

F15B

SERVICE MANUAL

290535

6D4-28197-5F-11

NOTICE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

Important information

Particularly important information is distinguished in this manual by the following notations:

 The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

WARNING

Failure to follow WARNING instructions could result in severe injury or death to the machine operator, a bystander, or a person inspecting or repairing the outboard motor.

CAUTION:










A CAUTION indicates special precautions that must be taken to avoid damage to the outboard motor.

NOTE:

A NOTE provides key information to make procedures easier or clearer.

**F15B
SERVICE MANUAL
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Contents

General information	 GEN INFO	1
Specifications	 SPEC	2
Periodic checks and adjustments	 CHK ADJ	3
Fuel system	 FUEL	4
Power unit	 POWR	5
Lower unit	 LOWR	6
Bracket unit	 BRKT	7
Electrical systems	 ELEC	8
Troubleshooting	 TRBL SHTG	9
Index		

General information

How to use this manual	1-1
Manual format.....	1-1
Symbols	1-2
 Safety while working	 1-3
Fire prevention.....	1-3
Ventilation	1-3
Self-protection.....	1-3
Parts, lubricants, and sealants	1-3
Good working practices	1-4
Disassembly and assembly	1-4
 Identification	 1-5
Applicable model	1-5
Serial number	1-5
 Propeller selection	 1-5
Propeller size	1-5
Selection	1-5
 Predelivery checks	 1-6
Checking the fuel system	1-6
Checking the engine oil level.....	1-6
Checking the gear oil.....	1-6
Checking the outboard motor mounting height	1-6
Checking the steering system	1-7
Checking the remote control cables	1-7
Checking the gearshift and throttle operation.....	1-7
Checking the engine stop lanyard switch	1-8
Checking the cooling water pilot hole.....	1-8
Test run.....	1-8
Break-in	1-9
After test run	1-9



How to use this manual

Manual format

The format of this manual has been designed to make service procedures clear and easy to understand. Use the information below as a guide for effective and quality service.

- ① Parts are shown and detailed in an exploded diagram and are listed in the components list.
- ② Tightening torque specifications are provided in the exploded diagrams and after a numbered step with tightening instructions.
- ③ Symbols are used to indicate important aspects of a procedure, such as the grade of lubricant and lubrication point.
- ④ The components list consists of part names and part quantities, as well as bolt and screw dimensions.
- ⑤ Service points regarding removal, checking, and installation are shown in individual illustrations to explain the relevant procedure.

NOTE:

For troubleshooting procedures, see Chapter 9, "Troubleshooting."

LOWR **Lower unit**

③ ②

Lower unit

No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Plastic tie	1	Not reusable
3	Hose	1	
4	Check screw	1	
5	Gasket	2	Not reusable
6	Dowel pin	2	
7	Bolt	4	M10 × 40 mm
8	Drain screw	1	
9	Grommet	1	
10	Bolt	1	M10 × 45 mm
11	Bolt	1	M8 × 60 mm
12	Thrust washer	1	
13	Propeller	1	
14	Washer	1	
15	Washer	1	
16	Cotter pin	1	Not reusable
17	Propeller nut	1	
18	Trim tab	1	

6-5
62Y6480K

LOWR **Lower unit**

Removing the drive shaft

1. Remove the drive shaft assembly and pinion, and then pull out the forward gear.

Drive shaft holder 4 (①): 90890-06518
Pinion nut holder (②): 90890-06505
Socket adapter 2 (③): 90890-06507

Disassembling the drive shaft

1. Install the pinion nut (①), tighten it finger tight, and then remove the drive shaft bearing (②) using a press.

CAUTION:

- Do not press the drive shaft threads (③) directly.

Do not reuse the bearing, always replace it with a new one.

Bearing inner race attachment (②): 90890-06639

Disassembling the forward gear

1. Remove the taper roller bearing from the forward gear using a press.

Bearing separator (①): 90890-06534

2. Remove the needle bearing from the forward gear.

CAUTION:

Do not reuse the bearing, always replace it with a new one.

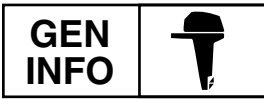
Stopper guide plate (②): 90890-06501
Stopper guide stand (③): 90890-06538
Bearing puller (④): 90890-06535
Bearing puller claw 1 (⑤): 90890-06536

6-19
62Y5A11

Symbols

The symbols below indicate the content of a chapter.

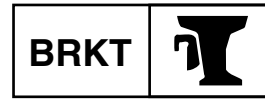
General information



Fuel system



Bracket unit



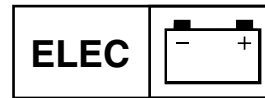
Specifications



Power unit



Electrical systems



Periodic checks and adjustments



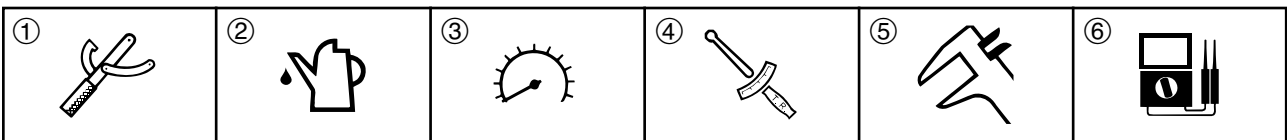
Lower unit



Troubleshooting

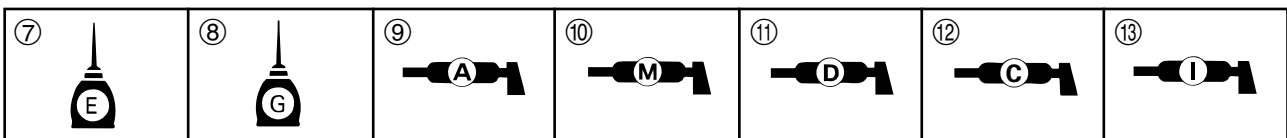


Symbols ① to ⑥ indicate specific data.



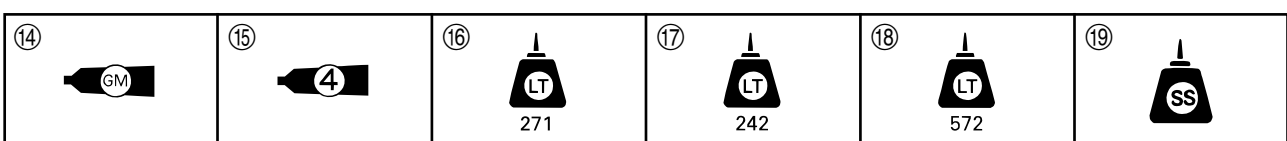
- ① Special tool
- ② Specified oil or fluid
- ③ Specified engine speed
- ④ Specified tightening torque
- ⑤ Specified measurement
- ⑥ Specified electrical value (resistance, voltage, electric current)

Symbols ⑦ to ⑬ in an exploded diagram or illustration 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 corrosion resistant grease (Yamaha grease D)
- ⑫ Apply low temperature resistant grease (Yamaha grease C)
- ⑬ Apply injector grease

Symbols ⑭ to ⑰ in an exploded diagram or illustration indicate the type of sealant or locking agent and the application point.



- ⑭ Apply Gasket Maker
- ⑮ Apply Yamabond No. 4
- ⑯ Apply LOCTITE 271 (red)
- ⑰ Apply LOCTITE 242 (blue)
- ⑱ Apply silicon sealant

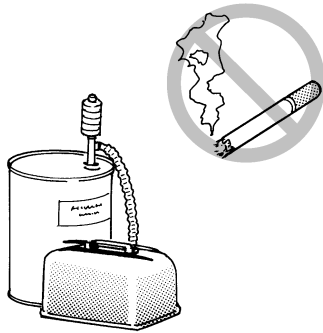


Safety while working

To prevent an accident or injury and to ensure quality service, follow the safety procedures provided below.

Fire prevention

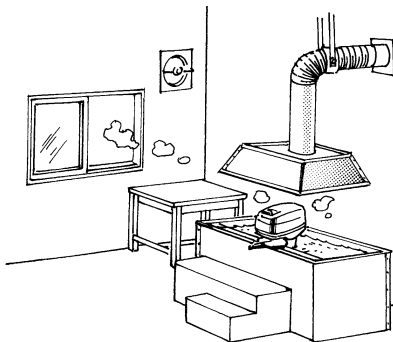
Gasoline is highly flammable. Keep gasoline and all flammable products away from heat, sparks, and open flames.



S69J1010

Ventilation

Gasoline vapor and exhaust gas are heavier than air and extremely poisonous. If inhaled in large quantities they may cause loss of consciousness and death within a short time. When test running an engine indoors (e.g., in a water tank) be sure to do so where adequate ventilation can be maintained.

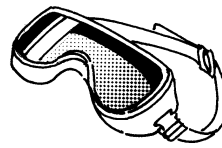


S69J1020

Self-protection

Protect your eyes by wearing safety glasses or safety goggles during all operations involving drilling and grinding, or when using an air compressor.

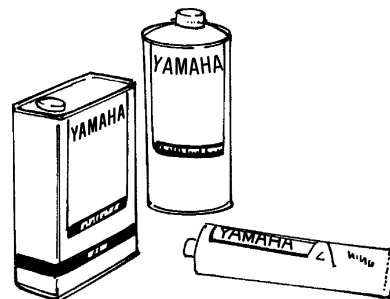
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.



S69J1030

Parts, lubricants, and sealants

Use only genuine Yamaha parts, lubricants, and sealants or those recommended by Yamaha, when servicing or repairing the outboard motor.



S69J1040

Under normal conditions, the lubricants mentioned in this manual should not harm or be hazardous to your skin. However, you should follow these precautions to minimize any risk when working with lubricants.

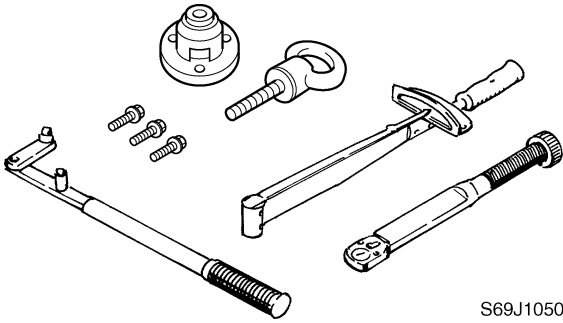
1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water after contact with a lubricant or lubricant soiled clothing has been made.
5. To protect your skin, apply a protective cream to your hands before working on the outboard motor.

6. Keep a supply of clean, lint-free cloths for wiping up spills, etc.

Good working practices

Special service tools

Use the recommended special service tools to protect parts from damage. Use the right tool in the right manner—do not improvise.



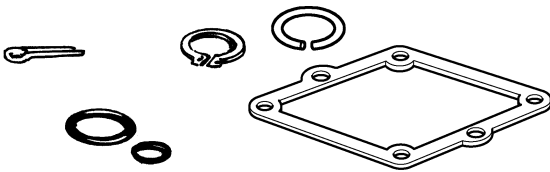
S69J1050

Tightening torques

Follow the tightening torque specifications provided throughout the manual. When tightening nuts, bolts, and screws, tighten the large sizes first, and tighten fasteners starting in the center and moving outward.

Non-reusable parts

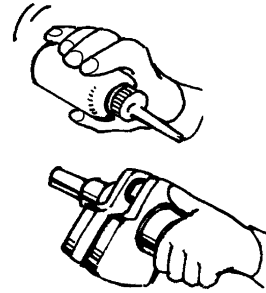
Always use new gaskets, seals, O-rings, cotter pins, circlips, etc., when installing or assembling parts.



S69J1060

Disassembly and assembly

1. Use compressed air to remove dust and dirt during disassembly.
2. Apply engine oil to the contact surfaces of moving parts before assembly.



S69J1070

3. Install bearings with the manufacture identification mark in the direction indicated in the installation procedure. In addition, be sure to lubricate the bearings liberally.
4. Apply a thin coat of water-resistant grease to the lip and periphery of an oil seal before installation.
5. Check that moving parts operate normally after assembly.

Identification

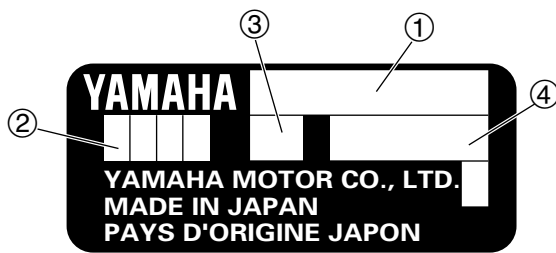
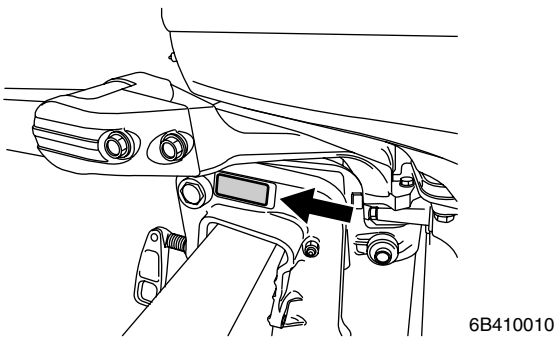
Applicable model

This manual covers the following models.

Applicable models
F15BMH, F15BM

Serial number

The outboard motor serial number is stamped on a label attached to the port clamp bracket.



- ① Model name
- ② Approved model code
- ③ Transom height
- ④ Serial number

Model name	Approved model code	Starting serial No.
F15BMH	6D4	S: 1000001-
		L: 1000001-
F15BM		L: 1000001-

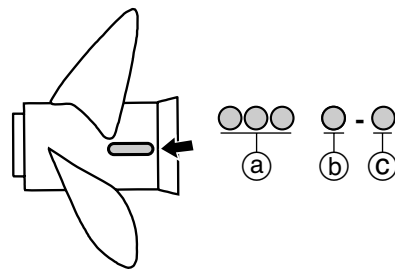
Propeller selection

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 outside of the propeller boss.



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

Selection

When the engine speed is at the full throttle operating range (4,500–5,500 r/min), the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

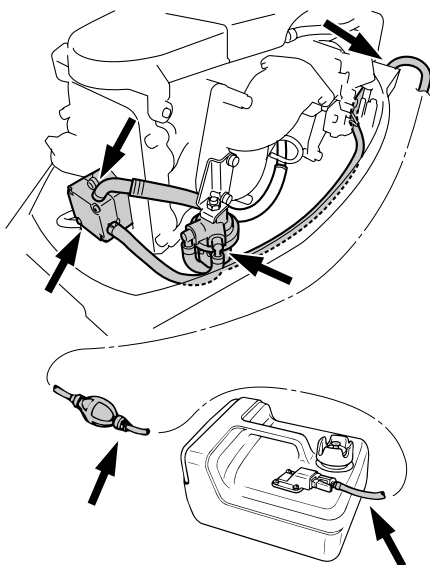
Propeller size (in)	Material
9 1/4 × 8 - J	Aluminum
9 1/4 × 9 - J	
9 1/4 × 9 3/4 - J	
9 1/4 × 10 - J	
9 1/4 × 10 1/2 - J	
9 1/4 × 11 - J	
9 1/4 × 12 - J	

Predelivery checks

To make the delivery process smooth and efficient, the predelivery checks should be completed as explained below.

Checking the fuel system

1. Check that the fuel hose is securely connected and that the fuel tank is filled with fuel.



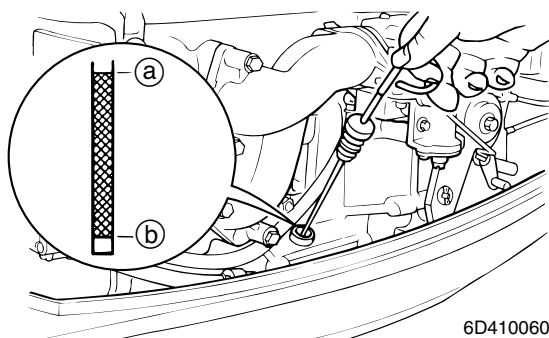
6D410040

CAUTION:

This is a 4-stroke engine. Never use pre-mixed fuel.

Checking the engine oil level

1. Check the oil level.



6D410060

NOTE:

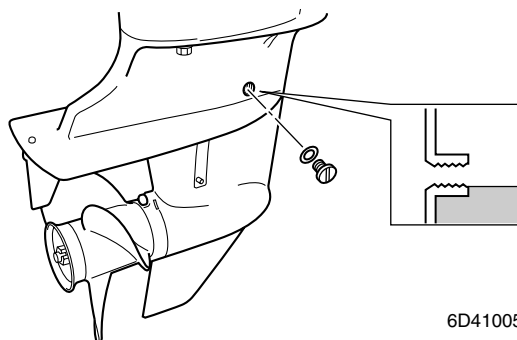
- If the engine oil is above the maximum level mark (a), drain sufficient oil until the level is between (a) and (b).
- If the engine oil is below the minimum level mark (b), add sufficient oil until the level is between (a) and (b).



Recommended engine oil:
4-stroke outboard motor oil
API: SE, SF, SG, SH or SJ
SAE: 10W-30 or 10W-40
Oil quantity:
(without oil filter replacement)
1.0 L (1.06 US qt, 0.88 Imp qt)

Checking the gear oil

1. Check the gear oil level.



6D410050

NOTE:

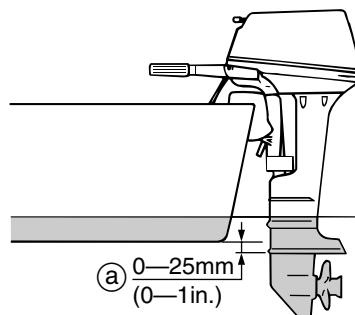
The gear oil level should be at the brim of the check hole.



Recommended gear oil:
Hypoid gear oil
SAE: 90
Oil quantity:
0.25 L (8.45 US oz, 8.82 Imp oz)

Checking the outboard motor mounting height

1. Check that the anti-cavitation plate is between the bottom of the boat and a maximum of 25 mm (1 in) (a) below it. If the mounting height is too high, cavitation will occur and propulsion will be reduced. Also, the engine speed will increase abnormally and cause the engine to over-heat. If the mounting height is too low, water resistance will increase and reduce engine efficiency.



6B410060



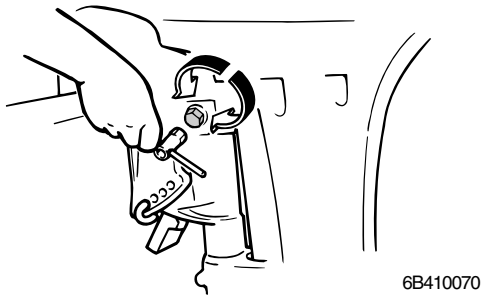
NOTE:

The optimum mounting height is affected by 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 screws.

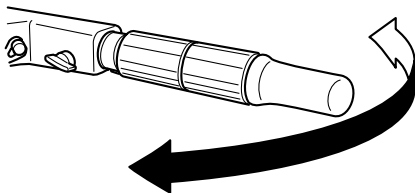
Checking the steering system

1. Check the steering friction for proper adjustment.

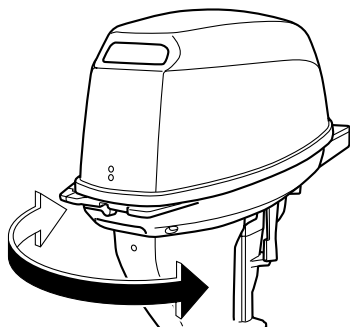


6B410070

2. Check that the steering operates smoothly.



6D410080



6D410090

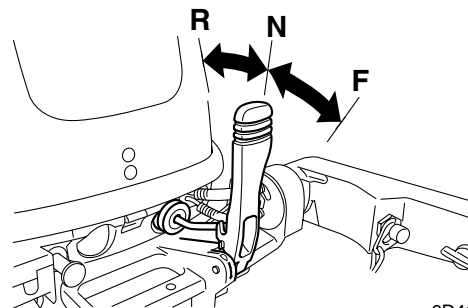
3. Check that there is no interference with wires or hoses when the outboard motors steered.

Checking the remote control cables

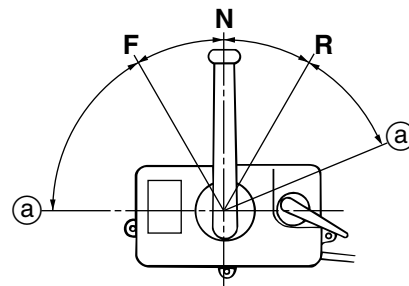
1. Check that the remote control cable proper position.
2. Set the remote control lever to the neutral position and fully close the throttle lever. Adjust if necessary.

Checking the gearshift and throttle operation

1. Check that the gearshift operates smoothly when the shift lever and or remote control lever is shifted from neutral into forward or reverse.

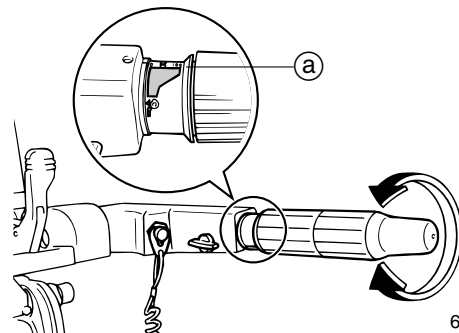


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6D410130

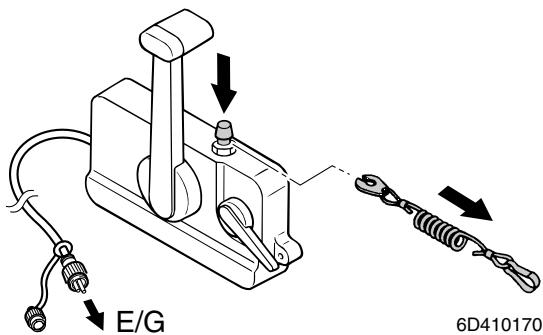
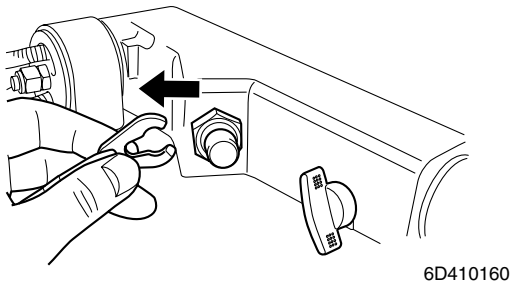
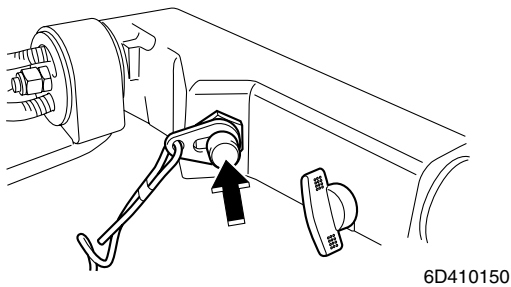
2. Check that the throttle operates smoothly when the throttle grip is turned from the fully closed position to the fully open position and or remote control lever is shifted from the fully closed position to the fully open position (a).



6D410140

Checking the engine stop lanyard switch

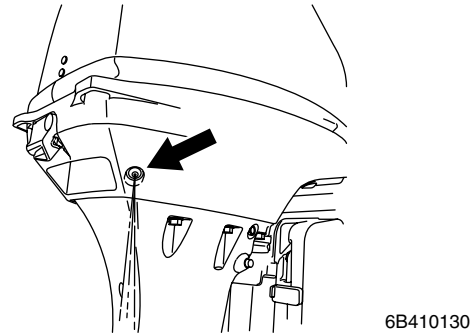
1. Check that the engine turns off when the engine stop lanyard switch is pushed or the engine stop lanyard is pulled from the engine stop lanyard switch.



NOTE: _____
 For remote control model. Be sure to connect the engine stop lanyard switch connector from the power unit side to the remote control box side.

Checking the cooling water pilot hole

1. Check that cooling water is discharged from the cooling water pilot hole.



Test run

1. Start the engine, then check that the gear shift operates smoothly.
2. Check the engine idle speed after the engine has been warmed up.
3. Operate at trolling speed.
4. Perform the break-in procedure up to step 3 as listed below.

NOTE: _____
 The test run is part of the break-in operation.

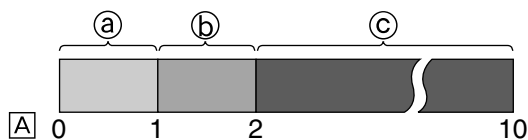




Break-in

During the test run, perform the break-in operation in the following 4 stages.

1. For the first hour of operation (a): Run the engine at 2000 r/min or at approximately half throttle.
2. For the second hour of operation (b): Run the engine at 3000 r/min or at approximately three-quarter throttle.
3. For the next eight hours of operation (c): Avoid continuous operation at full throttle for more than five minutes at a time.
4. After the first 10 hours: Operate the engine normally.



6D410190

[A] Hours

After test run

1. Check for water in the gear oil.
2. Check for fuel leakage in the cowling.
3. After a test run and while the engine is at idle, flush the cooling water passages with fresh water using the flushing kit.

Specifications

General specifications2-1

Maintenance specifications2-3

 Power unit2-3

 Lower unit2-6

 Electrical2-7

 Dimensions2-8

Tightening torques.....2-10

 Specified torques2-10

 General torques2-11

General specifications

Item	Unit	Model	
		F15BMH	F15BM
Dimensions			
Overall length	mm (in)	1,001 (39.4)	643 (25.3)
Overall width	mm (in)	427.5 (16.8)	369 (14.5)
Overall height			
(S)	mm (in)	1,080 (42.5)	—
(L)	mm (in)	1,207 (47.5)	
Transom height			
(S)	mm (in)	440 (17.3)	—
(L)	mm (in)	567 (22.3)	
Boat transom height			
(S)	mm (in)	381 (15.0)	—
(L)	mm (in)	508 (20.0)	
Dry weight			
(S)	kg (lb)	45.0 (99)	—
(L)	kg (lb)	47.0 (104)	46.0 (101)
Performance			
Maximum output	kW (hp) @ 5,000 r/min	11.0 (15.0)	
Full throttle operating range	r/min	4,500–5,500	
Maximum fuel consumption	L (US gal, Imp gal)/hr	5.3 (1.4, 1.2) @ 5,500 r/min	
Power unit			
Engine type		4-stroke, OHC, Twin	
Total displacement	cm ³ (cu. in)	323.0 (19.71)	
Bore x stroke	mm (in)	59.0 × 59.0 (2.32 × 2.32)	
Compression ratio		9.19:1	
Control system		Tiller handle	Remote control
Starting system		Manual starter	
Enrichment system		Choke valve	
Ignition control system		CDI	
Ignition timing	Degree	BTDC 5–30	
Maximum generator output	V-W	12–80	
Spark plug	(NGK)	DPR6EA–9	
Cooling system		Water	
Exhaust system		Propeller boss	
Lubrication system		Wet sump	

General specifications

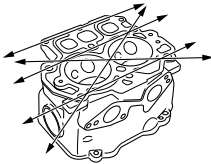
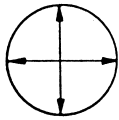
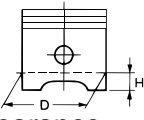
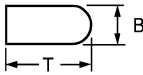


Item	Unit	Model	
		F15BMH	F15BM
Fuel and oil			
Fuel type		Unleaded regular gasoline	
Engine oil type		4-stroke outboard motor oil	
Engine oil grade	API SAE	SE, SF, SG, SH or SJ 10W-30 or 10W-40	
Engine oil quantity (with oil filter replacement)	L (US qt, Imp qt)	1.2 (1.27, 1.06)	
(without oil filter replacement)	L (US qt, Imp qt)	1.0 (1.06, 0.88)	
Gear oil type		Hypoid gear oil	
Gear oil grade	SAE	90	
Gear oil quantity	L (US oz, Imp oz)	0.25 (8.45, 8.82)	
Bracket unit			
Trim angle (*1)	Degree	8.0, 12.0, 16.0, 20.0	
Tilt-up angle	Degree	63.0	
Steering angle	Degree	45.0 + 40.0	
Drive unit			
Gear shift positions		F-N-R	
Gear ratio		2.08 (27/13)	
Reduction gear type		Spiral bevel gear	
Clutch type		Dog clutch	
Propeller shaft type		Spline	
Propeller direction (rear view)		Clockwise	
Propeller ID mark		J	

(*1) At 12-degree boat transom

Maintenance specifications

Power unit

Item	Unit	Model	
		F15BMH	F15BM
Power unit			
Minimum compression pressure (*1)	kPa (kgf/cm ² , psi)	765 (7.8, 111)	
Lubrication oil pressure (*2) at idle speed	kPa (kgf/cm ² , psi)	330 (3.36, 48)	
Cylinder head			
Warpage limit  (lines indicate straightedge position)	mm (in)	0.10 (0.0039)	
Camshaft journal inside diameter	mm (in)	35.000–35.012 (1.3780–1.3784)	
Cylinder			
Bore size 	mm (in)	59.000–59.015 (2.3228–2.3234)	
Wear limit	mm (in)	59.1 (2.33)	
Taper limit	mm (in)	0.08 (0.0032)	
Out-of-round limit	mm (in)	0.05 (0.0020)	
Pistons			
Piston diameter (D) 	mm (in)	58.950–58.965 (2.3209–2.3215)	
Measuring point (H)	mm (in)	5.0 (0.20)	
Piston-to-cylinder clearance	mm (in)	0.035–0.065 (0.0014–0.0026)	
Piston pin boss bore	mm (in)	14.004–14.015 (0.5513–0.5518)	
Over size piston diameter			
1 st	mm (in)	59.2 (2.33)	
2 nd	mm (in)	59.5 (2.34)	
Piston pins			
Outside diameter	mm (in)	13.996–14.000 (0.5510–0.5512)	
Piston rings			
Top ring 			
Dimension B	mm (in)	1.17–1.19 (0.0461–0.0469)	
Dimension T	mm (in)	2.00–2.20 (0.0787–0.0866)	
End gap	mm (in)	0.15–0.30 (0.0059–0.0118)	
Side clearance	mm (in)	0.04–0.08 (0.0016–0.0032)	
Over size			
1 st	mm (in)	59.25 (2.33)	
2 nd	mm (in)	59.50 (2.34)	

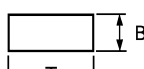

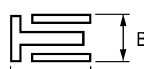



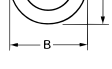
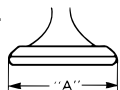
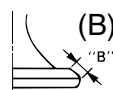
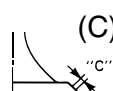
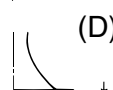
(*1) Measuring conditions:

Ambient temperature 20°C (68°F), wide open throttle, with spark plugs removed from all cylinders.


The figures are for reference only.

Since this outboard motor is equipped with an automatic decompression mechanism, accurate data may be difficult to obtain due to differences in the way the starter rope is pulled.

(*2) The figures are for reference only.

Item	Unit	Model	
		F15BMH	F15BM
2 nd ring Dimension B  Dimension T  End gap Side clearance Over size 1 st 2 nd	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	1.47–1.49 (0.0579–0.0590) 2.50–2.70 (0.0984–0.1063) 0.30–0.50 (0.0118–0.0197) 0.02–0.04 (0.0008–0.0016) 59.25 (2.33) 59.50 (2.34)	
Oil ring Dimension B  Dimension T  End gap Side clearance Over size 1 st 2 nd	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	2.31–2.51 (0.0909–0.0988) 2.30–2.60 (0.0906–0.1024) 0.20–0.70 (0.0079–0.0276) 0–0.22 (0–0.0087) 59.25 (2.33) 59.50 (2.34)	
Camshaft Intake  (A) Exhaust  (A) Intake and exhaust  (B) Camshaft journal diameter Camshaft journal oil clearance Camshaft run-out limit	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	27.596–27.696 (1.0865–1.0904) 27.616–27.716 (1.0872–1.0912) 23.950–24.050 (0.9429–0.9468) 34.935–34.955 (1.3754–1.3762) 0.050–0.080 (0.0020–0.0032) 0.03 (0.0012)	
Rocker arm shafts Outside diameter	mm (in)	12.941–12.951 (0.5095–0.5099)	
Rocker arms Inside diameter	mm (in)	13.000–13.018 (0.5118–0.5125)	
Valves Valve clearance (cold) Intake Exhaust Head diameter  (A) Intake Exhaust Face width  (B) Intake and exhaust Seat contact width  (C) Intake and exhaust Margin thickness  (D) Intake and exhaust	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	0.15–0.25 (0.0059–0.0098) 0.20–0.30 (0.0079–0.0118) 27.9–28.1 (1.10–1.11) 21.9–22.1 (0.86–0.87) 1.98–3.11 (0.0780–0.1224) 0.60–0.80 (0.0236–0.0315) 0.50–0.90 (0.0197–0.0354)	



Item	Unit	Model	
		F15BMH	F15BM
Stem diameter			
Intake	mm (in)	5.475–5.490 (0.2156–0.2161)	
Exhaust	mm (in)	5.460–5.475 (0.2150–0.2156)	
Guide inside diameter			
Intake and exhaust	mm (in)	5.500–5.512 (0.2165–0.2170)	
Stem-to-guide clearance			
Intake and exhaust	mm (in)	0.025–0.052 (0.0010–0.0020)	
Stem run-out limit	mm (in)	0.01 (0.0004)	
Valve springs			
Free length	mm (in)	34.40 (1.3543)	
Minimum free length	mm (in)	32.68 (1.2866)	
Tilt limit	mm (in)	1.5 (0.06)	
			
Connecting rods			
Small-end inside diameter	mm (in)	14.015–14.029 (0.5518–0.5523)	
Big-end inside diameter	mm (in)	31.030–31.042 (1.2217–1.2221)	
Crankpin oil clearance	mm (in)	0.021–0.045 (0.0008–0.0018)	
Crankshaft			
Crankshaft journal diameter	mm (in)	34.997–35.009 (1.3778–1.3783)	
Crankpin diameter	mm (in)	30.997–31.009 (1.2204–1.2208)	
Crankpin width	mm (in)	21.000–21.070 (0.8268–0.8295)	
Run-out limit	mm (in)	0.05 (0.0020)	
Big end side clearance	mm (in)	0.050–0.220 (0.0020–0.0087)	
Crankcase			
Crankshaft main journal oil clearance	mm (in)	0.012–0.045 (0.0005–0.0018)	
Upper and lower crankcase main journal bearing thickness			
A - (Blue)	mm (in)	1.494–1.498 (0.0588–0.0590)	
B - (Black)	mm (in)	1.498–1.502 (0.0590–0.0591)	
C - (Brown)	mm (in)	1.502–1.506 (0.0591–0.0593)	
Oil pump			
Type		Trochoid	
Outer rotor-to-housing clearance (A)	mm (in)	0.100–0.150 (0.0039–0.0059)	
Outer rotor-to-inner rotor clearance (B)	mm (in)	0.040–0.140 (0.0016–0.0055)	
Rotor-to-cover clearance (C)	mm (in)	0.030–0.090 (0.0012–0.0035)	
Discharge	L (US gal, Imp gal)/min	5.70 (1.506, 1.254)	
Relief valve opening pressure	kPa (kgf/cm ² , psi)	388.0–450.0 (3.88–4.50, 56.3–65.3)	

Maintenance specifications



Item	Unit	Model	
		F15BMH	F15BM
Thermostat			
Opening temperature	°C (°F)	58.0–62.0 (136.40–143.60)	
Fully open temperature	°C (°F)	70.0 (158.00)	
Valve open lower limit	mm (in)	3.0 (0.12)	
Carburetor			
ID mark		6D400	
Float height	mm (in)	9.5–10.5 (0.37–0.41)	
Valve seat size	mm (in)	1.4 (0.06)	
Main jet (M.J.)		#104	
Main nozzle (M.N.)	mm (in)	2.5 (0.10)	
Pilot jet (P.J.)		#45	
Pilot screw (P.S.)	turns out	1–2	
Idle speed	r/min	900–1,000	
Manual starter			
Starter rope length	mm (in)	1,550–1,750 (61.02–68.90)	

Lower unit

Item	Unit	Model	
		F15BMH	F15BM
Gear backlash			
Pinion forward	mm (in)	0.19–0.86 (0.0075–0.0339)	
Pinion reverse	mm (in)	0.95–1.65 (0.0374–0.0650)	
Pinion shims	mm	1.13, 1.2	
Forward shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Reverse shims	mm	0.10, 0.20, 0.30, 0.40, 0.50	

Electrical

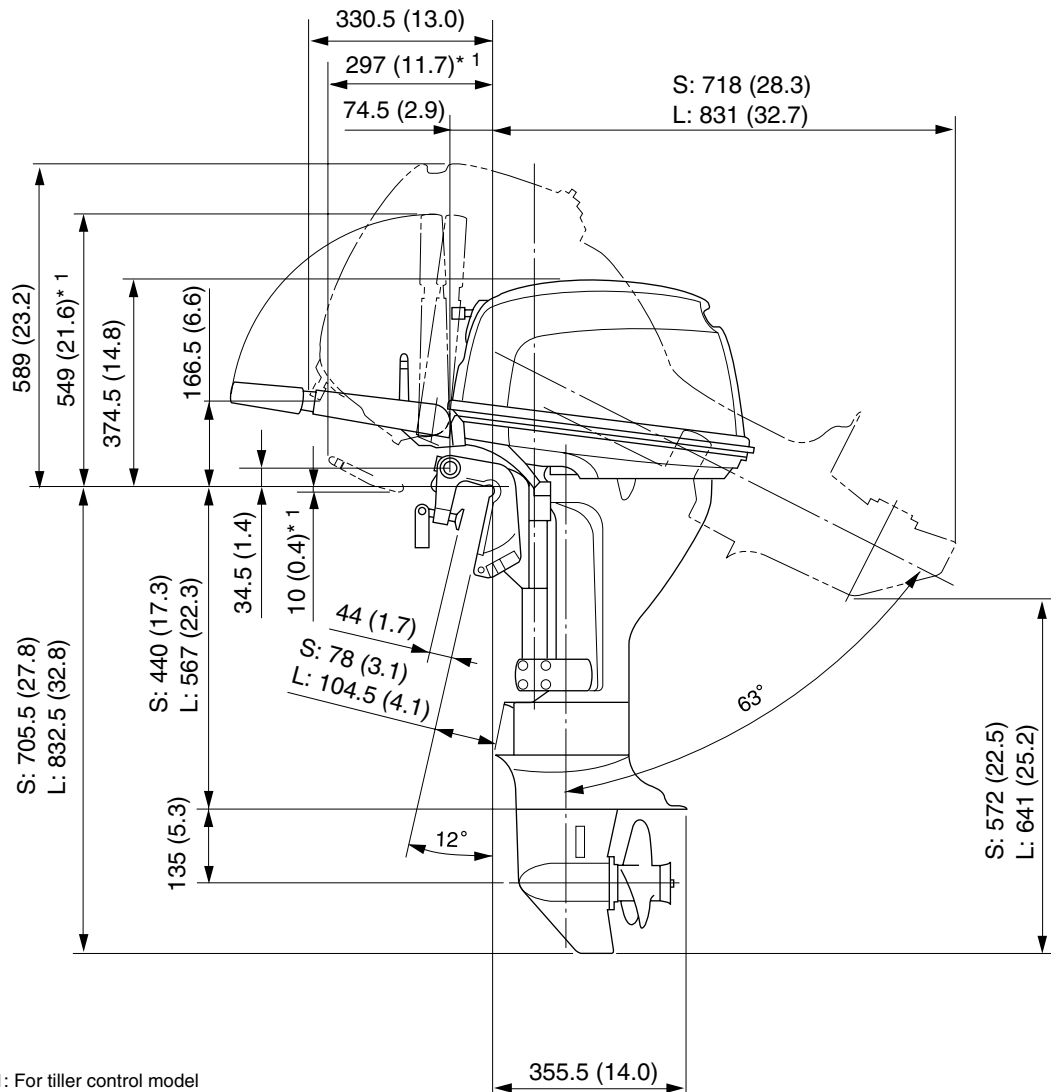
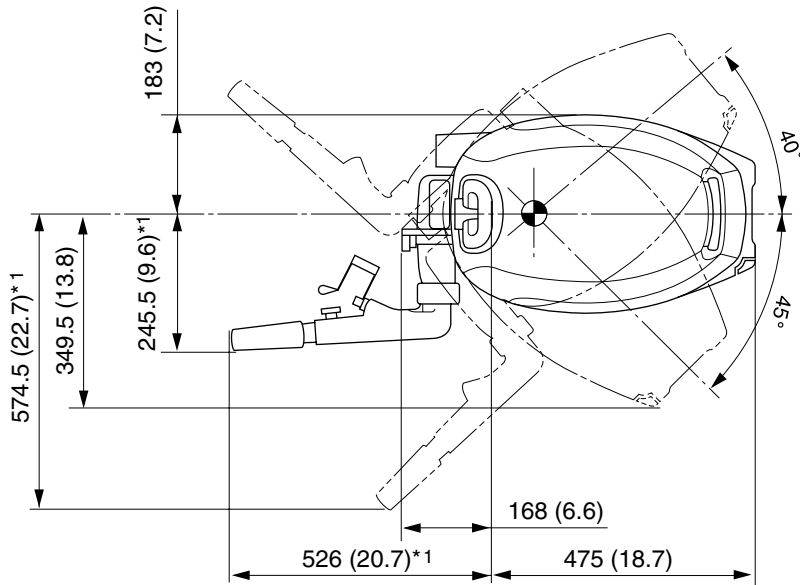
Item	Unit	Model	
		F15BMH	F15BM
Ignition system and ignition control system			
Ignition timing	Degree	BTDC 30	
Spark plug gap	mm (in)	0.8–0.9 (0.031–0.035)	
Spark plug cap resistance	kΩ	4.0–6.0	
Ignition coil resistance			
Primary coil (O–B)	Ω	0.16–0.24	
Secondary coil			
(spark plug wire–spark plug wire)	kΩ	3.92–5.88	
Pulser coil output peak voltage (W/G–B) (*1)			
@ Cranking (unload)	V	4.0	
@ Cranking (load)	V	4.0	
@ 1,500 r/min (load)	V	9	
@ 3,500 r/min (load)	V	17	
Pulser coil resistance (W/G–B)	Ω	234.0–348.0	
Charge coil output peak voltage (Br–L) (*1)			
@ Cranking (unload)	V	175	
@ Cranking (load)	V	170	
@ 1,500 r/min (load)	V	180	
@ 3,500 r/min (load)	V	180	
Charge coil resistance (Br–L)	Ω	272.0–408.0	
CDI unit output peak voltage (O–B) (*1)			
@ Cranking (load)	V	155	
@ 1,500 r/min (load)	V	170	
@ 3,500 r/min (load)	V	170	
Charging system			
Charging current			
(minimum) @3,000	A	5.5	
(maximum) @5,000	A	6.0	
Lighting coil output peak voltage (G–G) (*1)			
@ Cranking (unload)	V	14	
@ 1,500 r/min (unload)	V	30	
@ 3,500 r/min (unload)	V	70	
Lighting coil resistance (G–G)	Ω	0.48–0.72	
Rectifier regulator			
output peak voltage (R–B) (*1)			
@ 1,500 r/min (unload)	V	24	
@ 3,500 r/min (unload)	V	38	

(*1) The figures are for reference only.

Dimensions
Exterior

mm (in)

2

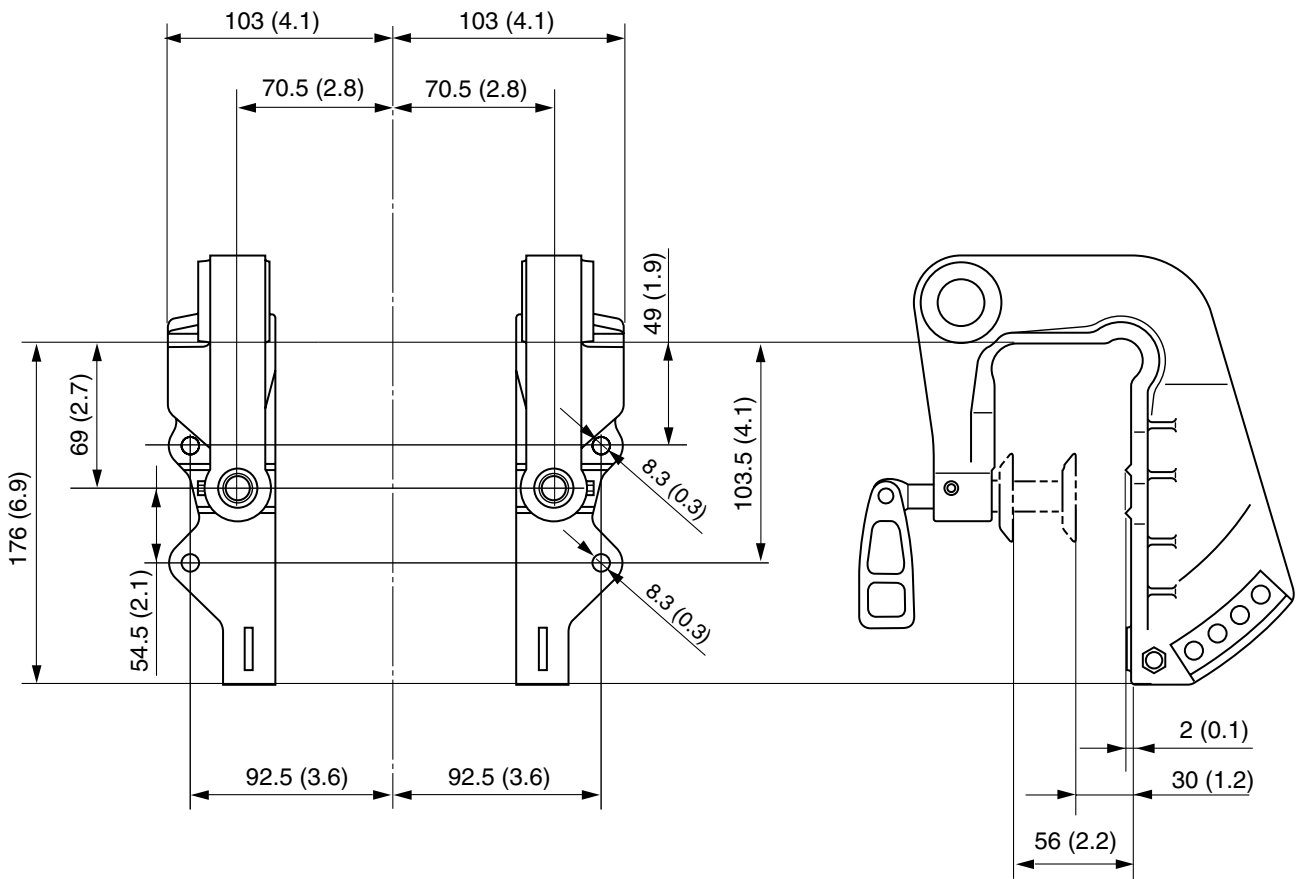


*1: For tiller control model

6D4001M

Clamp bracket

mm (in)



6D4002M

Tightening torques

Specified torques

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Power unit					
Crankcase bolt	1st	M8	15	1.5	11
	2nd		30	3.0	22
	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.7
Cylinder head bolt	1st	M8	15	1.5	11
	2nd		30	3.0	22
	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.7
Cylinder head cover bolt		M6	8	0.8	5.8
Exhaust cover and thermostat cover bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.7
Breather cover bolt		M6	8	0.8	5.8
Anode bolt		M5	5	0.5	3.7
Anode screw		—	2	0.2	1.5
Connecting rod	1st	M7	10	1.0	7.2
	2nd		21	2.1	16
Flywheel nut		M16	110	11	81
Oil filter		—	18	1.8	13
Union bolt		—	40	4.0	30
Valve adjusting screw locknut		—	14	1.4	10
Drive sprocket bolt		M6	13	1.3	9.6
Driven sprocket nut		M28	54	5.4	39
Power unit mount bolt		M8	21	2.1	16
Oil pump mount bolt		M6	8	0.8	5.8
Relief valve		—	8	0.8	5.8
Oil pressure switch		—	18	1.8	13
Spark plug		M12	18	1.8	13
Carburetor					
Intake manifold bolt		M6	8	0.8	5.8
Intake silencer bolt		M6	10	1.0	7.2
Drain bolt		M4	4.5	0.45	3.3
Float chamber screw		M4	2.0	0.2	1.5
Lower unit					
Lower unit mount bolt		M8	18	1.8	13
Cooling water inlet cover screw		—	5	0.5	3.7
Drain screw		M8	9	0.9	6.6
Check screw		M8	9	0.9	6.6
Propeller housing bolt		M6	8	0.8	5.8
Pinion nut		M8	25	2.5	18
Propeller nut		M10	17	1.7	12
Water pump housing bolt		M8	18	1.8	13
Engine oil drain bolt		M14	27	2.7	20

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Bracket unit				
Engine stop lanyard switch nut	—	2.5	0.25	1.8
Grease nipple	M6	3	0.3	2.2
Tiller handle bracket nut	—	10	1.0	7.2
Tiller handle bracket lock nut	—	23	2.3	17
Upper case mount bolt	M6	12	1.2	8.7
Upper rubber mount nut	M8	21	2.1	16
Lower rubber mount nut	M8	32	3.2	23
Clamp bracket through nut	—	22	2.2	16
Throttle grip mount screw	—	3.4	0.34	2.5
Ground lead screw	M6	2.5	0.25	1.8

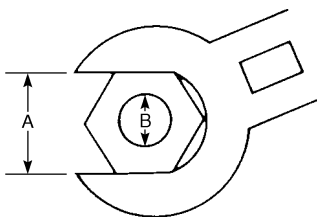
General torques

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual.

To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified torque is reached. Unless otherwise specified, torque specifications require clean, dry threads.

Components should be at room temperature.

Nut (A)	Bolt (B)	General torque specifications		
		N·m	kgf·m	ft·lb
8 mm	M5	5	0.5	3.6
10 mm	M6	8	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	26
17 mm	M12	43	4.3	31

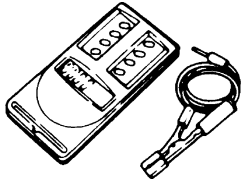


Periodic checks and adjustments

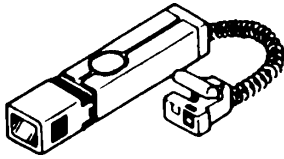
Special service tools.....	3-1
Maintenance interval chart.....	3-2
Fuel system	3-3
Checking the fuel line	3-3
Checking the fuel filter	3-3
Power unit.....	3-3
Checking the engine oil	3-3
Changing the engine oil.....	3-3
Replacing the oil filter	3-4
Checking the timing belt	3-5
Replacing the timing belt	3-5
Checking the spark plugs	3-6
Checking the thermostat.....	3-7
Checking the cooling water passages.....	3-7
Control system	3-7
Checking the start-in-gear protection	3-7
Adjusting the throttle cable	3-8
Checking the gearshift operation.....	3-9
Checking the engine idle speed	3-10
Checking the ignition timing.....	3-11
Bracket	3-11
Checking the tilt operation	3-11
Lower unit.....	3-12
Checking the gear oil level	3-12
Replacing the gear oil.....	3-12
Checking the lower unit for air leakage	3-13
Checking the propeller.....	3-13
General	3-13
Checking the anode.....	3-13
Checking the top cowling.....	3-14
Lubricating the outboard motor.....	3-14



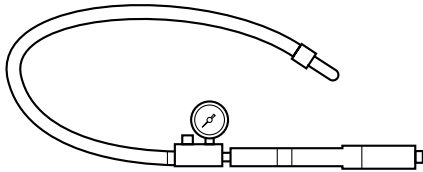
Special service tools



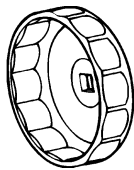
Digital tachometer
90890-06760



Timing light
90890-03141



Leakage tester
90890-06840



Oil filter wrench
90890-01426

Maintenance interval chart

Use the following chart as a guideline for general maintenance.

Adjust the maintenance intervals according to the operating conditions of the outboard motor.

Item	Actions	Initial		Every	
		10 hours (1 month)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)
Anode(s) (external)	Inspection / replacement		○	○	
Anode(s) (internal)	Inspection / replacement				○
Cooling water passages	Cleaning		○	○	
Cowling clamp	Inspection				○
Fuel filter (can be disassembled)	Inspection / cleaning	○	○	○	
Fuel system	Inspection	○	○	○	
Fuel tank (Yamaha portable tank)	Inspection / cleaning				○
Gear oil	Change	○		○	
Greasing points	Greasing			○	
Idling speed (carburetor models)	Inspection / adjustment	○		○	
Propeller and cotter pin	Inspection / replacement		○	○	
Shift link / shift cable	Inspection / adjustment				○
Thermostat	Inspection				○
Throttle link / throttle cable / throttle pick-up timing	Inspection / adjustment				○
Water pump	Inspection				○
Engine oil	Inspection / change	○		○	
Oil filter (cartridge)	Change				○
Spark plug(s)	Cleaning / adjustment / replacement	○			○
Timing belt	Inspection / replacement			○	○
Valve clearance (OHC)	Inspection / adjustment	○		○	

NOTE:

When operating in salt water, turbid or muddy water, the engine should be flushed with clean water after each use.

(additional)

Item	Actions	Every	
		500 hours (2.5 years)	1,000 hours (5 years)
Timing belt	Replacement		○

NOTE:

When using lead or high-sulfur gasoline, inspecting valve clearance may be required more frequently than every 500 hours.

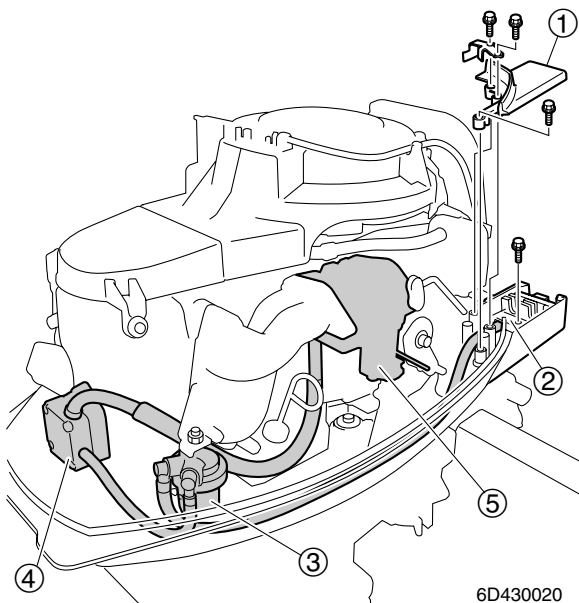




Fuel system

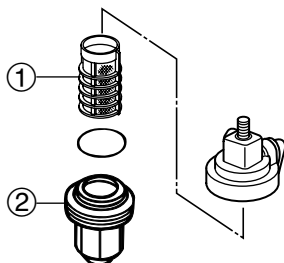
Checking the fuel line (fuel joint to carburetor)

1. Remove the fitting plate ①, and then check the fuel hose connections and fuel joint ② for leaks. Replace if necessary. Also, check the fuel filter ③, fuel pump ④, and carburetor ⑤ for leaks, and the fuel hoses for leaks and deterioration. Replace if necessary.



Checking the fuel filter

1. Check the fuel filter element ① for dirt and residue and check the fuel filter cup ② for foreign substances and cracks. Clean with straight gasoline or replace the filter element if necessary.



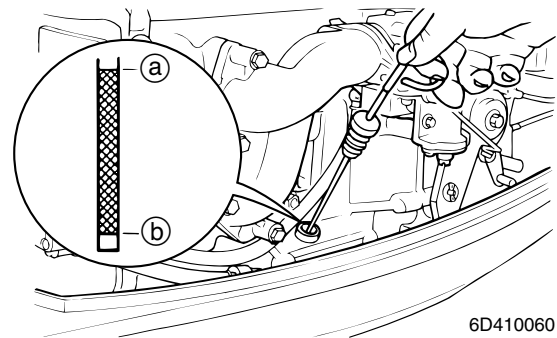
NOTE: _____

Be sure not to spill any fuel when removing the fuel filter cup.

Power unit

Checking the engine oil

1. Place the outboard in an upright position.
2. Remove the engine oil dipstick, wipe it clean, and then insert it back.
3. Remove the dipstick again to check the oil level and the oil for discoloration, and its viscosity.

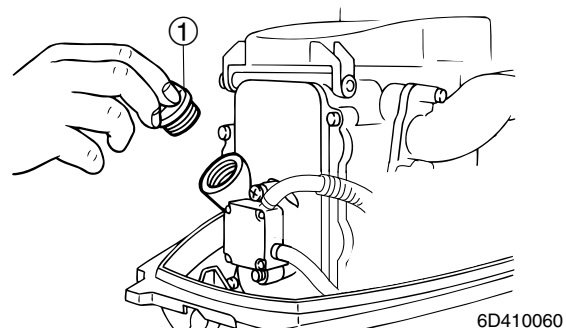


NOTE: _____

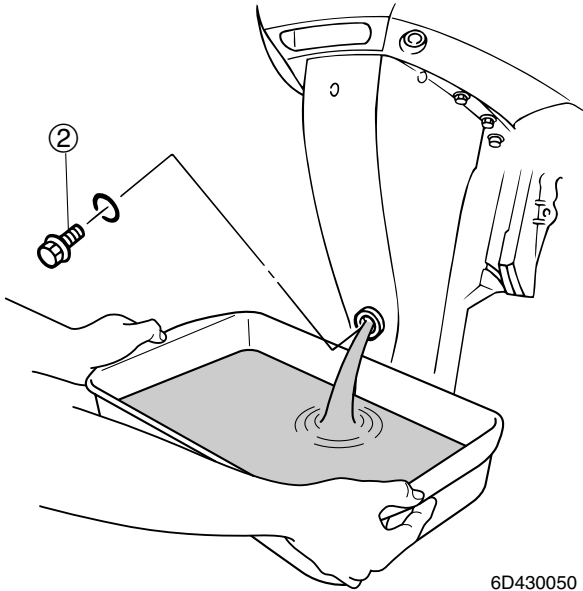
- Replace the oil if it appears milky or black.
- If the engine oil is above the maximum level mark ①, drain sufficient oil until the level is between ① and ②.
- If the engine oil is below the minimum level mark ②, add sufficient oil until the level is between ① and ②.

Changing the engine oil

1. Start the engine and warm it up.
2. Remove the engine oil dipstick and oil filler cap ①.



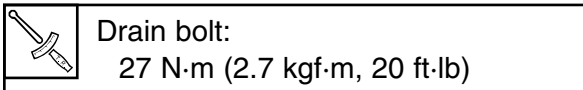
- Place a drain pan under the drain hole, and then remove the drain bolt ② and let the oil drain completely.



6D430050

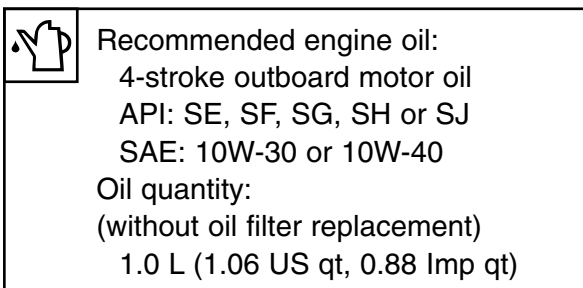
NOTE: _____
Be sure to clean up any oil spills.

- Install the drain bolt, and then tighten it to the specified torque.



Drain bolt:
27 N·m (2.7 kgf·m, 20 ft·lb)

- Pour the specified amount of the recommended engine oil into the oil filler hole.

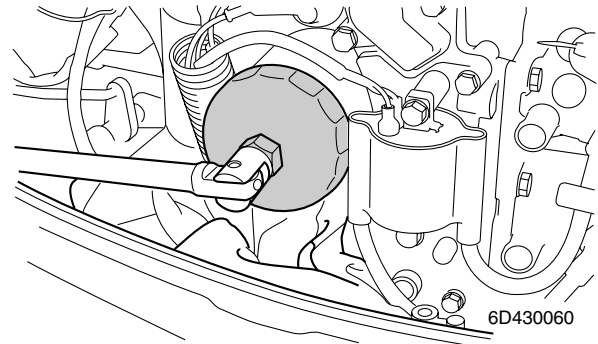


Recommended engine oil:
4-stroke outboard motor oil
API: SE, SF, SG, SH or SJ
SAE: 10W-30 or 10W-40
Oil quantity:
(without oil filter replacement)
1.0 L (1.06 US qt, 0.88 Imp qt)

- Install the oil filler cap and dipstick, and then start the engine and warm it up for 5 minutes.
- Turn the engine off, and then check the oil level and correct it if necessary.

Replacing the oil filter

- Place a rag under the oil filter, and then remove the filter.



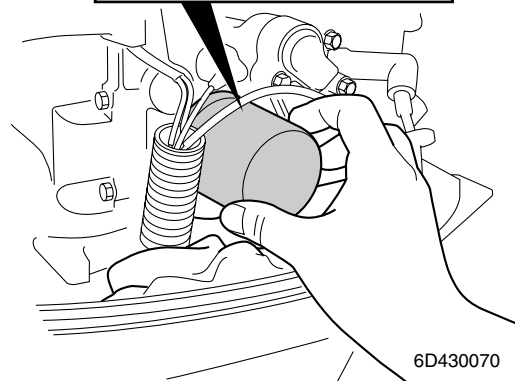
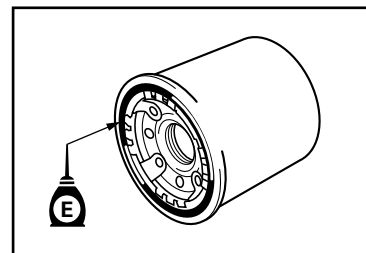
6D430060



Oil filter wrench:
90890-01426

NOTE: _____
Be sure to clean up any oil spills.

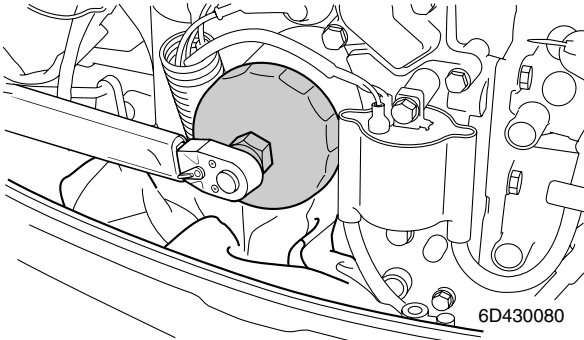
- Apply a thin coat of the new engine oil to the O-ring of the new oil filter.





6D430070



3. Install the oil filter, and then tighten it to the specified torque.

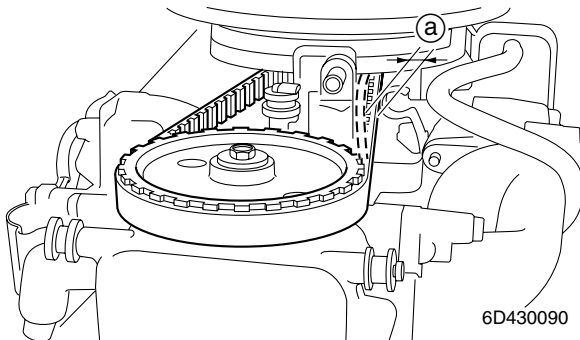


 Oil filter wrench:
90890-01426


 Oil filter:
18 N·m (1.8 kgf·m, 13 ft·lb)

Checking the timing belt

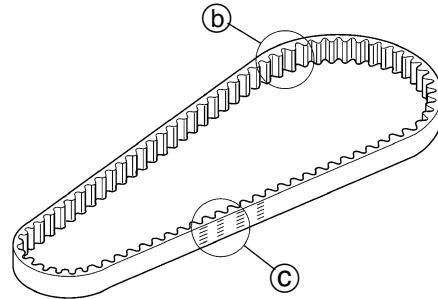
1. Remove the manual starter and cover.
2. Turn the flywheel magnet clockwise to transfer the slack (a) of the timing belt from port to starboard and hold the flywheel magnet.



3. Slightly push the timing belt with your finger between the drive sprocket and driven sprocket, and then measure the belt slack. Replace if necessary.

 Specified slack (a):
Less than 10.0 mm (3.9 in)

4. Check the interior (b) and the exterior (c) of the timing belt for cracks, damage, or wear. Replace if necessary.

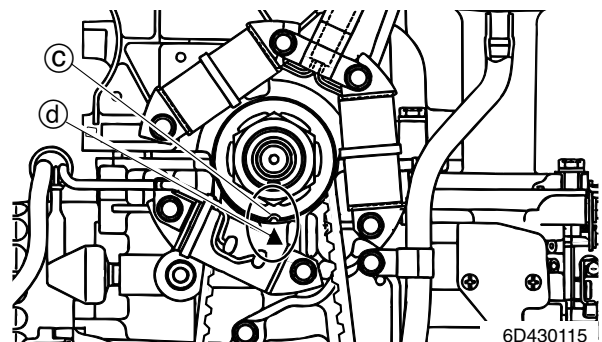
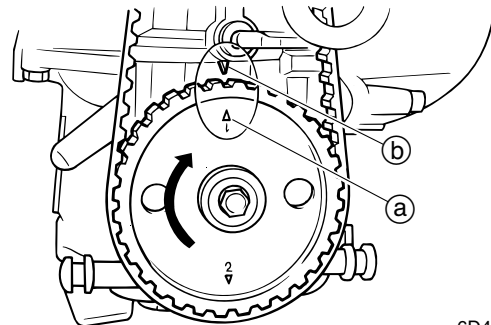


CAUTION:

Do not turn the flywheel magnet counter-clockwise, otherwise the valve system may be damaged.

Replacing the timing belt

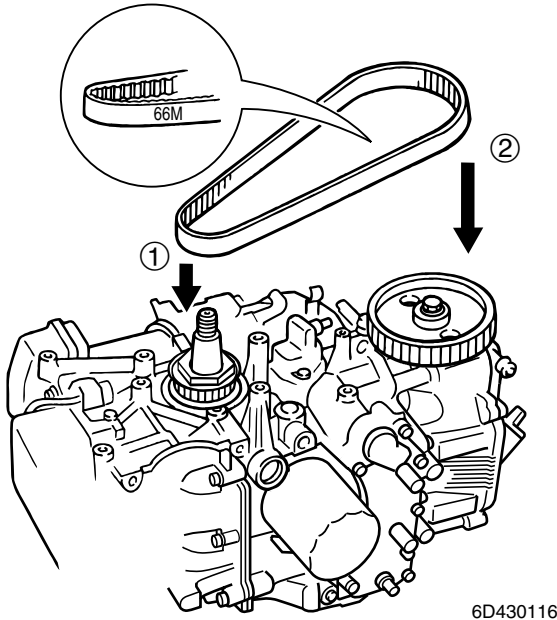
1. Turn the flywheel magnet clockwise and align the "1" mark (a) on the driven sprocket with the "▼" mark (b) on the cylinder head, and then remove the timing belt.



NOTE:

At the same time, check the cut out (c) on the driven sprocket with the "▲" mark (d) on the cylinder block is aligned.

2. Check the timing mark aligned, then install the new timing belt carefully on to the sprockets.



6D430116

NOTE:

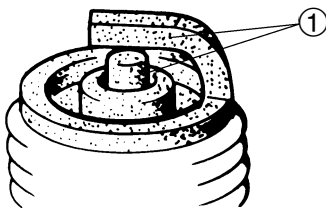
First install the drive sprocket side ①, then install the driven sprocket side ②.

CAUTION:

Do not turn the drive sprocket or the driven sprocket when the timing belt is not installed. Otherwise the piston and valves will interfere with each other and be damaged.

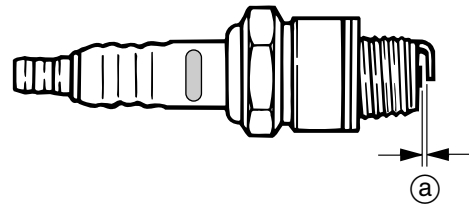
Checking the spark plugs

1. Remove the Spark plug caps, then remove the spark plugs.
2. Clean the electrodes ① with a spark plug cleaner or wire brush. Replace the spark plug if necessary.



6B430025

3. Check the electrodes for erosion and excessive carbon or other deposits, and the gasket for damage. Replace the spark plug if necessary.
4. Check the spark plug gap ①. Adjust if out of specification.



6B430030

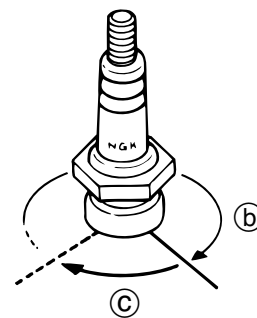


Specified spark plug:
DPR6EA-9 (NGK)



Spark plug gap ①:
0.8–0.9 mm (0.031–0.035 in)

5. Install the spark plug, tighten it finger tight ①, then to the specified torque with a spark plug wrench ②.



6B430040

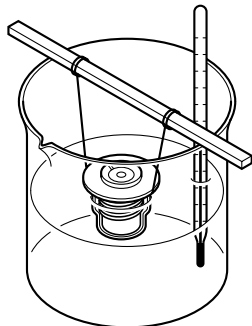


Spark plug:
18 N·m (1.8 kgf·m, 13 ft·lb)



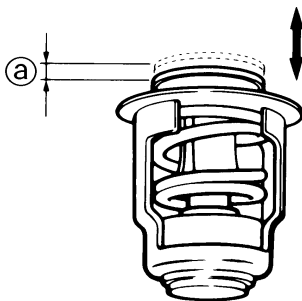
Checking the thermostat

1. Remove the thermostat. Refer to "Thermostat" in chapter 5.
2. Suspend the thermostat in a container of water.
3. Place a thermometer in the water and slowly heat the water.



6B430060

4. Check the thermostat valve opening at the specified water temperatures. Replace if out of specification.



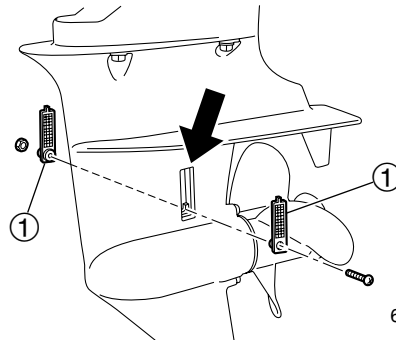
6B430070

Water temperature	Valve lift (a)
below 58.0–62.0°C (136.40–143.60°F)	0 mm (0 in)
above 70.0°C (158.00°F)	more than 3.0 mm (0.12 in)

5. Install the thermostat, new gasket, and thermostat cover.

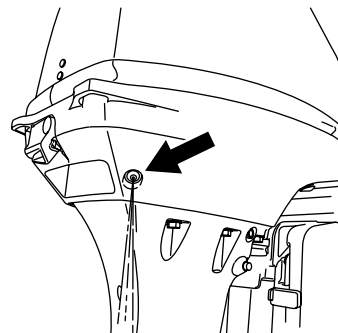
Checking the cooling water passages

1. Check the cooling water inlet covers (1) and cooling water inlet for clogging. Clean if necessary.



6D430200

2. Place the lower unit in water, then start the engine.
3. Check for water flow at the cooling water pilot hole. If there is no water flow, check the cooling water passages.



6B410130

Control system

Checking the start-in-gear protection

CAUTION:

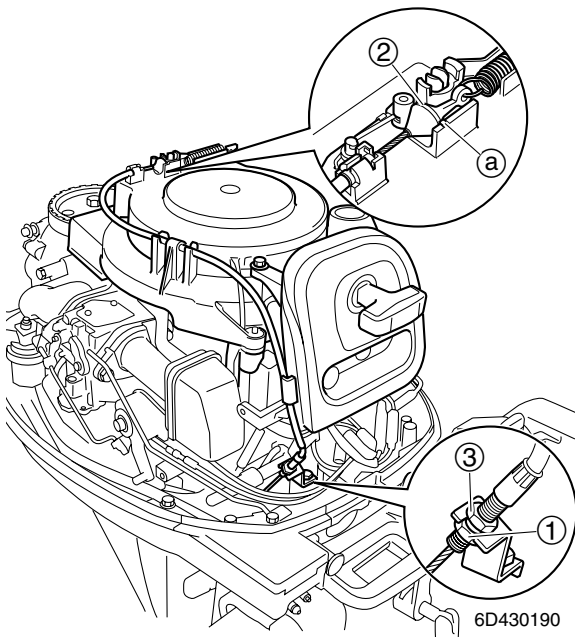
Be sure to remove the engine stop lanyard switch clip before checking the start-in-gear protection.

1. Set the shift lever and or remote control lever in the forward or reverse position, then pull the starter handle.
2. Check the operation of the start-in-gear protection cable. If the starter rope can be pulled out normally, adjust the start-in-gear protection cable.

NOTE:

If the starter rope cannot be pulled out, the start-in-gear protection is working correctly.

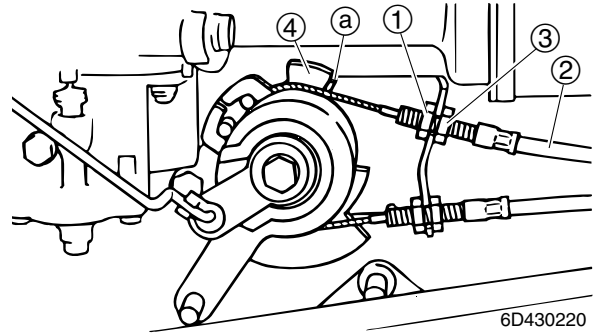
3. Set the shift lever and or remote control lever in the neutral position and loosen the locknut ①. Align the wire end ② with the mark (a) on the starter case to adjust the cable adjuster ③.



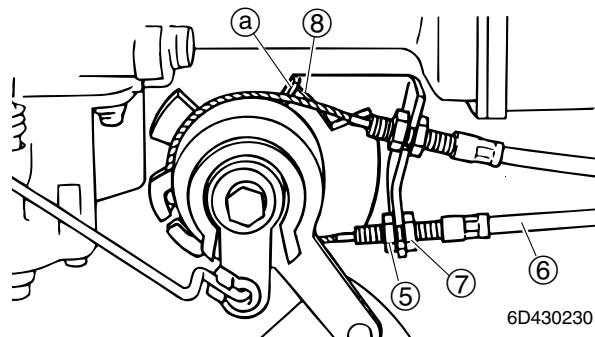
**Adjusting the throttle cable
(For tiller control model)**

1. Check that the throttle cables for smooth operation, looseness, fraying or damage. Replace if necessary.
2. With the throttle grip in the fully closed position, check that the stopper on the pulley, comes in contact with the throttle stopper plate. Adjust if necessary.

3. Loosen the locknut ① and adjust the length of the throttle cable (pull-side) ② with the adjusting nut ③ until the stopper ④ on the pulley contact the stopper plate (a) on the bracket, then tighten the locknut.



4. Turn the throttle grip to the fully closed position.
5. Loosen the locknut ⑤ and adjust the length of the throttle cable (push-side) ⑥ with the adjusting nut ⑦ until the stopper ⑧ on the pulley contact the stopper plate (a) on the bracket, then tighten the locknut.



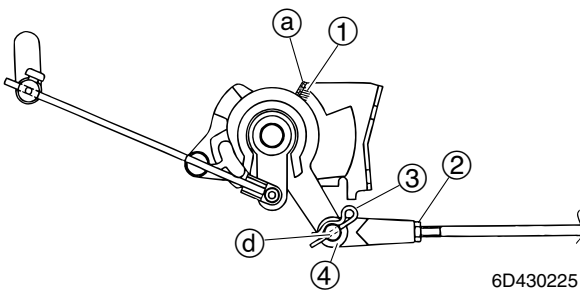
6. Fully open and close the throttle grip and make sure the stopper on the pulley contacts the stopper on the bracket (at the fully opened position) and stopper on the bracket contacts the stopper on the pulley (at the fully closed position). If proper contacts are not made, repeat the procedure.



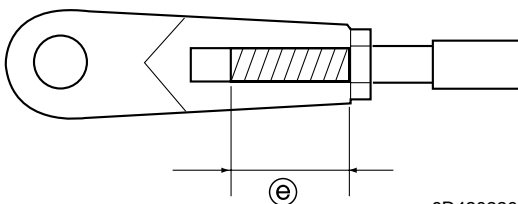


(For remote control model)

1. Check that the throttle cable for smooth operation, looseness, fraying or damage. Replace if necessary.
2. Check that the stopper ① on the pulley is contact the stopper plate on the bracket ② when the remote control lever is in neutral and the throttle lever is fully closed. Adjust the throttle cable length if necessary.
3. Loosen the locknut ②, remove the clip ③, and then disconnect the cable joint ④.



4. Adjust the position of the throttle cable joint until its hole is aligned with the set pin ④ on the pulley.



CAUTION: _____
The shift/throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ④.

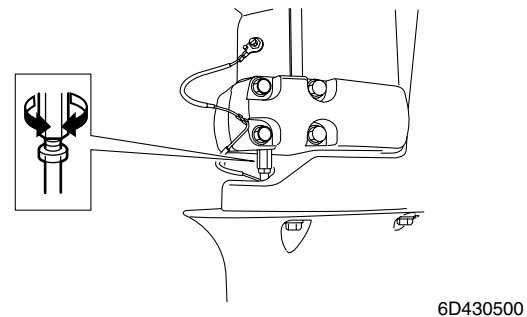
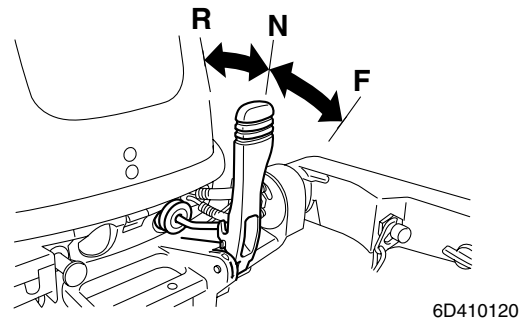
5. Install the clip and tighten the locknut.

6. Check the throttle cable for smooth operation.

NOTE: _____
 If the remote control cables cannot be properly adjusted at the engine side, make adjustments at the remote control side.

**Checking the gearshift operation
(For tiller control model)**

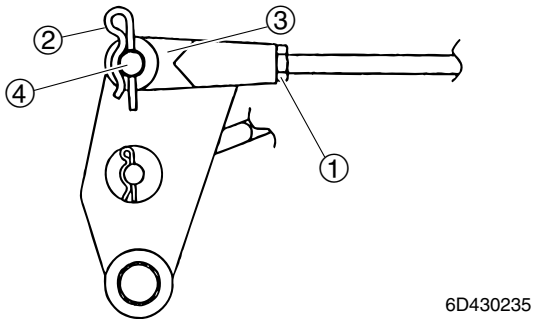
1. Check that the gearshift operates smoothly when shifting from neutral into forward and reverse. Adjust the shift rod if necessary.



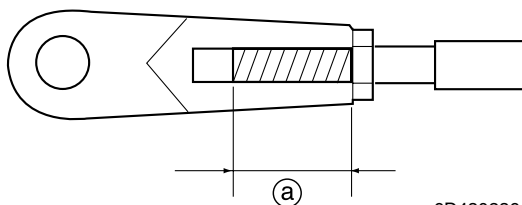
(For remote control model)

1. Check that the gearshift operates smoothly when shifting from neutral into forward and reverse. Adjust the shift rod and shift control cable joint if necessary.
2. Set the gearshift to the neutral position.

- Loosen the locknut ①, remove the clip ②, and then disconnect the shift cable joint ③.



6D430235

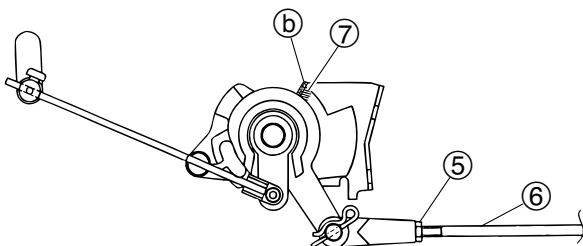


6D430236

CAUTION:

The shift/throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) a.

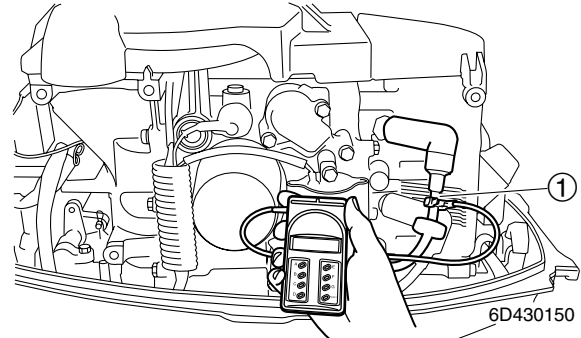
- Adjust the position of the shift cable joint until its hole is aligned with the set pin ④ on the shift lever.
- Install the clip and then tighten the locknut.
- Loosen the locknut ⑤ and adjust the length of the throttle cable ⑥ until the stopper ⑦ on the pulley contacts the stopper plate ⑧ on the bracket. And then tighten the locknut.



6D430228

Checking the engine idle speed

- Start the engine and warm it up for 5 minutes.
- Attach the special service tool to spark plug wire #1 ①, then check the engine idle speed. Adjust if out of specification.



6D430150

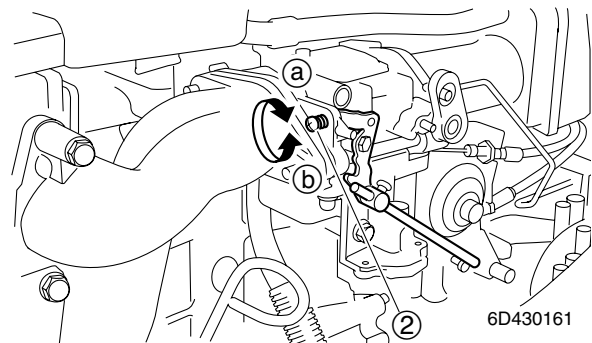


Digital tachometer: 90890-06760



Engine idle speed:
900–1,000 r/min

- Turn the throttle stop screw ② in direction a or b until the specified engine idle speed is obtained.



6D430161

NOTE:

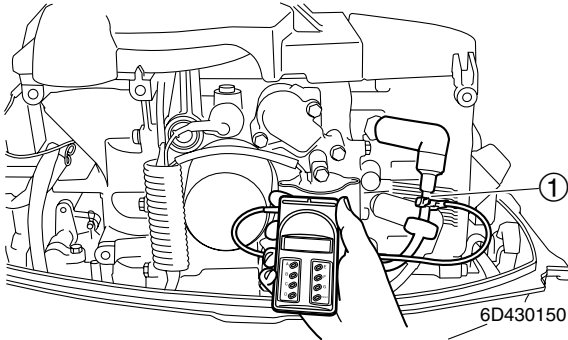
- To increase the idle speed, turn the throttle stop screw in direction a.
- To decrease the idle speed, turn the throttle stop screw in direction b.

- After adjusting the idle speed, rev the engine a few times and let it idle for at least 15 seconds to check the stability of the engine.



Checking the ignition timing

1. Start the engine and warm it up for 5 minutes.
2. Attach the special service tool to spark plug wire #1 ①, and then check the engine idle speed.

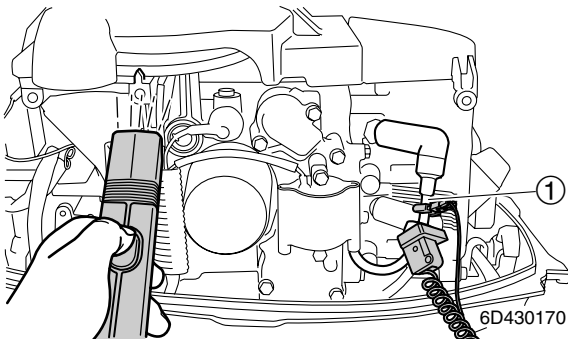


Digital tachometer: 90890-06760



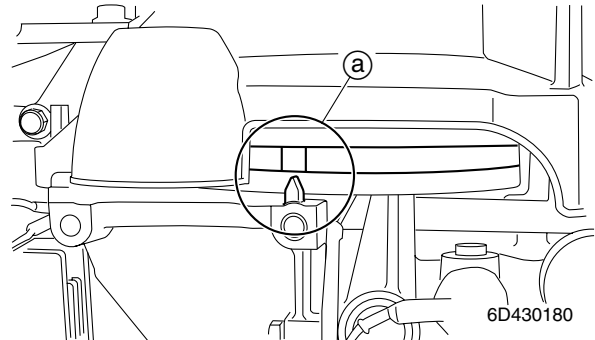
Engine idle speed:
900–1,000 r/min

3. Attach the special service tool to spark plug wire #1 ①.



Timing light: 90890-03141

4. Check that the line ① on the flywheel magnet is advances automatically, when the engine speed increased.



Ignition timing:

Full retarded:

B.T.D.C 5.0 ± 3.0 degree

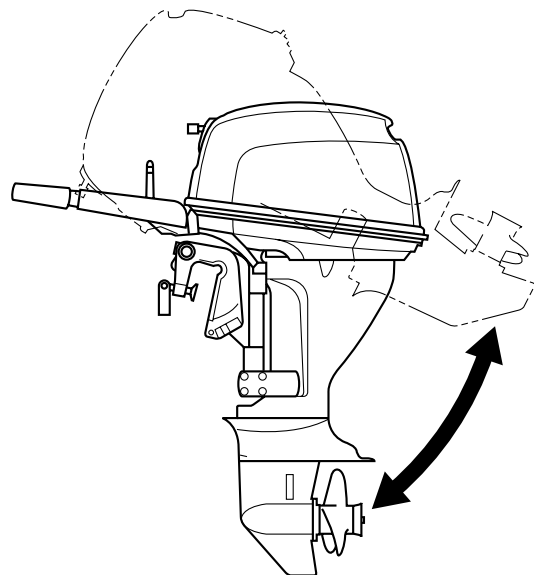
Full advanced:

B.T.D.C 30.0 ± 3.0 degree

Bracket

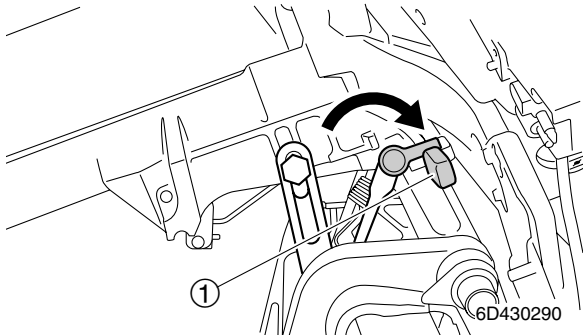
Checking the tilt operation

1. Fully tilt the outboard motor up and down a few times and check the entire tilt range for smooth operation. Check the tilt mechanism if necessary.



6D430195

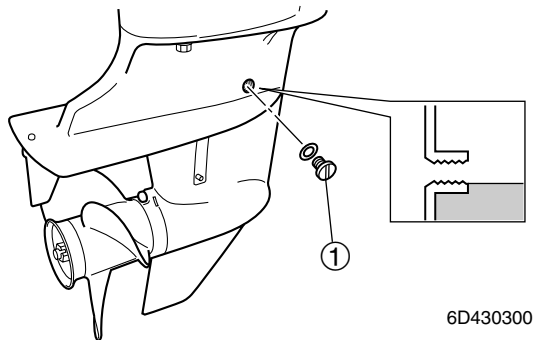
- Fully tilt the outboard motor up, then support it with the tilt support lever ① to check the lock mechanism of the lever.



Lower unit

Checking the gear oil level

- Fully tilt the outboard motor down.
- Remove the check screw ①, then check the gear oil level in the lower case.



NOTE:

The gear oil level should be at the brim of the check hole.

- If necessary, add sufficient gear oil of the recommended type to the correct level.

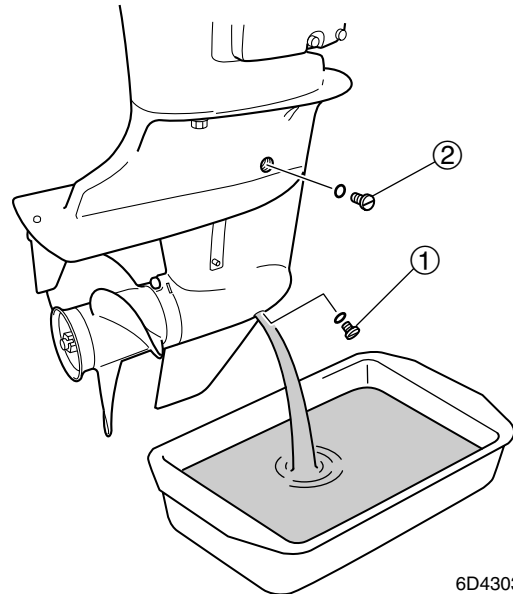
	Recommended gear oil: Hypoid gear oil SAE: 90
--	---

- Install the check screw, then tighten it to the specified torque.

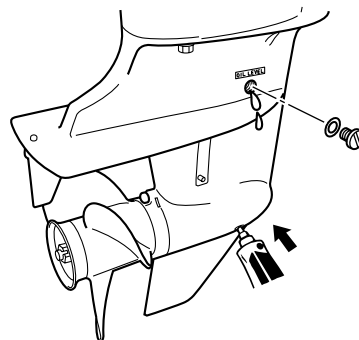
	Check screw: 9 N·m (0.9 kgf·m, 6.6 ft·lb)
--	--

Replacing the gear oil

- Fully tilt the outboard motor down.
- Place a drain pan under the drain screw ①, remove the drain screw, then the check screw ② to drain the oil.



- Check the oil for metal, discoloration, and viscosity. Check the internal parts of the lower case if necessary.
- Insert the gear oil tube into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.



	Recommended gear oil: Hypoid gear oil SAE: 90 Oil quantity: 0.25 L (8.45 US oz, 8.82 Imp oz)
--	--



5. Install the check screw, quickly install the drain screw, then tighten them to the specified torque.



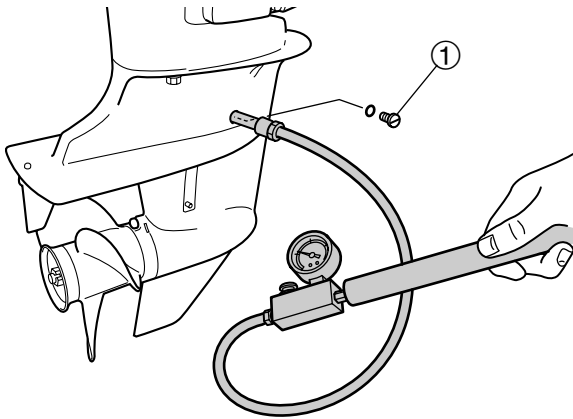
Check and drain screw:
9 N·m (0.9 kgf·m, 6.6 ft·lb)

Checking the lower unit for air leakage

CAUTION: _____

Do not over pressurize the lower unit, otherwise the oil seals may be damaged.

1. Remove the check screw ①, then install the special service tool.



6D430300



Leakage tester: 90890-06840

2. Apply the specified pressure to check whether the lower unit can hold it for at least 10 seconds.



Lower unit holding pressure:
100 kPa (1.0 kgf/cm², 14 psi)

3. If pressure drops below specification, check the drive shaft, propeller shaft oil seals, shift rod, and drain screw for damage.

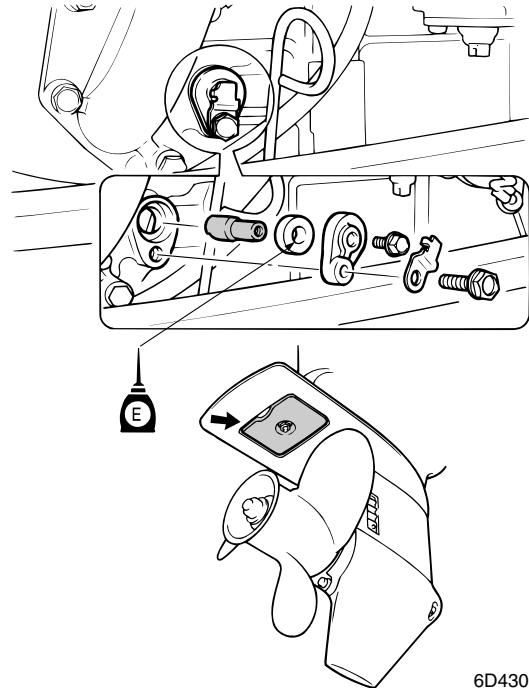
Checking the propeller

1. Check the propeller blades and splines for cracks, damage, or wear. Replace if necessary.

General

Checking the anode

1. Check the anode for scales, grease, and oil. Clean if necessary.



6D430335

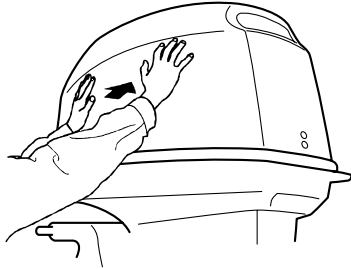
CAUTION: _____

Do not oil, grease, or paint the anode, otherwise it will be ineffective.

2. Replace the anode if excessively eroded.

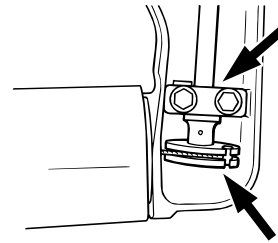
Checking the top cowling

1. Check the fitting of the top cowling by pushing on it with both hands.

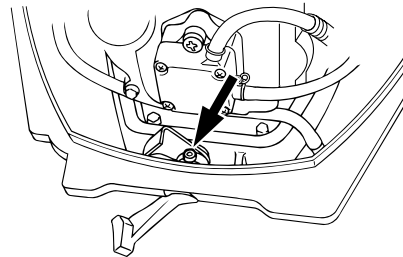


6D430010

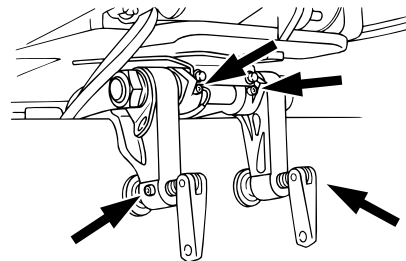
2. Check the top cowling for cracks or other damage. Replace if necessary.
3. Check the hooks and rivets for wear or damage. Repair if necessary.
4. Check the rubber trim for wear, deterioration or damage. Replace if necessary.
5. Check the lock mechanism for wear or damage. Repair if necessary.



6D430360



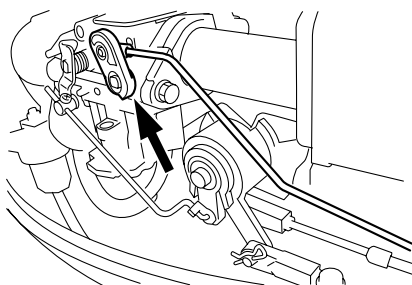
6D430370



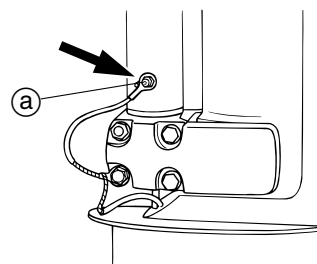
6D430380

Lubricating the outboard motor

1. Apply water resistant grease to the areas shown.

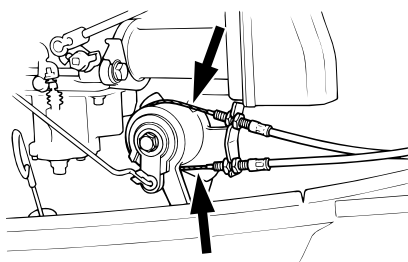


6D430340



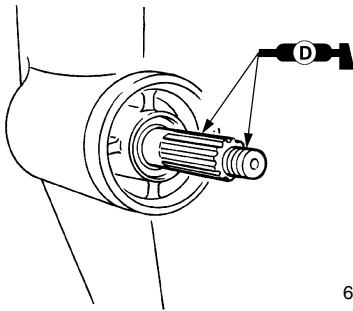
6D430400

NOTE: _____
 Apply grease to the grease nipple (a) until it flows from the bushings.



6D430350

2. Apply corrosion resistant grease to the area shown.



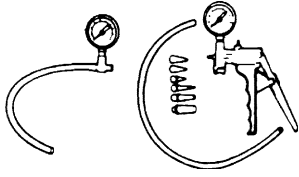
6B430300

Fuel system

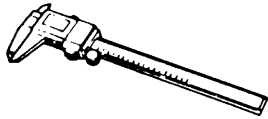
Special service tools	4-1
Hose routing	4-2
Fuel line	4-3
Checking the fuel joint	4-4
Checking the fuel filter	4-4
Carburetor	4-5
Disassembling the carburetor	4-8
Checking the carburetor	4-8
Assembling the carburetor.....	4-9
Adjusting the throttle link rod	4-10
Adjusting the pilot screw.....	4-10
Fuel pump	4-11
Checking the fuel pump.....	4-12
Disassembling the fuel pump	4-12
Checking the diaphragm and valves	4-13
Assembling the fuel pump	4-13



Special service tools



Vacuum/pressure pump gauge set
90890-06756

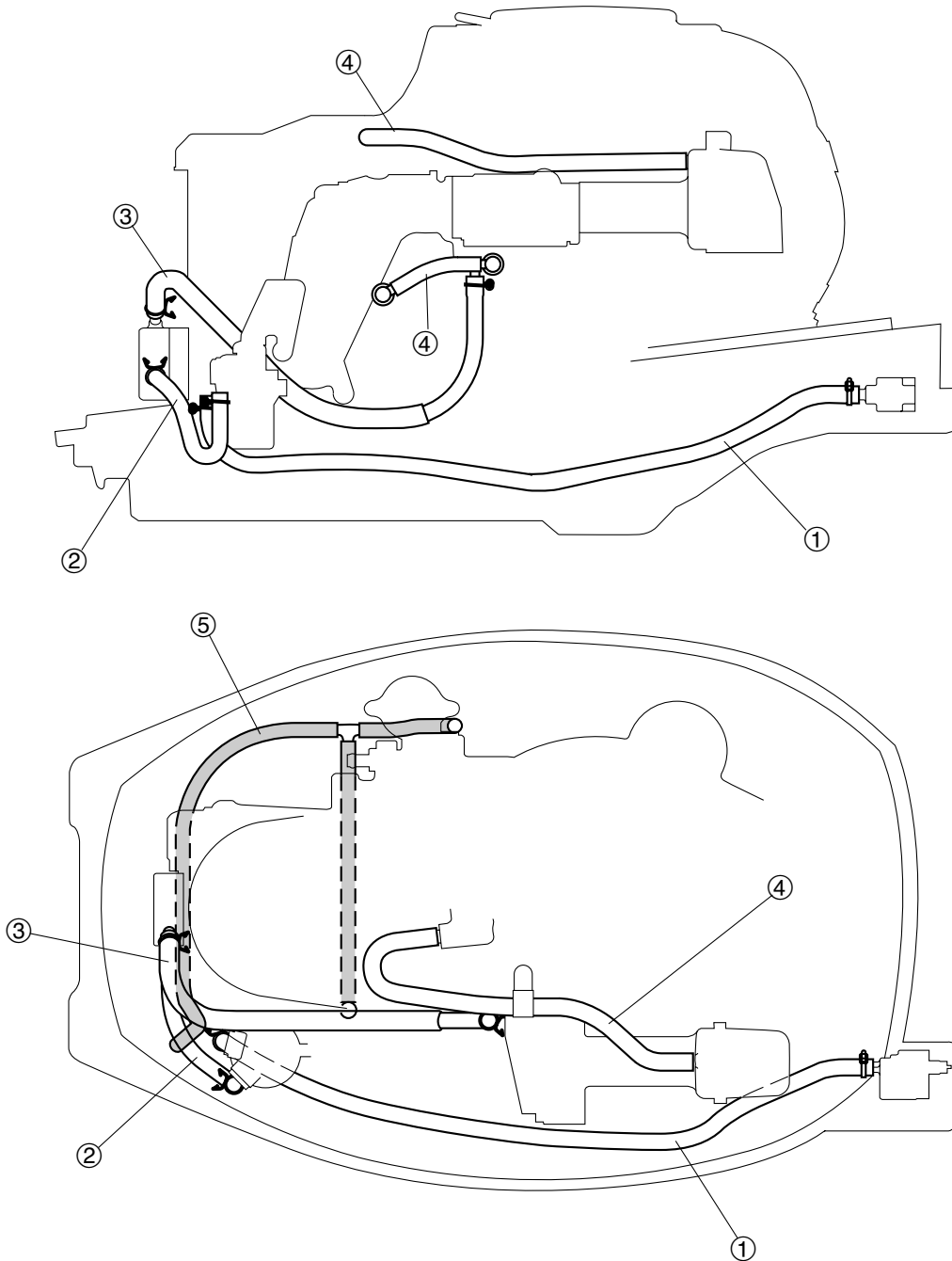


Digital caliper
90890-06704



Digital tachometer
90890-06760

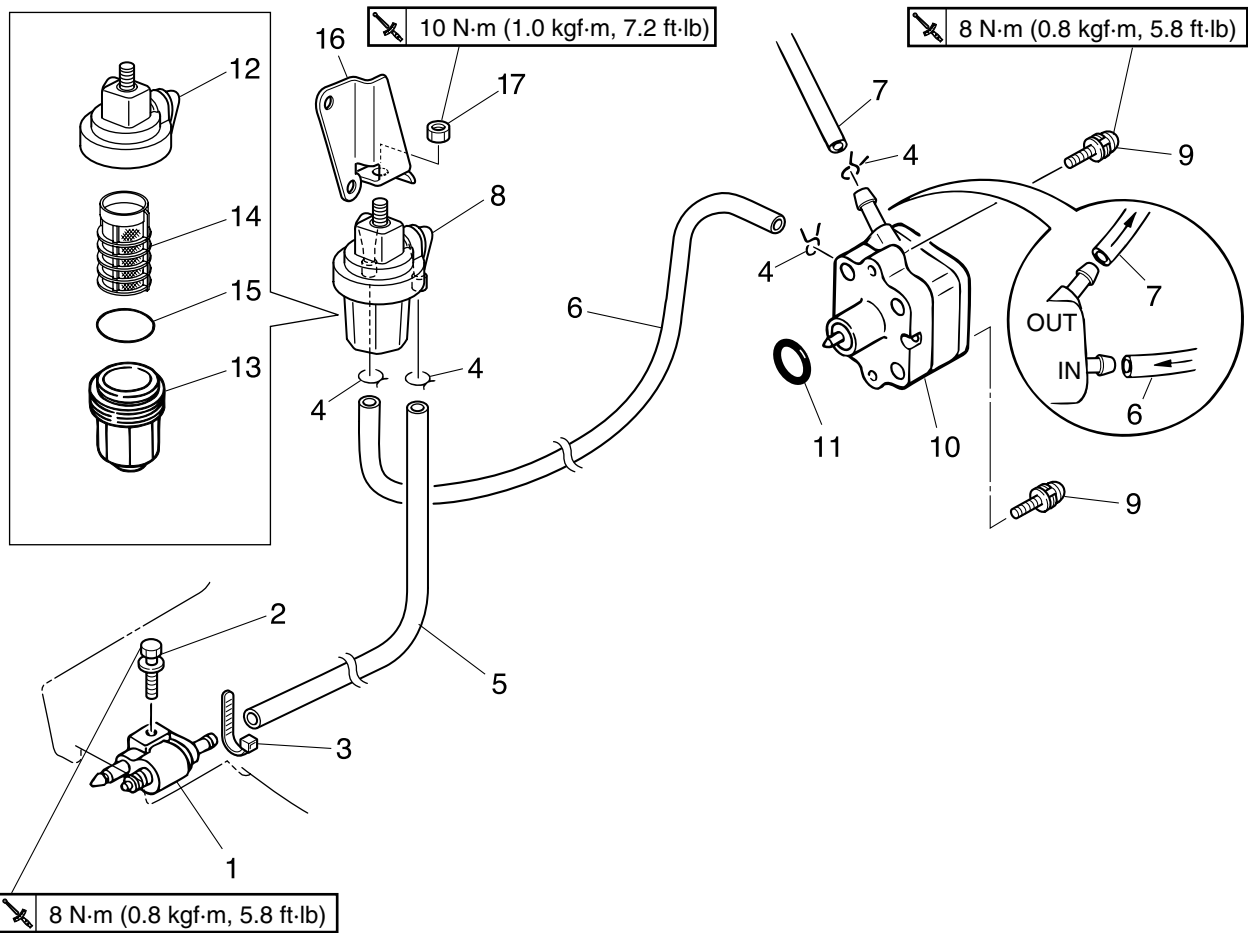
Hose routing



- ① Fuel hose (Fuel joint to fuel filter)
- ② Fuel hose (Fuel filter to fuel pump)
- ③ Fuel hose (Fuel pump to carburetor)
- ④ Breather hose
- ⑤ Pilot water hose

6D440010

Fuel line

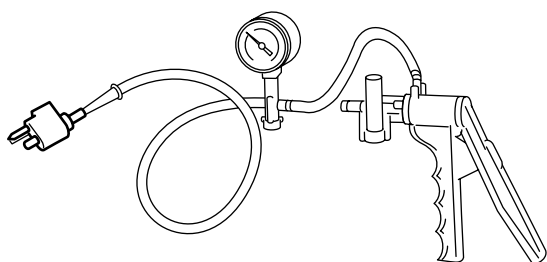


6D44010E

No.	Part name	Q'ty	Remarks
1	Fuel joint	1	
2	Bolt	1	M6 × 20 mm
3	Clamp	1	
4	Clip	4	
5	Hose	1	
6	Hose	1	
7	Hose	1	
8	Fuel filter assembly	1	
9	Screw	2	M4 × 30 mm
10	Fuel pump	1	
11	O-ring	1	Not reusable
12	Filter cap	1	
13	Filter cup	1	
14	Filter	1	
15	O-ring	1	Not reusable
16	Bracket	1	
17	Nut	1	

Checking the fuel joint

1. Visually check the fuel joint for cracks or damage.
2. Connect the special service tool at the outlet of fuel joint.
3. Apply the specified pressure to check that the pressure is maintained for 10 seconds. Replace the fuel joint if necessary.



6B440020



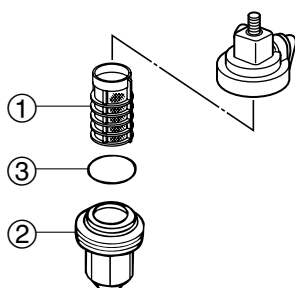
Vacuum/pressure pump gauge set:
90890-06756



Fuel joint holding pressure:
50 kPa (0.5 kgf/cm², 7.3 psi)

Checking the fuel filter

1. Check the fuel filter element ① for clogging, contamination, or foreign substances, and check the fuel filter cup ② for cracks or leakage. Clean with straight gasoline, or replace if necessary.

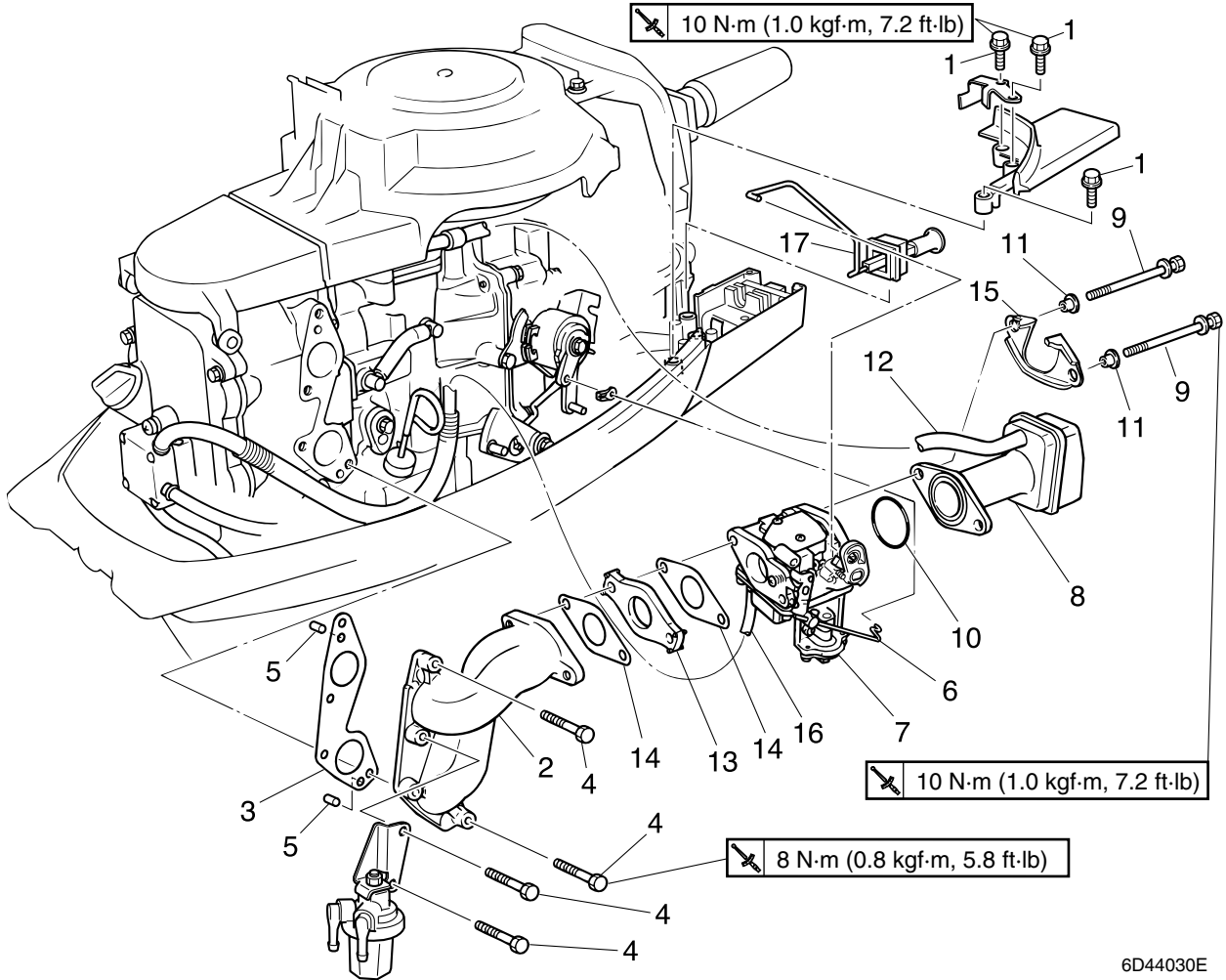


6B440035

NOTE:

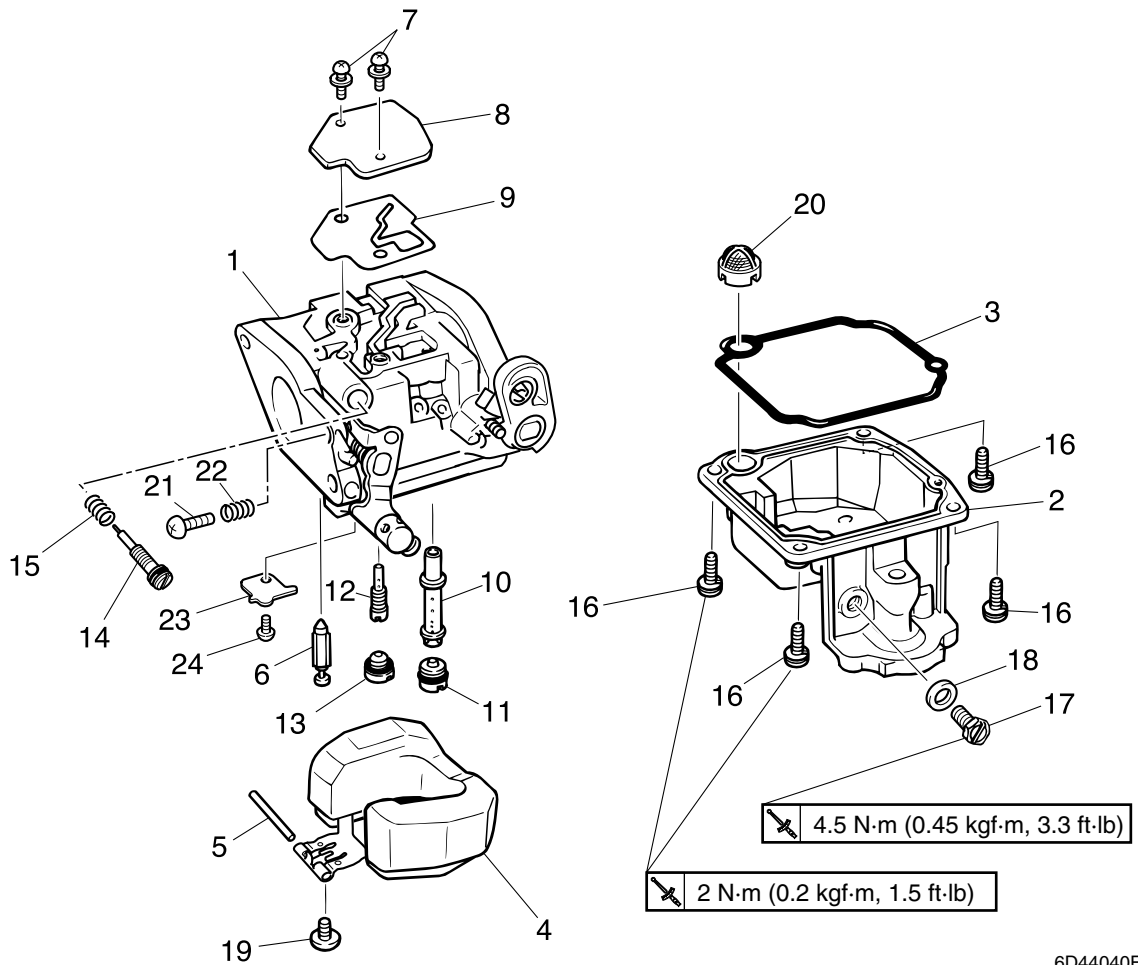
Apply a thin coat of gasoline to the O-ring ③ before assembling the fuel filter cup.

Carburetor



6D44030E

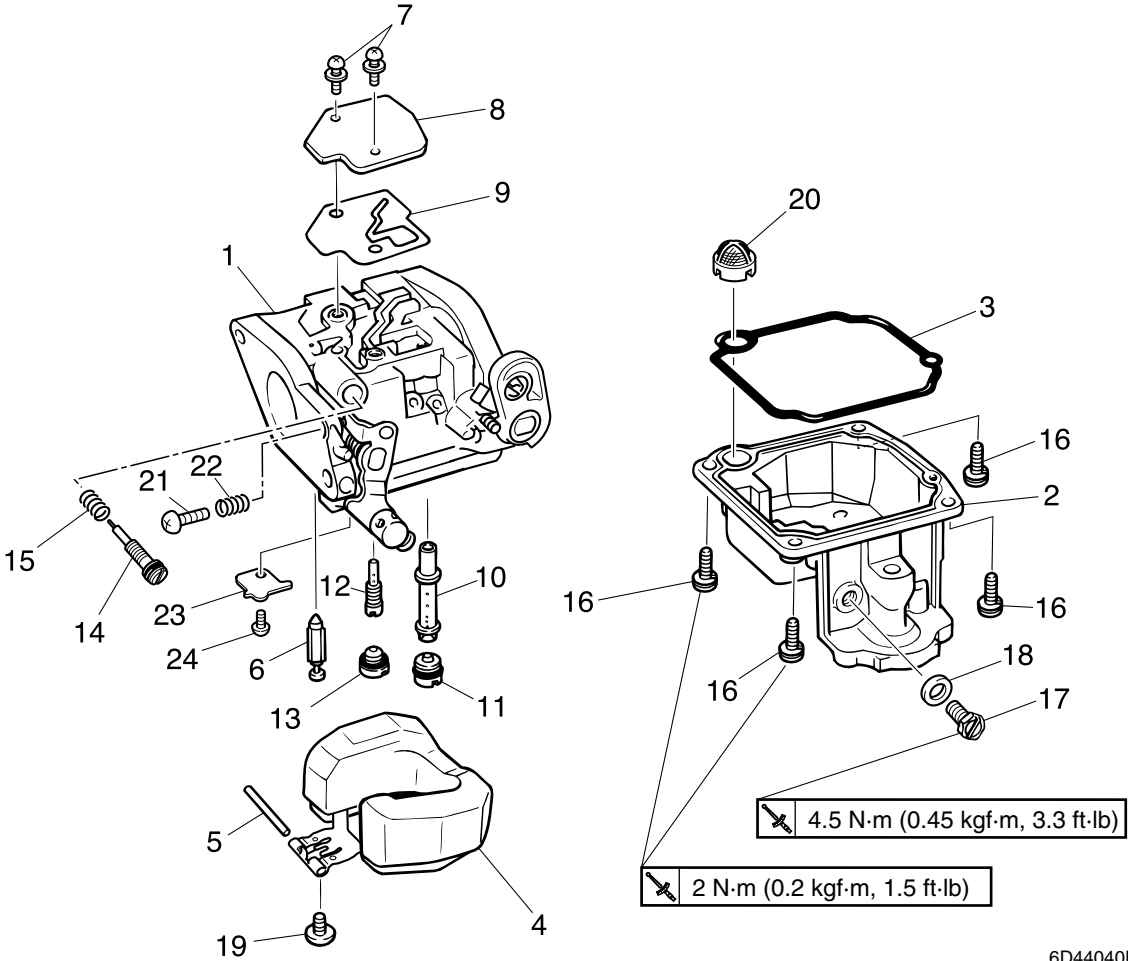
No.	Part name	Q'ty	Remarks
1	Bolt	3	M6 × 30 mm
2	Intake manifold	1	
3	Gasket	1	Not reusable
4	Bolt	4	M6 × 30 mm
5	Dowel pin	2	
6	Throttle link	1	
7	Carburetor assembly	1	
8	Intake silencer	1	
9	Bolt	2	M6 × 100 mm
10	O-ring	1	Not reusable
11	Collar	2	
12	Breather hose	1	
13	Insulator	1	
14	Gasket	2	Not reusable
15	Plate	1	
16	Hose	1	
17	Choke rod	1	



4

6D44040E

No.	Part name	Q'ty	Remarks
1	Carburetor body	1	
2	Float chamber	1	
3	O-ring	1	Not reusable
4	Float	2	
5	Float pin	1	
6	Needle valve	1	
7	Screw	2	
8	Cover plate	1	
9	Gasket	1	Not reusable
10	Main nozzle	1	
11	Main jet	1	
12	Pilot jet	1	
13	Plug	1	
14	Pilot screw	1	
15	Spring	1	
16	Screw	4	M4 × 12 mm
17	Drain bolt	1	



6D44040E

No.	Part name	Q'ty	Remarks
18	Gasket	1	Not reusable
19	Screw	1	
20	Filter	1	Plastic
21	Screw	1	
22	Spring	1	
23	Plate	1	
24	Screw	1	

Disassembling the carburetor

NOTE: _____

- Write down how many turns you have actually turned out the pilot screw.
- Disassembled jets and other components should be sorted out and kept in order, so that they can be re-assembled in their original positions.

Checking the carburetor

1. Clean the fuel and air passages and the carburetor body, and blow off any clogging with compressed air.

WARNING _____

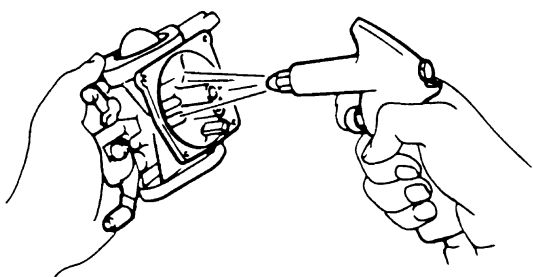
Wear appropriate protective eye gear during the cleaning process to prevent any eye injury by the blown-off debris or liquid.

CAUTION: _____

Do not use steel wire and the like for cleaning the carburetor. Do not try to disassemble the main nozzle if it does not come out easily. Excessive force may seriously impair performance.

NOTE: _____

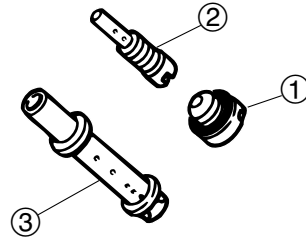
Clean the needle valve, main jet, and pilot jet after removal.



6D440025

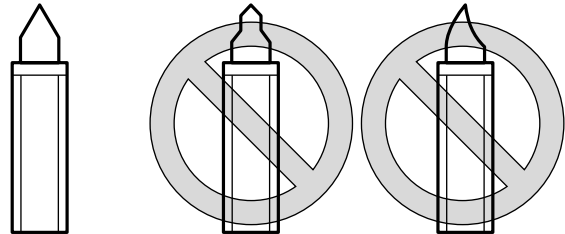
2. Check the carburetor body for cracks or damage. Replace if necessary.

3. Check the main jet ①, pilot jet ②, and main nozzle ③ for clogging and contamination. Clean or replace whenever appropriate.



6D440030

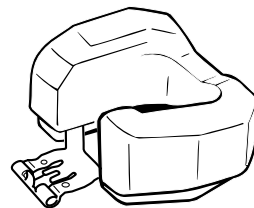
4. Check the pilot screws and needle valves for bending or stepped wear. Replace if necessary.



6B440040

4

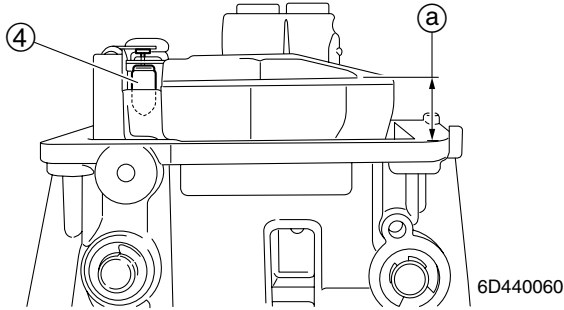
5. Check the float for deterioration. Replace if necessary.



6D440050



6. Measure the float height (a). Replace the float and needle valve, if out of specification, as a set.



6D440060

NOTE:

- Measure the float height as shown.
- The float should be resting on the needle valve (4), but not compressing it.
- Take measurements at the top of the float flange opposite its pivoted side.
- Turn the carburetor upside-down to make the measurement.

	Float height (a): 9.5–10.5 mm (0.37–0.41 in)
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	Digital caliper: 90890-06704
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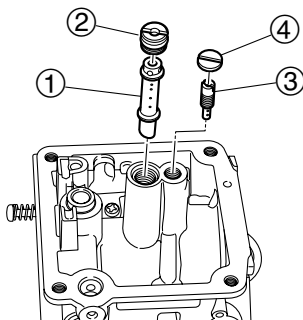
Assembling the carburetor

Refer to the following points when assembling the carburetor.

CAUTION:

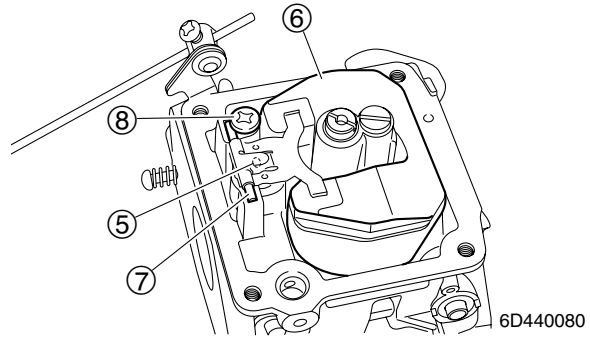
- Do not apply excessive force to push in the needle valve.
- Do not apply excessive force to screw in the pilot screw.

1. Install the main nozzle (1), main jet (2), pilot jet (3), and plug (4) to the carburetor body as shown.



6D440070

2. Install the needle valve (5), float (6), float pin (7), and screw (8) as shown, and then check the float for smooth operation.

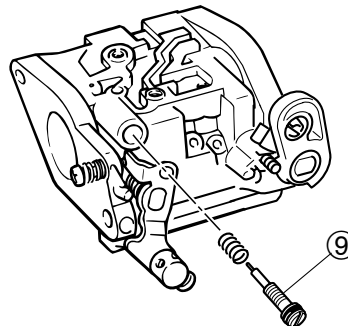


6D440080

NOTE:

- Place the needle valve in the valve seat when installing the float to the carburetor body.
- Fit the float pin into the slit on the carburetor body and lock it with the screw.

3. Install the pilot screw (9), turn it in until it is lightly seated, then out the specified number of turns.

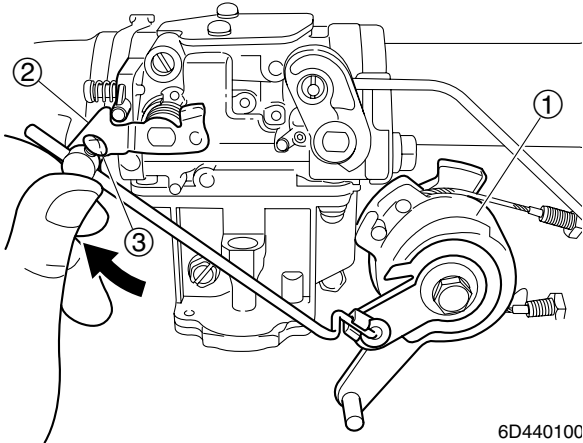


6D440090

	Pilot screw (9) turn-out: 1–2
--	----------------------------------

Adjusting the throttle link rod

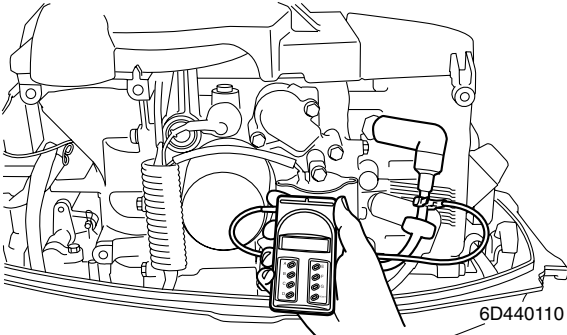
1. Turn the pulley ① to the fully open position as shown, and then push the carburetor throttle lever ② to the fully open position.




2. Set the both fully position and tighten the screw ③.

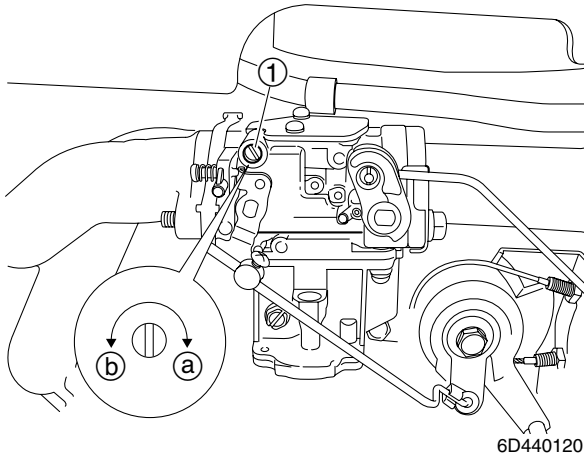
Adjusting the pilot screw


1. Start the engine and warm it up for 5 minutes to check the stability of the engine. Adjust the pilot screw if necessary.



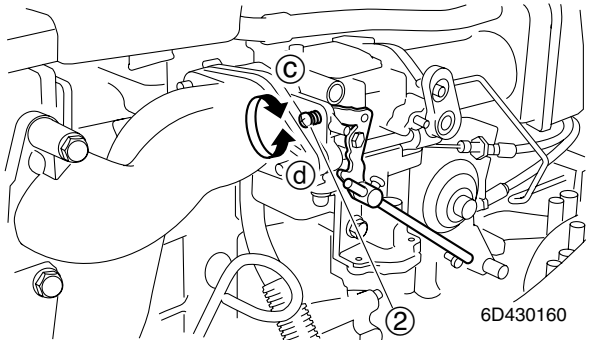
 Digital tachometer:
90890-06760

2. Turn the pilot screw ① in direction ① or ② until the engine idle speed has been specified.




 Pilot screw ① turn-out:
1-2

3. Turn the throttle stop screw ② in direction ③ or ④ until the specified engine idle speed is obtained.



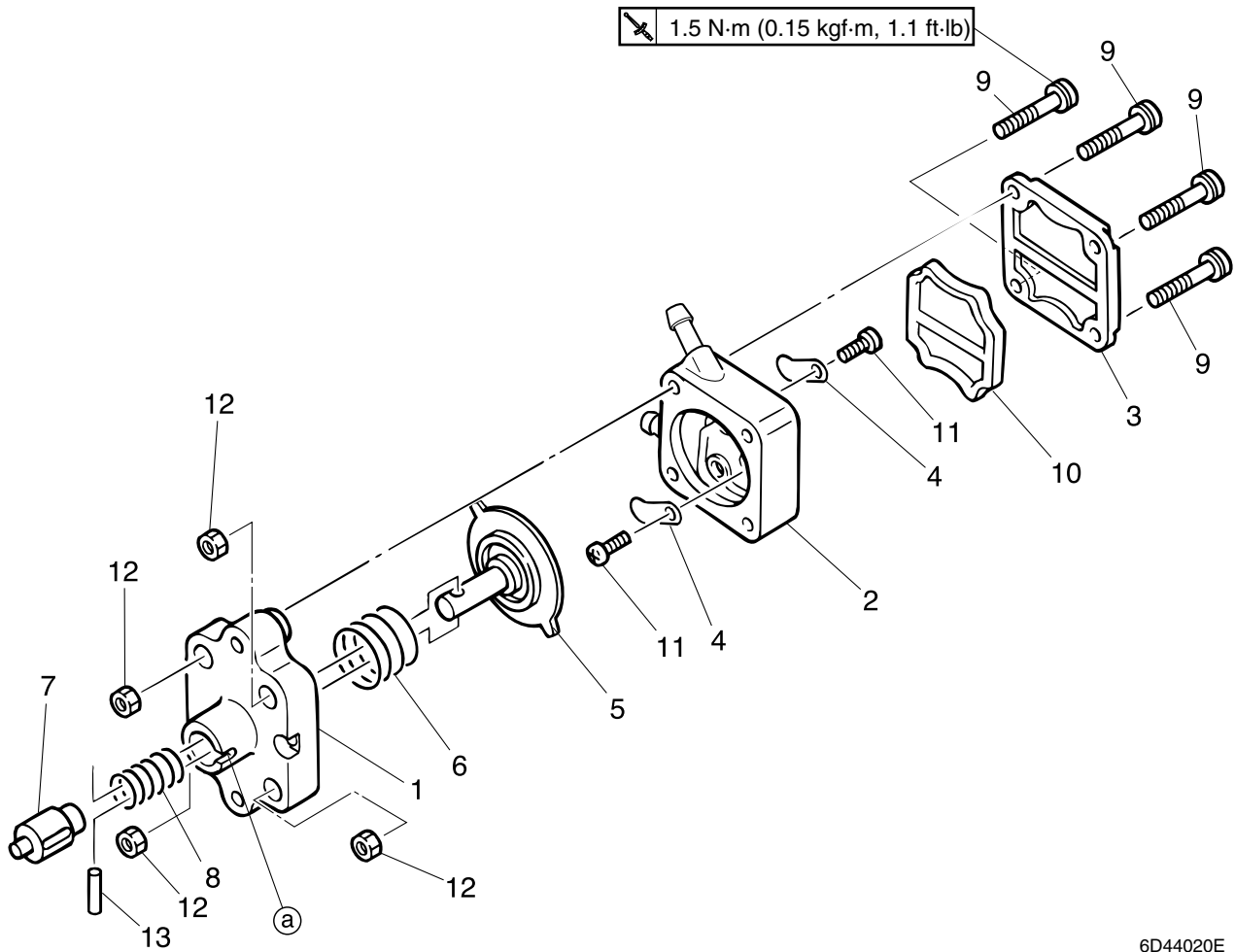
NOTE:

- To increase the idle speed, turn the throttle stop screw in direction ③.
- To decrease the idle speed, turn the throttle stop screw in direction ④.

 Engine idle speed:
900-1,000 r/min

4. After adjusting the idle speed, rev the engine a few times and let it idle for at least 15 seconds to check the stability of the engine.

Fuel pump

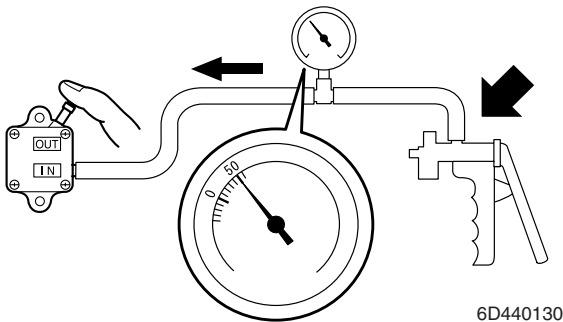


6D44020E

No.	Part name	Q'ty	Remarks
1	Fuel pump housing	1	
2	Fuel pump body	1	
3	Fuel pump cover	1	
4	Plate valve	2	
5	Diaphragm	1	
6	Spring	1	
7	Plunger	1	
8	Spring	1	
9	Screw	4	M4 × 9 mm
10	Diaphragm	1	
11	Screw	2	
12	Nut	4	
13	Pin	1	

Checking the fuel pump


1. Place a drain pan under the fuel hose connections, and then disconnect the fuel hoses from the fuel pump.
2. Connect the special service tool to the fuel pump inlet.
3. Cover the fuel pump outlet with a finger, and then apply the specified positive pressure. Check that there is not air leakage.




6D440130

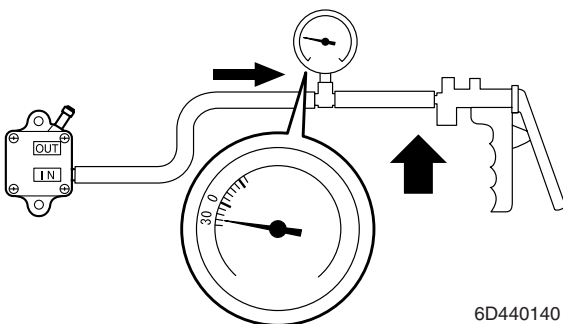
CAUTION:

Do not over pressurize the fuel pump, otherwise excessive pressure may cause air leakage.


 Vacuum/pressure pump gauge set:
90890-06756

 Specified pressure:
50 kPa (0.5 kgf/cm², 7.3 psi)

4. Apply the specified negative pressure and check that there is no air leakage.

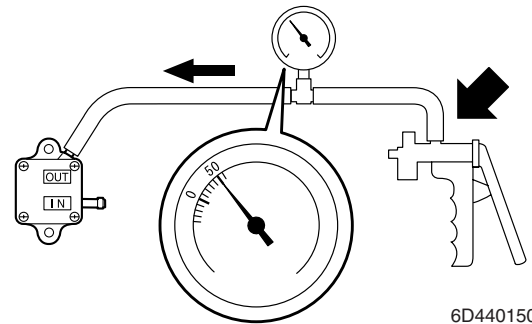


6D440140


 Specified pressure:
30 kPa (0.3 kgf/cm², 4.4 psi)

5. Connect the special service tool to the fuel pump outlet.

6. Apply the specified positive pressure and check that there is no air leakage. Disassemble the fuel pump if necessary.



6D440150

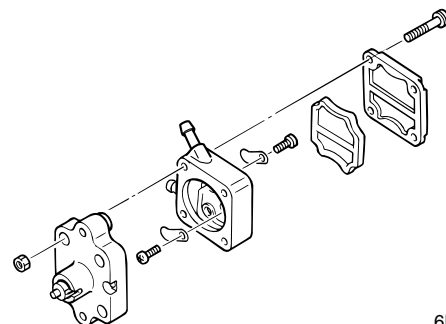
 Specified pressure:
50 kPa (0.5 kgf/cm², 7.3 psi)

NOTE:

Assemble the fuel pump valve to the fuel pump body, and moisten the inside of fuel pump with gasoline to ensure a better seal.

Disassembling the fuel pump

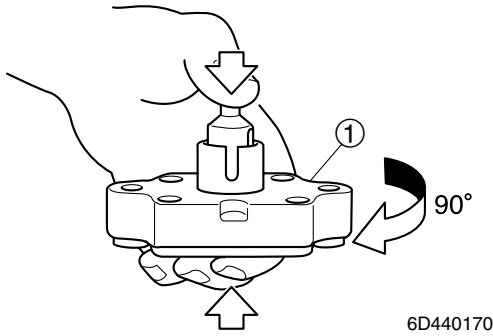
1. Disassemble the fuel pump as shown.



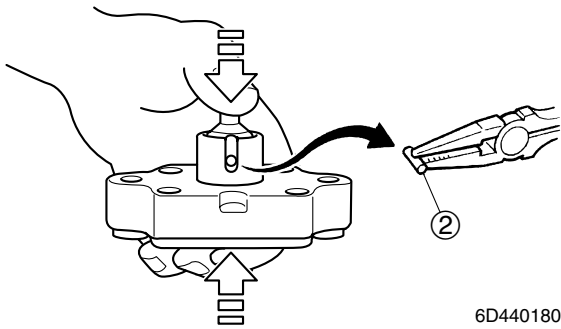
6D440160



2. Push down on the plunger and the diaphragm, turn the fuel pump body ① approximately 90° to a position where the pin ② can be removed easily, and then remove the pin.



6D440170

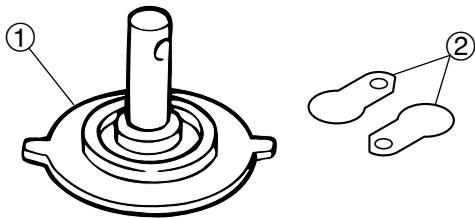


6D440180

3. Slowly let up on the plunger and diaphragm, and then remove them.

Checking the diaphragm and valves

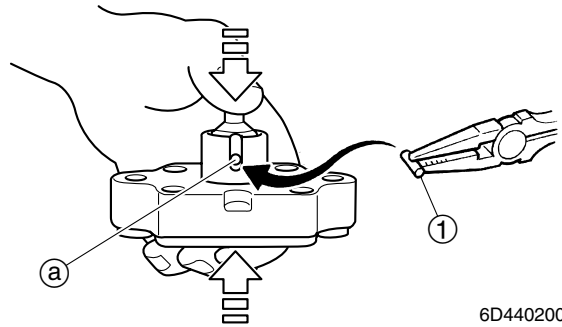
1. Check the diaphragm ① for tears and the plate valves ② for cracks. Replace if necessary.



6D440190

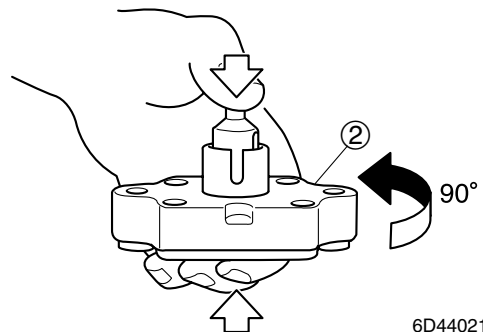
Assembling the fuel pump

1. Align the plunger and diaphragm installation holes ①, and then install the plunger into the diaphragm.
2. Push down on the plunger and the diaphragm, and then install the pin ①.



6D440200

3. Turn the fuel pump body ② approximately 90°, and then push down on the plunger several times to make sure that the pin does not come out.



6D440210

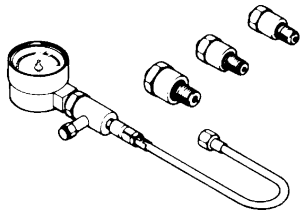
— MEMO —

Power unit

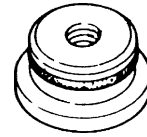
Special service tools.....	5-1
Power unit.....	5-3
Checking the compression pressure	5-3
Checking the oil pressure	5-3
Checking the oil pressure switch.....	5-4
Checking the valve clearance.....	5-4
Disassembling the manual starter	5-12
Checking the spiral spring	5-12
Assembling the manual starter	5-13
Removing the power unit.....	5-14
Timing belt and sprockets.....	5-17
Removing the timing belt and sprockets	5-18
Checking the timing belt and sprockets.....	5-19
Installing the timing belt and sprockets	5-19
Cylinder head	5-21
Removing the cylinder head	5-24
Checking the valve springs.....	5-25
Checking the valves	5-25
Checking the valve guides.....	5-26
Replacing the valve guides.....	5-26
Checking the valve seat	5-27
Refacing the valve seat	5-28
Checking the rocker arms and rocker arm shaft	5-29
Checking the camshaft.....	5-30
Checking the cylinder head	5-31
Checking the oil pump.....	5-31
Installing the valves	5-31
Installing the cylinder head.....	5-32
Cylinder block	5-34
Disassembling the cylinder block	5-37
Disassembling the piston and connecting rod assemblies.....	5-38
Checking the piston diameter	5-38
Checking the cylinder bore	5-39
Checking the piston clearance	5-39
Checking the piston rings	5-39
Checking the piston ring grooves	5-40
Checking the piston ring side clearance.....	5-40
Checking the piston pin boss bore	5-41
Checking the piston pin	5-41
Checking the connecting rod small end inside diameter.....	5-41
Checking the connecting rod big end side clearance.....	5-41
Checking the crankshaft.....	5-42

Checking the crankshaft pin oil clearance	5-42
Checking the crankshaft main journal oil clearance	5-43
Selecting the crankshaft main journal bearing	5-44
Assembling the piston and connecting rod assemblies	5-45
Assembling the cylinder block	5-47
Installing the power unit	5-49

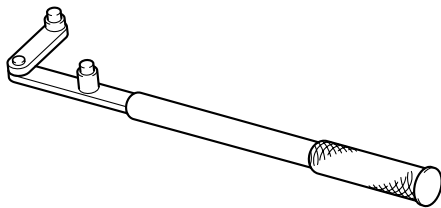
Special service tools



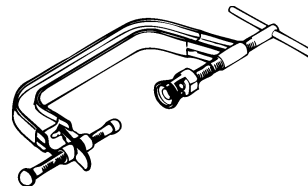
Compression gauge
90890-03160



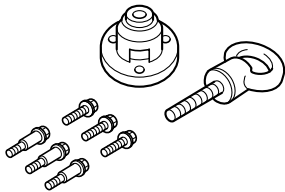
Ball bearing attachment
90890-06635



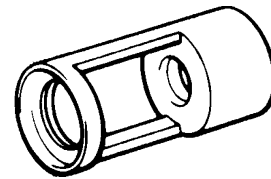
Flywheel holder
90890-06522



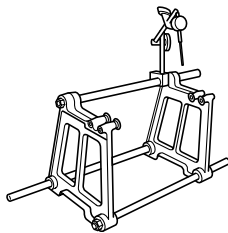
Valvespring compressor
90890-04019



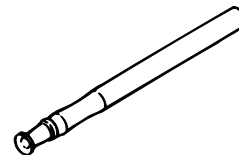
Flywheel puller
90890-06521



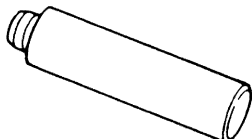
Valvespring compressor attachment
90890-06320



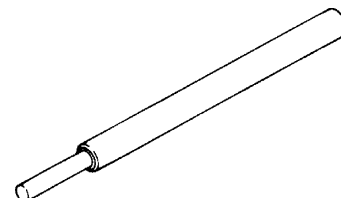
Crankshaft aligner
90890-03107



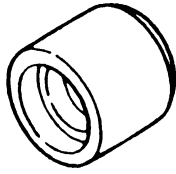
Valve lapper
90890-04101



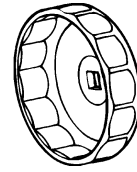
Driver rod LS
90890-06606



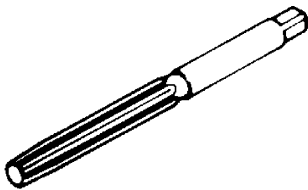
Valve guide remover/installer
90890-06801



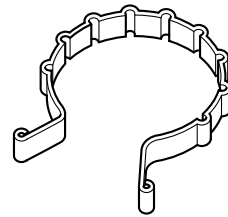
Valve guide installer
90890-06802



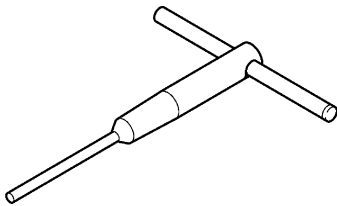
Oil filter wrench
90890-01426



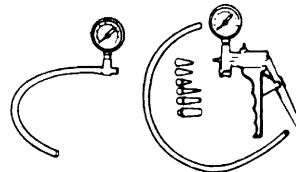
Valveguide reamer
90890-06804



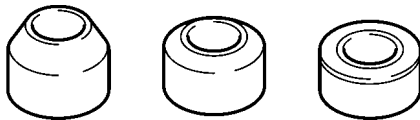
Piston slider
90890-06529



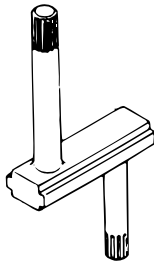
Valve seat cutter holder
90890-06316



Vacuum/pressure pump gauge set
90890-06756



Valve seat cutter
90890-06312, 90890-06313
90890-06314, 90890-06315



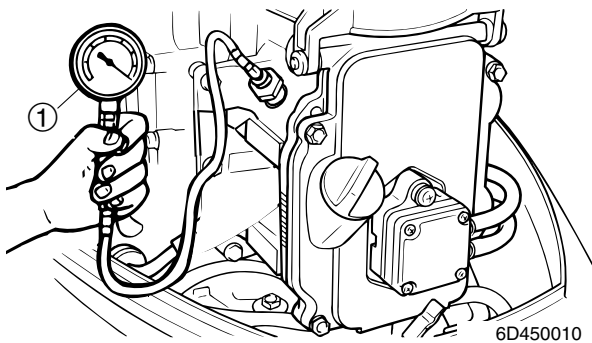
Shaft holder
90890-06069



Power unit

Checking the compression pressure

1. Start the engine, warm it up for 5 minutes, and then turn it off.
2. Remove the clip from the engine stop lanyard switch on the tiller handle or remote control box.
3. Remove the all spark plugs, and then install the special service tool to each spark plug hole.



CAUTION:

Before removing the spark plugs, blow compressed air in the spark plug well to clear out any dirt or dust that may fall into the cylinder.

	Compression gauge ①: 90890-03160
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4. Fully open the throttle, crank the engine until the reading on the compression gauge stabilizes, and then check the compression pressure.

NOTE:

- Do not pull the choke knob when checking the compression pressure.
- For remote control model. Remove the throttle link rod and full open the throttle lever on the carburetor by your finger, and then measuring the minimum compression pressure.

	Minimum compression pressure (reference data): 765 kPa (7.8 kgf/cm ² , 111 psi)
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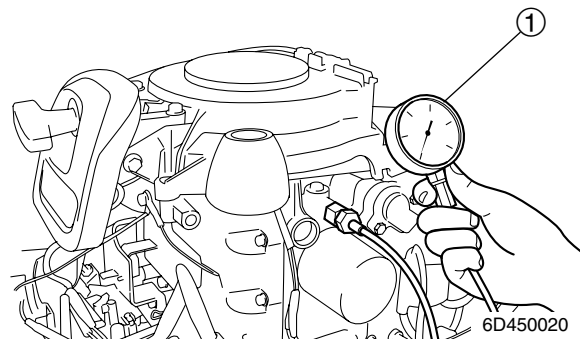
5. If the measured compression pressure is below specification, or it varies among the cylinders, add a small amount of engine oil to the cylinder, and check the pressure again.

NOTE:

- If the compression pressure increases, check the piston and piston rings for wear. Replace if necessary.
- If the compression pressure does not increase, check the valve clearance, valve, valve seat, cylinder sleeve, cylinder head gasket, and cylinder head. Adjust or replace if necessary.
- Since this outboard motor is equipped with an automatic decompression mechanism, accurate data may be difficult to obtain due to differences in the way the starter rope is pulled.

Checking the oil pressure

1. Start the engine, warm it up for 5 minutes, and then turn it off.
2. Remove the oil pressure switch, and then install an oil pressure gauge ① to the oil pressure switch installation hole.



NOTE:

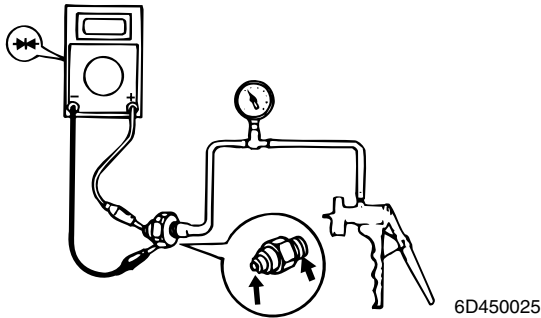
Use a pressure gauge with an adapter with a 1/8 pitch thread.


3. Check the oil pressure. Check the oil pump, relief valve, and oil strainer if out of specification.

	Oil pressure (reference data): 330 kpa (3.36 kgf/cm ² , 48 psi) at idle speed
--	--

Checking the oil pressure switch

1. Install the special service tool onto the oil pressure switch as shown.




 Vacuum/pressure pump gauge set:
90890-06756

2. Apply the specified pressure to oil pressure switch. Check the oil pressure switch continuity
3. If out of specification, replace if necessary.

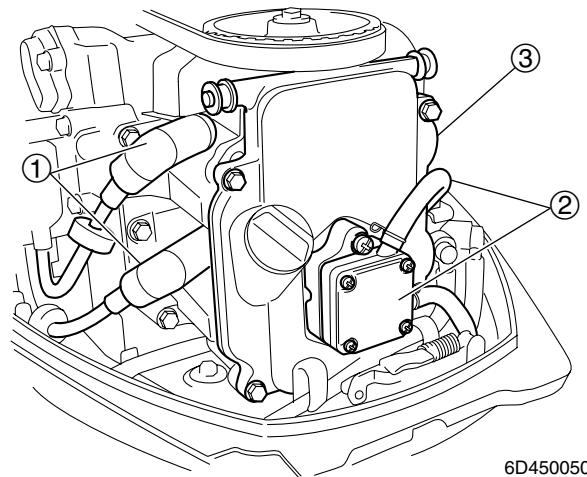
Pressure	Switch continuity
14.7 kPa (0.15 kg/cm ² , 2.13 psi) and above	No continuity
14.7 kPa (0.15 kg/cm ² , 2.13 psi) and below	Continuity

4. Check that the relief valve opening pressure, when the engine speed increased. Clean or replace if necessary.

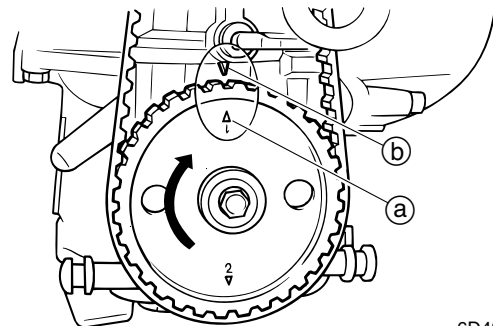
 Oil pressure (relief valve opening):
388.0–450.0 kpa
(3.88–4.50 kgf/cm²,
56.3–65.3 psi)

Checking the valve clearance

1. Remove the manual starter and timing belt cover and then disconnect the spark plug caps ①, spark plugs and fuel hoses.
2. Remove the fuel pump ②, and cylinder head cover ③.



3. Turn the flywheel clockwise and align the “1” mark ① on the driven sprocket with the “▼” mark ② on the cylinder head.



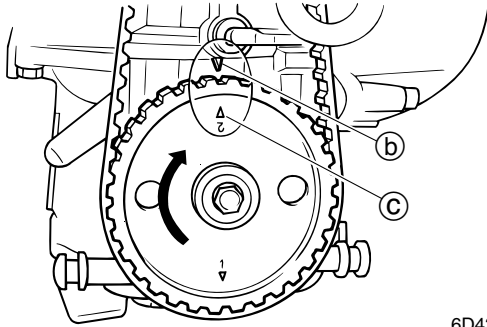
CAUTION:

Do not turn the flywheel counter-clockwise, otherwise the valve system may be damaged.

4. Check the intake and exhaust valve clearance for cylinders #1. Adjust if necessary.



- Turn the flywheel clockwise and align the “2” mark ③ on the driven sprocket with the “▼” mark ② on the cylinder head.

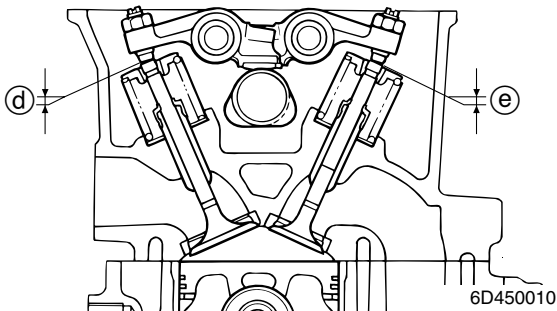


6D430115

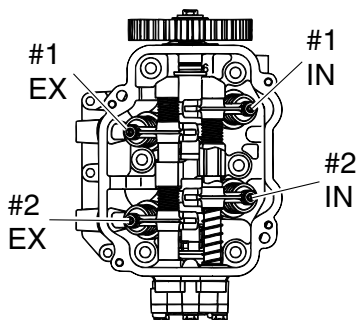
CAUTION:

Do not turn the flywheel counter-clockwise, otherwise the valve system may be damaged.

- Check the intake and exhaust valve clearance for cylinders #2. Adjust if necessary.



6D450010



6D450080

NOTE:

Adjust the valve clearance when the engine is cold.



Valve clearance:

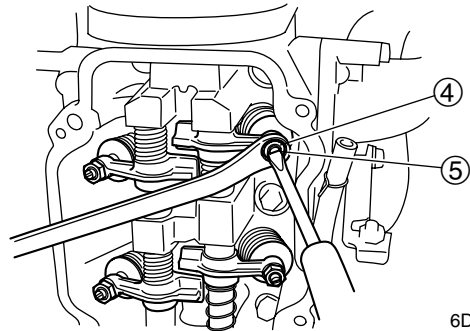
Intake ①:

0.15–0.25 mm (0.0059–0.0098 in)

Exhaust ②:

0.20–0.30 mm (0.0079–0.0118 in)

- Loosen the locknut ④, and then turn the adjusting screw ⑤ until the specified valve clearance is obtained.



6D450090

NOTE:

- To decrease the valve clearance, turn the adjusting screw clockwise.
- To increase the valve clearance, turn the adjusting screw counterclockwise.

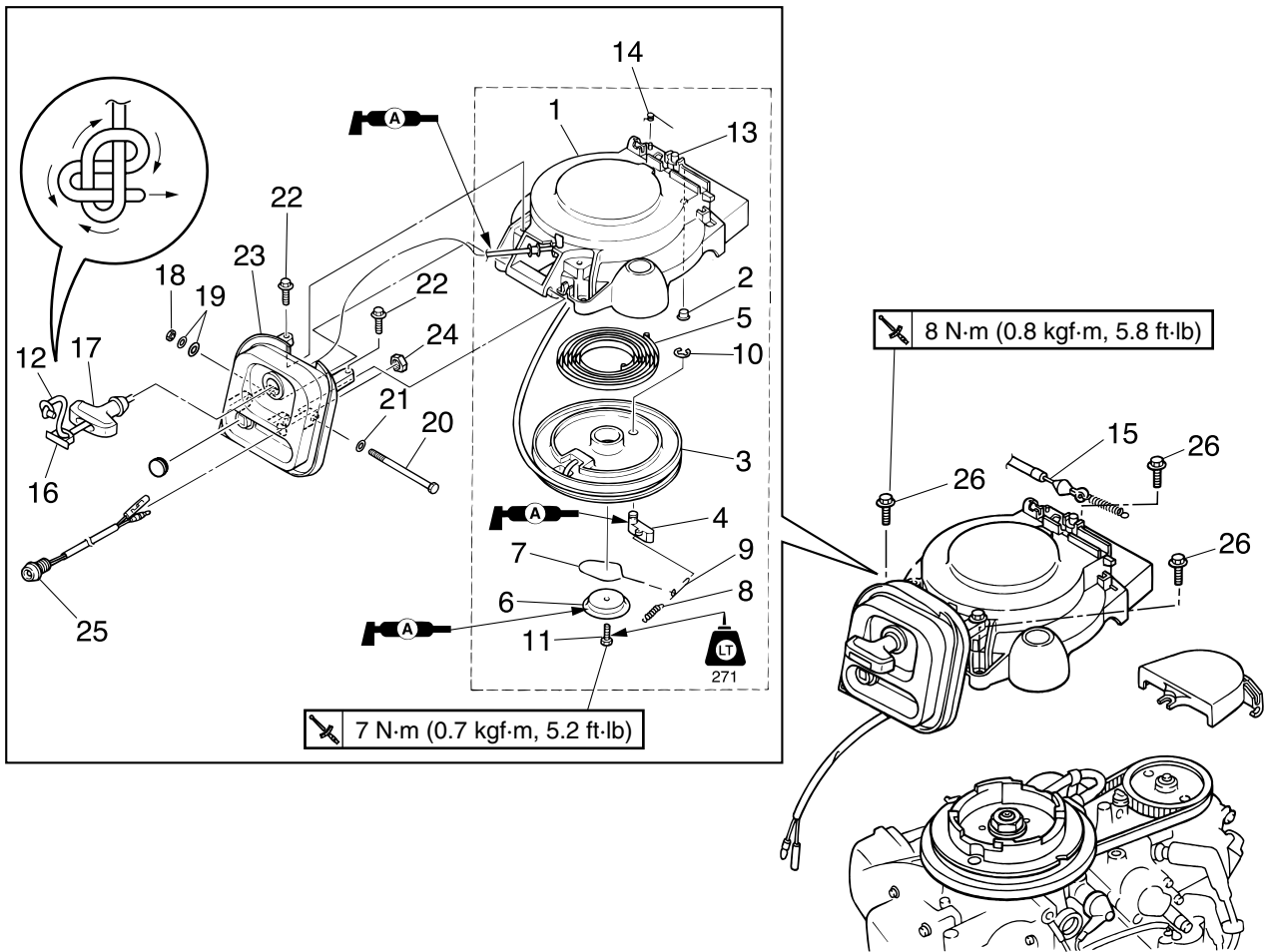
- Tighten the locknut, and then check the valve clearances. Adjust if necessary.



Locknut:

14 N·m (1.4 kgf·m, 10 ft·lb)

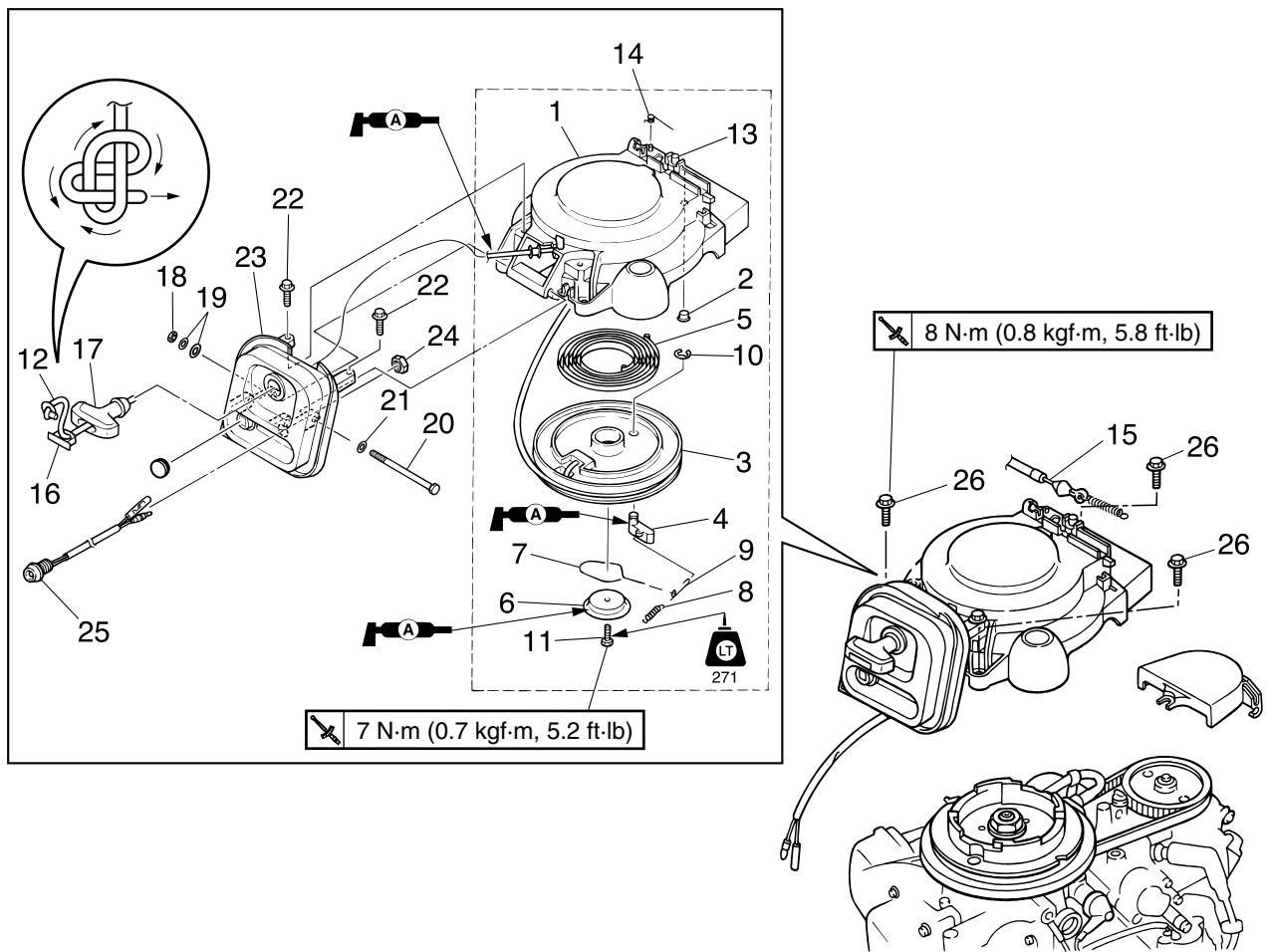
- Install the cylinder head cover, fuel pump, and spark plugs.
- Connect the fuel hoses and spark plug caps, and then install the manual starter and timing belt cover.



6D45010E

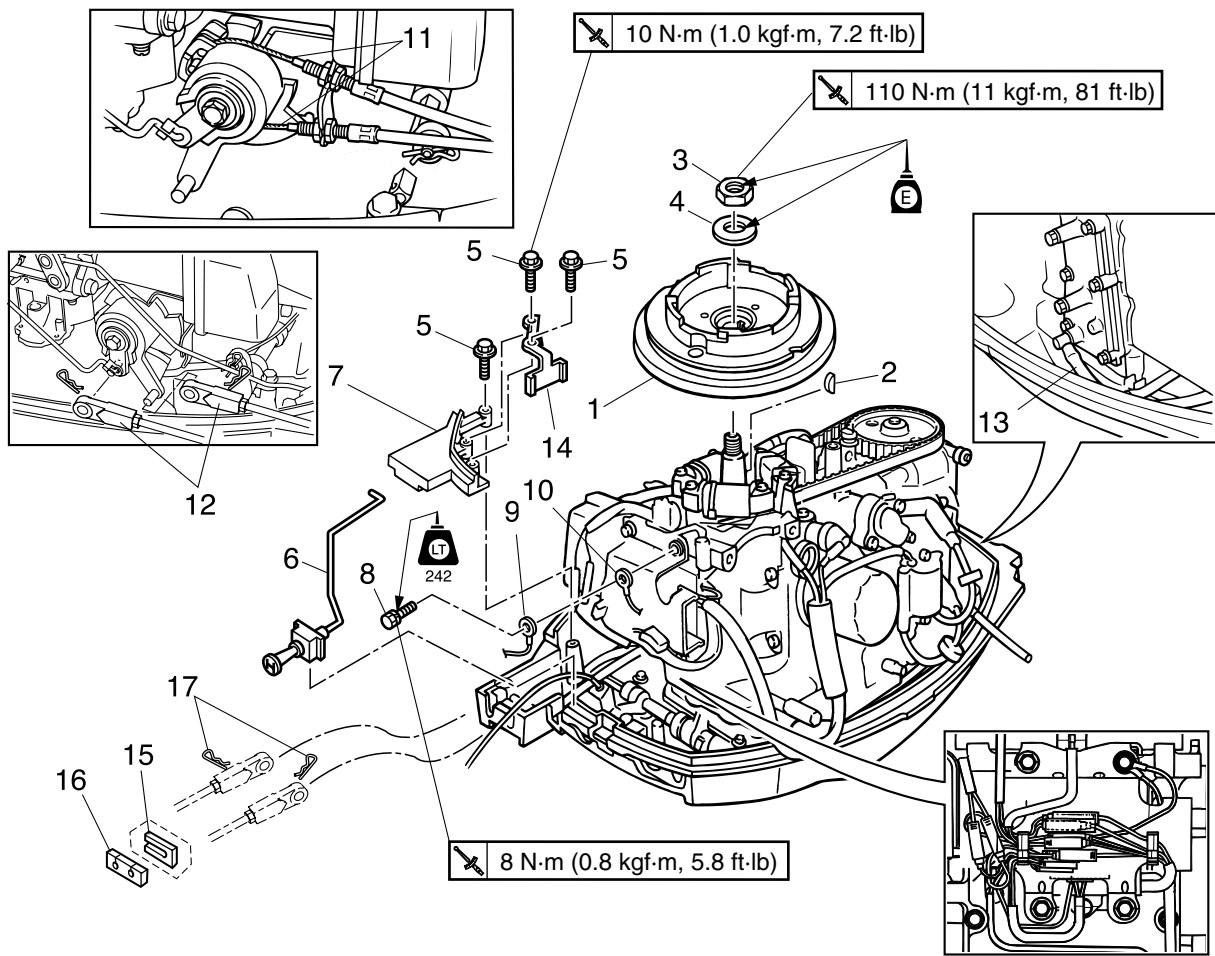
5

No.	Part name	Q'ty	Remarks
1	Cover	1	
2	Collar	1	
3	Sheave drum	1	
4	Drive pawl	1	
5	Spiral spring	1	
6	Drive plate	1	
7	Drive pawl spring	1	
8	Coil spring	1	
9	Pawl spring	1	
10	Circlip	1	
11	Bolt	1	M6 × 16 mm
12	Starter rope	1	
13	Starter plunger	1	
14	Spring	1	
15	Start-in-protection cable	1	
16	Cap	1	
17	Starter handle	1	



6D45010E

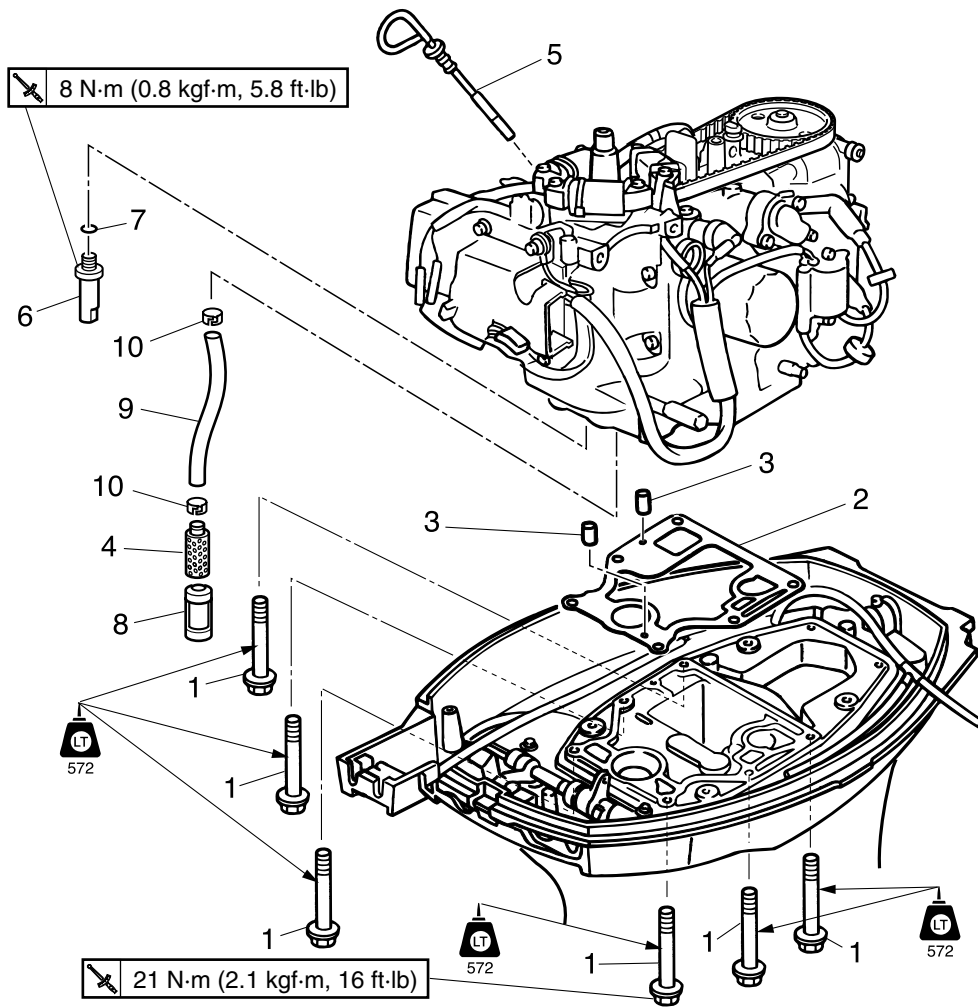
No.	Part name	Q'ty	Remarks
18	Nut	1	
19	Washer	2	
20	Bolt	1	
21	Washer	1	
22	Bolt	2	M6 × 28 mm
23	Starter panel assembly	1	
24	Nut	1	
25	Oil pressure warning lamp assembly	1	
26	Bolt	3	M6 × 20 mm



6D45040E

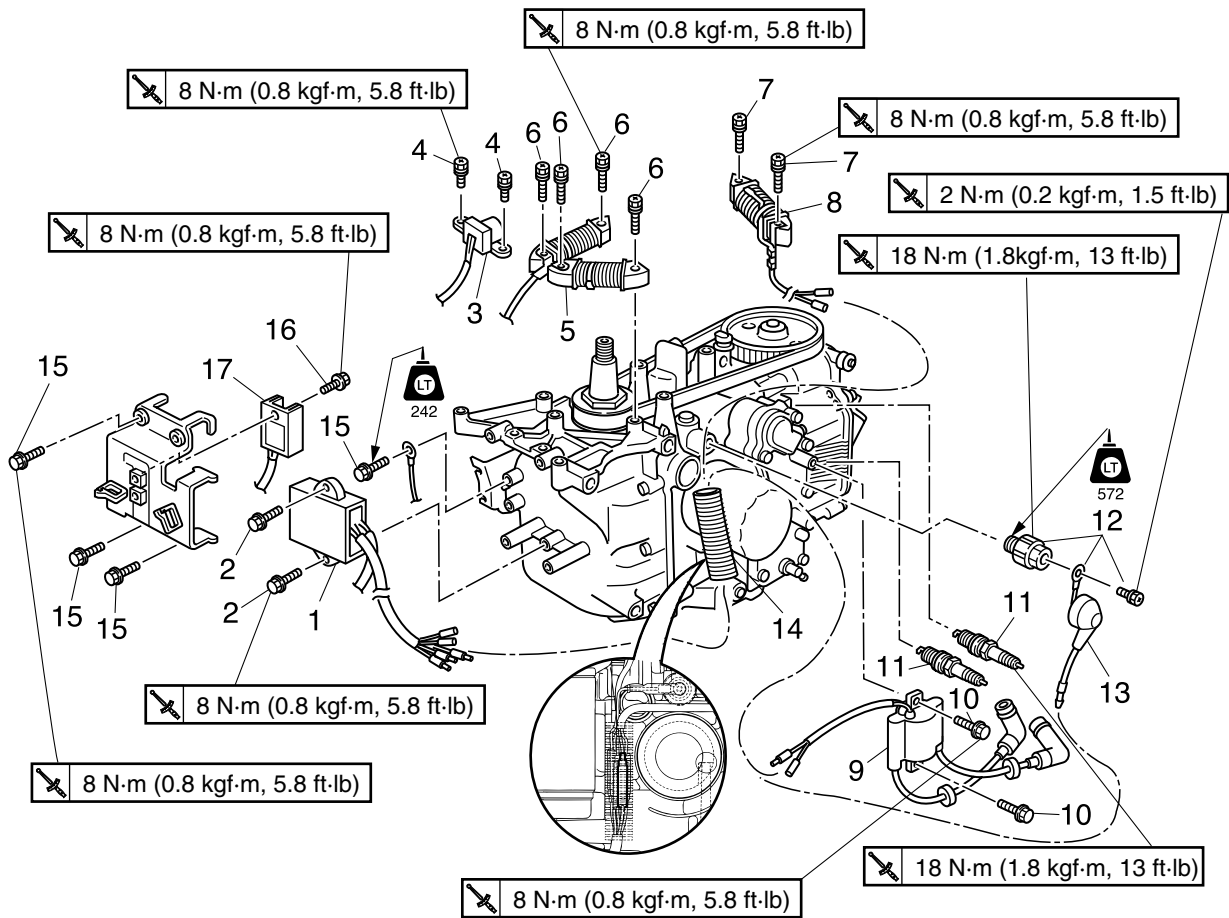
5

No.	Part name	Q'ty	Remarks
1	Flywheel magnet assembly	1	
2	Woodruff key	1	
3	Nut	1	
4	Washer	1	
5	Bolt	3	M6 × 30 mm
6	Choke rod	1	
7	Fitting plate	1	
8	Bolt	1	M6 × 20 mm
9	Ground lead	1	
10	Ground lead	1	
11	Throttle cable	2	For tiller control model
12	Remote control cable	2	For remote control model
13	Pilot water hose	1	
14	Plate	1	
15	Holder	1	For remote control model
16	Grommet	1	
17	Clip	2	For remote control model



6D45020E

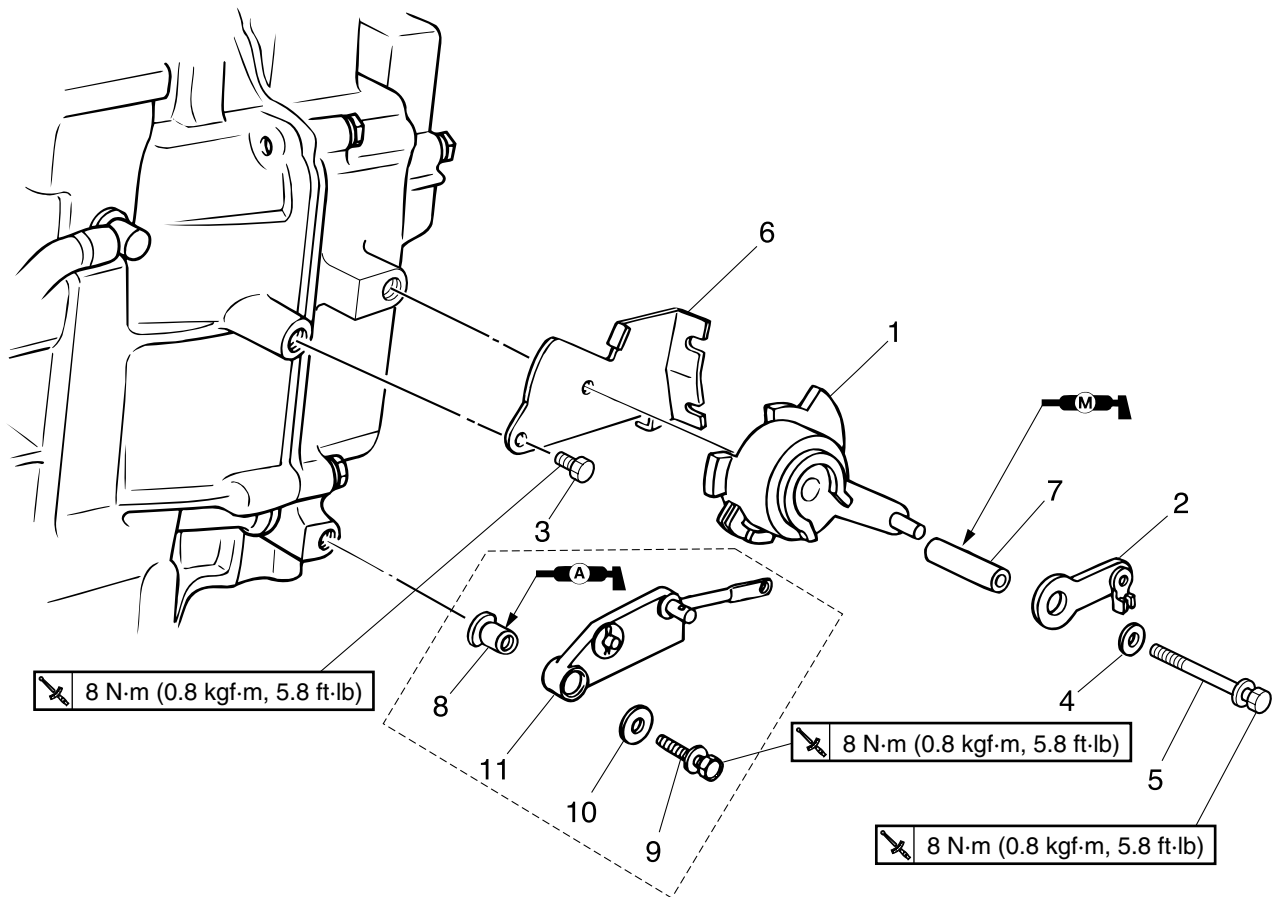
No.	Part name	Q'ty	Remarks
1	Bolt	6	M8 × 45 mm
2	Gasket	1	Not reusable
3	Dowel pin	2	
4	Oil strainer	1	
5	Dipstick	1	
6	Relief valve	1	
7	O-ring	1	Not reusable
8	Cover	1	
9	Hose	1	
10	Band	2	



5

6D45030E

No.	Part name	Q'ty	Remarks
1	CDI unit	1	
2	Bolt	2	M6 × 20 mm
3	Pulser coil	1	
4	Bolt	2	M6 × 16 mm
5	Lighting coil	2	
6	Bolt	4	M6 × 30 mm
7	Bolt	2	M6 × 25 mm
8	Charge coil	1	
9	Ignition coil	1	
10	Bolt	2	M6 × 20 mm
11	Spark plug	2	
12	Oil pressure switch	1	
13	Boots	1	
14	Plastic tube	1	
15	Bolt	4	M6 × 20 mm
16	Bolt	1	M6 × 16 mm
17	Rectifier regulator	1	

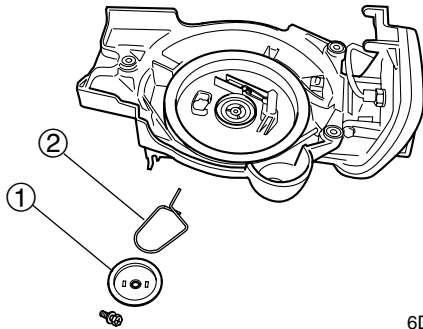


6D45060E

No.	Part name	Q'ty	Remarks
1	Pully	1	
2	Free axle lever	1	
3	Bolt	1	M6 × 10 mm
4	Washer	1	
5	Bolt	1	M6 × 55 mm
6	Bracket	1	
7	Collar	1	
8	Collar	1	For remote control model
9	Bolt	1	M6 × 10 mm : For remote control model
10	Washer	1	For remote control model
11	Shift rod lever	1	For remote control model

Disassembling the manual starter

1. Remove the drive plate ① and spring ②.

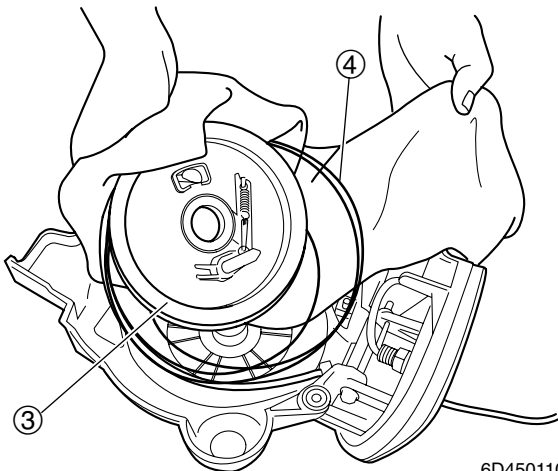


6D450100

⚠WARNING

The sheave drum can pop out. Hold the sheave drum with your hand, then pull it out.

2. Remove the sheave drum ③.



6D450110

⚠WARNING

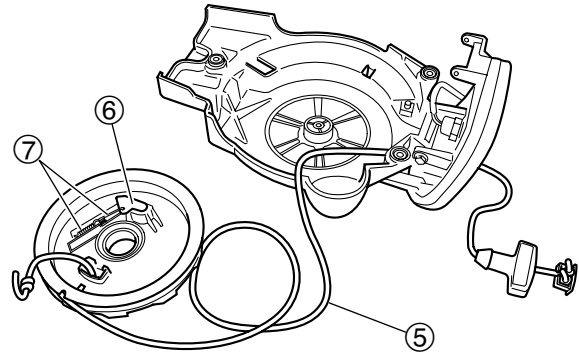
The spiral spring can pop out. Cover the spiral spring with cloths, then pull out the sheave drum.

3. Remove the spiral spring ④ from the starter case.

⚠WARNING

The spiral spring can pop out. To remove the spring, cover it with cloths.

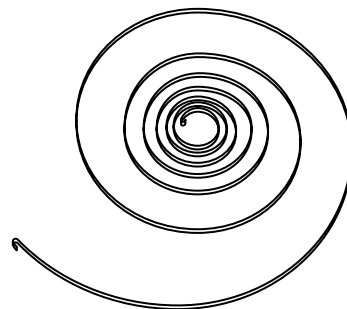
4. Remove the starter rope ⑤.
5. Remove the drive pawl ⑥ and springs ⑦ from the sheave drum.



6D450120

Checking the spiral spring

1. Check the spiral spring for cracks, bends, or damage. Replace if necessary.



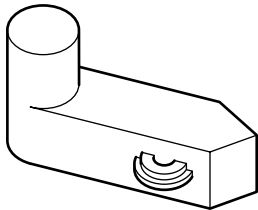
6B450200

5



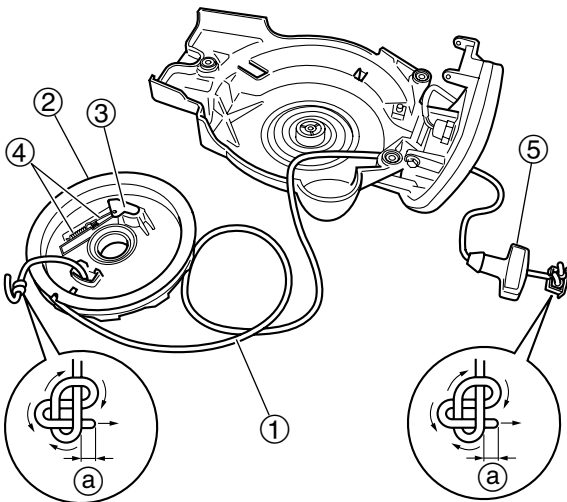
Assembling the manual starter

1. Install the starter rope ① into the sheave drum ②.
2. Check the drive pawl for cracks or damage. Replace if necessary



6B450210

3. Install the drive pawl ③ and springs ④.
4. Install the manual starter handle ⑤.



6D450130

NOTE:

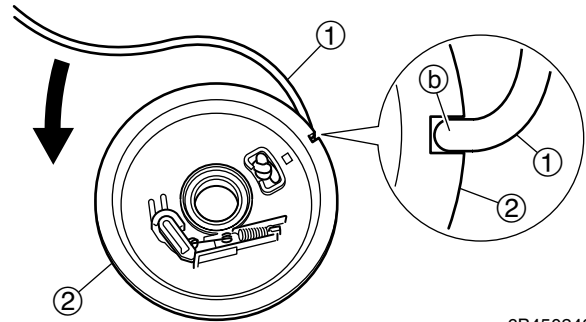
- Tie a knot at the end of the starter rope as shown in the illustration.
- Be sure to leave 5.0–10.0 mm at the end ① of the starter rope.

5. Measure the starter rope length. Replace if the length is out of specification.



Starter rope length:
1,550–1,750 mm (61.02–68.90 in)

6. Wind the starter rope ① twice around the sheave drum ② in the direction of the arrow shown in the illustration.

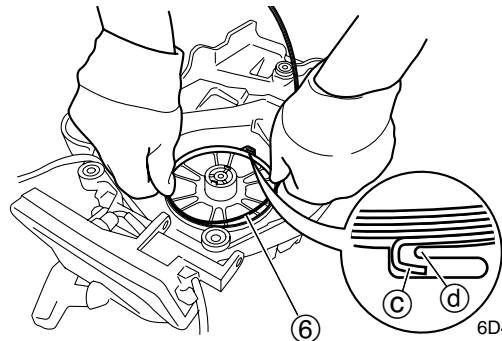


6B450240

NOTE:

After winding the starter rope around the sheave drum, install the starter rope in the notch ⑥.

7. Install the spiral spring ⑥ into the starter case.

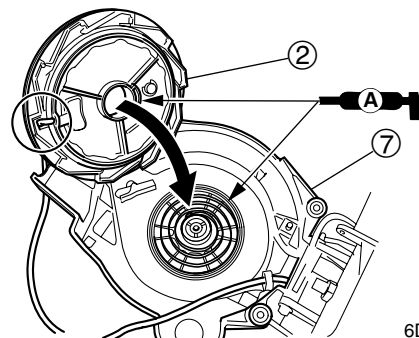


6D450140

NOTE:

Bend the outer end ③ of the spiral spring onto the cut-out ④ of the starter case.

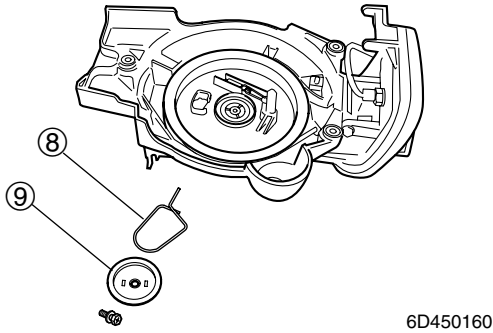
8. Install the sheave drum ② into the starter case ⑦.



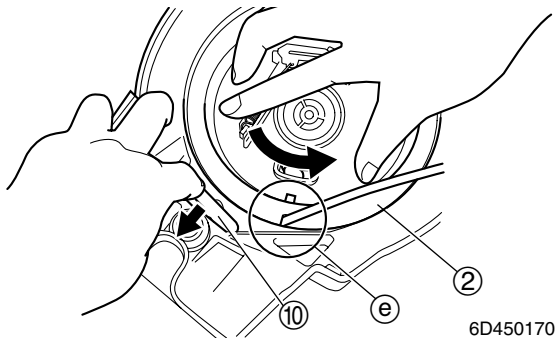
6D450150

NOTE: _____
Install the sheave drum, then set the spiral spring by turning the sheave drum.

9. Install the spring ⑧ drive plate ⑨.

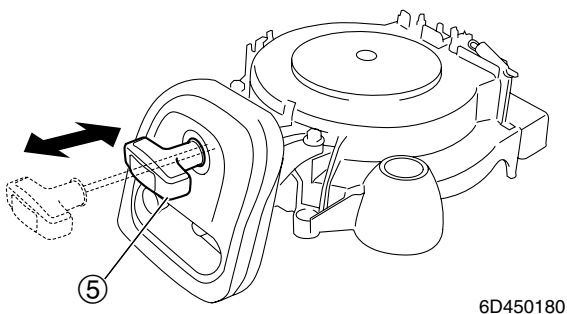


10. Turn the sheave drum ② 4 times in the direction of the arrow shown, and then remove the starter rope from the notch ③.

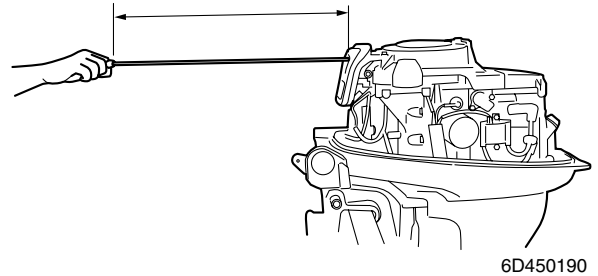



NOTE: _____
Hold the starter plunger ⑩ while turning the sheave drum as shown.

11. Pull the manual starter handle ⑤ several times to check that the sheave drum turns smoothly and to check the starter rope for slack. Repeat steps 6–10 if necessary.



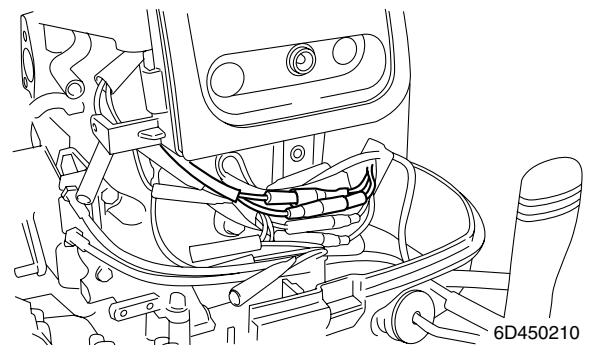
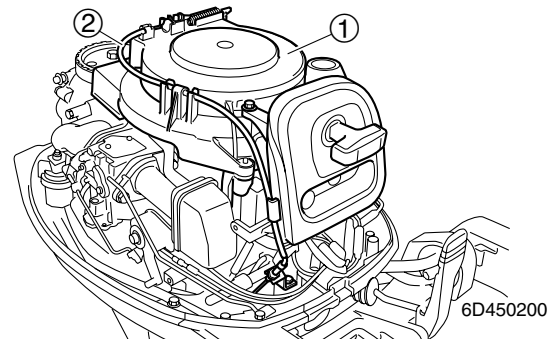
12. Pull the manual starter handle completely, then measure the starter rope length. Adjust if the starter rope length is out of specification.



 Starter rope length:
1,400–1,600 mm (55.12–62.99 in)

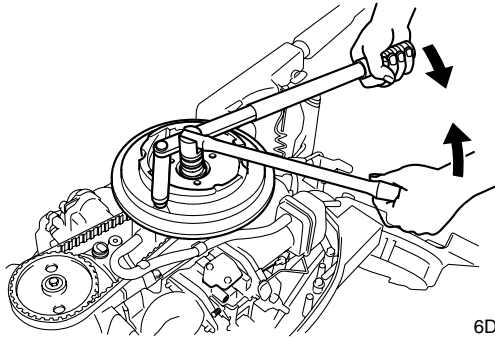
Removing the power unit

1. Remove the manual starter assembly ①, timing belt cover, oil pressure warning lamp leads and start-in-gear protection cable ②.



NOTE: _____
If the power unit is to be disassembled, it is recommended to loosen the nut on the flywheel magnet assembly before removing the power unit to improve working efficiency.

- Remove the nut on the flywheel magnet.



6D450220

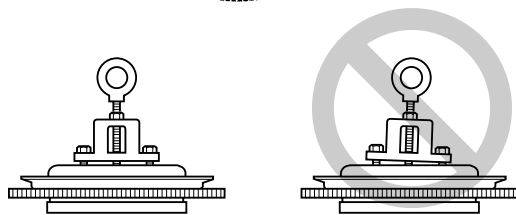
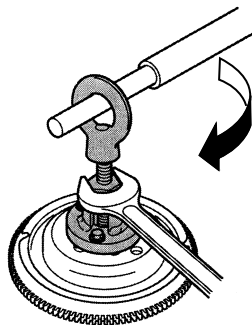
CAUTION:

Apply force in the direction of the arrows shown. While working, do not allow the flywheel holder to slip off the flywheel.



Flywheel holder: 90890-06522

- Remove the flywheel magnet.



6B450090

CAUTION:

- Screw in the flywheel puller set bolts evenly to the full extent.
- Make sure the puller plate is set parallel with the flywheel magnet.

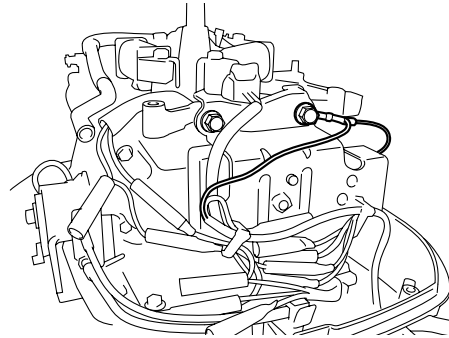
NOTE:

Screw in the flywheel puller set bolt until the flywheel magnet comes off completely.



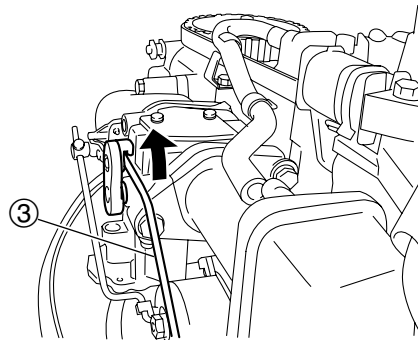
Flywheel puller: 90890-06521

- Remove the Woodruff key.
- Disconnect the engine stop lanyard switch leads and ground lead.



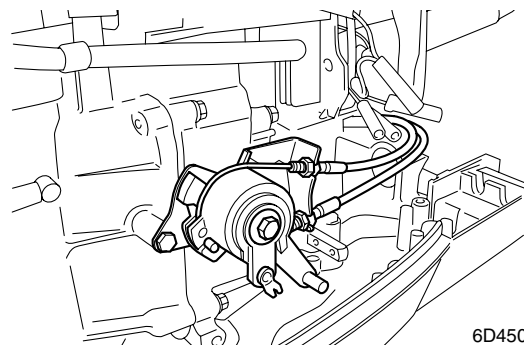
6D450230

- Remove the choke rod ③.

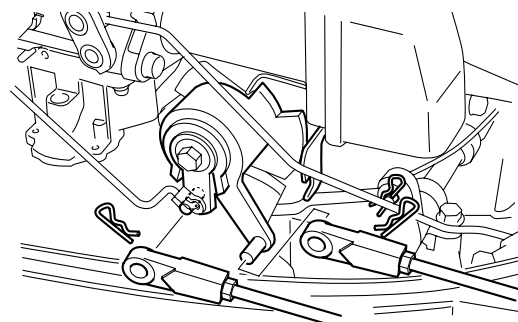


6D450240

- Remove the throttle cables (for tiller control model) or cable joints (for remote control model).

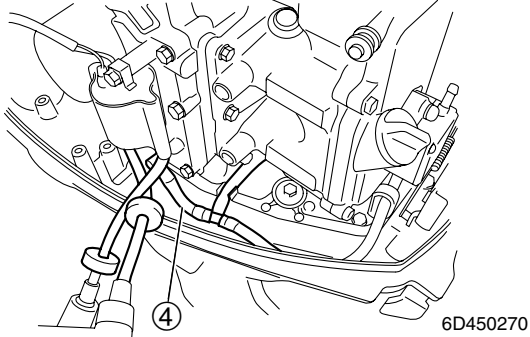


6D450250

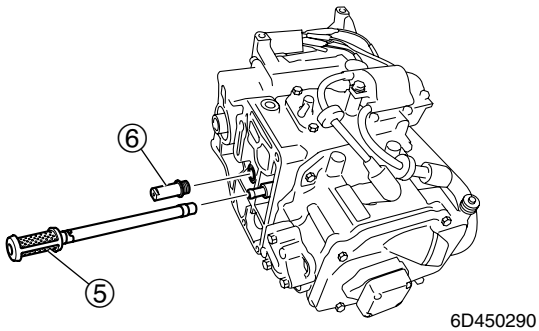


6D450260

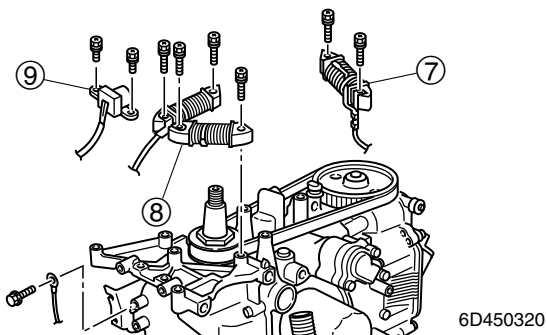
8. Disconnect the fuel hose from the fuel filter, and then remove the "Fuel system".
9. Disconnect the pilot water hose ④.



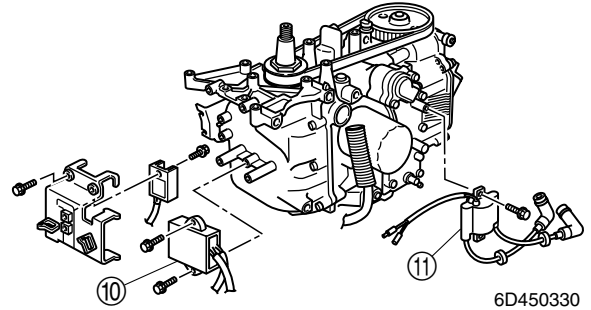
10. Lift up the power unit after removing the bolts. Remove the dowels.
11. Remove the oil strainer assembly ⑤ and relief valve ⑥.



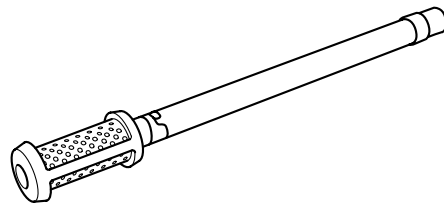
12. Remove the charge coil ⑦, lighting coil ⑧ and pulser coil ⑨.



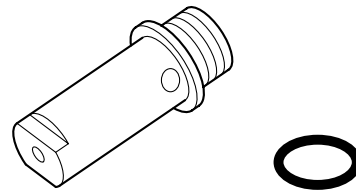
13. Remove the spark plug caps, CDI unit ⑩, ignition coil ⑪, oil pressure switch and spark plugs.



14. Check the oil strainer assembly for damage, clogs. Clean or replace, if necessary.

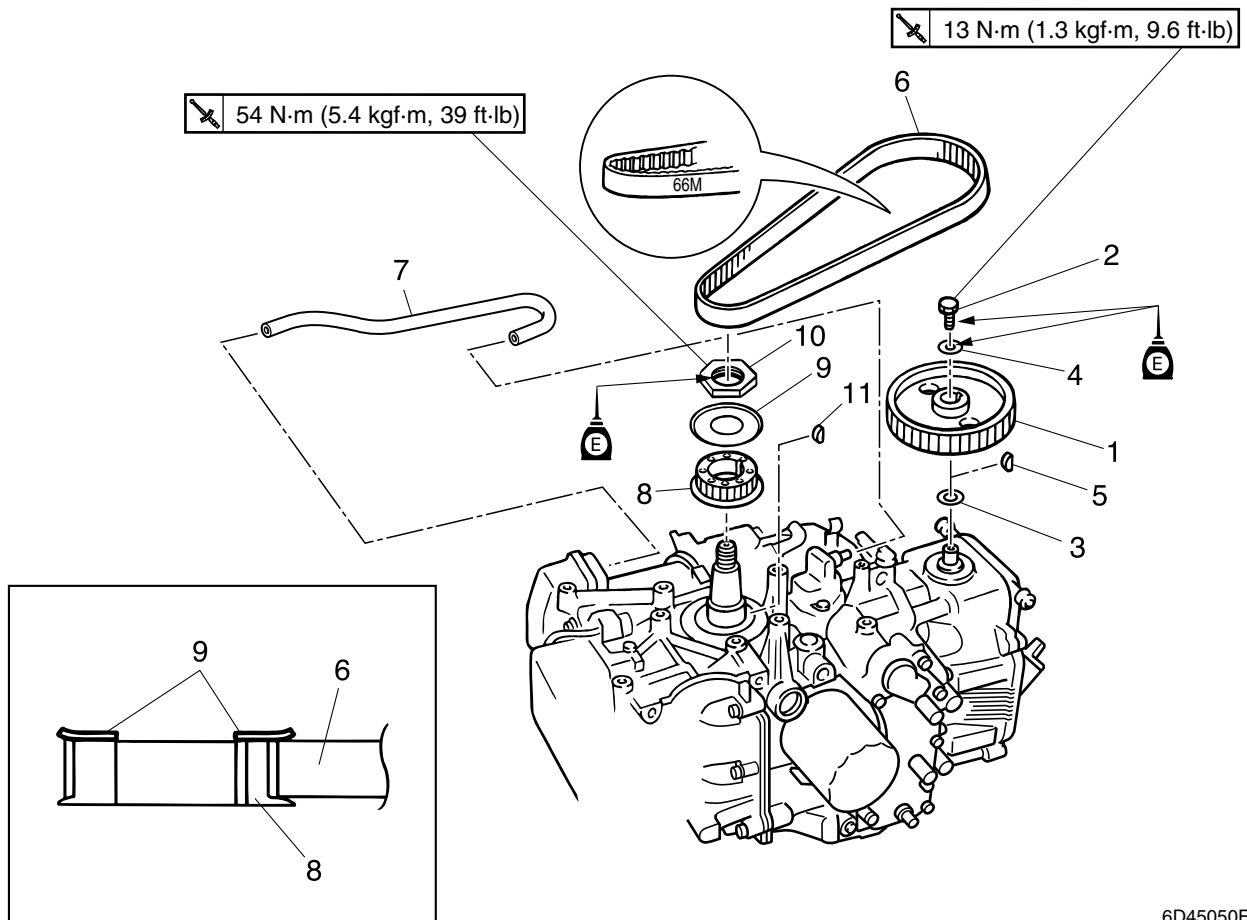


15. Check the relief valve for cracks or damage. Replace if necessary.



5

Timing belt and sprockets

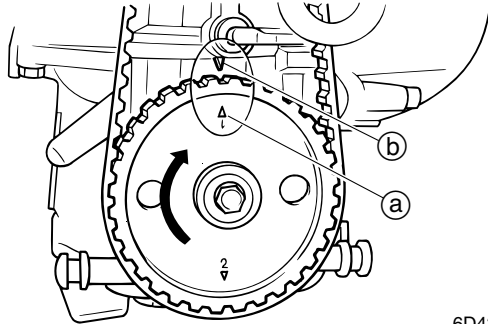


6D45050E

No.	Part name	Q'ty	Remarks
1	Driven sprocket	1	
2	Bolt	1	M6 × 20 mm
3	Washer	1	
4	Washer	1	
5	Woodruff key	1	
6	Timing belt	1	
7	Breather hose	1	
8	Drive sprocket	1	
9	Retaining plate	1	
10	Nut	1	
11	Woodruff key	1	

Removing the timing belt and sprockets

1. Set the cylinder #1 piston position to TDC of the compression stroke by aligning the "1" mark (a) on the driven sprocket with the "▼" mark (b) on the cylinder head.

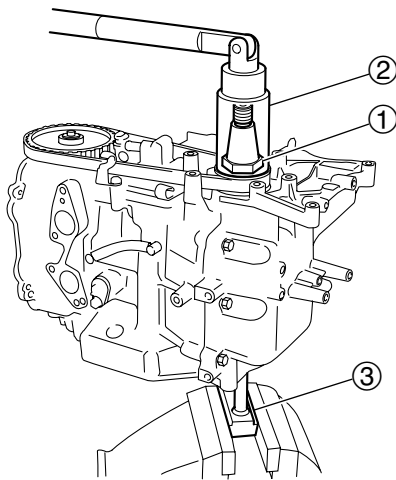


6D430110

CAUTION:

Do not turn the flywheel magnet counter-clockwise, otherwise the valve system may be damaged.

2. Remove the breather hose and loosen the drive sprocket nut (1).



6D450340

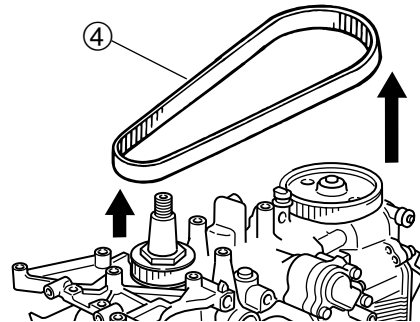
NOTE:

- Use a deep socket (2) (36 mm) for this procedure.
- Do not turn the camshaft when loosening the drive sprocket nut.



Shaft holder (3):
90890-06069

3. Remove the timing belt (4) from the driven sprocket side.

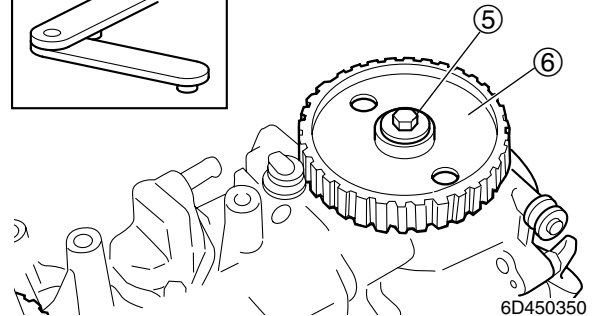
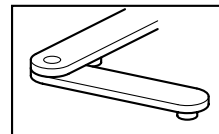


6D450365

CAUTION:

Do not turn the drive sprocket or the driven sprocket when the timing belt is not installed. Otherwise the piston and valves will interfere with each other and be damaged.

4. Loosen the driven sprocket bolt (5), remove the driven sprocket (6) and Woodruff key.



6D450350

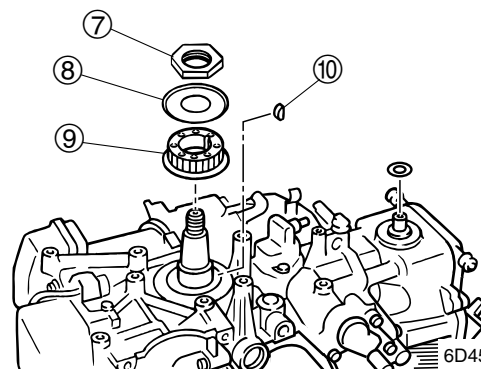
NOTE:

Do not turn the camshaft when loosening the driven sprocket bolt.



Flywheel holder:
90890-06522

5. Remove the nut (7), retaining plate (8), drive sprocket (9), and Woodruff key (10).

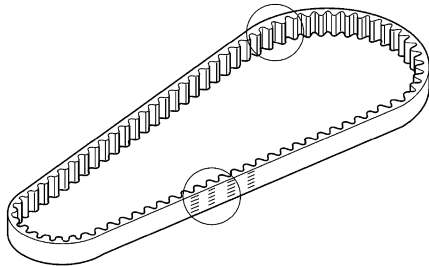


6D450360



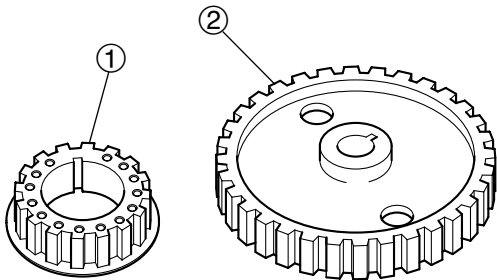
Checking the timing belt and sprockets

1. Check the interior and exterior of the timing belt for cracks, damage, or wear. Replace if necessary.



6D450380

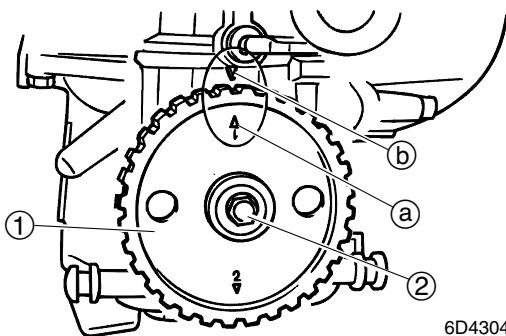
2. Check the drive sprocket ① and driven sprocket ② for cracks, damage, or wear. Replace if necessary.



6D450400

Installing the timing belt and sprockets

1. Install the washer, Woodruff key and check that the "1" mark (a) on the driven sprocket ① is aligned with the "▼" mark (b) on the cylinder head, and then temporarily tighten the bolt ②.

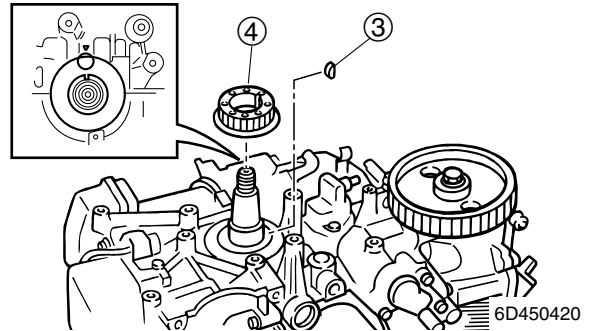


6D430410

CAUTION:

Do not turn the drive sprocket or the driven sprocket when the timing belt is not installed. Otherwise the piston and valves will interfere with each other and be damaged.

2. Install the Woodruff key ③, drive sprocket ④.

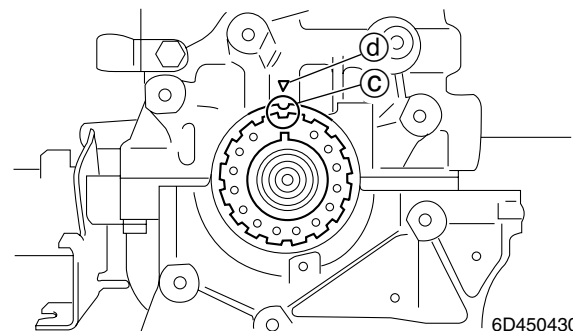


6D450420

NOTE:

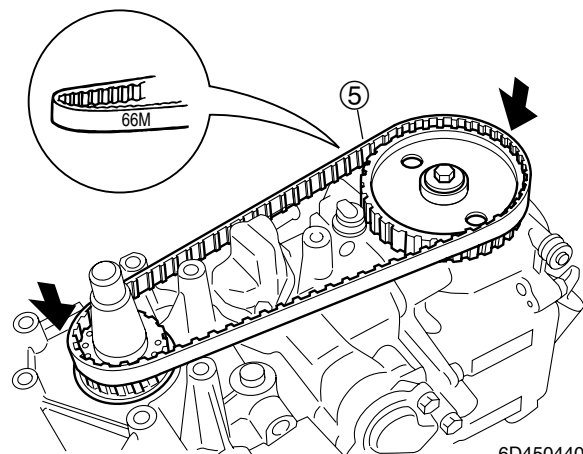
Align the key groove of the crankshaft and the mark on the cylinder block.

3. Check that the cut-out (c) on the drive sprocket is aligned with the "▼" mark (d) on the cylinder block.



6D450430

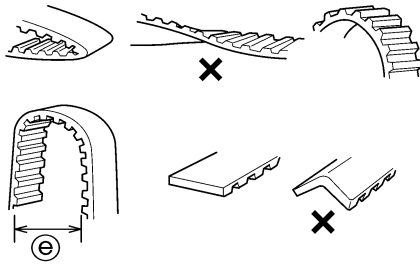
4. Install the new timing belt ⑤ from the drive sprocket side first with its part number in the upright position.



6D450440

NOTE:

Alternately push down on the drive and then driven sprocket until timing belt is properly seated.



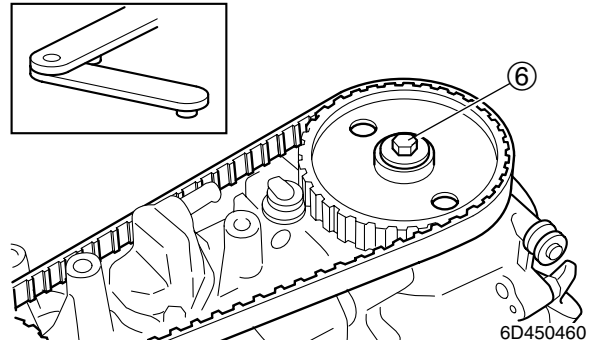
6D450450

CAUTION:

- Do not twist, turn inside out, or bend the timing belt beyond the maximum limit of 25 mm (1.0 in) E , otherwise it may be damaged.
- Do not get oil or grease on the timing belt.
- Do not turn the sprockets counterclockwise, otherwise the valve system may be damaged.

5. Install the retaining plate then tighten the nut temporary tighten.
6. Take up the timing belt slack by turning the drive sprocket clockwise at least two full turns.
7. Turn the drive sprocket two turns, and then check that the alignment marks are aligned.

8. Tighten the driven sprocket bolt 6 to the specified torque.

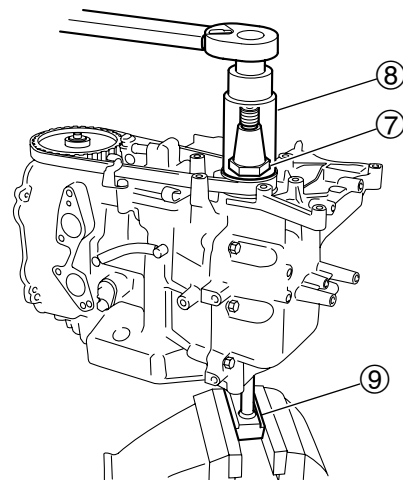


Flywheel holder:
90890-06522



Driven sprocket bolt 6 :
13 N·m (1.3 kgf·m, 9.6 ft·lb)

9. Tighten the drive sprocket nut 7 to the specified torque.



6D450470

NOTE:

Use a deep socket 8 (36 mm) for this procedure.



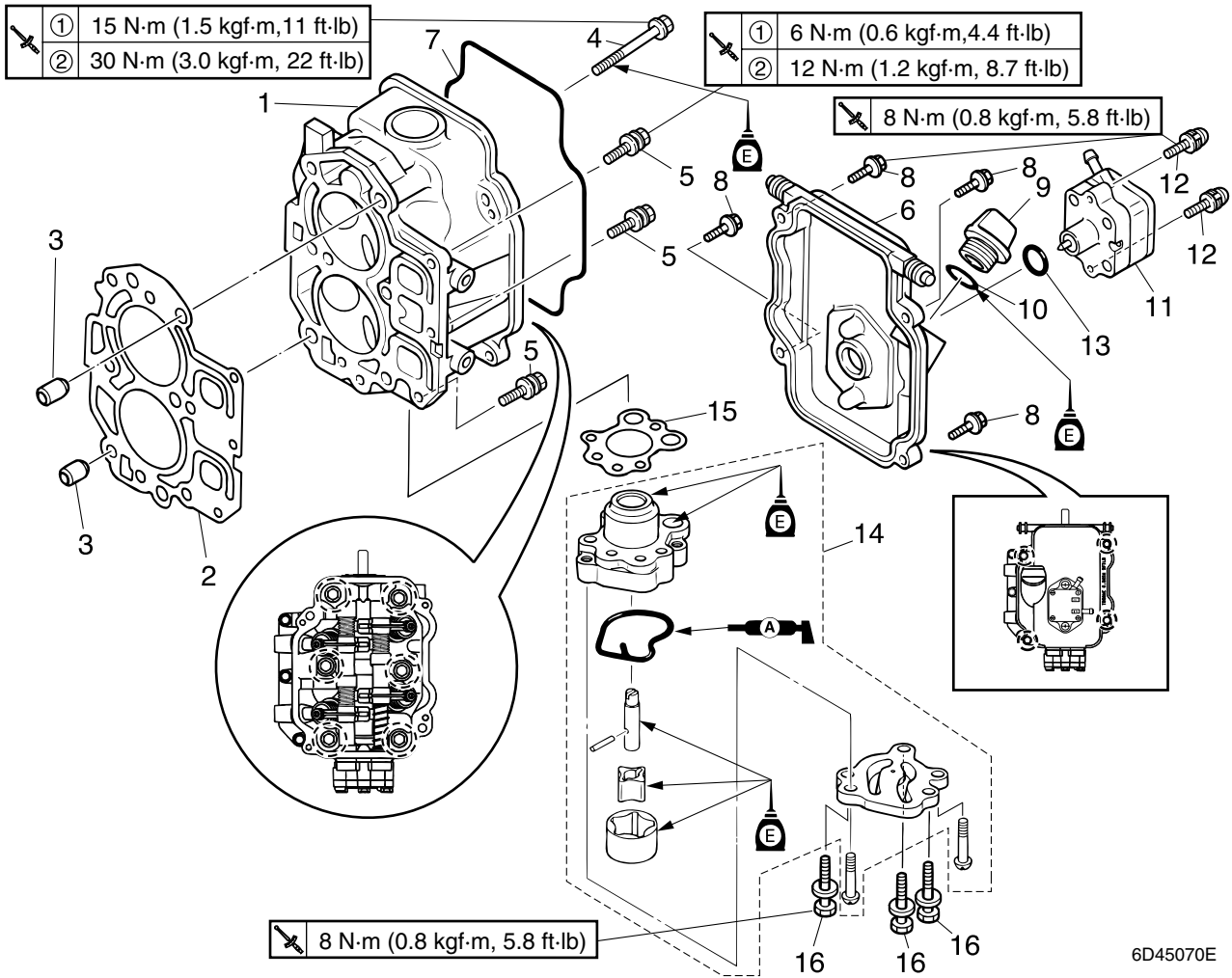
Shaft holder 9 :
90890-06069



Drive sprocket nut 7 :
54 N·m (5.4 kgf·m, 39 ft·lb)

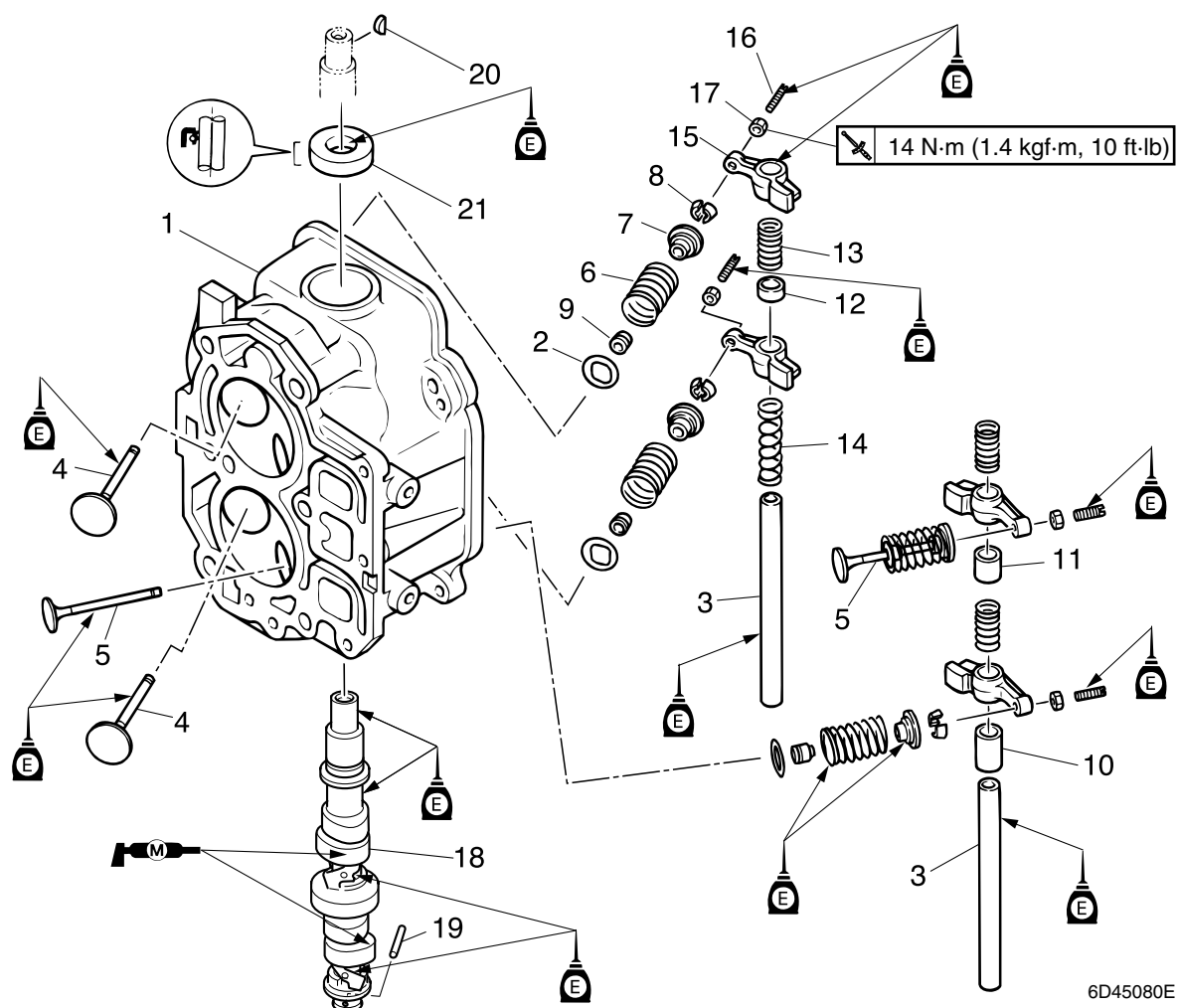
10. Install the breather hose.

Cylinder head



6D45070E

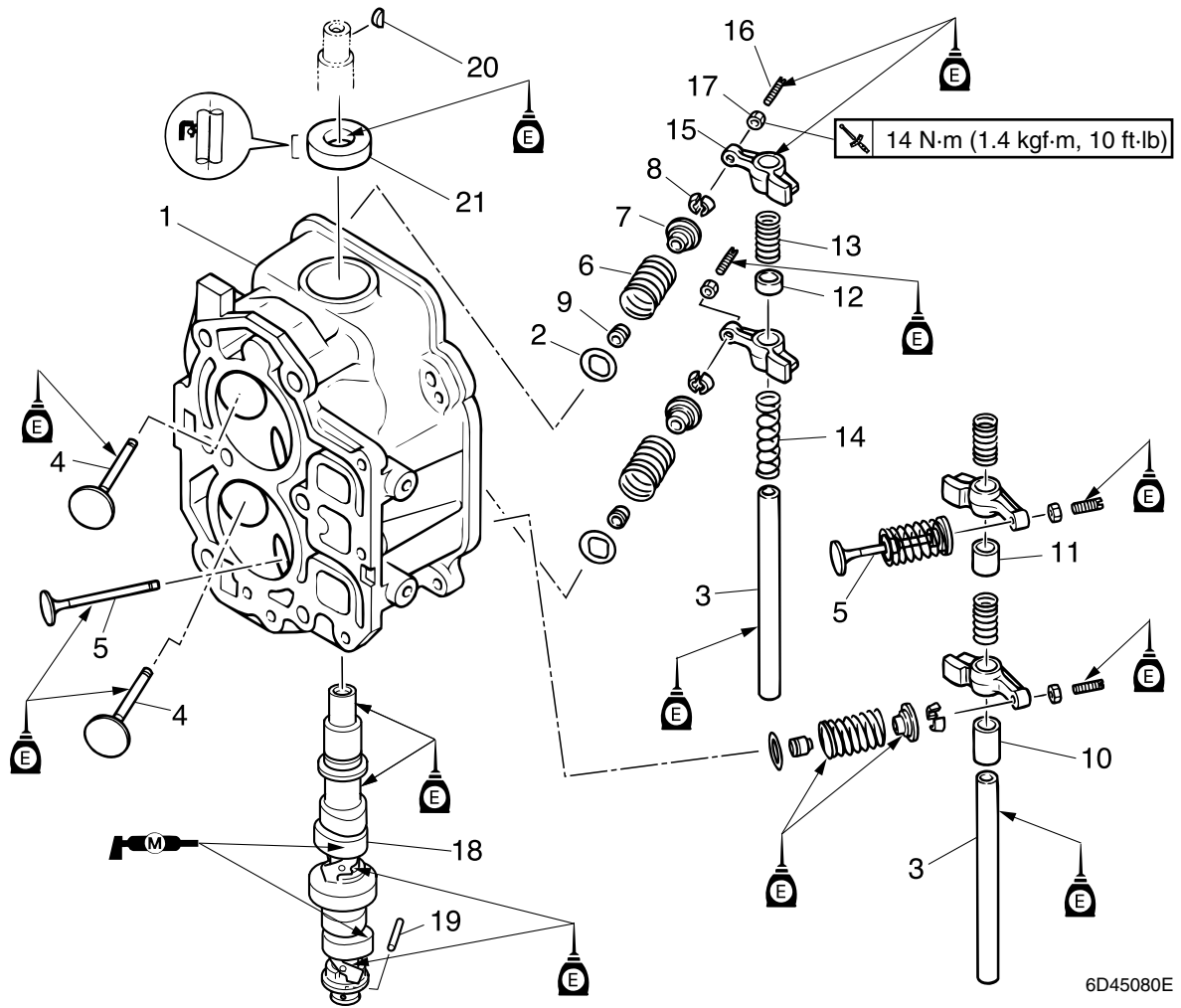
No.	Part name	Q'ty	Remarks
1	Cylinder head assembly	1	
2	Gasket	1	Not reusable
3	Dowel pin	2	
4	Bolt	6	M8 × 74 mm
5	Bolt	3	M6 × 25 mm
6	Cylinder head cover	1	
7	Seal	1	Not reusable
8	Bolt	4	M6 × 20 mm
9	Oil filler cap	1	
10	O-ring	1	Not reusable
11	Fuel pump assembly	1	
12	Screw	2	M6 × 30 mm
13	O-ring	1	Not reusable
14	Oil pump assembly	1	
15	Gasket	1	Not reusable
16	Bolt	3	M6 × 35 mm



6D45080E

5

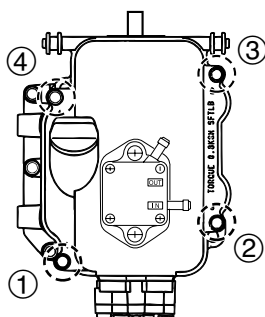
No.	Part name	Q'ty	Remarks
1	Cylinder head	1	
2	Valve spring seat	4	Not reusable
3	Rocker shaft	2	
4	Intake valve	2	
5	Exhaust valve	2	
6	Valve spring	4	
7	Valve spring retainer	4	
8	Valve cotter	8	
9	Valve stem seal	4	Not reusable
10	Collar	1	$\ell = 22.5 \text{ mm}$
11	Collar	1	$\ell = 15 \text{ mm}$
12	Collar	1	$\ell = 8.5 \text{ mm}$
13	Spring	3	$\ell = 28 \text{ mm}$
14	Spring	1	$\ell = 55 \text{ mm}$
15	Rocker arm	4	
16	Adjust screw	4	
17	Rock nut	4	



No.	Part name	Q'ty	Remarks
18	Camshaft assembly	1	
19	Pin	1	
20	Woodruff key	1	
21	Oil seal	1	Not reusable

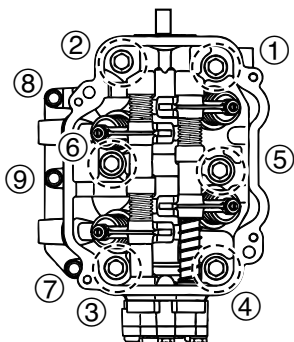
Removing the cylinder head

1. Remove the spark plugs.
2. Remove the cylinder head cover bolts in the sequence shown.



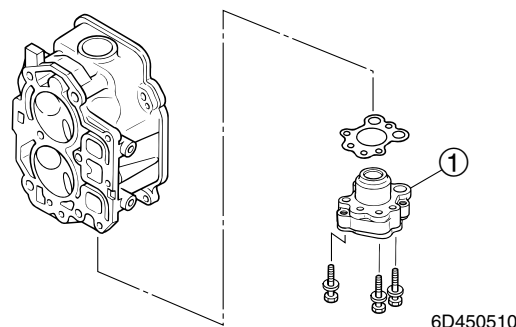
6D450490

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

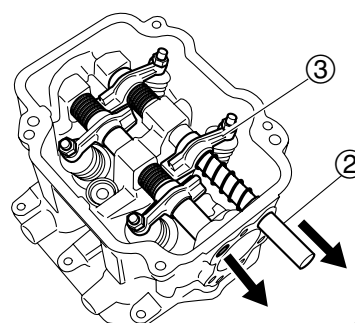


6D450500

4. Remove the oil pump (1), gasket, rocker arm shaft (2), spring, collar and rocker arm assembly (3).



6D450510

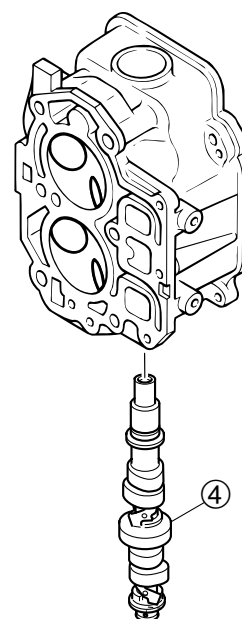


6D450520

NOTE: _____

- loosen the locknut and adjust screw to slack off the tension, before remove the rocker arm shaft.
- Do not mix the removing parts. Keep them original in their proper place.

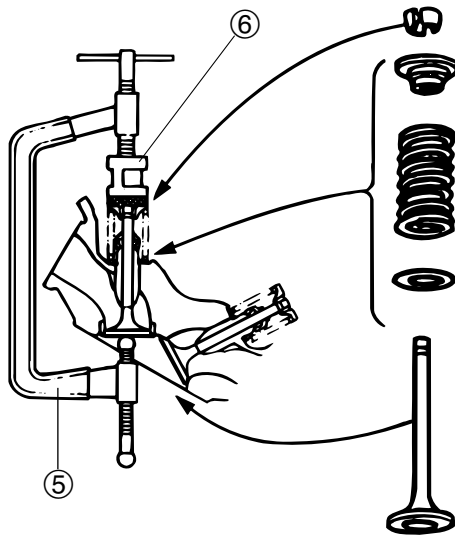
5. Remove the camshaft (4) by pulling it downward.



6D450530



- Remove the intake valve and exhaust valves.



6D450540

NOTE:

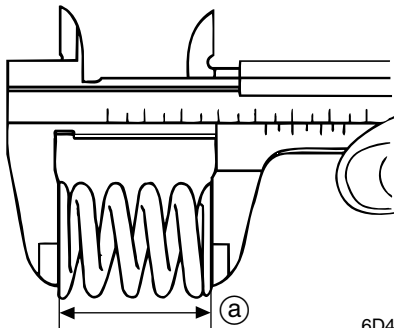
When replacing the valve, also replace the valve guide and stem seal.



Valve spring compressor (5):
90890-04019
Valve spring compressor
attachment (6):
90890-06320

Checking the valve springs

- Measure the valve spring free length (a).
Replace if out of specification.

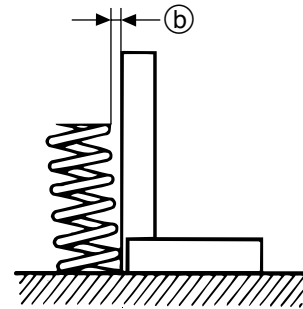


6D450550



Valve spring free length (a):
34.40 mm (1.3543 in)

- Measure the valve spring tilt (b). Replace if out of specification.



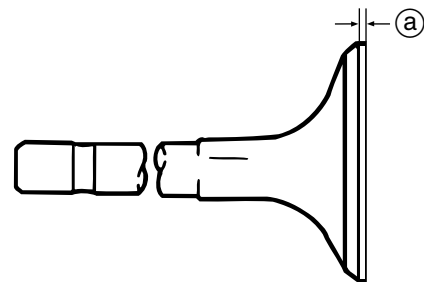
6D450560



Valve spring tilt limit (b):
1.5 mm (0.06 in)

Checking the valves

- Check the valve face for pitting or wear.
Replace if necessary.
- Measure the valve margin thickness (a).
Replace if out of specification.

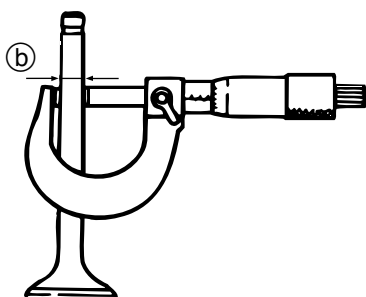


6D450570



Valve margin thickness (a):
Intake:
0.50–0.90 mm (0.0197–0.0354 in)
Exhaust:
0.50–0.90 mm (0.0197–0.0354 in)

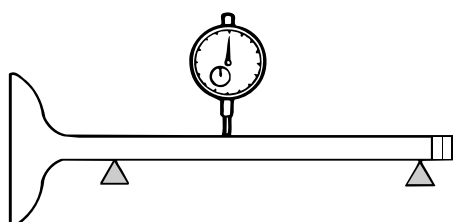
3. Measure the valve stem diameter (b). Replace if out of specification.



6D450580

	Valve stem diameter (b):
	Intake:
	5.475–5.490 mm (0.2156–0.2161 in)
	Exhaust:
	5.460–5.475 mm (0.2150–0.2156 in)

4. Measure the valve stem run-out. Replace if out of specification.

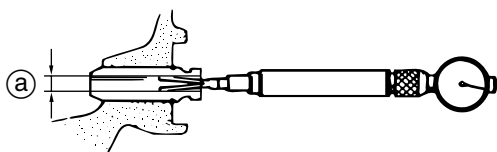


6D450590

	Valve stem run-out limit:
	Intake: 0.01 mm (0.0004 in)
	Exhaust: 0.01 mm (0.0004 in)

Checking the valve guides

1. Measure the valve guide inside diameter (a). Replace if out of specification.

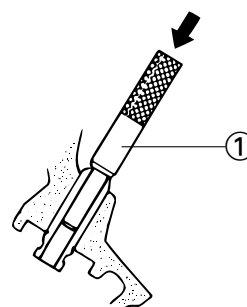


6D450600

	Valve guide inside diameter limit (a):
	5.500–5.512 mm
	(0.2165–0.2170 in)

Replacing the valve guides

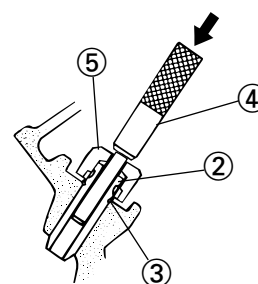
1. Remove the valve guide (1) by striking the special service tool from the combustion chamber side.



6D450610

	Valve guide remover/installer:
	90890-06801

2. Install the new valve guide (2) by striking the special service tool from the camshaft side until the valve guide clip (3) contacts the cylinder head.



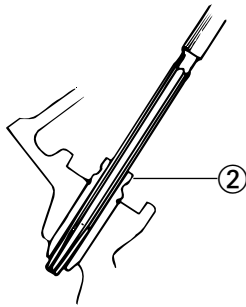
6D450620

NOTE: _____
Apply engine oil to the surface of the new valve guide.

	Valve guide remover/installer (4):
	90890-06801
	Valve guide installer (5):
	90890-06802



3. Insert the special service tool into the valve guide ②, and then ream the valve guide.



6D450630

NOTE:

- Turn the valve guide reamer clockwise to ream the valve guide.
- Do not turn the reamer counterclockwise when removing the reamer.



Valve guide reamer:
90890-06804

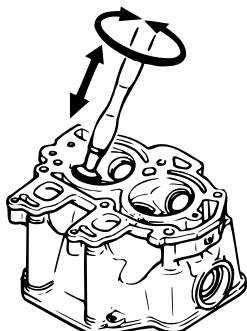
4. Measure the valve guide inside diameter. Replace the valve guide if out of specification.



Valve guide inside diameter:
5.500–5.512 mm
(0.2165–0.2170 in)

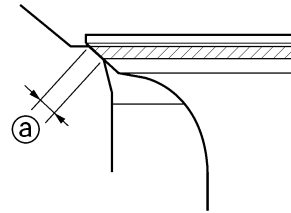
Checking the valve seat

1. Eliminate carbon deposits from the valve with scraper.
2. Apply a thin, even layer of Mechanic's blueing dye (Dykem) onto the valve seat.
3. Lap the valve slowly on the valve seat with valve lapper (commercially obtainable) as shown.

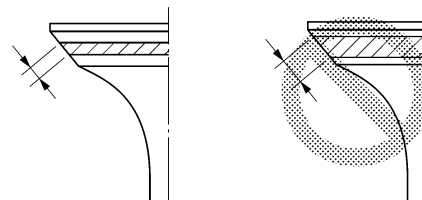
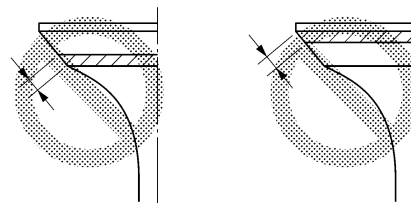


6D450640

4. Measure the valve seat contact width ① where the blueing dye is adhered to the valve face. Reface the valve seat if the valve is not seated properly or if the valve seat contact width is out of specification. Replace the valve guide if the valve seat contact is uneven.



6D450650



6D450660



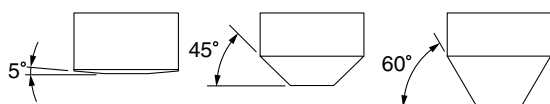
Valve seat contact width ①:
Intake:
0.60–0.80 mm (0.0236–0.0315 in)
Exhaust:
0.60–0.80 mm (0.0236–0.0315 in)



Valve lapper:
90890-04101

Refacing the valve seat

1. Reface the valve seat with the valve seat cutter.



6D450670



Valve seat cutter holder:
90890-06316

Valve seat cutter:

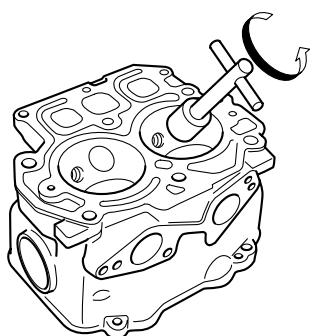
5° (intake): 90890-06314

5° (exhaust): 90890-06313

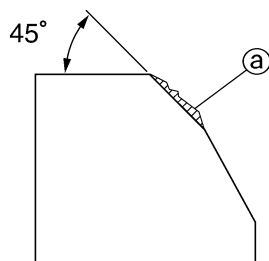
45° (intake and exhaust):
90890-06312

60° (intake and exhaust):
90890-06315

2. Cut the surface of the valve seat with a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth.



6D450690



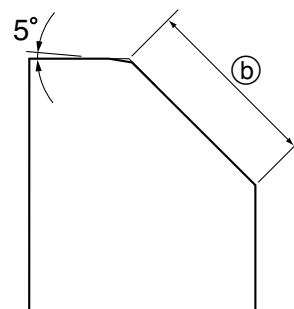
6D450680

- (a) Slag or rough surface

CAUTION:

Do not over cut the valve seat. Make sure to turn the cutter evenly downward at a pressure of 40–50 N (4–5 kgf, 8.8–11 lbf) to prevent chatter marks.

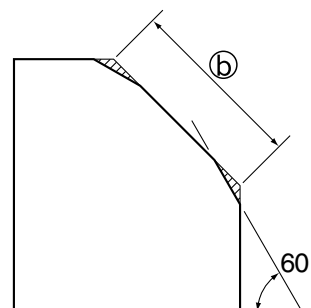
3. Use a 5° cutter to adjust the contact width of the top edge of the valve seat.



6D450700

- (b) Previous contact width

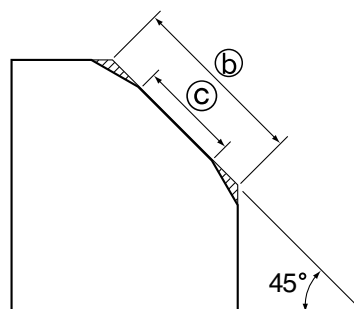
4. Use a 60° cutter to adjust the contact width of the bottom edge of the valve seat.



6D450710

- (b) Previous contact width

5. Use a 45° cutter to adjust the contact width of the valve seat to specification.

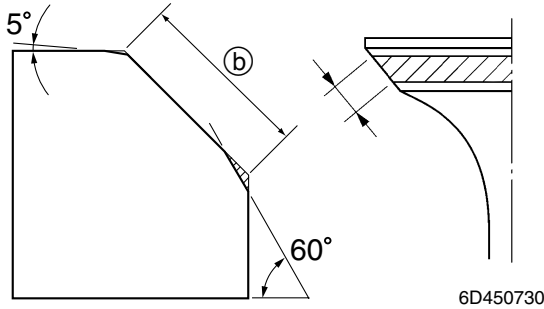


6D450720

- (b) Previous contact width
(c) Specified contact width

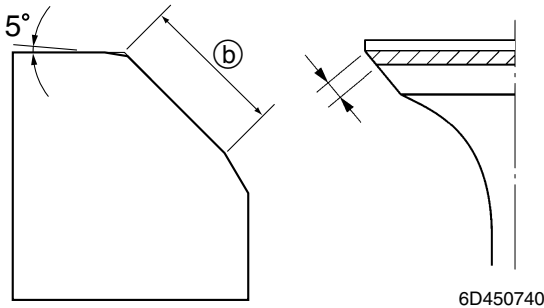


6. If the valve seat contact area is too wide and situated in the center of the valve face, use a 5° cutter to cut the top edge of the valve seat, a 60° cutter to cut the bottom edge to center the area and set its width.



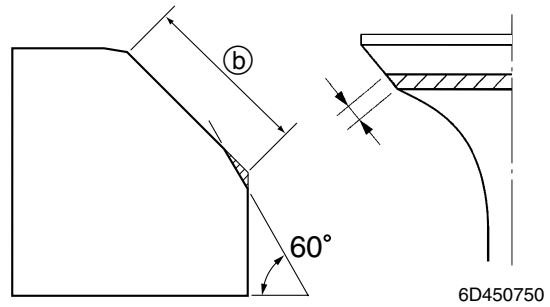
- (b) Previous contact width

7. If the valve seat contact area is too narrow and situated near the top edge of the valve face, use a 5° cutter to cut the top edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.



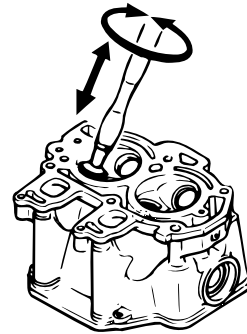
- (b) Previous contact width

8. If the valve seat contact area is too narrow and situated near the bottom edge of the valve face, use a 60° cutter to cut the bottom edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.



- (b) Previous contact width

9. Apply a thin, even layer of lapping compound onto the valve seat, and then lap the valve using a valve lapper (commercially obtainable).



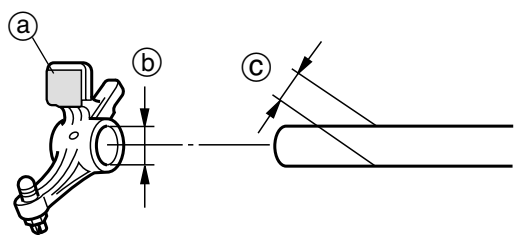
CAUTION:

Do not get the lapping compound on the valve stem and valve guide.

10. After every lapping procedure, be sure to clean off any remaining lapping compound from the cylinder head and the valve.
11. Check the valve seat contact area of the valve again.

Checking the rocker arms and rocker arm shaft

1. Check the rocker arms, rocker arm shaft, and rocker arm contact surface (a) for wear. Replace if necessary.
2. Measure the rocker arms inside diameter (b) and rocker arm shaft outside diameter (c) Replace if out of specification.

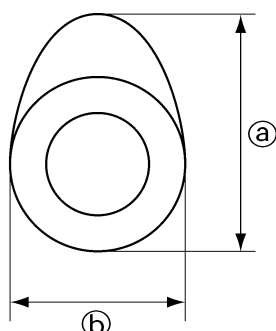


6D450770

	Rocker arm inside diameter (b):
	13.000–13.018 mm (0.5118–0.5125 in)
	Rocker arm shaft outside diameter (c):
	12.941–12.951 mm (0.5095–0.5099 in)

Checking the camshaft

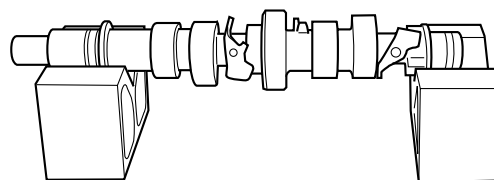
1. Measure the cam lobe. Replace if out of specification.



6D450780

	Cam lobe (a):
	Intake: 27.596–27.696 mm (1.0865–1.0904 in)
	Exhaust: 27.616–27.716 mm (1.0872–1.0912 in)
	Cam lobe (b):
	Intake: 23.950–24.050 mm (0.9429–0.9468 in)
	Exhaust: 23.950–24.050 mm (0.9429–0.9468 in)

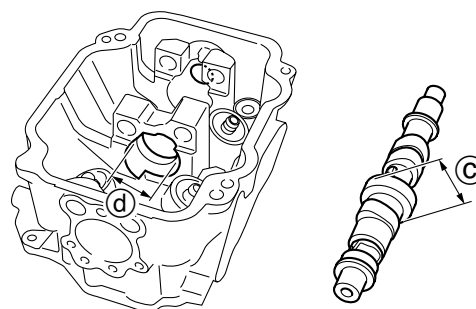
2. Measure the camshaft run-out. Replace if out of specification.



6D450790

	Camshaft run-out limit: 0.03 mm (0.0012 in)
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3. Measure the camshaft journal diameter (c) and cylinder head journal inside diameter (d). Replace the camshaft and cylinder head if out of specification.



6D450800

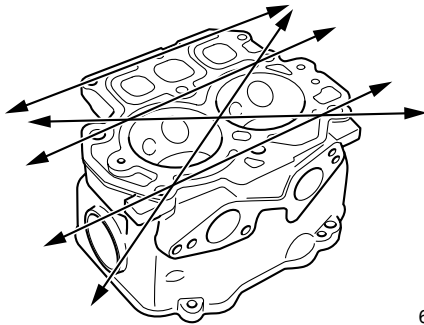
	Camshaft journal diameter (c):
	34.935–34.955 mm (1.3754–1.3762 in)
	Cylinder head journal inside diameter (d):
	35.000–35.012 mm (1.3780–1.3784 in)
	Camshaft journal oil clearance:
	0.050–0.080 mm (0.0020–0.0032 in)

4. Check the automatic decompression mechanism for cracks or damage. Replace the camshaft if necessary.

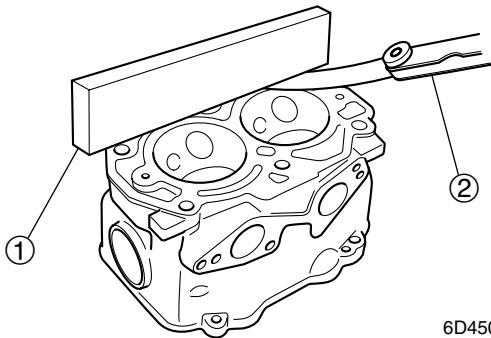


Checking the cylinder head

1. Eliminate carbon deposits from the combustion chambers and check for deterioration.
2. Check the cylinder head warpage using a straightedge ① and thickness gauge ② in five directions as shown. Replace if out of specification



6D450810



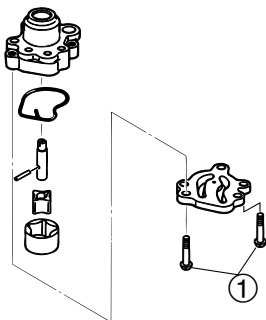
6D450820



Cylinder head warpage limit:
0.10 mm (0.0039 in)

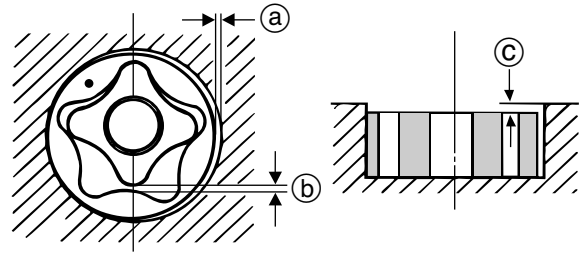
Checking the oil pump

1. Removing the screws ① and disassemble the oil pump.

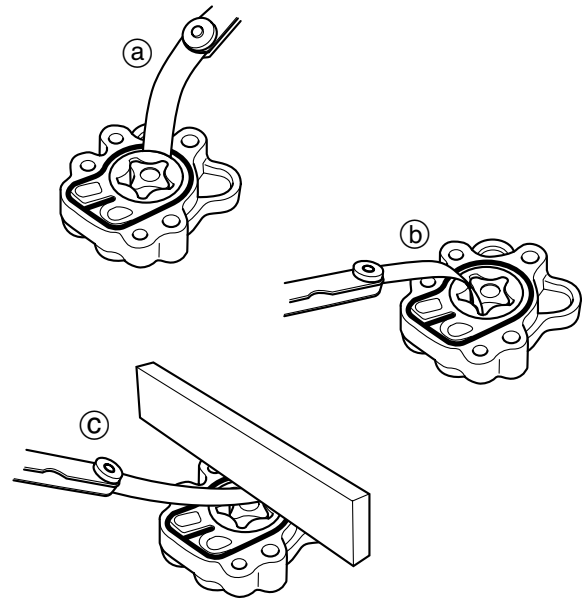


6D450531

2. Measure the oil pump rotor clearances as shown. Replace if out of specification.



6D450840



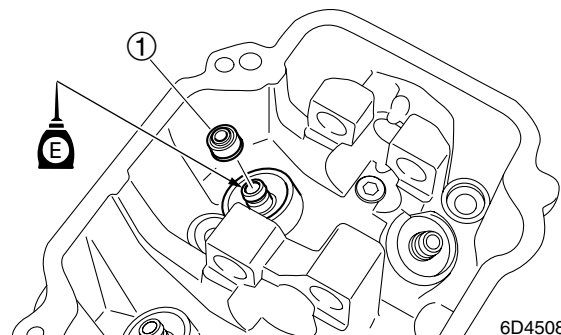
6D450840



Clearance (a):
0.100–0.150 mm (0.0039–0.0059 in)
Clearance (b):
0.040–0.140 mm (0.0016–0.0055 in)
Clearance (c):
0.030–0.090 mm (0.0012–0.0035 in)

Installing the valves

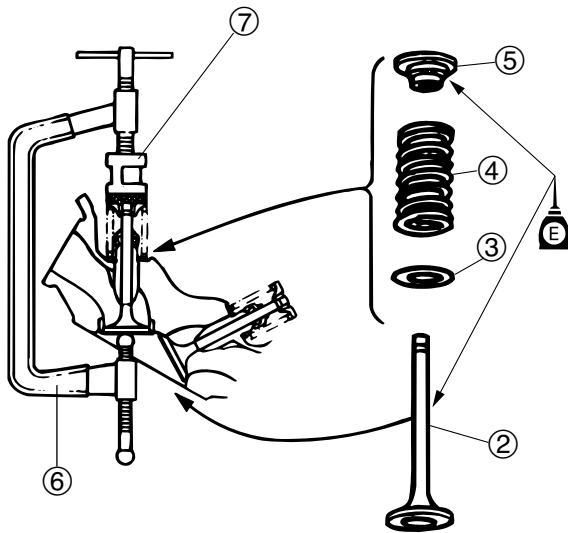
1. Install the new valve stem seal ① to the valve guide, and then apply engine oil to the valve guide.



6D450850

6D45F11

- Install the valve ②, spring seat ③, valve spring ④, and spring retainer ⑤ in the sequence shown, and then attach the special service tool.

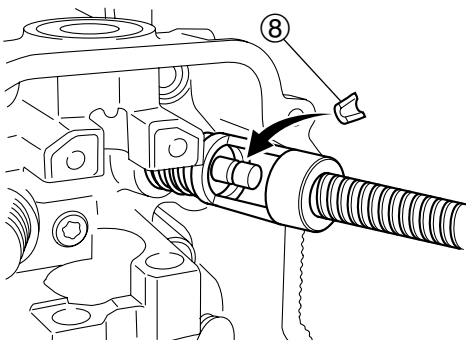


6D450860



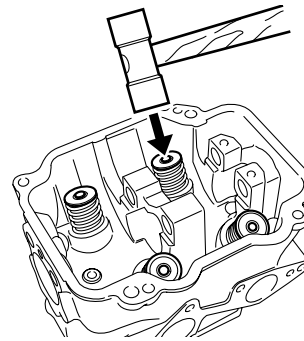
Valve spring compressor ⑥:
90890-04019
Valve spring compressor
attachment ⑦:
90890-06320

- Compress the valve spring, and then install the valve cotters ⑧.



6D450870

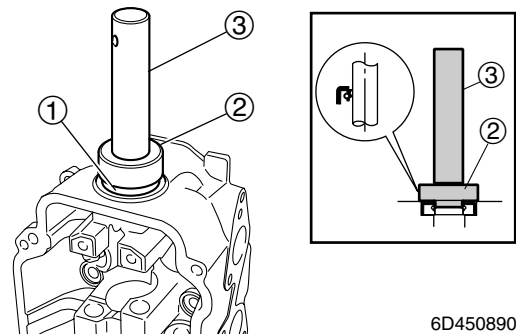
- Lightly tap the spring retainer with a plastic hammer to set the valve cotter securely.



6D450880

Installing the cylinder head

- Install the new oil seal ① using a special tool.

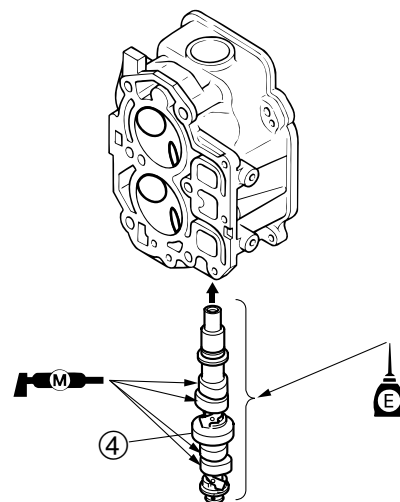


6D450890



Ball bearing attachment ②:
90890-06635
Driver rod ③:
90890-06606

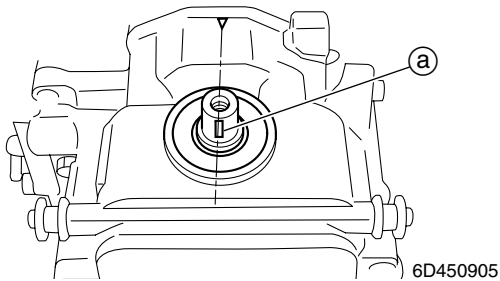
- Install the camshaft ④ in the direction shown.



6D450900



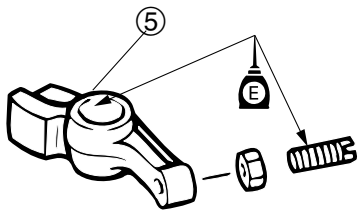
3. Check that the camshaft Woodruff key groove (a) is in the position shown in the illustration.
Adjust if necessary.



6D450905

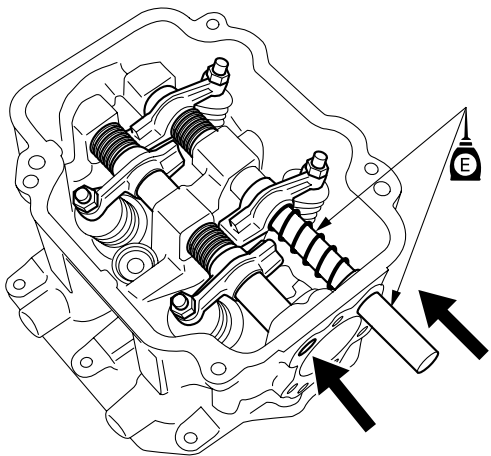
NOTE: _____
Align the valve position with the Top Dead Center of the #1 cylinder.

4. Assemble the rocker arm (5).



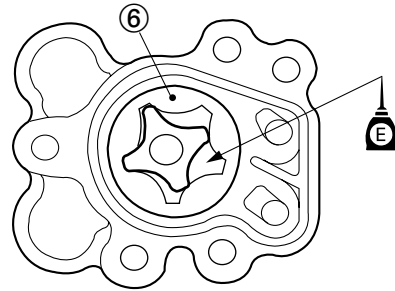
6D451000

5. Install the rocker arm assembly, springs and collars to the cylinder head.



6D451010

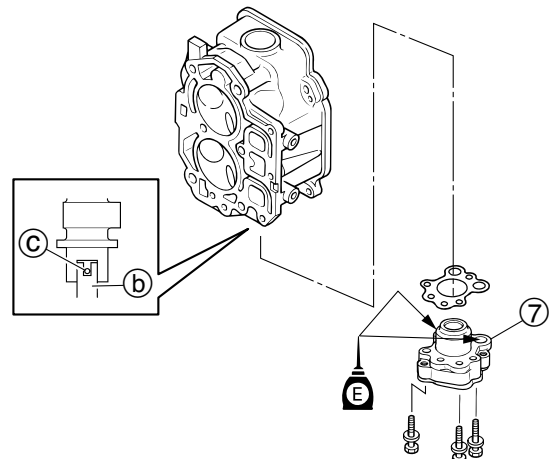
6. Assemble the oil pump as shown.



6D451016

NOTE: _____
Be sure to assemble the oil pump so that the "●" mark (6) on the outer rotor faces toward the oil pump cover side.

7. Install the oil pump (7) by aligning the oil pump drive shaft (b) with the camshaft pin (c).



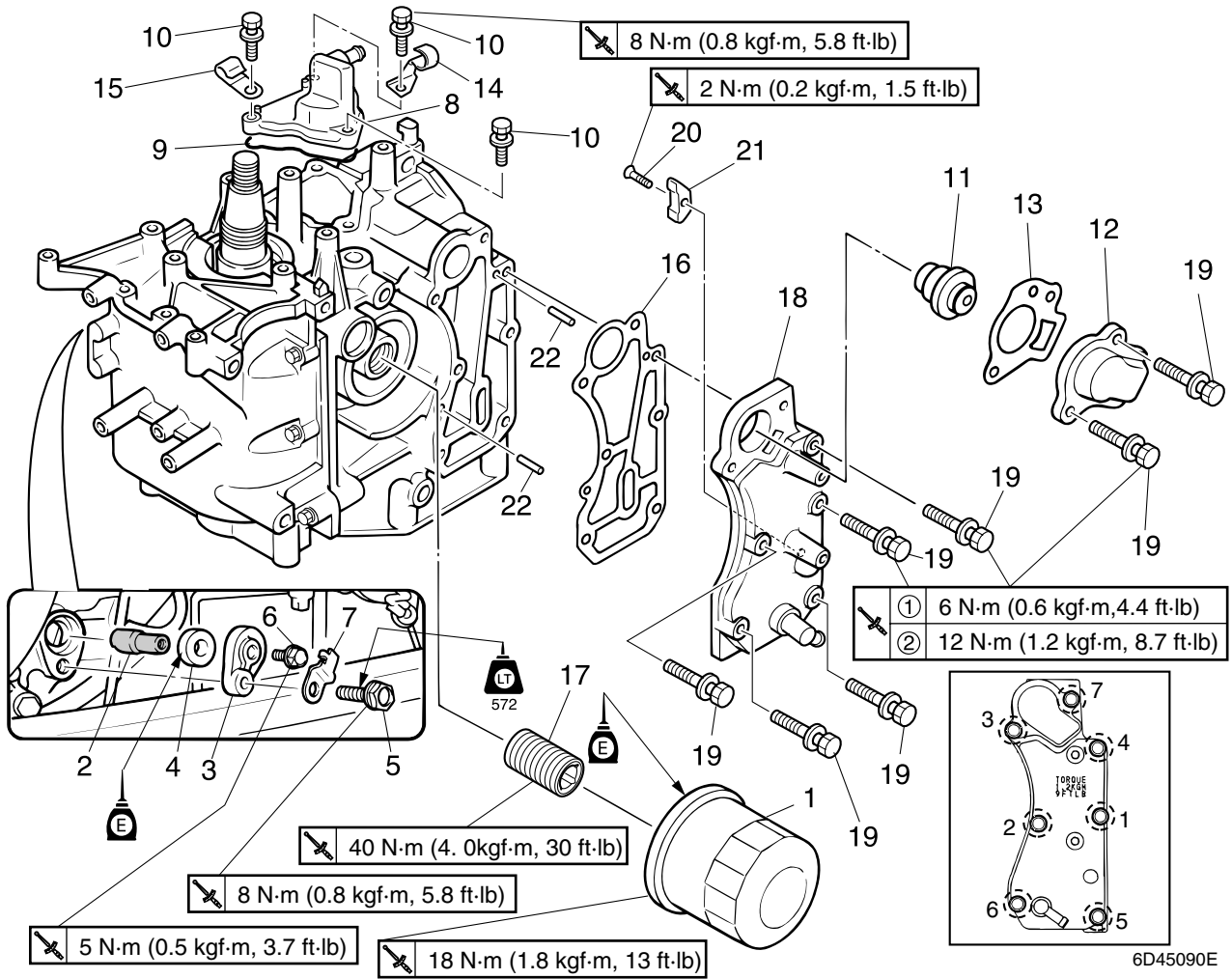
6D451011

CAUTION: _____
Before installing the oil pump, be sure to fill it with engine oil through the oil passage.



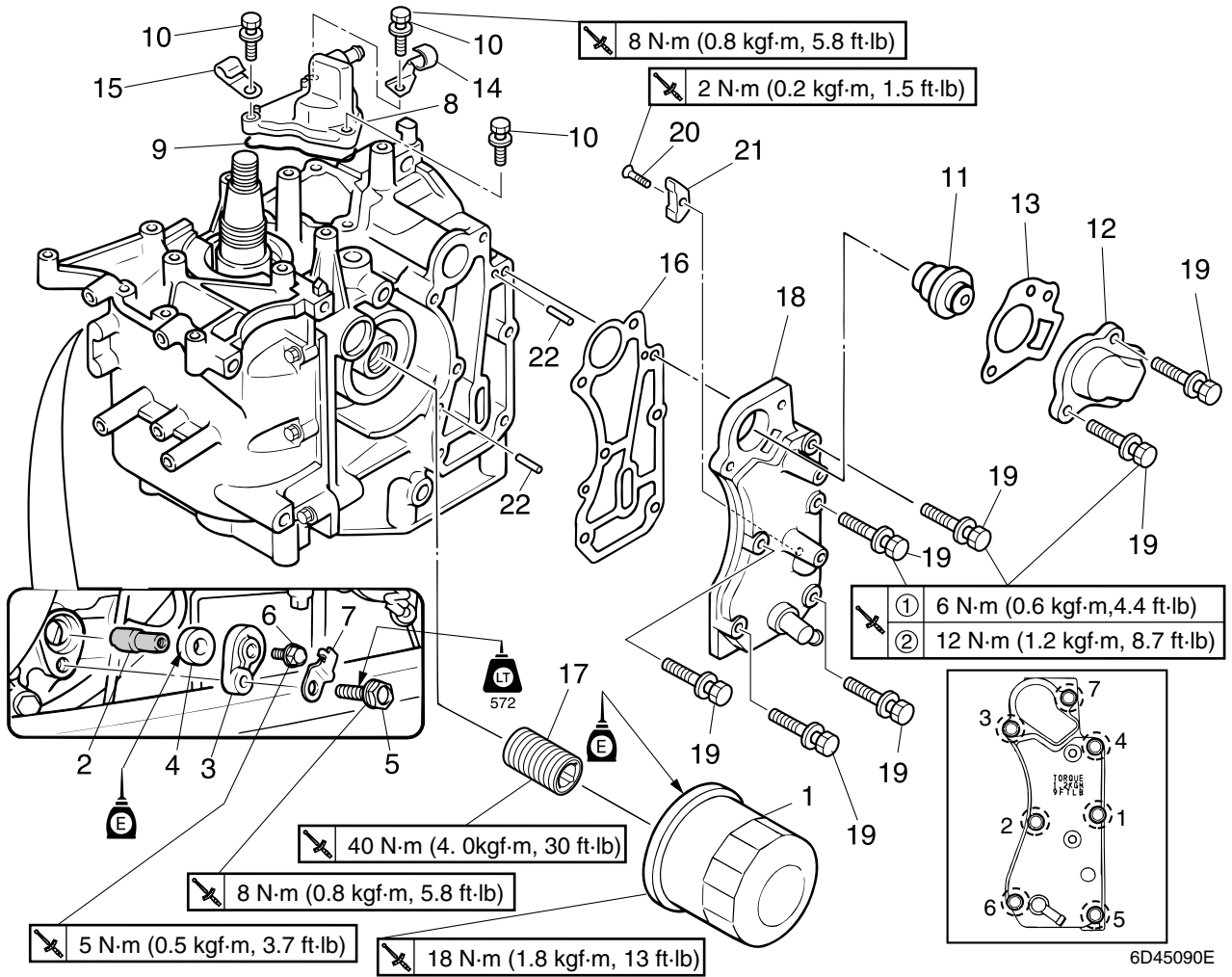
Oil pump bolts:
8 N·m (0.8 kgf·m, 5.8 ft·lb)

Cylinder block

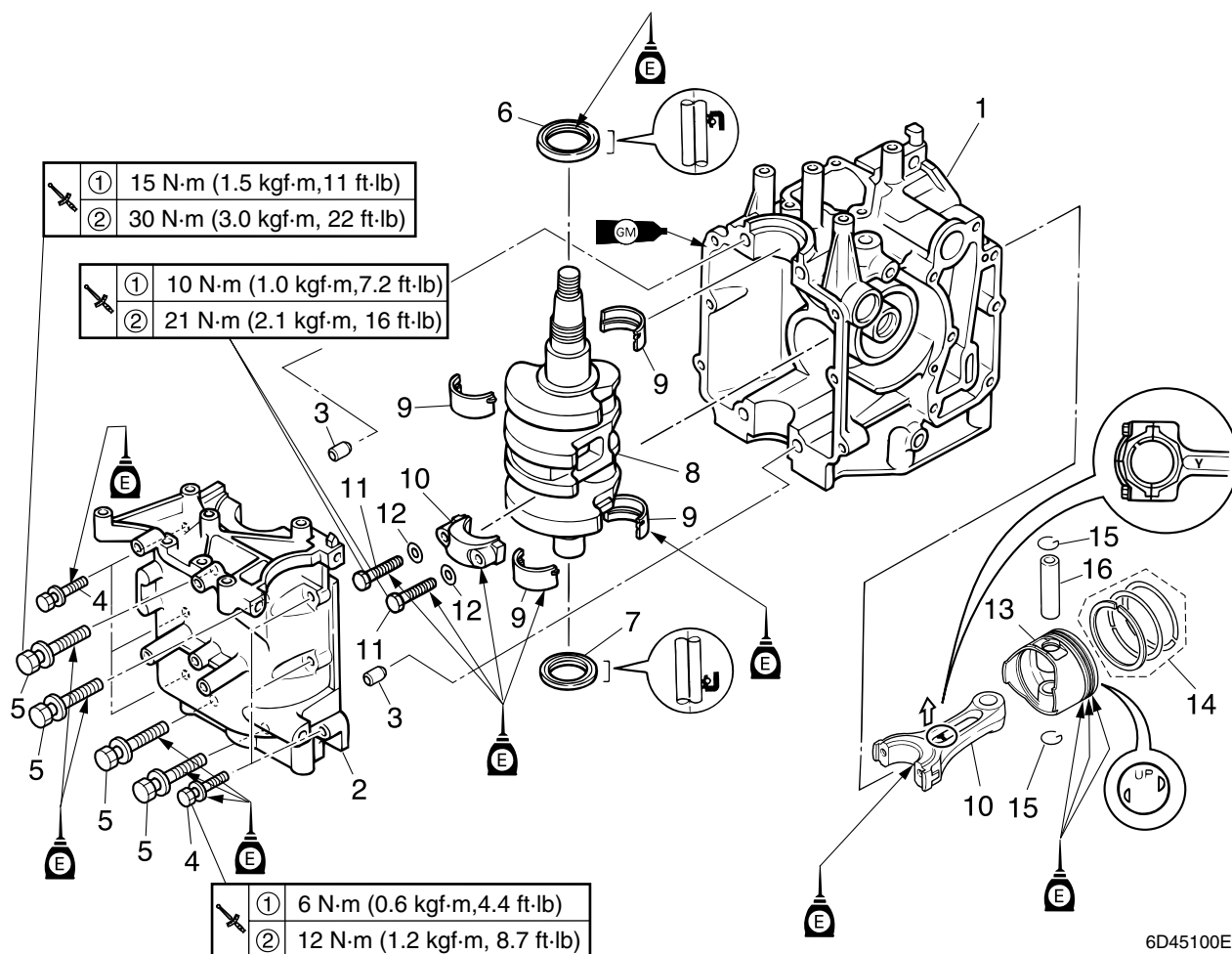


5

No.	Part name	Q'ty	Remarks
1	Oil filter	1	
2	Anode	1	
3	Cover	1	
4	Grommet	1	
5	Bolt	1	M6 × 20 mm
6	Bolt	1	M5 × 12 mm
7	Plate	1	
8	Breather cover	1	
9	Seal	1	Not reusable
10	Bolt	3	M6 × 20 mm
11	Thermostat	1	
12	Thermostat cover	1	
13	Gasket	1	Not reusable
14	Clamp	1	
15	Clamp	1	
16	Gasket	1	Not reusable
17	Union bolt	1	



No.	Part name	Q'ty	Remarks
18	Exhaust cover	1	
19	Bolt	7	M6 × 30 mm
20	Screw	1	
21	Anode	1	
22	Dowel pin	2	



6D45100E

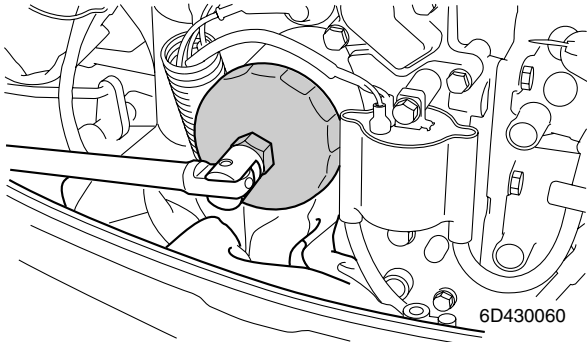
5

No.	Part name	Q'ty	Remarks
1	Cylinder body	1	
2	Crankcase	1	
3	Dowel pin	2	
4	Bolt	6	M6 × 35 mm
5	Bolt	4	M8 × 55 mm
6	Oil seal	1	Not reusable
7	Oil seal	1	Not reusable
8	Crankshaft	1	
9	Bearing	4	
10	Connecting rod assembly	2	
11	Bolt	4	M7 × 38 mm
12	Washer	4	
13	Piston	2	
14	Piston ring set	2	Not reusable
15	Piston pin clip	4	
16	Piston pin	2	



Disassembling the cylinder block

1. Place a rag under the oil filter, and then remove the filter.

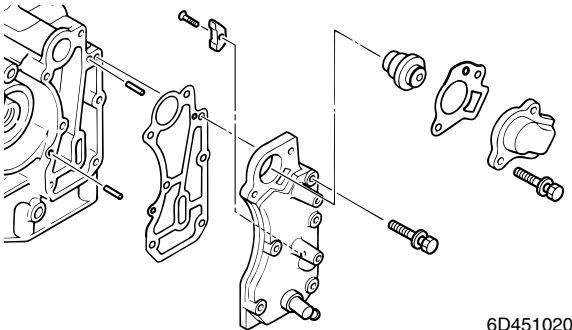


Oil filter wrench:
90890-01426

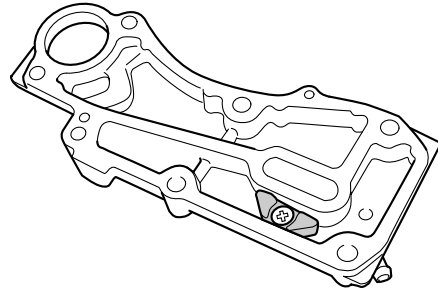
NOTE:

Be sure to clean up any oil spills.

2. Remove the thermostat cover, gasket and the thermostat.
3. Remove the exhaust cover, gasket and dowel pin.



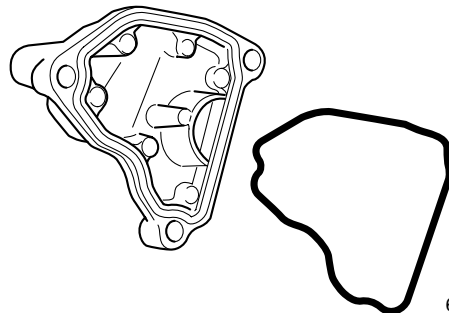
4. Check the anode on the exhaust cover. Clean the anode's surface, and replace if it has been eroded into half its size or smaller.



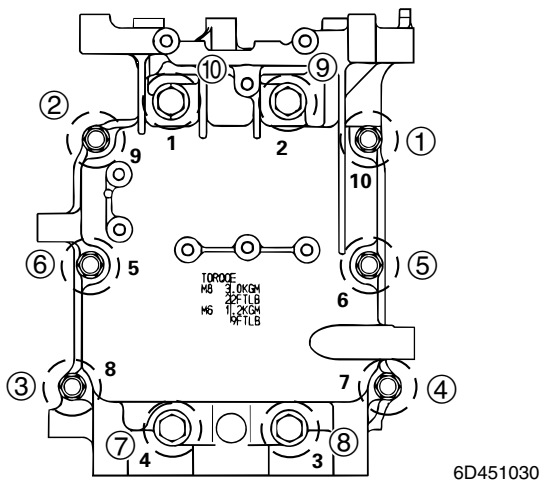
CAUTION:

Do not oil, grease, or the anodes, otherwise they will not be able to prevent galvanic corrosion effectively.

5. Clean the mineral deposits and contamination on the cylinder head. Also check for possible corrosion on the cylinder head. Replace if necessary.
6. Check the exhaust cover for cracks, distortion or corrosion. Clean or replace if necessary.
7. Remove the breather cover and gasket.
8. Check the breather cover for cracks, distortion or corrosion. Replace if necessary.

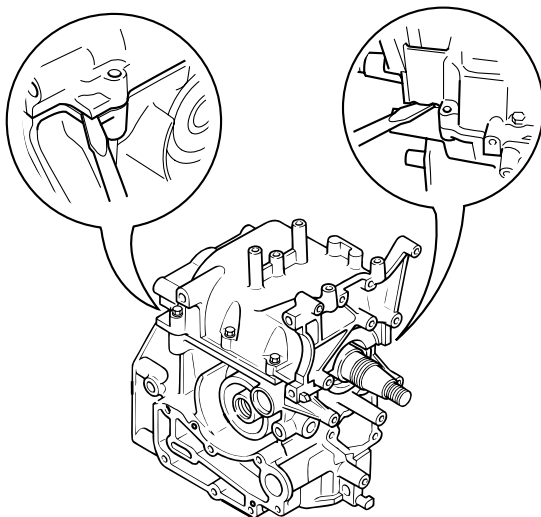
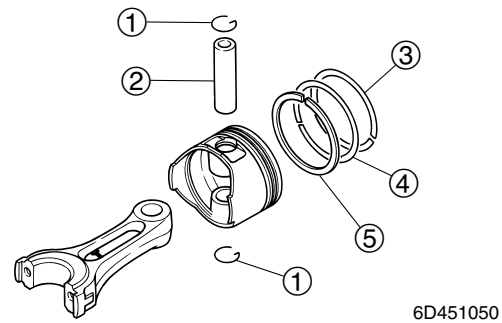


9. Remove the crankcase bolts in the sequence shown.



Disassembling the piston and connecting rod assemblies

1. Remove the clips ① with pliers, and then remove the piston pin ②.
2. Remove the top ring ③ 2nd piston ring ④ and oil ring set ⑤.



NOTE: _____
Insert a flat-head screw driver between the pry tabs to pry off the crankcase.

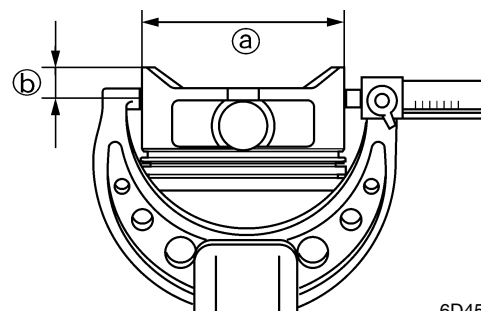
10. Remove the connecting rod bolts and the piston assemblies.

NOTE: _____
Be sure to paint the alignment mark on the connecting rods and caps, before remove the connecting rods.

11. Remove the crankshaft, oil seals, dowel pins and bearings.

Checking the piston diameter

1. Measure the piston outside diameter at the specified measuring point. Replace if out of specification.

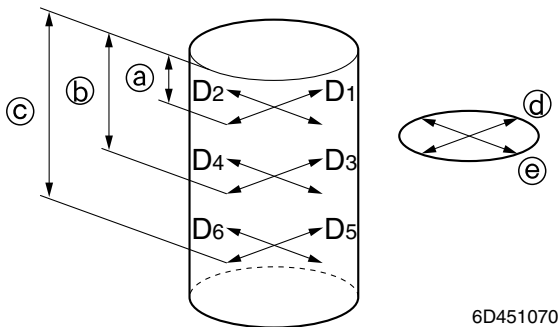


	Piston diameter ①a):
	58.950–58.965 mm (2.3209–2.3215 in)
	Measuring point ①b):
	5.0 mm (0.2 in) up from the bottom of the piston skirt
	Oversize piston diameter:
	Oversize 1: 59.2 mm (2.33 in)
	Oversize 2: 59.5 mm (2.34 in)



Checking the cylinder bore

1. Measure the cylinder bore (D₁–D₆) at measuring points (a), (b), and (c), and in direction (d) (D₁, D₃, D₅), which is parallel to the crankshaft, and direction (e) (D₂, D₄, D₆), which is at a right angle to the crankshaft.



- (a) 10 mm (0.39 in)
- (b) 40 mm (1.57 in)
- (c) 70 mm (2.76 in)



Cylinder bore (D₁–D₆):
59.000–59.015 mm
(2.3288–2.3234 in)

2. Calculate the taper limit. Replace or rebore the cylinder block if out of specification.



Taper limit:
D₁–D₅ (direction (d))
D₂–D₆ (direction (e))
0.08 mm (0.0032 in)

3. Calculate the out-of-round limit. Replace or rebore the cylinder block if out of specification.



Out-of-round limit:
D₂–D₁ (direction (a))
D₆–D₅ (direction (c))
0.05 mm (0.0020 in)

Checking the piston clearance

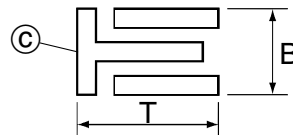
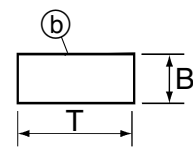
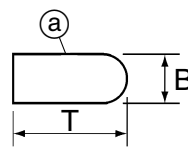
1. Rebore the cylinder or replace the piston and piston rings as a set, or the cylinder block, or all parts if out of specification.



Piston clearance:
0.035–0.065 mm
(0.0014–0.0026 in)

Checking the piston rings

1. Check the piston ring dimensions of B and T. Replace if out of specification.

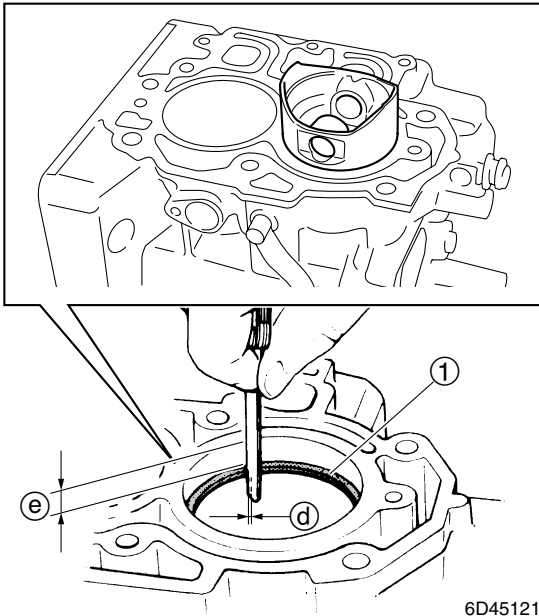


6D451200




Piston ring dimensions:
Top ring (a):
B: 1.17–1.19 mm
(0.0461–0.0469 in)
T: 2.00–2.20 mm
(0.0787–0.0866 in)
Second ring (b):
B: 1.47–1.49 mm
(0.0579–0.0590 in)
T: 2.50–2.70 mm
(0.0984–0.1063 in)
Oil ring (c):
B: 2.31–2.51 mm
(0.0909–0.0988 in)
T: 2.30–2.60 mm
(0.0906–0.1024 in)

- Level the piston ring ① in the cylinder with a piston crown.
- Check the piston ring end gap ④ at the specified measuring point. Replace if out of specification.



6D451210

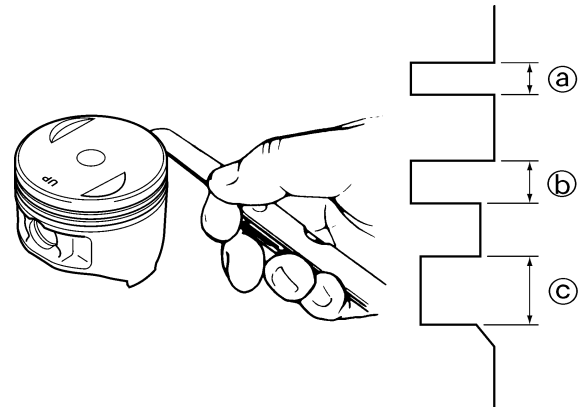
 **Piston ring end gap ④:**

- Top ring: 0.15–0.30 mm (0.0059–0.0118 in)
- Second ring: 0.30–0.50 mm (0.0118–0.0197 in)
- Oil ring: 0.20–0.70 mm (0.0079–0.0276 in)

Measuring point ⑤: 10 mm (0.4 in)

Checking the piston ring grooves

- Measure the piston ring grooves. Replace the piston if out of specification.



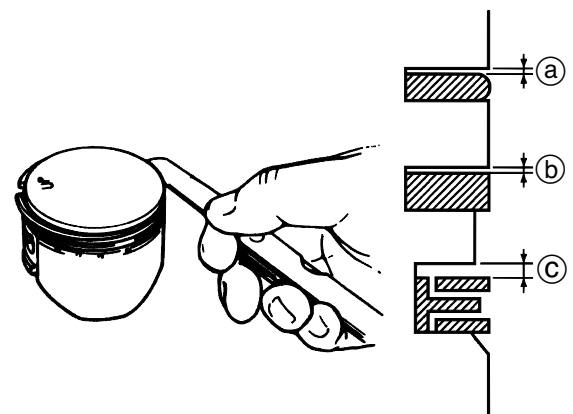
6D451220

 **Piston ring groove:**

- Top ring ⑥: 1.23–1.25 mm (0.048–0.049 in)
- Second ring ⑦: 1.52–1.54 mm (0.0598–0.0601 in)
- Oil ring ⑧: 2.51–2.53 mm (0.099–0.100 in)

Checking the piston ring side clearance

- Measure the piston ring side clearance. Replace the piston and piston rings as a set if out of specification.



6D451230

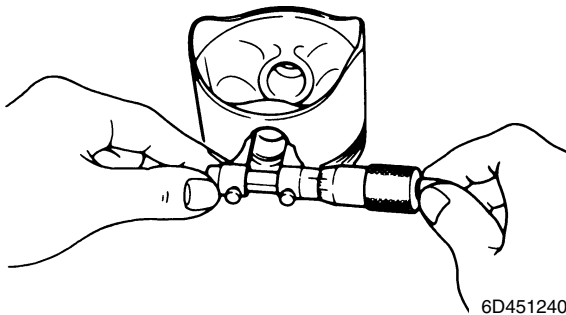


Piston ring side clearance:

- Top ring (a):
0.04–0.08 mm
(0.0016–0.0032 in)
- Second ring (b):
0.02–0.04 mm
(0.0008–0.0016 in)
- Oil ring (c):
0–0.22 mm
(0–0.0087 in)

Checking the piston pin boss bore

1. Measure the piston pin boss bore.
Replace the piston if out of specification.



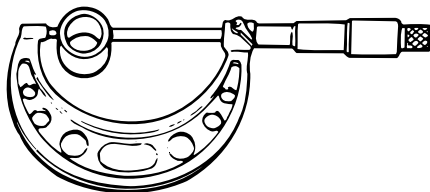
6D451240



Piston pin boss bore:
14.004–14.015 mm
(0.5513–0.5518 in)

Checking the piston pin

1. Measure the piston pin diameter.
Replace if out of specification.



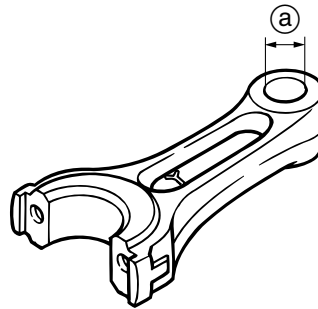
6D451250



Piston pin diameter:
13.996–14.000 mm
(0.5510–0.5512 in)

Checking the connecting rod small end inside diameter

1. Measure the connecting rod small end inside diameter (a). Replace the connecting rod if out of specification.



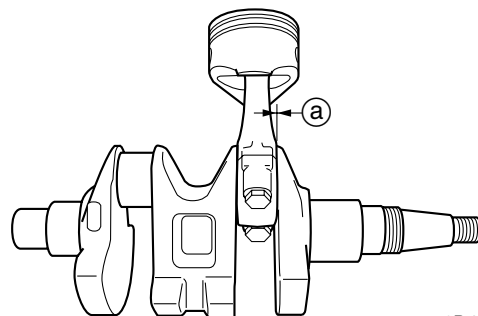
6D451265



Connecting rod small end inside diameter (a):
14.015–14.029 mm
(0.5518–0.5523 in)

Checking the connecting rod big end side clearance

1. Measure the connecting rod big end side clearance (a). Replace the connecting rod or crankshaft, or both if out of specification.



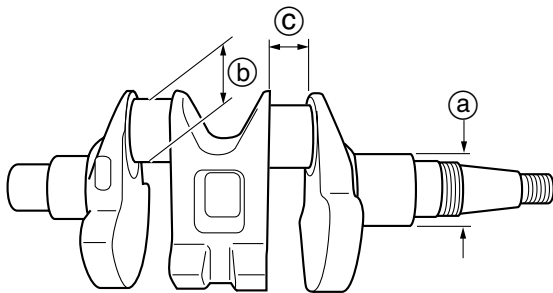
6D451270



Connecting rod big end side clearance (a):
0.050–0.220 mm
(0.0020–0.0087 in)

Checking the crankshaft

1. Measure the crankshaft journal diameter (a), crank pin diameter (b), and crank pin width (c). Replace the crankshaft if out of specification.

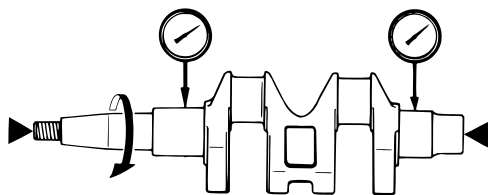


6D451280



Crankshaft journal diameter (a):
34.997–35.009 mm
(1.3778–1.3783 in)
Crank pin diameter (b):
30.997–31.009 mm
(1.2204–1.2208 in)
Crank pin width (c):
21.000–21.070 mm
(0.8268–0.8295 in)

2. Measure the crankshaft run-out. Replace the crankshaft if out of specification.



6D451290



Crank stand aligner:
90890-03107

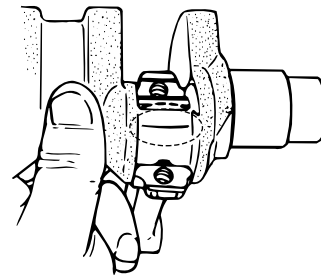


Crankshaft run-out limit:
0.05 mm (0.0020 in)

Checking the crankshaft pin oil clearance

1. Clean the bearings and the connecting rod.

2. Put a piece of Plastigauge® (PG-1) onto the crank pin, parallel to the crankshaft.

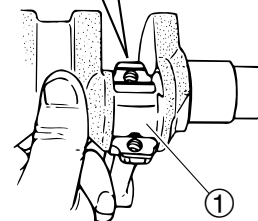
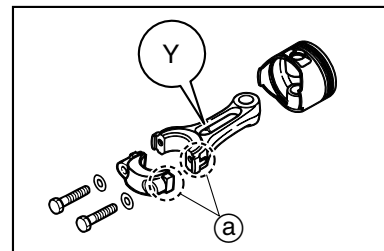


6D451340

NOTE:

Be sure not to put the Plastigauge® (PG-1) over the oil hole in the crank pin of the crankshaft.

3. Install the connecting rod to the crank pin (1).

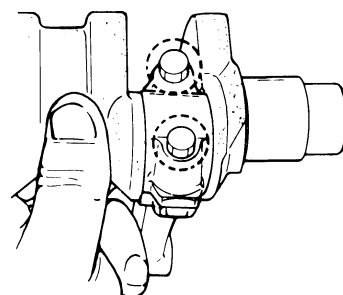


6D451350

NOTE:

- Align the finished side (a) on the connecting rod cap and connecting rod.
- Face the embossed “Y” mark on the connecting rod toward the flywheel side of the crankshaft.

4. Tighten the connecting rod bolts to the specified torques in two stages.



6D451360

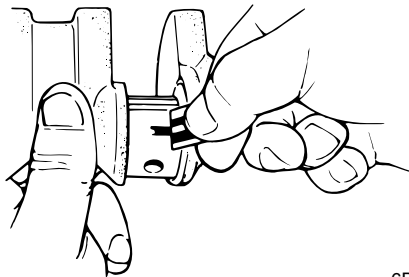


NOTE:
Do not turn the connecting rod until the crank pin oil clearance measurement has been completed.



Connecting rod bolt:
1st: 10 N·m (1.0 kgf·m, 7.2 ft·lb)
2nd: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Remove the connecting rod cap and measure the width of the compressed Plastigauge® (PG-1) on each crank pin. Replace the connecting rod.



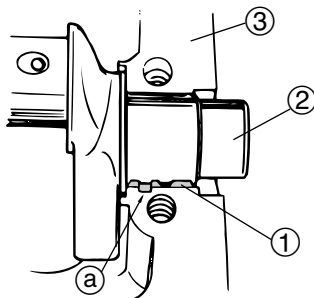
6D451370



Crank pin oil clearance:
0.021–0.045 mm
(0.0008–0.0018 in)

Checking the crankshaft main journal oil clearance

- Clean the bearings, main journals, and bearing portions of the crankcase and cylinder body.
- Place the cylinder body upside down on a bench.
- Install half of the bearings ① and the crankshaft ② into the cylinder body ③.

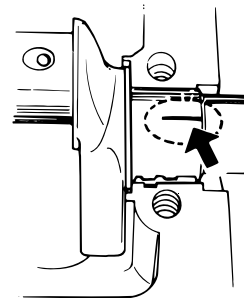


6D451300

CAUTION:
Install the bearings in their original positions.

NOTE:
Insert the projection (a) of the bearing into the notch in the cylinder body.

- Put a piece of Plastigauge® (PG-1) on each main journal parallel to the crankshaft.



6D451310

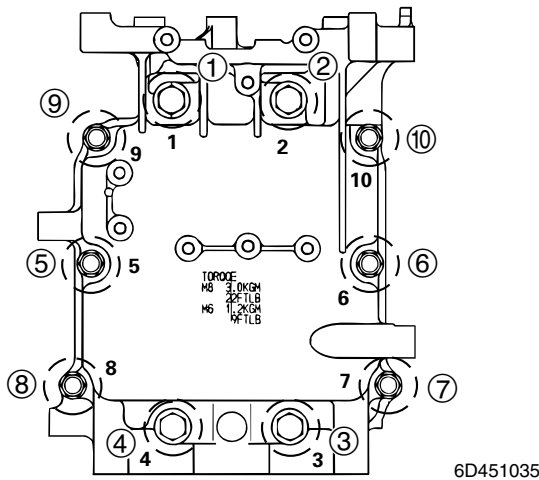
NOTE:
Do not put the Plastigauge® (PG-1) over the oil hole in the main journals of the crankshaft.

- Install the remaining half of the bearings into the crankcase.

NOTE:
Insert the projection of the bearing into the notch in the crankcase.

- Install the crankcase onto the cylinder body and apply engine oil onto the threads of the crankcase bolts.

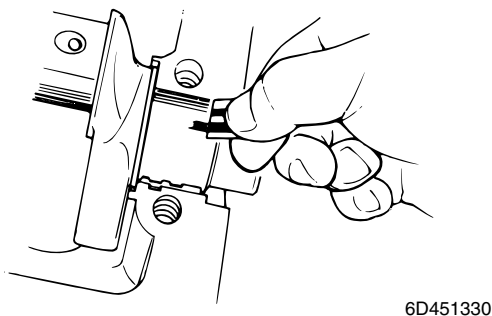
- Tighten the crankcase bolts to the specified torques in two stages and in the sequence shown.



NOTE:
Do not move the crankshaft until the main journal oil clearance measurement has been completed.

	Crankcase bolt (M8): ①-④
	1st: 15 N·m (1.5 kgf·m, 11 ft·lb)
	2nd: 30 N·m (3.0 kgf·m, 22 ft·lb)
	Crankcase bolt (M6): ⑤-⑩
	1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
	2nd: 12 N·m (1.2 kgf·m, 8.7 ft·lb)

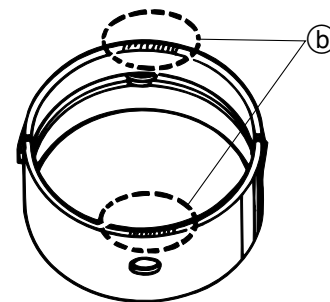
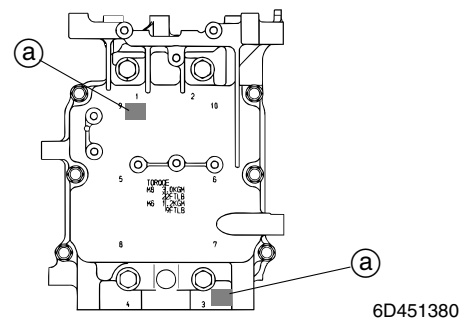
- Remove the crankcase and measure the width of the compressed Plastigauge® (PG-1) on each main journal. Replace the main bearing if out of specification.



	Crankshaft main journal oil clearance:
	0.012–0.045 mm
	(0.0005–0.0018 in)

Selecting the crankshaft main journal bearing

- When replacing the main bearing, select the suitable bearing as follows.
- Check the bearing color code indicator (a) is marked on the cylinder block.
- Select the suitable color (b) for the main bearing from the table.



Cylinder body mark	Bearing color
A	Blue
B	Black
C	Brown

- When installing the main bearing, insert the projection of the main bearing into the slot on the cylinder body.

CAUTION:

Remove any small metal particles and oil from the contact surfaces of the cylinder body and the main bearing.

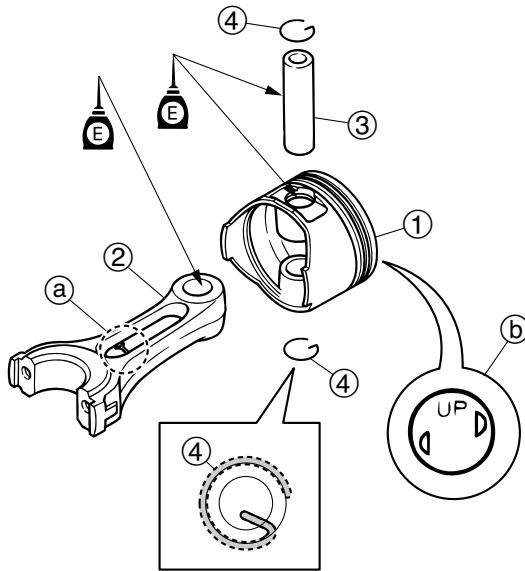
- Measure the main journal oil clearance with a piece of Plastigauge® (PG-1).



6. If the oil clearance is below specification, check the main bearing color and clean the contact surface of the cylinder body and the main bearing, and then check the main journal oil clearance again.
7. If the oil clearance is over specification, install an oversized main bearings as a set, and then check the main journal oil clearance again.

Assembling the piston and connecting rod assemblies

1. Assemble the pistons ①, connecting rods ②, piston pins ③, and new piston pin clips ④.

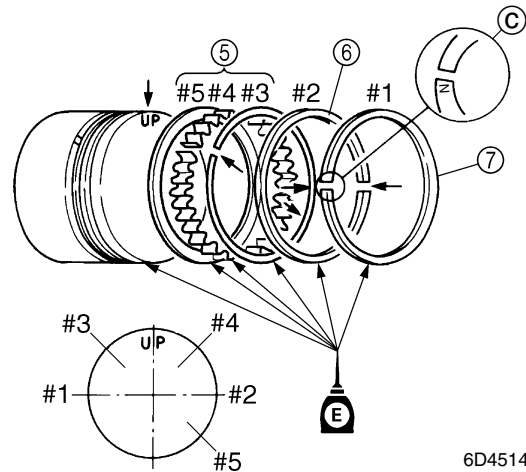


6D451400

- NOTE:**
- Face the embossed “Y” mark (a) on the connecting rod in the same direction as the “UP” mark (b) on the piston.
 - Always use new piston pin clips.

2. Install the oil ring ⑤, second ring ⑥, and top ring ⑦ to the piston with the “N” mark (C) on the piston rings facing upward.

3. Offset the piston ring end gaps as shown.



6D451410

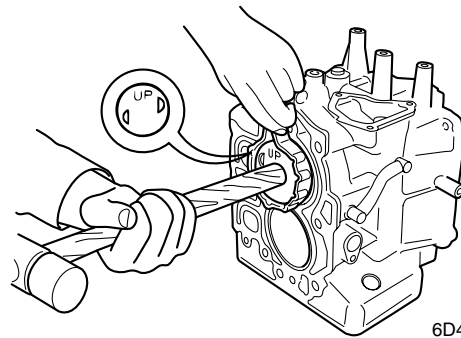
CAUTION:

Do not scratch the piston or break the piston rings.

NOTE:

After installing the piston rings, check that they move smoothly.

4. Install the piston with the “UP” mark on the piston crown facing towards the fly-wheel.



6D451420

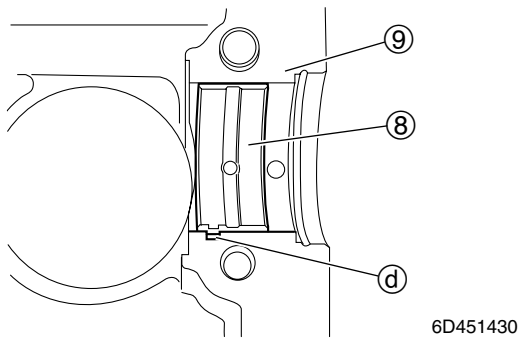
NOTE:

Apply engine oil to side of the piston assembly.



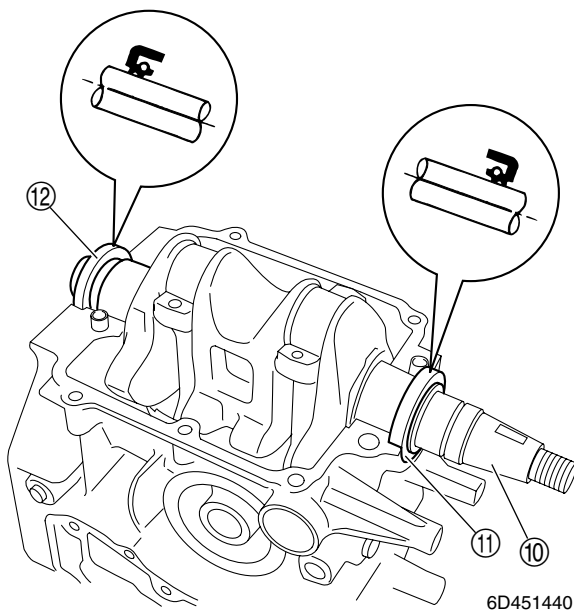
Piston slider: 90890-06529

5. Install half of the bearings ⑧ into the cylinder body ⑨.



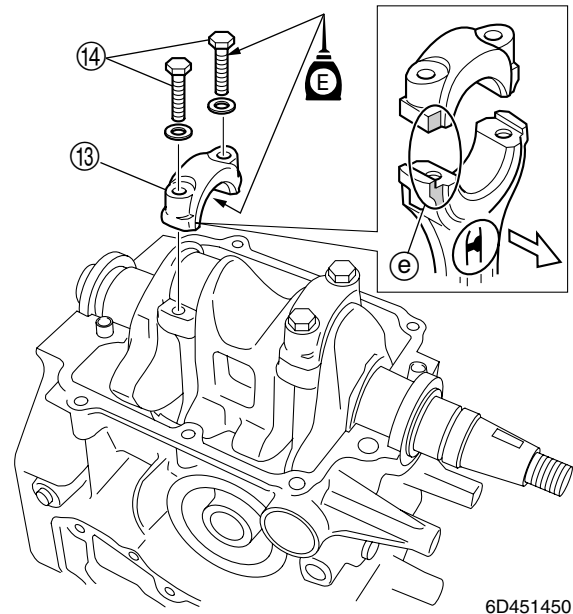
NOTE: _____
 Insert the projection ④ of the bearing into the notch in the cylinder body.

6. Set the crankshaft ⑩, and oil seals ⑪ and ⑫ into the cylinder body as shown. Apply engine oil to the inner oil seal, journal bearings.




CAUTION: _____
 The oil seals ⑪, ⑫ must be installed before installing the connecting rod.

7. Install the connecting rod cap ⑬ to the connecting rod, and then tighten the connecting rod bolts ⑭ to the specified torques in two stages.



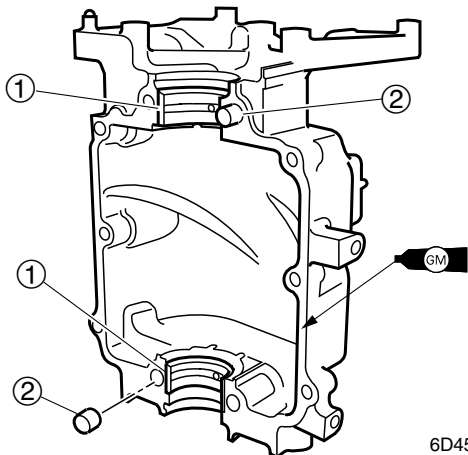
NOTE: _____
 • Apply engine oil to the connecting rod cap and connecting rod bolt before installation.
 • Align the finished side ⑤ on the connecting rod cap and connecting rod.

	Connecting rod bolt:
	1st: 10 N·m (1.0 kgf·m, 7.2 ft·lb)
	2nd: 22 N·m (2.2 kgf·m, 16 ft·lb)



Assembling the cylinder block

1. Install half of the bearings ① into the crankcase, then dowel pins ②.
2. Apply Gasket Maker® to the mating surface of the crankcase.

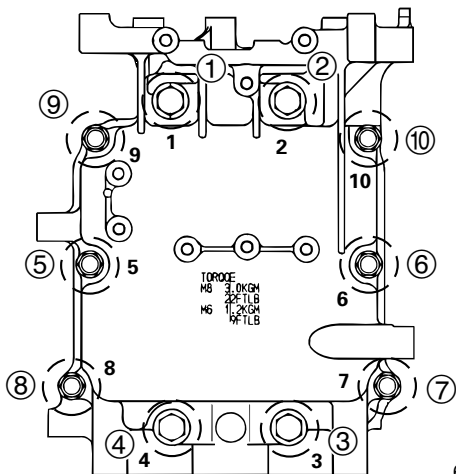


6D451460

NOTE:

Do not get any Gasket Maker® on the journal bearings.

3. Install the crankcase bolts, and then tighten them to the specified torques in two stages and in the sequence shown.



6D451035

NOTE:

Apply engine oil to the crankcase bolt before installation.



Crankcase bolt (M8): ①-④
 1st: 15 N·m (1.5 kgf·m, 11 ft·lb)
 2nd: 30 N·m (3.0 kgf·m, 22 ft·lb)
 Crankcase bolt (M6): ⑤-⑩
 1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
 2nd: 12 N·m (1.2 kgf·m, 8.7 ft·lb)

4. Install the union bolt to specified torque.



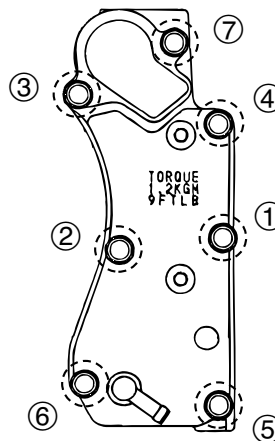
Union bolt:
 40 N·m (4.0 kgf·m, 30 ft·lb)

5. Install the new gasket and breather cover then tighten the bolts.



Breather cover bolt:
 8 N·m (0.8 kgf·m, 5.8 ft·lb)

6. Install the dowel pins, new gasket, exhaust cover, thermostat, new gasket and thermostat cover and then tighten the bolts to specified torques in two stages in the sequence shown.

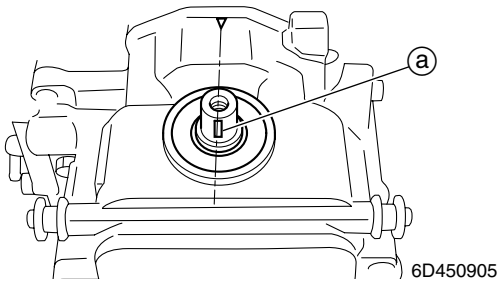


6D451480



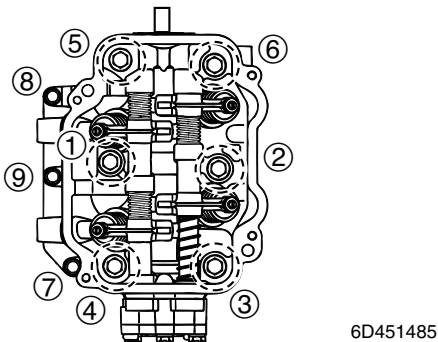
Exhaust cover and thermostat cover bolt:
 1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
 2nd: 12 N·m (1.2 kgf·m, 8.7 ft·lb)

7. Installing the dowel pins, new gasket and cylinder head assembly.
8. Check that the camshaft Woodruff key groove (a) is in the position shown in the illustration.
Adjust if necessary.



NOTE: _____
Align the valve position with the Top Dead Center of the #1 cylinder.

9. Tighten the cylinder head bolts to the specified torques in two stages and in the sequence shown.



NOTE: _____
Apply engine oil to the cylinder head bolts (M8) before installation.

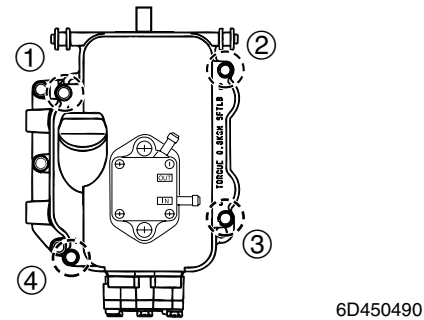
	Cylinder head bolt (M8): ①—⑥
	1st: 15 N·m (1.5 kgf·m, 11 ft·lb)
	2nd: 30 N·m (3.0 kgf·m, 22 ft·lb)
	Cylinder head bolt (M6): ⑦—⑨
	1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
	2nd: 12 N·m (1.2 kgf·m, 8.7 ft·lb)

10. Install the sprockets, timing belt and breather hose. Refer to “Installing the timing belt and sprockets”.

11. Adjust the valve clearance. Refer to “Checking the valve clearance”.

	Valve clearance:
	Intake:
	0.15–0.25 mm (0.0059–0.0098 in)
	Exhaust:
	0.20–0.30 mm (0.0079–0.0118 in)

12. Tighten the cylinder head cover bolts in the sequence shown.



	Cylinder head cover bolt:
	8 N·m (0.8 kgf·m, 5.8 ft·lb)

13. Install the bracket, pulley, collar, free axle lever, washer and then tighten the bolt to specified torque.

	Mounting bolt:
	8 N·m (0.8 kgf·m, 5.8 ft·lb)

14. For remote control model, install the collar, shift rod lever assembly, washer then tighten the bolt to specified torque.


	Mounting bolt:
	8 N·m (0.8 kgf·m, 5.8 ft·lb)

15. Install the oil pressure switch, ignition coil, CDI unit and rectifier regulator with bracket.

16. Install the pulser coil, lighting coils and charge coil.

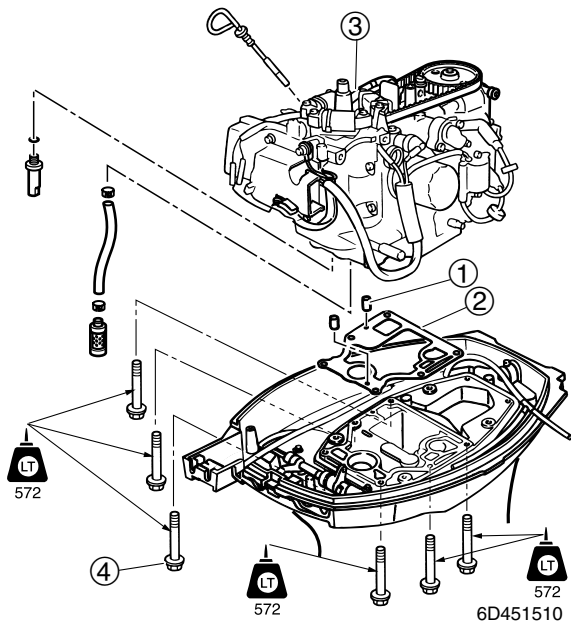
17. Install the spark plugs, then connect the spark plug caps.


18. Install the fuel system. Refer to "Fuel system" in the chapter 4.
19. Install the new O-ring, relief valve and oil strainer assembly.

	Relief valve: 8 N·m (0.8 kgf·m, 5.8 ft·lb)
---	---

Installing the power unit

1. Clean the power unit matching surface, and install the dowel pins ① and the new gasket ②.
2. Install the power unit ③ by installing the bolts ④, then tightening them to the specified torque.



	Mounting bolt ④: 21 N·m (2.1 kgf·m, 16 ft·lb)
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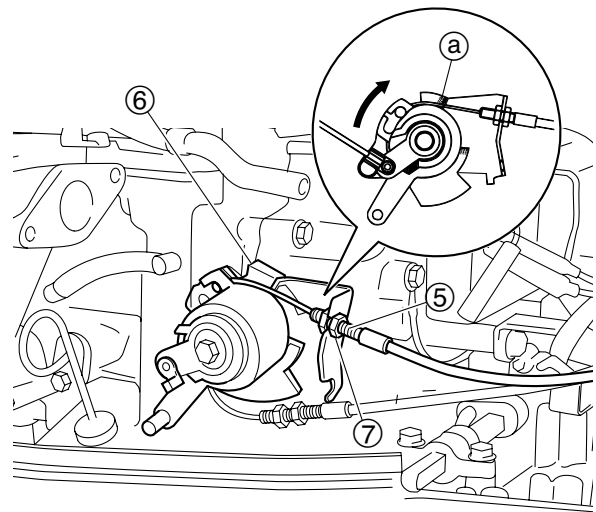
3. Connect the pilot water hose, charge coil leads, CDI unit leads, ignition coil leads, pulser coil leads, rectifier regulator leads, lighting coil leads and engine stop lanyard switch leads.

4. Install the throttle cable ⑤ (Pull side) to the pulley ⑥.

NOTE:

Be sure the throttle grip is in the fully close position when installing the throttle cables.

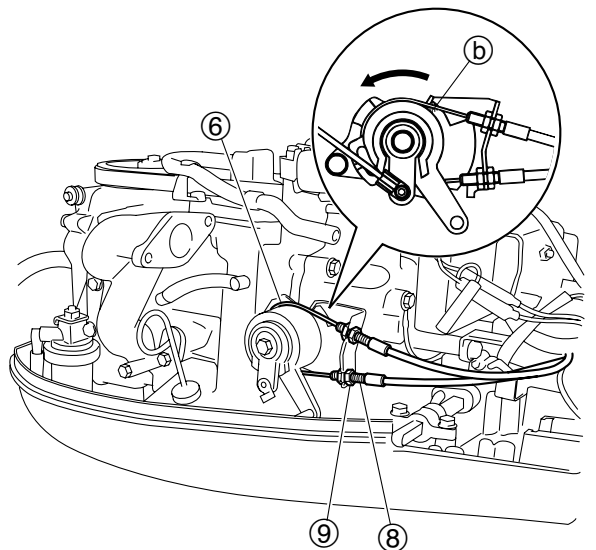
5. Turn the pulley ⑥ clockwise until lightly stop position (a), then adjust the throttle cable by adjusting nut ⑦. Tighten the locknut.



6D451520

6. Install the throttle cable ⑧ (Push side) to the pulley ⑥.

7. Turn the pulley clockwise until lightly stop position (b), then adjust the throttle cable by adjusting nut ⑨. Tighten the locknut.

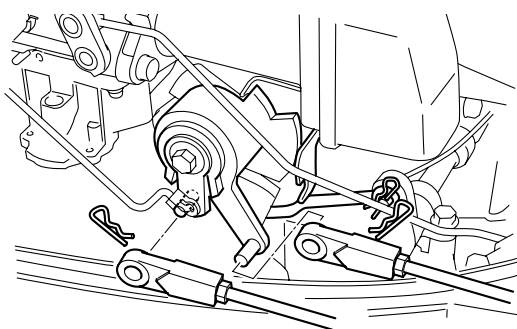


6D451530

NOTE: _____

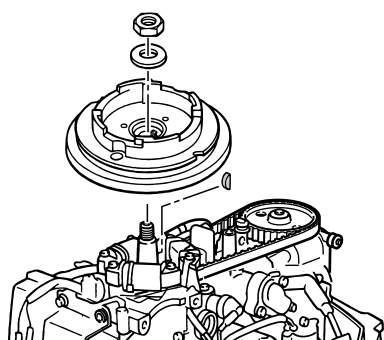
Adjust the throttle cable to slack off.

8. Turn the throttle grip from fully closed to fully open and back. Check stopper is contact (a), (b) and for each cable slack.
9. For remote control model, connect the shift cable/shift rod and throttle cable, and then adjust their lengths. For adjustment procedures, refer to "Checking the throttle cable operation" and "Checking the gearshift operation" In the Chapter 3.



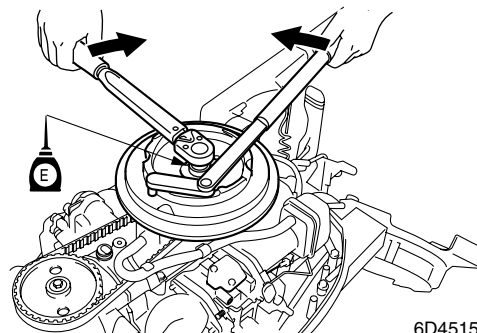
6D451560

10. Install the throttle link rod to the carburetor throttle lever. Then install the throttle link rod on the free axle lever side.
11. Adjust the throttle link rod. Refer to "Adjusting the throttle link rod" in the chapter 4.
12. Install the Woodruff key and flywheel magnet.



6D451570

13. Tighten the flywheel magnet nut to the specified torque.



6D451580

CAUTION: _____

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

NOTE: _____

Apply engine oil to the flywheel magnet nut before installation.

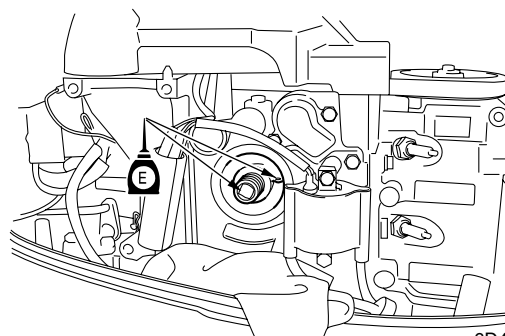


Flywheel holder:
90890-06522



Flywheel magnet nut:
110 N·m (11 kgf·m, 81 ft·lb)

14. Apply the small amount of engine oil to the oil passage and union bolt, then tighten the oil filter to specified torque.



6D451585



Oil filter :
18 N·m (1.8 kgf·m, 13 ft·lb)

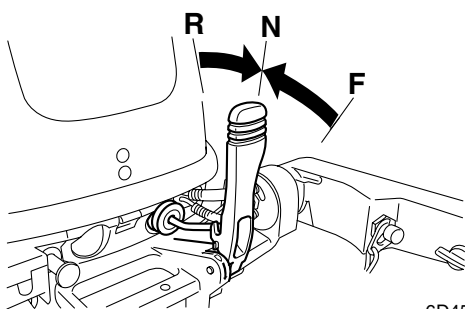


15. Fill the engine oil to specified quantity. Refer to “Replacing the engine oil” in the chapter 3.



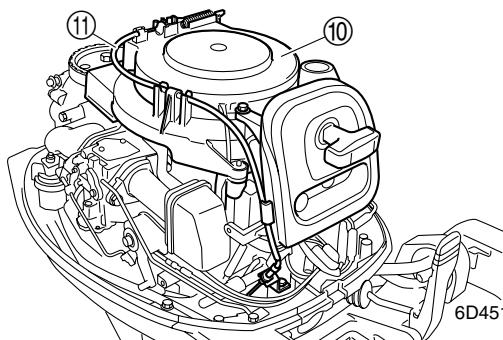
Recommended engine oil:
 4-stroke outboard motor oil
 API: SE, SF, SG, SH or SJ
 SAE: 10W-30 or 10W-40
Oil quantity:
 (oil filter replacement)
 1.2 L (1.27 US qt, 1.06 Imp qt)

16. Put the gear shift in neutral.

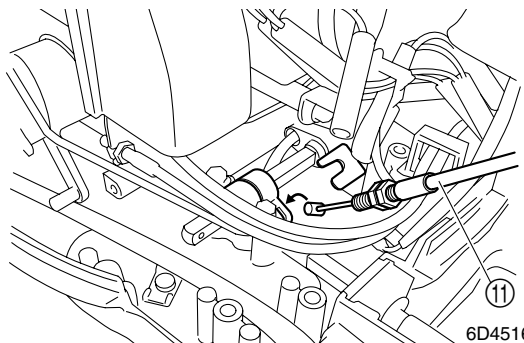


6D451590

17. Install the manual starter ⑩ and install the start-in-gear protection cable ⑪.

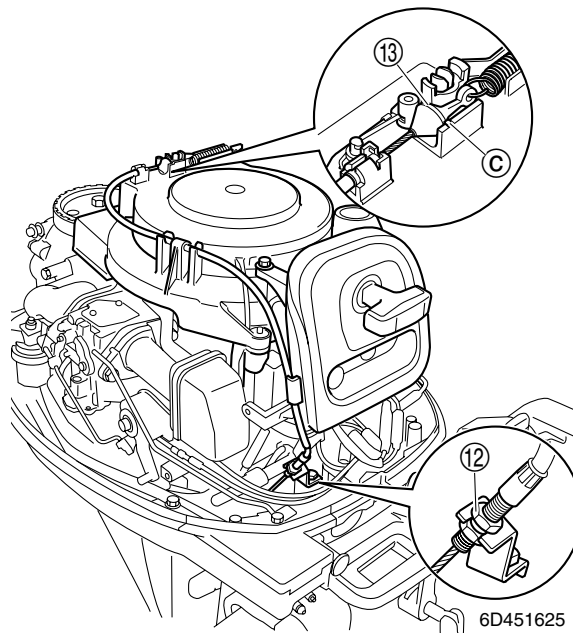


6D451595



6D451610

18. Using the adjusting nut ⑫, align the wire end ⑬ with the mark ① on the starter case.



6D451625

NOTE:

- Install the spring end of the start-in-gear protection cable on the starter plunger.
- Install the start-in-gear protection cable outer end so that it comes into contact with the starter case outer end connection point.
- Install the start-in-gear protection cable grommet on the starter case, and install the adjusting nut end of the cable on the lever.

19. Check that the starter rope can be pulled with the the gear shift in neutral. Also check that the starter rope cannot be pulled with the gear shift in forward and reverse. Adjust the start-in-gear protection cable if necessary.

20. Install the choke rod, fitting plate and plate, then tighten the bolts to specified torques.



Fitting plate bolt:
 10 N·m (1.0 kgf·m, 7.2 ft·lb)

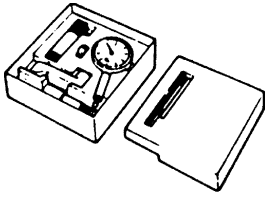
21. Connect the oil pressure warning lamp leads.



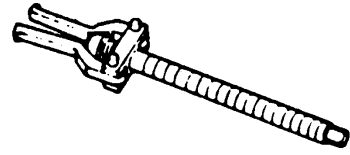
Lower unit

Special service tools	6-1
Lower unit	6-4
Water pump	6-6
Removing the lower unit	6-7
Removing the water pump.....	6-7
Checking the water pump.....	6-8
Propeller shaft housing	6-9
Removing the propeller shaft housing assembly.....	6-10
Disassembling the propeller shaft housing assembly	6-10
Disassembling the propeller shaft assembly	6-11
Checking the propeller shaft housing	6-11
Checking the propeller shaft	6-11
Assembling the propeller shaft assembly	6-12
Assembling the propeller shaft housing	6-12
Drive shaft and lower case	6-14
Removing the drive shaft and forward gear	6-15
Disassembling the lower case	6-15
Checking the bearing housing	6-16
Checking the pinion gear and forward gear	6-16
Checking the bearings.....	6-17
Checking the drive shaft.....	6-17
Checking the shift rod.....	6-17
Checking the lower case	6-17
Assembling the lower case.....	6-17
Installing the drive shaft.....	6-19
Installing the propeller shafts housing	6-19
Installing the water pump.....	6-20
Installing the lower unit.....	6-21
Shimming	6-23
Shimming.....	6-24
Selecting the pinion shims.....	6-24
Selecting the forward gear shims	6-24
Selecting the reverse gear shims	6-25
Backlash	6-26
Measuring the forward and reverse gear backlash	6-26

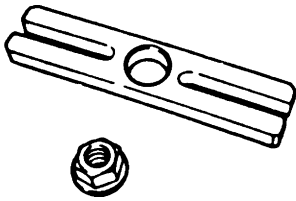
Special service tools



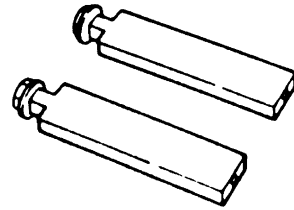
Dial gauge set
90890-01252



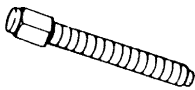
Bearing puller assembly
90890-06535



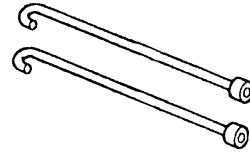
Stopper guide plate
90890-06501



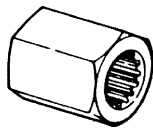
Stopper guide stand
90890-06538



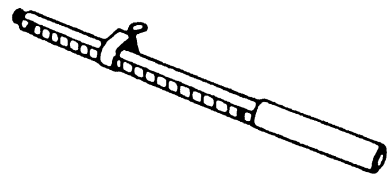
Center bolt
90890-06504



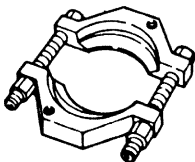
Bearing housing puller claw S
90890-06564



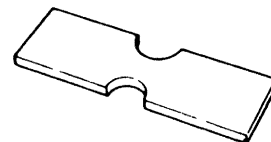
Drive shaft holder 1
90890-06515



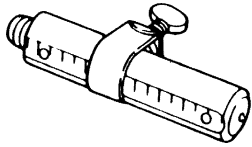
Driver rod SL
90890-06602



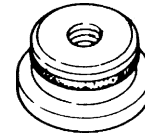
Bearing Separator
90890-06534



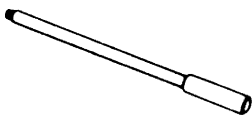
Bearing depth plate
90890-06603



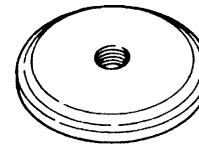
Driver rod SS
90890-06604



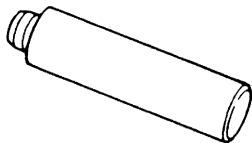
Ball bearing attachment
90890-06632



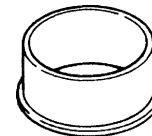
Driver rod LL
90890-06605



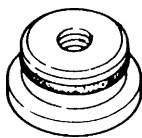
Bearing outer race attachment
90890-06625, 06627



Driver rod LS
90890-06606



Bearing inner race attachment
90890-06644



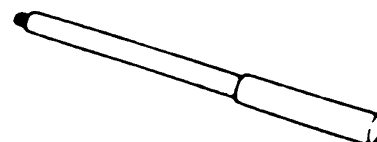
Needle bearing attachment
90890-06613, 90890-06616



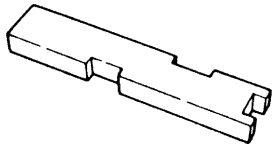
Bushing attachment
90890-06649



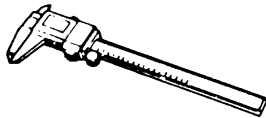
Needle bearing attachment
90890-06617



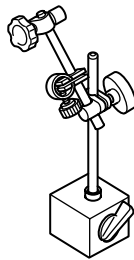
Driver rod L3
90890-06652



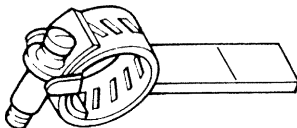
Shimming plate
90890-06701



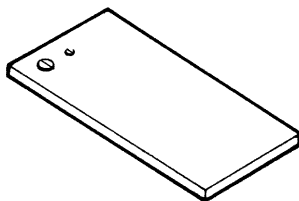
Digital caliper
90890-06704



Magnet base B
90890-06844

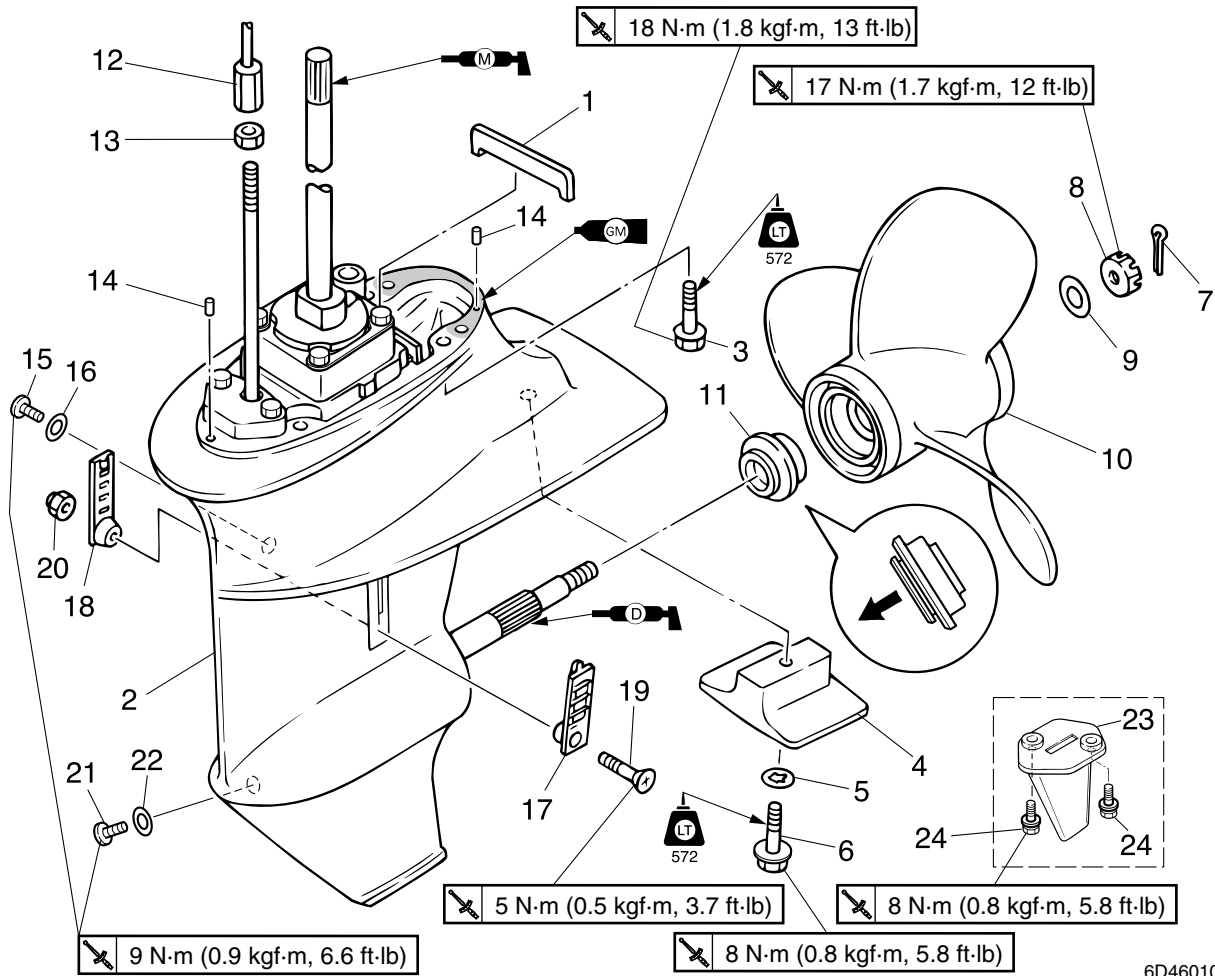


Backlash indicator
90890-06706



Magnet base plate
90890-07003

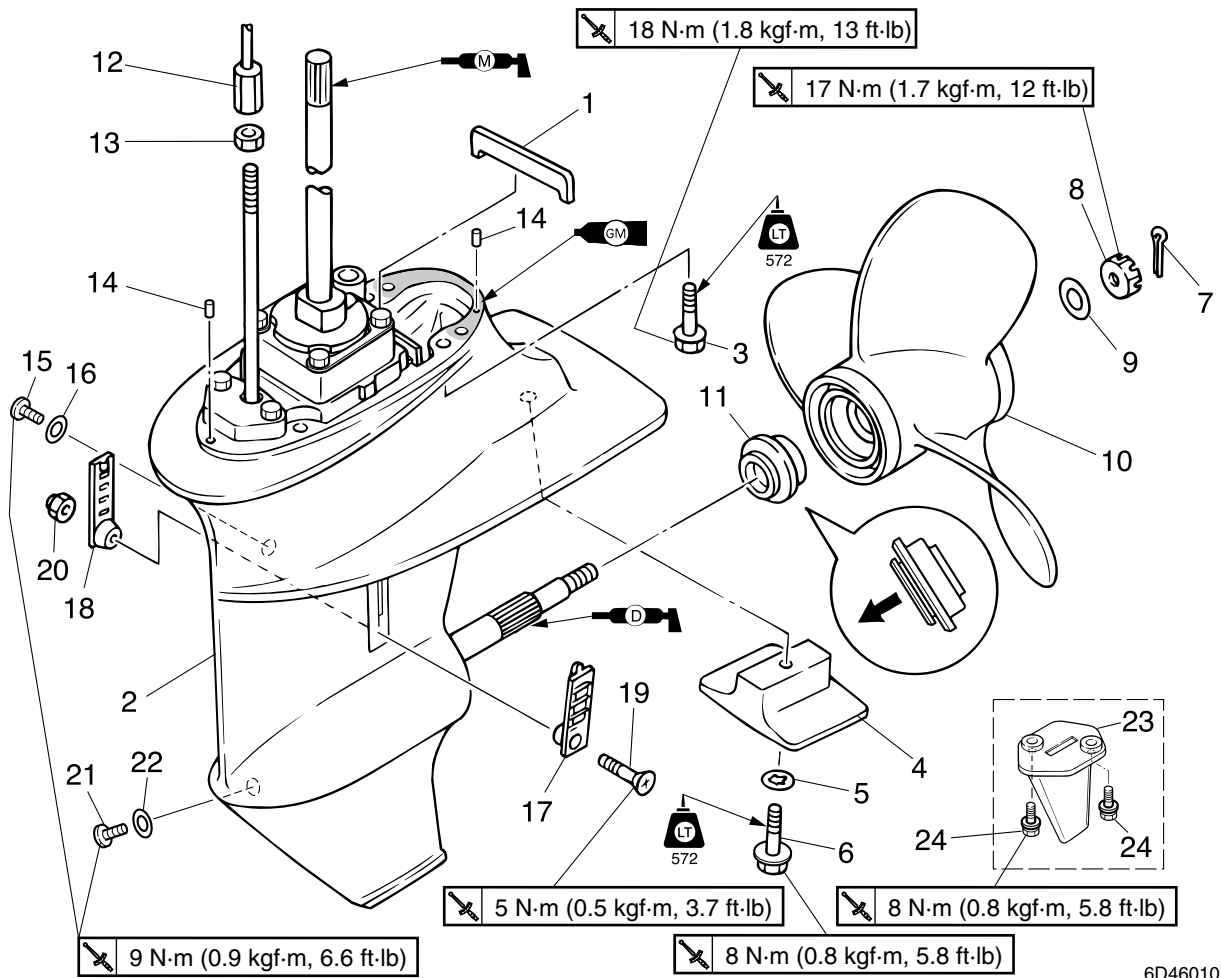
Lower unit



6D46010E



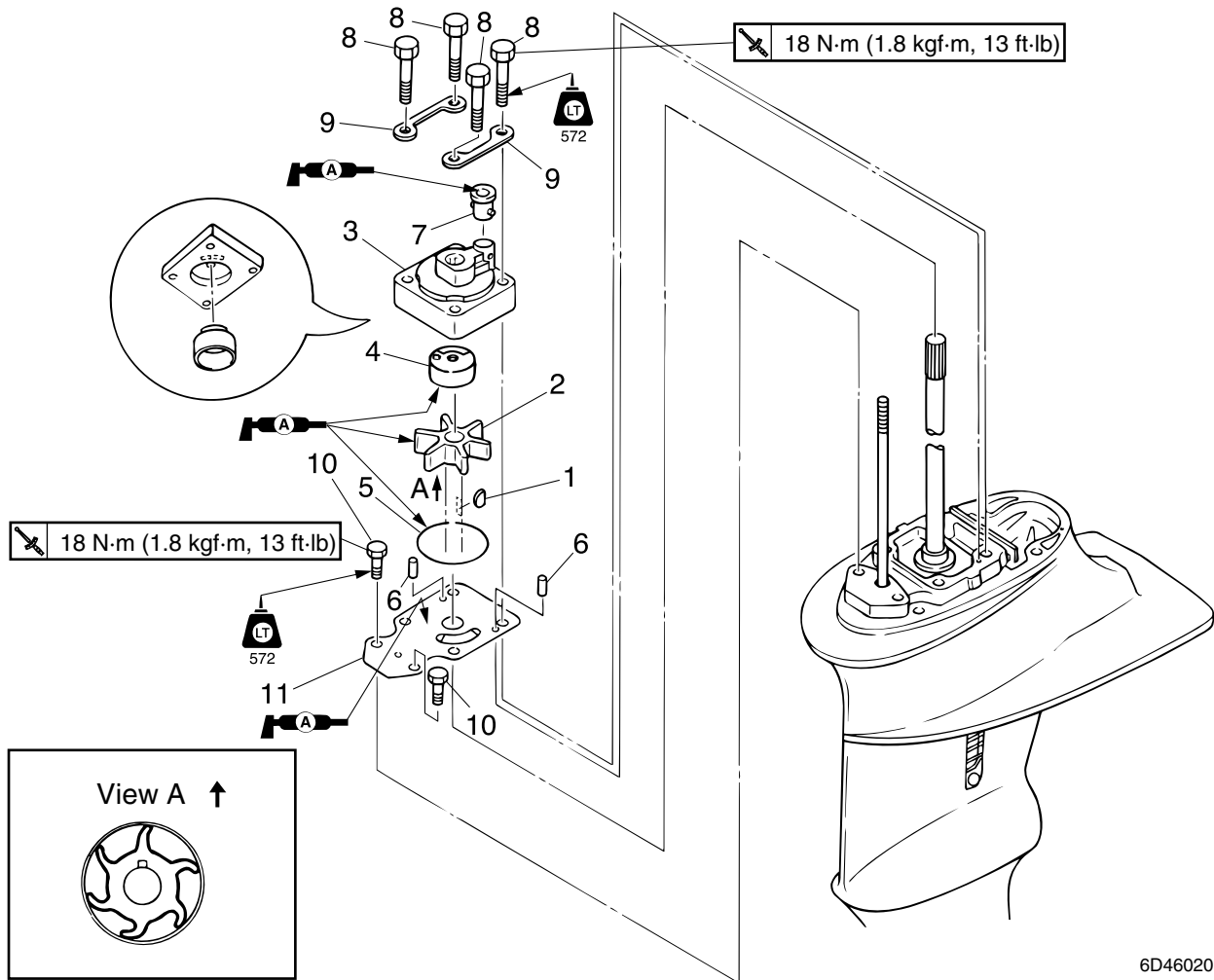
No.	Part name	Q'ty	Remarks
1	Rubber seal	1	
2	Lower case	1	
3	Bolt	4	M8 × 30 mm
4	Anode	1	
5	Special washer	1	Not reusable
6	Bolt	1	M6 × 30 mm
7	Cotter pin	1	Not reusable
8	Propeller nut	1	
9	Washer	1	
10	Propeller	1	
11	Spacer	1	
12	Adjuster	1	
13	Locknut	1	
14	Dowel pin	2	
15	Screw	1	
16	Gasket	1	Not reusable
17	Inlet cover	1	Port side



6D46010E

No.	Part name	Q'ty	Remarks
18	Inlet cover	1	Starboard side
19	Screw	1	
20	Nut	1	
21	Screw	1	
22	Gasket	1	Not reusable
23	Trim tab	1	For S-transom
24	Bolt	2	M6 × 16 mm : For S-transom

Water pump



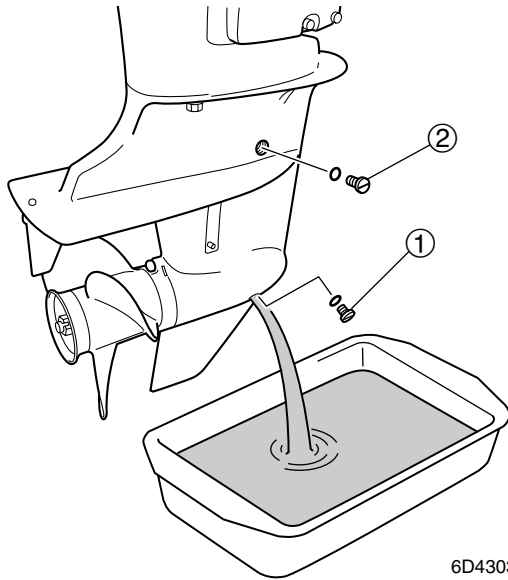
6

No.	Part name	Q'ty	Remarks
1	Woodruff key	1	
2	Impeller	1	
3	Water pump housing	1	
4	Insert cartridge	1	
5	O-ring	1	Not reusable
6	Dowel pin	2	
7	Rubber seal	1	
8	Bolt	4	M8 × 45 mm
9	Plate	2	
10	Bolt	2	M8 × 25 mm
11	Outer plate cartridge	1	

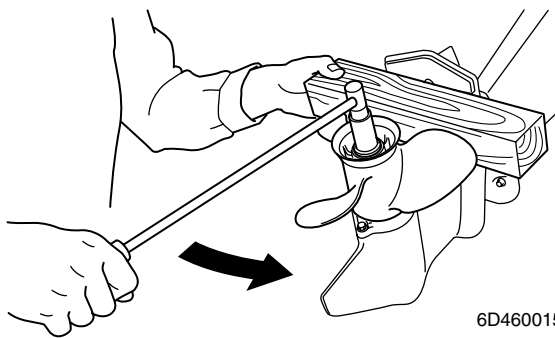


Removing the lower unit

1. Remove the clip for the engine stop lanyard switch.
2. Set the gear shift in the neutral position.
3. Remove the drain screw ①, then the check screw ② to drain the gear oil.



4. Remove the cotter pin.
5. Place a block of wood between the anti-cavitation plate and the propeller, and remove the propeller.



⚠WARNING

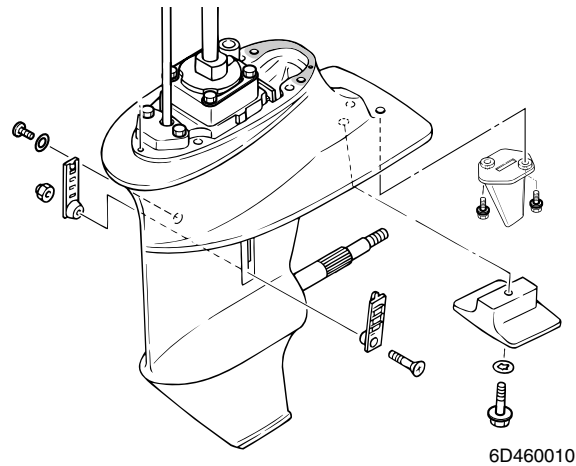
- Place a block of wood between the anti-cavitation plate and the propeller. Do not touch the propeller with your hands.
- Remove the clip for the engine stop lanyard switch to prevent the engine from starting.

6. Disconnect the shift rod. Loosen the adjuster while holding the locknut.

NOTE:

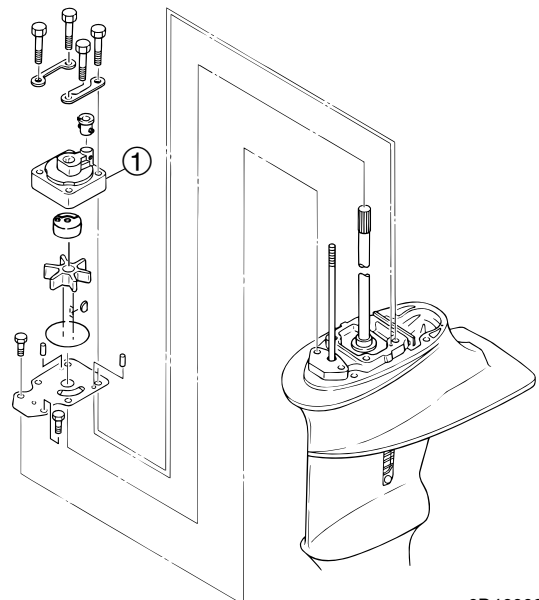
Set the gear shift in reverse first.

7. Tilt up the outboard motor and remove the lower unit after removing the bolts.
8. Remove the trim tab (for S-transom), anode and cooling water inlet covers.



Removing the water pump

1. Remove the water pump ①.

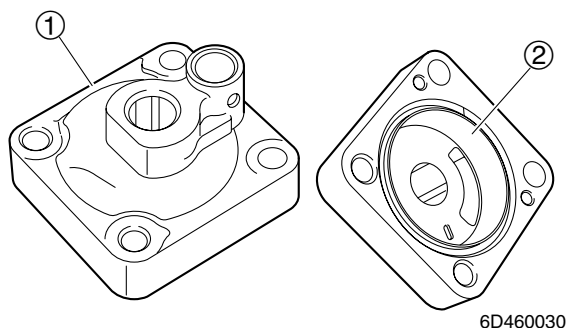


NOTE:

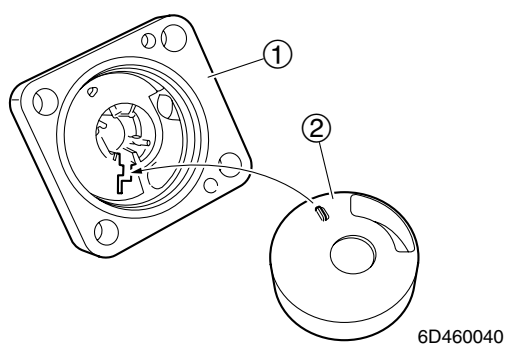
- Remove the Woodruff key from the drive shaft, then the outer plate cartridge.
- Make sure the dowels were removed from the lower case.

Checking the water pump

1. Check the water pump housing ① for deformation. Also check the insert cartridge ② for wear or deformation.



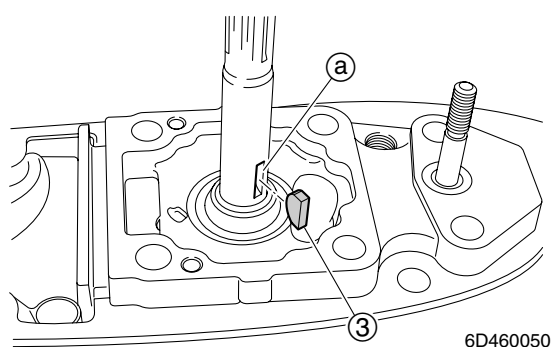
2. When the insert cartridge ② is removed, insert the projection on the insert cartridge into the water pump housing ① hole at the time of reassembly.



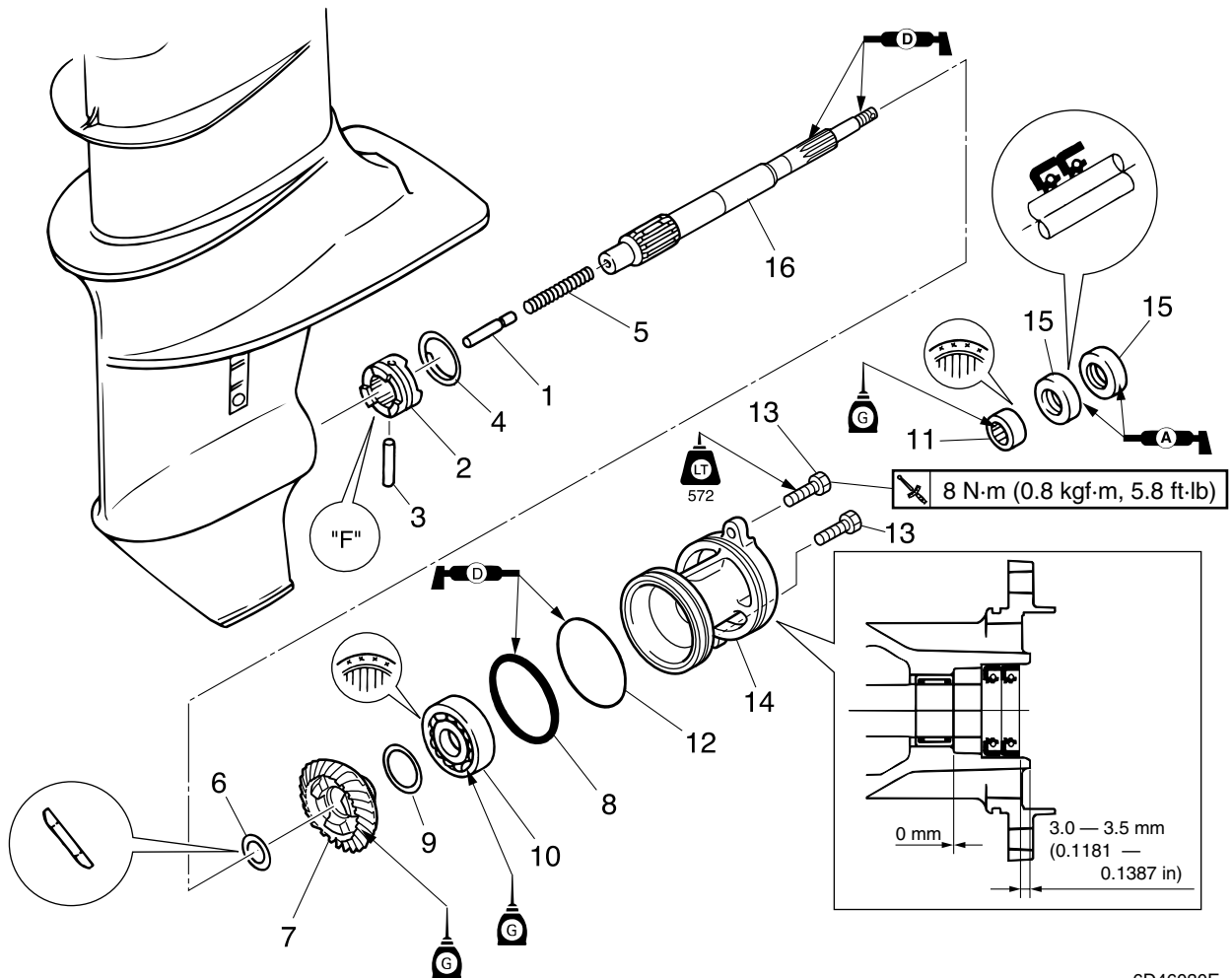
NOTE:

When installing the insert cartridge, insert the projection on the insert cartridge into the water pump housing hole.

3. Check the impeller for cracks or wear. Replace if necessary.
4. Check the Woodruff key ③ and the groove (a) for wear. Replace if necessary.



Propeller shaft housing

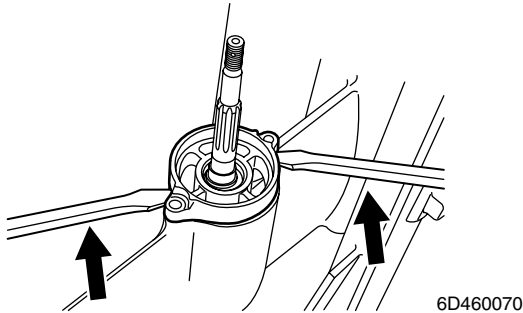


6D46030E

No.	Part name	Q'ty	Remarks
1	Shift plunger	1	
2	Dog clutch	1	
3	Cross pin	1	
4	Cross pin ring	1	
5	Spring	1	
6	Washer	1	
7	Reverse gear	1	
8	O-ring	1	Not reusable
9	Reverse gear shim	1	
10	Bearing	1	Not reusable
11	Needle bearing	1	Not reusable
12	O-ring	1	Not reusable
13	Bolt	2	M6 × 20 mm
14	Propeller housing	1	
15	Oil seal	2	Not reusable
16	Propeller shaft	1	

Removing the propeller shaft housing assembly

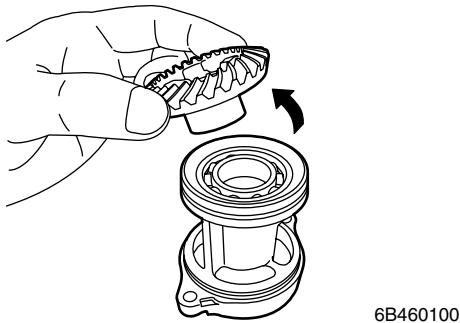
1. Remove the bolts and remove the propeller shaft housing assembly by prying the tabs apart with flat-head screwdrivers.



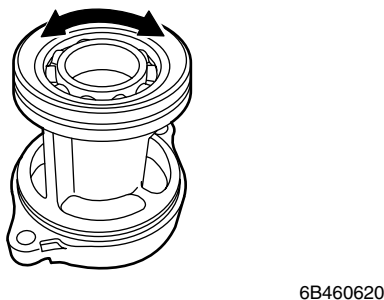
NOTE: _____
Make sure that the shims left in the lower case have been removed.

Disassembling the propeller shaft housing assembly

1. Remove the reverse gear and shim.

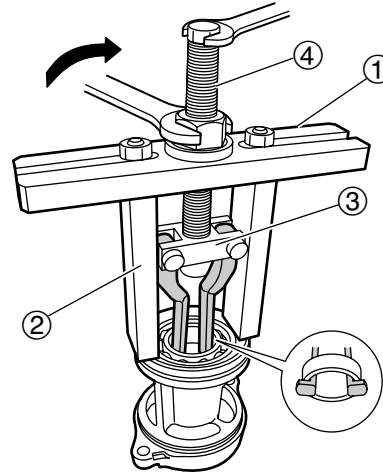



2. Check that the bearing spins smoothly in the housing. Check for roughness, wear, and damage.



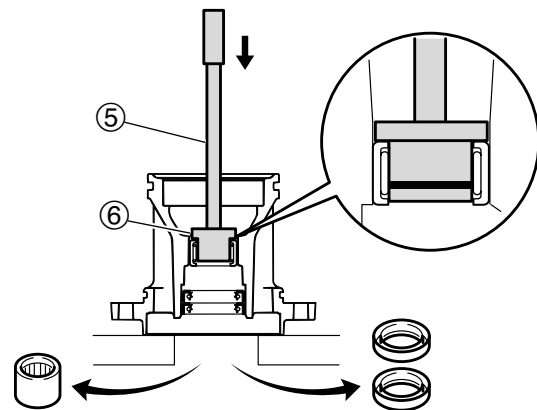
6D45F11

3. Remove the ball bearing.




	Stopper guide plate ①: 90890-06501
	Stopper guide stand ②: 90890-06538
	Bearing puller assembly ③: 90890-06535
	Center bolt ④: 90890-06540

4. Remove the oil seals, then remove the needle bearing.



NOTE: _____
When the oil seal or the needle bearing is removed, always replace them with new ones.

	Driver rod L3 ⑤: 90890-06652
	Needle bearing attachment ⑥: 90890-06616

6-10

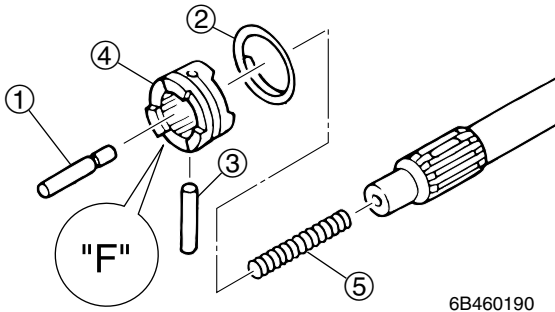


CAUTION:

Shimming is required when the reverse gear, ball bearing, or propeller shaft housing is replaced.

Disassembling the propeller shaft assembly

1. Remove the shift plunger ①.
2. Remove the cross pin ring ②, pull out the cross pin ③, and remove the dog clutch ④.
3. Pull out the spring ⑤.



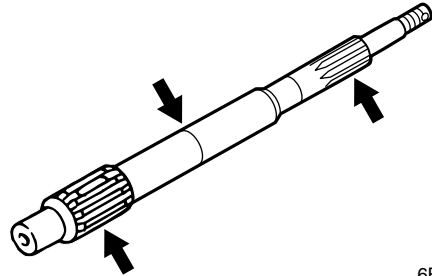
6B460190

Checking the propeller shaft housing

1. Clean the propeller shaft housing and check it for cracks, corrosion, or damage. Replace if necessary.
2. Check the teeth and dogs of the reverse gear for cracks or wear. Replace the gear if necessary.

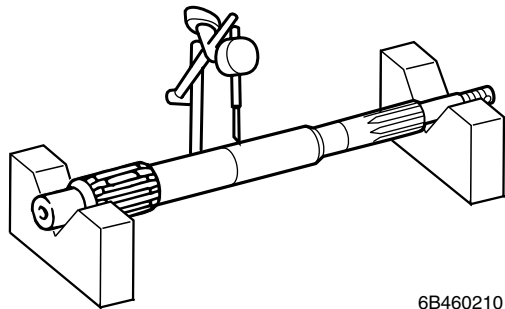
Checking the propeller shaft

1. Check the propeller shaft for bends or wear. Replace if necessary.



6B460200

2. Measure the propeller shaft run-out.



6B460210

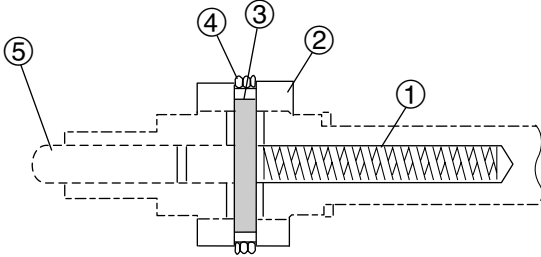


Run-out limit: 0.05 mm (0.0020 in)

3. Check the dog clutch for breakage or wear. Replace if necessary.

Assembling the propeller shaft assembly

1. Insert the spring ①.
2. Install the dog clutch ② so that the "F" mark faces the forward gear, and insert the cross pin ③.

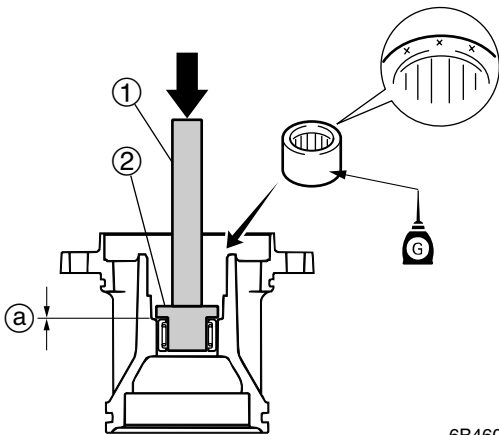


6B460230

3. Install the cross pin ring ④ and shift plunger ⑤.


Assembling the propeller shaft housing

1. Install a new needle bearing into the propeller shaft housing to the specified depth using a press.

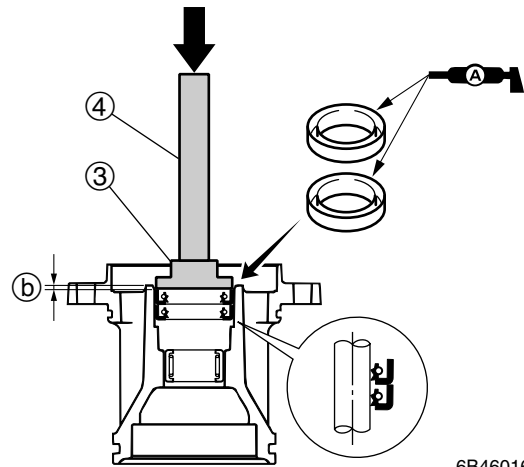


6B460150

	Driver rod SS ①: 90890-06604 Needle bearing attachment ②: 90890-06616
---	--

	Installation depth ① : 0 mm (0 in)
---	---------------------------------------


2. Install new oil seals into the propeller shaft housing to the specified depth.




6B460160

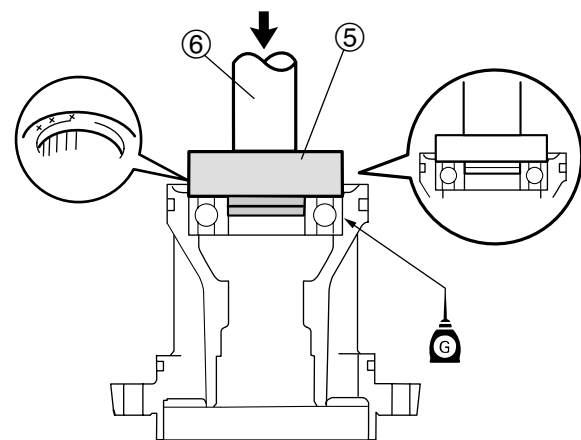
NOTE:

First, install the inner oil seal halfway into the propeller shaft housing, and then install the outer oil seal to the specified depth.


	Needle bearing attachment ③: 90890-06613 Driver rod SS ④: 90890-06604
---	--

	Installation depth ②: 3.0–3.5 mm (0.1181–0.1378 in)
---	--

3. Install the ball bearing into the propeller shaft housing.

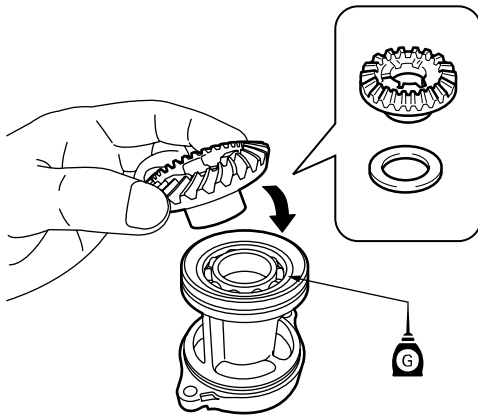


6D460080

	Ball bearing attachment ⑤: 90890-06632 Driver rod LS ⑥: 90890-06606
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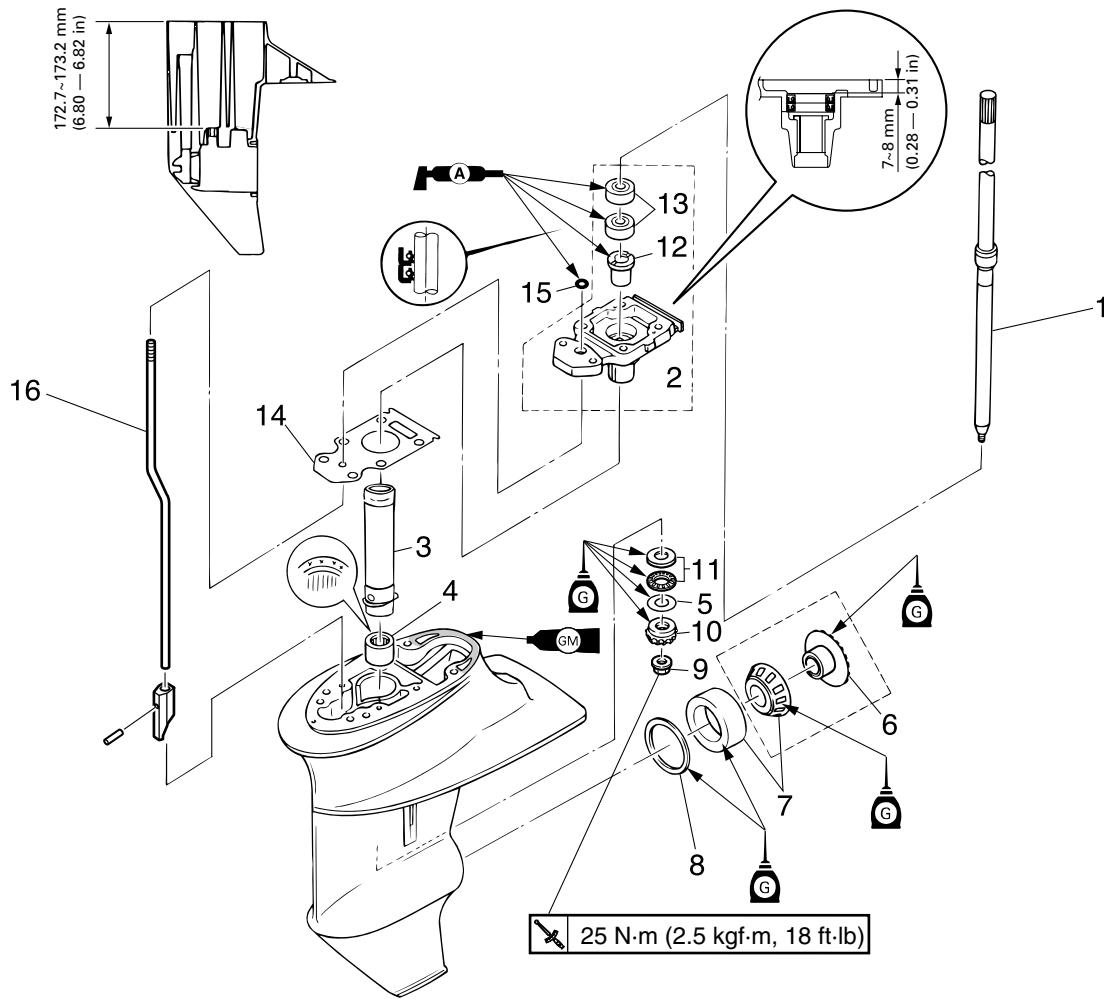
4. Install the reverse gear and shim into the propeller shaft housing.



6B460180

NOTE: _____
Shimming is required when the reverse gear or ball bearing is replaced.

Drive shaft and lower case



6D46040E

6

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Bearing housing	1	
3	Drive shaft sleeve	1	
4	Needle bearing	1	Not reusable
5	Pinion gear shim	1	
6	Forward gear	1	
7	Taper roller bearing	1	Not reusable
8	Forward gear shim	1	
9	Pinion nut	1	
10	Pinion gear	1	
11	Thrust bearing	1	
12	Bushing	1	
13	Oil seal	2	Not reusable
14	Gasket	1	Not reusable
15	O-ring	1	Not reusable
16	Shift rod	1	

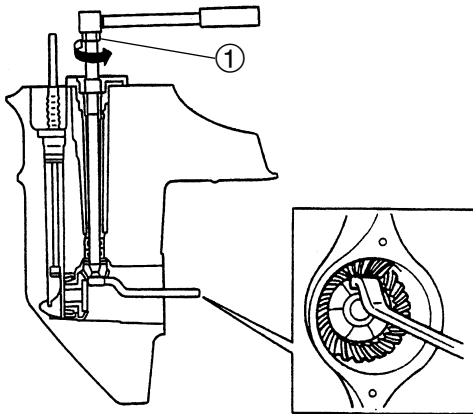


Removing the drive shaft and forward gear

NOTE:

Shimming is required when the forward gear or taper roller bearing is replaced.

1. Loosen the pinion nut.

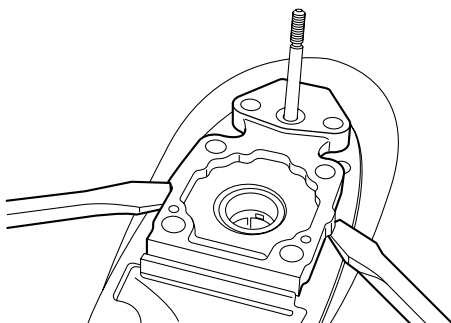


6B460240

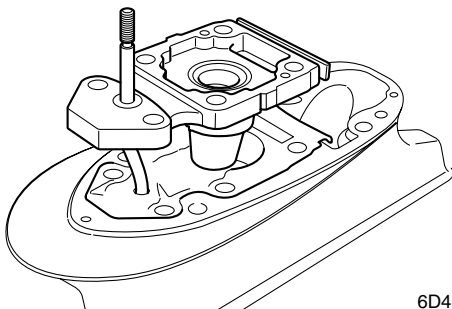


Drive shaft holder 1 ①:
90890-06515

2. Remove the pinion gear, shim, thrust bearing, and washer, then remove the drive shaft.
3. Remove the bearing housing, gasket, shift rod and dowel pins.



6D460090

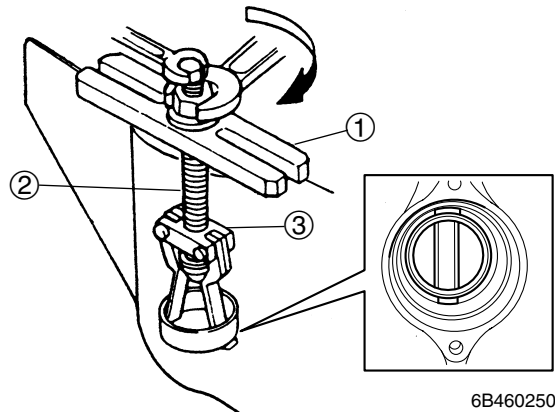


6D460100

4. Remove the drive shaft sleeve.
5. Remove the forward gear.

Disassembling the lower case

1. Remove the taper roller bearing outer race.



6B460250

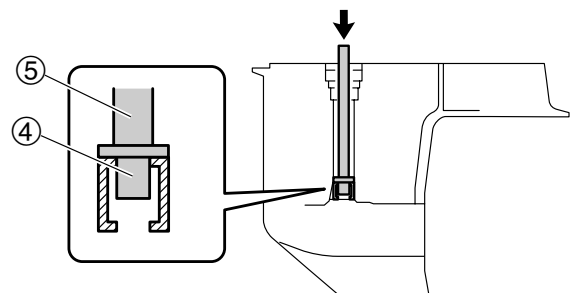
NOTE:

Install the puller claw as shown.



Stopper guide plate ①:
90890-06501
Center bolt ②:
90890-06504
Bearing puller assembly ③:
90890-06535

2. Remove the needle bearing.



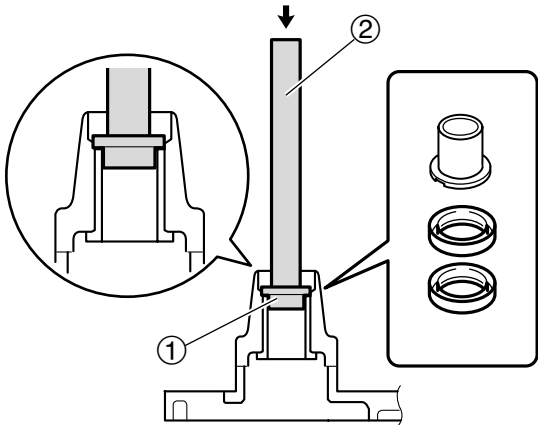
6B460260



Needle bearing attachment ④:
90890-06617
Driver rod L3 ⑤:
90890-06652

Checking the bearing housing

1. Check the bearing housing for cracks or damage. Also check the bushing for wear, and the oil seals for damage. Disassemble if necessary.
2. Remove the oil seals.
3. Remove the bushing.



6D460110

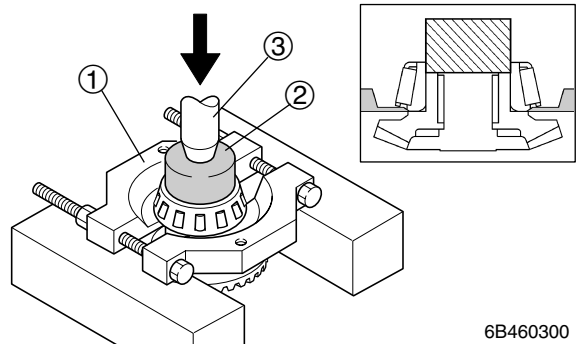
NOTE: _____
When the bushing and oil seals are removed, always replace them with new ones.



Bushing attachment ①:
90890-06649
Driver rod L3 ②:
90890-06652

Checking the pinion gear and forward gear

1. Check the pinion gear teeth for cracks or wear.
2. Check the teeth and dogs of the forward gear for cracks or wear. Also check the bearing for run-out or roughness. Disassemble if necessary.
3. Remove the bearing



6B460300



Bearing separator ①:
90890-06534
Needle bearing attachment ②:
90890-06616
Driver rod SS ③:
90890-06604

NOTE: _____
When the taper roller bearing is removed always replace it with a new one.



Checking the bearings

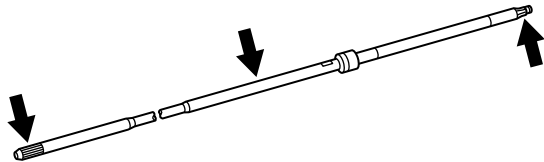
1. Check the needle bearing and the thrust bearing for run-out or roughness. Replace if necessary.

CAUTION:

Shimming is required when the thrust bearing is replaced.

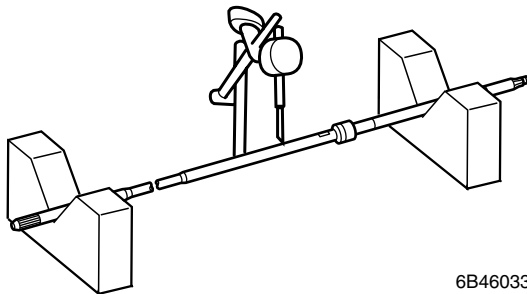
Checking the drive shaft

1. Check the drive shaft for bends or wear. Replace the shaft if necessary.



6B460320

2. Measure the drive shaft run-out.



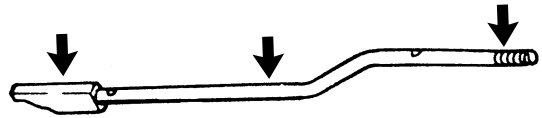
6B460330



Run-out limit:
0.5 mm (0.0197 in)

Checking the shift rod

1. Check the shift rod for deformation or wear. Replace if necessary.



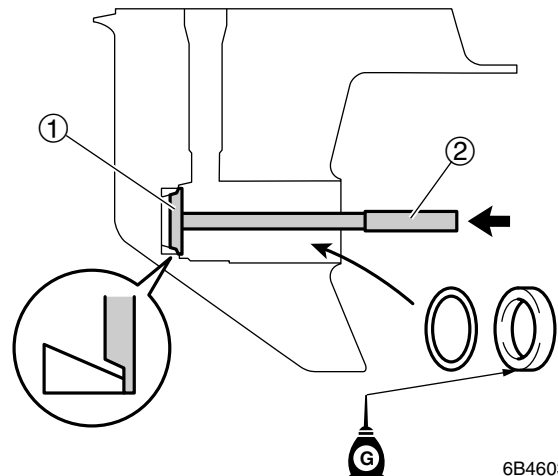
6B460080

Checking the lower case

1. Check the lower case for cracks or damage. Replace if necessary.

Assembling the lower case

1. Install the shims and the taper roller bearing outer race.



6B460350

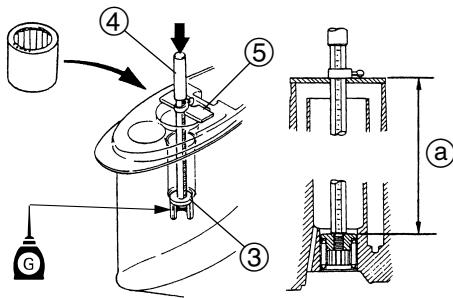
CAUTION:

Shimming is required when the forward gear, the taper roller bearing, or the lower case is replaced. Record the measured height of the bearing.





Bearing outer race attachment ①:
90890-06625
Driver rod LL ②:
90890-06605

2. Install the needle bearing.

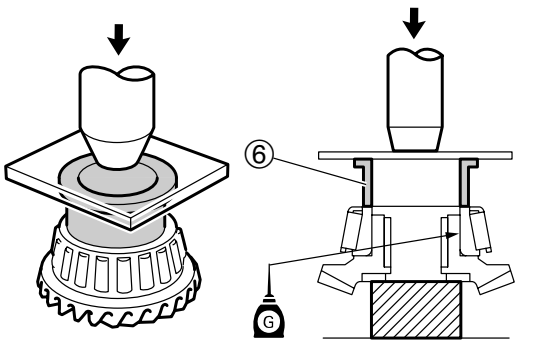


6B460360

 Needle bearing attachment (3):
90890-06617
Driver rod SL (4):
90890-06602
Bearing depth plate (5):
90890-06603


 Depth (a):
172.7–173.2 mm (6.80–6.82 in)

3. Install a new taper roller bearing.

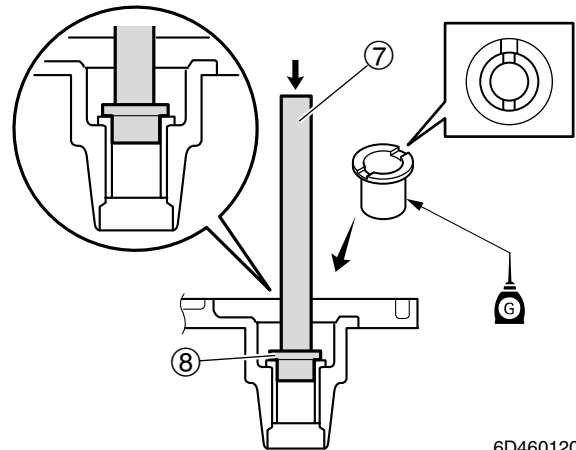


6B460310


NOTE: _____
Shimming is required when the taper roller bearing is replaced.

 Bearing inner race attachment (6):
90890-06644

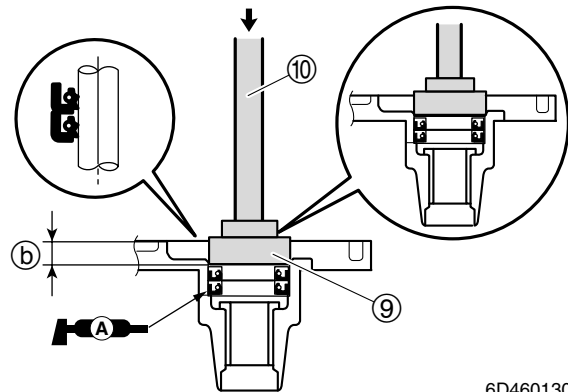
4. Install the bushing using a press.




6D460120


 Driver rod SS (7):
90890-06604
Bushing attachment (8):
90890-06649

5. First, install the inner oil seal halfway into the bearing housing, then install in the outer oil seal to the specified depth.



6D460130

 Needle bearing attachment (9):
90890-06613
Driver rod L3 (10):
90890-06652

 Installation depth (b):
7.0–8.0 mm (0.28–0.31 in)

6

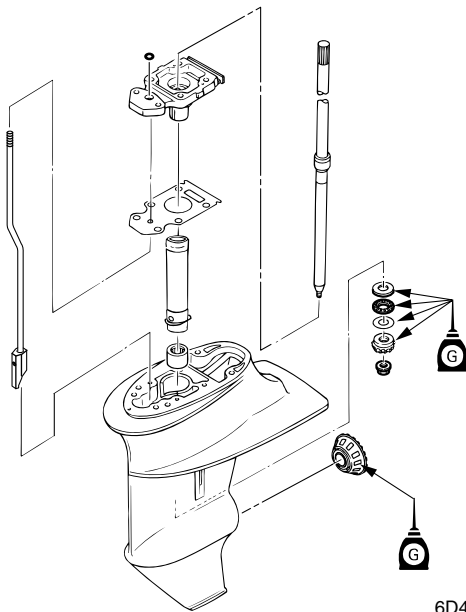


Installing the drive shaft

1. Install the drive shaft sleeve, shift rod, new gasket, bearing housing assembly, forward gear, drive shaft, shim, thrust bearing, and pinion gear.

CAUTION:

- Shimming is required when the drive shaft housing or the drive shaft is replaced.
- Shimming is required when the thrust bearing is replaced.

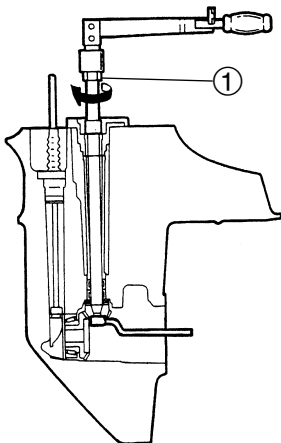


6D460170

NOTE:

Install the drive shaft by lifting it up slightly, then aligning its splines with the pinion gear.

2. Tighten the pinion nut.



6B460380



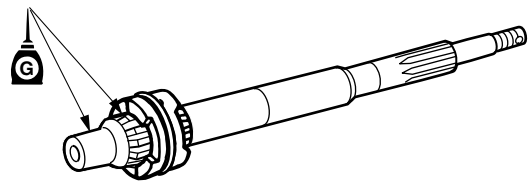
Drive shaft holder 1 ①:
90890-06515



Pinion nut:
25 N·m (2.5 kgf·m, 18 ft·lb)

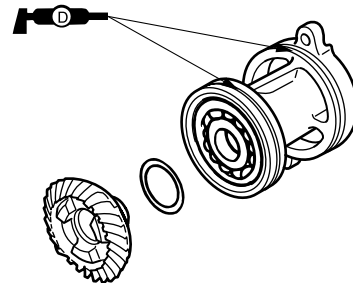
Installing the propeller shaft housing

1. Install the propeller shaft assembly.



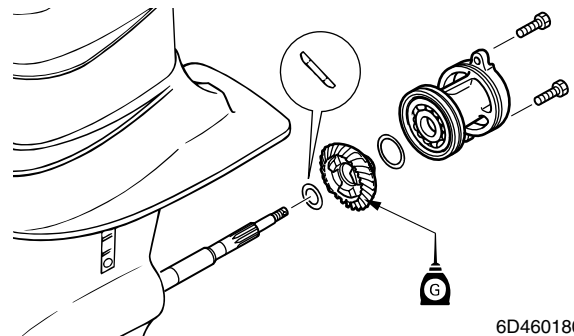
6B460390

2. Install the shim(s) and propeller shaft housing assembly.



6B460410

3. Install the washer and propeller housing, then tighten the bolts.

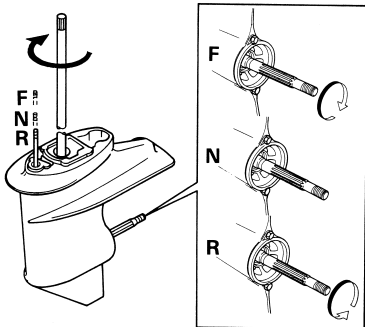


6D460180



Propeller housing bolt:
8 N·m (0.8 kgf·m, 5.8 ft·lb)

4. Make sure that the shifting mechanism works properly.

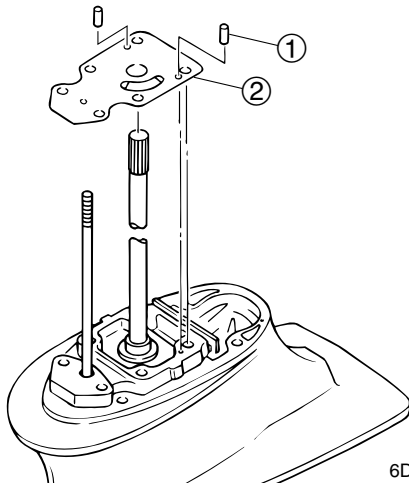


6B460430

NOTE: _____
Change the shift rod position to forward, to reverse, and to neutral. Make sure that the propeller shaft rotating direction is correct in forward and in reverse. Also make sure that the position is correct in neutral.

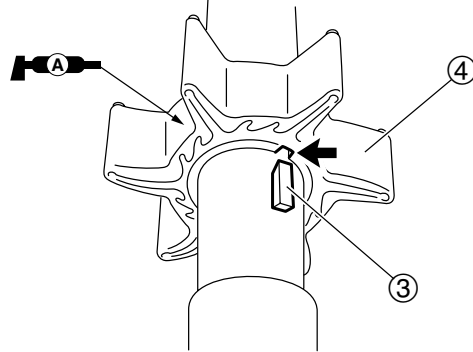
Installing the water pump

1. Install the dowels ①, the outer plate cartridge ②.



6D460190

2. Install the Woodruff key ③ into the drive shaft.
3. Install the impeller ④ after aligning it with the Woodruff key.

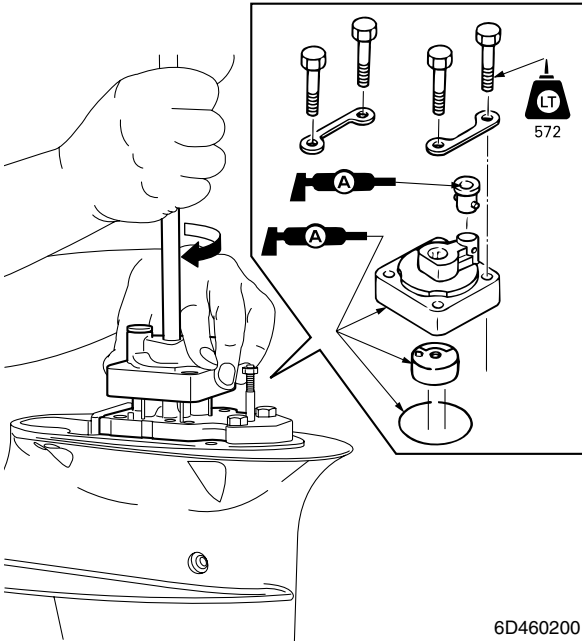


6D460195

- NOTE:** _____
- Align the groove on the impeller with the Woodruff key.
 - Apply Yamaha grease A on the sliding face between the impeller and the outer plate cartridge.



4. Install the water seal rubber and water pump housing cover into the water pump housing assembly, then install the water pump housing on the lower case.



6D460200

NOTE:

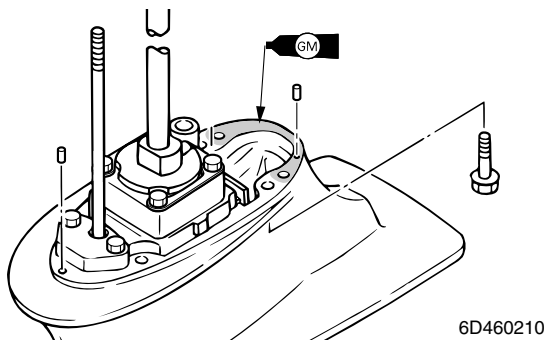
To install the water pump housing, apply Yamaha grease A to the inner face of the water pump housing assembly, and then turn the drive shaft clockwise while pushing down on the pump housing.



Water pump housing bolt:
18 N·m (1.8 kgf·m, 13 ft·lb)

Installing the lower unit

1. Install the dowels into the lower case.



6D460210

2. Put the gear shift lever in reverse. Make sure that the shift rod is in the reverse position. Install the lower unit onto the upper case, and tighten the lower case bolts to the specified torque.



Lower case bolt:
18 N·m (1.8 kgf·m, 13 ft·lb)

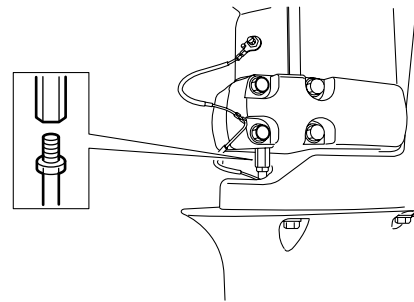
NOTE:

- Screw in the locknut completely.
- Push the shift rod down to shift into reverse.

3. Connect the shift rod.

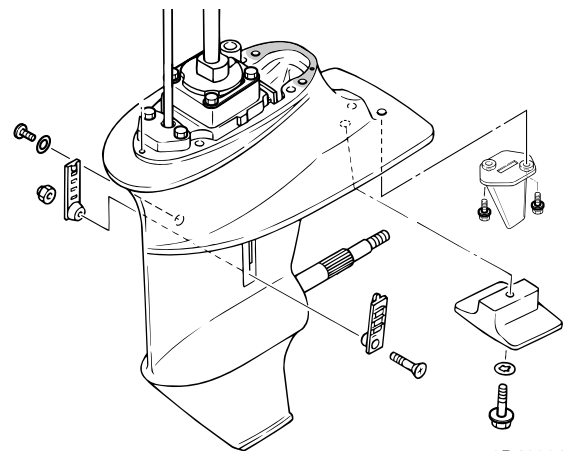
NOTE:

Screw the adjuster down until it comes in contact with the locknut.



6D460220

4. Install the anode, trim tab (for S-transom) and inlet covers to their original positions and tighten the anode bolts to the specified torque.



6D460010



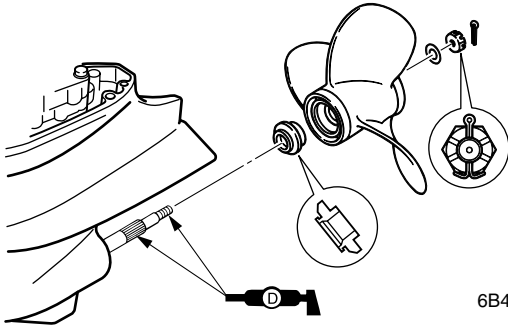
Anode bolt:
8 N·m (0.8 kgf·m, 5.8 ft·lb)

Drive shaft and lower case

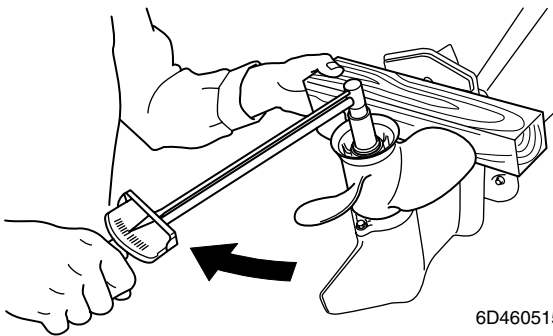


Trim tab bolts:
8 N·m (0.8 kgf·m, 5.8 ft·lb)

5. Install the propeller and the propeller nut. Place a block of wood between the anti-cavitation plate and the propeller to keep the propeller from turning. Then tighten the nut to the specified torque.



6B460500



6D460515

⚠ WARNING

- Place a block of wood between the anti-cavitation plate and the propeller. Do not touch the propeller with your hands.
- Remove the clip for the engine stop lanyard switch to prevent the engine from starting.

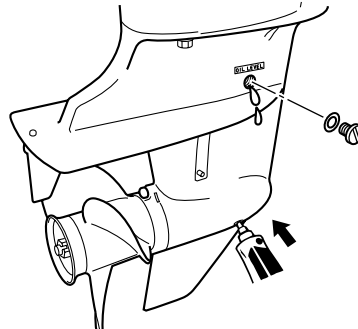
NOTE:

If the grooves in the propeller nut do not align with the cotter pin hole, tighten the nut further until they are aligned.



Propeller nut:
17 N·m (1.7 kgf·m, 12 ft·lb)

6. Insert the gear oil tube into the drain hole and fill the gear oil until it flows out of the check hole and no air bubbles are visible.



6D430320

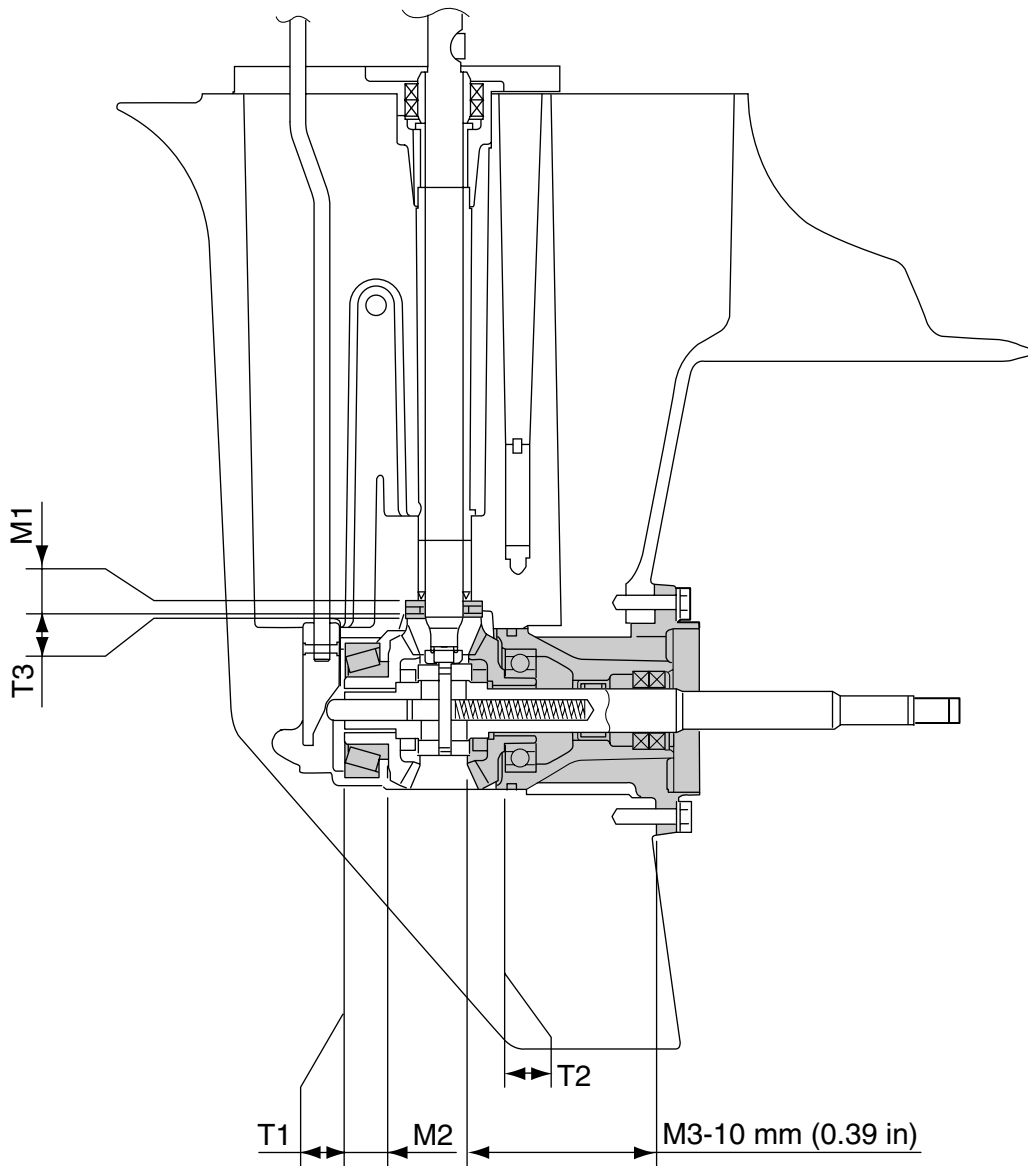


Recommended gear oil:
Hypoid gear oil
SAE: 90
Oil quantity:
0.25 L (8.45 US oz, 8.82 Imp oz)

7. Install the check screw, and quickly install the drain screw.



Shimming



6D460240

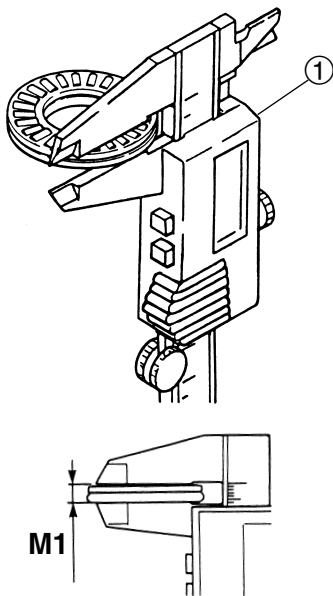
Shimming

NOTE:

- 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).

Selecting the pinion shims

1. Measure the thickness (M1) of the roller bearing with the special service tool.



6B460540

NOTE:

- Measure the roller bearing at 3 points to find the clearance average.
- Select the shim thickness (T3) by using the specified measurement and the calculation formula.

	Digital caliper ①: 90890-06704
--	-----------------------------------

2. Calculate the pinion shim thickness.

Pinion shim thickness (T3) = 6.05 - M1

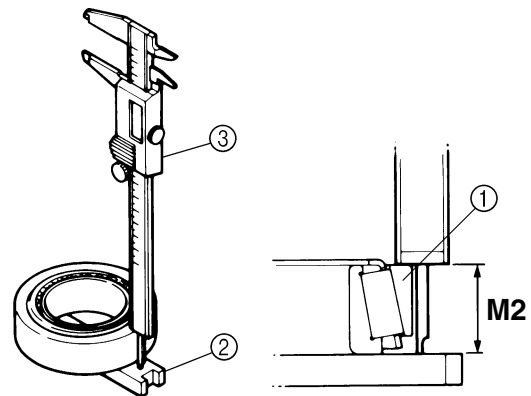
3. Select the pinion shim(s) (T3) as follows.

Calculated numeral		Use shim
more than	less than	
1.13	1.20	1.13
1.20	1.30	1.20

Available shims: 1.13 and 1.20

Selecting the forward gear shims

1. Turn the taper roller bearing outer race ① two or three times to seat the rollers, then measure the bearing height (M2) as shown.



6B460550

NOTE:

- Select the shim thickness (T1) by using the specified measurement(s) and the calculation formula.
- Measure the bearing outer race at three points to find the height average.

	Shimming plate ②: 90890-06701
	Digital caliper ③: 90890-06704



2. Calculate the shim thickness.

Forward gear shim thickness
 $(T1) = 16.60 - M2$

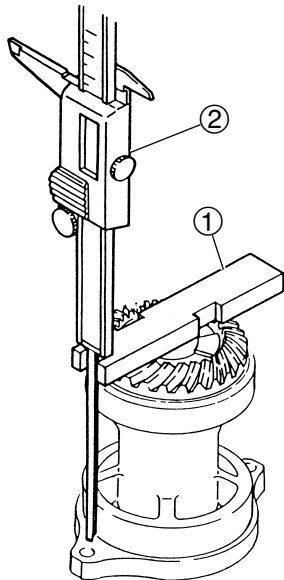
3. Select the forward gear shim(s) (T1) as follows.

Calculated numeral at 1/100th place		Use shim
more than	less than	
0.00	0.02	0.00
0.02	0.05	0.02
0.05	0.08	0.05
0.08	0.10	0.08

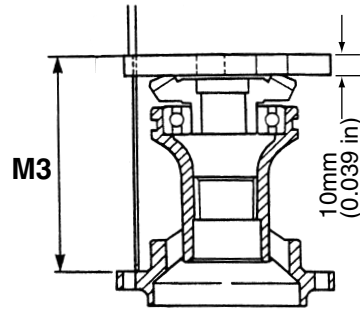
Available shim thicknesses:
 0.10, 0.12, 0.15, 0.18, 0.30, 0.40
 and 0.50 mm

Selecting the reverse gear shims

1. Remove the reverse gear shim and install the reverse gear into the end cap.
2. Measure (M3) as shown.



6B460560



6B460570



Shimming plate ①:
 90890-06701
 Digital caliper ②:
 90890-06704

3. Calculate the shim thickness.

Reverse gear shim thickness
 $(T2) = 80.57 - M3$

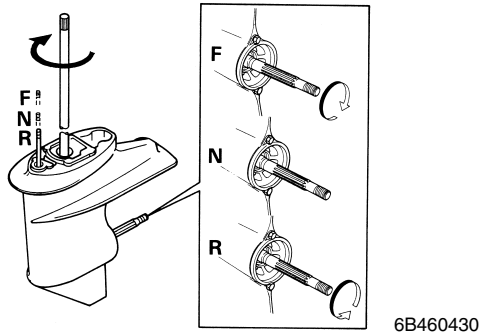
Calculated numeral at 1/100th place		Use shim
more than	less than	
0.30	0.40	0.30
0.40	0.50	0.40
0.50	0.60	0.50
0.60	0.70	0.60

Available shims:
 0.10, 0.20, 0.30, 0.40, and 0.50

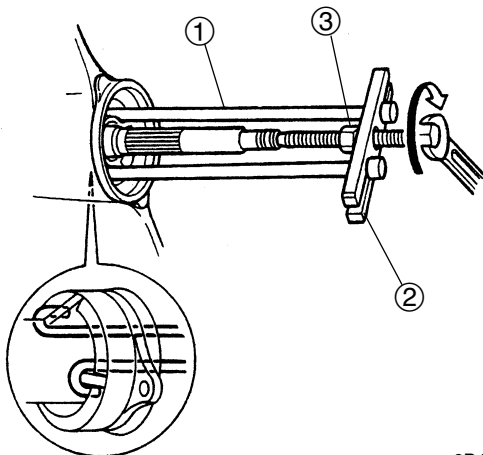
Backlash

Measuring the forward and reverse gear backlash

1. Remove the water pump assembly.
2. Set the gearshift to the neutral position.



3. Install the special service tool so that it pushes against the propeller shaft.

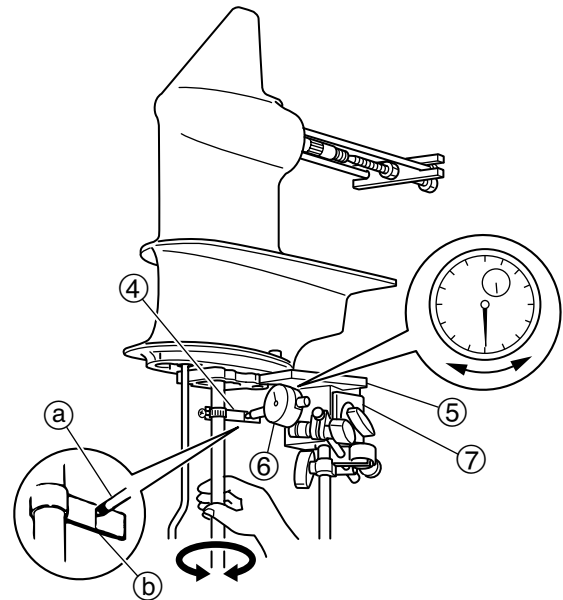


- NOTE:** _____
- Tighten the center bolt while turning the drive shaft until the drive shaft can no longer be turned.

	Bearing housing puller claw S ①: 90890-06564
	Stopper guide plate ②: 90890-06501
	Center bolt ③: 90890-06504

4. Turn the lower unit upside down.

5. Install the backlash indicator onto the drive shaft (13 mm [0.51 in] in diameter), then the dial gauge onto the lower unit.



- NOTE:** _____
- Install the dial gauge so that the plunger **a** contacts the mark **b** on the backlash indicator.

	Backlash indicator ④: 90890-06706
	Magnet base plate ⑤: 90890-07003
	Dial gauge set ⑥: 90890-01252
	Magnet base B ⑦: 90890-06844

6. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.

	Forward gear backlash: 0.19–0.86 mm (0.0075–0.0339 in)
--	---



7. Add or remove shims if out of specification.

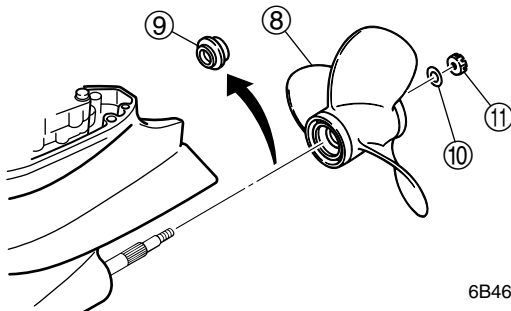
Forward gear backlash	Shim thickness
Less than 0.19 mm (0.0075 in)	To be decreased by $(0.52 - M) \times 0.43$
More than 0.86 mm (0.0339 in)	To be increased by $(M - 0.52) \times 0.43$

M: Measurement

Available shim thicknesses:
0.10, 0.12, 0.15, 0.18, 0.30, 0.40,
and 0.50 mm

8. Remove the special service tools from the propeller shaft.

9. Apply a load to the reverse gear by installing the propeller ⑧ without the spacer ⑨, then the washer ⑩ and nut ⑪ as shown.

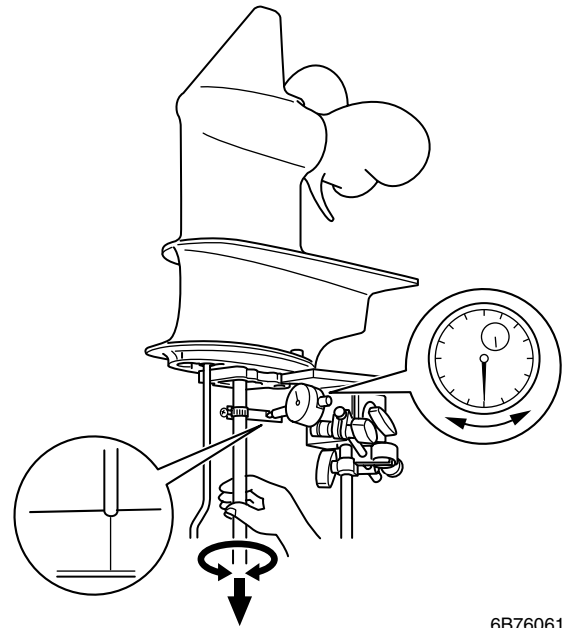


6B460600

10. Tighten the propeller nut.

Propeller nut:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

11. Slowly turn the drive shaft clockwise and counterclockwise and measure the backlash when the drive shaft stops in each direction.



6B760610

Reverse gear backlash:
0.95–1.65 mm (0.0374–0.650 in)

12. Add or remove shims if out of specification.

Reverse gear backlash	Shim thickness
Less than 0.95 mm (0.0374 in)	To be decreased by $(1.3 - M) \times 0.43$
More than 1.65 mm (0.650 in)	To be increased by $(M - 1.3) \times 0.43$

M: Measurement

Available shim thicknesses:
0.10, 0.20, 0.30, 0.40, and
0.50 mm

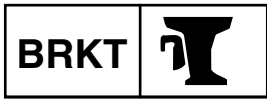
NOTE:

- If both the forward and reverse gear backlashes are larger than specification, the pinion gear may be too high.
- If both the forward and reverse gear backlashes are smaller than specification, the pinion gear may be too low.

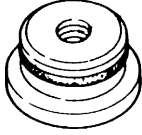
13. Remove the special service tools, then install the water pump assembly.

Bracket unit

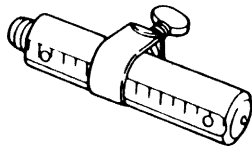
Special service tools	7-1
Tiller handle	7-2
Bottom cowling	7-4
Upper case and bracket unit	7-7
Disassembling the oil pan.....	7-13
Disassembling the upper case	7-13
Checking the upper case.....	7-14
Assembling the upper case	7-14



Special service tools

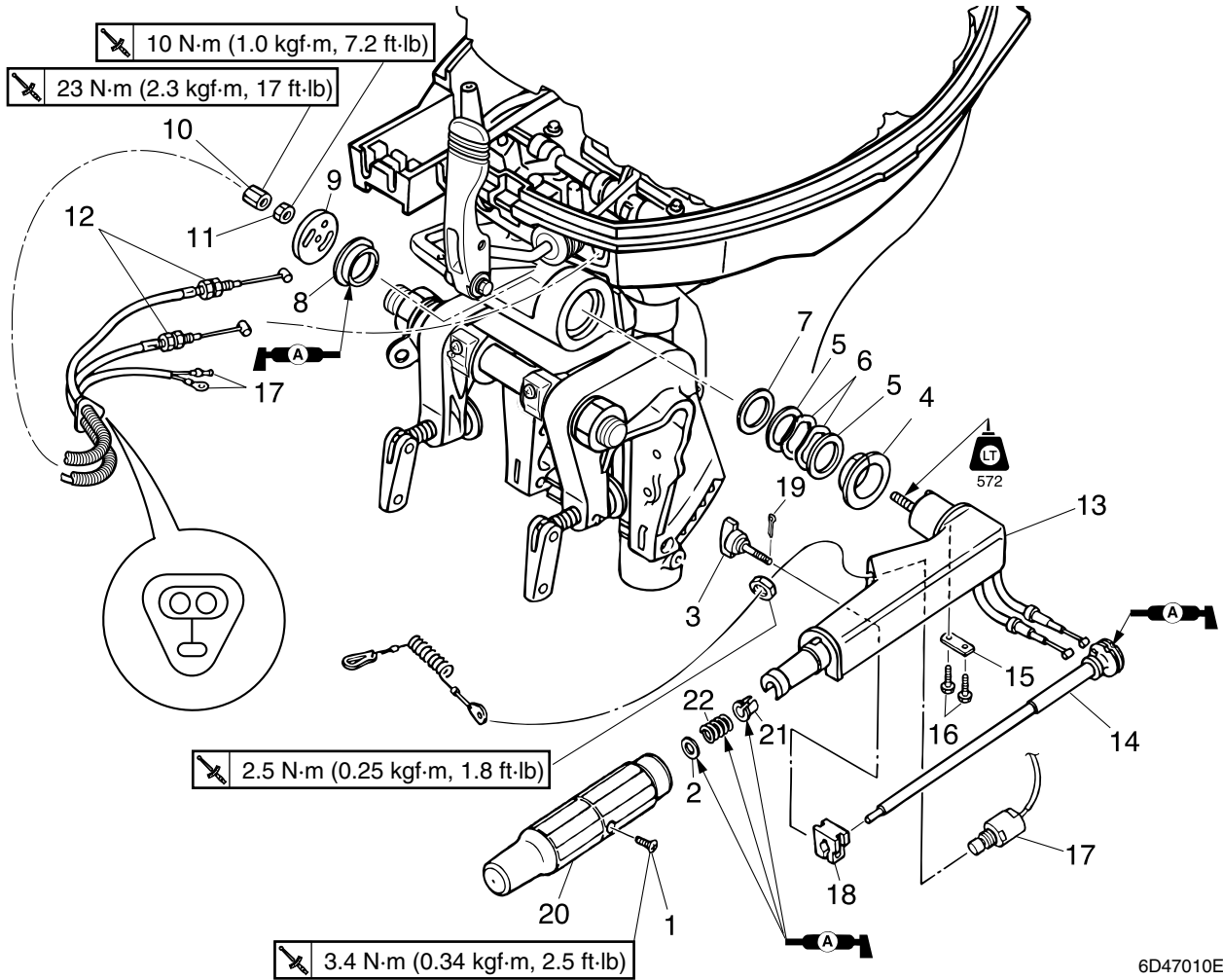


Needle bearing attachment
90890-06614



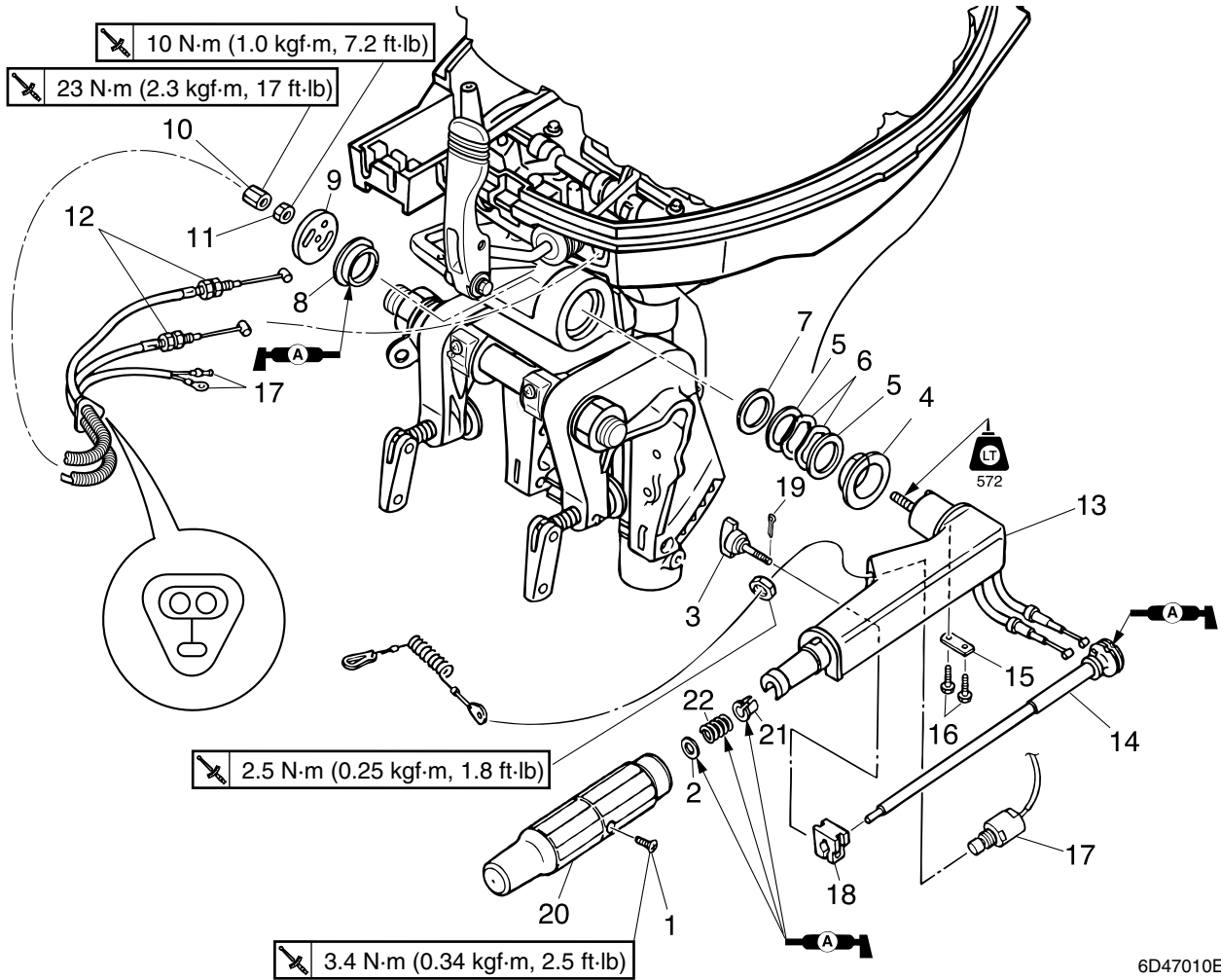
Driver rod SS
90890-06604

Tiller handle



6D47010E

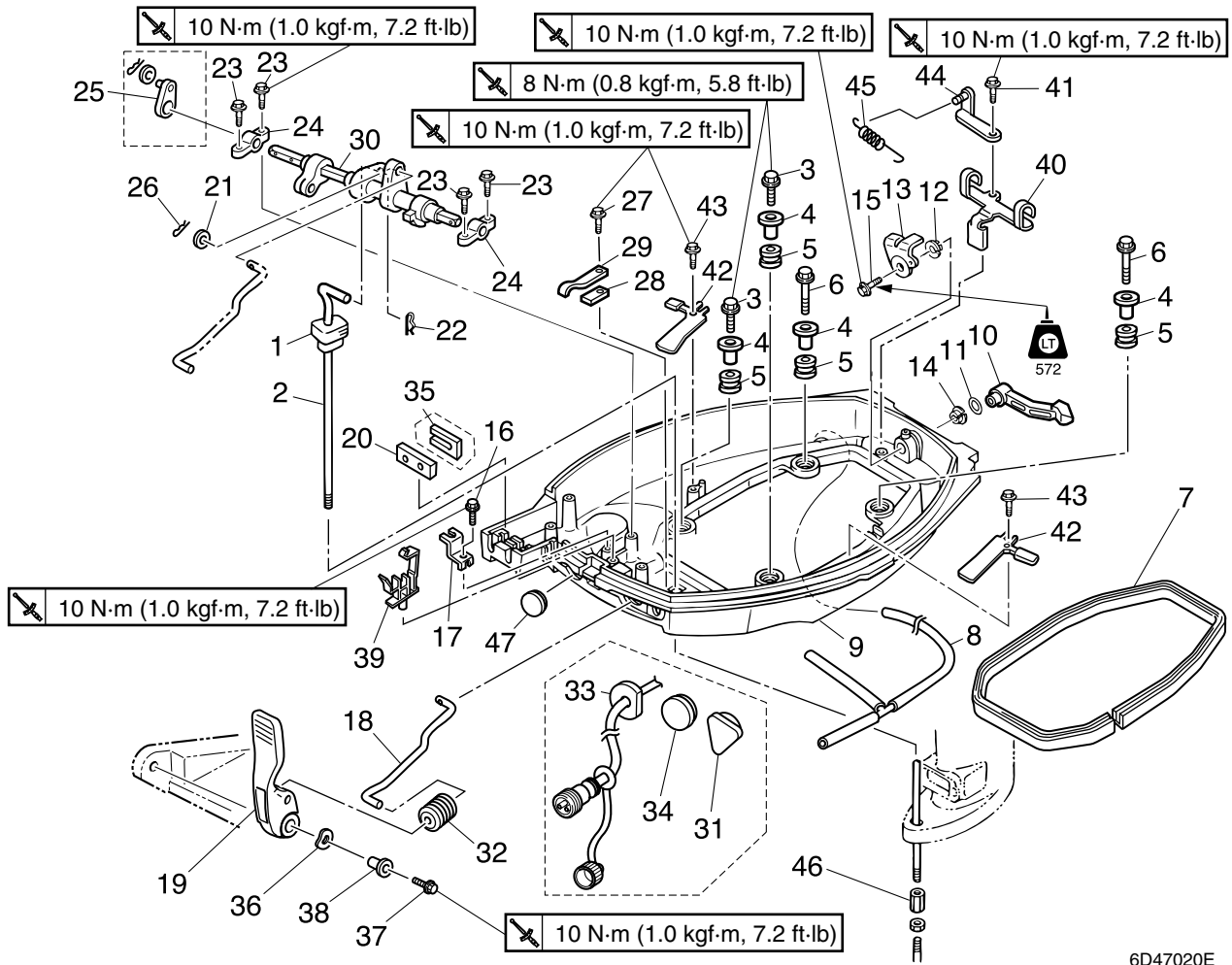
No.	Part name	Q'ty	Remarks
1	Screw	1	
2	Washer	1	
3	Throttle friction adjuster	1	
4	Bushing	1	Not reusable
5	Washer	2	
6	Wave washer	2	
7	Washer	1	
8	Bushing	1	
9	Steering handle cover	1	
10	Nut	1	
11	Nut	1	
12	Throttle cable	2	
13	Steering handle	1	
14	Throttle lever	1	
15	Stay	1	
16	Bolt	2	M6 Self tapping
17	Engine stop lanyard switch assembly	1	



6D47010E

No.	Part name	Q'ty	Remarks
18	Friction piece	1	
19	Cotter pin	1	Not reusable
20	Throttle grip assembly	1	
21	Bushing	1	
22	Spring	1	

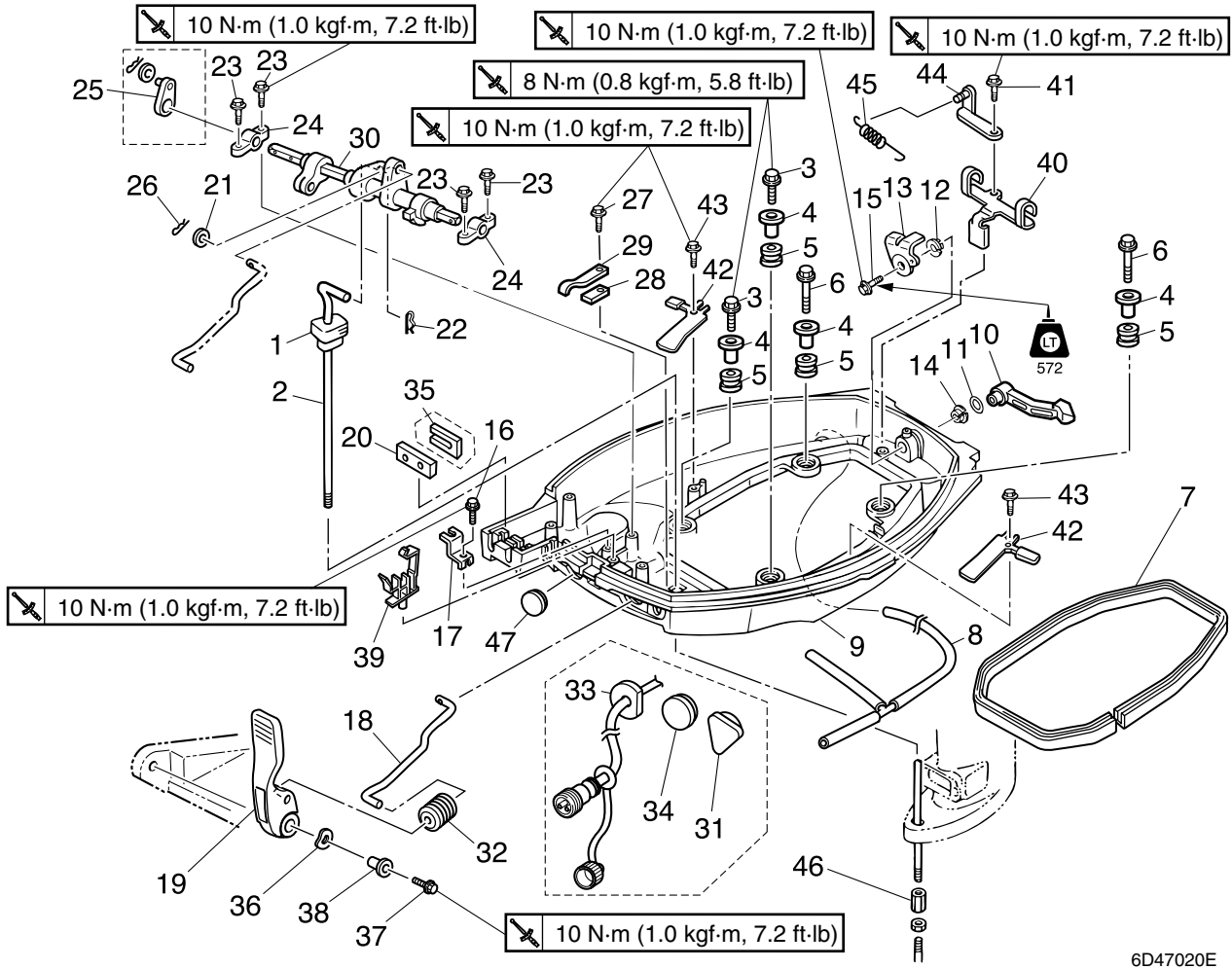
Bottom cowling



6D47020E

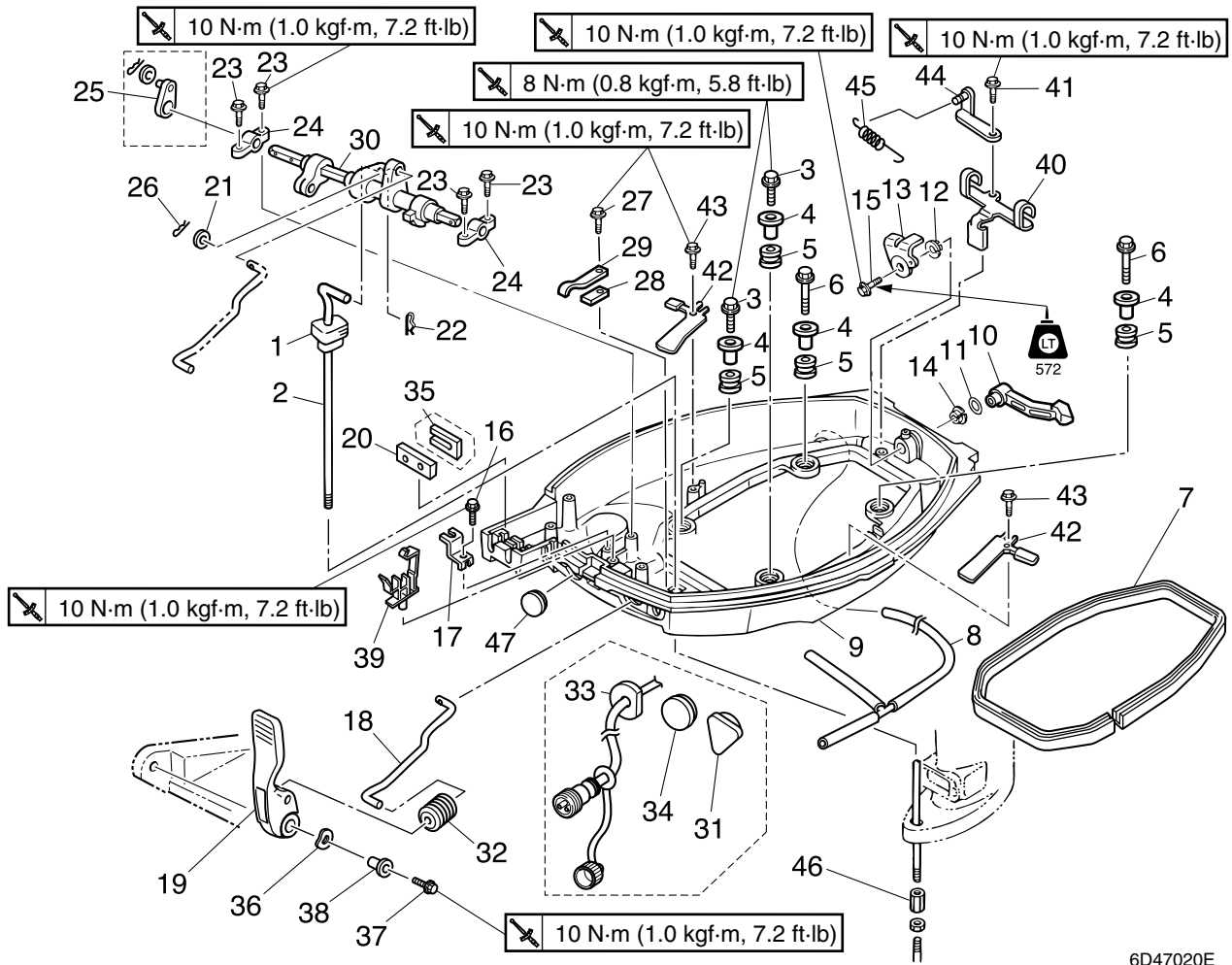
No.	Part name	Q'ty	Remarks
1	Boots	1	
2	Shift rod	1	
3	Bolt	2	M6 × 25 mm
4	Collar	4	
5	Grommet	4	
6	Bolt	2	M6 × 36 mm
7	Seal	1	
8	Hose	1	
9	Bottom cowling	1	
10	Cowling lock lever	1	
11	Wave washer	1	
12	Bushing	1	
13	Clamp lever	1	
14	Bushing	1	
15	Bolt	1	M6 × 12 mm
16	Bolt	1	M6 × 20 mm
17	Stay	1	

7



6D47020E

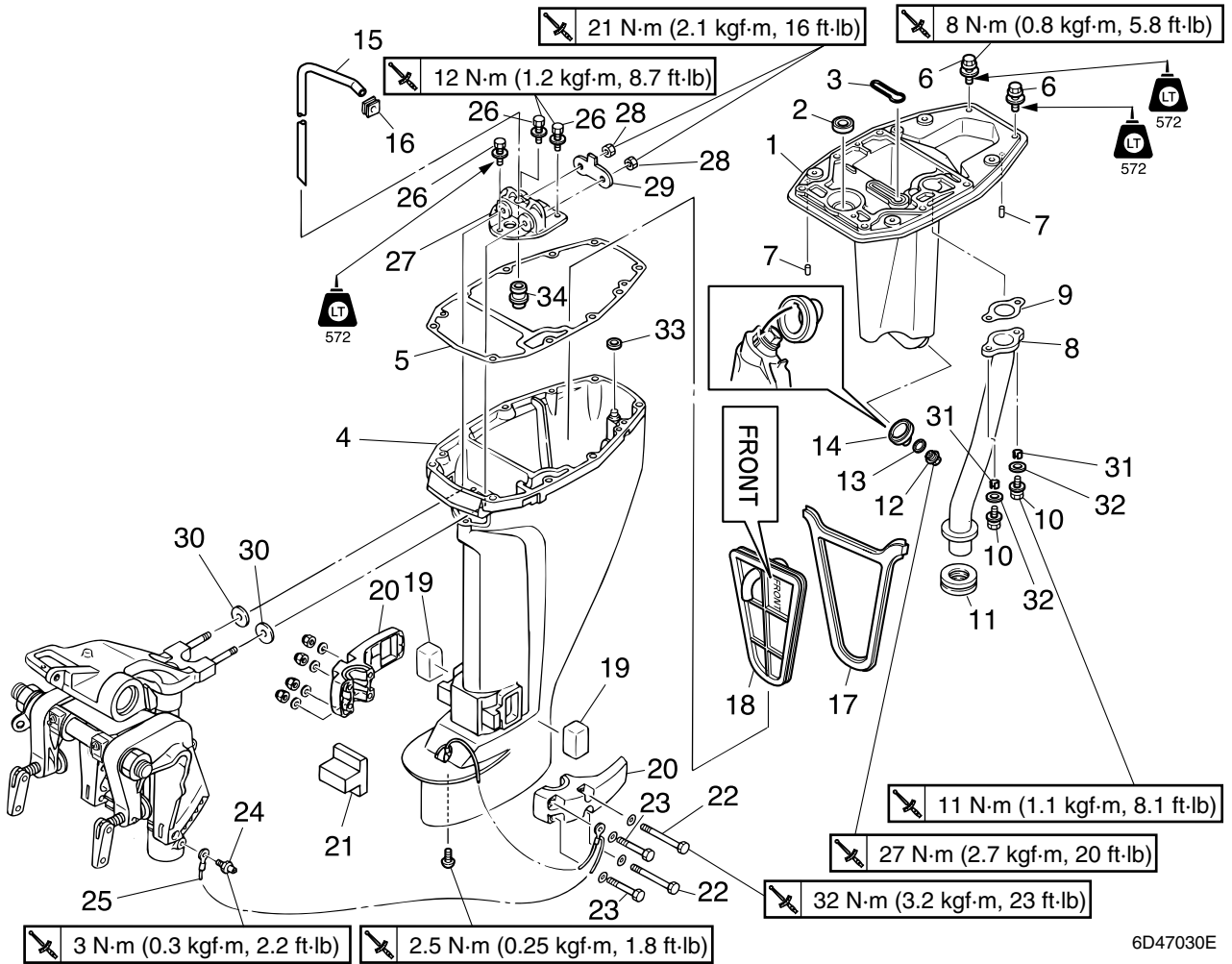
No.	Part name	Q'ty	Remarks
18	Shift rod link	1	For tiller control model
19	Shift lever	1	For tiller control model
20	Grommet	1	
21	Washer	1	
22	Clip	1	
23	Bolt	4	M6 × 25 mm
24	Bracket	2	
25	Joint	1	For remote control model
26	Clip	1	
27	Bolt	1	M6 × 20 mm
28	Stopper	1	
29	Spring	1	
30	Shift rod lever	1	
31	Grommet	1	For remote control model
32	Grommet	1	For tiller control model
33	Grommet	1	For remote control model
34	Grommet	1	For remote control model



6D47020E

No.	Part name	Q'ty	Remarks
35	Holder	1	For remote control model
36	Wave washer	1	For tiller control model
37	Bolt	1	M6 × 25 mm : For tiller control model
38	Collar	1	For tiller control model
39	Clamp	1	
40	Bracket	1	
41	Bolt	1	M6 × 25 mm
42	Bracket	2	
43	Bolt	2	M6 × 20 mm
44	Spring hook	1	
45	Spring	1	
46	Adjuster	1	
47	Grommet	1	For tiller control model

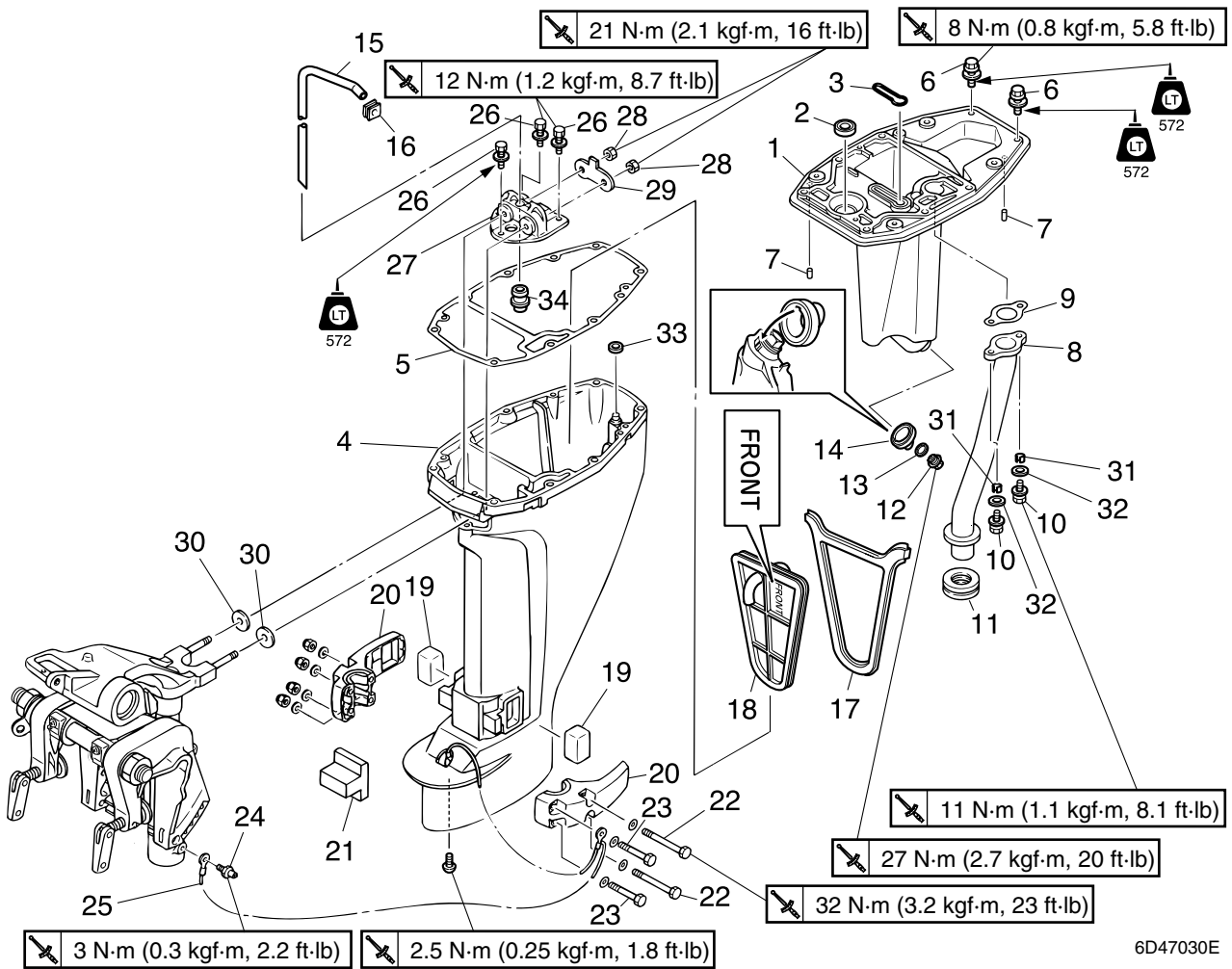
Upper case and bracket unit



6D47030E

No.	Part name	Q'ty	Remarks
1	Oil pan	1	
2	Oil seal	1	Not reusable
3	O-ring	1	Not reusable
4	Upper case	1	
5	Gasket	1	Not reusable
6	Bolt	2	M6 × 20 mm
7	Dowel pin	2	
8	Exhaust pipe	1	
9	Gasket	1	Not reusable
10	Bolt	2	M6 × 16 mm
11	Rubber seal	1	
12	Drain bolt	1	
13	Gasket	1	Not reusable
14	Drain bolt cap	1	
15	Water tube	1	
16	Rubber seal	1	
17	Gasket	1	Not reusable

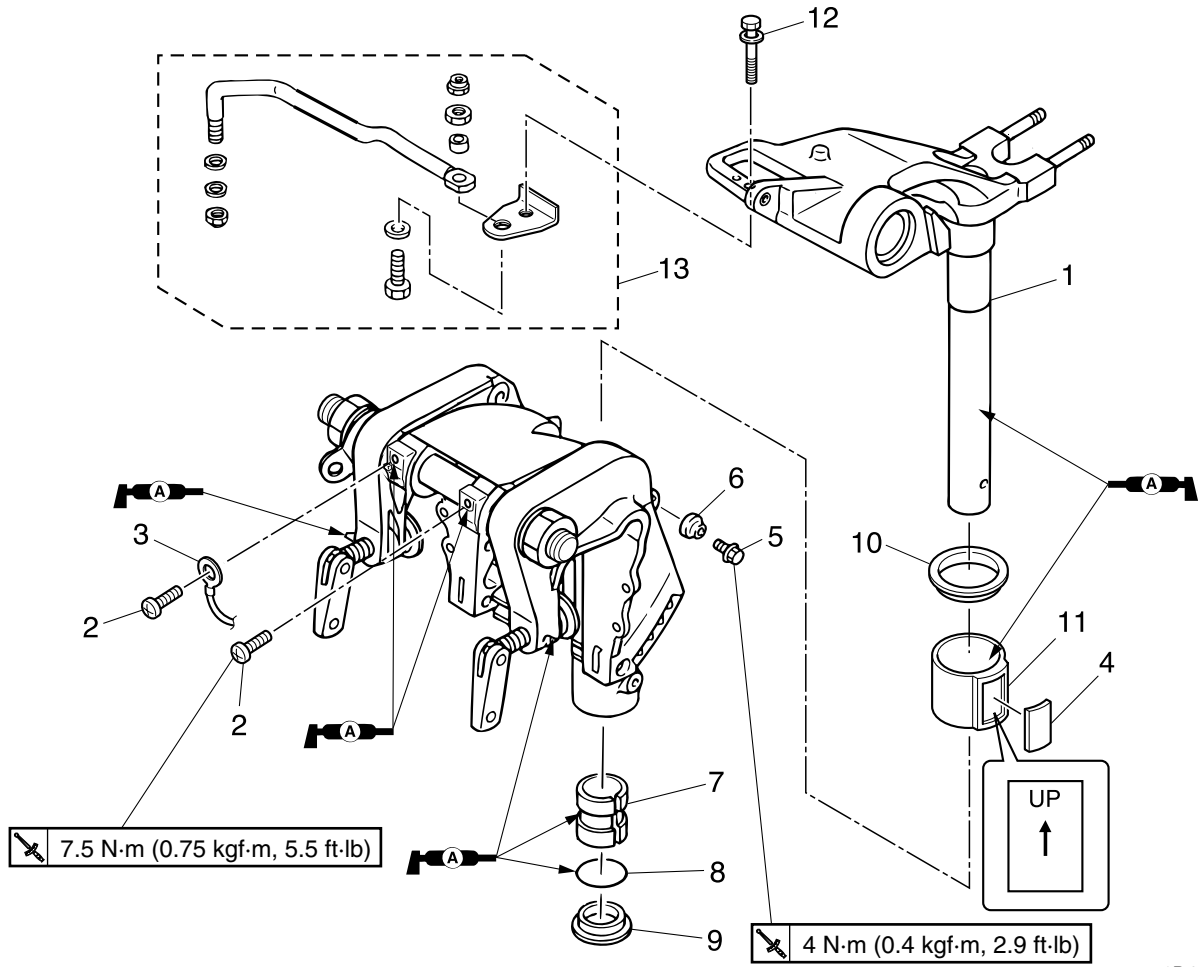
Upper case and bracket unit



6D47030E

No.	Part name	Q'ty	Remarks
18	Buffer plate	1	
19	Lower mount rubber	2	Side
20	Lower mount housing	2	
21	Lower mount rubber	1	Front
22	Bolt	2	M8 × 105 mm
23	Bolt	2	M8 × 85 mm
24	Grease nipple	1	
25	Ground lead	1	
26	Bolt	3	M6 × 25 mm
27	Upper mount	1	
28	Nut	2	
29	Plate	1	
30	Washer	2	
31	Collar	2	
32	Washer	2	
33	Rubber seal	1	Not reusable
34	Rubber seal	1	Not reusable

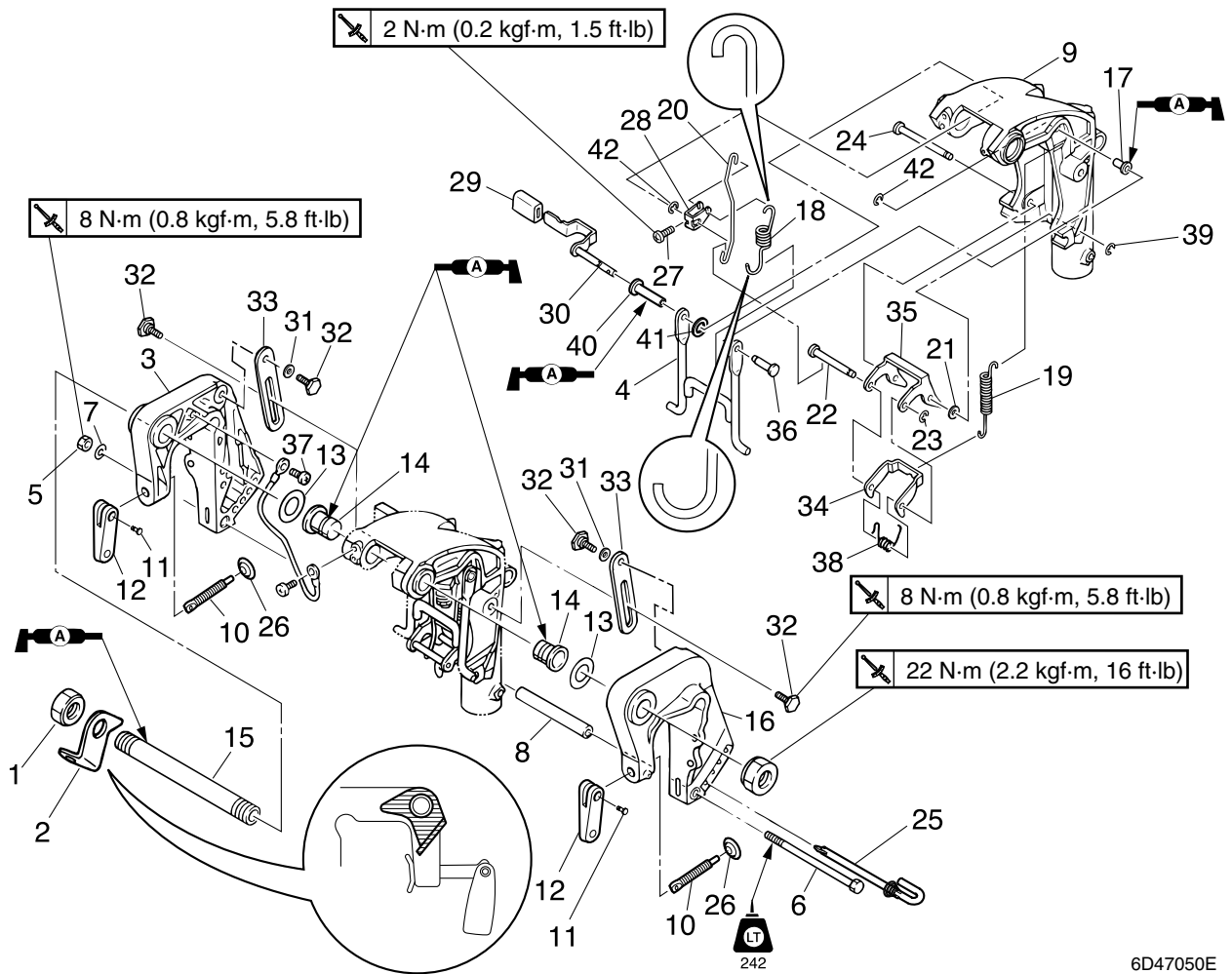
7



6D47040E

No.	Part name	Q'ty	Remarks
1	Steering bracket	1	
2	Screw	2	
3	Ground lead	1	
4	Friction piece	1	
5	Bolt	1	M6 × 20 mm
6	Rubber seal	1	
7	Bushing	1	
8	O-ring	1	Not reusable
9	Bushing	1	
10	Washer	1	
11	Pivot shaft bushing	1	
12	Bolt	1	M8 × 36 mm : For remote control model
13	Ride guide	1	For remote control model

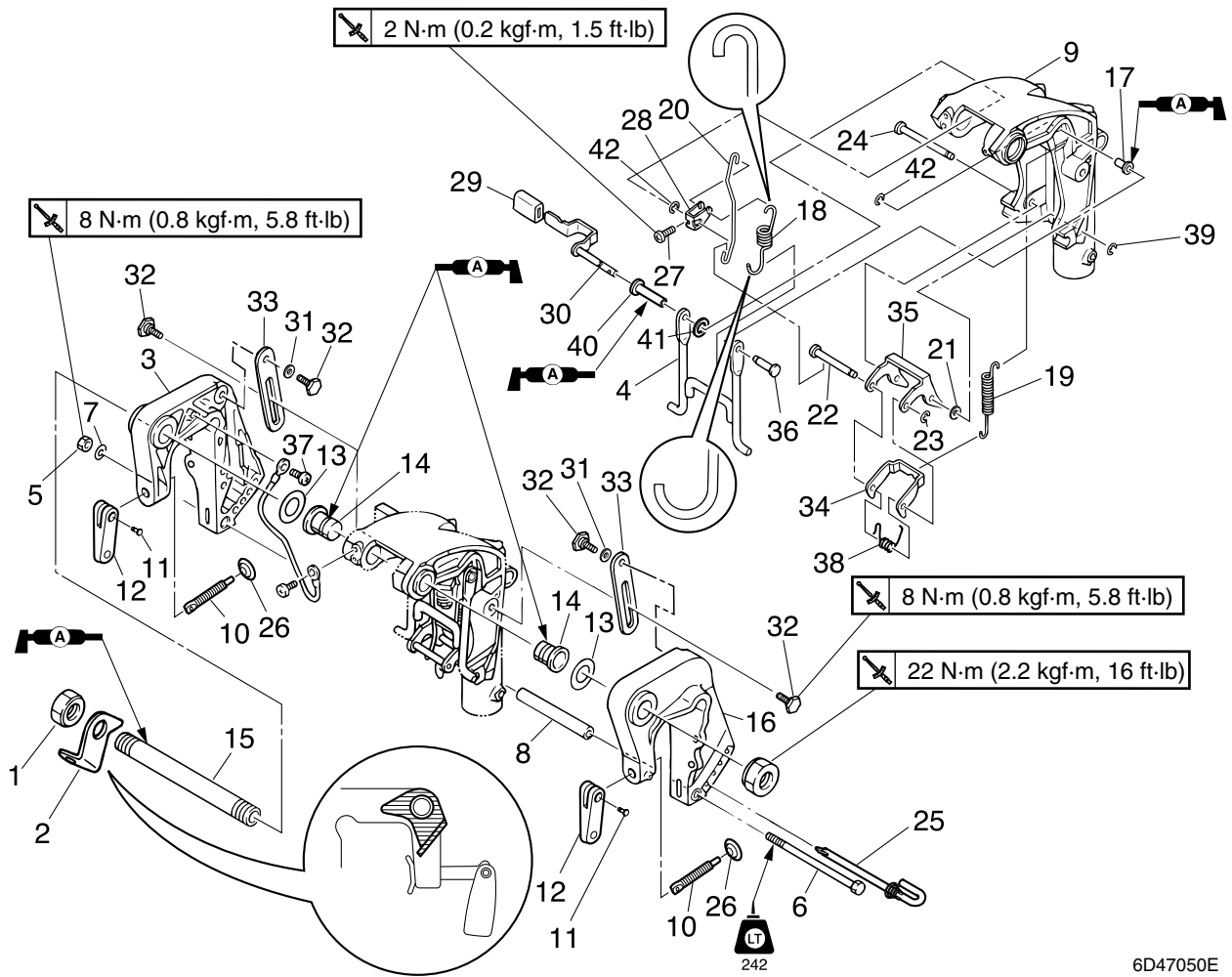
Upper case and bracket unit



6D47050E

No.	Part name	Q'ty	Remarks
1	Nut	1	
2	Plate	1	
3	Starboard clamp bracket	1	
4	Tilt lock arm	1	
5	Nut	1	
6	Bolt	1	M6 × 150 mm
7	Washer	1	
8	Collar	1	
9	Steering bracket	1	
10	Transom cramp screw	2	
11	Pin	2	
12	Transom cramp handle	2	
13	Washer	2	
14	Bush	2	
15	Clamp bracket bolt	1	
16	Port side clamp bracket	1	
17	Bush	1	

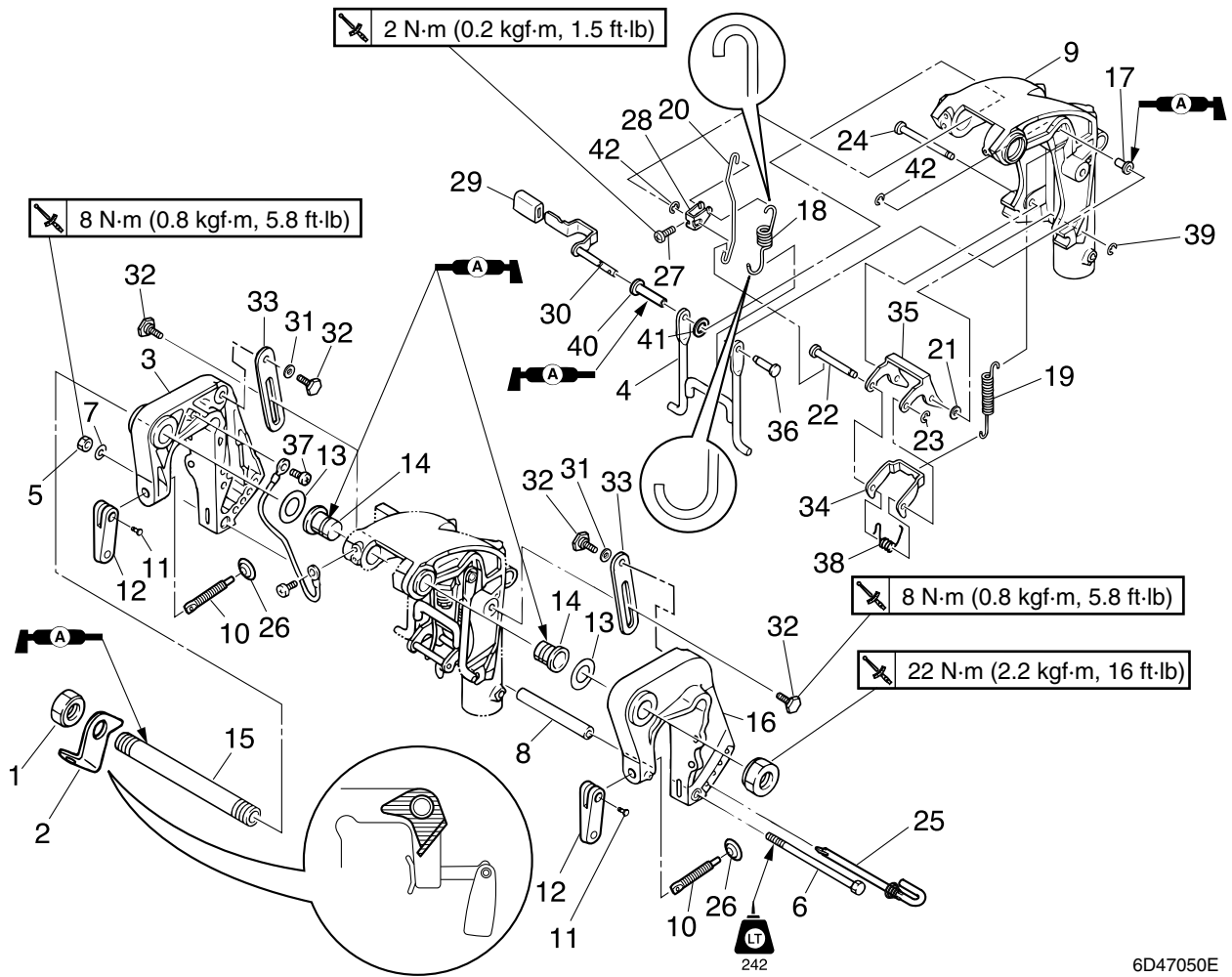
7



6D47050E

No.	Part name	Q'ty	Remarks
18	Spring	1	
19	Spring	1	
20	Rod	1	
21	Washer	1	
22	Tilt lock shaft	1	
23	Circlip	1	
24	Shaft	1	
25	Tilt rod	1	
26	Transom clamp pad	2	
27	Screw	1	
28	Tilt lever	1	
29	Cover	1	
30	Tilt lever assembly	1	
31	Wave washer	2	
32	Bolt	4	
33	Tilt stop lever	2	
34	Tilt lock plate	1	

Upper case and bracket unit



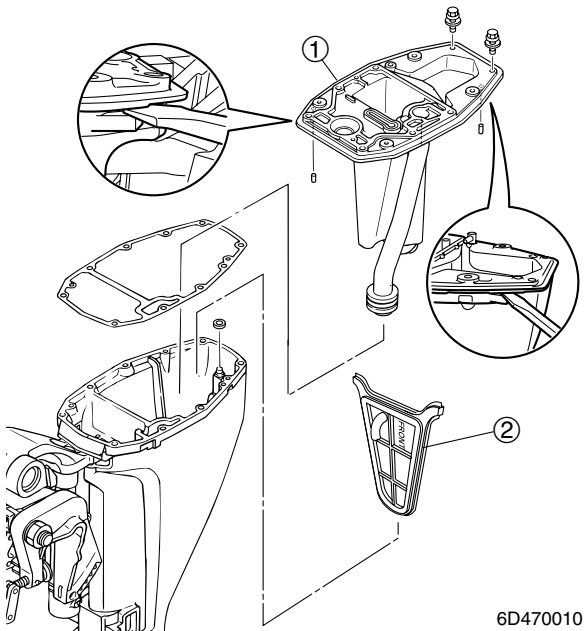
6D47050E

No.	Part name	Q'ty	Remarks
35	Reverse lock plate	1	
36	Shaft	1	
37	Screw	1	
38	Spring	1	
39	Circlip	1	
40	Collar	1	
41	Washer	1	
42	Washer	2	

7

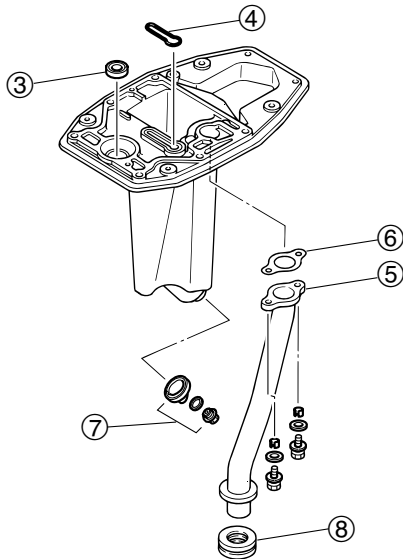
Disassembling the oil pan

1. Remove the oil pan ① and buffer plate ② gasket from the upper case.



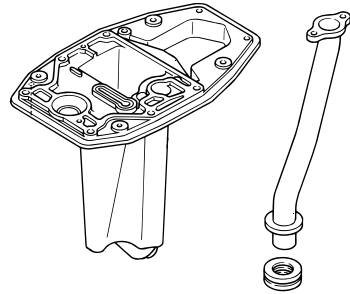
6D470010

2. Remove the oil seal ③ and O-ring ④.
3. Remove the exhaust pipe ⑤, gasket ⑥, drain bolt ⑦, gasket and rubber seal ⑧.



6D470020

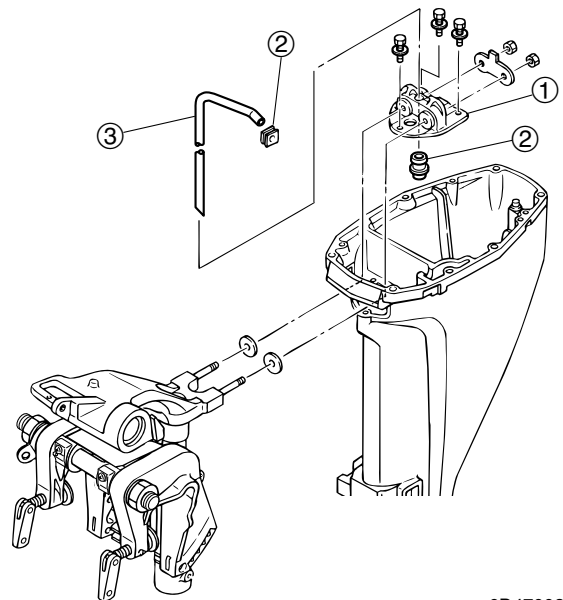
4. Check the exhaust pipe, oil pan for damage or corrosion. Replace if necessary.



6D470060

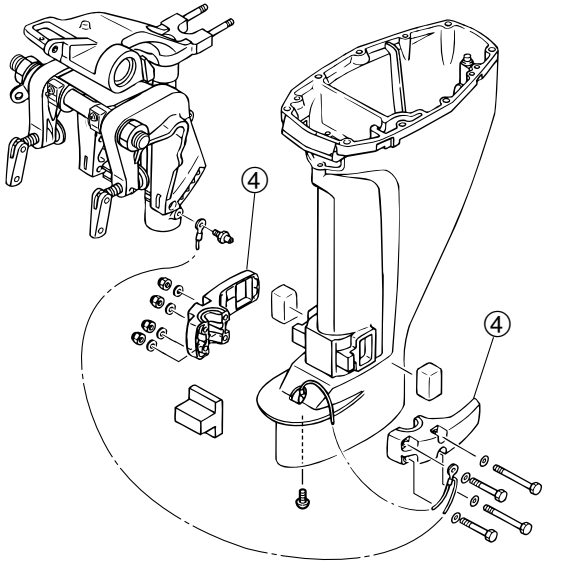
Disassembling the upper case

1. Remove the upper mount ①, rubber seal ② and water tube ③.



6D470030

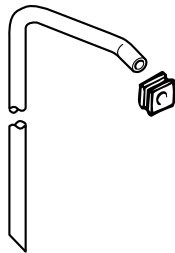
- Remove the lower mount brackets ④.



6D470040

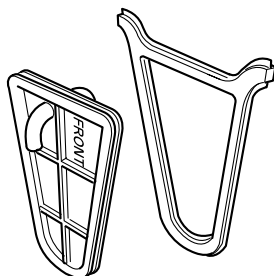
Checking the upper case

- Check the water tube for deformation or corrosion. Replace if necessary.



6D470050

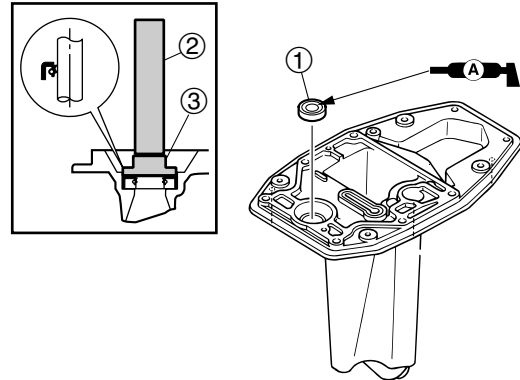
- Check the buffer plate for damage, deterioration and cracks. Replace if necessary.



6D470070

Assembling the upper case

- Install the new oil seal ① to the oil pan using the special service tools.



6D470090



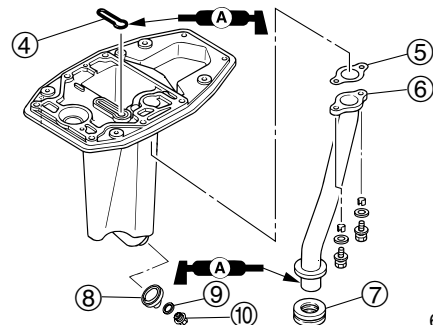
Driver rod SS ②:

90890-06604

Needle bearing attachment ③:

90890-06614

- Install the new O-ring ④ new gasket ⑤, exhaust pipe ⑥, rubber seal ⑦ to the oil pan and tighten the bolts.



6D470080



Exhaust pipe:

11 N·m (1.1 kgf·m, 8.1 ft·lb)

- Install the drain bolt cap ⑧ and new gasket ⑨, then tighten the drain bolt ⑩ to specified torque.

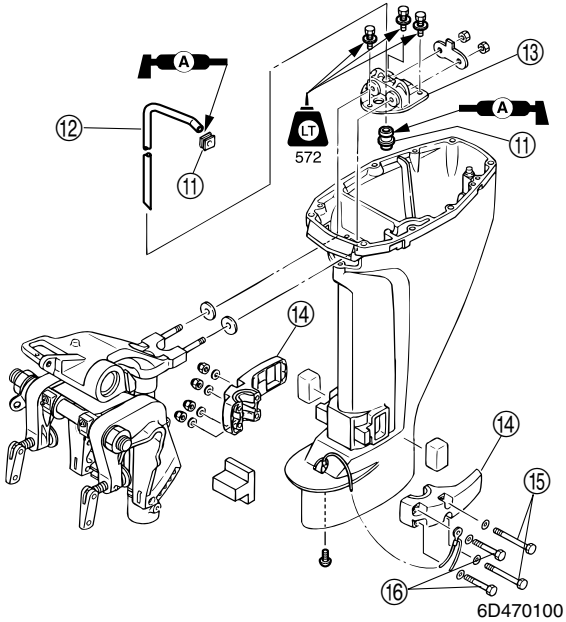


Drain bolt:


27 N·m (2.7 kgf·m, 20 ft·lb)



4. Install the rubber seal (11) and water tube (12) to the upper mount (13).
5. Install the upper mount (13) and lower mount brackets (14).



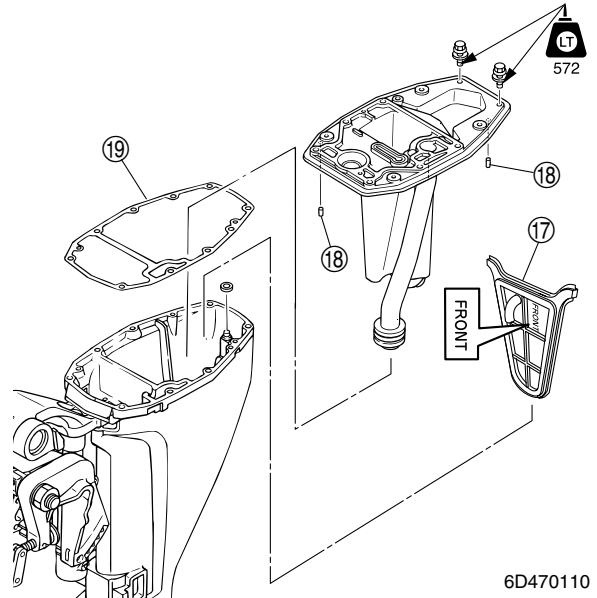
NOTE: _____
 First tighten the rear side bolts (15), then tighten the front side bolts (16) to specified torques.

	Upper mount bolts:
	12 N·m (1.2 kgf·m, 8.7 ft·lb)
	Upper mount nuts:
	21 N·m (2.1 kgf·m, 16 ft·lb)
	Lower mount bolts:
	32 N·m (3.2 kgf·m, 23 ft·lb)

6. Install the buffer plate (17) to the oil pan.

NOTE: _____
 Face the "FRONT" mark side to install.

7. Install the dowel pins (18), new gasket (19) and oil pan on to the upper case.

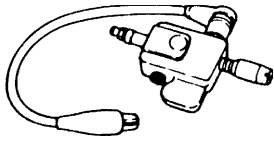


	Oil pan:
	8 N·m (0.8 kgf·m, 5.8 ft·lb)

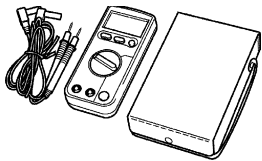
Electrical systems

Special service tools.....	8-1
Checking the electrical components	8-2
Measuring the peak voltage	8-2
Measuring low resistance	8-2
Electrical components	8-3
Top view.....	8-3
Starboard view.....	8-4
Aft view	8-5
Wiring harness	8-6
Ignition and ignition control system.....	8-7
Checking the ignition spark gap	8-7
Checking the spark plug caps	8-7
Checking the ignition coil.....	8-8
Checking the pulser coil	8-8
Checking the charge coil	8-9
Checking the CDI unit.....	8-10
Checking the oil pressure warning lamp	8-10
Checking the engine stop lanyard switch	8-11
Charging system	8-12
Checking the lighting coil.....	8-12
Checking the rectifier regulator.....	8-12

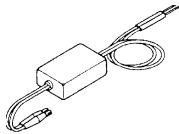
Special service tools



Ignition tester
90890-06754



Digital circuit tester
90890-03174



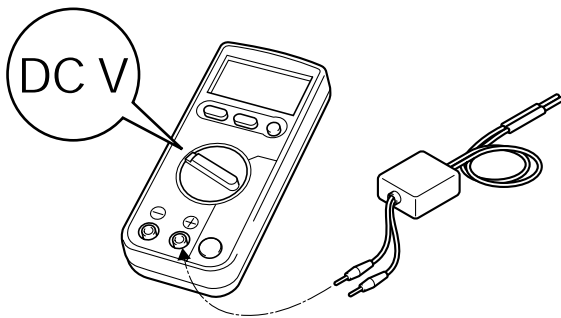
Peak voltage adaptor B
90890-03172

Checking the electrical components

Measuring the peak voltage

NOTE: _____
Before troubleshooting the peak voltage, check that all electrical connections are tight and free from corrosion.

The condition of the ignition system can be determined by measuring the peak voltage. Cranking speed is affected by many factors, such as fouled or weak spark plug. If one of these factors is present, the peak voltage will be lower than specification. In addition, if the peak voltage is lower than specification the engine will not operate properly.



6B480010

⚠ WARNING

When checking the peak voltage, do not touch any of the connections of the digital circuit tester leads.

NOTE: _____

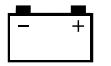
- Use the peak voltage adaptor with the digital circuit tester.
- When measuring the peak voltage, set the selector on the digital circuit tester to the **DC voltage mode**.
- Connect the positive pin on the peak voltage adaptor to the positive terminal of the digital circuit tester.

Measuring low resistance

When measuring a resistance of 10 or less with the digital circuit tester, the correct measurement cannot be obtained because of the internal resistance of the tester. To obtain the correct value, subtract the internal resistance from the displayed measurement.

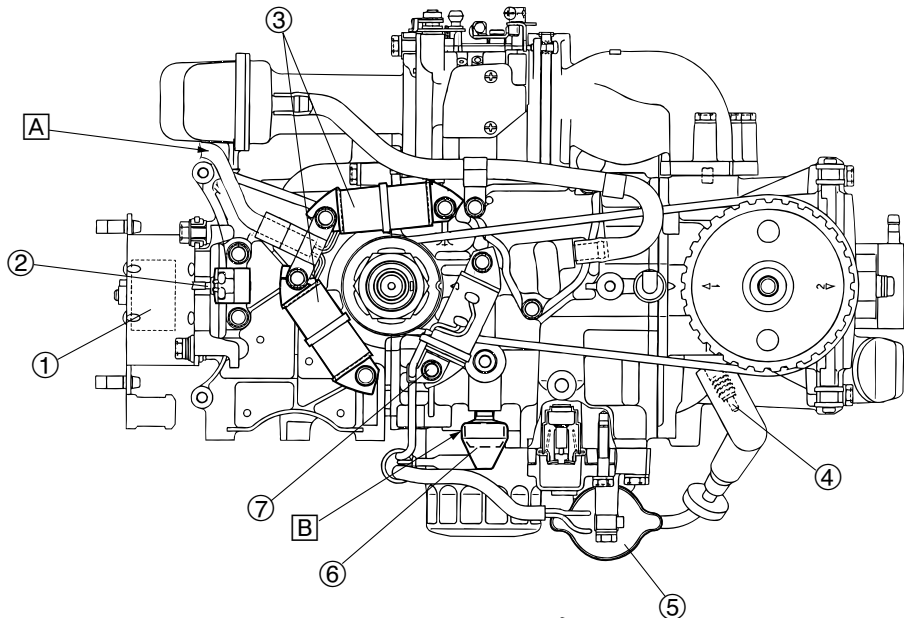
$$\text{Correct value} = \text{displayed measurement} - \text{internal resistance}$$

NOTE: _____
Obtain the internal resistance of the digital circuit tester by connecting both of its probes and checking the display.

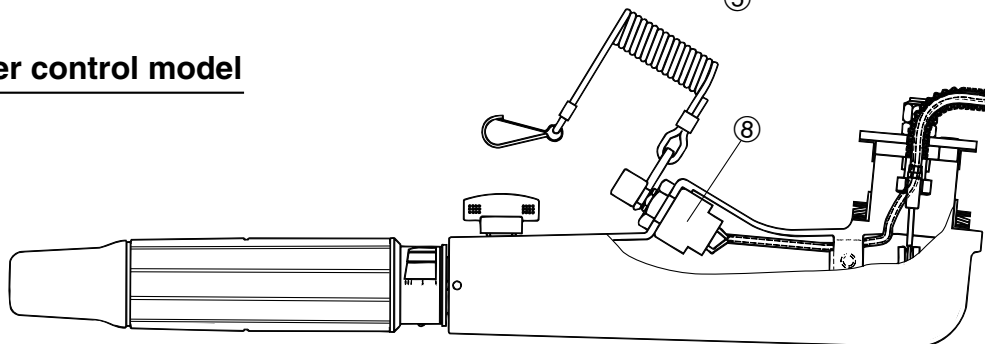


Electrical components

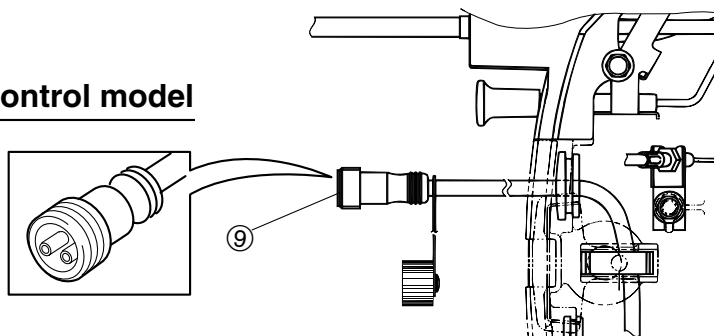
Top view



Tiller control model



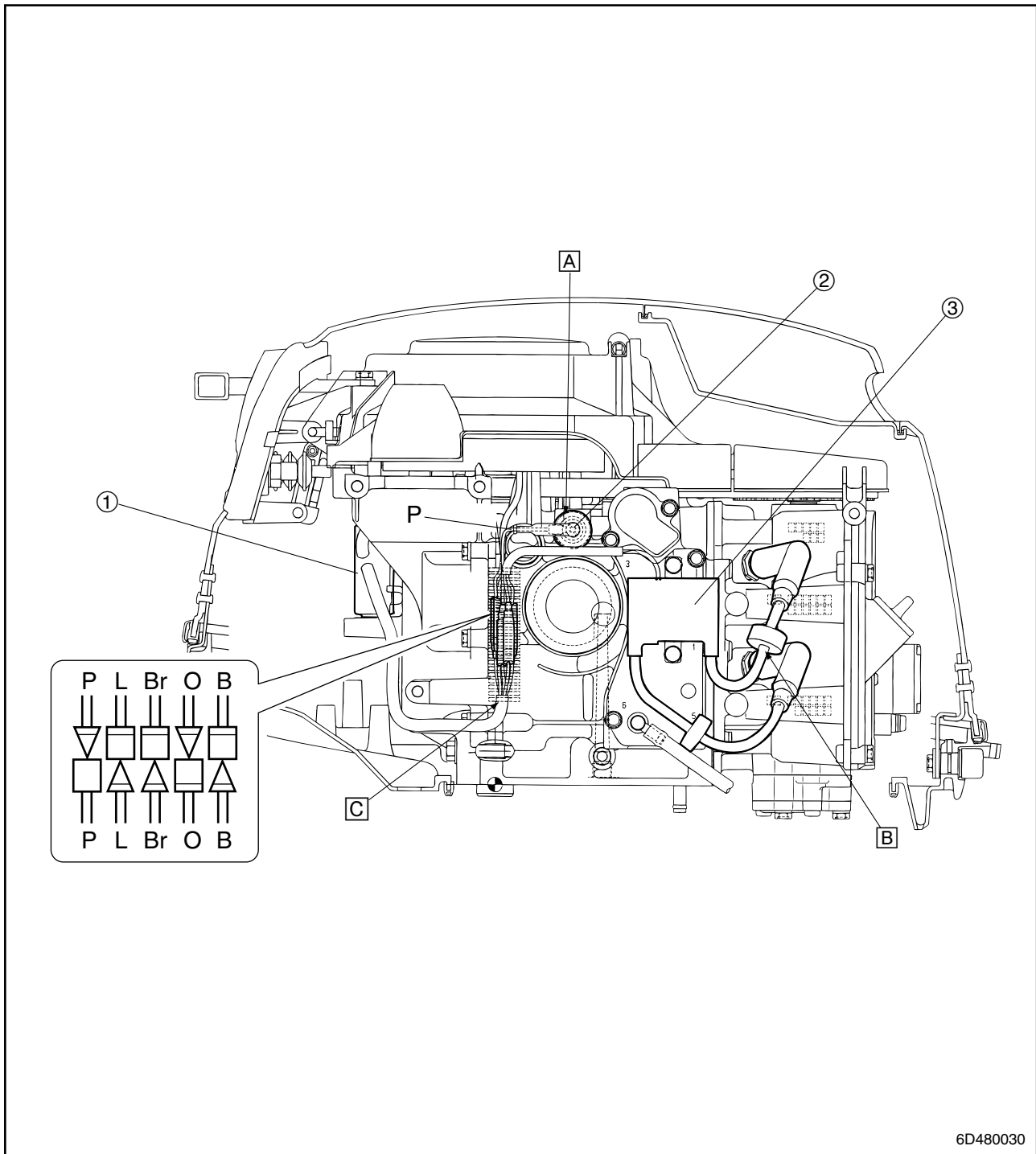
Remote control model



6D480020

- ① Rectifier regulator
 - ② Pulser coil
 - ③ Lighting coil
 - ④ Spark plug
 - ⑤ Ignition coil
 - ⑥ Oil pressure switch
 - ⑦ Charge coil
 - ⑧ Engine stop lanyard switch (for tiller control model)
 - ⑨ Engine stop lanyard switch connector (for remote control model: 701 remote control type)
- A** Pass the lighting coil lead as shown.
B Install the pink lead onto the oil pressure switch. Cover the oil pressure switch after tightening it.

Starboard view

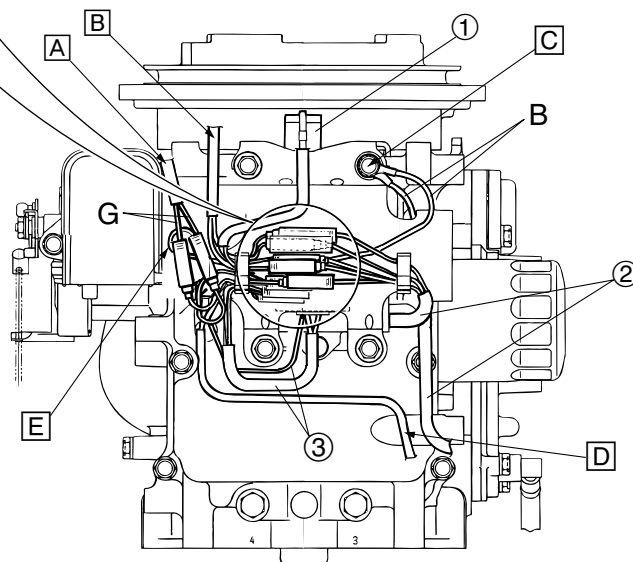
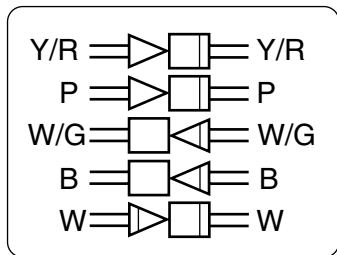


- ① CDI unit
- ② Oil pressure switch
- ③ Ignition coil

- A Install the connector in the proper direction as shown.
- B Pass each spark plug wire through the grommet.
- C Cover the oil pressure switch lead, ignition coil lead and charge coil lead with the plastic tube after connecting the same color leads.



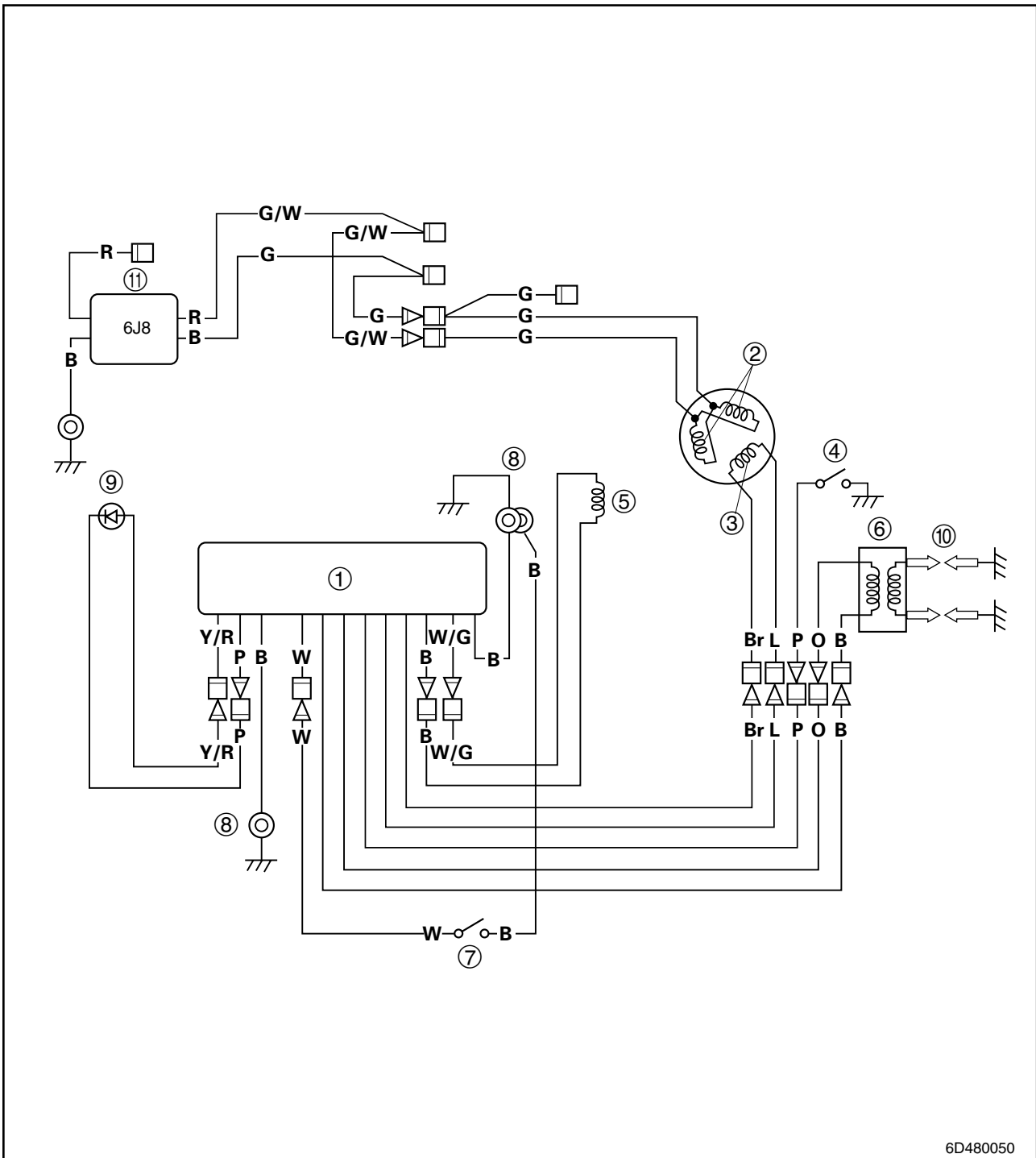
Aft view



6D480040

- ① Pulser coil
- ② CDI unit leads
- ③ Rectifier regulator leads
- A** To the lighting coil.
- B** To the warning lamp.
- C** Tighten with the CDI unit ground lead and the engine stop lanyard switch ground lead.
- D** To the engine stop lanyard switch.
- E** Tighten with the rectifier regulator ground lead.

Wiring harness



6D480050

- ① CDI unit
- ② Lighting coil
- ③ Charge coil
- ④ Oil pressure switch
- ⑤ Pulser coil
- ⑥ Ignition coil
- ⑦ Engine stop lanyard switch
- ⑧ Ground lead
- ⑨ Oil pressure warning lamp

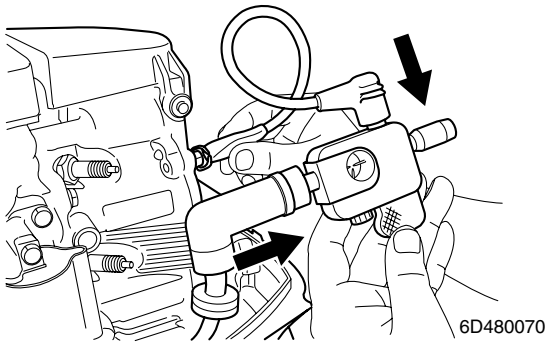
- ⑩ Spark plug
- ⑪ Rectifier regulator
- Br : Brown
- G : Green
- L : Blue
- O : Orange
- P : Pink
- R : Orange


- W : White
- G/W: Green /White
- W/G: White/Green
- Y/R : Yellow/Red

Ignition and ignition control system

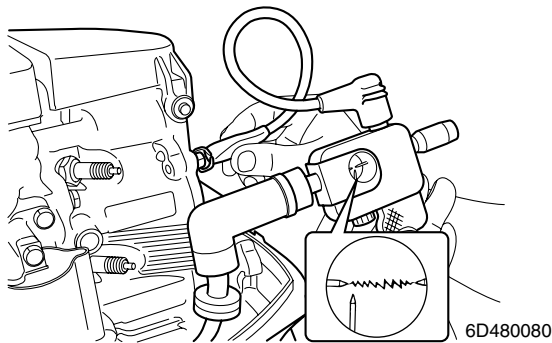
Checking the ignition spark gap

1. Disconnect the spark plug caps from the spark plugs.
2. Connect the spark gap tester to the spark plug cap.



 Ignition tester: 90890-06754

3. Crank the engine and observe the spark through the discharge window of the spark gap tester. If it does not work properly, check the plug cap, ignition coil, or the specified peak voltages.

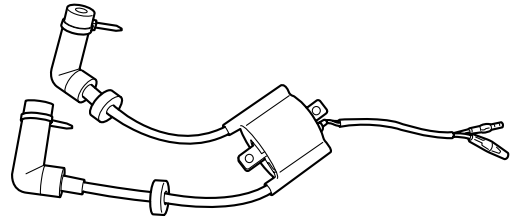


⚠ WARNING

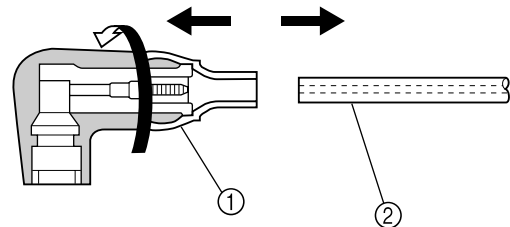
- Do not touch any of the connections of the spark gap tester leads.
- Do not let sparks leak out of the removed spark plug caps.
- Keep flammable gas or liquids away, since this test can produce sparks.

Checking the spark plug caps

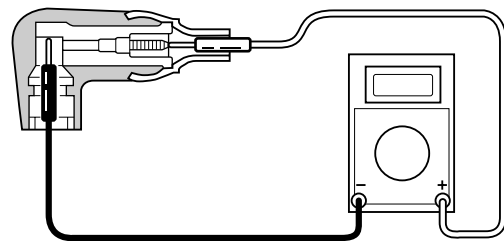
1. Check the spark plug caps for cracks or damage. Replace if necessary.




2. Remove the spark plug cap ① from the spark plug wire ② by turning the cap counter-clockwise.



3. Measure the spark plug cap resistance.



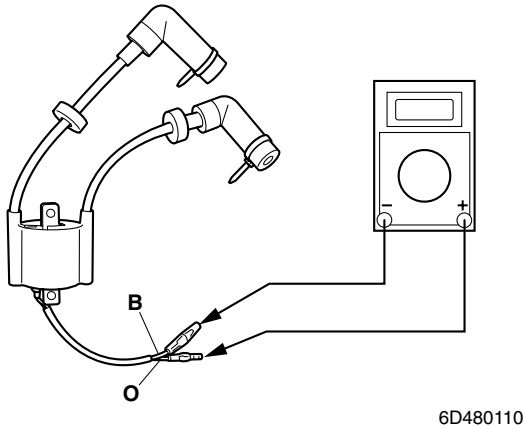
 Spark plug cap resistance:
4.0 – 6.0 kΩ

4. Check the spark plug wire for damage or cracks. Replace the ignition coil if necessary.

Checking the ignition coil

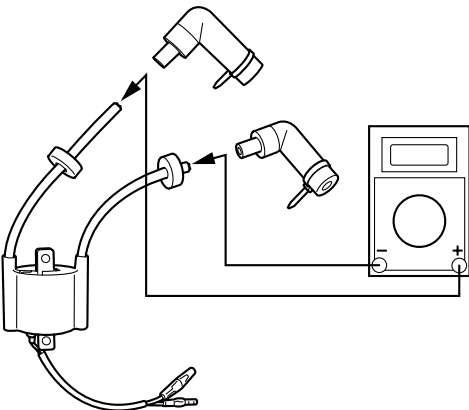
1. Remove the spark plug cap from the spark plug.
2. Disconnect the ignition coil lead.
3. Measure the ignition coil resistance. Replace if out of specification.

A



6D480110

B



6D480120

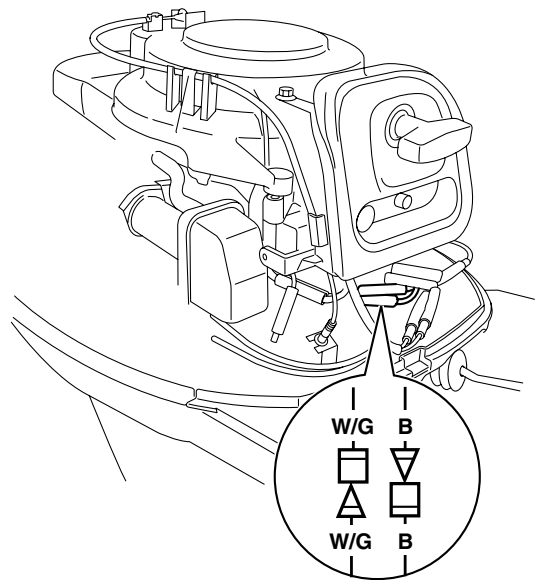


Ignition coil resistance:

- A** Primary coil:
Orange (O) – Black (B)
0.16 – 0.24Ω at 20°C (68°F)
- B** Secondary coil:
Spark plug wire – Spark plug wire
3.92 – 5.88 kΩ at 20°C (68°F)

Checking the pulser coil

1. Connect the digital circuit tester with peak voltage adaptor B to the connector.
2. Measure the pulser coil output peak voltage. If the measurement is below specification, check the leads and measure the pulser coil resistance. Replace the pulser coil if necessary.



6D480130

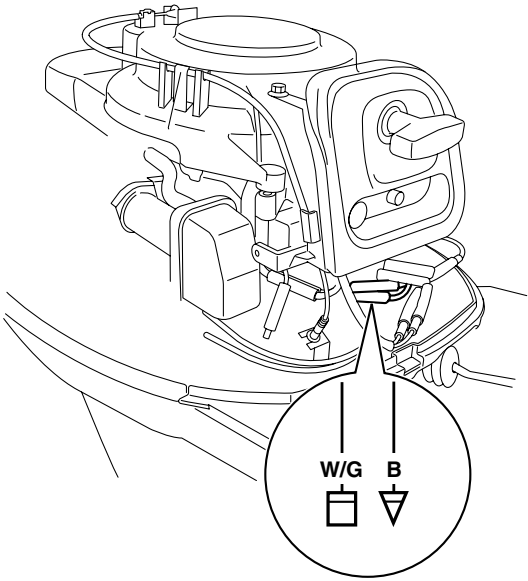


Digital circuit tester: 90890-3174
Peak voltage adaptor B:
90890-03172




Pulser coil peak voltage:
White/green (W/G) – Black (B)

r/min	Unloaded		Loaded	
	Cranking		1,500	3,500
DC V	4.0	4.0	9	17





6D480140

 **Pulser coil resistance**
(use as reference):
White/green (W/G) – Black (B)
234.0 – 348.0 Ω at 20°C (68°F)

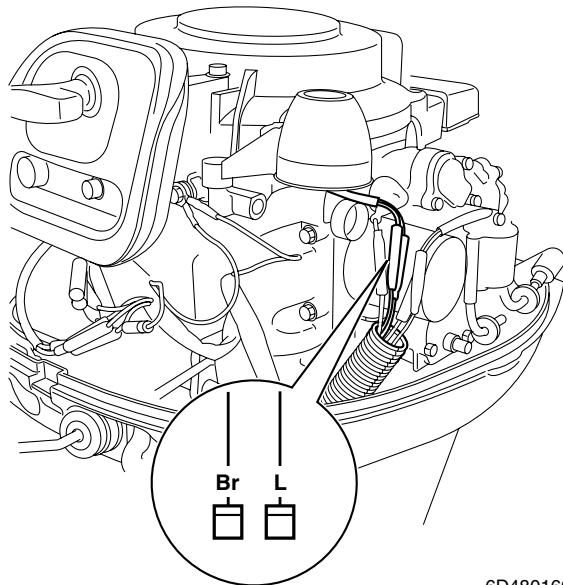
Checking the charge coil

1. Measure the charge coil output peak voltage. If the measurement is below specification, check the leads, and measure the charge coil resistance. Replace if necessary.


 **Digital circuit tester: 90890-03174**
Peak voltage adapter B:
90890-03172

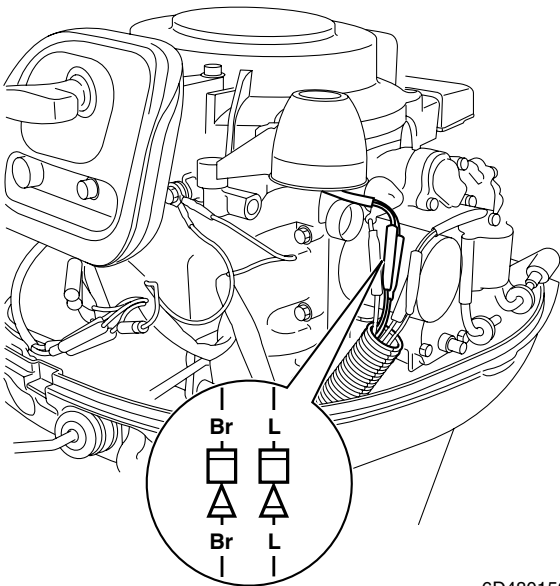
 **Charge coil peak voltage:**
Brown (Br) – Blue (L)

r/min	Unloaded		Loaded	
	Cranking		1,500	3,500
DC V	175	170	180	180



6D480160

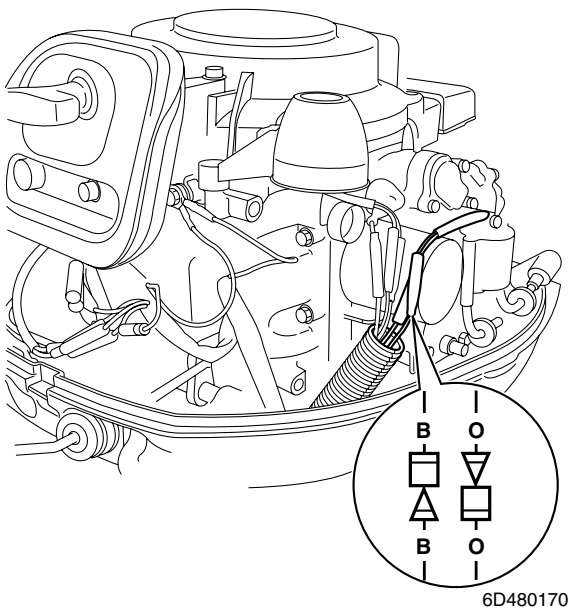
 **Charge coil resistance**
(use as reference):
Brown (Br) – Blue (L)
272.0 – 408.0 Ω at 20°C (68°F)





6D480150

Checking the CDI unit

1. Connect the digital circuit test leads to the orange and black leads from the CDI unit.
2. Measure the CDI unit output peak voltage. If the measurement is below specification, check the lead, and measure the peak output voltages of the pulser and charge coils.



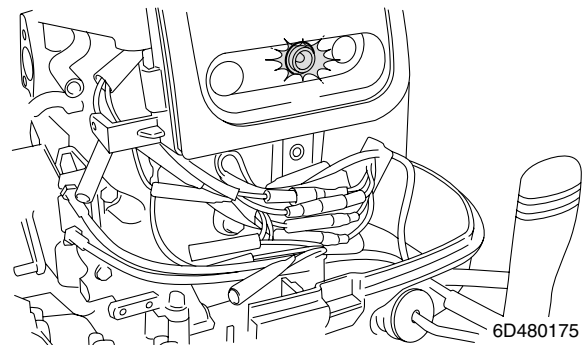
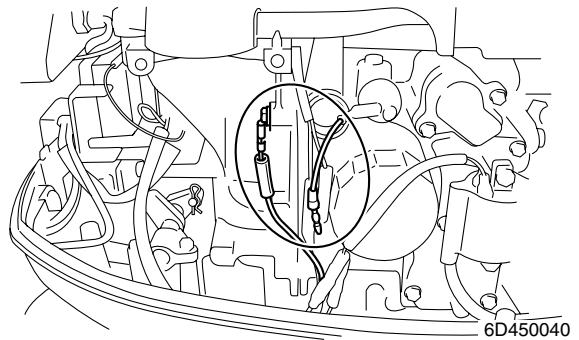
	Digital circuit tester: 90890-03174
	Peak voltage adapter B: 90890-03172

	CDI unit output peak voltage: Orange-ground lead		
r/min	Loaded		
	Cranking	1,500	3,500
DC V	155	170	170

NOTE: _____
 Replace the CDI unit if output peak voltages of the pulser and charge coils are on or above specification and the CDI unit output peak voltage is below specification.

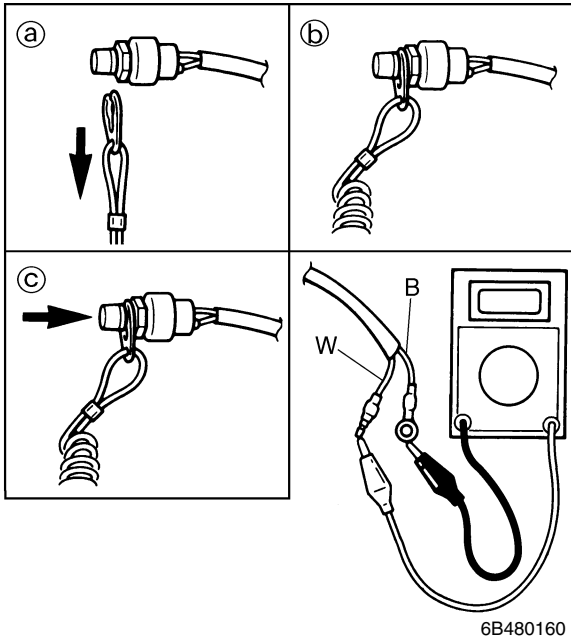
Checking the oil pressure warning lamp


1. Disconnect the connector from oil pressure switch.
2. Start the engine, then ground the oil pressure switch lead.
3. Check the lamp comes ON. Replace if necessary.



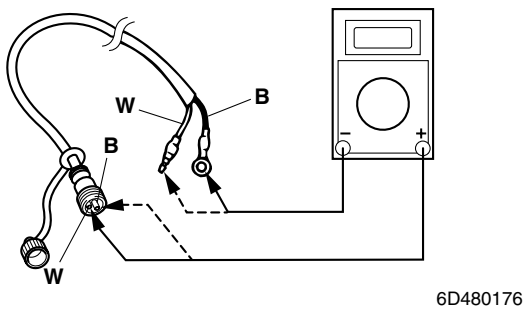
Checking the engine stop lanyard switch

1. Check the engine stop lanyard switch for continuity. Replace if there is no continuity.



	Lead color	
	White (W)	Black (B)
Clip removed (a)	○ — ○	○ — ○
Clip installed (b)	○ — ○	○ — ○
Engine shut-off button pushed (c)	○ — ○	○ — ○

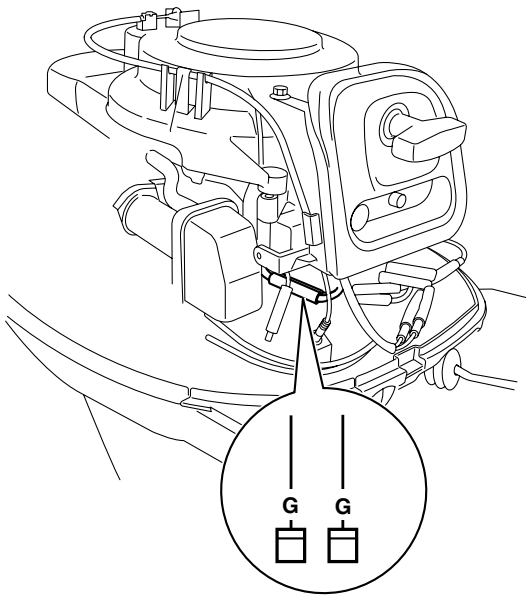
2. For remote control model. Check the engine stop lanyard switch connector for continuity. Replace if necessary.




Charging system


Checking the lighting coil

1. Connect the digital circuit tester lead to the lighting coil.
2. Measure the lighting coil output peak voltage. If the measurement is below specification, check the lead and measure the lighting coil resistance. Replace if necessary.




6D480200

 Digital circuit tester: 90890-03174
Peak voltage adapter B:
90890-03172

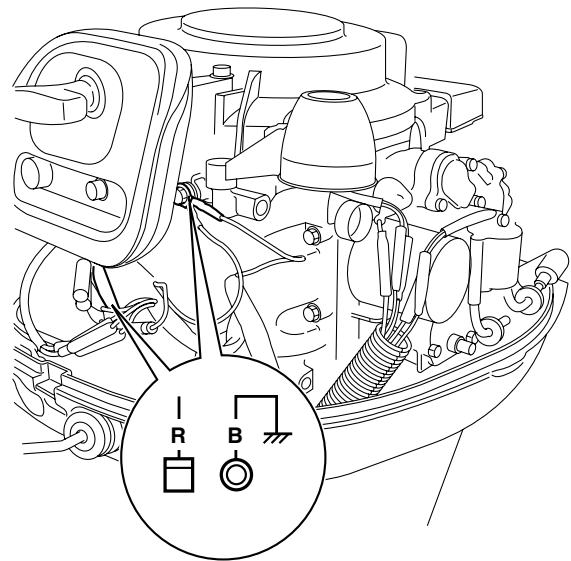
 Lighting coil peak voltage:
Green (G) – Green (G)

r/min	Unloaded		
	Cranking	1,500	3,500
DC V	14	30	70


 Lighting coil resistance
(use as reference):
Green (G) – Green (G)
0.48 – 0.72 Ω at 20°C (68°F)


Checking the rectifier regulator

1. Connect the digital circuit test leads to the red and black or ground leads from the rectifier regulator.
2. Measure the rectifier regulator output peak voltage. If the measurement is below specification, check the leads. Replace if necessary.

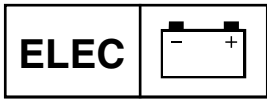


6D480210

 Digital circuit tester: 90890-03174
Peak voltage adapter B:
90890-03172

 Rectifier regulator peak voltage:
Red (R) – Black (B)

r/min	Unloaded	
	1,500	3,500
DC V	24	38



Electrical systems

— MEMO —

Troubleshooting

Power unit	9-1
Ignition system.....	9-1
Fuel system	9-3
Compression pressure.....	9-4
Lower unit	9-6

NOTE:

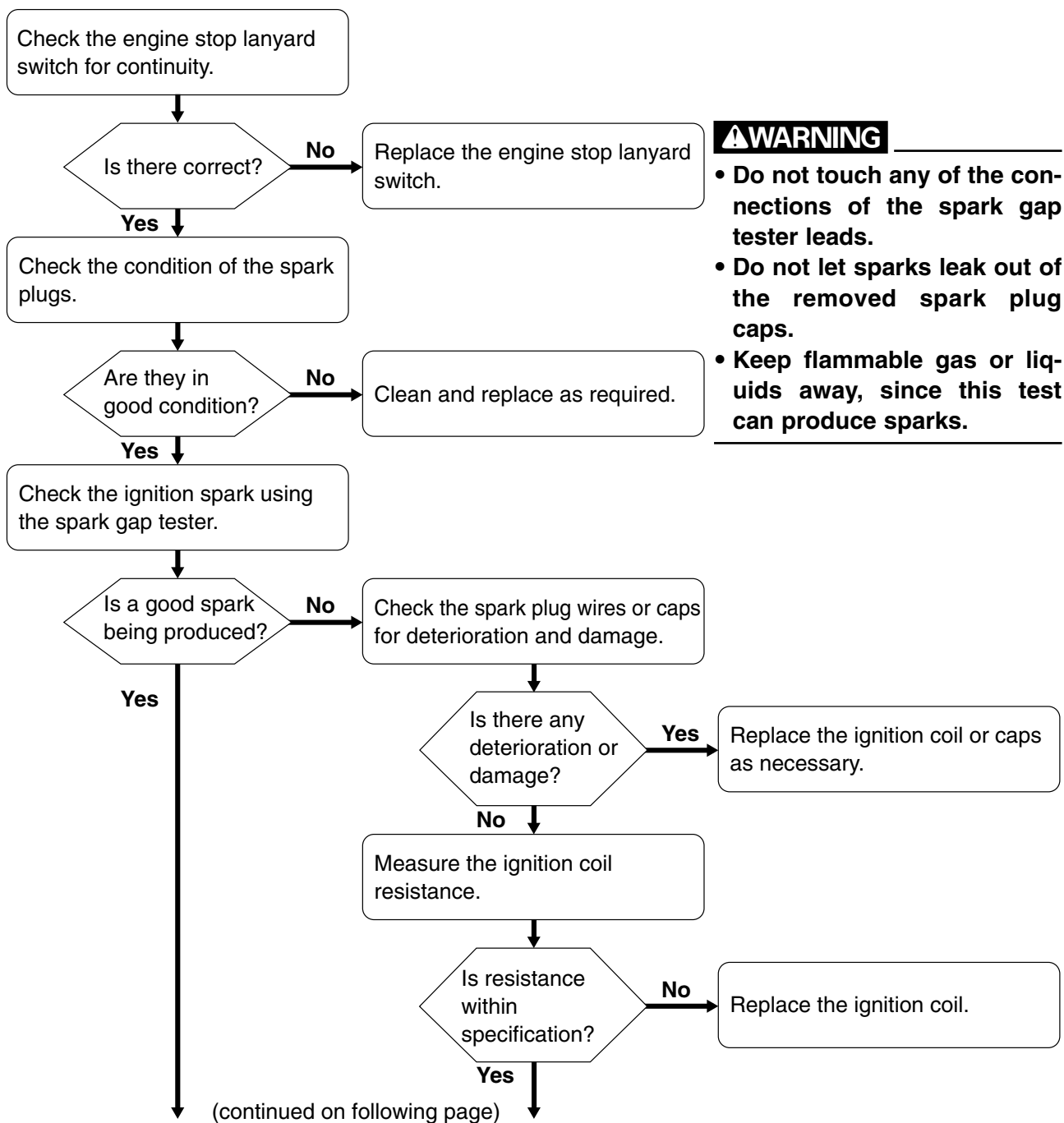
- To diagnose a mechanical malfunction, use the troubleshooting charts pertaining to the trouble located in this chapter. Also, when checking and maintaining the outboard motor, see Chapters 4–8 for safe maintenance procedures.
- Check that all electrical connections are tight and free from corrosion.

Power unit

Symptom: Manual starter turns but engine will not start.

- Check the ignition system, fuel system, and the compression pressure as listed below.
- Be sure the air vent screw on the fuel tank is open.
- Be sure insert the clip into the engine stop lanyard switch.

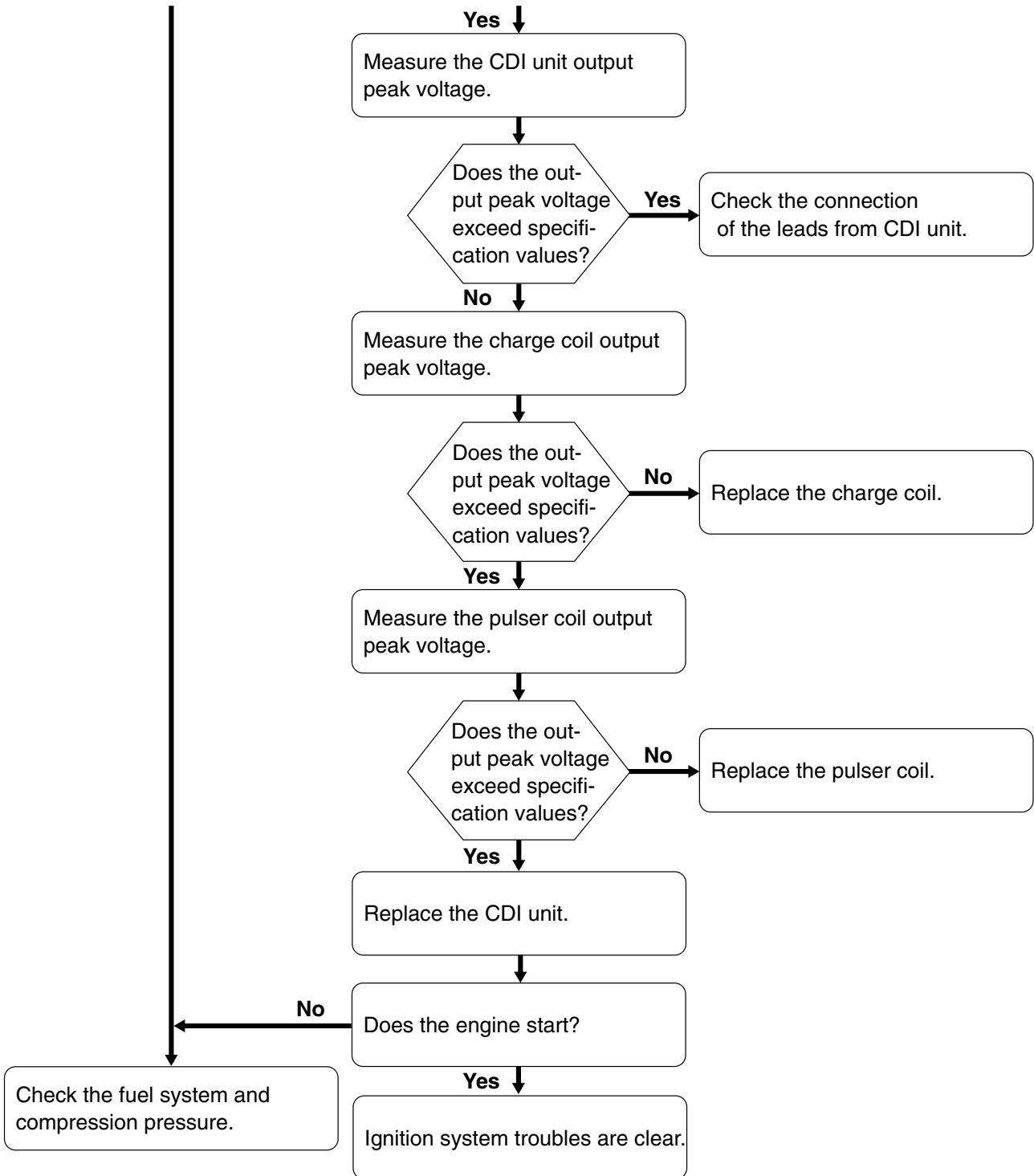
Ignition system



WARNING

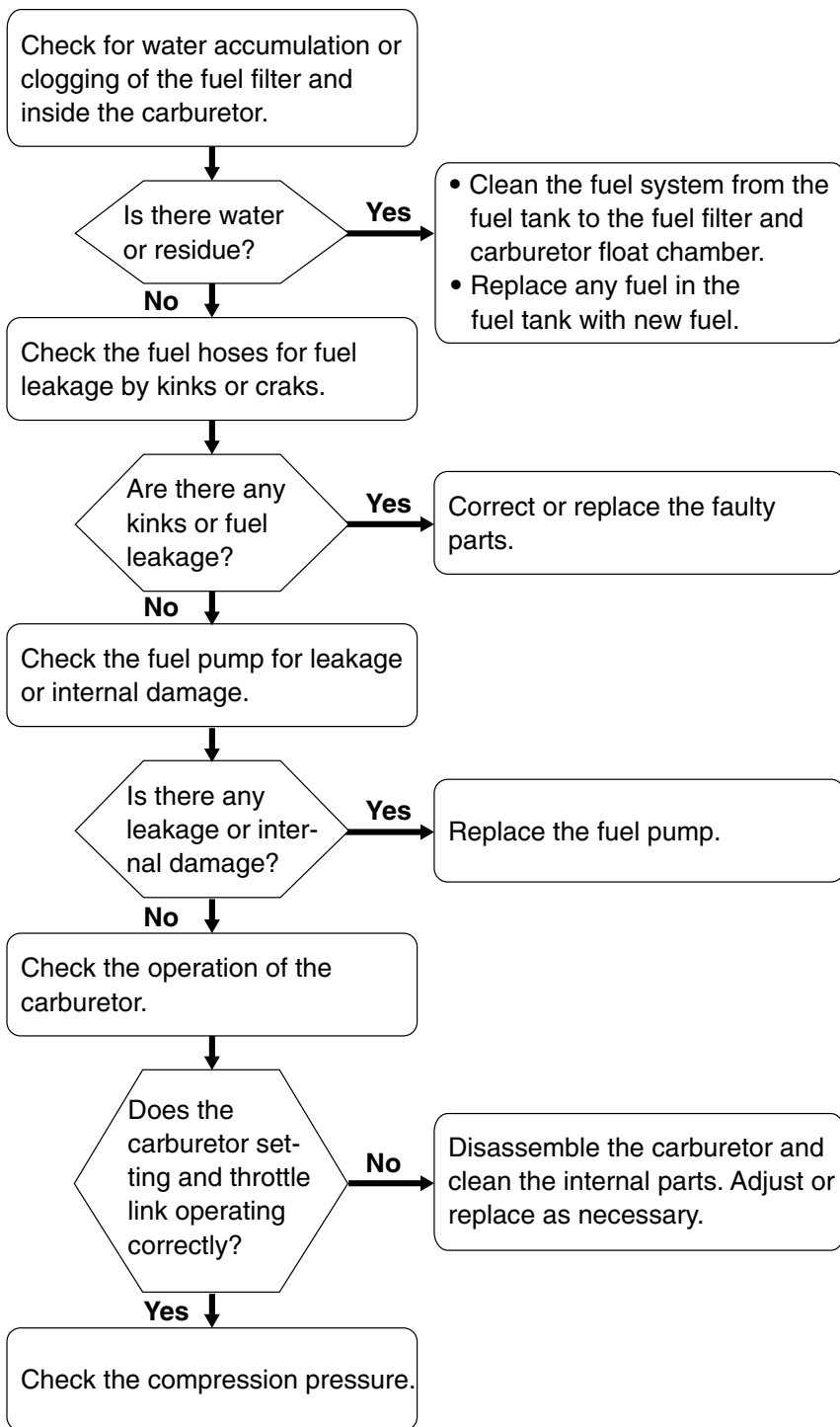
- Do not touch any of the connections of the spark gap tester leads.
- Do not let sparks leak out of the removed spark plug caps.
- Keep flammable gas or liquids away, since this test can produce sparks.

Ignition system (continued from previous page)



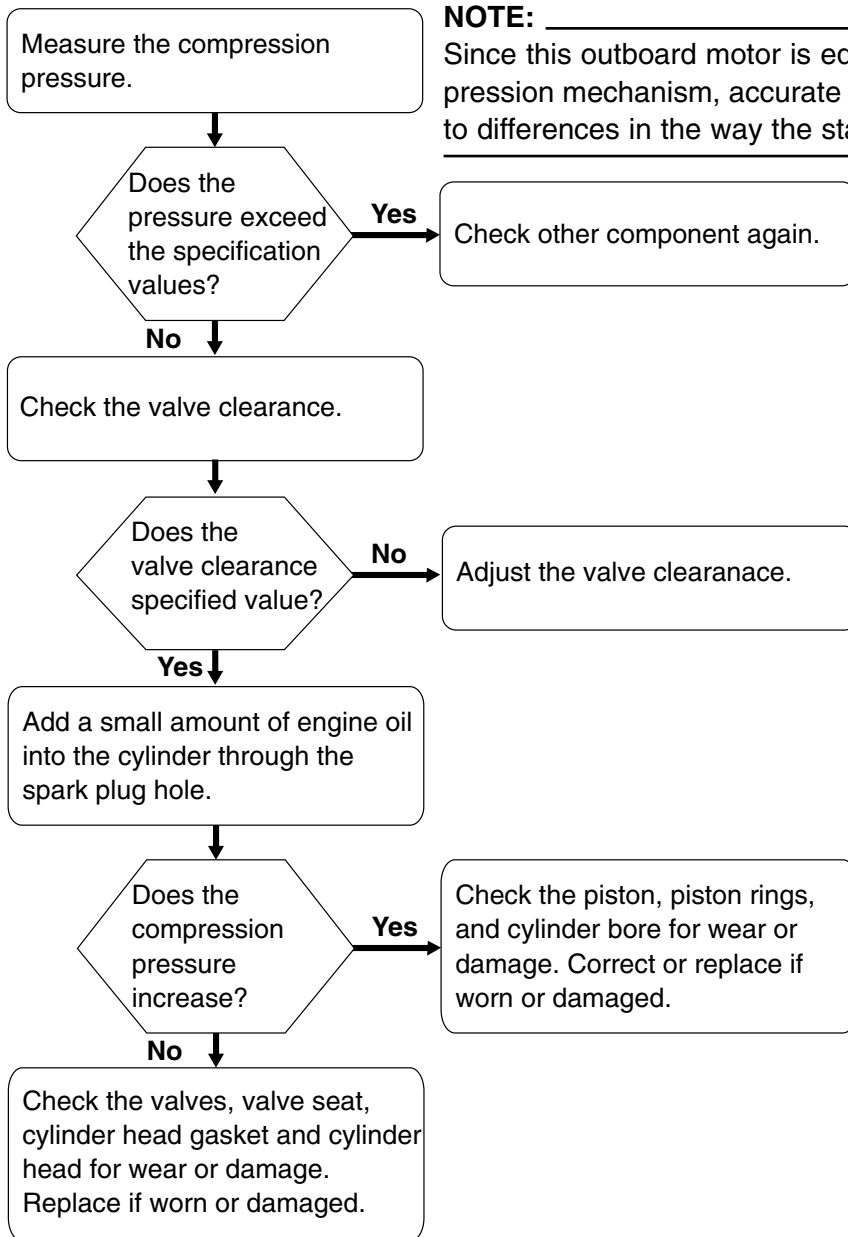
Fuel system

• Consult this chart after the ignition system has been checked.



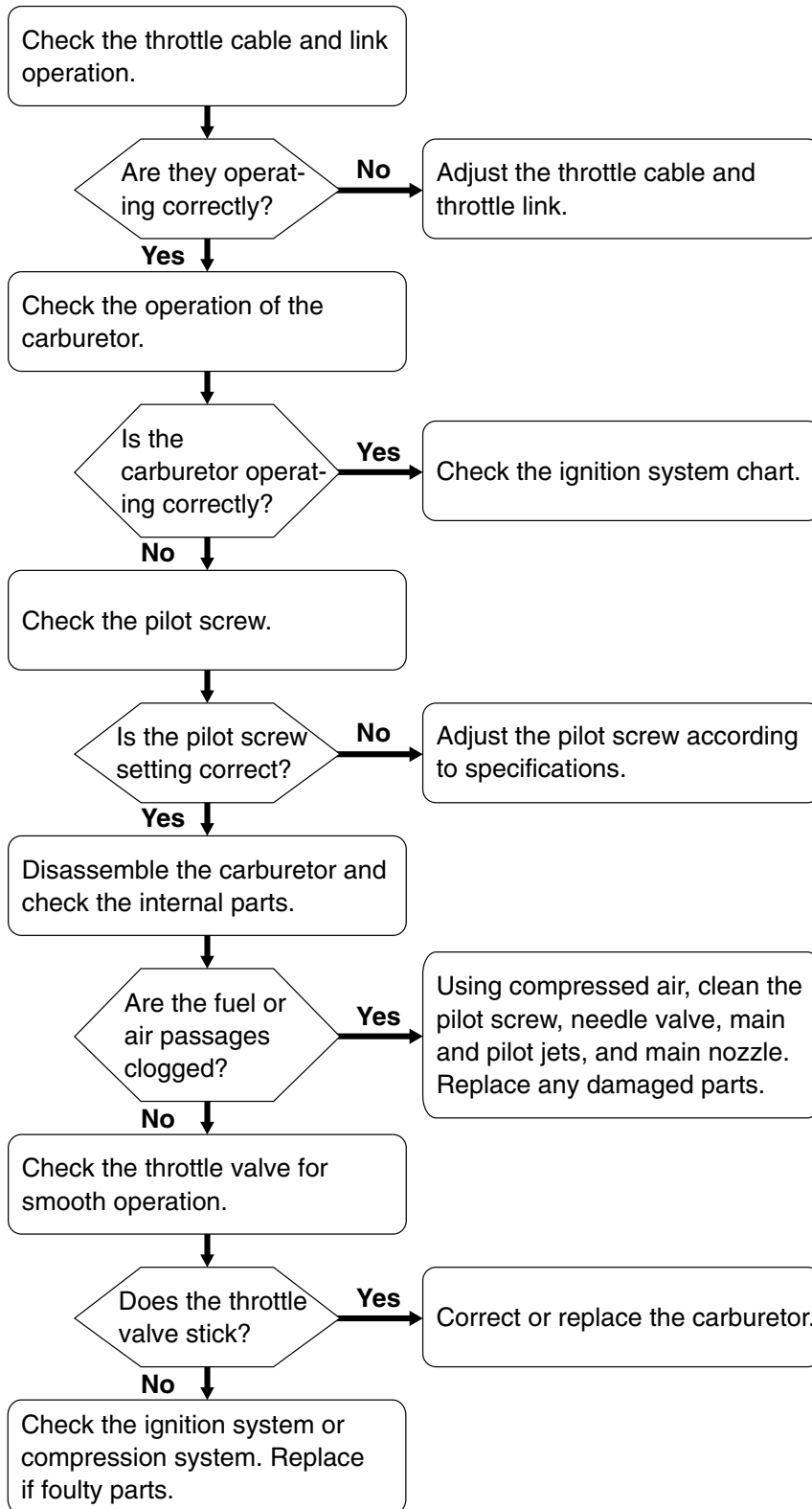
Compression pressure

- Consult this chart after the ignition and fuel systems have been checked.



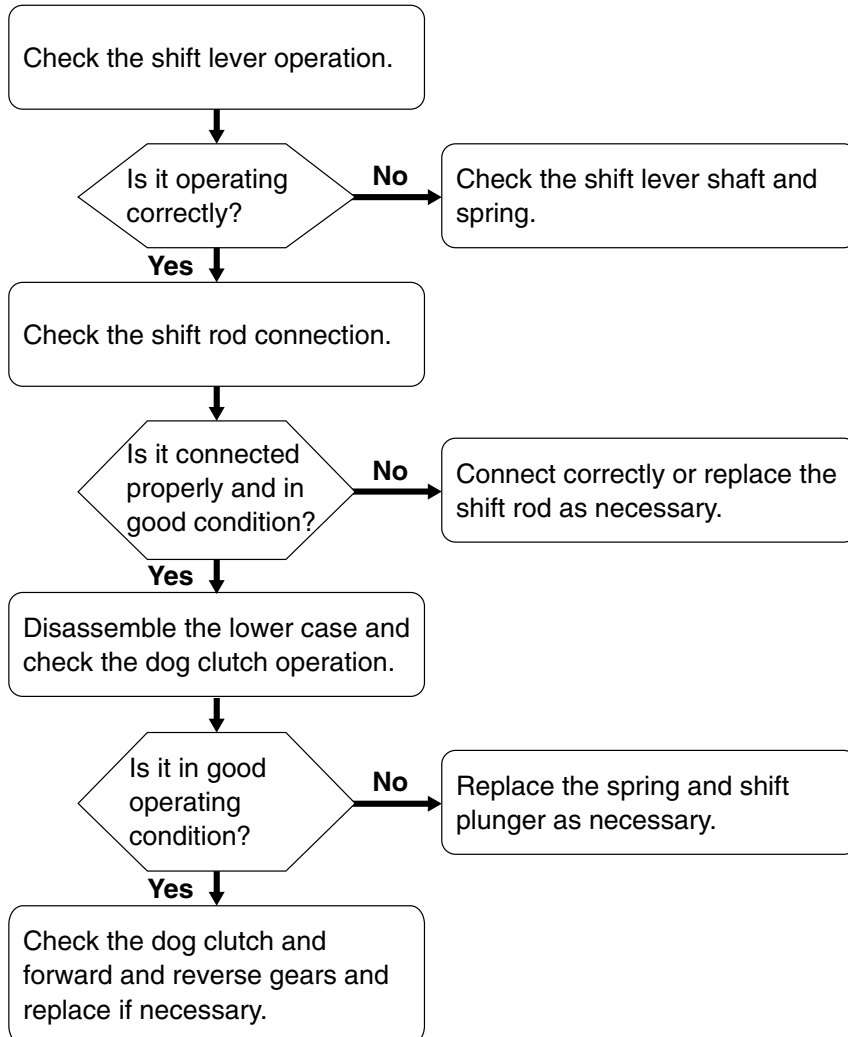
NOTE: _____
 While restoring a damaged part, it is also necessary to trace and solve the cause of the damage.

Symptom: The engine idle speed does not remain steady.



Lower unit

Symptom: The forward and reverse gear shift mechanism does not operate properly.



Index

A.

Adjusting the pilot screw4-10
Adjusting the throttle cable.....3-8
Adjusting the throttle link rod4-10
Aft view.....8-5
After test run1-9
Applicable model.....1-5
Assembling the carburetor4-9
Assembling the cylinder block.....5-47
Assembling the fuel pump.....4-13
Assembling the lower case6-17
Assembling the manual starter5-13
Assembling the piston and connecting rod
assemblies5-45
Assembling the propeller shaft
assembly6-12
Assembling the propeller shaft
housing.....6-12
Assembling the upper case.....7-14

B.

Backlash.....6-26
Bottom cowling.....7-4
Bracket3-11
Break-in.....1-9

C.

Carburetor4-5
Changing the engine oil3-3
Charging system8-12
Checking the CDI unit8-10
Checking the anode3-13
Checking the bearing housing6-16
Checking the bearings6-17
Checking the camshaft5-30
Checking the carburetor.....4-8
Checking the charge coil.....8-9
Checking the compression pressure.....5-3
Checking the connecting rod
big end side clearance5-41
Checking the connecting rod
small end inside diameter5-41
Checking the cooling water passages3-7
Checking the cooling water pilot hole1-8
Checking the crankshaft5-42
Checking the crankshaft main journal oil
clearance.....5-43
Checking the crankshaft pin
oil clearance5-42
Checking the cylinder bore5-39
Checking the cylinder head.....5-31
Checking the diaphragm and valves.....4-13
Checking the drive shaft6-17

Checking the electrical components8-2
Checking the engine idle speed.....3-10
Checking the engine oil.....3-3
Checking the engine oil level1-6
Checking the engine stop
lanyard switch1-8
Checking the engine stop
lanyard switch.....8-11
Checking the fuel filter3-3
Checking the fuel filter4-4
Checking the fuel joint.....4-4
Checking the fuel line.....3-3
Checking the fuel pump4-12
Checking the fuel system.....1-6
Checking the gear oil1-6
Checking the gear oil level.....3-12
Checking the gearshift and
throttle operation1-7
Checking the gearshift operation3-9
Checking the ignition coil8-8
Checking the ignition spark gap.....8-7
Checking the ignition timing3-11
Checking the lighting coil8-12
Checking the lower case6-17
Checking the lower unit for air leakage3-13
Checking the oil pressure5-3
Checking the oil pressure switch5-4
Checking the oil pressure
warning lamp.....8-10
Checking the oil pump5-31
Checking the outboard motor
mounting height.....1-6
Checking the pinion gear and
forward gear6-16
Checking the piston clearance.....5-39
Checking the piston diameter5-38
Checking the piston pin.....5-41
Checking the piston pin boss bore.....5-41
Checking the piston ring grooves5-40
Checking the piston ring
side clearance5-40
Checking the piston rings.....5-39
Checking the propeller3-13
Checking the propeller shaft6-11
Checking the propeller shaft housing.....6-11
Checking the pulser coil.....8-8
Checking the rectifier regulator8-12
Checking the remote control cables1-7
Checking the rocker arms and
rocker arm shaft5-29
Checking the shift rod6-17
Checking the spark plug caps.....8-7
Checking the spark plugs.....3-6
Checking the spiral spring.....5-12

Checking the start-in-gear protection.....	3-7
Checking the steering system.....	1-7
Checking the thermostat.....	3-7
Checking the tilt operation.....	3-11
Checking the timing belt.....	3-5
Checking the timing belt and sprockets.....	5-19
Checking the top cowling.....	3-14
Checking the upper case.....	7-14
Checking the valve clearance.....	5-4
Checking the valve guides.....	5-26
Checking the valve seat.....	5-27
Checking the valve springs.....	5-25
Checking the valves.....	5-25
Checking the water pump.....	6-8
Compression pressure.....	9-4
Control system.....	3-7
Cylinder block.....	5-34
Cylinder head.....	5-21

D.

Dimensions.....	2-8
Disassembling the carburetor.....	4-8
Disassembling the cylinder block.....	5-37
Disassembling the fuel pump.....	4-12
Disassembling the lower case.....	6-15
Disassembling the manual starter.....	5-12
Disassembling the oil pan.....	7-13
Disassembling the piston and connecting rod assemblies.....	5-38
Disassembling the propeller shaft assembly.....	6-11
Disassembling the propeller shaft housing assembly.....	6-10
Disassembling the upper case.....	7-13
Disassembly and assembly.....	1-4
Drive shaft and lower case.....	6-14

E.

Electrical.....	2-7
Electrical components.....	8-3

F.

Fire prevention.....	1-3
Fuel line.....	4-3
Fuel pump.....	4-11
Fuel system.....	3-3, 9-3

G.

General.....	3-13
General specifications.....	2-1
General torques.....	2-11
Good working practices.....	1-4

H.

Hose routing.....	4-2
How to use this manual.....	1-1

I.

Identification.....	1-5
Ignition and ignition control system.....	8-7
Ignition system.....	9-1
Index.....	
Installing the cylinder head.....	5-32
Installing the drive shaft.....	6-19
Installing the lower unit.....	6-21
Installing the power unit.....	5-49
Installing the propeller shafts housing.....	6-19
Installing the timing belt and sprockets.....	5-19
Installing the valves.....	5-31
Installing the water pump.....	6-20

L.

Lower unit.....	2-6, 3-12, 6-4, 9-6
Lubricating the outboard motor.....	3-14

M.

Maintenance interval chart.....	3-2
Maintenance specifications.....	2-3
Manual format.....	1-1
Measuring low resistance.....	8-2
Measuring the forward and reverse gear backlash.....	6-26
Measuring the peak voltage.....	8-2

P.

Parts, lubricants, and sealants.....	1-3
Power unit.....	2-3, 3-3, 5-3, 9-1
Predelivery checks.....	1-6
Propeller selection.....	1-5
Propeller shaft housing.....	6-9
Propeller size.....	1-5

Index

R.

- Refacing the valve seat.....5-28
- Removing the cylinder head5-24
- Removing the drive shaft and
forward gear6-15
- Removing the lower unit6-7
- Removing the power unit5-14
- Removing the propeller shaft
housing assembly6-10
- Removing the timing belt and
sprockets5-18
- Removing the water pump6-7
- Replacing the gear oil3-12
- Replacing the oil filter.....3-4
- Replacing the timing belt.....3-5
- Replacing the valve guides5-26

S.

- Safety while working1-3
- Selecting the crankshaft main journal
bearing5-44
- Selecting the forward gear shims6-24
- Selecting the pinion shims6-24
- Selecting the reverse gear shims6-25
- Selection1-5
- Self-protection1-3
- Serial number1-5
- Shimming6-23, 6-24
- Special service tools
.....3-1, 4-1, 5-1, 6-1, 7-1, 8-1
- Specified torques2-10
- Starboard view8-4
- Symbols1-2

T.

- Test run1-8
- Tightening torques2-10
- Tiller handle.....7-2
- Timing belt and sprockets5-17
- Top view8-3

U.

- Upper case and bracket unit.....7-7


V.

- Ventilation.....1-3

W.

- Water pump.....6-6
- Wiring harness8-6



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