YAMAHA

F4B
F5A
F6C

SERVICE MANUAL

6BV-28197-3M-11

Preface

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 the Bronze Technical Certificate of the YTA (Yamaha Technical Academy) marine or the equivalent 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. Also, up-to-date parts information is available on YPEC-web. Additional information and up-to-date information on Yamaha products and services are available on Yamaha Service Portal.

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

A WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

A NOTICE indicates special precautions that must be taken to avoid damages to the outboard motor or other property.

TIP:

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

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SERVICE MANUAL

3rd Edition, January 2019

Contents

General information

⚠Safety while working

To prevent an accident or injury and to provide quality service, observe the following safety procedures.

Rotating part

- Hands, feet, hair, jewelry, clothing, personal flotation device straps, and so on, can become entangled with internal rotating parts of the engine, resulting in serious injury or death.
- Keep the top cowling installed whenever possible. Do not remove or install the top cowling when the engine is running.
- Only operate the engine with the top cowling removed according to the specific instructions in the manual. Keep hands, feet, hair, jewelry, clothing, personal flotation device straps, and so on, away from any exposed moving parts.

Hot part

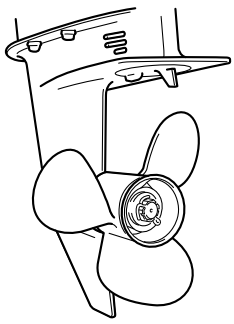
During and after operation, engine parts are hot enough to cause burns. Do not touch any parts under the top cowling until the engine has cooled.

Electric shock

Do not touch any electrical parts while starting or operating the engine. Otherwise, shock or electrocution could result.

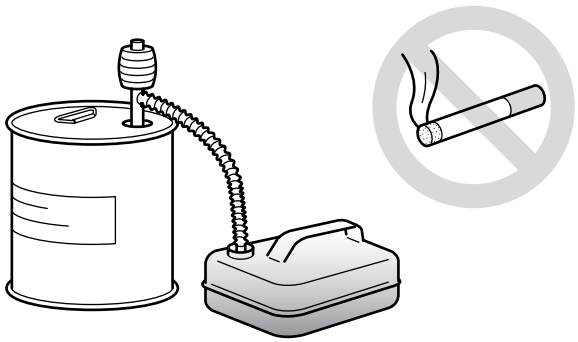
Propeller

Do not hold the propeller with your hands when loosening or tightening the propeller nut.



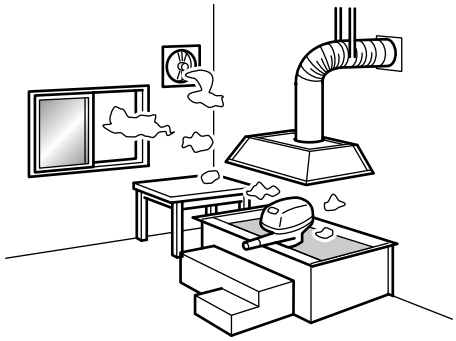
Handling of gasoline

- Gasoline is highly flammable. Keep gasoline and all flammable products away from heat, sparks, and open flames.
- Gasoline is poisonous and can cause injury or death. Handle gasoline with care. Never siphon gasoline by mouth. If you swallow some gasoline, inhale a lot of gasoline vapor, or get some gasoline in your eyes, see your doctor immediately. If gasoline spills on your skin, wash with soap and water. If gasoline spills on your clothing, change your clothes.



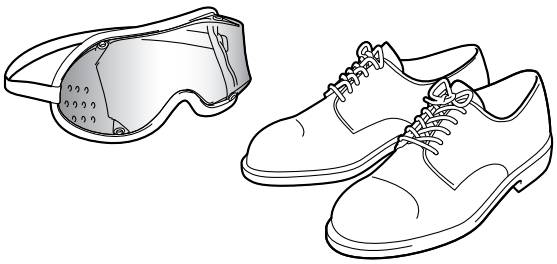
Ventilation

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



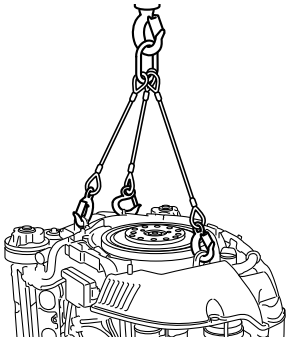
Self-protection

- 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.



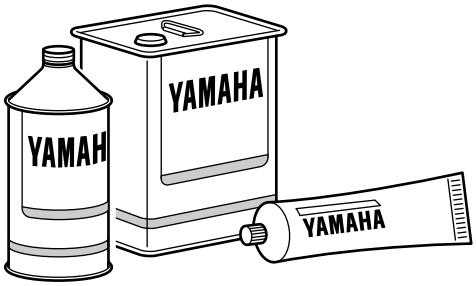
Working with crane

- Outboard motors weighing 18.0 kg (39.7 lb) and over must be carried by a crane.
- Use the wire ropes of adequate strength, and lift up the outboard motor using the three point suspension.
- If the outboard motor does not have three or more points to be suspended, support it using additional ropes or the like so that the outboard motor can be lifted and carried in a stable manner.



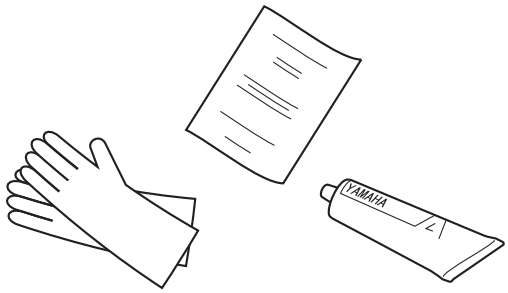
Part, lubricant, and sealant

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



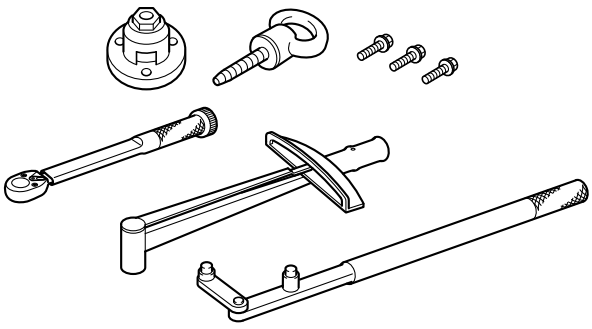
Handling of sealant

- Wear protective gloves to protect your skin, when using the sealants.
- See the material safety data sheet issued by the manufacturer. Some of the sealants may be harmful to human health.



Special service tool

Use the recommended special service tools to work safely, and to protect parts from damage.

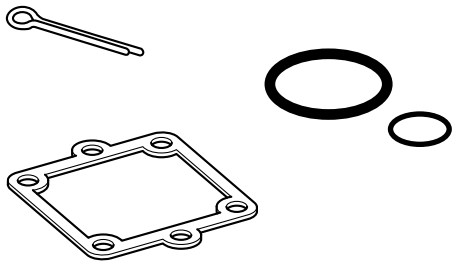


Tightening torque

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.

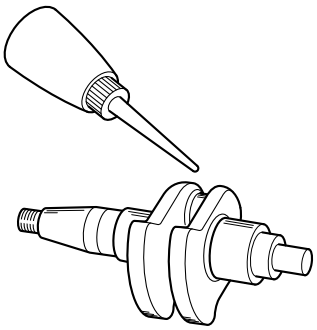
Non-reusable part

Always use new gaskets, seals, O-rings, cotter pins, and so on, when installing or assembling parts.



Disassembly and assembly

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



- Install bearings so that the bearing identification mark is facing in the direction indicated in the installation procedure. In addition, make sure to lubricate the bearings liberally.
- Apply a thin coat of water resistant grease to the lip and periphery of an oil seal before installation.
- Check that moving parts operate normally after assembly.

How to use this manual

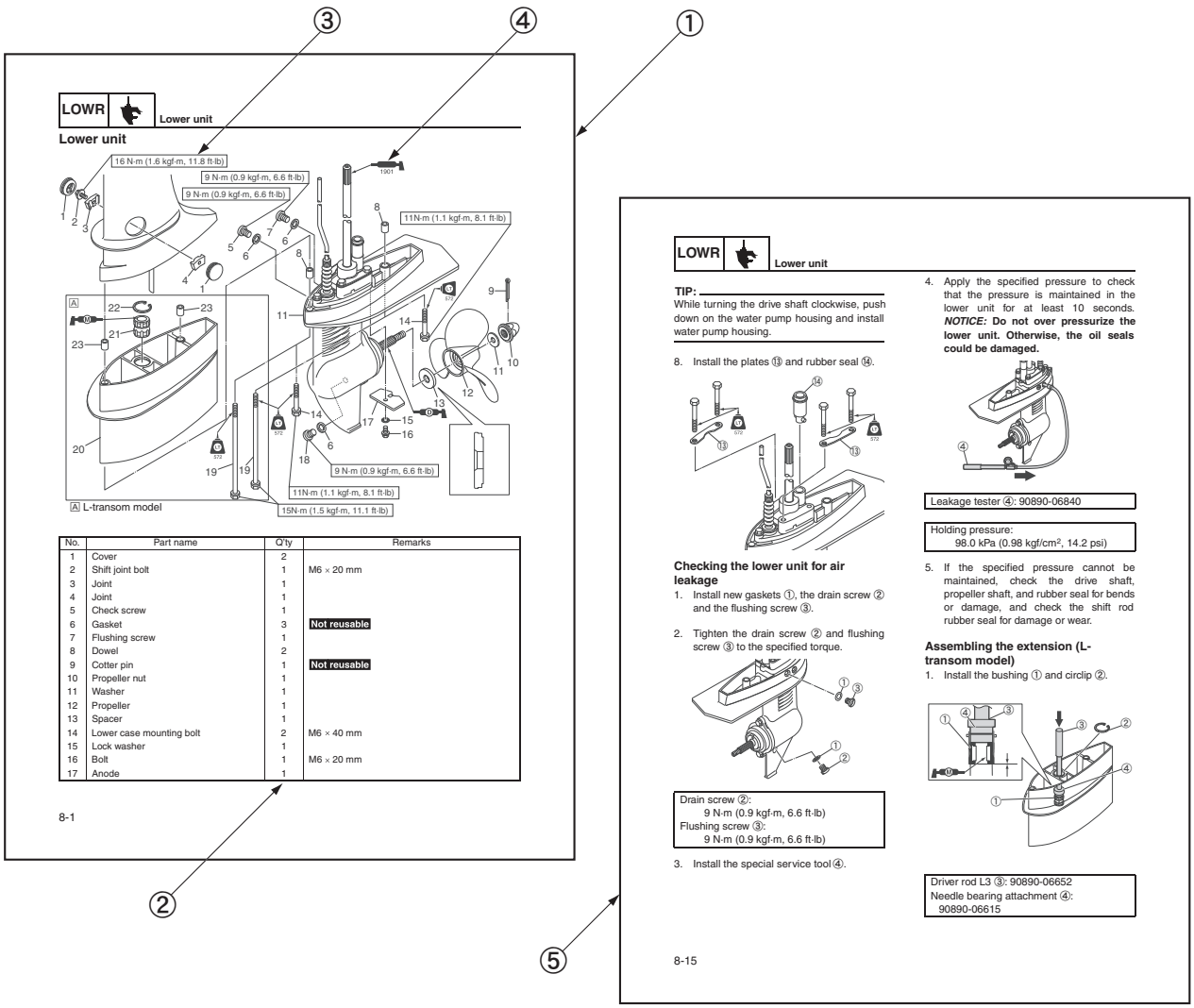
Manual format

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

- Parts are shown and detailed in an exploded diagram and are listed in the component list (see ① in the following figure for an example page).
- The component list consists of part names and quantities, as well as bolt and screw dimensions (see ② in the following figure).
- Symbols are used to indicate important aspects of a procedure, such as the grade of lubricant and the lubrication points (see ③ in the following figure).
- Tightening torque specifications are provided in the exploded diagrams (see ④ in the following figure), and in the related detailed instructions. Some torque specifications are listed in stages as torque figures or angles in degrees.
- Separate procedures and illustrations are used to explain the details of removal, checking, and installation where necessary (see ⑤ in the following figure for an example page).

TIP:

For troubleshooting procedures, see Chapter 4, “Troubleshooting.”



Abbreviation

The following abbreviations are used in this service manual.

Abbreviation	Description
API	American Petroleum Institute
BTDC	Before Top Dead Center
CCA	Cold Cranking Ampere
CDI	Capacitor Discharge Ignition
EN	European Norm (European standard)
F	Forward
IEC	International Electrotechnical Commission
N	Neutral
OHV	Overhead Valve
PORT	Port side
R	Reverse
RON	Research Octane Number
STBD	Starboard side
TDC	Top Dead Center

Lubricant, sealant, and thread locking agent

Symbol

Symbols in an exploded diagram or illustration indicate the grade of lubricant and the lubrication points.

Symbol	Name	Application
	Yamaha 4-stroke motor oil	Lubricant
	Gear oil	Lubricant
	Water resistant grease (Yamaha grease A)	Lubricant
	Molybdenum disulfide grease	Lubricant
	Corrosion resistant grease (Yamaha grease D)	Lubricant
	ThreeBond 1901	Lubricant

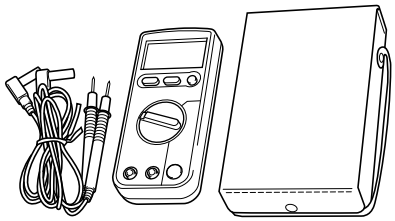
Symbols in an exploded diagram or illustration indicate the type of sealant or thread locking agent and the application points.

Symbol	Name	Application
	ThreeBond 1324	Thread locking agent
	ThreeBond 1342J	Thread locking agent
	Gasket Maker	Sealant
	LOCTITE 572 (white)	Sealant

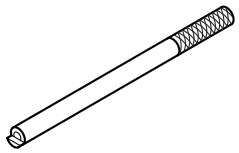
Special service tool

For all markets except U.S.A. and Canada
Special service tools with Yamaha part numbers (90890-*****) are distributed by the Parts Division.

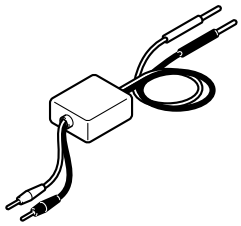
Digital circuit tester
90890-03174



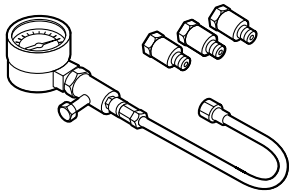
Pilot screw driver
90890-06673



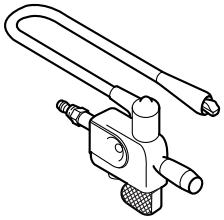
Peak voltage adapter B
90890-03172



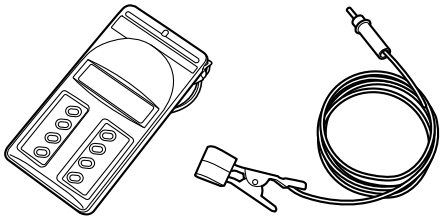
Compression gauge
90890-03160



Ignition tester (spark gap tester)
90890-06754



Digital tachometer
90890-06760



Vacuum/pressure pump gauge set
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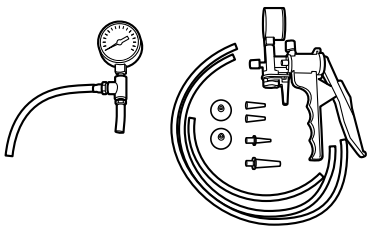
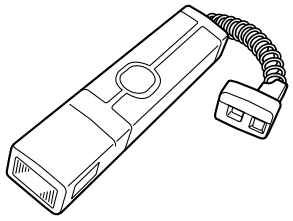


Timing light
90890-03141



Leakage tester
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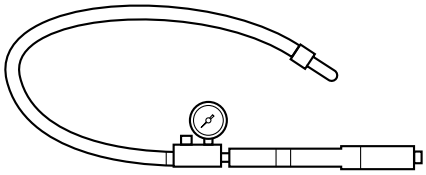
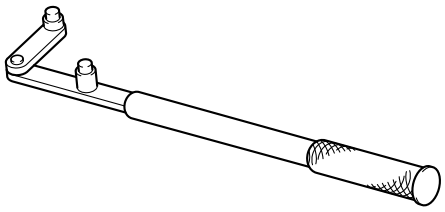
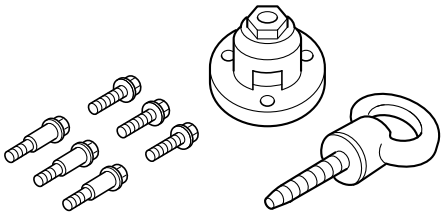


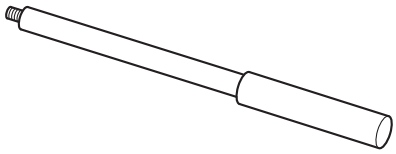
Flywheel holder
90890-06522



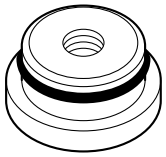
Flywheel puller
90890-06521



Driver rod L3
90890-06652



Needle bearing attachment
90890-06615



Needle bearing attachment
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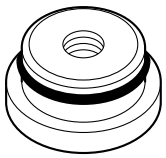
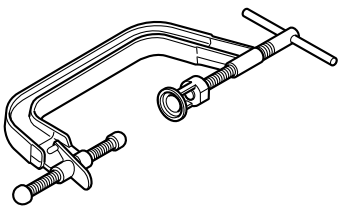


Valve spring compressor
90890-04019



Valve spring compressor attachment
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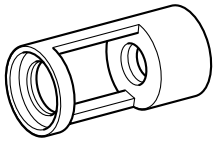
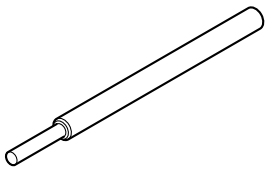
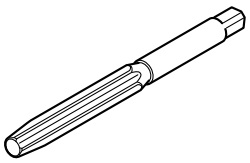


Valve guide remover/installer
90890-06801



Valve guide reamer
90890-06804



Valve lapper
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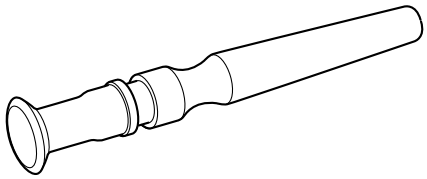
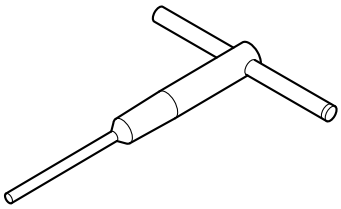
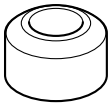


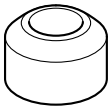
Valve seat cutter holder
90890-06316



Valve seat cutter 30°
90890-06818



Valve seat cutter 45°
90890-06312



Valve seat cutter 60°
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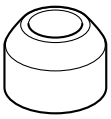

Valve seat cutter 30°
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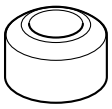

Valve seat cutter 45°
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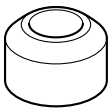

Valve seat cutter 60°
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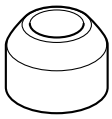
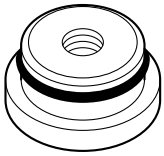
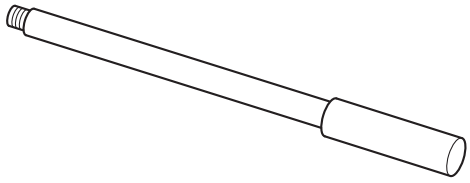


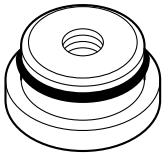
Needle bearing attachment
90890-06612



Driver rod LL
90890-06605



Ball bearing attachment
90890-06632



Driver rod LS
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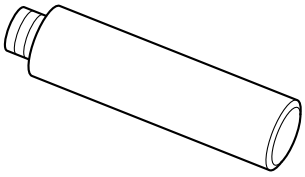

Ball bearing attachment
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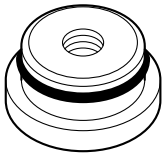
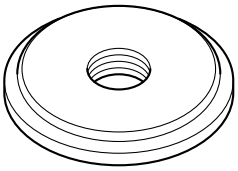


Bearing outer race attachment
90890-06628



Piston slider
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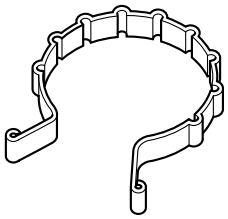
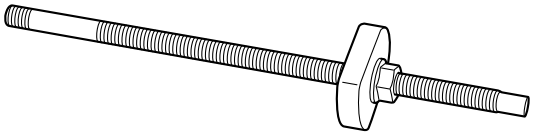
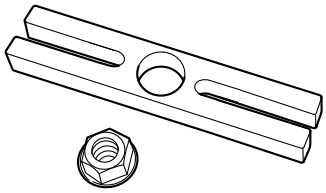


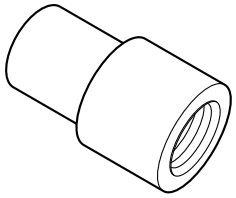
Bushing installer center bolt
90890-06601



Stopper guide plate
90890-06501



Bushing attachment
90890-06650



Stopper guide stand
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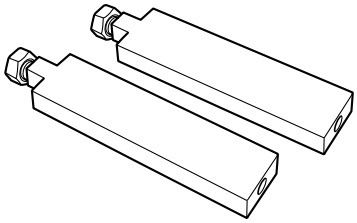

Bushing attachment
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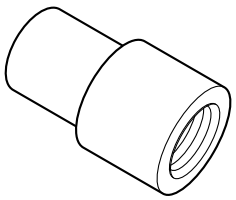

Bearing puller assembly
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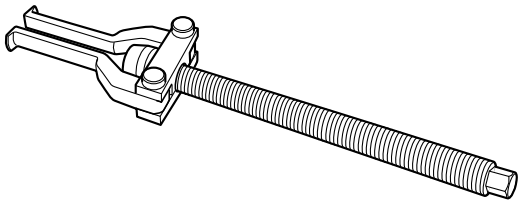


— MEMO —

Specification

Model feature

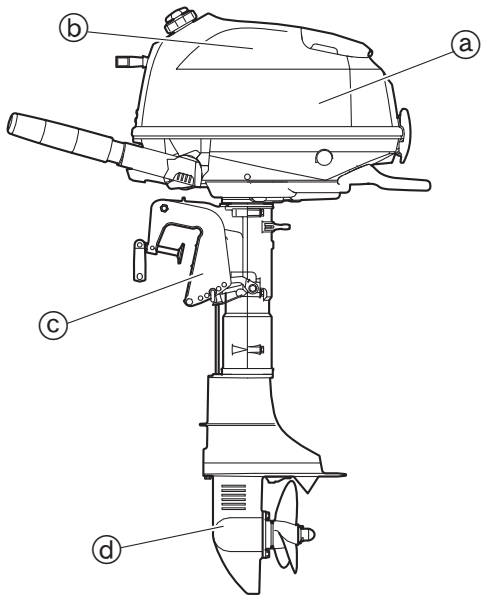
General feature

F4B, F5A, F6C Overall feature

- 4-stroke, 1-cylinder, OHV, 2-valve, 139.0 cm^3 (8.5 cu. in) engine
- Low emission in compliance with EU regulations

ⓐ **Power unit**

- Compact OHV engine
- Blowby gas reburning system
- Trochoid type oil pump lubrication
- Decompression starter
- Fuel line with a primer pump
- Dual fuel line
- Recoil manual starter



ⓑ **Electrical**

- Ignition timing control by CDI unit
- CDI unit with the integrated ignition coil
- Charging system (optional for European market)

ⓒ **Bracket unit**

- Manual tilt
- Reverse lock system
- Balanced carrying handle

ⓓ **Lower unit**

- Under water exhaust system

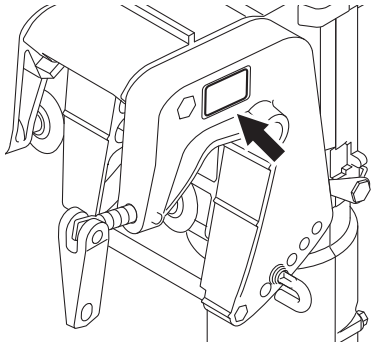
Model designation

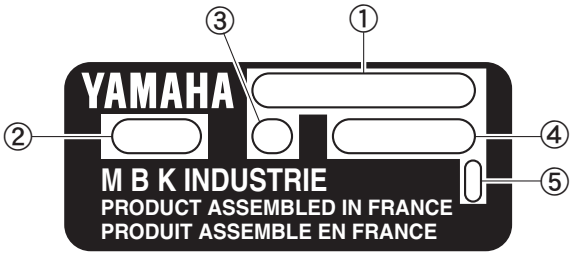
F 4 B M H S
① ② ③ ④ ⑤ ⑥

①	Model description	F: 4-stroke regular rotation
②	Model name	4: 4/5/6
③	Product generation	B: A and up
④	Functions	M: Manual starter
⑤		H: Tiller handle
⑥	Transom height	S: S (15 in)
		L: L (20 in)

Serial number

The outboard motor serial number is indicated on a label affixed to the port clamp bracket.





Model name	Approved model code	Starting serial No.
F4BMH	6EC	1000001–
F5AMH	6ED	1000001–
F6CMH	6EE	1000001–

① Model name
② Approved model code
③ Transom height
④ Serial number
⑤ Production model year

Model data

Dimension and weight

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Overall length	mm (in)	750.0 (29.5)		
Overall width	mm (in)	403.0 (15.9)		
Overall height				
S	mm (in)	1040.0 (40.9)		
L	mm (in)	1168.0 (46.0)		
Boat transom height				
S	mm (in)	440.0 (17.3)		
L	mm (in)	568.0 (22.4)		
Weight (with propeller)				
S	kg (lb)	27.0 (59.5)		
L	kg (lb)	28.0 (61.7)		

Performance

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Maximum output				
At 5000 r/min	kW (HP)	2.9 (3.9)	—	
At 5500 r/min	kW (HP)	—	3.7 (5.0)	4.4 (6.0)
Full throttle operating range	r/min	4000–5000	4500–5500	
Engine idle speed	r/min	1450–1550		

Power unit

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Type		4-stroke, OHV		
Cylinder quantity		1		
Total displacement	cm^3 (cu. in)	139.0 (8.5)		
Bore × stroke	mm (in)	62.0 × 46.0 (2.4 × 1.8)		
Compression ratio		8.90 : 1		
Control system		Tiller handle		
Starting system		Manual		
Fuel system		Carburetor		
Ignition control system		CDI		
Advance type		Microcomputer		
Starting enrichment		Choke valve		
Spark plug		CR6HSB (NGK)		
Cooling system		Water		
Exhaust system		Under water		
Lubrication system		Wet sump		

Lower unit

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Gear shift positions		F-N-R		
Gear ratio		2.08 (27/13)		
Reduction gear type		Straight bevel gear		
Clutch type		Dog clutch		
Propeller shaft type		Spline		
Propeller direction (rear view)		Clockwise		
Propeller mark		BA		

Bracket unit

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Trim angle				
At 12° boat transom	Degree	4 to 20		
Tilt-up angle	Degree	64		
Steering angle	Degree	90 + 90		
Trim and tilt system		Manual		

Fuel and oil requirement

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Fuel type		Regular unleaded gasoline		
Fuel minimum rating	RON	91		
Engine oil		4-stroke motor oil with combinations of the following SAE and API oil classifications		
Engine oil grade (*1)	API	SE, SF, SG, SH, SJ, SL		
	SAE	5W-30, 10W-30, 10W-40		
Total engine oil quantity (oil pan capacity)	L (US qt, Imp qt)	0.6 (0.63, 0.53)		
Gear oil type		Hypoid gear oil		
Gear oil grade (*2)	API	GL-4		
	SAE	90		
Gear oil quantity	L (US qt, Imp qt)	0.1 (0.11, 0.09)		

(*1) If the recommended engine oil grades are not available, use engine oil with an API classification of SH, SJ, or SL and an SAE classification of 15W-40, 20W-40, or 20W-50.

(*2) Meeting both API and SAE requirements.

Electrical technical data

Ignition timing control system

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Spark plug				
Cap resistance (*1)				
At 20 °C (68 °F)	kΩ	5.0		
Gap	mm (in)	0.6–0.7 (0.024–0.028)		
Ignition timing				
At 1500 r/min	Degree	BTDC 7–9		
CDI unit				
Air gap	mm (in)	0.4–0.6 (0.016–0.024)		

(*1) The figures are for reference only.

Charging system (optional for European market)

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Lighting coil				
Output peak voltage				
At cranking (unloaded)	V	20.0		
At 1500 r/min (unloaded)	V	30.1		
At 3500 r/min (unloaded)	V	64.3		
Resistance (*1)				
At 20 °C (68 °F)	Ω	0.771–0.869		
Rectifier Regulator				
Output peak voltage				
At 1500 r/min (loaded)	V	13.0		
At 3500 r/min (loaded)	V	13.0		

(*1) The figures are for reference only.

Fuel system technical data

Fuel system

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Fuel joint				
Holding pressure				
Positive pressure	kPa (kgf/cm^2, psi)	50.0 (0.50, 7.3)		
Fuel strainer				
Holding pressure				
Positive pressure	kPa (kgf/cm^2, psi)	200.0 (2.00, 29.0)		
Primer pump				
Holding pressure				
Positive pressure	kPa (kgf/cm^2, psi)	166.7 (1.667, 24.2)		

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Carburetor				
Float height (*1)	mm (in)	10.0 (0.4)		
Valve seat size	mm (in)	0.8 (0.03)		
Main jet (MJ)		# 60	# 70	# 75
Main nozzle	mm (in)	1.6 (0.06)	2.0 (0.08)	2.4 (0.09)
Pilot jet (PJ)		# 35		#42
Pilot air jet (PAJ)		# 105		# 110
Adjustable pilot screw (PS)	turns out	1 3/8 ± 3/4	2 1/8 ± 3/4	2 1/4 ± 3/4
Fuel pump				
Holding pressure				
Inlet positive pressure	kPa (kgf/cm^2, psi)	50.0 (0.50, 7.3)		
Outlet positive pressure	kPa (kgf/cm^2, psi)	50.0 (0.50, 7.3)		

(*1) The figures are for reference only.

Power unit technical data

Power unit

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Cylinder				
Minimum compression pressure (*1)	kPa (kgf/cm^2, psi)	700.0 (7.00, 101.5)		
Thermostat				
Valve opening temperature	°C (°F)	58–62 (136–144)		
Fully open temperature	°C (°F)	70 (158)		
Fully open stroke	mm (in)	3.0 (0.12)		

(*1) Measuring conditions: Ambient temperature 20 °C (68 °F), wide open throttle, with spark plug removed from cylinder.
When pulling the starter handle to crank the engine, the compression pressure may vary depending on the speed at which the starter handle is pulled. The figures are for reference only.

Manual starter

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Starter rope				
Length (*1)	mm (in)	1800.0 (70.9)		
Extended length	mm (in)	1430.0–1570.0 (56.3–61.8)		

(*1) The figures are for reference only.

Cylinder head assembly

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Valve				
Clearance				
Intake and exhaust	mm (in)	0.08–0.12 (0.003–0.005)		
Margin thickness				
Intake	mm (in)	0.800–1.200 (0.0315–0.0472)		
Exhaust	mm (in)	1.100–1.500 (0.0433–0.0591)		
Runout (*1)				
Intake	mm (in)	0.050 (0.0020)		
Exhaust	mm (in)	0.030 (0.0012)		
Seat contact width				
Intake and exhaust	mm (in)	0.6–0.8 (0.02–0.03)		
Cylinder head				
Warpage limit		0.10 (0.0039)		
Push rod				
Runout				
Intake and exhaust	mm (in)	0.5 (0.02)		
Valve spring				
Free length	mm (in)	27.6 (1.09)		
Tilt limit	mm (in)	1.0 (0.04)		
Valve stem				
Diameter				
Intake	mm (in)	5.475–5.490 (0.2156–0.2161)		
Exhaust	mm (in)	5.460–5.475 (0.2150–0.2156)		
Runout (*1)				
Intake	mm (in)	0.050 (0.0020)		
Exhaust	mm (in)	0.030 (0.0012)		
Valve guide				
Inside diameter				
Intake and exhaust	mm (in)	5.500–5.512 (0.2165–0.2170)		
Clearance				
Intake	mm (in)	0.010–0.037 (0.0004–0.0015)		
Exhaust	mm (in)	0.025–0.052 (0.0010–0.0020)		
Installation height	mm (in)	8.2–9.1 (0.32–0.36)		
Cam shaft				
Cam lobe height				
Intake	mm (in)	32.037–32.137 (1.2613–1.2652)		
Exhaust	mm (in)	32.038–32.138 (1.2613–1.2653)		
Cam lobe width				
Intake and exhaust	mm (in)	26.950–27.050 (1.0610–1.0650)		
Fuel pump cam diameter (*1)	mm (in)	19.600 (0.7717)		
Journal diameter	mm (in)	14.965–14.990 (0.5892–0.5902)		
Runout	mm (in)	0.030 (0.0012)		

(*1) The figures are for reference only.

Crankcase assembly

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Crankcase				
Crankshaft journal inside diameter	mm (in)	25.020–25.041 (0.9850–0.9859)		
Camshaft journal inside diameter	mm (in)	15.000–15.018 (0.5906–0.5913)		
Oil pump				
Rotor housing inside diameter	mm (in)	23.130–23.160 (0.9106–0.9118)		
Outer rotor diameter	mm (in)	22.980–23.000 (0.9047–0.9055)		
Outer rotor height	mm (in)	9.950–9.980 (0.3917–0.3929)		
Inner rotor height	mm (in)	9.950–9.980 (0.3917–0.3929)		
Piston				
Diameter	mm (in)	61.950–61.965 (2.4390–2.4396)		
Measuring point	mm (in)	1.0 (0.04)		
Oversize diameter				
1st	mm (in)	62.200–62.215 (2.4488–2.4494)		
2nd	mm (in)	62.450–62.465 (2.4587–2.4592)		
Piston clearance	mm (in)	0.035–0.065 (0.0014–0.0026)		
Ring groove (Top)	mm (in)	1.210–1.230 (0.0476–0.0484)		
Ring groove (2nd)	mm (in)	1.210–1.230 (0.0476–0.0484)		
Ring groove (Oil)	mm (in)	2.010–2.030 (0.0791–0.0799)		
Pin boss inside diameter	mm (in)	15.004–15.015 (0.5907–0.5911)		
Pin outside diameter	mm (in)	14.995–15.000 (0.5904–0.5906)		
Cylinder				
Bore	mm (in)	62.000–62.015 (2.4409–2.4415)		
Piston ring				
End gap measuring point (*1)	mm (in)	60.0 (2.36)		
Top ring				
Type		Barrel		
Dimension height (B)	mm (in)	1.170–1.190 (0.0461–0.0469)		
Dimension width (T)	mm (in)	2.500–2.700 (0.0984–0.1063)		
End gap (*1)	mm (in)	0.110–0.210 (0.0043–0.0083)		
Side clearance	mm (in)	0.020–0.060 (0.0008–0.0024)		
2nd ring				
Type		Taper		
Dimension height (B)	mm (in)	1.170–1.190 (0.0461–0.0469)		
Dimension width (T)	mm (in)	2.600–2.800 (0.1024–0.1102)		
End gap (*1)	mm (in)	0.260–0.410 (0.0102–0.0161)		
Side clearance	mm (in)	0.020–0.060 (0.0008–0.0024)		
Oil ring				
Dimension height (B)	mm (in)	1.850–2.000 (0.0728–0.0787)		
Dimension width (T) (*1)	mm (in)	2.550–2.850 (0.1004–0.1122)		
End gap (*1)	mm (in)	0.200–0.700 (0.0079–0.0276)		
Side clearance	mm (in)	0.010–0.180 (0.0004–0.0071)		

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Connecting rod				
Small end inside diameter	mm (in)	15.015–15.029 (0.5911–0.5917)		
Big end inside diameter	mm (in)	28.000–28.015 (1.1024–1.1030)		
Oil clearance	mm (in)	0.016–0.046 (0.0006–0.0018)		
Crankshaft				
Runout	mm (in)	0.020 (0.0008)		
Journal diameter (cylinder block side)	mm (in)	24.980–24.993 (0.9835–0.9840)		
Journal diameter (crankcase side)	mm (in)	24.982–24.994 (0.9835–0.9840)		
Crankpin diameter	mm (in)	27.969–27.984 (1.1011–1.1017)		
Crankpin width	mm (in)	21.000–21.100 (0.8268–0.8307)		
Valve lifter				
Outside diameter	mm (in)	7.965–7.980 (0.3136–0.3142)		

(*1) The figures are for reference only.

Lower unit technical data

Lower unit assembly

Item	Unit	Model		
		F4BMH	F5AMH	F6CMH
Lower unit				
Holding pressure	kPa (kgf/cm^2, psi)	98.0 (0.98, 14.2)		
Propeller shaft				
Runout	mm (in)	0.02 (0.001)		
Drive shaft				
Runout	mm (in)	0.4 (0.02)		

Specified tightening torque

Fuel system

Part to be tightened	Screw size	Tightening torques		
		N·m	kgf·m	ft·lb
Choke cable nut	—	4	0.4	3.0
Choke holder bolt	M5	4	0.4	3.0
Fuel cock screw	M6	7	0.7	5.2
Intake manifold bolt	M6	12	1.2	8.9
Throttle cable locknut	—	4	0.4	3.0
Throttle link screw	M4	1.5	0.15	1.11
Fuel pump valve screw	M3	0.5	0.05	0.37
Fuel pump screw	M4	2	0.2	1.5
Fuel pump bolt	M6	7	0.7	5.2

Power unit

Part to be tightened		Screw size	Tightening torques		
			N·m	kgf·m	ft·lb
CDI unit bolt		M6	10	1.0	7.4
Valve adjusting locknut		—	10	1.0	7.4
Drive plate screw		—	7	0.7	5.2
Start-in-gear protection cable locknut		—	2	0.2	1.5
Flywheel magnet nut		—	60	6.0	44.3
Engine shut-off switch nut		—	2	0.2	1.5
Power unit mounting bolt		M6	12	1.2	8.9
Crankcase bolt	1st	M6	5	0.5	3.7
	2nd		11	1.1	8.1
Blind plug		M8	20	2.0	14.8
Pivot bolt		—	10	1.0	7.4
Cylinder head bolt	1st	M8	13	1.3	9.6
	2nd		28	2.8	20.7
Thermostat cover anode screw		M5	2	0.2	1.5
Spark plug		—	13	1.3	9.6
Connecting rod cap bolt	1st	M7	6	0.6	4.4
	2nd		12	1.2	8.9
Breather plate screw		M5	8	0.8	5.9

Lower unit

Part to be tightened	Screw size	Tightening torques		
		N·m	kgf·m	ft·lb
Drain screw	—	9	0.9	6.6
Flushing screw	—	9	0.9	6.6
Lower case mounting bolt (S-transom model)	M6	11	1.1	8.1
Lower case mounting bolt (L-transom model)	M6	15	1.5	11.1
Shift joint bolt	M6	16	1.6	11.8
Check screw	—	9	0.9	6.6

Bracket unit

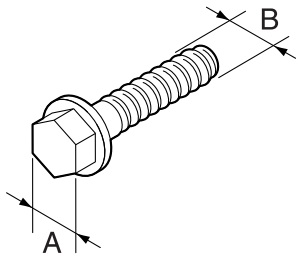
Part to be tightened	Screw size	Tightening torques		
		N·m	kgf·m	ft·lb
Throttle rod screw	M5	4	0.4	3.0
Throttle grip screw	M5	4	0.4	3.0
Tiller handle mounting bolt	M8	28	2.8	20.7
Carrying handle bolt	M8	19	1.9	14.0
Start-in-gear protection cable locknut	—	4	0.4	3.0
Primer pump holder bolt	M6	11	1.1	8.1
Shift lever bolt	M8	19	1.9	14.0
Shift link bolt	M5	3.5	0.35	2.58
Grease nipple	—	3	0.3	2.2
Self-locking nut	—	15	1.5	11.1

General tightening torque

This chart indicates the tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components and assemblies are provided in the applicable sections of this manual. To prevent warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified torque is reached. Unless otherwise indicated, torque specifications require clean, dry threads.

Components should be at room temperature.

Width across flats (A)	Screw size (B)	General torque specifications		
		N·m	kgf·m	ft·lb
8 mm	M5	5	0.5	3.7
10 mm	M6	8	0.8	5.9
12 mm	M8	18	1.8	13.3
14 mm	M10	36	3.6	26.6
17 mm	M12	43	4.3	31.7

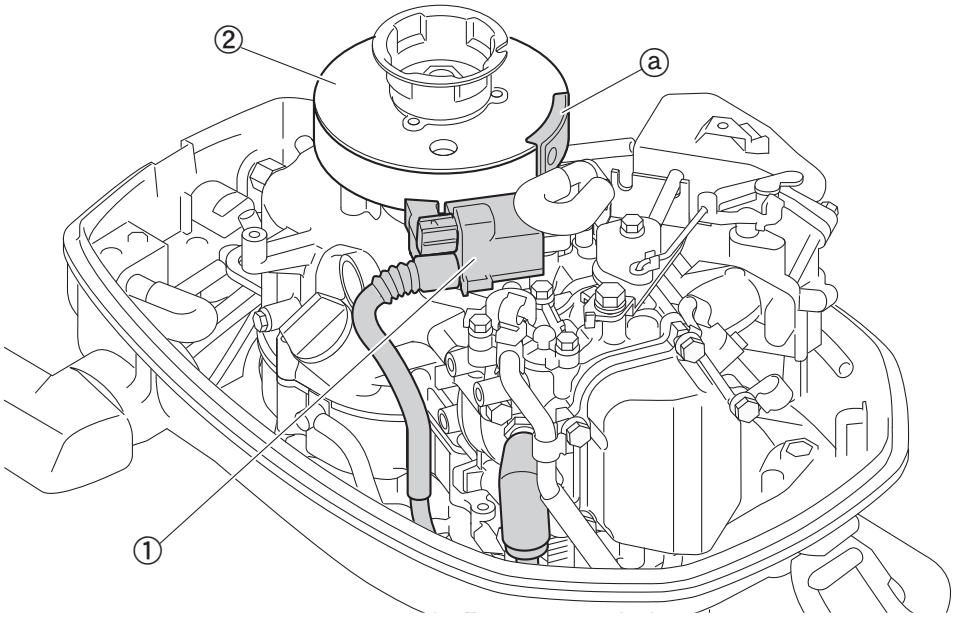


Technical features and description

Engine control system

Outline

The F4B, F5A, F6C adopt the CDI ignition system consisting of the CDI unit and a permanent magnet of the flywheel magnet.
The CDI unit has a compact design with an integrated ignition coil.
There are two types of ignition control systems. One is ignition timing control at normal operation, and the other one is ignition cut-off control during engine cranking and when over-revving.

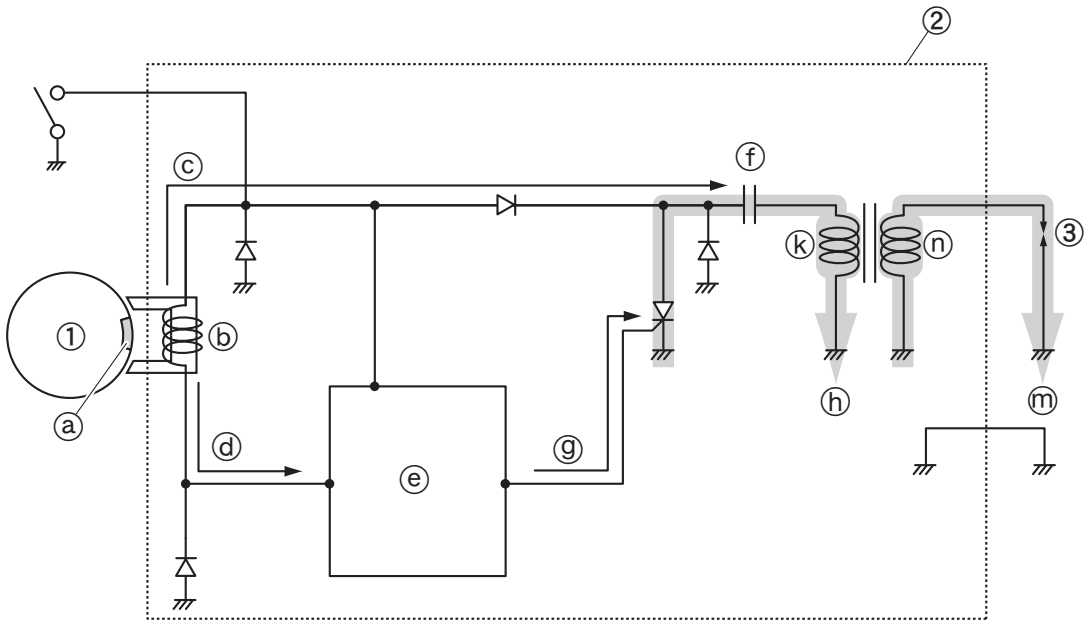


① CDI unit
② Flywheel magnet

ⓐ Permanent magnet

CDI unit

When the permanent magnet ⓐ on the flywheel magnet ① passes in front of the CDI unit ②, the exciter coil ⓑ in the CDI unit ② induces an electric current ⓒ to produce a crank signal ⓓ that will be transmitted to the ignition control circuit ⓔ. The electric current that has been induced by the exciter coil ⓑ is also sent to charge the capacitor ⓕ.
When the ignition control circuit ⓔ transmits an ignition signal ⓖ, the capacitor ⓕ will discharge and produce current ⓗ in the primary coil ⓚ, and induce a high voltage ⓜ in the secondary coil ⓝ to ignite the spark plug ③.
The CDI unit ② ignites the spark plug ③ once per crankshaft rotation.



Ignition timing control

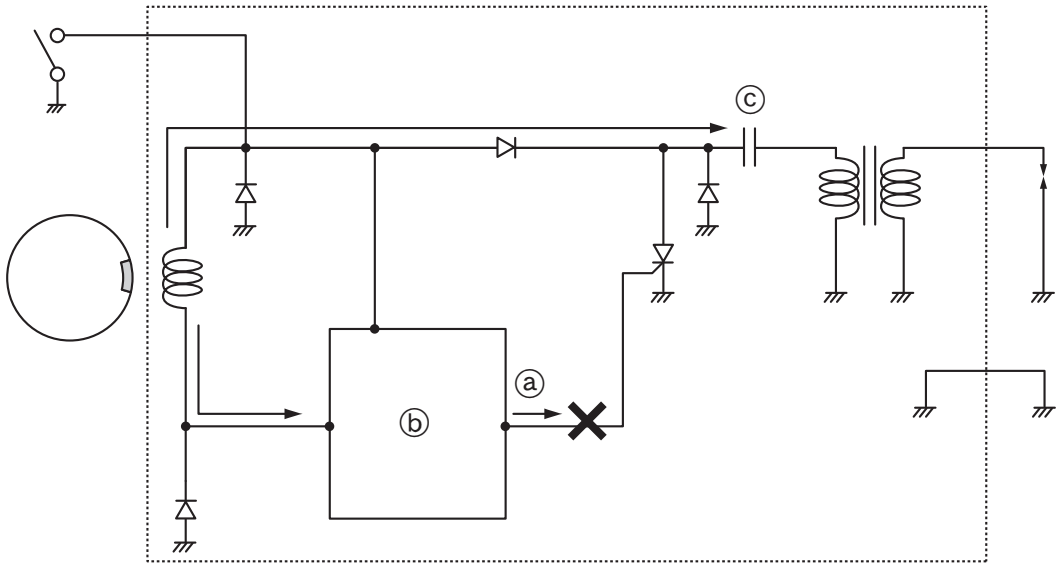
The CDI unit ignites the spark plug at the ignition timings that are programmed based on each engine speed.
The engine speed will be calculated based on the crank signals that are input into the ignition control circuit.

Ignition cut-off control

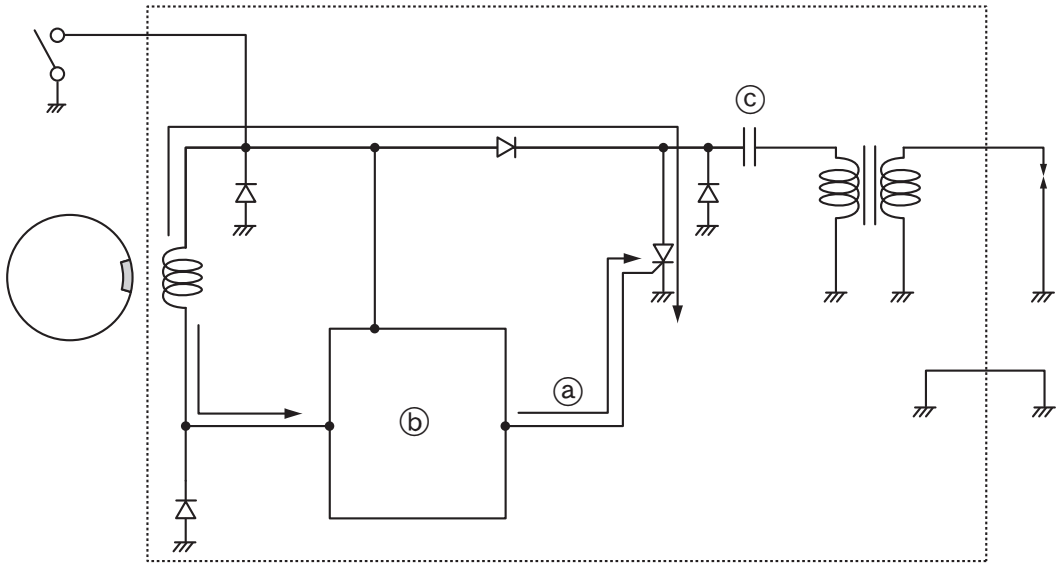
There are two types of ignition cut-off control. One is a system to cut off the ignition during engine cranking without outputting ignition signals ⓐ from ignition control circuit ⓑ when the engine speed is 150 r/min or lower. The other one is a system to stop ignition to prevent damage to the engine when over-revving. While this control system is activated, the ignition control circuit ⓑ keeps outputting ignition signals ⓐ without charging the capacitor ⓒ.

Ignition control during engine cranking	Engine speed control
150 r/min or less	5900 r/min or more

A



B

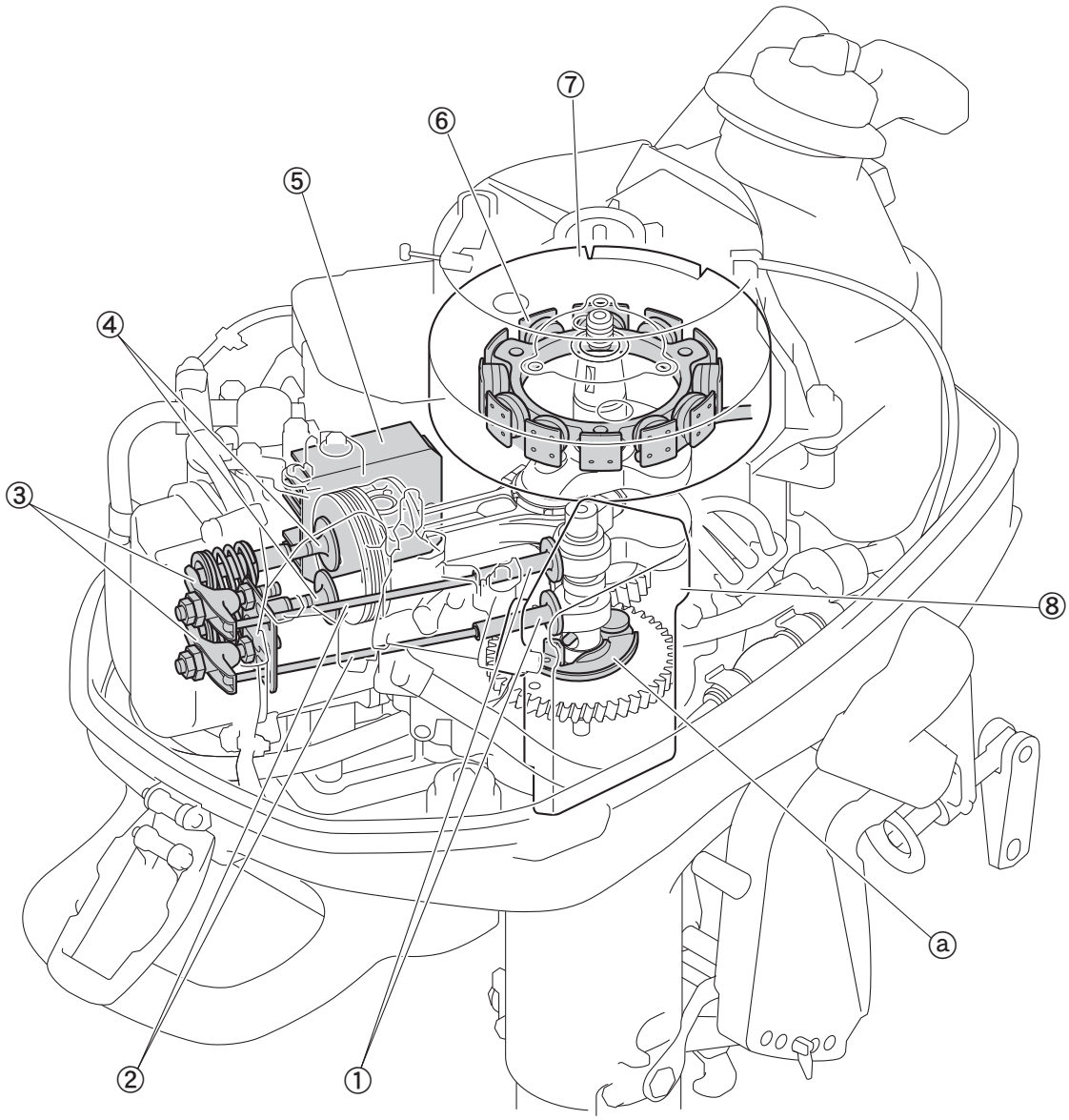


A Ignition control during engine cranking
B Engine speed control

Power unit system

Outline

The F4B, F5A, F6C feature an OHV engine with a newly designed cylinder head and cylinder block.
The decompressor is built into the camshaft to facilitate engine cranking with a manual starter.
In addition, a blowby gas reburning system is incorporated to reduce the amount of oil contained in the blowby gases.
The flywheel magnet, lighting coil, and Rectifier Regulator are available as optional accessories, and these will enable battery charging. (Optional for European market)

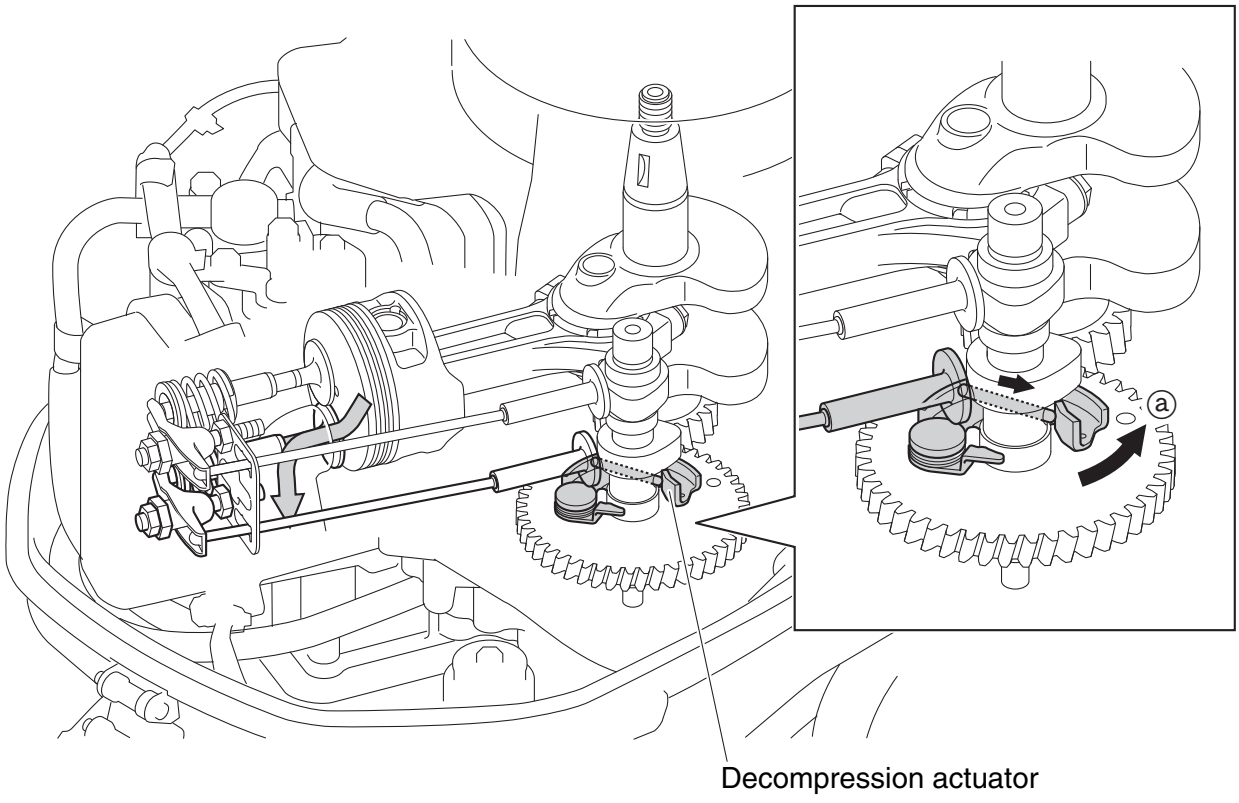


① Valve lifter
② Push rod
③ Rocker arm
④ Valve
⑤ Rectifier Regulator (optional)
⑥ Lighting coil (optional)
⑦ Flywheel magnet (optional)
⑧ Intake silencer

ⓐ Decompression actuator

Automatic decompressor

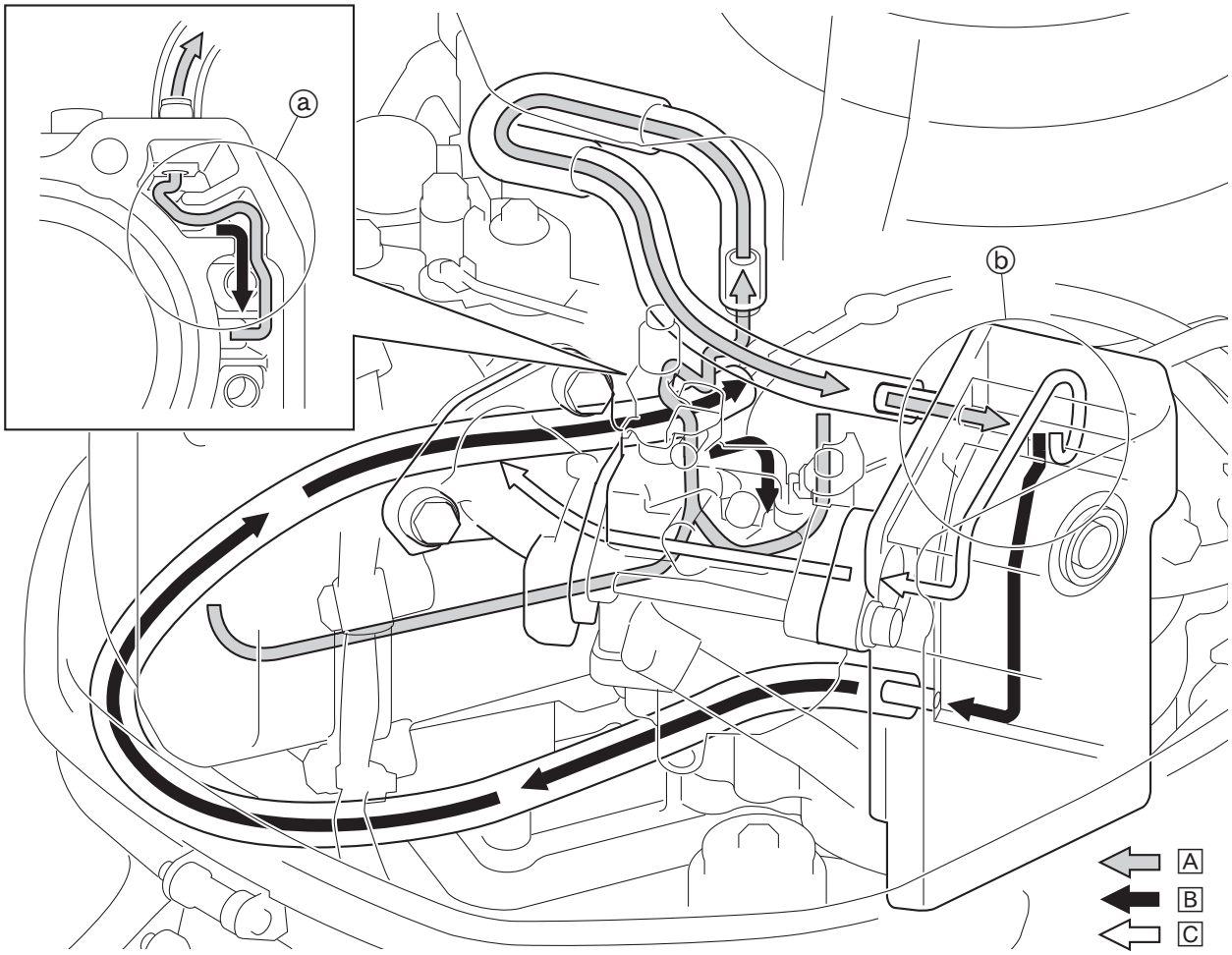
To facilitate engine cranking, the decompression actuator forcefully opens the exhaust valve on the compression stroke to release compression pressure during engine cranking and prevent pressure in the cylinder from increasing. As the cranking speed increases, the decompression actuator will move in the direction of ⓐ due to the centrifugal force and the exhaust valve will return to normal operation.



A Compression pressure

Blowby gas reburning system

A blowby gas reburning system is adopted to be respectful with the environment.
To reburn the blowby gases, this engine separates oil from the blowby gases in two labyrinths.
First, oil is separated from the blowby gases in the cylinder block labyrinth, and then in the intake silencer labyrinth.
The oil separated from the blowby gases flows back to the crankcase, and the blowby gases separated from the oil are sucked into the combustion chamber.

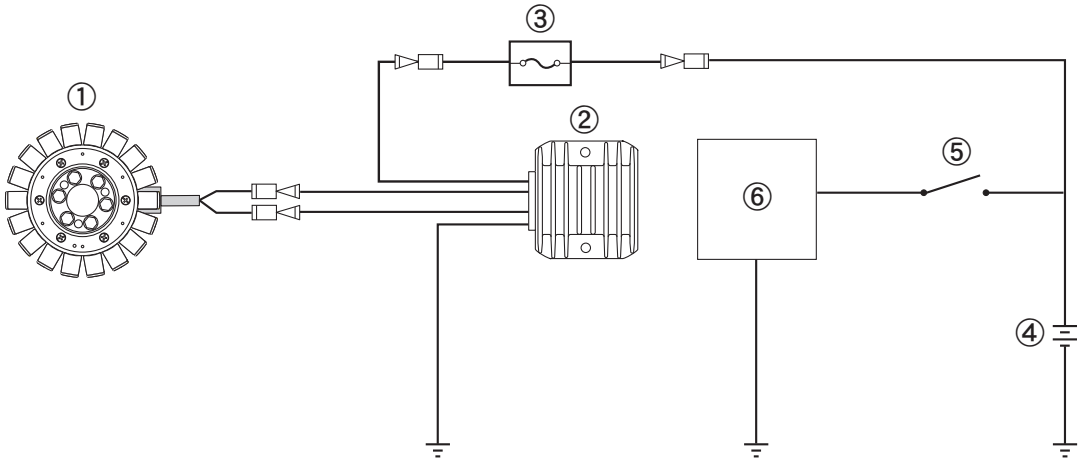


ⓐ Cylinder block labyrinth
ⓑ Intake silencer labyrinth

A Blowby gas
B Engine oil
C Air

Lighting coil (optional for European market)

The F4B, F5A, F6C can be equipped with a flywheel magnet, lighting coil, and Rectifier Regulator, available as optional accessories, to enable battery charging.
The electrical current generating capacity is 6A when the engine speed is at 6000 r/min.

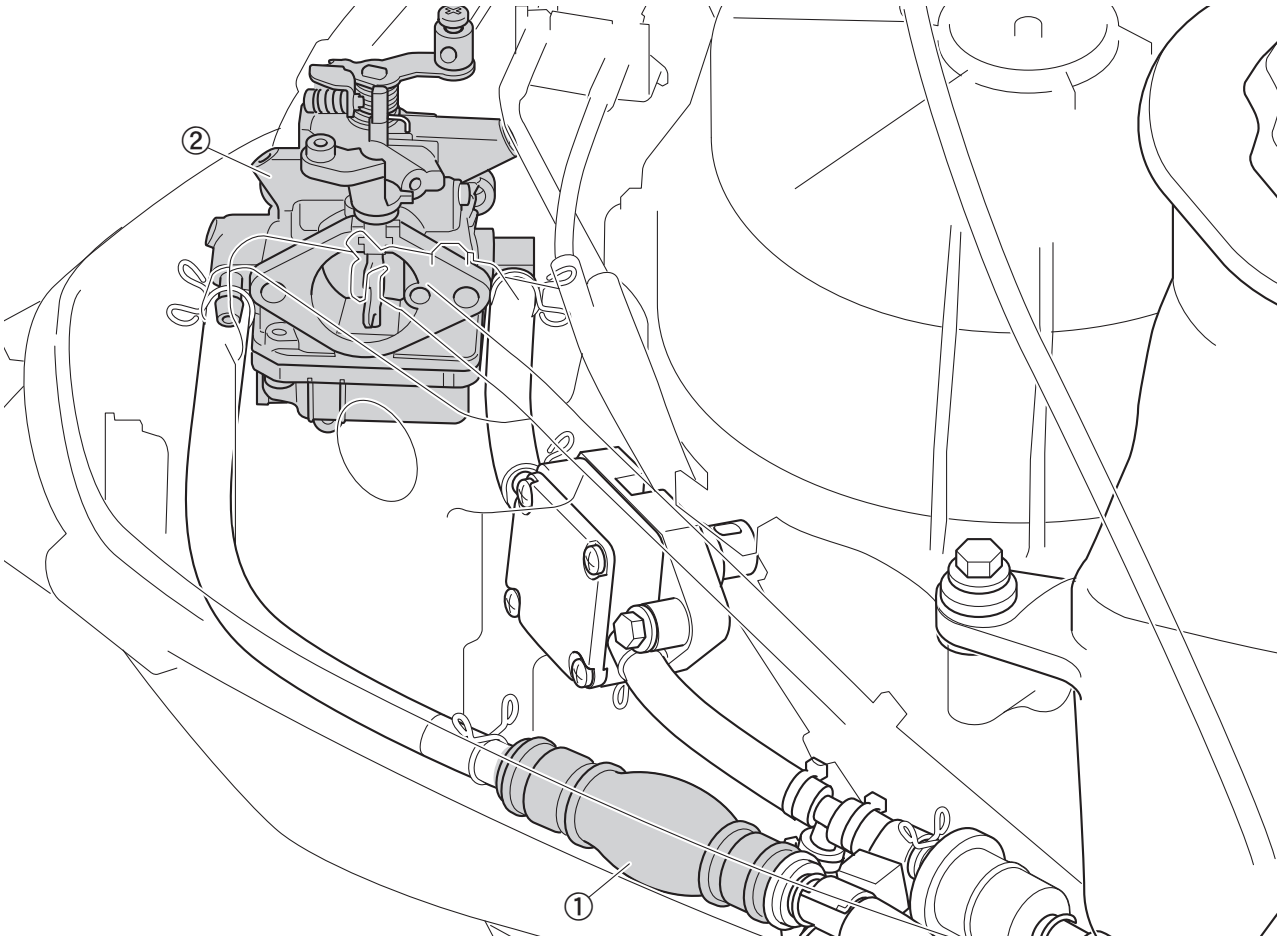


① Lighting coil
② Rectifier Regulator
③ Fuse
④ Battery
⑤ Switch
⑥ Electrical component

Fuel system

Outline

This engine is equipped with a simply-designed and reliable butterfly-type carburetor. A built-in primer pump is also provided in order to ease engine starting when the float chamber is empty, or when operating the engine after it has been stored for a long time.



① Primer pump
② Carburetor

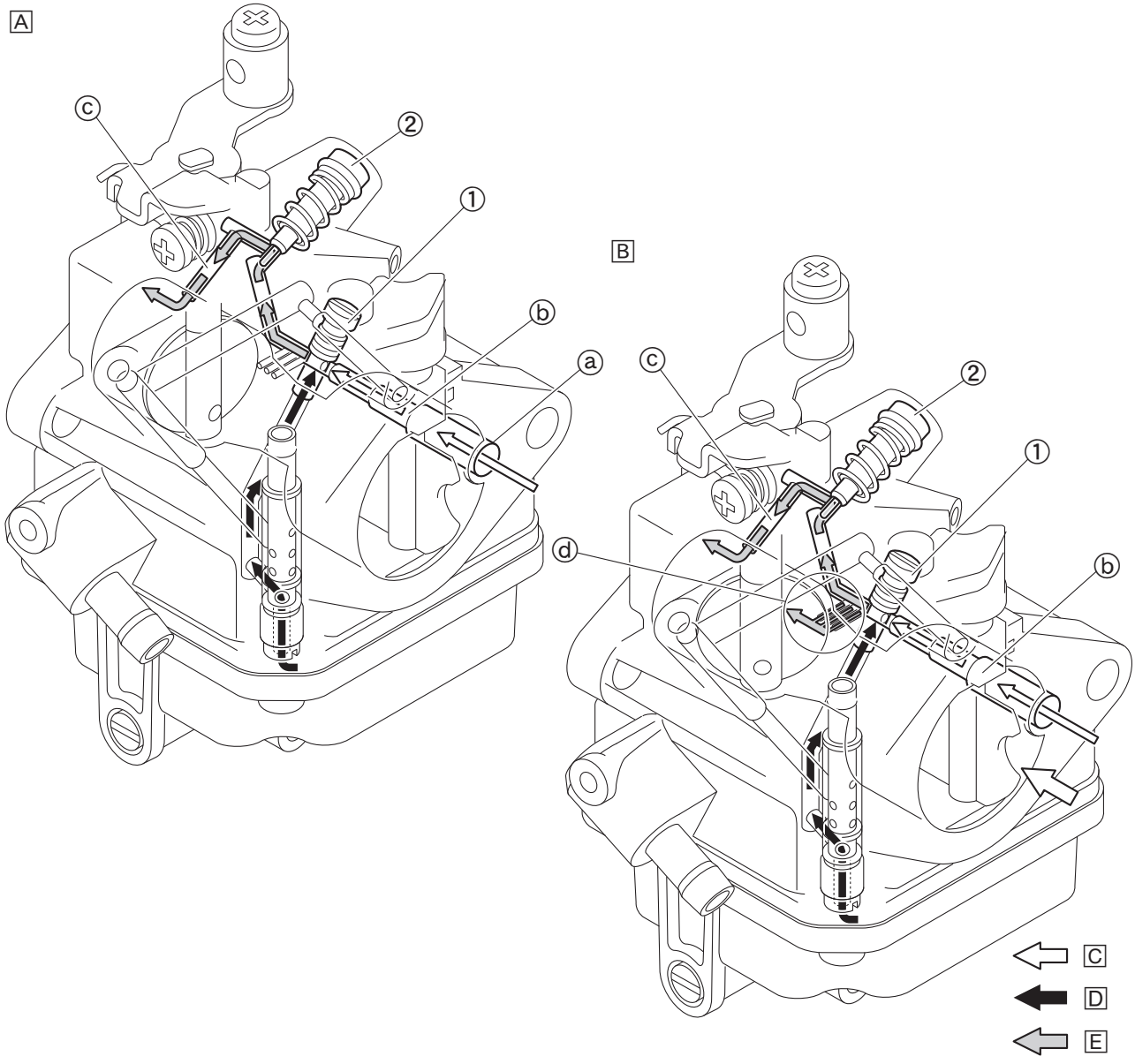
Carburetor

Idle and low speed operation

When the engine is running at idle or at low speed, negative pressure generated in the pilot passage ⓐ will be increased.

Air is drawn into the pilot passage through the pilot air jet ⓑ to be mixed with the fuel that is also sucked into the passage through the pilot jet ①. This air and fuel mixture is supplied to the engine through the pilot hole ⓒ. The pilot screw ② controls the amount of air and fuel mixture that will be supplied to the engine.

When running at low speed, the air and fuel mixture is supplied to the engine through the pilot hole ⓒ and through the bypass holes ⓓ.



A Idle operation
B Low speed operation
C Air
D Fuel
E Air and fuel mixture

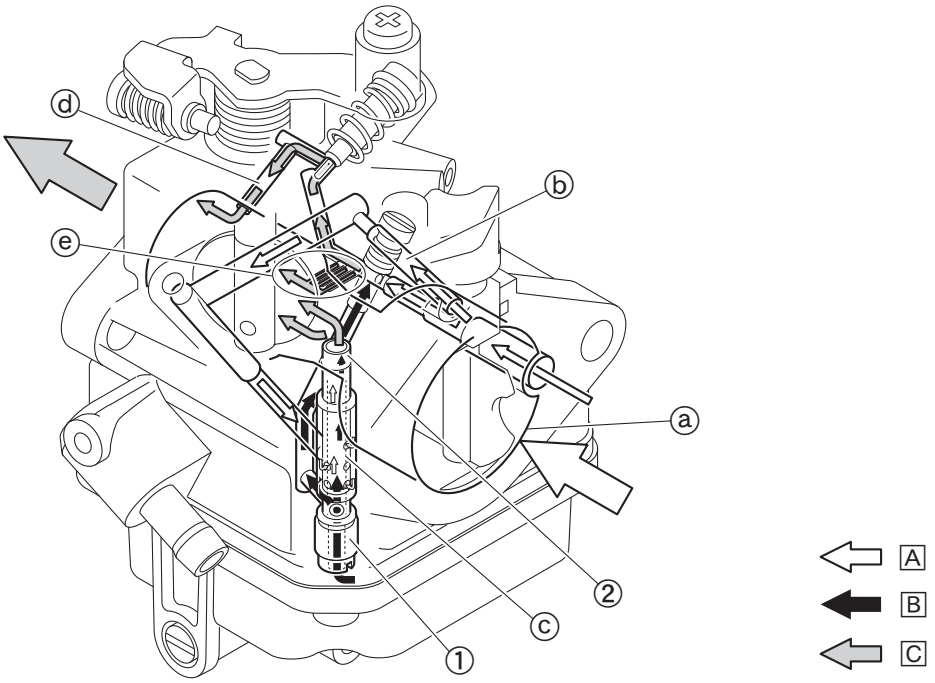
Medium speed operation

When running at medium speed, the air that has entered through the main bore ⓐ flows faster, causing negative pressure to increase in the main bore ⓐ.

When the negative pressure in the main bore ⓐ increases, the fuel is sucked from the main jet ① to be mixed with the air that has entered from the main air jet ⓑ through the emulsion tube ⓒ, and then drawn into the main nozzle ②.

The fuel drawn into the main nozzle ② is mixed with the air in the venturi, producing air and fuel mixture that will be supplied to the engine.

The air and fuel mixture is simultaneously supplied to the engine through the pilot hole ⓓ and the bypass holes ⓔ.

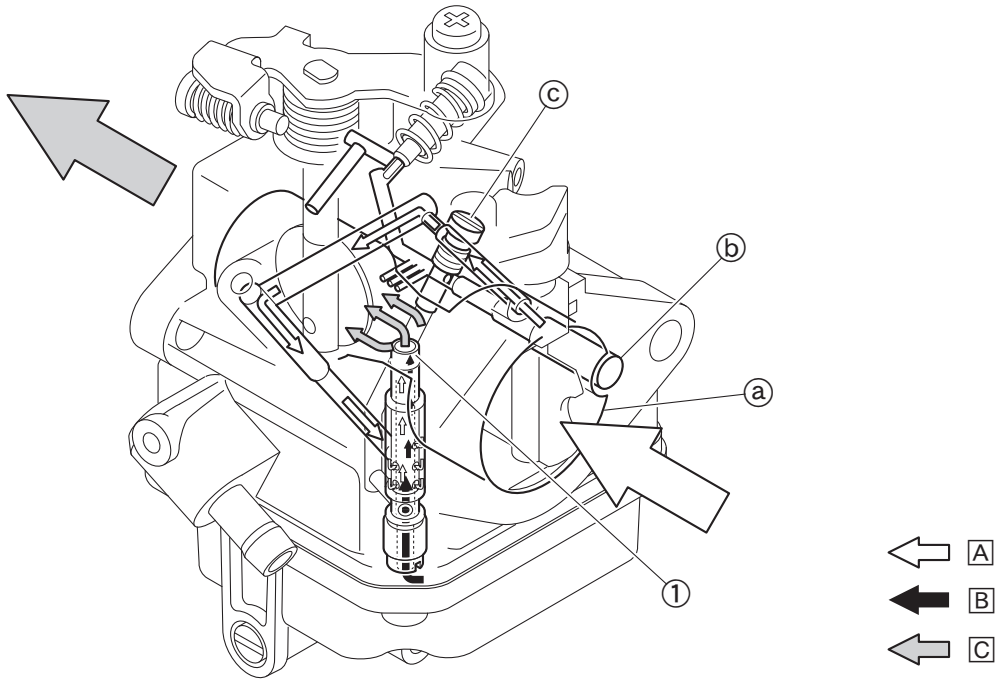


A Air
B Fuel
C Air and fuel mixture

High speed operation

When running at high speed, the throttle valve opening is near the fully open position, and the negative pressure generated in the main bore ⓐ becomes even higher. Consequently, a larger amount of air and fuel mixture is drawn from the main nozzle ① to be supplied to the engine.

At high speed operation, as the negative pressure in the main bore ⓐ becomes higher than the negative pressure in the pilot passage ⓑ, fuel is not drawn through the pilot jet ⓒ.

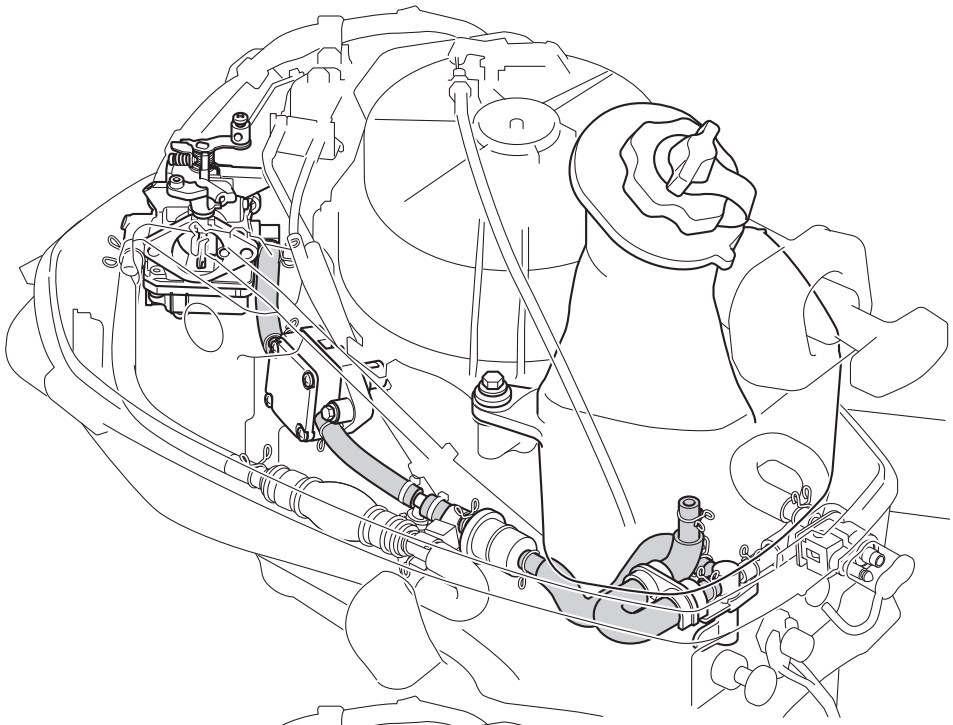


A Air
B Fuel
C Air and fuel mixture

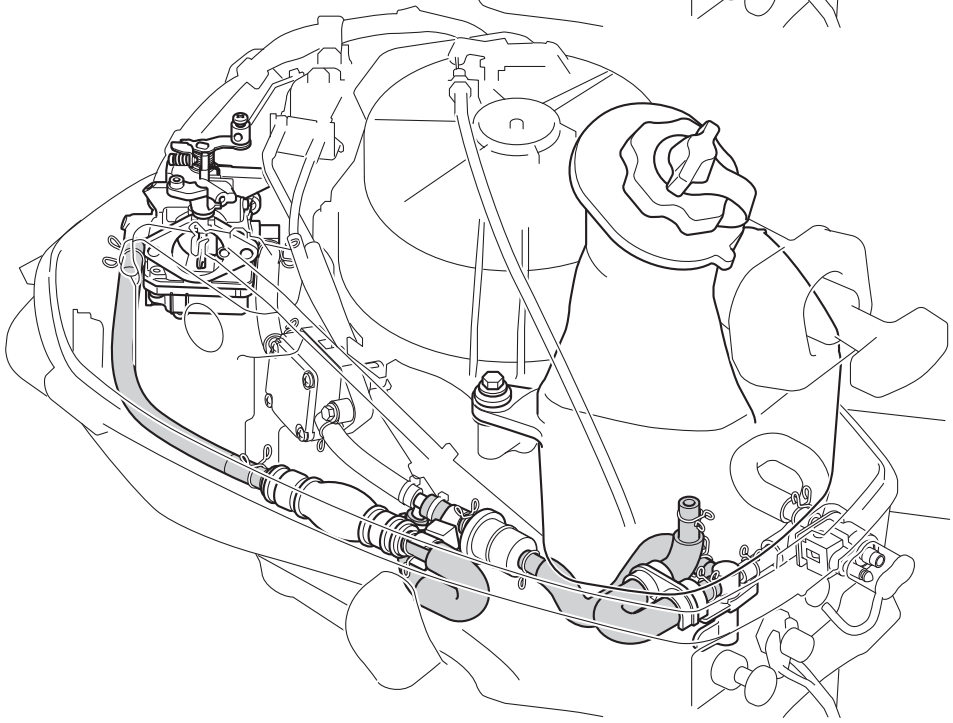
Built-in primer pump

This engine is equipped with a built-in primer pump in order to ease engine starting when the float chamber is empty, or when operating the engine after it has been stored for a long time.
The built-in primer pump sends fuel directly to the float chamber in the carburetor without operating the mechanical fuel pump.

A



B



A Fuel passage (mechanical fuel pump)
B Fuel passage (built-in primer pump)

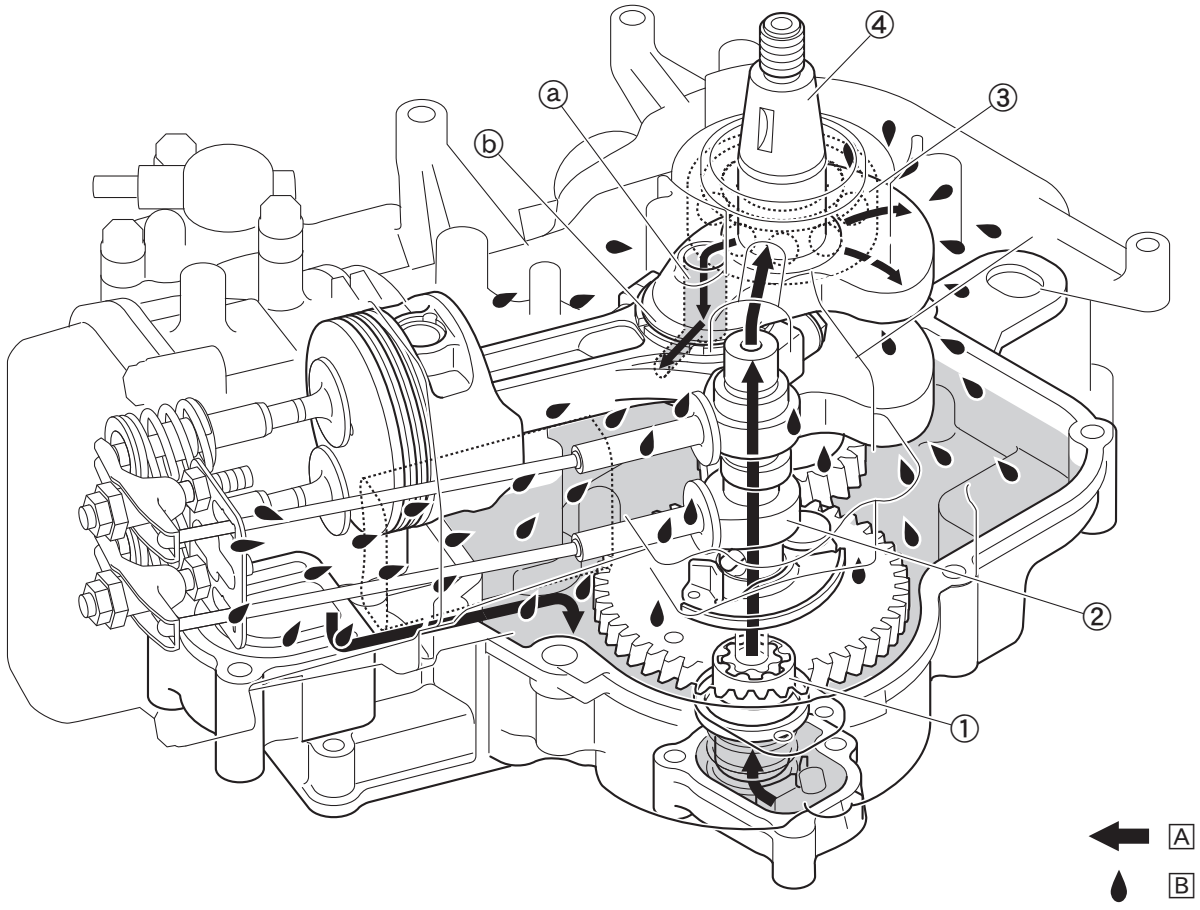
Lubrication system

Outline

For the first time in a single-cylinder engine, a trochoid type oil pump has been adopted in order to improve lubrication performance.
The oil hole in the crankshaft allows oil to lubricate the crankpin and connecting rod.

Oil pump and engine oil flow

The oil pump is driven by the camshaft.
The oil that has been pumped out by the oil pump flows into the camshaft, and it is then sent to the upper part of the engine to lubricate the crankshaft journal bearing.
After that, the oil flows down to the crankshaft, and then it is splashed by the rotational force of the crankshaft to lubricate all parts of the engine.
There is an oil hole in the crankshaft.
The oil entered through the oil hole will flow down to the crankpin to lubricate the crankpin and connecting rod.



① Oil pump
② Camshaft
③ Crankshaft journal bearing
④ Crankshaft

ⓐ Oil hole
ⓑ Crankpin

A Engine oil flow
B Splashing oil

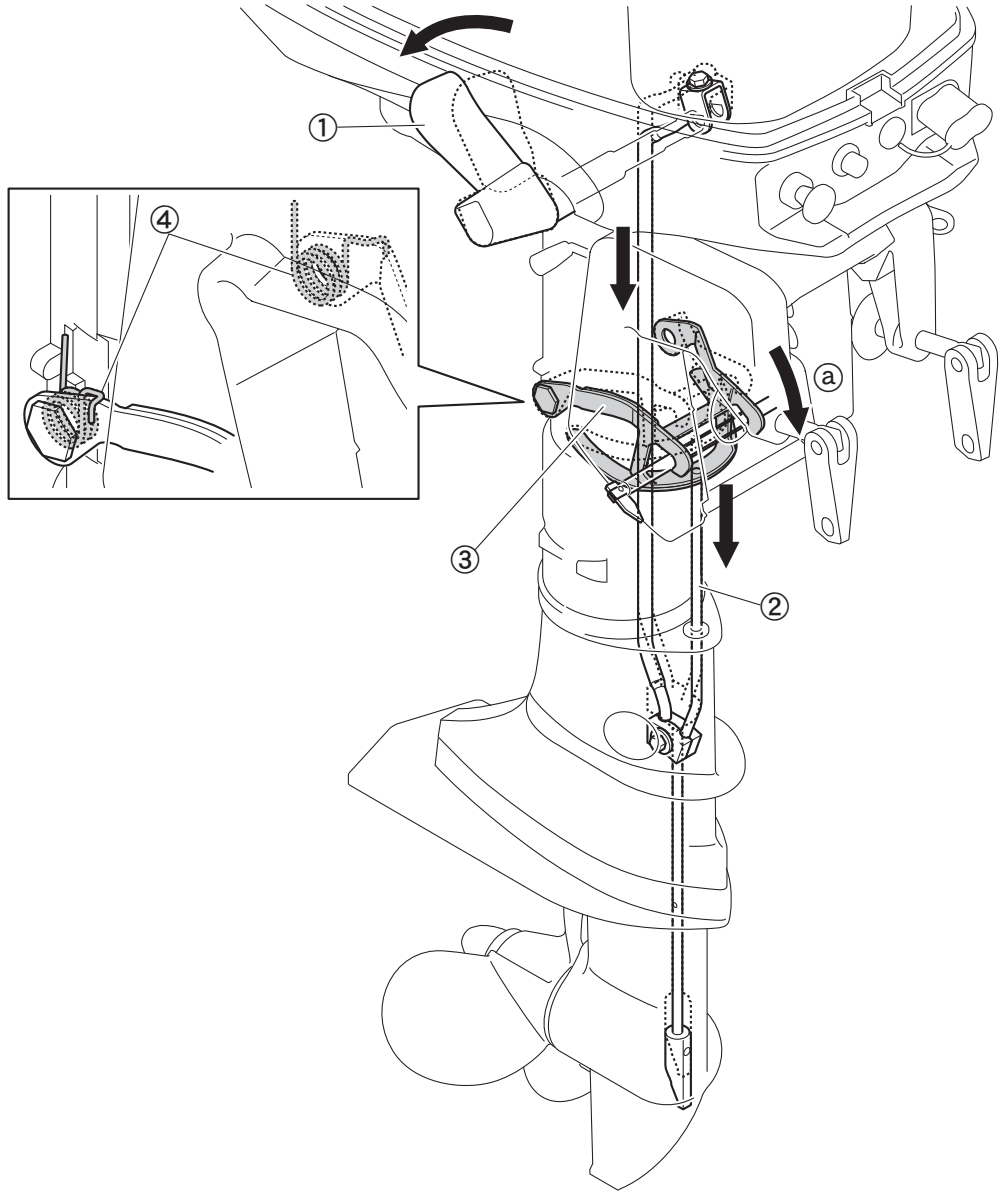
Tilt system

Outline

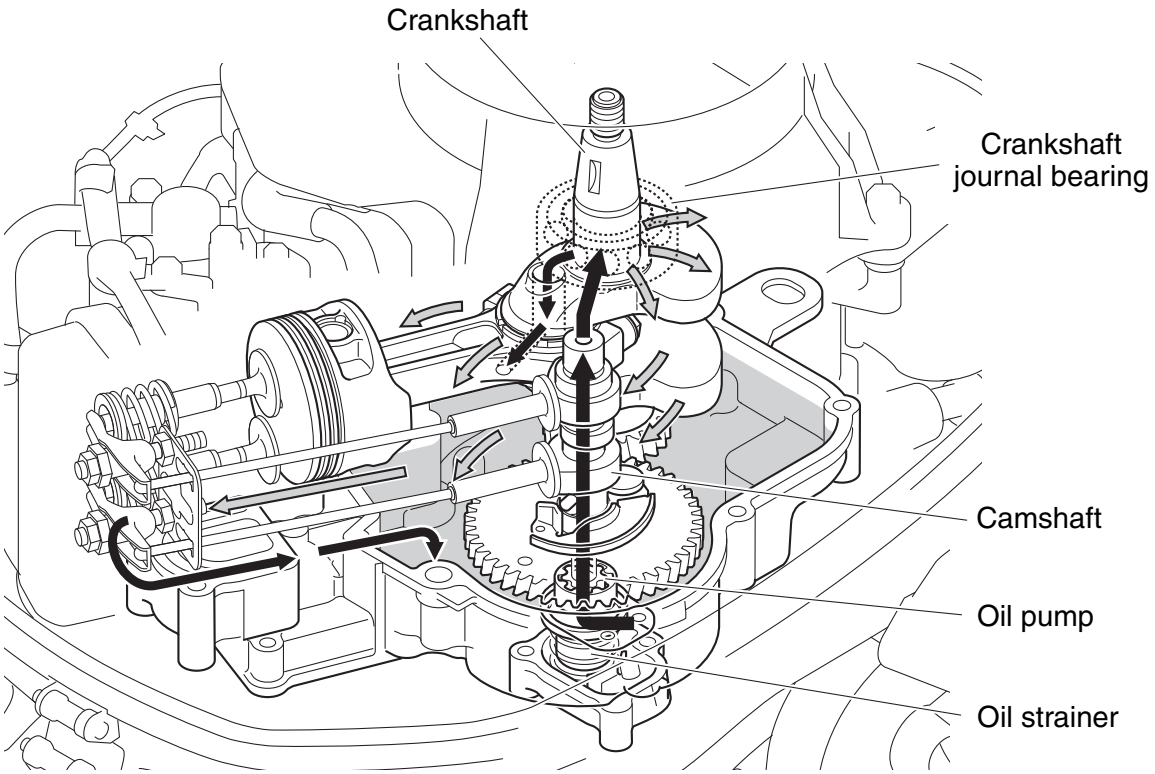
The incorporated reverse lock system prevents the outboard motor from tilting up when the shift position is in reverse and the throttle is applied.

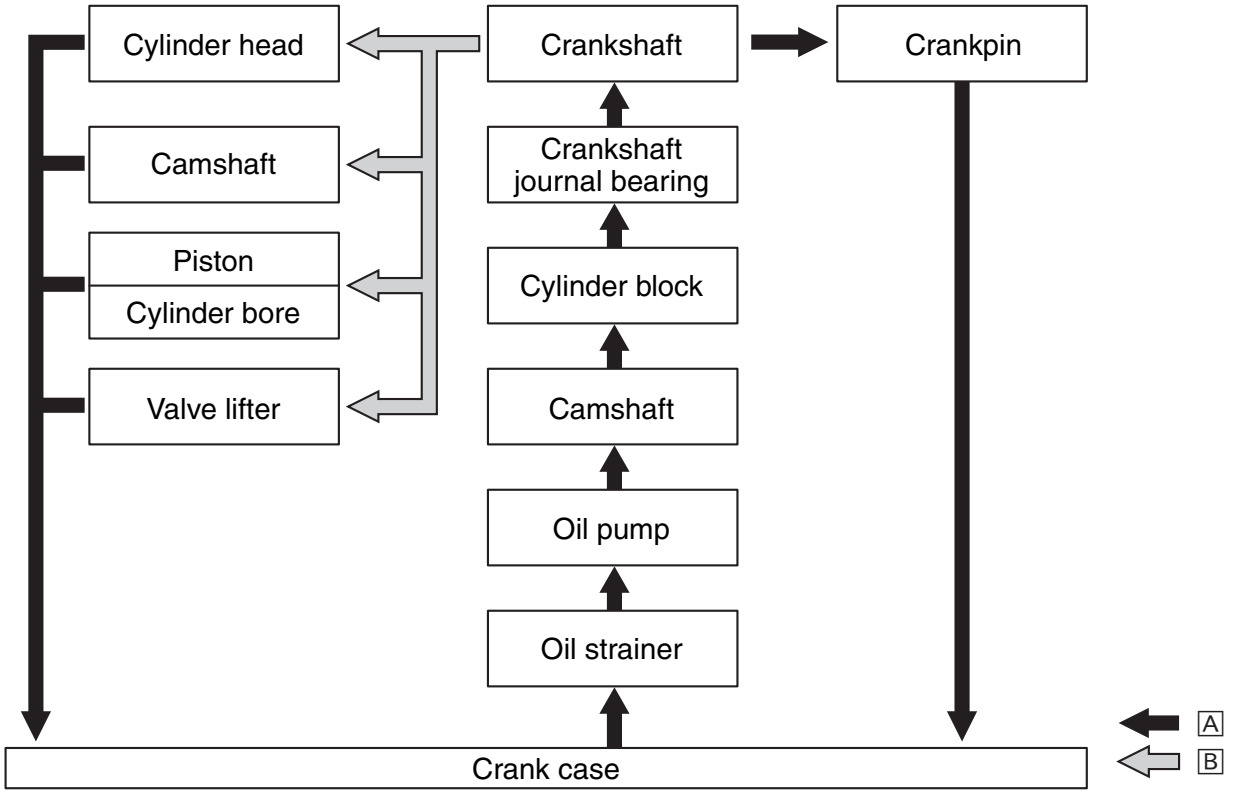
Reverse lock system

In this system, the tilt up function will be automatically locked when shifted in reverse. When the shift lever ① is moved to the reverse position, the rod ②, which was pushing up the reverse lock ③, moves down. Then, due to the return spring ④ force, the reverse lock ③ is forced to move in the direction ⓐ to prevent the outboard motor from tilting up.
The reverse lock system does not operate when the outboard motor is tilted up.



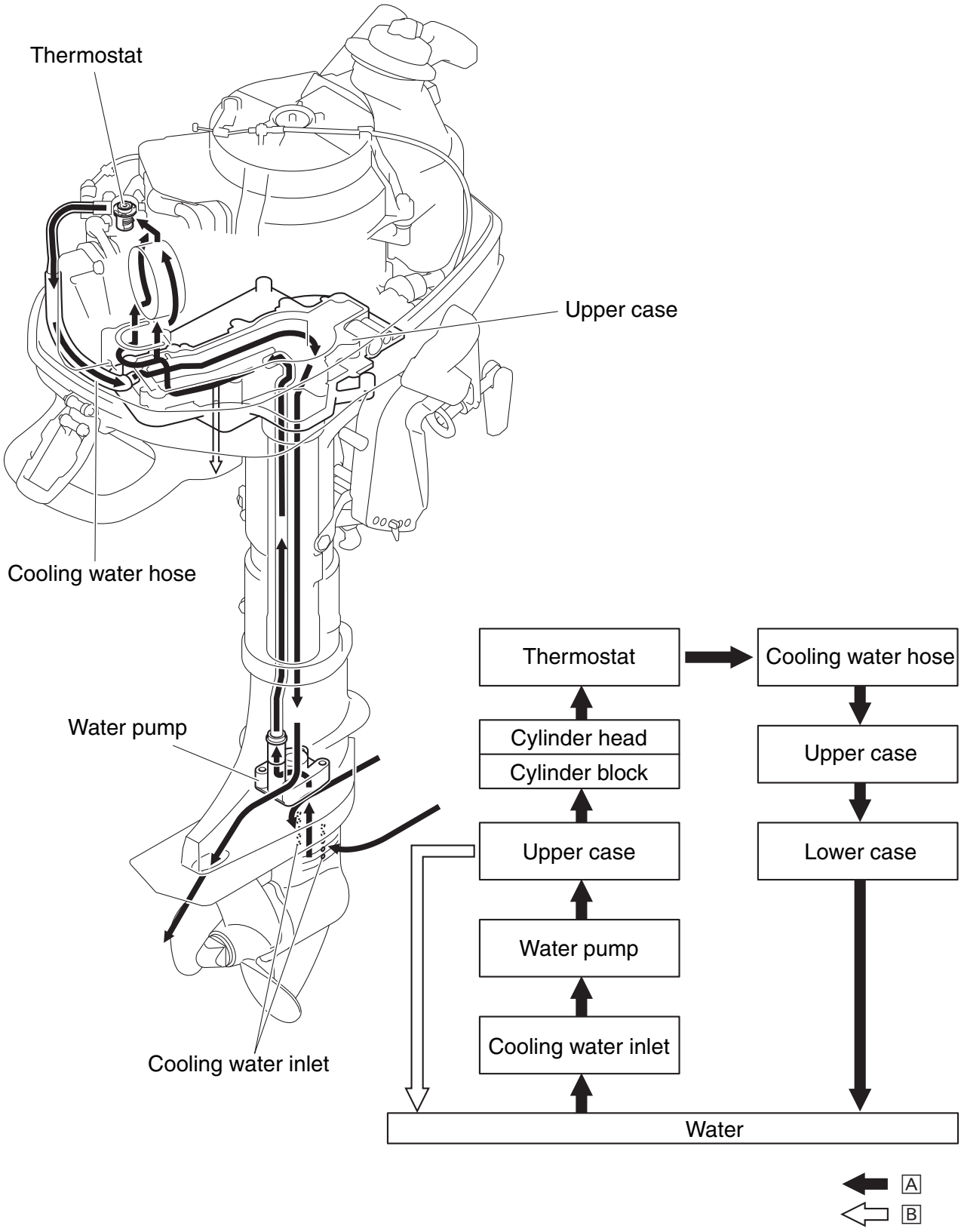
Lubrication diagram





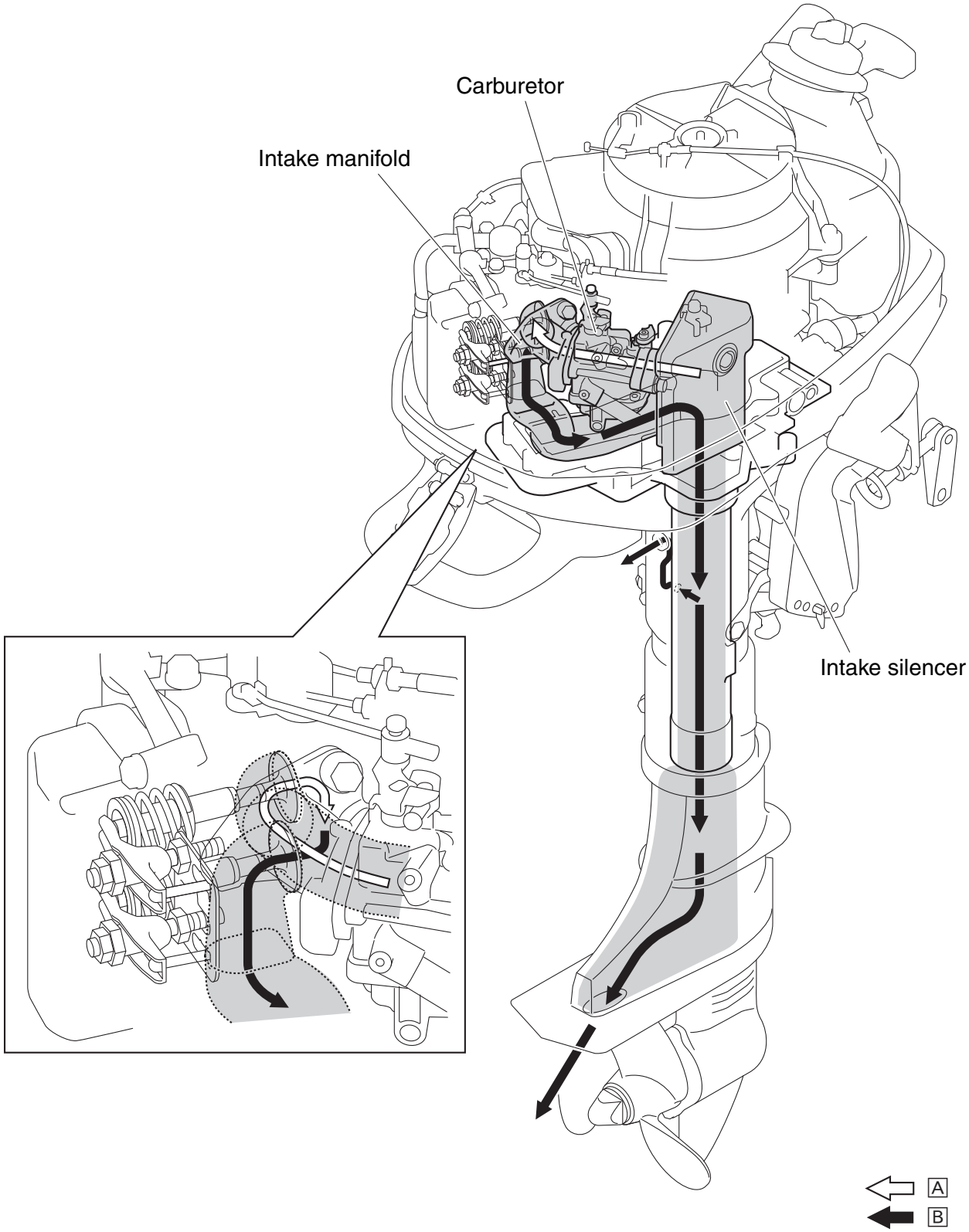
A Engine oil flow
B Splashing oil

Cooling flow diagram



A Cooling water flow
B Pilot water

Intake and exhaust flow diagram



A Intake air flow
B Exhaust gas flow

Rigging information

Outboard motor installation

⚠ WARNING

- **Overpowering a boat could cause severe instability. Do not mount an outboard motor with more horsepower than the maximum rating on the capacity plate of the boat. If the boat does not have a capacity plate, consult the boat manufacturer.**
- **Improper mounting of the outboard motor could result in hazardous conditions, such as poor handling, loss of control, or fire hazards. Consult your dealer or have a Yamaha-trained person experienced in proper rigging mount the outboard motor.**

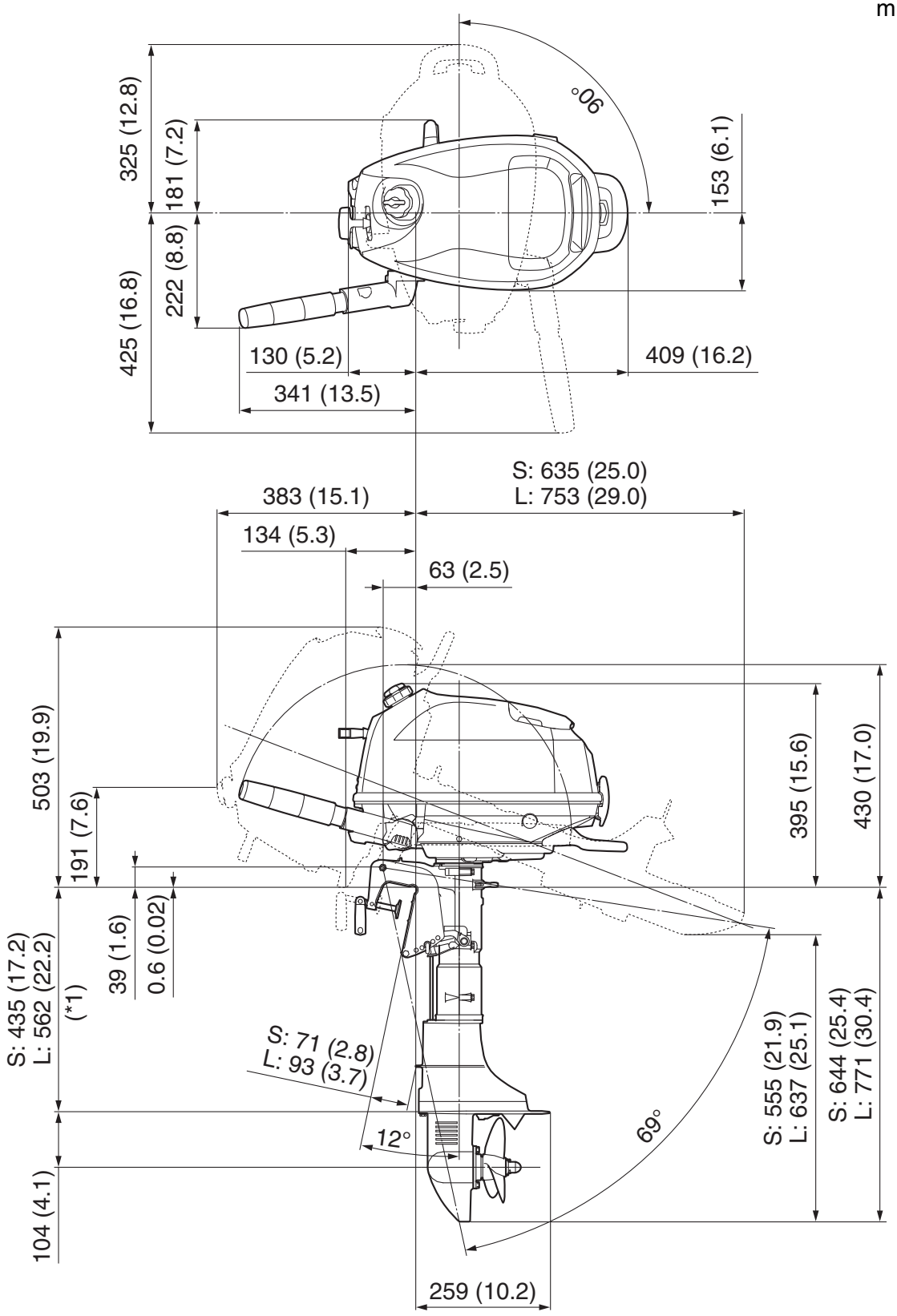
⚠ WARNING

Too much weight on the transom could change the center of gravity, buoyancy, operating balance, or performance of the boat, which could cause loss of control or swamping. Consult the boat manufacturer for the maximum engine weight allowable on the transom, which is different from the overall boat capacity. Overloading the transom with an outboard motor that is too heavy could also damage the hull, transom, deck, or helm area, as well as the outboard motor and other equipment.

Dimension

Exterior F4BMH, F5AMH, F6CMH

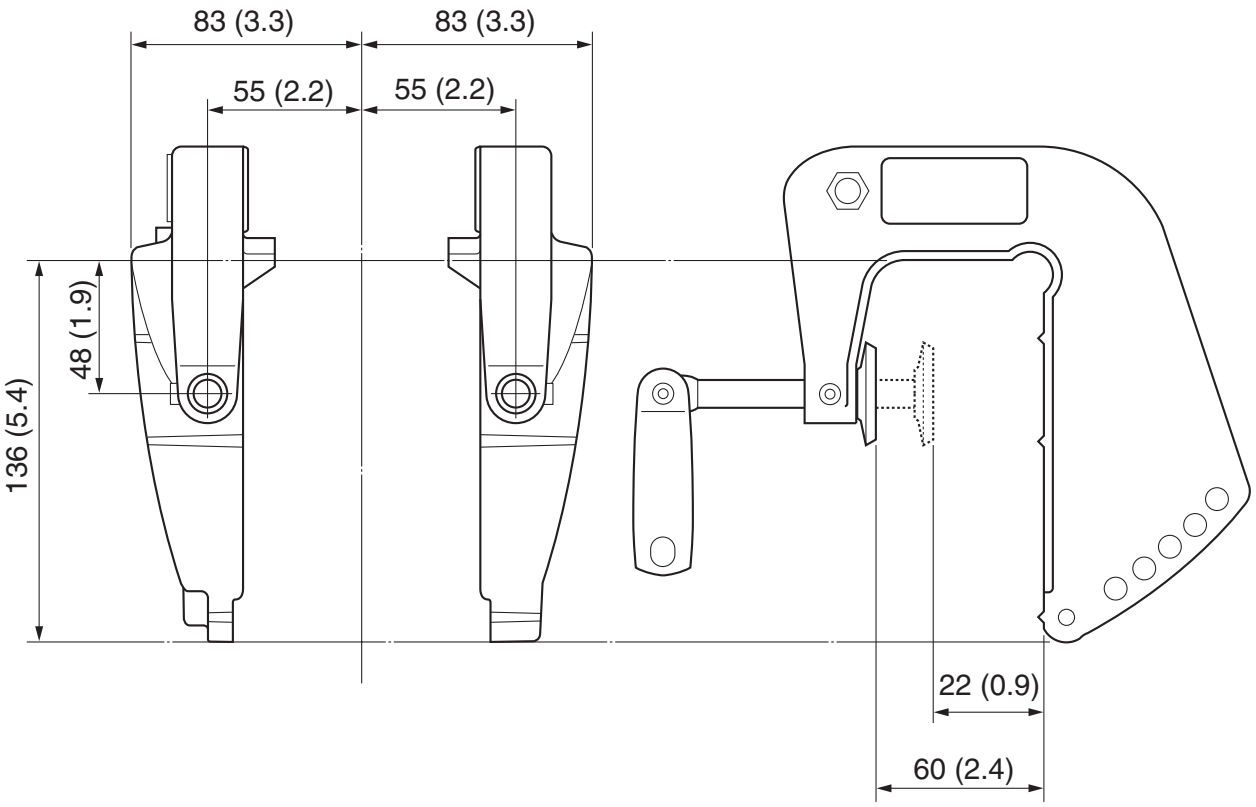
mm (in)



(*1) Transom height

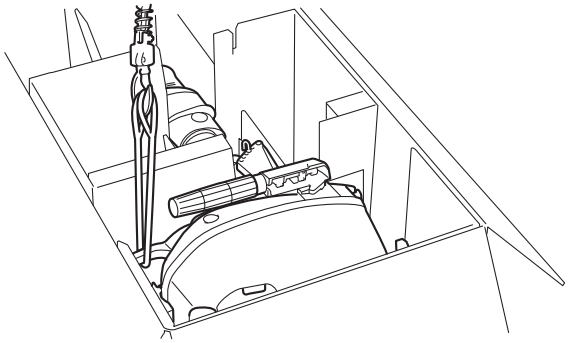
Clamp bracket

mm (in)

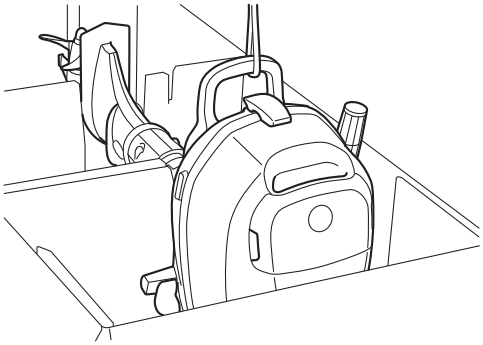


Uncrating procedure

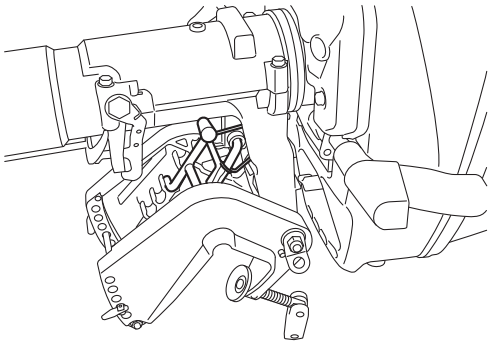
1. Check the crate for any shipping damage.
2. Open the top cover.
3. Remove the wrapping, and then check the outboard motor for concealed damage.
4. Pass the lifting rope around the carrying handle. ***NOTICE:*** **Do not use a lifting harness to lift up the outboard motor.**
5. Tension the lifting rope.



6. Lift up the outboard motor carefully so that the carrying handle is facing up.



7. Place the outboard motor on the boat or on a stand.



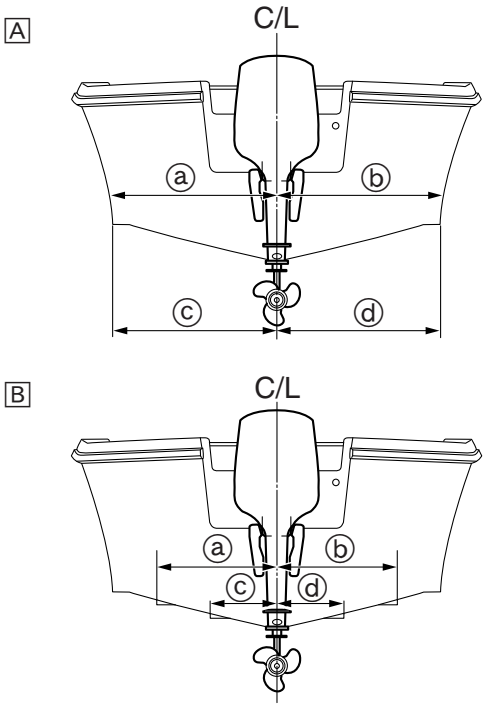
TIP:

Place the outboard motor on the boat or on a stand so that the clamp bracket is in the tilt-up position for easy mounting.

Outboard motor mounting

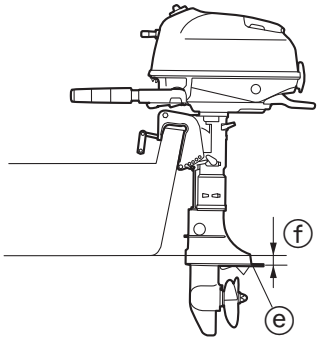
Proper mounting of the outboard motor will provide better performance, maximum reliability, and highest customer satisfaction. This chapter contains the specifications necessary to mount the outboard motor, and may vary slightly depending on applications.
When mounting the outboard motor, make sure that there is sufficient clearance for the outboard motor to fully move to port and starboard, as well as fully tilt up. See “Dimension” (3-2).

1. Place the outboard motor on the vertical centerline of the boat transom. Check that distance ⓐ is equal to distance ⓑ and that distance ⓒ is equal to distance ⓓ.



A Hull without strakes
B Hull with strakes
C/L: Centerline of transom

2. Adjust the position of the outboard motor so that the height of the anti-cavitation plate ⓔ is between the bottom of the boat and a maximum of 25.0 mm (1.0 in) ⓕ below it.



TIP:
This mounting height information is for reference only. It is impossible to provide complete instructions for every possible boat and outboard motor combination.

3. Tighten the clamp screws.

Installing the charging system (optional for European market)

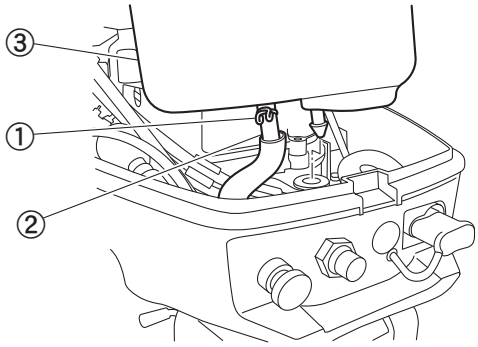
1. Drain any remaining fuel from the fuel tank.

2. Remove the manual starter. See "Removing the manual starter" (7-7).

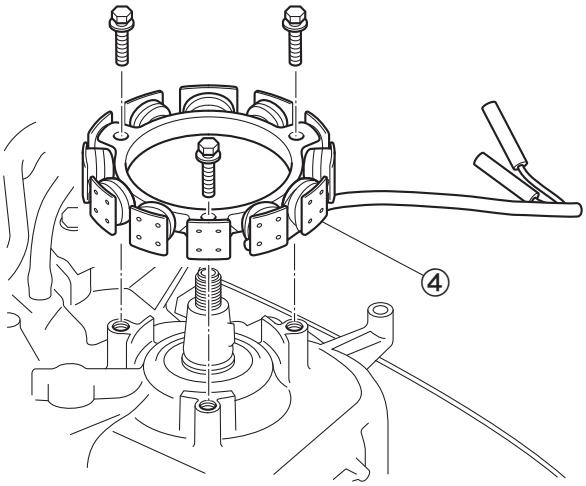
3. Remove the flywheel magnet. See "Removing the flywheel magnet" (7-19).

4. Slide the clamp ① down, and then disconnect the fuel hose ②.

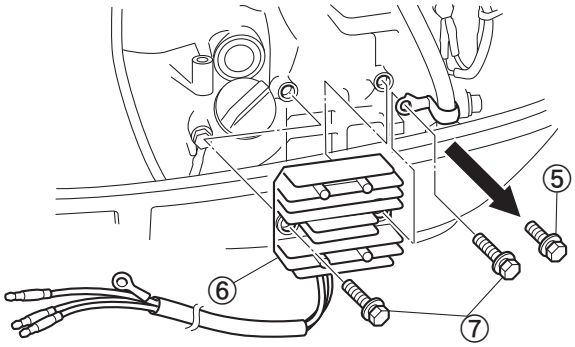
5. Remove the fuel tank ③.



6. Install the lighting coil ④.



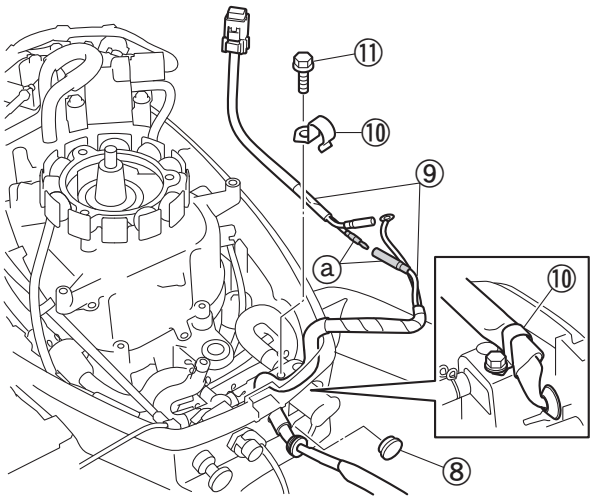
7. Remove the bolt ⑤, and then install the Rectifier Regulator ⑥ using the included bolts ⑦.



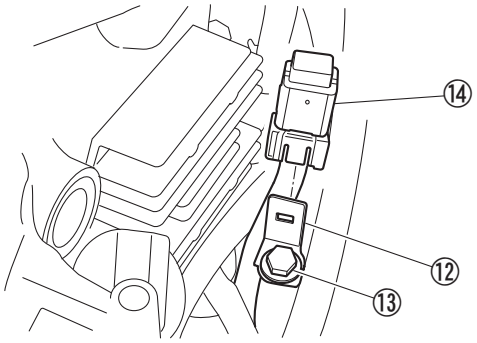
8. Remove the grommet ⑧, and then route the leads ⑨.

9. Install the holder ⑩ using the fuel joint bolt ⑪, and then fasten the leads using the holder ⑩.

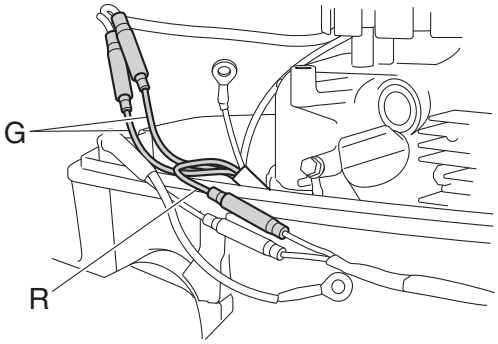
10. Connect the connector ⓐ of leads ⑨.



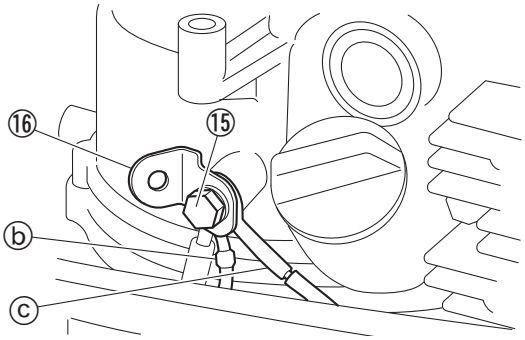
11. Install the bracket ⑫ to the bottom cowling using the self-tapping bolt ⑬, and then install the fuse box ⑭.



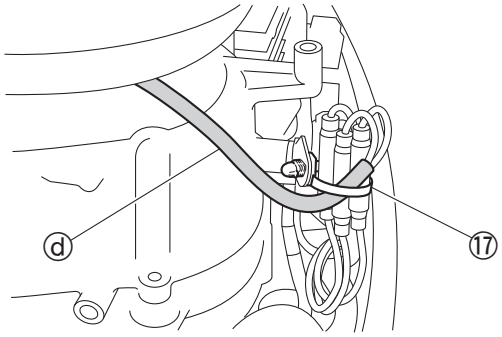
12. Connect the Rectifier Regulator connectors of Green (G) leads and Red (R) lead.



13. Remove the bolt ⑮, and then install the Rectifier Regulator ground lead ⓑ, fuse ground lead ⓒ, and bracket ⑯ using the removed bolt ⑮.



14. Install the holder ⑰, and then fasten the leads using the holder ⑰.



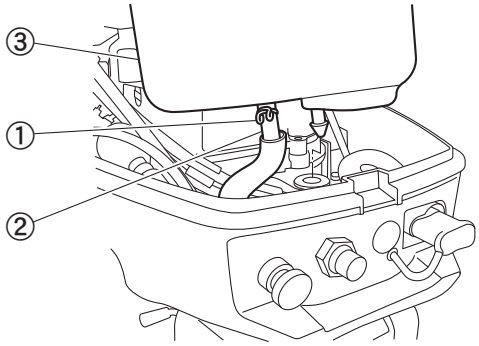
TIP:

Check that the lighting coil leads ⓓ do not interfere with the flywheel magnet.

15. Install the included flywheel magnet (optional). See “Installing the flywheel magnet” (7-19).

16. Connect the hose ②, and then fasten it using the clamp ①.

17. Install the fuel tank ③.



18. Install the manual starter. See “Installing the manual starter” (7-10).

Installing the battery (optional for European market)

⚠ WARNING

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

NOTICE

If battery connections are reversed, check the electrical system and replace any damaged components.

Rigging recommendations

Battery requirement

Make sure that the size of the battery cable terminals is appropriate for the size of the battery terminals.
To prevent the battery cable terminal connections from corroding, solder each battery cable terminal to the battery cable.

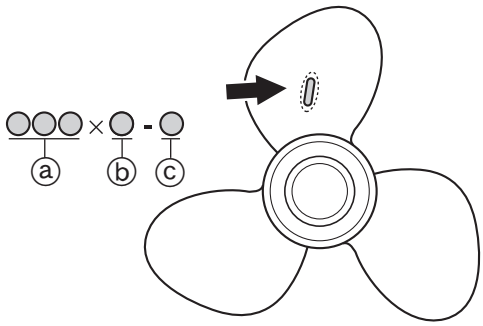
Ambient temperature above 0 °C (32 °F)	
Unit	Minimum capacity
CCA/EN	347.0 Amps
20HR/IEC	40.0 Ah

Propeller selection

The performance of a boat and outboard motor will be critically affected by the size and type of propeller that is used. 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 outboard motor.

Propeller size

The size of the propeller is indicated on a propeller blade.



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

Selection

When the engine speed is at the full throttle operating range, the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

Full throttle operating range:
F4B: 4000–5000 r/min
F5A, F6C: 4500–5500 r/min

Propeller size (in)	Material
7 1/2 × 8 - BA	Aluminum
7 1/4 × 6 1/2 - BA (*1)	
7 1/4 × 8 1/4 - BA (*2)	

(*1) For European market
(*2) F6C only

TRBL SHTG ?

Troubleshooting

Outboard motor troubleshooting

Troubleshooting procedure

1. Before troubleshooting the outboard motor, make sure that fresh fuel of the specified type has been used.
2. Make sure that all electrical connections are secure and free from corrosion.
3. If the outboard motor is equipped with the charging system (optional for European market), check that the battery is fully charged.

Troubleshooting the power unit

Troubleshooting consists of the following 3 items:
Symptom 1: Specific trouble conditions
Symptom 2: Trouble conditions of an area or individual part
Cause: Trouble causes of symptom 2
— : Not applicable

Symptom 1: Engine does not crank.

Symptom 2	Cause	Checking step	See page
Starter handle cannot be pulled	Gear shift not in the N position	Set the gear shift to the N position.	10-4
	Start-in-gear protection cable not adjusted properly	Adjust the start-in-gear protection cable.	7-10
	Manual starter malfunction	Disassemble and check the manual starter.	7-7
	Decompressor malfunction	Check the camshaft.	7-44
	Stuck piston or crankshaft	Disassemble and check the power unit.	7-21 7-39
	Stuck drive shaft	Disassemble and check the lower unit.	8-7 8-10
Starter handle can be pulled, but the engine does not crank	Manual starter malfunction	Disassemble and check the manual starter.	7-7
	Damaged flywheel magnet Woodruff key	Check the flywheel magnet Woodruff key.	7-18

Symptom 1: Engine will not start (engine cranks).

Symptom 2	Cause	Checking step	See page
Spark plug does not spark	—	Check the ignition spark.	5-5
	Spark plug malfunction	Check the spark plug.	7-35
	Spark plug cap malfunction	Check the spark plug cap.	5-5
	Engine shut-off switch malfunction	Check the engine shut-off switch.	5-6
Fuel not supplied	Fuel cock closed	Set the fuel cock to the proper position.	—
	Clogged fuel strainer	Check the fuel strainer for clog or dirt.	6-6
	Fuel leakage	Check the fuel line for fuel leakage.	6-1
	Fuel pump malfunction	Check the fuel pump for fuel leakage.	6-22
		Check the diaphragm for tears.	6-23
		Check the camshaft for wear.	7-44
	Carburetor malfunction	Disassemble and clean the carburetor.	6-18

Symptom 2	Cause	Checking step	See page
Compression pressure is low	Compression leakage	Measure the compression pressure.	7-1
		Check the valve for bends or stuck.	7-27
		Check the decompressor for proper operation.	7-44
		Check the piston and piston ring for damage.	7-41
		Check the cylinder for damage.	7-41
	Improper valve timing	Check the valve timing.	7-37

Symptom 1: Unstable engine idle speed, poor acceleration, poor performance, limited engine speed, or engine stalls.

Symptom 2	Cause	Checking step	See page
Fuel not supplied	—	Check that the air vent screw is open.	—
Throttle valve does not move properly	Carburetor malfunction	Check the throttle valve for proper movement.	6-18
	Throttle link and throttle cable not installed properly	Adjust the throttle link and throttle cable.	6-14
Spark is weak	—	Check the CDI unit air gap.	7-1
Improper fuel and air amount supplied	Choke valve does not operate properly	Check the choke valve operation.	—
	Carburetor malfunction	Adjust the pilot screw.	6-19
		Disassemble and clean the carburetor.	6-18
	Air leakage (carburetor to cylinder head)	Check the O-ring and gaskets of the carburetor and intake manifold.	6-10

Symptom 1: High engine idle speed.

Symptom 2	Cause	Checking step	See page
Improper fuel and air amount supplied	Carburetor malfunction	Adjust the pilot screw.	6-19
		Disassemble and clean the carburetor.	6-18
	Throttle link and throttle cable not installed properly	Adjust the throttle link and throttle cable.	6-14

Symptom 1: Engine overheats.

Symptom 2	Cause	Checking step	See page
Cooling water not discharged from the cooling water pilot hole	Clogged cooling water inlet	Check the cooling water inlet.	10-7
	Water pump impeller malfunction	Check the impeller.	8-6
		Check the pin.	8-6
	Water leakage from the water pump housing	Check the insert cartridge.	8-6
		Check the outer plate cartridge.	8-6
		Check the water pump housing.	8-6
	Leak or clogged cooling water passage	Check the water pipe for damage and proper installation.	9-9
		Check the cooling water passage.	2-16
—	Thermostat malfunction	Check the thermostat.	7-35

Symptom 1: Improper oil lubrication.

Symptom 2	Cause	Checking step	See page
Oil cannot be seen through the oil lubrication check window	Low engine oil level	Check the oil level.	10-3
		Check for engine oil leakage.	2-13
		Check the valve stem seal and valve.	7-27
		Check the piston ring.	7-41
	Insufficient oil lubrication	Check the oil pump.	7-23
		Check the oil strainer.	7-25
		Check the oil passage.	2-13

Symptom 1: Discharged battery (optional for European market).

Symptom 2	Cause	Checking step	See page
—	Battery performance decrease	Check the battery capacity and specific gravity.	—
	Short, open, or loose connection in charging circuit	Check the battery cable and terminals for proper connections.	—
	Lighting coil malfunction	Measure the lighting coil output peak voltage.	5-4
		Measure the lighting coil resistance.	5-4
	Rectifier Regulator malfunction	Measure the Rectifier Regulator output peak voltage.	5-4
		Check the Rectifier Regulator for continuity.	5-4

Troubleshooting the lower unit

Troubleshooting consists of the following 3 items:
Symptom 1: Specific trouble conditions
Symptom 2: Trouble conditions of an area or individual part
Cause: Trouble causes of symptom 2
— : Not applicable

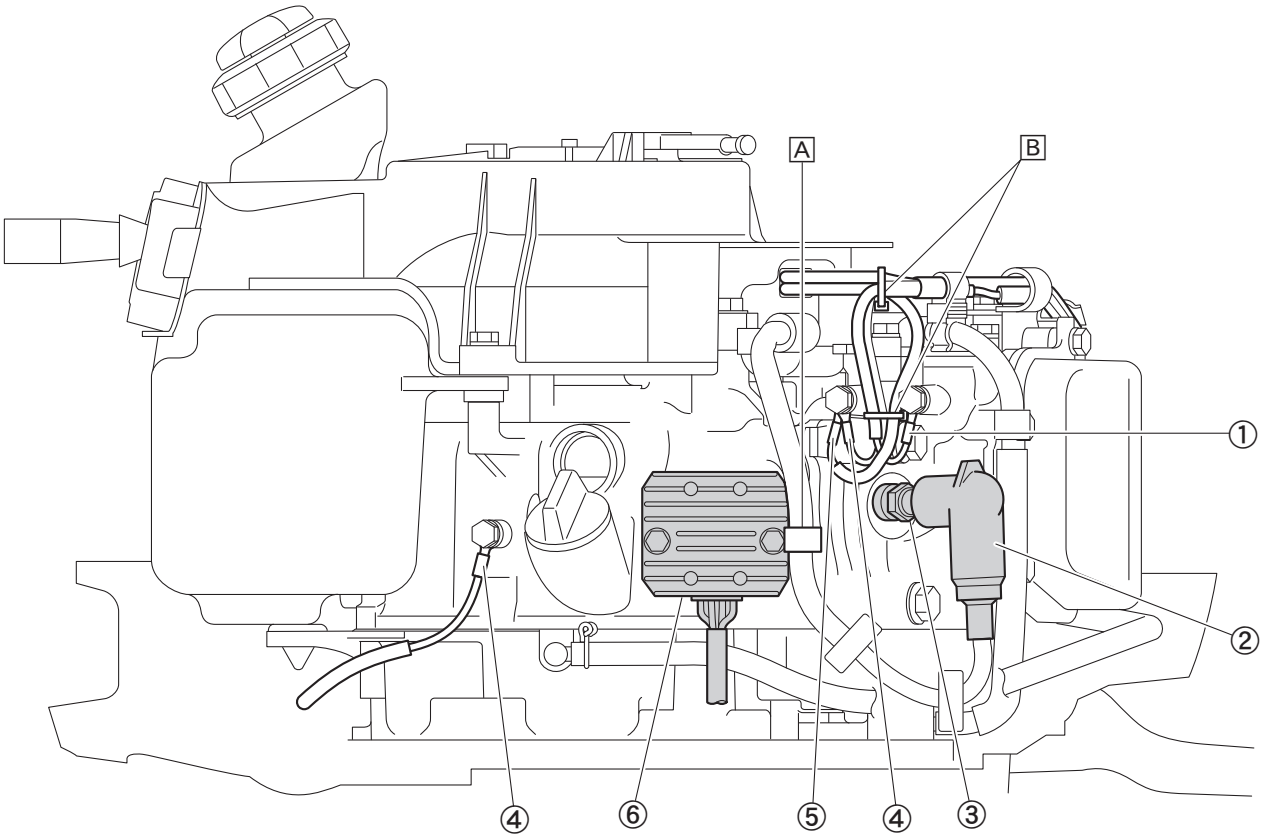
Symptom 1: Shift mechanism of the forward gear and reverse gear does not operate properly.

Symptom 2	Cause	Checking step	See page
—	Shift rod malfunction	Check the shift rod joint.	8-16
	Shift mechanism malfunction (lower unit)	Check the shift rod for wear.	8-6
		Check the dog clutch.	8-9
		Check the forward gear, reverse gear, and pinion for damage or wear.	8-9 8-11 8-11

Electrical system

Electrical component and wiring harness routing

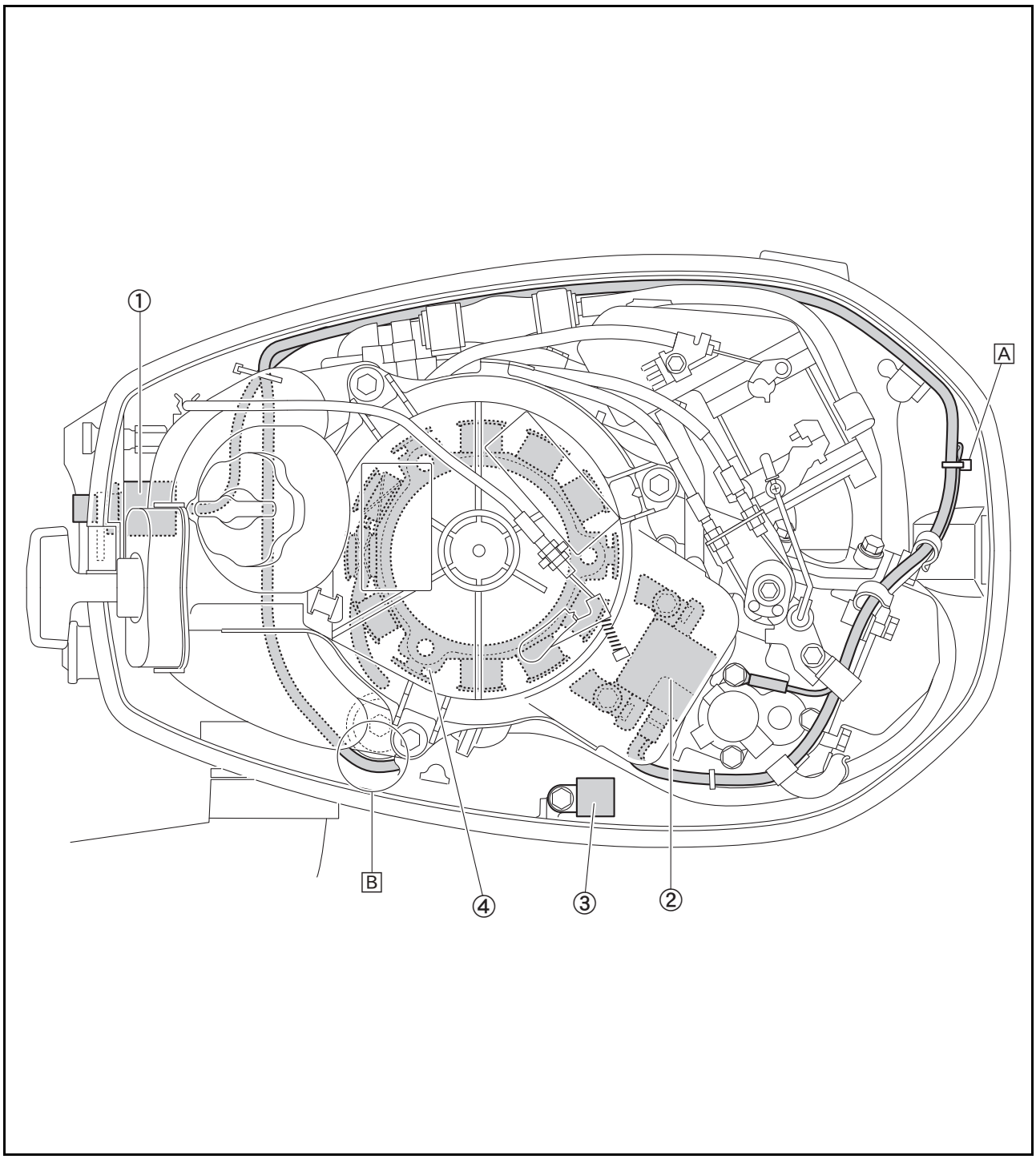
Port



① Engine shut-off switch lead (Black)
② Spark plug cap
③ Spark plug
④ Ground lead (Black)
⑤ CDI unit lead (Black)
⑥ Rectifier Regulator (optional for European market)

A Install the holder horizontally, and then fasten the spark plug wire using the holder.
B Point the end of plastic tie inward (engine side), and then cut the end.

Top



① Engine shut-off switch
② CDI unit
③ Fuse (20 A) (optional for European market)
④ Lighting coil (optional for European market)

A Fold the holders inward so that the leads do not come out from the holders.
B Check that the ground lead does not interfere with the bolt or washer.

Checking the electrical component

Measuring the peak voltage

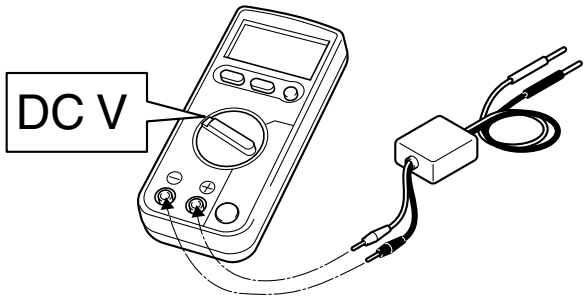
⚠ WARNING

When measuring the peak voltage, do not touch any of the connections of the digital tester probes.

NOTICE

When measuring the peak voltage between the terminals of an electrical component using the digital tester, make sure that the leads do not contact any metal parts. Otherwise, the electrical component may short-circuit and be damaged.

To check the electrical components or measure the peak voltage, use the special service tools. A malfunctioning electrical component can be checked easily by measuring the peak voltage. The specified engine speed when measuring the peak voltage is affected by many factors, such as fouled spark plugs or a weak battery. If one of these factors is present, the peak voltage cannot be measured properly.



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

TIP:

- Before measuring the peak voltage, check all wiring harness for corrosion. Also, make sure that the wiring harness is connected properly and that the battery is fully charged.
- Use peak voltage adapter B with the recommended digital circuit tester.
- Connect the positive pin of peak voltage adapter B to the positive terminal of the digital circuit tester, and the negative pin to the negative terminal.
- When measuring the peak voltage, set the digital circuit tester to the **DC voltage mode**.

Using the digital tester

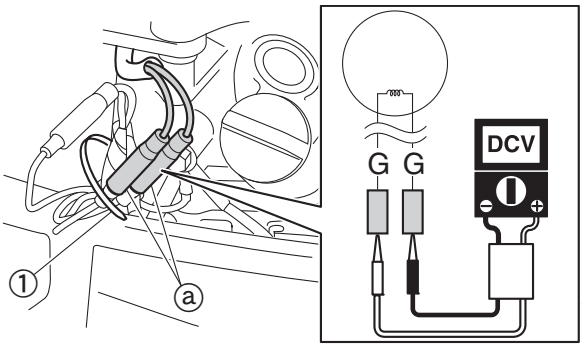
The electrical technical data apply to the measurements taken using the Yamaha-recommended tester.

The resistance values shown are the values taken before the engine is started. The actual resistance may vary depending on the environmental conditions and ambient temperature.

Charging unit and component

Checking the lighting coil (optional for European market)

1. Remove the holder ①, and then disconnect the lighting coil connectors ⓐ.



2. Measure the lighting coil output peak voltage.

Lighting coil output peak voltage: Green (G)–Green (G)			
r/min	Unloaded		
	Cranking	1500	3500
DC V	20.0	30.1	64.3

TIP:
To prevent the engine from starting when cranking it, remove the clip from the engine shut-off switch.

3. Measure the lighting coil resistance.

Lighting coil resistance (reference data): 0.771–0.869 Ω at 20 °C (68 °F)

4. Connect the lighting coil connectors, and then fasten the lighting coil leads using the holder ①.

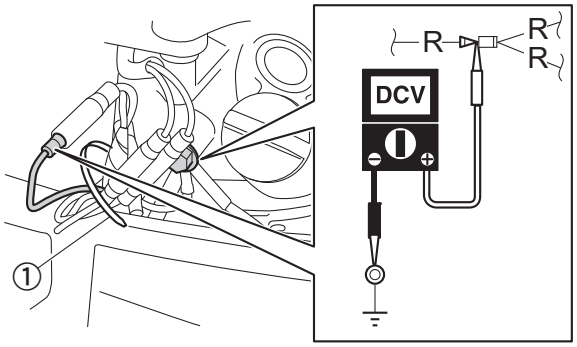
Checking the Rectifier Regulator (optional for European market)

NOTICE

If the battery cables are connected in reverse, the Rectifier Regulator can be damaged.

1. Remove the holder ①.

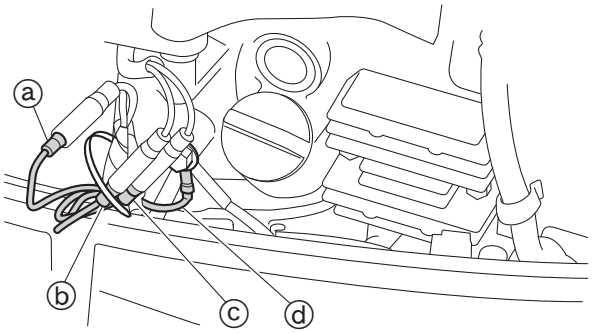
2. Measure the Rectifier Regulator output peak voltage.



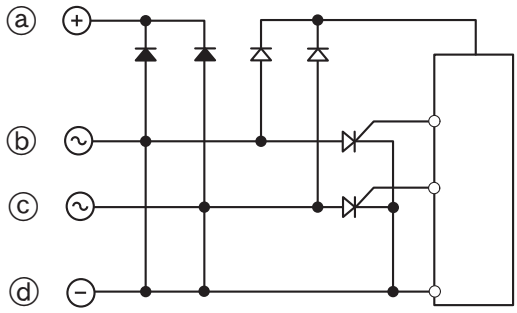
Rectifier Regulator peak voltage: Red (R)–Ground		
r/min	Loaded	
	1500	3500
DC V	13.0	13.0

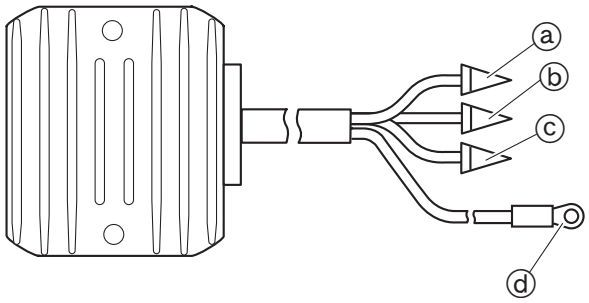
TIP:
Do not use peak voltage adapter B when measuring the Rectifier Regulator output peak voltage.

3. Disconnect the Rectifier Regulator connectors ⓐ, ⓑ, ⓒ, and Rectifier Regulator ground lead ⓓ.



4. Check the Rectifier Regulator for continuity. Replace if out of specification.





Rectifier Regulator continuity (testing diode mode):		
Tester probe		Display value (reference data)
⊕	⊖	
ⓐ	ⓑ	OL
	ⓒ	OL
	ⓓ	OL
ⓑ	ⓐ	0.384 V
	ⓒ	0.938 V
	ⓓ	0.649 V
ⓒ	ⓐ	0.384 V
	ⓑ	0.938 V
	ⓓ	0.654 V
ⓓ	ⓐ	0.716 V
	ⓑ	0.384 V
	ⓒ	0.384 V

OL: Indicates an overload

TIP:
Make sure to set the tester measurement range to the diode mode.

5. Connect the Rectifier Regulator connectors ⓐ, ⓑ, ⓒ, and Rectifier Regulator ground lead ⓓ.

6. Fasten the Rectifier Regulator leads using the holder ①.

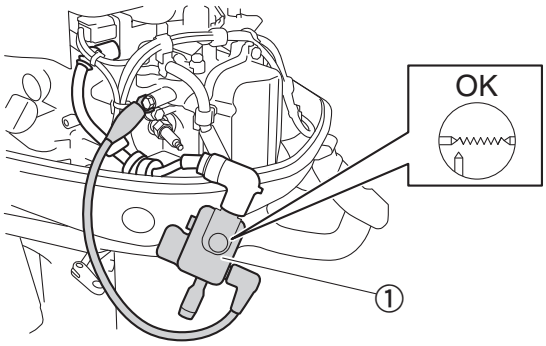
Ignition unit and component

Checking the ignition spark

1. Disconnect the spark plug cap from the spark plug.

2. Connect the spark plug cap to the special service tool ①.

3. Crank the engine and check for a spark. **WARNING! Do not touch any of the connections of the special service tool.**

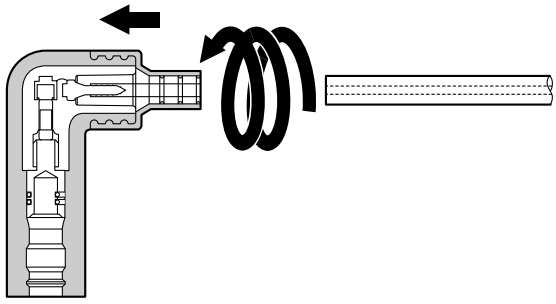


Ignition tester (spark gap tester) ①:
90890-06754

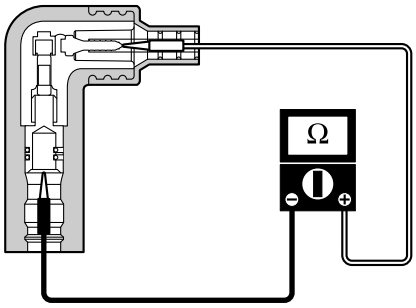
4. Disconnect the special service tool ①, and then connect the spark plug cap.

Checking the spark plug cap

1. Remove the spark plug cap from the spark plug wire by turning the cap counterclockwise.



2. Measure the spark plug cap resistance.



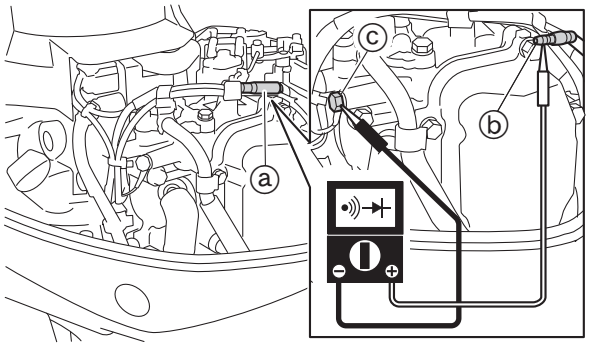
Spark plug cap resistance
(reference data):
5.0 kΩ at 20 °C (68 °F)

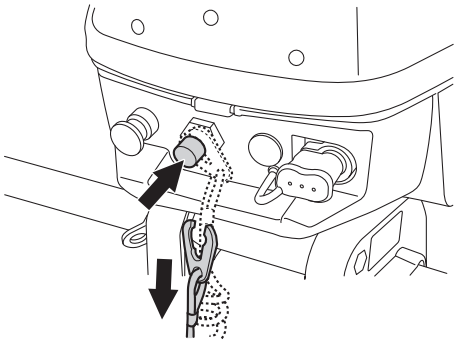
3. Install the spark plug cap to the spark plug wire by turning the spark plug cap clockwise.

Checking the engine shut-off switch

1. Disconnect the engine shut-off switch connector ⓐ.

2. Check the engine shut-off switch for continuity.





Switch position	Terminal	
	ⓑ	ⓒ
Clip installed		
Clip removed	O	O
Button pushed	O	O

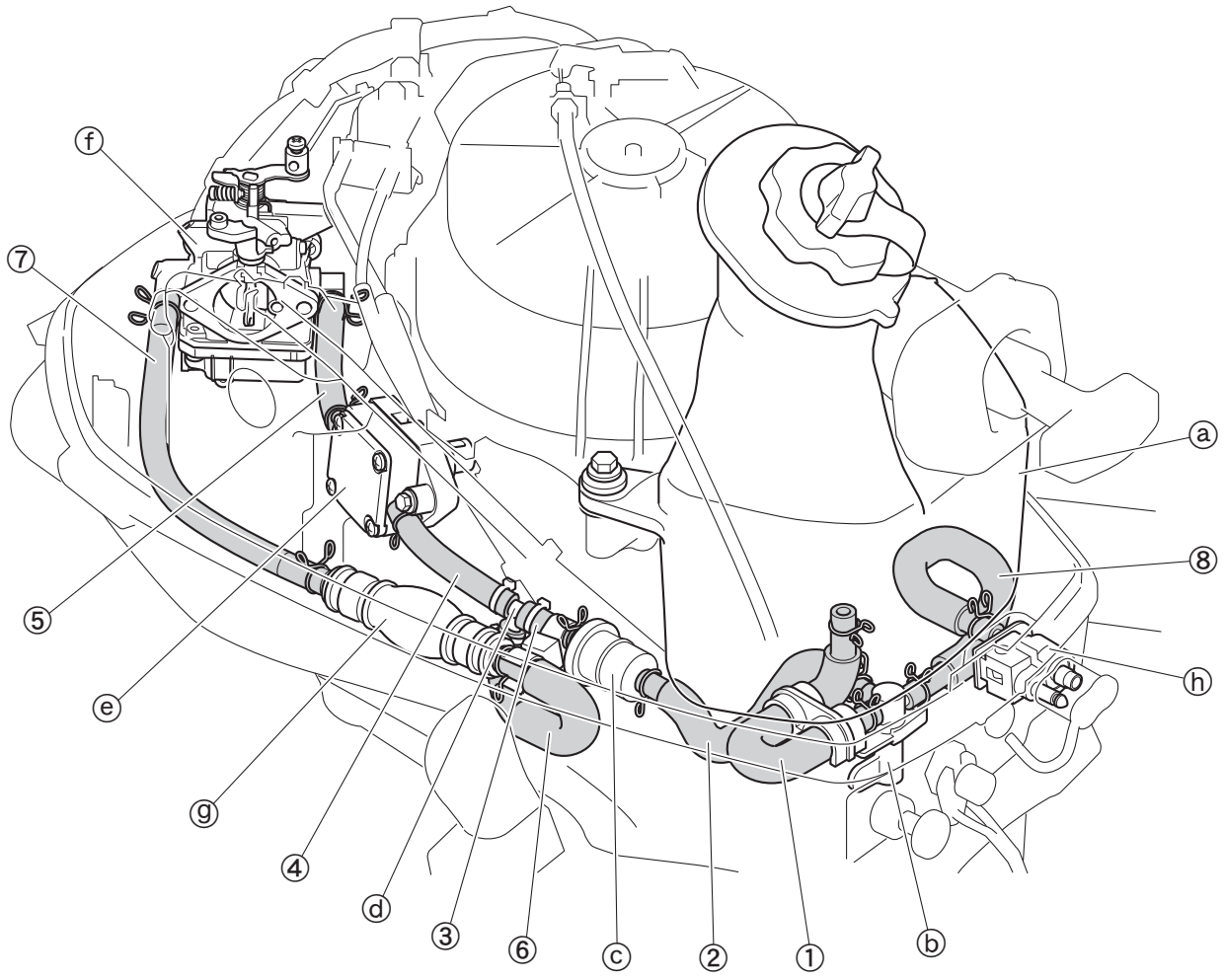
3. Connect the engine shut-off switch connector ⓐ.

— MEMO —

Fuel system

Hose routing

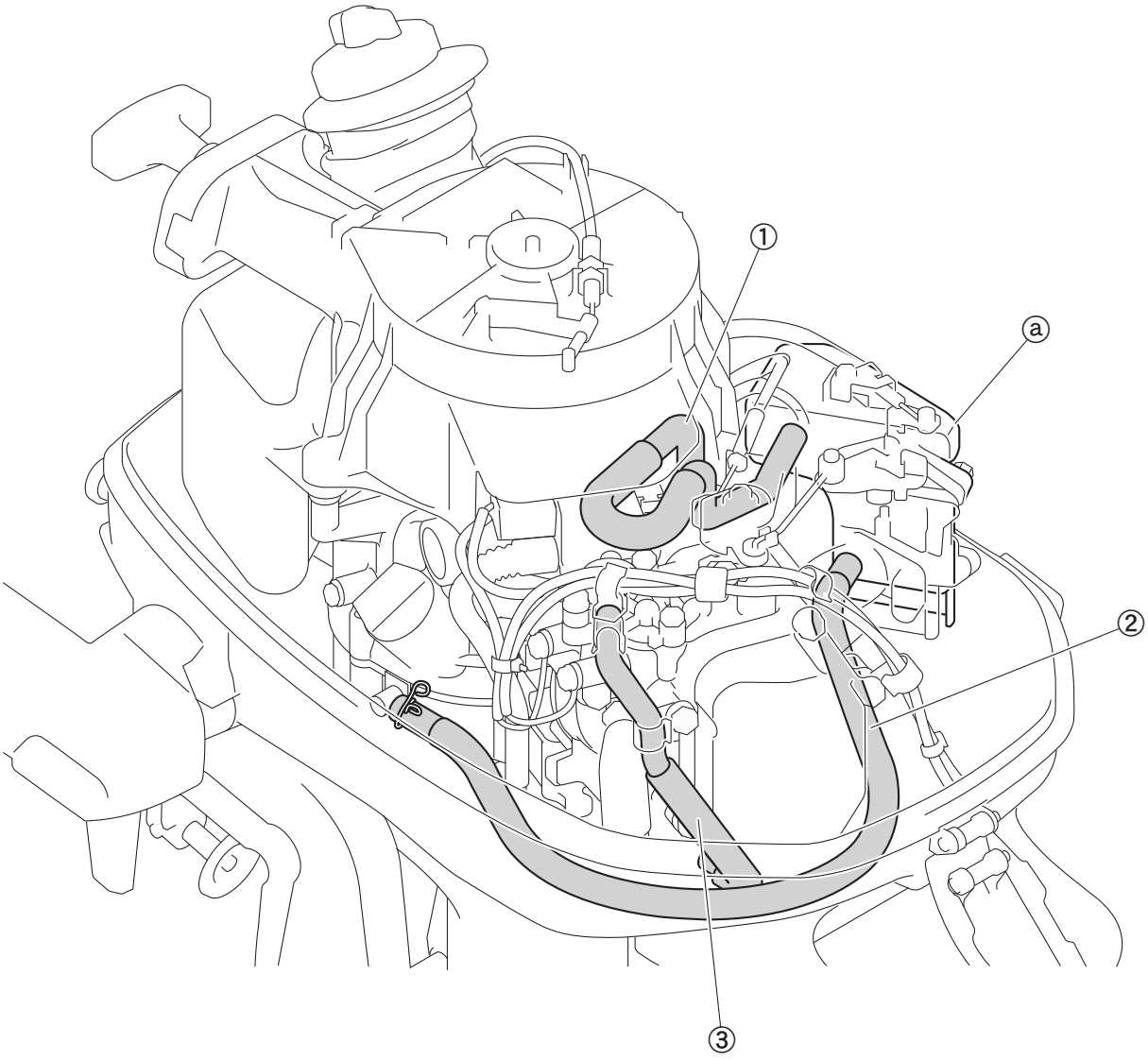
Fuel hose



① Fuel hose (fuel tank to fuel cock)
② Fuel hose (fuel cock to fuel strainer)
③ Fuel hose (fuel strainer to joint)
④ Fuel hose (joint to fuel pump)
⑤ Fuel hose (fuel pump to carburetor)
⑥ Fuel hose (joint to primer pump)
⑦ Fuel hose (primer pump to carburetor)
⑧ Fuel hose (fuel joint to fuel cock)

ⓐ Fuel tank
ⓑ Fuel cock
ⓒ Fuel strainer
ⓓ Joint
ⓔ Fuel pump
ⓕ Carburetor
ⓖ Primer pump
ⓗ Fuel joint

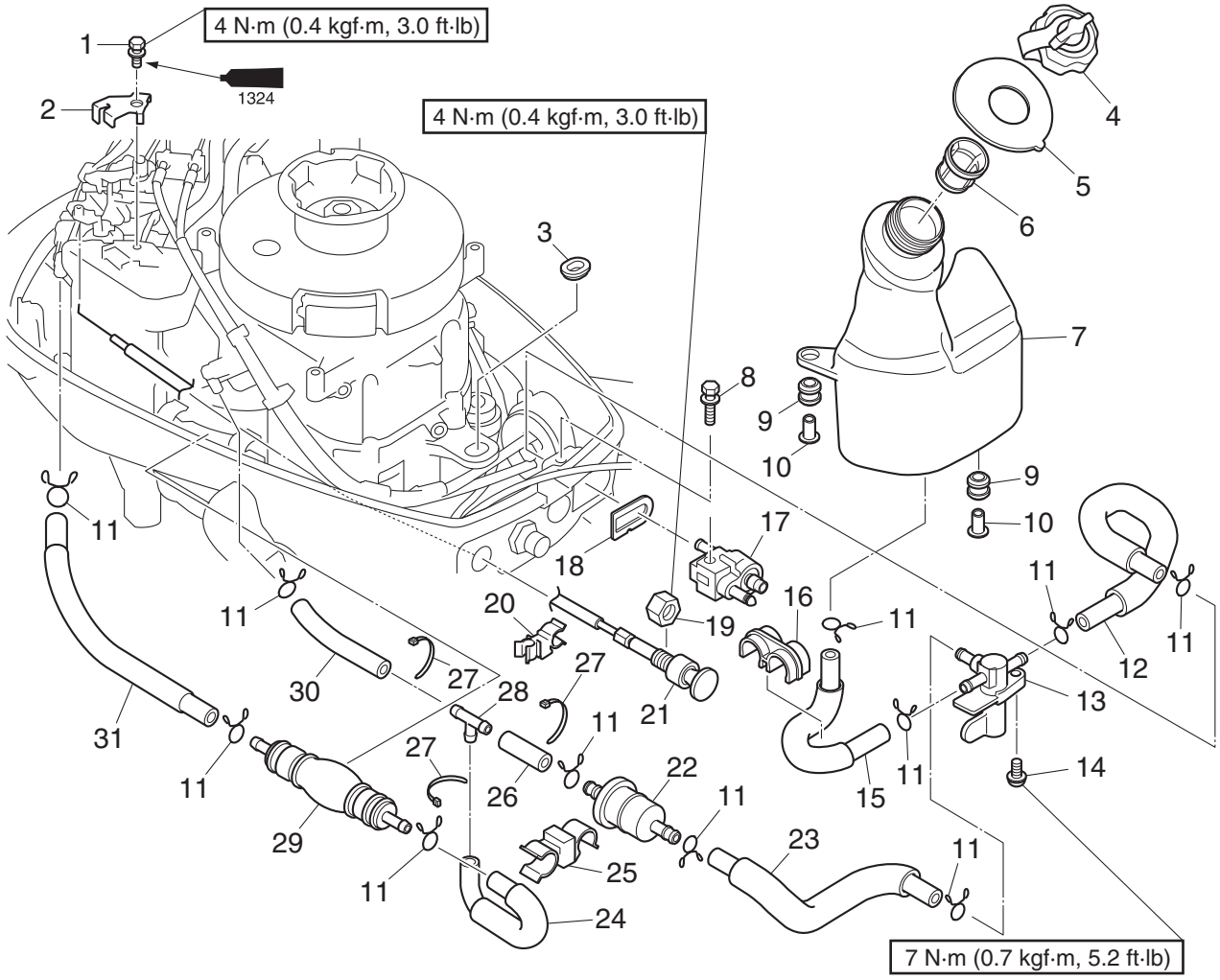
Blowby hose, oil return hose, and cooling water hose



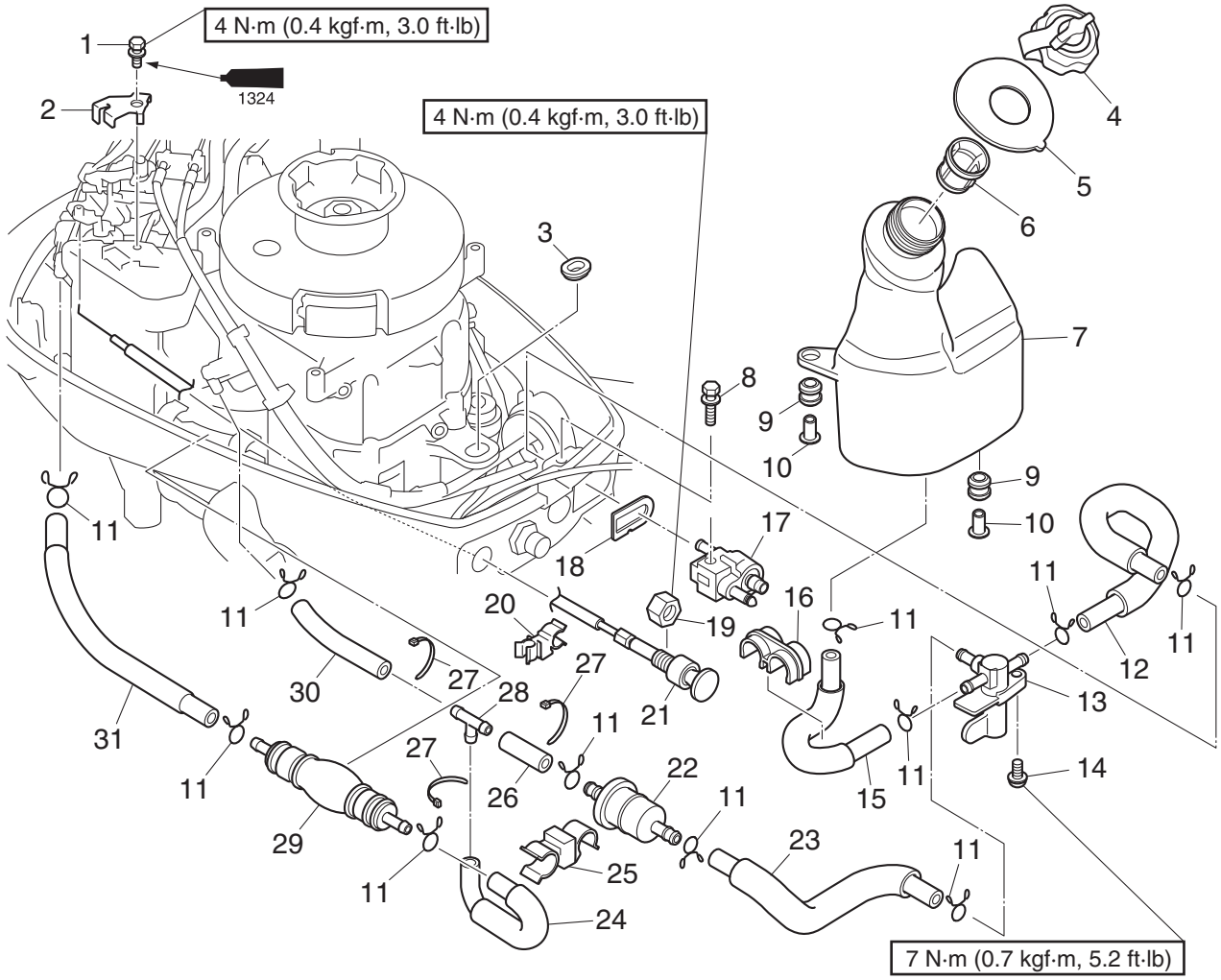
① Blowby hose (cylinder block to intake silencer)
② Oil return hose (intake silencer to crankcase)
③ Cooling water hose (thermostat cover to crankcase)

ⓐ Intake silencer

Fuel tank



No.	Part name	Q'ty	Remarks
1	Choke holder bolt	1	M5 × 10 mm
2	Holder	1	
3	Grommet	1	
4	Fuel cap	1	
5	Rubber seal	1	
6	Fuel strainer	1	
7	Fuel tank	1	
8	Bolt	1	M6 × 25 mm
9	Grommet	2	
10	Collar	2	
11	Clamp	11	
12	Hose	1	
13	Fuel cock	1	
14	Fuel cock screw	1	M6 × 12 mm
15	Hose	1	
16	Holder	1	
17	Fuel joint	1	

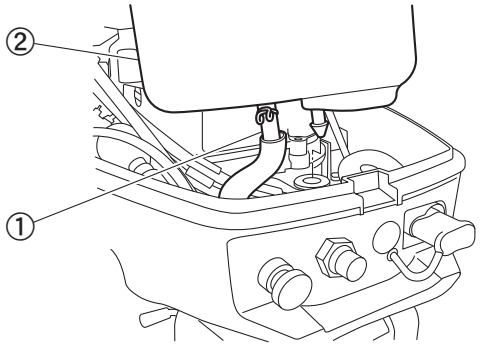


No.	Part name	Q'ty	Remarks
18	Rubber seal	1	
19	Choke cable nut	1	
20	Holder	1	
21	Choke cable	1	
22	Fuel strainer	1	
23	Hose	1	
24	Hose	1	
25	Holder	1	
26	Hose	1	
27	Plastic tie	3	**Not reusable**
28	Joint	1	
29	Primer pump	1	
30	Hose	1	
31	Hose	1	

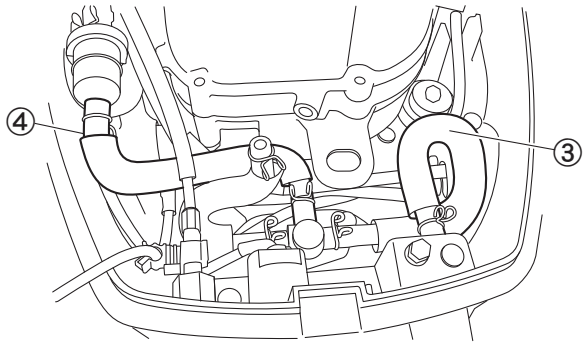
Removing the fuel tank

Cover the fuel components using a rag to prevent fuel from spilling out.

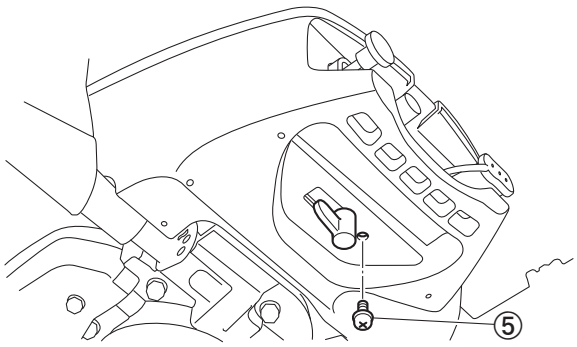
1. Drain the fuel from the fuel tank.
2. Remove the manual starter. See “Removing the manual starter” (7-7).
3. Disconnect the fuel hose ①, and then remove the fuel tank ②.



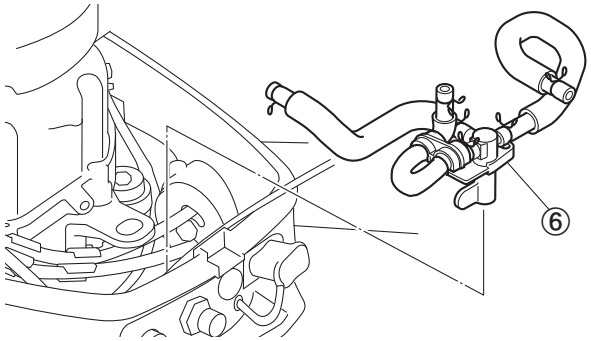
4. Disconnect the fuel hoses ③ and ④.



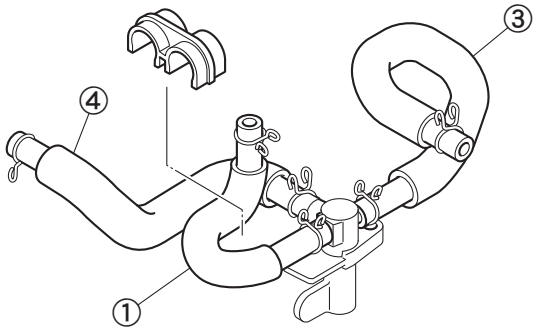
5. Remove the fuel cock screw ⑤.



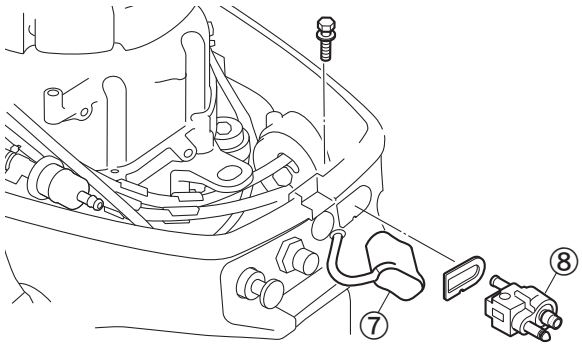
6. Remove the fuel cock ⑥.



7. Remove the fuel hoses ①, ③, and ④.



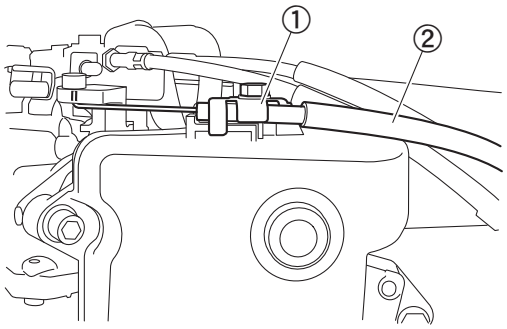
8. Remove the cap ⑦, and then remove the fuel joint ⑧.



Removing the primer pump

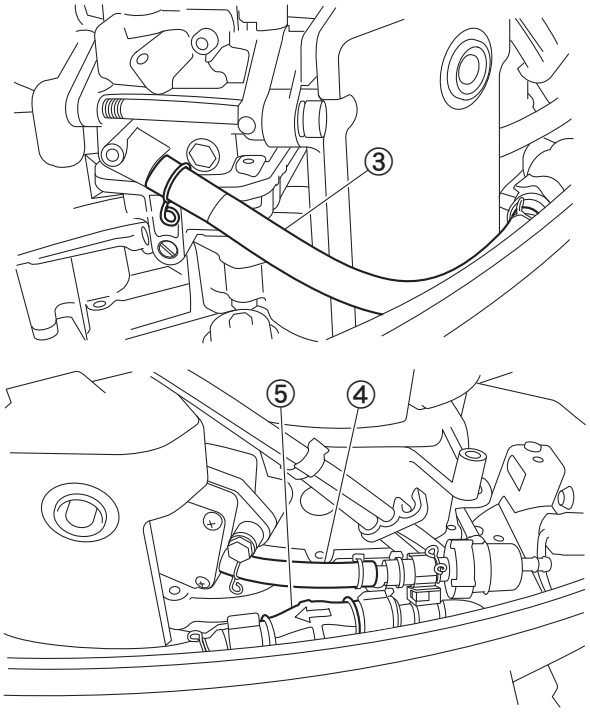
Cover the fuel components using a rag to prevent fuel from spilling out.

1. Remove the holder ①, and then remove the choke cable ②.

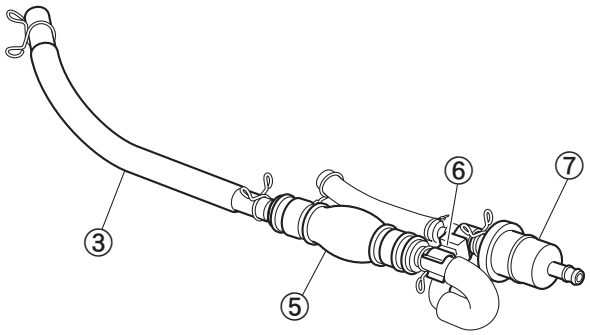


2. Disconnect the fuel hoses ③ and ④.

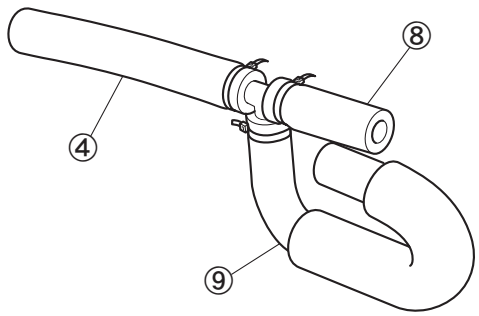
3. Remove the primer pump ⑤.



4. Remove the holder ⑥, fuel strainer ⑦, fuel hose ③, and primer pump ⑤.



5. Remove the fuel hoses ④, ⑧, and ⑨.



Checking the fuel tank

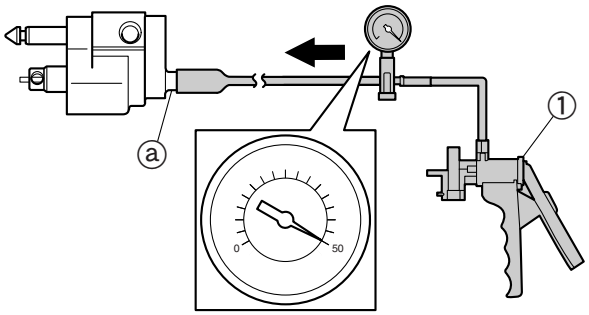
1. Check the fuel tank. Replace if cracked or damaged.

Checking the fuel joint

1. Check the fuel joint. Replace if cracked or damaged.

2. Connect the special service tool ① to the fuel joint outlet ⓐ.

3. Apply the specified positive pressure. Replace the fuel joint if the specified pressure cannot be maintained for at least 10 seconds.



Vacuum/pressure pump gauge set ①:
90890-06756

Specified positive pressure:
50.0 kPa (0.50 kgf/cm², 7.3 psi)

Checking the fuel strainer (tank side)

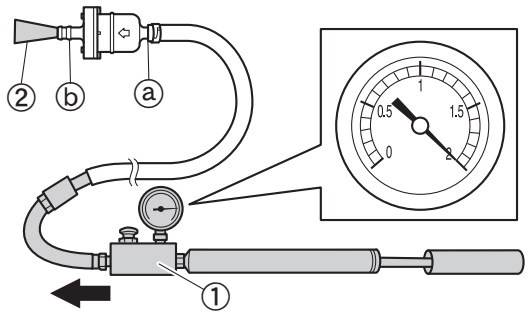
1. Check the fuel strainer. Clean it using straight gasoline if there is foreign material.

Checking the fuel strainer

1. Check the fuel strainer. Replace if cracked or damaged.

2. Connect the special service tool ① to the fuel inlet ⓐ.

3. Block the fuel outlet ⓑ using a rubber plug ②, and then apply the specified positive pressure. Replace the fuel strainer if the specified pressure cannot be maintained for at least 15 seconds.

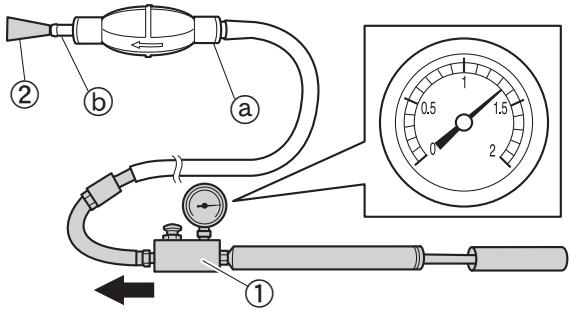


Leakage tester ①: 90890-06840

Specified positive pressure:
200.0 kPa (2.00 kgf/cm², 29.0 psi)

Checking the primer pump

1. Connect the special service tool ① to the primer pump inlet ⓐ.
2. Block the fuel outlet ⓑ using a rubber plug ②.
3. Apply the specified positive pressure. Replace the primer pump if the specified pressure cannot be maintained for at least 30 seconds.

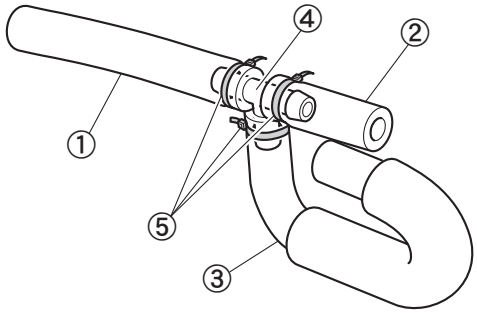


Leakage tester ①: 90890-06840

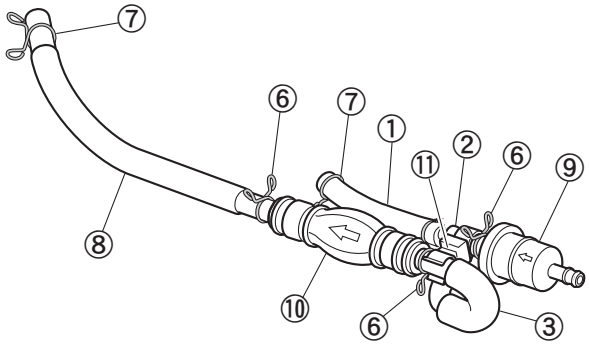
Specified positive pressure:
166.7 kPa (1.667 kgf/cm², 24.2 psi)

Installing the primer pump

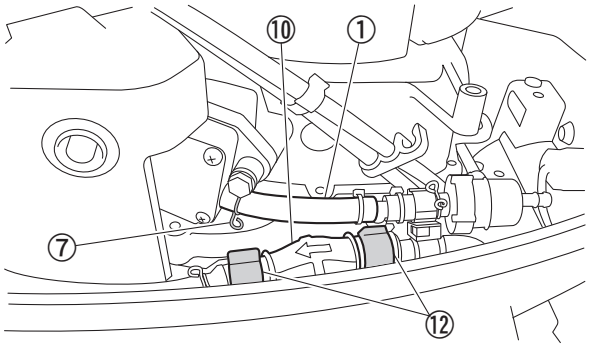
1. Connect the fuel hoses ①, ②, and ③ to the joint ④, and then fasten them using the plastic ties ⑤.



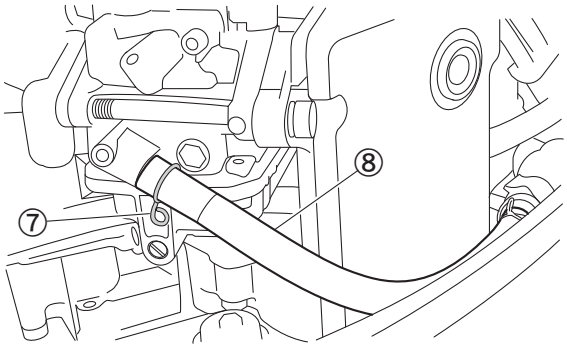
2. Install the clamps ⑥ and ⑦ temporarily onto the fuel hoses ①, ②, ③, and ⑧, and then connect the fuel hose to the fuel strainer ⑨ and primer pump ⑩.
3. Fasten the fuel hose ②, ③ and ⑧ using the clamps ⑥.
4. Install the holder ⑪.



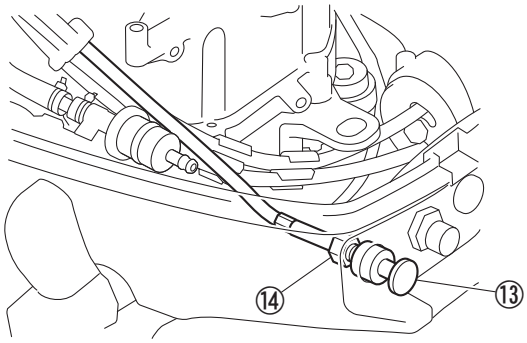
5. Install the primer pump ⑩ to the holders ⑫.
6. Connect the fuel hose ①, and then fasten it using the clamp ⑦.



7. Connect the fuel hose ⑧, and then fasten it using the clamp ⑦.



8. Pass the choke cable ⑬ through the hole in the bottom cowling, and then tighten the choke cable nut ⑭ to the specified torque.

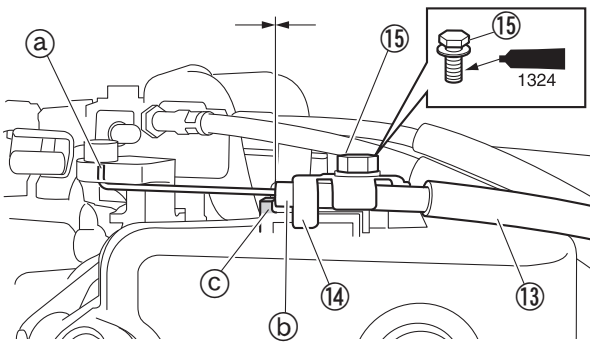


Choke cable nut ⑭:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

9. Insert the cable end ⓐ into the hole of choke lever.

10. Place the outer tube end ⓑ of choke cable ⑬ so that it contacts the stopper ⓒ, and then install the holder ⑭.

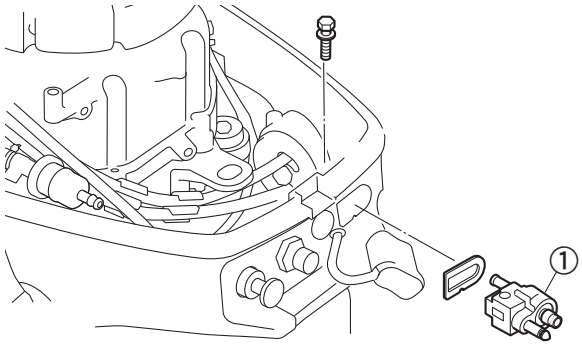
11. Tighten the choke holder bolt ⑮ to the specified torque.



Choke holder bolt ⑮:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

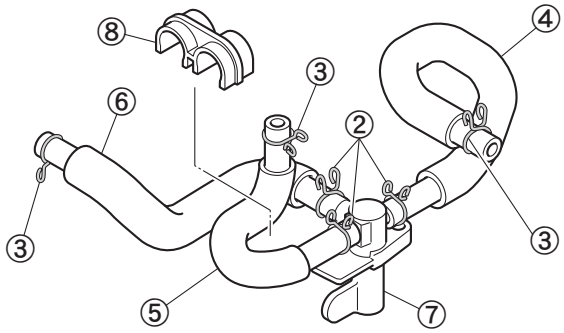
Installing the fuel tank

1. Install the fuel joint ①.

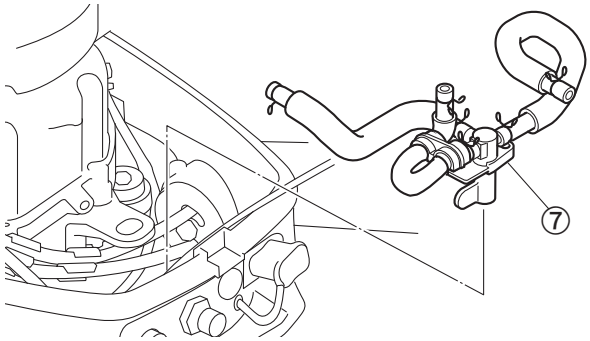


2. Install the clamps ② and ③ temporarily onto the fuel hoses ④, ⑤, and ⑥, and then connect the hoses to the fuel cock ⑦.

3. Fasten the fuel hoses using the clamps ②, and then install the holder ⑧.

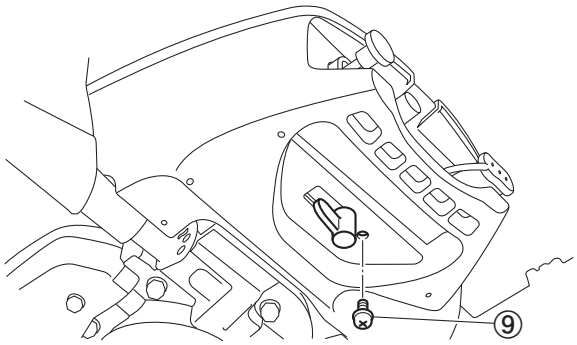


4. Install the fuel cock ⑦.



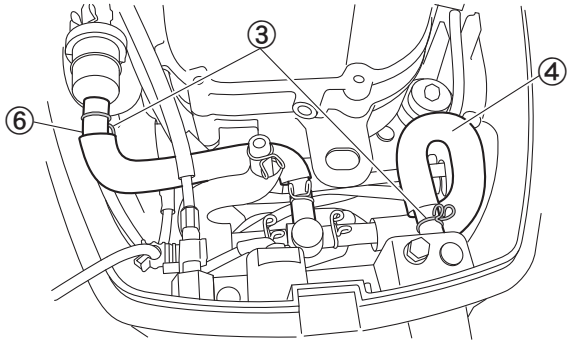
5. Tighten the fuel cock screw ⑨ to the specified torque.

6



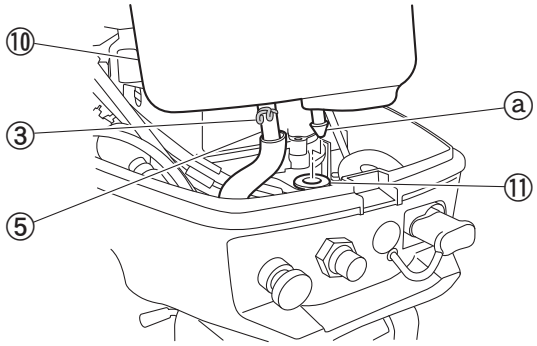
Fuel cock screw ⑨:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

6. Connect the hoses ④ and ⑥, and then fasten them using the clamps ③.



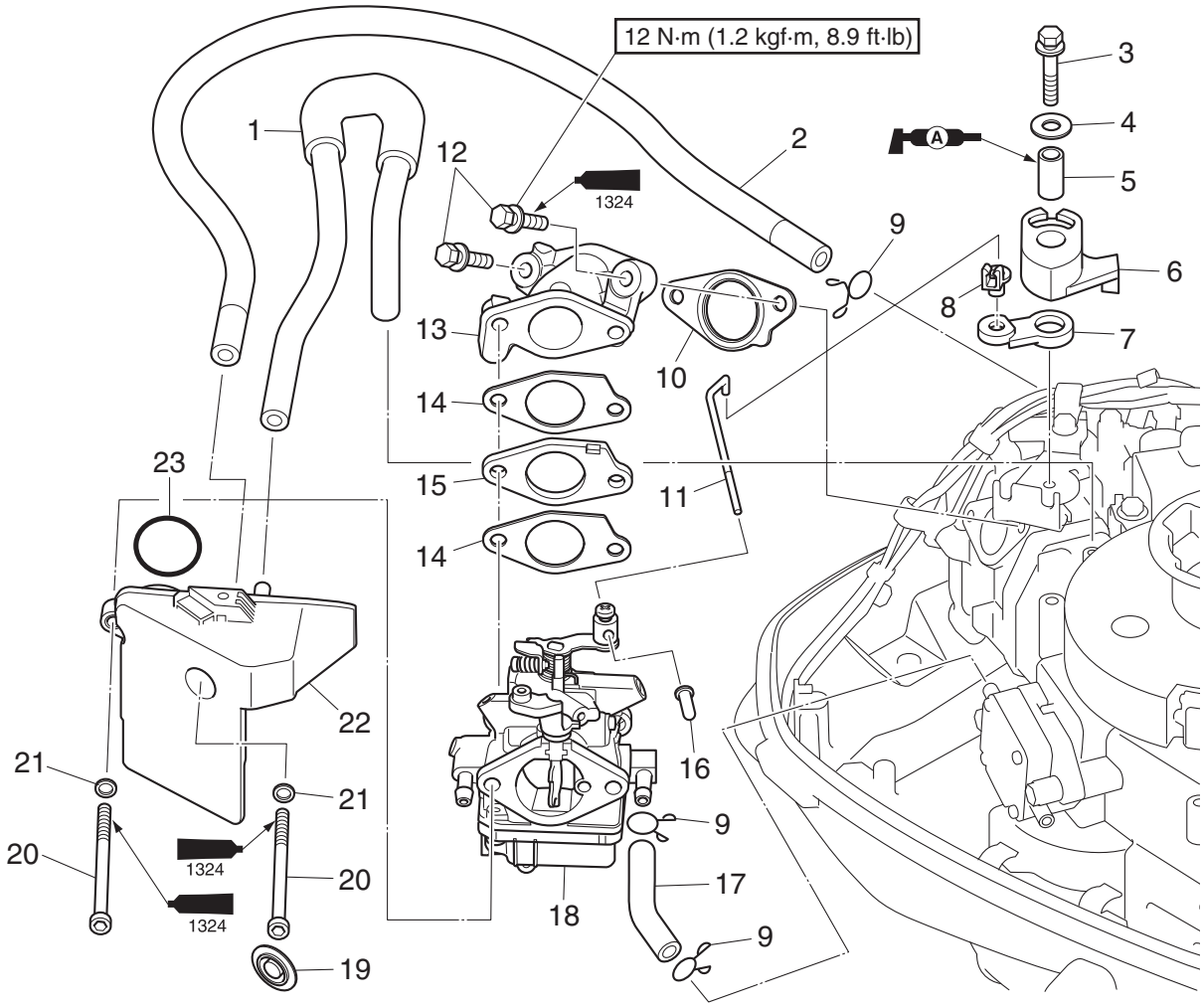
7. Connect the hose ⑤, and then fasten it using the clamp ③.

8. Insert the protrusion ⓐ of the fuel tank ⑩ into the grommet ⑪.

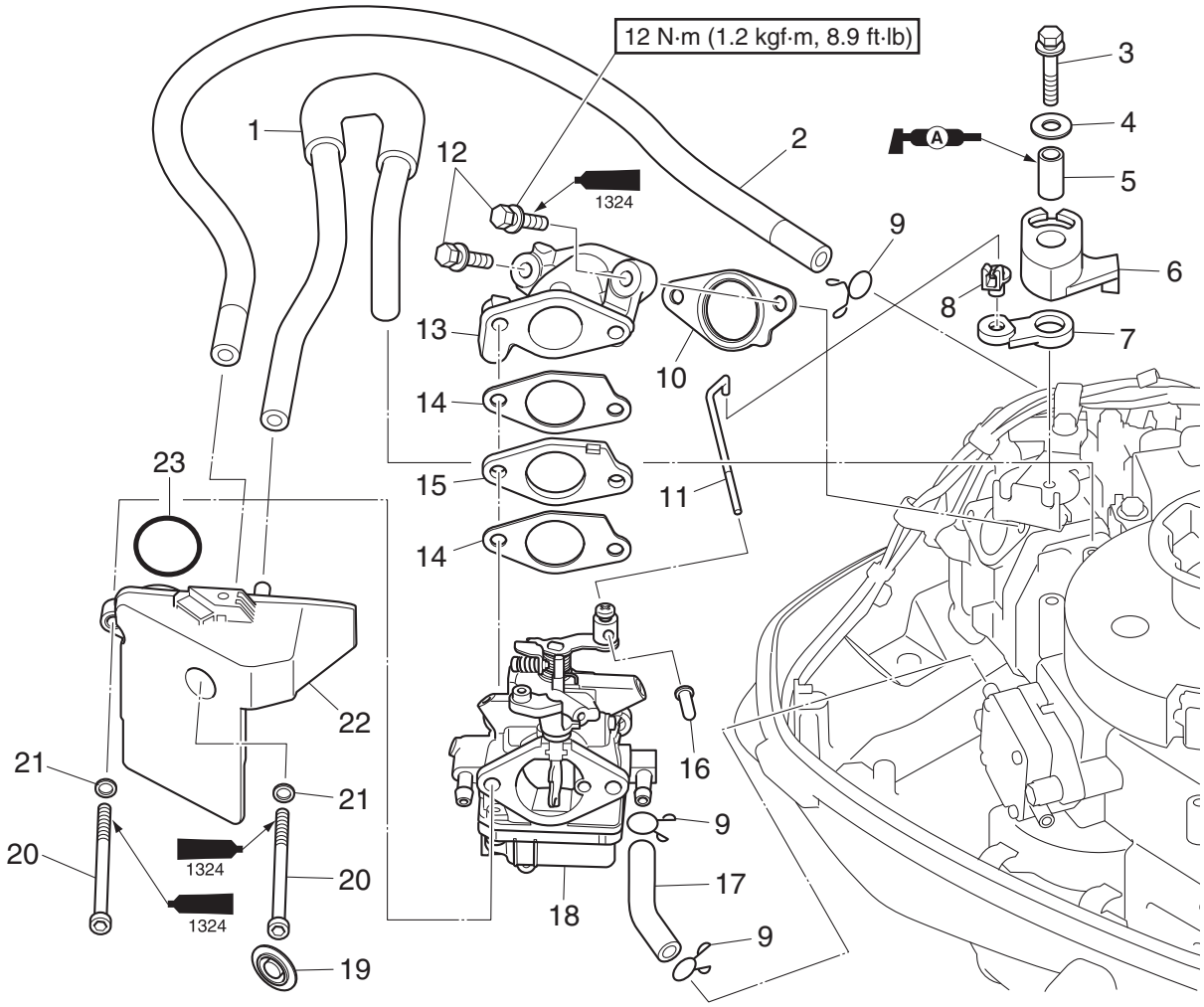


9. Install the manual starter. See “Installing the manual starter” (7-10).

Intake silencer



No.	Part name	Q'ty	Remarks
1	Hose	1	
2	Hose	1	
3	Bolt	1	M6 × 35 mm
4	Washer	1	
5	Collar	1	
6	Throttle cam	1	
7	Lever	1	
8	Holder	1	
9	Clamp	3	
10	Gasket	1	**Not reusable**
11	Throttle link rod	1	
12	Intake manifold bolt	2	M6 × 25 mm
13	Intake manifold	1	
14	Gasket	2	**Not reusable**
15	Spacer	1	
16	Cap	1	
17	Hose	1	

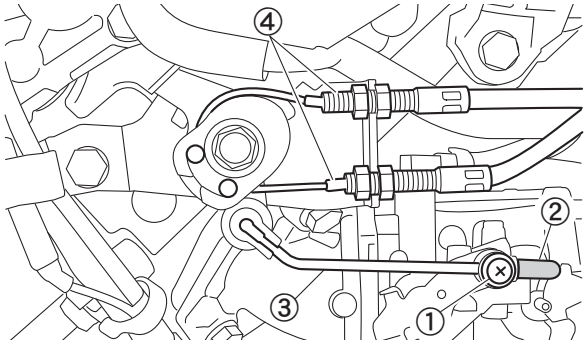


No.	Part name	Q'ty	Remarks
18	Carburetor assembly	1	
19	Cap	1	
20	Bolt	2	M6 × 85 mm
21	Washer	2	
22	Intake silencer	1	
23	O-ring	1	**Not reusable**

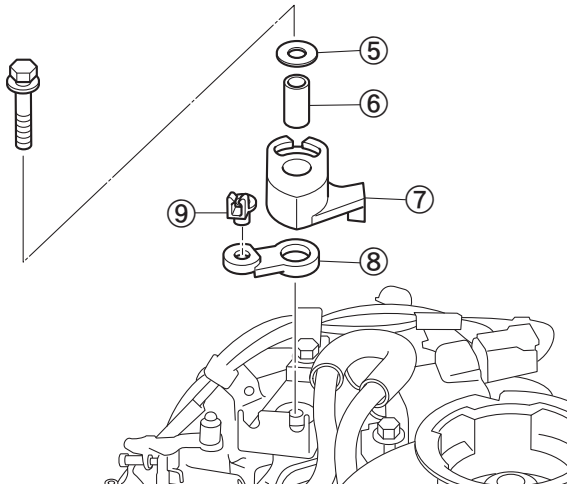
Removing the throttle cable and throttle link

1. Loosen the screw ①, and then remove the cap ② and throttle link rod ③.

2. Remove the throttle cables ④.



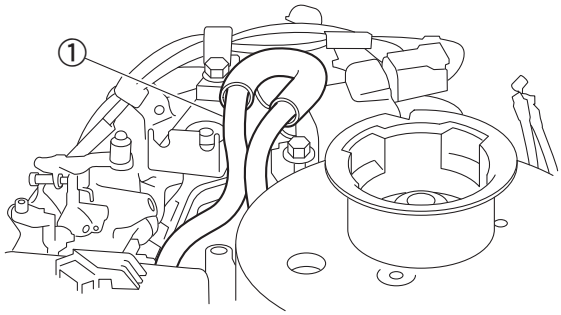
3. Remove the washer ⑤, collar ⑥, throttle cam ⑦, lever ⑧ and holder ⑨.



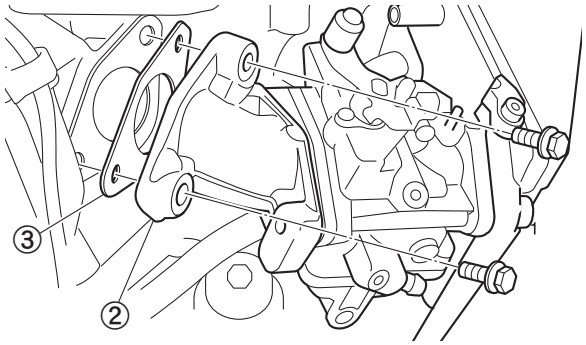
Removing the carburetor

Cover the fuel components using a rag to prevent fuel from spilling out.

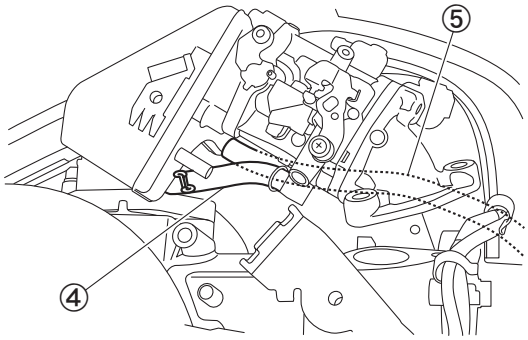
1. Remove the blowby hose ①.



2. Remove the intake manifold ② and gasket ③.

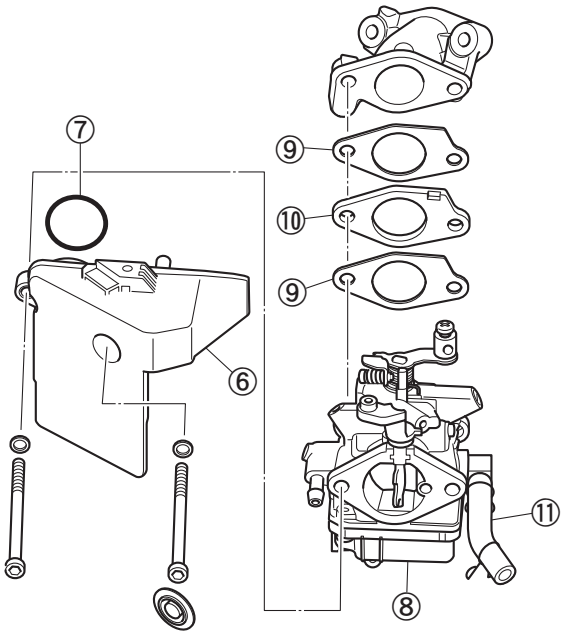


3. Disconnect the fuel hose ④ and oil return hose ⑤.



4. Remove the intake silencer ⑥, O-ring ⑦, carburetor ⑧, gaskets ⑨, and spacer ⑩.

5. Remove the fuel hose ⑪.

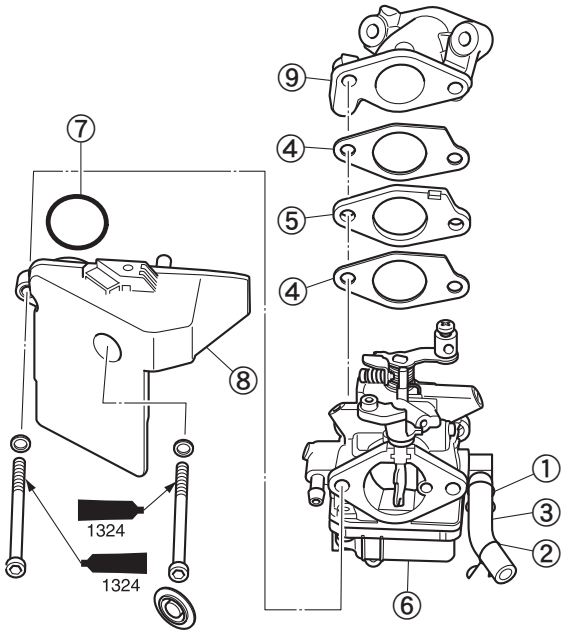


Installing the carburetor

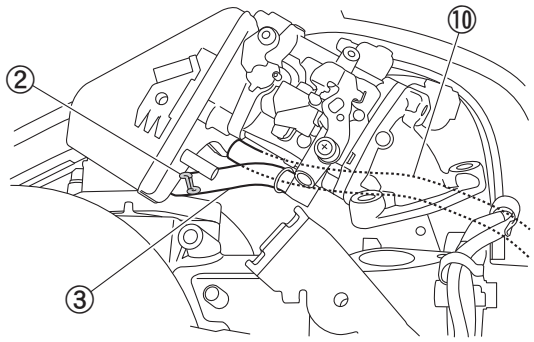
NOTICE

Do not reuse an O-ring or gasket, always replace it with a new one.

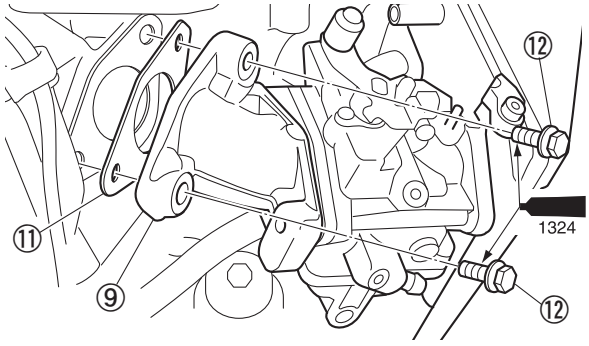
1. Install the clamps ① and ② temporarily onto the fuel hose ③.
2. Connect the fuel hose ③, and then fasten it using the clamp ①.
3. Install new gaskets ④, the spacer ⑤, the carburetor ⑥, a new O-ring ⑦, and the intake silencer ⑧ to the intake manifold ⑨.



4. Connect the oil return hose ⑩ and fuel hose ③, and then fasten the fuel hose using the clamp ②.

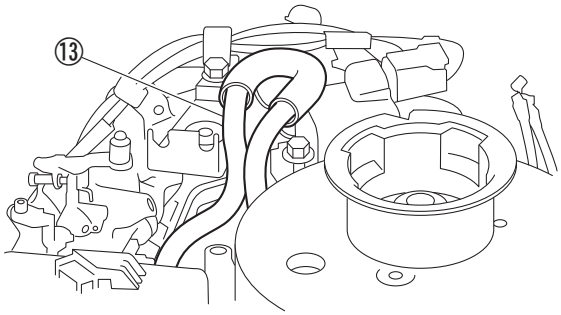


5. Install a new gasket ⑪ and the intake manifold ⑨, and then tighten the intake manifold bolt ⑫ to the specified torque.



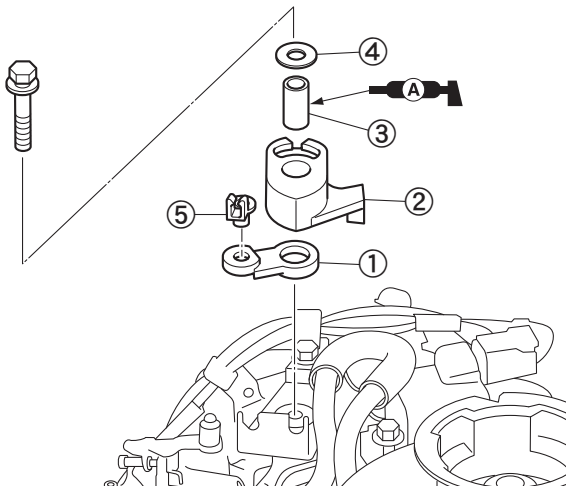
Intake manifold bolt ⑫:
12 N·m (1.2 kgf·m, 8.9 ft·lb)

6. Install the blowby hose ⑬.



Installing the throttle cable and throttle link

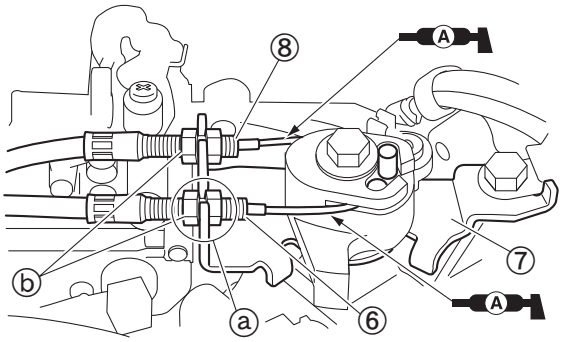
1. Install the lever ①, throttle cam ②, collar ③, washer ④, and holder ⑤.



2. Turn the throttle grip to the fully closed position.

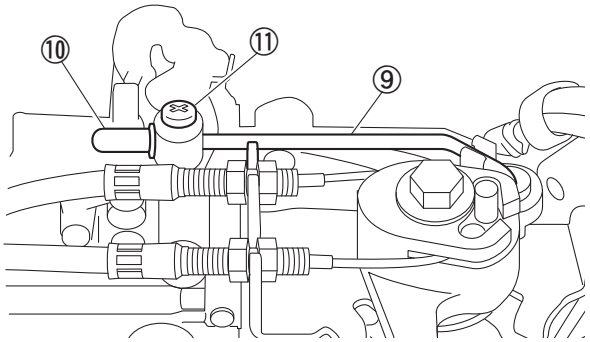
3. Install the shorter cable ⑥ to the section ⓐ of the bracket ⑦.

4. Install the throttle cable ⑧, and then tighten the locknuts ⓑ to the specified torque.



Throttle cable locknut ⓑ:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

5. Install the throttle link rod ⑨ and cap ⑩, and then tighten the throttle link screw ⑪ to the specified torque.



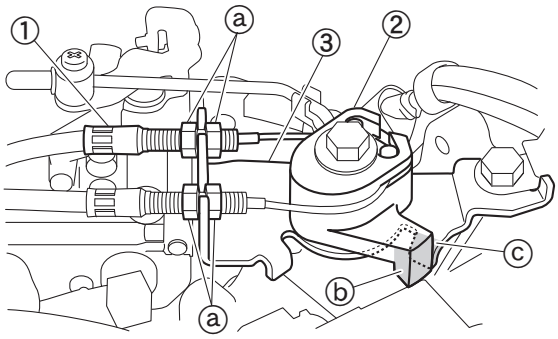
Throttle link screw ⑪:
1.5 N·m (0.15 kgf·m, 1.11 ft·lb)

Adjusting the throttle cable and throttle link

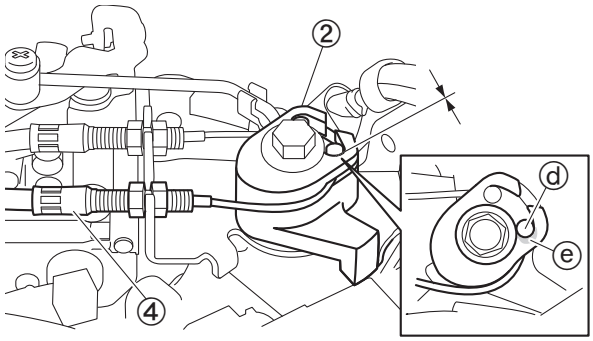
1. Loosen the locknuts ⓐ.

2. Turn the throttle grip to the fully open position.

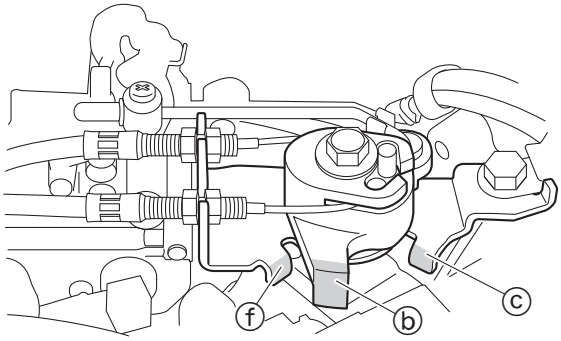
3. Adjust the length of cable ① so that the stopper ⓑ of the throttle cam ② contacts section ⓒ of the bracket ③.



4. Adjust the length of cable ④ so that there is no clearance between the cable end ⓓ and the section ⓔ of the throttle cam ②.

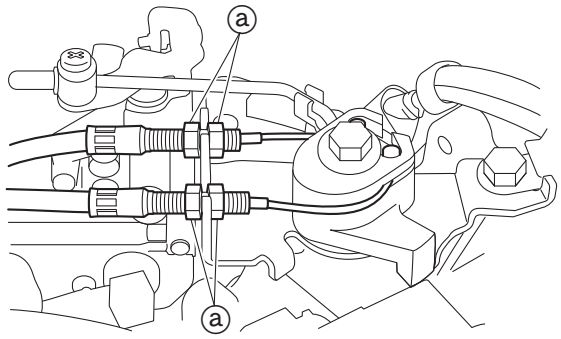


5. Check that the section ⓑ on the throttle cam contacts stopper ⓒ when the throttle grip is in the fully open position, and that the section ⓑ contacts stopper ⓕ when the throttle grip is in the fully closed position.



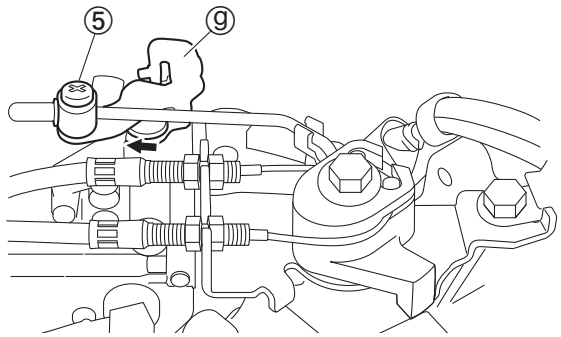
6. Tighten the throttle cable locknuts ⓐ to the specified torque.

6



Throttle cable locknut ⓐ: 4 N·m (0.4 kgf·m, 3.0 ft·lb)

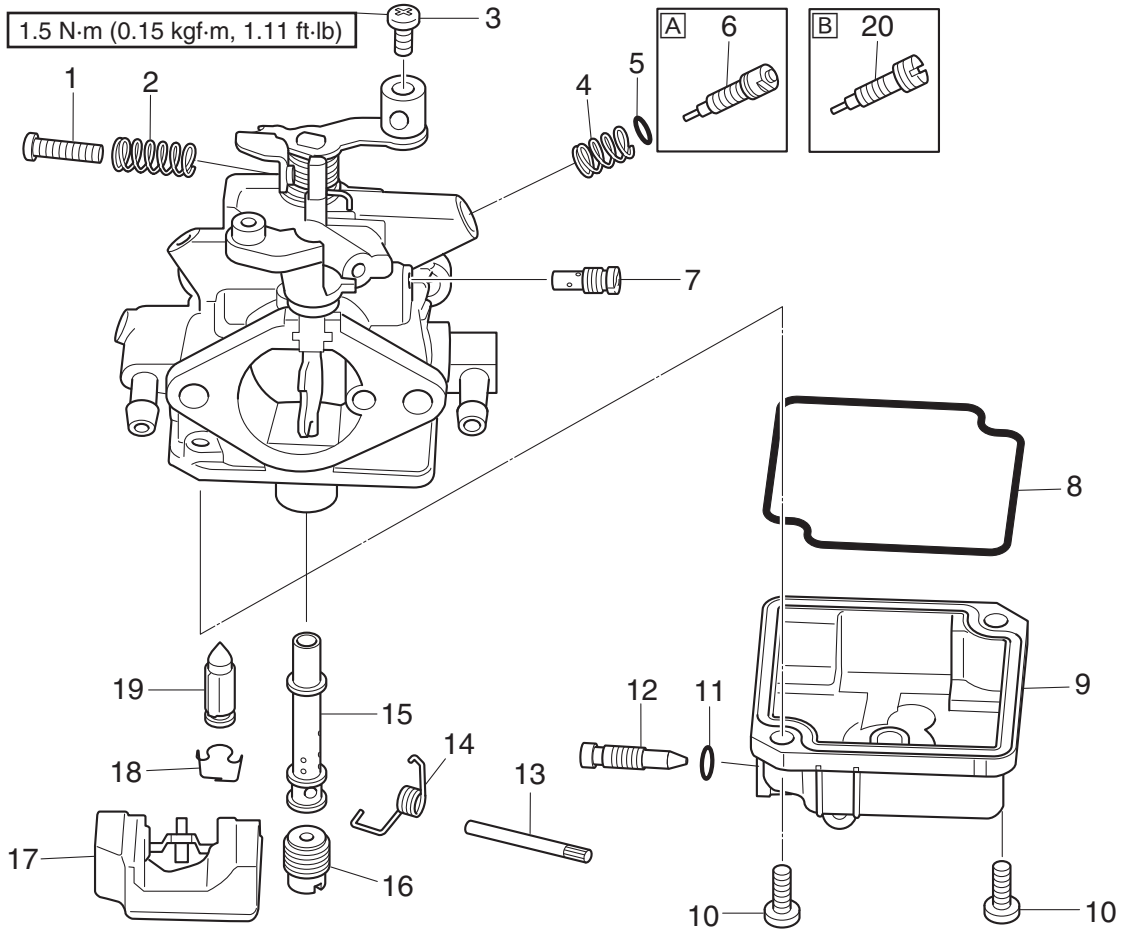
7. Loosen the throttle link screw ⑤.
8. Turn the throttle grip to the fully open position.
9. While pulling the lever ⓖ, tighten the throttle link screw ⑤ to the specified torque.



Throttle link screw ⑤: 1.5 N·m (0.15 kgf·m, 1.11 ft·lb)

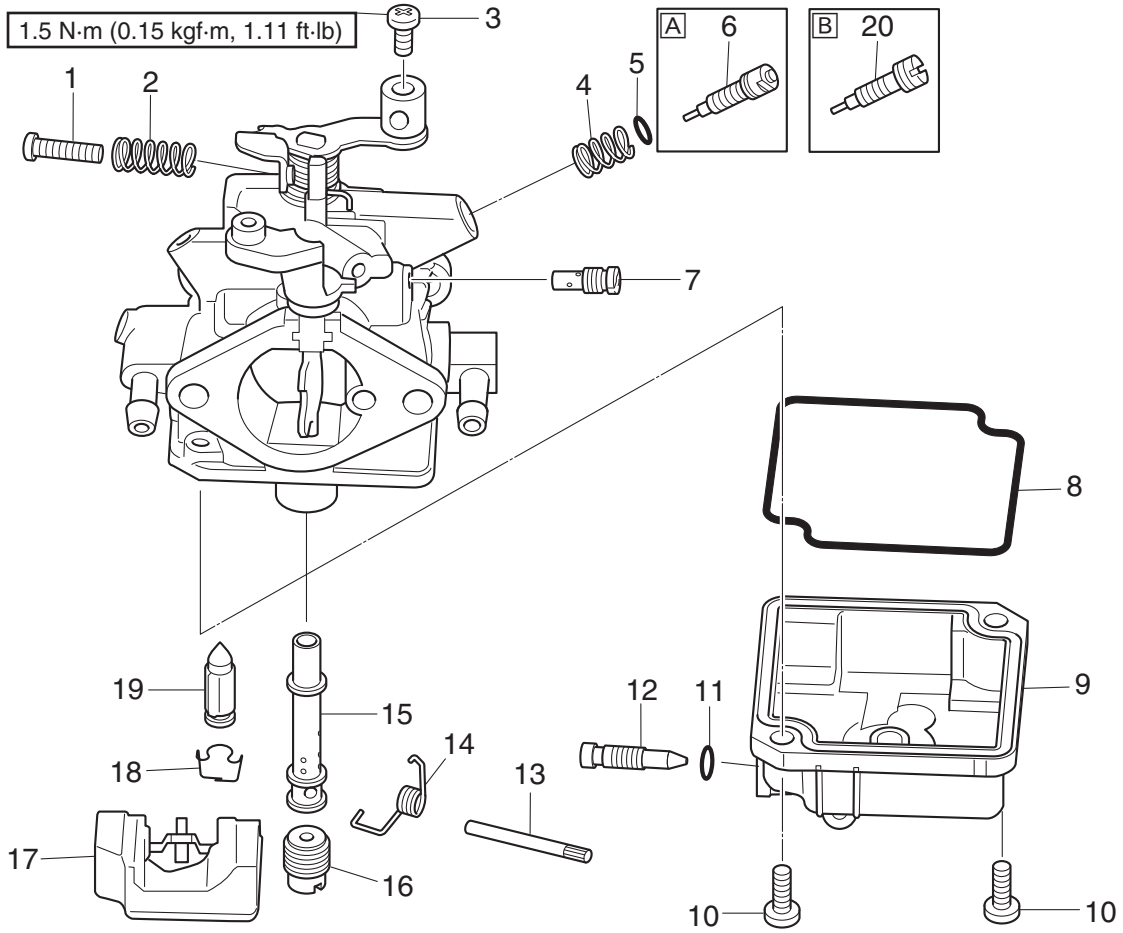
10. Check that the throttle link is in the fully open and fully closed positions when turning the throttle grip to the fully open and fully closed positions.

Carburetor



A For European market
B For Oceanian market

No.	Part name	Q'ty	Remarks
1	Throttle stop screw	1	M3 × 15 mm
2	Spring	1	
3	Throttle link screw	1	M4 × 6 mm
4	Spring	1	
5	O-ring	1	**Not reusable**
6	Pilot screw	1	
7	Pilot jet	1	
8	Gasket	1	**Not reusable**
9	Float chamber	1	
10	Screw	2	M4 × 12 mm
11	O-ring	1	**Not reusable**
12	Drain screw	1	
13	Pin	1	
14	Spring	1	
15	Main nozzle	1	
16	Main jet	1	
17	Float	1	



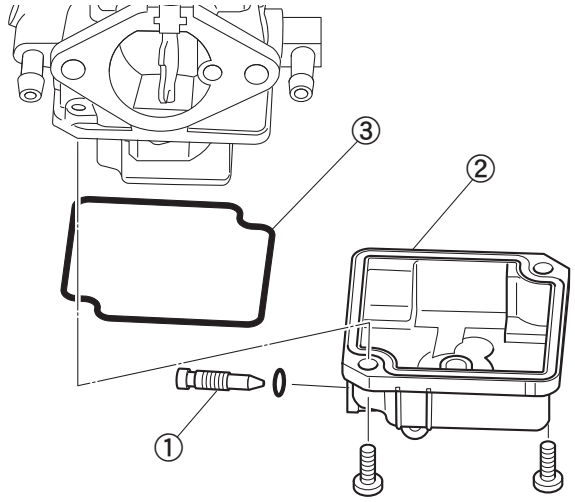
A For European market
B For Oceanian market

No.	Part name	Q'ty	Remarks
18	Clip	1	
19	Needle valve	1	
20	Pilot screw	1	

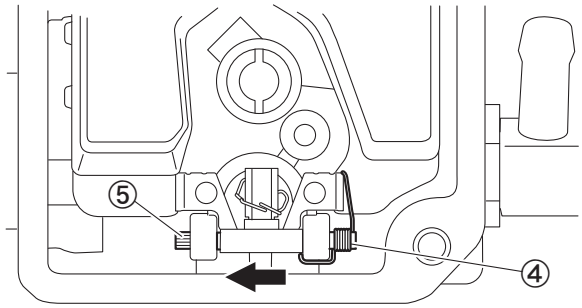
Disassembling the carburetor

1. Remove the drain screw ①.

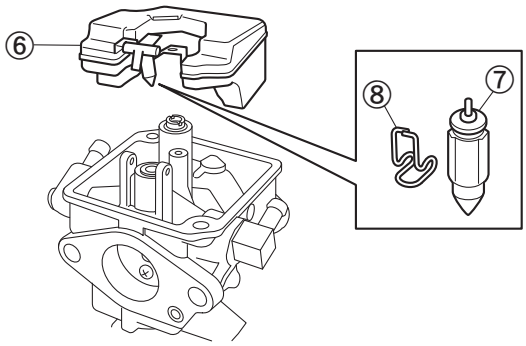
2. Remove the float chamber ② and gasket ③.



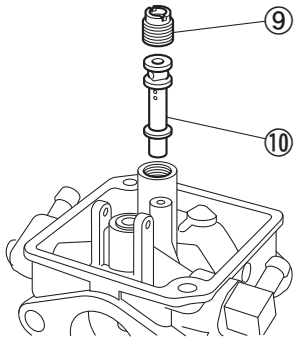
3. Remove the spring ④, and then remove the pin ⑤.



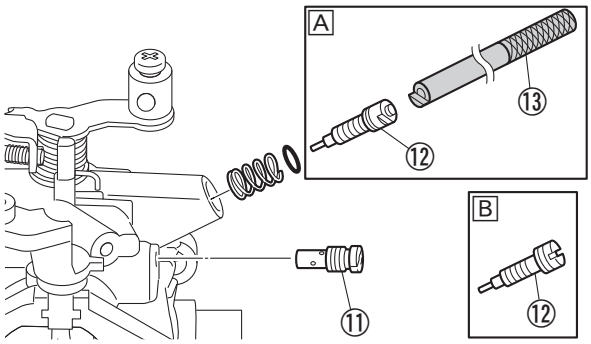
4. Remove the float ⑥, needle valve ⑦, and clip ⑧.



5. Remove the main jet ⑨ and main nozzle ⑩.



6. Remove the pilot jet ⑪ and pilot screw ⑫.



A For European market
B For Oceanian market

Pilot screw driver ⑬: 90890-06673

Checking the carburetor

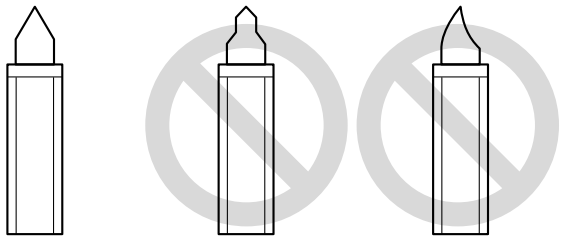
1. Check that the throttle valve operates smoothly.

2. Check the air and fuel passages. Clean the carburetor body if there is dirt or foreign material.

3. Blow compressed air into all passages and jets. **WARNING! When using compressed air, wear safety glasses or safety goggles. Otherwise, eye injury could result from flying debris or liquid.**

4. Check the main jet, pilot air jet, and main nozzle. Clean if there is dirt or residue. ***NOTICE:*** **Do not use steel wire to clean the jets. Otherwise, the jet diameters could be enlarged, which could seriously affect performance.**

5. Check the needle valve. Replace if deformed or worn.



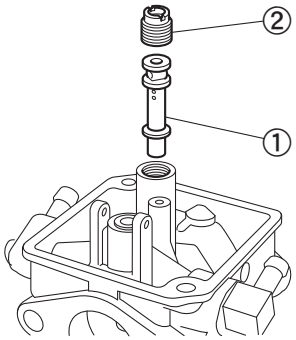
6. Check the float. Replace if cracked or deformed.

Assembling the carburetor

NOTICE

Do not reuse an O-ring or gasket, always replace it with a new one.

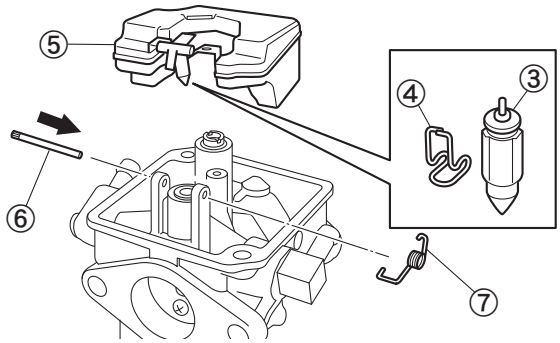
1. Install the main nozzle ① and main jet ②.

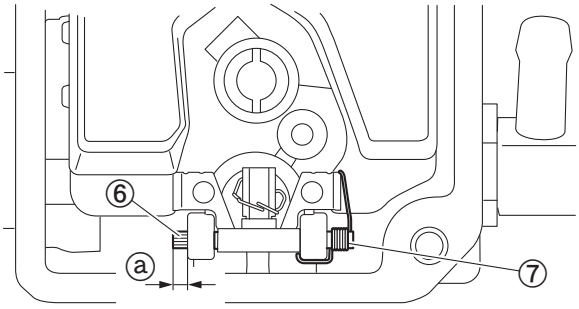


2. Install the needle valve ③, clip ④, and float ⑤.

3. Install the float pin ⑥ to the specified installation position ⓐ.

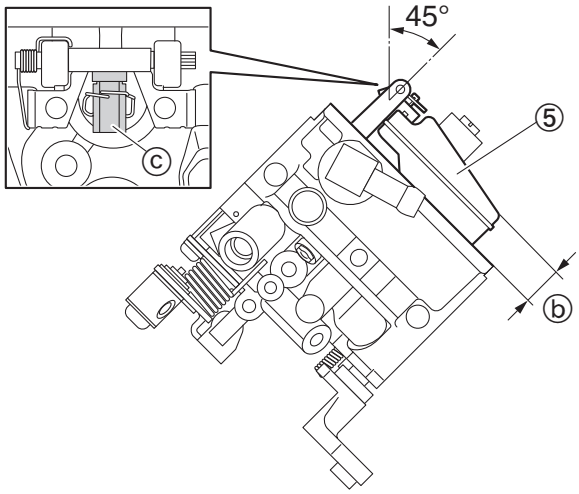
4. Install the spring ⑦.





Position ⓐ: 1.0 mm (0.04 in)

5. Measure the float height ⓑ. Adjust the float height by bending the tab ⓒ if out of specification.

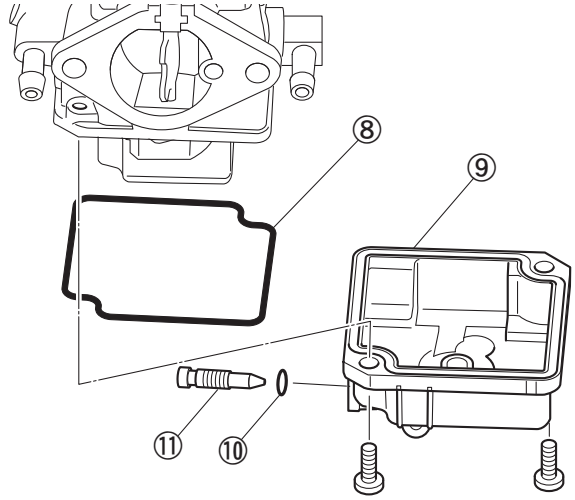


Float height ⓑ (reference data):
10.0 mm (0.4 in)

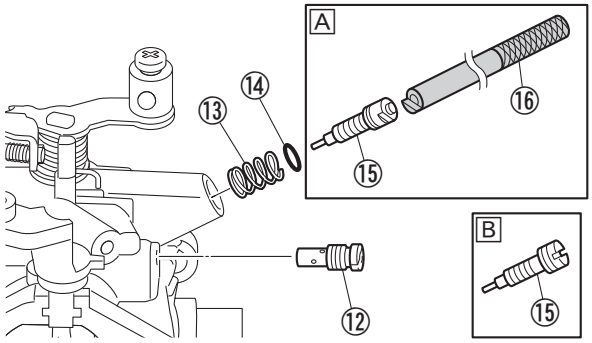
TIP:

When measuring the float height ⓑ hold the carburetor body at angle of 45° so that there is no load on the needle valve spring.

6. Install a new gasket ⑧, the float chamber ⑨, a new O-ring ⑩, and the drain screw ⑪.



7. Install the pilot jet ⑫, the spring ⑬, a new O-ring ⑭, and the pilot screw ⑮.



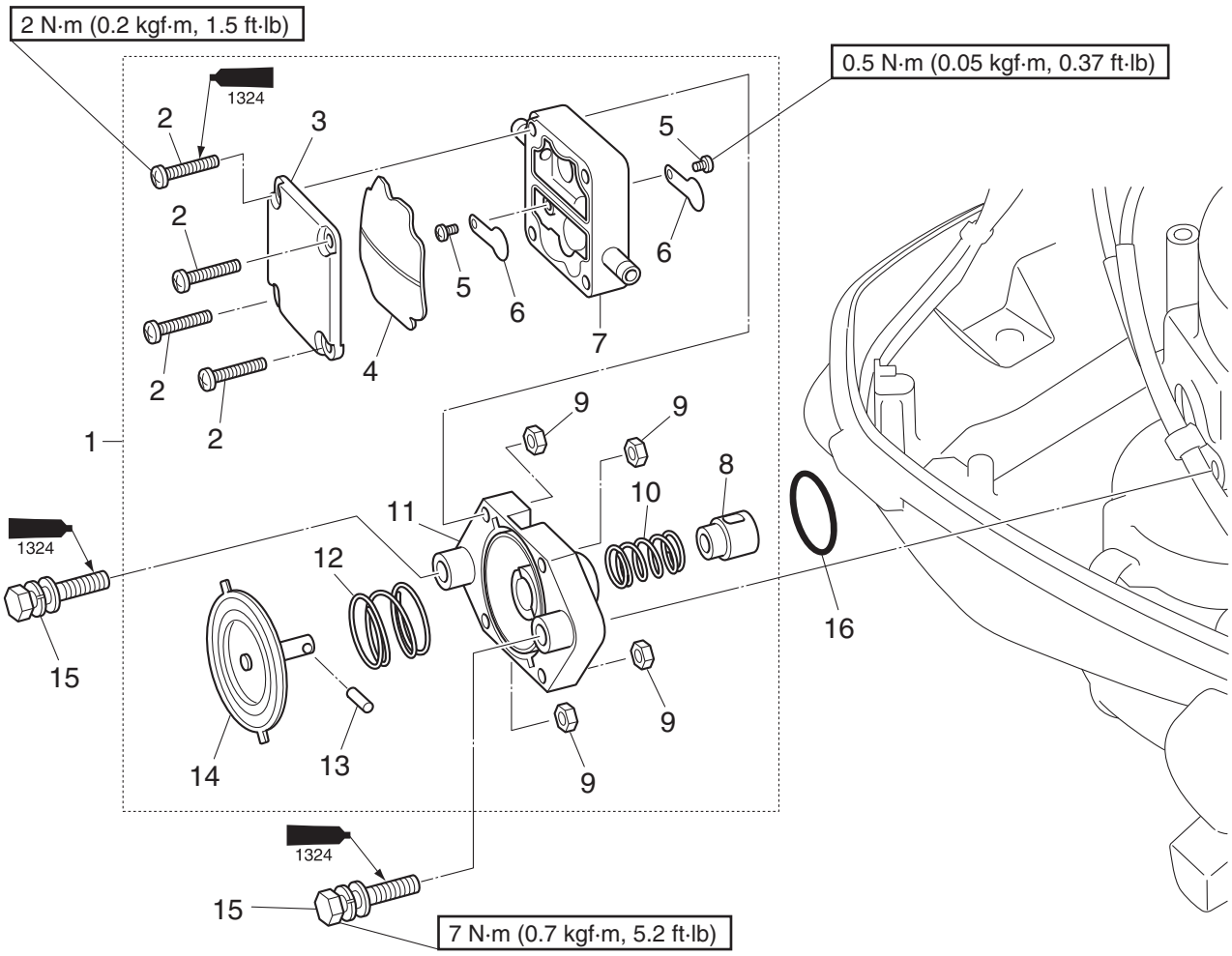
A For European market
B For Oceanian market

Pilot screw driver ⑯: 90890-06673

8. Turn the pilot screw ⑮ in until it is lightly seated, and then turn it out the specified number of turns.

Pilot screw setting: F4B: 1 3/8 ± 3/4 turns out F5A: 2 1/2 ± 3/4 turns out F6C: 1 3/8 ± 3/4 turns out

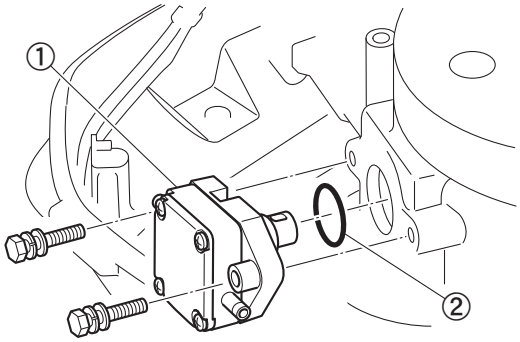
Fuel pump



No.	Part name	Q'ty	Remarks
1	Fuel pump	1	
2	Fuel pump screw	4	M4 × 25 mm
3	Cover	1	
4	Diaphragm	1	**Not reusable**
5	Fuel pump valve screw	2	M3 × 5 mm
6	Valve	2	
7	Fuel pump body 2	1	
8	Plunger	1	
9	Nut	4	
10	Spring	1	
11	Fuel pump body 1	1	
12	Spring	1	
13	Pin	1	
14	Diaphragm	1	**Not reusable**
15	Fuel pump bolt	2	M6 × 30 mm
16	O-ring	1	**Not reusable**

Removing the fuel pump

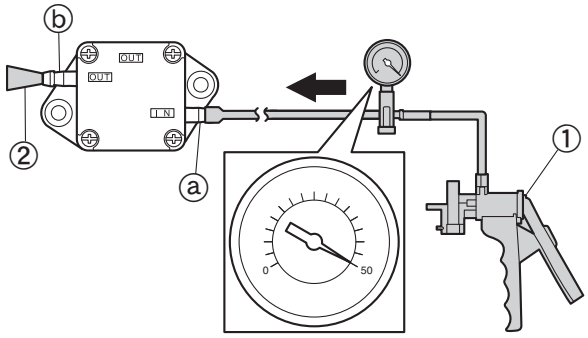
1. Remove the fuel pump ① and O-ring ②.



Checking the fuel pump

1. Connect the special service tool ① to the fuel pump inlet ⓐ.

2. Block the fuel pump outlet ⓑ using the rubber plug ②, and then apply the specified positive pressure. Check that there is no air leakage.

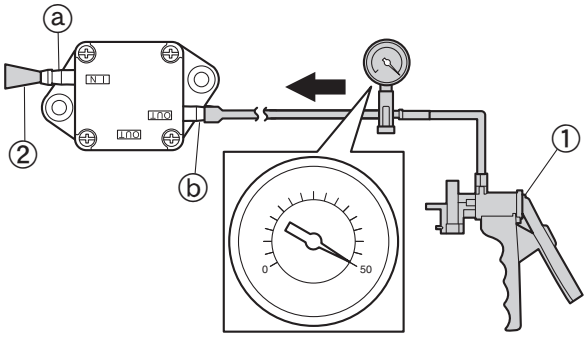


Vacuum/pressure pump gauge set ①:
90890-06756

Specified positive pressure:
50.0 kPa (0.50 kgf/cm², 7.3 psi)

3. Connect the special service tool ① to the fuel pump outlet ⓑ.

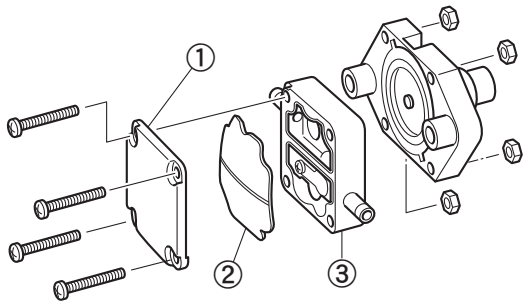
4. Block the fuel pump inlet ⓐ using the rubber plug ②, and then apply the specified positive pressure. Check that there is no air leakage.



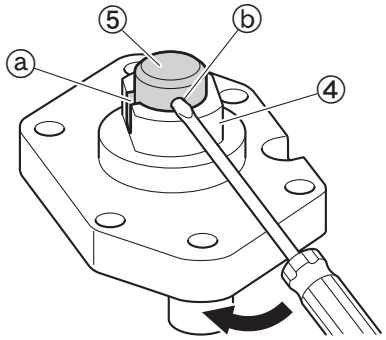
Specified positive pressure:
50.0 kPa (0.50 kgf/cm², 7.3 psi)

Disassembling the fuel pump

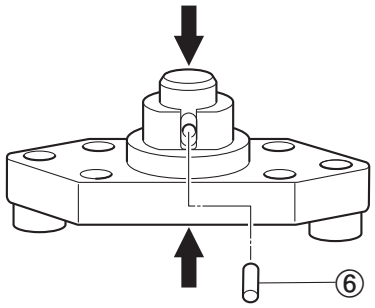
1. Remove the cover ①, diaphragm ②, and fuel pump body 2 ③.



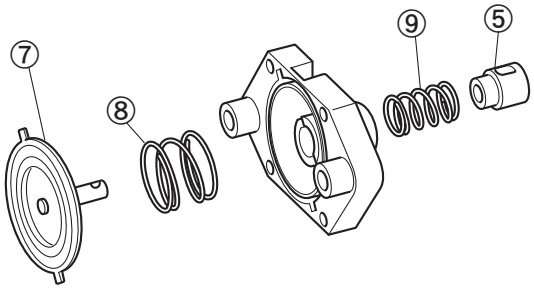
2. Align the slot ⓐ in the fuel pump body 1 ④ with the hole ⓑ in the plunger ⑤ by turning the plunger ⑤.



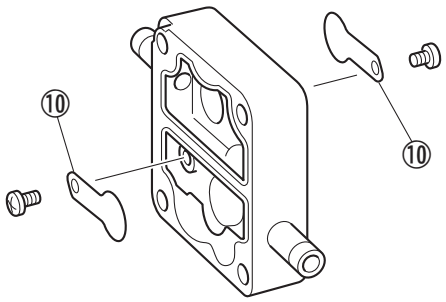
3. Remove the pin ⑥ by pushing the plunger and diaphragm.



4. Remove the diaphragm ⑦, spring ⑧, plunger ⑤, and spring ⑨.



5. Remove the valves ⑩.



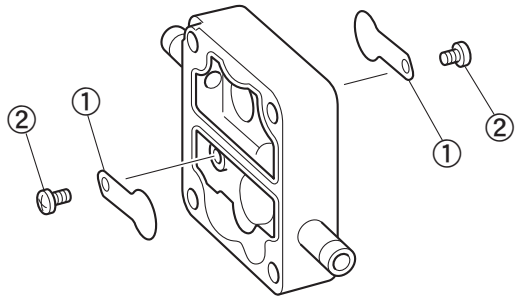
Checking the diaphragm and valve

1. Check the diaphragm. Replace if torn.
2. Check the valve. Replace if deformed or worn.

Assembling the fuel pump

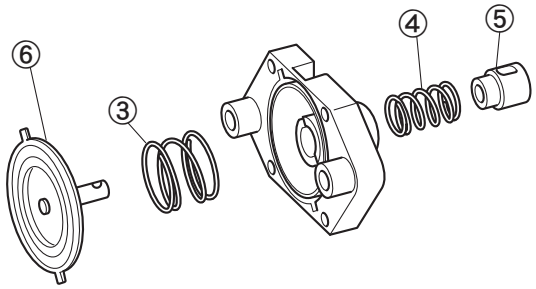
Before assembling the fuel pump, clean the parts and soak the valves and diaphragm in gasoline to obtain proper operation of the fuel pump.

1. Install the valves ①, and then tighten the fuel pump valve screws ② to the specified torque.

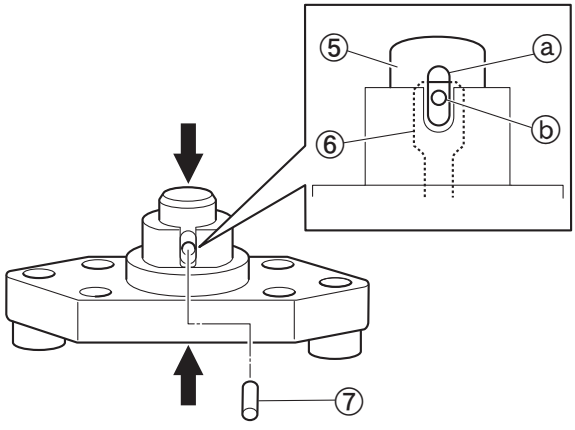


Fuel pump valve screw ②:
0.5 N·m (0.05 kgf·m, 0.37 ft·lb)

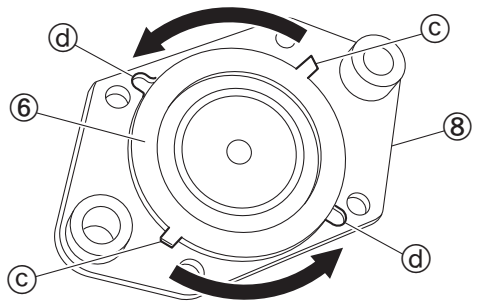
2. Install the springs ③ and ④, plunger ⑤, and diaphragm ⑥.



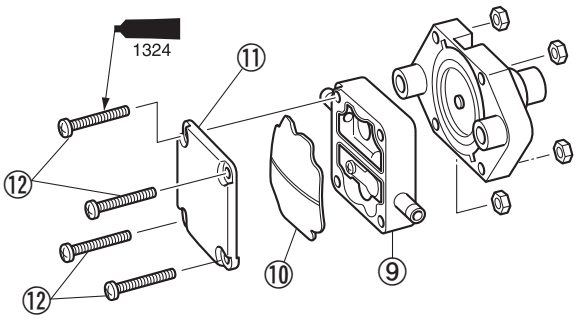
3. Align the hole ⓐ in the plunger ⑤ with the hole ⓑ in the diaphragm ⑥ by pushing the plunger and diaphragm.
4. Install the pin ⑦.



5. Turn the plunger so that the protrusions ⓒ in the diaphragm ⑥ fit into the slots ⓓ in the fuel pump body 1 ⑧.



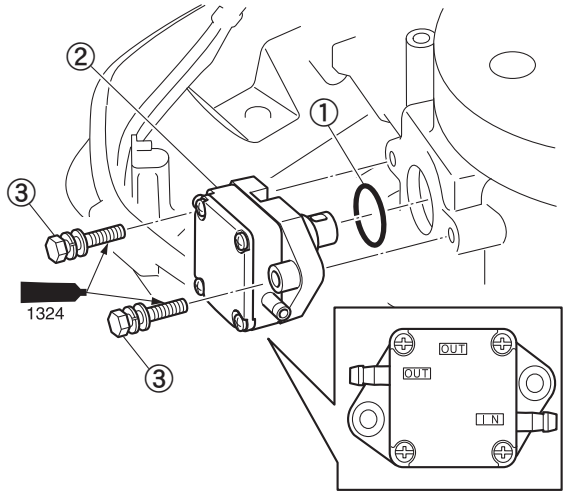
6. Install the fuel pump body 2 ⑨, a new diaphragm ⑩, and the cover ⑪, and then tighten the fuel pump screws ⑫ to the specified torque.



Fuel pump screw ⑫:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

Installing the fuel pump

1. Install a new O-ring ① and the fuel pump ②, and then tighten the fuel pump bolts ③ to the specified torque.



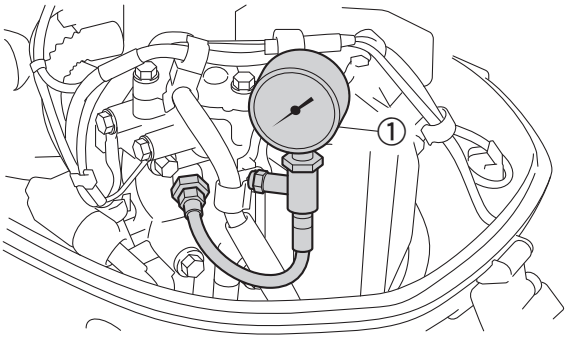
Fuel pump bolt ③:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

Power unit

Power unit (check and adjustment)

Checking the compression pressure

1. Start the engine, warm it up for 5 minutes, and then stop it.
2. Remove the clip from the engine shut-off switch.
3. Disconnect the spark plug cap, and then remove the spark plug. ***NOTICE:*** **Before removing the spark plug, remove any dirt or dust in the spark plug well that may fall into the cylinder.**
4. Install the special service tool ①.



Compression gauge ①: 90890-03160

5. Fully open the throttle.
6. Pull the starter handle quickly several times to crank until the reading on the compression gauge stabilizes, and then measure the compression pressure.

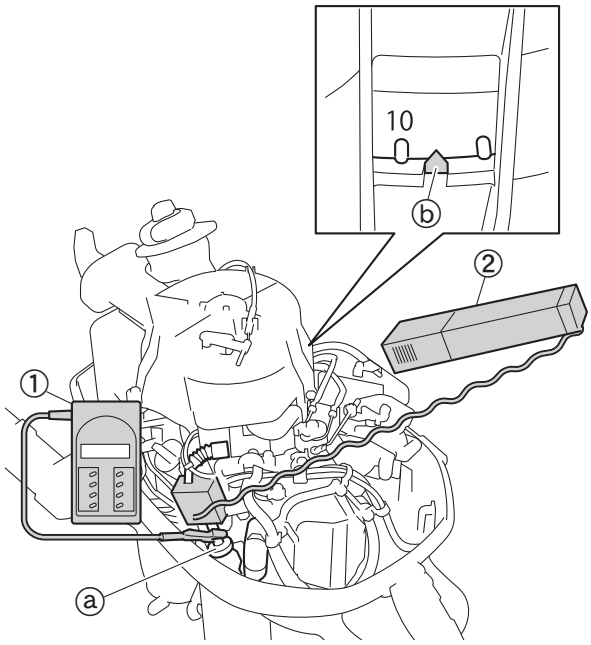
Minimum compression pressure (reference data):
700.0 kPa (7.00 kgf/cm^2, 101.5 psi) at 20 °C (68 °F)

TIP:
When pulling the starter handle to crank the engine, the compression pressure may vary depending on the speed at which the starter handle is pulled.

7. Remove the special service tool.
8. Install the spark plug. See step 4 in "Installing the cylinder head" (7-37).
9. Connect the spark plug cap.

Checking the ignition timing

1. Install the special service tools ① and ② to the spark plug wire ⓐ.
2. Start the engine and warm it up until the idle speed stabilizes at 1450–1550 r/min.
3. Check that the pointer ⓑ on the manual starter is aligned with the specified ignition timing mark on the flywheel magnet.



Digital tachometer ①: 90890-06760
Timing light ②: 90890-03141

Ignition timing: BTDC 7–9° at 1500 r/min

TIP:
Set the digital tachometer to the 2-cycle 1-cylinder mode because this engine ignites the spark plug once per crankshaft rotation.

Checking the CDI unit air gap

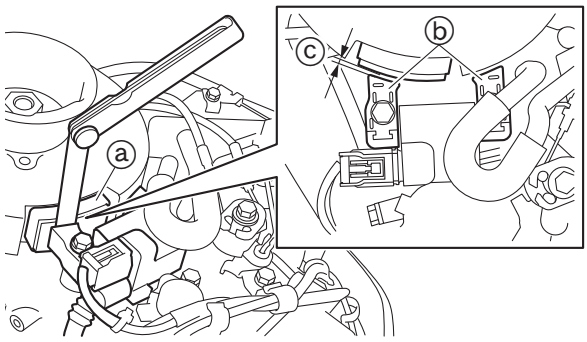
NOTICE

Do not turn the flywheel magnet counterclockwise. Otherwise, the water pump impeller could be damaged.

1. Remove the manual starter. See “Removing the manual starter” (7-7).

2. Turn the flywheel magnet clockwise to align the permanent magnet ⓐ with the protrusions ⓑ on the CDI unit.

3. Measure the CDI unit air gap ⓒ.



CDI unit air gap ⓒ:
0.4–0.6 mm (0.016–0.024 in)

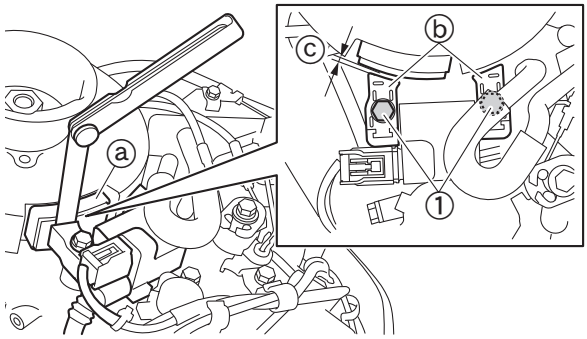
Adjusting the CDI unit air gap

NOTICE

Do not turn the flywheel magnet counter-clockwise. Otherwise, the water pump impeller could be damaged.

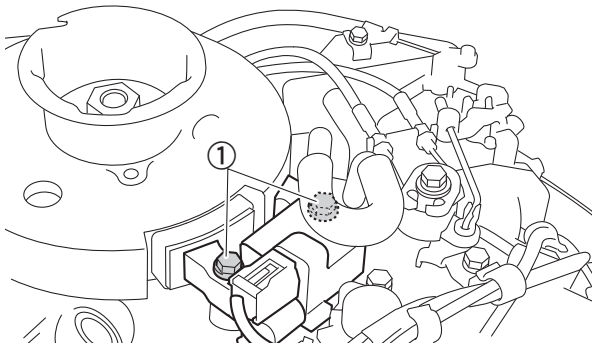
1. Turn the flywheel magnet clockwise to align the permanent magnet ⓐ with the protrusions ⓑ on the CDI unit.

2. Loosen the CDI unit bolts ①, and then adjust the CDI unit air gap ⓒ.



CDI unit air gap ⓒ:
0.4–0.6 mm (0.016–0.024 in)

3. Tighten the CDI unit bolts ① to the specified torque.



CDI unit bolt ①:
10 N·m (1.0 kgf·m, 7.4 ft·lb)

4. Measure the CDI unit air gap.

Checking the valve clearance

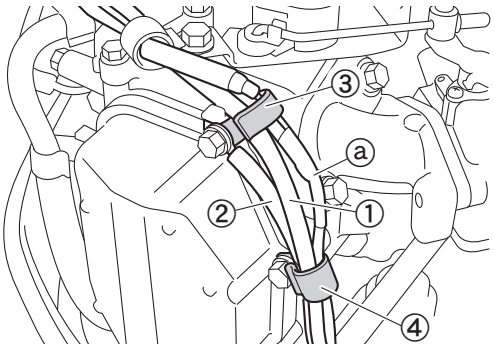
Measure the valve clearances when the engine is cold.

NOTICE

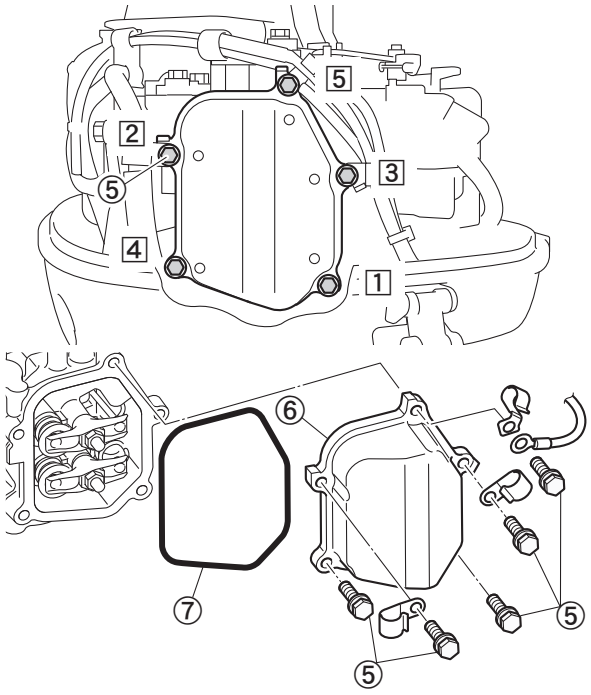
Do not turn the flywheel magnet counter-clockwise. Otherwise, the water pump impeller could be damaged.

1. Remove the clip from the engine shut-off switch.

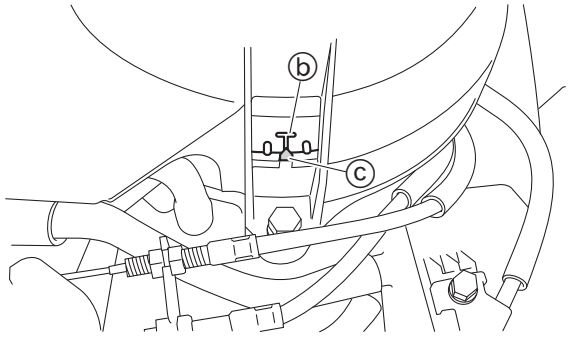
2. Remove the engine shut-off switch lead ⓐ, ground leads ① and ② from the holders ③ and ④.



3. Loosen the bolts ⑤ in the order 1, 2, and so on, and then remove the cylinder head cover ⑥ and gasket ⑦.

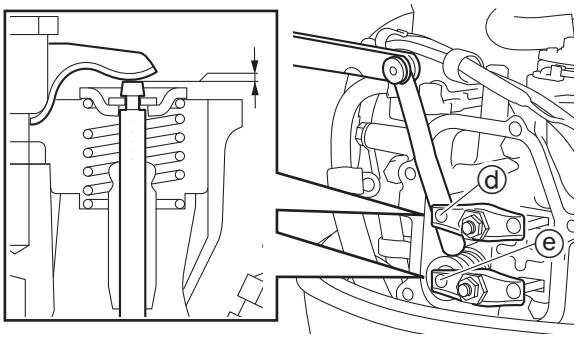


4. Slowly pull the starter handle to align the TDC mark ⓑ on the flywheel magnet and the pointer ⓒ of the manual starter.



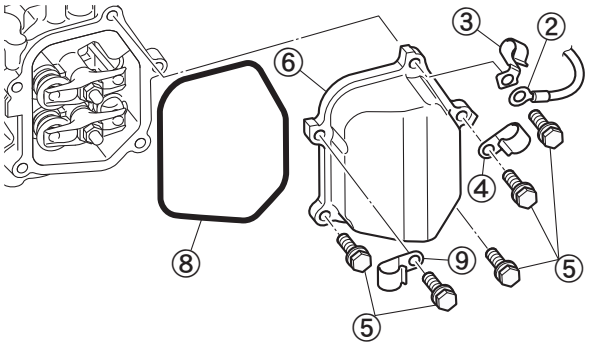
TIP:
Make sure that the rocker arms are not pushing the intake and exhaust valves.

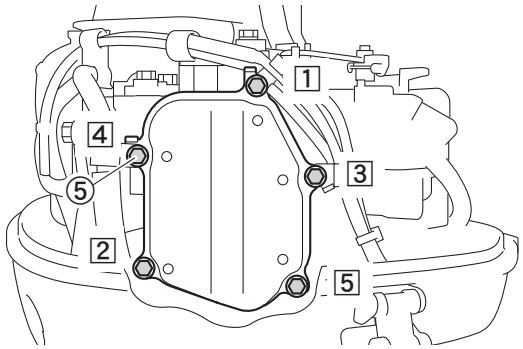
5. Measure the intake and exhaust valve clearances ⓓ and ⓔ.



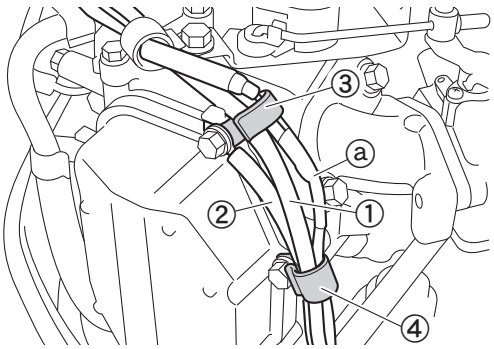
Valve clearance:
Intake ⓓ and exhaust ⓔ:
0.08–0.12 mm (0.003–0.005 in)

6. Install a new gasket ⑧, the cylinder head cover ⑥, the holders ③, ④, ⑨, and ground lead ②, and then tighten the bolts ⑤ in the order 1, 2, and so on. ***NOTICE:*** **Do not reuse a gasket, always replace it with a new one.**





7. Install the ground leads ①, ② and engine shut-off switch lead ⓐ to the holders ③ and ④.



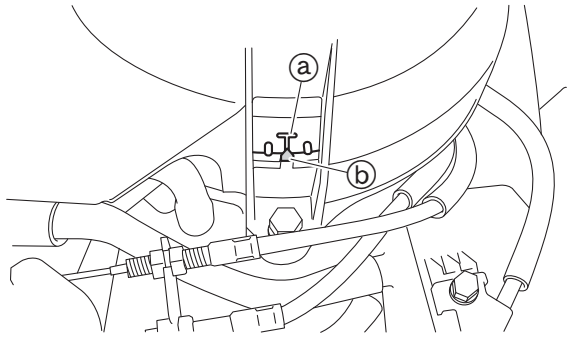
Adjusting the valve clearance

Adjust the valve clearances when the engine is cold.

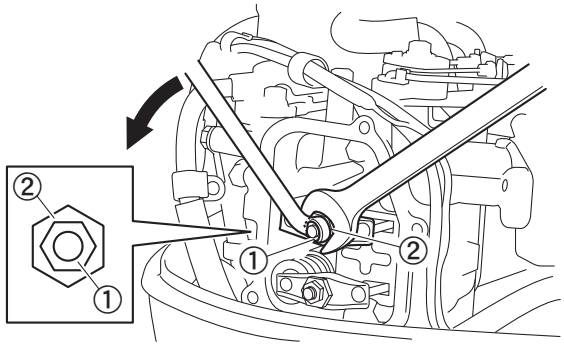
NOTICE

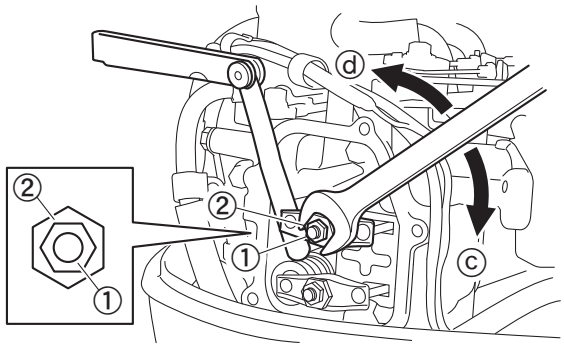
Do not turn the flywheel magnet counterclockwise. Otherwise, the water pump impeller could be damaged.

1. Align the TDC mark ⓐ on the flywheel magnet and the pointer ⓑ of the manual starter.



2. Loosen the valve adjusting locknut ①, and then turn the rocker arm pivot ② until the specified valve clearance is obtained.



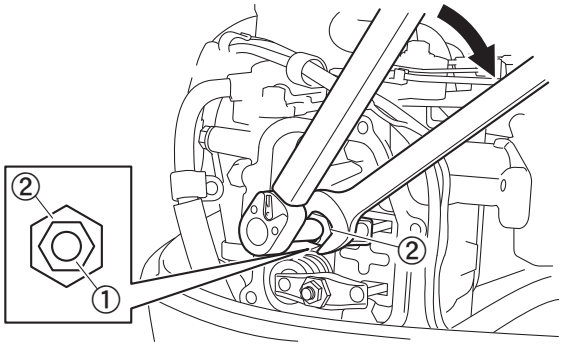


Valve clearance:
Intake and exhaust:
0.08–0.12 mm (0.003–0.005 in)

TIP:

- To decrease the valve clearance, turn the rocker arm pivot in direction ⓒ.
- To increase the valve clearance, turn the rocker arm pivot in direction ⓓ.

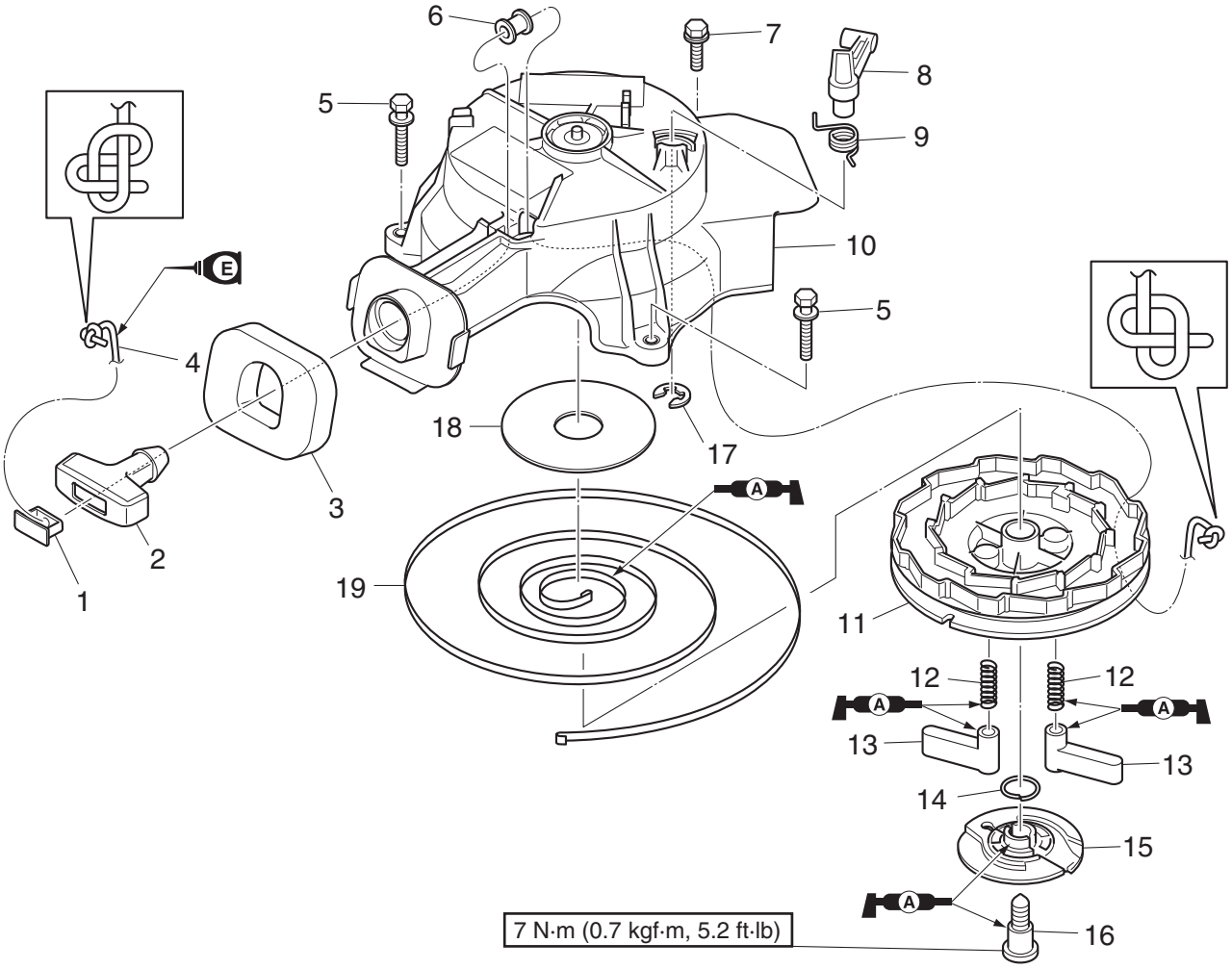
3. Tighten the valve adjusting locknut ① to the specified torque, and then check the valve clearances.



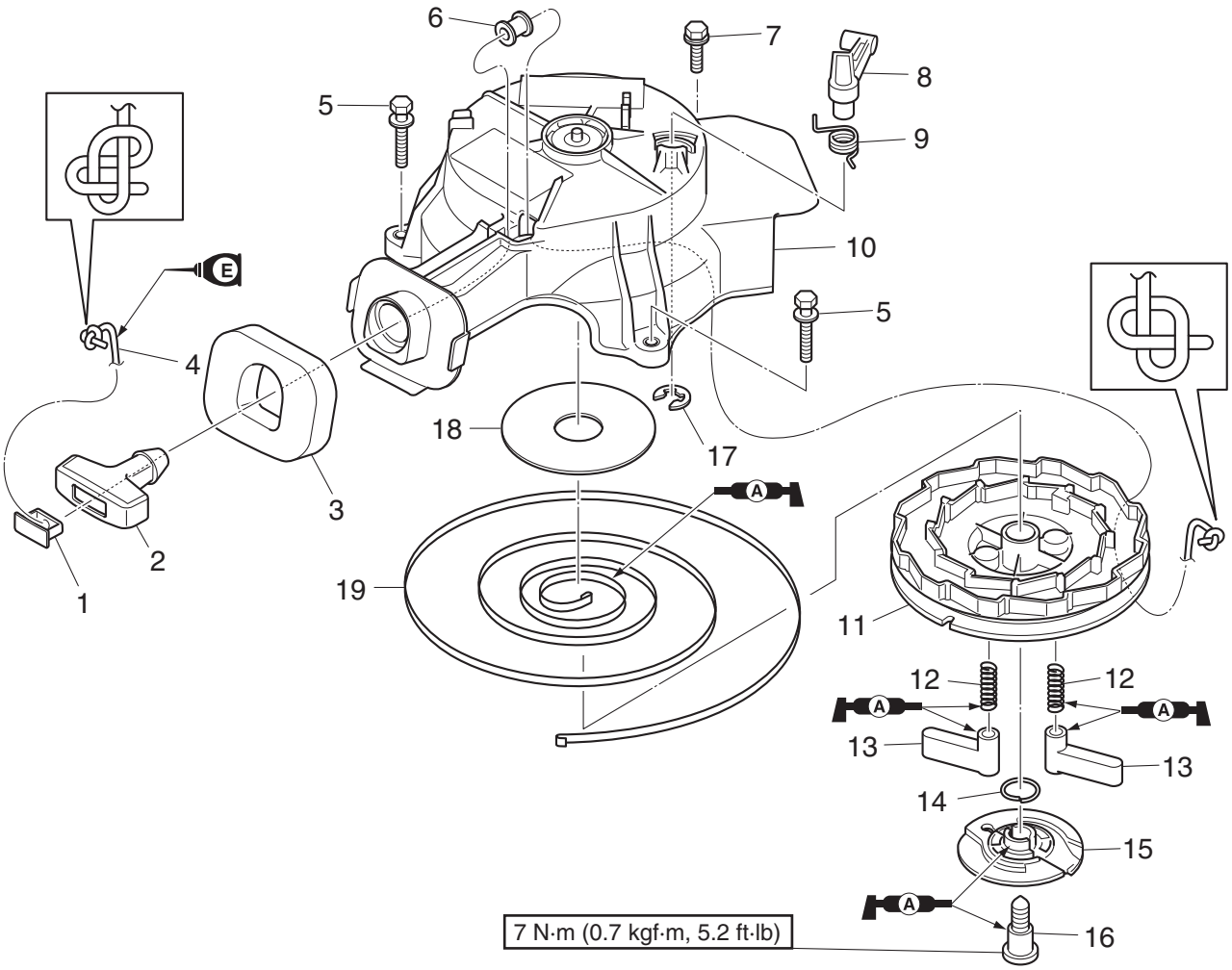
Valve adjusting locknut ①:
10 N·m (1.0 kgf·m, 7.4 ft·lb)

7

Manual starter



No.	Part name	Q'ty	Remarks
1	Cap	1	
2	Starter handle	1	
3	Rubber seal	1	
4	Starter rope	1	1800.0 mm (70.9 in) (reference data)
5	Bolt	2	M6 × 35 mm
6	Guide	1	
7	Bolt	1	M6 × 20 mm
8	Starter plunger	1	
9	Spring	1	
10	Cover	1	
11	Sheave drum	1	
12	Spring	2	
13	Drive pawl	2	
14	Clip	1	
15	Drive plate	1	
16	Drive plate screw	1	
17	E-clip	1	

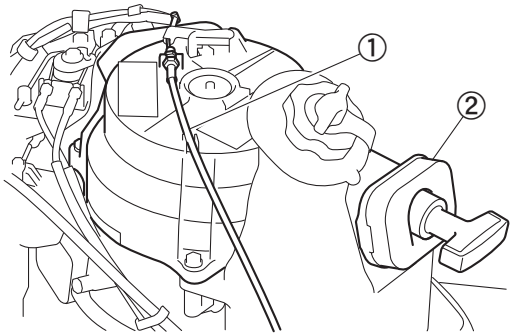


No.	Part name	Q'ty	Remarks
18	Plate	1	
19	Spiral spring	1	

Removing the manual starter

1. Disconnect the start-in-gear protection cable ①.

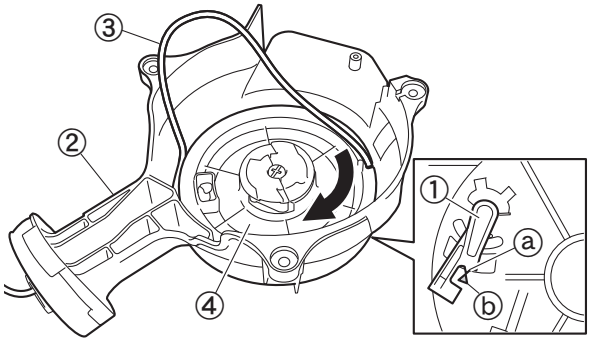
2. Remove the manual starter ②.



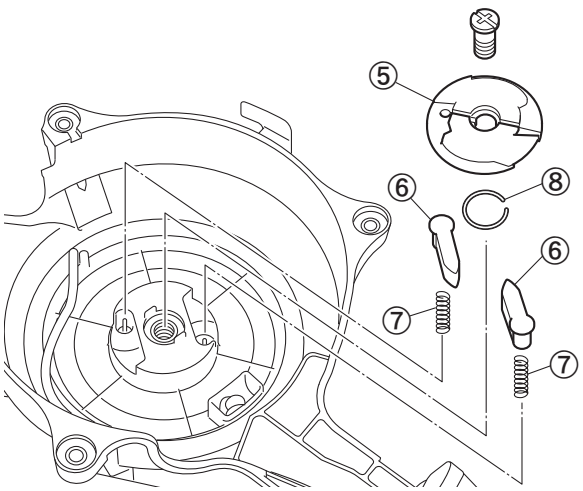
Disassembling the manual starter

1. Align the protrusion ⓐ on the starter plunger ① and the mark ⓑ on the manual starter ②.

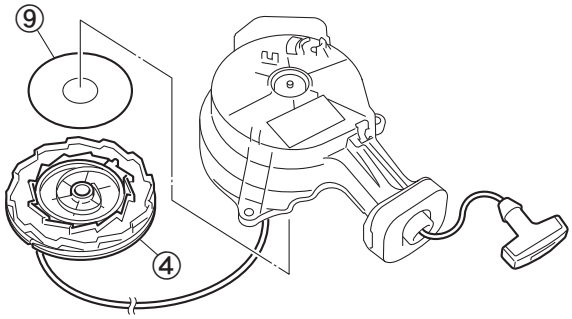
2. While holding the starter rope ③, turn the sheave dram ④ 3–4 turns clockwise.



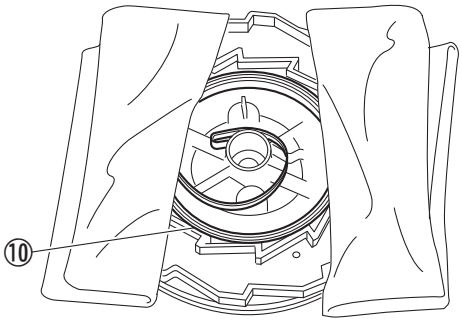
3. Remove the drive plate ⑤, drive pawls ⑥, and drive pawl springs ⑦, and then remove the clip ⑧ from the drive plate ⑤.



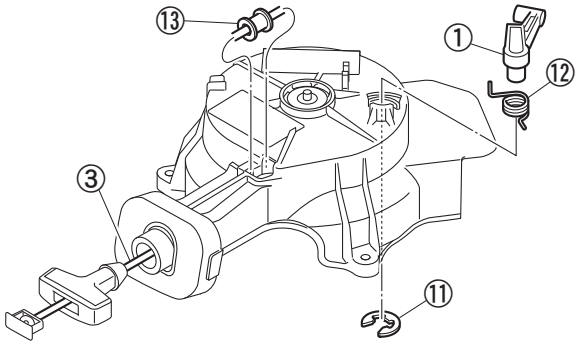
4. Remove the sheave drum ④ and plate ⑨.



5. Remove the spiral spring ⑩. **WARNING! The spiral spring can pop out. Cover the spiral spring with rags when removing it.**



6. Remove the starter rope ③, E-clip ⑪, starter plunger ①, starter plunger spring ⑫, and guide ⑬.



Checking the manual starter

1. Check the guide, drive pawls, drive plate, plate, and starter plunger. Replace if cracked or damaged.

2. Check the clip, drive pawl springs, E-clip, and starter plunger spring. Replace if bent, cracked, or damaged.

3. Check the sheave drum. Replace if cracked or damaged.

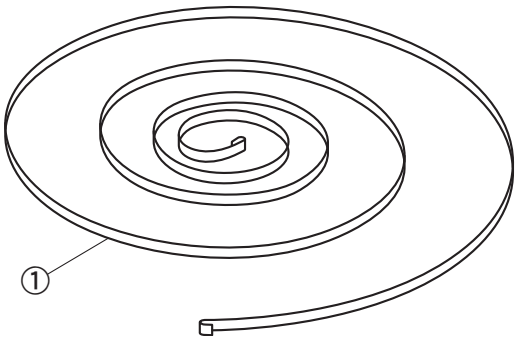
4. Check the starter handle. Replace if cracked or damaged.

5. Check the starter rope. Replace if damaged.

Starter rope length (reference data):
1800.0 mm (70.9 in)

Checking the spiral spring

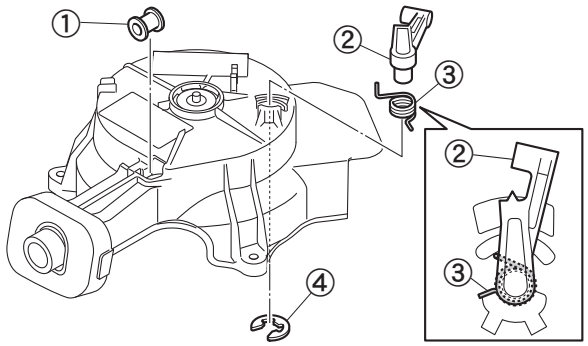
1. Check the spiral spring ①. Replace if bent, cracked, or damaged.



Assembling the manual starter

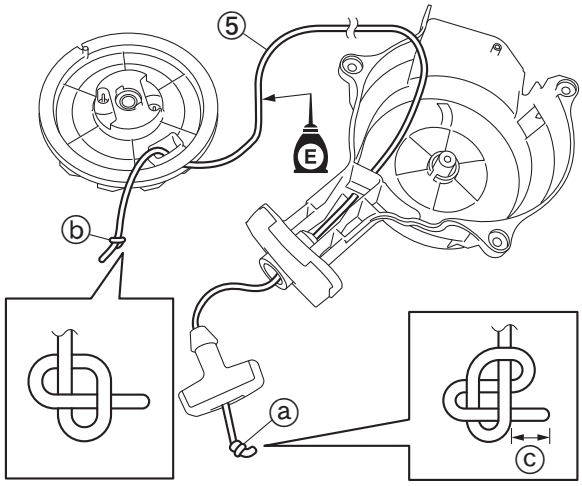
1. Install the guide ①.

2. Install the starter plunger ② and starter plunger spring ③, and then install the E-clip ④.



3. Route the starter rope ⑤.

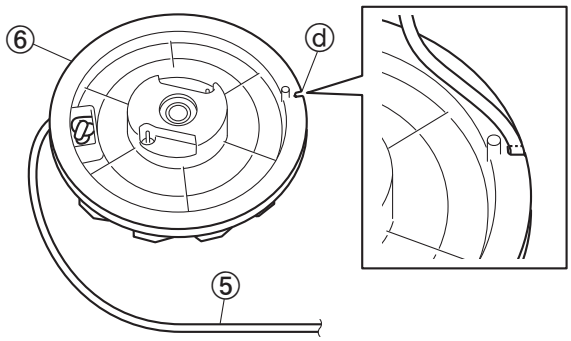
4. Tie a knot in both ends ⓐ and ⓑ of the starter rope ⑤.



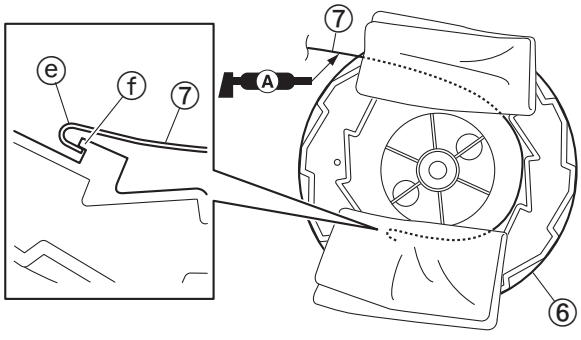
TIP:

Make sure to leave ⓒ 12.0 mm (0.47 in) or more at the end ⓐ of the starter rope.

5. Wind the starter rope ⑤ twice around the sheave drum ⑥ counterclockwise, and then fit the starter rope ⑤ into the slot ⓓ.



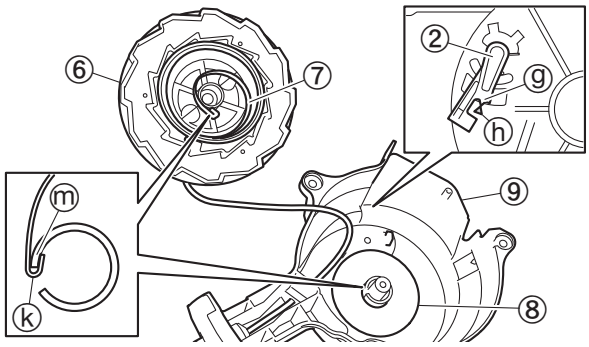
6. Hook the end ⓔ of the spiral spring ⑦ onto the section ⓕ of the sheave drum ⑥, and then install the spiral spring ⑦ into the sheave drum ⑥. **WARNING! The spiral spring can pop out. Cover the spiral spring with rags when installing it.**



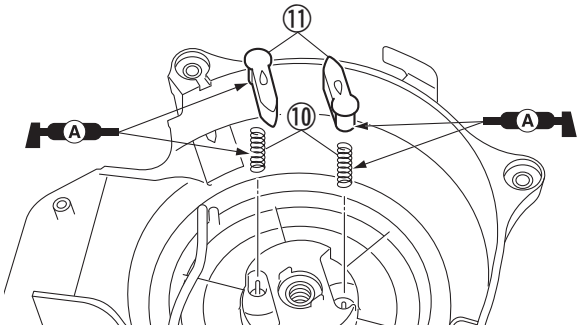
7. Install the plate ⑧.

8. Install the sheave drum ⑥ with the protrusion ⓖ on the starter plunger ② and the mark ⓗ of the manual starter ⑨ aligned.

9. Turn the sheave drum ⑥ to hook the end ⓚ of the spiral spring ⑦ onto the section ⓜ in the manual starter ⑨.

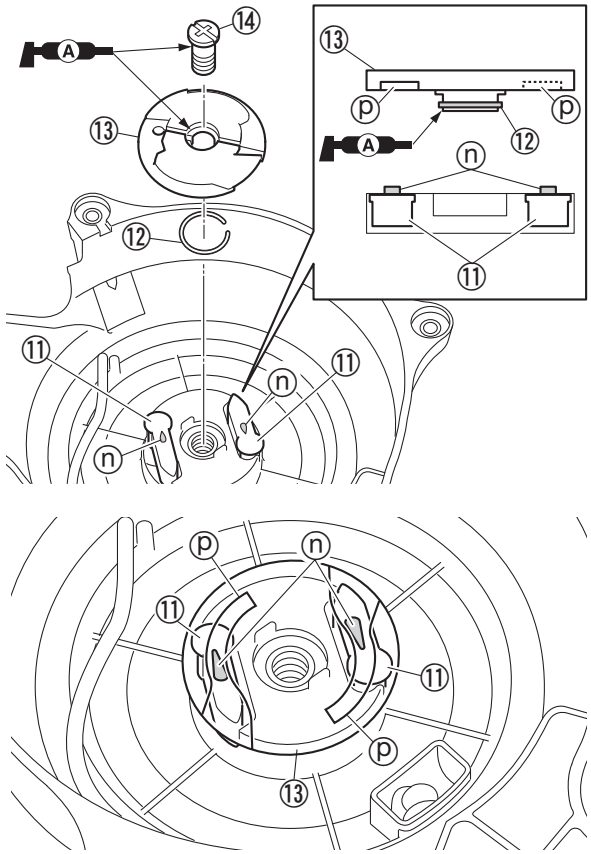


10. Install the drive pawl springs ⑩ and drive pawls ⑪.



11. Install the clip ⑫ to the drive plate ⑬.

12. Install the drive plate ⑬ by aligning the protrusion ⓝ on the drive pawls ⑪ and the slots Ⓟ in the drive plate ⑬, and then tighten the drive plate screw ⑭ to the specified torque.

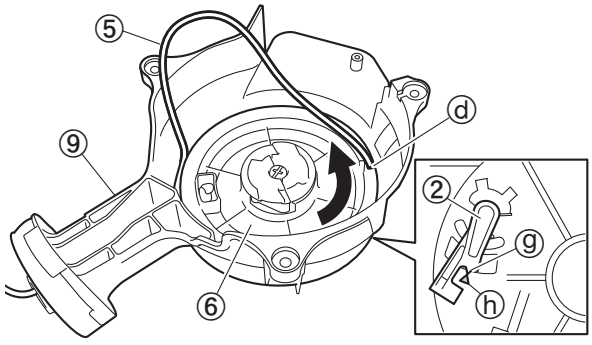


Drive plate screw ⑭:
7 N·m (0.7 kgf·m, 5.2 ft·lb)

13. Align the protrusion ⓖ on the starter plunger ② and the mark ⓗ on the manual starter ⑨.

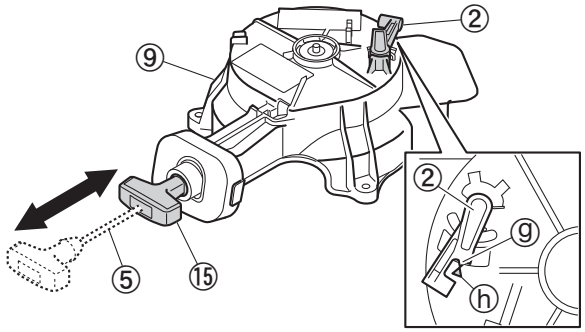
14. While holding the starter rope ⑤, turn the sheave dram ⑥ 3 turns counterclockwise.

15. Remove the starter rope ⑤ from the slot ⓓ, and then let the sheave drum ⑥ turn slowly so that the starter rope ⑤ is wound around the sheave drum ⑥.



16. Align the protrusion ⑨ on the starter plunger ② and the mark ⓗ on the manual starter ⑨.

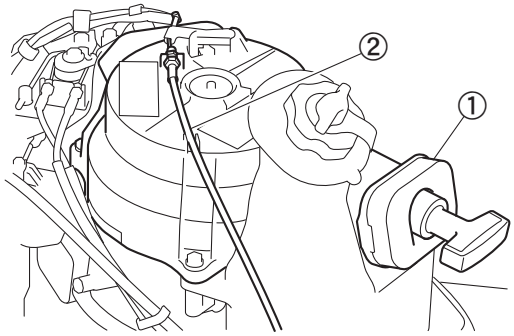
17. Pull the starter handle ⑮ several times to check that the sheave drum turns smoothly and to check the starter rope ⑤ for slack.



Installing the manual starter

1. Install the manual starter ①.

2. Connect the start-in-gear protection cable ②.



Adjusting the start-in-gear protection cable

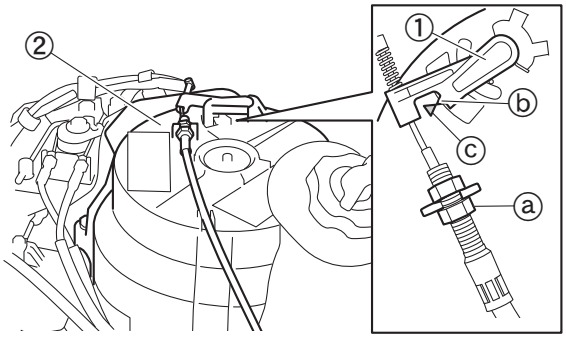
NOTICE

Make sure to remove the clip from the engine shut-off switch before checking the start-in-gear protection.

1. Move the shift lever to the N position.

2. Loosen the start-in-gear protection cable locknut ⓐ, and then align the protrusion ⓑ on the starter plunger ① and the mark ⓒ on the manual starter ②.

3. Tighten the start-in-gear protection cable locknut ⓐ to the specified torque.



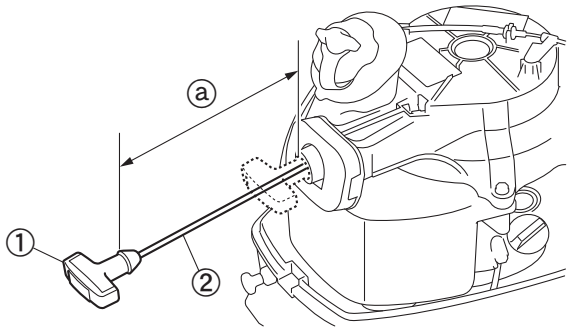
Start-in-gear protection cable locknut ⓐ: 2 N·m (0.2 kgf·m, 1.5 ft·lb)

4. Move the shift lever to the F or R position.

5. Check that the starter handle cannot be pulled.

Measuring the starter rope

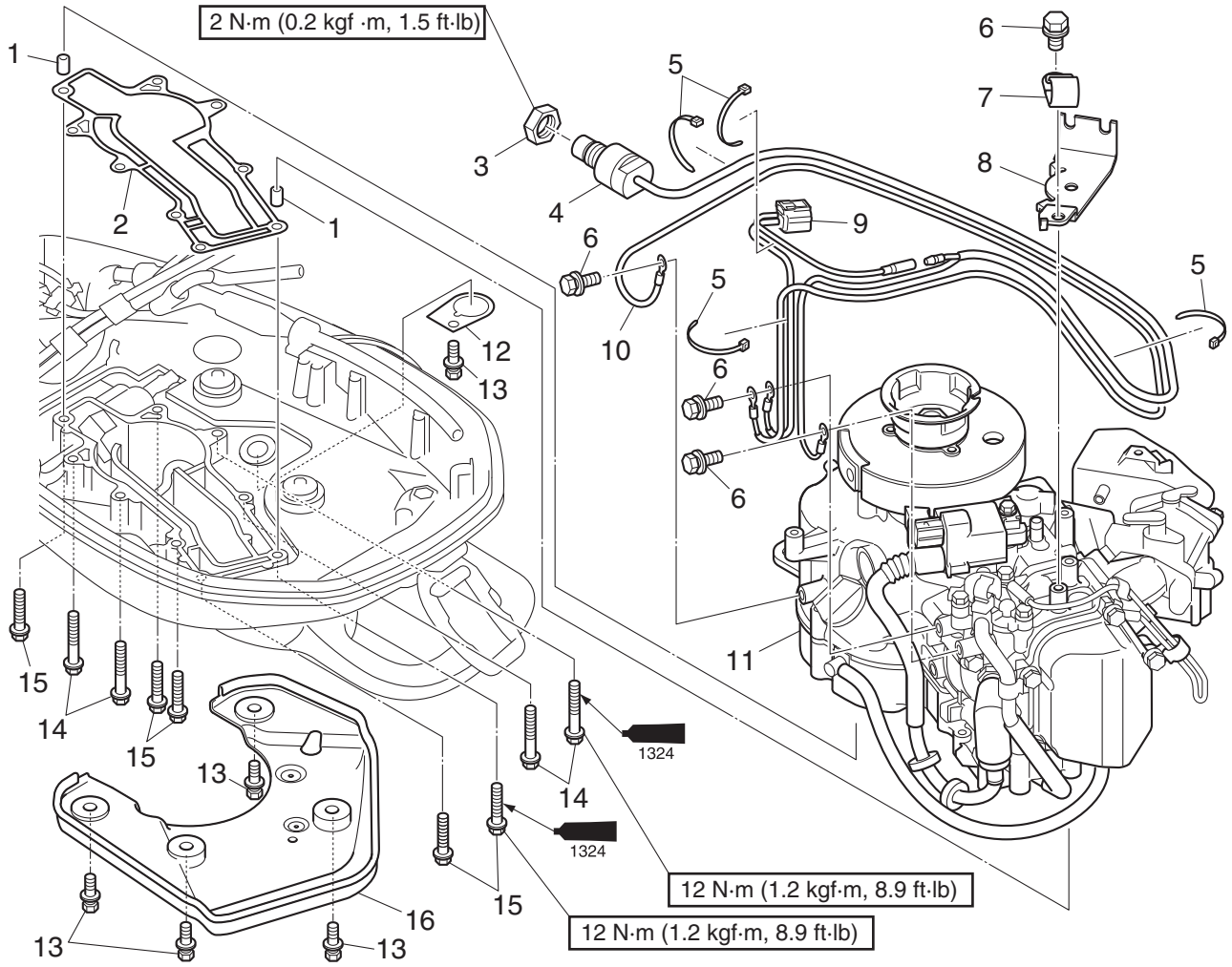
1. Pull the starter handle ① to extend the starter rope ② completely, and then measure the starter rope extended length ⓐ.



Starter rope extended length ⓐ: 1430.0–1570.0 mm (56.3–61.8 in)

7

Power unit assembly



No.	Part name	Q'ty	Remarks
1	Dowel	2	
2	Gasket	1	**Not reusable**
3	Engine shut-off switch nut	1	
4	Engine shut-off switch	1	
5	Plastic tie	4	**Not reusable**
6	Bolt	4	M6 × 12 mm
7	Holder	1	
8	Bracket	1	
9	CDI unit coupler	1	
10	Ground lead	1	
11	Power unit assembly	1	
12	Plate	1	
13	Bolt	5	M6 × 15 mm
14	Power unit mounting bolt	4	M6 × 50 mm
15	Power unit mounting bolt	5	M6 × 40 mm
16	Cover	1	

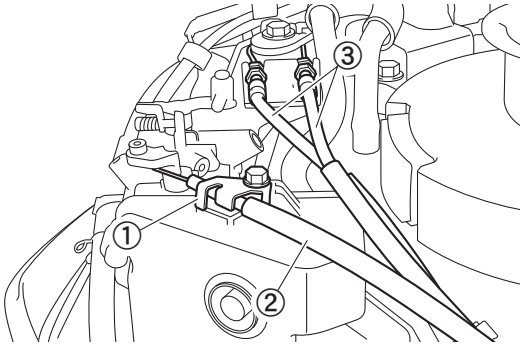
Removing the power unit

Cover the fuel components using a rag to prevent fuel from spilling out.

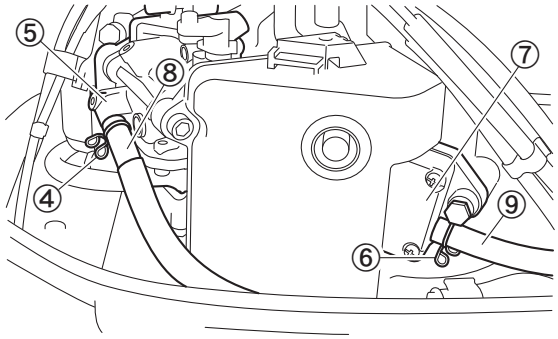
NOTICE

Do not turn the flywheel magnet counter-clockwise. Otherwise, the water pump impeller could be damaged.

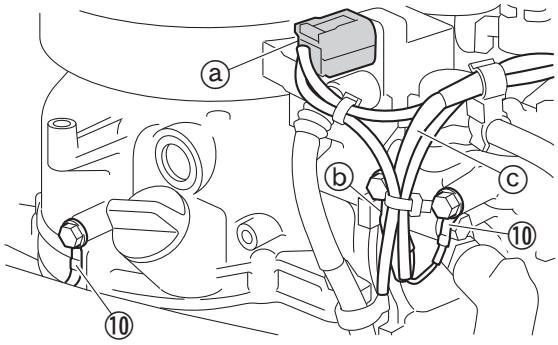
1. Drain the engine oil. See step 4 in "Changing the engine oil" (10-8).
2. Drain the fuel.
3. Remove the manual starter. See "Removing the manual starter" (7-7).
4. Remove the fuel tank. See step 3 in "Removing the fuel tank" (6-5).
5. Remove the holder ①, and then disconnect the choke cable ②.
6. Disconnect the throttle cables ③.



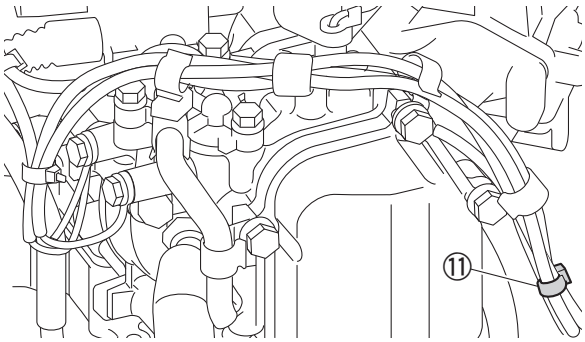
7. Slide the clamp ④ away from the carburetor ⑤, slide the clamp ⑥ away from the fuel pump ⑦, and then disconnect the fuel hoses ⑧ and ⑨.



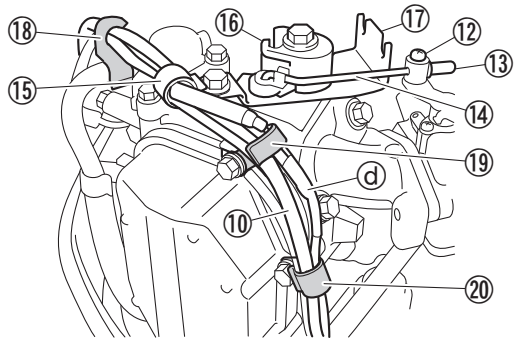
8. Disconnect the CDI unit coupler ⓐ, CDI unit ground lead ⓑ, engine shut-off switch ground lead ⓒ, and ground lead ⑩.



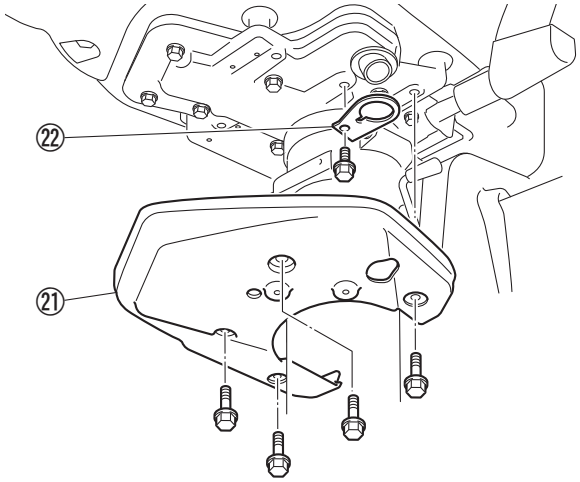
9. Remove the plastic tie ⑪.



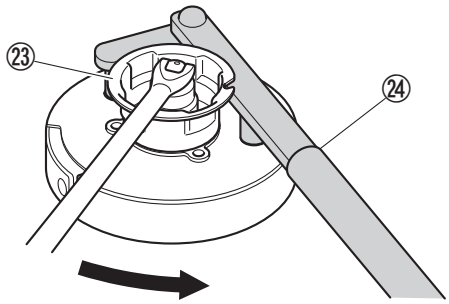
10. Loosen the screw ⑫, and then remove the cap ⑬ and throttle link rod ⑭.
11. Remove the holder ⑮, throttle cam ⑯, and bracket ⑰, and then remove the engine shut-off switch lead ⓓ and ground lead ⑩ from the holders ⑱, ⑲, and ⑳.



12. Remove the cover ㉑ and plate ㉒.

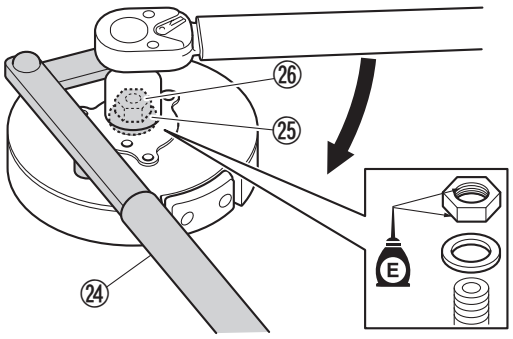


13. Remove the starter pulley ㉓. ***NOTICE:*** **Apply force in the direction of the arrow to prevent the flywheel holder ㉔ from slipping off easily.**



Flywheel holder ㉔: 90890-06522

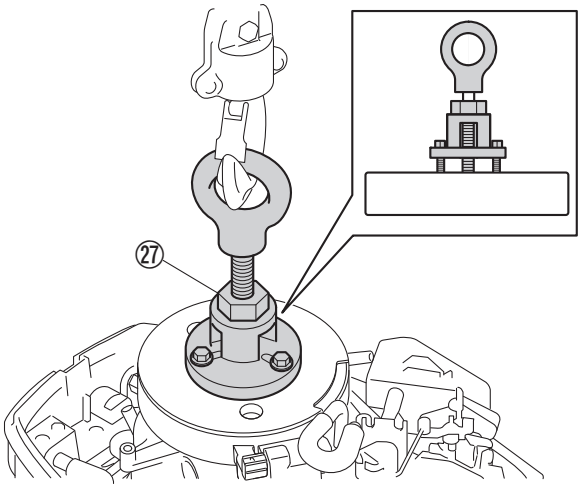
14. Install the washer ㉕, flywheel magnet nut ㉖, and then tighten the flywheel magnet nut ㉖ to the specified torque. ***NOTICE:*** **Apply force in the direction of the arrow to prevent the flywheel holder ㉔ from slipping off easily.**



Flywheel holder ㉔: 90890-06522

Flywheel magnet nut ㉖:
60 N·m (6.0 kgf·m, 44.3 ft·lb)

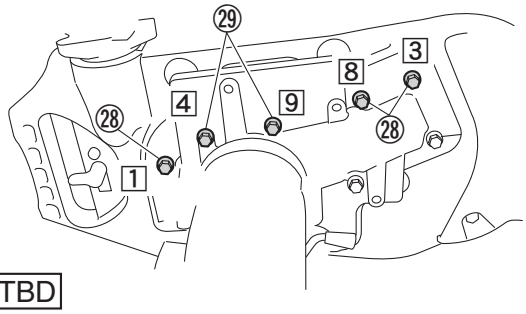
15. Install the special service tool ㉗, and then suspend the power unit. ***NOTICE:*** **To prevent damage to the engine or tool, screw in the puller set bolts evenly and completely so that the flywheel puller is parallel to the flywheel magnet.**



Flywheel puller ㉗: 90890-06521

16. Loosen the power unit mounting bolts ㉘ and ㉙ in the order 1, 2, and so on, and then remove the power unit assembly.

PORT



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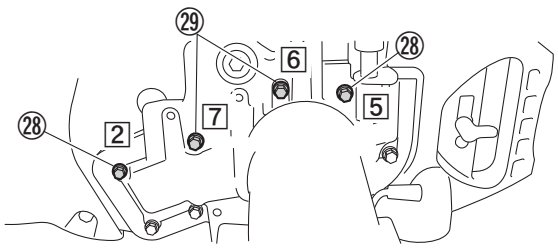
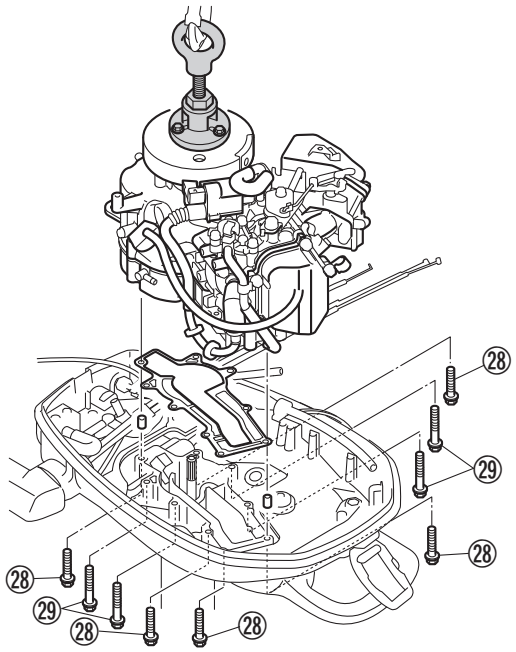
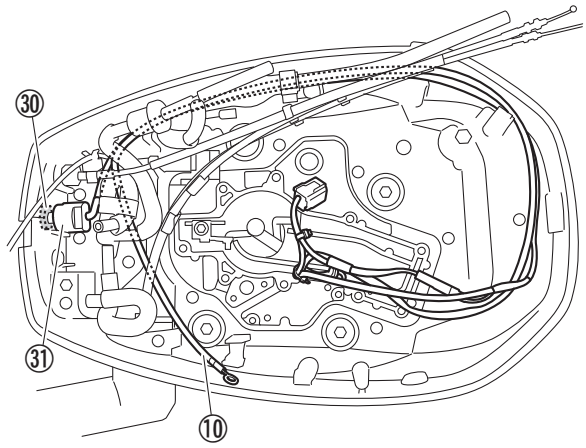




TIP:
Lift up the power unit using the crane, because the gasket on power unit is firmly adhered to the upper case.

17. Loosen the engine shut-off switch nut ㉚, and then remove the engine shut-off switch ㉛ and ground lead ⑩ from the bottom cowling.



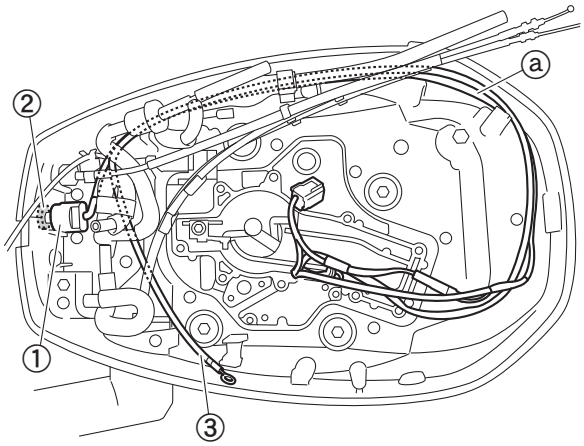
Installing the power unit

NOTICE

Do not turn the flywheel magnet counterclockwise. Otherwise, the water pump impeller could be damaged.

1. Install the engine shut-off switch ①, and then tighten the engine shut-off switch nut ② to the specified torque.

2. Route the engine shut-off switch lead ⓐ and ground lead ③.

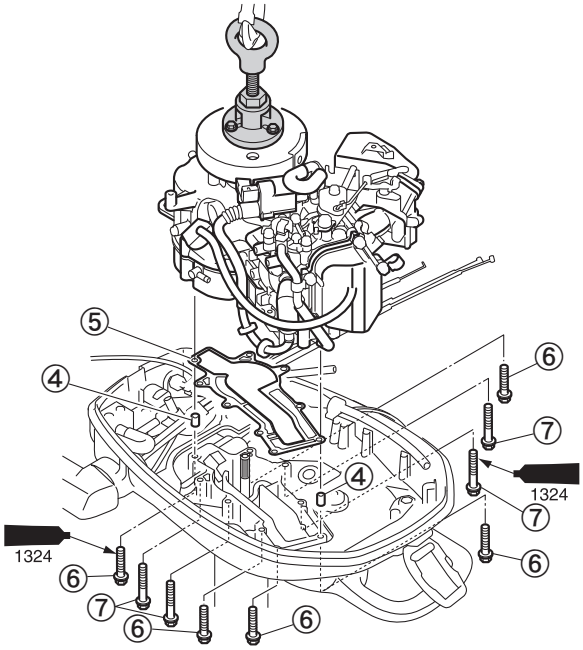


Engine shut-off switch nut ②:
2 N·m (0.2 kgf·m, 1.5 ft·lb)

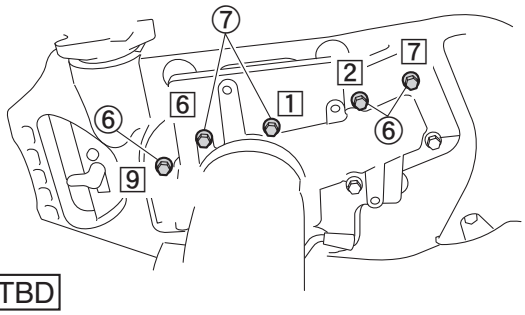
3. Install the special service tool. See steps 13–15 in “Removing the power unit” (7-12).

4. Clean the power unit mating surface, and then install the dowels ④ and a new gasket ⑤. ***NOTICE:*** **Do not reuse a gasket, always replace it with a new one.**

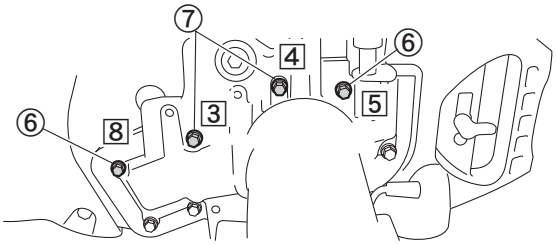
5. Install the power unit, and then tighten the power unit mounting bolts ⑥ and ⑦ to the specified torque in the order 1, 2, and so on.



PORT



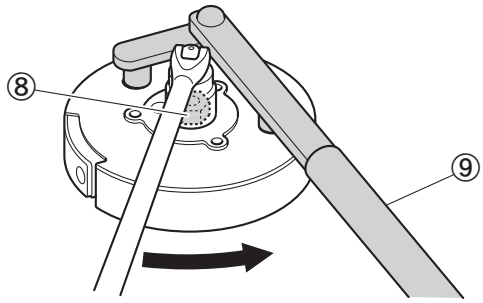
STBD



Power unit mounting bolt ⑥ and ⑦: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

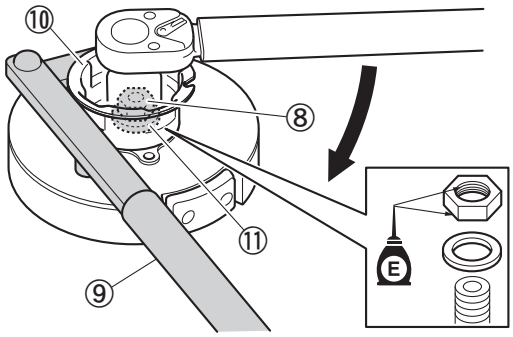
6. Remove the special service tool.

7. Loosen the flywheel magnet nut ⑧. ***NOTICE:*** **Apply force in the direction of the arrow to prevent the flywheel holder ⑨ from slipping off easily.**



Flywheel holder ⑨: 90890-06522

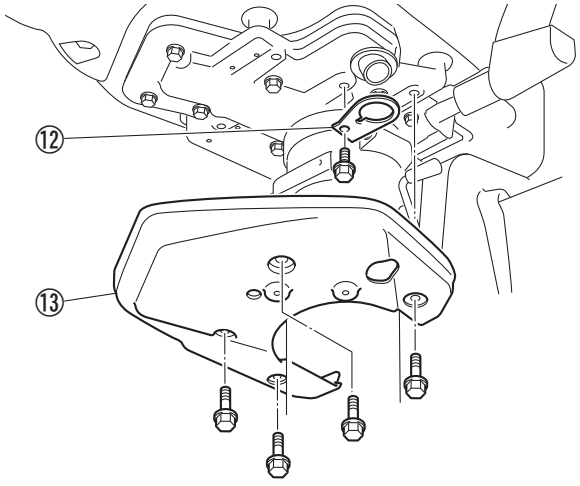
8. Install the starter pulley ⑩ and washer ⑪, and then tighten the flywheel magnet nut ⑧ to the specified torque. ***NOTICE:*** **Apply force in the direction of the arrow to prevent the flywheel holder ⑨ from slipping off easily.**



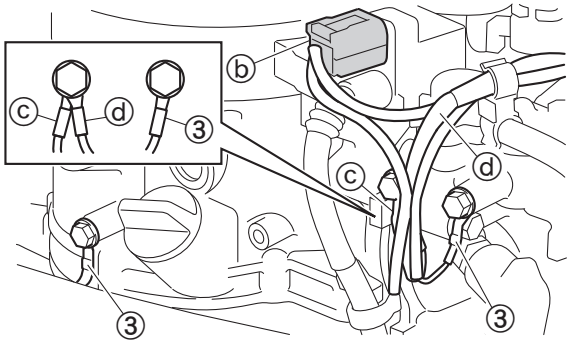
Flywheel holder ⑨: 90890-06522

Flywheel magnet nut ⑧: 60 N·m (6.0 kgf·m, 44.3 ft·lb)

9. Install the plate ⑫ and cover ⑬.



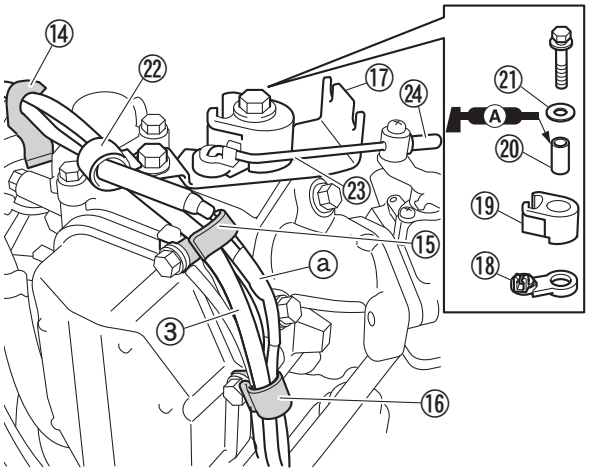
10. Connect the CDI unit coupler ⓑ, CDI unit ground lead ⓒ, engine shut-off switch ground lead ⓓ, and ground lead ③.



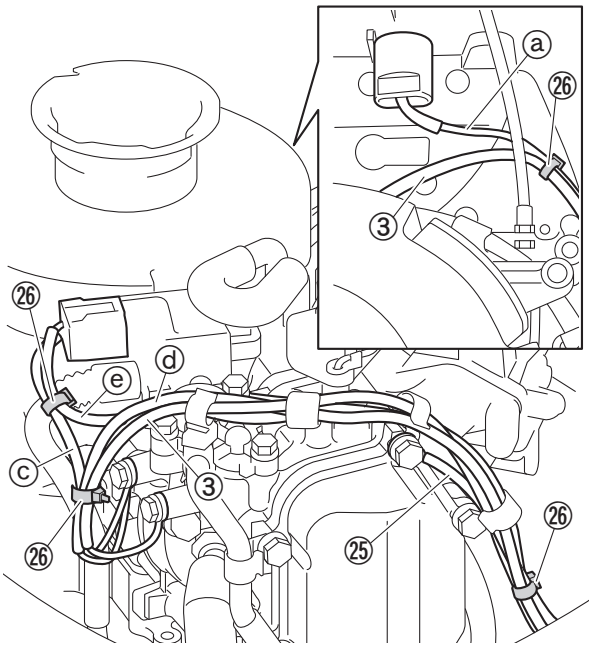
11. Install the engine shut-off switch lead ⓐ and ground lead ③ to the holders ⑭, ⑮, and ⑯.

12. Install the bracket ⑰, lever ⑱, throttle cam ⑲, collar ⑳, washer ㉑, and holder ㉒.

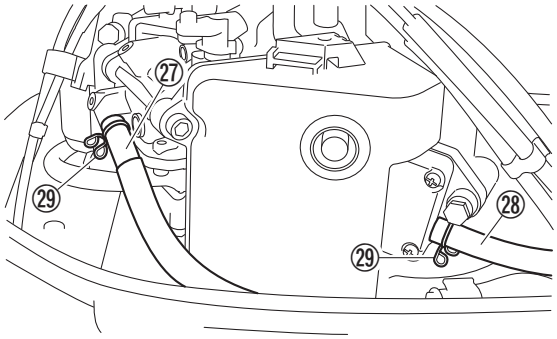
13. Install the throttle link rod ㉓ and cap ㉔.



14. Fasten the engine shut-off switch lead ⓐ, CDI unit ground lead ⓒ, CDI unit lead ⓔ, engine shut-off switch ground lead ⓓ, and ground leads ③ and ㉕ using the plastic ties ㉖.



15. Connect the fuel hoses ㉗ and ㉘, and then fasten them using the clamps ㉙.

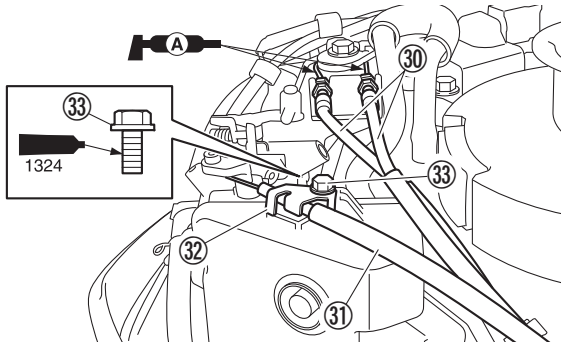


16. Connect the throttle cables ㉚, and then adjust the throttle cables ㉚. See steps 2–9 in “Adjusting the throttle cable and throttle link” (6-14).

17. Connect the choke cable ㉛, and then install the holder ㉜. See steps 9 and 10 in “Installing the primer pump” (6-7).

18. Tighten the choke holder bolt ㉝ to the specified torque.

7

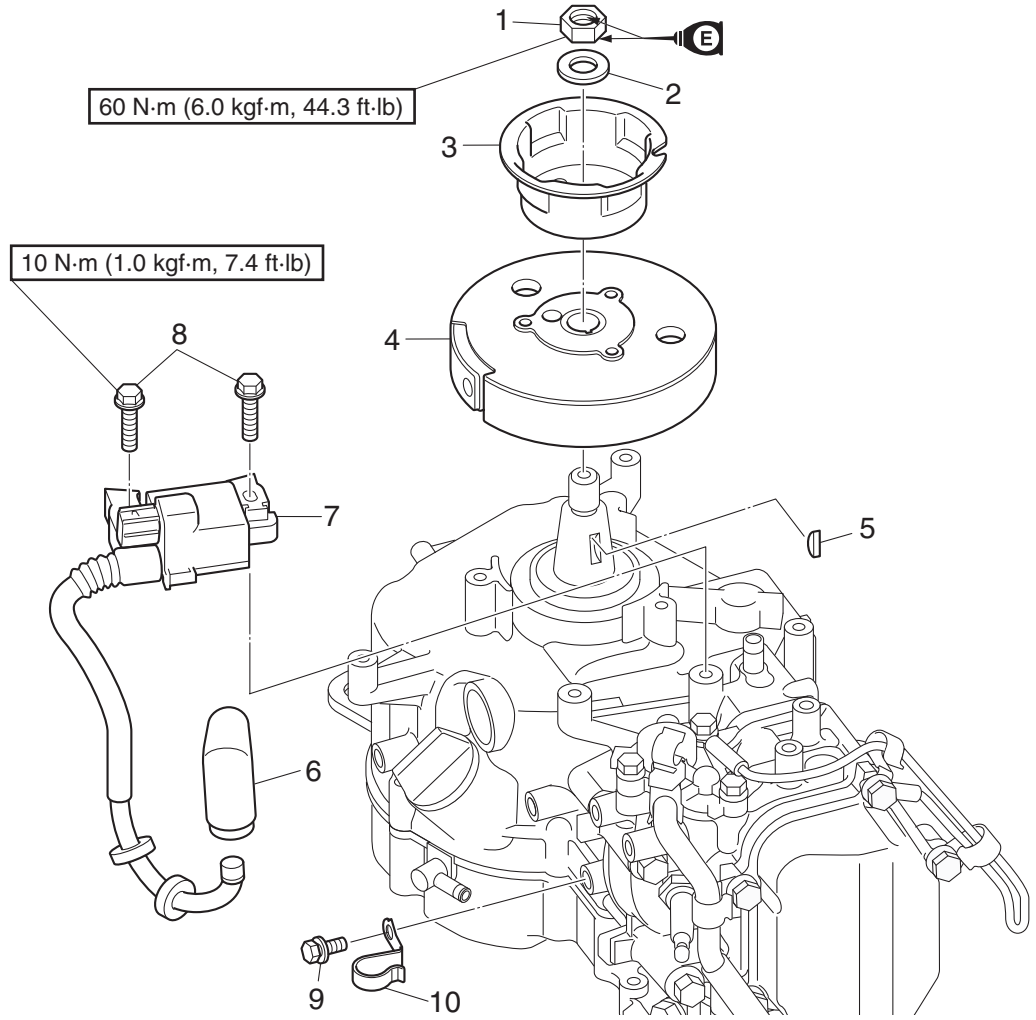


Choke holder bolt ㉝: 4 N·m (0.4 kgf·m, 3.0 ft·lb)

19. Install the fuel tank. See step 8 in “Installing the fuel tank” (6-8).

20. Install the manual starter. See “Installing the manual starter” (7-10).

Flywheel magnet

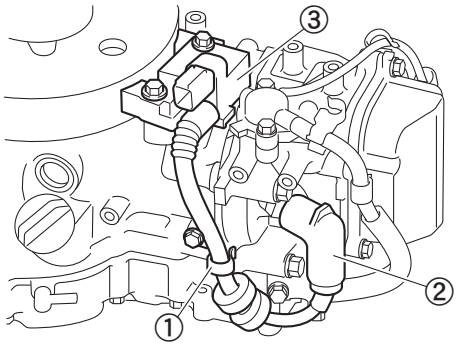


No.	Part name	Q'ty	Remarks
1	Flywheel magnet nut	1	Width across flats: 22 mm
2	Washer	1	
3	Starter pulley	1	
4	Flywheel magnet	1	
5	Woodruff key	1	
6	Spark plug cap	1	
7	CDI unit	1	
8	CDI unit bolt	2	M6 × 25 mm
9	Bolt	1	M6 × 12 mm
10	Holder	1	

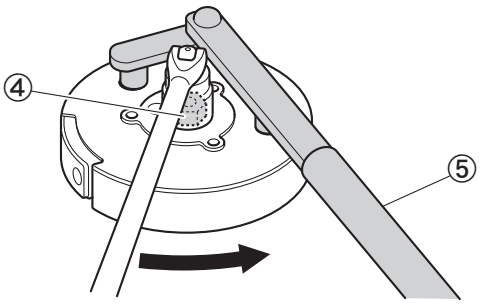
Removing the flywheel magnet

1. Remove the holder ①.

2. Disconnect the spark plug cap ②, and then remove the CDI unit ③.

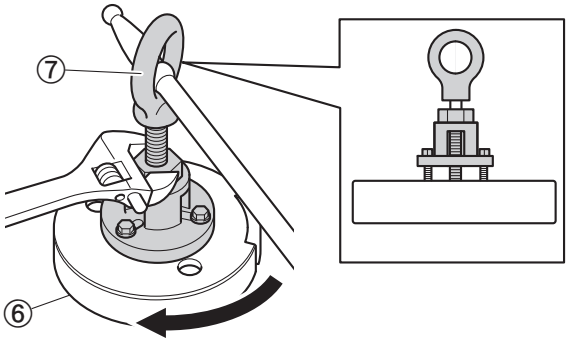


3. Remove the starter pulley ④. ***NOTICE:*** **Apply force in the direction of the arrow to prevent the flywheel holder ⑤ from slipping off easily.**



Flywheel holder ⑤: 90890-06522

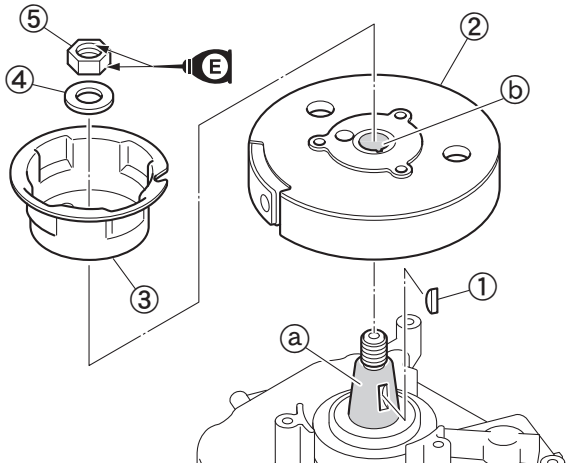
4. Remove the flywheel magnet ⑥ and Woodruff key. ***NOTICE:*** **To prevent damage to the engine or tool, screw in the puller set bolts evenly and completely so that the flywheel puller is parallel to the flywheel magnet.**

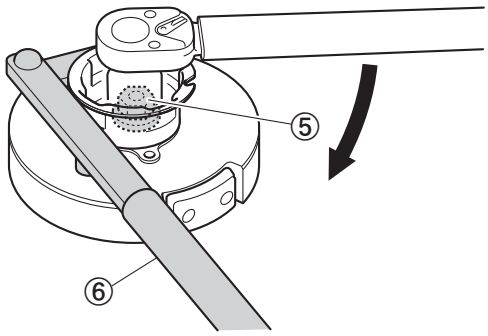


Flywheel puller ⑦: 90890-06521

Installing the flywheel magnet

1. Install the Woodruff key ①, flywheel magnet ②, starter pulley ③, and washer ④, and then tighten the flywheel magnet nut ⑤ to the specified torque. ***NOTICE:*** **Apply force in the direction of the arrow to prevent the flywheel holder ⑥ from slipping off easily.**





Flywheel holder ⑥: 90890-06522

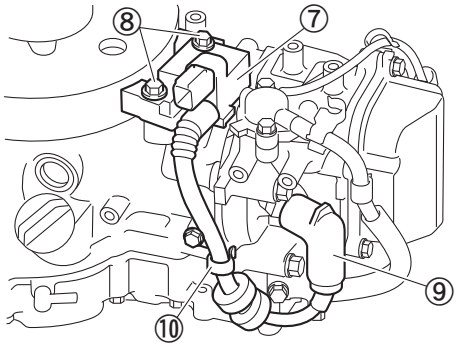
Flywheel magnet nut ⑤: 60 N·m (6.0 kgf·m, 44.3 ft·lb)

TIP:

Make sure to remove any grease from the tapered portion ⓐ of the crankshaft and the inner surface ⓑ of the flywheel magnet ②.

2. Install the CDI unit ⑦, and then tighten the CDI unit bolts ⑧ to the specified torque.

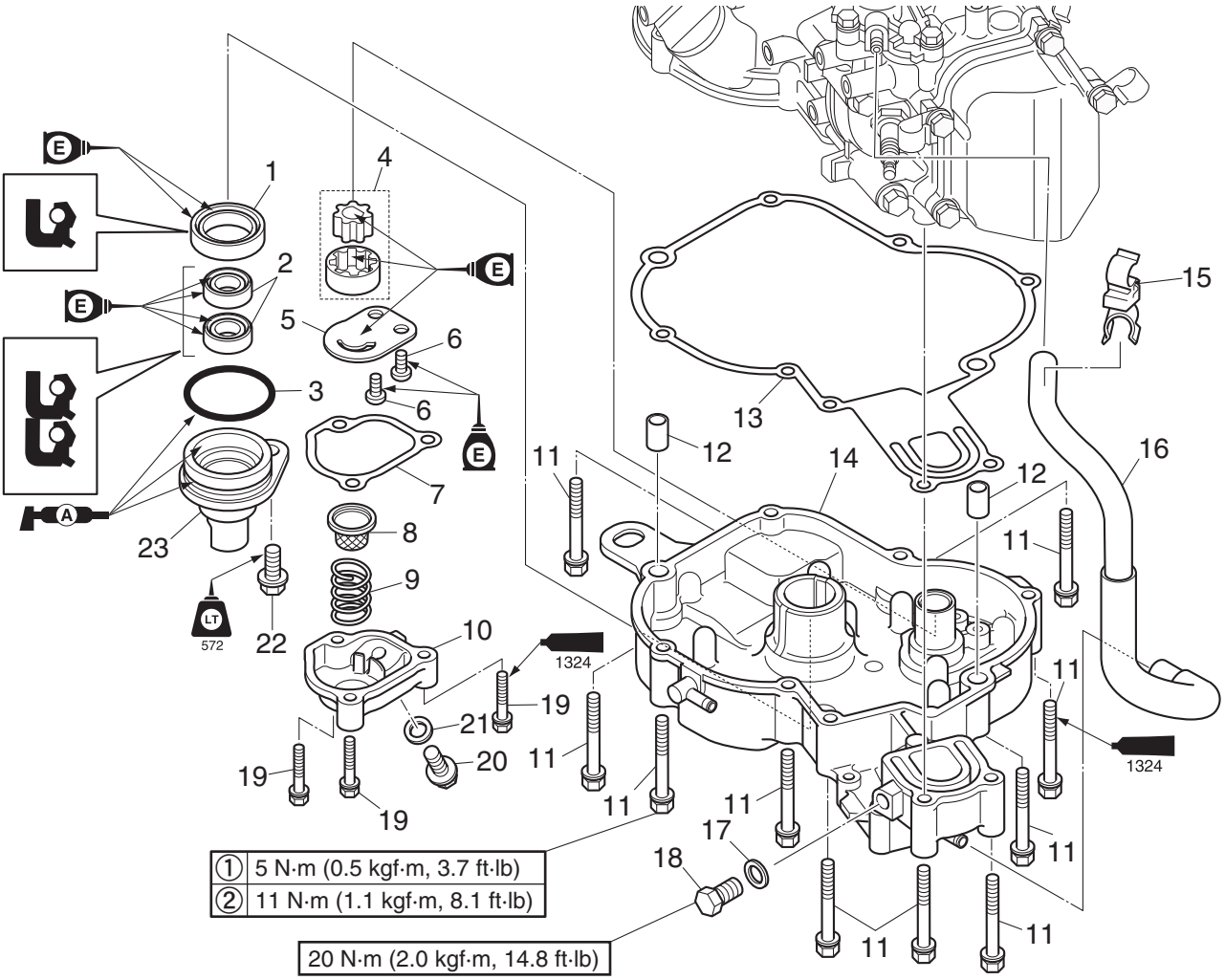
3. Connect the spark plug cap ⑨, and then install the holder ⑩.



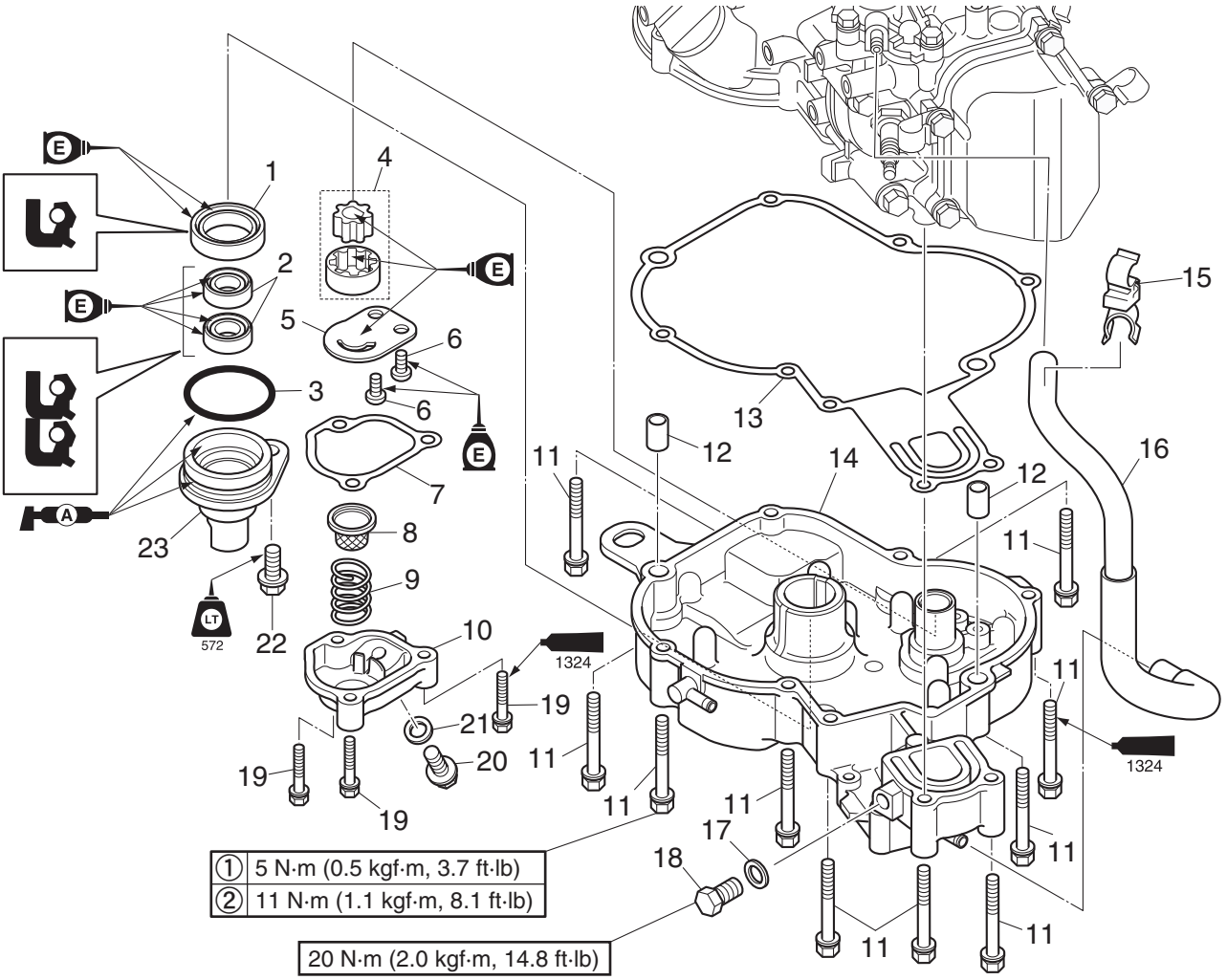
CDI unit bolt ⑧:
10 N·m (1.0 kgf·m, 7.4 ft·lb)

4. Adjust the CDI unit air gap. See “Adjusting the CDI unit air gap” (7-2).

Crankcase



No.	Part name	Q'ty	Remarks
1	Oil seal	1	**Not reusable**
2	Oil seal	2	**Not reusable**
3	O-ring	1	**Not reusable**
4	Rotor assembly	1	
5	Plate	1	
6	Screw	2	M6 × 12 mm
7	Gasket	1	**Not reusable**
8	Oil strainer	1	
9	Spring	1	
10	Cover	1	
11	Crankcase bolt	10	M6 × 50 mm
12	Dowel	2	
13	Gasket	1	**Not reusable**
14	Crankcase	1	
15	Holder	1	
16	Hose	1	
17	Gasket	1	**Not reusable**

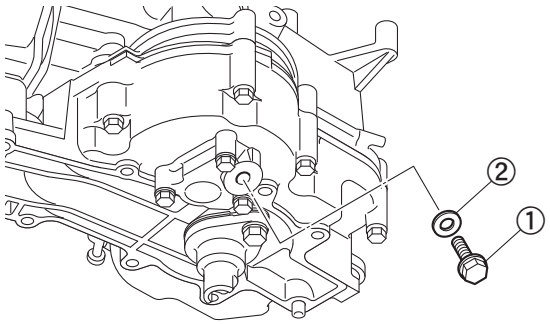


No.	Part name	Q'ty	Remarks
18	Blind plug	1	M8 × 15 mm
19	Bolt	3	M6 × 35 mm
20	Drain bolt	1	M8 × 20 mm
21	Gasket	1	**Not reusable**
22	Bolt	1	M8 × 20 mm
23	Oil seal housing	1	

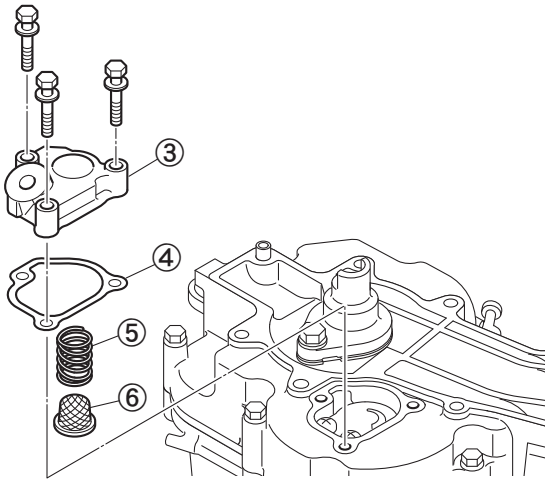
7

Removing the oil pump

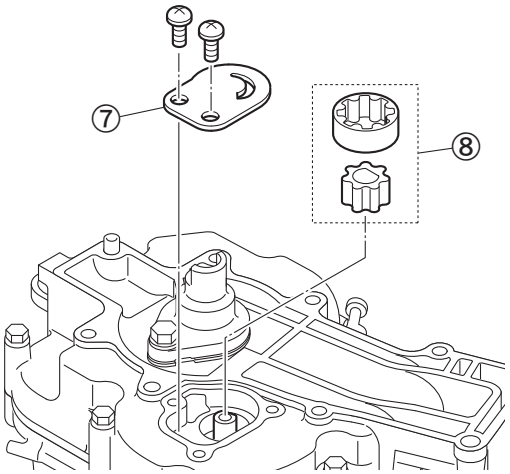
1. Remove the drain bolt ① and gasket ②, and then drain the remaining engine oil.



2. Remove the cover ③, gasket ④, spring ⑤, and oil strainer ⑥.



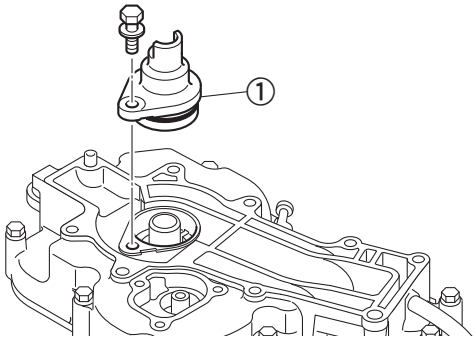
3. Remove the plate ⑦, and then remove the rotor assembly ⑧.



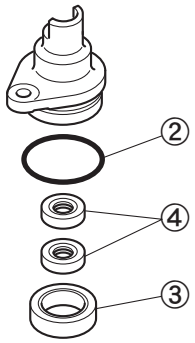
TIP:
Keep the rotor assembly ⑧ in the same direction as originally installed.

Removing the oil seal housing

1. Remove the oil seal housing ①.

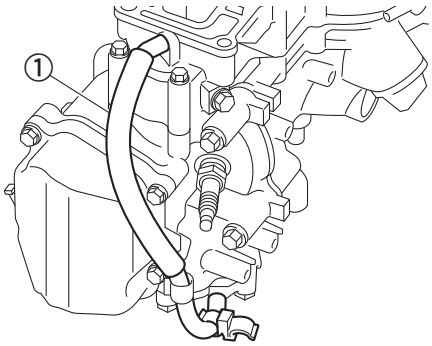


2. Remove the O-ring ② and oil seals ③ and ④.

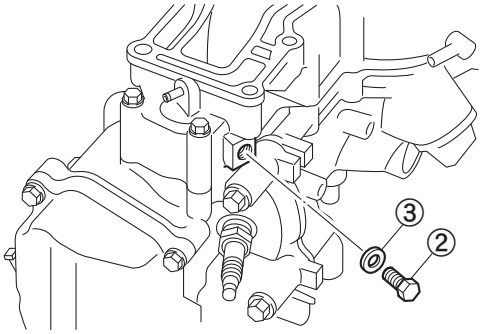


Removing the crankcase

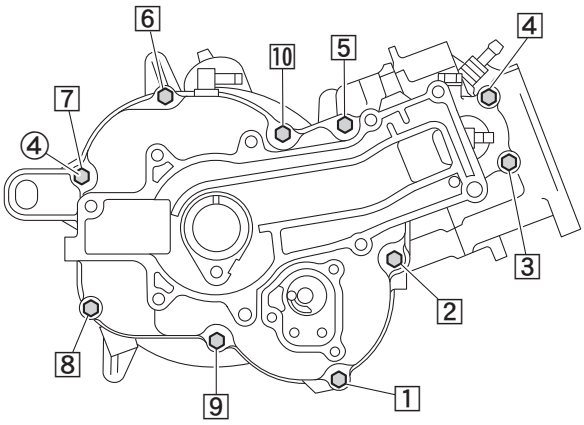
1. Remove the cooling water hose ①.

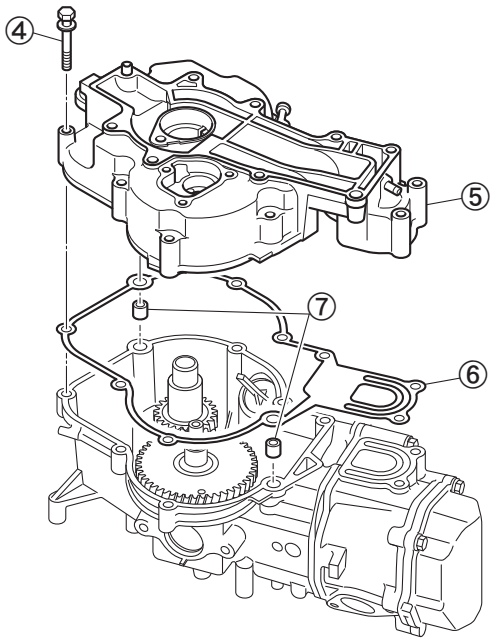


2. Remove the blind plug ② and gasket ③.



3. Loosen the crankcase bolts ④ in the order 1, 2, and so on, and then remove the crankcase ⑤, gasket ⑥, and dowels ⑦.



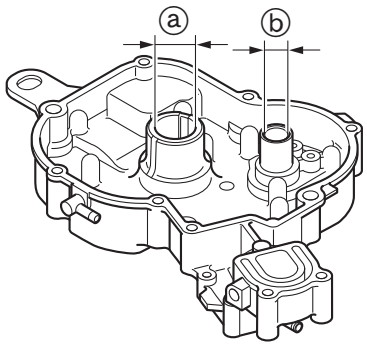


Checking the crankcase

1. Check the crankcase. Replace if corroded or cracked.

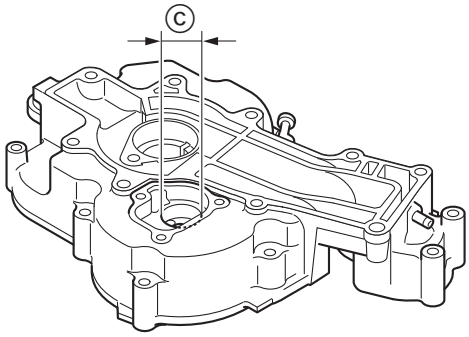
2. Measure the crankshaft journal inside diameter ⓐ.

3. Measure the camshaft journal inside diameter ⓑ.



Crankshaft journal inside diameter ⓐ:
25.020–25.041 mm
(0.9850–0.9859 in)
Camshaft journal inside diameter ⓑ:
15.000–15.018 mm
(0.5906–0.5913 in)

4. Measure the rotor housing inside diameter ⓒ.

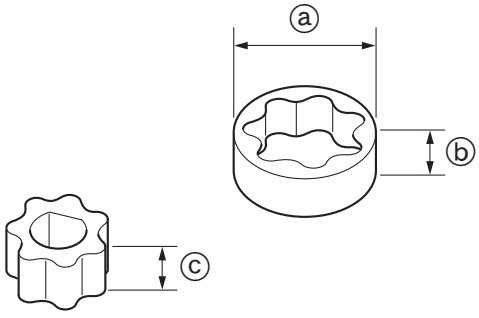


Rotor housing inside diameter ⓒ:
23.130–23.160 mm
(0.9106–0.9118 in)

Checking the rotor assembly

1. Check the rotor assembly. Replace if cracked or worn.

2. Measure the rotor assembly dimensions ⓐ, ⓑ, and ⓒ.



Outer rotor diameter ⓐ:
22.980–23.000 mm
(0.9047–0.9055 in)
Outer rotor height ⓑ:
9.950–9.980 mm (0.3917–0.3929 in)
Inner rotor height ⓒ:
9.950–9.980 mm (0.3917–0.3929 in)

Checking the oil strainer

1. Check the oil strainer. Clean if there is dirt or residue.

Checking the oil seal housing

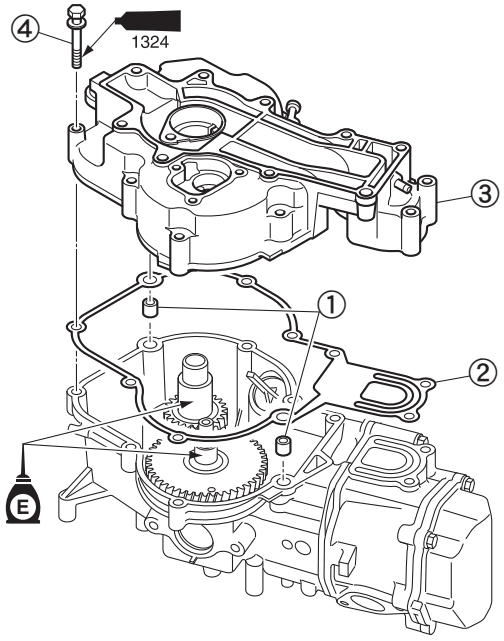
1. Check the oil seal housing. Replace if cracked or damaged.

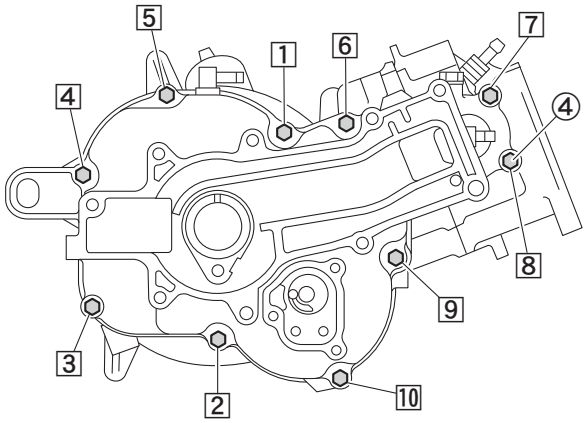
Installing the crankcase

NOTICE

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

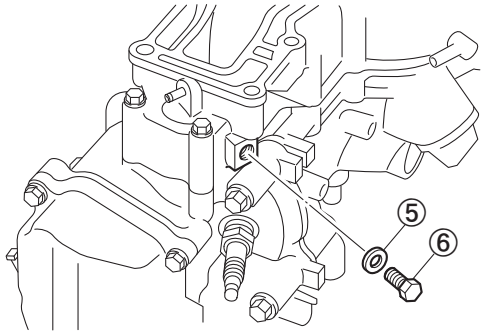
1. Install the dowels ① and a new gasket ②.
2. Install the crankcase ③, and then tighten the crankcase bolts ④ to the specified torques in 2 stages and in the order 1, 2, and so on.





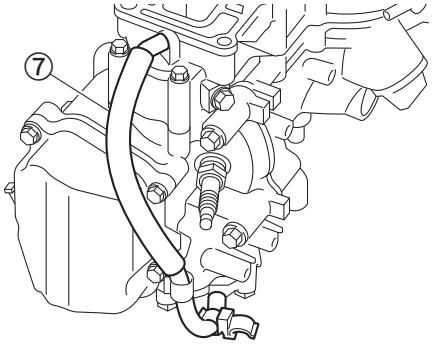
Crankcase bolt ④:
1st: 5 N·m (0.5 kgf·m, 3.7 ft·lb)
2nd: 11 N·m (1.1 kgf·m, 8.1 ft·lb)

3. Install a new gasket ⑤, and then tighten the blind plug ⑥ to the specified torque.



Blind plug ⑥:
20 N·m (2.0 kgf·m, 14.8 ft·lb)

4. Install the cooling water hose ⑦.



Installing the oil pump

NOTICE

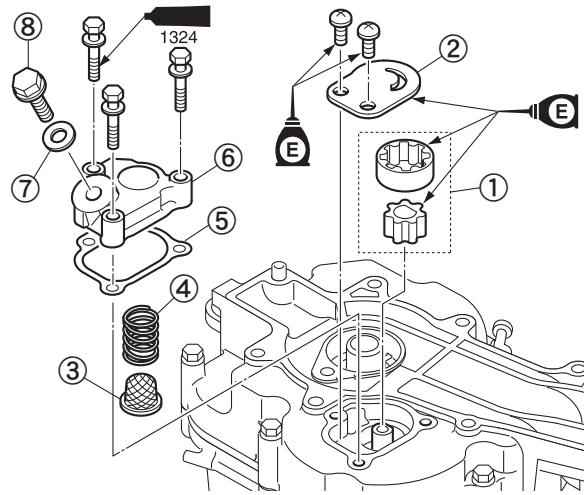
Do not reuse a gasket, always replace it with a new one.

1. Install the rotor assembly ① and plate ②.

TIP:

Install the rotor assembly in the same direction as when it was removed.

2. Install the oil strainer ③, the spring ④, a new gasket ⑤, and the cover ⑥.
3. Install a new gasket ⑦ and the drain bolt ⑧.

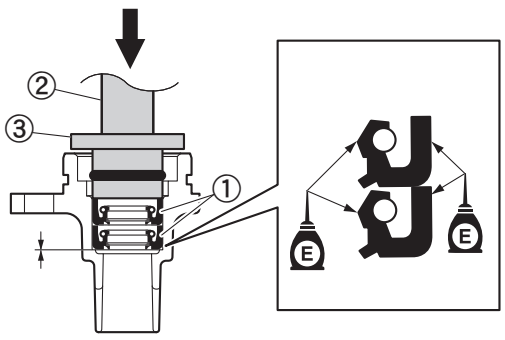


Installing the oil seal housing

NOTICE

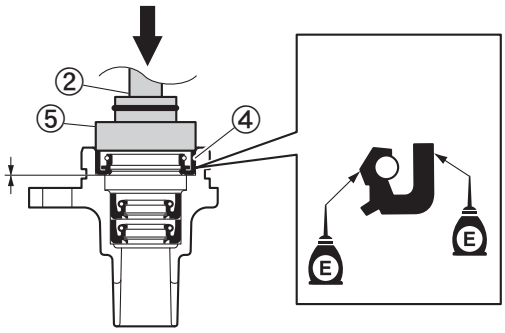
Do not reuse an oil seal or O-ring, always replace it with a new one.

1. Install new oil seals ①.



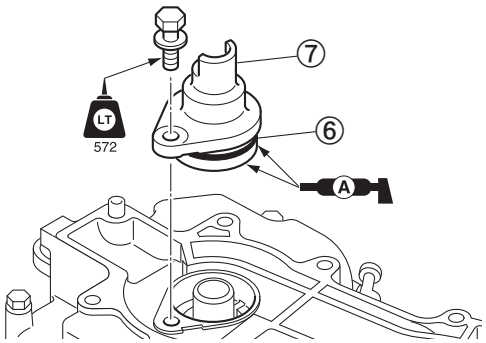
Driver rod L3 ②: 90890-06652
Needle bearing attachment ③:
90890-06615

2. Install the oil seal ④.



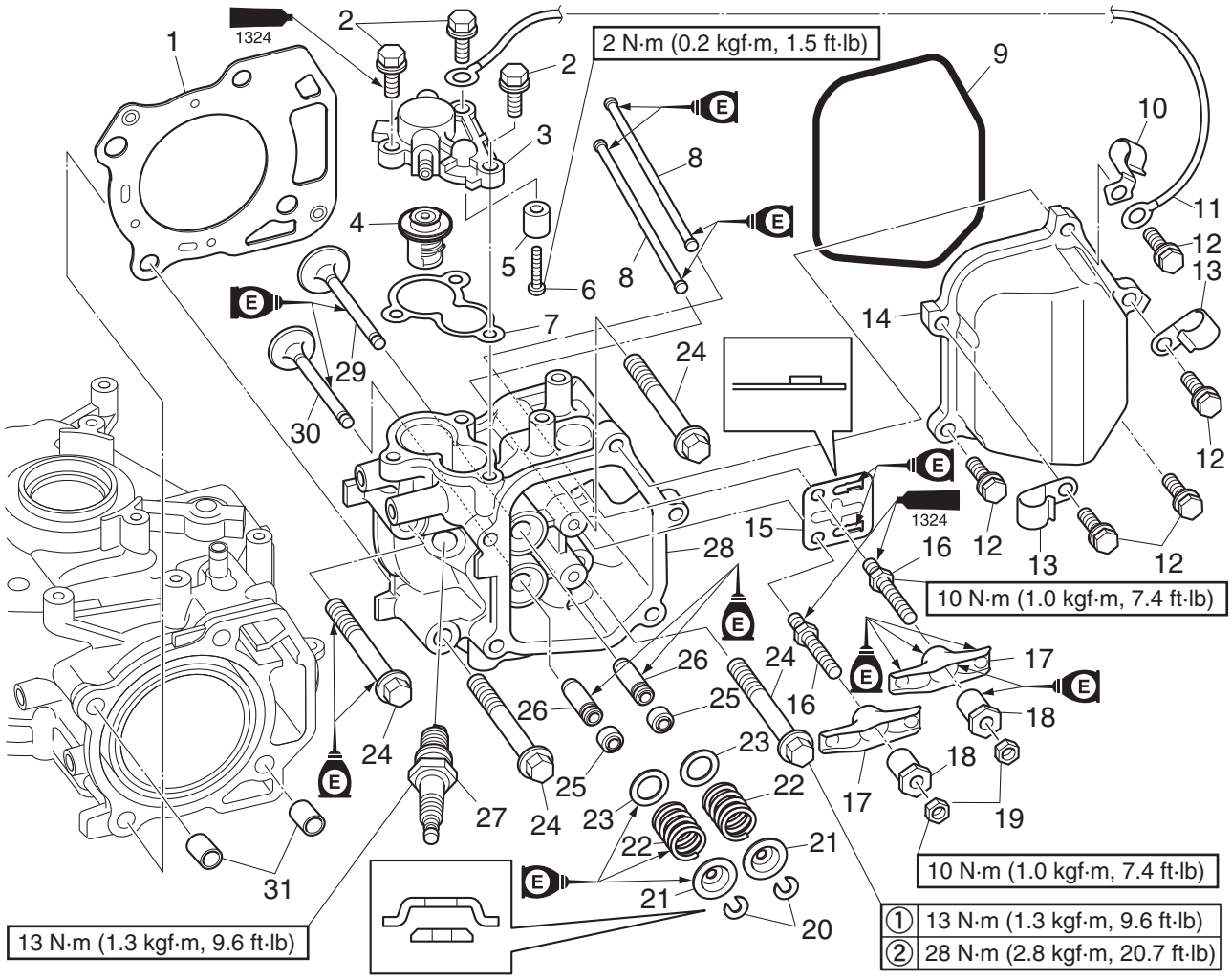
Driver rod L3 ②: 90890-06652
Needle bearing attachment ⑤:
90890-06613

3. Install a new O-ring ⑥ to the oil seal housing ⑦, and then install the oil seal housing ⑦.

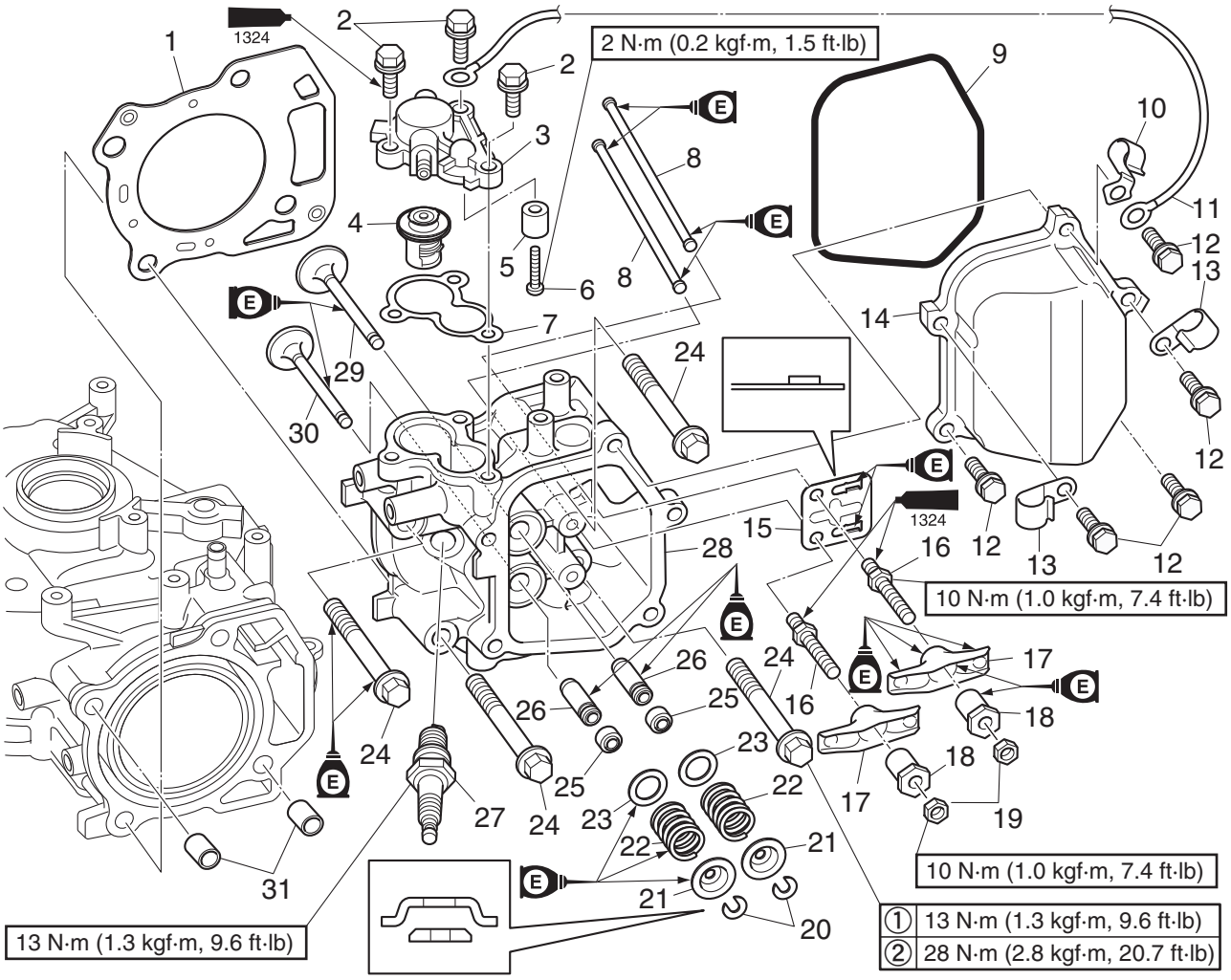


7

Cylinder head



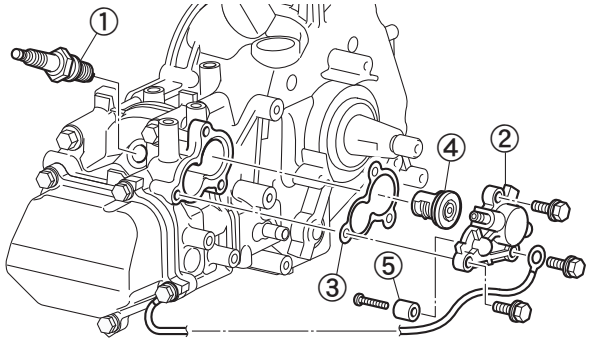
No.	Part name	Q'ty	Remarks
1	Gasket	1	**Not reusable**
2	Bolt	3	M6 × 20 mm
3	Thermostat cover	1	
4	Thermostat	1	
5	Anode	1	
6	Thermostat cover anode screw	1	M5 × 25 mm
7	Gasket	1	**Not reusable**
8	Push rod	2	
9	Gasket	1	**Not reusable**
10	Holder	1	
11	Ground lead	1	
12	Bolt	5	M6 × 25 mm
13	Holder	2	
14	Cylinder head cover	1	
15	Push rod guide	1	
16	Pivot bolt	2	
17	Rocker arm	2	



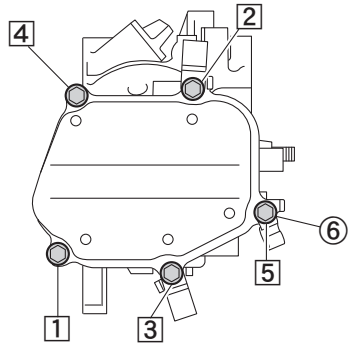
No.	Part name	Q'ty	Remarks
18	Rocker arm pivot	2	
19	Valve adjusting locknut	2	
20	Valve cotter	2	
21	Valve spring retainer	2	
22	Valve spring	2	
23	Spring seat	2	
24	Cylinder head bolt	4	M8 × 60 mm
25	Valve seal	2	**Not reusable**
26	Valve guide	2	
27	Spark plug	1	
28	Cylinder head	1	
29	Intake valve	1	
30	Exhaust valve	1	
31	Dowel	2	

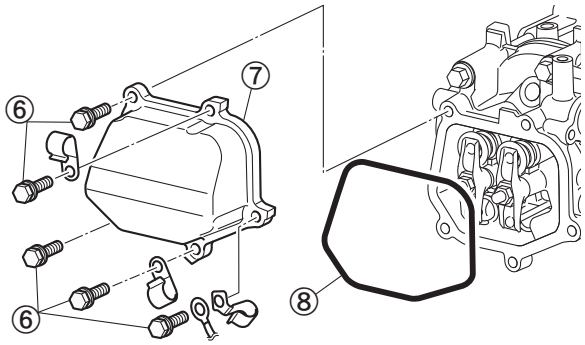
Removing the cylinder head

1. Remove the spark plug ①, thermostat cover ②, gasket ③, thermostat ④, and thermostat cover anode ⑤.

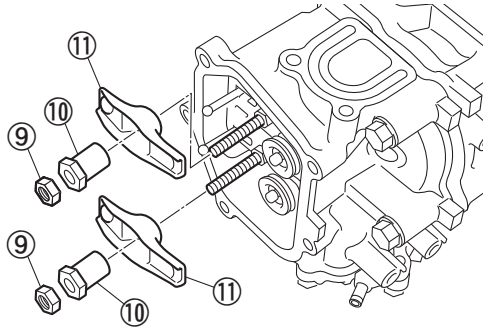


2. Loosen the bolts ⑥ in the order [1], [2], and so on, and then remove the cylinder head cover ⑦ and gasket ⑧.

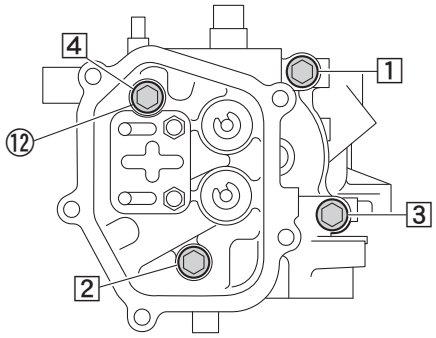


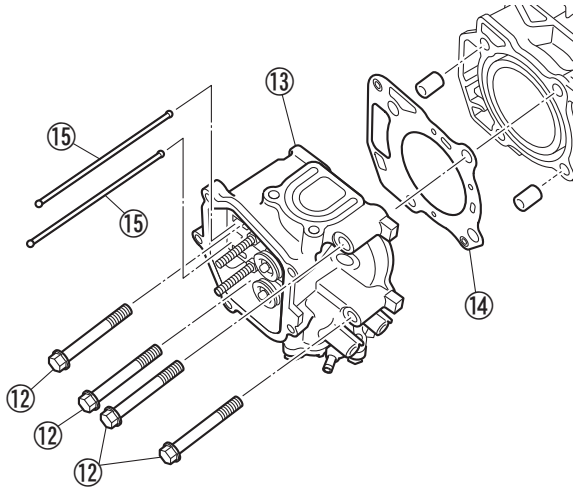


3. Loosen the valve adjusting locknuts ⑨, and then remove the rocker arm pivots ⑩ and rocker arms ⑪.



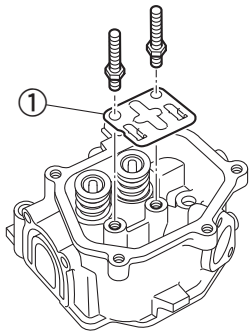
4. Loosen the cylinder head bolts ⑫ in the order [1], [2], and so on, and then remove the cylinder head ⑬, gasket ⑭, and push rods ⑮. ***NOTICE:*** **Do not scratch or damage the mating surfaces of the cylinder head and cylinder block.**



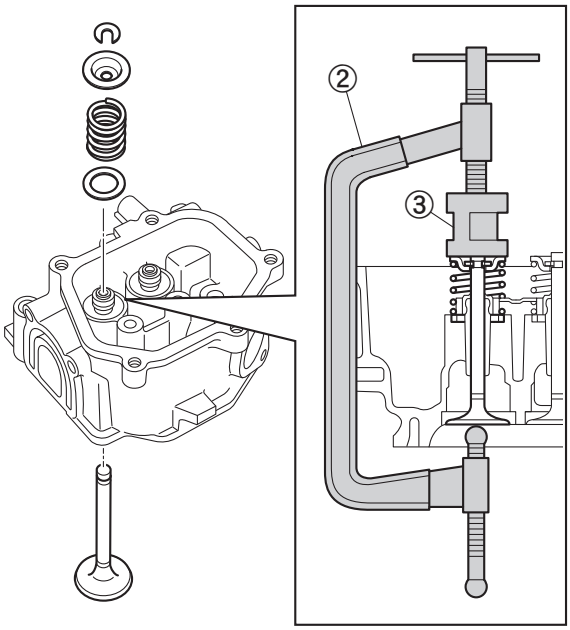


Disassembling the cylinder head

1. Remove the push rod guide ①.



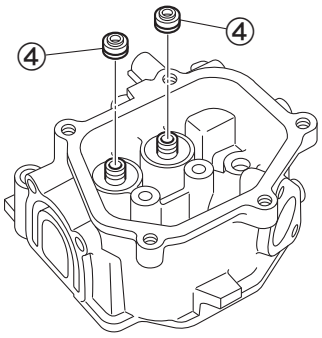
2. Remove the intake and exhaust valves.



Valve spring compressor ②:
90890-04019
Valve spring compressor attachment ③:
90890-06320

TIP:
Make sure to keep the parts in the order of removal.

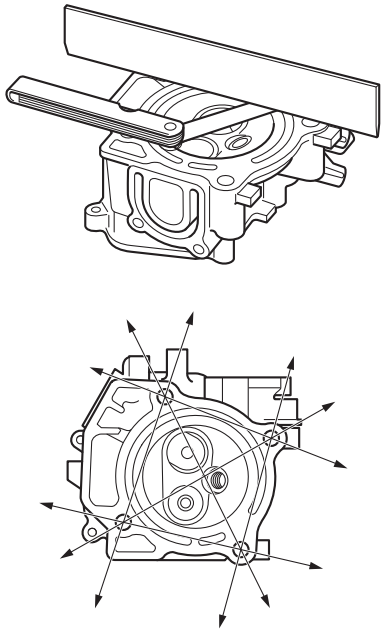
3. Remove the valve seals ④.



Checking the cylinder head

1. Remove carbon deposits from the combustion chamber, and then check the cylinder head for corrosion or scratches.

2. Check the cylinder head warpage in 6 directions. Replace the cylinder head assembly if above specification.



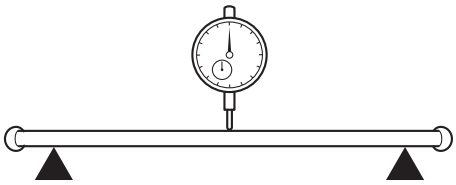
Cylinder head warpage limit:
0.10 mm (0.0039 in)

Checking the rocker arm

1. Check the rocker arms. Replace if cracked, damaged, or worn.

Checking the push rod

1. Measure the push rod runout.

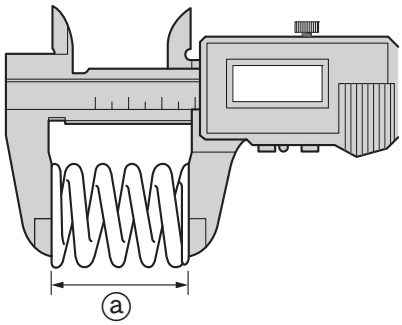


Push rod runout: 0.5 mm (0.02 in)

Checking the valve spring

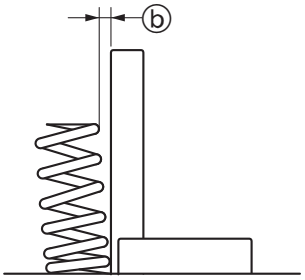
1. Measure the valve spring free length ⓐ.

7



Valve spring free length ⓐ:
27.6 mm (1.09 in)

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

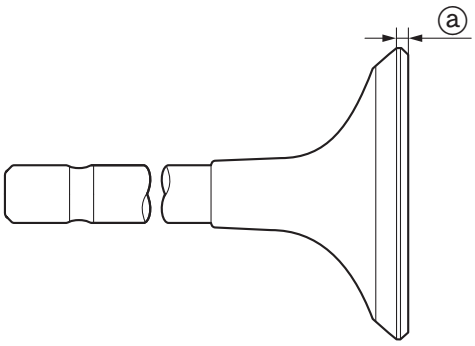


Valve spring tilt limit ⓑ: 1.0 mm (0.04 in)

Checking the valve

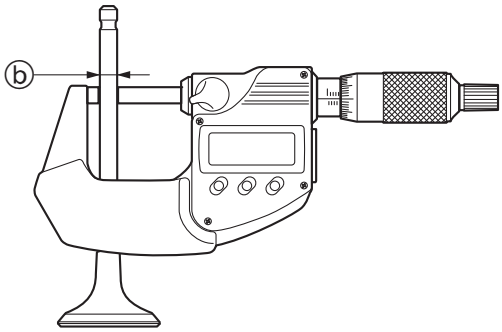
1. Check the valve face. Replace the valve if pitted or worn.

2. Measure the valve margin thickness ⓐ. Replace if out of specification.



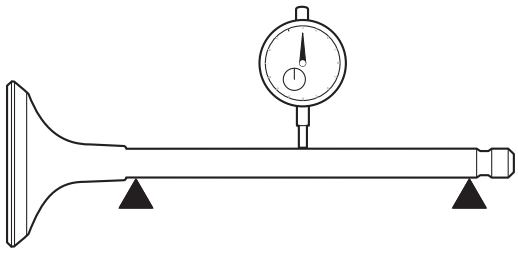
Valve margin thickness ⓐ:
Intake:
0.800–1.200 mm (0.0315–0.0472 in)
Exhaust:
1.100–1.500 mm (0.0433–0.0591 in)

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



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

4. Measure the valve stem runout.

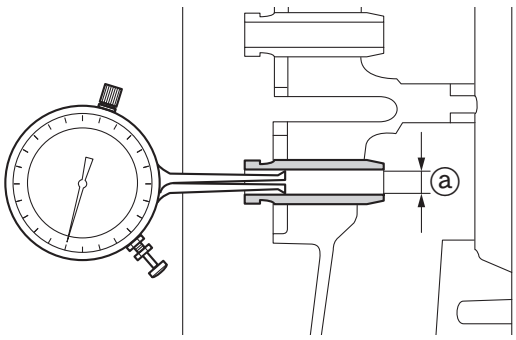


Valve stem runout (reference data):
Intake: 0.050 mm (0.0020 in)
Exhaust: 0.030 mm (0.0012 in)

Checking the valve guide

Before checking the valve guide, make sure to check the valve.

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



Valve guide inside diameter ⓐ:
Intake and exhaust:
5.500–5.512 mm (0.2165–0.2170 in)

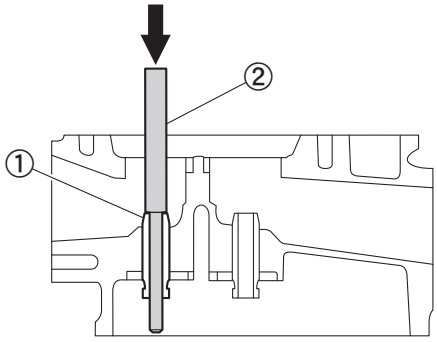
2. Calculate the valve guide clearance. Replace the valve guide if out of specification.

Valve guide clearance:
Intake:
0.010–0.037 mm (0.0004–0.0015 in)
Exhaust:
0.025–0.052 mm (0.0010–0.0020 in)

Replacing the valve guide

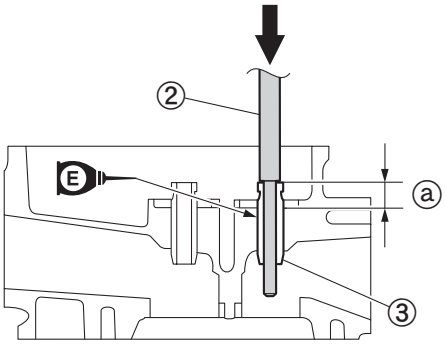
After replacing the valve guide, check the valve seat contact area.

1. Remove the valve guide ① from the combustion chamber side using the special service tool ②.



Valve guide remover/installer ②:
90890-06801

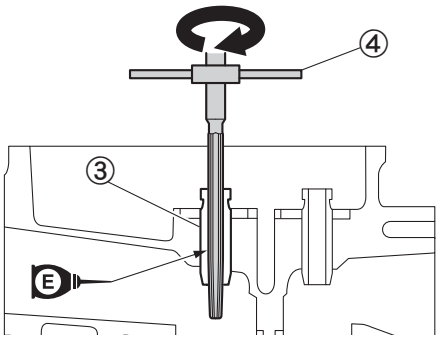
2. Install a new valve guide ③ from the rocker arm side to the specified installation height ⓐ using the special service tool ②.



Valve guide remover/installer ②:
90890-06801

Valve guide installation height ⓐ:
8.2–9.1 mm (0.32–0.36 in)

3. Insert the special service tool ④ into the valve guide ③, and then ream the valve guide.



Valve guide reamer ④: 90890-06804

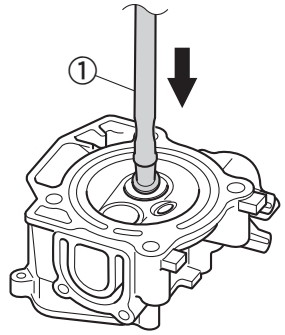
TIP:
- Turn the valve guide reamer clockwise to ream the valve guide.
- Do not turn the valve guide reamer counterclockwise when removing it.
- Make sure to clean the valve guide after reaming it.

4. Measure the valve guide inside diameter.

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

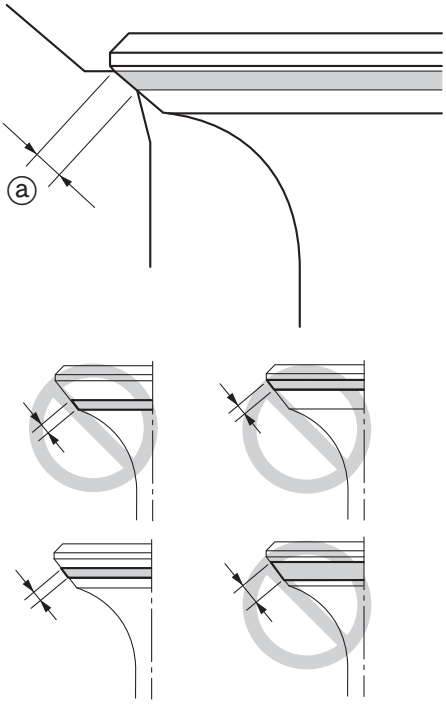
Checking the valve seat

1. Remove carbon deposits from the valves.
2. Apply a thin, even layer of Mechanic's blueing dye (Dykem) onto the valve seat.
3. Press the valve lightly against the valve seat using the special service tool ①.



Valve lapper ①: 90890-04101

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



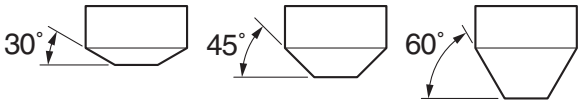
Valve seat contact width ⓐ:
Intake and exhaust:
0.6–0.8 mm (0.02–0.03 in)

Refacing the valve seat

NOTICE

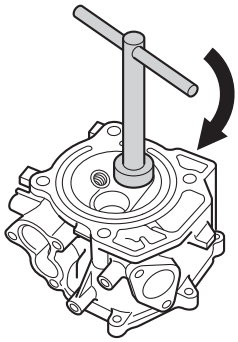
After every lapping procedure, make sure to clean off any remaining lapping compound from the cylinder head and valves.

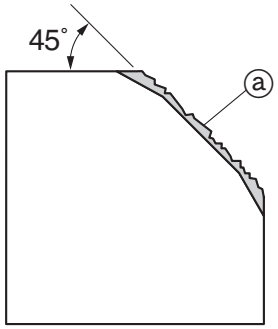
1. Reface the valve seat using valve seat cutters.



Valve seat cutter holder: 90890-06316
Intake:
Valve seat cutter 30°: 90890-06818
Valve seat cutter 45°: 90890-06312
Valve seat cutter 60°: 90890-06323
Exhaust:
Valve seat cutter 30°: 90890-06819
Valve seat cutter 45°: 90890-06814
Valve seat cutter 60°: 90890-06813

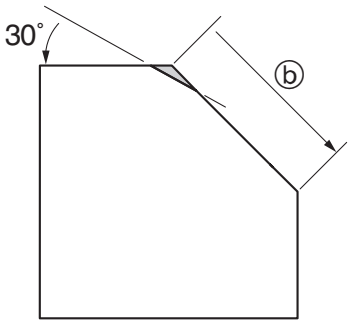
2. Cut the surface of the valve seat using a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth. ***NOTICE:*** **Do not over cut the valve seat. To prevent chatter marks, make sure to turn the cutter evenly using a downward force of 40–50 N (4.0–5.0 kgf, 8.8–11.0 lbf).**





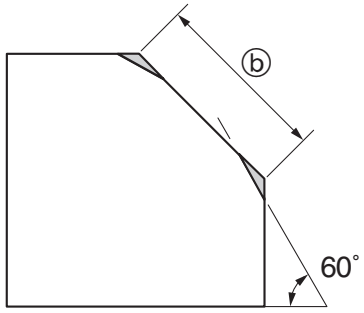
ⓐ Slag or rough surface

3. Adjust the top edge of the valve seat contact width using a 30° cutter.



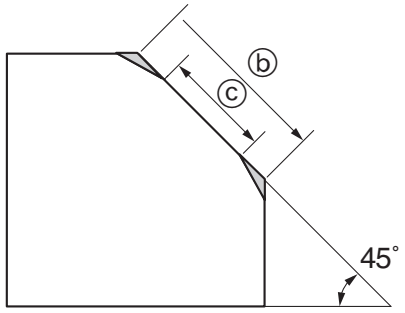
ⓑ Previous contact width

4. Adjust the bottom edge of the valve seat contact width using a 60° cutter.



ⓑ Previous contact width

5. Adjust the valve seat contact width to specification using a 45° cutter.

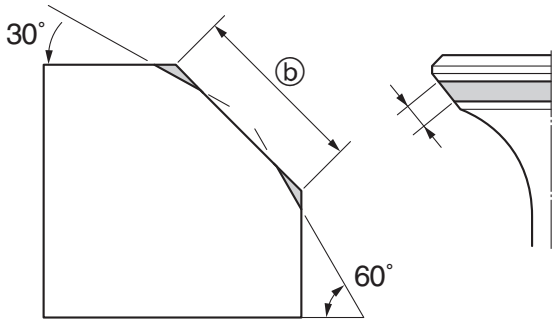


ⓑ Previous contact width
ⓒ Specified contact width

6. Check the valve seat contact area of the valve. See “Checking the valve seat” (7-32).

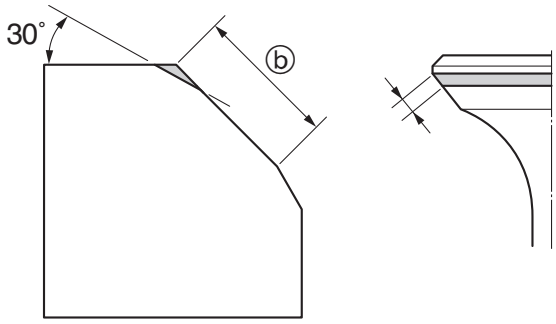
Example:

- If the valve seat contact area is too wide and situated in the center of the valve face, cut the top edge of the valve seat using a 30° cutter, and then cut the bottom edge using a 60° cutter to center the area and set its width.



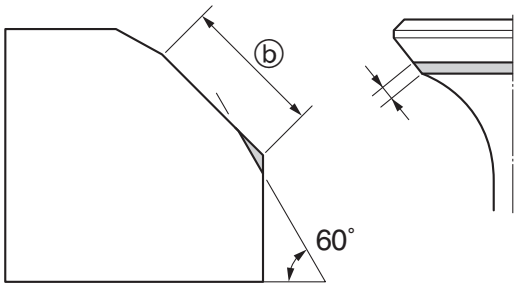
ⓑ Previous contact width

- If the valve seat contact area is too narrow and situated near the top edge of the valve face, cut the top edge of the valve seat using a 30° cutter to center the area, and then set its width using a 45° cutter.



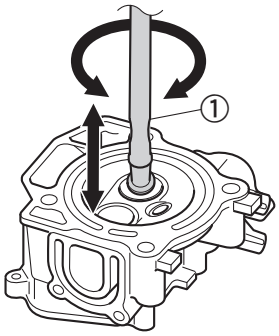
ⓑ Previous contact width

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



ⓑ Previous contact width

7. After refacing the contact width of the valve seat to specification, apply a thin, even layer of lapping compound onto the valve seat, and then lap the valve using the special service tool ①. ***NOTICE:*** **Do not get the lapping compound on the valve stem and valve guide.**

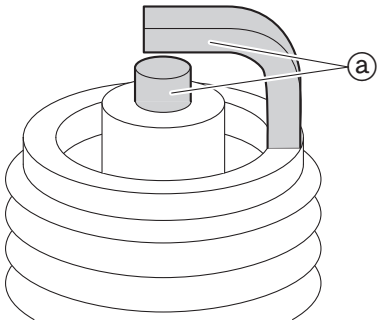


Valve lapper ①: 90890-04101

8. Recheck the valve seat contact area of the valve. See “Checking the valve seat” (7-32).

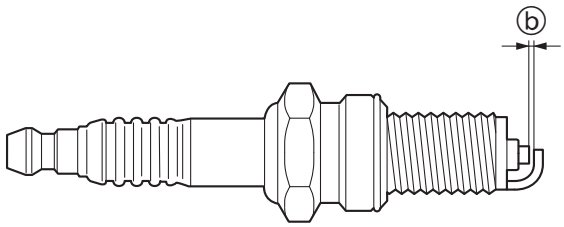
Checking the spark plug

1. Clean the electrodes ⓐ using a spark plug cleaner.



2. Check the spark plug. Replace if the electrodes are eroded, there is carbon or other deposits.

3. Check the spark plug gap ⓑ. Replace if out of specification.



Specified spark plug: CR6HSB (NGK) Spark plug gap ⓑ: 0.6–0.7 mm (0.024–0.028 in)

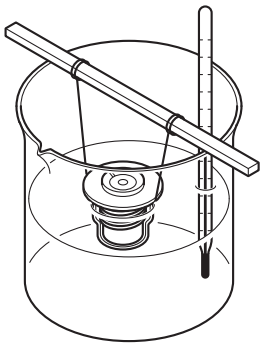
Checking the thermostat cover anode

1. Check the anode. Replace if eroded. Clean if there is grease, oil, or scales. ***NOTICE:*** **Do not apply grease, oil, or paint to the anode.**

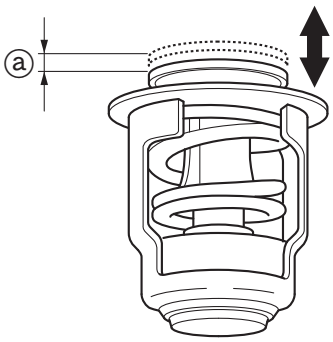
Checking the thermostat

1. Suspend the thermostat in a container of water.

2. Place a thermometer in the water and slowly heat the water.



3. Measure the thermostat valve opening ⓐ at the specified water temperatures. Replace if out of specification.



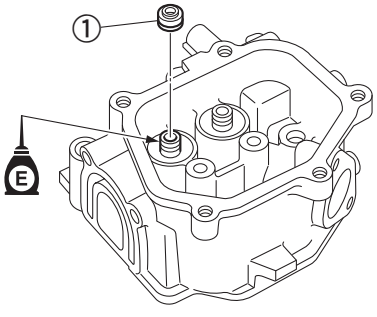
Water temperature	Valve opening ⓐ
58–62 °C (136–144 °F)	Starts opening
above 70 °C (158 °F)	3.0 mm (0.12 in) or above

Assembling the cylinder head

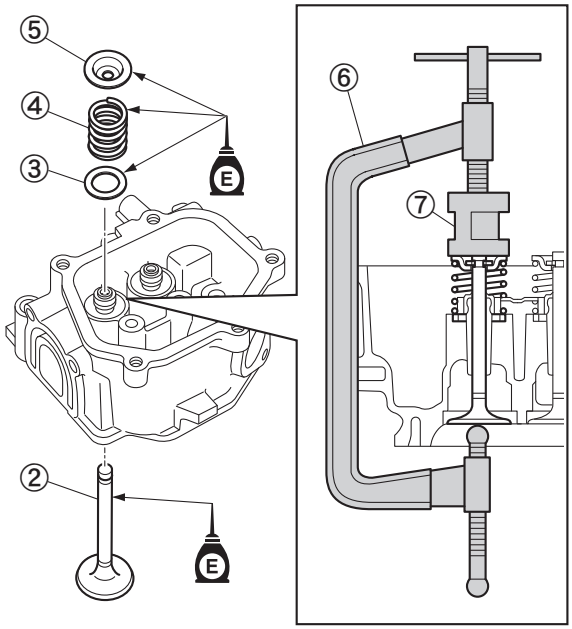
NOTICE

Do not reuse a gasket or oil seal, always replace it with a new one.

1. Install a new valve seal ①.

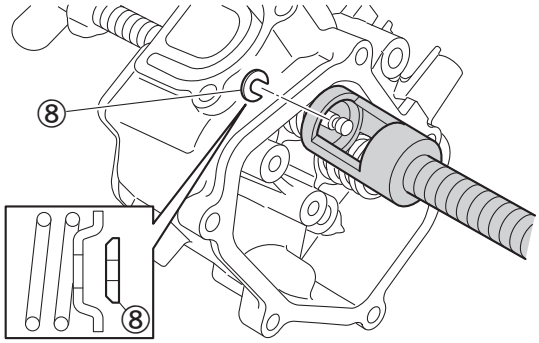


2. Install the valve ②, spring seat ③, valve spring ④, and valve spring retainer ⑤ in this order, and then install the special service tools ⑥ and ⑦.



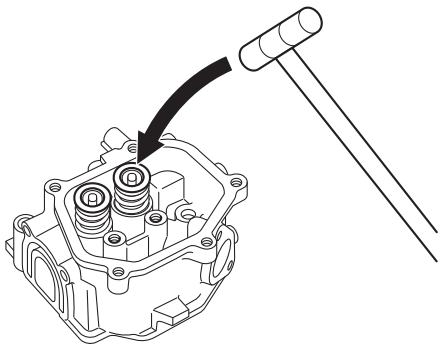
Valve spring compressor ⑥:
90890-04019
Valve spring compressor attachment ⑦:
90890-06320

3. Compress the valve spring, and then install the valve cotter ⑧.

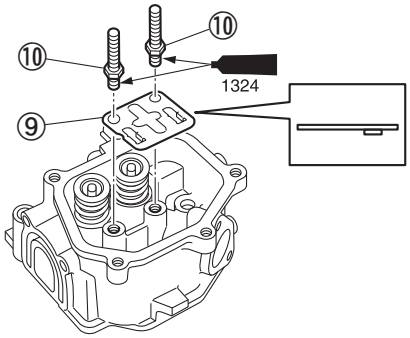


7

4. Tap the valve spring retainer lightly using a plastic hammer to seat the valve cotter securely.



5. Install the push rod guide ⑨, and then tighten the pivot bolts ⑩ to the specified torque.



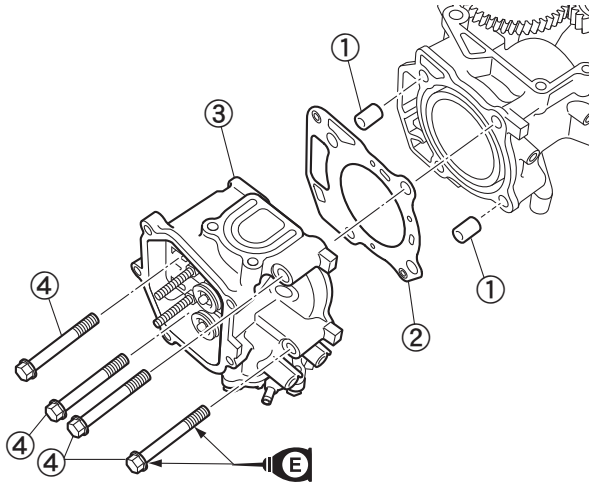
Pivot bolt ⑩:
10 N·m (1.0 kgf·m, 7.4 ft·lb)

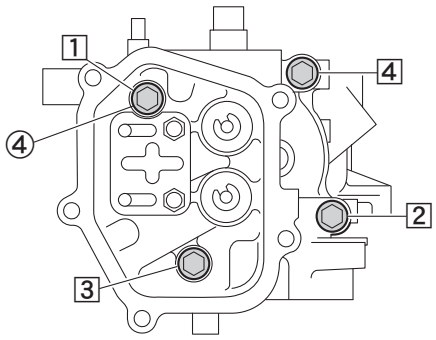
Installing the cylinder head

NOTICE

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

1. Install the dowels ①, a new gasket ②, and the cylinder head ③, and then tighten the cylinder head bolts ④ to the specified torques in 2 stages and in the order 1, 2, and so on.



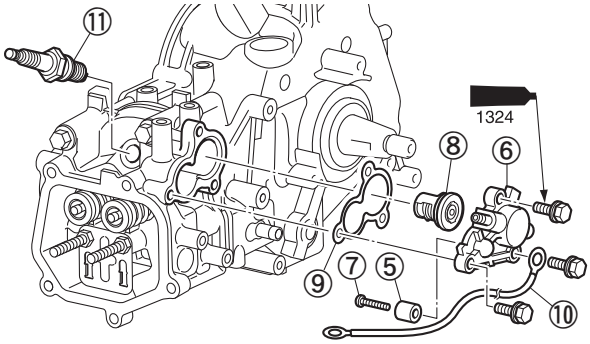


Cylinder head bolt ④:
1st: 13 N·m (1.3 kgf·m, 9.6 ft·lb)
2nd: 28 N·m (2.8 kgf·m, 20.7 ft·lb)

2. Install the thermostat cover anode ⑤ to the thermostat cover ⑥, and then tighten the thermostat cover anode screw ⑦ to the specified torque.

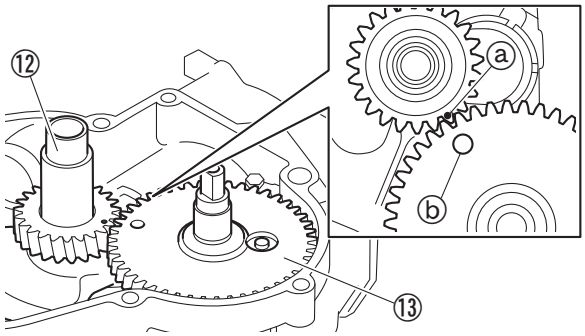
3. Install the thermostat ⑧, a new gasket ⑨, the thermostat cover ⑥, and then connect the ground lead ⑩.

4. Install the spark plug ⑪, and then tighten it to the specified torque.

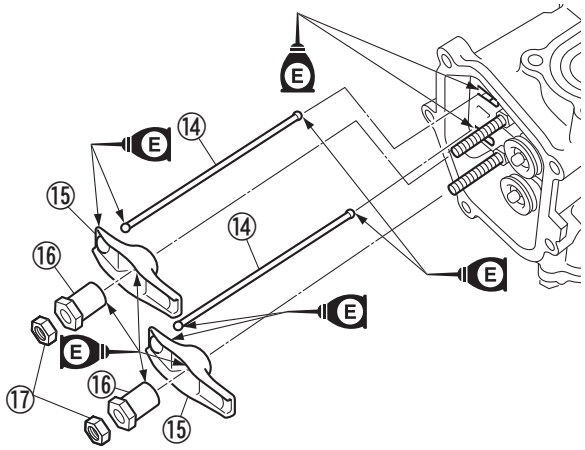


Thermostat cover anode screw ⑦: 2 N·m (0.2 kgf·m, 1.5 ft·lb) Spark plug ⑪: 13 N·m (1.3 kgf·m, 9.6 ft·lb)

5. Check that the mark ⓐ on the crankshaft ⑫ is aligned with the hole ⓑ on the camshaft ⑬.



6. Install the push rods ⑭ and rocker arms ⑮, and then screw in the rocker arm pivots ⑯ and valve adjusting locknuts ⑰.

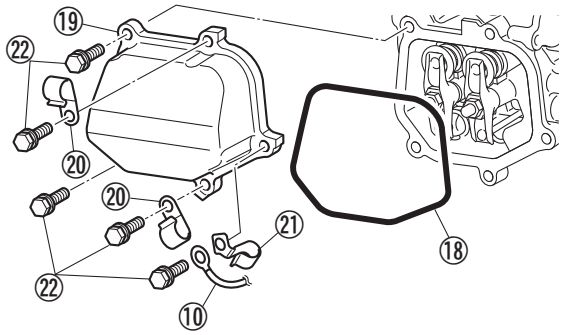


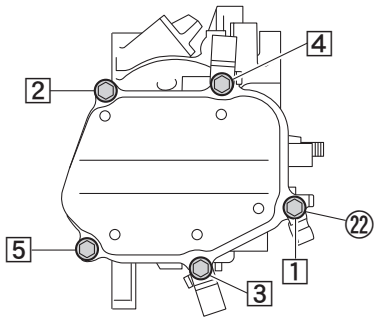
7. Install the crankcase. See “Installing the crankcase” (7-25).

8. Adjust the valve clearance. See steps 2 and 3 in “Adjusting the valve clearance” (7-3).

9. Install a new gasket ⑱, the cylinder head cover ⑲, and the clamps ⑳, ㉑, and then connect the ground lead ⑩.

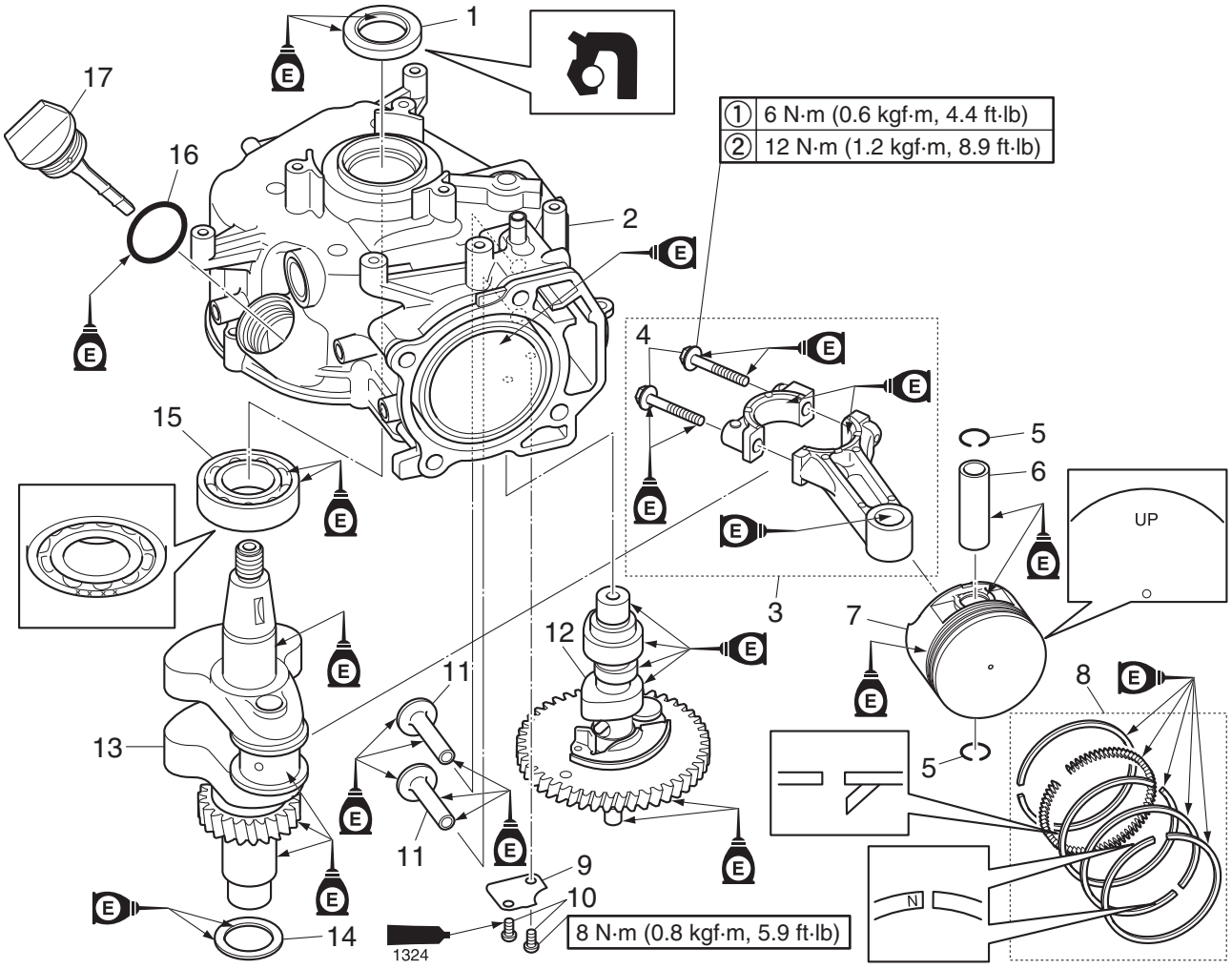
10. Tighten the bolts ㉒ in the order 1, 2, and so on.





7

Cylinder block

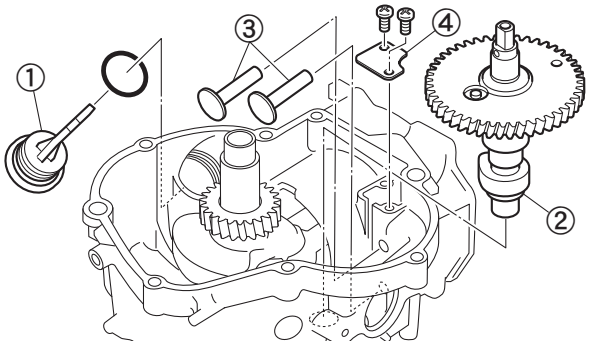


No.	Part name	Q'ty	Remarks
1	Oil seal	1	**Not reusable**
2	Cylinder block	1	
3	Connecting rod assembly	1	
4	Connecting rod bolt	2	M7 × 35 mm
5	Clip	2	**Not reusable**
6	Piston pin	1	
7	Piston	1	
8	Piston ring set	1	
9	Plate	1	
10	Breather plate screw	2	M5 × 10 mm
11	Valve lifter	2	
12	Camshaft	1	
13	Crankshaft	1	
14	Washer	1	
15	Ball bearing	1	**Not reusable**
16	O-ring	1	**Not reusable**
17	Dipstick	1	

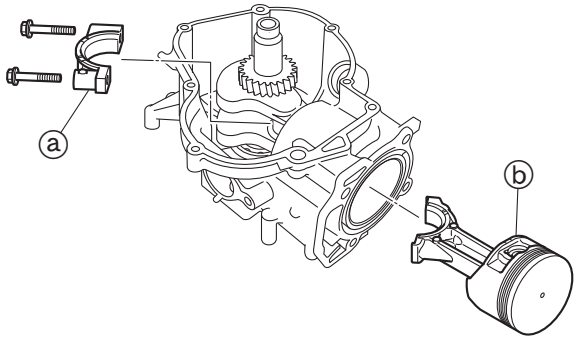
Disassembling the cylinder block

1. Remove the dipstick ①.

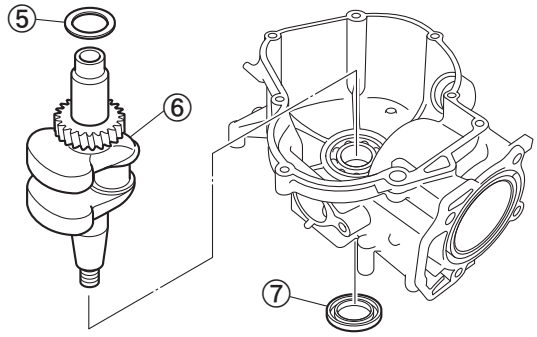
2. Remove the camshaft ②, valve lifters ③, and plate ④.



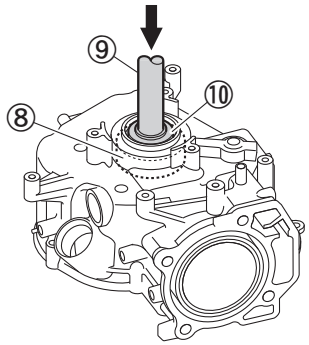
3. Remove the connecting rod cap ⓐ, and then remove the connecting rod and piston assembly ⓑ.



4. Remove the washer ⑤, crankshaft ⑥, and oil seal ⑦.

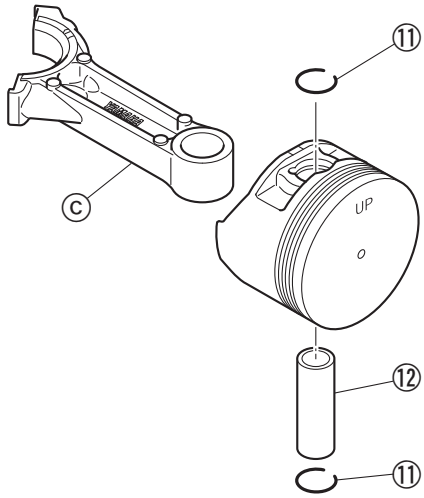


5. Remove the ball bearing ⑧.



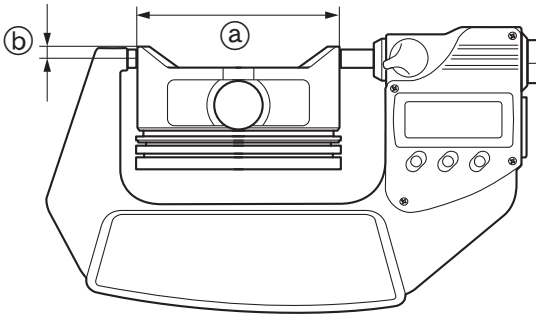
Driver rod L3 ⑨: 90890-06652 Needle bearing attachment ⑩: 90890-06612

6. Remove the clips ⑪, and then remove the piston pin ⑫ and connecting rod ⓒ.



Checking the piston diameter

1. Measure the piston diameter ⓐ at the specified measuring point ⓑ.

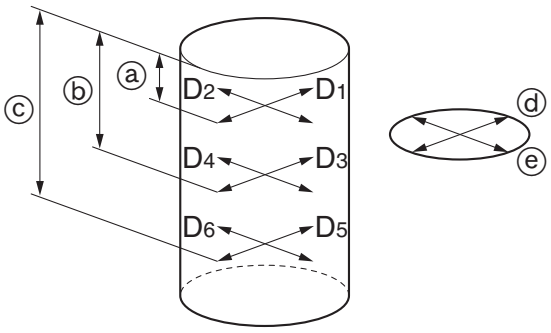


7

Piston diameter ⓐ:
61.950–61.965 mm
(2.4390–2.4396 in)
Measuring point ⓑ:
1.0 mm (0.04 in) up from the bottom of the piston skirt
Oversize piston diameter:
Oversize 1st:
62.200–62.215 mm
(2.4488–2.4494 in)
Oversize 2nd:
62.450–62.465 mm
(2.4587–2.4592 in)

Checking the cylinder bore

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

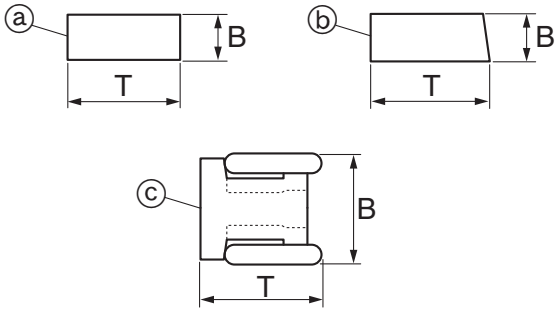


ⓐ 5.0 mm (0.20 in)
ⓑ 28.0 mm (1.10 in)
ⓒ 50.0 mm (1.97 in)

Cylinder bore (D1–D6):
62.000–62.015 mm
(2.4409–2.4415 in)

Checking the piston ring

1. Measure the piston ring dimensions B and T.

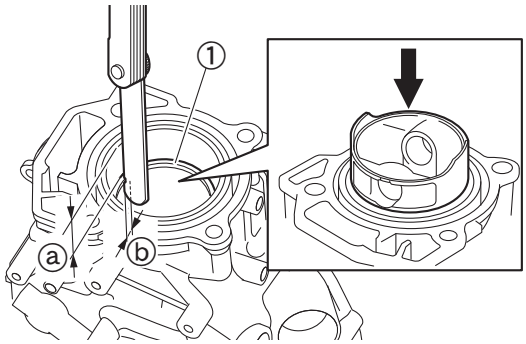


Piston ring dimensions:
Top ring ⓐ:
B: 1.170–1.190 mm (0.0461–0.0469 in)
T: 2.500–2.700 mm (0.0984–0.1063 in)
2nd ring ⓑ:
B: 1.170–1.190 mm (0.0461–0.0469 in)
T: 2.600–2.800 mm (0.1024–0.1102 in)
Oil ring ⓒ:
B: 1.850–2.000 mm (0.0728–0.0787 in)
T: 2.550–2.850 mm (0.1004–0.1122 in)
(reference data)

Checking the piston ring end gap

1. Level the piston ring ① in the cylinder with a piston crown at the specified measuring point ⓐ.

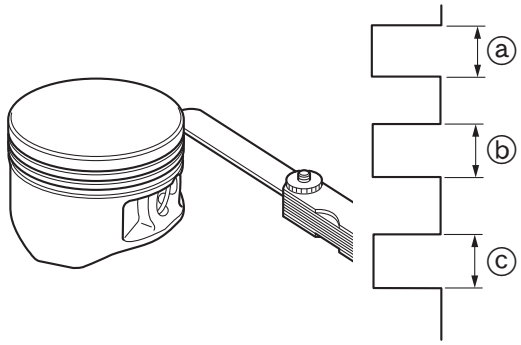
2. Measure the piston ring end gap ⓑ.



Measuring point ⓐ (reference data):
60.0 mm (2.36 in)
Piston ring end gap ⓑ (reference data):
Top ring:
0.110–0.210 mm (0.0043–0.0083 in)
2nd ring:
0.260–0.410 mm (0.0102–0.0161 in)
Oil ring:
0.200–0.700 mm (0.0079–0.0276 in)

Checking the piston ring groove

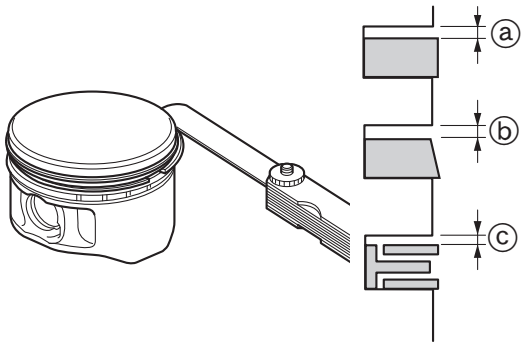
1. Measure the piston ring grooves.



Piston ring groove:
Top ring ⓐ:
1.210–1.230 mm (0.0476–0.0484 in)
2nd ring ⓑ:
1.210–1.230 mm (0.0476–0.0484 in)
Oil ring ⓒ:
2.010–2.030 mm (0.0791–0.0799 in)

Checking the piston ring side clearance

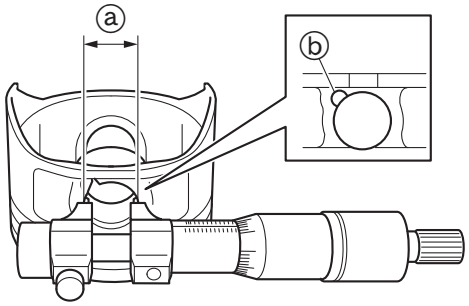
1. Measure the piston ring side clearance.



Piston ring side clearance:
Top ring ⓐ:
0.020–0.060 mm (0.0008–0.0024 in)
2nd ring ⓑ:
0.020–0.060 mm (0.0008–0.0024 in)
Oil ring ⓒ:
0.010–0.180 mm (0.0004–0.0071 in)

Checking the piston pin boss inside diameter

1. Measure the piston pin boss inside diameter ⓐ.

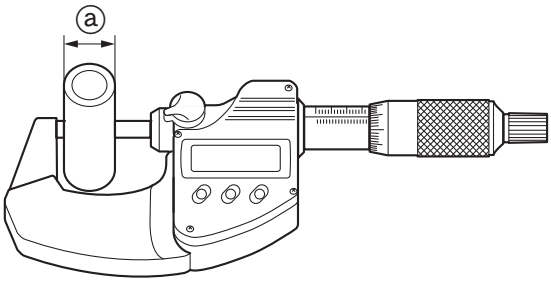


Piston pin boss inside diameter ⓐ:
15.004–15.015 mm
(0.5907–0.5911 in)

TIP:
Do not measure it at the groove ⓑ.

Checking the piston pin diameter

1. Measure the piston pin outside diameter ⓐ.



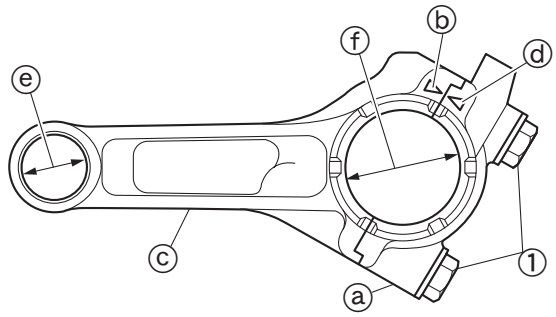
Piston pin outside diameter ⓐ:
14.995–15.000 mm
(0.5904–0.5906 in)

Checking the connecting rod small end inside diameter and big end inside diameter

1. Install the connecting rod cap ⓐ by aligning the mark ⓑ on the connecting rod ⓒ and the mark ⓓ on the connecting rod cap ⓐ, and then tighten the connecting rod cap bolts ① to the specified torques in 2 stages.

2. Measure the connecting rod small end inside diameter ⓔ and the big end inside diameter ⓕ.

7



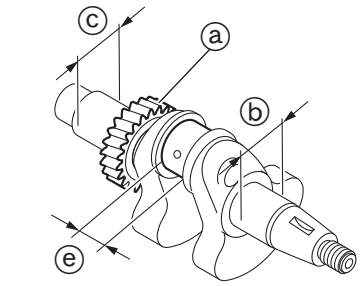
Connecting rod small end inside diameter ⓔ: 15.015–15.029 mm (0.5911–0.5917 in) Connecting rod big end inside diameter ⓕ: 28.000–28.015 mm (1.1024–1.1030 in)

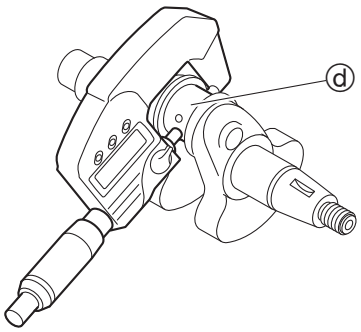
Connecting rod cap bolt ①: 1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb) 2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

Checking the crankshaft

1. Check the crankshaft gear ⓐ. Replace the crankshaft if damaged or worn.

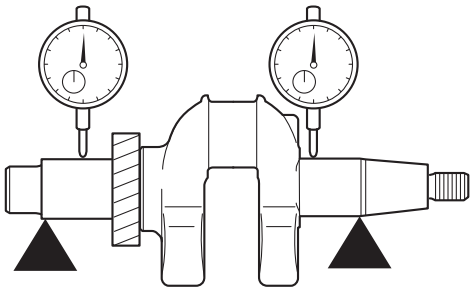
2. Measure the crankshaft journal diameter ⓑ and ⓒ, crankpin diameter ⓓ, and crankpin width ⓔ.





Crankshaft journal diameter (cylinder block side) ⓑ: 24.980–24.993 mm (0.9835–0.9840 in) Crankshaft journal diameter (crankcase side) ⓒ: 24.982–24.994 mm (0.9835–0.9840 in) Crankpin diameter ⓓ: 27.969–27.984 mm (1.1011–1.1017 in) Crankpin width ⓔ: 21.000–21.100 mm (0.8268–0.8307 in)

3. Measure the crankshaft runout.

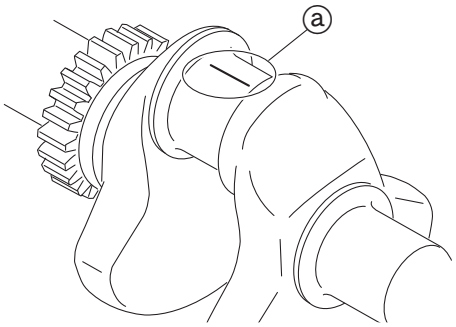


Crankshaft runout: 0.020 mm (0.0008 in)

Checking the connecting rod oil clearance

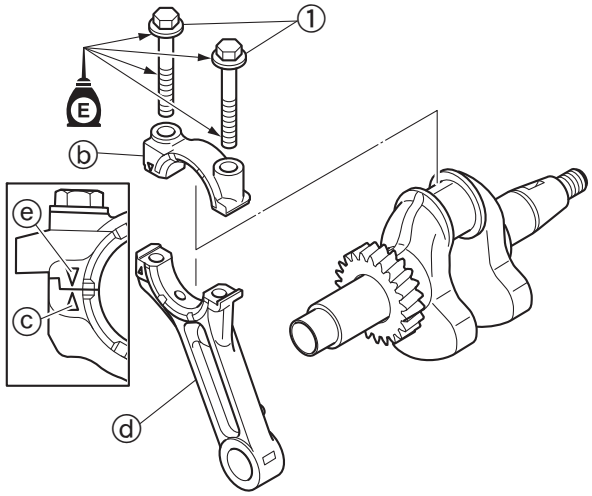
1. Clean the connecting rod, connecting rod cap, and crankpin.

2. Place a piece of Plastigauge (PG-1) onto the crankpin ⓐ, parallel to the crankshaft.



TIP:
Do not place the Plastigauge (PG-1) over the oil hole in the crankpin of the crankshaft.

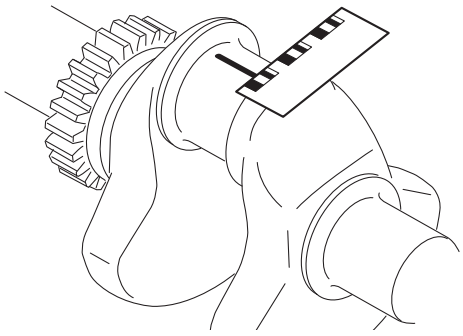
3. Install the connecting rod cap ⓑ by aligning the mark ⓒ on the connecting rod ⓓ and the mark ⓔ on the connecting rod cap ⓑ, and then tighten the connecting rod cap bolts ① to the specified torques in 2 stages.



Connecting rod cap bolt ①:
1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

TIP:
Do not turn the connecting rod until the connecting rod oil clearance measurement has been completed.

4. Remove the connecting rod cap, and then measure the width of the compressed Plastigauge (PG-1) on the crankpin.

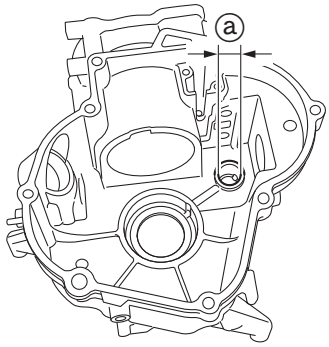


Connecting rod oil clearance:
0.016–0.046 mm (0.0006–0.0018 in)

Checking the cylinder block

1. Check the cylinder block. Replace if corroded or cracked.

2. Measure the camshaft journal inside diameter ⓐ.

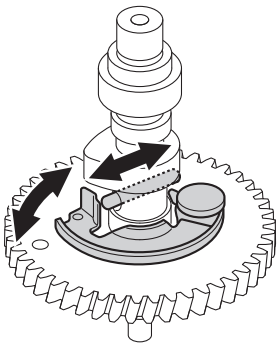


Camshaft journal inside diameter ⓐ:
15.000–15.018 mm
(0.5906–0.5913 in)

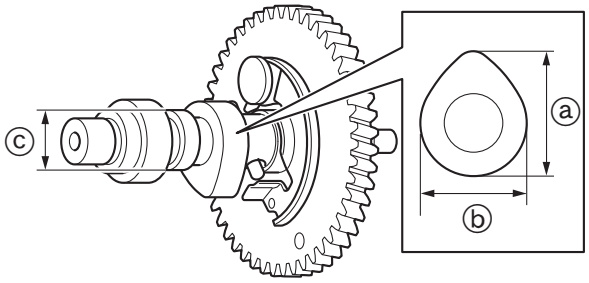
Checking the camshaft

1. Check the camshaft gear. Replace the camshaft if damaged or worn.

2. Check the decompression actuator. Replace the camshaft if the decompression actuator does not operate smoothly.

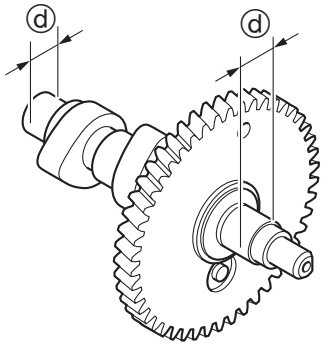


3. Measure the cam lobe height ⓐ, cam lobe width ⓑ, and fuel pump cam diameter ⓒ.



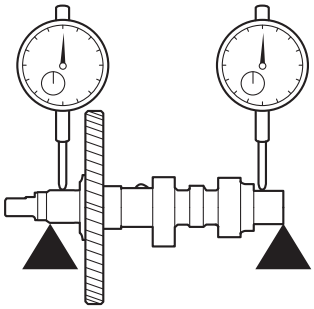
Cam lobe height ⓐ:
  Intake:
    32.037–32.137 mm
    (1.2613–1.2652 in)
  Exhaust:
    32.038–32.138 mm
    (1.2613–1.2653 in)
Cam lobe width ⓑ:
  Intake and exhaust:
    26.950–27.050 mm
    (1.0610–1.0650 in)
  Fuel pump cam diameter ⓒ:
    19.600 mm (0.7717 in)
    (reference data)

4. Measure the camshaft journal diameter ⓓ.



Camshaft journal diameter ⓓ:
    14.965–14.990 mm
    (0.5892–0.5902 in)

5. Measure the camshaft runout.

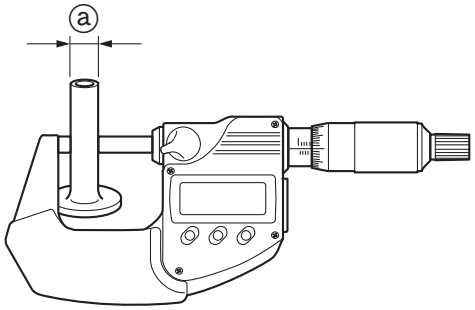


Camshaft runout: 0.030 mm (0.0012 in)

Checking the valve lifter

1. Check the valve lifter. Replace if damaged or worn.

2. Measure the valve lifter outside diameter ⓐ.



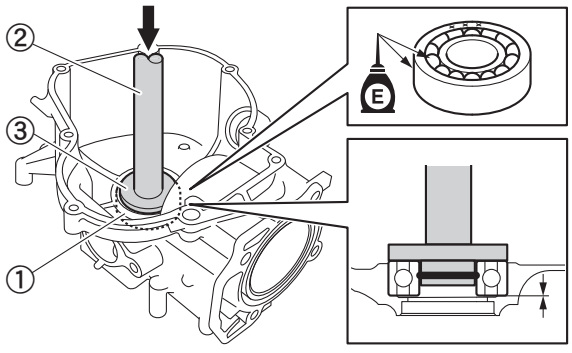
Valve lifter outside diameter ⓐ:
    7.965–7.980 mm (0.3136–0.3142 in)

Assembling the cylinder block

NOTICE

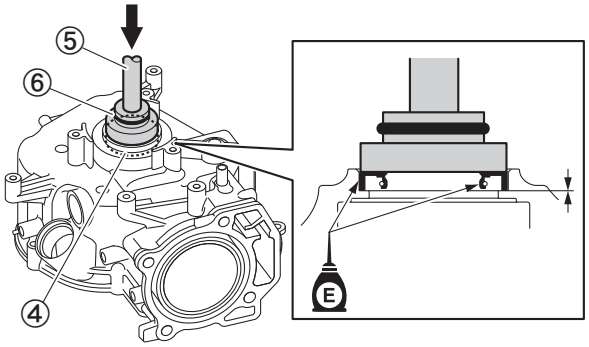
Do not reuse an O-ring or oil seal, piston pin clip, or bearing, always replace it with a new one.

1. Install a new ball bearing ①.



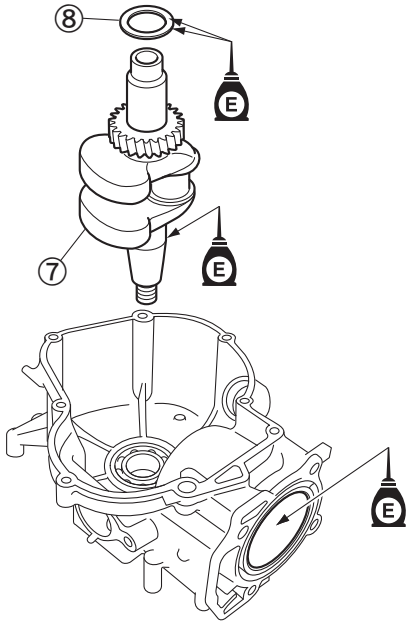
Driver rod LL ②: 90890-06605
Ball bearing attachment ③: 90890-06632

2. Install a new oil seal ④.

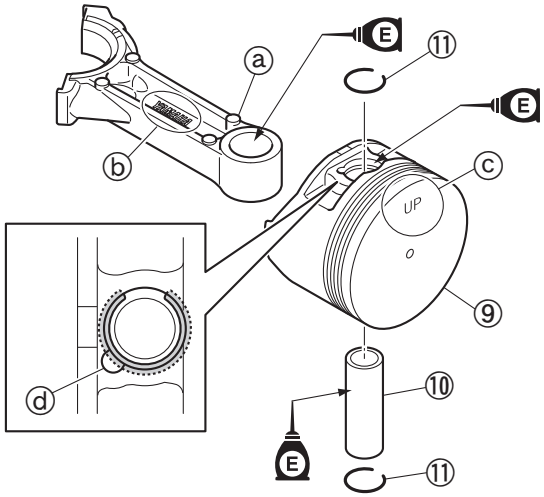


Driver rod LS ⑤: 90890-06606
Ball bearing attachment ⑥:
90890-06655

3. Install the crankshaft ⑦ and washer ⑧.



4. Assemble the piston ⑨, connecting rod ⓐ, piston pin ⑩, and clips ⑪.

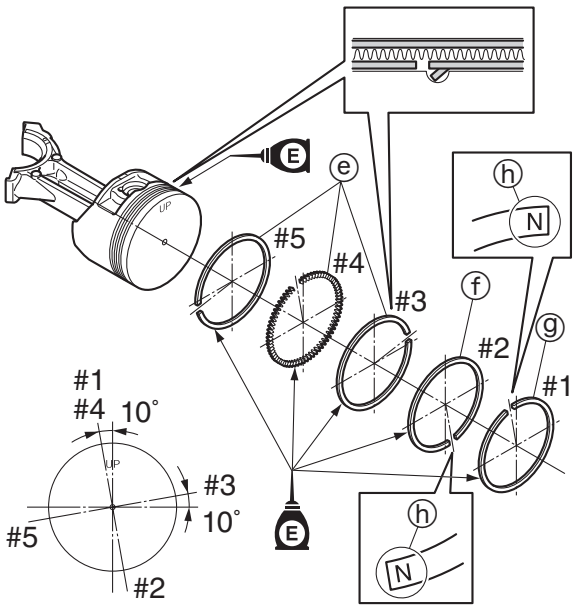


TIP:

- Face the "YAMAHA" mark ⓑ on the connecting rod ⓐ in the same direction as the "UP" mark ⓒ on the piston crown.
- Do not align the clip end with the groove ⓓ in the piston pin boss.

5. Install the oil rings ⓔ, 2nd ring ⓕ, and top ring ⓖ.

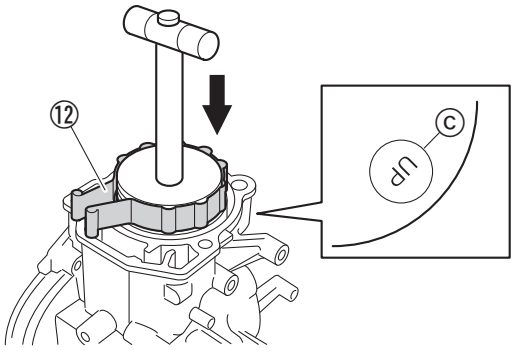
6. Offset the piston ring end gaps. ***NOTICE:*** **Do not scratch the pistons or break the piston rings.**



7

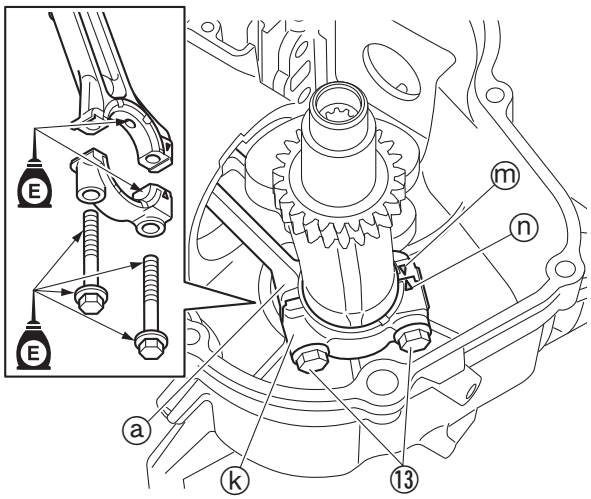
TIP:
- Make sure that the "N" marks ⓗ of the 2nd ring ⓕ and the top ring ⓖ are facing upward.
- Make sure that the piston rings move smoothly.

7. Install the piston with the "UP" mark ⓒ on the piston crown facing toward the flywheel magnet.



Piston slider ⑫: 90890-06529

8. Install the connecting rod cap ⓚ by aligning the mark ⓜ on the connecting rod ⓐ and the mark ⓝ on the connecting rod cap ⓚ, and then tighten the connecting rod cap bolts ⑬ to the specified torques in 2 stages.



Connecting rod cap bolt ⑬:
1st: 6 N·m (0.6 kgf·m, 4.4 ft·lb)
2nd: 12 N·m (1.2 kgf·m, 8.9 ft·lb)

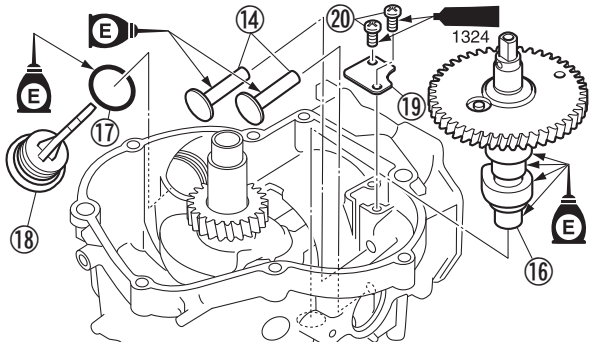
TIP:
Make sure that the crankshaft turns smoothly.

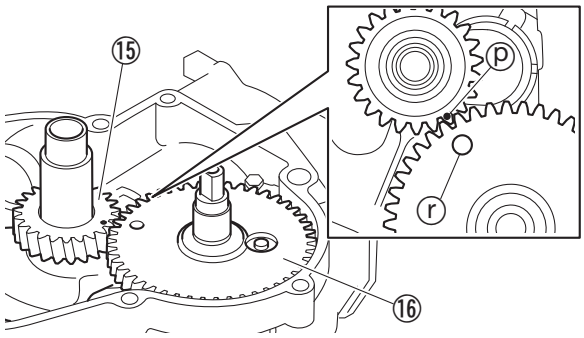
9. Install the valve lifters ⑭.

10. Align the mark ⓟ on the crankshaft ⑮ with the mark ⓡ on the camshaft ⑯, and then install the camshaft ⑯.

11. Install a new O-ring ⑰ to the dipstick ⑱, and then screw in the dipstick ⑱.

12. Install the plate ⑲, and then tighten the breather plate screws ⑳ to the specified torque.

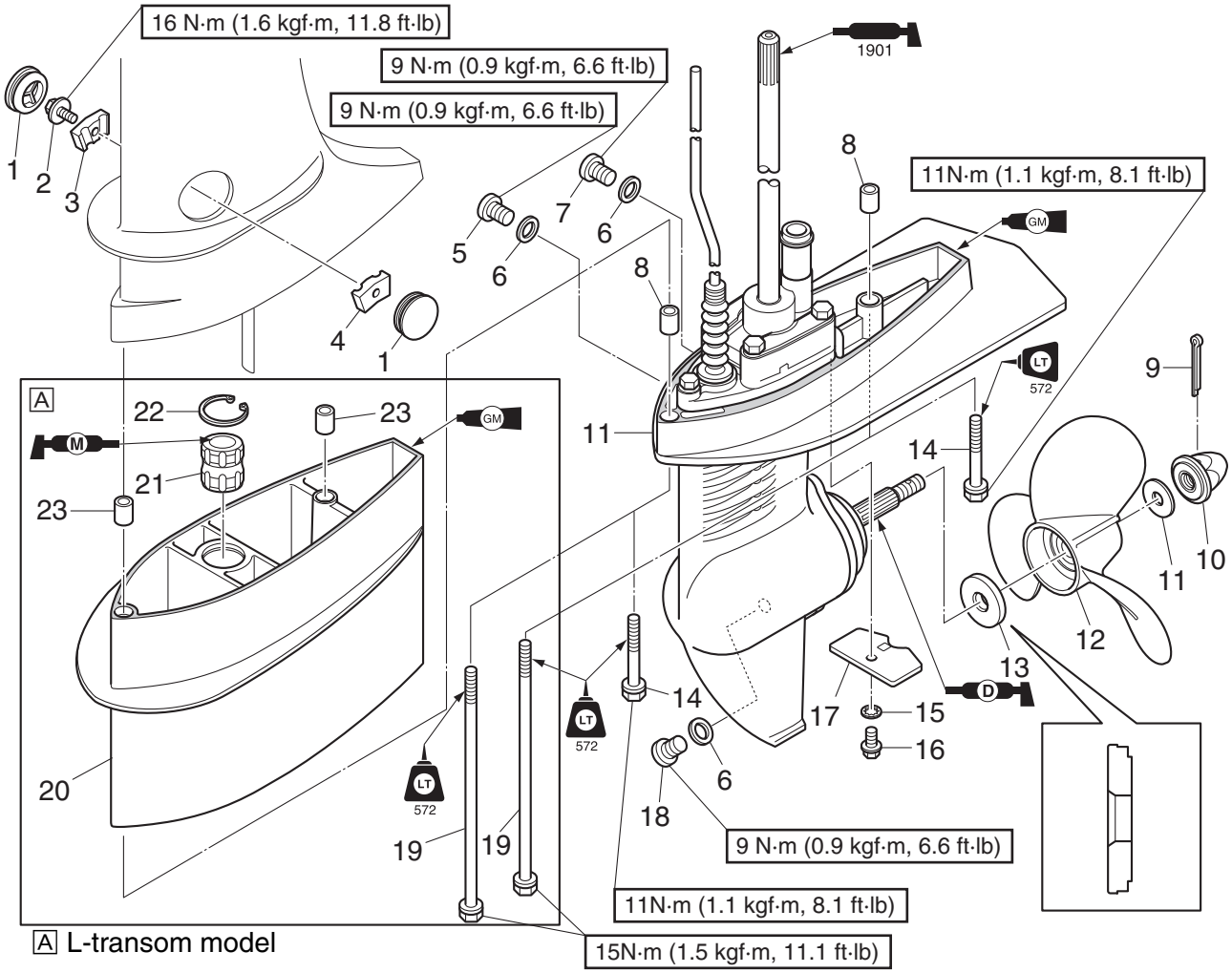




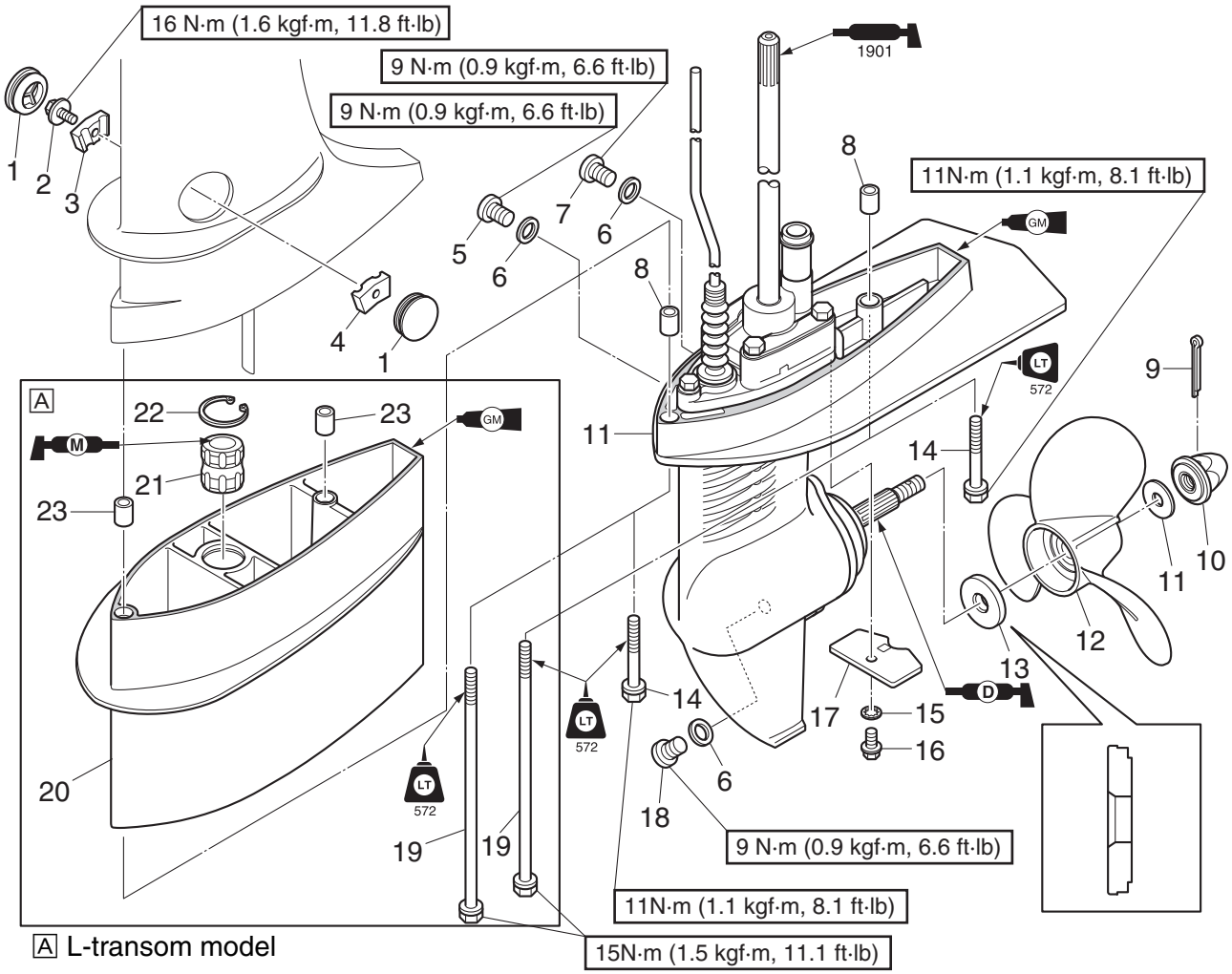
Breather plate screw ⑳:
8 N·m (0.8 kgf·m, 5.9 ft·lb)

Lower unit

Lower unit



No.	Part name	Q'ty	Remarks
1	Cover	2	
2	Shift joint bolt	1	M6 × 20 mm
3	Joint	1	
4	Joint	1	
5	Check screw	1	
6	Gasket	3	**Not reusable**
7	Flushing screw	1	
8	Dowel	2	
9	Cotter pin	1	**Not reusable**
10	Propeller nut	1	
11	Washer	1	
12	Propeller	1	
13	Spacer	1	
14	Lower case mounting bolt	2	M6 × 40 mm
15	Lock washer	1	
16	Bolt	1	M6 × 20 mm
17	Anode	1	



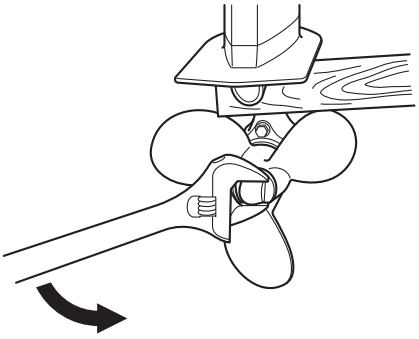
No.	Part name	Q'ty	Remarks
18	Drain screw	1	
19	Lower case mounting bolt	2	M6 × 167 mm
20	Extension	1	
21	Bushing	1	
22	Circlip	1	
23	Dowel	2	

Removing the lower unit (S-transom model)

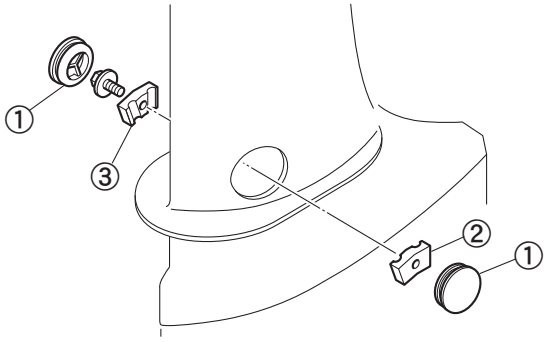
⚠ WARNING

- **Make sure to remove the clip from the engine shut-off switch.**
- **When removing the lower unit with the power unit installed, make sure to suspend the outboard motor. If the outboard motor is not suspended, it can fall suddenly and result in severe injuries.**
- **Do not hold the propeller with your hands when loosening or tightening the propeller nut.**

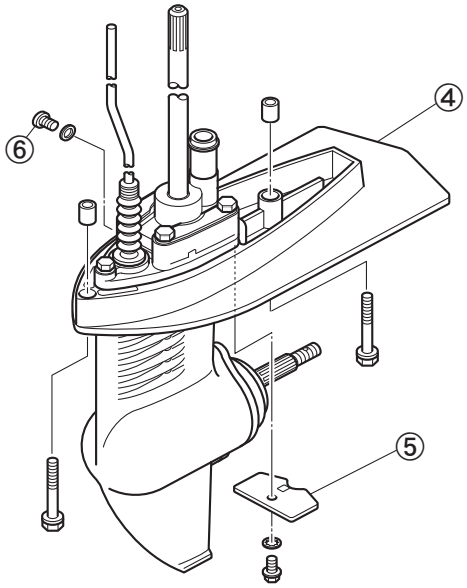
1. Drain the gear oil. See steps 1–4 in "Changing the gear oil" (10-9).
2. Remove the cotter pin.
3. Set the gear shift to the N position.
4. Place a block of wood between the anti-cavitation plate and the propeller to keep the propeller from turning, and then remove the propeller nut and propeller.



5. Set the gear shift to the R position.
6. Remove the covers ①, and then remove the joints ② and ③.



7. Remove the lower unit ④.
8. Remove the anode ⑤ and flushing screw ⑥.



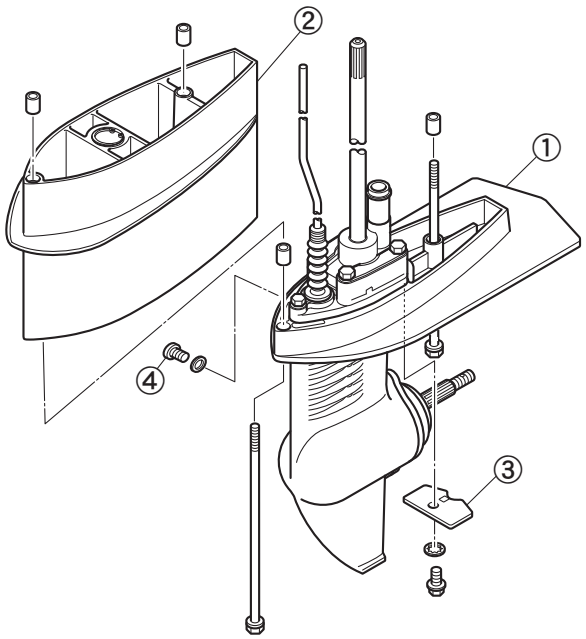
Removing the lower unit (L-transom model)

⚠ WARNING

- **Make sure to remove the clip from the engine shut-off switch.**
- **When removing the lower unit with the power unit installed, make sure to suspend the outboard motor. If the outboard motor is not suspended, it can fall suddenly and result in severe injuries.**
- **Do not hold the propeller with your hands when loosening or tightening the propeller nut.**

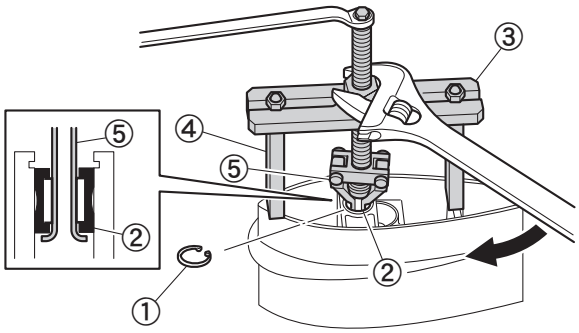
See steps 1–6 in "Removing the lower unit (S-transom model)" (8-3).

1. Remove the lower unit ① and extension ②.
2. Remove the anode ③ and flushing screw ④.



Disassembling the extension (L-transom model)

1. Remove the circlip ①, and then remove the bushing ②.



Stopper guide plate ③: 90890-06501 Stopper guide stand ④: 90890-06538 Bearing puller assembly ⑤: 90890-06535

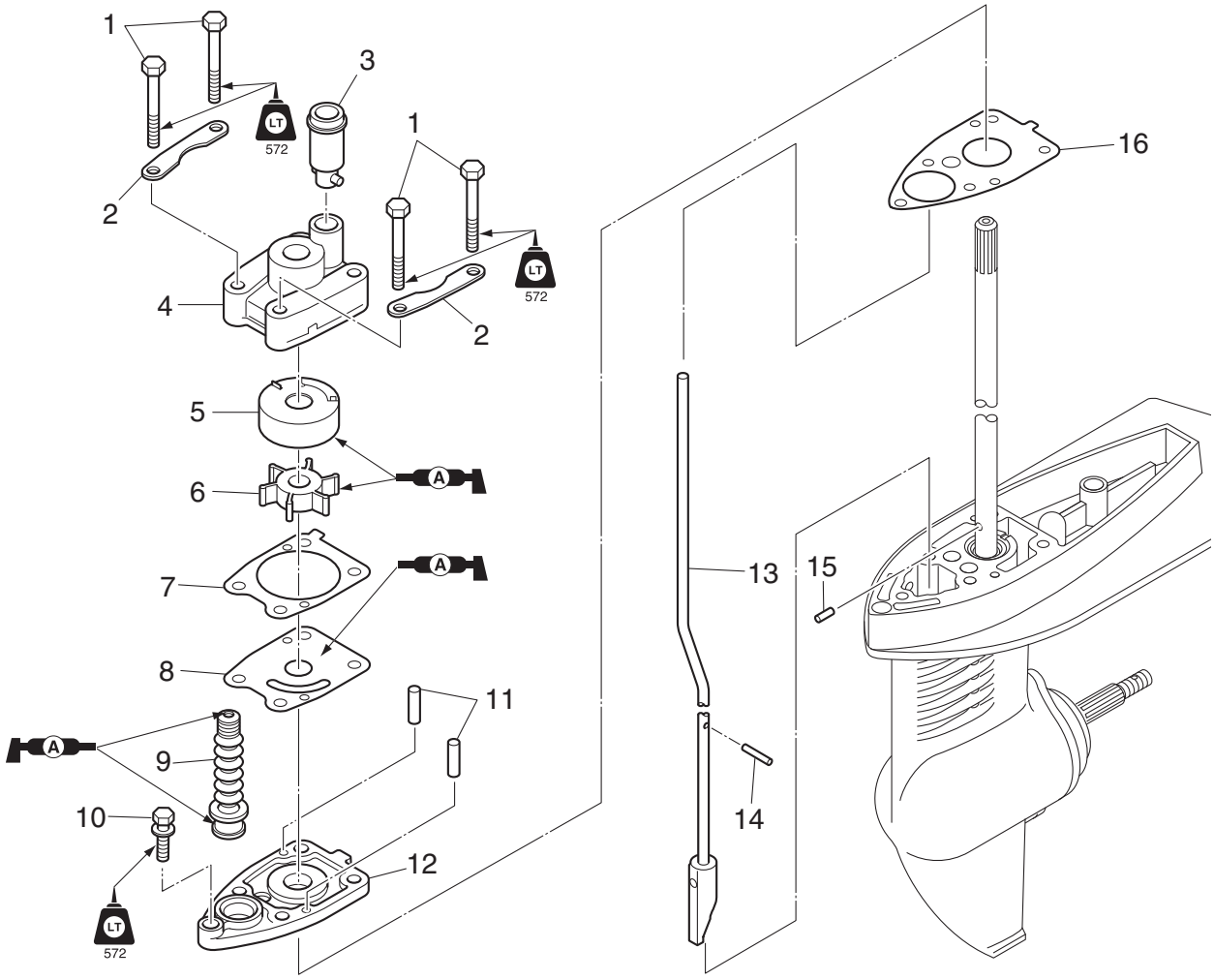
Checking the propeller

1. Check the propeller blades and splines. Replace the propeller if cracked, damaged, or worn.

Checking the lower unit anode

1. Check the anode. Replace if eroded. Clean if there is grease, oil, or scales. ***NOTICE:*** **Do not apply grease, oil, or paint to the anode.**

Water pump and shift rod

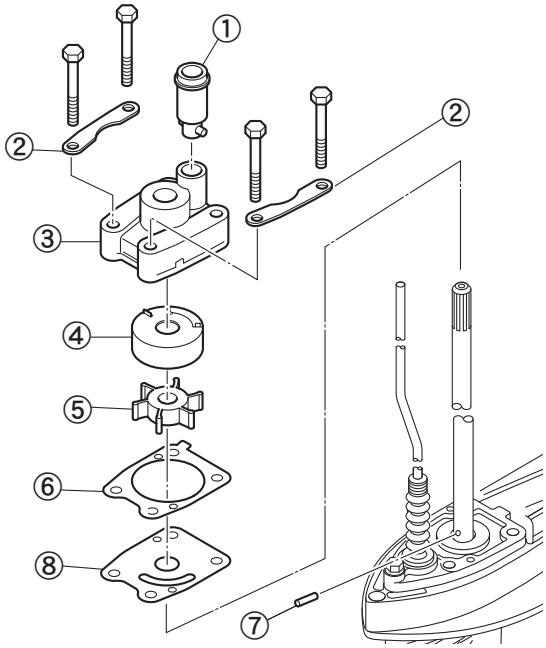


No.	Part name	Q'ty	Remarks
1	Bolt	4	M6 × 45 mm
2	Plate	2	
3	Rubber seal	1	
4	Water pump housing	1	
5	Insert cartridge	1	
6	Impeller	1	
7	Gasket	1	**Not reusable**
8	Outer plate cartridge	1	
9	Rubber seal	1	
10	Bolt	1	M6 × 25 mm
11	Dowel	2	
12	Housing	1	
13	Shift rod	1	
14	Pin	1	
15	Pin	1	
16	Gasket	1	**Not reusable**

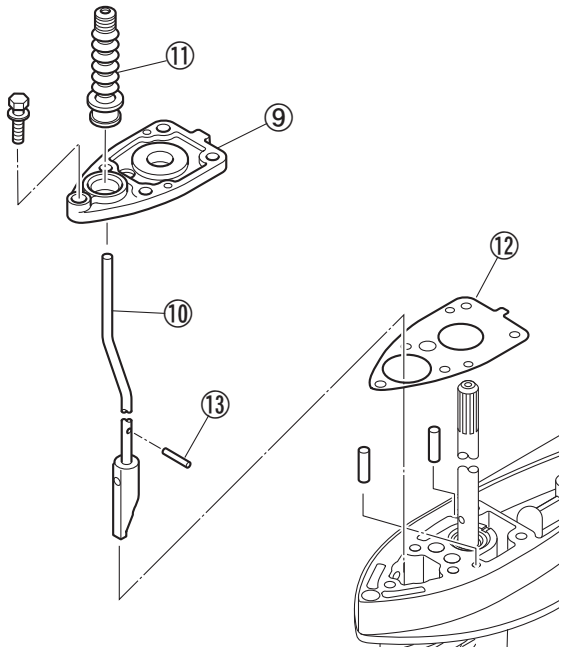
Removing the water pump and shift rod

1. Remove the rubber seal ①, plates ②, water pump housing ③, insert cartridge ④, and impeller ⑤.

2. Remove the gasket ⑥, pin ⑦ and outer plate cartridge ⑧.



3. Remove the housing ⑨, shift rod ⑩, rubber seal ⑪, gasket ⑫, and pin ⑬.



Checking the water pump

1. Check the water pump housing. Replace if cracked or deformed.

TIP:
If the engine overheated, check the water pump housing for deformation.

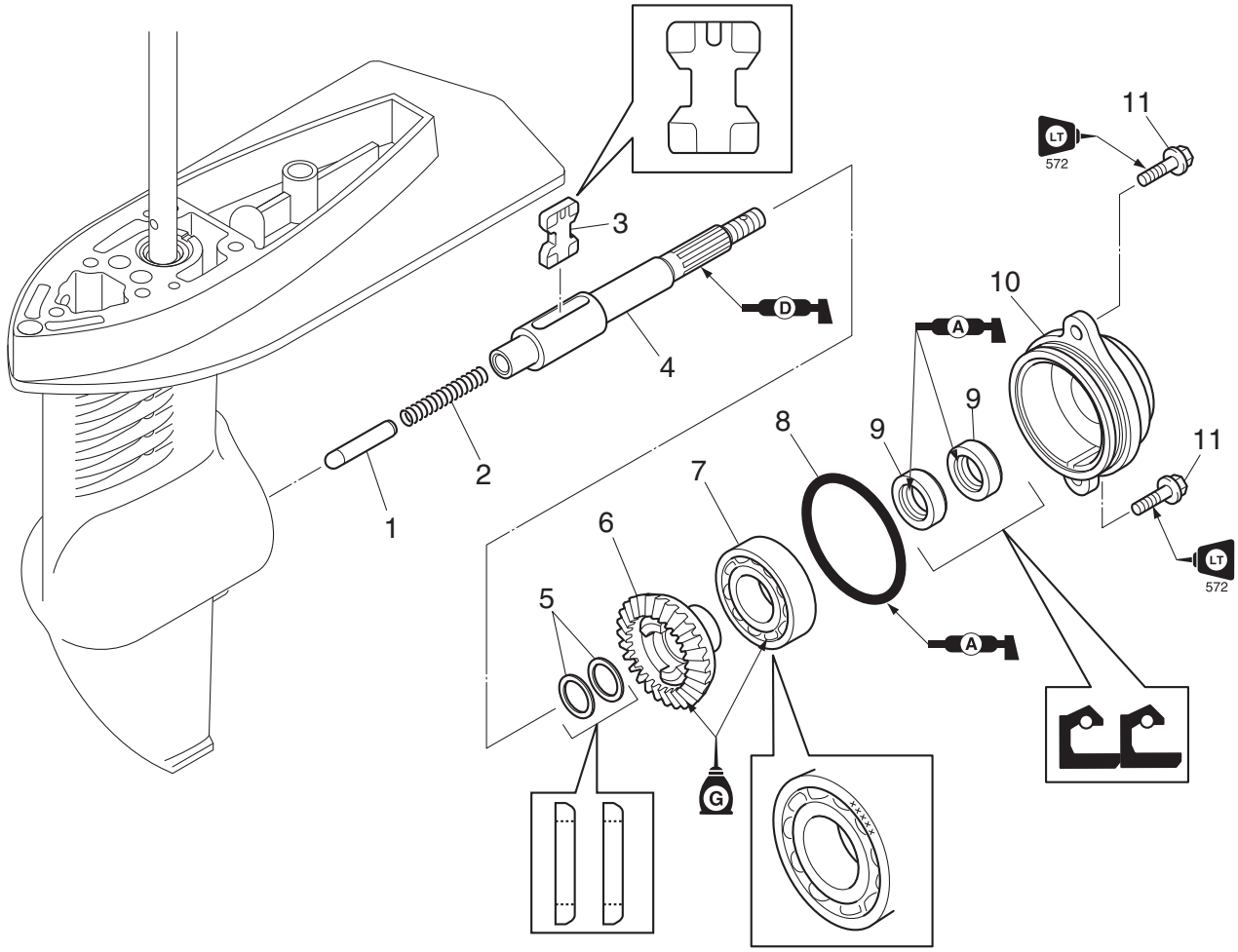
2. Check the impeller, insert cartridge, and outer plate cartridge. Replace if cracked or worn.

3. Check the pin and pin hole in the drive shaft. Replace if deformed or worn.

Checking the shift rod

1. Check the shift rod. Replace if deformed or worn.

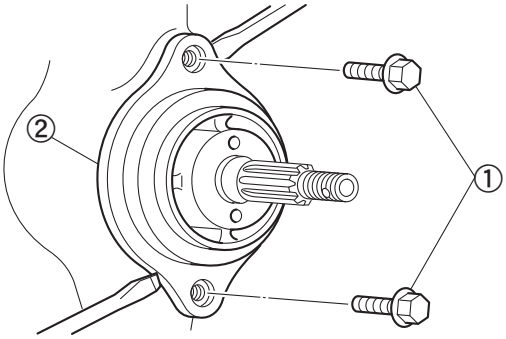
Propeller shaft housing



No.	Part name	Q'ty	Remarks
1	Shift plunger	1	
2	Spring	1	
3	Dog clutch	1	
4	Propeller shaft	1	
5	Washer	2	
6	Reverse gear	1	
7	Ball bearing	1	**Not reusable**
8	O-ring	1	**Not reusable**
9	Oil seal	2	**Not reusable**
10	Propeller shaft housing	1	
11	Bolt	2	M6 × 15 mm

Removing the propeller shaft housing assembly

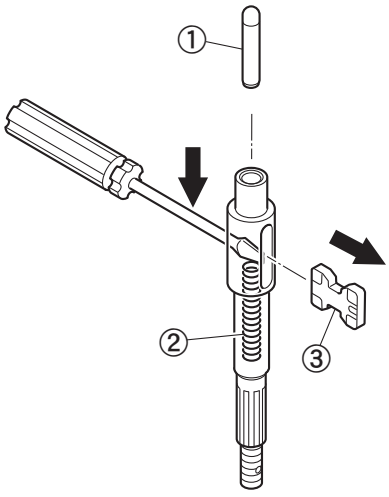
1. Remove the bolts ①, and then remove the propeller shaft housing assembly ②.



TIP:
Insert flat-head screwdrivers between the propeller shaft housing assembly ② and the lower case to remove the propeller shaft housing assembly.

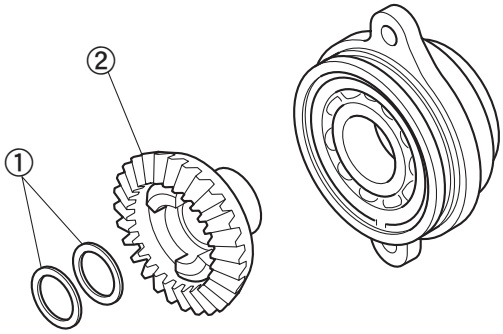
Disassembling the propeller shaft assembly

1. Remove the shift plunger ①.
2. Push the spring ②, and then remove the dog clutch ③.
3. Remove the spring ②.

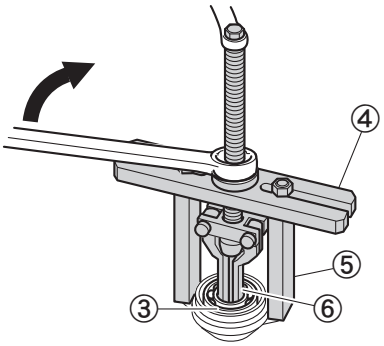


Disassembling the propeller shaft housing assembly

1. Remove the washers ① and reverse gear ②.

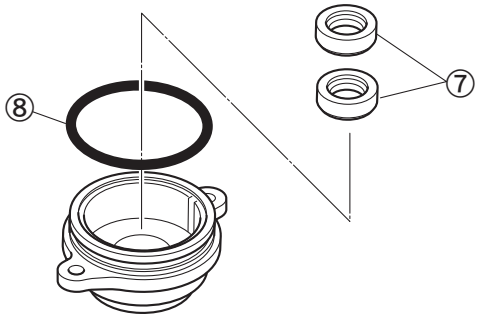


2. Remove the ball bearing ③.



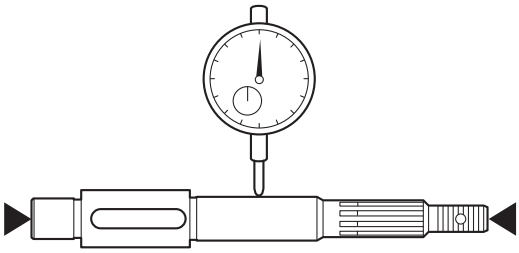
Stopper guide plate ④: 90890-06501
Stopper guide stand ⑤: 90890-06538
Bearing puller assembly ⑥: 90890-06535

3. Remove the oil seals ⑦ and O-ring ⑧.



Checking the propeller shaft

1. Check the propeller shaft. Replace if damaged or worn.
2. Measure the propeller shaft runout.



Propeller shaft runout:
0.02 mm (0.001 in)

Checking the dog clutch

1. Check the dog clutch, shift plunger, and spring. Replace if cracked or worn.

Checking the propeller shaft housing

1. Check the propeller shaft housing. Replace if cracked or damaged.

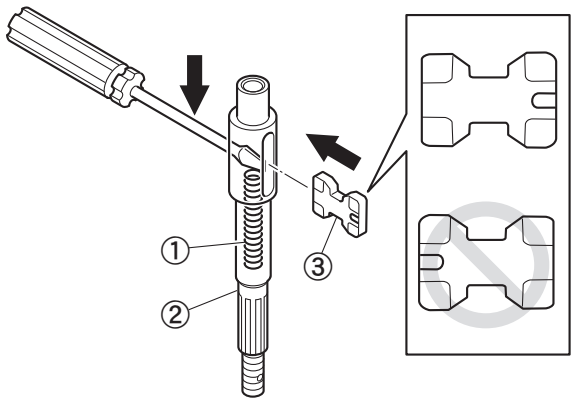
Checking the reverse gear

1. Check the teeth and dogs of the reverse gear. Replace if cracked or worn.

Assembling the propeller shaft assembly

1. Install the spring ① into the hole in the propeller shaft ②.

2. Push the spring ①, and then install the dog clutch ③.

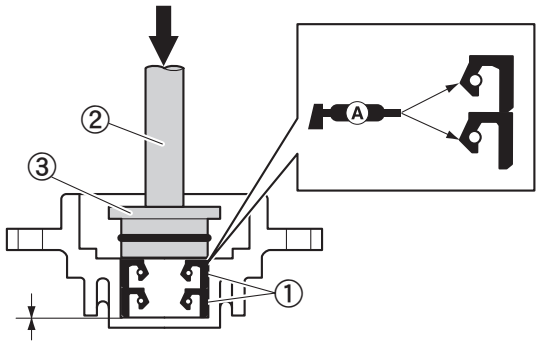


Assembling the propeller shaft housing assembly

NOTICE

Do not reuse a bearing, oil seal, or O-ring, always replace it with a new one.

1. Install new oil seals ①.



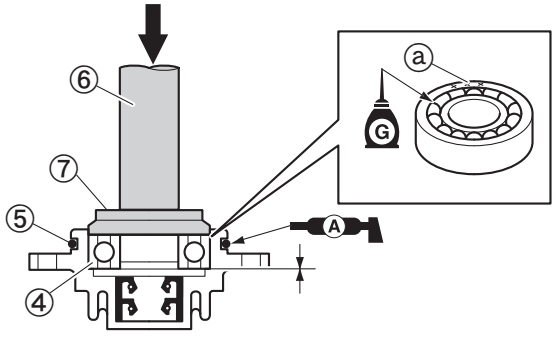
Driver rod L3 ②: 90890-06652
Needle bearing attachment ③:
90890-06615

TIP:

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

2. Install a new ball bearing ④.

3. Install a new O-ring ⑤.

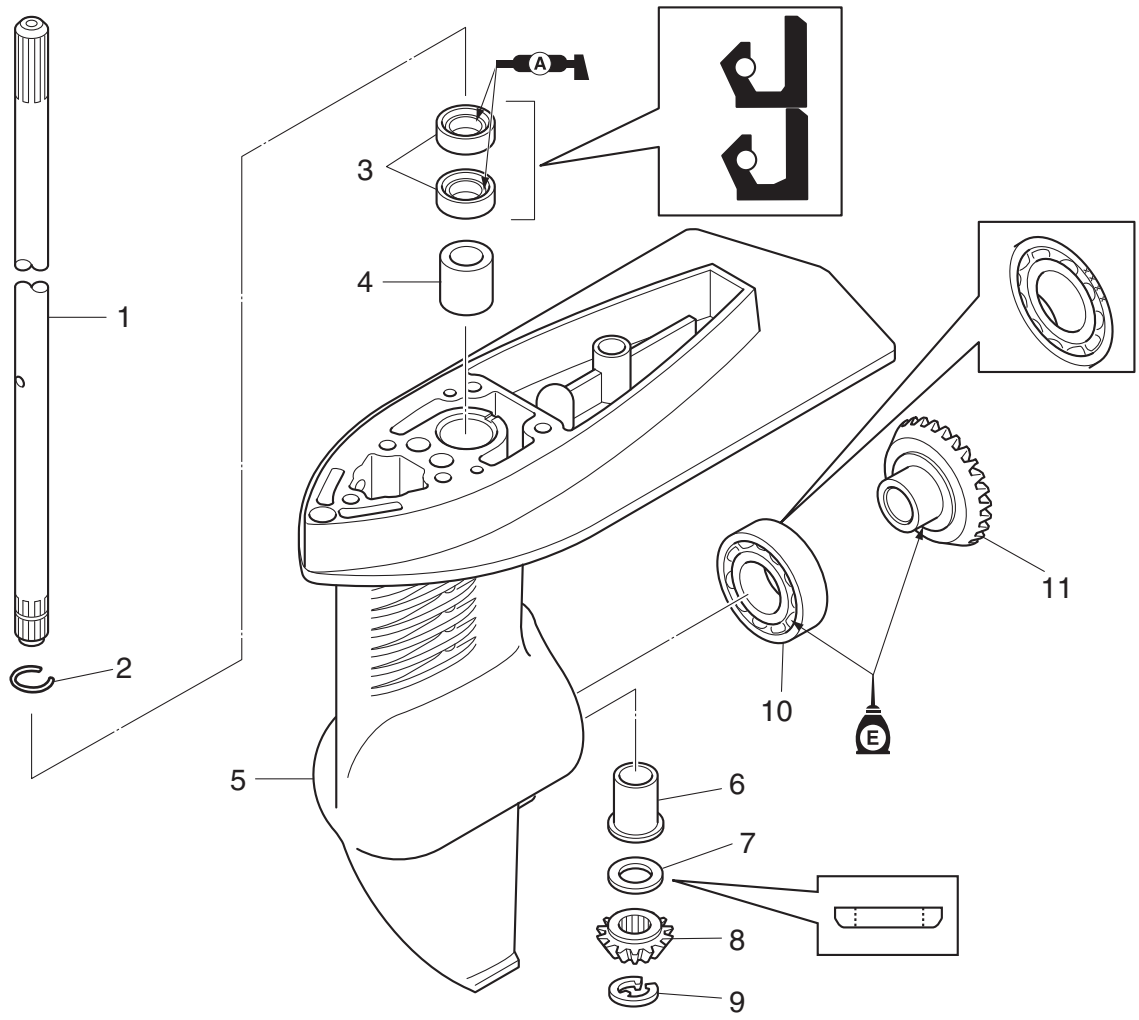


Driver rod LS ⑥: 90890-06606
Bearing outer race attachment ⑦:
90890-06628

TIP:

Face the identification mark ⓐ on the ball bearing toward the reverse gear.

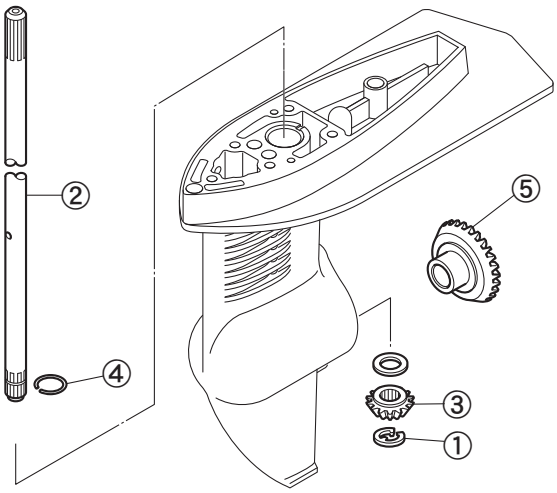
Drive shaft and lower case



No.	Part name	Q'ty	Remarks
1	Drive shaft	1	
2	Clip	1	**Not reusable**
3	Oil seal	2	**Not reusable**
4	Bushing	1	**Not reusable**
5	Lower case	1	
6	Bushing	1	**Not reusable**
7	Washer	1	
8	Pinion	1	
9	E-clip	1	
10	Ball bearing	1	**Not reusable**
11	Forward gear	1	

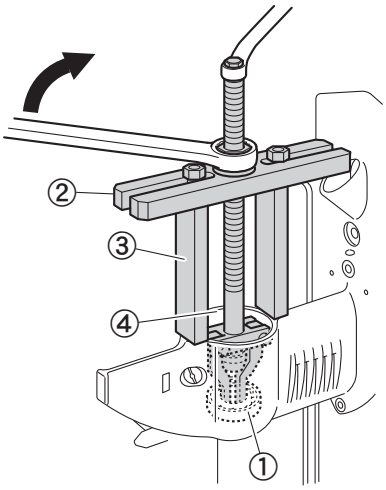
Removing the drive shaft

1. Remove the E-clip ①, and then remove the drive shaft ② and pinion ③.
2. Remove the clip ④.
3. Remove the forward gear ⑤.



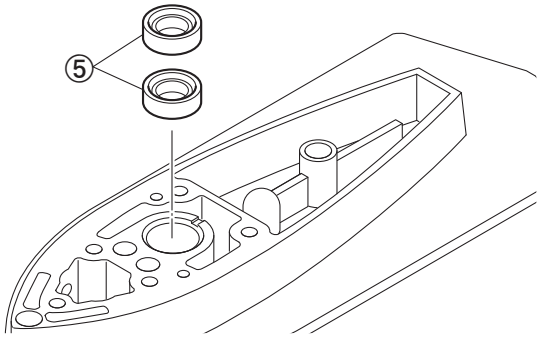
Disassembling the lower case

1. Remove the ball bearing ①.

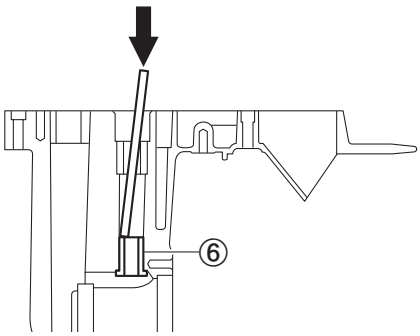


Stopper guide plate ②: 90890-06501 Stopper guide stand ③: 90890-06538 Bearing puller assembly ④: 90890-06535

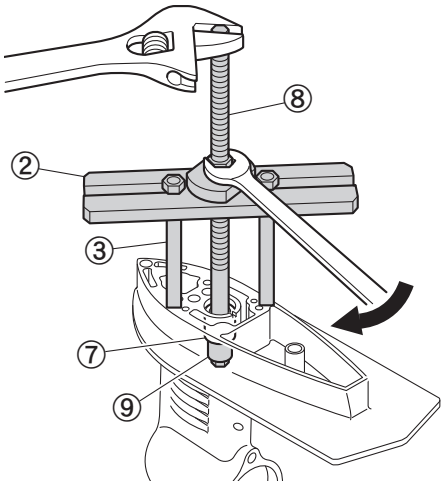
2. Remove the oil seals ⑤.



3. Remove the bushing ⑥.



4. Remove the bushing ⑦.



Stopper guide plate ②: 90890-06501 Stopper guide stand ③: 90890-06538 Bushing installer center bolt ⑧: 90890-06601 Bushing attachment ⑨: 90890-06650

Checking the pinion

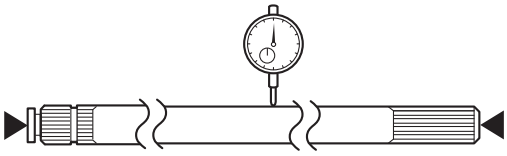
1. Check the teeth of the pinion. Replace if cracked or worn.

Checking the forward gear

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

Checking the drive shaft

1. Check the drive shaft. Replace if damaged or worn.
2. Measure the drive shaft runout.



Drive shaft runout: 0.4 mm (0.02 in)

Checking the lower case

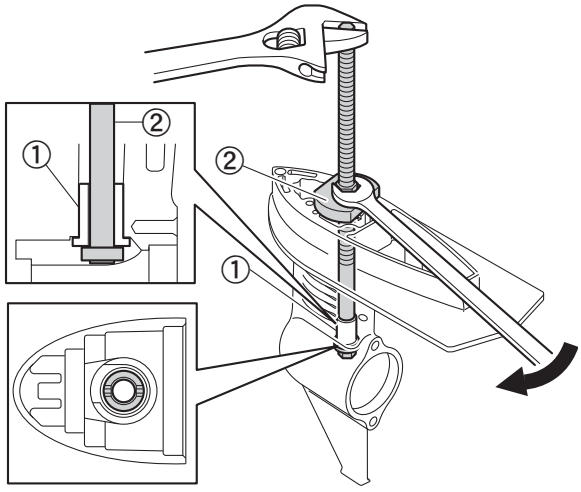
1. Check the lower case. Replace if cracked or damaged.

Assembling the lower case

NOTICE

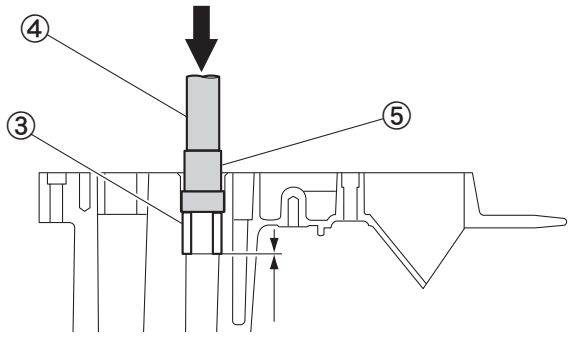
Do not reuse a bearing, bushing, or oil seal, always replace it with a new one.

1. Install a new bushing ①.



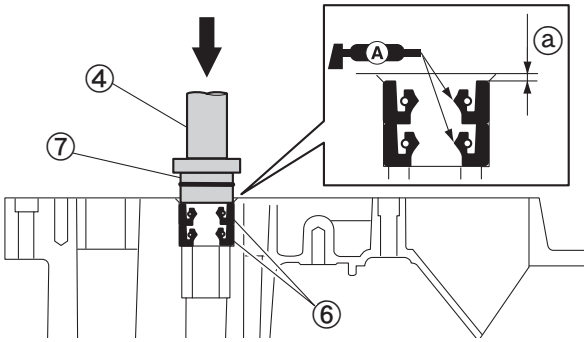
Bushing installer center bolt ②:
90890-06601

2. Install a new bushing ③.



Driver rod L3 ④: 90890-06652
Bushing attachment ⑤: 90890-06649

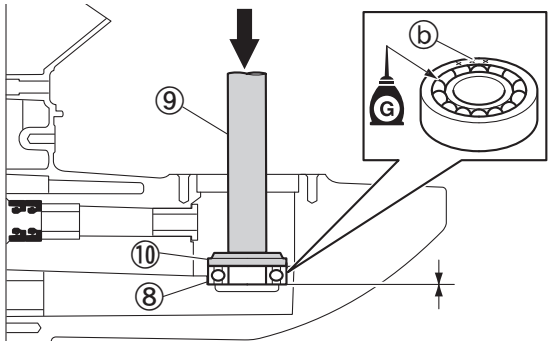
3. Install new oil seals ⑥ to the specified depth ⓐ.



Driver rod L3 ④: 90890-06652
Needle bearing attachment ⑦:
90890-06615

Depth ⓐ: 1.0 mm (0.04 in)

4. Install the ball bearing ⑧.

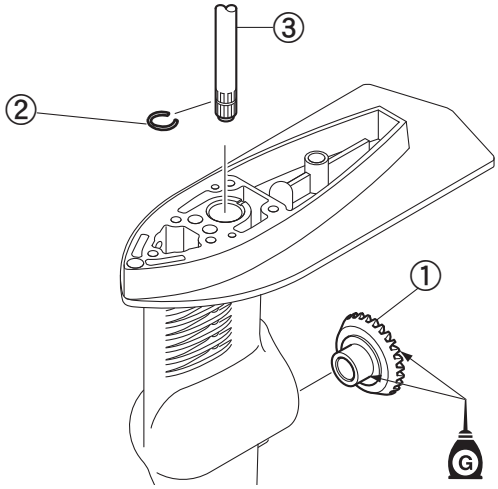


Driver rod LS ⑨: 90890-06606
Bearing outer race attachment ⑩:
90890-06628

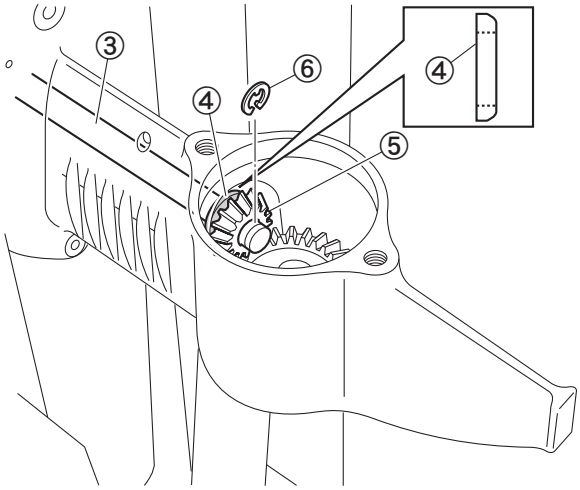
TIP:
Face the identification mark ⓑ on the ball bearing toward the forward gear.

Installing the drive shaft

1. Install the forward gear ①.
2. Install a new clip ② to the drive shaft ③.
   NOTICE: **Do not reuse a clip, always replace it with a new one.**

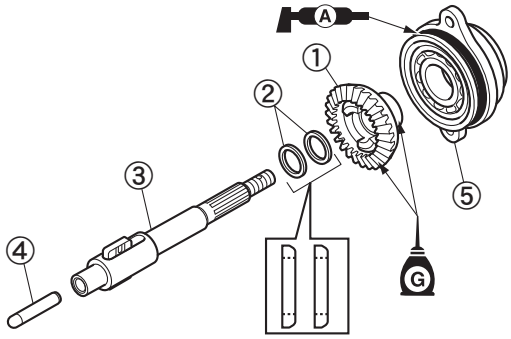


3. Install the washer ④, pinion ⑤, and drive shaft ③, and then install the E-clip ⑥.

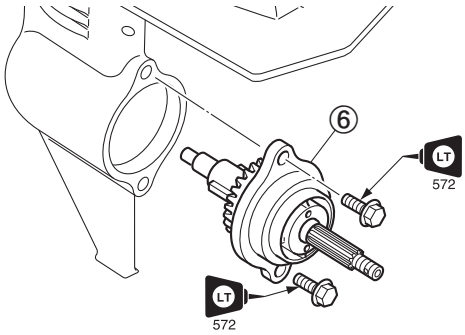


Installing the propeller shaft housing assembly (S-transom model)

1. Install the reverse gear ①, washers ②, drive shaft ③, and shift plunger ④ to the propeller shaft housing ⑤.

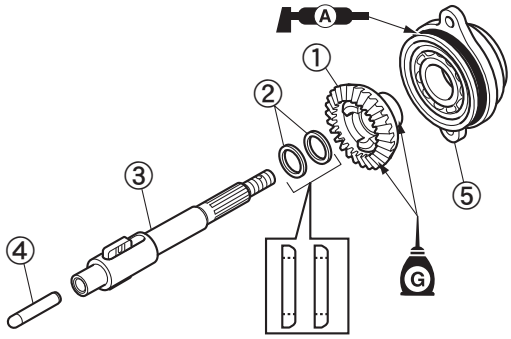


2. Install the propeller shaft housing assembly ⑥.

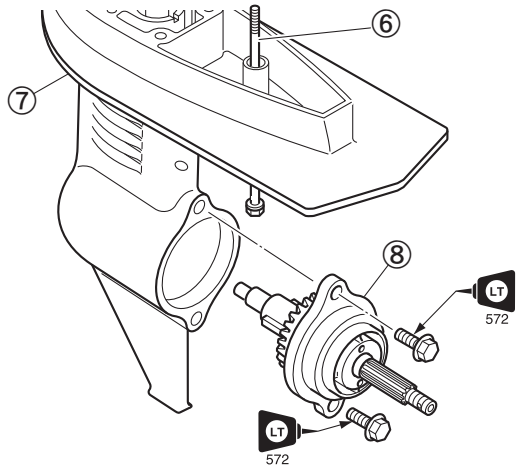


Installing the propeller shaft housing assembly (L-transom model)

1. Install the reverse gear ①, washers ②, drive shaft ③, and shift plunger ④ to the propeller shaft housing ⑤.



2. Install the lower case mounting bolt ⑥ into the hole in the rear of the lower case ⑦, and then install the propeller shaft housing assembly ⑧.

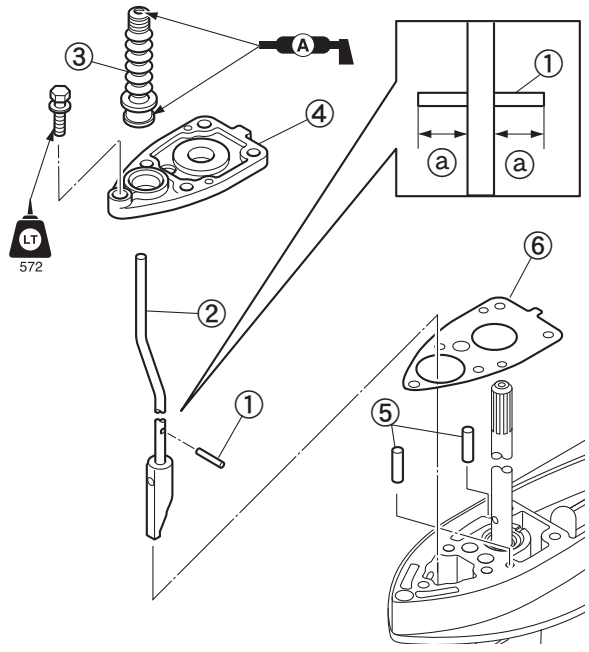


Installing the water pump and shift rod

NOTICE

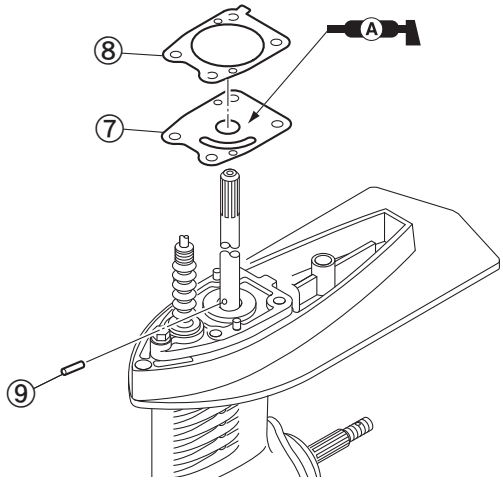
Do not reuse a gasket, always replace it with a new one.

1. Install the pin ① to the shift rod ②.
2. Install the rubber seal ③ to the housing ④, and then install the shift rod ②.
3. Install the dowels ⑤, a new gasket ⑥, and the housing ④.

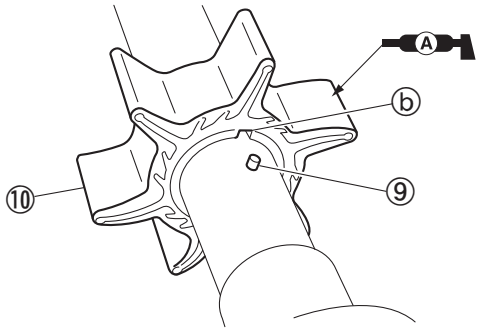


ⓐ: 1.0 mm (0.04 in)

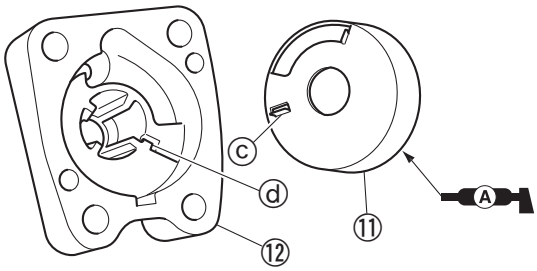
4. Install the outer plate cartridge ⑦, a new gasket ⑧, and then install the pin ⑨.



5. Align the slot ⓑ in the impeller ⑩ with the pin ⑨, and then install the impeller.



6. Align the protrusion ⓒ on the insert cartridge ⑪ with the groove ⓓ in the water pump housing ⑫, and then install the insert cartridge.

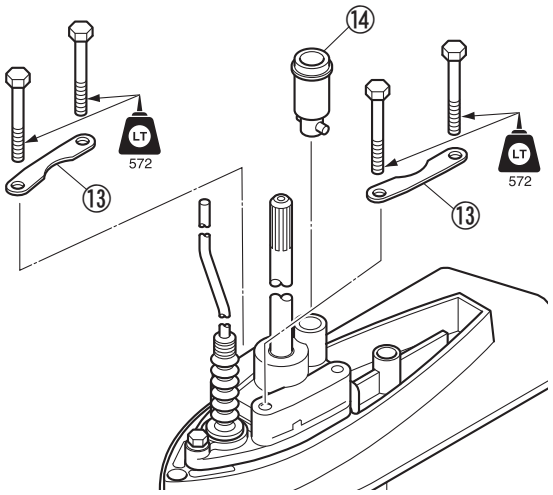


7. Install the water pump housing assembly.
   NOTICE: **Do not turn the drive shaft counterclockwise. Otherwise, the water pump impeller could be damaged.**

8

TIP:
While turning the drive shaft clockwise, push down on the water pump housing and install water pump housing.

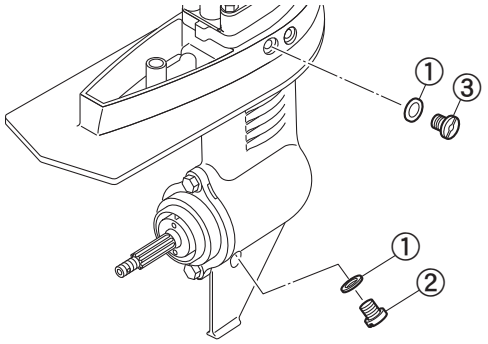
8. Install the plates ⑬ and rubber seal ⑭.



Checking the lower unit for air leakage

1. Install new gaskets ①, the drain screw ② and the flushing screw ③.

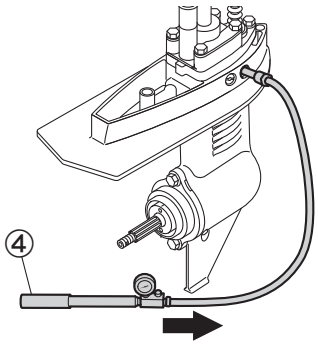
2. Tighten the drain screw ② and flushing screw ③ to the specified torque.



Drain screw ②: 9 N·m (0.9 kgf·m, 6.6 ft·lb) Flushing screw ③: 9 N·m (0.9 kgf·m, 6.6 ft·lb)

3. Install the special service tool ④.

4. Apply the specified pressure to check that the pressure is maintained in the lower unit for at least 10 seconds. ***NOTICE:*** **Do not over pressurize the lower unit. Otherwise, the oil seals could be damaged.**



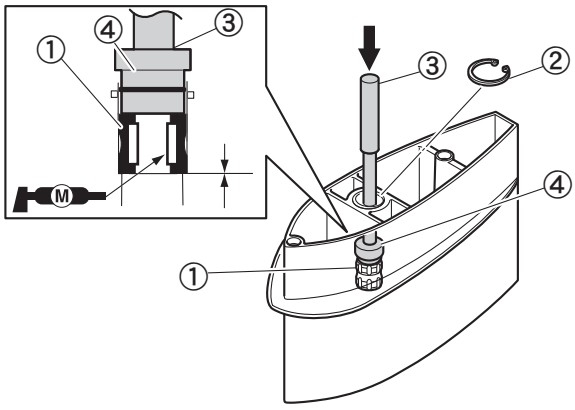
Leakage tester ④: 90890-06840

Holding pressure: 98.0 kPa (0.98 kgf/cm², 14.2 psi)

5. If the specified pressure cannot be maintained, check the drive shaft, propeller shaft, and rubber seal for bends or damage, and check the shift rod rubber seal for damage or wear.

Assembling the extension (L-transom model)

1. Install the bushing ① and circlip ②.



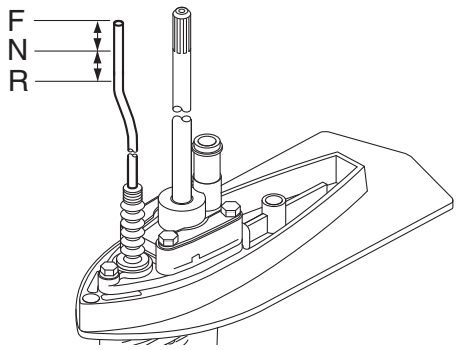
Driver rod L3 ③: 90890-06652 Needle bearing attachment ④: 90890-06615

Installing the lower unit (S-transom model)

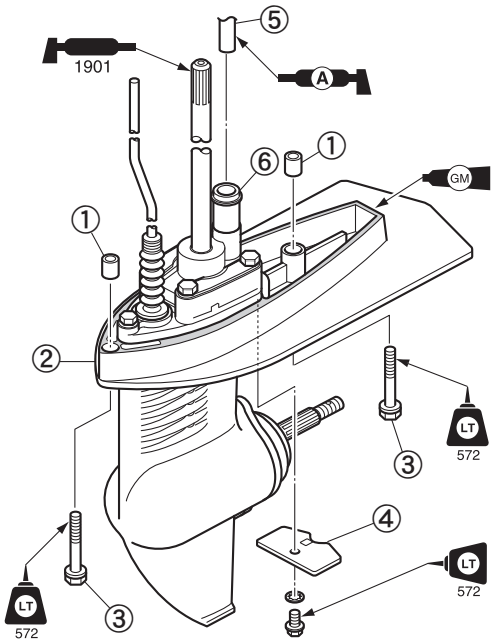
⚠ WARNING

- **Make sure to remove the clip from the engine shut-off switch.**
- **Do not hold the propeller with your hands when loosening or tightening the propeller nut.**
- **When installing the lower unit with the power unit installed, make sure to suspend the outboard motor. If the outboard motor is not suspended, it can fall suddenly and result in severe injuries.**

1. Move the shift lever to the R position.
2. Set the gear shift to the R position.



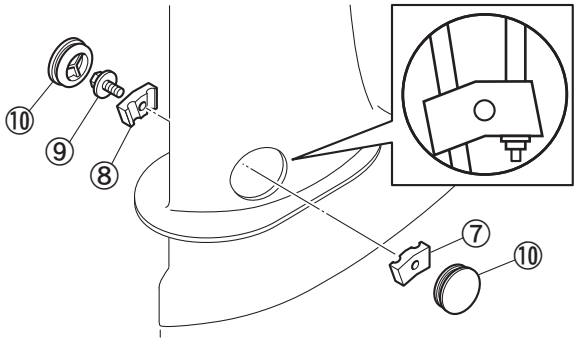
3. Install the dowels ①.
4. Install the lower unit ② to the upper case, and then tighten the lower case mounting bolts ③ to the specified torque.
5. Install the anode ④.



Lower case mounting bolt ③:
11 N·m (1.1 kgf·m, 8.1 ft·lb)

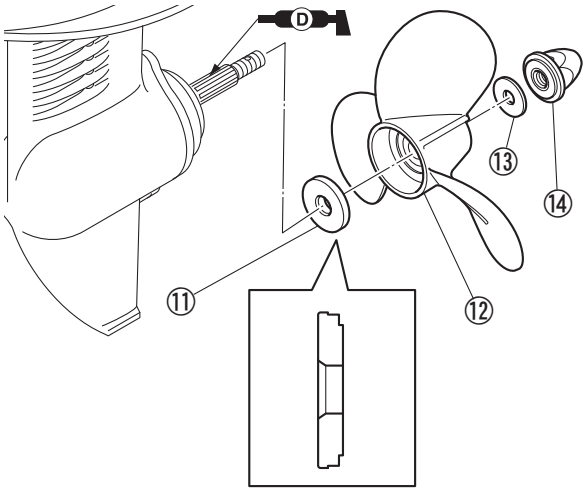
TIP:
Make sure that the cooling water pipe ⑤ is inserted securely into the rubber seal ⑥.

6. Install the joints ⑦ and ⑧, and then tighten the shift joint bolt ⑨ to the specified torque.
7. Install the covers ⑩.



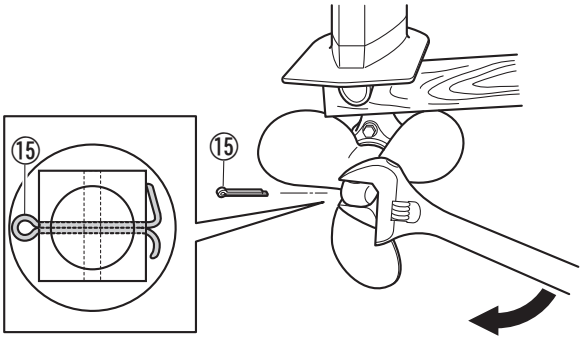
Shift joint bolt ⑨:
16 N·m (1.6 kgf·m, 11.8 ft·lb)

8. Move the shift lever to the N position.
9. Install the spacer ⑪, propeller ⑫, washer ⑬, and propeller nut ⑭.



10. Place a block of wood between the anti-cavitation plate and the propeller to keep the propeller from turning, and then tighten the propeller nut.

11. Install a new cotter pin ⑮. ***NOTICE:*** **Do not reuse a cotter pin, always replace it with a new one.**



12. Fill the lower unit with gear oil up to the proper level. See steps 5–8 in "Changing the gear oil" (10-9).

Installing the lower unit (L-transom model)

⚠ WARNING

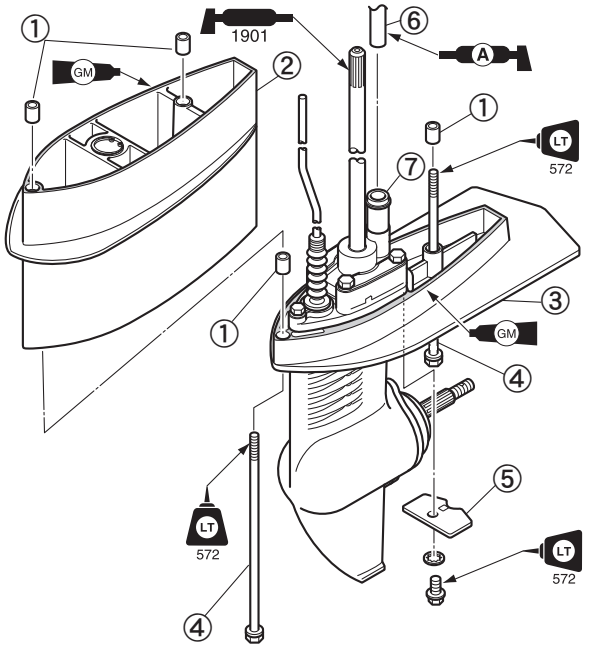
- **Make sure to remove the clip from the engine shut-off switch.**
- **Do not hold the propeller with your hands when loosening or tightening the propeller nut.**
- **When installing the lower unit with the power unit installed, make sure to suspend the outboard motor. If the outboard motor is not suspended, it can fall suddenly and result in severe injuries.**

See steps 1 and 2 in "Installing the lower unit (S-transom model)" (8-16).

1. Install the dowels ① and extension ②.

2. Install the lower unit ③ to the upper case, and then tighten the lower case mounting bolts ④ to the specified torque.

3. Install the anode ⑤.



Lower case mounting bolt ④:
15 N·m (1.5 kgf·m, 11.1 ft·lb)

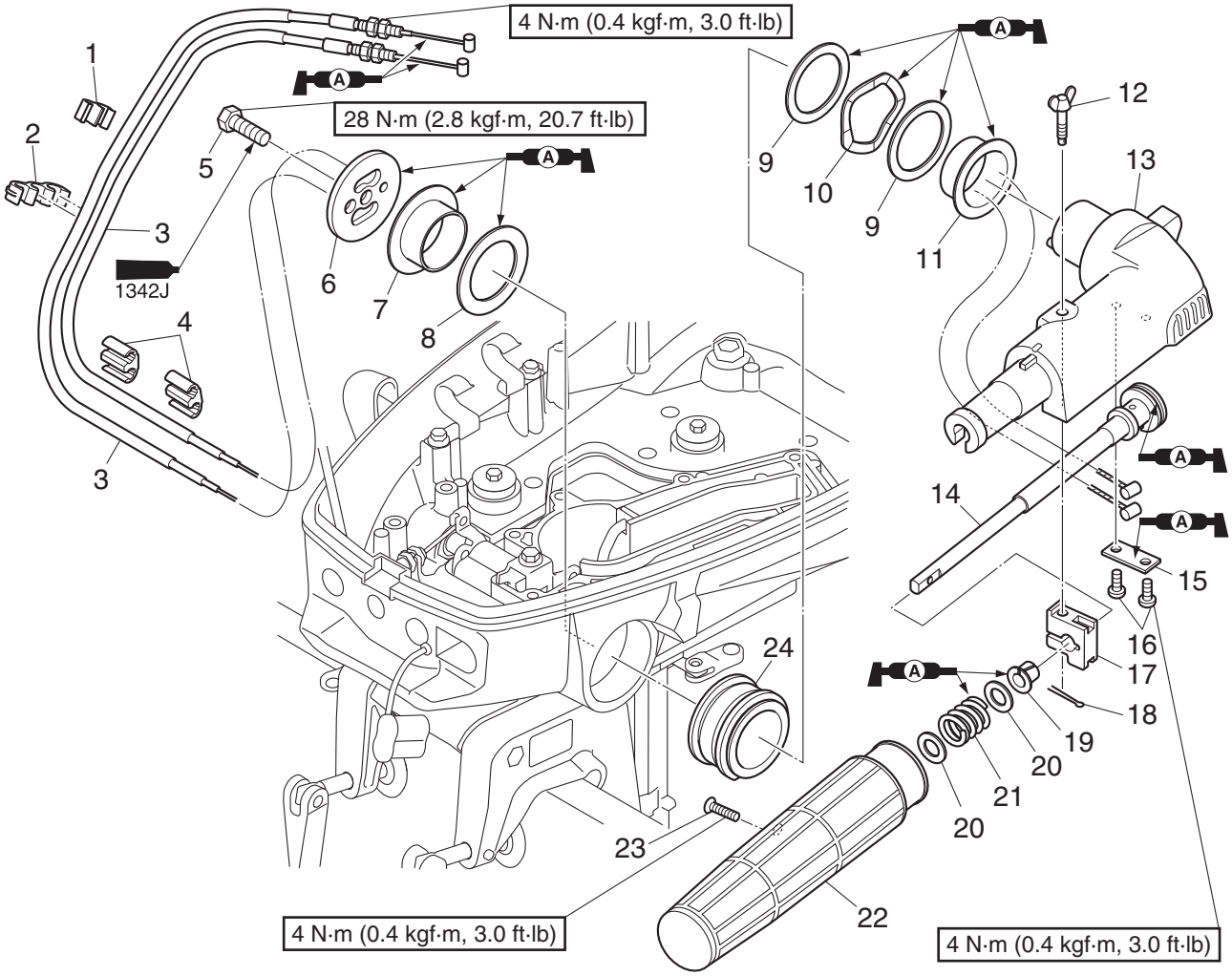
TIP:
Make sure that the cooling water pipe ⑥ is inserted securely into the rubber seal ⑦.

See steps 6–12 in “Installing the lower unit (S-transom model)” (8-16).

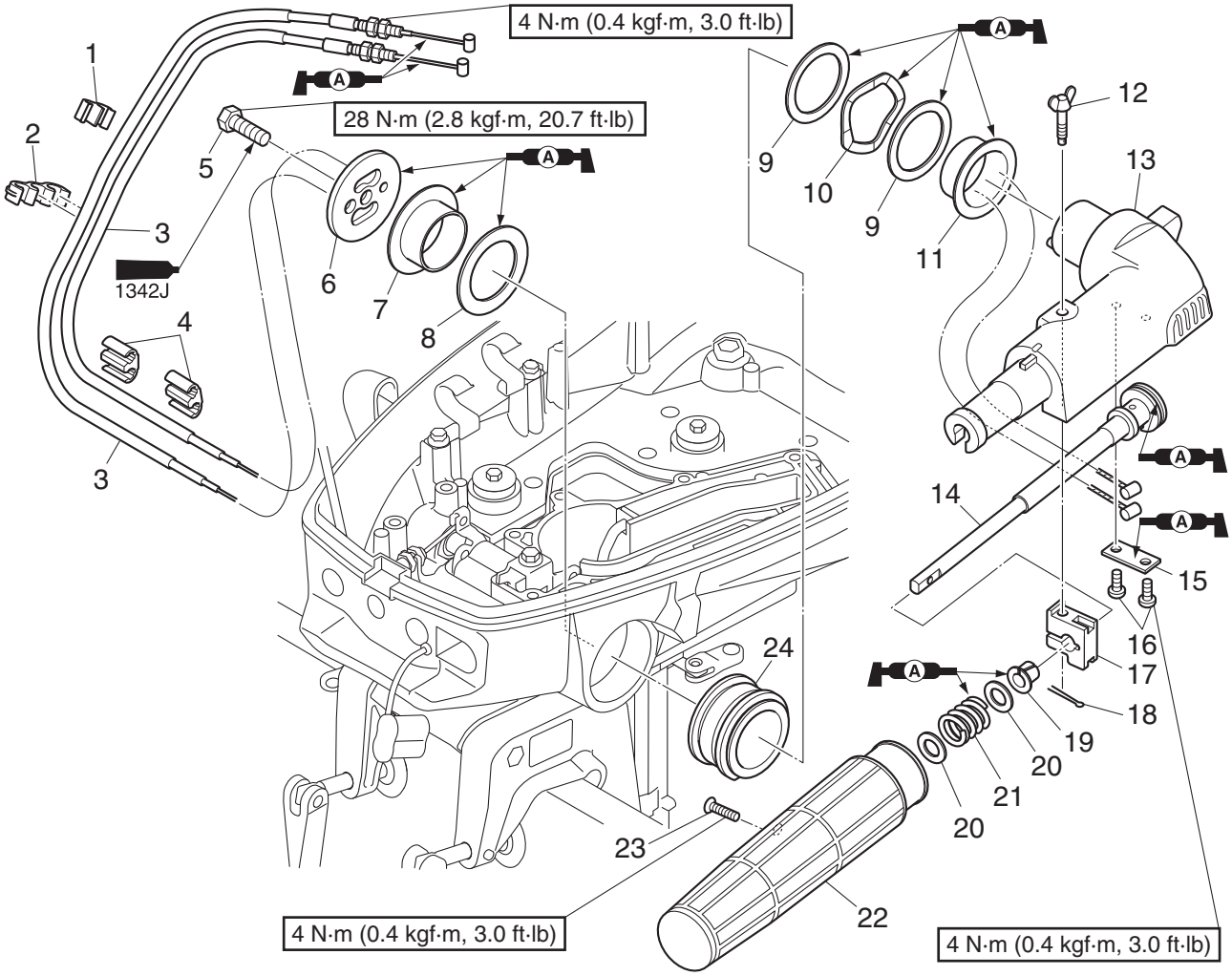
— MEMO —

Bracket unit

Tiller handle



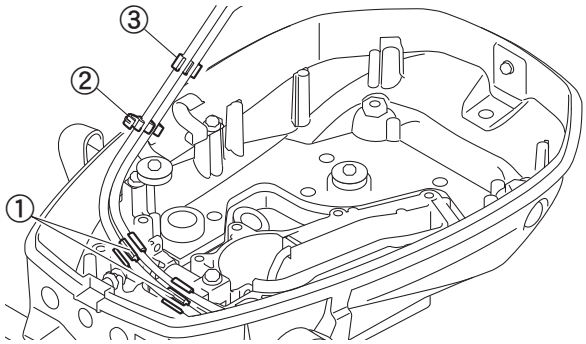
No.	Part name	Q'ty	Remarks
1	Holder	1	
2	Holder	1	
3	Throttle cable	2	
4	Holder	2	
5	Tiller handle mounting bolt	1	M8 × 25 mm
6	Plate	1	
7	Bushing	1	
8	Washer	1	
9	Washer	2	
10	Wave washer	1	
11	Bushing	1	
12	Throttle friction adjuster	1	
13	Tiller handle	1	
14	Throttle rod	1	
15	Plate	1	
16	Throttle rod screw	2	M5 × 12 mm
17	Friction piece	1	



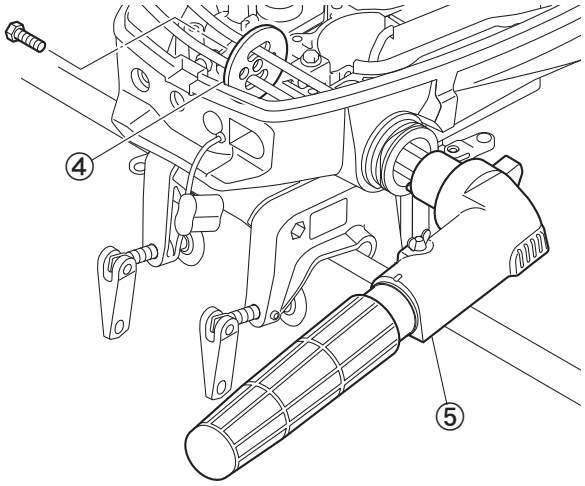
No.	Part name	Q'ty	Remarks
18	Cotter pin	1	**Not reusable**
19	Bushing	1	
20	Washer	2	
21	Spring	1	
22	Throttle grip	1	
23	Throttle grip screw	1	M5 × 20 mm
24	Bushing	1	

Disassembling the tiller handle

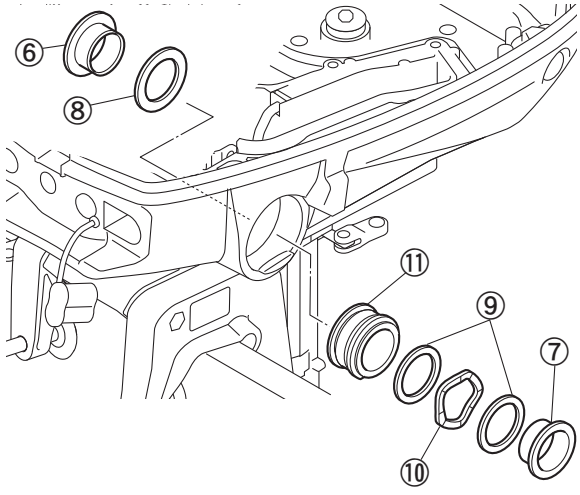
1. Remove the holders ①, ②, and ③.



2. Remove the plate ④ and tiller handle assembly ⑤.

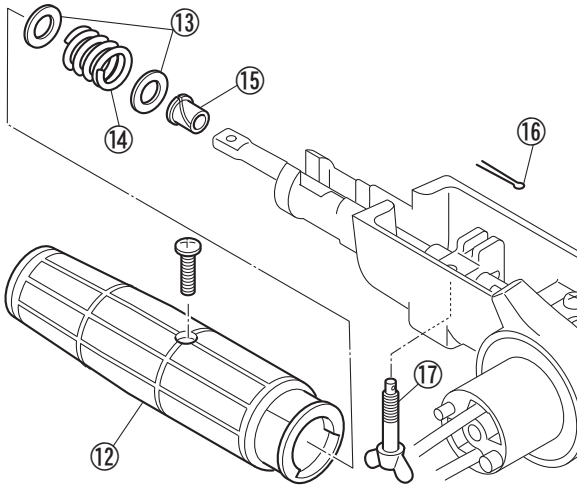


3. Remove the bushings ⑥, ⑦, washers ⑧, ⑨, and wave washer ⑩, and then remove the bushing ⑪.

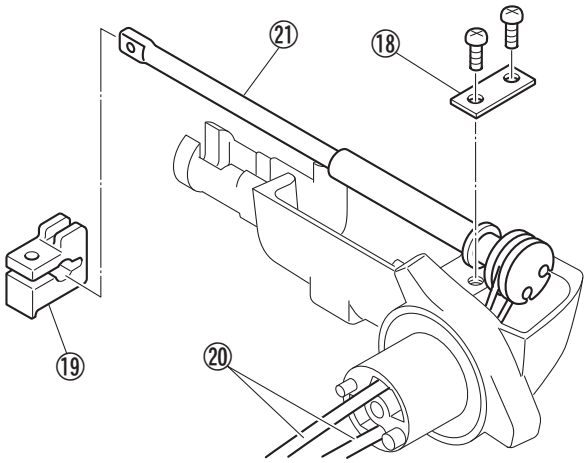


4. Remove the throttle grip ⑫, washers ⑬, spring ⑭, and bushing ⑮.

5. Remove the cotter pin ⑯ and throttle friction adjuster ⑰.

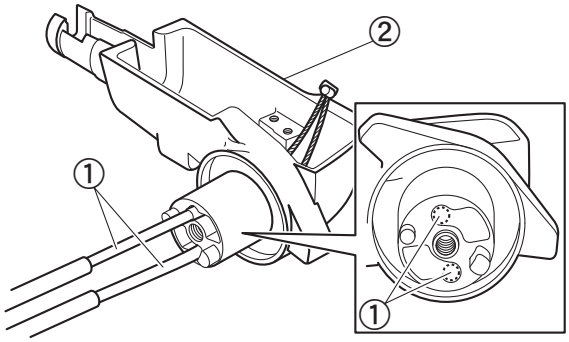


6. Remove the plate ⑱, friction piece ⑲, throttle cables ⑳, and throttle rod ㉑.

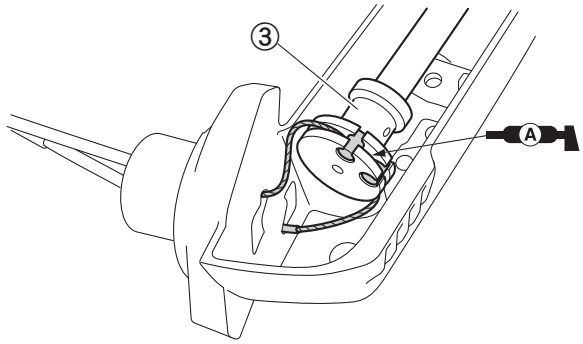


Assembling the tiller handle

1. Pass the throttle cables ① through the holes in the tiller handle ②.

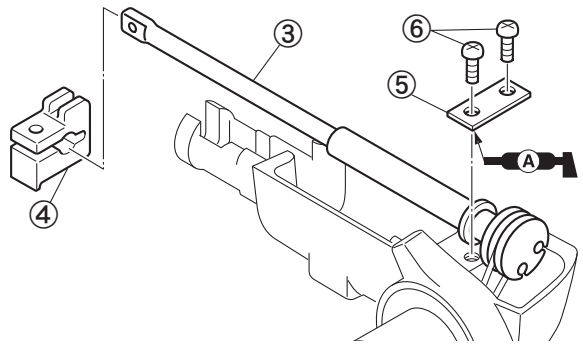


2. Install the cable into the throttle rod ③.



3. Install the friction piece ④ onto the throttle rod ③, and then install the plate ⑤.

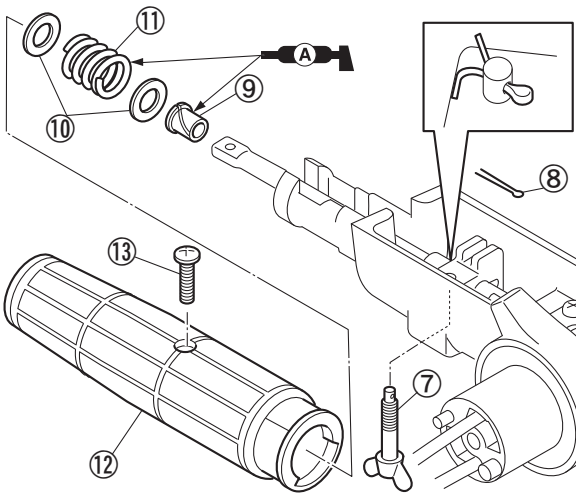
4. Tighten the throttle rod screws ⑥ to the specified torque.



Throttle rod screw ⑥:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

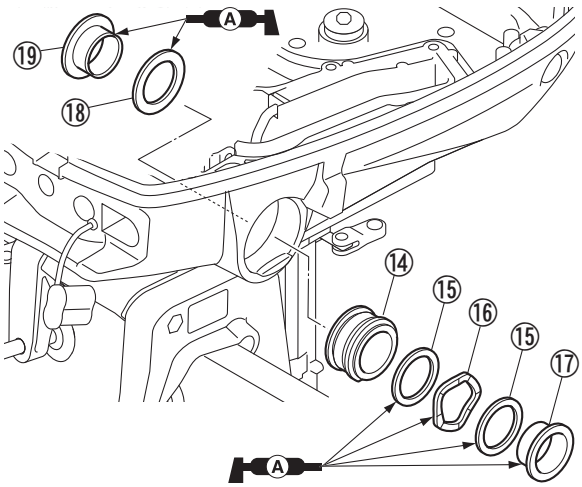
5. Install the throttle friction adjuster ⑦, and then install a new cotter pin ⑧. ***NOTICE:*** **Do not reuse a cotter pin, always replace it with a new one.**

6. Install the bushing ⑨, washers ⑩, spring ⑪, throttle grip ⑫, and then tighten the throttle grip screw ⑬ to the specified torque.

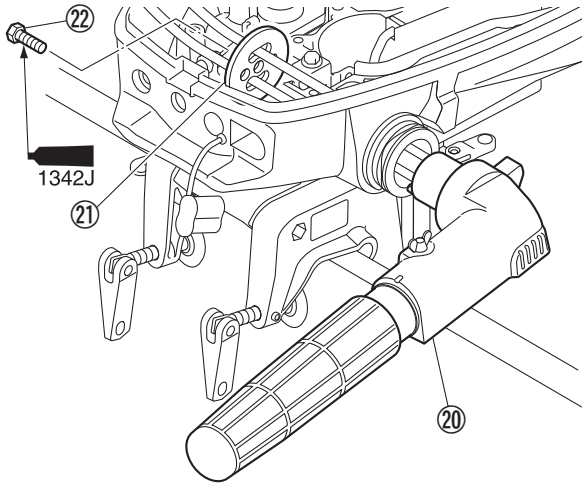


Throttle grip screw ⑬:
4 N·m (0.4 kgf·m, 3.0 ft·lb)

7. Install the bushing ⑭, and then install the washers ⑮, wave washer ⑯, bushing ⑰, washer ⑱, and bushing ⑲.

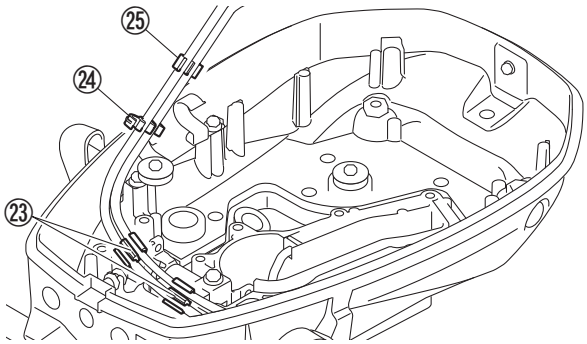


8. Install the tiller handle assembly ⑳ and plate ㉑, and then tighten the tiller handle mounting bolt ㉒ to the specified torque.

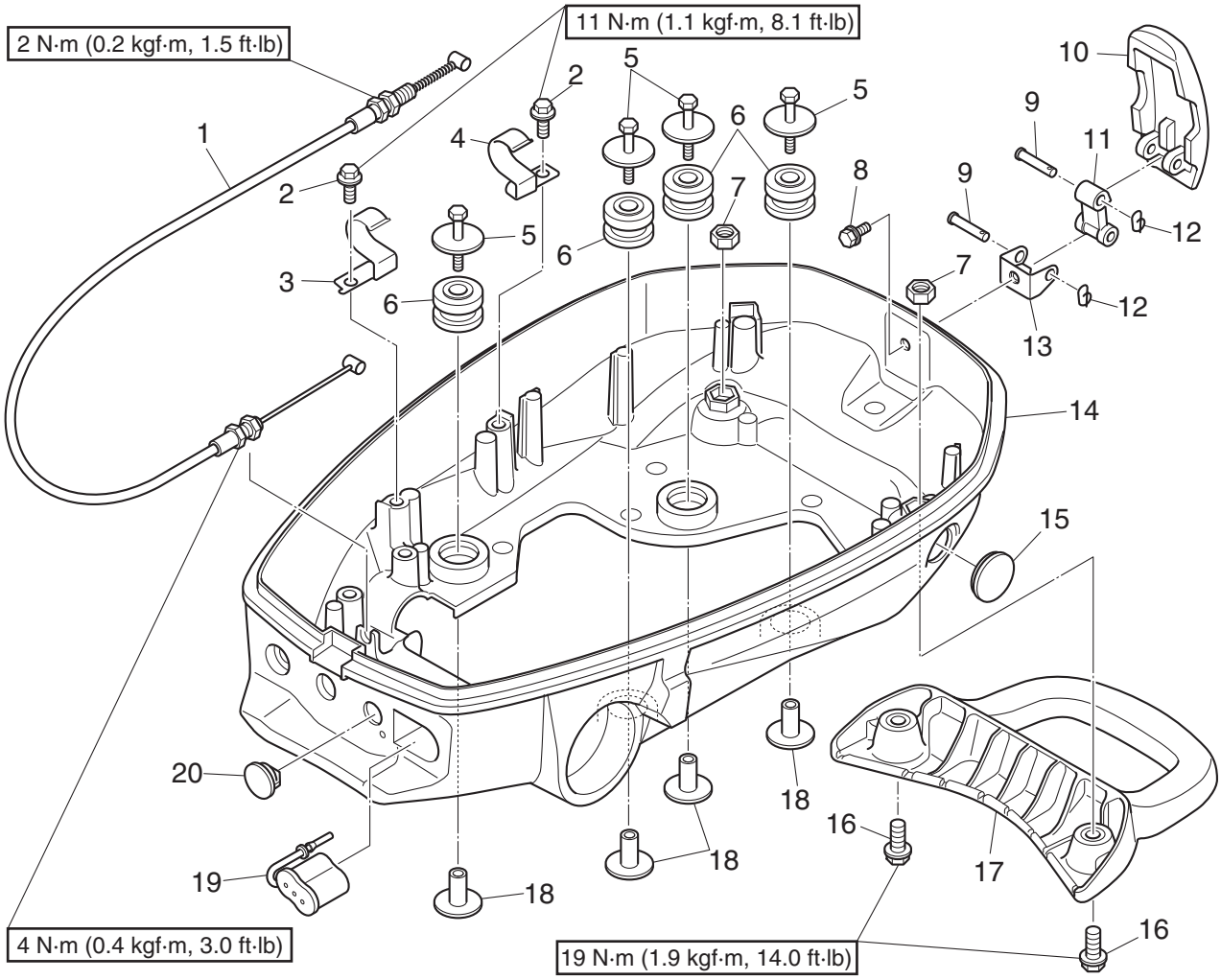


Tiller handle mounting bolt ㉒: 28 N·m (2.8 kgf·m, 20.7 ft·lb)

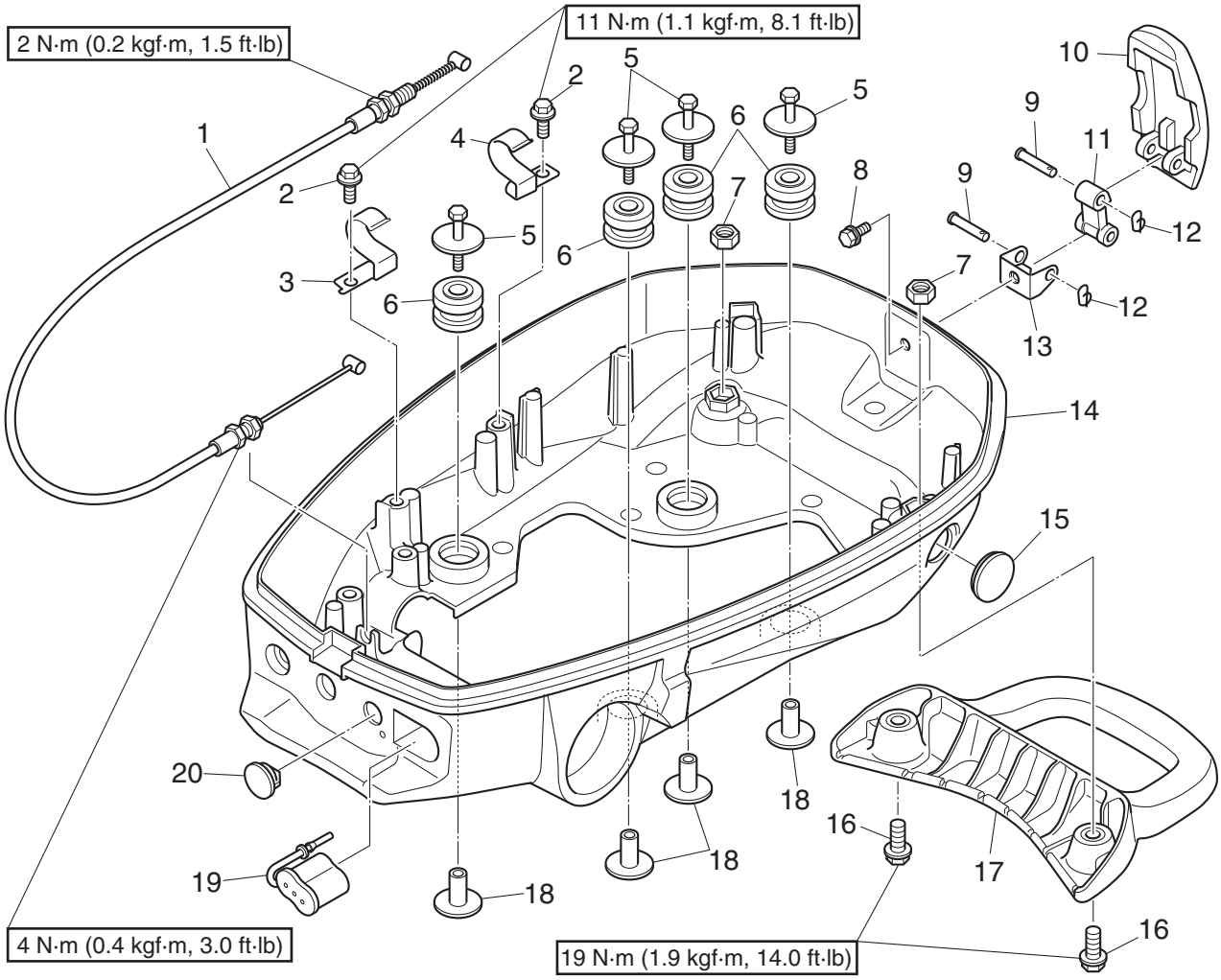
9. Install the holders ㉓, ㉔, and ㉕.



Bottom cowling



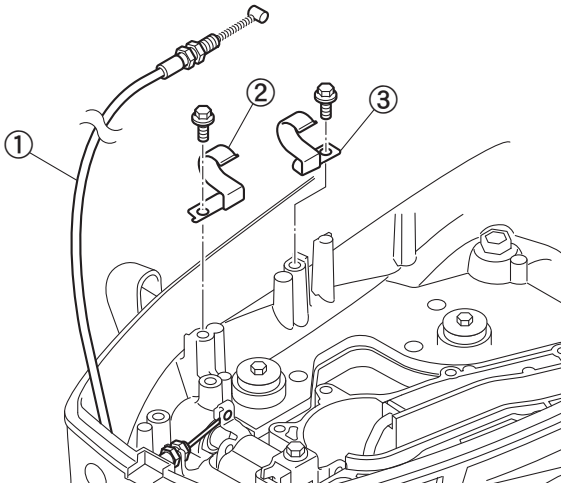
No.	Part name	Q'ty	Remarks
1	Start-in-gear protection cable	1	
2	Primer pump holder bolt	2	M6 × 16 mm
3	Holder	1	
4	Holder	1	
5	Bolt	4	M6 × 35 mm
6	Grommet	4	
7	Nut	2	
8	Bolt	1	M6 × 20 mm
9	Pin	2	
10	Cowling lock lever	1	
11	Bracket	1	
12	Clip	2	
13	Bracket	1	
14	Bottom cowling	1	
15	Grommet	1	
16	Carrying handle bolt	2	M8 × 20 mm
17	Carrying handle	1	



No.	Part name	Q'ty	Remarks
18	Collar	4	
19	Cap	1	
20	Grommet	1	

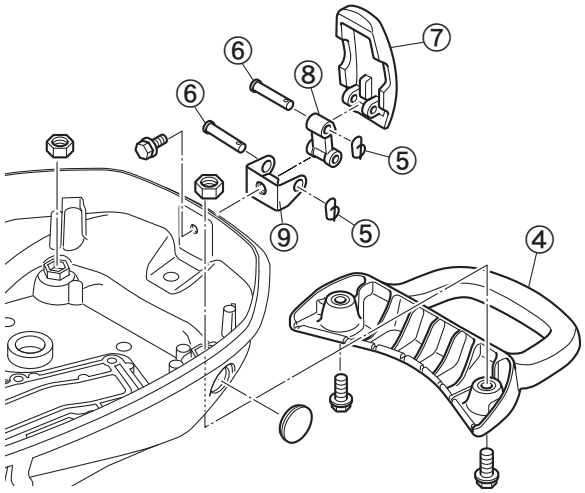
Disassembling the bottom cowling

1. Remove the start-in-gear protection cable ① and holders ② and ③.



2. Remove the carrying handle ④.

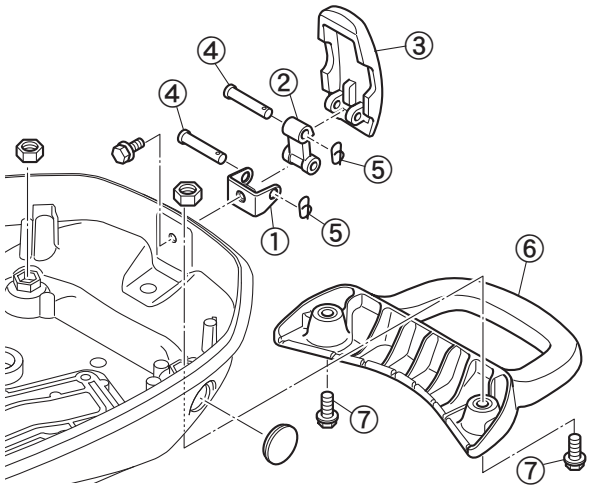
3. Remove the clips ⑤, pins ⑥, cowling lock lever ⑦, and brackets ⑧ and ⑨.



Assembling the bottom cowling

1. Install the brackets ①, ②, cowling lock lever ③, pins ④, and clips ⑤.

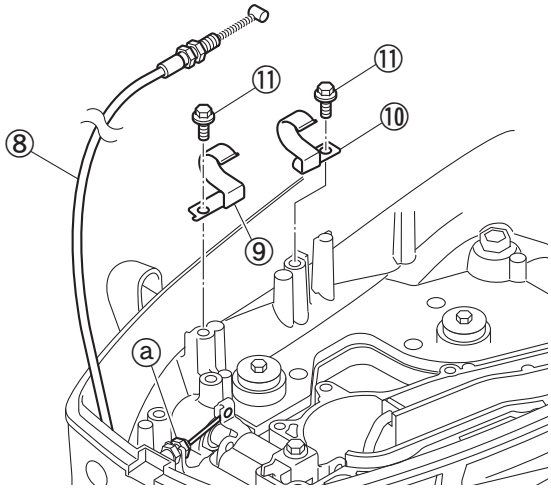
2. Install the carrying handle ⑥, and then tighten the carrying handle bolts ⑦ to the specified torque.



Carrying handle bolt ⑦:
19 N·m (1.9 kgf·m, 14.0 ft·lb)

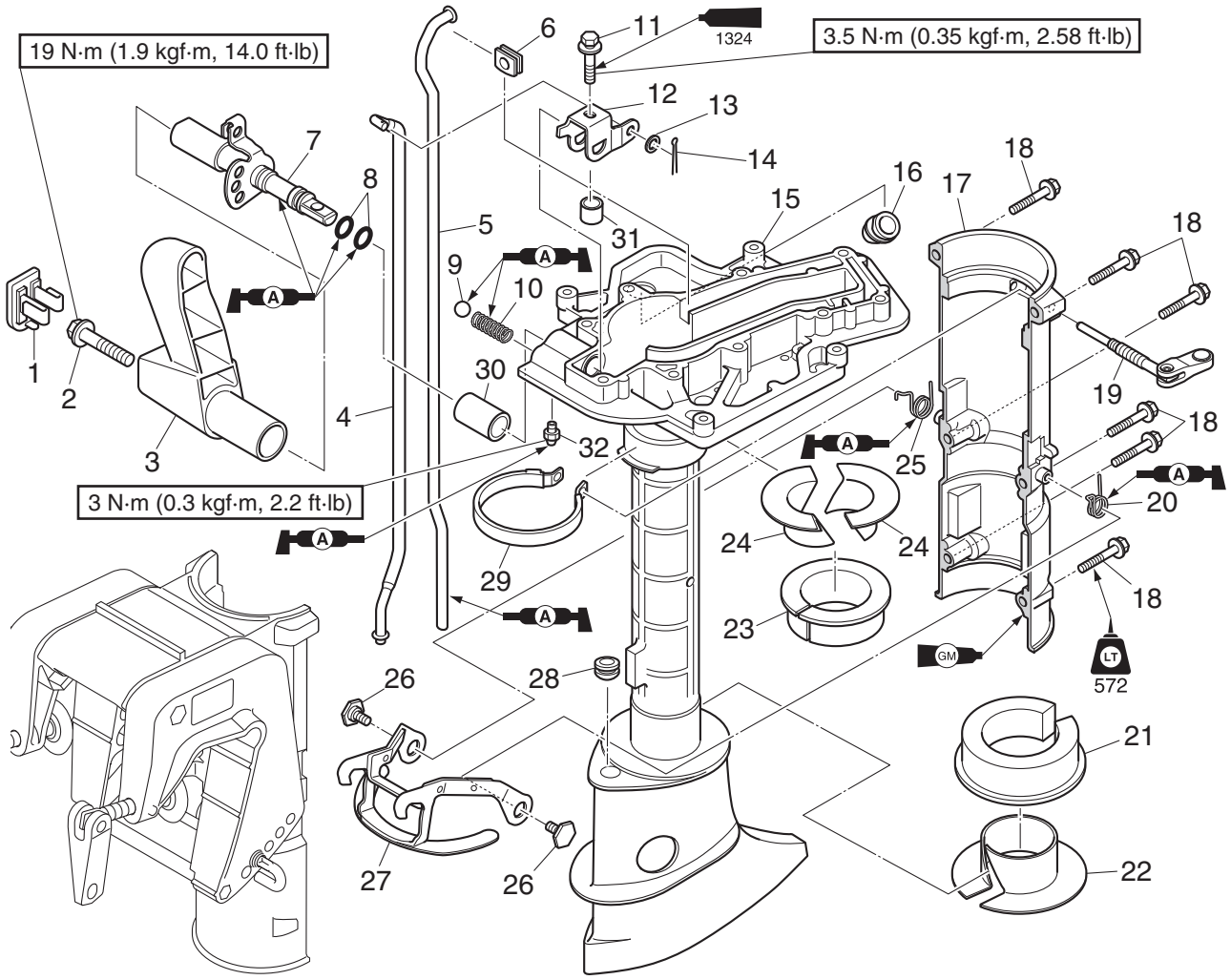
3. Install the start-in-gear protection cable ⑧ and holders ⑨ and ⑩.

4. Tighten the start-in-gear protection cable locknut ⓐ and primer pump holder bolts ⑪ to the specified torque.

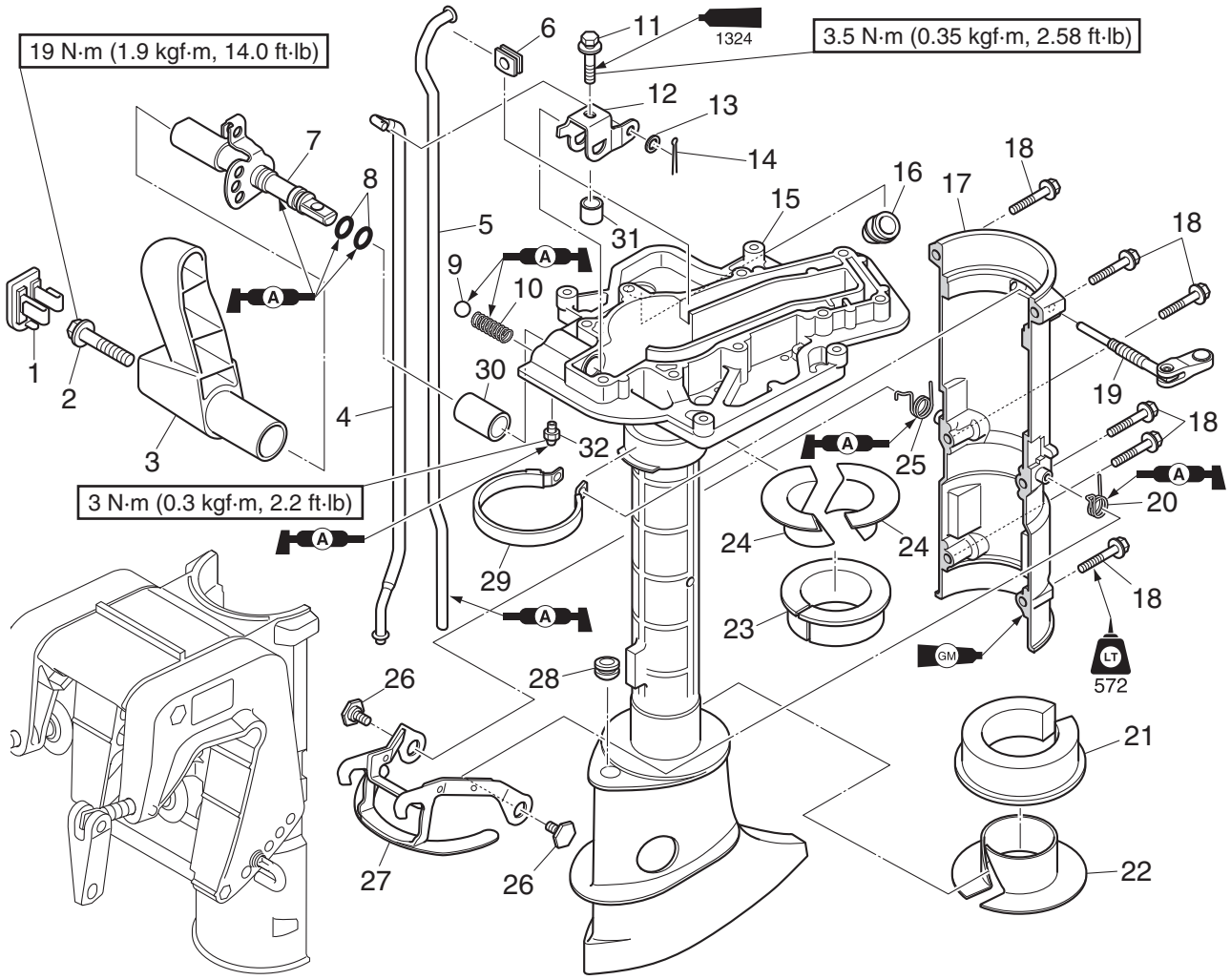


Start-in-gear protection cable locknut ⓐ:
4 N·m (0.4 kgf·m, 3.0 ft·lb)
Primer pump holder bolt ⑪:
11 N·m (1.1 kgf·m, 8.1 ft·lb)

Upper case and shift lever



No.	Part name	Q'ty	Remarks
1	Cap	1	
2	Shift lever bolt	1	M8 × 40 mm
3	Shift lever	1	
4	Shift rod	1	
5	Pipe	1	
6	Rubber seal	1	
7	Shift link lever	1	
8	O-ring	2	**Not reusable**
9	Ball	1	
10	Spring	1	
11	Shift link bolt	1	M5 × 25 mm
12	Bracket	1	
13	Washer	1	
14	Cotter pin	1	**Not reusable**
15	Upper case	1	
16	Damper	1	
17	Cover	1	

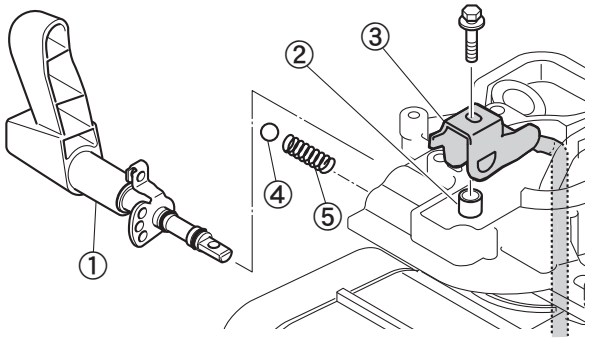


No.	Part name	Q'ty	Remarks
18	Bolt	6	M6 × 35 mm
19	Steering friction adjuster	1	
20	Spring	1	
21	Bushing	1	
22	Bushing	1	
23	Bushing	1	
24	Bushing	2	
25	Spring	1	
26	Bolt	2	
27	Reverse lock	1	
28	Grommet	1	
29	Friction piece	1	
30	Bushing	1	**Not reusable**
31	Collar	1	
32	Grease nipple	1	

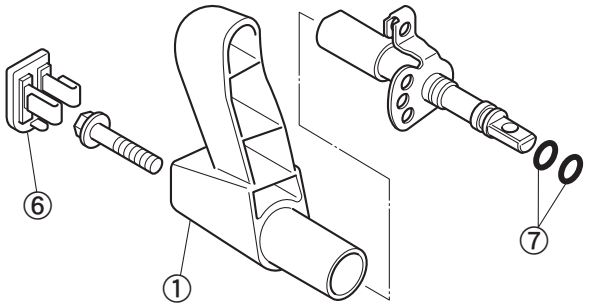
Removing the shift lever

1. Remove the shift lever ①, collar ②, and bracket ③.

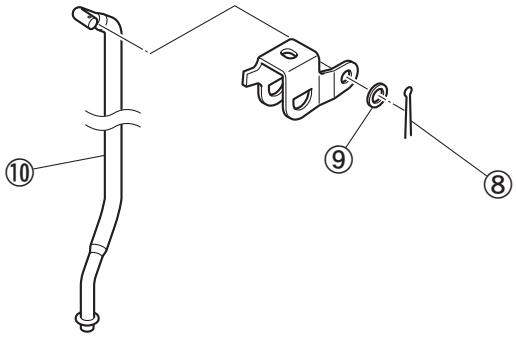
2. Remove the ball ④ and spring ⑤.



3. Remove the cap ⑥, shift lever ①, and O-rings ⑦.

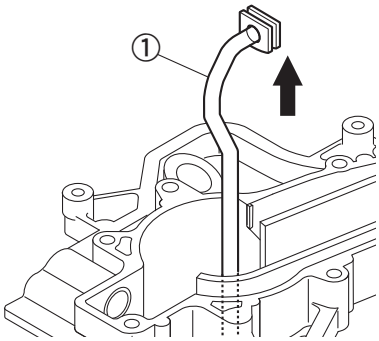


4. Remove the cotter pin ⑧, washer ⑨, and shift rod ⑩.

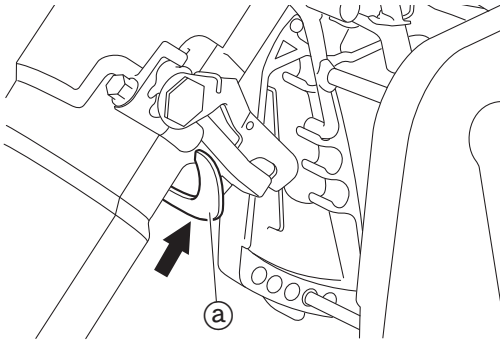


Removing the upper case

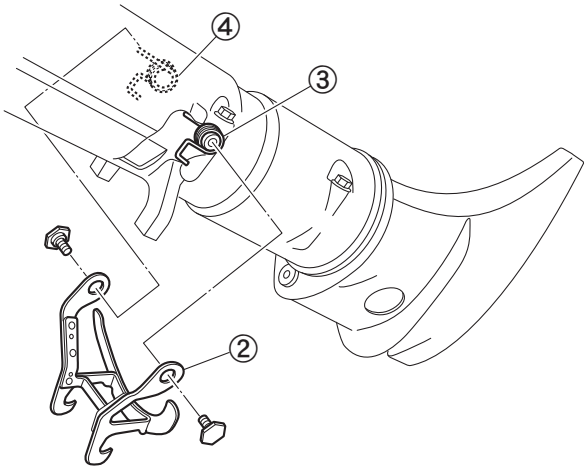
1. Remove the water pipe ①.



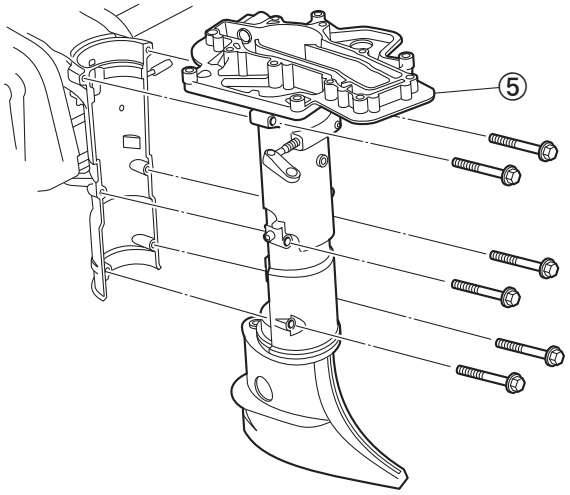
2. Move the plate ⓐ up, and then tilt the outboard motor up.



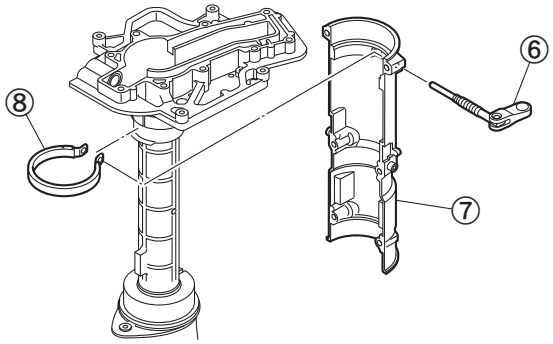
3. Remove the reverse lock ② and springs ③ and ④.



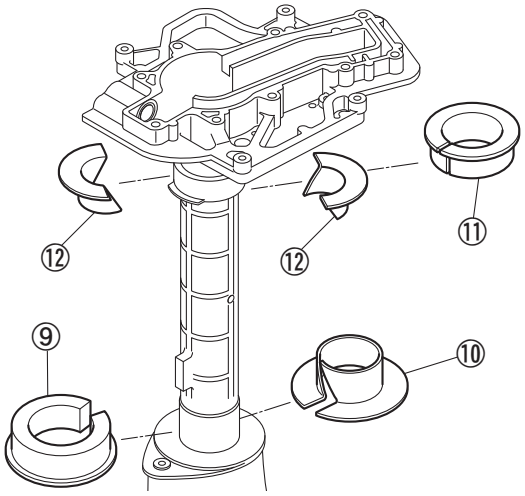
4. Remove the upper case ⑤.



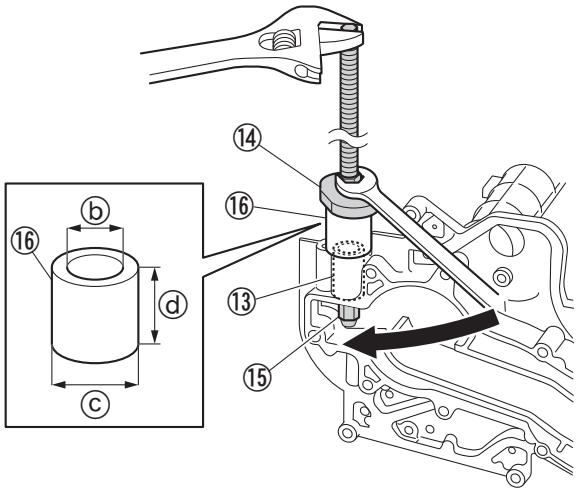
5. Remove the steering friction adjuster ⑥, and then remove the cover ⑦ and friction piece ⑧.



6. Remove the bushings ⑨, ⑩, ⑪, and ⑫.



7. Remove the bushing ⑬.



Bushing installer center bolt ⑭: 90890-06601 Bushing attachment ⑮: 90890-06650

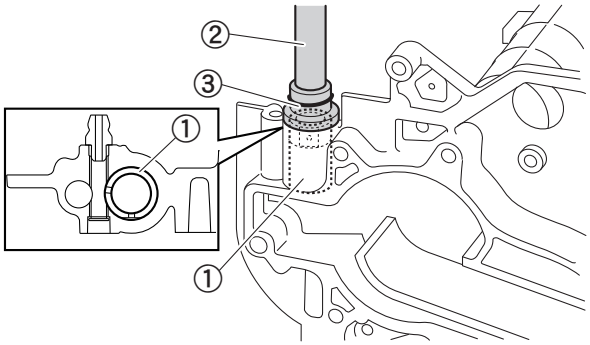
Pipe ⑯ (reference): ⓑ: 12.0 mm (0.5 in) ⓒ: 16.0 mm (0.7 in) ⓓ: 37.0 mm (1.5 in)

Checking the upper case

1. Check the upper case. Replace if cracked or eroded.

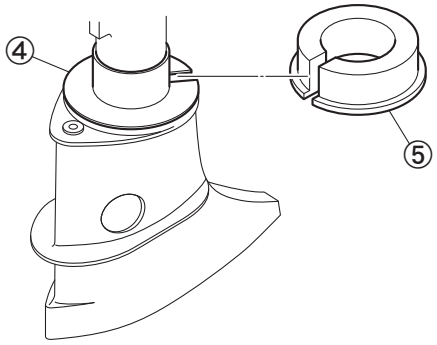
Installing the upper case

1. Install a new bushing ①. ***NOTICE:*** **Do not reuse a bushing, always replace it with a new one.**

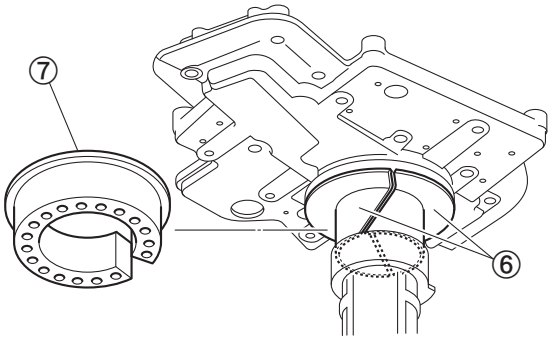


Driver rod L3 ②: 90890-06652 Needle bearing attachment ③: 90890-06615

2. Install the bushings ④ and ⑤.

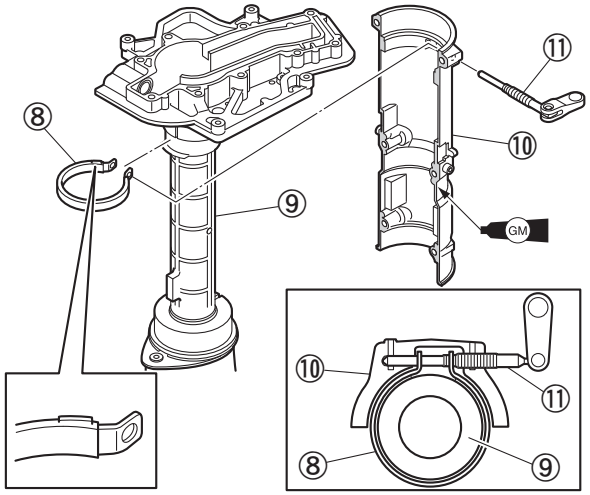


3. Install the bushings ⑥ and ⑦.

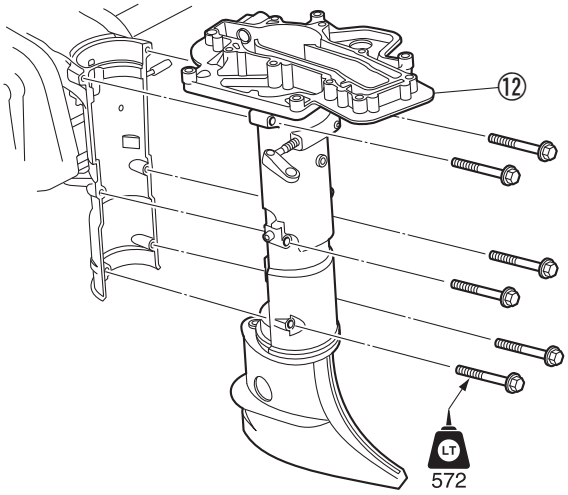


4. Install the friction piece ⑧ to the upper case ⑨.

5. Install the cover ⑩, and then install the steering friction adjuster ⑪.

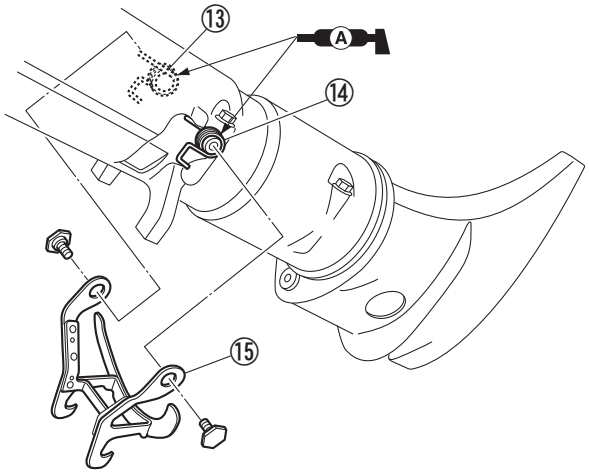


6. Install the upper case ⑫.

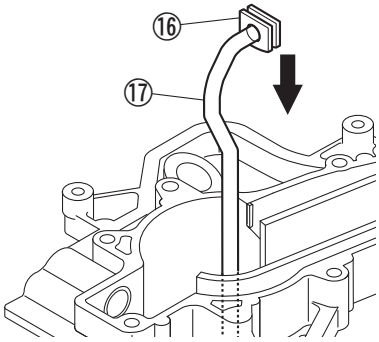


7. Tilt the outboard motor up.

8. Install the springs ⑬, ⑭ and reverse lock ⑮.



9. Install the rubber seal ⑯ to the water pipe ⑰, and then install the water pipe ⑰.

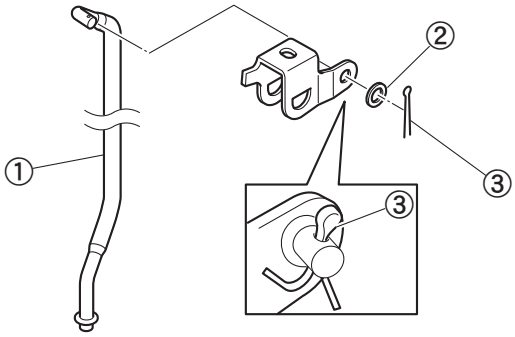


Installing the shift lever

NOTICE

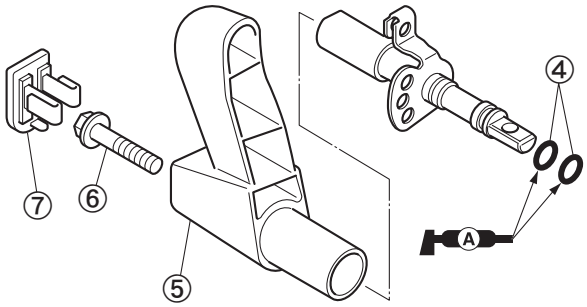
Do not reuse a cotter pin or O-ring, always replace it with a new one.

1. Install the shift rod ①, the washer ②, and a new cotter pin ③.



2. Install new O-rings ④ and the shift lever ⑤.

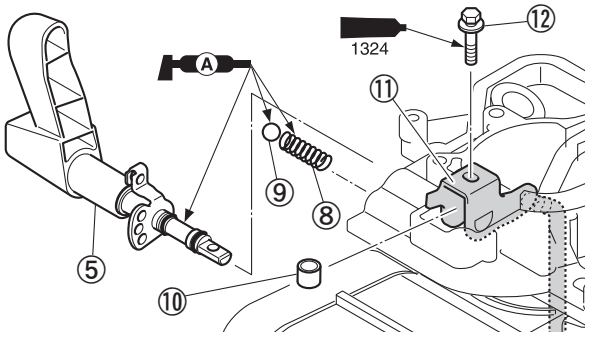
3. Tighten the shift lever bolt ⑥ to the specified torque, and then install the cap ⑦.



Shift lever bolt ⑥:
19 N·m (1.9 kgf·m, 14.0 ft·lb)

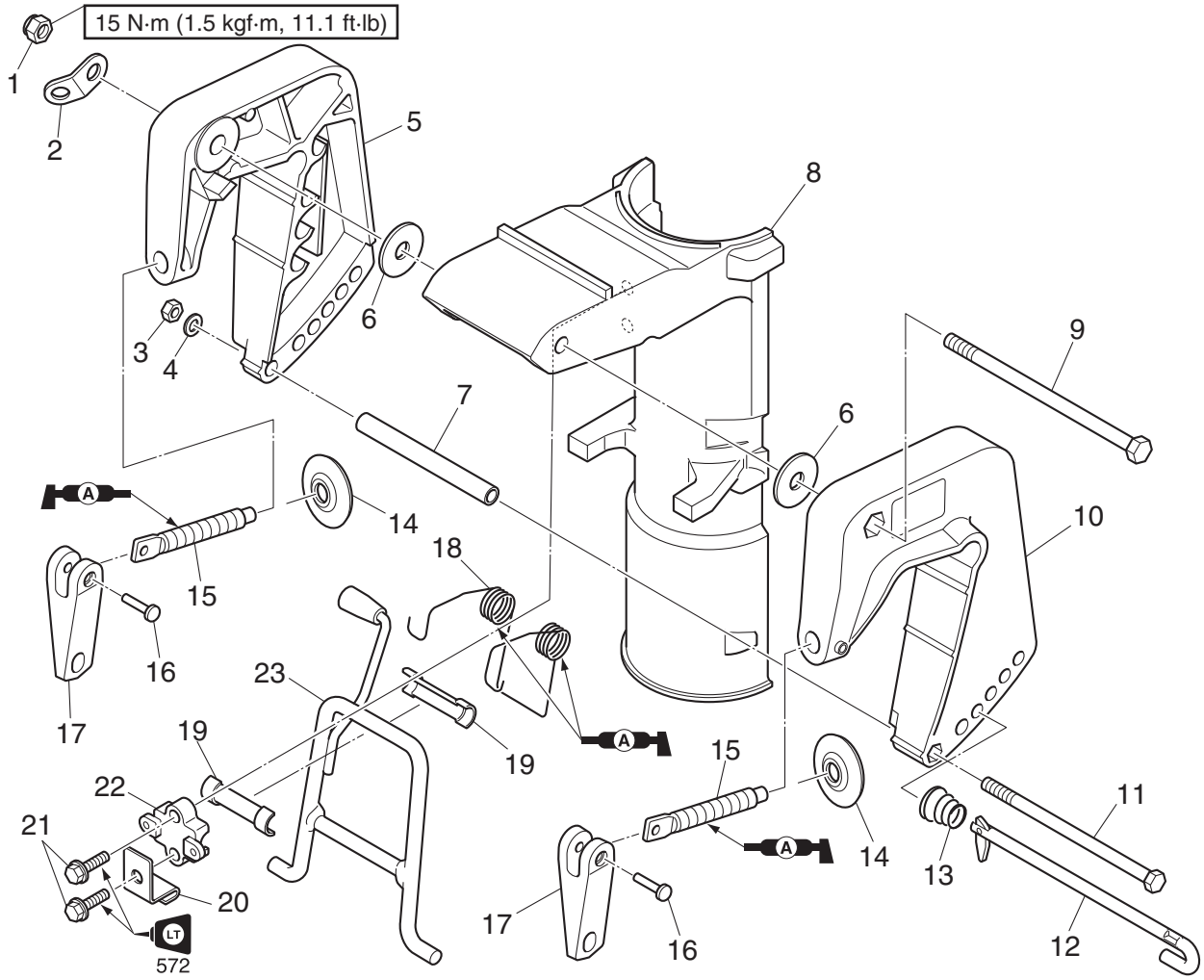
4. Install the spring ⑧, ball ⑨, collar ⑩, bracket ⑪, and shift lever ⑤.

5. Tighten the shift link bolt ⑫ to the specified torque.

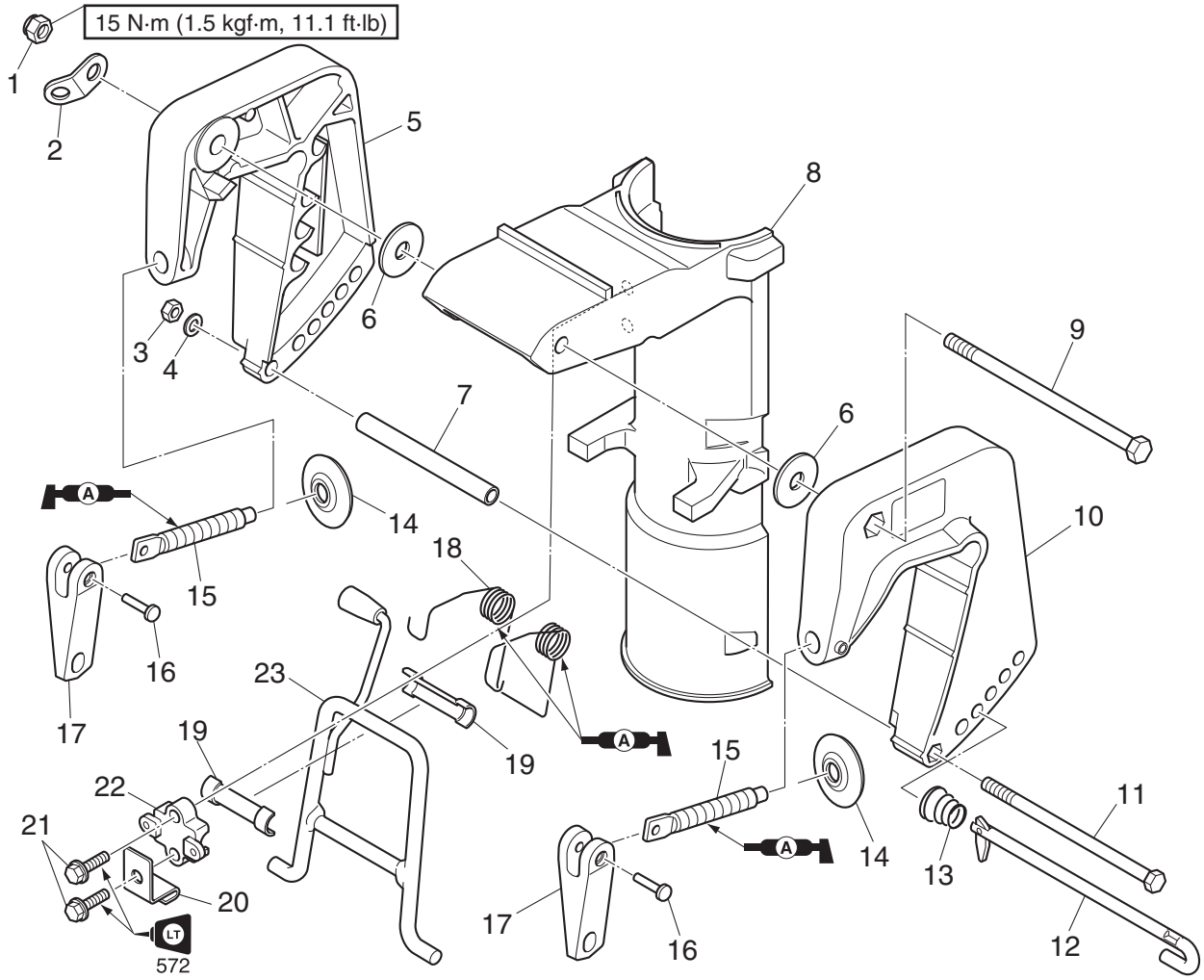


Shift link bolt ⑫:
3.5 N·m (0.35 kgf·m, 2.58 ft·lb)

Clamp bracket



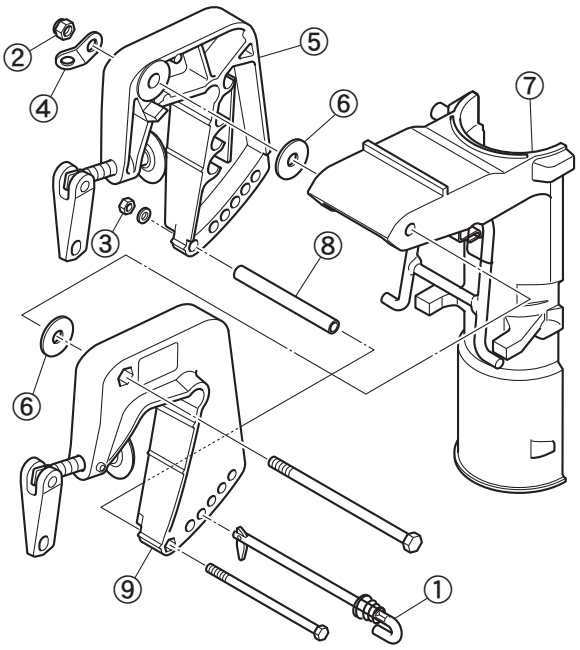
No.	Part name	Q'ty	Remarks
1	Self-locking nut	1	
2	Plate	1	
3	Nut	1	
4	Washer	1	
5	Clamp bracket (STBD)	1	
6	Washer	2	
7	Collar	1	
8	Swivel bracket	1	
9	Bolt	1	M8 × 135 mm
10	Clamp bracket (PORT)	1	
11	Bolt	1	M6 × 120 mm
12	Tilt pin	1	
13	Spring	1	
14	Clamp pad	2	
15	Clamp screw	2	
16	Pin	2	
17	Clamp handle	2	



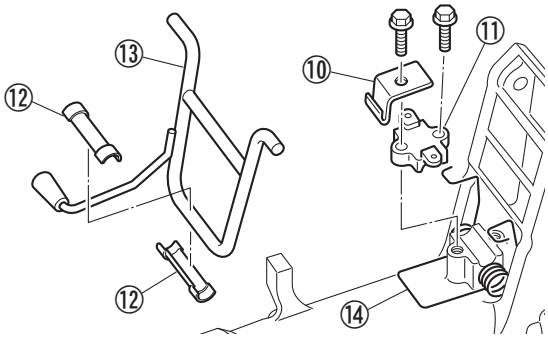
No.	Part name	Q'ty	Remarks
18	Spring	1	
19	Bushing	2	
20	Plate	1	
21	Bolt	2	M6 × 20 mm
22	Cover	1	
23	Tilt lock lever	1	

Disassembling the clamp bracket

1. Remove the tilt pin ①.
2. Remove the self-locking nut ② and nut ③.
3. Remove the plate ④, clamp bracket (STBD) ⑤, washers ⑥, swivel bracket ⑦, collar ⑧, and clamp bracket (PORT) ⑨.

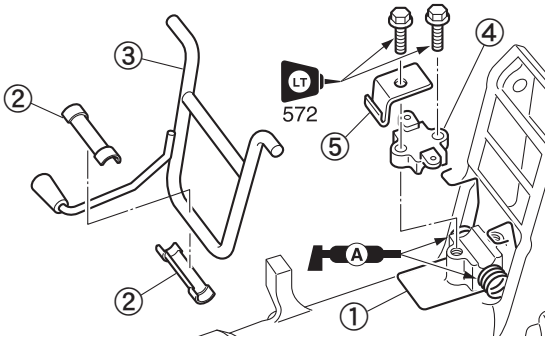


4. Remove the plate ⑩, cover ⑪, bushings ⑫, tilt lock lever ⑬, and spring ⑭.

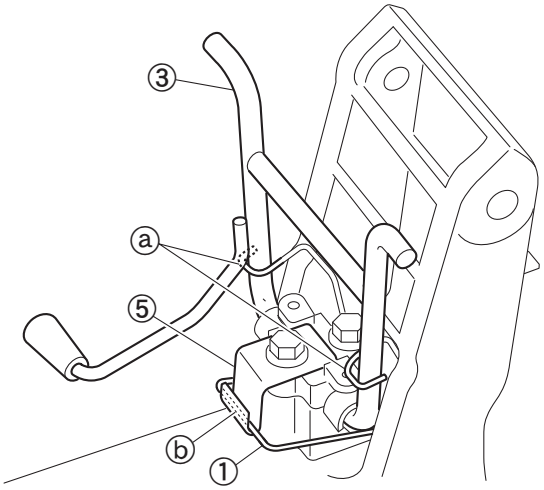


Assembling the clamp bracket

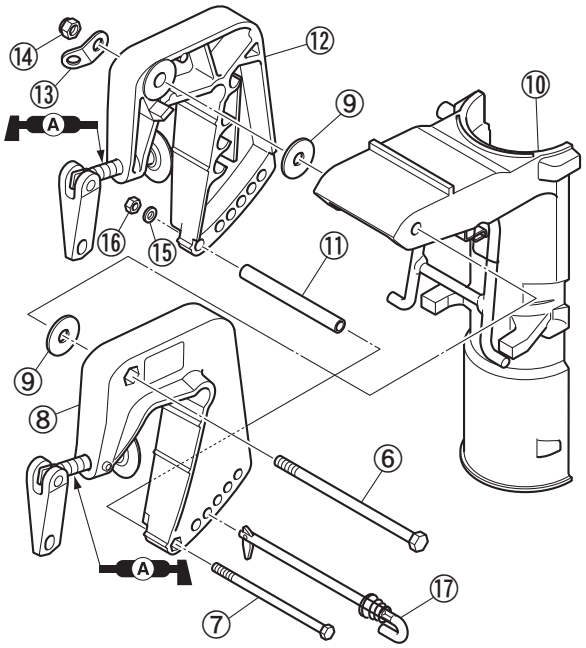
1. Place the spring ①.
2. Install the bushings ②, tilt lock lever ③, cover ④, and plate ⑤.



3. Hook the sections ⓐ of the spring ① onto the tilt lock lever ③, and then fit the section ⓑ into the slot in the plate ⑤.



4. Install the bolts ⑥ and ⑦ into the clamp bracket (PORT) ⑧.
5. Install the washers ⑨, swivel bracket ⑩, collar ⑪, clamp bracket (STBD) ⑫ onto the bolts ⑥ and ⑦.
6. Install the plate ⑬, self-locking nut ⑭, washer ⑮, nut ⑯, and tilt pin ⑰.
7. Tighten the self-locking nut ⑭ to the specified torque.



Self-locking nut ⑭: 15 N·m (1.5 kgf·m, 11.1 ft·lb)

— MEMO —

Maintenance

Outline

- To obtain long product life, Yamaha strongly recommends that the specified periodic checks and maintenance be performed according to the maintenance interval chart.
- If replacement parts are necessary, use only genuine Yamaha parts of equivalent design and quality. Any parts of inferior quality may cause a malfunction, and the resulting loss of control could endanger the operator and passengers. Yamaha genuine parts and accessories are available from Yamaha dealers.
- The service intervals provided in the Maintenance Chart are based upon “typical” operating conditions that include speed variations, sufficient time for engine warm up and cool-down, medium to light load, and an average cruising speed in the 3000 to 4000 r/min range. If your normal operating conditions are more intensive, more frequent servicing will be required, especially the engine oil and gear oil changes. Examples of the intensive operation will be: wide-open-throttle, trolling, or idling operation for extended periods of time, carrying heavy loads, and frequent starting and stopping or shifting. In most cases, the frequent maintenance pays off in increased engine life and greater owner satisfaction.
- The maintenance cycle on these charts assumes usage of 100 hours per year and regular flushing of the cooling water passages. Adjust the maintenance frequency when operating the engine under adverse conditions, such as extended trolling.
- Disassembly or repairs may be necessary depending on the outcome of maintenance checks.
- Expendable or consumable parts and lubricants will lose their effectiveness over time and through normal usage regardless of the warranty period.
- When operating the outboard motor in salt water, or in muddy, turbid (cloudy), or acidic water, flush the engine using clean water after each use.

Maintenance interval chart

Item	Actions	Initial	Every			See page
		20 hours (3 months)	100 hours (1 year)	300 hours (3 years)	500 hours (5 years)	
Anode (external)	Check/replace		○			8-4
Anode (thermostat cover)	Check/replace		○			7-35
Battery (electrolyte level, terminal)	Check/charge/replace	○	○			10-3
Cooling water leakage	Check	○	○			10-7
Cowling lock lever	Check		○			10-11
Engine starting condition/ noise	Check	○	○			10-6
Engine idle speed/noise	Check	○	○			10-7
Engine oil	Replace	○	○			10-8
Engine shut-off switch	Check/replace	○	○			10-4
Fuel strainer	Check/replace	○	○			6-6
Fuel hose	Check/replace	○	○			6-1
Fuel pump	Check/replace			○		6-22
Fuel/oil leakage	Check	○	○			6-1
Gear oil	Replace	○	○			10-9
Greasing points	Lubricate	○	○			10-10
Impeller/ water pump housing	Check/replace		○			8-6 8-14

Item	Actions	Initial	Every			See page
		20 hours (3 months)	100 hours (1 year)	300 hours (3 years)	500 hours (5 years)	
Impeller/ water pump housing	Replace			○		8-6 8-14
Pilot water	Check	○	○			10-3
Propeller/propeller nut/ cotter pin	Check/replace	○	○			8-4
Shift link	Check/replace	○	○			8-16 9-11
Spark plug	Check/replace		○			7-35
Spark plug cap	Check/replace	○	○			5-5
Throttle link/ throttle cable	Check/adjust/replace	○	○			6-14
Thermostat	Check/replace		○			7-35
Valve clearance	Check/adjust				○	7-2 7-3
Water inlet	Check	○	○			10-7
Wiring harness connections/wiring coupler connections	Check/replace	○	○			—
Fuel tank (built-in tank)	Check		○			6-6

— : Not applicable

Item	Actions	Every	See page
		1000 hours	
Upper case	Check/replace	○	9-12

TIP:
When using lead high-sulfur gasoline, checking the valve clearance may be required more frequently than every 500 hours.

Predelivery check

To make the delivery process smooth and efficient, complete the predelivery checks as explained in the following procedures.

Checking the battery (optional for European market)

⚠ WARNING

Battery electrolyte is dangerous; it contains sulfuric acid, which is poisonous and highly caustic. Always follow these preventive measures:
- **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.**

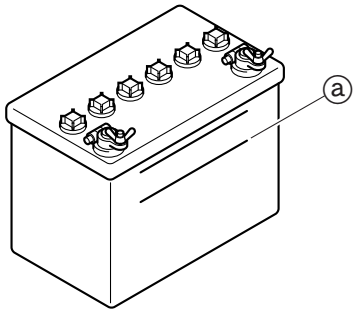
Antidote (EXTERNAL):
- **SKIN - Wash with water.**
- **EYES - Flush with water for 15 minutes and get immediate medical attention.**

Antidote (INTERNAL):
- **Drink large quantities of water or milk followed with milk of magnesia, beaten egg, or vegetable oil. Get immediate medical attention.**

Batteries produce explosive, hydrogen gas. Always follow these preventive measures:
- **Charge batteries in a well-ventilated area.**
- **Keep batteries away from fire, sparks, or open flames (for example, welding equipment and lighted cigarettes).**
- **DO NOT SMOKE when charging or handling batteries.**

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

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



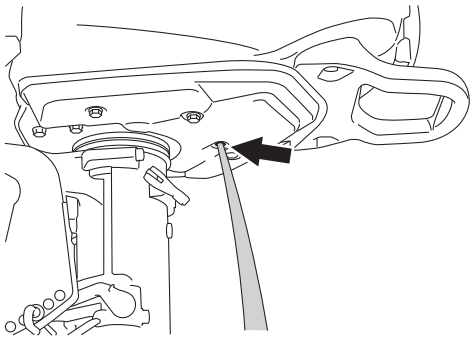
2. Check the specific gravity of the electrolyte. Fully charge the battery if below specification.

Recommended battery capacity: CCA/EN: 347.0 A 20HR/IEC: 40.0 Ah Electrolyte specific gravity: 1.280 at 20 °C (68 °F)

TIP:
- Batteries vary depending on the manufacturer. The procedures mentioned in this manual may not always apply. Therefore, see the instruction manual of the battery.
- Disconnect the negative battery cable first, and then the positive battery cable.

Checking the cooling water pilot hole

1. Start the engine, and then check that cooling water is discharged from the cooling water pilot hole.



Checking the engine oil level

1. Place the outboard motor in an upright position. ***NOTICE:*** **If the outboard motor is not level, the oil level indicated on the dipstick may not be accurate.**

2. Start the engine and warm it up for 5–10 minutes.

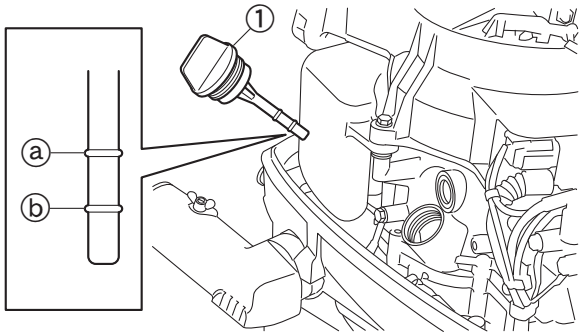
3. Stop the engine and leave it off for 5–10 minutes.

4. Remove the top cowling.

5. Remove the dipstick and wipe it clean using a rag.

6. Screw in the dipstick completely for accurate measurement and remove it.

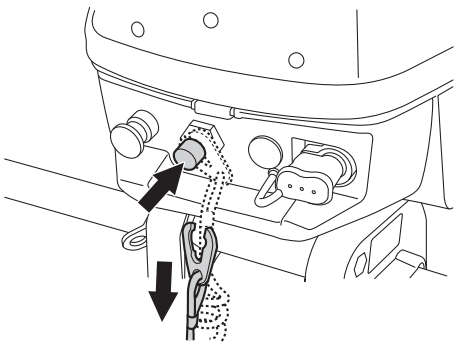
7. Check the oil level using the dipstick to make sure the level falls at the center between the upper level ⓐ and the lower level ⓑ. Add oil if it is below the lower level ⓑ, or extract to the center level if it is above the upper level ⓐ.



Checking the engine shut-off switch

1. Check that the engine turns off when the clip is pulled from the engine shut-off switch.

2. Check that the engine turns off when the engine shut-off switch is pushed.



Checking the fuel system

1. Check that the fuel hoses are securely connected. See “Fuel hose” (6-1). ***NOTICE:*** **This is a 4-stroke engine. Never use premixed fuel or 2-stroke outboard motor oil.**

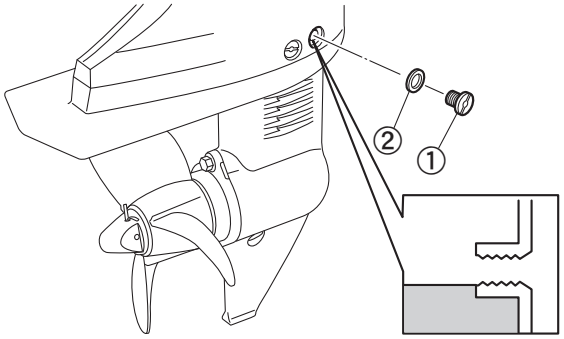
Checking the gear oil level

1. Place the outboard motor in an upright position.

2. Remove the check screw ①, and then check the gear oil level in the lower case.

TIP:
If the oil is at the proper level, a small amount of oil should flow out of the check hole.

3. Install a new gasket ② and the check screw ①, and then tighten the check screw ① to the specified torque. ***NOTICE:*** **Do not reuse a gasket, always replace it with a new one.**



Check screw ①:
9 N·m (0.9 kgf·m, 6.6 ft·lb)

Checking the gear shift and throttle operation

⚠ WARNING

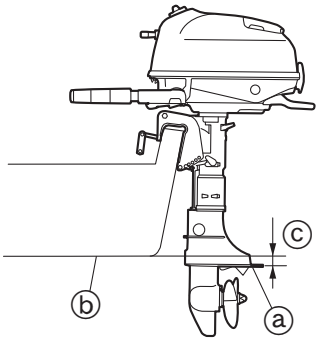
Do not overtighten the friction adjuster. If there is too much resistance, it could be difficult to move the throttle grip, which could result in an accident.

1. Check that the gear shift operates smoothly when the shift lever is moved from the N to the F or R position.

2. Check that the throttle operates smoothly when the throttle grip is turned from the fully closed position to the fully open position.

Checking the outboard motor mounting height

1. Check that the anti-cavitation plate ⓐ is between the bottom of the boat ⓑ and a maximum of 25.0 mm (1.0 in) ⓒ below it. If the mounting height is too high, cavitation will occur and propulsion will decrease. Besides, the engine speed will increase abnormally and cause the engine to overheat. If the mounting height is too low, water resistance will increase, which will decrease engine efficiency and performance.

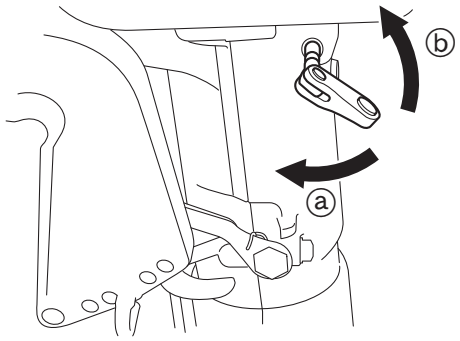


TIP:
The optimum mounting height depends on the combination of the boat and outboard motor. To determine the optimum mounting height, test run the outboard motor at different heights.

2. Check that the clamp brackets are secured using the clamp screws.

Checking the steering system

1. Check the steering friction for proper adjustment.



TIP:
- To increase the friction, move the steering friction adjuster in direction ⓐ.
- To decrease the friction, move the steering friction adjuster in direction ⓑ.

2. Check that the steering operates smoothly.

3. Check that there is no interference with wires or hoses when steering the outboard motor. (When equipped with the optional parts)

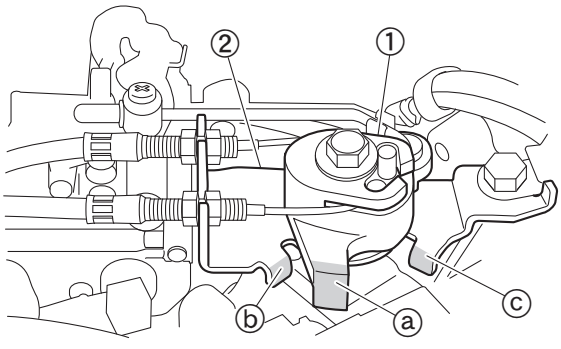
Checking the throttle cable

1. Turn the throttle grip to the fully closed position.

2. Check that the stopper ⓐ on the throttle cam ① contacts the stopper ⓑ on the bracket ②.

3. Turn the throttle grip to the fully open position.

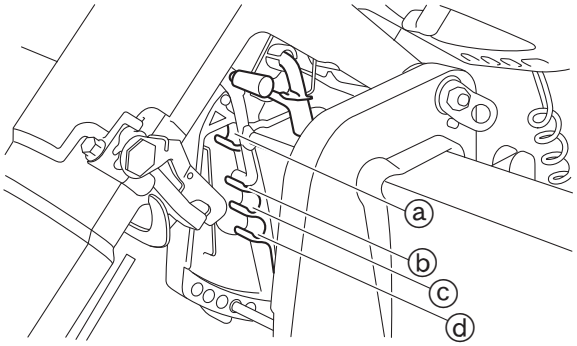
4. Check that the stopper ⓐ on the throttle cam ① contacts the stopper ⓒ on the bracket ②.



Checking the tilt system

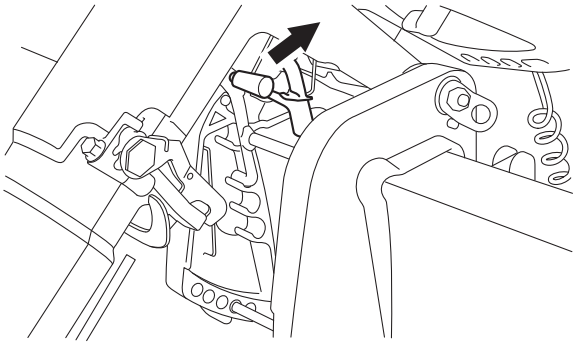
1. Move the shift lever to the N position.

2. Fully tilt up the outboard motor, and then check that the outboard motor tilts up smoothly and automatically locks in ⓐ, ⓑ, ⓒ, ⓓ positions when it is tilted up.



3. Check that there is no interference with hoses or leads when the tilted-up outboard motor is steered. (When equipped with the optional parts)

4. Slightly tilt the outboard motor up and move the tilt lock lever to the release position, and then fully tilt outboard motor down. Check that the outboard motor tilts down smoothly.



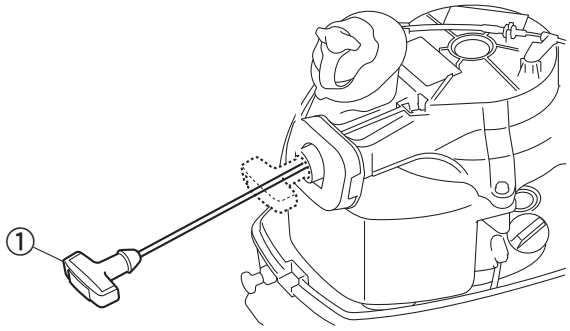
5. Check that the outboard motor does not tilt up when the shift lever is moved to the R position.

Starting the engine

Engine starting procedure differs depending on the conditions.

1. Move the shift lever to the N position.

2. Check that the engine starts when the starter handle ① is pulled.



3. Move the shift lever to the F or R position.

4. Check that the starter handle cannot be pulled.

Test run

1. Start the engine, and then check that the gear shift operates smoothly.

2. Warm up the engine, and then check the engine idle speed.

3. Operate the engine at trolling speed.

4. Operate the outboard motor according to the break-in procedure.

5. Check that the outboard motor does not tilt up when the shift lever is moved to the R position and that water does not flow in over the transom.

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

Break-in

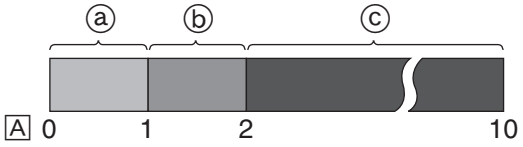
Operate the engine under load (in gear with a propeller installed) for 10 hours as follows:

1. For the 1st hour ⓐ of operation:
   Operate the engine at varying speeds up to 2000 r/min or approximately 1/2 throttle.

2. For the 2nd hour ⓑ of operation:
   Operate the engine at 3000 r/min or at approximately 3/4 throttle.

3. For the remaining 8 hours ⓒ of operation:
   Operate the engine at any engine speed. However, do not operate the engine at full throttle for more than 5 minutes at a time.

4. After the 1st 10 hours of operation:
   Operate the engine normally.



A Hour

After test run

1. Check for water in the gear oil.

2. Check for fuel leakage in the cowling.

3. Flush the cooling water passages using fresh water. ***NOTICE:*** **Do not perform this procedure on land while the engine is running. Otherwise, the water pump could be damaged and the engine could be severely damaged due to overheating.**

TIP:
When using the flushing device (flushing hose joint adapter), flush the cooling water passages without starting the engine.

General periodic maintenance

Checking the anode

NOTICE

Do not apply grease, oil, or paint to the anodes. Otherwise, the anodes become ineffective.

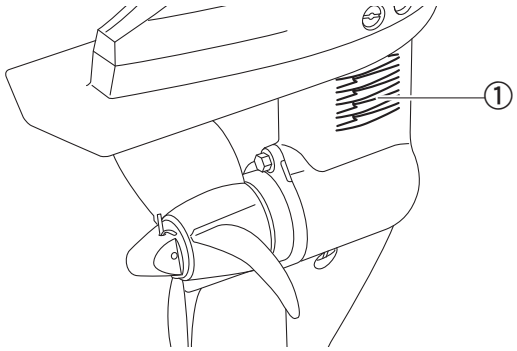
1. Check the anodes. See “Checking the thermostat cover anode” (7-35), and “Checking the lower unit anode” (8-4).

Checking the battery (optional for European market)

1. Check the battery. See “Checking the battery (optional for European market)” (10-3).

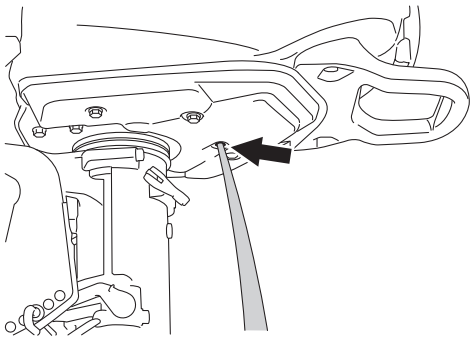
Checking the cooling water passage

1. Check the water inlets ①. Clean if clogged.



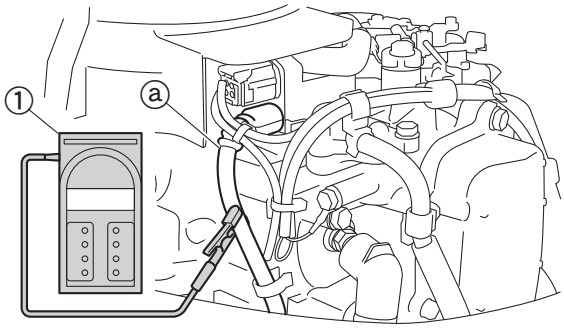
2. Place the lower unit in water, and then start the engine.

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.



Checking the engine idle speed

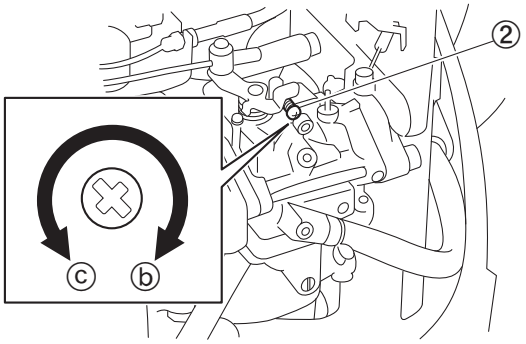
1. Install the special service tool ① to spark plug wire ⓐ.



Digital tachometer ①: 90890-06760

TIP:
Set the digital tachometer to the 2-cycle 1-cylinder mode because this engine ignites the spark plug once per crankshaft rotation.

2. Start the engine and warm it up for 5–10 minutes.
3. Check the engine idle speed. Adjust if out of specification.
4. Turn the throttle stop screw ② in directions ⓑ or ⓒ until the specified engine idle speed is obtained.



Engine idle speed: 1450–1550 r/min

TIP:
- To increase the engine idle speed, turn the throttle stop screw ② in direction ⓑ.
- To decrease the engine idle speed, turn the throttle stop screw ② in direction ⓒ.

5. Rev the engine a few times.
6. Stop the engine, and then remove the special service tool.

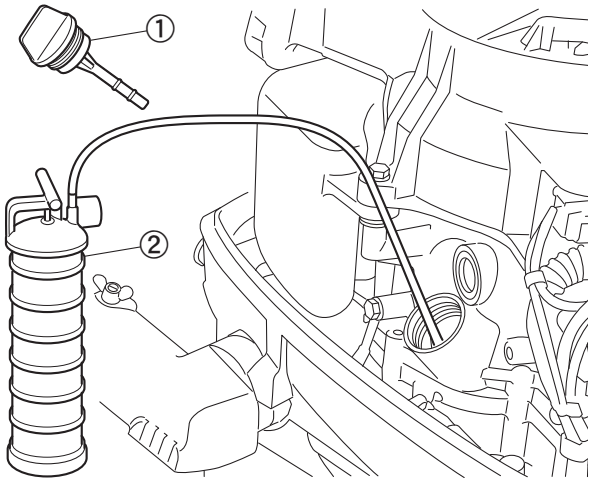
Changing the engine oil

The engine oil should be extracted using an oil changer.

NOTICE

Change the engine oil after the first 20 hours of operation or 3 months, and every 100 hours or at 1-year intervals thereafter.

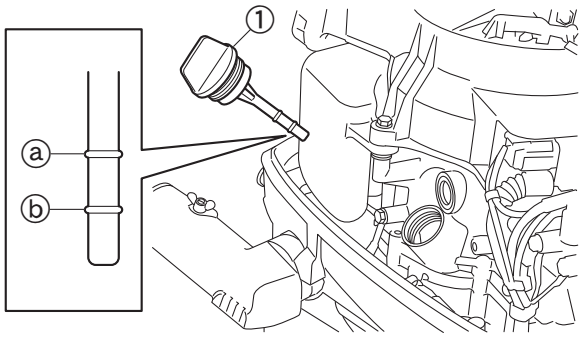
1. Place the outboard motor in an upright position. ***NOTICE:*** **If the outboard motor is not level, the oil level indicated on the dipstick may not be accurate.**
2. Start the engine and warm it up for 5–10 minutes.
3. Stop the engine and leave it off for 5–10 minutes.
4. Remove the dipstick ①, and then extract the oil completely using the oil changer ②.



5. Fill the engine with the specified amount of the recommended engine oil through the oil filler hole. Screw in the dipstick ①. ***NOTICE:*** **Overfilling the oil could cause leakage or damage. If the oil level is above the upper level mark, extract until the level meets the specified level.**

Recommended engine oil:
4-stroke motor oil with combinations of the following SAE and API oil classifications:
API: SE, SF, SG, SH, SJ, SL
SAE: 5W-30, 10W-30, 10W-40
Replacement engine oil quantity:
0.6 L (0.63 US qt, 0.53 lmp qt)

6. Leave the outboard motor off for 5–10 minutes.
7. Remove the dipstick ① and wipe it clean using a rag.
8. Fully screw the dipstick ① all the way in, and then remove it.
9. Check the oil level using the dipstick to make sure that the level falls between the upper level ⓐ and lower level ⓑ.



10. Screw in the dipstick.
11. Start the engine, and then check that the oil can be seen through the oil check hole and that there is no oil leakage. ***NOTICE:*** **If the oil cannot be seen through the oil check hole or if there is oil leakage, stop the engine and find the cause.**

Checking the engine oil level

1. Check the engine oil level. See “Checking the engine oil level” (10-3).

Checking the engine shut-off switch

1. Check the engine shut-off switch. See “Checking the engine shut-off switch” (10-4).

Checking the fuel joint and fuel hoses (fuel joint to carburetor)

1. Check the fuel joint and fuel hose connections. See “Fuel hose” (6-1).

Checking the fuel strainer

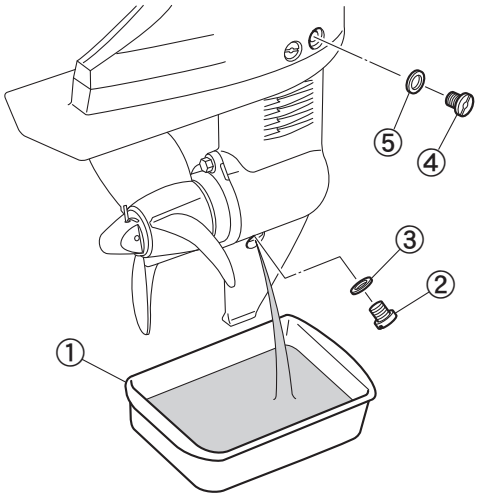
1. Check the fuel strainer. See “Checking the fuel strainer” (6-6).

Changing the gear oil

NOTICE

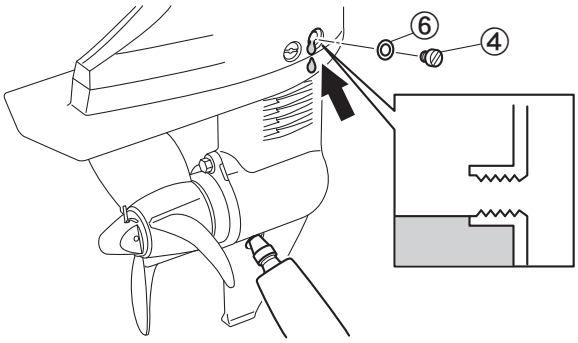
Do not reuse a gasket, always replace it with a new one.

1. Place the outboard motor in an upright position.
2. Place a drain pan ① under the gear oil drain hole.
3. Remove the drain screw ② and gasket ③.
4. Remove the check screw ④ and the gasket ⑤ and let the oil drain completely. ***NOTICE:*** **Check the used oil after it has been drained. If the oil is milky, water is getting into the lower case which can cause gear damage.**



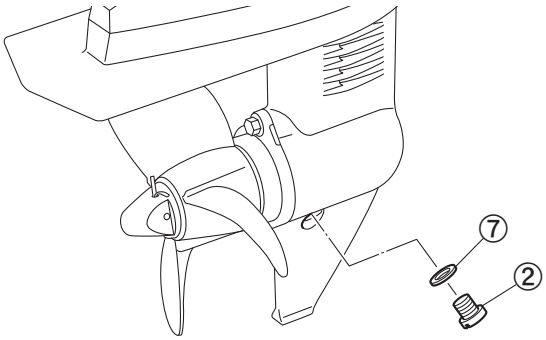
5. Insert the gear oil tube into the drain hole, and then slowly fill the lower case with gear oil until oil flows out of the check hole and no air bubbles are visible.

6. Install a new gasket ⑥ and the check screw ④.



Recommended gear oil: Hypoid gear oil: API: GL-4 SAE: 90 Oil quantity: 0.1 L (0.11 US qt, 0.09 lmp qt)

7. Remove the gear oil tube, and then install a new gasket ⑦ and the drain screw ②.



8. Tighten the check screw ④ and drain screw ② to the specified torque.

Check screw ④: 9 N·m (0.9 kgf·m, 6.6 ft·lb) Drain screw ②: 9 N·m (0.9 kgf·m, 6.6 ft·lb)

Checking the gear oil level

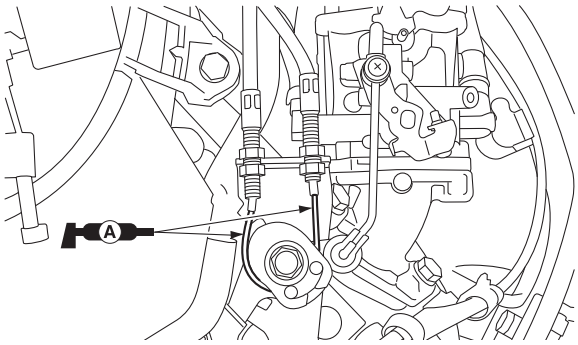
1. Check the gear oil level. See “Checking the gear oil level” (10-4).

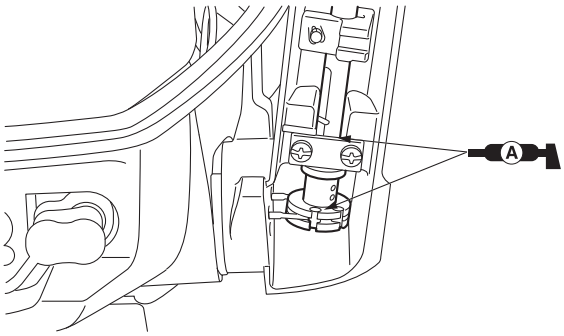
Checking the ignition timing

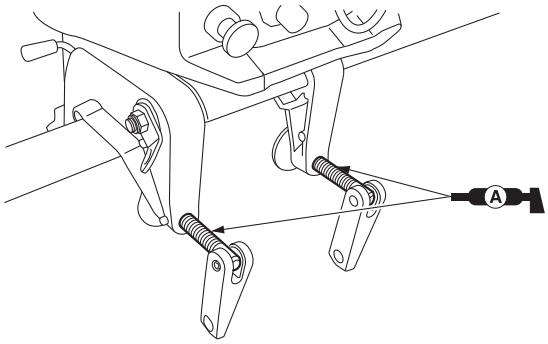
1. Check the ignition timing. See “Checking the ignition timing” (7-1).

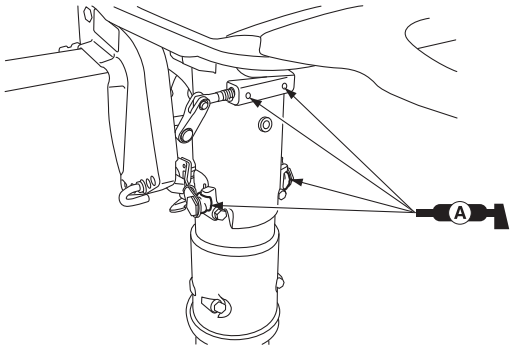
Lubricating the outboard motor

1. Apply water resistant grease to the specified areas.









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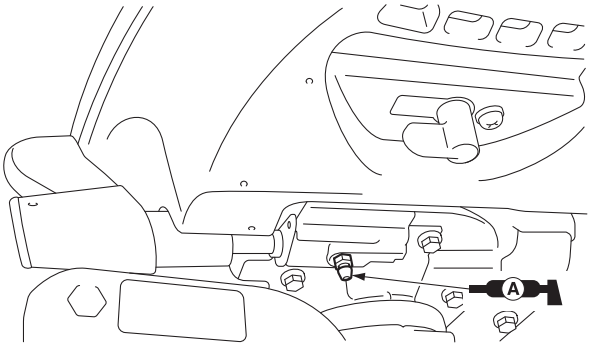
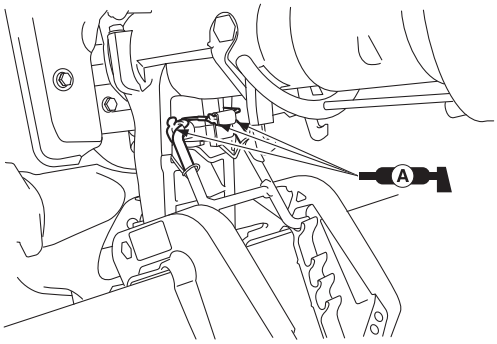
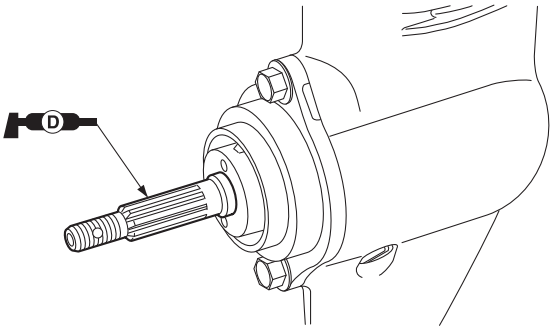




2. Apply corrosion resistant grease to the specified area.



Checking the propeller
1. Check the propeller. See “Checking the propeller” (8-4).

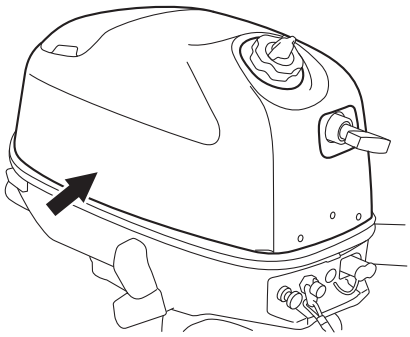
Checking the spark plug
1. Check the spark plug. See “Checking the spark plug” (7-35).

Checking the spark plug cap
1. Check the spark plug cap. See “Checking the spark plug cap” (5-5).

Checking the thermostat
1. Check the thermostat. See “Checking the thermostat” (7-35).

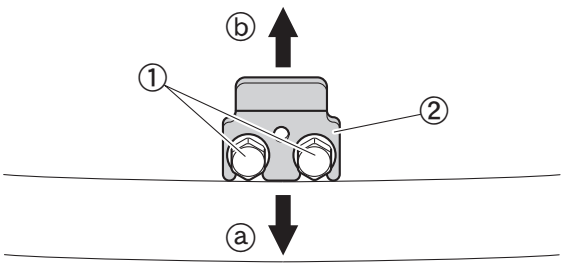
Adjusting the throttle link rod and throttle cable
1. Adjust the throttle link rod. See “Adjusting the throttle cable and throttle link” (6-14).

Checking the top cowling
1. Check the fitting by pushing the top cowling. Adjust if there is free play.



2. Loosen the bolts ①.

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



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

4. Tighten the bolts ①.

5. Recheck the fitting. Replace the cowling seal if the free play cannot be adjusted.

Checking the valve clearance
1. Check the valve clearance. See “Checking the valve clearance” (7-2).

Checking the water pump

1. Check the water pump housing and impeller. See “Checking the water pump” (8-6).

A.

B.

C.

D.

E.

F.

G.

H.

I.

L.

M.

N.

O.

P.

R.

S.

T.

U.

V.

W.

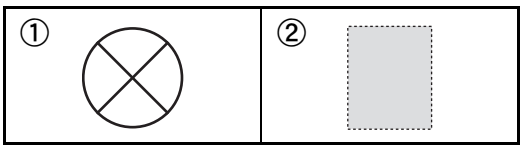
— MEMO —

Appendix

Wiring diagram

How to use the wiring diagram

Legend symbols in the wiring diagrams



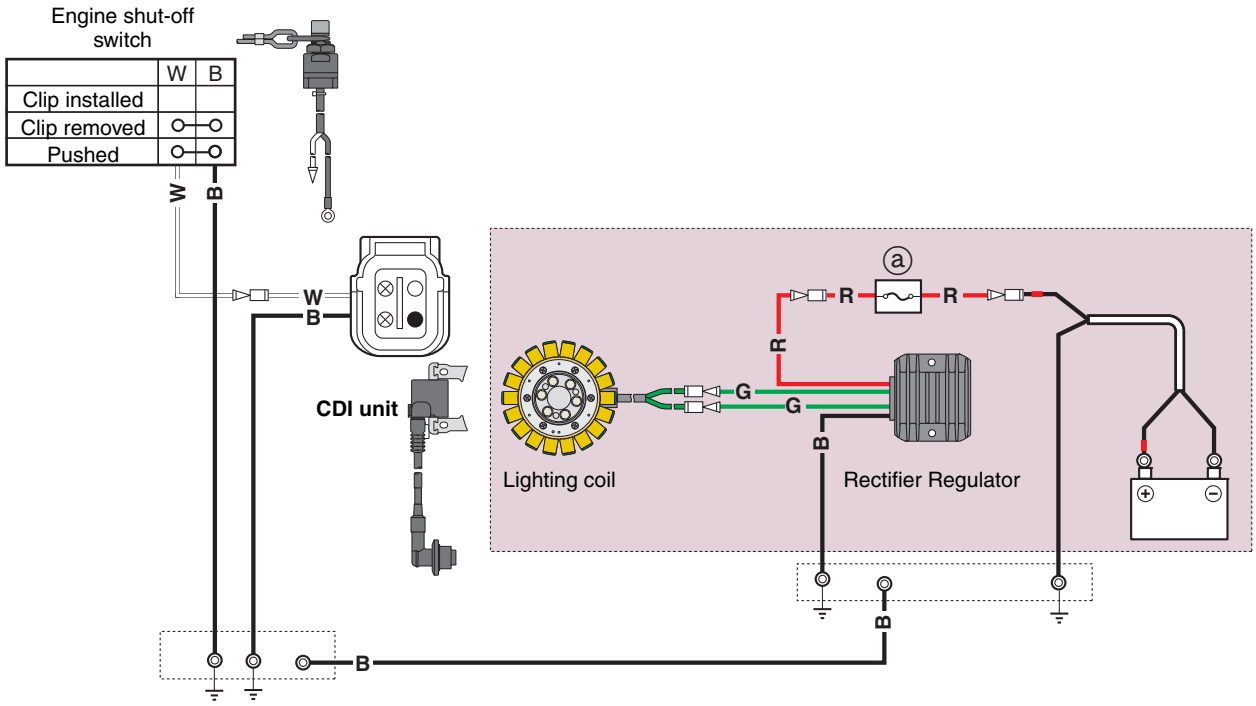
① No wire connector
② Optional parts

Color Code

B : Black
G : Green
R : Red
W : White

F4B, F5A, F6C

ⓐ Fuse (20A) (Battery)



Jan. 2019 ABE
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