

E60H

SERVICE MANUAL

69D-28197-5G-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.

**E60H
SERVICE MANUAL
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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 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:

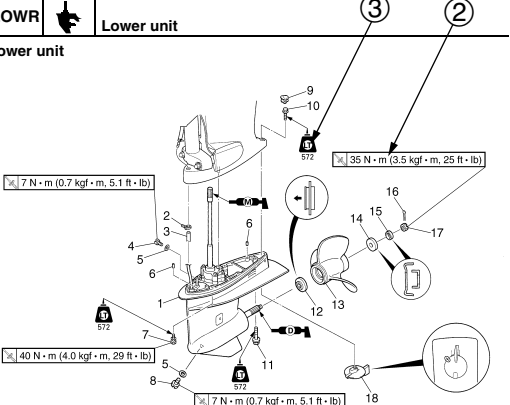
For troubleshooting procedures, see Chapter 9, "Troubleshooting."

LOWR 

Lower unit


③ ②

Lower unit



No.	Part name	Qty	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
62Y6A0K
62Y5A11

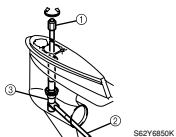
LOWR 


Lower unit

①

Removing the drive shaft

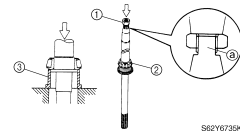
1. Remove the drive shaft assembly and pinion, and then pull out the forward gear.



 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:

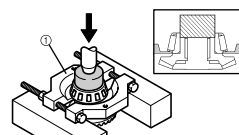
- Do not press the drive shaft threads ③ directly.

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

 Bearing inner race attachment ②: 90890-06639

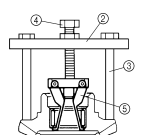
Disassembling the forward gear


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



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
62Y6A0K
62Y5A11

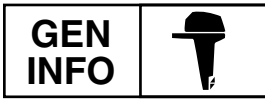
④

⑤

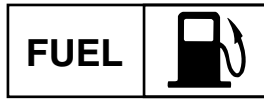
Symbols

The symbols below indicate the content of a chapter.

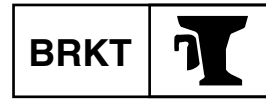
General information



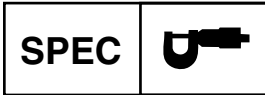
Fuel system



Bracket unit



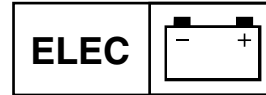
Specifications



Power unit



Electrical systems



Periodic checks and adjustments



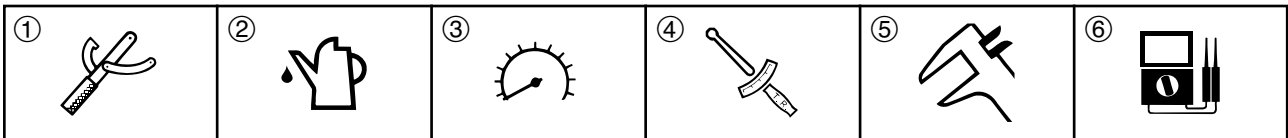
Lower unit



Troubleshooting

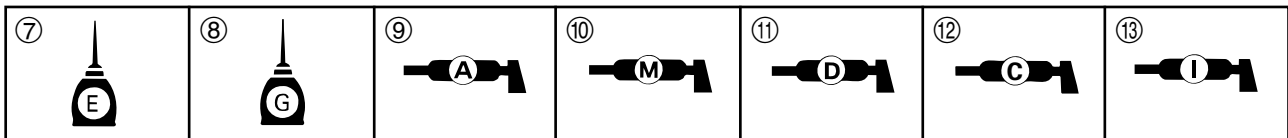


Symbols ① to ⑥ indicate specific data.



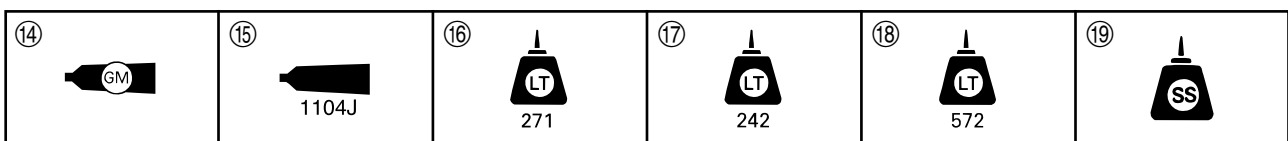
- ① Special tool
- ② Specified oil or fluid
- ③ Specified engine speed
- ④ Specified tightening torque
- ⑤ Specified measurement
- ⑥ Specified electrical value (resistance, voltage, electric current)

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



- ⑦ Apply Yamaha 2-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 Three bond 1104J
- ⑯ Apply LOCTITE 271 (red)
- ⑰ Apply LOCTITE 242 (blue)
- ⑱ Apply LOCTITE 572
- ⑲ Apply silicon sealant

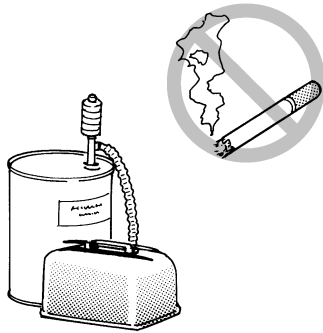


Safety while working

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

Fire prevention

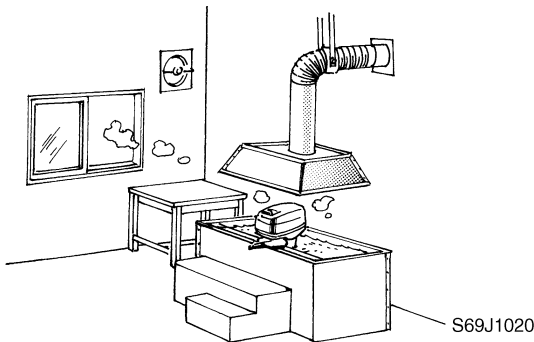
Gasoline is highly flammable. Keep gasoline and all flammable products away from heat, sparks, and open flames.



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.

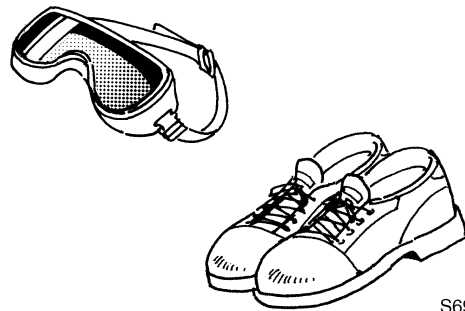


S69J1020

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.

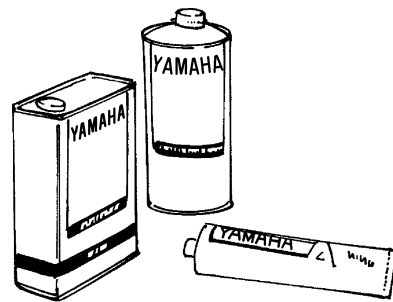
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.



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.

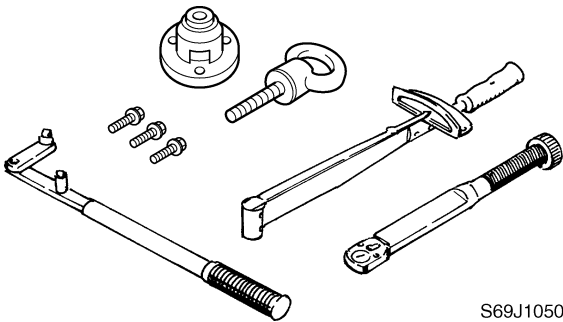
1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water 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.



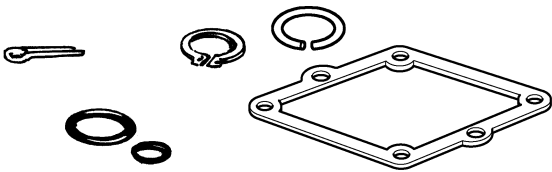
S69J1050

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

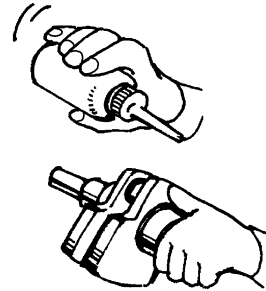
Always use new gaskets, seals, O-rings, cotter pins, circlips, etc., when installing or assembling parts.



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

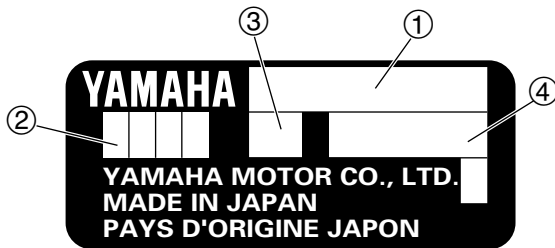
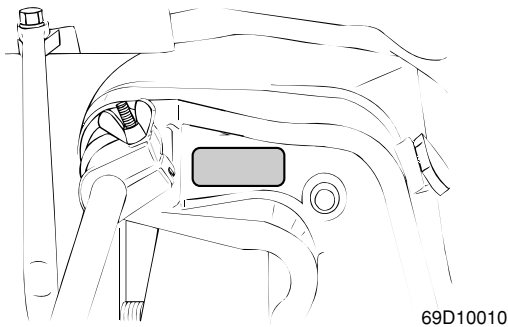
Applicable model

This manual covers the following models.

Applicable models
E60HMHD, E60HWHD, E60HWD

Serial number

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



6B410020

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

Model name	Approved model code	Starting serial No.
E60H	6K5K	1002506-

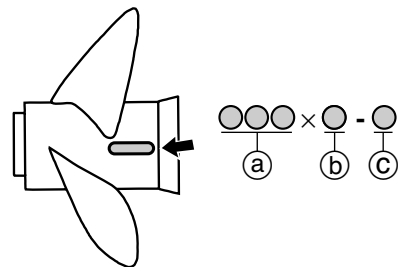
Propeller selection

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.

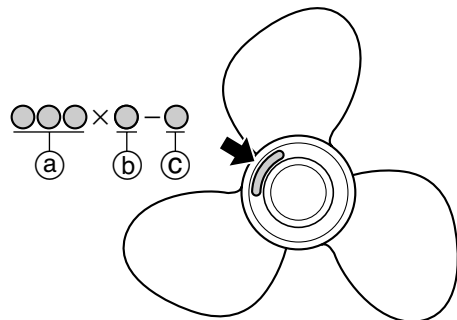
Use the following information as a guide for selecting a propeller that meets the operating conditions of the boat and the outboard motor.

Propeller size

The size of the propeller is indicated as shown.



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69D10020

- Ⓐ Propeller diameter (in inches)
- Ⓑ Propeller pitch (in inches)
- Ⓒ 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.

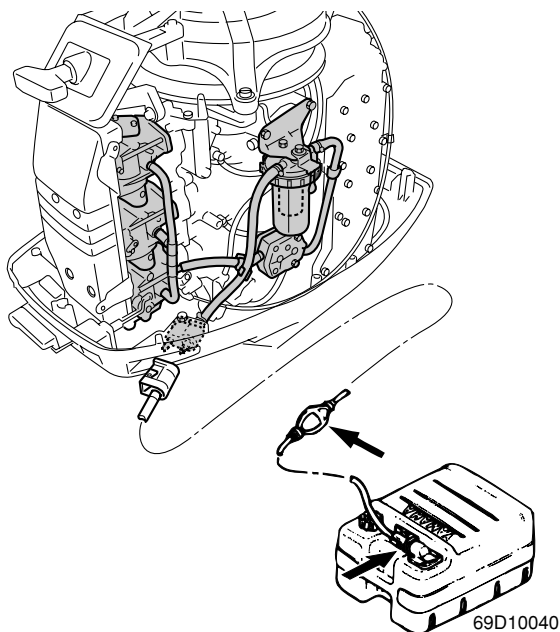
Propeller size (in)	Material
14 × 11 - K	Aluminum
13 5/8 × 13 - K	
13 1/2 × 14 - K	
13 1/2 × 15 - K	
13 1/2 × 16 - K	
13 × 17 - K	
13 1/4 × 17 - K	
13 × 19 - K	
13 × 21 - K	
12 5/8 × 21 - K	
13 × 23 - K	
13 × 25 - K	

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.



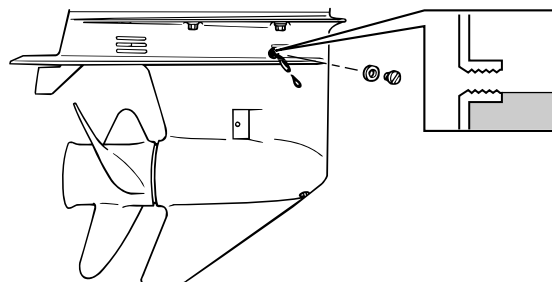
CAUTION:

Use pre-mixed fuel only.

Fuel and oil mixing ratio is 50:1. For break-in period, 25:1 mixture shall be used.

Checking the gear oil

1. Check the gear oil level.



69D10055

Checking the battery (WHD, WD)

1. Check the capacity, electrolyte level, and specified gravity of the battery.



Recommended battery capacity:
 CCA/EN: 430 A
 20HR/IEC: 70 Ah
 Electrolyte specified gravity:
 1.280 at 20°C (68°F)

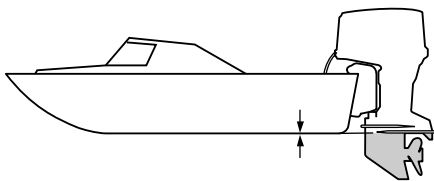
2. Check that the positive and negative battery leads are securely connected.





Checking the outboard motor mounting height

1. Check that the anti-cavitation plate is aligned with the bottom of the boat. 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.



69D10045

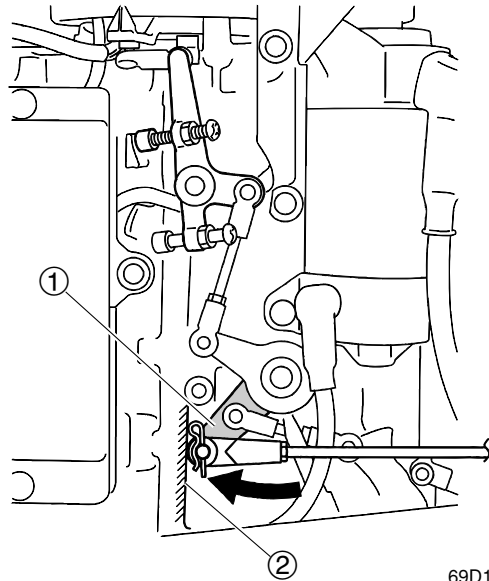
NOTE:

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.

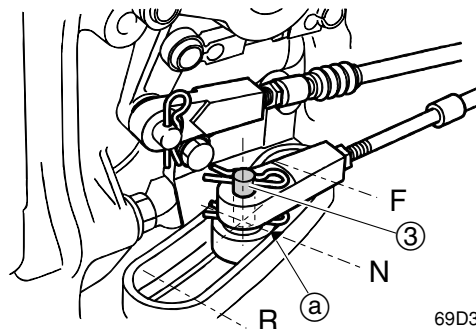
Checking the remote control cables (remote control model)

1. Set the remote control lever to the neutral position and fully close the throttle lever.
2. Check that the control lever ① is in its fully closed position, and check the lever is contact crankcase ②.

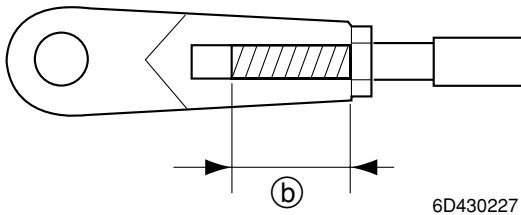


69D10060

3. Check that the shift lever or remote control lever is in the neutral position, and check that the center of the set pin ③ is aligned with the mark ④ on the shift bracket.



69D30220



6D430227

⚠ WARNING

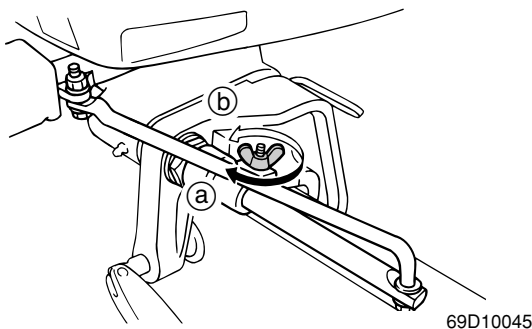
The shift/throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) **(b)**.

NOTE:

Check the throttle valve fully open, after setting the remote control cables.

Checking the steering system

1. Check the steering friction for proper adjustment.

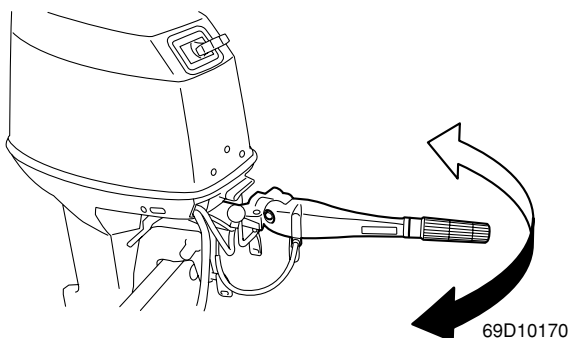


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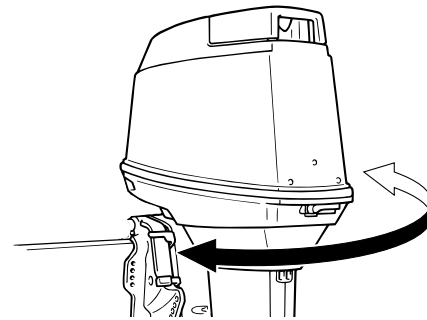
NOTE:

- To increase the friction, turn the friction adjusting bolt in direction **(a)**.
- To decrease the friction, turn the friction adjusting bolt in direction **(b)**.

2. Check that the steering operates smoothly.



69D10170

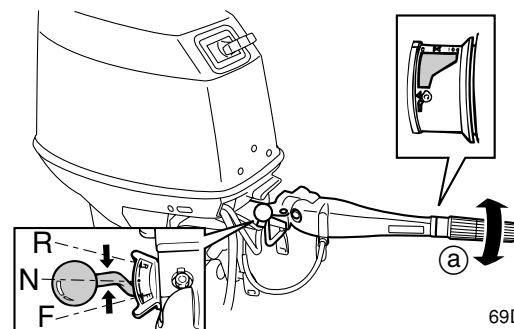


69D10180

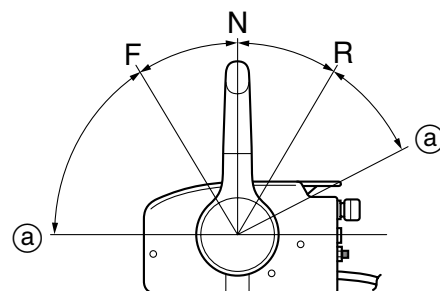
3. Check that there is no interference with wires or hoses when the outboard motor is steered.

Checking the gear shift and throttle operation

1. Check that the gear shift operates smoothly when the shift lever or remote control lever is shifted from neutral to forward or reverse.
2. Check that the throttle operates smoothly when the throttle grip (tiller handle model) is turned from the fully closed position to the fully open position **(a)**. Check that the throttle operates smoothly when the remote control lever (remote control model) is shifted from forward or reverse to the fully open positions **(a)**.



69D10190

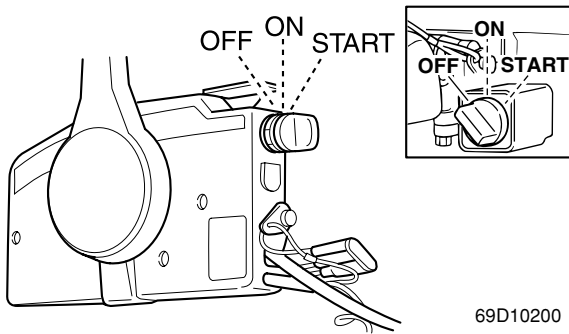


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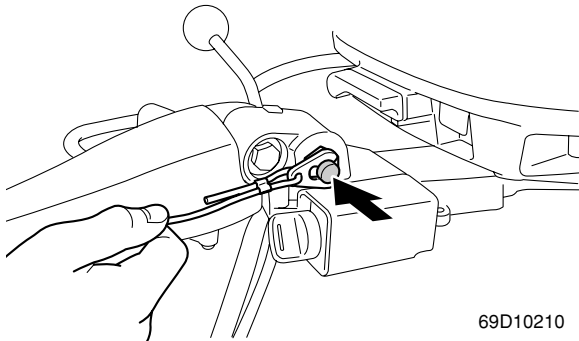
Checking the engine start switch, engine stop lanyard switch and engine stop button

1. Check that the engine starts when the engine start switch is turned to START. (WHD, WD)
2. Check that the engine turns off when the engine start switch is turned to OFF. (WHD, WD)

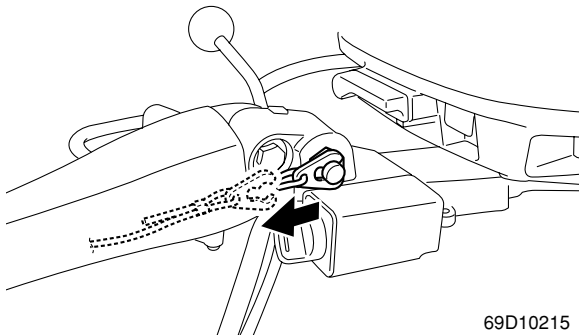


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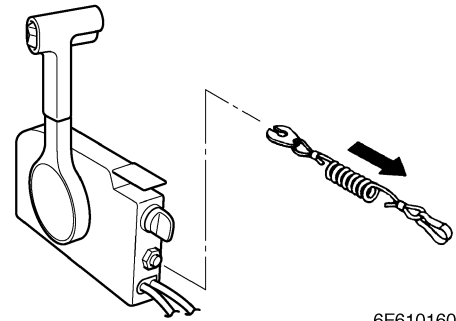
3. Check that the engine turns off when the engine stop lanyard switch is pushed or the engine stop lanyard is pulled from the engine stop lanyard switch.



69D10210



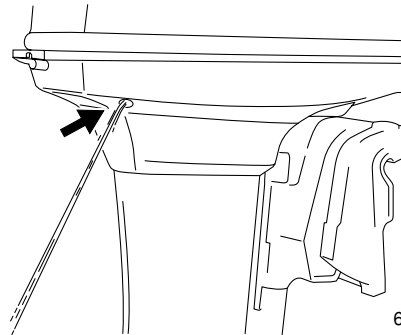
69D10215



6F610160

Checking the cooling water pilot hole

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



6F610170

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. Run the outboard motor for 1 hour at 3,000 r/min or at half throttle, then for another hour at 4,000 r/min or at 3/4 throttle.
5. Check that the outboard motor does not tilt up when shifting into reverse and that water does not flow in over the transom.

NOTE: _____

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

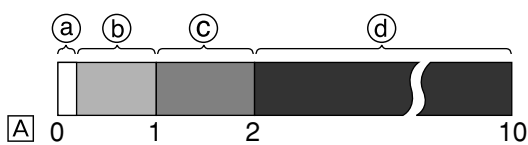
Break-in

During the test run, perform the break-in operation in the following 5 stages.

1. 10 minutes (a) at the lowest possible speed. A fast idle in neutral is best.
2. 50 minutes (b) at 1/2 throttle (approximately 3,000 r/min) or less. Vary engine speed occasionally. On an easy-planing boat, accelerate at full throttle onto plane, then immediately reduce the throttle to 3,000 r/min or less.
3. 1 hour (c) at 3/4 throttle (approximately 4,000 r/min). Vary engine speed occasionally. Run at full throttle for 1 minute, then allow about 10 minutes of operation at 3/4 throttle or less to let the engine cool.
4. 8 hours (d) at any speed, but avoid operating at full throttle for more than 5 minutes at a time. Let the engine cool between full-throttle runs. Vary engine speed occasionally.
5. After the first 10 hours. Use standard pre-mix ratio of fuel and oil. Refer to page 1-6.

After test run

1. Check for water in the gear oil.
2. Check for fuel leakage in the cowling.
3. Flush the cooling water passage with fresh water using the flushing kit and with the engine running at idle.



6F610180

[A] Hours

— MEMO —

Specifications

- General specification 2-1**

- Maintenance specification 2-3**
 - Power unit 2-3
 - Lower unit 2-5
 - Electrical 2-5
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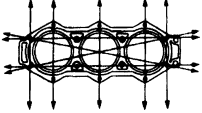

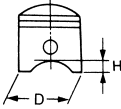
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General specification

Item	Unit	Model		
		E60HMHD	E60HWHD	E60HWD
Dimensions				
Overall length	mm (in)	1,197 (47.1)		713 (28.1)
Overall width	mm (in)	364 (14.3)		
Overall height				
(S)	mm (in)	1,358 (53.5)	–	–
(L)	mm (in)	1,479 (58.2)		
(X)	mm (in)	1,556 (61.3)	–	–
Boat transom height				
(S)	mm (in)	381 (15.0)	–	–
(L)	mm (in)	508 (20.2)		
(X)	mm (in)	635 (25.0)	–	–
Weight				
(with aluminum propeller)				
(S)	kg (lb)	96.0 (212)	–	–
(L)	kg (lb)	102.0 (225)	105.0 (231)	100.0 (220)
(X)	kg (lb)	105.0 (231)	–	–
Performance				
Maximum output	kW (hp)	44.1 (60) at 5,000 r/min		
Full throttle operating range	r/min	4,500–5,500		
Maximum fuel consumption	L (US gal, Imp gal)/hr	25.5 (6.7, 5.6) at 5,500 r/min		
Engine idle speed	r/min	950–1,050		
Power unit				
Engine type		2-stroke, L		
Cylinder quantity		3		
Total displacement	cm ³ (cu. in)	849.0 (51.81)		
Bore x stroke	mm (in)	72.0 × 69.5 (2.83 × 2.74)		
Compression ratio		6.10		
Intake system		Reed valve		
Scavenging system		Loop charge		
Control system		Tiller handle	Tiller handle	Remote control
Starting system		Manual	Manual and electric	
Fuel system		Carburetor		
Ignition control system		CDI		
Maximum generator output	(W) V, A	(80)	12, 6	
Starting enrichment		Choke valve		
Spark plug	(NGK)	B8HS-10 (NGK), BR8HS-10 (NGK)		
Cooling system		Water		
Exhaust system		Propeller boss		
Lubrication system		Pre-mixed fuel		

Maintenance specification

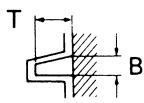
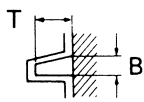
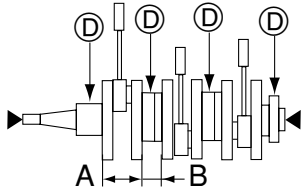
Power unit

Item	Unit	Model		
		E60HMHD	E60HWHD	E60HWD
Power unit Minimum compression pressure (*1)	kPa (kgf/cm ² , psi)	540 (5.4, 76)		
Cylinder head Warpage limit  (lines indicate straightedge position)	mm (in)	0.1 (0.0039)		
Cylinders Bore size Wear limit Taper limit Out-of-round limit 	mm (in) mm (in) mm (in) mm (in)	72.000–72.020 (2.8346–2.8354) 72.1 (2.84) 0.08 (0.0032) 0.05 (0.0020)		
Pistons Piston diameter (D) Measuring point (H) Piston-to-cylinder clearance (limit) Piston pin boss bore Oversize piston 1st 2nd Oversize piston diameter 1st 2nd 	mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in) mm (in)	71.940–71.965 (2.8323–2.8333) 10.0 (0.39) 0.055–0.060 (0.0022–0.0024) 0.110 (0.0043) 19.904–19.915 (0.7836–0.7841) 0.25 (0.010) 0.50 (0.020) 72.190–72.215 (2.8421–2.8431) 72.440–72.465 (2.8520–2.8529)		
Piston pins Outside diameter	mm (in)	19.895–19.900 (0.7833–0.7835)		

(*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.

Item	Unit	Model		
		E60HMHD	E60HWHD	E60HWD
Piston rings				
Top ring				
Dimension B 	mm (in)	1.970–1.990 (0.0776–0.0783)		
Dimension T	mm (in)	2.900–3.100 (0.1142–0.1220)		
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)		
Side clearance	mm (in)	0.03–0.07 (0.0012–0.0028)		
Oversize diameter				
1st	mm (in)	72.25 (2.845)		
2nd	mm (in)	72.50 (2.854)		
2nd piston ring 				
Dimension B	mm (in)	1.970–1.990 (0.0776–0.0783)		
Dimension T	mm (in)	2.900–3.100 (0.1142–0.1220)		
End gap	mm (in)	0.30–0.50 (0.0118–0.0197)		
Side clearance	mm (in)	0.03–0.07 (0.0012–0.0028)		
Oversize diameter				
1st	mm (in)	72.25 (2.845)		
2nd	mm (in)	72.50 (2.854)		
Connecting rods				
Small-end inside diameter	mm (in)	24.900–24.912 (0.9803–0.9808)		
Big-end side clearance	mm (in)	0.200–0.700 (0.0079–0.0276)		
Small-end axial play limit	mm (in)	2.0 (0.08)		
Crankshaft				
Crankshaft width A	mm (in)	57.90–57.95 (2.280–2.282)		
Crankshaft width B	mm (in)	35.88–36.10 (1.413–1.421)		
Crankpin diameter	mm (in)	26.994–27.000 (1.0628–1.0630)		
Runout limit	mm (in)	0.05 (0.0020)		
				
Thermostat				
Opening temperature	°C (°F)	48–52 (118.4–125.6)		
Fully open temperature	°C (°F)	60 (140)		
Valve open lower limit	mm (in)	3.0 (0.12)		
Reed valves				
Valve stopper height	mm (in)	2.8–3.2 (0.110–0.126)		
Valve bending limit	mm (in)	0.2 (0.0079)		

Item	Unit	Model		
		E60HMHD	E60HWHD	E60HWD
Carburetor		6K503		
ID mark		135		
Main jet (M.J.)	#	145		
Main air jet (M.A.J.)	#	3.0 (0.12)		
Main nozzle (M.N.)	mm (in)	70		
Pilot jet (P.J.)	#	85		
Pilot air jet (P.A.J.)	#	1 1/4 – 1 3/4		
Pilot screw (P.S.)	turns out	1.4 (0.06)		
Valve seat size	mm (in)	12.0–16.0 (0.47–0.63)		
Float height	mm (in)			

Lower unit

Item	Unit	Model		
		E60HMHD	E60HWHD	E60HWD
Gear backlash				
Pinion-to-forward	mm (in)	0.14–0.46 (0.0055–0.0181)		
Pinion-to-reverse	mm (in)	0.77–1.16 (0.0303–0.0457)		
Pinion gear shims	mm	0.10, 0.20, 0.15, 0.18, 0.30, 0.40, 0.50		
Forward gear shims	mm	0.10, 0.20, 0.15, 0.18, 0.30, 0.40, 0.50		
Reverse gear shims	mm	0.10, 0.20, 0.15, 0.18, 0.30, 0.40, 0.50		

Electrical

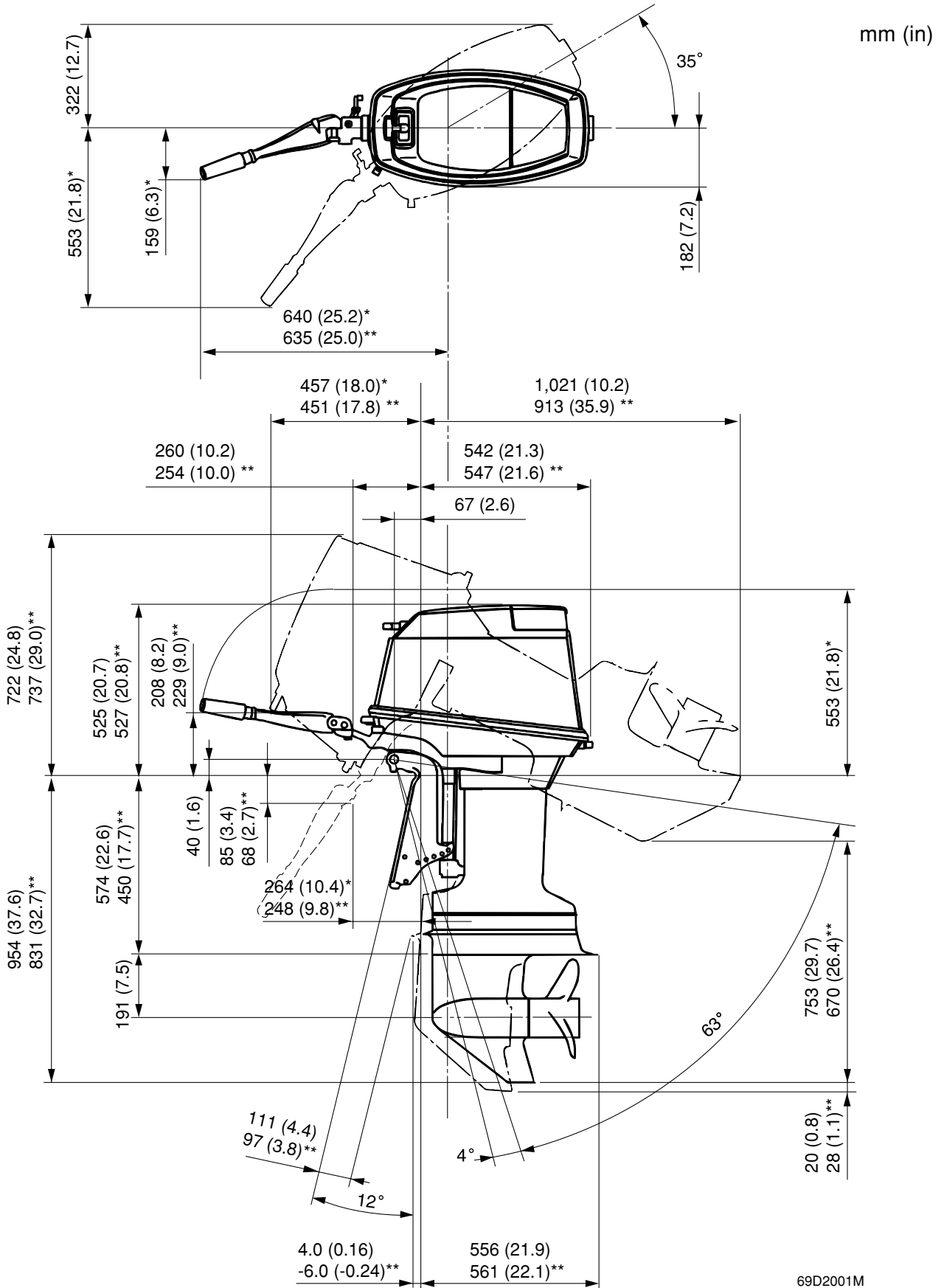
Item	Unit	Model		
		E60HMHD	E60HWHD	E60HWD
Ignition and ignition control system				
Ignition timing (full retarded)	Degree	ATDC 1.0–3.0		
Pston position (full retarded)	mm (in)	ATDC 0.01–0.05 (0.0004–0.0020)		
Ignition timing (full advanced)	Degree	BTDC 18.0–20.0		
Pston position (full advanced)	mm (in)	BTDC 2.18–2.68 (0.086–0.105)		
Spark plug gap	mm (in)	0.9–1.0 (0.035–0.040)		
Ignition coil resistance				
Primary coil (B/W–B) at 20°C (68°F)	Ω	0.18–0.26		
Secondary coil (B/W–spark plug wire) at 20°C (68°F)	kΩ	3.84–5.76		
CDI unit output peak voltage (B/W–B)				
at Cranking (loaded)	V	100		
at 1,500 r/min (loaded)	V	140		
at 3,500 r/min (loaded)	V	100		

Maintenance specification



Item	Unit	Model		
		E60HMHD	E60HWHD	E60HWD
Pulser coil output peak voltage (W/R-B, W/B-B, W/G-B)				
at Cranking (unloaded)	V		2.0	
at Cranking (loaded)	V		2.0	
at 1,500 r/min (loaded)	V		6.0	
at 3,500 r/min (loaded)	V		10.0	
Pulser coil resistance (W/R-B)	Ω		117-143	
Pulser coil resistance (W/B-B)	Ω		117-143	
Pulser coil resistance (W/G-B)	Ω		117-143	
Charge coil output peak voltage (Positive side: Br- Negative side: Ground)				
at Cranking (unloaded)	V		120	
at Cranking (loaded)	V		110	
at 1,500 r/min (loaded)	V		150	
at 3,500 r/min (loaded)	V		110	
Charge coil resistance (Br-Ground)	Ω		149-182	
Starter motor				
Type		—	Bendix	
Brushes				
Length limit	mm (in)	—	9.0 (0.35)	
Armature				
Commutator diameter	mm (in)	—	30.0 (1.18)	
Commutator diameter limit	mm (in)	—	29.0 (1.14)	
Commutator undercut limit	mm (in)	—	0.2 (0.01)	
Charging system				
Fuse	A	—	20	
Lighting coil output peak voltage (G-G)				
at Cranking (unloaded)	V		5.0	
at 1,500 r/min (unloaded)	V		20.0	
at 3,500 r/min (unloaded)	V		40.0	
Lighting coil resistance (G-G)	Ω			
1-Lighting coil model			0.4-0.5	
2-Lighting coil model			1.3-1.6	
Rectifier output peak voltage (R-B)				
at 1,500 r/min (unloaded)	V	—	20	
at 3,500 r/min (unloaded)	V	—	40	

Dimensions
Exterior

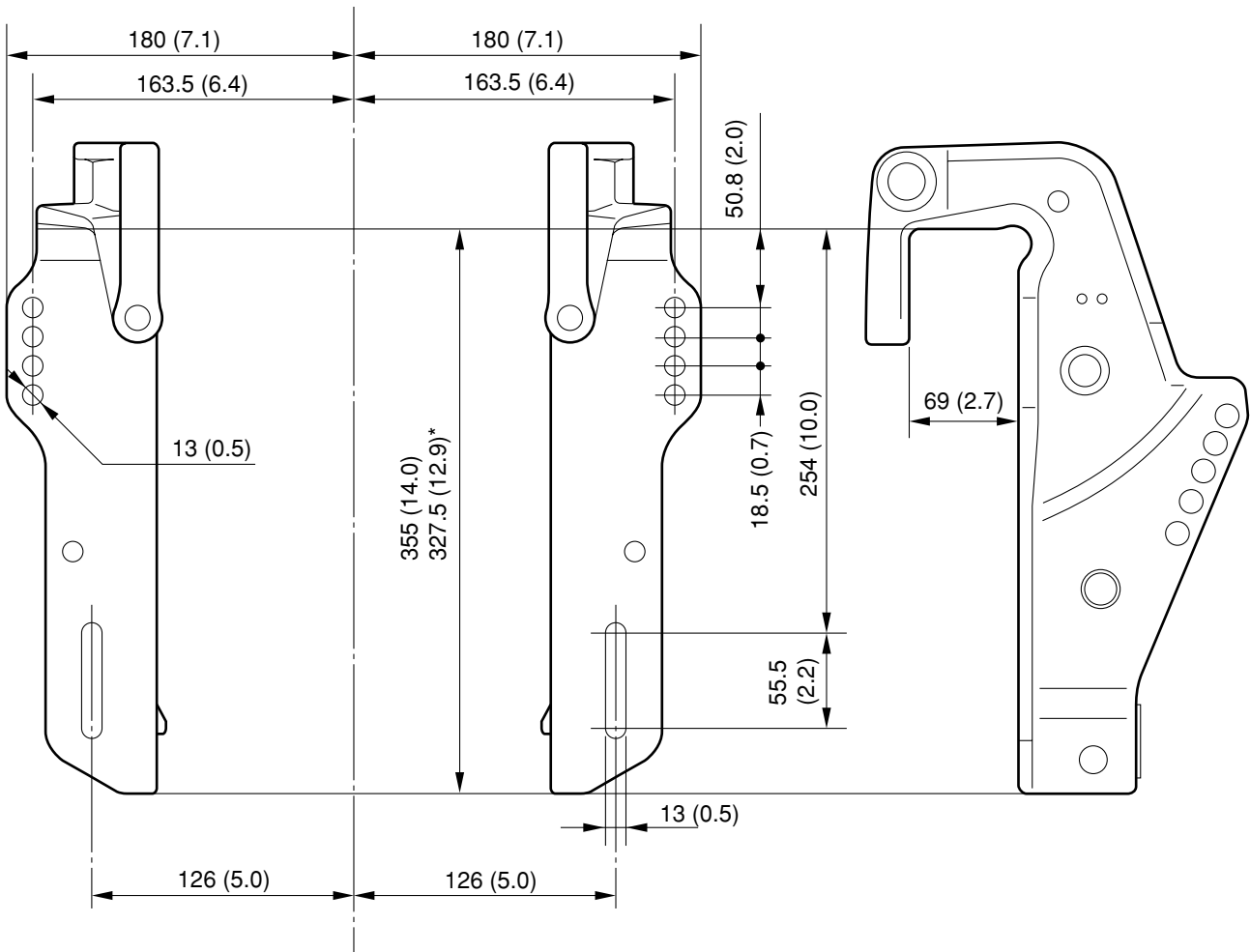


*MHD, WHD **MHD S-transom

Clamp bracket (S, L-transom model)

mm (in)

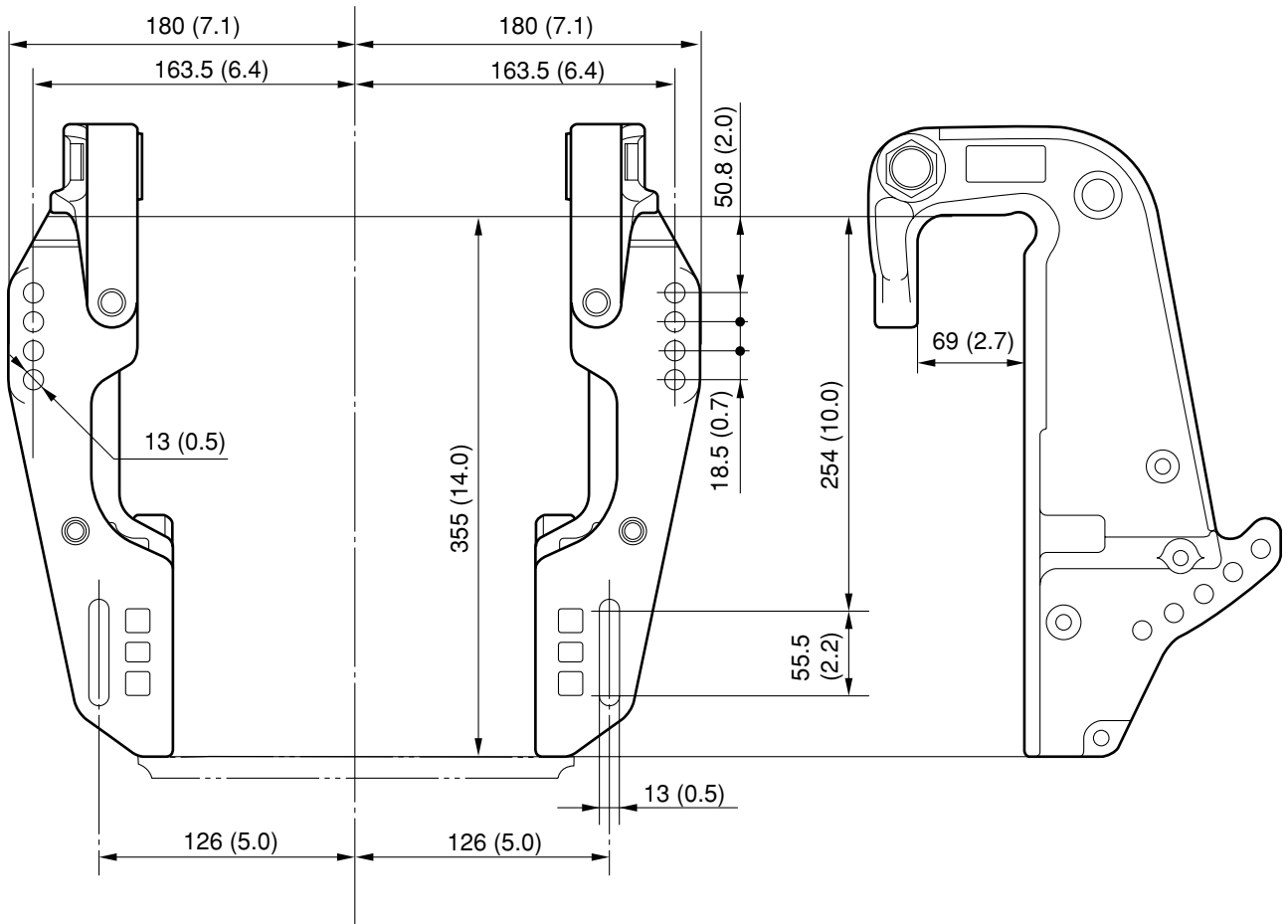
2



*S-transom
69D5G11

Clamp bracket (X-transom model)

mm (in)



Tightening torques

Specified torques

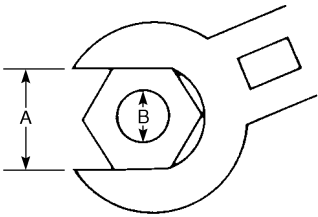
Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Fuel system					
Intake silencer		—	2	0.2	1.5
Power unit					
Power unit mounting bolt		M8	21	2.1	15.5
Flywheel nut		M20	160	16	115
Intake manifold bolt	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.8
Reed valve stopper		—	0.8	0.08	0.6
Starter motor bolt		M8	20	2.0	15
Plug		—	23	2.3	17
Neutral switch bracket	1st	M6	4	0.4	3.0
	2nd		8	0.8	5.8
Cylinder head bolt	1st	M8	15	1.5	11.1
	2nd		32	3.2	23
Stud bolt		—	10	1.0	7.2
Exhaust outer cover bolt	1st	M6	3	0.3	2.2
	2nd		8	0.8	5.8
Crankcase bolt	1st	M8	10	1.0	7.2
	2nd		20	2.0	15
	1st	M10	20	2.0	15
	2nd		40	4.0	29.5
Spark plug		M14	25	2.5	18
Lower unit					
Check screw		—	9	0.9	6.6
Drain screw		—	9	0.9	6.6
Lower case mounting nut		M10	40	4.0	29.5
Cooling water inlet cover		M5	4.5	0.45	3.3
Propeller nut		M16	35	3.5	25.3
Propeller shaft housing ring nut		—	105	10.5	76
Pinion nut		M16	95	9.5	68
Bracket unit					
Tiller handle bracket nut		M12	40	4.0	29.5
Bracket nut		M10	40	4.0	29.5
Engine stop lanyard switch nut		—	4	0.4	3.0
Upper case bolt		M8	21	2.1	15.5
Exhaust manifold bolt		M8	21	2.1	15.5
Muffler assembly bolt		M8	21	2.1	15.5
Self locking nut (S, L-transom models)		M22	22	2.2	16.2
Self locking nut (X-transom model)		M22	15	1.5	11.1
Reverse lock lever bolt (X-transom model)		M6	8	0.8	5.8
Grease nipple		—	3	0.3	2.2

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

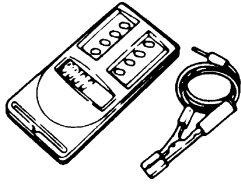


Periodic checks and adjustments

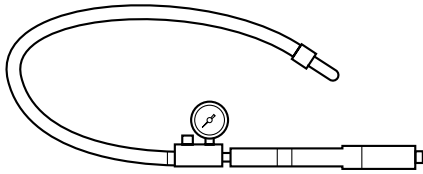
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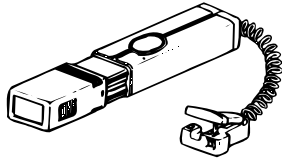
Special service tools



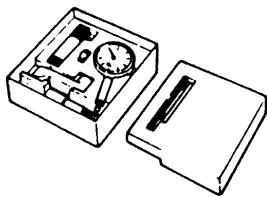
Digital tachometer
90890-06760



Leakage tester
90890-06840



Timing light
90890-03141



Dial gauge set
90890-01252

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		Refer to page
		10 hours (Break-in)	50 hours (3 months)	100 hours (6 months)	200 hours (1 year)	
Anode (s) (external)	Check / replace		○	○		3-13
Anode (s) (internal)	Check / replace				○	5-35
Battery	Check / charge	○				3-13
Cooling water passages	Clean		○	○		3-5
Cowling clamp	Check				○	3-3
Fuel filter (can be dis-assembled)	Check / clean	○	○	○		3-3
Fuel system	Check	○	○	○		3-3
Fuel tank (Yamaha portable tank)	Check / clean				○	—
Gear oil	Change	○		○		3-12
Lubrication points	Lubricate			○		3-14
Idling speed (carburetor model)	Check / adjust	○		○		3-6
Propeller and cotter pin	Check / replace		○	○		3-13
Shift link / shift cable	Check / adjust				○	3-8
Thermostat	Check				○	3-4
Throttle link / throttle cable / throttle pick-up timing	Check / adjust				○	3-6, 3-7
Water pump	Check				○	6-10
Spark plug	Clean / adjust / replace	○	○	○		3-3

NOTE:

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

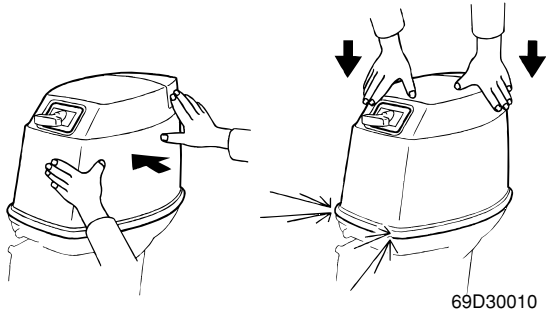




Top cowling

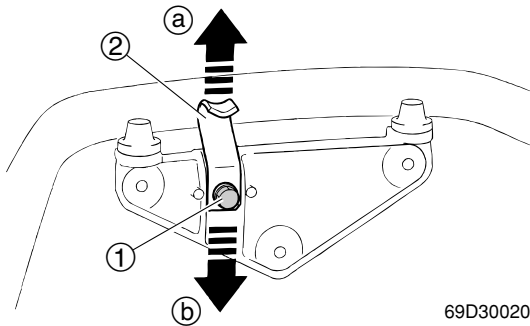
Checking the top cowling

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



69D30010

2. Loosen the bolts ①, and then move the hook ② up or down slightly to adjust its position.



69D30020

NOTE: _____

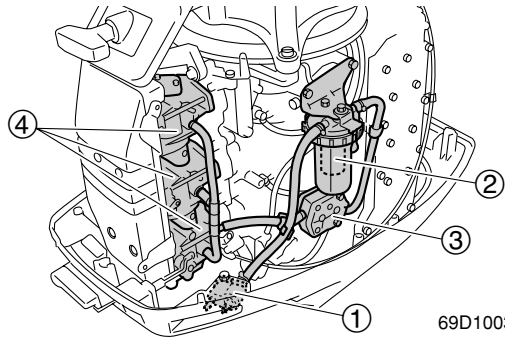
- To loosen the fitting, move the hook in direction (a).
- To tighten the fitting, move the hook in direction (b).

3. Tighten the bolts.
4. Check the fitting again and, if necessary, repeat steps 2-3.

Fuel system

Checking the fuel joint and fuel hoses (fuel joint-to-carburetors)

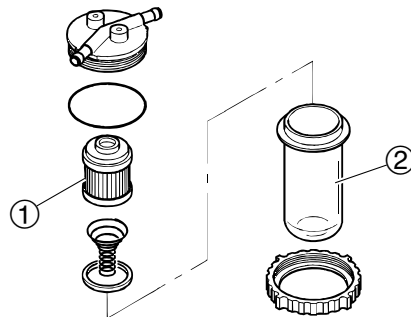
1. Check the fuel hose connections and fuel joint ① for leaks. Replace if necessary. Also, check the fuel filter ②, fuel pump ③, and carburetors ④ for leaks or deterioration. Replace if necessary.



69D10030

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 the cup with straight gasoline and replace the element if necessary.



69D30040

NOTE: _____

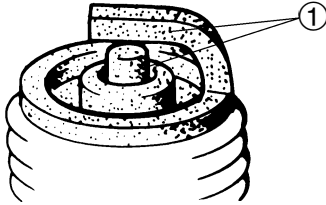
Be sure not to spill any fuel when removing the fuel filter cup.

Power unit

Checking the spark plugs

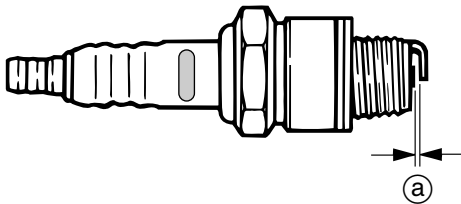
1. Disconnect the spark plug caps, and then remove the spark plugs.

- Clean the electrodes ① with a spark plug cleaner or wire brush. Replace the spark plug if necessary.




6B430025


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



6B430030

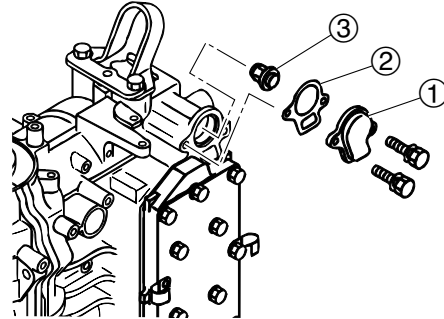
 Specified spark plug:
B8HS-10, BR8HS-10 (NGK)
Spark plug gap ①:
0.9—1.0 mm (0.035—0.040 in)

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

 Spark plug:
25 N·m (2.5 kgf·m, 18 ft·lb)

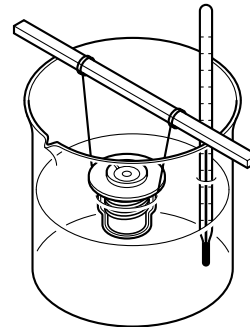
Checking the thermostat

- Remove the thermostat cover ①, gasket ②, and thermostat ③.



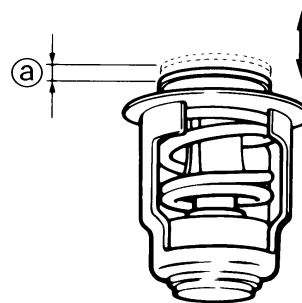
69D30050

- Suspend the thermostat in a container of water.
- Place a thermometer in the water and slowly heat the water.




6B430060

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



... 6B430070

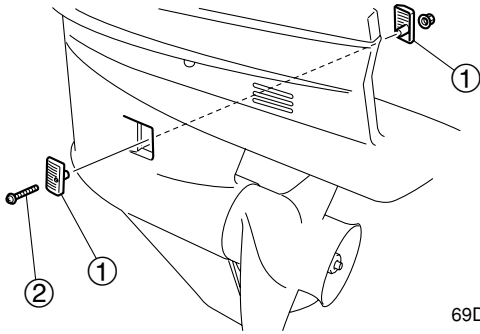
 Water temperature	Valve lift ①
48—52°C (118.4—125.6°F)	0 mm (0 in) (valve begins to tilt)
above 60°C (140°F)	more than 3.0 mm (0.12 in)



5. Install the thermostat and thermostat cover, and then tighten the cover bolts.

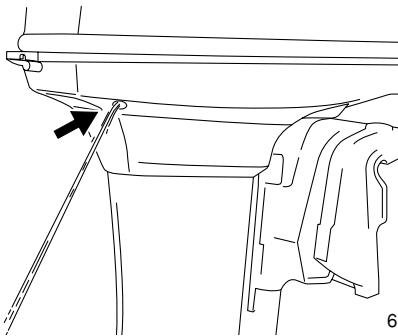
Checking the cooling water passages

1. Check the cooling water inlet cover ①, screw ② and cooling water inlet for clogging. Clean if necessary.



69D30060

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 passage inside the outboard motor.

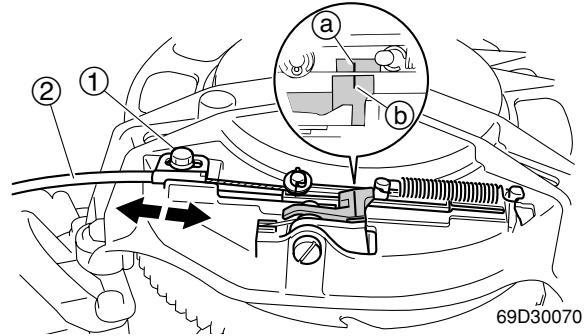


6F610170

Control system

Adjusting the start-in-gear protection

1. Set the gear shift to the neutral position.
2. Loosen the bolt ①, and then adjust the start-in-gear protection cable ② until the mark ① on the guide, aligns with the mark ② on the stopper.



69D30070

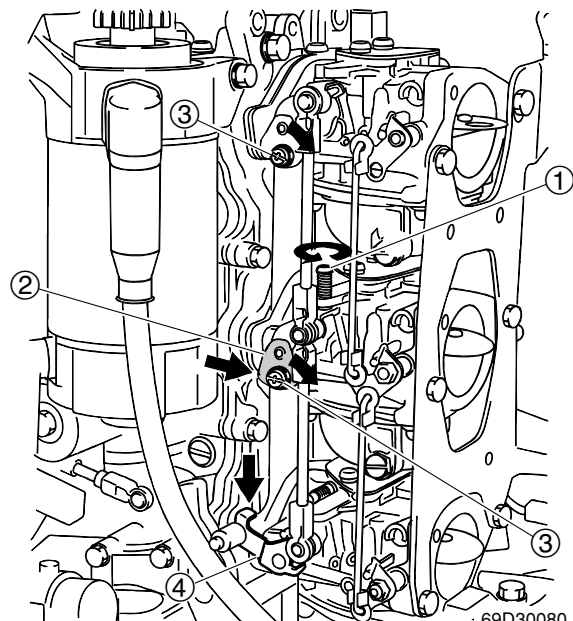
3. Tighten the bolt ①.

Synchronizing the carburetors

1. Loosen the throttle stop screw ① of the carburetor #2 and push the throttle lever ② for fully close the throttle valve.
2. Loosen the screw of the carburetor #1 and carburetor #2 by turning the screws ③ clockwise.

NOTE:

The screw ③ is left hand thread.



69D30080

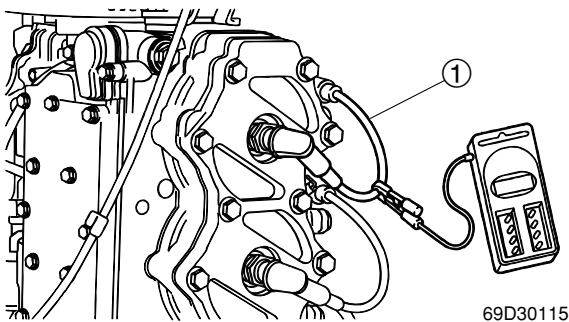
- While lightly pushing the throttle lever ④ of the carburetor #3 in the direction of the arrow (full-closed), and then tighten the screws ③ of the carburetor #1 and #2.


NOTE: _____
After synchronizing the carburetor, adjust the engine idling speed to tighten the throttle stop screw ①.


Checking the engine idle speed

NOTE: _____
Be sure to check the engine idle speed before adjusting the pilot screw.

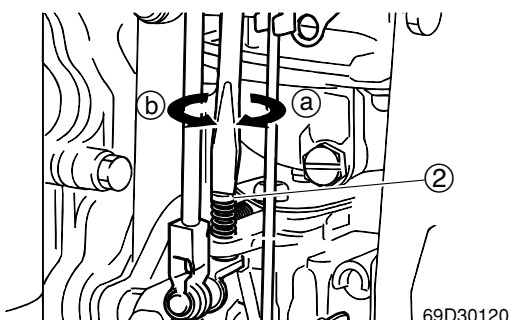
- Start the engine and warm it up for 5 minutes.
- Attach the special service tool to spark plug wire #1 ①, and then check the engine idle speed. Adjust if out of specification.



 Digital tachometer: 90890-06760

 Engine idle speed:
950—1,050 r/min

- Turn the throttle stop screw ② in direction ① or ② until the specified engine idle speed is obtained.



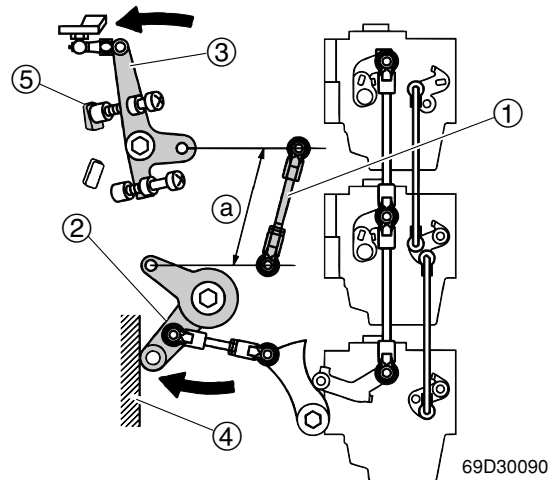
69D5G11

NOTE: _____
• To increase the idle speed, turn the throttle stop screw in direction ①.
• To decrease the idle speed, turn the throttle stop screw in direction ②.

- If the specified engine idle speed cannot be obtained, adjust the throttle cable.

Adjusting the throttle link position

- Remove the link rod ① from the control levers ② and ③.

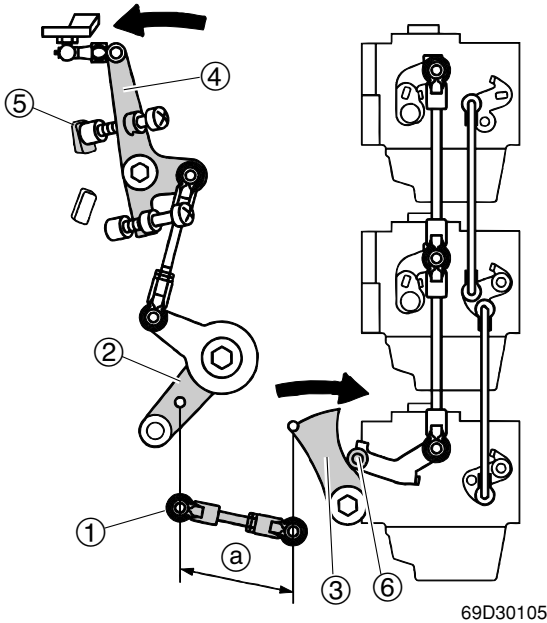


- Turn the control lever ② until it contacts the crankcase ④.
- Set the control lever ③ to fully retard position, it contacts the stopper ⑤.
- Adjust the length ① of the link rod ① until the holes align with the set pins on the control levers ② and ③, and then install the link rod ①.



Adjusting the pick up timing

1. Remove the link rod ① from the control lever ② and cam ③.



69D30105

2. Set the control lever ④ to fully retard position, it contacts the stopper ⑤.
3. Turn the cam ③ to lightly contact to the throttle lever roller ⑥.

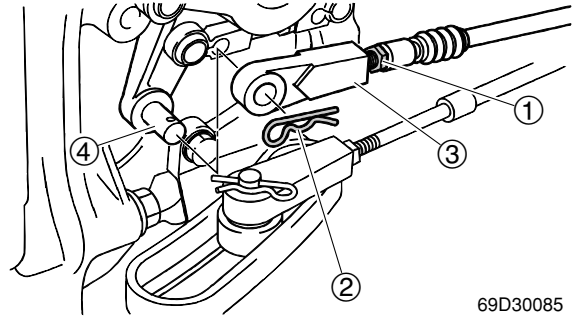
NOTE: _____
The throttle valve should not open.

4. Adjust the length ① of the link rod ① until the holes align with the set pins on the control lever ② and cam ③, and then install the link rod ①.

Adjusting the throttle cable

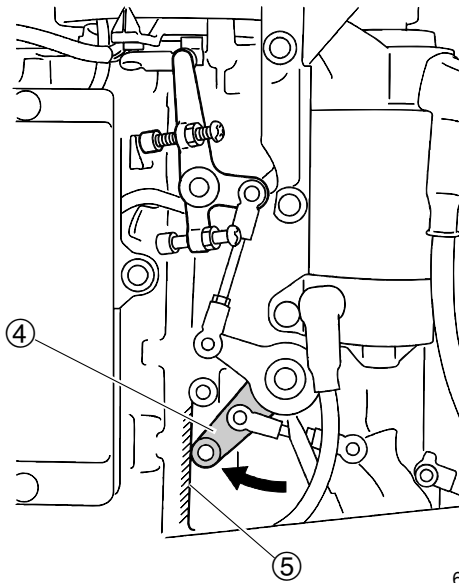
NOTE: _____
Before adjusting the throttle cable, the throttle stop screw should be properly adjusted.

1. Loosen the locknut ①, remove the clip ② and then remove the throttle cable joint ③.



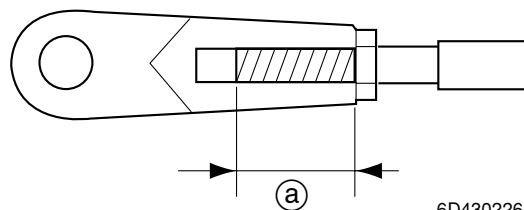
69D30085

2. Set the throttle grip or remote control lever to the fully closed position.
3. Check that the control lever ④ contacts the crankcase ⑤.



69D30095

4. Adjust the position of the throttle cable joint ③ until its hole aligned with the set pin on the control lever ④.

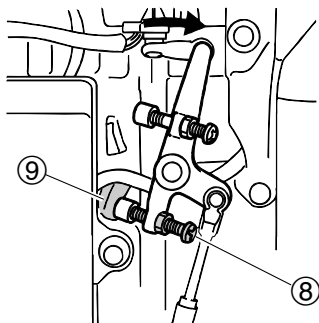


6D430226

⚠WARNING

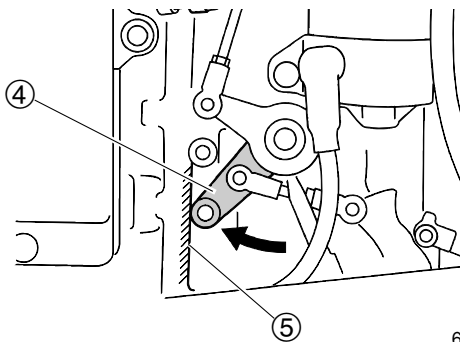
The throttle cable end must be screwed in a minimum of 8.0 mm (0.31 in) (a).

5. Install the throttle cable joint (3), clip (2), and then tighten the lock nut (1).
6. Check that the full advanced screw (8) contacts the stopper (9) when the throttle grip or remote control lever is fully opened position.



69D30290

7. Check that the control lever (4) contacts the crankcase (5) when the throttle grip or remote control lever is fully closed position.



69D30095

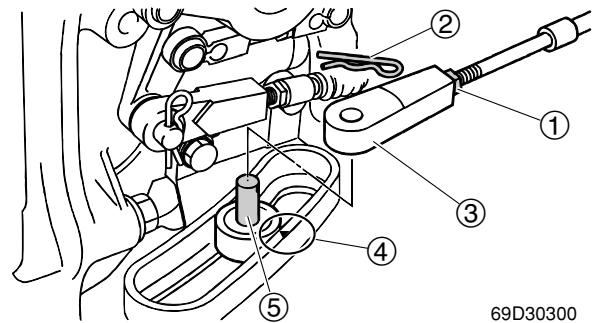
8. Check the throttle cable for smooth operation, if necessary, repeat steps 3-7.

NOTE:

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

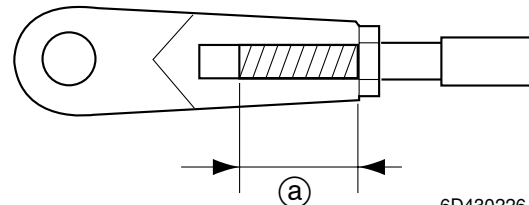
Checking the gear shift operation

1. Check that the gear shift operates smoothly when shifting it from neutral to forward or reverse. Adjust the shift cable if necessary.
2. Set the gear shift to the neutral position.
3. Loosen the locknut (1), remove the clip (2), and then remove the shift cable joint (3).



69D30300

4. Align the set pin with the alignment mark (4) in the center of the shift bracket.
5. Adjust the position of the shift cable joint until its hole is aligned with the set pin (5).



6D430226

⚠WARNING

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

6. Install the shift cable joint (3), install the clip (2), and then tighten the locknut (1).
7. Check the gear shift for smooth operation and adjust the shift cable length, if necessary, repeat the steps 3-6.

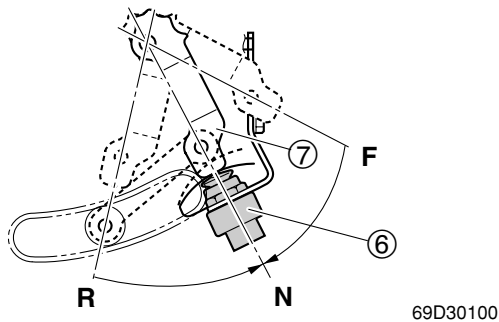
NOTE:

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

3

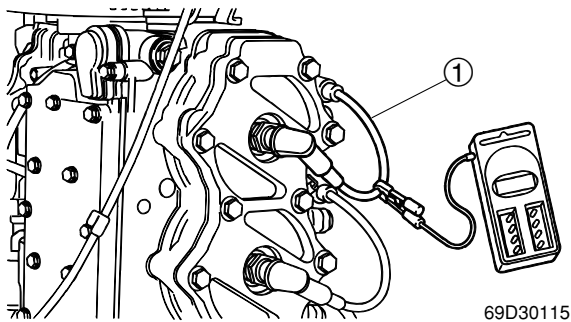



- Check that the neutral switch ⑥ is pushing by the shift lever ⑦. (WHD)




Checking the ignition timing

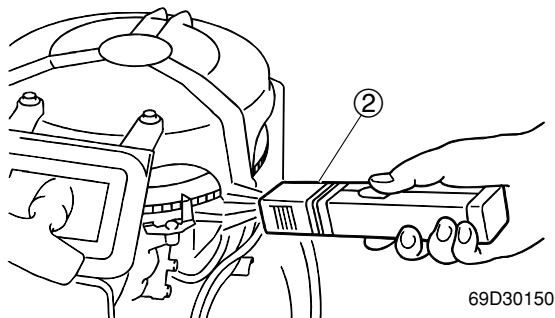
- Start the engine and warm it up for 5 minutes.
- Attach the special service tool to spark plug wire #1 ①, and then check the engine idle speed.




 Digital tachometer: 90890-06760

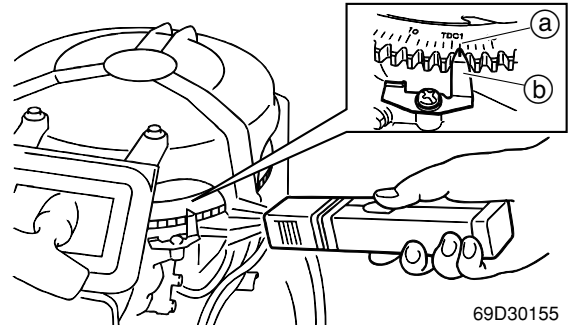
 Engine idle speed:
950—1,050 r/min


- Attach the special service tool ② to spark plug wire #1, and then check the engine ignition timing.



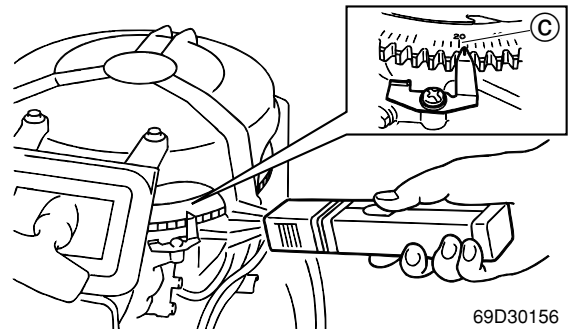
 Timing light ②: 90890-03141

- Check that the ATDC 2° scale ① on the flywheel magnet is aligned with the pointer ② on the timing plate. Adjust if necessary.



 Timing plate position:
ATDC 1°—3°

- Check that the scale ③ on the flywheel magnet is advanced to BTDC 19° scale, when the engine speed increased. Adjust if necessary.

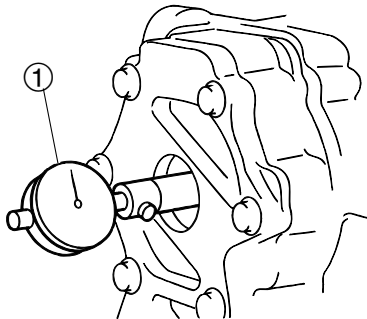


Adjusting the ignition timing

NOTE:

- Remove the all spark plugs and the engine stop lanyard switch clip before adjusting the ignition timing.
- Make sure that the engine is stopped before adjusting the ignition timing.

1. Remove the throttle cable or the remote control cable.
2. Install the dial gauge ① into the spark plug hole of the cylinder #1.



69D30160



Dial gauge set ①: 90890-01252

3. Slowly turn the flywheel magnet clockwise and stop it when the piston is at TDC.
4. Set the dial gauge to “zero” position, and then align the specified position to turn the flywheel magnet clockwise.

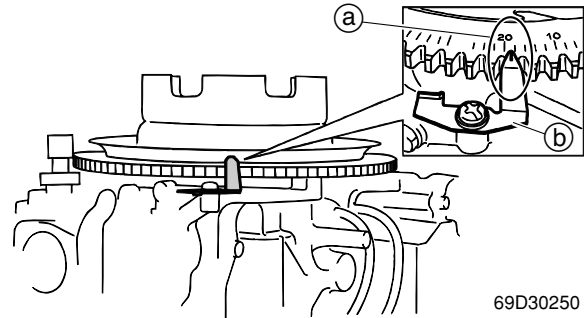


Cylinder #1 piston stroke (BTDC):
2.18—2.68 mm (0.086—0.105 in)

NOTE:

Turn the flywheel magnet to clockwise when to locate the piston TDC.

5. Check that the scale ① on the flywheel magnet with the timing plate ② are specified position.

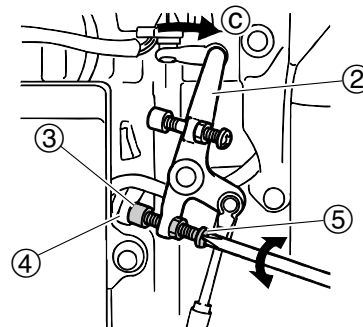


69D30250



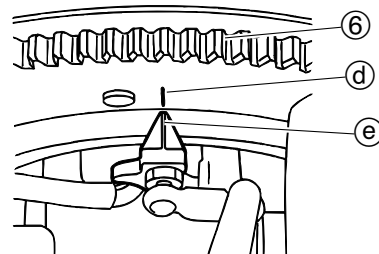
Timing plate position:
BTDC 18°—20°

6. When the piston at specified position, set the control lever ② to the full advanced position ③, it stop contacts the cap ④ to the stopper ④.



69D30260

7. Turn the adjusting screw ⑤ so that the line ① on the flywheel magnet ⑥ aligned with the pointer ② on the base assembly.



69D30265

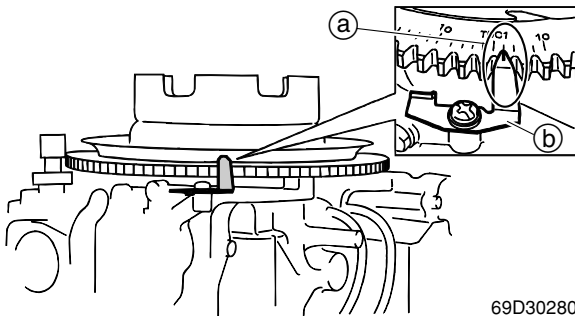


- Slowly turn the flywheel magnet to clockwise to the dial gauge indicates to the specified position.



Cylinder #1 piston stroke (ATDC):
0.01—0.05 mm
(0.0004—0.0020 in)

- Check that the scale (a) on the flywheel magnet with the timing plate (b) are specified position.

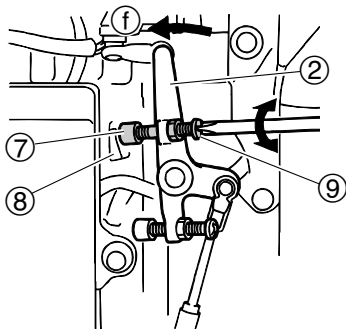


69D30280



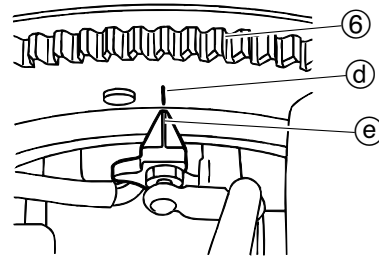
Timing plate position:
ATDC 1°—3°

- When the piston at ATDC position, set the control lever (2) to the full retard position (f), it stop contacts the cap (7) to the stopper (8).



69D30270

- Turn the adjusting screw (9) so that the mark (d) on the flywheel magnet (6) aligned with the pointer (e) on the base assembly.

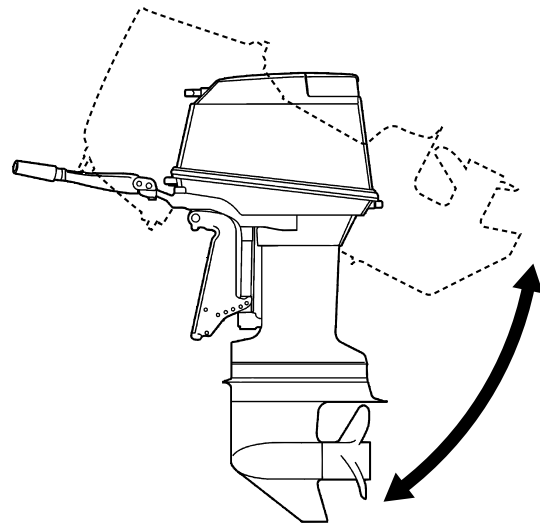


69D30265

Bracket

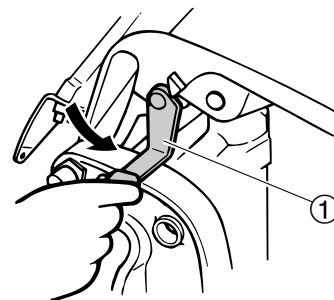
Checking the tilt operation

- 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.



69D30130

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

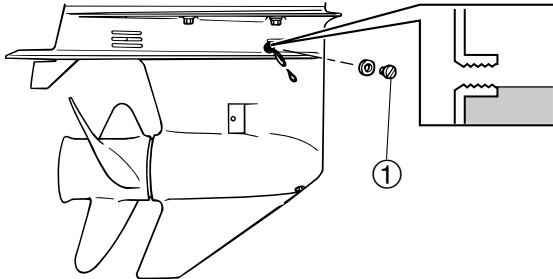


69D30135

Lower unit

Checking the gear oil level

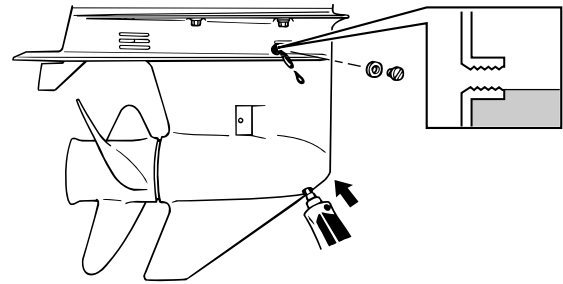
- 1 Fully tilt the outboard motor down.
2. Remove the check screw ①, and then check the gear oil level in the lower case.



69D10055



Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90



69D10050



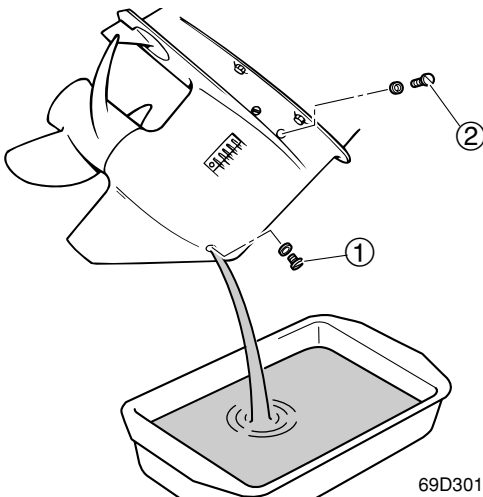
Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Oil quantity:
610 cm³
(20.62 US oz, 21.51 Imp oz)



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

Changing the gear oil

1. Fully tilt the outboard motor up.
2. Place a drain pan under the drain screw ①, remove the drain screw, then the check screw ② and let the oil drain completely.



69D30140

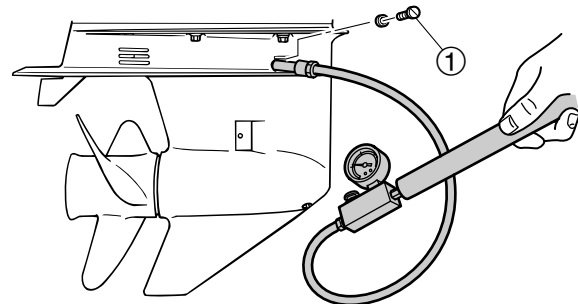
3. Check the oil for metal and discoloration, and its viscosity. Check the internal parts of the lower case if necessary.
4. Insert a gear oil tube or gear oil pump into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.

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, and then install the special service tool.



69D30145



Leakage tester: 90890-06840



- Apply the specified pressure to check that the pressure is maintained in the lower unit for at least 10 seconds.

NOTE:

Cover the check hole with a rag when removing the special service tool from the lower unit.



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

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

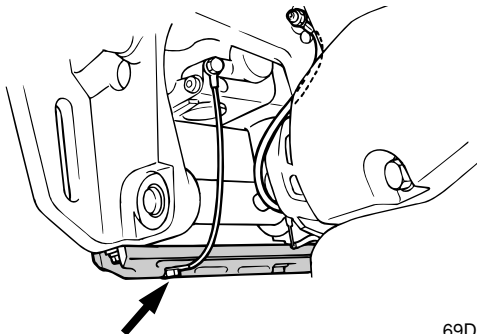
Checking the propeller

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

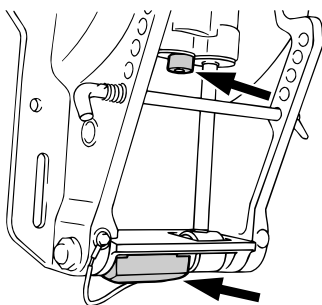
General

Checking the anodes

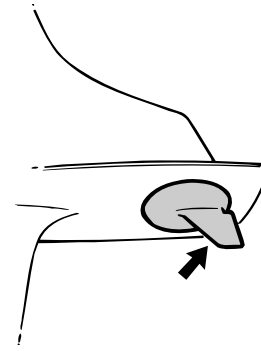
- Check the anodes and trim tab for scales, grease, and oil. Clean if necessary.



69D30310



69D30320



69D30330

CAUTION:

Do not oil, grease, or paint the anodes or the trim tab, otherwise they will be ineffective.

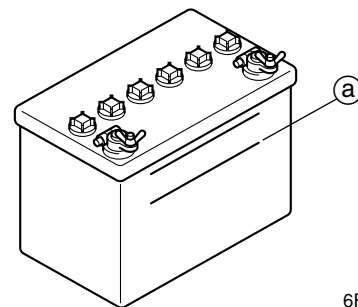
- Replace the anodes or trim tab if excessively eroded.

NOTE:

For checking the cylinder anodes, refer to the chapter 5.

Checking the battery

- Check the battery electrolyte level. If the level is at or below the minimum level mark (a), add distilled water until the level is between the maximum and minimum level marks.



6F630240

- Check the specific gravity of the electrolyte. Fully charge the battery if below specification.

⚠ WARNING

Battery electrolyte is dangerous; it contains sulfuric acid which is poisonous and highly caustic.

- Avoid bodily contact with electrolyte as it can cause severe burns or permanent eye injury.
- Wear protective eye gear when handling or working near batteries.

Antidote (EXTERNAL):

- SKIN – Wash with water.
- EYES – Flush with water for 15 minutes and get immediate medical attention.

Antidote (INTERNAL):

- Drink large quantities of water or milk followed with milk of magnesia, beaten egg, or vegetable oil. Get immediate medical attention.
- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks or open flames (e.g., welding equipment, lighted cigarettes).
- DO NOT SMOKE when charging or handling batteries.

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

NOTE:

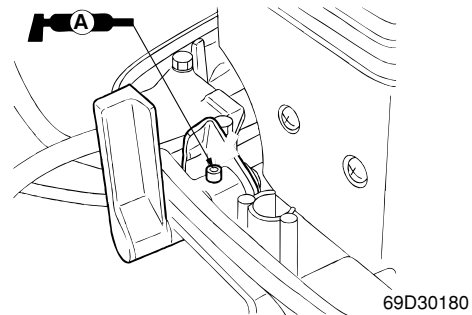
- Batteries vary per manufacturer. The procedures mentioned in this manual may not always apply, therefore, consult the instruction manual of the battery.
- Disconnect the negative battery lead first, then the positive battery lead.



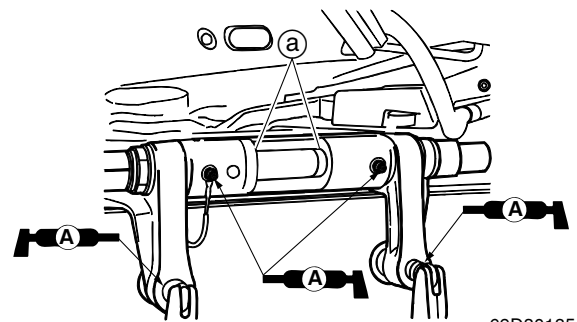
Electrolyte specific gravity:
1.280 at 20° C (68° F)

Lubricating the outboard motor

1. Apply water resistant grease to the areas shown.



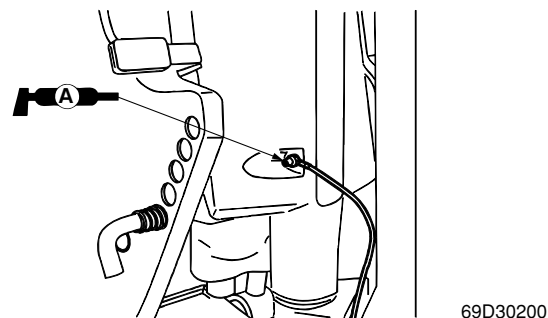
69D30180



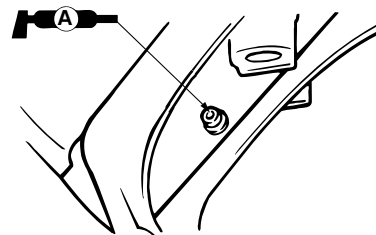
69D30185

NOTE:

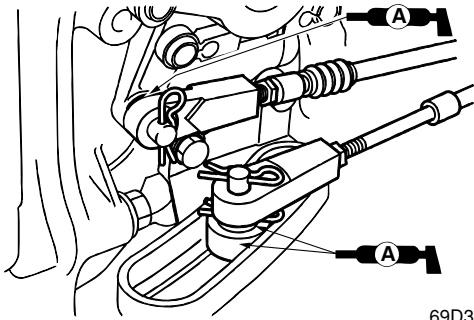
Apply grease to the grease nipple until it flows from the bushings (a).



69D30200

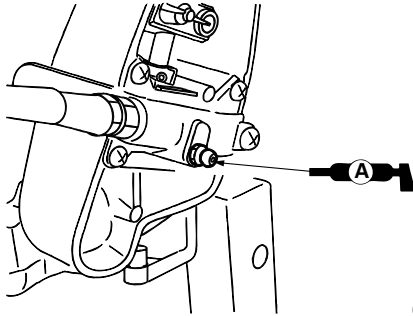


69D30205



69D30220

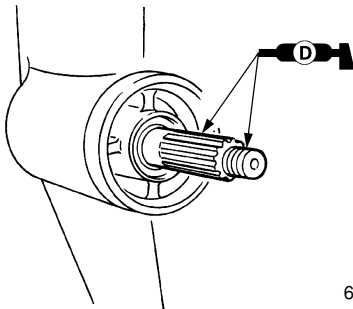
A



69D30225

A Tiller handle model

2. Apply corrosion resistant grease to the area shown.

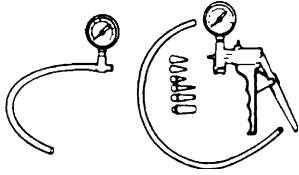


6B430300

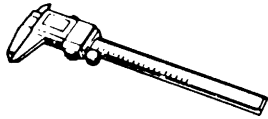
Fuel system

Special service tools	4-1
Hose routing	4-2
Fuel line	4-3
Carburetor	4-6
Disassembling the carburetor	4-8
Checking the carburetor	4-8
Assembling the carburetors	4-9
Adjusting the throttle stop screw	4-9
Fuel pump	4-10
Checking the fuel pump	4-11
Disassembling the fuel pump	4-11
Assembling the fuel pump	4-12
Checking the fuel joint	4-12

Special service tools

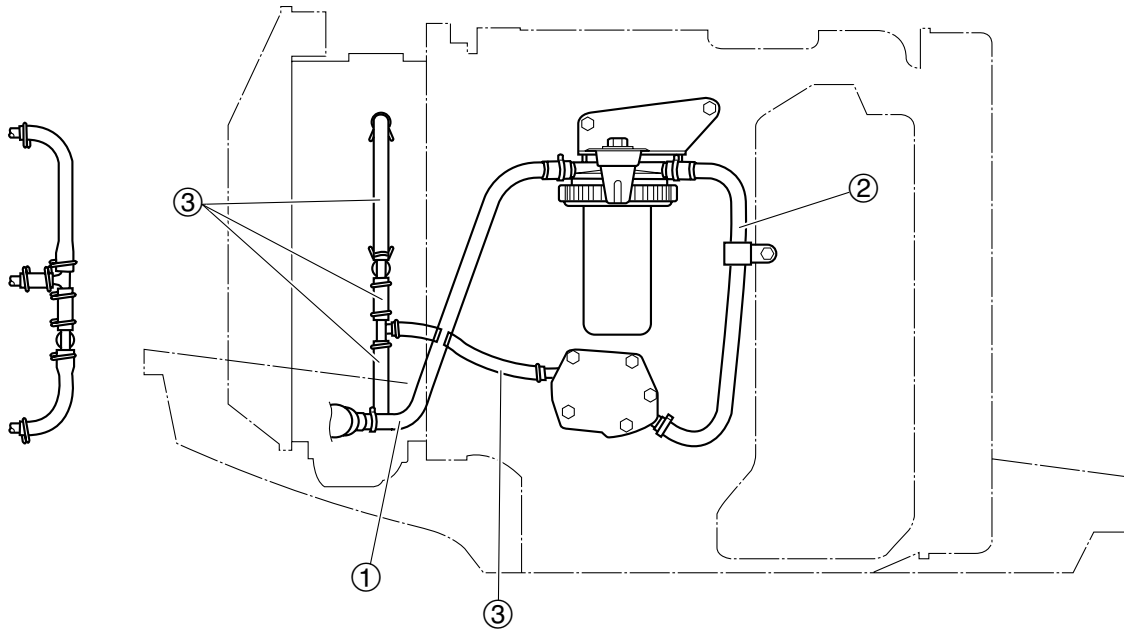
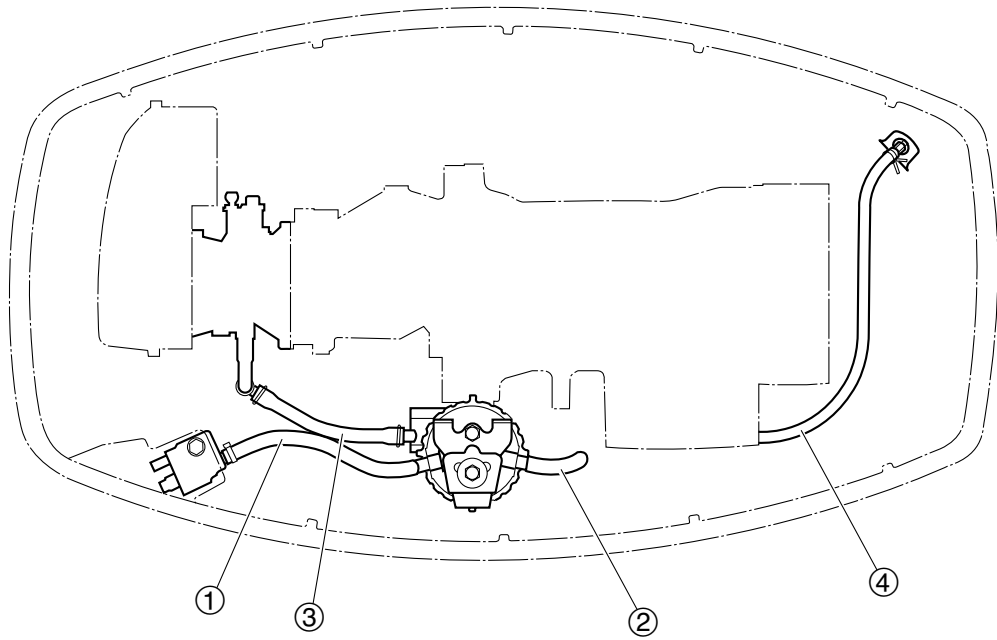


Vacuum/pressure pump gauge set
90890-06756



Digital caliper
90890-06704

Hose routing

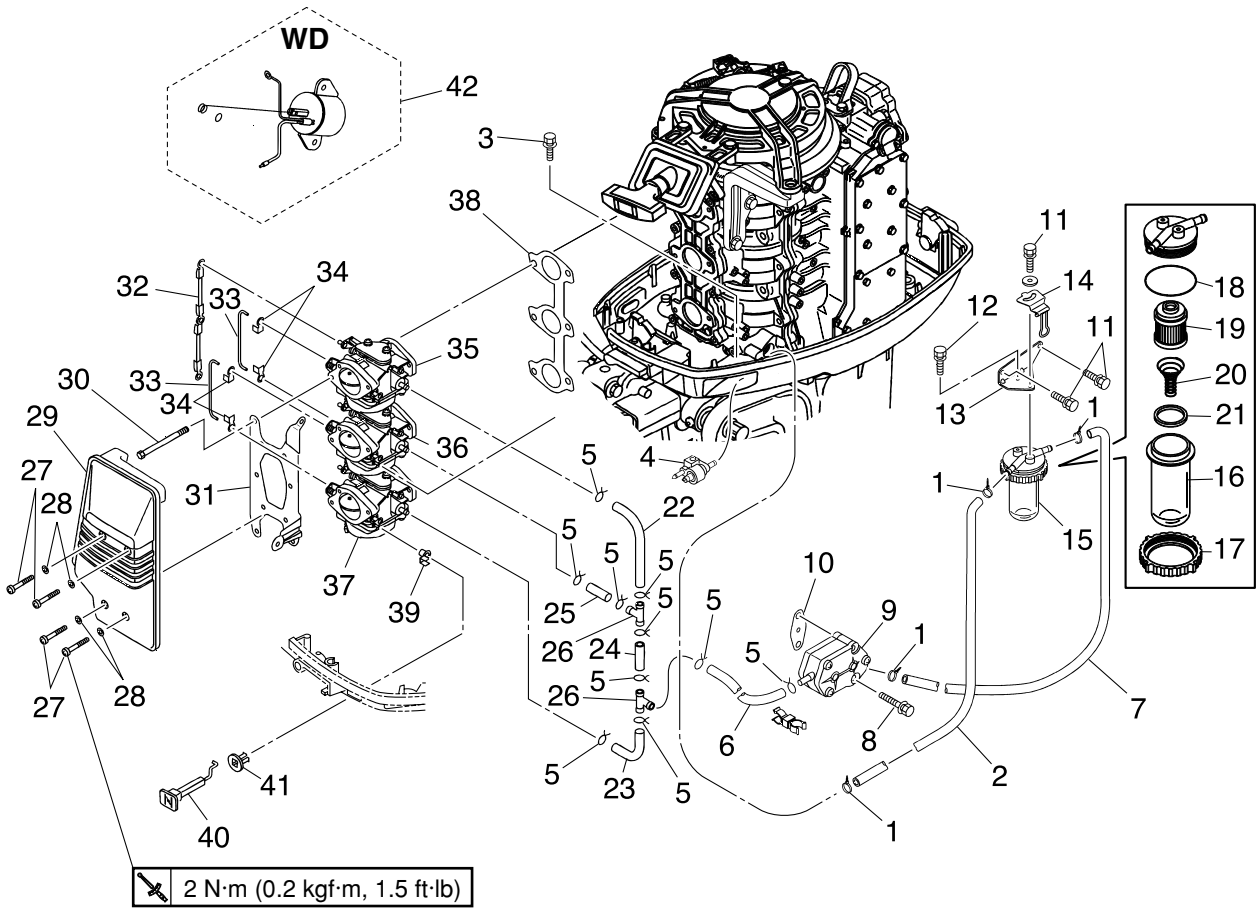


4

69D4010E

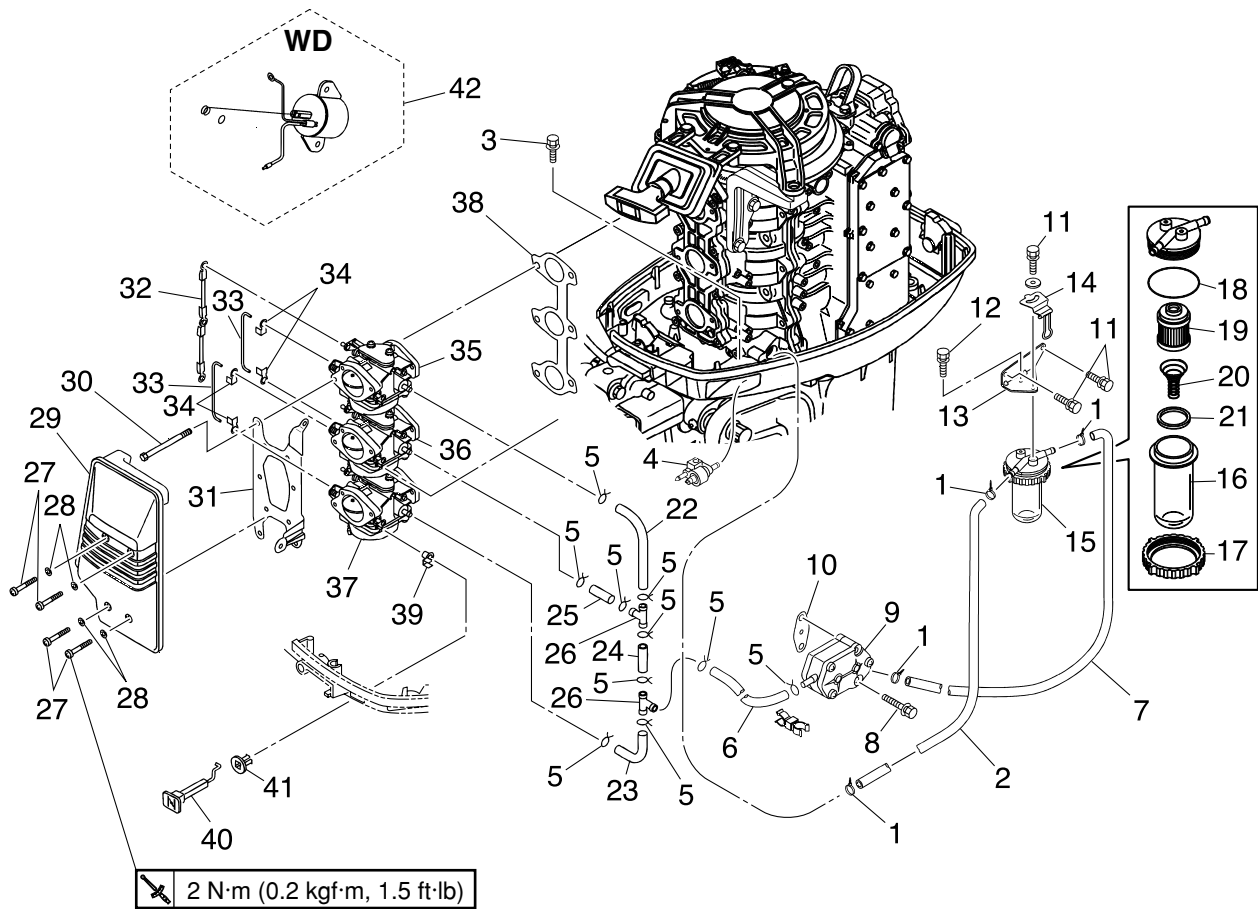
- ① Fuel hose (Fuel joint-to-fuel filter)
- ② Fuel hose (Fuel filter-to-fuel pump)
- ③ Fuel hose (Fuel pump-to-carburetors)
- ④ Pilot water hose

Fuel line



69D4020E

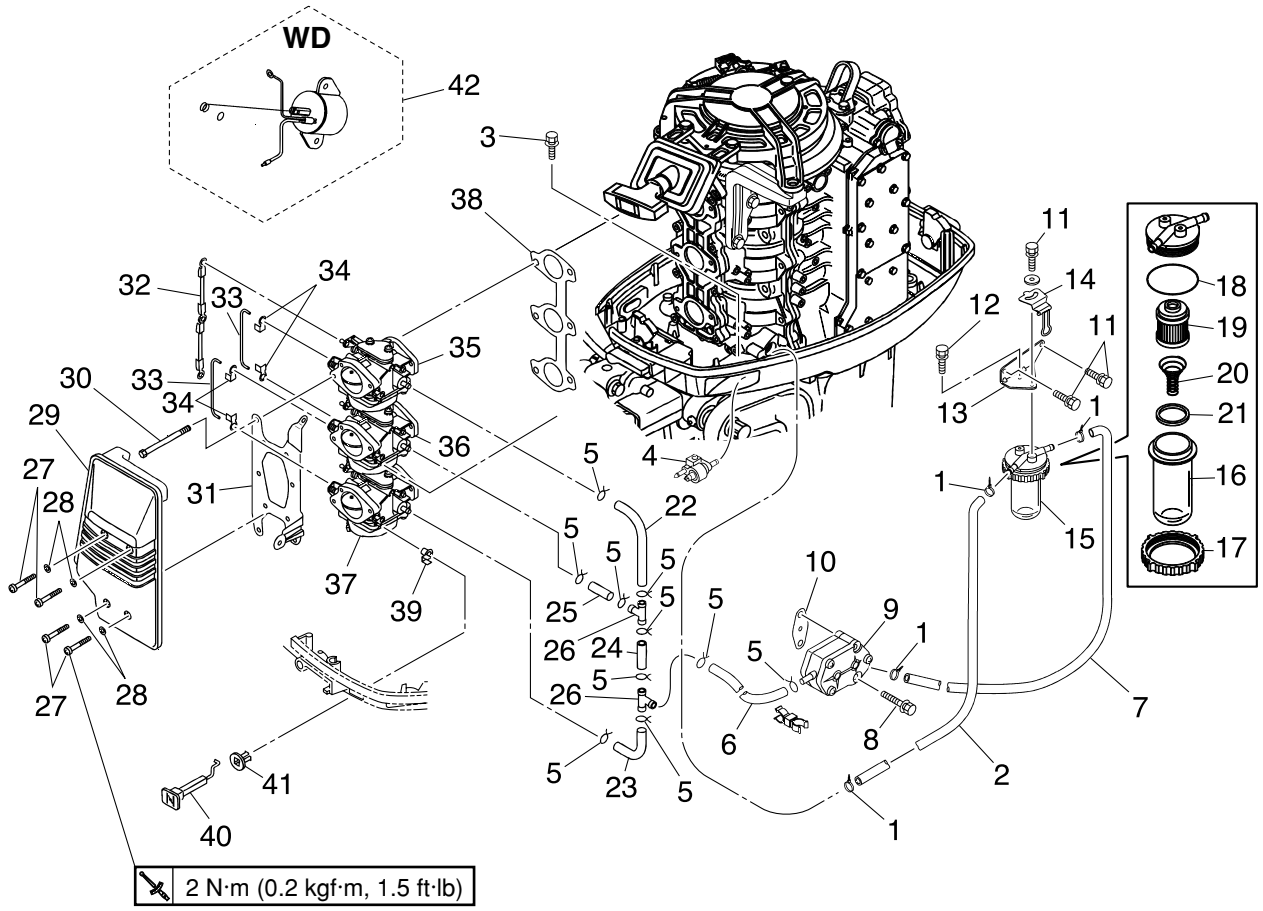
No.	Part name	Q'ty	Remarks
1	Lock tie	4	Not reusable
2	Fuel hose	1	
3	Bolt	1	M6 × 25 mm
4	Fuel joint	1	
5	Clamp	10	
6	Fuel hose	1	
7	Fuel hose	1	
8	Bolt	2	M6 × 40 mm
9	Fuel pump	1	
10	Gasket	1	Not reusable
11	Bolt	3	M6 × 16 mm
12	Bolt	1	M6 × 14 mm
13	Bracket	1	
14	Holder	1	
15	Fuel filter assembly	1	
16	Cup	1	
17	Nut	1	



4

69D4020E

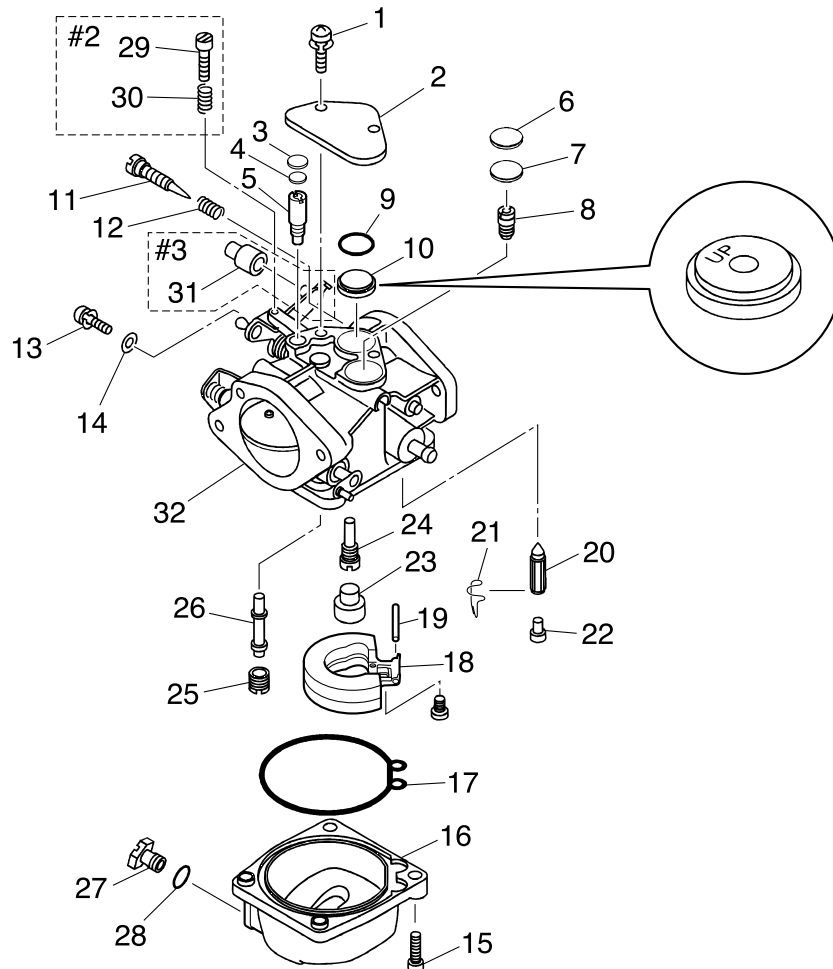
No.	Part name	Q'ty	Remarks
18	O-ring	1	Not reusable
19	Fuel filter element	1	
20	Spring	1	
21	Float	1	
22	Fuel hose	1	
23	Fuel hose	1	
24	Fuel hose	1	
25	Fuel hose	1	
26	Pipe	2	
27	Screw	4	ø6 × 45 mm
28	Washer	4	
29	Intake silencer	1	
30	Bolt	6	M6 × 45 mm
31	Bracket	1	
32	Link rod	1	
33	Rod	2	
34	Joint	4	



69D4020E

No.	Part name	Q'ty	Remarks
35	Carburetor assembly #1	1	
36	Carburetor assembly #2	1	
37	Carburetor assembly #3	1	
38	Gasket	1	Not reusable
39	Joint	1	
40	Choke rod	1	
41	Grommet	1	
42	Choke solenoid	1	WD model

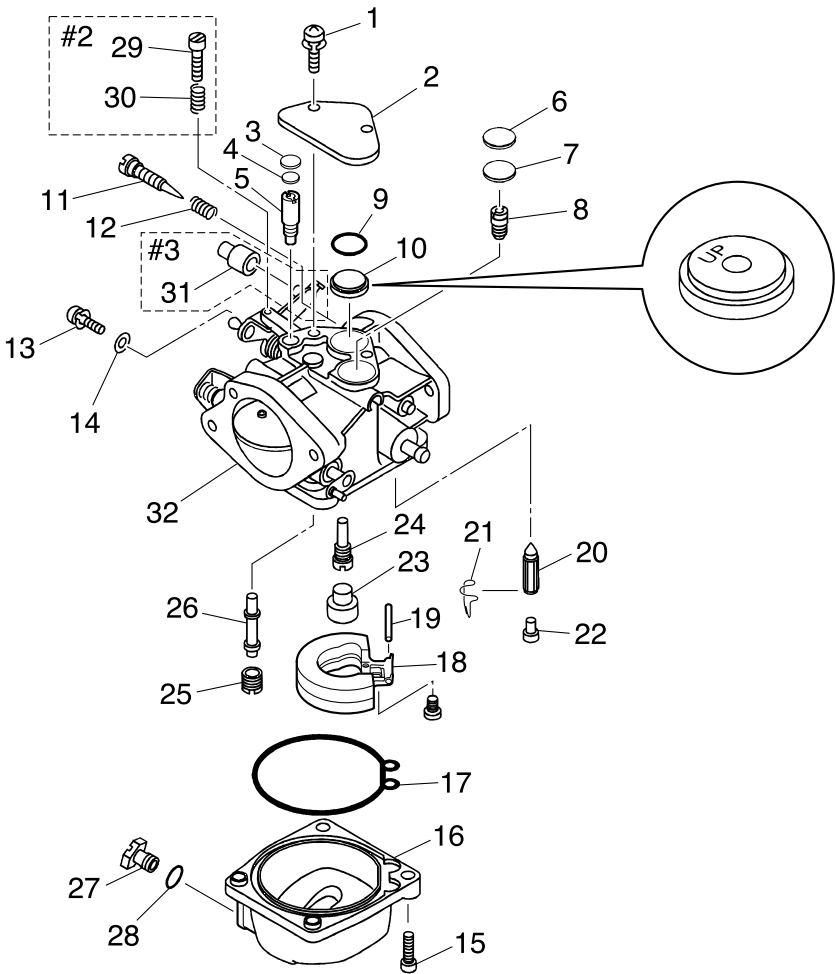
Carburetor



69D4030E

4

No.	Part name	Q'ty	Remarks
1	Screw	6	ø4 × 30 mm
2	Plate	3	
3	Gasket	3	Not reusable
4	Plate	3	
5	Main air jet	3	
6	Gasket	3	Not reusable
7	Plate	3	
8	Pilot air jet	3	
9	O-ring	3	Not reusable
10	Plate	3	
11	Pilot air screw	3	
12	Spring	3	
13	Screw	3	#1 and #2 carburetor
14	Washer	3	#1 and #2 carburetor
15	Screw	12	ø4 × 14 mm
16	Float chamber	3	
17	Gasket	3	Not reusable



69D4030E

No.	Part name	Q'ty	Remarks
18	Float	3	
19	Float pin	3	
20	Needle valve	3	
21	Clip	3	
22	Pin	3	
23	Cap	3	
24	Pilot jet	3	
25	Main jet	3	
26	Main nozzle	3	
27	Drain screw	3	
28	Gasket	3	Not reusable
29	Throttle stop screw	1	#2 carburetor
30	Spring	1	#2 carburetor
31	Cap	1	#3 carburetor
32	Carburetor assembly	3	

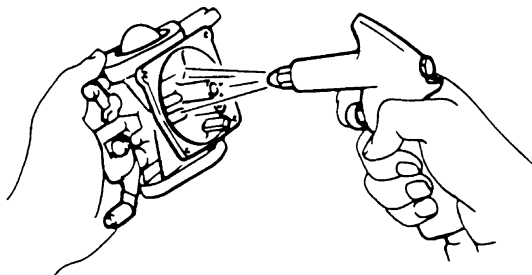
Disassembling the carburetors

NOTE:

- Before disassembling the carburetors, make sure to note the number of times the pilot screw is turned out from the seated position to its set position.
- 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 carburetors

1. Check the air and fuel passages and jets, for dirt and foreign matter. Clean the carburetor body with a petroleum based solvent if necessary.
2. Blow compressed air into all passages and jets.



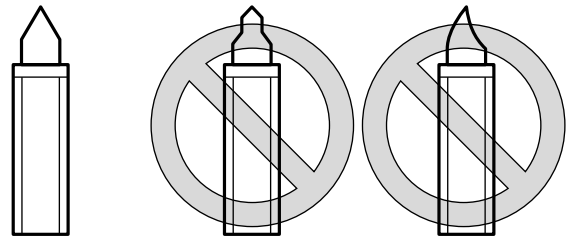
6D440025

CAUTION:

- Direct the compressed air downward, otherwise cleaning solvent may be blown into your eyes or small parts of the carburetor may be blown off.
- Do not use steel wire for cleaning the jets, otherwise the jet diameters may be enlarged, which may seriously affect performance.

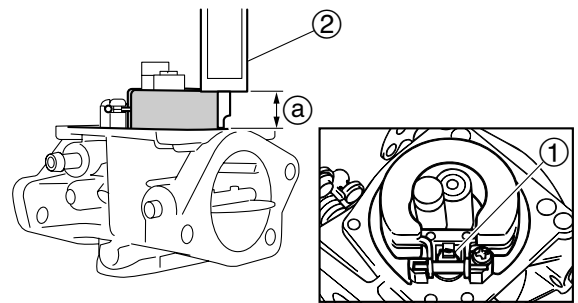
3. Check the main jet, pilot jet, and main nozzle for dirt or residue. Clean if necessary.

4. Check the pilot screw and needle valve for bends or wear. Replace if necessary.



6B440040

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



69D40010

NOTE:

The float should be resting on the needle valve ①, but not compressing it.

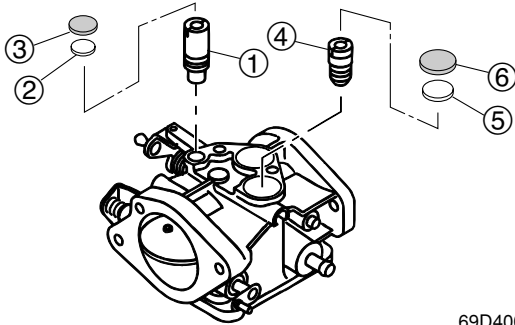
	Digital caliper ②: 90890-06704
--	--------------------------------

	Float height (a): 12.0—16.0 mm (0.47—0.63 in)
--	--



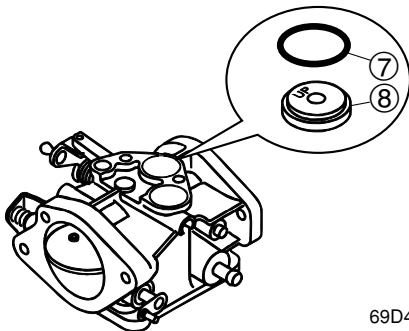
Assembling the carburetors

1. Install the main air jet ①, and then install the plate ② and a new gasket ③ into the carburetor body.
2. Install the pilot air jet ④, and then install the plate ⑤ and a new gasket ⑥ into the carburetor body.



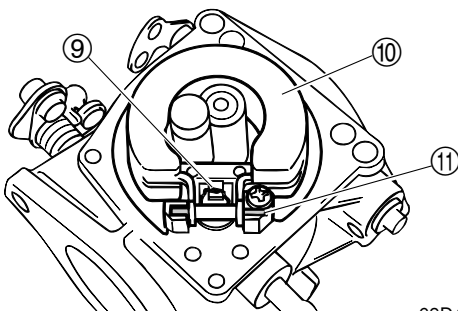
69D40015

3. Install a new O-ring ⑦ to the plate ⑧ and face the mark upward to the carburetor body.



69D40020

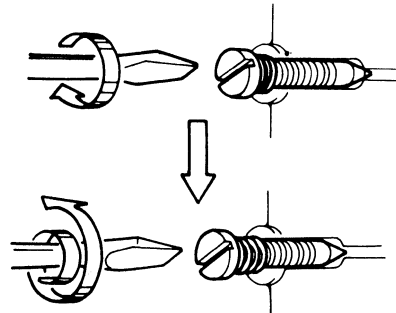
4. Install the cover onto the carburetor body.
5. Install the needle valve ⑨, float ⑩, and float pin ⑪, as shown, and then the check the float for smooth operation.



69D40030

NOTE: _____
Place the needle valve in the valve seat when installing the float to the chamber.

6. Install the pilot screw, turn it in until it is lightly seated, then out the specified number of turns.



6F640100

NOTE: _____
• Adjust the throttle cable whenever the carburetor has been disassembled or the engine idle speed has been adjusted.
• For adjustment procedures, see Chapter 3.

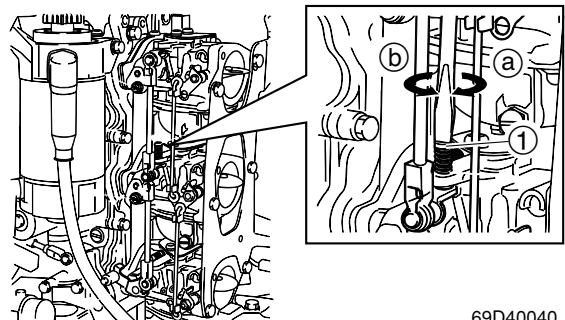


Pilot screw setting:
1 1/4 — 1 3/4 turns out

5. Install the carburetor assembly.

Adjusting the throttle stop screw

1. Start the engine and warm it up for 5 minutes.
2. Turn the throttle stop screw ① on the carburetor #2 in direction ② or ③ until the specified engine idle speed is obtained.



69D40040

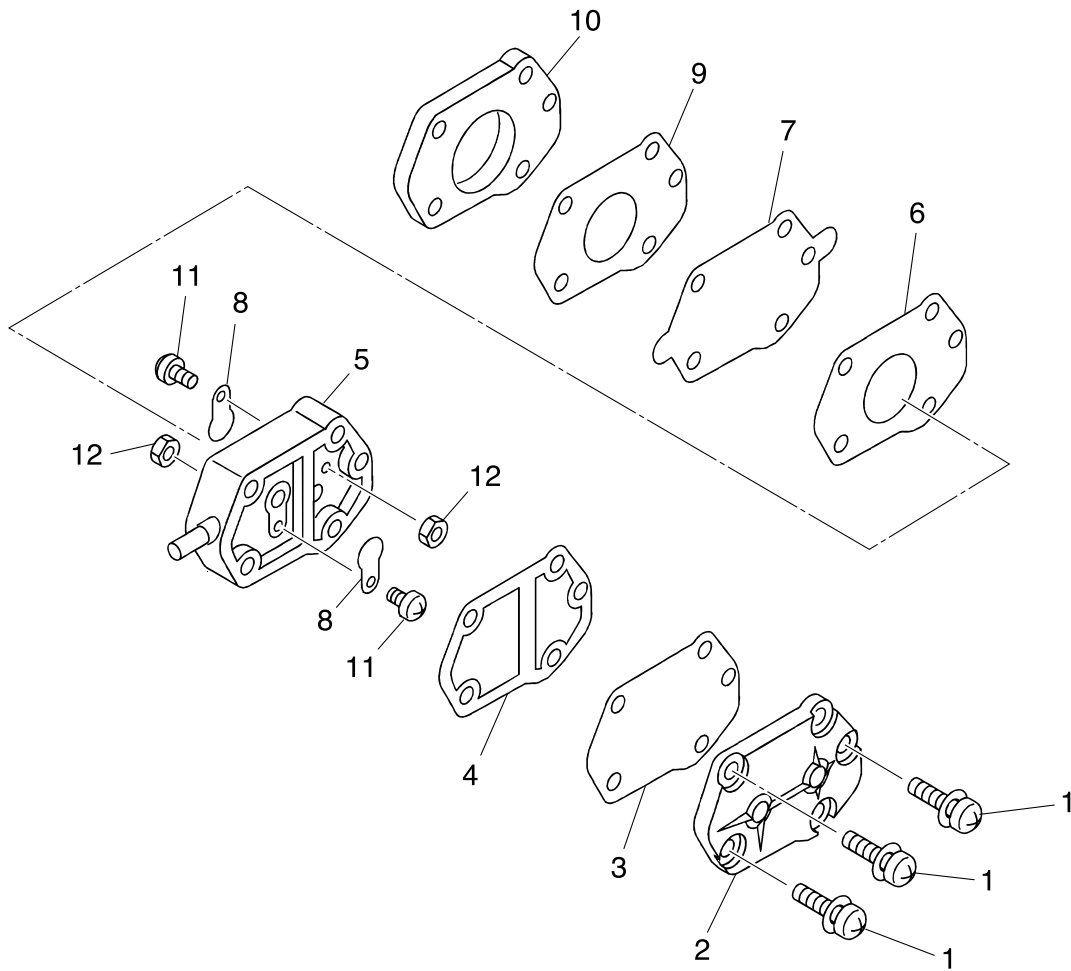
NOTE: _____
• To increase the idle speed, turn the throttle stop screw in direction ②.
• To decrease the idle speed, turn the throttle stop screw in direction ③.



Engine idle speed:
950—1,050 r/min

3. If the specified engine idle speed cannot be obtained, adjust the throttle cable.

Fuel pump



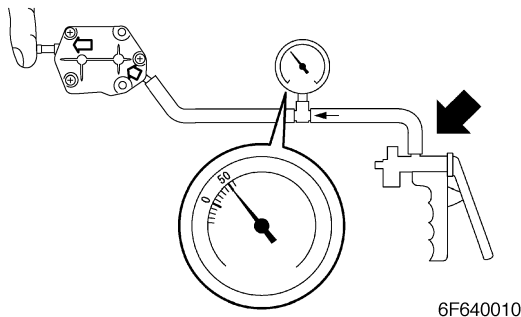
4


69D4040E


No.	Part name	Q'ty	Remarks
1	Screw	3	ø6 × 30 mm
2	Cover	1	
3	Diaphragm	1	
4	Gasket	1	Not reusable
5	Fuel pump body	1	
6	Gasket	1	Not reusable
7	Diaphragm	1	
8	Check valve	2	
9	Gasket	1	Not reusable
10	Cover	1	
11	Screw	2	
10	Nut	2	

Checking the fuel pump

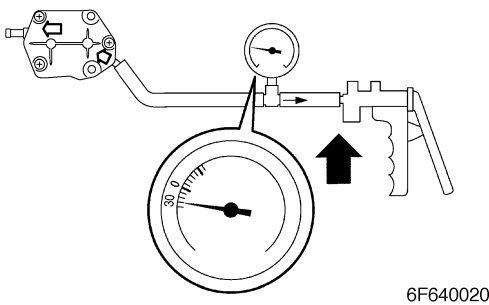
1. Place a drain pan under the fuel hose connections, and then disconnect the fuel hoses from the fuel pump.
2. Connect the special service tool to the fuel pump inlet.
3. Cover the fuel pump outlet with a finger, and then apply the specified positive pressure. Check that there is not air leakage.




 Vacuum/pressure pump gauge set:
90890-06756

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

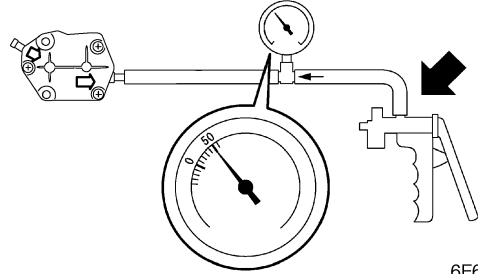
4. Apply the specified negative pressure and check that there is no air leakage.



 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.



6F640030

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.

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

Disassembling the fuel pump

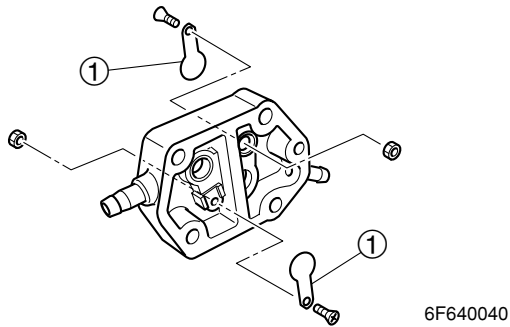
1. Disassemble the fuel pump.
2. Check the diaphragms for tears or damage. Replace if necessary.
3. Check the valves for bends or damage. Replace if necessary. Also, check the fuel pump body for damage. Replace if necessary.
4. Clean the fuel pump body.

Assembling the fuel pump

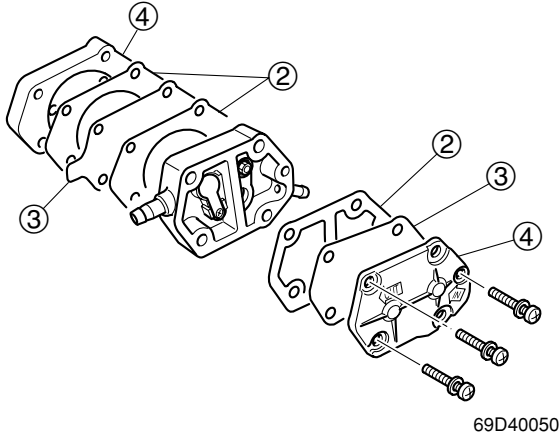
NOTE: _____

Clean the parts and soak the valves and the diaphragms in gasoline before assembly to obtain prompt operation of the fuel pump when starting the engine.

1. Install the check valves ① onto the fuel pump body.



2. Install new gaskets ②, the diaphragms ③, and covers ④.

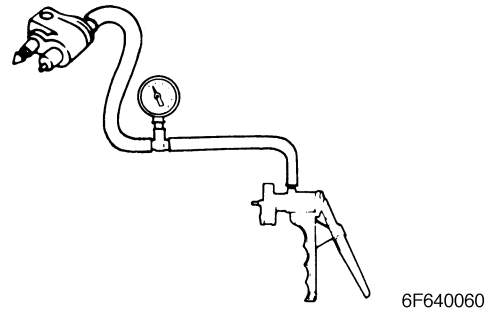


NOTE: _____

Make sure that the gaskets and diaphragms are kept in place through the assembly process.

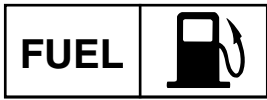
Checking the fuel joint

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.



	Vacuum/pressure pump gauge set: 90890-06756
--	--

	Specified pressure: 50 kPa (0.5 kgf/cm ² , 7.3 psi)
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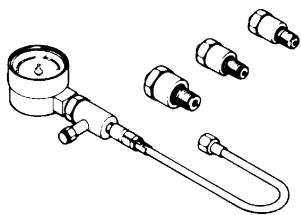
— MEMO —

Power unit

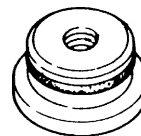
Special service tools	5-1
Power unit	5-5
Checking the compression pressure	5-5
Disassembling the manual starter	5-17
Checking the spiral spring	5-17
Checking the drive pawl	5-17
Measuring the starter rope	5-17
Assembling the manual starter	5-17
Removing the power unit	5-18
Removing the flywheel magnet	5-20
Removing the electrical components	5-20
Removing the control levers	5-20
Assembling the control lever	5-21
Reed valves	5-22
Removing the reed valve assembly	5-23
Checking the reed valves	5-23
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Removing the cylinder head	5-26
Checking the cylinder head	5-26
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Checking the exhaust cover	5-26
Installing the stud bolt	5-26
Installing the thermoswitch	5-27
Crankcase	5-28
Removing the oil seal housing	5-32
Removing the crankcase	5-32
Removing the crankshaft assembly	5-32
Checking the cylinder bore	5-32
Disassembling the oil seal housing	5-33
Checking the oil seal housing	5-33
Assembling the oil seal housing	5-33
Disassembling the upper bearing	5-33
Assembling the upper bearing	5-33
Checking the piston diameter	5-34
Checking the piston clearance	5-34
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Checking the piston pin boss bore	5-35
Checking the piston pin	5-35
Checking the internal anodes	5-35
Disassembling the crankshaft	5-36
Assembling the crankshaft	5-37
Checking the crankshaft	5-39
Assembling the piston	5-40
Assembling the power unit	5-40
Installing the power unit	5-43



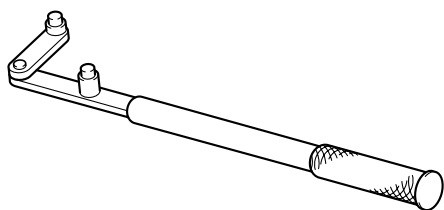
Special service tools



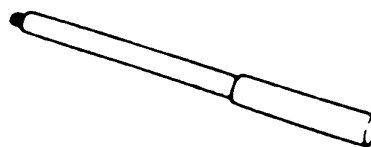
Compression gauge
90890-03160



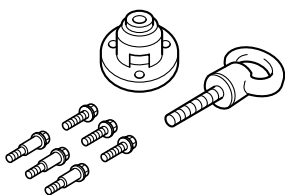
Needle bearing attachment
90890-06637



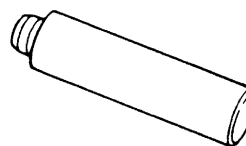
Flywheel holder
90890-06522



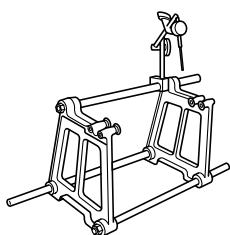
Driver rod L3
90890-06652



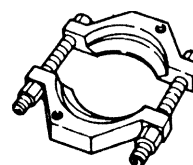
Flywheel puller
90890-06521



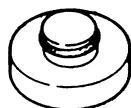
Driver rod LS
90890-06606



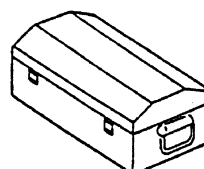
Crankshaft aligner
90890-03107



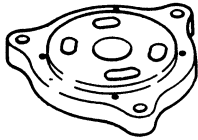
Bearing Separator
90890-06534



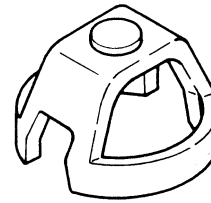
Needle bearing attachment
90890-06631



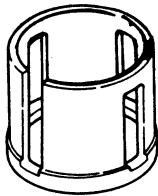
Crank jig set
90890-02422



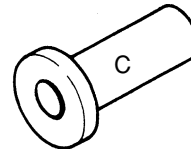
Flange
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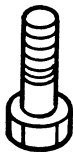
Press body
90890-02385



Body
90890-02352



Bearing pressure C
90890-02393



Bolt
90890-02353



Height ring (H-11)
90890-02377



Washer
90890-02354

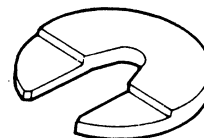
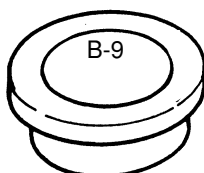
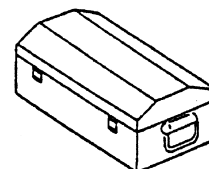


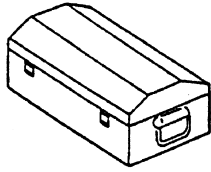
Plate C
90890-02402



Bushing-9 (D30)
90890-02363



Crank separator kit (set 02416 + 02417)
90890-02418



Disassembling kit
90890-02416

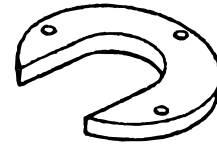
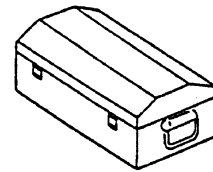


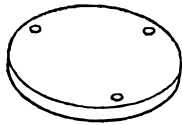
Plate B
90890-02411



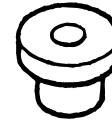
Nut
90890-02407



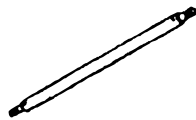
Assembling kit
90890-02417



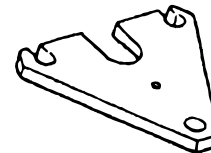
Pressure plate
90890-02408



Guide
90890-02412



Pole
90890-02409



Guide plate
90890-02413

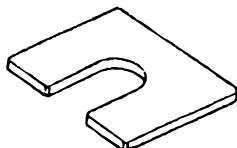
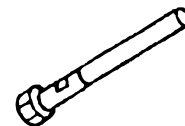
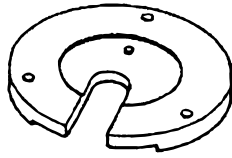


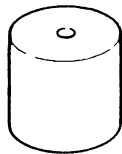
Plate A
90890-02410



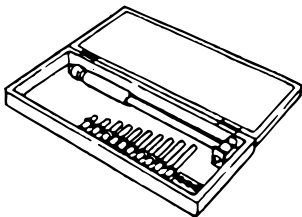
Guide pole
90890-02414



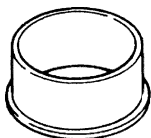
Base
90890-02415



Small end bearing installer
90890-06527



Cylinder gauge
90890-06759



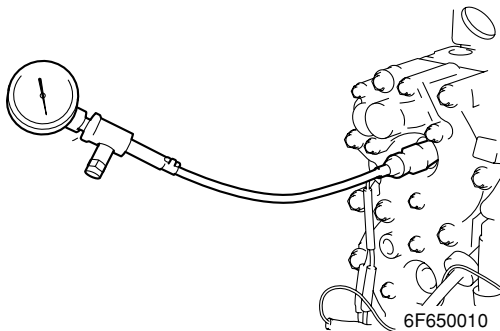
Bearing inner race attachment
90890-06641



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.
3. Remove the spark plug caps and all spark plugs, and then install the special service tools into a 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:
90890-03160

4. Fully open the throttle, and then crank the engine until the reading on the compression gauge stabilizes.

NOTE: _____

Do not pull the choke knob when checking the compression pressure.

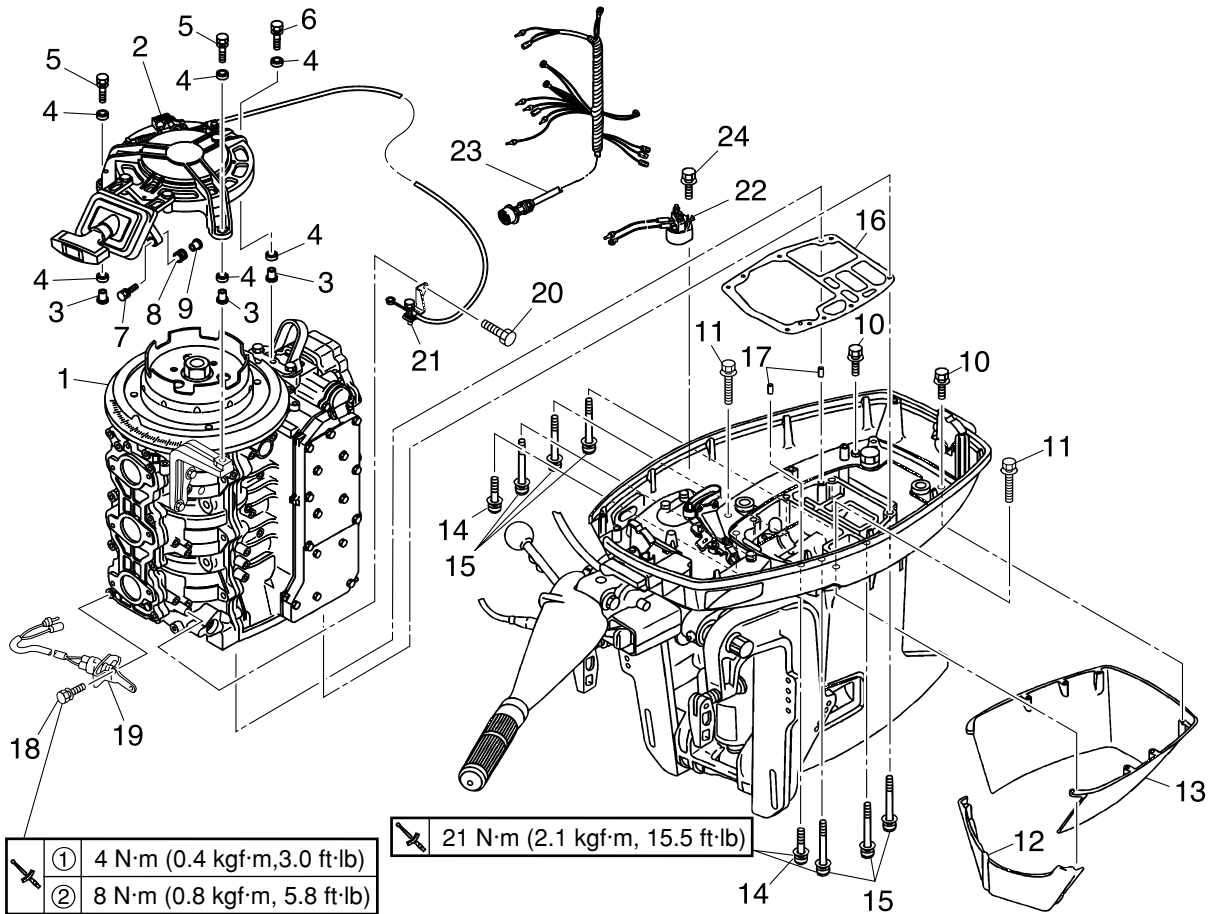


Minimum compression pressure
(reference data):
540 kPa (5.4 kgf/cm², 76 psi)

5. If the compression pressure is below specification and the compression pressure for each cylinder is unbalanced, add a small amount of engine oil to the cylinders, and then check the compression pressure again.

NOTE: _____

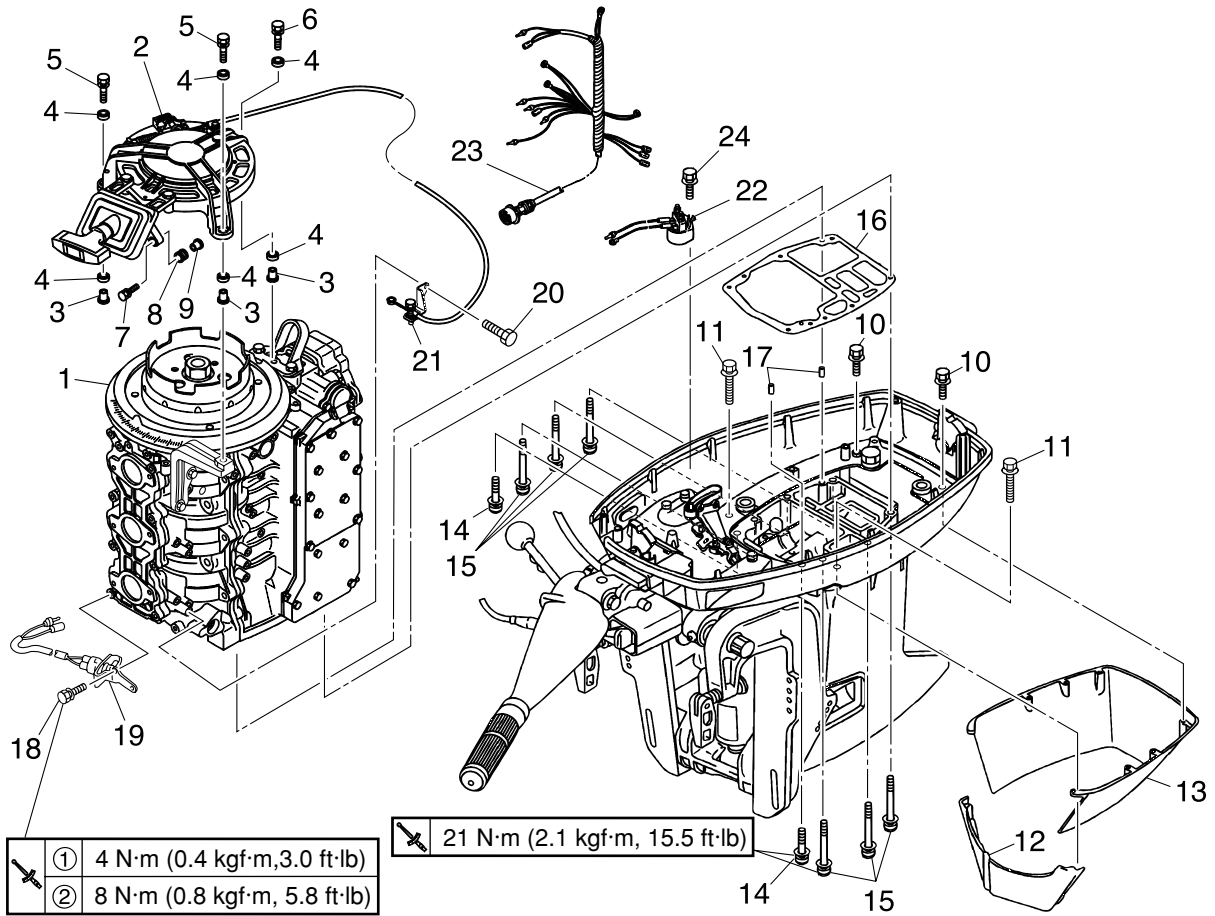
- If the compression pressure increases, check the pistons and piston rings for wear. Replace if necessary.
- If the compression pressure does not increase, check the cylinder head gasket, and cylinder head. Replace if necessary.



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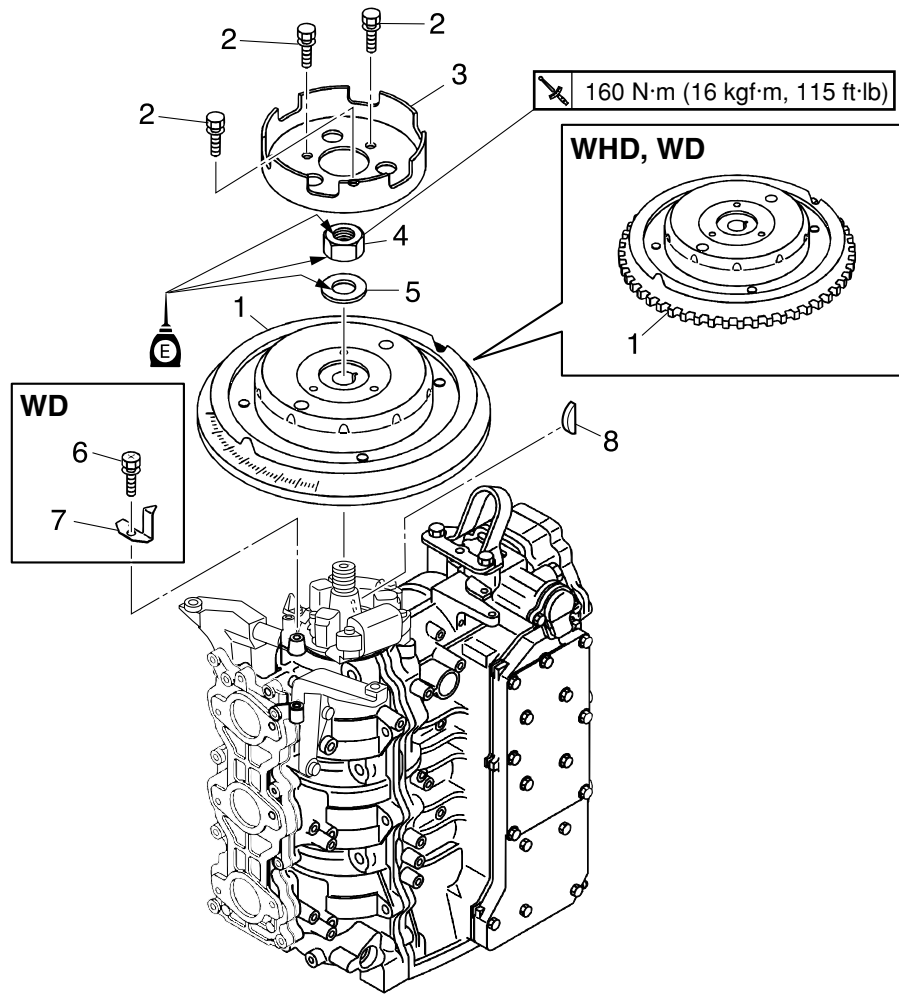
5

No.	Part name	Q'ty	Remarks
1	Power unit	1	
2	Manual starter assembly	1	
3	Collar	3	
4	Grommet	6	
5	Bolt	2	M8 × 30 mm
6	Bolt	1	M8 × 26 mm
7	Bolt	2	M8 × 30 mm
8	Grommet	2	
9	Collar	2	
10	Bolt	2	M6 × 20 mm
11	Bolt	2	M6 × 25 mm
12	Apron	1	
13	Apron	1	
14	Bolt	2	M8 × 35 mm
15	Bolt	6	M8 × 85 mm
16	Gasket	1	Not reusable
17	Dowel	2	



69D5010E

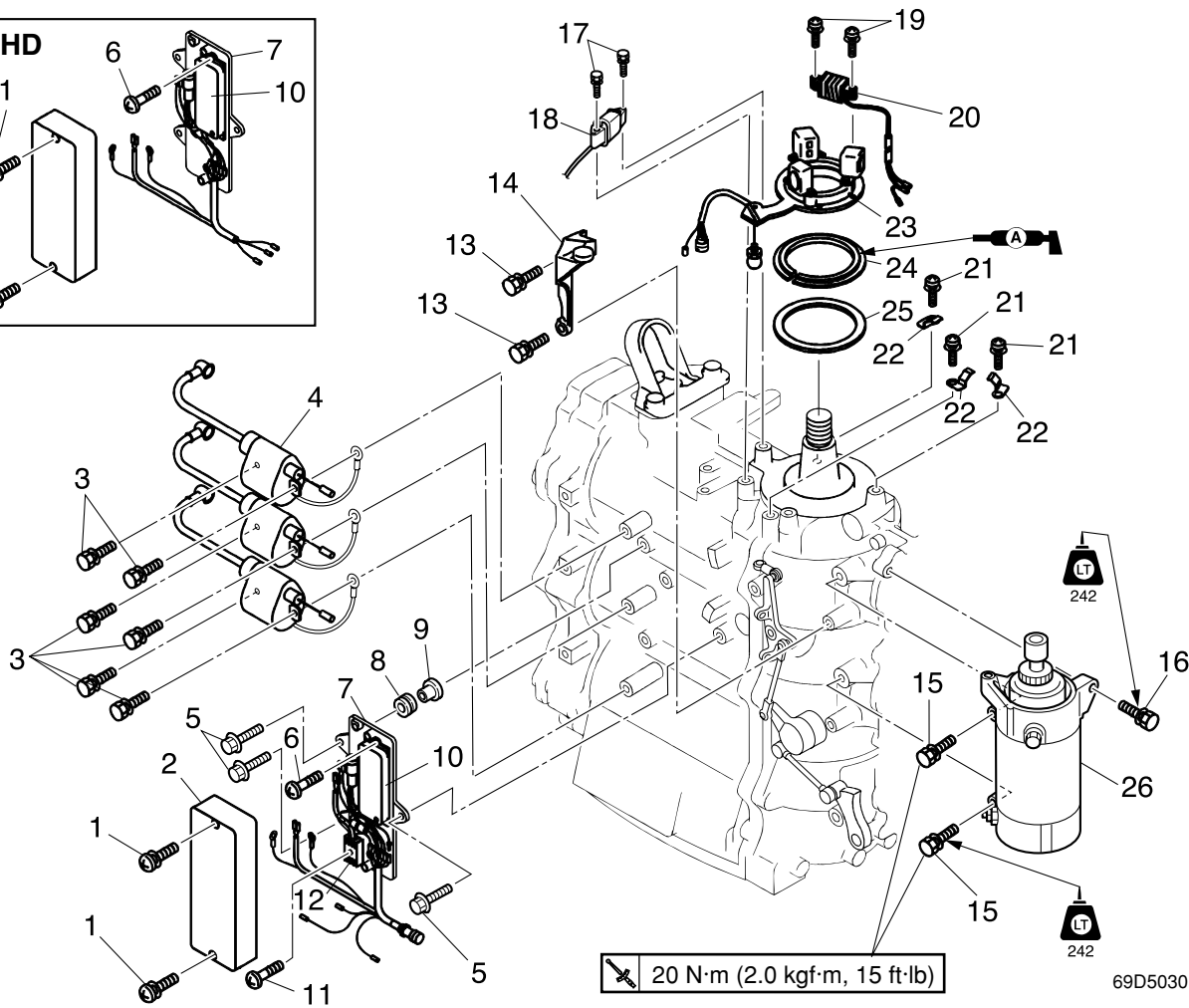
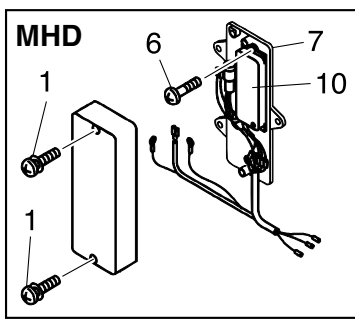
No.	Part name	Q'ty	Remarks
18	Bolt	1	M6 × 25 mm
19	Neutral switch assembly	1	
20	Bolt	1	M6 × 12 mm
21	Bracket	1	
22	Starter relay	1	
23	Wireharness	1	
24	Bolt	1	M6 × 16 mm



69D5020E

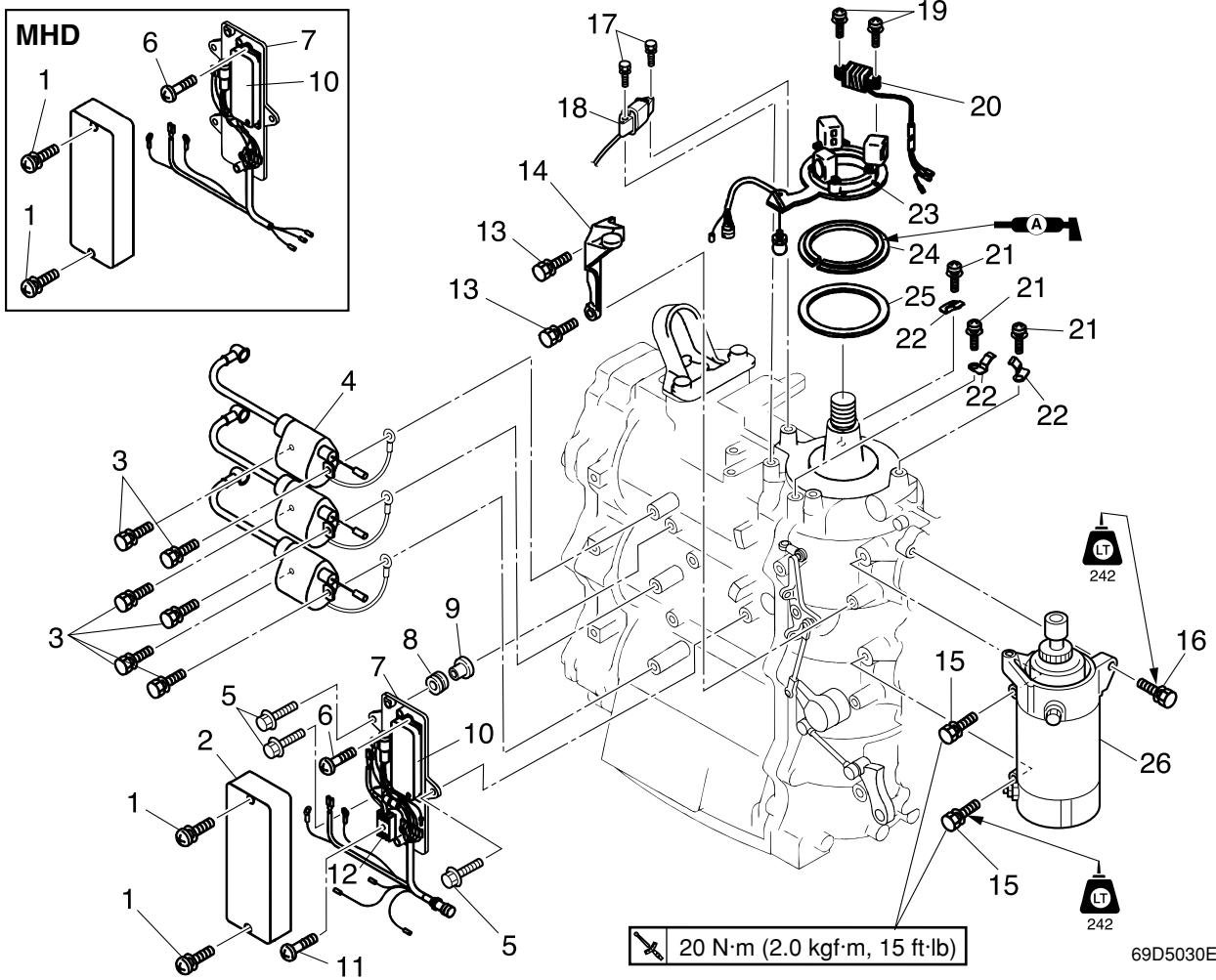
5

No.	Part name	Q'ty	Remarks
1	Flywheel magnet	1	
2	Bolt	3	M8 × 12 mm
3	Starter pulley	1	
4	Nut	1	
5	Washer	1	
6	Bolt	1	M6 × 10 mm
7	Timing plate	1	
8	Woodruff key	1	



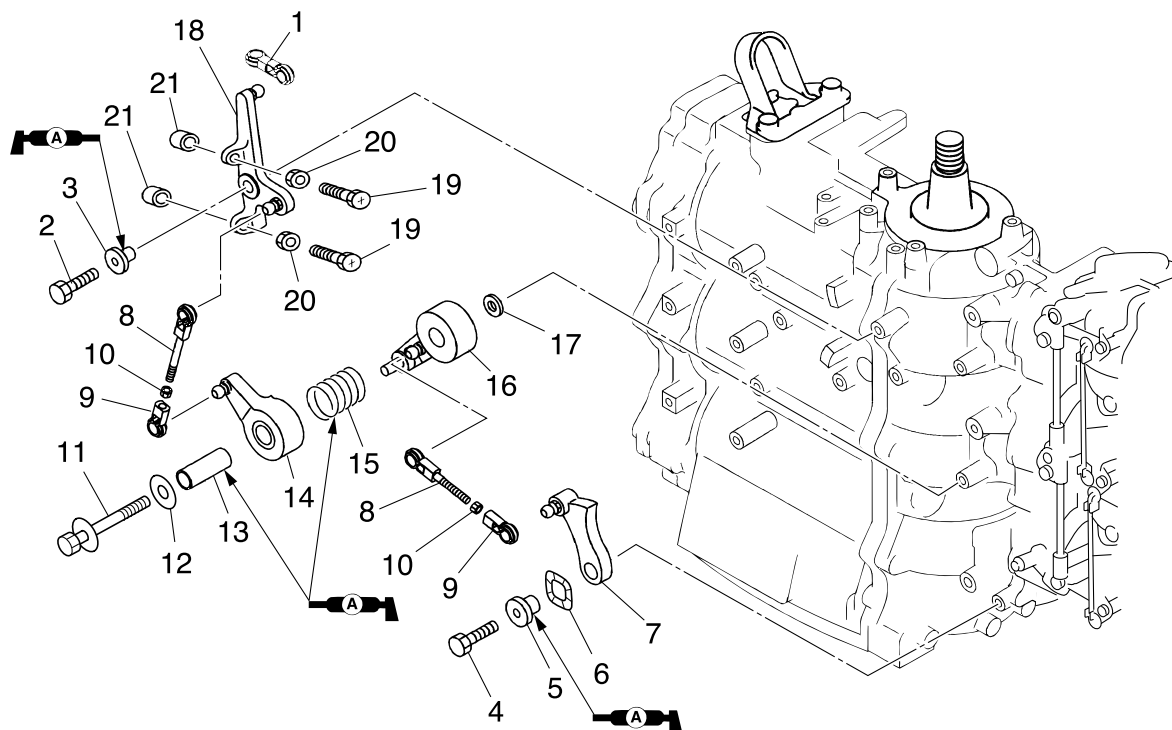
69D5030E

No.	Part name	Q'ty	Remarks
1	Screw	2	
2	Cover	1	
3	Bolt	6	M6 × 25 mm
4	Ignition coil	3	
5	Bolt	3	M6 × 16 mm
6	Screw	2	
7	Bracket	1	
8	Grommet	3	
9	Collar	3	
10	CDI unit	1	
11	Screw	1	ø6 × 25 mm : WHD and WD models
12	Rectifier	1	WHD and WD models
13	Bolt	2	M6 × 55 mm
14	Bracket	1	
15	Bolt	2	M6 × 35 mm : WHD and WD models
16	Bolt	1	M6 × 25 mm : WHD and WD models
17	Bolt	2	M6 × 30 mm



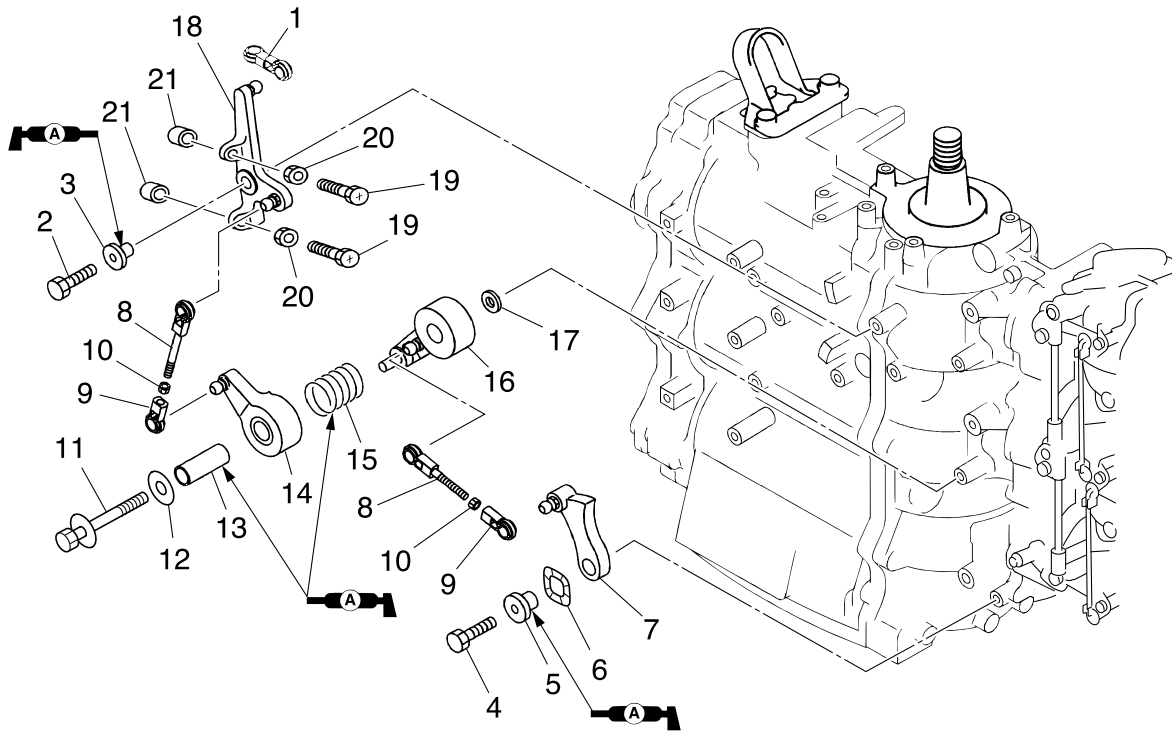
5

No.	Part name	Q'ty	Remarks
18	Lighting coil	1	
19	Screw	2	ø5 × 25 mm
20	Charge coil	1	
21	Screw	3	ø6 × 12 mm
22	Retainer	3	
23	Base assembly	1	
24	Retainer	1	
25	Washer	1	
26	Starter motor	1	WHD and WD models



69D5040E

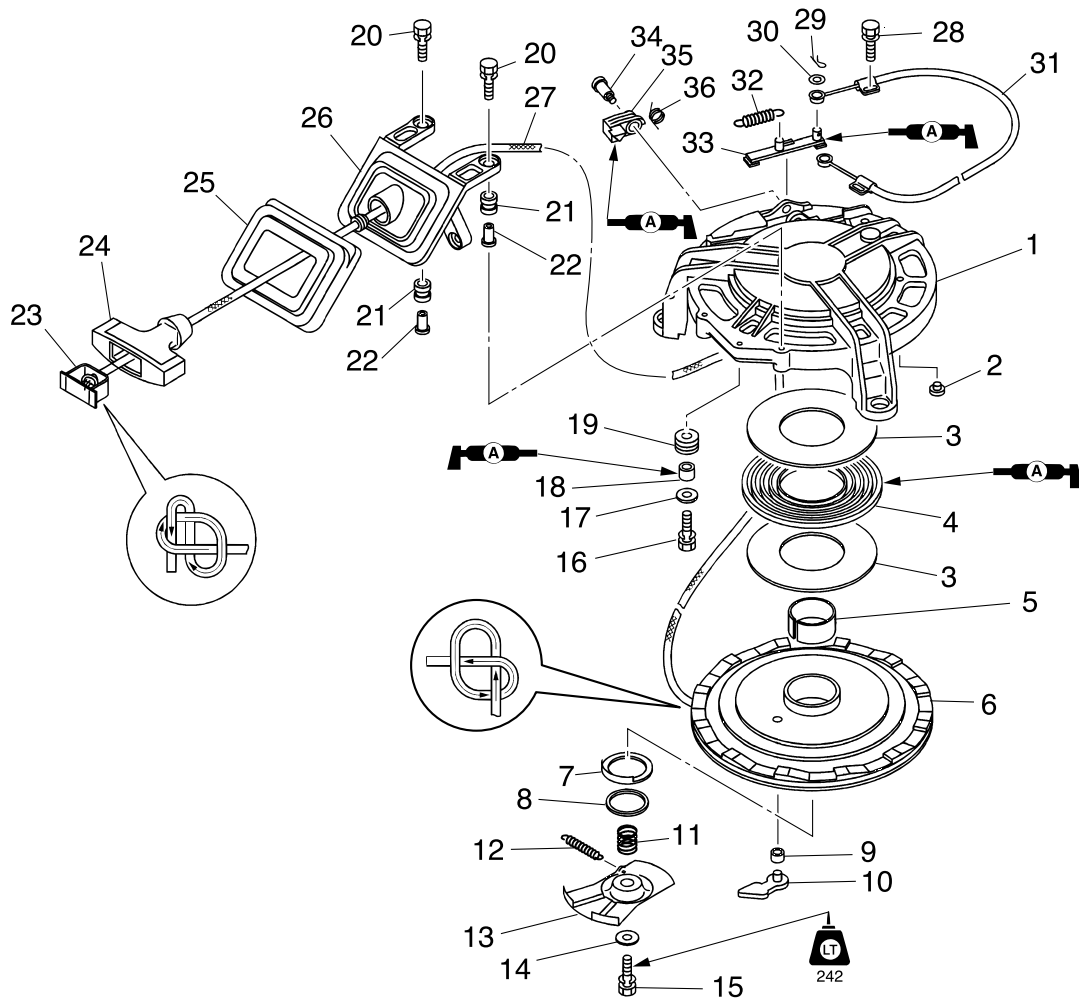
No.	Part name	Q'ty	Remarks
1	Joint	1	
2	Bolt	1	M6 × 16 mm
3	Collar	1	
4	Bolt	1	M6 × 25 mm
5	Collar	1	
6	Wave washer	1	
7	Cam	1	
8	Link rod	1	
9	Joint	2	
10	Nut	2	
11	Bolt	1	M6 × 45 mm
12	Washer	1	
13	Collar	1	
14	Control lever	1	
15	Spring	1	
16	Control lever	1	
17	Washer	1	



5

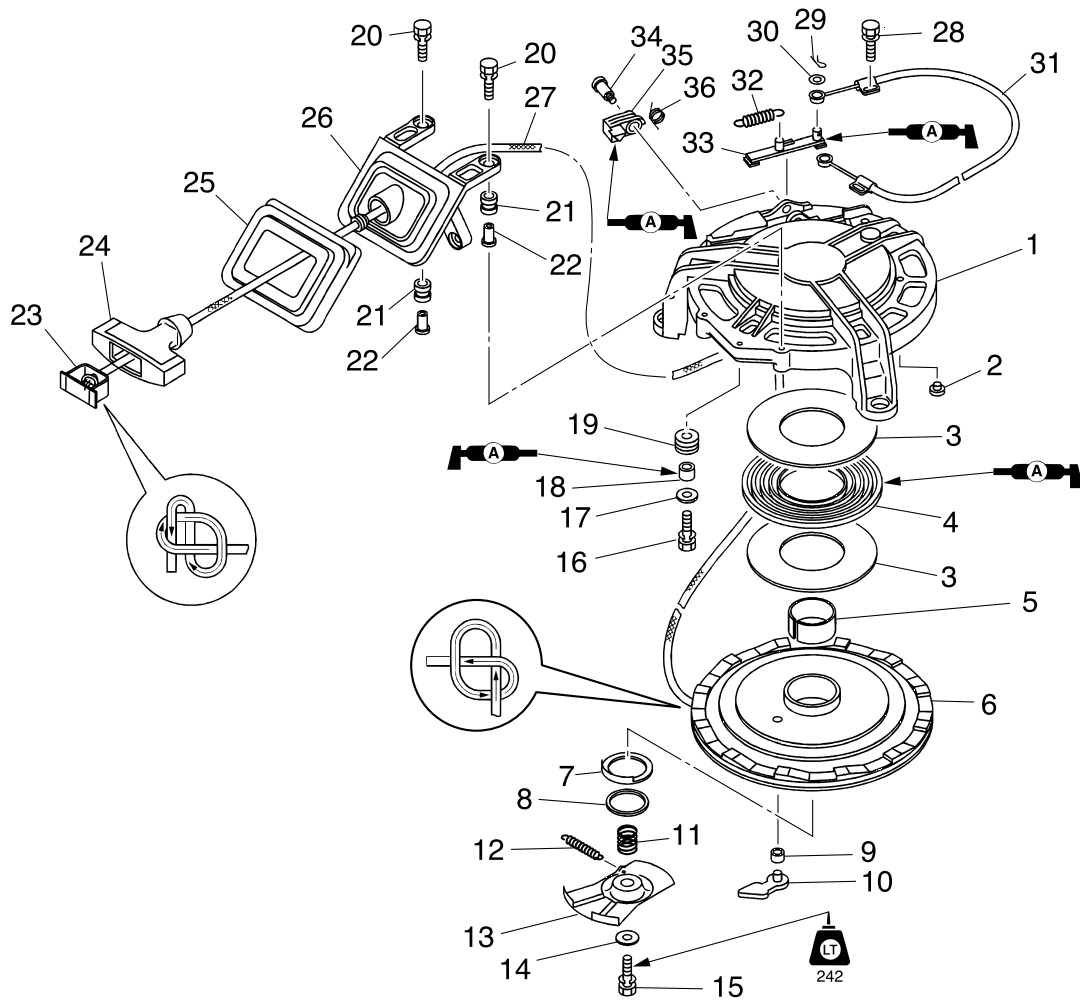
69D5040E

No.	Part name	Q'ty	Remarks
18	Control lever	1	
19	Screw	2	
20	Nut	2	
21	Cap	2	



69D5050E

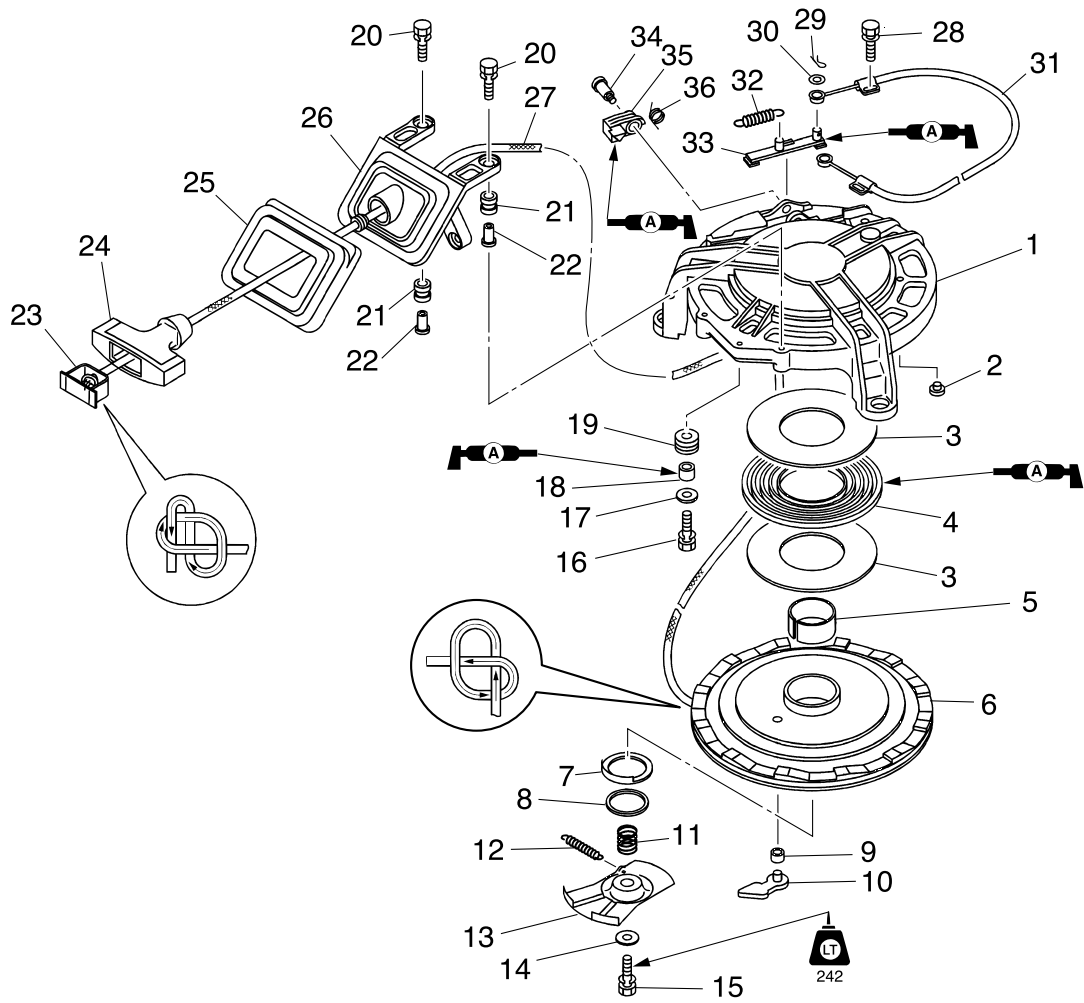
No.	Part name	Q'ty	Remarks
1	Manual starter case	1	
2	Stay	5	
3	Washer	2	
4	Spiral spring	1	
5	Collar	1	
6	Sheave drum	1	
7	Cover	1	
8	Clip	1	
9	Collar	1	
10	Drive pawl	1	
11	Spring	1	
12	Spring	1	
13	Drive plate	1	
14	Washer	1	
15	Bolt	1	M6 × 16 mm
16	Bolt	1	M6 × 25 mm
17	Washer	1	



69D5050E

5

No.	Part name	Q'ty	Remarks
18	Bushing	1	
19	Roller	1	
20	Bolt	2	M6 × 30 mm
21	Grommet	2	
22	Collar	2	
23	Cover	1	
24	Manual starter handle	1	
25	Damper	1	
26	Starter rope guide	1	
27	Starter rope	1	
28	Bolt	1	M6 × 12 mm
29	Clip	1	
30	Washer	1	
31	Start-in-gear protection cable	1	
32	Spring	1	
33	Guide	1	
34	Bolt	1	

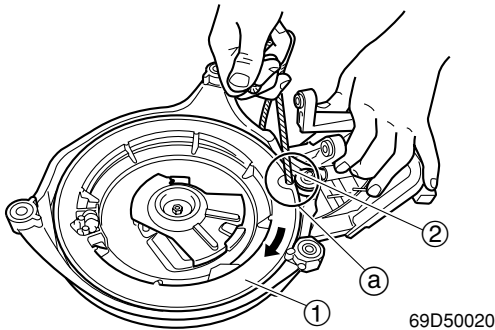


69D5050E

No.	Part name	Q'ty	Remarks
35	Stopper	1	
36	Spring	1	

Disassembling the manual starter

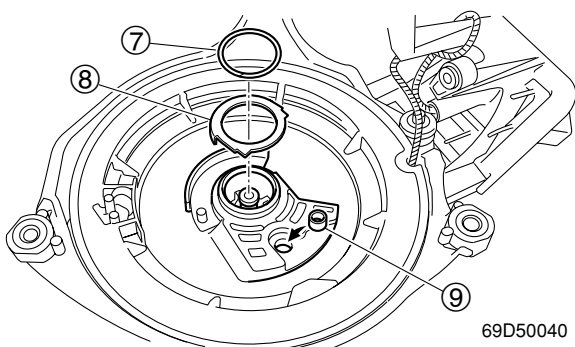
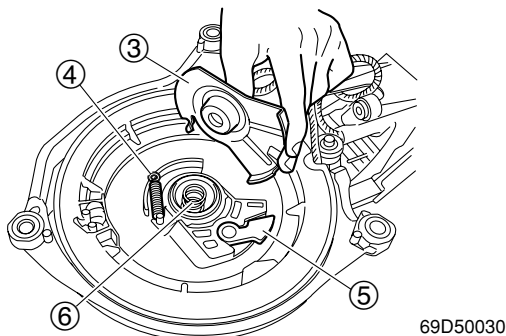
1. Turn the sheave drum ① clockwise until the spiral spring is free.



NOTE:

- Turn the sheave drum so that the notch on the outer surface of the sheave drum faces toward the manual starter handle.
- Pass the starter rope ② through the notch ①.

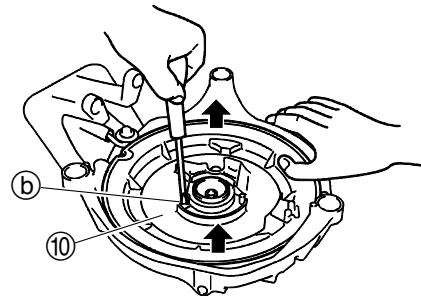
2. Remove the bolt, drive plate ③, spring ④, drive pawl ⑤, spring ⑥, clip ⑦, cover ⑧ and collar ⑨.



⚠WARNING

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

3. Remove the sheave drum ⑩ from the manual starter case.



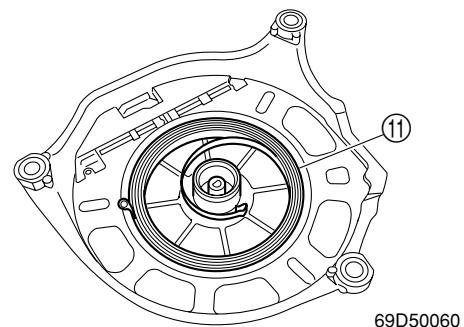
NOTE:

Insert a flat-head screwdriver into the hole ⑥ in the sheave drum and push down on the spiral spring so that it release from the sheave drum.

⚠WARNING

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

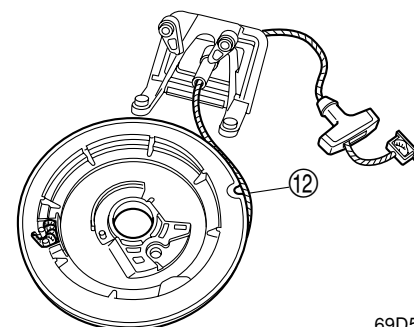
4. Remove the spiral spring ⑪ from the manual starter case.



⚠WARNING

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

5. Remove the starter rope ⑫.





Checking the spiral spring

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

Checking the drive pawl

1. Check the drive pawl for cracks or damage. Replace if necessary.

Measuring the starter rope

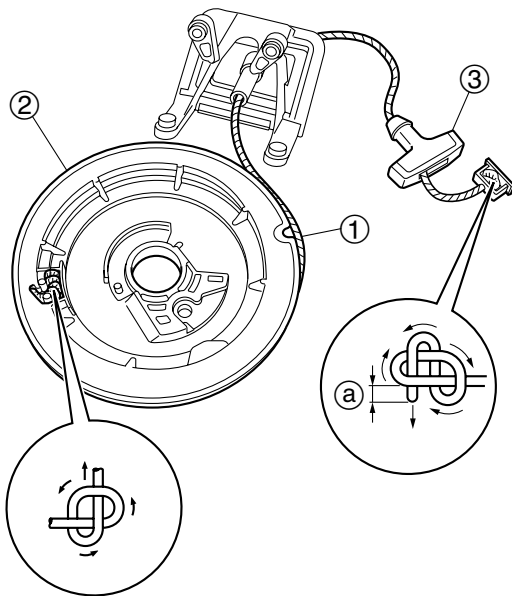
1. Measure the starter rope length. Replace if the length is below specification.



Starter rope length:
1,920—2,080 mm (75.6—81.9 in)

Assembling the manual starter

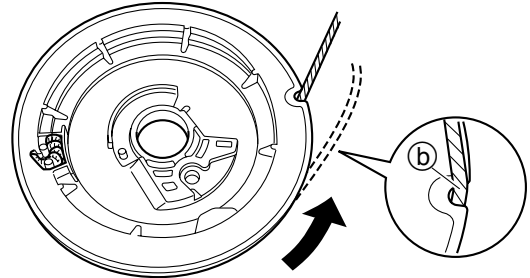
1. Install the starter rope ① into the sheave drum ②.
2. Install the drive pawl and springs.
3. Install the manual starter handle ③.



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 (0.2—0.4 in) at the end ① of the starter rope.

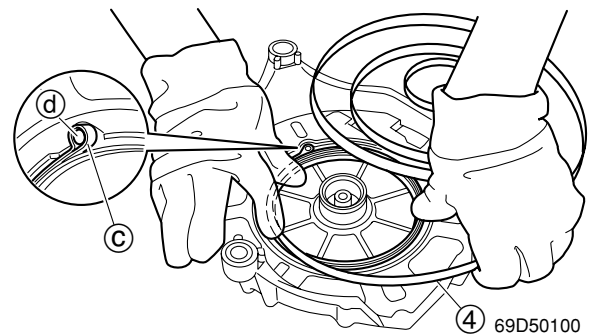
4. Wind the starter rope 2-1/2 around the sheave drum in the direction of the arrow shown in the illustration.



NOTE:

After winding the starter rope around the sheave drum, install the starter rope in the notch ①.

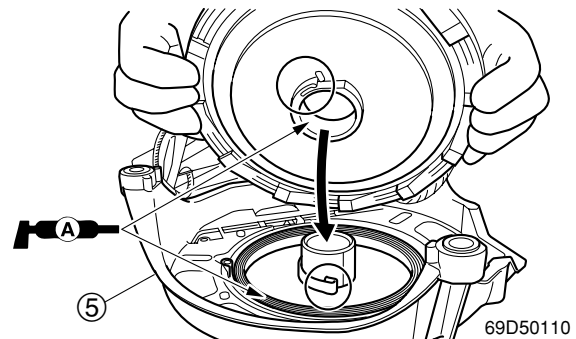
5. Install the washer and the spiral spring ④ into the starter case.



NOTE:

Install the outer end ③ of the spiral spring onto the pin ④ of the starter case.

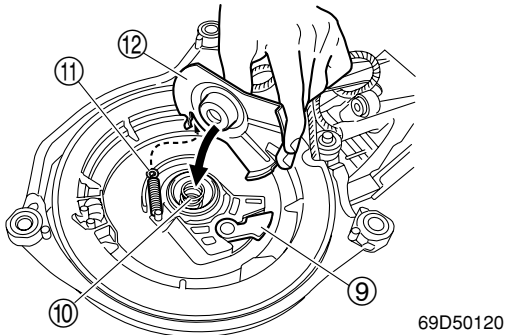
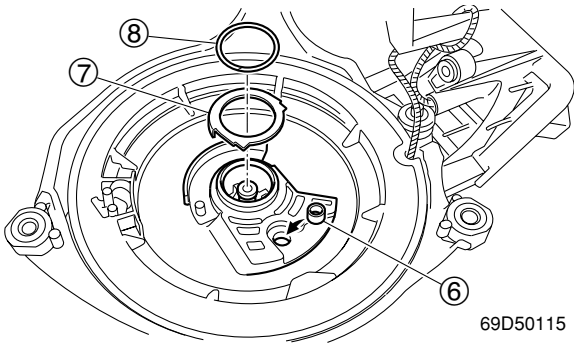
6. Install the collar and the sheave drum into the manual starter case ⑤.



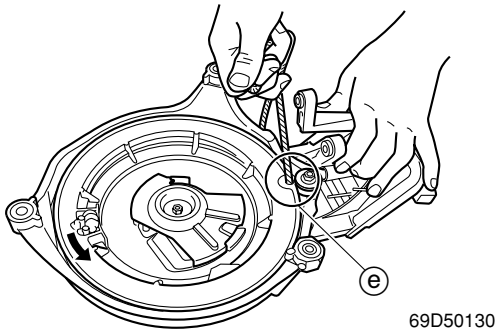
NOTE:

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

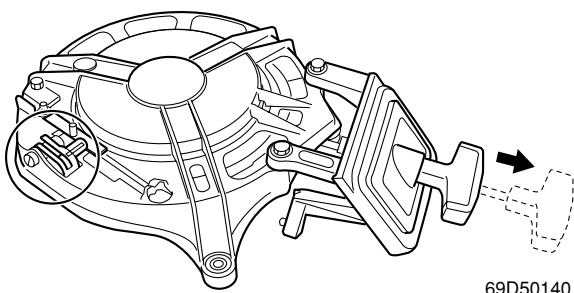
7. Install the collar ⑥, cover ⑦, clip ⑧, drive pawl ⑨, spring ⑩, spring ⑪, and drive plate ⑫.



8. Turn the sheave drum 6 times in the direction of the arrow shown, and then remove the starter rope from the notch ⑤.

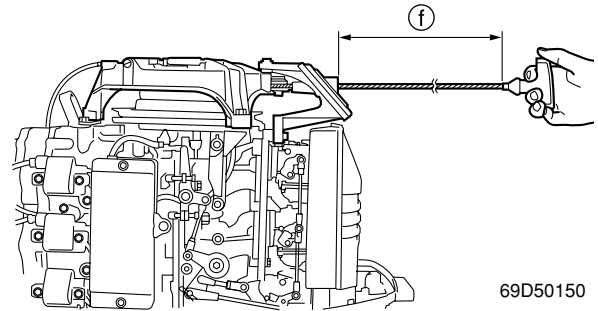



9. Pull the manual starter handle several times to check that the sheave drum turns smoothly and to check the starter rope for slack. Repeat steps 4—8 if necessary.



NOTE: _____
Align the mark on the stopper with guide, and then turn the sheave drum.

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

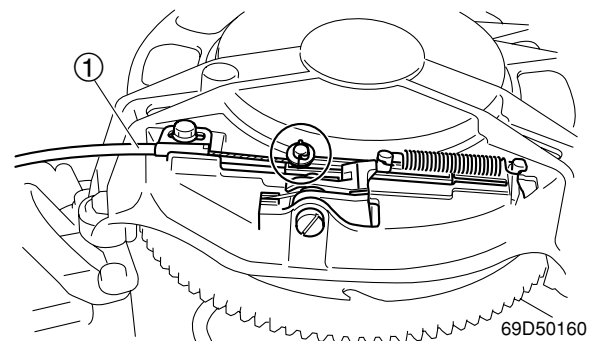


 Starter rope length (f):
1,700–1,900 mm (66.9–74.8 in)

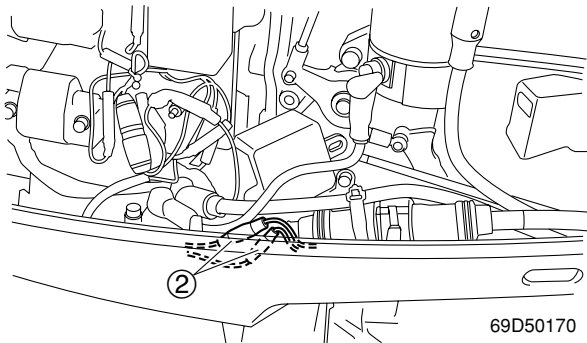
Removing the power unit

NOTE: _____
It is recommended to loosen the flywheel magnet nut before removing the power unit to improve working efficiency.

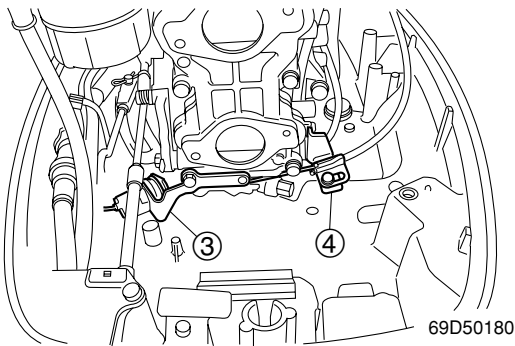
1. Remove the carburetor assembly.
2. Remove the start-in-protection cable ①, and then remove the manual starter.



3. Disconnect the neutral switch connector ②. (WHD)



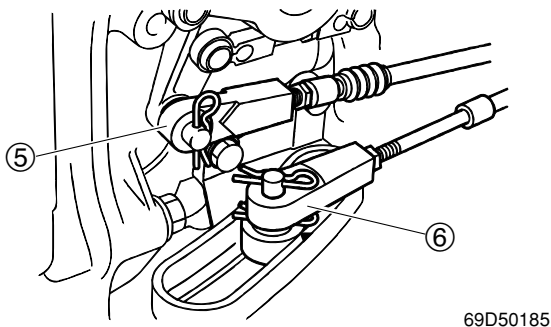
4. Remove the neutral switch bracket ③ (WHD) and bracket ④.



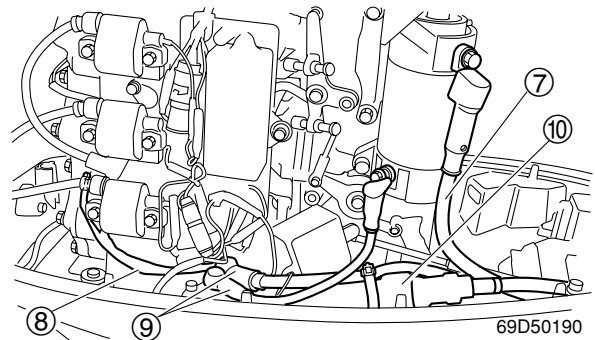
NOTE:

Set the shift position to the reverse, when remove the neutral switch bracket and bracket.

5. Disconnect the remote control cables (remote control model) or throttle cable ⑤ and shift cable ⑥ (tiller control cable).



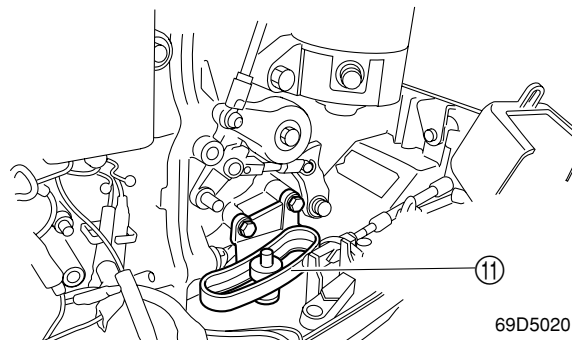
6. Disconnect the battery leads ⑦ (WHD, WD), warning indicator leads engine stop lanyard switch lead (MHD, WHD) and ground leads ⑧.



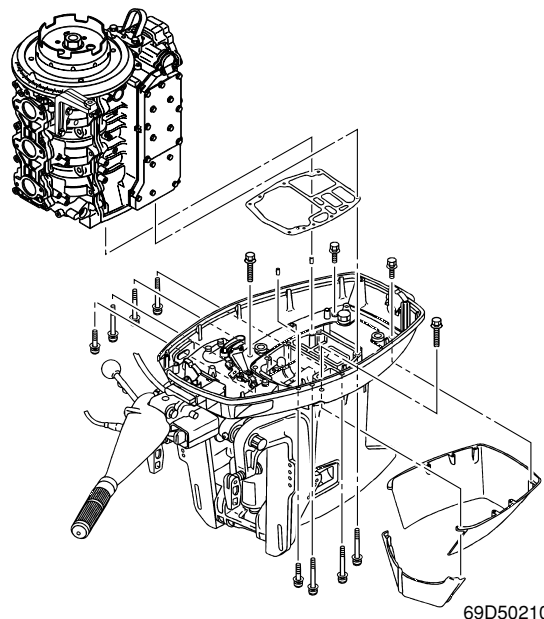
7. Disconnect the starter relay leads ⑨ (WHD, WD) and coupler ⑩ from the wire-harness.

8. Disconnect the pilot water hose.

9. Remove the shift bracket ⑪.



10. Remove the apron, and then remove the power unit by removing the bolts.

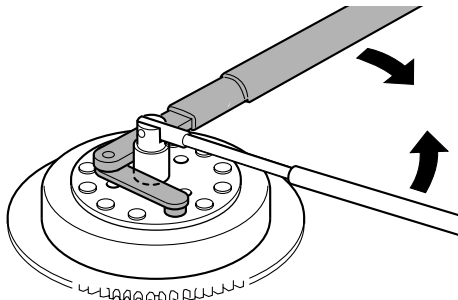


69D50210

69D5G11

Removing the flywheel magnet

1. Remove the starter pulley, and then loosen the flywheel magnet nut.



6F650200

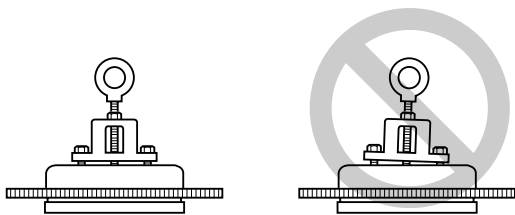
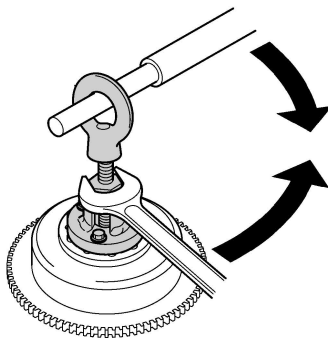
CAUTION:

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

2. Remove the flywheel magnet.



6B450090

CAUTION:

To prevent damage to the engine or tools, screw in the flywheel puller set bolts evenly and completely so that the flywheel puller plate is parallel to the flywheel magnet.

NOTE:

Apply force to the crankshaft end until the flywheel magnet comes off the tapered portion of the crankshaft.

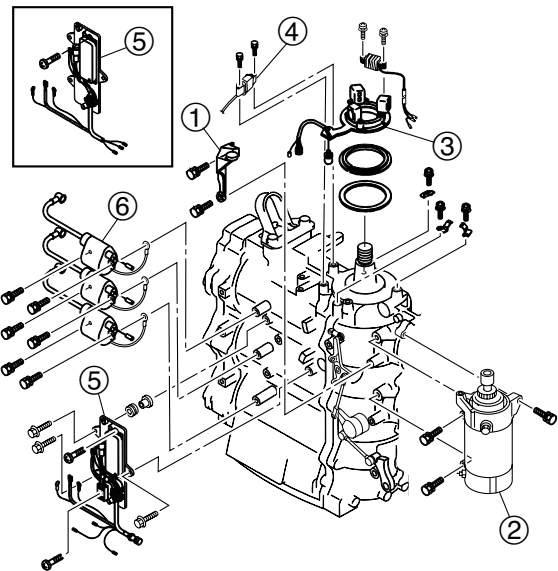


Flywheel puller: 90890-06521

3. Remove the Woodruff key.

Removing the electrical components

1. Remove the bracket (1), the starter motor (2) (WHD, WD models).
2. Remove the base assembly (3), the lighting coil (4), and the CDI unit (5).

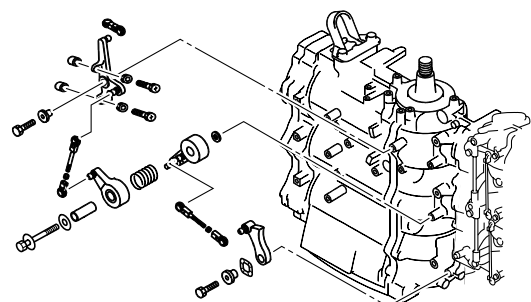


69D50220

3. Remove the spark plug caps from the spark plugs, and then remove the ignition coils (6).

Removing the control levers

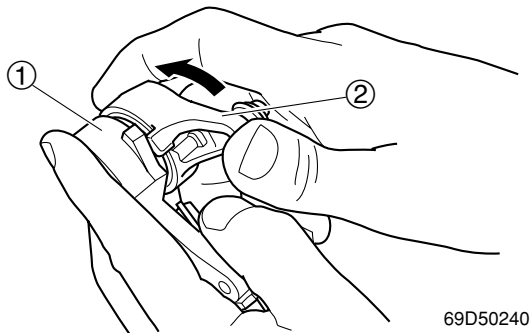
1. Remove the control levers.



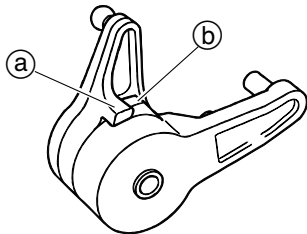
69D50230

Assembling the control lever

1. Install the spring into the control lever ①, and then install the control lever ②.



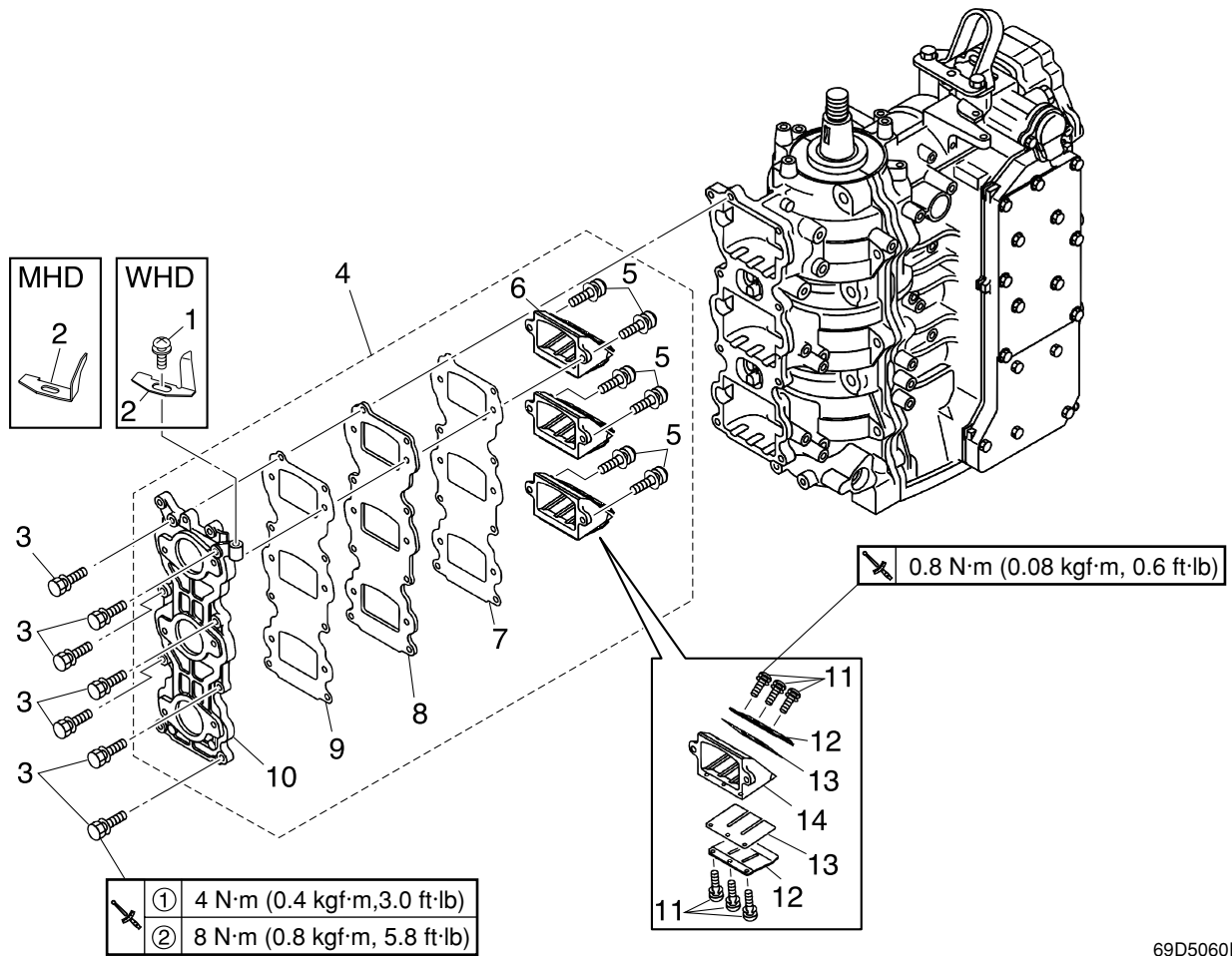
69D50240



69D50245

NOTE: _____
Align the projection ① on the control lever ② with projection ② on the control lever ① to turn the direction.

Reed valves



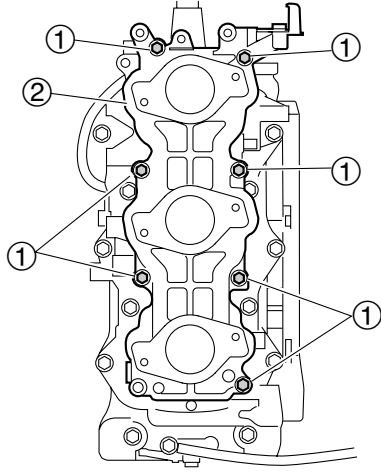
69D5060E

5

No.	Part name	Q'ty	Remarks
1	Screw	1	
2	Timing plate	1	
3	Bolt	7	M6 × 25 mm
4	Intake manifold assembly	1	
5	Screw	6	∅5 × 16 mm
6	Reed valve assembly	3	
7	Gasket	1	Not reusable
8	Plate	1	
9	Gasket	1	Not reusable
10	Intake manifold	1	
11	Screw	18	∅3 × 7 mm
12	Valve stopper	6	
13	Reed valve	6	
14	Body	3	

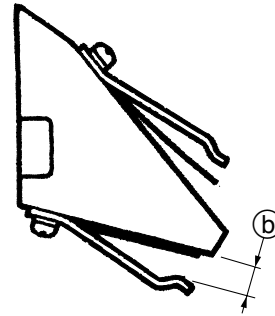
Removing the reed valve assembly

1. Remove the intake manifold bolts ①, and then remove the intake manifold cover ②, gasket and reed valve assembly.




69D50250

2. Measure the valve stopper height ⑥. Replace if out of specification.

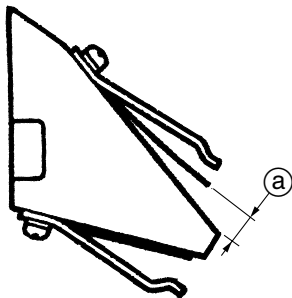


69D50270


	Valve stopper height ⑥: 2.8—3.2 mm (0.11—0.13 in)
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Checking the reed valves

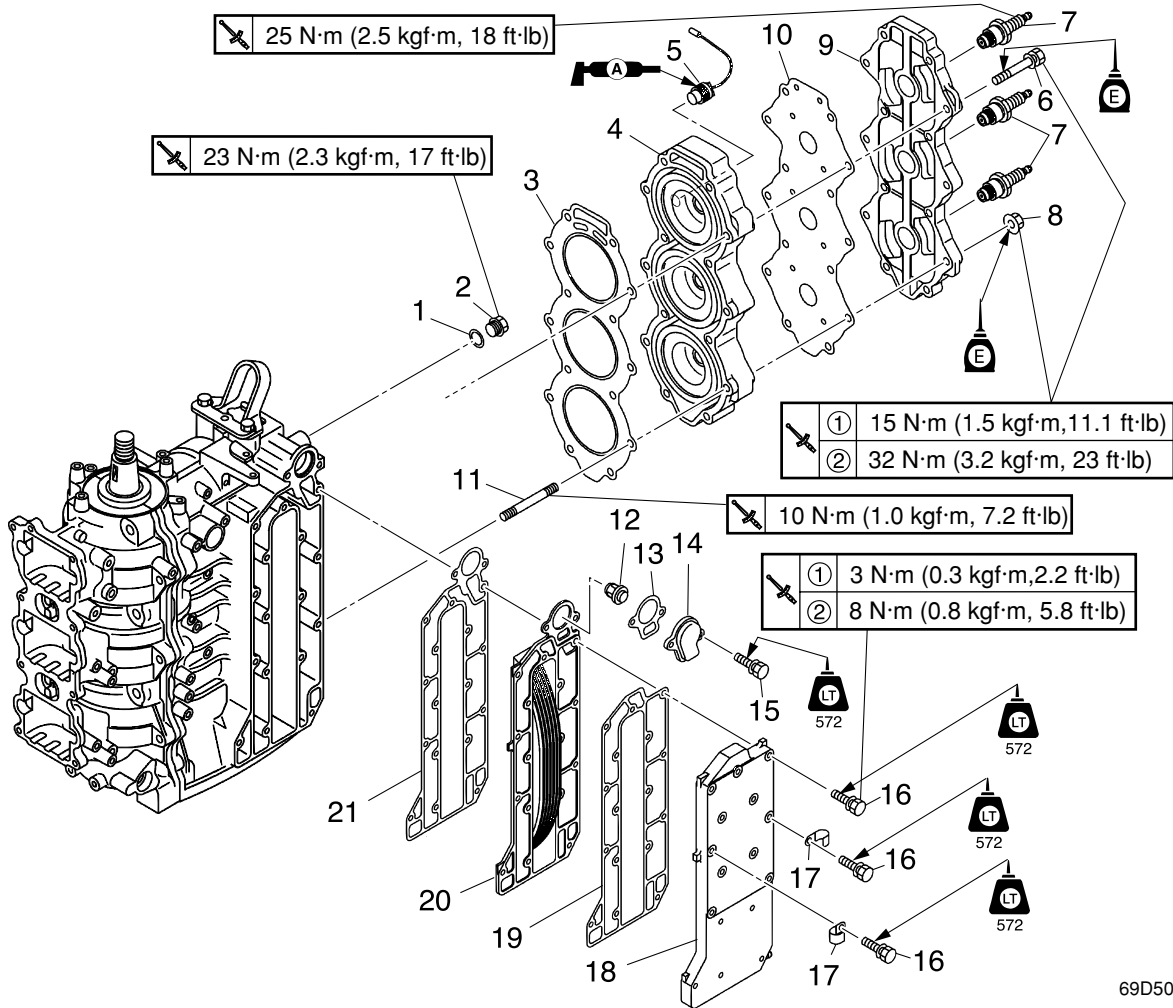
1. Check the reed valves for bends ⑦. Replace if above specification.



69D50265

	Valve bend limit ⑦: 0.20 mm (0.0079 in)
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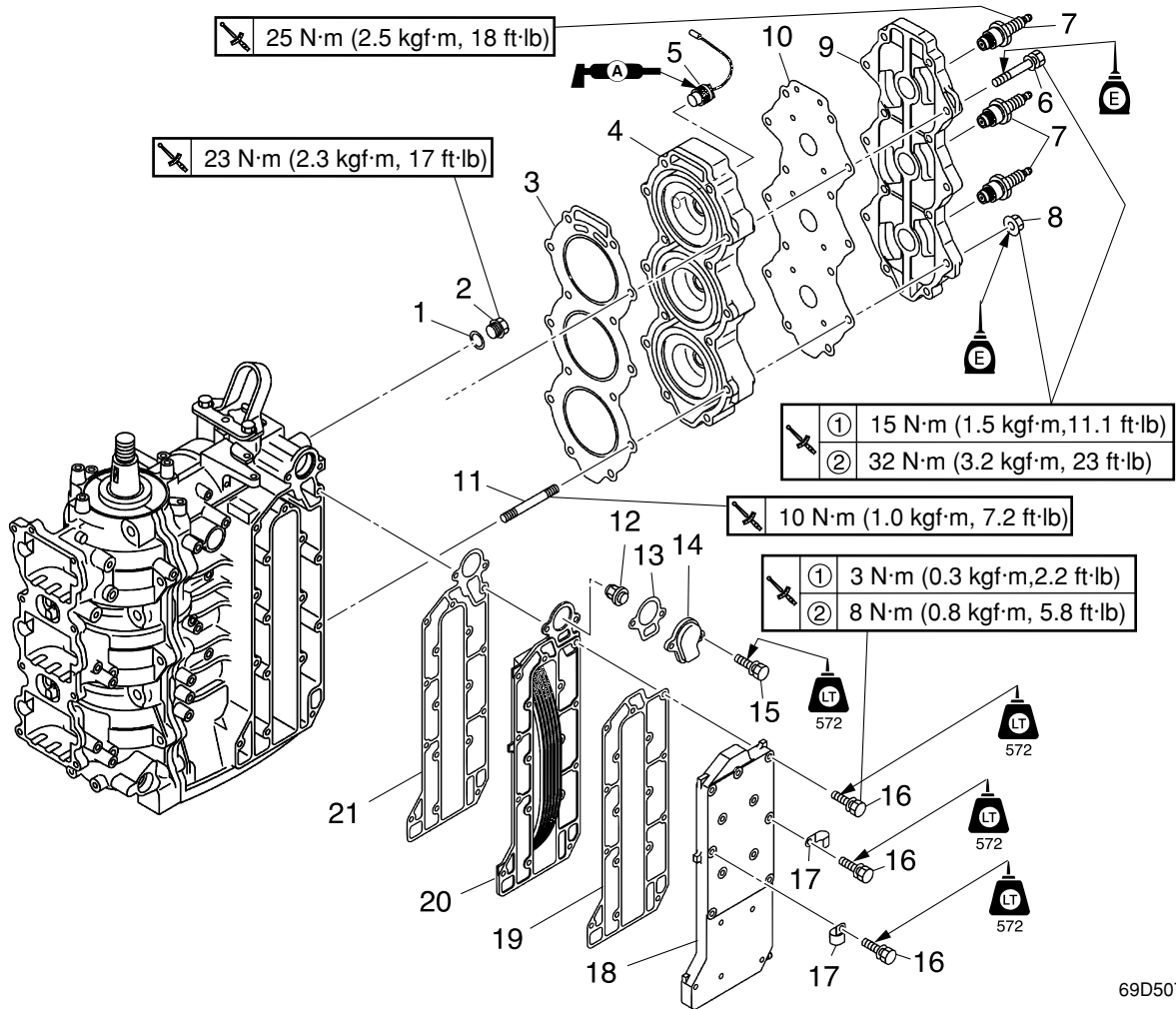
Cylinder head



69D5070E

5

No.	Part name	Q'ty	Remarks
1	Gasket	1	Not reusable
2	Plug	1	
3	Gasket	1	Not reusable
4	Cylinder head	1	
5	Thermoswitch	1	
6	Bolt	13	M8 × 70 mm
7	Spark plug	3	
8	Nut	1	
9	Cylinder head cover	1	
10	Gasket	1	Not reusable
11	Stud bolt	1	
12	Thermostat	1	
13	Gasket	1	Not reusable
14	Cover	1	
15	Bolt	2	M6 × 25 mm
16	Bolt	16	M6 × 35 mm
17	Clamp	2	

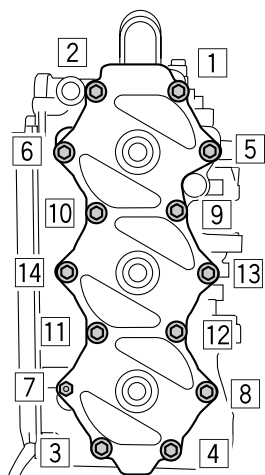


69D5070E

No.	Part name	Q'ty	Remarks
18	Exhaust outer cover	1	
19	Gasket	1	Not reusable
20	Exhaust inner cover	1	
21	Gasket	1	Not reusable

Removing the cylinder head

1. Remove the spark plugs, thermostat cover, thermostat and thermoswitch.
2. Remove the cylinder head bolts (nut) in the sequence shown.



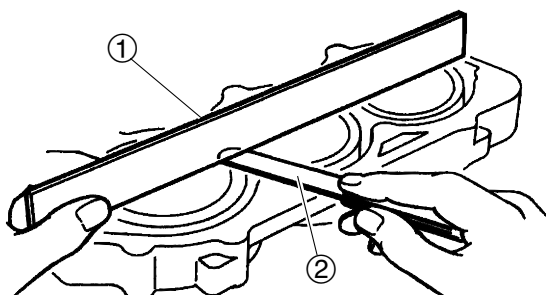
69D50280

CAUTION:

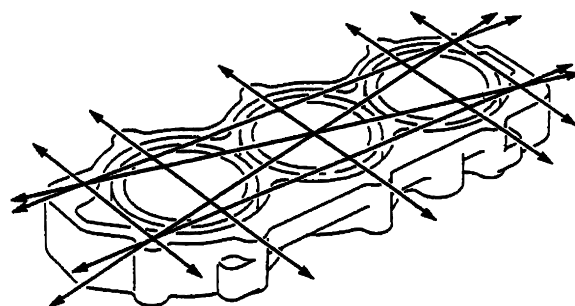
Do not scratch or damage the mating surfaces of the cylinder head and cylinder block.

Checking the cylinder head

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



69D50290



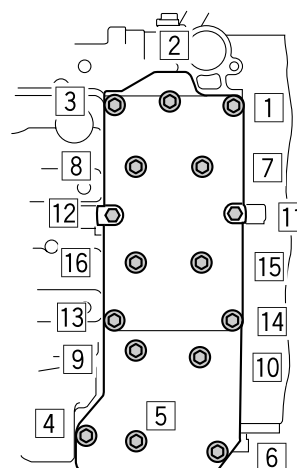
69D50300



Cylinder head warpage limit:
0.1 mm (0.0039 in)

Removing the exhaust cover

1. Remove the exhaust cover bolts in the sequence shown.



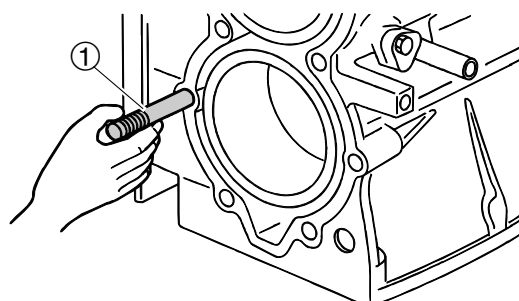
69D50310

Checking the exhaust cover

1. Check the exhaust cover for distortion or corrosion. Replace if necessary.

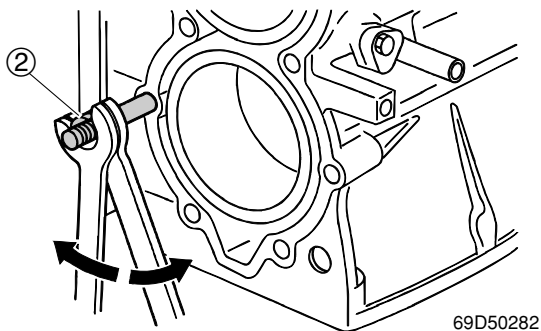
Installing the stud bolt

1. Temporary tighten the stud bolt ①.



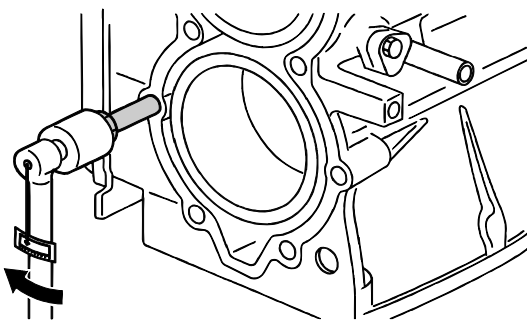
69D50281

2. Install the two nuts ②, and then locking the nut as shown.




69D50282

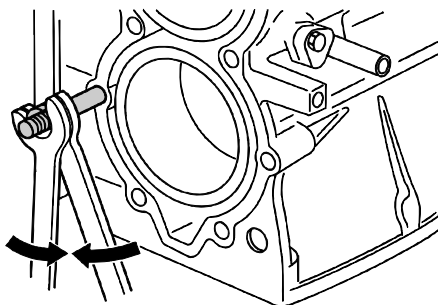
3. Tighten the nuts to specified torque.



69D50283

	<p>Stud bolt: 10 N·m (1.0 kgf·m, 7.2 ft·lb)</p>
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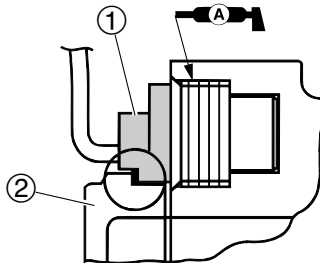
4. Remove the two nuts from the stud bolt.



69D50284

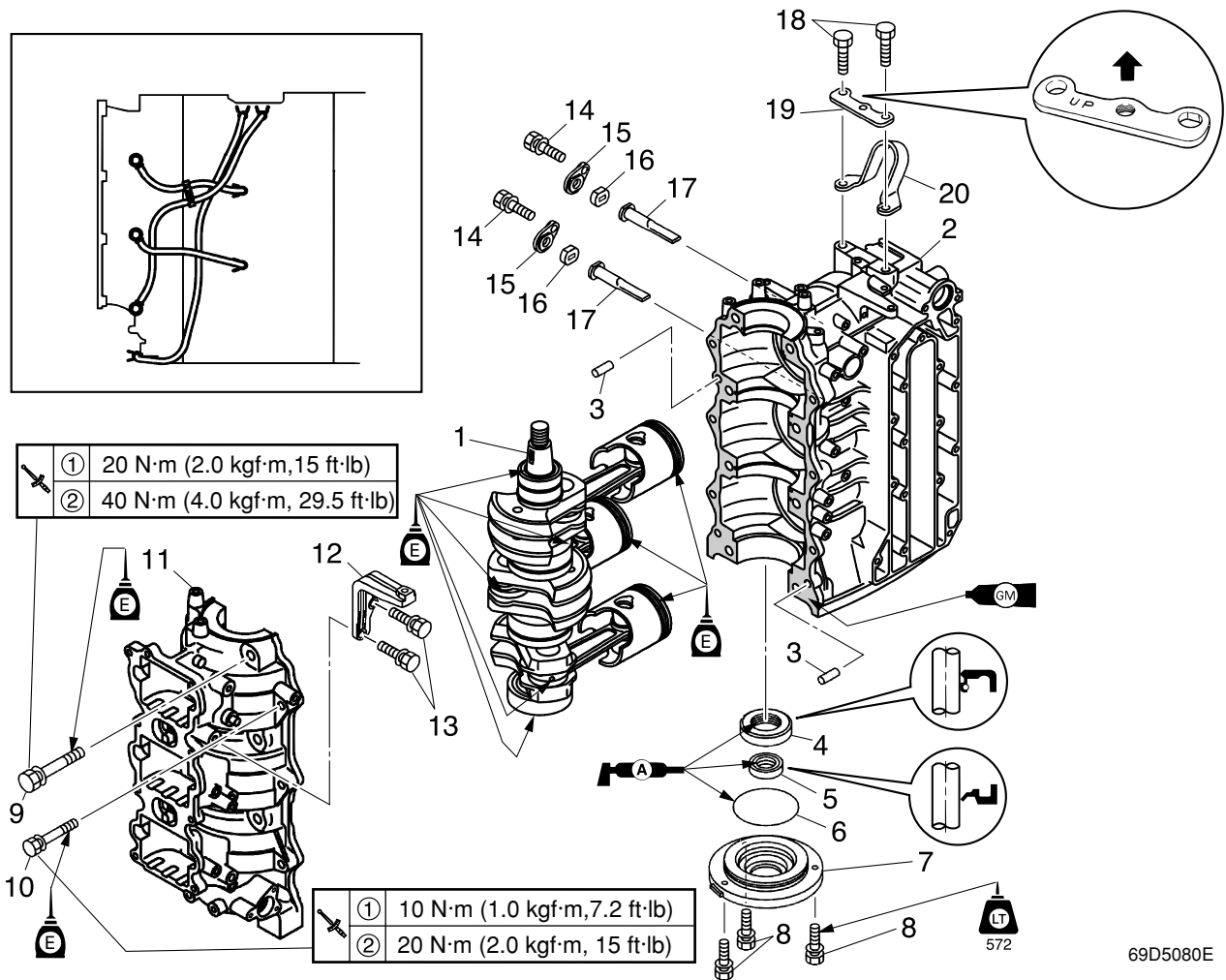
Installing the thermostat

1. Install the thermostat ①, push into the bottom of the flange on the cylinder head cover ②.



69D50320

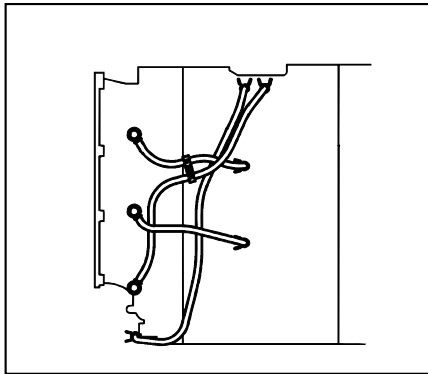
Crankcase



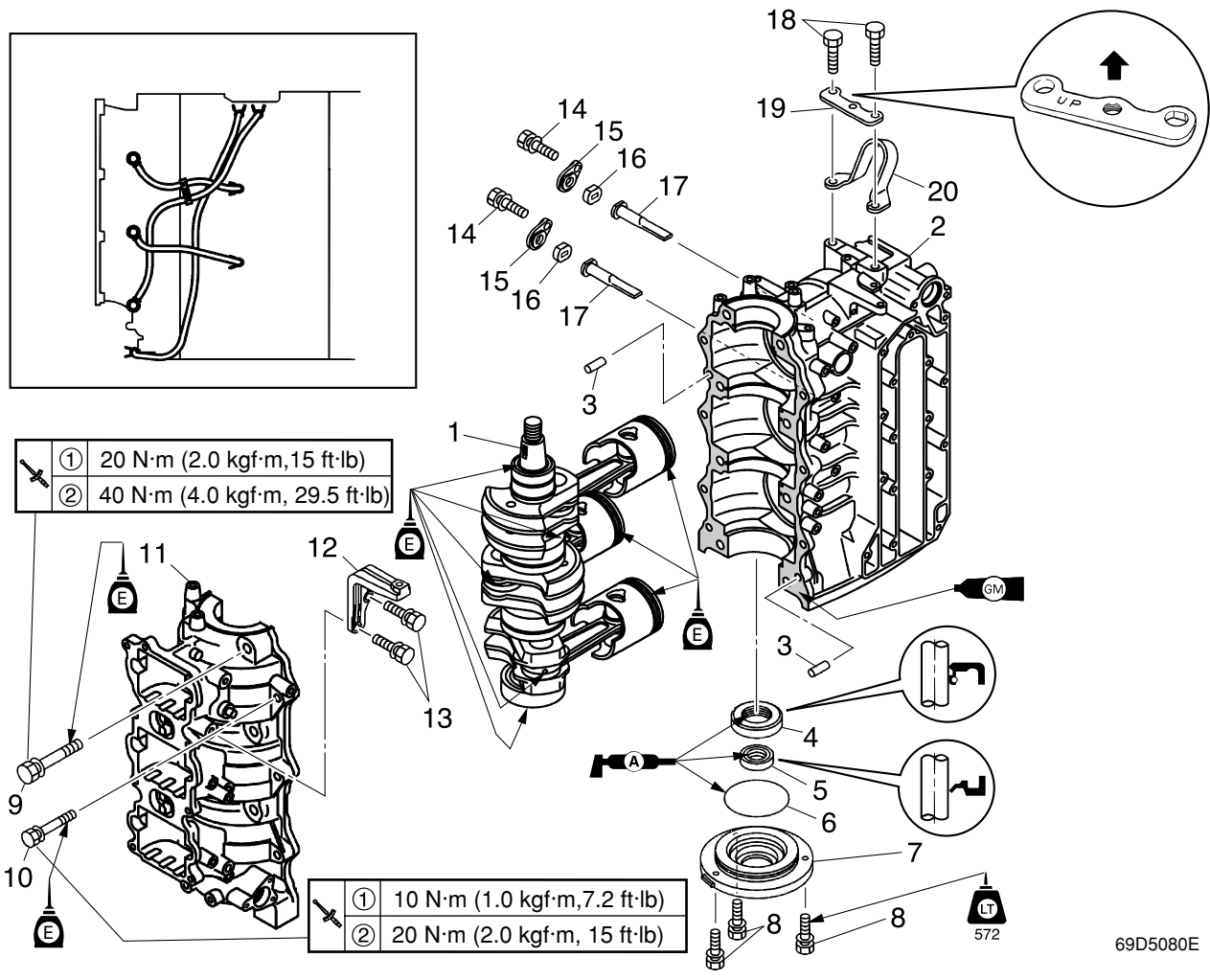
5

69D5080E

No.	Part name	Q'ty	Remarks
1	Crankshaft assembly	1	
2	Cylinder Block	1	
3	Dowel	2	
4	Oil seal	1	Not reusable
5	Oil seal	1	Not reusable
6	O-ring	1	Not reusable
7	Oil seal housing	1	
8	Bolt	3	M6 × 25 mm
9	Bolt	8	M10 × 55 mm
10	Bolt	6	M8 × 40 mm
11	Crankcase	1	
12	Bracket	1	
13	Bolt	2	M6 × 25 mm
14	Bolt	2	M6 × 16 mm
15	Cover	2	
16	Grommet	2	
17	Anode	2	



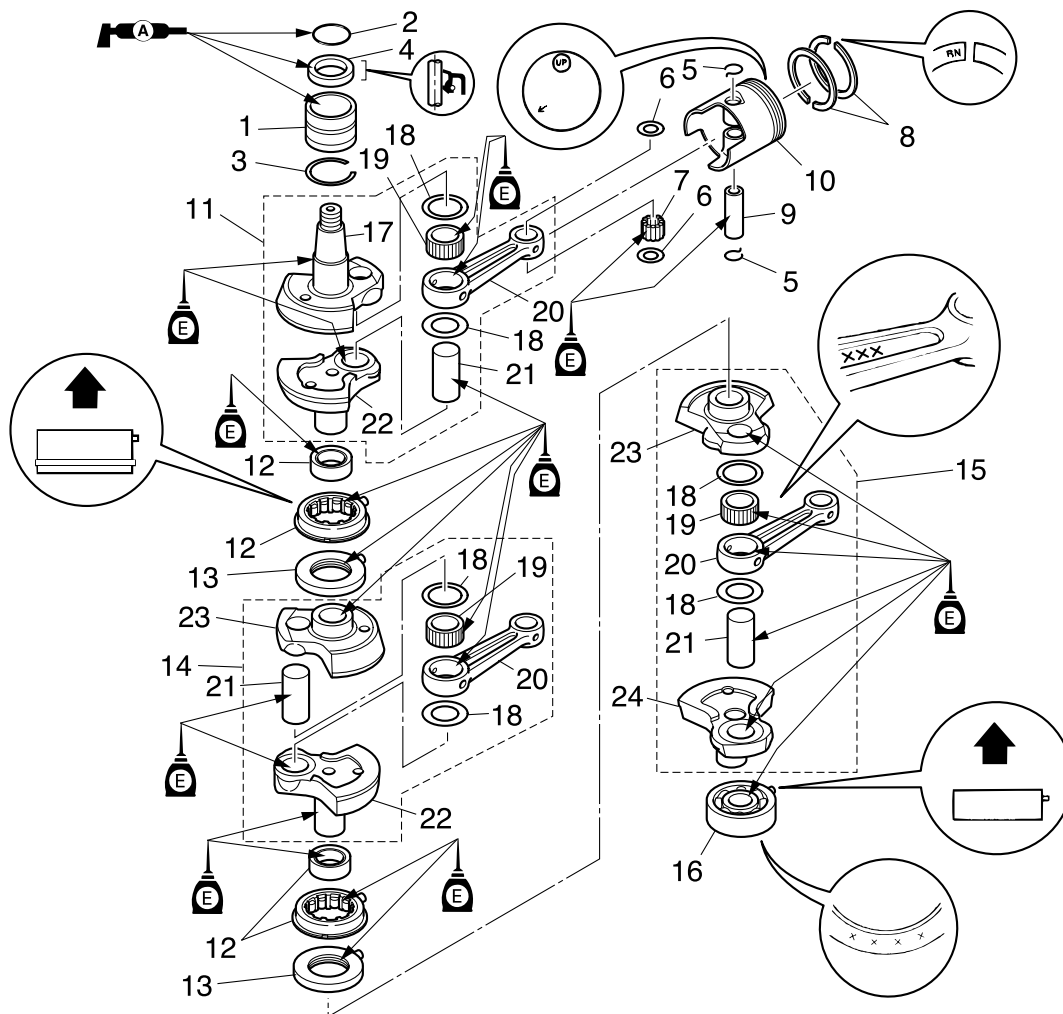
- | | |
|---|--------------------------------|
| ① | 20 N·m (2.0 kgf·m, 15 ft·lb) |
| ② | 40 N·m (4.0 kgf·m, 29.5 ft·lb) |



- | | |
|---|-------------------------------|
| ① | 10 N·m (1.0 kgf·m, 7.2 ft·lb) |
| ② | 20 N·m (2.0 kgf·m, 15 ft·lb) |

69D5080E

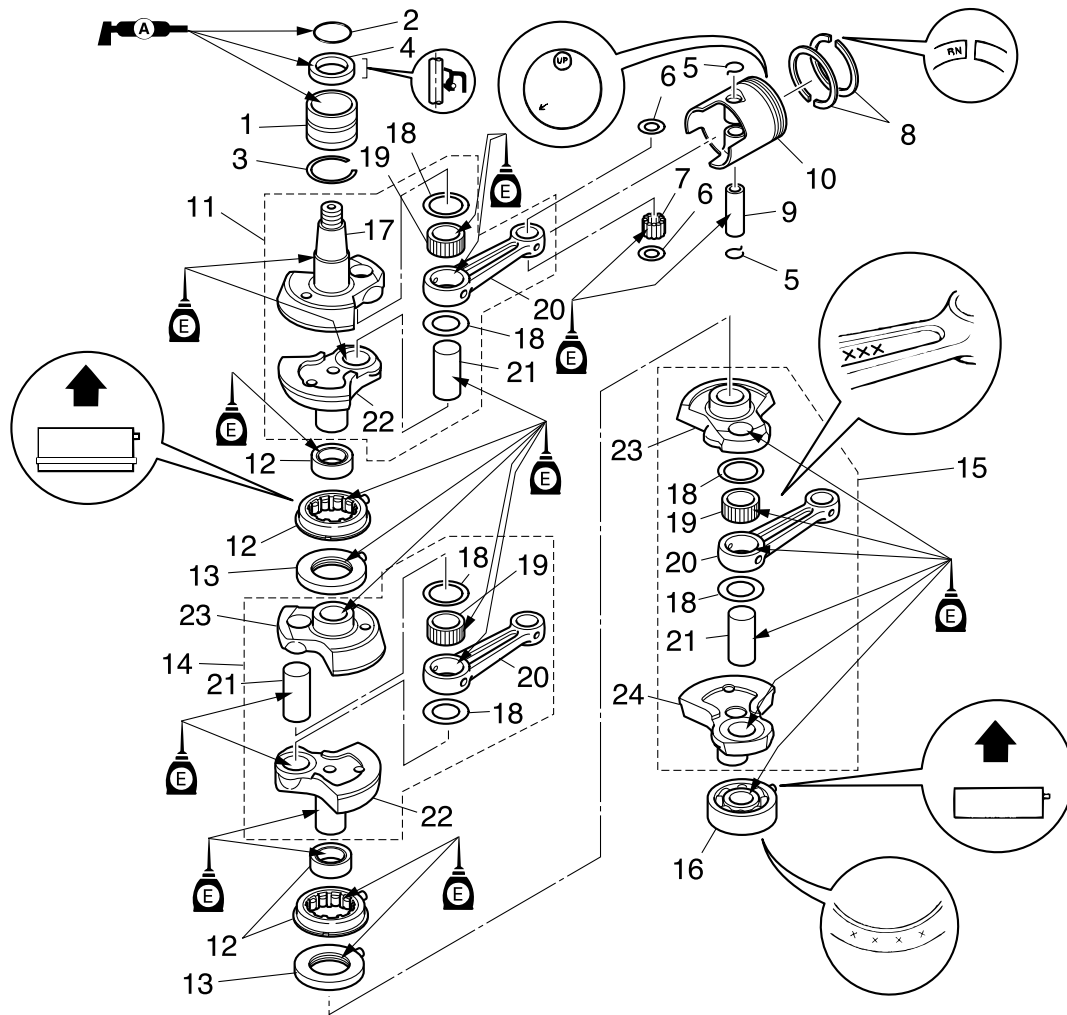
No.	Part name	Q'ty	Remarks
18	Bolt	2	M8 × 20 mm
19	Plate	1	
20	Bracket	1	



69D5090E

5

No.	Part name	Q'ty	Remarks
1	Upper bearing	1	
2	O-ring	1	Not reusable
3	Clip	1	
4	Oil seal	1	Not reusable
5	Circlip	6	
6	Washer	6	
7	Needle bearing	84	
8	Piston ring set	3	
9	Piston pin	3	
10	Piston	3	
11	Crank assembly #1	1	
12	Roller bearing assembly	2	Not reusable
13	Labyrinth ring	2	
14	Crank assembly #2	1	
15	Crank assembly #3	1	
16	Ball bearing	1	Not reusable
17	Crank 1	1	

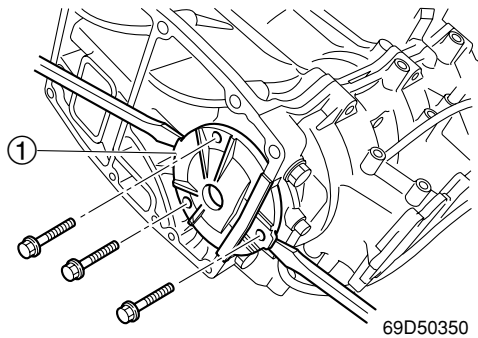


69D5090E

No.	Part name	Q'ty	Remarks
18	Washer	6	
19	Roller bearing	3	
20	Connecting rod	3	
21	Crank pin	3	
22	Crank 2	2	
23	Crank 3	2	
24	Crank 4	1	

Removing the oil seal housing

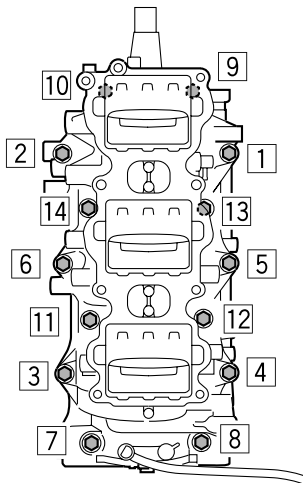
1. Remove the oil seal housing ①.



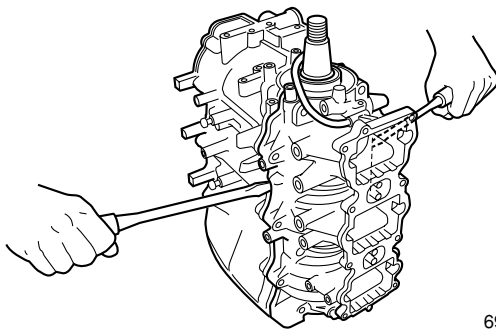
69D50350

Removing the crankcase

1. Remove the crankcase bolts in the sequence shown.



69D50330

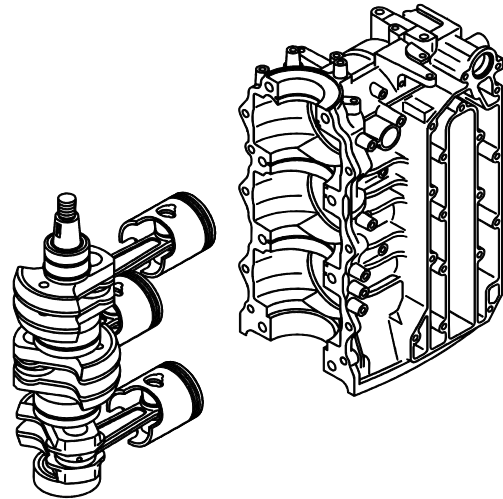


69D50340

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

Removing the crankshaft assembly

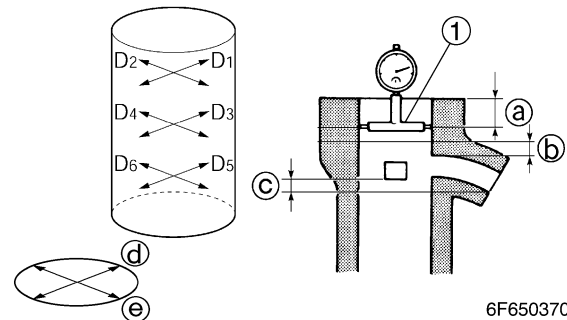
1. Remove the crankshaft assembly and oil seal housing.



69D50360

Checking the cylinder bore

1. Measure the cylinder bore (D_1 — D_6) at measuring points (a), (b), and (c), and in direction (d) (D_1 , D_3 , D_5), which is parallel to the crankshaft, and direction (e) (D_2 , D_4 , D_6), which is at a right angle to the crankshaft.



6F650370

- (a): 10.0 mm (0.39 in) from the cylinder head top surface
- (b): 5.0 mm (0.20 in) above the exhaust port upper edge
- (c): 5.0 mm (0.20 in) below the scavenging port lower edge

	Cylinder bore diameter (D_1 — D_6): 72.000 — 72.020mm (2.8346 — 2.8354 in)
--	--

	Cylinder gauge ①: 90890-06759
--	----------------------------------



2. Calculate the taper limit. Replace or rebores the cylinder block if above specification.

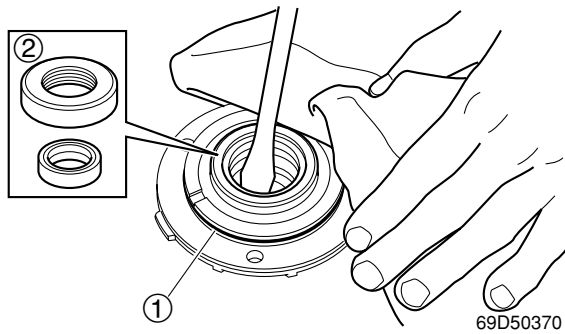
Taper limit:
 D₁ — D₅ (direction Ⓓ)
 D₂ — D₆ (direction Ⓔ)
 0.08 mm (0.0032 in)

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

Out of round limit:
 D₂ — D₁ (direction Ⓐ)
 D₆ — D₅ (direction Ⓒ)
 0.05 mm (0.0020 in)

Disassembling the oil seal housing

1. Remove the O-ring ① and oil seals ②.



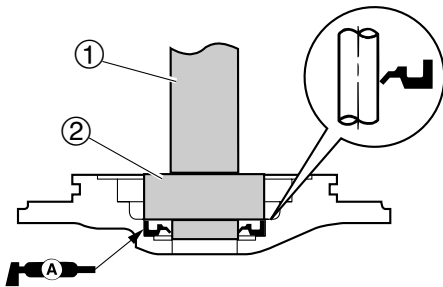
69D50370

Checking the oil seal housing

1. Check the oil seal housing for cracks, damage, or corrosion. Replace if necessary.

Assembling the oil seal housing

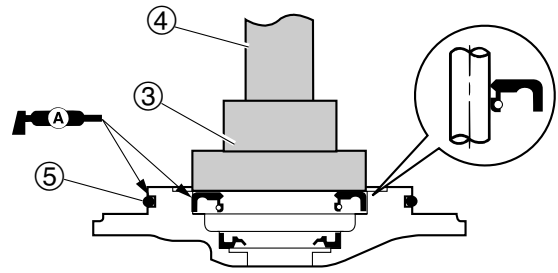
1. Apply grease to new oil seal, then install them into the oil seal housing.



69D50380

Driver rod L3 ①:90890-06652
 Needle bearing attachment ①:
 90890-06637

2. Apply grease to new oil seal, then install them into the oil seal housing.



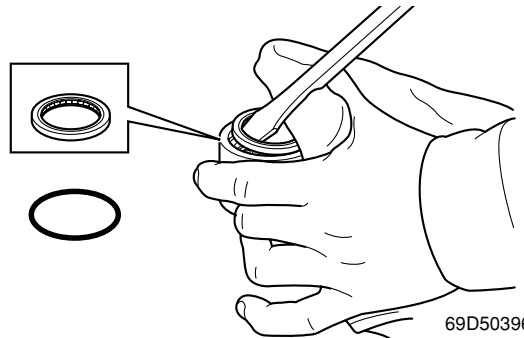
69D50380

Needle bearing attachment ③:
 90890-06631
 Driver rod LS ④:90890-06606

3. Apply grease to new O-ring ⑤, and then install.

Disassembling the upper bearing

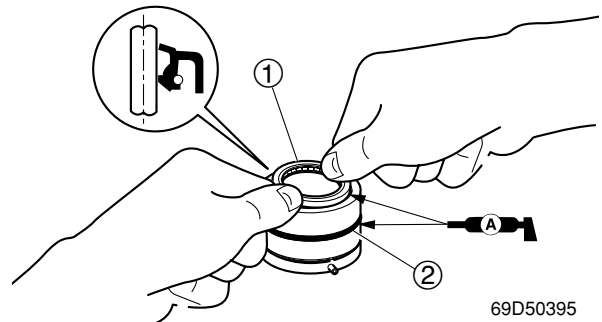
1. Remove the O-ring and oil seal.



69D50396

Assembling the upper bearing

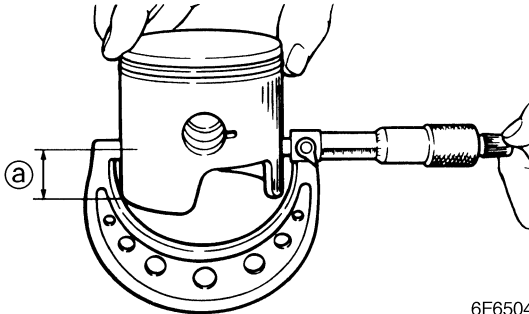
1. Apply grease to the new oil seal ①, O-ring ②, and then install them onto the upper bearing.



69D50395

Checking the piston diameter

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



6F650420

	Piston outside diameter:
	71.940—71.965 mm (2.8323—2.8333 in)
	Measuring point (a):
	10.0 mm (0.39 in) up from the bottom of the piston skirt.
	Oversize piston diameter:
	1st: 72.190—72.215 mm (2.8421—2.8431 in) 2nd: 72.440—72.465 mm (2.8520—2.8529 in)

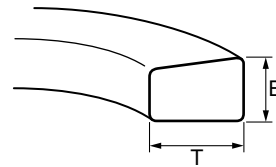
Checking the piston clearance

1. Calculate the piston clearance using the piston outside diameter and the cylinder bore specifications. Replace the piston and piston rings as a set or the cylinder block or all parts, or rebore the cylinder if out of specification.

	Piston clearance:
	0.055—0.060 mm (0.0022—0.0024 in)

Checking the piston rings

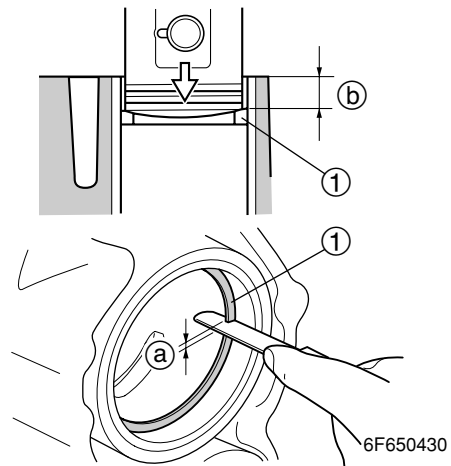
1. Check the piston ring dimensions of B and T. Replace if out of specification.



69D50410

	Piston ring dimensions
	Top ring and 2nd piston ring:
	B: 1.970—1.990 mm (0.0776—0.0783 in)
	T: 2.900—3.100 mm (0.1142—0.1220 in)

2. Level the piston rings ① in a cylinder with a piston crown.
3. Check the piston ring end gap (a) at the specified measuring point. Replace if out of specification.



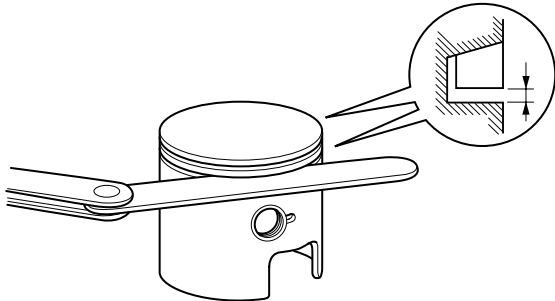
6F650430

	Piston ring end gap (a):
	Top ring and 2nd piston ring:
	0.30—0.50 mm (0.0118—0.0197 in)
	Measuring point (b):
	10.0 mm (0.39 in)



Checking the piston ring side clearance

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



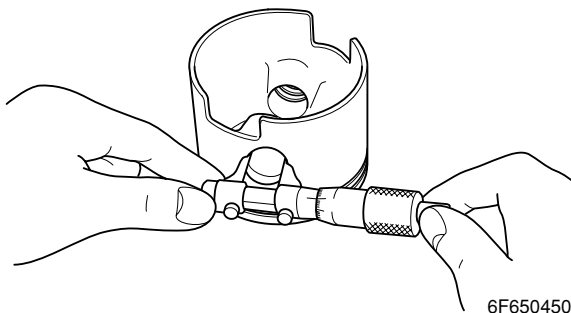
69D50425



Piston ring side clearance:
 Top ring and 2nd ring:
 0.03—0.07 mm
 (0.0012—0.0028 in)

Checking the piston pin boss bore

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



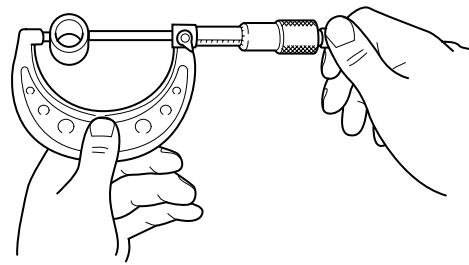
6F650450



Piston pin boss bore:
 19.904—19.915 mm
 (0.7836—0.7841 in)

Checking the piston pin

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



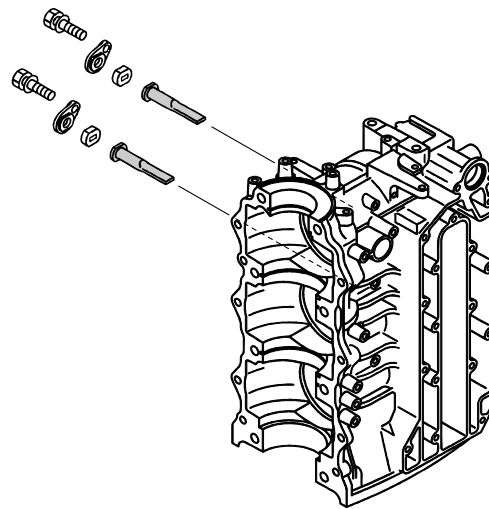
6B450530



Piston pin diameter:
 19.895—19.900 mm
 (0.7833—0.7835 in)

Checking the internal anodes

1. Check the anodes on the cylinder block. Clean the anode's surface and replace if it has been eroded into half size or smaller.



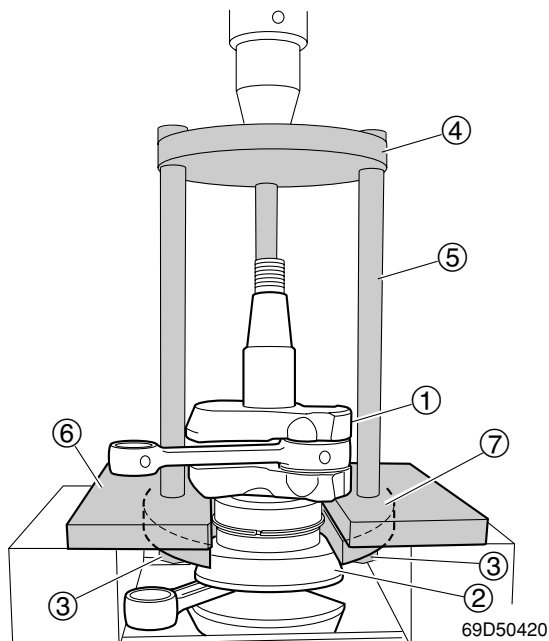
69D50365

CAUTION:

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

Disassembling the crankshaft

1. Insert the special service tools between #1 crank assembly ① and #2 crank assembly ②, and then separate them using a press.



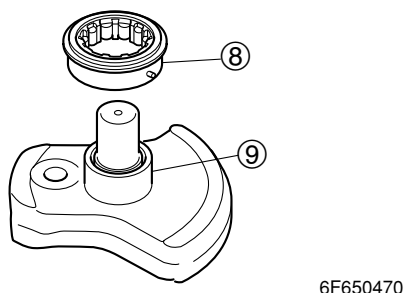
NOTE:

When forcing out the crank assembly, use care so that they do not fall.

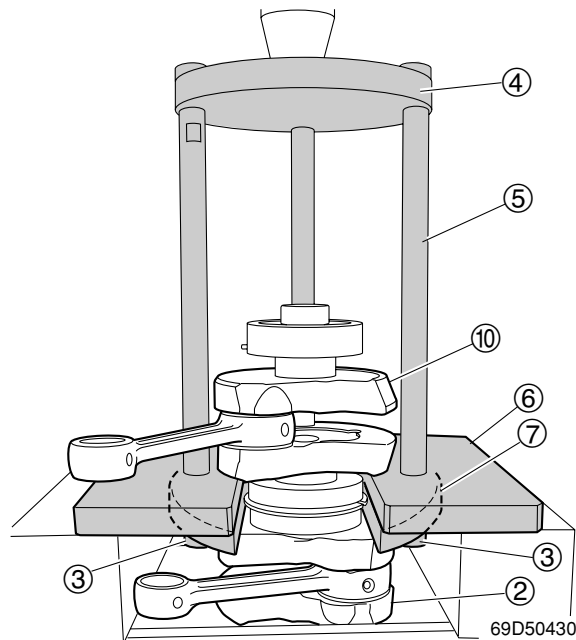


- Nut ③: 90890-02407
- Pressure plate ④: 90890-02408
- Pole ⑤: 90890-02409
- Plate A ⑥: 90890-02410
- Plate B ⑦: 90890-02411

2. Remove the roller bearing ⑧ from the inner race ⑨ of the #1 crank assembly.

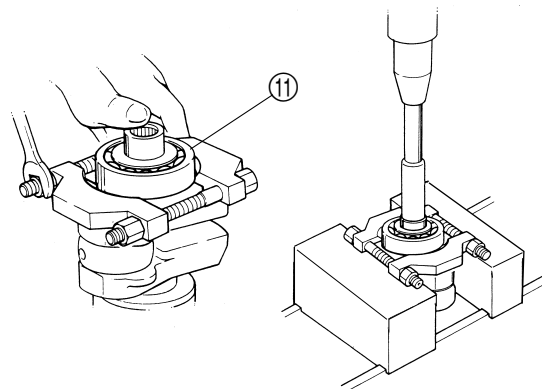


3. Insert the special service tools between #3 crank assembly ⑩ and #2 crank assembly ②, and then separate them using a press.



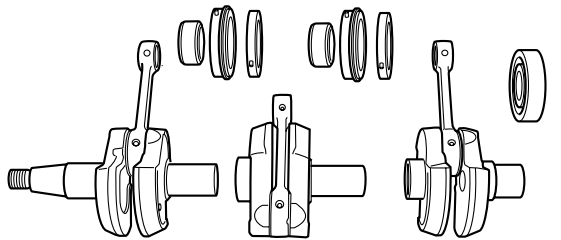
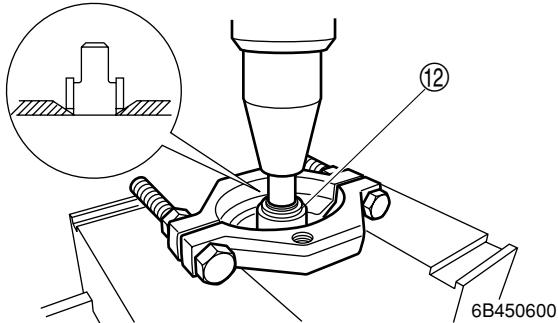
- Nut ③: 90890-02407
- Pressure plate ④: 90890-02408
- Pole ⑤: 90890-02409
- Plate A ⑥: 90890-02410
- Plate B ⑦: 90890-02411

4. Remove the roller bearing from the inner race of the #2 crank assembly, same procedure as #1 crank assembly.
5. Remove the lower bearing ⑪.




- Bearing separator:
90890-06534

6. Using the bearing separator to slightly move the inner race ⑫ off the shaft, and then remove the inner race.



6B450600

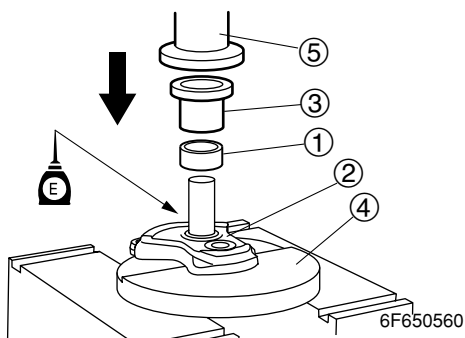
 **Bearing separator:**
90890-06534

Assembling the crankshaft

CAUTION:

- When reassembling the crankshaft, wash all component parts in clean kerosene (do not use gasoline).
- Do not reuse bearings, always replace them with new ones.

1. Install the inner race ① onto crank ② by using a press and the bushing ③. Carefully press the inner race onto the shaft.

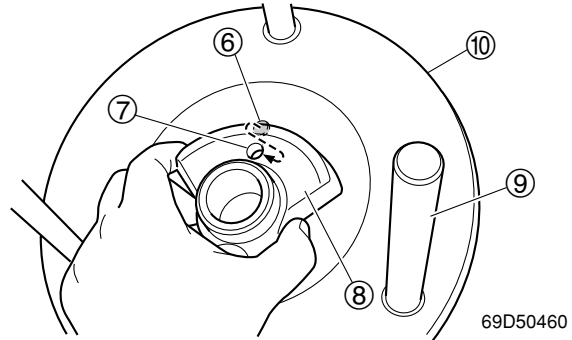


6F650560

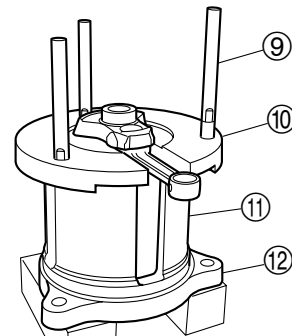


Bushing-9 (D30) ③ : 90890-02363
Plate C ④ : 90890-02402
Bearing pressure C ⑤:
90890-02393

2. Insert the pin ⑥ on the special service tool into the hole ⑦ on the #2 crank assembly ⑧.



69D50460

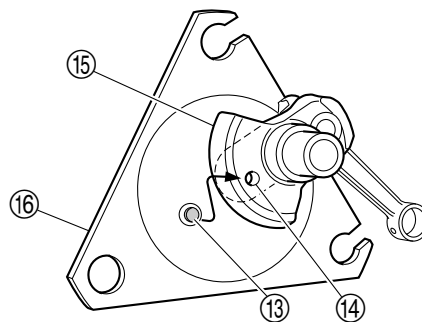


69D50465



Guide pole ⑨: 90890-02414
Base ⑩: 90890-02415
Body ⑪: 90890-02352
Flange ⑫: 90890-02351

3. Insert the pin ⑬ on the special service tool ⑯ into the hole ⑭ on the #1 crank assembly ⑮.



69D50470



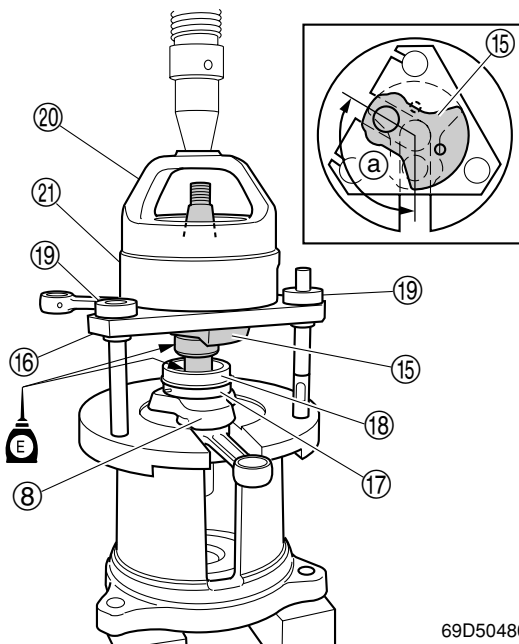
Guide plate ⑯: 90890-02413

4. Install the labyrinth ring (17) onto #2 crank assembly (8) and install the roller bearing (18) onto #1 crank assembly (15), before assembling the #2 and #1.

NOTE: _____

Make sure the pin side of the bearing faces #1 crank assembly.

5. Align the crank angle of #1 (15) for #2 crankshaft assembly (8) in direction to become angle of 120 degrees (a) to set the special service tool (16) clockwise, and then install using a press.



NOTE: _____

- Install the guide (19), and then align the crank angle.
- Place the press body (20) on the assembling kit.

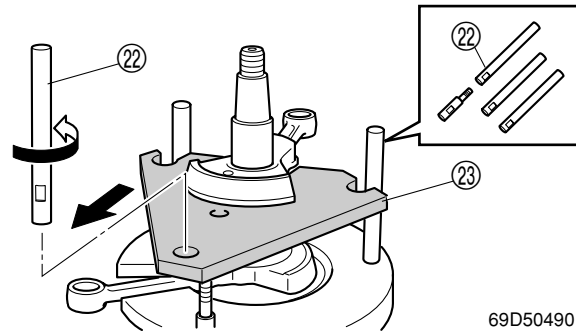
CAUTION: _____

Do not apply force in excess of 7 tons.



Guide plate (16): 90890-02413
 Guide (19): 90890-02412
 Press body (20):
 90890-02385
 Height ring (H-11) (21):
 90890-02377

6. Remove the guide pole (22) (long), and then remove the three guide, and pull out the guide plate (23).



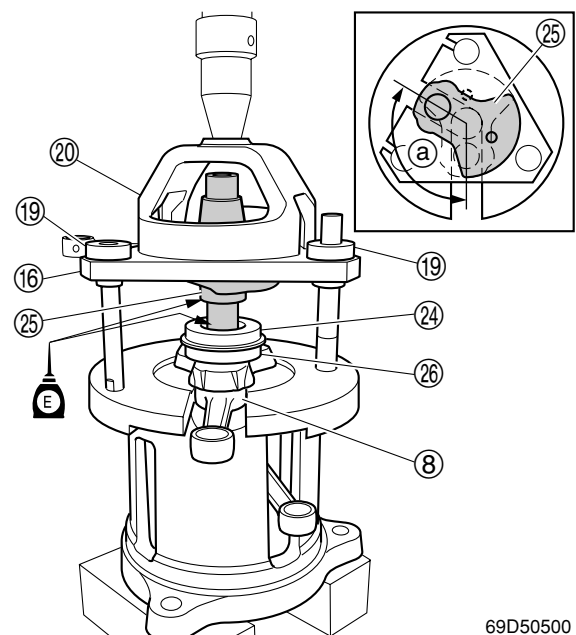
7. Insert the pin on the special service tool into the hole on the #2 crank assembly and insert the pin on the special service tool into the hole on the #3 crank assembly as same procedure as #1 and #2.

8. Install the labyrinth ring (24) onto #3 crank assembly (25) and install the roller bearing (26) onto #2 crank assembly (8), before assembling the #2 and #3.

NOTE: _____

Make sure the pin side of the bearing faces #2 crank assembly.

9. Align the crank angle of #3 (25) for #2 crankshaft assembly (8) in direction to become angle of 120 degrees (a) to set the special service tool (16) clockwise, and then install using a press.





NOTE:

- Install the guide (19), and then align the crank angle.
- Place the press body (20) on the assembling kit.

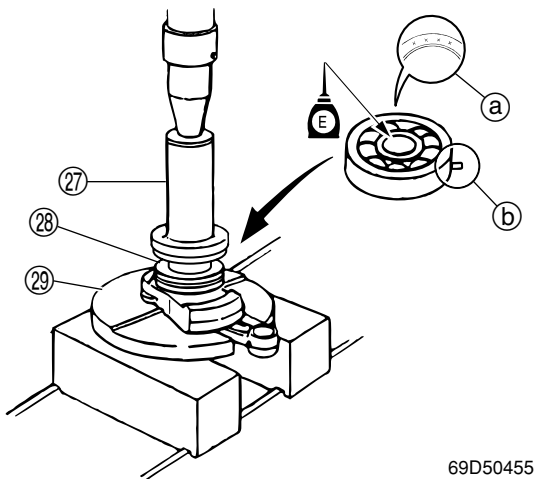
CAUTION:

Do not apply force in excess of 7 tons.



Guide (19): 90890-02412
Press body (20): 90890-02385

10. Remove the guide plate as same #1 and #2 procedure.
11. Install the lower bearing to #3 crank assembly using a press.



69D50455

NOTE:

- Install the lower bearing so that the manufacture identification mark (a) face the lower side.
- Install the lower bearing so that the pin (b) faces the flywheel magnet side.

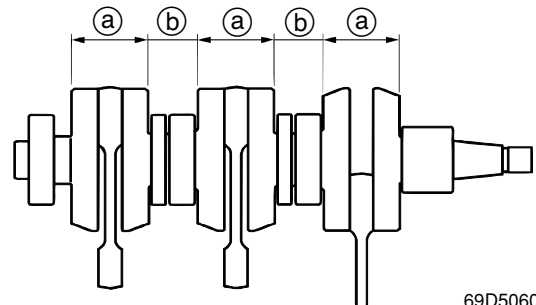


Bearing pressure C (27):
90890-02393
Bearing inner race attachment (28):
90890-06641
Plate C (29):
90890-02402

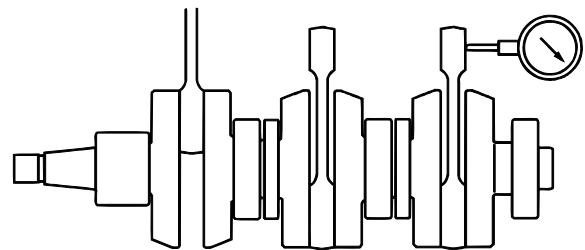
12. Install the upper bearing, and then slowly turn the crankshaft and connecting rods. If it does not turn smoothly, disassemble the crankshaft and adjust or replace any parts as necessary.

Checking the crankshaft

1. Measure the crankshaft widths (a) and (b). Repair or disassemble the crankshaft if out of specification.
2. Measure the connecting rod small end axial play. Replace the bearing and connecting rod if above specification.



69D50600

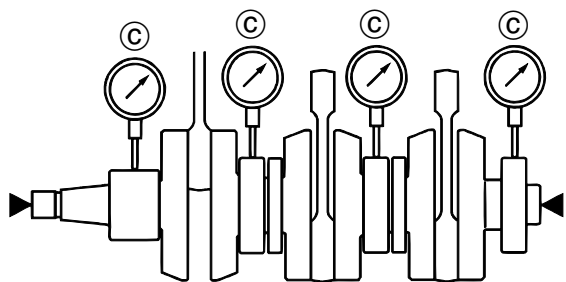


69D50620





Crankshaft width (a):
57.90–57.95 mm
(2.280–2.282 in)
Crankshaft width (b):
35.88–36.10 mm
(1.413–1.421 in)
Connecting rod small-end axial play limit:
2.0 mm (0.08 in)

3. Measure the crankshaft runout. Repair or disassemble the crankshaft if above specification.



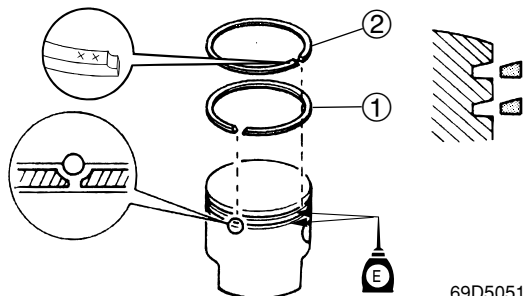
69D50610

 Crankshaft runout limit (C):
0.05 mm (0.0020 in)

 Crankshaft aligner:
90890-03107

Assembling the piston

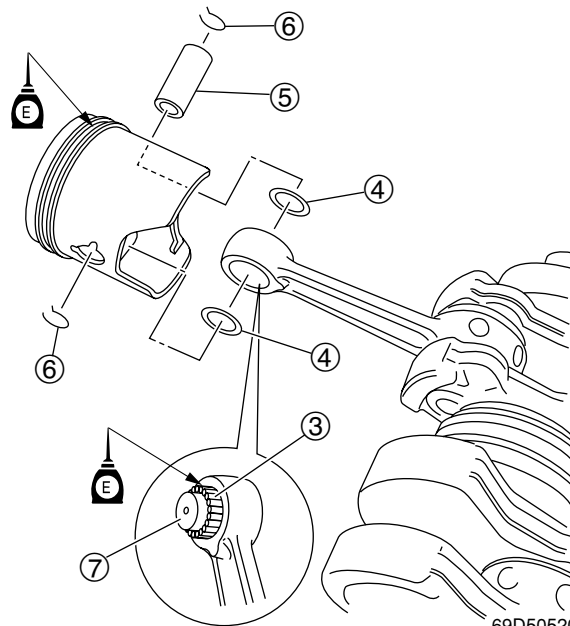
1. Install the 2nd piston ring (1) and top ring (2) onto the pistons.



69D50510

NOTE: _____
Install the piston rings with the recess for the locating pin facing up toward the piston crown.


2. Install the needle bearings (3), washers (4), piston pin (5), and new clips (6).



69D50520

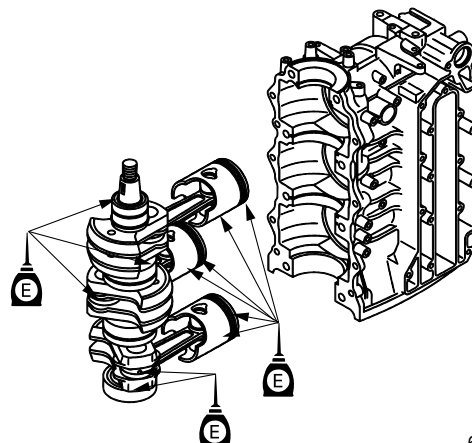
NOTE: _____

- Make sure that the piston and piston pin bearings are installed in their original combination.
- Use the small end bearing installer (7) to install the needle bearings.
- Make sure that the up mark on the piston crown faces the flywheel magnet side.

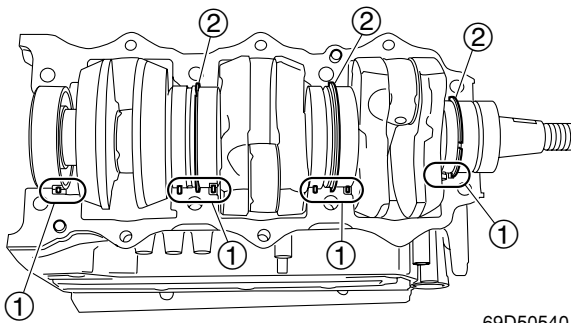
 Small end bearing installer (7):
90890-06527

Assembling the power unit

1. Install the crankshaft assembly into the cylinder block.



69D50530

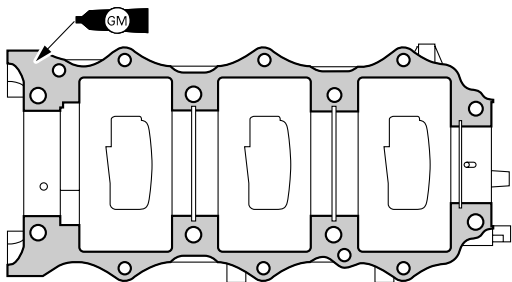


69D50540

NOTE:

- Apply engine oil to the pistons, piston rings and bearings before installation.
- Align the dowels of the bearings with the slot ① on the cylinder block.
- Align the rings ② with the grooves in the cylinder block.

3. Apply sealant to the mating surface of the crankcase.

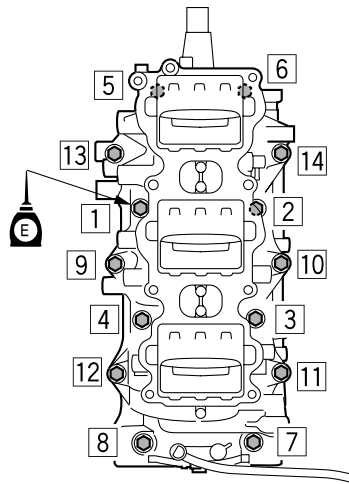


69D50550

NOTE:

Do not get any sealant on the crankshaft journals.

4. Install the crankcase onto the cylinder block, and then tighten the crankcase bolts to the specified torques in two stages and in the sequence shown.



69D50580

NOTE:

Apply engine oil to the crankcase bolts before installation.



Crankcase bolt (M8):

1st:

10 N·m (1.0 kgf·m, 7.2 ft·lb)

2nd:

20 N·m (2.0 kgf·m, 15 ft·lb)

Crankcase bolt (M10):

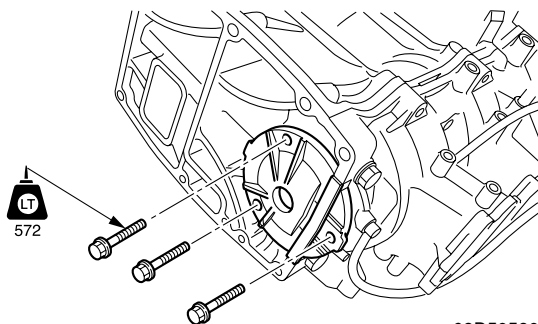
1st:

20 N·m (2.0 kgf·m, 15 ft·lb)

2nd:

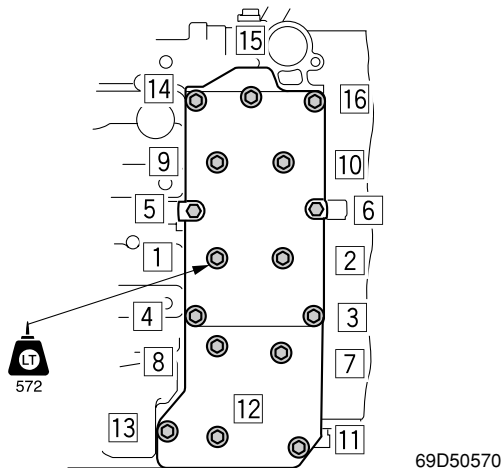
40 N·m (4.0 kgf·m, 29.5 ft·lb)

5. Install the oil seal housing.



69D50590

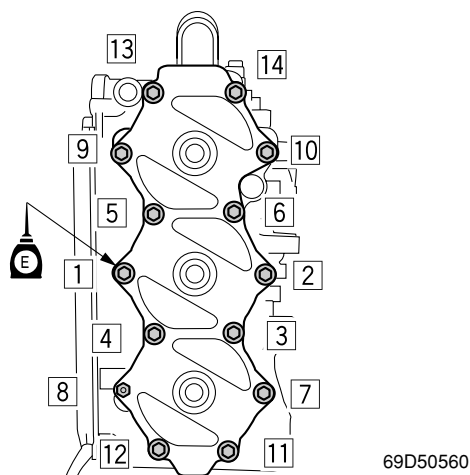
6. Install a new gasket and the exhaust cover, and then tighten the bolts to the specified torques in two stages and in the sequence shown.



NOTE: Apply LOCTITE 572 to the exhaust cover bolts before installation.

	Exhaust outer cover bolt: 1st: 3 N·m (0.3 kgf·m, 2.2 ft·lb) 2nd: 8 N·m (0.8 kgf·m, 5.8 ft·lb)
--	---

7. Install a new cylinder head gasket, the cylinder head, thermostat, a new cylinder head cover gasket, and cylinder head cover, and then tighten the cylinder head bolts (nut) to the specified torques in two stages and in the sequence shown.



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

	Cylinder head bolt (Nut): 1st: 15 N·m (1.5 kgf·m, 11.1 ft·lb) 2nd: 32 N·m (3.2 kgf·m, 23 ft·lb)
--	---

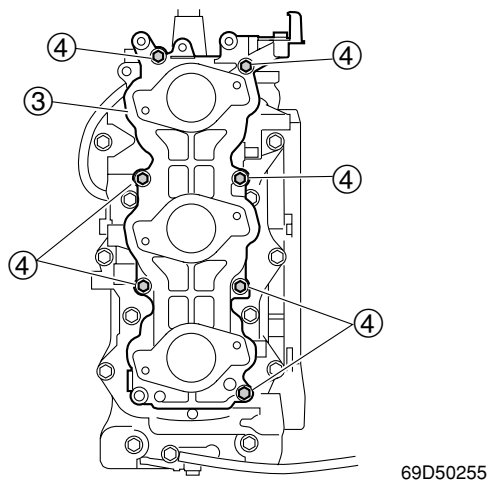
8. Install the thermostat, a new gasket and thermostat cover.

NOTE: Apply LOCTITE 572 to the thermostat cover bolts before installation.

9. Install the spark plugs, tighten them temporary tight, then to the specified torque with a spark plug wrench.

	Spark plug: 25 N·m (2.5 kgf·m, 18 ft·lb)
--	---

10. Install the intake manifold assembly ③, and then tighten the intake manifold bolts ④ to the specified torques in two stages.



	Intake manifold bolts: 1st: 4 N·m (0.4 kgf·m, 3.0 ft·lb) 2nd: 8 N·m (0.8 kgf·m, 5.8 ft·lb)
--	--

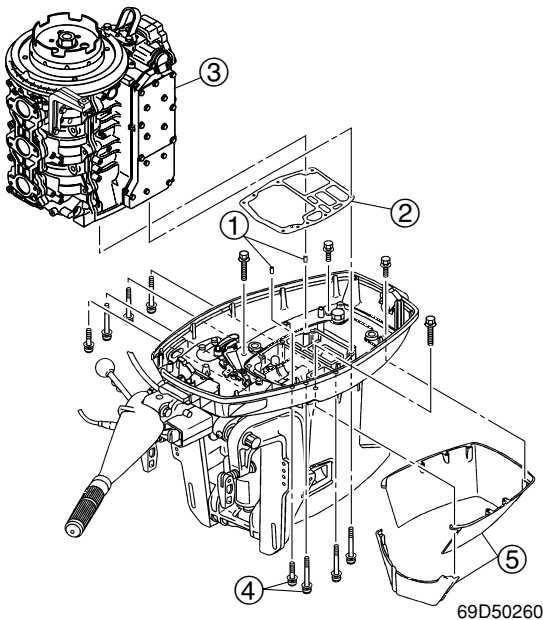
11. Connect the hoses .




12. Install the control levers, and the electrical components to the power unit.

Installing the power unit

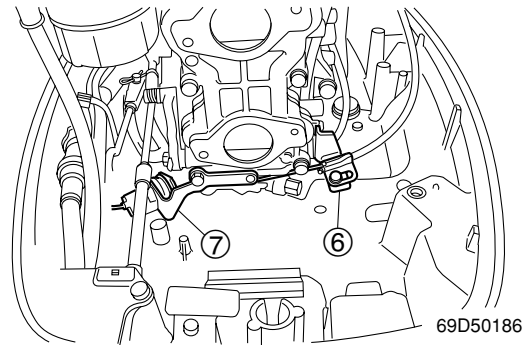
1. Clean the power unit mating surface, and install the dowels ① and a new gasket ②.
2. Install the power unit ③, and then tighten the power unit mounting bolts ④ to the specified torque.
3. Install the apron ⑤.



	<p>Power unit mounting bolt ④: 21 N·m (2.1 kgf·m, 15.5 ft·lb)</p>
---	---

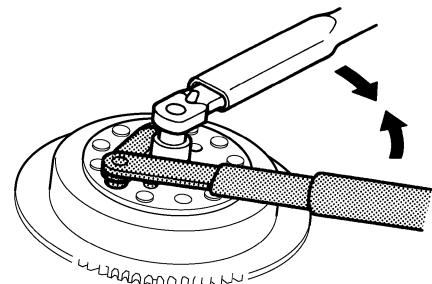
4. Install the shift bracket.
5. Connect the pilot water hose.
6. Connect the starter relay leads and coupler (WHD, WD).
7. Connect the ground leads, engine stop lanyard switch leads (MHD, WHD), warning indicator leads and the battery leads (WHD, WD).
8. Connect the remote control cables (remote control model) or the throttle cable (tiller handle model), and then adjust their length. For adjustment procedures, see Chapter 3.

9. Install the bracket ⑥ and neutral switch bracket ⑦ (WHD).




NOTE: _____
Set the shift position to the reverse, when install the neutral switch bracket.


10. Connect the neutral switch connectors (WHD, WD).
11. Install the Woodruff key and flywheel magnet.
12. Tighten the flywheel magnet nut to the specified torque.



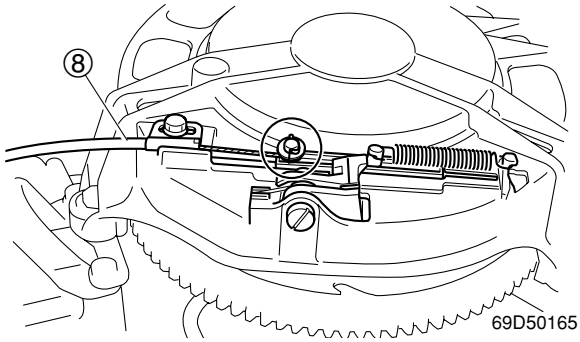
CAUTION: _____
Apply force in the direction of the arrows shown, to prevent the flywheel holder from slipping off easily.

NOTE: _____
Apply engine oil to the flywheel magnet nut before installation.

	<p>Flywheel holder: 90890-06522</p>
---	-------------------------------------

	<p>Flywheel magnet nut: 160 N·m (16.0 kgf·m, 115 ft·lb)</p>
---	---

13. Install the starter pulley.
14. Install the manual starter and start-in-gear protection cable ⑧, and then adjust its length. For adjustment procedures, see Chapter 3.



15. Install all removed parts.
16. Set the shift lever to the neutral position and check that the start-in-gear protection lever position.(WHD) Adjust if necessary.



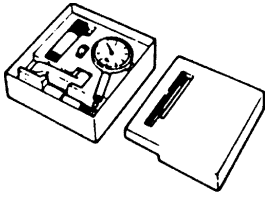
— MEMO —



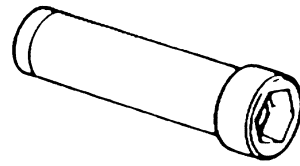
Lower unit

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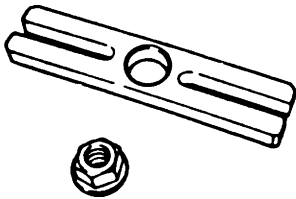
Special service tools



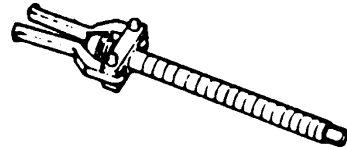
Dial gauge set
90890-01252



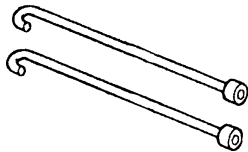
Ring nut wrench extension
90890-06513



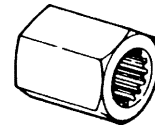
Stopper guide plate
90890-06501



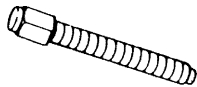
Bearing puller assembly
90890-06535



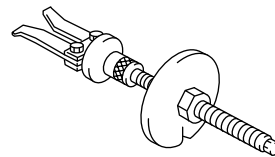
Bearing housing puller claw L
90890-06502



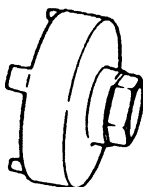
Drive shaft holder 3
90890-06517



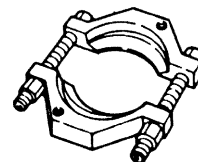
Center bolt
90890-06504



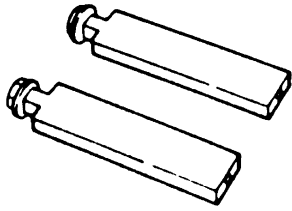
Bearing outer race puller assembly
90890-06523



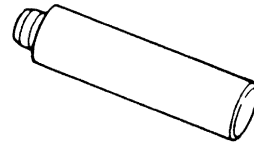
Ring nut wrench
90890-06511



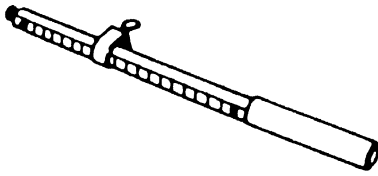
Bearing Separator
90890-06534



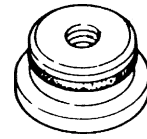
Stopper guide stand
90890-06538



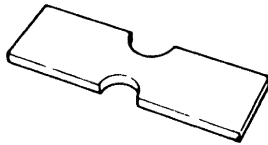
Driver rod LS
90890-06606



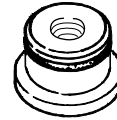
Driver rod SL
90890-06602



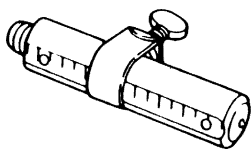
Needle bearing attachment
90890-06608



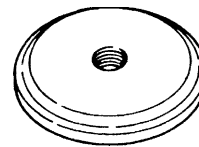
Bearing depth plate
90890-06603



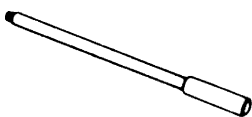
Needle bearing attachment
90890-06611, 90890-06612



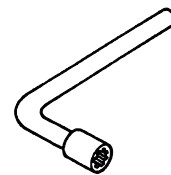
Driver rod SS
90890-06604



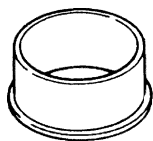
Bearing outer race attachment
90890-06621, 90890-06626



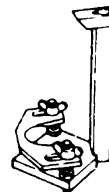
Driver rod LL
90890-06605



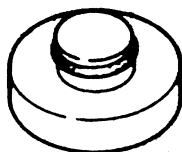
Shift rod push arm
90890-06052



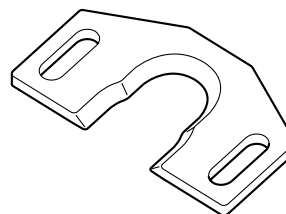
Bearing inner race attachment
90890-06639, 90890-06643
90890-06662



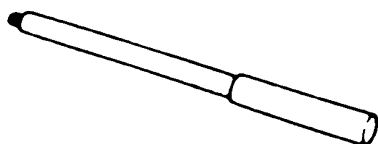
Pinion height gauge
90890-06710



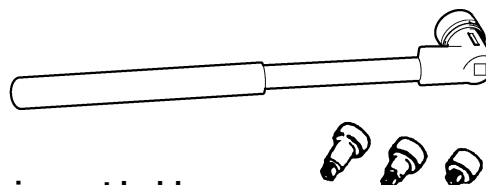
Ball bearing attachment
90890-06655



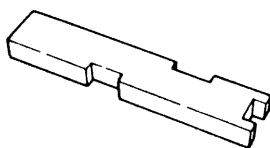
Pinion height gauge plate B
90890-06712



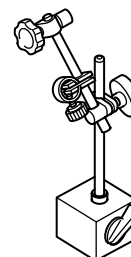
Driver rod L3
90890-06652



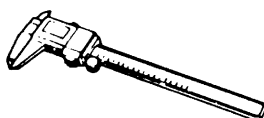
Pinion nut holder
New: 90890-06715
Current: 90890-06505



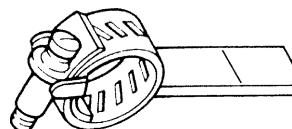
Shimming plate
90890-06701



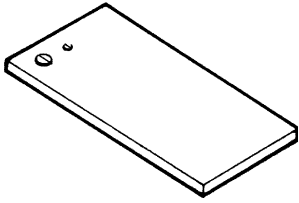
Magnet base B
90890-06844



Digital caliper
90890-06704

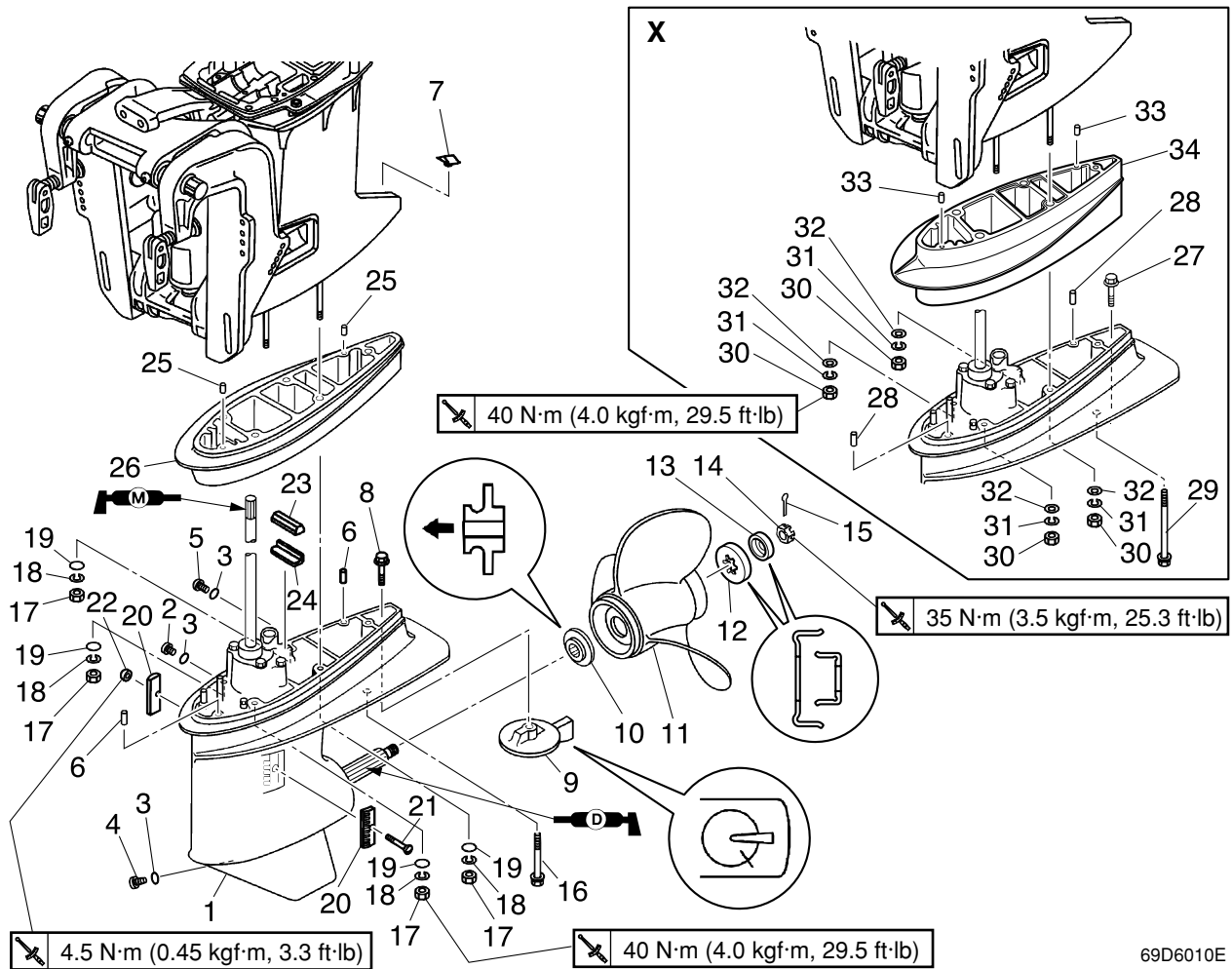


Backlash indicator
90890-06706



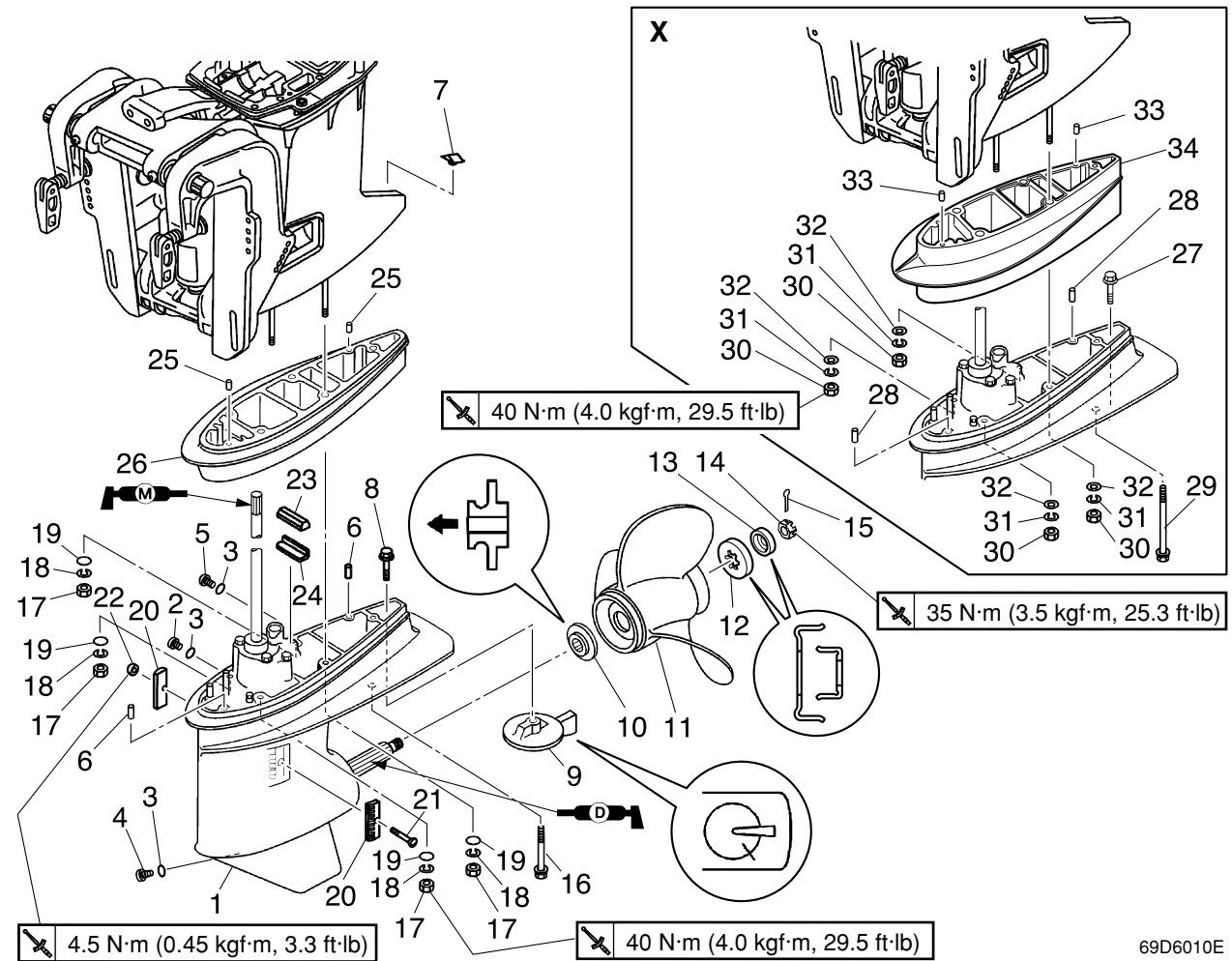
Magnet base plate
90890-07003

Lower unit



69D6010E

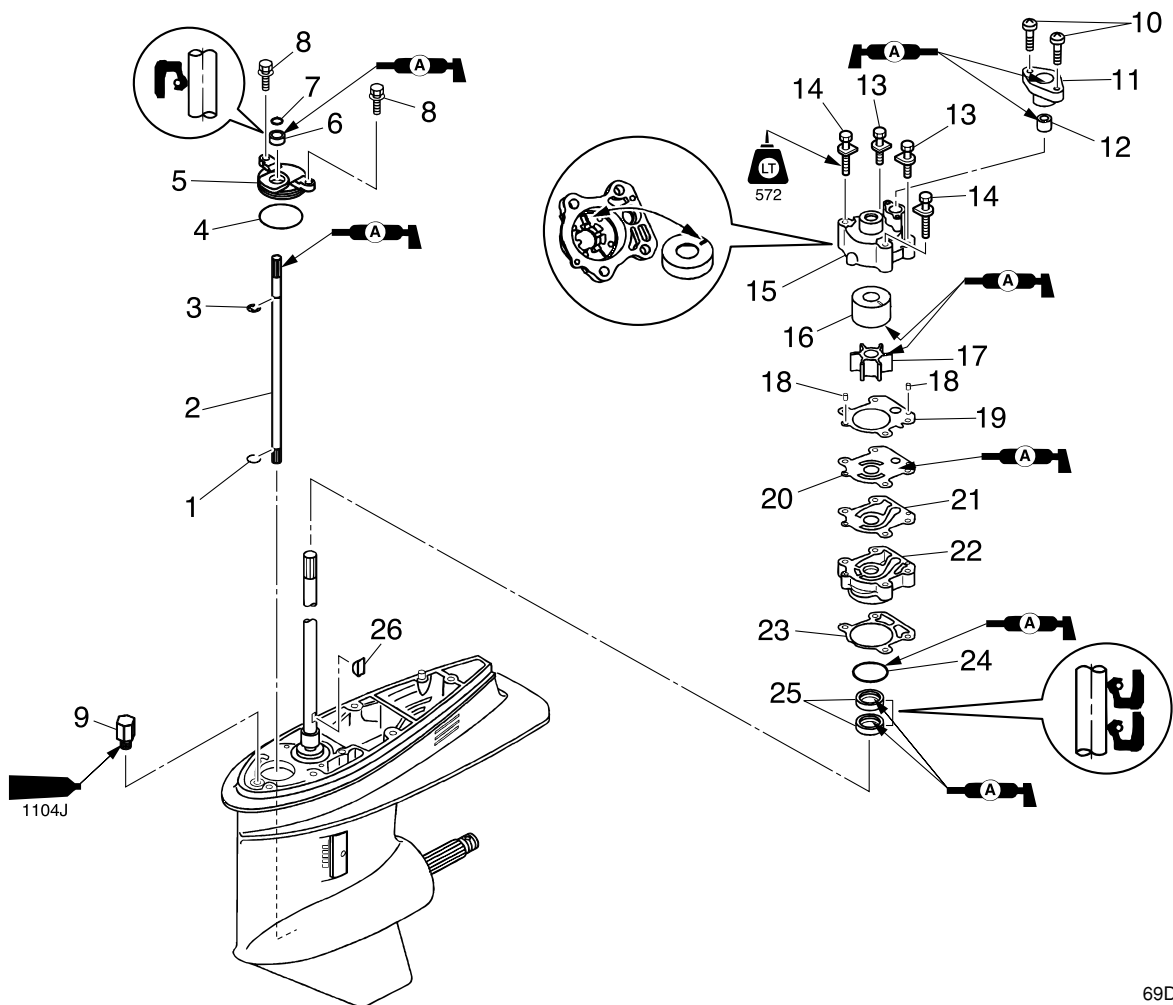
No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Check screw	1	
3	Gasket	3	Not reusable
4	Drain screw	1	
5	Screw	1	
6	Dowel	2	
7	Cover	1	
8	Bolt	1	M10 × 45 mm
9	Anode	1	
10	Washer	1	
11	Propeller	1	
12	Washer	1	
13	Washer	1	
14	Propeller nut	1	
15	Cotter pin	1	Not reusable
16	Bolt	1	M8 × 112 mm
17	Nut	4	



69D6010E

6

No.	Part name	Q'ty	Remarks
18	Spring washer	4	
19	Washer	4	
20	Water inlet cover	2	
21	Screw	1	ø5 × 42 mm
22	Nut	1	
23	Seal	1	
24	Guide	1	
25	Dowel	2	
26	Extension	1	S and L-transom model
27	Bolt	1	M10 × 45 mm : X-transom model
28	Dowel	2	X-transom model
29	Bolt	1	M8 × 190 mm : X-transom model
30	Nut	4	X-transom model
31	Spring washer	4	X-transom model
32	Washer	4	X-transom model
33	Dowel	2	X-transom model
34	Extension	1	X-transom model



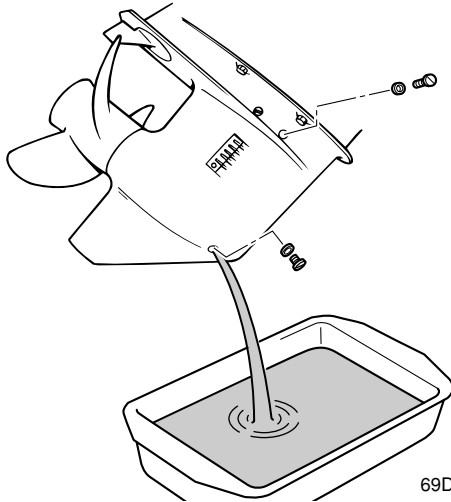
69D6020E

No.	Part name	Q'ty	Remarks
1	Circlip	1	
2	Shift rod	1	
3	Circlip	1	
4	O-ring	1	Not reusable
5	Plate	1	
6	Oil seal	1	Not reusable
7	O-ring	1	Not reusable
8	Bolt	2	M6 × 45 mm
9	Cap	1	
10	Screw	2	
11	Grommet	1	
12	Seal	1	
13	Bolt	2	M8 × 70 mm
14	Bolt	2	M8 × 50 mm
15	Water pump housing	1	
16	Insert cartridge	1	
17	Impeller	1	



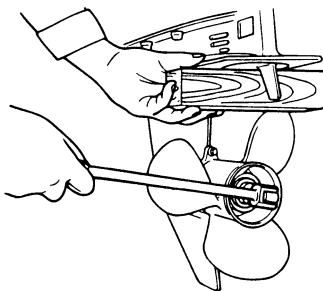
Removing the lower unit

1. Drain the gear oil.



69D60015

2. Shift the shift lever or remote control lever to neutral, place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then remove the propeller nut and propeller.



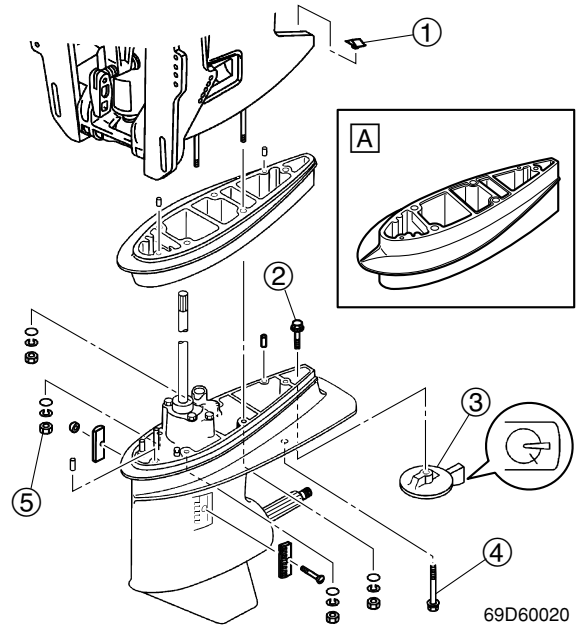
6F660020

⚠WARNING

- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery leads from the battery and the clip from the engine stop lanyard switch.
- Put a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning.

3. Mark the trim tab at the area shown.
4. Remove the cover ①, then remove the trim tab bolt ② and trim tab ③.

5. Loosen the bolt ④ and nuts ⑤, and then remove the lower unit from the upper case.



69D60020

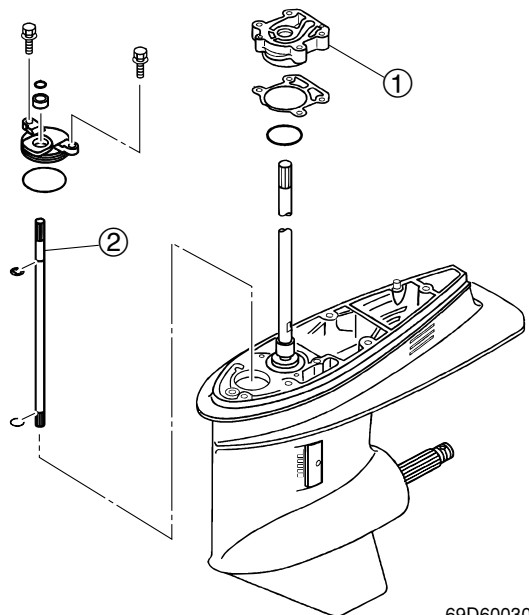
A X-transom model

Removing the water pump

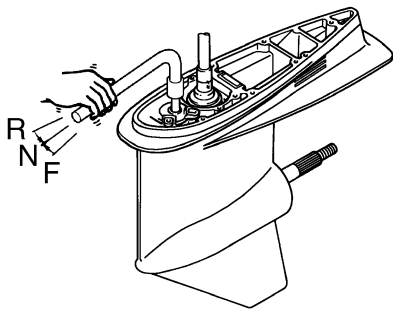
1. Remove the water pump assembly.

Removing the oil seal housing and shift rod

1. Remove the oil seal housing ①, and then remove the shift rod assembly ②.



69D60030



69D60035

NOTE:

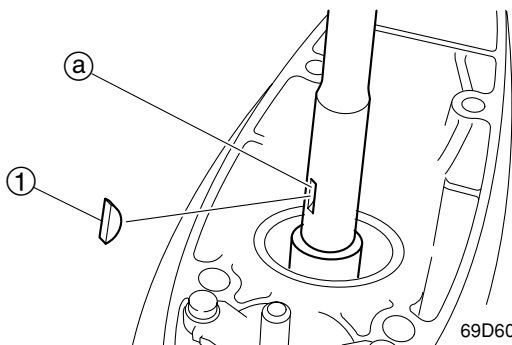
Set the shift to the neutral position using the special service tool, before remove the shift rod assembly.



Shift rod push arm:
90890-06052

Checking the water pump and shift rod

1. Check the water pump housing for deformation. Replace if necessary.
2. Check the impeller and insert cartridge for cracks or wear. Replace if necessary.
3. Check the Woodruff key ① and the keyway ② in the drive shaft for wear. Replace if necessary.

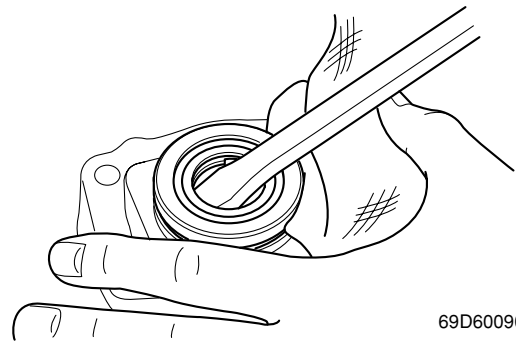


69D60040

4. Check the shift rod for cracks or wear. Replace if necessary.

Disassembling the oil seal housing

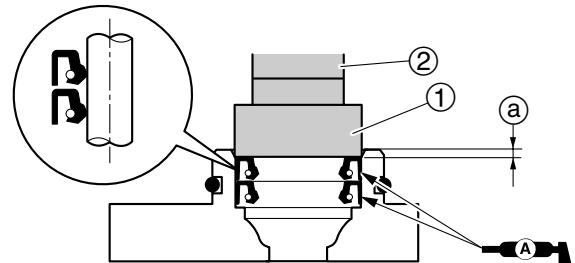
1. Remove the oil seals using a flat head screwdriver.



69D60090

Assembling the oil seal housing

1. Apply grease to new oil seals, and then install them into the oil seal housing.



69D60120

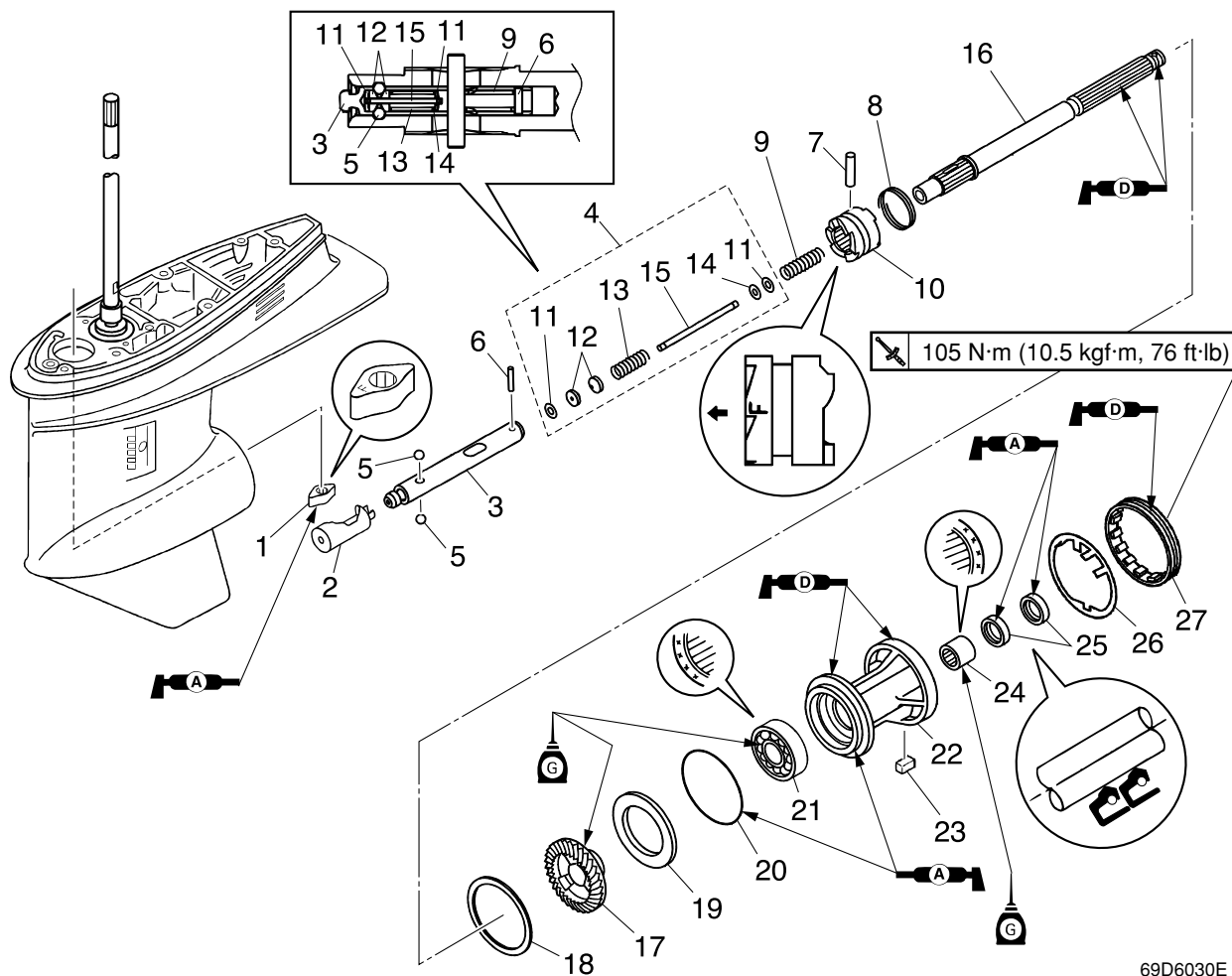


Ball bearing attachment ①:
90890-06608
Driver rod L3 ②: 90890-06652



Depth ②:
3.5—4.5 mm (0.138—0.177 in)

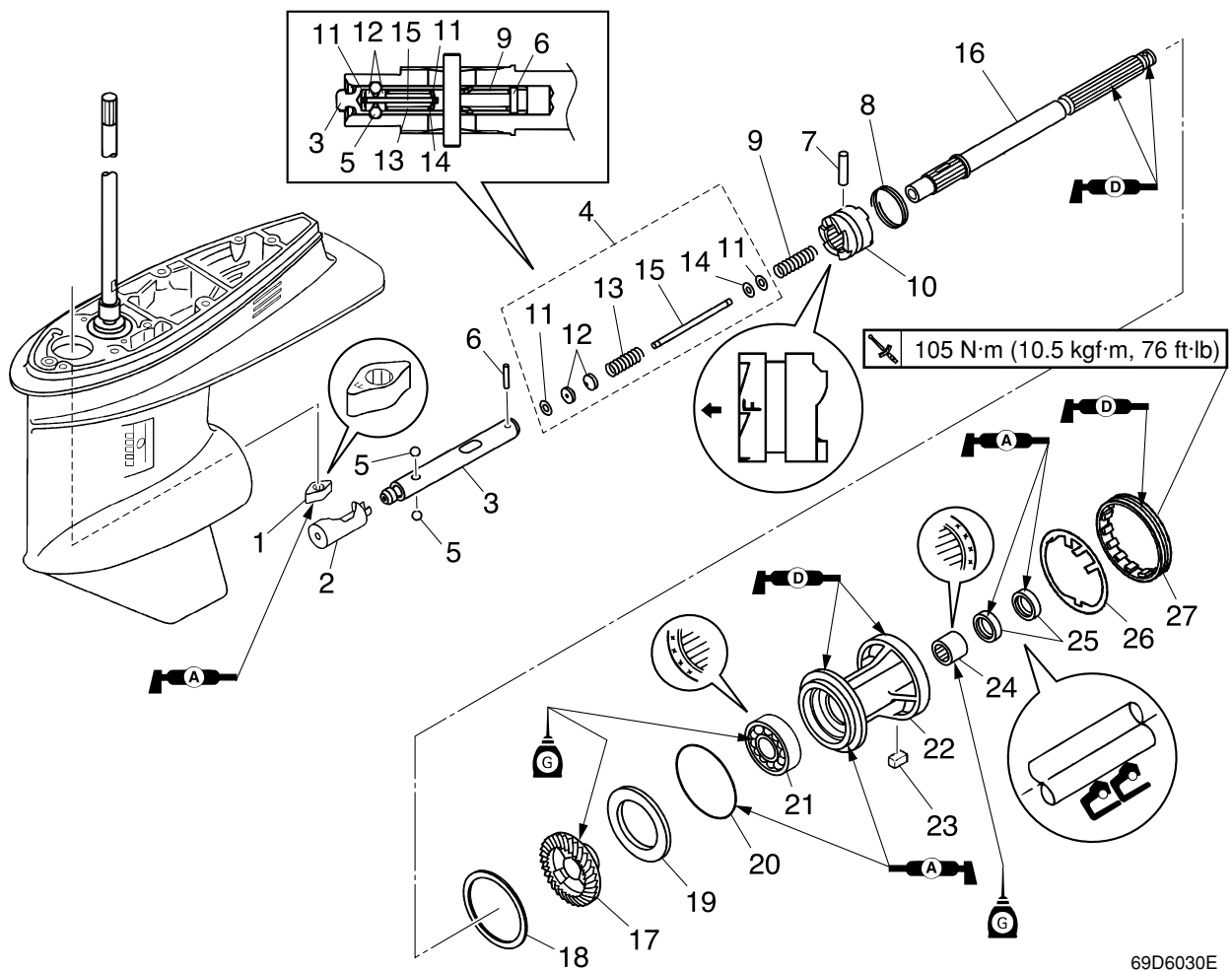
Propeller shaft housing



69D6030E

No.	Part name	Q'ty	Remarks
1	Slider	1	
2	Shifter	1	
3	Shift slider	1	
4	Shaft assembly	1	
5	Ball	2	
6	Pin	1	
7	Cross pin	1	
8	Spring	1	
9	Spring	1	
10	Dog clutch	1	
11	Spring nut	2	
12	Plunger	2	
13	Spring	1	
14	Washer	1	
15	Shaft	1	
16	Propeller shaft	1	
17	Reverse gear	1	

Propeller shaft housing



69D6030E

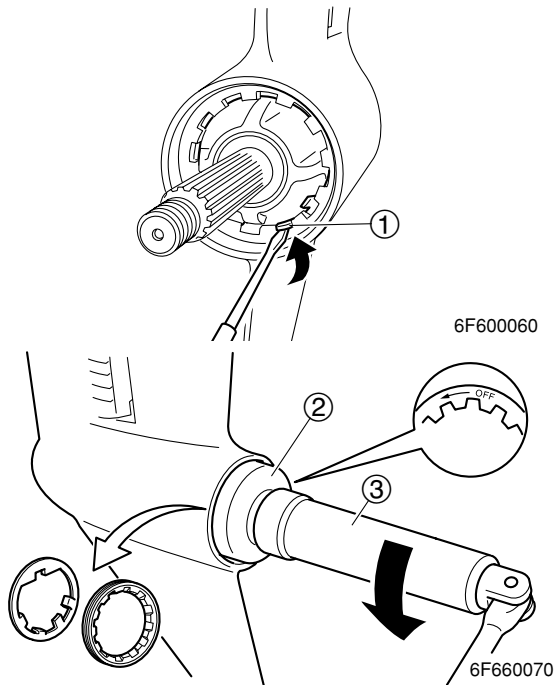
6

No.	Part name	Q'ty	Remarks
18	Reverse gear shim	—	
19	Washer	1	
20	O-ring	1	Not reusable
21	Bearing	1	
22	Propeller shaft housing	1	
23	Straight key	1	
24	Needle bearing	1	Not reusable
25	Oil seal	2	Not reusable
26	Lock washer	1	
27	Ring nut	1	



Removing the propeller shaft housing assembly

1. Remove the ring nut from the propeller shaft housing, use the special service tools.



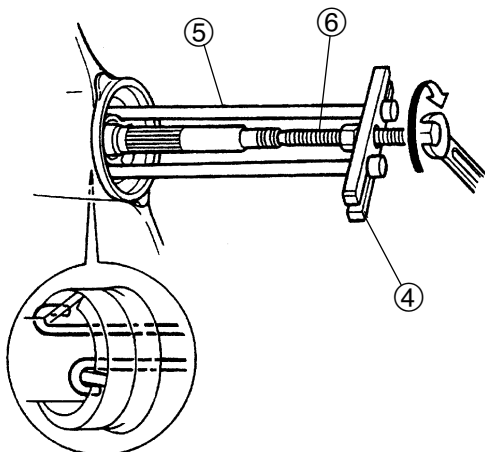
NOTE:

- Straighten the one tab ① of the lock washer, then turn the ring nut.
- When the ring nut toward to "OFF".



Ring nut wrench ②: 90890-06511
 Ring nut wrench extension ③:
 90890-06513

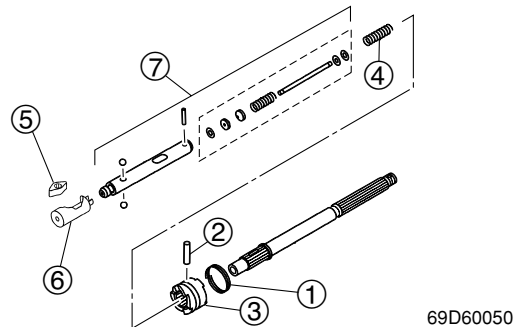
2. Remove the propeller shaft housing use the special tools.



Stopper guide plate ④:
 90890-06501
 Bearing housing puller claw L ⑤:
 90890-06502
 Center bolt ⑥: 90890-06504

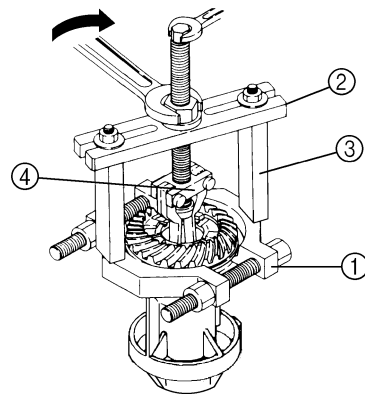
Disassembling the propeller shaft assembly

1. Remove the spring ①, then the cross pin ②, dog clutch ③, spring ④, slider ⑤, shifter ⑥, and shift slider assembly ⑦.



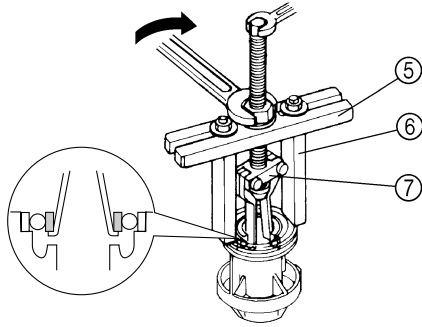
Disassembling the propeller shaft housing

1. Remove the reverse gear.



Bearing separator ①: 90890-06534
 Stopper guide plate ②:
 90890-06501
 Stopper guide stand ③:
 90890-06538
 Bearing puller assembly ④:
 90890-06535

- Remove the ball bearing.



6F660110

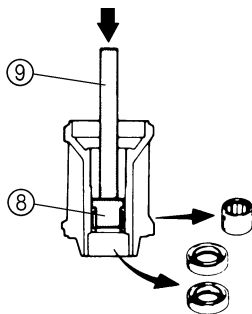
CAUTION:

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



- Stopper guide plate (5): 90890-06501
- Stopper guide stand (6): 90890-06538
- Bearing puller assembly (7): 90890-06535

- Remove the oil seals and needle bearing.



S68S6350



- Needle bearing attachment (8): 90890-06612
- Driver rod L3 (9): 90890-06652

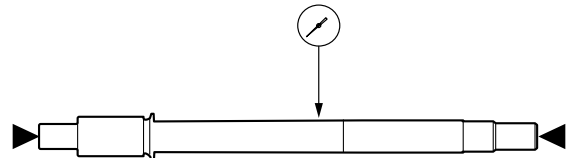
Checking the propeller shaft housing

- Clean the propeller shaft housing using a soft brush and cleaning solvent, and then check it for cracks. Replace if necessary.
- Check the teeth and dogs of the reverse gear for cracks or wear. Replace the gear if necessary.

- Check the bearings for pitting or rumbling. Replace if necessary.

Checking the propeller shaft

- Check the propeller shaft for bends or wear. Replace if necessary.
- Measure the propeller shaft runout.



6F660130

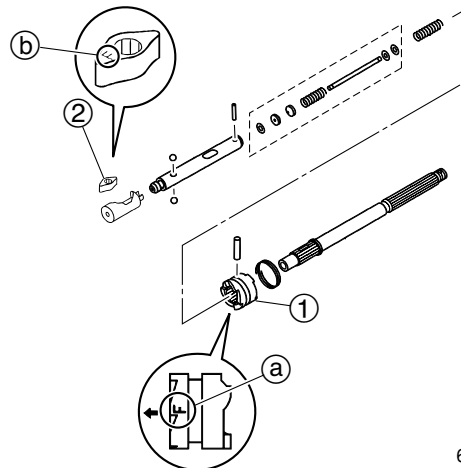


Runout limit: 0.02 mm (0.0008 in)

- Check the dog clutch and shift slider for cracks or wear. Replace if necessary.

Assembling the propeller shaft assembly

- Install the dog clutch (1) and the slider (2) as shown.



69D60060

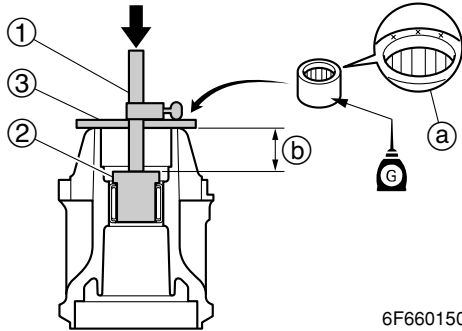
NOTE:

- Install the dog clutch (1) with the "F" mark (a) facing toward the shift plunger.
- Install the slider (2) with the "F" mark (b) facing toward the shift rod.



Assembling the propeller shaft housing

1. Install the needle bearing into the propeller shaft housing to the specified depth.



6F660150

NOTE:

Install the needle bearing with the manufacture identification mark (a) facing toward the oil seal (propeller side).

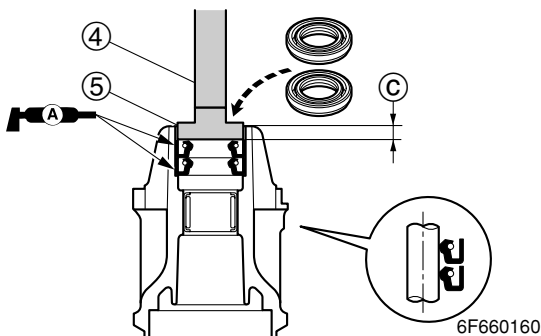


- Driver rod SS (1): 90890-06604
- Needle bearing attachment (2): 90890-06612
- Bearing depth plate (3): 90890-06603



Depth (b): 25.0—25.5 mm (0.984—1.004 in)

2. Apply grease to new oil seals, and then install them into the propeller shaft housing.



6F660160

NOTE:

Install an oil seal halfway into the propeller shaft housing, then the other oil seal.

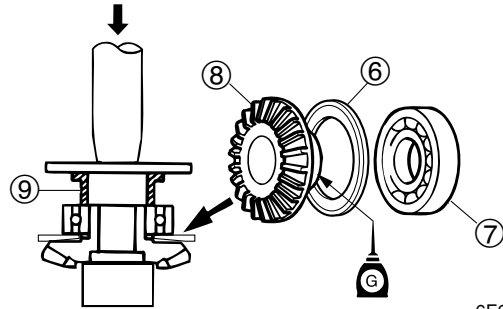


- Driver rod LS (4): 90890-06606
- Ball bearing attachment (5): 90890-06655



Depth (c): 4.5—5.5 mm (0.177—0.214 in)

3. Install the washer (6) and new ball bearing (7) onto the reverse gear (8) using a press.

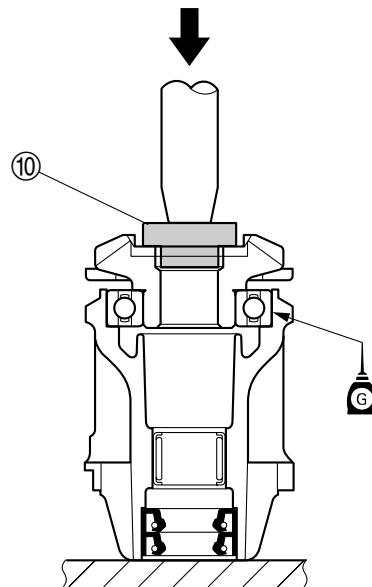


6F660170



Bearing inner race attachment (9): 90890-06662

4. Install the reverse gear assembly into the propeller shaft housing using a press.

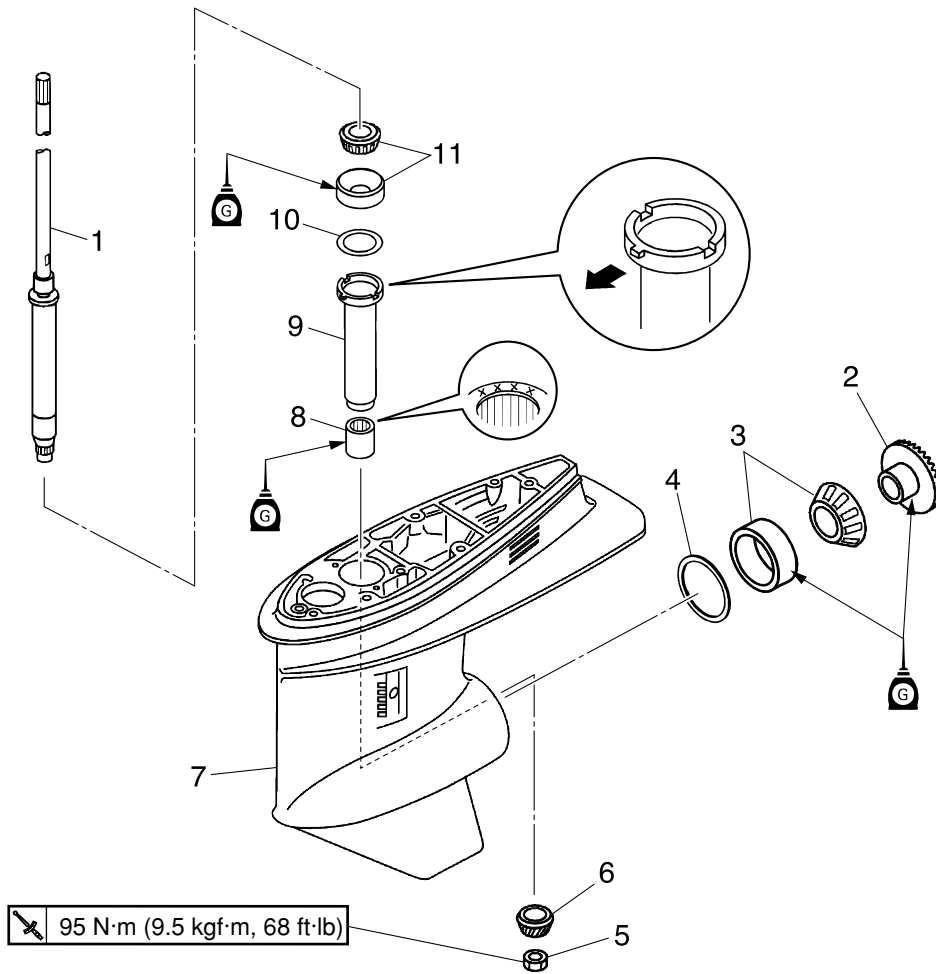


69D60080



Needle bearing attachment (10): 90890-06612

Drive shaft and lower case



69D6040E

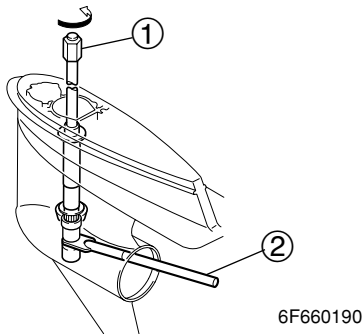
6

No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Forward gear	1	
3	Taper roller bearing assembly	1	Not reusable
4	Forward gear shim	—	
5	Nut	1	
6	Pinion gear	1	
7	Lower case	1	
8	Needle bearing	1	Not reusable
9	Sleeve	1	
10	Pinion gear shim	—	
11	Taper roller bearing assembly	1	Not reusable



Removing the drive shaft

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



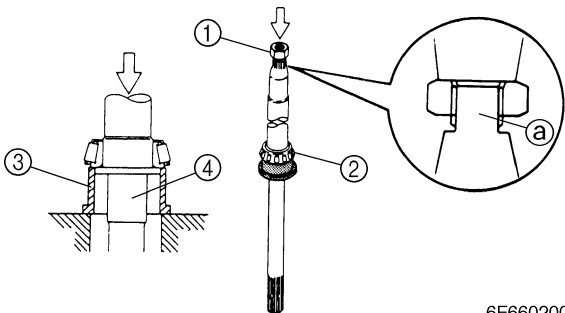
6F660190



Drive shaft holder 3 (1):
90890-06517
Pinion nut holder (2):
New: 90890-06715
Current: 90890-06505

Disassembling the drive shaft

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



6F660200

CAUTION:

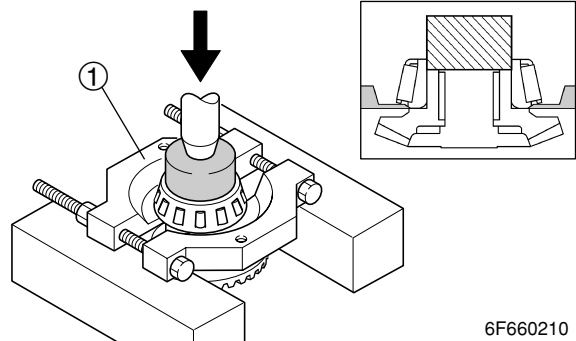
- Do not press the drive shaft threads (a) directly.
- When removing the drive shaft bearing, do not damage the drive shaft collar (4).
- Do not reuse the bearing, always replace it with a new one.



Bearing inner race attachment (3):
90890-06639

Disassembling the forward gear

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



6F660210

CAUTION:

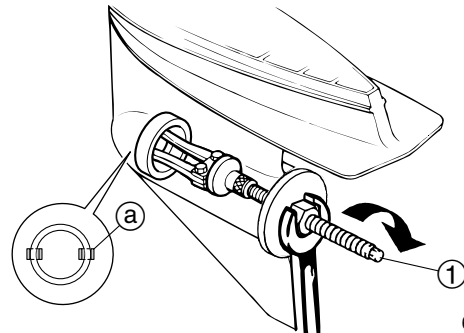
Do not reuse the bearing, always replace it with a new one.



Bearing separator (1): 90890-06534

Disassembling the lower case

1. Remove the taper roller bearing outer race and shim(s).



6F660230

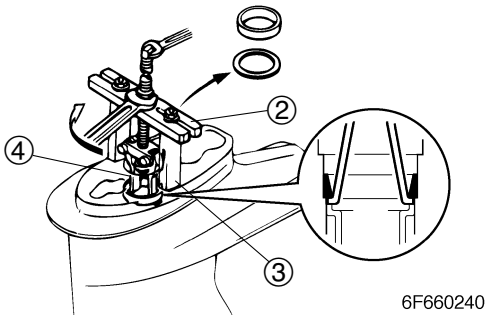
NOTE:

Install the claws (a) as shown.



Bearing outer race puller assembly (1): 90890-06523

- Remove the drive shaft bearing outer race, shim(s), and drive shaft sleeve.



6F660240

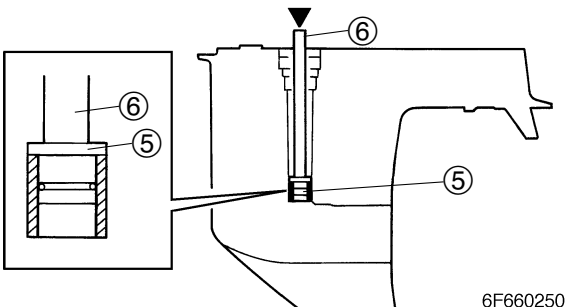
NOTE:

Install the claws as shown.



- Stopper guide plate (2) : 90890-06501
- Stopper guide stand (3) : 90890-06538
- Bearing puller assembly (4) : 90890-06535

- Remove the needle bearing.



6F660250



- Needle bearing attachment (5) : 90890-06611
- Driver rod L3 (6): 90890-06652

Checking the pinion and forward gear

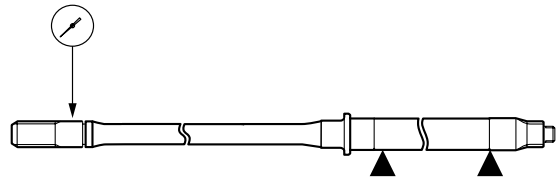
- Check the teeth of the pinion, and the teeth and dogs of the forward gear for cracks or wear.

Checking the bearings

- Check the bearings for pitting or rumbling.

Checking the drive shaft

- Check the drive shaft for bends or wear. Replace if necessary.
- Measure the drive shaft runout.



69D60110



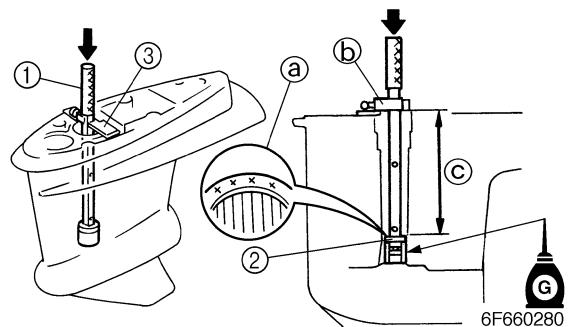
Runout limit: 1.0 mm (0.039 in)

Checking the lower case

- Check the skeg and torpedo for cracks or damage. Replace the lower case if necessary.

Assembling the lower case

- Install the needle bearing into the lower case to the specified depth.



6F660280

NOTE:

- Install the needle bearing with the manufacture identification mark (a) facing up.
- Be careful not to let the stopper (b) get out of position when using the driver rod SL.



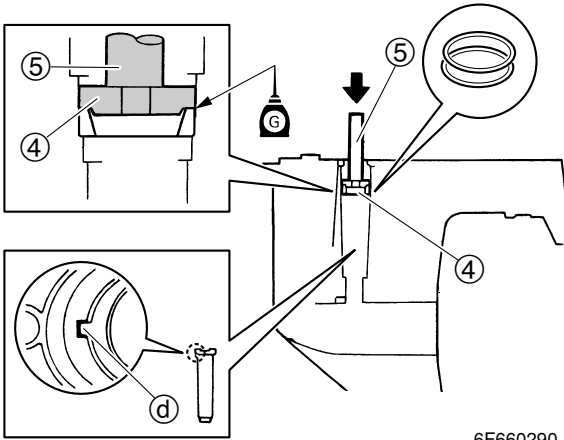
- Driver rod SL (1) : 90890-06602
- Needle bearing attachment (2) : 90890-06611
- Bearing depth plate (3) : 90890-06603



Depth (c) :
187.6 — 188.6 mm
(7.39 — 7.43 in)



2. Install the sleeve, original shim(s), and drive shaft bearing outer race.



CAUTION:

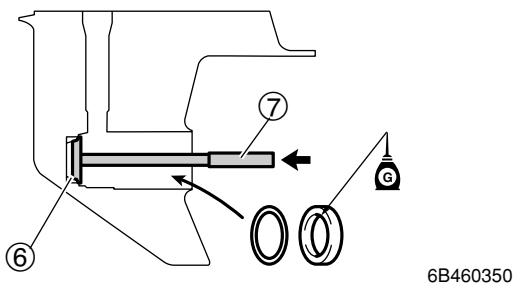
Add or remove shim(s), if necessary, if replacing the pinion or lower case.

NOTE:

- Apply gear oil to the inside and outside of the sleeve before installation.
- Install the sleeve with the projection **d** facing forward.

	Bearing outer race attachment ④ :
	90890-06626
	Driver rod LS ⑤ : 90890-06606

3. Install the original shim(s) and taper roller bearing outer race.



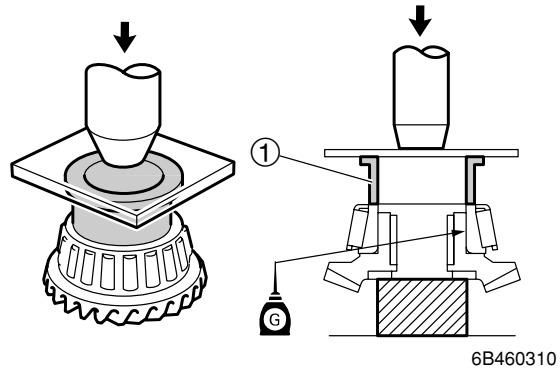
CAUTION:

Add or remove shim(s), if necessary, if replacing the forward gear or lower case.

	Bearing outer race attachment ⑥ :
	90890-06621
	Driver rod LL ⑦ : 90890-06605

Assembling the forward gear

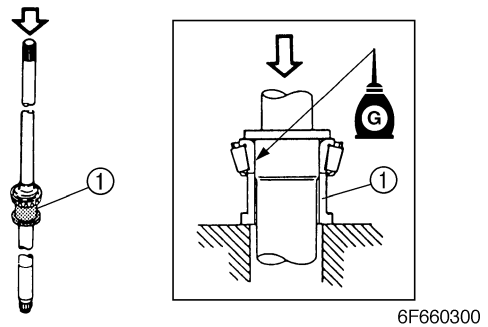
1. Install a new taper roller bearing into the forward gear using a press.



	Bearing inner race attachment ① :
	90890-06662

Assembling the drive shaft

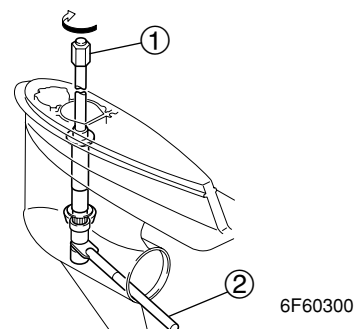
1. Install a new drive shaft bearing onto the drive shaft using a press.



	Bearing inner race attachment ① :
	90890-06643

Installing the drive shaft

1. Install the forward gear, then the drive shaft assembly, spacer, pinion, and pinion nut.
2. Tighten the nut to the specified torque.





Drive shaft holder 3 ①:
90890-06517

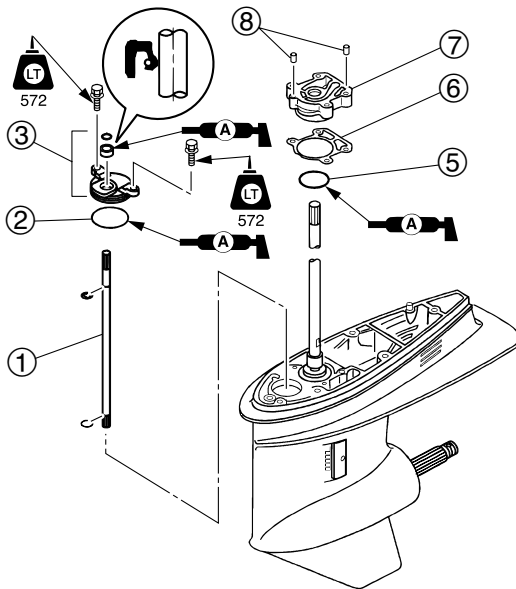
Pinion nut holder ②:
New: 90890-06715
Current: 90890-06505



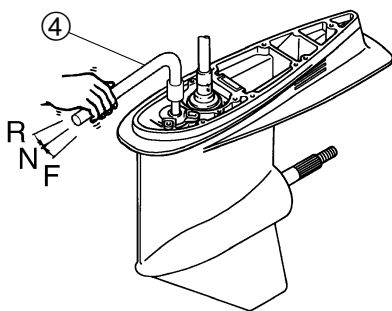
Pinion nut:
95 N·m (9.5 kgf·m, 68 ft·lb)

Installing the shift rod and oil seal housing

1. Install the shift rod ①, new O-ring ② and plate assembly ③.



69D60220



69D60045

NOTE:

Using a special service tool ④, check the forward, neutral and reverse position of the shift rod to set the neutral position.

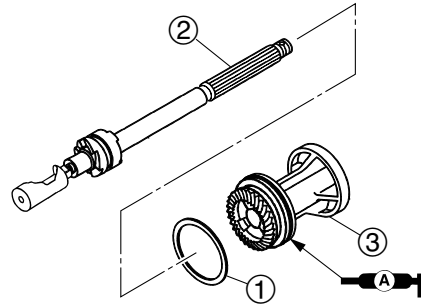


Shift rod push arm ④:
90890-06052

2. Install a new O-ring ⑤, new gasket ⑥, oil seal housing ⑦ and the dowels ⑧.

Installing the propeller shaft housing

1. Install the original shim(s) ①, and propeller shaft assembly ② into the propeller shaft housing assembly ③.
2. Apply grease to new O-rings.

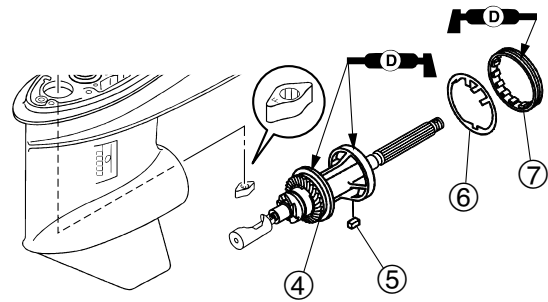


69D60230

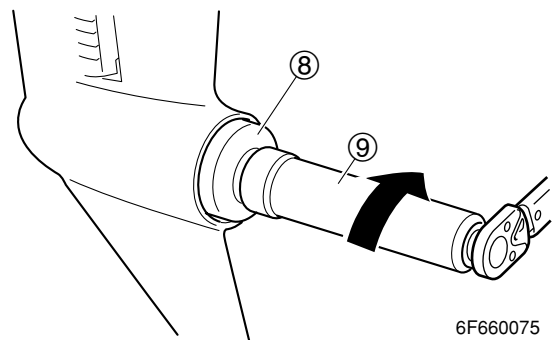
CAUTION:

Add or remove shim(s), if necessary, if replacing the reverse gear, propeller shaft housing, or lower case.

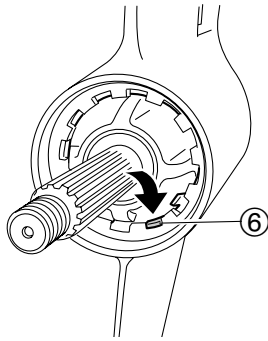
3. Install the propeller shaft housing assembly ④, straight key ⑤ and lock washer ⑥ into the lower case, and then tighten the ring nut ⑦ to the specified torque.



69D60245



6F660075



6F600065

NOTE:

To secure the ring nut, and lock washer ⑥ bend one lobe into the ring nut slot, and the other towards the gear side.



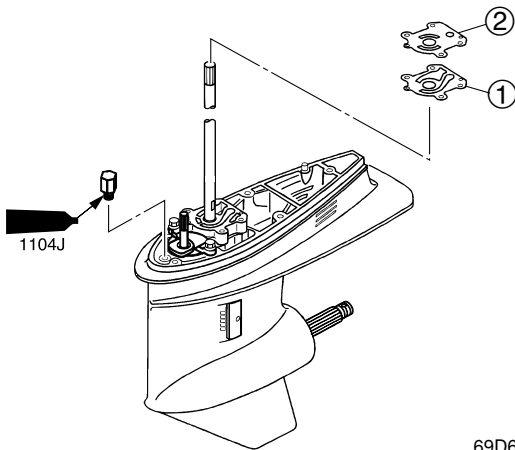
Ring nut wrench ⑧: 90890-06511
 Ring nut wrench extension ⑨:
 90890-06513



Ring nut :
 105 N·m (10.5 kgf·m, 76 ft·lb)

Installing the water pump

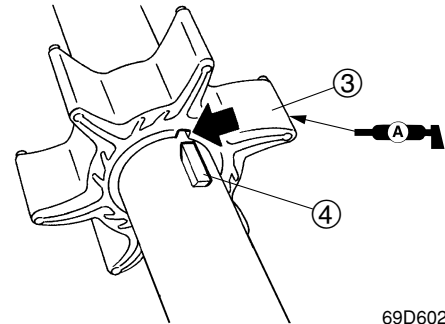
1. Install a new gasket ①, and outer plate cartridge ②.



69D60260

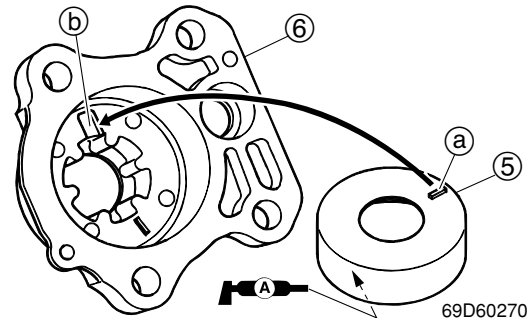
2. Install the Woodruff key into the drive shaft.

3. Align the groove in the impeller ③ with the Woodruff key ④, and then install the impeller onto the drive shaft.



69D60235

4. Install the insert cartridge ⑤ into the pump housing ⑥, and then apply grease to the inside of the insert cartridge.

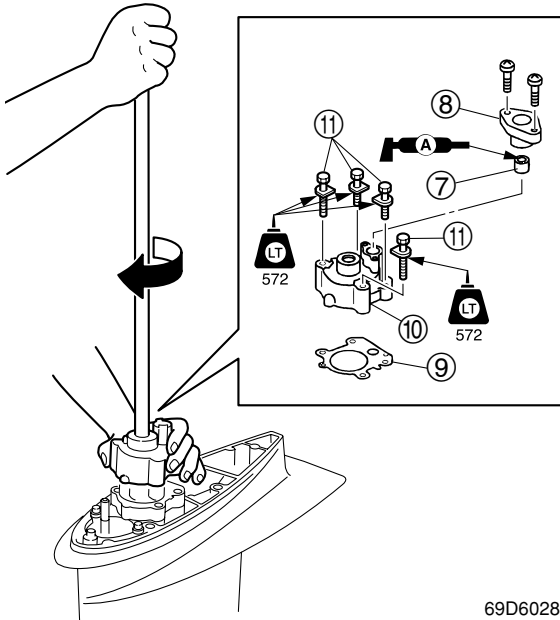


69D60270

NOTE:

Align the insert cartridge projection ① with the hole ② in the pump housing.

5. Install the seal (7), grommet (8), a new gasket (9) and pump housing assembly (10) into the lower case, tighten the bolts (11).



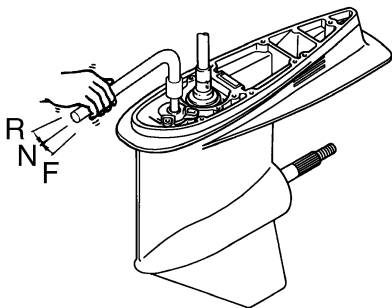
69D60280

NOTE:

When installing the pump housing, apply grease to the inside of the housing, and then turn the drive shaft clockwise while pushing down the pump housing.

Installing the lower unit

1. Set the gear shift to the neutral position at the lower unit and power unit. Make sure that the shift rod is in the neutral position using a special service tool.

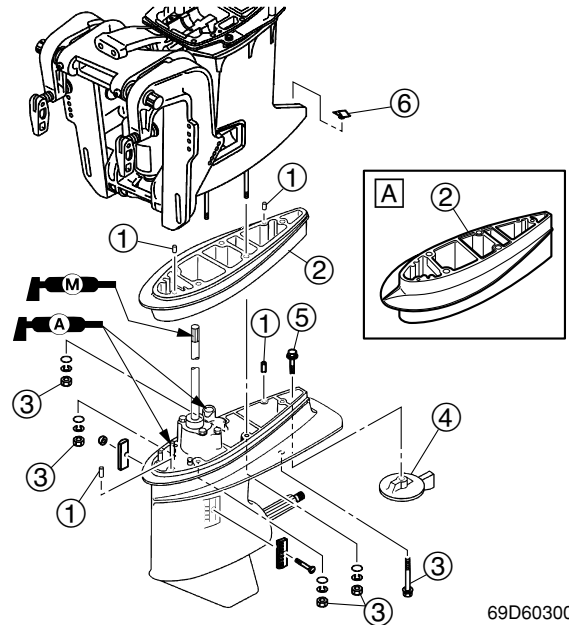


69D60035

	Shift rod push arm: 90890-06052
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2. Install the dowels (1) into the lower unit and extension.

3. Install the lower unit into the upper case, and then tighten the lower case mounting bolt and nuts (3) to the specified torque.
4. Install the trim tab (4) to its original position, and then tighten the trim tab bolt (5).



69D60300

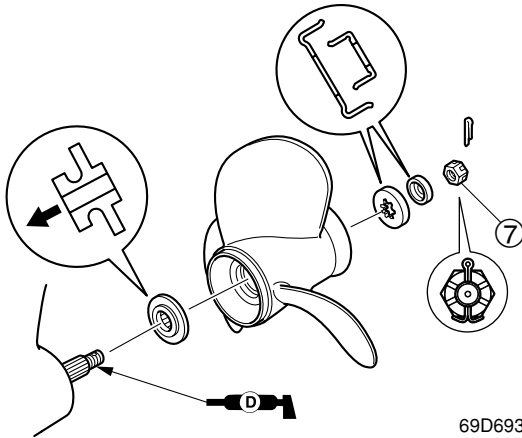
AX-transom model

	Lower case mounting bolt (nut) (3): 40 N·m (4.0 kgf·m, 29.5 ft·lb)
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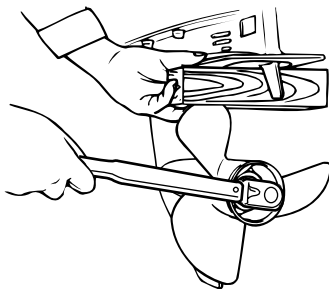
5. Install the cap (6).



- Install the propeller and propeller nut, and then tighten the nut temporary tight. Place a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning, and then tighten the nut to the specified torque.



69D69310



6F660420

⚠WARNING

- Do not hold the propeller with your hands when loosening or tightening it.
- Be sure to disconnect the battery leads from the battery and the clip from the engine stop lanyard switch.
- Put a block of wood between the anti-cavitation plate and propeller to keep the propeller from turning.

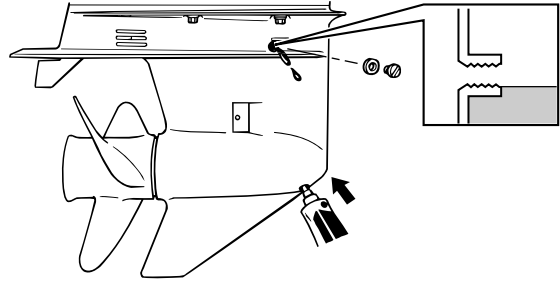
NOTE:

If the grooves in the propeller nut (7) do not align with the cotter pin hole, tighten the nut until they are aligned.



Propeller nut (7):
35 N·m (3.5 kgf·m, 25.3 ft·lb)

- Insert a gear oil tube or gear oil pump into the drain hole and slowly fill the gear oil until oil flows out of the check hole and no air bubbles are visible.



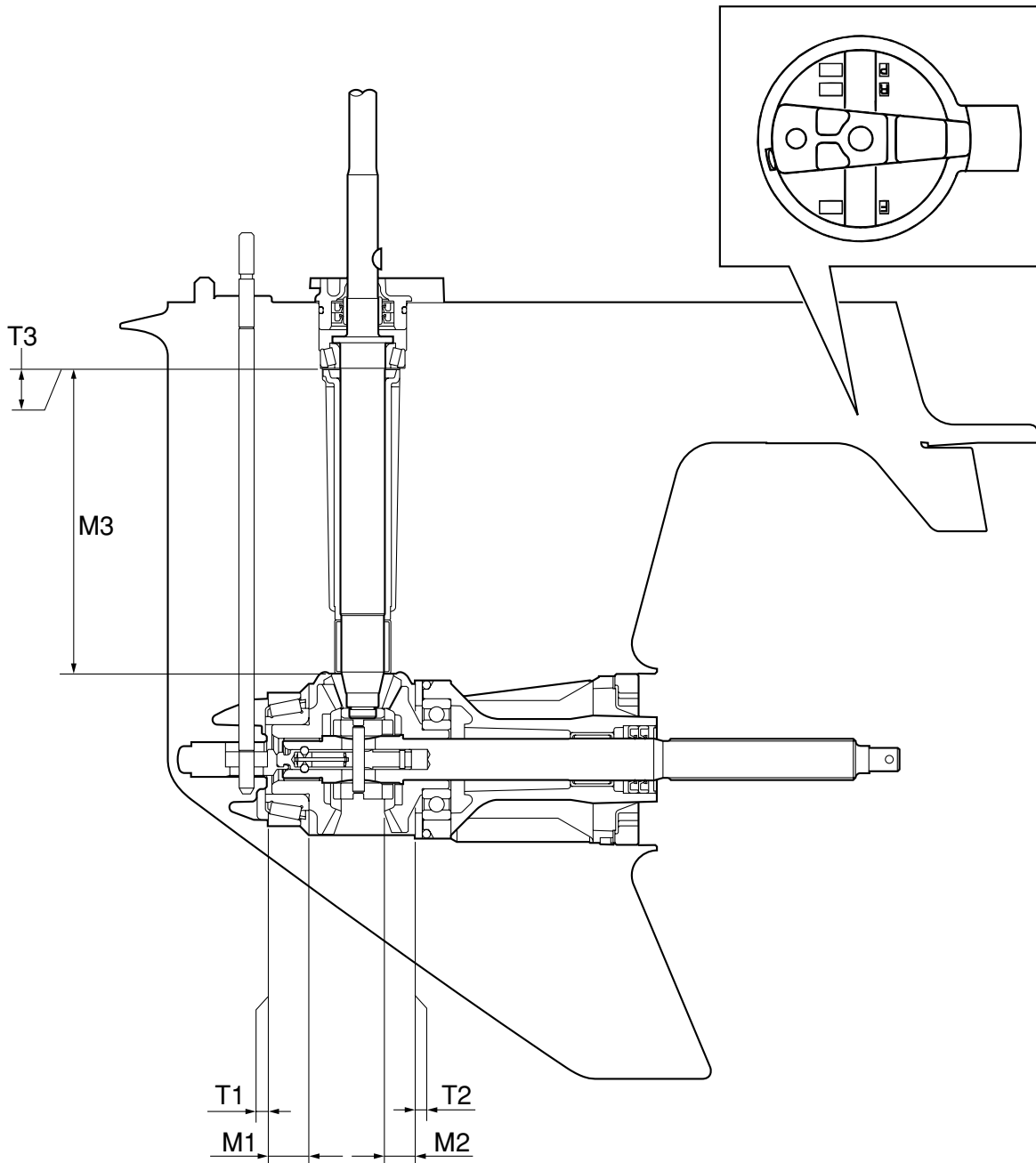
69D10050



Recommended gear oil:
Hypoid gear oil
API: GL-4
SAE: 90
Oil quantity:
610 cm³
(20.62 US oz, 21.51 Imp oz)

- Install the check screw and quickly install the drain screw.

Shimming



6

69D6050E



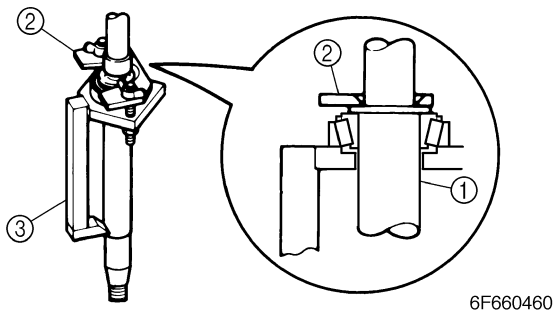
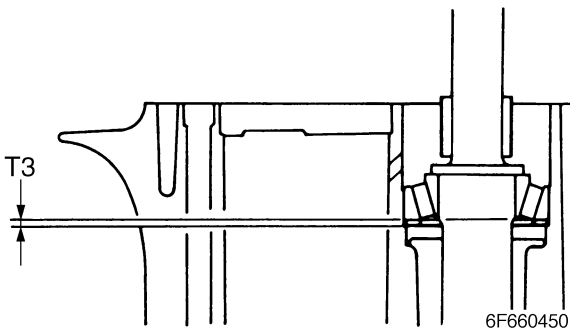
Shimming

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. Install the special service tools onto the drive shaft ①.



NOTE:

- Select the shim thickness (T3) by using the specified measurement(s) and the calculation formula.
- Install the special service tool onto the drive shaft so that the shaft is at the center of the hole.
- Tighten the wing nuts another 1/4 of a turn after they contact the plate ②.



Pinion height gauge plate B ②:
90890-06712

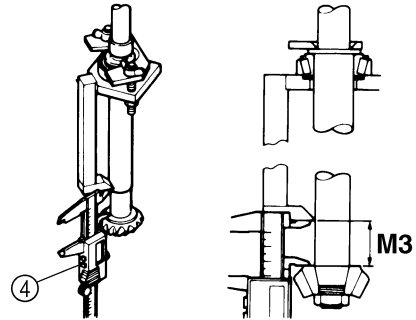
Pinion height gauge ③:
90890-06710

2. Install the pinion and pinion nut, and then tighten the nut to the specified torque.



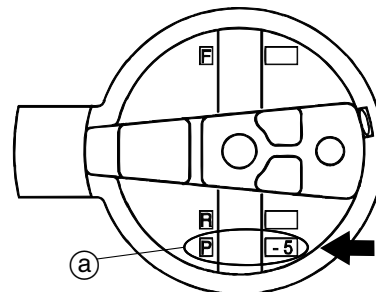
Pinion nut:
95 N·m (9.5 kgf·m, 68 ft·lb)

3. Measure the distance (M3) between the special service tool and the pinion as shown.



Digital caliper ④: 90890-06704

4. Calculate the pinion shim thickness (T3) as shown in the examples below.



NOTE:

“P” is the deviation of the lower case dimension from standard. The “P” mark ① is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the “P” mark is unreadable, assume that “P” is zero and check the backlash when the unit is assembled.

Calculation formula:

$$\text{Pinion shim thickness (T3)} = M3 - 31.5 - P/100$$

Example:

If "M3" is 32.10 mm and "P" is (-5), then
 $T3 = 32.10 - 31.50 - (-5)/100 \text{ mm}$
 $= 0.60 + 0.05 \text{ mm}$
 $= 0.65 \text{ mm}$

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

Calculated numeral at 1/100th place	Rounded numeral
1, 2	2
3, 4, 5	5
6, 7, 8	8
9, 10	10

Available shim thicknesses:

0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

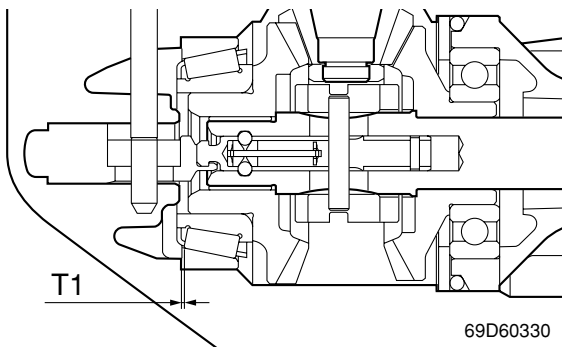
Example:

If "T3" is 0.43 mm, then the pinion shim is 0.45 mm.

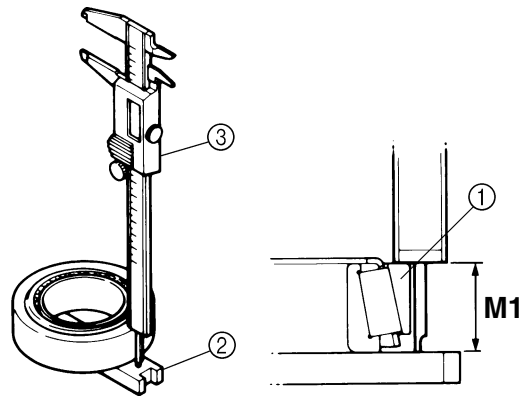
If "T3" is 0.38 mm, then the pinion shim is 0.38 mm.

Selecting the forward gear shims

1. Turn the taper roller bearing outer race ① two or three times to seat the rollers, and then measure the bearing height (M1) as shown.



69D60330



6B460550

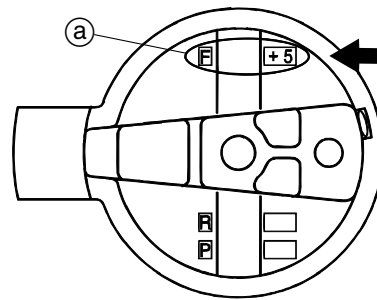
NOTE:

- 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 forward gear shim thickness (T1) as shown in the examples below.



69D69340

NOTE:

"F" is the deviation of the lower case dimension from standard. The "F" mark (a) is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the "F" mark is unreadable, assume that "F" is zero and check the backlash when the unit is assembled.



Calculation formula:

$$\text{Forward gear shim thickness (T1)} = 24.50 + F/100 - M1$$

Example:

If "M1" is 24.00 mm and "F" is (+5), then

$$T1 = 24.50 + (+5)/100 - 24.00 \text{ mm}$$

$$= 24.50 + 0.05 - 24.00 \text{ mm}$$

$$= 0.55 \text{ mm}$$

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

Calculated numeral at 1/100th place	Rounded numeral
1, 2	0
3, 4, 5	2
6, 7, 8	5
9, 10	8

Available shim thicknesses:

0.10, 0.12, 0.15, 0.18, 0.30, 0.40 and 0.50 mm

Example:

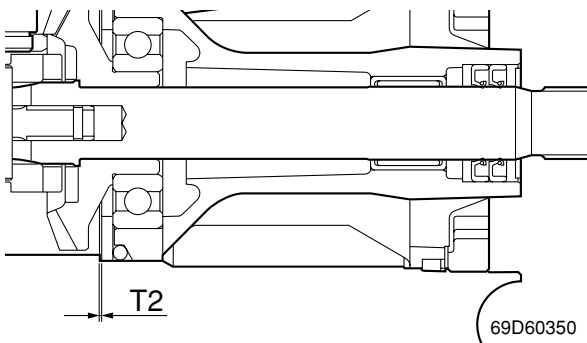
If "T1" is 0.44 mm, then the forward gear shim is 0.42 mm.

If "T1" is 0.50 mm, then the forward gear shim is 0.48 mm.

Selecting the reverse gear shims

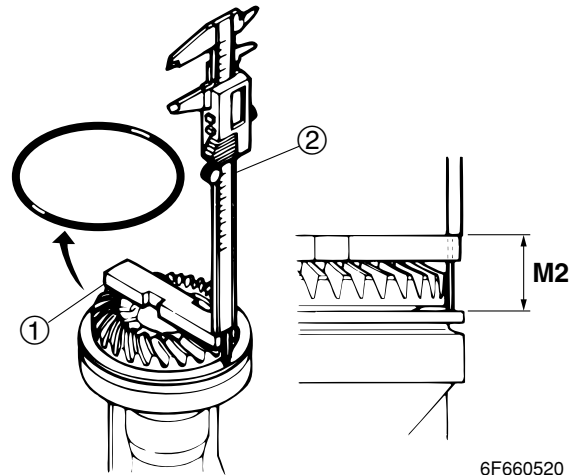
1. Install the ball bearing onto the propeller shaft housing.

2. Measure the bearing housing height (M2) as shown.



NOTE:

When measuring the reverse gear bearing height, without the O-ring.



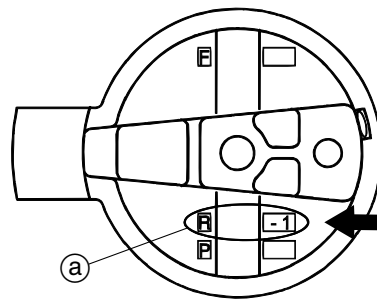
NOTE:

- Select the shim thickness (T2) by using the specified measurement(s) and the calculation formula.
- Measure the bearing housing at three points to find the height average.



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

3. Calculate the reverse gear shim thickness (T2) as shown in the examples below.



NOTE:

"R" is the deviation of the lower case dimension from standard. The "R" mark (a) is stamped on the trim tab mounting surface of the lower case in 0.01 mm units. If the "R" mark is unreadable, assume that "R" is zero and check the backlash when the unit is assembled.

Calculation formula:
Reverse gear shim thickness (T2) =
 $M2 - 28.00 - R/100$

Example:
If "M2" is 28.60 mm and "R" is (-1), then
 $T2 = 28.60 \text{ mm} - 28.00 \text{ mm} - (-1)/100$
 $= 28.60 - 28.00 + 0.01$
 $= 0.61 \text{ mm}$

4. Select the reverse gear shim(s) (T2) as follows.

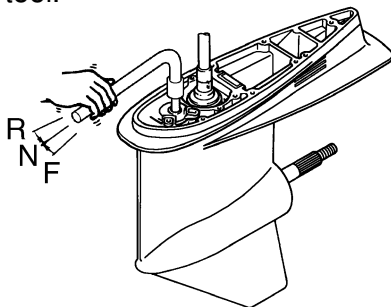
Calculated numeral at 1/100th place	Rounded numeral
1, 2	2
3, 4, 5	5
6, 7, 8	8
9, 10	10

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


Example:
If "T2" is 0.47 mm, then the reverse gear shim is 0.48 mm.
If "T2" is 0.41 mm, then the reverse gear shim is 0.42 mm.

Backlash Measuring the forward and reverse gear backlash

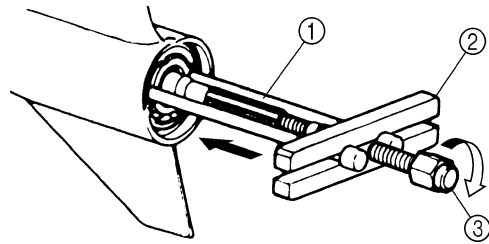
1. Remove the water pump assembly.
2. Set the gear shift to the neutral position at lower unit using the special service tool.



69D60035


 Shift rod push arm:
90890-06052

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

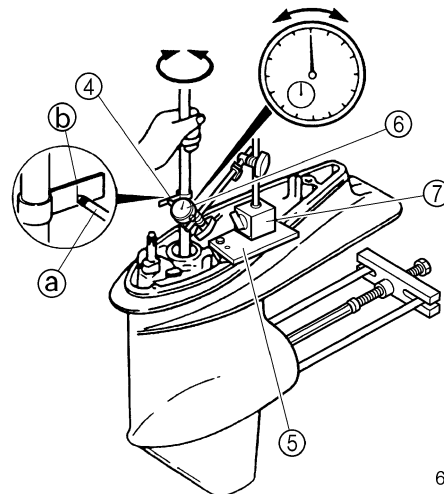


6F660540

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


 Bearing housing puller claw L (1):
90890-06502
Stopper guide plate (2):
90890-06501
Center bolt (3): 90890-06504

4. Install the backlash indicator onto the drive shaft (20.0 mm [0.78 in] in diameter), then the dial gauge onto the lower unit.



6F660550

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



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

	Forward gear backlash: 0.14– 0.46 mm (0.0053– 0.0182 in)
--	---

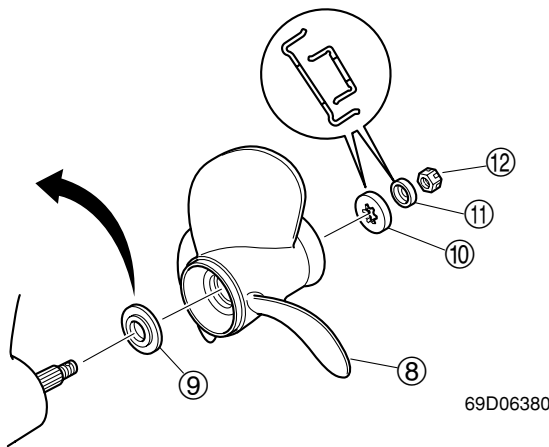
- Add or remove shim(s) if out of specification.

Forward gear backlash	Shim thickness
Less than 0.14 mm (0.0053 in)	To be decreased by $(0.30 - M) \times 0.52$
More than 0.46 mm (0.0182 in)	To be increased by $(M - 0.30) \times 0.52$

M: Measurement

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

- Remove the special service tools from the propeller shaft.
- Apply a load to the reverse gear by installing the propeller ⑧ without the spacer ⑨, the washer ⑩, then the washer ⑪ as shown.

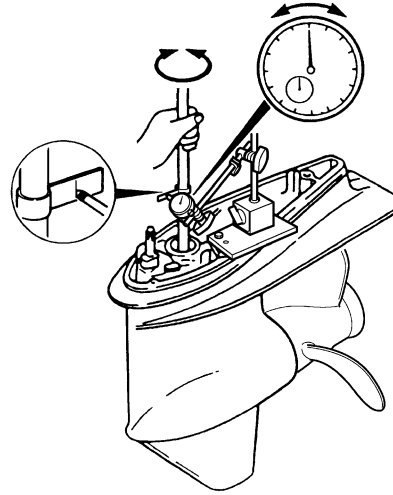


69D06380

NOTE:

Tighten the propeller nut ⑫ while turning the drive shaft until the drive shaft can no longer be turned.

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



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	Reverse gear backlash: 0.77– 1.16 mm (0.0304– 0.0456 in)
--	--

- Add or remove the shim(s) if out of specification.

Reverse gear backlash	Shim thickness
Less than 0.77 mm (0.0304 in)	To be increased by $(0.97 - M) \times 0.52$
More than 1.16 mm (0.0456 in)	To be decreased by $(M - 0.97) \times 0.52$

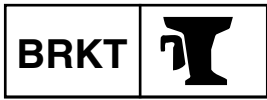
M: Measurement

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

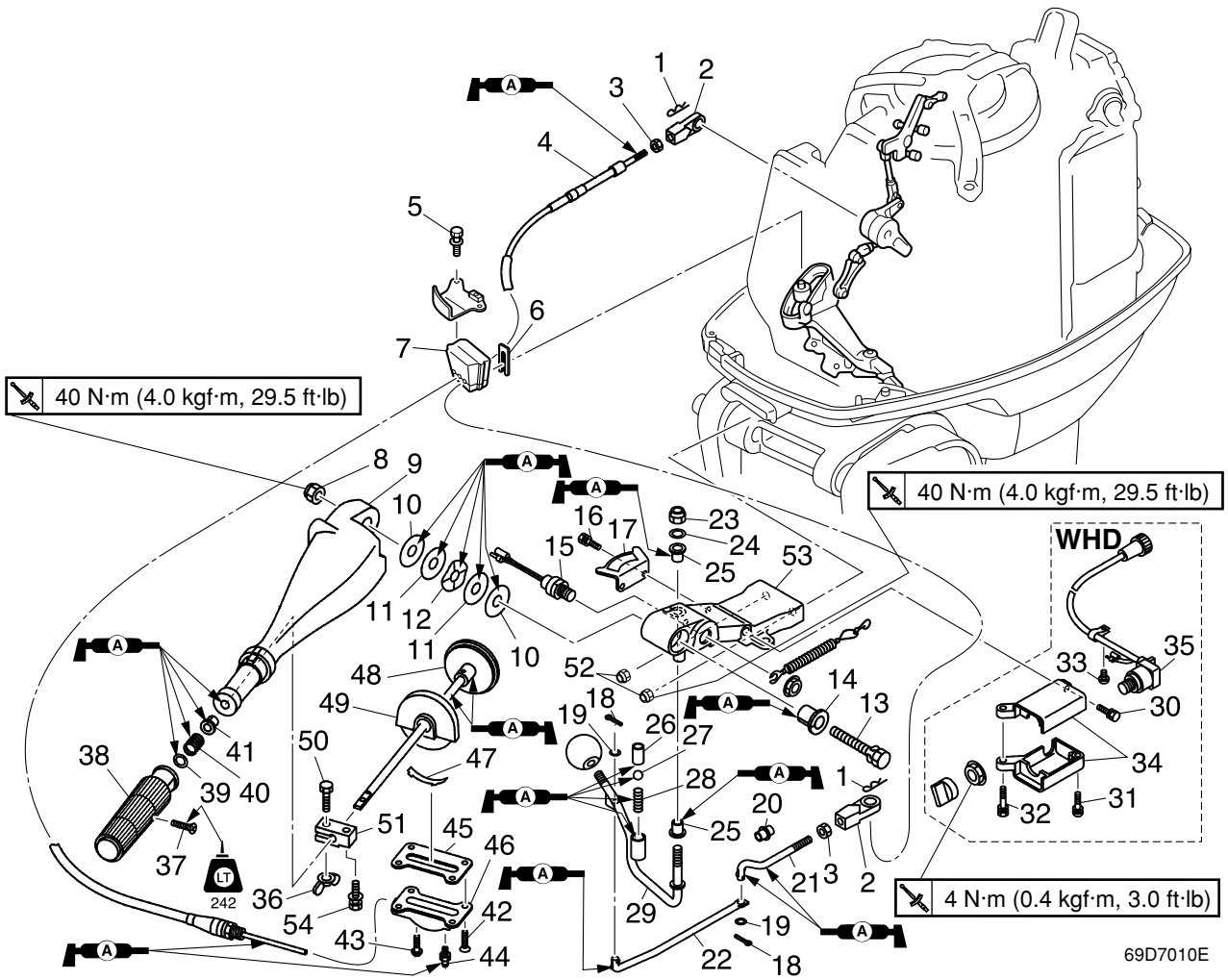
- Remove the special service tools, and then install the water pump assembly.

Bracket unit

Tiller handle (MHD, WHD)	7-1
Checking the throttle cable and shift rod	7-5
Assembling the tiller handle	7-5
Lubricating the throttle gear	7-5
 Bottom cowling	 7-6
 Upper case, pivot shaft	 7-8
Removing the pivot shaft	7-12
Installing the pivot shaft	7-12
Disassembling the upper case	7-13
Checking the upper case	7-13
Assembling the upper case	7-13
Installing the upper case	7-14
 Clamp brackets, swivel bracket (S, L-transom)	 7-16
 Clamp brackets, swivel bracket (X-transom model)	 7-19
Removing the hydro tilt assembly	7-22
Installing the hydro tilt assembly	7-23
Removing the clamp brackets	7-23
Installing the clamp brackets	7-23

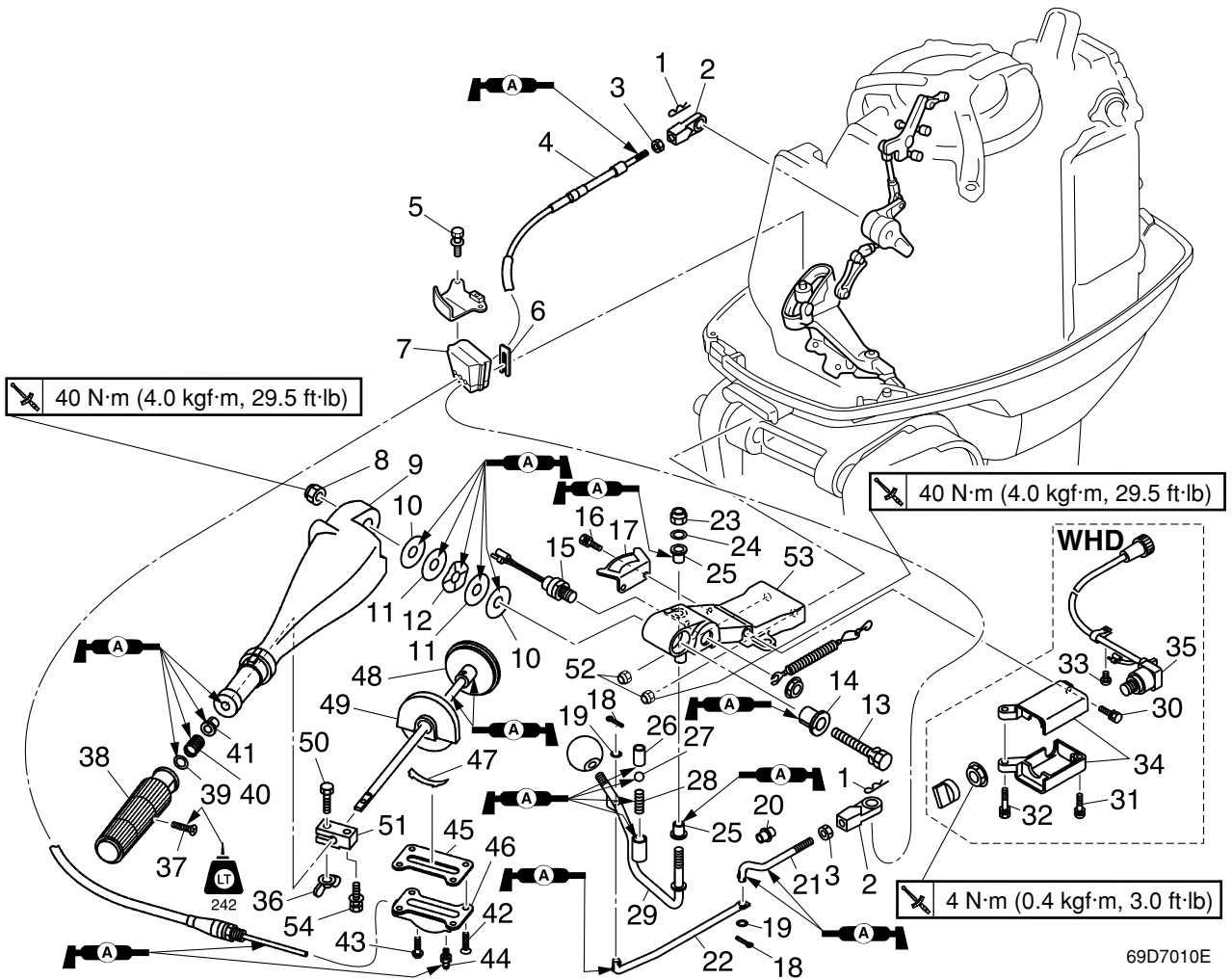


Tiller handle (MHD, WHD)



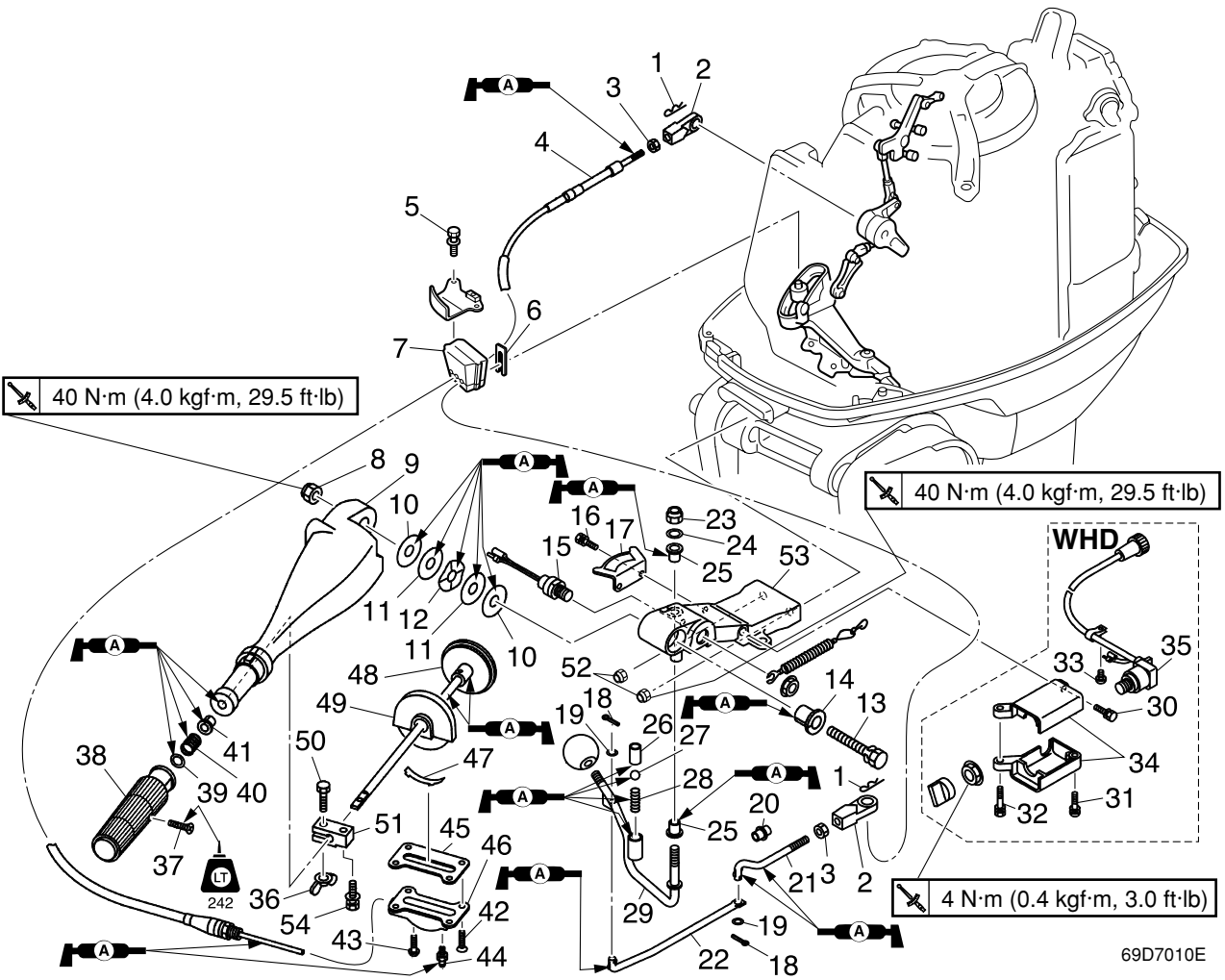
69D7010E

No.	Part name	Q'ty	Remarks
1	Clip	2	
2	Joint	2	
3	Nut	2	
4	Throttle cable	1	
5	Bolt	2	M6 × 16 mm
6	Cable clamp	1	
7	Grommet	1	
8	Nut	1	
9	Tiller handle bracket	1	
10	Plastic washer	2	
11	Metal washer	2	
12	Wave washer	1	
13	Bolt	1	M7 × 70 mm
14	Collar	1	
15	Engine stop lanyard switch	1	
16	Bolt	2	M6 × 16 mm
17	Bracket	1	

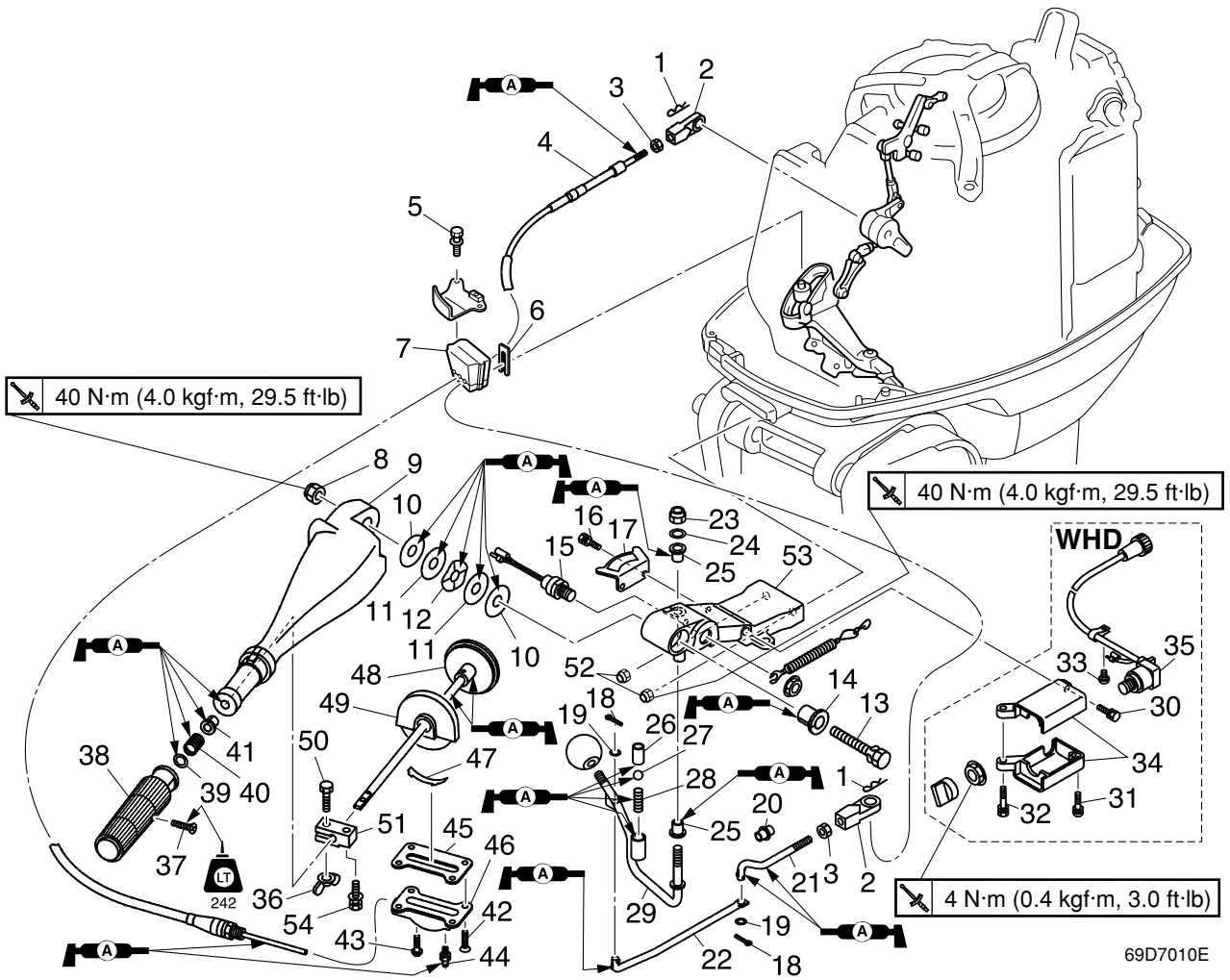


69D7010E

No.	Part name	Q'ty	Remarks
18	Cotter pin	2	
19	Washer	2	
20	Collar	1	
21	Shift rod	1	
22	Shift rod	1	
23	Nut	1	
24	Washer	1	
25	Collar	2	M5 × 10 mm
26	Holder	1	
27	Ball	1	
28	Spring	1	
29	Shift lever	1	
30	Bolt	1	M6 × 20 mm
31	Screw	1	ø6 × 26 mm
32	Bolt	1	M6 × 30 mm
33	Screw	1	ø6 × 10 mm
34	Switch holder	2	



No.	Part name	Q'ty	Remarks
35	Start switch	1	
36	Nut	1	
37	Screw	1	
38	Throttle grip	1	
39	Washer	1	
40	Spring	1	
41	Collar	1	
42	Screw	4	ø5 × 12 mm
43	Screw	1	ø6 × 8 mm
44	Nipple	1	
45	Gasket	1	Not reusable
46	Cover	1	
47	Plate	1	
48	Throttle shaft	1	
49	Housing	1	
50	Bolt	1	M6 × 25 mm
51	Friction control piece	1	



69D7010E

No.	Part name	Q'ty	Remarks
52	Nut	2	
53	Bracket	1	
54	Bolt	1	M6 × 25 mm

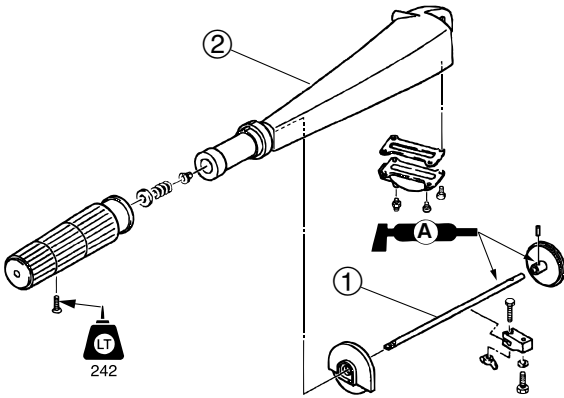


Checking the throttle cable and shift rod

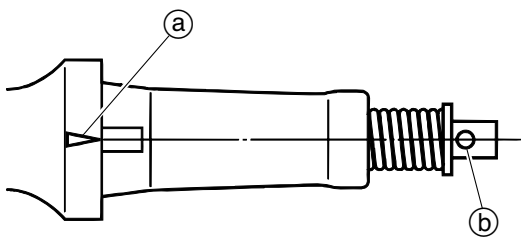
1. Check that the operation of the throttle cable and shift rod.
2. Check the inner wire, outer wire of the cable and rod for bends or damage, and the rubber seals for damage. Replace if necessary.

Assembling the tiller handle

1. Install the throttle shaft (1) into the tiller handle (2) by aligning the mark "▲" (a) of the tiller handle with the screw hole (b) of the throttle shaft.

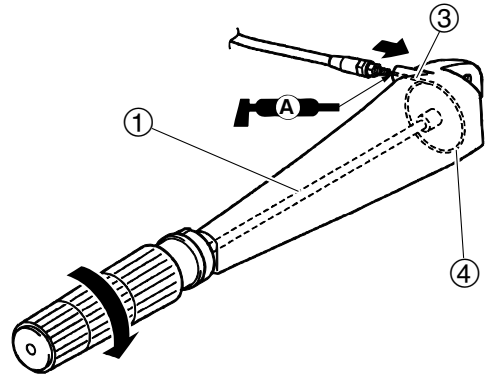


69D70140



69D70150

2. Install the throttle cable (3) into the gear (4) until the inner cable is engaged with the gear.
3. Turn the throttle shaft (1) clockwise to wind the inner cable around the gear (4).



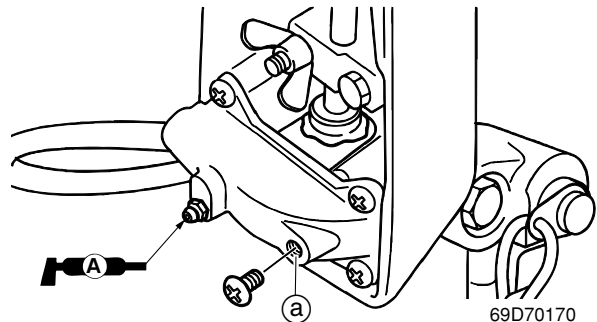
69D70160

NOTE:

Make sure that the throttle grip is fully closed when installing the throttle cable.

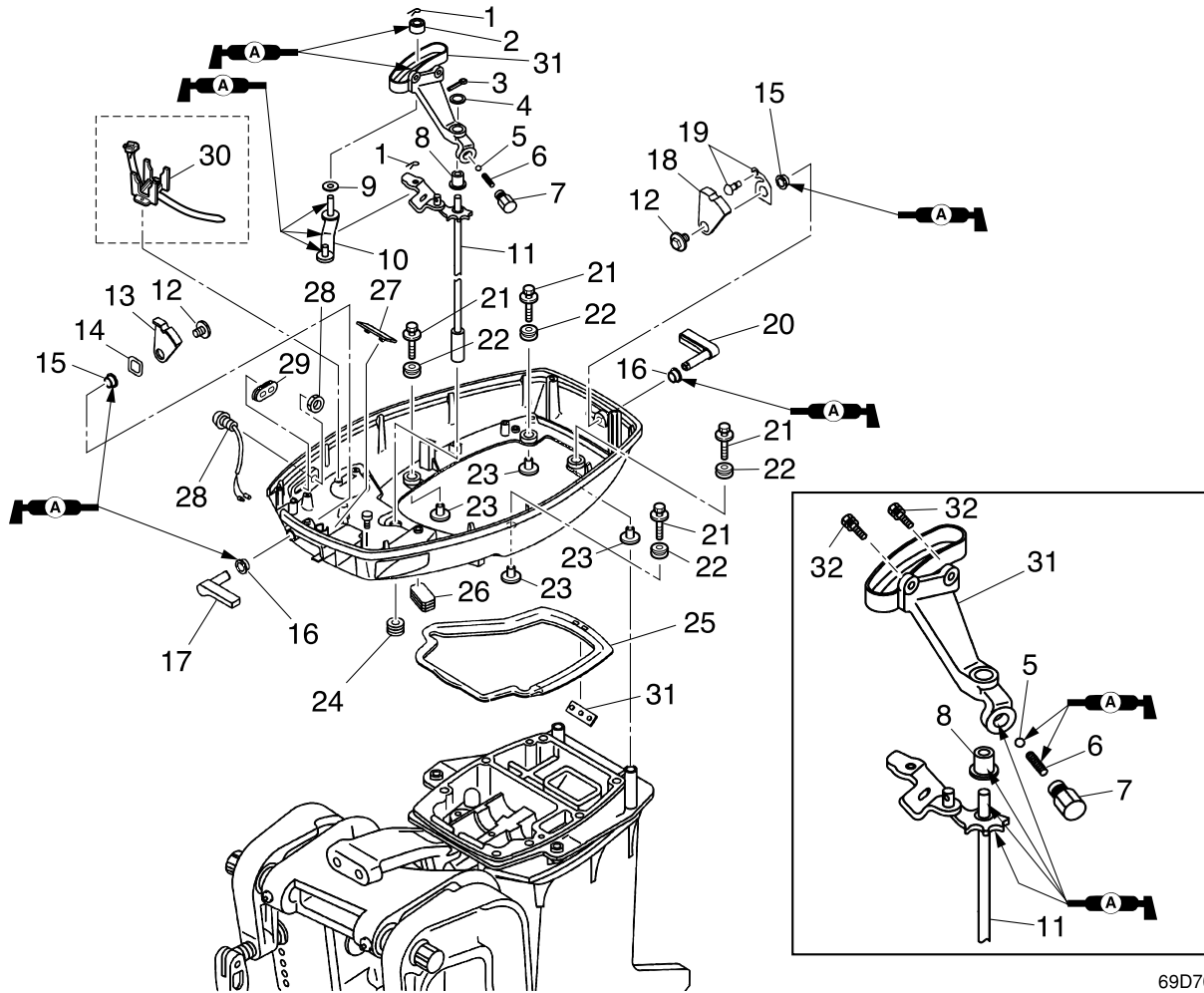
Lubricating the throttle gear

1. Inject grease into the grease nipple until grease comes out from the screw hole (a).



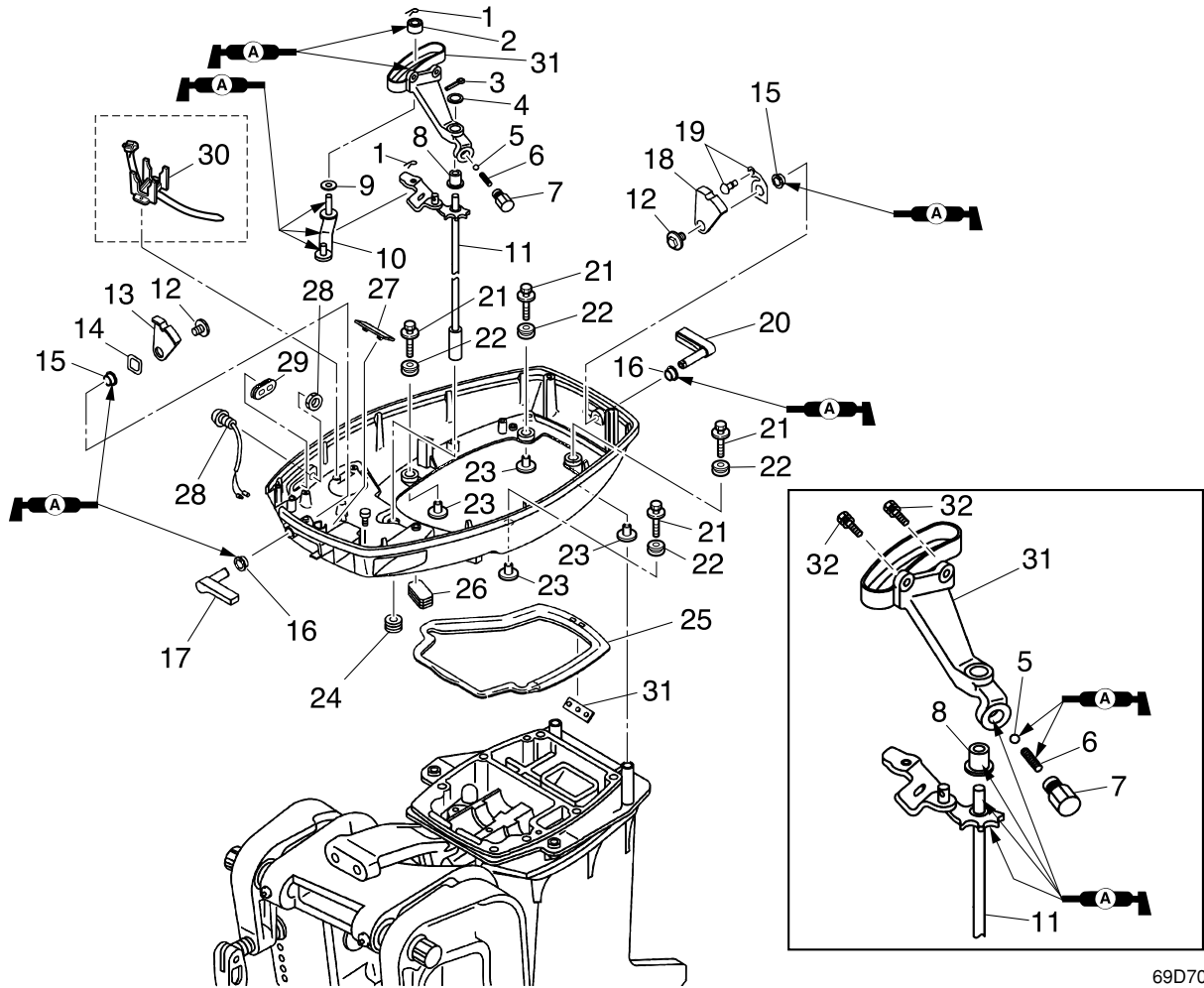
69D70170

Bottom cowling



69D7020E

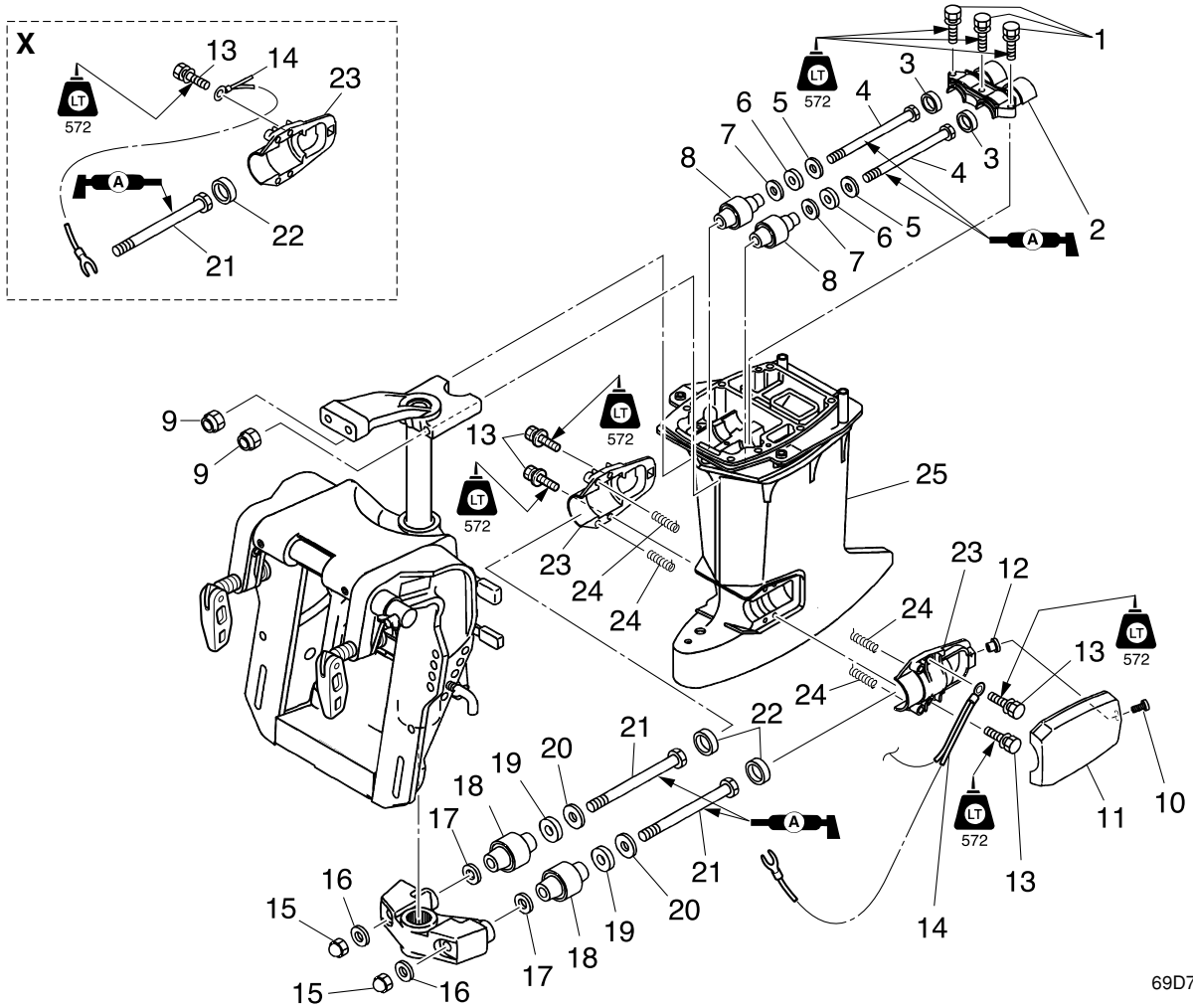
No.	Part name	Q'ty	Remarks
1	Clip	2	
2	Bushing	1	
3	Cotter pin	1	
4	Washer	1	
5	Ball	1	
6	Spring	1	
7	Plug	1	
8	Collar	1	
9	Washer	1	
10	Shift rod lever	1	
11	Shift rod lever assembly	1	
12	Bolt	2	M6 × 12 mm
13	Bracket	1	
14	Wave washer	1	
15	Collar	2	
16	Collar	2	
17	Cowling lock lever	1	



69D7020E

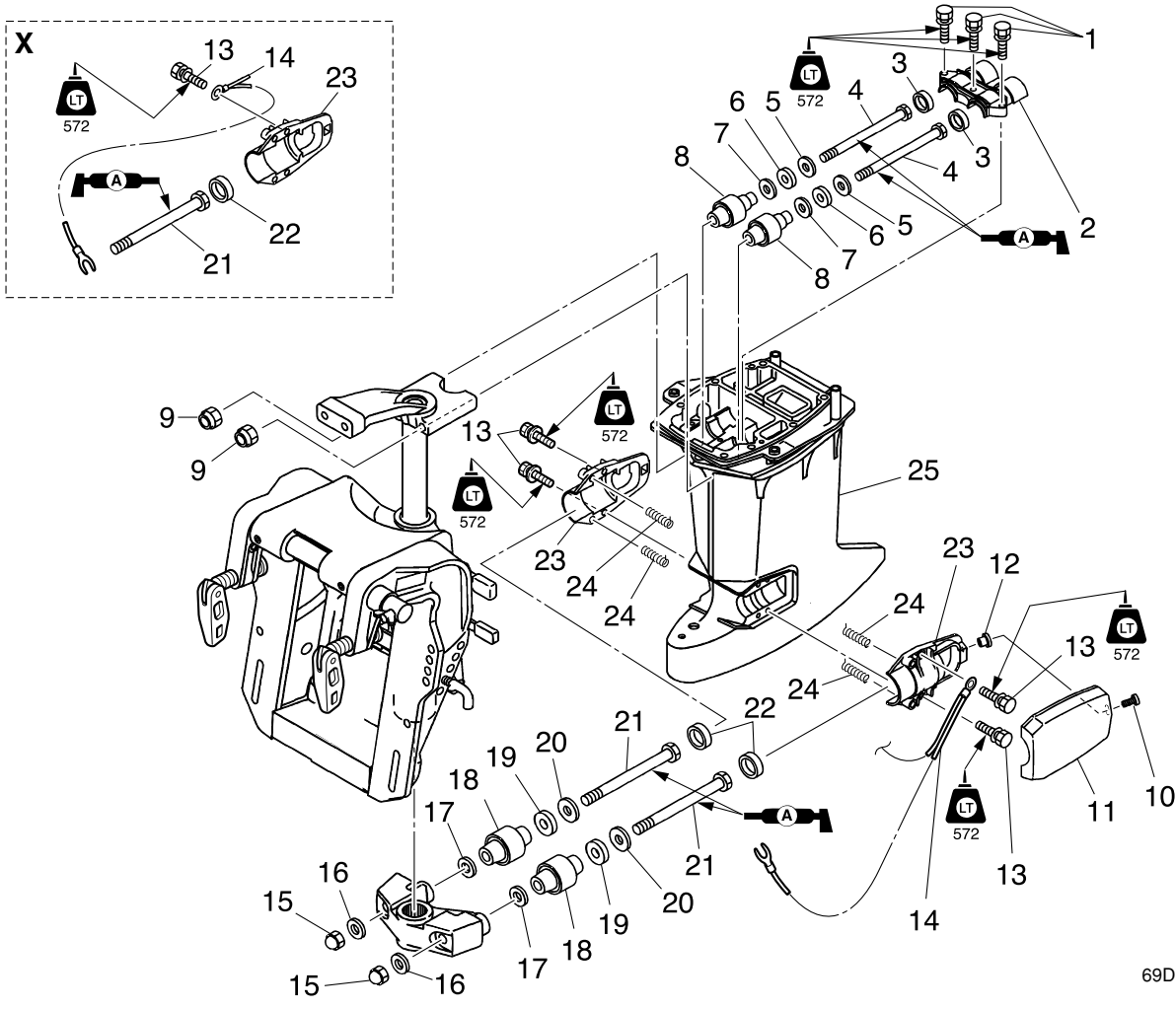
No.	Part name	Q'ty	Remarks
18	Bracket	1	
19	Washer	1	
20	Cowling lock lever	1	
21	Bolt	4	M6 × 30 mm
22	Grommet	4	
23	Collar	4	
24	Boot	1	
25	Seal	1	
26	Grommet	1	
27	Damper	1	
28	Warning indicator	1	
29	Grommet	1	
30	Clamp	1	WHD and WD models
31	Shift bracket	1	
32	Bolt	2	M6 × 20 mm

Upper case, pivot shaft



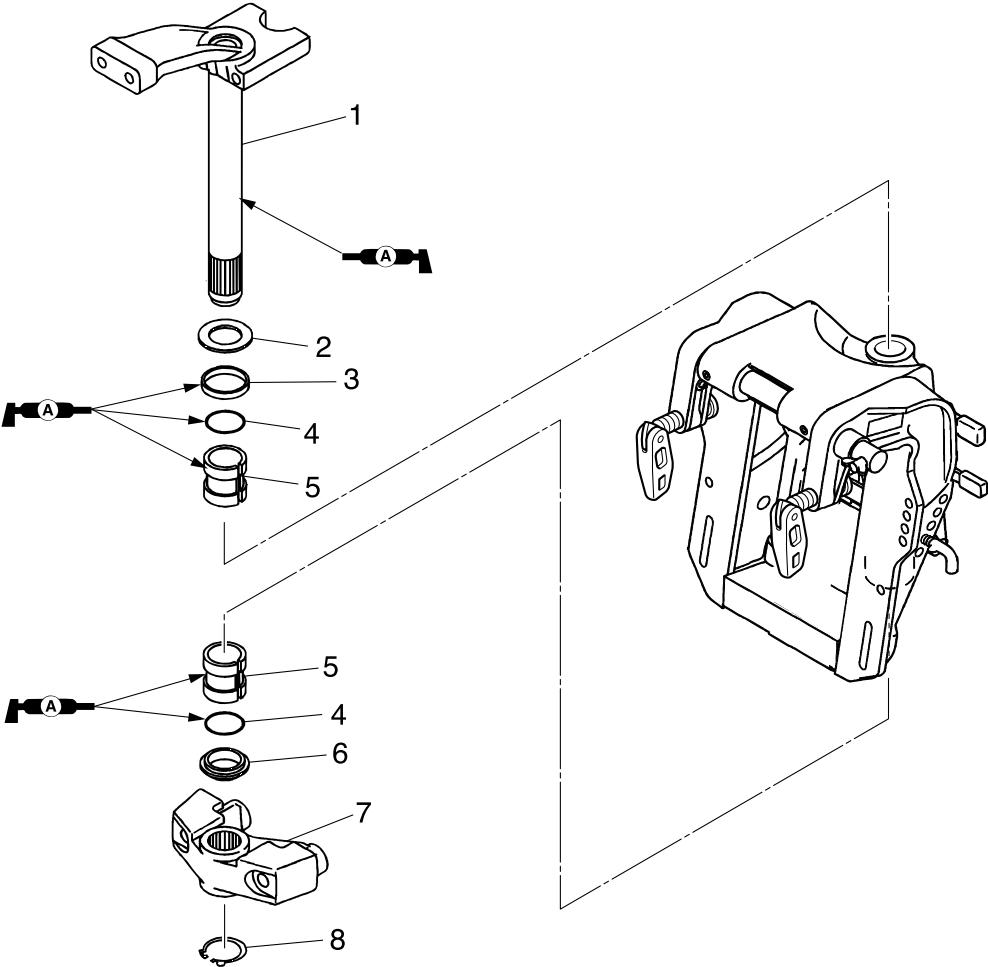
69D7030E

No.	Part name	Q'ty	Remarks
1	Bolt	3	M8 × 35 mm
2	Upper mount housing	1	
3	Cap	2	
4	Bolt	2	M10 × 174 mm
5	Washer	2	
6	Washer	2	
7	Washer	2	
8	Upper mount	2	
9	Nut	2	
10	Screw	2	
11	Cover	2	
12	Collar	2	
13	Bolt	4	M8 × 25 mm
14	Ground lead	1	
15	Nut	2	
16	Washer	2	
17	Washer	2	



69D7030E

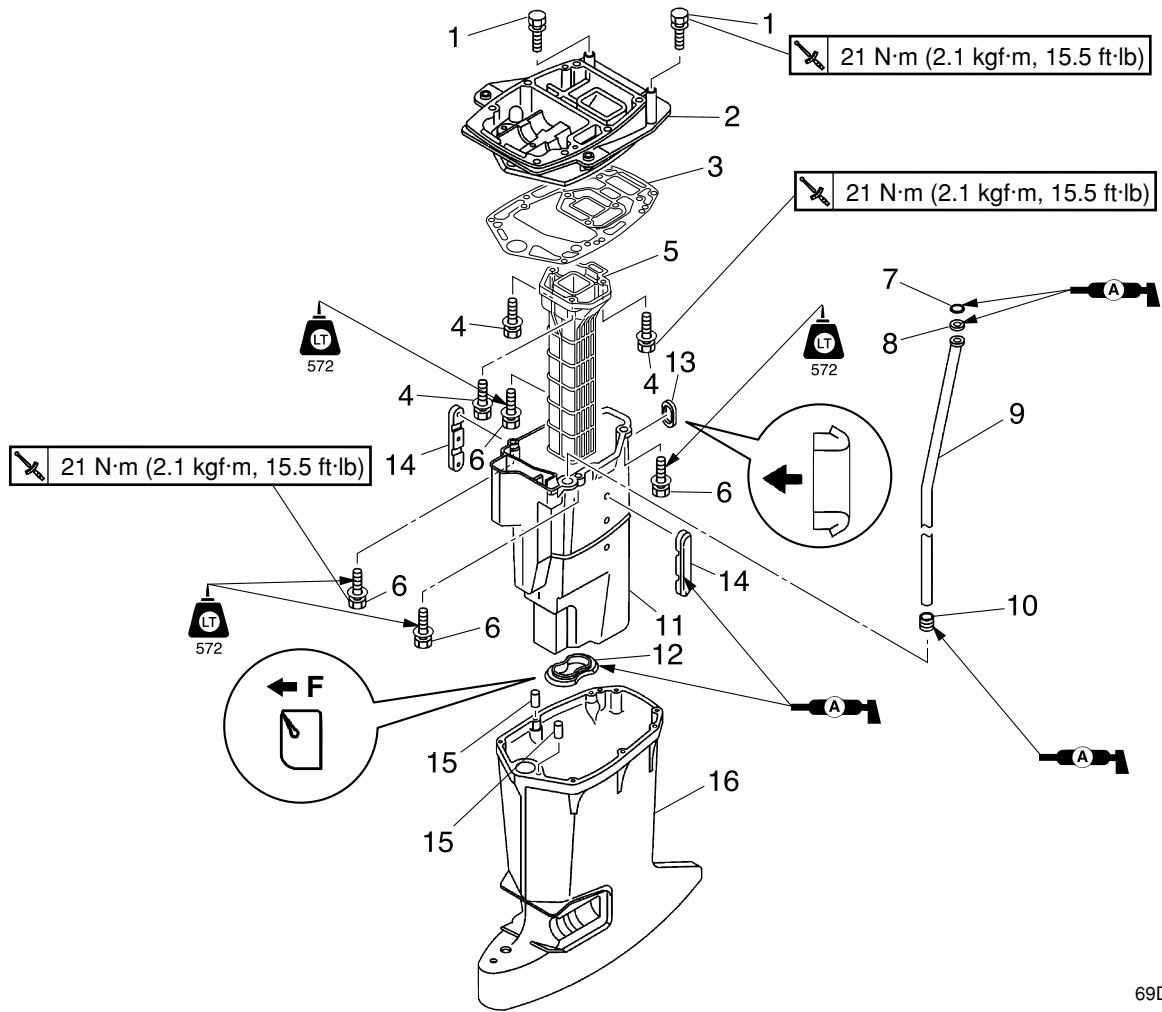
No.	Part name	Q'ty	Remarks
18	Lower mount	2	
19	Washer	2	
20	Washer	2	
21	Bolt	2	M8 × 155 mm
22	Cap	2	
23	Lower mount housing	2	
24	Spring	4	
25	Upper case	1	



69D7050E

No.	Part name	Q'ty	Remarks
1	Pivot shaft	1	
2	Washer	1	
3	Bushing	1	
4	O-ring	2	Not reusable
5	Bushing	2	
6	Bushing	1	
7	Mount housing	1	
8	Circlip	1	



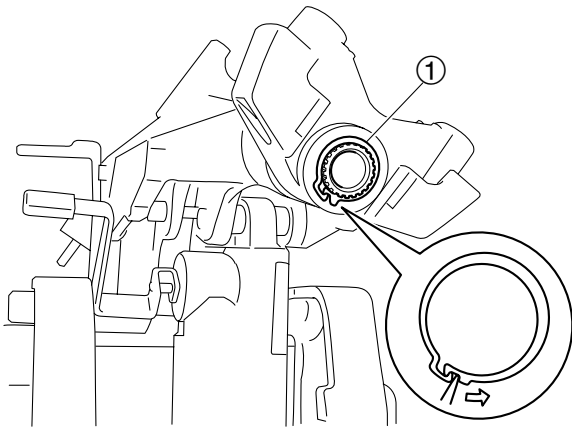


69D7040E

No.	Part name	Q'ty	Remarks
1	Bolt	2	M8 × 30 mm
2	Exhaust guide	1	
3	Gasket	1	Not reusable
4	Bolt	3	M8 × 30 mm
5	Exhaust manifold	1	
6	Bolt	4	M8 × 30 mm
7	Rubber washer	1	
8	Collar	1	
9	Water pipe	1	
10	Seal	1	
11	Muffler	1	
12	Seal	1	Not reusable
13	Seal	1	
14	Damper	2	
15	Dowel	2	
16	Upper case	1	

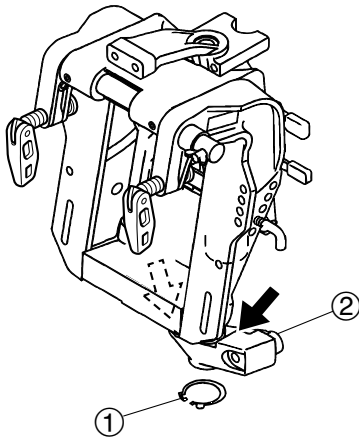
Removing the pivot shaft

- 1 Remove the circlip ①.



69D70120

- 2 Remove the mount housing ② by striking it with a plastic hammer.

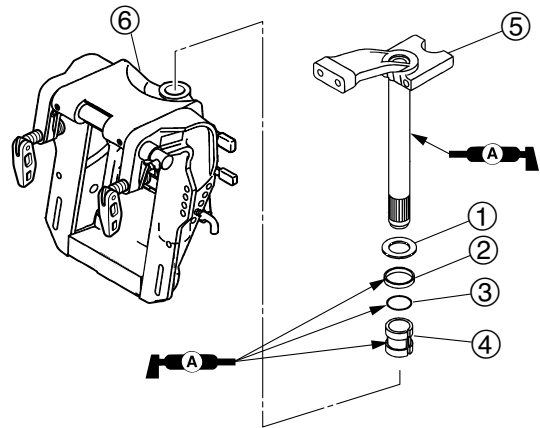


69D70180

- 3 Remove the pivot shaft from the swivel bracket by pulling the arm off the bracket.

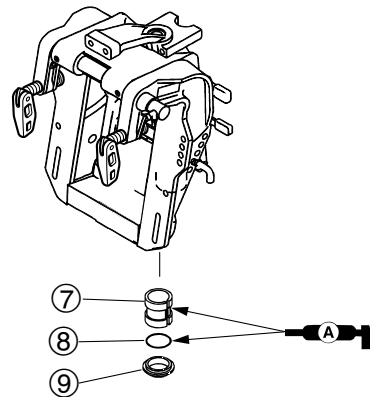
Installing the pivot shaft

1. Installing the washer ①, bushing ②, a new O-ring ③, and bushing ④ onto the pivot shaft ⑤.
2. Place the swivel bracket ⑥ in an upright position, and then install the pivot shaft onto the swivel bracket.



69D70190

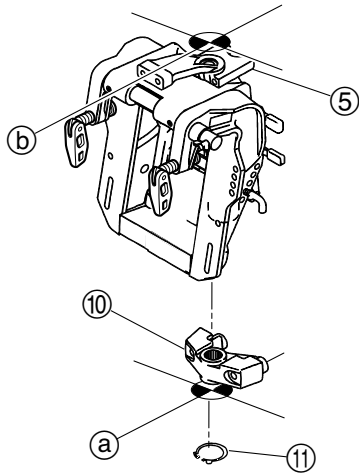
3. Install the bushing ⑦, a new O-ring ⑧, and bushing ⑨, onto the swivel bracket.



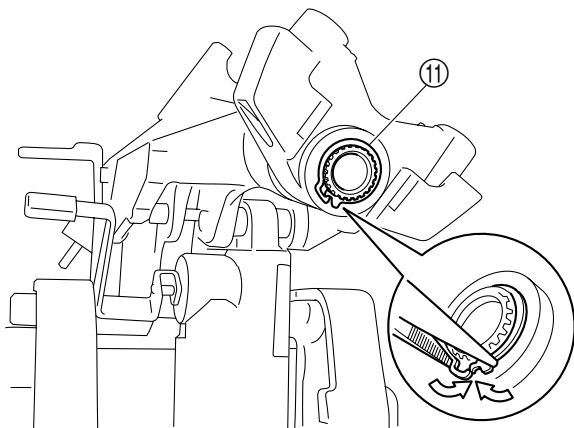
69D70200



4. Install the pivot shaft ⑤ into the mount housing ⑩ by aligning the center ① of the mount housing with the center ② of the pivot shaft.
5. Install the circlip ③.



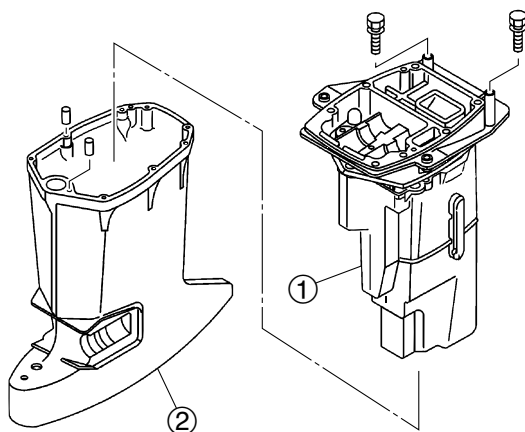
69D70210



69D70130

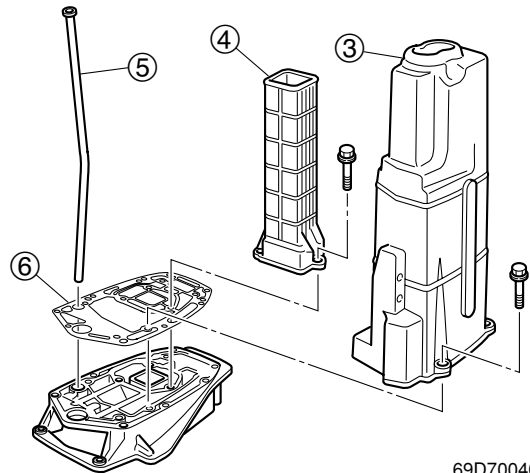
Disassembling the upper case

1. Remove the muffler assembly ① from the upper case ②.



69D70030

2. Remove the muffler ③, exhaust manifold ④, water pipe ⑤ and gasket ⑥.



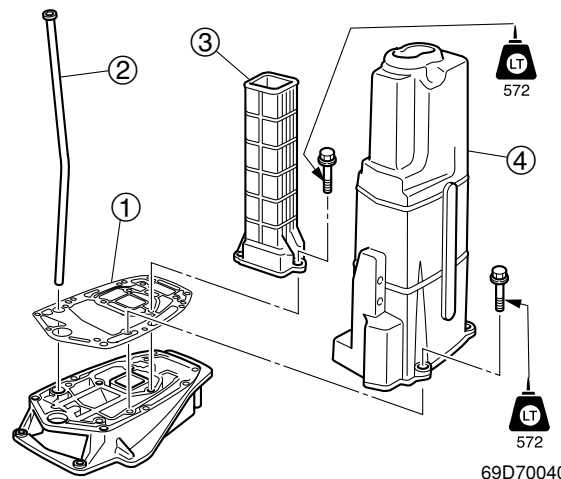
69D70040

Checking the upper case


1. Check the water pipe for deformation or corrosion. Replace if necessary.
2. Check the exhaust guide and exhaust manifold for damage or corrosion. Replace if necessary.

Assembling the upper case

1. Install a new gasket ①, the water pipe ②, the exhaust manifold ③, the muffler ④ and the bolts, and then tighten the bolts.

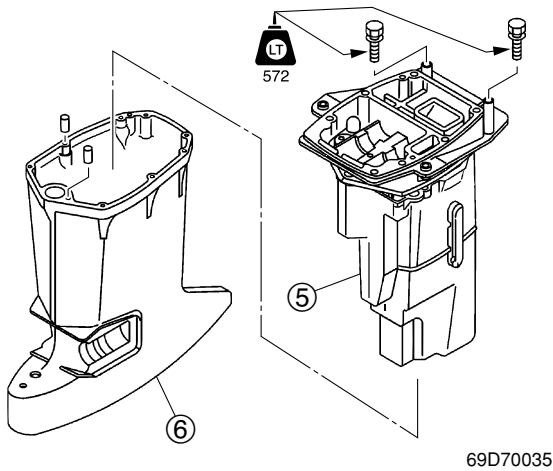


69D70040


 Exhaust manifold and muffler bolts :
21 N·m (2.1 kgf·m, 15.5 ft·lb)

Upper case, pivot shaft

3. Install the muffler assembly (5) into the uppercase (6).

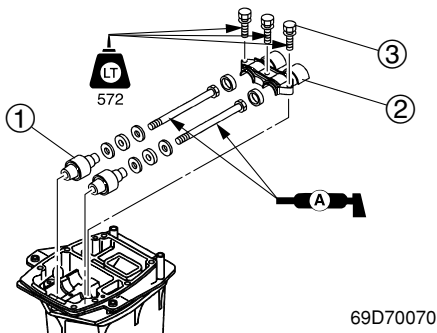


69D70035

 Upper case bolts :
21 N·m (2.1 kgf·m, 15.5 ft·lb)

Installing the upper case

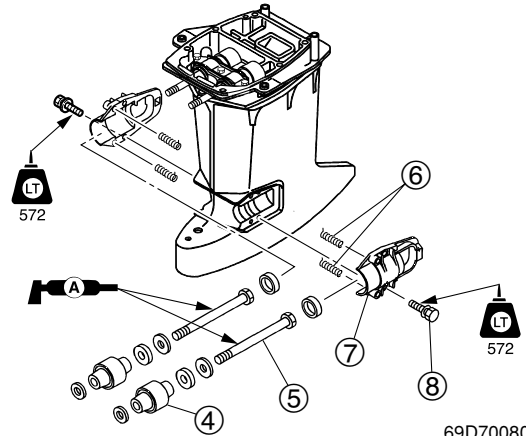
1. Install the upper mount (1), upper mount housing (2) and bolts (3) into the upper case.



69D70070

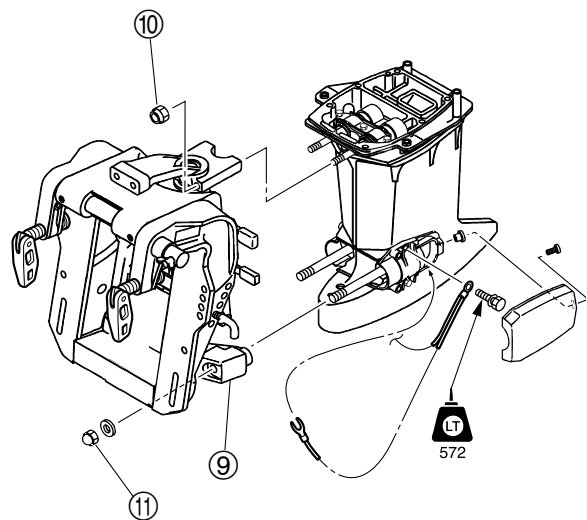
NOTE: _____
First tighten the center located, when tighten the bolts (3).

2. Set the lower mount (4) and bolts (5) to the upper case.
3. Install the end of the springs (6) into the groove of the lower mount housing (7), and then tighten the bolts (8).



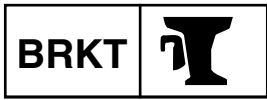
69D70080

4. Install the upper and lower mounting bolts into the pivot shaft (9) simultaneously.
5. Install the upper mounting nuts (10) and lower mounting nuts (11), and then tighten them.



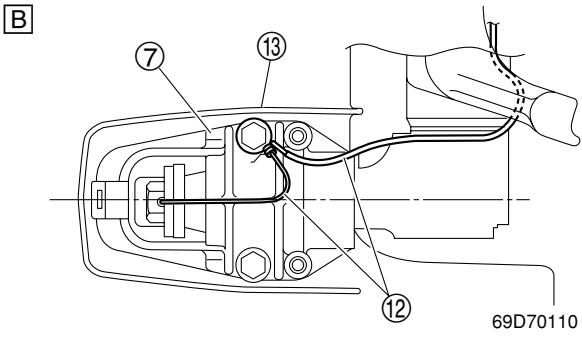
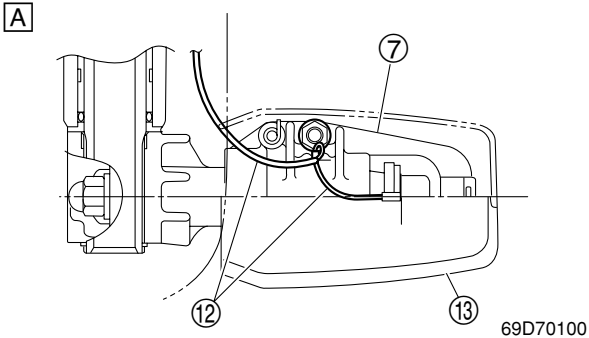
69D70090

7



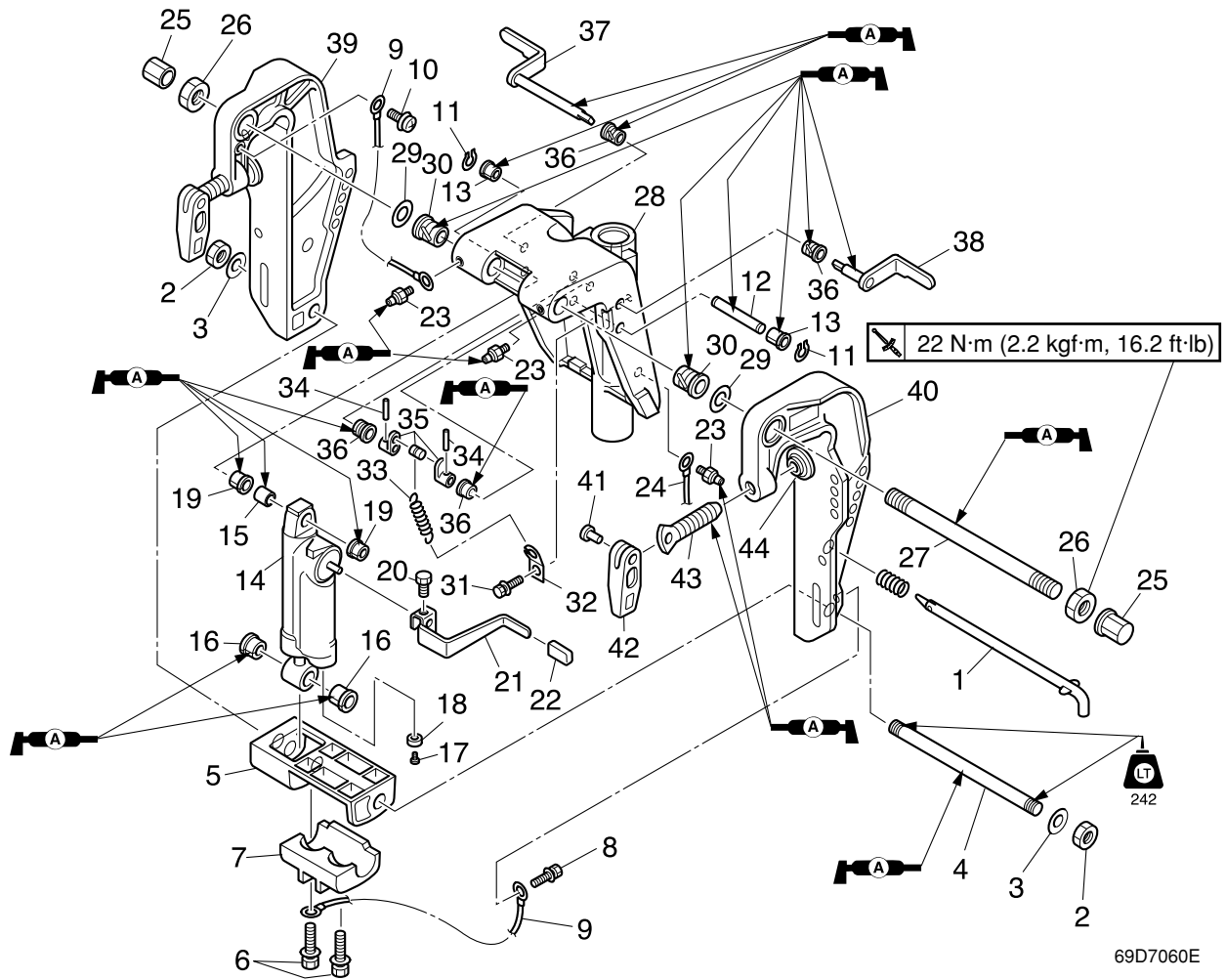
Bracket unit

6. Install the ground lead ⑫ into the mount housing ⑦ as shown, and then install the cover ⑬.



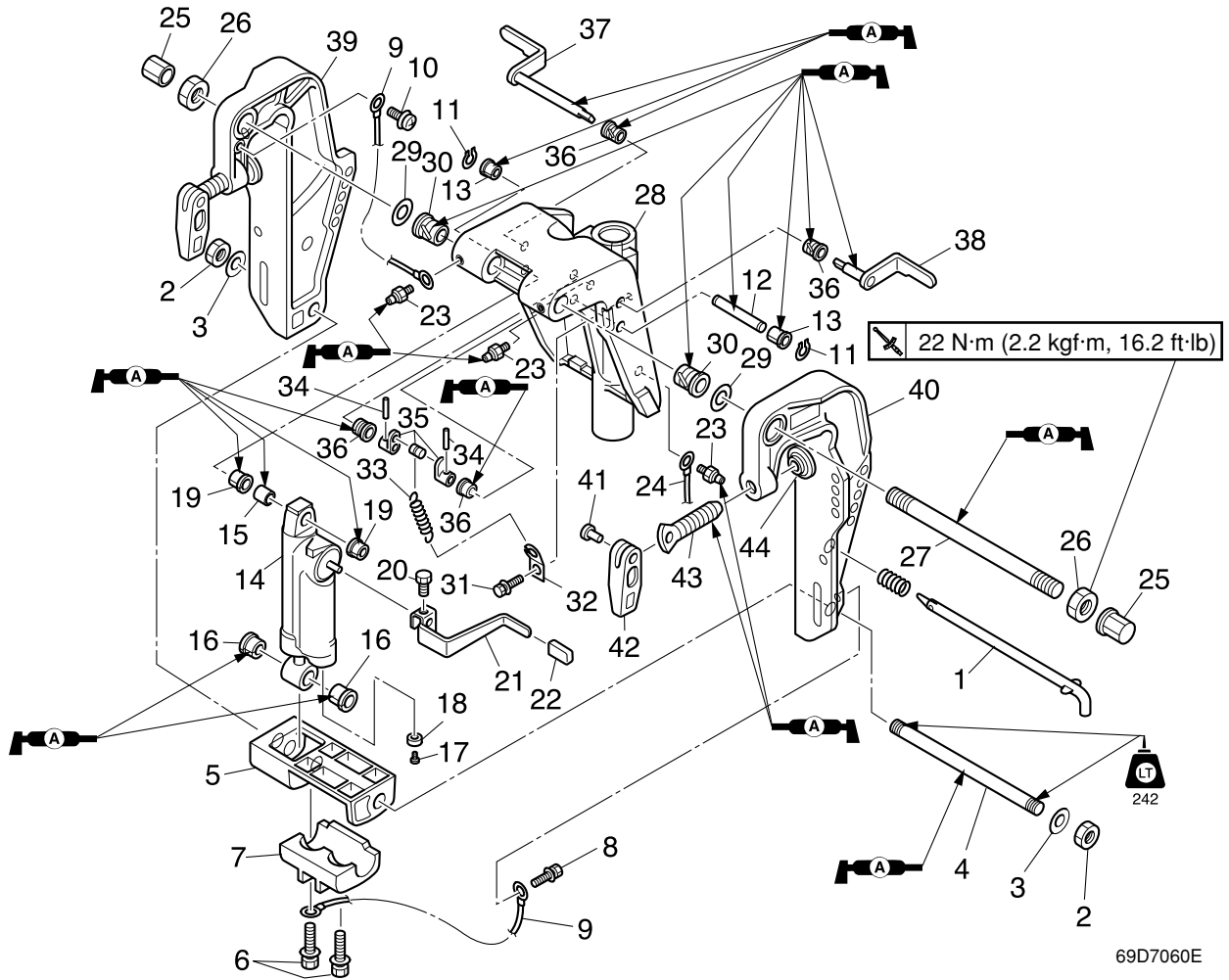
- A** S, L-transom models (port side)
- B** X-transom model (starboard side)

Clamp brackets, swivel bracket (S, L-transom)



69D7060E

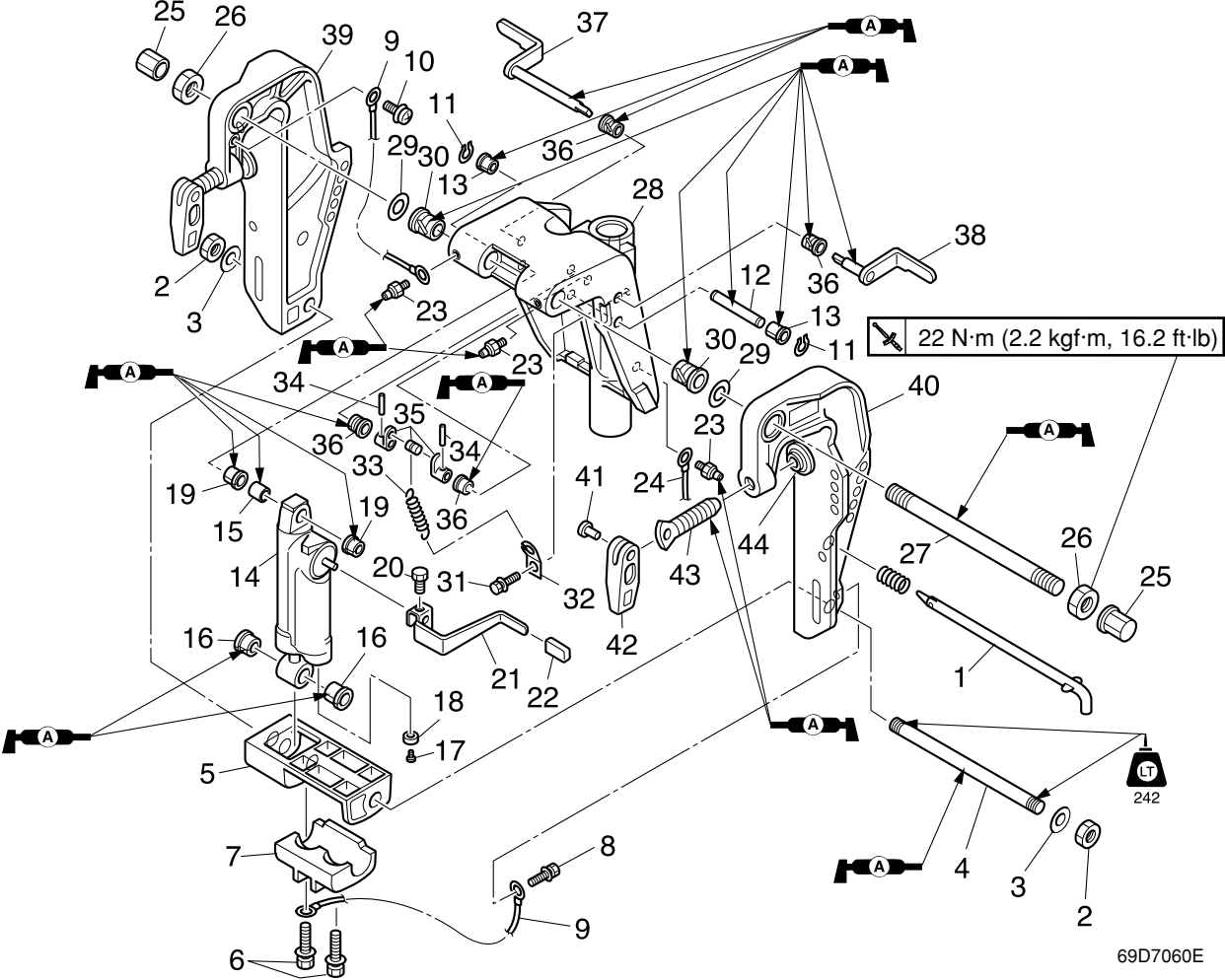
No.	Part name	Q'ty	Remarks
1	Tilt pin	1	
2	Nut	2	
3	Washer	2	
4	Bolt	1	
5	Spacer	1	
6	Bolt	2	M6 × 25 mm
7	Anode	1	
8	Bolt	1	M6 × 10 mm
9	Ground lead	2	
10	Screw	1	∅6 × 8 mm
11	Circlip	2	
12	Pin	1	
13	Bushing	2	
14	Hydro tilt assembly	1	
15	Bushing	1	
16	Bushing	2	
17	Screw	1	



69D7060E

No.	Part name	Q'ty	Remarks
18	Anode	1	
19	Bushing	2	
20	Bolt	1	M6 × 10 mm
21	Tilt lever	1	
22	Cap	1	
23	Grease nipple	3	
24	Ground lead	1	
25	Cap	2	
26	Self-locking nut	2	
27	Through tube	1	
28	Swivel bracket	1	
29	Washer	2	
30	Bushing	2	
31	Bolt	1	M6 × 10 mm
32	Plate	1	
33	Spring	1	
34	Pin	2	

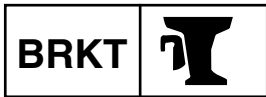
Clamp brackets, swivel bracket



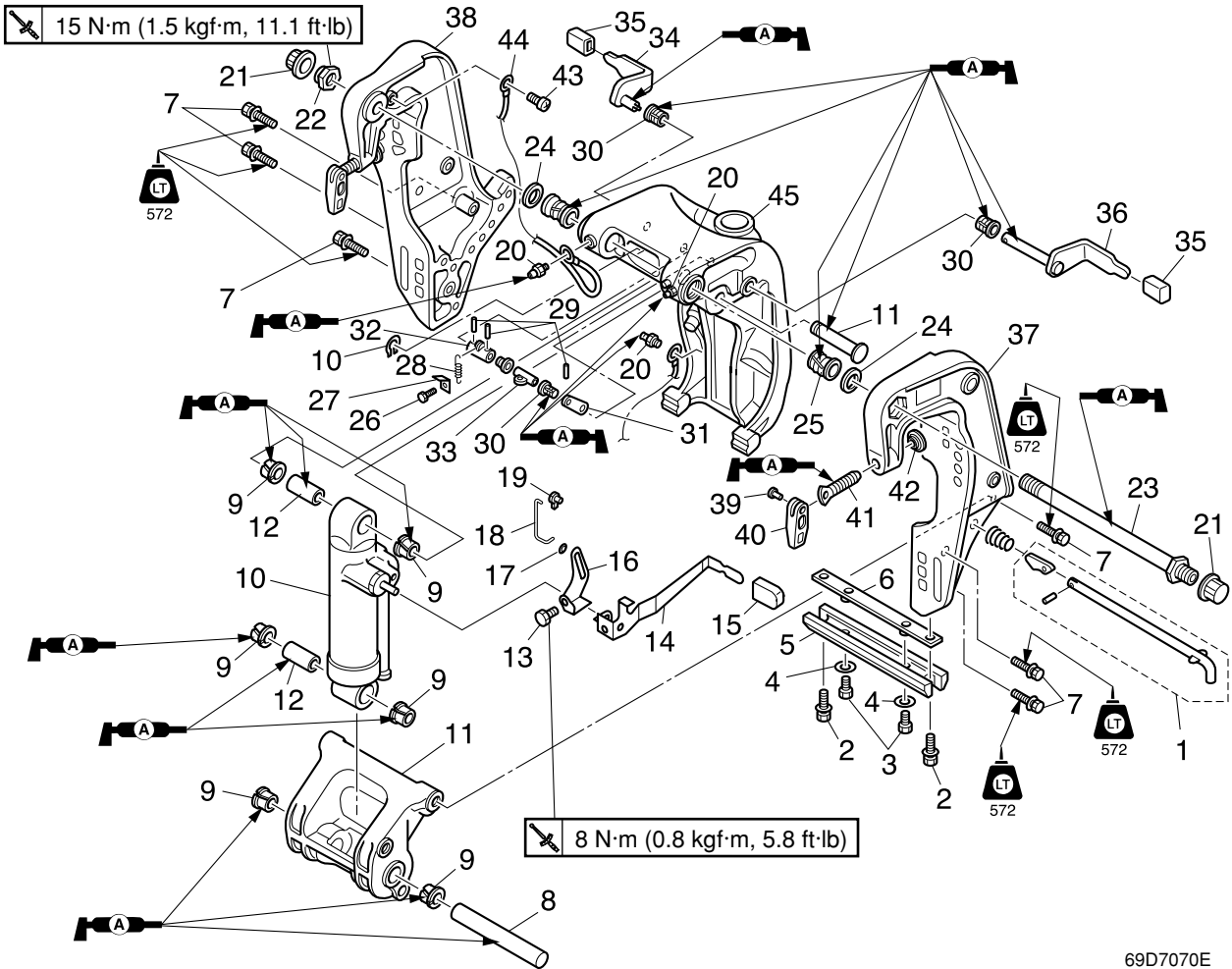
69D7060E

No.	Part name	Q'ty	Remarks
35	Collar	1	
36	Bushing	4	
37	Tilt stop lever	1	
38	Tilt stop lever	1	
39	Clamp bracket	1	
40	Clamp bracket	1	
41	Pin	2	
42	Clamp handle	2	
43	Pad pin	2	
44	Clamp pad	2	





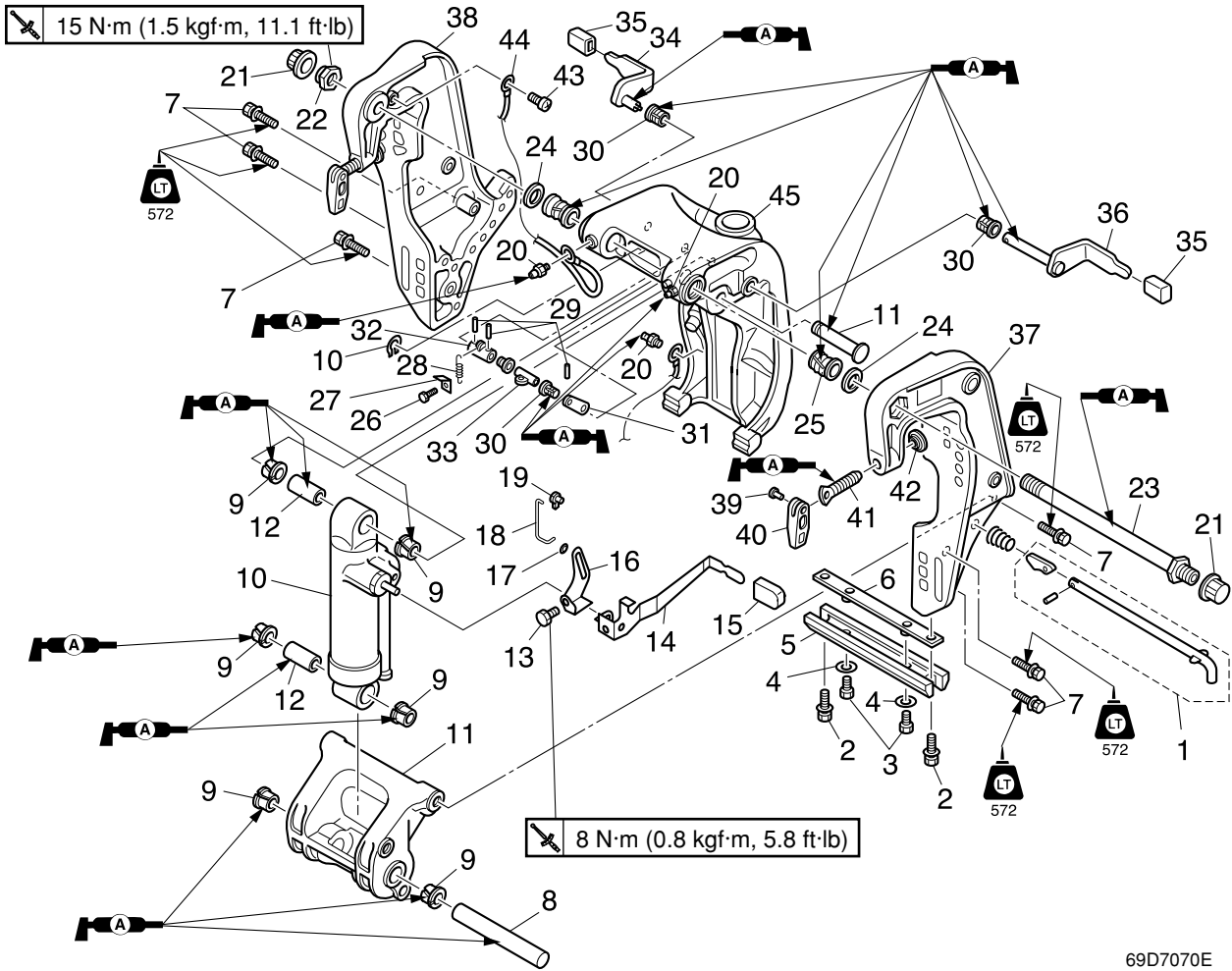
Clamp brackets, swivel bracket (X-transom model)



69D7070E

No.	Part name	Q'ty	Remarks
1	Tilt pin	1	
2	Bolt	2	M6 × 16 mm
3	Bolt	2	M6 × 29 mm
4	Washer	2	
5	Anode	1	
6	Plate	1	
7	Bolt	6	M10 × 45 mm
8	Pin	1	
9	Bushing	6	
10	Hydro tilt assembly	1	
11	Spacer	1	
12	Bushing	2	
13	Bolt	1	M6 × 10 mm
14	Tilt lever	1	
15	Cap	1	
16	Reverse lock lever	1	
17	Washer	1	

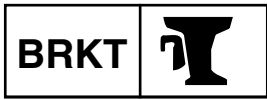
Clamp brackets, swivel bracket



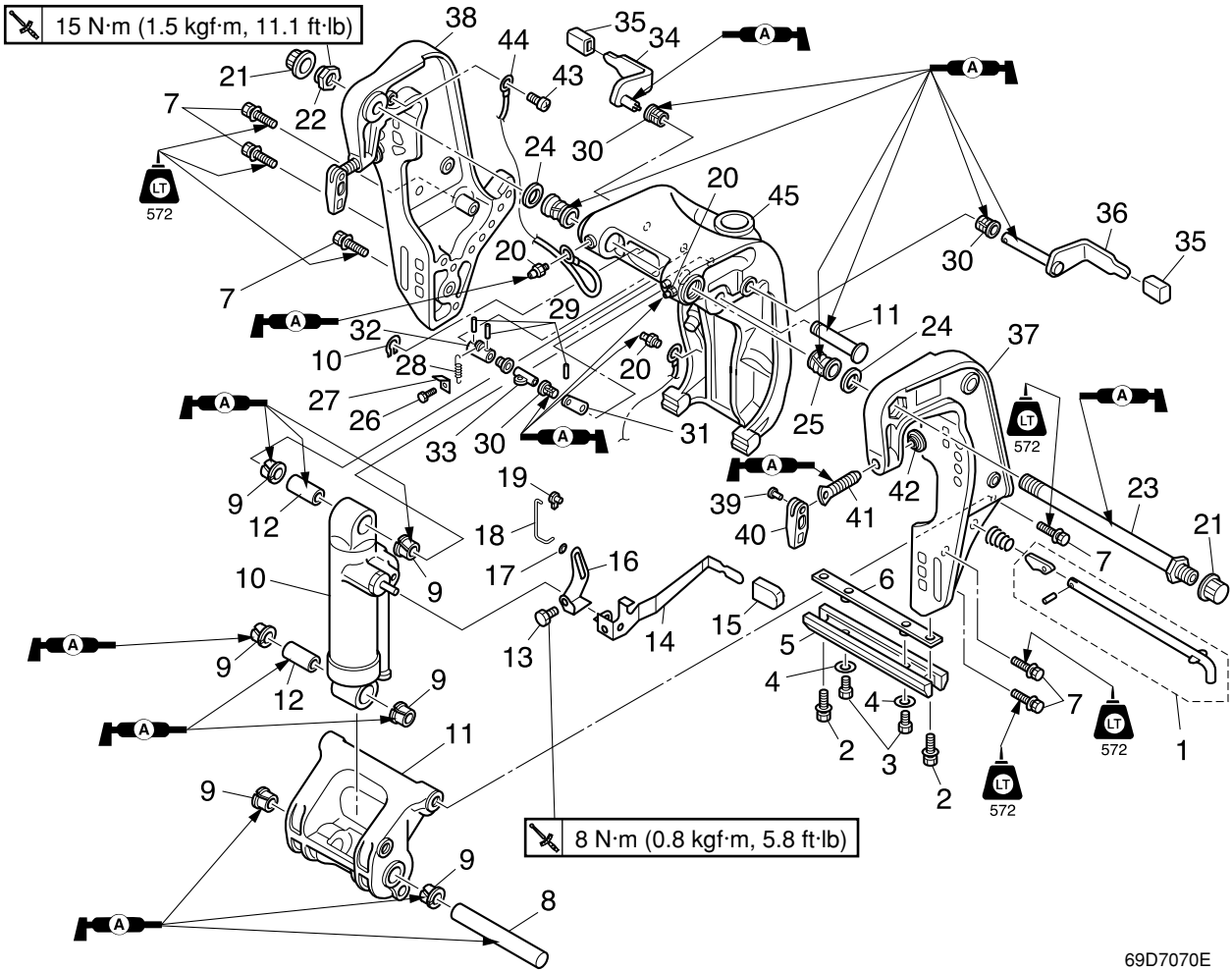
69D7070E

No.	Part name	Q'ty	Remarks
18	Rod	1	
19	Joint	1	
20	Grease nipple	3	
21	Cap	2	
22	Self-locking nut	1	
23	Through tube	1	
24	Washer	2	
25	Bushing	2	
26	Bolt	1	M6 × 10 mm
27	Plate	1	
28	Spring	1	
29	Pin	3	
30	Bushing	4	
31	Lever	1	
32	Collar	1	
33	Collar	1	
34	Tilt stop lever	1	





Bracket unit

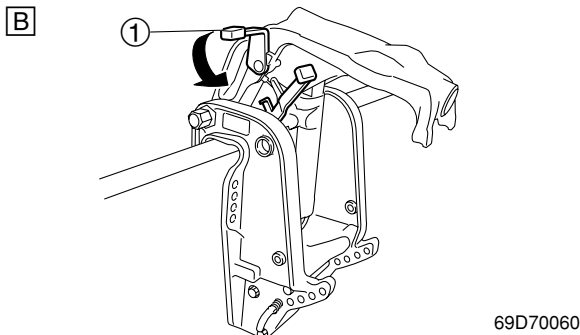
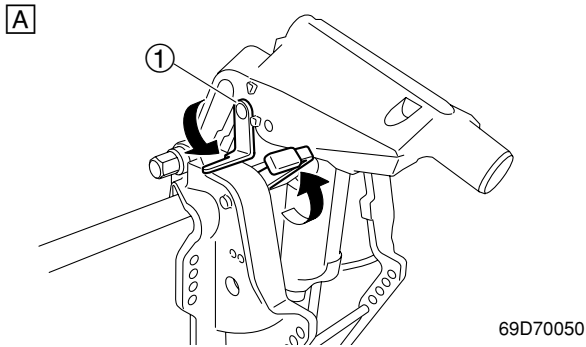


69D7070E

No.	Part name	Q'ty	Remarks
35	Cap	2	
36	Tilt stop lever	1	
37	Clamp bracket	1	
38	Clamp bracket	1	
39	Pin	2	
40	Clamp handle	2	
41	Pad pin	2	
42	Clamp pad	2	
43	Screw	1	
44	Ground lead	1	
45	Swivel bracket	1	

Removing the hydro tilt assembly

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever ①.

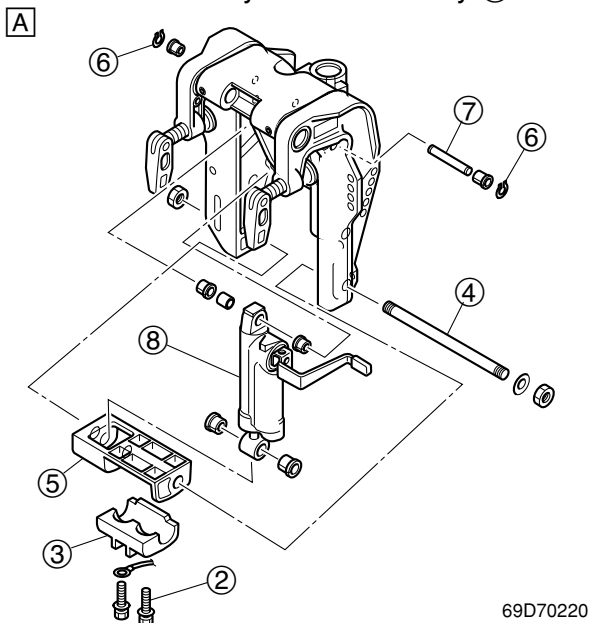


- A** S, L-transom models
- B** X-transom model

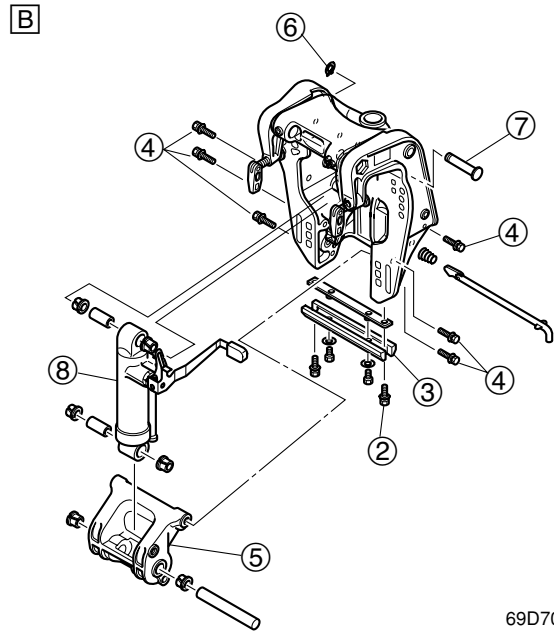
⚠WARNING

After tilting up the outboard motor, be sure to support it with the tilt stop lever.

2. Remove the tilt pin.
3. Remove the bolts ② and anode ③.
4. Remove the bolt(s) ④ and spacer ⑤.
5. Remove the circlip(s) ⑥ and pin ⑦.
6. Remove the hydro tilt assembly ⑧.



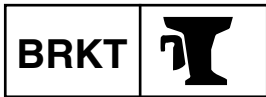
69D5G11



- A** S, L-transom models
- B** X-transom model

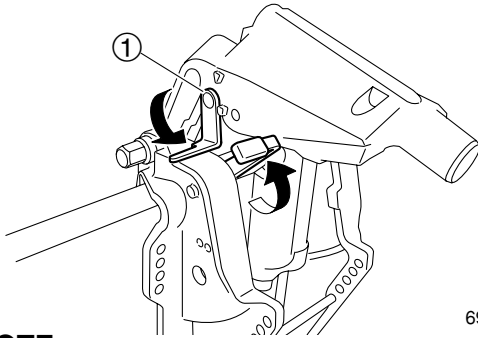
⚠WARNING

- Do not tamper or attempt to open the hydro tilt assembly.
- Do not subject the hydro tilt assembly to an open flame or any other source of high heat. High heat can cause an explosion due to excessive gas pressure.
- Do not deform or damage the hydro tilt assembly in any way. If the hydro tilt assembly is damaged, damping performance will suffer.



Installing the hydro tilt assembly

1. Fully tilt the outboard motor up, and then support it with the tilt stop lever ①.



69D70050

NOTE:

After tilting up the outboard motor, be sure to support it with the tilt stop lever ①.

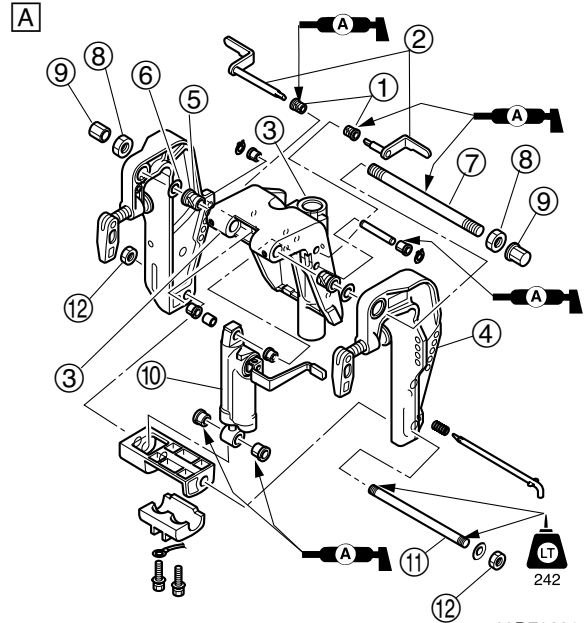
2. Install the hydro tilt assembly on to the clamp bracket.
3. Install the anodes and tighten the bolt(s).

Removing the clamp brackets

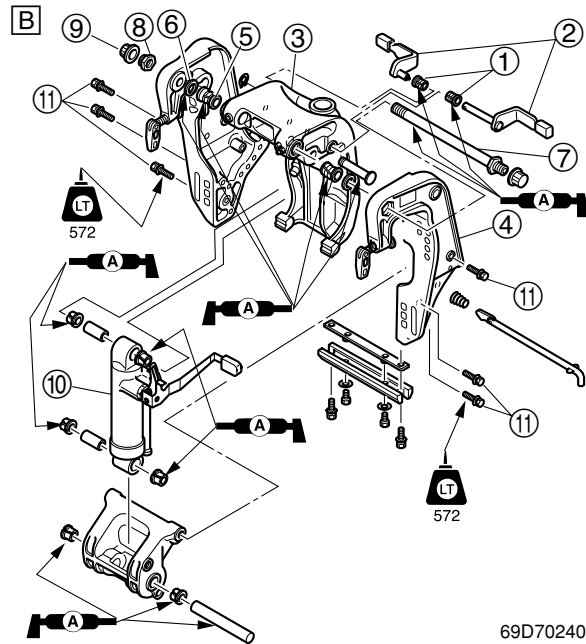
1. Remove the tilt pin, and then remove the bolt(s), nuts, and hydro tilt assembly.
2. Remove the caps, then the self-locking nuts.
3. Remove the pins and both tilt stop levers.
4. Remove the through tube, then disassemble the clamp brackets.

Installing the clamp brackets

1. Install the bushings ① and tilt stop levers ② to the swivel bracket ③.
2. Assemble the clamp brackets ④, bushings ⑤, washers ⑥, and swivel bracket ③, and then install the through tube ⑦.
3. Tighten the self-locking nuts ⑧ to the specified torque, and then tighten the caps ⑨.
4. Install the hydro tilt assembly ⑩, and bolt(s) ⑪, and then tighten the nut ⑫.
5. Install the tilt pin.



69D70230



69D70240

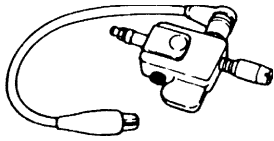
- A S, L-transom models
- B X-transom model

	Self-locking nut ⑧ :
	S, L-transom models
	22 N·m (2.2 kgf·m, 16.2 ft·lb)
	X-transom model
	15 N·m (1.5 kgf·m, 11.1 ft·lb)

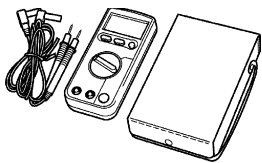
Electrical systems

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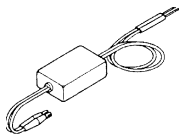
Special service tools



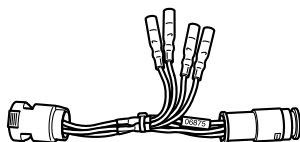
Ignition tester
90890-06754



Digital circuit tester
90890-03174



Peak voltage adaptor B
90890-03172



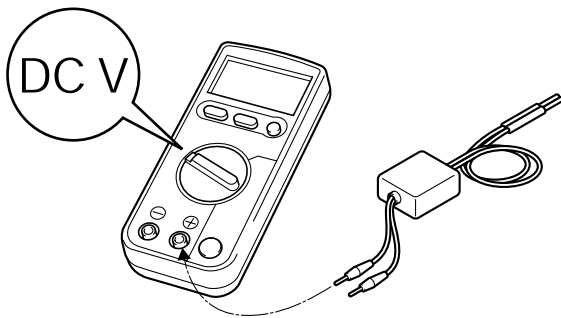
Test harness (4 pins)
New: 90890-06875
Current: 90890-06775

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.

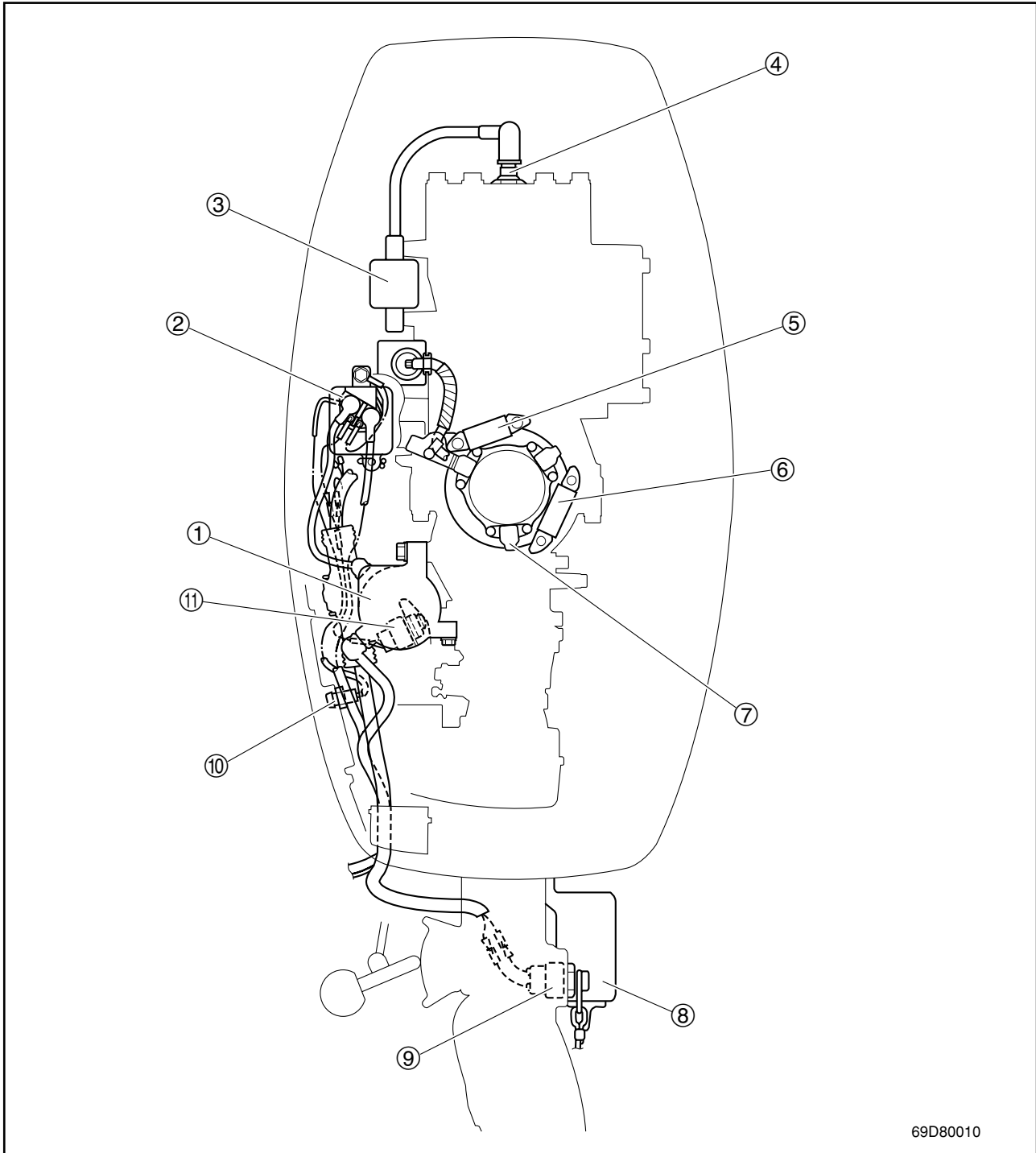
$\text{Correct value} =$ $\text{displayed measurement}$ $- \text{internal resistance}$
--

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



Electrical components

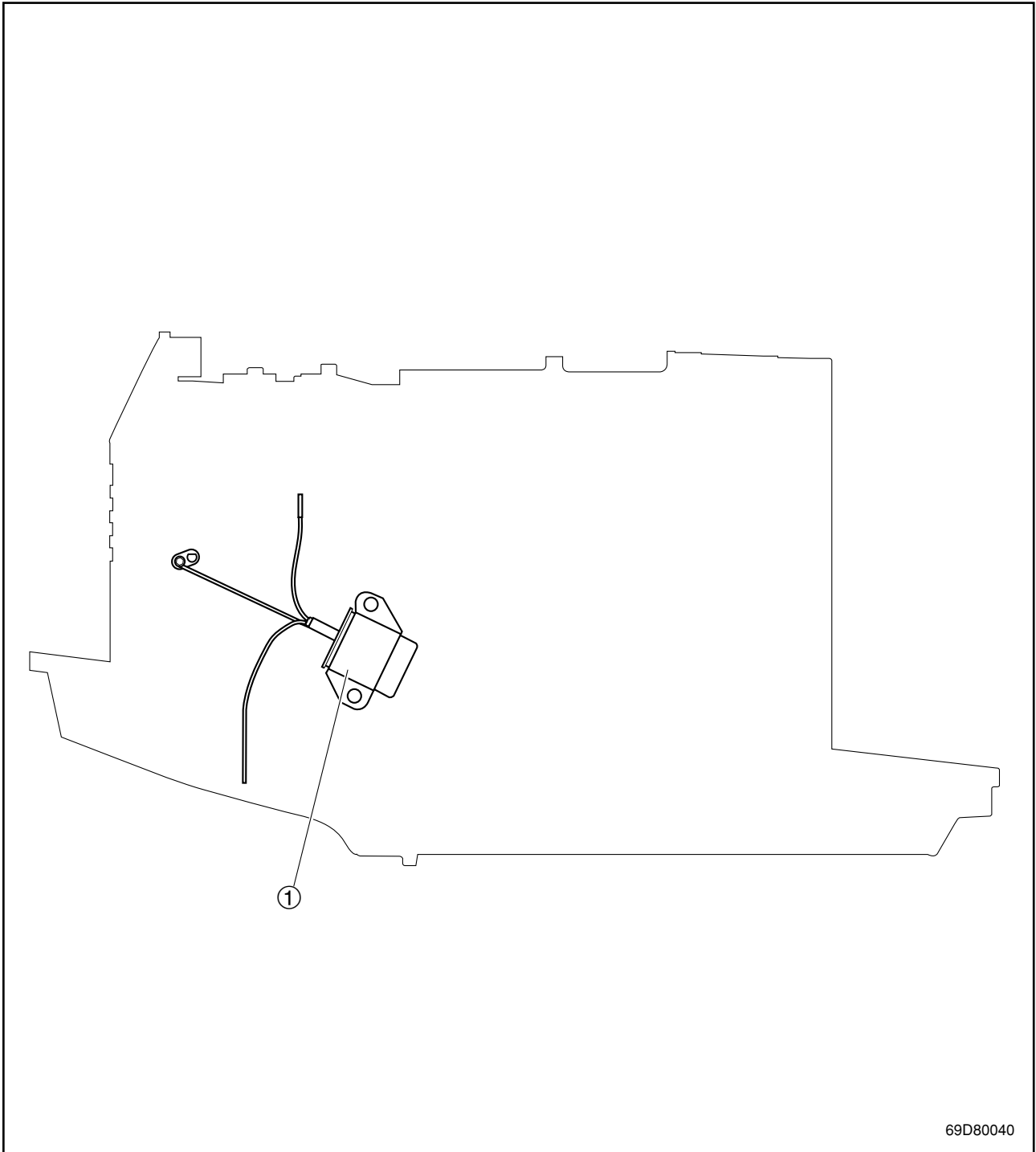
Top view



69D80010

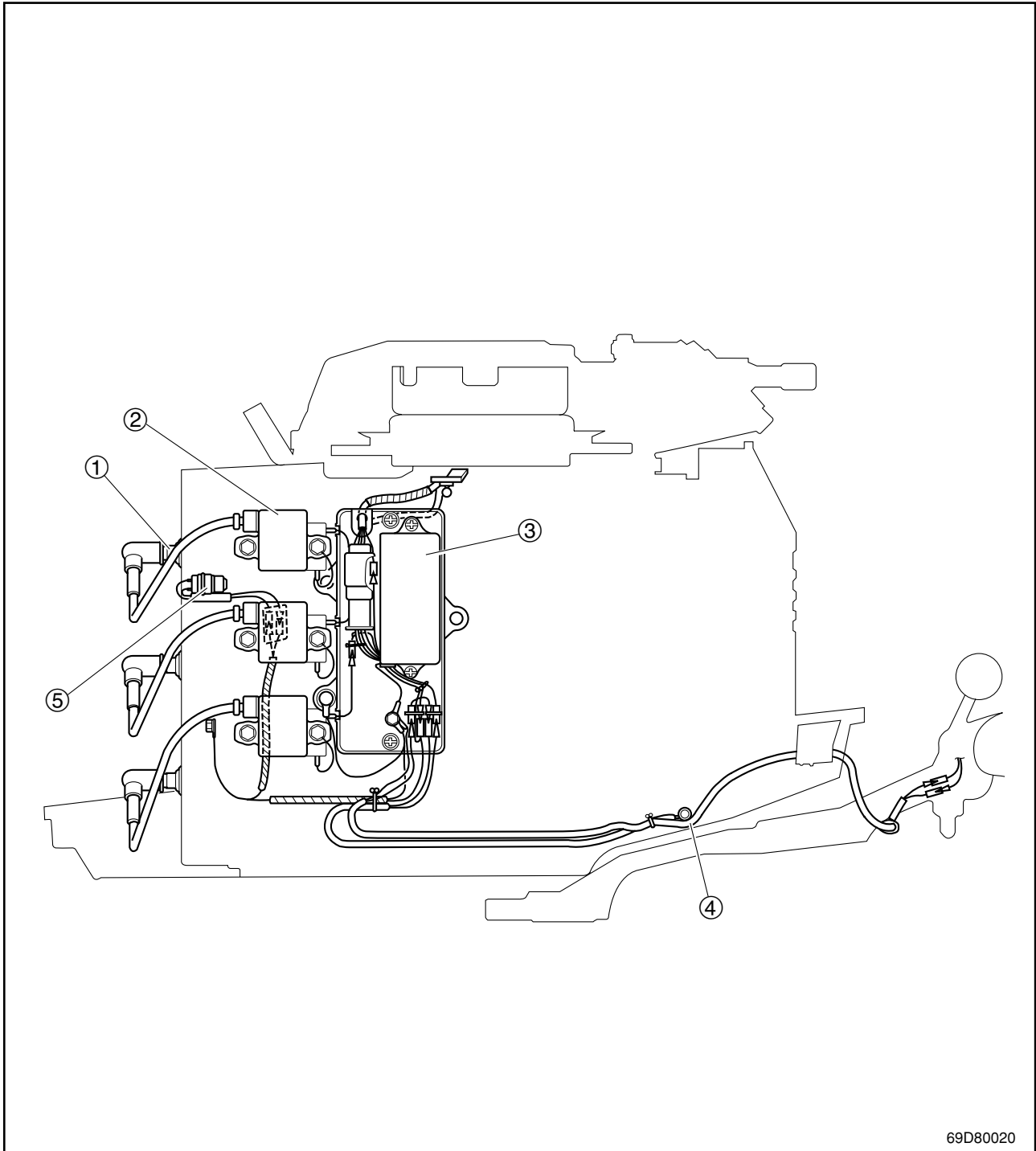
- | | |
|---|--|
| ① Starter motor (WHD, WD) | ⑩ Warning indicator |
| ② Starter relay (WHD, WD) | ⑪ Neutral switch (WHD) (WD: If equipped) |
| ③ Ignition coil | |
| ④ Spark plug | |
| ⑤ Lighting coil | |
| ⑥ Charge coil | |
| ⑦ Pulser coil | |
| ⑧ Engine start switch (WHD) | |
| ⑨ Engine stop lanyard switch (MHD, WHD) | |

Port view (WD)



69D80040

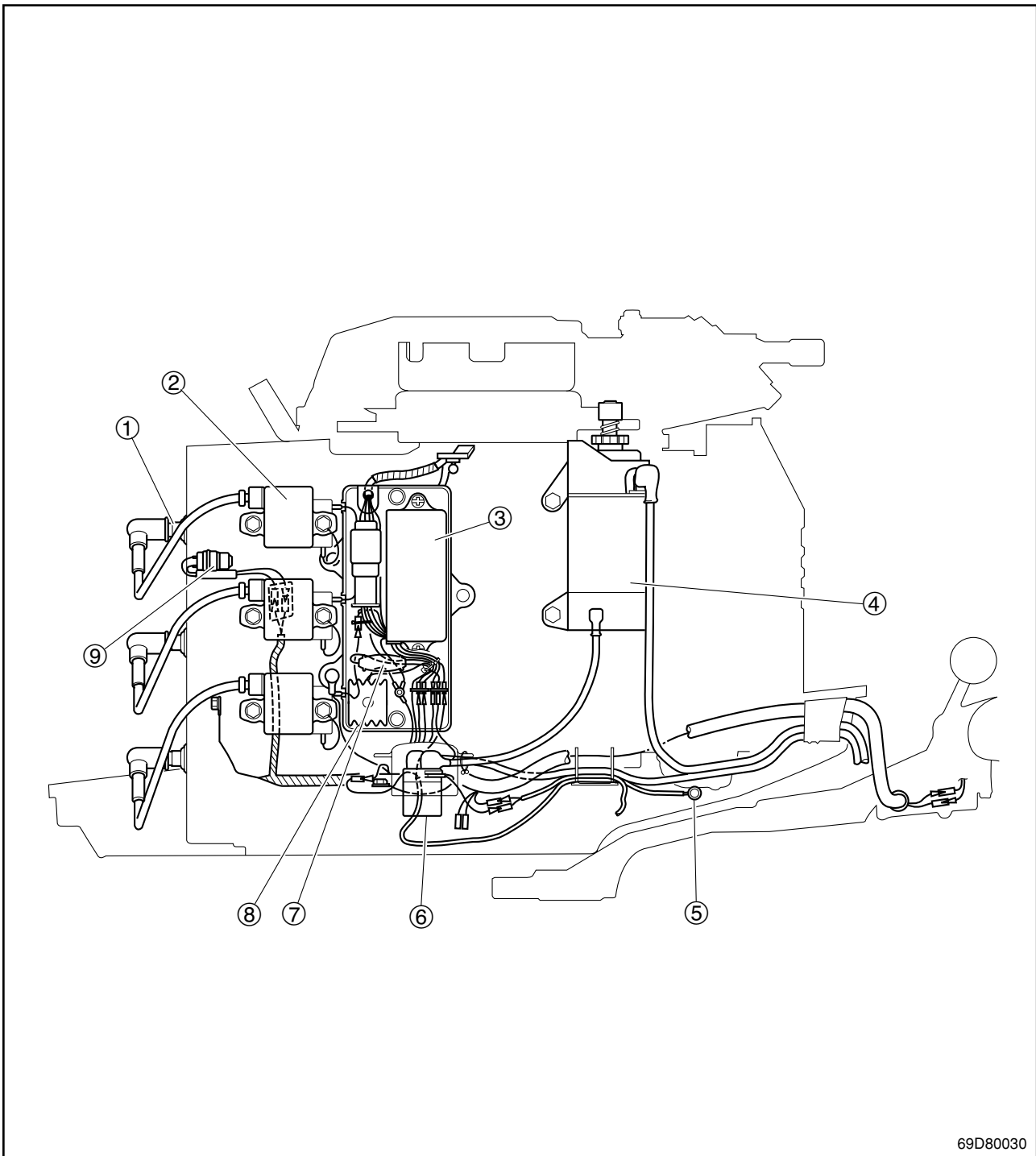
① Choke solenoid

**Starboard view (MHD)**

69D80020

- ① Spark plug
- ② Ignition coil
- ③ CDI unit
- ④ Warning indicator
- ⑤ Thermoswitch

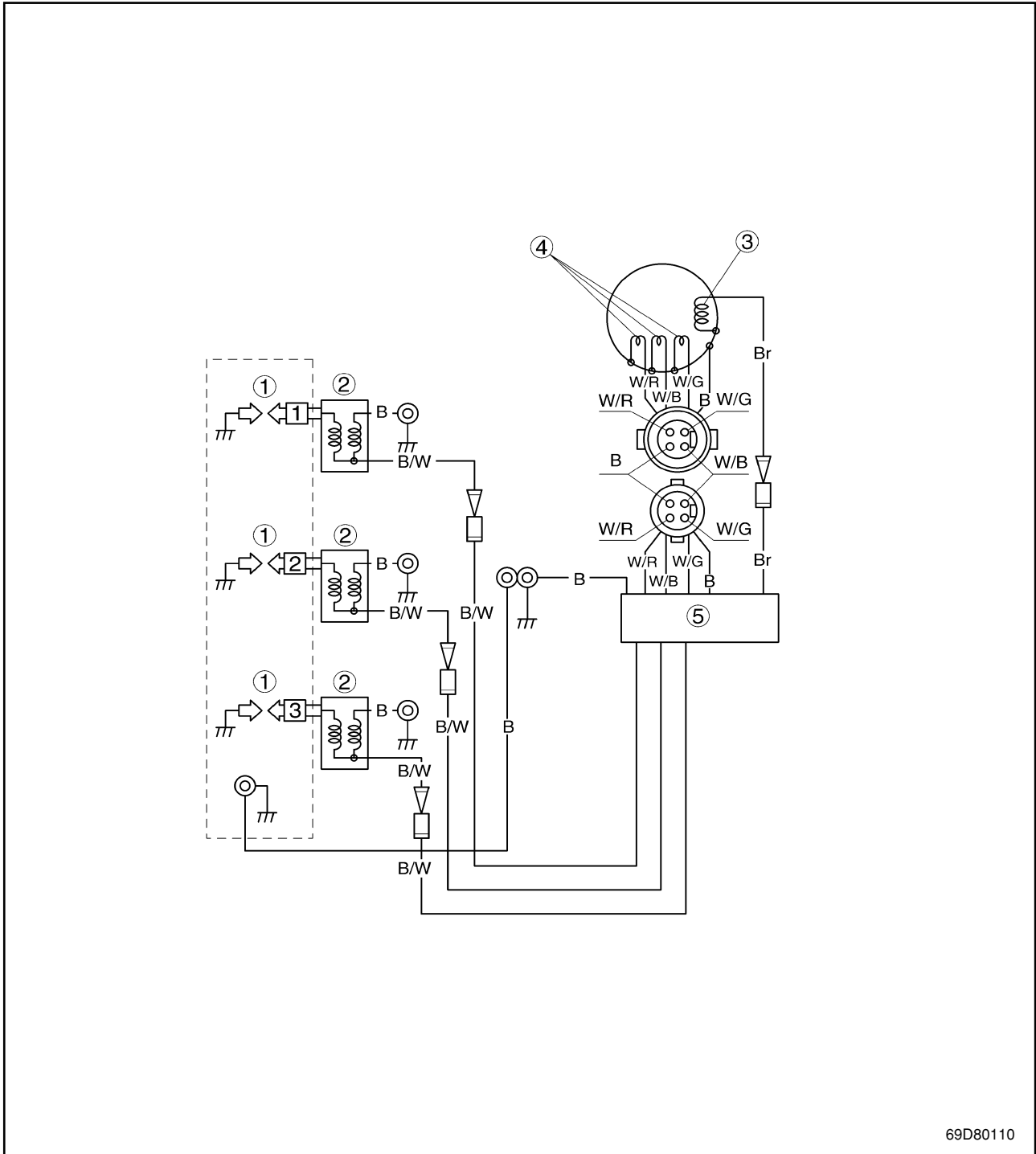
Starboard view (WHD, WD)



69D80030

- ① Spark plug
- ② Ignition coil
- ③ CDI unit
- ④ Starter motor
- ⑤ Warning indicator
- ⑥ Starter relay
- ⑦ Fuse
- ⑧ Rectifier
- ⑨ Thermoswitch

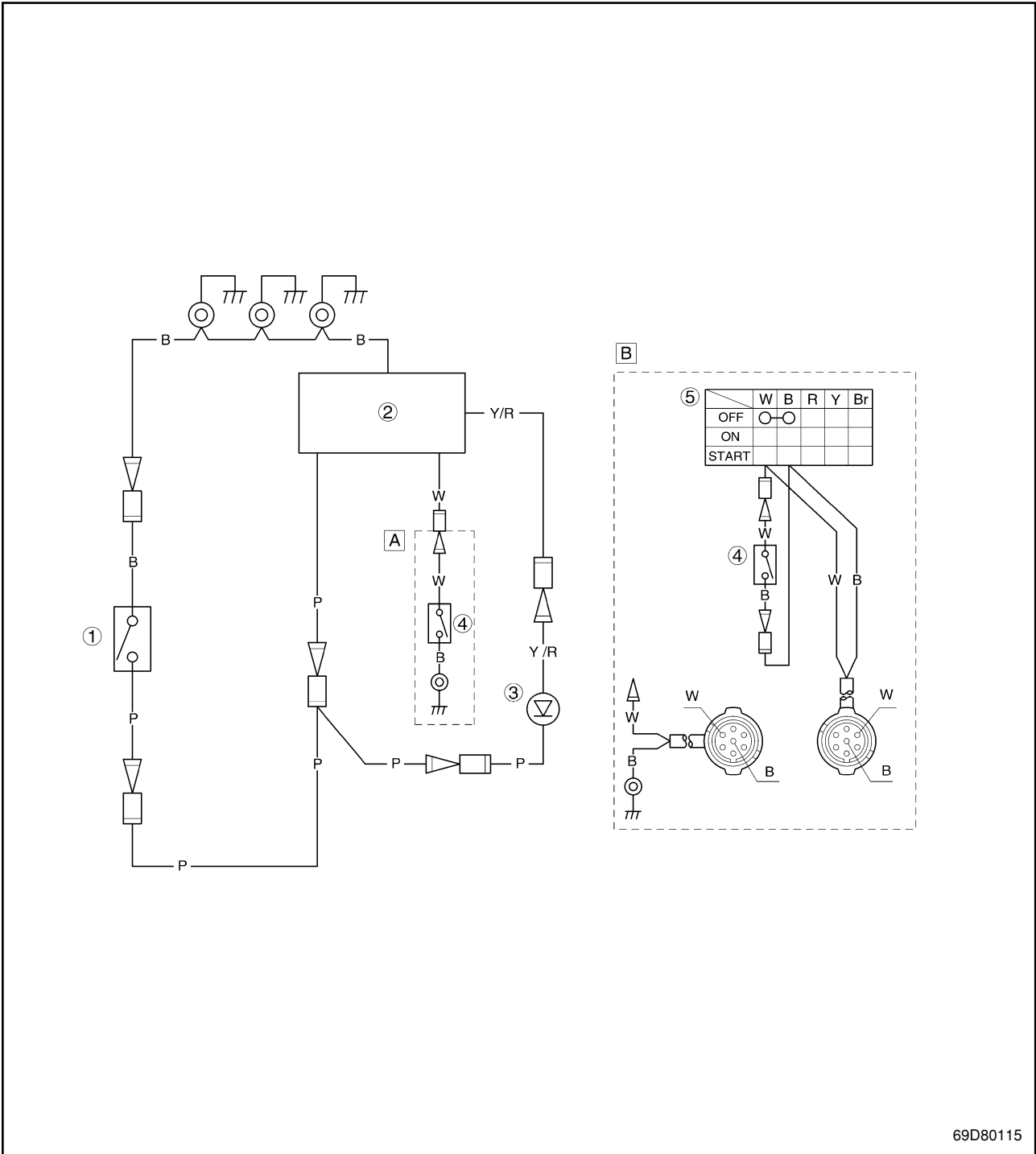
Ignition and ignition control system



69D80110

- ① Spark plug
- ② Ignition coil
- ③ Charge coil
- ④ Pulser coil
- ⑤ CDI unit

- B : Black
- Br : Brown
- B/W : Black/White
- W/B : White/Black
- W/R : White/Red
- W/G : White/Green

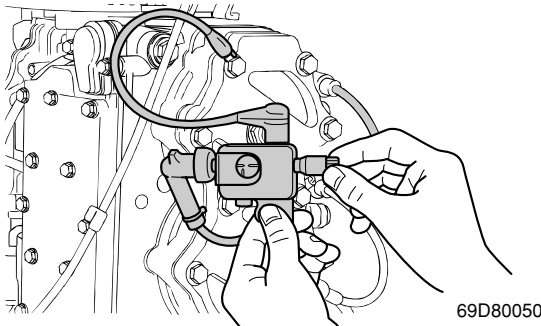



69D80115

- ① Thermoswitch
- ② CDI unit
- ③ Warning indicator
- ④ Engine stop lanyard switch (MHD, WHD)
- ⑤ Engine start switch (WHD)
- Ⓐ MHD, WHD
- Ⓑ WHD
- B : Black
- P : Pink
- W : White
- Y/R : Yellow/Red

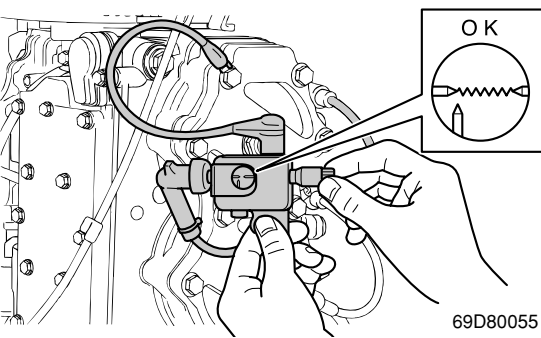
Checking the ignition spark gap

1. Disconnect the spark plug caps from the spark plugs.
2. Connect a spark plug cap to the special service tool.



 Ignition tester: 90890-06754

3. Crank the engine and observe the spark through the discharge window of the spark gap tester. Check the ignition system if the spark is weak.

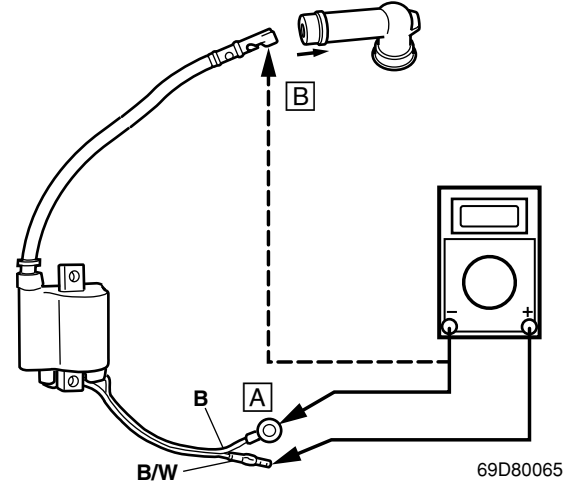



⚠ WARNING

- 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 ignition coils

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

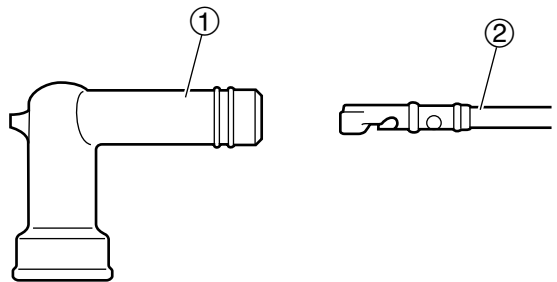


 Ignition coil resistance:

- A** Primary coil:
Black and White (B/W) — Black (B)
0.18 — 0.26 Ω at 20°C (68°F)
- B** Secondary coil:
Black and White (B/W) — Spark plug wire
3.84 — 5.76 kΩ at 20°C (68°F)

Checking the spark plug caps

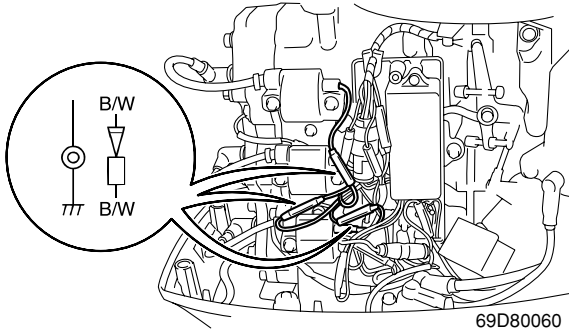
1. Check the spark plug caps for cracks or damage. Replace if necessary.
2. Remove the spark plug cap ① from the spark plug wire ②.
3. Check the spark plug wire for damage or cracks. Replace if necessary.





6B480070

Checking the CDI unit

1. Measure the CDI unit output peak voltage. If below specification, measure the pulser coil output peak voltage. Replace the CDI unit if the output peak voltage of the pulser coil is above specification.



	Digital circuit tester: 90890-3174 Peak voltage adaptor B: 90890-03172
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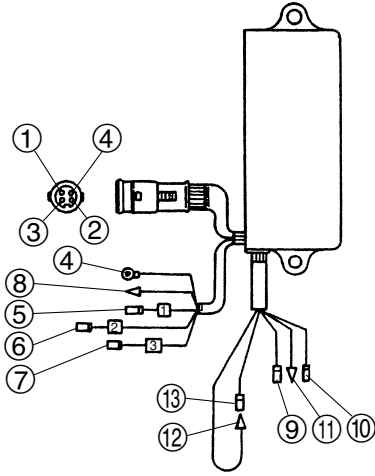
	CDI unit output peak voltage: Black and White (B/W)-Ground (B)		
r/min	Loaded		
	Cranking	1,500	3,500
DC V	100	140	100

NOTE: _____
Remove the all spark plug caps, set the engine start switch to “ON” position and install the engine stop lanyard switch clip, when measure the CDI unit peak voltage at the clanking to use the manual starter. (WHD)

CDI unit resistance chart (reference)

1. Check the CDI unit terminal resistance. If out of specification, replace the CDI unit.

- ① W/R : White/Red
- ② W/B : White/Black
- ③ W/G : White/Green
- ④ B : Black
- ⑤, ⑥, ⑦ B/W : Black/White
- ⑧ Br : Brown
- ⑨ W : White
- ⑩ Y/R : Yellow/Red
- ⑪ P : Pink
- ⑫, ⑬ Gy : Gray
- ∞ : No continuity



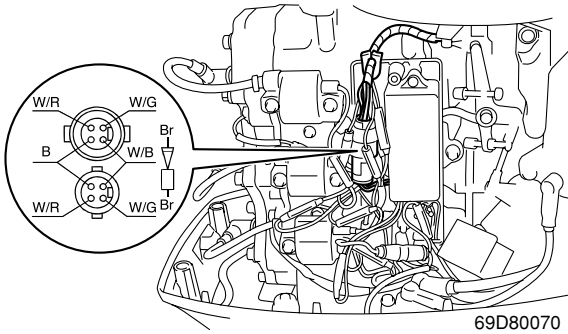
69D80180

Unit: kΩ

Positive lead \ Negative lead	Pulser			Ground	Ignition			Charge	Stop	Overheat	Thermo-switch	Over-rev.	
	① W/R	② W/B	③ W/G	④ B	⑤ B/W #1	⑥ B/W #2	⑦ B/W #3	⑧ Br	⑨ W	⑩ Y/R	⑪ P	⑫ Gy	⑬ Gy
W/R		64-96	64-96	21.6-31.4	46.4-69.6	46.4-69.6	46.4-69.6	44-66	3.8-5.6	52-78	32-48	32-48	72-108
W/B	64-96		64-96	21.6-31.4	46.4-69.6	46.4-69.6	46.4-69.6	44-66	3.8-5.6	52-78	32-48	32-48	72-108
W/G	64-96	64-96		21.6-31.4	46.4-69.6	46.4-69.6	46.4-69.6	44-66	3.8-5.6	52-78	32-48	32-48	72-108
B	23.2-34.8	23.2-34.8	23.2-34.8		3.4-5.0	3.4-5.0	3.4-5.0	3.5-5.3	6-9	5.8-7.2	24-36	16-24	12.4-18.6
B/W #1	∞	∞	∞	∞		∞	∞	∞	∞	∞	∞	∞	∞
B/W #2	∞	∞	∞	∞	∞		∞	∞	∞	∞	∞	∞	∞
B/W #3	∞	∞	∞	∞	∞	∞		∞	∞	∞	∞	∞	∞
Br	36-54	36-54	36-54	8.4-12.6	16-24	16-24	16-24		6.4-9.6	16-24	30-45	28-42	28-42
W	36-54	36-54	36-54	8.4-12.6	21.6-32.4	21.4-32.4	21.4-32.4	20.8-31.2		24-36	16-24	16-24	36-54
Y/R	∞	∞	∞	∞	∞	∞	∞	∞	∞		∞	∞	∞
P	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		∞	∞
Gy	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		∞
Gy	800-1200 ~∞	800-1200 ~∞	800-1200 ~∞	800-1200	160-240	800-1200 ~∞	800-1200 ~∞	800-1200 ~∞	280-420	320-480	800-1200 ~∞	800-1200 ~∞	

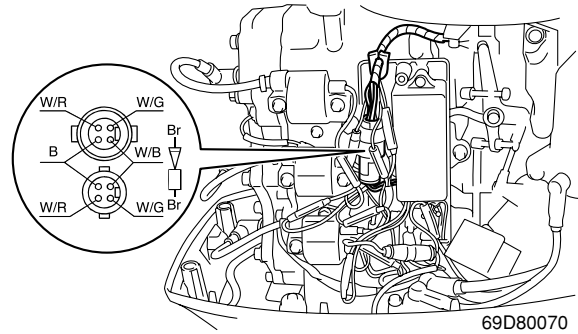
Checking the pulser coils


1. Disconnect the CDI unit coupler.
2. Connect the test harness (4 pins) to the pulser coil.
3. Measure the pulser coil output peak voltage. Replace the pulser coil if below specification.





Checking the charge coil

1. Disconnect the CDI unit coupler.
2. Connect the test harness (4 pins) to the charge coil.
3. Measure the charge coil output peak voltage. Replace the charge coil if below specification.




 Digital circuit tester: 90890-3174
 Peak voltage adaptor B:
 90890-03172
 Test harness (4-pins):
 New: 90890-06875
 Current: 90890-06775


 Digital circuit tester: 90890-3174
 Peak voltage adaptor B:
 90890-03172
 Test harness (4-pins):
 New: 90890-06875
 Current: 90890-06775


 Pulser coil output peak voltage:
 White/Red (W/R) — Ground (B)
 White/Black (W/B) — Ground (B)
 White/Green (W/G) — Ground (B)

r/min	Unloaded	Loaded	
	Cranking	1,500	3,500
DC V	2.0	2.0	10.0

 Charge coil output peak voltage:
 Positive side: Brown (Br) —
 Negative side: Ground (B)

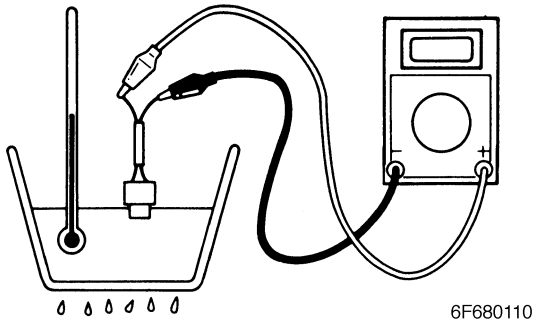
r/min	Unloaded	Loaded	
	Cranking	1,500	3,500
DC V	120	110	110

 Pulser coil resistance
 (reference data):
 White/red (W/R) — Ground (B)
 White/Black (W/B) — Ground (B)
 White/Green (W/G) — Ground (B)
 117 — 143 Ω
 at 20°C (68°F)

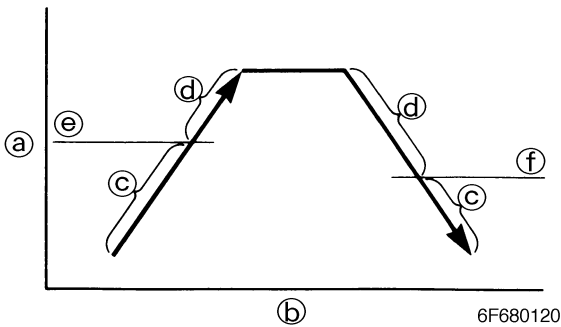
 Charge coil resistance
 (reference data):
 Brown (Br) — Ground (B)
 149 — 182 Ω at 20°C (68°F)

Checking the thermoswitch


- Place the thermoswitch in a container of water and slowly heat the water.



- Check the switch for continuity at the specified temperatures. Replace if out of specification.

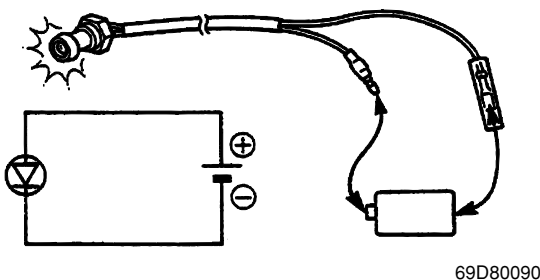


- (a) Temperature
- (b) Time
- (c) No continuity
- (d) Continuity

	Thermoswitch continuity temperature:
	Pink (P) — Black (B)
	ⓔ: 84 — 90 °C (183 — 194°F)
	ⓕ: 60 — 74 °C (140 — 165°F)

Checking the warning indicator

- Disconnect the warning indicator connector.
- Check that the indicator for continuity.



CAUTION:

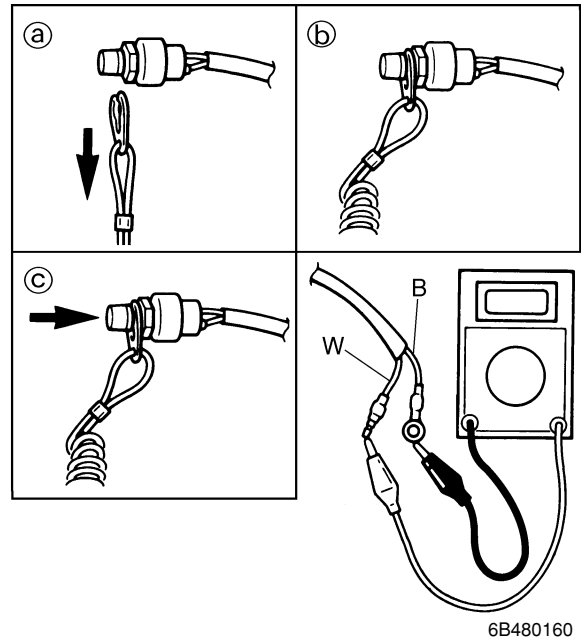
Make sure use the 1.5 V dry sell battery, other than higher voltage batteries will be burnt the diode.


NOTE:

LED has an direction for electrical current. Therefore try reverse connection if there is no lighting.

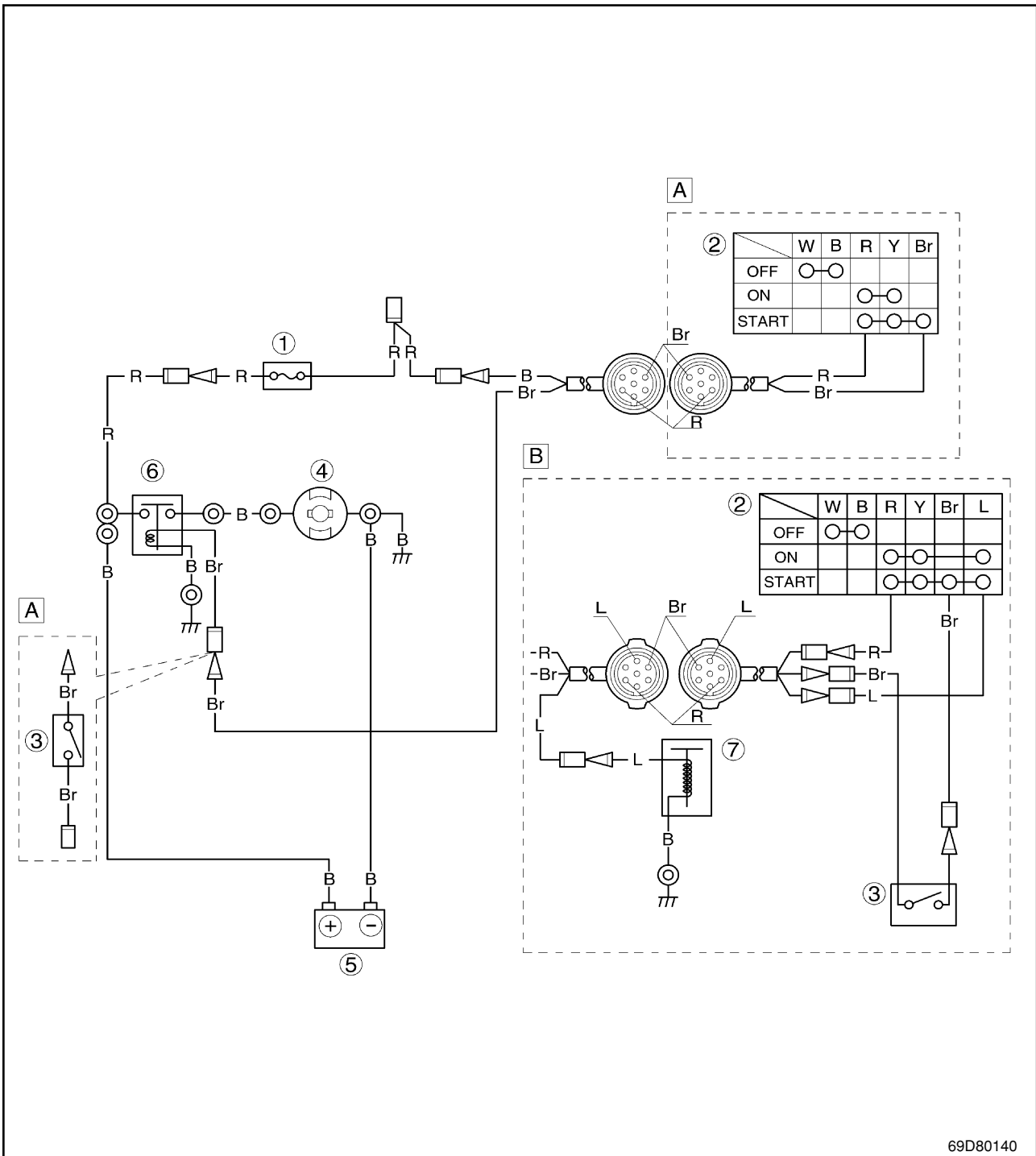
Checking the engine stop lanyard switch (MHD, WHD)

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



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

Starting system (WHD, WD)



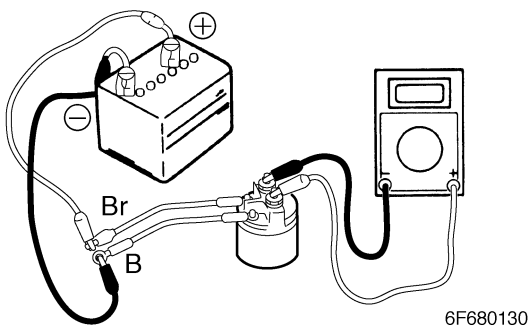
- ① Fuse
 - ② Engine start switch (WHD)
 - ③ Neutral switch (WHD) (WD: if equipped)
 - ④ Starter motor
 - ⑤ Battery
 - ⑥ Starter relay
 - ⑦ Choke solenoid (WD)
- A** WHD
 - B** WD
 - B : Black
 - Br : Brown
 - B/W : Black/White
 - L : Blue
 - R : Red

Checking the fuse (WHD,WD)

1. Check the fuse for continuity. Replace if there is no continuity.

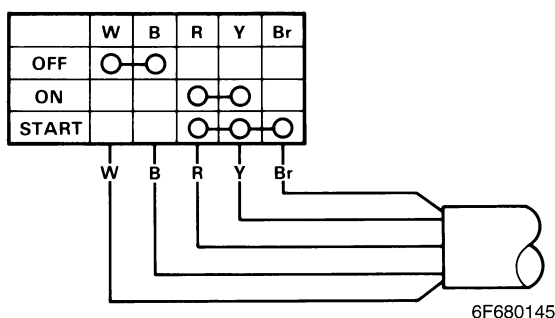
Checking the starter relay (WHD, WD)

1. Connect the digital circuit tester leads to the starter relay terminals.
2. Connect the positive battery terminal to the brown (Br) lead.
3. Connect the negative battery terminal to the black (B) lead.
4. Check for continuity between the starter relay terminals. Replace if there is no continuity.
5. Check that there is no continuity between the starter relay terminals after disconnecting a battery terminal from the brown or black lead. Replace if there is continuity.



Checking the engine start switch (WHD)

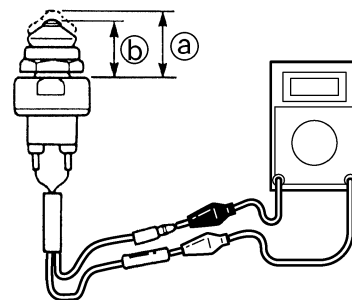
1. Check the engine start button for continuity. Replace if there is no continuity.



Switch position	Lead color				
	White (W)	Black (B)	Red (R)	Yellow (Y)	Brown (Br)
OFF		○—○			
ON			○—○		
START			○—○	○—○	

Checking the neutral switch (WHD) (WD: if equipped)

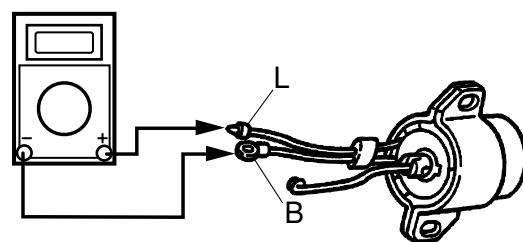
1. Check the neutral switch for continuity. Replace if there is no continuity.




Switch position	Lead color	
	Brown (Br)	Brown (Br)
Free (a)		
Push (b)	○—○	○—○

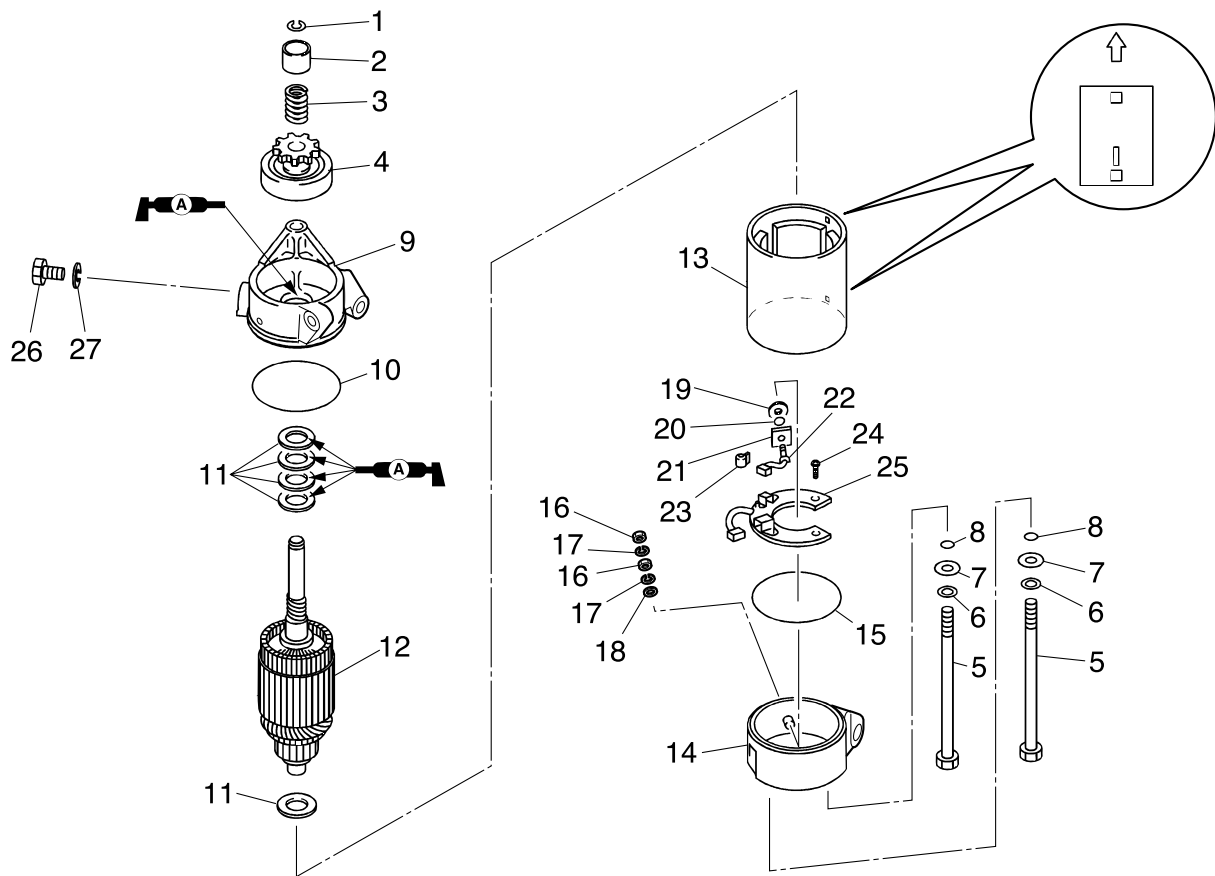
Checking the choke solenoid (WD)

1. Measure the resistance of the choke solenoid.



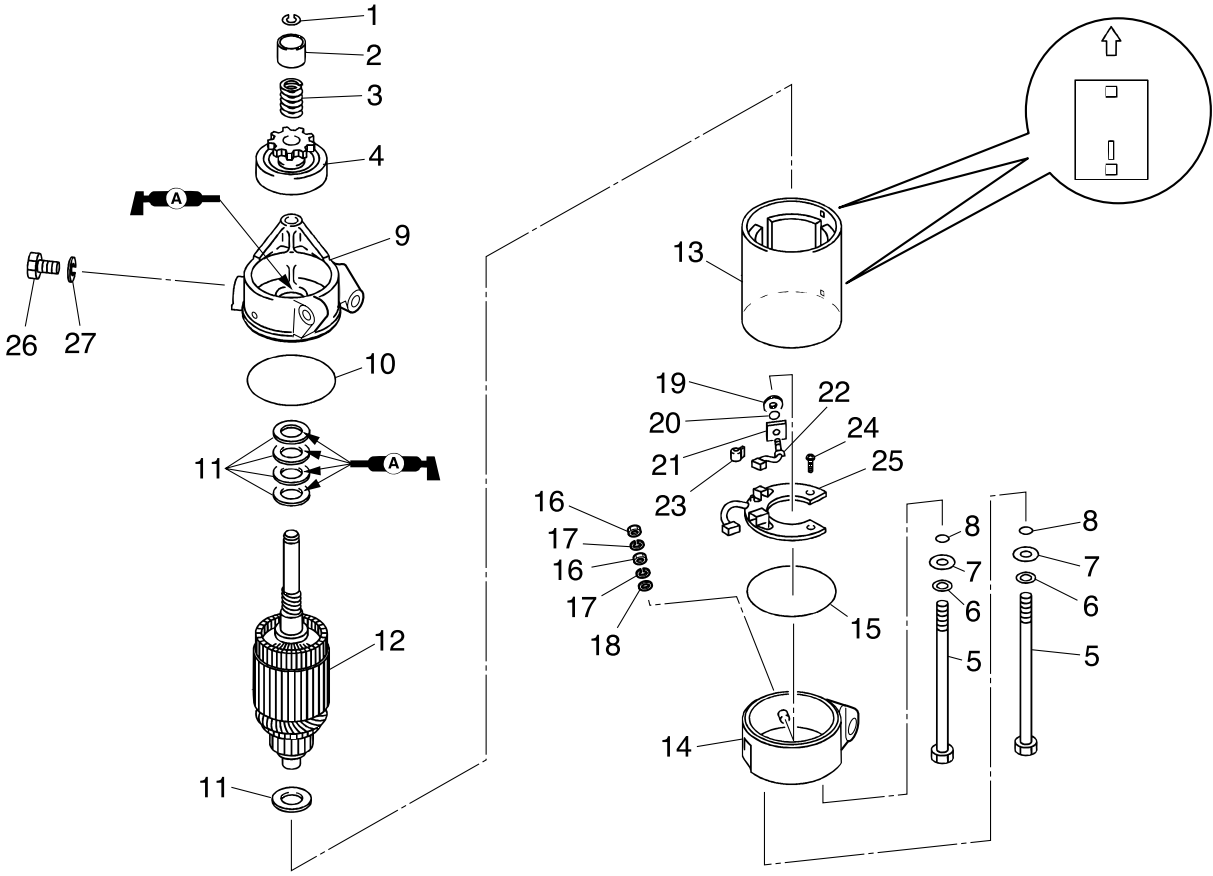
	Choke solenoid resistance (reference data):
	Blue (L) — Black (B) 3.4 — 4.0 Ω at 20°C (68°F)

Starter motor (WHD, WD)



69D8000E

No.	Part name	Q'ty	Remarks
1	Clip	1	
2	Pinion stopper	1	
3	Spring	1	
4	Pinion assembly	1	
5	Bolt	2	
6	Washer	2	
7	Washer	2	
8	O-ring	2	Not reusable
9	Front cover	1	
10	O-ring	1	Not reusable
11	Washer set	—	
12	Armature assembly	1	
13	Yoke assembly	1	
14	Bracket	1	
15	O-ring	1	Not reusable
16	Nut	2	
17	Spring washer	2	

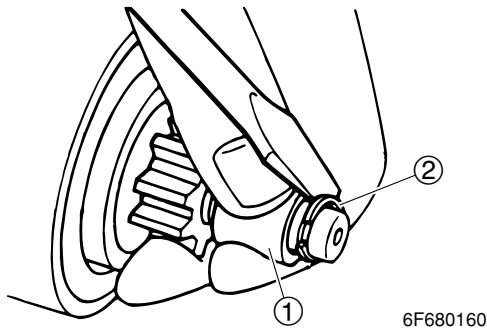


69D8000E

No.	Part name	Q'ty	Remarks
18	Plate washer	1	
19	Bushing	1	
20	O-ring	1	Not reusable
21	Bushing	1	
22	Brush	2	
23	Spring	2	
24	Screw	2	
25	Brush holder	1	
26	Bolt	1	
27	Washer	1	

Removing the starter motor pinion

1. Slide the pinion stopper ① down as shown, and then remove the clip ②.

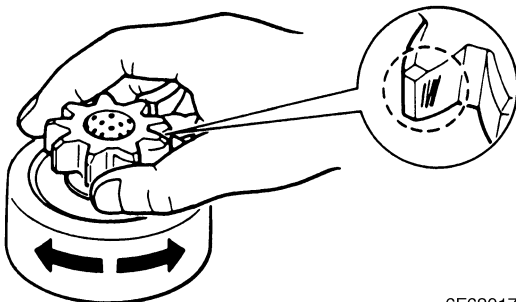


6F680160

NOTE: _____
Remove the clip with a thin screwdriver.

Checking the starter motor pinion

1. Check the teeth of the pinion for cracks or wear. Replace if necessary.
2. Check for smooth operation. Replace if necessary.

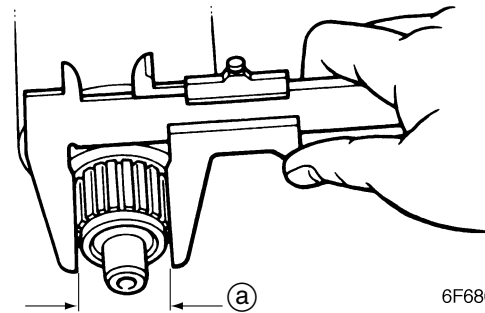


6F680170


NOTE: _____
Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.

Checking the armature

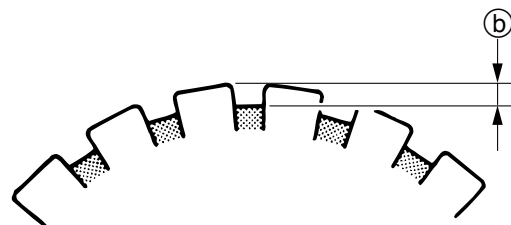
1. Check the commutator for dirt. Clean with 600– grit sandpaper and compressed air if necessary.
2. Measure the commutator diameter ①. Replace the armature if below specification.




6F680175

 Commutator diameter limit ①:
29.0 mm (1.14 in)

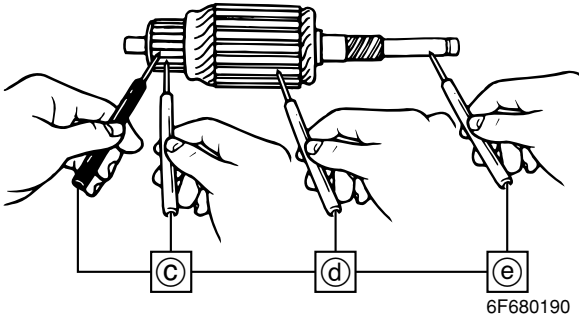
3. Measure the commutator undercut ②. Replace the armature if below specification.




6F680180

 Commutator undercut limit ②:
0.2 mm (0.01 in)

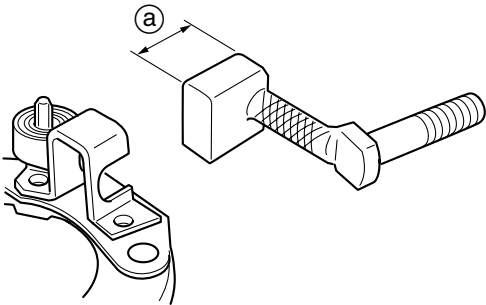
4. Check the armature for continuity. Replace if out of specifications.




 Armature continuity	
Commutator segments (c)	Continuity
Segment – Armature core (d)	No continuity
Segment – Armature shaft (e)	No continuity

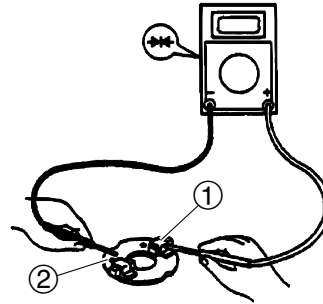
Checking the brushes


1. Measure the brush length (a). Replace the brush assembly if below specification.



	Brush length limit (a): 9.0 mm (0.35 in)
---	---

2. Check the brush holder assembly for continuity. Replace if out of specifications.

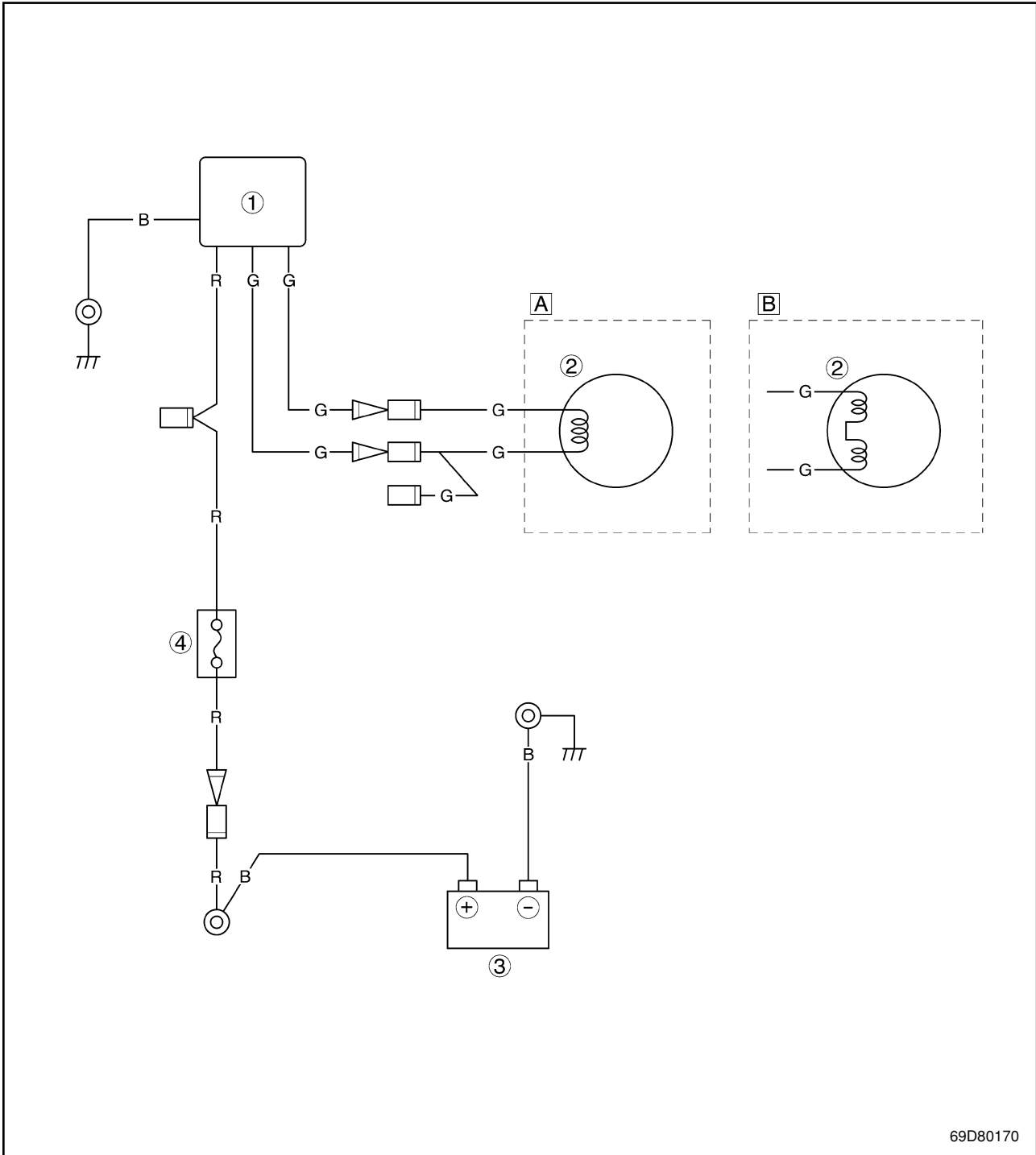


 Brush continuity:	
Brush holder (1) — Brush base (2)	No continuity

Checking the starter motor operation

1. Check the operation of the starter motor after installing it onto the power unit.

Charging system



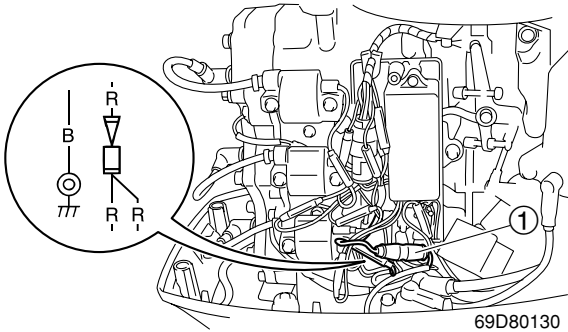
69D80170

- ① Rectifier (WHD, WD)
- ② Lighting coil
- ③ Battery (WHD, WD)
- ④ Fuse (WHD, WD)
- A 1-Lighting coil model
- B 2-Lighting coil model

- B : Black
- G : Green
- R : Red


Checking the rectifier (WHD, WD)


1. Measure the rectifier output peak voltage. If below specification, measure the lighting coil output peak voltage. Replace the rectifier if the output peak voltage of the lighting coil is above specification.



NOTE:

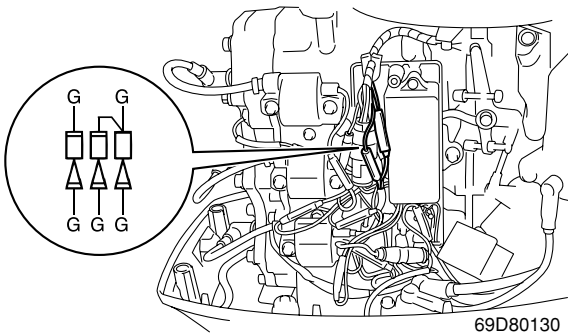
After starting the engine, disconnect the output lead (red lead) ① of the rectifier when measuring the output peak voltage.


 Digital circuit tester: 90890-3174


 Rectifier output peak voltage: Red (R) — Black (B)		
r/min	Unloaded	
	1,500	3,500
DC V	20	40


Checking the lighting coil

1. Measure the lighting coil output peak voltage. Replace the lighting coil if below specification.



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

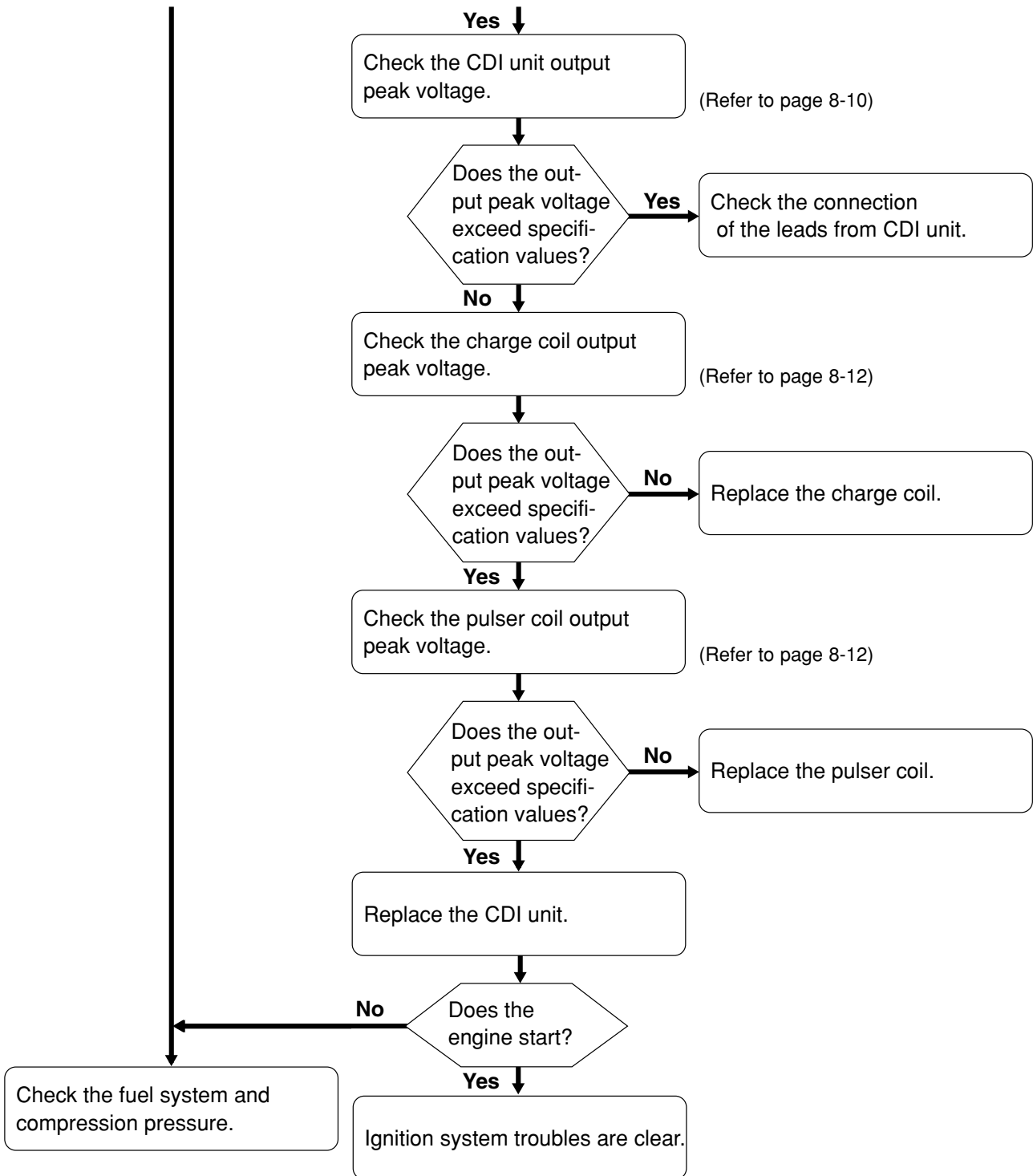
 Lighting coil output peak voltage: Green (G) – Green (G)			
r/min	Unloaded		
	Cranking	1,500	3,500
DC V	5.0	20.0	40.0

 Lighting coil resistance (reference data):	
Green (G) – Green (G)	
MHD:	
1.3 – 1.6 Ω at 20°C (68°F) (2-Lighting coil model)	
WHD, WD:	
0.4 – 0.5 Ω at 20°C (68°F) (1-Lighting coil model)	

Troubleshooting

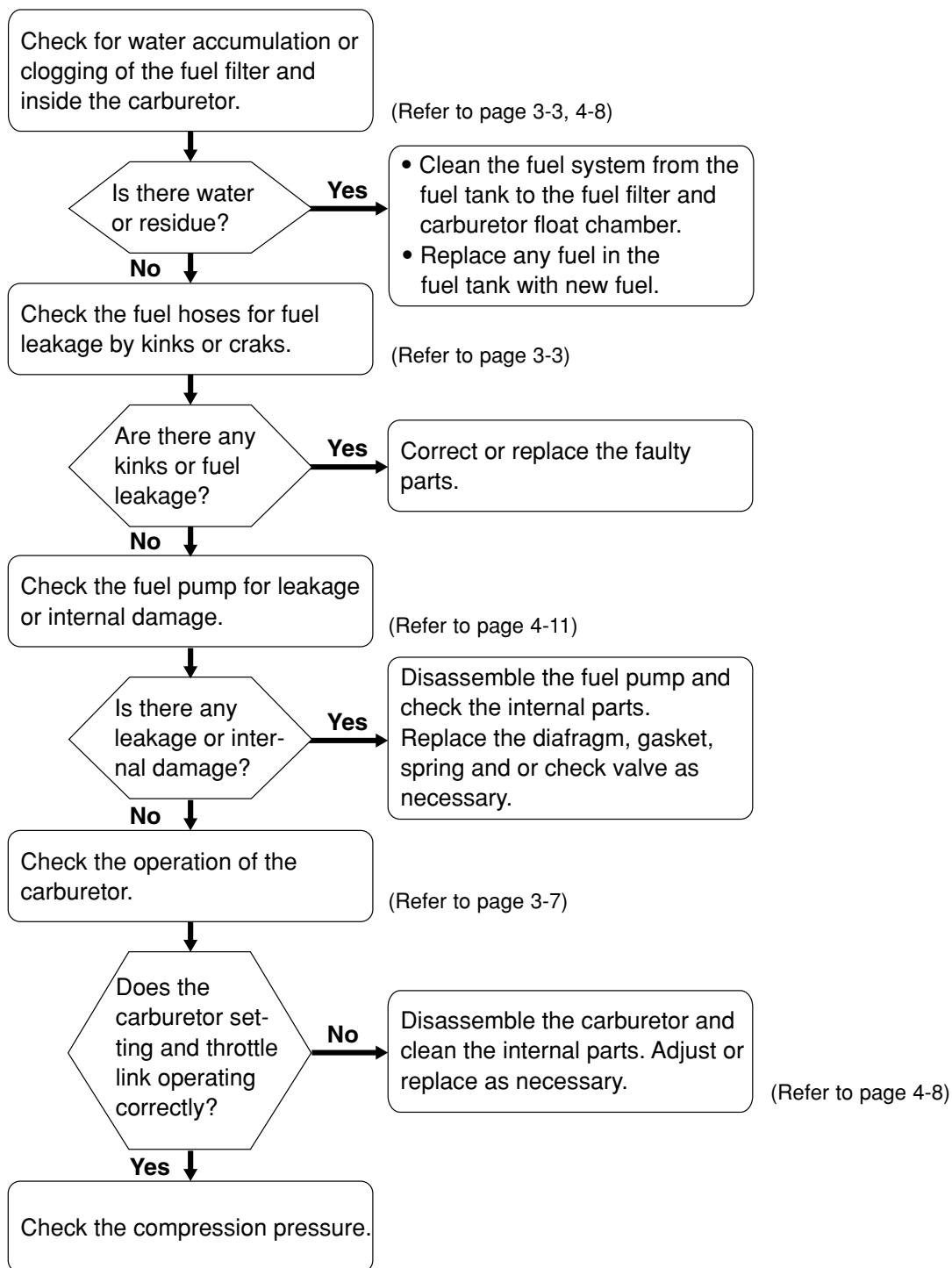
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Ignition system (continued from previous page)



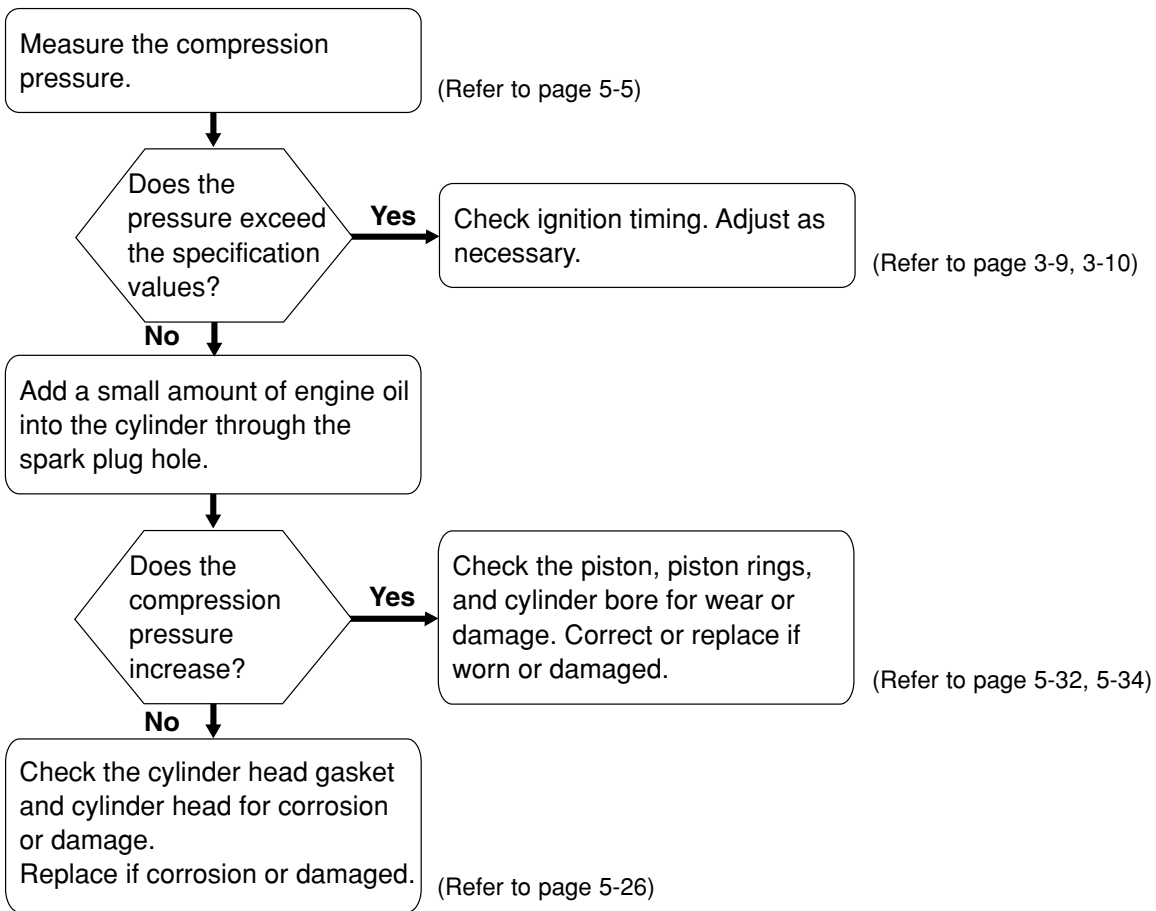
Fuel system

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



Compression pressure

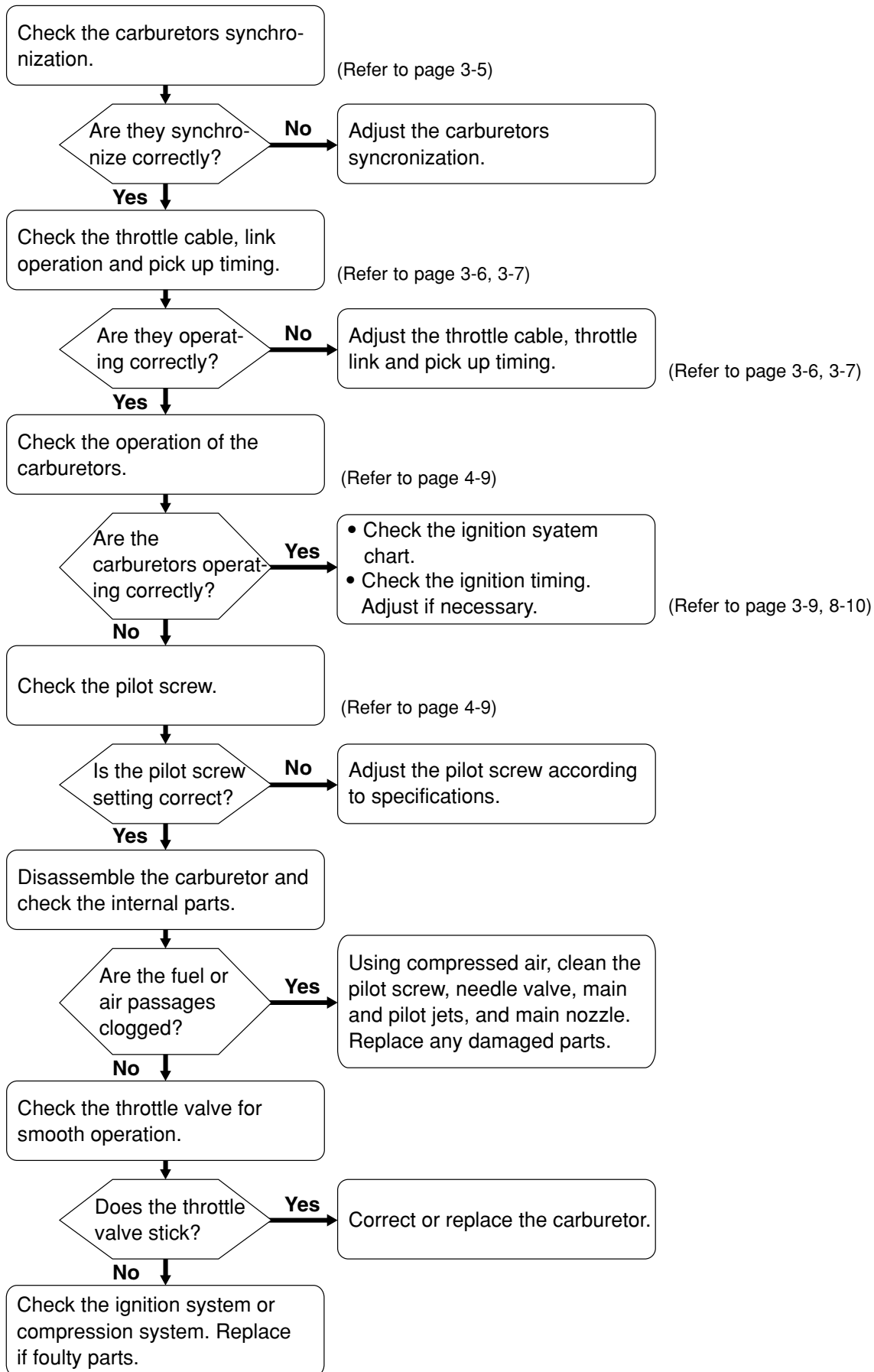
• Consult this chart after the ignition and fuel systems have been checked.



NOTE:

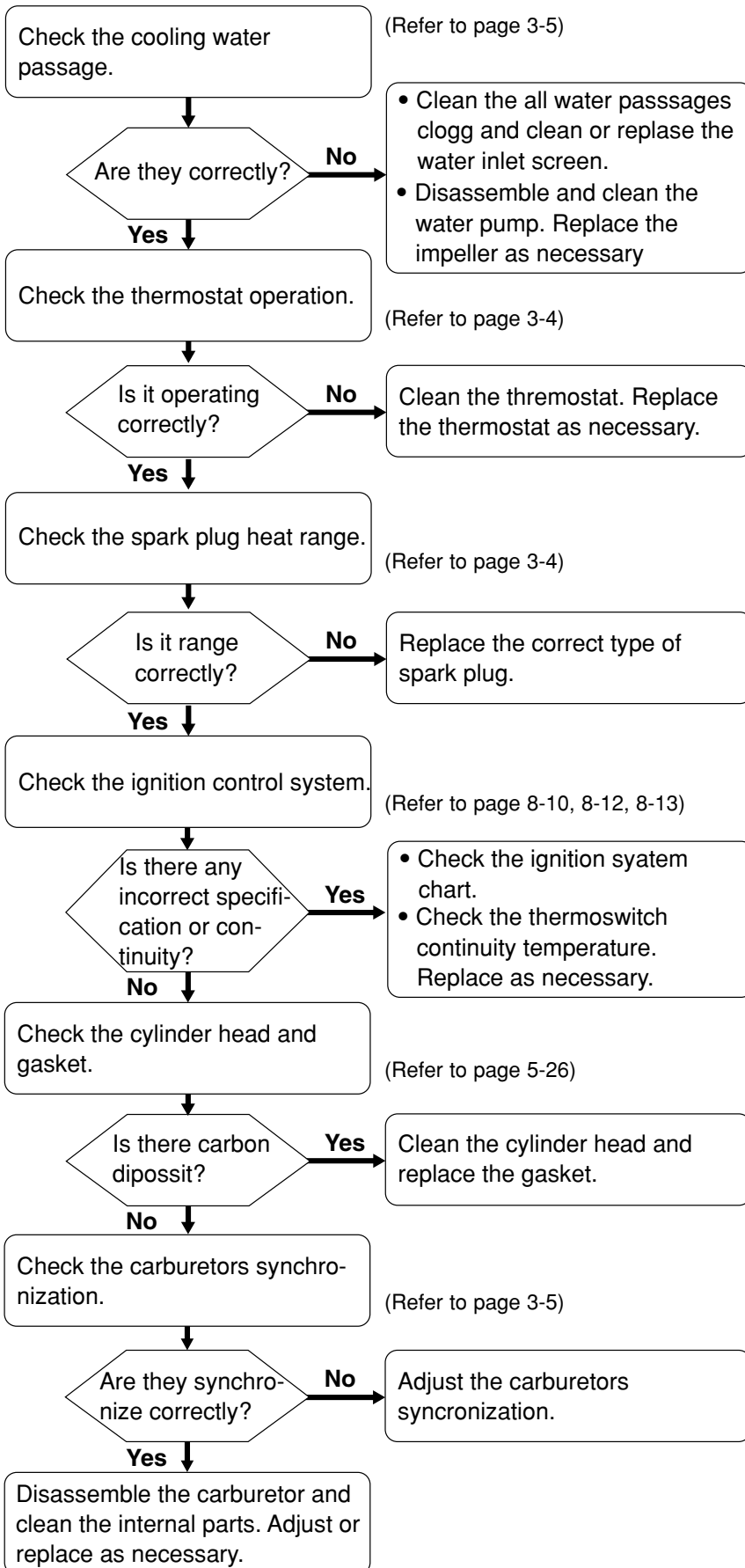
While restoring a damaged part, it is also necessary to trace and solve the cause of the damage.

Symptom: The engine idle speed does not remain steady.



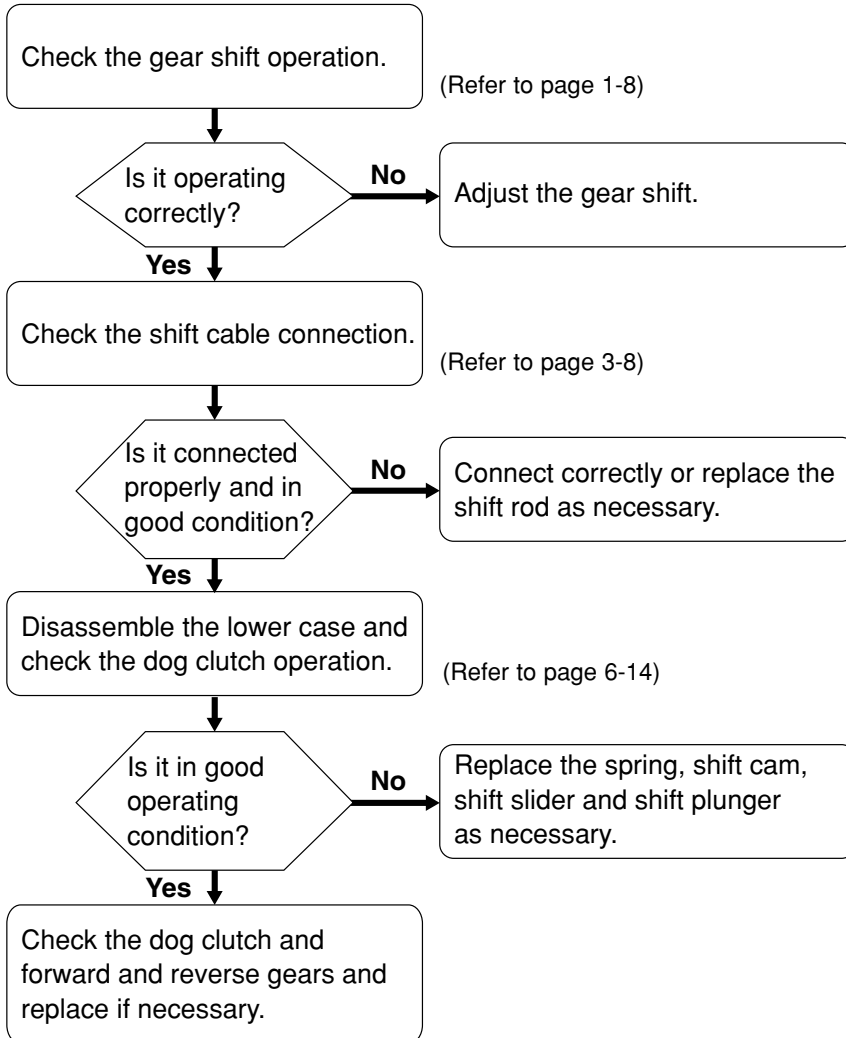
Symptom: The engine speed does not exceed 2,000 r/min.

- Be sure use the correct octane gasoline.



Lower unit

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

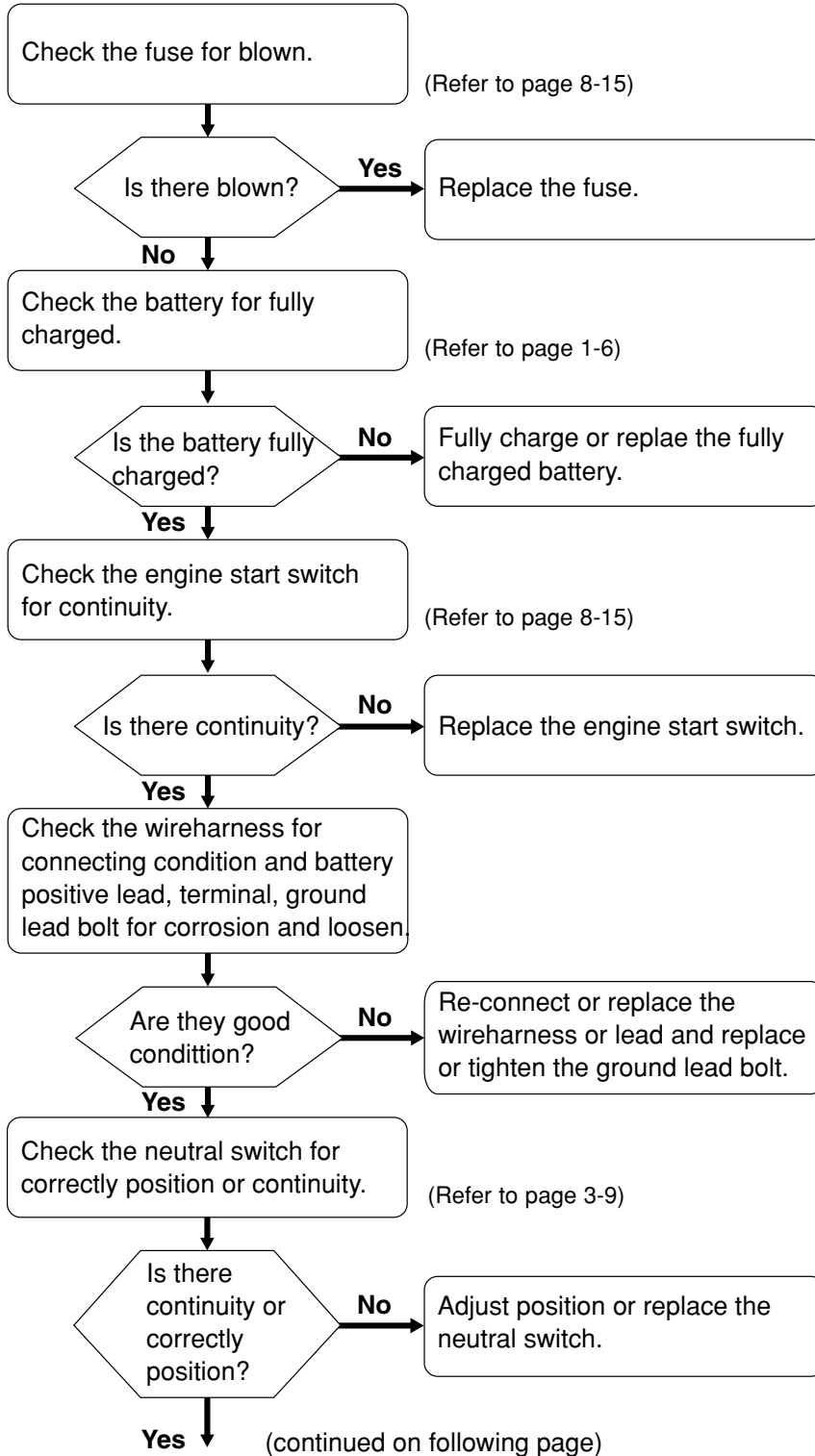


Electrical system

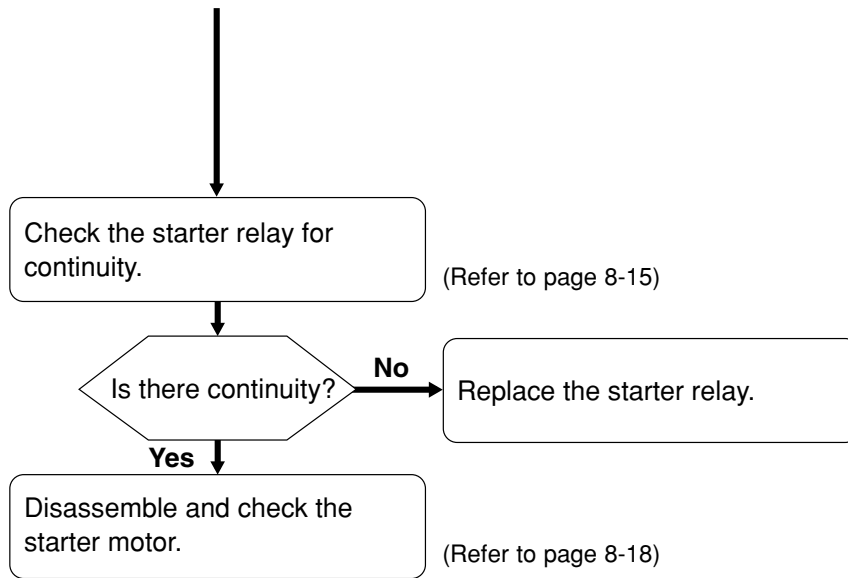
Symptom: The starter motor does not operate. (WHD, WD)

- Engine stop lanyard switch is operating normally.

Starting system



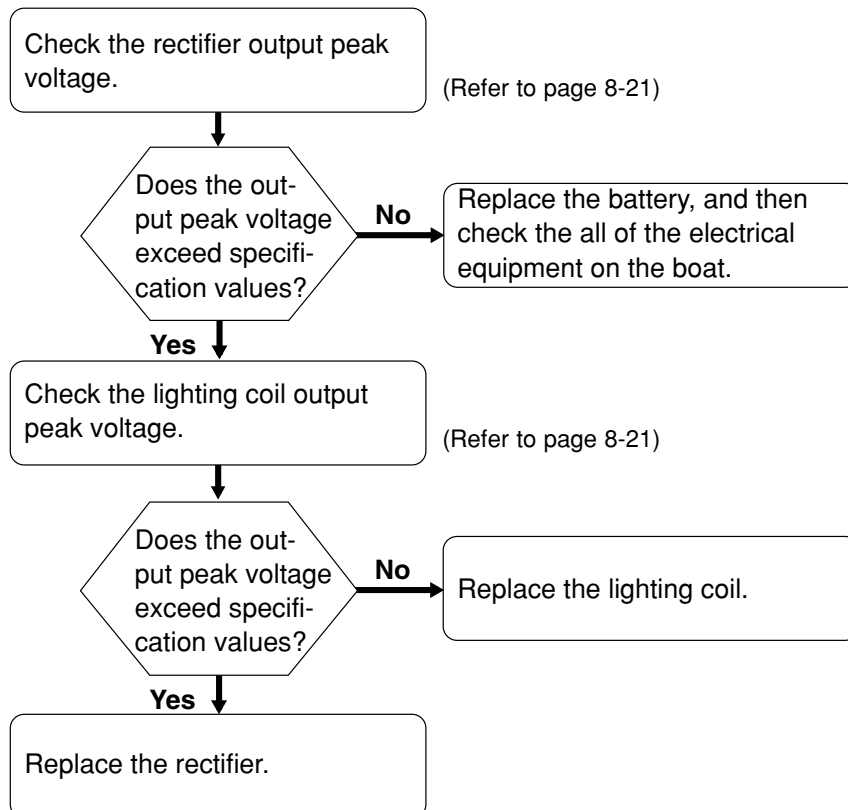
Starting system (continued from previous page)



Symptom: The battery loses power quickly. (WHD, WD)

- Be sure the electrolyte level and gravity are specific condition.
- Be sure the wireharness, couplers and connectores are good connection.

Charging system



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WIRING DIAGRAM E60HMHD

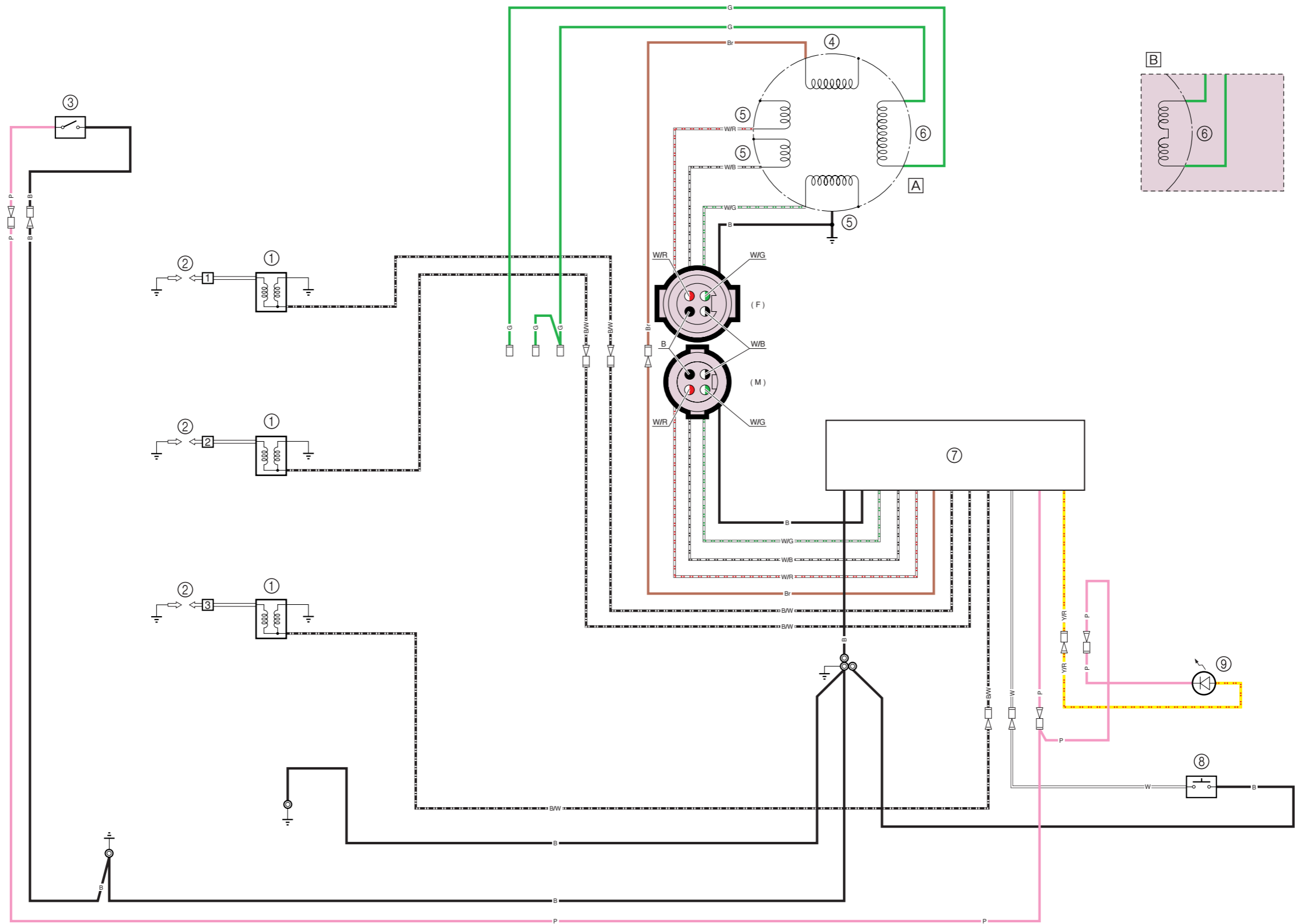
- ① Ignition coil
- ② Spark plug
- ③ Thermoswitch
- ④ Charge coil
- ⑤ Pulser coil
- ⑥ Lighting coil
- ⑦ CDI unit
- ⑧ Engine stop lanyard switch
- ⑨ Warning indicator

- A** 1-Lighting coil model
- B** 2-Lighting coil model

Color code

- B : Black
- Br : Brown
- P : Pink
- W : White
- B/W : Black/White
- W/G : White/Green
- W/B : White/Black
- W/R : White/Red
- Y/R : Yellow/Red

E60HMHD



WIRING DIAGRAM E60HWHD, E60HWD

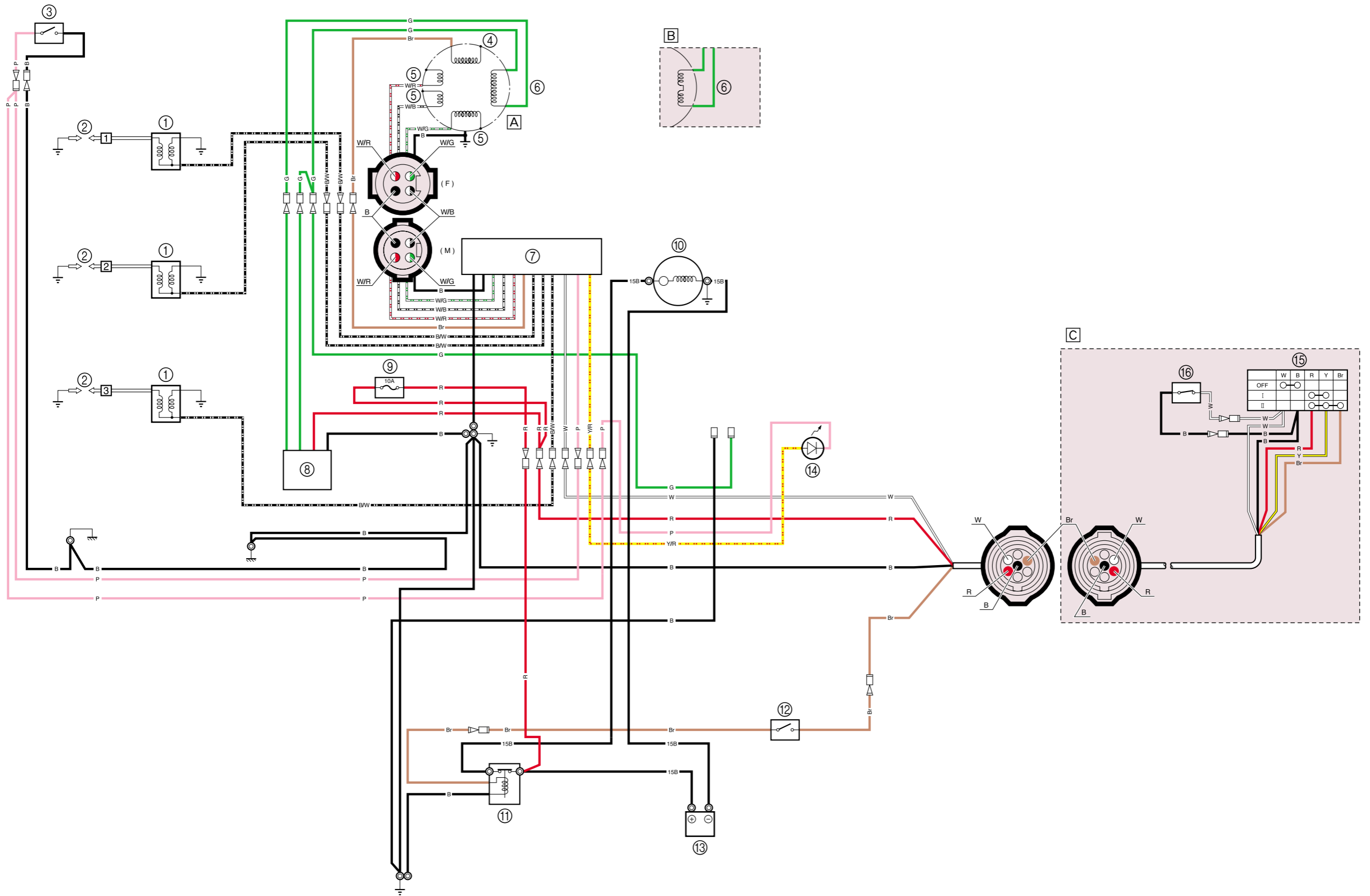
- ① Ignition coil
- ② Spark plug
- ③ Thermostat
- ④ Charge coil
- ⑤ Pulser coil
- ⑥ Lighting coil
- ⑦ CDI unit
- ⑧ Rectifier
- ⑨ Fuse
- ⑩ Starter motor
- ⑪ Starter relay
- ⑫ Neutral switch (WD: if equipped)
- ⑬ Battery
- ⑭ Warning indicator
- ⑮ Engine start switch (WHD)
- ⑯ Engine stop lanyard switch

- A 1-Lighting coil model
- B 2-Lighting coil model
- C WHD


Color code

- B : Black
- Br : Brown
- G : Green
- P : Pink
- R : Red
- W : White
- B/W : Black/White
- W/B : White/Black
- W/G : White/Green
- W/R : White/Red
- Y/R : Yellow/Red

E60HWD,E60HWHD





Printed in Japan
Oct. 2004 – 0.9 × 1 
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Printed on recycled paper