YAMAHA

F300
LF300
F350
LF350

SERVICE MANUAL

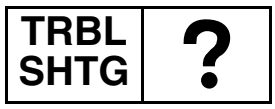
LIT-18616-03-08 6BJ-28197-1K-11

Symbol

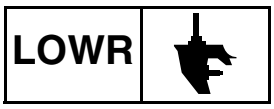
The symbols below are designed to indicate the content of a chapter.

General information

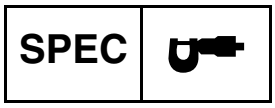
Troubleshooting



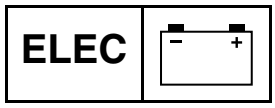
Lower unit



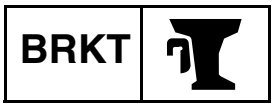
Specification



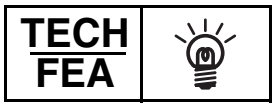
Electrical system



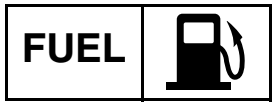
Bracket unit



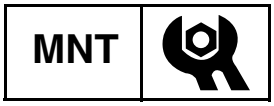
Technical features and description



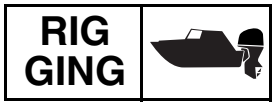
Fuel system



Maintenance

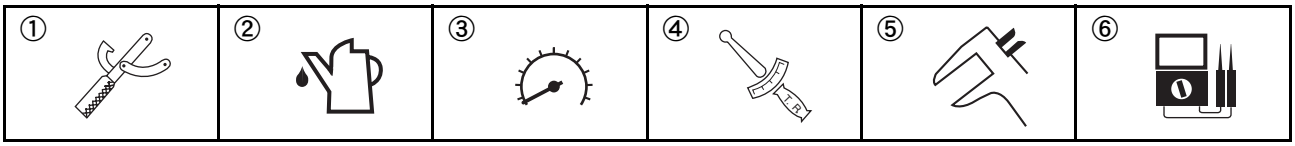


Rigging information



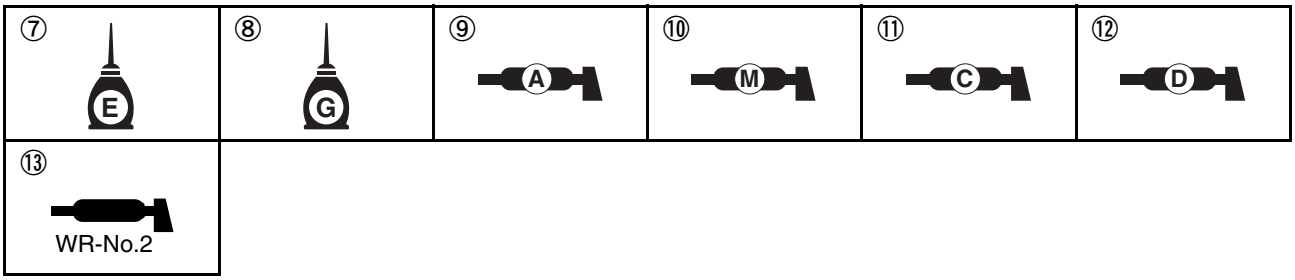
Power unit

Symbols ① to ⑥ indicate specific data.

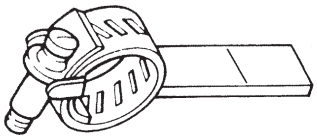


① Special service tool
② Specified oil or fluid
③ Specified engine speed
④ Specified tightening torque
⑤ Specified measurement
⑥ Specified electrical value (resistance, voltage, electric current)

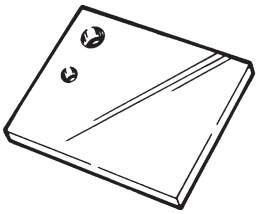
Symbols ⑦ to ⑬ in an exploded diagram and text indicate the grade of lubricant and the lubrication point.



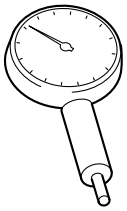
⑦ Apply Yamaha 4-stroke motor oil
⑧ Apply gear oil
⑨ Apply water resistant grease (Yamaha grease A)
⑩ Apply molybdenum disulfide grease
⑪ Apply low temperature resistant grease (Yamaha grease C)
⑫ Apply corrosion resistant grease (Yamaha grease D)
⑬ Apply WR-No.2 grease



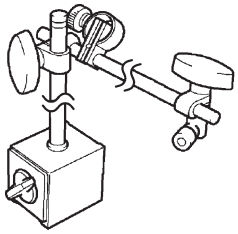
Backlash indicator
90890-06836



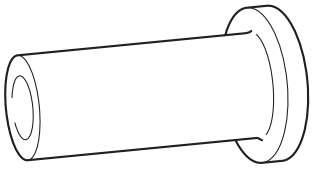
Backlash adjustment plate
YB-07003



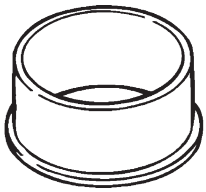
Dial indicator gauge
YU-03097



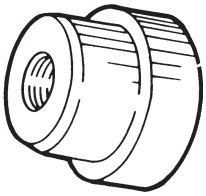
Magnetic base stand
YU-A8438



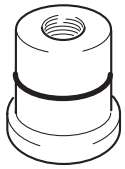
Ring nut extension
90890-06666



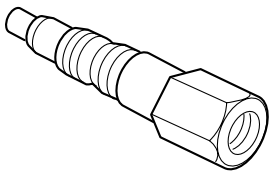
Forward gear bearing cap installer
YB-06277-A



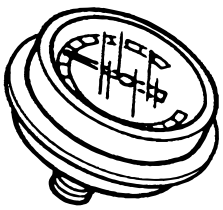
Drive shaft needle bearing installer and remover
YB-06196



Oil seal installer
YB-06167



Up-relief fitting
90890-06838



Hydraulic pressure gauge
90890-06776, 90890-06800

Connecting rod

Item	Unit	Model			
		F300	LF300	F350	LF350
Big end inside diameter	mm (in)	53.025–53.045 (2.0876–2.0884)			
Big end side clearance(*1)	mm (in)	0.14–0.31 (0.006–0.012)			
Crankpin oil clearance	mm (in)	0.025–0.055 (0.0010–0.0022)			
Big end bearing thickness					
Green	mm (in)	1.496–1.502 (0.0587–0.0591)			
Blue	mm (in)	1.505–1.511 (0.0593–0.0595)			
Red	mm (in)	1.514–1.520 (0.0596–0.0598)			

(*1) The figures are for reference only.

Crankshaft

Item	Unit	Model			
		F300	LF300	F350	LF350
Crankshaft journal diameter	mm (in)	62.972–62.992 (2.4792–2.4800)			
Crankpin diameter	mm (in)	49.980–50.000 (1.9677–1.9685)			
Runout limit	mm (in)	0.03 (0.0012)			

Crankcase

Item	Unit	Model			
		F300	LF300	F350	LF350
Crankshaft journal oil clearance (J1, J3)	mm (in)	0.026–0.051 (0.0010–0.0020)			
Crankshaft journal oil clearance (J2, J4)	mm (in)	0.038–0.063 (0.0015–0.0025)			
Crankshaft journal oil clearance (J5)	mm (in)	0.032–0.057 (0.0013–0.0022)			
Upper crankcase main bearing thickness					
Yellow	mm (in)	2.488–2.494 (0.0980–0.0982)			
Green	mm (in)	2.494–2.500 (0.0982–0.0984)			
Brown	mm (in)	2.500–2.506 (0.0984–0.0987)			
Black	mm (in)	2.506–2.512 (0.0987–0.0989)			
Blue	mm (in)	2.512–2.518 (0.0989–0.0991)			
Lower crankcase main bearing thickness					
Yellow	mm (in)	2.488–2.494 (0.0980–0.0982)			
Green	mm (in)	2.494–2.500 (0.0982–0.0984)			
Brown	mm (in)	2.500–2.506 (0.0984–0.0987)			
Black	mm (in)	2.506–2.512 (0.0987–0.0989)			
Blue	mm (in)	2.512–2.518 (0.0989–0.0991)			
Thrust bearing thickness (J3)	mm (in)	1.907–1.957 (0.0751–0.0770)			

Lower unit (counter rotation model)

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Gear oil check screw	—	9	0.9	6.6
Gear oil drain screw	—	9	0.9	6.6
Cooling water inlet cover screw	ϕ5	3	0.3	2.2
Cooling water inlet cover bolt	M5	3	0.3	2.2
Drive shaft nut	—	40	4.0	141.6
Pinion nut	—	162	16.2	119.5
Ring nut (drive shaft)	—	177	17.7	130.5
Ring nut (propeller shaft)	—	192	19.2	141.6
Lower case mounting bolt	M10	47	4.7	34.7
Lower case mounting nut (U-transom model)	—	47	4.7	34.7
Cap bolt	M10	42	4.2	31.0
Anode bolt	M10	42	4.2	31.0
Propeller nut	—	54	5.4	39.8

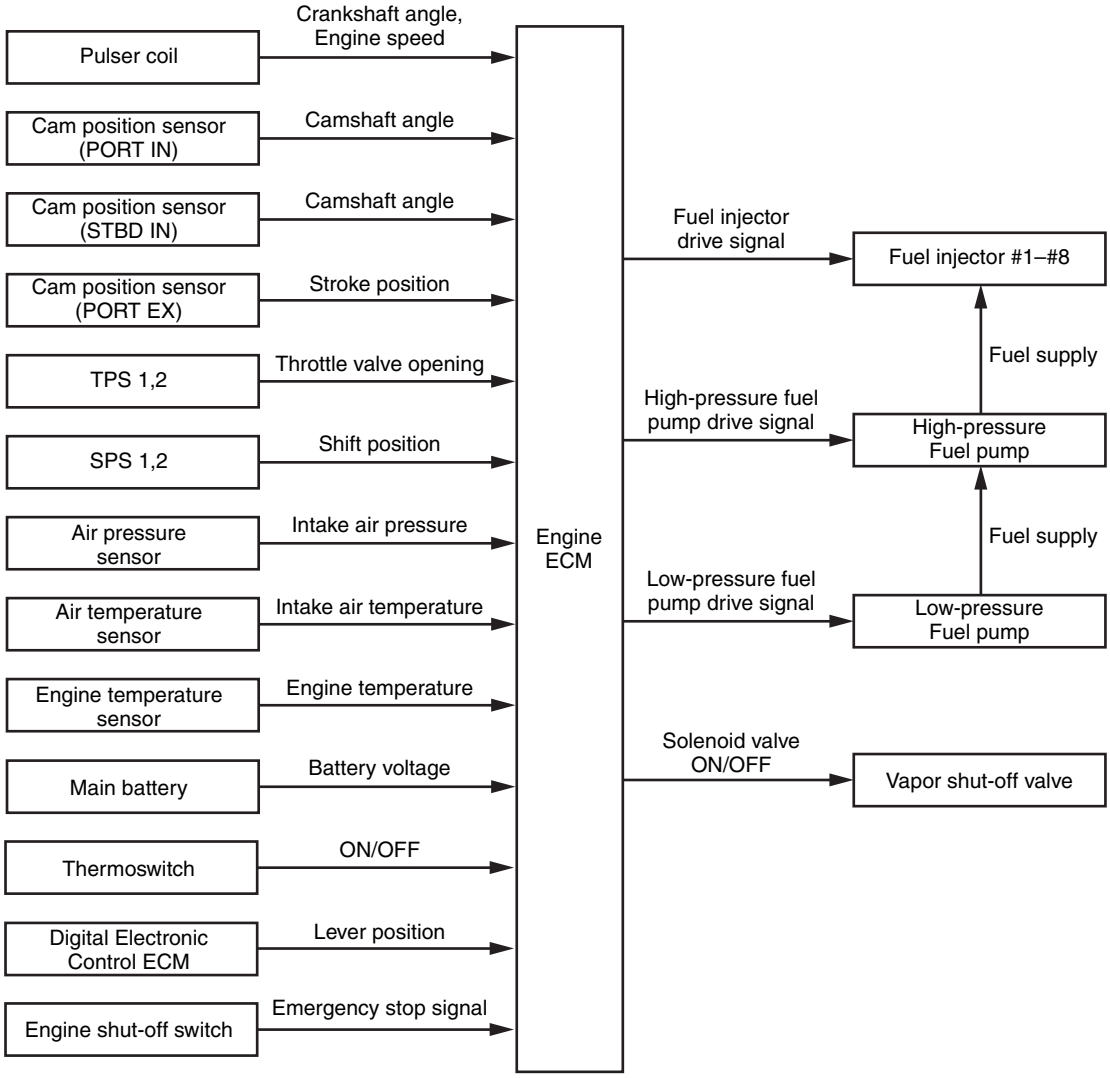
Bracket unit

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Hose joint adapter screw	ϕ6	5	0.5	3.7
Shift-actuator bolt	M8	26	2.6	19.2
Shift-actuator bracket bolt	M8	26	2.6	19.2
Engine oil drain bolt	M14	27	2.7	19.9
Relief valve	—	44	4.4	32.5
Oil strainer bolt	M6	10	1.0	7.4
Exhaust manifold bolt	M8	20	2.0	14.8
Oil pan bolt	M8	20	2.0	14.8
Muffler bolt	M8	20	2.0	14.8
Oil pan bolt	M10	42	4.2	31.0
Upper case bolt	M8	20	2.0	14.8
	M10	42	4.2	31.0
PCV	—	9	0.9	6.6
Upper mount nut	—	96	9.6	70.8
Lower mount nut	—	72	7.2	53.1
Bracket bolt (upper mount)	M10	54	5.4	39.8
Bracket bolt (lower mount)	M10	54	5.4	39.8
Trim stopper nut	—	36	3.6	26.6
Self-locking nut	—	22	2.2	16.2
Friction plate screw	ϕ6	4	0.4	3.0
Grease nipple	—	3	0.3	2.2

Electronic fuel injection control system

Fuel injection timing and amount on F300/LF300 and F350/LF350 are managed by the electronic fuel injection control system. High output power, improved fuel economy, and low exhaust emissions are attained by controlling the fuel injection amount (example: how long the fuel injectors are turned on) to assure the appropriate air/fuel ratio. The control is based on the intake air flow rate calculated from intake air pressure and engine speed, and the engine operating conditions indicated by the signals from each sensor are taken into account. Two types of fuel injections are carried out. One is synchronous injection in which the fuel injection always occurs at certain crankshaft angle, after the required correction is made in accordance with the signals from each sensor. The other is asynchronous injection in which the fuel is injected every time the demand for the fuel injection is identified in the signals from each sensor, regardless of the crankshaft angle.

Block diagram

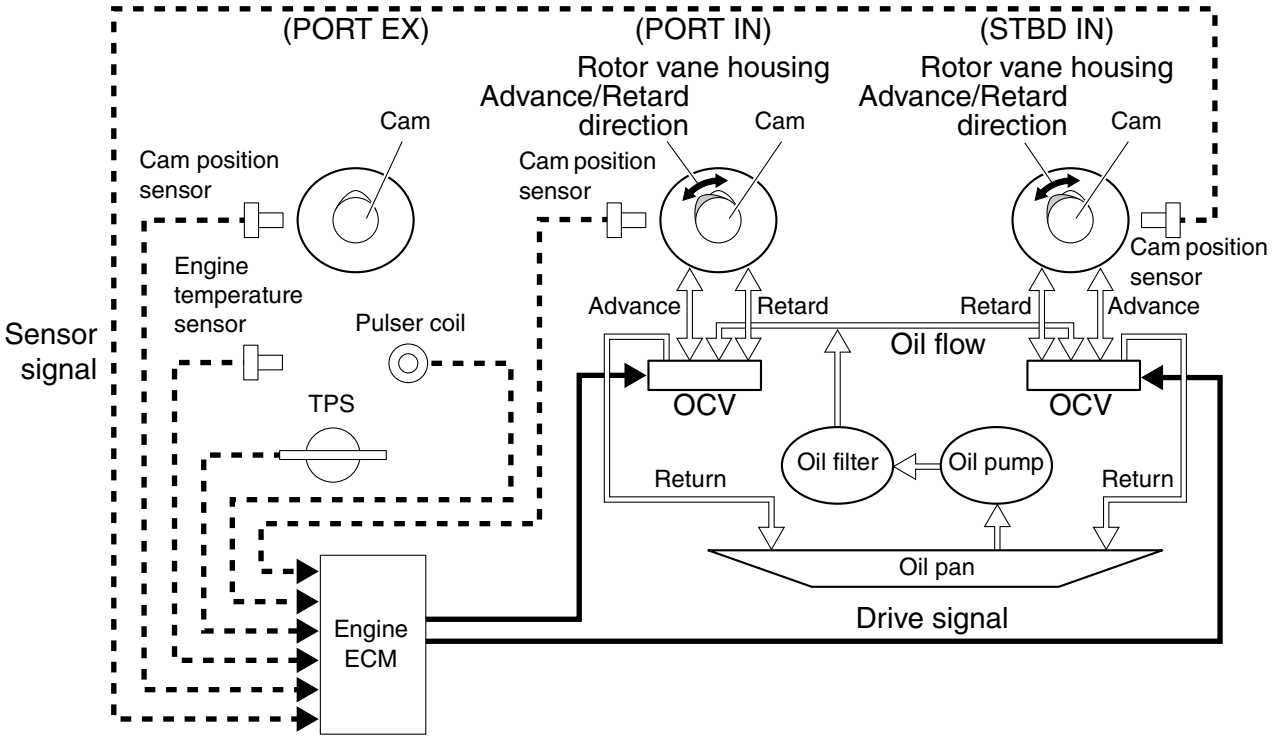


S6AW02004

VCT control system

Intake valve opening and closing timings on F300/LF300 and F350/LF350 are managed by the VCT control system. Engine ECM optimizes the intake valve opening/closing timing by operating the OCV depending on the engine speed and the electronically-controlled throttle valve opening.
High output power is attained by improving the air filling efficiency in the combustion chamber in every engine operating condition.

VCT control system diagram



S6AW02013

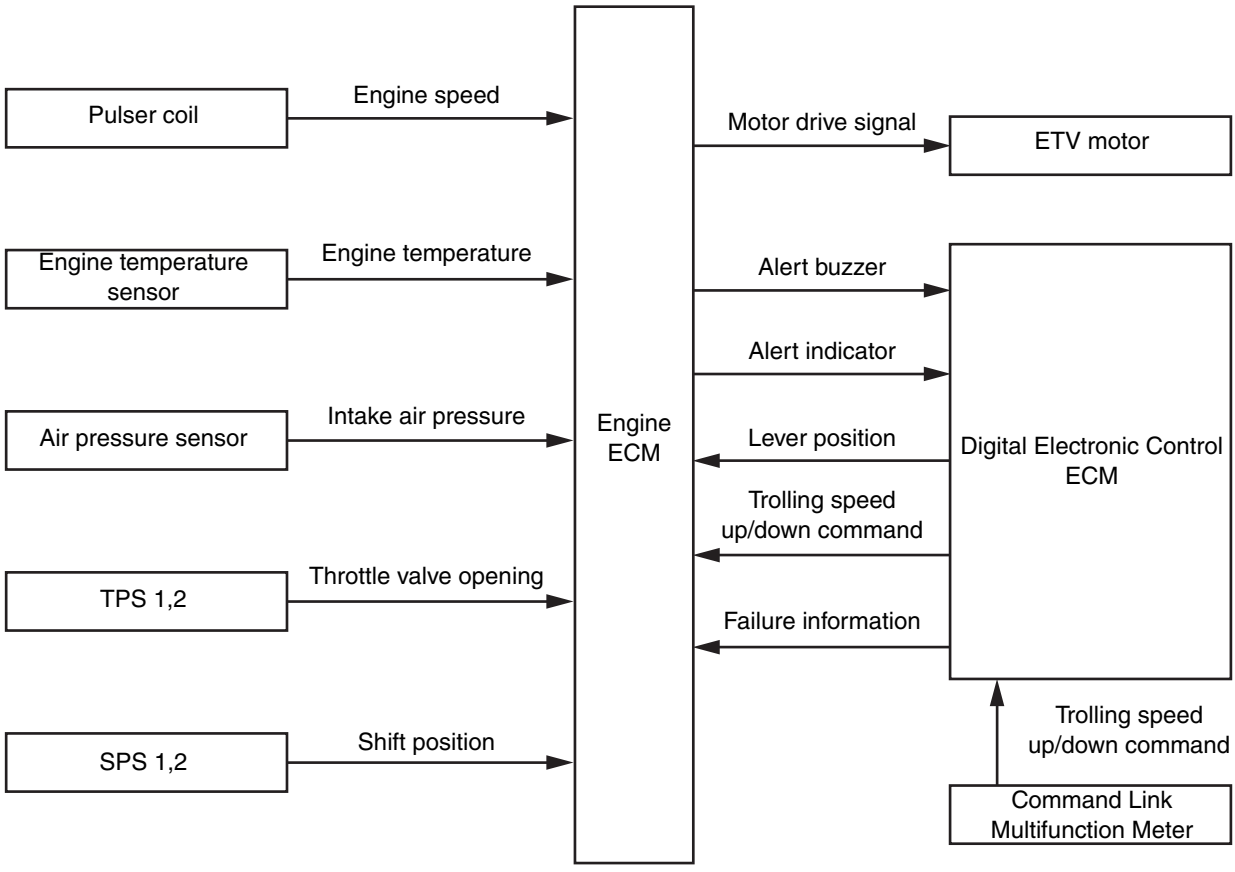
Engine ECM determines the intake valve opening/closing timing suitable for the current engine operating conditions based on the engine speed, electronically-controlled throttle valve opening and engine temperature. Engine ECM also detects the actual ignition advance by means of exhaust and intake cam position sensors, and performs feed back control with OCV to make it closer to the target ignition advance position. Receiving the signal from engine ECM, the OCV delivers the engine oil to the advance chamber or to the retard chamber located in the rotor vane housing, by switching the oil passage leading to each chamber. Then, the rotor vane is driven by the engine oil pressure, advancing or retarding the angle of the camshaft integrated with the rotor vane.

Control Name		Description	Engine condition	
Skip-firing control		Carries out the skip-firing control based on the criteria in the table below:		
	ETV is locked in an open position.	Controls the engine speed when ETV is determined to have got locked in an open position.	Over 1,501 r/min	Firing will be skipped in all cylinders.
			1,427–1,500 r/min	Firing will be skipped at cylinders #8, #4, #3, #6, #5, #7, and #2.
			1,356–1,426 r/min	Firing will be skipped at cylinders #8, #4, #3, #5, #7, and #2.
			1,286–1,355 r/min	Firing will be skipped at cylinders #8, #4, #3, #5, and #2.
			1,216–1,285 r/min	Firing will be skipped at cylinders #8, #3, #5, and #2.
			1,142–1,215 r/min	Firing will be skipped at cylinders #8, #3, and #5.
			1,071–1,141 r/min	Firing will be skipped at cylinders #8, and #5.
			1,001–1,070 r/min	Firing will be skipped at cylinders #8.
	When over-rev. taken place.	Controls the engine speed when over-rev. is detected.	Over 6,501 r/min	Firing will be skipped in all cylinders.
			6,415–6,500 r/min	Firing will be skipped at cylinders #8, #4, #3, #6, #5, #7, and #2.
			6,380–6,414 r/min	Firing will be skipped at cylinders #8, #4, #3, #5, #7, and #2.
			6,345–6,379 r/min	Firing will be skipped at cylinders #8, #4, #3, #5, and #2.
			6,310–6,344 r/min	Firing will be skipped at cylinders #8, #3, #5, and #2.
			6,274–6,309 r/min	Firing will be skipped at cylinders #8, #3, and #5.
			6,235–6,273 r/min	Firing will be skipped at cylinders #8, and #5.
			6,200–6,234 r/min	Firing will be skipped at cylinders #8.
	Under shift-cut-out control	Detects the activation of shift-cutout control, and controls the engine speed.	Reduces the engine speed to the extent that the gearshift can be disengaged safely.	
	Engine shut-off switch ON	Cancels the fuel injection control and the ignition control at all cylinders.		

ETV control system

Throttle opening or closing operation by the control lever is converted into the electric signal, and the throttle valve is adjusted by the ECM to the proper opening taking account of the detected operating conditions. Electronically-controlled single throttle valve is used. Dual system (main station and sub station) is applied for both LPS and TPS inner circuits to carry out mutual monitoring against the sensor failure. If the TPS double error is detected, failure control is activated to lock the throttle valve opening at the given position, and to control the ignition timing in accordance with the throttle opening information from LPS. If the LPS double error is detected, the throttle valve is controlled to take the fully closed position, and the engine speed is kept constant regardless of the control lever movement.

Block diagram

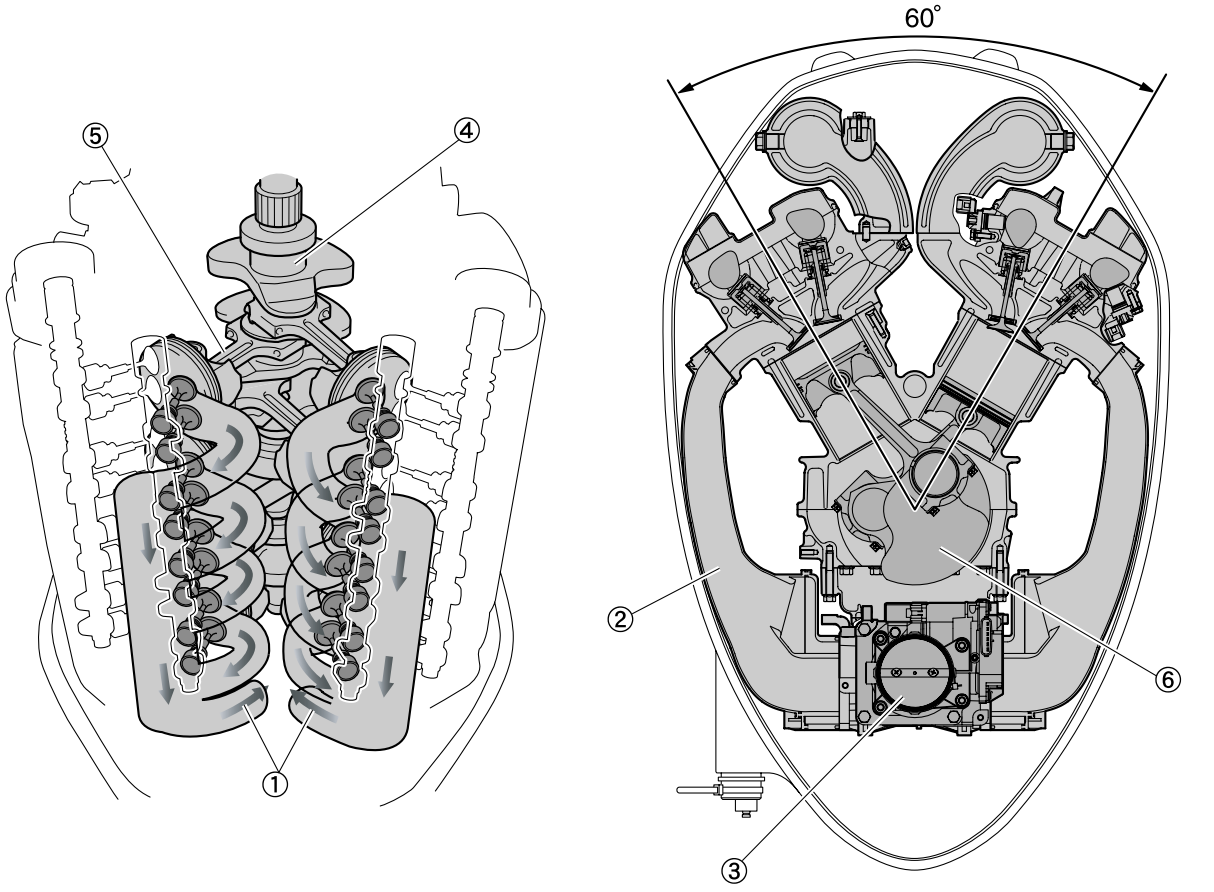


S6AW02034

Power unit system

Outline of system

F300/LF300 and F350/LF350 is equipped with newly developed V8 4-stroke engine having 60° V cylinder banks.
The balance weight distribution and the crank pin arrangement on the crankshaft are optimized for suppressing the vibration and noise.
Intake system features electronically-controlled single valve throttle body with long intake manifold made of resin, designed for higher intake efficiency to attain higher output power and improved fuel economy.
In-bank exhaust system contributes to the reduction of engine size.

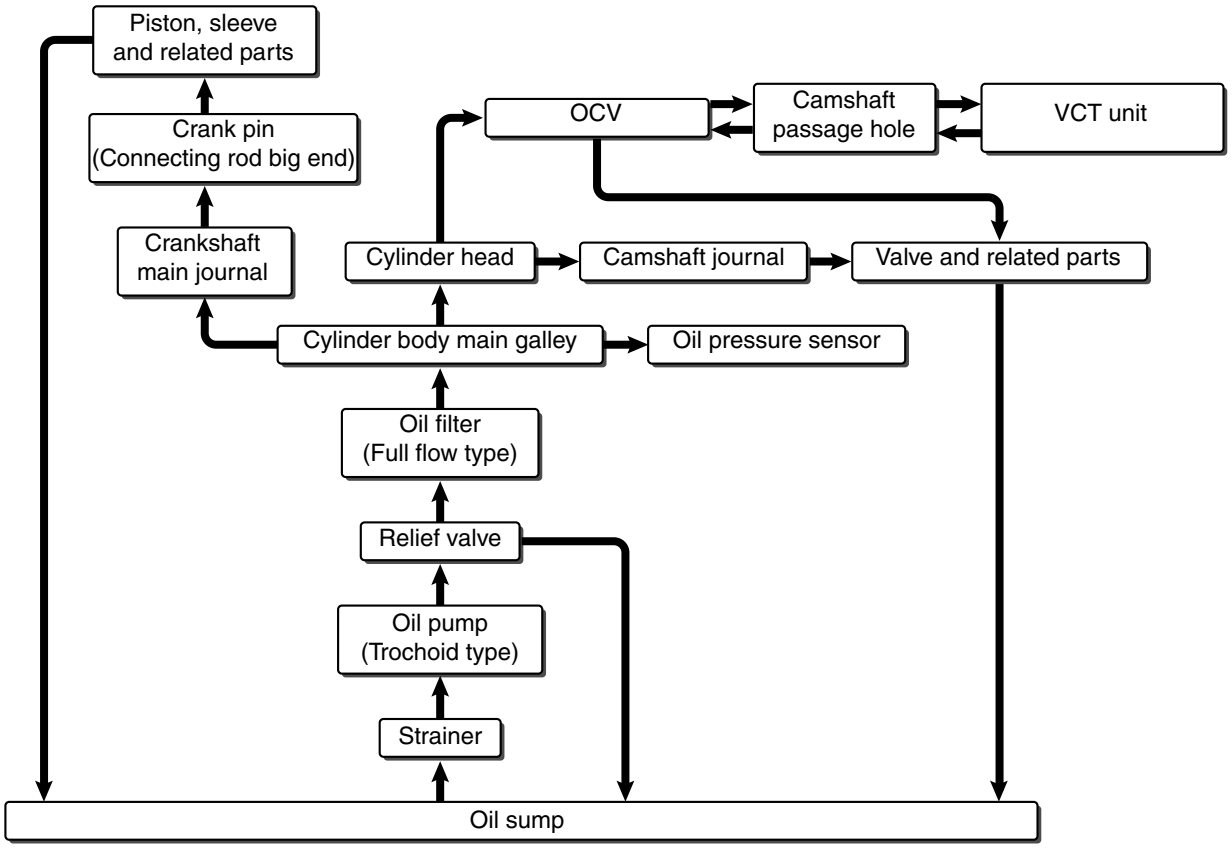


S6AW02080

① In-bank exhaust system
② Long intake manifold
③ Single type electronic throttle body assembly
④ Crank shaft
⑤ Connecting rod assembly
⑥ Balance weight

Lubrication system

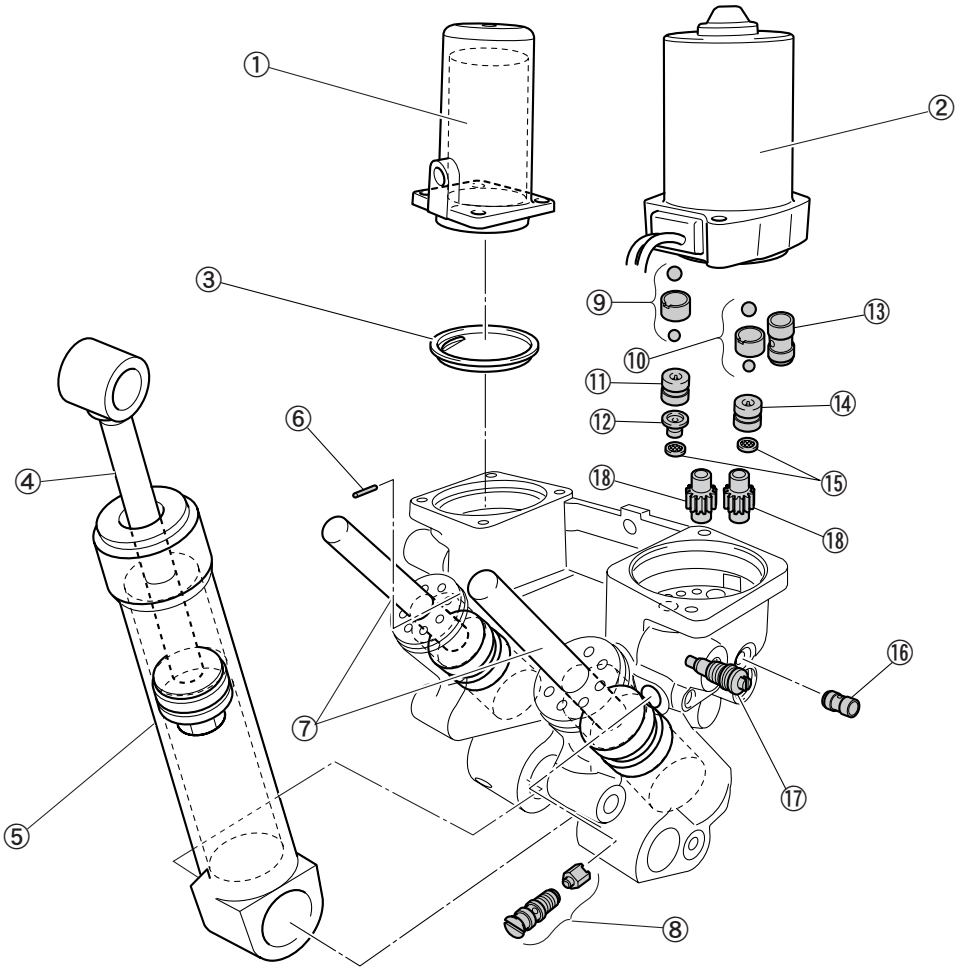
The lubrication oil flow diagram is as follows.



S6AW02057

PTT unit

Hydraulic path is contained in the main body of the newly designed PTT unit, resulting in less number of components and the compact size of the unit. Also, the up-main valve, down-main valve, up-relief valve, and down-relief valve have been integrated into the gear pump housing. Improved serviceability and reliable operation are obtained by the consolidated design.

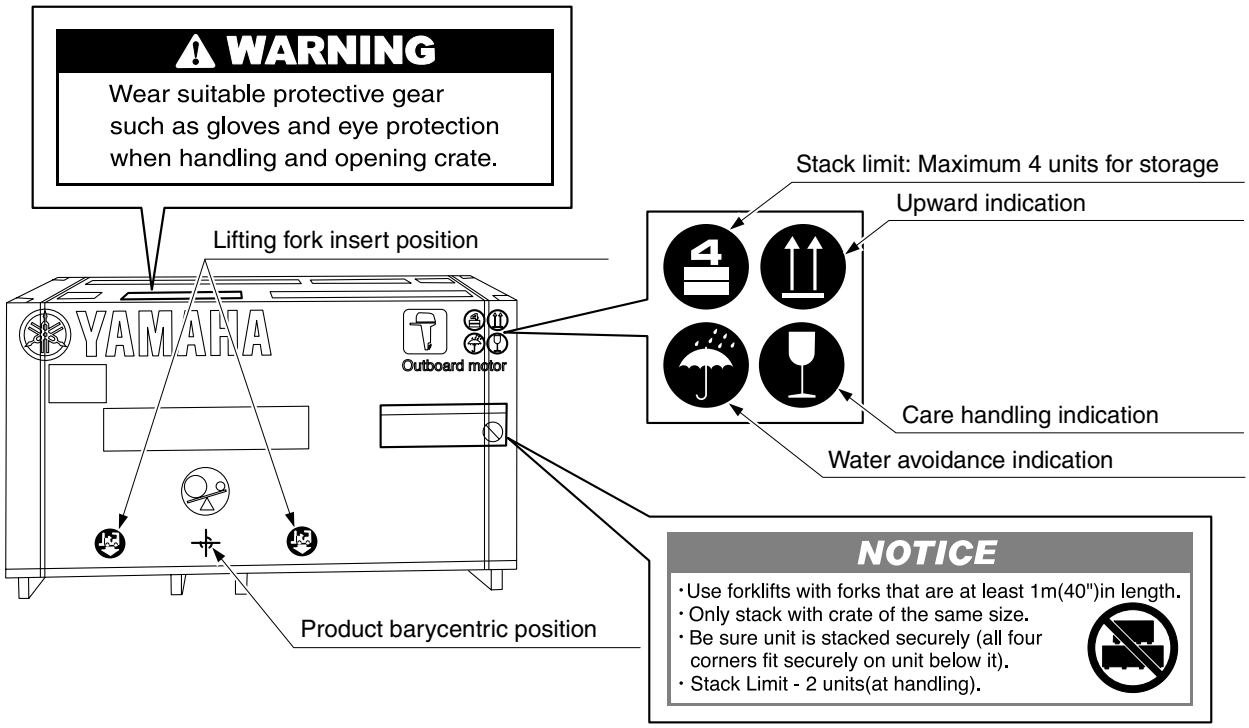


S6AW02082

① Reservoir
② PTT motor
③ Plate
④ Tilt ram
⑤ Tilt cylinder
⑥ Pin
⑦ Trim ram
⑧ Port plug assembly
⑨ Up-shuttle piston
⑩ Down-shuttle piston
⑪ Up-main valve
⑫ Valve seat
⑬ Down-relief valve
⑭ Down-main valve
⑮ Filter
⑯ Up-relief valve
⑰ Manual valve
⑱ Gear pump

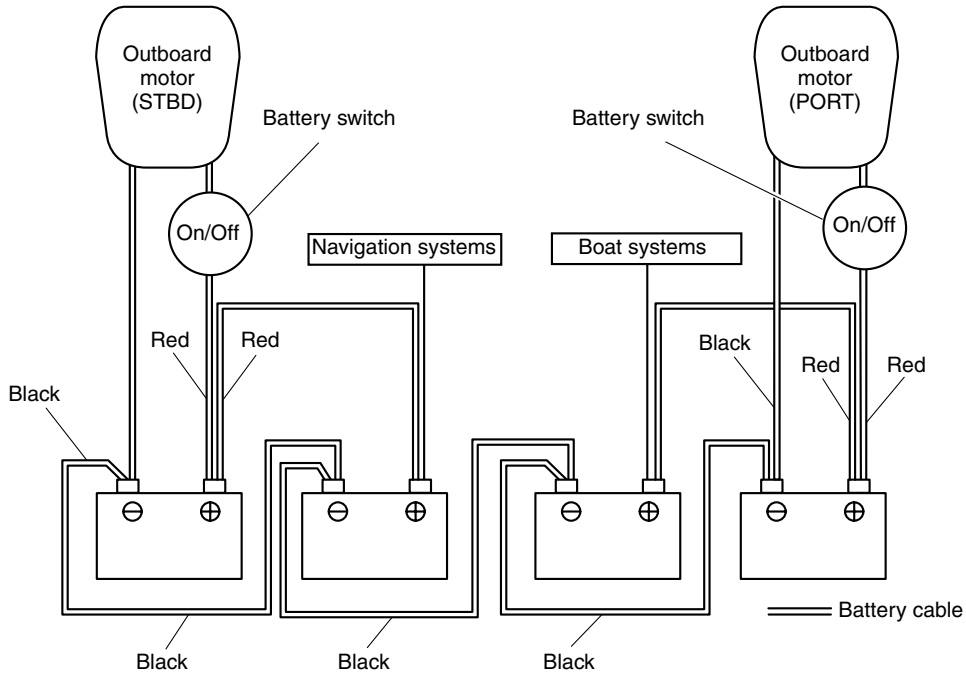
Crate top cover pictograph description

The following pictographs are important sign to handle the crate.
Read the notice and understand what pictographs mean to avoid a damage to the product when handling, transporting and/or keeping the crate.



S6AW09058

3. This battery configuration requires splitting the house system load, half to each engine bank. However in the event of excessive amperage draw, isolated cranking batteries and house batteries are required.

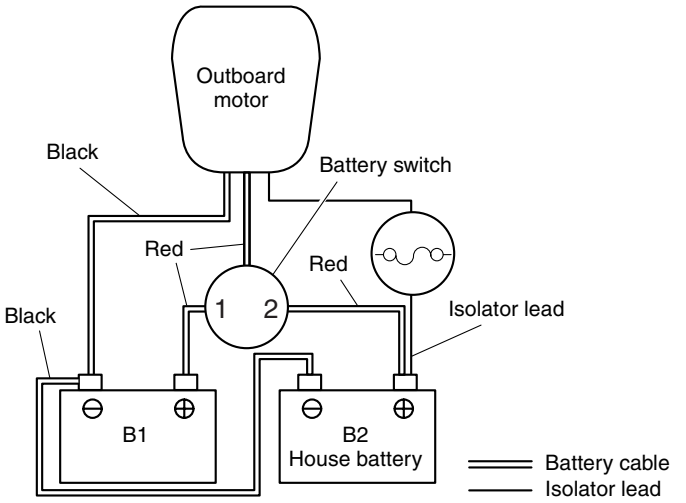


Battery wiring with house (accessory) battery

⚠ WARNING

Improper battery connections or cable size selection may result in a fire.

- **When only one battery is used for one engine, connect the positive battery cable and the isolator lead to the positive battery terminal. If the isolator lead is left unconnected, accidental contact of the isolator lead with the negative terminal of the battery can cause a short circuit which may result in a fire.**
- **When using a house battery, a negative connecting cable must be installed between the house battery and the engine battery. This cable must be sized equivalent to the engine battery cables or lager AWG cable size in accordance with ABYC specifications.**
- **Battery switches must be capable of meeting intermittent and continuous current ratings for engines and accessories.**

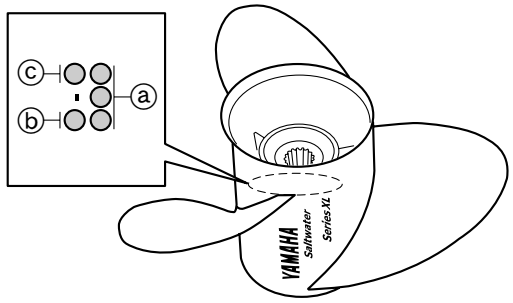


Propeller selection

The performance of a boat and outboard motor will be critically affected by the size and type of propeller you choose. Propellers greatly affect boat speed, acceleration, engine life, fuel economy, and even boating and steering capabilities. An incorrect choice could adversely affect performance and could also seriously damage the engine.
Use the following information as a guide for selecting a propeller that meets the operating conditions of the boat and the outboard motor.

Propeller size

The size of the propeller is indicated on the propeller boss end, on the side of the propeller boss.



S6AW09089

ⓐ : Propeller diameter (in inches)
ⓑ : Propeller pitch (in inches)
ⓒ : Propeller type (propeller mark)

Selection

When the engine speed is at the full throttle operating range (5,000–6,000 r/min), the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

Regular rotation model

Propeller size (in)	Material
16 1/4 x 17 - X	Stainless
16 1/4 x 19 - X	
15 1/2 x 21 - X	
15 1/4 x 23 - X	
15 1/4 x 25 - X	

Counter rotation model

Propeller size (in)	Material
16 1/4 x 17 - XL	Stainless
16 1/4 x 19 - XL	
15 1/2 x 21 - XL	
15 1/4 x 23 - XL	
15 1/4 x 25 - XL	

Trouble code and checking step

Description in < > is relevant to the twin and triple engine installation.
—: Not applicable

Trouble code	Item	Condition	Lan gauge display	Symptom	Remarks	Checking steps	Refer to page
13	Pulser coil malfunction	Irregular signal	C/E	Engine does not restart. <Unstable engine speed while the engine is running.>	Engine stops suddenly.	1. Measure the pulser coil air gap.	7-2
						2. Check the projections of the flywheel magnet for damage.	7-2
						3. Measure the pulser coil resistance.	5-48 a-6
						4. Check for wiring continuity between the pulser coil and engine ECM.	5-25 a-6
15	Engine temp sensor malfunction	Out of specification	C/E	Higher idle speed. Degraded acceleration performance. Declining maximum engine speed. <Difference in idle speeds.> <Engine speeds do not synchronize.> <Difference in maximum engine speed.>	—	1. Measure the engine temperature sensor input voltage.	5-50 a-6
						2. Check for wiring continuity between the engine temperature sensor and engine ECM.	5-25 a-6
						3. Measure the engine temperature sensor resistance.	5-50 a-6

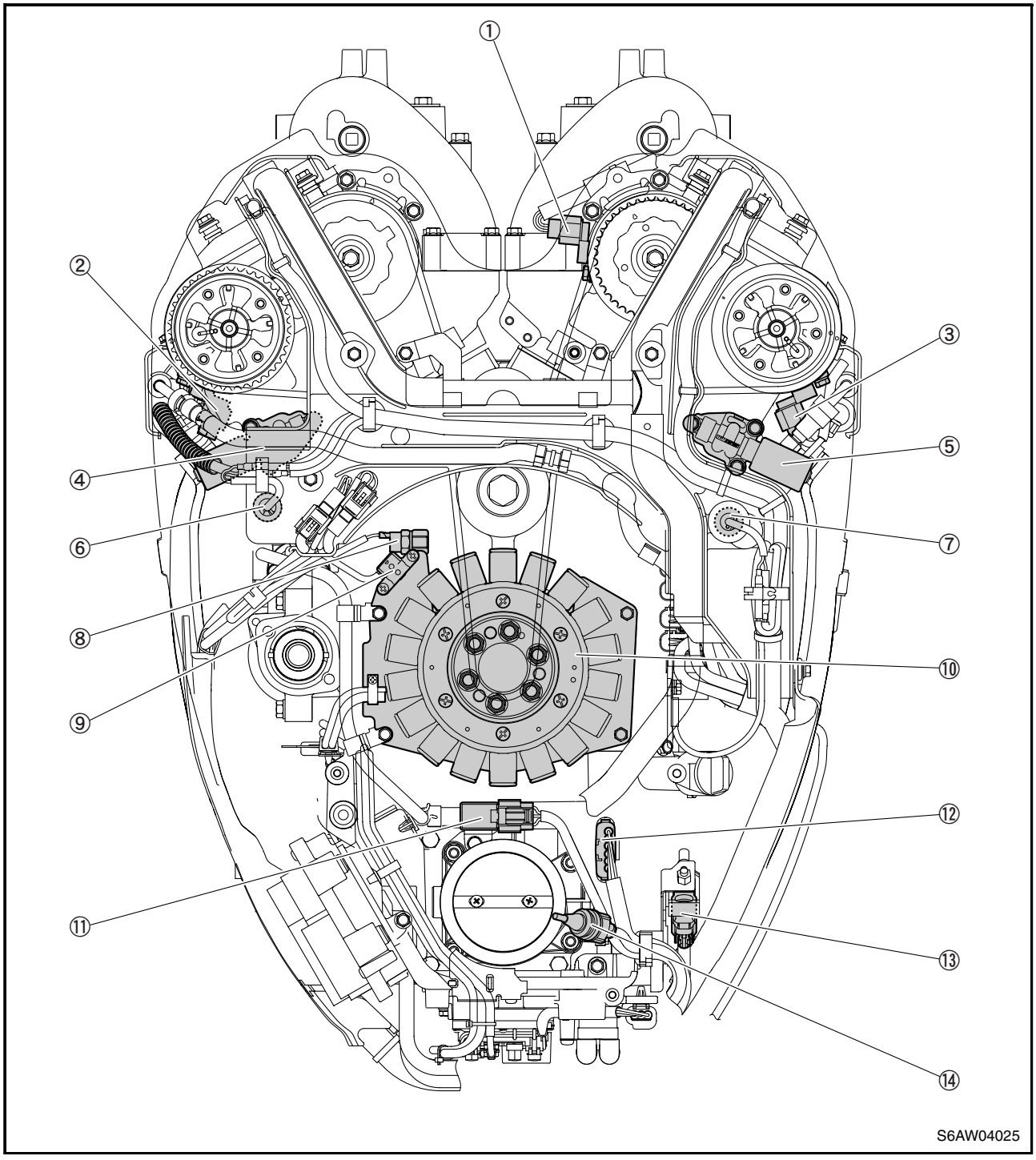
Trouble code	Item	Condition	Lan gauge display	Symptom	Remarks	Checking steps	Refer to page
124 125	Throttle position sensor malfunction	Out of specification	C/E	Unstable idle speed. Degraded acceleration performance. Declining maximum engine speed. <Difference in idle speeds.> <Engine speeds do not synchronize.> <Difference in maximum engine speeds.>	—	1. Check the TPS output voltage using the engine monitoring function of YDIS.	5-27
						2. Check the throttle opening angle using the engine monitoring function of YDIS.	5-27
						3. Check the ETV circuit.	5-28 a-2
124 125 126 127 128	Throttle position sensor malfunction	Out of specification	C/E	Higher idle speed Throttle does not work. <Difference in idle speeds.> <Engine speeds do not synchronize.> <Difference in maximum engine speeds.>	Engine speed is fixed at about 1,500 r/min.	1. Check the TPS output voltage using the engine monitoring function of YDIS.	5-27
						2. Check the throttle opening angle using the engine monitoring function of YDIS.	5-27
						3. Measure the TPS input voltage.	5-27 a-2
						4. Check the ETV operation.	5-27
						5. Check for wiring continuity between the TPS and engine ECM.	5-28 a-2
127 128	Throttle position sensor malfunction	Out of specification	C/E	Degraded acceleration performance. Declining maximum engine speed. <Engine speeds do not synchronize.> <Difference in maximum engine speeds.>	—	1. Check the TPS output voltage using the engine monitoring function of YDIS.	5-27
						2. Check the throttle opening angle using the engine monitoring function of YDIS.	5-27
						3. Check the ETV circuit.	5-28 a-2

Trouble code	Item	Condition	Lan gauge display	Symptom	Remarks	Checking steps	Refer to page
165	Remote control system malfunction (Main station)	LPS Irregular signal	C/E	Fully closed throttle. Throttle does not work. Shift-actuator rod returns to neutral. Shift actuator does not work.(*1) Alert indicator is “ON.” <Difference in idle speeds.> <Engine speeds do not synchronize.>(*2)	(*1) Shift actuator is possible with manual operation. (*2) Failed engine locked at idle speed.	1. Check the LPS output voltage.	See the Digital Electronic Control SM.
						2. Check for wiring continuity between the LPS and Digital Electronic Control ECM.	See the Digital Electronic Control SM.
166 167 168 169	Remote control system malfunction (Main station)	LPS Irregular signal	C/E	Higher idle speed.(*1) Alert indicator is “ON.” Degraded acceleration performance. Declining maximum engine speed.(*2) <Difference in idle speeds.> <Engine speeds do not synchronize.> <Difference in maximum engine speeds.>	These are symptoms of the center outboard motor. (*1) Unstable (*2) Throttle restricted to 1/2 opening.	1. Check the LPS output voltage.	See the Digital Electronic Control SM.
						2. Check for wiring continuity between the LPS and Digital Electronic Control ECM.	See the Digital Electronic Control SM.
				Fully closed throttle. Shift-actuator rod returns to neutral. Alert indicator is “ON.” <Engine speeds do not synchronize.>	When either one of the trouble codes 166 and 167, and either one of the trouble codes 168 and 169 took place simultaneously. These are symptoms of the center outboard motor.	1. Check the LPS output voltage.	See the Digital Electronic Control SM.
						2. Check for wiring continuity between the LPS and Digital Electronic Control ECM.	See the Digital Electronic Control SM.

Symptom 1: Limited engine speed (below 2,000 r/min).

Symptom 2	Cause 1	Cause 2	Checking step	Refer to page
Buzzer comes on. Overheat alert indicator comes on. Cooling water does not discharge from the cooling water pilot hole.	Clogged cooling water inlet.	—	Check the cooling water inlet.	2-62
	Water pump malfunction.	Water pump impeller malfunction.	Check the impeller.	8-8 8-51
			Check the flat key.	8-8 8-51
		Water leakage from water pump housing.	Check the water pump housing.	8-8 8-51
			Check the insert cartridge.	8-8 8-51
			Check the outer plate cartridge.	8-8 8-51
	Clogged cooling water passage.	—	Check the cooling water passage (power unit, EX guide, and upper case).	2-58
	Thermostat malfunction.	—	Check the thermostat.	10-26
Buzzer comes on. Oil pressure alert indicator comes on.	Insufficient engine oil.	—	Add sufficient oil.	10-5
	Engine oil pressure decrease.	Oil pump malfunction.	Check the oil pressure.	7-2
		Clogged oil strainer.	Check the oil strainer.	9-19
		Clogged oil passage.	Check the oil passage (power unit and oil pump).	2-56
		Clogged oil filter.	Replace the oil filter.	10-17

Top view

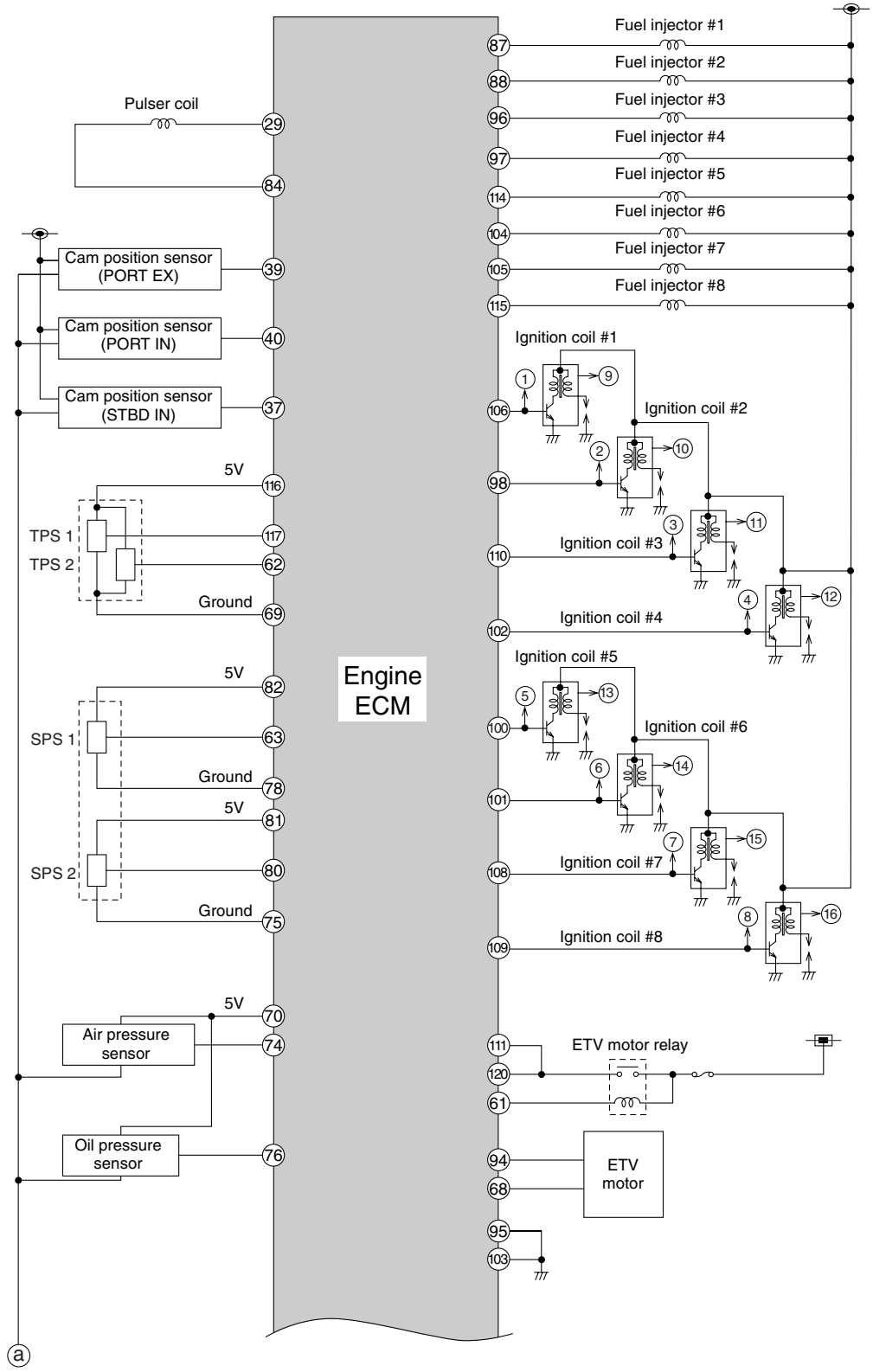


① Cam position sensor (PORT EX)
② Cam position sensor (STBD IN)
③ Cam position sensor (PORT IN)
④ OCV (STBD)
⑤ OCV (PORT)
⑥ Thermoswitch (STBD)
⑦ Thermoswitch (PORT)
⑧ Engine temperature sensor
⑨ Pulser coil
⑩ Stator assembly
⑪ Air pressure sensor
⑫ TPS coupler
⑬ Vapor shut-off valve
⑭ Air temperature sensor

5

Circuit diagram

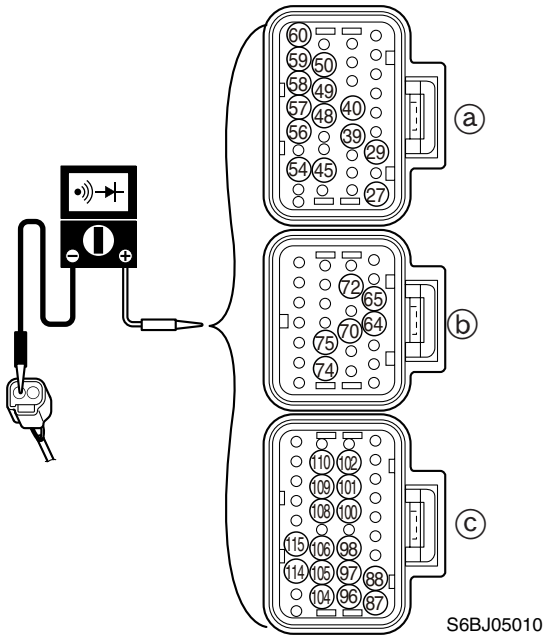
NOTE:
The circled numbers in the illustration indicate the engine ECM terminal numbers.



S6AW04933

: Same marks are connected by each other.
: Same marks are connected by each other.

2. Check for continuity between the engine ECM and each item. Replace the wiring harness if there is no continuity.



Wiring harness continuity:

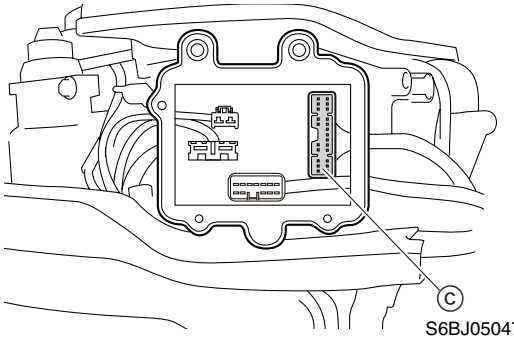
No.	Item	Color
27	PTT sensor	Pink
29	Pulser coil	White/Black
37	Cam position sensor (STBD IN)	White/Black
39	Cam position sensor (EX)	White/Blue
40	Cam position sensor (PORT IN)	White/Green
45	PTT switch UP	Sky blue
48	Water pressure sensor	Blue/Black
49	OCV (STBD)	Purple
50	OCV (PORT)	Purple
54	PTT switch down	Light green
56	Low-pressure fuel pump	Blue/White
57	Low-pressure fuel pump	Blue/White
58	High-pressure fuel pump	Blue/Red
59	High-pressure fuel pump	Blue/Red
60	High-pressure fuel pump	Red/White
64	Engine temperature	Black/Yellow
65	Air temperature sensor	Black/Yellow
70	Air pressure sensor Oil pressure sensor	Orange
72	Water detection switch	Red/White
74	Air pressure sensor	Pink/Green
75	Oil pressure sensor	Pink/Green
87	Fuel injector #1	Purple/Red
88	Fuel injector #2	Purple/Black
96	Fuel injector #3	Purple/Yellow
97	Fuel injector #4	Purple/Green
98	Ignition coil #2	Black/Blue
100	Ignition coil #5	Black/Blue
101	Ignition coil #6	Black/Brown
104	Fuel injector #6	Purple/White
105	Fuel injector #7	Purple/Red
106	Ignition coil #1	Black/Orange
108	Ignition coil #7	Black/Orange
109	Ignition coil #8	Black/Orange
114	Fuel injector #5	Purple/Blue
115	Fuel injector #8	Purple/Black

3. Check for continuity between each item coupler (wiring harness end) and ground. Check the ground connection, or replace the wiring harness if there is no continuity.

4. Connect the engine ECM coupler ⓐ, ⓑ, and ⓒ.

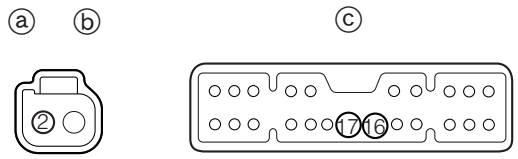
5

2. Disconnect the fuse holder coupler ⓒ.



S6BJ05047

3. Check the wiring harness continuity. Replace the wiring harness if there is no continuity.



S6BJ05048

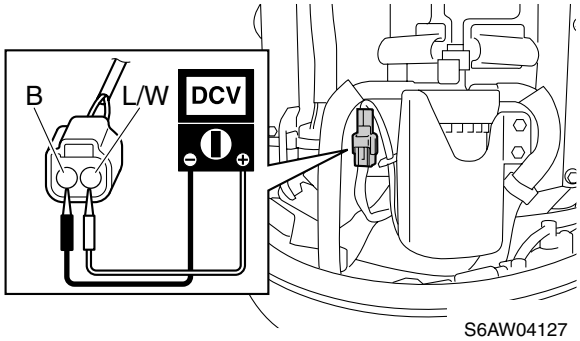
Wiring harness continuity:	
Terminal No.	
Coupler ⓐ, ⓑ	Coupler ⓒ
PORT: 2	16
STBD: 2	17

4. Check for continuity between the engine ECM and OCV. See “Checking the continuity between the engine ECM and each item” (5-25).

Checking the water detection switch

1. Disconnect the water detection switch coupler.

2. Turn the engine start switch to “ON,” and then measure the input voltage at the water detection switch coupler (wiring harness end). Check the wiring harness if out of specification. To check the wiring harness, see “Checking the continuity between the engine ECM and each item” (5-25).



S6AW04127

Water detection switch input voltage (reference data):
Blue/White (L/W)–Black (B)
4.75–5.25 V

3. Turn the engine start switch to “OFF.”

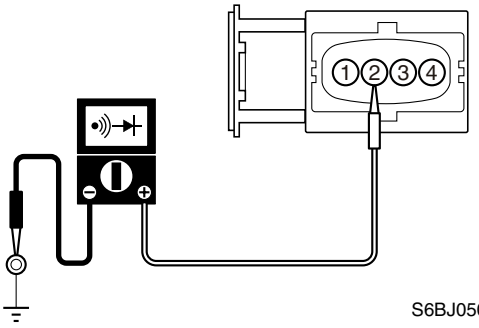
4. Remove the fuel filter cover.

5. Remove the filter cup assembly.

6. Before checking the water detection switch, make sure that the float ① is able to move to positions A and B as shown.

5

5. Check for continuity between the ignition coil coupler (wiring harness end) and ground.



S6BJ05016

6. Connect the ignition coil couplers.

7. Install the side covers and rear cover.

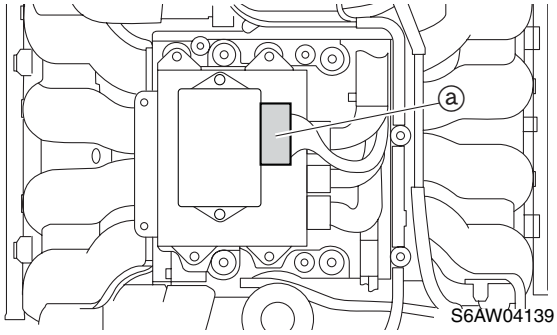
Checking the IDM circuit

NOTE:

Check the spark plug and the ignition coil prior to the IDM circuit check to verify their proper functionality.

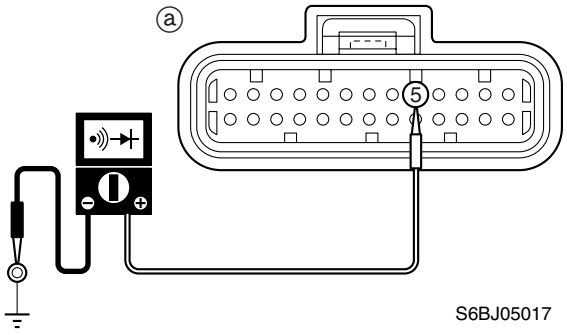
1. Remove the fuel filter.

2. Disconnect the IDM coupler ⓐ.



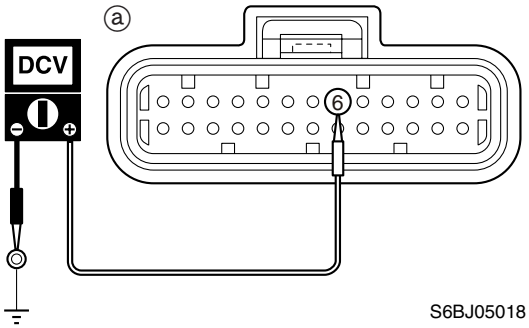
S6AW04139

3. Check for continuity between the IDM coupler terminal ⑤ (wiring harness end) and ground.



S6BJ05017

4. Turn the engine start switch to "ON." Measure the voltage between the IDM coupler terminal ⑥ (wiring harness end) and ground. Check the wiring harness if the measurement is not the specified value.

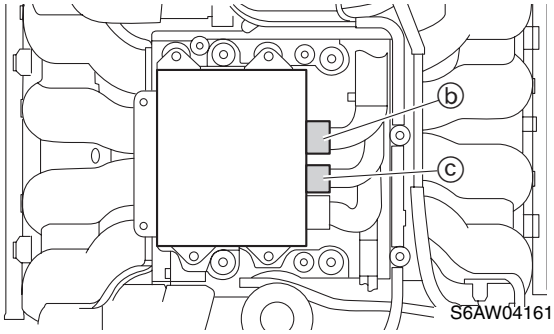


S6BJ05018

Terminal ⑥–Ground:
12 V (battery voltage)

5. Turn the engine start switch to "OFF."

6. Disconnect the engine ECM couplers ⓑ and ⓒ.



S6AW04161

5

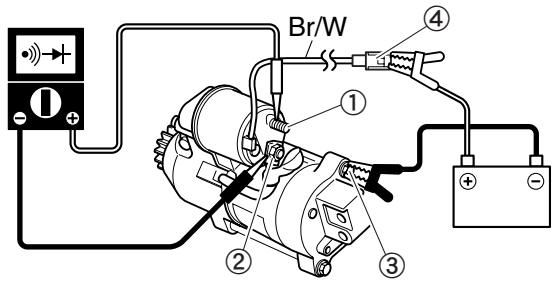
Removing the starter motor

NOTE:
Check the engine start switch, starter relay, and starter relay fuse before removing the starter motor.

1. Remove the intake manifold (STBD) and intake silencer.
2. Remove the starter motor from the power unit. See “Starter motor” (7-34).

Checking the magnet switch

1. Connect the tester probes between the magnet switch terminals ① and ② as shown.
2. Connect the negative battery cable to the starter motor body ③.
3. Connect the positive battery cable to the starter motor lead (Br/W) ④, and then check the magnet switch continuity.



S6AW04154

CAUTION:
Do not connect the starter motor lead (Br/W) to the battery for more than 1 second, otherwise the magnet switch can be damaged.

4. Check that there is continuity between the magnet switch terminals ① and ②. Replace if there is no continuity.

Battery Lead	Magnet switch terminal No.	
	①	②
Connect	○	○
Disconnect		

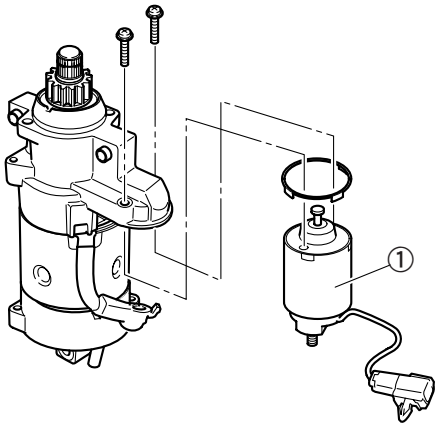
5. Disconnect the negative battery cable and positive battery cable from the battery terminals.

Checking the starter motor pinion

1. Check the pinion teeth. Replace the pinion if cracked or worn.
2. Check for smooth operation. Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

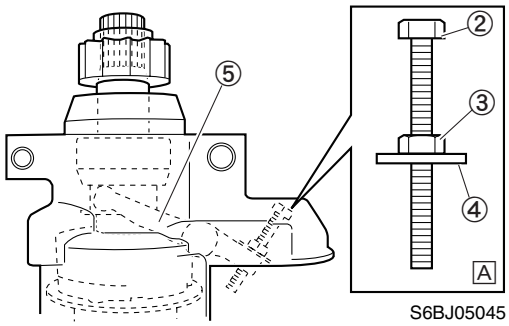
Disassembling the starter motor

1. Remove the magnet switch assembly ①.



S6BJ05039

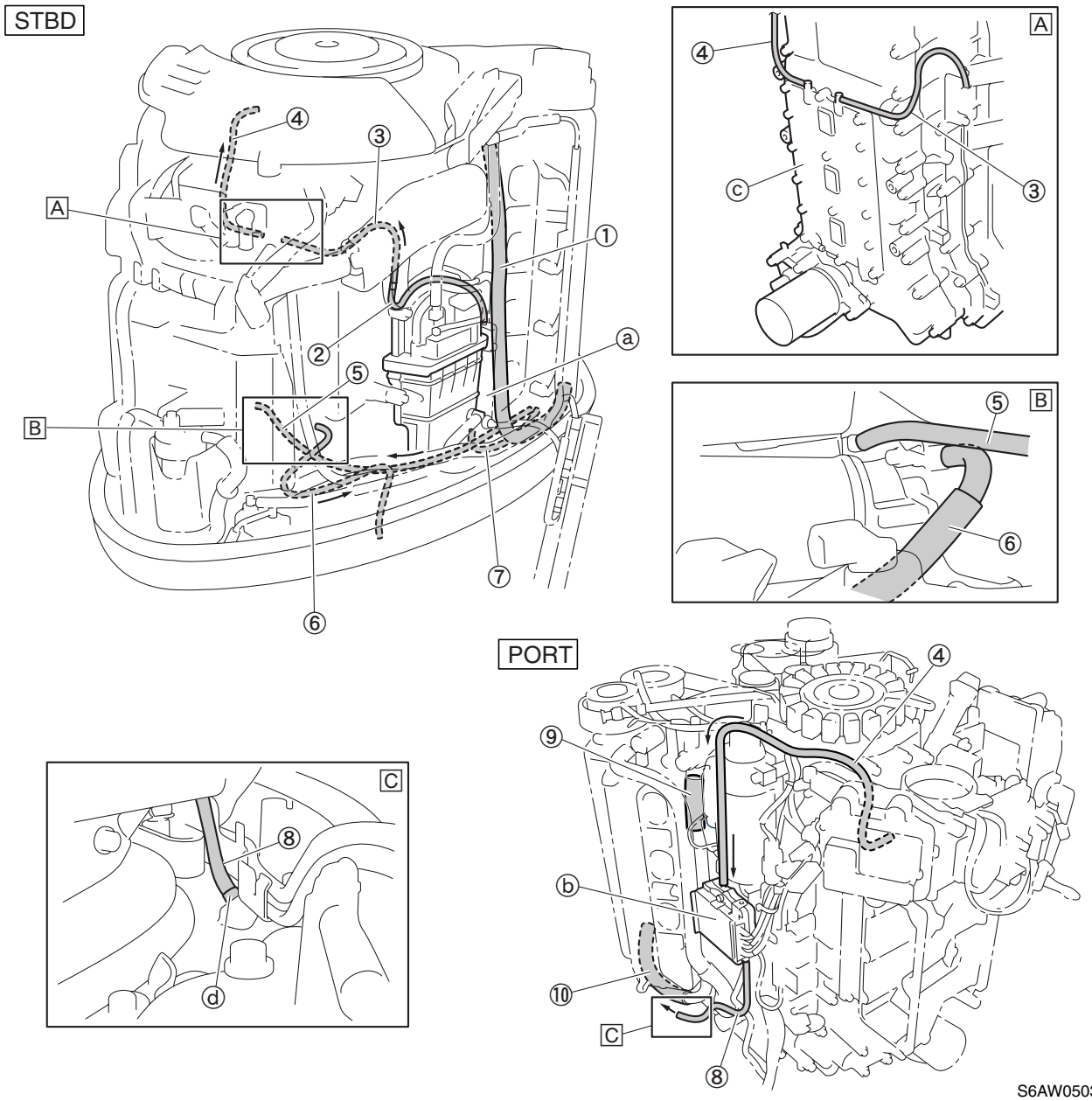
2. To fix the lever ⑤ in the pulled-out position, use the bolt A.



S6BJ05045

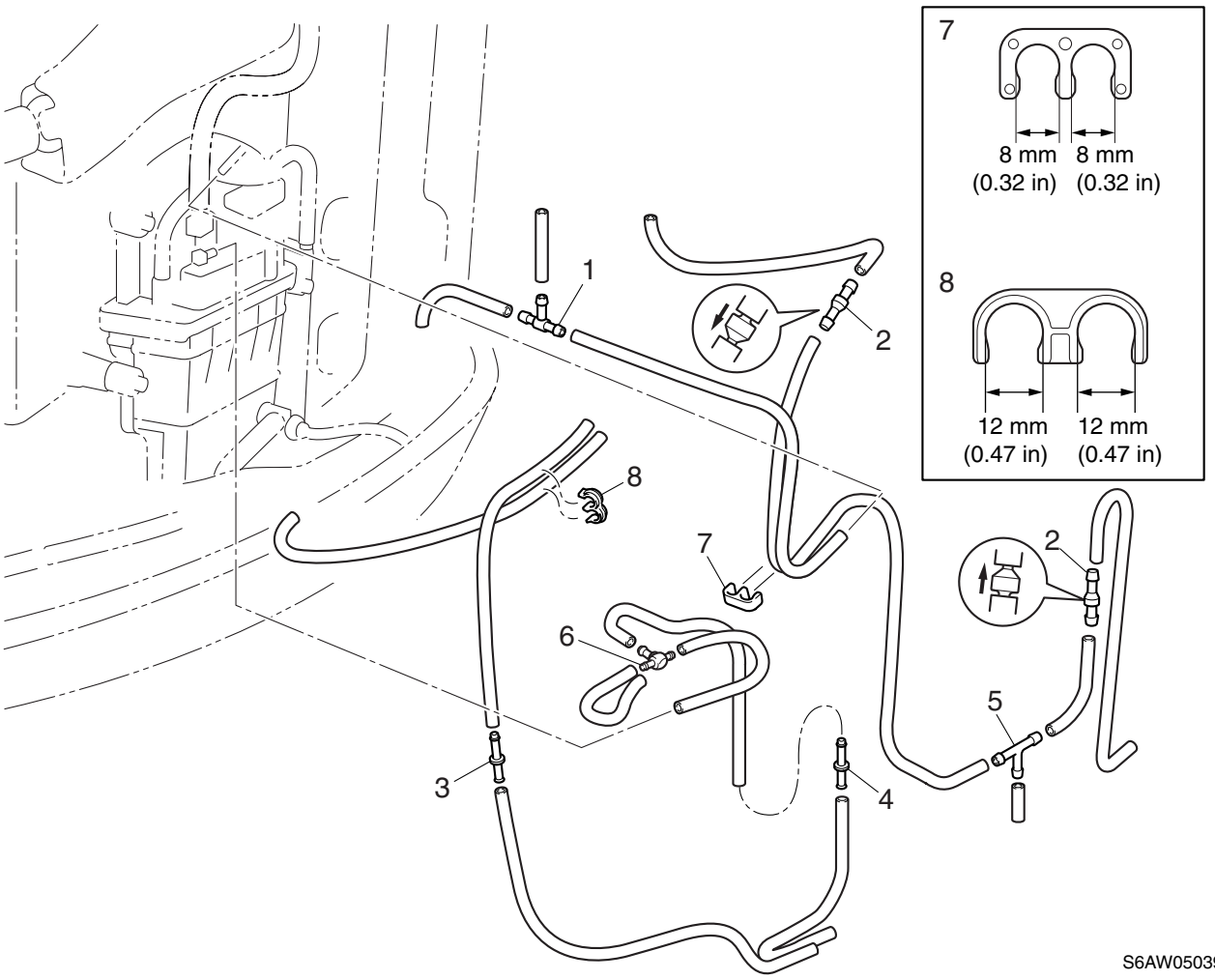
Bolt ②: M5 × 35 mm
Nut ③: M5
Washer ④
Inside diameter: 6.5 mm (0.24 in)
Outside diameter: 16.0 mm (0.63 in)

Cooling water hose

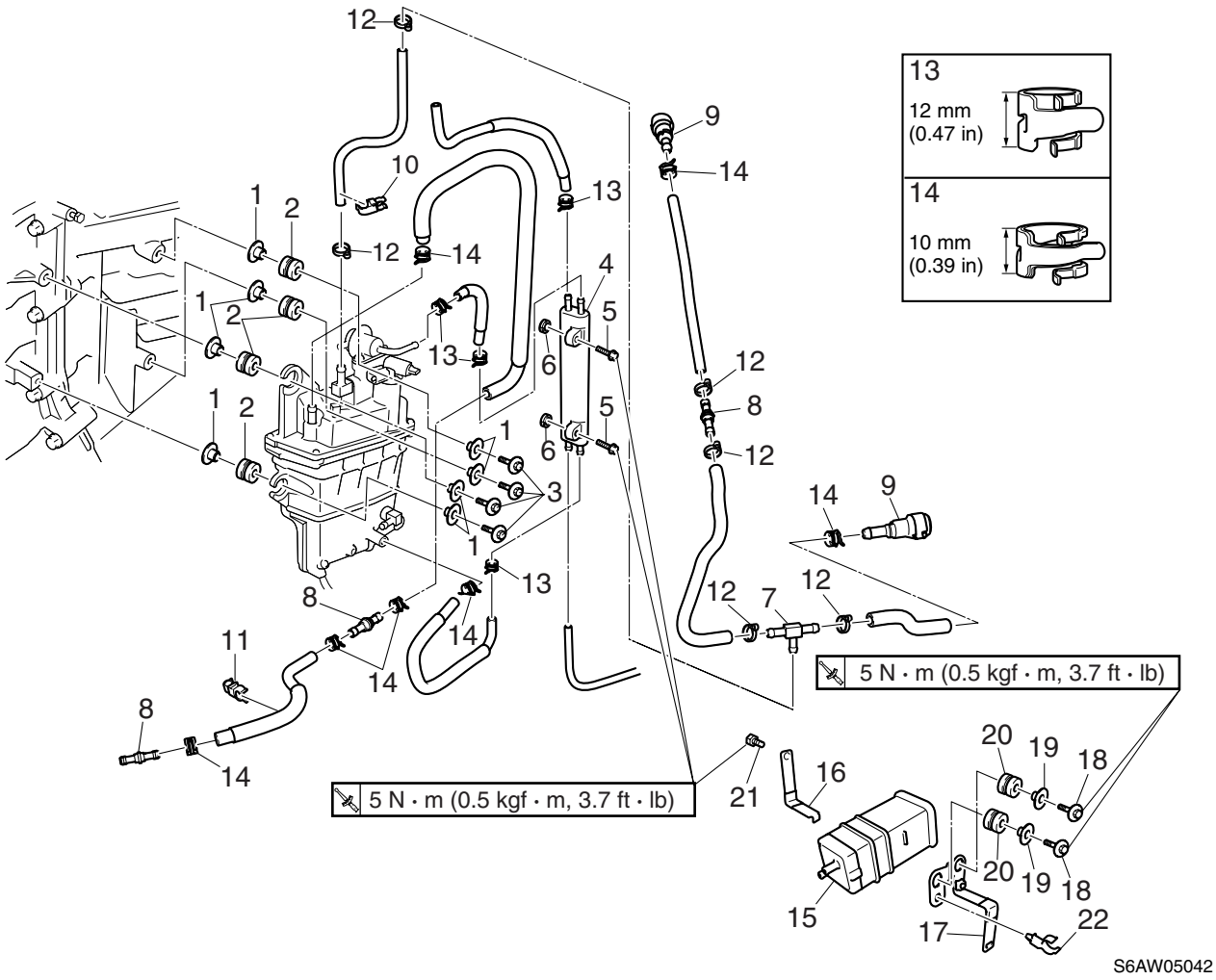


① Cooling water hose (thermostat cover-to-cooling water pipe)
② Cooling water hose (fuel cooler-to-joint)
③ Cooling water hose (joint-to-crankcase cover)
④ Cooling water hose (crankcase cover-to-Rectifier Regulator)
⑤ Cooling water hose (cylinder block-to-crankcase cover)
⑥ Cooling water hose (crankcase cover-to-bottom cowling)
⑦ Cooling water hose (cylinder block-to-fuel cooler)
⑧ Cooling water hose (Rectifier Regulator-to-cooling water pilot hole)
⑨ Cooling water hose (thermostat cover-to-cooling water pipe)
⑩ Cooling water hose (cooling water pipe-to-cooling water pipe)

ⓐ Fuel cooler
ⓑ Rectifier Regulator
ⓒ Crankcase cover
ⓓ Cooling water pilot hole



No.	Part name	Q'ty	Remarks
1	Joint	1	
2	Check valve	2	
3	Joint	1	ø5
4	Joint	1	ø5
5	Joint	1	
6	Joint	1	
7	Holder	1	
8	Holder	1	



No.	Part name	Q'ty	Remarks
18	Bolt	2	M6 × 28 mm
19	Collar	2	
20	Grommet	2	
21	Bolt	1	M6 × 10 mm
22	Clamp	1	

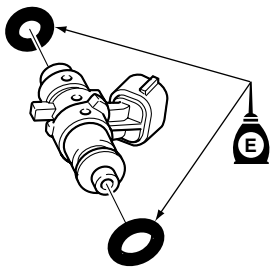
Checking the fuel rail

1. Reduce the fuel pressure. See “Reducing the fuel pressure” (6-27).

2. Check the fuel rails. Replace the fuel rail if cracked or deformed. To check the fuel injectors, see “Checking the fuel injector” (5-37).

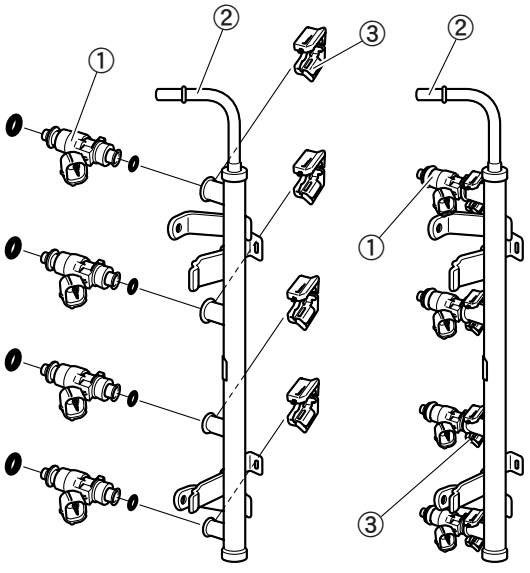
Installing the fuel injector

1. Apply engine oil to new O-rings, and then install them onto the fuel injectors.



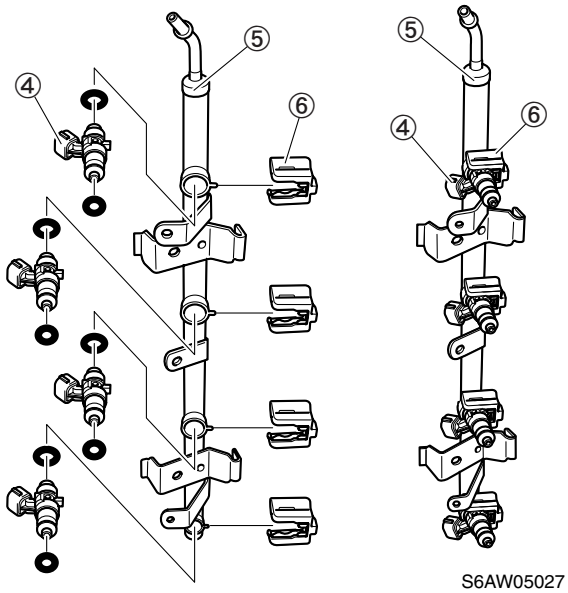
S6AW05025

2. Install the fuel injectors ① onto the port fuel rail ②, and then install the holders ③ as shown.



S6AW05026

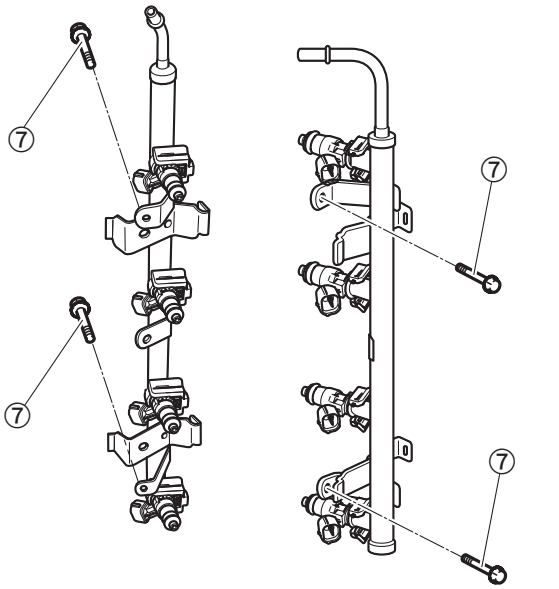
3. Install the fuel injectors ④ onto the starboard fuel rail ⑤, and then install the holders ⑥ as shown.



S6AW05027

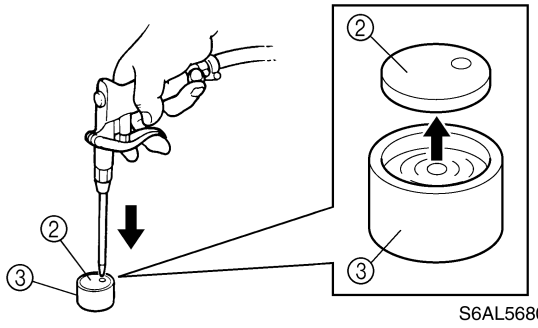
4. Install the fuel rails onto the cylinder heads.

5. Tighten the bolts ⑦ equally and gradually.



S6AW05028

12. Remove the valve shim ② from the valve lifter ③ using compressed air.



S6AL5680

NOTE:
Do not mix the valve train parts. Keep them organized in their proper groups.

13. Measure the valve shim thickness using a micrometer, and then note the measurement data.

14. Select the necessary valve shim by calculating its thickness using the following formula.

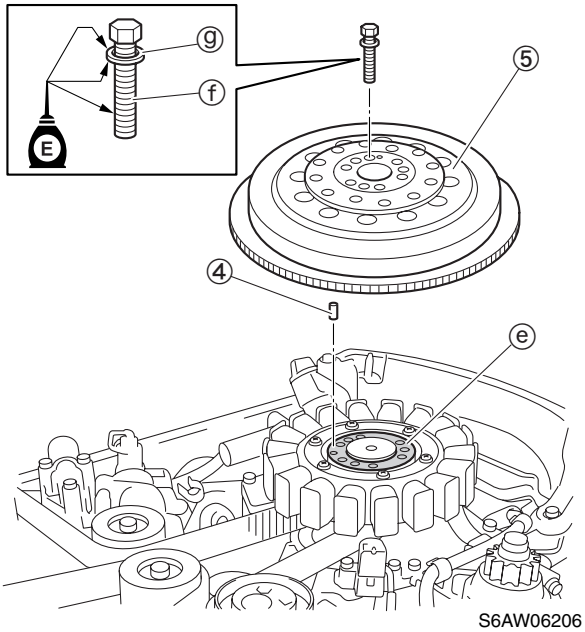
Necessary valve shim thickness = Removed valve shim thickness + Measured valve clearance – Specified valve clearance

15. Install the necessary valve shim into the valve lifter.

16. Install the camshafts, driven sprockets, and timing belt. To install the camshafts, driven sprockets, and timing belt, see "Installing the camshaft, driven sprocket, and timing belt" (7-59).

17. Install the stator assembly.

18. Install the dowel ④ and the flywheel magnet ⑤. Totally the crankshaft flange seating ⓔ and the flywheel magnet seating must be cleaned and degrease before installation. Apply some engine oil to the threads of the flywheel magnet bolts ⓕ and the washers ⓖ.

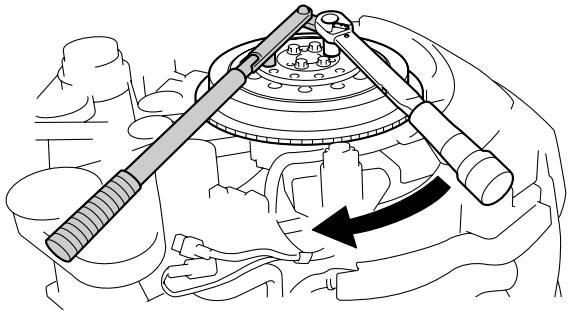


S6AW06206

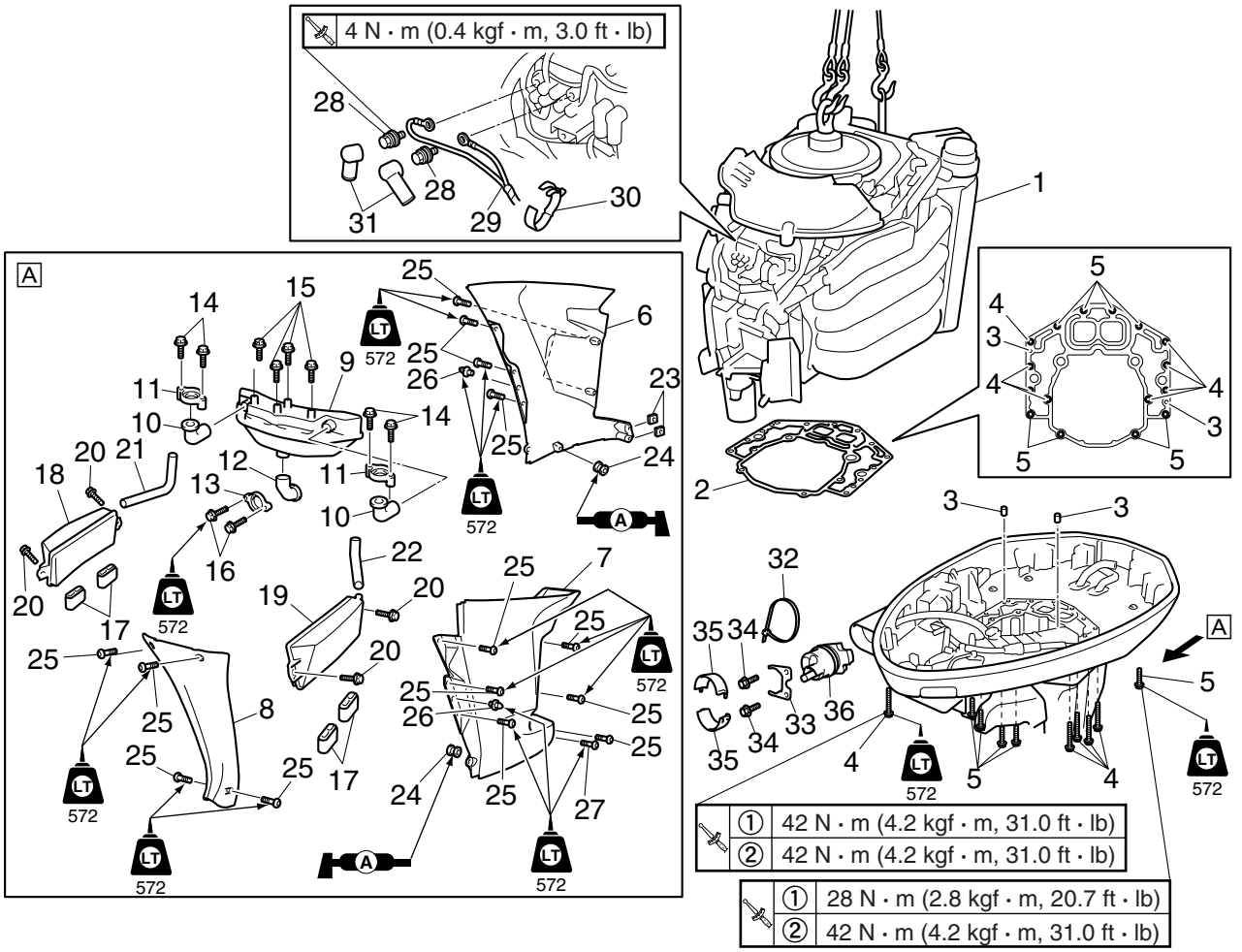
CAUTION:
Do not reuse the flywheel magnet bolts, always replace it with a new one.

19. Install the intake manifold (STBD).

20. Tighten the flywheel magnet bolts to the specified torque.


S6AW06059

CAUTION:
Apply force in the direction of the arrows shown to prevent the flywheel holder from slipping off easily.



S6AW06189

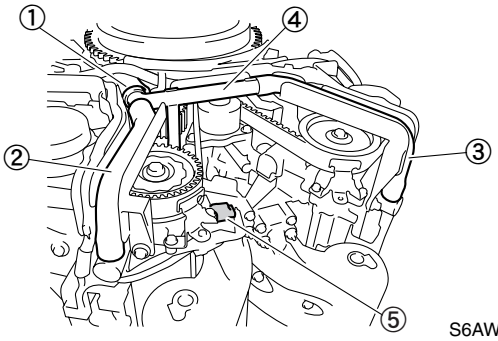
No.	Part name	Q'ty	Remarks
35	Tube retainer	1	
36	Grommet	1	

7

Removing the wiring harness, the wiring harness guide and the flywheel magnet

1. When remove the wiring harness and wiring harness guide, the fuel line must be disconnected, so be sure to reduce the fuel pressure before performing the disassembly procedure. To reduce the fuel pressure, see “Reducing the fuel pressure” (6-27).

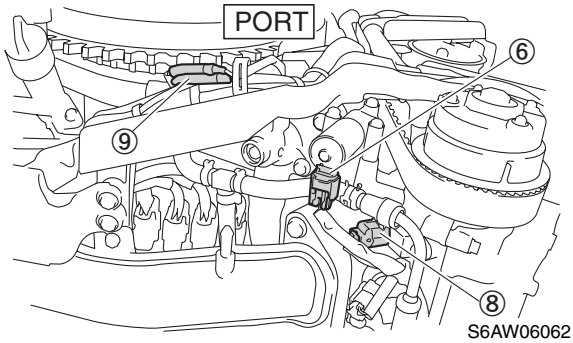
2. Remove the breather hoses ①, ②, ③, and the breather pipe ④.



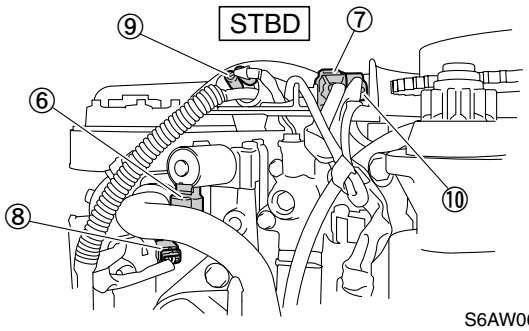
S6AW06061

3. Disconnect the OCV coupler ⑥, the engine temperature sensor coupler ⑦, the exhaust cam position sensor coupler ⑤, the intake cam position sensor couplers ⑧, and the thermoswitch connector ⑨.

4. Remove the engine temperature sensor coupler ⑦ and the pulser coil coupler ⑩ from the wiring harness guide.

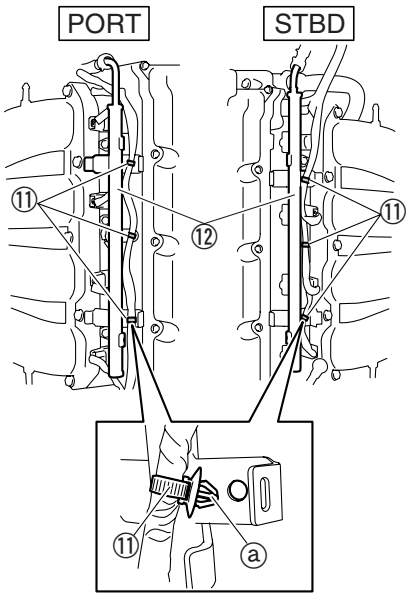


S6AW06062



S6AW06063

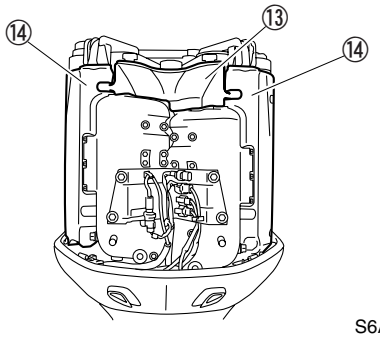
5. Remove the projections ⓐ on the holders ⑪ from fuel rails ⑫ (PORT and STBD), and then pull up the wiring harness.



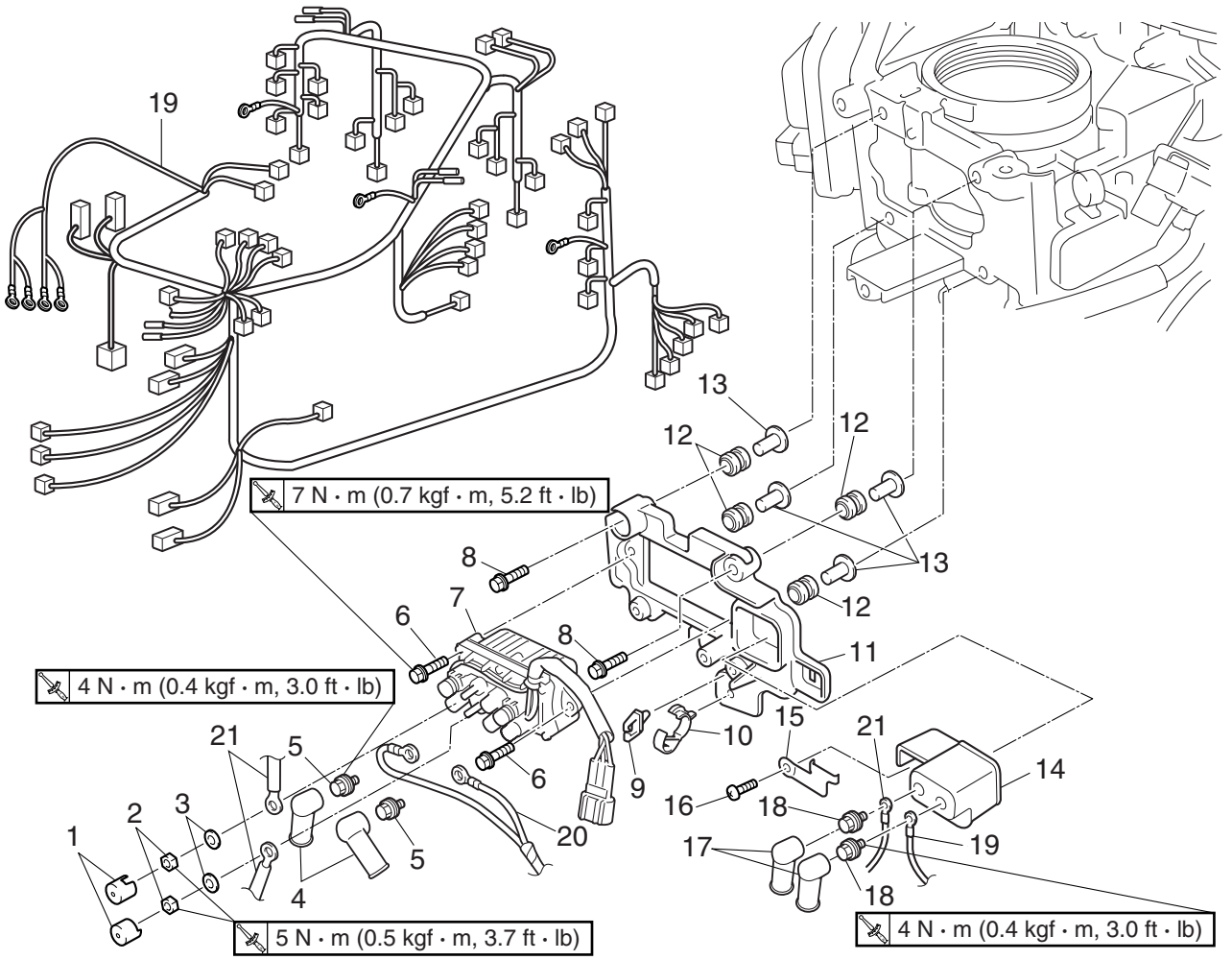
S6BJ07007

6. Disconnect all ignition coil couplers.

7. Remove the rear cover ⑬ and the side covers ⑭, and then disconnect all the fuel injector couplers and ground read (STBD).



S6AW06012-1



S6AW06202

No.	Part name	Q'ty	Remarks
18	Bolt	2	M6 × 10 mm
19	Wiring harness	1	
20	PTT motor lead	1	
21	Wiring harness	1	

7

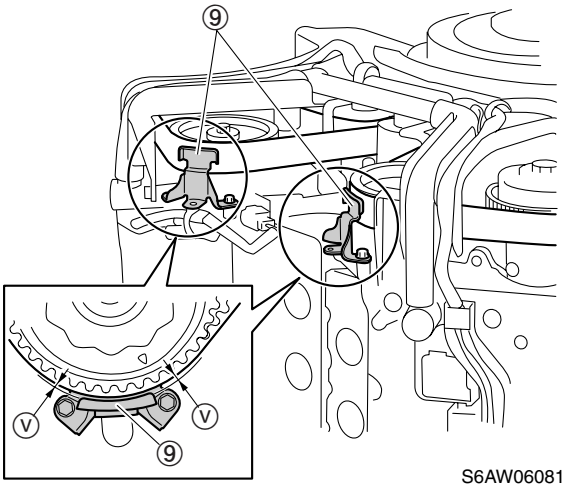
Flywheel holder: YB-06139

Flywheel magnet bolts:
1st: 40 N·m (4.0 kgf·m, 29.5 ft·lb)
2nd: 90°

29. Install the wiring harness guide. To install the wiring harness guide, see “Installing the wiring harness, the wiring harness guide and the flywheel magnet” (7-29).

30. Install all parts removed during disassembly.

31. Install the timing belt guides ⑨, and then adjust the timing belt guide clearance ⓥ.



S6AW06081-a

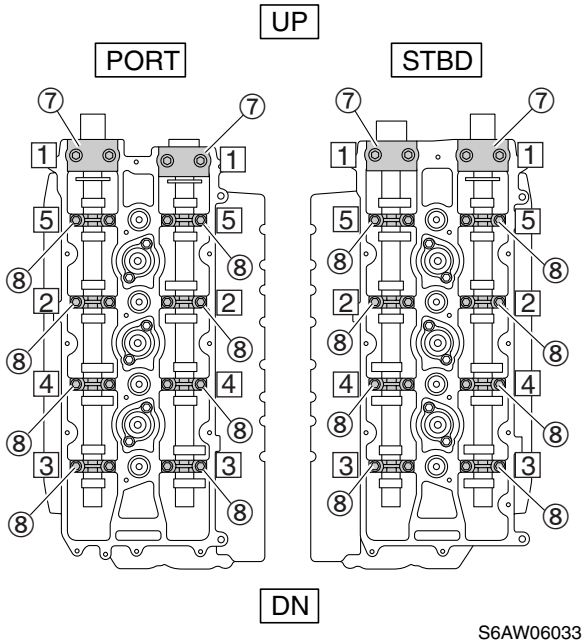
Timing belt guide clearance ⓥ:
1.0 ± 0.5 mm (0.04 ± 0.02 in)

32. Check that the wiring harness, hoses, and other parts do not interfere with any moving parts.

CAUTION:

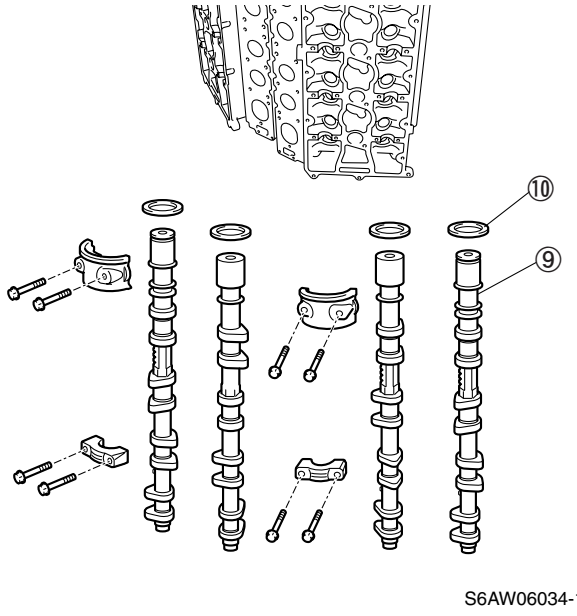
Incorrect assembly of the flywheel magnet cover may result in the interference with the timing belt.

15. Gradually loosen the camshaft caps ⑦ and ⑧ in several stages and in the sequence shown. Take precaution not to tilt the camshafts.



S6AW06033

16. Remove the camshafts ⑨ and oil seals ⑩.



S6AW06034-1

NOTE:
See the exploded diagram (7-52).

17. Remove the valve lifters from the cylinder heads.

NOTE:
Do not mix the valve train parts. Keep them organized in their proper groups.

Checking the sprocket

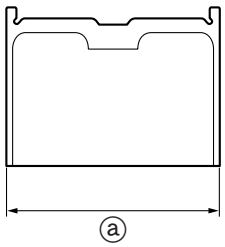
1. Check the drive sprocket. Replace if cracked, damaged, or worn.

2. Check the driven sprockets. Replace the VCT assembly or driven sprocket if cracked, damaged, or worn.

Checking the valve lifter

1. Check the valve lifters. Replace if damaged, scratched, or worn.

2. Measure the valve lifter outside diameter. Replace if out of specification.



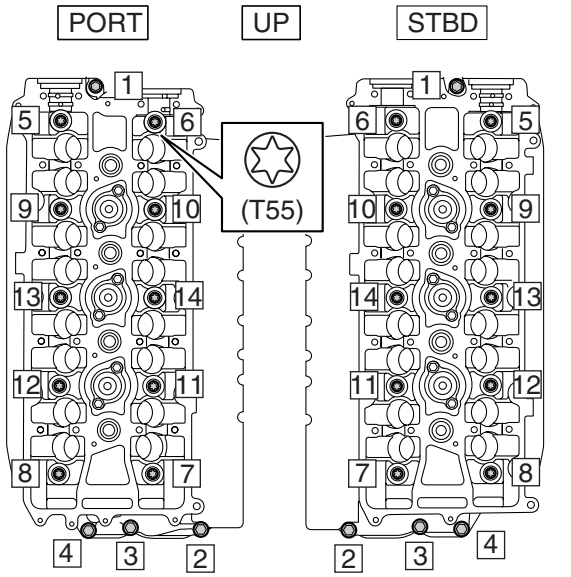
S6AW06084

Valve lifter outside diameter ⓐ:
32.982–32.997 mm
(1.2985–1.2991 in)

7

Removing the cylinder head

1. Remove the cylinder head bolts in the sequence shown.

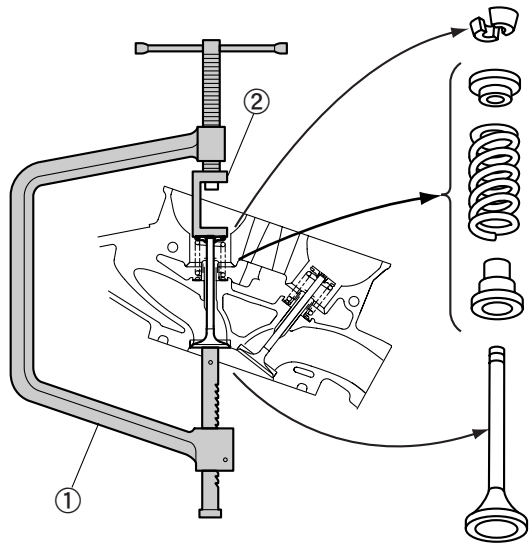


S6AW06076

CAUTION:

Do not scratch or damage the mating surfaces of the cylinder head and cylinder block.

2. Remove the intake and exhaust valves.



S6AW06077

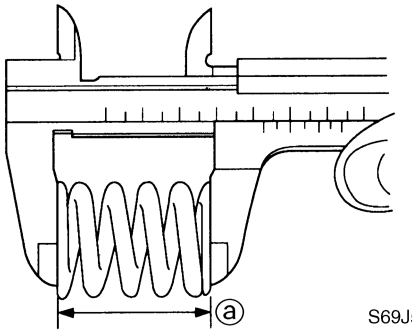
NOTE:

Be sure to keep the valves, springs, and other parts in the order as they were removed.

Valve spring compressor ①:
(commercially available)
Valve spring compressor attachment ②:
(commercially available)

Checking the valve spring

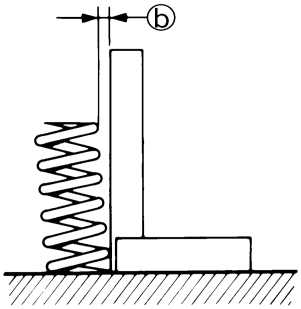
1. Measure the valve spring free length ⓐ. Replace if below specification.



S69J5720

Valve spring free length ⓐ:
44.20 mm (1.740 in)

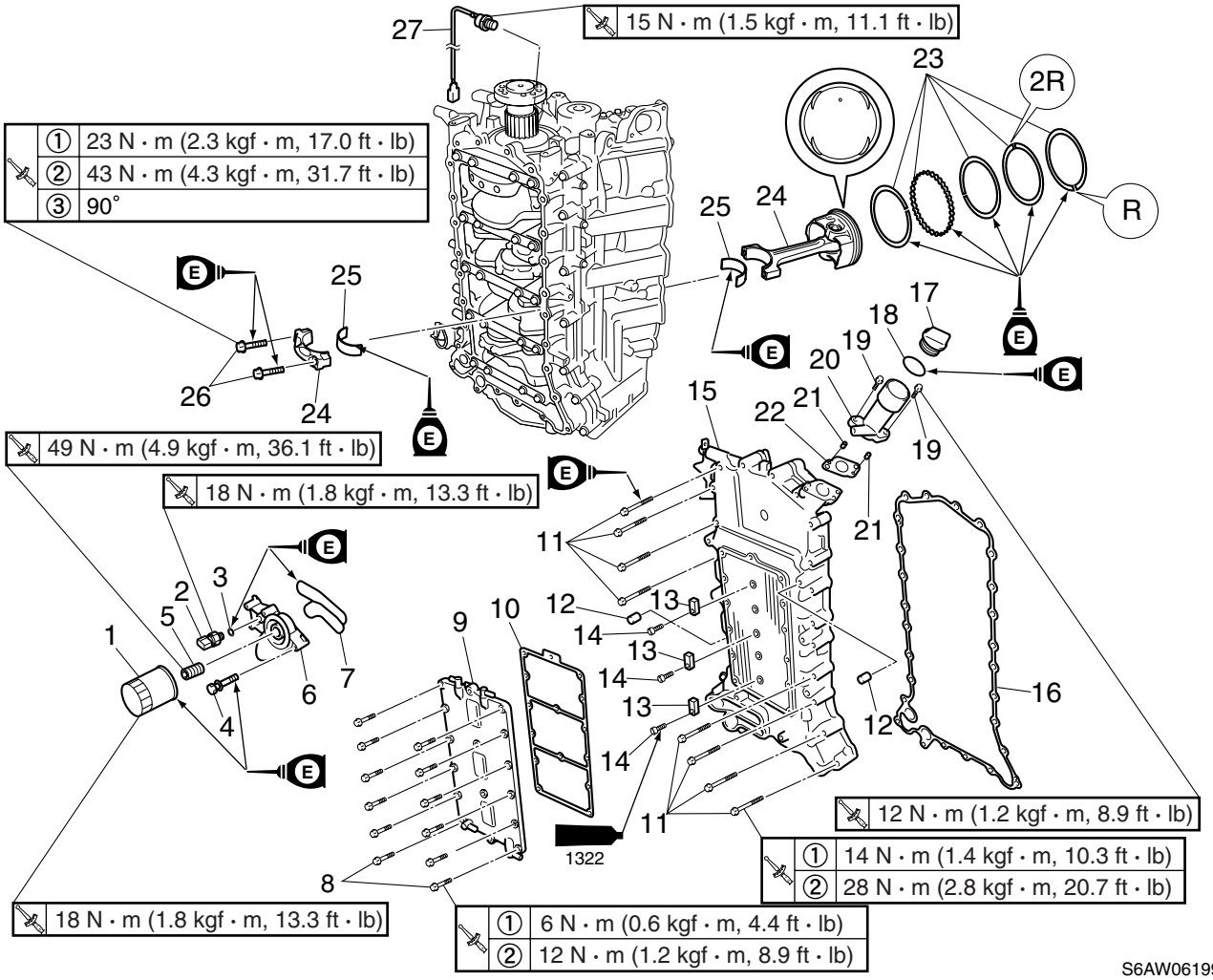
2. Measure the valve spring tilt ⓑ. Replace if above specification.



S69J5730

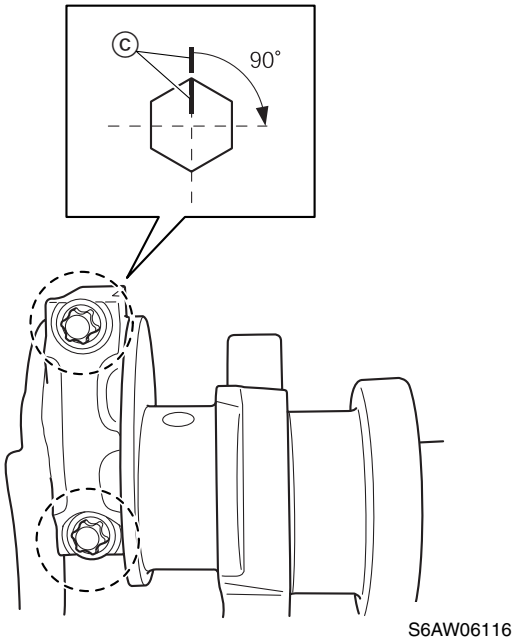
Valve spring tilt limit ⓑ:
1.2 mm (0.05 in)

7



No.	Part name	Q'ty	Remarks
18	O-ring	1	
19	Bolt	2	M6 × 20 mm
20	Joint	1	
21	Dowel	2	
22	Gasket	1	**Not reusable**
23	Piston ring set	8	
24	Connecting rod assembly	8	
25	Connecting rod bearing	16	
26	Bolt	16	**Not reusable** M9 × 44 mm
27	Engine temperature sensor	1	

5. Tighten the connecting rod cap bolts to the specified torque in 3 stages. Then, put a mark ⓒ over the connecting rod cap bolts and the connecting rod cap, and retighten the bolt by additional 90°.

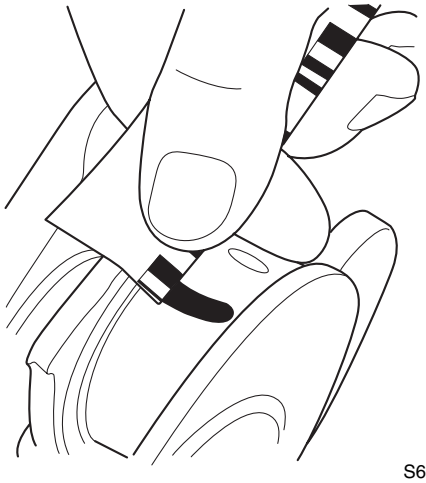


S6AW06116

NOTE:
- Reuse the removed connecting rod cap bolts when checking the oil clearance.
- Do not turn the connecting rod until the crankpin oil clearance measurement has been completed.

Connecting rod cap bolt:
1st: 23 N·m (2.3 kgf·m, 17.0 ft·lb)
2nd: 43 N·m (4.3 kgf·m, 31.7 ft·lb)
3rd: 90°

6. Remove the connecting rod cap and measure the width of the compressed Plastigauge (PG-1) on each crankpin. Replace the connecting rod bearing if out of specification.



S6AW06117

Crankpin oil clearance:
0.025–0.055 mm
(0.0010–0.0022 in)

7. After the measurement, thoroughly remove the plastigauge adhered to the crank pins and the connecting rod bearings, taking care not to scratch these parts.

Selecting the connecting rod bearing

1. When replacing the connecting rod bearings, select the suitable bearings as follows.

2. Assembling the connecting rod assembly, and then tighten the connecting rod assembly bolts to the specfied torque.

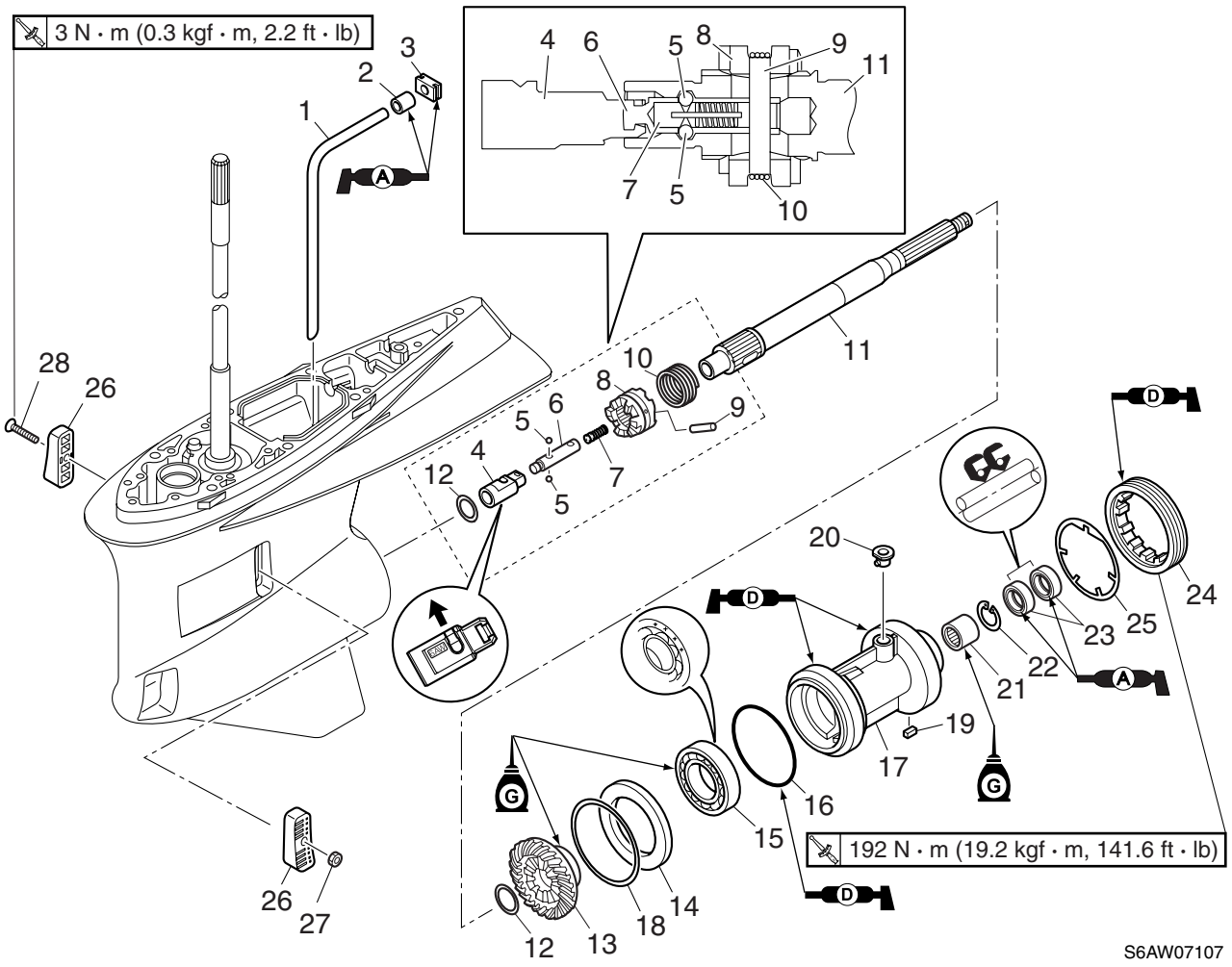
NOTE:
Reuse the connecting rod assembly bolts.

Connecting rod cap bolt:
1st: 23 N·m (2.3 kgf·m, 17.0 ft·lb)
2nd: 43 N·m (4.3 kgf·m, 31.7 ft·lb)
3rd: 90°

7

Lower unit

Propeller shaft housing (regular rotation model)

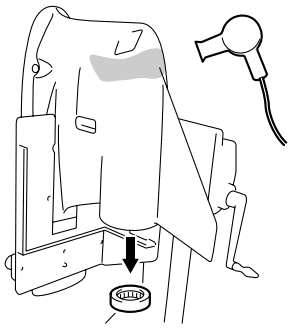


No.	Part name	Q'ty	Remarks
1	Water pipe	1	
2	Rubber seal	1	
3	Rubber seal	1	
4	Shift rod joint	1	
5	Ball	2	
6	Slider	1	
7	Shift plunger	1	
8	Dog clutch	1	
9	Cross pin	1	
10	Spring	1	
11	Propeller shaft	1	
12	Washer	2	
13	Reverse gear	1	
14	Thrust washer	1	
15	Ball bearing	1	**Not reusable**
16	O-ring	1	**Not reusable**
17	Propeller shaft housing	1	

NOTE:
Be sure to remove the forward gear before removing the needle bearing.

Needle bearing attachment ①: 90890-06665
Driver rod LL ②: 90890-06605

3. Turn the lower unit upside down as shown, and remove the roller bearing by heating all areas of the roller bearing on the lower case to approximately 80 °C (176 °F), using a heat gun or a burner.



S6AW07044

⚠ WARNING
- **Use a heat-resistant glove, since it may cause a burn.**
- **Keep away any flammable materials such as gasoline and oil in the work area to prevent possible fire.**
- **Work with a good ventilation.**

NOTE:
- Roller bearing will fall off suddenly, so place something to cushion beneath it.
- Tap lightly on the torpedo of the lower case using a plastic hammer if the roller bearing does not come off.

Checking the pinion and forward gear

1. Check the teeth of the pinion, and the teeth and dogs of the forward gear. Replace the pinion or forward gear if cracked or worn.

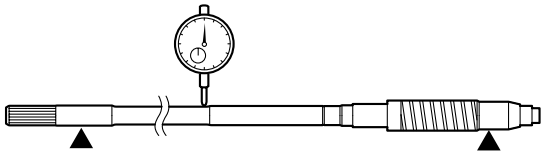
Checking the bearing

1. Check the bearings. Replace the bearing if pitted or if there is rumbling.

Checking the drive shaft

1. Check the drive shaft. Replace the drive shaft if bent or worn.

2. Measure the drive shaft runout. Replace the drive shaft if above specification.



S6AW07045

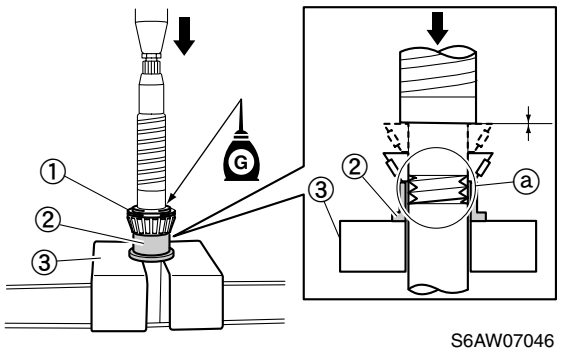
Drive shaft runout limit: 1.0 mm (0.04 in)

Checking the lower case

1. Check the skeg, torpedo, and anti cavitation plate. Replace the lower case if cracked or damaged.

Assembling the drive shaft

1. Install the bearing ① to the drive shaft.



S6AW07046

CAUTION:
- **Make sure that the special service tool ② or the base ③ does not interfere with the screw ⓐ of the drive shaft.**
- **Do not reuse the bearing, always replace it with a new one.**

Bearing inner race attachment ②: 90890-06662

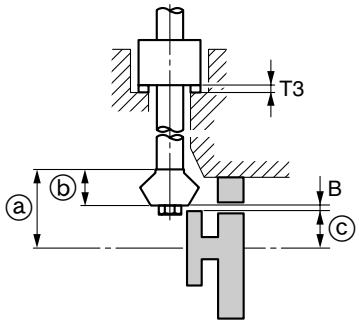
8

Shimming

Shimming is not required when assembling the original lower case and inner parts.
Shimming is required when assembling the original inner parts and a new lower case.
Shimming is required when replacing the inner part(s).
Position of the pinion is the base for the selection of shim T1 and the shim T2, so always select the shim T3 before selecting the shim T1 and the shim T2.

Selecting the pinion shim T3

Install the shim T3 using the "compensation measurement of pinion MD" and the "tooth contact compensation."



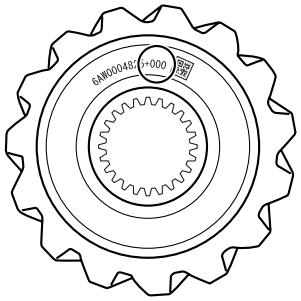
S6AW07111

ⓐ : MD (69 mm)
ⓑ : Pinion height (32 mm)
ⓒ : Special service tool measurement (36.5 mm)
Tooth contact compensation value "Z":
0.14 mm

B = (MD) ⓐ + (MD compensation "measurement P") + (Tooth contact compensation "Z") – (Pinion height) ⓑ – (Pinion height compensation "measurement H") – (Special service tool measurement) ⓒ
= 69 + (MD compensation "measurement P") + 0.14 – 32 – (Pinion height compensation "measurement H") – 36.5
= 0.64 – (MD compensation "measurement P") – (Pinion height compensation "measurement H")

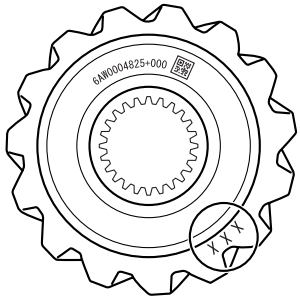
When the difference between the calculated value B and the measurement M is larger than ± 0.07 mm, adjust the difference by the shims.

1. Check the last 3 digits of the manufacturer's stamped mark at the left of the QR code on the pinion gear, and use the 1/1,000 of the value as the measurement P.



S6AW07089

2. Check the hand written engraving on the pinion gear, and use the 1/1,000 of the value as the measurement H.

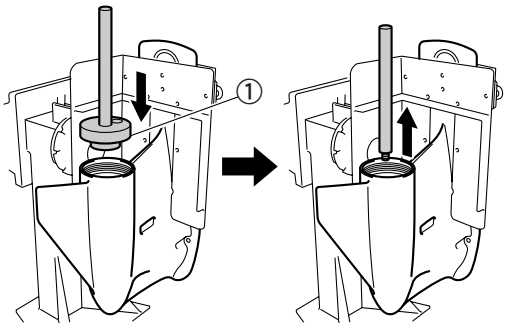


S6AW07090

3. Obtain the calculated value B based on P and H measurements on the pinion gear, see "Pinion 'Calculated value B' table" (8-34).

Example:
When measurement P is 0.00 mm and measurement H is 0.03 mm, the calculated value B is 0.61 mm.

4. Install the special service tool ① inside the lower case, and remove the rod.

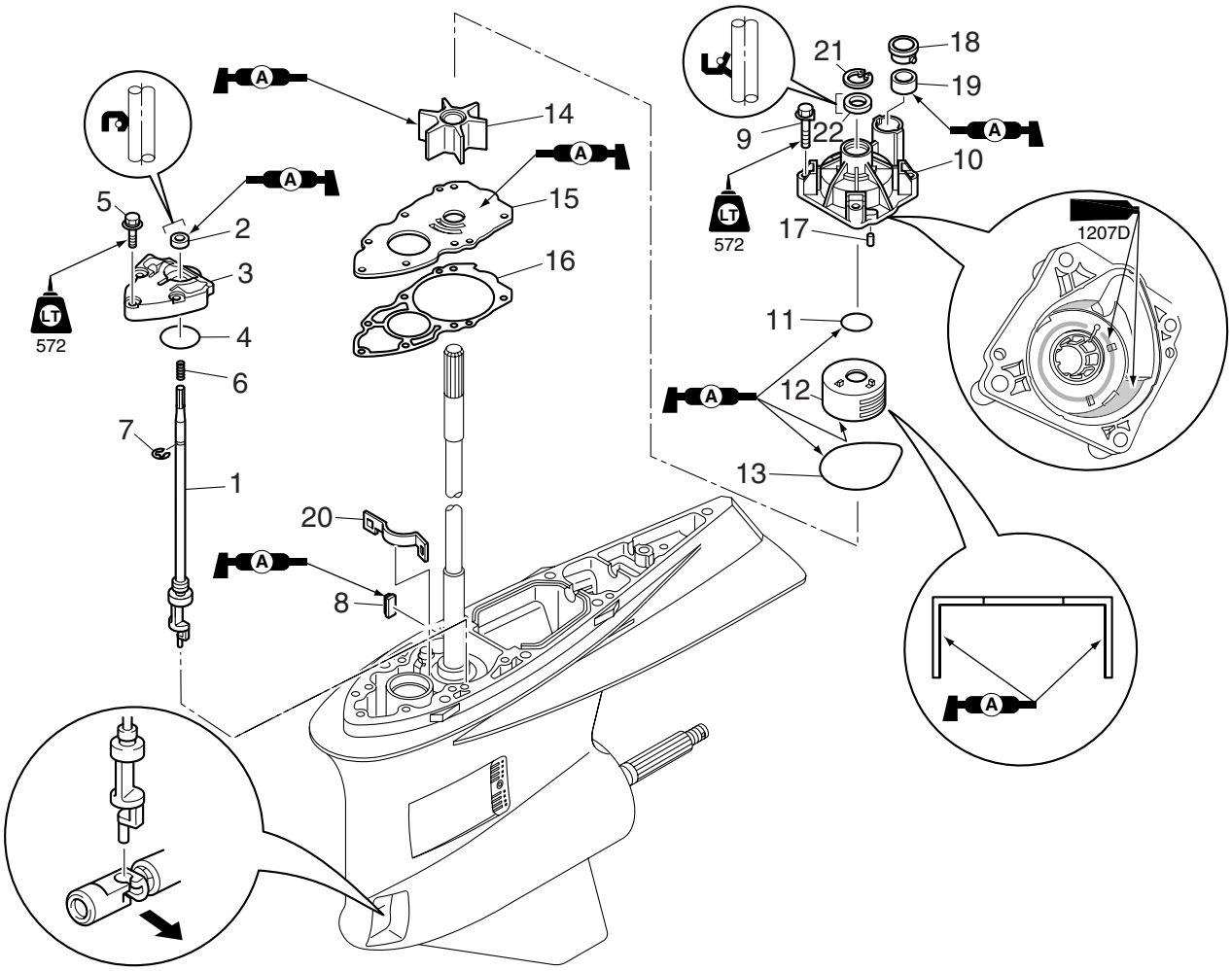


S6AW07091

8

(mm)

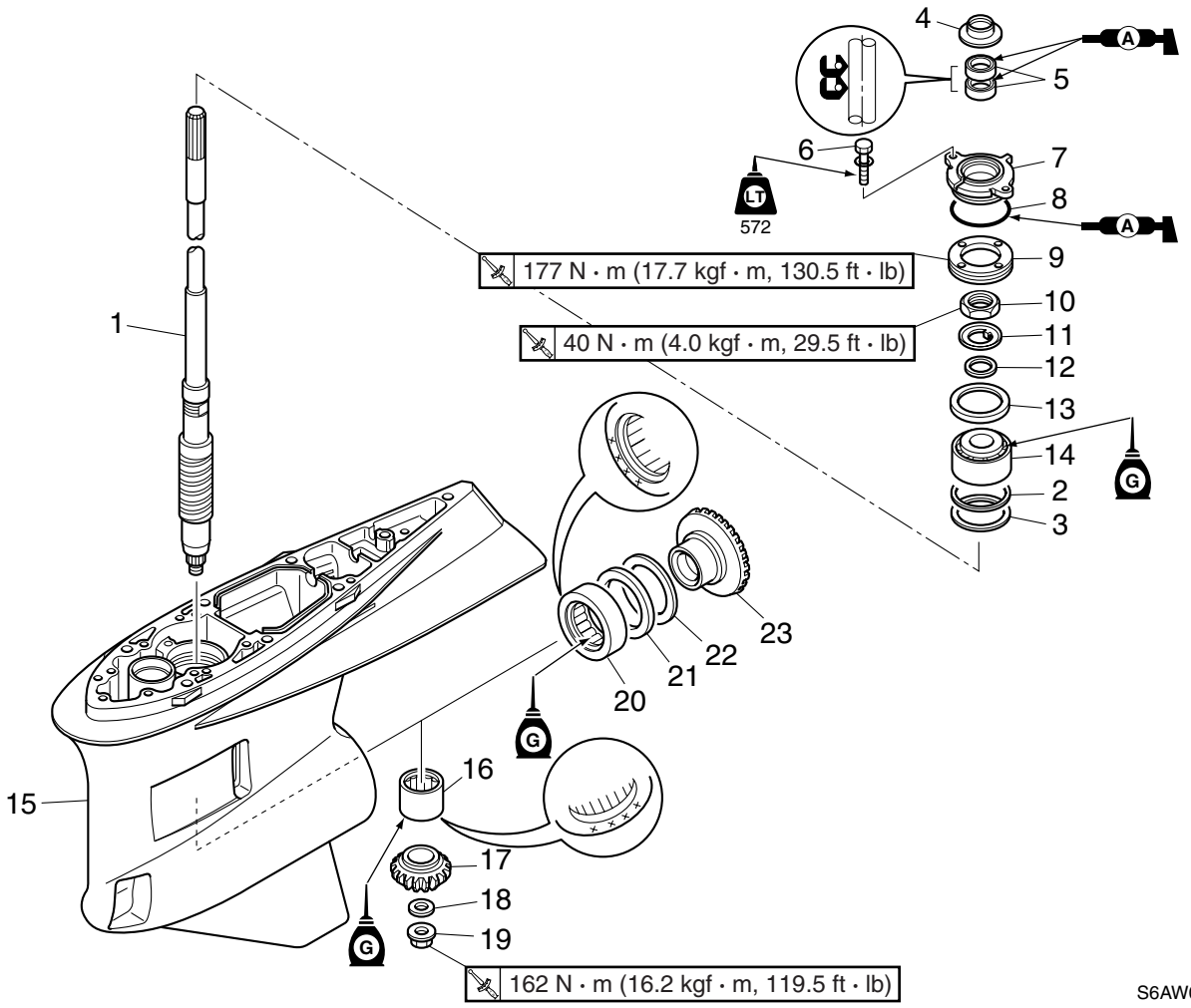
Calculated value: B \ Measurement: M	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64
0.47	*	*	-0.10	-0.10	-0.10	-0.10	-0.12	-0.12	-0.15	-0.15	-0.15	-0.18	-0.18
0.48	*	*	*	-0.10	-0.10	-0.10	-0.10	-0.12	-0.12	-0.15	-0.15	-0.15	-0.18
0.49	*	*	*	*	-0.10	-0.10	-0.10	-0.10	-0.12	-0.12	-0.15	-0.15	-0.15
0.50	*	*	*	*	*	-0.10	-0.10	-0.10	-0.10	-0.12	-0.12	-0.15	-0.15
0.51	*	*	*	*	*	*	-0.10	-0.10	-0.10	-0.10	-0.12	-0.12	-0.15
0.52	*	*	*	*	*	*	*	-0.10	-0.10	-0.10	-0.10	-0.12	-0.12
0.53	*	*	*	*	*	*	*	*	-0.10	-0.10	-0.10	-0.10	-0.12
0.54	*	*	*	*	*	*	*	*	*	-0.10	-0.10	-0.10	-0.10
0.55	*	*	*	*	*	*	*	*	*	*	-0.10	-0.10	-0.10
0.56	*	*	*	*	*	*	*	*	*	*	*	-0.10	-0.10
0.57	*	*	*	*	*	*	*	*	*	*	*	*	-0.10
0.58	*	*	*	*	*	*	*	*	*	*	*	*	*
0.59	0.10	*	*	*	*	*	*	*	*	*	*	*	*
0.60	0.10	0.10	*	*	*	*	*	*	*	*	*	*	*
0.61	0.10	0.10	0.10	*	*	*	*	*	*	*	*	*	*
0.62	0.10	0.10	0.10	0.10	*	*	*	*	*	*	*	*	*
0.63	0.12	0.10	0.10	0.10	0.10	*	*	*	*	*	*	*	*
0.64	0.12	0.12	0.10	0.10	0.10	0.10	*	*	*	*	*	*	*
0.65	0.15	0.12	0.12	0.10	0.10	0.10	0.10	*	*	*	*	*	*
0.66	0.15	0.15	0.12	0.12	0.10	0.10	0.10	0.10	*	*	*	*	*
0.67	0.15	0.15	0.15	0.12	0.12	0.10	0.10	0.10	0.10	*	*	*	*
0.68	0.18	0.15	0.15	0.15	0.12	0.12	0.10	0.10	0.10	0.10	*	*	*
0.69	0.18	0.18	0.15	0.15	0.15	0.12	0.12	0.10	0.10	0.10	0.10	*	*
0.70	0.18	0.18	0.18	0.15	0.15	0.15	0.12	0.12	0.10	0.10	0.10	0.10	*
0.71	0.20	0.18	0.18	0.18	0.15	0.15	0.15	0.12	0.12	0.10	0.10	0.10	0.10
0.72	0.20	0.20	0.18	0.18	0.18	0.15	0.15	0.15	0.12	0.12	0.10	0.10	0.10
0.73	0.22	0.20	0.20	0.18	0.18	0.18	0.15	0.15	0.15	0.12	0.12	0.10	0.10
0.74	0.22	0.22	0.20	0.20	0.18	0.18	0.18	0.15	0.15	0.15	0.12	0.12	0.10
0.75	0.25	0.22	0.22	0.20	0.20	0.18	0.18	0.18	0.15	0.15	0.15	0.12	0.12



S6BJ08013

No.	Part name	Q'ty	Remarks
1	Shift rod	1	
2	Oil seal	1	**Not reusable**
3	Oil seal housing	1	
4	O-ring	1	**Not reusable**
5	Bolt	3	M8 × 35 mm
6	Spring	1	
7	E-clip	1	
8	Flat key	1	
9	Bolt	4	M8 × 45 mm
10	Water pump housing	1	
11	O-ring	1	**Not reusable**
12	Insert cartridge	1	
13	O-ring	1	**Not reusable**
14	Impeller	1	
15	Outer plate cartridge	1	
16	Gasket	1	**Not reusable**
17	Dowel	2	

Drive shaft and lower case (counter rotation model)

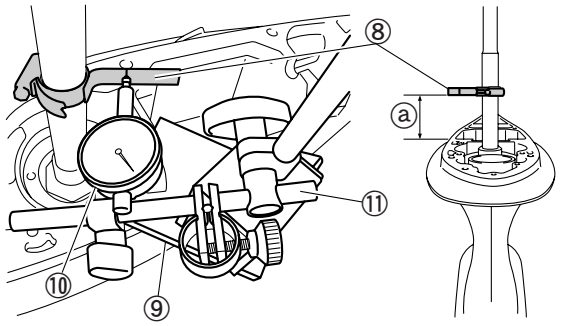


S6AW07108

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Shim T3	—	
3	Washer	1	
4	Cover	1	
5	Oil seal	2	**Not reusable**
6	Bolt	2	M8 × 20 mm
7	Oil seal housing	1	
8	O-ring	1	**Not reusable**
9	Ring nut	1	
10	Nut	1	
11	Claw washer	1	
12	Washer	1	
13	Spacer	1	
14	Taper roller bearing	1	**Not reusable**
15	Lower case	1	
16	Needle bearing	1	
17	Pinion	1	

Ring nut:
120 N·m (12.0 kgf·m, 88.5 ft·lb)

4. Install the backlash indicator ⑧ to the drive shaft, and then install the dial gauge to the lower unit.



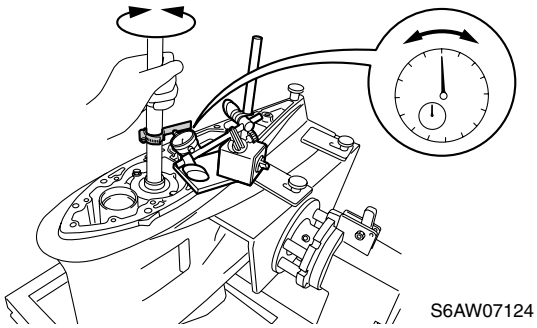
S6AW07129

NOTE:
Install the dial gauge so that the plunger contacts the mark on the backlash indicator.

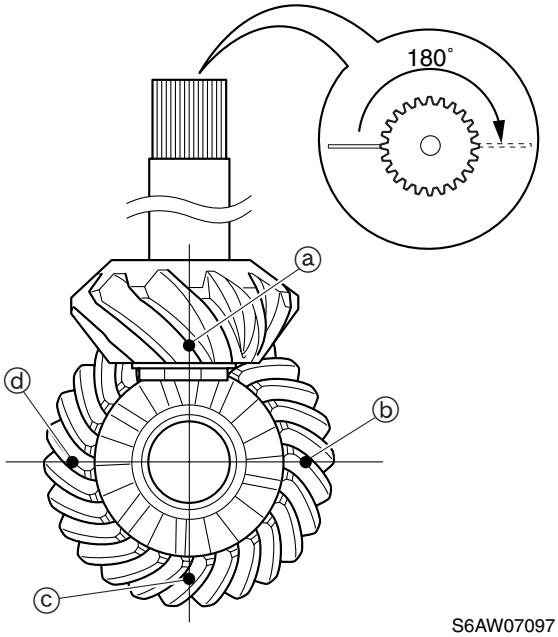
Backlash indicator ⑧: 90890-06836
Backlash adjustment plate ⑨:
YB-07003
Dial indicator gauge ⑩: YU-03097
Magnetic base stand ⑪: YU-A8438

Backlash indicator mounting height ⓐ: 90 mm (3.54 in)

5. Rotate the drive shaft slowly to clockwise and counterclockwise. Measure the backlash at the position it stops rotating for each direction.


S6AW07124

6. Measure the backlash 4 times by rotating the drive shaft by 180°, measuring at the points ⓐ, ⓑ, ⓒ, and ⓓ.



S6AW07097

7. Calculate the average of the 4 measurements values, and use that value as BL1. Shim adjustment is not necessary if the BL1 is within the range of the recommended backlash value.

Recommended backlash:
0.40–0.94 mm (0.0157–0.0370 in)

8. Shim adjustment is necessary if it is out of recommended backlash. Increase or decrease the shim T1 according to the relevant value in the “Reverse gear shim T1 increase or decrease chart” (8-80).
Adjust the shim so it will be at the recommended medium value when the backlash measurement BL1 is out of the recommended backlash value.

Available shim thicknesses:
2.00, 2.03, 2.06, 2.09, 2.12, and
2.15 mm

Use only single shim for the shim T1.

8

Propeller shaft shim T4 increase or decrease table

* Shim adjustment is not necessary where is no number.

(mm)

Measurement M	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16
Increasing or decreasing of shim thickness	-0.28	-0.25	-0.25	-0.22	-0.20	-0.18	-0.15	-0.15	-0.12

Measurement M	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.34
Increasing or decreasing of shim thickness	-0.10	-0.10	-0.10	-0.10	*	*	*	*	*

Measurement M	0.36	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52
Increasing or decreasing of shim thickness	0.10	0.10	0.10	0.10	0.12	0.15	0.15	0.18	0.20

Measurement M	0.54	0.56	0.58	0.60	0.62	0.64	0.66	0.68	0.70
Increasing or decreasing of shim thickness	0.22	0.25	0.25	0.28	0.30	0.32	0.35	0.35	0.38

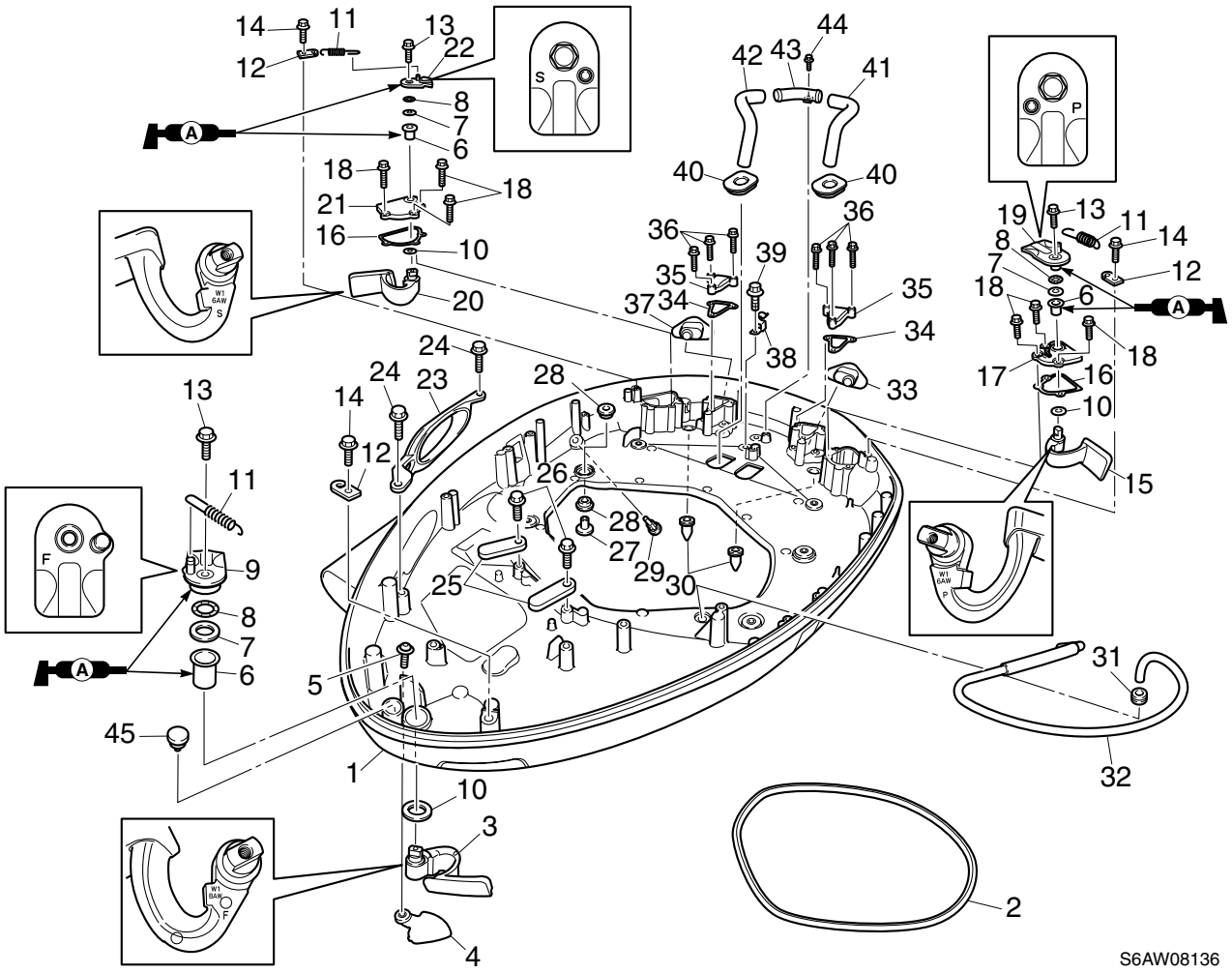
Measurement M	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86	0.88
Increasing or decreasing of shim thickness	0.40	0.42	0.45	0.45	0.48	0.50	0.52	0.55	0.55

Measurement M	0.90	0.92	0.94	0.96	0.98	1.00	1.02	1.04	1.06
Increasing or decreasing of shim thickness	0.58	0.60	0.62	0.65	0.65	0.68	0.72	0.72	0.75

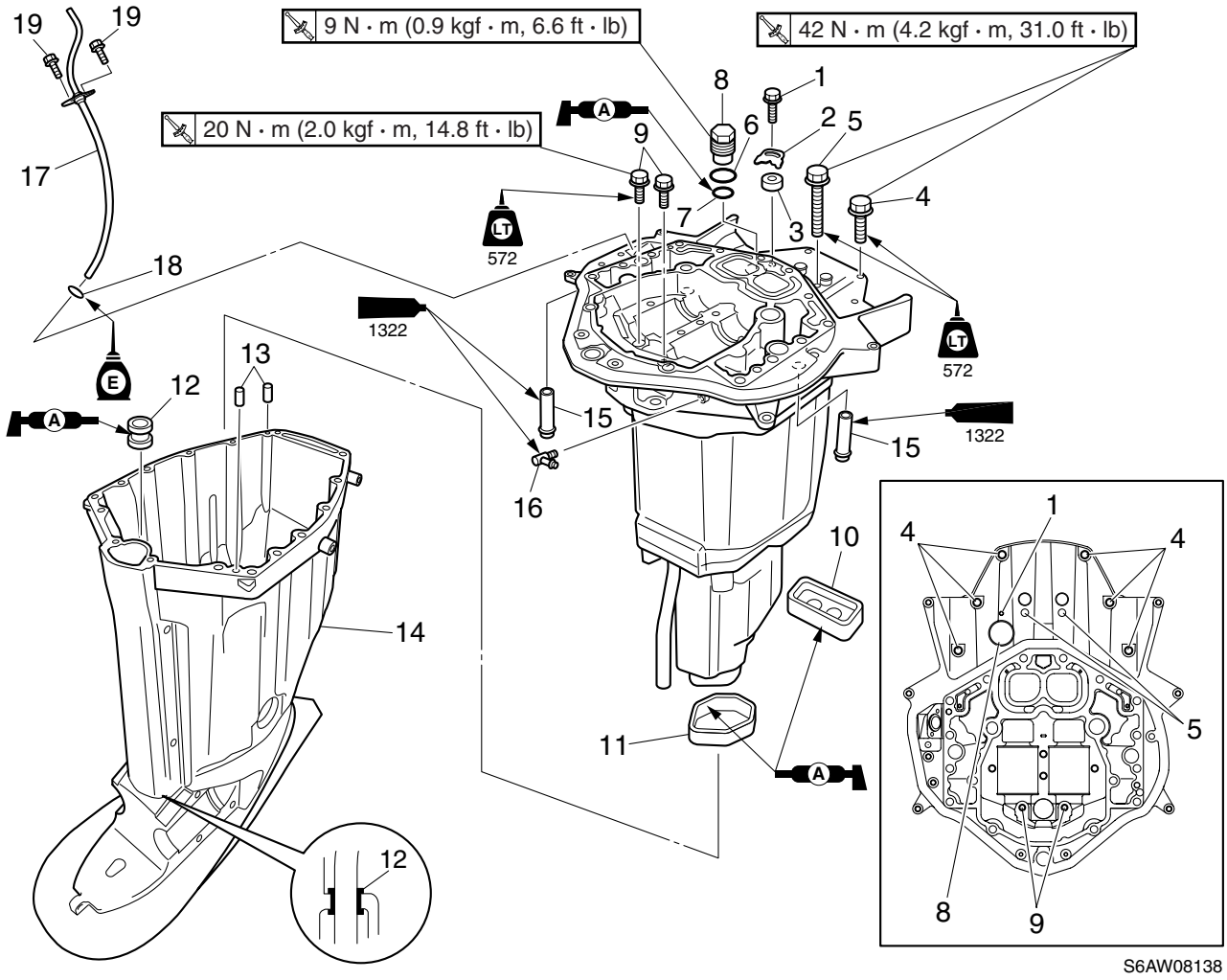
Measurement M	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24
Increasing or decreasing of shim thickness	0.75	0.78	0.80	0.82	0.85	0.85	0.88	0.90	0.92

Measurement M	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.40	1.42
Increasing or decreasing of shim thickness	0.95	0.95	0.98	1.00	1.02	1.05	1.05	1.08	1.10

Measurement M	1.44	1.46	1.48	1.50	1.52
Increasing or decreasing of shim thickness	1.12	1.15	1.15	1.18	1.20

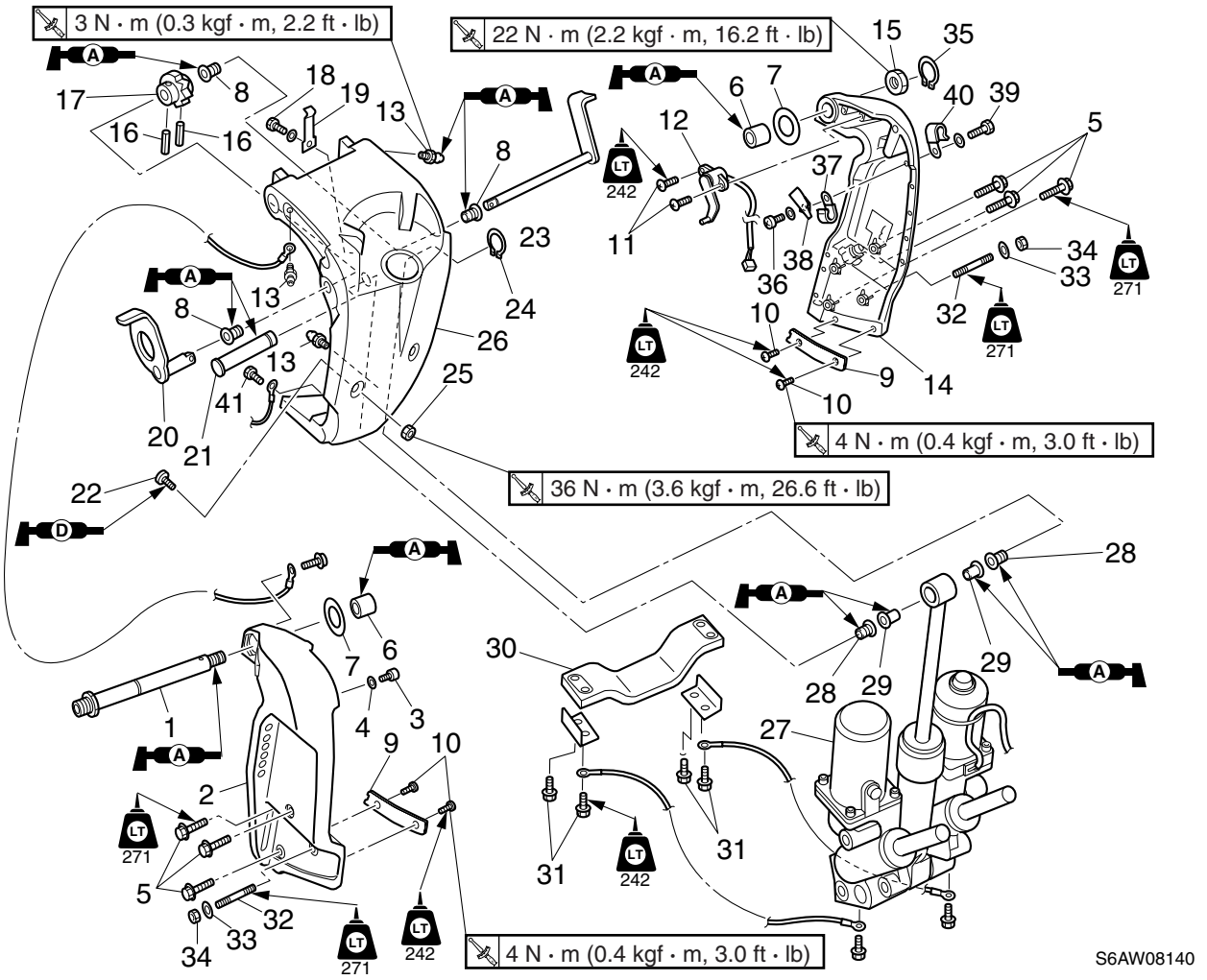


No.	Part name	Q'ty	Remarks
1	Bottom cowling	1	
2	Rubber seal	1	
3	Cowling lock lever	1	
4	Cover	1	
5	Bolt	1	M6 × 12 mm
6	Bush	3	
7	Washer	3	
8	Wave washer	3	
9	Lever	3	
10	Washer	3	
11	Spring	3	
12	Hook	3	
13	Bolt	3	M6 × 20 mm
14	Bolt	3	M6 × 20 mm
15	Cowling lock lever	1	
16	Gasket	2	**Not reusable**
17	Plate	1	



No.	Part name	Q'ty	Remarks
18	O-ring	1	**Not reusable**
19	Bolt	2	M6 × 16 mm

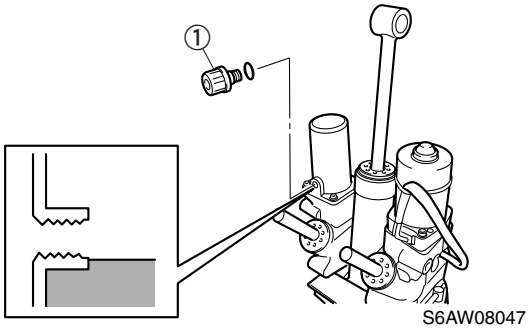
Clamp bracket and swivel bracket



No.	Part name	Q'ty	Remarks
1	Through tube	1	
2	Clamp bracket (PORT)	1	
3	Bolt	2	M10 × 20 mm
4	Washer	2	
5	Bolt	6	M10 × 45 mm
6	Bushing	2	
7	Washer	2	
8	Bushing	4	
9	Friction plate	2	
10	Screw	4	ø6 × 10 mm
11	Screw	2	ø6 × 15 mm
12	PTT sensor	1	
13	Grease nipple	3	
14	Clamp bracket (STBD)	1	
15	Self-locking nut	1	
16	Pin	2	
17	Distance collar	2	

Checking the hydraulic pressure

1. Full extend the PTT rams.
2. Remove the reservoir cap ①, and then check the fluid level in the reservoir.



⚠ WARNING

Make sure that the PTT rams are fully extended when removing the reservoir cap, otherwise fluid can spurt out from the unit due to internal pressure.

NOTE:

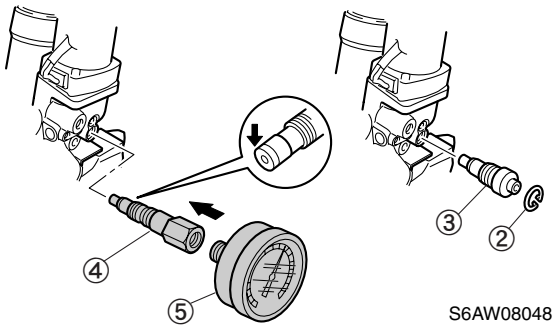
If the fluid is at the correct level, the fluid should overflow out of the filler hole when the reservoir cap is removed.

Recommended PTT fluid:
ATF Dexron II

3. Install the reservoir cap, and then tighten it to the specified torque.

Reservoir cap:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

4. Remove the circlip ② and the manual valve ③.
5. Install the up-relief fitting ④ and the hydraulic pressure gauge ⑤.

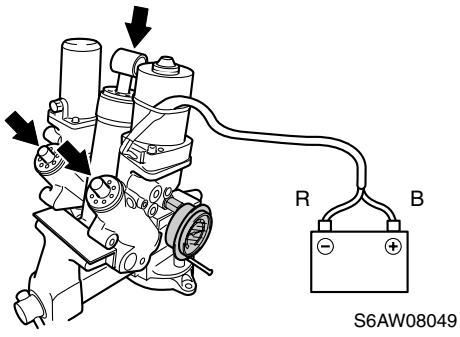


NOTE:

Quickly install the special service tools before any fluid flows out of the hole.

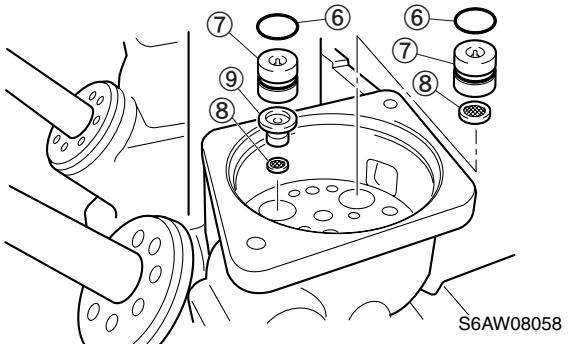
Up-relief fitting ④:
90890-06838
Hydraulic pressure gauge ⑤:
90890-06800

6. Connect the PTT motor leads to the battery terminals to fully retract the PTT rams.

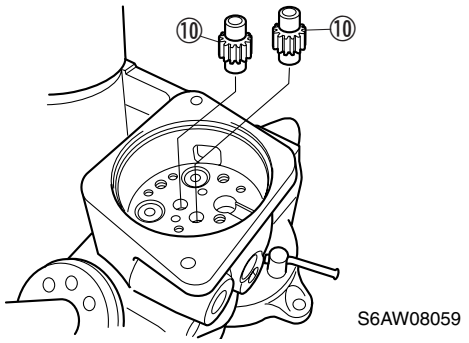


Ram	PTT motor lead	Battery terminal
Down	Red (R)	⊖
	Black (B)	⊕

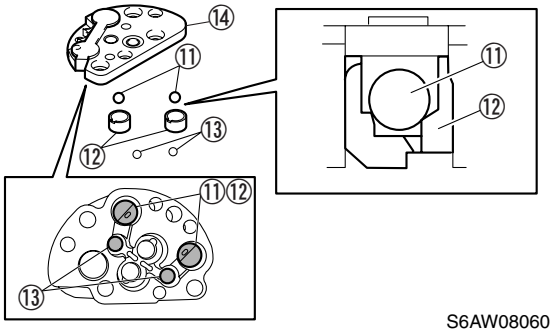
2. Install new O-rings ⑥ onto the main valves ⑦, and then install the filters ⑧, valve seat ⑨, the main valves ⑦ into the gear pump housing.



3. Install the drive gears ⑩ into the gear pump housing.

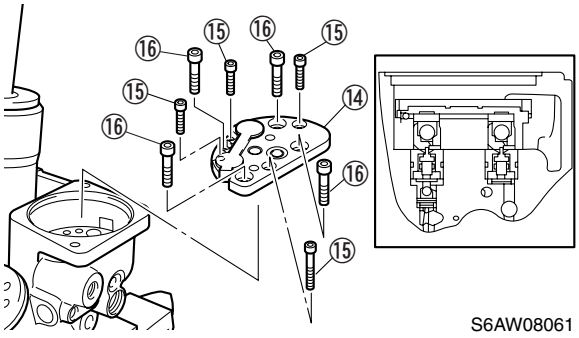


4. Install the balls ⑪, shuttle pistons ⑫, and balls ⑬ into the gear pump assembly ⑭.



NOTE:
Apply grease to the balls to prevent them from falling out of the gear pump assembly.

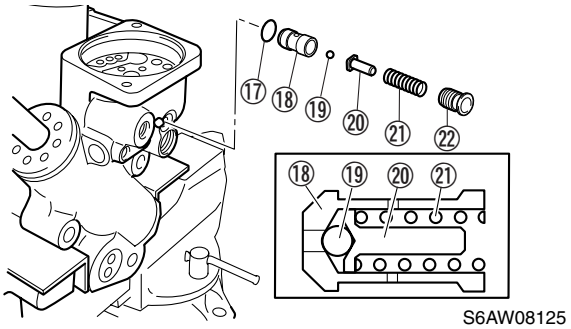
5. Install the gear pump assembly ⑭ into the gear pump housing, and then tighten the bolts ⑮ and ⑯ temporarily.



6. Check that the gear pump turns smoothly, and then tighten the gear pump assembly bolts ⑮ and ⑯ to the specified torque.

	Gear pump bolt (M4) ⑮: 5 N·m (0.5 kgf·m, 3.7 ft·lb) Gear pump bolt (M5) ⑯: 7 N·m (0.7 kgf·m, 5.2 ft·lb)

7. Install a new O-ring ⑰, the up-relief valve seat ⑱, ball ⑲, absorber valve pin ⑳, and spring ㉑ into the gear pump housing. And then tighten up-relief valve plug ㉒ to the specified torque.

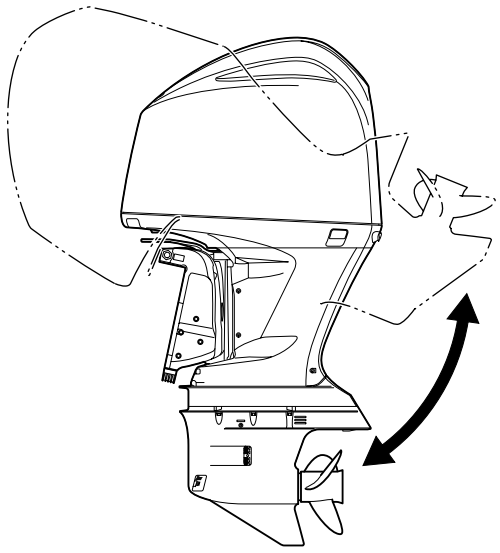


	Up-relief valve plug ㉒: 6 N·m (0.6 kgf·m, 4.4 ft·lb)

Bleeding the PTT unit (built-in)

Clear the tilt limiter setting before starting the procedure.

1. Push the PTT switch to fully tilt up and fully trim down the outboard motor for several times.



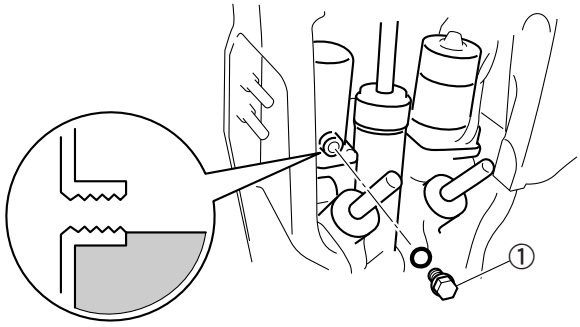
S6AW08129

2. Let the fluid settle for 5 minutes with the outboard motor trimmed down.
3. Push the PTT switch to fully tilt up the outboard motor.
4. Support the outboard motor with the support lever, and then let the fluid settle for 5 minutes.

⚠ WARNING

- **Make sure that the PTT rams are fully extended when removing the reservoir cap, otherwise fluid can spurt out from the unit due to internal pressure.**
- **After tilting up the outboard motor, be sure to support it with the support lever. Otherwise, the outboard motor could suddenly lower if the PTT unit should lose fluid pressure.**

5. Remove the reservoir cap ① to check the fluid level and the presence of air bubble in the fluid.



S6AW08128

NOTE:

If the fluid is at the correct level, a small amount of fluid should overflow out of the filler hole when the reservoir cap is removed.

Recommended PTT fluid:
ATF Dexron II

6. Install a new O-ring and the reservoir cap ①, and then tighten the reservoir cap to the specified torque.

Reservoir cap ①:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

7. Replenish the fluid if the fluid level is lower than the specified height. If air bubble remains in the fluid, repeat the steps 1–6 until no more air bubble comes out.

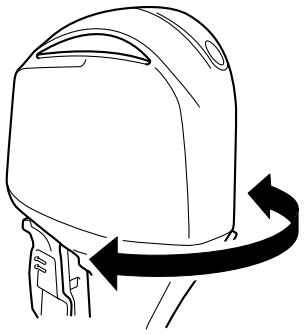
9

NOTE:
The proper mounting height is depends on the combination of the boat and the outboard motor. To determine the optimum mounting height, test run the outboard motor at different heights.

2. Check that the clamp brackets are secured with the clamp bolts.

Checking the steering system

1. Check that the steering system operates smoothly.



S6AW10004

2. Check that there is no interference with wires or hoses when the outboard motor is steered.

Checking the PTT system

1. Check that the outboard motor tilts up and down smoothly when operating the PTT unit. If the outboard motor interferes with the motor well, change the set up of the tilt limiter. To change the tilt limiter setting, see "Setting the tilt limiter" (10-7).

2. Check that there is no abnormal noise produced when the outboard motor is tilted up or down.

3. Check that there is no interference with wires or hoses when the tilted-up outboard motor is steered.

4. Check that the trim meter points down when the outboard motor is tilted all the way down.

Checking the propeller nut

1. Check that the propeller nut is tightened to the specified torque.

Propeller nut:
54 N·m (5.4 kgf·m, 39.8 ft·lb)

Check and adjustment using the YDIS

Use YDIS for checking sensors and other components. When a connector must be disconnected for checking the voltages and resistance of sensors and components the engine ECM interprets this operation as a failure of the part and sets a trouble code. Therefore, be sure to delete the diagnosis record after checking the input voltage. Since the main relay stays on for approximately 10 seconds after the engine start switch is turned to "OFF," the power of the engine ECM cannot be turned off. Therefore, if the engine start switch is turned to "ON" within 10 seconds after it was turned to "OFF," the trouble codes cannot be deleted.

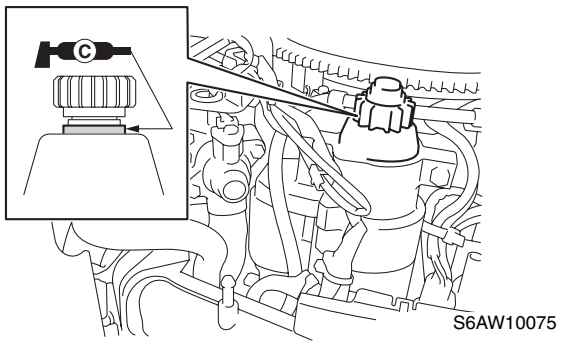
NOTE:
- Before checking the electrical components, make sure that the battery is fully charged.
- The YDIS requires that you use an exclusive communication cable and CD-ROM to connect to a computer. For a description of the communication cable and CD-ROM to be used, see "YDIS" (4-1). Also, be sure to check the CD-ROM version before using it.
- To connect the YDIS, see "YDIS" (4-1) or the YDIS (Ver. 1.30 or later) Instruction manual.

YDIS (CD-ROM, Ver. 1.30):
60V-WS853-04
YDIS (KIT):
60V-85300-04

Digital Electronic Control system reset

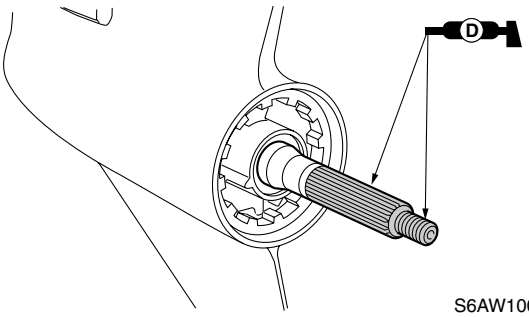
1. Reset the Digital Electronic Control system if the Digital Electronic Control ECM and the engine ECM cannot communicate with each other. For details of the reset procedure, see "Digital Electronic Control system reset" (3-23).

2. Apply low temperature resistant grease to the area shown.



S6AW10075

3. Apply corrosion resistant grease to the area shown.



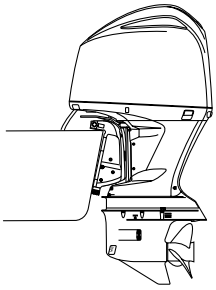
S6AW10029

Checking the engine oil level

1. Check the engine oil level. To check the engine oil level, See “Checking the engine oil level” (10-5).

Changing the engine oil

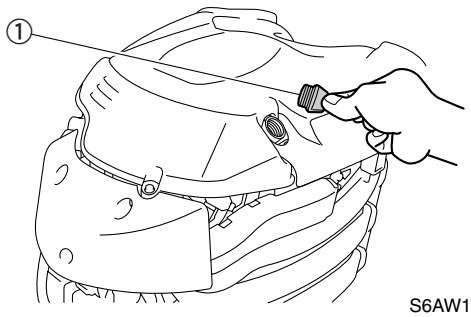
1. Put the outboard motor in an upright position (not tilted).


S6BJ10007

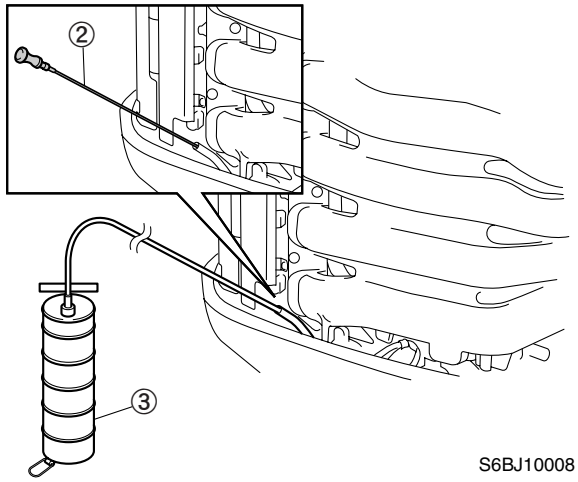
2. Start the engine. Warm it up and keep the idle speed for 5–10 minutes.

3. Stop the engine and leave it for 5–10 minutes.

4. Remove the oil filler cap ①. Pull out the dipstick ② and use the oil changer ③ to extract the oil completely.



S6AW10035



S6BJ10008

5. Add the correct amount of oil through the filler hole. Put back the filler cap ① and the dipstick ②.

Recommended engine oil:
Yamalube 4-M FC-W or equivalent
Marine FC-W 10W-30 or 20W-40 motor oil
Amount of adding engine oil (at periodic maintenance):
Without oil filter:
6.3 L (6.66 US qt, 5.54 Imp qt)

6. Leave the outboard motor for 5–10 minutes.

7. Remove the dipstick ② and wipe it clean.

8. Insert the dipstick ② completely and remove it again.

Specified spark plug:
LFR6A-11 (NGK)
Spark plug gap ⓐ:
1.0–1.1 mm (0.039–0.043 in)

5. Install the all spark plugs, all ignition coils, side covers (PORT and STBD) and rear cover. See “Wiring harness and flywheel magnet” (7-24).

Checking the timing belt

1. Check the timing belt. To check the timing belt, see “Checking the timing belt” (7-42).

Checking the thermostat

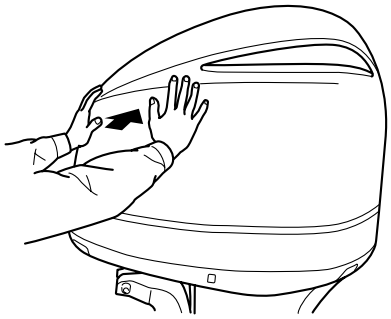
1. Check the thermostat. To check the thermostat, see “Checking the thermostat” (7-9).

Replacing the timing belt

1. Replace the timing belt. To replace the timing belt, see “Replacing the timing belt” (7-42).

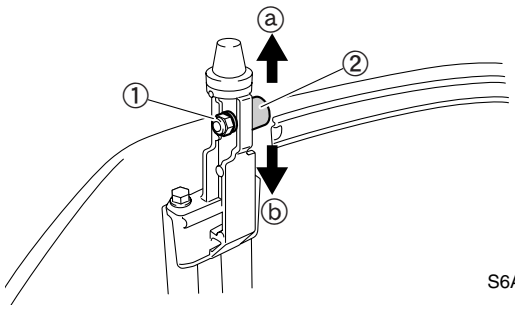
Checking the top cowling

1. Check the fitting by pushing the cowling with both hands. Adjust if necessary.



S6AW10010

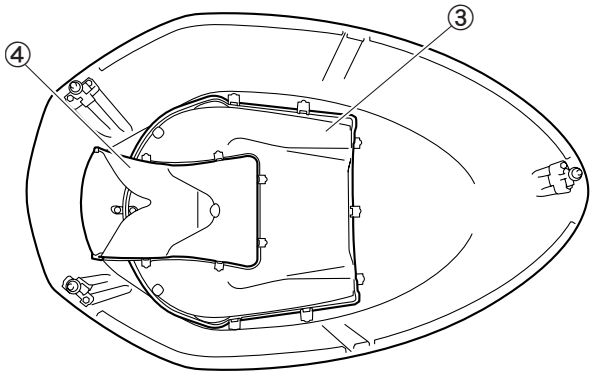
2. Loosen the nut ①.
3. Move the hook ② up or down slightly to adjust its position.



S6AW10011

NOTE:
To loosen the fitting, move the hook in direction ⓐ.
To tighten the fitting, move the hook in direction ⓑ.

4. Tighten the nut ①.
5. Check the fitting again and, if necessary, repeat steps 2–4.
6. Check the air duct molding ③ and the water-separator duct ④. Replace if cracks or other damage was found. To disassemble the air duct molding ③ and water-separator duct ④, see “Disassembling the top cowling” (7-13).



S6AW10012

Checking the valve clearance

1. Check the valve clearance. To check the valve clearance, see “Checking the valve clearance” (7-3).