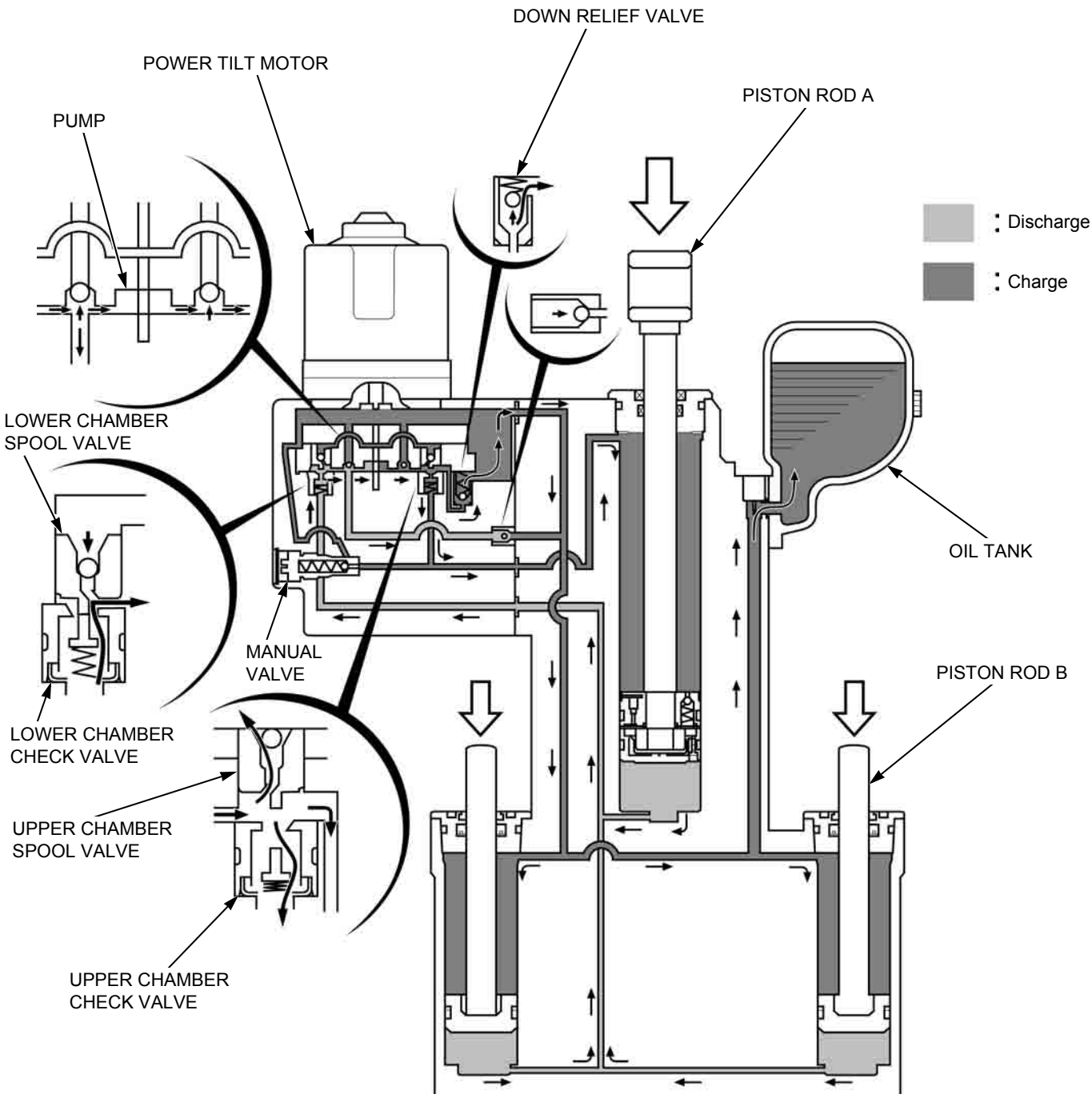


ATF LINE DESCRIPTION

Trim/tilt up:

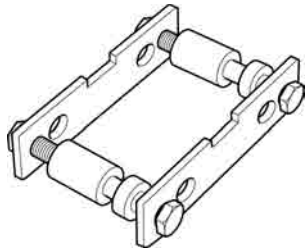
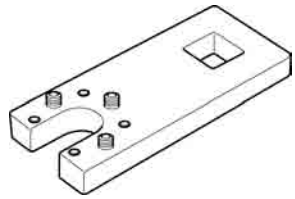
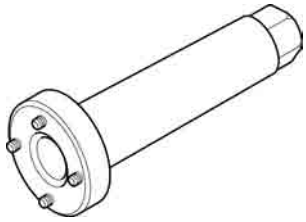
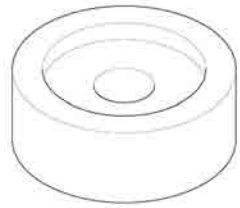
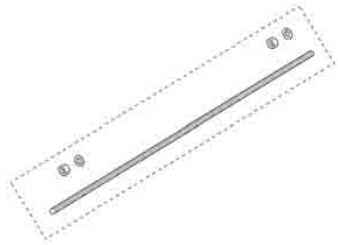
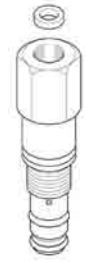
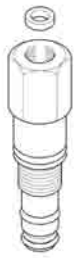


Trim/tilt down:



TOOLS

LIST

Lower mount puller adapter 07APB-ZY3A200 	Pressure gauge, 0 – 5,000 psi 07KPJ-VD6020B 	Pin wrench, 6 mm 07SPA-ZW1010A 
Pin wrench, 4 mm 07SPA-ZW1020A 	Attachment, 30 x 37 mm 070PD-ZY6A200 	Attachment, 50 mm 07APF-ZY3A100 
Puller adapter 07APF-ZY3A200 	Assembly shaft 07APF-ZY3A300 	Oil pressure gauge joint A 07SPJ-ZW1010A 
Oil pressure gauge joint B 07SPJ-ZW1020A 		

POWER TRIM/TILT/SWIVEL CASE REMOVAL/INSTALLATION

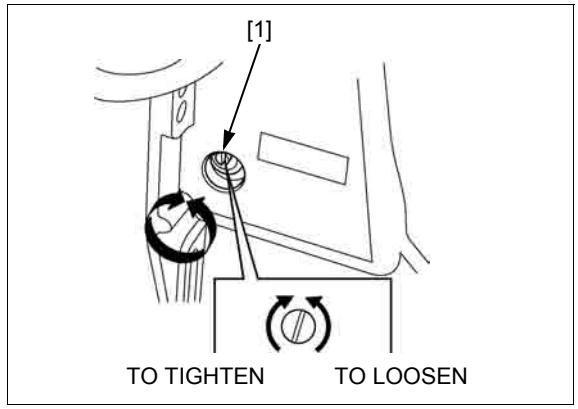
REMOVAL

Remove the mount case (page 18-4) and swivel case/ stern bracket from the boat.

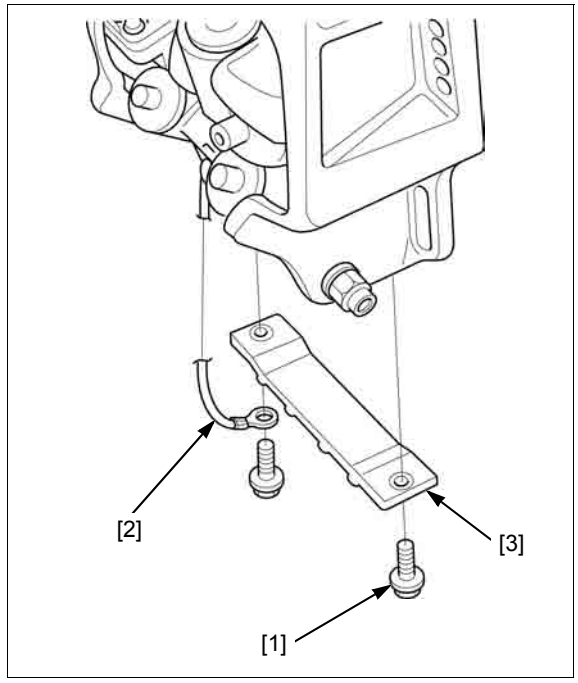
Loosen the manual valve [1] fully and set the swivel case to the uppermost position.

After raising the swivel case to the uppermost position, secure it in the position with the tilt stopper and tighten the manual valve to the specified torque.

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



Remove the two bolts (6 x 32 mm) [1], ground terminal [2], and anode [3].



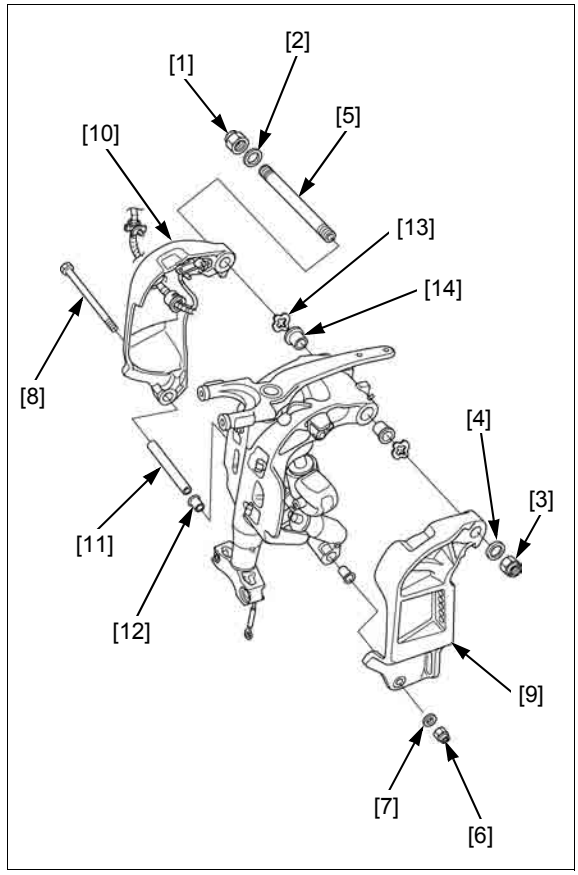
Remove the self-locking nut (25 x 2.0 mm) [1], washer (25 mm) [2], self-locking nut (7/8-14 UNF) [3], washer (7/8 in) [4], and tilting shaft [5].

Remove the self-locking nut (10 mm) [6], washer (10 mm) [7], and bolt (10 x 235 mm) [8].

Remove the R. stern bracket [9] from the swivel case and release the L. stern bracket [10] from the lower cylinder collar [11].

Remove the lower cylinder collar and two lower cylinder bushings [12].

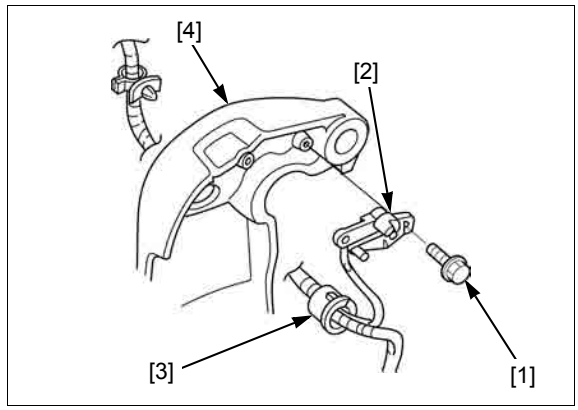
Remove the two wave washers (26 mm) [13] and two swivel case bushings [14].



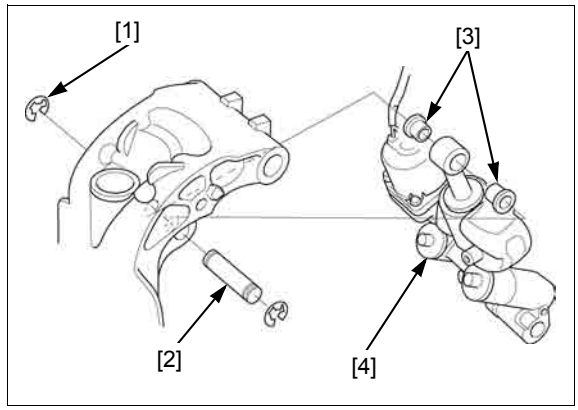
Remove the two bolts (6 x 20 mm) [1] and trim angle sensor [2].

Remove the motor cord bushing [3] from the L. stern bracket [4].

Remove the L. stern bracket.

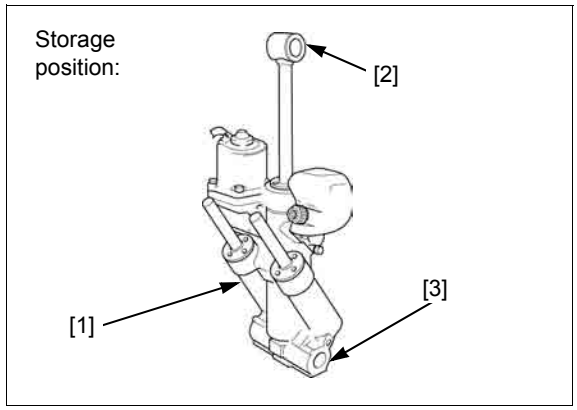


Remove the two E-rings [1], upper cylinder pin [2], and two upper cylinder bushings [3], and remove the power trim/tilt assembly [4].

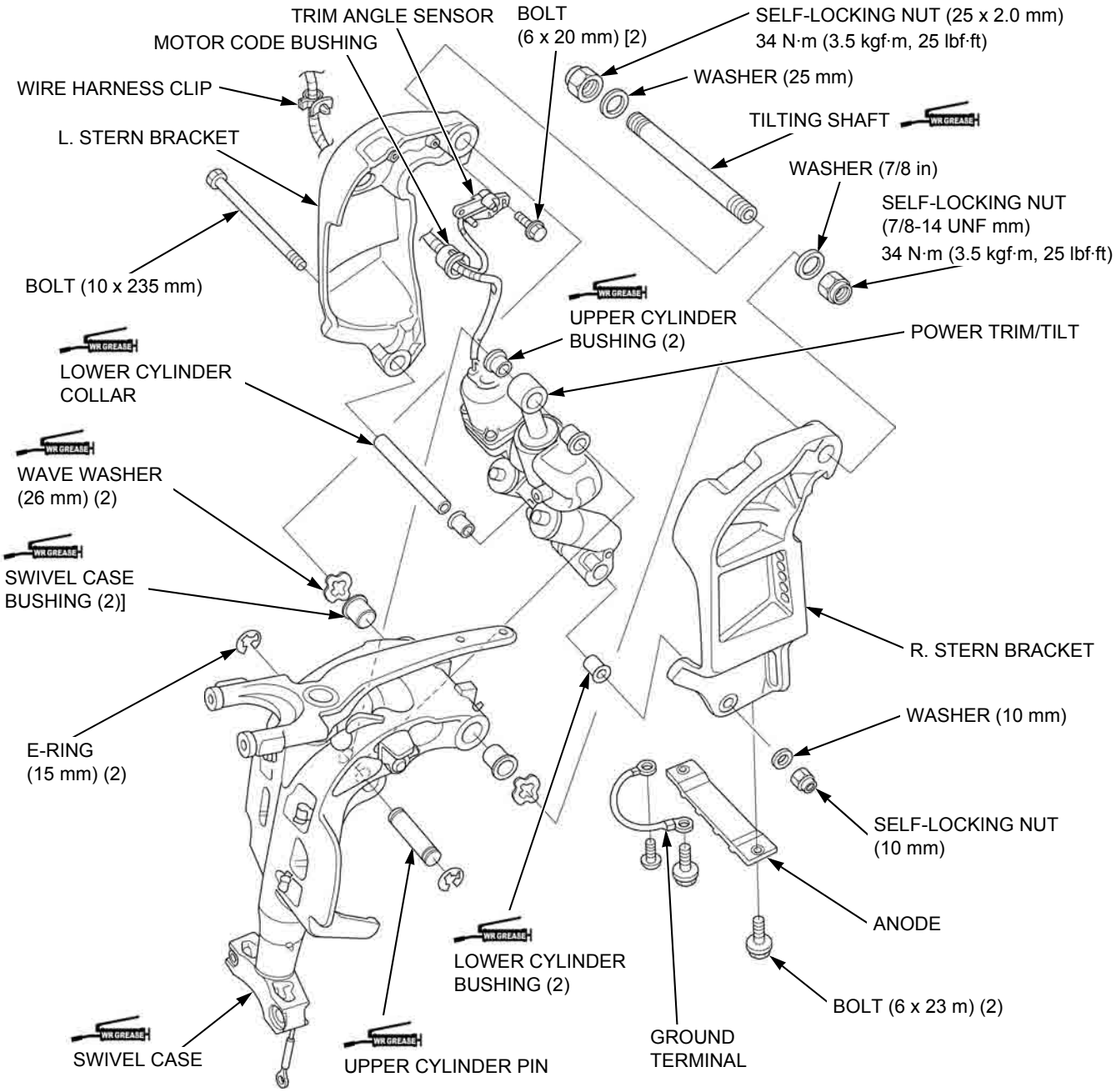


NOTICE

Store the power trim/tilt assembly [1] vertically with the upper cylinder bushing section [2] facing up after removal. Never store the power trim/tilt with the motor facing up or with the lower cylinder bushing section [3] facing up.



EXPLODED VIEW

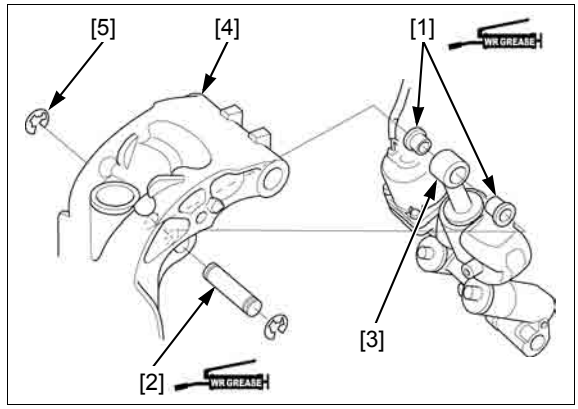


INSTALLATION

Apply marine grease to the upper cylinder bushings [1] inner and outer surfaces, upper cylinder pin [2] outer surface.

Install the two upper cylinder bushings to the power trim/tilt piston rod A [3].

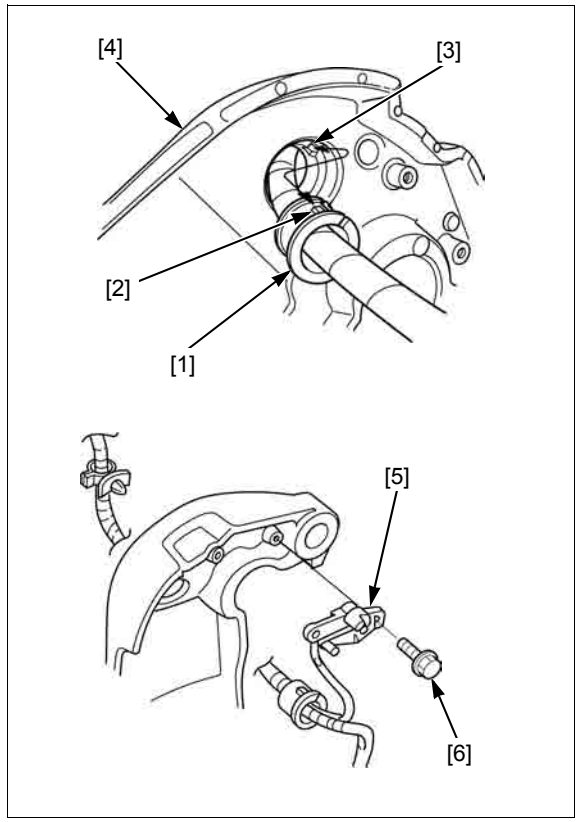
install the power trim/tilt piston rod A to the swivel case [4].
Insert the upper cylinder pin and set the two E-rings [5] to the cylinder pin grooves.



Pass each wire through the motor code bushing [1].

Install the motor cord bushing by aligning the projection [2] on the motor cord bushing with the groove [3] in the L. stern bracket [4].

Install the trim angle sensor [5] and tighten the two bolts (6 x 20 mm) [6].



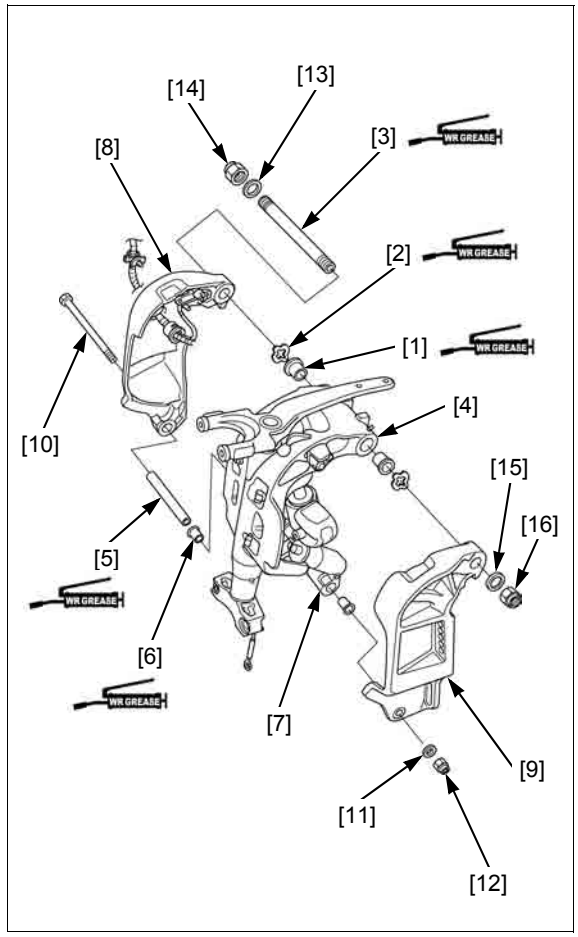
Apply marine grease to the swivel case bushings [1] inner and outer surfaces, wave washer (26 mm) [2], tilting shaft [3] bearing part and threads and swivel case [4] tilting shaft sliding part.
Install the two swivel case bushings, two wave washers (26 mm), and tilting shaft to the swivel case.

Apply marine grease to the lower cylinder collar [5], outer surface and lower cylinder bushing [6] inner and outer surfaces.
Install the lower cylinder collar and two lower cylinder bushings to the power trim/tilt lower cylinder [7].

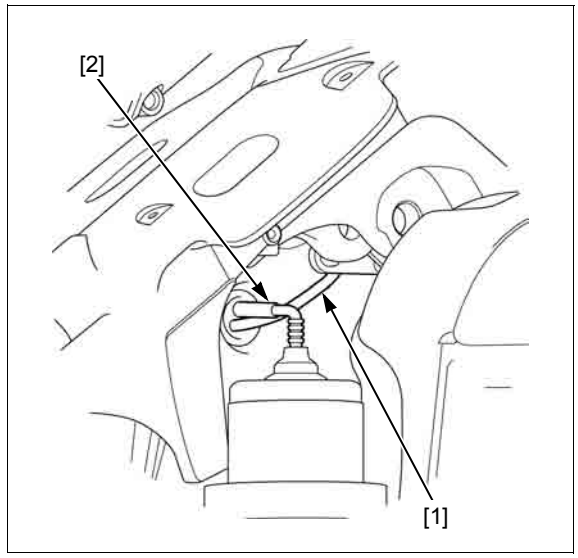
Install the L. stern bracket [8], R. stern bracket [9], bolt (10 x 235 mm) [10], washer (10 mm) [11], and self-locking nut (10 mm) [12].
Tighten the self-locking nut.

Install the washer (25 mm) [13], self-locking nut (25 x 2.0 mm) [14], washer (7/8 in) [15], and self-locking nut (7/8 in-14 UNF) [16].
Tighten the self-locking nuts to the specified torque.

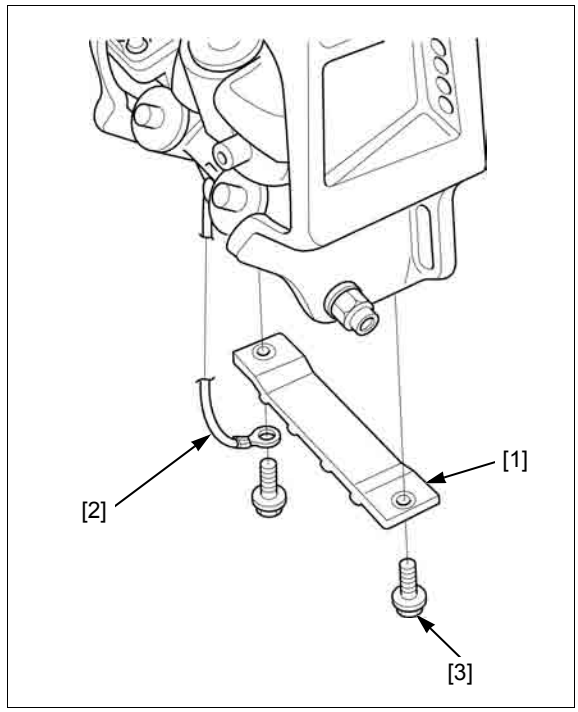
TORQUE: 34 N·m (3.5 kgf·m, 25 lbf·ft)



After installing the power trim/tilt, check the trim angle sensor wire [1] and power tilt motor wire [2], to make sure they are not slack and twisted.



Install the anode [1], ground terminal [2] and two bolts (6 x 23 mm) [4].

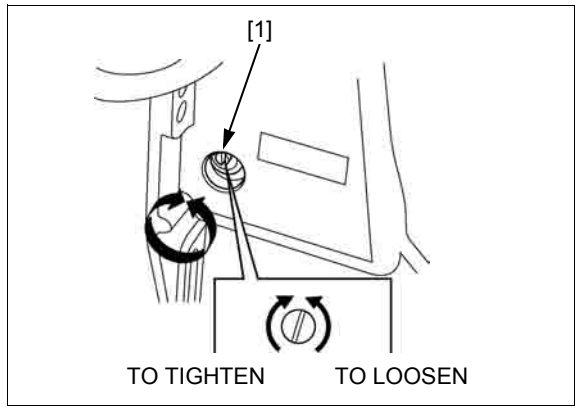


If the manual valve [1] is tightened, loosen it fully.

Raise the swivel case a little, unlock the tilt stopper, and lower the swivel case to the lowermost position.

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

Install the swivel case/stern bracket to the boat.
Install the mount case (page 18-4).



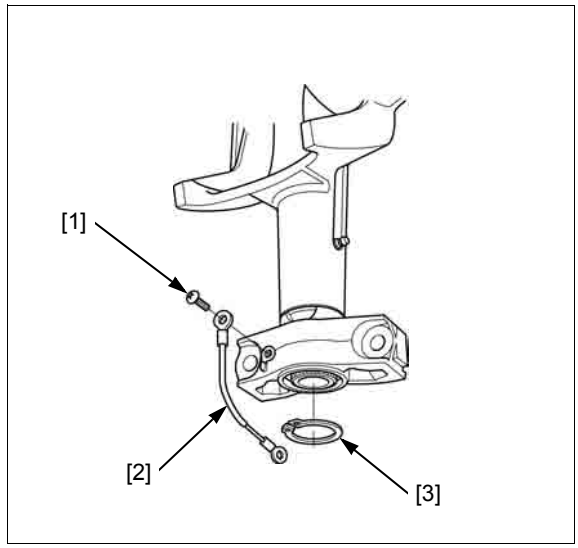
SWIVEL CASE/MOUNT FRAME DISASSEMBLY/ASSEMBLY

DISASSEMBLY

Remove the swivel case (page 19-6).

Remove the screw (6 x 8 mm) [1] and ground cable [2].

Remove the external circlip [3].



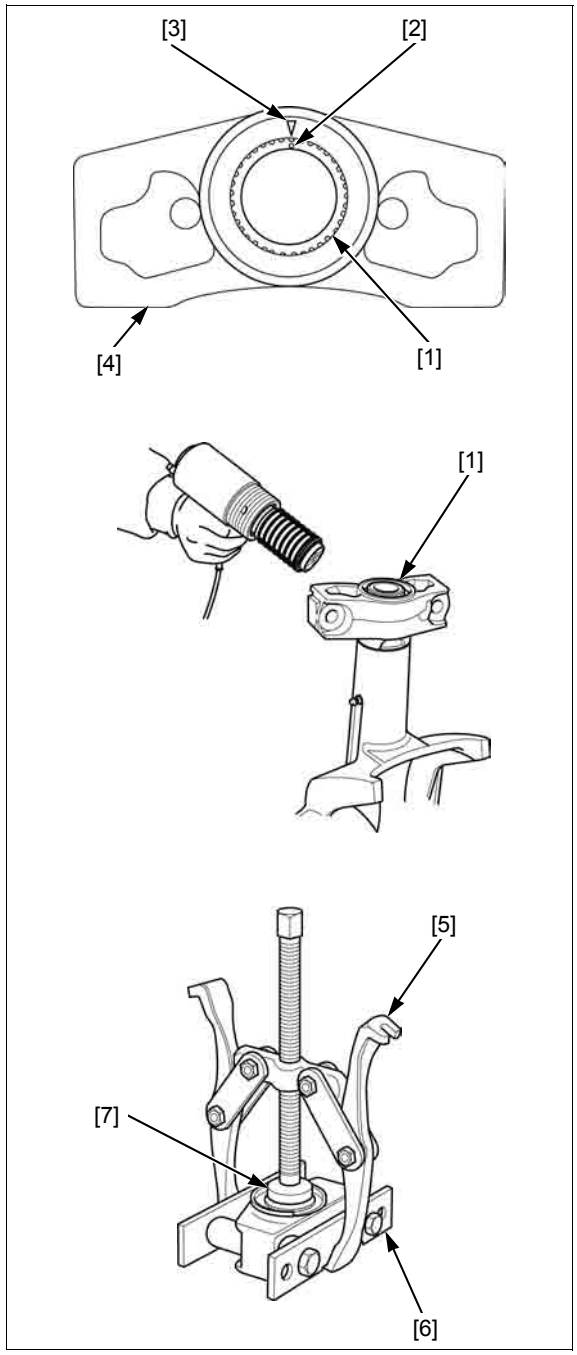
Mark the mount frame [1] so that punch mark [2] aligns with the "△" mark [3] on the lower mount center housing [4].

Pull the lower mount center housing from the mount frame using an 8-inch 2-jaw puller (commercially available) [5] and special tools.

TOOL:

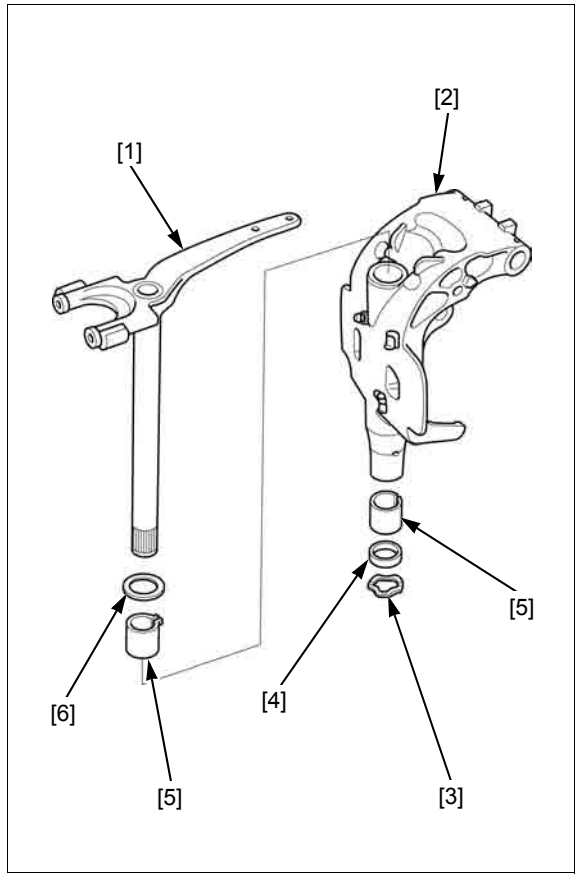
Lower mount puller adapter [6]	**07APB-ZY3A200**
Puller adapter [7]	**07APF-ZY3A200**

Warm up the lower mount center housing using a heat gun (ETB1600: commercially available) if it is difficult to remove.
Wear gloves to protect your hands when handling the lower mount center housing.



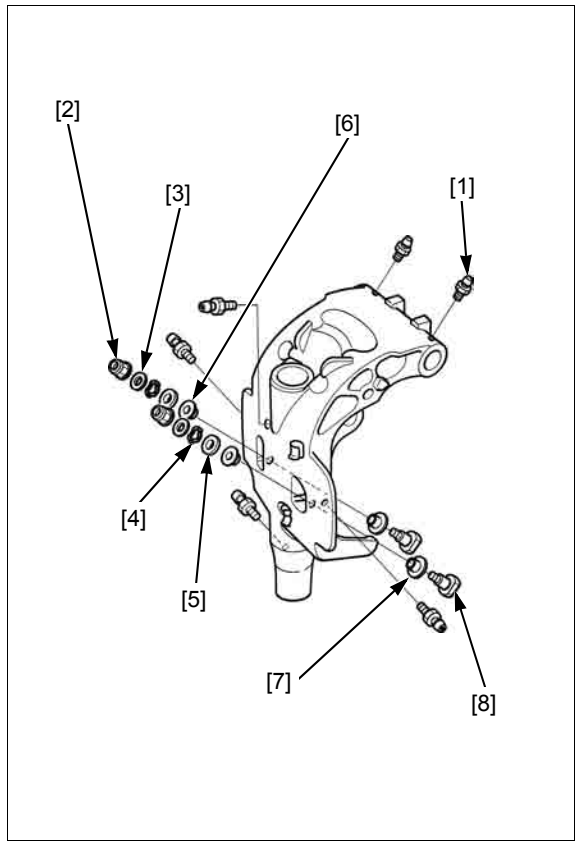
Remove the mount frame [1] from the swivel case [2].

Remove the wave washer (40 mm) [3], oil seal (39.5 x 52 x 6 mm) [4], two swivel case liners [5], and thrust washer (34 mm) [6] from the swivel case.

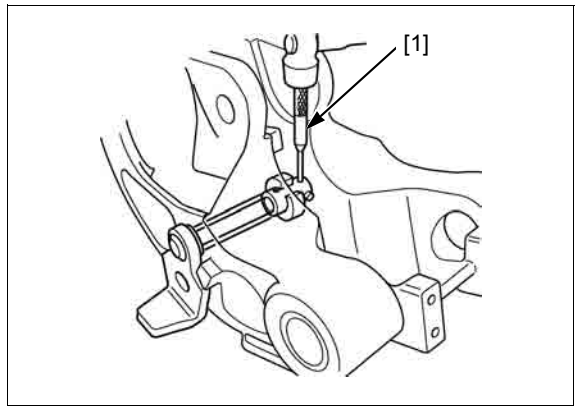


Remove the six grease fittings [1] from the swivel case.

Remove the two self-locking nuts [2], two plain washers (6 mm) [3], two wave washers [4], two plain washers (12 mm) [5], two thrust receiver bushing B [6], two thrust receiver bushing A [7], and two thrust receivers [8].



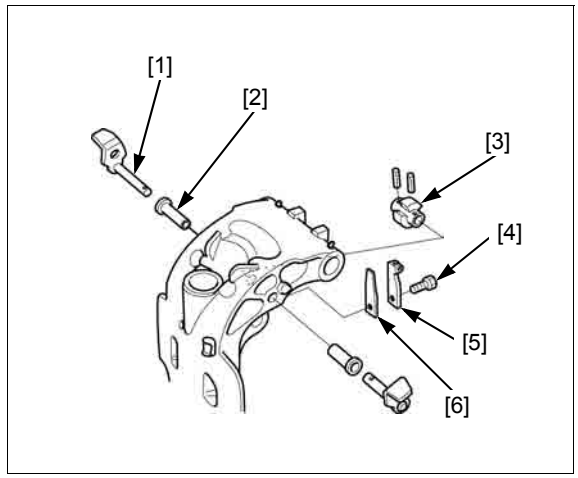
Remove the spring pins using a commercially available pin punch [1].



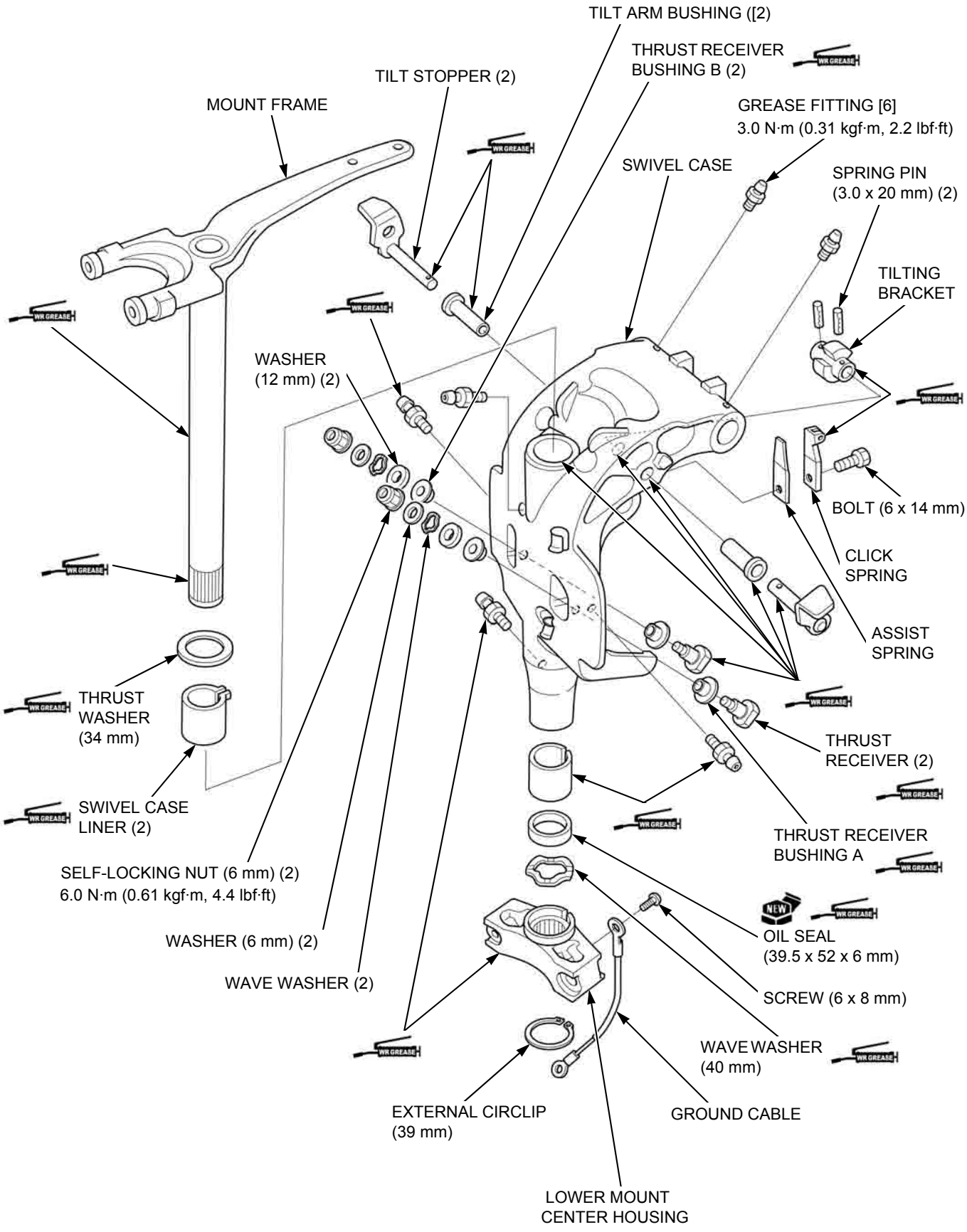
Remove the two tilt stoppers [1], two tilt arm bushings [2] and the tilting bracket [3].

Check the tilt arm bushing for wear and damage. Replace if necessary.

Remove the bolt (6 x 14 mm) [4], click spring [5] and assist spring [6].



EXPLODED VIEW

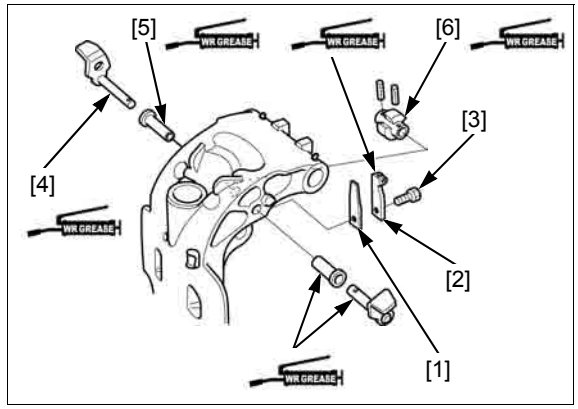


ASSEMBLY

Install the assist spring [1], click spring [2], and bolt (6 x 14 mm) [3], and tighten it.
Apply marine grease to the click spring roller.

Apply marine grease to the tilt stopper [4] shaft, tilt arm bushing [5] inner and outer surface and tilting bracket [6] cam part.

Set the two tilt arm bushings and two tilt stoppers to the swivel case, and insert the tilting bracket into the right and left tilt stopper shafts.



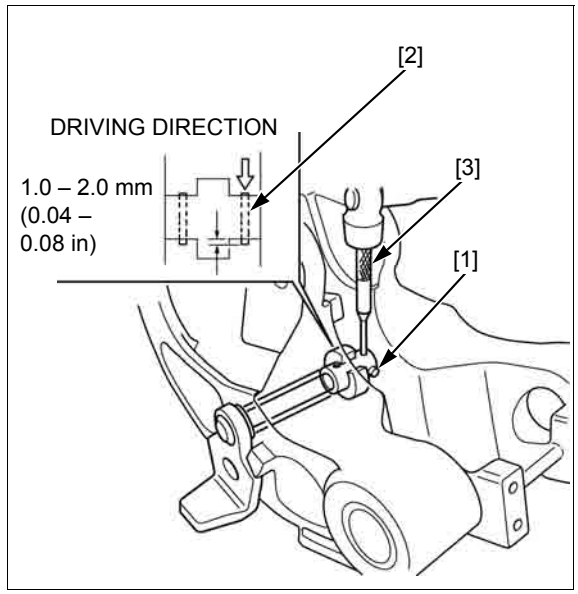
Make sure that the projection [1] on the tilting bracket is at the right side and facing up when viewed from the mount frame installation hole side in the swivel case.

Drive in the spring pins [2] using a commercially available pin punch [3].

Drive in the pins so that 1.0 – 2.0 mm (0.04 – 0.08 in) of the pin end is out of the tilting bracket on the opposite side from the driving side.

NOTICE

- *Do not drive in the spring pins excessively. The tilt stopper cannot operate properly if the extrusion length of the pin end is more than 1 – 2 mm (0.04 – 0.08 in).*



Apply marine grease to the thrust receiver [1] shaft and thrust sliding part.

Apply marine grease to the thrust receiver bushing inner surface and thrust sliding part.

Install the two thrust receiver bushing A [2], two thrust receivers, two thrust receiver bushing B [3], two washers (12 mm) [4], two wave washers [5], two washers (6 mm) [6], and two self-locking nuts [7].

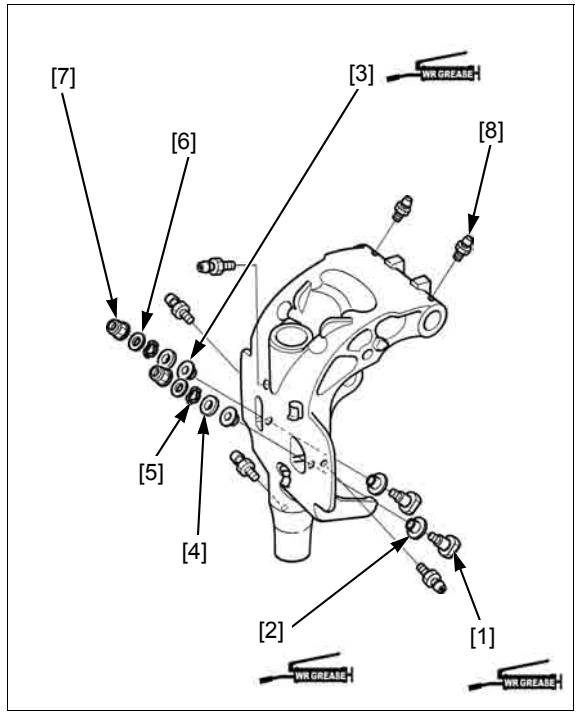
Tighten the self-locking nut to the specified torque.

TORQUE: 6.0 N·m (0.61 kgf·m, 4.4 lbf·ft)

Install and tighten the six grease fittings [8] to the specified torque.

TORQUE: 3.0 N·m (0.31 kgf·m, 2.2 lbf·ft)

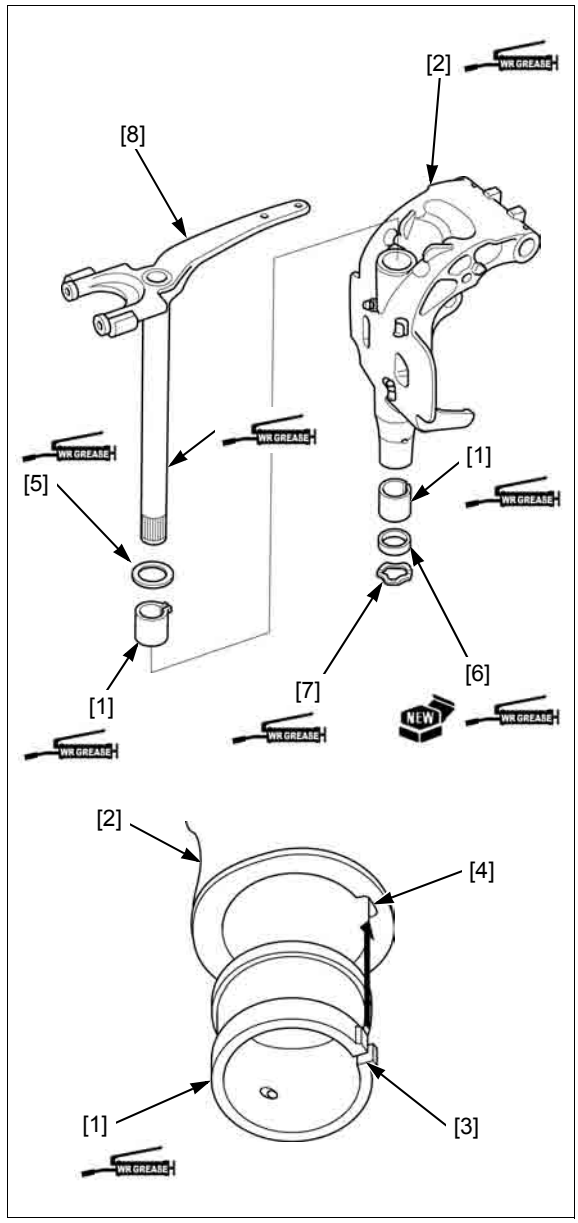
Apply marine grease to the thrust receiver piston rod B sliding part.



Apply marine grease to the circumference of the swivel case liner [1], swivel case [2] thrust receiver part and shaft sliding part.

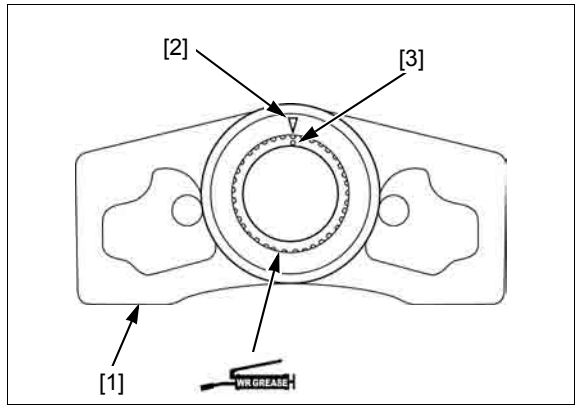
Install the swivel case liner by aligning the projection [3] on the swivel case liner with the groove [4] in the swivel case.

Apply marine grease to the thrust washer (34 mm) [5], new oil seal (39.5 x 52 x 6 mm) [6] lip and outer surface, wave washer (40 mm) [7], and mount frame [8] shaft and spline, and then install them to the swivel case.



Apply marine grease to the spline of the lower mount center housing [1] spline.

If the original lower mount center housing is reused, install the lower mount center housing on the mount frame by aligning the "△" mark [2] on the lower mount center housing with the mark [3] on the mount frame during disassembly.



Install the lower mount center housing [1] on the mount frame using the special tools as shown.

TOOLS:

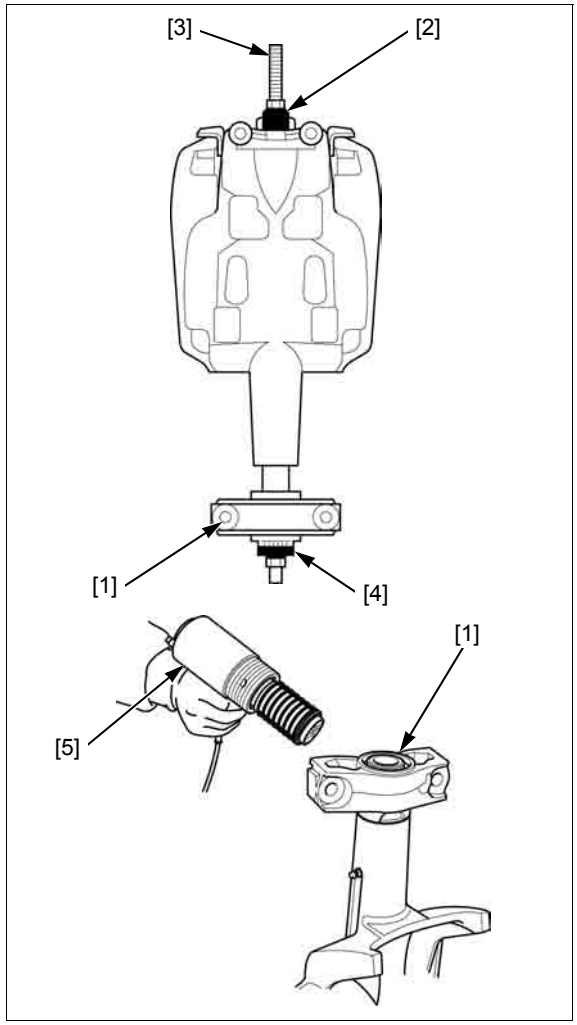
Attachment, 30 x 37 mm [2]	**070PD-ZY6A200**
Assembly shaft [3]	**07APF-ZY3A300**
Attachment, 50 mm [4]	**07APF-ZY3A100**

To ease assembly, apply grease or lubricating oil to the threads, nuts and washers of the threaded rods before drawing the parts together.

Warm up the lower mount center housing using a heat gun (ETB1600: commercially available) [5] if it is difficult to install.
Wear gloves to protect your hands when handling the lower mount center housing.

NOTICE

- *Overheating the lower mount center housing may cause damage to the painted surfaces.*



Check that the mount frame turns smoothly.
If the mount frame does not smoothly:

Attach the 8-inch 2-jaw puller (commercially available) [1] and special tools on the lower mount center housing [2] as shown.

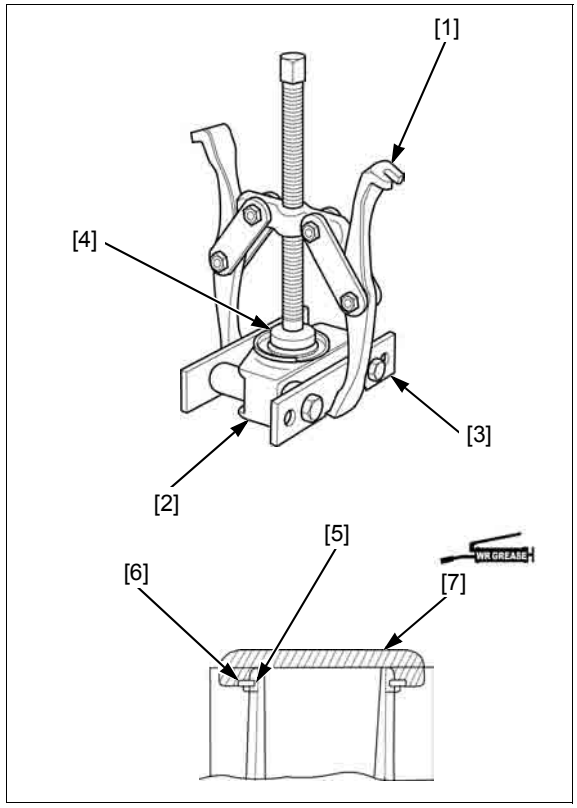
TOOLS:

Lower mount puller adapter [3]	**07APB-ZY3A200**
Puller adapter [4]	**07APF-ZY3A200**

Tighten the puller bolt and align the surface of the lower mount center housing with the external clip installation groove [5] in the mount frame.

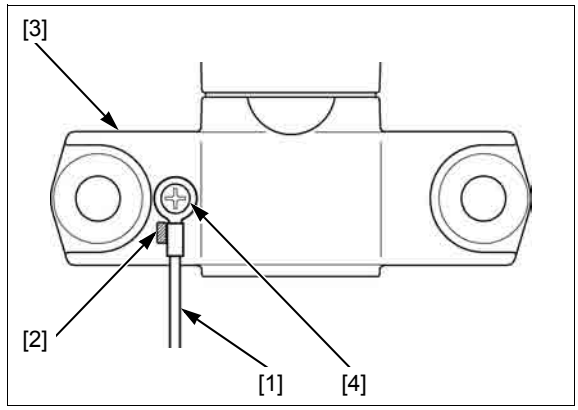
Install the external circlip [6] and apply water resistant molybdenum disulfide grease to the part of "A" [7] shown in the drawing.

Install the swivel case (page 19-9).



Position the ground cable [1] against the stopper [2] of the lower mount center housing [3], and then install and tighten the screw (6 x 8 mm) [4].

Install the swivel case (page 19-9).



POWER TRIM/TILT DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

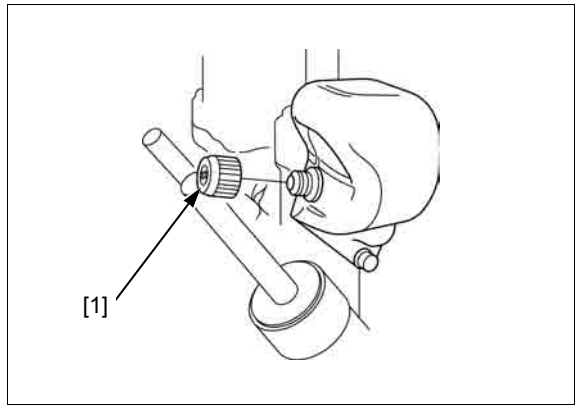
- Do not disassemble the pump. If it is faulty, replace it as an assembly.
- Do not use a shop towel, cloth, or gloves during removal.
- Use the recommended automatic transmission fluid (ATF).
  Recommended ATF: Honda Genuine Automatic Transmission Fluid (ATF), DEXRON® or equivalent.
- Do not reuse the drained ATF.
- Do not tighten the vise excessively when holding the power trim/tilt in a vise during operation.
- Clean the removed parts in fresh ATF, and blow each port of the parts with compressed air. Set the parts neatly in a suitable container with care not to contaminate them with dust and dirt.
- Do not reuse O-rings and oil seals.
- Take care not to damage the sliding surface of the piston rod when removing them.

Remove the power trim/tilt (page 19-6).

Operate the power tilt motor until the each rod reach the fully extended position (page 19-31).

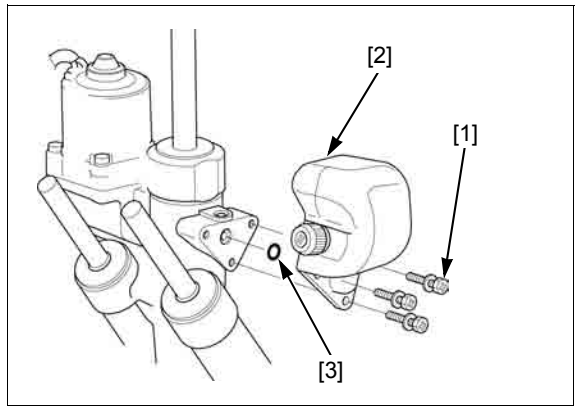
Remove the oil tank cap [1], and drain the ATF from the oil tank.
Do not drain the ATF by pushing the piston rod in.

Loosely install the oil tank cap on the oil tank.

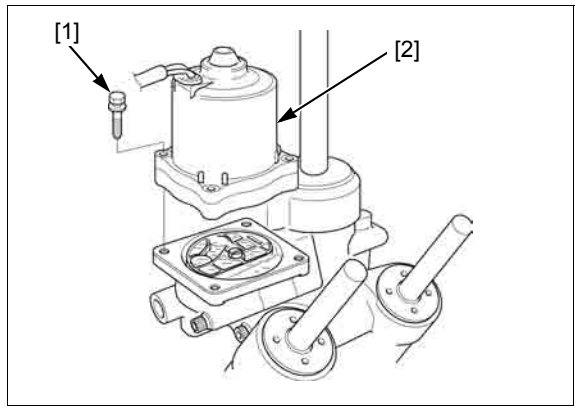


Remove the three oil tank mounting bolt/washers (6 x 8 mm) [1] and oil tank [2] from the cylinder. Remove the O-ring [3] from the cylinder.

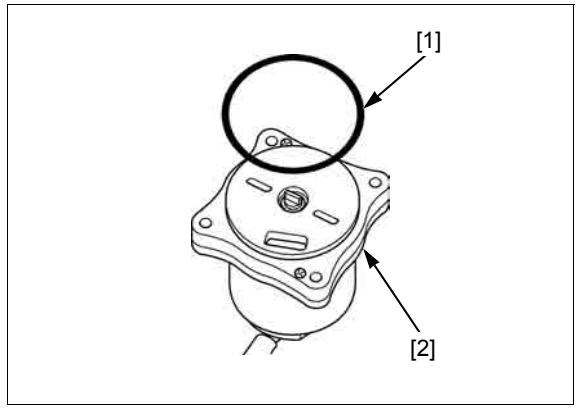
Drain the residual ATF in the oil tank.



Remove the four power tilt motor mounting bolt/ washers (6 x 34 mm) [1] and power tilt motor [2] from the pump.

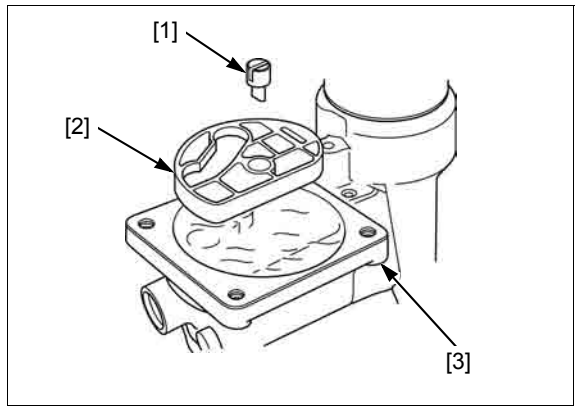


Remove the O-ring [1] from the power tilt motor [2].



Remove the drive joint [1] and filter B [2] from the pump [3].

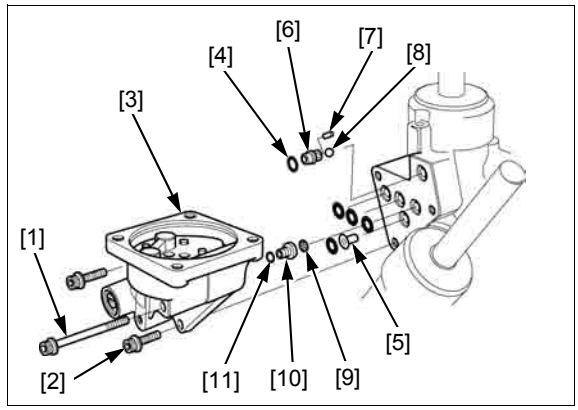
Check the mesh of filter B for blockage and tears.
If it is torn, replace filter B with a new one.
If it is clogged with dust and dirt, blow the mesh with air to remove the blockage.
Take care not to damage the mesh.



Remove socket bolts A (8 x 84 mm) [1], two socket bolts B (8 x 23 mm) [2], and the pump [3]. Remove the five O-rings [4] and orifice collar [5] from the cylinder.

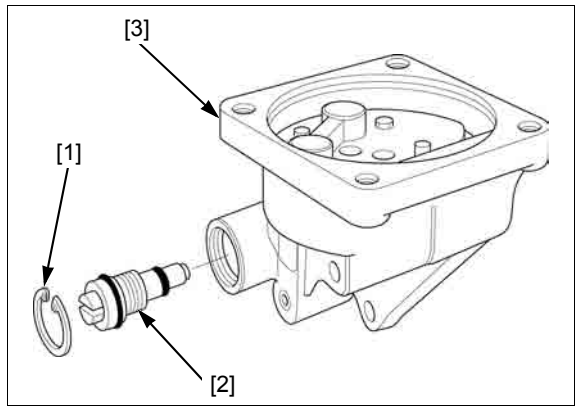
Remove the reservoir valve [6], pin [7], and steel ball [8] from the cylinder.

Remove the filter [9], valve seat [10], and O-ring [11].



Remove the internal circlip [1] and manual valve [2] from the pump [3].

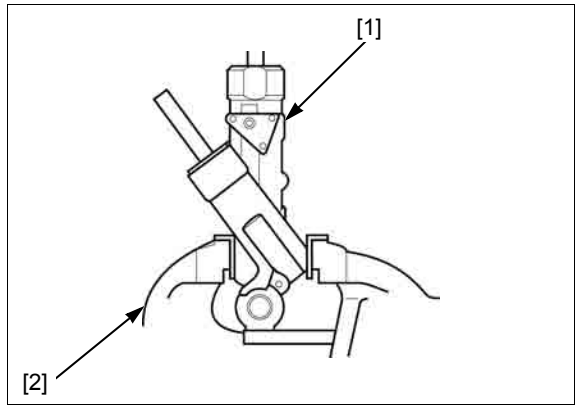
Check the manual valve and O-ring for deterioration, wear, and damage.
Replace the manual valve with a new one if necessary.



Hold the cylinder [1] in a vise [2] with a shop towel or soft jaws as shown.

NOTICE

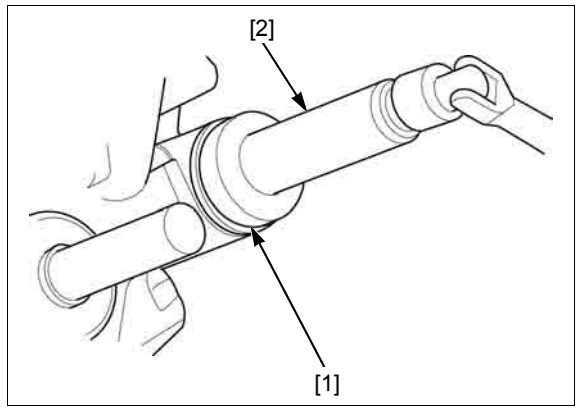
Do not tighten the vise excessively, as it can damage the cylinder.



- Make sure the right and left piston rod B are fully extended.
- Do not push piston rod B into the trim cylinder.

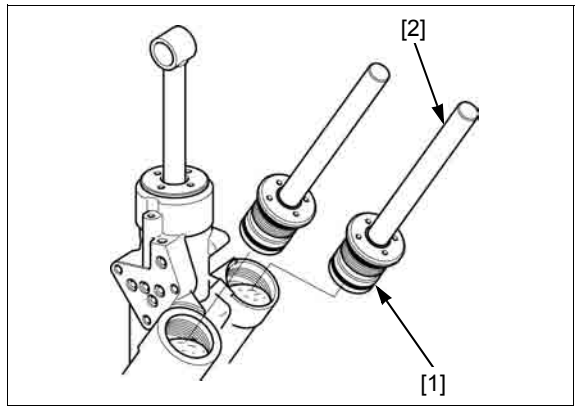
Remove the rod guide [1] using the special tool as shown.

TOOL:
Pin wrench, 4 mm [2] **07SPA-ZW1020A**

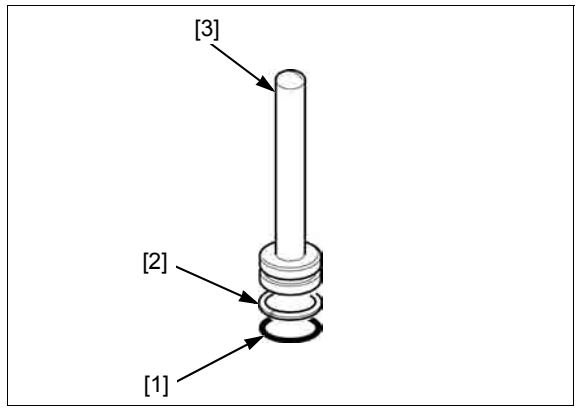


Remove the rod guide [1] and piston rod B [2] from the trim cylinder slowly.
Remove the rod guide from piston rod B.

Drain the ATF from the trim cylinders.



Remove the O-ring [1] and backup ring [2] from piston rod B [3].

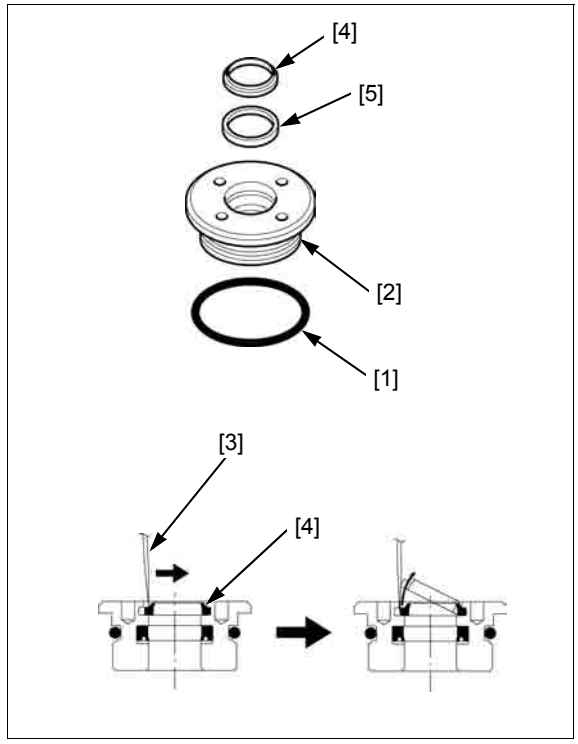


Remove the O-ring [1] from the rod guide [2].

Insert a sharp-end screwdriver [3] into the gap between the dust seal [4] and the rod guide.
Lift the dust seal and remove it from the rod guide.
Take care not to damage inside the rod guide during this operation.

Remove the oil seal [5] in the rod guide in the same manner.

- Be careful not to damage the oil seal installation surface of the rod guide.
  Replace the rod guide with a new one, if damaged.

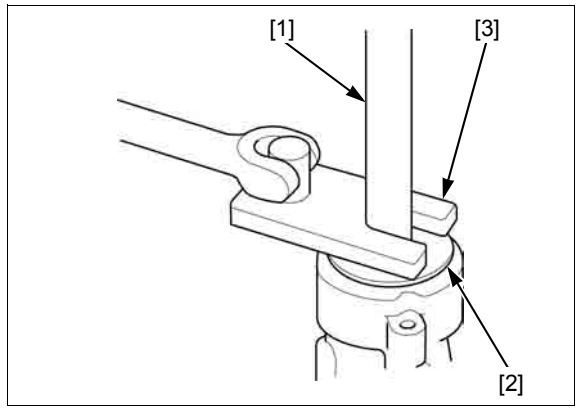


Hold the cylinder with a vise (page 19-21).

Make sure that the piston rod A [1] is in the fully extended position.

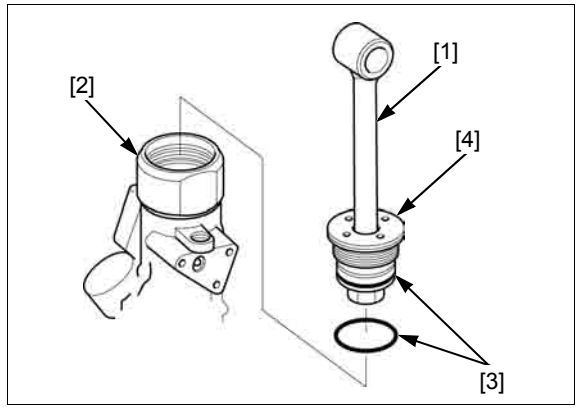
Set the special tool on the cylinder cap [2] as shown, and remove the piston rod A.

TOOL:
Pin wrench, 6 mm [3] **07SPA-ZW1010A**



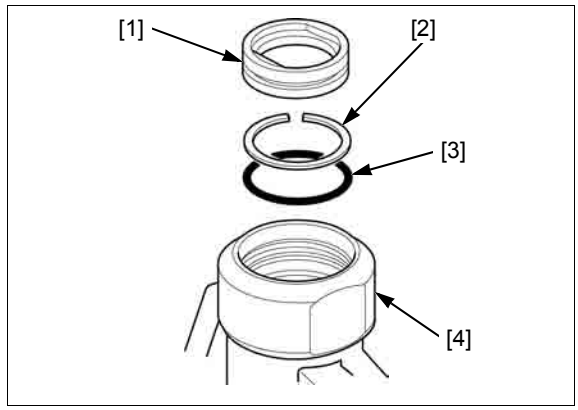
Remove the piston rod A [1] from the cylinder [2].

Remove the two O-rings [3] from the cylinder cap [4].

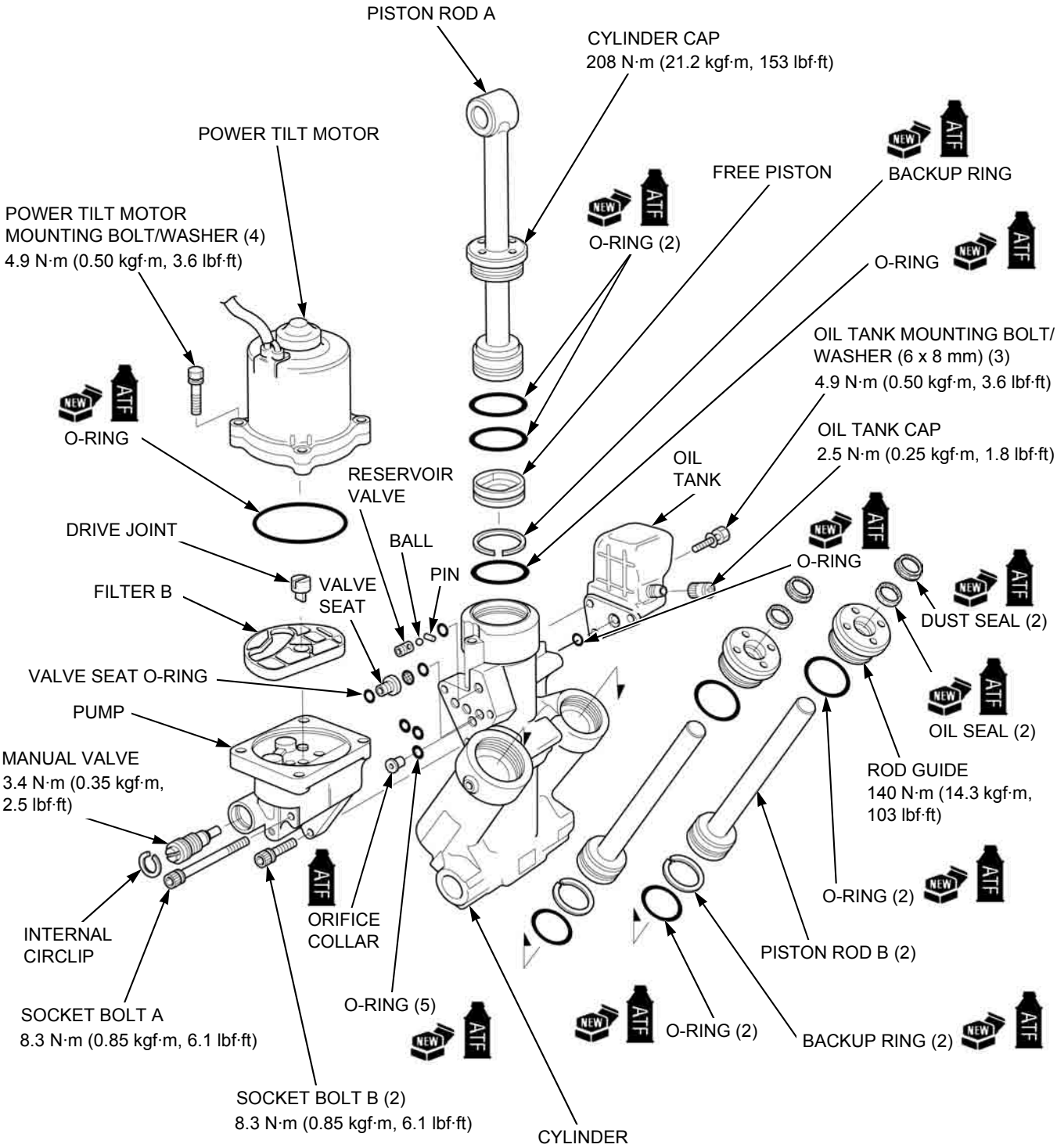


Remove the free piston [1], backup ring [2], and O-ring [3] from the cylinder [4].

Check the sliding surface of the free piston for wear and damage and replace if necessary.



EXPLODED VIEW

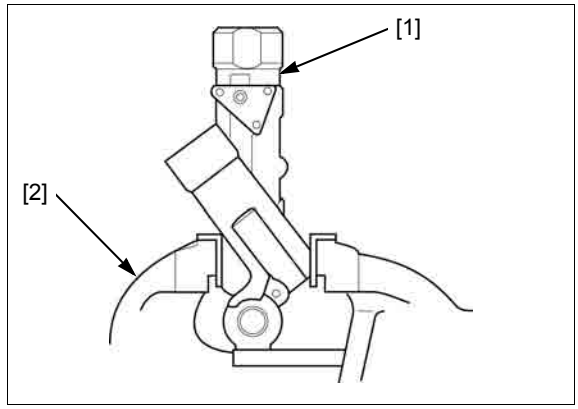


ASSEMBLY

- Do not reuse O-rings and oil seals.
- Do not use a shop towel or equivalent cloth, and do not wear gloves during this operation.
- Do not reuse the drained ATF.
- When operation is made by holding the cylinder in a vise, do not tighten the vise excessively.
- Add ATF slowly.
- Assemble the power trim/tilt with the piston rod A and piston rod B fully extended. Do not push in the piston rod A and piston rod B.
- Do not allow dust, dirt, and other foreign material to enter the cylinder and the pump during 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.

Clean the parts with the flesh ATF and blow each port with compressed air to remove dust and dirt. Check that the parts are clean before assembly.

Hold the cylinder [1] in a vise [2] with shop towel or soft jaws as shown.



NOTICE

Do not tighten the vise excessively, as it can damage the cylinder.

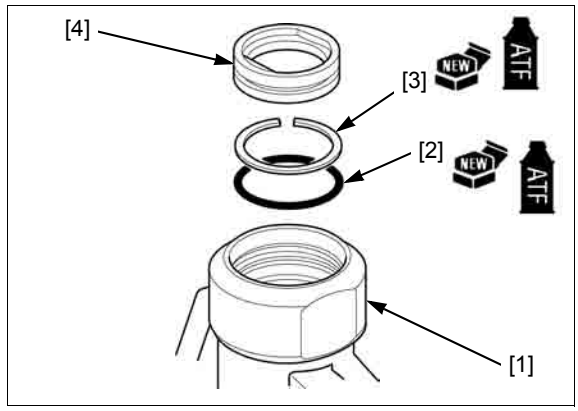
Pour approximately 30 cm^3 (1.0 fl oz) of ATF into the piston rod chamber of the cylinder [1].

RECOMMENDED OIL:

Honda Genuine Automatic Transmission Fluid (ATF) DEXRON®, or equivalent

Apply ATF to a new O-ring [2] and new backup ring [3].

Install the backup ring and O-ring on the free piston [4].

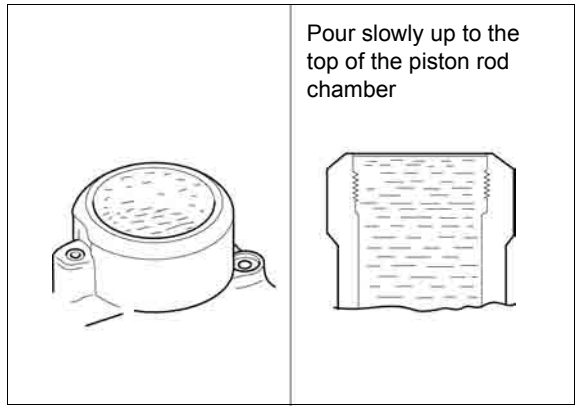


NOTICE

Install the backup ring on the free piston with care not to break it.

Apply ATF to the circumference of the free piston and push it in the piston rod chamber slowly until it bottoms out.

After fully installing the free piston, pour the fresh ATF slowly up to the top of the piston rod chamber of the cylinder.



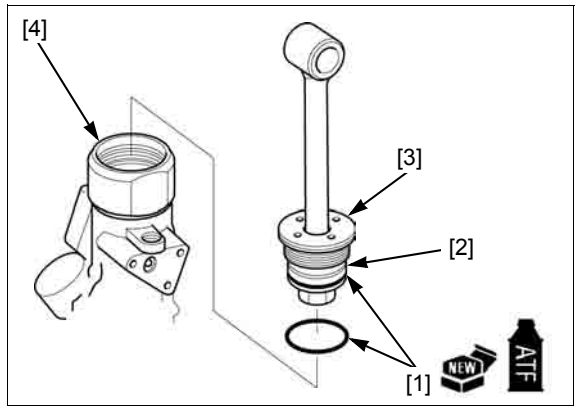
Apply ATF to a new O-ring [1] and Install it on the bottom (i.e. nut side) of the piston rod A [2].

Apply ATF to a new O-ring [1] and Install it on the cylinder cap [3] of the piston rod A.

With the piston rod A fully extended, install the piston rod A slowly in the piston rod chamber of the cylinder [4].

Loosely tighten the cylinder cap.

Do not install the piston rod A by pushing it in the piston rod chamber.



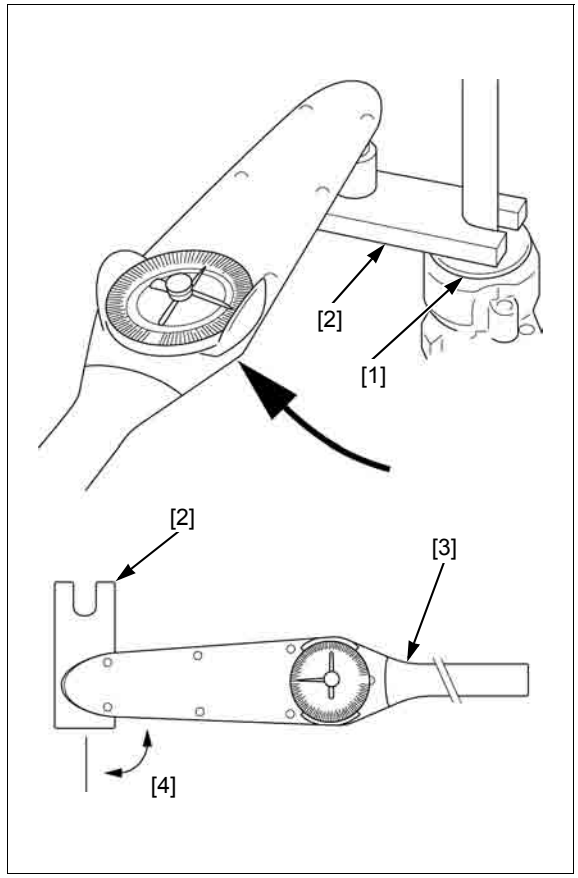
Tighten the cylinder cap [1] to the specified torque using the special tool as shown.

TOOL:
Pin wrench, 6 mm [2] 07SPA-ZW1010A

TORQUE: 208 N·m (21.2 kgf·m, 153 lbf·ft)

NOTICE

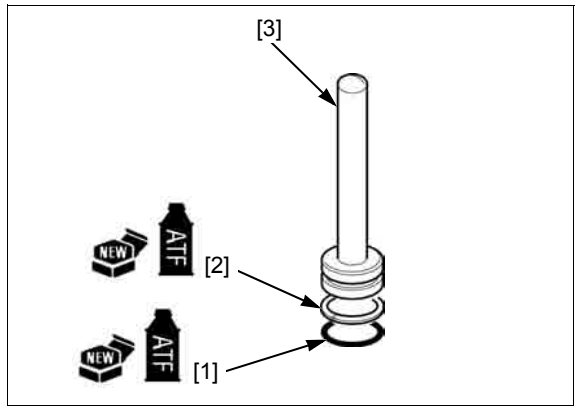
- *Make sure the torque wrench [3] stays perpendicular [4] to the special tool. If the torque wrench is not held 90 degrees to the tool, the torque reading will be incorrect.*



Apply ATF to a new O-ring [1] and new backup ring [2], and install them on the piston rod B [3].

NOTICE

- *Install the backup ring on the piston rod B with care not to break it.*



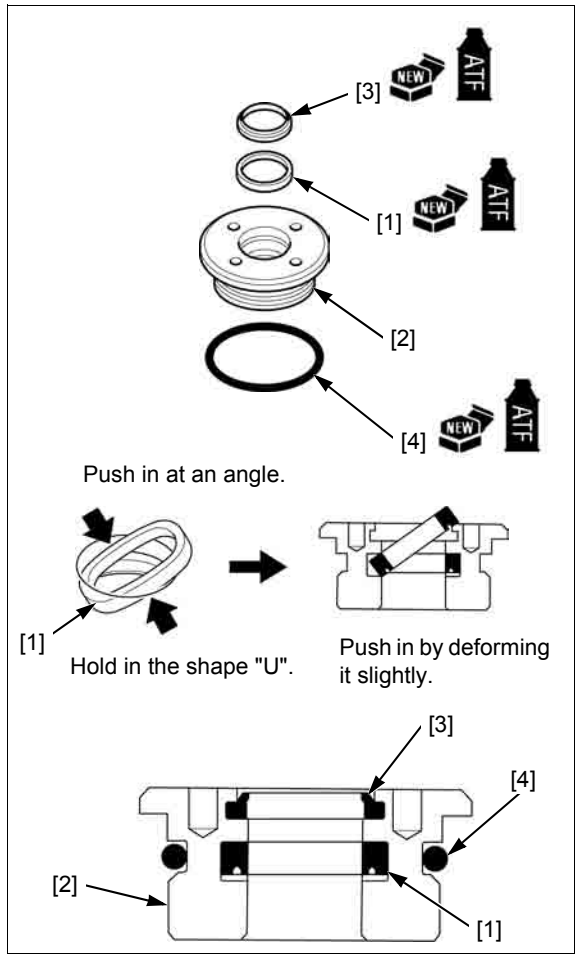
Apply ATF to a new oil seal [1].

Holding the oil seal in the shape of a "U" with your fingers, install it in the lower groove in the rod guide [2], taking care not to damage the oil seal.

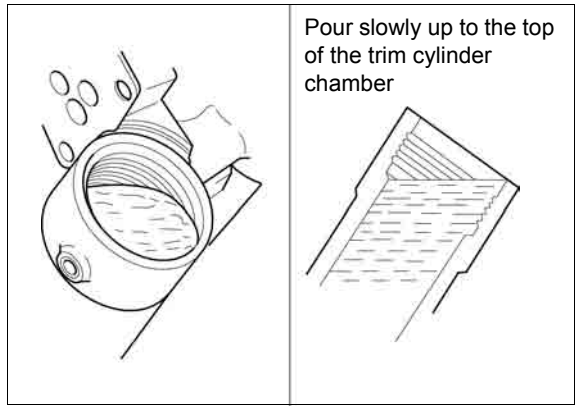
Apply ATF to a new dust seal [3].

Holding the dust seal in the shape of a "U" with your fingers, install it in the upper groove in the rod guide, taking care not to damage the dust seal.

Apply ATF to a new O-ring [4] and install it on the rod guide.



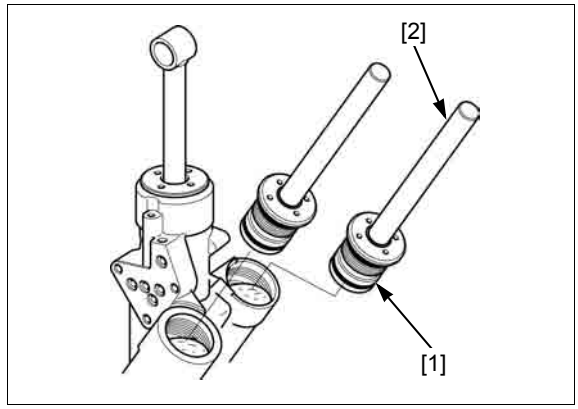
Pour fresh ATF in the right and left trim cylinder chambers up to the top of the trim cylinder chamber.



Install the rod guide [1] on piston rod B [2].
Extend the piston rod B fully and hold it in that position.

Set one piston rod B in the left cylinder chamber and one in the right cylinder chamber.
Do not install either piston rod B by pushing it into the trim cylinder.

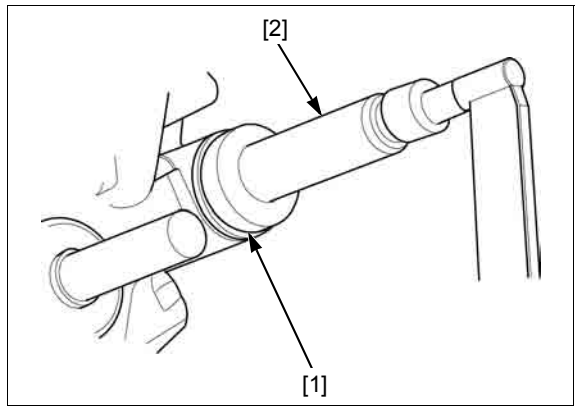
Holding each piston rod B in place, loosely tighten the rod guides on the cylinders.
Do not install either piston rod B by pushing it into the trim cylinder.



Using the special tool, tighten the left and right rod guides [1] to the specified torque.

TOOL:
Pin wrench, 4 mm [2] 07SPA-ZW1020A

TORQUE: 140 N·m (14.3 kgf·m, 103 lbf·ft)

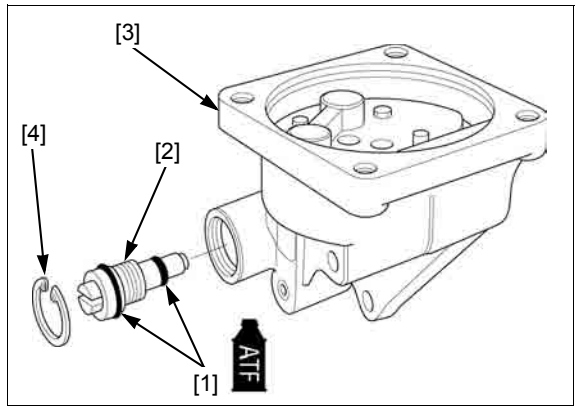


Apply ATF to the manual valve O-rings [1].

Install the manual valve [2] to the pump [3] and tighten it to the specified torque.

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

Install the internal circlip [4].



Apply ATF to five new O-rings [1], valve seat O-ring [2] and orifice collar [3].

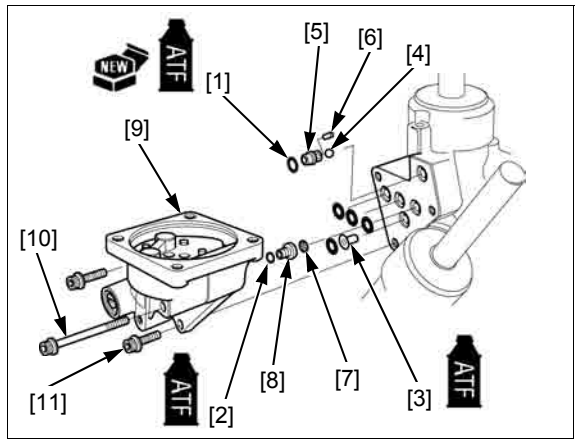
Install the steel ball [4] into the reservoir valve [5] and set the pin [6].
Install the reservoir valve into the cylinder.

Install the filter [7] and valve seat O-ring to the valve seat [8].
Install the valve seat into the pump.

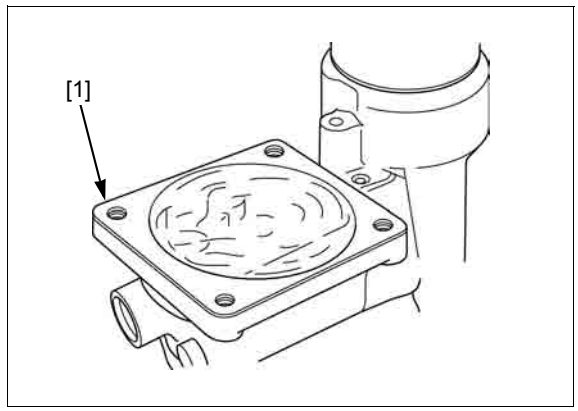
Install the five O-rings and orifice collar in the cylinder and install the pump [9] on the cylinder.

Install and tighten the socket bolts A [10] and B [11] to the specified torque.

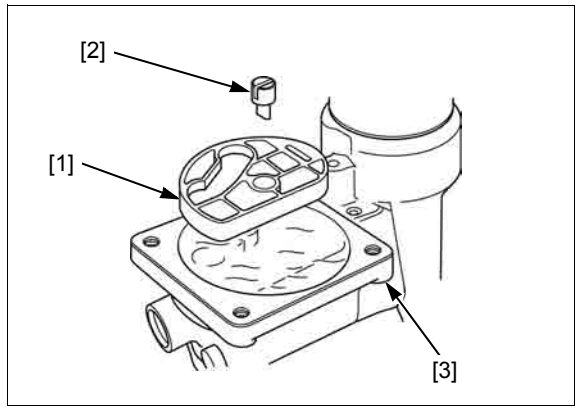
TORQUE: 8.3 N·m (0.85 kgf·m, 6.1 lbf·ft)



Fill the pump [1] fully with fresh ATF.
Do not fill up the pump quickly. Pour ATF in the pump slowly.



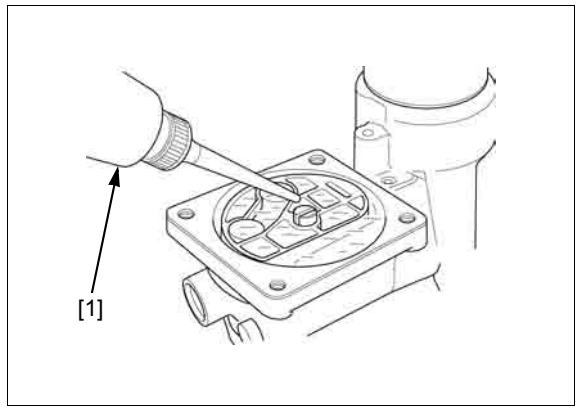
Install the filter B [1] and drive joint [2] on the pump [3].



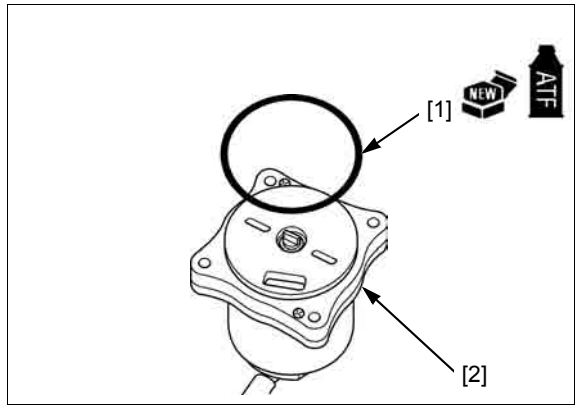
After installation, check filter B for bubbles. Remove the bubbles with the oil bottle [1] or an equivalent tool if necessary.

Be sure to remove the air bubbles, or it will cause air in the system.

After removing the air bubbles, fill the pump fully with ATF again.



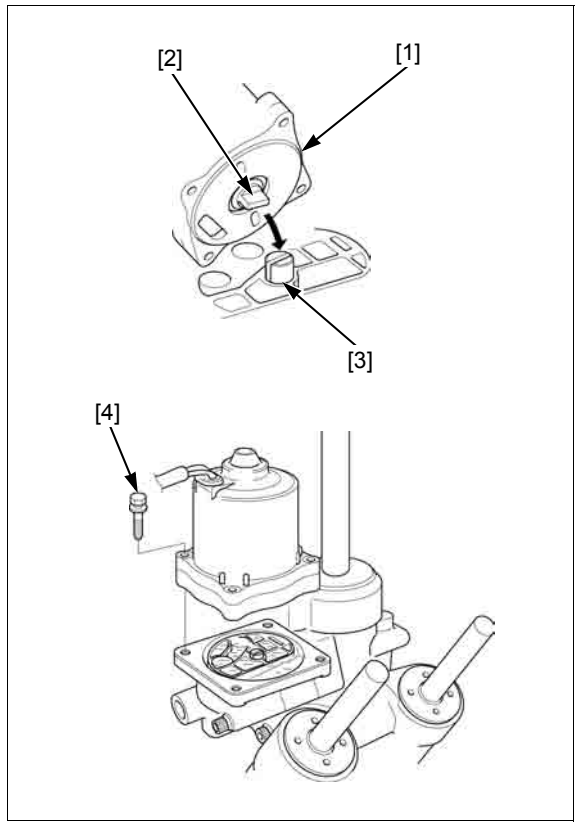
Apply ATF to a new O-ring [1] and install it on the power tilt motor [2].



Install the power tilt motor [1] on the pump by aligning the projection [2] on the motor with the cutout in the drive joint [3].
Set the motor wire of the power tilt motor facing toward the manual valve side.

Tighten the four power tilt motor mounting bolt/washers [4] to the specified torque.

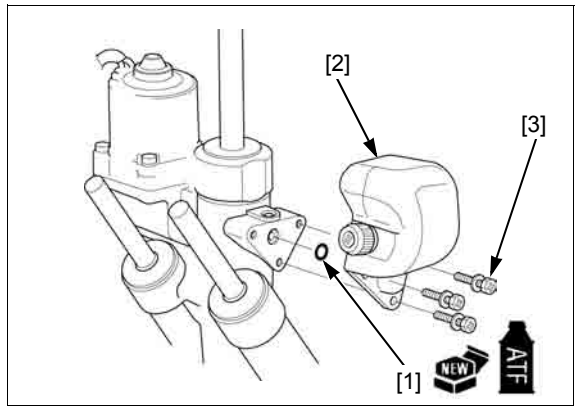
TORQUE: 4.9 N·m (0.50 kgf·m, 3.6 lbf·ft)



Apply ATF to a new O-ring [1] and install it on the cylinder.

Install the oil tank [2] on the cylinder and tighten the three oil tank mounting bolt/washers [3] to the specified torque.

TORQUE: 4.9 N·m (0.50 kgf·m, 3.6 lbf·ft)



Remove the oil tank cap [1]. Pour flesh ATF to the upper limit [2] of the oil tank filler port.

OIL CAPACITY:
0.68 liter (0.72 US qt, 0.6 Imp qt)

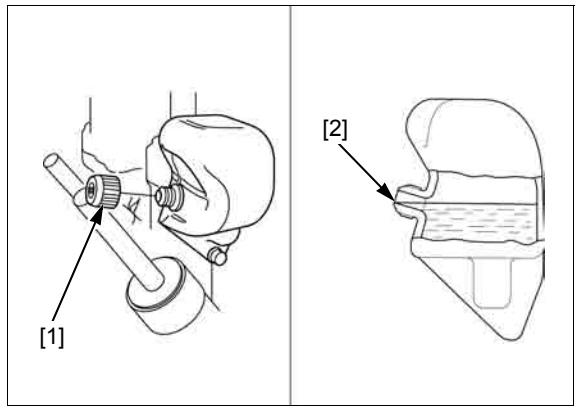
NOTICE

- *Do not overfill with ATF; that will damage the oil seal of the motor when each rod is compressed.*

After filling the oil tank with ATF, bleed air from the power tilt/trim (without mounting on the outboard motor) (page 19-31).

Install the oil tank cap and tighten it to the specified torque.

TORQUE: 2.5 N·m (0.25 kgf·m, 1.8 lbf·ft)



AIR BLEEDING

- Bleed air from the unit whenever the power trim/tilt is assembled.
- Perform the following procedure to bleed air:

1. Bleed air without mounting the unit on the outboard motor.
2. Check hydraulic pressure (page 19-33).
3. Bleed air after mounting the unit on the outboard motor (page 19-32).

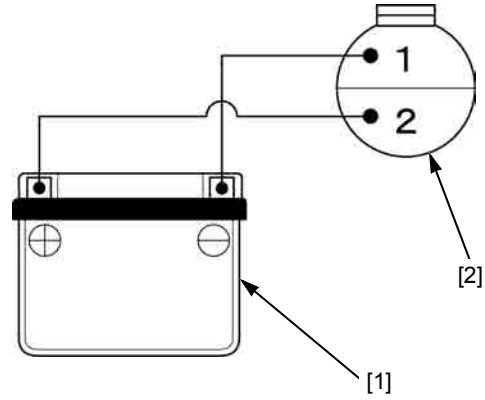
Power trim/tilt not mounted on the outboard motor

1. Hold the power trim/tilt vertically.
2. Operate the power tilt motor to compress each rod fully (Connect the battery [1] negative (–) cable to the green terminal of the power tilt motor 2P connector [2], and the battery positive (+) cable to the blue terminal.)
3. Operate the power tilt motor to extend each rod fully (Connect the battery positive (+) cable to the green terminal of the power tilt motor 2P connector, and the battery negative (–) cable to the blue terminal.)

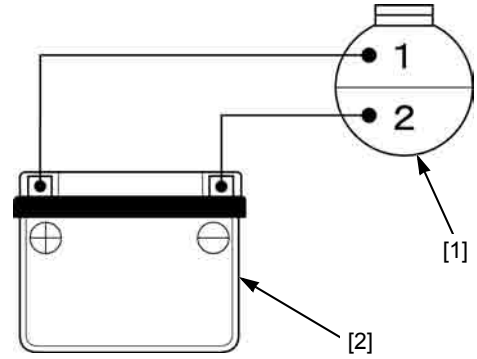
NOTICE

- *Connect the battery cables to the power tilt motor 2P connector terminals with care not to short-circuit the connector.*

To compress the piston rod:



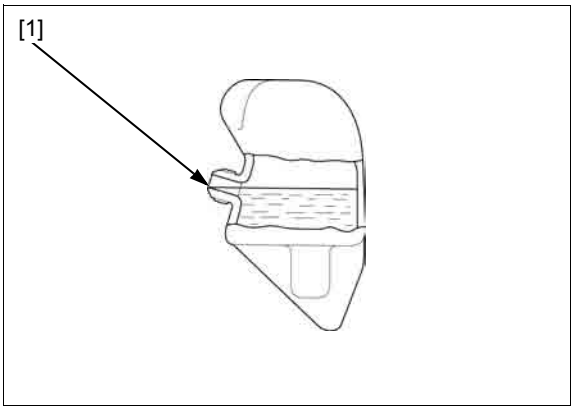
To extend the piston rod:



4. Remove the oil tank cap with each rod extended fully. Check whether the Automatic Transmission Fluid (ATF) is at the upper limit [1] of the filler port.

   If ATF does not flow out of the filler port, add ATF until it flows out.

   Check the fluid level with the rods fully extended. Note that ATF will spurt out when the oil tank cap is removed with the rods fully compressed.



5. After adding ATF, repeat the procedure from step 2 through 4 two or three times to bleed air from the unit.
6. Be sure that the rods fully extend and compress during the step 5 operation.

   When the rods fully extend and compress fully, perform the hydraulic pressure check (page 19-33).

   If the rods do not compress fully, perform the following procedure.

7. With the rods extended fully, operate the power tilt motor to extend the each rod until relief valve opens again. Operate the power tilt motor to compress the each rod and be sure that the rods compress (page 19-31).

   If the rods extend and compress fully, go to the hydraulic pressure check (page 19-33).

8. If the rods do not compress after the step 7 operation, operate the power tilt motor to compress each rod (page 19-31) while pushing the piston rod B [1], and check whether the rods compress.

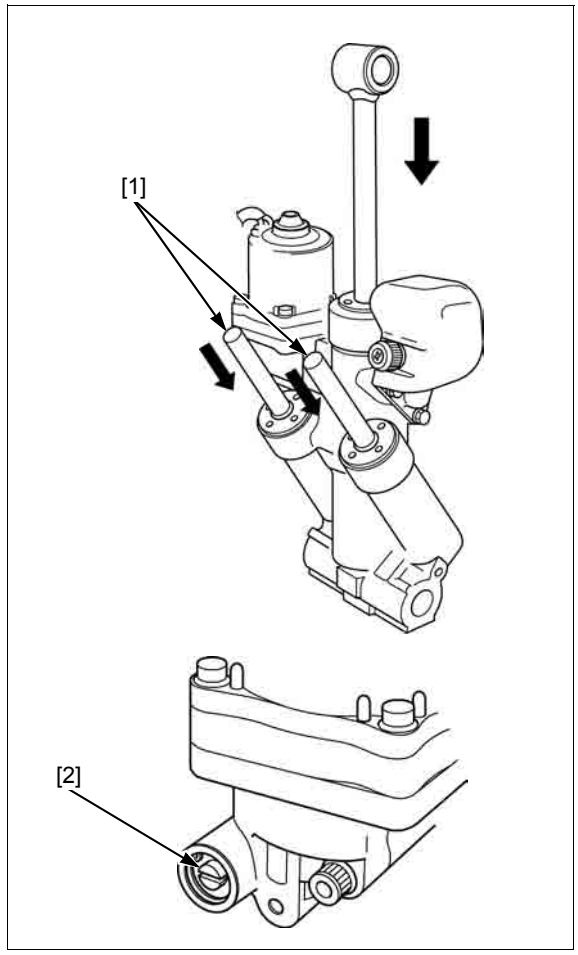
   If the rods extend and compress fully, go to the hydraulic pressure check (page 19-33).

9. If the rods still do not compress after the step 8 operation, loosen the manual valve [2] and compress each rod. Tighten the manual valve securely again. Operate the power tilt motor to extend the each rod fully, and then operate the power tilt motor to compress the each rod and check whether the rods compress fully (page 19-31).

   If the rods extend and compress fully, go to the hydraulic pressure check (page 19-33).

10. If the rods do not compress after the above operations, perform the following.

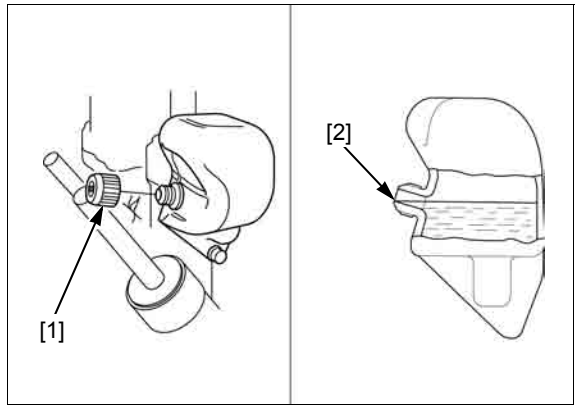
– Disassemble and assemble the power trim/tilt (page 19-19).
– Bleed air with the power trim/tilt not mounted on the outboard motor (page 19-31).



Air bleeding with the power trim/tilt on the outboard motor

Perform the following procedure after bleeding air without mounting the power trim/tilt on the outboard motor and after checking the hydraulic pressure.

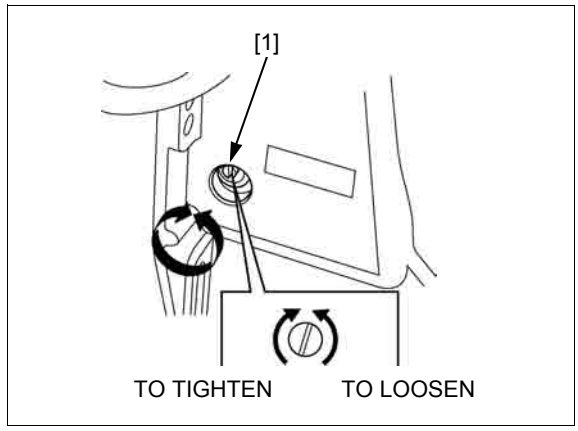
1. Install the power trim/tilt on the outboard motor securely (page 19-9).
2. Push the "UP" side of the power tilt switch, and raise the outboard motor to the uppermost position.
3. Remove the oil tank cap [1], and check whether the ATF is at the upper limit [2] of the oil filler port. Add ATF if necessary.



4. Lower the outboard motor slowly to the lowermost position by loosening the manual valve [1].
5. Tighten the manual valve to the specified torque.

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

6. Hold the outboard motor in the lowermost position for five minutes.
7. 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.
8. Repeat the procedure from step 4 through 7 five times.



HYDRAULIC PRESSURE CHECK

After bleeding air from the power trim/tilt without installing on the outboard motor and checking each rod for proper compression, perform the following operation in the same manner as bleeding air without installing on the outboard motor.

– Be sure each rod is extended fully.
– Check the hydraulic pressure both at the upper and lower chambers.

Lower chamber hydraulic pressure

Remove the internal circlip [1] and manual valve [2] from the power trim/tilt.

A small amount of oil will flow out when the manual valve is removed. Catch it with a container.

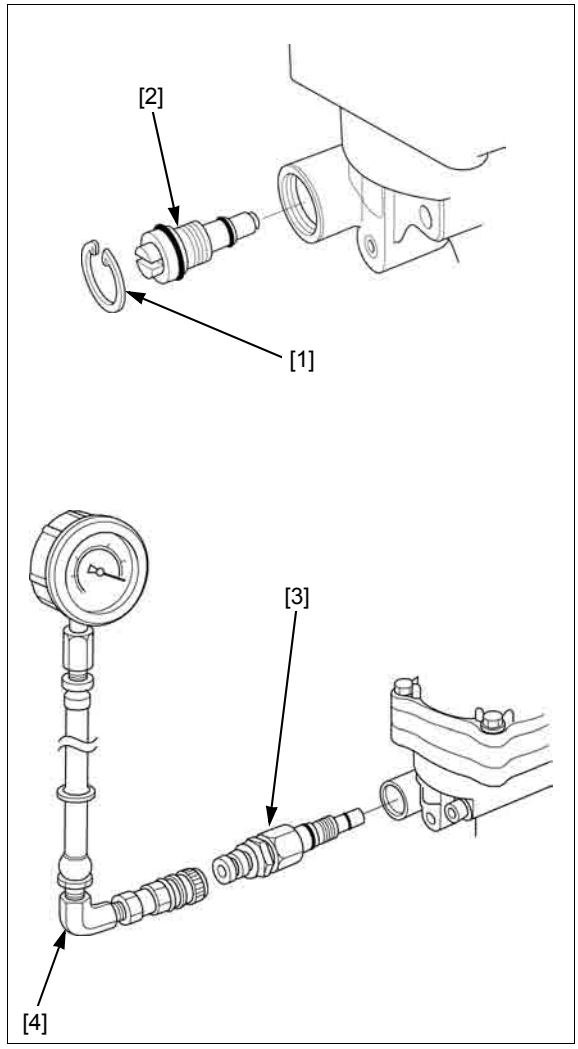
Install the special tool to where the manual valve was removed as shown and tighten it to the specified torque.

TOOL:
Oil pressure gauge joint B [3] 07SPJ-ZW1020A

TORQUE: 9.0 N·m (0.92 kgf·m, 6.6 lbf·ft)

Attach the special tool to gauge joint B as shown.

TOOL:
Pressure gauge, 0 – 5,000 psi [4] 07KPJ-VD6020B



Remove the oil tank cap [1] and check wether the ATF is at the upper limit of the filler port [2].

Operate the power tilt motor to compress the each rod (page 19-31) fully.

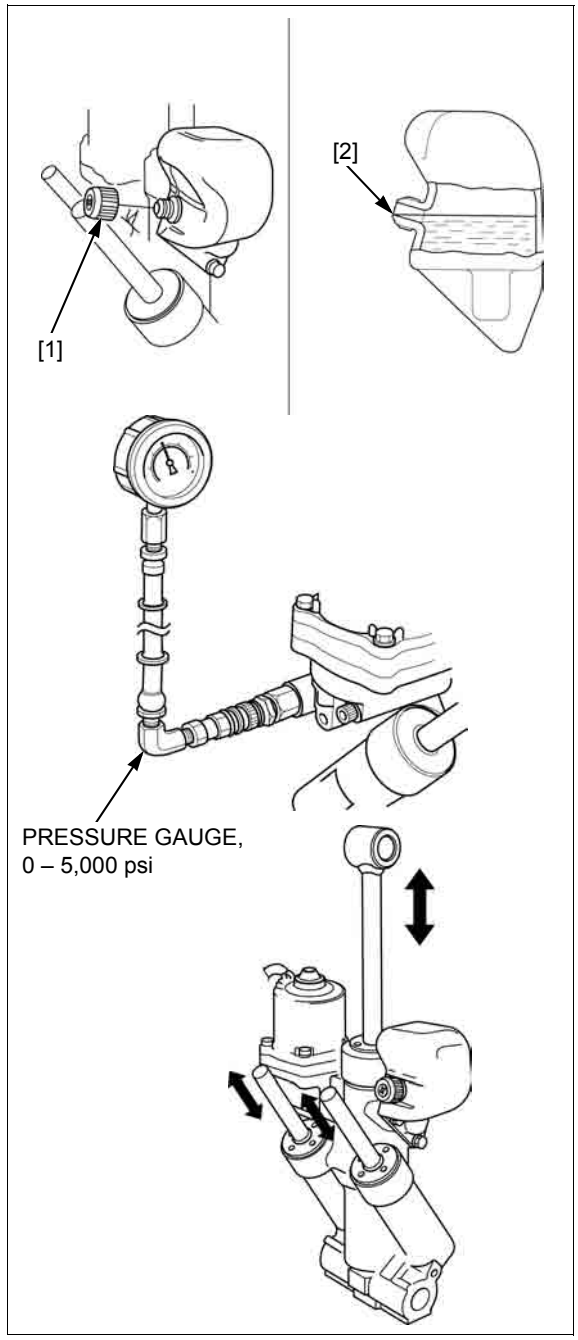
Operate the power tilt motor to extend the each rod (page 19-31) fully again, and read the pressure gauge to measure the lower chamber hydraulic pressure.

LOWER CHAMBER HYDRAULIC PRESSURE:
8,826 – 11,768 kPa
(90 – 120 kgf/cm^2, 1,280 – 1,707 psi)

If a sharp pressure drop is observed, check the power tilt motor for a damaged oil seal (page 19-19).

If the hydraulic pressure is lower than the specified pressure, check for oil leaks.

Measure the upper chamber hydraulic pressure (page 19-34).



Upper chamber hydraulic pressure

After measuring the lower chamber hydraulic pressure, remove the special tools (oil pressure gauge joint B [1] and oil pressure gauge) with each rod fully extended.

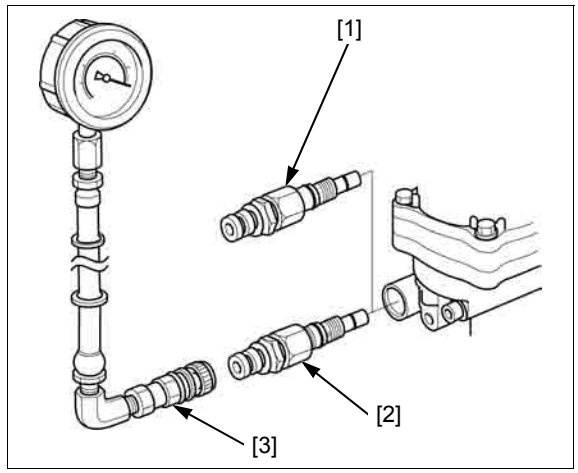
Install the special tool and tighten the specified torque.

TOOL:
Oil pressure gauge joint A [2] 07SPJ-ZW1010A

TORQUE: 9.0 N·m (0.92 kgf·m, 6.6 lbf·ft)

Attach the special tools as shown.

TOOL:
Pressure gauge, 0 – 5,000 psi [3] 07KPJ-VD6020B

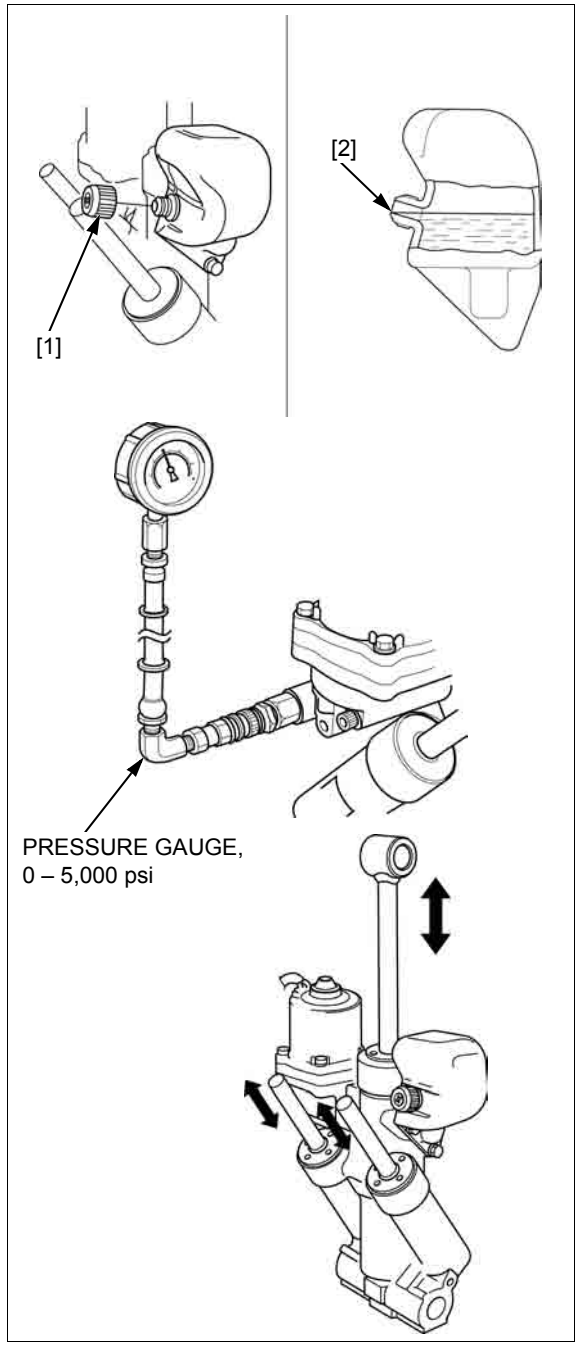


Remove the oil tank cap [1] and check wether the ATF is at the upper limit of the filler port [2].

Operate the power tilt motor to compress the each rod (page 19-31) fully, and read the pressure gauge to measure the upper chamber hydraulic pressure.

UPPER CHAMBER HYDRAULIC PRESSURE:
3,923 – 7,355 kPa (40 – 75 kgf/cm^2, 569 – 1,067 psi)

If the hydraulic pressure is lower than the specified pressure, check for oil leaks.

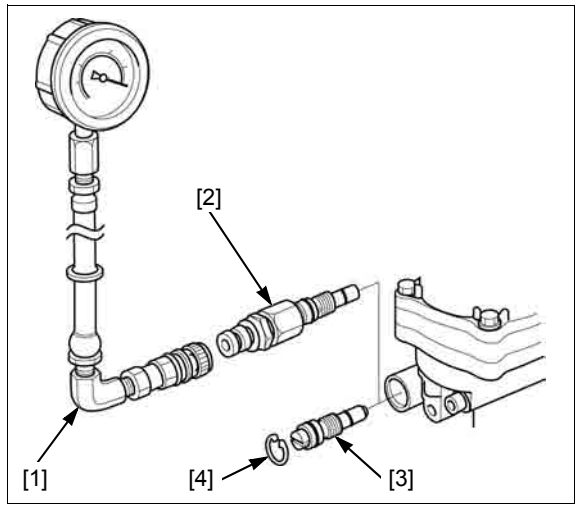


After checking, operate the power tilt motor to extend the each rod (page 19-31). With each rod extended fully, remove the special tools (oil pressure gauge [1] and oil pressure gauge joint A [2]).
Instal the manual valve [3] to the pump and tighten it to the specified torque.

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

Install the internal circlip [4].

Recheck the ATF level.

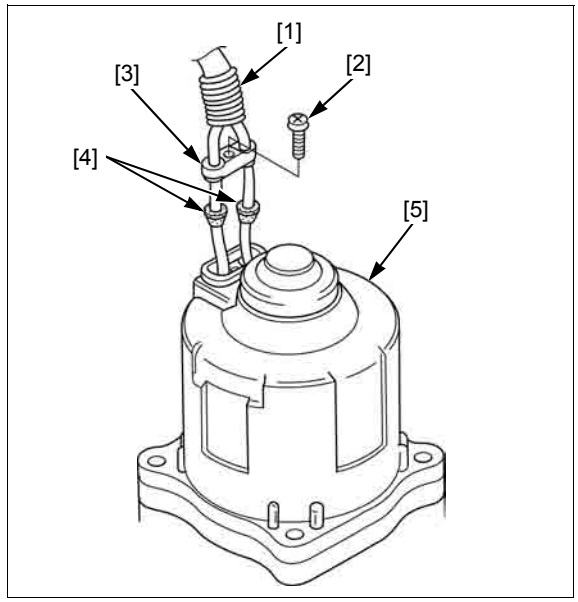


POWER TILT MOTOR DISASSEMBLY/ ASSEMBLY

DISASSEMBLY

Untape the corrugated teflon tube [1], and pull the tube to the opposite side of the wire holder.

Remove the wire holder screw (stainless steel screw: 4 x 16 mm) [2]. Pull out the wire holder [3] and the two grommets [4] from the yoke [5], and move them to the tube side.



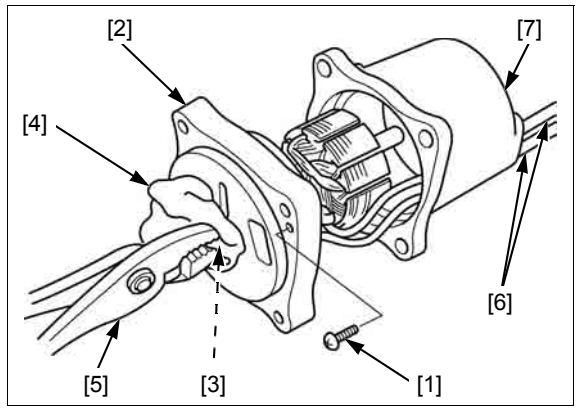
NOTICE

- *Pull out the grommets with care not to damage them.*

Remove the two screws (4 x 16 mm) [1] from the front bracket [2].

Wrap the armature shaft [3] with a shop towel [4] or equivalent material to protect, and hold the shaft with pliers [5].

Pushing the two motor wires [6] toward the yoke [7], remove the armature/front bracket from the yoke.
Do not allow the commutator to become contaminated with oil or grease.



Pull the brushes [1] from the brush holders and remove the two brush springs [2].

Disconnect the motor wire (Blue wire) terminal [3] from the breaker [4] while holding the breaker with a screwdriver.

NOTICE

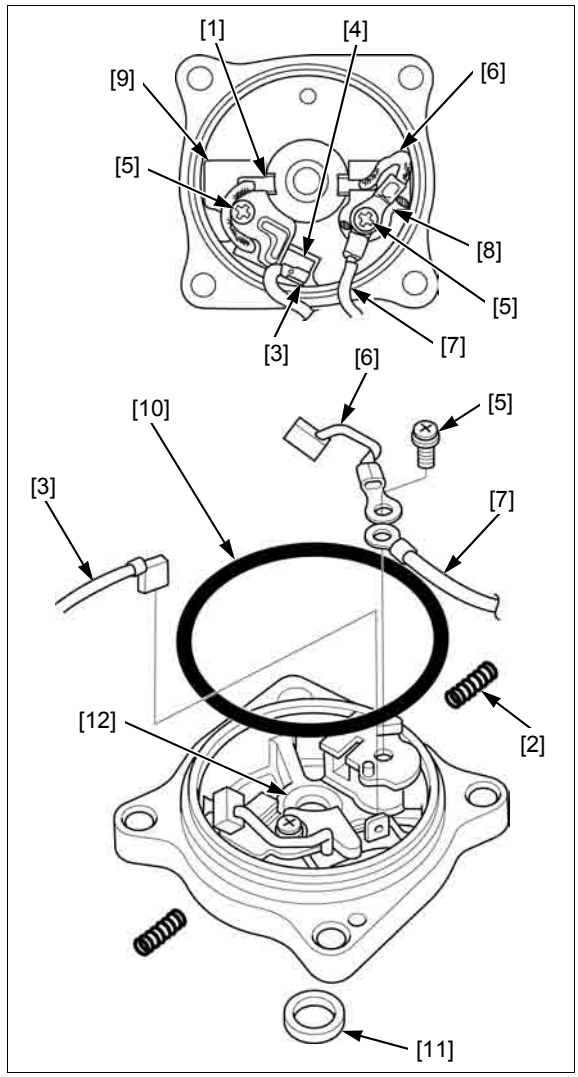
- *Do not disconnect the Blue wire terminal without holding the breaker, or it can cause damage to the breaker. Be sure to disconnect the terminal while holding the breaker.*
- *Take care not to touch the bimetal part of the breaker during removal.*

Remove the two screws (4 x 10 mm) [5], brush terminal [6], motor wire (Green wire) [7], brush holders A [8] and B [9], and breaker.

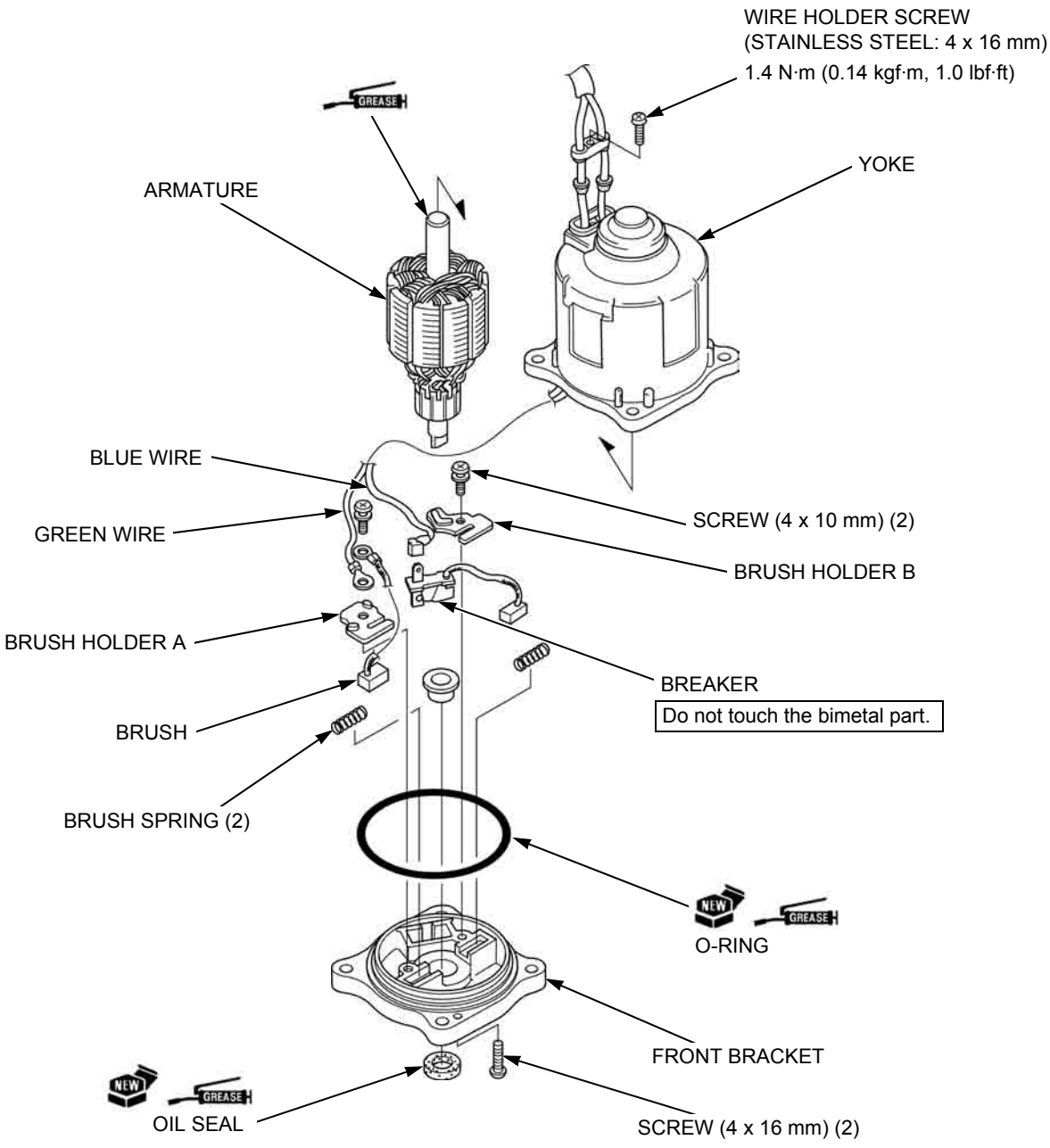
Remove the O-ring [10] from the front bracket groove.

Check the oil seal [11] for damage or wear.
Replace the oil seal with a new one if necessary.

Check the metal part [12] of the front bracket for damage and wear.
Replace the front bracket assembly if necessary.



EXPLODED VIEW



ASSEMBLY

Apply grease to the oil seal lips.

Apply grease to a new O-ring [1] and install it to the front bracket groove [2].

Set the brush holder A [3] and brush terminal [4] above the motor wire (Green wire) terminal [5] and loosely tighten the screw (4 x 10 mm) [6].
Be sure that the motor wire (Green wire) terminal and the brush assembly wire terminal contact the respective projections [7] on brush holder A, and then tighten the screw.

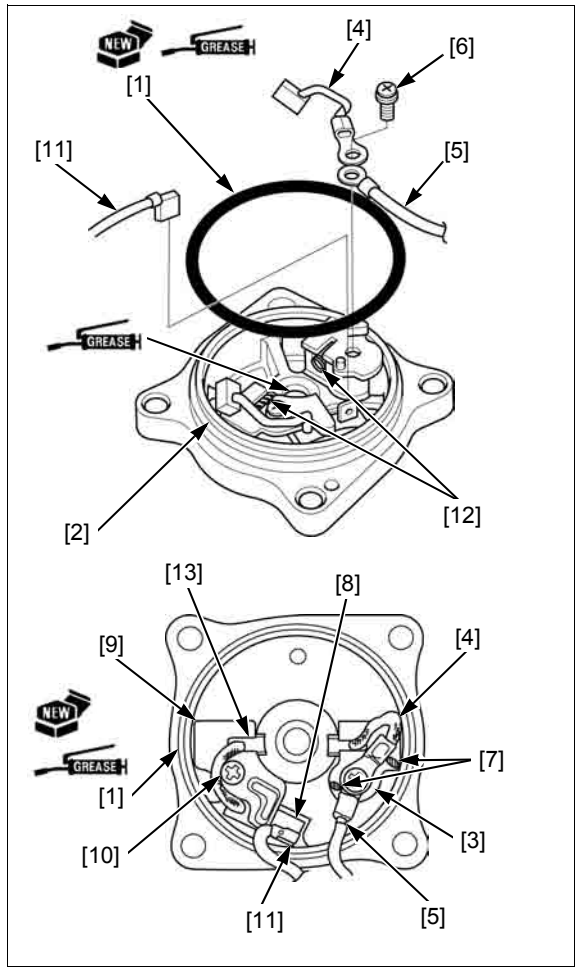
Install the breaker [8] and brush holder B [9], and tighten the screw (4 x 10 mm) [10].

NOTICE

Do not touch the bimetal part of the breaker.

Connect the motor wire (Blue wire) terminal [11] to the breaker.

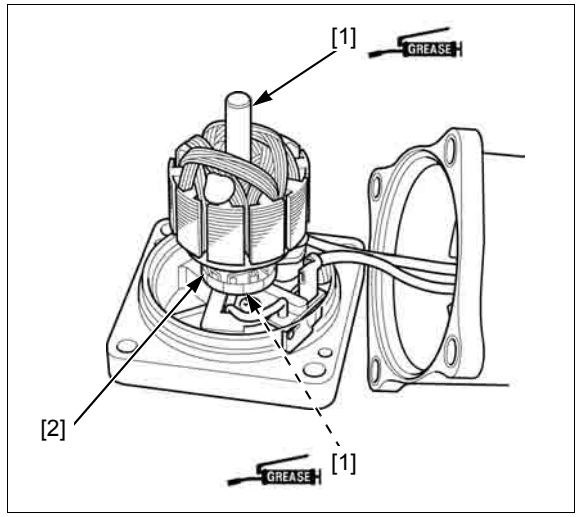
Install the two springs [12] in the place under the brush holders A and B.
Set the two brushes [13] on the brush holders.



Apply grease to the sliding surface of the armature shaft [1], taking care that the commutator surface [2] is not contaminated with grease.

Install the armature on the front bracket while pushing the brush terminal into the holder.

- Be careful not to damage the brushes when installing the armature into the front bracket.



Make sure that there is no washer, etc. on the magnet in the yoke [1].

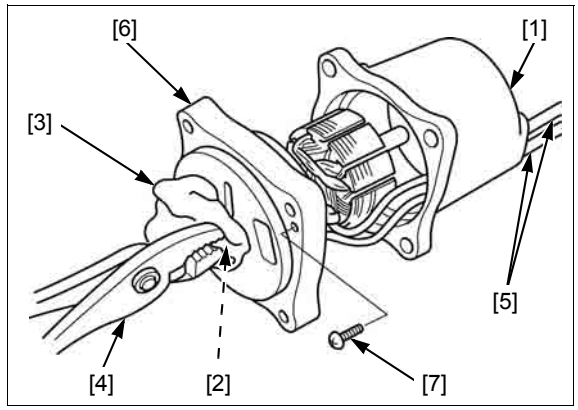
Wrap the armature shaft [2] with a shop towel [3] or equivalent material, and hold the shaft with pliers [4].

Pulling the two motor wires [5] of the yoke side slowly, install the armature/front bracket [6] on the yoke.

If it is hard to install the armature/front bracket in the yoke, check whether the metal of the yoke (i.e. where the armature shaft is installed) is out of position and repeat.

After installation, check that the armature turns smoothly and tighten the two screws (4 x 16 mm) [7].

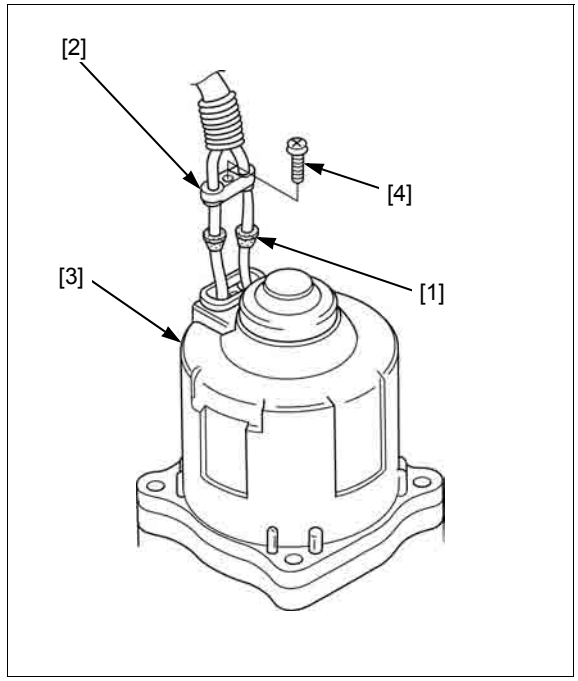
After tightening the two screws, connect the battery to the power tilt motor 2P connector and check whether the motor turns (page 19-41). If the motor does not turn, disassemble the power tilt motor again, and check whether the motor wire (Blue wire) terminal is disconnected.



Install the two grommets [1] and wire holder [2] on the yoke [3].

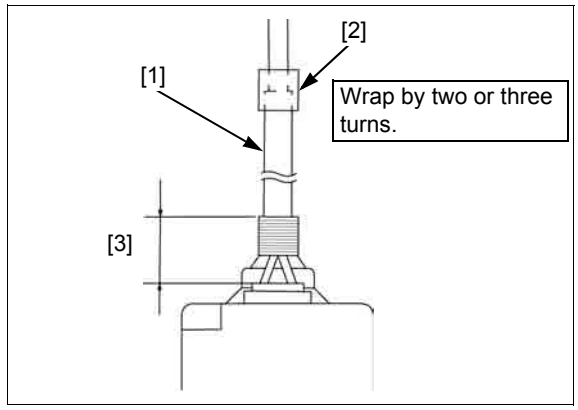
Tighten the screw (stainless steel screw: 4 x 16 mm) [4] to the specified torque. Do not overtighten it.

TORQUE: 1.4 N·m (0.14 kgf·m, 1.0 lbf·ft)



Tape the corrugated teflon tube [1] with heat resisting tape [2] so that the distance from the wire holder end to the tube end is 30 mm (1.2 in) or less [3] as shown.

Bleed air from the power trim/tilt without mounting on the outboard motor (page 19-31).

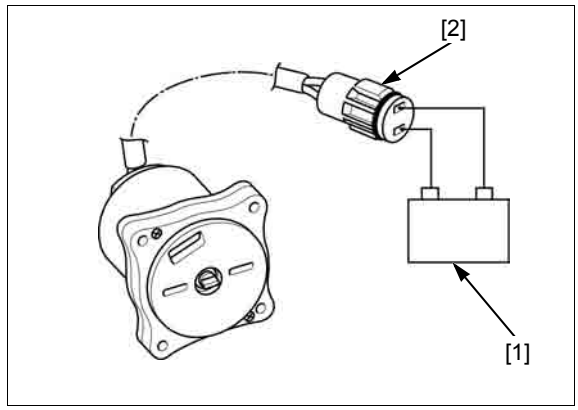


POWER TILT MOTOR INSPECTION

OPERATION INSPECTION

Connect the battery [1] to the power tilt motor 2P connector terminals [2] and check that the motor turns.

Connect the battery in reverse and check that the motor turns in the opposite direction.



NOTICE

Connect the battery, being very careful not to cause a short-circuit.

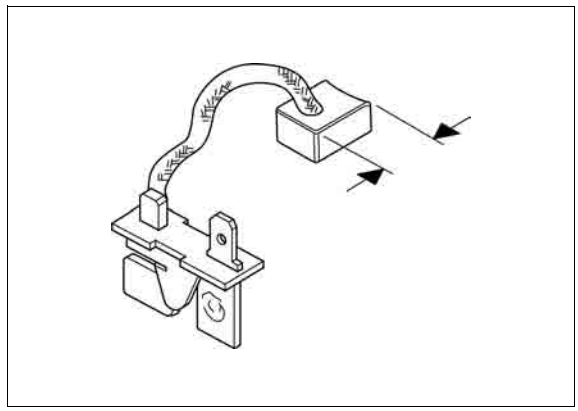
Disassemble and inspect the components of the motor if there is any abnormality.

BRUSH LENGTH

Measure the brush length.

STANDARD: 9.8 mm (0.39 in)
SERVICE LIMIT: 4.8 mm (0.19 in)

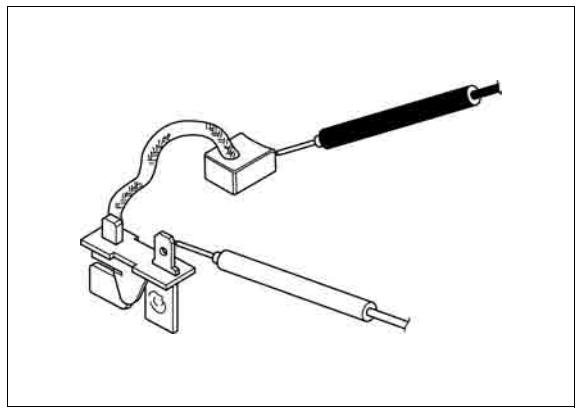
If brush length is less than the service limit, replace the brush assembly.



BREAKER

Check for continuity between the brush and terminal.

If there is no continuity, replace the brush assembly.

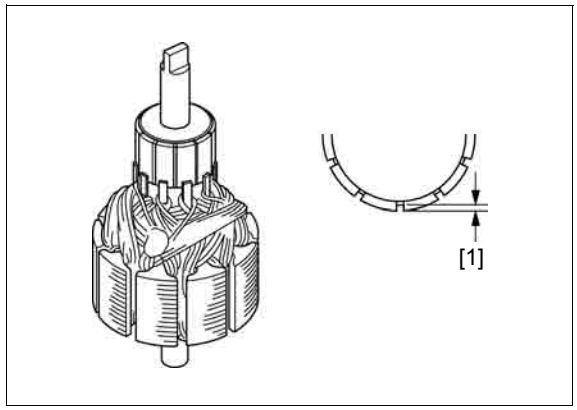


MICA DEPTH

Check the grooves of the commutator and measure the mica depth [1].

SERVICE LIMIT: 0.50 mm (0.020 in)

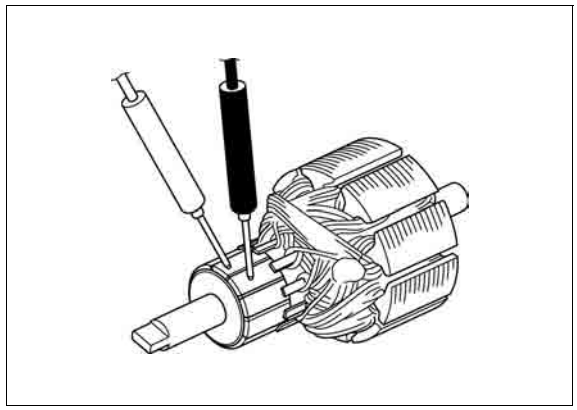
If the grooves are clogged or mica depth is less than the service limit, recut the grooves using a hacksaw blade or a small file.



ARMATURE

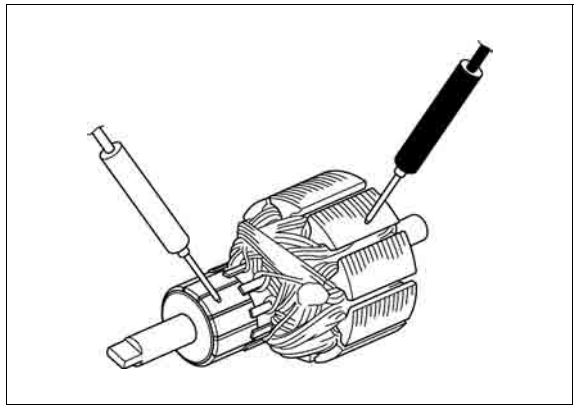
Check for continuity between each segment.

If an open circuit exists between any two segments, replace the armature.



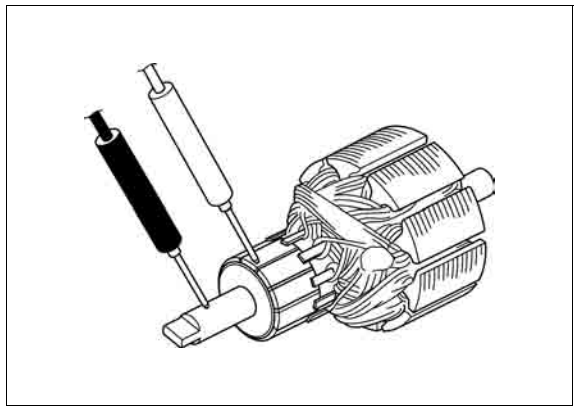
Check for continuity between the commutator and armature coil core.

If there is continuity, replace the armature.



Check for continuity between the commutator and armature shaft.

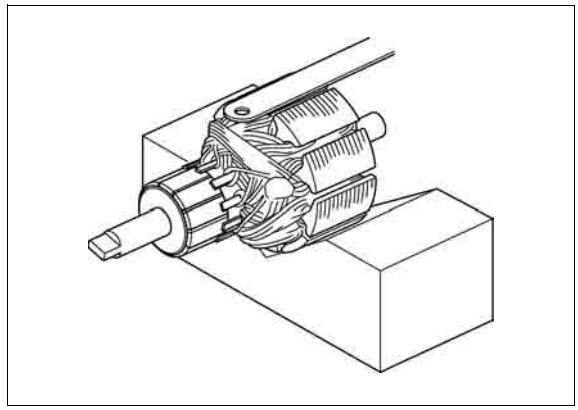
If there is continuity, replace the armature.



Place the armature on an armature tester (commercially available.)

Hold a hacksaw blade close to the armature core.

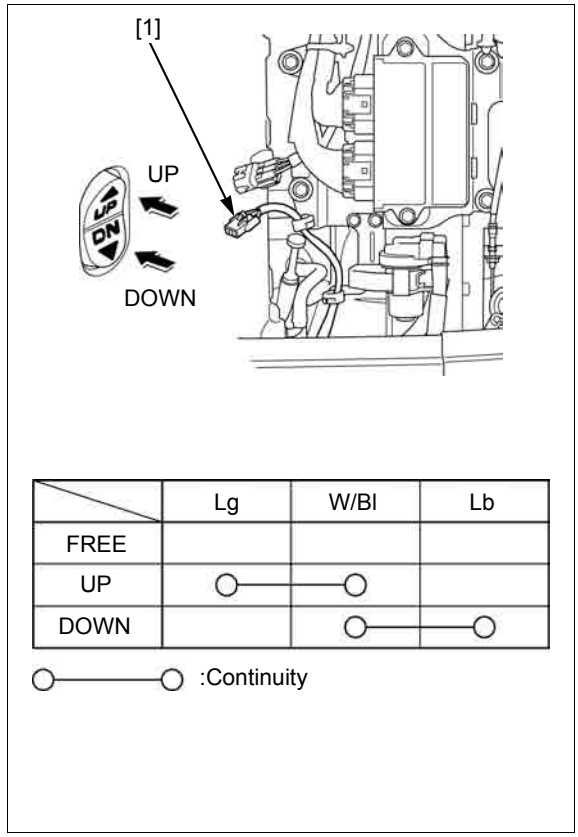
If the blade is attracted to the core or vibrates when the core is turned, the armature is shorted. Replace the armature.



POWER TILT SWITCH INSPECTION

Disconnect the power tilt switch 3P connector [1].

Attach the tester lead to each terminal and check for continuity.
When the switch is pushed "UP" or "DN", there should be continuity between the terminals marked with a circle in the table below.



	Lg	W/Bl	Lb
FREE			
UP	○——	——○	
DOWN		○——	——○

○—— ——○ :Continuity

MEMO

COMPONENT LOCATION ····· 20-2

SHIFT CONTROL CABLE REMOVAL/ INSTALLATION ····· 20-3

THROTTLE CONTROL CABLE REMOVAL/ INSTALLATION ····· 20-6

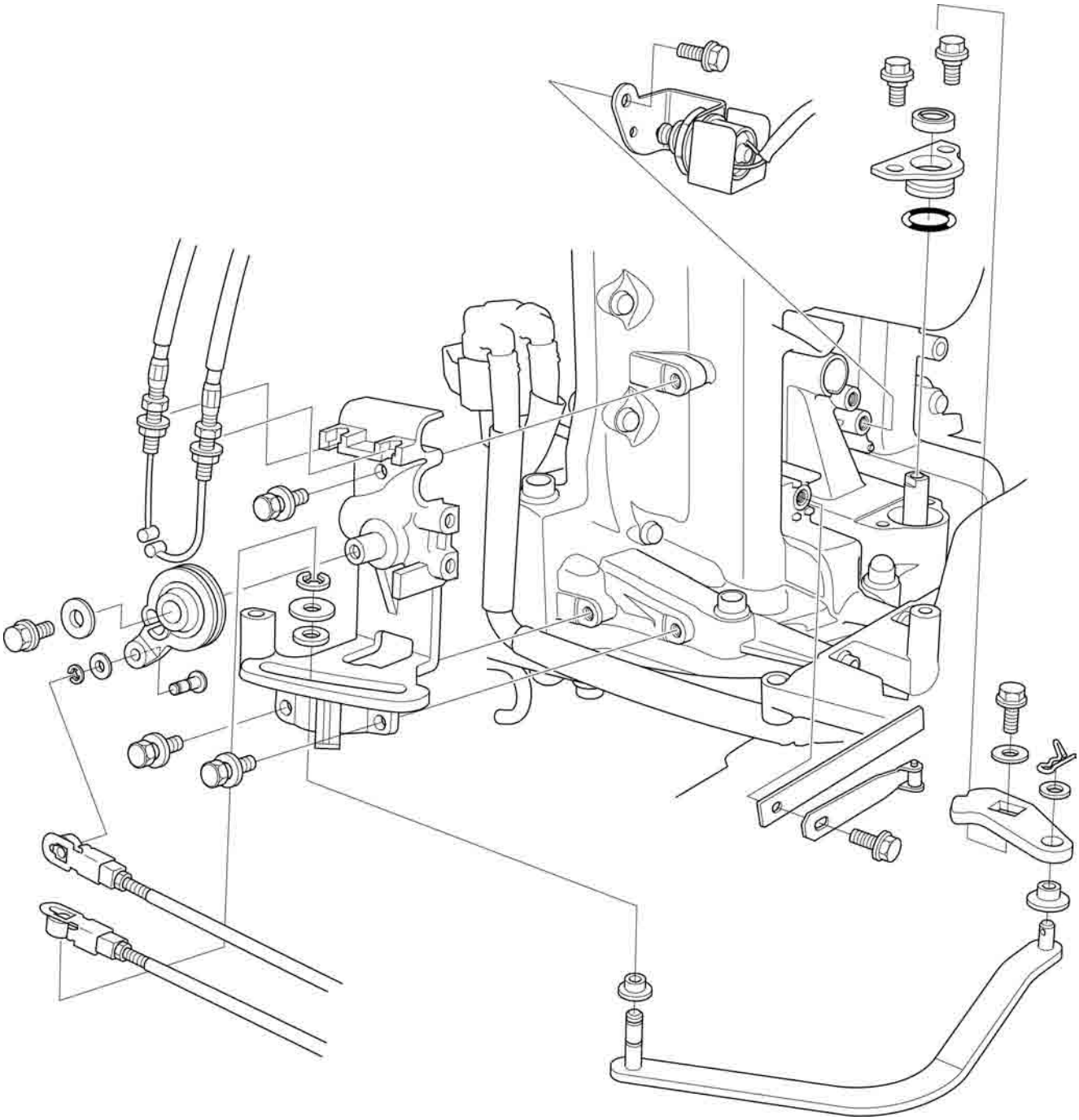
THROTTLE ARM/SHIFT LINK BRACKET REMOVAL/INSTALLATION ····· 20-7

SHIFT ARM/LINK ROD REMOVAL/ INSTALLATION ····· 20-9

SHIFT CONTROL CABLE INSPECTION/ ADJUSTMENT ····· 20-10

SHIFT SHAFT ALIGNMENT ····· 20-12

COMPONENT LOCATION

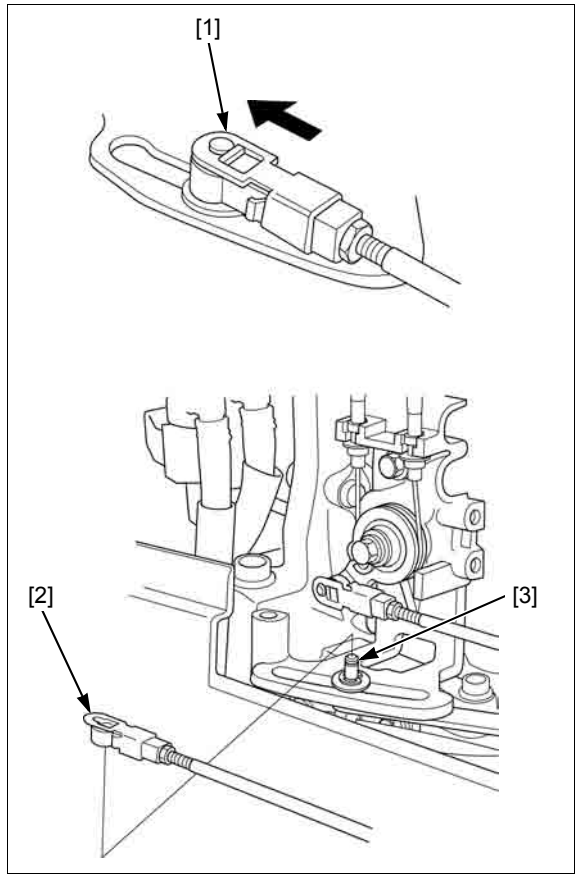


SHIFT CONTROL CABLE REMOVAL/ INSTALLATION

REMOVAL

Remove the front separate cover (page 6-3).

Slide the lock plate [1] backward and remove the shift control cable [2] from the link rod [3].

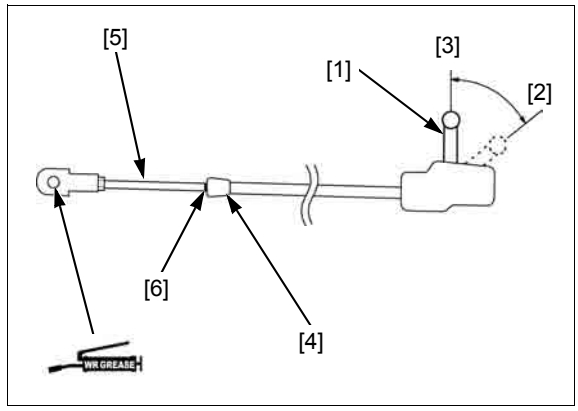


INSTALLATION

- Before installing the cable to the outboard motor, check the following.
  – Make sure that the cable is connected to the remote control box side securely.
  – Make sure the assist spring tip push the neutral switch and click spring roller is in the shift arm groove.

1. Apply marine grease to the mating surface of the shift pivot.
2. Move the remote control lever [1] fully to the "F" (Forward) side [2].

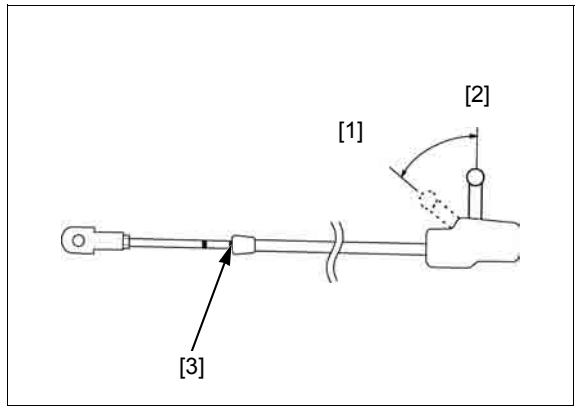
   Return the lever to the "N" (Neutral) position [3] slowly.
3. With the lever returned to the "N" (Neutral) position, mark a mark at the cable outer seal end [4] on the inner cable [5] (Mark (A) [6]).



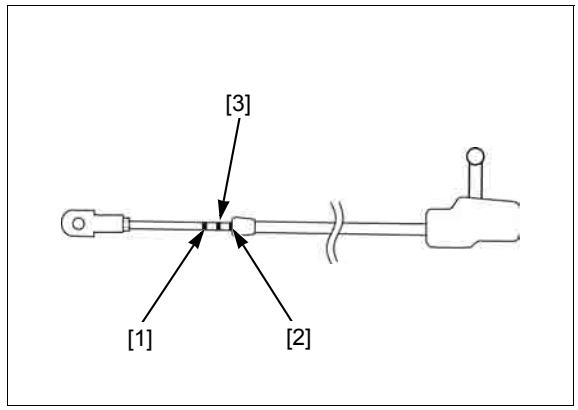
4. Move the remote control lever fully to the "R" (Reverse) side [1].

   Return the lever to the "N" (Neutral) position [2] slowly.

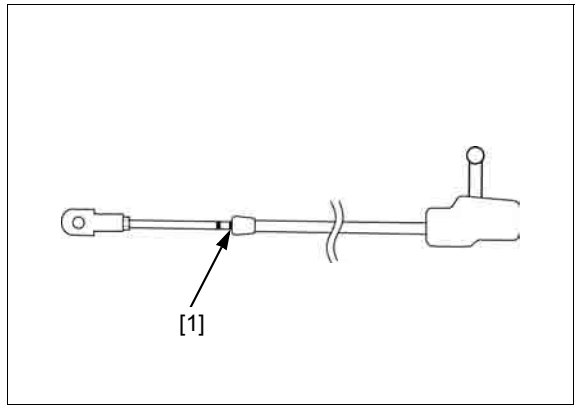
5. With the lever returned to the "N" (Neutral) position, mark a mark on the cable outer seal end of the inner cable (Mark (B) [3]).



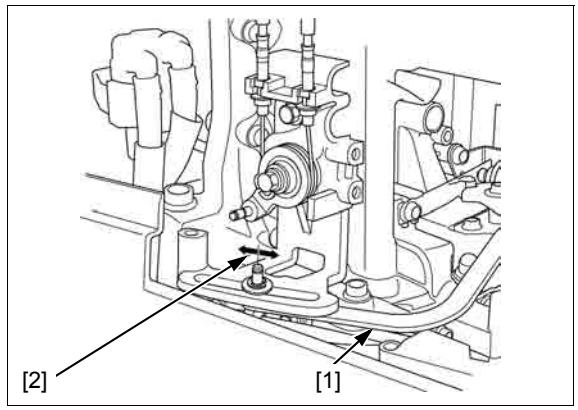
6. Mark a mark at the mid point between the mark (A) [1] and mark (B) [2] on the inner cable (Mark (C) [3]).



7. Push on the inner cable and align mark (C) [1] with the cable outer seal end.



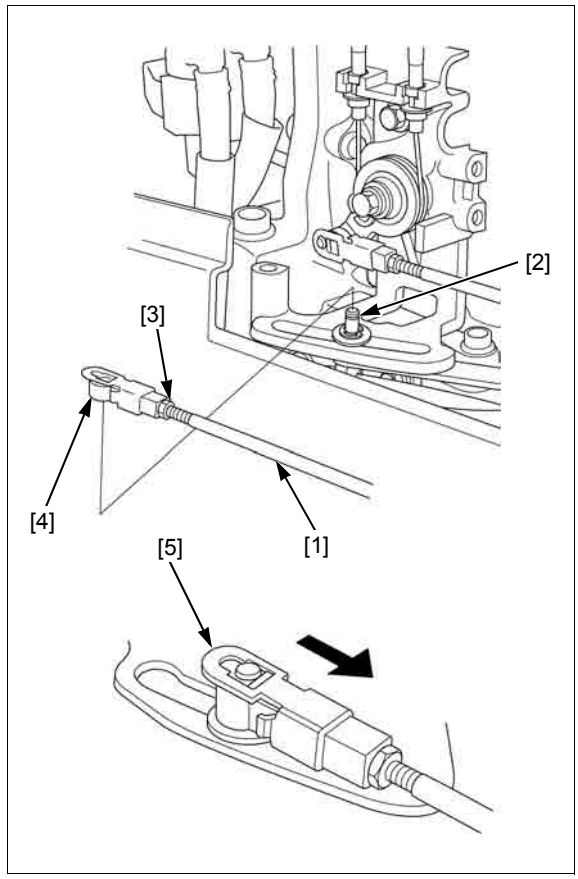
8. Push on the link rod [1] end lightly right and left and check for play. If there is play in the link rod, set the link rod at the center of the play [2].



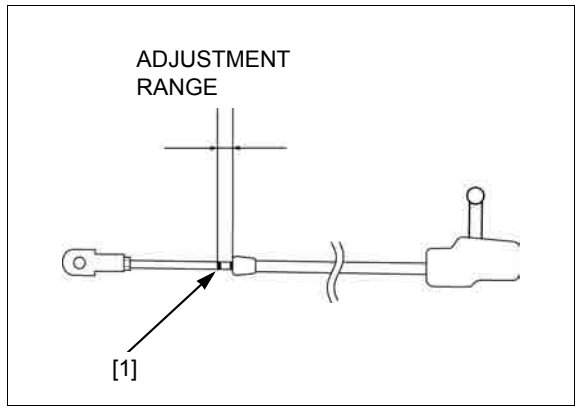
9. With the shift control cable [1] in the condition described in step 7, connect the shift control cable to the link rod [2] while loosen the adjusting nut [3] and turning the shift pivot [4] so the shift pivot sets on the link rod smoothly.

   Take care not to move mark (C) and outer seal end out of alignment. Hold the link rod at the center of the play.

   Lock the lock plate [5] by sliding it to the groove of the link rod and tighten the adjusting nut.

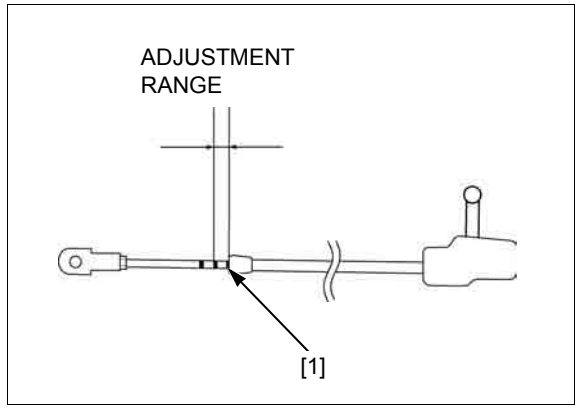


10. After connecting the cable, move the remote control lever back and forth and check for proper shifting.
    If it is hard to put the remote control lever in the "F" (Forward) or "R" (Reverse) position with the engine stopped, shift the gear while turning the propeller or propeller shaft. Do not shift 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 control cable and move the inner cable toward the mark (A) [1]. Repeat the procedure from the step 8.



12. If the gear is not in neutral by moving the remote control lever from the "R" (Reverse) to the "N" (Neutral) position, remove the shift control cable and move the inner cable toward the mark (B) [1]. Repeat the procedure from the step 8.
13. After adjustment, check operation of each lever. If the gear is not in neutral securely, perform steps 11 or 12 again.

    Install the front separate cover (page 6-3).

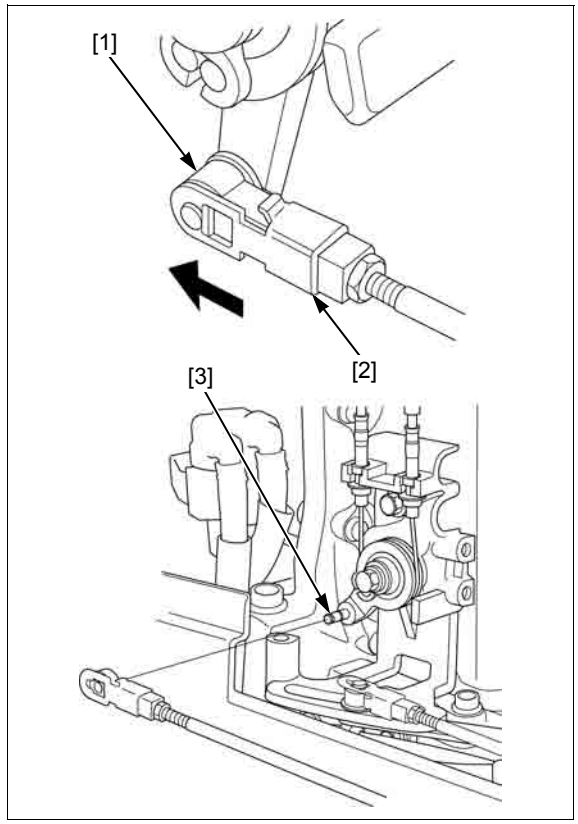


THROTTLE CONTROL CABLE REMOVAL/INSTALLATION

REMOVAL

Remove the front separate cover (page 6-3).

Slide the lock plate [1] backward and remove throttle control cable [2] from the throttle arm [3].



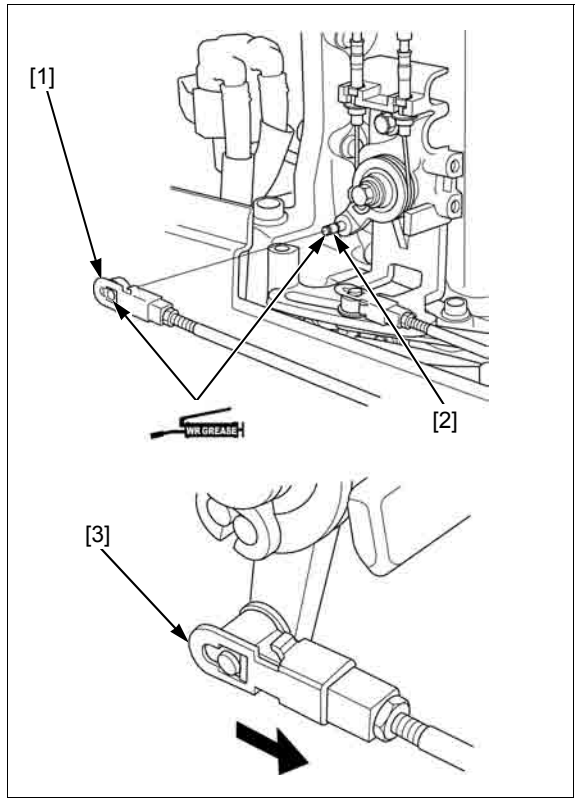
INSTALLATION

Before installing the cable to the outboard motor, check that the cable is connected to the remote control box side properly.

Apply marine grease to the mating surface of the throttle arm pivot.

Install the throttle control cable pivot [1] to the throttle arm [2].
Lock the lock plate [3] by sliding it to the groove of the throttle arm.

After installation, inspect and adjust the throttle control cable (page 3-11).



THROTTLE ARM/SHIFT LINK BRACKET REMOVAL/INSTALLATION

REMOVAL

Remove the following:

– R. engine under cover (page 6-3)
– Shift control cable (page 20-3)
– Throttle control cable (page 20-6)

Disconnect the throttle cables [1].

Remove the bolt (6 x 12 mm) [2], washer (6 mm) [3], and throttle arm [4].

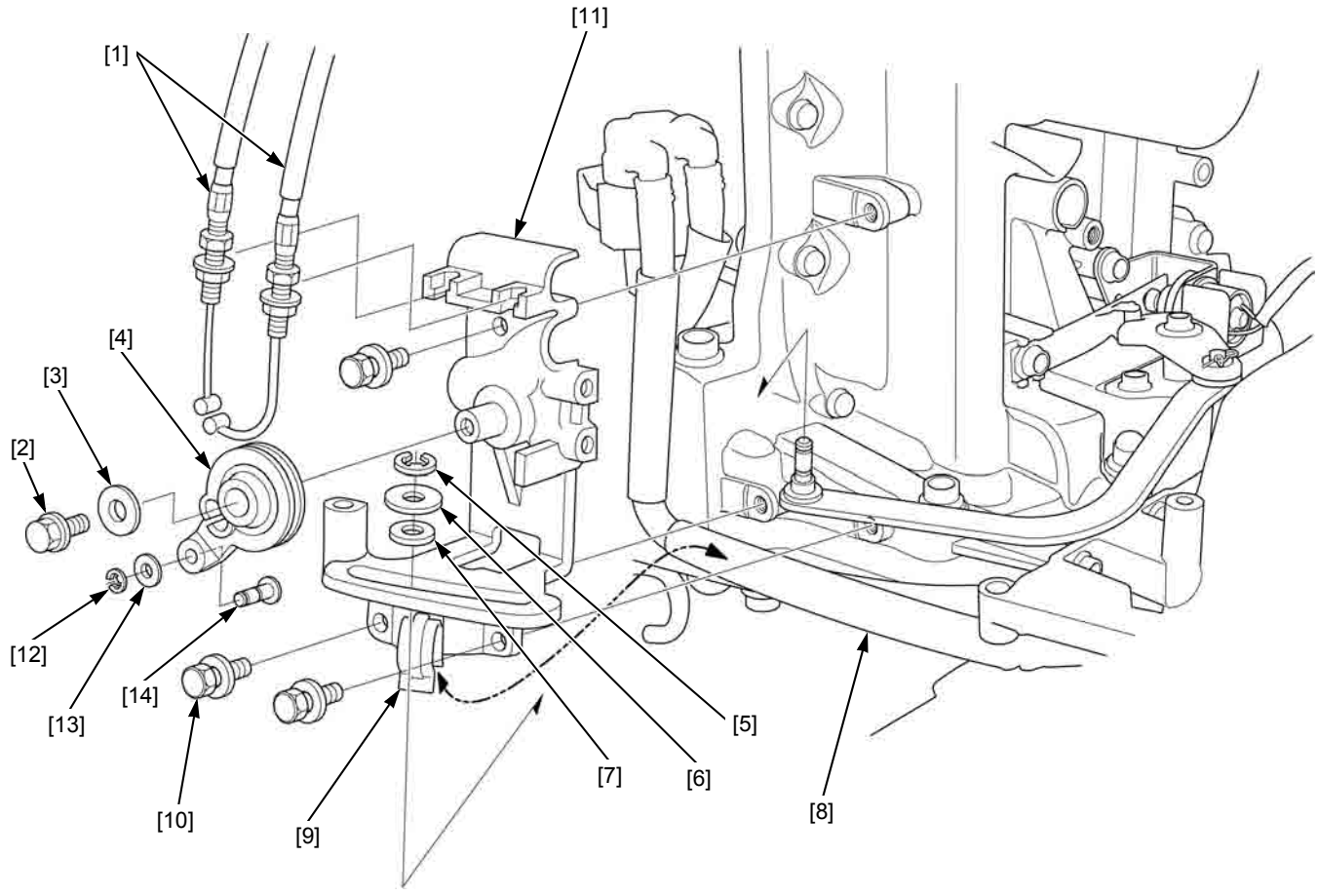
Remove the E-ring [5], washer (large) [6], and washer (small) [7].

Release the fuel tube A [8] from the tube clamp [9].

Remove the three bolt/washers (6 x 16 mm) [10] and the shift link bracket [11].

Remove the tube clamp from the shift link bracket.

Remove the E-ring [12], washer [13] and link pin [14] from the throttle arm.



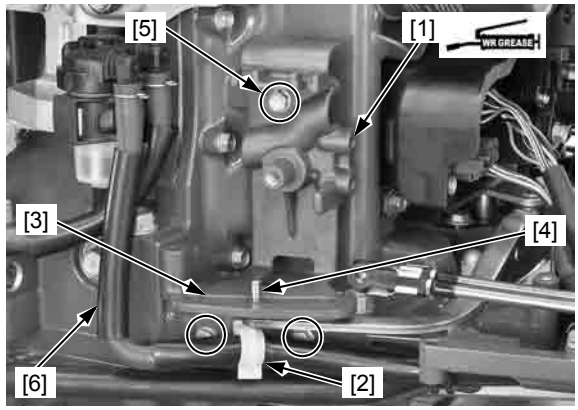
INSTALLATION

Apply marine grease to the link rod insertion part and throttle arm insertion part of the shift link bracket [1].

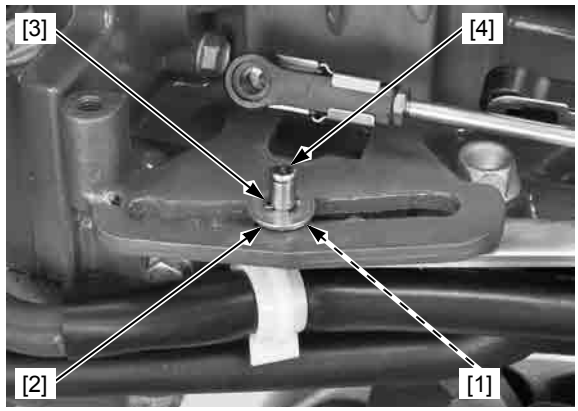
Install the tube clamp [2] to the shift link bracket.

Install the shift link bracket by aligning the groove [3] of the shift link bracket with the link rod [4], and then install and tighten the three bolt/washers (6 x 12 mm) [5].

Install the fuel tube A [6] to the tube clamp.

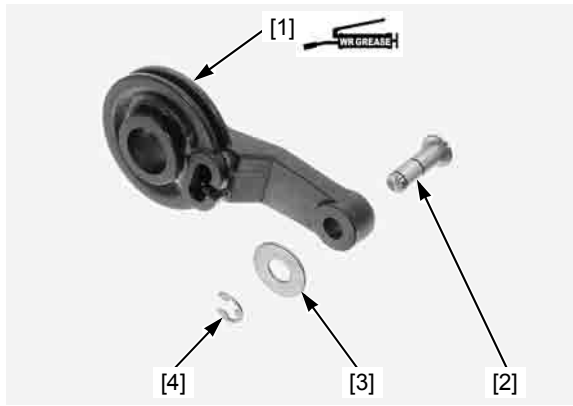


Install the washer (small) [1], washer (large) [2], and E-ring [3] to the link rod [4].



Apply marine grease to the throttle arm [1] bearing part.

Install the link pin [2], washer [3], and E-ring [4] to the throttle arm.



Install the throttle arm [1] and tighten the bolt (6 x 12 mm) [2] and washer [3].

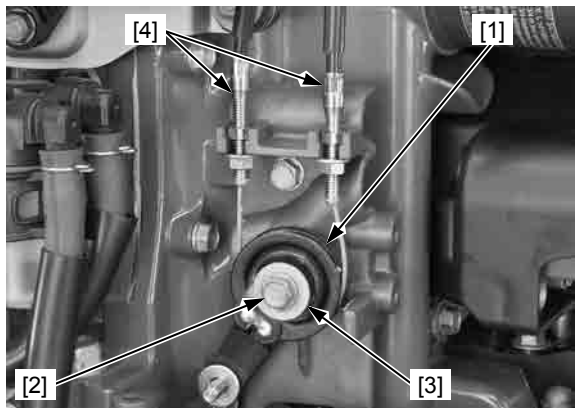
Connect the throttle cables [4] to the throttle arm and install them to the shift link bracket.

Install the following:

– R. engine under cover (page 6-3).
– Shift control cable (page 20-3)
– Throttle control cable (page 20-6)

Inspect and adjust the following:

– Throttle operation (page 3-11)
– Shift operation (page 20-3)



SHIFT ARM/LINK ROD REMOVAL/ INSTALLATION

REMOVAL

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

Remove the following:

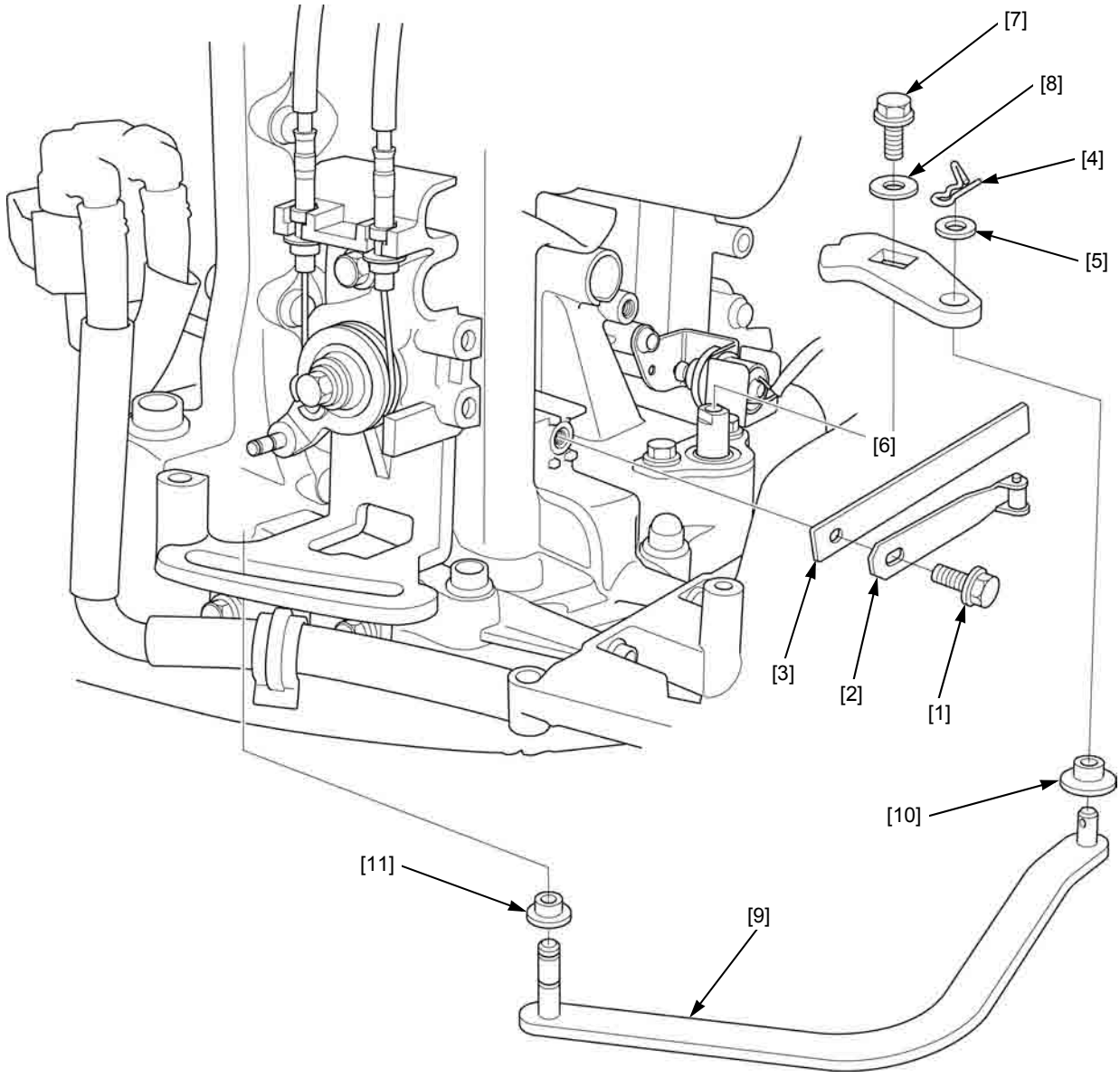
– Electric parts case (page 10-4)
– Shift control cable (page 20-3)

Remove the bolt (6 X 14 mm) [1], click spring [2], and assist spring [3]

Remove the snap pin [4] and washer (6 mm) [5] from the shift arm [6].

Remove the bolt (6 x 16 mm) [7], washer (6 mm) [8], and the shift arm.

Remove the link rod [9], arm bush [10], and slider collar [11].

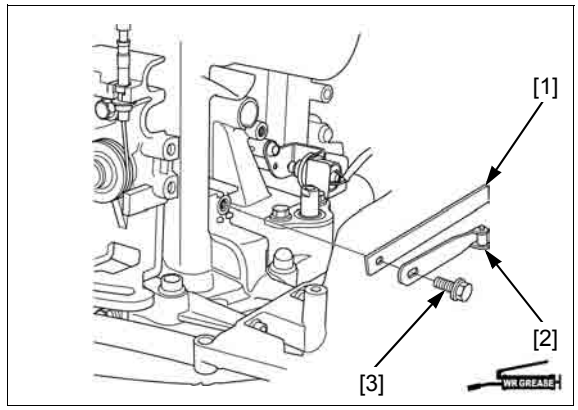


INSTALLATION

Apply marine grease to the click spring roller.

Install the assist spring [1] and click spring [2] to the crankcase.
Loosely tighten the bolt (6 x 14 mm) [3].

After adjusting the shift control cable, tighten the bolt.

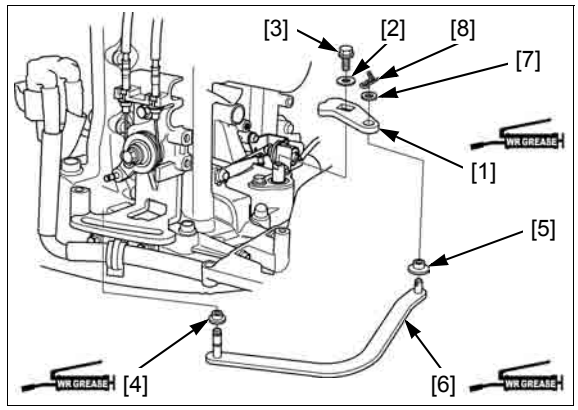


Apply marine grease to the link rod insertion part and click part of the shift arm.

Install the shift arm [1] and washer (6 mm) [2] to shift shaft B and tighten the bolt (6 x 16 mm) [3].

Apply marine grease to the slider collar [4] outer surface.

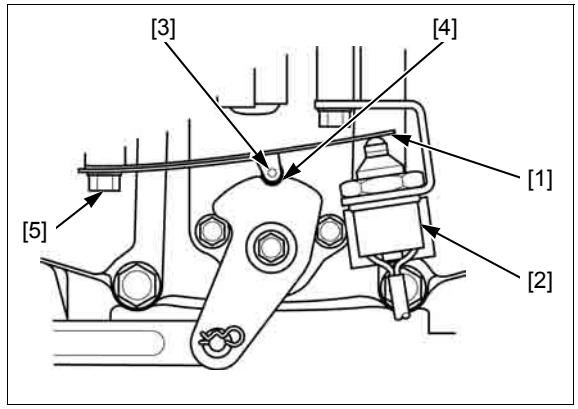
Install the slider collar and arm bush [5] to the link rod [6].
Install the link rod to the shift arm and set the washer (6 mm) [7] and snap pin [8].



Make sure the assist spring [1] tip pushes the neutral switch [2].

Make sure the click spring roller [3] is in the shift arm groove [4], and then tighten the bolt (6 x 14 mm) [5].
If the shift arm groove and the click spring roller do not fit, loosen the bolt, fit them, and tighten the bolt again.

Inspect and adjust the shift control cable (page 20-10).



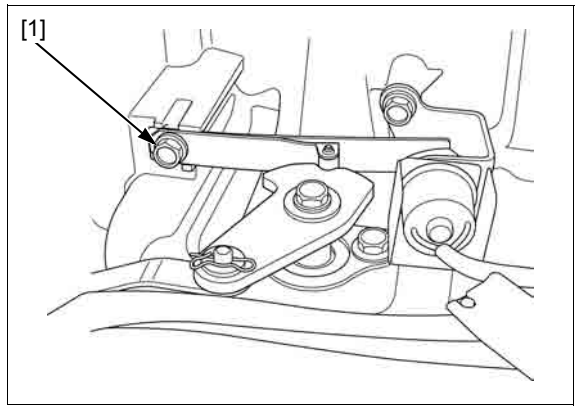
SHIFT CONTROL CABLE INSPECTION/ ADJUSTMENT

Remove the electric parts case (page 10-4).

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

Remove the shift control cable (page 20-3).

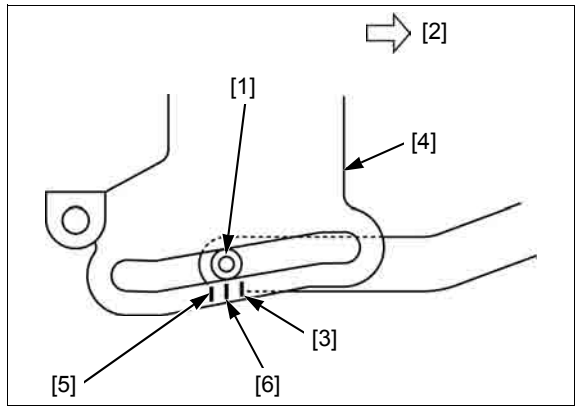
Loosen the bolt (6 x 14 mm) [1].



Move the link rod [1] forward [2] lightly until it stops at the end of the freeplay; mark indicator A [3] on the shift link bracket [4] as shown.

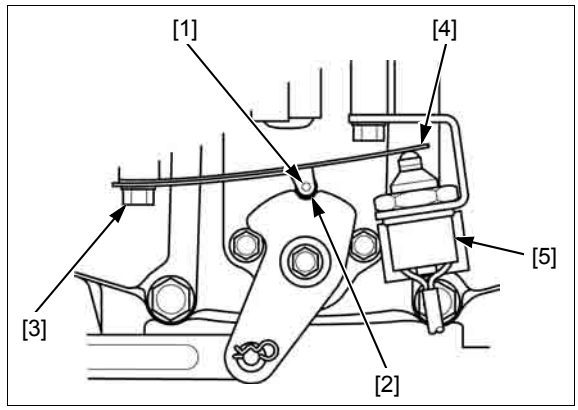
Move the link rod until it stops at the end of the freeplay; mark indicator B [5] on the shift link bracket as shown.

Mark indicator C [6] half way between indicator A and indicator B.



Align the link rod end with indicator C and hold the click spring roller [1] in the shift arm groove [2], and then tighten the bolt (6 x 14 mm) [3] securely.

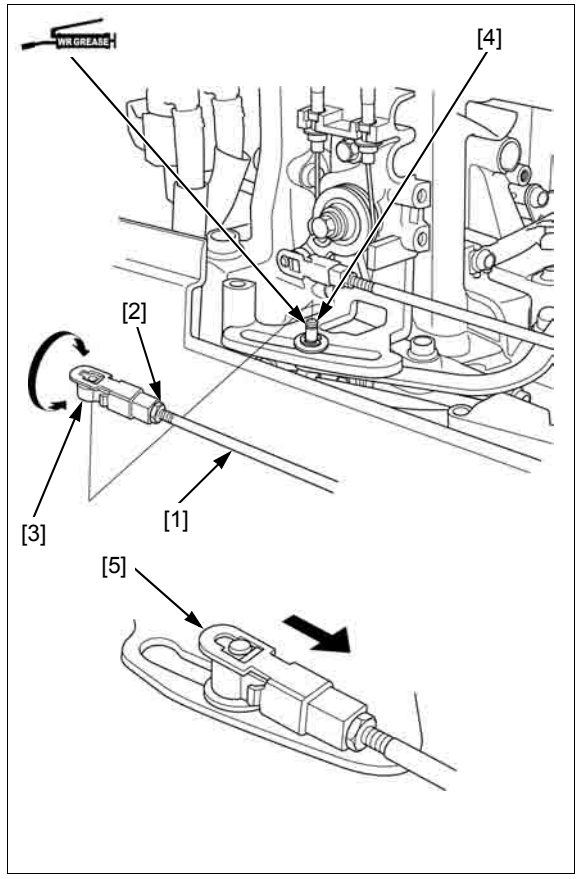
If the assist spring [4] tip does not push the neutral switch [5], check the assist spring and neutral switch bracket for deformation.
Replace them if necessary.



Loosen the shift control cable [1] adjusting nut [2].

Adjust the shift control cable by turning the shift pivot [3] until the shift cable pivot will install over the link rod end [4] without moving the link rod.

After adjustment, apply marine grease to the link rod insertion part and install the shift control cable on the link rod end. Lock the lock plate [5] by sliding it to the groove of the link rod and tighten the adjusting nut.



SHIFT SHAFT ALIGNMENT

NOTICE

When shift shafts A and B are not properly aligned, it may be possible to start the engine in either forward or reverse gear. Always make sure the shafts are properly aligned.

After reassembly and before starting the engine:

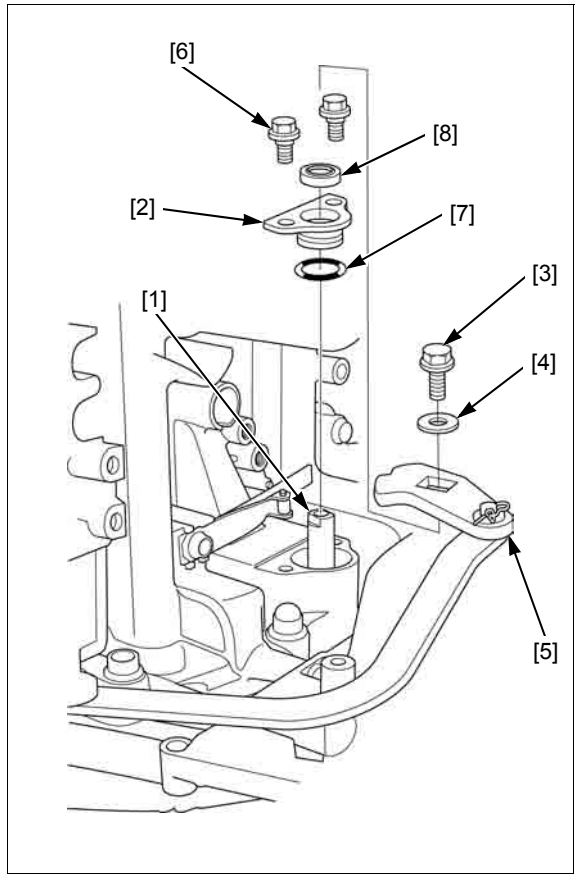
- *Remove the emergency stop switch clip from the emergency stop switch.*
- *Remove the propeller.*
- *Put the remote control lever in the neutral position.*
- *Try turning the propeller shaft by hand.*
  If it does not turn freely, recheck shift shaft A and B alignment.

If shift shaft B [1] has become disengaged from shift shaft A during the removal of the seal holder [2], perform the following steps.

Remove the bolt (6 x 16 mm) [3] and washer (6 mm) [4] from the sift shaft B and remove the shift arm [5].

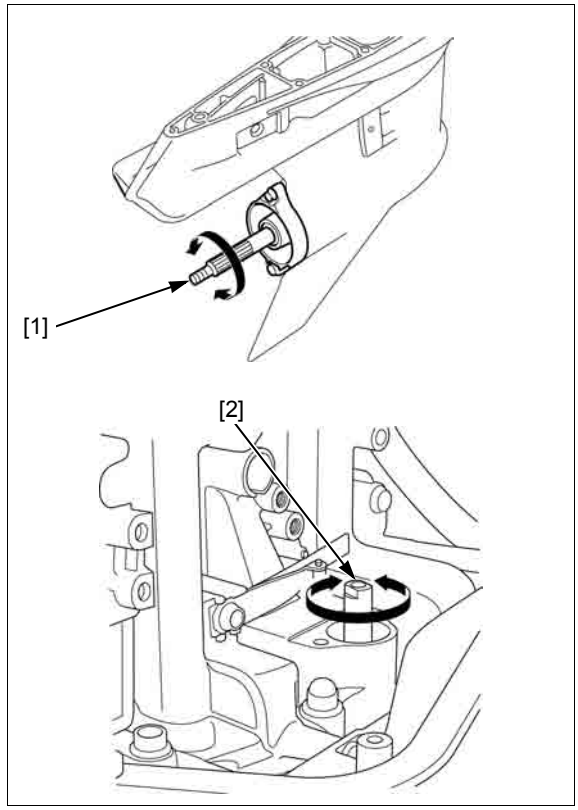
Remove the two bolts (6 x 11 mm) [6] and the seal holder.
Remove shift shaft B to the back side of the engine assembly.

Remove the O-ring [7] and oil seal [8] from the seal holder.



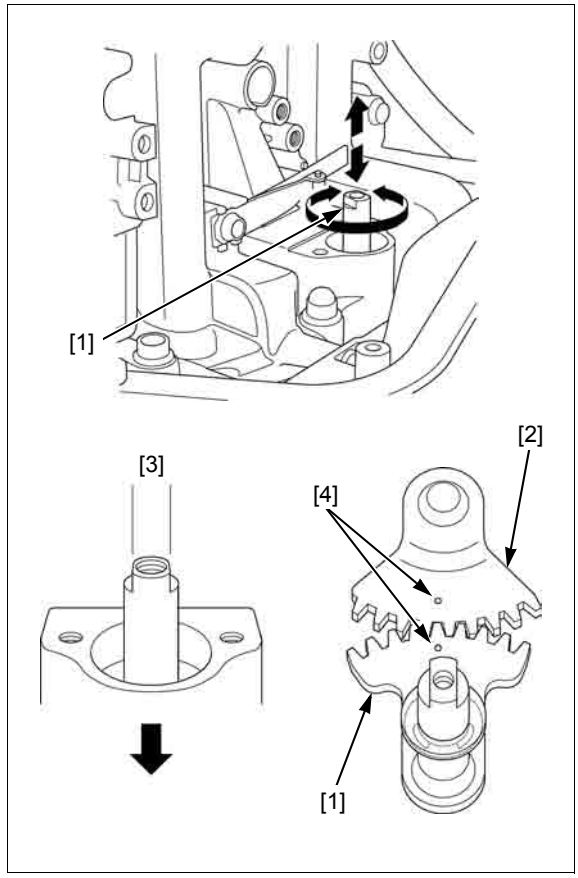
Verify the gear case is in the neutral position by rotating the propeller shaft [1] by hand and checking for free, quiet rotation. Use gloves to protect your hands.

If the gear case is not in the neutral position, temporarily lower shift shaft B [2] until it engages with shift shaft A. Use an open end wrench to rotate shift shaft B slightly right or left until neutral is obtained in the gear case.



Lift up and disengage shift shaft B [1] from shift shaft A [2]. Position shift shaft B so the flat sides are facing straight forward [3]. Lower shift shaft B slowly to engage the gear on shift shaft A.

This will put the alignment marks [4] on shift shafts A and B in the correct position as shown.



Apply marine grease to the seal holder [1] O-ring groove and bearing part.

Install a new O-ring [2] to the seal holder and apply marine grease to it.

Install the seal holder on shift shaft B [3] so that shift shaft B does not tilt on the mount case.
Install the two bolts (6 x 11 mm) [4] to the seal holder and tighten them.

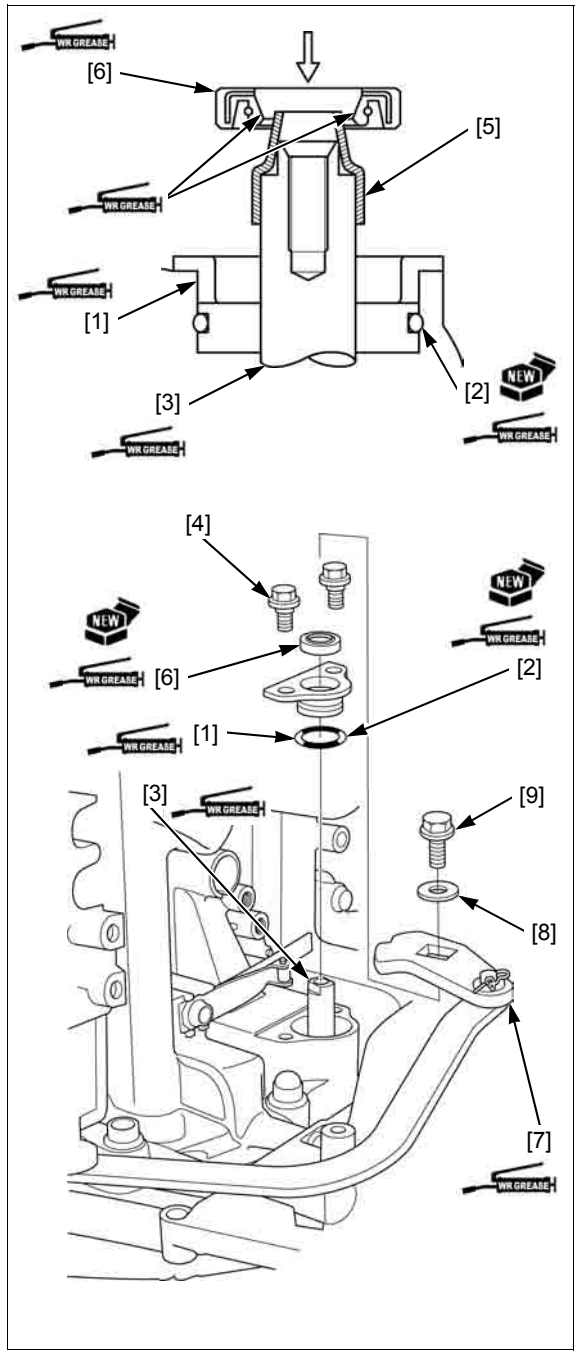
Tape [5] shift shaft B as shown.

Apply marine grease to the oil seal contact surface of the shift shaft B.

Apply marine grease to the lip part and soapy water to the outer circumference of a new oil seal [6], and install the oil seal to shift shaft B so that the oil seal lip is toward the lower side.

Apply marine grease to the shift arm [7] click part.

After installing the oil seal, remove the tape, and install the shift arm to shift shaft B and tighten the washer (6 mm) [8] and bolt (6 x 16 mm) [9].



Make sure the assist spring [1] tip pushes the neutral switch [2].

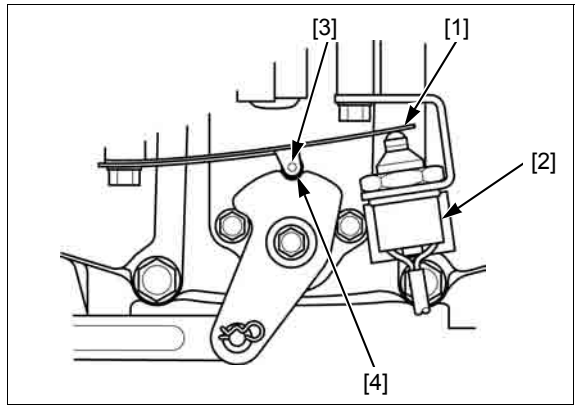
Make sure the click spring roller [3] is in the shift arm groove [4].

Make sure the assist spring tip does not contact the neutral switch when the shift lever is in either forward or reverse.

Inspect the shift control cable and if necessary, adjust it (page 20-3).

After reassembly, try turning the propeller shaft by hand in the neutral position. If it does not turn freely, recheck shift shaft A and B alignment.

Also, make sure the outboard shifts properly into forward, neutral, and reverse.



21. TECHNICAL FEATURES

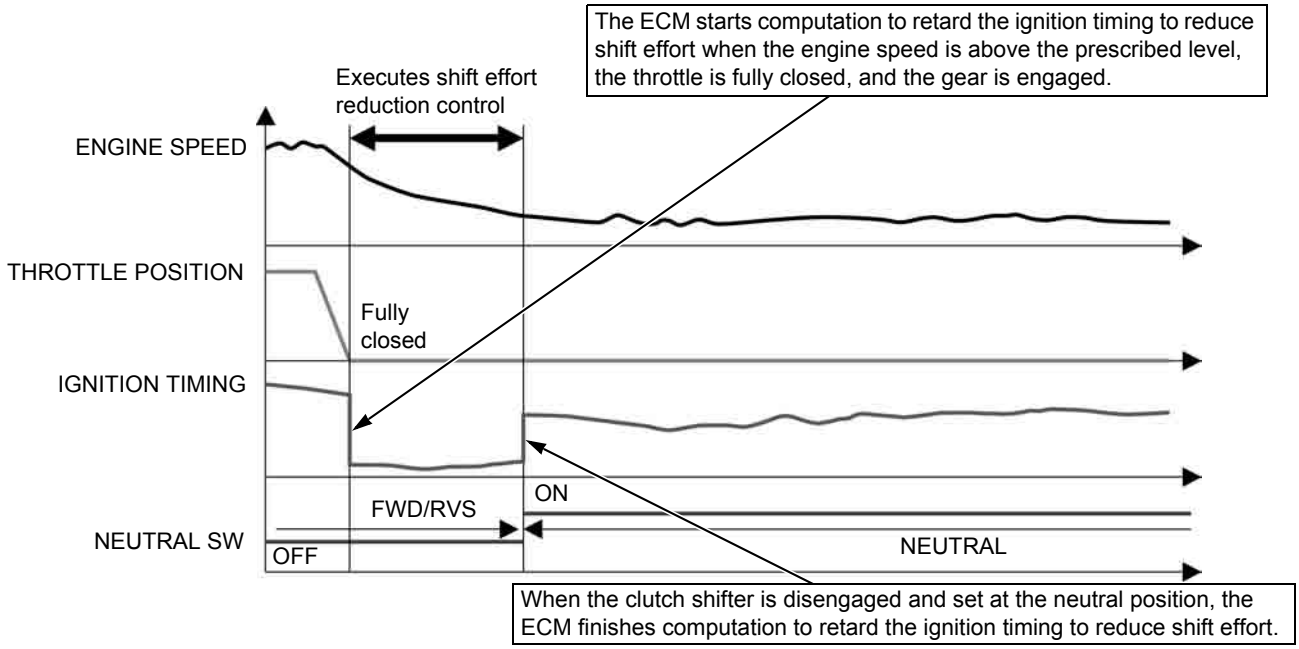
SHIFT EFFORT REDUCTION SYSTEM ····· 21-2

CHARGE OUTPUT ENHANCEMENT WHEN IDLING ····· 21-4

SHIFT EFFORT REDUCTION SYSTEM

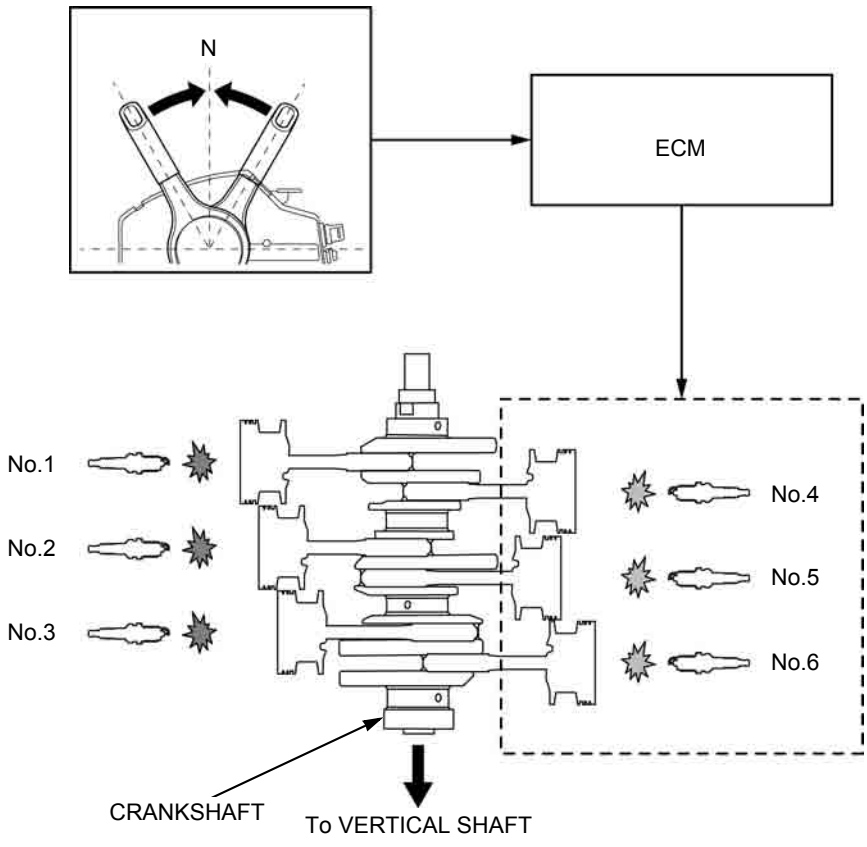
GENERAL

The effort when shifting the control lever (throttle valve) from the half-open position to the neutral is reduced by retarding the ignition timing by the ECM.



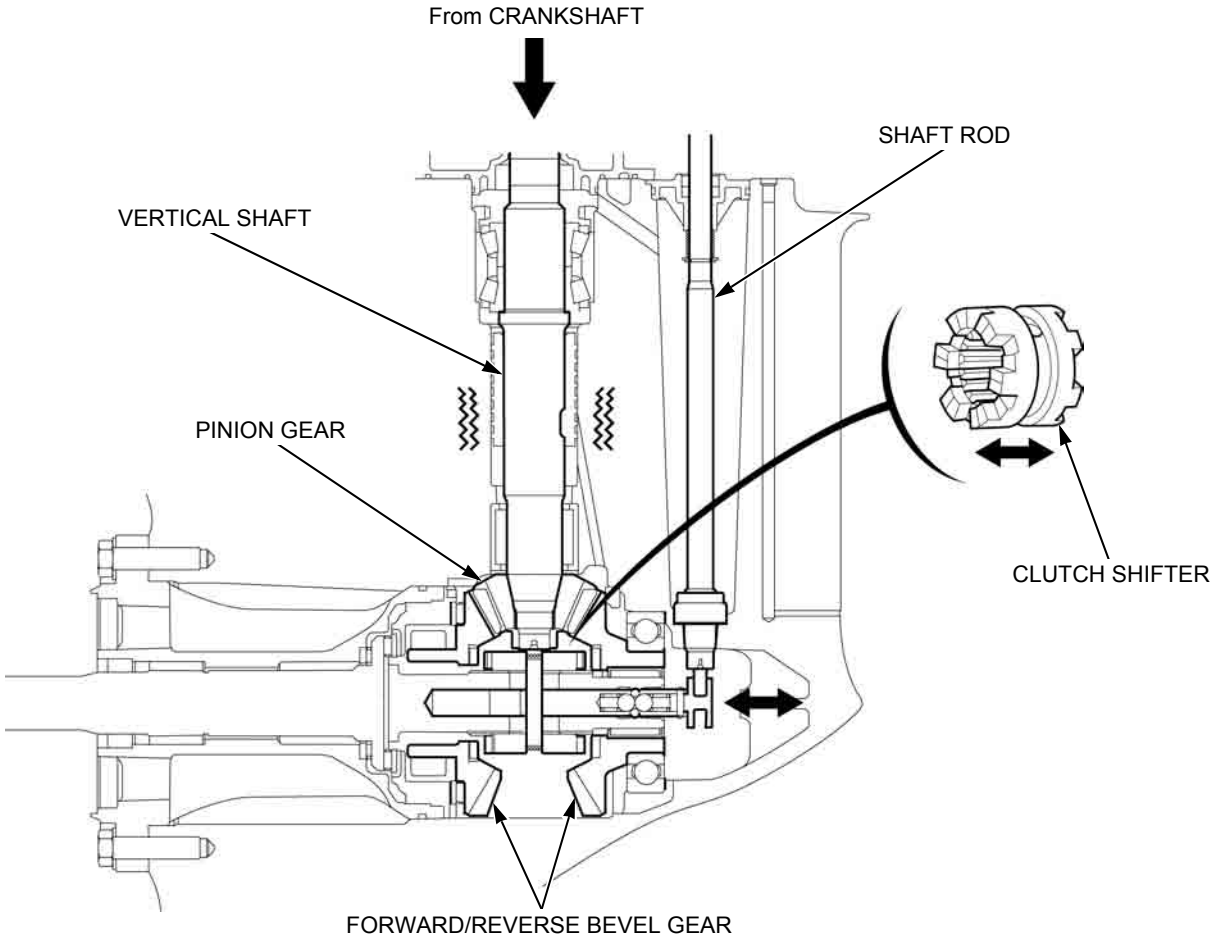
CONSTRUCTION AND FEATURES

Using engine speed and throttle opening signals from each sensor, the ECM computes and retards the ignition timing of No.4, 5, and 6 spark plugs to temporarily alter the crankshaft speed.



The crankshaft speed variations are transmitted to the clutch shifter dog, which is in mesh with the forward/reverse bevel gear, via the vertical shaft and the pinion gear.

The torque variations occurring in the clutch shifter dog reduce the shift effort.



CHARGE OUTPUT ENHANCEMENT WHEN IDLING

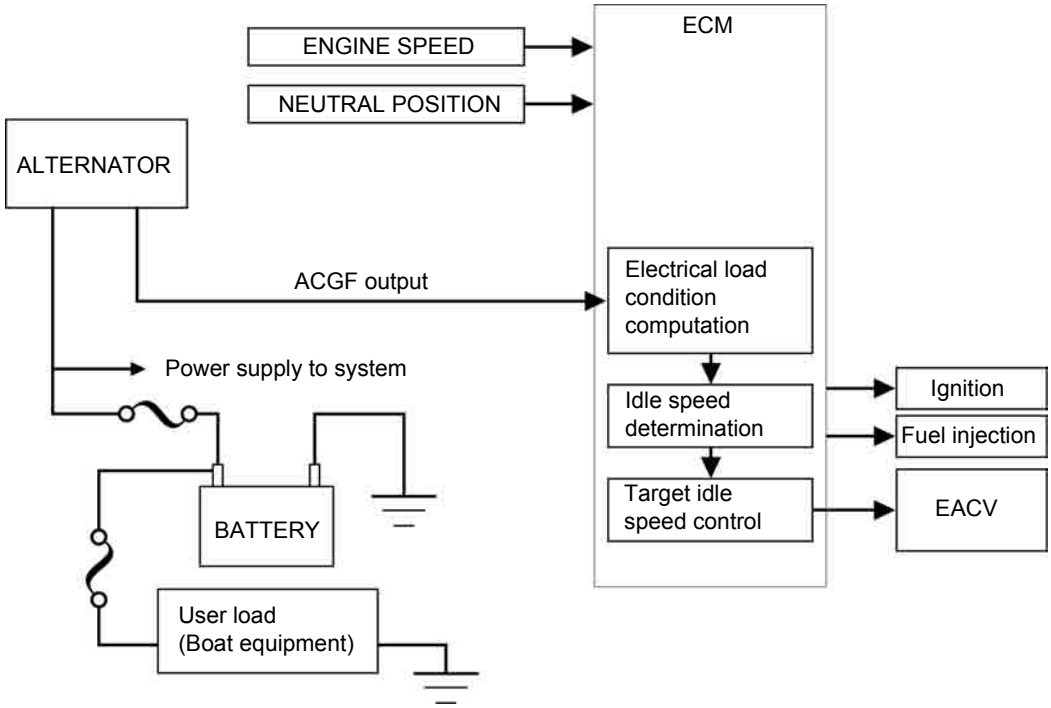
GENERAL

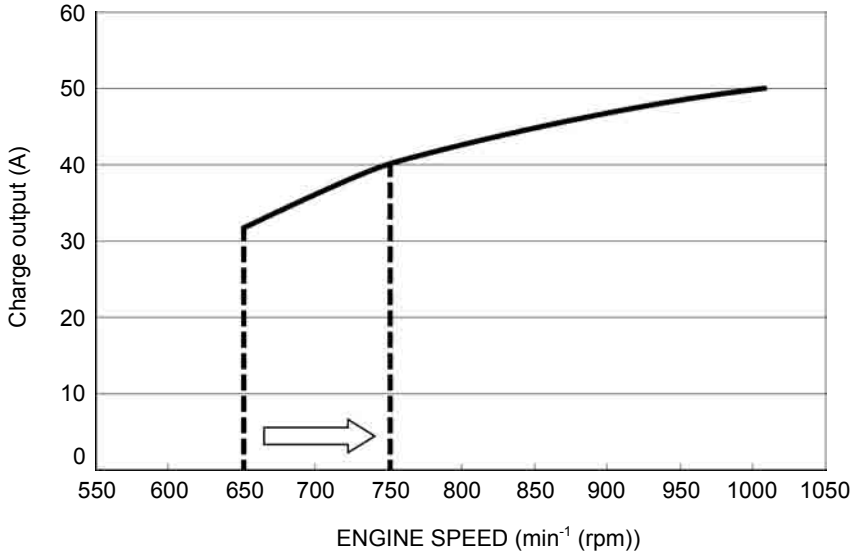
Detecting electrical loads in the outboard motor when idling, the engine idle speed is enhanced when the electrical loads are high to increase charging capacity to allow for use of more electrical power in the outboard motor. (Only when in neutral)

CONSTRUCTION AND FEATURES

The ECM detects ACGF output (ACGF load condition output) from the alternator and computes current electrical loads in the outboard motor.

When a large electrical load is identified, the ECM controls the ignition timing, fuel injection and EACV, and enhances the engine idle speed from 650 min^{-1} (rpm) to 750 min^{-1} (rpm).





22. WIRING DIAGRAMS

HOW TO READ A WIRING DIAGRAM & RELATED INFORMATION ····· 22-2

WIRING DIAGRAM ····· 22-5

SYSTEM WIRING DIAGRAM ····· 22-6

CONNECTOR GENERAL LAYOUT DRAWING ····· 22-7

HOW TO READ A WIRING DIAGRAM & RELATED INFORMATION

The wiring diagram, connector general layout drawing, connector drawings, and the symbols used in troubleshooting are explained in this section.

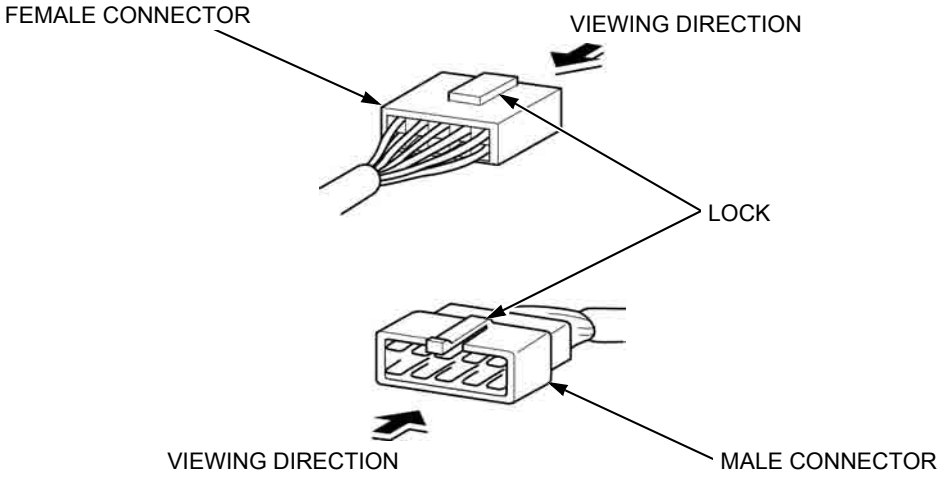
HOW TO READ CONNECTOR DRAWINGS

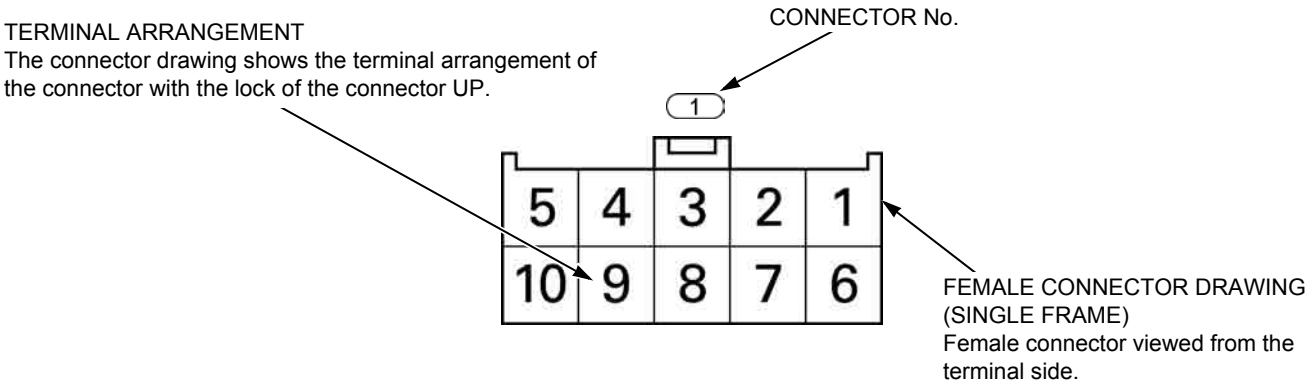
Connector drawings show the terminal arrangement, terminal No., number of pins, and the shape of terminal (male or female).

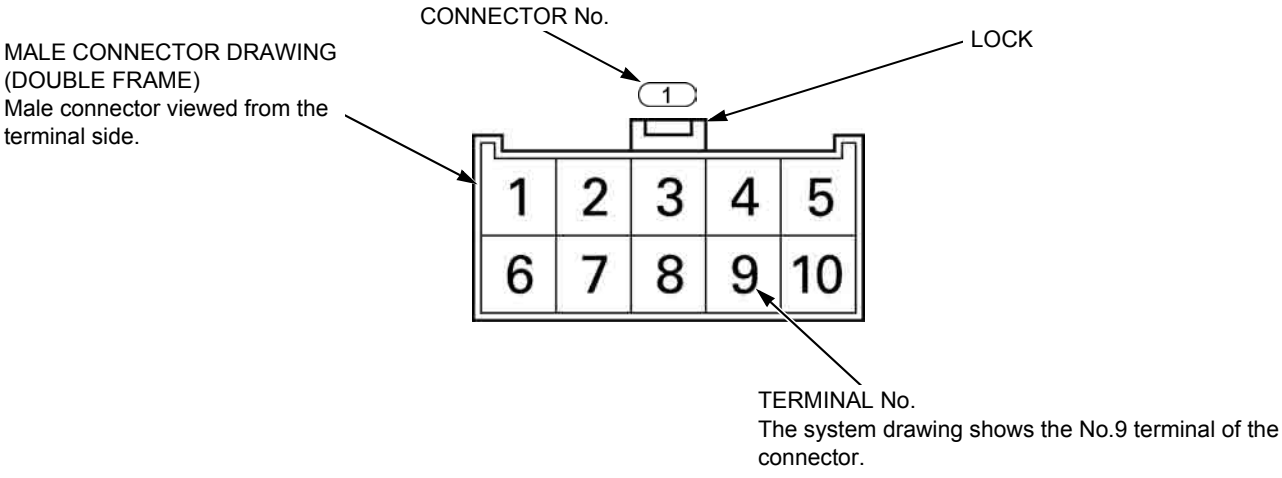
Both the male and female connectors are shown for the common connectors, while only the main wire harness side connectors are shown for the dedicated connectors.

The double frame connectors represent the male connectors and the single frame connectors represent the female connectors.

Both the male and female connectors are shown by viewing them from the terminal side.



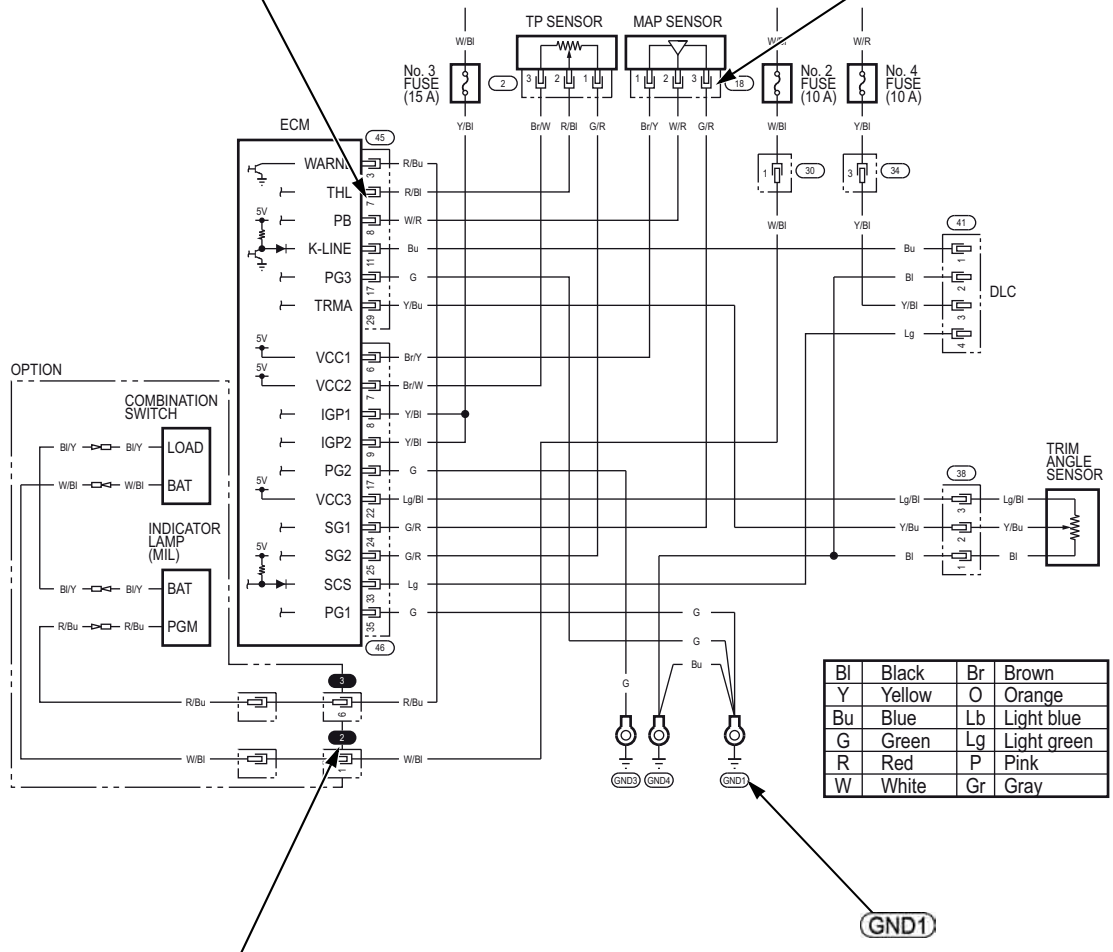




HOW TO READ A WIRING DIAGRAM

SYMBOL OF TERMINAL
It shows the shape of each terminal to identify whether it is a male or female terminal.

TERMINAL No.



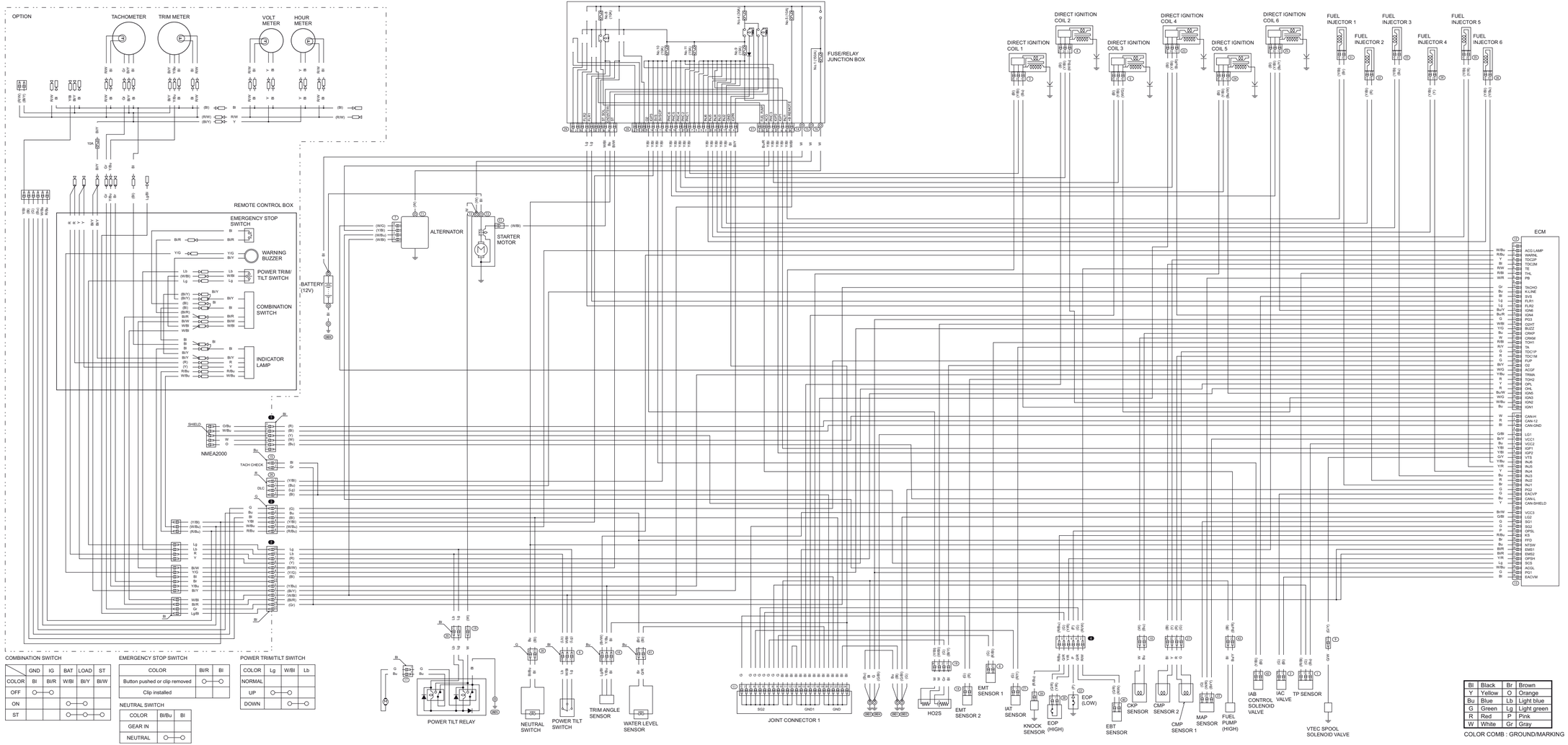
Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

CONNECTOR/TERMINAL No.
Every connector and terminal has a number to help the users find the location and shape of the connector and the terminal arrangement by referring to the “Connector general layout drawing” and/or the “Connector drawing”. All the connector/terminal numbers shown in this Service Manual are either of those shown in this section.

GND1
Indicates the ground.
(Circled GND followed with No. in white background)

- 1 : Connector that joins a harness to a harness (Circled No. in black background)
- (1) : Connector that connects to electrical equipment (Circled No. in white background)
- (C1) : Connector (Circled C followed with No. in white background)
- (T1) : Terminal (Circled T followed with No. in white background)
- (GND1) : Ground (Circled GND followed with No. in white background)

WIRING DIAGRAM



COMBINATION SWITCH

	GND	IG		BAT	LOAD	ST
COLOR	Bl	Bl/R	W/Bl	Bl/Y	Bl/W	
OFF	o					
ON				o	o	
ST				o	o	o

EMERGENCY STOP SWITCH

COLOR	Bl/R	Bl
Button pushed or clip removed		
Clip installed	o	o

NEUTRAL SWITCH

COLOR	Bl/Bu	Bl
GEAR IN		
NEUTRAL	o	o

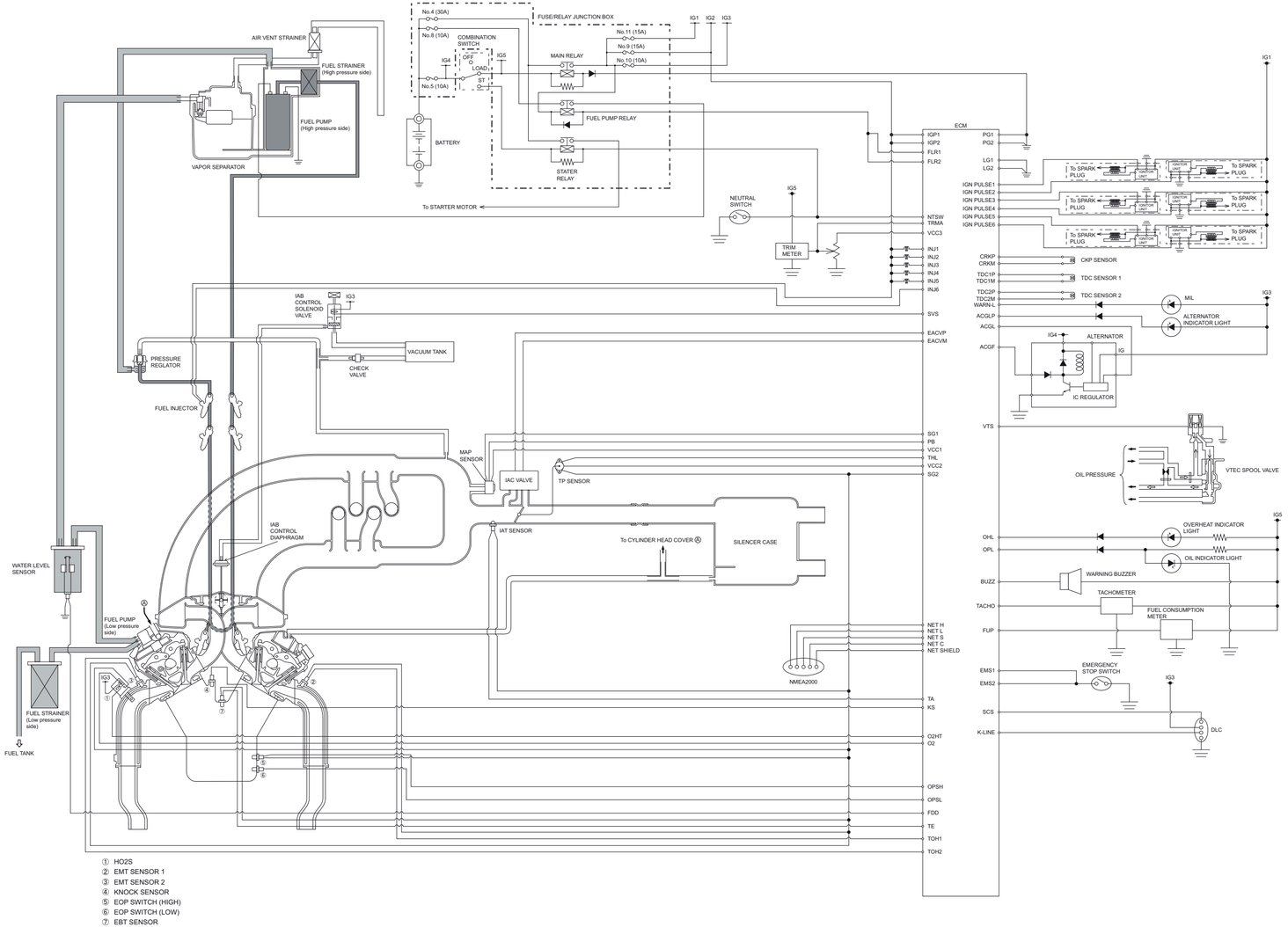
POWER TRIM/TILT SWITCH

COLOR	Lg	W/Bl	Lb
NORMAL			
UP	o		
DOWN		o	o

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

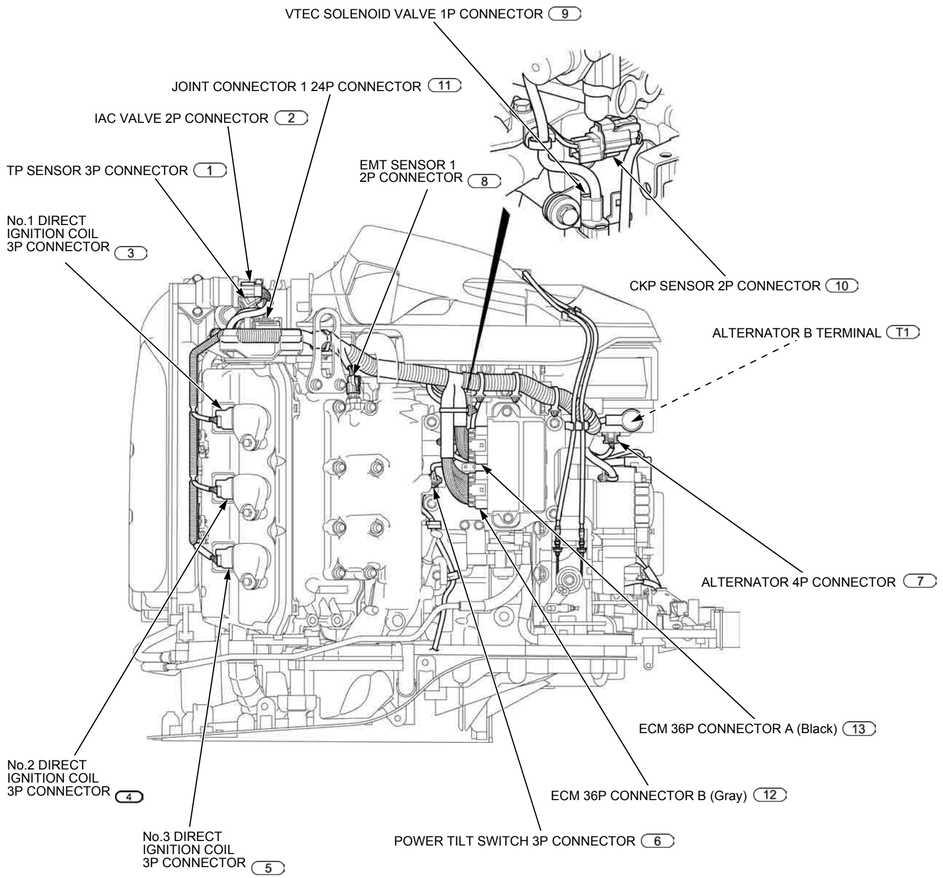
COLOR COMB : GROUND/MARKING

SYSTEM WIRING DIAGRAM



① HO2S
② EMT SENSOR 1
③ EMT SENSOR 2
④ KNOCK SENSOR
⑤ EOP SWITCH (HIGH)
⑥ EOP SWITCH (LOW)
⑦ EBT SENSOR

CONNECTOR GENERAL LAYOUT DRAWING



ALTERNATOR B TERMINAL

Terminal number	Wire color
T1	W

1



Main wire harness side

Terminal number	Wire color
1	G
2	R/Bl
3	Bu

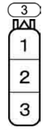
2



Main wire harness side

Terminal number	Wire color
1	Bl
2	G

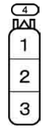
3



Main wire harness side

Terminal number	Wire color
1	Bu
2	Bl
3	Y/Bl

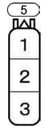
4



Main wire harness side

Terminal number	Wire color
1	W/Bu
2	Bl
3	Y/Bl

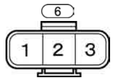
5



Main wire harness side

Terminal number	Wire color
1	W/G
2	Bl
3	Y/Bl

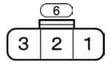
6



Main wire harness side

Terminal number	Wire color
1	Lg
2	W/Bl
3	Lb

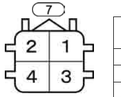
6



Power tilt switch side

Terminal number	Wire color
1	Lg
2	W/Bl
3	Lb

7



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	W/Bl
3	W/Bu
4	W/G

8



Main wire harness side

Terminal number	Wire color
1	R/Y
2	G

9



Main wire harness side

Terminal number	Wire color
1	G/Y

9



VTEC solenoid valve side

Terminal number	Wire color
1	G/W

10



Main wire harness side

Terminal number	Wire color
1	Bu
2	W

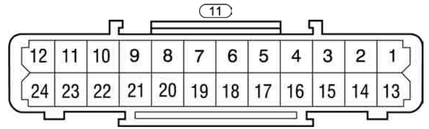
10



CKP sensor side

Terminal number	Wire color
1	Bu
2	W

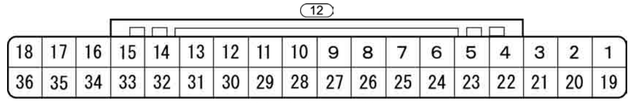
11



Main wire harness side

Terminal number	Wire color	Terminal number	Wire color	Terminal number	Wire color	Terminal number	Wire color
1	G	7	G	13	Bl	19	Bl
2	–	8	G	14	Bl	20	Bl
3	G	9	G	15	Bl	21	Bl
4	G	10	Bl	16	Bl	22	Bl
5	G	11	Bl	17	Bl	23	Bl
6	G	12	Bl	18	Bl	24	Bl

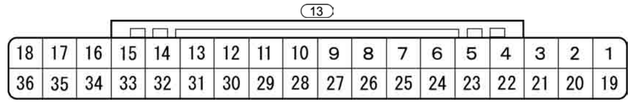
12



Main wire harness side

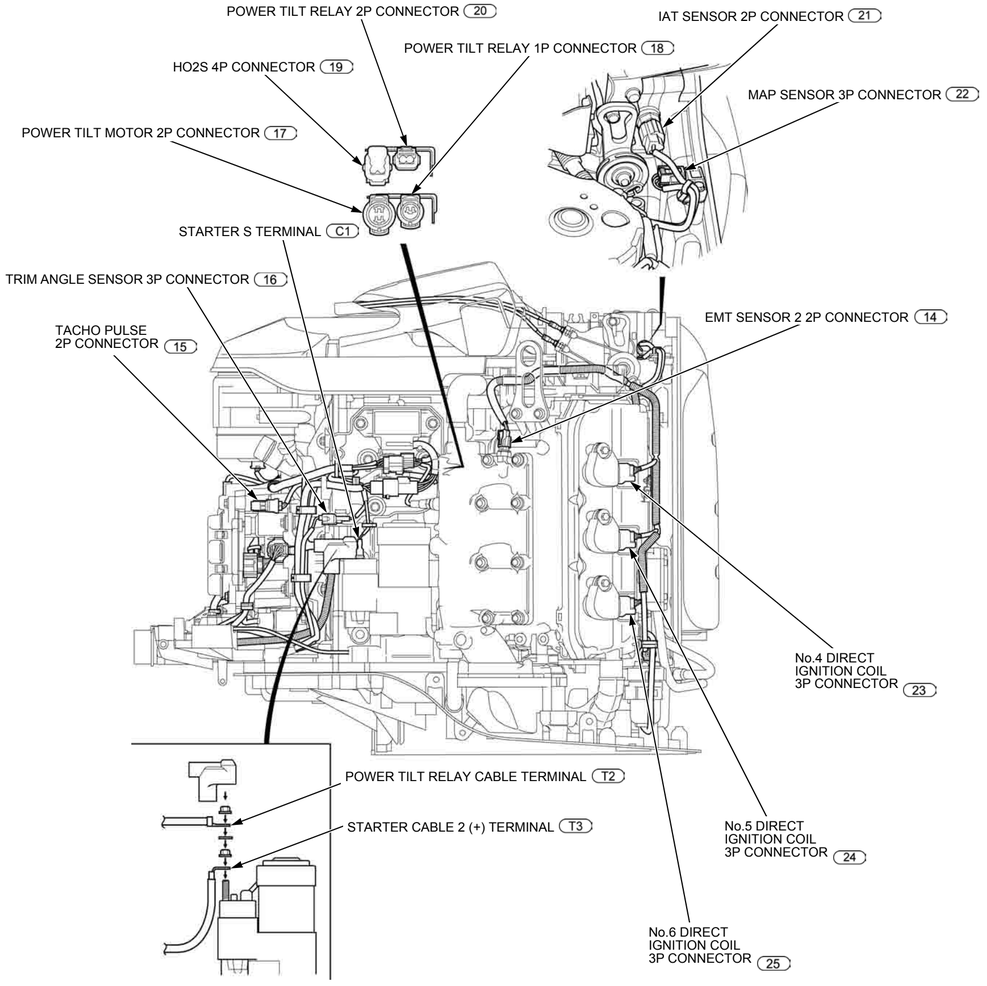
Terminal number	Wire color	Terminal number	Wire color	Terminal number	Wire color	Terminal number	Wire color
1	–	10	Gr	19	Y/G	28	W/G
2	W/Bu	11	Bu	20	Bu	29	Y/Bu
3	R/Bu	12	Bl	21	W	30	R
4	Y	13	Lg	22	R/Bl	31	Y
5	Bl	14	Lg	23	R/Y	32	R
6	R/W	15	Bu/Y	24	G	33	Bu/W
7	R/Bl	16	Bu/R	25	R	34	W/G
8	W/R	17	G	26	G	35	W/Bu
9	–	18	W/Bl	27	Bl/Y	36	Bu

13



Main wire harness side

Terminal number	Wire color	Terminal number	Wire color	Terminal number	Wire color	Terminal number	Wire color
1	W	10	G/Y	19	Bu	28	Br
2	R	11	Y/Bu	20	Y	29	Bu
3	Bl	12	Y/R	21	–	30	Bl/R
4	–	13	Y	22	Br/W	31	Bl/R
5	G/Bl	14	Bu	23	G/Bl	32	Y/R
6	Br/Y	15	R	24	G	33	Lg
7	Bu	16	Br	25	G	34	W/Bu
8	Y/Bl	17	G	26	P	35	G
9	Y/Bl	18	G	27	R/Bu	36	Bl



14



Main wire harness side

Terminal number	Wire color
1	R
2	G

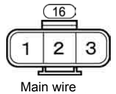
15



Main wire harness side

Terminal number	Wire color
1	Bl
2	Gr

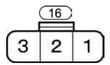
16



Main wire harness side

Terminal number	Wire color
1	Bl
2	Y/Bu
3	Br/W

16



Trim angle sensor side

Terminal number	Wire color
1	Bl
2	Y/Bu
3	Lg/Bl

17



Power tilt relay side

Terminal number	Wire color
1	G
2	Bu

17



Power tilt relay side

Terminal number	Wire color
1	G
2	Bu

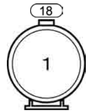
18



Power tilt relay cable side

Terminal number	Wire color
1	W

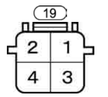
18



Power tilt relay side

Terminal number	Wire color
1	W

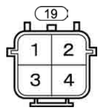
19



Main wire harness side

Terminal number	Wire color
1	Bl/Y
2	G
3	W/Bl
4	Y/Bl

19



O_2 sensor side

Terminal number	Wire color
1	Bl
2	Gr
3	W
4	W

20



Main wire harness side

Terminal number	Wire color
1	Lb
2	Lg

20



Power tilt relay side

Terminal number	Wire color
1	Lb
2	Lg

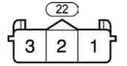
21



Main wire harness side

Terminal number	Wire color
1	R/Y
2	G

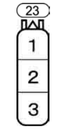
22



Main wire harness side

Terminal number	Wire color
1	Br/Y
2	W/R
3	G

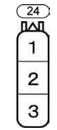
23



Main wire harness side

Terminal number	Wire color
1	Bu/R
2	Bl
3	Y/Bl

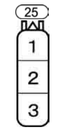
24



Main wire harness side

Terminal number	Wire color
1	Bu/W
2	Bl
3	Y/Bl

25



Main wire harness side

Terminal number	Wire color
1	Bu/Y
2	Bl
3	Br/Bl

STARTER S TERMINAL

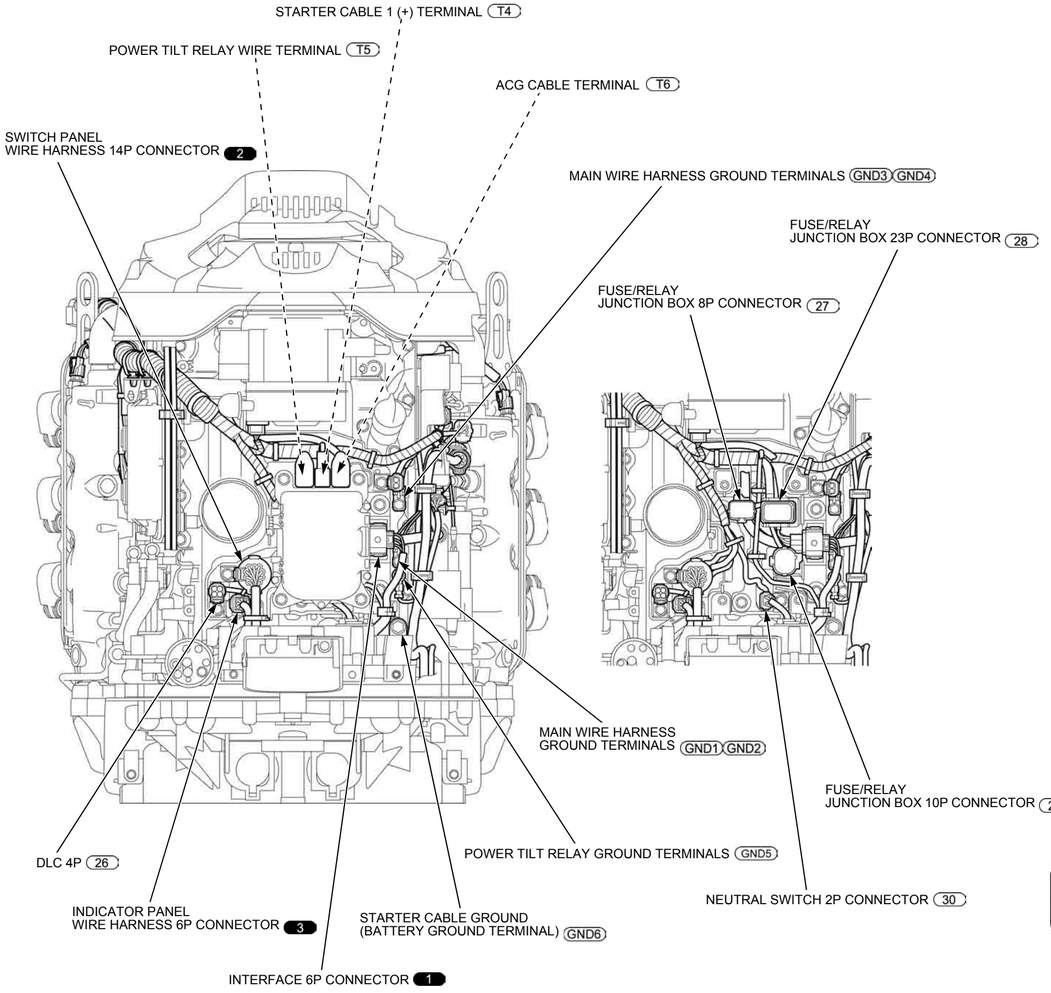
Terminal number	Wire color
C1	W/Bl

POWER TILT RELAY CABLE TERMINAL

Terminal number	Wire color
T2	W

STARTER CABLE 2 (+) TERMINAL

Terminal number	Wire color
T3	Bl



MAIN WIRE HARNESS

Terminal number	Wire color
GND1	G
	G/Bl
GND2	Bl
	Bu
GND3	G
	G/Bl
GND4	Bl
	Bu

POWER TILT RELAY

Terminal number	Wire color
GND5	Bl

STARTER CABLE GROUND (BATTERY GROUND TERMINAL)

Terminal number	Wire color
GND6	Bl

POWER TRIM/TILT RELAY GROUND CABLE TERMINAL

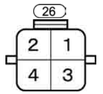
Terminal number	Wire color
T5	W

STATER CABLE 1 (+) TERMINAL

Terminal number	Wire color
T4	W

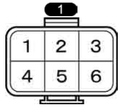
ALTERNATOR CABLE TERMINAL

Terminal number	Wire color
T6	W



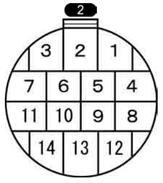
Main wire harness side

Terminal number	Wire color
1	Bu
2	Bl
3	Y/Bl
4	Lg



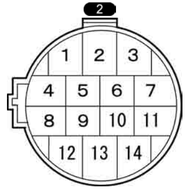
Main wire harness side

Terminal number	Wire color
1	–
2	Bl
3	R
4	Y
5	Bu
6	W



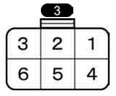
Main wire harness side

Terminal number	Wire color
1	W/Bl
2	Bl/Y
3	Bl
4	Y/G
5	Y/Bu
6	Y
7	R
8	Bl/W
9	Bl/R
10	Lg
11	Lb
12	–
13	–
14	Gr



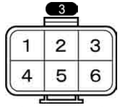
Switch panel wire side

Terminal number	Wire color
1	W/Bl
2	Bl/Y
3	Bl
4	Y/G
5	Y/Bu
6	Y
7	R
8	Bl/W
9	Bl/R
10	Lg
11	Lb
12	Lg/Bl
13	Br
14	Gr



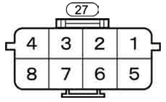
Main wire harness side

Terminal number	Wire color
1	Bl
2	Bu
3	G
4	Y/Bl
5	W/Bu
6	R/Bu



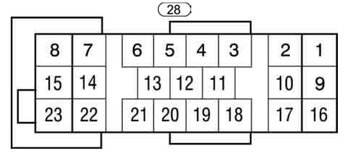
Indicator panel wire side

Terminal number	Wire color
1	Bl
2	Bu
3	G
4	Y/Bl
5	W/Bu
6	R/Bu



Main wire harness side

Terminal number	Wire color
1	–
2	Y/Bl
3	Y/Bl
4	W/Bl
5	Bu/R
6	Y/Bl
7	Y/Bl
8	Y/Bl

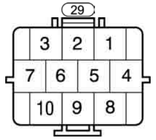


Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	Y/Bl
3	–
4	Bl/Y
5	–
6	–
7	–
8	–

Terminal number	Wire color
9	Bl
10	Y/Bl
11	Y/Bl
12	–
13	Y/Bl
14	Y/Bl
15	–
16	Y/Bl

Terminal number	Wire color
17	Y/Bl
18	Y/Bl
19	Y/Bl
20	Y/Bl
21	Y/Bl
22	Y/Bl
23	Y/Bl



Main wire harness side

Terminal number	Wire color
1	Bl/W
2	–
3	–
4	Lg
5	Lg
6	W/Bl
7	–
8	–
9	Bu
10	–



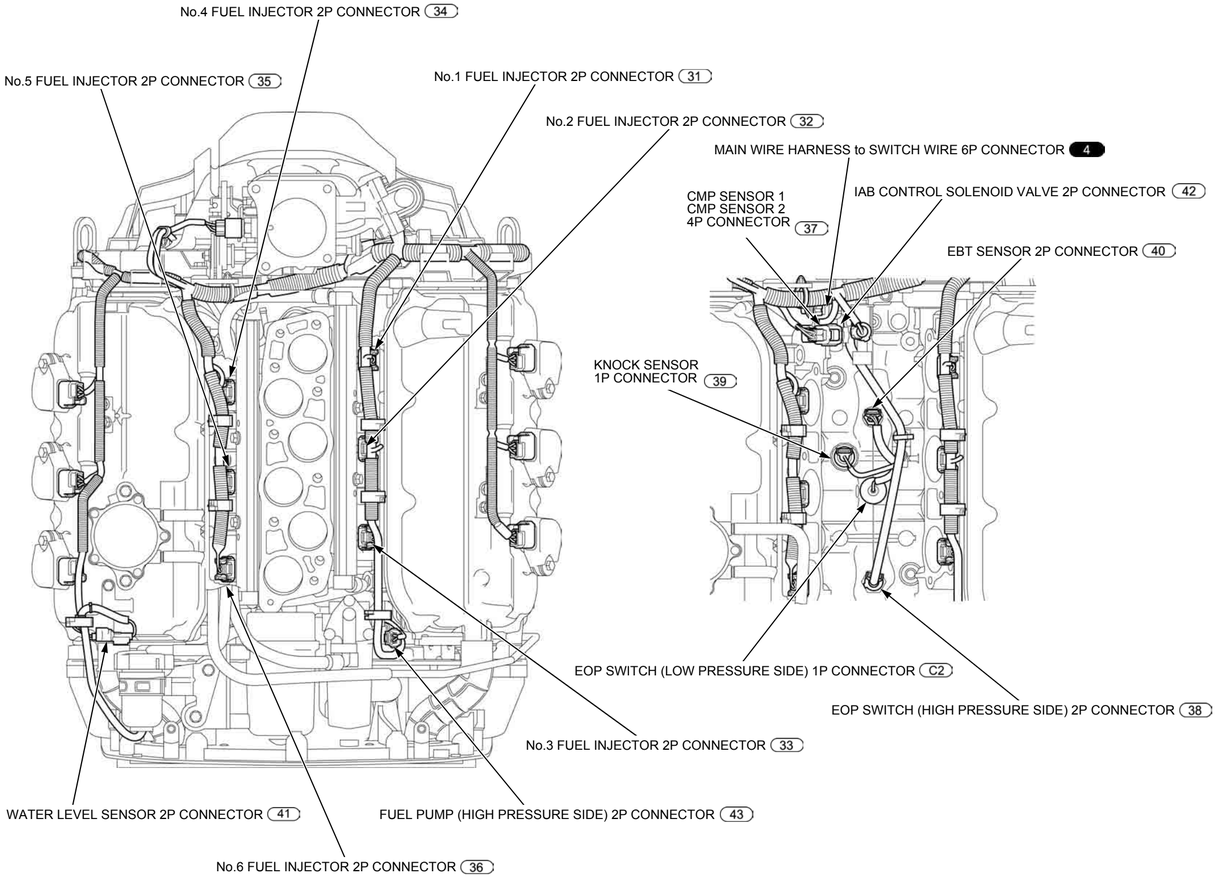
Main wire harness side

Terminal number	Wire color
1	Bl
2	Bu



Neutral switch side

Terminal number	Wire color
1	Bl
2	Bl/Bu



31



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	Br

32



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	R

33



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	Bu

34



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	Y

35



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	Y/R

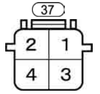
36



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	Y/Bu

37



Main wire harness side

Terminal number	Wire color
1	G
2	R
3	Y
4	Bl

37



CMP sensor side

Terminal number	Wire color
1	G
2	R
3	Y
4	Bl

38



Switch wire side

Terminal number	Wire color
1	Y/R
2	G/R

39



Switch wire side

Terminal number	Wire color
1	R/Bu

40



Switch wire side

Terminal number	Wire color
1	R/W
2	G/R

41



Main wire harness side

Terminal number	Wire color
1	Bl
2	Br

41



Water level sensor side

Terminal number	Wire color
1	G/R
2	Br

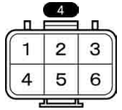
42



Main wire harness side

Terminal number	Wire color
1	Y/Bl
2	Bl

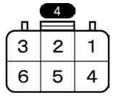
4



Main wire harness side

Terminal number	Wire color
1	Y/R
2	R/W
3	R/Bu
4	G
5	G
6	P

4



Switch wire side

Terminal number	Wire color
1	Y/R
2	R/W
3	R/Bu
4	G/R
5	G/R
6	P

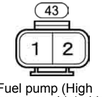
43



Main wire harness side

Terminal number	Wire color
1	Bl
2	Bu/R

43



Fuel pump (High pressure side) side

Terminal number	Wire color
1	Bl
2	Bu/Y

SWITCH CODE

Terminal number	Wire color
C2	P

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