

Worldwide:

***F250N*** <sup>(6KD)</sup>

***FL250N*** <sup>(6KE)</sup>

***F300F*** <sup>(6KA)</sup>

***FL300F*** <sup>(6KB)</sup>

USA, CAN, EUR, AUS and NZL:

***F250B*** <sup>(6KD)</sup>

***LF250B*** <sup>(6KE)</sup>

***F300B*** <sup>(6KA)</sup>

***LF300B*** <sup>(6KB)</sup>

# SERVICE MANUAL

6KA-28197-Z3-11●

LIT-18616-04-31

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## Preface

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained technicians 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 subsequent editions of this manual. Also, up-to-date parts information is available on YMBS (Yamaha Marine Business System, USA only) or YPEC-web (except USA). Additional information and up-to-date information on Yamaha products and services are available on YMBS, YMPE (Yamaha Multimedia Product Encyclopedia, Canada only), or Yamaha Service Portal (except USA and Canada).

### Important information

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

: This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

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#### **WARNING**

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

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#### **NOTICE**

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

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#### **TIP:**

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

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F300B, LF300B  
SERVICE MANUAL  
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## General information

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## Model information

### Applicable model

This manual applies to the following models.

#### Worldwide

Model name	Approved model code	Starting serial No.
F300FST	6KA	1000001–
FL300FST	6KB	1000001–
F250NST	6KD	1000001–
FL250NST	6KE	1000001–

#### USA, CAN, EUR, AUS and NZL

Model name	Approved model code	Starting serial No.
F300SB	6KA	1000001–
LF300SB	6KB	1000001–
F250SB	6KD	1000001–
LF250SB	6KE	1000001–

### Model name designation

#### Worldwide

1
2
3
4
5
6

1	Model category	F: 4-stroke L: Counter rotating propeller
2	Output horsepower	250/300
3	Model generation	F/N
4	Model variation	Level 1: Starting method E: Electric start  Level 2: Control method None: Remote control without tiller handle S: Built-in SBW and electric start  Level 3: Trim and tilt method T: PT/T (Power trim and tilt)
5	Color code	None: Gray 2: White 7: Unpainted
6	Motor transom height	X (25 in) U (30 in) E (35 in) N: Without lower unit

USA, CAN, EUR, AUS and NZL

LF
300
X
 
S
B
2

1
2
3
4
5
6
7

1	Model category	F: 4-stroke L: Counter rotating propeller
2	Horsepower	250/300
3	Motor transom height	X: 25 in N: Without lower unit
4	Starting method/PTT	Blank: PTT and electric start
5	Control method	Blank: Remote control S: Built-in SBW and electric start
6	Generation	B
7	Color code	None: Gray 2: White 7: Unpainted

## General feature

- Electronic fuel injected, 4-stroke, V6, DOHC, 24-valve, 4169 cm<sup>3</sup> (254.4 cu. in) engine
- Low exhaust emissions conform to EU1, US EPA, and CARB 3-STAR regulations.
- Low fuel evaporative/permeation emissions conform to EPA regulation.
- Easy operation of the high-output engine due to the SBW (Steer by Wire) system
- Enhanced reverse thrust at low speeds
- New packaging method
- Various transom heights available for larger boats (X: 25", U: 30", E: 35")

### a. Power unit

- Exhaust valve with improved heat resistance
- Shimless valve lifter
- Composite cylinder head cover and electrical bracket
- Large-diameter intake valve head
- Damperless flywheel
- VCT (IN)
- Oil cooler
- Sleeveless cylinder
- Vapor gas treatment

### b. Electrical

- Electronic fuel injection control
- Digital ignition control
- ETV control
- VCT control (IN)
- Shift actuator control
- Knock control
- Over-revolution control
- Fail-safe control
- Tilt limiter
- Self-diagnosis system with YDIS (2.49 or later versions)
- Water-cooled rectifier/regulator/isolator
- High generator output (maximum 70 A)
- High output recharging system (maximum 48 A)
- Compatible with CL5 Display
- Speed sensor (standard equipment and optional settings depend on the destination.)
- Water pressure sensor (standard equipment and optional settings depend on the destination.)
- DBW (Drive by Wire)
- Propeller light (optional)

### c. Bracket unit

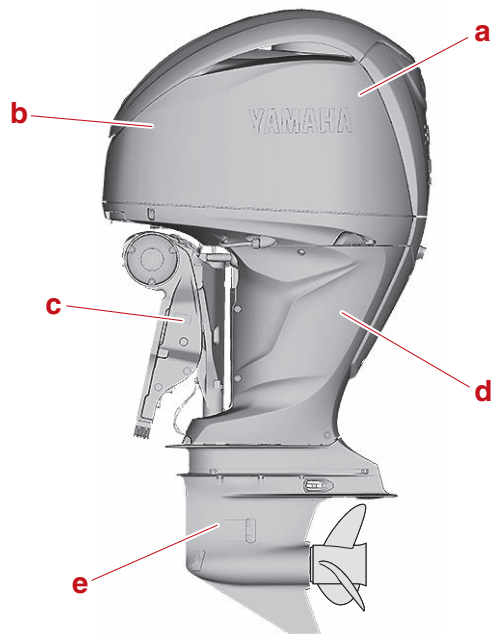
- New clamp brackets
- SBW (Steer by Wire) system
- New PTT TotalTilt™

### d. Upper case

- Composite bottom cowling
- Changed the holding part of the drive shaft
- Exhaust guide height increased by 71 mm (2.80 in)

### e. Lower unit

- Drive shaft with a double tapered roller bearing
- Patented shift damper system (Shift Damper System [SDS] stainless steel propeller)
- New drive shaft (connectable)
- New series propeller (6KA/6KB)
- Changed the exhaust structure



## Important safety and service information

### Important safety and service information

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

#### Rotating parts

- 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 parts

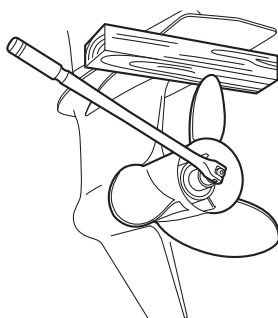
During and after operation, engine parts are hot enough to cause burns. Do not touch any parts under the top cowling until the engine has cooled.

#### Electric shock

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

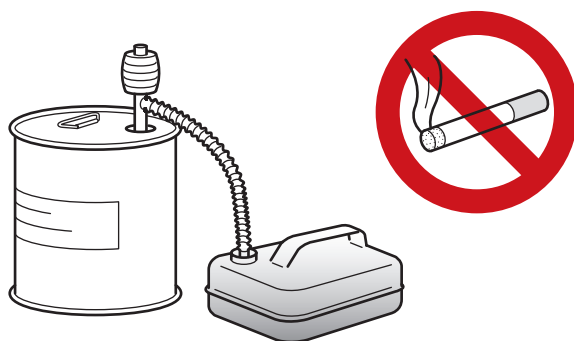
#### Propeller

Do not hold the propeller with your hands when loosening or tightening the propeller nut. Sharp propeller edges can cause injury. Place a wood block between the gearcase and propeller to hold the propeller for removal and installation.



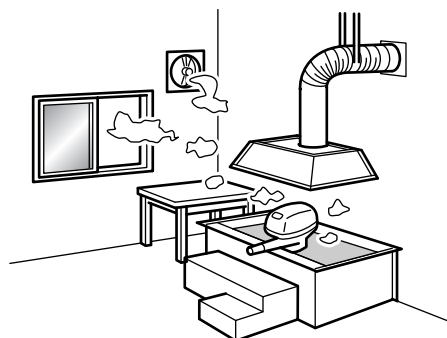
### Handling of gasoline

- 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.



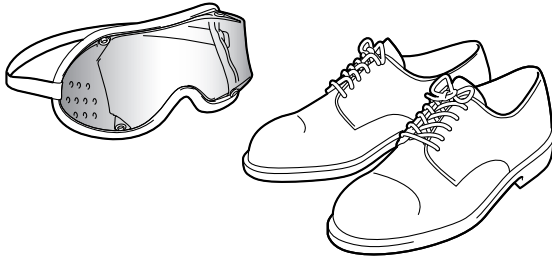
### Ventilation

- Gasoline vapor and exhaust gases are heavier than air and extremely poisonous. If gasoline vapor or exhaust gases are 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.



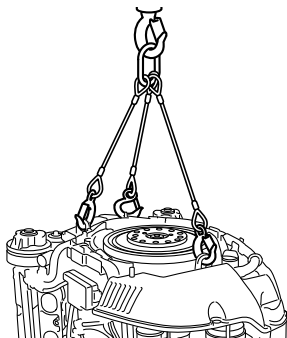
### Self-protection

- 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.



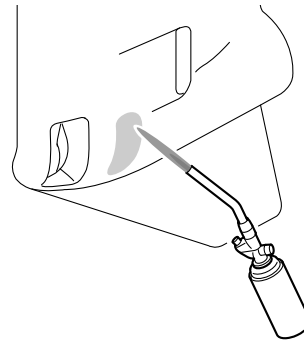
### Lifting outboard motors

- Outboard motors weighing 18 kg (40 lb) and over must be carried by a crane or equivalent.
- Use a wire cable lifting harness of adequate strength to lift up the outboard motor in a stable manner.
- Lift and suspend the outboard motor in a stable manner using the designated lifting attachment points.
- Do not work on or under an outboard motor while it is suspended from a lifting device. Securely mount the motor on a suitable work stand or place it on a stable work surface as soon as possible.



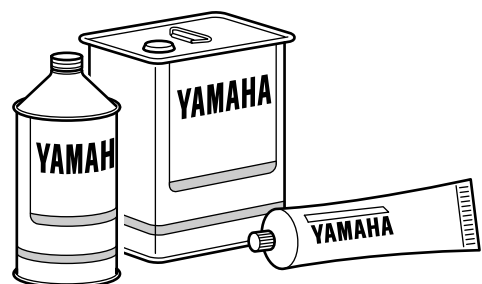
### Handling of gas torch

- Improper handling of a gas torch may result in burns. For information on the proper handling of the gas torch, see the operation manual issued by the manufacturer.
- When using a gas torch, keep it away from gasoline and oil to prevent a fire.
- Components become hot enough to cause burns. Do not touch any hot components directly.



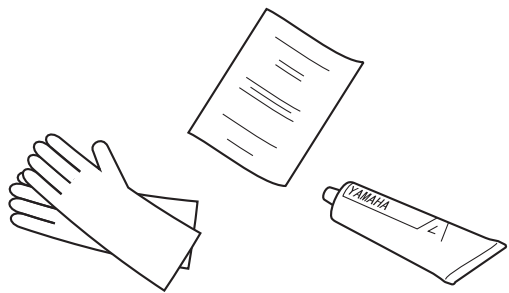
### Parts, lubricants, and sealants

Use only genuine Yamaha parts, lubricants, and sealants, or those recommended by Yamaha, when servicing or repairing the outboard motor. Failures caused by the use of parts, lubricants, or sealants that are not equivalent in design and quality to genuine Yamaha parts, lubricants, or sealants will not be covered by warranty.



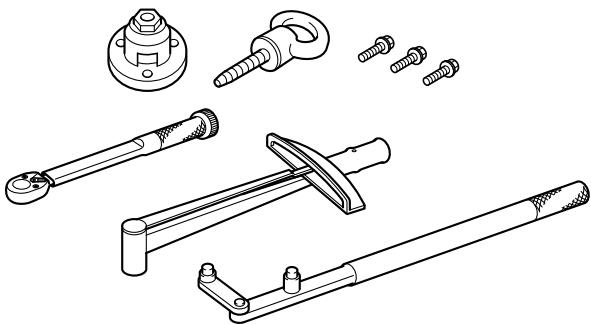
### Handling of lubricants and sealants

- Follow all instructions and safety precautions provided on the product label and the material safety data sheet (MSDS/SDS) for lubricants, sealants, and other shop chemicals.
- Wear impervious gloves, eye protection, or other protective apparel when required.
- Wash skin thoroughly after contact with lubricants, sealants, and other shop chemicals, and change clothing if contaminated with them.



### Special service tools

For safety and to help protect parts from damage, use the recommended special service tools.

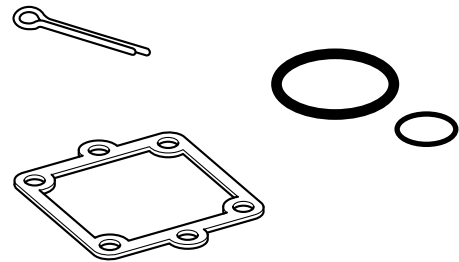


### Tightening torque

When tightening nuts, bolts, and screws, follow the tightening instructions provided throughout the manual. If the tightening order is not specified, tighten the large sizes first, and then tighten the small sizes, starting from the center and moving outward.

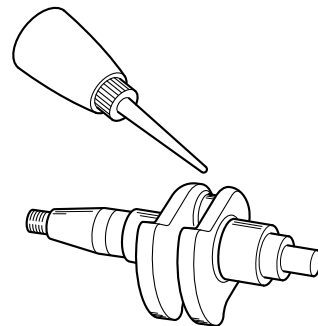
### Non-reusable parts

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.



- During disassembly, cover all openings, such as intake and exhaust ports, to prevent foreign materials from entering the engine. Foreign materials could cause severe internal damage when the engine is started.
- 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.
- When starting the engine after reassembly, check for fuel and water leaks from hoses and pipes that were disconnected or removed while servicing.
- When assembling the PTT/PT unit, do not use a rag. Otherwise, dust and particles could get on the PTT/PT unit components, causing poor performance.



**Disposal of used components and chemicals**

Obey all federal, state and local regulations when disposing of used components and/or chemicals such as crate frames, replaced parts, gaskets, oil, and so on.

## How to use this manual

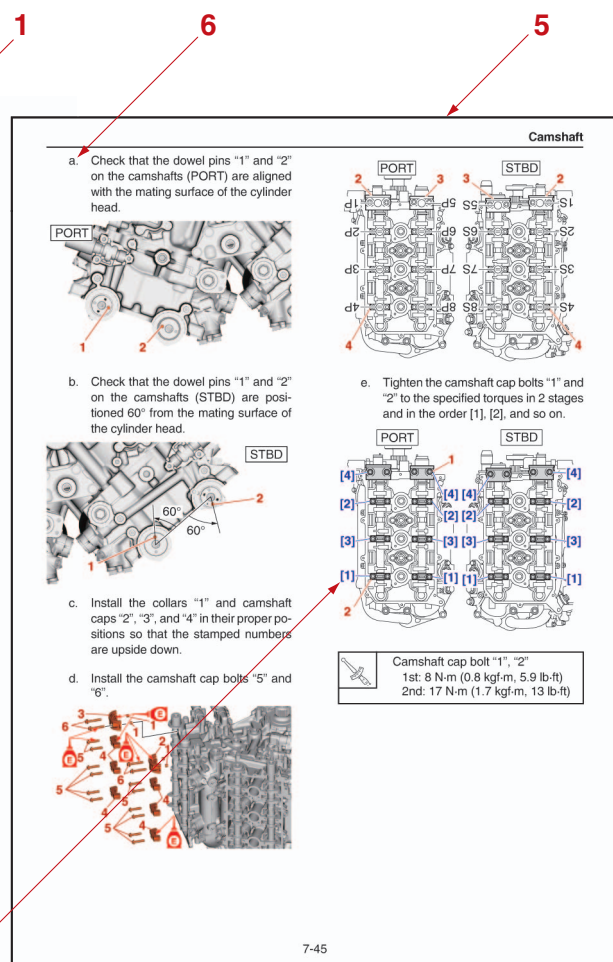
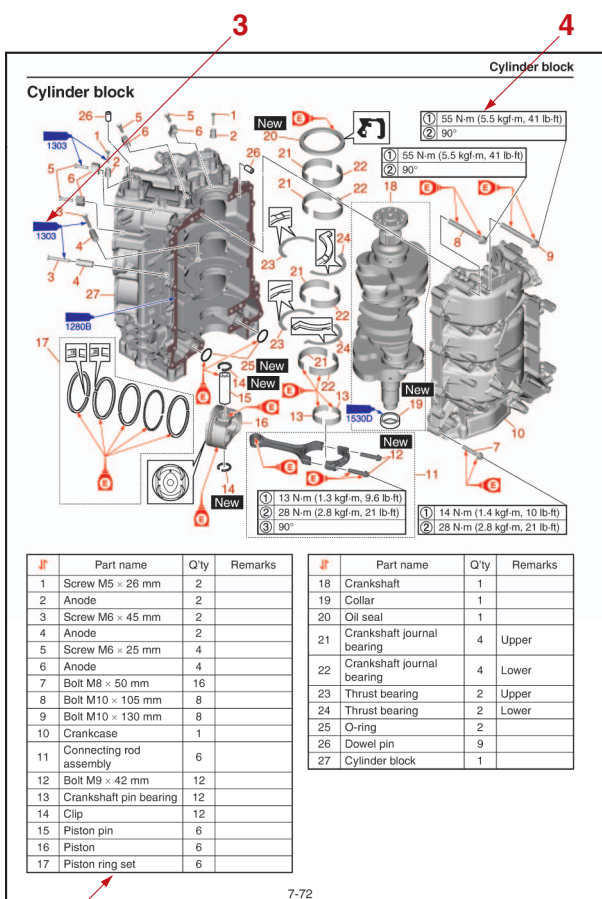
### Manual format

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 the basic removal or disassembly order (“↓”), part names, quantities, and remarks, which indicate the bolt and screw dimensions and other information (see “2” in the following figure). For the installation or assembly procedure, reverse the order.
- 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 values 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). Detailed explanations of the procedures are expressed by using lower case letters such as a, b, c, .... (see “6” in the following figure).
- Numbers enclosed in brackets are used to indicate the removal or tightening order of bolts, screws, and other parts (see “7” in the following figure).

### TIP:

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



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0-8

## Conditions when testing and adjusting

Conditions can affect specifications when checking, measuring, and making certain adjustments. Service data in this manual was determined under the following conditions:

- Electrical resistance for components such as ignition coils and sensors was measured at 20 °C (68 °F).
- Engine compression was measured at:
  - Sea level
  - 20 °C (68 °F)
  - All spark plugs removed
  - Throttle valve at WOT (depending on model specification)
- Trim/tilt angles shown are when the transom angle is 12 degrees.

## Abbreviation

The following abbreviations are used in this service manual.


Abbreviation	Description
ABYC	American Boat and Yacht Council
BCU	Boat Control Unit
ECM	Electronic Control Module
EN	European Norm (European standard)
EPA	Environmental Protection Agency
ETV	Electronic Throttle Valve
HCU	Helm Control Unit
LPS	Lever Position Sensor
OCV	Oil Control Valve
PCU	Power-train Control Unit
PTT	Power Trim and Tilt
SBW	Steer By Wire
SCU	Steering Control Unit
SDS	Shift Dampener System
SPS	Shift Position Sensor
TPS	Throttle Position Sensor
VCT	Variable Camshaft Timing
Y-COP	Yamaha Customer Outboard Protection
YDIS	Yamaha Diagnostic System
WOT	Wide Open Throttle

## Specified tightening torque

### Color code

B	 Black	Lg	 Light green	Sb	 Sky blue
Br	 Brown	Or	 Orange	W	 White
G	 Green	P	 Pink	Y	 Yellow
Gy	 Gray	Pu	 Purple		
L	 Blue	R	 Red		

### TIP:

For example, "R/Y" stands for a Red with Yellow tracer stripe wire. 

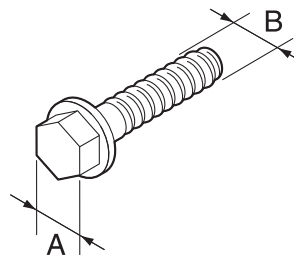
## Specified tightening torque

Specified tightening torques are provided for specific nuts, bolts, and screws. Specified tightening torque specifications are provided in the exploded diagrams and in the related working instructions. When tightening these fasteners, follow the tightening torque specifications and procedures indicated throughout the manual to meet the design aims of the outboard motor.

## General tightening torque

This chart indicates the tightening torques for standard fasteners with a standard ISO thread pitch.


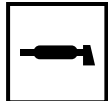



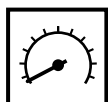
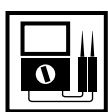

Width across flats (A)	Thread size (B)	General torque specifications		
		N·m	kgf·m	lb·ft
8 mm	M5	5	0.5	3.7
10 mm	M6	8	0.8	5.9
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	27
17 mm	M12	52	5.2	38



## Symbol








### Specification symbol

Illustrated symbols are used to identify the specifications which appear.

Symbol	Definition	Symbol	Definition
	Filling fluid		Lubricant
	Special tool		Tightening torque
	Wear limit, clearance		Engine speed
	Electrical data		Replace the part with a new one.

















### 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
	YAMALUBE 4 or YAMALUBE 4M FC-W	Lubricant
	YAMALUBE outboard gear oil or Yamalube Marine Gearcase Lube	Lubricant
	Water resistant grease (Yamalube grease A or Yamalube Marine Grease)	Lubricant
	Low temperature resistant grease (Yamaha grease C or Yamalube Molybdenum Disulfide grease)	Lubricant
	Corrosion resistant grease (Yamaha grease D or Yamalube Marine Grease)	Lubricant
	Molybdenum disulfide grease (Yamalube Molybdenum Disulfide grease)	Lubricant
	YAMAHA WR-No.2 grease	Lubricant

## Symbol



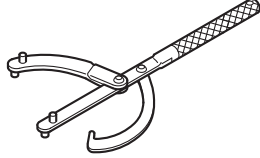
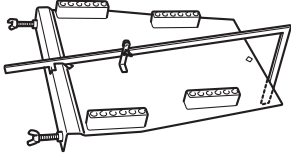
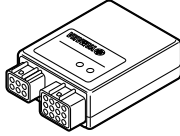
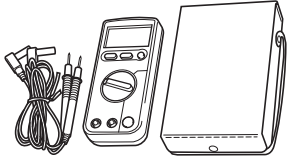
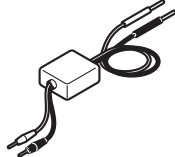

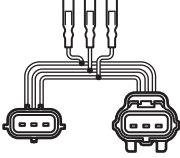
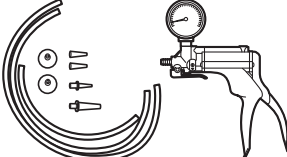
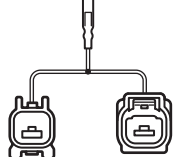
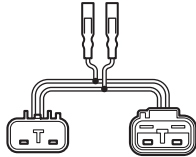
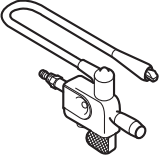
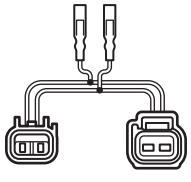
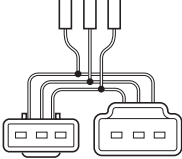
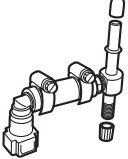
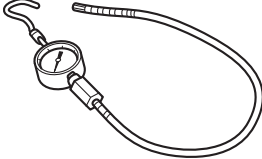
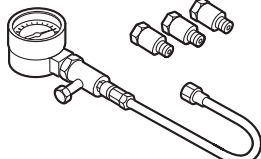
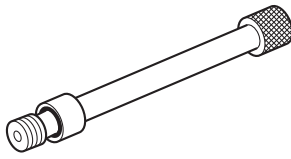
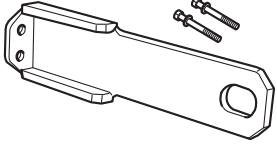
Symbols in an exploded diagram or illustration indicate the type of sealant or thread locking agent and the application points.

Symbol	Name	Application
	YAMAHA Gasket Maker	Sealant
	ThreeBond 1280B (Yamabond 4 Marine)	Sealant
	ThreeBond 1303	Thread locking agent
	ThreeBond 1303N	Thread locking agent
	ThreeBond 1322D	Thread locking agent
	ThreeBond 1386B	Sealant
	ThreeBond 1377B	Thread locking agent
	ThreeBond 1530D	Sealant
	ThreeBond 1533D	Sealant
	LOCTITE 210 (red)	Thread locking agent
	LOCTITE 241 (blue)	Thread locking agent
	LOCTITE 242 (blue)	Thread locking agent
	LOCTITE 271 (red)	Thread locking agent
	LOCTITE 572 (white)	Sealant
	LOCTITE 648 (green)	Thread locking agent
	Silicone sealant	Sealant


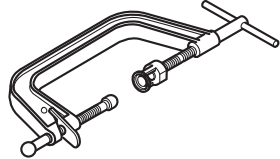
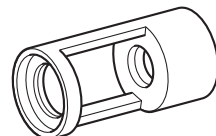


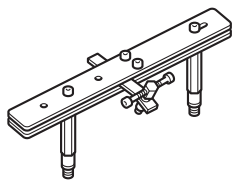
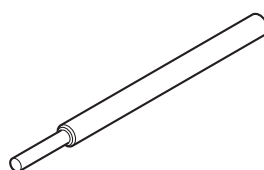
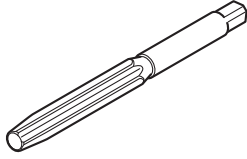
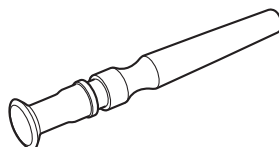
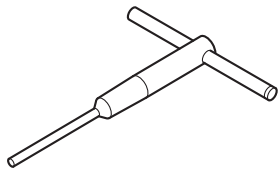

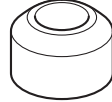




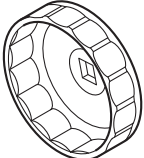
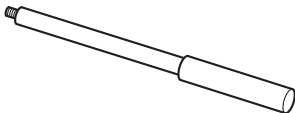

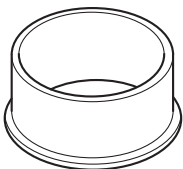
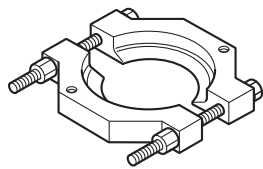
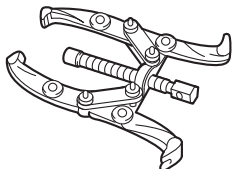

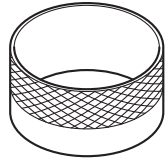
## Special service tool

Special service tools with Yamaha part numbers (90890-\*\*\*\*\*) are distributed by the Parts Division. USA and Canada tool numbers (YB/YM/YS/YU-\*\*\*\*\*) are distributed by K&L Supply Co. Some of the special service tools are only available from the Marine Service Division.

### WW SST No.

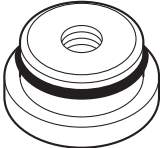
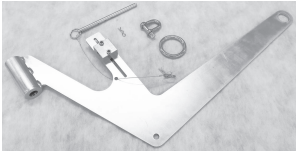
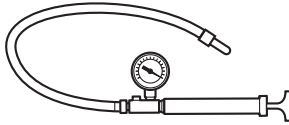
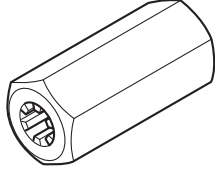
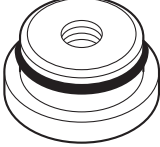
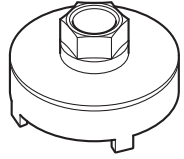
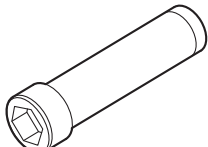
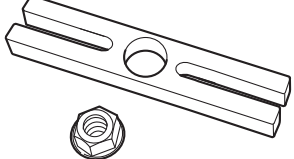
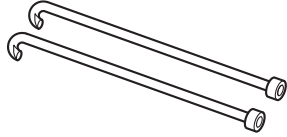
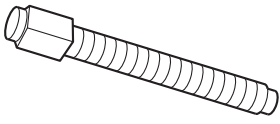
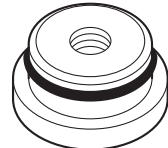
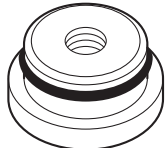
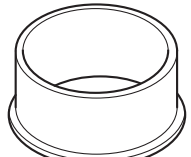
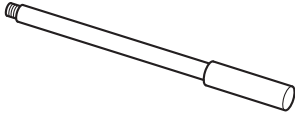
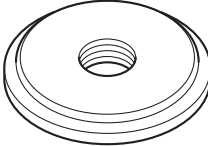
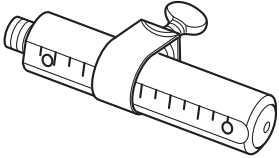

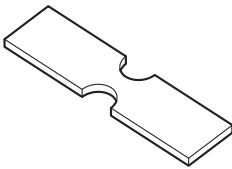
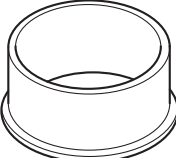
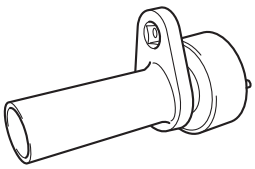
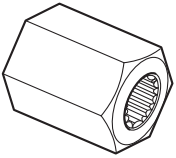

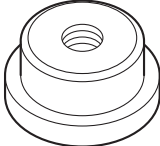
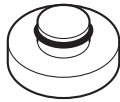
<p>Lifting eye 90890-06953</p> 	<p>Bolt hexagon with washer 90890-06821</p> 	<p>Rotor holder 90890-01235</p> 	<p>Drilling plate 90890-06783</p> 
<p>YDIS 2 HARDWARE KIT III 90890-06980</p> 	<p>Digital circuit tester 90890-03243</p> 	<p>Peak voltage adapter B 90890-03172</p> 	<p>Tester leads 90890-06881</p> 
<p>Test harness EJ-II-3 90890-06913</p> 	<p>Vacuum/pressure pump gauge set 90890-06945</p> 	<p>Test harness FW13613-1 90890-06915</p> 	<p>Test harness FW13613-2 90890-06916</p> 
<p>Ignition checker (Spark gap tester) 90890-06754</p> 	<p>Test harness FWY-2 90890-06917</p> 	<p>Test harness FWY-3-L 90890-06918</p> 	<p>Fuel pressure gauge adapter 90890-06946</p> 
<p>Fuel pressure gauge 90890-06753</p> 	<p>Compression gauge 90890-03160</p> 	<p>Compression gauge extension 90890-06563</p> 	<p>Balance hanger 90890-06822</p> 

**Special service tool**

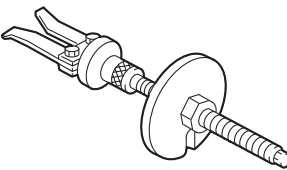
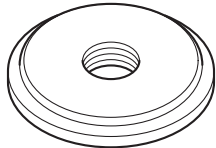
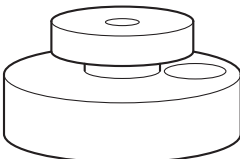
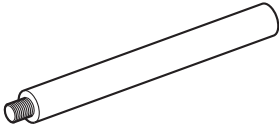
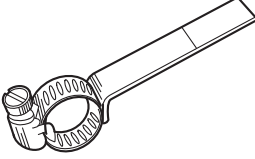
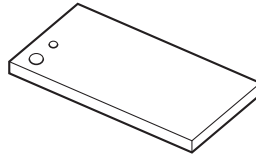
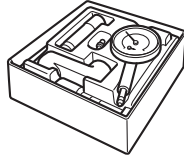
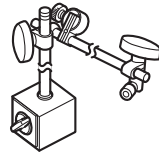
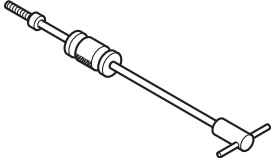
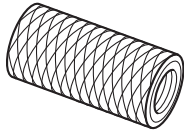
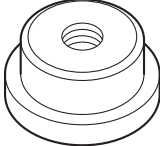
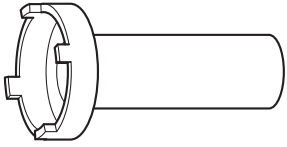

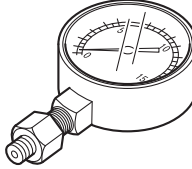
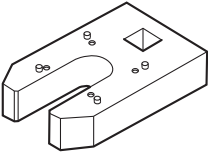
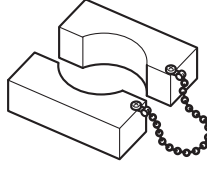
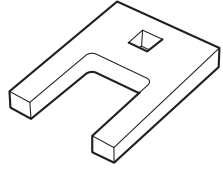
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<p>Support assy 3 90890-06952</p> 	<p>Valve spring compressor 90890-06689</p> 	<p>Valve guide remover/installer 90890-06801</p> 	<p>Valve guide reamer 90890-06804</p> 
<p>Valve lapper 90890-04101</p> 	<p>Valve seat cutter holder 90890-06316</p> 	<p>Valve seat cutter 30° 90890-06331</p> 	<p>Valve seat cutter 45° 90890-06332</p> 
<p>Valve seat cutter 60° 90890-06333</p> 	<p>Valve seat cutter 30° 90890-06327</p> 	<p>Valve seat cutter 45° 90890-06325</p> 	<p>Valve seat cutter 60° 90890-06324</p> 
<p>Oil filter wrench 90890-06874</p> 	<p>Driver rod L3 90890-06652</p> 	<p>Needle bearing attachment 90890-06612</p> 	<p>Bearing inner race attachment 90890-06640</p> 
<p>Bearing separator 90890-06534</p> 	<p>Gear puller 90890-06540</p> 	<p>Needle bearing attachment 90890-06615</p> 	<p>Piston slider 96 mm 90890-06684</p> 



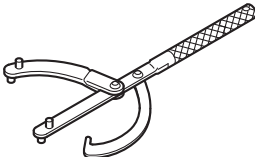
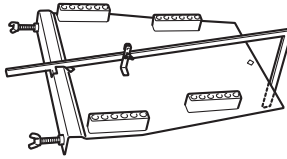
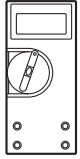
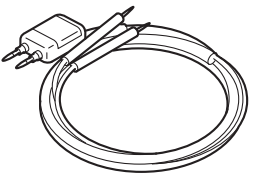
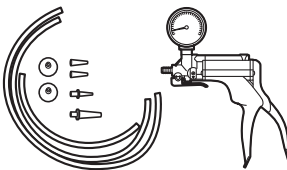
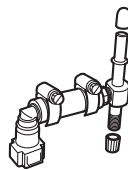
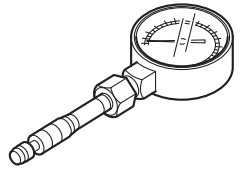
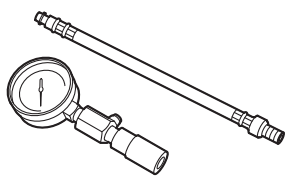
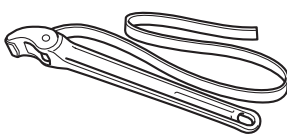
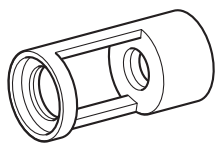
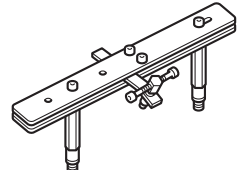
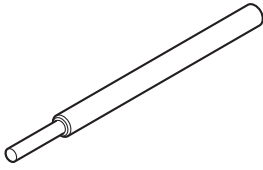
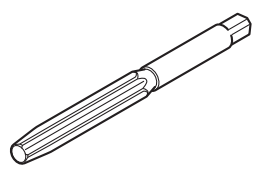
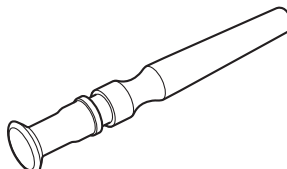
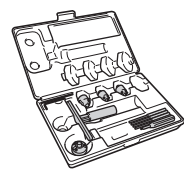
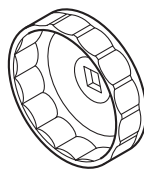
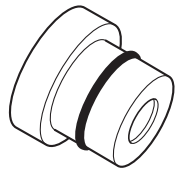
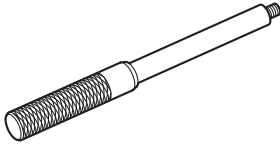
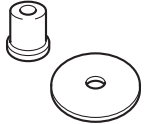
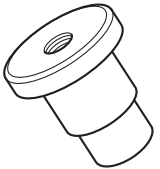
**Special service tool**

<p>Needle bearing attachment 90890-06610</p> 	<p>Lifting hanger 90890-06951</p> 	<p>Leakage tester 90890-06840</p> 	<p>Shift rod socket 90890-06681</p> 
<p>Needle bearing attachment 90890-06614</p> 	<p>Ring nut wrench 6 90890-06677</p> 	<p>Ring nut wrench extension 90890-06513</p> 	<p>Stopper guide plate 90890-06501</p> 
<p>Bearing housing puller claw L 90890-06502</p> 	<p>Center bolt 90890-06504</p> 	<p>Ball bearing attachment 90890-06634</p> 	<p>Needle bearing attachment 90890-06611</p> 
<p>Bearing inner race attachment 90890-06661</p> 	<p>Driver rod LL 90890-06605</p> 	<p>Bearing outer race attachment 90890-06623</p> 	<p>Driver rod SS 90890-06604</p> 
<p>Needle bearing attachment 90890-06653</p> 	<p>Bearing depth plate 90890-06603</p> 	<p>Bearing inner race attachment 90890-06642</p> 	<p>Ring nut wrench 90890-06833</p> 
<p>Drive shaft holder 6 90890-06520</p> 	<p>Pinion nut holder 90890-06451</p> 	<p>Needle bearing attachment 90890-06680</p> 	<p>Ball bearing attachment 90890-06655</p> 

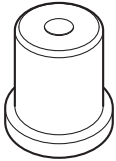
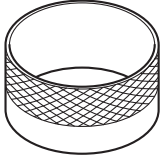
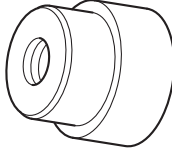
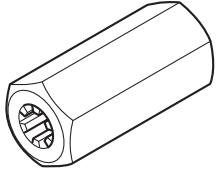
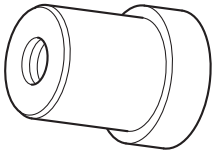
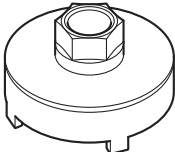
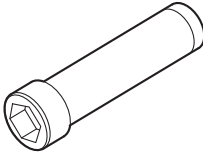
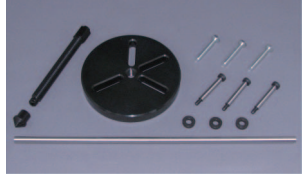
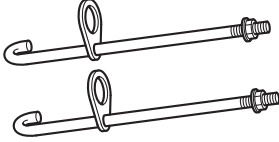

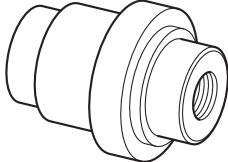
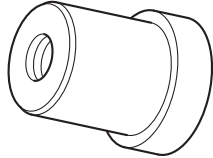
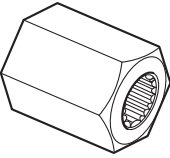
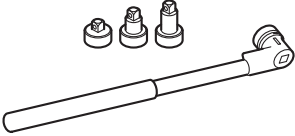
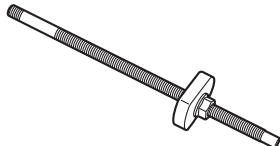
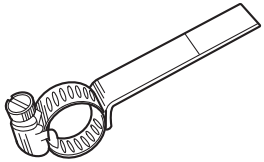
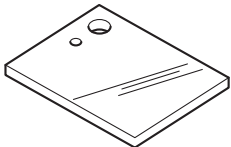

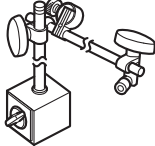
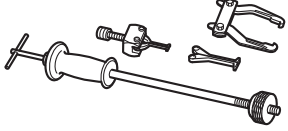
**Special service tool**

<p>Bearing outer race puller assembly 90890-06523</p> 	<p>Bearing outer race attachment 90890-06628</p> 	<p>Pinion shimming gauge 90890-06675</p> 	<p>Pinion shimming gauge rod 90890-06676</p> 
<p>Backlash indicator 90890-06836</p> 	<p>Magnet base plate 90890-07003</p> 	<p>Dial gauge set 90890-03238</p> 	<p>Magnet base B 90890-06844</p> 
<p>Slide hammer handle 90890-06531</p> 	<p>Puller head 90890-06514</p> 	<p>Needle bearing attachment 90890-06607</p> 	<p>Ring nut wrench 90890-06578</p> 
<p>Bush remover 90890-06977</p> 	<p>PTT oil pressure gauge assembly 90890-06580</p> 	<p>Cylinder end screw wrench 90890-06591</p> 	<p>PTT piston vice attachment 90890-06572</p> 
<p>Tilt rod wrench 90890-06569</p> 			

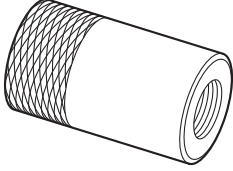
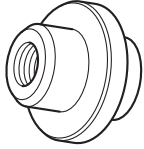
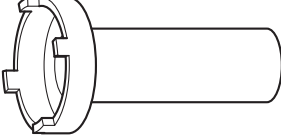
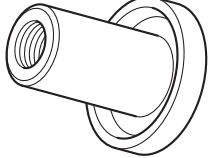
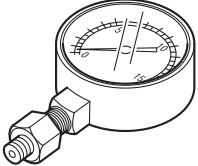
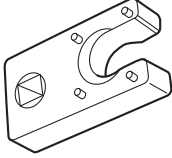
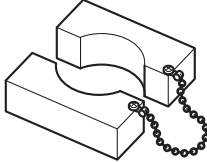
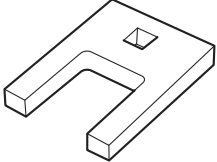
US SST No.

<p>Universal magneto and rotor holder YU-01235</p> 	<p>Drilling plate YB-34465-A</p> 	<p>Digital multimeter YU-34899-A</p> 	<p>Peak volt adapter YU-39991</p> 
<p>Pressure/vacuum tester YB-35956-B</p> 	<p>Fuel pressure gauge adapter YB-06946</p> 	<p>Fuel pressure gauge YU-03153M</p> 	<p>Combination compression gauge and cylinder leakdown test kit YB-45544-A</p> 
<p>Rotor holding tool YM-04166</p> 	<p>Valve spring compressor adaptor YB-06320</p> 	<p>Valve spring compressor YB-06689</p> 	<p>Valve guide remover YB-06801</p> 
<p>Valve guide reamer YB-06804</p> 	<p>Valve lapping tool YM-A8998</p> 	<p>Neway valve seat kit YB-91044</p> 	<p>Oil filter wrench YB-06874</p> 
<p>Driveshaft bearing installer YB-06155</p> 	<p>Driver handle (large) YB-06071</p> 	<p>Roller bearing installer/remover YB-06432</p> 	<p>Bearing housing bearing/oil seal installer YB-06111</p> 

**Special service tool**

<p>Needle bearing remover and installer YB-06346</p> 	<p>Piston slider 96 mm YB-06684</p> 	<p>Driveshaft needle bearing installer and remover YB-06196</p> 	<p>Shift rod socket YB-06681</p> 
<p>Needle bearing attachment YB-06112</p> 	<p>Ring nut wrench 6 YB-06677</p> 	<p>Ring nut wrench extension YB-06513</p> 	<p>Universal Puller YB-06117</p> 
<p>Bearing housing puller YB-06207</p> 	<p>Bearing cup installer YB-06167</p> 	<p>Forward gear needle bearing installer YB-06261</p> 	<p>Driveshaft bearing installer YB-06246</p> 
<p>Driveshaft holder YB-06520</p> 	<p>Pinion nut holder YB-06715</p> 	<p>Pinion gear bushing installer YB-06029</p> 	<p>Backlash indicator YB-06836</p> 
<p>Backlash adjustment plate YB-07003</p> 	<p>Dial indicator gauge YU-03097</p> 	<p>Magnetic base stand YU-A8438</p> 	<p>Slide hammer YB-06096</p> 

**Special service tool**

<p>Propeller shaft and bearing housing remover YB-06335</p>  A cylindrical tool with a textured, knurled section on one end and a smooth section on the other.	<p>Driveshaft installer YB-06244</p>  A cylindrical tool with a threaded section on one end and a smooth section on the other.	<p>Gland nut wrench YB-06578</p>  A tool consisting of a cylindrical handle and a circular head with a split design.	<p>Forward gear bearing installer YB-06345</p>  A cylindrical tool with a threaded section on one end and a smooth section on the other.
<p>PTT pressure gauge YB-06580</p>  A circular gauge with a needle and a threaded connection on the side.	<p>Trim cylinder wrench YB-06175-2B</p>  A U-shaped tool with a central opening and a small notch on one side.	<p>PTT piston vice tool YB-06572</p>  A tool consisting of two rectangular blocks with a central opening and a chain attached to one side.	<p>Tilt rod wrench YB-06569</p>  A U-shaped tool with a central opening and a small notch on one side.

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## Specification

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## Specification data

For specification data, see Appendix, "Specification" (A-1).

## External dimensions

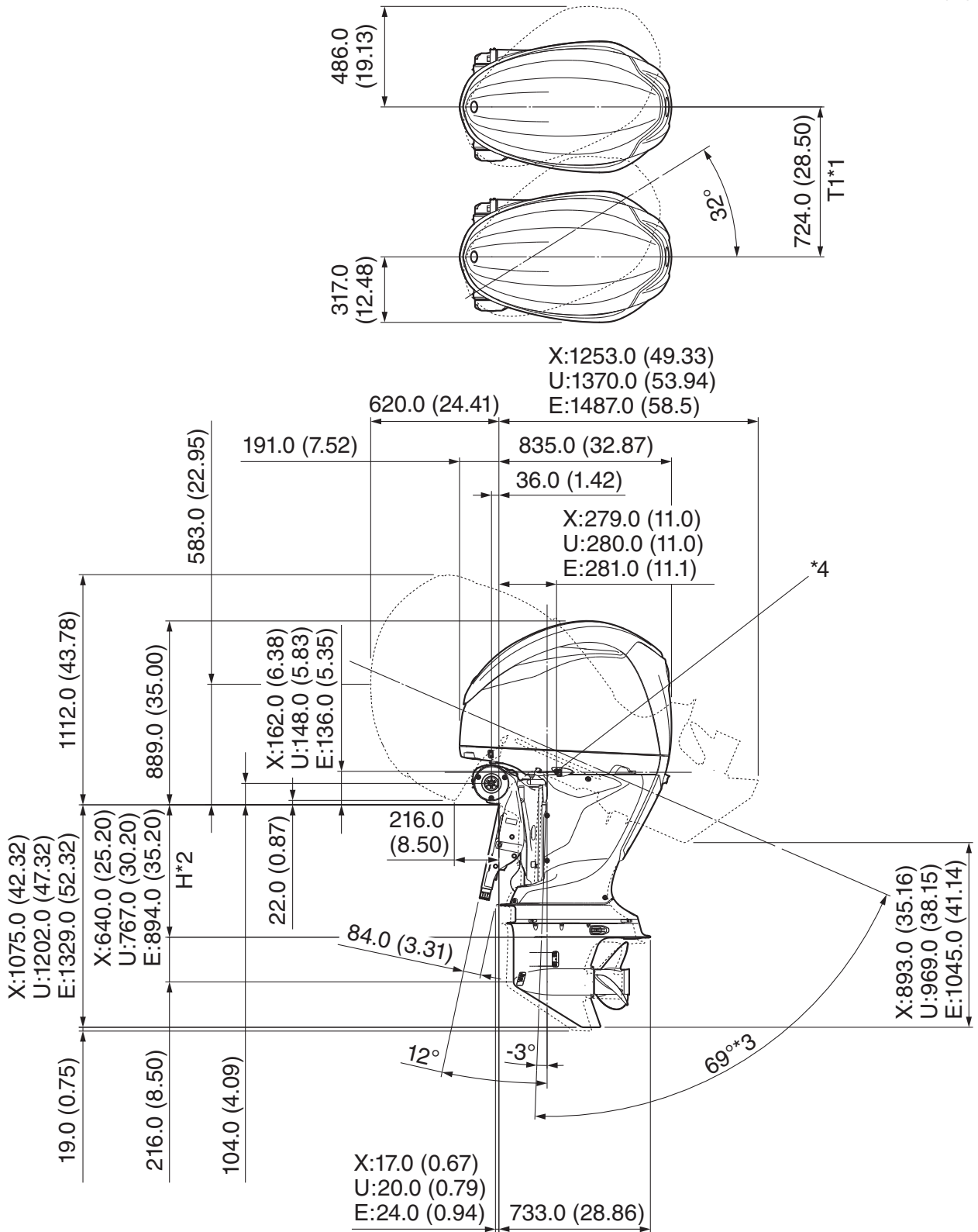
**TIP:** \_\_\_\_\_

The dimension values may include reference values.

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# External dimensions

mm (in)

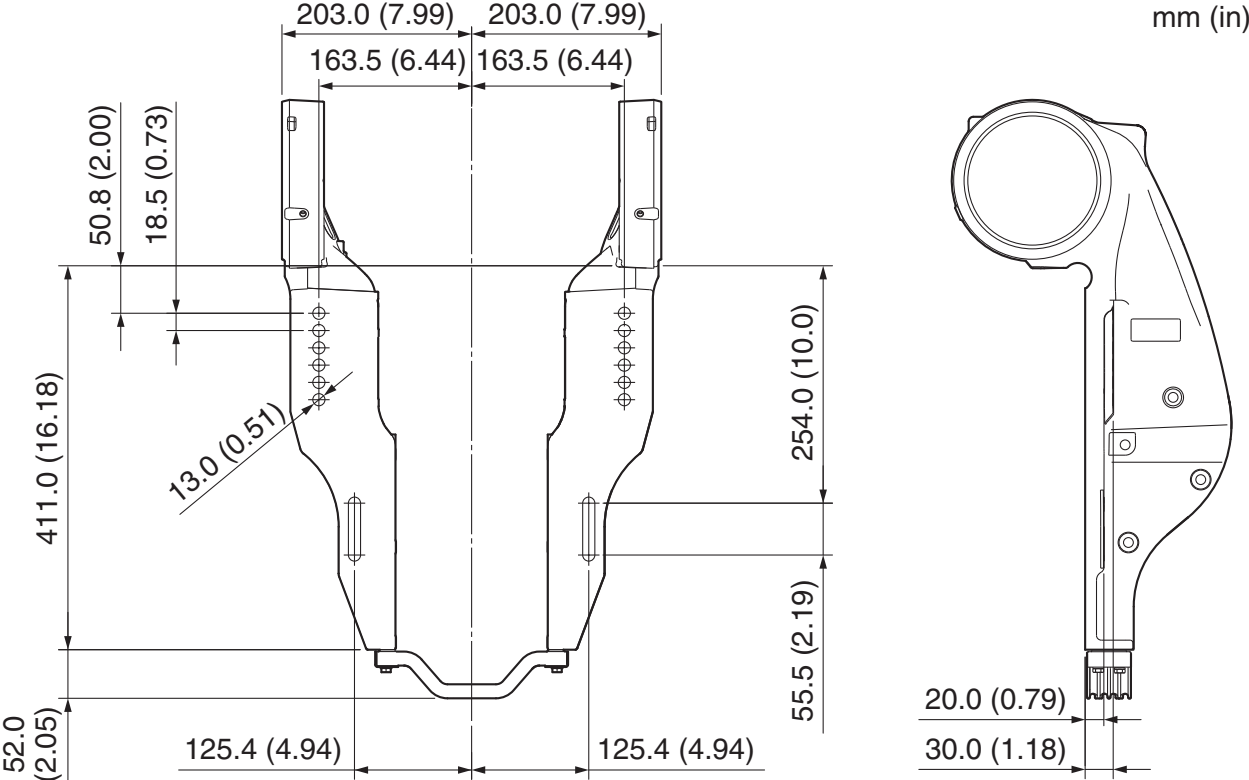


- \*1. Minimum distance between the outboard motors in twin or triple engine application
- \*2. Motor transom height
- \*3. Fully tilt-up angle (Not tilt support angle)
- \*4. Gravity point



### Clamp bracket dimensions

**TIP:** \_\_\_\_\_  
The dimension values may include reference values.



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## Technical feature and description

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## Technical feature and description

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### **Electronic control system**

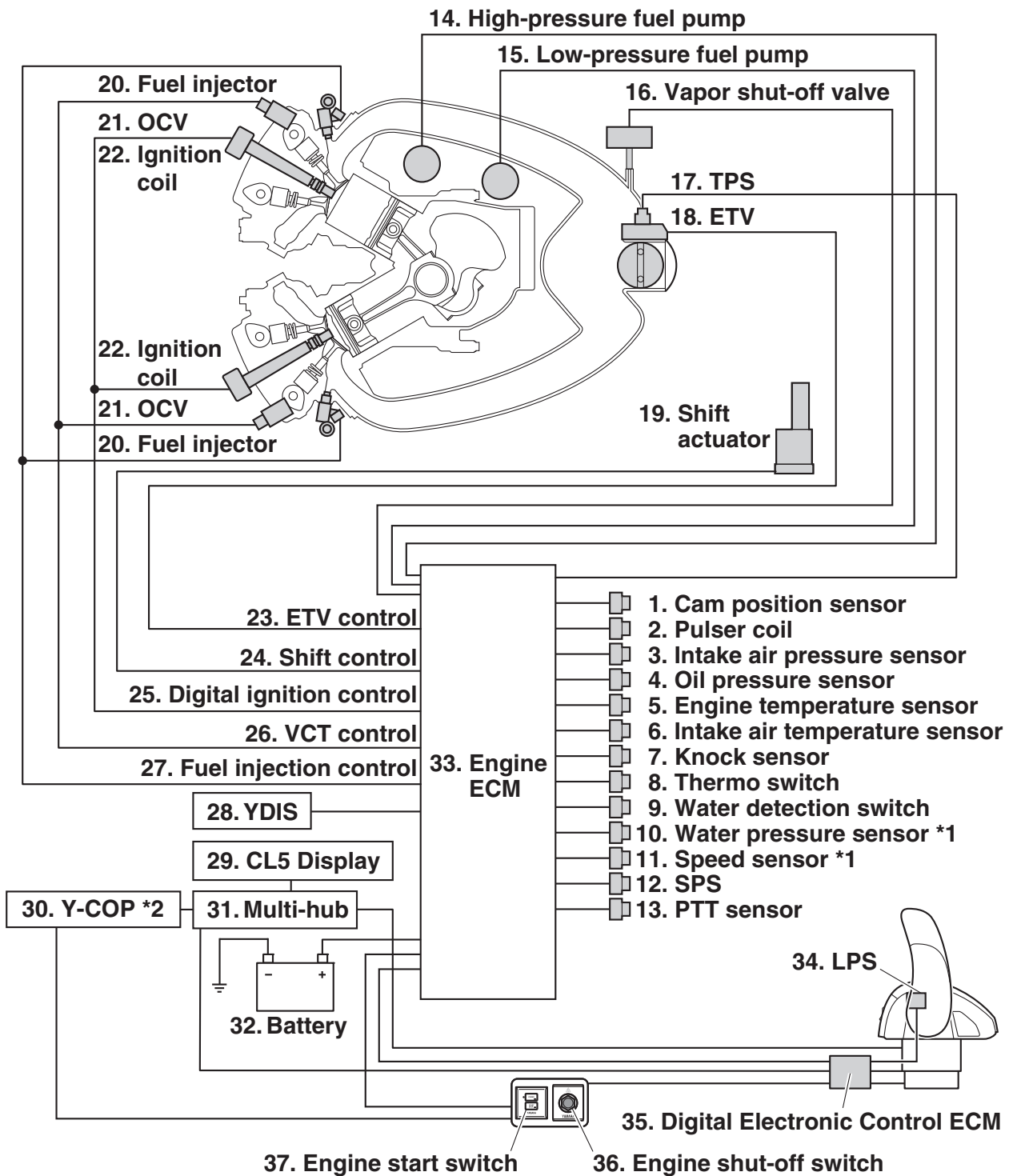
This model uses an electronic fuel injection control, digital ignition control, ETV control, VCT control, knock control, over-revolution control, alert control, and fail-safe control.

The engine ECM performs these controls based on data received from each sensor and switch.

This model supports Digital Electronic Control. Shift-cut control and ETV control are performed based on the signal from the Digital Electronic Control ECM.

The engine ECM is equipped with a self-diagnosis function. This function can be used to check trouble codes on the YDIS.

It is also equipped with Y-COP as an anti-theft measure (optional).



## Electronic control system

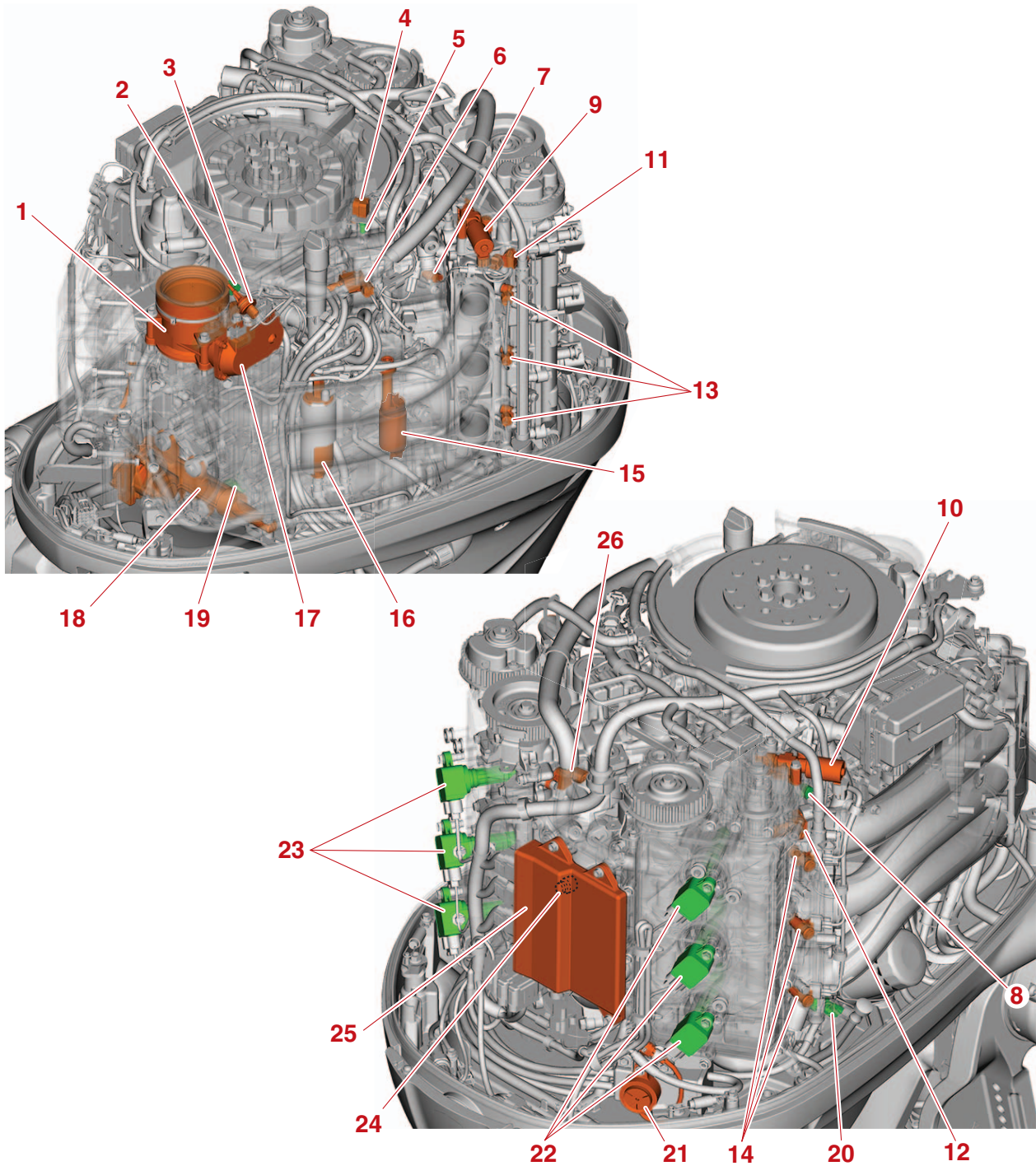
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- |                                  |                                    |
|----------------------------------|------------------------------------|
| 1. Cam position sensor           | 20. Fuel injector                  |
| 2. Pulser coil                   | 21. OCV                            |
| 3. Intake air pressure sensor    | 22. Ignition coil                  |
| 4. Oil pressure sensor           | 23. ETV control                    |
| 5. Engine temperature sensor     | 24. Shift control                  |
| 6. Intake air temperature sensor | 25. Digital ignition control       |
| 7. Knock sensor                  | 26. VCT control                    |
| 8. Thermo switch                 | 27. Fuel injection control         |
| 9. Water detection switch        | 28. YDIS                           |
| 10. Water pressure sensor *1     | 29. CL5 Display                    |
| 11. Speed sensor *1              | 30. Y-COP *2                       |
| 12. SPS                          | 31. Multi-hub                      |
| 13. PTT sensor                   | 32. Battery                        |
| 14. High-pressure fuel pump      | 33. Engine ECM                     |
| 15. Low-pressure fuel pump       | 34. LPS                            |
| 16. Vapor shut-off valve         | 35. Digital Electronic Control ECM |
| 17. TPS                          | 36. Engine shut-off switch         |
| 18. ETV                          | 37. Engine start switch            |
| 19. Shift actuator               |                                    |

\*1. Standard equipment and optional settings depend on the destination.

\*2. Optional

Electrical components



## Electronic control system

Part name		Function
1	ETV	Opens and closes the throttle valve using an electric motor.
2	Intake air pressure sensor	Detects the intake air pressure.
3	Intake air temperature sensor	Detects the intake air temperature.
4	Pulser coil	Detects the engine speed.
		Detects the crankshaft angle and piston positions.
		Determines each group of cylinders (#1 and #4, #2 and #5, and #3 and #6).
5	Engine temperature sensor	Detects the engine temperature.
6	Vapor shut-off valve	Controls the amount of vapor gas to be sent from the vapor separator to the intake system.
7	Thermo switch (PORT)	Detects engine overheating.
8	Thermo switch (STBD)	
9	OCV (PORT)	Advances or retards the intake camshaft timing by switching the oil passages through which the engine oil is sent into the advance chamber or the retard chamber in the rotor vane housing.
10	OCV (STBD)	
11	Cam position sensor (PORT IN)	Detects the advance angle on the intake camshaft.
12	Cam position sensor (STBD IN)	
13	Fuel injector (PORT)	Injects fuel.
14	Fuel injector (STBD)	
15	High-pressure fuel pump	Pressurizes the fuel and sends the fuel to the fuel rail.
16	Low-pressure fuel pump	Sends the fuel from the fuel tank to the vapor separator.
17	TPS (TPS 1, TPS 2)	Detects the throttle valve opening angle. TPS 1 is the main sensor and TPS 2 is the sub sensor. TPS 1 and TPS 2 mutually monitor each other for malfunctions.
18	Shift actuator	The boat direction is shifted between forward, neutral, and reverse based on the signal from the engine ECM.
19	SPS (SPS 1, SPS 2)	Detect the shift position. SPS 1 is the main sensor and SPS 2 is the sub sensor. SPS 1 and SPS 2 mutually monitor each other for malfunctions.
20	Oil pressure sensor	Detects the oil pressure.
21	PTT buzzer	To prevent danger, the PTT buzzer (power unit part) sounds to warn to the surrounding when the PTT TotalTilt™ function is operating.
22	Ignition coil (STBD)	Produces high voltage to ignite a spark plug.
23	Ignition coil (PORT)	
24	Knock sensor	Detects engine knocking.



## Electronic control system

Part name		Function
25	Engine ECM	Determines the engine operating conditions according to the input signals from the sensors and switches which are installed at various locations on the engine, and sends output signals to operate the actuators to perform the various control functions.
26	Cam position sensor (PORT EX)	Determines the stroke of each cylinder according to the signals from both the pulser coil and the cam position sensor (PORT EX).

### Fail-safe

In the fail-safe control, the engine ECM enters the fail-safe control mode when an electrical component malfunctions.

The fail-safe control system records the trouble codes according to the engine trouble conditions.

Item	Trouble conditions to be detected	Controls performed by ECM
Pulser coil	There is a signal from cam position sensor (PORT EX) but no signal from pulser coil.	No control.
Cam position sensor (PORT EX)	No signal from cam position sensor (PORT EX) during 2 rotations of the crankshaft.	Switch to group fuel injection mode. Ignition timing advance angle is limited to BTDC 10°. Set VCT in full retard position. High engine idle speed.
Cam position sensor (STBD IN)	No signal from cam position sensor (STBD IN) during 2 rotations of the crankshaft.	Set VCT in full retard position. High engine idle speed.
Cam position sensor (PORT IN)	No signal from cam position sensor (PORT IN) during 2 rotations of the crankshaft.	Set VCT in full retard position. High engine idle speed.
TPS	TPS 1 output voltage is 0.35 V or less or 4.80 V or more. TPS 2 output voltage is 2.25 V or less or 4.80 V or more. Difference between TPS 1 and TPS 2 voltages is 1.7 V or less or 2.30 V or more.	Set to intake air pressure. Throttle valve is set at specified opening angle. Set VCT in full retard position.
Intake air pressure sensor	Output voltage is less than 0.20 V or more than 4.50 V.	Set to TPS value. High engine idle speed.
Water detection switch	Water detection switch is turned on.	Operates the buzzer.
Engine temperature sensor	Output voltage is less than 0.18 V or more than 4.90 V.	Set to intake air temperature when starting. Set to 40 °C (104 °F) when running. High engine idle speed. Set VCT in full retard position.
Intake air temperature sensor	Output voltage is less than 0.20 V or more than 4.50 V.	Set to 40 °C (104 °F). High engine idle speed.

## Electronic control system

Item	Trouble conditions to be detected	Controls performed by ECM
Oil pressure sensor	Output voltage is less than 0.30 V, more than 4.80 V for 260 seconds, or more than 4.80 V when engine is stopped.	High engine idle speed.
Knock sensor	Output voltage is less than 0.90 V or more than 4.00 V.	High engine idle speed.
PTT sensor	Output voltage is less than 0.20 V or more than 4.80 V.	Deactivate tilt limiter.
Thermo switch	Thermo switch ON when the engine temperature is less than 40 °C (104 °F) or OFF when the engine temperature is more than 215 °C (419 °F).	Thermo switch is always recognized as OFF. High engine idle speed.
PTT buzzer	No signal from PTT buzzer. (When setting the PTT TotalTilt™, the PTT buzzer does not sound even if the PTT switch is pressed.)	The PTT TotalTilt™ operation stops.
OCV	Open or short circuit.	Set VCT in full retard position. High engine idle speed.
SPS	Output voltage is less than 0.29 V or more than 4.60 V. SPS circuit is open or short. Difference between SPS 1 and SPS 2 voltages is more than 0.3 V.	Shift actuator does not operate.
Shift actuator	When the electric current to drive the motor exceeds 4.015 A for 20 seconds. When an SPS failure is detected. When a remote control failure is detected.	Shift control is stopped.
Extension wire harness	Communication error between the engine ECM and Digital Electronic Control.	Fully closed throttle. Shift actuator rod returns to the N position.
LPS	LPS characteristics are abnormal. Both LPS 1 and LPS 2 are malfunctioning.	Fully closed throttle. Shift actuator rod returns to the N position.
SBW	Abnormal information from the steering components is input using Digital Electronic Control.	—
SCU	Abnormal information from the steering components is input using Digital Electronic Control.	—
HELM	Abnormal information from the steering components is input using Digital Electronic Control.	—

## Rigging information

### Crate top cover

The material of the crate top cover, which is used for shipping, has been changed from cardboard to polyethylene (PE).

Because the cover is semi-transparent, the contents of the crate can be seen through the cover, which helps to prevent the forklift operator from accidentally damaging the product with the forklift forks. In addition, a recyclable material was selected in consideration of the environment.



## Bracket unit SBW (Steer by Wire) system

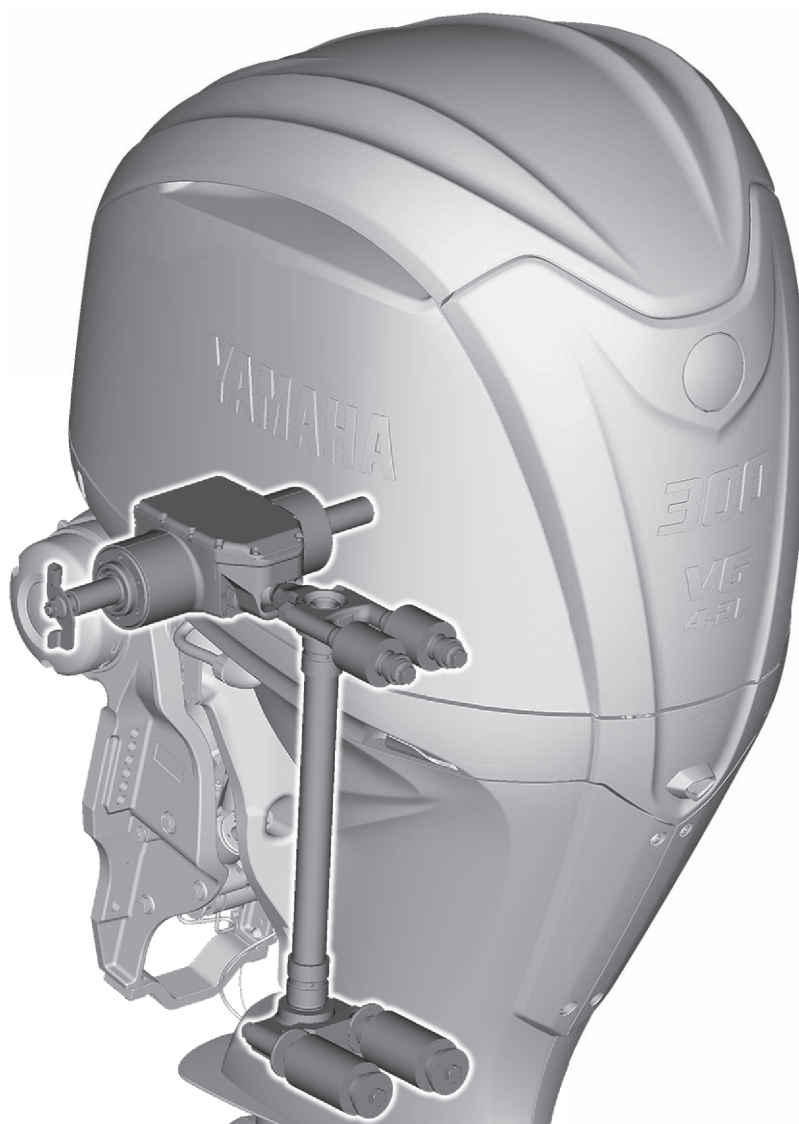
### Outline

The steering system has been changed from a mechanical system that was used for previous models to an electronically controlled power-operated steering system. Because the steering system has been designed with a sufficient margin for use with large boats, the system is responsive and provides a stable feeling when steering the boat.

The system is comprised of an integrated unit that is simple and compact. Because the system has an easy-to-use design that can be used just by connecting the wiring, the time required for rigging is reduced and space is used more efficiently.

For multiple engine applications, because the system is always monitoring the positions of the outboard motors, the system controls the outboard motors to ensure that the appropriate distance is maintained between the outboard motors.

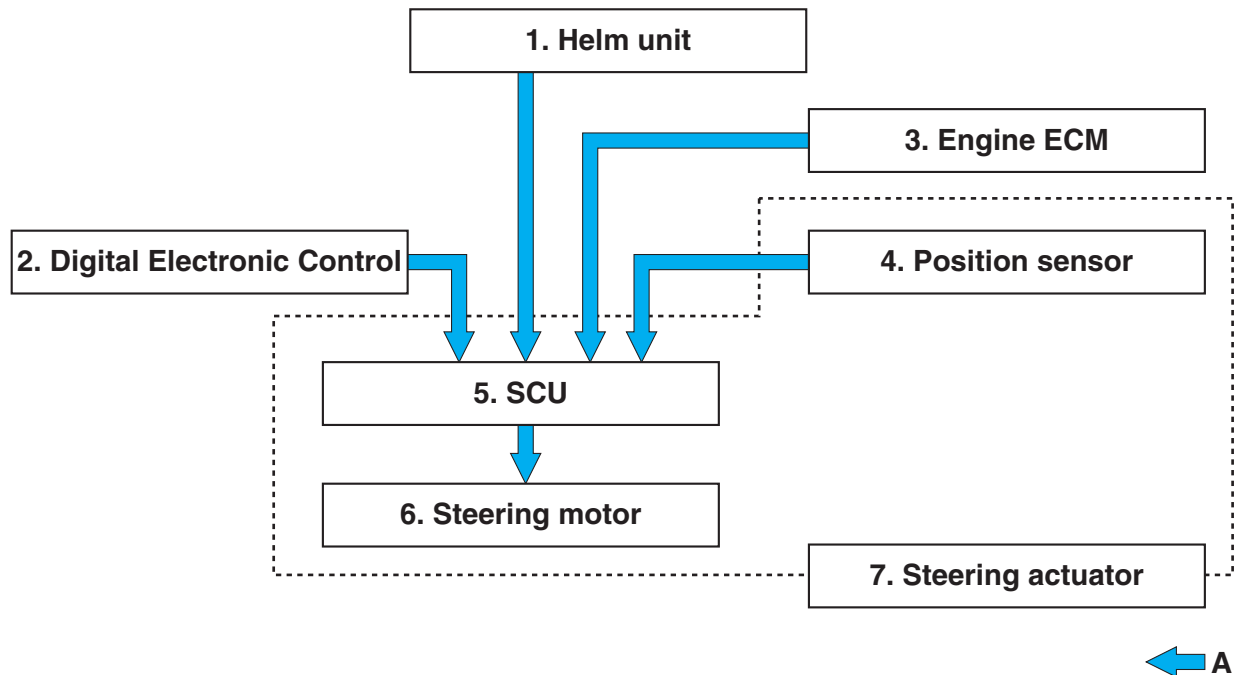
In addition, because the system includes a dual monitoring system, the boat can still be steered using the backup system if a malfunction occurs. Even if a malfunction occurs that prevents the power-operated steering of the boat, the system includes a mechanism for adjusting the steering angle manually.



## System diagram

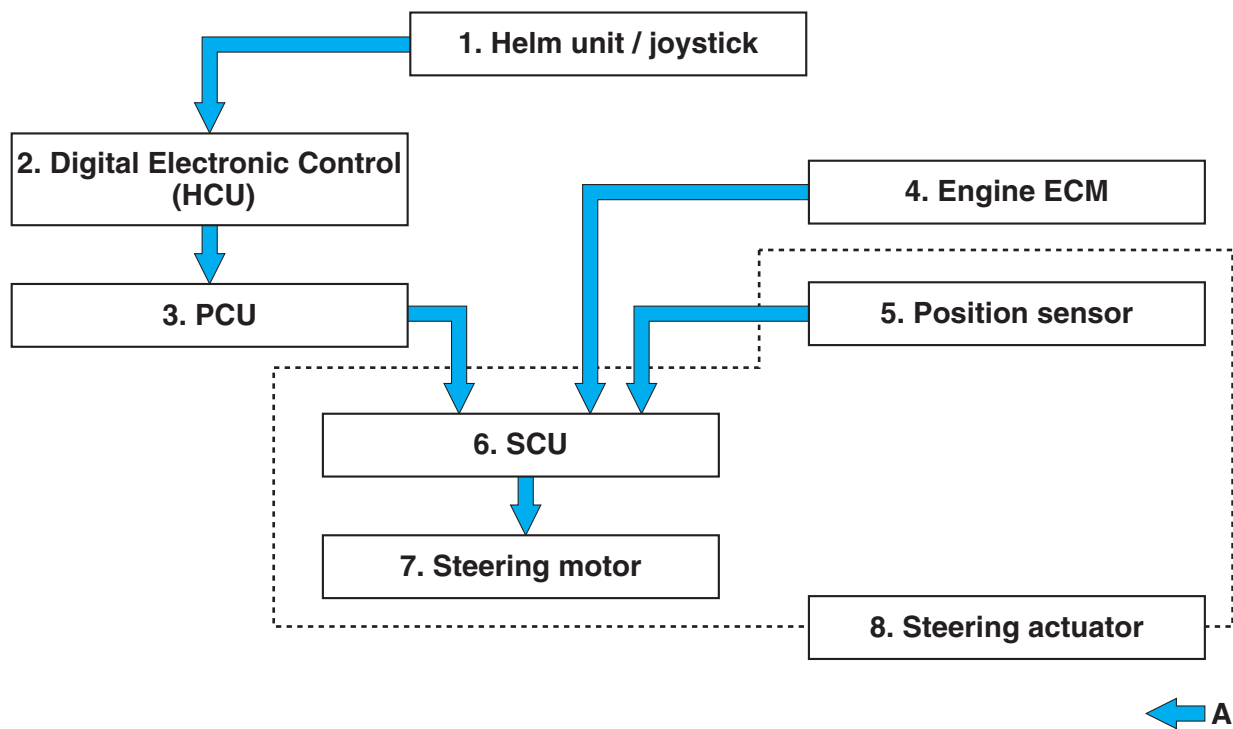
When the signals from the steering wheel and joystick are input into the steering control unit (SCU), the SCU uses that information together with the information from other sensors to calculate the optimal steering control and operates the steering motor to match the intended steering angle of the operator. For multiple engine applications, the system controls the steering angle of each outboard motor so that the boat moves in the intended direction.

### Digital Electronic Control model



1. Helm unit
  2. Digital Electronic Control
  3. Engine ECM
  4. Position sensor
  5. SCU
  6. Steering motor
  7. Steering actuator
- A. Electronic signal

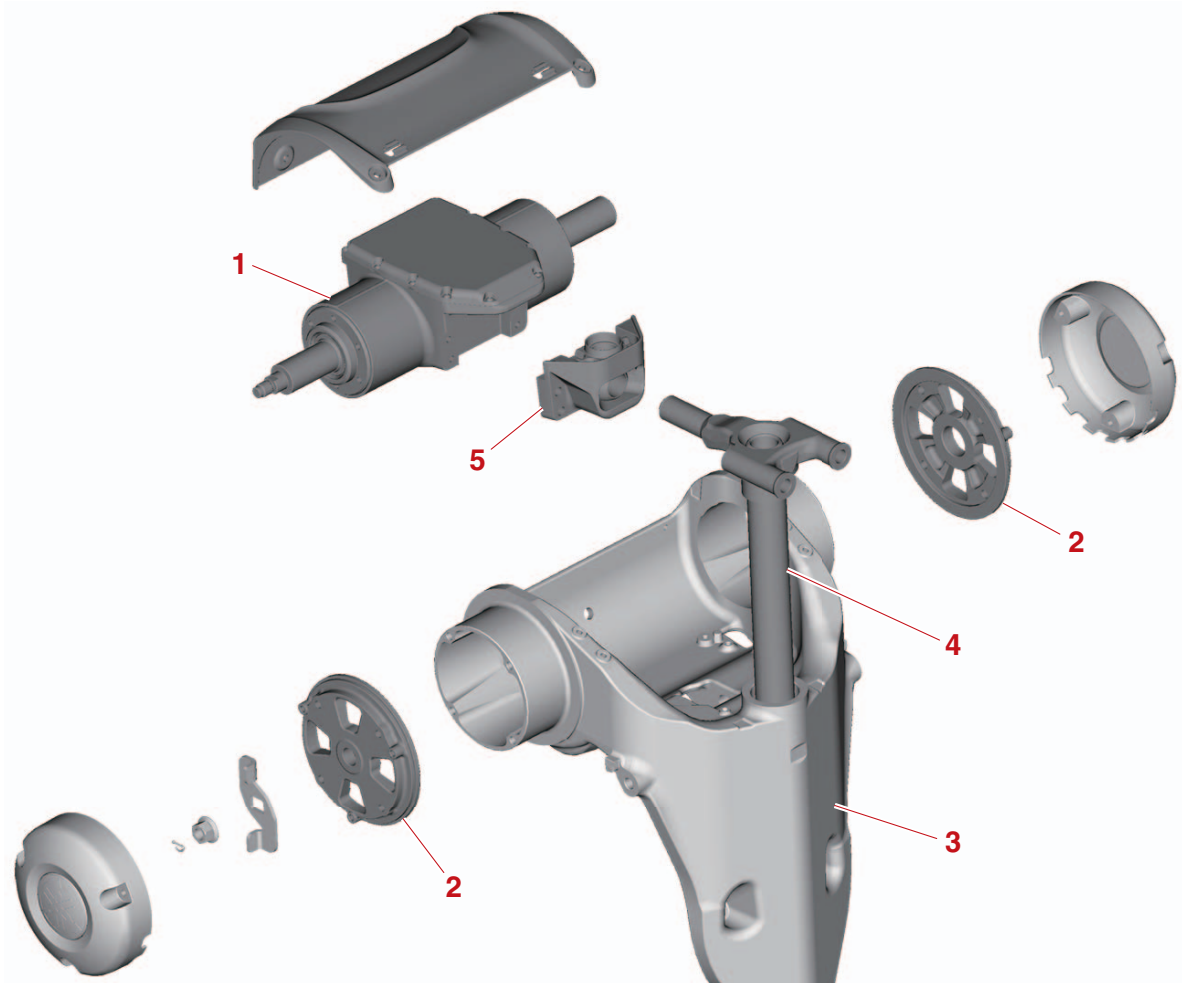
## Helm Master model



1. Helm unit/joystick
  2. Digital Electronic Control (HCU)
  3. PCU
  4. Engine ECM
  5. Position sensor
  6. SCU
  7. Steering motor
  8. Steering actuator
- A. Electronic signal

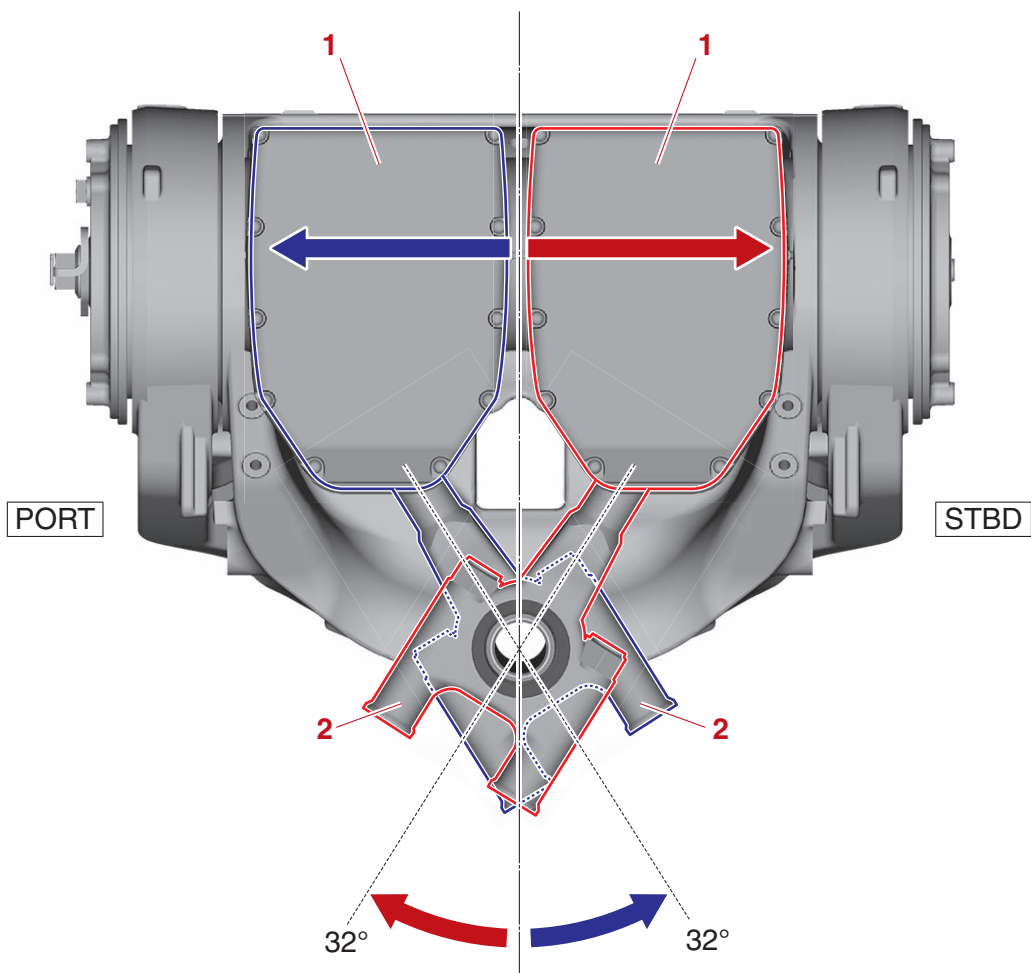
**Structure**

The steering actuator “1” is an integrated unit with a built-in steering control unit (SCU) and a built-in steering motor and cannot be disassembled. The steering motor, which has an integrated pipe, is located inside the actuator on one end and a shaft runs through the center of that pipe. The pipe is supported by a bearing on the other end. When the motor is supplied with power, the pipe turns inside the actuator. The inside of the pipe and the outside of the shaft have threads, which are engaged using planetary gears. The brackets “2” are installed to both ends of the shaft, and the steering actuator is suspended inside the swivel bracket “3”. In addition, the rear of the actuator is connected to the steering arm “4” through the ball joint “5”.



## Operation

When power is supplied to the steering motor inside the steering actuator "1", the pipe integrated with the motor turns. The rotational speed of the pipe is reduced as it is transmitted through the planetary gears to the shaft in the center of the pipe. Because both ends of the shaft are secured to the swivel bracket, the steering actuator moves 2 mm (0.08 in), which is the internal thread pitch distance, in a straight line in the shaft direction for each turn of the pipe. The movement direction of the actuator changes according to the turning direction of the motor. When the steering actuator moves toward the starboard side, the outboard motor is steered to the port side and when the steering actuator moves toward the port side, the outboard motor is steered to the starboard side. Because the rear of the actuator is connected to the steering arm "2", the linear movement of the actuator is converted into turning movement (with the steering arm shaft as the axis) in order to steer the outboard motor.





## Outboard motor manual steering method

If the SBW (Steer by Wire) system does not operate due to a malfunction, the outboard motor can be steered manually.

Usually, the pipe inside the steering actuator moves as it is turned by the motor force, but when the outboard motor is steered manually, the shaft is turned to move the pipe.

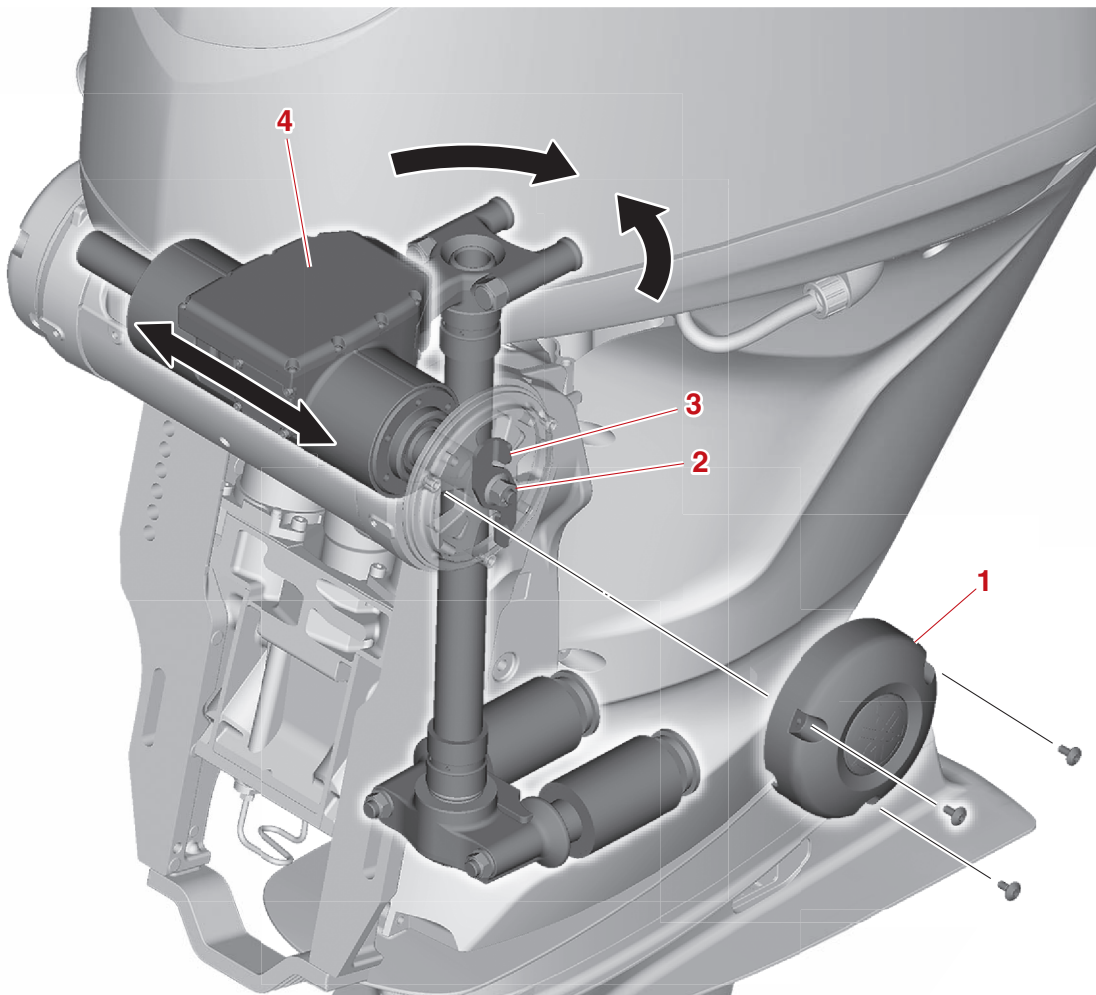
[Steering the outboard motor manually]

1. Remove the clamp bracket cover (PORT) "1" by removing the bolts.
2. Loosen the nut "2" until it contacts the cotter pin.
3. Turn the lever "3" that is installed to the shaft.

### TIP:

When the lever is turned clockwise, the steering actuator "4" moves toward the port side and the outboard motor is steered to the starboard side.

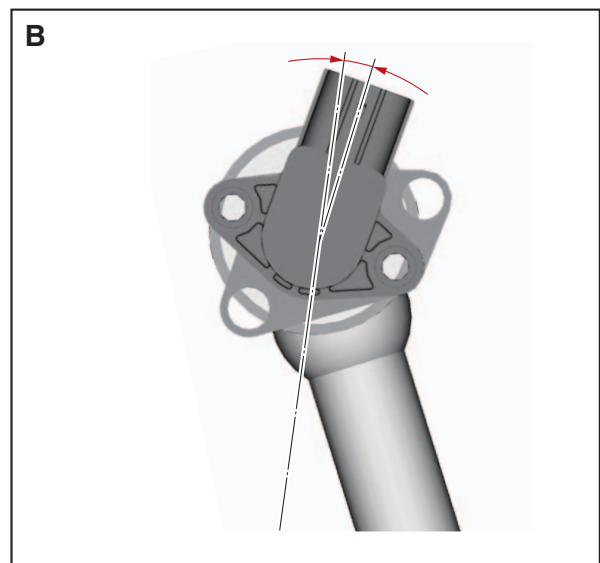
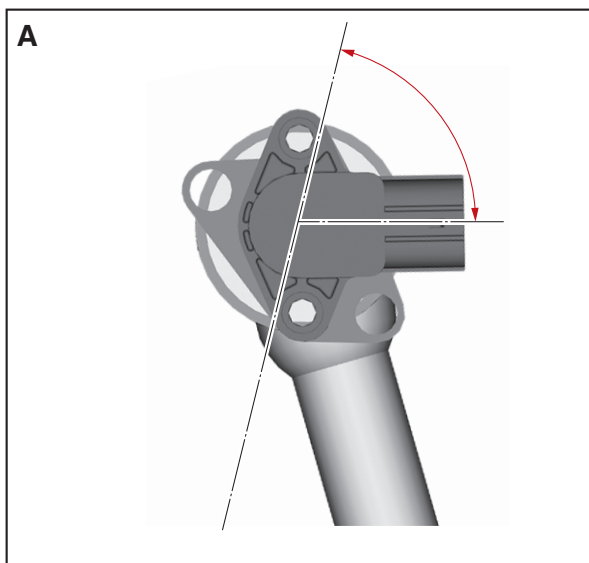
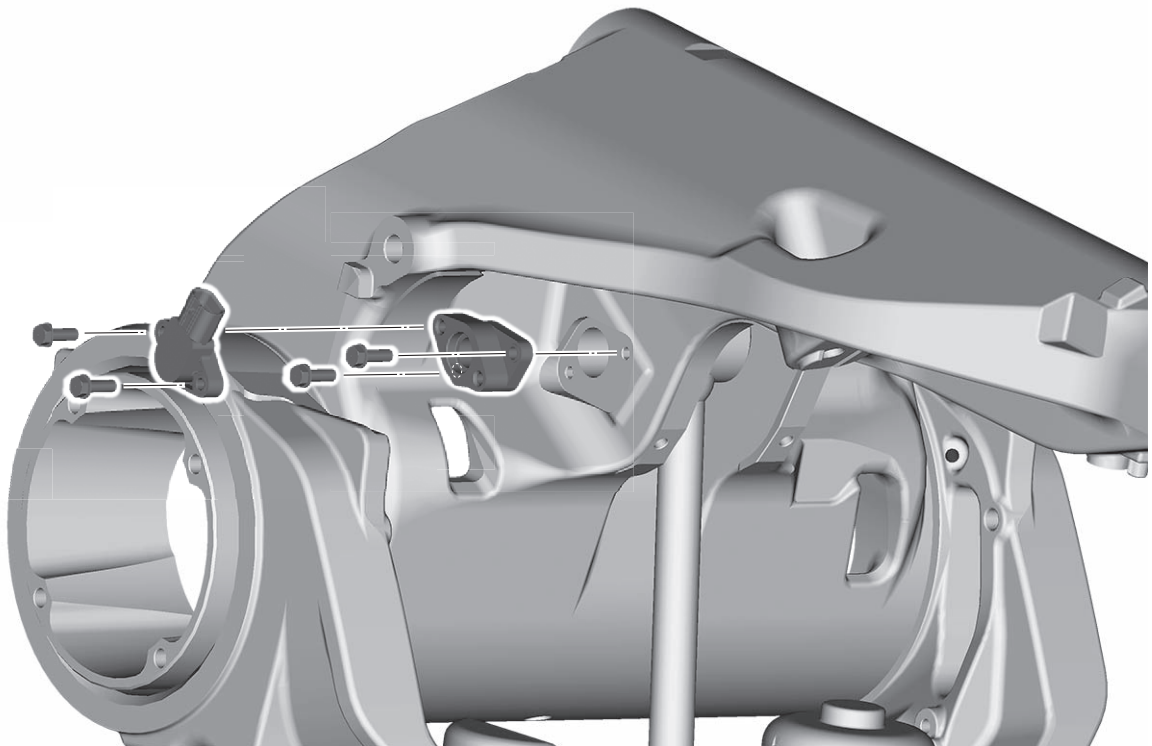
4. When the outboard motor is positioned at the desired steering angle, tighten the nut "2".



**PTT sensor**

This model is equipped with a PTT sensor that detects the trim and tilt angle of the outboard throughout the full range of movement from fully tilted down to fully tilted up. The end of the pin on the tilt rod fits into the PTT sensor that is installed to the swivel bracket. The pin is secured in the tilt rod and when the swivel bracket moves vertically, the relative angle between the pin and the sensor changes. This change is used to detect the trim and tilt angles of the outboard motor. While the outboard motor is tilted up from the fully tilted down position “A”, the relative angle becomes smaller. When the outboard motor is in the fully tilted up position “B”, the PTT sensor is almost parallel to the tilt rod.

In addition, because the sensor is completely waterproof due to its mounting structure, durability is increased.



**PTT TotalTilt™**

This outboard motor is equipped with an automatic PTT tilt function. When this function is activated, you can tilt the outboard motor up/down automatically by pressing the switch twice quickly instead of keeping the PTT switch pushed.

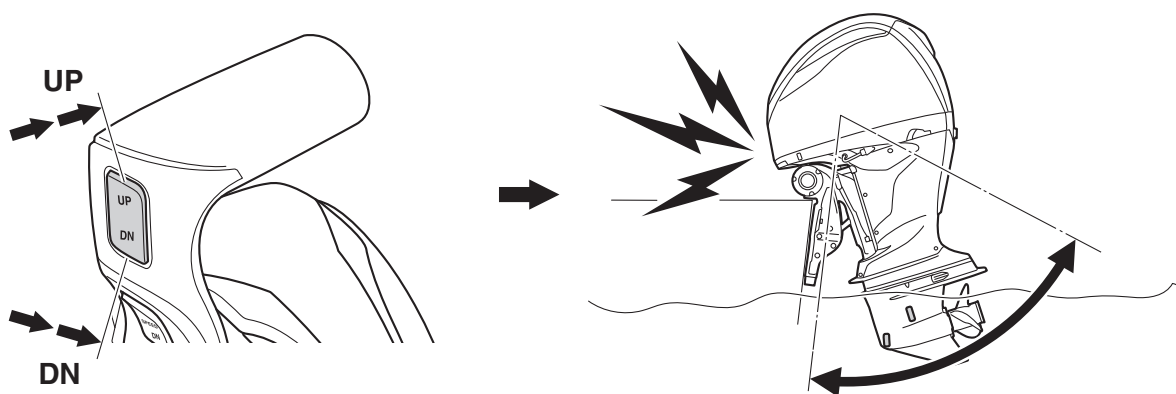
The PTT TotalTilt™ function is available only when the engine is stopped. To prevent danger, the PTT buzzer (power unit part) sounds to warn the surrounding when the PTT TotalTilt™ function is operating.

When tilting up, the outboard motor stops at the set limiter position.

This function is deactivated by default. It can be activated or deactivated by changing the setting.

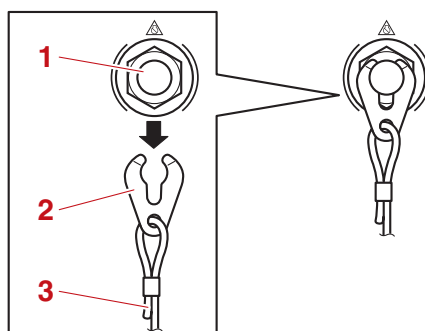
**TIP:**

The PTT switch can be used not only on the remote control lever side, but also on the bottom cowling side.

**Activating and deactivating the PTT TotalTilt™ function****⚠ WARNING**

Make sure that all people are clear of the outboard motor when tilting the outboard motor up and down. Body parts can be crushed between the outboard motor and the clamp bracket when the outboard motor is trimmed or tilted.

1. Fully tilt the outboard motor down.
2. Remove the clip from the engine shut-off switch.

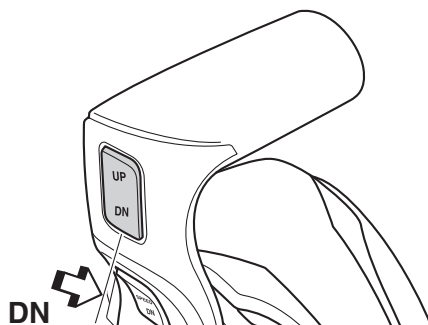


1. Engine shut-off switch
2. Clip
3. Engine shut-off cord (lanyard)

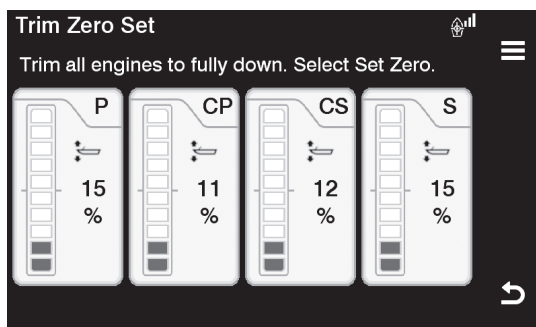
3. Hold the “DN” (down) side of the PTT switch pushed.

**TIP:**

The PTT switch can be used not only on the remote control lever side, but also on the bottom cowling side.



4. Operate the trim zero set while keeping the “DN” (down) side of the PTT switch pushed.

**TIP:**

- For how to operate the trim zero set, see the owner’s manual included with the gauge.
- When the PTT TotalTilt™ function is activated, the PTT buzzer will sound once.
- When the PTT TotalTilt™ function is deactivated, the PTT buzzer will sound twice.

**Automatic tilt-up****⚠ WARNING**

**Make sure that all people are clear of the outboard motor when tilting the outboard motor up and down. Body parts can be crushed between the outboard motor and the clamp bracket when the outboard motor is trimmed or tilted.**

1. Make sure that the PTT TotalTilt™ function is activated.
2. Push the “UP” (up) side of the PTT switch twice quickly.

**TIP:**

- This operation causes the outboard motor to automatically tilt up to the fully tilted-up position and stop.
- If the tilt limiter is installed, the auto tilt up operation causes the outboard motor to automatically tilt up to the angle set by the tilt limiter and stop.
- The PTT buzzer sounds before the automatic operation begins, and sounds intermittently during automatic tilting.
- Pushing the PTT switch briefly during the automatic operation, stops the operation.

---

**Automatic tilt-down****⚠ WARNING**

Make sure that all people are clear of the outboard motor when tilting the outboard motor up and down. Body parts can be crushed between the outboard motor and the clamp bracket when the outboard motor is trimmed or tilted.

---

1. Make sure that the PTT TotalTilt™ function is activated.
2. Push the “DN” (down) side of the PTT switch twice quickly.

**TIP:**

- This function causes the outboard motor to automatically tilt down to the fully trimmed-out position and stop.
  - The PTT buzzer sounds before the automatic operation begins, and sounds intermittently during automatic tilting.
  - Pushing the PTT switch briefly during the automatic operation, stops the operation.
- 

**If automatic tilting does not operate**

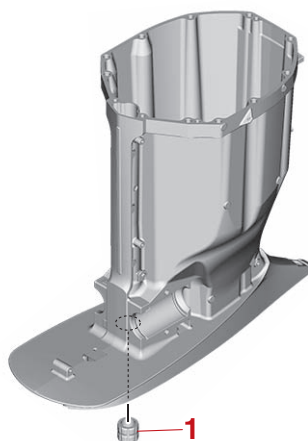
In the following situations, the PTT TotalTilt™ function is deactivated and does not operate. If a malfunction is suspected, check the PTT function.

- The PTT unit is stuck, or foreign matter is preventing the tilting operation. See “PTT unit” (9-27), “PTT motor” (9-36), “PTT gear pump” (9-41), “PTT cylinder” (9-46).
- The PTT buzzer is malfunctioning. See “Checking the PTT buzzer” (5-51).
- The tilt sensor is malfunctioning. See “Checking the PTT sensor” (5-51).

**Upper case****Bushing of the drive shaft**

The passage has been prepared to cool the bushing “1” of the drive shaft.

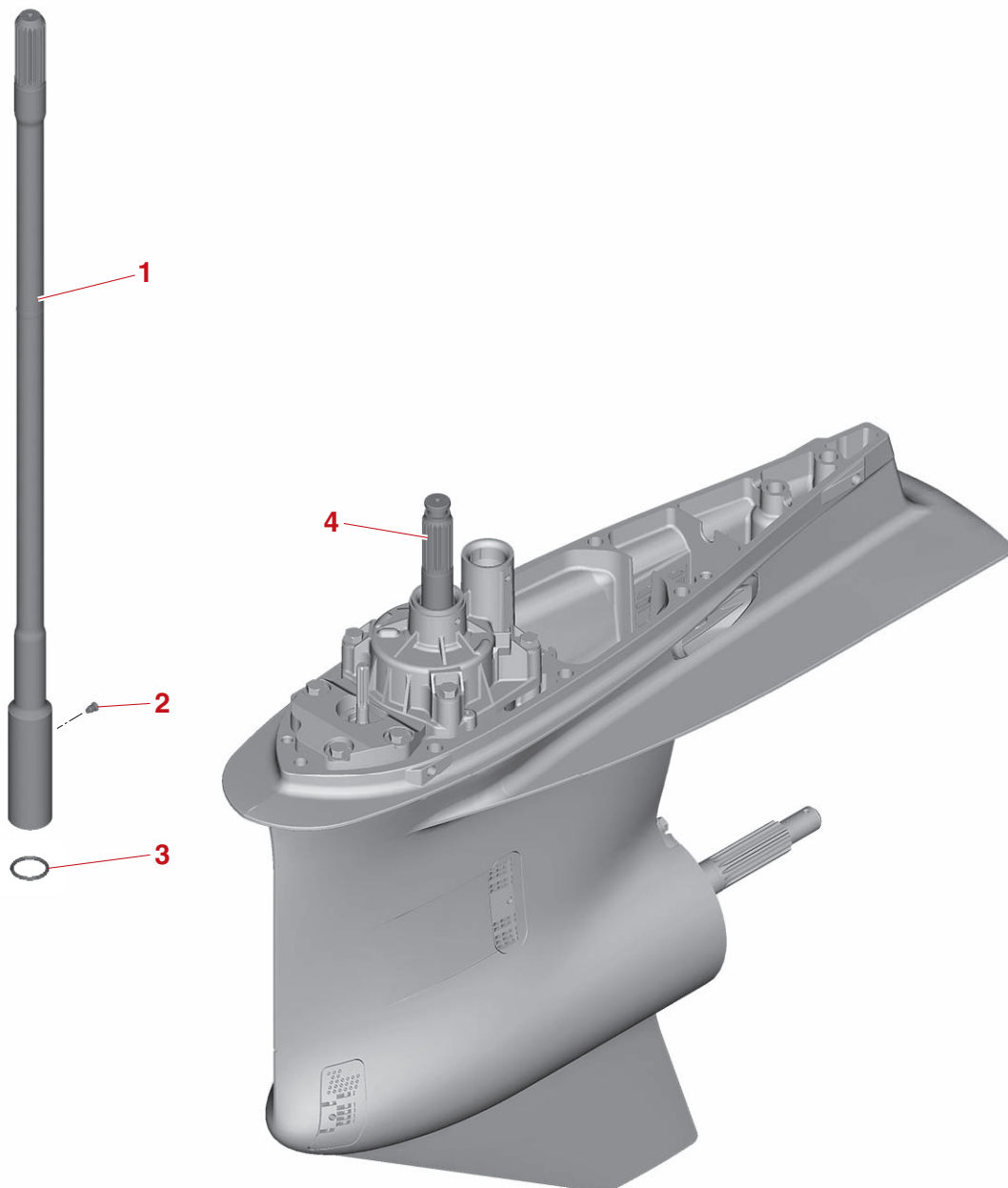
In addition, the adoption of the intermediate drive shaft has changed the position of the bushing to the deeper side.



## Lower unit

### Split-type drive shaft

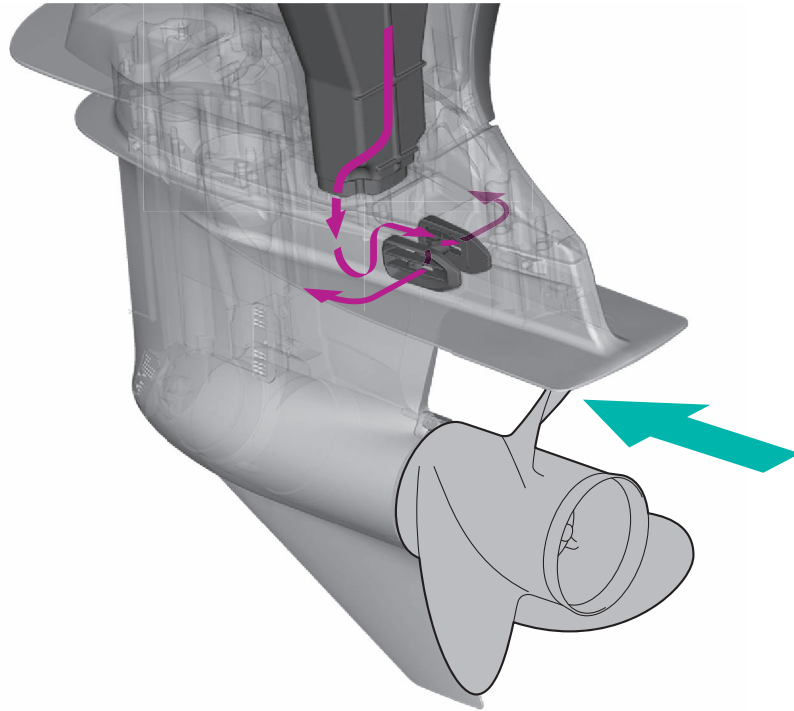
For the newly-designed lower unit, a split-type drive shaft has been adopted. The intermediate shaft is secured to the drive shaft component using a screw. The change of the shaft length has enabled the integrated lower unit to support a wider range of transoms. In addition, the removal of the intermediate shaft has facilitated easy servicing and storage.



1. Intermediate shaft
2. Screw
3. O-ring
4. Drive shaft

**Reverse thrust**

The outboard motor has a structure that discharges the exhaust gas from above the anti-cavitation plate when the remote control lever is in the R position and the engine speed is 2000 r/min or less. As a result, propeller cavitation can be prevented when the outboard motor is operating in reverse. In addition, thrust when operating in reverse and stopping performance have been improved, while vibration and noise are lower. For boats that are equipped with Helm Master, performance when moving sideways has been improved.



- A. Exhaust gas flow
- B. Water flow

## Engine ECM

### PTT protection control

PTT protection control system prevents damage to PTT unit, bracket and other related components when the engine speed becomes excessively high while the outboard motor is raised higher than its trim range. The engine speed is limited to the given rpm or below by the system if the PTT sensor output voltage exceeds the specification value.

Model		PTT sensor output voltage (or higher)	RPM limitation
F300FST, F300SB	6KA	2.095 V	1551 r/min
FL300FST, LF300SB	6KB		
F250NST, F250SB	6KD		
FL250NST, LF250SB	6KE		

## Fuel system

### High-pressure fuel pump control

The high-pressure fuel pump operates for 5 seconds after the engine start switch is turned to ON, and always operates while the engine is running.

The fuel pump continues to operate for 1 second after the engine is turned OFF.

#### TIP:

After the engine start switch is turned to ON, all injectors are activated one time to prevent clogging before the high-pressure fuel pump operates.

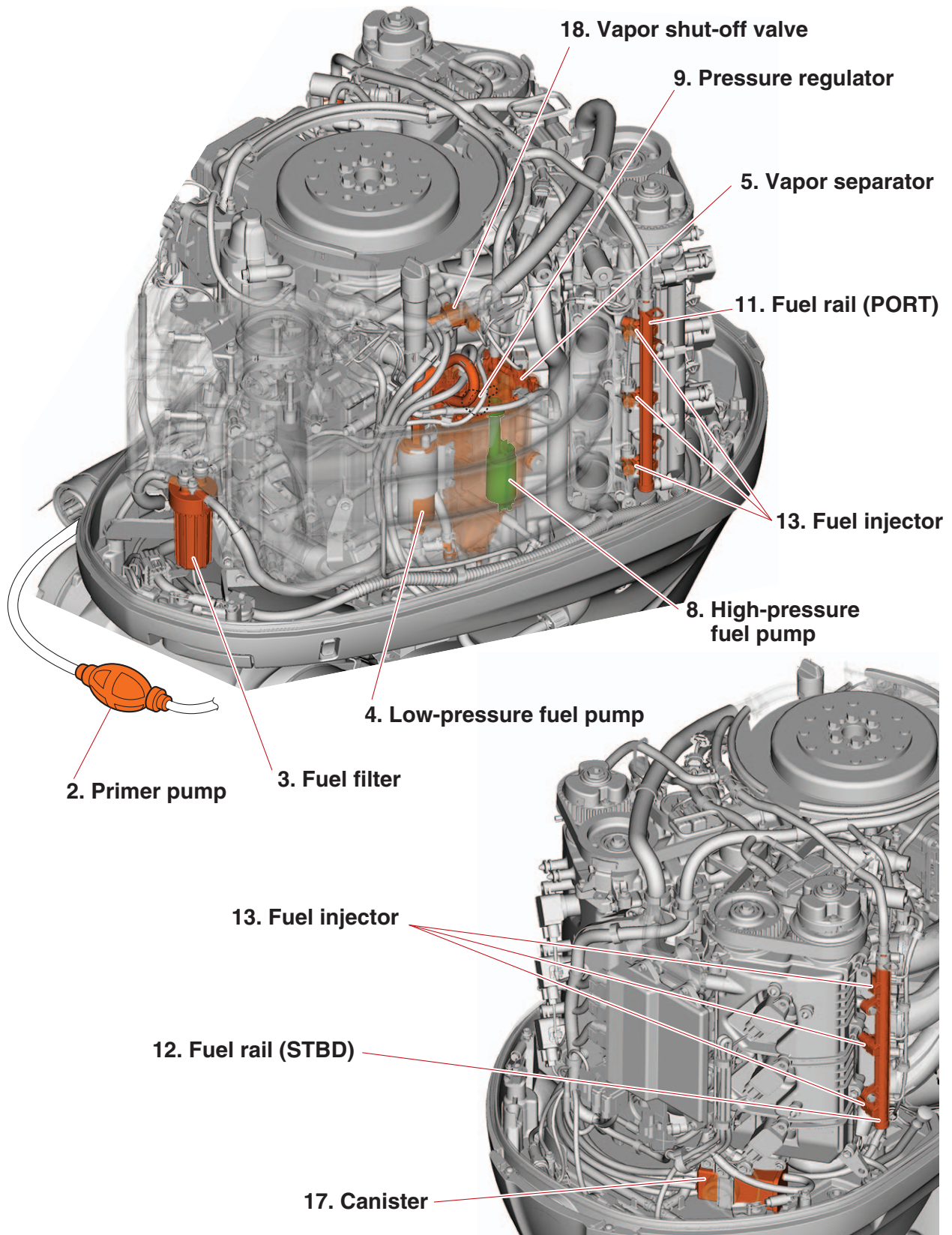
### Low-pressure fuel pump control

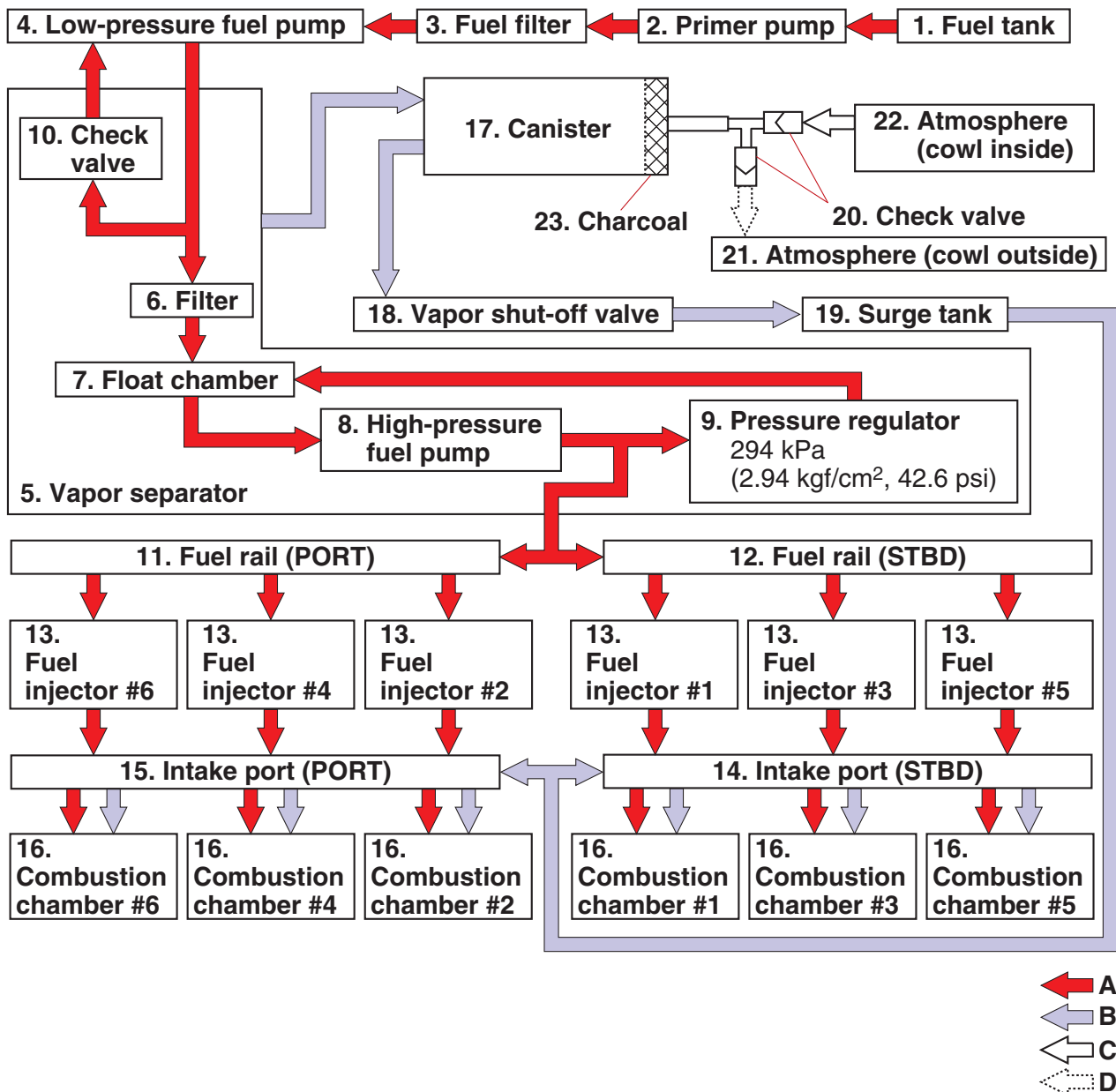
Between idle and 1100 r/min, the pump will cycle ON for 10 seconds and OFF for 20 seconds.

Above 1100 r/min, the pump is ON continuously.



Fuel diagram

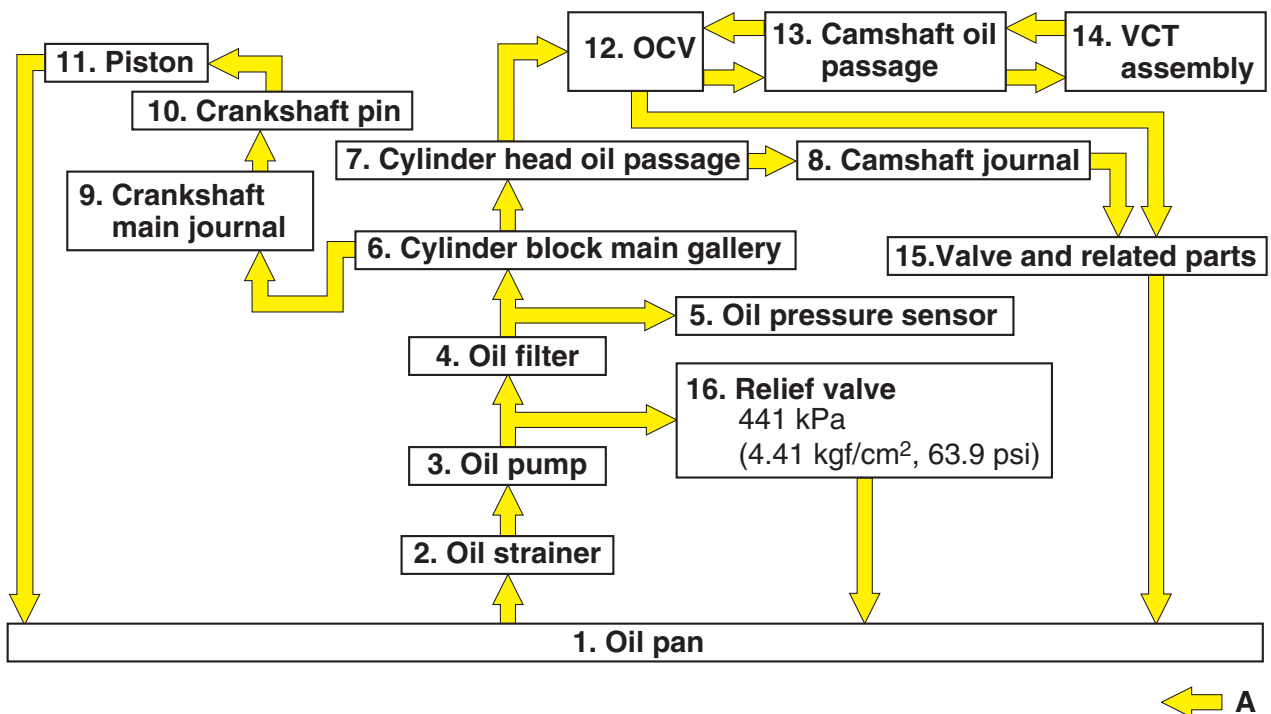
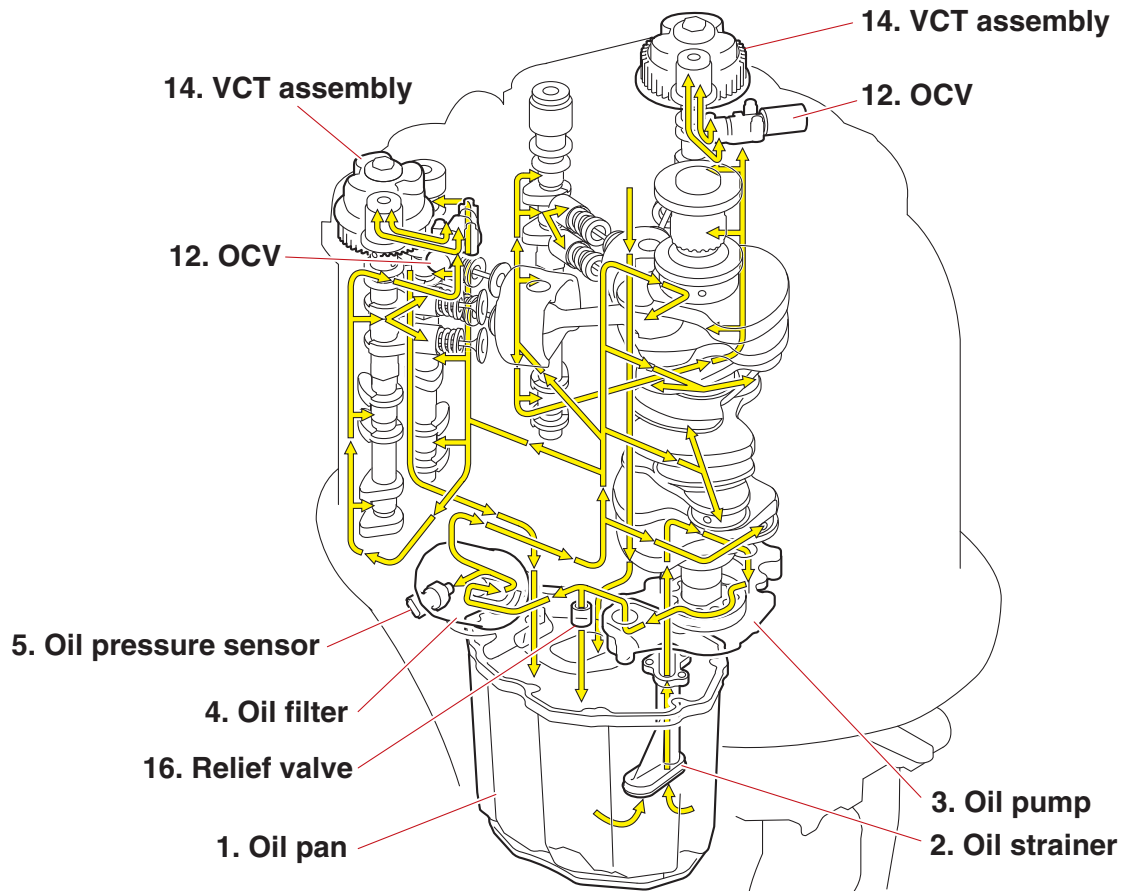




- 1. Fuel tank
- 2. Primer pump
- 3. Fuel filter
- 4. Low-pressure fuel pump
- 5. Vapor separator
- 6. Filter
- 7. Float chamber
- 8. High-pressure fuel pump
- 9. Pressure regulator
- 10. Check valve
- 11. Fuel rail (PORT)
- 12. Fuel rail (STBD)
- 13. Fuel injector
- 14. Intake port (STBD)
- 15. Intake port (PORT)

- 16. Combustion chamber
- 17. Canister
- 18. Vapor shut-off valve
- 19. Surge tank
- 20. Check valve
- 21. Atmosphere (cowl outside)
- 22. Atmosphere (cowl inside)
- 23. Charcoal
- A. Fuel flow
- B. Vapor gas flow
- C. Air flow
- D. Purified gas flow

**Lubrication system**  
**Lubrication diagram**

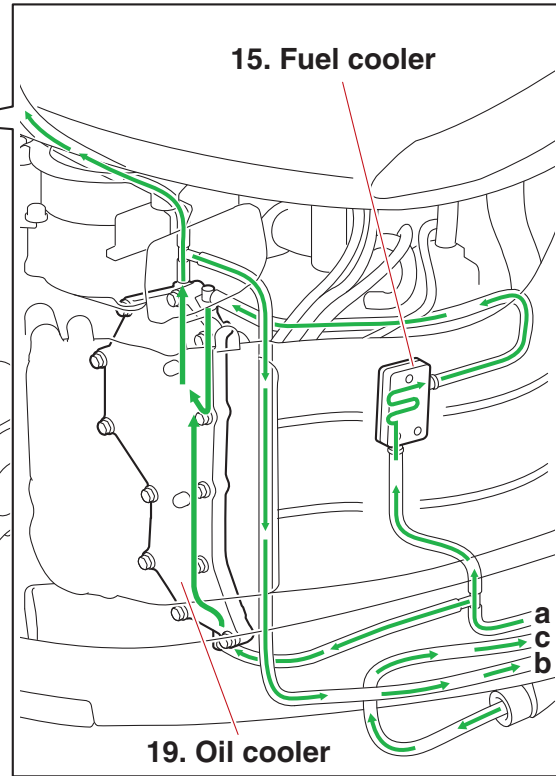
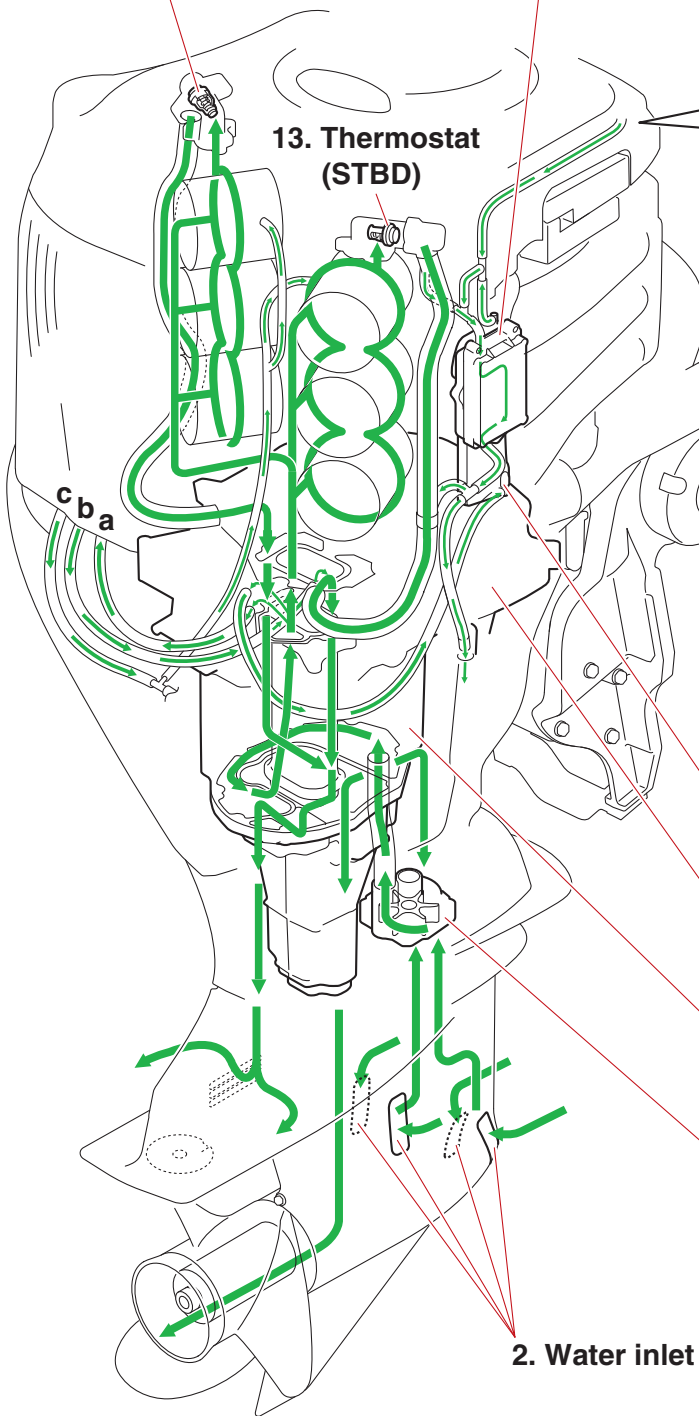


1. Oil pan
  2. Oil strainer
  3. Oil pump
  4. Oil filter
  5. Oil pressure sensor
  6. Cylinder block main gallery
  7. Cylinder head oil passage
  8. Camshaft journal
  9. Crankshaft main journal
  10. Crankshaft pin
  11. Piston
  12. OCV
  13. Camshaft oil passage
  14. VCT assembly
  15. Valve and related parts
  16. Relief valve
- A. Engine oil flow

**Cooling system**  
**Cooling diagram**

10. Thermostat (PORT)

17. Rectifier/regulator/isolator



13. Thermostat (STBD)

15. Fuel cooler

19. Oil cooler

16. Cooling water cover

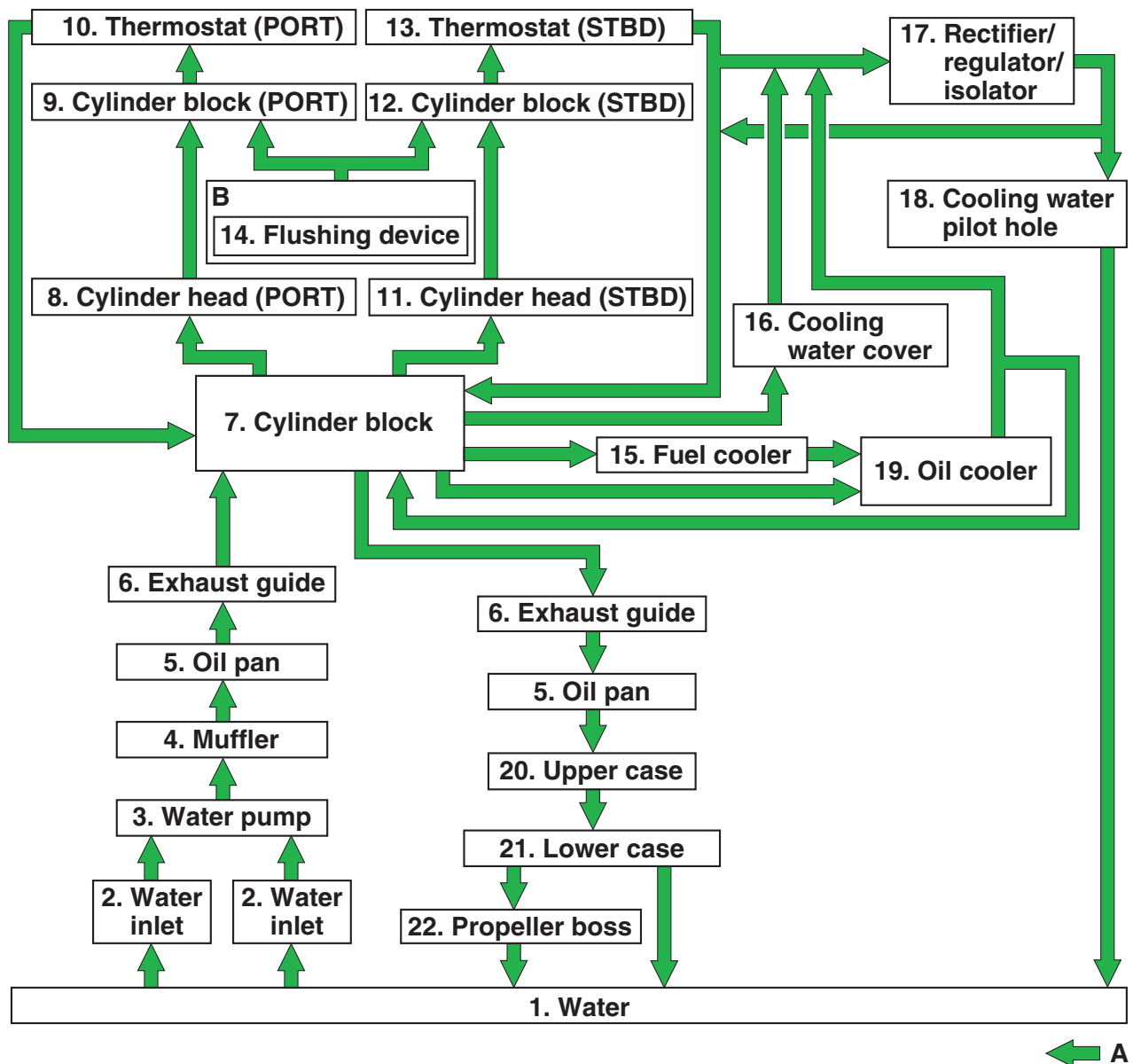
6. Exhaust guide

5. Oil pan

3. Water pump

2. Water inlet

## Cooling system



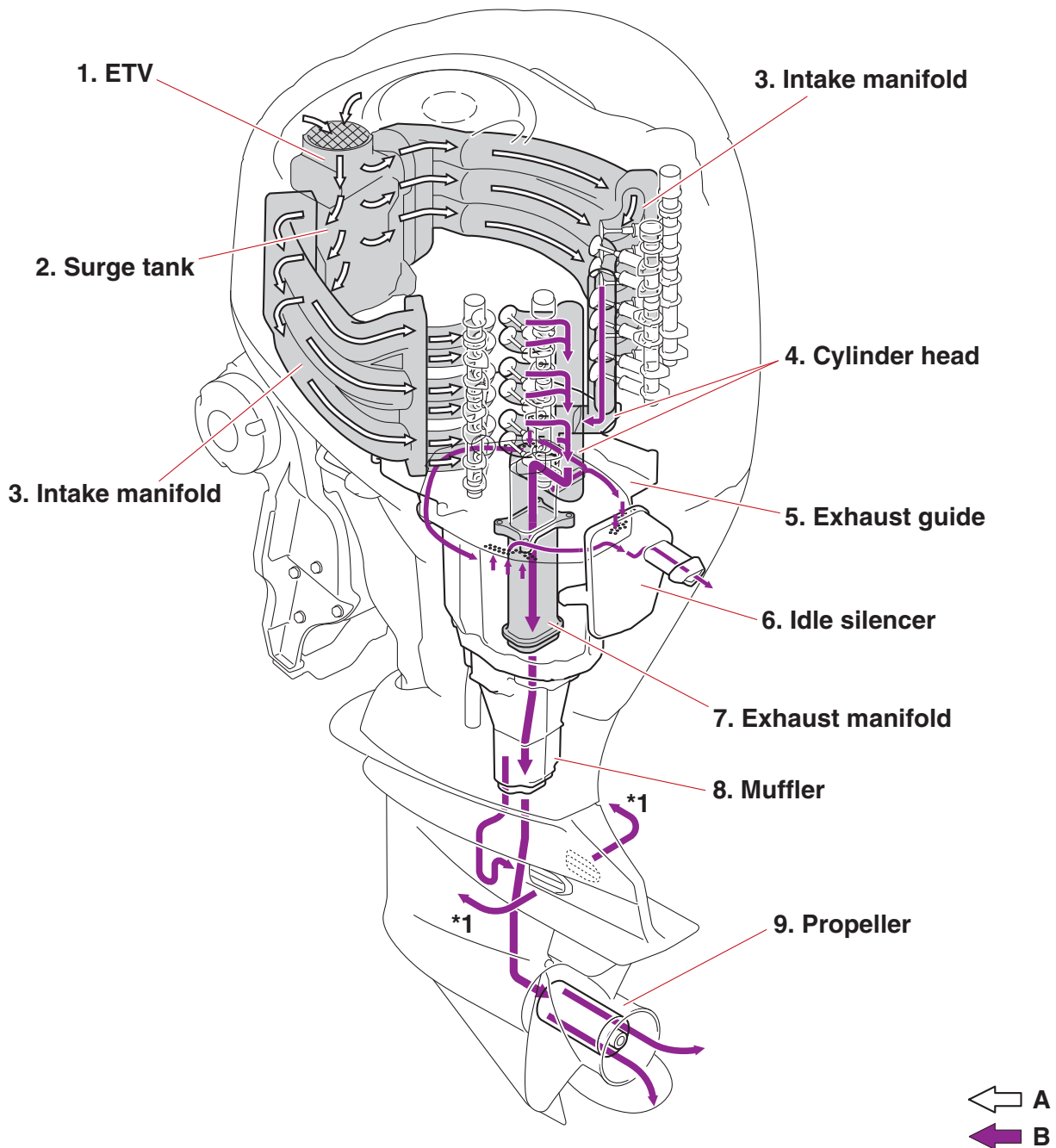
1. Water
2. Water inlet
3. Water pump
4. Muffler
5. Oil pan
6. Exhaust guide
7. Cylinder block
8. Cylinder head (PORT)
9. Cylinder block (PORT)
10. Thermostat (PORT)
11. Cylinder head (STBD)
12. Cylinder block (STBD)
13. Thermostat (STBD)
14. Flushing device
15. Fuel cooler
16. Cooling water cover

17. Rectifier/regulator/isolator
18. Cooling water pilot hole
19. Oil cooler
20. Upper case
21. Lower case
22. Propeller boss

- A. Cooling water flow
- B. When flushing the cooling water passages



**Intake and exhaust system**  
**Intake and exhaust diagram**



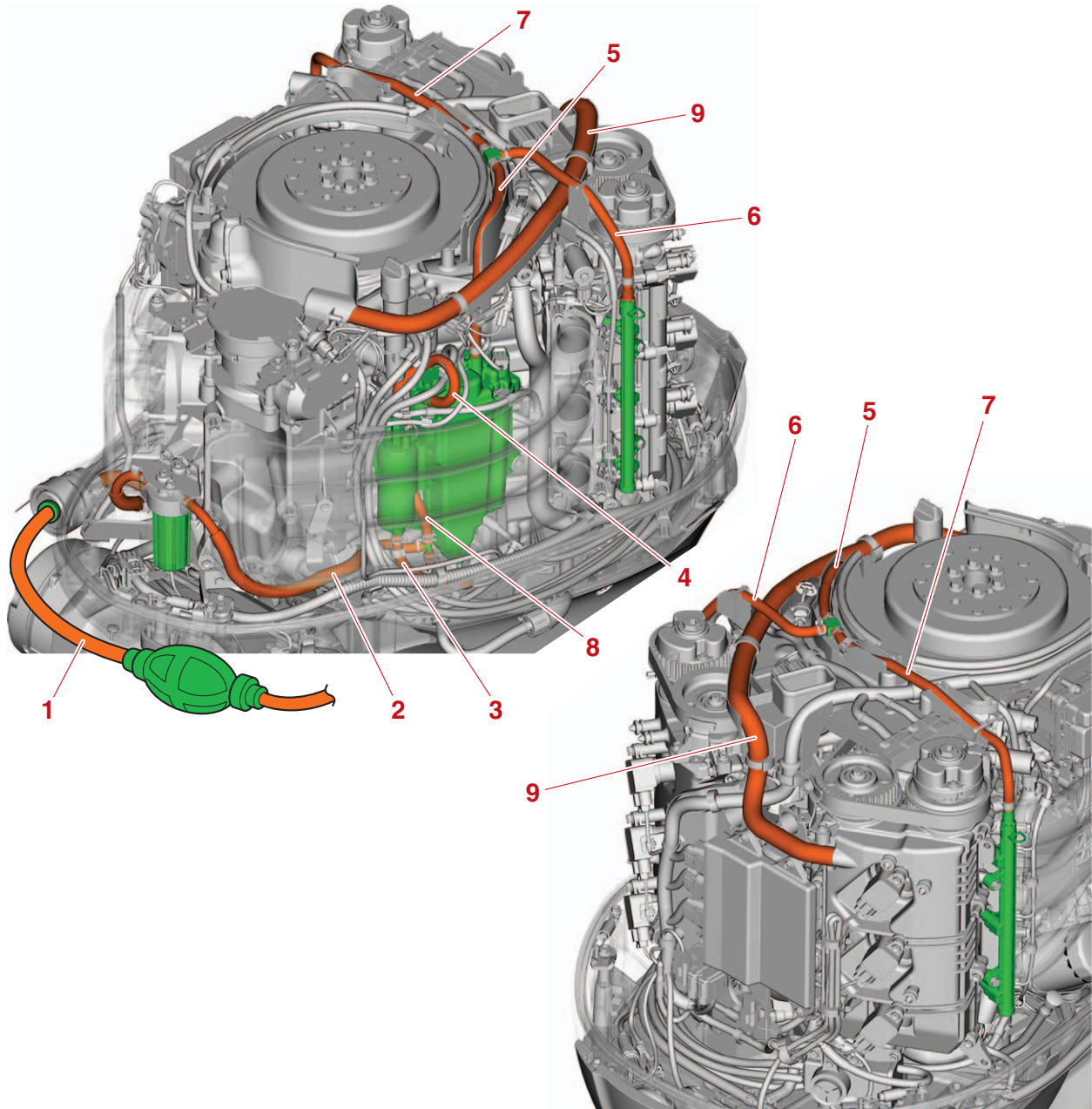
- 1. ETV
- 2. Surge tank
- 3. Intake manifold
- 4. Cylinder head
- 5. Exhaust guide
- 6. Idle silencer

- 7. Exhaust manifold
- 8. Muffler
- 9. Propeller
- A. Intake air flow
- B. Exhaust gas flow

\*1. When the remote control lever is in the R position and the engine speed is 2000 r/min or less

## Hose routing

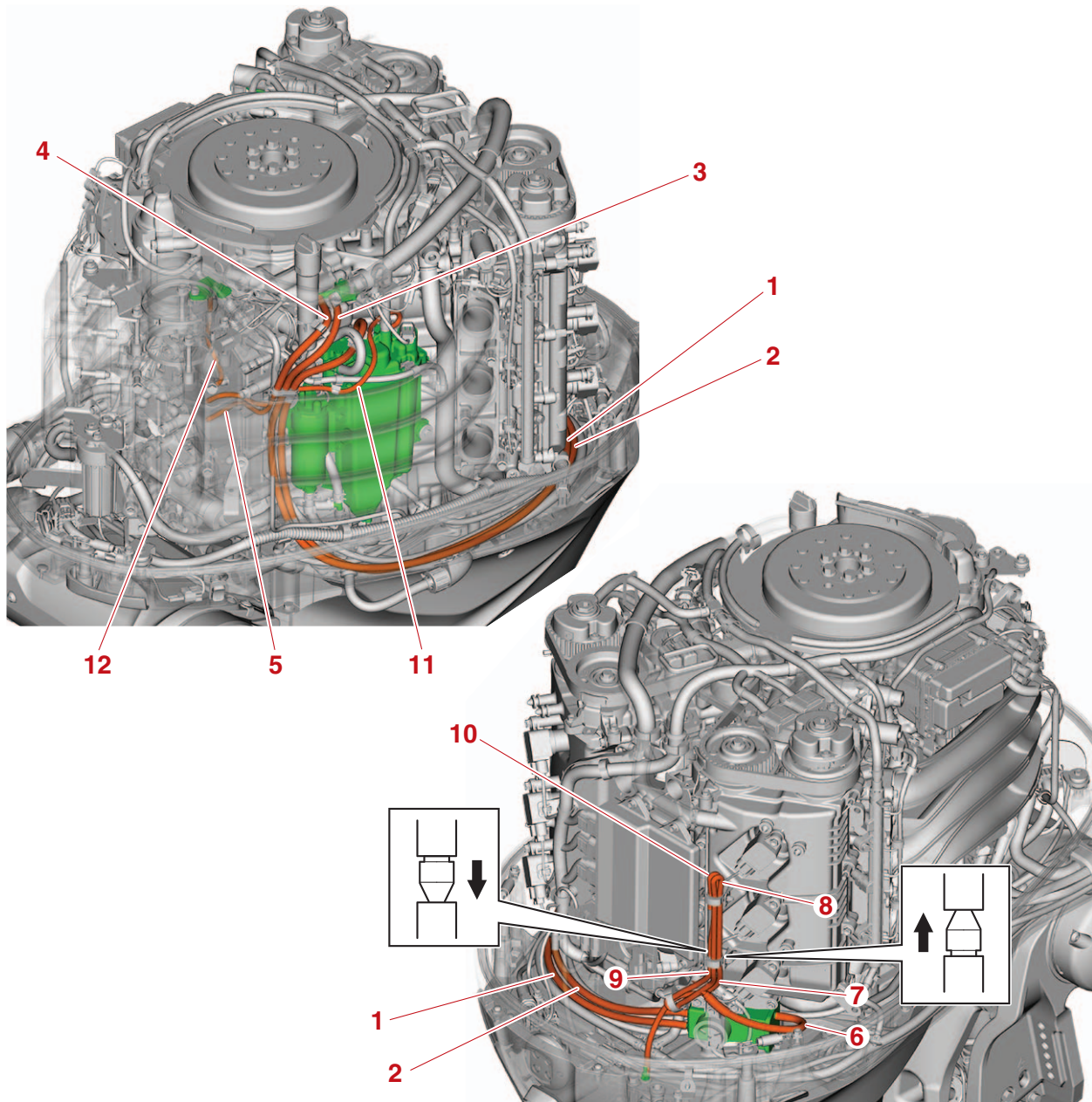
### Fuel hose and blowby hose



1. Joint to fuel filter assembly
2. Fuel filter assembly to joint
3. Joint to low-pressure fuel pump
4. Low-pressure fuel pump to vapor separator
5. Vapor separator to joint
6. Joint to quick connector (PORT)
7. Joint to quick connector (STBD)
8. Vapor separator to joint
9. Cylinder head cover (PORT) to intake silencer

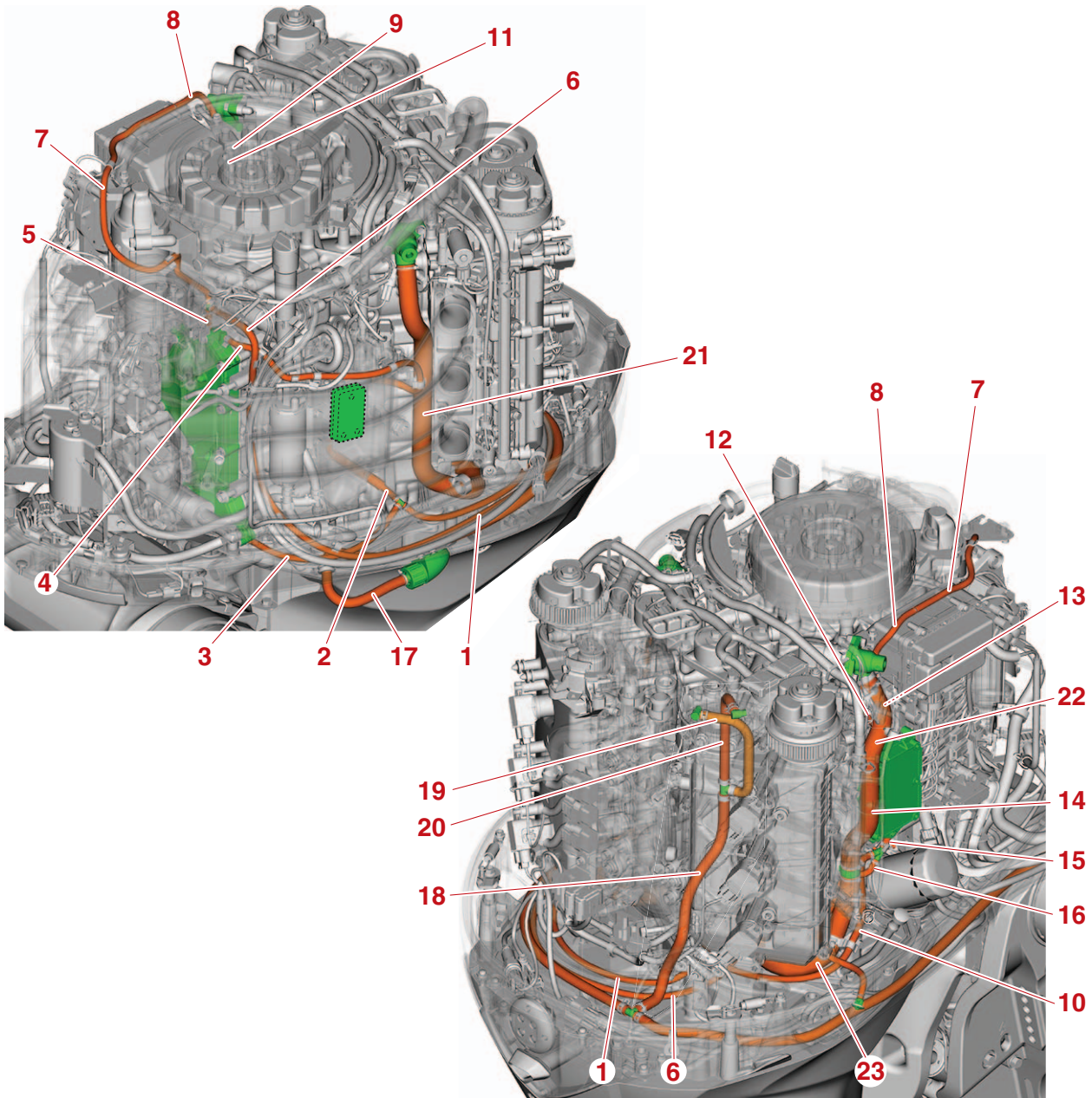


Pressure regulator hose, vapor gas hose, and intake air pressure sensor hose



1. Vapor separator to canister tank port
2. Canister purge port to joint
3. Joint to vapor shut-off valve
4. Vapor shut-off valve to joint
5. Joint to surge tank
6. Canister atmospheric port to joint
7. Joint to check valve
8. Check valve to bottom cowling
9. Check valve to joint
10. Atmosphere to check valve
11. Pressure regulator to surge tank
12. Surge tank to intake air pressure sensor

Cooling water hose



- 1. Cylinder block to joint
- 2. Joint to fuel cooler
- 3. Joint to oil cooler
- 4. Fuel cooler to oil cooler
- 5. Oil cooler to joint
- 6. Joint to cylinder block
- 7. Joint to joint
- 8. Joint to joint
- 9. Joint to joint
- 10. Cylinder block to cooling water cover
- 11. Cooling water cover to joint

- 12. Thermostat cover (STBD) to joint
- 13. Joint to rectifier/regulator/isolator
- 14. Rectifier/regulator/isolator to joint
- 15. Joint to joint
- 16. Joint to cooling water outlet
- 17. Flushing hose adapter to joint
- 18. Joint to joint
- 19. Joint to cylinder block (PORT)
- 20. Joint to cylinder block (STBD)
- 21. Thermostat cover (PORT) to cylinder block
- 22. Thermostat cover (STBD) to joint
- 23. Joint to cylinder block

---

## Rigging information

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## Rigging information

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## Important reminder on rigging

### Outboard motor mounting instructions

#### **⚠ WARNING**

- Overpowering a boat could cause severe instability. Do not install 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.
- 

#### **⚠ WARNING**

Too much weight on the transom can 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.

---

#### **⚠ WARNING**

Before mounting the outboard motor, consult the manufacturer of the engine jack plates or brackets. Excessive loads could damage the engine jack plates, brackets, boat transom, steering system, or engine. These damages could cause loss of control.

---

#### **NOTICE**

This outboard motor is designed exclusively for use with the Digital Electronic Control and CL5 Display/CL7 Display. Do not use this outboard motor with other control equipment or measuring devices.

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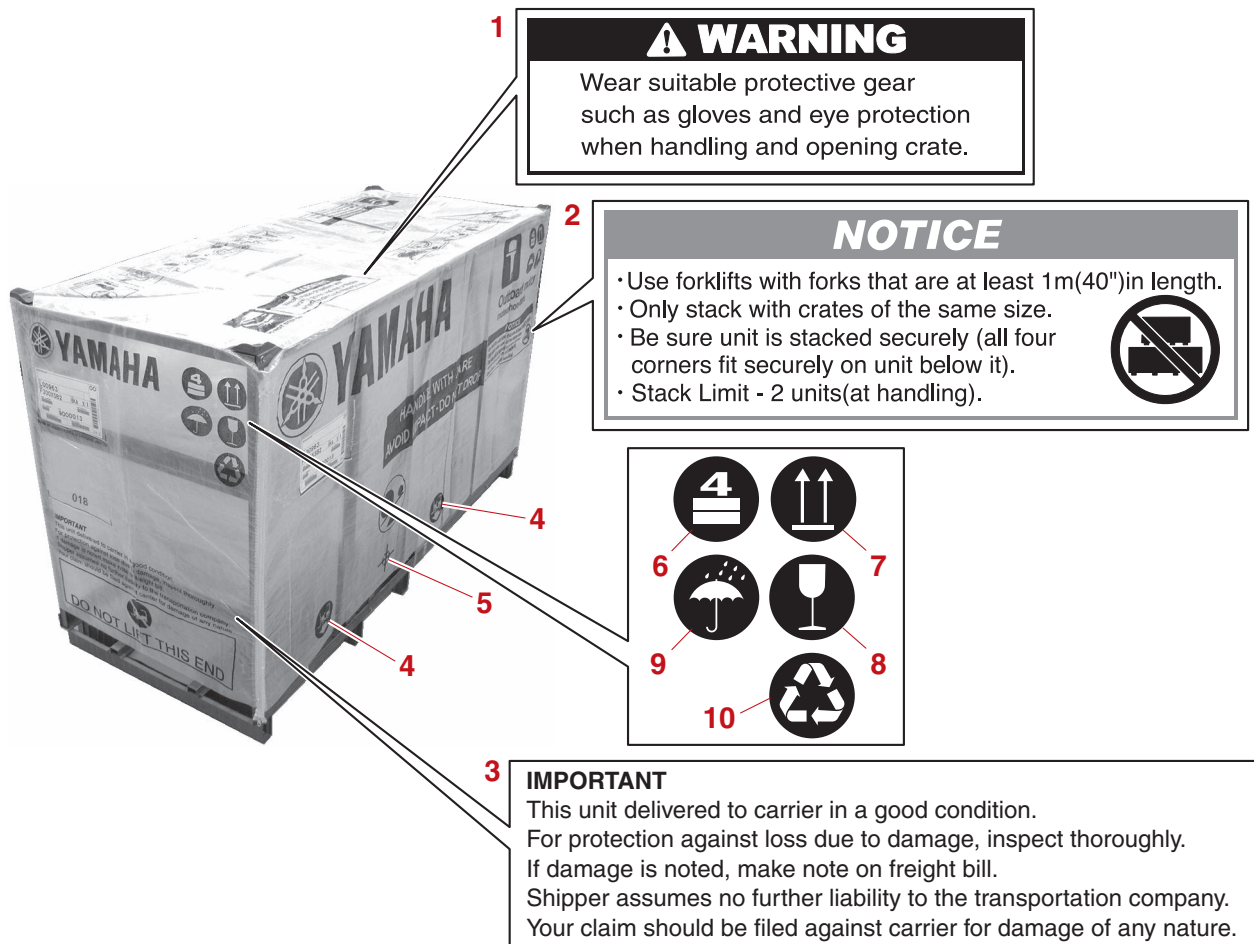


## Crate handling

### Crate top cover symbol description

The following symbols are important when handling the crate.

Read the notice and understand what each symbol means to prevent damage to the outboard motor when handling, transporting, and storing the crate.



1. **WARNING**

Wear suitable protective gear such as gloves and eye protection when handling and opening crate.

2. **NOTICE**

- Use forklifts with forks that are at least 1 m (40 in) in length.
- Only stack with crates of the same size.
- Be sure unit is stacked securely (all four corners fit securely on unit below it).
- Stack Limit - 2 units (at handling).

3. **IMPORTANT**

This unit delivered to carrier in a good condition. For protection against loss due to damage, inspect thoroughly. If damage is noted, make note on freight bill. Shipper assumes no further liability to the transportation company. Your claim should be filed against carrier for damage of any nature.

- 4. Lifting fork insert position
- 5. Crate barycentric position
- 6. Stack limit: Maximum 4 units for storage
- 7. Upward indication
- 8. Care handling indication
- 9. Water avoidance indication
- 10. Recycling indication

## Uncrating

### Uncrating procedure

#### **WARNING**

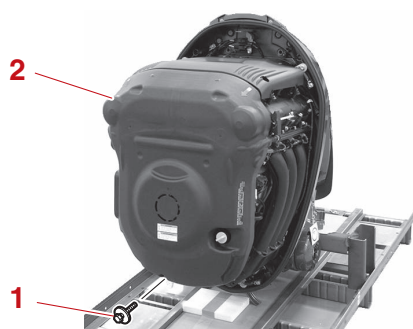
Wear gloves to avoid injury from sharp steel edges while uncrating.

1. Check:
  - Crate for shipping damage  
Damage → Consult your Yamaha distributor.
2. Remove:
  - Top cover
  - Frame
  - Wrapping

#### **NOTICE**

Be careful not to damage the outboard motor.

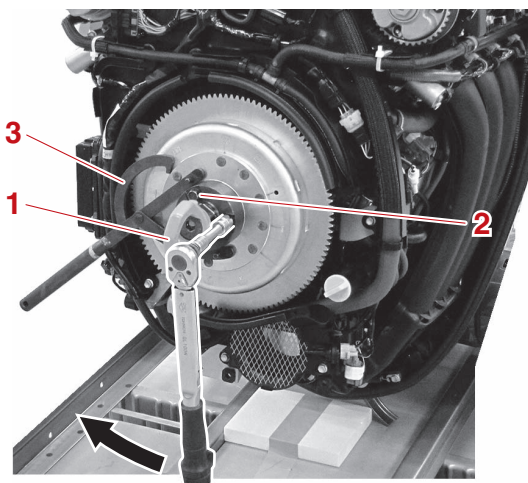
3. Check:
  - Outboard motor for concealed damage  
Damage → Consult your Yamaha distributor.
4. Remove:
  - Top cowling
  - Bolt “1”
  - Flywheel magneto cover “2”



5. Install:
  - Special service tool “1”, “2”, “3”

#### **NOTICE**

When lifting the outboard motor, make sure to use the specified special service tool. Other bolts and hanging jigs could bend or break, causing the outboard motor to fall.

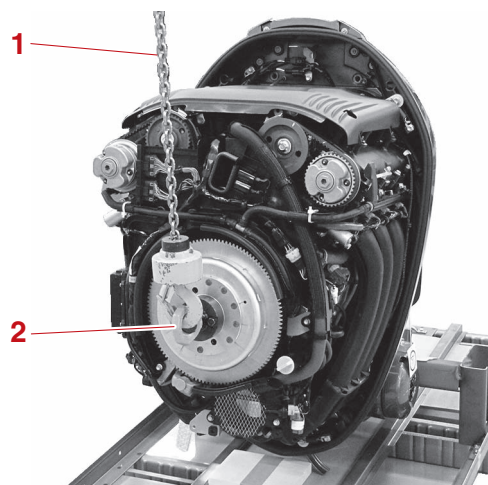


Lifting eye “1”  
90890-06953  
Bolt hexagon with washer “2”  
90890-06821  
Rotor holder “3”  
90890-01235  
Universal magneto and rotor holder  
“3”  
YU-01235



Lifting eye bolt  
36 N·m (3.6 kgf·m, 27 lb·ft)

6. Install:
  - Lifting harness “1”  
(to the lifting eye “2”)
7. Apply tension to the lifting harness.

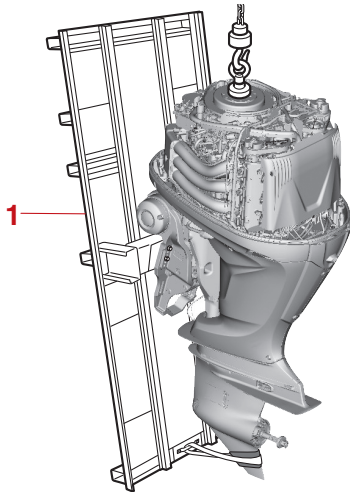


## Outboard motor mounting

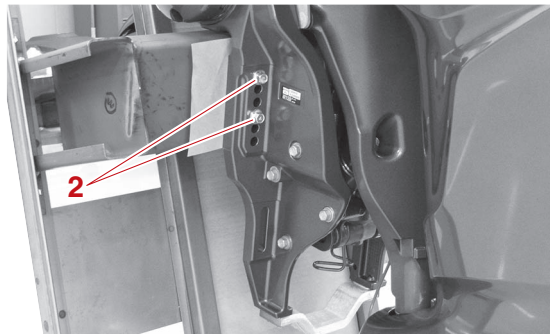
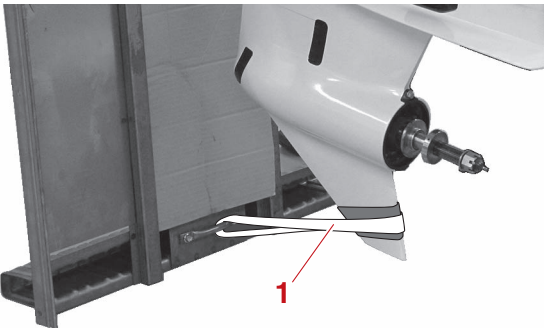
- Lift up the outboard motor carefully along with the bottom frame "1".

### NOTICE

**Make sure that the lifting harnesses do not damage any parts of the outboard motor.**



- Remove:
  - Skeg holder "1"
  - Mount bolt "2"
  - Bottom frame



- Remove the steering retainer, and then install a hydraulic steering cylinder or steering cable following the recommendation of the manufacturer.

- For the procedure of outboard motor mounting on boat, see "Rigging Guide" (6YR-2819Y-\*\*).

- Remove the lifting harness and shackles, and then install the flywheel magneto cover and top cowling.

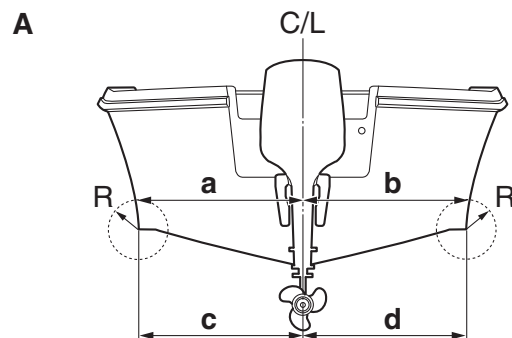
## Outboard motor mounting Installing the outboard motor

Properly mounting the outboard motor will result in better engine performance, product reliability, fuel economy, customer satisfaction, etc. This chapter provides a brief summary of the procedures for mounting the outboard motor. The first requirement is to make sure the outboard motor has clearance for full movement, from port to starboard, as well as during tilt operation. For the motor dimensions, see "External dimensions" (1-1).

- For a single outboard motor application, place the outboard motor on the vertical centerline of the boat transom. For a hull without strakes, make the same radius (R) at both sides of the hull, and use another measurement point.

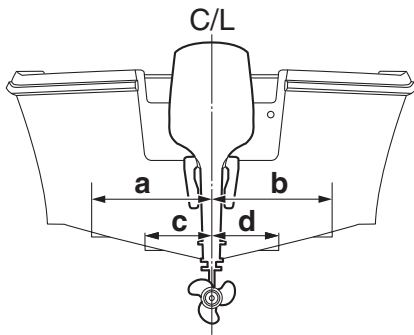
### TIP:

Make sure that distance "a" is equal to distance "b", and distance "c" is equal to distance "d".





B



A. Hull without strakes

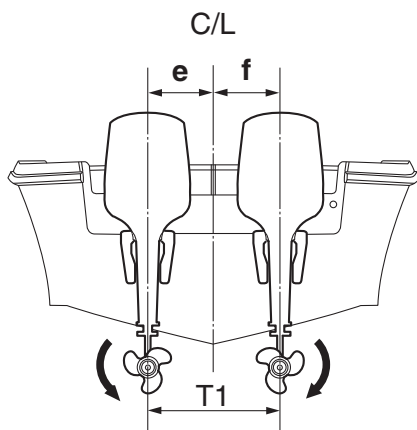
B. Hull with strakes

C/L.Centerline of the transom

For a twin outboard motor application, place the outboard motors so that the distance from the C/L of each outboard motor to the C/L of the boat transom are equal on both sides.

**TIP:**

- Make sure that the distance “e” is equal to distance “f”.
- For the distance (T1), see “External dimensions” (1-1).

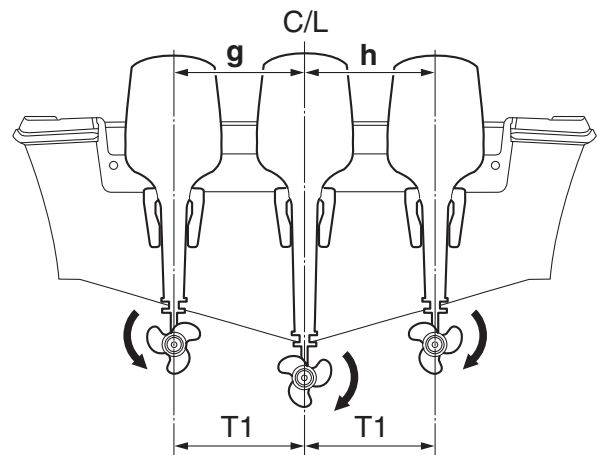


C/L.Centerline of the transom

For a triple outboard motor application, place the center outboard motor so that the C/L of the outboard motor is aligned with the C/L of the boat transom. Place the other two outboard motors on both sides so that the distance from the C/L of each outboard motor to the C/L of the boat transom are equal.

**TIP:**

- Make sure that the distance “g” is equal to distance “h”.
- If the boat has a V shape hull, the center outboard motor should have a longer transom height than the outboard motors on both sides.
- For the distance (T1), see “External dimensions” (1-1).

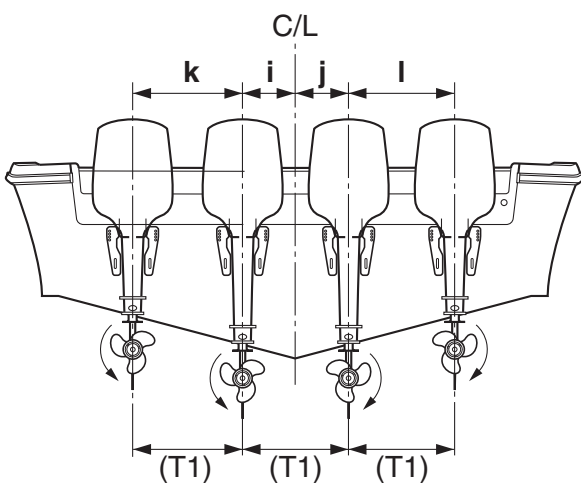


C/L.Centerline of the transom

For a quad outboard motor application, place the outboard motors so that the distance from the C/L of each outboard motor to the C/L of the boat transom are equal on both sides.

**TIP:** \_\_\_\_\_

- Make sure that the distance “i” is equal to distance “j”.
- Make sure that the distance “k” is equal to distance “l”.
- If the boat has a V shape hull, the center outboard motors should have a longer transom height than the outboard motors on both sides.
- For the distance (T1), see “External dimensions” (1-1).



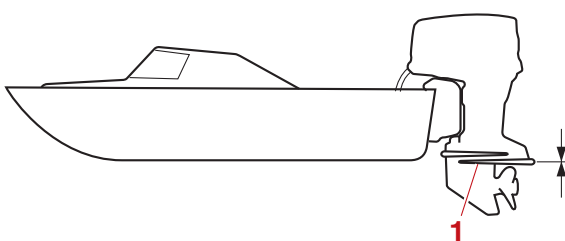
C/L.Centerline of the transom

2. Adjust the position of the outboard motor so that the height of the anti-cavitation plate “1” is equal to the bottom of the boat transom.

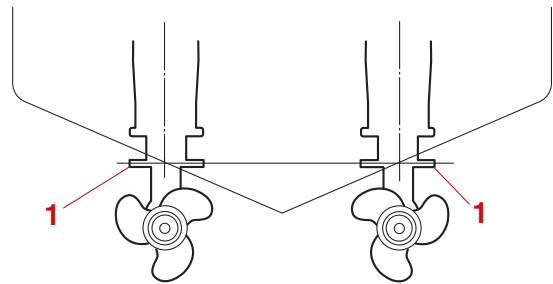
**TIP:** \_\_\_\_\_

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

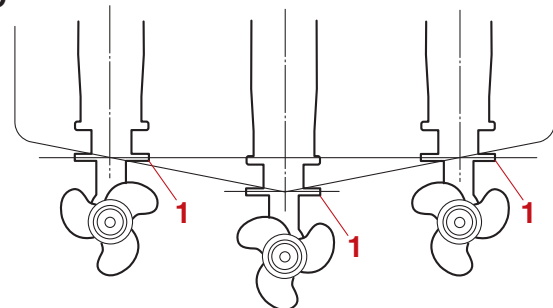
**A**



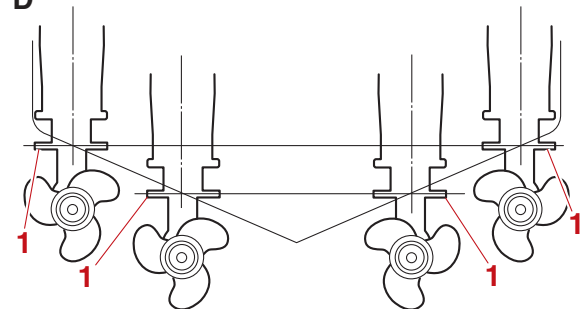
**B**



**C**



**D**




- A. Single outboard motor application
- B. Twin outboard motor application
- C. Triple outboard motor application
- D. Quad outboard motor application

**TIP:** \_\_\_\_\_

The mounting height of an outboard motor varies based on the boat and engine model combination. For more information for your specific boat package, contact your boat manufacturer.

3. Install:
  - Special service tool “1”

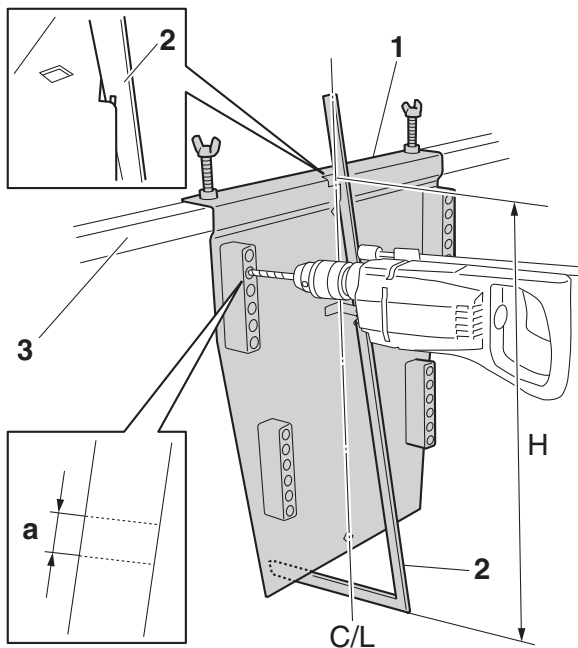
	Drilling plate “1”
	90890-06783
	Drilling plate “1”
	YB-34465-A

- Adjust the height of the scale "2" to the transom height (H), and place it on the special service tool "1". Secure the special service tool "1" to the boat transom using screws or vises.

**TIP:**

For the transom height (H), see "External dimensions" (1-1).

- When the outboard motor mounting position has been determined, mark the best suited 6 symmetrical mounting holes on the boat transom "3". Drill the mounting holes perpendicular to the surface of the boat transom using a 13.0 mm (0.5 in) "a" drill bit.



C/L.Centerline of the transom

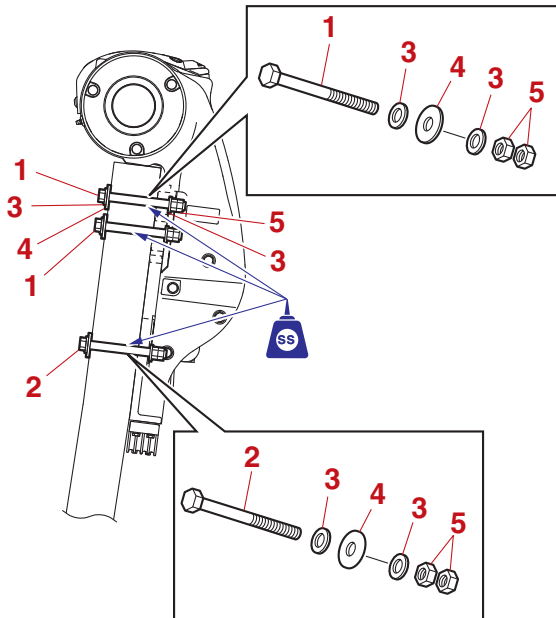
- Apply sealant to the mounting holes, and then secure the outboard motor using the included mounting bolts "1" and "2", small washers "3", large washers "4", and nuts "5".

**NOTICE**

Make sure that there is no clearance between the surfaces of the boat transom and the clamp brackets. Otherwise, the clamp brackets or boat transom may be damaged.

**TIP:**

The second hole from the top of each clamp bracket is recommended for the upper mounting bolt.



Upper mounting bolt "1"

Mounting bolt size	Part number
M12 × 150 mm (5.91 in)	90101-12067

Lower mounting bolt "2"

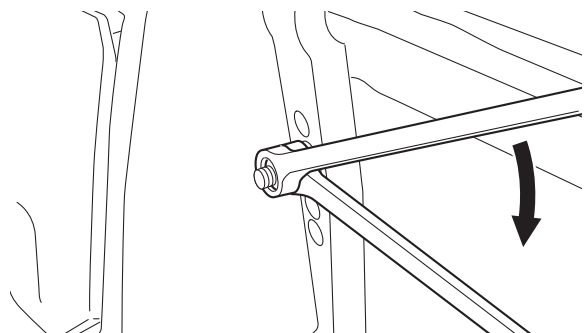
Mounting bolt size	Part number
M12 × 130 mm (5.12 in)	90101-12076

- Install the mounting bolts, and then tighten the nuts firmly.

**NOTICE**

Make sure that the clamp brackets do not bite into the boat transom.

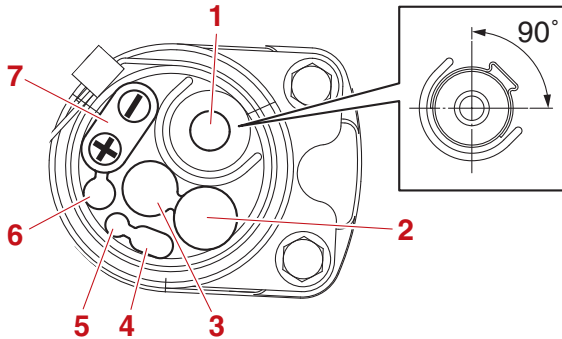
- Tighten the locknuts firmly.



## Rigging grommet mounting

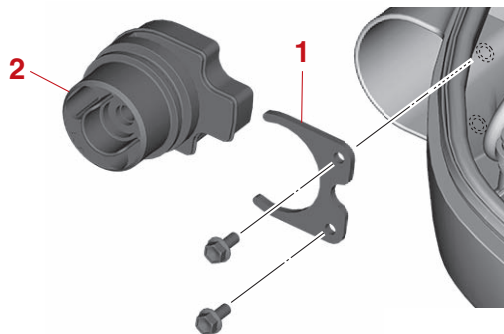
### Rigging grommet description

Pass all the rigging components through the proper holes in the rigging grommet.



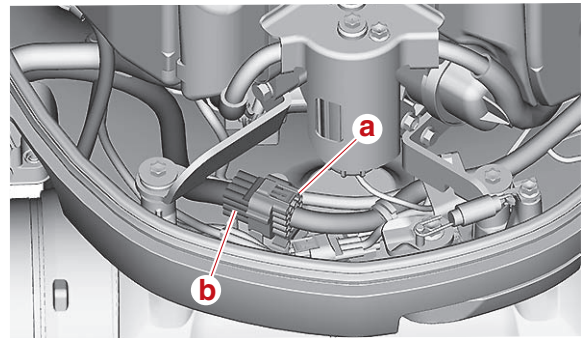
1. Fuel hose
2. Main wire harness
3. Flushing hose
4. SCU communication lead (optional)
5. Speedometer hose (optional)
6. Isolator lead (optional)
7. Battery cable

1. Remove:
  - Grommet holder "1"
  - Rigging grommet "2"



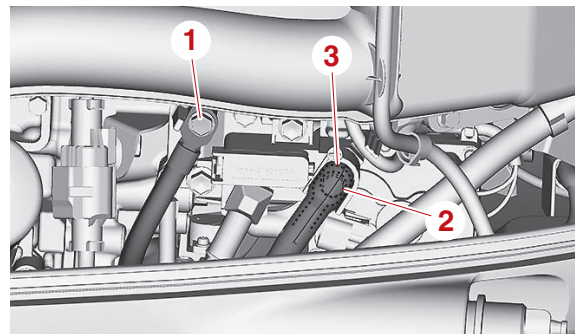
### Installing the main wire harness

1. Install:
  - Main wire harness
    - a. Route the extension wire harness through the bottom cowling. See "Bottom cowling" (5-11).
    - b. Connect the extension wire harness coupler "b" to the main wire harness coupler "a".



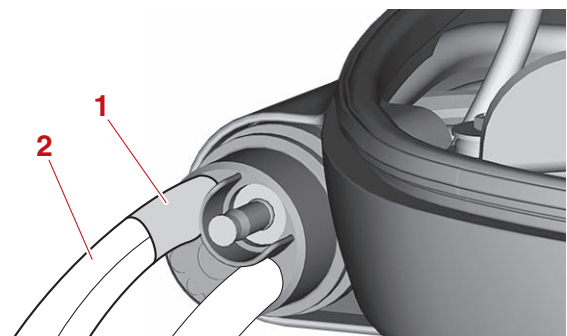
### Installing the battery cable

1. Install:
  - Negative battery cable "1"
  - Positive battery cable "2"
  - Cap "3"

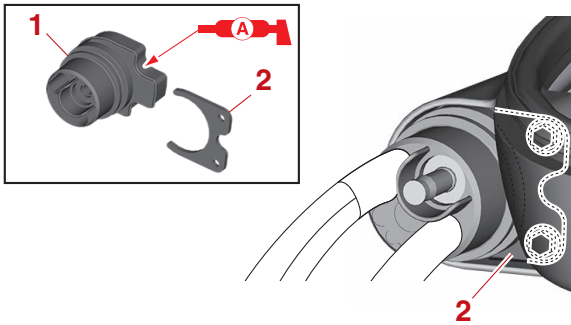


### Installing the rigging grommet

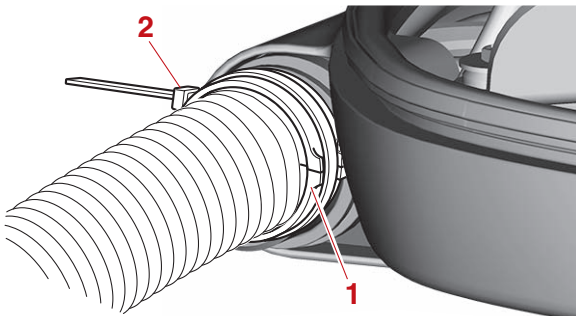
1. Install:
  - Rigging grommet
    - a. Route each harness through the proper hole in the rigging grommet. See "Rigging grommet description" (3-8).
    - b. Align the white tape "1" on the battery cable "2" with the outer end of the rigging grommet.



- c. Install the rigging grommet "1" along with the grommet holder "2".



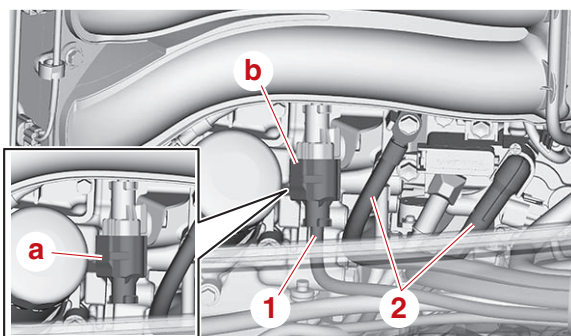
- d. Install the rigging tube retainer "1", and then fasten it using the plastic tie "2".



### Optional equipment Installing the isolator lead

1. Install:
  - Isolator lead
    - a. Remove the cap "a".
    - b. Connect the isolator lead coupler "b".

**TIP:** Pass the isolator lead "1" over the battery cable "2" so that they do not cross over each other.



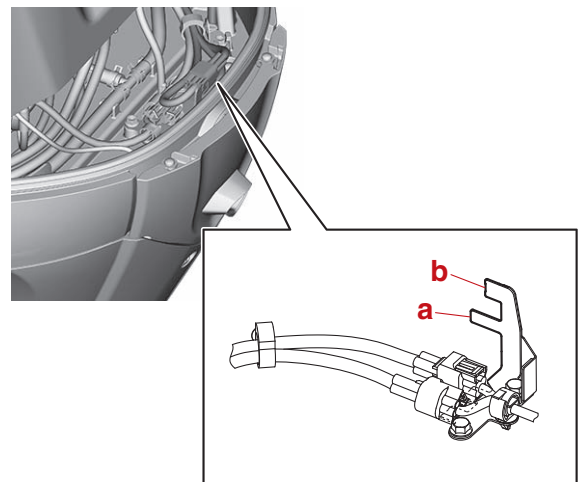
### Installing the SCU communication lead

To improve working efficiency for the rigging of multiple engine applications, start from the outboard motor on the port side of the boat.

1. Install:
  - SCU communication lead
    - a. Insert the SCU communication lead into the bottom cowling.
    - b. Install the SCU communication lead coupler.

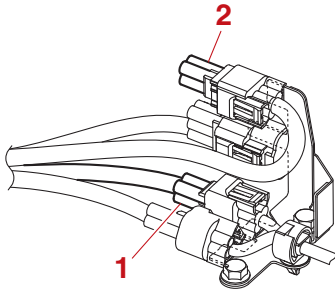
**TIP:**

- For the port or starboard outboard motor of multiple engine applications, install the coupler (6 pins) onto the tab "a" and install the coupler (4 pins) onto the tab "b".
- For the center outboard motor of multiple engine applications, install the coupler (4 pins) onto the tab "b".

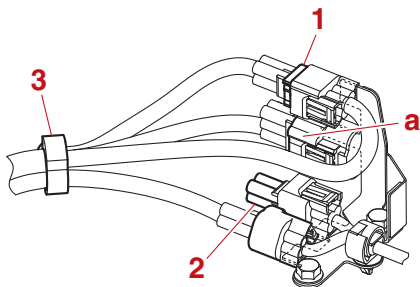


- c. Disconnect the SCU signal coupler (4P) "1".

- d. Remove the coupler cap from the SCU communication lead coupler (4P) “2”, and then install the cap to the SCU signal coupler (4P) “1” (female section).



- e. Connect the SCU signal coupler (male section) to the SCU communication lead coupler (4P) “1”.
- f. Fasten the SCU communication lead using the holder “3” shown in the illustration.



2. Cap (SCU signal coupler (4P))

- a. For the port or starboard outboard motor of multiple engine applications only

**TIP:** \_\_\_\_\_  
 Make sure that there is no slack in the wire harness.  
 \_\_\_\_\_

## Battery installation

### ⚠ WARNING

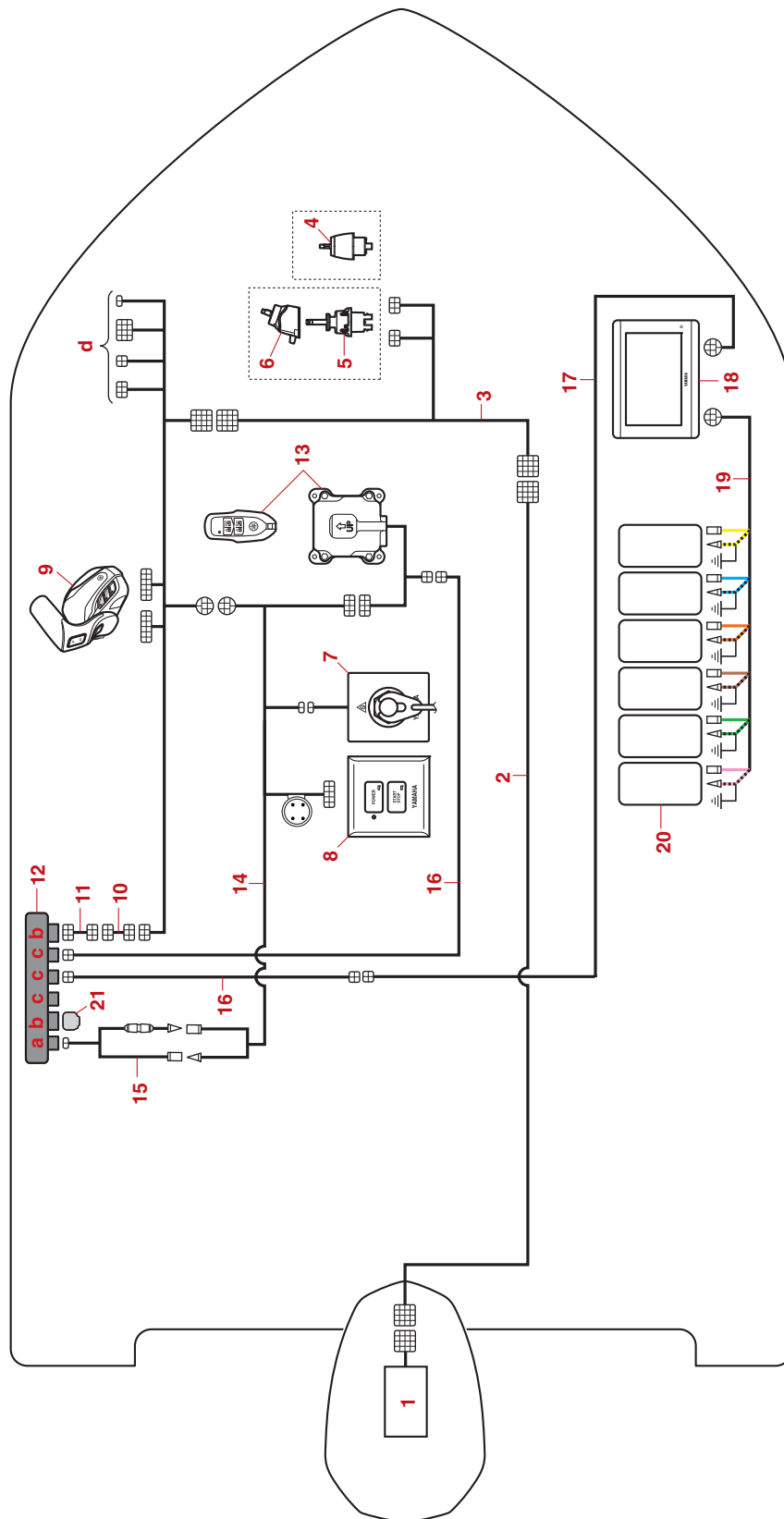
- Make sure to connect the battery properly and select the proper cable sizes. Otherwise, a fire could result.
- If an optional isolator lead is installed and connected to a house battery, overcurrent protection in compliance with ABYC (E-11) or equivalent must be provided.

### NOTICE

Do not reverse the battery connections. Otherwise, the charging system could be damaged.

System diagram

Single outboard motor application (single station)





## System diagram

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
		6X6-8258A-81	24 m (79 ft)
3	Helm harness (Main/Single)	6GR-8258A-01	0.9 m (3 ft)
		6GR-8258A-41	1.8 m (6 ft)
4	Helm unit assembly	6X9-762H0-01	
5	Helm unit assembly	6GR-615A0-00	
6	Tilt helm unit	6GR-6154A-00	
7	Engine shut-off switch	6X9-82570-70	
8	Power switch	6X9-82570-01	
9	Digital Electronic Control	6X9-48205-05	Main station
10	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
11	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)
12	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
13	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
14	EKS harness	6X9-82716-21	DEC to switch panel
15	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)



**System diagram**

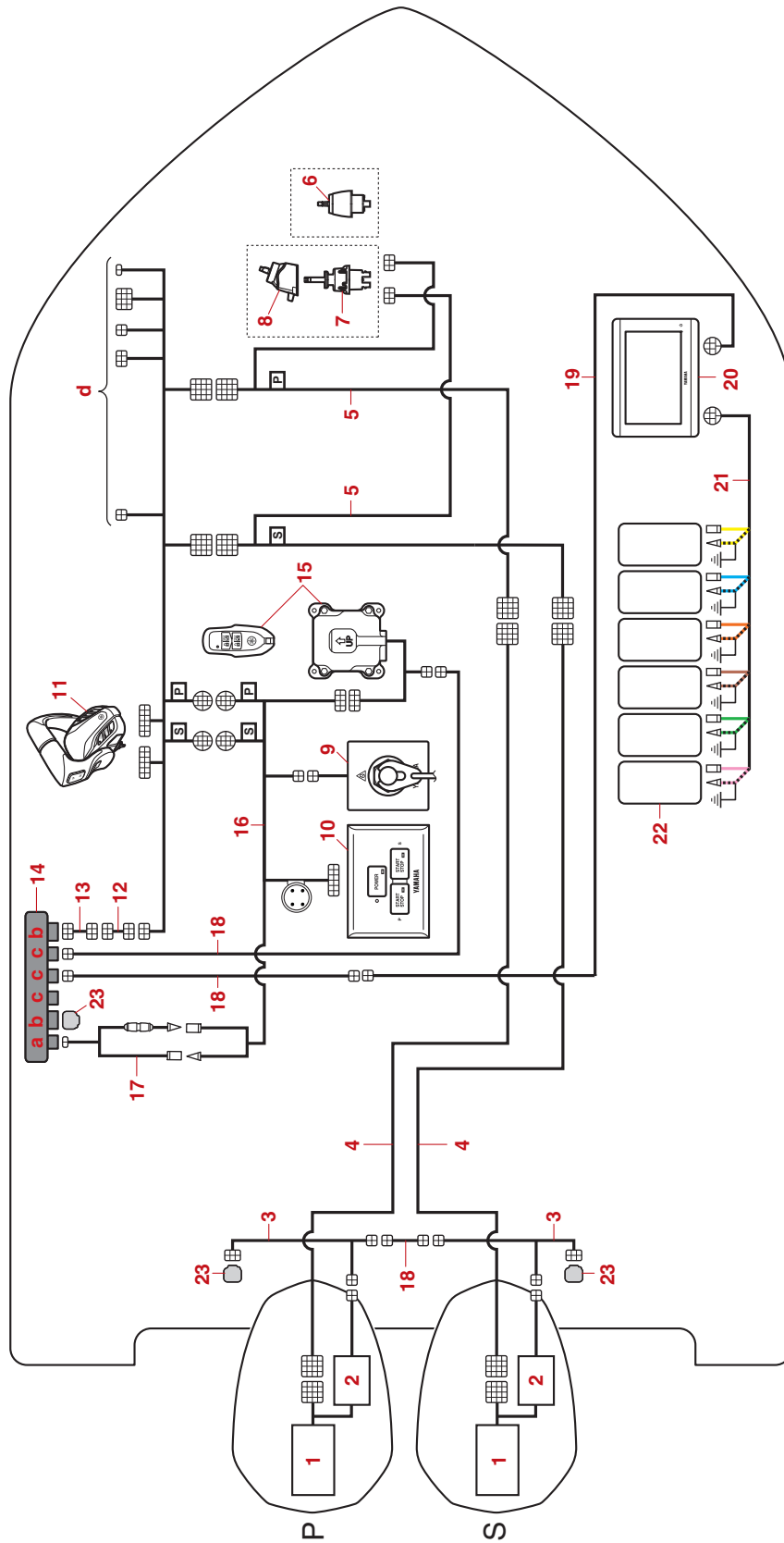
Ref. No.	Part name	Part No.	Remarks
16	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
17	Conversion harness	6YM-83553-00	0.9 m (3 ft)
18	CL5 display	6YM-83710-16	No Wi-Fi
19	Tank wire	6YD-8356N-00	
20	Fuel tank	—	
21	Resistor cap	6Y8-85371-01	6P, Gray

- a. Power port
- b. Bus port
- c. Device port
- d. For sub station helm

**TIP:** \_\_\_\_\_  
The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

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Twin outboard motor application (single station)



## System diagram

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	SCU	—	
3	SCU communication lead	6X9-81115-00	0.3 m (1 ft)
		6GR-81115-00	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-10	w/ resistor cap, 3 m (10 ft)
4	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
		6X6-8258A-81	24 m (79 ft)
5	Helm harness (Main/Multi)	6GR-8258A-11	0.9 m (3 ft)
		6GR-8258A-51	1.8 m (6 ft)
		6GR-8258A-61	2.7 m (9 ft)
6	Helm unit assembly	6X9-762H0-01	
7	Helm unit assembly	6GR-615A0-00	
8	Tilt helm unit	6GR-6154A-00	
9	Engine shut-off switch	6X9-82570-80	
10	Power switch	6X9-82570-11	
11	Digital Electronic Control	6X9-48207-05	Main station
12	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
13	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)
14	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
15	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
16	EKS harness	6X9-82716-32	DEC to switch panel

**System diagram**

Ref. No.	Part name	Part No.	Remarks
17	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)
18	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
19	Conversion harness	6YM-83553-00	0.9 m (3 ft)
20	CL5 display	6YM-83710-16	No Wi-Fi
21	Tank wire	6YD-8356N-00	
22	Fuel tank	—	
23	Resistor cap	6Y8-85371-01	6P, Gray

a. Power port

P. Port

b. Bus port

S. Starboard

c. Device port

d. For sub station helm

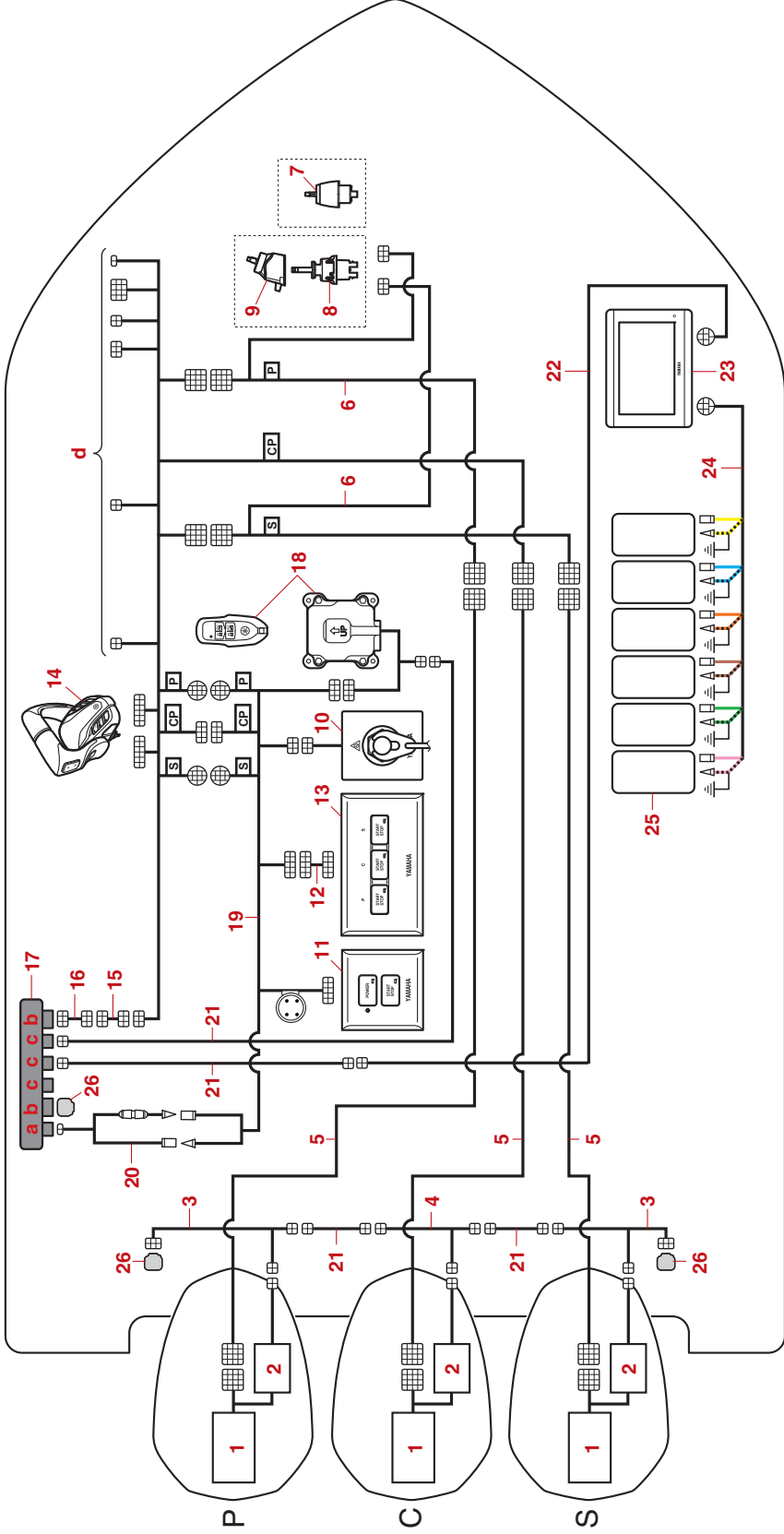
**TIP:**


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The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

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# Triple outboard motor application (single station)



## System diagram

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	SCU	—	
3	SCU communication lead (Starboard side/Port side)	6X9-81115-00	0.3 m (1 ft)
		6GR-81115-00	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-10	w/ resistor cap, 3 m (10 ft)
4	SCU communication lead (Center)	6X9-81115-10	0.3 m (1 ft)
		6GR-81115-20	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-30	w/ resistor cap, 3 m (10 ft)
5	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
6	Helm harness (Main/Multi)	6GR-8258A-11	0.9 m (3 ft)
		6GR-8258A-51	1.8 m (6 ft)
		6GR-8258A-61	2.7 m (9 ft)
7	Helm unit assembly	6X9-762H0-01	
8	Helm unit assembly	6GR-615A0-00	
9	Tilt helm unit	6GR-6154A-00	
10	Engine shut-off switch	6X9-82570-C0	
11	Power switch	6X9-82570-01	
12	EKS harness extension	6X9-82586-00	4.6 m (15 ft)
		6X9-82586-10	9.1 m (30 ft)
13	Start/stop switch	6X9-82570-41	
14	Digital Electronic Control	6X9-48208-05	Main station
15	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
16	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)

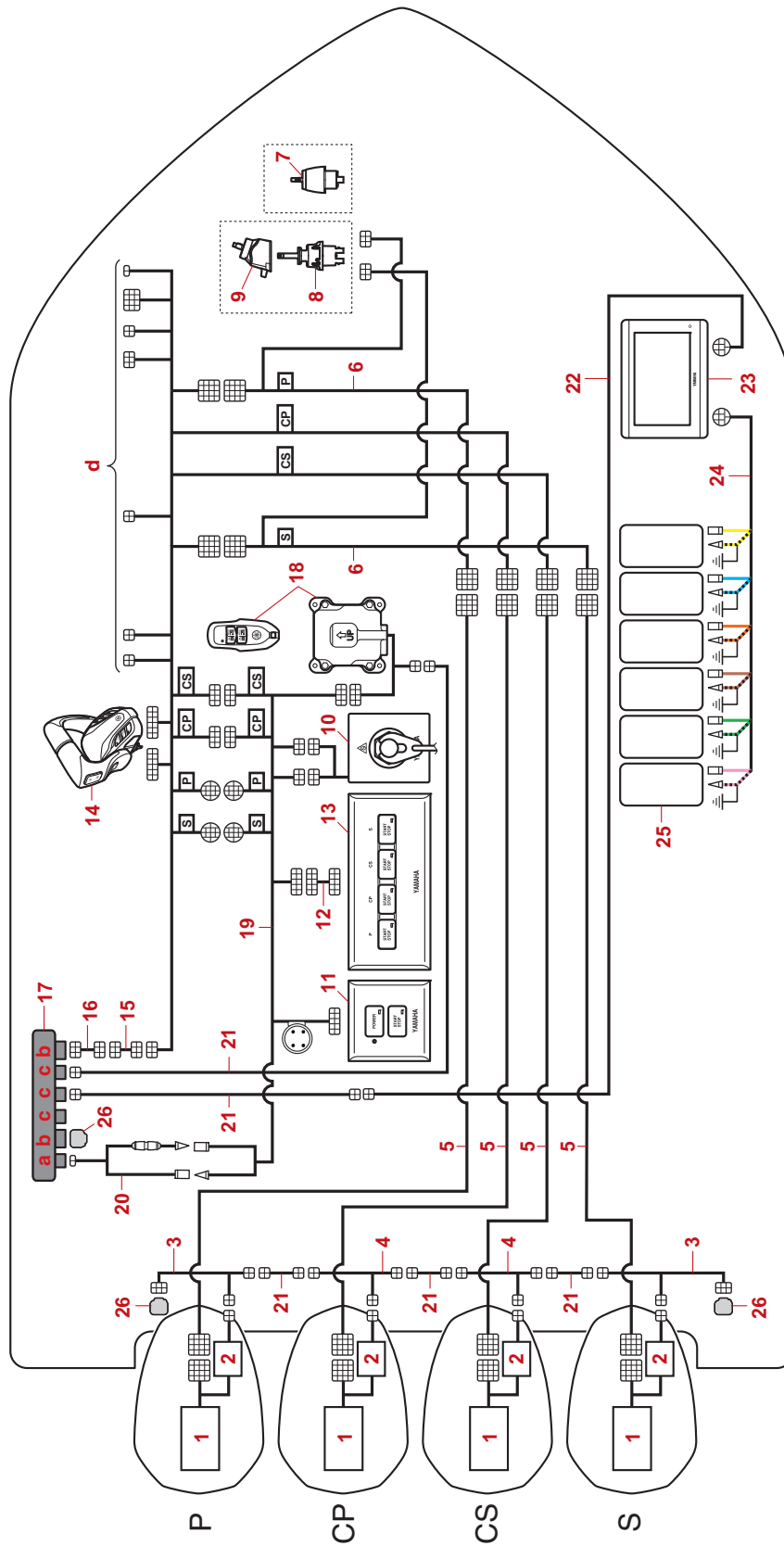
## System diagram

Ref. No.	Part name	Part No.	Remarks
17	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
18	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
19	EKS harness	6X9-82716-41	DEC to switch panel
20	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)
21	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
22	Conversion harness	6YM-83553-00	0.9 m (3 ft)
23	CL5 display	6YM-83710-16	No Wi-Fi
24	Tank wire	6YD-8356N-00	
25	Fuel tank	—	
26	Resistor cap	6Y8-85371-01	6P, Gray

- |                         |              |
|-------------------------|--------------|
| a. Power port           | P. Port      |
| b. Bus port             | C. Center    |
| c. Device port          | S. Starboard |
| d. For sub station helm |              |

**TIP:** \_\_\_\_\_  
 The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

Quad outboard motor application (single station)





## System diagram

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	SCU	—	
3	SCU communication lead (Starboard side/Port side)	6X9-81115-00	0.3 m (1 ft)
		6GR-81115-00	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-10	w/ resistor cap, 3 m (10 ft)
4	SCU communication lead (Center)	6X9-81115-10	0.3 m (1 ft)
		6GR-81115-20	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-30	w/ resistor cap, 3 m (10 ft)
5	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
6	Helm harness (Main/Multi)	6GR-8258A-11	0.9 m (3 ft)
		6GR-8258A-51	1.8 m (6 ft)
		6GR-8258A-61	2.7 m (9 ft)
7	Helm unit assembly	6X9-762H0-01	
8	Helm unit assembly	6GR-615A0-00	
9	Tilt helm unit	6GR-6154A-00	
10	Engine shut-off switch	6X9-82570-D0	
11	Power switch	6X9-82570-01	
12	EKS harness extension	6X9-82586-00	4.6 m (15 ft)
		6X9-82586-10	9.1 m (30 ft)
13	Start/stop switch	6X9-82570-51	
14	Digital Electronic Control	6X9-48209-05	Main station
15	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
16	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)

## System diagram

Ref. No.	Part name	Part No.	Remarks
17	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
18	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
19	EKS harness	6X9-82716-91	DEC to switch panel
20	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)
21	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
22	Conversion harness	6YM-83553-00	0.9 m (3 ft)
23	CL5 display	6YM-83710-16	No Wi-Fi
24	Tank wire	6YD-8356N-00	
25	Fuel tank	—	
26	Resistor cap	6Y8-85371-01	6P, Gray

a. Power port

b. Bus port

c. Device port

d. For sub station helm

P. Port

CP. Center port

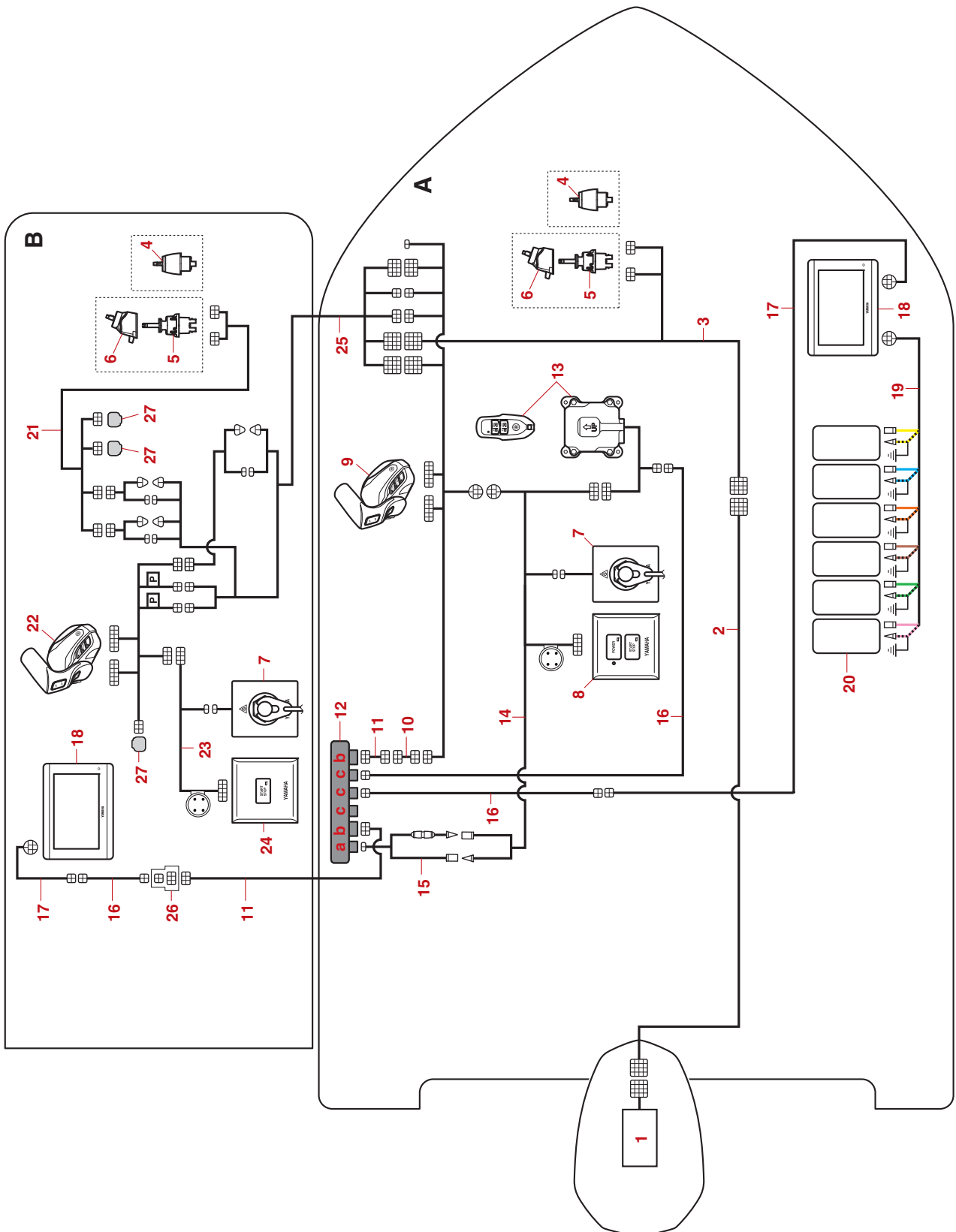
CS. Center starboard

S. Starboard

**TIP:** \_\_\_\_\_

The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

Single outboard motor application (dual station)



## System diagram

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
		6X6-8258A-81	24 m (79 ft)
3	Helm harness (Main/Single)	6GR-8258A-01	0.9 m (3 ft)
		6GR-8258A-41	1.8 m (6 ft)
4	Helm unit assembly	6X9-762H0-01	
5	Helm unit assembly	6GR-615A0-00	
6	Tilt helm unit	6GR-6154A-00	
7	Engine shut-off switch	6X9-82570-70	
8	Power switch	6X9-82570-01	
9	Digital Electronic Control	6X9-48205-05	Main station
10	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
11	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)
12	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
13	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
14	EKS harness	6X9-82716-21	DEC to switch panel
15	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)

## System diagram

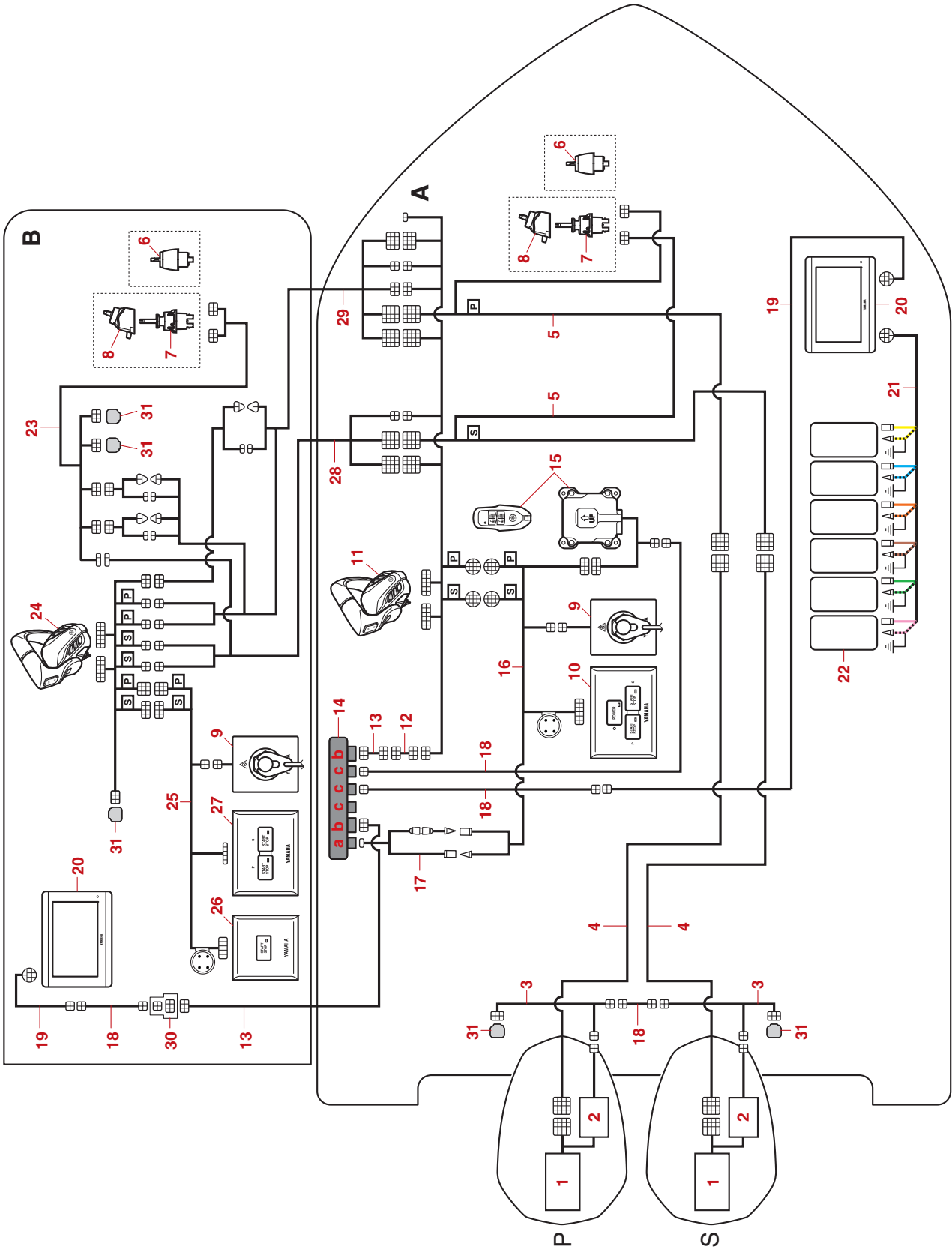
Ref. No.	Part name	Part No.	Remarks
16	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
17	Conversion harness	6YM-83553-00	0.9 m (3 ft)
18	CL5 display	6YM-83710-16	No Wi-Fi
19	Tank wire	6YD-8356N-00	
20	Fuel tank	—	
21	Helm harness (2nd station)	6X9-8258A-A1	0.9 m (3 ft)
22	Digital Electronic Control	6X9-48205-12	2nd station
23	EKS harness	6X9-82716-60	
24	Start/stop switch	6X9-82570-B1	
25	2nd helm harness	6X9-8258A-00	5 m (16 ft)
		6X9-8258A-10	8 m (26 ft)
		6X9-8258A-20	12 m (38 ft)
26	Single (inline) hub	6Y8-81920-11	w/ resistor, 4–6P, White
27	Resistor cap	6Y8-85371-01	6P, Gray

- a. Power port
- b. Bus port
- c. Device port

- A. Main station
- B. Sub station

**TIP:** \_\_\_\_\_  
 The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

Twin outboard motor application (dual station)



**System diagram**

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	SCU	—	
3	SCU communication lead	6X9-81115-00	0.3 m (1 ft)
		6GR-81115-00	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-10	w/ resistor cap, 3 m (10 ft)
4	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
		6X6-8258A-81	24 m (79 ft)
5	Helm harness (Main/Multi)	6GR-8258A-11	0.9 m (3 ft)
		6GR-8258A-51	1.8 m (6 ft)
		6GR-8258A-61	2.7 m (9 ft)
6	Helm unit assembly	6X9-762H0-01	
7	Helm unit assembly	6GR-615A0-00	
8	Tilt helm unit	6GR-6154A-00	
9	Engine shut-off switch	6X9-82570-80	
10	Power switch	6X9-82570-11	
11	Digital Electronic Control	6X9-48207-05	Main station
12	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
13	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)
14	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
15	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
16	EKS harness	6X9-82716-32	DEC to switch panel

## System diagram

Ref. No.	Part name	Part No.	Remarks
17	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)
18	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
19	Conversion harness	6YM-83553-00	0.9 m (3 ft)
20	CL5 display	6YM-83710-16	No Wi-Fi
21	Tank wire	6YD-8356N-00	
22	Fuel tank	—	
23	Helm harness (2nd station)	6X9-8258A-B1	0.9 m (3 ft)
24	Digital Electronic Control	6X9-48207-12	2nd station
25	EKS harness	6X9-82716-71	
26	All start/stop switch	6X9-82570-B1	
27	Start/stop switch	6X9-82570-31	
28	2nd helm harness (Starboard side)	6X9-8258A-30	5 m (16 ft)
		6X9-8258A-40	8 m (26 ft)
		6X9-8258A-50	12 m (38 ft)
29	2nd helm harness (Port side)	6X9-8258A-00	5 m (16 ft)
		6X9-8258A-10	8 m (26 ft)
		6X9-8258A-20	12 m (38 ft)
30	Single (inline) hub	6Y8-81920-11	w/ resistor, 4–6P, White
31	Resistor cap	6Y8-85371-01	6P, Gray

a. Power port

P. Port

b. Bus port

S. Starboard

c. Device port

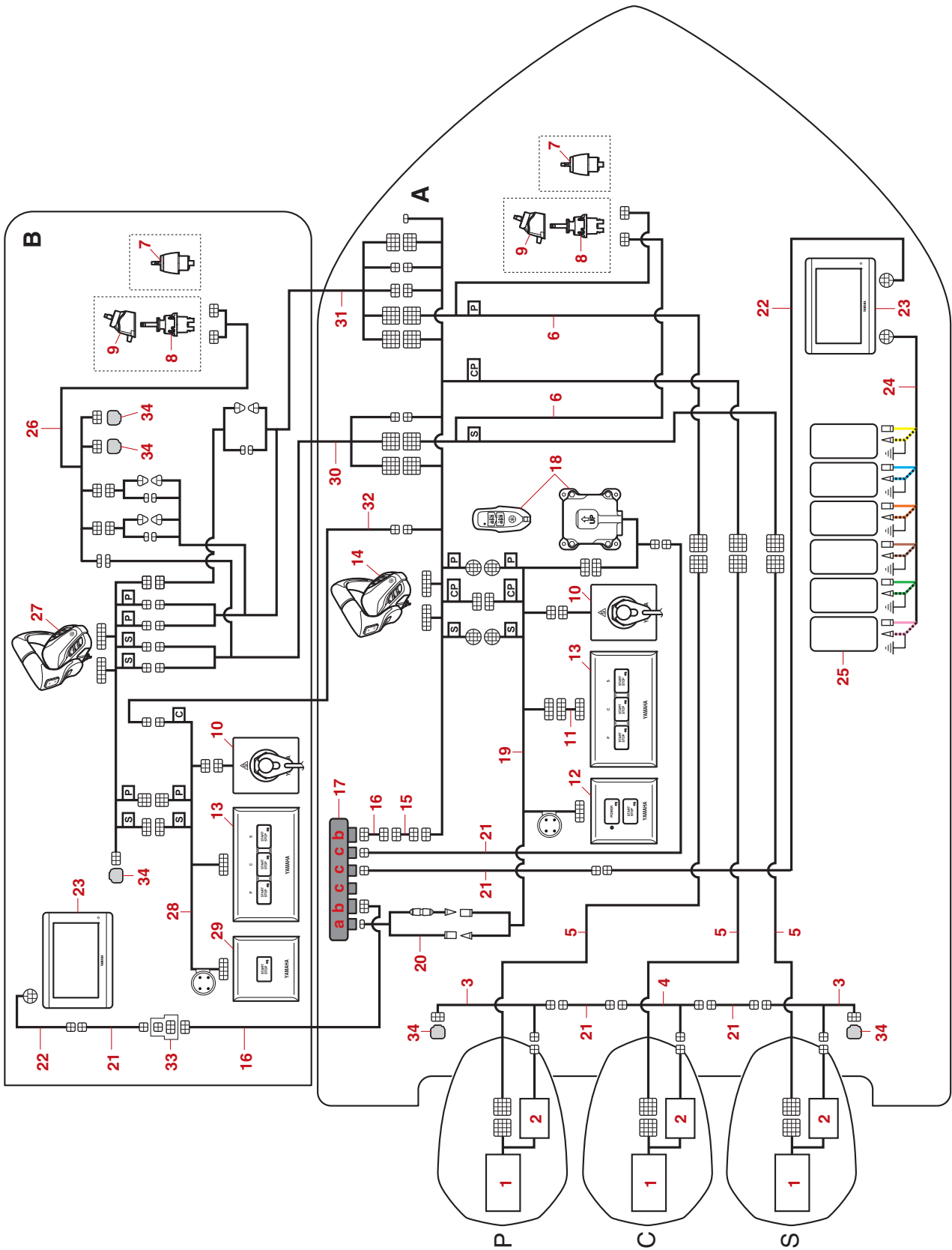
A. Main station

B. Sub station

**TIP:** \_\_\_\_\_  
 The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.



Triple outboard motor application (dual station)



## System diagram

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	SCU	—	
3	SCU communication lead (Starboard side/Port side)	6X9-81115-00	0.3 m (1 ft)
		6GR-81115-00	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-10	w/ resistor cap, 3 m (10 ft)
4	SCU communication lead (Center)	6X9-81115-10	0.3 m (1 ft)
		6GR-81115-20	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-30	w/ resistor cap, 3 m (10 ft)
5	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
6	Helm harness (Main/Multi)	6GR-8258A-11	0.9 m (3 ft)
		6GR-8258A-51	1.8 m (6 ft)
		6GR-8258A-61	2.7 m (9 ft)
7	Helm unit assembly	6X9-762H0-01	
8	Helm unit assembly	6GR-615A0-00	
9	Tilt helm unit	6GR-6154A-00	
10	Engine shut-off switch	6X9-82570-C0	
11	EKS harness extension	6X9-82586-00	4.6 m (15 ft)
		6X9-82586-10	9.1 m (30 ft)
12	Power switch	6X9-82570-01	
13	Start/stop switch	6X9-82570-41	
14	Digital Electronic Control	6X9-48208-05	Main station
15	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
16	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)

**System diagram**

Ref. No.	Part name	Part No.	Remarks
17	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
18	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
19	EKS harness	6X9-82716-41	DEC to switch panel
20	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)
21	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
22	Conversion harness	6YM-83553-00	0.9 m (3 ft)
23	CL5 display	6YM-83710-16	No Wi-Fi
24	Tank wire	6YD-8356N-00	
25	Fuel tank	—	
26	Helm harness (2nd station)	6X9-8258A-B1	0.9 m (3 ft)
27	Digital Electronic Control	6X9-48207-12	2nd station
28	EKS harness	6X9-82716-80	
29	All start/stop switch	6X9-82570-B1	
30	2nd helm harness (Starboard side)	6X9-8258A-30	5 m (16 ft)
		6X9-8258A-40	8 m (26 ft)
		6X9-8258A-50	12 m (38 ft)
31	2nd helm harness (Port side)	6X9-8258A-00	5 m (16 ft)
		6X9-8258A-10	8 m (26 ft)
		6X9-8258A-20	12 m (38 ft)
32	2nd helm harness (Center)	6X9-8258A-60	5 m (16 ft)
		6X9-8258A-70	8 m (26 ft)
		6X9-8258A-80	12 m (38 ft)
33	Single (inline) hub	6Y8-81920-11	w/ resistor, 4–6P, White

## System diagram

Ref. No.	Part name	Part No.	Remarks
34	Resistor cap	6Y8-85371-01	6P, Gray

a. Power port

b. Bus port

c. Device port

P. Port

C. Center

S. Starboard

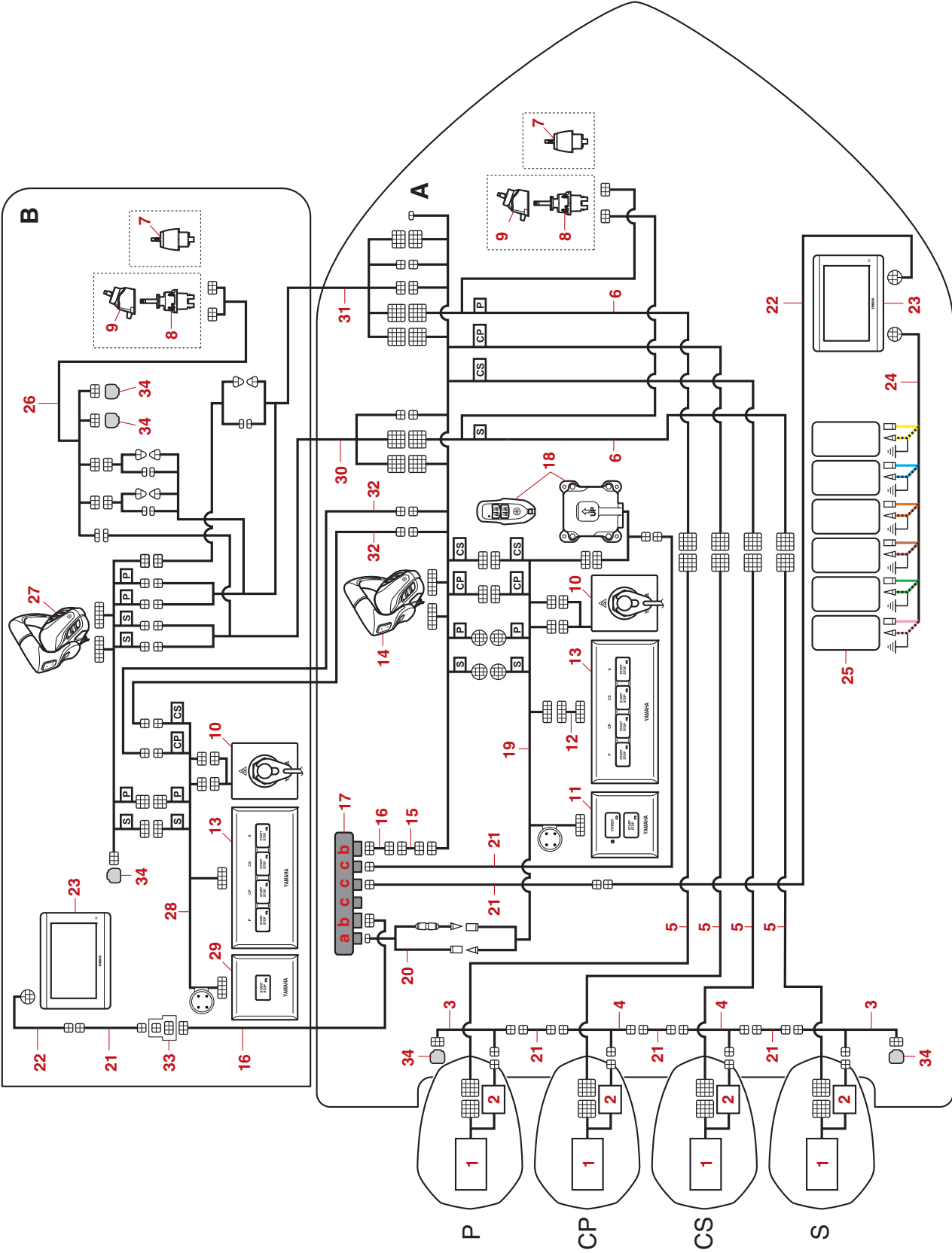
A. Main station

B. Sub station

### **TIP:**

The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

Quad outboard motor application (dual station)



## System diagram

Ref. No.	Part name	Part No.	Remarks
1	Engine ECM	—	
2	SCU	—	
3	SCU communication lead (Starboard side/Port side)	6X9-81115-00	0.3 m (1 ft)
		6GR-81115-00	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-10	w/ resistor cap, 3 m (10 ft)
4	SCU communication lead (Center)	6X9-81115-10	0.3 m (1 ft)
		6GR-81115-20	w/ resistor cap, 1.5 m (5 ft)
		6GR-81115-30	w/ resistor cap, 3 m (10 ft)
5	Main wire harness (16P)	6X6-8258A-91	1.5 m (5 ft)
		6X6-8258A-51	3.7 m (12 ft)
		6X6-8258A-61	5.2 m (17 ft)
		6X6-8258A-01	6.1 m (20 ft)
		6X6-8258A-11	7 m (23 ft)
		6X6-8258A-21	8 m (26 ft)
		6X6-8258A-31	10 m (32 ft)
		6X6-8258A-41	12 m (39 ft)
		6X6-8258A-71	15 m (49 ft)
		6X6-8258A-81	24 m (79 ft)
6	Helm harness (Main/Multi)	6GR-8258A-11	0.9 m (3 ft)
		6GR-8258A-51	1.8 m (6 ft)
		6GR-8258A-61	2.7 m (9 ft)
7	Helm unit assembly	6X9-762H0-01	
8	Helm unit assembly	6GR-615A0-00	
9	Tilt helm unit	6GR-6154A-00	
10	Engine shut-off switch	6X9-82570-D0	
11	Power switch	6X9-82570-01	
12	EKS harness extension	6X9-82586-00	4.6 m (15 ft)
		6X9-82586-10	9.1 m (30 ft)
13	Start/stop switch	6X9-82570-51	
14	Digital Electronic Control	6X9-48209-05	Main station
15	Conversion harness	6Y9-83553-00	DEC to hub, 0.3 m (1 ft)
16	Main bus wire	6Y8-82553-01	0.3 m (1 ft)
		6Y8-82553-50	3 m (10 ft)
		6Y8-82553-11	4.6 m (15 ft)
		6Y8-82553-21	6.1 m (20 ft)
		6Y8-82553-31	7.6 m (25 ft)
		6Y8-82553-41	9.1 m (30 ft)

**System diagram**

Ref. No.	Part name	Part No.	Remarks
17	Multi-hub	6Y8-81920-01	w/ resistor cap, Gray
18	Key fob and receiver assembly	6X9-86254-04	Radio frequency 433 MHz, Key fob: 2 pcs.
		6X9-86254-14	Radio frequency 315 MHz, Key fob: 2 pcs.
19	EKS harness	6X9-82716-91	DEC to switch panel
20	System power supply wire	6Y8-83553-02	w/ 10 A fuse, 2.4 m (8 ft)
21	Pigtail bus wire	6Y8-82521-01	0.3 m (1 ft)
		6Y8-82521-11	0.6 m (2 ft)
		6Y8-82521-21	0.9 m (3 ft)
		6Y8-82521-31	1.8 m (6 ft)
		6Y8-82521-41	2.7 m (9 ft)
		6Y8-82521-51	3.6 m (12 ft)
22	Conversion harness	6YM-83553-00	0.9 m (3 ft)
23	CL5 display	6YM-83710-16	No Wi-Fi
24	Tank wire	6YD-8356N-00	
25	Fuel tank	—	
26	Helm harness (2nd station)	6X9-8258A-B1	0.9 m (3 ft)
27	Digital Electronic Control	6X9-48207-12	2nd station
28	EKS harness	6X9-82716-A0	
29	All start/stop switch	6X9-82570-B1	
30	2nd helm harness (Starboard side)	6X9-8258A-30	5 m (16 ft)
		6X9-8258A-40	8 m (26 ft)
		6X9-8258A-50	12 m (38 ft)
31	2nd helm harness (Port side)	6X9-8258A-00	5 m (16 ft)
		6X9-8258A-10	8 m (26 ft)
		6X9-8258A-20	12 m (38 ft)
32	2nd helm harness (Center)	6X9-8258A-60	5 m (16 ft)
		6X9-8258A-70	8 m (26 ft)
		6X9-8258A-80	12 m (38 ft)
33	Single (inline) hub	6Y8-81920-11	w/ resistor, 4–6P, White

## System diagram

Ref. No.	Part name	Part No.	Remarks
34	Resistor cap	6Y8-85371-01	6P, Gray

a. Power port

b. Bus port

c. Device port

P. Port

CP. Center port

CS. Center starboard

S. Starboard

A. Main station

B. Sub station

### **TIP:**

The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

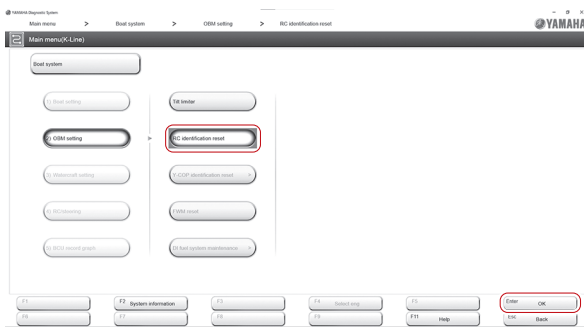


## Digital Electronic Control

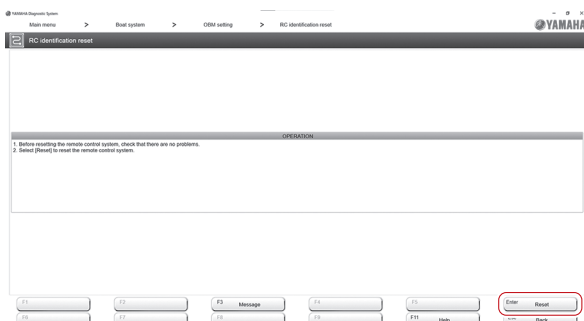
### Digital Electronic Control system reset

A Digital Electronic Control system reset is required after the replacement of the Digital Electronic Control ECM or the engine ECM.

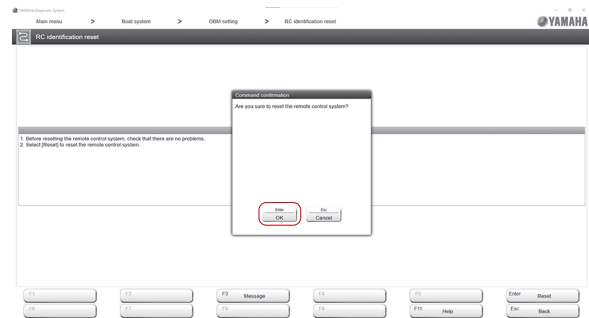
1. Connect the YDIS to display “Boat system” menu. To connect and operate the YDIS, see the YDIS (Ver. 2.49 or later) instruction manual.
2. Click the “RC identification reset” button or “OK” button, or select “RC identification reset” using the arrow keys, and then press the Enter key on the keyboard.



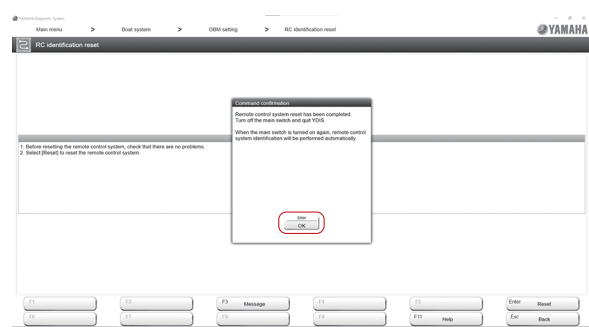
3. Click the “Reset” button or press the Enter key on the keyboard.



4. Click the “OK” button or press the Enter key on the keyboard.



5. Click the “OK” button or press the Enter key on the keyboard.



6. Turn the engine start switch to OFF, and then remove the extension wire harness of the Digital Electronic Control.

#### TIP: \_\_\_\_\_

The outboard motor will automatically identify the newly connected Digital Electronic Control under any of the following conditions:

- When the extension wire harness is connected and the engine start switch is turned to ON again.
- When the engine start switch is turned to OFF, and then turned to ON again after waiting for about 10 seconds until the power to the engine ECM is shut off.

## Tilt limiter

### Setting the tilt limiter

#### **WARNING**

- Check that the outboard motor is mounted on the boat or on a stand securely.
- Never get under the outboard motor while it is tilted.

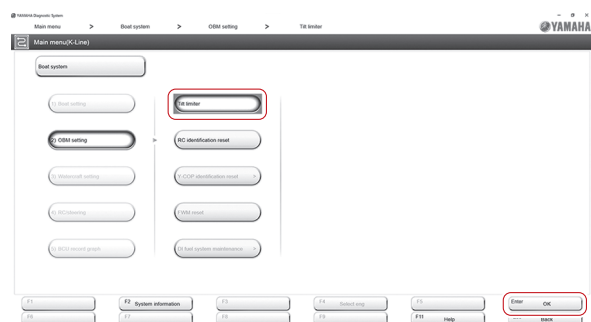
If there is interference between the top cowling and the motor well when the outboard motor is tilted up, adjust the setting angle of the tilt limiter using the following procedures.

1. Fully tilt the outboard motor down.
2. Connect the YDIS to display “Boat system” menu. To connect and operate the YDIS, see the YDIS (Ver. 2.49 or later) instruction manual.

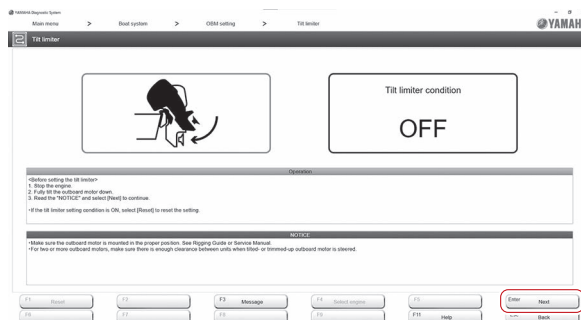
#### **TIP:**

It is not possible to set or clear the tilt limiter if there is any problem with the PTT sensor or the wiring. In that case, correct the problem first, and then set or clear the tilt limiter.

3. Click the “Tilt limiter” button or “OK” button, or select the “Tilt limiter” using the arrow keys, and then press the Enter key on the keyboard.



4. Click the “Next” button or press the Enter key on the keyboard.



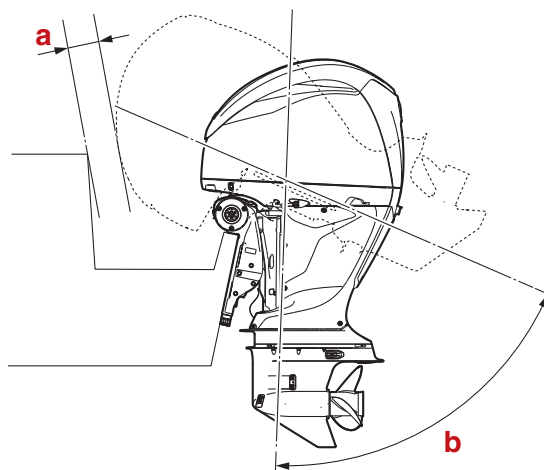
5. Operate the PTT switch on the bottom cowling to tilt the outboard motor up to the position where the tilt limiter is to be activated.

#### **NOTICE**

- Do not use the PTT switch on the Digital Electronic Control during the tilt limiter setting to avoid interference between the motor well and the top cowling.
- Make sure to keep the clearance “a” of 50.8 mm (2.0 in) or more between the outboard motor and the motor well.

#### **TIP:**

The tilt up angle can be set at any tilt setting range “b”.



- Click the “Set” button or press the Enter key on the keyboard.



- Click the “OK” button or press the Enter key on the keyboard.



- Check that the outboard motor stops at the set position.

**TIP:** \_\_\_\_\_

- If the tilt limiter does not operate at the set position, or to change the setting position, clear the tilt limiter setting, and then reset it.
- If the tilt limiter is set to a position where the tilt support lever cannot be engaged, or if the outboard motor is tilted up with the tilt support lever released for a long time, the outboard motor can fall under its own weight.

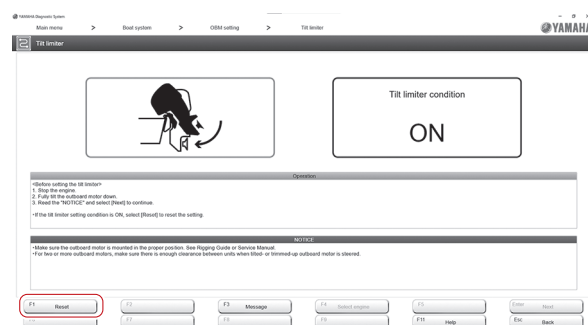
**Clearing the tilt limiter**

- Connect the YDIS to display “Boat system” menu. To connect and operate the YDIS, see the YDIS (Ver. 2.49 or later) instruction manual.

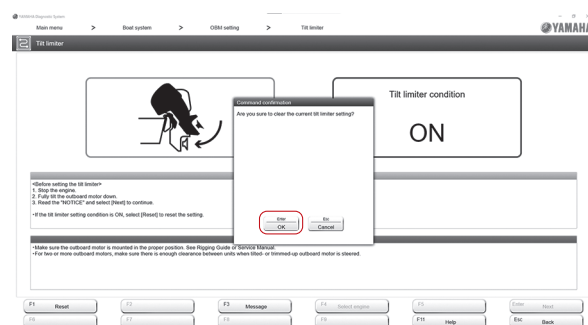
**TIP:** \_\_\_\_\_

It is not possible to set or clear the tilt limiter if there is any problem with the PTT sensor or the wiring. In that case, correct the problems before setting or clearing the tilt limiter.

- Click the “Reset” button or press the F1 key on the keyboard.

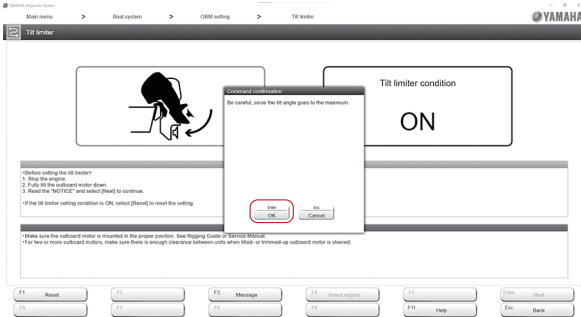


- Click the “OK” button or press the Enter key on the keyboard.



- Click the “OK” button or press the Enter key on the keyboard.

**TIP:** \_\_\_\_\_  
 To reset the tilt limiter setting, see “Setting the tilt limiter” (3-38).

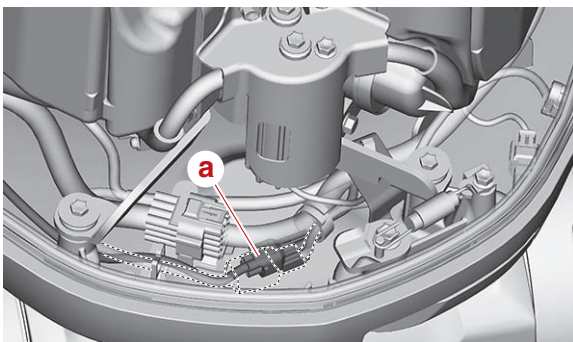


### Deactivating the tilt limiter

The tilt limiter can be deactivated temporarily without using the YDIS for services or maintenance. Deactivate the tilt limiter using the following procedure.

1. Disconnect the PTT sensor (sub lead) coupler “a”.

**TIP:** \_\_\_\_\_  
 When the engine start switch is turned to ON with the PTT sensor coupler disconnected, diagnosis code 83 (PTT sensor malfunction) will be recorded in the engine ECM. Make sure to connect the PTT sensor coupler and delete the diagnosis code after services or maintenance is complete.



### Calibration (6X9 Digital Electronic Control)

#### Calibration (6X9 Digital Electronic Control)

- If the steering actuator is removed, the steering sensor must be calibrated after the unit is installed.
- Check that the battery is fully charged before performing the calibration. Otherwise, the calibration cannot be performed properly.
- Do not turn the steering wheel while the calibration is being performed.

**TIP:** \_\_\_\_\_  
 Steering calibration is not required with the factory default setting.

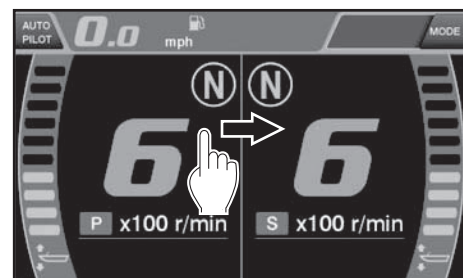
#### CL5 display calibration

- If the steering actuator is removed, the steering sensor must be calibrated after the unit is installed.
- Check that the battery is fully charged before performing the calibration. Otherwise, the calibration cannot be performed properly.
- Do not turn the steering wheel while the calibration is being performed.

**TIP:** \_\_\_\_\_  
 Steering calibration is not required with the factory default setting.

#### Configuring the number of outboard motors

1. Turn the power switch to “ON”.
2. Open the menu screen by swipe.



3. Tap "Reset".



4. Tap "Number of Engines".



5. Select the number of outboard motors mounted on the boat.

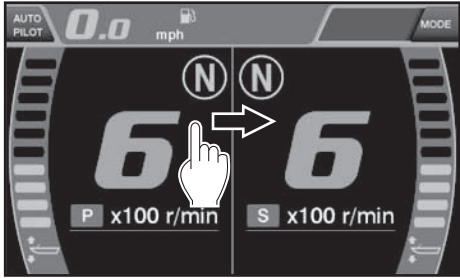


6. Tap "Reset" to confirm that the number of outboard motors has been changed.



Accessing the calibration menu

1. Open the menu screen by swipe.

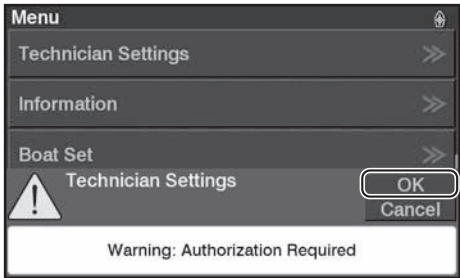


2. Tap and hold the "Menu" bar for 10 seconds. The "Technician Settings" menu will be added to the menu.

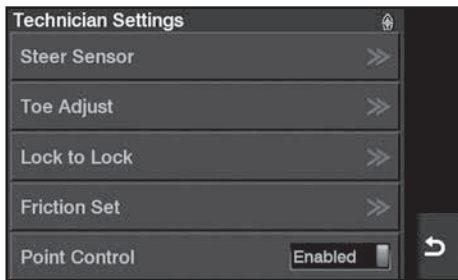
TIP: Tap while the screen is scrolled all the way to the top.



3. When the "Technician Settings" message appears, tap "OK".



- The “Technician Settings” menu will appear.

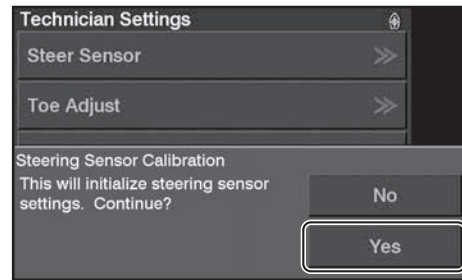
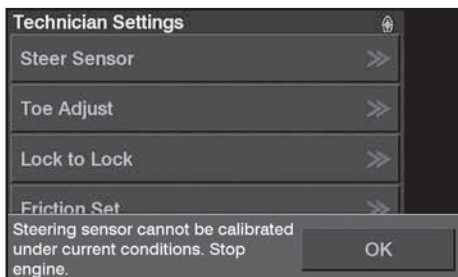
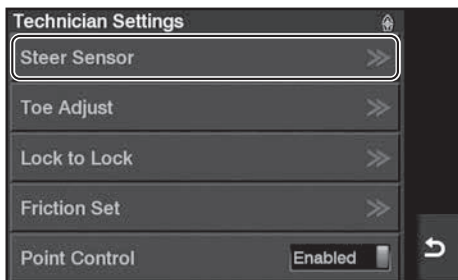


### Steering sensor

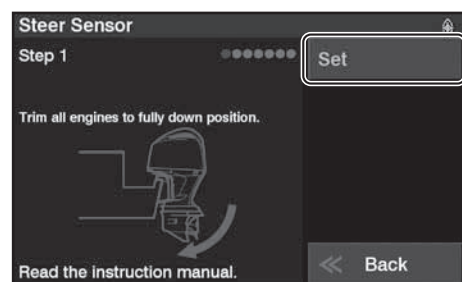
During this process, only the corresponding steering actuator will operate as the steering sensor is being calibrated.

- Before performing this menu, switch the battery switch(es) to the “ALL” position.
- From the “Technician Settings” menu, select “Steer Sensor”, and then tap “Yes”.

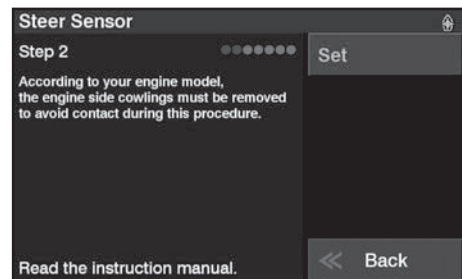
**TIP:** \_\_\_\_\_  
When the engine is running, this function is not available.



- Tap “Set” to trim all engines to the fully down position.



- Check the contents of the display and proceed to the next step.

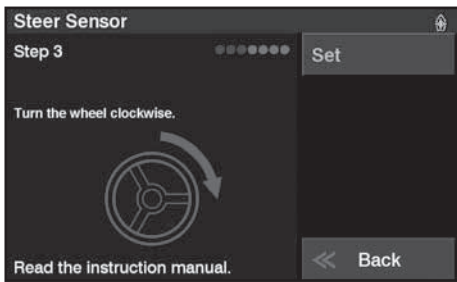
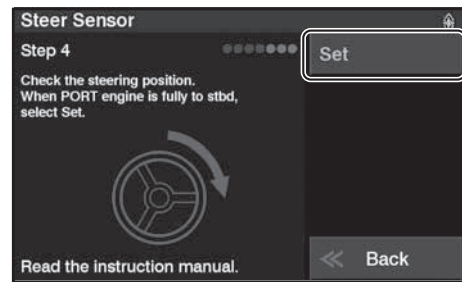


- Turn the steering wheel clockwise until starboard outboard motor reaches full STBD lock and the message appears. Confirm the starboard outboard motor is at full STBD lock, and then tap “Set”.



**TIP:** \_\_\_\_\_

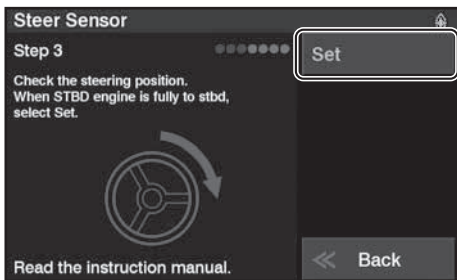
- For triple engine applications, after this step, do the center outboard motor, and then do the port outboard motor.
- For quad engine applications, after this step, do the center starboard outboard motor, then the center port outboard motor, and then do the port outboard motor.



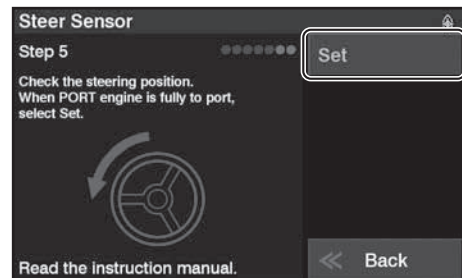
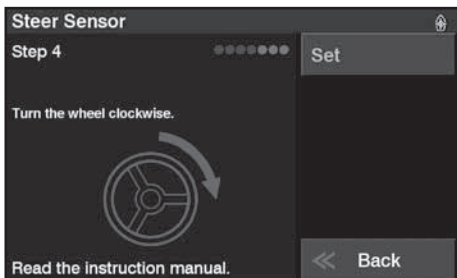
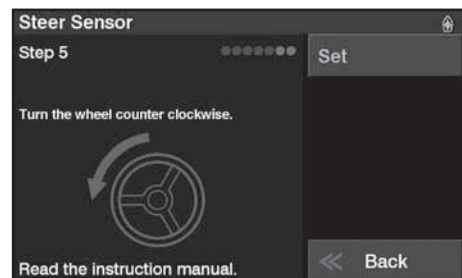
7. Turn the steering wheel counterclockwise until the port outboard motor reaches full PORT lock and the message appears. Confirm the port outboard motor is at full PORT lock, and then tap "Set".

**TIP:** \_\_\_\_\_

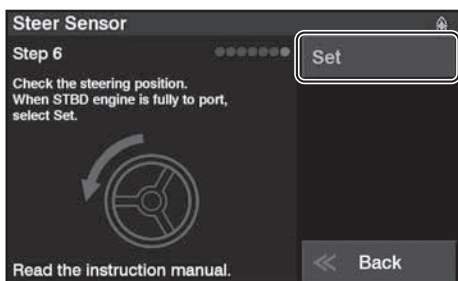
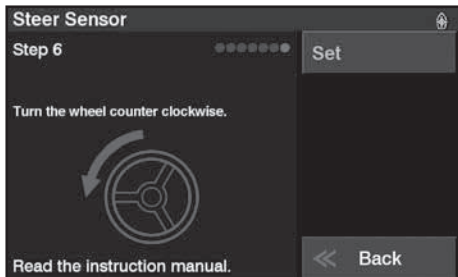
- For triple engine applications, after this step, do the center outboard motor, and then do the port outboard motor.
- For quad engine applications, after this step, do the center port outboard motor, then the center starboard outboard motor, and then do the starboard outboard motor.



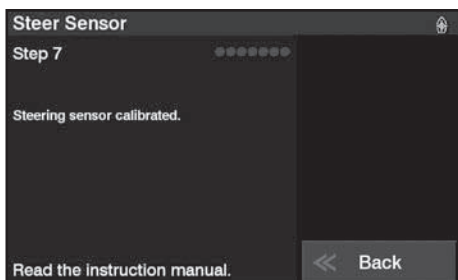
6. Turn the steering wheel clockwise until the port outboard motor reaches full STBD lock and the message appears. Confirm the port outboard motor is at full STBD lock, and then tap "Set".



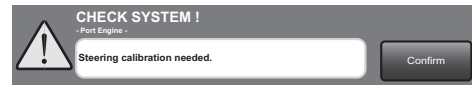
- Turn the steering wheel counterclockwise until the starboard outboard motor reaches full PORT lock and the message appears. Confirm the starboard outboard motor is at full PORT lock, and then tap “Set”.



- Once the calibration is complete, a message will appear verifying the procedure is completed.



- If there is an invalid value when calibrating the steering sensor, a notification will appear. Perform the complete calibration procedure again.
- If the steering system still requires calibration, a warning notification will appear. The engine will not start until calibration is performed again.



### Toe Adjust

You can freely adjust the toe angle of outboard motors according to the structure of the hull on which they are mounted. This should be determined by on-water testing.

#### TIP:

- For twin engines without BCU, triple engines (Toe Adjust: numerical value input)
- For twin engines with BCU (Wedge/Toe: numerical value input, adjust up and down)
- For quad engines (Inner/Outer: numerical value input)

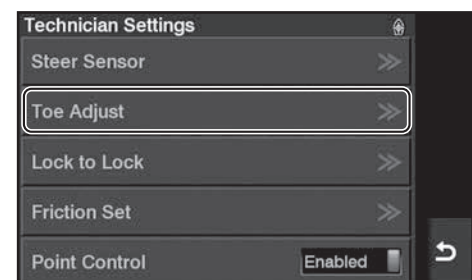
### Wedge/Toe settings

Do this setting for “Wedge/Toe” only if the adjustment width of the toe angle is insufficient due to the shape of the transom.

#### TIP:

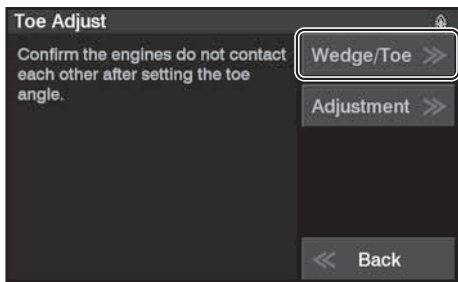
Single engine application: No setting  
 Twin engine application: Wedge and Toe  
 Triple, quad engine application: Toe Adjust only

- From the “Technician Settings” menu, select “Toe Adjust”.

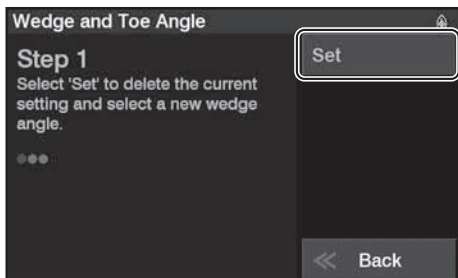




2. Tap “Wedge/Toe”.



3. Select “Set” to delete the current setting and select a new wedge angle.

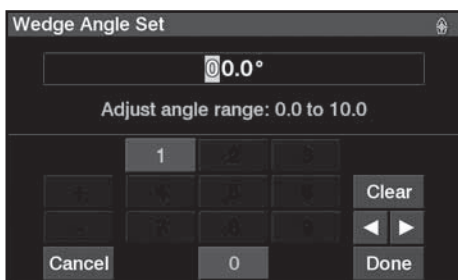


4. Adjust the wedge angle. Tap “Done” to confirm.

**TIP:** \_\_\_\_\_

The Helm Master EX control system comes with the toe set at 00.0°. The adjustment range is:

- 0.0° to +10.0° in 0.1° increments.
- Plus (+) degrees equals toe-out.



5. Select “Set” to adjust the toe angle.



6. Adjust the toe angle. Tap “Done” to confirm.

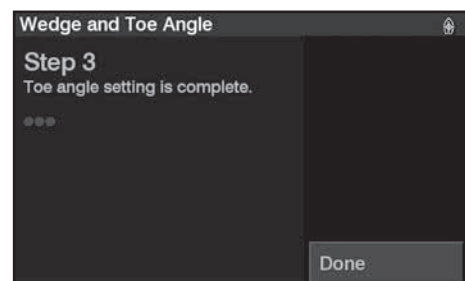
**TIP:** \_\_\_\_\_

The Helm Master EX control system comes with the toe set at 0.0°. The adjustment range is:

- -2.0° to +2.0° in 0.2° increments (up to 0.2 in).
- Minus (-) degrees equals toe-in.
- Plus (+) degrees equals toe-out.



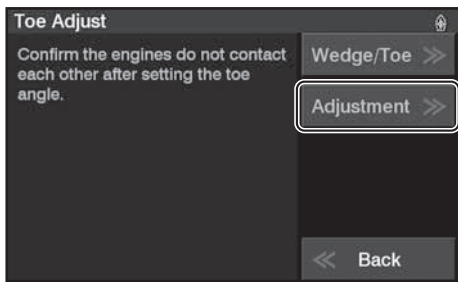
7. When the Wedge/Toe calibration is completed, a message will appear.



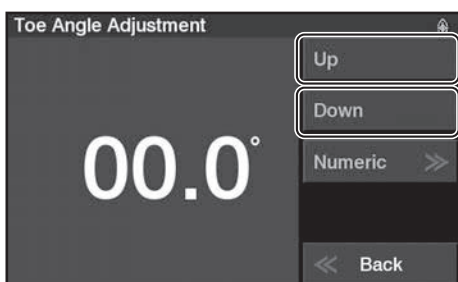
**Adjustment settings**

If you are adjusting only the toe angle, do the setting in “Adjustment”.

1. Tap “Adjustment”.



2. Tap “Up” or “Down” to adjust the toe angle.

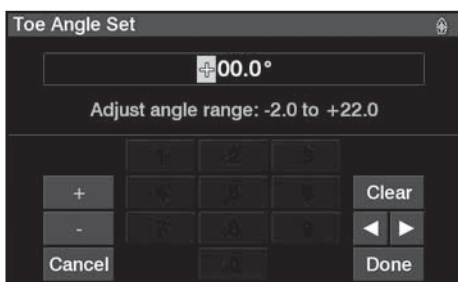


Tap “Numeric” to adjust the toe angle.

**TIP:** \_\_\_\_\_

The Helm Master EX control system comes with the toe set at 00.0°. The adjustment range is:

- -2.0° to +22.0° in 0.2° increments.
- Minus (-) degrees equals toe-in.
- Plus (+) degrees equals toe-out.



### Lock to Lock

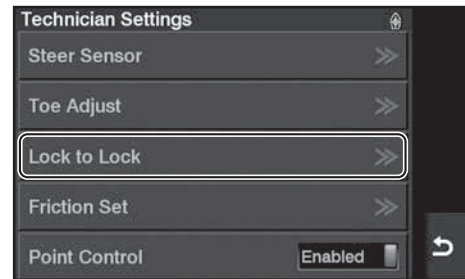
You can freely adjust the number of turns of the steering wheel lock to lock.

#### Constant

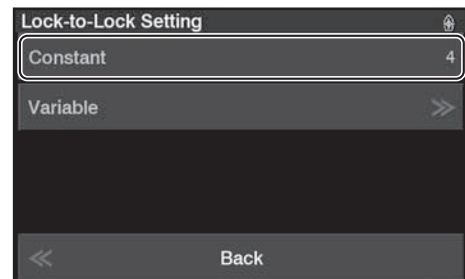
1. From the “Technician Settings” menu, select “Lock to Lock”.

**TIP:** \_\_\_\_\_

When the engine is running, this function is not available.



2. Tap “Constant”.

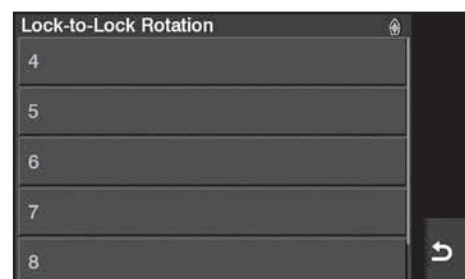


3. Select the steering wheels’ rotation range. Tap to confirm your setting.

**TIP:** \_\_\_\_\_

This setting allows you to adjust the number of turns from “Lock to Lock”.

- Minimum: 4 turns
- Maximum: 9 turns
- Default: 4 turns

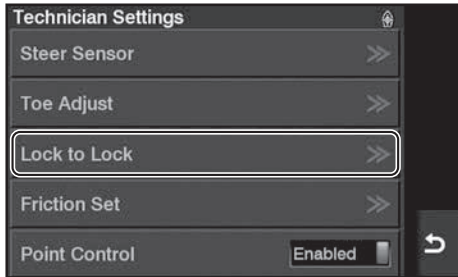


#### Variable

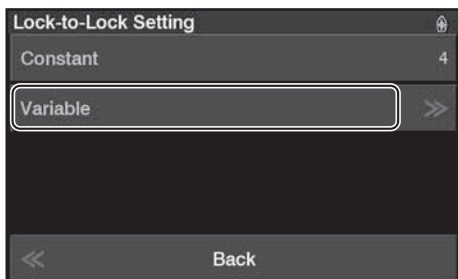
Select the rotational angle of the steering wheel according to the engine speed.

1. From the “Technician Settings” menu, select “Lock to Lock”.

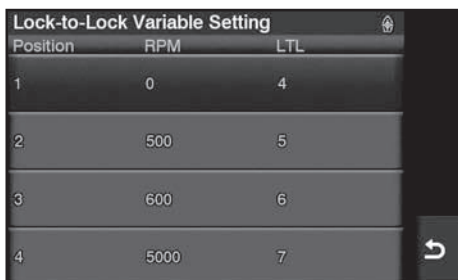
**TIP:** \_\_\_\_\_  
 When the engine is running, this function is not available.



2. Tap “Variable”.

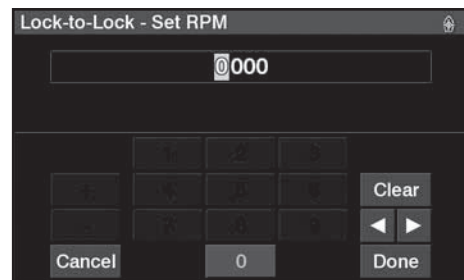
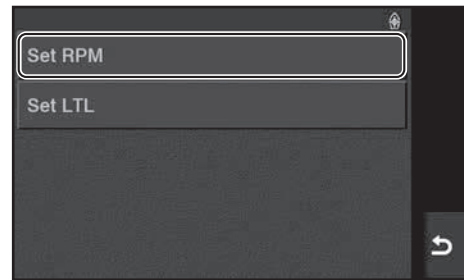


3. Select the positions, 1 to 4, to set.



4. Tap “Set RPM” to adjust the RPM of engines 1 to 4.

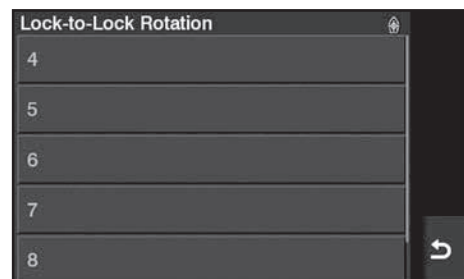
**TIP:** \_\_\_\_\_  
 You can adjust this to any value in a range of 0 to 6000 r/min.



5. Tap “Set LTL” and then select a rotational angle, from 1 to 9, for the steering wheel.

**TIP:** \_\_\_\_\_  
 This setting allows you to adjust the number of turns from “Lock to Lock”.

- Minimum: 4 turns
- Maximum: 9 turns
- Default: 4 turns



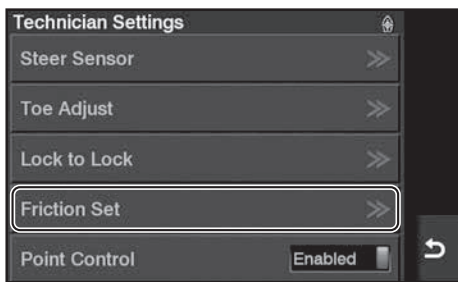
## Friction Set

The Helm Master EX control steering system has a unique function related to the friction of the steering system. The steering will automatically adjust the friction setting depending on engine speed. At higher engine speeds, the friction increases. At lower engine speeds, the friction decreases.

Regardless of the setting chosen, the steering still increases and decreases the friction based on the engine speed.

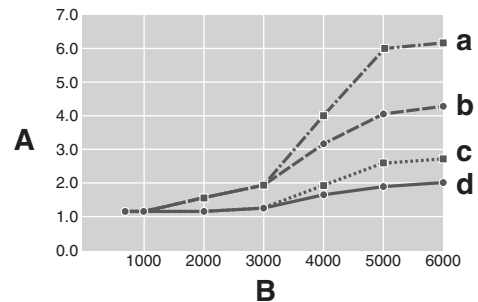
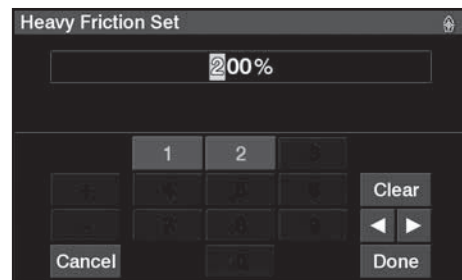
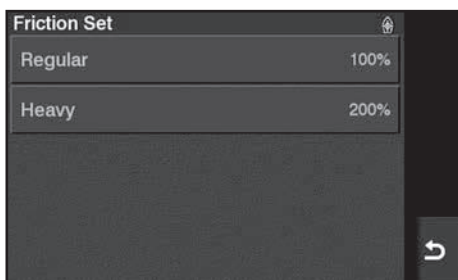
1. From the “Technician Settings” menu, select “Friction Set”.

**TIP:** \_\_\_\_\_  
When the engine is running, this function is not available.



2. First choose “Regular” or “Heavy”, then adjust the percentage of friction. Tap “Done” to confirm.

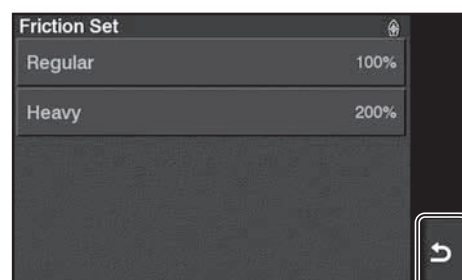
**TIP:** \_\_\_\_\_  
The setting choices allow you to choose between “Regular” and “Heavy”. In each of those settings, it is adjustable between 100% and 200% in 10% increments. The default setting is 100%.



- a. Heavy 200%
- b. Regular 200%
- c. Heavy 100%
- d. Regular 100%

- A. Steering friction (N-m)
- B. Engine speed (r/min)

3. When the “Friction Set” setting is completed, tap “return mark” to return to the “Technician Settings” menu.



## **Rigging recommendation**

### **Battery cable length**


The battery cable length from the negative terminal of the battery cable to the rigging grommet.

The positive battery cable is 100 mm (3.9 in) longer than the negative battery cable.

See "Model data" (A-1).

## Propeller selection

With the engine speed at full throttle operating range and under a maximum boat load, the engine speed should be within the upper half of the full throttle operating speed range.

	Full throttle operating range 5000–6000 r/min
---	--

### Regular rotation model

Blade	Dia. (in)	Pitch (in)	Mark	Material	Part number	Remarks
3	14 1/4	22	M	Stainless steel	60H-45978-00	*1
3	14 1/4	20	M	Stainless steel	60H-45976-00	*1
3	14 1/4	18	M	Stainless steel	60H-45974-00	*1
3	14 1/4	16	M	Stainless steel	60H-45972-00	*1
3	14 1/4	14	M	Stainless steel	60H-45970-00	*1
3	15 3/4	13	T	Stainless steel	6CE-45930-20	*1, *2
3	15 3/4	15	T	Stainless steel	6CE-45976-20	*1, *2
3	15 1/2	16	T	Stainless steel	6CE-45938-20	*1, *2
3	15 1/2	17	T	Stainless steel	6CE-45978-20	*1, *2
3	15 1/4	18	T	Stainless steel	6CE-45934-20	*1, *2
3	15 1/4	19	T	Stainless steel	6CE-45970-20	*1, *2
3	15	20	T	Stainless steel	6CE-45932-20	*1, *2
3	15	21	T	Stainless steel	6CE-45972-20	*1, *2
3	14 3/4	22	T	Stainless steel	6CE-45936-20	*1, *2
3	14 3/4	23	T	Stainless steel	6CE-45974-20	*1, *2
4	15	21	T	Stainless steel	6CE-45B70-20	*1, *3
4	15	22	T	Stainless steel	6CE-45B72-20	*1, *3
4	15	23	T	Stainless steel	6CE-45B74-20	*1, *3
3	14 1/2	13	M	Stainless steel	68F-45932-20	*1, *4
3	14 1/2	14	M	Stainless steel	68F-45930-20	*1, *4
3	14 1/2	15	M	Stainless steel	68F-45970-20	*1, *4
3	14 1/4	17	M	Stainless steel	68F-45972-20	*1, *4
3	14 1/4	18	M	Stainless steel	68F-45978-20	*1, *4
3	13 3/4	19	M	Stainless steel	68F-45974-20	*1, *4
3	13 3/4	21	M	Stainless steel	68F-45976-20	*1, *4
3	15	20	T	Stainless steel	6KA-45974-00	*1, *5
3	15	21	T	Stainless steel	6KA-45976-00	*1, *5

## Propeller selection

Blade	Dia. (in)	Pitch (in)	Mark	Material	Part number	Remarks
3	15 1/4	18	T	Stainless steel	6KA-45970-00	*1, *5
3	15 1/4	19	T	Stainless steel	6KA-45972-00	*1, *5

- \*1. Shift Dampener System (SDS) propellers
- \*2. Saltwater II propellers
- \*3. Saltwater HS propellers
- \*4. Reliance propellers
- \*5. Saltwater II HP propellers

**TIP:** \_\_\_\_\_

The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.

### Counter rotation model

Blade	Dia. (in)	Pitch (in)	Mark	Material	Part number	Remarks
3	14 1/4	22	ML	Stainless steel	60J-45978-00	*1
3	14 1/4	20	ML	Stainless steel	60J-45976-00	*1
3	14 1/4	18	ML	Stainless steel	60J-45974-00	*1
3	14 1/4	16	ML	Stainless steel	60J-45972-00	*1
3	14 1/4	14	ML	Stainless steel	60J-45970-00	*1
3	15 3/4	13	TL	Stainless steel	6CF-45930-20	*1, *2
3	15 3/4	15	TL	Stainless steel	6CF-45976-20	*1, *2
3	15 1/2	17	TL	Stainless steel	6CF-45978-20	*1, *2
3	15 1/4	18	TL	Stainless steel	6CF-45934-20	*1, *2
3	15 1/4	19	TL	Stainless steel	6CF-45970-20	*1, *2
3	15	20	TL	Stainless steel	6CF-45932-20	*1, *2
3	15	21	TL	Stainless steel	6CF-45972-20	*1, *2
3	14 3/4	22	TL	Stainless steel	6CF-45936-20	*1, *2
3	14 3/4	23	TL	Stainless steel	6CF-45974-20	*1, *2
4	15	21	TL	Stainless steel	6CF-45B70-20	*1, *3
4	15	22	TL	Stainless steel	6CF-45B72-20	*1, *3
4	15	23	TL	Stainless steel	6CF-45B74-20	*1, *3
3	14 1/2	14	ML	Stainless steel	68G-45930-20	*1, *4
3	14 1/2	15	ML	Stainless steel	68G-45970-20	*1, *4
3	14 1/4	17	ML	Stainless steel	68G-45972-20	*1, *4
3	14 1/4	18	ML	Stainless steel	68G-45978-20	*1, *4
3	13 3/4	19	ML	Stainless steel	68G-45974-20	*1, *4
3	13 3/4	21	ML	Stainless steel	68G-45976-20	*1, *4
3	15	20	TL	Stainless steel	6KB-45974-00	*1, *5
3	15	21	TL	Stainless steel	6KB-45976-00	*1, *5

## Propeller selection

Blade	Dia. (in)	Pitch (in)	Mark	Material	Part number	Remarks
3	15 1/4	18	TL	Stainless steel	6KB-45970-00	*1, *5
3	15 1/4	19	TL	Stainless steel	6KB-45972-00	*1, *5

- \*1. Shift Dampener System (SDS) propellers
- \*2. Saltwater II propellers
- \*3. Saltwater HS propellers
- \*4. Reliance propellers
- \*5. Saltwater II HP propellers

**TIP:** \_\_\_\_\_  
The part numbers are subject to change without notice. Make sure to confirm the latest part numbers.



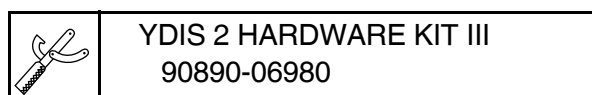
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## Troubleshooting

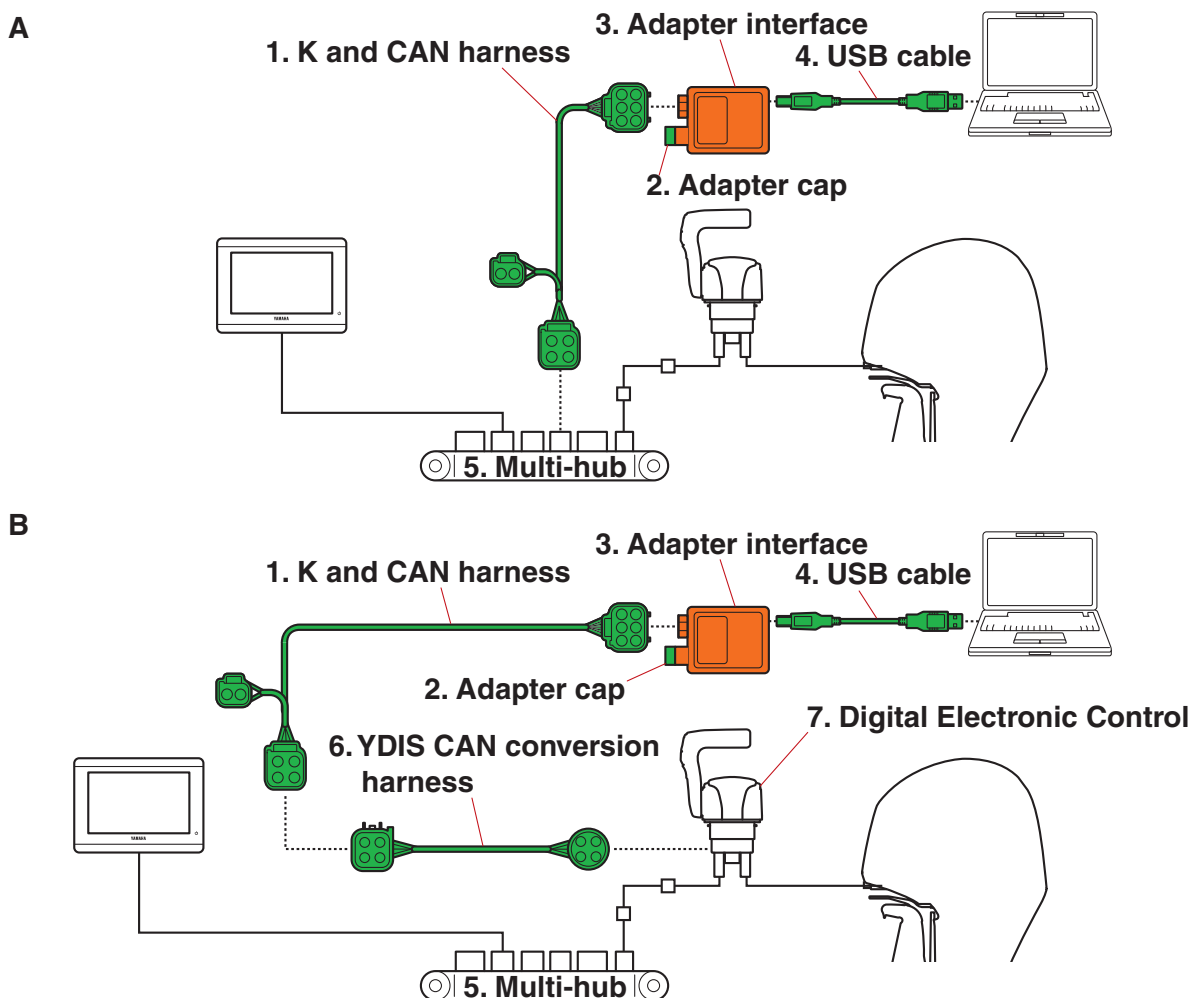
<b>YDIS</b> .....	<b>4-1</b>
Connecting the communication cable .....	4-1
ECM reprogramming .....	4-3
<b>Outboard motor troubleshooting</b> .....	<b>4-4</b>
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## YDIS

The Yamaha Diagnostic System uses precision fault diagnosis to offer better serviceability at a time when there is increasing demand for service tools for electronically controlled products. It provides quick, reliable, safe, and reasonable service, and is intended to obtain customer satisfaction. The Yamaha Diagnostic System features updated software and expanded tool functions that allow it to respond to new models and technologies, maintaining compatibility with regulations. See YDIS (Ver. 2.49 or later) instruction manual for detailed information.



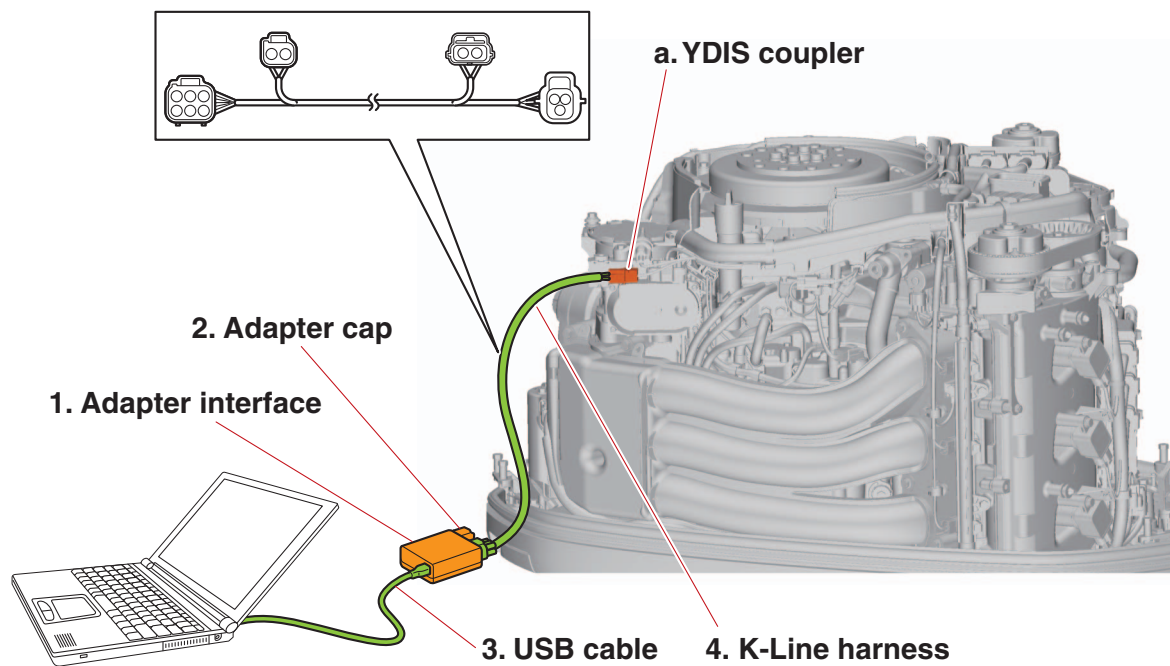
### Connecting the communication cable CAN-Line



1. K and CAN harness
2. Adapter cap
3. Adapter interface
4. USB cable
5. Multi-hub
6. YDIS CAN conversion harness
7. Digital Electronic Control

- A. When connecting to multi-hub
- B. When connecting to Digital Electronic Control

**K-Line**



- 1. Adapter interface
- 2. Adapter cap
- 3. USB cable
- 4. K-Line harness
- a. YDIS coupler (gray)

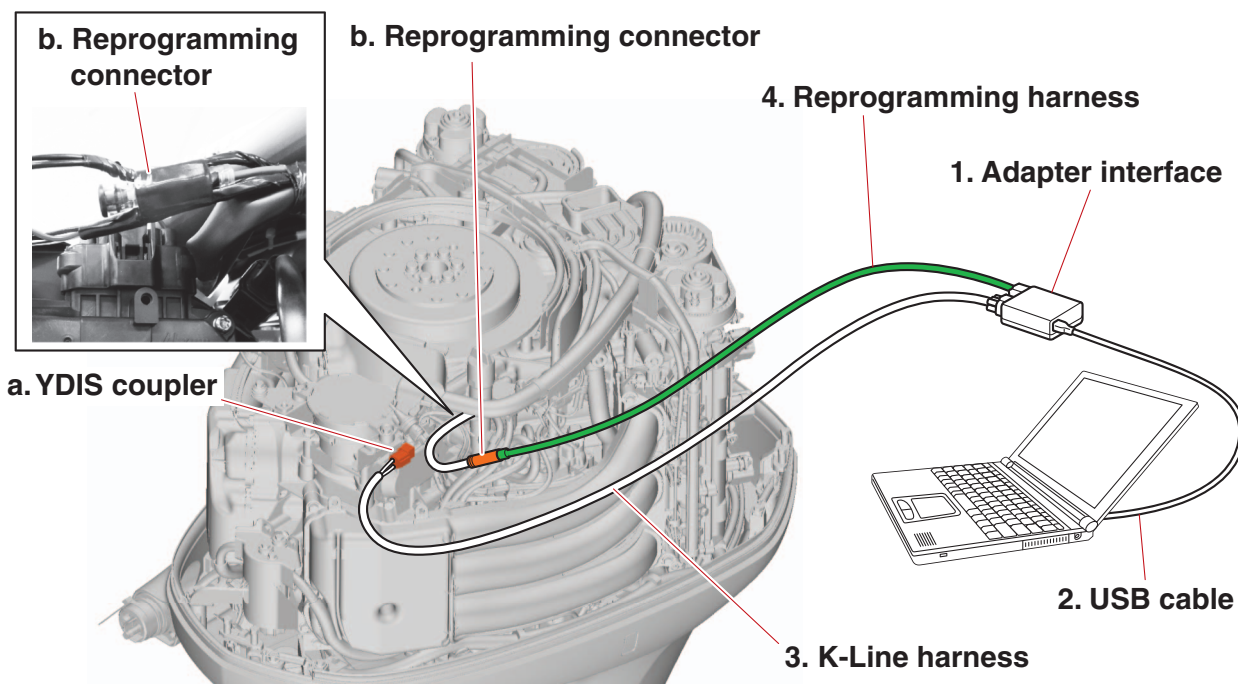
## ECM reprogramming

### Program update function

This function allows you to update the engine ECM program to the latest version using a reprogramming harness (K and CAN harness).

### Writing function of engine serial numbers

A new function enables you to write an engine serial number to a new, replacement part engine ECM (supplied by the Part Division). With this new function, it will be possible to reprogram engine ECMs that are supplied as replacement parts by communicating with YMAN.



1. Adapter interface
  2. USB cable
  3. K-Line harness
  4. Reprogramming harness
- a. YDIS coupler (gray)
  - b. Reprogramming connector (green/orange)

## Outboard motor troubleshooting

### Troubleshooting procedure

1. Before troubleshooting the outboard motor, check that fresh fuel of the specified type has been used.
2. Check that all electrical connections are secure and free from corrosion, and that the battery is fully charged.
3. Check the trouble code using the YDIS first, and then check the electronic control system following the trouble code chart.
4. When a trouble code is detected, check the data logger of the engine ECM record graph as well.
5. If a trouble code is not detected, check the power unit according to “Troubleshooting the power unit” (4-21).
6. Before using the YDIS to check the power unit, check the engine ECM circuit. See “Checking the engine ECM circuit” (5-22).

### TIP:

- When deleting the diagnosis record on the YDIS, make sure to check the time that the trouble codes were detected.
  - When checking the input voltage of a part, the coupler or connector must be disconnected. As a result, the engine ECM determines that the part is disconnected and a trouble code is detected. Therefore, make sure to delete the diagnosis record after checking the input voltage.
  - Since the main relay comes on for approximately 10 seconds after the engine start switch is turned to OFF, the power of the engine ECM cannot be turned off. Therefore, if the engine start switch is turned to ON within 10 seconds after it was turned to OFF, the trouble codes cannot be deleted.
- 

### Troubleshooting the power unit using the YDIS

1. Use the trouble codes, displayed by the YDIS, to check each part according to the table of “Trouble code and checking step” (4-7).
2. Delete the trouble codes after checking, repairing, or replacing a part and check that the trouble codes are not detected again. If the same trouble codes are detected, the engine ECM may be faulty.
3. Check the items listed in the table. If all of the items are in good condition, delete the trouble codes, and then check the trouble codes again. If the same trouble codes are detected again, the engine ECM is faulty.

**Trouble code table**

To display trouble codes (code number 300 and higher) for the SBW system, connect using the CAN-Line harness.

✓: Indicated

—: Not indicated

Code No.	Item	YDIS diagnosis	YDIS diagnosis record
13	Pulser coil	✓	✓
15	Engine temperature sensor	✓	✓
17	Knock sensor	✓	✓
19	Battery voltage	✓	✓
23	Air temperature sensor	✓	✓
24	Cam position sensor (EX)	✓	✓
27	Water in fuel filter	✓	✓
29	Air pressure sensor	✓	✓
39	Oil pressure sensor	✓	✓
44	Engine shut-off switch	✓	—
71	Cam position sensor (S IN)	✓	✓
72	Cam position sensor (P IN)	✓	✓
73	OCV (S)	✓	✓
74	OCV (P)	✓	✓
83	PTT sensor	✓	✓
84	PTT buzzer	✓	✓
86	Immobilizer	—	✓
112, 113, 114, 115, 116, 117, 119, 123, 138, 141, 142, 143, 144, 145	ETV	✓	✓
124, 125, 126, 127, 128	TPS	✓	✓
146, 147, 148, 149, 150, 153, 154, 155	SPS	✓	✓
156, 157	Engine-RC communication	✓	✓

## Outboard motor troubleshooting

Code No.	Item	YDIS diagnosis	YDIS diagnosis record
160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 183, 184, 186, 187	Remote control system	✓	✓
223	Steering system	✓	✓
224	Steering system–Outboard (SCU)	✓	✓
225	Steering system–Helm (HELM)	✓	✓
320	Trim drive	✓	✓
321	R/C to Steering Communication	✓	✓
322, 323	Remote Control System	✓	✓
324	RC to steering system comm. (BC)	✓	✓
325	RC to BC system communication	✓	✓
326	Main RC unit communication	✓	✓
327	2nd ST. RC unit communication	✓	✓
328	RC to BCU communication	✓	✓
512, 513	System Voltage Low	✓	✓
514	System Voltage High	✓	✓
515, 517, 518, 519, 520, 521	Steering System–Position Sensor	✓	✓
516	Steering Sensor(s) Calibration	✓	✓
522	Steering System–Actuator Temp.	✓	✓
523, 524	Steering System–Temperature Sensor	✓	✓
525, 526, 527	Steering System–Actuator Current	✓	✓
528, 529	Steering System–Control Unit	✓	✓
530	Steering System–Current Sensor	✓	✓
531	Steering System–Brake Current	✓	✓
532, 533	Steering System–Actuator	✓	✓
534	R/C to Steering Communication	✓	✓
535	Steering to Steering Communication	✓	✓

## Outboard motor troubleshooting

Code No.	Item	YDIS diagnosis	YDIS diagnosis record
536	Steering System Communication	✓	✓
537, 538	Steering System–Main Helm	✓	✓
539, 540	Steering System–2nd Helm	✓	✓
541	Steering System–Control Unit	✓	✓
542	Incompatible Hardware	✓	✓
543	Steering System–Control Unit	✓	✓
544	Steering to R/C Communication	✓	✓
545	Incompatible Software	✓	✓
546	Steering System–Configuration	✓	✓
547	Outboard to Steering Communication	✓	✓

### Trouble code and checking step

The descriptions enclosed by < > are applicable to the twin and triple engine installations.

For code number 300 and higher checking steps, see the Helm master EX rigging guide (6X9-28197-\*\*).

\*1: See the Digital Electronic Control service manual.

—: Not applicable

Trouble code	Item (Condition)	Symptom	Checking steps	See page
13	Pulser coil (Irregular signal)	“Check Engine” is displayed. Engine stops suddenly. Engine does not restart.	Measure the pulser coil air gap.	7-2
			Measure the pulser coil output peak voltage.	5-37
			Measure the pulser coil resistance.	5-37
			Check for wiring continuity between the pulser coil and the engine ECM.	A-13
			Check the protrusions on the flywheel magneto for damage.	7-14
15	Engine temperature sensor (Out of specification)	“Check Engine” is displayed. Degraded acceleration performance. Declining maximum engine speed.	Measure the engine temperature sensor input voltage.	5-39
			Measure the engine temperature sensor resistance.	5-39
			Check for wiring continuity between the engine temperature sensor and the engine ECM.	A-13



## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
17	Knock sensor (Irregular signal)	"Check Engine" is displayed. High engine idle speed.	Measure the knock sensor resistance.	5-41
			Check for wiring continuity between the knock sensor and the engine ECM.	A-13
19	Battery voltage (Below specified voltage)	Battery voltage and battery alert are displayed. Engine operates normally. Engine does not restart (depends on battery condition).	Check the battery capacity and specific gravity.	10-7
			Check the fuse.	5-5
			Check the battery cable and terminals for proper connection.	10-7
			Measure the lighting coil output peak voltage.	5-34
			Measure the lighting coil resistance.	5-34
			Measure the rectifier/regulator/isolator output peak voltage.	5-35
23	Intake air temperature sensor (Out of specification)	"Check Engine" is displayed. High engine idle speed. <Engine speeds do not synchronize>	Check the intake air temperature using the YDIS.	5-38
			Measure the intake air temperature sensor input voltage.	5-38
			Measure the intake air temperature sensor resistance.	5-38
			Check for wiring continuity between the intake air temperature sensor and the engine ECM.	A-13
24	Cam position sensor (EX) (Irregular signal)	"Check Engine" is displayed. High engine idle speed. Degraded acceleration performance. Declining maximum engine speed. <Difference in engine idle speeds> <Engine speeds do not synchronize>	Measure the cam position sensor input voltage.	5-26
			Measure the cam position sensor output voltage.	5-26
			Check for wiring continuity between the cam position sensor and the main relay.	A-11
			Check for wiring continuity between the cam position sensor and the engine ECM.	A-11
			Check the brim of the camshaft.	7-41

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
27	Water in fuel filter (Water in fuel filter)	"Water in fuel" is displayed. Alert buzzer comes on while the shift is in the N position.	Check the fuel filter for water.	—
			Measure the water detection switch input voltage.	5-30
			Check the water detection switch for continuity.	5-30
			Check for wiring continuity between the water detection switch and the engine ECM.	A-12
29	Intake air pressure sensor (Out of specification)	"Check Engine" is displayed. High engine idle speed. Declining maximum engine speed. <Difference in engine idle speeds> <Engine speeds do not synchronize>	Measure the intake air pressure sensor input voltage.	5-39
			Measure the intake air pressure sensor output voltage.	5-39
			Check for wiring continuity between the intake air pressure sensor and the engine ECM.	A-13
39	Oil pressure sensor (Out of specification)	"Check Engine" is displayed. High engine idle speed. Declining maximum engine speed. <Difference in engine idle speeds>	Check the oil pressure using the YDIS.	7-1
			Measure the oil pressure sensor input voltage.	5-29
			Measure the oil pressure sensor output voltage.	5-29
			Check for wiring continuity between the oil pressure sensor and the engine ECM.	A-11
71	Cam position sensor (S IN) (Irregular signal)	"Check Engine" is displayed. High engine idle speed. Degraded acceleration performance. Declining maximum engine speed. <Difference in engine idle speeds> <Engine speeds do not synchronize>	Measure the cam position sensor input voltage.	5-26
			Measure the cam position sensor output voltage.	5-26
			Check for wiring continuity between the cam position sensor and the main relay.	A-11
			Check for wiring continuity between the cam position sensor and the engine ECM.	A-11
			Check the brim of the camshaft.	7-41

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
72	Cam position sensor (P IN) (Irregular signal)	"Check Engine" is displayed. High engine idle speed. Degraded acceleration performance. Declining maximum engine speed. <Difference in engine idle speeds> <Engine speeds do not synchronize>	Measure the cam position sensor input voltage.	5-26
			Measure the cam position sensor output voltage.	5-26
			Check for wiring continuity between the cam position sensor and the main relay.	A-11
			Check for wiring continuity between the cam position sensor and the engine ECM.	A-11
			Check the brim of the camshaft.	7-41
73	OCV (S) (Irregular load current value)	"Check Engine" is displayed. High engine idle speed. Degraded acceleration performance. Declining maximum engine speed. <Engine speeds do not synchronize>	Check the OCV operation using the YDIS.	5-28
			Measure the OCV input voltage.	5-28
			Measure the OCV resistance.	5-28
			Check for wiring continuity between the OCV and the main relay.	A-11
			Check for wiring continuity between the OCV and the engine ECM.	A-11
			Check the OCV filter.	7-49
74	OCV (P) (Irregular load current value)	"Check Engine" is displayed. High engine idle speed. Degraded acceleration performance. Declining maximum engine speed. <Engine speeds do not synchronize>	Check the OCV operation using the YDIS.	5-28
			Measure the OCV input voltage.	5-28
			Measure the OCV resistance.	5-28
			Check for wiring continuity between the OCV and the main relay.	A-11
			Check for wiring continuity between the OCV and the engine ECM.	A-11
			Check the OCV filter.	7-49

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
83	PTT sensor (Out of specification)	"Check Engine" is displayed.	Measure the PTT sensor resistance.	5-51
			Measure the PTT sensor input voltage.	5-51
			Check for wiring continuity between the PTT sensor and the engine ECM.	A-15
84	PTT buzzer	When setting the PTT TotalTilt™, the PTT buzzer does not sound even if the PTT switch is pressed twice quickly.	Check the PTT buzzer.	5-51
			Check for continuity between the PTT buzzer and the engine ECM.	A-15
86	Immobilizer (Communication error)	"Check Engine" is displayed. Declining maximum engine speed.	Check that Y-COP is connected properly.	—
			Measure the Y-COP input voltage.	—
112	ETV system (Engine ECM internal circuit malfunction)	"Check Engine" is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Replace the engine ECM.	7-28
113	ETV system (Throttle valve malfunction)	"Check Engine" is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Measure the TPS output voltage using the YDIS.	5-23
			Check the ETV circuit.	A-11
			Check the fuse.	5-5
			Check the ETV motor relay.	5-24
114	ETV system (Engine ECM internal circuit malfunction)	Engine will not start.	Replace the engine ECM.	7-28
115 116	ETV system (Throttle valve malfunction)	"Check Engine" is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Check the ETV circuit.	A-11
			Check the ETV.	6-14
117	ETV system (Throttle valve malfunction)	"Check Engine" is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Check the ETV circuit.	A-11
			Check the fuse.	5-5
			Check the ETV motor relay.	5-24
			Check the ETV.	6-14

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
119	ETV system (Throttle valve malfunction)	“Check Engine” is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Check the ETV circuit.	A-11
123	ETV power supply (Out of specification)	“Check Engine” is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Check the ETV circuit.	A-11
			Check the fuse.	5-5
			Check the ETV motor relay.	5-24
124 125	TPS (Out of specification)	“Check Engine” is displayed. High engine idle speed. Degraded acceleration performance. Declining maximum engine speed.	Measure the TPS output voltage using the YDIS.	5-23
			Check the throttle opening angle using the YDIS.	5-23
			Measure the TPS input voltage using the YDIS.	5-23
			Check the ETV circuit.	A-11
126	TPS (Out of specification)	“Check Engine” is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Measure the TPS output voltage using the YDIS.	5-23
			Check the throttle opening angle using the YDIS.	5-23
			Measure the TPS input voltage using the YDIS.	5-23
			Check the ETV circuit.	A-11
127 128	TPS (Out of specification)	“Check Engine” is displayed. Degraded acceleration performance. Declining maximum engine speed.	Measure the TPS output voltage using the YDIS.	5-23
			Check the throttle opening angle using the YDIS.	5-23
			Measure the TPS input voltage using the YDIS.	5-23
			Check the ETV circuit.	A-11
138	ETV system (Engine ECM internal circuit malfunction)	“Check Engine” is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Replace the engine ECM.	7-28
141	ETV system (Throttle valve malfunction)	“Check Engine” is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Check the ETV circuit.	A-11

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
142	ETV system (Throttle valve malfunction)	“Check Engine” is displayed. Declining maximum engine speed.	Check the throttle valve operation.	6-14
			Replace the ETV.	6-13
143	ETV system (Engine ECM internal circuit malfunction)	“Check Engine” is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Replace the engine ECM.	7-28
144	ETV system (Throttle valve malfunction)	“Check Engine” is displayed. High engine idle speed. Throttle does not operate. Engine speed is set at approximately 1500 r/min.	Check the battery cable and terminals for proper connection.	10-7
			Check the fuse.	5-5
			Measure the lighting coil output peak voltage.	5-34
			Measure the lighting coil resistance.	5-34
			Measure the rectifier/regulator/isolator output peak voltage.	5-35
			Check the rectifier/regulator/isolator for continuity.	5-35
145	ETV system (Throttle valve malfunction)	High engine idle speed. <Difference in engine idle speeds> <Engine speeds do not synchronize>	Check that other trouble codes (112–144) are detected.	4-4
			Check the ETV.	6-14
146 147	SPS (Out of specification)	“Check Engine” is displayed. Engine operates normally unless it is stopped. Engine does not restart (No cranking). Alert indicator is ON. <Engine speeds do not synchronize>	Measure the SPS input voltage.	5-24
			Measure the SPS output voltage.	5-24
			Check for wiring continuity between the SPS and the engine ECM.	A-11
			Measure the shift actuator rod stroke.	5-26

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
148 149	SPS (Out of specification)	<p>“Check Engine” is displayed.                      Engine operates normally unless it is stopped.                      Engine does not restart (No cranking).                      Alert indicator is ON.                      &lt;Engine speeds do not synchronize&gt;</p>	Measure the SPS input voltage.	5-24
			Measure the SPS output voltage.	5-24
			Check for wiring continuity between the SPS and the engine ECM.	A-11
			Measure the shift actuator rod stroke.	5-26
150	SPS (Out of specification)	<p>“Check Engine” is displayed.                      High engine idle speed.                      Engine does not restart (In a shift-in position).                      Shift actuator does not operate.                      Alert indicator is ON.                      &lt;Engine speeds do not synchronize&gt;</p>	Measure the SPS input voltage.	5-24
			Measure the SPS output voltage.	5-24
			Check for wiring continuity between the SPS and the engine ECM.	A-11
153	SPS (Out of specification)	<p>“Check Engine” is displayed.                      High engine idle speed.                      Engine does not restart (In a shift-in position).                      Throttle does not operate.                      Alert indicator is ON.                      &lt;Engine speeds do not synchronize&gt;</p>	Check the fuse.	5-5
			Measure the shift actuator motor resistance.	5-26
			Check for wiring continuity between the shift actuator and the engine ECM.	A-11
			Check that the gear shift operates properly.	10-8
			Measure the shift actuator rod stroke.	5-26
			Check the shift mechanism.	9-1
			Check the lower unit.	8-4

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
154	SPS (Out of specification)	“Check Engine” is displayed. Engine does not restart. Shift does not disengage from the shift-in position. Alert indicator is ON.	Check the fuse.	5-5
			Measure the shift actuator relay input voltage.	5-25
			Measure the shift actuator motor resistance.	5-26
			Check for wiring continuity between the shift actuator and the engine ECM.	A-11
			Check the shift actuator relay.	5-25
			Check for wiring continuity between the shift actuator relay and the engine ECM.	A-11
			Measure the shift actuator rod stroke.	5-26
			Check the shift mechanism.	9-1
			Check the lower unit.	8-10 8-15 8-47
155	SPS (Out of specification)	“Check Engine” is displayed. Engine does not restart (In a shift-in position). Gear shift does not operate. Alert indicator is ON. <Engine speeds do not synchronize>	Check the fuse.	5-5
			Measure the shift actuator relay input voltage.	5-25
			Measure the shift actuator motor resistance.	5-26
			Check for wiring continuity between the shift actuator and the engine ECM.	A-11
			Check the shift actuator relay.	5-25
			Check for wiring continuity between the shift actuator relay and the engine ECM.	A-11
			Measure the shift actuator rod stroke.	5-26
			Check the shift mechanism.	9-1
			Check the lower unit.	8-4



## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
156 157	Engine-RC communication (Communication error)	"Check Engine" is displayed. Alert indicator is ON. <Engine speeds do not synchronize>	Check the extension wire harness for proper connection and damage.	—
			Check for wiring continuity between the engine ECM and the engine main harness.	A-11
			Check the Digital Electronic Control circuit.	*1
		Engine does not restart. Fully closed throttle. Shift actuator rod returns to the N position. CL5 gauge does not operate. Trouble codes 156 and 157 detected simultaneously. Alert indicator is ON. <Engine speeds do not synchronize> Unable to switch the active station in the case of dual station arrangement (trouble code 186).	Check that the extension wire harness is connected properly and that there is no damage.	—
			Check for wiring continuity between the engine ECM and engine main harness.	A-11
			Check the Digital Electronic Control circuit.	*1
160 161 162 163	Remote control system (Main station [LPS Irregular signal])	"Check Engine" is displayed. Alert indicator is ON. <Engine speeds do not synchronize>	Measure the LPS output voltage using the YDIS.	*1
			Check for wiring continuity between the LPS and the Digital Electronic Control ECM.	
		Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON. <Engine speeds do not synchronize> When either one of the trouble codes 160 and 161, and either one of the trouble codes 162 and 163 took place simultaneously.	Measure the LPS output voltage using the YDIS.	
			Check for wiring continuity between the LPS and the Digital Electronic Control ECM.	

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
164	Remote control system (Main station LPS Irregular signal [Digital Electronic Control ECM internal circuit malfunction])	<p>“Check Engine” is displayed. Locked at engine idle speed. Shift actuator rod returns to the N position. Shift actuator can be operated manually. Alert indicator is ON.</p>	<p>Replace the Digital Electronic Control ECM. (When replacing the Digital Electronic Control ECM with a new one, resetting of Digital Electronic Control ECM is necessary.)</p>	*1
165	Remote control system (Main station [LPS Irregular signal])	<p>“Check Engine” is displayed. Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON. &lt;Difference in engine idle speeds&gt; &lt;Engine speeds do not synchronize&gt;</p>	<p>Measure the LPS output voltage using the YDIS.</p> <p>Check for wiring continuity between the LPS and the Digital Electronic Control ECM.</p>	*1
166 167 168 169	Remote control system (Main station, center outboard motor [LPS Irregular signal])	<p>“Check Engine” is displayed. Locked at engine idle speed. Alert indicator is ON.</p> <p>Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON. When either one of the trouble codes 166 and 167, and either one of the trouble codes 168 and 169 took place simultaneously.</p>	<p>Measure the LPS output voltage using the YDIS.</p> <p>Check for wiring continuity between the LPS and the Digital Electronic Control ECM.</p> <p>Measure the LPS output voltage using the YDIS.</p> <p>Check for wiring continuity between the LPS and the Digital Electronic Control ECM.</p>	*1
170	Remote control system (Main station [LPS Irregular signal])	<p>“Check Engine” is displayed. Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON.</p>	<p>Measure the LPS output voltage using the YDIS.</p> <p>Check for wiring continuity between the LPS and the Digital Electronic Control ECM.</p>	*1

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
171 172 173 174	Remote control system (Sub station [LPS Irregular signal])	“Check Engine” is displayed. Locked at engine idle speed. Alert indicator is ON.	Measure the LPS output voltage using the YDIS. Check for wiring continuity between the LPS and the Digital Electronic Control ECM.	*1
Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON.		Measure the LPS output voltage using the YDIS.		
When either one of the trouble codes 171 and 172, and either one of the trouble codes 173 and 174 took place simultaneously.		Check for wiring continuity between the LPS and the Digital Electronic Control ECM.		
175	Remote control system (LPS Irregular signal [Sub station Digital Electronic Control ECM internal circuit malfunction])	“Check Engine” is displayed. Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON.	Replace the Digital Electronic Control ECM. (When replacing the Digital Electronic Control ECM with a new one, resetting of Digital Electronic Control ECM is necessary.)	*1
176	Remote control system (Sub station, center outboard motor [LPS Irregular signal])	“Check Engine” is displayed. Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON.	Measure the LPS output voltage using the YDIS. Check for wiring continuity between the LPS and the Digital Electronic Control ECM.	*1
177 178 179 180	Remote control system (Sub station, center outboard motor [LPS Irregular signal])	“Check Engine” is displayed. Locked at engine idle speed. Alert indicator is ON.	Measure the LPS output voltage using the YDIS. Check for wiring continuity between the LPS and the Digital Electronic Control ECM.	*1
Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON.		Measure the LPS output voltage using the YDIS.		
When either one of the trouble codes 177 and 178, and either one of the trouble codes 179 and 180 took place simultaneously.		Check for wiring continuity between the LPS and the Digital Electronic Control ECM.		

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
181	Remote control system (Sub station [LPS Irregular signal])	"Check Engine" is displayed. Locked at engine idle speed. Throttle does not operate. Shift actuator rod returns to the N position. Alert indicator is ON.	Measure the LPS output voltage using the YDIS.	*1
			Check for wiring continuity between the LPS and the Digital Electronic Control ECM.	
183	Remote control system (LPS Irregular signal [Digital Electronic Control ECM internal circuit malfunction])	"Check Engine" is displayed. Station selection is impossible. Alert indicator is ON.	Replace the Digital Electronic Control ECM of the main station. (When replacing the Digital Electronic Control ECM with a new one, resetting of Digital Electronic Control ECM is necessary.)	*1
184	Remote control system (LPS Irregular signal [Digital Electronic Control ECM internal circuit malfunction])	"Check Engine" is displayed. Engine selection is impossible. Alert indicator is ON.	Replace the Digital Electronic Control ECM of the main station. (When replacing the Digital Electronic Control ECM with a new one, resetting of Digital Electronic Control ECM is necessary.)	*1
186	Remote control system (Main station [LPS Irregular signal])	Sub station Digital Electronic Control does not operate. Unable to change to the sub station Digital Electronic Control. Locked at engine idle speed. Shift actuator rod returns to the N position. Alert indicator is ON.	Turn off the engine start switch once, and turn it on again.	—
			Check the extension wire harness for proper connection and damage.	—
187	Remote control system (LPS Irregular signal [Digital Electronic Control ECM internal circuit malfunction])	"Check Engine" is displayed. Engine does not restart. Alert indicator is ON.	Replace the Digital Electronic Control ECM. (When replacing the Digital Electronic Control ECM with a new one, resetting of Digital Electronic Control ECM is necessary.)	*1
223	Steering system (Irregular signal)	Stop engine synchronization control.	Check detail by using YDIS CAN communication cable.	—

## Outboard motor troubleshooting

Trouble code	Item (Condition)	Symptom	Checking steps	See page
224	Steering system—Outboard (SCU) (Irregular signal)	Stop engine synchronization control.	Check detail by using YDIS CAN communication cable.	—
225	Steering system—Helm (HELM) (Irregular signal)	Stop engine synchronization control.	Check detail by using YDIS CAN communication cable.	—

**Troubleshooting procedure (trouble code not detected)**

Troubleshooting consists of the following 5 items:

Symptom 1: Specific trouble conditions

Symptom 2: Trouble conditions of an area or individual part

Cause: Trouble causes of symptom 2

Checking steps: Method for checking

See page: Reference page

—: Not applicable

**Troubleshooting the power unit**

**Symptom 1: Engine does not crank.**

Symptom 2	Cause	Checking steps	See page
Starter motor does not operate	Gear shift not in the N position	Set the gear shift to the N position.	5-24
	Blown fuse	Check the fuse.	5-5
	Engine start switch malfunction	Check the engine start switch.	5-42
		Check the engine start/stop button.	5-43
	Short, open, or loose connection in starter motor circuit	Check the wire harness for continuity.	A-14
	Starter motor malfunction	Disassemble and check the starter motor.	5-45
Y-COP is locked	Unlock Y-COP.	—	
Starter motor operates, but the engine does not crank	Starter motor malfunction	Disassemble and check the starter motor.	5-45
	Stuck piston or crankshaft	Disassemble and check the power unit.	7-72
	Stuck drive shaft	Check the drive shaft bushing.	9-12
		Disassemble and check the lower unit.	8-25 8-53

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

Symptom 2	Cause	Checking steps	See page
Engine ECM does not operate	Blown fuse	Check the fuse.	5-5
	Main relay malfunction	Check the main relay.	5-21
	Short, open, or loose connection in the engine ECM circuit	Check for wire harness continuity between the main relay and the engine ECM.	A-11
		Check for wire harness continuity between the engine ECM and ground.	5-22
	Engine ECM ID and Digital Electronic Control ECM ID do not match.	Reset the Digital Electronic Control system using the YDIS.	—
	Engine ECM malfunction	Replace the engine ECM.	7-28
	Extension wire harness malfunction	Check the extension wire harness for continuity.	5-49
Spark plug does not produce a spark (all cylinders)	Short, open, or loose connection in the pulser coil circuit	Check the wire harness continuity between the pulser coil and the engine ECM.	A-12
	Y-COP is locked	Unlock Y-COP.	—

## Outboard motor troubleshooting

Symptom 2	Cause	Checking steps	See page	
Fuel not supplied (all cylinders)	Pinched or kinked fuel hose	Check the fuel hose.	2-29	
	Fuel leakage	Check the fuel line for leakage.	2-29	
	Clogged fuel filter element	Check the fuel filter element for dirt and obstructions.	6-7	
	Blown fuse	Check the fuse.	5-5	
	High-pressure fuel pump malfunction		Check the high-pressure fuel pump operation using the YDIS.	5-31
			Measure the high-pressure fuel pump resistance.	5-31
	Short, open, or loose connection in high-pressure fuel pump circuit		Check the high-pressure fuel pump input voltage.	5-31
			Check for wiring continuity between the high-pressure fuel pump relay and the engine ECM.	A-12
			Check for wiring continuity between the high-pressure fuel pump and the high-pressure fuel pump relay.	A-12
			Check for wiring continuity between the high-pressure fuel pump and ground.	A-12
	Low-pressure fuel pump malfunction		Check the low-pressure fuel pump operation using the YDIS.	5-31
			Check the low-pressure fuel pump resistance.	5-31
	Short, open, or loose connection in low-pressure fuel pump circuit		Check the low-pressure fuel pump input voltage.	5-31
			Check for wiring continuity between the low-pressure fuel pump and the engine ECM.	A-12
			Check for wiring continuity between the low-pressure fuel pump and the main relay.	A-12
	Compression pressure is low	Improper valve timing	Check the valve timing.	7-35
Check the timing belt.			7-35	
Compression leakage		Check the valve for bends and sticking.	7-52	
		Check the piston and piston rings for damage.	7-72	
		Check the cylinder for scratches.	7-74	



## Outboard motor troubleshooting

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

Symptom 2	Cause	Checking steps	See page
Spark plug does not produce a spark (some cylinders)	Spark plug malfunction	Check the spark plug.	7-30
	Short, open, or loose connection in ignition coil circuit	Measure the ignition coil input voltage.	5-36
		Check for wiring continuity between the ignition coil and the engine ECM.	A-13
		Check for wiring continuity between the ignition coil and the main relay.	A-13
	Ignition coil malfunction	Exchange the ignition coil with a different one, and then check the ignition spark.	5-36
Engine ECM malfunction	Replace the engine ECM.	7-28	
Fuel pressure is low	Fuel leakage	Check for fuel leakage.	2-29
	Clogged fuel filter	Check the fuel filter for dirt and obstructions.	6-7
	High-pressure fuel pump malfunction	Measure the high-pressure fuel pump resistance.	5-31
Fuel not supplied (some cylinders)	Fuel injector malfunction	Check the fuel injector operation using the YDIS.	5-30
		Measure the fuel injector resistance.	5-30
	Short, open, or loose connection in fuel injector circuit	Measure the fuel injector input voltage.	5-30
		Check for wiring continuity between the fuel injector and the main relay.	A-12
		Check for wiring continuity between the fuel injector and the engine ECM.	A-12
	Clogged fuel injector	Replace the fuel injector.	6-29
Engine ECM malfunction	Replace the engine ECM.	7-28	
Compression pressure is low	Improper valve timing	Check the valve timing.	7-35
		Check the timing belt.	7-35
	Compression leakage	Check the valve for bends and sticking.	7-52
		Check the piston and piston rings for damage.	7-72
		Check the cylinder for scratches.	7-74

## Outboard motor troubleshooting

### Symptom 1: High engine idle speed.

Symptom 2	Cause	Checking steps	See page
—	Air leakage (ETV–cylinder head)	Check the gaskets of the intake manifolds, surge tank, and ETV.	6-10 6-13

### Symptom 1: Engine stalls, unstable engine idle speed, or poor acceleration.

Symptom 2	Cause	Checking steps	See page
Improper intake cam timing	Stuck OCV plunger	Check the OCV operation using the YDIS.	5-28
		Check the OCV plunger.	5-28
	Clogged OCV filter	Replace the OCV filter.	7-49
	Clogged oil passage	Check the oil passage.	2-24
	Stuck VCT	Replace the VCT assembly.	7-38

### Symptom 1: Limited engine speed (below 2000–3000 r/min).

Symptom 2	Cause	Checking steps	See page
Buzzer comes on. Overheat alert indicator comes on.	Thermo switch malfunction	Measure the thermo switch input voltage.	5-40
		Check the thermo switch for continuity.	5-40
		Check for continuity between the thermo switch and the engine ECM.	A-13
	Clogged cooling water inlet	Check the cooling water inlet.	10-13
	Water pump malfunction	Check the impeller.	8-11
		Check the impeller key.	8-11
		Check the water pump housing.	8-11
		Check the insert cartridge.	8-11
		Check the outer plate cartridge.	8-11
	Clogged cooling water passage	Check the cooling water passage.	2-26
	Thermostat malfunction	Check the thermostat.	7-69

## Outboard motor troubleshooting

Symptom 2	Cause	Checking steps	See page
Buzzer comes on. Oil pressure alert indicator comes on.	Insufficient engine oil	Check the engine oil level.	10-7
		Check for engine oil leakage.	2-24
		Check the valve stem seals and valves.	7-54
		Check the piston rings.	7-75
	—	Measure the oil pressure.	7-1
	Engine oil pressure decrease	Check the oil pump.	7-62
		Check the oil strainer.	9-15
		Check the oil passage (power unit and oil pump).	2-24
Replace the oil filter.		10-16	
Engine speed cannot increase when tilt up	PTT is raised too high while cruising	Check the numerical value of PTT protection control range.	2-21
PTT protection control is not deactivated when the trim is lowered	No change in the PTT sensor output voltage when the PTT is operated	Check the PTT sensor.	5-51

### Symptom 1: Discharged battery.

Symptom 2	Cause	Checking steps	See page
Low voltage indicator activates on the gauge	Battery performance decrease	Check the battery capacity and specific gravity.	10-7
		Check the proper connection of battery cables and terminals.	—
	Short, open, or loose connection in charging circuit	Check the proper connection of the charging circuit and for damage.	A-14
	Stator assembly malfunction	Measure the lighting coil resistance.	5-34
	Rectifier/regulator/isolator malfunction	Check the rectifier/regulator/isolator for continuity.	5-35
		Check the rectifier/regulator/isolator output voltage.	5-35

**Troubleshooting the PTT unit**

**Symptom 1: PTT unit does not operate.**

Symptom 2	Cause	Checking steps	See page
PTT relay does not operate	Blown fuse	Check the fuse.	5-5 A-15
	PTT switch malfunction	Check the PTT switch.	5-50
	PTT relay malfunction	Check the PTT relay.	5-49
	Short, open, or loose connection of the wire harness	Measure the PTT switch input voltage.	5-50
		Measure the PTT relay input voltage.	5-49
		Check for continuity between the PTT switch and the PTT relay.	A-15
		Check for wiring continuity between the PTT relay and the ECM.	A-15
PTT motor does not operate	PTT motor malfunction	Check the PTT motor.	9-36
	Short, open, or loose connection of the PTT motor lead	Check for wiring continuity between the PTT motor and the PTT relay.	A-15
PTT fluid pressure does not increase	Open manual valve	Check the manual valve.	9-31
	Insufficient PTT fluid	Add sufficient PTT fluid.	10-20
	PTT fluid leakage	Check for PTT fluid leakage.	10-20
	Clogged fluid passage	Disassemble and check the PTT unit.	9-41 9-46
		Check the filter for dirt and obstructions.	9-41
		Check the valves for damage.	9-31
		Check the fluid passages for obstructions.	9-41 9-46
	PTT motor malfunction	Check the PTT motor.	9-36
Gear pump malfunction	Check the gear pump assembly.	9-43	

## Outboard motor troubleshooting

### Symptom 1: PTT unit does not hold the outboard motor up.

Symptom 2	Cause	Checking steps	See page
Decrease in PTT fluid pressure in lower chamber of PTT cylinders	Open manual valve	Check the manual valve.	9-31
	Insufficient PTT fluid	Add sufficient PTT fluid.	10-20
	PTT fluid leakage	Check for PTT fluid leakage.	10-20
	Clogged or open fluid passage	Disassemble and check the PTT unit.	9-41 9-46
		Check the valves for damage.	9-43
		Check the fluid passages for obstructions.	9-41 9-46

### Troubleshooting the lower unit

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

Symptom 2	Cause	Checking steps	See page
—	Shift rod does not operate properly	Check the shift actuator operation.	5-26
		Check the shift rod for wear.	8-11
	Shift mechanism malfunction (in lower unit)	Check the shift rod connection.	8-11
		Check the dog clutch.	8-19
		Check the forward gear, reverse gear, and pinion for damage and wear.	8-28
			8-19 8-28

---

## Electrical system

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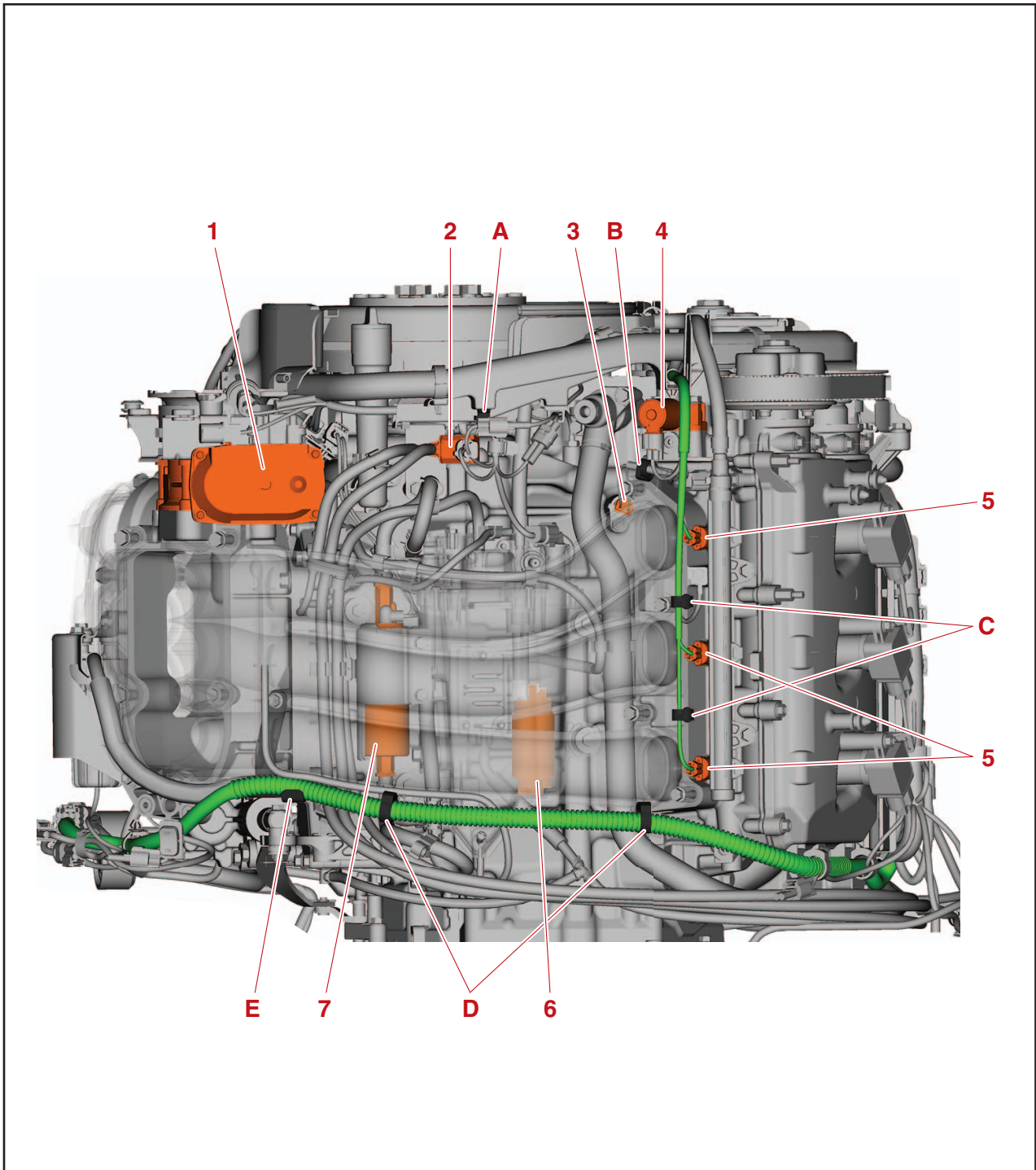
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## Electrical system

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# Electrical component and wire harness routing

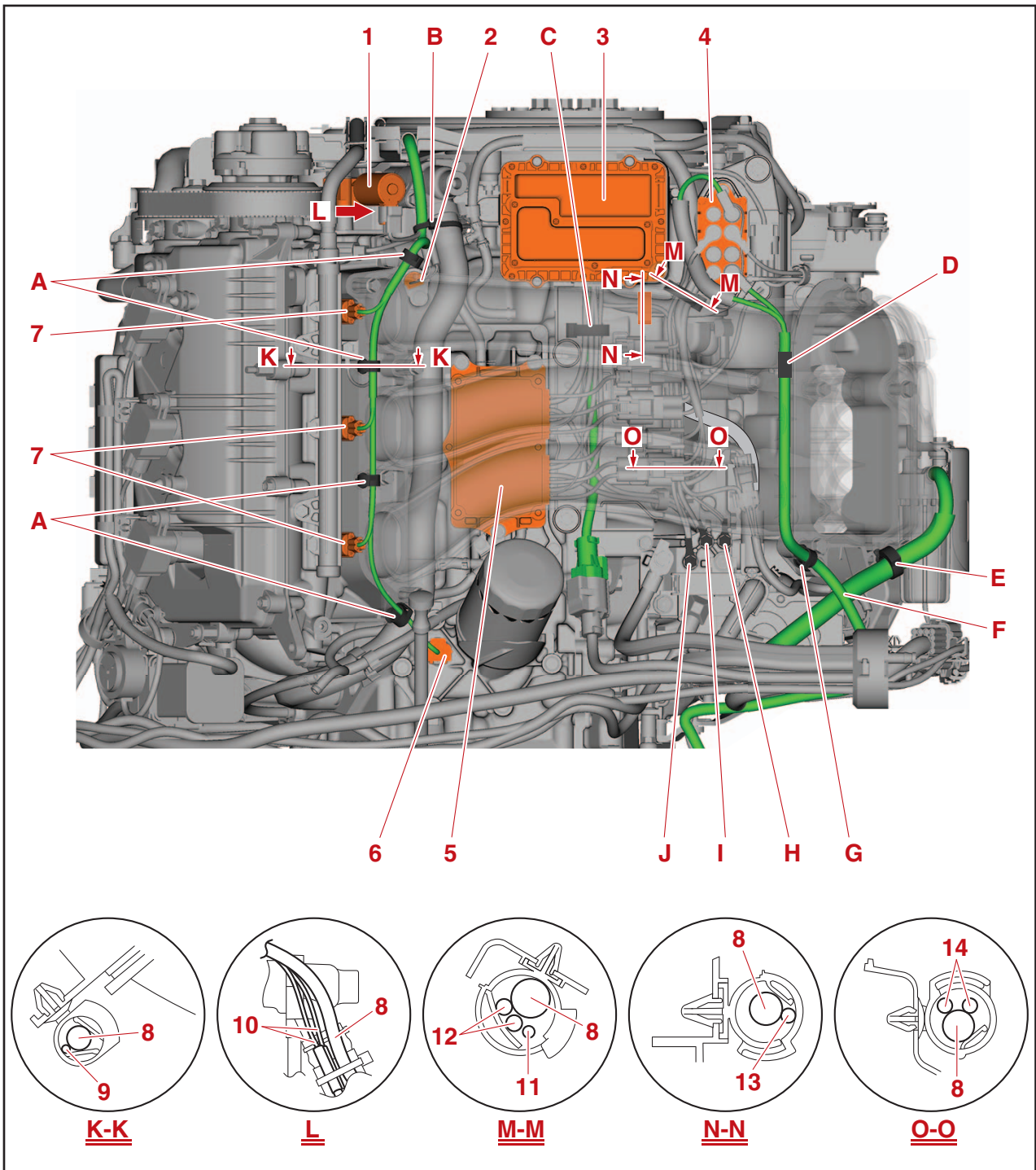
## Port





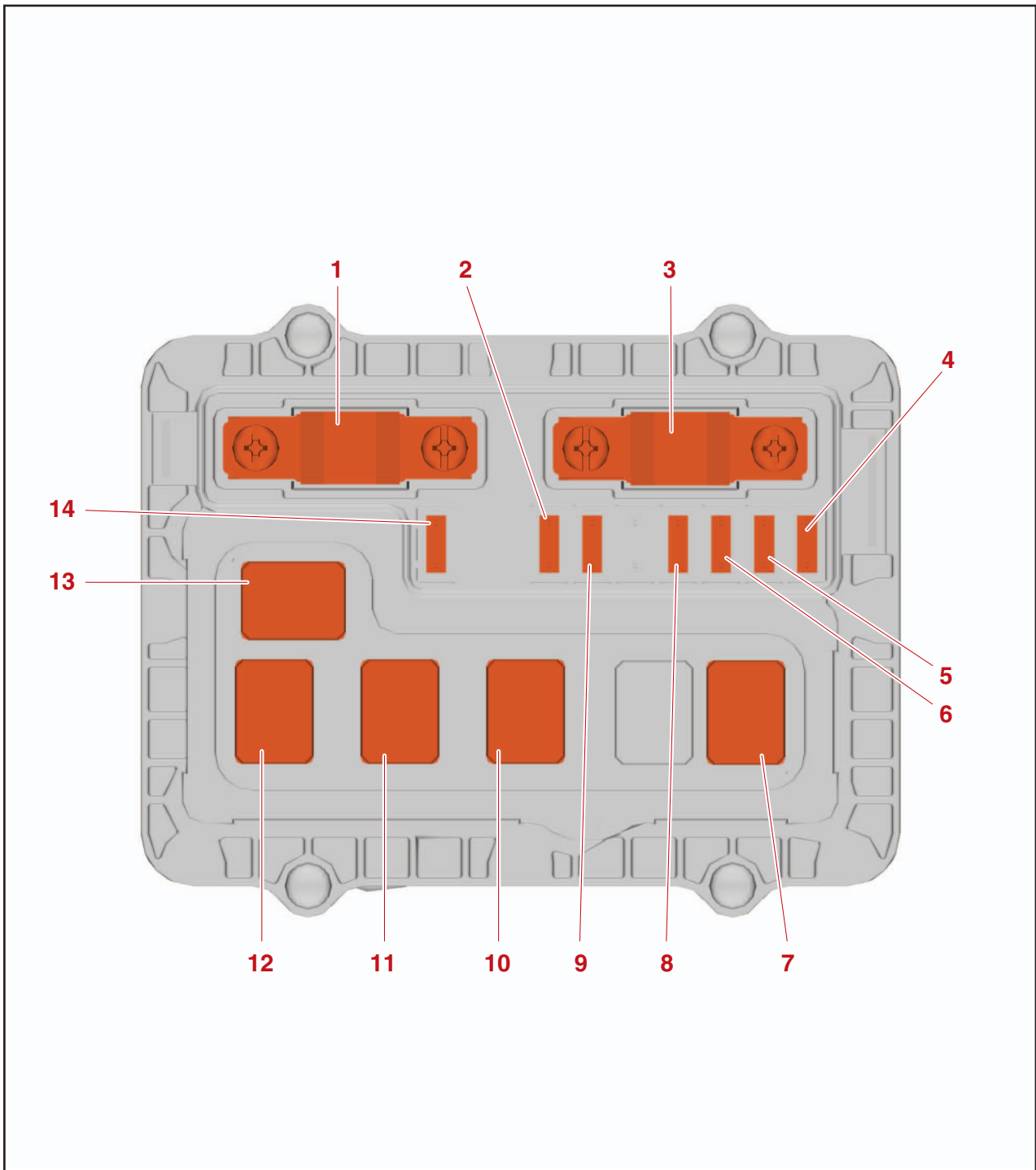
1. ETV (TPS)
  2. Vapor shut-off valve
  3. Thermo switch (PORT)
  4. OCV (PORT)
  5. Fuel injector
  6. High-pressure fuel pump
  7. Low-pressure fuel pump
- 
- A. Install the pulser coil coupler to the wire harness guide.
  - B. Install the holder to the intake manifold, and then fasten the thermo switch connectors using the holder.
  - C. Install the holders to the intake manifold, connect the fuel injector couplers, and then fasten the fuel injector leads using the holders.
  - D. Install the holders to the intake manifold so that the catch of each holder is facing up, and then fasten the main wire harness using the holders.
  - E. Route the main wire harness through the guide.

Starboard



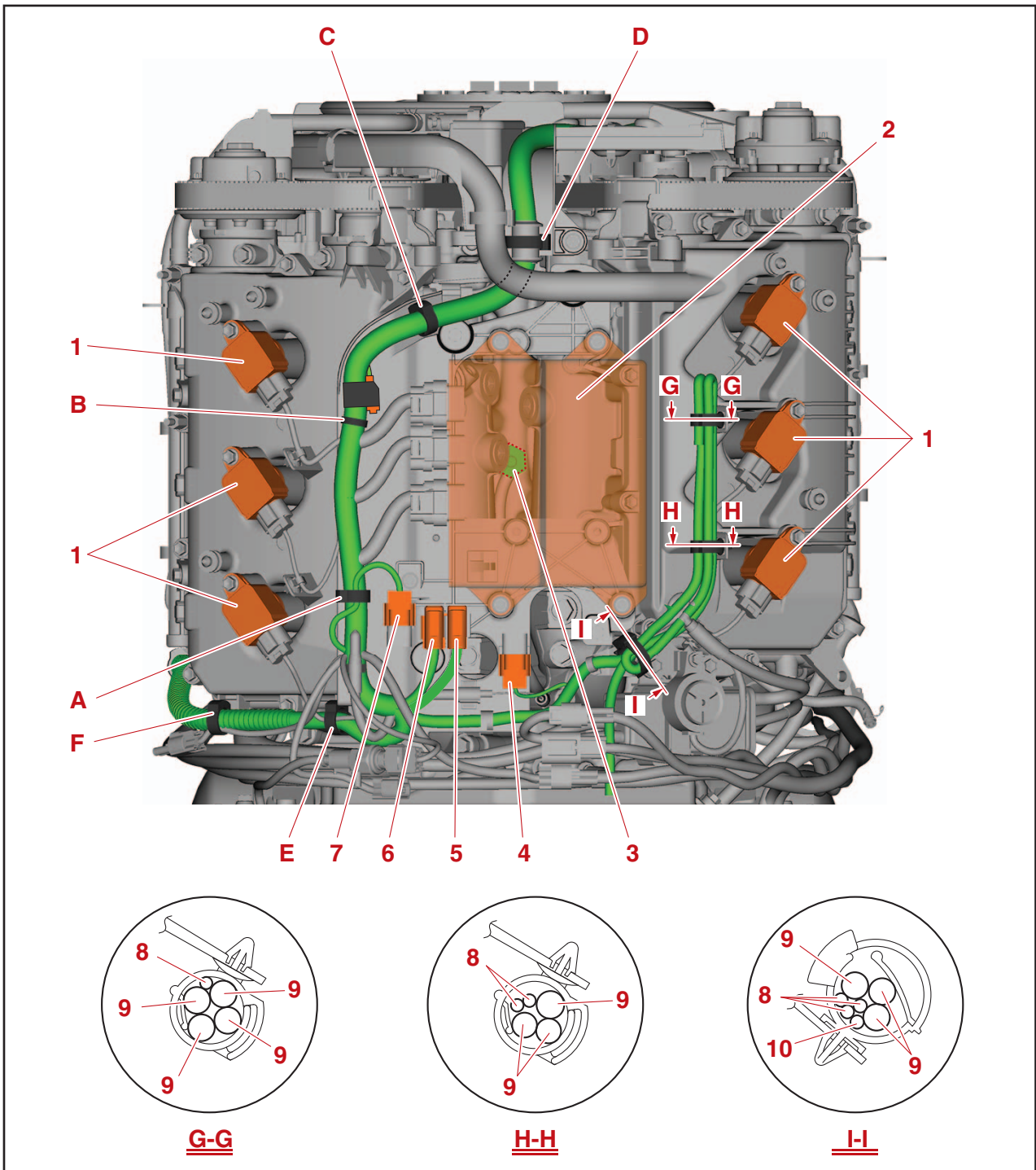
1. OCV (STBD)
  2. Thermo switch (STBD)
  3. Fuse holder
  4. PTT relay
  5. Rectifier/regulator/isolator
  6. Oil pressure sensor
  7. Fuel injector
  8. Wire harness
  9. Ground lead
  10. Thermo switch lead
  11. PTT ground lead
  12. Lighting coil lead
  13. Power supply lead
  14. Ground lead
- 
- A. Install the holders to the intake manifold, and then fasten the main wire harness using the holder.
  - B. Fasten the main wire harness, thermo switch connectors, and cooling water hose using the plastic tie.
  - C. Install the holder to the bracket, and then fasten the rectifier/regulator lead and isolator lead using the holder.
  - D. Fit the section of the PTT motor lead marked with white tape into the slot in the intake manifold.
  - E. Fasten the fuel hose using the holder.
  - F. Route the PTT motor lead to the front of the fuel hose.
  - G. Install the holders to the intake manifold, and then fasten the PTT motor lead using the holder.
  - H. Install the terminal of the ground lead with gray tape so that it contacts the stopper.
  - I. Install the terminal of the ground lead that are fastened together using tape so that they contact the stopper.
  - J. Install the rectifier/regulator ground lead terminal and PTT relay ground lead terminal so that they contact the stopper.

Fuse holder



- |  |  |
|--|--|
| 1. Fuse (100 A) (engine battery)   | 7. Main relay                            |
| 2. Fuse (20 A) (engine start switch, PTT switch, and Digital Electronic Control ECM) | 8. Fuse (30 A) (starter relay)           |
| 3. Fuse (100 A) (house [accessory] battery)  | 9. Fuse (15 A) (shift actuator)          |
| 4. Fuse (15 A) (high-pressure fuel pump)   | 10. Shift actuator relay                 |
| 5. Fuse (10 A) (ETV)   | 11. ETV motor relay                      |
| 6. Fuse (30 A) (ignition coil, VCT, fuel injector, and engine ECM)                   | 12. Fuel pump relay (high-pressure)      |
|  | 13. Starter relay                        |
|  | 14. Fuse (10 A) (low-pressure fuel pump) |

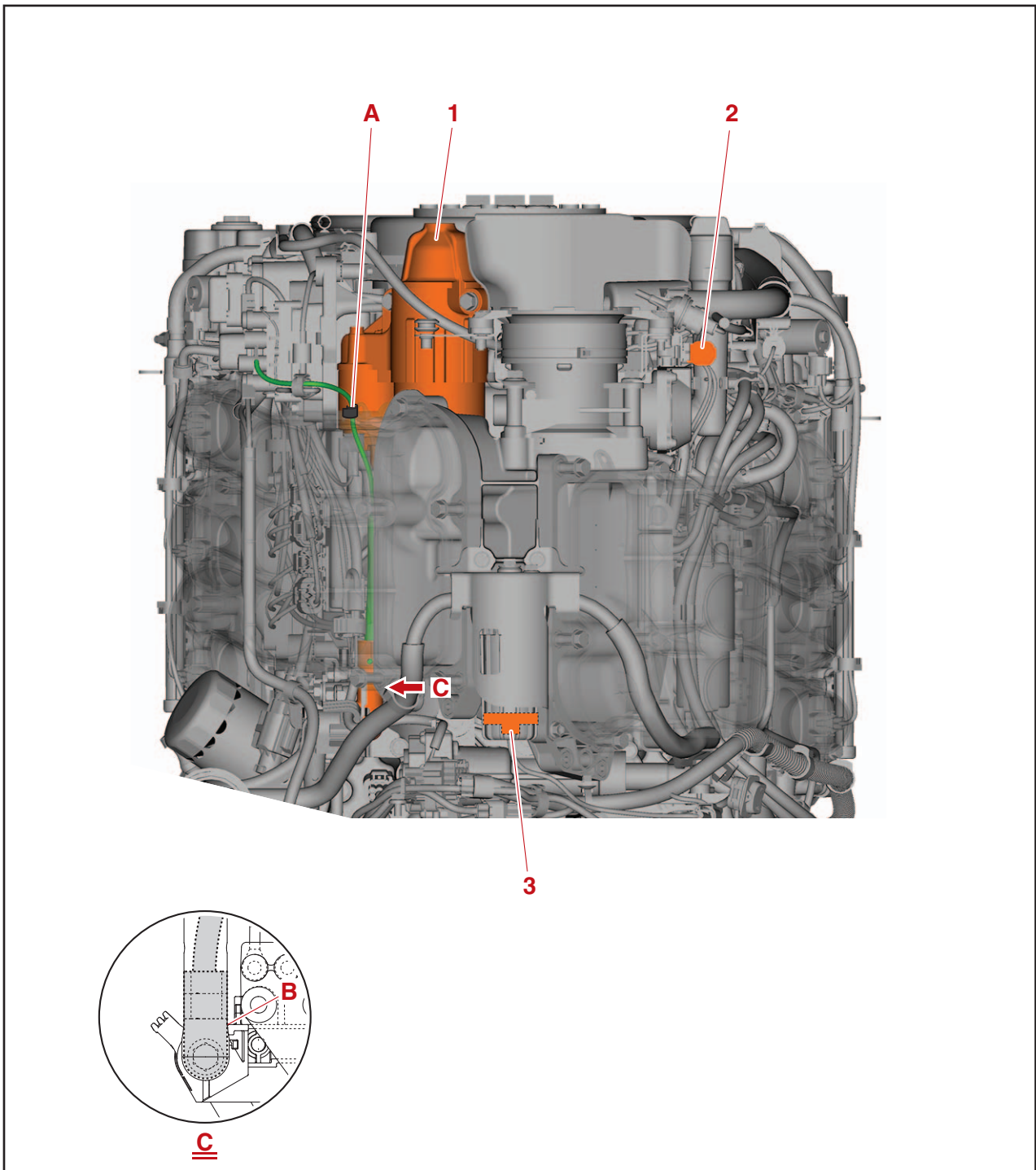
Rear



1. Ignition coil
  2. Engine ECM
  3. Knock sensor
  4. Water pressure sensor coupler
  5. Joint connector 5
  6. Joint connector 2
  7. Speed sensor coupler
  8. Ignition coil lead
  9. Vapor gas hose
  10. PTT buzzer lead
- 
- A. Install the holder on the main wire harness and water pressure sensor at the white tape.
  - B. Install the holder on the main wire harness to the bracket.
  - C. Fasten the main wire harness at the white tape using the holder.
  - D. Fasten the main wire harness and ignition coil lead using the holder.
  - E. Fasten the main wire harness and ignition coil lead using the holder.
  - F. Fasten the main wire harness at the white tape using the holder.

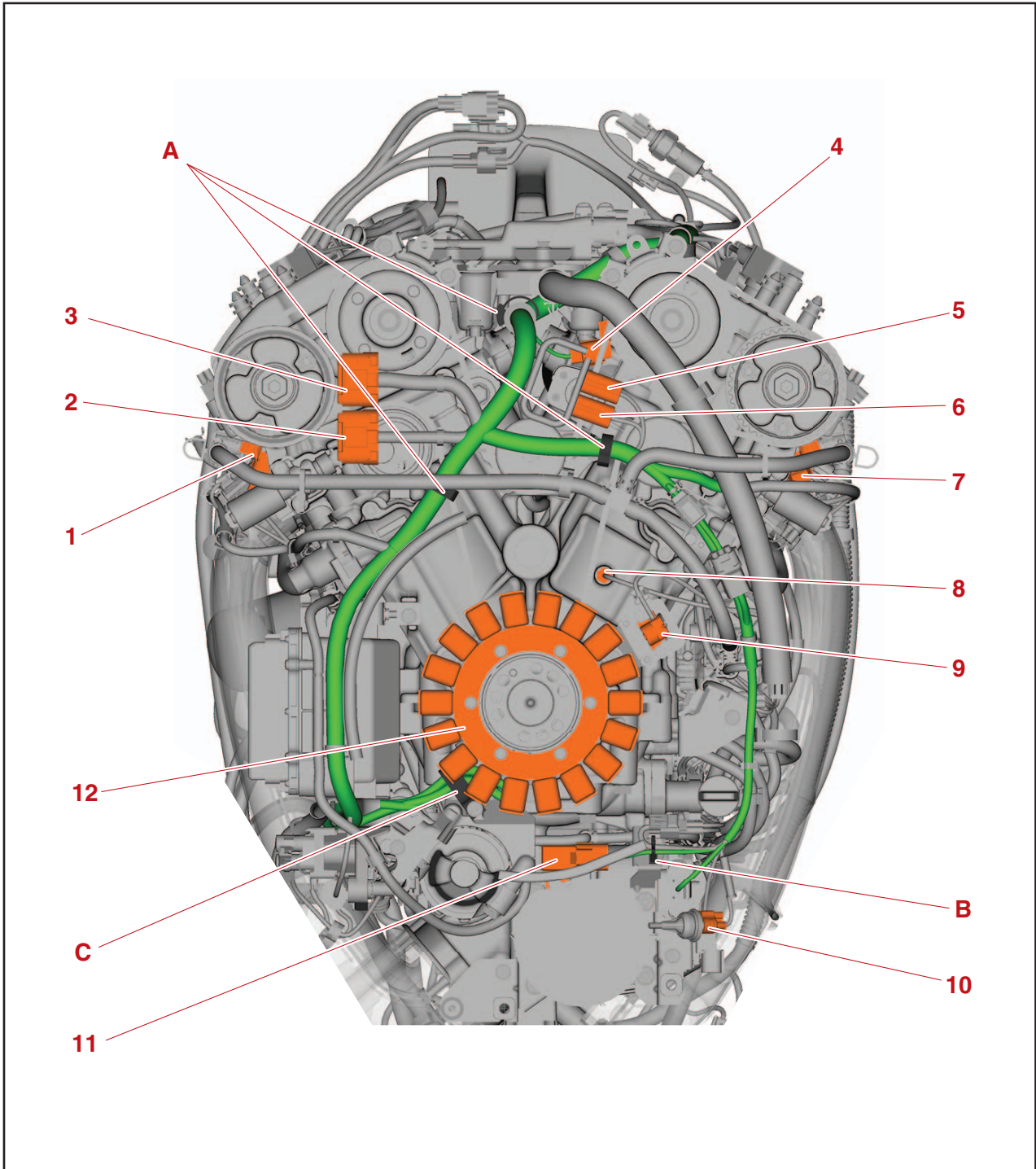


Front



1. Starter motor
  2. YDIS coupler
  3. Water detection switch (in fuel cup assembly)
- A. Fasten the PTT relay lead using the holder.
- B. Make sure that the starter motor lead contacts the detent, and then install it.

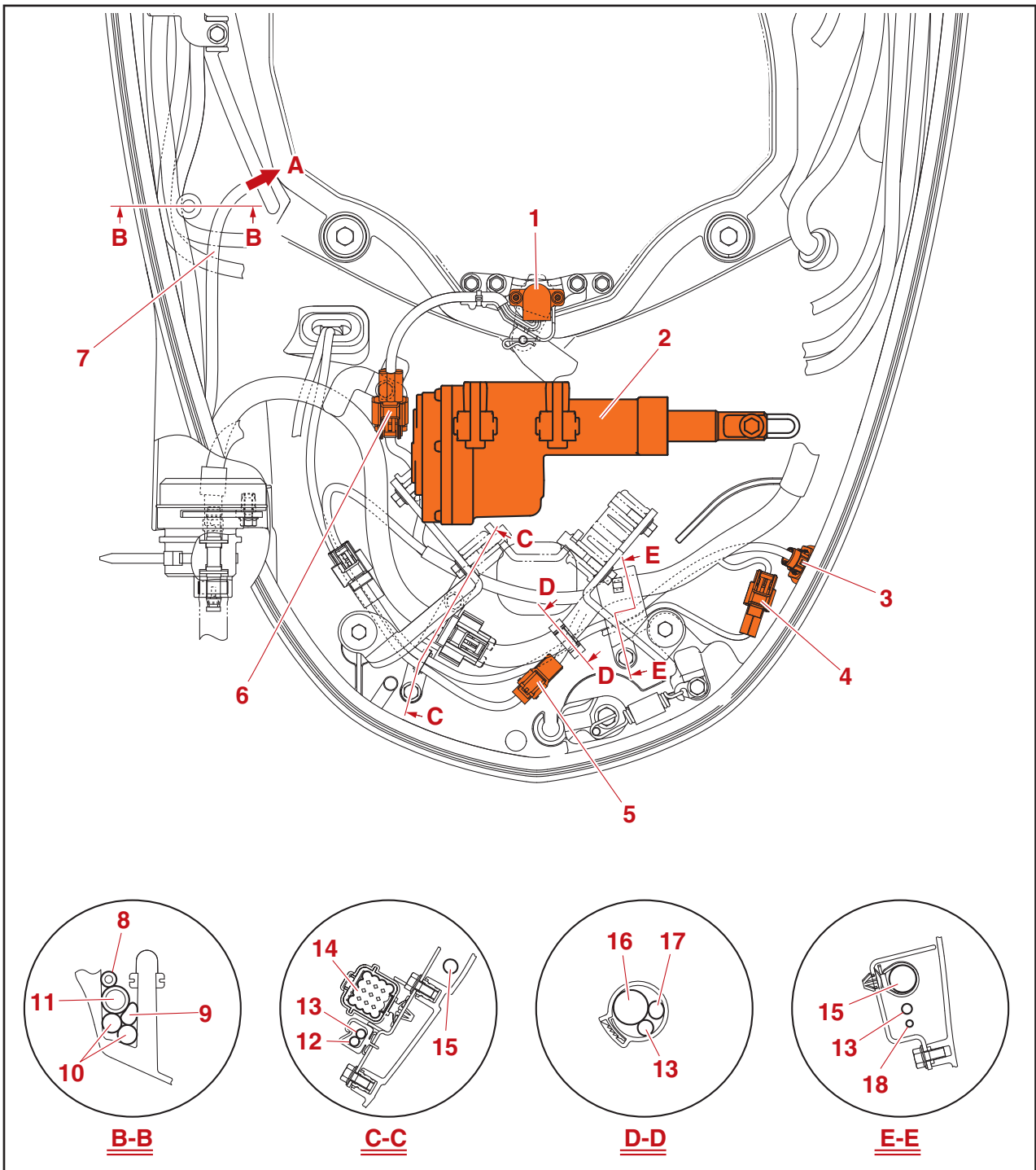
Top





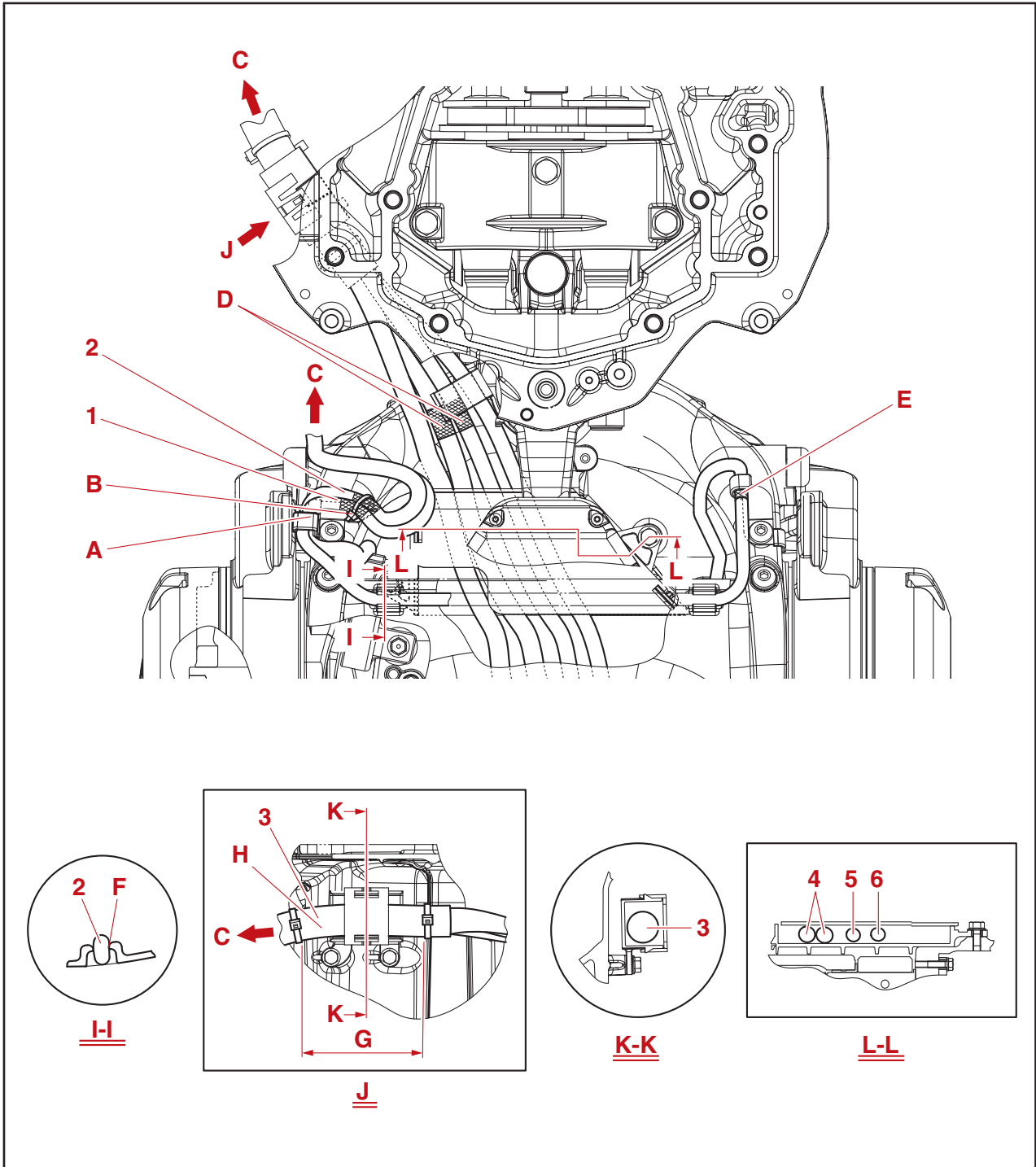
1. Cam position sensor (STBD IN)
  2. Joint connector 4
  3. Joint connector 1
  4. Cam position sensor (PORT EX)
  5. Condenser
  6. Condenser
  7. Cam position sensor (PORT IN)
  8. Engine temperature sensor
  9. Pulser coil
  10. Intake air temperature sensor
  11. Intake air pressure sensor
  12. Lighting coil (stator assembly)
- A. Install the holders to the wire harness guide, and then fasten the main wire harness using the holders.
  - B. Fasten the low-pressure fuel pump lead and intake air pressure sensor lead using the holder.
  - C. Route the lighting coil leads under the holder.

Bottom cowling



1. SPS
  2. Shift actuator
  3. PTT switch
  4. Water detection switch coupler
  5. PTT sensor coupler
  6. SPS coupler
  7. Isolator lead (optional)
  8. Speedometer hose (Analog) (optional)
  9. SCU communication lead (When using multiple machines) (optional)
  10. SBW power source
  11. Flushing hose
  12. Angle sensor lead
  13. PTT switch lead
  14. Coupler (16P)
  15. Main wire harness
  16. Main wire harness (16P)
  17. Main wire harness (Angle sensor)
  18. Water detection switch lead
- A. To fuse holder

Bracket

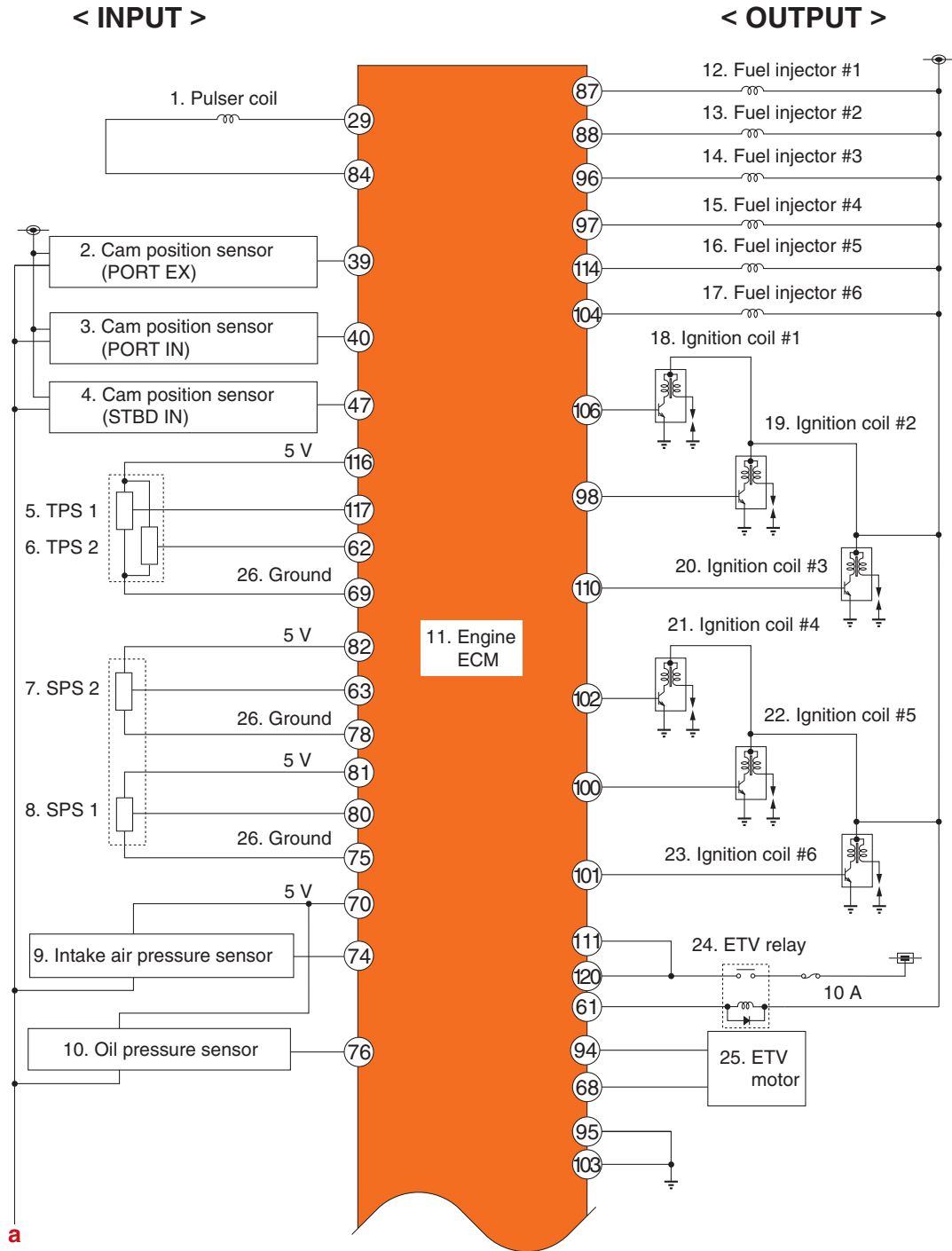


1. PTT sensor lead
  2. PTT motor lead
  3. SBW harness
  4. SCU signal lead
  5. SCU positive lead
  6. SCU negative lead
- 
- A. Route the PTT motor lead and PTT sensor lead under the clamp.
  - B. Fasten the PTT motor lead (gray tape) and PTT sensor lead (white tape) together at each tape position using the clamp.
  - C. To control assembly
  - D. Blue tape
  - E. Fasten the PTT sensor lead at the white tape position using the clamp.
  - F. Route the PTT sensor lead along the swivel cover, and then hook the lead in the claw.
  - G. Range for installing the plastic tie.
  - H. Do not break the twist tube within the range for installing the plastic tie.

### ECM circuit diagram

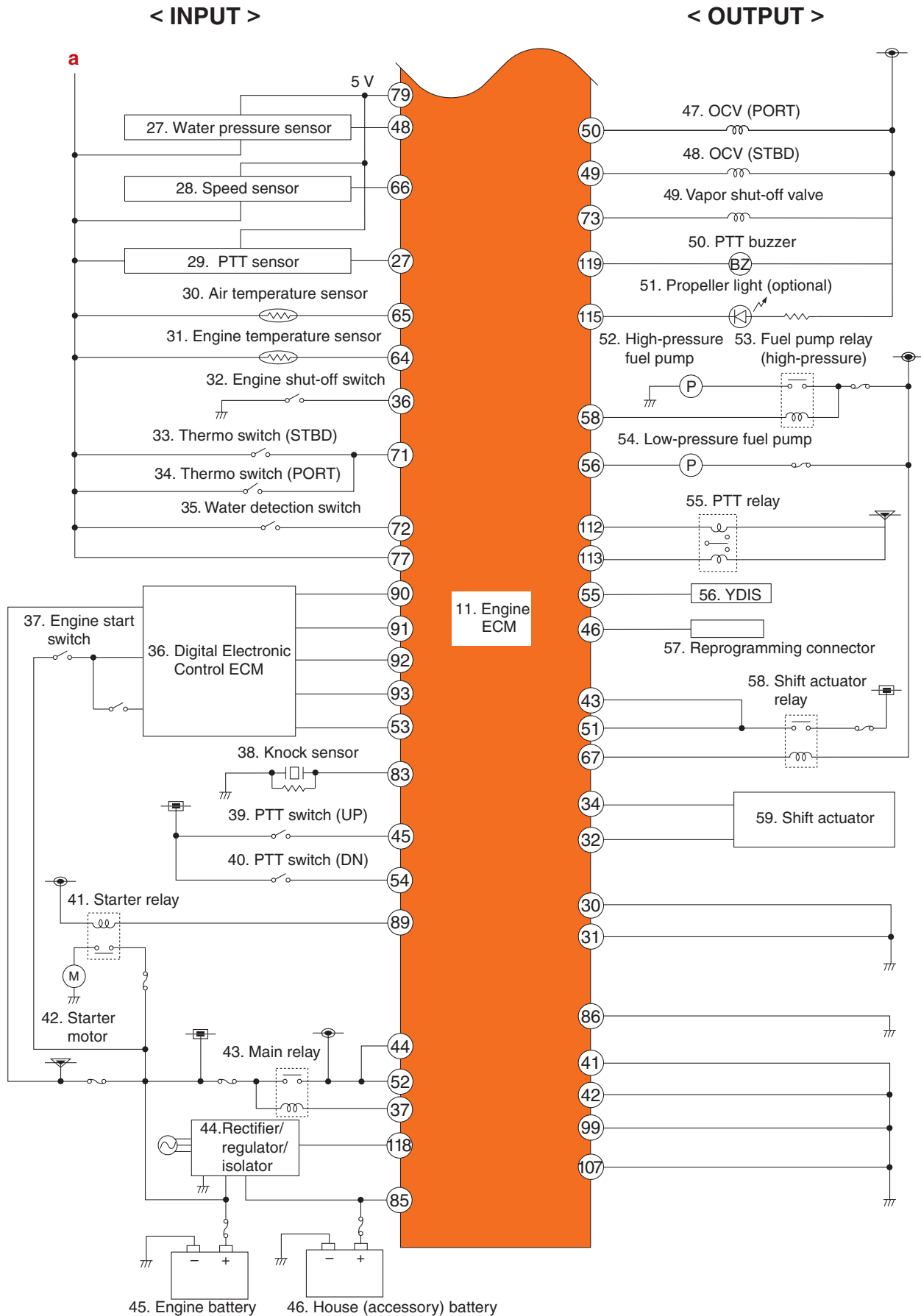
⊕, ⊖, ⊔, a: Indicate a connection between the symbols.

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



⊕, ⊖, ⚡, a: Indicate a connection between the symbols.

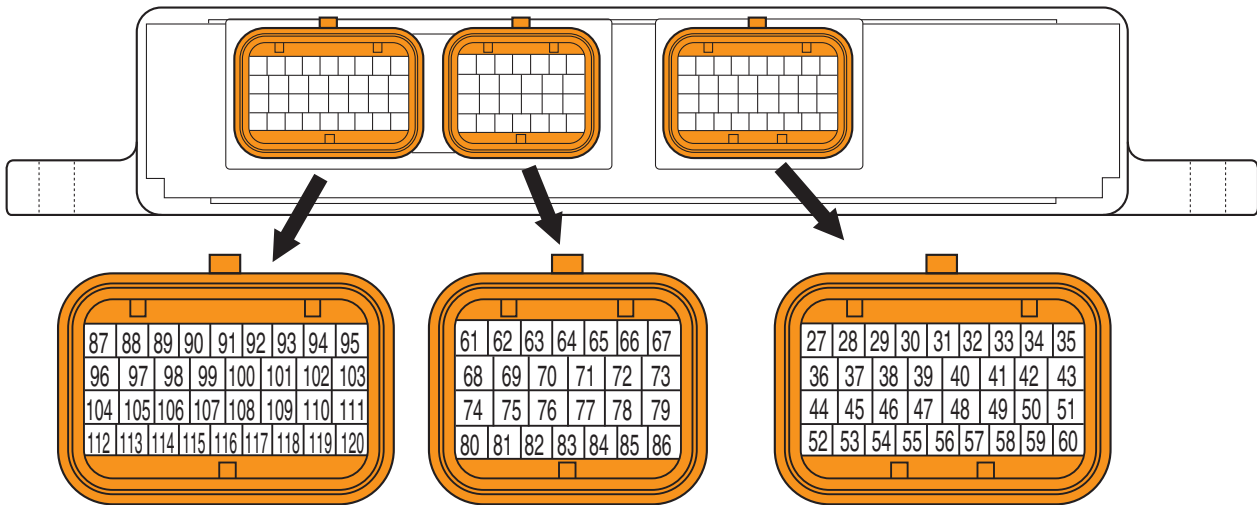
The circled numbers in the illustration indicate the engine ECM terminal numbers.



1. Pulser coil
2. Cam position sensor (PORT EX)
3. Cam position sensor (PORT IN)
4. Cam position sensor (STBD IN)
5. TPS 1
6. TPS 2
7. SPS 2
8. SPS 1
9. Intake air pressure sensor
10. Oil pressure sensor
11. Engine ECM
12. Fuel injector #1
13. Fuel injector #2
14. Fuel injector #3
15. Fuel injector #4
16. Fuel injector #5
17. Fuel injector #6
18. Ignition coil #1
19. Ignition coil #2
20. Ignition coil #3
21. Ignition coil #4
22. Ignition coil #5
23. Ignition coil #6
24. ETV relay
25. ETV motor
26. Ground
27. Water pressure sensor
28. Speed sensor
29. PTT sensor
30. Air temperature sensor
31. Engine temperature sensor
32. Engine shut-off switch
33. Thermo switch (STBD)
34. Thermo switch (PORT)
35. Water detection switch
36. Digital Electronic Control ECM
37. Engine start switch
38. Knock sensor
39. PTT switch (UP)
40. PTT switch (DN)
41. Starter relay
42. Starter motor
43. Main relay
44. Rectifier/regulator/isolator
45. Engine battery
46. House (accessory) battery
47. OCV (PORT)
48. OCV (STBD)
49. Vapor shut-off valve
50. PTT buzzer
51. Propeller light (optional)
52. High-pressure fuel pump
53. Fuel pump relay (high-pressure)
54. Low-pressure fuel pump
55. PTT relay
56. YDIS
57. Reprogramming connector
58. Shift actuator relay
59. Shift actuator



## ECM coupler layout



No.	Connecting part	Color
27	PTT sensor	Pink
28	—	—
29	Pulser coil	White/Red
30	Shift ground	Black
31	Shift ground	Black
32	Shift actuator	Green/Black
33	—	—
34	Shift actuator	Green/Red
35	—	—
36	Engine shut-off switch	White
37	Main relay	Yellow/Green
38	Engine start switch	Brown
39	Cam position sensor (PORT EX)	White/Blue
40	Cam position sensor (PORT IN)	White/Green
41	Engine ECM ground	Black
42	Engine ECM ground	Black
43	Shift power source	Red/Green
44	Battery power source	Red/Yellow
45	PTT switch (UP)	Sky blue
46	Reprogramming connector	Green/Orange
47	Cam position sensor (STBD IN)	White/Black

No.	Connecting part	Color
48	Water pressure sensor	Blue/Black
49	OCV (STBD)	Purple
50	OCV (PORT)	Purple
51	Shift power source	Red/Green
52	Battery power source	Red/Yellow
53	Wake up pulse (Digital Electronic Control)	Yellow
54	PTT switch (DN)	Light green
55	YDIS	White/Black
56	Low-pressure fuel pump	Blue/White
57	—	—
58	High-pressure fuel pump relay	Yellow/Green
59	—	—
60	—	—
61	ETV power source	Yellow/Green
62	TPS 2	Pink/White
63	SPS 2	Pink
64	Engine temperature sensor	Black/Yellow
65	Intake air temperature sensor	Black/Yellow
66	Speed sensor	Blue
67	Shift power source	Yellow/Green

## ECM coupler layout

No.	Connecting part	Color
68	ETV motor	Green/Black
69	TPS ground	Black
70	Sensor power source	Orange
71	Thermo switch	Pink
72	Water detection switch	Blue/White
73	Vapor shut-off valve	Green/Black
74	Intake air pressure sensor	Pink/Green
75	SPS 1 ground	Black
76	Oil pressure sensor	Pink/White
77	Sensor ground	Black
78	SPS 2 ground	Black
79	Sensor power source	Orange
80	SPS 1	Pink/White
81	SPS 1 power source	Orange
82	SPS 2 power source	Orange
83	Knock sensor	Green
84	Pulser coil ground	Black
85	Isolator	Red
86	Engine ECM ground	Black
87	Fuel injector #1	Purple/Red
88	Fuel injector #2	Purple/Black
89	Starter relay	Black
90	Digital Electronic Control 1 (H)	White
91	Digital Electronic Control 1 (L)	Blue
92	Digital Electronic Control 2 (H)	White
93	Digital Electronic Control 2 (L)	Blue
94	ETV motor	Green/Red
95	ETV ground	Black
96	Fuel injector #3	Purple/Yellow
97	Fuel injector #4	Purple/Green
98	Ignition coil #2	Black/White
99	Engine ECM ground	Black
100	Ignition coil #5	Black/Blue

No.	Connecting part	Color
101	Ignition coil #6	Black/Brown
102	Ignition coil #4	Black/Green
103	ETV ground	Black
104	Fuel injector #6	Purple/White
105	—	—
106	Ignition coil #1	Black/Orange
107	—	—
108	—	—
109	—	—
110	Ignition coil #3	Black/Yellow
111	ETV power source	Red/Green
112	PTT relay (UP)	Sky blue
113	PTT relay (DN)	Light green
114	Fuel injector #5	Purple/Blue
115	Propeller light (optional)	Pink/Black
116	TPS power source	Orange
117	TPS 1	Pink
118	Rectifier/regulator	Blue/Green
119	PTT buzzer	Pink
120	ETV power source	Red/Green

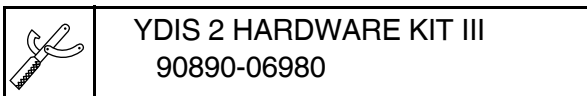
## Checking the electrical component

### Using the YDIS

When checking the ETV, TPS, SPS, OCV, ignition spark, high-pressure fuel pump, fuel injector, and related sensors, use the YDIS.

**TIP:** \_\_\_\_\_

- When deleting the diagnosis record in the YDIS, make sure to check the time that the trouble codes were detected.
- When checking the input voltage of a part, the coupler or connector must be disconnected. As a result, the engine ECM determines that the part is disconnected and a trouble code is detected. Therefore, make sure to delete the diagnosis record after checking the input voltage.
- To connect and operate the YDIS, see the YDIS (Ver. 2.49 or later) instruction manual.
- The software is available through YMAN (Yamaha Marine Associate Network).



### Measuring the peak voltage

**WARNING**

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

**NOTICE**

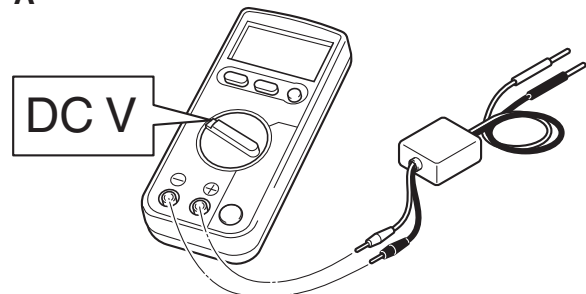
When measuring the peak voltage between the terminals of an electrical component using the digital tester, make sure that the leads do not contact any metal parts. Otherwise, the electrical component may short-circuit and be damaged.

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.

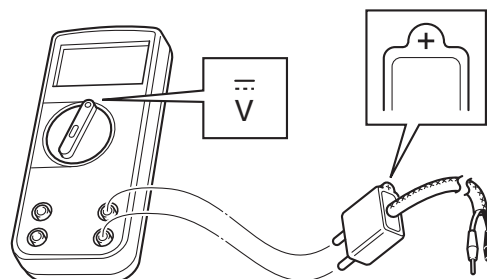
**TIP:** \_\_\_\_\_

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


A



B



- A. Worldwide
- B. USA and Canada

	Digital circuit tester 90890-03243
	Digital multimeter YU-34899-A
	Peak voltage adapter B 90890-03172
	Peak volt adapter YU-39991

### Using the digital tester


The electrical technical data applies 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.

The input voltage changes depending on the battery voltage. Check the battery and wire harness if the input voltage is less than the specified value. Check the components between the battery and the input voltage measuring point if there is no problem with the battery and wire harness.

If the tester probe cannot be inserted into the coupler, prepare a test lead suitable for the measurement.

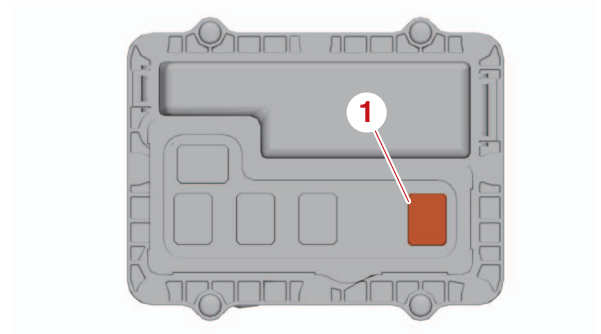


	Tester leads 90890-06881


## Engine control unit and component

### Checking the main relay

1. Remove:
  - Relay cover
  - Main relay "1"



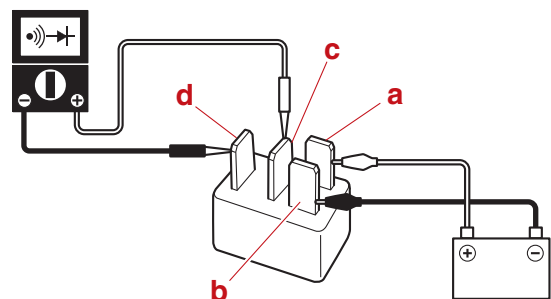
2. Check:
  - Relay continuity
 No continuity → Replace.

	Relay continuity Terminal "c"–Terminal "d"

### NOTICE

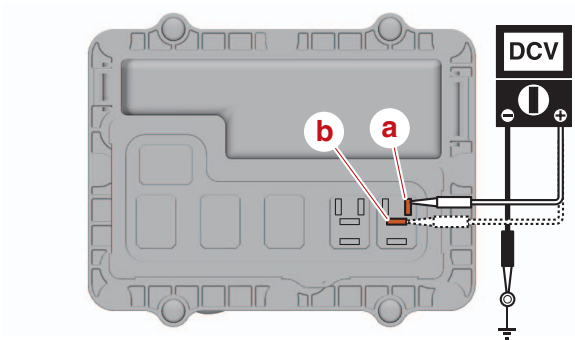
#### Do not reverse the battery leads.

- a. Connect the positive battery lead to the terminal "a", and the negative battery lead to the terminal "b", and then check for continuity between the terminals "c" and "d".



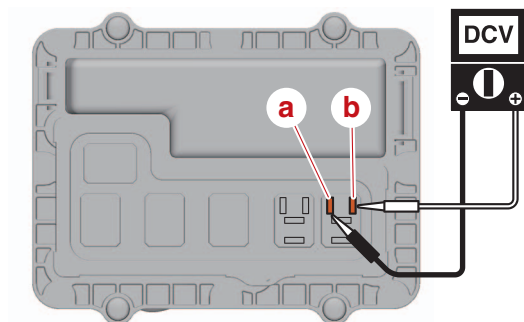
3. Measure:
  - Main relay input voltage
 Out of specification → See "Troubleshooting procedure (trouble code not detected)" (4-21).

- a. Measure the input voltage between the terminal “a” and ground, and the terminal “b” and ground.



	Input voltage 12 V Terminal “a”–Ground Terminal “b”–Ground
--	---

- b. Turn the engine start switch to ON, and measure the input voltage between the terminals “a” and “b”.



	Input voltage 12 V Terminal “a”–Terminal “b”
--	--

- c. Turn the engine start switch to OFF.

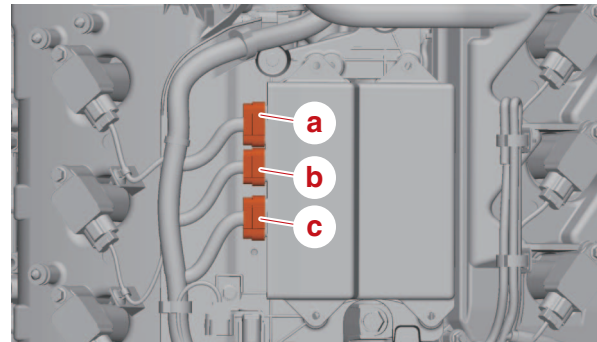
4. Install:
  - Main relay
  - Relay cover

### Checking the engine ECM circuit

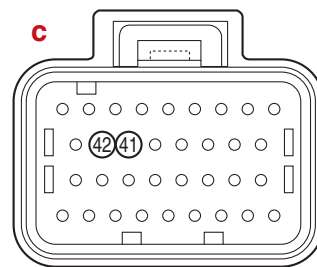
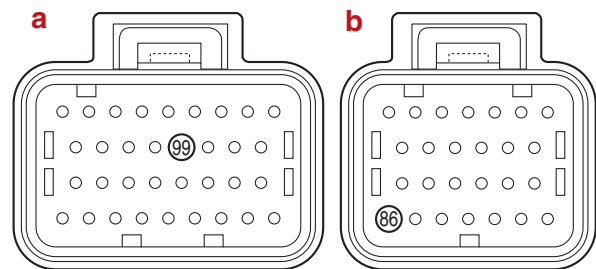
1. Check:
  - Wire harness continuity  
Out of specification → Replace the wire harness.

	Wire harness continuity Terminal 41–Ground Terminal 42–Ground Terminal 86–Ground Terminal 99–Ground
--	---

- a. Disconnect the engine ECM couplers “a”, “b” and “c”.

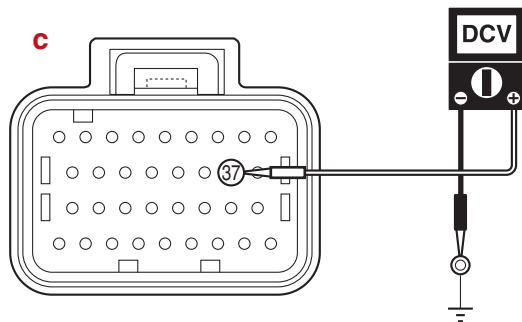



- b. Check the wire harness for continuity.



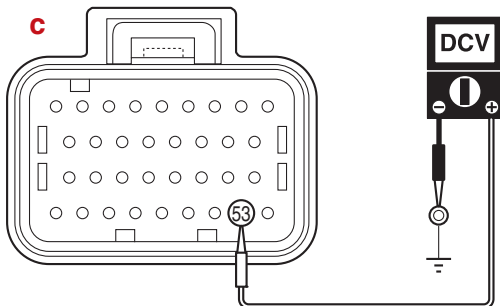
2. Measure:
  - Engine ECM input voltage  
Out of specification → Check the wire harness for continuity.


- a. Measure the input voltage between the engine ECM coupler terminal 37 and ground.



	Input voltage 12 V Terminal 37–Ground
---	---

- b. Turn the engine start switch to ON, and then measure the input voltage between the engine ECM coupler terminal 53 and ground.



	Input voltage (reference data) 11.6 V Terminal 53–Ground
---	--

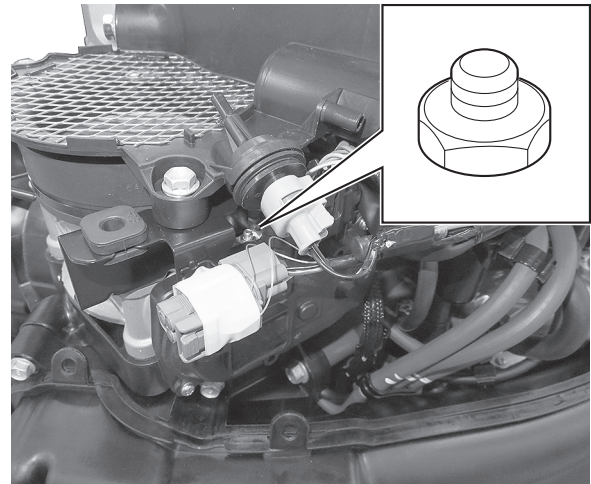
- c. Turn the engine start switch to OFF.  
d. Connect the engine ECM couplers.

### Checking the ETV and TPS


TPS 1 and TPS 2 are components of the ETV, which cannot be disassembled.

#### NOTICE

**Do not loosen the throttle stop screw nut or turn the throttle stop screw.**



1. Measure:
- TPS 1 and TPS 2 output voltage  
Out of specification → Check the TPS input voltage.

	TPS 1 output voltage at throttle valve fully closed (reference data) 0.760 V TPS 2 output voltage at throttle valve fully closed (reference data) 2.750 V Throttle valve opening angle at throttle valve fully closed (reference data) 4.9° TPS 1 output voltage at throttle valve fully open (reference data) 4.350 V TPS 2 output voltage at throttle valve fully open (reference data) 4.640 V
--	--

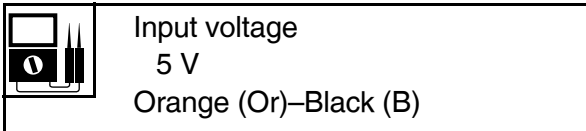
- a. Connect the YDIS to display “TPS 1” and “TPS 2”.
- b. Start the engine, warm it up for 5–10 minutes, and then stop it.
- c. Turn the engine start switch to ON, and then measure the TPS output voltages when the Digital Electric Control lever is at the fully closed position and fully open position.
- d. Turn the engine start switch to OFF.



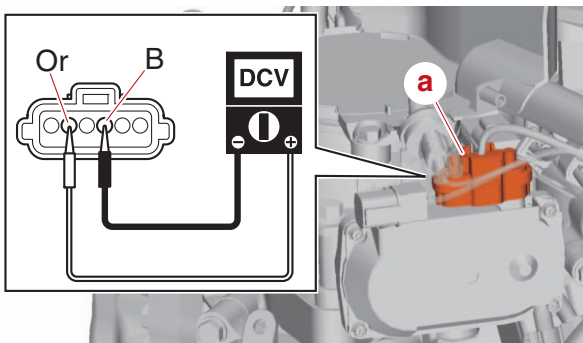
## Engine control unit and component

### 2. Measure:

- TPS input voltage  
Out of specification → Check the wire harness for continuity.



- Disconnect the ETV coupler “a”.
- Turn the engine start switch to ON, and then measure the TPS input voltage at the ETV coupler.

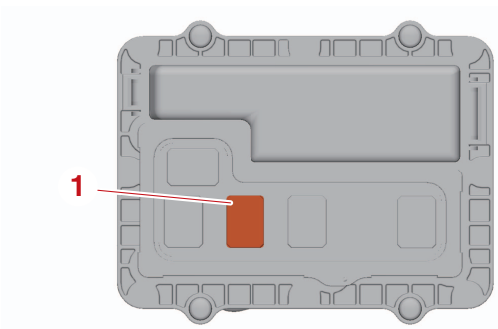


- Turn the engine start switch to OFF.
- Connect the ETV coupler.

### Checking the ETV motor relay

#### 1. Remove:

- Relay cover
- ETV motor relay “1”

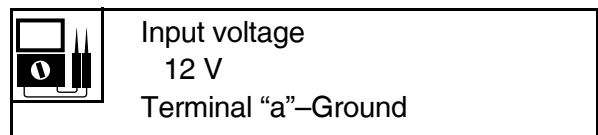
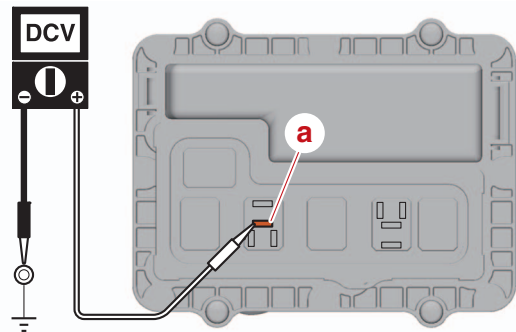


#### 2. Check:

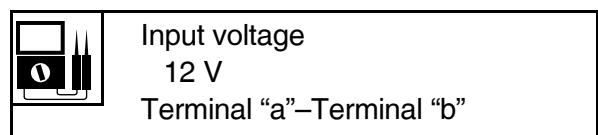
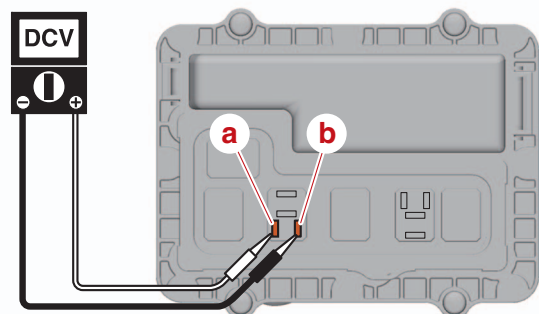
- ETV motor relay  
See step (2) in “Checking the main relay” (5-21).

### 3. Measure:

- ETV motor relay input voltage  
Out of specification → Check the wire harness for continuity.
  - Measure the input voltage between the terminal “a” and ground.



- Turn the engine start switch to ON, and then measure the input voltage between the terminals “a” and “b”.



- Turn the engine start switch to OFF.

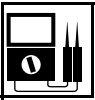
#### 4. Install:

- ETV motor relay
- Relay cover

### Checking the SPS

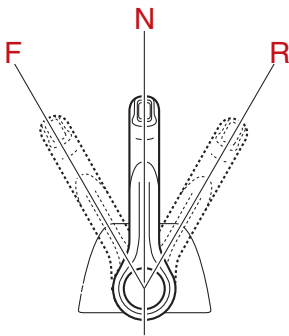
#### 1. Measure:

- SPS 1 and SPS 2 output voltage  
Out of specification → Check the SPS input voltage.



Output voltage at gear shift in the F position (reference data)  
0.47–1.68 V  
Output voltage at gear shift in the N position (reference data)  
2.30–2.67 V  
Output voltage at gear shift in the R position (reference data)  
3.21–4.39 V

- a. Connect the YDIS to display “SPS 1” and “SPS 2”.
- b. Turn the engine start switch to ON.
- c. Turn the engine start switch to ON, and then measure the SPS output voltages when the Digital Electric Control lever is at the positions F, N, and R.



- d. Turn the engine start switch to OFF.

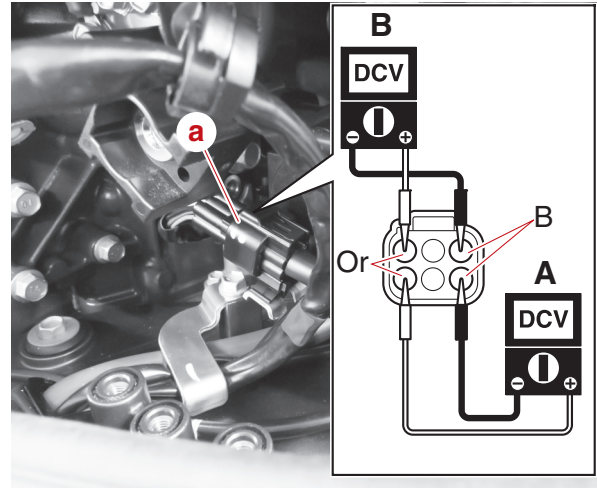
2. Measure:

- SPS input voltage  
Out of specification → Check the wire harness for continuity.



Input voltage  
5 V  
SPS 1: Orange (Or)–Black (B)  
SPS 2: Orange (Or)–Black (B)

- a. Disconnect the SPS coupler “a”.
- b. Turn the engine start switch to ON, and then measure the input voltage at the SPS coupler.



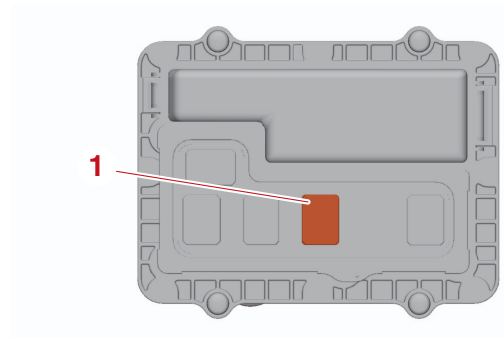
- A. SPS 1  
B. SPS 2

- c. Turn the engine start switch to OFF, and then connect the SPS coupler.

**Checking the shift actuator relay**

1. Remove:

- Relay cover
- Shift actuator relay “1”

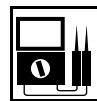


2. Check:

- Shift actuator relay  
See step (2) in “Checking the main relay” (5-21).

3. Measure:

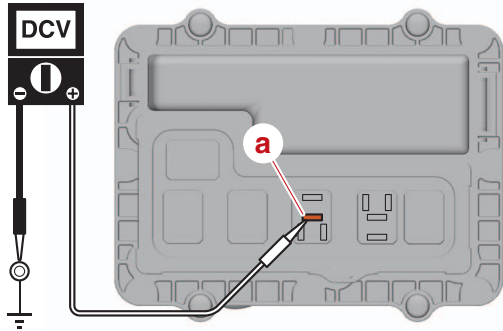
- Shift actuator relay input voltage  
Out of specification → Check the wire harness for continuity.



Input voltage  
12 V  
Terminal “a”–Ground



- a. Measure the input voltage between the terminal “a” and ground.



- b. Turn the engine start switch to OFF.

4. Install:

- Shift actuator relay
- Relay cover

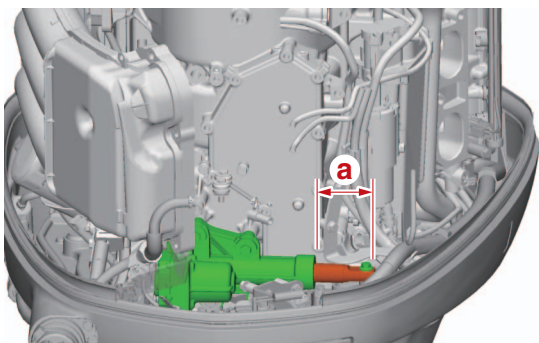
**Checking the shift actuator**

1. Measure:

- Shift actuator rod stroke

	Rod stroke at gear shift in the F position (reference data)
	80.0 mm (3.15 in)
	Rod stroke at gear shift in the N position (reference data)
	61.5 mm (2.42 in)
	Rod stroke at gear shift in the R position (reference data)
	39.5 mm (1.56 in)

- a. Operate the Digital Electronic Control to check the shift actuator rod stroke “a” at the positions F, N, and R.

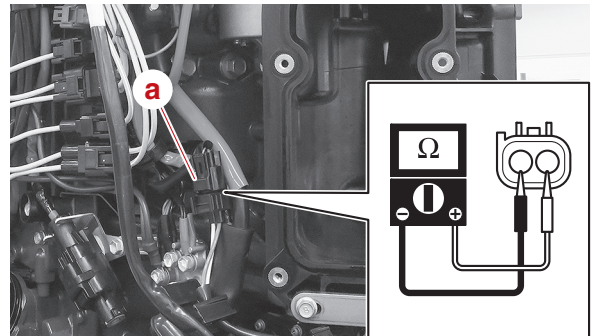


2. Measure:

- Shift actuator motor resistance

	Motor resistance (reference data)
	1.7 Ω

- a. Remove the intake manifold (PORT).
- b. Disconnect the shift actuator coupler “a”, and then measure the shift actuator motor resistance.



- c. Connect the shift actuator coupler, and then install the intake manifold (PORT).

**Checking the cam position sensor**

1. Measure:

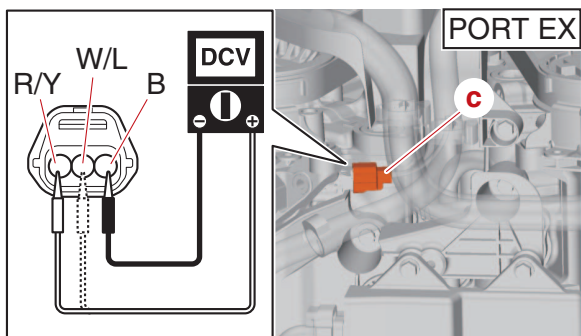
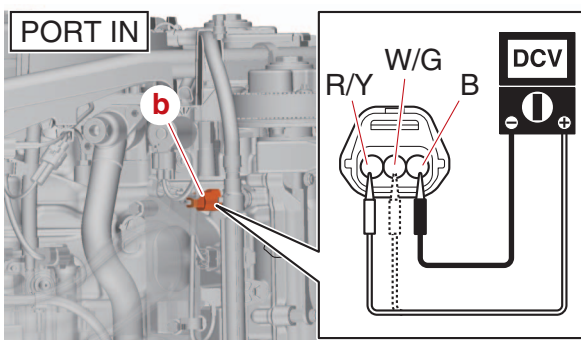
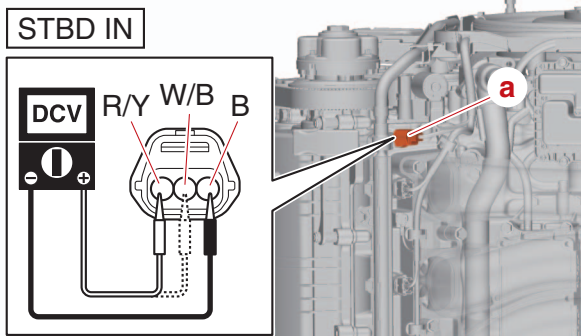
- Cam position sensor input voltage  
Out of specification → Check the wire harness for continuity.

	Input voltage
	12 V
	Red/Yellow (R/Y)–Black (B)
	Input voltage
	5 V
	White/Black (W/B)–Black (B) (STBD IN)
	White/Green (W/G)–Black (B) (PORT IN)
	White/Blue (W/L)–Black (B) (PORT EX)

- a. Disconnect the cam position sensor couplers “a”, “b”, and “c”.

## Engine control unit and component

- b. Turn the engine start switch to ON, and then measure the input voltage at the cam position sensor coupler.



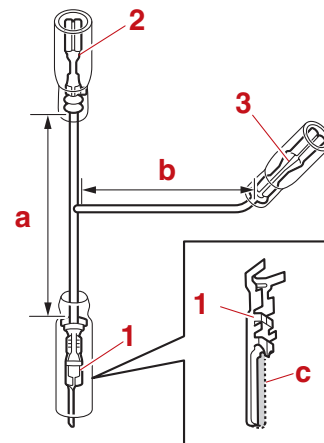
- c. Turn the engine start switch to OFF.


### 2. Measure:

- Cam position sensor output voltage  
Out of specification → Replace.

Output voltage	
White/Black (W/B)–Black (B) (STBD IN)	
White/Green (W/G)–Black (B) (PORT IN)	
White/Blue (W/L)–Black (B) (PORT EX)	
Position	Voltage
“a”, “c”	More than 4.8
“b”	Less than 1.0

- a. Make 3 test leads.



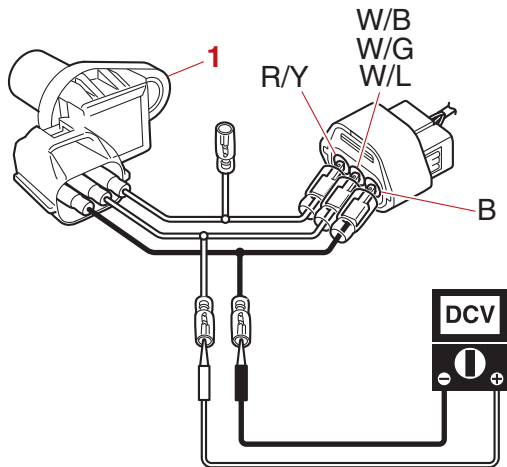
	Test lead
	Terminal, male “1” 9E212-10303
	Terminal, female “2” 9E212-11303
	Terminal, female “3” (commercially available)
	“a” = 100 mm (3.94 in)
	“b” = 50 mm (1.97 in)
	“c” = Cutout area

- b. Reduce the fuel pressure. See “Reducing the fuel pressure” (6-1).
- c. Remove the fuel rails and cam position sensors “1”.
- d. Connect the test leads to the cam position sensor “1” and cam position sensor coupler.

### **NOTICE**

**Make sure that the test leads do not contact each other and cause a short circuit. Otherwise, the fuse could blow when the engine start switch is turned to ON.**

- e. Connect the tester probes to the test leads.

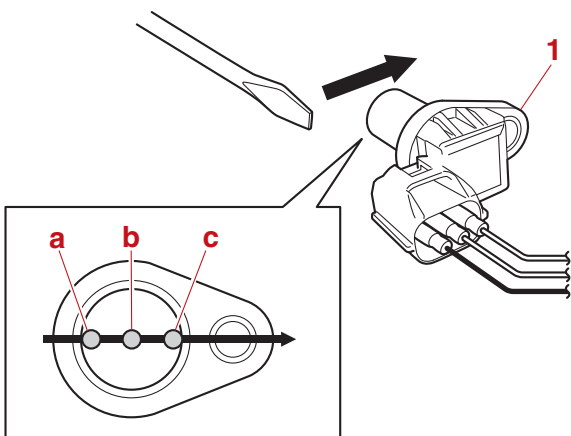


- f. Turn the engine start switch to ON, and then measure the output voltage when moving a screwdriver close to the cam position sensor "1".

**NOTICE**

Make sure to remove the high-pressure fuel pump fuse.

**TIP:** Using an analog circuit tester is recommended.

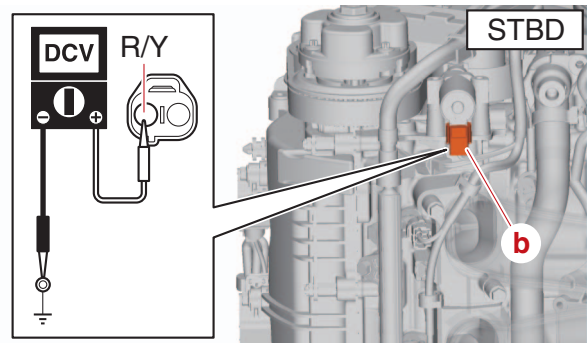
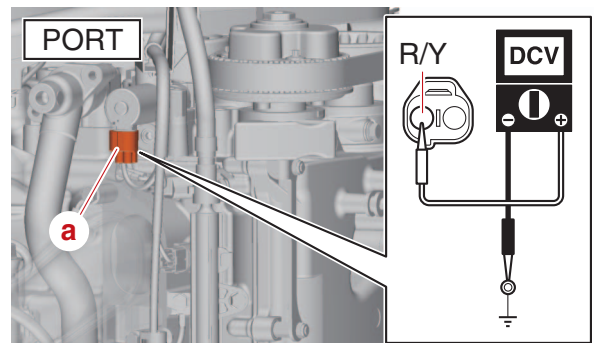


- g. Turn the engine start switch to OFF.  
 h. Disconnect the test leads, and then install the cam position sensors and fuel rail.  
 i. Install the fuel pump fuse.

- j. Connect the cam position sensor couplers.

**Checking the OCV**

1. Check:
  - OCV operation (using the YDIS "Stationary test")  
 No operation sound → Check the OCV input voltage.
    - a. Check the operation of the OCV using the YDIS "Stationary test" and check the operating sound.
2. Measure:
  - OCV input voltage  
 Out of specification → Check the wire harness for continuity.
    - a. Disconnect the OCV couplers "a" and "b".
    - b. Turn the engine start switch to ON, and then measure the input voltage between the OCV coupler and ground.



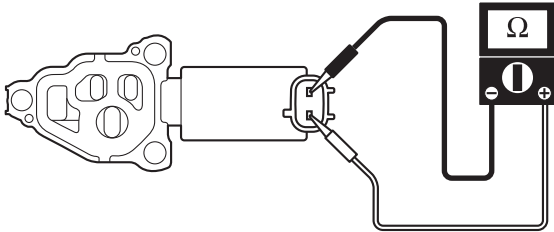
	Input voltage
	12 V
	Red/Yellow (R/Y)–Ground


- c. Turn the engine start switch to OFF.

## Engine control unit and component

### 3. Measure:

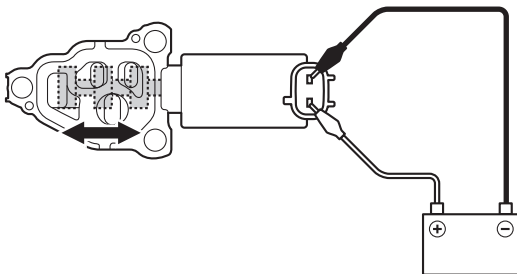
- OCV resistance  
Out of specification → Replace.
- a. Remove the OCV.
- b. Measure the OCV resistance.



	Resistance 6.7–7.7 Ω
---	-------------------------

### 4. Check:

- OCV operation  
No operation → Replace.
- a. Connect the battery leads to the terminals and check the operation of the spool valve.




- b. Disconnect the battery leads.
- c. Install the OCV, and then connect the OCV couplers.

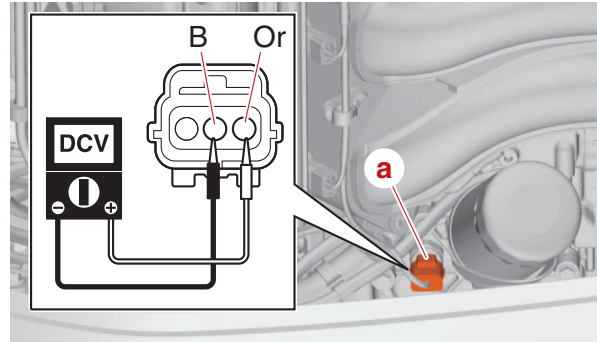
## Checking the oil pressure sensor

### 1. Measure:

- Oil pressure sensor input voltage  
Out of specification → Check the wire harness for continuity.


	Input voltage 5 V Orange (Or)–Black (B)
---	---

- a. Disconnect the oil pressure sensor coupler “a”.
- b. Turn the engine start switch to ON, and then measure the input voltage at the oil pressure sensor coupler.

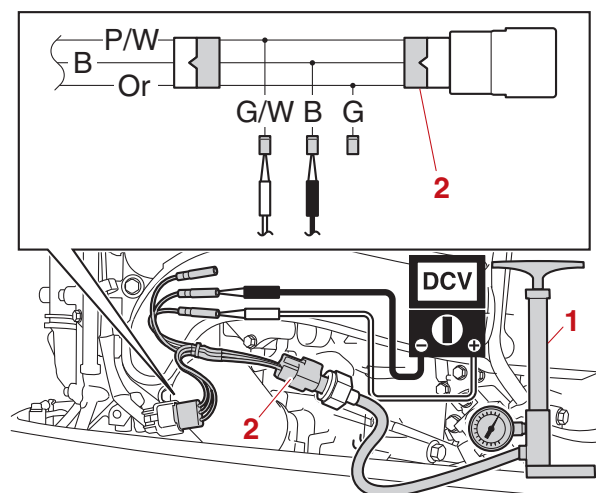



### 2. Measure:

- Oil pressure sensor output voltage  
Out of specification → Replace.

	Output voltage at 392 kPa (3.92 kgf/cm <sup>2</sup> , 56.8 psi) 2.5 V Output voltage at 784 kPa (7.84 kgf/cm <sup>2</sup> , 113.7 psi) 4.5 V Pink/White (P/W)–Black (B)
--	---

- a. Remove the oil pressure sensor, and then connect a pressure pump “1” and the special service tool “2”.
- b. Apply positive pressure to the oil pressure sensor slowly, and then measure the output voltage at the specified pressures.




	<p>Pressure pump "1" (commercially available) Test harness EJ-II-3 "2" 90890-06913</p>
---	--

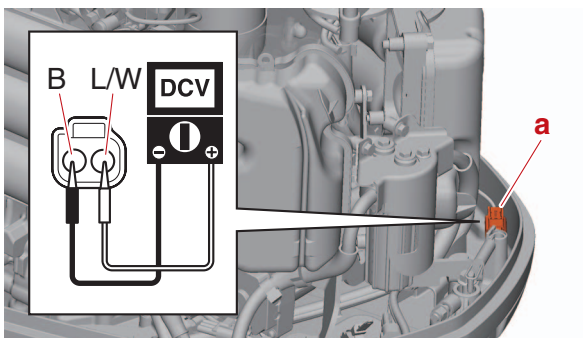
- c. Turn the engine start switch to OFF, and then disconnect the special service tool and pressure pump.
- d. Install the oil pressure sensor.

### Fuel control unit and component Checking the water detection switch

1. Measure:
  - Water detection switch input voltage  
Out of specification → Check the wire harness for continuity.


	<p>Input voltage 5 V Blue/White (L/W)–Black (B)</p>
--	---

- a. Disconnect the water detection switch coupler "a".
- b. Turn the engine start switch to ON, and then measure the input voltage at the water detection switch coupler.



- c. Turn the engine start switch to OFF.

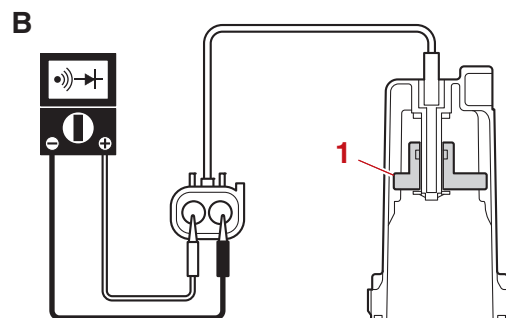
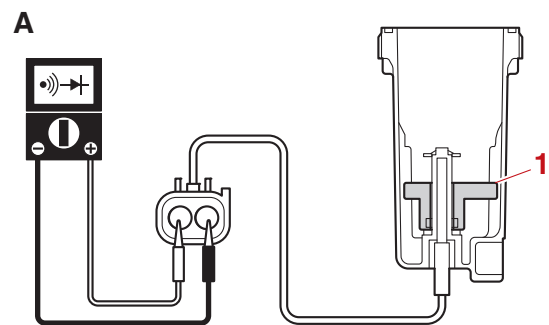
2. Check:
  - Water detection switch continuity  
Out of specification → Replace the fuel cup assembly.

	<p>Water detection switch continuity No continuity Float position "A" Continuity Float position "B"</p>
---	---

- a. Remove the fuel cup assembly. See "Fuel filter assembly" (6-6).
- b. Check that the float "1" moves smoothly.
- c. Check the water detection switch for continuity when the float "1" is in positions "A" and "B".

### NOTICE

Do not remove the clip and float.



- d. Install the fuel cup assembly. See "Fuel filter assembly" (6-6).


### Checking the fuel injector

1. Check:
  - Fuel injector operation (using the YDIS "Stationary test")  
No operating sound → Check the fuel injector input voltage.

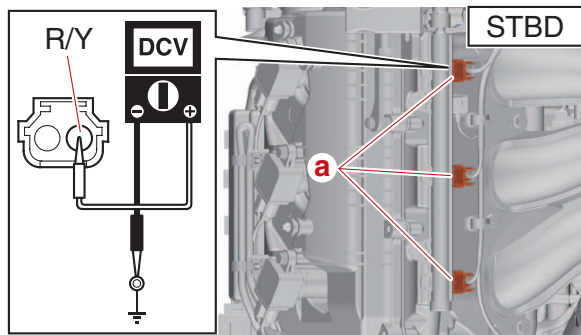
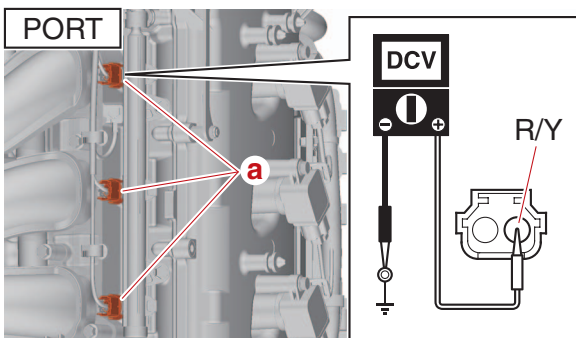


2. Measure:

- Fuel injector input voltage  
Out of specification → Check the wire harness for continuity.

	Input voltage 12 V Red/Yellow (R/Y)–Ground
---	--


- Disconnect the fuel injector couplers “a”.
- Turn the engine start switch to ON, and then measure the input voltage between the fuel injector coupler terminal and ground.



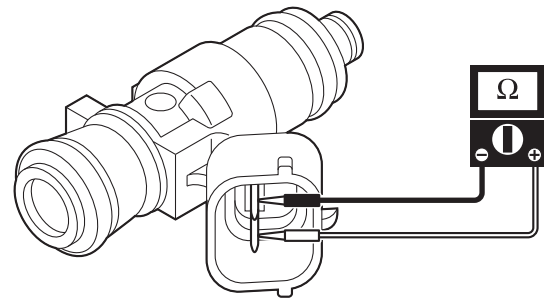
- Turn the engine start switch to OFF.
- Connect the fuel injector couplers.

3. Measure:

- Fuel injector resistance  
Out of specification → Replace.

	Resistance (reference data) 11.50–13.00 Ω
---	--

- Disconnect the fuel injector couplers.
- Measure the fuel injector resistance.



- Connect the fuel injector couplers.


Checking the low-pressure fuel pump and high-pressure fuel pump

1. Check:

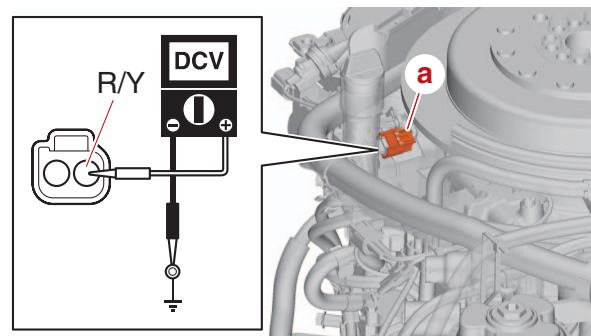
- Fuel pump operation (using the YDIS “Stationary test”)  
No operation sound → Check the fuel pump input voltage.

2. Measure:

- Low-pressure fuel pump input voltage  
Out of specification → Check the wire harness for continuity.

	Input voltage 12 V Red/Yellow (R/Y)–Ground
---	--

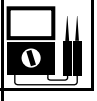
- Disconnect the low-pressure fuel pump coupler “a”.
- Turn the engine start switch to ON, and then measure the input voltage between the low-pressure fuel pump coupler terminal and ground.



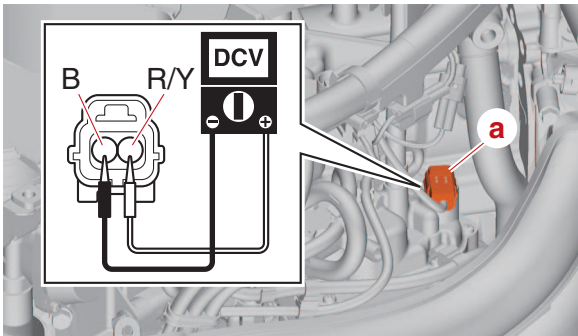
- Turn the engine start switch to OFF.

3. Measure:

- High-pressure fuel pump input voltage  
Out of specification → Check the wire harness for continuity.

	Input voltage 12 V Red/Yellow (R/Y)–Ground
---	--

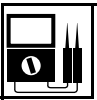
- Disconnect the high-pressure fuel pump coupler “a”.
- Connect the tester probes to the terminals of the high-pressure fuel pump coupler “a”, and then measure the input voltage within 5 seconds after turning the engine start switch to ON.



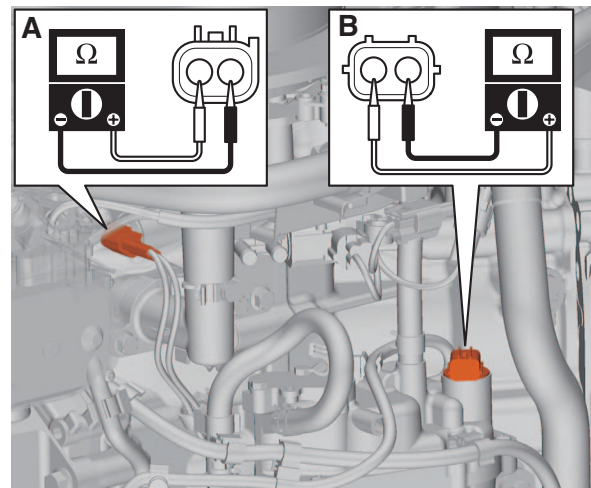
- Turn the engine start switch to OFF.

4. Measure:

- Fuel pump resistance  
Out of specification → Replace.

	Low-pressure fuel pump Resistance (reference data) 0.5–4.0 Ω
	High-pressure fuel pump Resistance (reference data) 0.2–3.0 Ω

- Measure the resistance of the fuel pump motors.



A. Low-pressure fuel pump  
B. High-pressure fuel pump

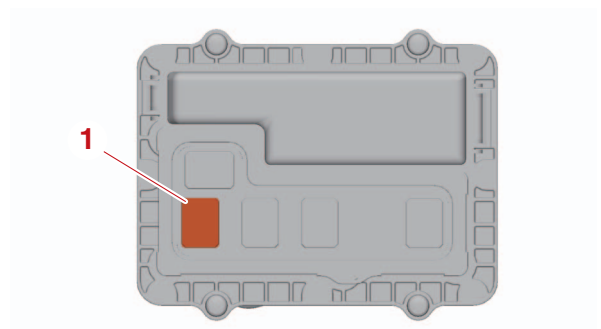
5. Connect:

- Low-pressure fuel pump coupler
- High-pressure fuel pump coupler

**Checking the high-pressure fuel pump relay**

1. Remove:

- Relay cover
- High-pressure fuel pump relay “1”



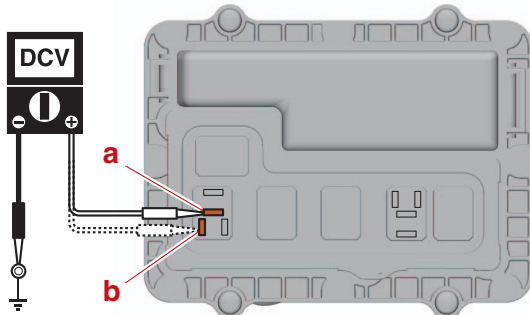
2. Check:

- High-pressure fuel pump relay  
See step (2) in “Checking the main relay” (5-21).

3. Measure:

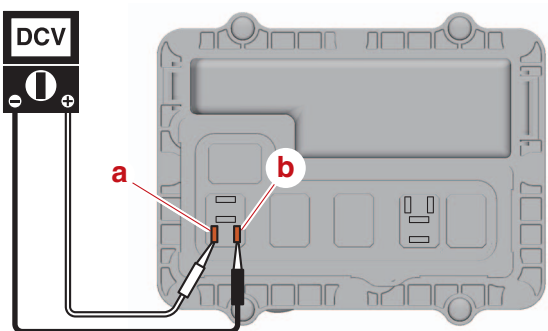
- High-pressure fuel pump relay input voltage  
Out of specification → See “Troubleshooting procedure” (4-4).

- a. Connect the tester probes to the terminals “a” and “b”, and then measure the input voltage within 5 seconds after turning the engine start switch to ON.



	Input voltage
	12 V
	Terminal “a”–Ground Terminal “b”–Ground

- b. Turn the engine start switch to ON, and then measure the input voltage between the terminals “a” and “b”.



	Input voltage
	12 V
	Terminal “a”–Terminal “b”

- c. Turn the engine start switch to OFF.

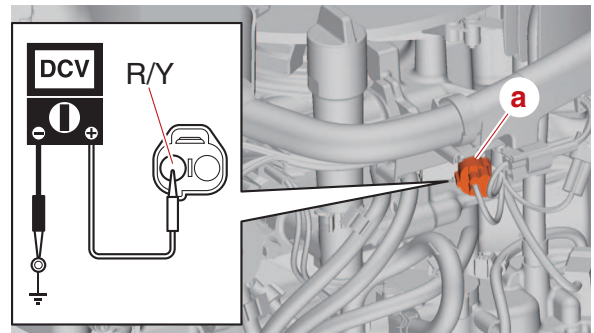
4. Install:
  - High-pressure fuel pump relay
  - Relay cover

### Checking the vapor shut-off valve

1. Measure:
  - Vapor shut-off valve input voltage  
Out of specification → Check the wire harness for continuity.

	Input voltage
	12 V
	Red/Yellow (R/Y)–Ground

- a. Disconnect the vapor shut-off valve coupler “a”.
- b. Turn the engine start switch to ON, and then measure the input voltage between the vapor shut-off valve coupler terminal and ground.

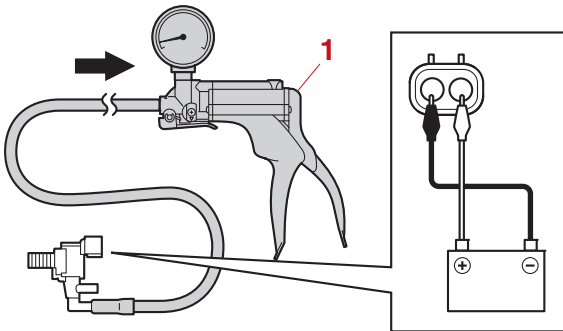


2. Check:
  - Vapor shut-off valve operation  
Not operating → Replace.
    - a. Remove the vapor shut-off valve, and then connect the special service tool “1” to the vapor shut-off valve.
    - b. Apply the specified negative pressure to the vapor shut-off valve.
    - c. Check that the vapor shut-off valve opens and the negative pressure is released when the battery leads are connected to the vapor shut-off valve terminals.



**NOTICE**

Connect the battery leads to the vapor shut-off valve terminals for only a few seconds.



	Vacuum/pressure pump gauge set "1"
	90890-06945
	Pressure/vacuum tester "1"
	YB-35956-B

	Specified negative pressure
	67.0 kPa (0.67 kgf/cm <sup>2</sup> , 9.7 psi)

- d. Disconnect the special service tool.
- e. Install the vapor shut-off valve.

3. Measure:

- Vapor shut-off valve resistance
- Out of specification → Replace.

	Resistance
	30.0–34.0 Ω

- a. Disconnect the vapor shut-off valve coupler.
- b. Measure the resistance between the vapor shut-off valve terminals.
- c. Connect the vapor shut-off valve coupler.

**Charging unit and component**  
**Checking the lighting coil (stator assembly)**

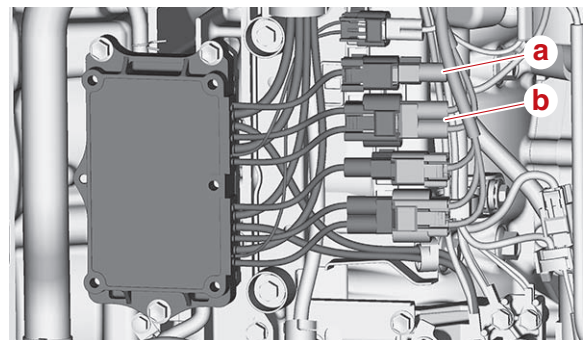
1. Measure:

- Lighting coil output peak voltage
- Below specification → Replace the stator assembly.

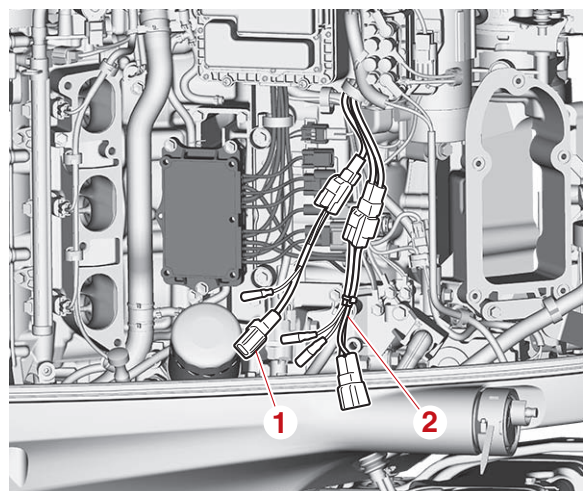
Lighting coil output peak voltage (reference data)  
 Green (G)–Green (G)


r/min	Unloaded		
	Cranking	1500	3500
DC V	6.9	38.0	83.2

- a. Remove the intake manifold (STBD).
- b. Disconnect the lighting coil couplers "a" and "b".

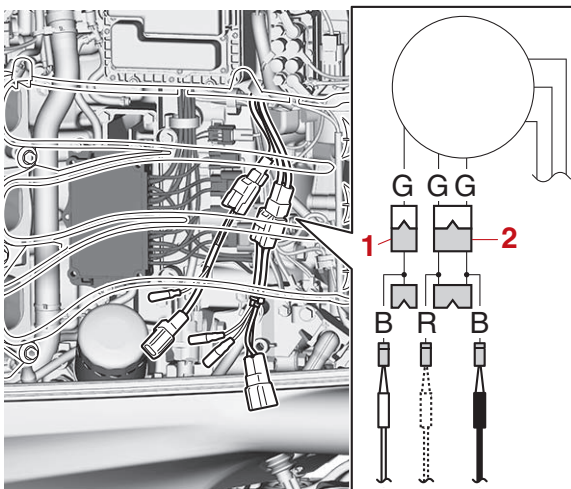


- c. Connect the special service tools "1" and "2".




	Test harness FW13613-1 "1"
	90890-06915
	Test harness FW13613-2 "2"
	90890-06916

- d. Install the intake manifold (STBD).
- e. Remove the clip from the engine shut-off switch.
- f. While cranking the engine, measure the peak voltage.
- g. Insert the clip into the engine shut-off switch.
- h. Start the engine, and then measure the peak voltage at the specified engine speed.
- i. Measure the lighting coil output peak voltage between all combinations of the connectors.



- j. Stop the engine, and then disconnect the special service tool.
- k. Remove the intake manifold (STBD).
- l. Connect the lighting coil couplers.

2. Measure:
  - Lighting coil resistance
 Out of specification → Replace.

	Resistance (reference data)
	0.1056–0.1584 Ω
	Green (G)–Green (G)


- a. Remove the intake manifold (STBD).
- b. Disconnect the lighting coil couplers.
- c. Measure the lighting coil resistance.
- d. Connect the lighting coil couplers.
- e. Install the intake manifold (STBD).

### Checking the rectifier/regulator/isolator

#### NOTICE

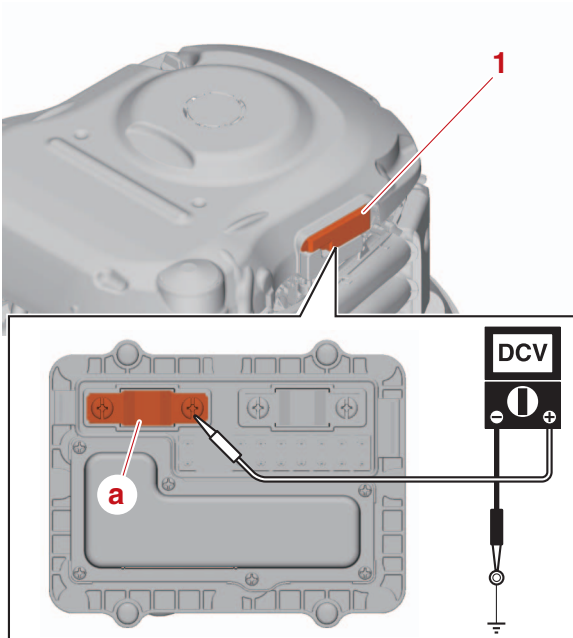
**Do not connect the battery cables in reverse. Otherwise, the rectifier/regulator could be damaged.**

1. Measure:
  - Rectifier/regulator/isolator output peak voltage
 Out of specification → Check the rectifier/regulator/isolator for continuity.

	Output voltage at 1500 r/min (loaded) (reference data)
	13 V
	Output voltage at 3500 r/min (loaded) (reference data)
	13 V
	Fuse "a"–Ground

## Ignition unit and component

- a. Remove the fuse cover "1", and then measure the rectifier/regulator/isolator output peak voltage at the specified engine speed.



### 2. Check:

- Rectifier/regulator/isolator continuity  
Out of specification → Replace.
  - a. Remove the intake manifold (STBD).
  - b. Disconnect the rectifier/regulator/isolator coupler.
  - c. Set the digital circuit tester to the diode mode, and then check the rectifier/regulator/isolator for continuity. See "Rectifier/regulator/isolator continuity table" (A-16).
  - d. Connect the rectifier/regulator/isolator coupler.
  - e. Install the intake manifold (STBD).

## Ignition unit and component

### Checking the ignition spark

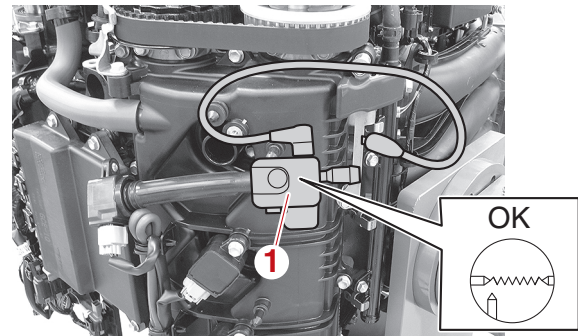
#### 1. Check:

- Ignition spark  
No spark → Check ignition system circuit.
  - a. Remove the ignition coils.
  - b. Connect the special service tool "1" to the ignition coil.

- c. Check the ignition spark using the YDIS "Stationary test".

### ⚠ WARNING

Do not touch any of the connections of the special service tool.



Ignition checker (Spark gap tester)  
"1"  
90890-06754

- d. Remove the special service tool, and then install the ignition coils.

### Checking the ignition coil

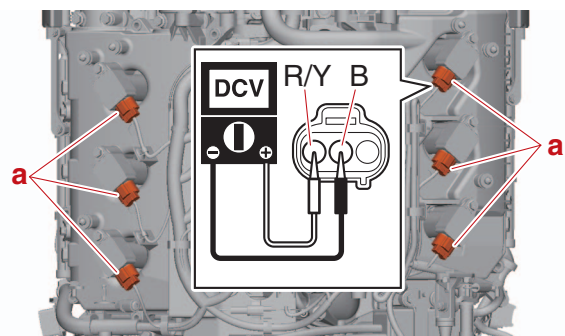
#### 1. Measure:

- Ignition coil input voltage  
Out of specification → Check the wire harness for continuity.



Input voltage  
12 V  
Red/Yellow (R/Y)–Black (B)

- a. Disconnect the ignition coil couplers "a".
- b. Turn the engine start switch to ON, and then measure the input voltage at the ignition coil coupler.



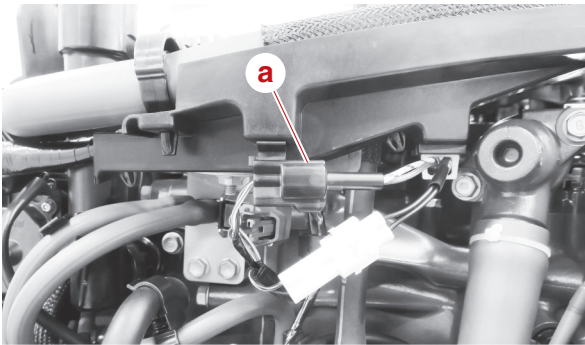
- c. Turn the engine start switch to OFF.
- d. Connect the ignition coil couplers.

### Checking the pulser coil

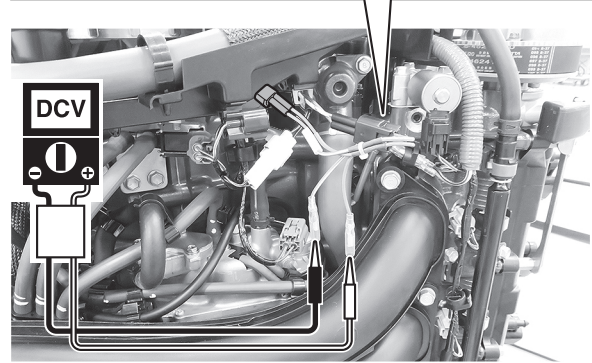
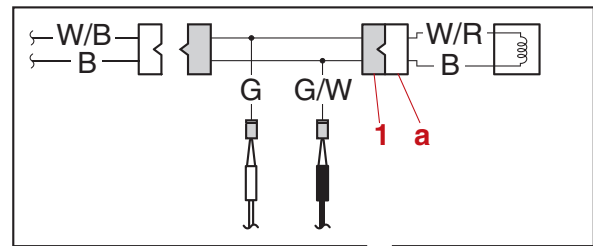
1. Measure:
  - Pulser coil output peak voltage  
Below specification → Measure the pulser coil resistance.

Pulser coil output peak voltage (reference data)				
White/Red (W/R)–Black (B)				
r/min	Unloaded	Loaded		
	Cranking	1500	3500	
DC V	7.6	6.9	23.9	25.1

- a. Disconnect the pulser coil coupler “a”.

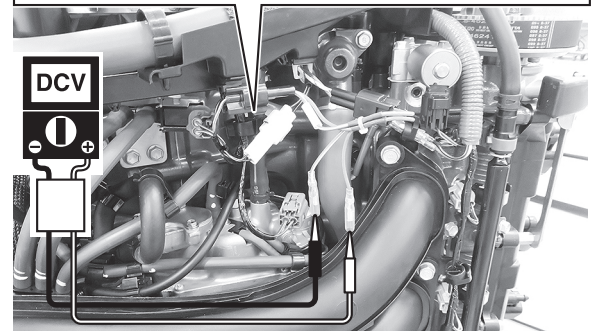
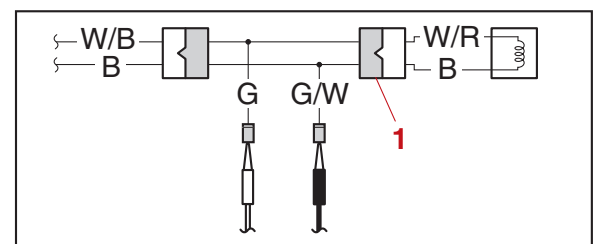


- b. Connect the special service tool “1” to the pulser coil coupler “a” (wire harness end).
- c. Remove the clip from the engine shut-off switch.



	<p>Test harness FWY-2 “1” 90890-06917</p>
--	---

- d. While cranking the engine, measure the peak voltage under loaded condition.
- e. Insert the clip into the engine shut-off switch.
- f. Start the engine, and then measure the peak voltage at the specified engine speed.




- g. Stop the engine.



- h. Disconnect the special service tool.
- i. Connect the pulser coil coupler.

### 2. Measure:

- Pulser coil resistance  
Out of specification → Replace.

	Resistance 396.0–594.0 Ω
---	-----------------------------

- a. Disconnect the pulser coil coupler.
- b. Measure the pulser coil resistance.
- c. Connect the pulser coil coupler.

### Checking the intake air temperature sensor

#### 1. Measure:


- Ambient temperature
- Intake air temperature (YDIS display)
  - a. Connect the YDIS to display “Intake air temperature”.
  - b. Check that the difference between the ambient temperature and the displayed intake air temperature is within  $\pm 5\text{ }^{\circ}\text{C}$  ( $\pm 9\text{ }^{\circ}\text{F}$ ).

#### TIP:

- Check the intake air temperature sensor when the engine is cold.
- When checking the intake air temperature sensor, remove the top cowling and do not start the engine.

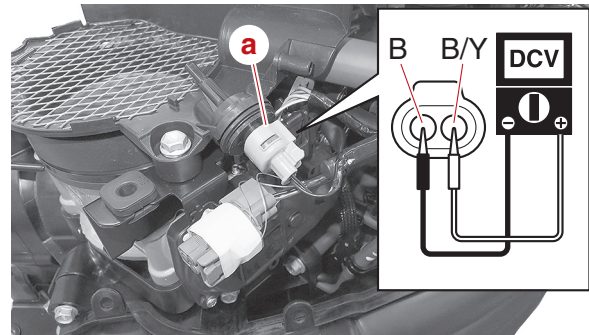
#### 2. Measure:

- Intake air temperature sensor input voltage  
Out of specification → Check the wire harness for continuity.

	Input voltage 5 V Black/Yellow (B/Y)–Black (B)
---	--

- a. Disconnect the intake air temperature sensor coupler “a”.


- b. Turn the engine start switch to ON, and then measure the input voltage at the intake air temperature sensor coupler.



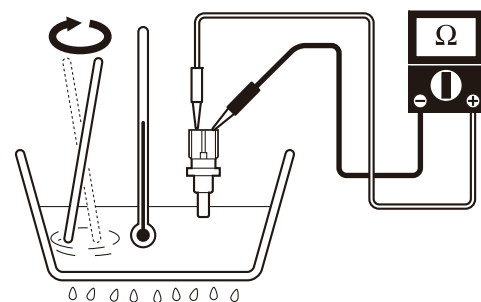
- c. Turn the engine start switch to OFF.

#### 3. Measure:

- Intake air temperature sensor resistance  
Out of specification → Replace.

	Resistance at 20 °C (68 °F) 2.200–2.700 kΩ Resistance at 80 °C (176 °F) 0.322 kΩ
--	---


- a. Remove the intake air temperature sensor.
- b. Place the intake air temperature sensor in a container of water and heat the water slowly.



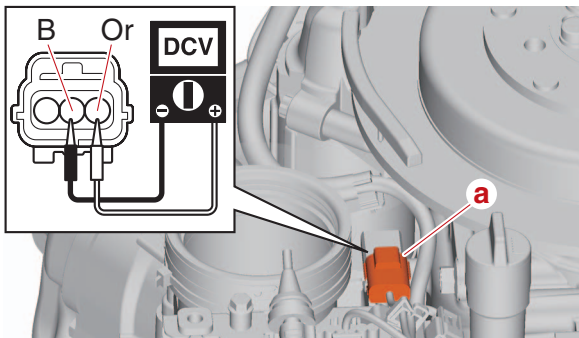
- c. Measure the intake air temperature sensor resistance.
- d. Install the intake air temperature sensor and connect the coupler.

### Checking the intake air pressure sensor

1. Measure:
  - Intake air pressure sensor input voltage  
Out of specification → Check the wire harness for continuity.


	Input voltage 5 V Orange (Or)–Black (B)
---	---

- a. Disconnect the intake air pressure sensor coupler “a”.
- b. Turn the engine start switch to ON, and then measure the input voltage at the intake air pressure sensor coupler.

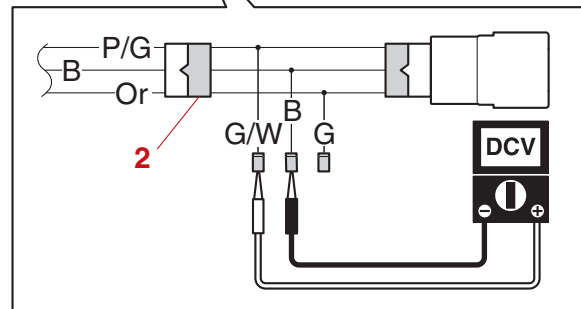
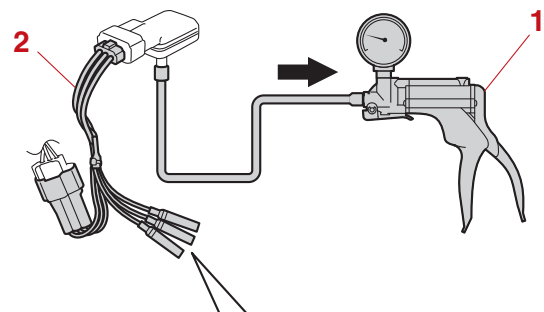



- c. Turn the engine start switch to OFF.

2. Measure:
  - Intake air pressure sensor output voltage  
Out of specification → Replace.

	Output voltage at -20.0 kPa (-0.20 kgf/cm <sup>2</sup> , -2.9 psi) 3.21 V Output voltage at -46.7 kPa (-0.467 kgf/cm <sup>2</sup> , -6.8 psi) 2.16 V Pink/Green (P/G)–Black (B)
---	---

- a. Remove the intake silencer and intake air pressure sensor.
- b. Connect the special service tools “1” and “2”.




	Vacuum/pressure pump gauge set “1” 90890-06945 Pressure/vacuum tester “1” YB-35956-B Test harness EJ-II-3 “2” 90890-06913
--	---

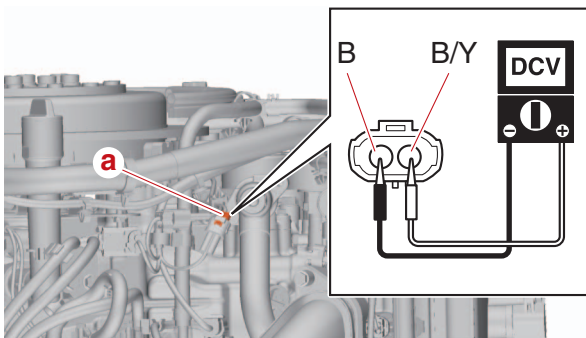
- c. Turn the engine start switch to ON.
- d. Apply negative pressure to the intake air pressure sensor slowly, and then measure the output voltage at the specified pressure.
- e. Turn the engine start switch to OFF.
- f. Disconnect the special service tools.
- g. Install the intake air pressure sensor and connect the coupler.
- h. Install the intake silencer.

### Checking the engine temperature sensor

1. Measure:
  - Engine temperature sensor input voltage  
Out of specification → Check the wire harness for continuity.


	Input voltage 5 V Black/Yellow (B/Y)–Black (B)
---	--

- a. Disconnect the engine temperature sensor coupler “a”.
- b. Turn the engine start switch to ON, and then measure the input voltage at the engine temperature sensor coupler.

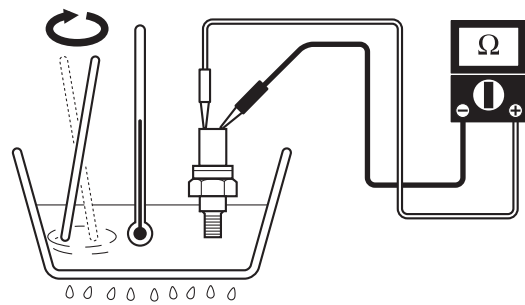


- c. Turn the engine start switch to OFF.

2. Measure:
  - Engine temperature sensor resistance  
Out of specification → Replace.

	Resistance at 5 °C (41 °F) (reference data) 4.55 kΩ Resistance at 100 °C (212 °F) (reference data) 0.16–0.20 kΩ Resistance at 25 °C (77 °F) (reference data) 1.90–2.10 kΩ
---	--


- a. Remove the engine temperature sensor.
- b. Place the engine temperature sensor in a container of water and heat the water slowly.
- c. Measure the engine temperature sensor resistance.



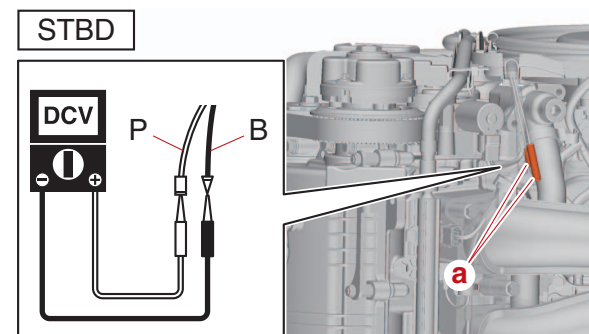
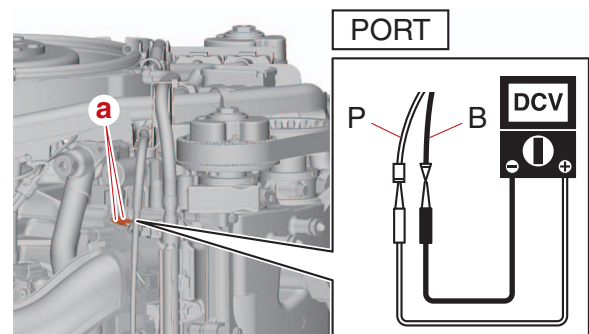
- d. Install the engine temperature sensor and connect the coupler.

### Checking the thermo switch

1. Measure:
  - Thermo switch input voltage  
Out of specification → Check the wire harness for continuity.

	Input voltage 5 V Pink (P)–Black (B)
--	--


- a. Disconnect the thermo switch connectors “a”.
- b. Turn the engine start switch to ON, and then measure the input voltage at the thermo switch connector.



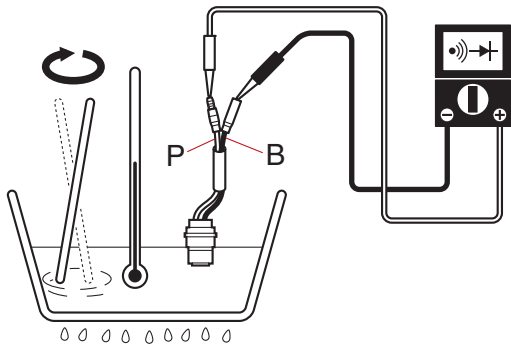
- c. Turn the engine start switch to OFF.

2. Check:

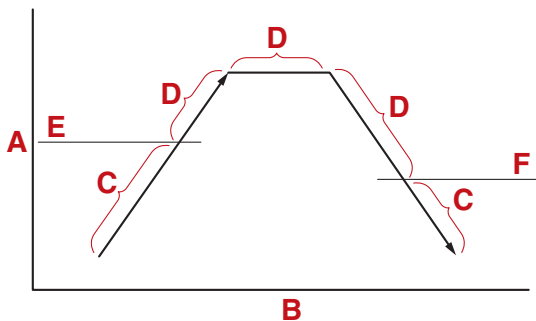
- Thermo switch continuity  
Out of specification → Replace.

	Switch ON temperature 84–90 °C (183–194 °F)
	Switch OFF temperature 68–82 °C (154–180 °F)

- Remove the thermo switch.
- Place the thermo switch in a container of water and heat the water slowly.



- Check the thermo switch for continuity at the specified temperatures.




- A. Temperature
- B. Time
- C. No continuity
- D. Continuity
- E. Switch ON temperature
- F. Switch OFF temperature

- Install the thermo switch.
- Connect the thermo switch connectors.

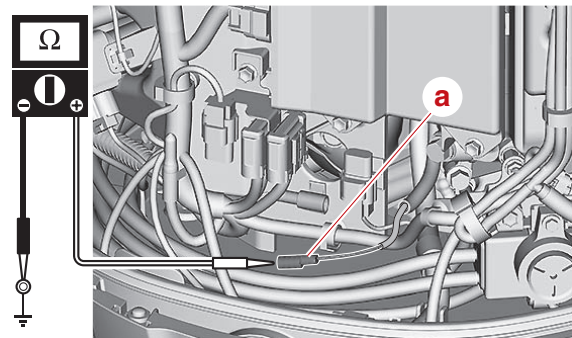
**Checking the knock sensor**

1. Measure:

- Knock sensor resistance  
Out of specification → Replace.

	Resistance 504–616 kΩ
---	--------------------------

- Disconnect the knock sensor coupler “a”.
- Measure the knock sensor resistance.




- Connect the knock sensor coupler.

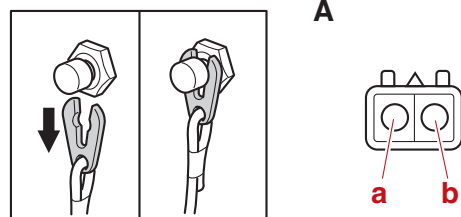
**Checking the engine shut-off switch**

1. Check:

- Engine shut-off switch continuity  
Out of specification → Replace.

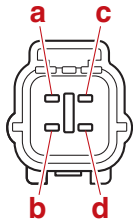
	Engine shut-off switch continuity Clip removed:
	Terminal “a”–Terminal “b” Terminal “c”–Terminal “d” Terminal “e”–Terminal “f” Terminal “g”–Terminal “h” Terminal “i”–Terminal “j”

- Disconnect the engine shut-off switch coupler.
- Check the engine shut-off switch for continuity.

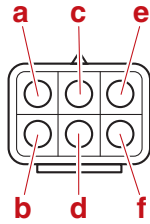




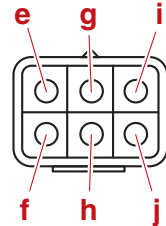
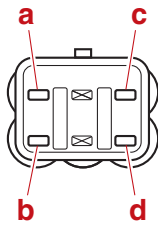
B



C



D



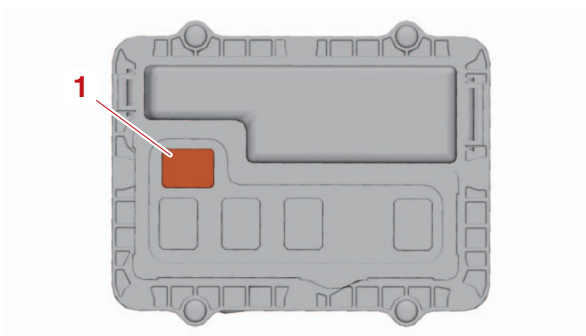
- A. Single type
- B. Twin type
- C. Triple type
- D. Quad type

c. Connect the engine shut-off switch coupler.

## Starting unit and component

### Checking the starter relay

1. Remove:
  - Relay cover
  - Starter relay "1"

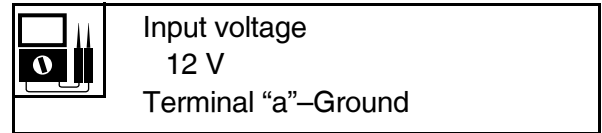


2. Check:
  - Starter relay

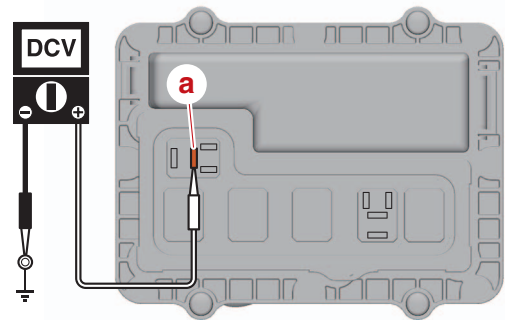
See step (2) in "Checking the main relay" (5-21).

3. Measure:

- Starter relay input voltage
- Out of specification → Check the wire harness for continuity.



- a. Measure the input voltage between the terminal "a" and ground.



- b. Turn the engine start switch to OFF.

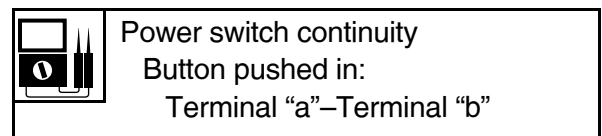
4. Install:

- Starter relay
- Relay cover

### Checking the power switch

1. Check:
  - Power switch continuity

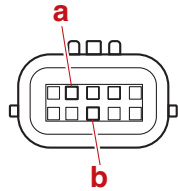
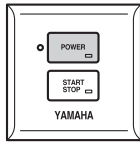
Out of specification → Replace.



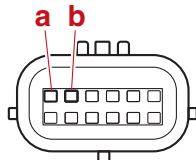
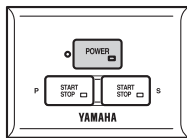
- a. Disconnect the power switch coupler.

- b. Check the power switch for continuity at the power switch coupler.

A



B



- A. Single type  
B. Twin type

- c. Connect the power switch coupler.

### Checking the engine start/stop button

1. Check:
- Engine start/stop button continuity  
Out of specification → Replace.



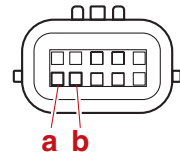
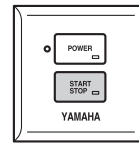
#### Engine start/stop button continuity

Button pushed in:

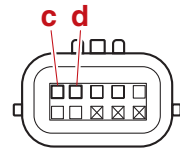
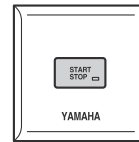
- Terminal "a"–Terminal "b"
- Terminal "c"–Terminal "d"
- Terminal "e"–Terminal "f"
- Terminal "e"–Terminal "g"
- Terminal "h"–Terminal "i"
- Terminal "h"–Terminal "j"
- Terminal "k"–Terminal "l"
- Terminal "k"–Terminal "m"
- Terminal "k"–Terminal "n"
- Terminal "o"–Terminal "p"
- Terminal "o"–Terminal "q"
- Terminal "o"–Terminal "r"
- Terminal "o"–Terminal "s"

- a. Disconnect the engine start/stop button coupler.
- b. Check the engine start/stop button for continuity at the engine start/stop button coupler.

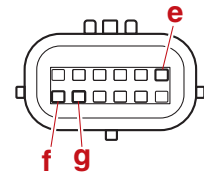
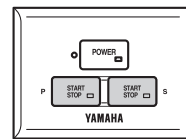
A



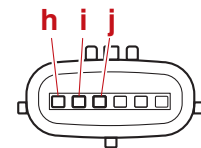
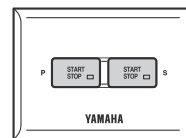
B



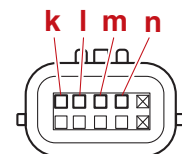
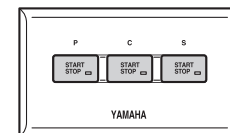
C



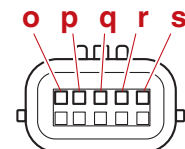
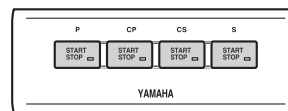
D



E



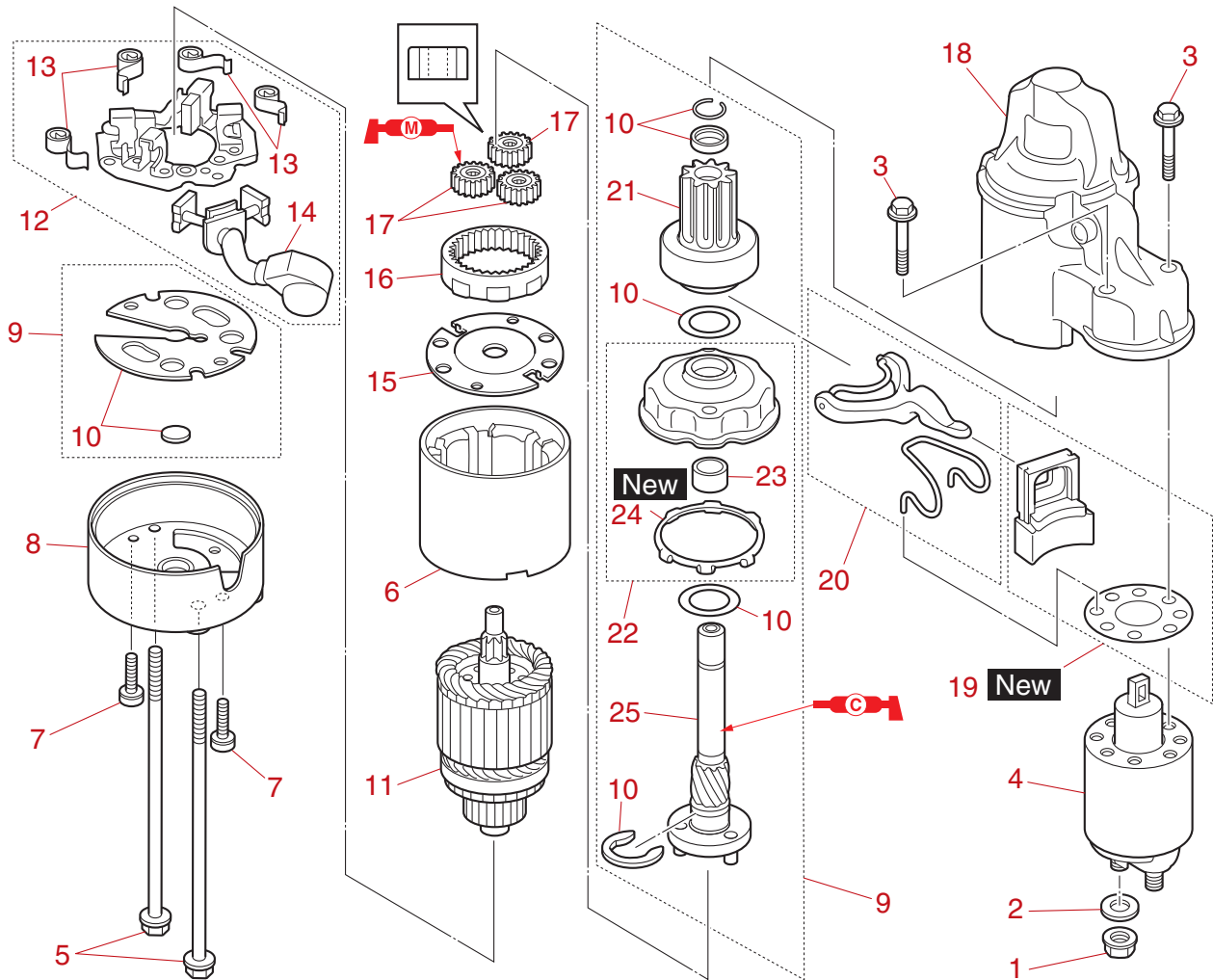
F



- A. Power switch (single type)  
B. All start/stop button  
C. Power switch (twin type)  
D. Start/stop button (twin type)  
E. Start/stop button (triple type)  
F. Start/stop button (quad type)

- c. Connect the engine start/stop button coupler.

Starter motor



↑↓	Part name	Q'ty	Remarks
1	Nut M8	1	
2	Washer	1	
3	Bolt M6 × 35 mm	2	
4	Magnet switch	1	
5	Bolt M5 × 127 mm	2	
6	Stator	1	
7	Screw M4 × 16 mm	2	
8	Bracket	1	
9	Starter motor gear assembly	1	
10	Washer set	1	
11	Armature	1	
12	Brush holder assembly	1	
13	Brush spring	4	
14	Brush assembly	1	
15	Plate	1	
16	Outer gear	1	
17	Planetary gear	3	

↑↓	Part name	Q'ty	Remarks
18	Cover	1	
19	Seal set	1	
20	Lever assembly	1	
21	Pinion assembly	1	
22	Bracket assembly	1	
23	Bearing	1	
24	Gasket	1	
25	Pinion shaft	1	

## Removing the starter motor

### NOTICE

Before removing the starter motor, make sure to disconnect the negative battery terminal.

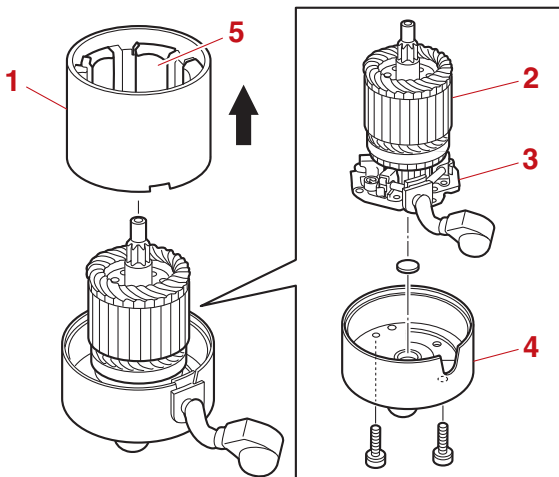
1. Remove:
  - Starter motor
  - See "Starter motor" (7-26).

## Disassembling the starter motor

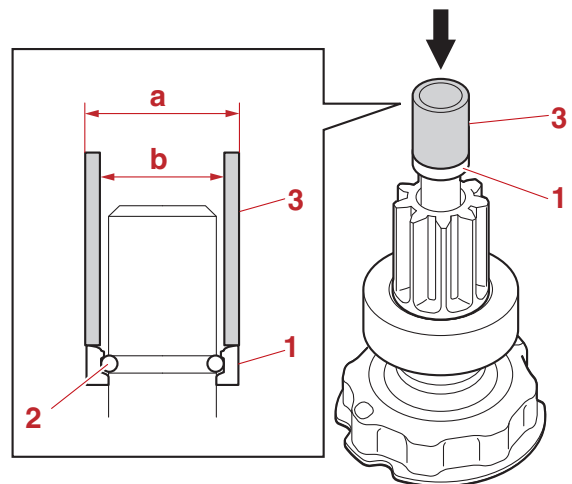
1. Remove:
  - Stator
  - Bracket screw
  - Bracket
  - Armature
    - a. Remove the stator "1".
    - b. Remove the armature "2" along with the brush holder assembly "3" from the bracket "4".


### NOTICE

Do not disassemble the stator. Do not remove the magnets "5" from it.



2. Remove:
  - Pinion stopper
  - Clip
    - a. Push the pinion stopper "1" down, and then remove the clip "2".



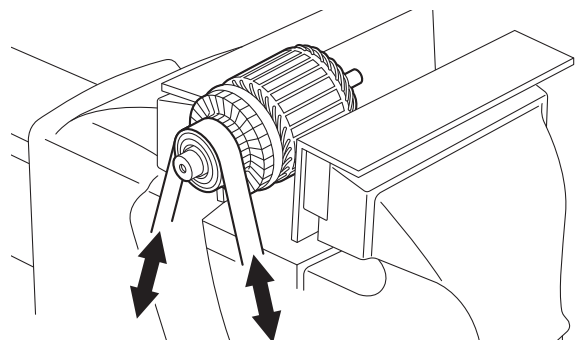
	<p>Pipe "3" (commercially available) "a": 18.0 mm (0.71 in) "b": 13.0 mm (0.51 in)</p>
---	--

## Checking the starter motor pinion

1. Check:
  - Pinion teeth  
Cracked/worn → Replace the pinion.
2. Check:
  - Pinion movement  
Not smooth → Replace.
    - a. Turn the pinion counterclockwise to check that it operates smoothly and turn it clockwise to check that it locks in place.


## Checking the armature (starter motor)

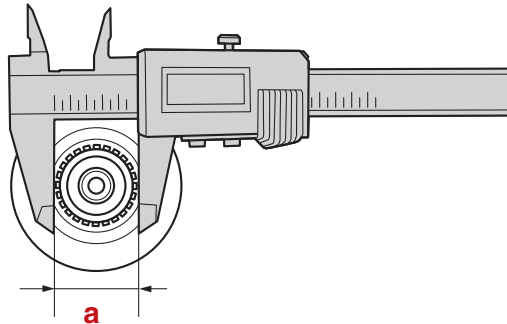
1. Check:
  - Commutator  
Dirty → Clean using 600-grit sandpaper and compressed air.



2. Measure:


- Commutator diameter "a"  
Below specification → Replace the armature.

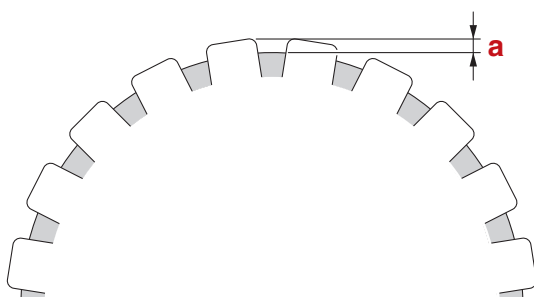
	Standard commutator diameter
	29.0 mm (1.14 in)
	Wear limit
	28.0 mm (1.10 in)



3. Measure:

- Commutator undercut "a"  
Below specification → Replace the armature.

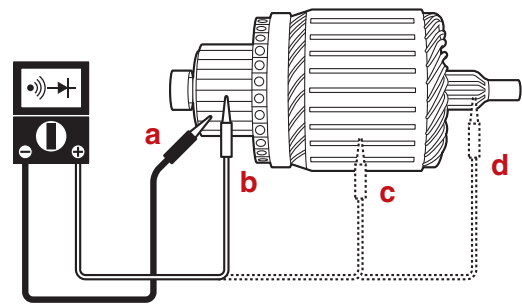
	Standard commutator undercut
	0.8 mm (0.03 in)
	Wear limit
	0.2 mm (0.01 in)



4. Check:

- Armature continuity  
Out of specification → Replace the armature.

Armature continuity			
"a"	"b"	"c"	"d"
○ — ○			

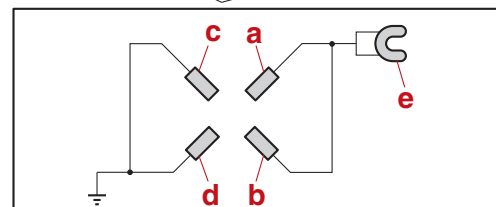
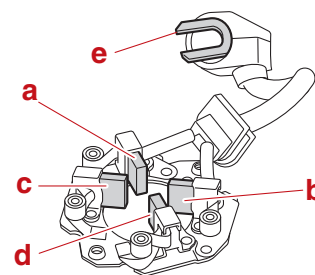


Checking the brush holder

1. Check:


- Brush holder assembly continuity  
Out of specification → Replace.

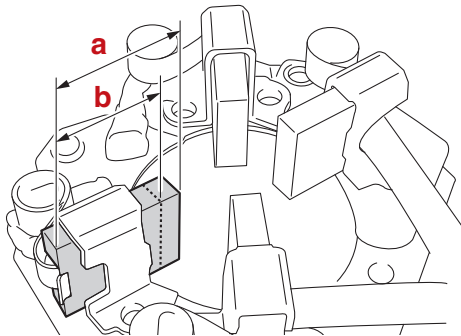
Brush holder assembly continuity				
"a"	"b"	"c"	"d"	"e"
○ — ○				
		○ — ○		



2. Measure:

- Brush length  
Below specification → Replace the brush.

	Standard brush length
	15.5 mm (0.61 in)
	Wear limit
	9.5 mm (0.37 in)



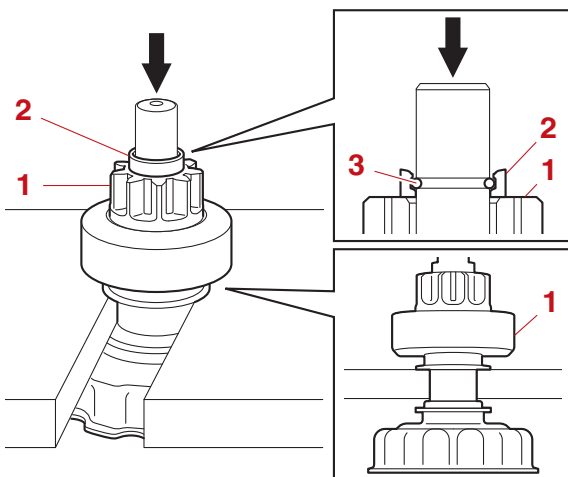
- a. Standard brush length
- b. Wear limit

### Assembling the starter motor

#### NOTICE

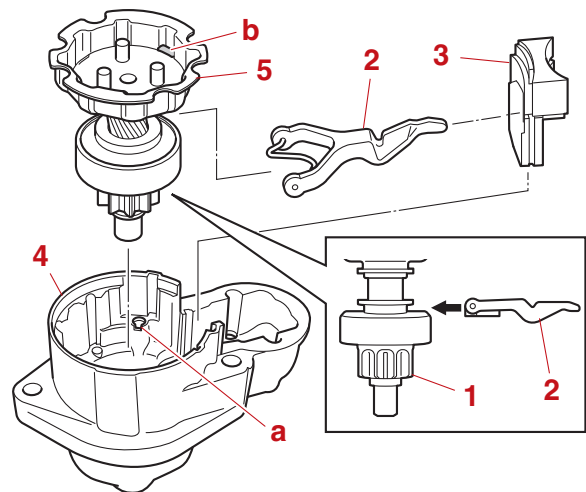
Do not apply grease or oil to the commutator of the armature.

1. Install:
  - Washer (to the pinion shaft)
  - Gasket **New** (to the bracket)
  - Bearing (to the bracket)
  - Bracket (to the pinion shaft)
  - Washer (to the pinion shaft)
  - E-clip (to the pinion shaft)
2. Install:
  - Pinion assembly "1"
  - Pinion stopper "2"
  - Clip "3"

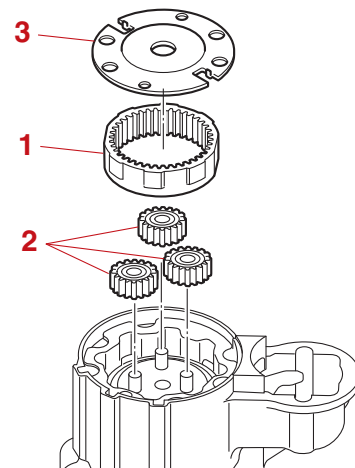


3. Install:
  - Pinion shaft assembly "1"
  - Lever "2"
  - Rubber seal "3" **New**

**TIP:** Align the holes "a" in the cover "4" with the holes "b" in the bracket "5".



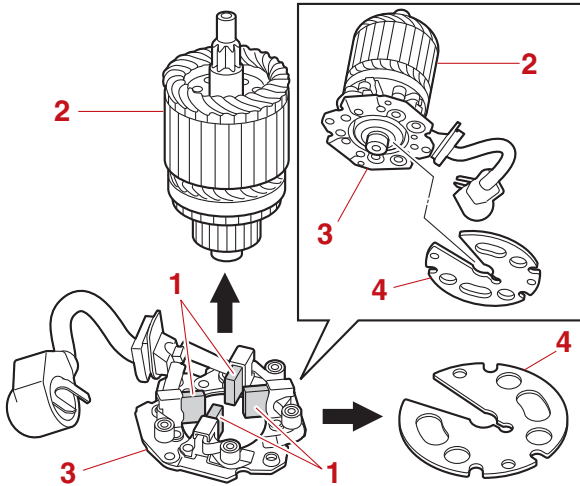
4. Install:
  - Outer gear "1"
  - Planetary gear "2"
  - Plate "3"



5. Install:
  - Brush spring (to the brush holder)
  - Brush assembly (to the brush holder)
6. Install:
  - Armature
  - Plate

- a. Push the brushes "1" into the holders, and then install the armature "2" to the brush holder assembly "3".

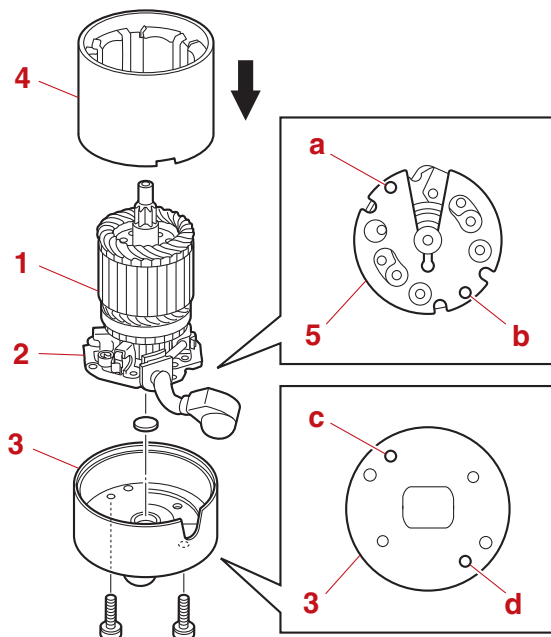
- b. Install the plate "4".



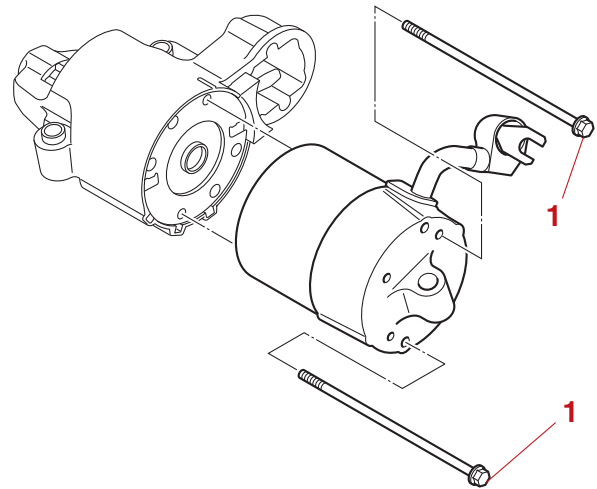
7. Install:
  - Brush holder assembly
  - Bracket
  - Bracket screw
  - Stator

- a. Install the armature "1" along with the brush holder assembly "2" to the bracket "3", and then install the stator "4".

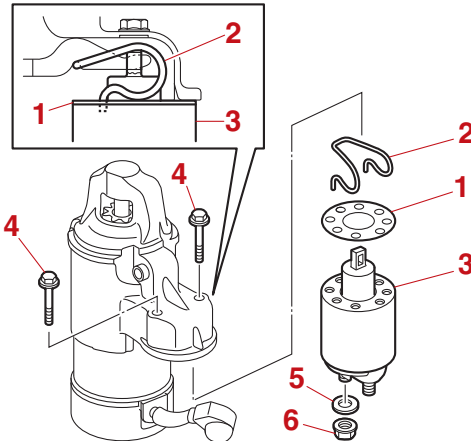
**TIP:** Align the holes "a" and "b" in the plate "5" with the holes "c" and "d" in the bracket "3".



8. Install:
  - Stator bolt "1"



9. Install:
  - Gasket "1" **New**
  - Spring "2"
  - Magnet switch "3"
  - Magnet switch bolt "4"
  - Washer "5"
  - Magnet switch nut "6"



### Installing the starter motor

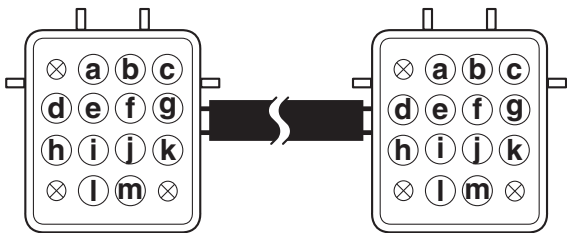
1. Install:
  - Starter motor
 See "Installing the starter motor" (7-27).



## Outboard motor and Digital Electronic Control connection

### Checking the extension wire harness

1. Check:
  - Extension wire harness continuity  
Out of specification → Replace.
  - a. Check the extension wire harness for continuity. Check the wire terminal numbers from “a” to “m”.



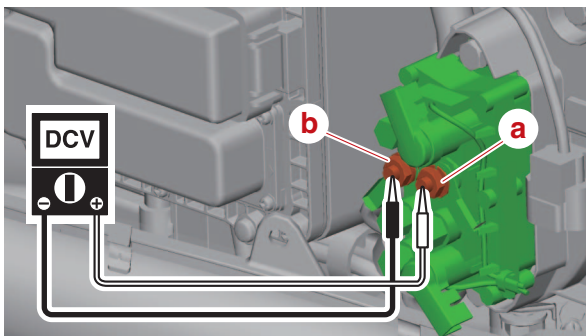
### PTT system

#### Checking the PTT relay

1. Measure:
  - PTT relay input voltage  
Out of specification → Check the wire harness for continuity.

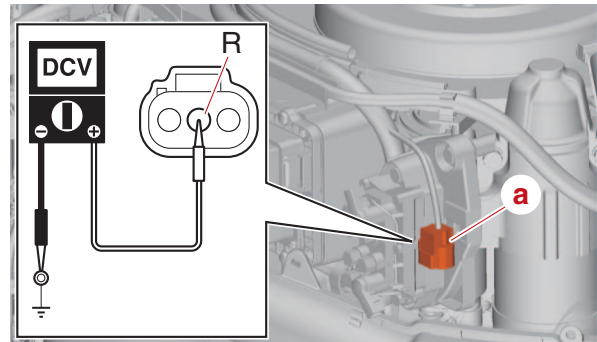
	Input voltage 12 V Terminal “a”–Terminal “b” (or ground)
--	--

- a. Remove the caps.
- b. Measure the input voltage between the PTT relay terminal “a” and terminal “b”.



- c. Install the caps.
- d. Disconnect the PTT relay coupler “a”.

- e. Measure the input voltage between the PTT relay coupler terminal and ground.

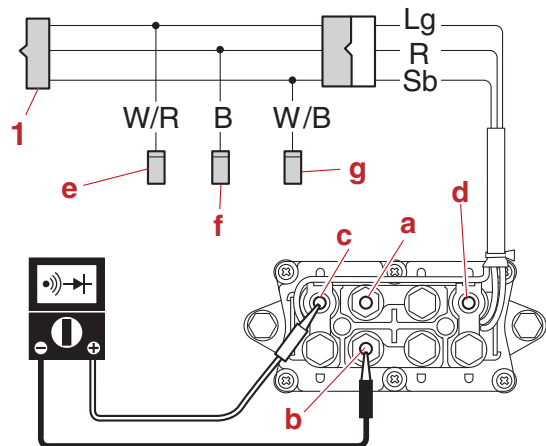


2. Check:
  - PTT relay continuity  
Out of specification → Replace.
  - a. Disconnect the PTT relay leads and PTT motor leads.

### NOTICE

Before disconnecting the PTT relay terminals, make sure to disconnect the battery negative terminal.

- b. Connect the special service tool “1”.
- c. Check the PTT relay for continuity.

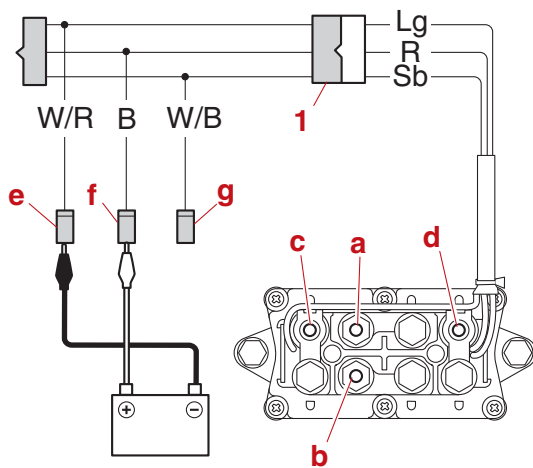


	Test harness FWY-3-L “1” 90890-06918
--	---



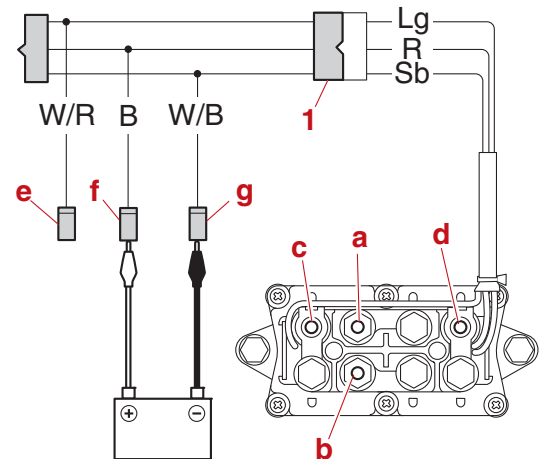
PTT relay continuity						
"a"	"b"	"c"	"d"	"e"	"f"	"g"
	○—○					
	○—○					
				○—○		
						○—○

d. Connect the positive battery lead to the connector "f", connect the negative battery lead to the connector "e", and then check the PTT relay for continuity.



PTT relay continuity			
"a"	"b"	"c"	"d"
○—○			
	○—○		

e. Connect the positive battery lead to the connector "f", connect the negative battery lead to the connector "g", and then check the PTT relay for continuity.



PTT relay continuity			
"a"	"b"	"c"	"d"
	○—○		
		○—○	

- f. Disconnect the special service tool.
- g. Install the PTT relay.
- h. Connect the PTT relay leads, and PTT motor leads.

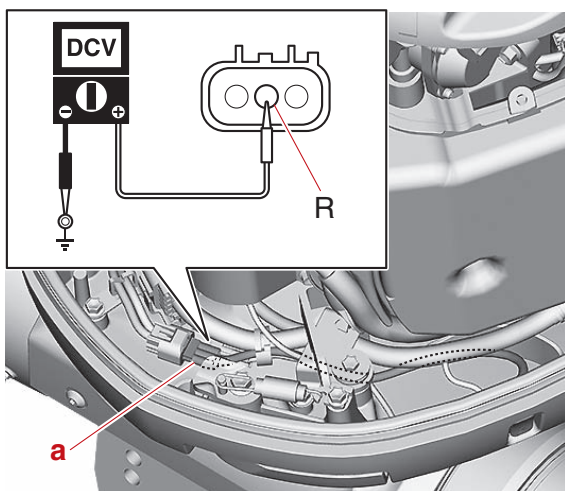
### Checking the PTT switch (on bottom cowling)

1. Measure:
  - PTT switch input voltage
 Out of specification → Check the wire harness for continuity.

	Input voltage
	12 V
	Red (R)–Ground

- a. Disconnect the PTT switch coupler "a".

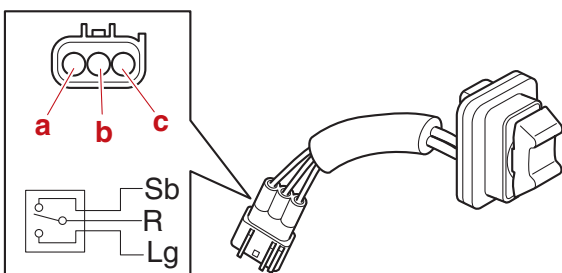
- b. Measure the input voltage between the PTT switch coupler terminal and ground.



- c. Connect the PTT switch coupler.

2. Check:

- PTT switch continuity
  - Out of specification → Replace.
  - a. Disconnect the PTT switch coupler.
  - b. Check the PTT switch for continuity.



PTT switch continuity			
Switch position	Terminal		
	“a”	“b”	“c”
UP	○ — ○		
DN		○ — ○	

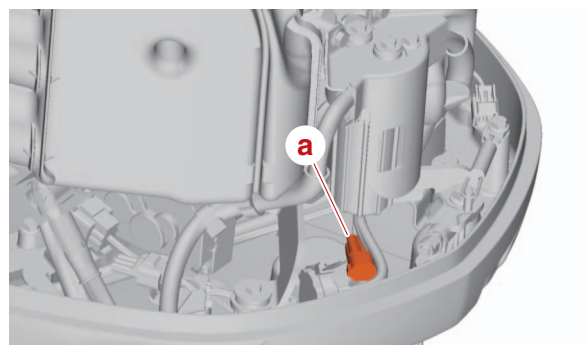
- c. Connect the PTT switch coupler.

**Checking the PTT sensor**

- 1. Measure:
  - PTT sensor input voltage
    - Out of specification → Check the wire harness for continuity.

	Input voltage
	5 V
	Orange (Or)—Black (B)

- a. Disconnect the PTT sensor coupler “a”.
- b. Turn the engine start switch to ON, and then measure the input voltage at the PTT sensor coupler.



- c. Turn the engine start switch to OFF, and then connect the PTT sensor coupler.

2. Check:

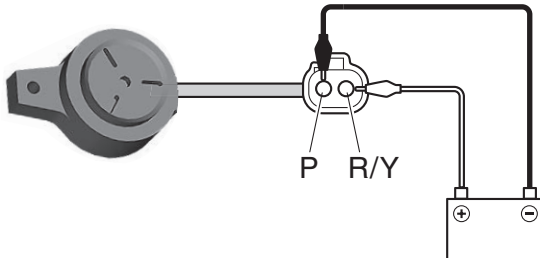
- PTT sensor
  - a. Connect the YDIS to display “PTT sensor”.
  - b. Tilt the outboard motor up and down, and measure the PTT sensor output voltage at the specified positions.

Output voltage	
Position	Voltage
Fully tilted-up position	4.23
Fully tilted-down position	0.90

**Checking the PTT buzzer**

- 1. Check:
  - PTT buzzer continuity
    - Out of specification → Replace.
    - a. Remove the PTT buzzer.

- b. Connect the battery leads to the PTT buzzer coupler, and check that the PTT buzzer comes on. Replace the PTT buzzer if it does not come on.



- c. Install the PTT buzzer.

---

## Fuel system

<b>Fuel system .....</b>	<b>6-1</b>
Reducing the fuel pressure .....	6-1
Disconnecting the quick connector.....	6-1
Measuring the fuel pressure .....	6-2
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Removing the fuel filter assembly .....	6-7
Checking the fuel filter assembly.....	6-7
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Checking the fuel cup assembly.....	6-7
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Assembling the fuel filter .....	6-8
Installing the fuel filter.....	6-8
<b>Intake manifold .....</b>	<b>6-10</b>
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---

## Fuel system

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Assembling the vapor separator.....	6-27
<b>Fuel injector .....</b>	<b>6-29</b>
Checking the fuel rail.....	6-30
Installing the fuel injector.....	6-30

## Fuel system

### Reducing the fuel pressure

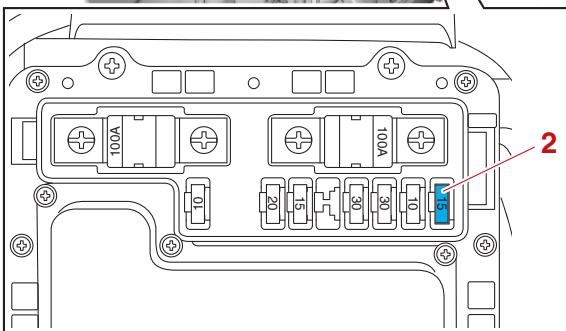
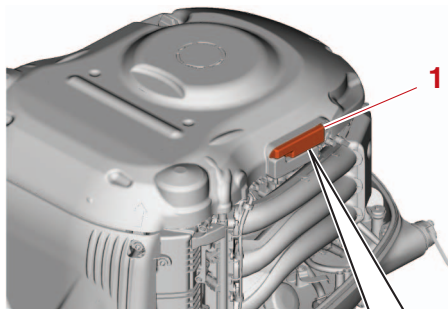
#### **WARNING**

Before servicing the high-pressure fuel line or vapor separator, make sure to reduce the fuel pressure in the fuel line. Otherwise, pressurized fuel could spray out.

1. Reduce:
  - Fuel pressure
    - a. Remove the fuse holder cover “1” and fuse (15 A) (high-pressure fuel pump system) “2”.
    - b. Start the engine.

#### **TIP:**

Wait until the engine stalls.



- c. After the engine stalls, crank the engine 2 or 3 times.
- d. Turn the engine start switch to OFF.
- e. Install the fuse (15 A) (high-pressure fuel pump system) and fuse holder cover.

### Disconnecting the quick connector

#### **WARNING**

Before disconnecting the quick connector, reduce the fuel pressure. Otherwise, pressurized fuel could spray out.

1. Reduce:
  - Fuel pressure
 

See “Reducing the fuel pressure” (6-1).
2. Disconnect:
  - Quick connector

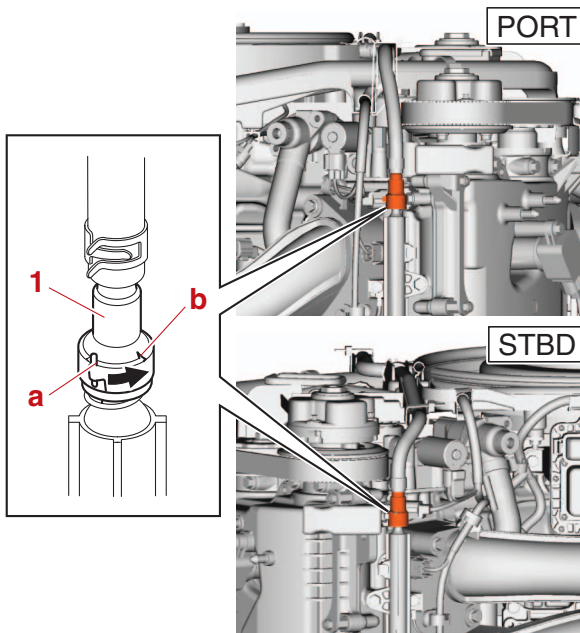
#### **NOTICE**

Do not push the quick connector tab past the stopper. Otherwise, the quick connector could be damaged.

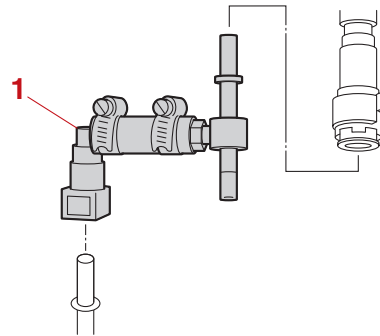
- a. Wrap a rag around the quick connector “1”.
- b. Push the quick connector tab “a” toward the stopper “b”.
- c. Disconnect the quick connector “1” from the fuel rail.

**TIP:** \_\_\_\_\_

- After disconnecting the quick connector “1”, be careful not to lose the retainer “2”.
- Cover the quick connector and fuel rail with a plastic bag to prevent damage and to protect them from dirt.



- Disconnect the quick connector from the fuel rail. See “Disconnecting the quick connector” (6-1).
- Connect the special service tool “1” to the quick connector and the fuel rail.

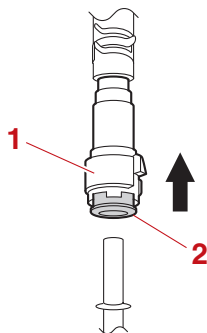


	Fuel pressure gauge adapter “1” 90890-06946
	Fuel pressure gauge adapter “1” YB-06946

- Connect the special service tool “1”.

**⚠ WARNING** \_\_\_\_\_

To prevent fuel from leaking out, screw in the gauge gently until it is connected firmly.



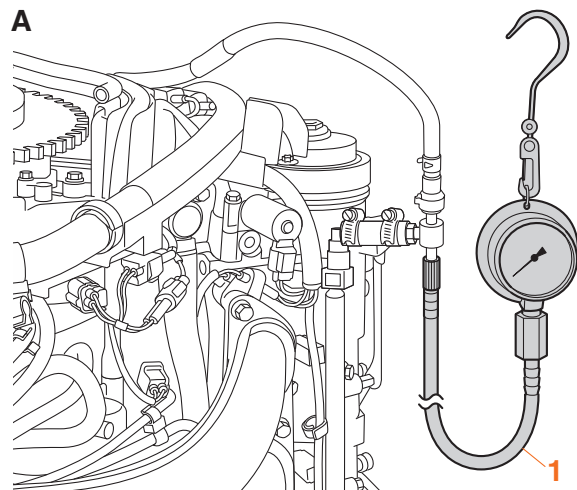
**Measuring the fuel pressure**

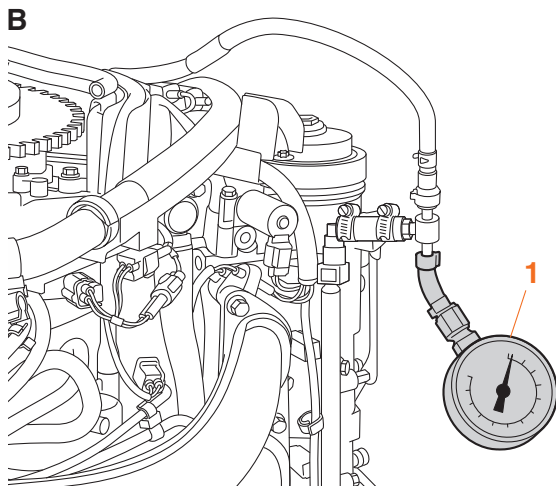
Cover the fuel components using a rag to prevent fuel from spilling out.

- Measure:
  - Fuel pressure
 Out of specification → Check the fuel line.

	Fuel pressure at engine start switch to “ON” within 5 seconds 315 kPa (3.2 kgf/cm <sup>2</sup> , 45.7 psi)
--	---

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





- A. Worldwide
- B. USA and Canada

	Fuel pressure gauge "1"
	90890-06753
	Fuel pressure gauge "1"
	YU-03153M

- e. Install the flywheel magneto cover.
- f. Turn the engine start switch to ON, and then measure the fuel pressure within 5 seconds.

**TIP:** \_\_\_\_\_

- The fuel pressure will decrease 5 seconds after the engine start switch is turned to ON.
- The high-pressure fuel pump does not operate when the engine start switch is turned to ON again within 10 seconds after turning the engine start switch to OFF.

- g. Start the engine and warm it up until the engine idle speed stabilizes at the specified engine idle speed range.

	Idle speed (in neutral)
	650–750 r/min

- h. Measure the fuel pressure.

	Fuel pressure at idle speed
	260 kPa (2.6 kgf/cm <sup>2</sup> , 37.7 psi)

- i. Reduce the fuel pressure. See "Reducing the fuel pressure" (6-1).
- j. Disconnect the special service tools.

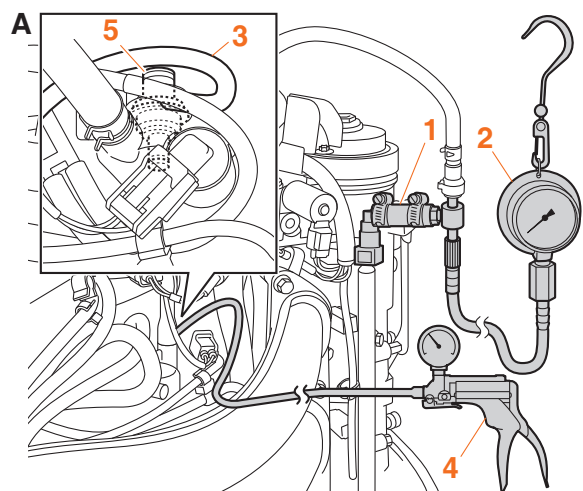
**⚠ WARNING**

Before disconnecting the special service tools, cover the end of the hose using a clean and dry rag.

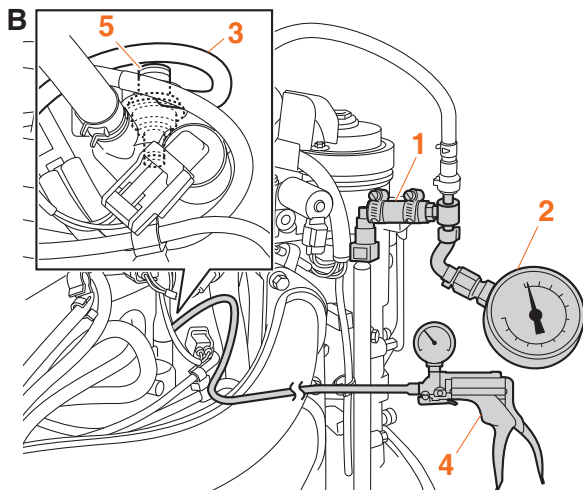
- k. Connect the quick connector to the fuel rail.

**Checking the pressure regulator**

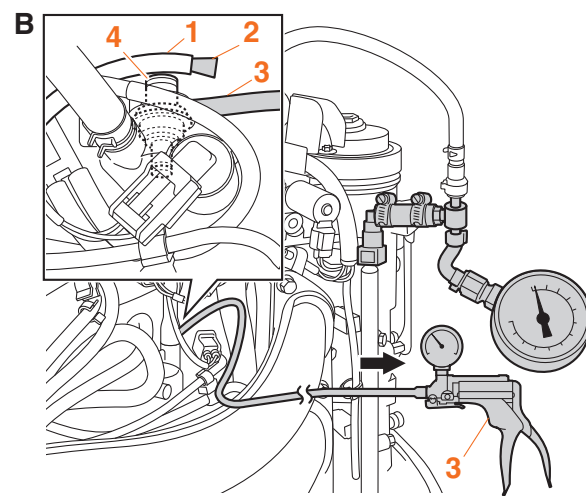
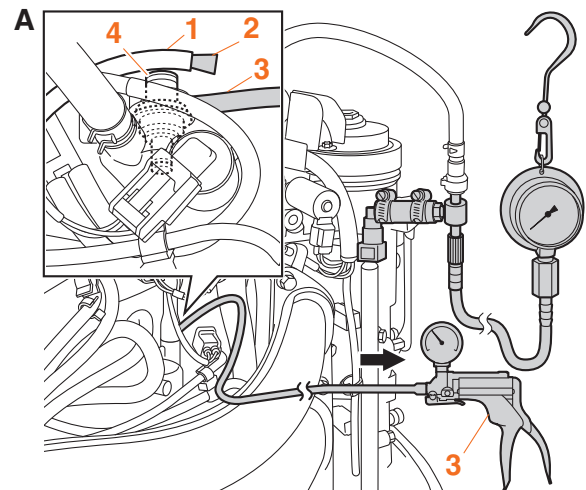
1. Reduce:
  - Fuel pressure  
See "Reducing the fuel pressure" (6-1).
2. Disconnect:
  - Quick connector  
See step (2) in "Disconnecting the quick connector" (6-1).
3. Check:
  - Pressure regulator
    - a. Connect the special service tools "1" and "2".  
See steps (c) and (d) in "Measuring the fuel pressure" (6-2).
    - b. Disconnect the pressure regulator hose "3", and then connect the special service tool "4" to the pressure regulator "5".








A. Worldwide  
B. USA and Canada



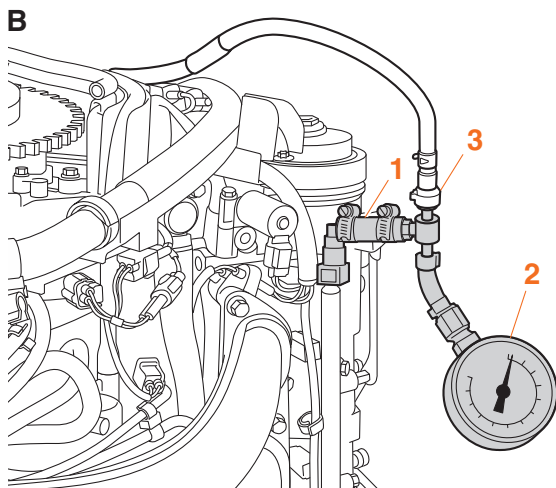
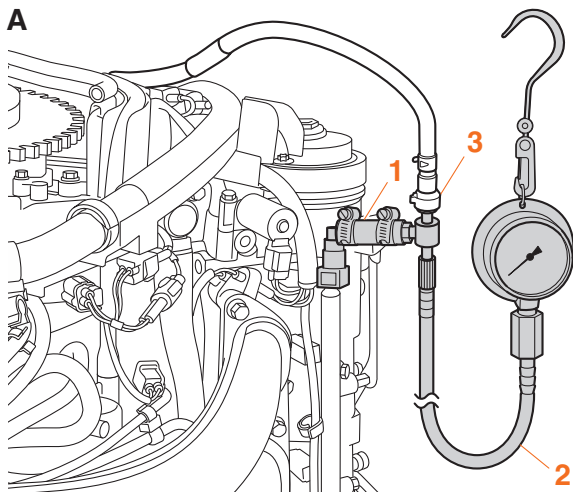
A. Worldwide  
B. USA and Canada

	Fuel pressure gauge adapter "1" 90890-06946
	Fuel pressure gauge adapter "1" YB-06946
	Fuel pressure gauge "2" 90890-06753
	Fuel pressure gauge "2" YU-03153M
	Vacuum/pressure pump gauge set "4" 90890-06945
	Pressure/vacuum tester "4" YB-35956-B

- c. Block the end of the pressure regulator hose "1" using a rubber plug "2".
- d. Start the engine and let it idle.
- e. Check that the fuel pressure is reduced when negative pressure is applied to the pressure regulator. If the fuel pressure is not reduced, replace the pressure regulator.
- f. Turn the engine start switch to OFF.
- g. Remove the rubber plug "2".
- h. Disconnect the special service tool "3", and then connect the pressure regulator hose "1" to the pressure regulator "4".

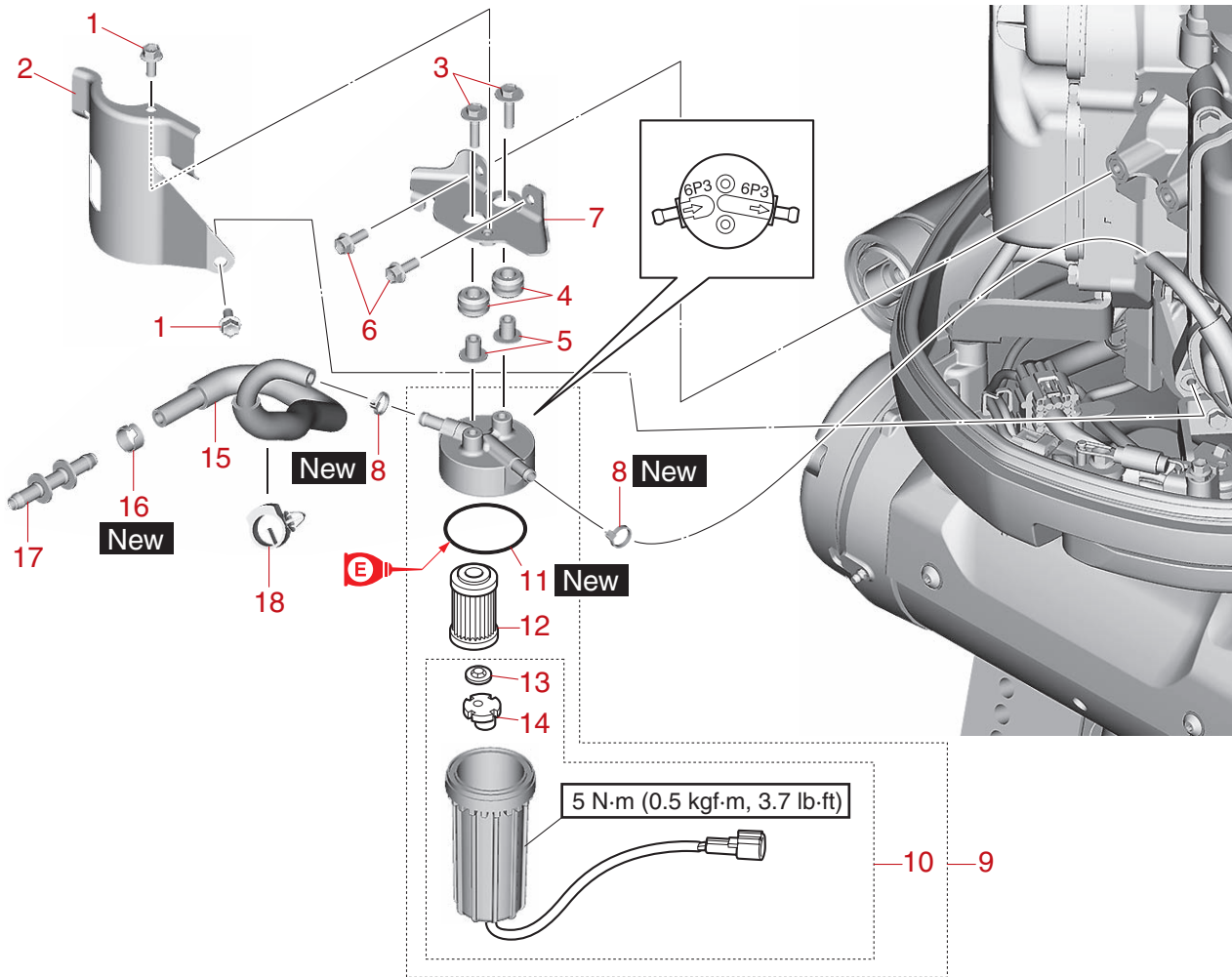
4. Reduce:
  - Fuel pressure  
See "Reducing the fuel pressure" (6-1).
5. Disconnect:
  - Special service tool "1", "2"

6. Connect:
- Quick connector "3"



- A. Worldwide  
B. USA and Canada

Fuel filter assembly



∩∩	Part name	Q'ty	Remarks
1	Bolt M6 × 14 mm	2	
2	Cover	1	
3	Bolt M6 × 25 mm	2	
4	Grommet	2	
5	Collar	2	
6	Bolt M6 × 16 mm	2	
7	Bracket	1	
8	Plastic tie	2	
9	Fuel filter assembly	1	
10	Fuel cup assembly	1	
11	O-ring	1	
12	Fuel filter element	1	
13	Clip	1	
14	Float	1	
15	Hose	1	
16	Clamp	1	
17	Joint	1	
18	Holder	1	


### Removing the fuel filter assembly

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

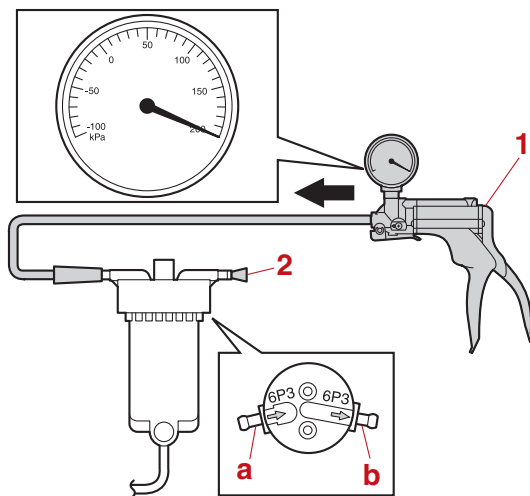
### Checking the fuel filter assembly


1. Check:

- Fuel inlet holding pressure (positive pressure)  
Air leakage → Replace the O-ring, cup assembly, or fuel filter assembly.

	Fuel inlet holding pressure (positive pressure) 200.0 kPa (2.00 kgf/cm <sup>2</sup> , 29.0 psi)
---	--


- Connect the special service tool "1" to the fuel inlet "a".
- Block the fuel outlet "b" using a rubber plug "2", and then apply the specified positive pressure for 15 seconds or more.



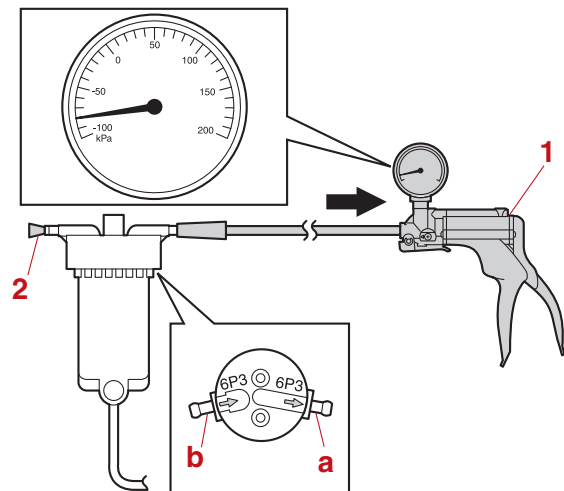
	Vacuum/pressure pump gauge set "1" 90890-06945 Pressure/vacuum tester "1" YB-35956-B
---	---


2. Check:

- Fuel outlet holding pressure (negative pressure)  
Air leakage → Replace the O-ring, cup assembly, or fuel filter assembly.

	Fuel outlet holding pressure (negative pressure) 80.0 kPa (0.80 kgf/cm <sup>2</sup> , 11.6 psi)
---	--

- Connect the special service tool "1" to the fuel outlet "a".
- Block the fuel inlet "b" using a rubber plug "2", and then apply the specified negative pressure for 15 seconds or more.



	Vacuum/pressure pump gauge set "1" 90890-06945 Pressure/vacuum tester "1" YB-35956-B
---	---

### Checking the fuel filter element

1. Check:

- Fuel filter element  
Dirt/residue → Replace.

### Checking the fuel cup assembly

#### NOTICE

When cleaning the fuel cup assembly, do not remove the clip and float.


1. Check:

- Fuel cup assembly  
Foreign material → Clean.  
Cracked → Replace.

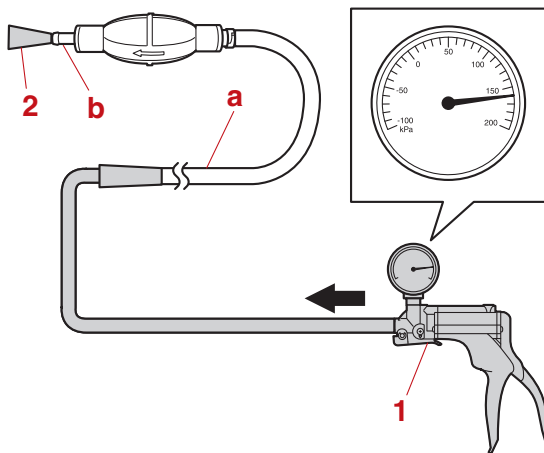
## Checking the primer pump


1. Check:

- No air leakage
- Air leakage → Replace.

	Positive pressure 166.7 kPa (1.67 kgf/cm <sup>2</sup> , 24.2 psi)
---	--

- Connect the special service tool "1" to the fuel inlet "a".
- Block the fuel outlet "b" using a rubber plug "2", and then apply the specified positive pressure for at least 30 seconds.



	Vacuum/pressure pump gauge set "1"
	90890-06945
	Pressure/vacuum tester "1"
	YB-35956-B

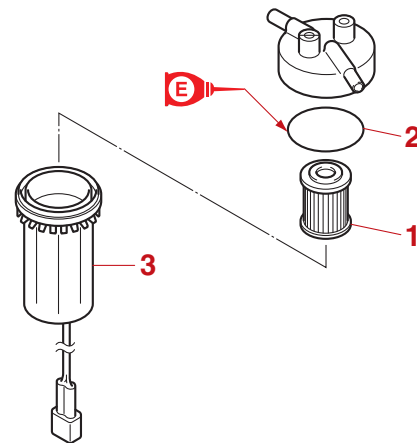
2. Check:


- Pump operation
- Fuel is not sent to the outboard motor even after priming the pump → Replace.

## Assembling the fuel filter

1. Install:

- Fuel filter element "1"
- O-ring "2" **New**
- Fuel cup assembly "3"
- Fuel filter cap

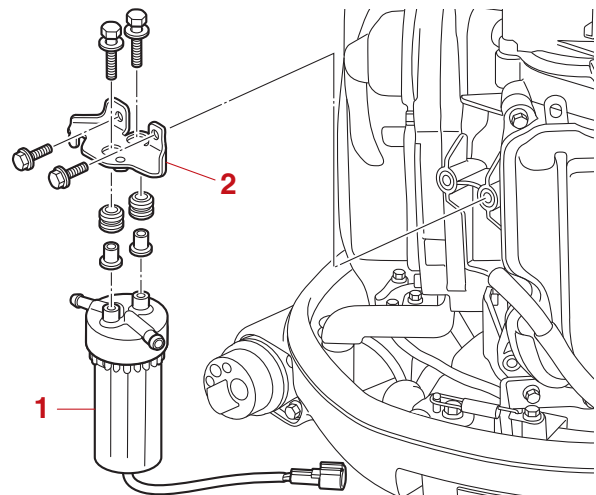


	Fuel cup assembly "3"
	5 N·m (0.5 kgf·m, 3.7 lb·ft)

## Installing the fuel filter

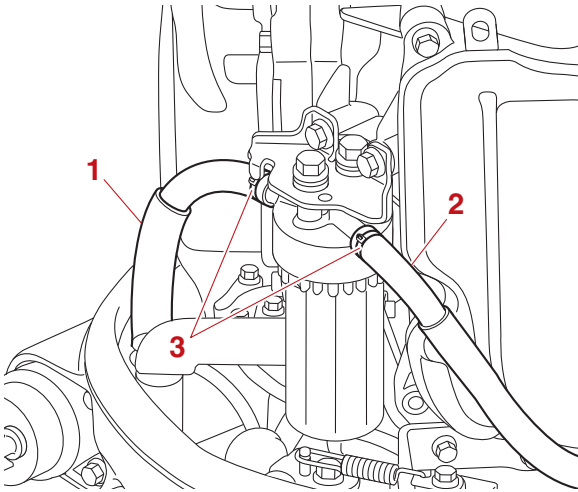
1. Install:

- Fuel filter assembly "1"
- Bracket "2"



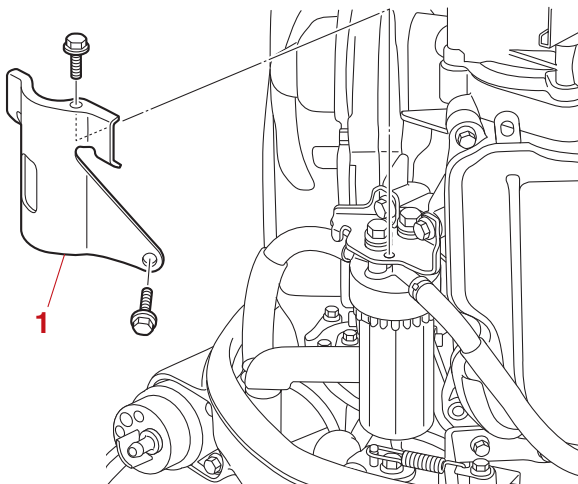
### 2. Connect:

- Hose "1", "2"
- Plastic tie "3" **New**



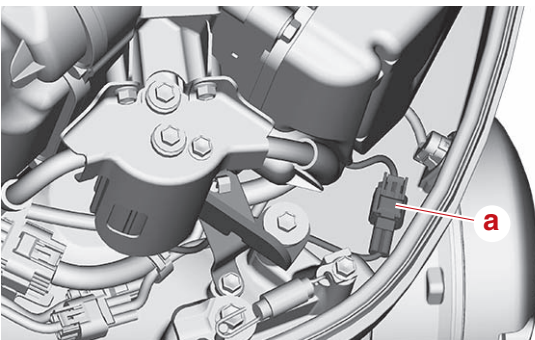
### 3. Install:

- Cover "1"



### 4. Connect:

- Water detection switch coupler "a"

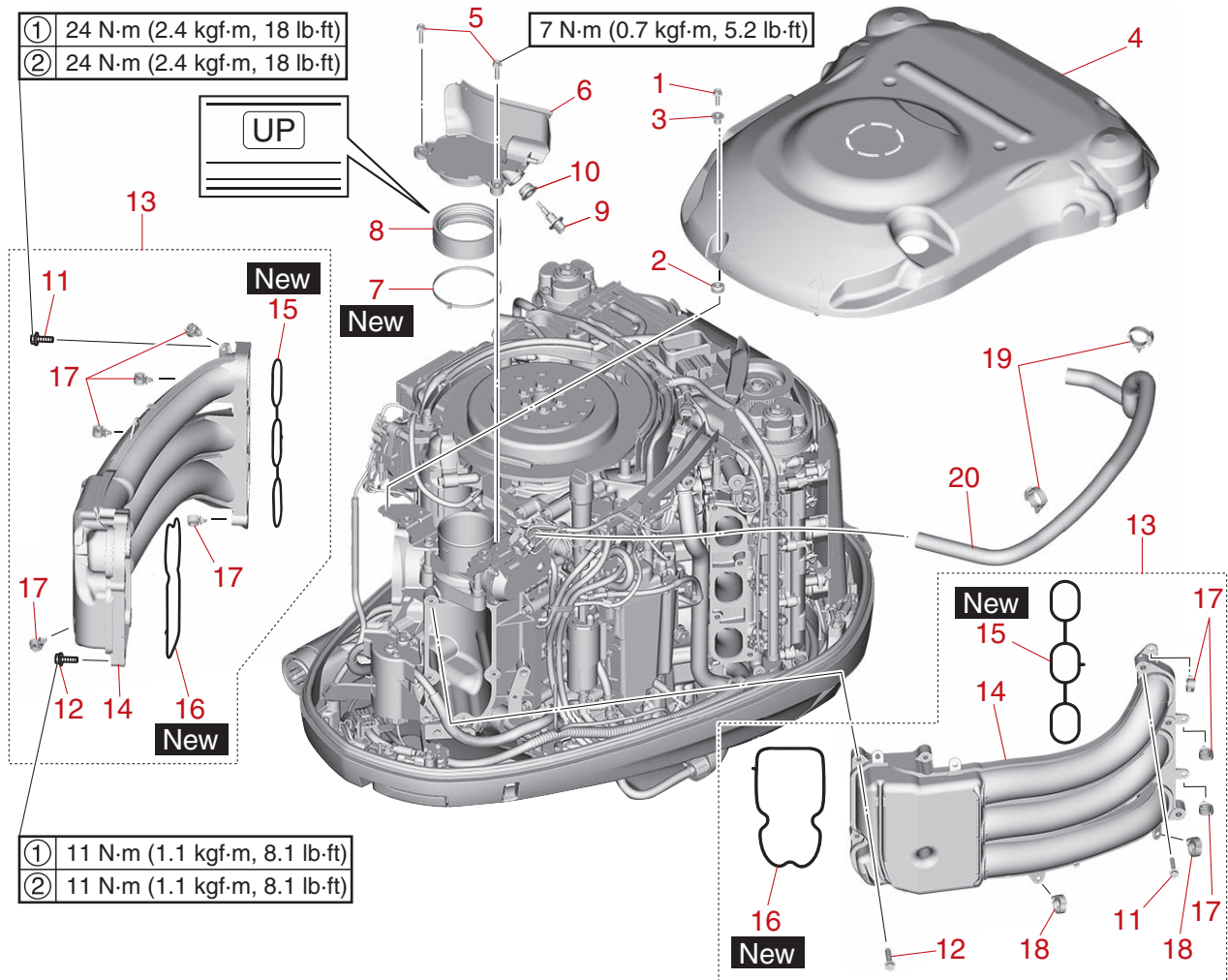


### 5. Check:

- Fuel flow  
Leak/clog → Replace the fuel filter assembly.



Intake manifold



↑↓	Part name	Q'ty	Remarks
1	Bolt M6 × 25 mm	1	
2	Collar	1	
3	Grommet	1	
4	Flywheel magneto cover	1	
5	Bolt M6 × 25 mm	2	
6	Intake silencer	1	
7	Plastic tie	1	
8	Joint	1	
9	Intake air temperature sensor	1	
10	Grommet	1	
11	Bolt M8 × 40 mm	8	
12	Bolt M6 × 35 mm	10	
13	Intake manifold assembly	2	
14	Intake manifold	2	
15	Gasket	2	

↑↓	Part name	Q'ty	Remarks
16	Gasket	2	
17	Holder	8	
18	Holder	2	
19	Holder	2	
20	Blowby hose	1	

### Checking the intake manifold

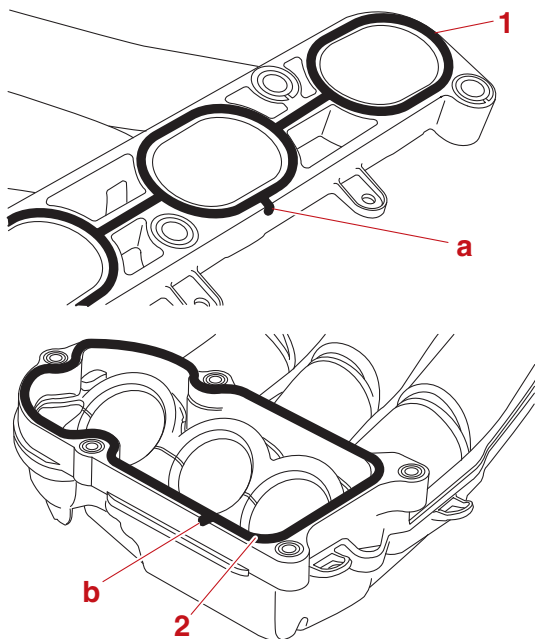
1. Check:
  - Intake manifold  
Cracked/damaged → Replace.

### Installing the intake manifold

1. Install:
  - Gasket **New**

**TIP:**

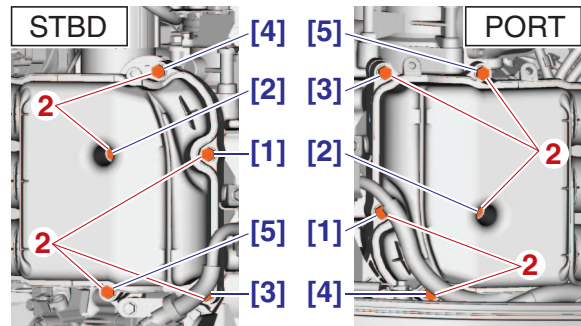
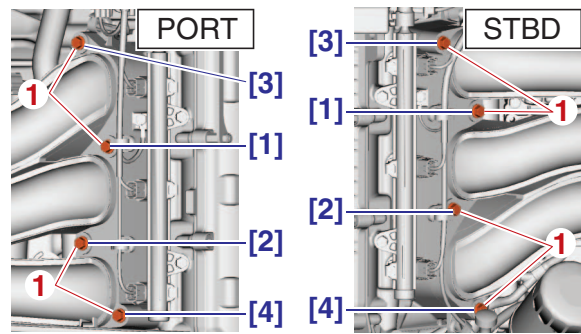
Make sure to fit the tabs on the gaskets “1” and “2” properly and firmly with the grooves “a” and “b” in the intake manifold.



2. Install:
  - Intake manifold
  - Intake manifold bolt (temporarily)
    - a. Tighten the intake manifold bolts “1” and “2” to the specified torque in the order [1], [2], and so on.

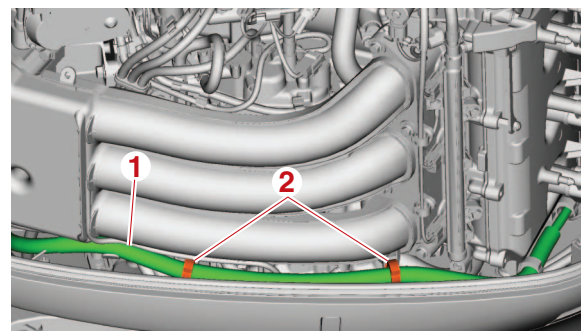
**TIP:**

Tighten the intake manifold bolts “1” and “2” to the same torque in both stages.



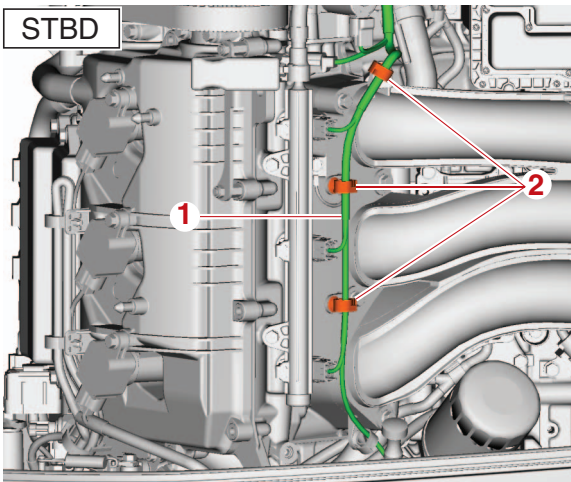
	Intake manifold bolt “1” (M8)
	1st: 24 N·m (2.4 kgf·m, 18 lb·ft)
	2nd: 24 N·m (2.4 kgf·m, 18 lb·ft)
	Intake manifold bolt “2” (M6)
	1st: 11 N·m (1.1 kgf·m, 8.1 lb·ft)
	2nd: 11 N·m (1.1 kgf·m, 8.1 lb·ft)

3. Fasten:
  - Wire harness
    - a. Fasten the main wire harness “1” using the holders “2”.

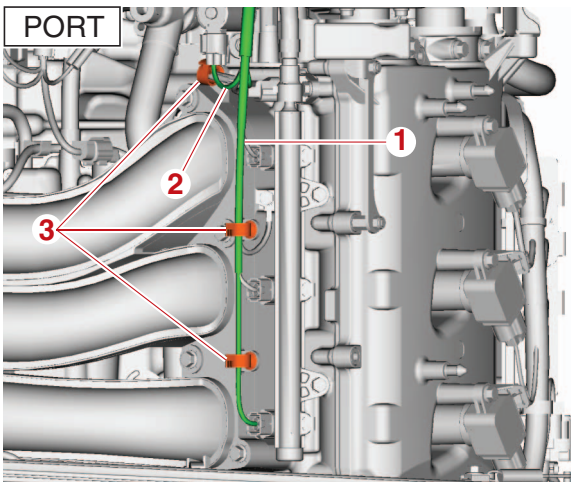




- b. Fasten the fuel injector lead “1” using the holders “2”.



- c. Fasten the fuel injector lead “1” and thermo switch lead “2” using the holders “3”.



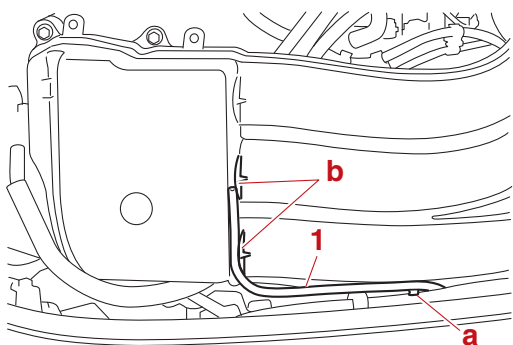
### Installing the intake silencer

1. Install:
  - Joint
  - Plastic tie **New**
  - Intake silencer
  - Intake air temperature sensor
  - Blowby hose

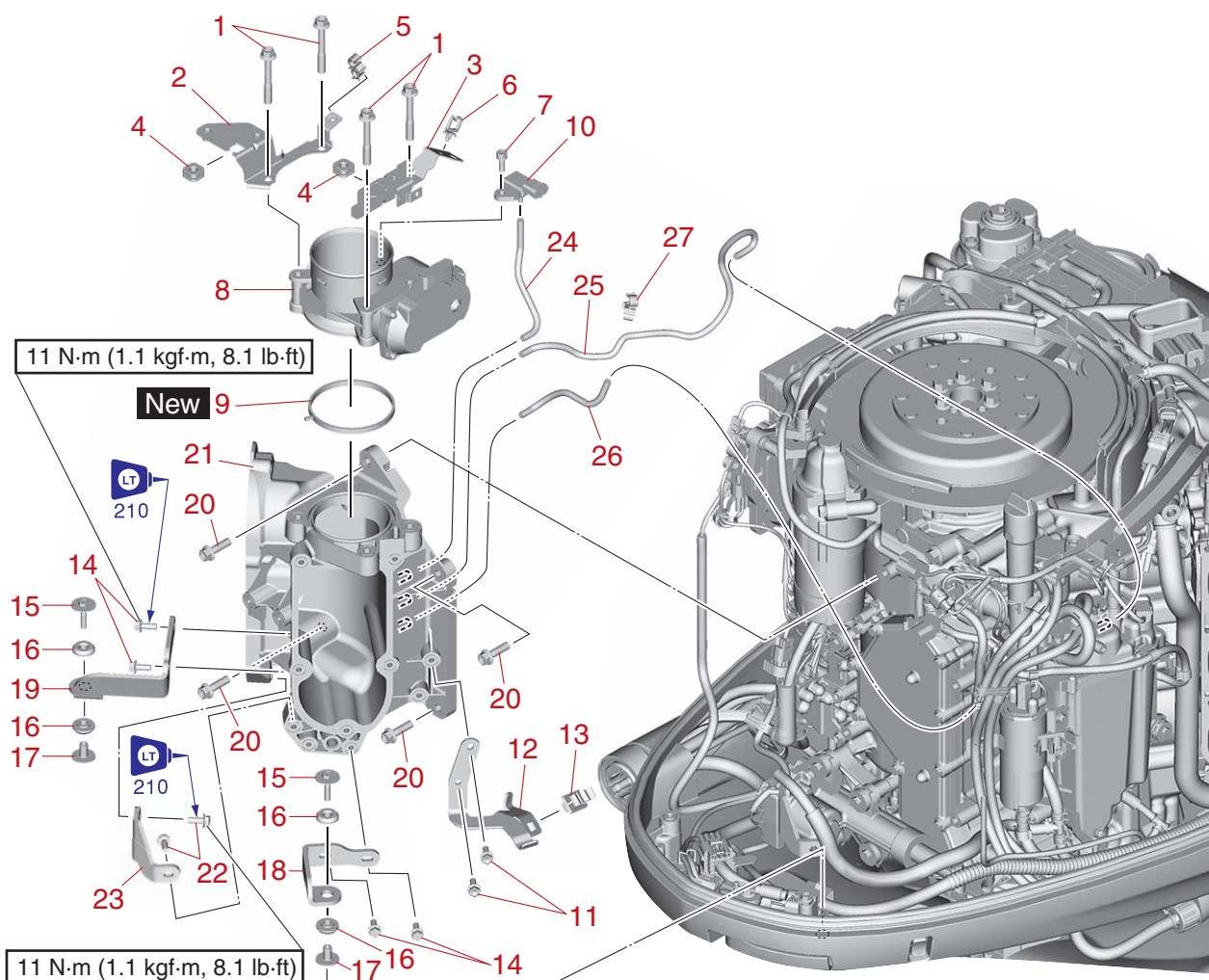
	Intake silencer bolt 7 N·m (0.7 kgf·m, 5.2 lb·ft)
--	--

2. Connect:
  - Intake air temperature sensor coupler

4. Install:
  - Drain hose
    - a. Install the drain hose “1” into the holder “a” and guides “b” on the intake manifold.



ETV

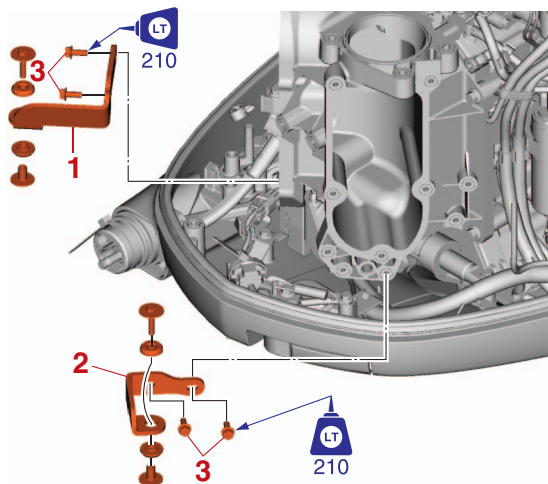
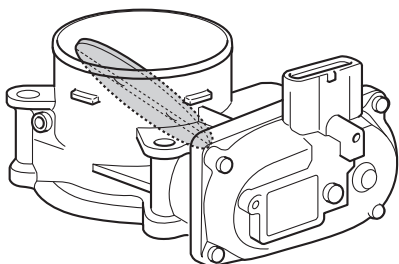



№	Part name	Q'ty	Remarks
1	Bolt M6 × 60 mm	4	
2	Bracket	1	
3	Bracket	1	
4	Grommet	2	
5	Holder	1	
6	Holder	1	
7	Bolt M6 × 20 mm	1	
8	ETV	1	
9	Gasket	1	
10	Intake air pressure sensor	1	
11	Bolt M6 × 16 mm	2	
12	Bracket	1	
13	Holder	1	
14	Bolt M6 × 16 mm	4	
15	Bolt M6 × 30 mm	2	
16	Grommet	4	
17	Collar	2	

№	Part name	Q'ty	Remarks
18	Bracket	1	
19	Bracket	1	
20	Bolt M8 × 30 mm	4	
21	Surge tank	1	
22	Bolt M6 × 16 mm	2	
23	Bracket	1	
24	Hose	1	
25	Hose	1	
26	Hose	1	
27	Holder	1	

### Checking the ETV

1. Check:
  - ETV  
Cracked → Replace.
2. Check:
  - Throttle valve movement  
Rough movement → Clean.



	Surge tank bracket bolt "3" 11 N·m (1.1 kgf·m, 8.1 lb·ft)
---	--

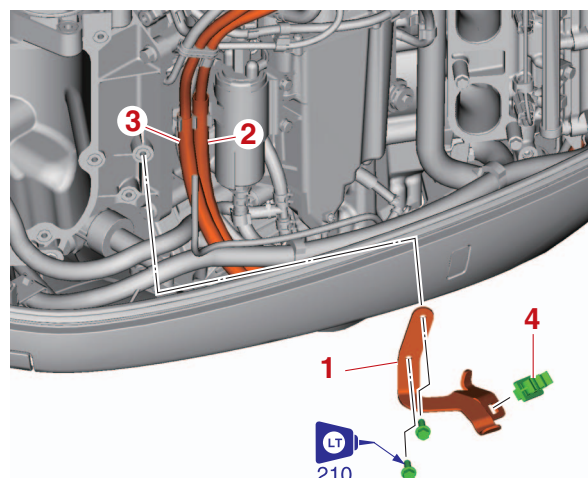
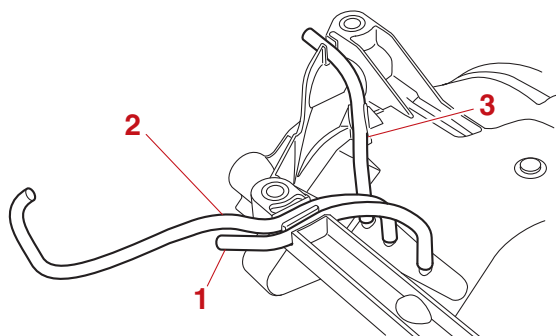
### Checking the intake air pressure sensor

1. Check:
  - Intake air pressure sensor  
Cracked → Replace.


4. Install:
  - Bracket "1"
  - Vapor gas hose "2", "3"
    - a. Install the vapor gas hoses "2" and "3" to the holder "4".

### Installing the ETV and surge tank

1. Install:
  - Vapor gas hose "1"
  - Pressure regulator hose "2"
  - Intake air pressure sensor hose "3"



2. Install:
  - Surge tank

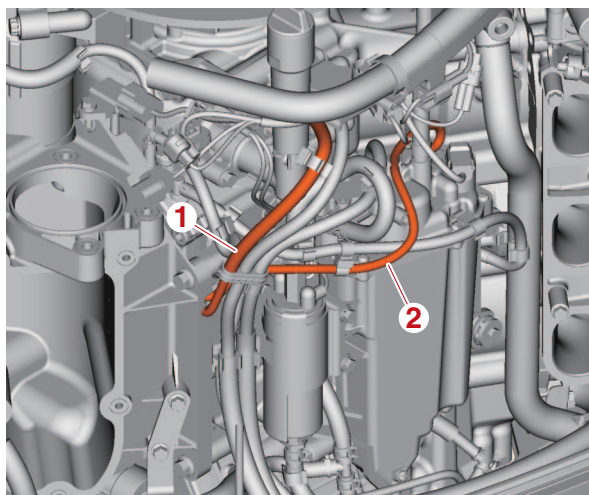
	Bracket bolt 11 N·m (1.1 kgf·m, 8.1 lb·ft)
---	---

3. Install:
  - Bracket "1", "2"
    - a. Tighten the surge tank bracket bolts "3" to the specified torque.



## 5. Connect:

- Pressure regulator hose “1”
- Vapor gas hose “2”

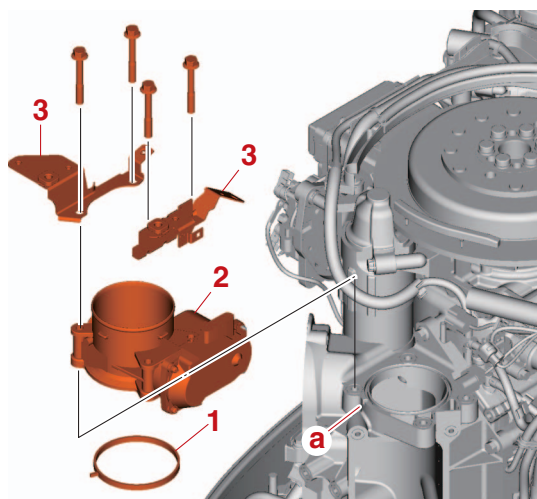


## 6. Install:

- Gasket “1” **New**
- ETV “2”
- Bracket “3”

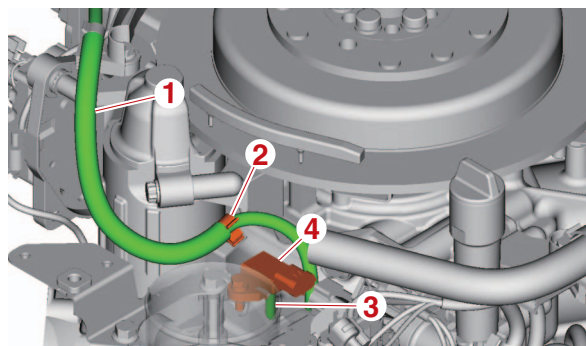
**TIP:**

Check that the tab on the gasket “1” is properly and firmly fitted into the groove “a” in the surge tank.



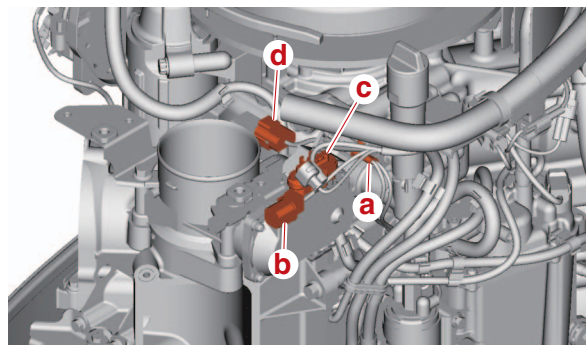
## 7. Install:

- Cooling water hose
- Intake air pressure sensor
  - a. Install the cooling water hose “1” to the holder “2”.
  - b. Connect the intake air pressure sensor hose “3”, and then install the intake air pressure sensor “4”.

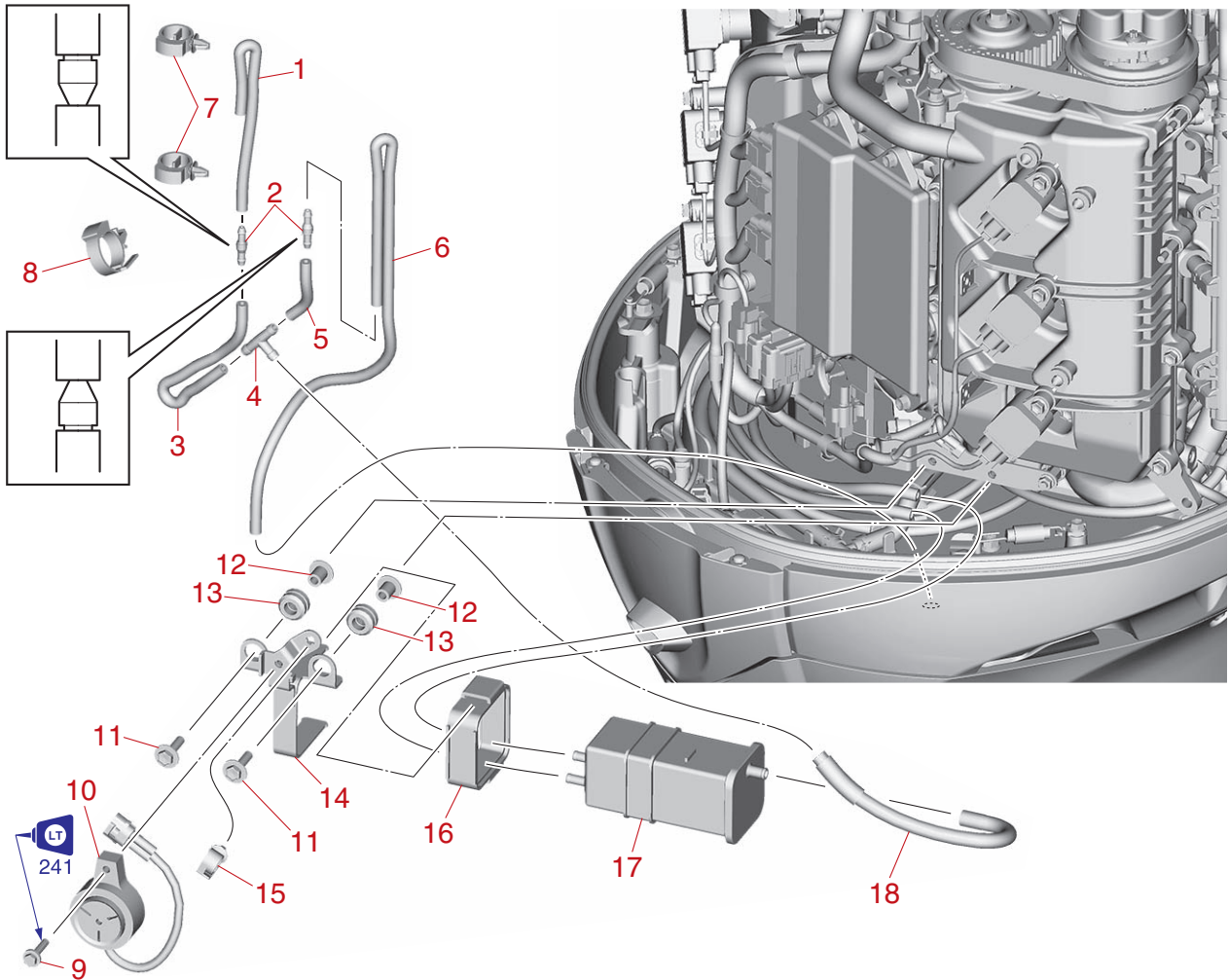


## 8. Connect:

- Low-pressure fuel pump coupler “a”
- YDIS coupler “b”
- ETV coupler “c”
- Intake air pressure sensor coupler “d”



Canister

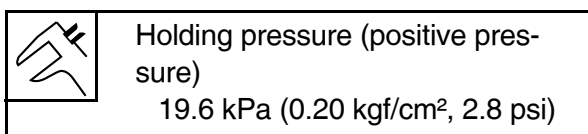
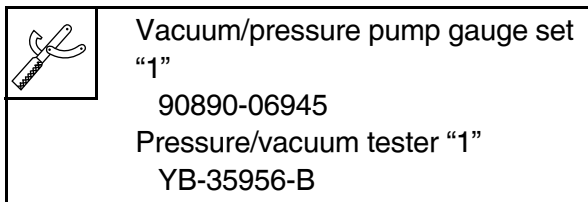
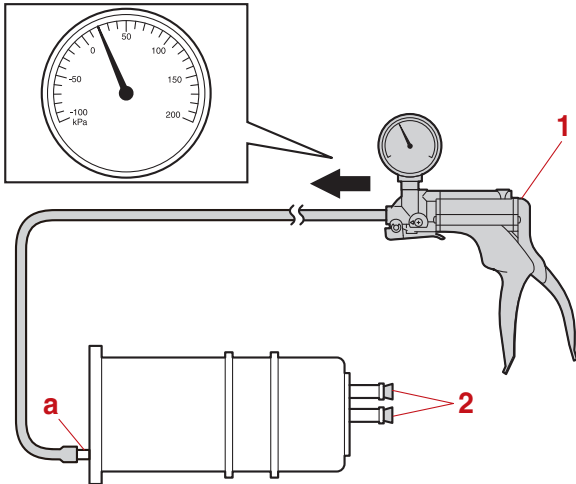


↓↑	Part name	Q'ty	Remarks
1	Hose	1	
2	Check valve	2	
3	Hose	1	
4	Joint	1	
5	Hose	1	
6	Hose	1	
7	Holder	2	
8	Holder	1	
9	Bolt M5 × 25 mm	1	
10	Buzzer	1	
11	Bolt M6 × 25 mm	2	
12	Collar	2	
13	Grommet	2	
14	Bracket	1	
15	Holder	1	
16	Cover	1	
17	Canister	1	
18	Hose	1	

## Checking the canister

### 1. Check:

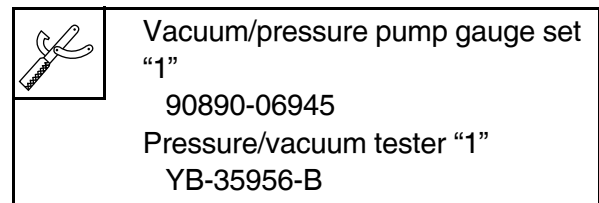
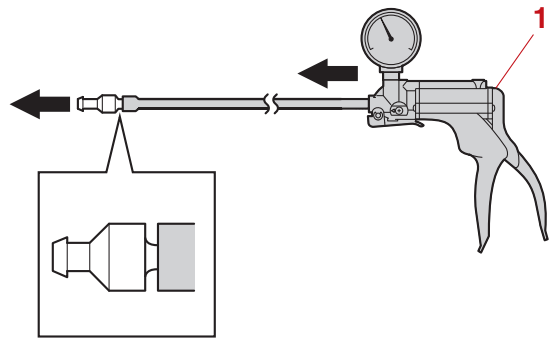
- Canister  
Cracked/air leakage → Replace.
- a. Connect the special service tool “1” to the atmospheric port “a” and block the other ports using rubber plugs “2”.
- b. Apply the specified positive pressure and check that there is no air leakage.



## Checking the canister check valve

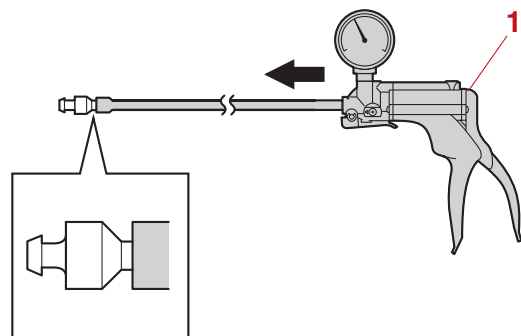
### 1. Check:

- Canister check valve  
No air comes out → Replace.
- a. Connect the special service tool “1” to the canister check valve port.
- b. Apply positive pressure and check that air comes out of the opposite end of the canister check valve.



### 2. Check:

- Canister check valve  
Air comes out → Replace.
- a. Connect the special service tool “1” to the opposite canister check valve port.
- b. Apply positive pressure and check that no air comes out of the opposite end of the canister check valve.



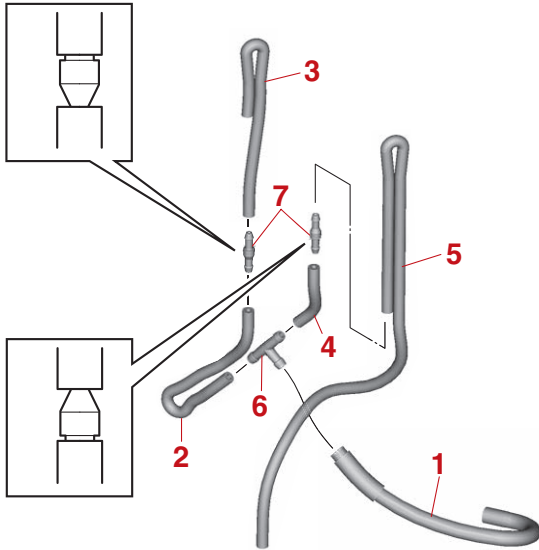
## Installing the canister

### 1. Install:

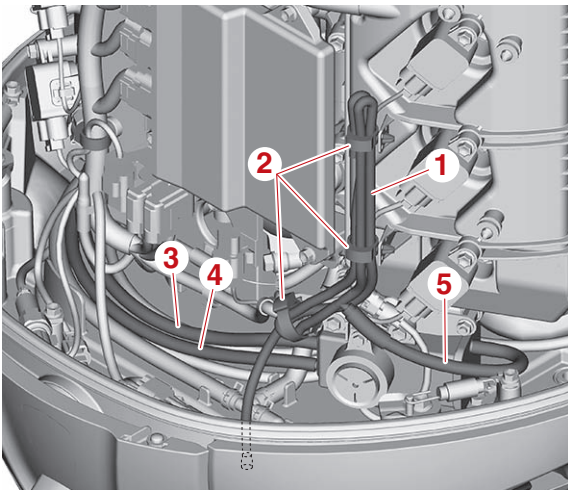
- Canister

2. Connect:

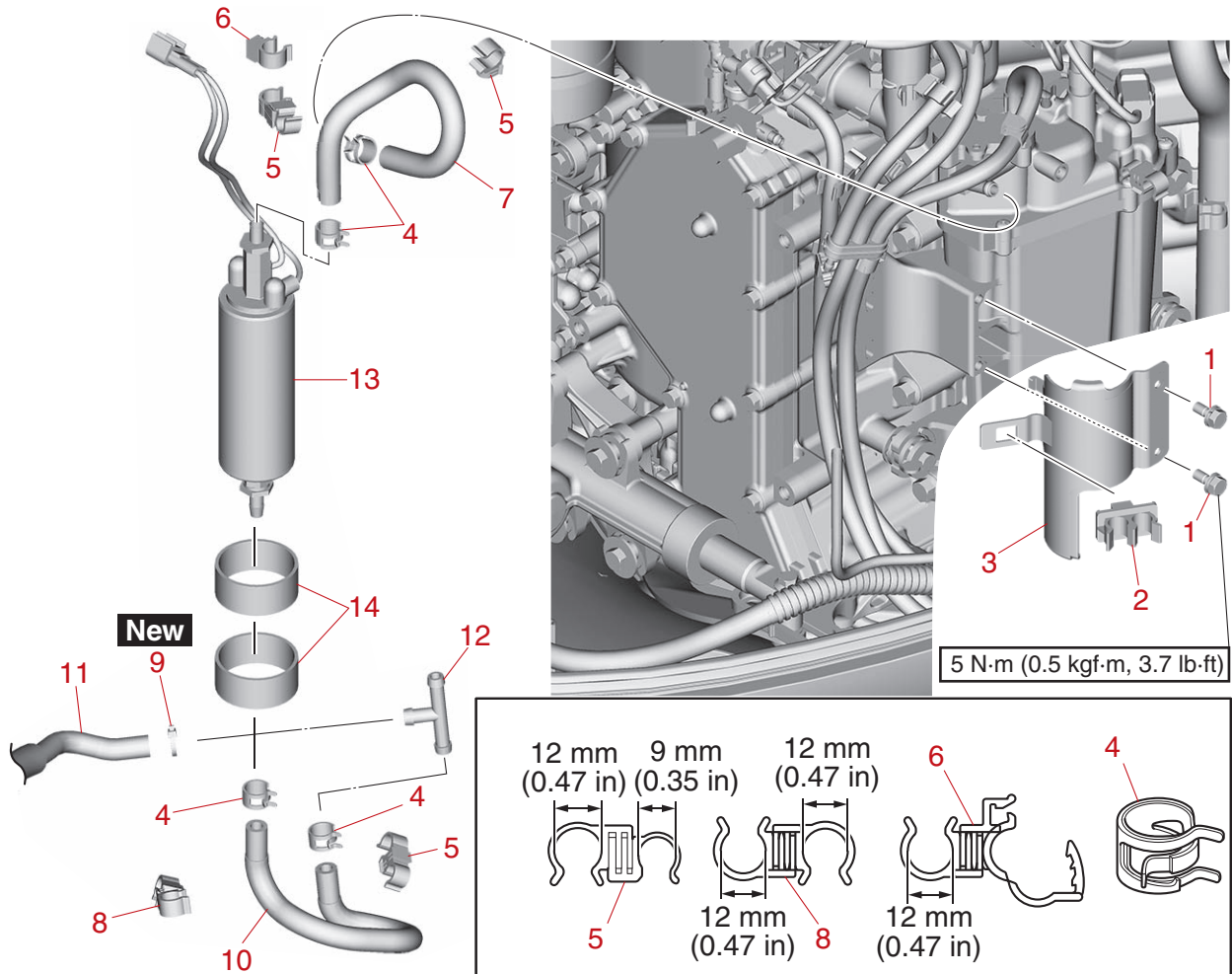
- Vapor gas hose “1”, “2”, “3”, “4”, “5”
- Joint “6”
- Check valve “7”



- a. Fasten the vapor gas hose “1” using the holders “2”.
- b. Connect the vapor gas hoses “3”, “4”, and “5” to the canister.



Low-pressure fuel pump



↓↑	Part name	Q'ty	Remarks
1	Bolt M6 × 15 mm	2	
2	Holder	1	
3	Cover	1	
4	Clamp	4	
5	Holder	3	
6	Holder	1	
7	Hose	1	
8	Holder	1	
9	Plastic tie	1	
10	Hose	1	
11	Hose	1	
12	Joint	1	
13	Low-pressure fuel pump	1	
14	Bushing	2	

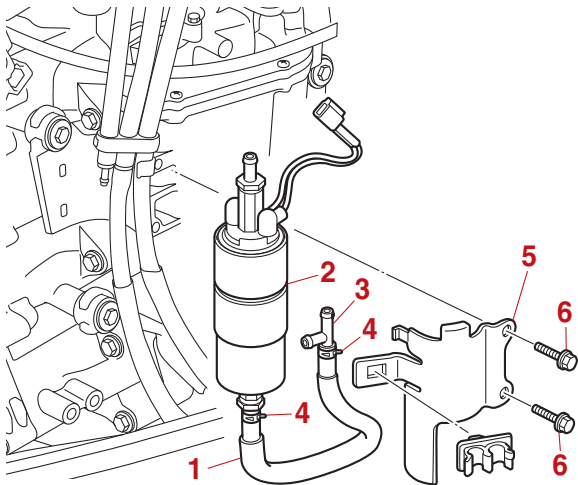


## Low-pressure fuel pump

### Installing the low-pressure fuel pump

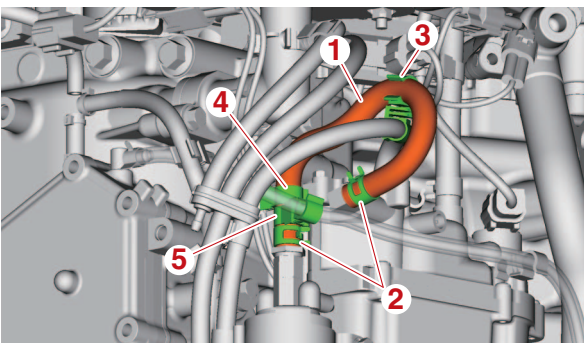
#### 1. Install:

- Low-pressure fuel pump
  - a. Connect the fuel hose "1" to the low-pressure fuel pump "2" and joint "3", and then fasten the fuel hose "1" using the clamp "4".
  - b. Install the low-pressure fuel pump "2" and cover "5", and then tighten the cover bolts "6" to the specified torque.



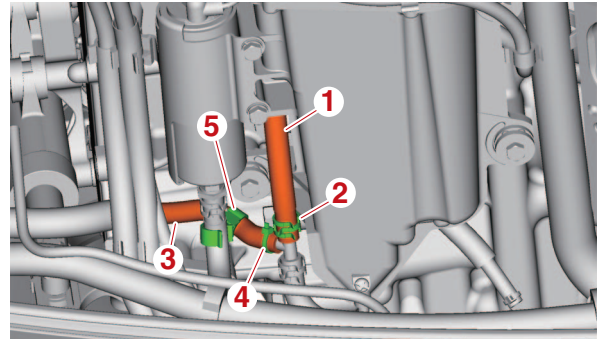
Cover bolt "6"  
5 N·m (0.5 kgf·m, 3.7 lb·ft)

- c. Connect the fuel hose "1", and then fasten it using the clamps "2".
- d. Install the fuel hose "1" to the holders "3", "4" and "5".

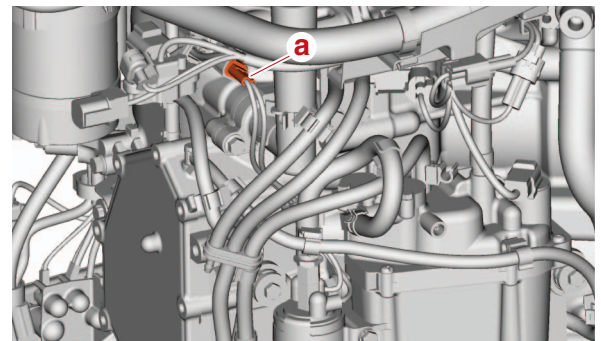


- e. Connect the fuel hose "1", and then fasten it using the clamp "2".

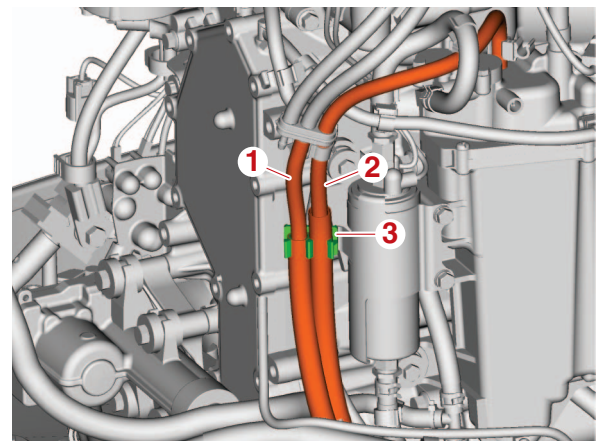
- f. Connect the fuel hose "3" to the joint and fasten the fuel hose using a new plastic tie "4", and then install the fuel hose to the holder "5".



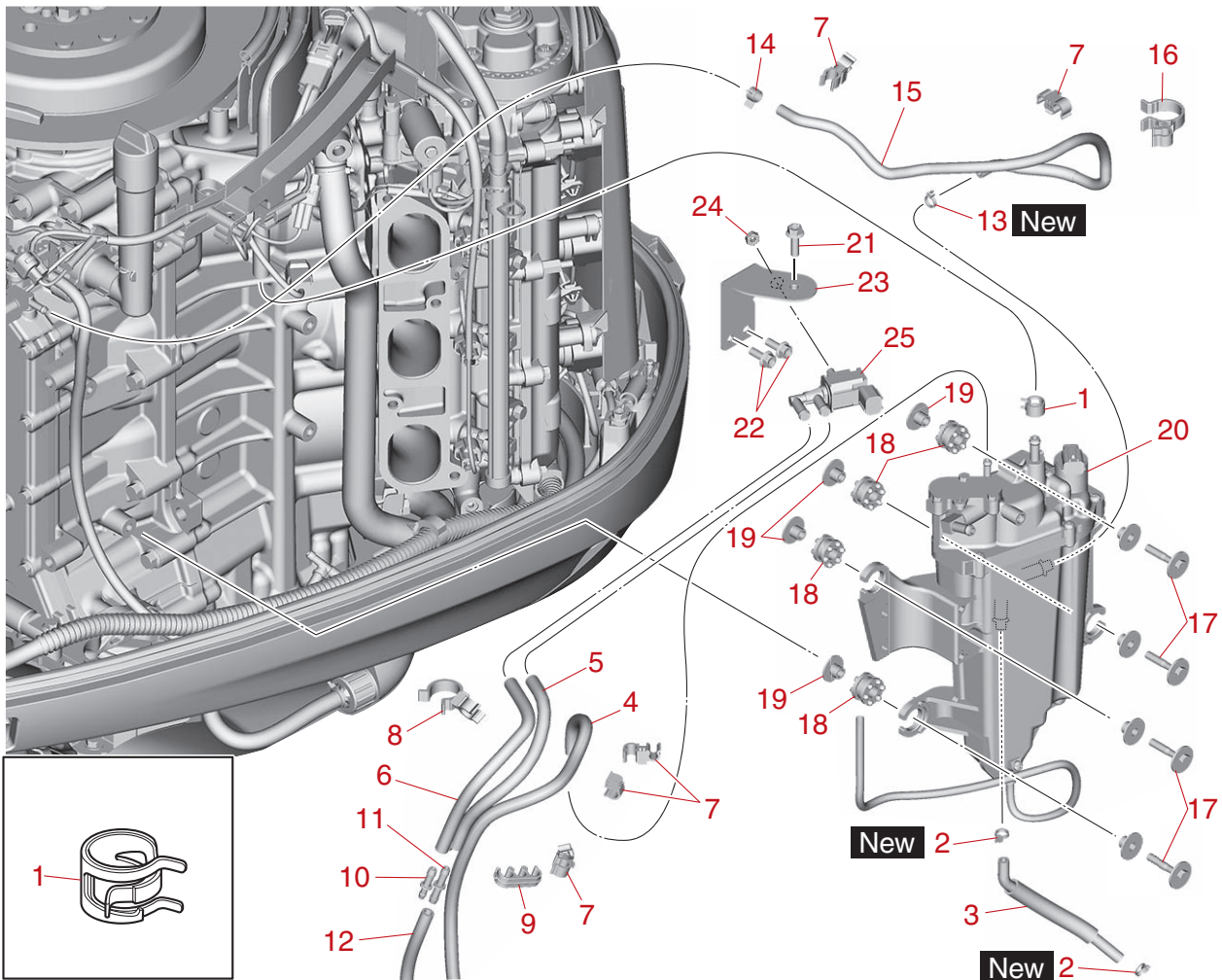
- g. Connect the low-pressure fuel pump coupler "a".



- h. Fasten the vapor gas hoses "1" and "2" using the holder "3".



Vapor separator and vapor shut-off valve



↑↓	Part name	Q'ty	Remarks
1	Clamp	1	
2	Plastic tie	2	
3	Hose	1	
4	Hose	1	
5	Hose	1	
6	Hose	1	
7	Holder	5	
8	Holder	1	
9	Holder	1	
10	Joint	1	
11	Joint	1	
12	Hose	1	
13	Plastic tie	1	
14	Clamp	1	
15	Hose	1	
16	Holder	1	
17	Bolt M6 × 35 mm	4	
18	Grommet	4	

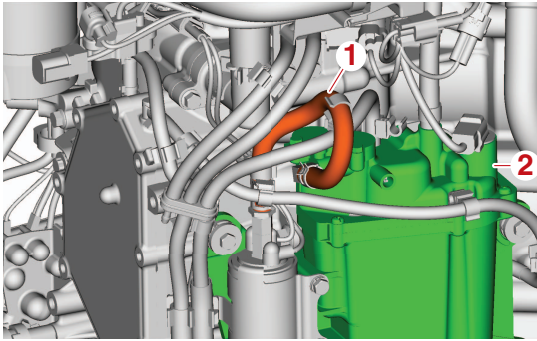
↑↓	Part name	Q'ty	Remarks
19	Collar	4	
20	Vapor separator	1	
21	Bolt M6 × 20 mm	1	
22	Bolt M6 × 16 mm	2	
23	Bracket	1	
24	Nut M6	1	
25	Vapor shut-off valve	1	

## Vapor separator and vapor shut-off valve

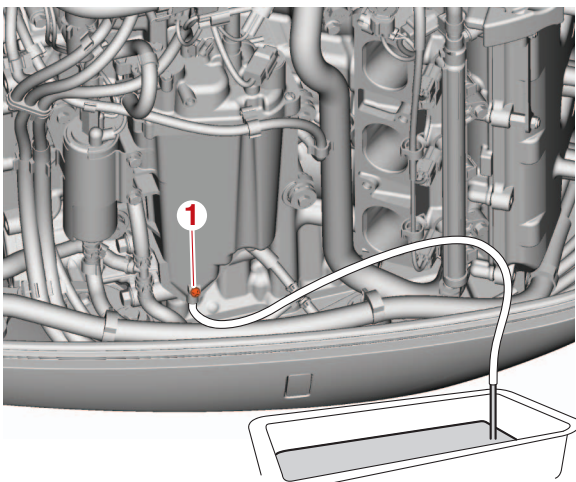
### Draining the fuel

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

1. Drain:
  - Fuel
    - a. Disconnect the fuel hose "1" from the vapor separator assembly "2".



- b. Loosen the vapor separator drain screw "1" to drain the fuel into a drain pan.
  - c. Tighten the vapor separator drain screw "1" to the specified torque.



Vapor separator drain screw "1"  
2.0 N·m (0.20 kgf·m, 1.5 lb-ft)

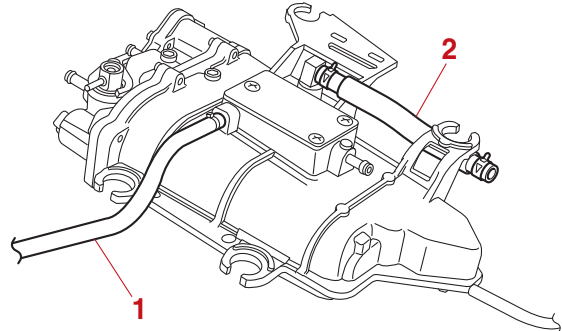
- d. Connect the fuel hose to the vapor separator assembly.

### Checking the vapor shut-off valve

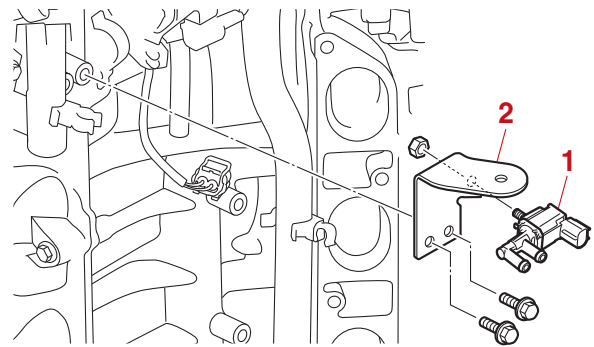
1. Check:
  - Vapor shut-off valve exterior  
Cracked → Replace.

### Installing the vapor separator

1. Install:
  - Vapor separator
  - Vapor shut-off valve
    - a. Install the cooling water hose "1" and fuel hose "2".



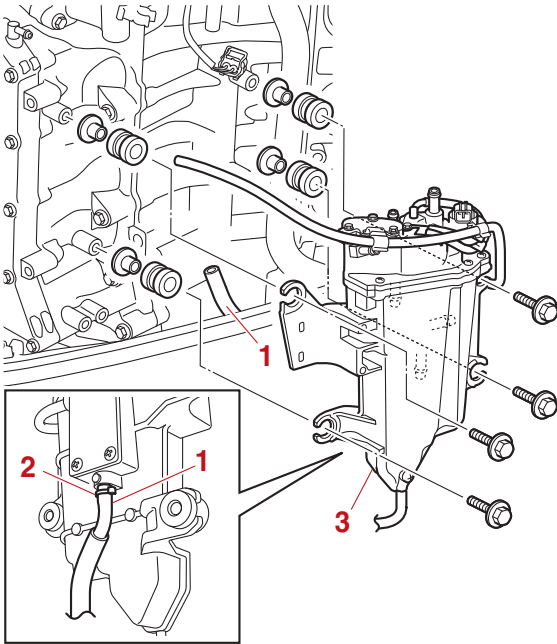
- b. Install the vapor shut-off valve "1" and bracket "2".



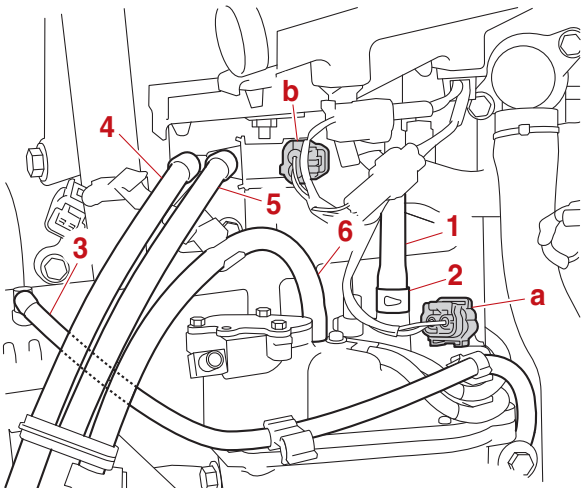
- c. Connect the cooling water hose "1", and then fasten it using a new plastic tie "2".



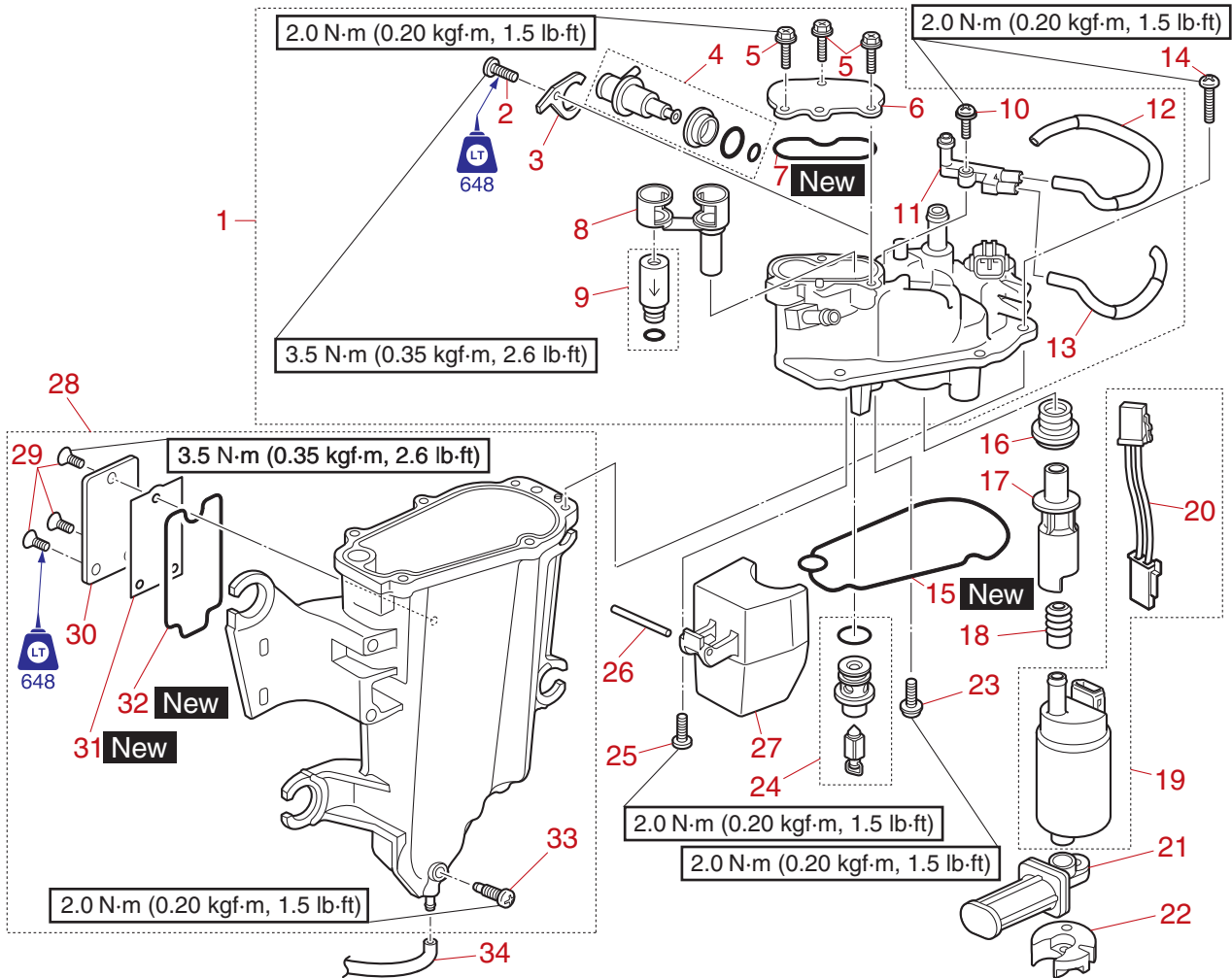
- d. Install the vapor separator assembly  
“3”.



- e. Connect the fuel hose “1”, and then fasten it using the clamp “2”.
- f. Connect the cooling water hose “3” and vapor gas hoses “4”, “5”, and “6”.
- g. Connect the high-pressure fuel pump coupler “a” and vapor shut-off valve coupler “b”.



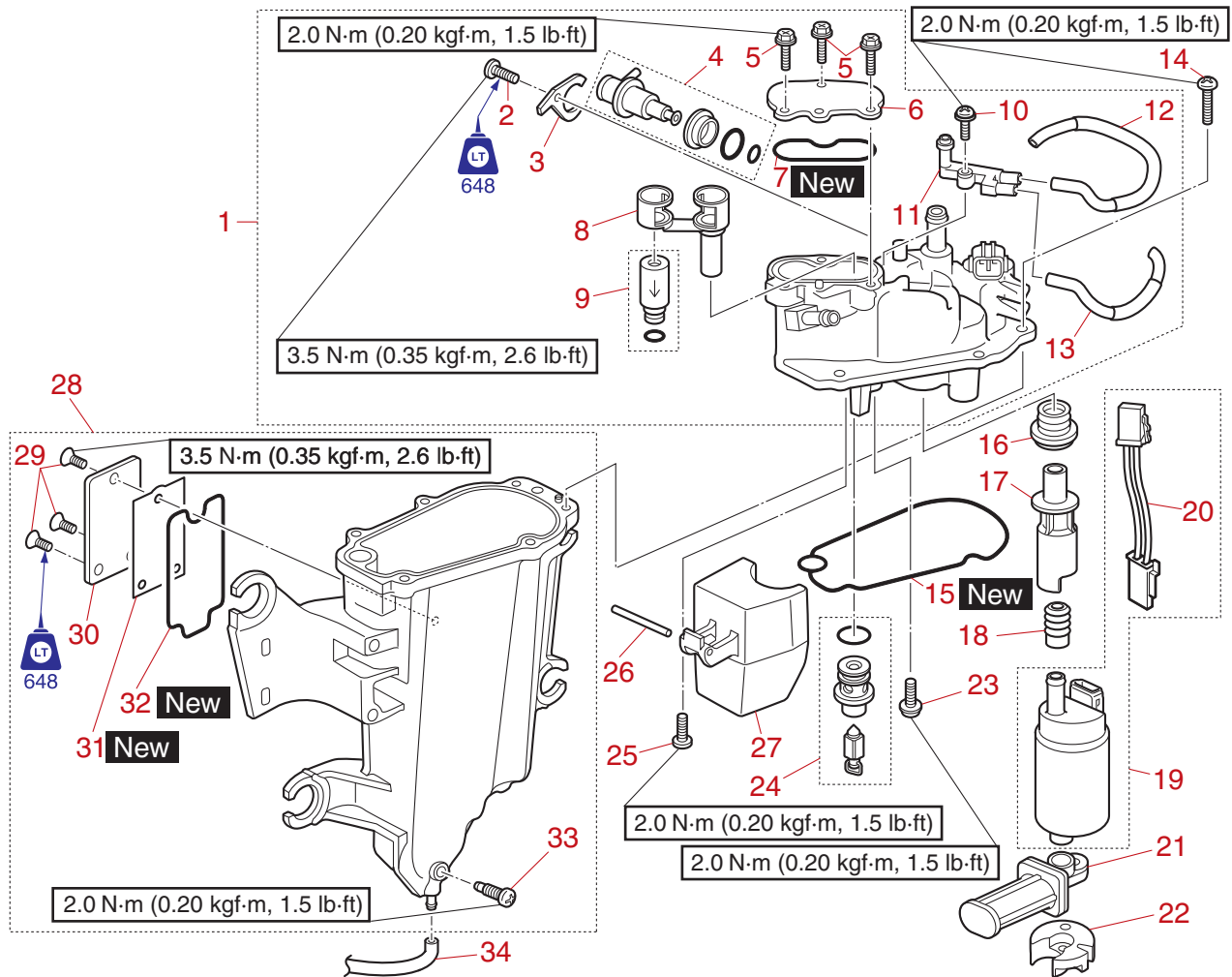
Vapor separator and high-pressure fuel pump



↑↓	Part name	Q'ty	Remarks
1	Vapor separator cover assembly	1	
2	Screw M5 × 12 mm	1	
3	Holder	1	
4	Pressure regulator	1	
5	Bolt M4 × 12 mm	3	
6	Cover	1	
7	Gasket	1	
8	Filter	1	
9	Check valve	1	
10	Screw M4 × 14 mm	1	
11	Joint pipe	1	
12	Hose	1	
13	Hose	1	
14	Screw M4 × 16 mm	6	
15	Gasket	1	
16	Grommet	1	
17	Joint	1	

↑↓	Part name	Q'ty	Remarks
18	Damper	1	
19	High-pressure fuel pump	1	
20	Lead	1	
21	Filter	1	
22	Holder	1	
23	Screw M4 × 8 mm	1	
24	Needle valve assembly	1	
25	Screw M4 × 8 mm	1	
26	Pin	1	
27	Float	1	
28	Float chamber assembly	1	
29	Screw M5 × 6 mm	3	
30	Cover	1	
31	Gasket	1	
32	Gasket	1	

## Vapor separator and high-pressure fuel pump



↑↓	Part name	Q'ty	Remarks
33	Drain screw	1	
34	Drain hose	1	

### Checking the high-pressure fuel pump

1. Check:
  - Electrical performance of the high-pressure fuel pump  
See “Checking the low-pressure fuel pump and high-pressure fuel pump” (5-31).

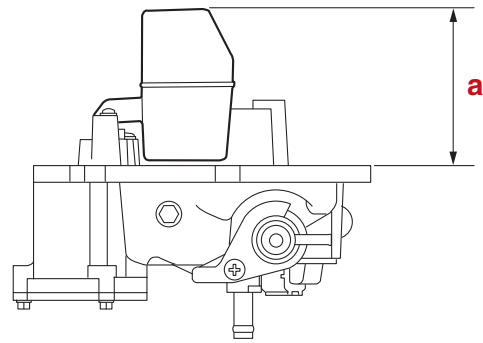
### Checking the vapor separator


1. Check:
  - Needle valve  
Bent/worn → Replace the needle valve assembly.



2. Check:
  - Float  
Deteriorated → Replace.
3. Check:
  - Filter  
Dirt/residue → Clean.
4. Measure:
  - Float height “a”  
Out of specification → Replace the float.
    - a. Place the cover assembly upside down, and then measure the float height “a”.

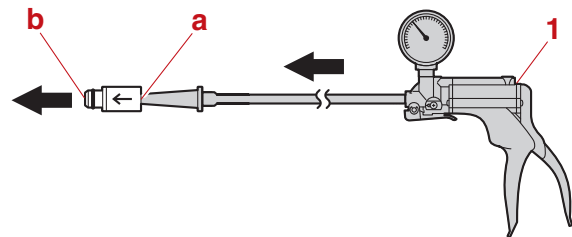
**TIP:** \_\_\_\_\_  
When measuring the float height, the float should be resting on the needle valve. Do not press the float.




	Float height 65.0–70.0 mm (2.56–2.76 in)
---	---

### Checking the check valve

1. Check:
  - Check valve  
No air comes out → Replace.
    - a. Connect the special service tool “1” to the check valve port “a”.
    - b. Apply positive pressure and check that air comes out of the opposite end “b” of the check valve.

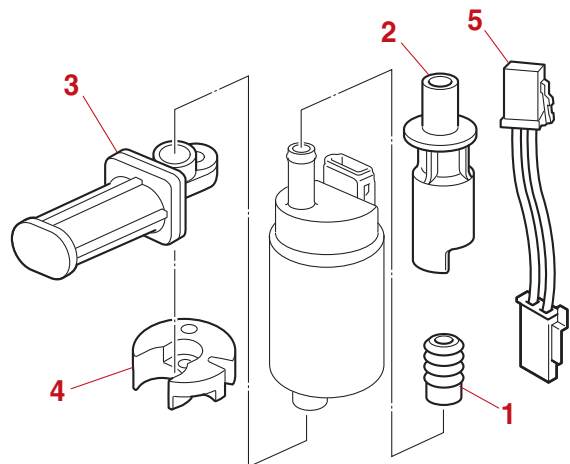
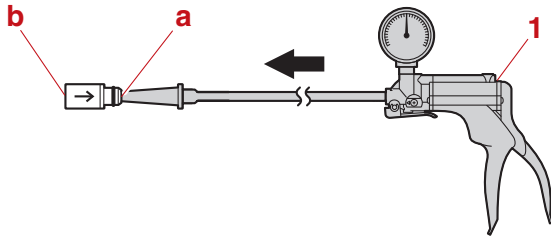


	Vacuum/pressure pump gauge set “1” 90890-06945 Pressure/vacuum tester “1” YB-35956-B
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2. Check:
  - Check valve  
Air comes out → Replace.
    - a. Connect the special service tool “1” to the opposite check valve port “a”.

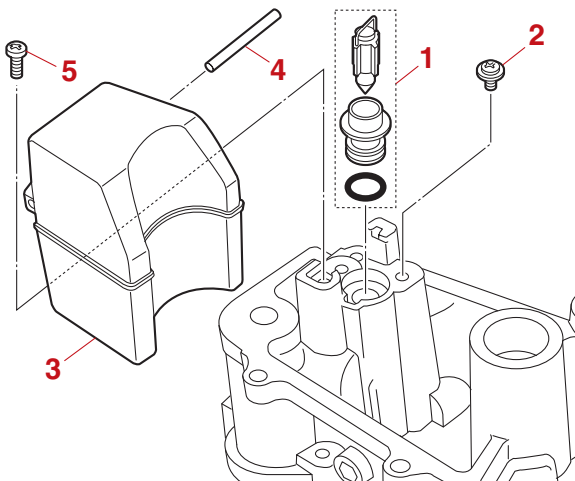
## Vapor separator and high-pressure fuel pump


- b. Apply positive pressure and check that no air comes out of the opposite end "b" of the check valve.



### Assembling the vapor separator

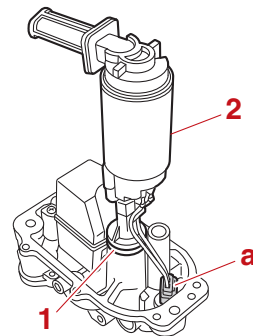
1. Install:
  - Needle valve assembly "1"
  - Needle valve assembly screw "2"
  - Float "3"
  - Pin "4"
  - Float pin screw "5"



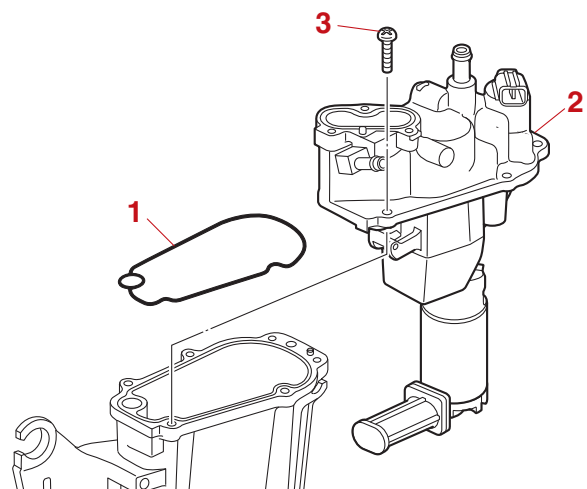
	Needle valve assembly screw "2" 2.0 N·m (0.20 kgf·m, 1.5 lb·ft)
	Float pin screw "5" 2.0 N·m (0.20 kgf·m, 1.5 lb·ft)


2. Install:
  - Damper "1"
  - Joint "2"
  - Filter "3"
  - Filter holder "4"
  - Lead "5"

3. Install:
  - Grommet "1"
  - High-pressure fuel pump "2"
  - High-pressure fuel pump coupler "a"



4. Install:
  - Gasket "1" **New**
  - Vapor separator cover "2"
  - Float chamber cover screw "3"



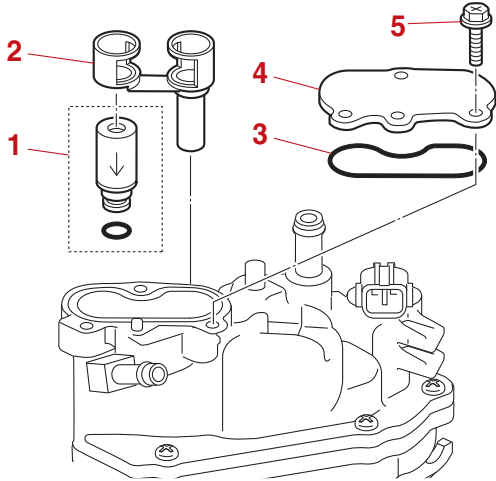
	Float chamber cover screw "3" 2.0 N·m (0.20 kgf·m, 1.5 lb·ft)
---	--



## Vapor separator and high-pressure fuel pump

### 5. Install:

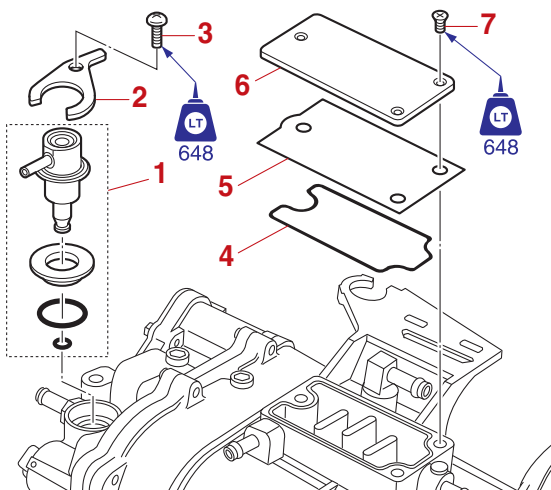
- Check valve "1"
- Filter "2"
- Gasket "3" **New**
- Cover "4"
- Cover bolt "5"



Cover bolt "5"  
2.0 N·m (0.20 kgf·m, 1.5 lb·ft)

### 6. Install:

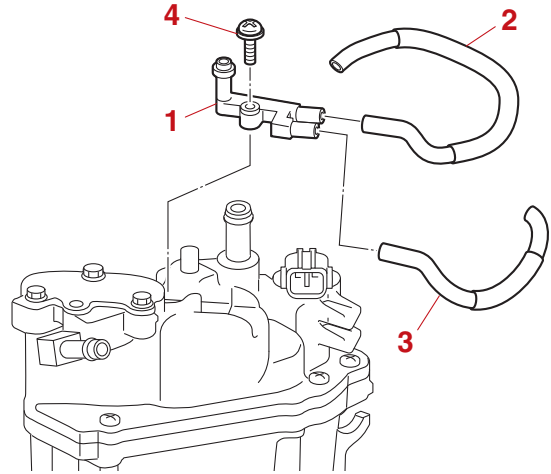
- Pressure regulator "1"
- Holder "2"
- Pressure regulator screw "3"
- Gasket "4", "5" **New**
- Fuel cooler cover "6"
- Fuel cooler cover screw "7"



Pressure regulator screw "3"  
3.5 N·m (0.35 kgf·m, 2.6 lb·ft)  
Fuel cooler cover screw "7"  
3.5 N·m (0.35 kgf·m, 2.6 lb·ft)

### 7. Install:

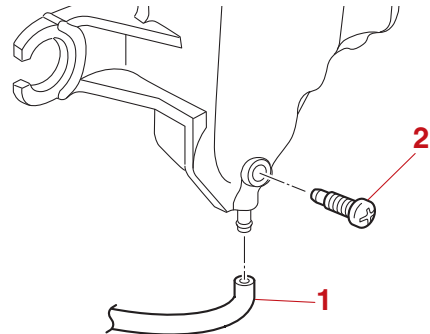
- Joint pipe "1"
- Vapor gas hose "2", "3"
- Joint pipe screw "4"



Joint pipe screw "4"  
2.0 N·m (0.20 kgf·m, 1.5 lb·ft)

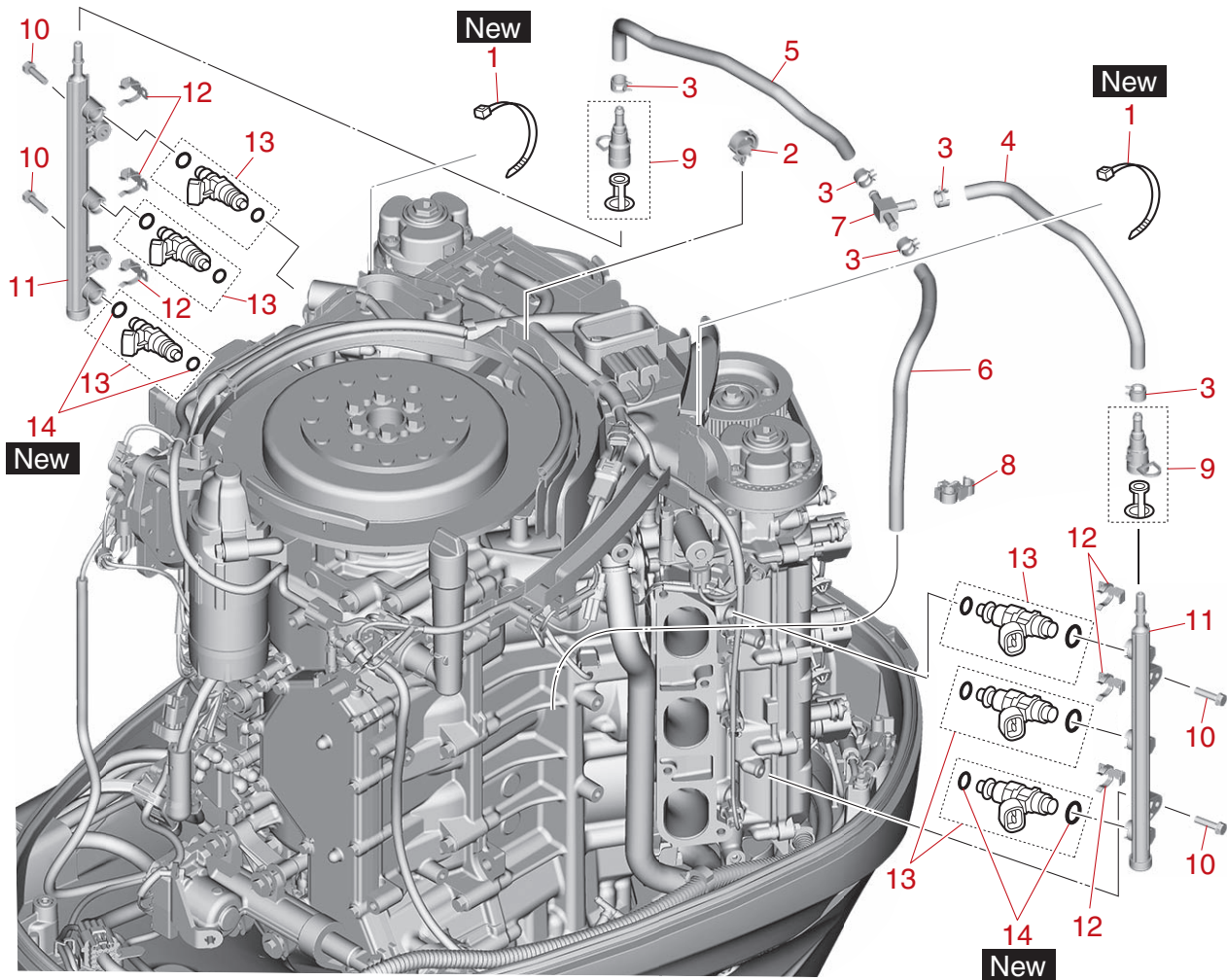
### 8. Install:

- Drain hose "1"
- Drain screw "2"



Drain screw "2"  
2.0 N·m (0.20 kgf·m, 1.5 lb·ft)

Fuel injector



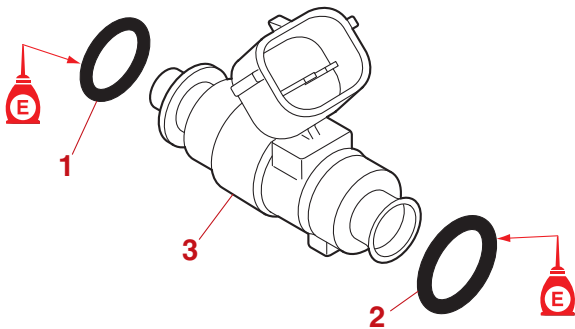
↕	Part name	Q'ty	Remarks
1	Plastic tie	2	
2	Holder	1	
3	Clamp	5	
4	Hose	1	
5	Hose	1	
6	Hose	1	
7	Joint	1	
8	Holder	1	
9	Quick connector	2	
10	Bolt M6 × 25 mm	4	
11	Fuel rail	2	
12	Holder	6	
13	Fuel injector	6	
14	O-ring set	6	

### Checking the fuel rail

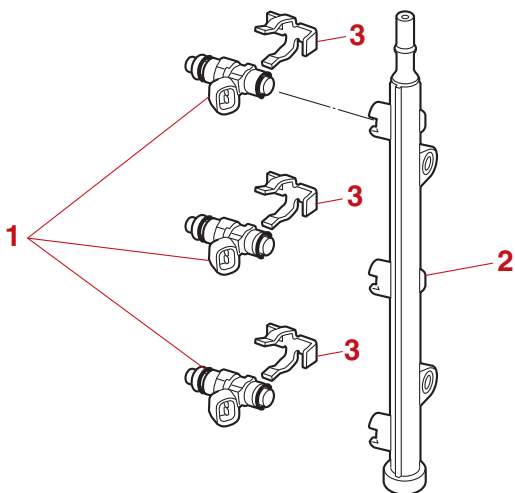
1. Check:
  - Fuel rail  
Cracked/deformed → Replace.
2. Check:
  - Electrical performance of the fuel injector  
See “Checking the fuel injector” (5-30).

### Installing the fuel injector

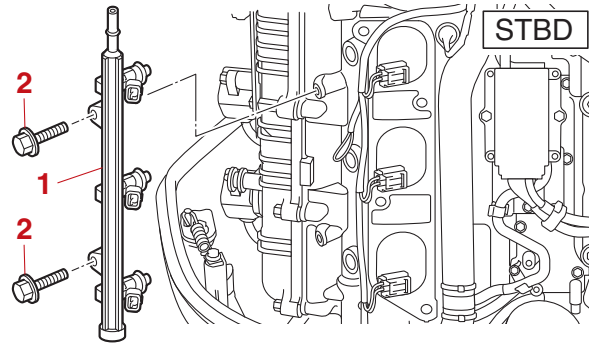
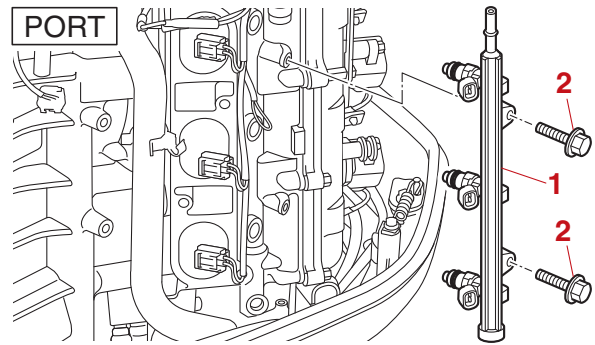
1. Install:
  - O-ring **New**
  - Fuel injector
  - Fuel rail
  - Fuel rail bolt
    - a. Install new O-rings “1” and “2” to the fuel injector “3”.



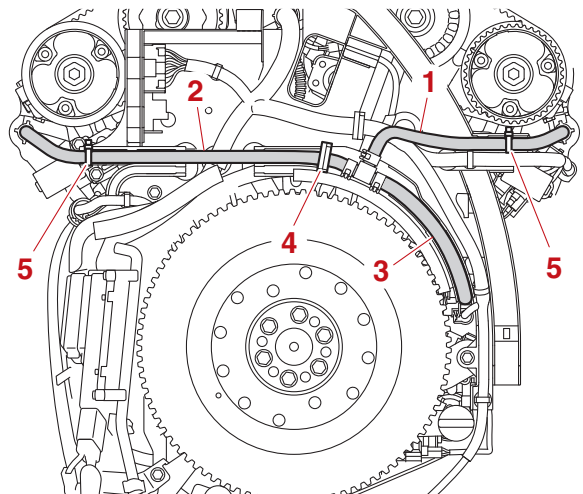
- b. Install the fuel injectors “1” onto the fuel rail “2”, and then install the holders “3”.



- c. Install the fuel rails “1” onto the cylinder heads.
  - d. Tighten the bolts “2” equally.



2. Connect:
  - Fuel hose
  - Injector coupler
  - Quick connector
    - a. Install the fuel hoses “1”, “2”, and “3” using the holder “4” and new plastic ties “5”.



---

## Power unit

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## Power unit

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## Power unit

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## Power unit (check and adjustment)

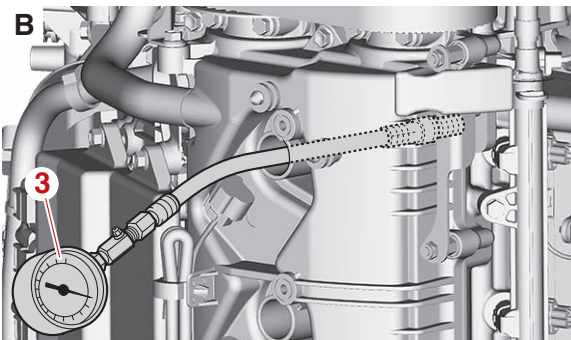
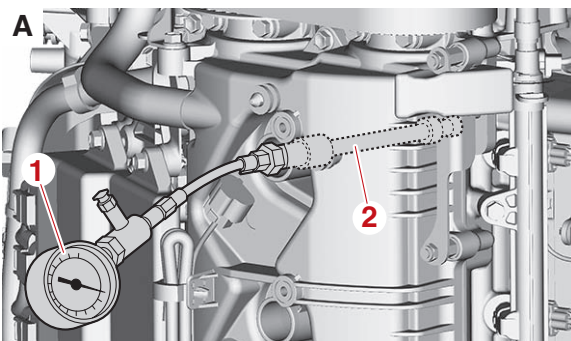
### Checking the compression pressure

1. Start the engine, warm it up for 5–10 minutes, and then stop it.
2. Remove:
  - Clip (from the engine shut-off switch)
  - Fuel injector coupler See “Fuel injector” (6-29).
  - Ignition coil
  - Spark plug See “Camshaft” (7-38).

#### NOTICE

Before removing the spark plugs, remove any dirt or dust in the spark plug wells that could fall into the cylinders.

3. Install:
  - Special service tool



A. Worldwide  
B. USA and Canada

	Compression gauge “1”
	90890-03160
	Compression gauge extension “2”
	90890-06563
Combination compression gauge and cylinder leakdown test kit “3”	
YB-45544-A	

4. Measure:
  - Compression pressure

Below specification → Check the engine internal parts.

**TIP:** \_\_\_\_\_

Crank the engine until the reading on the compression gauge stabilizes.

	Compression pressure
	Minimum (reference data)
	694.2 kPa (6.94 kgf/cm <sup>2</sup> , 100.7 psi)

5. Remove:
  - Special service tool
6. Install:
  - Spark plug
  - Ignition coil See “Camshaft” (7-38).
  - Clip (to the engine shut-off switch)

	Spark plug
	28 N·m (2.8 kgf·m, 21 lb·ft)


### Checking the oil pressure

1. Connect the YDIS to display “Oil pressure”.
2. Start the engine and warm it up until the engine idle speed stabilizes at the specified engine idle speed range.

	Idle speed (in neutral)
	650–750 r/min



3. Measure:
  - Oil pressure  
Below specification → Check the engine internal parts.


	Engine oil pressure at idle speed (reference data)
	412.0 kPa (4.12 kgf/cm <sup>2</sup> , 59.7 psi)
	Engine oil pressure at 3000 r/min (reference data)
	688.0 kPa (6.88 kgf/cm <sup>2</sup> , 99.8 psi)

### Checking the pulser coil air gap

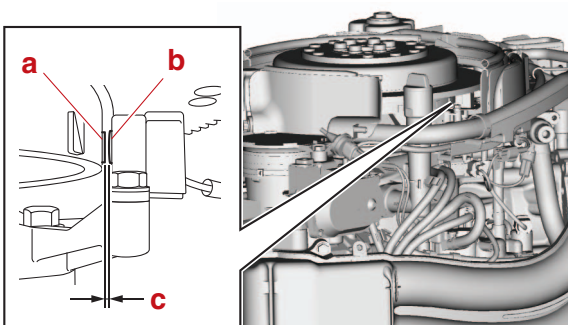
#### NOTICE

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

1. Check:
  - Pulser coil air gap  
Out of specification → Adjust the air gap.

	Pulser coil
	Air gap
	0.36–1.14 mm (0.014–0.045 in)

- a. Turn the flywheel magneto clockwise to align the protrusion “a” on the flywheel magneto with the protrusion “b” on the pulser coil.
- b. Measure the pulser coil air gap “c”.



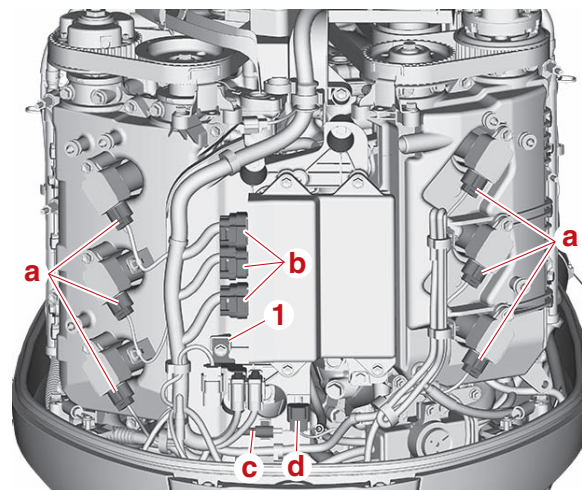
### Checking the valve clearance

- Measure the valve clearances when the engine is cold.
- Cover the fuel components using a rag to prevent fuel from spilling out.

#### NOTICE

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

1. Remove:
  - Blowby hose  
See “Intake manifold” (6-10).
  - Vapor gas hose
  - Canister
  - PTT buzzer  
See “Canister” (6-16).
2. Disconnect:
  - Ignition coil coupler “a”
  - Engine ECM coupler “b”
  - Knock sensor coupler “c”
  - Water pressure sensor coupler “d”
3. Remove:
  - Bracket “1”
  - Ignition coil
  - Spark plug

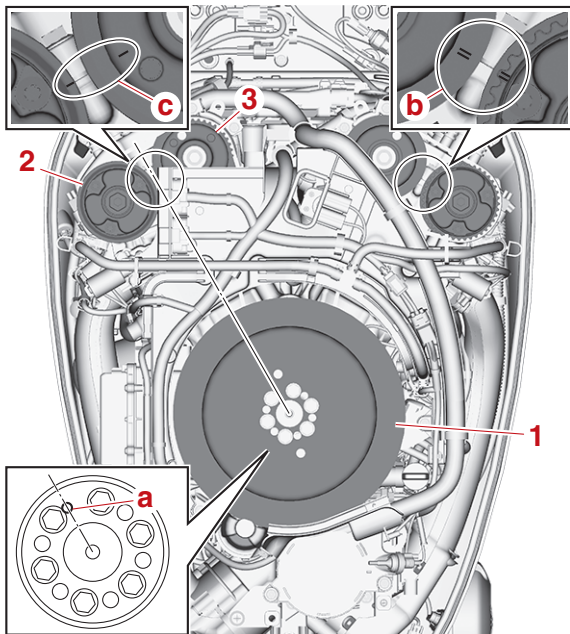


4. Remove:
  - Engine ECM
  - Engine ECM bracket
5. Align:
  - Flywheel magneto
  - Driven sprocket
  - VCT assembly
  - Dowel pin hole



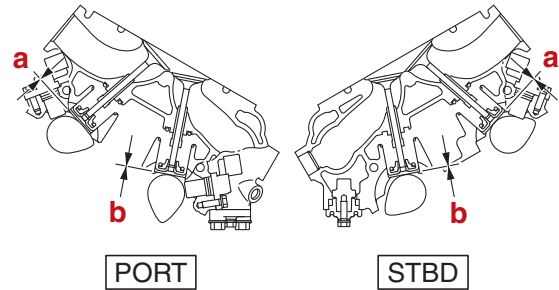
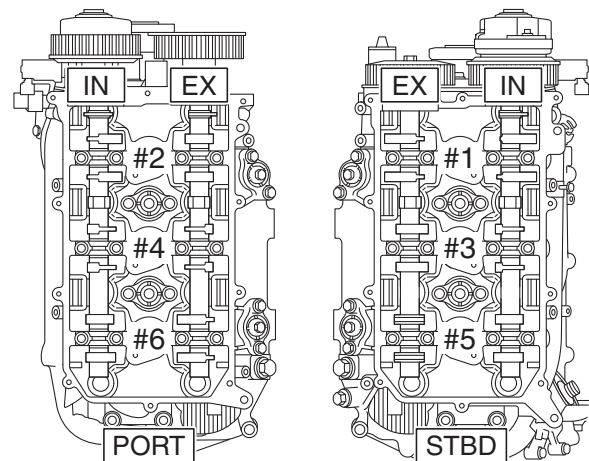
## Power unit (check and adjustment)


- a. Turn the flywheel magneto "1" clockwise until the dowel pin hole "a" in the flywheel magneto "1" is aligned between the VCT assembly (STBD) "2" and driven sprocket (STBD) "3".
- b. Check that the "I" marks "b" on the VCT assembly (PORT) and driven sprocket (PORT) are aligned, and check that the "I" marks "c" on the VCT assembly (STBD) and driven sprocket (STBD) are aligned.



6. Remove:
  - Timing belt guide (STBD)
  - Cylinder head cover
7. Measure:
  - Valve clearance "a"
  - Valve clearance "b"

**TIP:** \_\_\_\_\_  
Write down the measurement data.



	Valve clearance IN (cold engine)	0.17–0.24 mm (0.0067–0.0094 in)
	Valve clearance EX (cold engine)	0.31–0.38 mm (0.0122–0.0150 in)

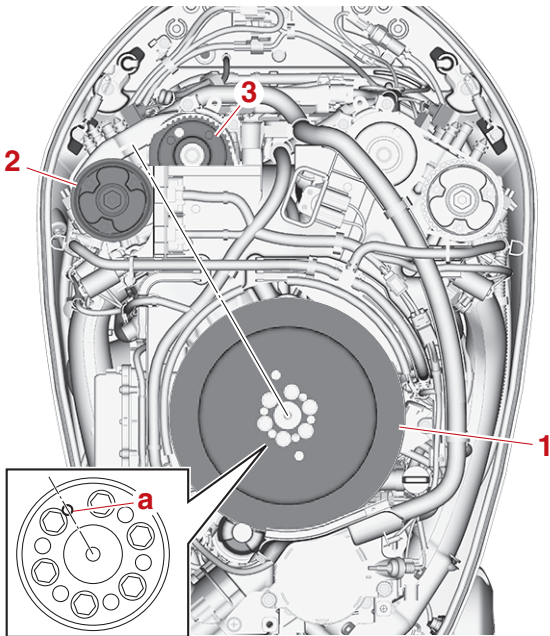
8. Check:
  - Valve clearance  
Out of specification → Adjust.  
See "Adjusting the valve clearance" (7-4).
    - a. Measure the intake and exhaust valve clearances of the specified cylinders.

	#1	#2	#3	#4	#5	#6
IN	✓	—	—	—	✓	✓
EX	✓	✓	✓	—	—	—

—: Not applicable  
✓: Specified cylinder

## Power unit (check and adjustment)

- b. Turn the flywheel magneto "1" an additional 360° clockwise until the dowel pin hole "a" in the flywheel magneto "1" is aligned between the VCT assembly (STBD) "2" and driven sprocket (STBD) "3".



- c. Measure the intake and exhaust valve clearances of the specified cylinders. Adjust if out of specification.

	#1	#2	#3	#4	#5	#6
IN	—	✓	✓	✓	—	—
EX	—	—	—	✓	✓	✓

—: Not applicable

✓: Specified cylinder

9. Install:


- Gasket **New**
- Cylinder head cover  
See "Camshaft" (7-38).
- Timing belt guide (STBD)

10. Adjust:

- Timing belt guide clearance  
See "Installing the timing belt" (7-35).

11. Install:

- Engine ECM bracket
- Engine ECM
- Spark plug
- Ignition coil

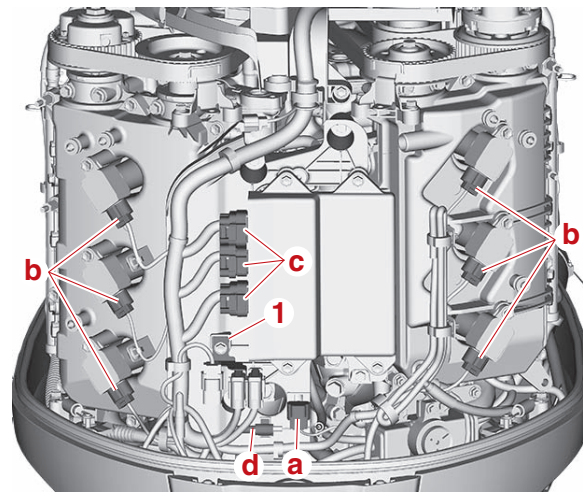
	Spark plug 28 N·m (2.8 kgf·m, 21 lb·ft)
---	--

12. Install:

- Bracket "1"

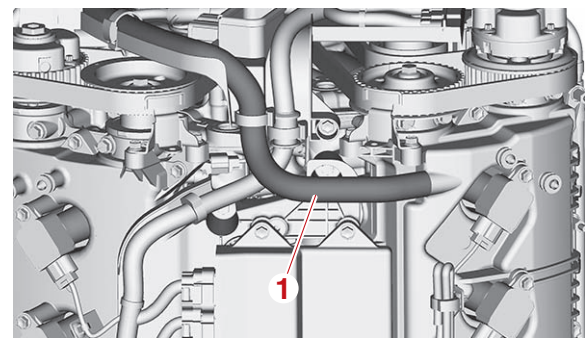
13. Connect:

- Water pressure sensor coupler "a"
- Ignition coil coupler "b"
- Engine ECM coupler "c"
- Knock sensor coupler "d"



14. Install:

- PTT buzzer
- Canister
- Vapor gas hose
- Blowby hose "1"



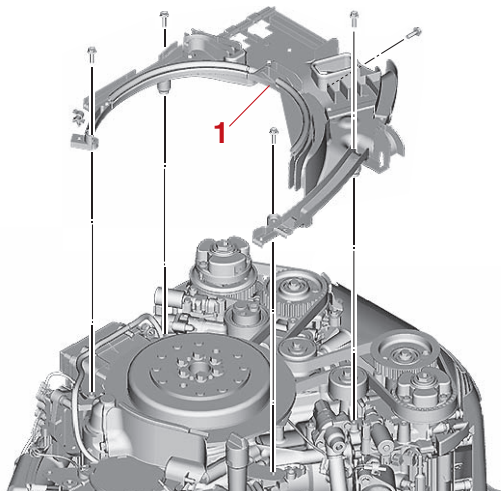
### Adjusting the valve clearance

Adjust the valve clearances when the engine is cold.

**NOTICE**

- Do not turn the flywheel magneto counterclockwise. Otherwise, the water pump impeller could be damaged.
- Do not turn the flywheel magneto, VCT assembly or driven sprocket when the timing belt is not installed. Otherwise, the pistons and valves, or intake and exhaust valves will collide with each other and be damaged.

1. Reduce:
  - Fuel pressure  
See “Reducing the fuel pressure” (6-1).
2. Disconnect:
  - Quick connector  
See “Disconnecting the quick connector” (6-1).
3. Remove:
  - Fuel hose (high-pressure)
  - Intake manifold (STBD)  
See “Intake manifold” (6-10).
4. Remove:
  - Wire harness  
See “Wire harness” (7-17).
  - Wire harness guide “1”



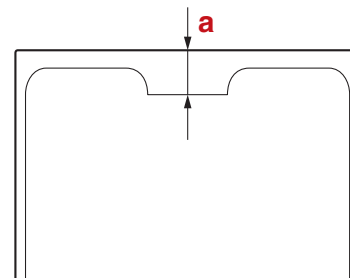
5. Remove:
  - Flywheel magneto
  - Pulser coil
  - Stator assembly  
See “Removing the flywheel magneto” (7-15).

6. Remove:
  - Timing belt  
See “Removing the timing belt” (7-34).
7. Remove:
  - VCT assembly
  - Driven sprocket
  - Camshaft  
See “Removing the camshaft, VCT assembly, and driven sprocket” (7-39).

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

8. Measure:
  - Valve lifter thickness “a”

**TIP:** \_\_\_\_\_  
• Make sure to keep the parts in the order of removal.  
• Write down the measurement data.



9. Select:
  - Valve lifter
    - a. Select the necessary valve lifter by calculating its thickness using the following formula.

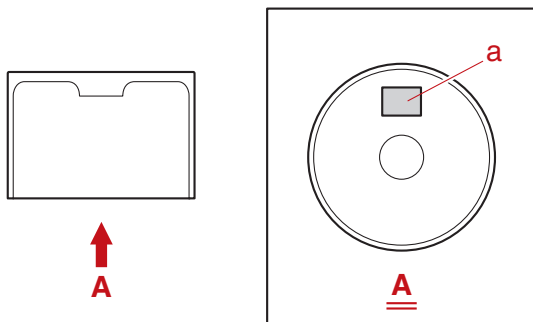
Calculation formula:  
Necessary valve lifter thickness =  
Removed valve lifter thickness +  
Measured valve clearance –  
Specified valve clearance

Example:  
Removed valve lifter thickness =  
3.000 mm  
Measured valve clearance = 0.255  
mm  
Specified valve clearance = 0.205 mm  
Necessary valve lifter thickness  
= 3.000 mm + 0.255 mm – 0.205 mm  
= 3.050 mm

10. Install:

- Valve lifter
- Camshaft
- Camshaft cap
- VCT assembly
- Driven sprocket  
See “Installing the camshaft, VCT assembly, and driven sprocket” (7-43).
- Timing belt  
See “Installing the timing belt” (7-35).

**TIP:** \_\_\_\_\_  
ID mark “a” is stamped as shown to easily know new valve lifter thickness.



11. Measure:

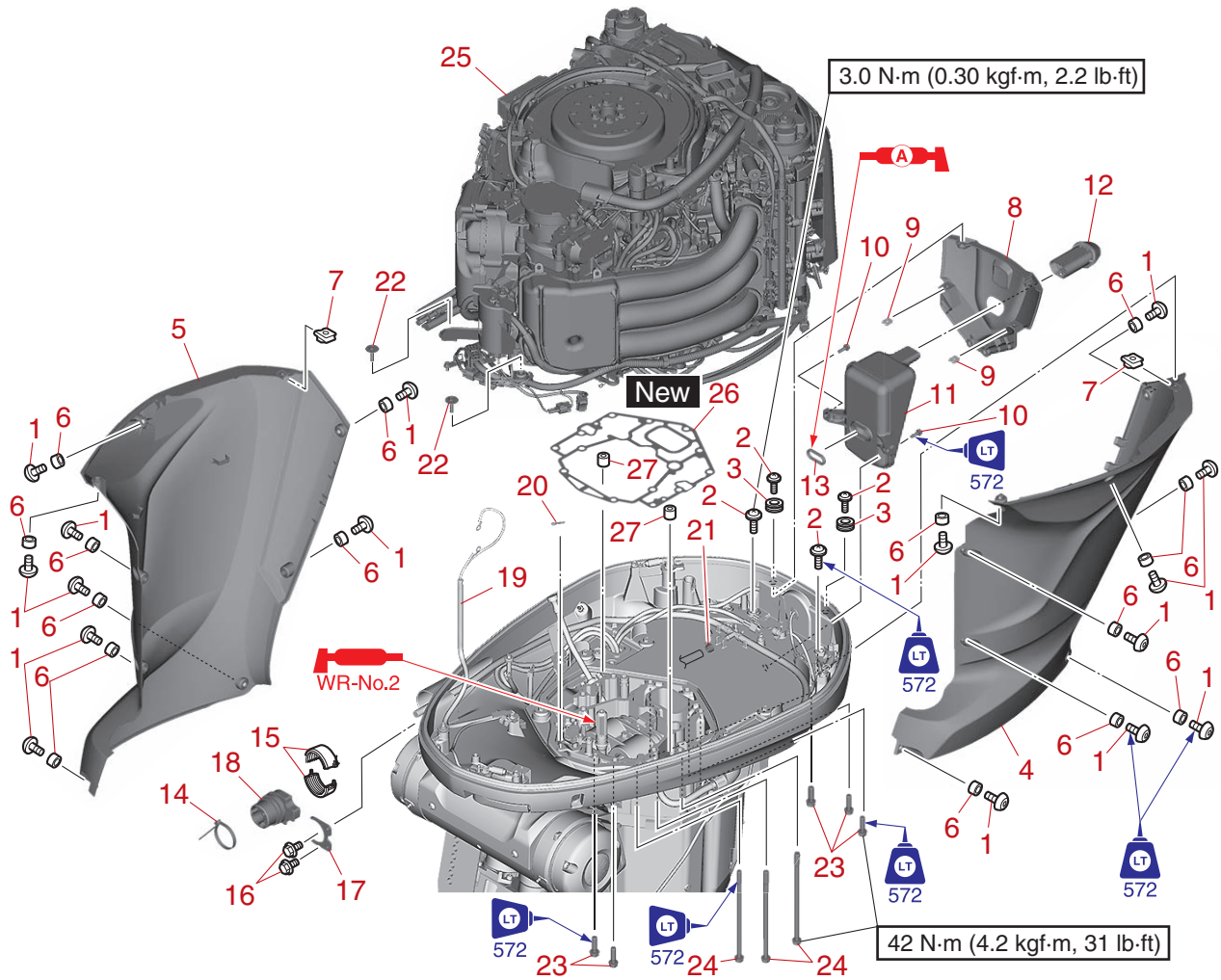
- Valve clearance  
See “Checking the valve clearance” (7-2).

12. Install:

- Pulser coil
- Stator assembly
- Flywheel magneto  
See “Installing the flywheel magneto” (7-15).
- Wire harness guide
- Wire harness
- Intake manifold (STBD)  
See “Installing the intake manifold” (6-11).



Power unit assembly



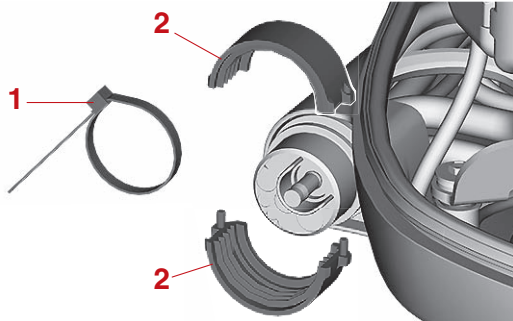
↑↓	Part name	Q'ty	Remarks
1	Bolt M6 × 14 mm	16	
2	Screw M6 × 20 mm	4	
3	Grommet	2	
4	Apron	1	
5	Apron	1	
6	Collar	16	
7	Nut M6	2	
8	Cover	1	
9	Nut M6	2	
10	Bolt M6 × 20 mm	2	
11	Idle silencer	1	
12	Rubber seal	1	
13	Grommet	1	
14	Plastic tie	1	
15	Rigging tube retainer	1	
16	Bolt M6 × 14 mm	2	
17	Grommet holder	1	
18	Rigging grommet	1	

↑↓	Part name	Q'ty	Remarks
19	PTT unit lead	1	
20	Clip	1	
21	Clip	1	
22	Bolt M6 × 30 mm	2	
23	Bolt M10 × 35 mm	7	
24	Bolt M10 × 210 mm	6	
25	Power unit assembly	1	
26	Gasket	1	
27	Dowel pin	2	

## Removing the power unit

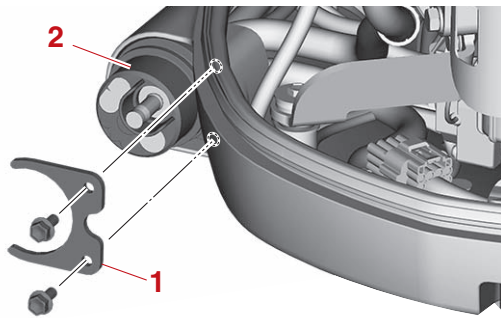
1. Remove:

- Plastic tie "1"
- Rigging tube retainer "2"



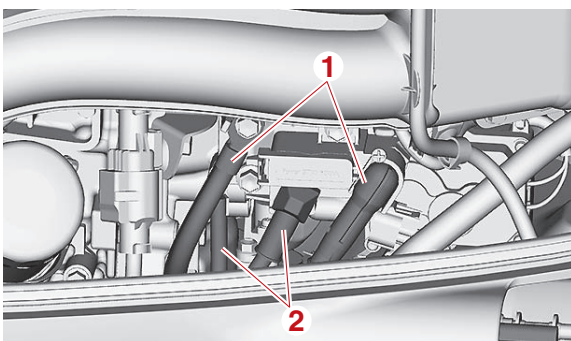
2. Remove:

- Grommet holder "1"
- Rigging grommet "2"



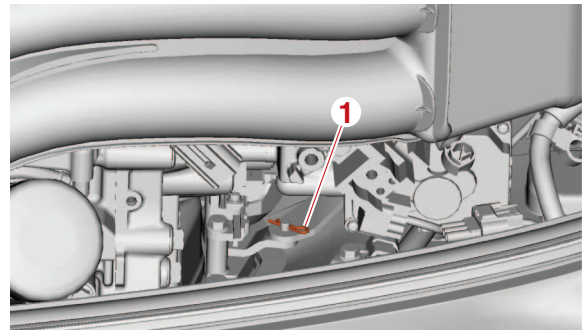
3. Disconnect:

- Battery cable "1"
- SCU lead "2"



4. Remove:

- Clip "1"

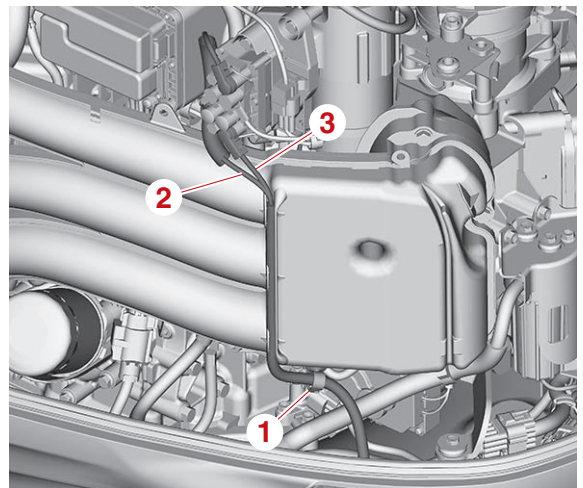


5. Remove:

- Holder "1"

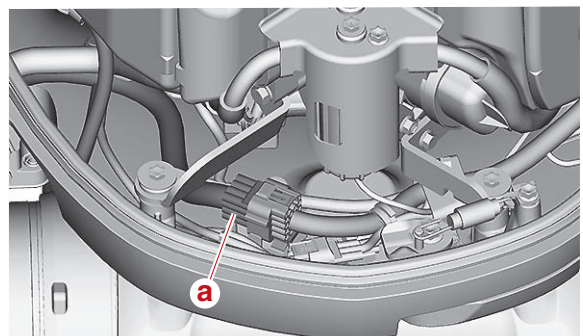
6. Disconnect:

- PTT motor lead "2", "3" (from the holder "1")

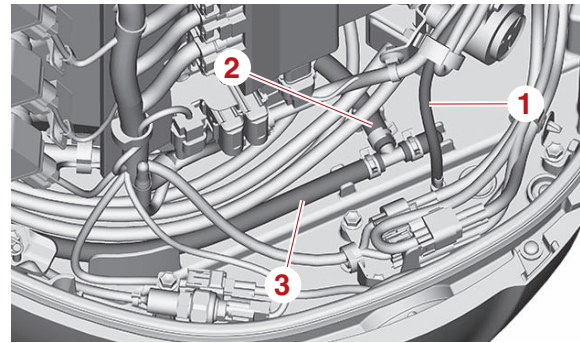
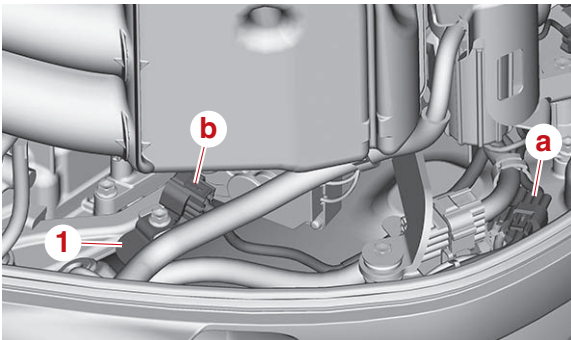


7. Disconnect:

- Extension wire harness coupler "a"

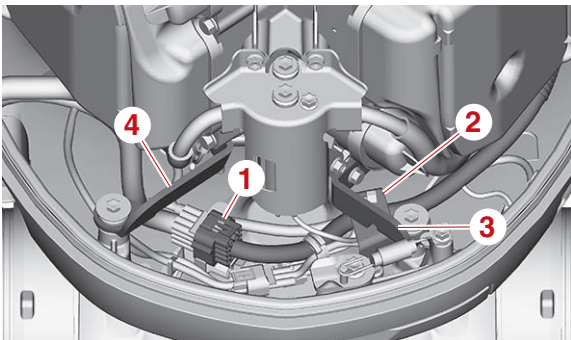
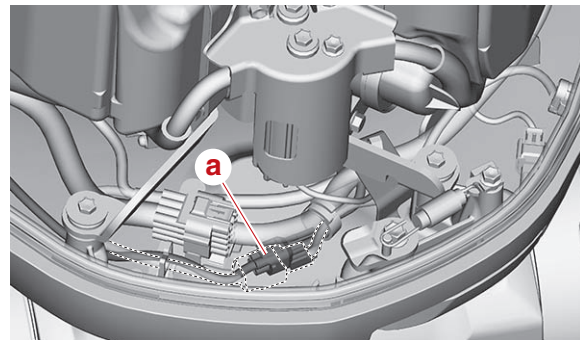


8. Disconnect:
- PTT switch coupler “a”
  - SPS coupler “b” (from the bracket “1”)



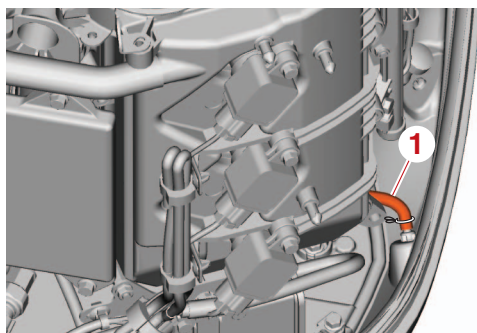
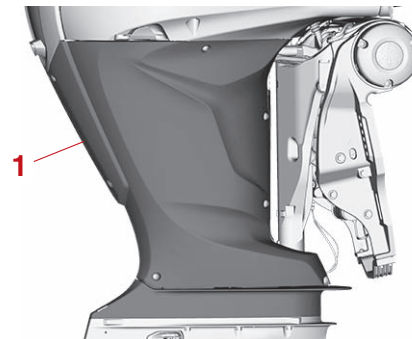
12. Disconnect:
- PTT sensor coupler “a”

9. Remove:
- Wire harness “1” (from the holder “2”)
  - Bracket “3”, “4”

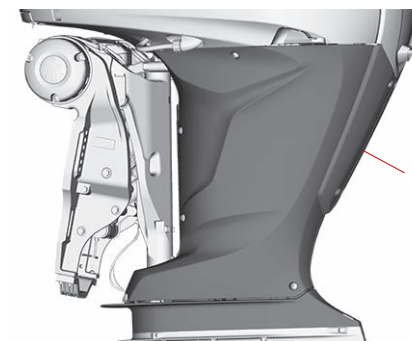


13. Remove:
- Apron “1”, “2”

10. Disconnect:
- Cooling water hose “1”



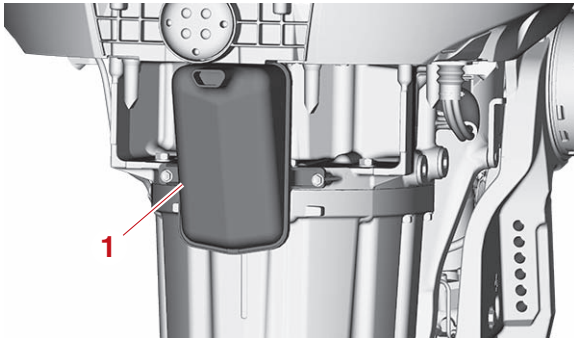
11. Disconnect:
- Vapor gas hose “1”
  - Flushing hose “2”, “3”





14. Remove:

- Idle silencer "1"



	Lifting eye "1"
	90890-06953
	Bolt hexagon with washer "2"
	90890-06821
	Balance hanger "3"
	90890-06822

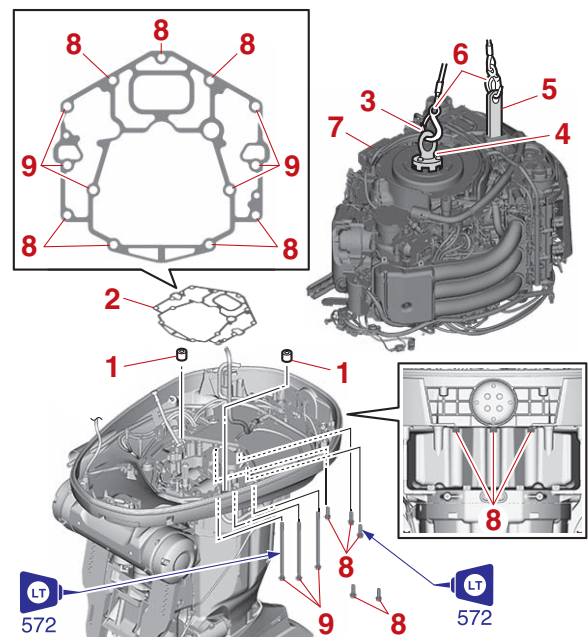
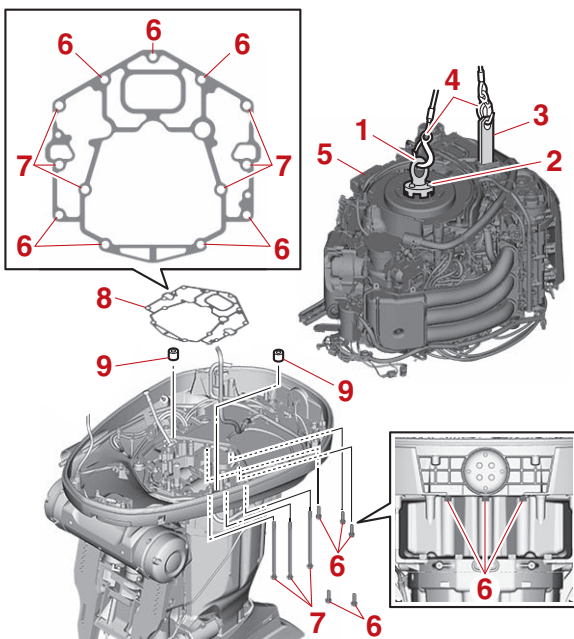
	Lifting eye bolt
	36 N·m (3.6 kgf·m, 27 lb·ft)

15. Remove:

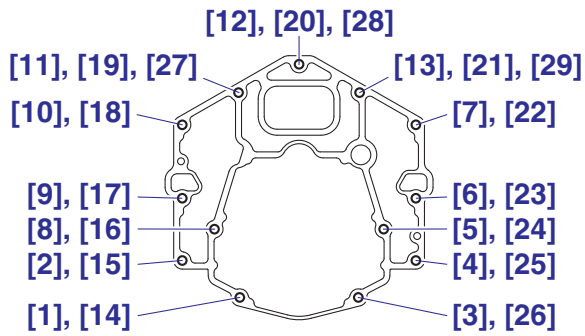
- Power unit
  - Install the special service tools "1", "2" and "3" and then tighten the lifting eye bolts "2" to the specified torque.
  - Hook a lifting harness "4" onto the special service tools "1" and "3", and then suspend the power unit "5".
  - Remove the power unit mounting bolts "6" and "7", and then remove the power unit "5", gasket "8" and dowel pins "9".


Installing the power unit


- Clean:
  - Power unit matching surface
- Install:
  - Dowel pin "1"
  - Gasket "2" **New**
  - Power unit "7"
    - Install the special service tools "3", "4", and "5" to the flywheel magneto, and then tighten the lifting eye bolts to the specified torque.
    - Hook a lifting harness "6" onto the special service tools "3" and "5", and then suspend the power unit "7".
    - Install the power unit "7", and then tighten the power unit mounting bolts "8" and "9" to the specified torque in the order [1], [2], and so on.



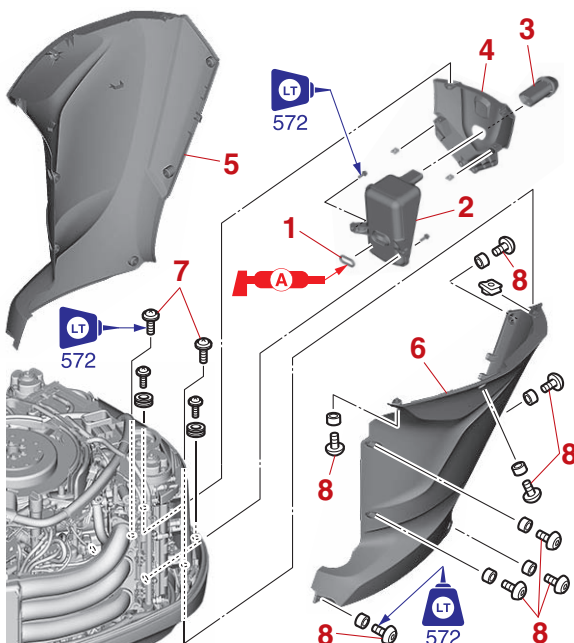





	<p>Lifting eye "3" 90890-06953</p> <p>Bolt hexagon with washer "4" 90890-06821</p> <p>Balance hanger "5" 90890-06822</p>
---	--

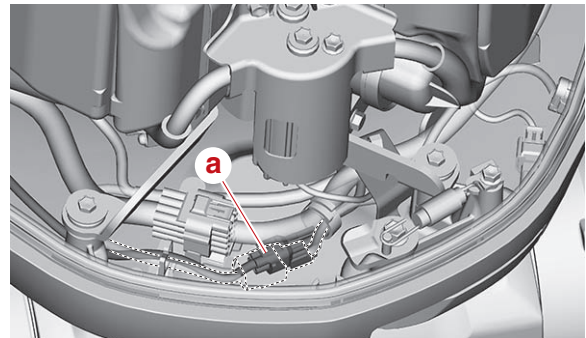
	<p>Lifting eye bolt 36 N·m (3.6 kgf·m, 27 lb·ft)</p> <p>Power unit mounting bolt "8", "9" 42 N·m (4.2 kgf·m, 31 lb·ft)</p>
---	--

3. Install:
- Grommet "1"
  - Idle silencer "2"
  - Rubber seal "3"
  - Cover "4"
  - Apron "5", "6"
  - Apron screw "7"
  - Bolt "8"

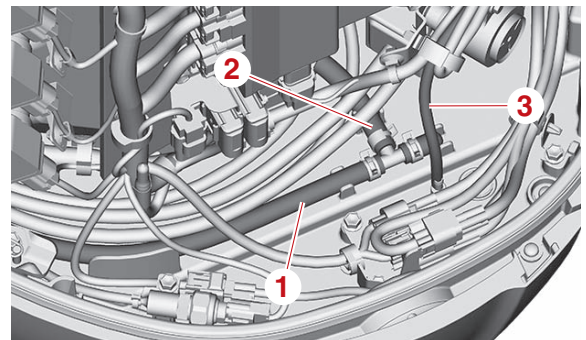


	<p>Apron screw "7" 3.0 N·m (0.30 kgf·m, 2.2 lb·ft)</p>
---	--

4. Connect:
- PTT sensor coupler "a"

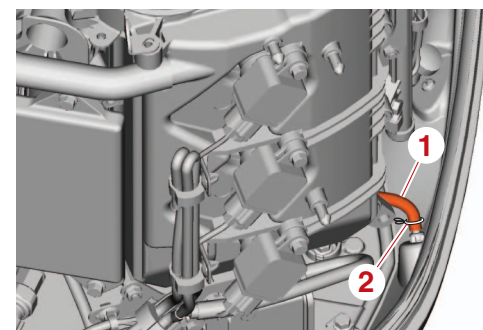


5. Connect:
- Flushing hose "1", "2"
  - Vapor gas hose "3"

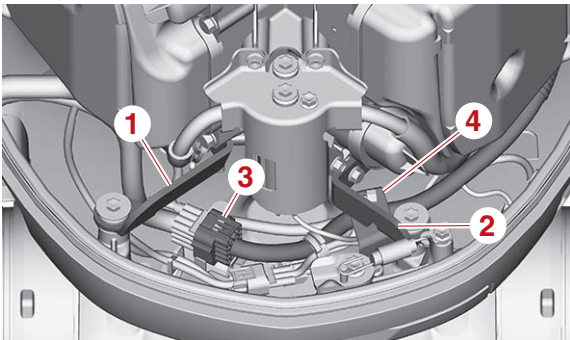


6. Connect:
- Cooling water hose "1"

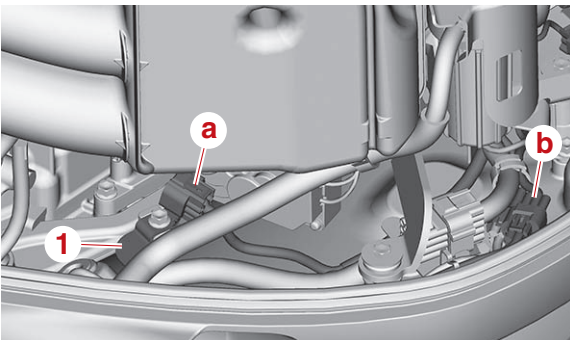
7. Install:
- Clip "2"



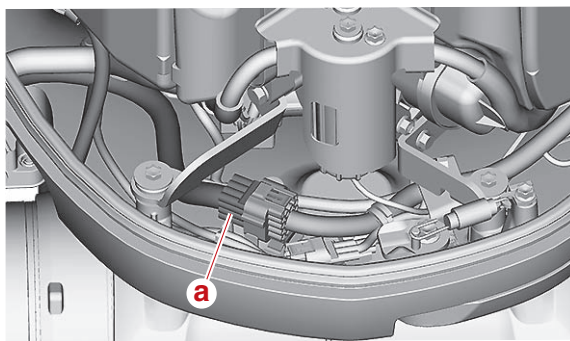
8. Install:
- Bracket "1", "2"
  - Wire harness "3" (to the holder "4")



9. Connect:
- SPS coupler "a" (to the bracket "1")
  - PTT switch coupler "b"

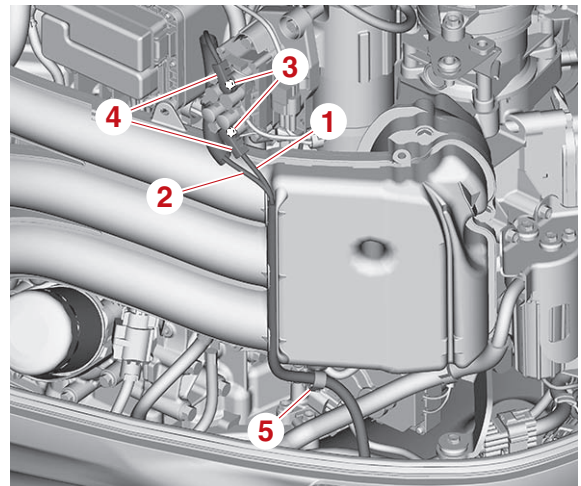


10. Connect:
- Extension wire harness coupler "a"



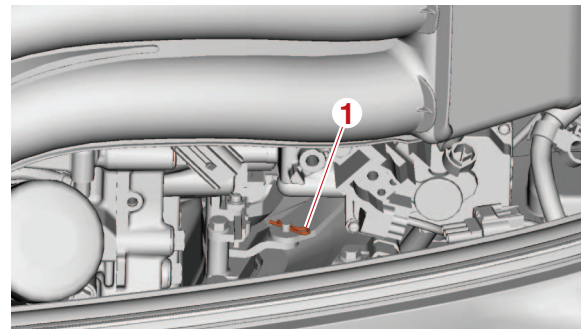
11. Connect:
- PTT motor lead "1", "2"

12. Install:
- PTT motor lead bolt "3"
  - Cap "4"
  - Holder "5"

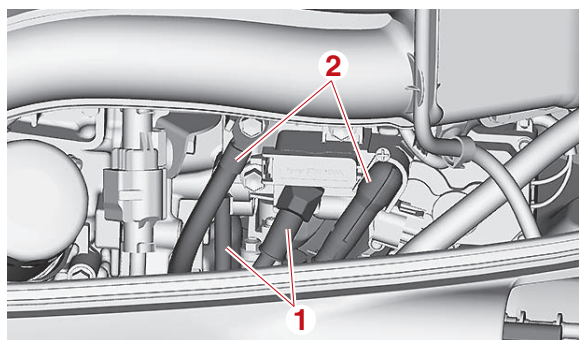


	PTT motor lead bolt "3" 3.5 N·m (0.35 kgf·m, 2.6 lb-ft)
--	--

13. Install:
- Clip "1"



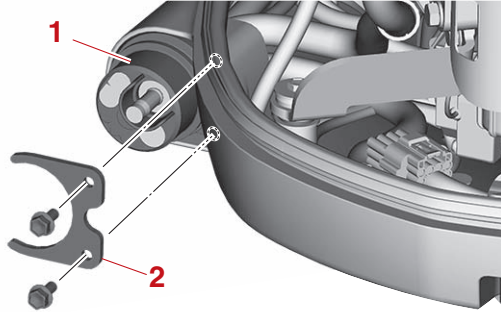
14. Connect:
- SCU lead "1"
  - Battery cable "2"



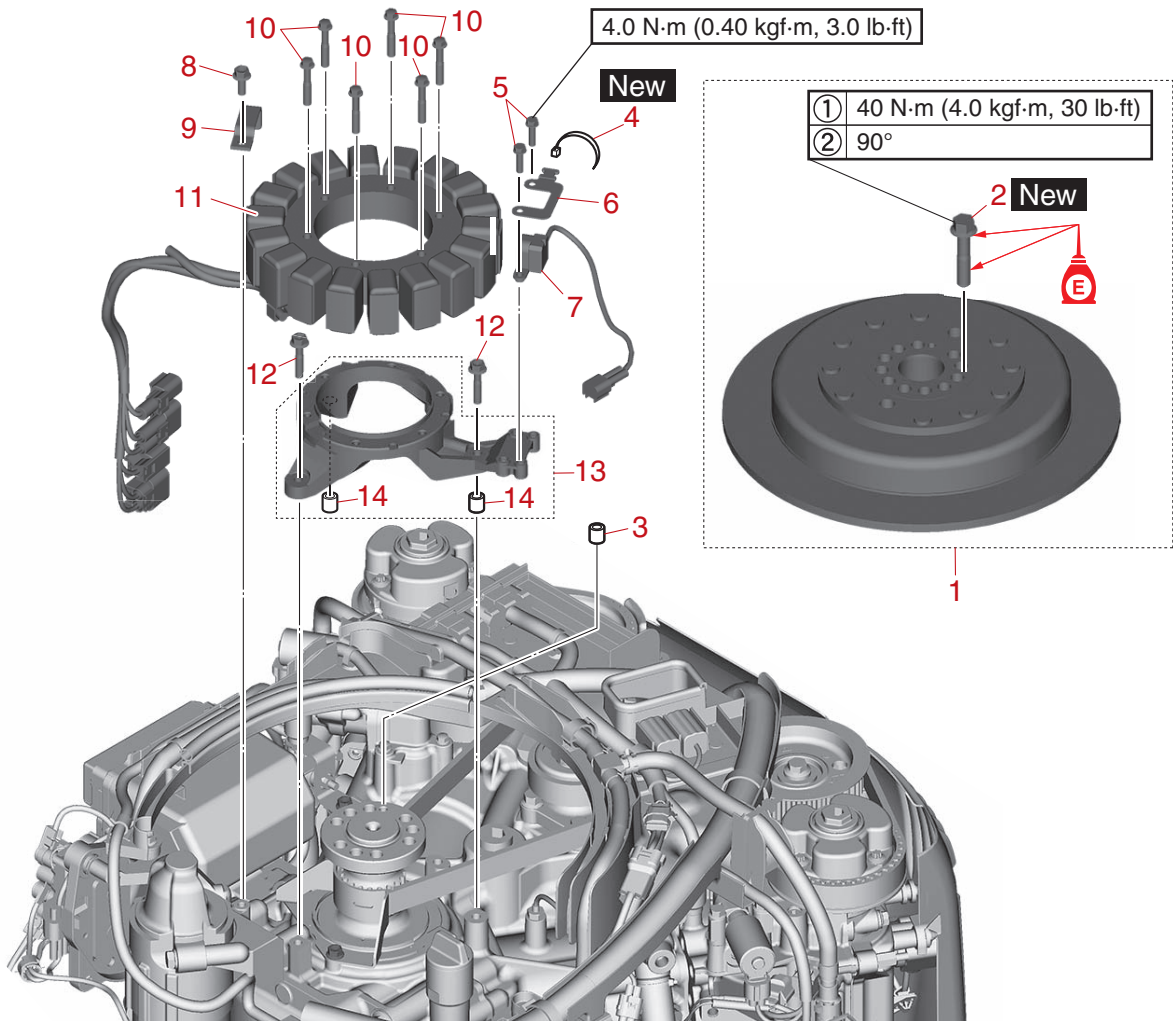
15. Install:

- Rigging grommet "1"
- Grommet holder "2"

See "Installing the rigging grommet" (3-8).



Flywheel magneto



↕	Part name	Q'ty	Remarks
1	Flywheel magneto	1	
2	Bolt M10 × 50 mm	6	
3	Dowel pin	1	
4	Plastic tie	1	
5	Bolt M5 × 20 mm	2	
6	Bracket	1	
7	Pulser coil	1	
8	Bolt M6 × 16 mm	1	
9	Holder	1	
10	Bolt M6 × 35 mm	6	
11	Stator assembly	1	
12	Bolt M6 × 30 mm	4	
13	Base assembly	1	
14	Dowel	2	

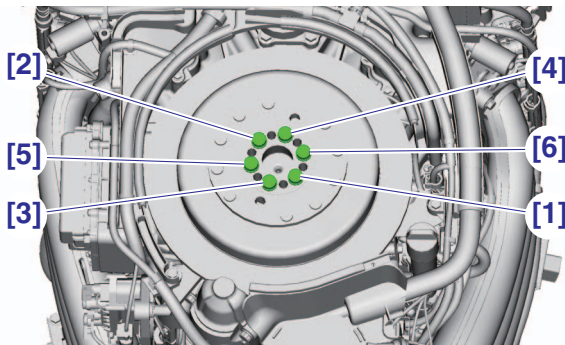
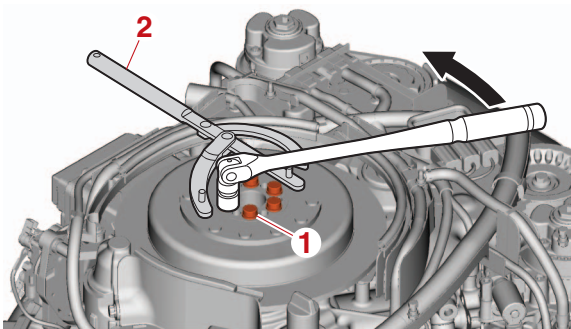



## Removing the flywheel magneto

1. Remove:
  - Flywheel magneto
    - a. Loosen the flywheel magneto bolts “1” in the order [1], [2], and so on, and then remove the flywheel magneto and dowel pin.

### NOTICE

Apply force in the direction of the arrow to prevent the special service tool “2” from slipping off easily.




	Rotor holder “2” 90890-01235 Universal magneto and rotor holder “2” YU-01235
---	--

2. Disconnect:
  - Stator assembly coupler
  - Pulser coil coupler
3. Remove:
  - Holder
  - Stator assembly
  - Pulser coil
  - Base

## Installing the flywheel magneto

1. Install:
  - Dowel
  - Base
  - Pulser coil
  - Bracket
  - Plastic tie **New**
  - Stator assembly
  - Holder
  - Dowel pin

	Pulser coil bolt 4.0 N·m (0.40 kgf·m, 3.0 lb·ft)
---	---

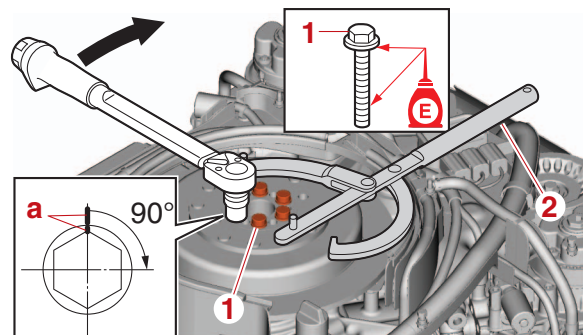
2. Connect:
  - Stator assembly coupler
  - Pulser coil coupler
3. Install:
  - Flywheel magneto
    - a. Install the flywheel magneto, and then tighten new flywheel magneto bolts “1” to the specified torques in 2 stages and in the order [1], [2], and so on.

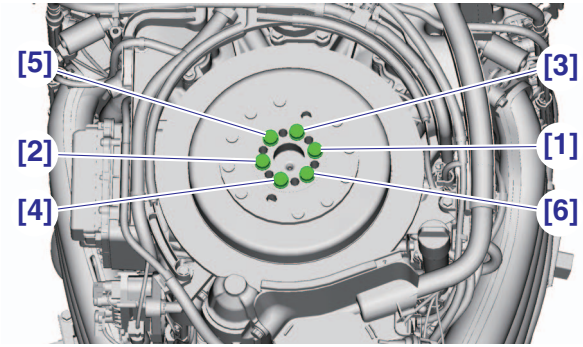
### NOTICE


Apply force in the direction of the arrow to prevent the special service tool “2” from slipping off easily.


### TIP:

In the second tightening stage for the flywheel magneto bolts “1”, mark the bolts and flywheel magneto with identification marks “a”, and then tighten the bolts 90° from the marks on the flywheel magneto.

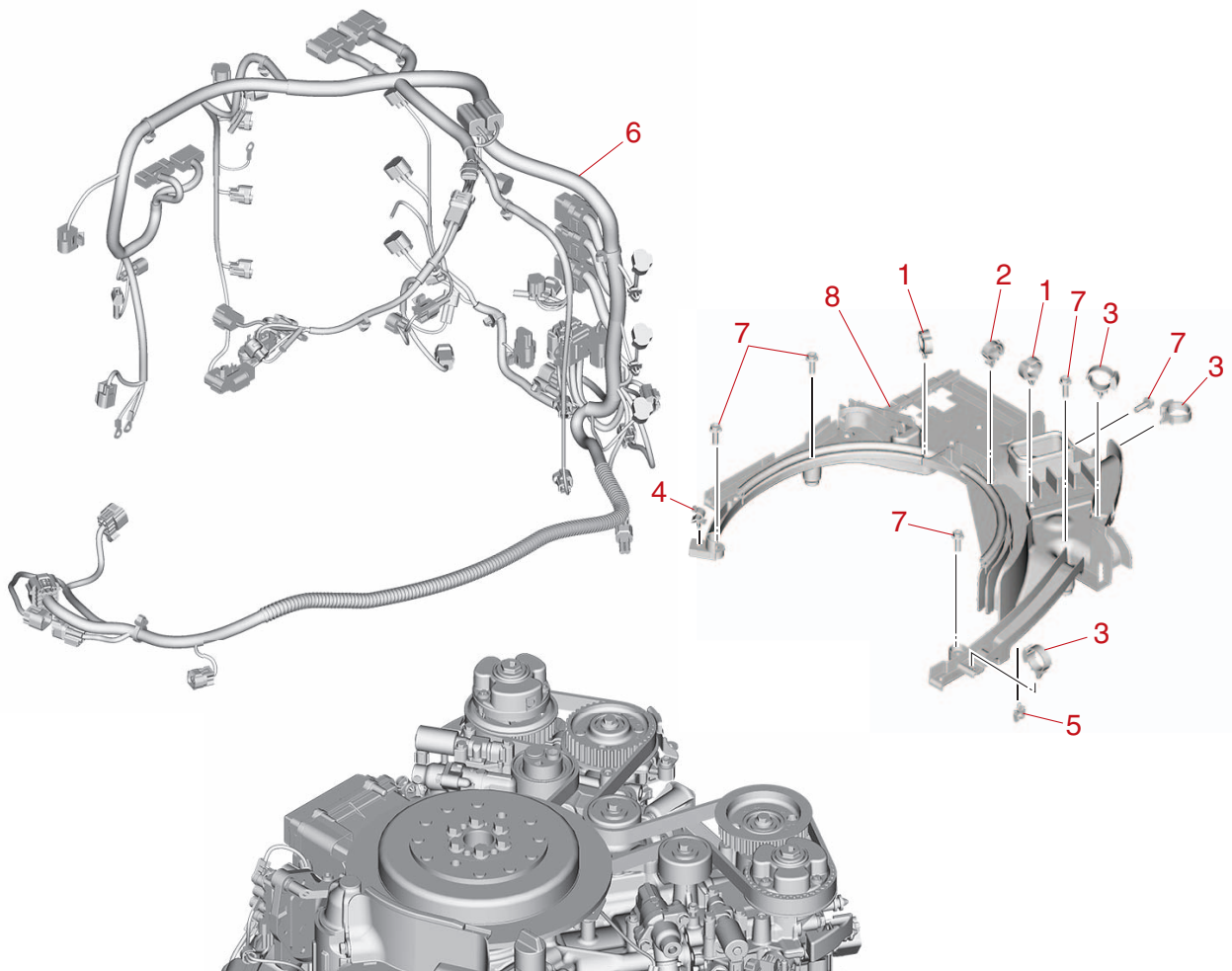




	<p>Rotor holder "2" 90890-01235 Universal magneto and rotor holder "2" YU-01235</p>
---	---

	<p>Flywheel magneto bolt "1" 1st: 40 N·m (4.0 kgf·m, 30 lb·ft) 2nd: 90°</p>
---	---

## Wire harness



↕	Part name	Q'ty	Remarks
1	Holder	2	
2	Holder	1	
3	Holder	3	
4	Holder	1	
5	Holder	1	
6	Wire harness	1	
7	Bolt M6 × 20 mm	5	
8	Wire harness guide	1	

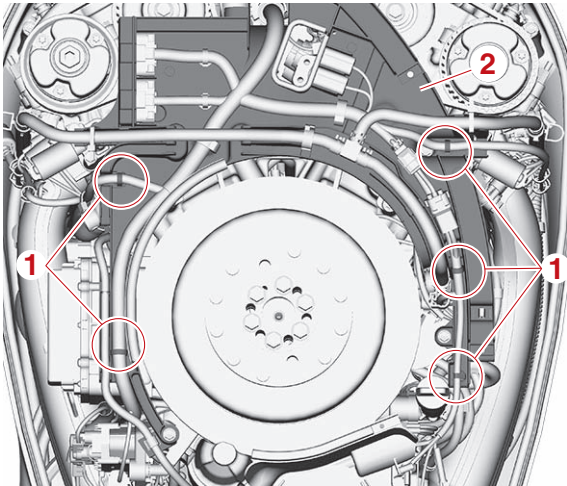


### Installing the wire harness

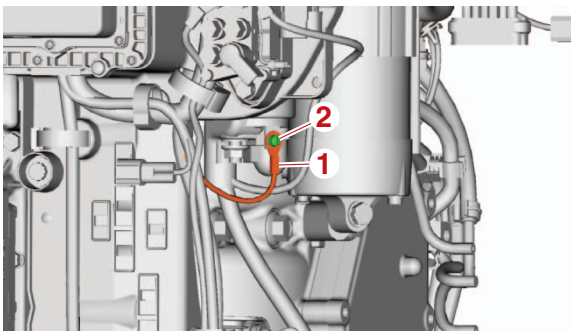
Route the wire harness.


See “Electrical component and wire harness routing” (5-1).

1. Install:
  - Wire harness guide
  - Holder “1” (to the wire harness guide “2”)

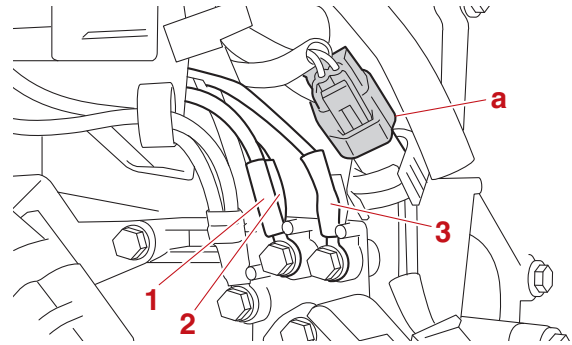


2. Install:
  - Starter motor lead “1”
  - Starter motor lead screw “2”

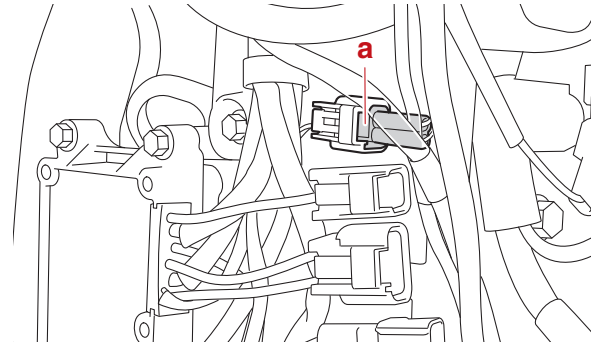


	<p>Starter motor lead screw “2” 2.0 N·m (0.20 kgf·m, 1.5 lb·ft)</p>
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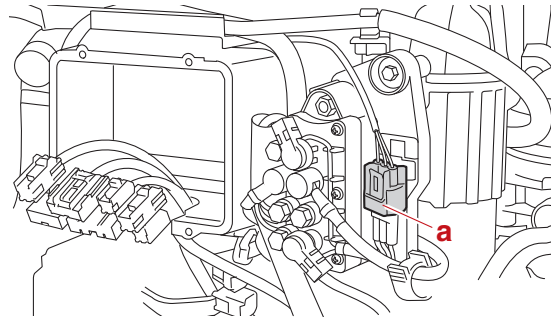
3. Install:
  - Ground lead “1”, “2”, “3”
4. Connect:
  - Shift actuator coupler “a”



5. Connect:
  - Rectifier/regulator/isolator coupler “a”

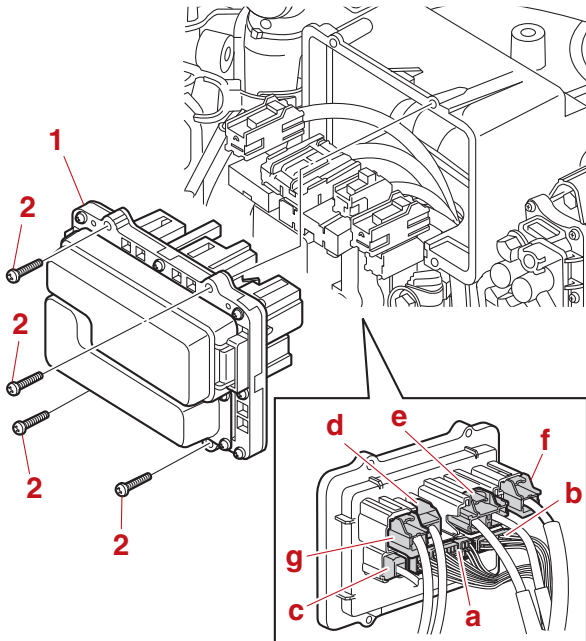



6. Connect:
  - PTT relay coupler “a”



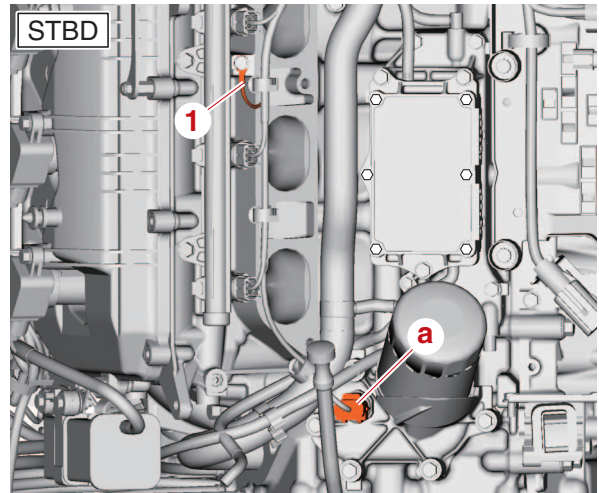
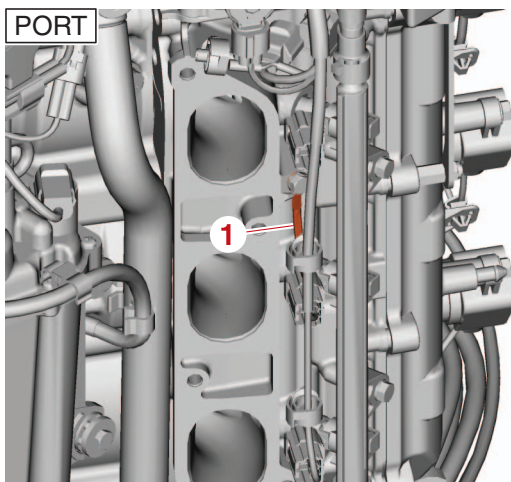
7. Connect:
  - Fuse holder coupler “a”, “b”
  - Rectifier/regulator/isolator coupler “c”, “d”, “e”
  - Power source coupler “f”
  - Isolator coupler “g”

8. Install:
- Fuse box "1"



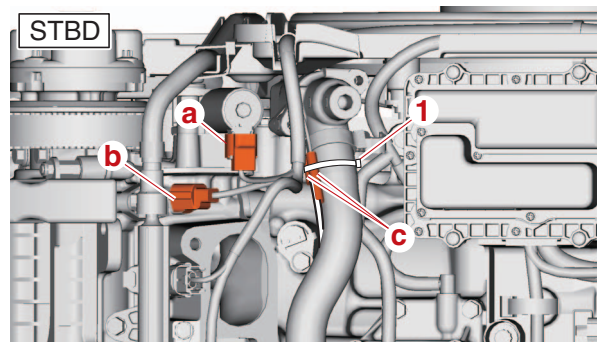
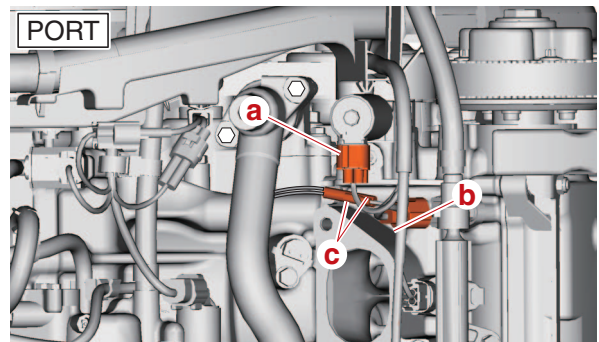
	<p>Fuse box screw "2" 2.0 N·m (0.20 kgf·m, 1.5 lb·ft)</p>
---	---

9. Install:
- Ground lead "1"
10. Connect:
- Oil pressure sensor coupler "a"



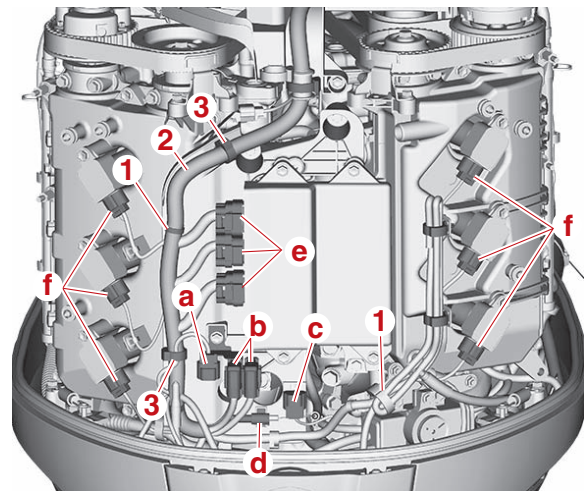
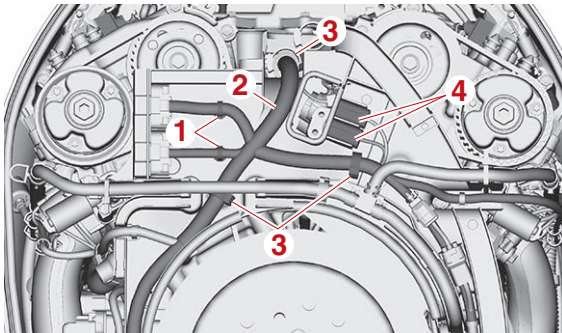
11. Connect:
- OCV coupler "a"
  - Cam position sensor coupler "b"
  - Thermo switch connector "c"

12. Install:
- Plastic tie "1" **New**



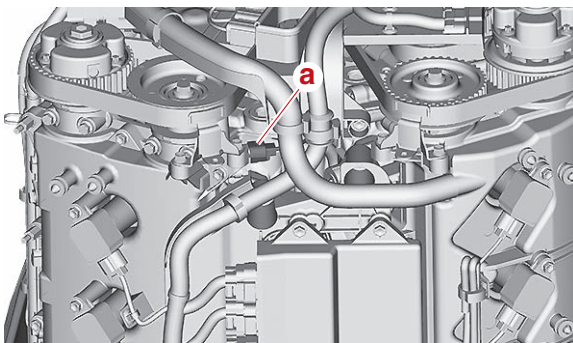
13. Install:

- Holder "1" (to the wire harness guide)
- Wire harness "2"
- Holder "3"
- Condenser "4"



14. Connect:

- Cam position sensor coupler (PORT EX) "a"



15. Install:

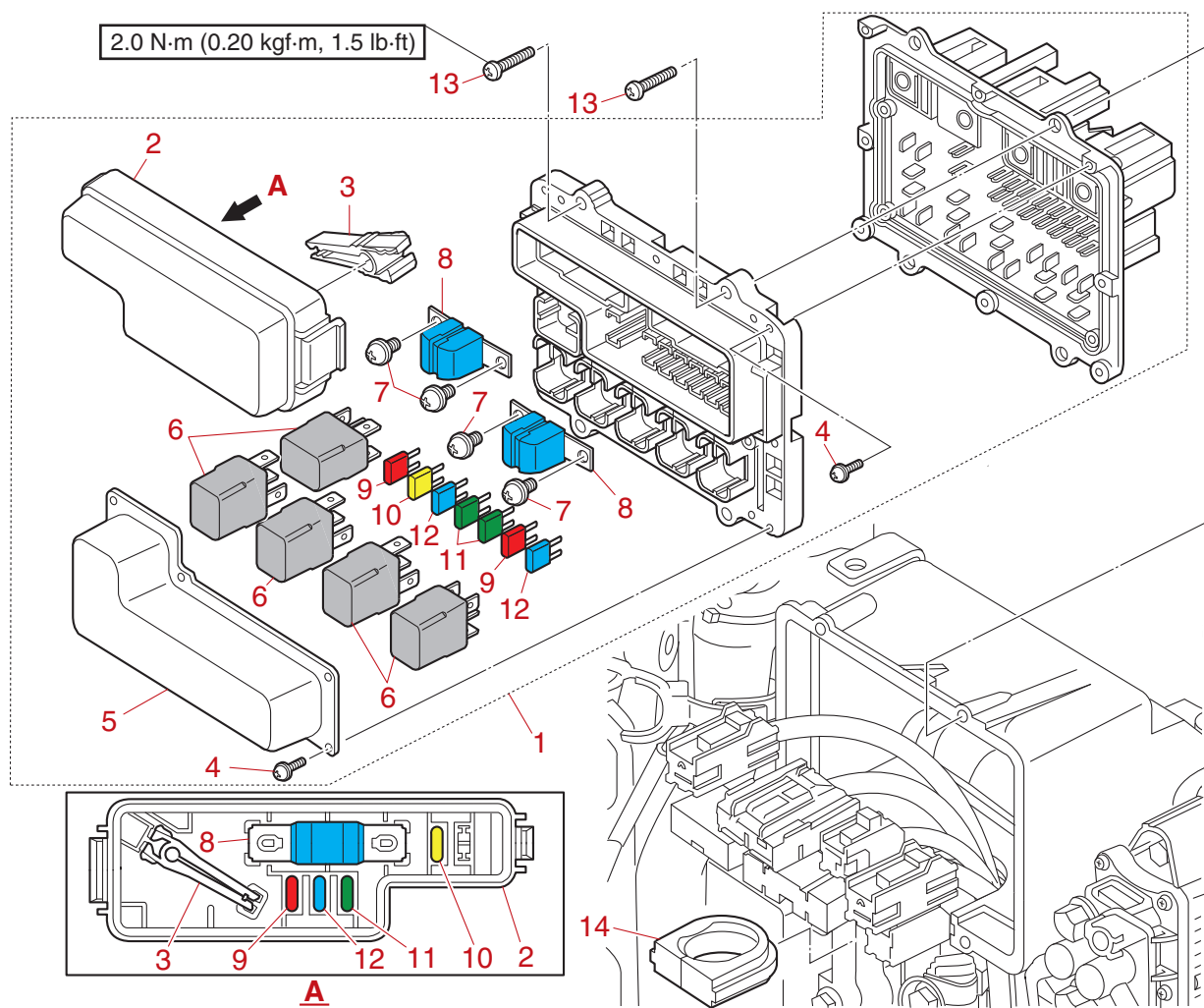
- Holder "1" (to the ECM bracket)
- Wire harness "2" (to the holders "3")

16. Connect:

- Speed sensor coupler "a"
- Joint coupler "b"
- Water pressure sensor coupler "c"
- Knock sensor coupler "d"
- Engine ECM coupler "e"
- Ignition coil coupler "f"

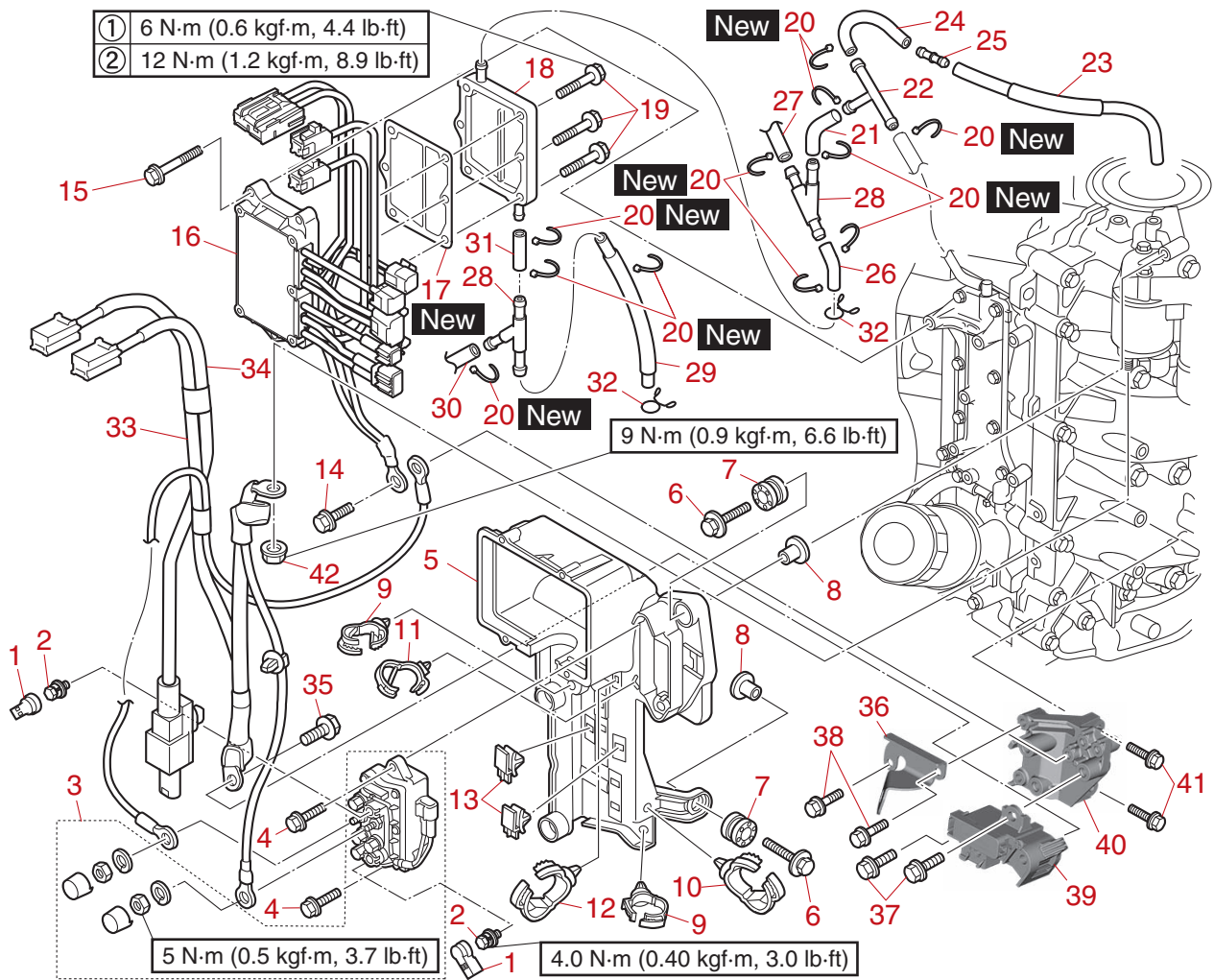


## Fuse box



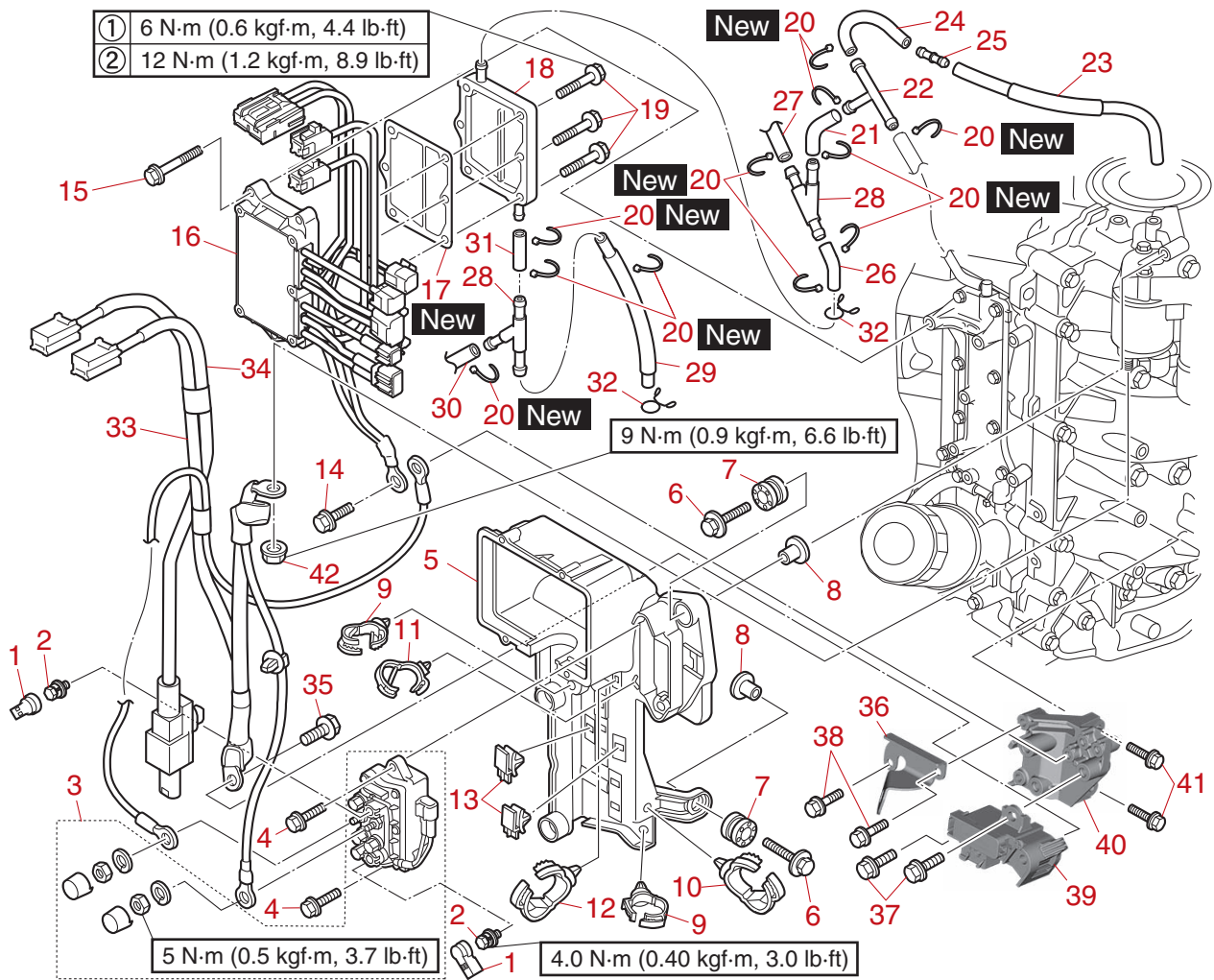
↕	Part name	Q'ty	Remarks
1	Fuse box assembly	1	
2	Cover	1	
3	Fuse puller	1	
4	Screw M3 × 10 mm	13	
5	Cover	1	
6	Relay	5	
7	Screw M5 × 10 mm	4	
8	Fuse	3	100 A, spare is included.
9	Fuse	3	10 A, spare is included.
10	Fuse	2	20 A, spare is included.
11	Fuse	3	30 A, spare is included.
12	Fuse	3	15 A, spare is included.
13	Screw M5 × 20 mm	4	
14	Grommet	1	

Junction box



↑↓	Part name	Q'ty	Remarks
1	Cap	2	
2	Bolt M6 × 10 mm	2	
3	PTT relay	1	
4	Bolt M6 × 20 mm	2	
5	Junction box	1	
6	Bolt M6 × 30 mm	5	
7	Grommet	5	
8	Collar	5	
9	Holder	2	
10	Holder	1	
11	Holder	1	
12	Holder	1	
13	Bracket	2	
14	Bolt M6 × 15 mm	1	
15	Bolt M6 × 35 mm	3	
16	Rectifier/Regulator/Isolator	1	
17	Gasket	1	

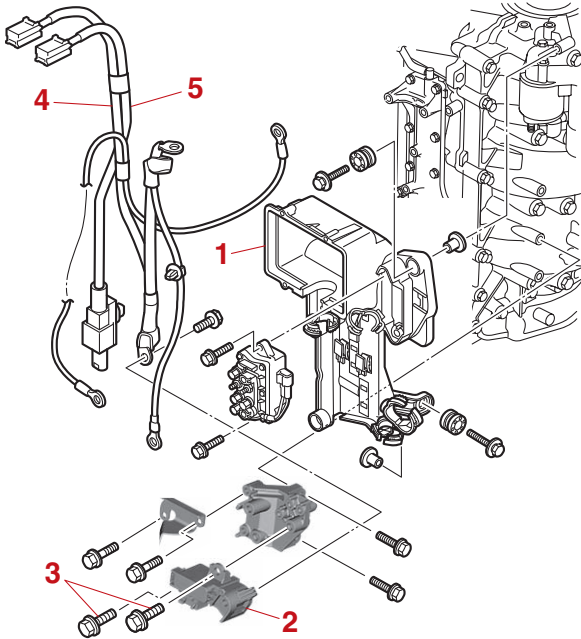
↑↓	Part name	Q'ty	Remarks
18	Cover	1	
19	Bolt M6 × 25 mm	6	
20	Plastic tie	11	
21	Hose	1	
22	Joint	1	
23	Hose	1	
24	Hose	1	
25	Joint	1	
26	Hose	1	
27	Hose	1	
28	Joint	2	
29	Hose	1	
30	Hose	1	
31	Hose	1	
32	Clamp	2	
33	Wire harness	1	
34	Isolator lead	1	Optional
35	Bolt M6 × 16 mm	1	



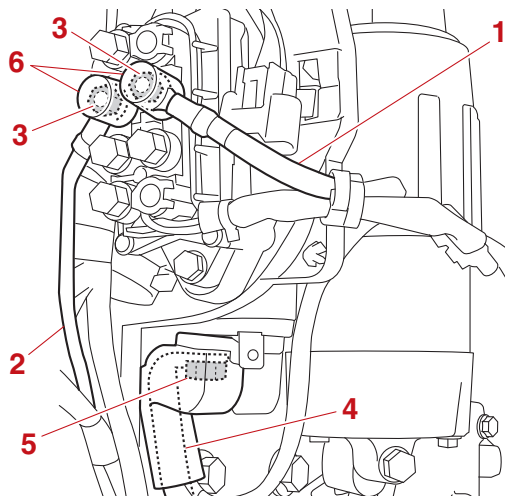
↕	Part name	Q'ty	Remarks
36	Bracket	1	
37	Bolt M8 × 20 mm	2	
38	Bolt M6 × 15 mm	2	
39	Terminal	1	
40	Bracket	1	
41	Bolt M6 × 20 mm	2	
42	Nut	1	


### Installing the junction box

1. Install:
  - Junction box "1"
  - Terminal "2"
  - Terminal bolt "3"
  - Power source lead "4"
  - Isolator lead "5" (optional)



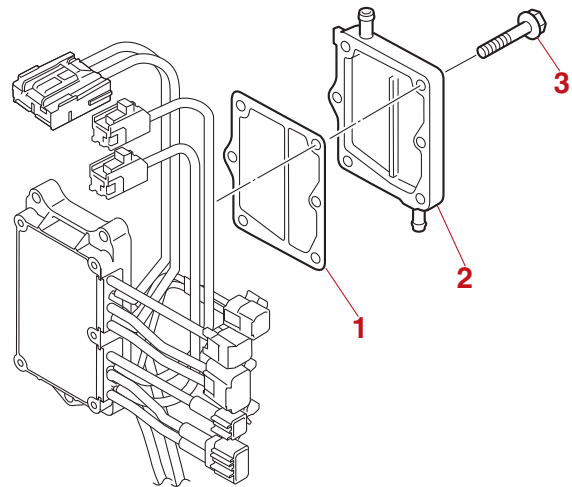
2. Install:
  - PTT relay lead "1", "2"
  - PTT relay lead nut "3"
  - Starter motor lead "4"
  - Starter motor nut "5"
  - Cap "6"




	PTT relay lead nut "3"
	5 N·m (0.5 kgf·m, 3.7 lb·ft)
	Starter motor nut "5"
	9 N·m (0.9 kgf·m, 6.6 lb·ft)

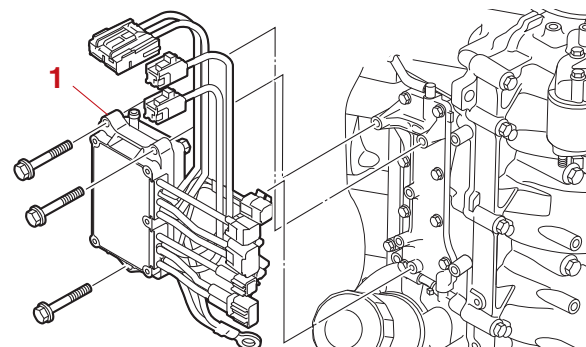
### Installing the Rectifier/Regulator/Isolator

1. Install:
  - Gasket "1" **New**
  - Cover "2"
  - Rectifier/regulator/isolator cover bolt "3"



	Rectifier/regulator/isolator cover bolt "3"
	1st: 6 N·m (0.6 kgf·m, 4.4 lb·ft)
	2nd: 12 N·m (1.2 kgf·m, 8.9 lb·ft)

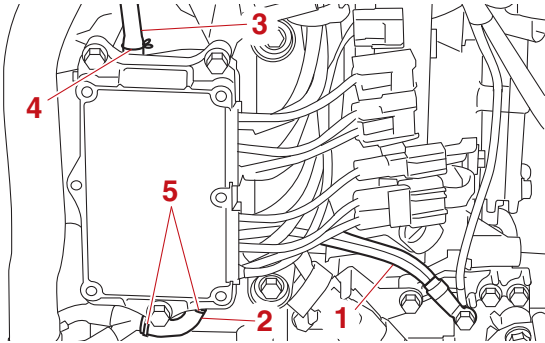
2. Install:
  - Rectifier/regulator/isolator "1"



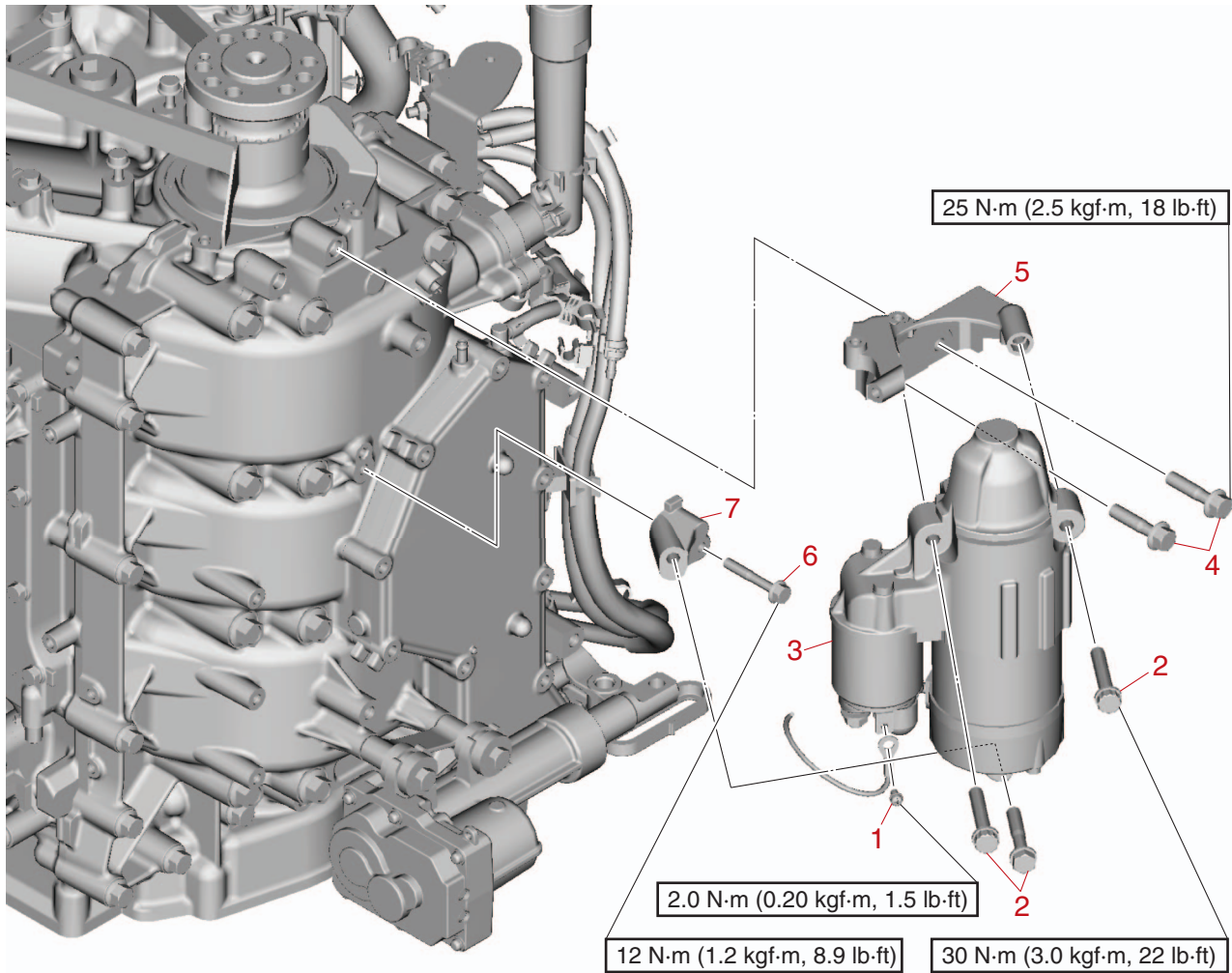


3. Install:

- Ground lead "1"
- Cooling water hose "2", "3"
- Clamp "4"
- Plastic tie "5" **New**




Starter motor



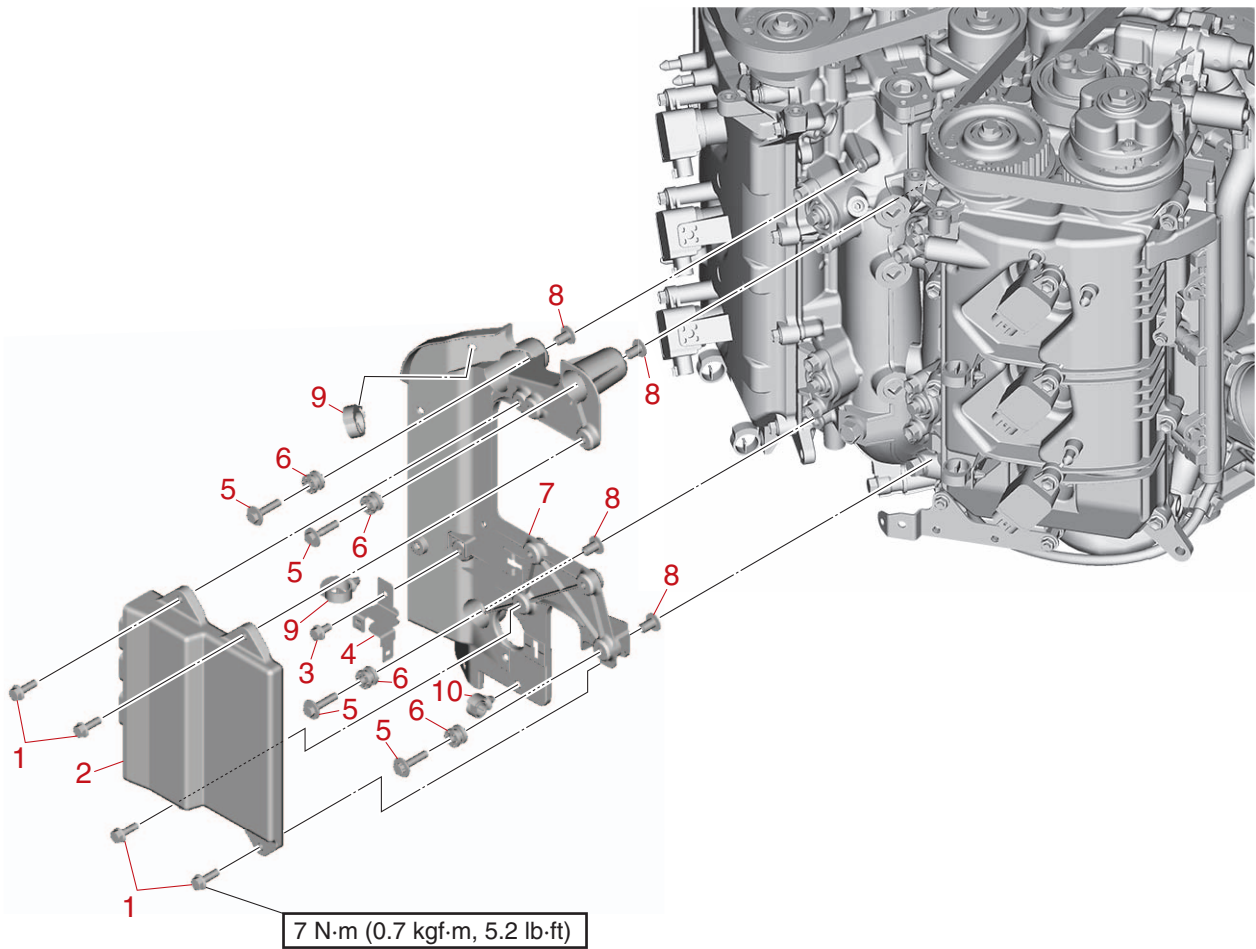
↑↓	Part name	Q'ty	Remarks
1	Screw M4 × 6 mm	1	
2	Bolt M8 × 45 mm	3	
3	Starter motor	1	
4	Bolt M8 × 35 mm	2	
5	Bracket	1	
6	Bolt M6 × 40 mm	1	
7	Bracket	1	

## Installing the starter motor

1. Install:
  - Bracket
  - Bracket bolt
  - Starter motor
  - Starter motor bolt

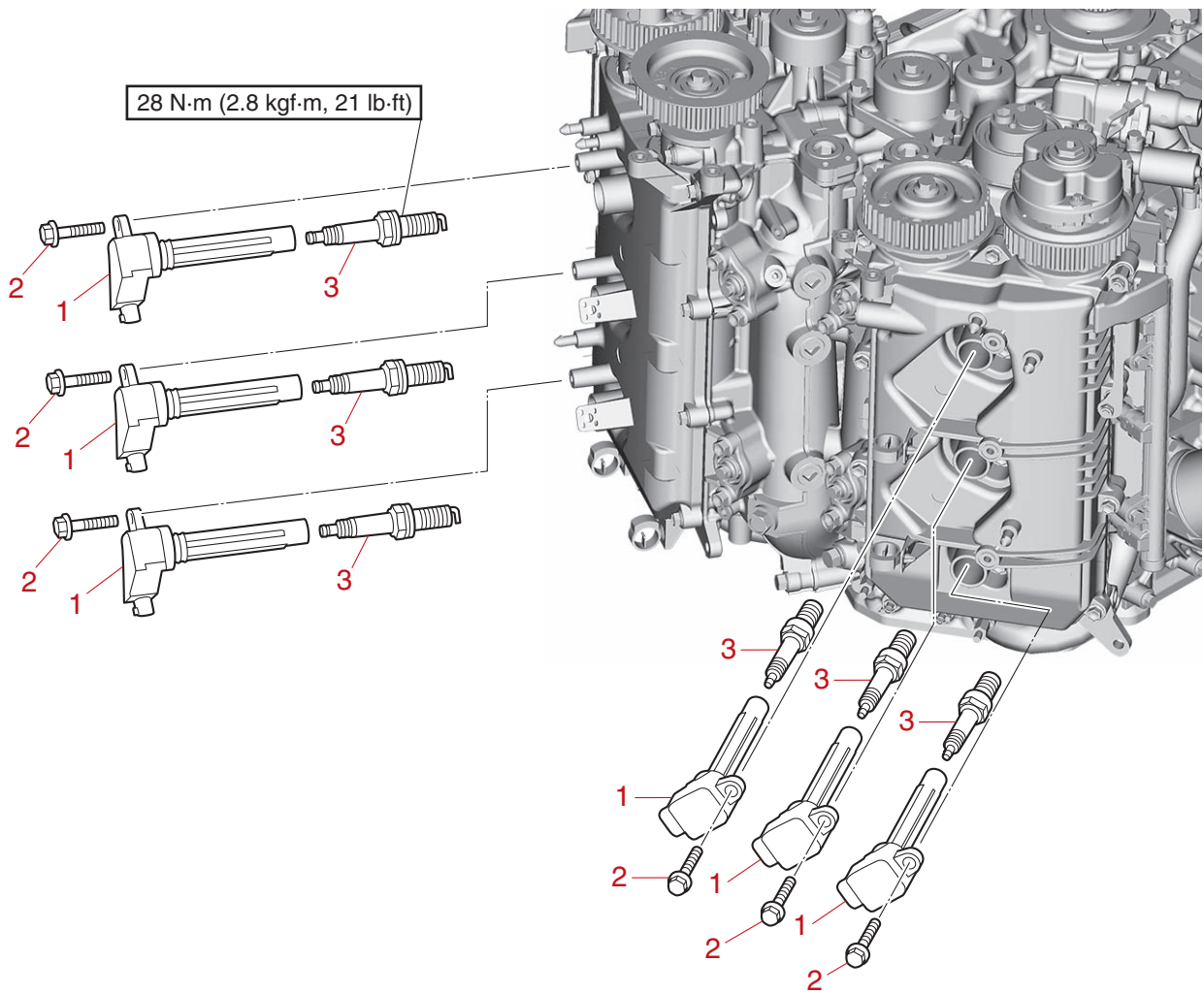
	Bracket bolt (M6) 12 N·m (1.2 kgf·m, 8.9 lb·ft)
	Bracket bolt (M8) 25 N·m (2.5 kgf·m, 18 lb·ft)
	Starter motor bolt 30 N·m (3.0 kgf·m, 22 lb·ft)

Engine ECM



↕	Part name	Q'ty	Remarks
1	Bolt M6 × 20 mm	4	
2	Engine ECM	1	
3	Bolt M6 × 12 mm	1	
4	Bracket	1	
5	Bolt M6 × 30 mm	4	
6	Grommet	4	
7	Bracket	1	
8	Collar	4	
9	Holder	2	
10	Holder	1	

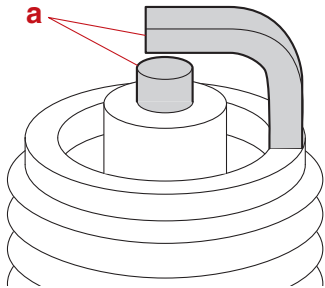
## Ignition coil and spark plug



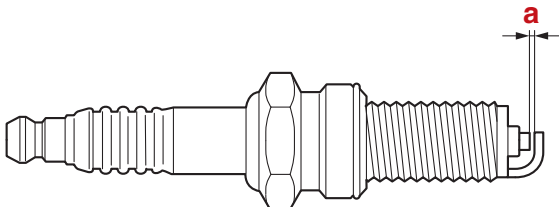
↓↑	Part name	Q'ty	Remarks
1	Ignition coil	6	
2	Bolt M6 × 25 mm	6	
3	Spark plug	6	


### Checking the spark plug

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

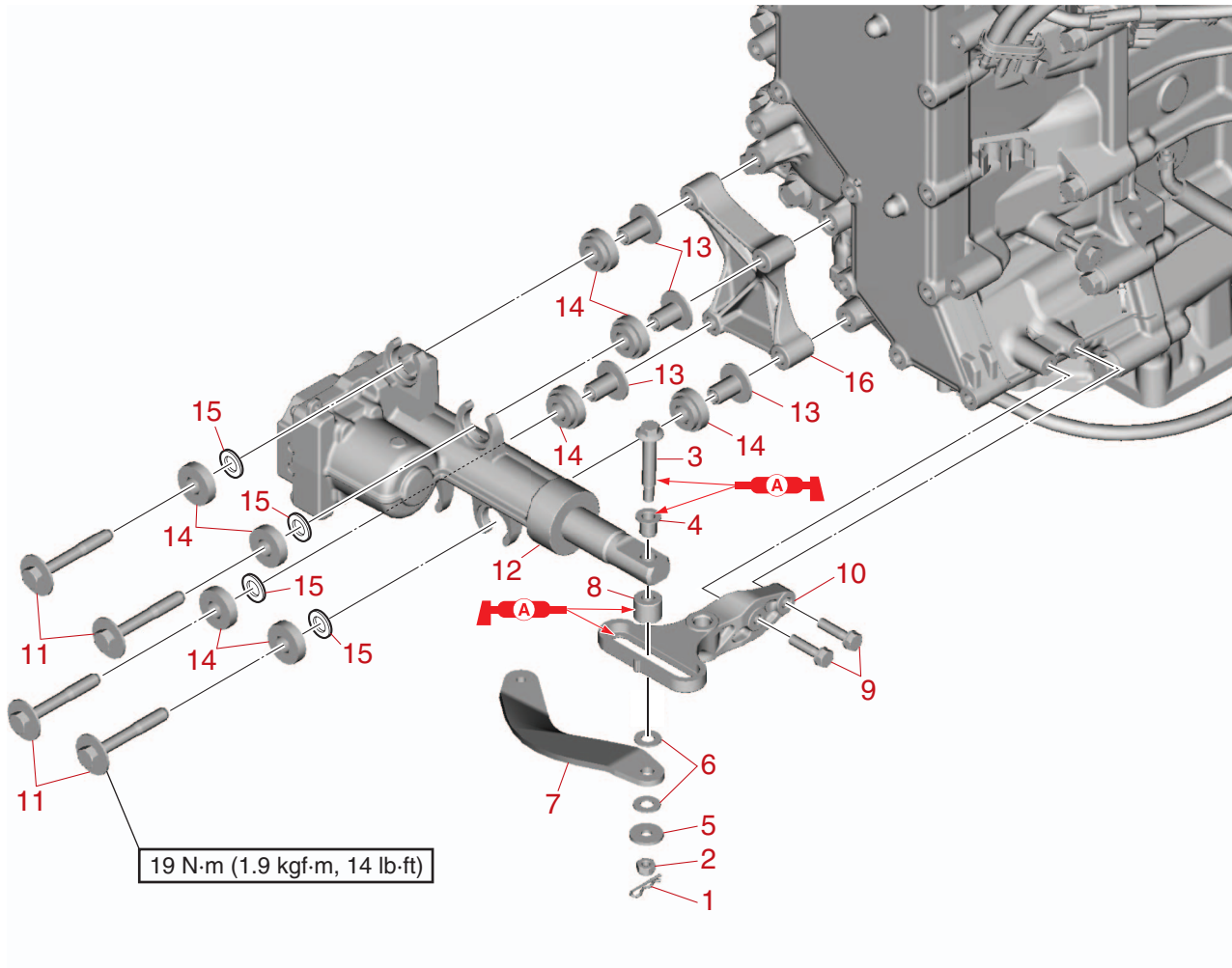


2. Check:
  - Spark plug  
Electrodes are eroded, edges of electrodes are rounded, insulator is damaged, or there is carbon or other deposits → Replace.
3. Measure:
  - Spark plug gap "a"  
Out of specification → Adjust or replace.



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

Shift actuator

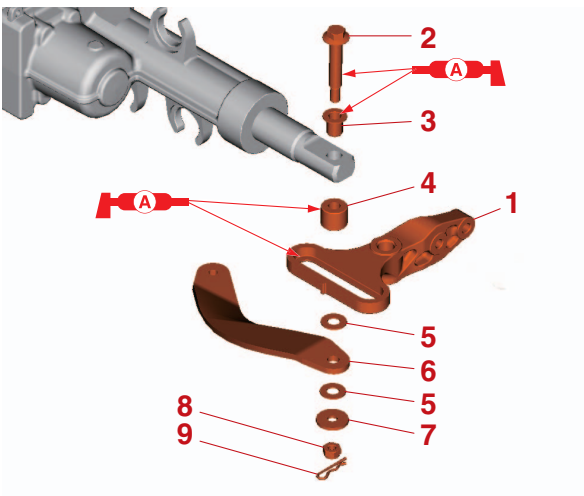


∩∩	Part name	Q'ty	Remarks
1	Clip	1	
2	Nut M6	1	
3	Joint pin	1	
4	Bushing	1	
5	Washer	1	
6	Washer	2	
7	Shift lever	1	
8	Bushing	1	
9	Bolt M6 × 25 mm	2	
10	Bracket	1	
11	Bolt M8 × 60 mm	4	
12	Shift actuator	1	
13	Collar	4	
14	Bushing	8	
15	Washer	4	
16	Bracket	1	



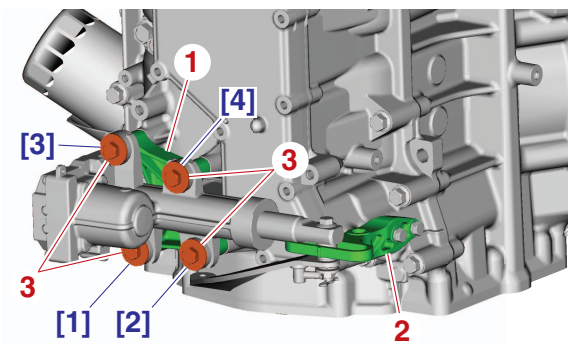
## Assembling the shift actuator assembly


1. Install:
  - Bracket "1"
  - Joint pin "2"
  - Bushing "3"
  - Bushing "4"
  - Washer "5"
  - Shift lever "6"
  - Washer "7"
  - Nut "8"
  - Clip "9"



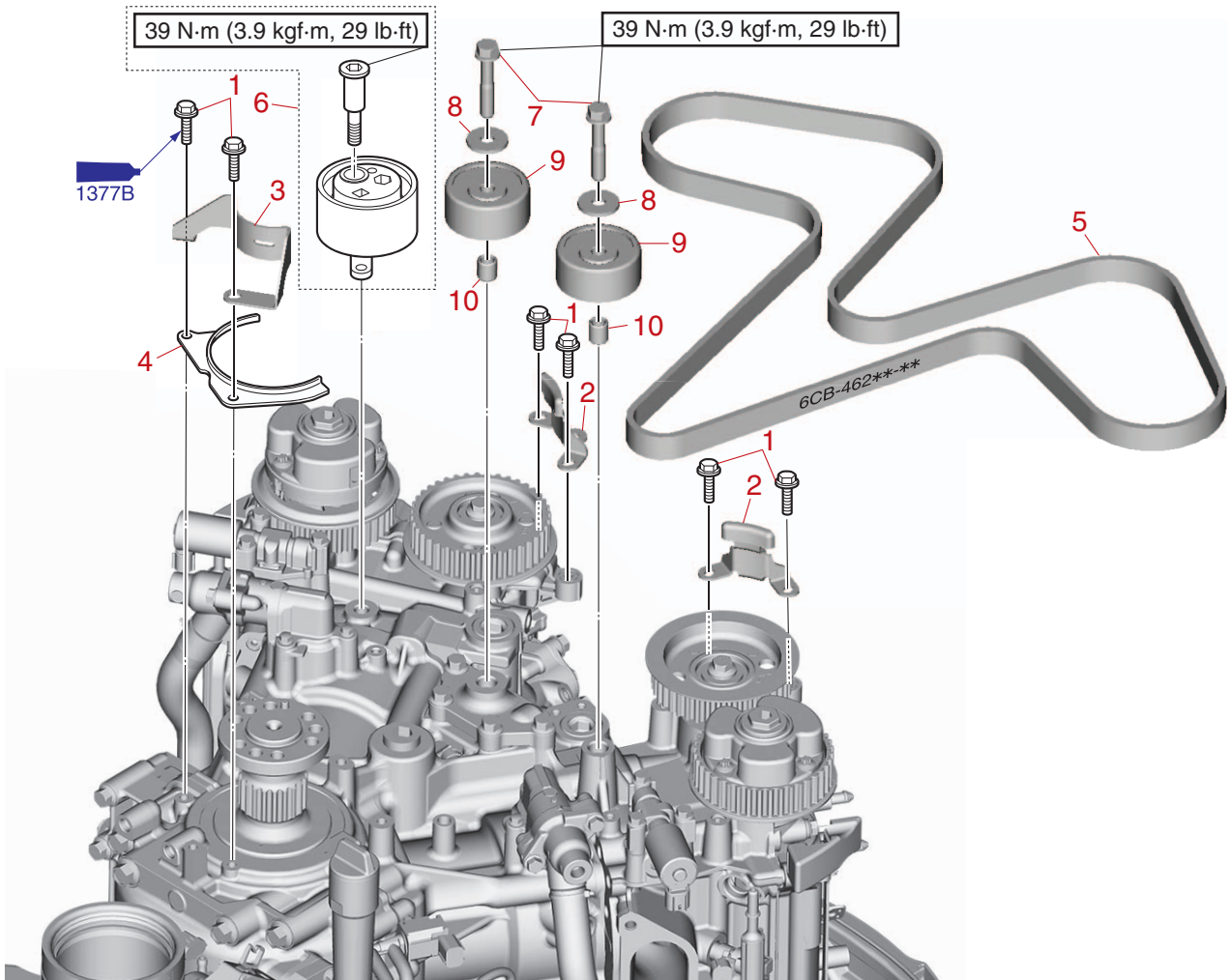
## Installing the shift actuator assembly

1. Install:
  - Bracket "1"
  - Shift actuator
  - Bracket "2"
  - Shift actuator bolt "3"
    - a. Tighten the shift actuator bolts "3" to the specified torques in the order [1], [2], and so on.



	<p>Shift actuator bolt "3" 19 N·m (1.9 kgf·m, 14 lb·ft)</p>
---	---

Timing belt



↕	Part name	Q'ty	Remarks
1	Bolt M6 × 14 mm	6	
2	Guide	2	
3	Guide	1	
4	Plate	1	
5	Timing belt	1	
6	Timing belt tensioner	1	
7	Bolt M10 × 55 mm	2	
8	Washer	2	
9	Pulley	2	
10	Collar	2	

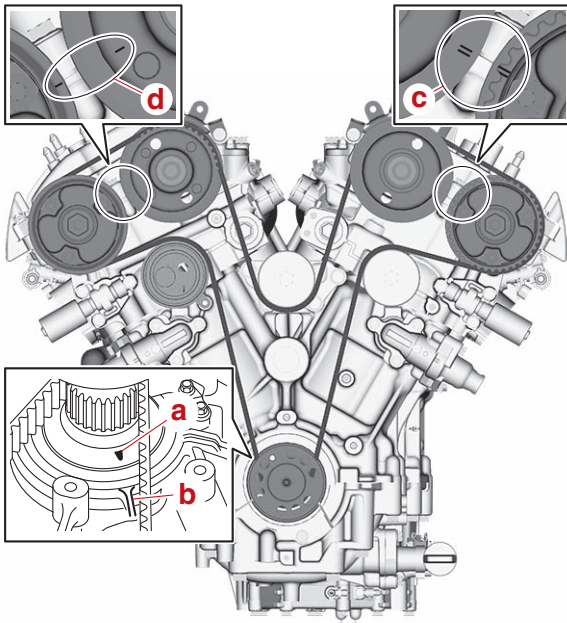
## Removing the timing belt

### NOTICE

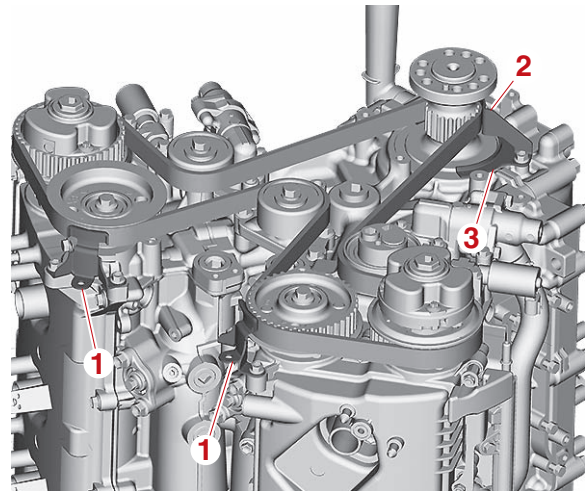
When the timing belt is not installed, do not turn the crankshaft, driven sprocket or VCT assembly. Otherwise, the pistons and valves could collide with each other and be damaged.

#### 1. Remove:

- Timing belt
  - a. Align the large “▲” mark “a” on the crankshaft with the rib “b” on the cylinder block.
  - b. Check that the “II” marks “c” on the VCT assembly (PORT) and driven sprocket (PORT) are aligned, and check that the “I” marks “d” on the VCT assembly (STBD) and driven sprocket (STBD) are aligned.



- c. Remove the timing belt guides “1” and “2” and plate “3”.



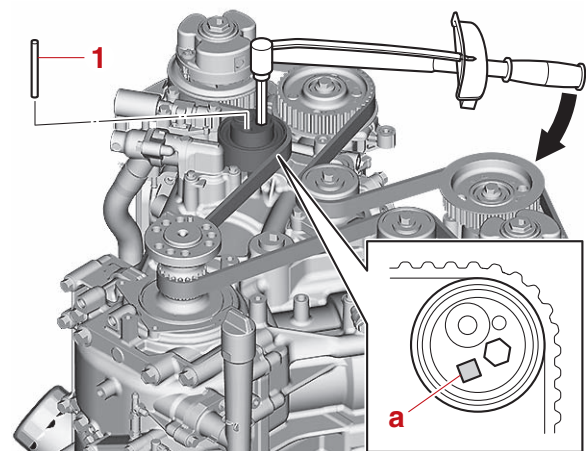
- d. Hold the timing belt tensioner, applying a torque of 15 N·m (1.5 kgf·m, 11.1 lb·ft) or less clockwise, using a hexagon wrench for 20 seconds, and then insert a 5.0 mm (0.2 in) diameter pin “1” into the hole “a”.

### NOTICE

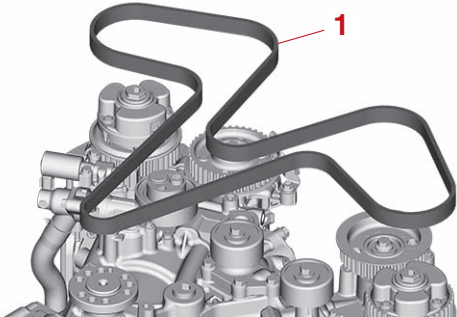
Do not turn the timing belt tensioner by applying a torque higher than 15 N·m (1.5 kgf·m, 11.1 lb·ft). Otherwise, the timing belt tensioner could be damaged.

#### TIP:

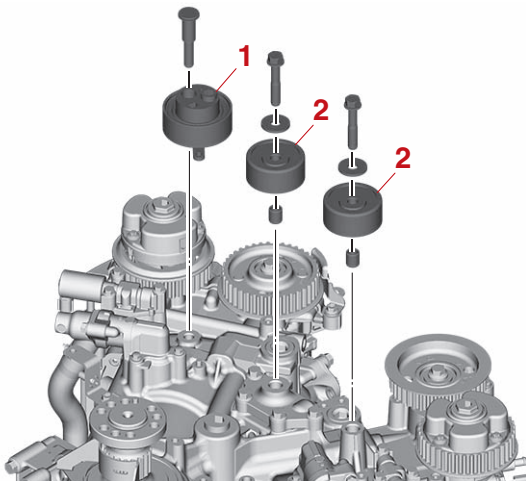
Leave the pin “1” inserted into the hole “a” of the timing belt tensioner until the timing belt is installed again.



- e. Remove the timing belt "1" from the VCT assembly (PORT) or driven sprocket (STBD), and then remove it from the crankshaft.



- f. Remove the timing belt tensioner "1" and pulleys "2".



### Checking the timing belt

- Check:
  - Interior and exterior of the timing belt  
Cracked/damaged/worn → Replace.

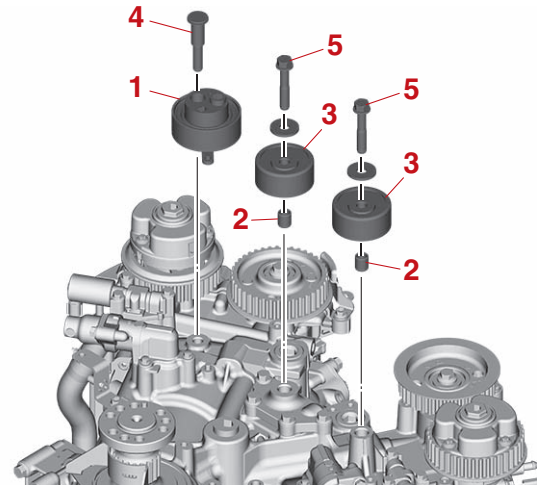
### Installing the timing belt

#### NOTICE

When the timing belt is not installed, do not turn the crankshaft, driven sprocket or VCT assembly. Otherwise, the pistons and valves could collide with each other and be damaged.

- Install:
  - Timing belt

- a. Install the timing belt tensioner "1", collars "2", and pulleys "3", and then tighten the timing belt tensioner bolt "4" and pulley bolts "5" to the specified torque.



Timing belt tensioner bolt "4"  
39 N·m (3.9 kgf·m, 29 lb·ft)  
Pulley bolt "5"  
39 N·m (3.9 kgf·m, 29 lb·ft)

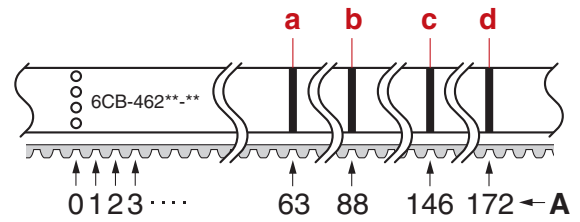
- b. Install the timing belt "1" onto the crankshaft so that the part number "a" is in the upright position and the belt position mark "b" is aligned with the small "▲" mark on the crankshaft.

#### NOTICE

**Do not apply grease or oil to the timing belt.**

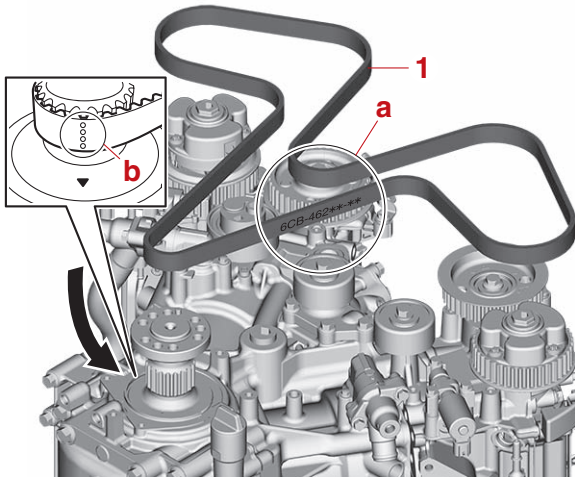


**TIP:** Before installing the timing belt, make sure that the marks on the crankshaft and cylinder block are aligned. Also, make sure that the marks on the VCT assemblies and driven sprockets are aligned. See “Removing the timing belt” (7-34).

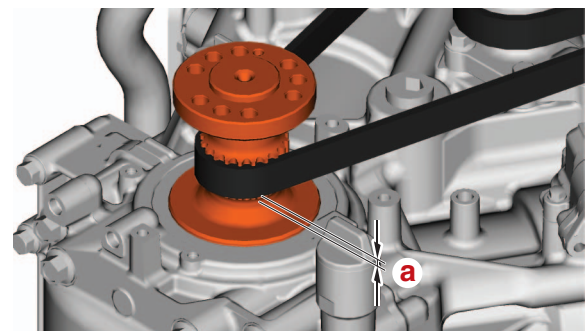



A. Belt teeth number

- d. Adjust the timing belt installation height “a” to specification.



- c. Install the timing belt onto the VCT assemblies and driven sprockets by aligning the belt position marks “a”, “b”, “c”, and “d” with the “▲” marks in the order listed.

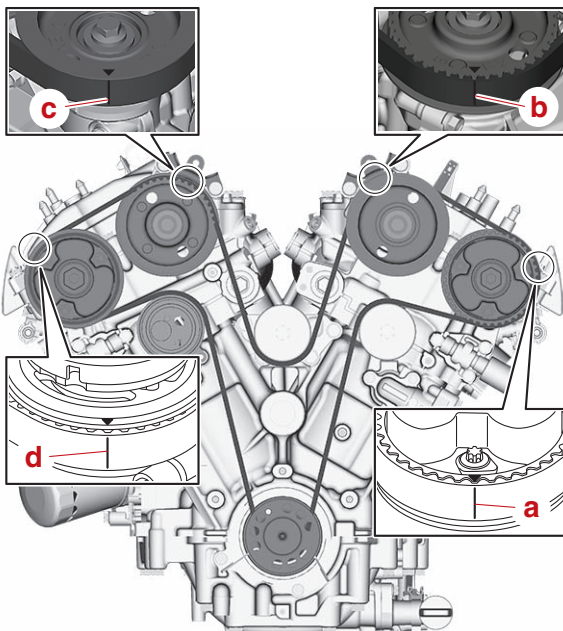


	Timing belt installation height “a” 2.5 mm (0.10 in)
---	---

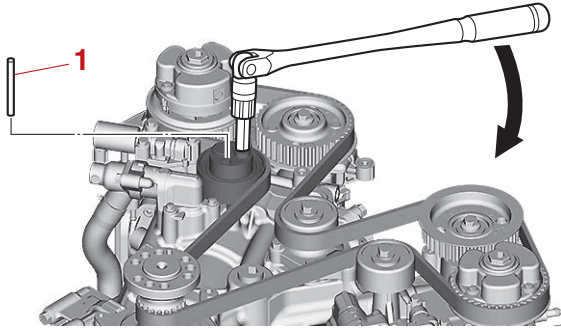
- e. While holding the timing belt tensioner applying a torque of 15 N·m (1.5 kgf·m, 11.1 lb·ft) or less clockwise using a hexagon wrench, remove the pin “1”.

**NOTICE**

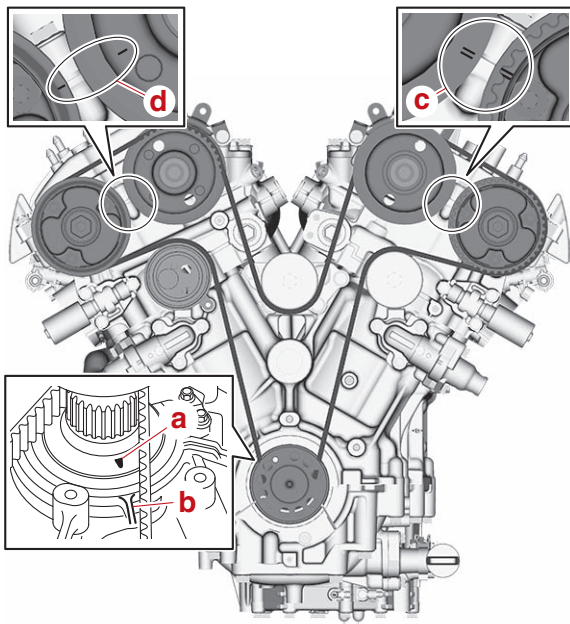
Do not turn the timing belt tensioner by applying a torque higher than 15 N·m (1.5 kgf·m, 11.1 lb·ft). Otherwise, the timing belt tensioner could be damaged.



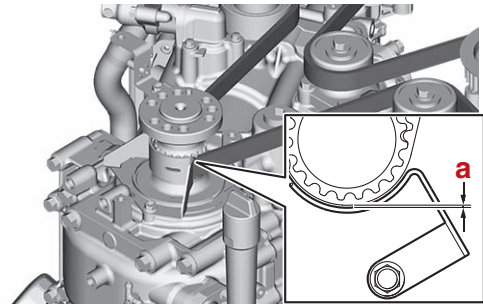
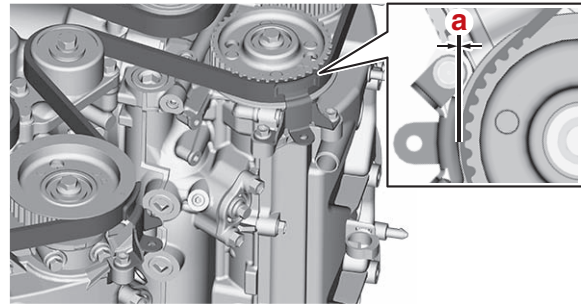
**TIP:** \_\_\_\_\_  
 Make sure that the belt position marks are aligned with the “▲” marks. See steps (b) and (c).




- f. Turn the timing belt tensioner gradually counterclockwise until the timing belt is taut.
- g. Install the timing belt guides and plate.
- h. Turn the crankshaft clockwise 2 full turns until the large “▲” mark “a” on the crankshaft is aligned with the rib “b” on the cylinder block. Check that the marks “c” and “d” on the VCT assemblies and driven sprockets are aligned.

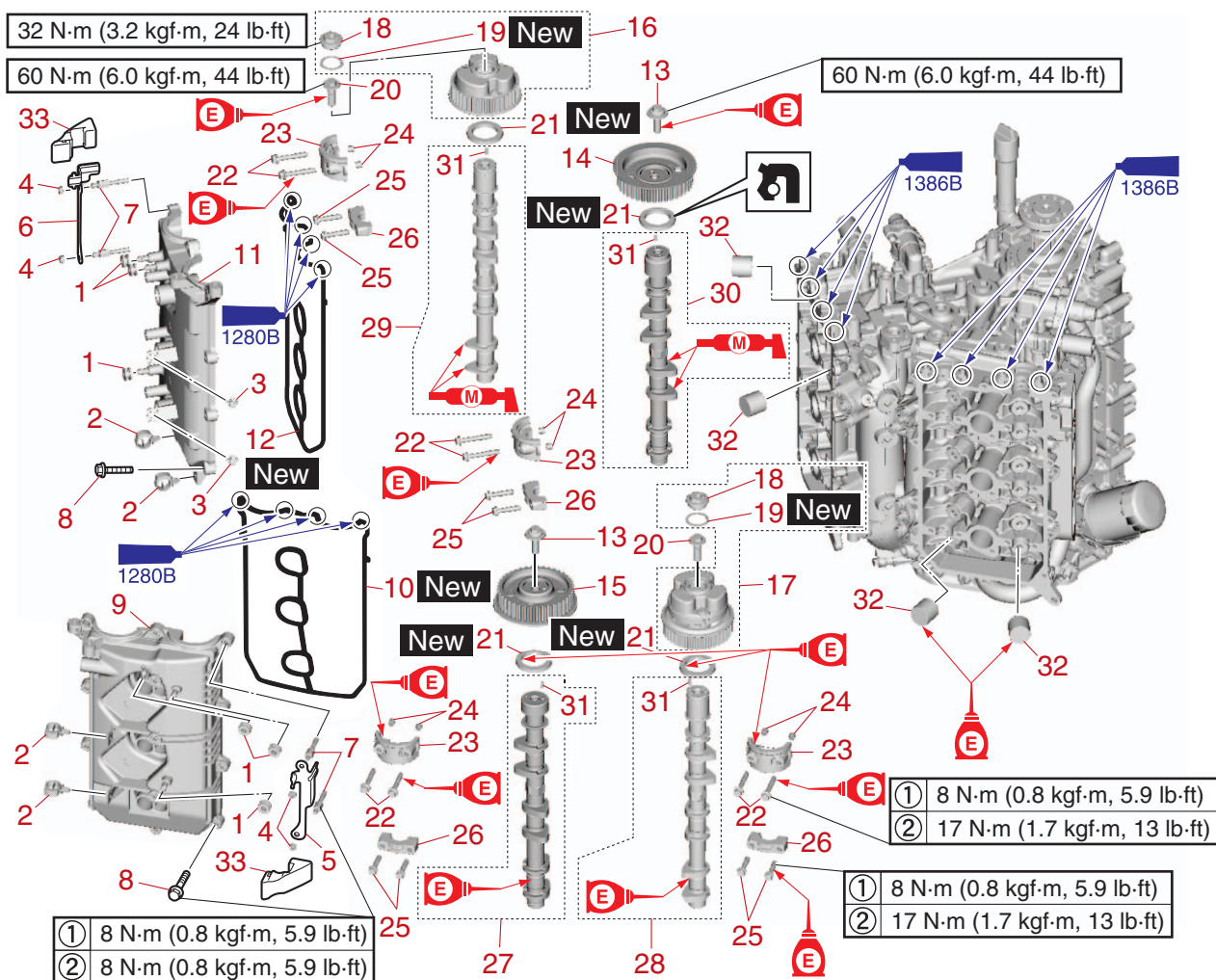


- i. Adjust the timing belt guide clearance “a”.



	Timing belt guide clearance “a” 0.5–1.5 mm (0.02–0.06 in)
---	--

# Camshaft



№	Part name	Q'ty	Remarks
1	Grommet	6	
2	Holder	4	
3	Holder	2	
4	Nut	4	
5	Bracket	1	
6	Bracket	1	
7	Bolt	4	
8	Bolt M6 × 30 mm	20	
9	Cylinder head cover	1	STBD
10	Gasket	1	STBD
11	Cylinder head cover	1	PORT
12	Gasket	1	PORT
13	Bolt M10 × 35 mm	2	
14	Driven sprocket	1	
15	Driven sprocket	1	
16	VCT assembly	1	PORT
17	VCT assembly	1	STBD
18	Cap	2	

№	Part name	Q'ty	Remarks
19	Gasket	2	
20	Bolt	2	
21	Oil seal	4	
22	Bolt M7 × 48 mm	8	
23	Camshaft cap	4	
24	Collar	8	
25	Bolt M7 × 36 mm	24	
26	Camshaft cap	12	
27	Camshaft	1	STBD EX
28	Camshaft	1	STBD IN
29	Camshaft	1	PORT IN
30	Camshaft	1	PORT EX
31	Dowel pin	4	
32	Valve lifter	24	
33	Damper	2	



## Removing the camshaft, VCT assembly, and driven sprocket

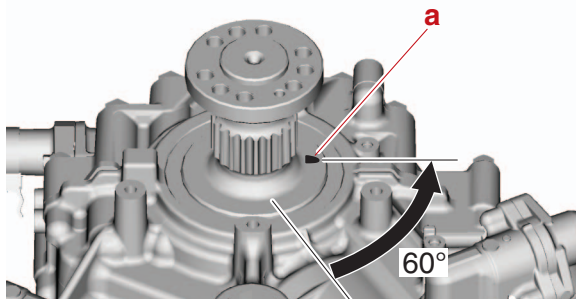
### NOTICE

When the timing belt is not installed, do not turn the crankshaft or camshafts. Otherwise, the intake and exhaust valves could collide with each other or with the pistons and be damaged.

1. Remove:
  - Cylinder head cover  
See "Camshaft" (7-38).
2. Remove:
  - VCT assembly
  - Driven sprocket
    - a. Turn the crankshaft counterclockwise 60° gradually until the large "▲" mark "a" on the crankshaft is aligned with the mating surface of the crankcase and cylinder block.

### NOTICE

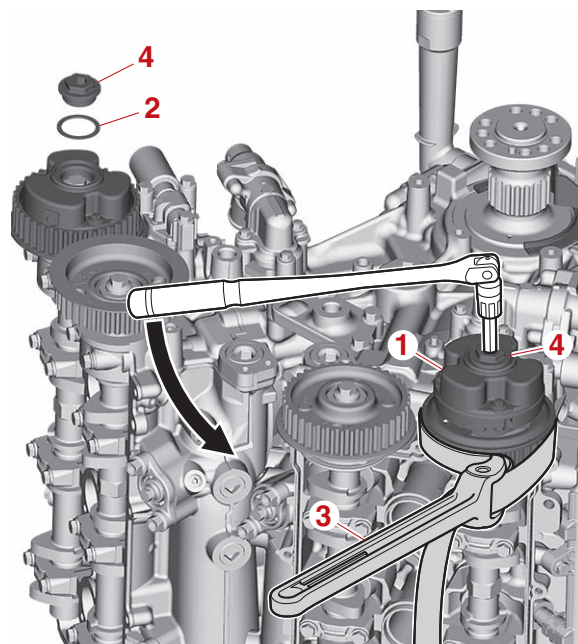
Do not turn the crankshaft clockwise more than 60°. Otherwise, the pistons and valves could collide with each other and be damaged.



- b. Secure the VCT assemblies "1" and "2" using the special service tool "3", and then remove the VCT caps "4".

### NOTICE

- When removing the VCT cap, do not secure the camshaft. Otherwise, the VCT assembly could be damaged.
- When removing the VCT cap, do not turn the VCT assembly. Otherwise, the intake and exhaust valves could collide with each other and be damaged.

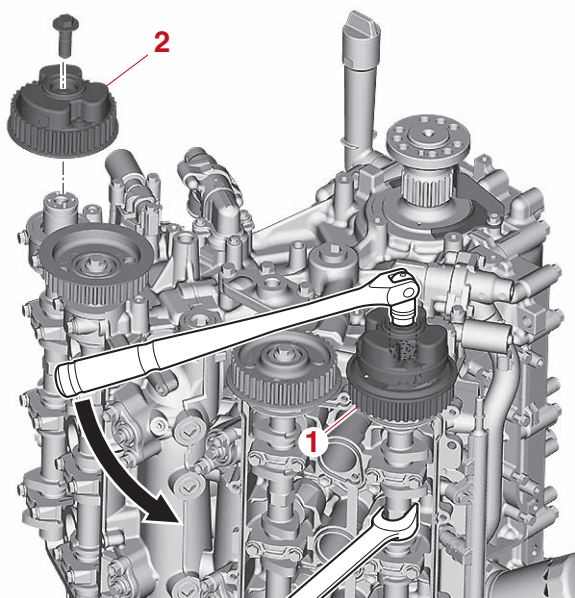


Rotor holding tool "3"  
90890-04166  
Rotor holding tool "3"  
YM-04166

- c. Remove the special service tool.
- d. Secure the intake camshaft using a wrench, and then remove the VCT assemblies "1" and "2".

**NOTICE**

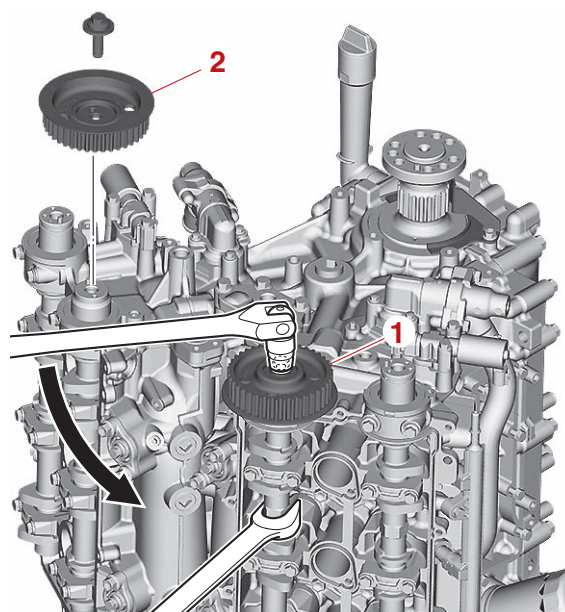
- When removing the VCT bolt, do not secure the VCT assembly. Otherwise, the VCT assembly could be damaged.
- When removing the VCT assembly, do not turn the intake camshaft. Otherwise, the intake and exhaust valves could collide with each other and be damaged.



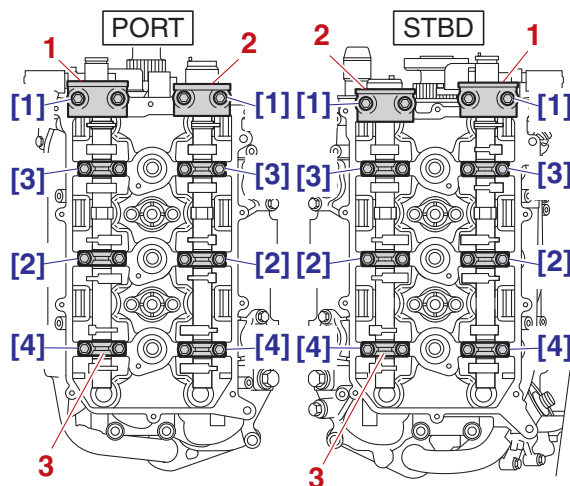
- e. Secure the exhaust camshaft using a wrench, and then remove the driven sprockets "1" and "2".

**NOTICE**

When removing the driven sprocket, do not turn the exhaust camshaft. Otherwise, the intake and exhaust valves could collide with each other and be damaged.



3. Remove:
- Camshaft cap
    - a. Remove the camshaft caps "1", "2", and "3" in the order [1], [2], and so on.

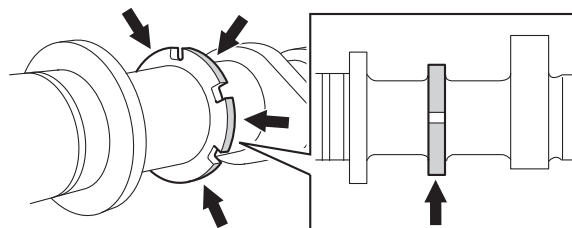


4. Remove:
- Camshaft
  - Oil seal
  - Valve lifter

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

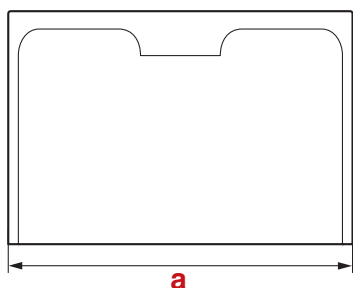
### Checking the sprocket

1. Check:
  - Driven sprocket
  - VCT assembly
  - Cracked/damaged/worn → Replace.

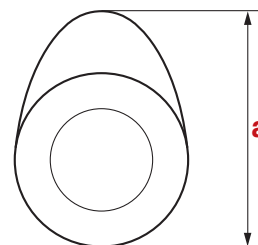



### Checking the valve lifter


1. Check:
  - Valve lifter
  - Damaged/scratched/worn → Replace.
2. Measure:
  - Valve lifter outside diameter “a”
  - Out of specification → Replace.



2. Measure:
  - Cam lobe height “a”
  - Out of specification → Replace.



	Outside diameter 30.970–30.980 mm (1.2193– 1.2197 in)
---	---

	Cam lobe height IN 46.661–46.761 mm (1.8370– 1.8410 in) Limit 46.611 mm (1.8351 in) Cam lobe height EX 46.960–47.060 mm (1.8488– 1.8528 in) Limit 46.910 mm (1.8468 in)
---	--

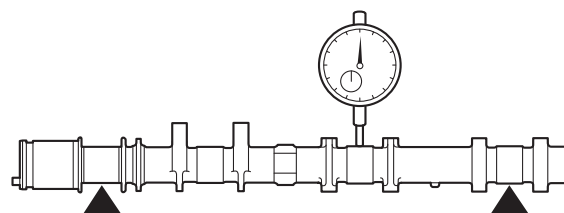
### Checking the camshaft


1. Check:
  - Pulser rotor
  - Damaged/rough/scratched → Replace.

**TIP:** \_\_\_\_\_

- Be careful not to scratch or damage the face of the flange.
- If there is a scratch that is more than 0.2 mm (0.008 in) deep or more than 0.5 mm (0.020 in) wide on the surface of the flange, an error may occur in the cam position sensor signal.

3. Measure:
  - Camshaft runout
  - Out of specification → Replace.



	Runout 0.030 mm (0.0012 in)
---	--------------------------------

### Checking the camshaft journal oil clearance

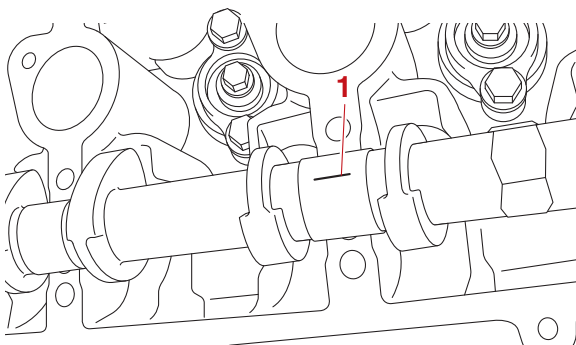
1. Install:
  - Camshaft
  - Plastigauge (PG-1) "1"

**NOTICE**

Do not place the Plastigauge (PG-1) over the oil hole in each camshaft journal.

**TIP:**

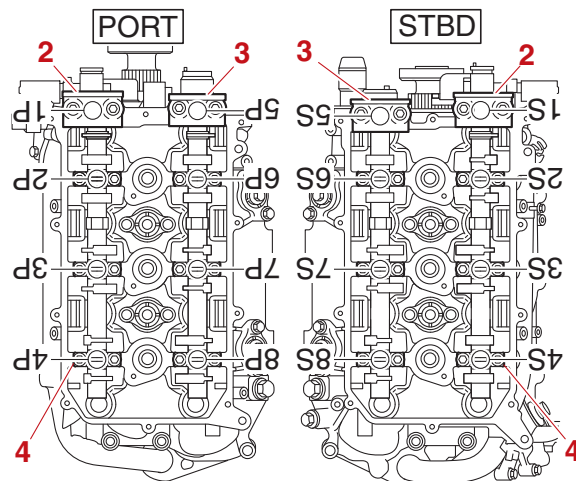
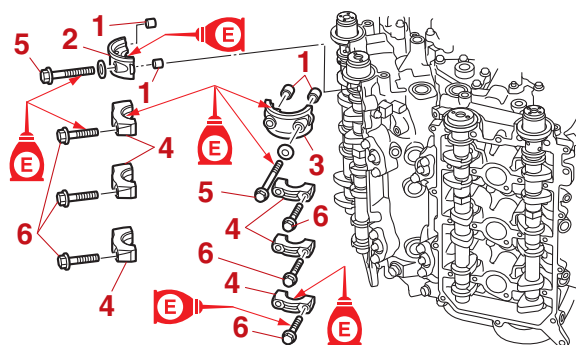
Place the camshafts onto the cylinder head, and then place a piece of Plastigauge (PG-1) "1" onto each camshaft journal, parallel to the camshaft.



2. Install:
  - Collar "1"
  - Camshaft cap "2", "3", "4"
  - Camshaft cap bolt "5", "6"

**TIP:**

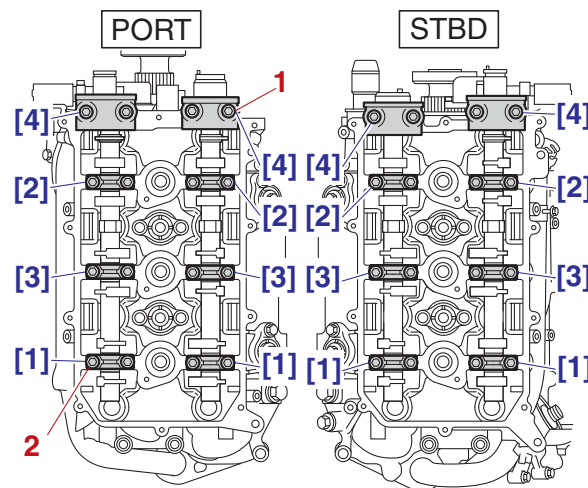
Install the camshaft caps "2", "3", and "4" in their proper positions so that the stamped numbers are upside down.




3. Tighten:
  - Camshaft cap bolt "1", "2"
    - a. Tighten the camshaft cap bolts "1" and "2" to the specified torques in 2 stages and in the order [1], [2], and so on.

**TIP:**

Do not turn the camshafts when measuring the camshaft journal oil clearance using the Plastigauge (PG-1).

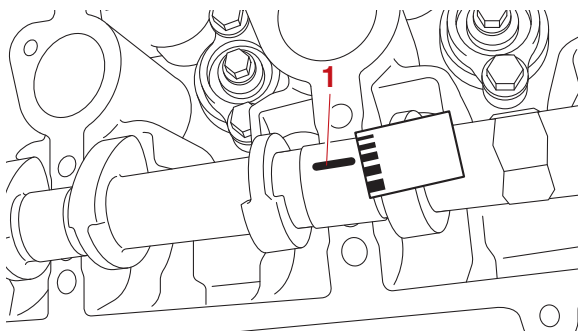


	Camshaft cap bolt "1", "2" 1st: 8 N·m (0.8 kgf·m, 5.9 lb·ft) 2nd: 17 N·m (1.7 kgf·m, 13 lb·ft)
---	--

4. Remove:
  - Camshaft cap

See steps (2) and (3) in "Removing the camshaft, VCT assembly, and driven sprocket" (7-39).

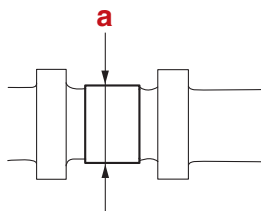
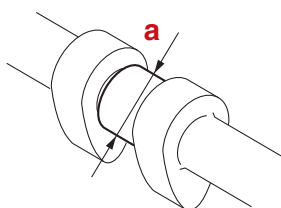
5. Measure:
  - Width of the Plastigauge (PG-1) “1”  
Out of specification → Check the camshaft journal outside diameter and camshaft journal inside diameter. See “Checking the camshaft journal outside diameter and camshaft journal inside diameter” (7-43).



	Camshaft journal oil clearance
	0.020–0.061 mm (0.0008–0.0024 in)
	Limit
	0.080 mm (0.0032 in)

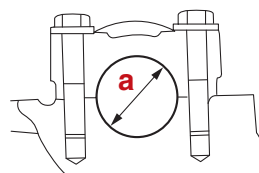
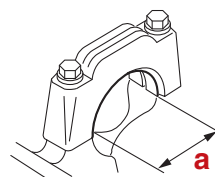
### Checking the camshaft journal outside diameter and camshaft journal inside diameter

1. Measure:
  - Camshaft journal outside diameter “a”  
Below specification → Replace.



	Journal diameter
	24.960–24.980 mm (0.9827–0.9835 in)

2. Install:
  - Camshaft cap  
See “Checking the camshaft journal oil clearance” (7-42).
3. Measure:
  - Camshaft journal inside diameter “a”  
Above specification → Replace the cylinder head and camshaft cap as a set.



	Journal inside diameter
	25.000–25.021 mm (0.9843–0.9851 in)

### Installing the camshaft, VCT assembly, and driven sprocket

If the valve clearances are adjusted or any parts related to valve movement are replaced after installing the timing belt, check the valve clearances. See “Checking the valve clearance” (7-2).

#### NOTICE

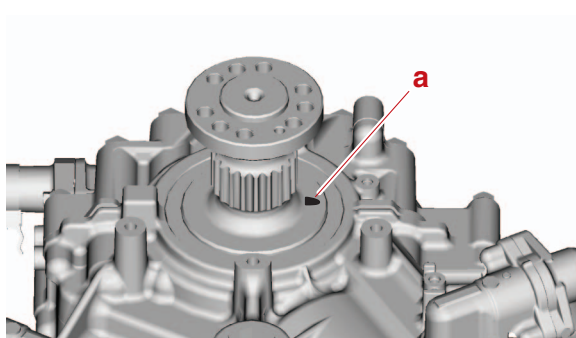
**When the timing belt is not installed, do not turn the crankshaft or camshaft. Otherwise, the pistons and valves could collide with each other and be damaged.**

1. Check:
  - Crankshaft



**TIP:** \_\_\_\_\_

Check that the large “▲” mark “a” on the crankshaft is aligned with the mating surface of the crankcase and cylinder block.

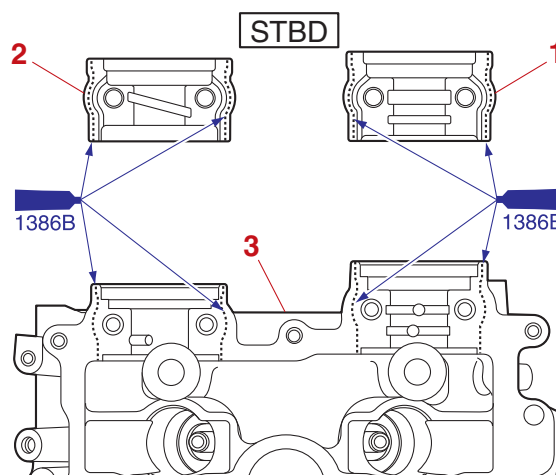
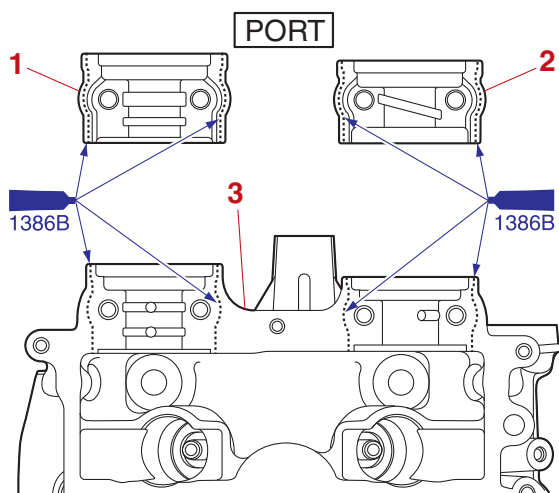


2. Apply:

- Camshaft cap
  - a. Apply a thin, even coat of sealant to the mating surfaces of the camshaft caps “1” and “2” and cylinder heads “3”.

**TIP:** \_\_\_\_\_

Do not block the oil passages or oil holes with the sealant.

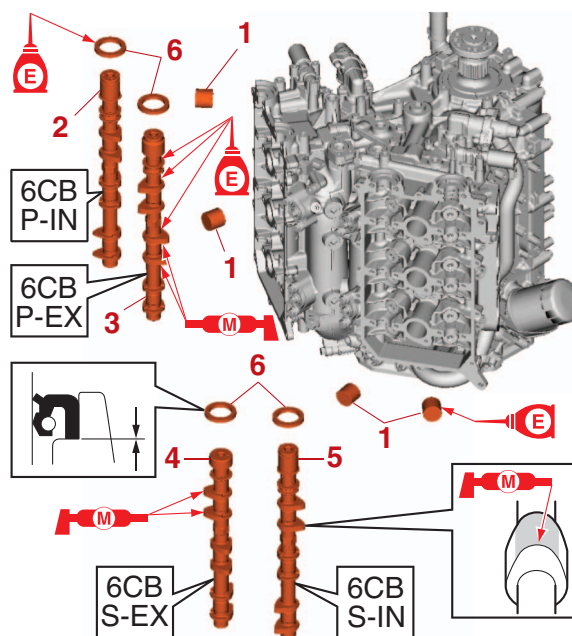


3. Install:

- Valve lifter “1”
- Camshaft “2”, “3”, “4”, “5”
- Oil seal “6” **New**
- Dowel pin

**TIP:** \_\_\_\_\_

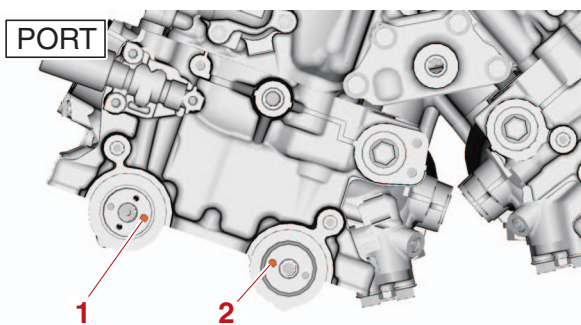
- Install the valve lifters in their original positions.
- Install the camshafts “2”, “3”, “4”, and “5” in the proper positions and new oil seals “6”.



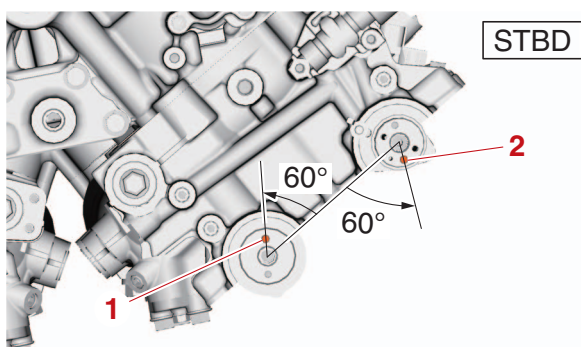
4. Install:

- Camshaft cap
- Camshaft cap bolt

- a. Check that the dowel pins “1” and “2” on the camshafts (PORT) are aligned with the mating surface of the cylinder head.

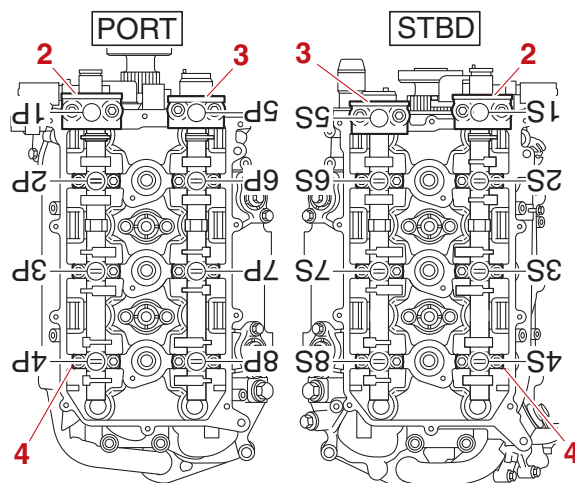
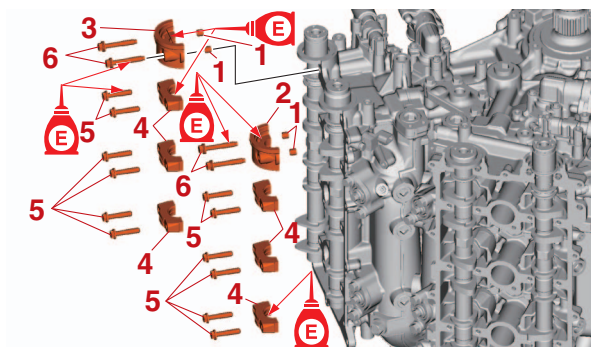


- b. Check that the dowel pins “1” and “2” on the camshafts (STBD) are positioned 60° from the mating surface of the cylinder head.

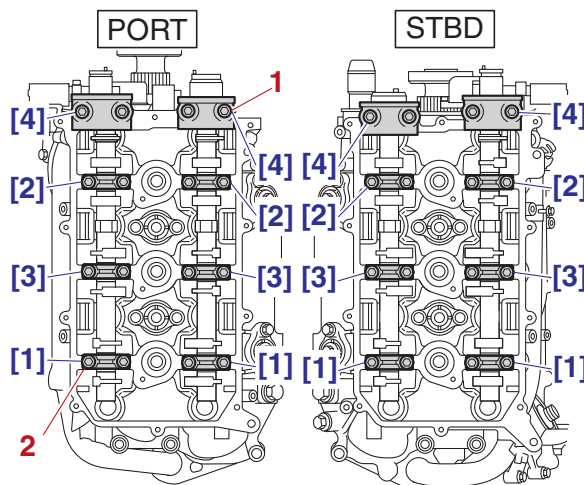



- c. Install the collars “1” and camshaft caps “2”, “3”, and “4” in their proper positions so that the stamped numbers are upside down.

- d. Install the camshaft cap bolts “5” and “6”.



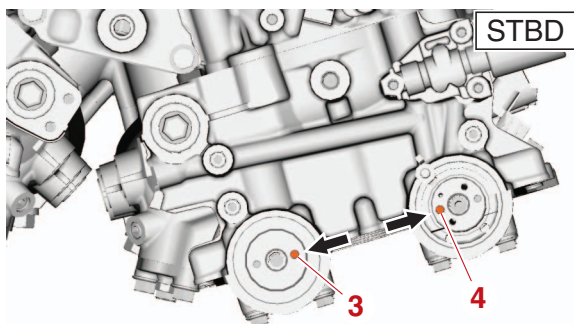
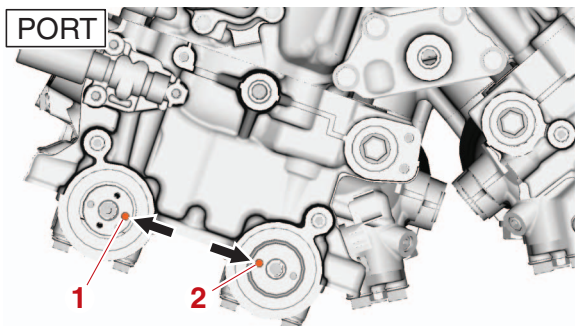
- e. Tighten the camshaft cap bolts “1” and “2” to the specified torques in 2 stages and in the order [1], [2], and so on.



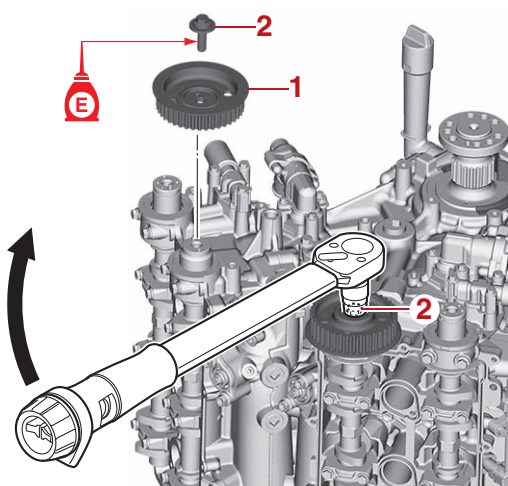
	Camshaft cap bolt “1”, “2”
	1st: 8 N·m (0.8 kgf·m, 5.9 lb·ft)
	2nd: 17 N·m (1.7 kgf·m, 13 lb·ft)




- f. Check that the dowel pins “1” and “2” on the camshafts (PORT) are aligned, and check that the dowel pins “3” and “4” on the camshafts (STBD) are aligned.



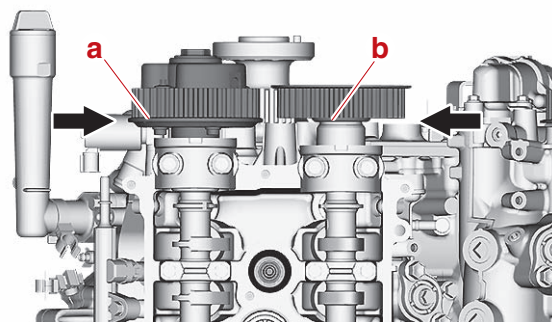
- g. Install the driven sprockets “1”.
- h. Secure the exhaust camshaft using a wrench, and then tighten the driven sprocket bolts “2” to the specified torque.



	<p>Driven sprocket bolt “2” 60 N·m (6.0 kgf·m, 44 lb·ft)</p>
---	--

- i. Install the VCT assemblies.

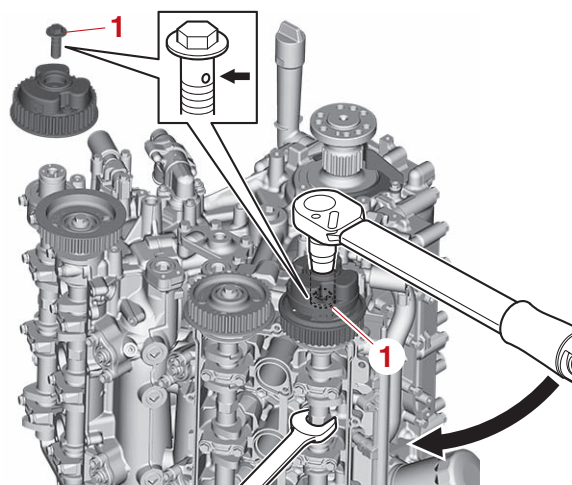
- j. Check that the lower edges “a” and “b” of the driven sprocket and VCT assemblies are aligned.




- k. Secure the intake camshaft using a wrench, and then tighten the VCT bolts “1” to the specified torque.

**NOTICE**

When tightening the VCT bolt, do not secure the driven sprocket. Otherwise, the VCT assembly could be damaged.

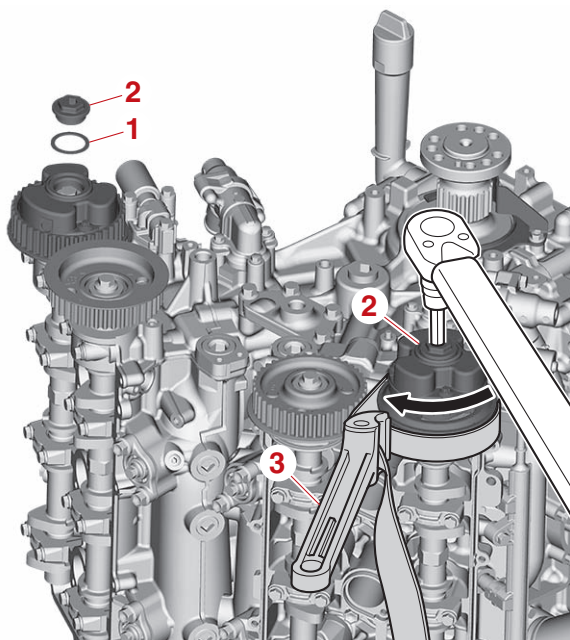


	<p>VCT bolt “1” 60 N·m (6.0 kgf·m, 44 lb·ft)</p>
---	--

- l. Install new gaskets “1” and the VCT caps “2”, secure the VCT assemblies using the special service tool “3”, and then tighten the VCT caps “2” to the specified torque.

**NOTICE**

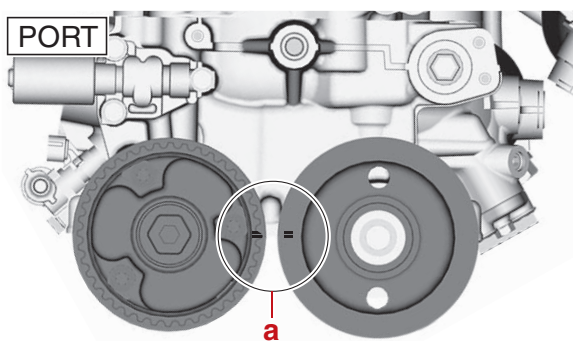
When tightening the VCT cap, do not secure the camshaft. Otherwise, the VCT assembly could be damaged.



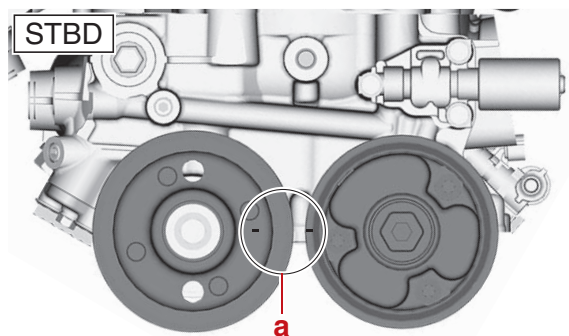
	Rotor holding tool "3" 90890-04166 Rotor holding tool "3" YM-04166
--	---

	VCT cap "2" 32 N·m (3.2 kgf·m, 24 lb·ft)
--	---

- m. Check that the "I" marks "a" on the VCT assembly (PORT) and driven sprocket (PORT) are aligned.



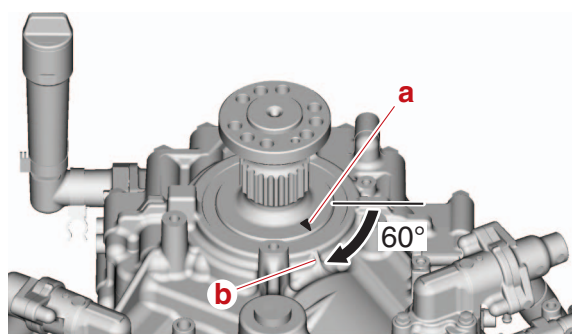
- n. Check that the "I" marks "a" on the VCT assembly (STBD) and driven sprocket (STBD) are aligned.



- o. Turn the crankshaft clockwise 60° gradually until the large "▲" mark "a" on the crankshaft is aligned with the rib "b" on the cylinder block.

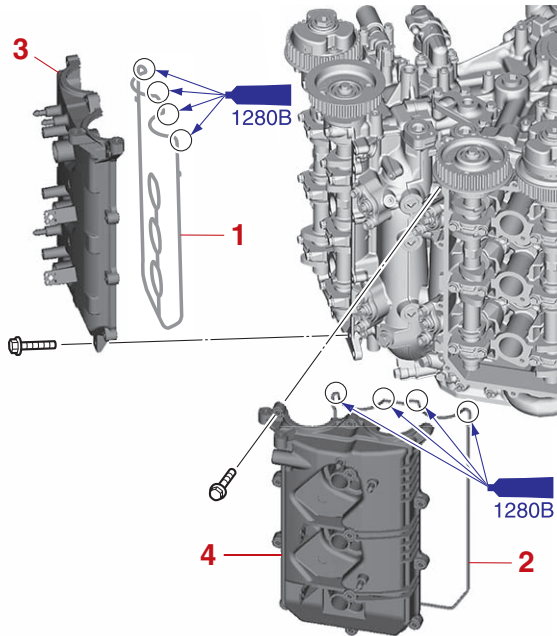
**NOTICE**

Do not turn the crankshaft clockwise more than 60°. Otherwise, the pistons and valves could collide with each other and be damaged.



- p. Install new gaskets "1" and "2" and the cylinder head covers "3" and "4".

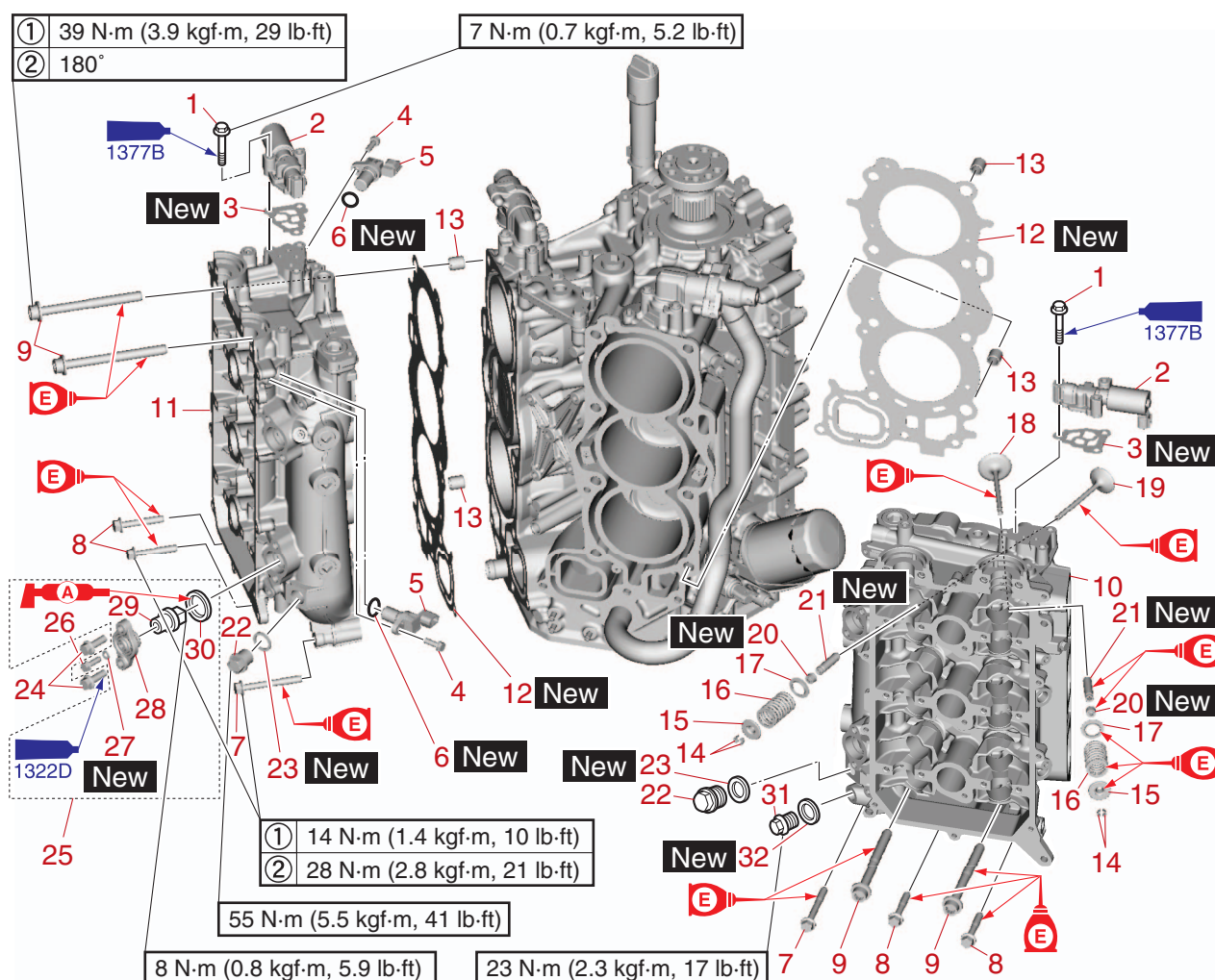
**TIP:** \_\_\_\_\_  
Tighten the cylinder head cover bolts to the specified torques in 2 stages.



Cylinder head cover bolt  
1st: 8 N·m (0.8 kgf·m, 5.9 lb·ft)  
2nd: 8 N·m (0.8 kgf·m, 5.9 lb·ft)



# Cylinder head



↑↓	Part name	Q'ty	Remarks
1	Bolt M6 × 35 mm	6	
2	OCV	2	
3	Gasket	2	
4	Bolt M6 × 20 mm	3	
5	Cam position sensor	3	
6	O-ring	3	
7	Bolt M8 × 70 mm	2	
8	Bolt M8 × 50 mm	4	
9	Bolt M11 × 120 mm	16	
10	Cylinder head	1	STBD
11	Cylinder head	1	PORT
12	Gasket	2	
13	Dowel	4	
14	Valve cotter	48	
15	Valve spring retainer	24	
16	Valve spring	24	
17	Valve spring seat	24	
18	Intake valve	12	

↑↓	Part name	Q'ty	Remarks
19	Exhaust valve	12	
20	Valve seal	24	
21	Valve guide	24	
22	Plug M18 × 17 mm	2	
23	Gasket	2	
24	Bolt M8 × 25 mm	16	
25	Anode assembly	8	
26	Bolt M6 × 20 mm	8	
27	Gasket	8	
28	Cover	8	
29	Anode	8	
30	Grommet	8	
31	Plug M14 × 12 mm	1	
32	Gasket	1	

### Removing the cylinder head

- Remove:
  - OCV assembly
  - Gasket
  - Cylinder head

**NOTICE**

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

**TIP:**

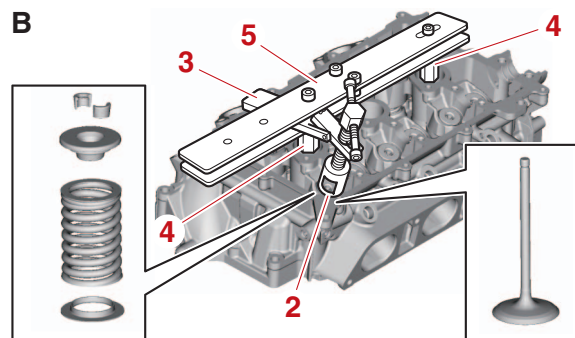
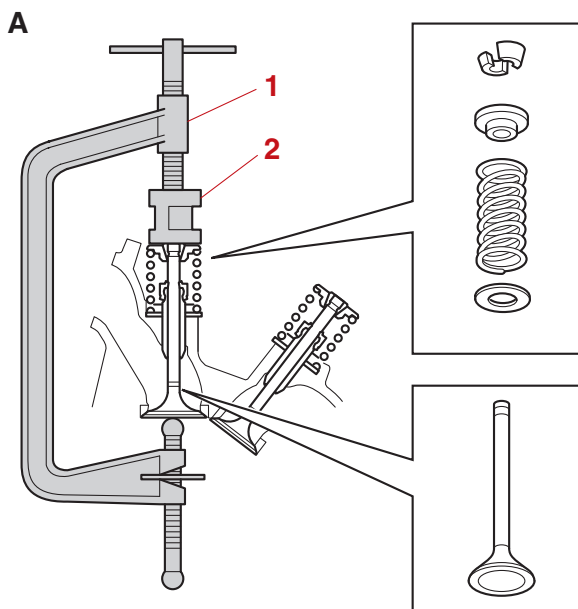
Remove the cylinder head bolts (M11) using a triple-square type.

### Disassembling the cylinder head

- Remove:
  - Camshaft position sensor
  - Anode assembly
  - Intake valve
  - Exhaust valve

**TIP:**

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



A. Conventional special service tool

B. New special service tool

Conventional special service tool



Valve spring compressor "1"  
90890-04200

Valve spring compressor attachment "2"  
90890-06320

Valve spring compressor adaptor "2"  
YB-06320

New special service tool



Valve spring compressor attachment "2"  
90890-06320

Valve spring compressor adaptor "2"  
YB-06320

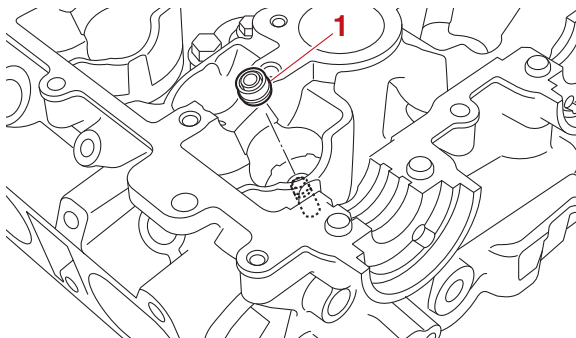
Lever assy "3"  
90890-06956

Support assy 3 "4"  
90890-06952

Valve spring compressor "5"  
90890-06689

Valve spring compressor "5"  
YB-06689

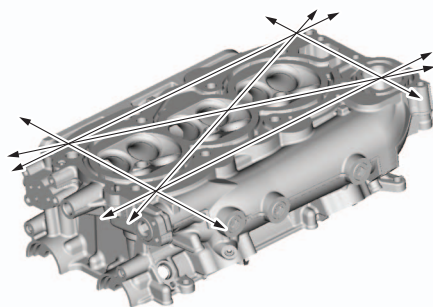
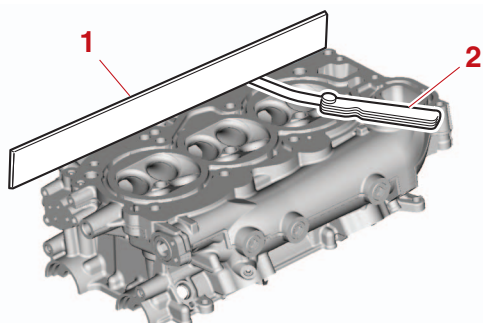
2. Remove:
  - Valve seal "1"



### Checking the cylinder head

1. Remove:
  - Combustion chamber carbon deposits
2. Check:
  - Cylinder head  
Damaged/scratched → Replace.
  - Cylinder head warpage  
Above specification → Replace.

**TIP:** \_\_\_\_\_  
Check the cylinder head warpage using a straightedge "1" and a thickness gauge "2" in 6 directions.

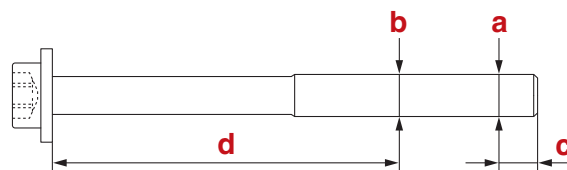


	<p>Warpage limit 0.10 mm (0.0039 in)</p>
--	--

### Checking the cylinder head bolt

1. Measure:
  - Cylinder head bolt diameter  
Above specification → Replace.

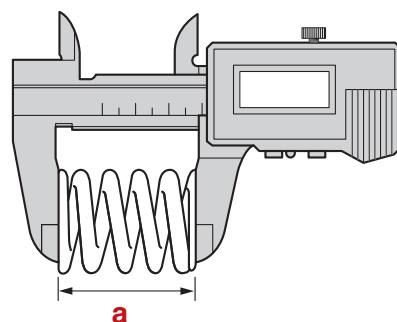
**TIP:** \_\_\_\_\_  
Measure the diameters "a" and "b" of the cylinder head bolt (M11) at the specified measuring points "c" and "d".




	<p>Cylinder head bolt (M11) diameter difference limit "a" – "b" = Less than 0.20 mm (0.0079 in) Measuring point "c": 10.0 mm (0.39 in) Measuring point "d": 85.0 mm (3.35 in)</p>
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### Checking the valve spring

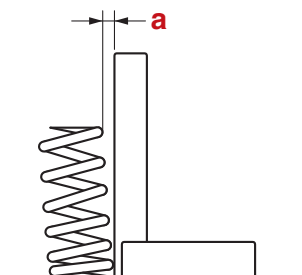
1. Measure:
  - Free length "a"  
Below specification → Replace.




	Free length IN
	48.08 mm (1.89 in)
	Limit
	45.67 mm (1.80 in)
	Free length EX
	48.08 mm (1.89 in)
Limit	
45.67 mm (1.80 in)	

2. Measure:

- Spring tilt “a”  
Above specification → Replace.



	Tilt limit IN
	1.7 mm (0.07 in)
	Tilt limit EX
	1.7 mm (0.07 in)

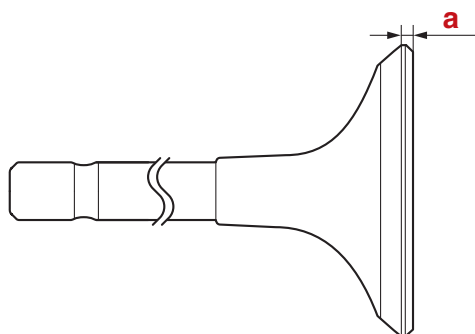
### Checking the valve


1. Check:

- Valve face  
Pitted/worn → Replace.

2. Measure:

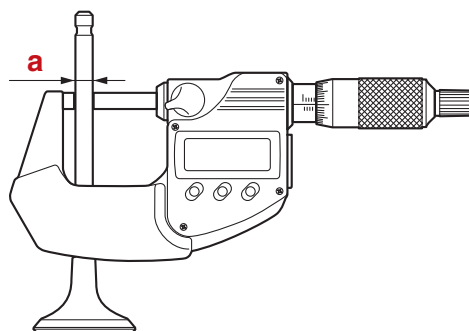
- Margin thickness “a”  
Below specification → Replace.




	Margin thickness IN
	0.75–1.15 mm (0.0295–0.0453 in)
	Margin thickness EX
	0.90–1.30 mm (0.0354–0.0512 in)

3. Measure:

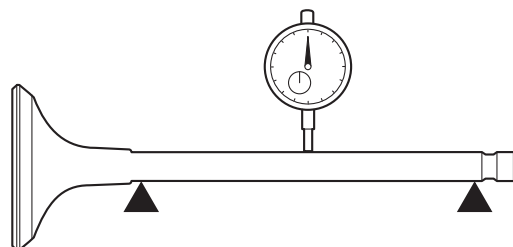
- Stem diameter “a”  
Below specification → Replace.




	Diameter IN
	5.477–5.492 mm (0.2156–0.2162 in)
	Limit
	5.447 mm (0.2144 in)
	Diameter EX
	5.464–5.479 mm (0.2151–0.2157 in)
	Limit
	5.434 mm (0.2139 in)

4. Measure:

- Stem runout  
Above specification → Replace.



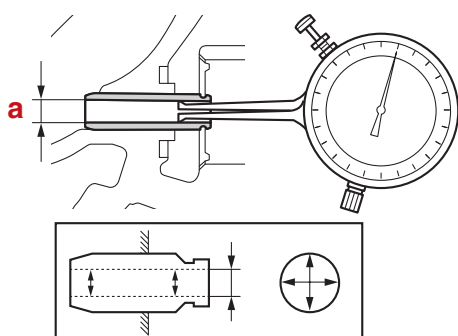



	Runout limit IN
	0.01 mm (0.0004 in)
	Runout limit EX
	0.01 mm (0.0004 in)

### Checking the valve guide


Before checking the valve guides, make sure that the valve stem diameter is within specification.

- Measure:
  - Inside diameter "a"
    - Above specification → Replace.



	Inside diameter IN
	5.504–5.522 mm (0.2167–0.2174 in)
	Inside diameter EX
	5.504–5.522 mm (0.2167–0.2174 in)

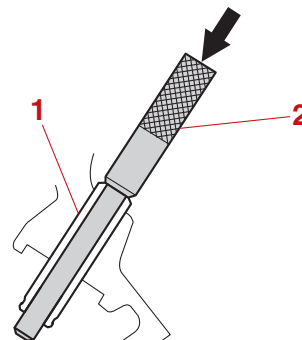
- Calculate:
  - Valve stem to valve guide clearance
    - Out of specification → Replace the valve and valve guide.


	Valve stem to valve guide clearance = Valve guide inside diameter – Valve stem diameter
	Clearance IN
	0.012–0.045 mm (0.0005–0.0018 in)
	Limit
	0.070 mm (0.0028 in)
	Clearance EX
	0.025–0.058 mm (0.0010–0.0023 in)
	Limit
	0.080 mm (0.0032 in)

### Replacing the valve guide

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

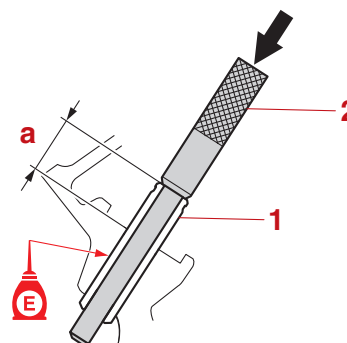
- Remove:
  - Valve guide "1"
    - (from the combustion chamber side)





	Valve guide remover/installer "2"
	90890-06801
	Valve guide remover "2"
	YB-06801

- Install:
  - Valve guide "1" **New**
    - (from the camshaft side)

**TIP:** \_\_\_\_\_  
 Make sure that the valve guide installation height "a" is within specification.



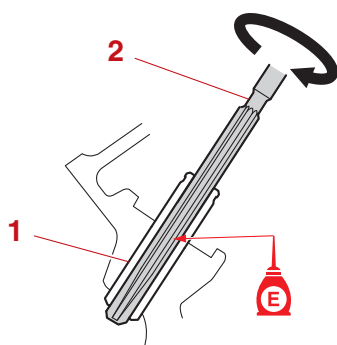
	Valve guide remover/installer "2"
	90890-06801
	Valve guide remover "2"
	YB-06801

	Installation height
	11.30–11.70 mm (0.4449–0.4606 in)

3. Ream:
  - Valve guide “1”

**TIP:**

- To ream the valve guide “1”, turn the valve guide reamer “2” clockwise.
- When removing the valve guide reamer “2”, do not turn it counterclockwise.
- After reaming the valve guide “1”, make sure to clean it.



	Valve guide reamer “2” 90890-06804
	Valve guide reamer “2” YB-06804

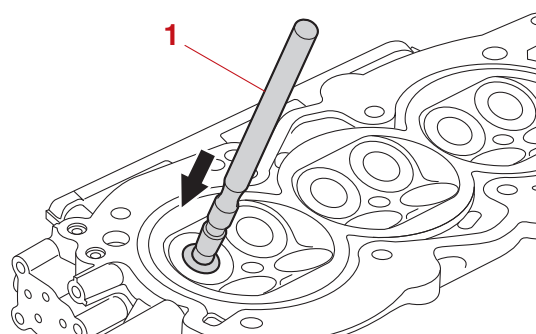
4. Measure:
  - Inside diameter

	Inside diameter IN 5.504–5.522 mm (0.2167–0.2174 in)
	Inside diameter EX 5.504–5.522 mm (0.2167–0.2174 in)

**Checking the valve seat**

1. Remove:
  - Carbon deposit
2. Measure:
  - Valve seat contact width
  - Not seated properly/out of specification → Reface the valve seat.
  - Uneven → Check the valve guide.
  - a. Apply a thin, even layer of blue layout fluid (Dykem) onto the valve seat.

- b. Press the valve lightly against the valve seat using the special service tool “1”.

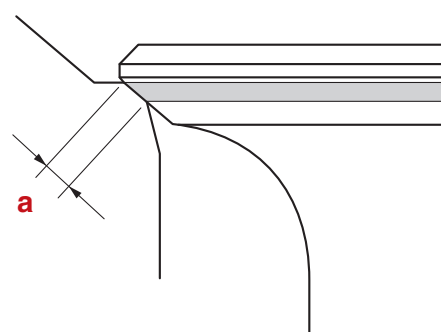


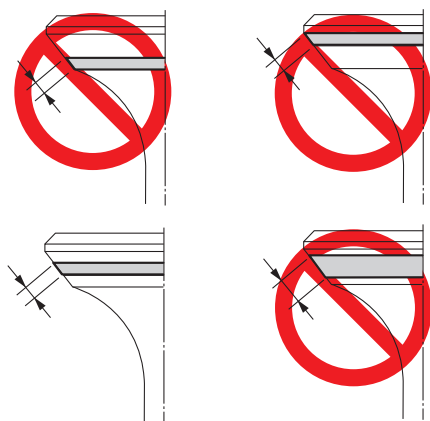
	Valve lapper “1” 90890-04101
	Valve lapping tool “1” YM-A8998

- c. Measure the valve seat contact width “a” where the blue layout fluid is adhered to the valve face.

**TIP:**

- 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.





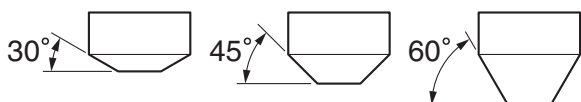
	Seat contact width IN
	1.10–1.40 mm (0.0433–0.0551 in)
	Limit
	1.850 mm (0.0728 in)
	Seat contact width EX
	1.40–1.70 mm (0.0551–0.0669 in)
Limit	
	2.150 mm (0.0846 in)

### 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:
  - Valve seat
    - a. Reface the valve seat using the special service tools.



Valve seat cutter holder  
90890-06316

Intake:

Valve seat cutter 30°  
90890-06331

Valve seat cutter 45°  
90890-06332

Valve seat cutter 60°  
90890-06333

Exhaust:

Valve seat cutter 30°  
90890-06327

Valve seat cutter 45°  
90890-06325

Valve seat cutter 60°  
90890-06324

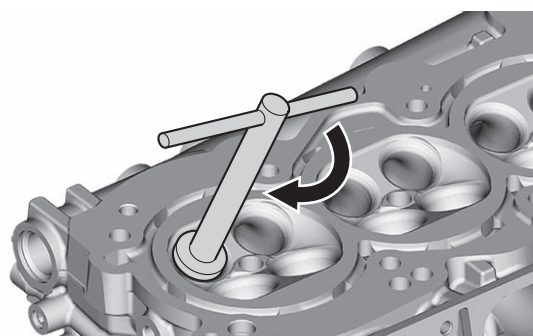
Neway valve seat kit  
YB-91044

- b. Cut the surface of the valve seat using a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth.

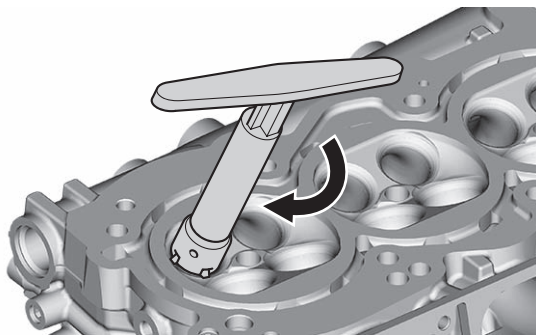
#### NOTICE

Do not overcut 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).

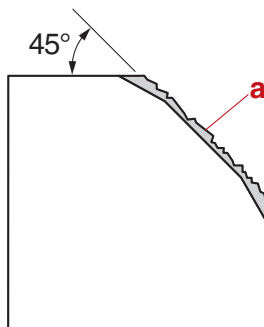
A



B

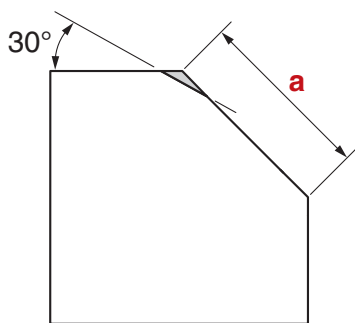


- A. Worldwide
- B. USA and Canada



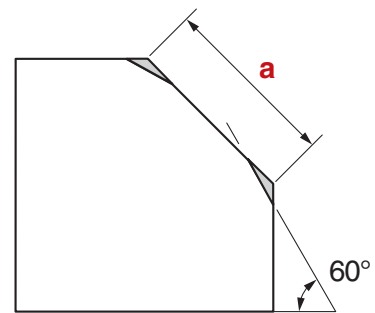
a. Slag or rough surface

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



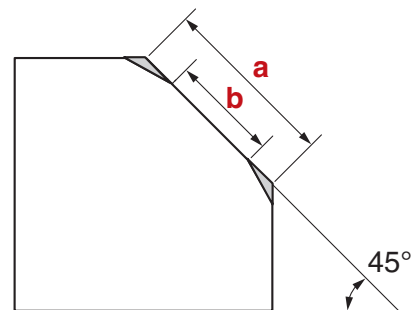
a. Previous contact width

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



a. Previous contact width

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

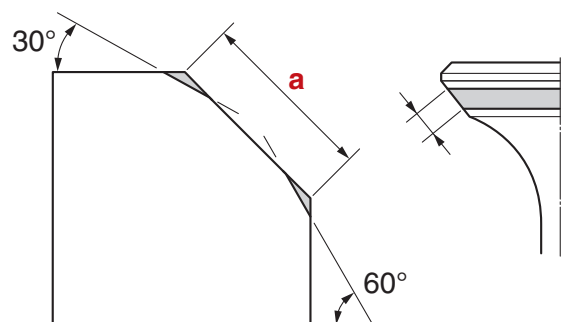


a. Previous contact width  
b. Specified contact width

- f. Check the valve seat contact area of the valve. See “Checking the valve seat” (7-54).

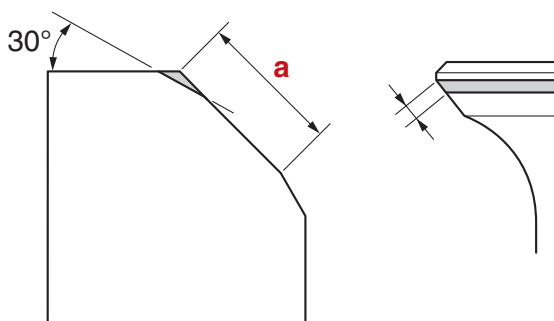
Example:

- 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.



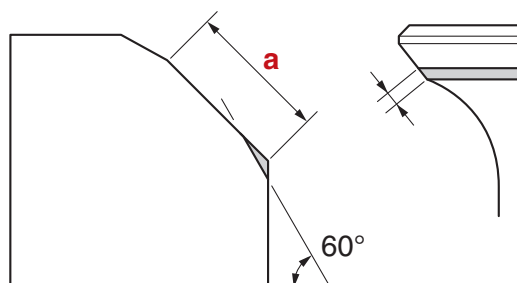
a. Previous contact width

- 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.



a. 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.



a. Previous contact width

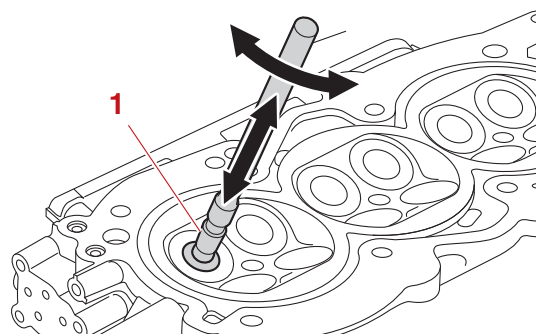
2. Lap:
  - Valve seat

**NOTICE**

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

**TIP:**

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”.



Valve lapper “1”  
90890-04101  
Valve lapping tool “1”  
YM-A8998

3. Measure:
  - Valve seat contact width  
See step (2) in “Checking the valve seat” (7-54).

**Checking the cylinder head anode**

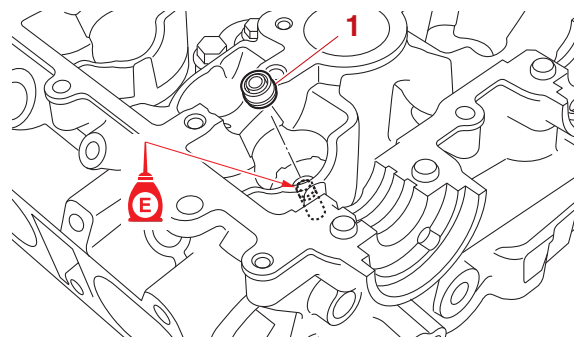
1. Check:
  - Anode  
Eroded (1/2 or more worn out) → Replace.  
Adhered grease, oil, or scales → Clean.

**NOTICE**

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

**Assembling the cylinder head**

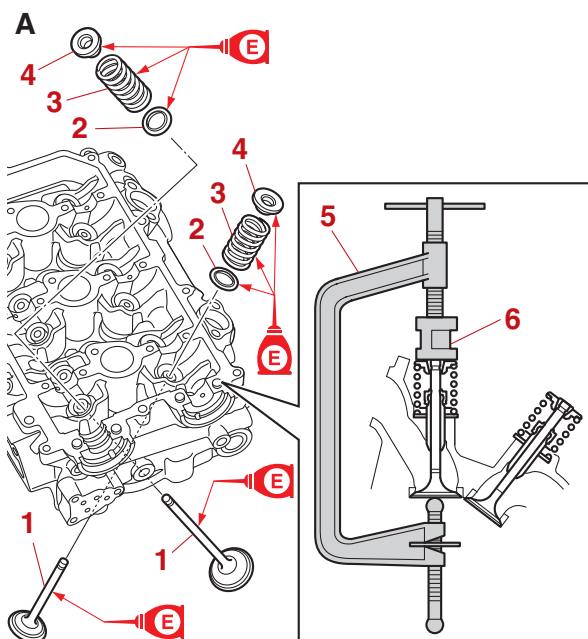
1. Install:
  - Valve seal “1” **New**



2. Install:

- Valve
- Valve spring seat
- Valve spring
- Valve spring retainer
- Valve cotter

a. Install the valve "1", valve spring seat "2", valve spring "3", and valve spring retainer "4" in this order, and then install the special service tools.



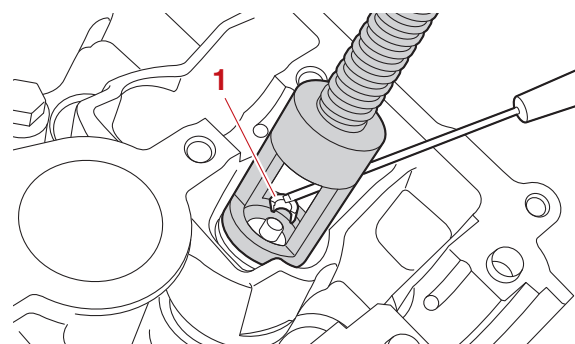
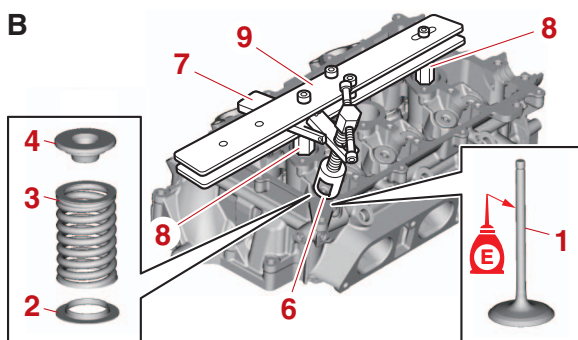
Valve spring compressor "5"  
90890-04200  
Valve spring compressor attachment "6"  
90890-06320  
Valve spring compressor adaptor "6"  
YB-06320

New special service tool



Valve spring compressor attachment "6"  
90890-06320  
Valve spring compressor adaptor "6"  
YB-06320  
Lever assy "7"  
90890-06956  
Support assy 3 "8"  
90890-06952  
Valve spring compressor "9"  
90890-06689  
Valve spring compressor "9"  
YB-06689

b. Compress the valve spring, and then install the valve cottes "1".

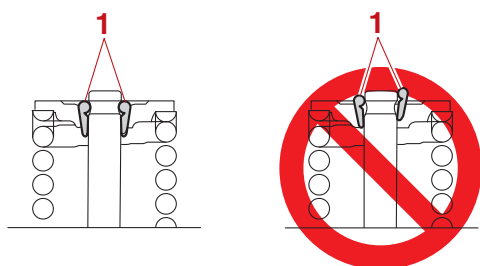
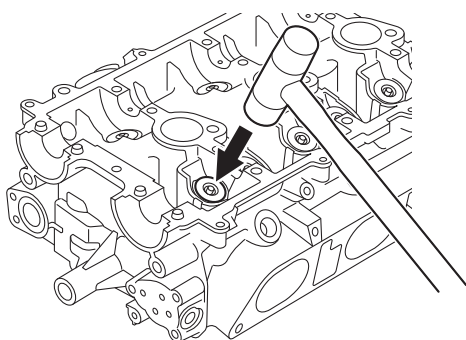


A. Conventional special service tool

B. New special service tool

Conventional special service tool

- c. Tap the valve spring retainer lightly using a plastic hammer to seat the valve cutters "1" securely.



### 3. Install:

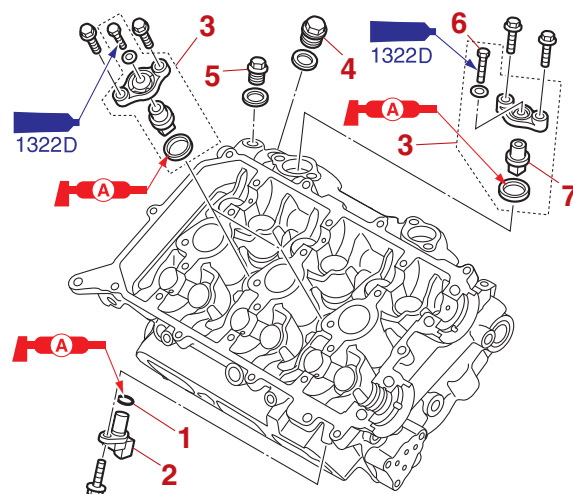
- O-ring "1" **New**
- Cam position sensor "2"
- Cylinder head anode "3"
- Exhaust plug "4"
- Braided plug "5"


### NOTICE

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

### TIP:

When installing the cylinder head anode "3", install the bolt "6", and then tighten the anode "7" to the specified torque.



	Exhaust plug "4"
	55 N·m (5.5 kgf·m, 41 lb·ft)
	Braided plug "5"
	23 N·m (2.3 kgf·m, 17 lb·ft)
	Anode "7"
	8 N·m (0.8 kgf·m, 5.9 lb·ft)

### Installing the cylinder head

Before assembling the cylinder head, check the cylinder head bolts. See "Checking the cylinder head bolt" (7-51).

#### 1. Install:

- Gasket "1" **New**
- OCV "2"
- OCV bolt "3"
- Gasket "4" **New**
- Dowel "5"
- Cylinder head "6"
- Cylinder head bolt "7"
- Cylinder head bolt "8"
- Cylinder head bolt "9"

a. Install new gaskets "1" and the OCV "2", and then tighten the OCV bolts "3" to the specified torque.

b. Install new gaskets "4", the dowels "5", and the cylinder heads "6", and then tighten the cylinder head bolts (M11) "7".


c. Tighten the cylinder head bolts (M11) "7" to the specified torques in 2 stages and in the order [1], [2], and so on.

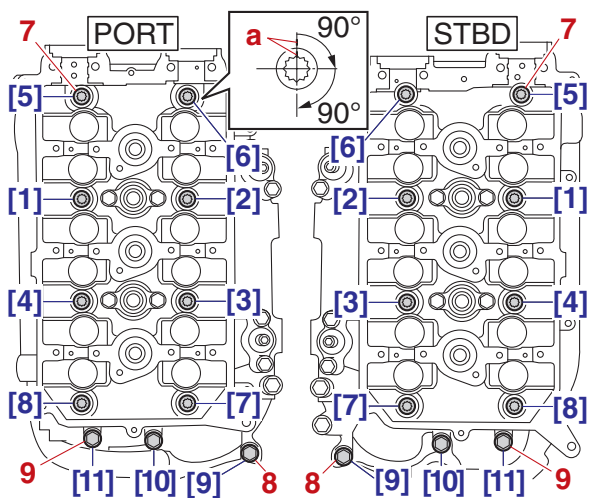
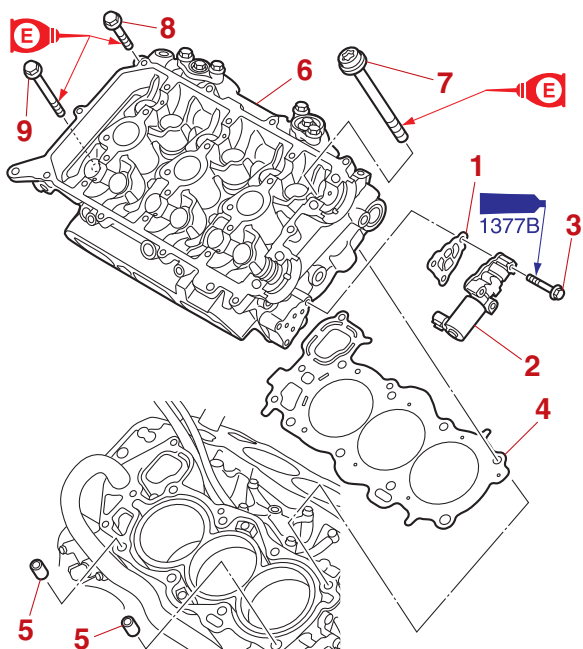


**TIP:** \_\_\_\_\_

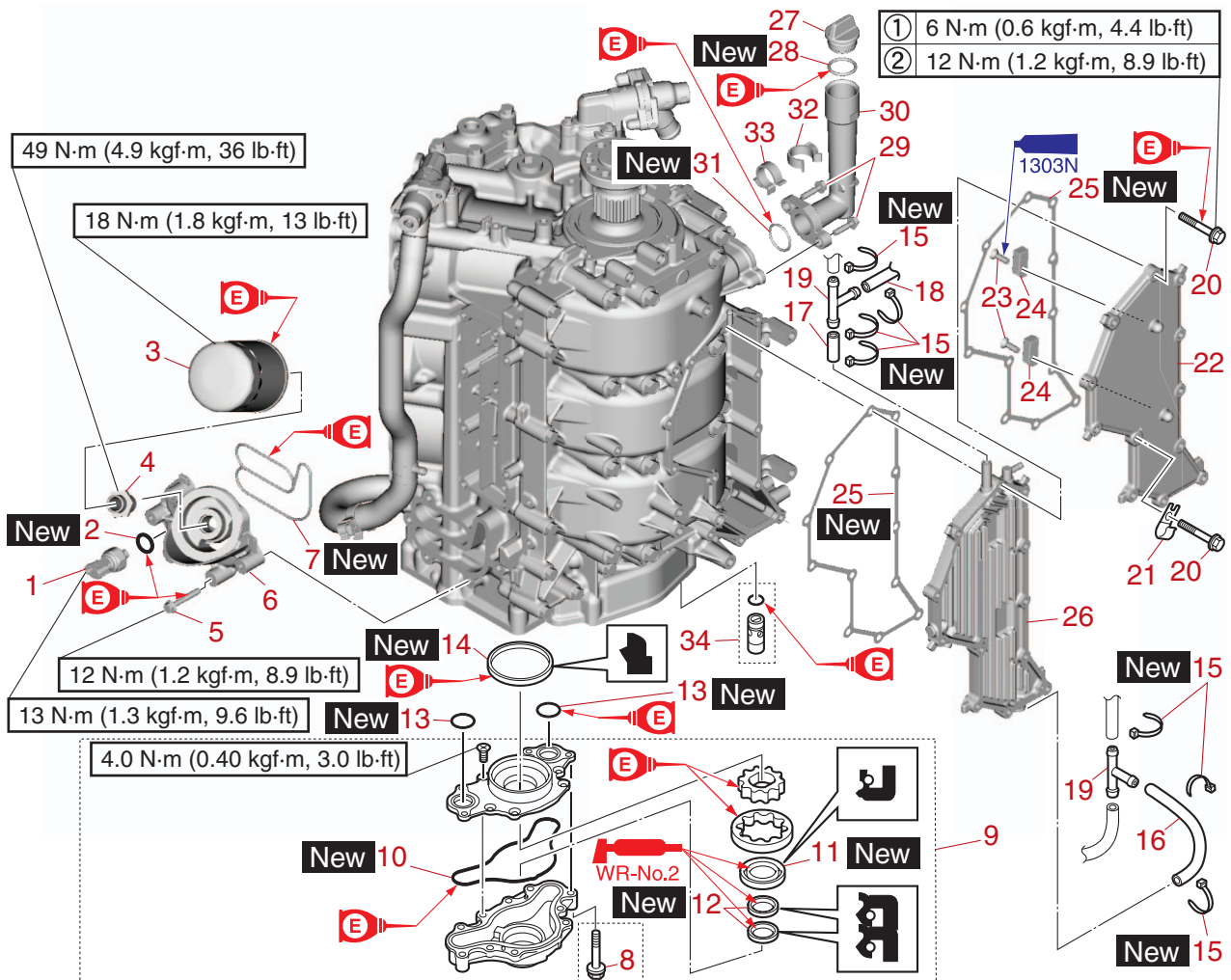
- Tighten the cylinder head bolts (M11) using a triple-square type.
- In the second stage, mark the cylinder head bolts (M11) and cylinder head with identification marks “a”, tighten the cylinder head bolts (M11) 90° from the marks, and then tighten another 90°.

d. Tighten the cylinder head bolts (M8) “8” and “9” to the specified torques in 2 stages and in the order [9], [10], and so on.

	OCV bolt “3”
	7 N·m (0.7 kgf·m, 5.2 lb·ft)
	Cylinder head bolt (M11) “7” [1]–[8]
	1st: 39 N·m (3.9 kgf·m, 29 lb·ft)
	2nd: 180°
	Cylinder head bolt (M8) “8”, “9” [9]–[11]
	1st: 14 N·m (1.4 kgf·m, 10 lb·ft)
	2nd: 28 N·m (2.8 kgf·m, 21 lb·ft)



Oil cooler and oil pump assembly

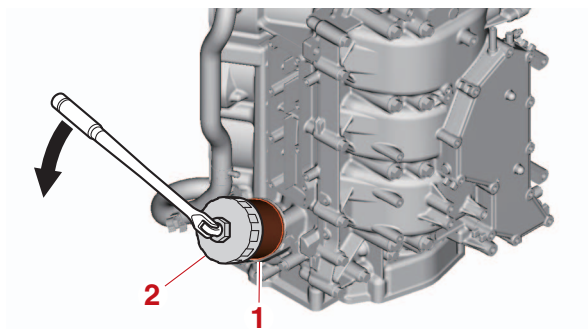


↑↓	Part name	Q'ty	Remarks
1	Oil pressure sensor	1	
2	O-ring	1	
3	Oil filter	1	
4	Union bolt	1	
5	Bolt M6 × 40 mm	5	
6	Bracket	1	
7	Gasket	1	
8	Bolt M6 × 40 mm	4	
9	Oil pump assembly	1	
10	Gasket	1	
11	Oil seal	1	
12	Oil seal	2	
13	O-ring	2	
14	Oil seal	1	
15	Plastic tie	7	
16	Hose	1	
17	Hose	1	
18	Hose	1	

↑↓	Part name	Q'ty	Remarks
19	Joint	2	
20	Bolt M6 × 40 mm	12	
21	Holder	1	
22	Oil cooler	1	
23	Screw M6 × 16 mm	2	
24	Anode	2	
25	Gasket	2	
26	Oil cooler	1	
27	Oil filler cap	1	
28	O-ring	1	
29	Bolt M6 × 25 mm	2	
30	Oil filler neck	1	
31	O-ring	1	
32	Holder	1	
33	Holder	1	
34	Relief valve	1	

## Removing the oil filter

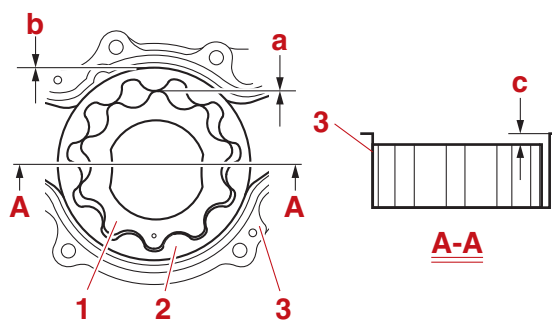
- Remove:
  - Oil filter "1"



Oil filter wrench "2"  
90890-06874  
Oil filter wrench "2"  
YB-06874

## Checking the oil pump

- Check:
  - Inner surface of the oil pump housing  
Scratched → Replace the oil pump assembly.
- Check:
  - Gear teeth of the inner rotor and outer rotor  
Cracked/worn → Replace the oil pump assembly.
- Measure:
  - Inner rotor to outer rotor tip clearance "a"
  - Outer rotor to oil pump housing clearance "b"
  - Oil pump housing to inner rotor and outer rotor clearance "c"  
Out of specification → Replace the oil pump assembly.



- Inner rotor
- Outer rotor
- Oil pump housing



Inner rotor to outer rotor tip clearance (reference data)  
0.12 mm (0.0047 in)  
Limit (reference data)  
0.16 mm (0.0063 in)



Outer rotor to oil pump housing clearance (reference data)  
0.1 mm (0.0040 in)  
Limit (reference data)  
0.20 mm (0.0079 in)



Oil pump housing to inner rotor and outer rotor clearance (reference data)  
0.03 mm (0.0012 in)  
Limit (reference data)  
0.12 mm (0.0047 in)

## Checking the oil cooler

- Check:
  - Oil cooler  
Corroded/cracked → Replace the oil cooler.

## Checking the oil cooler anode

- Check:
  - Anode  
Eroded (1/2 or more worn out) → Replace.  
Adhered grease, oil, or scales → Clean.

### **NOTICE**

**Do not apply grease, oil, or paint to the anodes.**

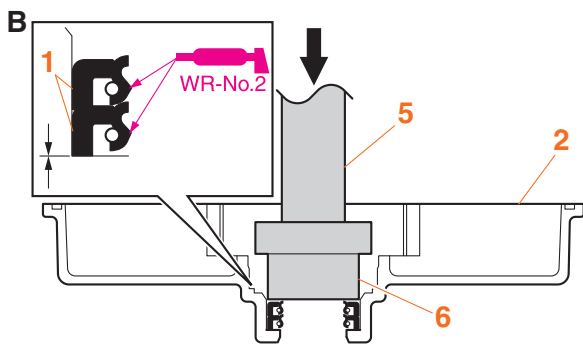
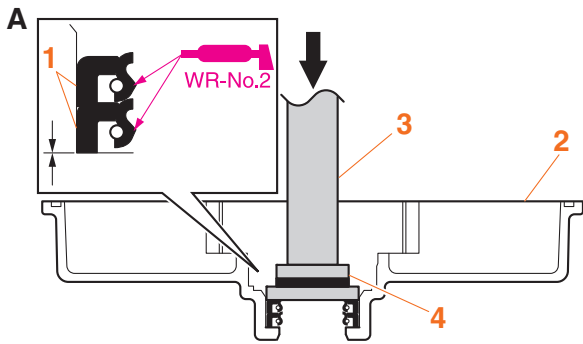
### Assembling the oil pump

1. Install:

- Oil seal "1" **New**  
(into the oil pump housing "2")

**TIP:**

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

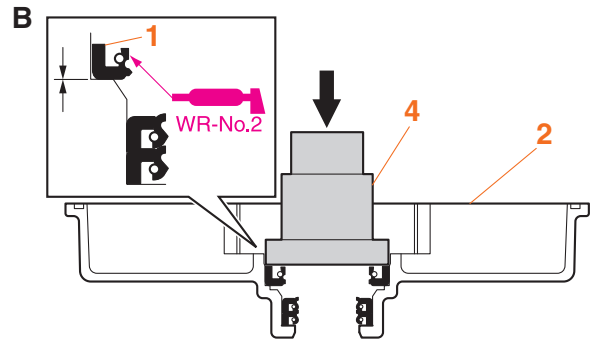
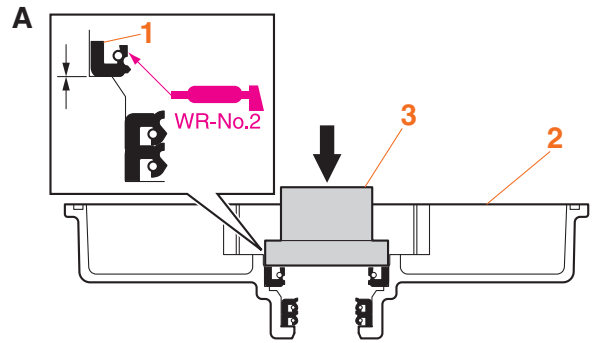


A. Worldwide  
B. USA and Canada

	Driver rod L3 "3" 90890-06652
	Needle bearing attachment "4" 90890-06612
	Driveshaft bearing installer "4" YB-06155
	Driver handle (large) "5" YB-06071
	Roller bearing installer/remover "6" YB-06432

2. Install:

- Oil seal "1" **New**  
(into the oil pump housing "2")

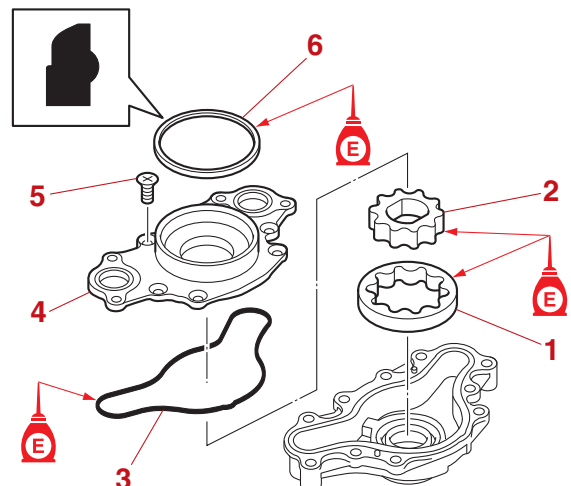


A. Worldwide  
B. USA and Canada

	Bearing inner race attachment "3" 90890-06640
	Bearing housing bearing/oil seal installer "4" YB-06111

3. Install:

- Outer rotor "1"
- Inner rotor "2"
- Gasket "3" **New**
- Oil pump cover "4"
- Oil pump cover screw "5"
- Oil seal "6" **New**



## Oil cooler and oil pump assembly



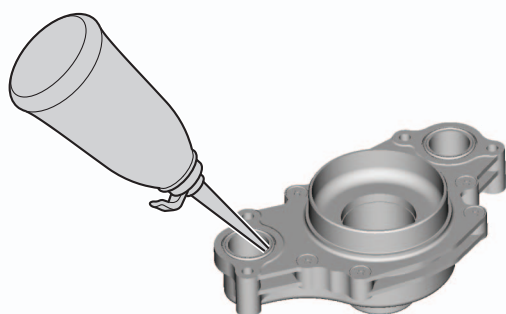
Oil pump cover screw "5"  
4.0 N·m (0.40 kgf·m, 3.0 lb·ft)

### Installing the oil pump assembly

1. Install:
  - Oil pump assembly

#### TIP:

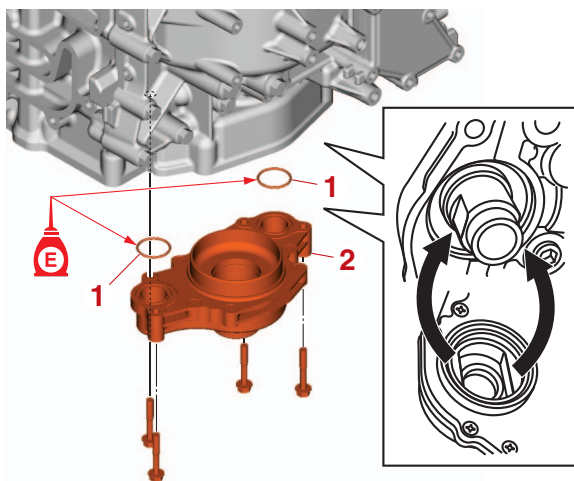
Fill the oil pump assembly with engine oil through the oil passage.



2. Install:
  - O-ring "1" **New**
  - Oil pump assembly "2"

#### TIP:

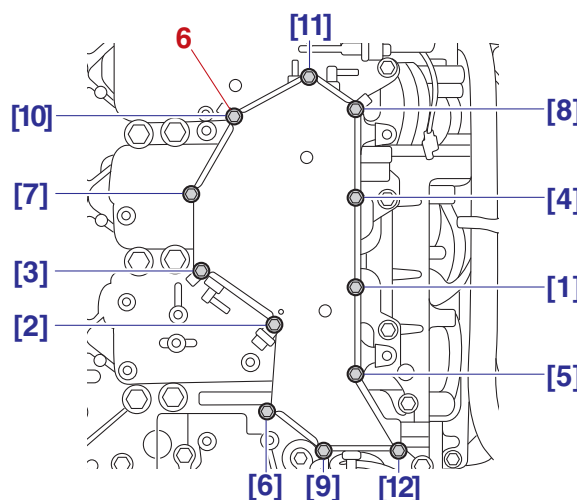
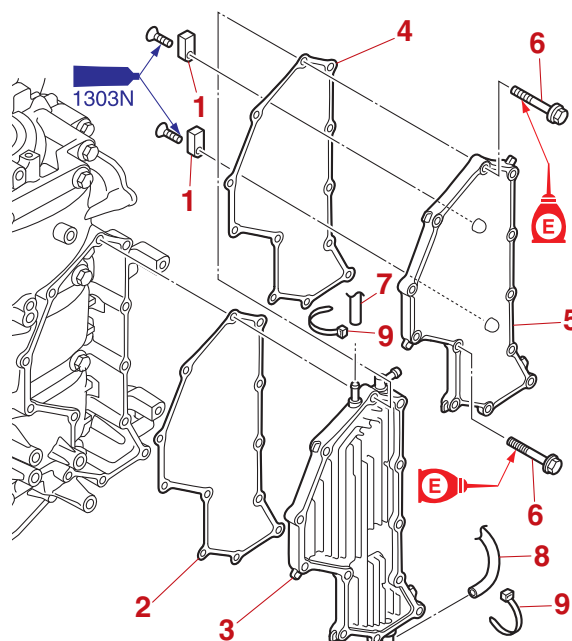
Aligning the oil pump gear with the crankshaft.



### Installing the oil cooler

1. Install:
  - Anode "1"
  - Gasket "2" **New**
  - Oil cooler "3"
  - Gasket "4" **New**
  - Cover "5"

2. Tighten:
  - Oil cooler bolt "6"
    - a. Tighten the oil cooler bolts "6" to the specified torques in 2 stages and in the order [1], [2], and so on.
3. Connect:
  - Cooling water hose "7", "8"
    - a. Connect the cooling water hoses "7" and "8", and then fasten them using new plastic ties "9".



Oil cooler bolt "6"  
1st: 6 N·m (0.6 kgf·m, 4.4 lb·ft)  
2nd: 12 N·m (1.2 kgf·m, 8.9 lb·ft)



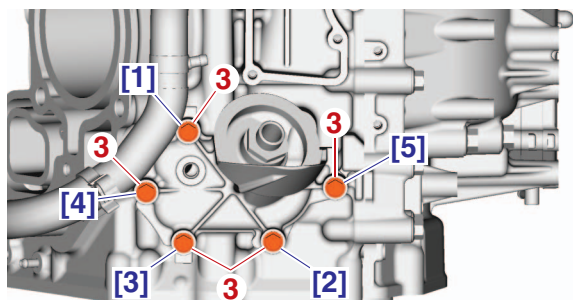
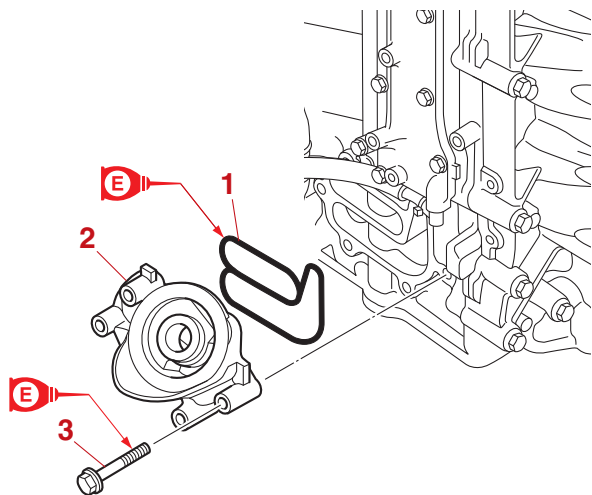
### Installing the oil filter


1. Install:

- Gasket "1" **New**
- Oil filter bracket "2"
- Oil filter bracket bolt "3"

**TIP:** \_\_\_\_\_

Tighten the oil filter bracket bolts "3" to the specified torque in the order [1], [2], and so on.



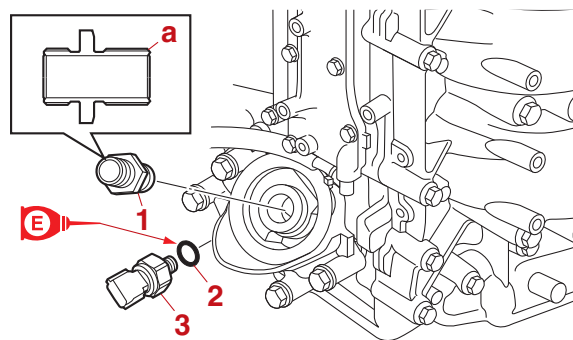
	Oil filter bracket bolt "3" 12 N·m (1.2 kgf·m, 8.9 lb·ft)
---	--


2. Install:

- Oil filter union bolt "1"
- O-ring "2" **New**
- Oil pressure sensor "3"

**TIP:** \_\_\_\_\_

Install the longer threaded portion "a" of the oil filter union bolt "1" into the oil filter bracket.



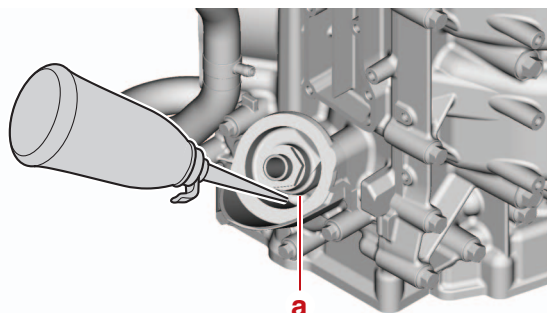
	Oil filter union bolt "1" 49 N·m (4.9 kgf·m, 36 lb·ft)
	Oil pressure sensor "3" 13 N·m (1.3 kgf·m, 9.6 lb·ft)

3. Fill:

- Oil passage "a"

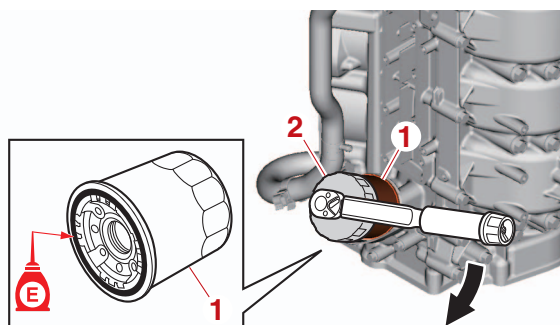
**TIP:** \_\_\_\_\_


Add a small amount of engine oil through the oil passage "a" of the oil filter bracket.




4. Install:

- Oil filter "1"

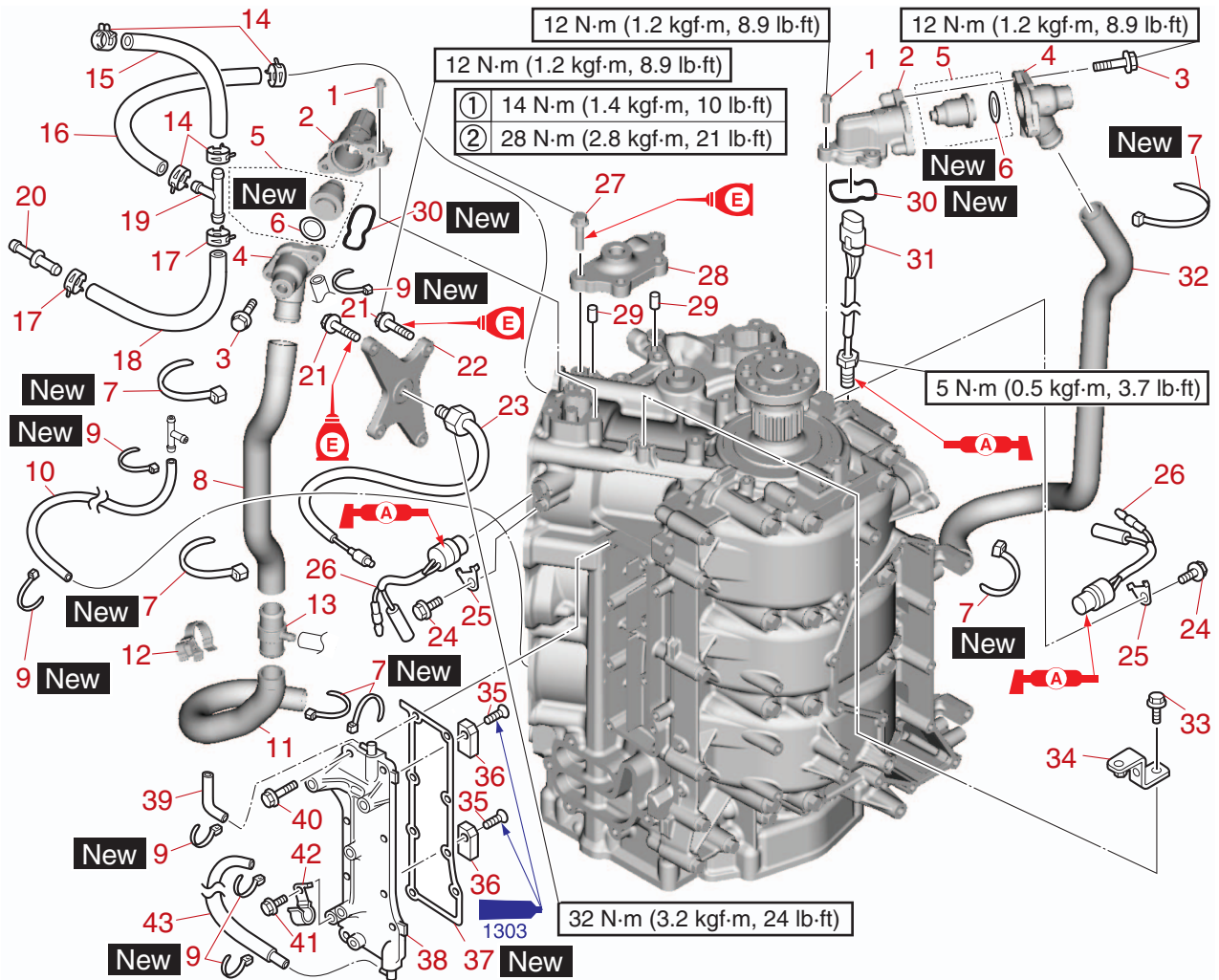


	Oil filter wrench "2" 90890-06874
	Oil filter wrench "2" YB-06874

	<p>Oil filter "1" 18 N·m (1.8 kgf·m, 13 lb·ft)</p>
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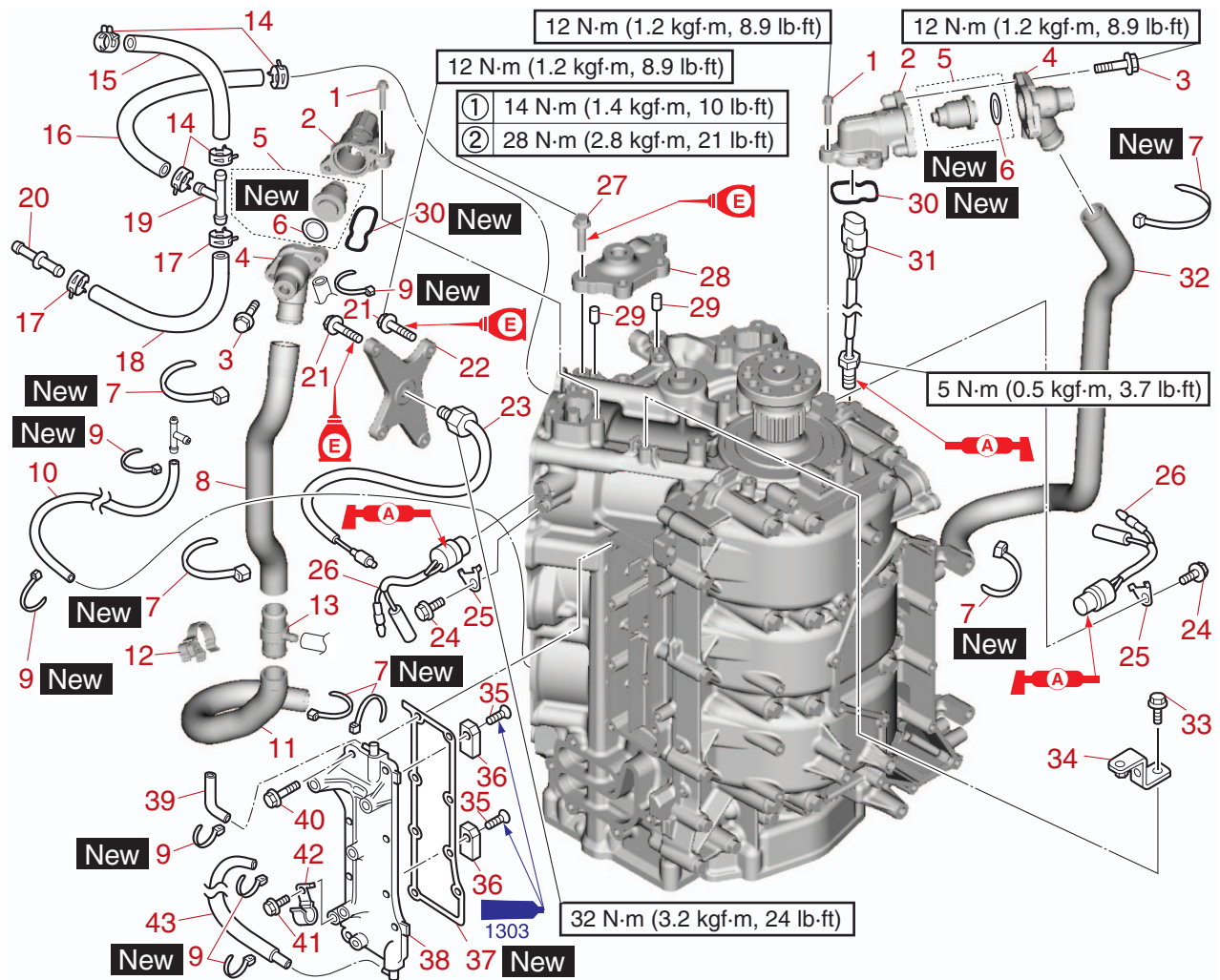
Cylinder block sensor and switch



№	Part name	Q'ty	Remarks
1	Bolt M6 × 25 mm	6	
2	Thermostat housing	2	
3	Bolt M6 × 25 mm	4	
4	Cover	2	
5	Thermostat	2	
6	Gasket	2	
7	Plastic tie	6	
8	Hose	1	
9	Plastic tie	6	
10	Hose	1	
11	Hose	1	
12	Holder	1	
13	Joint	1	
14	Clamp	4	
15	Hose	1	
16	Hose	1	
17	Clamp	2	
18	Hose	1	

№	Part name	Q'ty	Remarks
19	Joint	1	
20	Joint	1	
21	Bolt M6 × 25 mm	4	
22	Bracket	1	
23	Knock sensor	1	
24	Bolt M6 × 12 mm	2	
25	Holder	2	
26	Thermo switch	2	
27	Bolt M8 × 30 mm	4	
28	Bracket	1	
29	Dowel pin	2	
30	Gasket	2	
31	Engine temperature sensor	1	
32	Hose	1	
33	Bolt M6 × 16 mm	1	
34	Bracket	1	
35	Screw M6 × 16 mm	2	

## Cylinder block sensor and switch



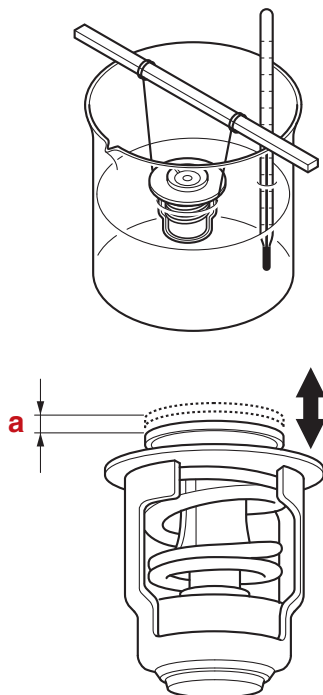
↑↓	Part name	Q'ty	Remarks
36	Anode	2	
37	Gasket	1	
38	Cover	1	
39	Hose	1	
40	Bolt M6 × 20 mm	8	
41	Bolt M6 × 12 mm	1	
42	Holder	1	
43	Hose	1	

### Checking the thermostat

- Measure:
  - Valve opening "a"  
(at the specified water temperatures)  
Out of specification → Replace.

**TIP:** \_\_\_\_\_

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



Water temperature	Valve opening "a"
50–54 °C (122–129 °F)	Starts opening
above 62 °C (144 °F)	4.3 mm (0.17 in) or above

### Checking the cooling water cover anode

- Check:
  - Anode  
Eroded (1/2 or more worn out) → Replace.  
Adhered grease, oil, or scales → Clean.

**NOTICE** \_\_\_\_\_

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

### Installing the thermostat

- Install:
  - Thermo switch "1"
  - Gasket "2" **New**
  - Thermostat housing "3"
  - Thermostat housing bolt "4"
  - Gasket "5" **New**
  - Thermostat "6"

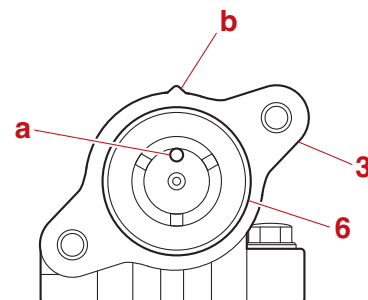
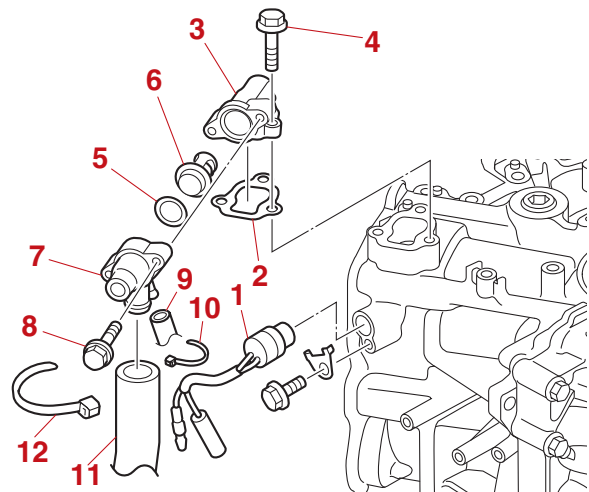
**TIP:** \_\_\_\_\_

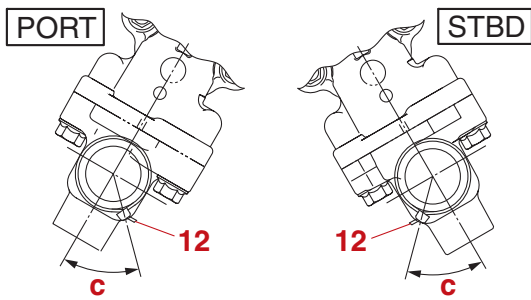
Align the hole "a" in the thermostat "6" with the protrusion "b" on the thermostat housing "3".

- Install:
  - Thermostat cover "7"
  - Thermostat cover bolt "8"
  - Cooling water hose "9"
  - Plastic tie "10" **New**
  - Cooling water hose "11"
  - Plastic tie "12" **New**


**TIP:** \_\_\_\_\_

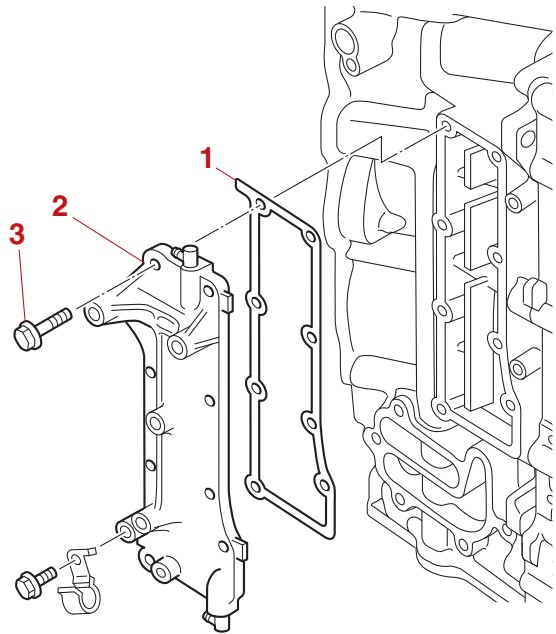
Secure the buckle of the plastic tie "12" within the range "c" shown.





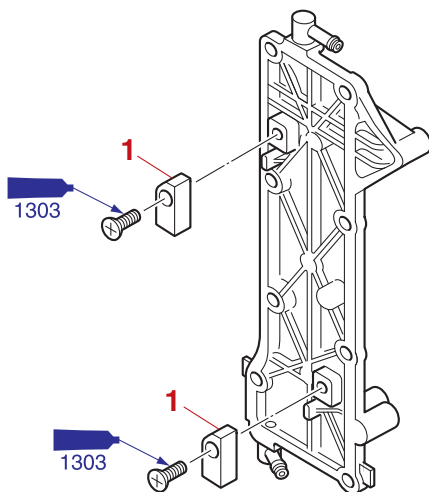
c. 45°

	Thermostat housing bolt "4"
	12 N·m (1.2 kgf·m, 8.9 lb·ft)
	Thermostat cover bolt "8"
	12 N·m (1.2 kgf·m, 8.9 lb·ft)



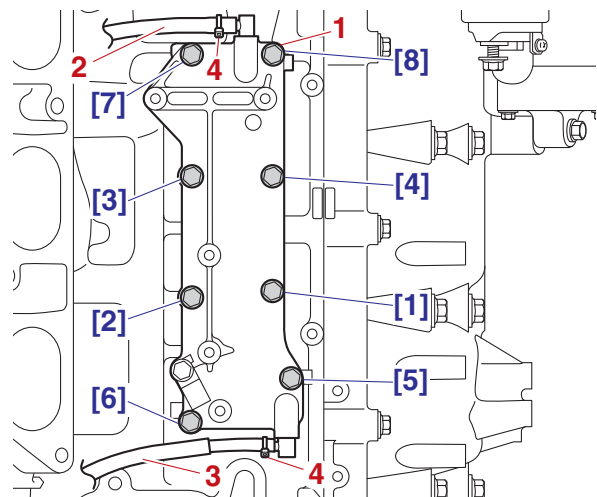
### Installing the cooling water cover

1. Install:
  - Anode "1"



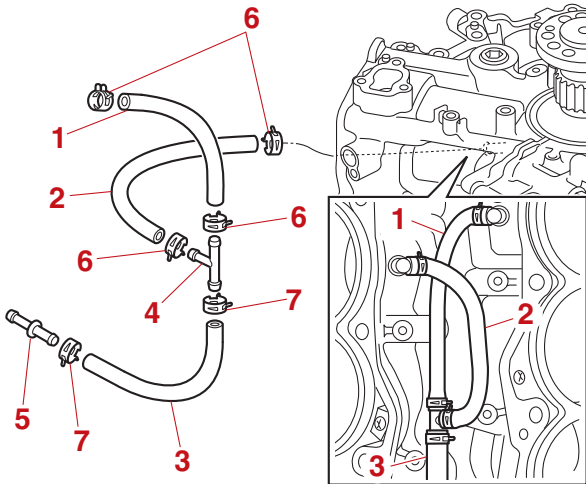
2. Install:
  - Gasket "1" **New**
  - Cooling water cover "2"
  - Cooling water cover bolt "3"

3. Tighten:
  - Cooling water cover bolt "1"
    - a. Tighten the cooling water cover bolts "1" in the order [1], [2], and so on.
4. Connect:
  - Cooling water hose
    - a. Connect the cooling water hoses "2" and "3", and then fasten them using new plastic ties "4".



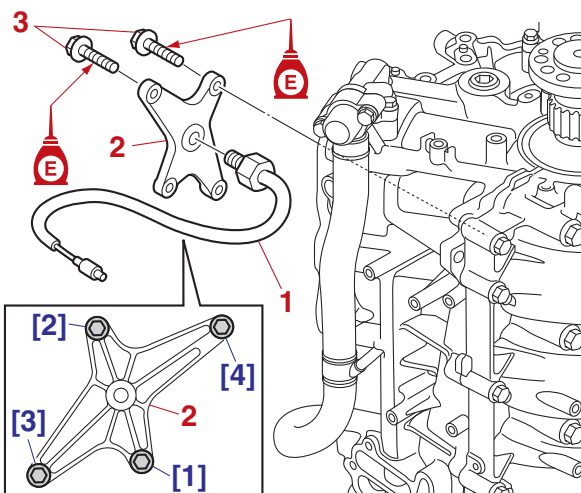
### Installing the knock sensor

1. Install:
  - Cooling water hose "1", "2", "3"
  - Joint "4", "5"
  - Clamp "6", "7"



2. Install:
  - Knock sensor "1"
  - Bracket "2"
  - Knock sensor bracket bolt "3"

**TIP:** Tighten the knock sensor bracket bolts "3" to the specified torque in the order [1], [2], and so on.

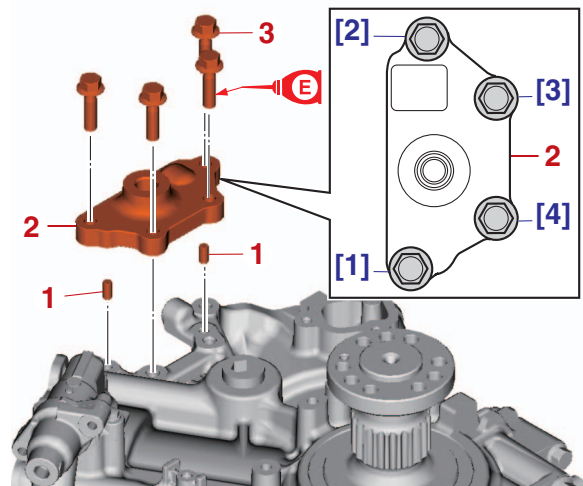


	Knock sensor "1"
	32 N·m (3.2 kgf·m, 24 lb·ft)
	Knock sensor bracket bolt "3"
	12 N·m (1.2 kgf·m, 8.9 lb·ft)

### Installing the pulley bracket

1. Install:
  - Dowel pin "1"
  - Pulley bracket "2"
  - Pulley bracket bolt "3"

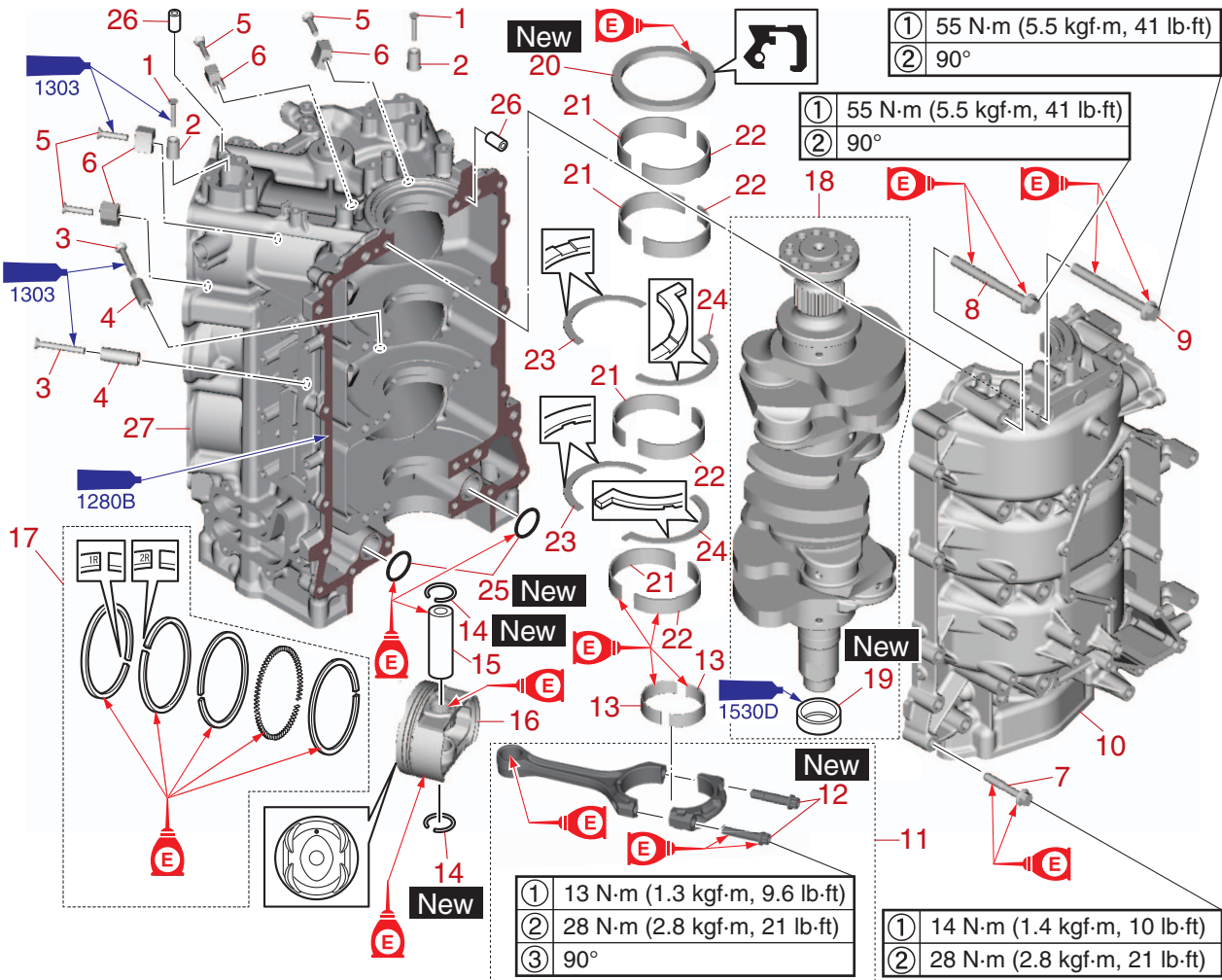
**TIP:** Tighten the pulley bracket bolts "3" to the specified torques in 2 stages and in the order [1], [2], and so on.



	Pulley bracket bolt "3"
	1st: 14 N·m (1.4 kgf·m, 10 lb·ft)
	2nd: 28 N·m (2.8 kgf·m, 21 lb·ft)



Cylinder block



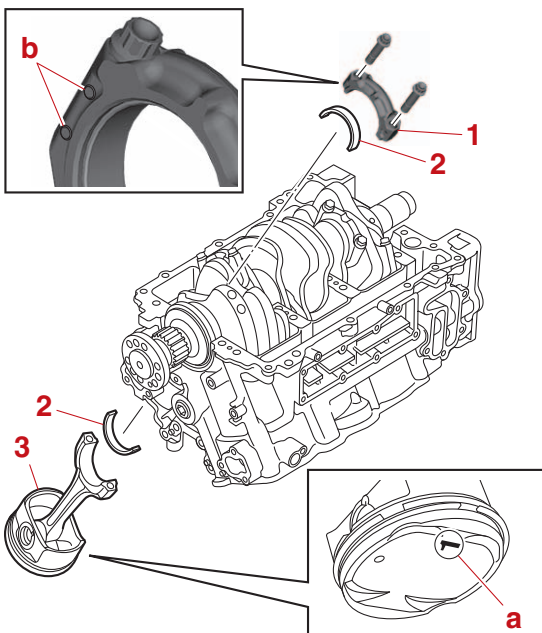
№	Part name	Q'ty	Remarks
1	Screw M5 × 26 mm	2	
2	Anode	2	
3	Screw M6 × 45 mm	2	
4	Anode	2	
5	Screw M6 × 25 mm	4	
6	Anode	4	
7	Bolt M8 × 50 mm	16	
8	Bolt M10 × 105 mm	8	
9	Bolt M10 × 130 mm	8	
10	Crankcase	1	
11	Connecting rod assembly	6	
12	Bolt M9 × 42 mm	12	
13	Crankshaft pin bearing	12	
14	Clip	12	
15	Piston pin	6	
16	Piston	6	
17	Piston ring set	6	

№	Part name	Q'ty	Remarks
18	Crankshaft	1	
19	Collar	1	
20	Oil seal	1	
21	Crankshaft journal bearing	4	Upper
22	Crankshaft journal bearing	4	Lower
23	Thrust bearing	2	Upper
24	Thrust bearing	2	Lower
25	O-ring	2	
26	Dowel pin	8	
27	Cylinder block	1	

### Disassembling the cylinder block

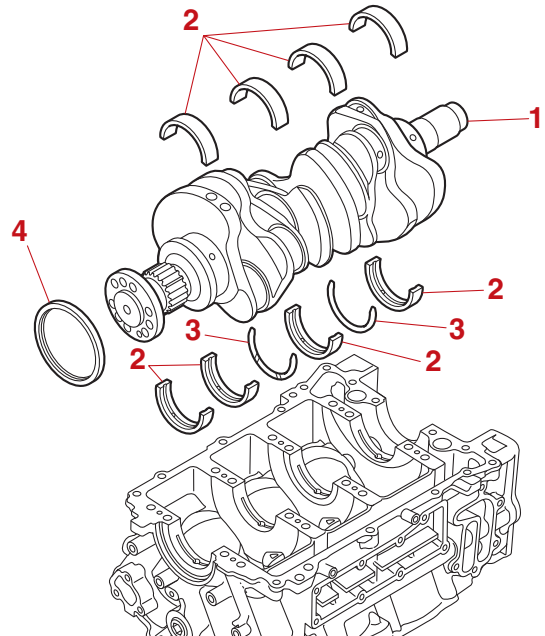
1. Remove:
  - Crankcase
  - Thrust bearing
  
2. Remove:
  - Piston and connecting rod assembly
    - a. Remove the connecting rod caps "1", and then remove the crankshaft pin bearings "2", piston and connecting rod assemblies "3".

- TIP:**
- To prevent mixing the piston and connecting rod assemblies "3" and connecting rod caps "1", mark each with an identification number "a" of the corresponding cylinder.
  - Mark each connecting rod and connecting rod cap with mark "b" on the side facing toward the flywheel magneto end of the crankshaft.
  - Make sure to keep the parts in the order of removal.

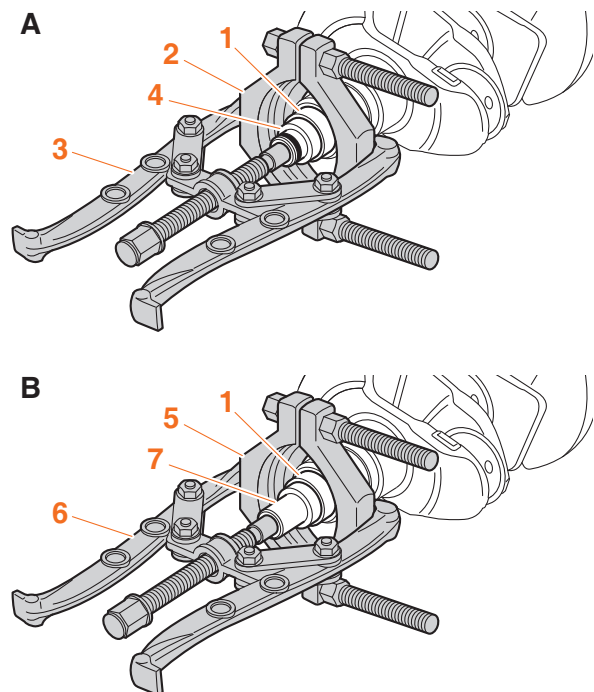


3. Remove:
  - Crankshaft "1"
  - Crankshaft journal bearing "2"
  - Thrust bearing "3"
  - Oil seal "4"

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



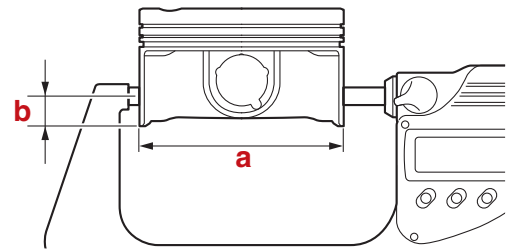
4. Remove:
  - Collar "1"



A. Worldwide  
 B. USA and Canada



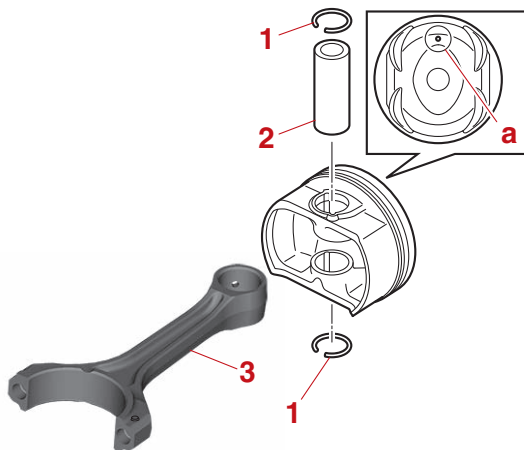
	Bearing separator "2"
	90890-06534
	Gear puller "3"
	90890-06540
	Needle bearing attachment "4"
	90890-06615
	Bearing separator "5"
(commercially available)	
Gear puller "6"	
(commercially available)	
Needle bearing remover and installer "7"	
YB-06346	



	Piston
	Diameter
	95.945–95.960 mm (3.7774–3.7779 in)
	Limit
	95.905 mm (3.7758 in)
Measuring point	
13.5 mm (0.53 in)	

5. Remove:
- Piston pin clip "1"
  - Piston pin "2"
  - Connecting rod "3"

- TIP:**
- Remove the piston pin from the side marked with "a".
  - Make sure to keep the parts in the order of removal.



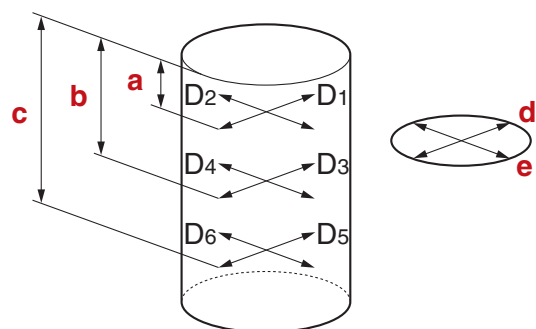
6. Remove:
- Piston ring

### Checking the piston diameter


1. Measure:
- Piston diameter "a"  
(at the specified measuring point "b")  
Below specification → Replace.

### Checking the cylinder bore

1. Measure:
- Cylinder bore (D1–D6)  
(at measuring points "a", "b", and "c", and in directions "d" [D1, D3, D5] and "e" [D2, D4, D6])  
Above specification → Replace the cylinder block.




- a. 10.0 mm (0.39 in)
- b. 77.0 mm (3.03 in)
- c. 106.0 mm (4.17 in)
- d. Parallel to the crankshaft
- e. At a right angle to the crankshaft

	Cylinder Bore
	96.000–96.012 mm (3.7795–3.7800 in)
	Limit 96.072 mm (3.7824 in)

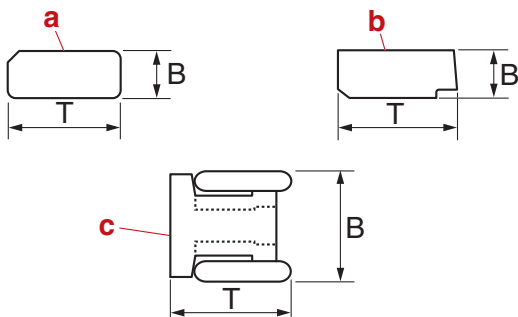
### Checking the piston clearance

- Measure:
  - Piston diameter  
See “Checking the piston diameter” (7-74).
  - Cylinder bore  
See “Checking the cylinder bore” (7-74).
- Calculate:
  - Piston clearance  
Out of specification → Replace the piston or cylinder block.


	Piston clearance = Maximum cylinder bore – Piston outside diameter
	Piston clearance 0.040–0.067 mm (0.0016–0.0026 in)
	Limit 0.167 mm (0.0066 in)

### Checking the piston ring

- Measure:
  - Piston ring dimension  
Below specification → Replace.



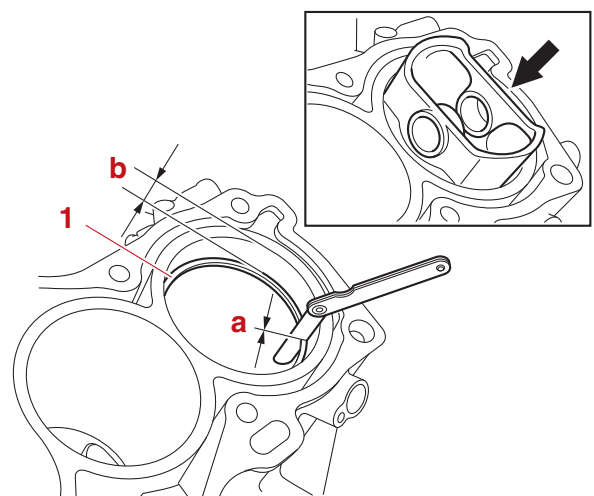
- a. Top ring
- b. 2nd ring
- c. Oil ring


	Piston ring dimensions
	Top ring
	Height (B) 1.170–1.185 mm (0.0461–0.0467 in)
	Width (T) 2.800–3.000 mm (0.1102–0.1181 in)
	2nd ring
	Height (B) 1.170–1.190 mm (0.0461–0.0469 in)
	Width (T) 3.800–4.000 mm (0.1496–0.1575 in)
	Oil ring
	Height (B) 2.400–2.470 mm (0.0945–0.0972 in)
	Width (T) 2.350–2.750 mm (0.0925–0.1083 in)

### Checking the piston ring end gap

- Measure:
  - Piston ring end gap “a”  
Above specification → Replace.

**TIP:** \_\_\_\_\_  
Level the piston ring “1” in the cylinder using a piston crown at the specified measuring point “b”.





**Piston ring end gap**  
 End gap measuring point  
 20.0 mm (0.79 in)

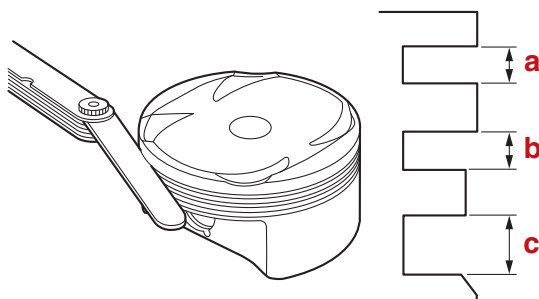
**Top ring**  
 End gap  
 0.20–0.30 mm (0.0079–0.0118 in)  
 Limit  
 0.470 mm (0.0185 in)

**2nd ring**  
 End gap  
 0.60–0.75 mm (0.0236–0.0295 in)  
 Limit  
 0.900 mm (0.0354 in)


**Oil ring**  
 End gap  
 0.15–0.60 mm (0.0059–0.0236 in)

**Checking the piston ring groove**

- Measure:
  - Piston ring groove  
 Above specification → Replace.



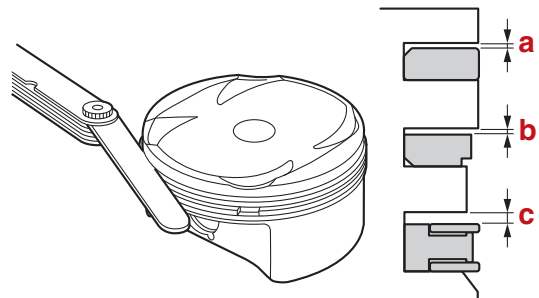
- Ring groove (Top)
- Ring groove (2nd)
- Ring groove (Oil)




**Piston ring groove**  
 Ring groove (Top)  
 1.22–1.25 mm (0.0480–0.0492 in)  
 Ring groove (2nd)  
 1.22–1.24 mm (0.0480–0.0488 in)  
 Ring groove (Oil)  
 2.51–2.53 mm (0.0988–0.0996 in)

**Checking the piston ring side clearance**

- Measure:
  - Piston ring side clearance  
 Above specification → Check the piston ring grooves and piston ring.  
 See “Checking the piston ring groove” (7-76) and “Checking the piston ring” (7-75).



- Top ring side clearance
- 2nd ring side clearance
- Oil ring side clearance

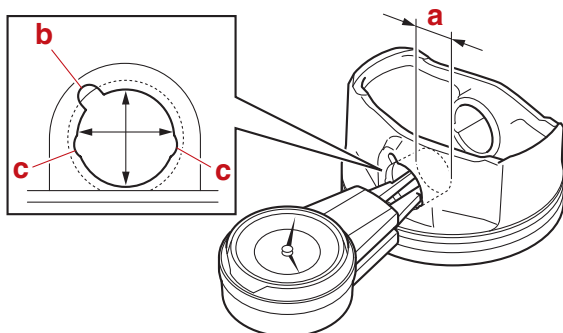


**Piston ring side clearance**  
 Top ring  
 Side clearance  
 0.04–0.08 mm (0.0016–0.0032 in)  
 Limit  
 0.130 mm (0.0051 in)  
 2nd ring  
 Side clearance  
 0.03–0.07 mm (0.0012–0.0028 in)  
 Limit  
 0.110 mm (0.0043 in)  
 Oil ring  
 Side clearance  
 0.04–0.13 mm (0.0016–0.0051 in)

**Checking the piston pin boss inside diameter**

- Measure:
  - Piston pin boss inside diameter “a”  
 Above specification → Replace.

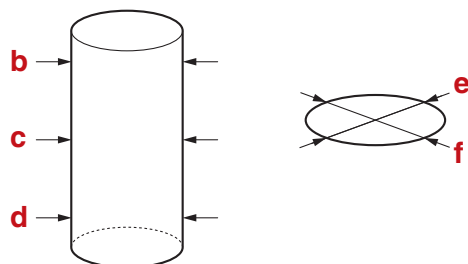
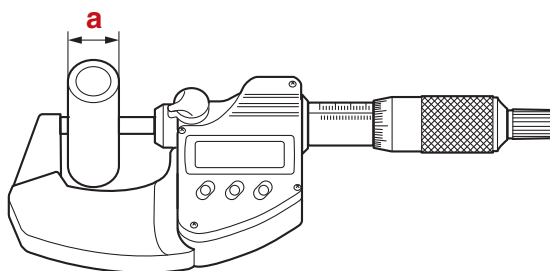
**TIP:** \_\_\_\_\_  
 When measuring the piston pin boss inside diameter, do not measure it at the ring groove “b” or oil groove “c”.



	Pin boss inside diameter
	22.011–22.018 mm (0.8666–0.8668 in)
	Limit
	22.038 mm (0.8676 in)

### Checking the piston pin diameter

- Measure:
  - Piston pin outside diameter “a” (at measuring points “b”, “c”, and “d”, and in directions “e” and “f”) Below specification → Replace.

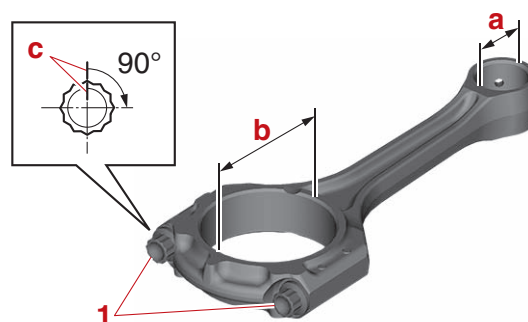


	Pin outside diameter
	21.996–22.005 mm (0.8660–0.8663 in)
	Limit
	21.986 mm (0.8656 in)

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

- Measure:
  - Small end inside diameter “a”
  - Big end inside diameter “b”
 Above specification → Replace the connecting rod assembly.

- TIP:** \_\_\_\_\_
- When checking the big end inside diameter, reuse the removed connecting rod bolt.
  - Tighten the connecting rod bolts “1” to the specified torques in 3 stages.
  - In the third tightening stage for the connecting rod bolts “1”, mark the connecting rod bolts and the connecting rod cap with identification marks “c”, and then tighten the bolts 90° from the marks on the connecting rod cap.

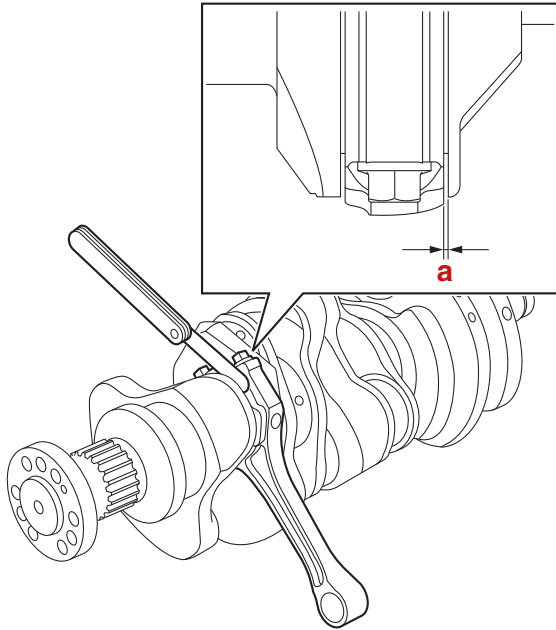



	Connecting rod bolt “1”
	1st: 13 N·m (1.3 kgf·m, 9.6 lb·ft)
	2nd: 28 N·m (2.8 kgf·m, 21 lb·ft)
	3rd: 90°

	Small end inside diameter
	22.010–22.024 mm (0.8665–0.8671 in)
	Big end inside diameter
	55.990–56.010 mm (2.2043–2.2051 in)

### Checking the connecting rod big end side clearance

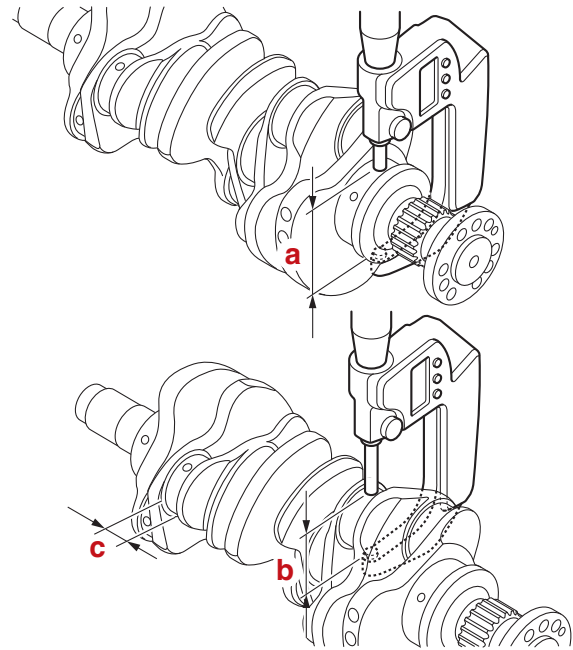
- Measure:
  - Big end side clearance "a"  
Above specification → Check the crankshaft pin width.  
See "Checking the crankshaft" (7-78).




	Big end side clearance 0.140–0.310 mm (0.0055–0.0122 in) Limit 0.36 mm (0.0142 in)
---	---

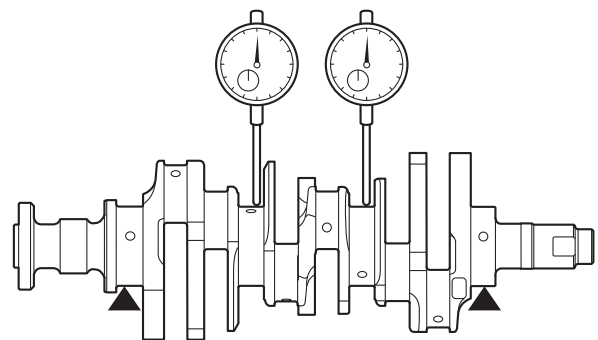
### Checking the crankshaft


- Measure:
  - Journal diameter "a"
  - Crankshaft pin diameter "b"
  - Crankshaft pin width "c"  
Below specification → Replace the crankshaft.



	Journal diameter 72.976–72.996 mm (2.8731–2.8739 in) Crankshaft pin diameter 52.980–53.000 mm (2.0858–2.0866 in) Crankshaft pin width 21.00–21.10 mm (0.8268–0.8307 in)
---	--

- Measure:
  - Crankshaft runout  
Above specification → Replace the crankshaft.



	Runout 0.03 mm (0.0012 in) Limit 0.04 mm (0.0016 in)
---	---

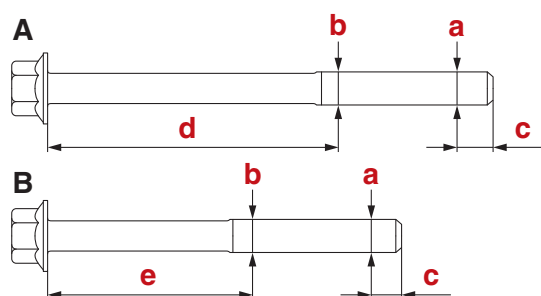
## Checking the crankcase bolt

1. Measure:

- Crankcase bolt diameter  
Above specification → Replace.

### TIP:

Measure the diameters “a” and “b” of the crankcase bolt at the specified measuring points “c” and “d”, and “c” and “e”.



A. M10 × 130 mm

B. M10 × 105 mm



Crankcase bolt diameter difference limit

“a” – “b” = Less than 0.20 mm  
(0.0079 in)

Measuring point “c”: 10.0 mm  
(0.39 in)

Measuring point “d”: 85.0 mm  
(3.35 in)

Measuring point “e”: 60.0 mm  
(2.36 in)

## Checking the big end oil clearance

### TIP:

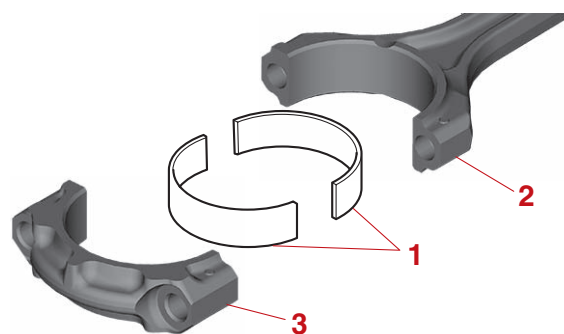
Clean the mating surfaces of the parts in advance.

1. Install:

- Crankshaft pin bearings “1” (into the connecting rod “2” and connecting rod cap “3”)

### TIP:

Install the crankshaft pin bearings in their original positions.



2. Install:

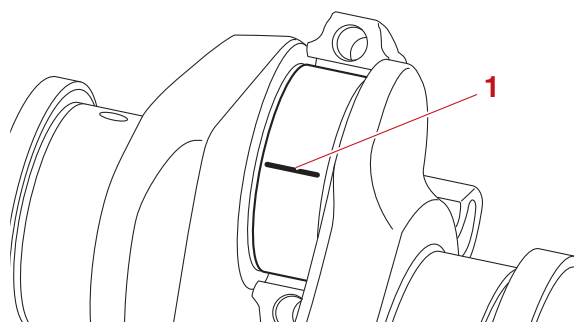
- Plastigauge (PG-1) “1”

### NOTICE

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

### TIP:

Place a piece of Plastigauge (PG-1) “1” onto the crankshaft pin, parallel to the crankshaft.

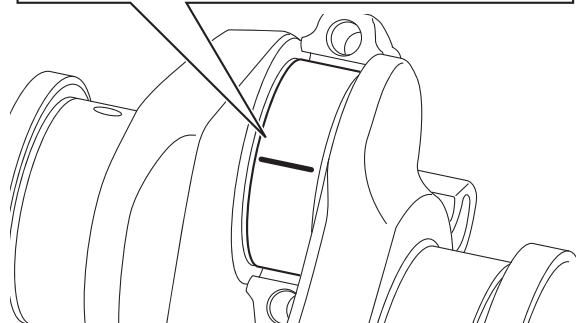
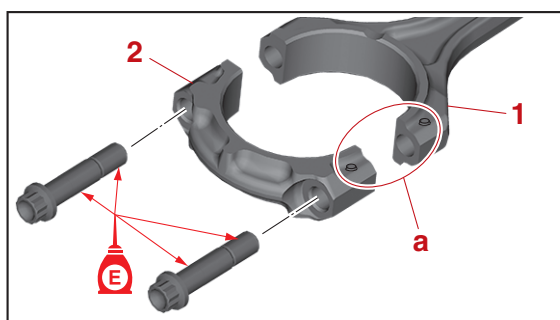


3. Install:

- Connecting rod “1”
- Connecting rod cap “2”
- Connecting rod bolt (temporarily)

**TIP:** \_\_\_\_\_

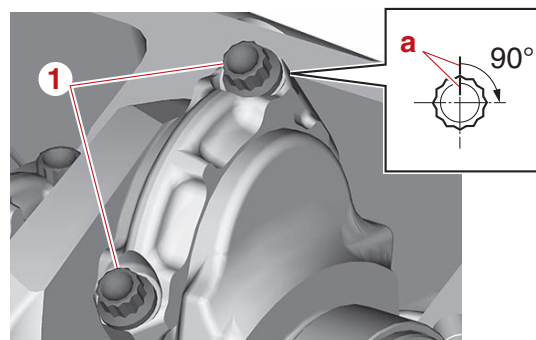
- When checking the oil clearance, reuse the removed connecting rod bolts.
- Make sure that the marks “a” on the connecting rod “1” and connecting rod cap “2” face toward the flywheel magneto end of the crankshaft.
- Do not turn the connecting rod until the big end oil clearance measurement has been completed.




4. Tighten:
- Connecting rod bolt “1”

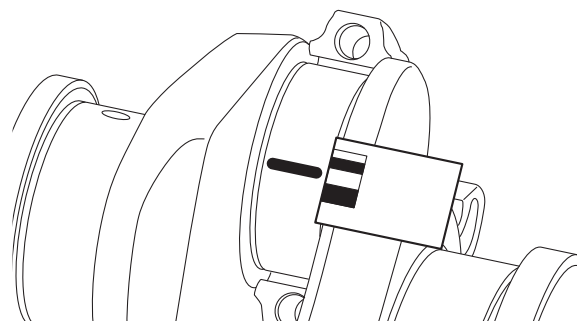
**TIP:** \_\_\_\_\_


- Tighten the connecting rod bolts “1” to the specified torques in 3 stages.
- In the third tightening stage for the connecting rod bolts “1”, mark the connecting rod bolts and the connecting rod cap with identification marks “a”, and then tighten the bolts 90° from the marks on the connecting rod cap.



	Connecting rod bolt “1”
	1st: 13 N·m (1.3 kgf·m, 9.6 lb·ft)
	2nd: 28 N·m (2.8 kgf·m, 21 lb·ft)
	3rd: 90°

5. Remove:
- Connecting rod bolt
  - Connecting rod cap
6. Measure:
- Width of the compressed Plastigauge (PG-1)
- Above specification → Replace the crankshaft pin bearing.



	Big end oil clearance
	0.025–0.050 mm (0.0010–0.0020 in)
	Limit
	0.080 mm (0.0032 in)

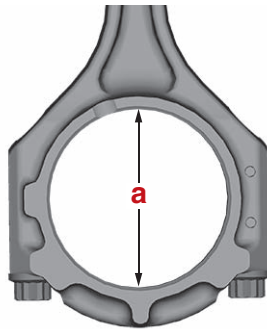
**Selecting the crankshaft pin bearing**


When replacing the crankshaft pin bearing, select the bearing as follows.



1. Measure:

- Connecting rod big end inside diameter “a”



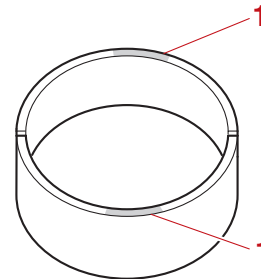
	Big end inside diameter 55.990–56.010 mm (2.2043– 2.2051 in)
---	--

Example:

Connecting rod big end inside diameter “a”	Number in table
56.005 mm	05

**TIP:**

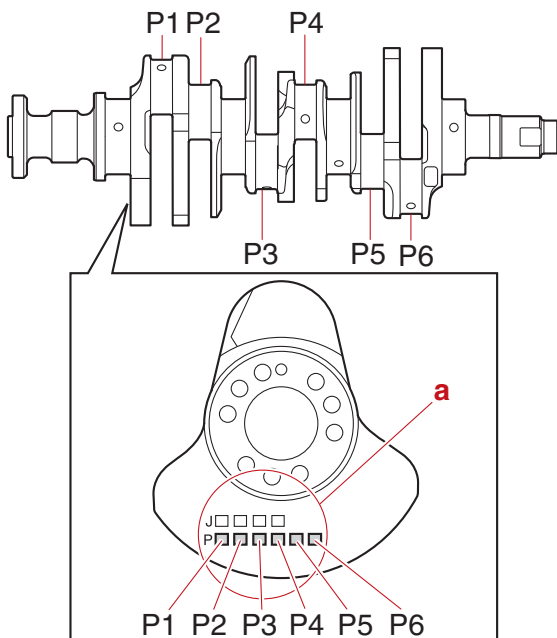
Select the suitable colors “1” for the crankshaft pin bearing from the “Crankshaft pin bearing selection table” (7-82).



	Rod side bearing color	Cap side bearing color
“a”	Black	Black
“b”	Black	Pink
“c”	Pink	Pink
“d”	Red	Pink

2. Check:

- Stamped mark “a” (on the crank web)



Example:

If the connecting rod big end inside diameter is “05” and the crankshaft pin mark is “81”, select the bearing colors in “d”. The rod side bearing color is red and the cap side bearing color is pink.

		90	91	04	05	06	07
	80						
	81						
	82						

The cell at row 81, column 05 is highlighted in red and contains the letter 'd'.

3. Select:

- Crankshaft pin bearing

**Crankshaft pin bearing selection table**

		A																						
		90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10		
B	80	Light Pink									Dark Pink													
	81	Light Pink										Dark Pink												
	82	Light Pink											Dark Pink										d	
	83	Dark Purple	Light Pink										Dark Pink											
	84	Dark Purple	Dark Purple	Light Pink																				
	85	Dark Purple	Dark Purple	Dark Purple	Light Pink																			
	86	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink																Dark Pink		
	87	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink														Dark Pink	Dark Pink		
	88	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink												Dark Pink	Dark Pink	Dark Pink		
	89	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink										Dark Pink	Dark Pink				
	90	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink														
	91	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink													
	92	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink												
	93	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink									Dark Pink		
	94	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink								Dark Pink	Dark Pink	
	95	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink							Dark Pink	Dark Pink	Dark Pink
	96	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink						Dark Pink	Dark Pink	Dark Pink
	97	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink					Dark Pink	Dark Pink	Dark Pink
	98	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink				Dark Pink	Dark Pink	Dark Pink
	99	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink			Dark Pink	Dark Pink	Dark Pink	
	00	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Dark Purple	Light Pink		Dark Pink	Dark Pink	Dark Pink	Dark Pink	

A. Connecting rod big end inside diameter

B. Crankshaft pin mark

## Checking the journal oil clearance

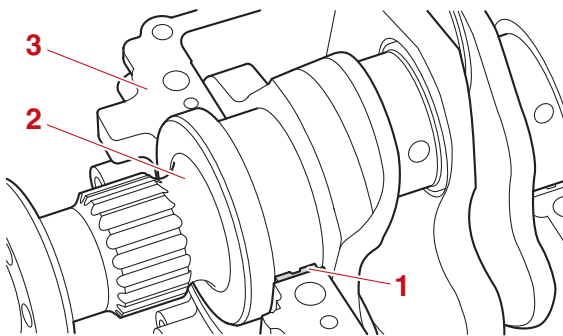
**TIP:** \_\_\_\_\_

- After checking the journal oil clearance, check the crankcase bolts. See “Checking the crankcase bolt” (7-79).
- Clean the mating surfaces of the parts in advance.

1. Install:
  - Crankshaft journal bearing “1”
  - Crankshaft “2”  
(into the cylinder block “3”)

**TIP:** \_\_\_\_\_

Install the crankshaft journal bearings “1” in their original positions.

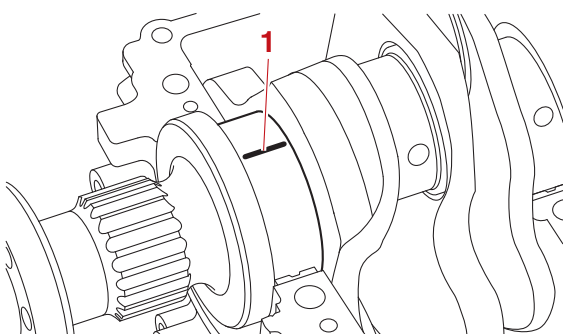


2. Install:
  - Plastigauge (PG-1) “1”

**NOTICE**  
Do not place the Plastigauge (PG-1) over the oil hole in each crankshaft journal.

**TIP:** \_\_\_\_\_

Place a piece of Plastigauge (PG-1) “1” onto the crankshaft journal, parallel to the crankshaft.



3. Install:
  - Crankshaft journal bearing  
(into the crankcase)

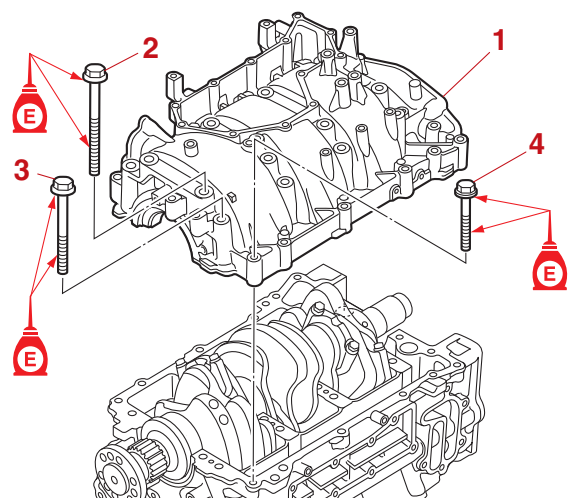
**TIP:** \_\_\_\_\_

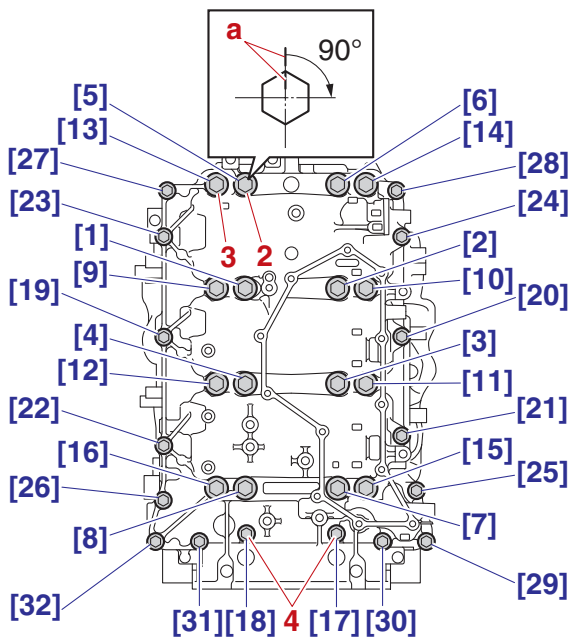
Install the crankshaft journal bearings in their original positions.

4. Install:
  - Crankcase “1”
    - a. Tighten the crankcase bolts (M10) “2” and “3” to the specified torques in 2 stages and in the order [1], [2], and so on.
    - b. Tighten the crankcase bolts (M8) “4” to the specified torques in 2 stages and in the order [17], [18], and so on.

**TIP:** \_\_\_\_\_

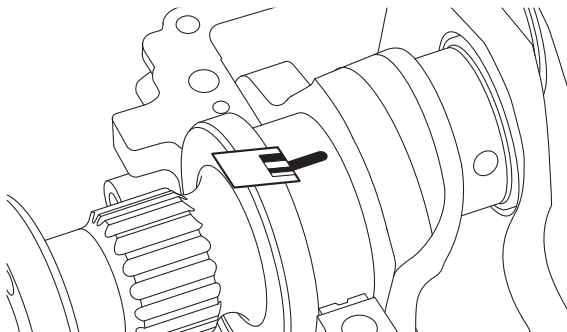
- When checking the oil clearance, reuse the removed crankcase bolts.
- Do not turn the crankshaft until the journal oil clearance measurement has been completed.
- In the second tightening stage for the crankcase bolts (M10) “2” and “3”, mark the crankcase bolts (M10) and the crankcase with identification marks “a”, and then tighten the bolts 90° from the marks on the crankcase.





	Crankcase bolt (M10) "2", "3" [1]–[16]
	1st: 55 N·m (5.5 kgf·m, 41 lb·ft) 2nd: 90°
	Crankcase bolt (M8) "4" [17]–[32]
	1st: 14 N·m (1.4 kgf·m, 10 lb·ft) 2nd: 28 N·m (2.8 kgf·m, 21 lb·ft)

5. Remove:
  - Crankcase
6. Measure:
  - Width of the compressed Plastigauge (PG-1)
 Out of specification → Replace the crankshaft journal bearing.

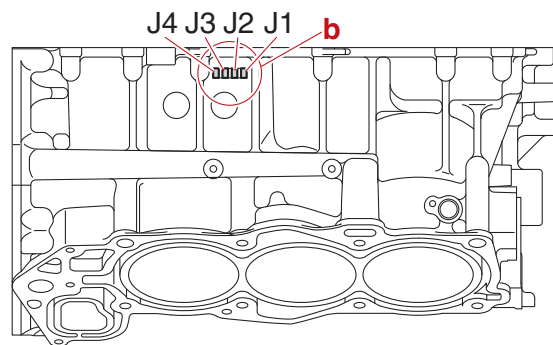
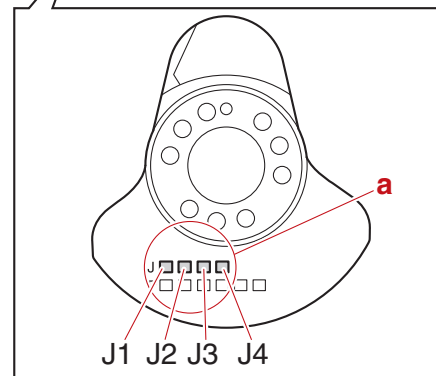
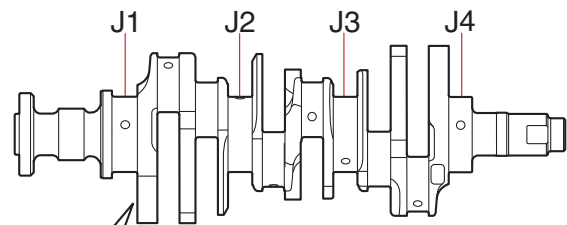


	Journal oil clearance
	0.029–0.045 mm (0.0011–0.0018 in)
	Limit
	0.065 mm (0.0026 in)

### Selecting the crankshaft journal bearing

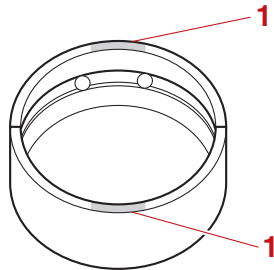
When replacing the crankshaft journal bearing, select the bearing as follows.

1. Check:
  - Stamped mark "a" (on the crank web)
  - Stamped mark "b" (on the cylinder block)



2. Select:
  - Crankshaft journal bearing

**TIP:** \_\_\_\_\_  
 Select the suitable colors “1” for the crankshaft journal bearing from the “Crankshaft journal bearing selection table” (7-86).



	Block side bearing color	Crankcase side bearing color
“a”	Purple	Purple
“b”	Purple	Yellow
“c”	Yellow	Yellow
“d”	Yellow	Red
“e”	Red	Red
“f”	Red	Green
“g”	Green	Green
“h”	Green	Brown
“i”	Brown	Brown

Example:

If the crankshaft journal mark is “77” and the cylinder block mark is “17”, select the bearing colors in “i”. The block side bearing color is brown and the crankcase side bearing color is brown.

	00	01	16	17	18	19	20
76							
77				i			
78							

**Crankshaft journal bearing selection table**

		B																				
		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
A	76	Red	Red	Red	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Brown	Brown	Brown	Brown	Brown	
	77	Red	Red	Red	Red	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Brown	Brown	Brown	Green	i
	78	Red	Red	Red	Red	Red	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Brown	Brown	Brown
	79	Orange	Red	Red	Red	Red	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	h
	80	Orange	Orange	Red	Red	Red	Red	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Brown
	81	Orange	Orange	Orange	Red	Red	Red	Red	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	82	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green	Green	g
	83	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Green	Green	Green	Green	Green	Green	Green
	84	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Green	Green	Green	Green	Green	f
	85	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Green	Green	Green	Green	Green
	86	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Green	Green	Green	e
	87	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Brown	Green	Green
	88	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Green	Green
	89	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown	Green
	90	Brown	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown	Brown
	91	Brown	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	Brown	Brown
	92	Purple	Brown	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Red	Brown
93	Purple	Purple	Brown	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Brown	
94	Purple	Purple	Purple	Brown	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	
95	Purple	a	Purple	Purple	Brown	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	Red	
96	Purple	Purple	Purple	Purple	Brown	Brown	Brown	Brown	Brown	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	

- A. Crankshaft journal mark
- B. Cylinder block mark

### Checking the cylinder block anode

- Check:
  - Anode
    - Eroded (1/2 or more worn out) → Replace.
    - Adhered grease, oil, or scales → Clean.

**NOTICE**

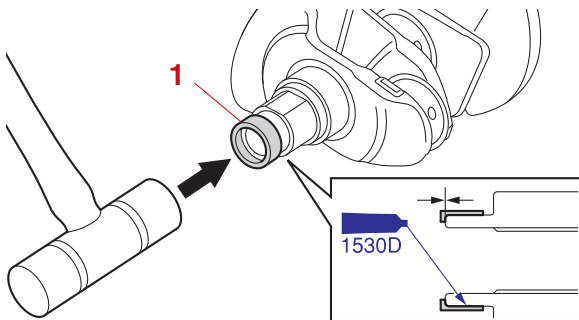
Do not apply grease, oil, or paint to the anodes.

### Assembling the cylinder block

**TIP:**

Before assembling the cylinder block, check the crankcase bolts. See “Checking the crankcase bolt” (7-79).

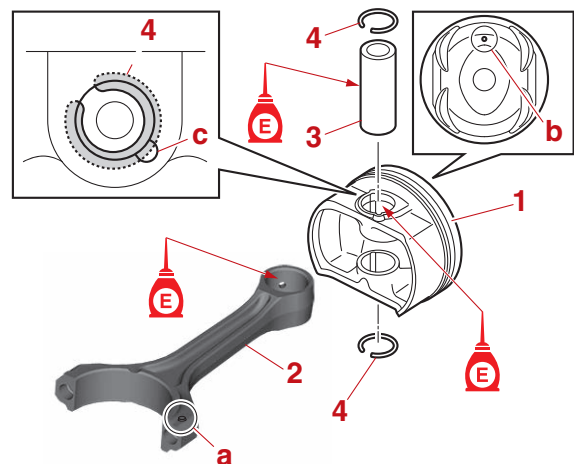
- Install:
  - Collar “1” **New**



- Assemble:
  - Piston
  - Connecting rod
  - Piston pin
  - Piston pin clip **New**
  - Piston ring
    - Assemble the piston “1”, connecting rod “2”, piston pin “3”, and new piston pin clips “4”.

**TIP:**

- Face the mark “a” on the connecting rod “2” in the same direction as the mark “b” on the piston crown.
- Install the piston pin from the side marked with “b”.
- Make sure that the clip “4” end is not aligned with the groove “c” in the piston pin boss.



- Install the oil rings “1”, 2nd ring “2”, and top ring “3”.

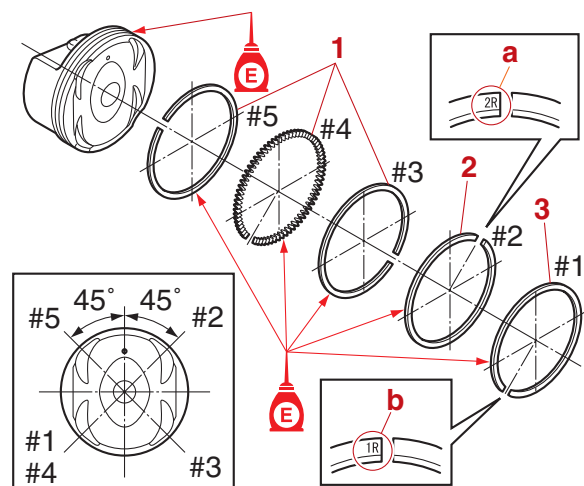
**NOTICE**

Do not scratch the pistons or break the piston rings.

**TIP:**

- Make sure that the “2R” mark “a” on the 2nd ring “2” and “1R” mark “b” on the top ring “3” are facing up.
- Make sure that the piston rings move smoothly.

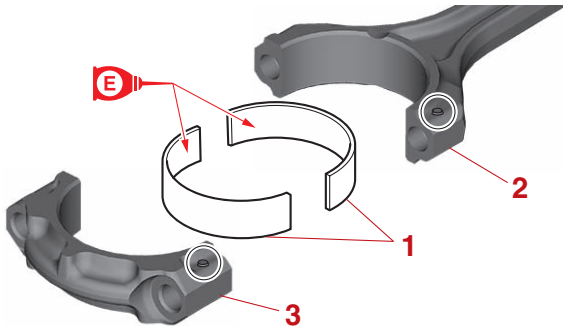
- Offset the piston ring end gaps.



- Install:
  - Crankshaft pin bearing “1” (into the connecting rod “2” and connecting rod cap “3”)



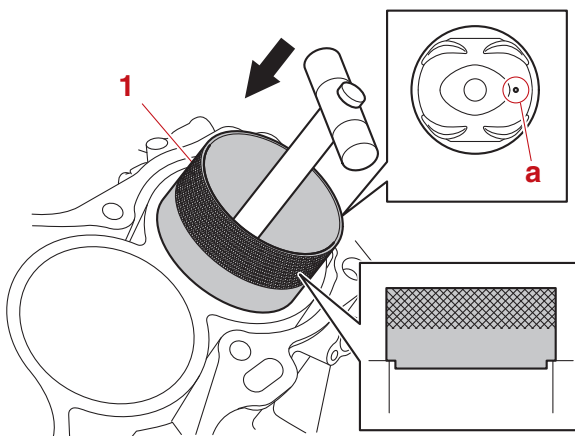
**TIP:** \_\_\_\_\_  
Install the crankshaft pin bearings in the original positions.



4. Install:
- Piston

**TIP:** \_\_\_\_\_

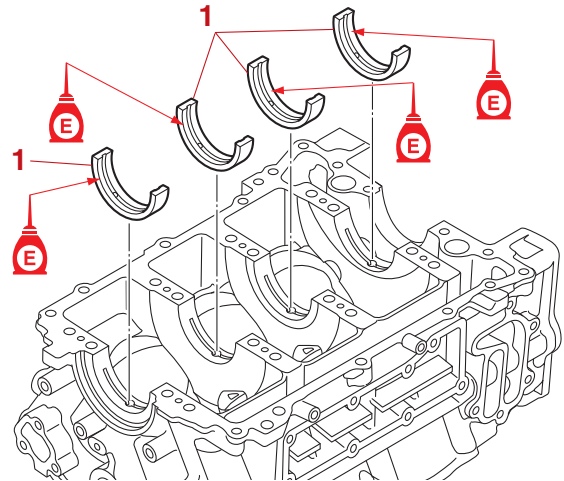
- Apply engine oil to the side of the piston, piston rings, and cylinder wall.
- Install the piston so that the mark “a” on the piston crown is facing toward the flywheel magneto end of the crankshaft.



	Piston slider 96 mm “1”
	90890-06684
	Piston slider 96 mm “1”
	YB-06684

5. Install:
- Crankshaft journal bearing “1” (cylinder block side)

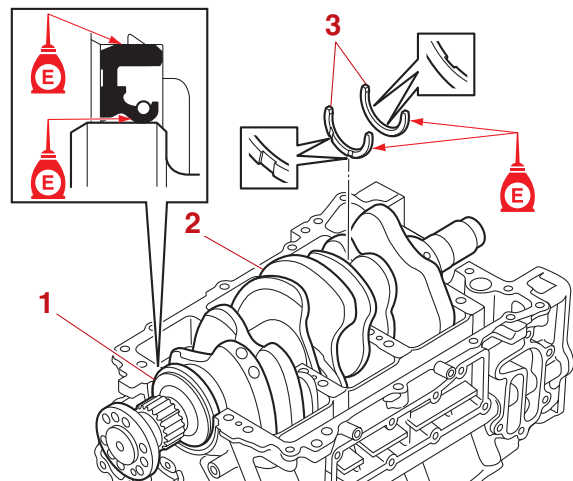
**TIP:** \_\_\_\_\_  
Install the crankshaft journal bearings “1” in their original positions.



6. Install:
- Oil seal “1” **New**
  - Crankshaft “2”
  - Thrust bearing “3” (cylinder block side)

**TIP:** \_\_\_\_\_

- Install each thrust bearing with its grooves facing outward.



7. Install:
- Connecting rod cap
  - Connecting rod bolt **New**
    - Install the connecting rod caps “1” to the connecting rods.

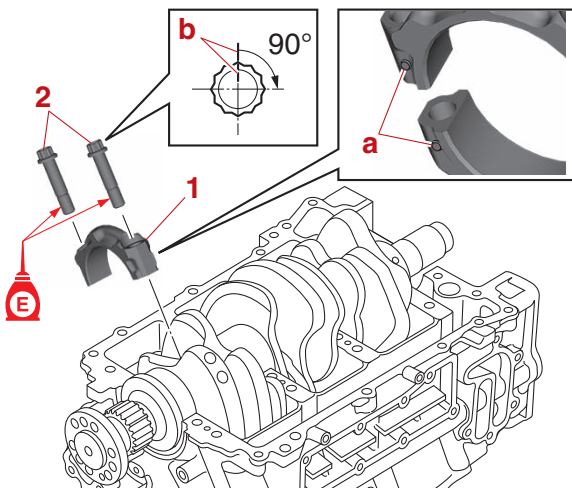
**TIP:** \_\_\_\_\_


Make sure that the marks “a” on the connecting rod and connecting rod caps “1” are facing toward the flywheel magneto end of the crankshaft.

- b. Tighten new connecting rod bolts “2” to the specified torques in 3 stages.

**TIP:** \_\_\_\_\_

- In the third tightening stage for the connecting rod bolts “2”, mark the connecting rod bolts and connecting rod cap with paint marks “b”, and then tighten the bolts 90° from the marks on the connecting rod cap.
- After tightening the connecting rod bolts “2”, make sure that the crankshaft turns smoothly.

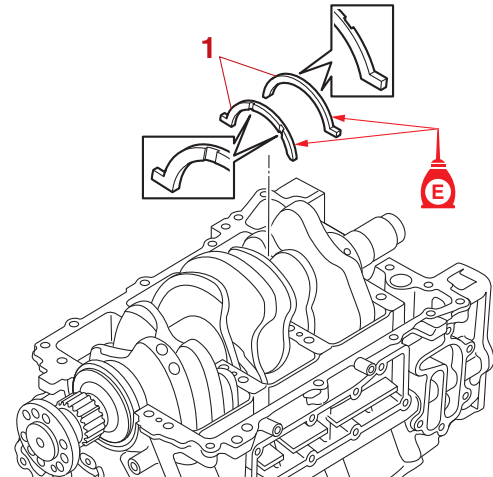


	<b>Connecting rod bolt “2”</b>
	1st: 13 N·m (1.3 kgf·m, 9.6 lb·ft)
	2nd: 28 N·m (2.8 kgf·m, 21 lb·ft)
	3rd: 90°

8. Install:
  - Thrust bearing “1” (crankcase side)
  - Crankshaft journal bearing (crankcase side)
  - O-ring **New**
  - Crankcase
    - a. Install the thrust bearing “1”.

**TIP:** \_\_\_\_\_

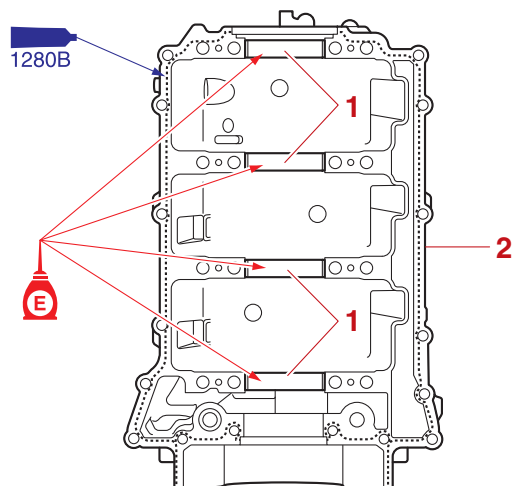
- Install each thrust bearing with its grooves facing outward.
- Fit the protrusion on thrust bearing into the slot in the crankcase.



- b. Apply a thin, even layer of sealant onto the mating surface of the crankcase “2”.

**TIP:** \_\_\_\_\_

- Install the crankshaft journal bearings “1” in their original positions.
- Do not apply any sealant to the crankshaft journal bearings “1”.




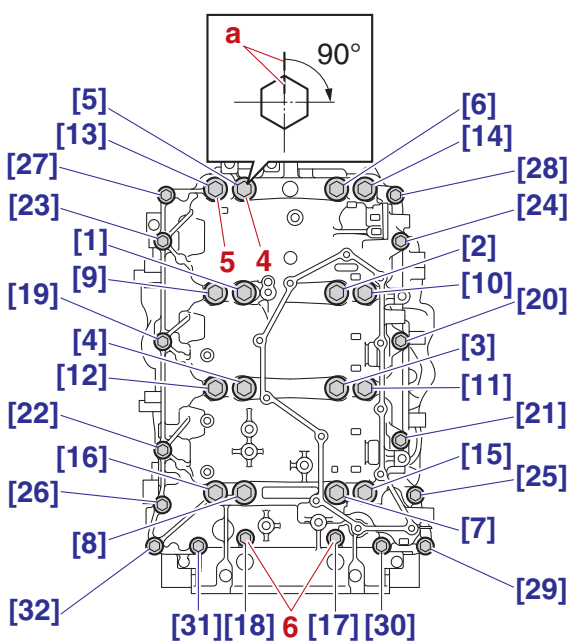
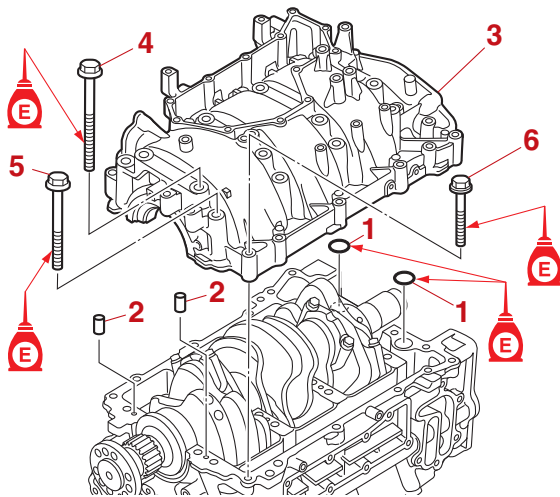
- c. Install new O-rings “1”, dowel pins “2” and the crankcase “3”, and then tighten the crankcase bolts (M10) “4” and “5” to the specified torques in 2 stages and in the order [1], [2], and so on.

**TIP:**  
 In the second tightening stage for the crankcase bolts (M10) “4” and “5”, mark the crankcase bolts (M10) and the crankcase with identification marks “a”, and then tighten the bolts 90° from the marks on the crankcase.

- d. Tighten the crankcase bolts (M8) “6” to the specified torques in 2 stages and in the order [17], [18], and so on.

**TIP:**  
 After tightening the crankcase bolts “4”, “5”, and “6”, make sure that the crankshaft turns smoothly.

	Crankcase bolt (M10) “4”, “5” [1]–[16]
	1st: 55 N·m (5.5 kgf·m, 41 lb·ft)
	2nd: 90°
	Crankcase bolt (M8) “6” [17]–[32]
	1st: 14 N·m (1.4 kgf·m, 10 lb·ft)
	2nd: 28 N·m (2.8 kgf·m, 21 lb·ft)



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## Lower unit

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## Lower unit

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### **Drive shaft and lower case (counter rotation model) ... 8-53**

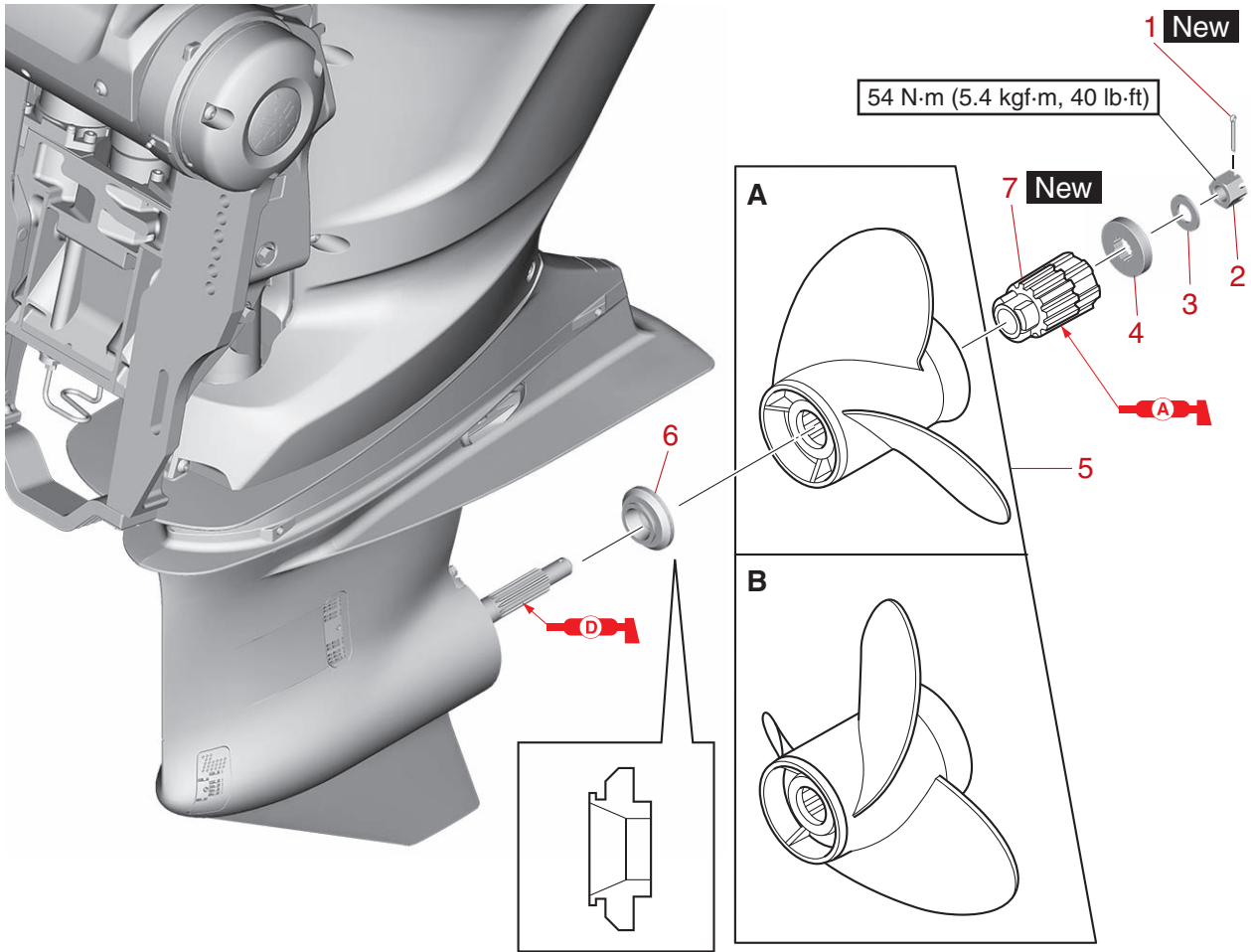
Removing the drive shaft.....	8-54
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## Lower unit

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Selecting the pinion shim (T3) .....	8-59
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Measuring the forward gear backlash and reverse gear backlash .....	8-61

Propeller



↑↓	Part name	Q'ty	Remarks
1	Cotter pin	1	
2	Propeller nut M18	1	
3	Washer	1	
4	Spacer	1	

↑↓	Part name	Q'ty	Remarks
5	Propeller	1	
6	Spacer	1	
7	Damper	1	

- A. Regular rotation model
- B. Counter rotation model



## Removing the propeller

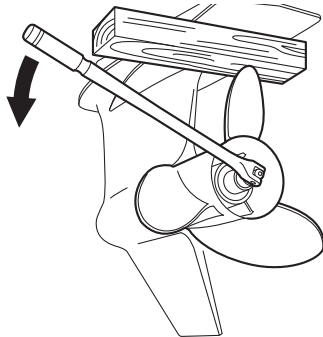
### ⚠ WARNING

- Make sure to disconnect the battery cables from the battery, and remove the clip from the engine shut-off switch.
- When loosening or tightening the propeller nut, do not hold the propeller using your hands.

1. Remove:
  - Cotter pin
  - Propeller nut
  - Washer
  - Spacer
  - Propeller
  - Spacer

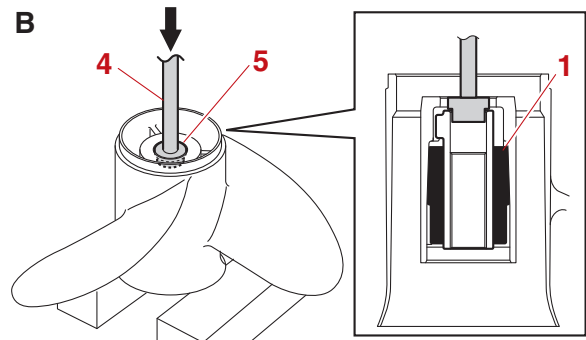
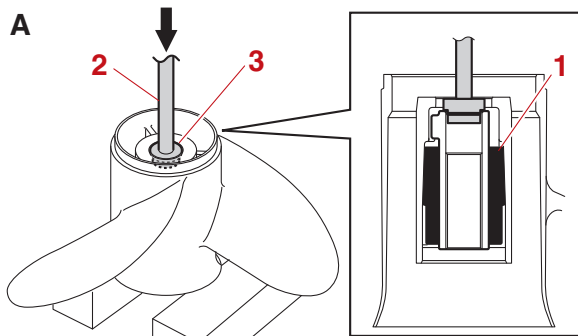
### TIP:

- Set the gear shift to the N position.
- Place a block of wood between the anti-cavitation plate and the propeller to prevent the propeller from turning, and then remove the propeller nut and propeller.



## Disassembling the propeller (Shift Dampener System [SDS] propeller)

1. Remove:
  - Damper "1"



- A. Worldwide  
B. USA and Canada



Driver rod L3 "2"  
90890-06652  
Needle bearing attachment "3"  
90890-06610  
Driver handle (large) "4"  
YB-06071  
Driveshaft needle bearing installer  
and remover "5"  
YB-06196

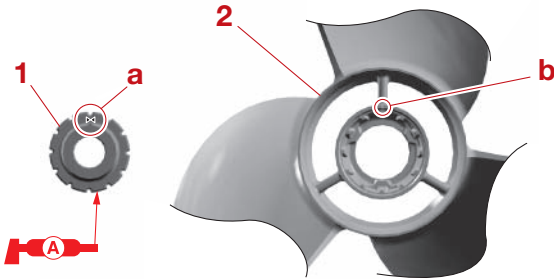
## Checking the propeller

1. Check:
  - Propeller
  - Spline
  - Damper  
Cracked/damaged/worn → Replace the propeller or damper.

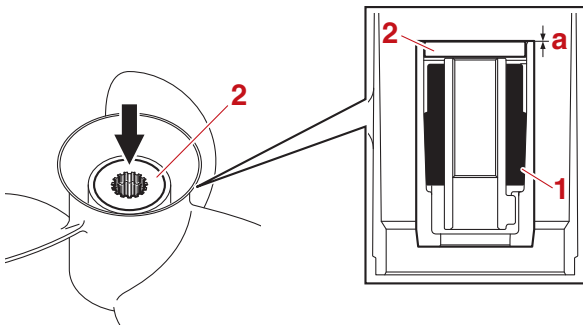
## Assembling the propeller (Shift Dampener System [SDS] propeller)


1. Install:
  - Damper **New**
    - a. Align the mark "a" on the damper "1" with the mark "b" on the propeller "2".

**TIP:** \_\_\_\_\_  
 When installing the damper “1”, make sure that the spacer does not contact the propeller boss.



b. Install the damper “1” using the special service tools and spacer “2” to the specified installation depth “a”.



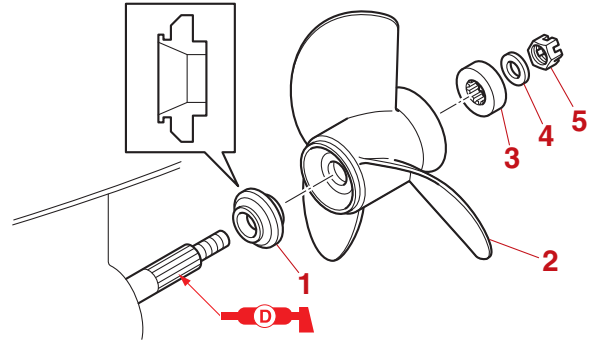
	Installation depth “a” 0.0–1.3 mm (0.00–0.05 in)
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### Installing the propeller

**⚠ WARNING** \_\_\_\_\_

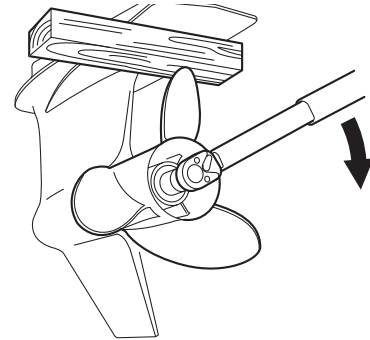
- Make sure to disconnect the battery cables from the battery, and remove the clip from the engine shut-off switch.
- When loosening or tightening the propeller nut, do not hold the propeller using your hands.


1. Install:
  - Spacer “1”
  - Propeller “2”
  - Spacer “3”
  - Washer “4”
  - Propeller nut “5”



2. Tighten:
  - Propeller nut

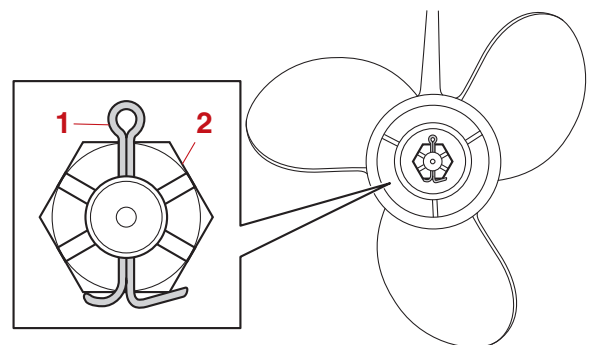
**TIP:** \_\_\_\_\_  
 Place a block of wood between the anti-cavitation plate and the propeller to prevent the propeller from turning.



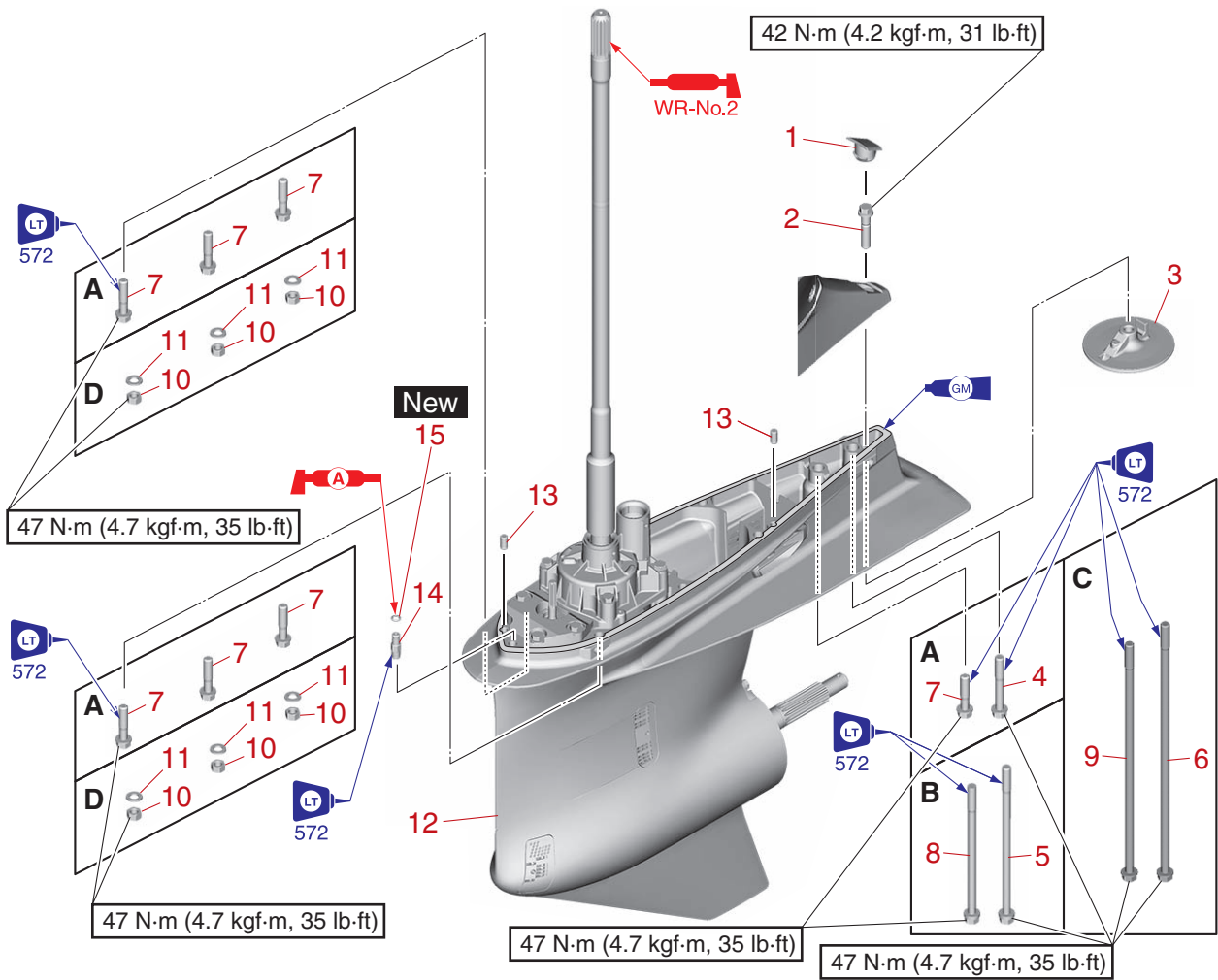
	Propeller nut 54 N·m (5.4 kgf·m, 40 lb-ft)
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3. Install:
  - Cotter pin “1” **New**

**TIP:** \_\_\_\_\_  
 If the slots in the propeller nut “2” are not aligned with the cotter pin hole, tighten the propeller nut “2” until they are aligned.



Lower unit



↑↓	Part name	Q'ty	Remarks
1	Grommet	1	
2	Bolt M10 × 45 mm	1	
3	Anode	1	
4	Bolt M10 × 70 mm	1	
5	Bolt M10 × 200 mm	1	
6	Bolt M10 × 325 mm	1	
7	Bolt M10 × 45 mm	7	
8	Bolt M10 × 174 mm	1	

↑↓	Part name	Q'ty	Remarks
9	Bolt M10 × 299 mm	1	
10	Nut M10	6	
11	Washer	6	
12	Lower unit	1	
13	Dowel pin	2	
14	Hose nipple	1	
15	O-ring	1	

- A. X-transom model
- B. U-transom model
- C. E-transom model
- D. Except for X-transom model

## Removing the lower unit

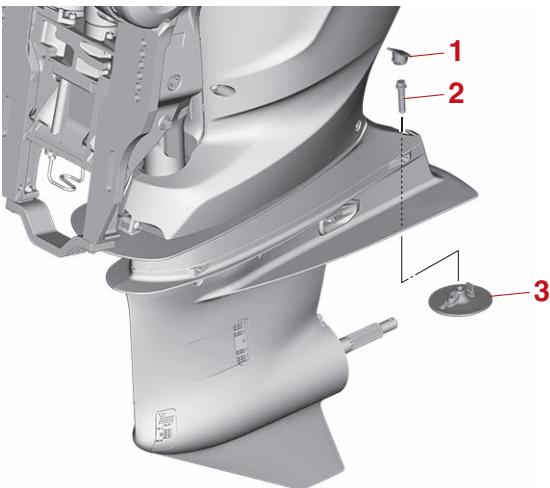
### **WARNING**

- Make sure to disconnect the battery cables from the battery, and remove the clip from the engine shut-off switch.
- When removing or installing the lower unit with the power unit installed, make sure to suspend the outboard motor. Otherwise, the outboard motor could fall suddenly and result in severe injuries.

### TIP:

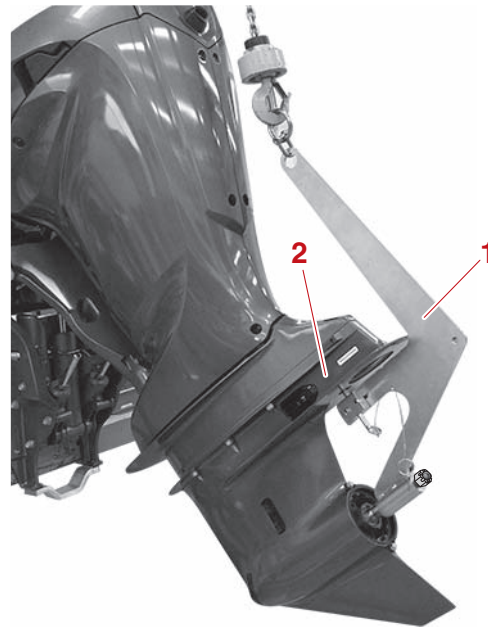
When disassembling the lower unit, measure the backlash before disassembly. See “Measuring the forward gear backlash and reverse gear backlash” (8-41) or “Measuring the forward gear backlash and reverse gear backlash” (8-61).

1. Drain:
  - Gear oil  
See steps (1) and (2) in “Changing the gear oil” (10-17).
2. Remove:
  - Grommet “1”
  - Anode bolt “2”
  - Anode “3”



3. Remove:
  - Lower case mounting bolt (X-transom model)
  - Lower case mounting nut (except for X-transom model)
  - Lower unit

- a. Place the outboard motor in an upright position.
- b. Tilt the outboard motor up, and then install the special service tool “1” to the lower unit “2”.



	Lifting hanger “1” 90890-06951
--	-----------------------------------

- c. Remove the lower case mounting bolts. (X-transom model)  
Remove the lower case mounting nuts. (except for X-transom model)
- d. Hook a lifting harness onto the special service tool.
- e. Remove the lower unit.

## Checking the lower unit anode

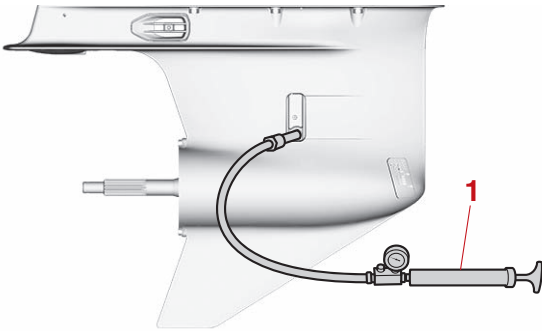
1. Check:
  - Anode  
Eroded (1/2 or more worn out) → Replace.  
Adhered grease, oil, or scales → Clean.

### **NOTICE**

**Do not apply grease, oil, or paint to the anode.**

### Checking the lower unit for leakage

1. Install:
  - Gasket **New**
  - Drain screw
  - Special service tool "1" (to the oil level plug hole)



	Leakage tester "1" 90890-06840
--	-----------------------------------

2. Check:
  - Holding pressure  
Pressure is not maintained → Repair the location of the leak.

#### NOTICE

**Do not overpressurize the lower unit. Otherwise, the oil seals could be damaged.**

- a. Apply the specified pressure and check that the pressure is maintained in the lower unit for 10 seconds or more.

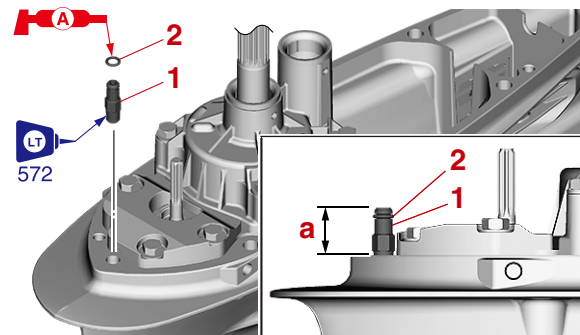
	Holding pressure 68.6 kPa (0.69 kgf/cm <sup>2</sup> , 9.9 psi) (F250NST, F250SB, F300FST, F300SB)
	Holding pressure 68.6 kPa (0.69 kgf/cm <sup>2</sup> , 9.9 psi) (FL250NST, FL300FST, LF250SB, LF300SB)

### Installing the lower unit

#### ⚠ WARNING

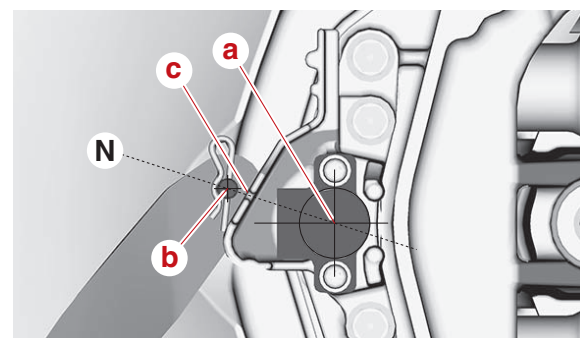
- Make sure to disconnect the battery cables from the battery, and remove the clip from the engine shut-off switch.
- When removing or installing the lower unit with the power unit installed, make sure to suspend the outboard motor. Otherwise, the outboard motor could fall suddenly and result in severe injuries.

1. Install:
  - Dowel pin
  - Hose nipple "1"
  - O-ring "2" **New**

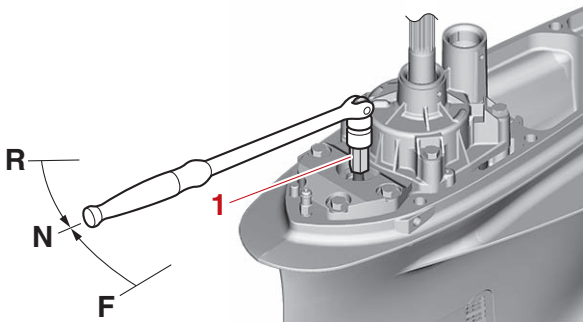



	Installation height "a" 23.0–24.5 mm (0.906–0.965 in)
--	--

- a. Align center "a" of the SPS and pin "b" with the notch "c".



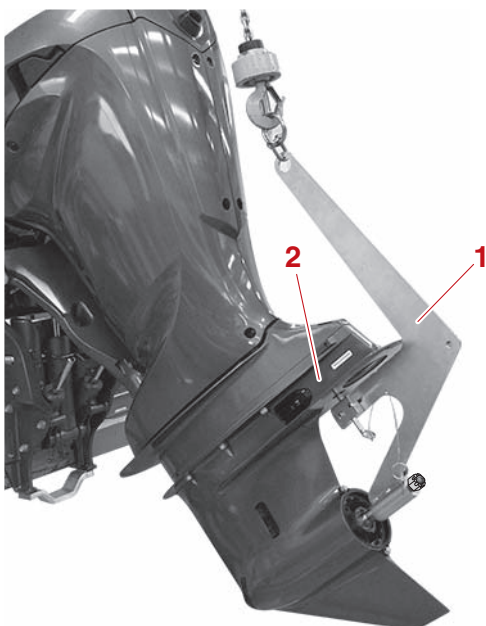
b. Set the gear shift to the N position.




	Shift rod socket "1"
	90890-06681
	Shift rod socket "1"
	YB-06681

2. Install:

- Lower unit
- Lower case mounting bolt (X-transom model)
- Lower case mounting nut (except for X-transom model)
  - a. Install the special service tool "1" onto the lower unit "2".
  - b. Hook a lifting harness onto the special service tool "1".
  - c. Tilt the outboard motor up so that the mating surface of the outboard motor is parallel to the mating surface of the lower unit.




	Lifting hanger "1"
	90890-06951

d. Install the lower unit.

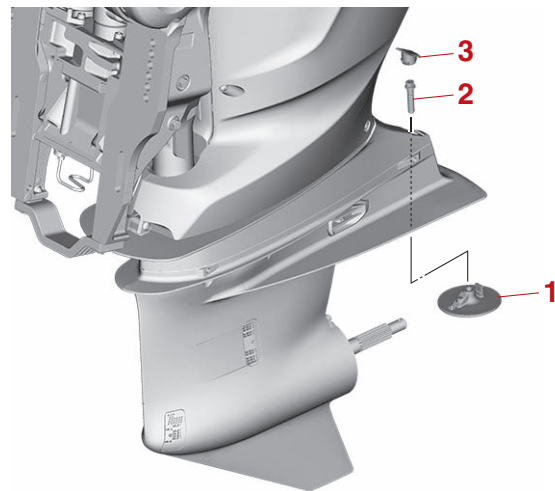
3. Tighten:


- Lower case mounting bolt (X-transom model)
- Lower case mounting nut (except for X-transom model)

	Lower case mounting bolt (X-transom model)
	47 N·m (4.7 kgf·m, 35 lb·ft)
	Lower case mounting nut (except for X-transom model)
	47 N·m (4.7 kgf·m, 35 lb·ft)

4. Install:

- Anode "1"
- Anode bolt "2"
- Grommet "3"
  - a. Install the anode "1", and then tighten the anode bolt "2" to the specified torque.



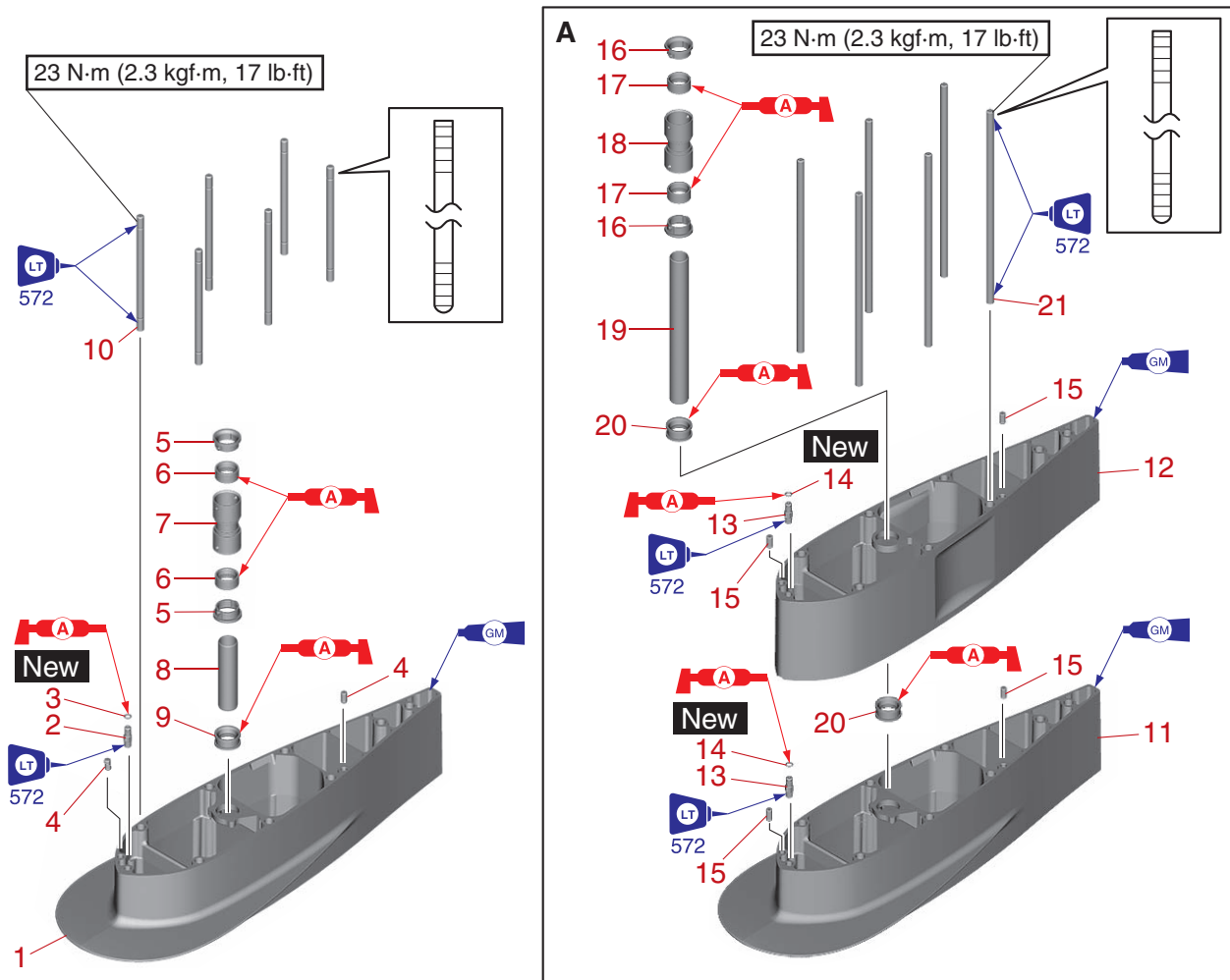
	Anode bolt "2"
	42 N·m (4.2 kgf·m, 31 lb·ft)

5. Fill:

- Gear oil  
See step (3) in "Changing the gear oil" (10-17).



Extension (except for X-transom model)



↑↓	Part name	Q'ty	Remarks
1	Extension	1	
2	Hose nipple	1	
3	O-ring	1	
4	Dowel pin	2	
5	Cover	2	
6	Rubber seal	2	
7	Water tube	1	
8	Water tube	1	
9	Rubber seal	1	
10	Stud bolt M10 × 165 mm	6	Point the flat end of the stud bolt up.
11	Extension	1	

↑↓	Part name	Q'ty	Remarks
12	Extension	1	
13	Hose nipple	2	
14	O-ring	2	
15	Dowel pin	4	
16	Cover	2	
17	Rubber seal	2	
18	Water tube	1	
19	Water tube	1	
20	Rubber seal	2	
21	Stud bolt M10 × 292 mm	6	Point the flat end of the stud bolt up.

A. E-transom model



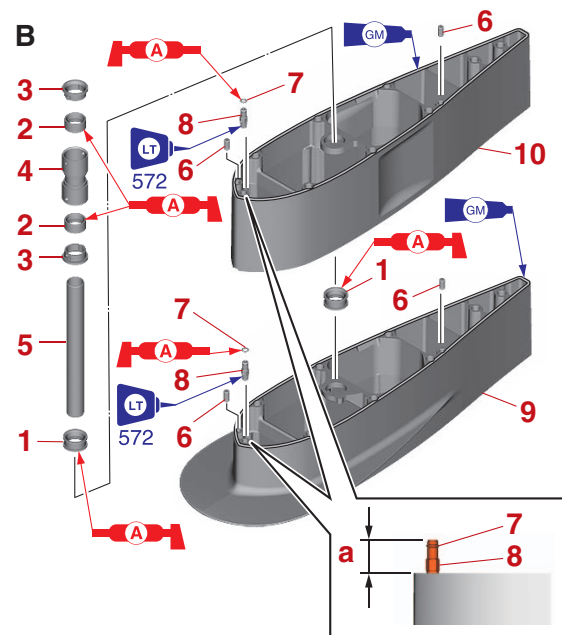
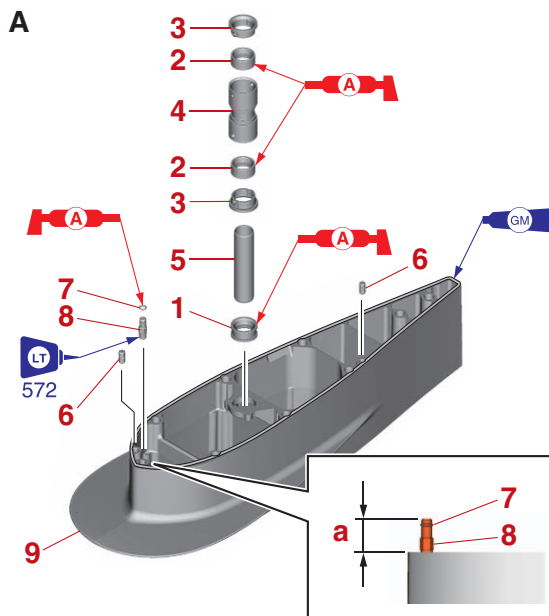
## Extension (except for X-transom model)

### Checking the extension

- Check:
  - Extension
  - Cracked/damaged → Replace.


### Assembling the extension

- Install:
  - Rubber seal "1"
  - Rubber seal "2"
  - Cover "3"
  - Water tube "4"
  - Water tube "5"
  - Dowel pin "6"
  - O-ring "7" **New**
  - Hose nipple "8"
  - Extension "9"
  - Extension "10"



A. U-transom model

B. E-transom model


	Installation height "a" 23.0–24.5 mm (0.906–0.965 in)
---	--

### Installing the extension

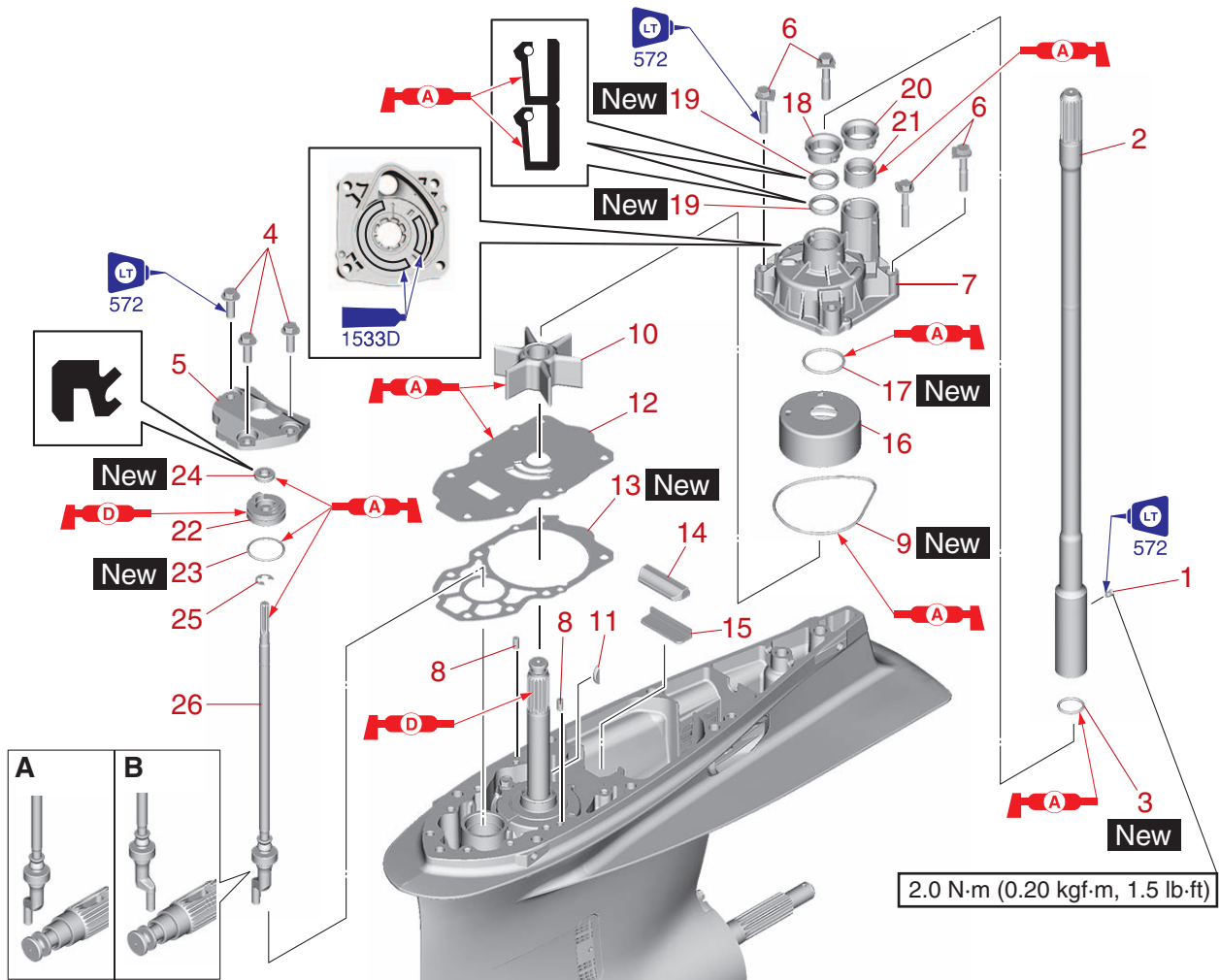
- Install:
  - Stud bolt

**TIP:** \_\_\_\_\_

Point the flat end of the stud bolt up.

	Stud bolt (lower case mounting) 23 N·m (2.3 kgf·m, 17 lb·ft)
---	---

Water pump and shift rod



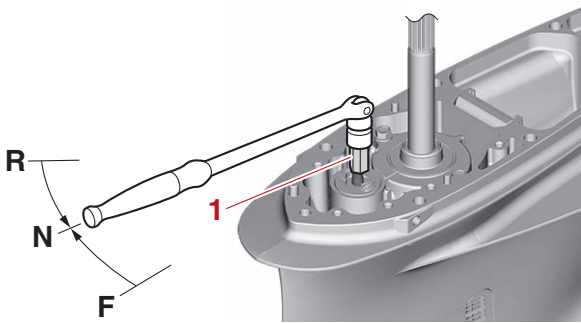
↑↓	Part name	Q'ty	Remarks
1	Screw	1	
2	Intermediate drive shaft	1	
3	O-ring	1	
4	Bolt M8 × 25 mm	3	
5	Cover	1	
6	Bolt M8 × 45 mm	4	
7	Water pump housing	1	
8	Dowel pin	2	
9	O-ring	1	
10	Impeller	1	
11	Impeller key	1	
12	Outer plate cartridge	1	
13	Gasket	1	


↑↓	Part name	Q'ty	Remarks
14	Rubber seal	1	
15	Plate	1	
16	Insert cartridge	1	
17	O-ring	1	
18	Cover	1	
19	Oil seal	2	
20	Cover	1	
21	Seal	1	
22	Plate	1	
23	O-ring	1	
24	Oil seal	1	
25	E-clip	1	
26	Shift rod	1	

A. Regular rotation model  
 B. Counter rotation model

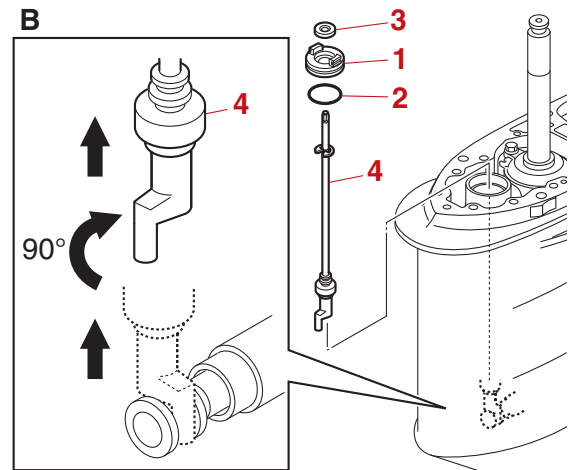
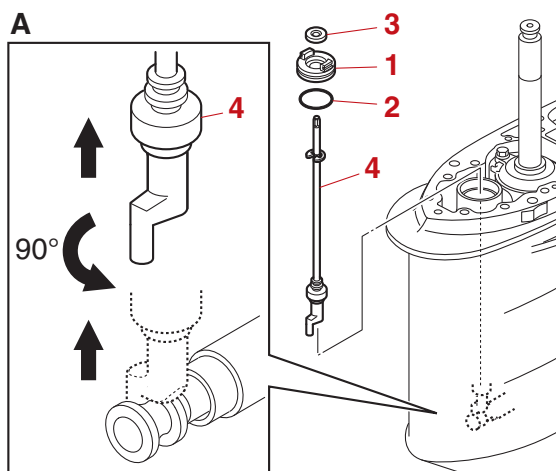
## Removing the water pump and shift rod

1. Remove:
  - Cover
  - Intermediate drive shaft
  - O-ring
  - Water pump housing
  - Dowel pin
  - O-ring
  - Impeller
  - Impeller key
  - Outer plate cartridge
  - Gasket
2. Remove:
  - Shift rod assembly
    - a. Set the gear shift to the N position.



	Shift rod socket "1" 90890-06681 Shift rod socket "1" YB-06681
---	---

- b. Remove the plate "1", O-ring "2", oil seal "3", and shift rod "4".



- A. Regular rotation model  
 B. Counter rotation model

## Checking the water pump

1. Check:
  - Water pump housing  
 Deformed → Replace.

### TIP:

If the engine overheats, the inside of the water pump housing may be deformed. Therefore, make sure to remove the insert cartridge when checking the upper water pump housing.

2. Check:
      - Impeller
      - Insert cartridge
      - Outer plate cartridge  
 Cracked/worn → Replace.
    3. Check:
      - Impeller key
      - Keyway in the drive shaft  
 Deformed/worn → Replace.

## Checking the shift rod

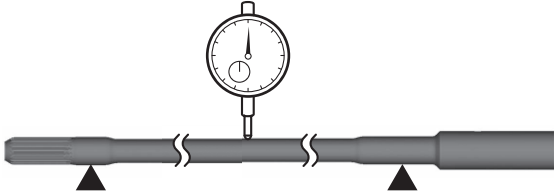
1. Check:
  - Shift rod  
 Bent/cracked/worn → Replace.

## Checking the intermediate drive shaft

1. Check:
  - Intermediate drive shaft  
 Damaged/worn → Replace.

2. Measure:

- Intermediate drive shaft runout  
Above specification → Replace.

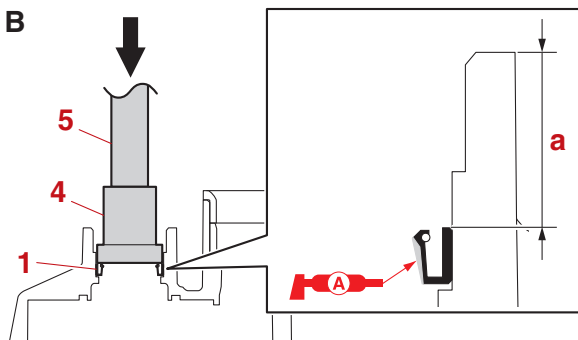
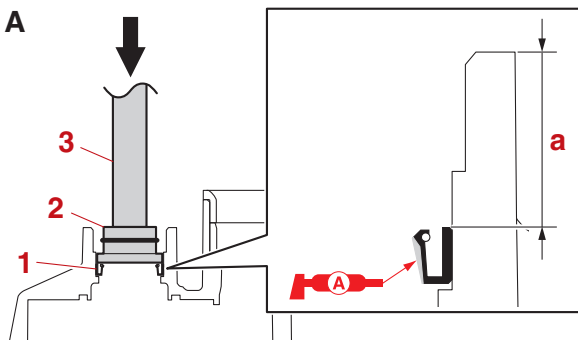


	Runout 0.25 mm (0.010 in) (F250NST, F250SB, F300FST, F300SB)
--	---

**Assembling the water pump housing**

1. Install:

- Oil seal "1" **New**
  - Install a new oil seal "1" in the water pump housing.

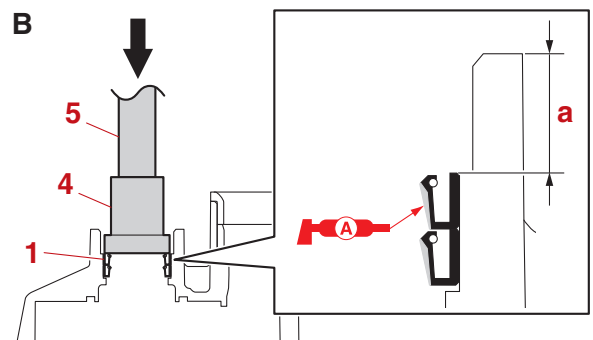
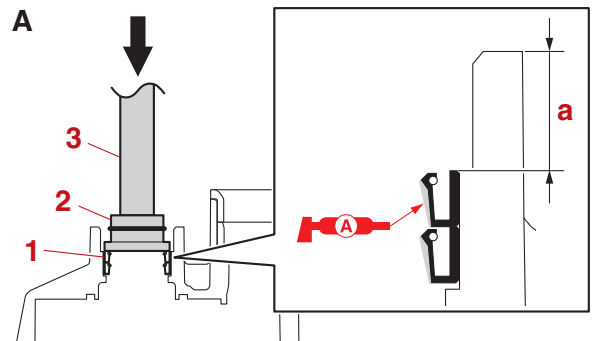


A. Worldwide  
B. USA and Canada

	Needle bearing attachment "2" 90890-06614 Driver rod L3 "3" 90890-06652 Needle bearing attachment "4" YB-06112 Driver handle (large) "5" YB-06071
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	Installation depth "a" 15.5 mm (0.61 in)
--	---

- Install a new oil seal "1" in the water pump housing.

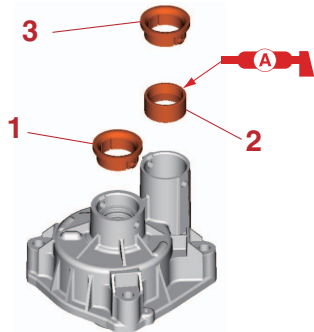


A. Worldwide  
B. USA and Canada

	Needle bearing attachment "2" 90890-06614 Driver rod L3 "3" 90890-06652 Needle bearing attachment "4" YB-06112 Driver handle (large) "5" YB-06071
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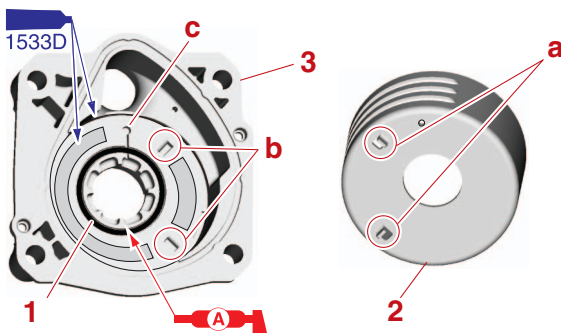
	<p>Installation depth "a" 10.25–10.75 mm (0.404–0.423 in)</p>
---	---

2. Install:
- Cover "1"
  - Seal "2"
  - Cover "3"



3. Install:
- O-ring "1" **New**
  - Insert cartridge "2"

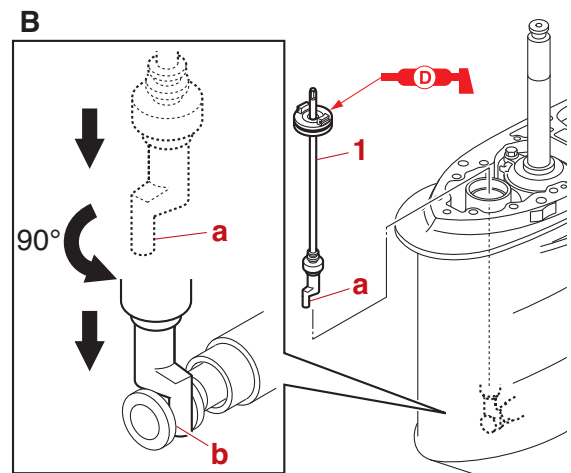
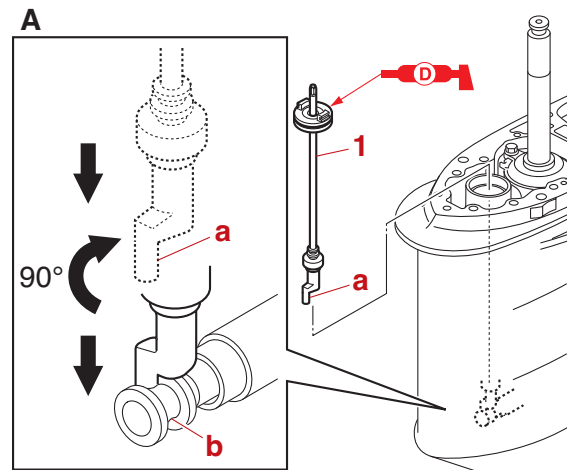
- TIP:**
- Fit the protrusions "a" on the insert cartridge "2" into the slots "b" in the water pump housing "3".
  - Avoid the area "c" when applying ThreeBond 1533D on the water pump housing "3".



### Installing the shift rod

1. Install:
- Shift rod
  - E-clip
  - Plate
  - O-ring **New**
  - Oil seal **New**
2. Install:
- Shift rod assembly "1"

- TIP:**
- Turn the shift rod assembly "1" clockwise or counterclockwise 90°, and then push it down so that the tip "a" of the shift rod fits into the groove "b" in the shift slider.
  - Check that the shift rod operates smoothly.



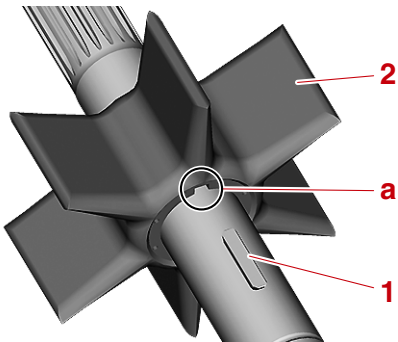
A. Regular rotation model  
B. Counter rotation model

### Installing the water pump

1. Install:
- Plate
  - Rubber seal
  - Dowel pin
  - Gasket **New**
  - Outer plate cartridge
  - Cover
  - Impeller key
  - Impeller

## Water pump and shift rod

- a. Align the slot "a" in the impeller "2" with the impeller key "1", and then install the impeller "2".

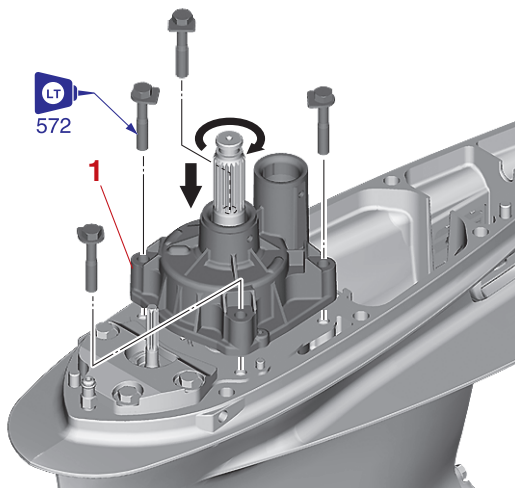


2. Install:
  - O-ring **New** (to the water pump housing)
  - Water pump housing "1"

### NOTICE

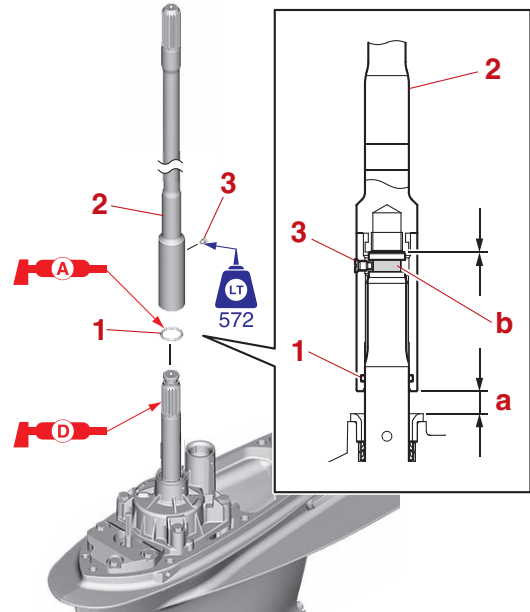
Do not turn the drive shaft counterclockwise. Otherwise, the water pump impeller could be damaged.


**TIP:** While turning the drive shaft clockwise, push the water pump housing down to install it.




3. Install:
  - O-ring "1" **New**
  - Intermediate drive shaft "2"
  - Screw "3"

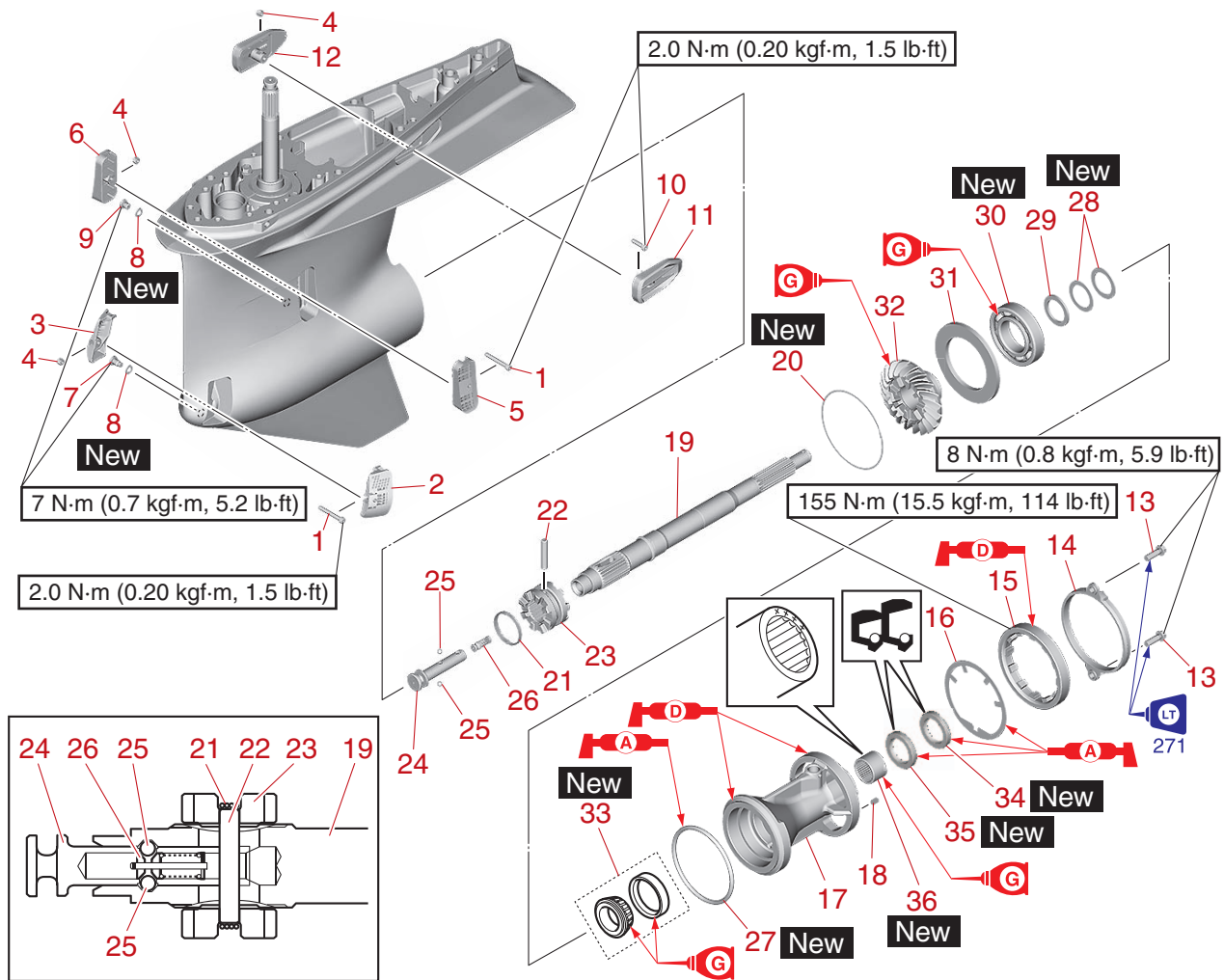
**TIP:** Assemble the intermediate drive shaft "2", check the position of the groove "b" of the drive shaft from the hole of the intermediate drive shaft "2", and then assemble the screw "3".



 Installation depth "a"  
13 mm (0.51 in) or less

 Screw "3"  
2.0 N·m (0.20 kgf·m, 1.5 lb·ft)

Propeller shaft housing (regular rotation model)

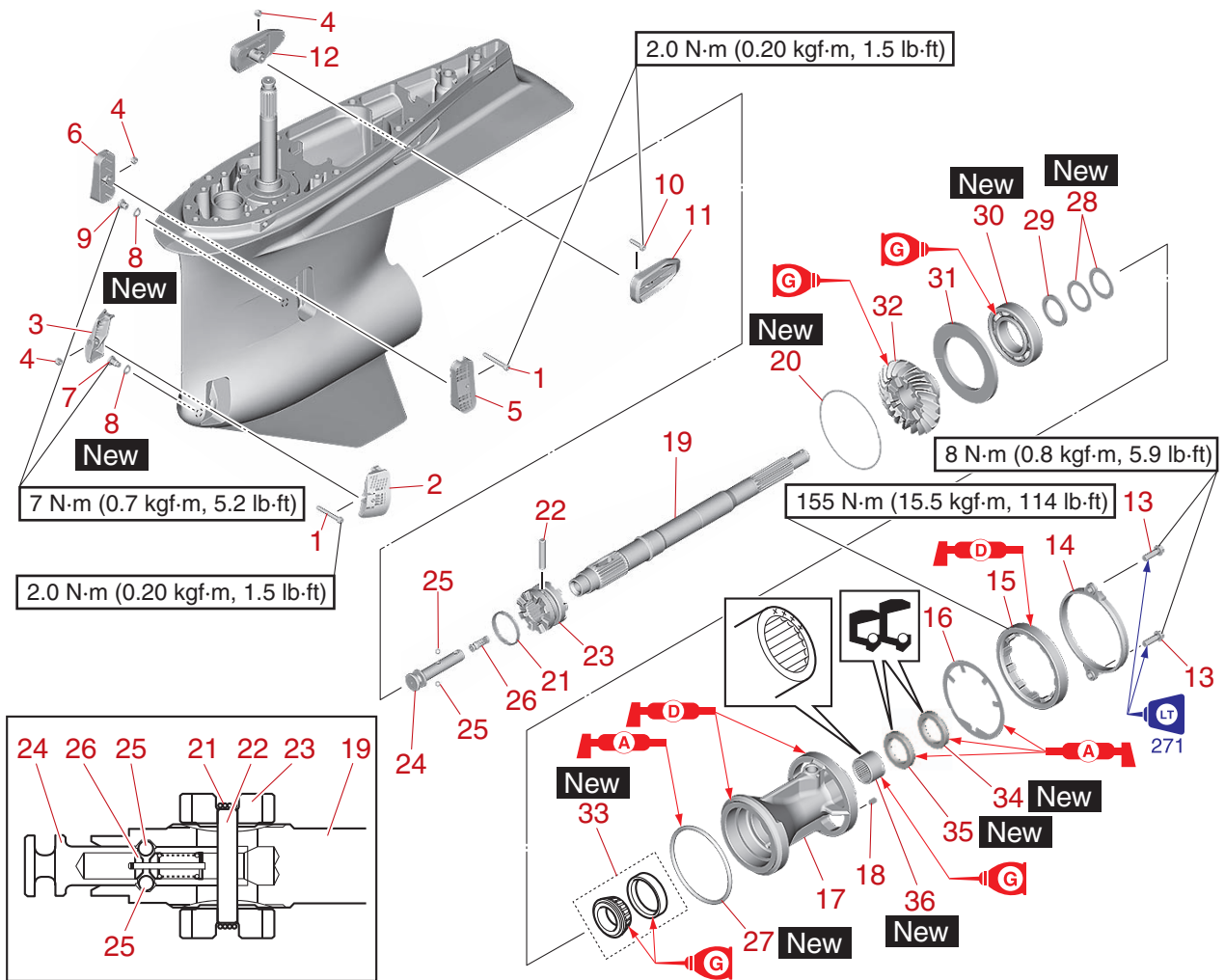


↑↓	Part name	Q'ty	Remarks
1	Screw M5 × 40 mm	2	
2	Water inlet cover (PORT)	1	
3	Water inlet cover (STBD)	1	
4	Self-locking nut M5	3	
5	Water inlet cover (PORT)	1	
6	Water inlet cover (STBD)	1	
7	Drain screw	1	
8	Gasket	2	
9	Oil level plug	1	
10	Screw M5 × 20 mm	1	
11	Outlet cover (PORT)	1	
12	Outlet cover (STBD)	1	
13	Bolt M8 × 25 mm	2	
14	Cover	1	
15	Ring nut M119	1	

↑↓	Part name	Q'ty	Remarks
16	Claw washer	1	
17	Propeller shaft housing	1	
18	Key	1	
19	Propeller shaft	1	
20	Reverse gear shim (T2)	—	
21	Spring	1	
22	Cross pin	1	
23	Dog clutch	1	
24	Slider	1	
25	Ball 6.35 mm (0.25 in) (reference data)	2	
26	Shift plunger	1	
27	O-ring	1	
28	Propeller shaft shim (T4)	—	
29	Washer	1	
30	Ball bearing	1	



## Propeller shaft housing (regular rotation model)

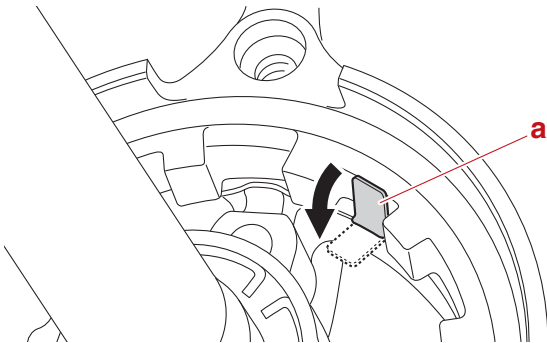


↑↓	Part name	Q'ty	Remarks
31	Thrust washer	1	
32	Reverse gear	1	
33	Tapered roller bearing	1	
34	Oil seal	1	
35	Oil seal	1	
36	Needle bearing	1	

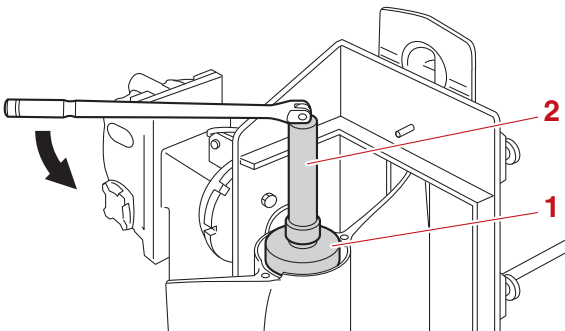
## Propeller shaft housing (regular rotation model)

### Removing the propeller shaft housing assembly

1. Remove:
  - Cover
2. Remove:
  - Ring nut
  - Claw washer
    - a. Straighten the bent tab "a" on the claw washer.



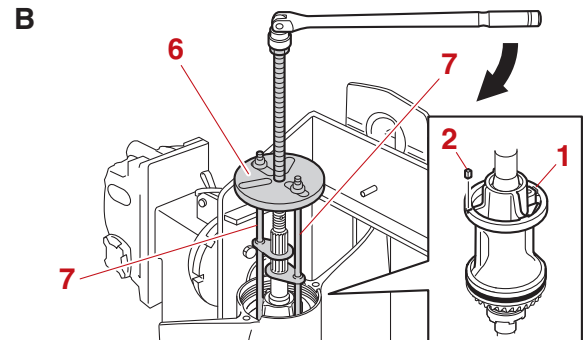
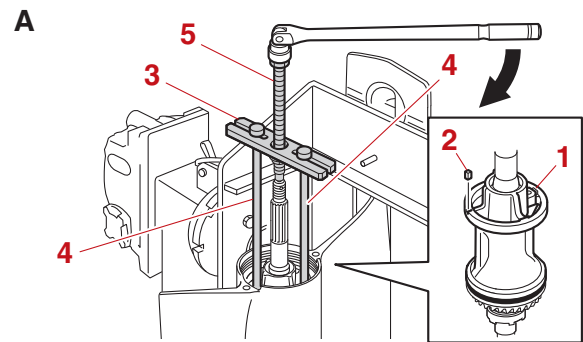
- b. Loosen the ring nut.



	Ring nut wrench 6 "1" 90890-06677 Ring nut wrench 6 "1" YB-06677 Ring nut wrench extension "2" 90890-06513 Ring nut wrench extension "2" YB-06513
--	--

- c. Remove the ring nut and claw washer.

3. Remove:
  - Propeller shaft housing assembly "1"
  - Key "2"



- A. Worldwide  
 B. USA and Canada

	Stopper guide plate "3" 90890-06501 Bearing housing puller claw L "4" 90890-06502 Center bolt "5" 90890-06504 Universal Puller "6" YB-06117 Bearing housing puller "7" YB-06207
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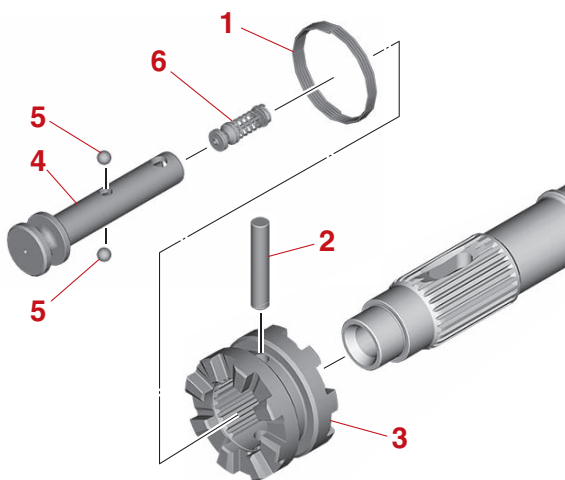
4. Remove:
  - Propeller shaft assembly
  - Reverse gear shim
  - O-ring
5. Remove:
  - Tapered roller bearing
  - Propeller shaft shim
  - Washer
  - Reverse gear assembly

## Propeller shaft housing (regular rotation model)

### Disassembling the propeller shaft assembly

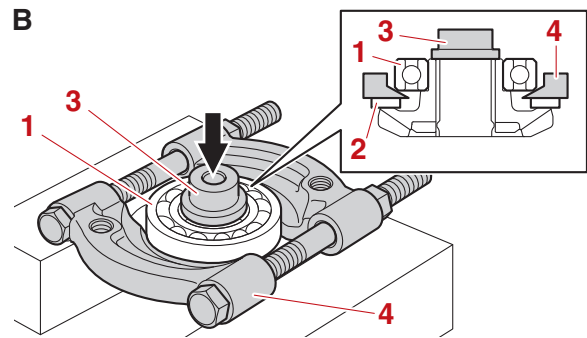
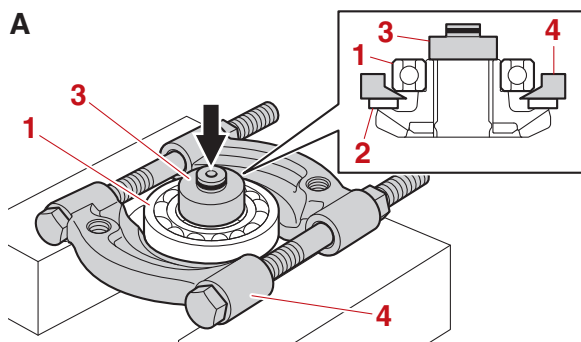
- Remove:
  - Spring "1"
  - Cross pin "2"
  - Dog clutch "3"
  - Slider "4"
  - Ball "5"
  - Shift plunger "6"

**TIP:** \_\_\_\_\_  
 When removing the slider "4", make sure that the balls "5" do not fall out of position.




### Disassembling the reverse gear

- Remove:
  - Ball bearing "1"
  - Washer "2"



- Worldwide
- USA and Canada

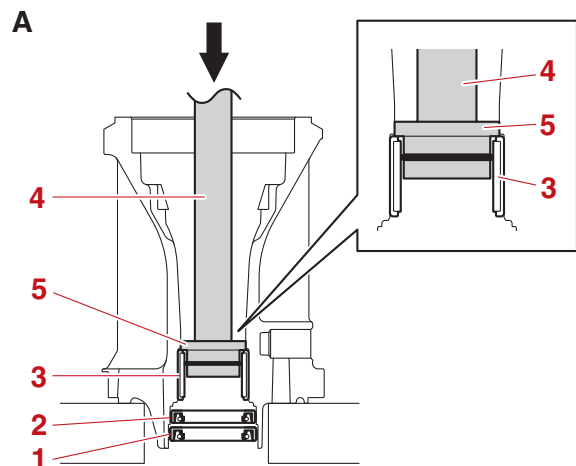
	Ball bearing attachment "3" 90890-06634
	Bearing cup installer "3" YB-06167
	Bearing splitter plate "4" (commercially available)

### Disassembling the propeller shaft housing assembly

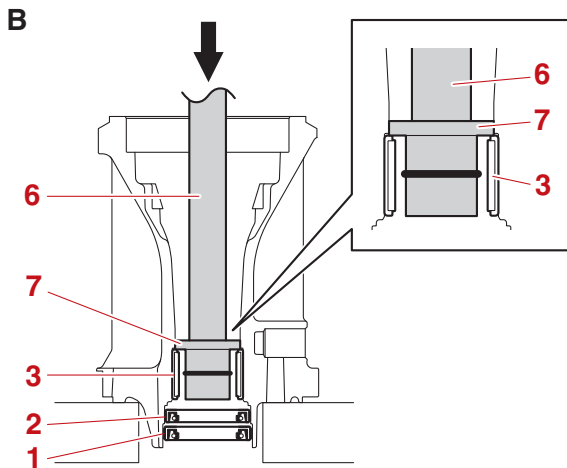
#### **⚠ WARNING**

- Use heat-resistant gloves. Otherwise, burns could result.
- To prevent fires, remove any flammable substances, such as gasoline and oil, around the working area.
- Keep good ventilation while working.

- Remove:
  - Oil seal "1", "2"
  - Needle bearing "3"



## Propeller shaft housing (regular rotation model)



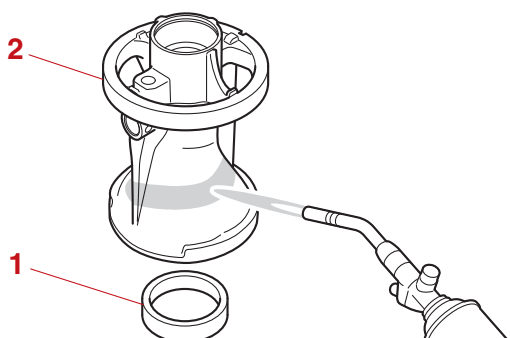
A. Worldwide  
B. USA and Canada

	Driver rod L3 "4" 90890-06652
	Needle bearing attachment "5" 90890-06611
	Driver handle (large) "6" YB-06071
	Driveshaft bearing installer "7" YB-06155

2. Remove:
  - Tapered roller bearing outer race "1"
    - a. Heat the installation area of the tapered roller bearing outer race in the propeller shaft housing "2" using a gas torch, and then remove the tapered roller bearing outer race "1".

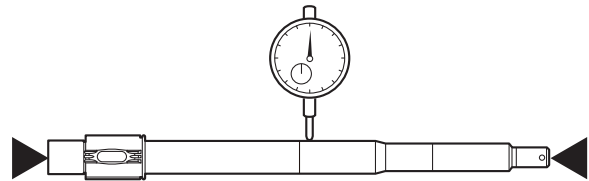
### NOTICE

When heating the propeller shaft housing, heat the entire installation area evenly. Otherwise, the propeller shaft housing could be damaged.



### Checking the propeller shaft

1. Check:
  - Propeller shaft  
Damaged/worn → Replace.
2. Measure:
  - Propeller shaft runout  
Above specification → Replace.



	Runout 0.02 mm (0.0008 in) (F250NST, F250SB, F300FST, F300SB)
--	---

### Checking the dog clutch

1. Check:
  - Dog clutch
  - Shift plunger
  - Cross pin
  - Spring
  - Ball
  - Slider  
Cracked/worn → Replace.

### Checking the propeller shaft housing

1. Check:
  - Propeller shaft housing  
Cracked/damaged → Replace.

### Checking the reverse gear

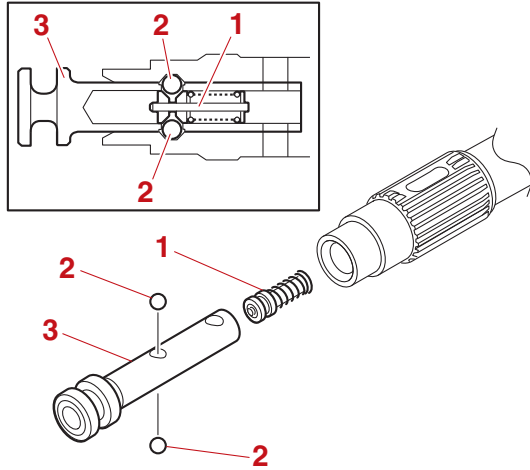
1. Check:
  - Teeth and dogs of the reverse gear  
Cracked/worn → Replace.

### Assembling the propeller shaft assembly

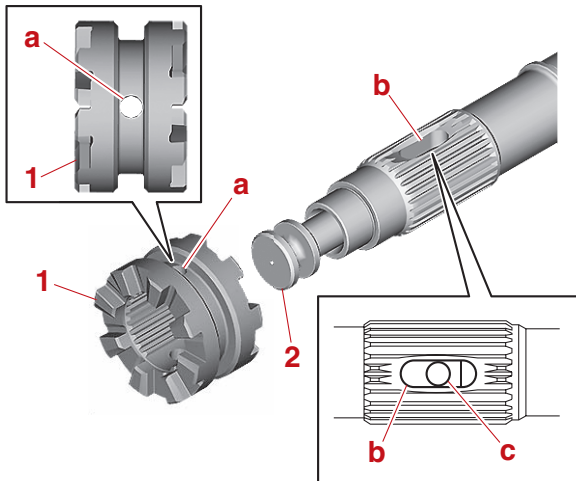
1. Install:
  - Shift plunger "1"
  - Ball "2"
  - Slider "3"

## Propeller shaft housing (regular rotation model)

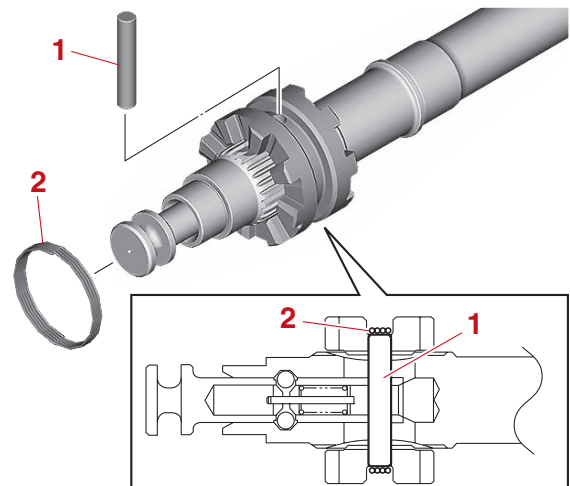
**TIP:** \_\_\_\_\_  
When installing the slider “3”, make sure that the balls “2” do not fall out of position.



2. Install:
  - Dog clutch
  - Cross pin
  - Spring
  - a. Install the dog clutch “1” so that the hole “a” in the dog clutch “1” and the hole “b” in the propeller shaft are aligned with the hole “c” in the slider “2”.

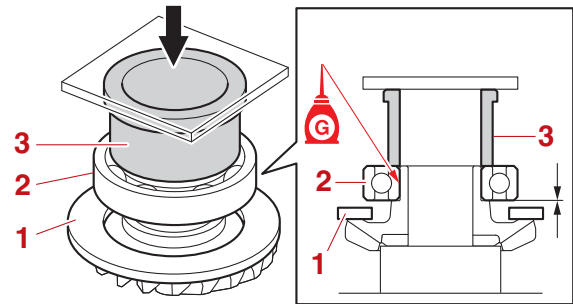


- b. Install the cross pin “1”, and then install the spring “2”.



### Assembling the reverse gear

1. Install:
  - Thrust washer “1”
  - Ball bearing “2” **New**



Bearing inner race attachment “3”  
90890-06661

### Assembling the propeller shaft housing assembly

#### **WARNING**

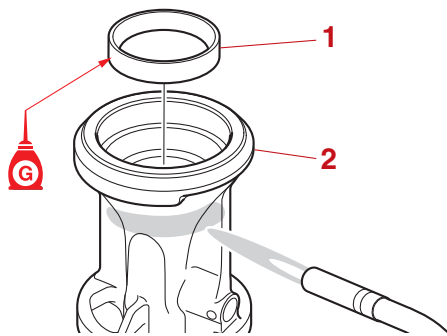
- Use heat-resistant gloves. Otherwise, burns could result.
- To prevent fires, remove any flammable substances, such as gasoline and oil, around the working area.
- Keep good ventilation while working.

## Propeller shaft housing (regular rotation model)

1. Install:
  - Tapered roller bearing outer race "1"
    - a. Heat the installation area of the tapered roller bearing outer race in the propeller shaft housing "2" using a gas torch, and then install a new tapered roller bearing outer race "1".

### NOTICE

When heating the propeller shaft housing, heat the entire installation area evenly. Otherwise, the propeller shaft housing could be damaged.

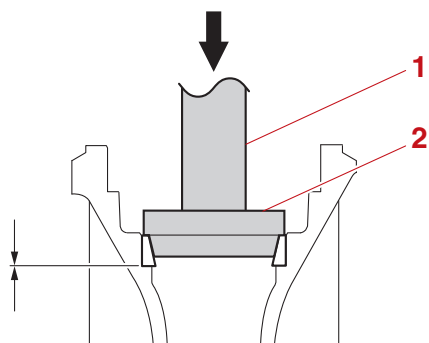


- b. While holding the special service tool "1", strike the tool to check that the tapered roller bearing outer race is installed properly.

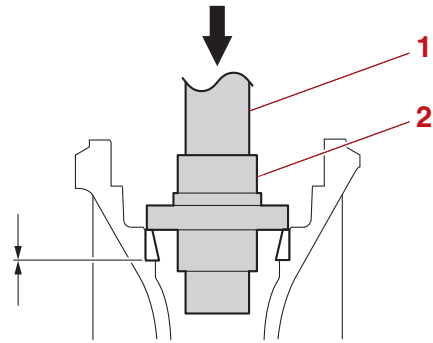
### TIP:

If a high-pitched metallic sound is produced when the special service tool is struck, the outer race is installed properly.

A



B



A. Worldwide

B. USA and Canada



Driver rod LL "1"

90890-06605

Driver handle (large) "1"

YB-06071

Bearing outer race attachment "2"

90890-06623

Forward gear needle bearing installer "2"

YB-06261

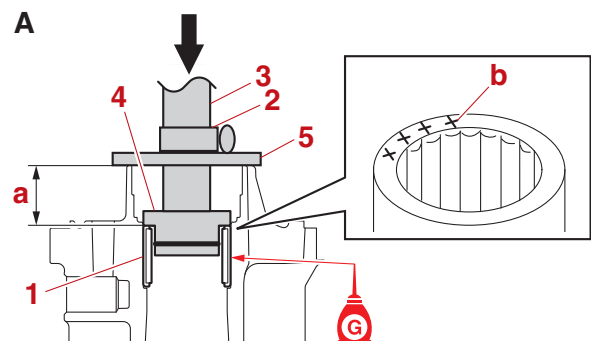
2. Install:

- Needle bearing "1" **New**
  - a. Install a new needle bearing "1" in the propeller shaft housing at the specified installation depth "a".

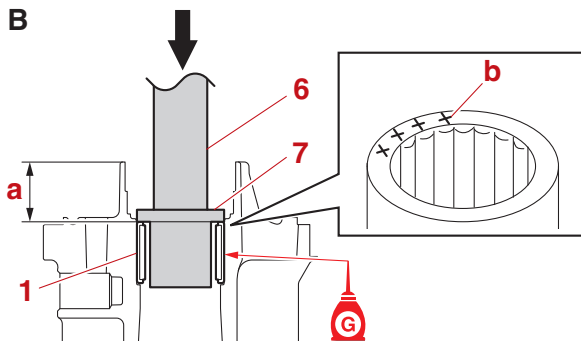
### TIP:

- Face the bearing identification mark "b" on the needle bearing toward the propeller.
- When using the driver rod, do not strike the special service tool in a manner that will force the stopper "2" out of place.

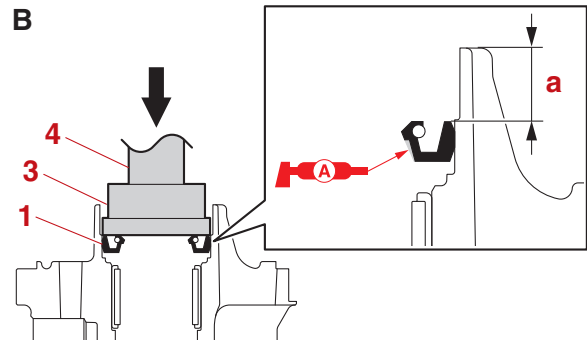
A




## Propeller shaft housing (regular rotation model)





A. Worldwide  
B. USA and Canada




A. Worldwide  
B. USA and Canada

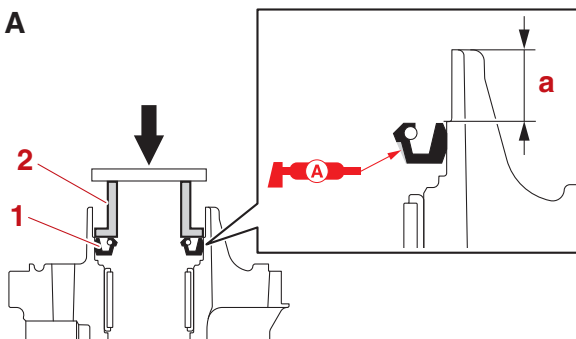
	Driver rod SS "3" 90890-06604 Needle bearing attachment "4" 90890-06653 Bearing depth plate "5" 90890-06603 Driver handle (large) "6" YB-06071 Driveshaft needle bearing installer and remover "7" YB-06196
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	Bearing inner race attachment "2" 90890-06642 Bearing cup installer "3" YB-06167 Driver handle (large) "4" YB-06071
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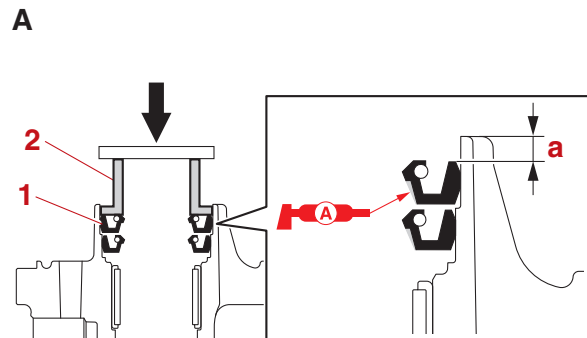
	Installation depth "a" 12.75–13.25 mm (0.502–0.522 in)
---	--

	Installation depth "a" 25.05–25.55 mm (0.986–1.006 in)
---	--

3. Install:
- Oil seal "1" **New**
    - Install a new oil seal "1" in the propeller shaft housing at the specified installation depth "a".



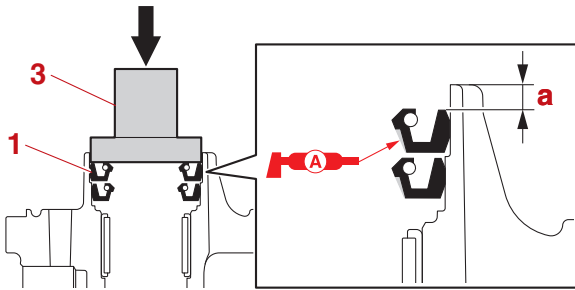
4. Install:
- Oil seal "1" **New**
    - Install a new oil seal "1" in the propeller shaft housing at the specified installation depth "a".



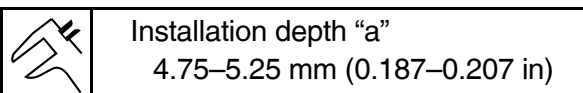
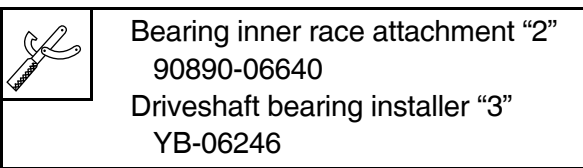


## Propeller shaft housing (regular rotation model)

B



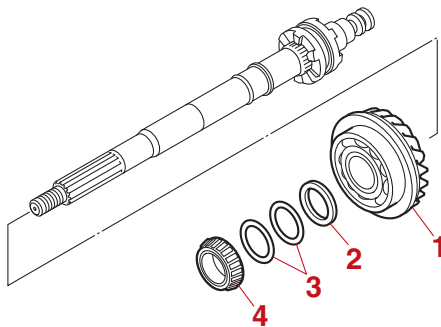
- A. Worldwide  
B. USA and Canada



### Installing the propeller shaft housing assembly

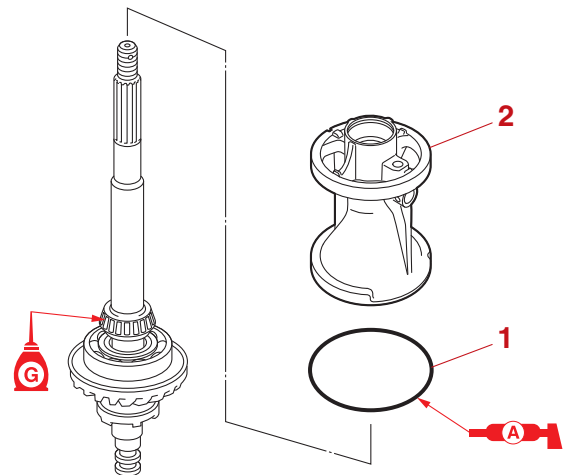
1. Install:

- Reverse gear assembly "1"
- Washer "2"
- Propeller shaft shim "3" **New**
- Tapered roller bearing "4" **New**



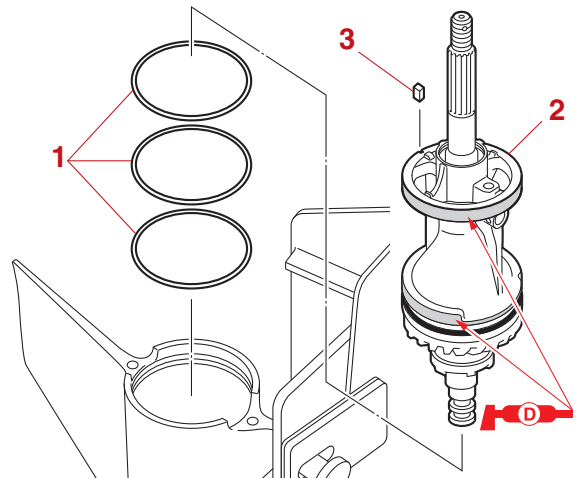
2. Install:

- O-ring "1" **New**
- Propeller shaft housing assembly "2"



3. Install:

- Reverse gear shim "1" **New**
- Propeller shaft housing assembly "2"
- Key "3"
  - Turn the drive shaft and check that the propeller shaft housing assembly "2" is installed securely.

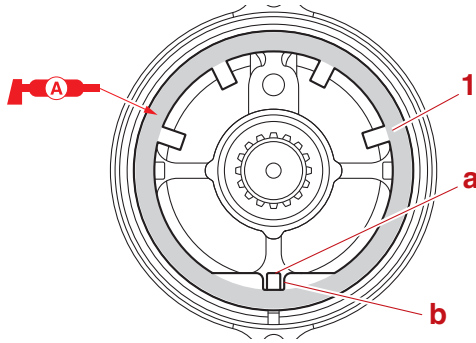


4. Install:

- Claw washer "1"

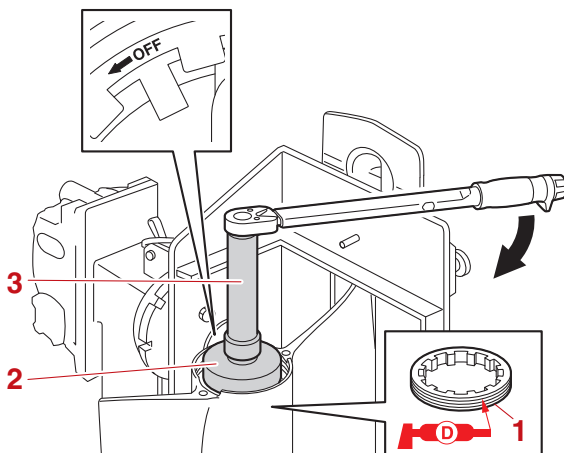
## Propeller shaft housing (regular rotation model)


**TIP:** \_\_\_\_\_  
 Make sure to fit the protrusion “a” on the propeller shaft housing into the slot “b” in the claw washer “1”.




5. Install:


- Ring nut “1”
  - a. Install the ring nut “1”, and then tighten it to the specified torque.



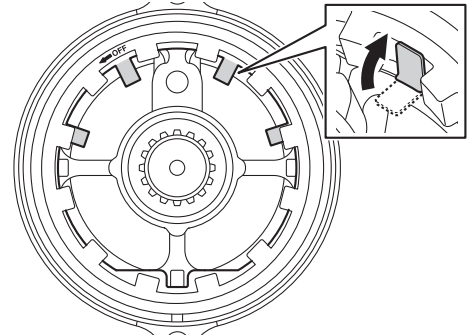
	Ring nut wrench 6 “2”
	90890-06677
	Ring nut wrench 6 “2”
	YB-06677
	Ring nut wrench extension “3”
90890-06513	
Ring nut wrench extension “3”	
YB-06513	

	Ring nut “1”
	155 N·m (15.5 kgf·m, 114 lb·ft)

- b. Turn the propeller shaft 10 turns or more, and then tighten the ring nut “1” to the specified torque.


	Ring nut “1”
	155 N·m (15.5 kgf·m, 114 lb·ft)

- c. Bend one of the 4 tabs on the claw washer outward, and then bend the other 3 tabs inward.

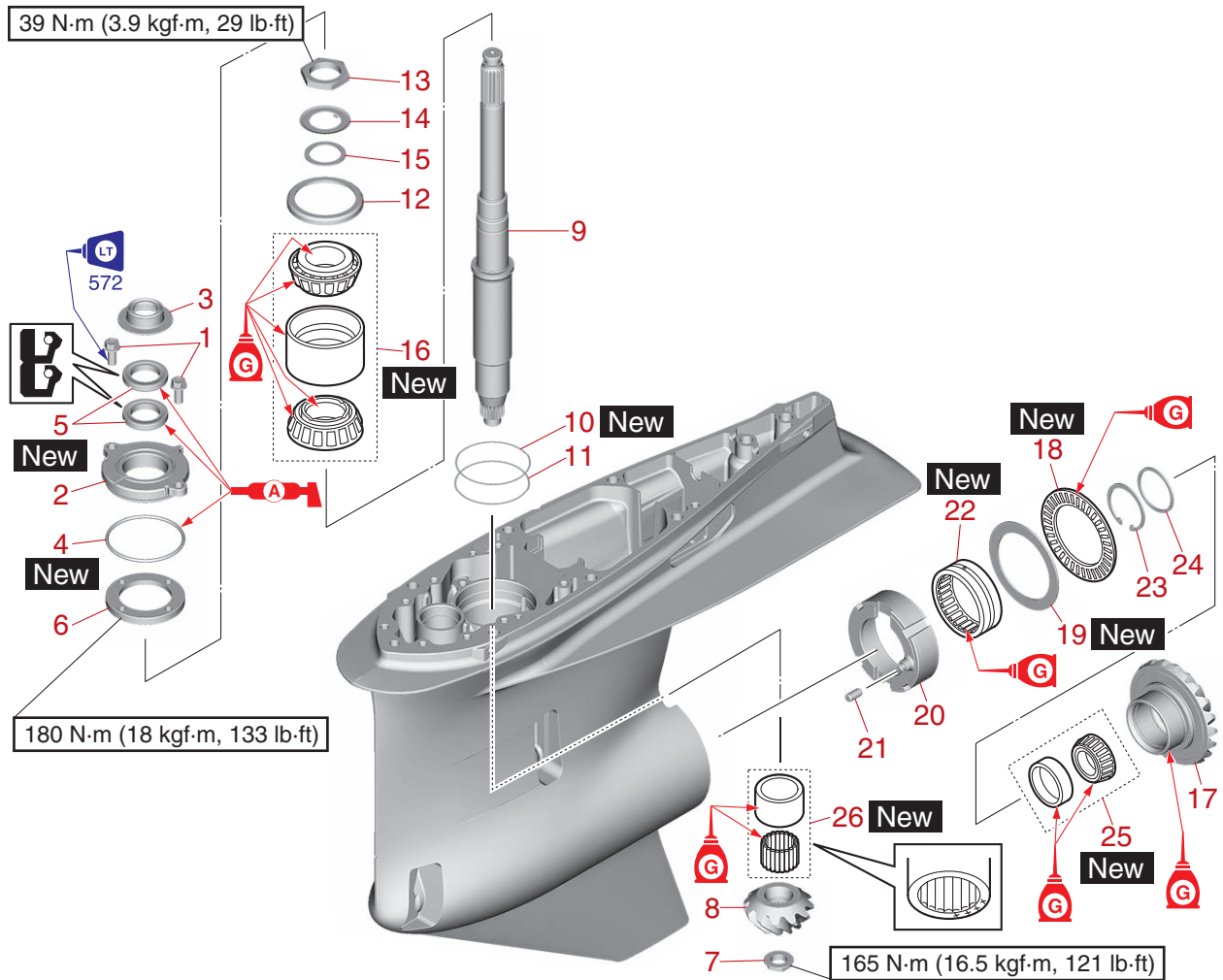


6. Install:

- Cover
- Cover bolt

	Cover bolt
	8 N·m (0.8 kgf·m, 5.9 lb·ft)

Drive shaft and lower case (regular rotation model)



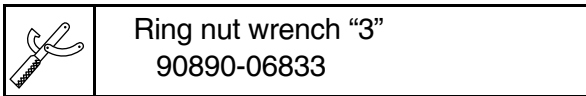
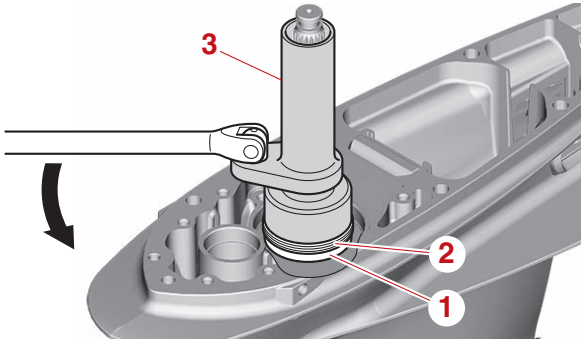
↑↓	Part name	Q'ty	Remarks
1	Bolt M8 × 20 mm	2	
2	Oil seal housing	1	
3	Cover	1	
4	O-ring	1	
5	Oil seal	2	
6	Ring nut M75	1	
7	Pinion nut M18	1	
8	Pinion	1	
9	Drive shaft	1	
10	Pinion shim (T3)	—	
11	Washer	1	
12	Spacer	1	
13	Nut M30	1	
14	Claw washer	1	
15	Washer	1	
16	Tapered roller bearing	1	
17	Forward gear	1	
18	Thrust bearing	1	

↑↓	Part name	Q'ty	Remarks
19	Forward gear shim (T1)	1	
20	Adapter	1	
21	Dowel	1	
22	Roller bearing	1	
23	Circlip	1	
24	Washer	1	
25	Tapered roller bearing	1	
26	Needle bearing	1	

## Drive shaft and lower case (regular rotation model)

### Removing the drive shaft

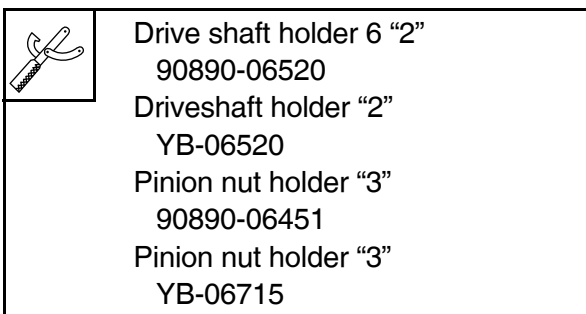
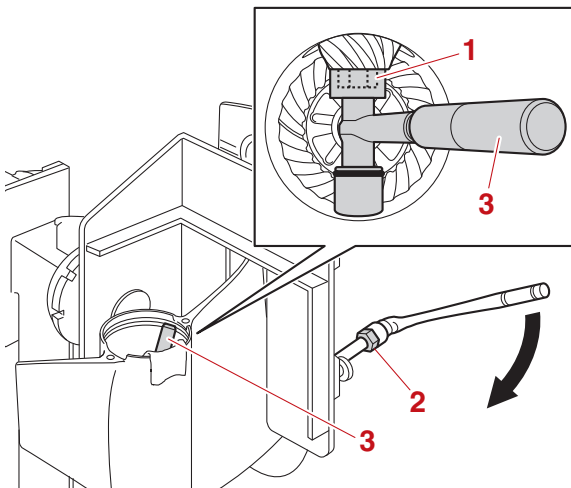
1. Remove:
  - Oil seal housing
  - Ring nut "1"
  - Spacer "2"



2. Loosen:
  - Pinion nut "1"

#### TIP:

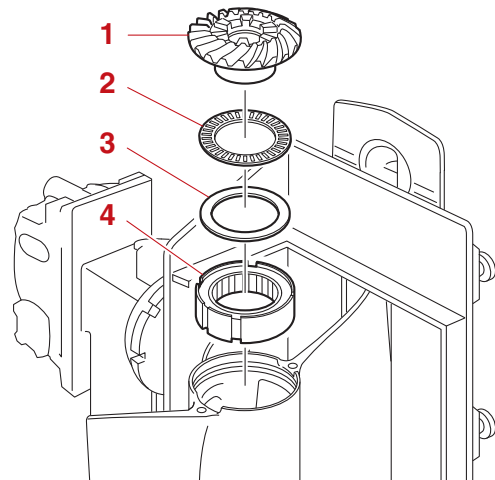
Place a rag at the point where the special service tool "3" contacts the lower case.



3. Remove:
  - Pinion
  - Drive shaft
  - Pinion shim
  - Washer

### Removing the forward gear

1. Remove:
  - Forward gear assembly "1"
  - Thrust bearing "2"
  - Forward gear shim "3"
  - Adapter assembly "4"

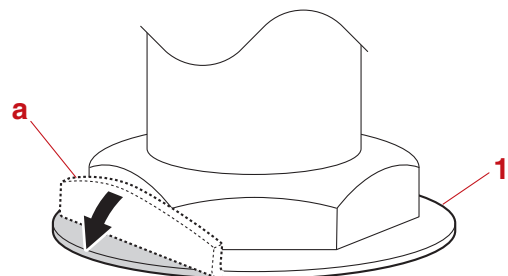


### Disassembling the oil seal housing

1. Remove:
  - Cover
  - O-ring
  - Oil seal

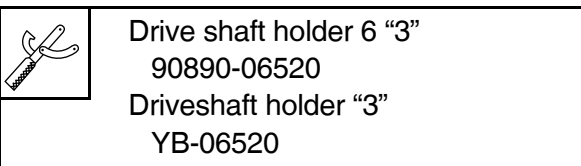
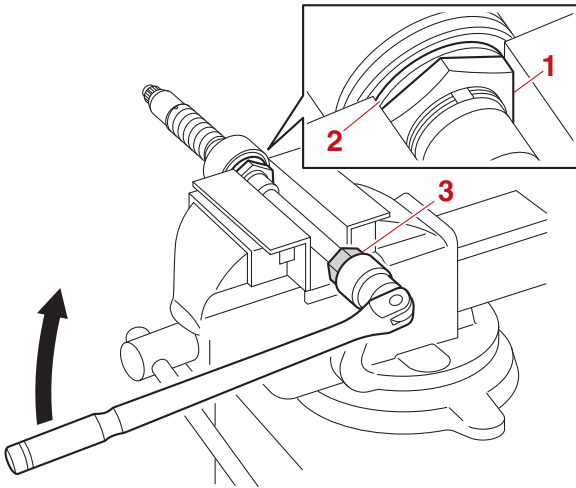
### Disassembling the drive shaft

1. Remove:
  - Drive shaft nut
  - Claw washer
    - a. Straighten the tab "a" on the claw washer "1".



## Drive shaft and lower case (regular rotation model)

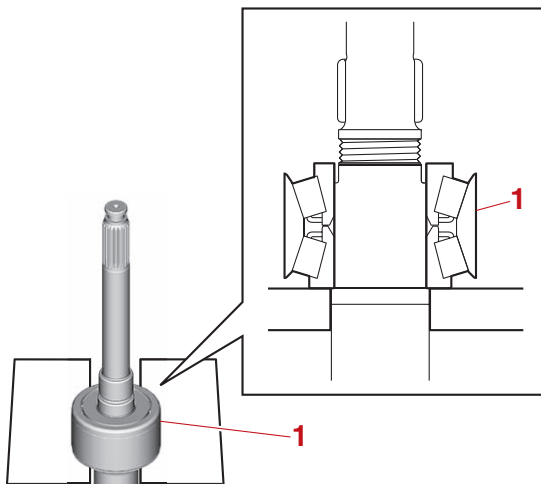
- b. Secure the drive shaft nut "1" on the drive shaft.
- c. Loosen the drive shaft nut "1", and then remove the drive shaft nut "1" and claw washer "2".



2. Remove:
  - Washer
  - Tapered roller bearing "1"

### NOTICE

Make sure that the inner race of the tapered roller bearing is placed properly on the blocks.

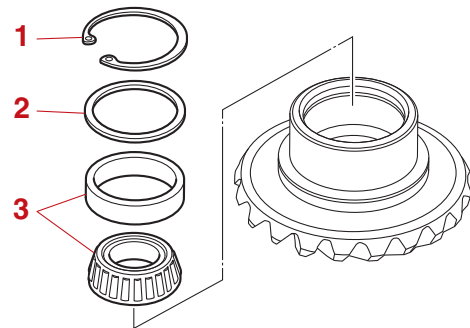


## Disassembling the forward gear

### WARNING

- Use heat-resistant gloves. Otherwise, burns could result.
- To prevent fires, remove any flammable substances, such as gasoline and oil, around the working area.
- Keep good ventilation while working.

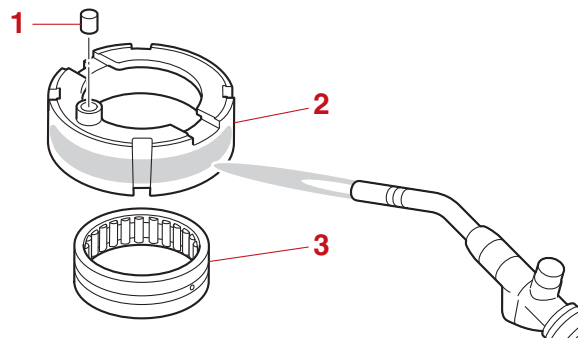
1. Remove:
  - Circlip "1"
  - Washer "2"
  - Tapered roller bearing "3"



2. Remove:
  - Dowel "1"
  - Adapter "2"
  - Roller bearing "3"
    - a. Heat the installation area of the roller bearing in the adapter "2" using a gas torch, and then remove the roller bearing "3".

### NOTICE

When heating the adapter, heat the entire installation area evenly. Otherwise, the adapter could be damaged.



## Disassembling the lower case

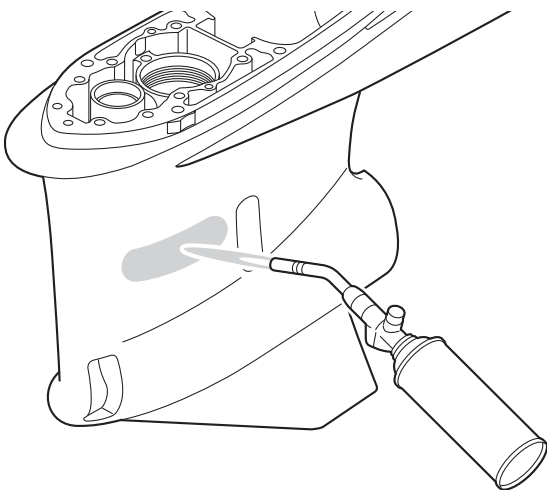
### **⚠ WARNING**

- Use heat-resistant gloves. Otherwise, burns could result.
- To prevent fires, remove any flammable substances, such as gasoline and oil, around the working area.
- Keep good ventilation while working.

1. Remove:
  - Needle bearing
    - a. Heat the installation area of the needle bearing in the lower case using a gas torch.

### **NOTICE**

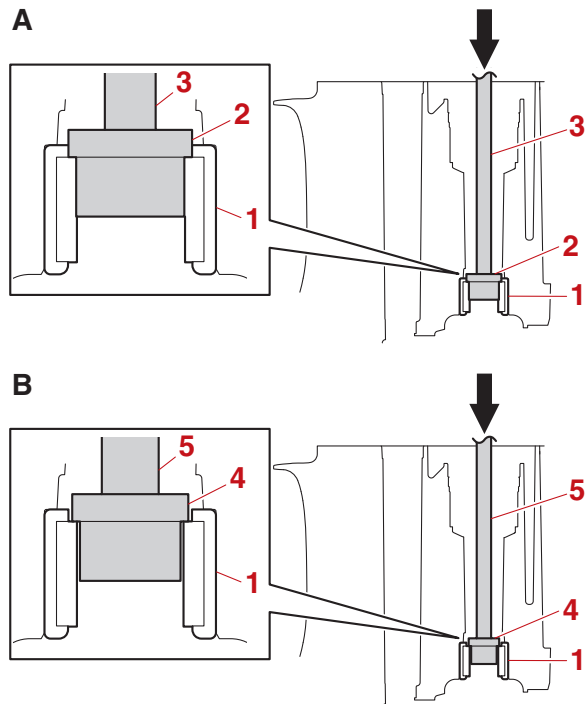
When heating the lower case, heat the entire installation area evenly. Otherwise, the paint on the lower case could be burned.



- b. Remove the needle bearing "1".

### **TIP:**

- Before removing the needle bearing, make sure to remove the forward gear assembly.
- Before installing the special service tool, make sure that the rollers are installed in the needle bearing outer race.



- A. Worldwide  
B. USA and Canada

	Needle bearing attachment "2" 90890-06680
	Driver rod L3 "3" 90890-06652
	Driveshaft needle bearing installer and remover "4" YB-06196
	Driver handle (large) "5" YB-06071

## Checking the pinion

1. Check:
  - Teeth of the pinion  
Cracked/worn → Replace.

## Checking the forward gear

1. Check:
  - Teeth and dogs of the forward gear  
Cracked/worn → Replace.

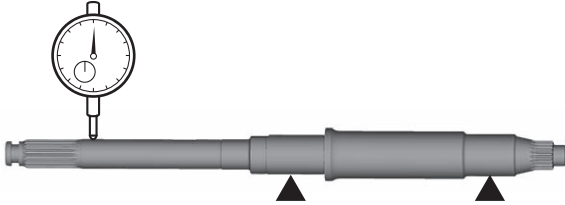
## Checking the drive shaft

1. Check:
  - Drive shaft  
Damaged/worn → Replace.

## Drive shaft and lower case (regular rotation model)

### 2. Measure:

- Drive shaft runout  
Above specification → Replace.



	Runout 0.3 mm (0.012 in) (F250NST, F250SB, F300FST, F300SB)
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### Checking the lower case

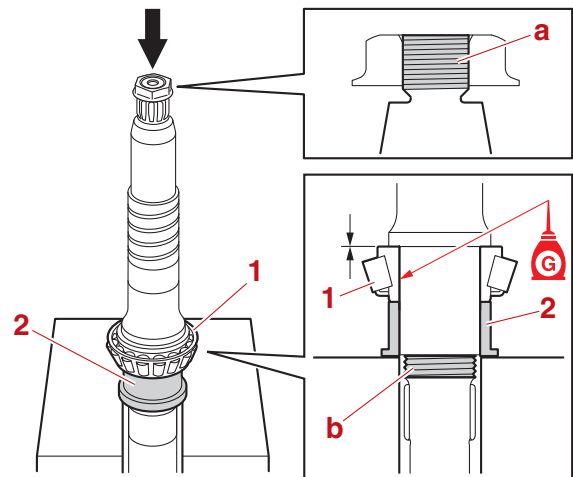
1. Check:
  - Lower case  
Cracked/damaged → Replace.

### Assembling the drive shaft

1. Install:
  - Tapered roller bearing **New**
  - Washer
  - Claw washer
  - Drive shaft nut
    - a. Install a new tapered roller bearing inner race "1".

#### **NOTICE**

Do not press the threads "a" of the drive shaft directly. Make sure that the special service tool and blocks do not contact the threads "b" of the drive shaft.



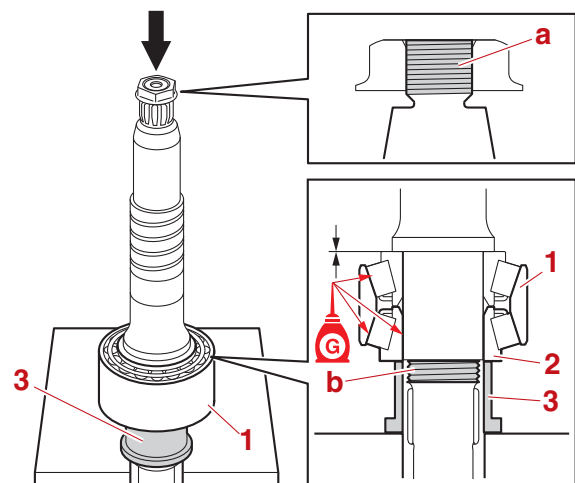
	Bearing inner race attachment "2" 90890-06640
--	--

	Press load (bearing) $50 \times 10^3$ N (5000 kgf, 11000 lbf)
--	--

- b. Install a new tapered roller bearing outer race "1" and the tapered roller bearing inner race "2".

#### **NOTICE**

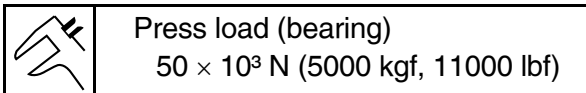
Do not press the threads "a" of the drive shaft directly. Make sure that the special service tool and blocks do not contact the threads "b" of the drive shaft.



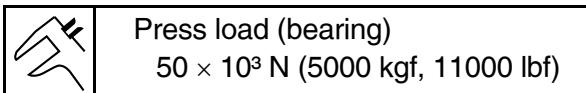
	Bearing inner race attachment "3" 90890-06640
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## Drive shaft and lower case (regular rotation model)



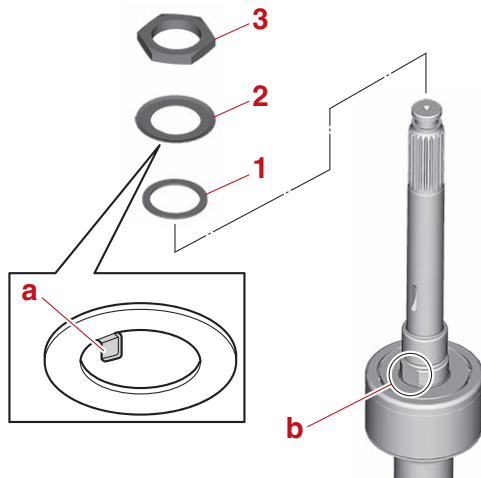
- c. Turn the tapered roller bearing 10 turns or more to seat the bearing, and then press the drive shaft again using the specified load.



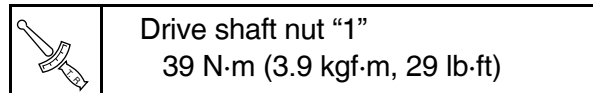
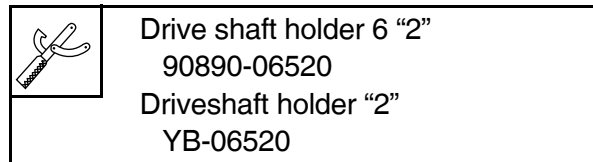
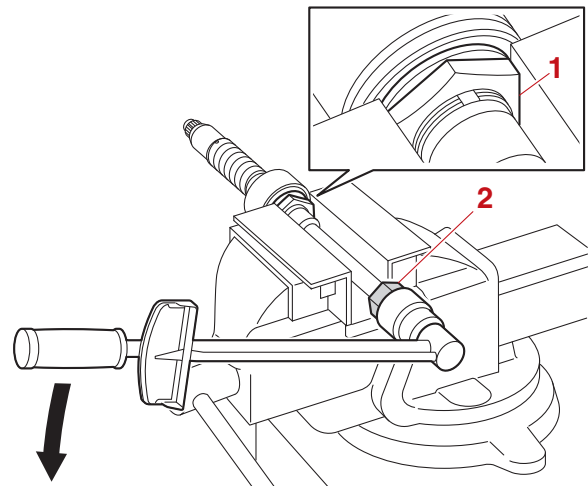
- d. Turn the tapered roller bearing 10 turns or more to seat the bearing.
- e. Install the washer "1", claw washer "2", and drive shaft nut "3", and then tighten the drive shaft nut "3" temporarily.

### TIP:

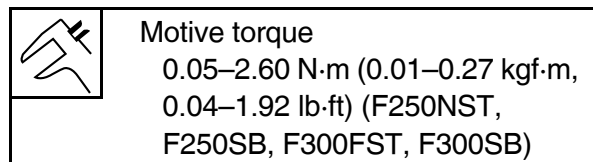
Make sure to fit the tab "a" on the claw washer "2" into the slot "b" in the drive shaft.



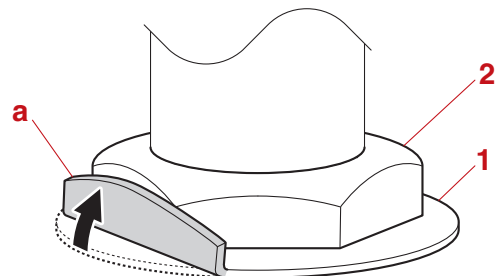
- f. Secure the drive shaft nut "1" on the drive shaft.
- g. Tighten the drive shaft nut "1" to the specified torque.



- h. Hold the tapered roller bearing outer race, and then measure the motive torque of the drive shaft.



- i. Bend the tab "a" on the claw washer "1" to secure the drive shaft nut "2".



## Assembling the forward gear

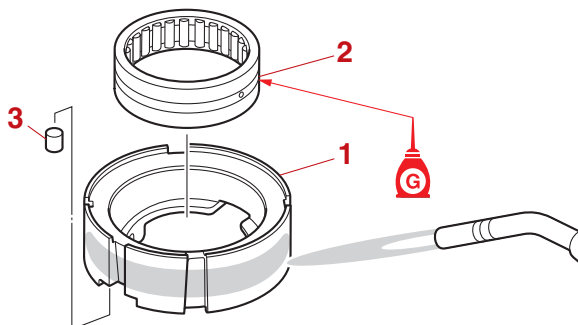
### ⚠ WARNING

- Use heat-resistant gloves. Otherwise, burns could result.
- To prevent fires, remove any flammable substances, such as gasoline and oil, around the working area.
- Keep good ventilation while working.

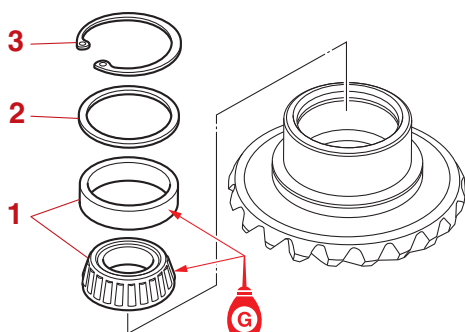
1. Install:
  - Adapter "1"
  - Roller bearing "2" **New**
  - Dowel "3"
  - a. Heat the installation area of the roller bearing in the adapter "1" using a gas torch, and then install a new roller bearing "2".

### NOTICE

When heating the adapter, heat the entire installation area evenly. Otherwise, the adapter could be damaged.



2. Install:
  - Tapered roller bearing "1" **New**
  - Washer "2"
  - Circlip "3"

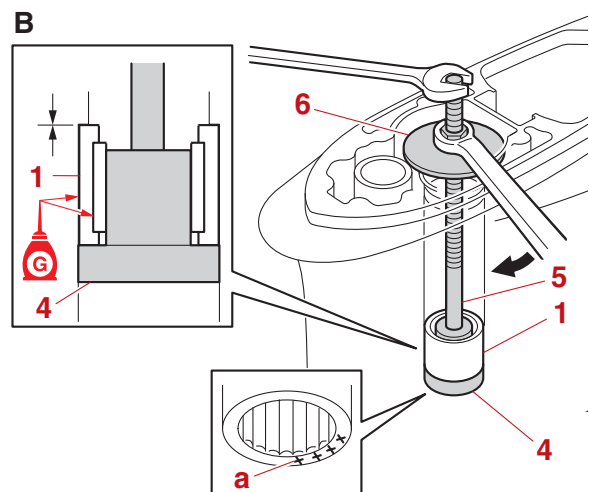
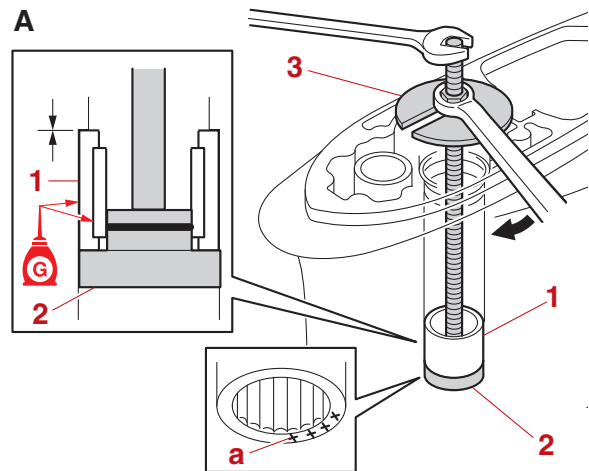


## Assembling the lower case

1. Install:
  - Needle bearing "1" **New**


### TIP:

- Make sure to face the bearing identification mark "a" on the needle bearing toward the pinion.
- The needle bearing contains 24 rollers.



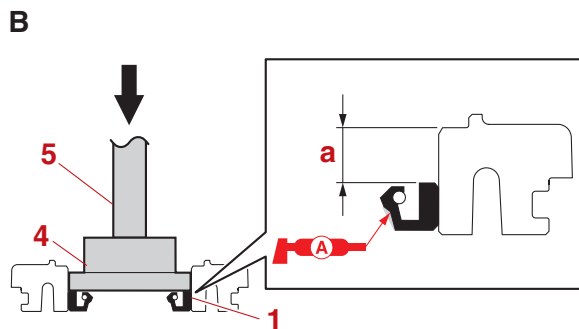
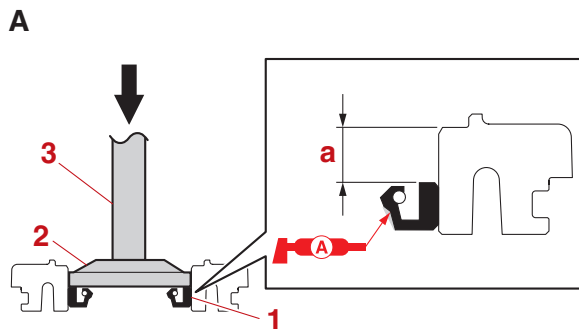
A. Worldwide  
B. USA and Canada

## Drive shaft and lower case (regular rotation model)


	Ball bearing attachment "2" 90890-06655 Bearing outer race puller assembly "3" 90890-06523 Driveshaft bearing installer "4" YB-06246 Pinion gear bushing installer "5" YB-06029 Roller bearing installer/remover "6" YB-06432
---	---


### Assembling the oil seal housing

1. Install:
- Oil seal "1" **New**

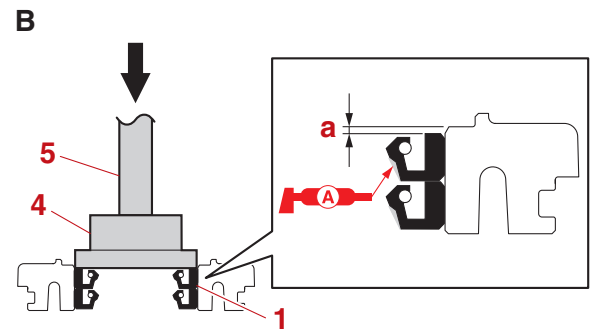
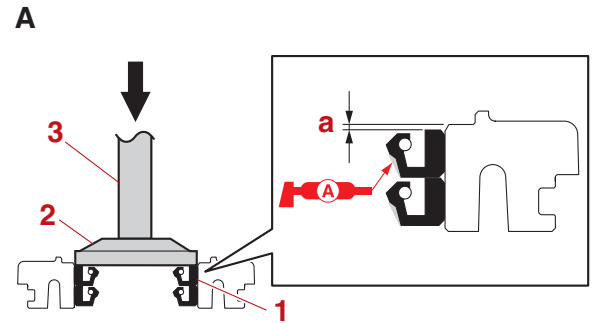


- A. Worldwide  
 B. USA and Canada


	Bearing outer race attachment "2" 90890-06628 Driver rod LL "3" 90890-06605 Bearing cup installer "4" YB-06167 Driver handle (large) "5" YB-06071
---	--


	Installation depth "a" 7.25–7.75 mm (0.258–0.305 in)
---	---

2. Install:
- Oil seal "1" **New**



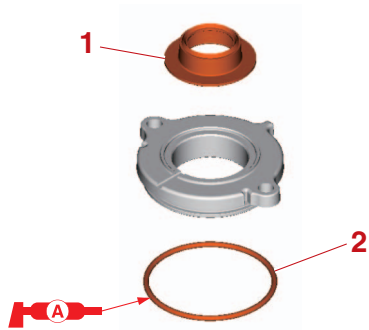
- A. Worldwide  
 B. USA and Canada

	Bearing outer race attachment "2" 90890-06628 Driver rod LL "3" 90890-06605 Bearing cup installer "4" YB-06167 Driver handle (large) "5" YB-06071
---	--

	Installation depth "a" 0.25–0.75 mm (0.001–0.030 in)
---	---

## Drive shaft and lower case (regular rotation model)

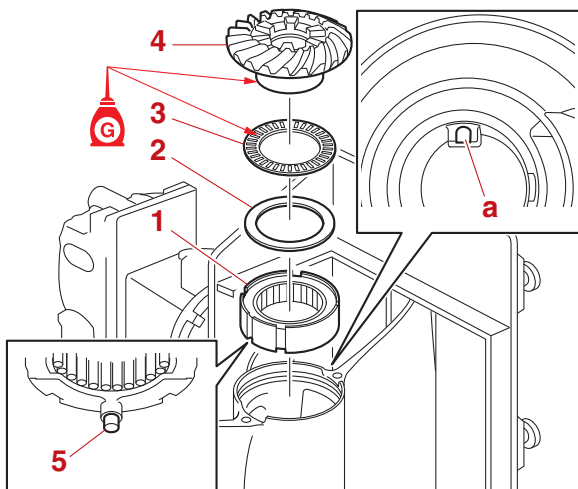
3. Install:
- Cover "1"
  - O-ring "2" **New**



### Installing the forward gear

1. Install:
- Adapter assembly "1"
  - Forward gear shim "2" **New**
  - Thrust bearing "3" **New**
  - Forward gear assembly "4"

**TIP:** \_\_\_\_\_  
 Make sure to fit the dowel "5" into the slot "a" in the lower case.

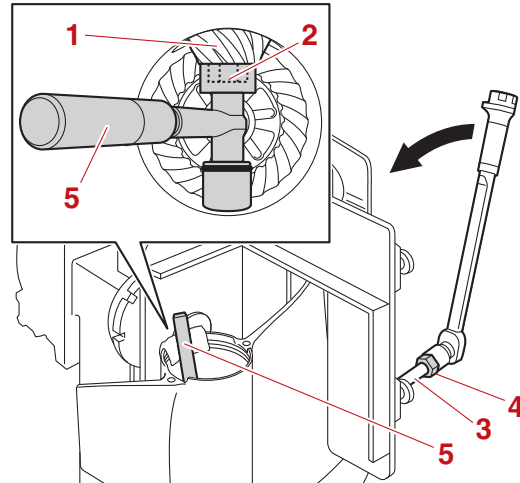



### Installing the drive shaft


1. Install:
- Washer
  - Pinion shim **New**
  - Drive shaft
2. Install:
- Pinion "1"
  - Pinion nut "2"
    - a. Check that the drive shaft turns smoothly.

**TIP:** \_\_\_\_\_

- When installing the pinion "1", lift up the drive shaft "3" slightly and align the splines on the drive shaft with the splines on the pinion.
- Place a rag at the point where the special service tool "5" contacts the lower case.



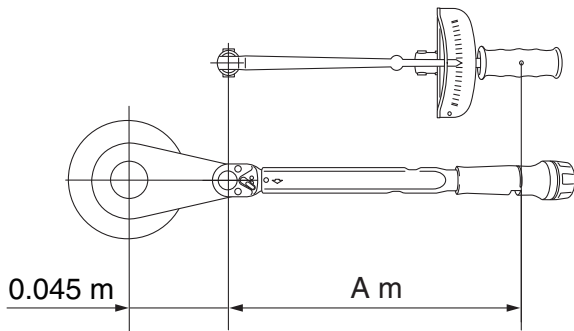
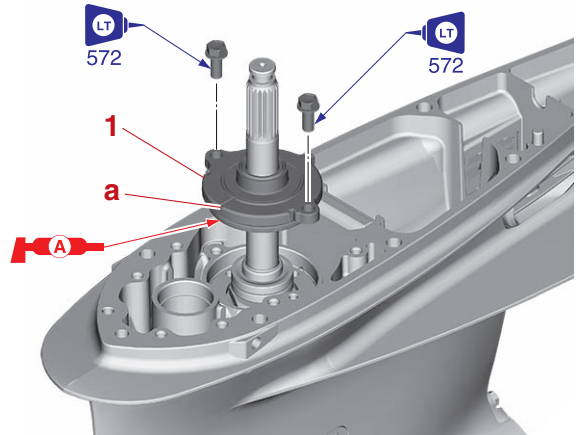
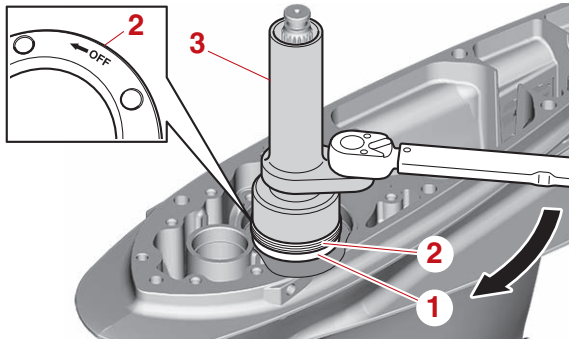
	Drive shaft holder 6 "4" 90890-06520
	Driveshaft holder "4" YB-06520
	Pinion nut holder "5" 90890-06451
	Pinion nut holder "5" YB-06715

	Pinion nut "2" 165 N·m (16.5 kgf·m, 121 lb·ft)
---	---

3. Install:
- Spacer "1"
  - Ring nut "2"

**NOTICE**

The correct setting value of the torque wrench varies depending on its length. When tightening the drive shaft ring nut to the specified torque, use the following calculation formula to obtain the correct setting value.



	Ring nut wrench "3" 90890-06833
--	------------------------------------

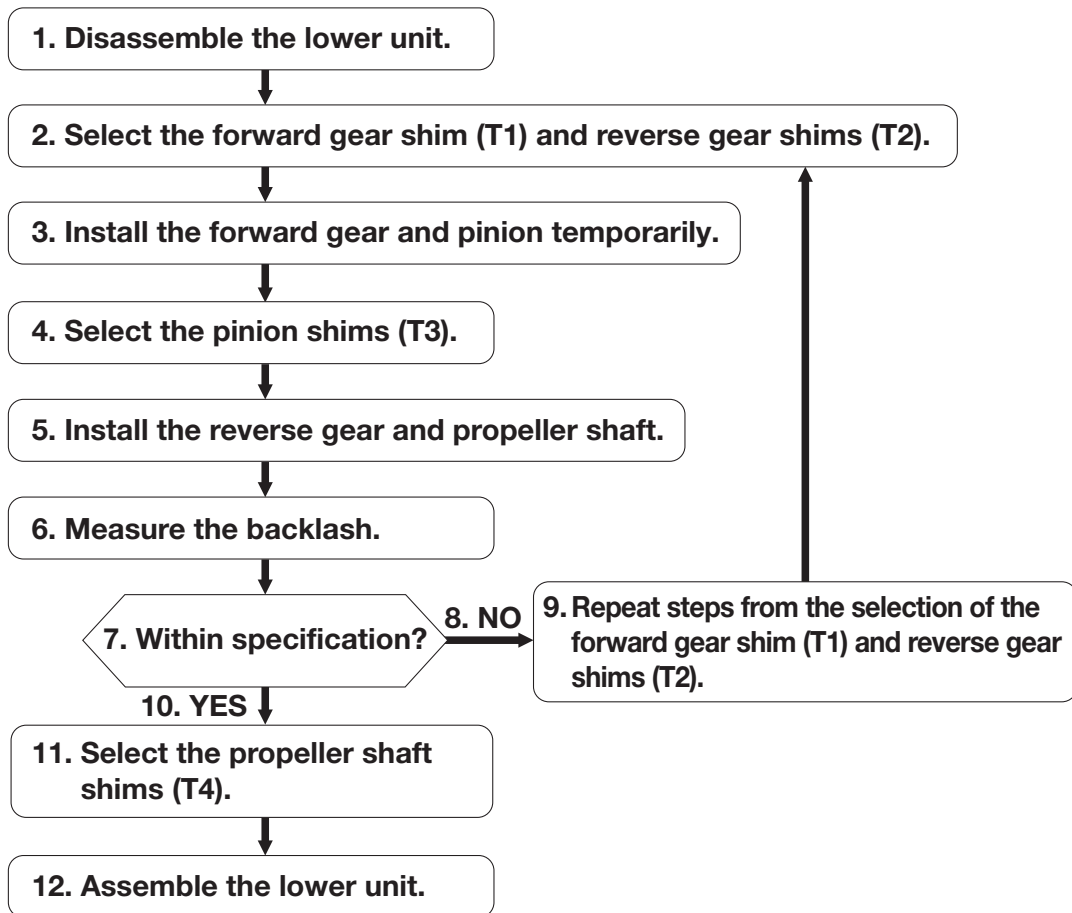
	Torque wrench setting value = $180 \text{ N}\cdot\text{m} \div (A + 0.045) \times A$ 180 N·m (18 kgf·m, 133 lb-ft) Specified tightening torque for the drive shaft ring nut 0.045 m Ring nut wrench length A m Torque wrench length
--	---

4. Install:
- Oil seal housing

**TIP:** \_\_\_\_\_

- Make sure to face the cutout "a" in the oil seal housing "1" forward.

**Shimming (regular rotation model)**  
**Shimming workflow**



1. Disassemble the lower unit.
2. Select the forward gear shim (T1) and reverse gear shims (T2).
3. Install the forward gear and pinion temporarily.
4. Select the pinion shims (T3).
5. Install the reverse gear and propeller shaft.
6. Measure the backlash.

7. Within specification?
8. NO
9. Repeat steps from the selection of the forward gear shim (T1) and reverse gear shims (T2).
10. YES
11. Select the propeller shaft shims (T4).
12. Assemble the lower unit.

**TIP:**

- Make sure to drain the gear oil before measuring the backlash.
- If the backlash is within specification, shimming is not required.
- When assembling the original inner parts and a new lower case, shimming is required.
- When replacing the pinion, forward gear, reverse gear, bearings, drive shaft, or propeller shaft housing, shimming is required.

**Shimming check sheet**

Lower case deviation

Serial number	P	F	R	Remarks
		—	—	

Pinion height

	Measurements (mm)
Measuring point "a"	
Measuring point "b"	
Measuring point "c"	
Measuring point "d"	
Average	
Round-down average	

Forward gear backlash

	Measurements (mm)
Measuring point "a"	
Measuring point "b"	
Measuring point "c"	
Measuring point "d"	
Average	
Round-down average	

Reverse gear backlash

	Measurements (mm)
Measuring point "a"	
Measuring point "b"	
Measuring point "c"	
Measuring point "d"	
Average	
Round-down average	

Propeller shaft motive torque

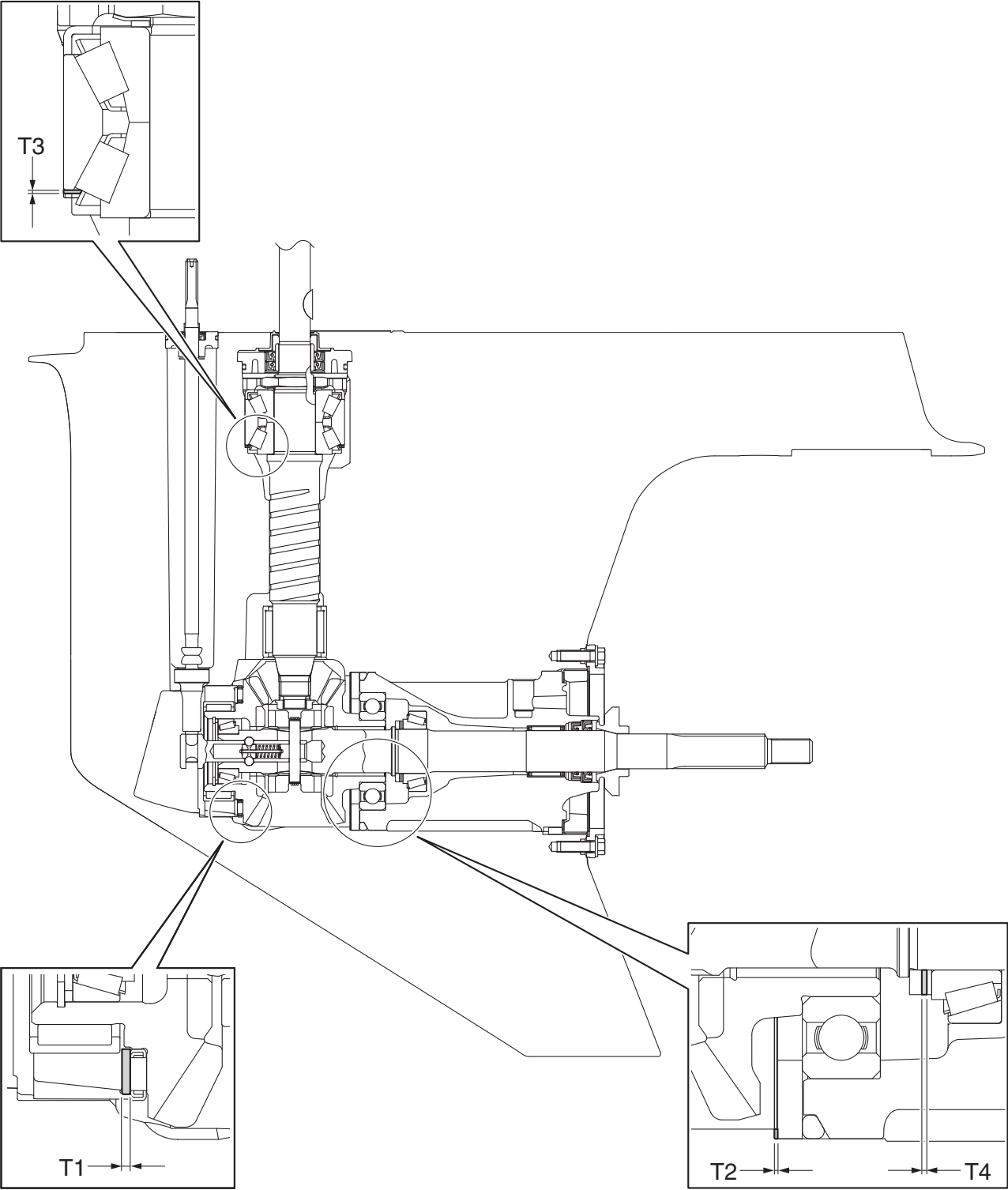
Measurement (N·m)	
-------------------	--



### Shimming procedure

- Shim thickness is specified for the forward gear shim (T1) and reverse gear shims (T2).
- After selecting the pinion shims (T3), do not apply gear oil, grease or sealant to the lower unit parts and teeth of the gear to measure the backlash.
- When the backlash adjustment is completed for the forward gear and reverse gear, make sure to select the propeller shaft shims (T4).
- When assembling the lower unit after shimming is completed, make sure to apply gear oil, grease, and sealant to the specified areas.

Shim location





### Selecting the forward gear shim (T1) and reverse gear shim (T2)

1. Select:
  - Forward gear shim (T1)
  - Reverse gear shim (T2)

**TIP:** \_\_\_\_\_

- Do not reuse shims.
- For forward gear shim (T1), use only 1 shim to obtain the specified shim thickness.
- For reverse gear shim (T2), use up to 3 shims to obtain the specified shim thickness.

	Shim thickness (T1)
	2.06 mm
	Shim thickness (T2)
	0.75 mm

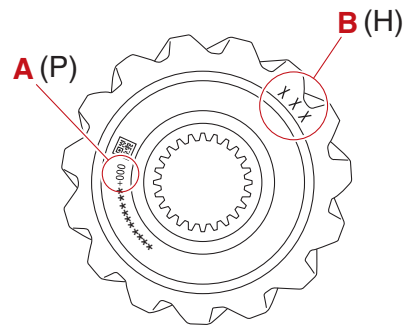
### Selecting the pinion shim (T3)

- Spray anti-rust lubricant on the gears and bearings before installation. Do not apply gear oil to the parts. Otherwise, correct measurements cannot be obtained.
- Keep the parts free of foreign material, such as dirt and lint.

**NOTICE**

**Be careful not to damage the measurement plane surface of the special service tool. Otherwise, correct measurements cannot be obtained.**

1. Measure:
  - Pinion mark
    - a. Disassemble the lower unit. See “Water pump and shift rod” (8-10), “Propeller shaft housing (regular rotation model)” (8-15), and “Drive shaft and lower case (regular rotation model)” (8-25).
    - b. Obtain the calculated value (B) based on marks (P) and (H) on the pinion. See “Calculated value (B) table” (A-18).



**Example:**  
When mark (P) is “000” “a” and mark (H) is “020” “b”, the calculated value (B) is 0.73 mm.

		A			a	
		-010	-009	-008	001	000
B	000					
	005					
	010					
	015					
	020					0.73
	025					
	030					

- A. Mark (P)
- B. Mark (H)

2. Install:
  - Adapter assembly
  - Specified forward gear shim (T1) **New**
  - Forward gear assembly  
See “Installing the forward gear” (8-33).
3. Install:
  - Original pinion shim (T3)
  - Drive shaft
  - Pinion
  - Pinion nut
  - Drive shaft ring nut  
See steps (1)–(4) in “Installing the drive shaft” (8-33).

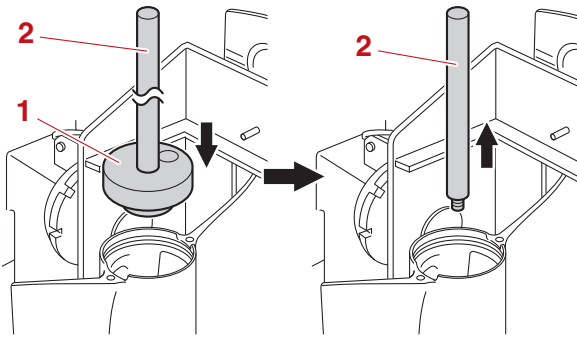
**TIP:** \_\_\_\_\_


- If the original shims (T3) are missing, install new shims with a combined thickness of 0.70 mm.
- Do not reuse a shim (T3) if deformed or scratched.

## Shimming (regular rotation model)

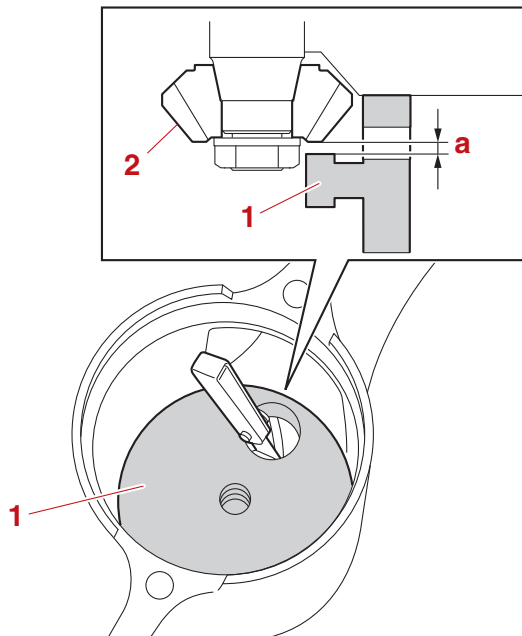
### 4. Measure:

- Pinion distance
  - a. Check that the drive shaft turns smoothly.
  - b. Set up the special service tools “1” and “2”, and then remove the special service tool “2”.



	Pinion shimming gauge “1” 90890-06675
	Pinion shimming gauge rod “2” 90890-06676

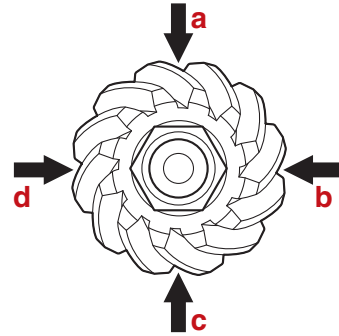
- c. Measure the distance “a” between the special service tool “1” and the pinion “2”.



- d. Turn the drive shaft 90° clockwise and measure the distance again.

### TIP: \_\_\_\_\_

- Measure the distance at 4 points: “a”, “b”, “c”, and “d”, turning the drive shaft 90° clockwise after each measurement.
- Write down the measurement data in the “Shimming check sheet”.



- e. Determine the distance average, and then round down the average to the 1/100 place.

Example:  
(mm)

Measuring point “a”	0.70
Measuring point “b”	0.71
Measuring point “c”	0.71
Measuring point “d”	0.69
Average	0.7025
Round-down average	0.70

### 5. Select:

- Pinion shim (T3)
  - a. Determine the pinion shim (T3) thickness adjustment using the calculated value (B) and pinion distance measurement (M). See “Pinion shim (T3) selection table” (A-19).

### TIP: \_\_\_\_\_

- If the shim thickness adjustment value is positive, increase the current shim thickness by that amount and, if the value is negative, decrease the current shim thickness by that amount.
- The blue-colored area on the selection table indicates that a pinion shim adjustment is not necessary.

## Shimming (regular rotation model)

Example:

Calculated value (B) = 0.70 mm “a”

Pinion distance measurement (M) = 0.52 mm “b”

Pinion shim (T3) thickness adjustment = 0.18 mm

The current shim thickness must be increased by 0.18 mm.

		A				
		0.51	0.52	0.53	0.54	0.55
B	0.55					
	0.56					
	0.57					
	0.58					
	0.59					
B	0.68					
	0.69					
	0.70					
	0.71					
	0.72					

Diagram showing a curved line representing a shim profile. A red circle highlights the value 0.52 in the 'A' row and 0.70 in the 'B' row. A red arrow labeled 'a' points to the 0.70 value, and another red arrow labeled 'b' points to the 0.52 value. A horizontal arrow labeled '+0.18' points from the 0.70 value to the right.

A. Pinion distance measurement (M)

B. Calculated value (B)

- b. Calculate the new pinion shim (T3) thickness.

### TIP:

- Use up to 3 shims to obtain the required shim thickness. However, if the pinion shim thickness is 1.21 mm or more, 4 shims may be used.
- If the calculated shim thickness cannot be obtained with a combination of the available shims, increase or decrease the pinion distance measurement by 0.01 mm.

Calculation formula:

New pinion shim (T3) thickness = Current pinion shim thickness + Shim thickness adjustment

Example:

Use the following formula when the shim thickness adjustment value is positive.

Current pinion shim thickness = 0.70 mm

Shim thickness adjustment = 0.18 mm


New pinion shim (T3) thickness = 0.70 mm + 0.18 mm = 0.88 mm

Use the following formula when the shim thickness adjustment value is negative.

Current pinion shim thickness = 0.70 mm

Shim thickness adjustment = -0.09 mm

New pinion shim (T3) thickness = 0.70 mm + (-0.09 mm) = 0.61 mm

	Available shim thicknesses
	Pinion shims 0.10/0.12/0.15/0.18/0.30/0.40/ 0.50 mm (F250NST, F250SB, F300FST, F300SB)

6. Remove:

- Special service tool

7. Install:

- Determined pinion shim (T3) **New**

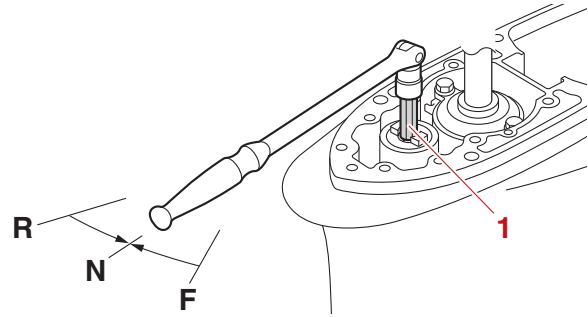
### Measuring the forward gear backlash and reverse gear backlash

- Spray anti-rust lubricant on the gear and bearings before installation. Do not apply gear oil to the parts. Otherwise, correct measurements cannot be obtained.
- Keep the parts free of foreign material, such as dirt and lint.
- When measuring the forward gear or reverse gear backlash, use the shims of the specified thickness for the forward gear shim (T1) and reverse gear shims (T2), and use the shims of the selected thickness for the pinion shims (T3).

## Shimming (regular rotation model)

1. Install:
  - Adapter assembly
  - Specified forward gear shim (T1) **New**
  - Thrust bearing
  - Forward gear assembly
 See "Installing the forward gear" (8-33).

**TIP:** \_\_\_\_\_  
Do not reuse a shim if deformed or scratched.



2. Install:
  - Determined pinion shim (T3) **New**
  - Drive shaft
  - Pinion
  - Pinion nut
  - Drive shaft ring nut
 See steps (1)–(3) in "Installing the drive shaft" (8-33).

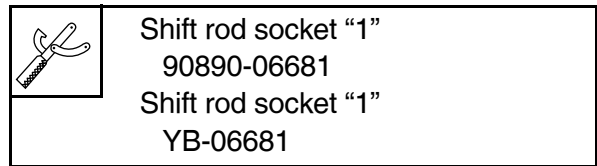
**TIP:** \_\_\_\_\_  
• Do not reuse a shim if deformed or scratched.  
• Check that the drive shaft turns smoothly.

3. Install:
  - Specified reverse gear shims (T2) **New**
  - Propeller shaft assembly
  - Propeller shaft housing assembly
  - Key
  - Claw washer (do not bend the tabs)
  - Ring nut
 See steps (1)–(5) in "Installing the propeller shaft housing assembly" (8-23).

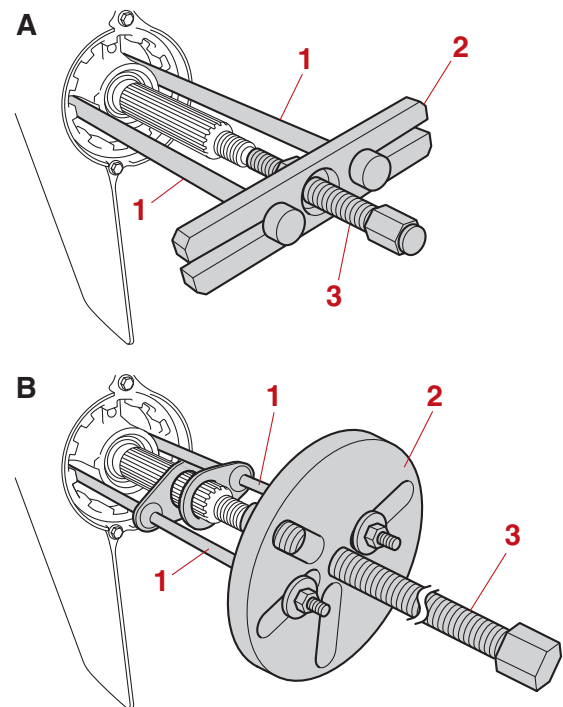
**TIP:** \_\_\_\_\_  
• Do not reuse a shim if deformed or scratched.  
• Check that the drive shaft turns smoothly.

4. Install:
  - Shift rod assembly
 See "Installing the shift rod" (8-13).

5. Measure:
  - Forward gear backlash
 Out of specification → Repeat steps from the selection of the forward gear shim (T1) and reverse gear shims (T2).
  - a. Set the gear shift to the N position.



- b. Set up the special service tools "1", "2", and "3", and then tighten the center bolt "3" to the specified torque.



A. Worldwide  
B. USA and Canada

## Shimming (regular rotation model)

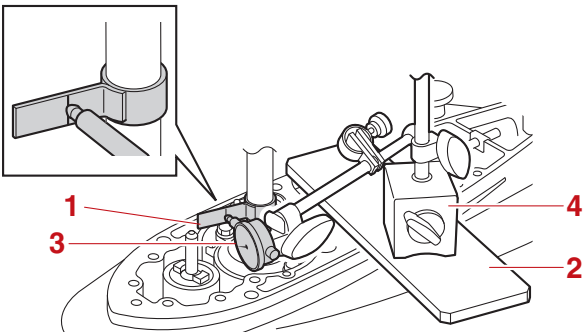


Bearing housing puller claw L "1"  
90890-06502  
Bearing housing puller "1"  
YB-06207  
Stopper guide plate "2"  
90890-06501  
Universal Puller "2"  
YB-06117  
Center bolt "3"  
90890-06504



Center bolt "3" (shimming)  
4.9 N·m (0.49 kgf·m, 3.6 lb-ft)

- c. Install the special service tool "1" onto the drive shaft at the lowest possible position where the shaft diameter is 22.4 mm (0.881 in), and then set up the special service tools "2", "3", and "4".

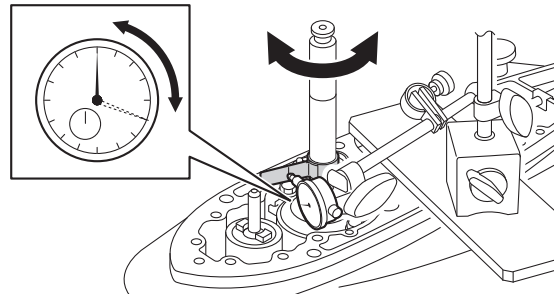


Backlash indicator "1"  
90890-06836  
Backlash indicator "1"  
YB-06836  
Magnet base plate "2"  
90890-07003  
Backlash adjustment plate "2"  
YB-07003  
Dial gauge set "3"  
90890-03238  
Dial indicator gauge "3"  
YU-03097  
Magnet base B "4"  
90890-06844  
Magnetic base stand "4"  
YU-A8438

- d. Turn the drive shaft slowly clockwise and counterclockwise, and then measure the backlash between where the drive shaft stops in each direction.

### TIP:

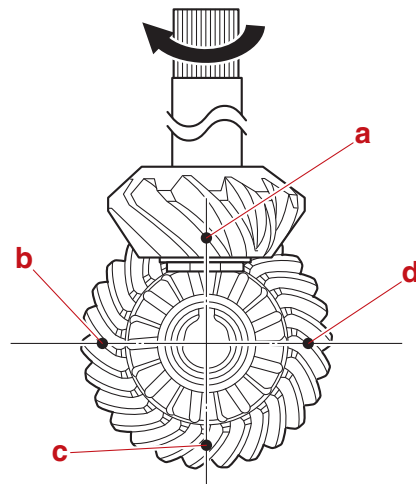
Do not turn the drive shaft using too much force. Otherwise, the forward gear will turn, leading to incorrect measurements.



- e. Turn the drive shaft 180° clockwise, and then measure the backlash again.

### TIP:

- Measure the backlash at 4 points: "a", "b", "c", and "d", turning the drive shaft 180° clockwise after each measurement.
- Write down the measurement data in the "Shimming check sheet".



- f. Determine the backlash average, and then round down the average to 2 decimal places.



## Shimming (regular rotation model)

Example:  
(mm)

Measurement point "a"	0.25
Measurement point "b"	0.26
Measurement point "c"	0.26
Measurement point "d"	0.24
Average	0.2525
Round-down average	0.25

- g. Check that the forward gear backlash average is within specification.

### TIP:

Repeat steps from the selection of the forward gear shim (T1) and reverse gear shims (T2) if the forward gear backlash is out of specification.



Forward gear backlash  
0.27–0.80 mm (0.0106–0.0315  
in) (F250NST, F250SB,  
F300FST, F300SB)

- h. Remove the special service tools from the propeller shaft.

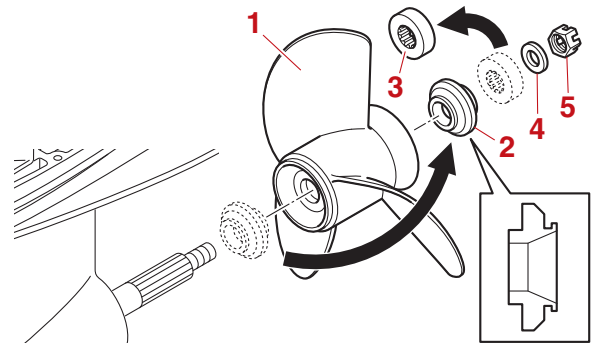
### 6. Measure:

- Reverse gear backlash  
Out of specification → Repeat steps from the selection of the forward gear shim (T1) and reverse gear shims (T2).
- a. Apply a load to the reverse gear by installing the propeller "1", spacer "2" (without installing the spacer "3"), and washer "4".

### TIP:

Install the spacer "2" in the direction shown.

- b. Tighten the propeller nut "5" to the specified torque.

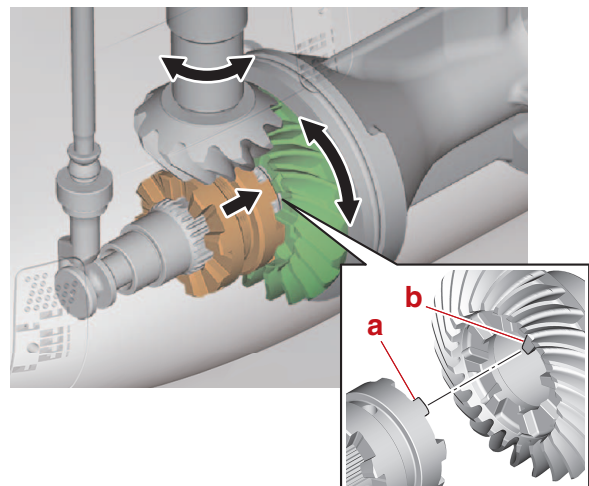
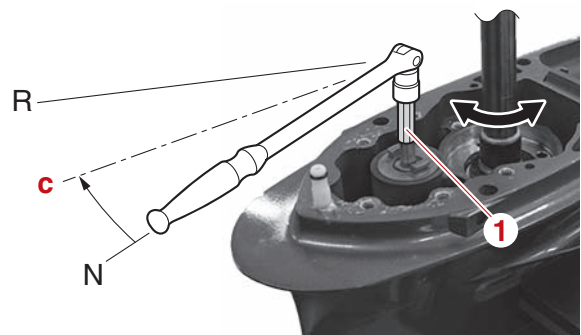


Propeller nut "5" (shimming)  
10 N·m (1.0 kgf·m, 7.4 lb·ft)

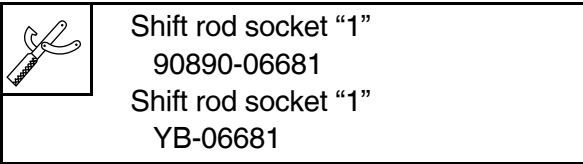
- c. While turning the drive shaft, move the gear shift toward the R position. Set the shift rod at the position where the protrusion "a" on the dog clutch hits the protrusion "b" on the reverse gear.

### TIP:

When the protrusion on the dog clutch hits the protrusion on the reverse gear, the shift rod is fixed at the position "c" which is in between the N position and the R position.

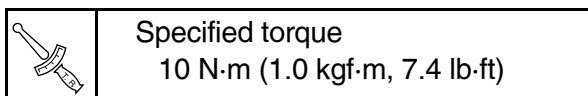
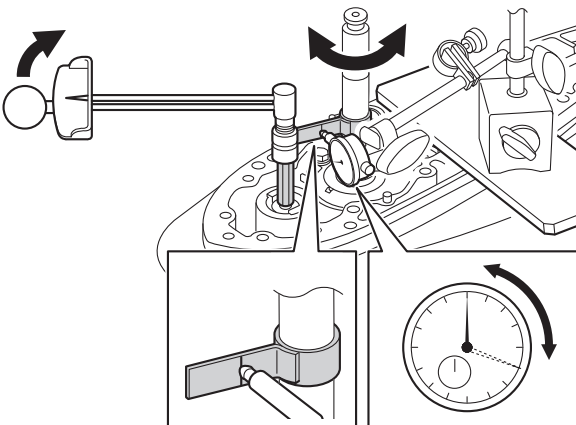


## Shimming (regular rotation model)



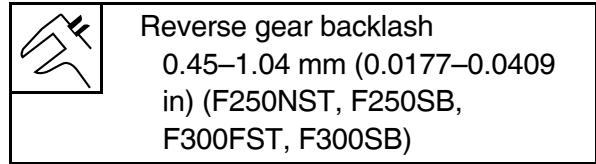
- d. While turning the shift rod toward the R position using the specified torque, turn the drive shaft slowly clockwise and counterclockwise and measure the backlash between where the drive shaft stops in each direction.

**TIP:** Do not turn the drive shaft using too much force. Otherwise, the reverse gear will turn, leading to incorrect measurements.



- e. Repeat steps (5) (e)–(g) to measure the reverse gear backlash.
- f. Check that the reverse gear backlash average is within specification.

**TIP:** Repeat steps from the selection of the forward gear shim (T1) and reverse gear shims (T2) if the reverse gear backlash is out of specification.



- g. Remove the special service tools, and then install the water pump assembly. See "Installing the water pump" (8-13).

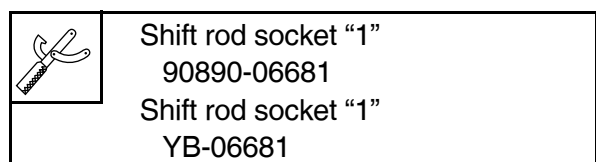
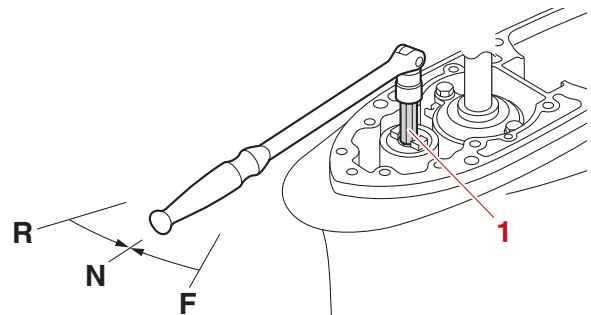
### Selecting the propeller shaft shim (T4)

- Install:
  - Original propeller shaft shim (T4)
  - Propeller shaft assembly
  - Specified reverse gear shim (T2) **New**
  - O-ring **New**
  - Propeller shaft housing assembly
  - Claw washer (do not bend the tabs)
  - Ring nut

See steps (1)–(5) in "Installing the propeller shaft housing assembly" (8-23).

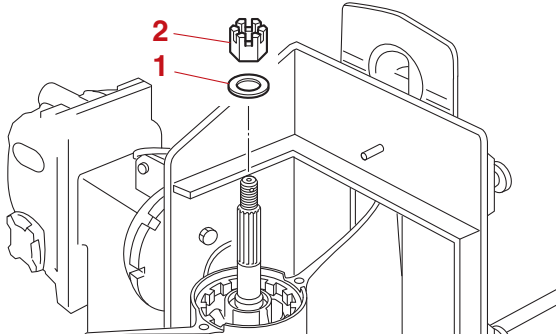
- TIP:**
- If the original shims (T4) are missing, install new shims with a combined thickness of 2.00 mm.
  - Do not reuse a shim (T4) if deformed or scratched.
  - Check that there is no free play in the propeller shaft.

- Measure:
  - Propeller shaft motive torque
    - Set the gear shift to the N position.

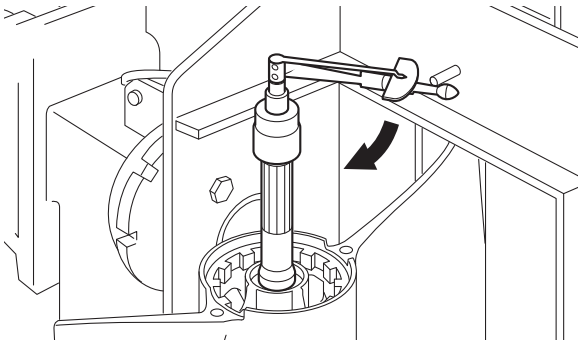



## Shimming (regular rotation model)

- b. Turn the propeller shaft 5 turns or more.
- c. Install the washer "1" and propeller nut "2".



- d. Measure the motive torque of the propeller shaft.



	<b>Propeller shaft motive torque</b> 0.44–1.32 N·m (0.04–0.13 kgf·m, 0.32–0.97 lb·ft)
---	---

3. Select:
  - Propeller shaft shim (T4)

### TIP:

- Shimming is not required if the measurement value is within specification.
- If the measurement value is below specification, adjust the motive torque to specification by increasing the propeller shaft shim thickness by 0.10 mm.
- If the measurement value is above specification, adjust the motive torque to specification by decreasing the propeller shaft shim thickness by 0.10 mm.
- Use up to 3 shims to obtain the required shim thickness.



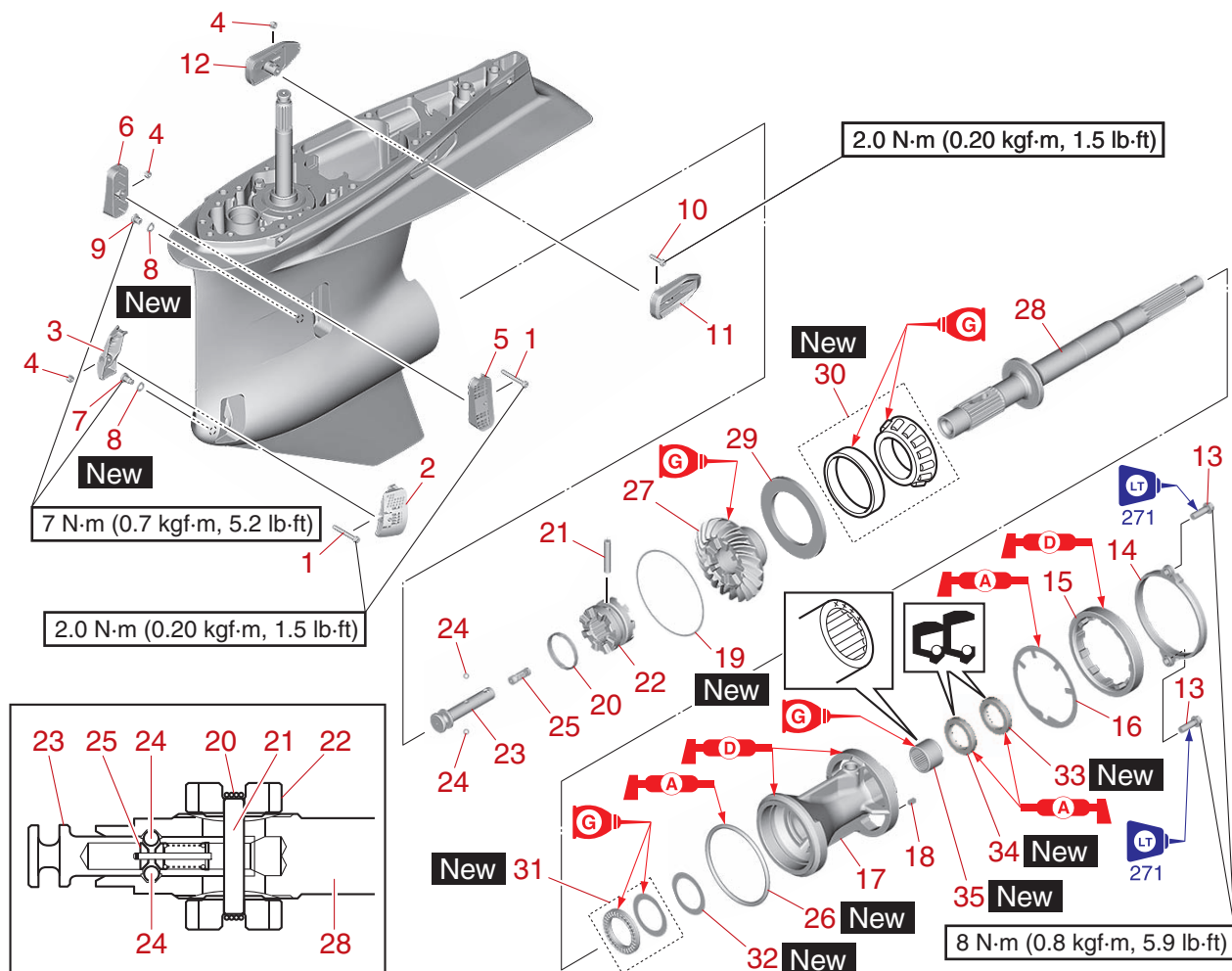
### Available shim thicknesses

#### Propeller shaft shims

0.7/0.8/0.9/1.0/1.1/1.2

(F250NST, F250SB, F300FST,  
F300SB)

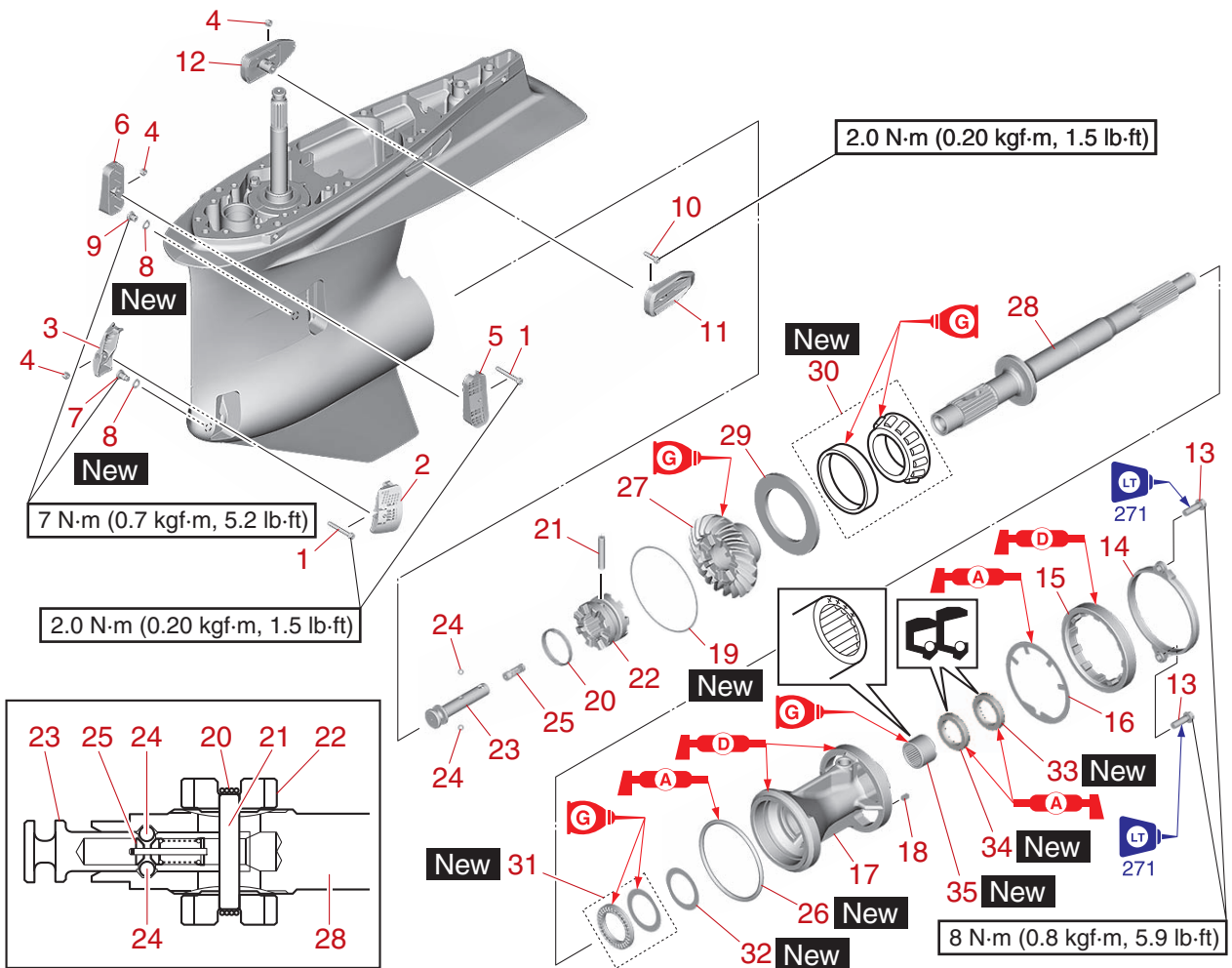
Propeller shaft housing (counter rotation model)



↑↓	Part name	Q'ty	Remarks
1	Screw M5 × 40 mm	2	
2	Water inlet cover (PORT)	1	
3	Water inlet cover (STBD)	1	
4	Self-locking nut M5	3	
5	Water inlet cover (PORT)	1	
6	Water inlet cover (STBD)	1	
7	Drain screw	1	
8	Gasket	2	
9	Oil level plug	1	
10	Screw M5 × 20 mm	1	
11	Outlet cover (PORT)	1	
12	Outlet cover (STBD)	1	
13	Bolt M8 × 25 mm	2	
14	Cover	1	
15	Ring nut M119	1	

↑↓	Part name	Q'ty	Remarks
16	Claw washer	1	
17	Propeller shaft housing	1	
18	Key	1	
19	Forward gear shim (T2)	—	
20	Spring	1	
21	Cross pin	1	
22	Dog clutch	1	
23	Slider	1	
24	Ball 6.35 mm (0.25 in) (reference data)	2	
25	Shift plunger	1	
26	O-ring	1	
27	Forward gear	1	
28	Propeller shaft	1	
29	Thrust washer	1	
30	Tapered roller bearing	1	

## Propeller shaft housing (counter rotation model)

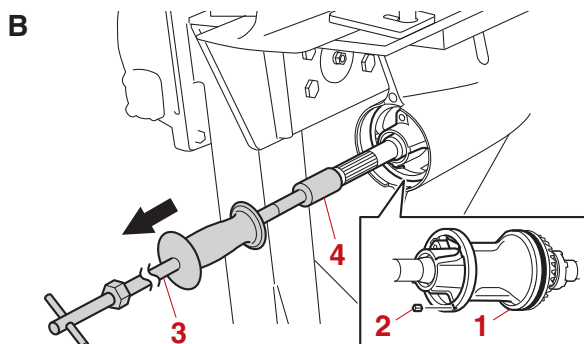
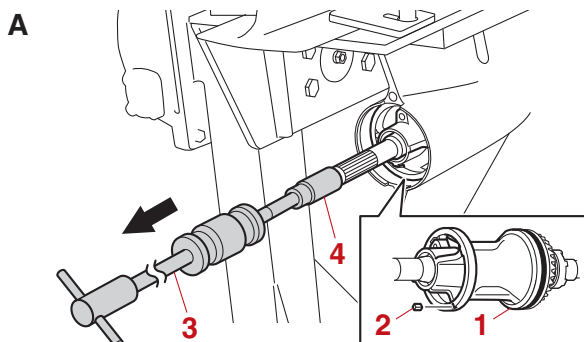


↑↓	Part name	Q'ty	Remarks
31	Thrust bearing	1	
32	Propeller shaft shim (T4)	—	
33	Oil seal	1	
34	Oil seal	1	
35	Needle bearing	1	


### Removing the propeller shaft housing assembly

1. Remove:
  - Cover
2. Remove:
  - Ring nut
  - Claw washer

See step (2) in “Removing the propeller shaft housing assembly” (8-17).
3. Remove:
  - Propeller shaft housing assembly “1”
  - Key “2”
  - Forward gear shim



A. Worldwide  
B. USA and Canada

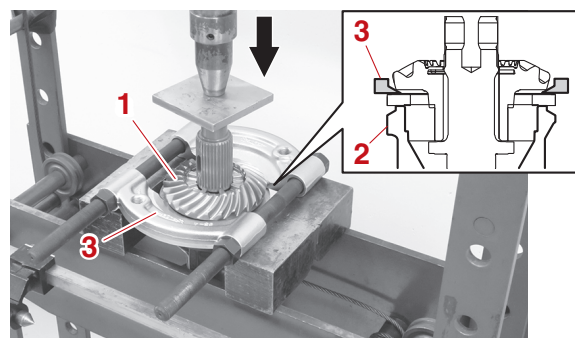
	Slide hammer handle “3” 90890-06531
	Slide hammer “3” YB-06096
	Puller head “4” 90890-06514
	Propeller shaft and bearing housing remover “4” YB-06335


### Disassembling the propeller shaft housing assembly

1. Remove:
  - Dog clutch

See “Disassembling the propeller shaft assembly” (8-18).

  - O-ring
2. Remove:
  - Forward gear assembly “1” (from the propeller shaft housing “2”)



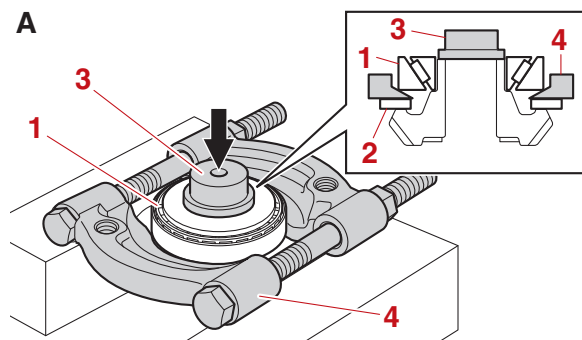
	Bearing splitter plate “3” (commercially available)
---	--

3. Remove:
  - Propeller shaft
  - Thrust bearing
  - Propeller shaft shim
4. Remove:
  - Oil seal
  - Needle bearing

See step (1) in “Disassembling the propeller shaft housing assembly” (8-18).

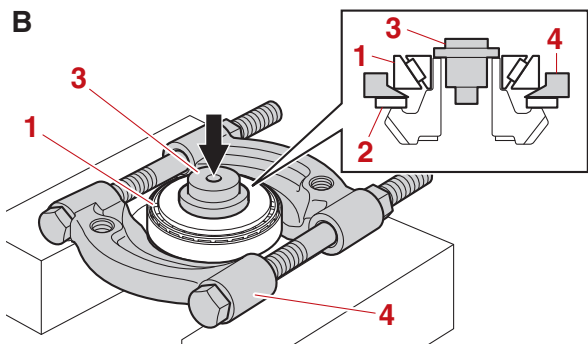
### Disassembling the forward gear

1. Remove:
  - Tapered roller bearing “1”
  - Thrust washer “2”





## Propeller shaft housing (counter rotation model)



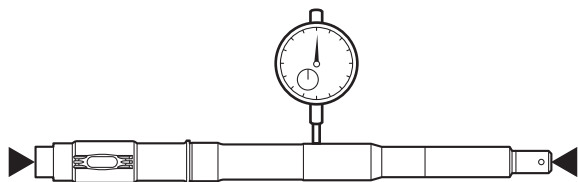
- A. Worldwide  
B. USA and Canada



Needle bearing attachment "3"  
90890-06607  
Driveshaft installer "3"  
YB-06244  
Bearing splitter plate "4"  
(commercially available)

### Checking the propeller shaft

- Check:
  - Propeller shaft  
Damaged/worn → Replace.
- Measure:
  - Propeller shaft runout  
Above specification → Replace.



Runout  
0.02 mm (0.0008 in) (FL250NST,  
FL300FST, LF250SB, LF300SB)

### Checking the dog clutch

See "Checking the dog clutch" (8-19).

### Checking the propeller shaft housing

See "Checking the propeller shaft housing" (8-19).

### Checking the forward gear

- Check:
  - Teeth and dogs of the forward gear  
Cracked/worn → Replace.

### Assembling the propeller shaft housing and forward gear

- Install:
  - Needle bearing **New**
  - Oil seal **New**

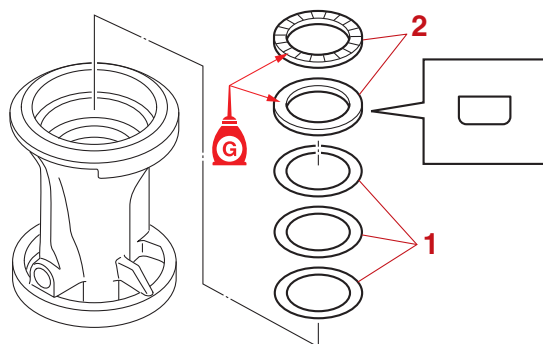
See steps (1) and (2) in "Assembling the propeller shaft housing assembly" (8-20).

- Install:

- Propeller shaft shim "1" **New**
- Thrust bearing "2" **New**

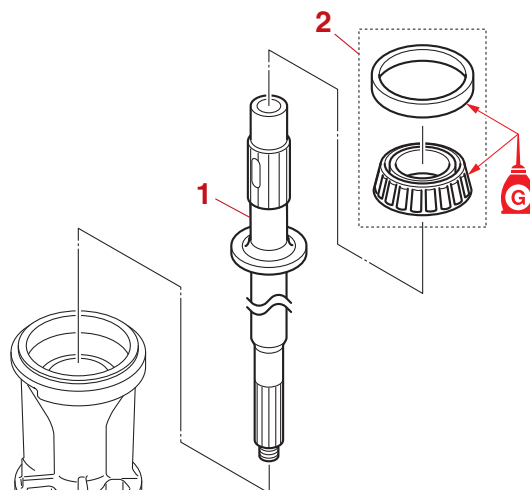
#### TIP:

Position the thickest propeller shaft shim toward the propeller shaft housing.



- Install:

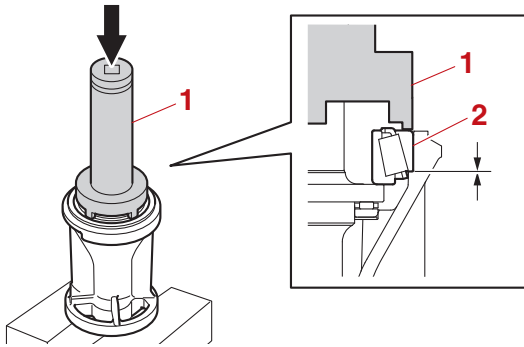
- Propeller shaft
- Tapered roller bearing **New**
  - Install the propeller shaft "1" and tapered roller bearing "2".





## Propeller shaft housing (counter rotation model)

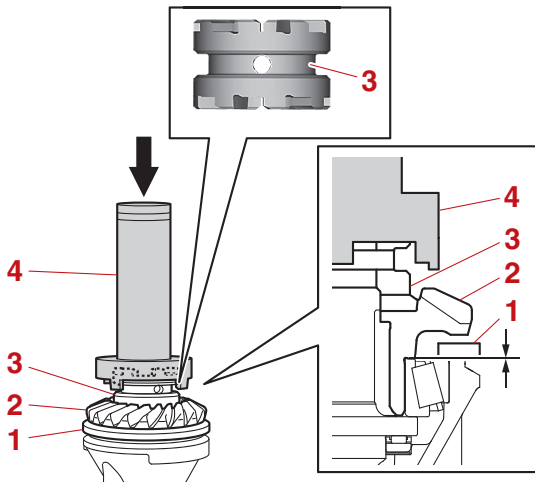
- b. Install the tapered roller bearing outer race "2" using the special service tool "1".



Ring nut wrench "1"  
90890-06578  
Gland nut wrench "1"  
YB-06578

### 4. Install:

- Thrust washer "1"
- Forward gear "2"
- a. Install the thrust washer "1" and forward gear "2" using the dog clutch "3" and special service tool "4".



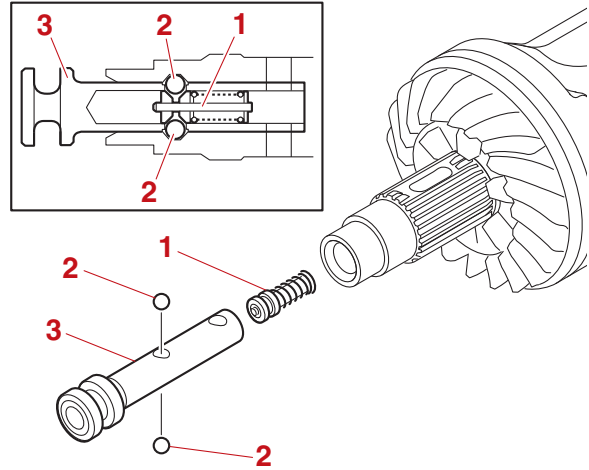
Ring nut wrench "4"  
90890-06578  
Gland nut wrench "4"  
YB-06578

### 5. Install:

- Shift plunger "1"
- Ball "2"
- Slider "3"

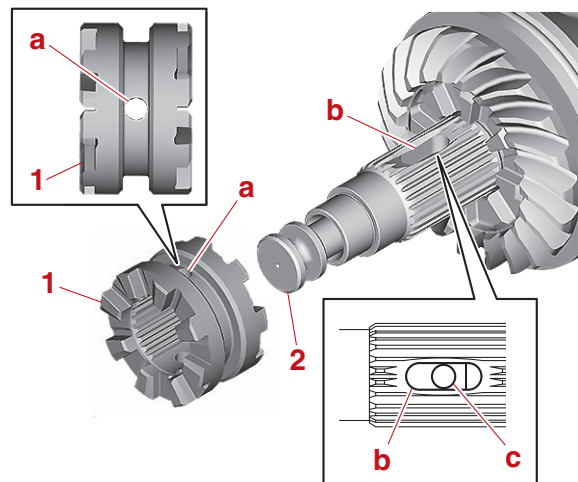
### TIP:

When installing the slider "3", make sure that the balls "2" do not fall out of position.

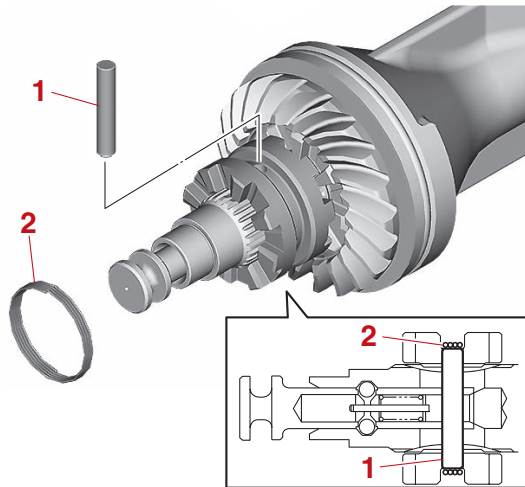


### 6. Install:

- Dog clutch "1"
- a. Install the dog clutch "1" so that the hole "a" in the dog clutch "1" and the hole "b" in the propeller shaft are aligned with the hole "c" in the slider "2".

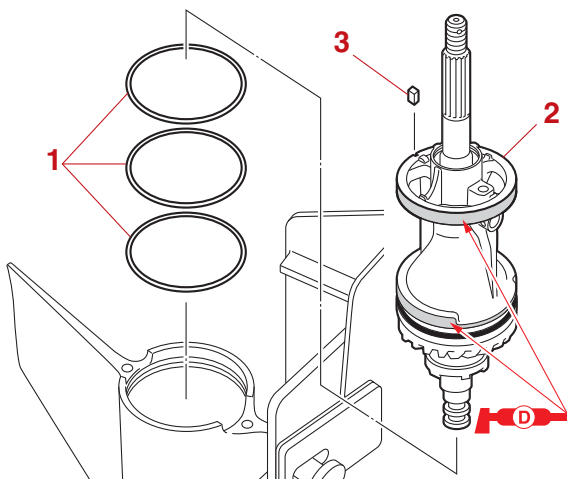


7. Install:
- Cross pin “1”
  - Spring “2”



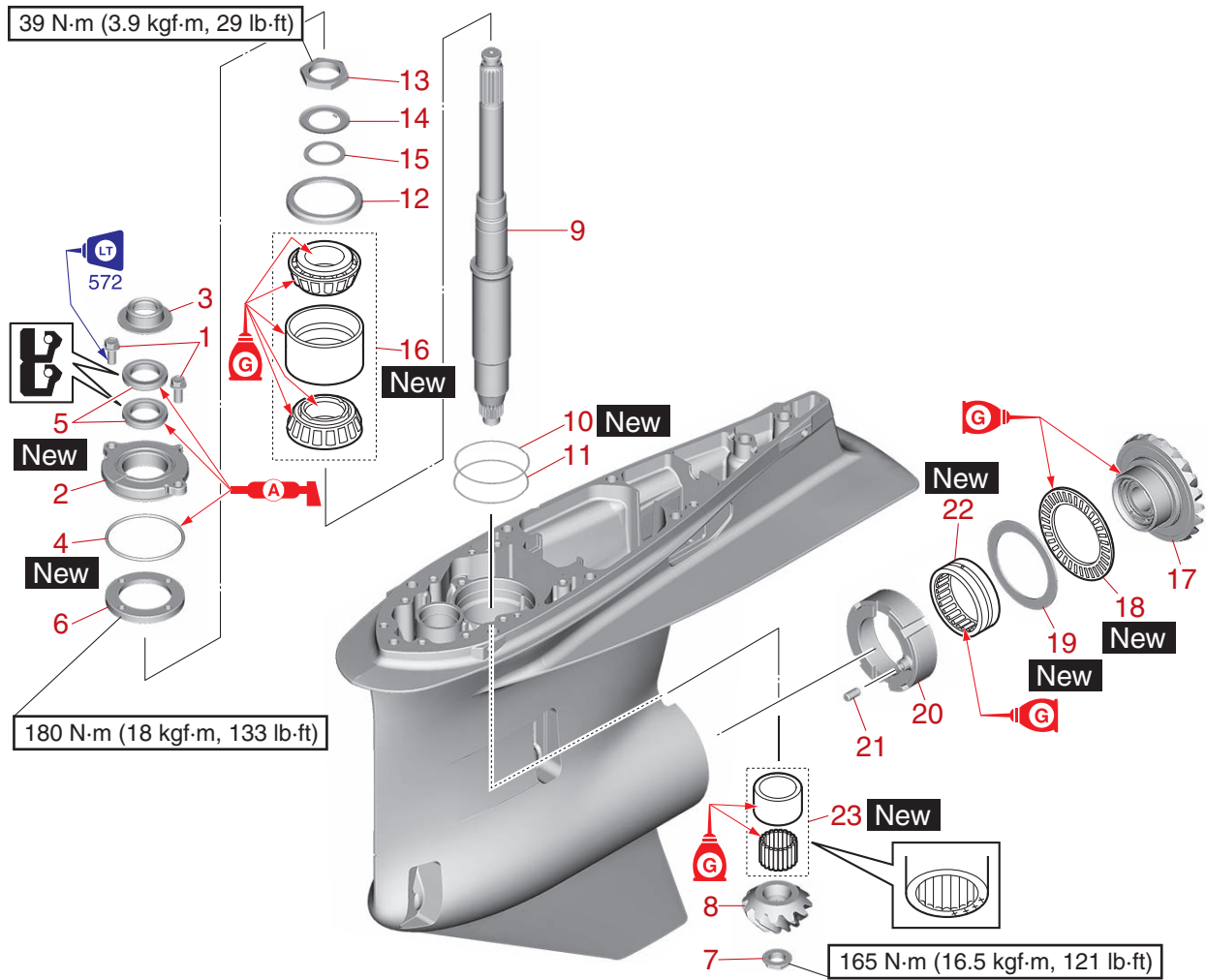
### Installing the propeller shaft housing assembly

1. Install:
- Propeller shaft housing assembly
    - a. Install new forward gear shims “1”, propeller shaft housing assembly “2”, and key “3”.
    - b. Turn the drive shaft and check that the propeller shaft housing assembly “2” is installed securely.



- c. Install the claw washer, ring nut, and cover. See steps (4)–(6) in “Installing the propeller shaft housing assembly” (8-23).

Drive shaft and lower case (counter rotation model)



↑↓	Part name	Q'ty	Remarks
1	Bolt M8 × 20 mm	2	
2	Oil seal housing	1	
3	Cover	1	
4	O-ring	1	
5	Oil seal	2	
6	Ring nut M75	1	
7	Pinion nut M18	1	
8	Pinion	1	
9	Drive shaft	1	
10	Pinion shim (T3)	—	
11	Washer	1	
12	Spacer	1	
13	Nut M30	1	
14	Claw washer	1	
15	Washer	1	
16	Tapered roller bearing	1	
17	Reverse gear	1	
18	Thrust bearing	1	

↑↓	Part name	Q'ty	Remarks
19	Reverse gear shim (T1)	1	
20	Adapter	1	
21	Dowel	1	
22	Roller bearing	1	
23	Needle bearing	1	

### Removing the drive shaft

See "Removing the drive shaft" (8-26).

### Removing the reverse gear

1. Remove:
  - Reverse gear assembly
  - Thrust bearing
  - Reverse gear shim
  - Adapter assembly

### Disassembling the oil seal housing

See "Disassembling the oil seal housing" (8-26).

### Disassembling the drive shaft

See "Disassembling the drive shaft" (8-26).

### Disassembling the lower case

See "Disassembling the lower case" (8-28).

### Checking the pinion

See "Checking the pinion" (8-28).

### Checking the reverse gear

1. Check:
  - Teeth and dogs of the reverse gear  
Cracked/worn → Replace.

### Checking the drive shaft

See "Checking the drive shaft" (8-28).

### Checking the lower case

See "Checking the lower case" (8-29).

### Assembling the drive shaft

See "Assembling the drive shaft" (8-29).

### Assembling the lower case

See "Assembling the lower case" (8-31).

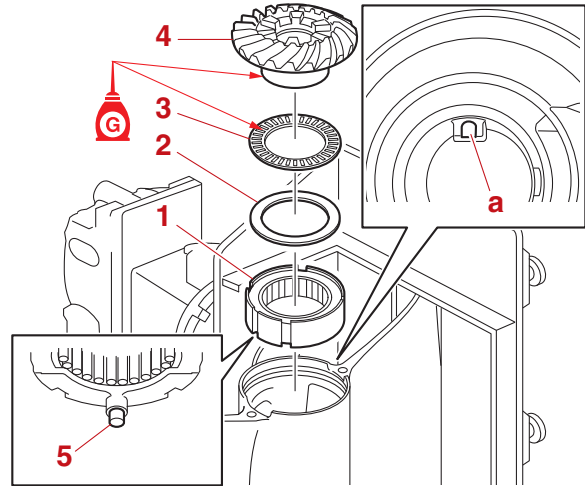
### Assembling the oil seal housing

See "Assembling the oil seal housing" (8-32).

### Installing the reverse gear

1. Install:
  - Adapter assembly "1"
  - Reverse gear shim "2" **New**
  - Thrust bearing "3" **New**
  - Reverse gear assembly "4"

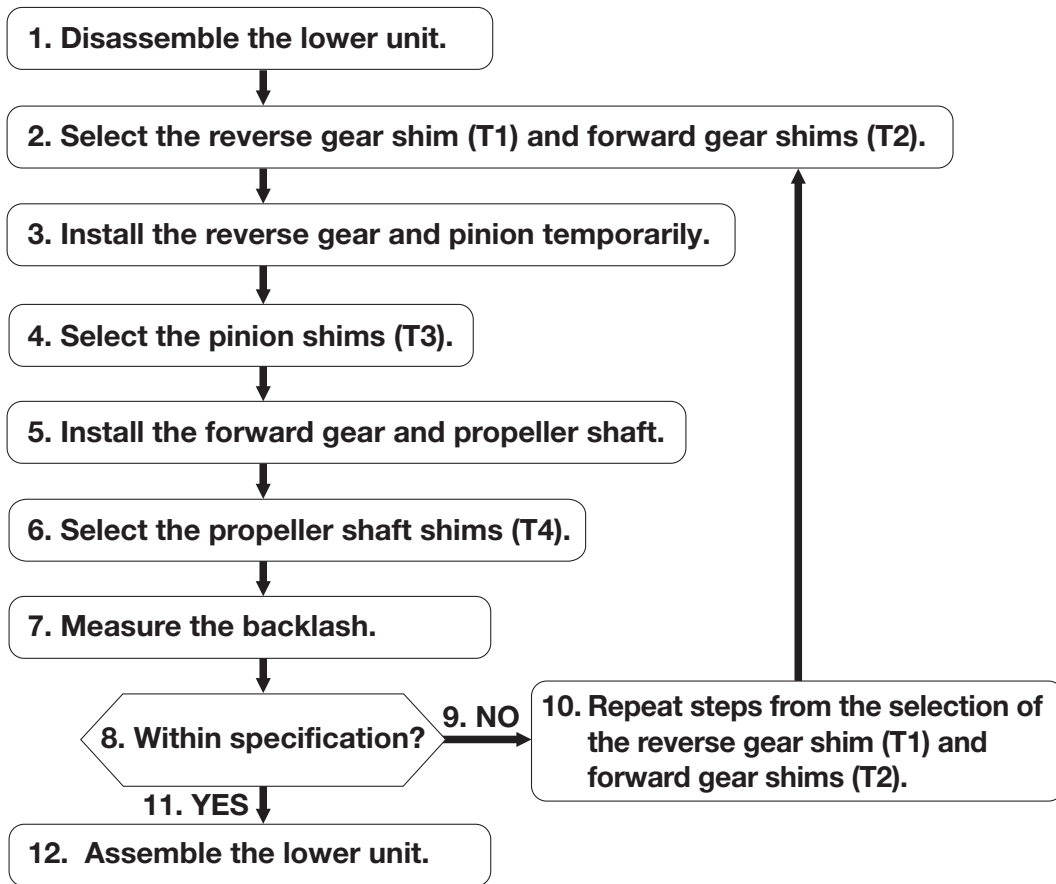
**TIP:** \_\_\_\_\_  
Make sure to fit the dowel "5" into the slot "a" in the lower case.



### Installing the drive shaft

See "Installing the drive shaft" (8-33).

**Shimming (counter rotation model)**  
**Shimming workflow**



1. Disassemble the lower unit.
2. Select the reverse gear shim (T1) and forward gear shims (T2).
3. Install the reverse gear and pinion temporarily.
4. Select the pinion shims (T3).
5. Install the forward gear and propeller shaft.
6. Select the propeller shaft shims (T4).

7. Measure the backlash.
8. Within specification?
9. NO
10. Repeat steps from the selection of the reverse gear shim (T1) and forward gear shims (T2).
11. YES
12. Assemble the lower unit.

**TIP:**

- Make sure to drain the gear oil before measuring the backlash.
- If the backlash is within specification, shimming is not required.
- When assembling the original inner parts and a new lower case, shimming is required.
- When replacing the pinion, forward gear, reverse gear, bearings, drive shaft, or propeller shaft housing, shimming is required.

**Shimming check sheet**

Lower case deviation

Serial number	P	F	R	Remarks
		—	—	

Pinion height

	Measurements (mm)
Measuring point "a"	
Measuring point "b"	
Measuring point "c"	
Measuring point "d"	
Average	
Round-down average	

Forward gear backlash

	Measurements (mm)
Measuring point "a"	
Measuring point "b"	
Measuring point "c"	
Measuring point "d"	
Average	
Round-down average	

Reverse gear backlash

	Measurements (mm)
Measuring point "a"	
Measuring point "b"	
Measuring point "c"	
Measuring point "d"	
Average	
Round-down average	

Propeller shaft free play

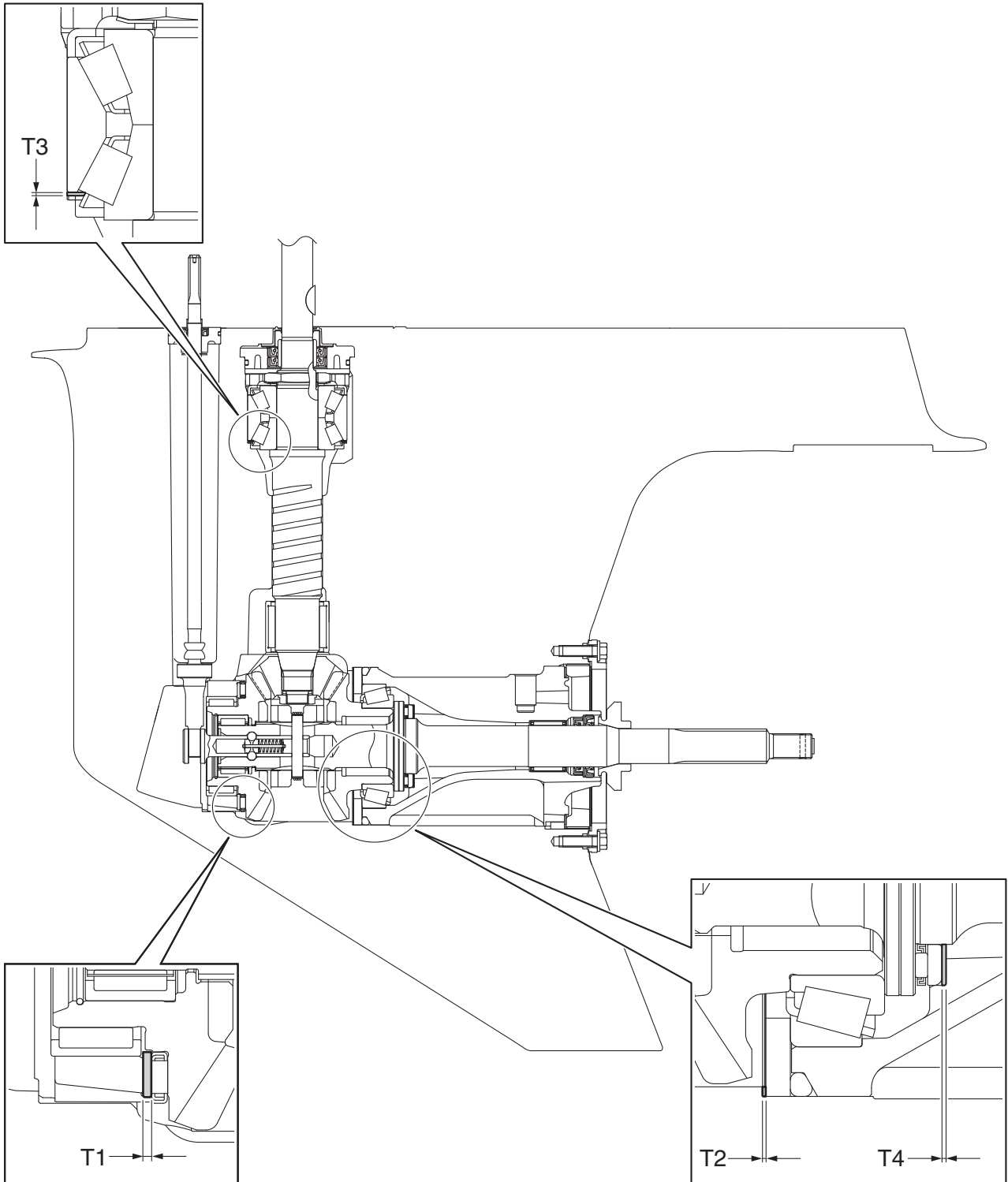
Measurement (mm)	
------------------	--

### Shimming procedure

- Shim thickness is specified for the reverse gear shim (T1) and forward gear shims (T2).
- After selecting the pinion shims (T3), do not apply gear oil, grease or sealant to the lower unit parts and teeth of the gear to measure the backlash.
- When the backlash adjustment is completed for the forward gear and reverse gear, make sure to select the propeller shaft shims (T4).
- When assembling the lower unit after shimming is completed, make sure to apply gear oil, grease, and sealant to the specified areas.



Shim location




### Selecting the reverse gear shim (T1) and forward gear shim (T2)

1. Select:
  - Reverse gear shim (T1)
  - Forward gear shim (T2)

**TIP:** \_\_\_\_\_

- Do not reuse shims.
- For reverse gear shim (T1), use only 1 shim to obtain the specified shim thickness.
- For forward gear shim (T2), use up to 3 shims to obtain the specified shim thickness.

	Shim thickness (T1)
	2.06 mm
	Shim thickness (T2)
	0.58 mm

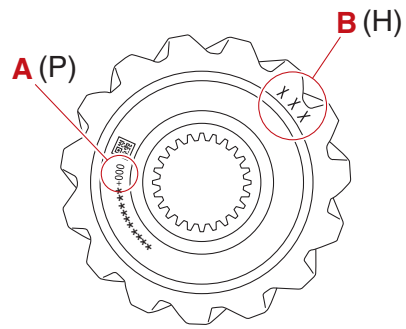
### Selecting the pinion shim (T3)

- Spray anti-rust lubricant on the gears and bearings before installation. Do not apply gear oil to the parts. Otherwise, correct measurements cannot be obtained.
- Keep the parts free of foreign material, such as dirt and lint.

**NOTICE**

**Be careful not to damage the measurement plane surface of the special service tool. Otherwise, correct measurements cannot be obtained.**

1. Measure:
  - Pinion mark
    - a. Disassemble the lower unit. See “Water pump and shift rod” (8-10), “Propeller shaft housing (counter rotation model)” (8-47), and “Drive shaft and lower case (counter rotation model)” (8-53).
    - b. Obtain the calculated value (B) based on marks (P) and (H) on the pinion.



**Example:**  
When mark (P) is “000” “a” and mark (H) is “020” “b”, the calculated value (B) is 0.73 mm.

		A			a	
		-010	-009	-008	001	000
B	000					
	005					
	010					
	015					
	020					0.73
	025					
	030					

- A. Mark (P)
- B. Mark (H)

2. Install:
  - Adapter assembly
  - Specified reverse gear shim (T1) **New**
  - Reverse gear assembly  
See “Installing the reverse gear” (8-54).

3. Select:
  - Pinion shim (T3)  
See steps (3)–(7) in “Selecting the pinion shim (T3)” (8-39).

### Selecting the propeller shaft shim (T4)

1. Install:
  - Original propeller shaft shim (T4)  
See steps (2)–(7) in “Assembling the propeller shaft housing and forward gear” (8-50).

**TIP:** \_\_\_\_\_

- If the original shims (T4) are missing, measure the free play without any shims.
- Do not reuse a shim (T4) if deformed or scratched.

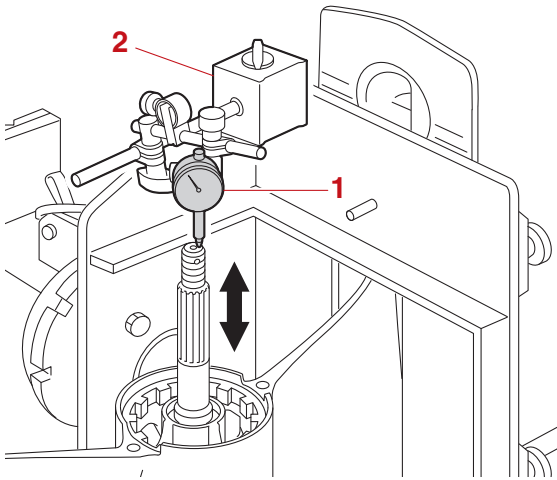
## Shimming (counter rotation model)

### 2. Install:

- Specified forward gear shim (T2) **New**
- Propeller shaft assembly
- Propeller shaft housing assembly
- Claw washer (do not bend the tabs)
- Ring nut

See step (1) in “Installing the propeller shaft housing assembly” (8-52) and steps (4) and (5) in “Installing the propeller shaft housing assembly” (8-23).

- Set up the special service tools “1” and “2”.
- Measure the propeller shaft free play.



	Dial gauge set “1” 90890-03238
	Dial indicator gauge “1” YU-03097
	Magnet base B “2” 90890-06844
	Magnetic base stand “2” YU-A8438

	Free play 0.25–0.35 mm (0.0098–0.0138 in) (FL250NST, FL300FST, LF250SB, LF300SB)
--	---

### 3. Select:

- Propeller shaft shim (T4) thicknesses
  - Select the propeller shaft shim (T4) thicknesses if out of specification.

### TIP: \_\_\_\_\_

Use the rounded measurement value for the free play measurement.

- Determine the value of propeller shaft shim (T4) thickness adjustment using the “Propeller shaft shim (T4) selection table” according to the free play measurement. See “Propeller shaft shim (T4) selection table” (A-21).

### TIP: \_\_\_\_\_

- If the shim thickness adjustment value is positive, the current shim thickness must be increased by that amount and, if the value is negative, the current shim thickness must be decreased by that amount.
- The gray-colored cell on the selection table indicates the specified propeller shaft free play. Shimming is not required if the measured propeller shaft free play is 0.25–0.35 mm.
- The values for the shim thickness adjustments specified in the selection table are intended to obtain the specified propeller shaft free play of 0.3 mm.

Example:

Free play measurement = 1.1 mm “a”  
Propeller shaft shim (T4) thickness adjustment = 0.8 mm “b”  
The current shim thickness must be increased by 0.8 mm.

		a	(mm)
A	1.0	1.1	
B	+0.7	+0.8	
		b	

A. Free play measurement

B. Shim thickness adjustment

- Calculate the new propeller shaft shim (T4) thickness.

**TIP:** \_\_\_\_\_

Use up to 3 shims to obtain the required shim thickness.

Calculation formula:

New propeller shaft shim (T4) thickness = Current propeller shaft shim thickness + Shim thickness adjustment

Example:

Use the following formula when the shim thickness adjustment value is positive.

Current propeller shaft shim thickness = 0.8 mm

Shim thickness adjustment = 0.2 mm

New propeller shaft shim (T4) thickness = 0.8 mm + 0.2 mm = 1.0 mm

Use the following formula when the shim thickness adjustment value is negative.

Current propeller shaft shim thickness = 0.8 mm

Shim thickness adjustment = -0.1 mm

New propeller shaft shim (T4) thickness = 0.8 mm + (-0.1 mm) = 0.7 mm



Available shim thicknesses

Propeller shaft shims

0.10/0.12/0.15/0.18/0.30/0.40/

0.50 mm (FL250NST,

FL300FST, LF250SB,

LF300SB)

- d. Remove the special service tools, and then install the determined propeller shaft shims.

**Measuring the forward gear backlash and reverse gear backlash**

- Spray anti-rust lubricant on the gear and bearings before installation. Do not apply gear oil to the parts. Otherwise, correct measurements cannot be obtained.
- Keep the parts free of foreign material, such as dirt and lint.
- When measuring the forward gear or reverse gear backlash, use the shims of the specified thickness for the reverse gear shim (T1) and forward gear shims (T2), and use the shims of the selected thickness for the pinion shims (T3).

1. Install:

- Adapter assembly
  - Specified reverse gear shim (T1) **New**
  - Thrust bearing
  - Reverse gear assembly
- See "Installing the reverse gear" (8-54).

**TIP:** \_\_\_\_\_

Do not reuse a shim if deformed or scratched.

2. Install:

- Determined pinion shim (T3) **New**
  - Drive shaft
  - Pinion
  - Pinion nut
  - Drive shaft ring nut
- See steps (1)–(3) in "Installing the drive shaft" (8-33).

**TIP:** \_\_\_\_\_

- Do not reuse a shim if deformed or scratched.
- Check that the drive shaft turns smoothly.

## Shimming (counter rotation model)

### 3. Install:

- Specified forward gear shims (T2) **New**
- Propeller shaft assembly
- Propeller shaft housing assembly
- Key
- Claw washer (do not bend the tabs)
- Ring nut

See step (1) in "Installing the propeller shaft housing assembly" (8-52) and steps (4) and (5) in "Installing the propeller shaft housing assembly" (8-23).

### TIP:

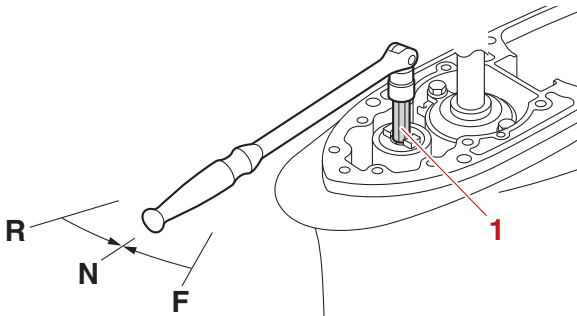
- Do not reuse a shim if deformed or scratched.
- Check that the drive shaft turns smoothly.


### 4. Install:

- Shift rod assembly  
See "Installing the shift rod" (8-13).

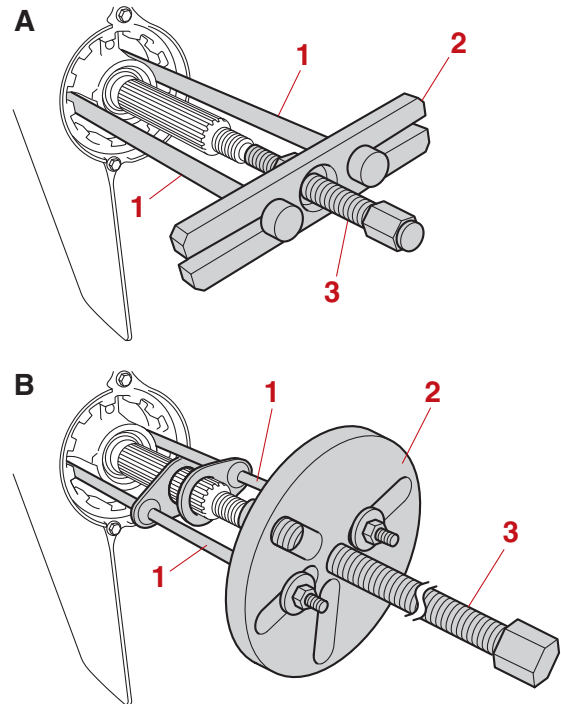
### 5. Measure:

- Forward gear backlash  
Out of specification → Repeat steps from the selection of the reverse gear shim (T1) and forward gear shims (T2).  
a. Set the gear shift to the N position.




	Shift rod socket "1" 90890-06681
	Shift rod socket "1" YB-06681


- b. Set up the special service tools "1", "2", and "3", and then tighten the center bolt "3" to the specified torque.



A. Worldwide

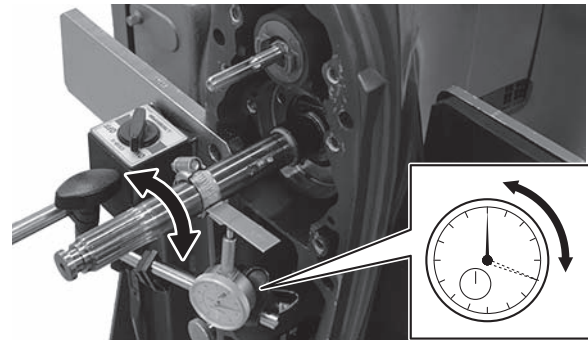
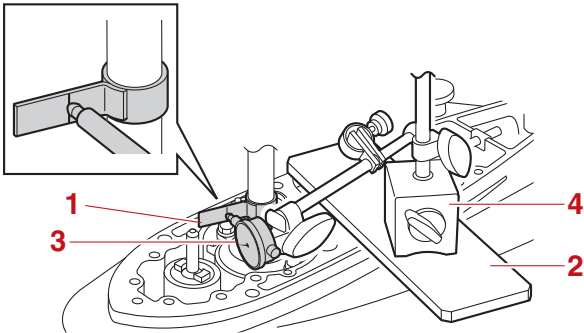
B. USA and Canada

	Bearing housing puller claw L "1" 90890-06502
	Bearing housing puller "1" YB-06207
	Stopper guide plate "2" 90890-06501
	Universal Puller "2" YB-06117
	Center bolt "3" 90890-06504

	Center bolt "3" (shimming) 4.9 N·m (0.49 kgf·m, 3.6 lb·ft)
---	---

## Shimming (counter rotation model)

- c. Install the special service tool “1” onto the drive shaft at the lowest possible position where the shaft diameter is 22.4 mm (0.881 in), and then set up the special service tools “2”, “3”, and “4”.



- f. Turn the drive shaft 180° clockwise, and then measure the backlash again.

### TIP:

- Measure the backlash at 4 points: “a”, “b”, “c”, and “d”, turning the drive shaft 180° clockwise after each measurement.
- Write down the measurement data in the “Shimming check sheet”.

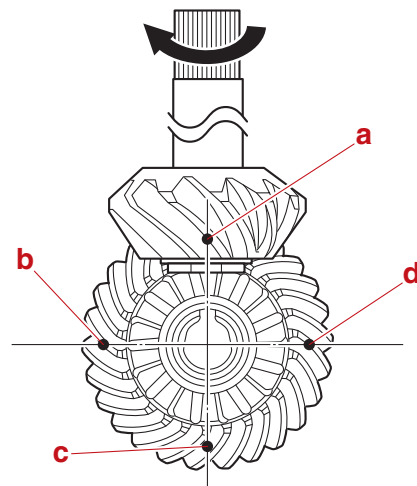


Backlash indicator “1”  
90890-06836  
Backlash indicator “1”  
YB-06836  
Magnet base plate “2”  
90890-07003  
Backlash adjustment plate “2”  
YB-07003  
Dial gauge set “3”  
90890-03238  
Dial indicator gauge “3”  
YU-03097  
Magnet base B “4”  
90890-06844  
Magnetic base stand “4”  
YU-A8438

- d. Face the lower unit torpedo upward.
- e. Turn the drive shaft slowly clockwise and counterclockwise, and then measure the backlash between where the drive shaft stops in each direction.

### TIP:

Do not turn the drive shaft using too much force. Otherwise, the forward gear will turn, leading to incorrect measurements.



- g. Determine the backlash average, and then round down the average to 2 decimal places.

Example:  
(mm)

Measurement point “a”	0.25
Measurement point “b”	0.26
Measurement point “c”	0.26
Measurement point “d”	0.24
Average	0.2525
Round-down average	0.25

## Shimming (counter rotation model)

- h. Check that the forward gear backlash average is within specification.

### TIP:

Repeat steps from the selection of the reverse gear shim (T1) and forward gear shims (T2) if the forward gear backlash is out of specification.



Forward gear backlash  
0.43–0.97 mm (0.0169–0.0382  
in) (FL250NST, FL300FST,  
LF250SB, LF300SB)

- i. Remove the special service tools from the propeller shaft.

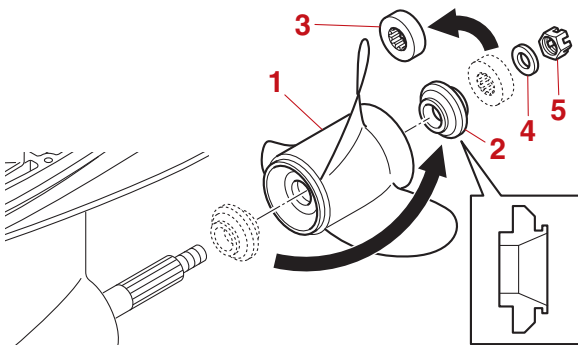
### 6. Measure:

- Reverse gear backlash  
Out of specification → Repeat steps from the selection of the reverse gear shim (T1) and forward gear shims (T2).
- a. Apply a load to the reverse gear by installing the propeller “1”, spacer “2” (without installing the spacer “3”), and washer “4”.

### TIP:

Install the spacer “2” in the direction shown.

- b. Tighten the propeller nut “5” to the specified torque.

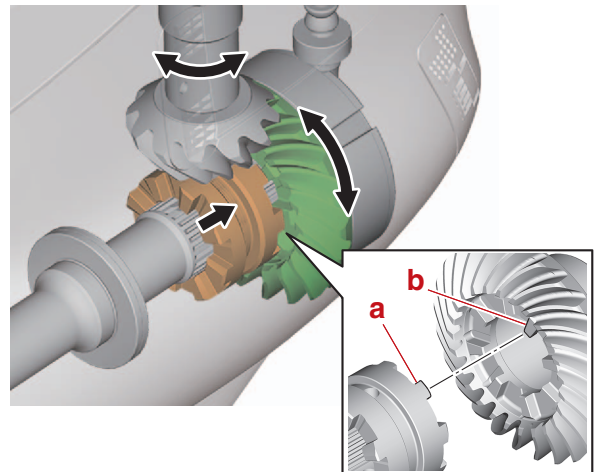
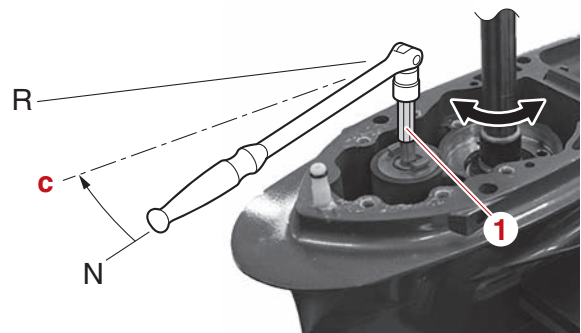


Propeller nut “5” (shimming)  
10 N·m (1.0 kgf·m, 7.4 lb·ft)

- c. While turning the drive shaft, move the gear shift toward the R position. Set the shift rod at the position where the protrusion “a” on the dog clutch hits the protrusion “b” on the reverse gear.

### TIP:

When the protrusion on the dog clutch hits the protrusion on the reverse gear, the shift rod is fixed at the position “c” which is in between the N position and the R position.



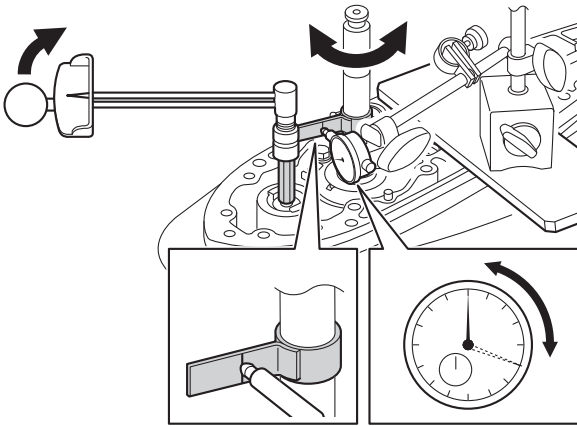
Shift rod socket “1”  
90890-06681  
Shift rod socket “1”  
YB-06681


- d. While turning the shift rod toward the R position using the specified torque, turn the drive shaft slowly clockwise and counterclockwise and measure the backlash between where the drive shaft stops in each direction.



## Shimming (counter rotation model)


**TIP:** \_\_\_\_\_  
Do not turn the drive shaft using too much force. Otherwise, the reverse gear will turn, leading to incorrect measurements.



	Specified torque 10 N·m (1.0 kgf·m, 7.4 lb·ft)
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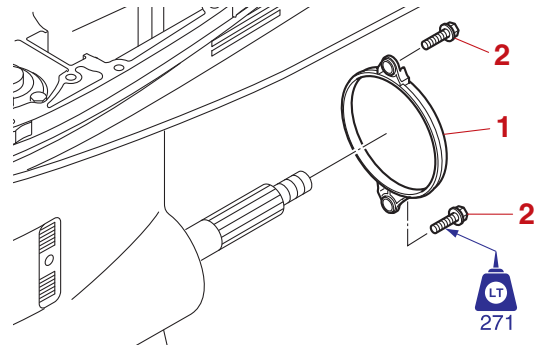
- e. Repeat steps (5) (f)–(h) to measure the reverse gear backlash.
- f. Check that the reverse gear backlash average is within specification.


**TIP:** \_\_\_\_\_  
Repeat steps from the selection of the reverse gear shim (T1) and forward gear shims (T2) if the reverse gear backlash is out of specification.

	Reverse gear backlash 0.48–1.05 mm (0.0189–0.0413 in) (FL250NST, FL300FST, LF250SB, LF300SB)
---	---

- g. Remove the special service tools and propeller, and then install the water pump assembly. See “Installing the water pump” (8-13).

7. Install:
  - Cover “1”
  - Cover bolt “2”



	Cover bolt “2” 8 N·m (0.8 kgf·m, 5.9 lb·ft)
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## Bracket unit

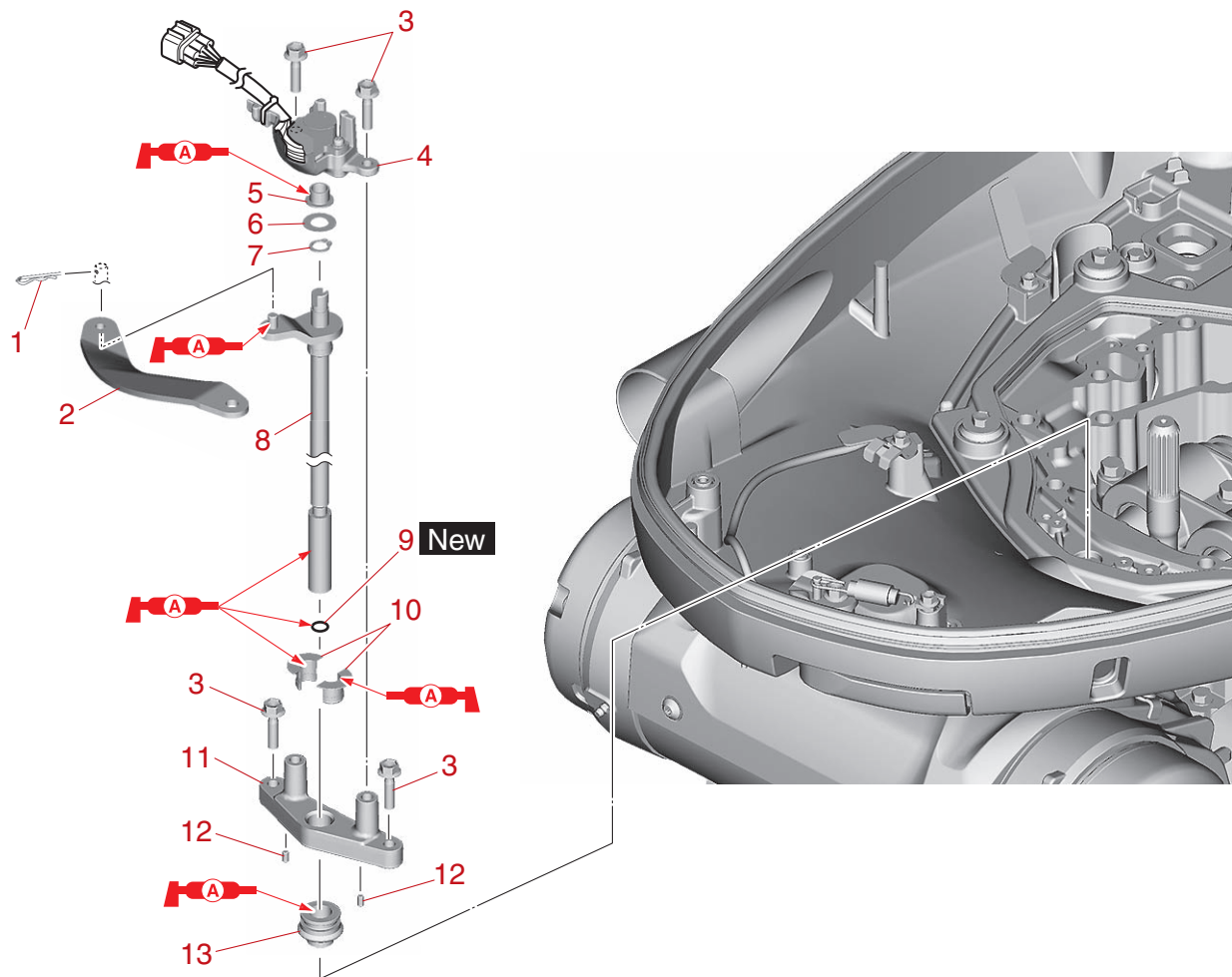
<b>Shift rod and SPS .....</b>	<b>9-1</b>
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---

## Bracket unit

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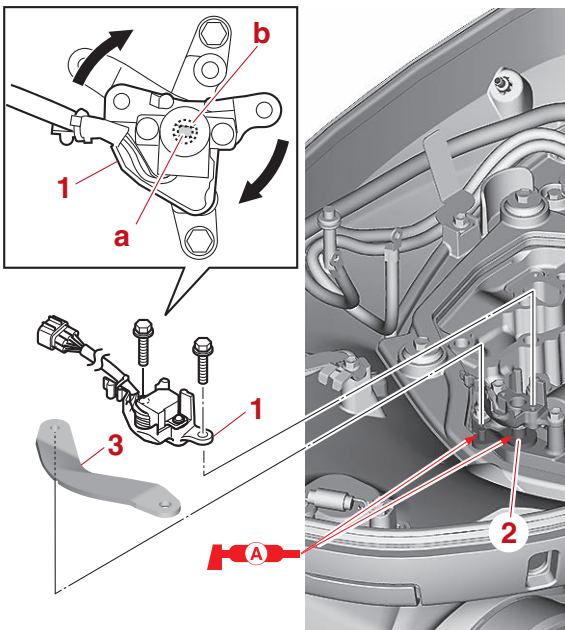
## Shift rod and SPS



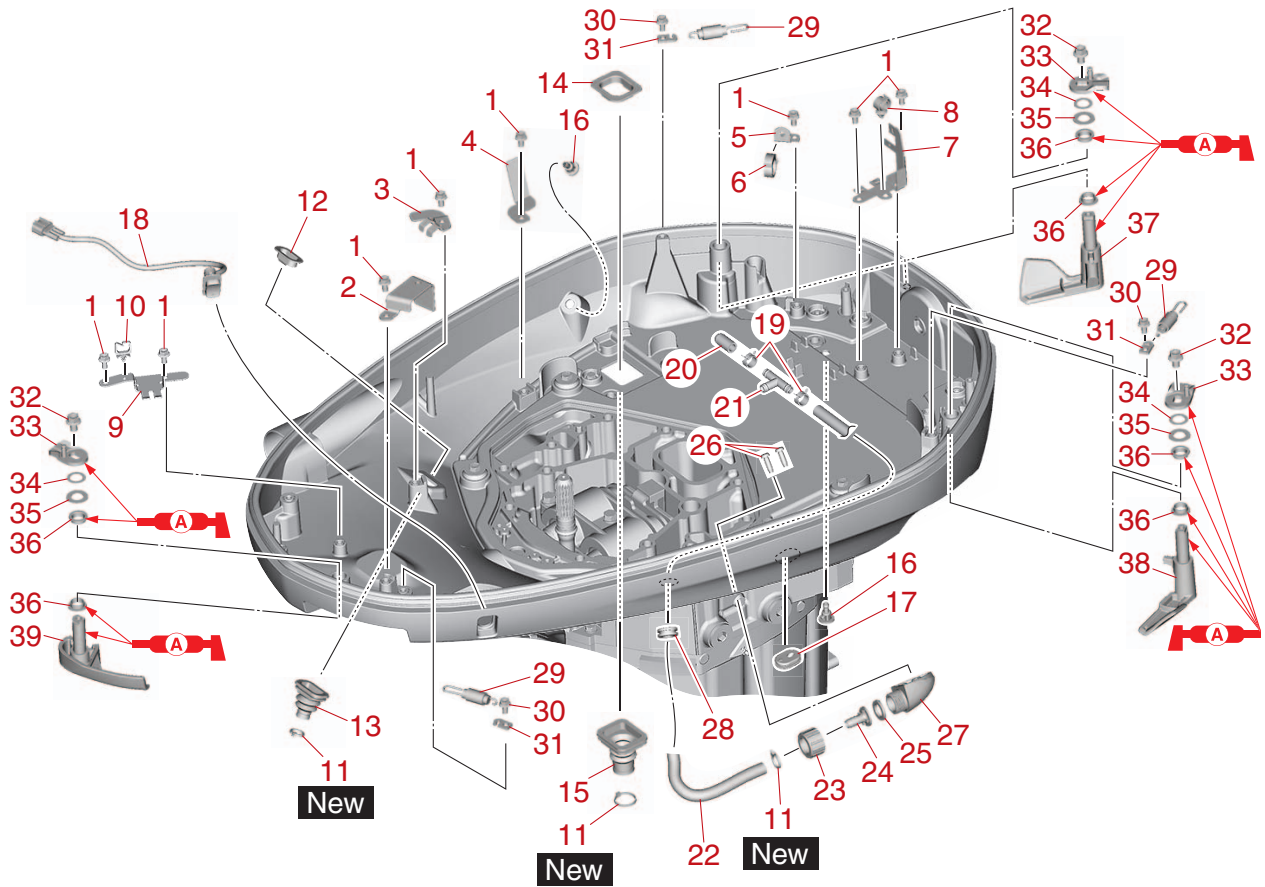
↓↑	Part name	Q'ty	Remarks
1	Clip	1	
2	Shift lever	1	
3	Bolt M6 × 25 mm	4	
4	SPS	1	
5	Bushing	1	
6	Washer	1	
7	Circlip	1	
8	Shift rod	1	
9	O-ring	1	
10	Bushing	2	
11	Bracket	1	
12	Dowel pin	2	
13	Grommet	1	

## Installing the shift rod and SPS

1. Install:
  - Bushing
  - Grommet
  - Dowel pin
  - Bracket
  - O-ring **New**
  - Shift rod
  - Circlip
  - Washer
  - Bushing
2. Install:
  - SPS
    - a. Fit the protrusion “a” on the SPS “1” into the slot “b” in the tip of the shift rod “2”, and then turn the SPS “1” in the direction of the arrow to install it.
    - b. Install the shift lever “3”.



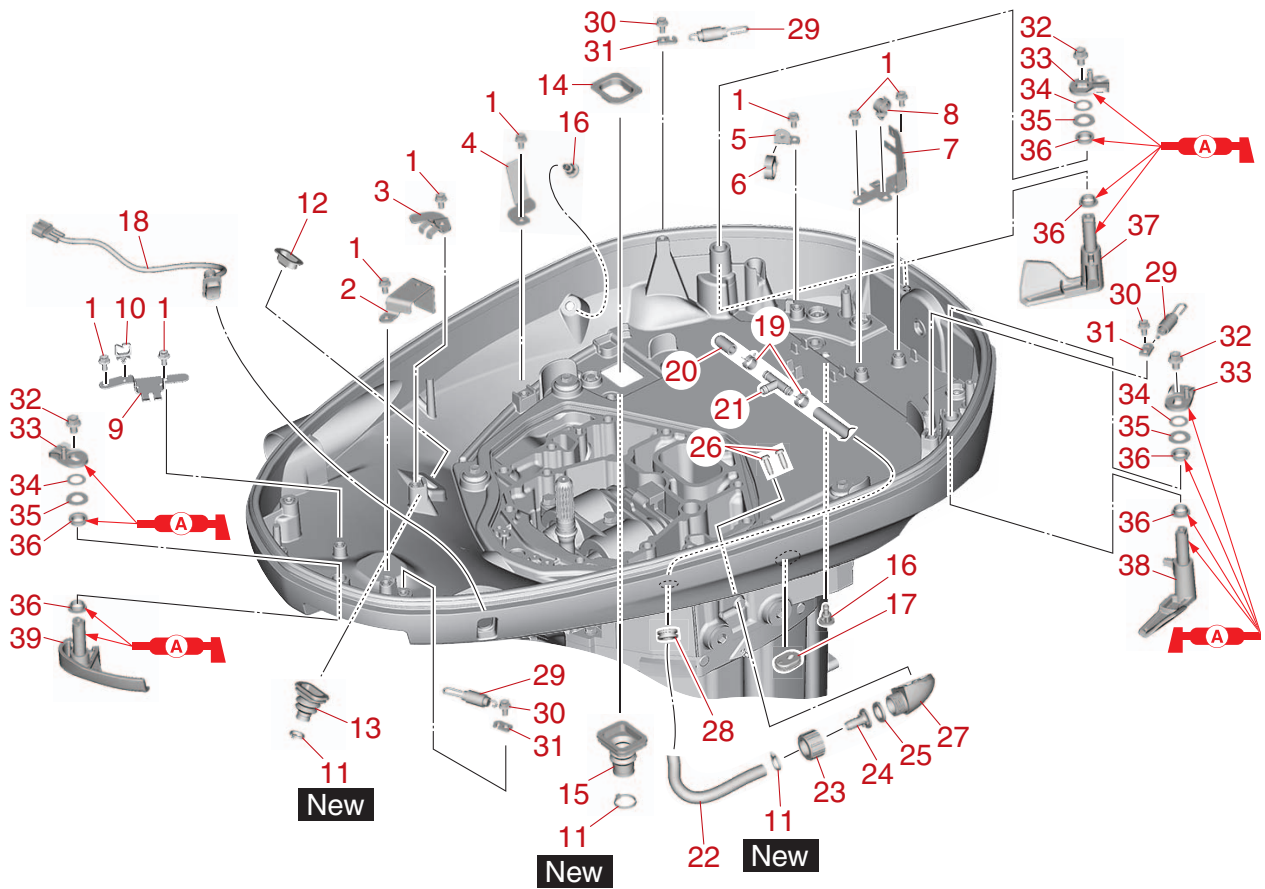
PTT switch and cowling lock lever



№	Part name	Q'ty	Remarks
1	Bolt M6 × 12 mm	8	
2	Bracket	1	
3	Bracket	1	
4	Bracket	1	
5	Bracket	1	
6	Holder	1	
7	Bracket	1	
8	Holder	1	
9	Bracket	1	
10	Holder	1	
11	Plastic tie	3	
12	Gasket	1	
13	Grommet	1	
14	Gasket	1	
15	Grommet	1	
16	Water outlet	2	
17	Grommet	1	
18	PTT switch	1	

№	Part name	Q'ty	Remarks
19	Clamp	2	
20	Cap	1	
21	Joint	1	
22	Hose	1	
23	Joint	1	
24	Joint	1	
25	Gasket	1	
26	Screw M6 × 20 mm	2	
27	Adapter	1	
28	Grommet	1	
29	Spring	3	
30	Bolt M6 × 12 mm	3	
31	Hook	3	
32	Bolt M8 × 12 mm	3	
33	Lever	3	
34	Wave washer	3	
35	Washer	3	
36	Bushing	6	

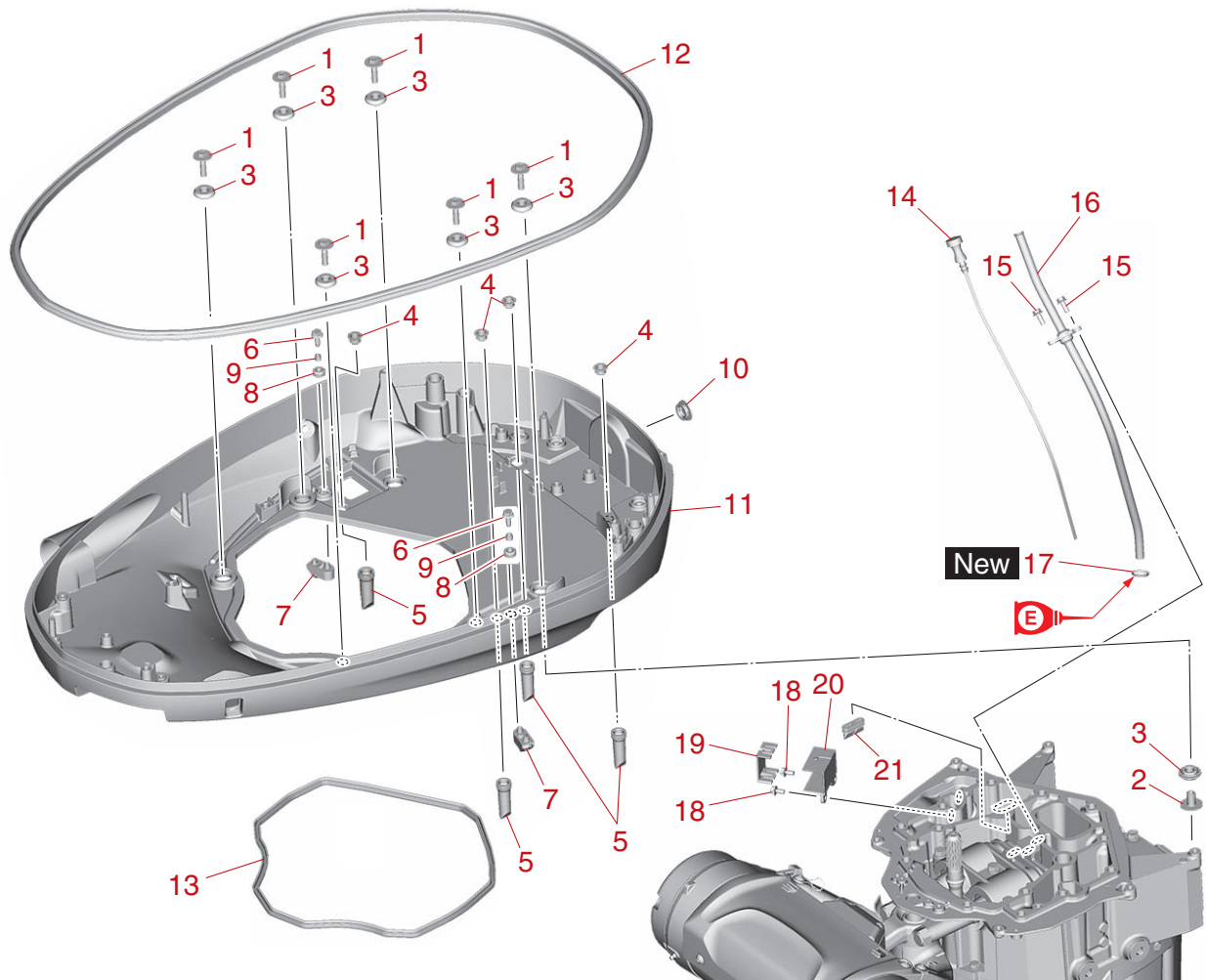
## PTT switch and cowling lock lever



↓↑	Part name	Q'ty	Remarks
37	Cowling lock lever (STBD)	1	
38	Cowling lock lever (PORT)	1	
39	Cowling lock lever (front)	1	



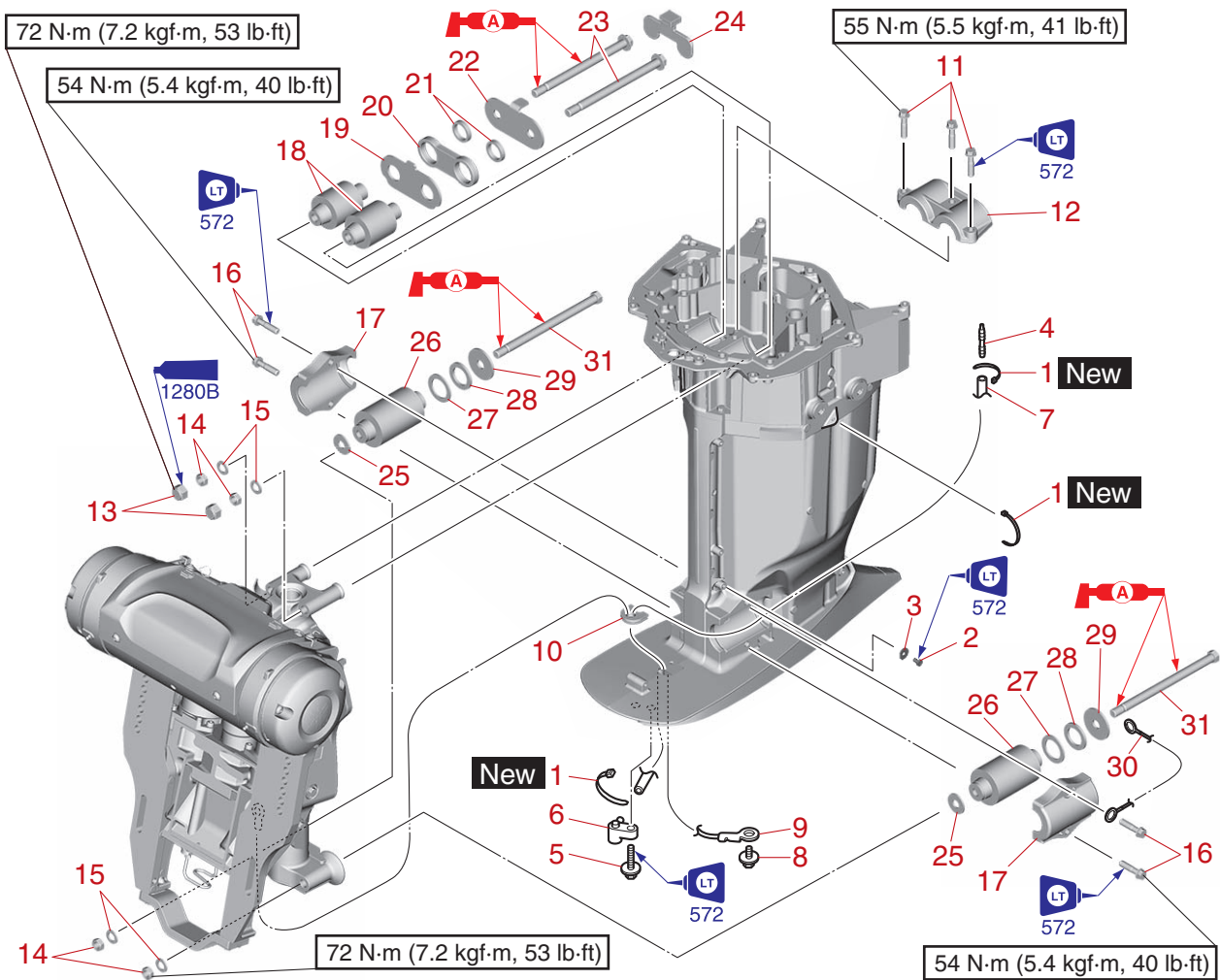
Bottom cowling



↑↓	Part name	Q'ty	Remarks
1	Bolt M8 × 35 mm	6	
2	Collar	6	
3	Grommet	12	
4	Cap seal	4	
5	Grommet	4	
6	Bolt M6 × 16 mm	2	
7	Bracket	2	
8	Grommet	2	
9	Collar	2	
10	Grommet	1	
11	Bottom cowling	1	
12	Rubber seal	1	
13	Rubber seal	1	
14	Oil dipstick	1	
15	Bolt M6 × 16 mm	2	
16	Dipstick guide	1	
17	O-ring	1	
18	Bolt M6 × 12 mm	2	

↑↓	Part name	Q'ty	Remarks
19	Bracket	1	
20	Bracket	1	
21	Rubber seal	1	

Upper case and mounts



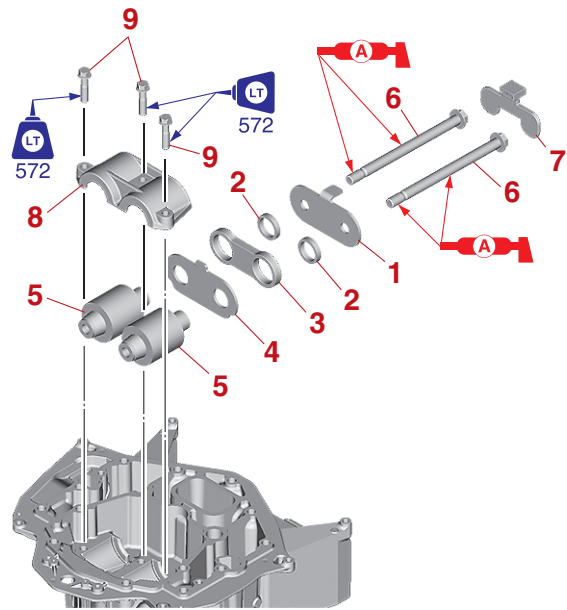
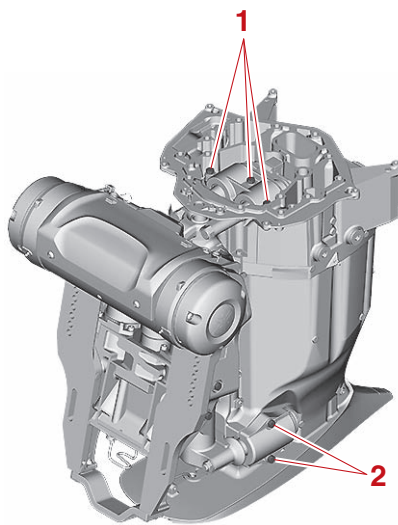
↑↓	Part name	Q'ty	Remarks
1	Plastic tie	3	
2	Bolt M6 × 10 mm	1	
3	Washer	1	
4	Nipple	1	
5	Bolt M6 × 20 mm	1	
6	Adapter	1	
7	Hose	1	Adapter to nipple
8	Bolt M6 × 10 mm	1	
9	Ground lead	1	
10	Grommet	1	
11	Bolt M10 × 45 mm	3	
12	Bracket	1	
13	Cap	2	
14	Self-locking nut M14	4	
15	Washer	4	
16	Bolt M10 × 45 mm	4	
17	Cover	2	

↑↓	Part name	Q'ty	Remarks
18	Upper mount	2	
19	Plate	1	
20	Collar	1	
21	Stopper	2	
22	Plate	1	
23	Bolt M14 × 207 mm	2	
24	Damper	1	
25	Washer	2	
26	Lower mount	2	
27	Washer	2	
28	Washer	2	
29	Washer	2	
30	Ground lead	1	
31	Bolt M14 × 227 mm	2	

## Removing the upper case

1. Drain:
  - Engine oil
2. Remove:
  - Upper case

**TIP:** \_\_\_\_\_  
 Before removing the upper case, loosen the upper mount bolts "1" and lower mount cover bolts (PORT and STBD) "2".



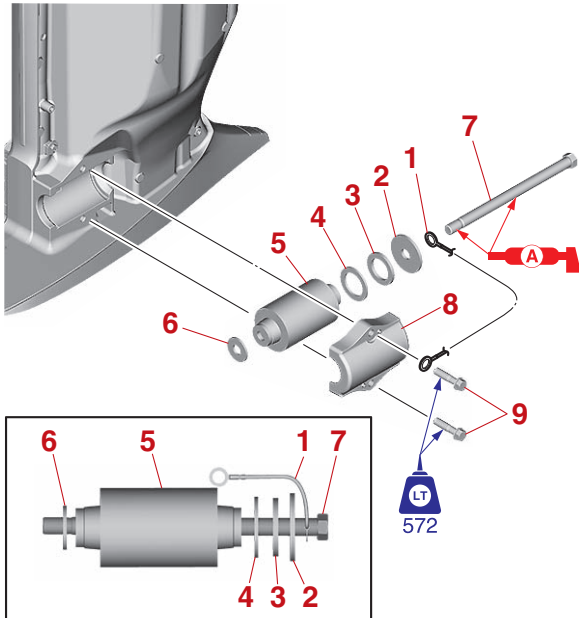
2. Install:
  - Ground lead "1"
  - Washer "2"
  - Washer "3"
  - Washer "4"
  - Lower mount "5"
  - Washer "6"
  - Lower mount bolt "7"
  - Lower mount cover "8"
  - Lower mount cover bolt "9" (temporarily tighten)

## Installing the upper case

1. Install:
  - Plate "1"
  - Collar "2"
  - Stopper "3"
  - Plate "4"
  - Upper mount "5"
  - Upper mount bolt "6"
  - Damper "7"
  - Upper mount bracket "8"
  - Upper mount bracket bolt "9" (temporarily tighten)

**TIP:** \_\_\_\_\_

The ground lead "1" should be installed on the same side as originally installed.

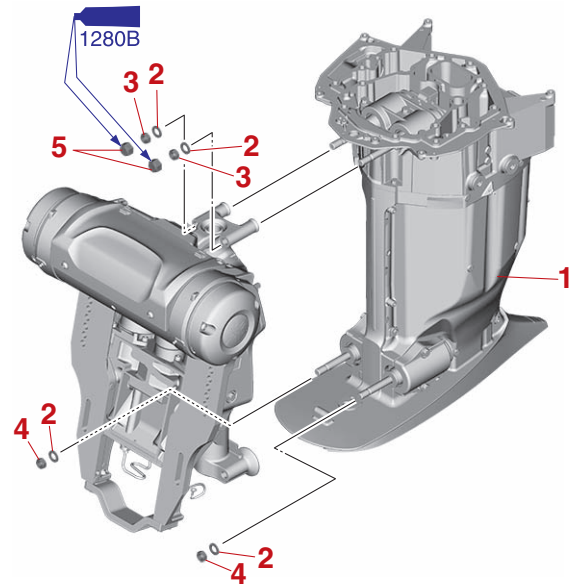



3. Install:

- Upper case assembly "1"
- Washer "2"
- Upper mounting nut "3"
- Lower mounting nut "4"
- Cap "5"

**NOTICE** \_\_\_\_\_

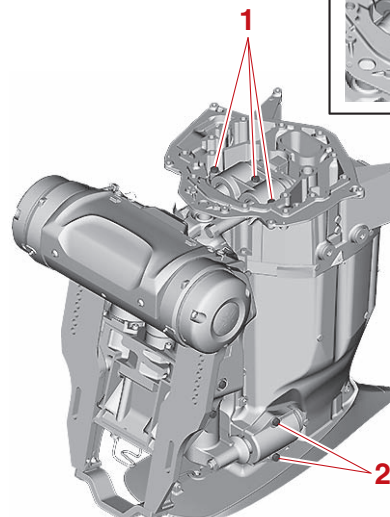
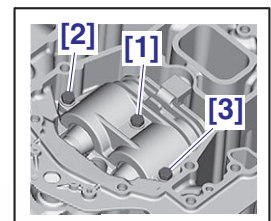
When tightening the lower mounting nut, make sure that the ground lead does not turn along with the bolt.




	Upper mounting nut "3"
	72 N·m (7.2 kgf·m, 53 lb·ft)
	Lower mounting nut "4"
	72 N·m (7.2 kgf·m, 53 lb·ft)

4. Tighten:

- Upper mount bolt
- Lower mount bolt (PORT and STBD)
  - a. Tighten the upper mount bolts "1" to the specified torque in the order [1], [2], and so on.
  - b. Tighten the lower mount bolts (PORT and STBD) "2" to the specified torque.



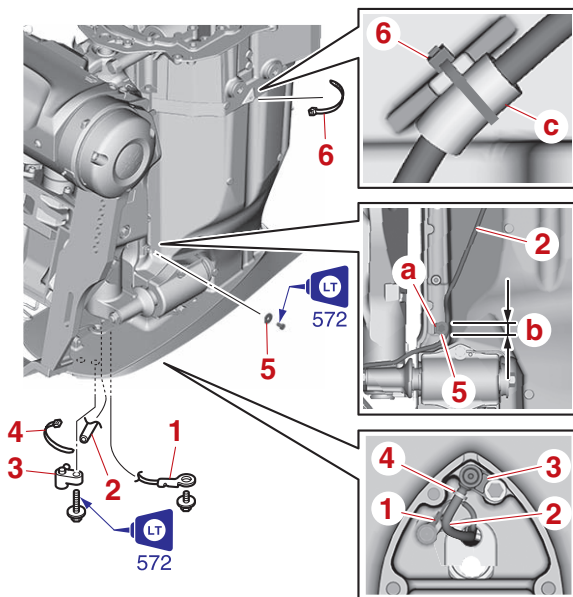
	Upper mount bolt "1" 55 N·m (5.5 kgf·m, 41 lb·ft)
	Lower mount bolt "2" 54 N·m (5.4 kgf·m, 40 lb·ft)

5. Install:

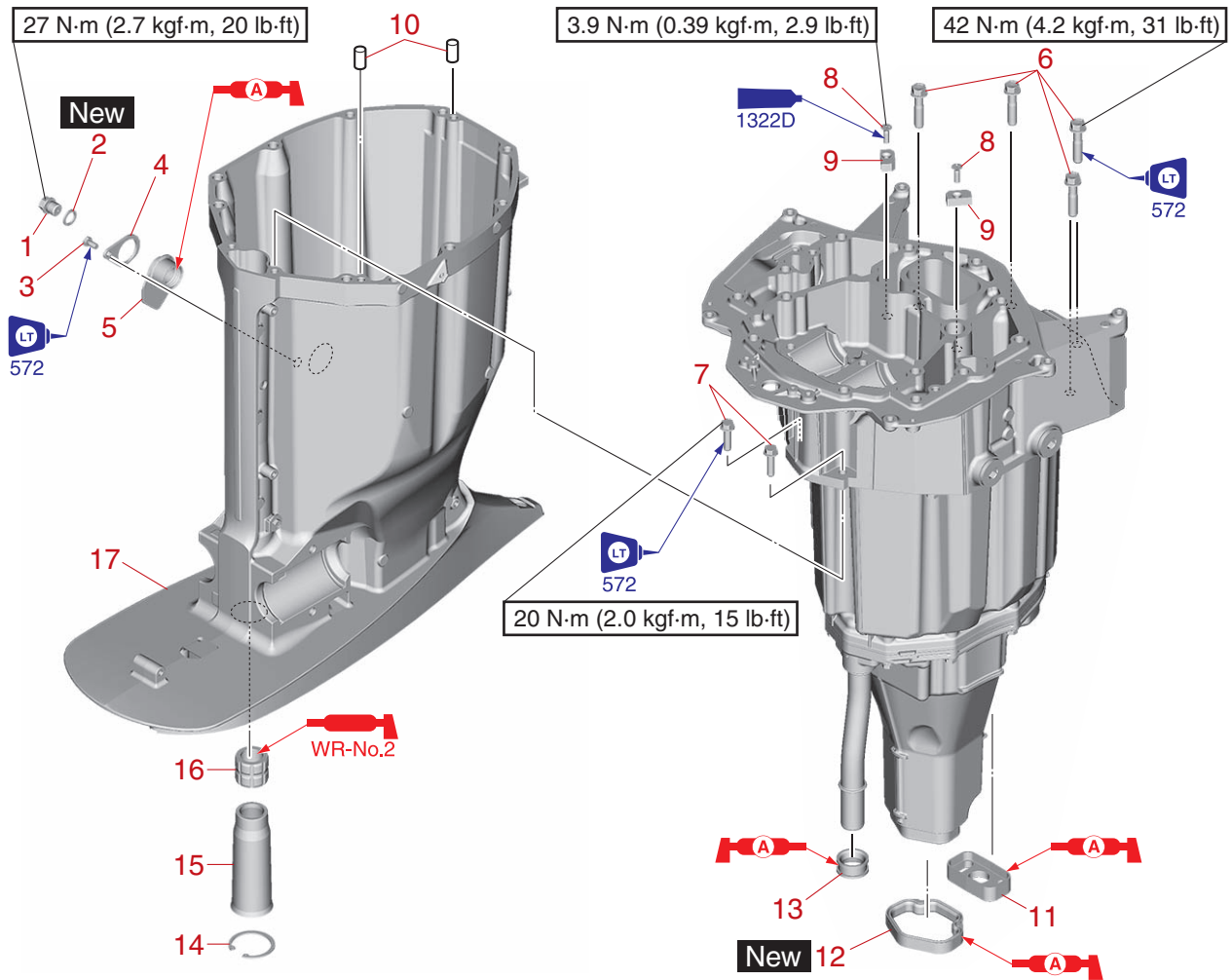
- Ground lead "1"
- Speed sensor hose "2"
- Adapter "3"
- Plastic tie "4" **New**
- Washer "5"
- Plastic tie "6" **New**

**TIP:** \_\_\_\_\_

- The white paint mark "a" on the speed sensor hose "2" must be placed within the area "b" of the washer "5" seating surface.
- Fasten the plastic tie "6" near the center of the protective tube "c".



Upper case

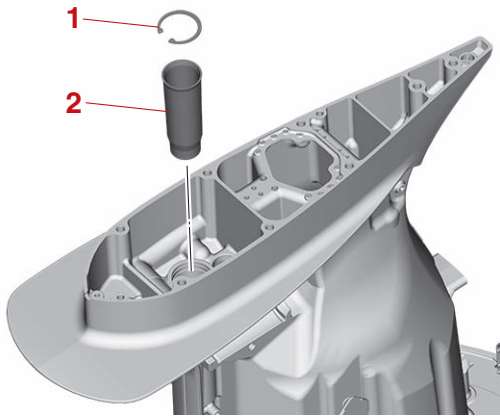


∩∩	Part name	Q'ty	Remarks
1	Drain bolt M14 × 12 mm	1	
2	Gasket	1	
3	Bolt M6 × 12 mm	1	
4	Cover	1	
5	Damper	1	
6	Bolt M10 × 45 mm	4	
7	Bolt M8 × 30 mm	2	
8	Screw M6 × 15 mm	2	
9	Anode	2	
10	Dowel pin	2	
11	Rubber seal	1	
12	Rubber seal	1	
13	Rubber seal	1	
14	Circlip	1	
15	Collar	1	
16	Bushing	1	
17	Upper case	1	



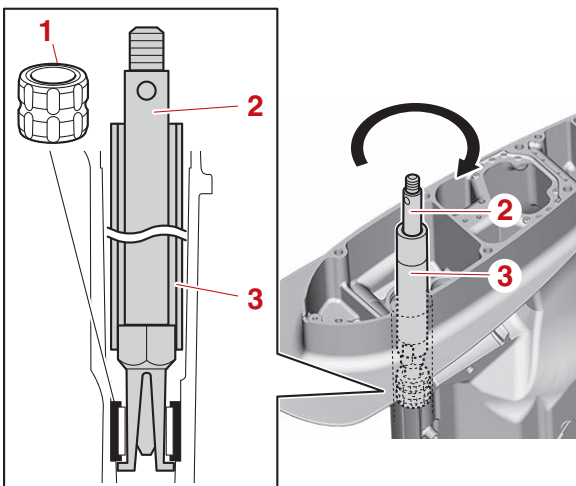
**Disassembling the upper case**

1. Remove:
  - Circlip "1"
  - Collar "2"

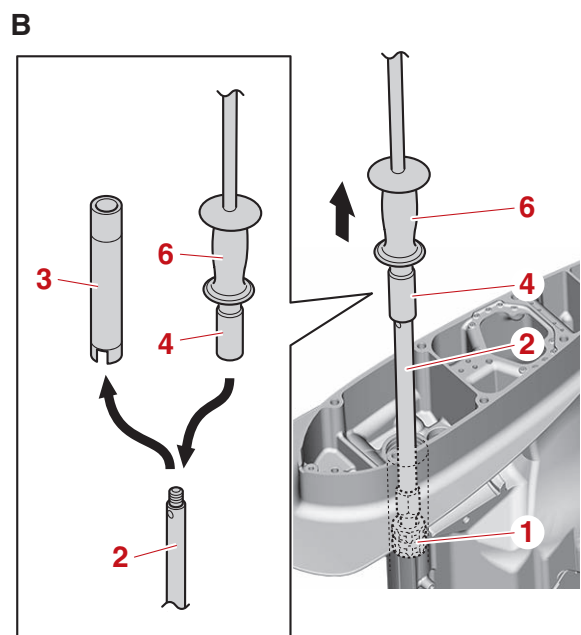
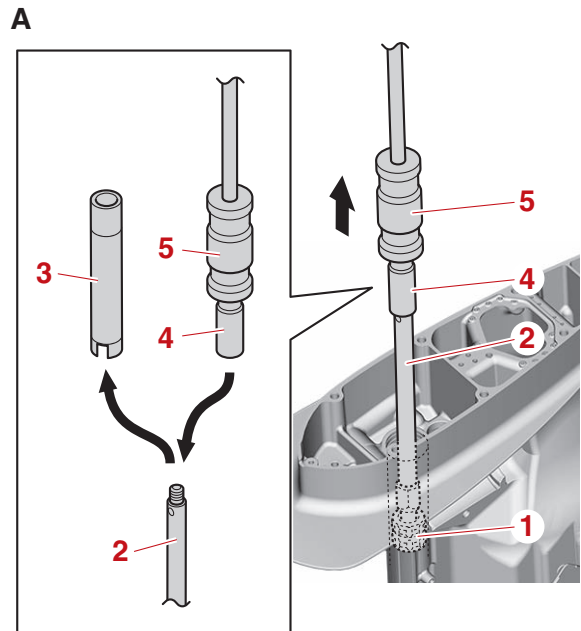


2. Remove:
  - Bushing "1"
    - a. Set the special service tools (rod) "2" and (holder) "3" to the bushing "1", and then turn the special service tool (rod) "2" clockwise while holding the special service tools (holder) "3".


**TIP:** \_\_\_\_\_  
 Make sure that the special service tool (rod) "2" is installed in the bushing "1".




- b. Remove the special service tool (holder) "3", and then connect the special service tools "4" and "5" or "4" and "6" to the special service tool (rod) "2". Remove the bushing "1".



A. Worldwide  
 B. USA and Canada

	<p>Bush remover "2", "3"                  90890-06977</p>
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	Puller head "4"
	90890-06514
	Slide hammer "4"
	YB-06096
	Slide hammer handle "5"
	90890-06531
	Propeller shaft and bearing housing
	remover "6"
	YB-06335

### Checking the exhaust guide anode

1. Check:
  - Anode  
Eroded (1/2 or more worn out) → Replace.  
Adhered grease, oil, or scales → Clean.

### NOTICE

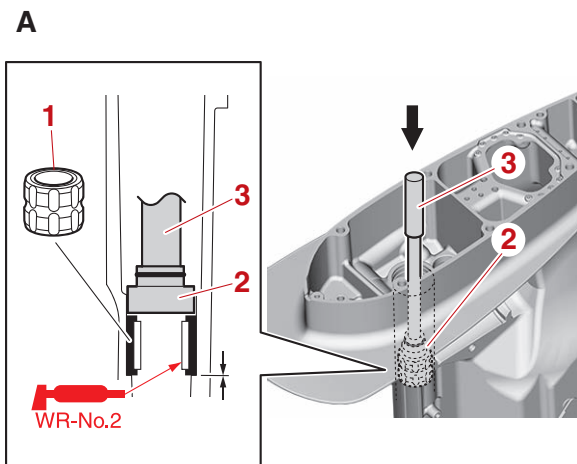
Do not apply grease, oil, or paint to the anode.

### Checking the drive shaft bushing

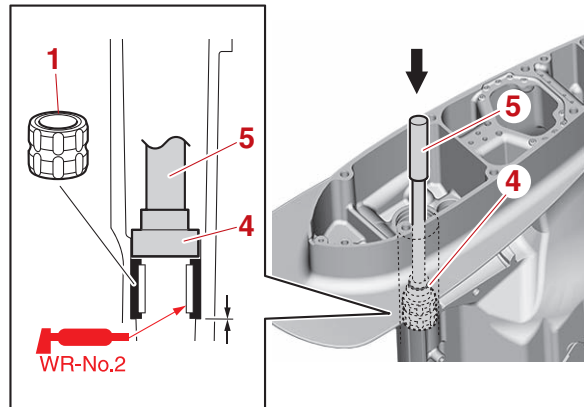
1. Check:
  - Drive shaft bushing  
Cracked/worn → Replace.

### Assembling the upper case


1. Install:
  - Bushing "1"



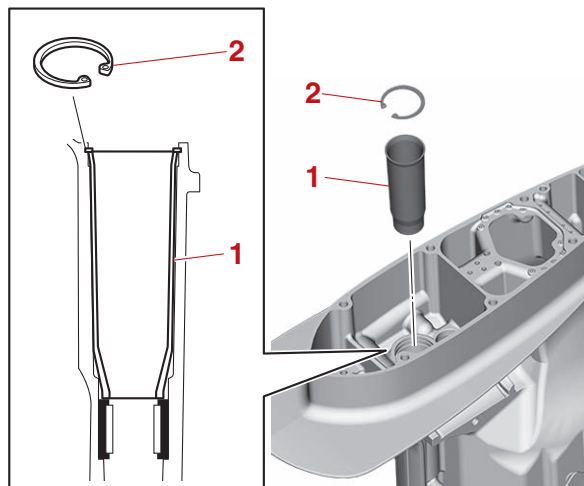
B



- A. Worldwide  
B. USA and Canada

	Needle bearing attachment "2"
	90890-06611
	Driver rod L3 "3"
	90890-06652
	Forward gear bearing installer "4"
	YB-06345
	Driver handle (large) "5"
	YB-06071

2. Install:
  - Collar "1"
  - Circlip "2"




3. Install:

- Dowel pin “1”
- Rubber seal “2”
- Rubber seal “3” **New**
- Rubber seal “4”
- Oil pan assembly “5”
- Oil pan assembly bolt “6”
- Oil pan assembly bolt “7”
- Anode “8”
- Anode screw “9”
- Cooling water pipe “10”


**TIP:**

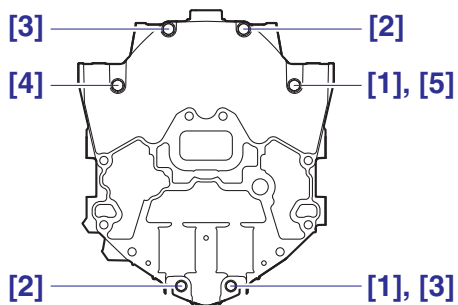
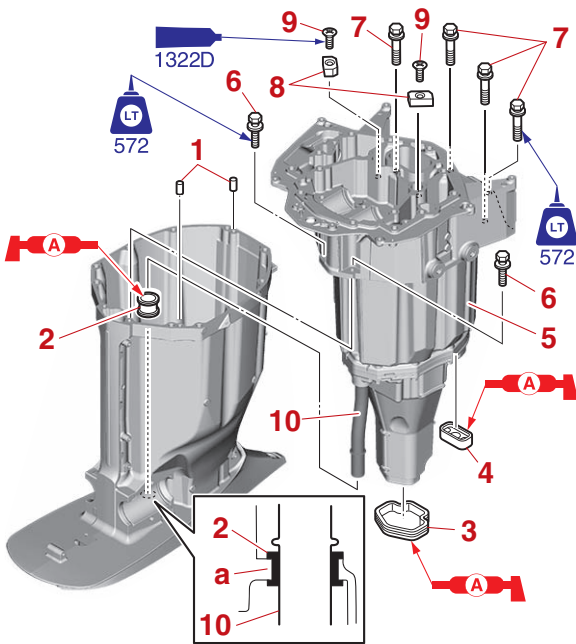
- Make sure to fit the tip of the cooling water pipe “10” into the joint hole “a” in the upper case.
- Tighten the oil pan assembly bolts “6” and “7” to the specified torque in the order [1], [2], and so on.

	Oil pan assembly bolt (M8) “6”
	20 N·m (2.0 kgf·m, 15 lb·ft)
	Oil pan assembly bolt (M10) “7”
	42 N·m (4.2 kgf·m, 31 lb·ft)
	Anode screw “9”
	3.9 N·m (0.39 kgf·m, 2.9 lb·ft)

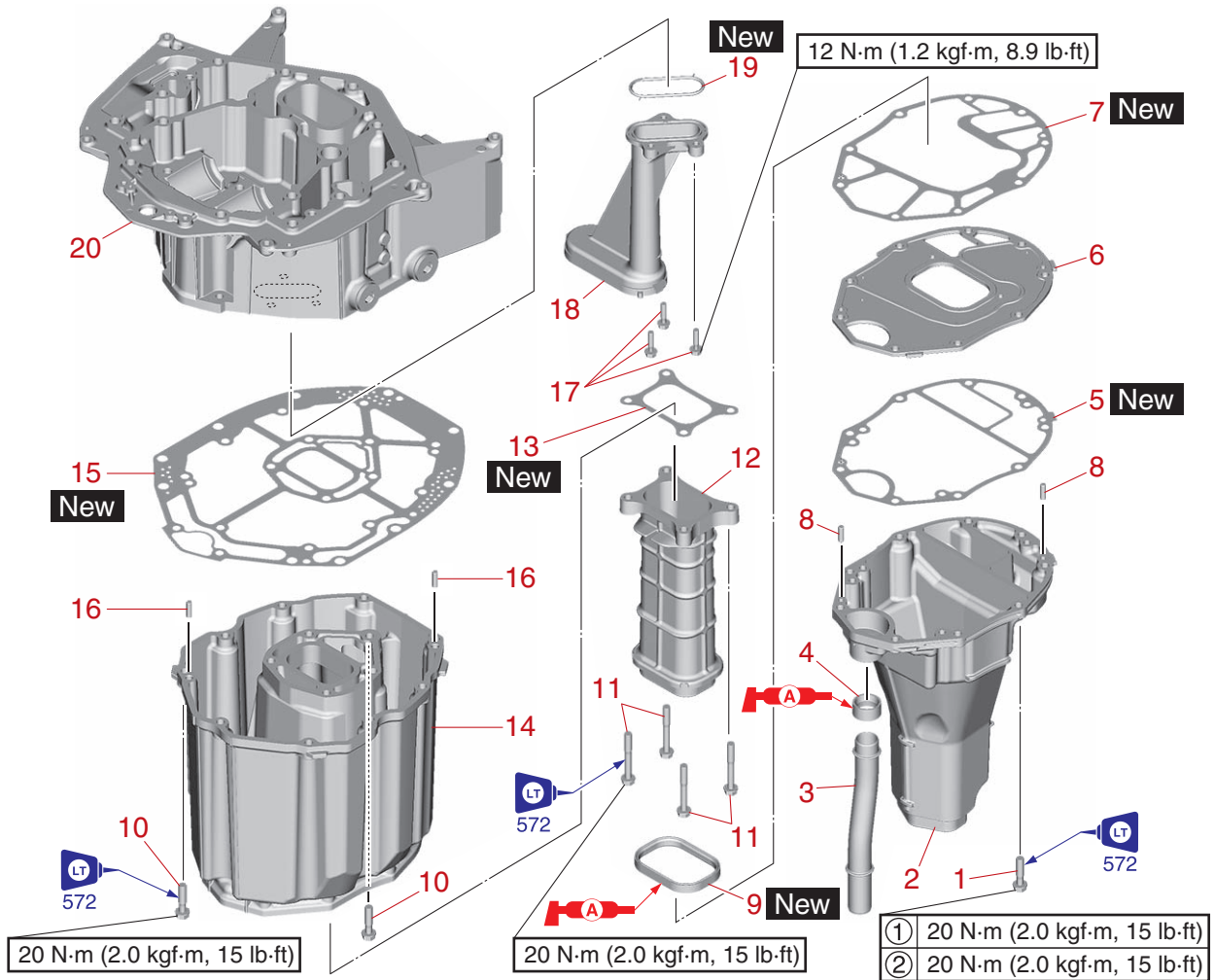
4. Install:

- Damper
- Cover
- Gasket **New**
- Drain bolt

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



Oil pan and exhaust manifold

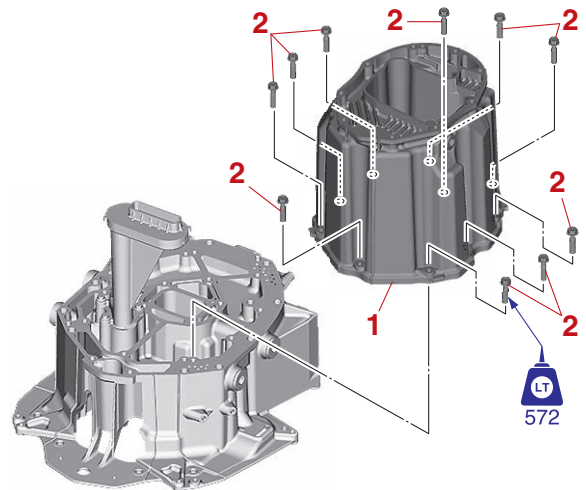


↑↓	Part name	Q'ty	Remarks
1	Bolt M8 × 35 mm	9	
2	Muffler	1	
3	Water pipe	1	
4	Rubber seal	1	
5	Gasket	1	
6	Plate	1	
7	Gasket	1	
8	Dowel pin	2	
9	Rubber seal	1	
10	Bolt M8 × 35 mm	10	
11	Bolt M8 × 60 mm	4	
12	Exhaust manifold	1	
13	Gasket	1	
14	Oil pan	1	
15	Gasket	1	
16	Dowel pin	2	
17	Bolt M6 × 25 mm	3	
18	Oil strainer	1	

↑↓	Part name	Q'ty	Remarks
19	Gasket	1	
20	Exhaust guide	1	

### Checking the oil pan and exhaust manifold

1. Clean:
  - Removed parts
2. Check:
  - Exhaust guide
  - Exhaust manifold
  - Muffler
  - Oil pan
  - Corroded/cracked → Replace.



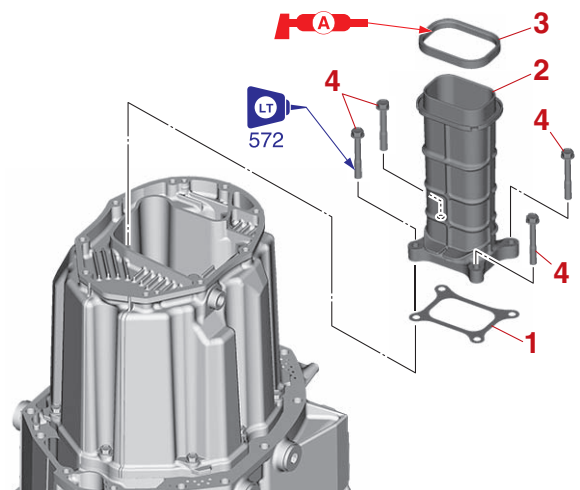
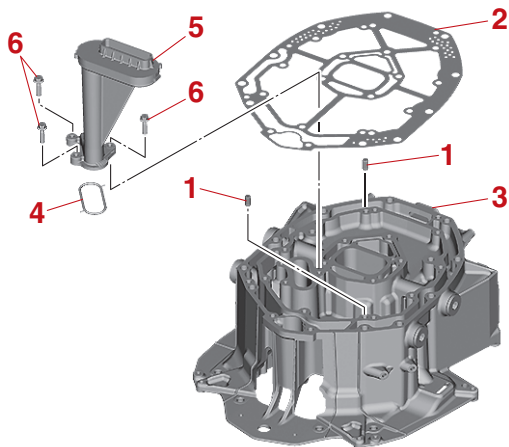
### Checking the oil strainer

1. Check:
  - Oil strainer
  - Dirt/residue → Clean.

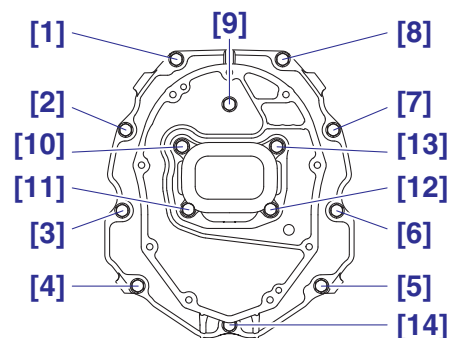
3. Install:
  - Gasket "1" **New**
  - Exhaust manifold "2"
  - Rubber seal "3" **New**
  - Exhaust manifold bolt "4" (temporarily tighten)


### Assembling the oil pan and exhaust manifold

1. Install:
  - Dowel pin "1"
  - Gasket "2" **New**
  - Exhaust guide "3"
  - Gasket "4" **New**
  - Oil strainer "5"
  - Oil strainer bolt "6"




- a. Tighten the oil pan bolts and the exhaust manifold bolts "4" to the specified torque in the order [1], [2], and so on.




	Oil strainer bolt "6" 12 N·m (1.2 kgf·m, 8.9 lb·ft)
---	--

2. Install:
  - Oil pan "1"
  - Oil pan bolt "2" (temporarily tighten)

## Oil pan and exhaust manifold

	Oil pan bolt
	20 N·m (2.0 kgf·m, 15 lb·ft)
	Exhaust manifold bolt "4"
	20 N·m (2.0 kgf·m, 15 lb·ft)

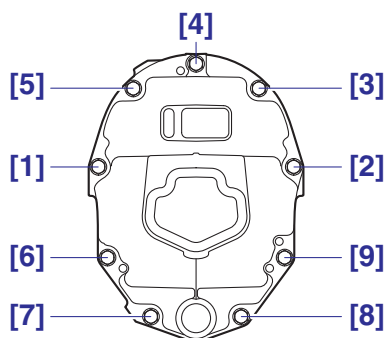
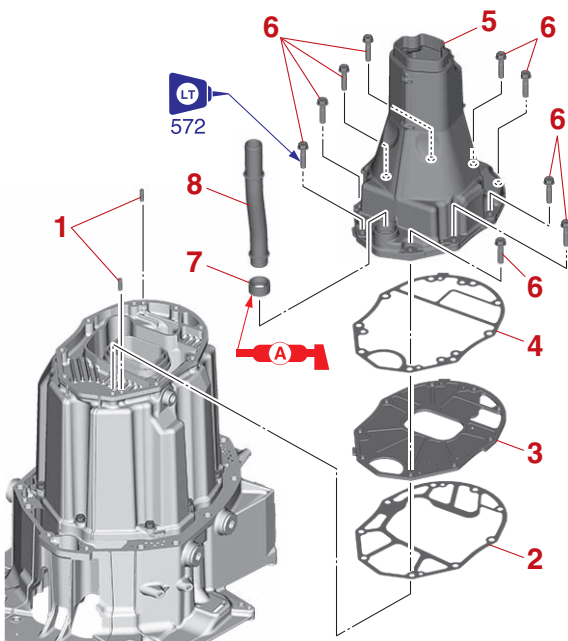
	Muffler bolt "6"
	1st: 20 N·m (2.0 kgf·m, 15 lb·ft)
	2nd: 20 N·m (2.0 kgf·m, 15 lb·ft)

### 4. Install:

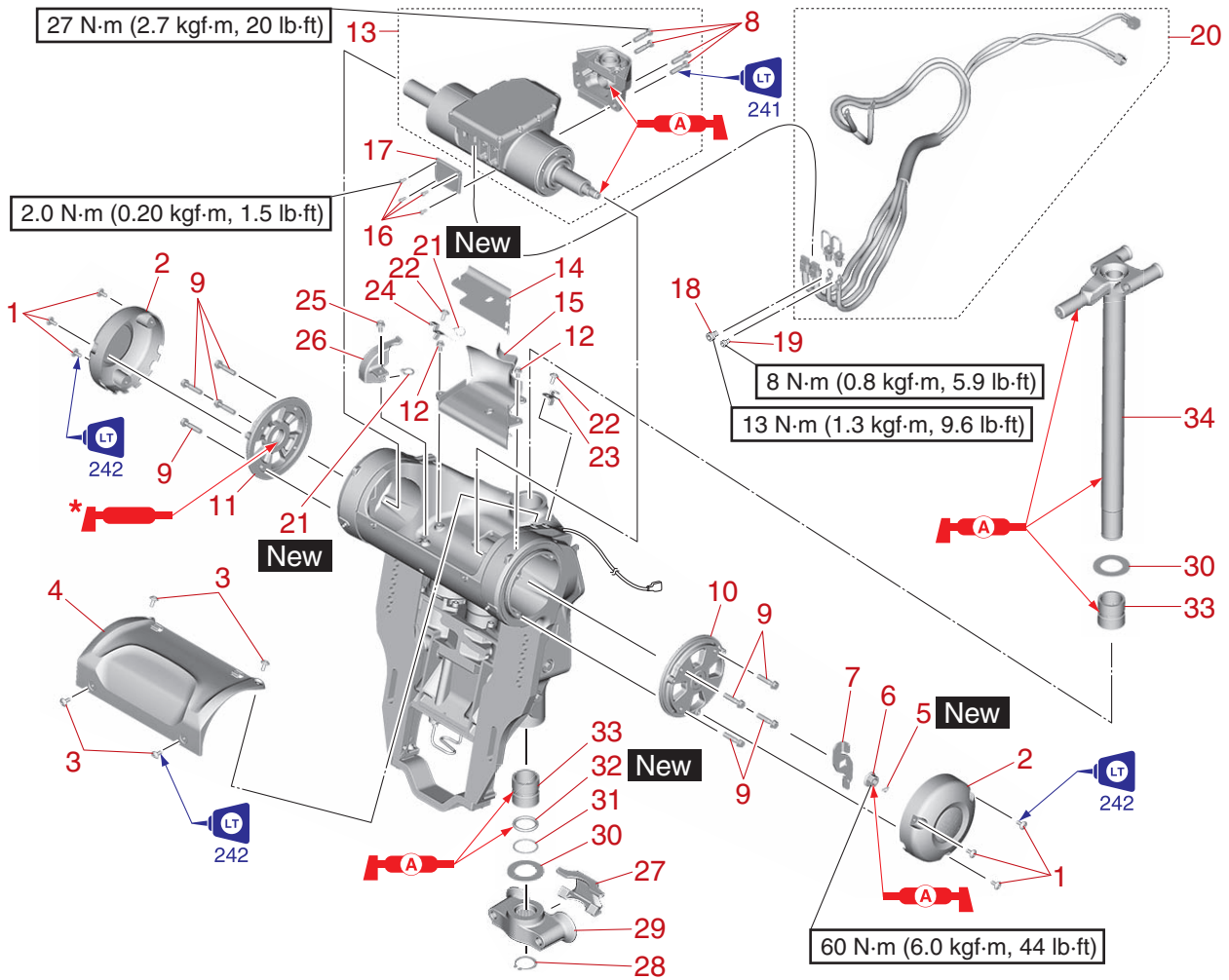
- Dowel pin "1"
- Gasket "2" **New**
- Plate "3"
- Gasket "4" **New**
- Muffler "5"
- Muffler bolt "6"
- Rubber seal "7"
- Water pipe "8"

### TIP:

Tighten the muffler bolts "6" to the specified torques in 2 stages and in the order [1], [2], and so on.



Steering actuator and steering arm

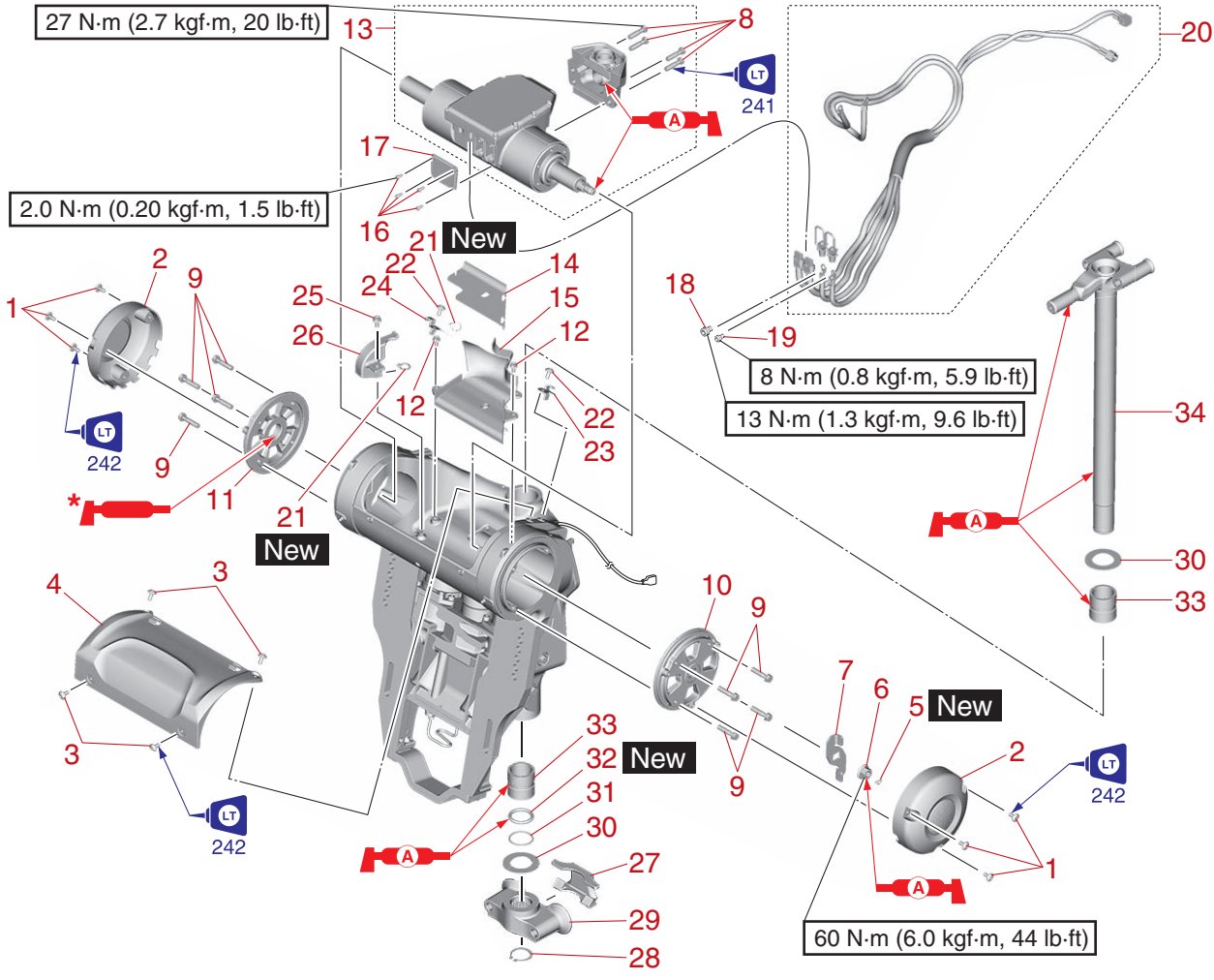


№	Part name	Q'ty	Remarks
1	Bolt M6 × 14 mm	6	
2	Cover	2	
3	Bolt M6 × 14 mm	4	
4	Cover	1	
5	Cotter pin	1	
6	Nut M14	1	
7	Lever	1	
8	Bolt M8 × 35 mm	4	
9	Bolt M8 × 40 mm	8	
10	Bracket (PORT)	1	
11	Bracket (STBD)	1	
12	Bolt M6 × 12 mm	2	
13	Steering actuator	1	
14	Guide	1	
15	Guide	1	
16	Bolt M4 × 10 mm	4	
17	Cover	1	

№	Part name	Q'ty	Remarks
18	Bolt M8 × 8 mm	1	Positive terminal
19	Bolt M6 × 8 mm	1	Negative terminal
20	Lead	1	
21	Plastic tie	2	
22	Bolt M6 × 14 mm	2	
23	Holder	1	
24	Holder	1	
25	Bolt M6 × 12 mm	1	
26	Protector	1	
27	Stopper	1	
28	Circlip	1	
29	Steering yoke	1	
30	Washer	2	
31	Washer	1	
32	O-ring	1	



# Steering actuator and steering arm



↑↓	Part name	Q'ty	Remarks
33	Bushing	2	
34	Steering arm	1	

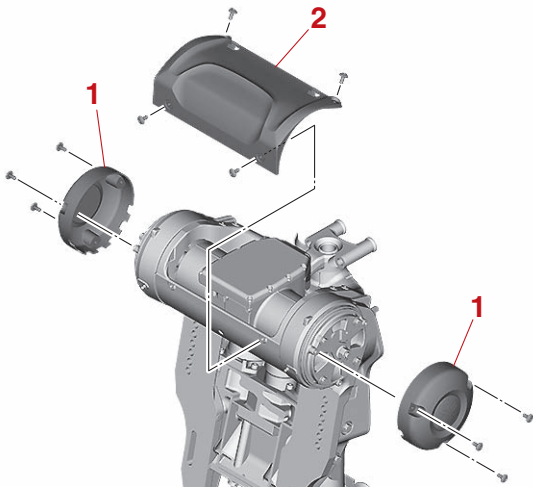
\*. Apply Valvoline X-ALL.



**Removing the power steering unit**

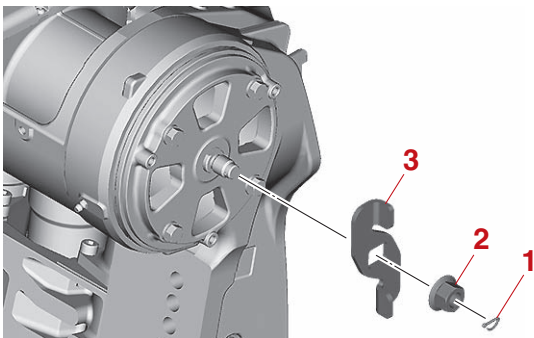
1. Remove:

- Clamp bracket side cover "1"
- Swivel bracket top cover "2"

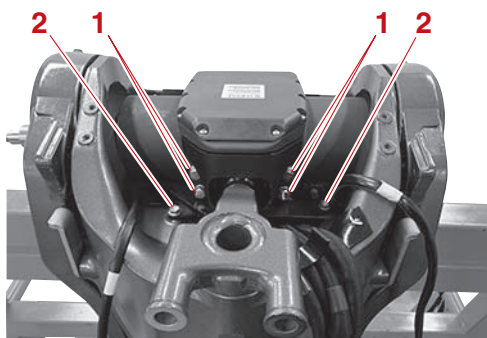


2. Remove:

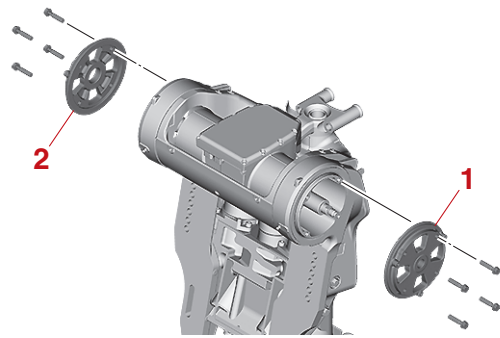
- Steering actuator
  - a. Remove the cotter pin "1", nut "2", and manual steering lever "3".



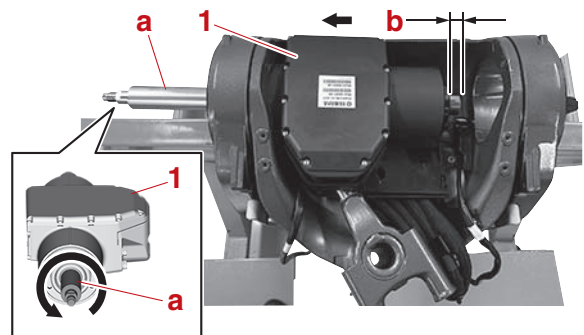
b. Remove the bolts "1" and "2".




c. Remove the steering actuator brackets "1" and "2".

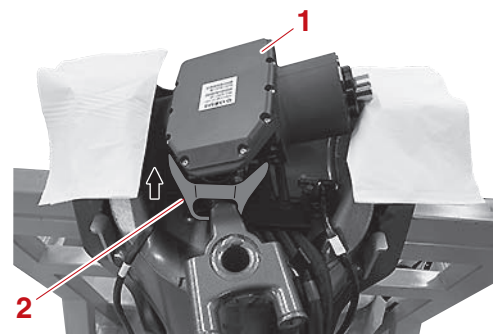


d. Turn the shaft "a" of the steering actuator "1" counterclockwise until the port end of the shaft is the specified length "b", and then move the steering actuator to the port side as shown.

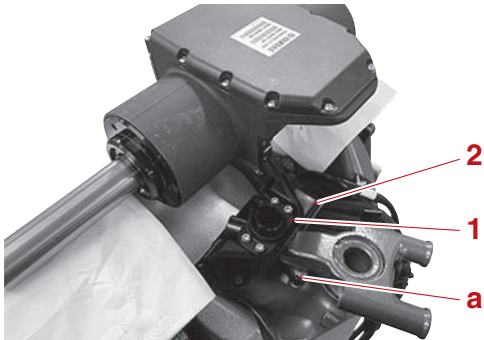


	Length "b" 20 mm (0.79 in)
---	-------------------------------

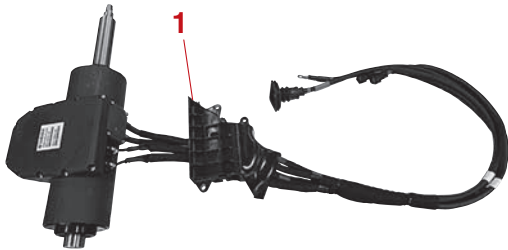
e. Lift up the steering actuator "1" from the steering arm joint "2" while removing it as shown.



- f. Remove the steering arm joint "1", and then remove the guide "2" from the pin "a".

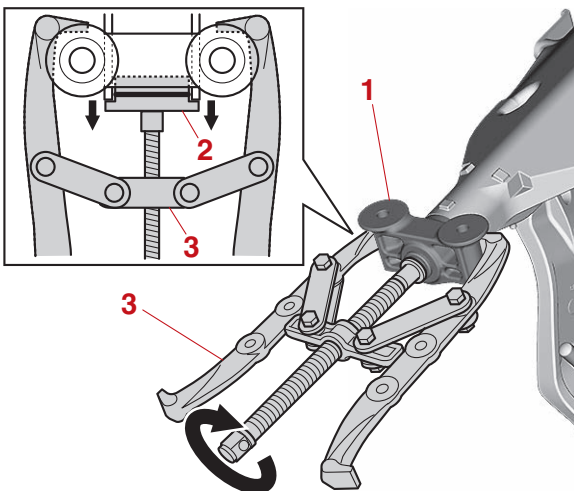


- g. Remove the guide "1" from the steering actuator lead.



### Removing the steering arm

- Remove:
  - Stopper
  - Circlip
- Remove:
  - Steering yoke "1"



Needle bearing attachment "2"  
90890-06612  
Driveshaft bearing installer "2"  
YB-06155  
Gear puller "3"  
(commercially available)

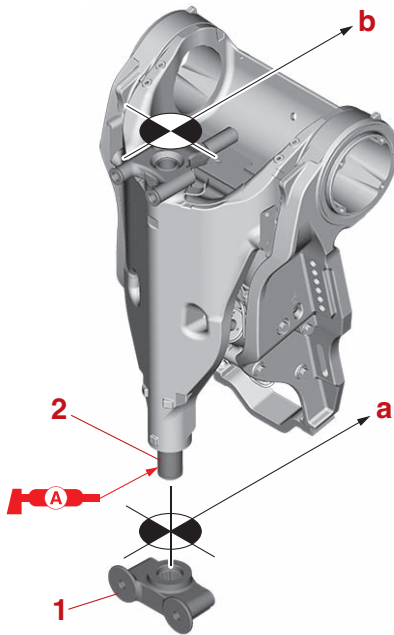
### Checking the steering arm and steering arm joint

- Check:
  - Steering arm  
Worn → Replace.
  - Steering arm joint  
Cracked/worn → Replace the steering actuator.

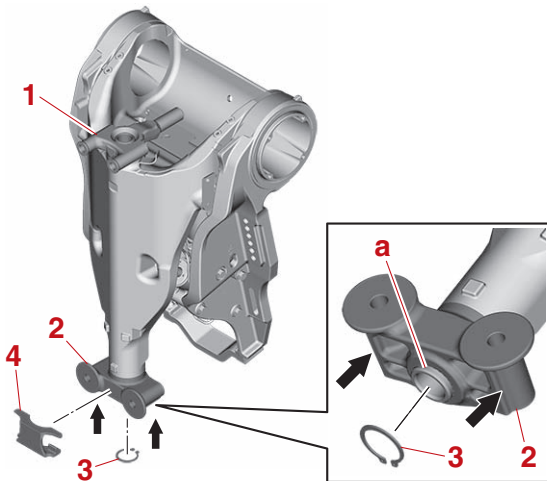
### Installing the steering arm

- Install:
  - Washer (to the steering arm)
  - Bushing (to the steering arm)
  - Steering arm
  - Bushing (to the swivel bracket)
  - O-ring **New** (to the swivel bracket)
  - Washer (to the swivel bracket)
- Install:
  - Steering yoke
  - Circlip
  - Stopper

- a. Install the steering yoke "1" so that it faces the same direction as the steering arm "2" (aligning "a" with "b").



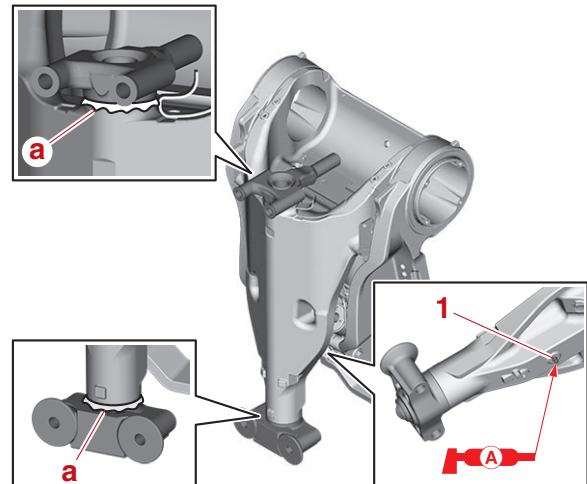
- b. Hold the steering arm "1", and then strike the steering yoke "2" using a copper hammer until the groove "a" for installing the circlip is visible.
- c. Install the circlip "3" and stopper "4".



3. Inject:
- Grease

**TIP:**

Inject grease into the grease nipple "1" until grease comes out from both the upper and lower bushings "a".



**Installing the steering actuator**

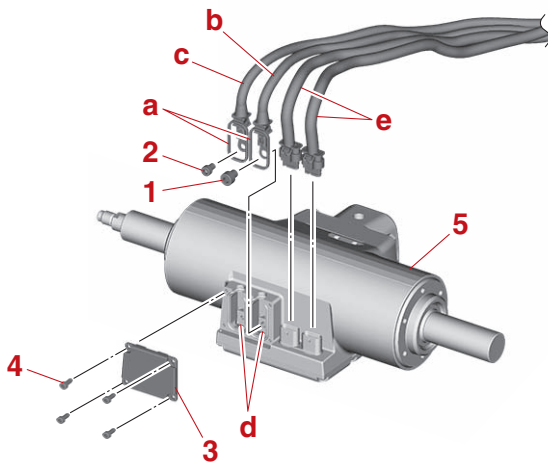
If the steering actuator is removed, the calibration is required after installation. See "Calibration (6X9 Digital Electronic Control)" (3-40).


1. Install:
- SCU lead (to the steering actuator)
  - SCU positive terminal bolt "1"
  - SCU negative terminal bolt "2"
  - Terminal cover "3"
  - Terminal cover bolt "4"

## Steering actuator and steering arm

### TIP:

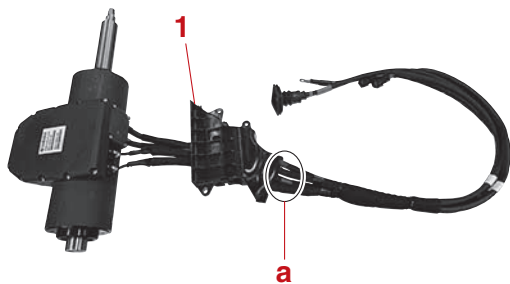
- Fit the grommets “a” on the SCU positive lead “b” and SCU negative lead “c” into the slots “d” in the steering actuator “5”, and then install the terminal cover “3” to the steering actuator.
- Position the SCU negative lead “c”, SCU positive lead “b”, and SCU signal lead “e” in the order listed from port to starboard so that the leads do not overlap.
- Tighten the terminal cover bolt “4” in 2 stages.



	SCU positive terminal bolt “1” 13 N·m (1.3 kgf·m, 9.6 lb·ft)
	Terminal cover bolt “4” 2.0 N·m (0.20 kgf·m, 1.5 lb·ft)

### 2. Install:

- Guide “1”
  - a. Align the guide “1” with the position “a” of the blue tape as shown, and then install it.



### 3. Install:

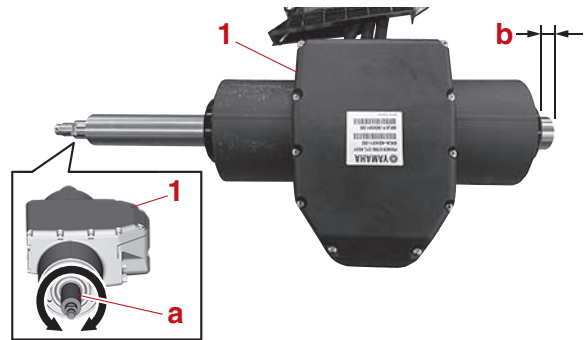
- Steering actuator


- a. Turn the shaft “a” of the steering actuator “1” until the port end of the shaft is the specified length “b”.

### TIP:

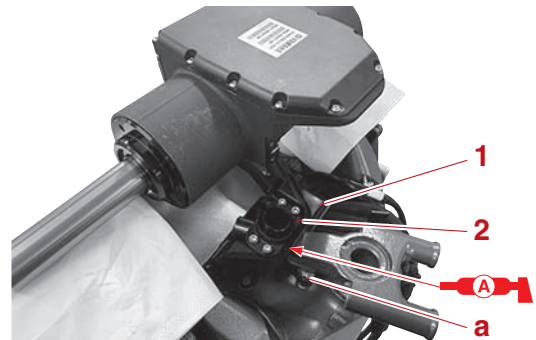
To increase the shaft length “b”, turn the shaft “a” clockwise.

To decrease the shaft length “b”, turn the shaft “a” counterclockwise.

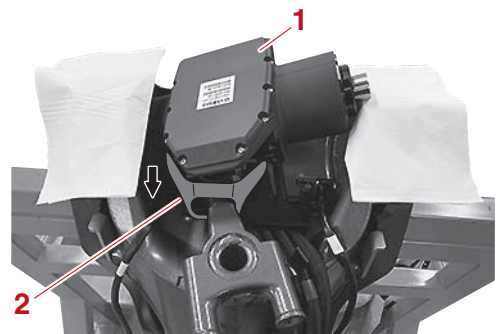


	Length “b” 20 mm (0.79 in)
--	-------------------------------

- b. Install the guide “1” to the pin “a”, and then install the steering arm joint “2”.



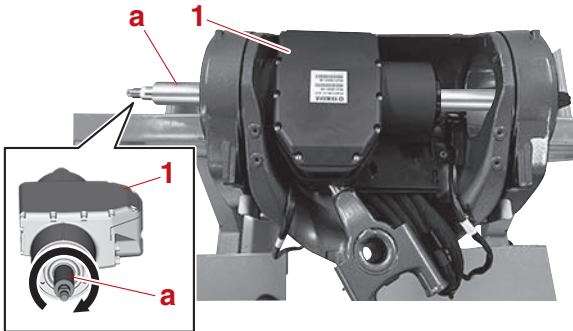
- c. Install the steering actuator “1” to the steering arm joint “2” while fitting it as shown.





## Steering actuator and steering arm

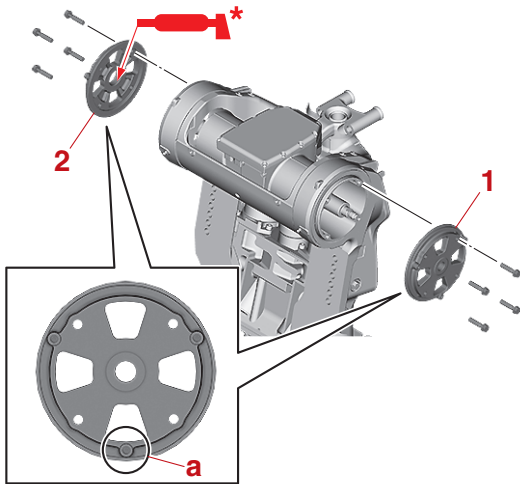
- d. Turn the shaft "a" of the steering actuator "1" clockwise to position the shaft in the center steering position.



- e. Install the steering actuator brackets "1" and "2".

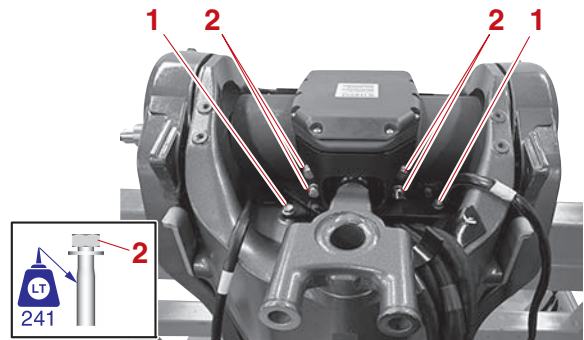
### TIP:


- Install the steering actuator bracket "1" with the smaller center hole on the port side, and install the steering actuator bracket "2" with the larger center hole on the starboard side.
- Install the steering actuator brackets "1" and "2" at the position where the cover installation hole "a" faces downward.



\*. Apply Valvoline X-ALL.

- f. Tighten the guide bolts "1" and steering arm joint bolts "2".



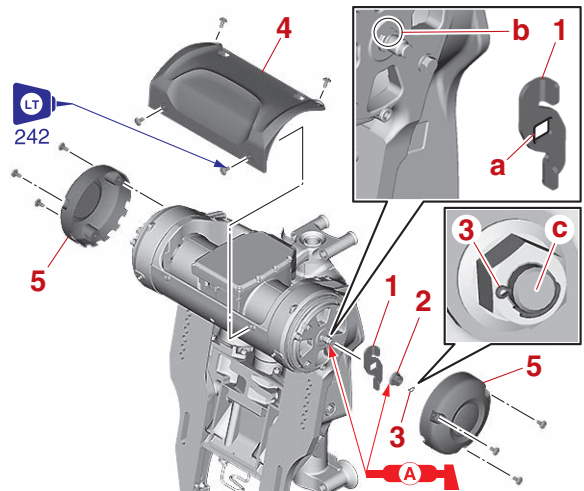
	Steering arm joint bolt "2" 27 N·m (2.7 kgf·m, 20 lb·ft)
---	---


4. Install:

- Manual steering lever "1"
- Steering shaft end nut "2"
- Cotter pin "3" **New**
- Swivel bracket top cover "4"
- Clamp bracket side cover "5"

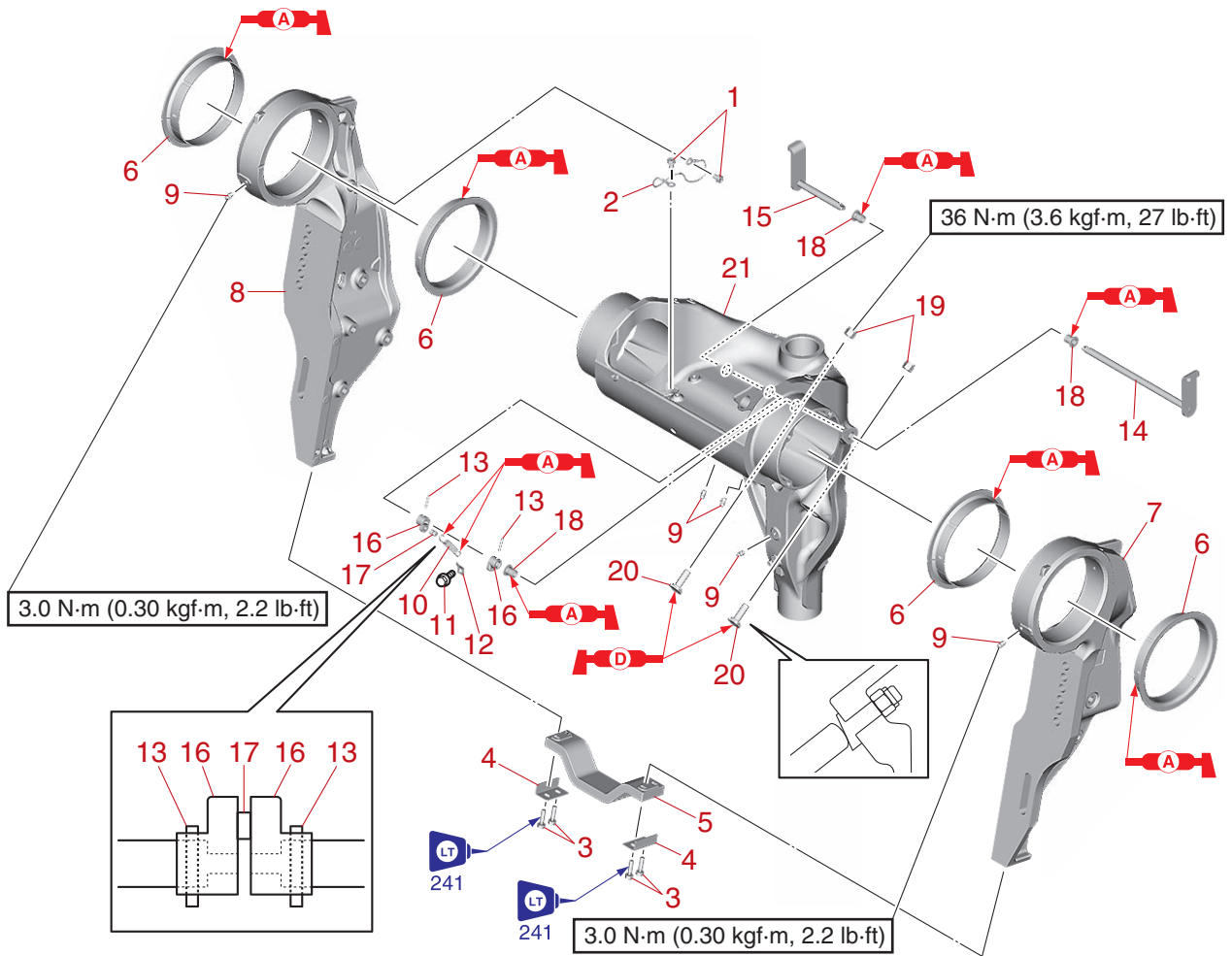
### TIP:

- Align the hole "a" in the manual steering lever "1" with the flat sides "b" of the steering shaft.
- Bend the ends of the cotter pin "3" along the shaft "c" as shown.



	Steering shaft end nut "2" 60 N·m (6.0 kgf·m, 44 lb·ft)
---	--

Clamp bracket and swivel bracket



↑↓	Part name	Q'ty	Remarks
1	Bolt M6 × 10 mm	2	
2	Ground lead	1	
3	Bolt M6 × 25 mm	4	
4	Plate	2	
5	Anode	1	
6	Bushing	4	
7	Clamp bracket (PORT)	1	
8	Clamp bracket (STBD)	1	
9	Grease nipple M6	5	
10	Spring	1	
11	Bolt M6 × 12 mm	1	
12	Hook	1	
13	Pin	2	
14	Tilt support lever (PORT)	1	
15	Tilt support lever (STBD)	1	
16	Distance collar	2	

↑↓	Part name	Q'ty	Remarks
17	Pin	1	
18	Bushing	3	
19	Nut M10	2	
20	Trim stopper	2	
21	Swivel bracket	1	

### Removing the clamp bracket

1. Remove:
  - PTT unit  
See "Removing the PTT unit" (9-28).

### Checking the clamp bracket anode

1. Check:
  - Anode  
Eroded (1/2 or more worn out) → Replace.  
Adhered grease, oil, paint, or scales → Clean.

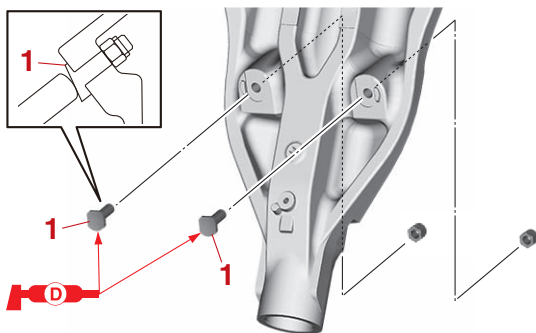
**NOTICE**


Do not apply grease, oil, or paint to the anode.

### Assembling the swivel bracket

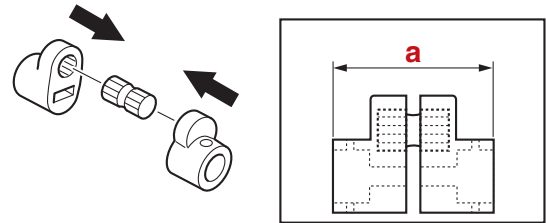
1. Install:
  - Grommet
  - Grease nipple
  - Trim stopper "1"


**TIP:** Install the trim stoppers "1" in the direction shown.



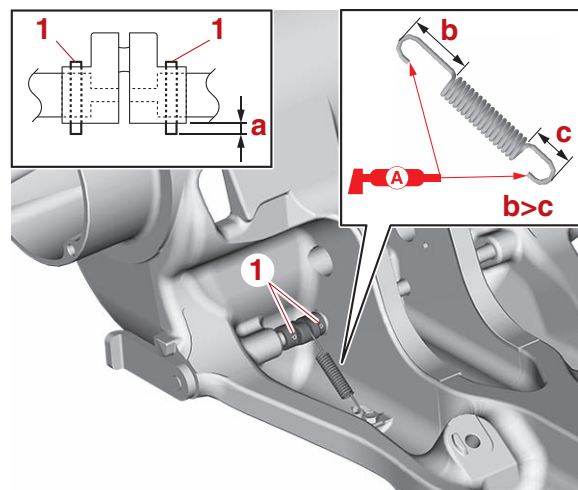
	Grease nipple
	3.0 N·m (0.30 kgf·m, 2.2 lb·ft)
	Trim stopper nut
	36 N·m (3.6 kgf·m, 27 lb·ft)


2. Assemble:
  - Pin
  - Distance collar



	Distance "a"
	30.3–30.6 mm (1.19–1.20 in)


3. Install:
  - Bushing
  - Tilt support lever
  - Distance collar assembly
  - Pin "1"
  - Hook
  - Spring



	Distance "a"
	2.5–3.5 mm (0.10–0.14 in)

### Installing the clamp bracket

1. Install:
  - Grease nipple
  - Clamp bracket
  - Bushing
  - Clamp bracket anode
  - Plate
  - Ground lead

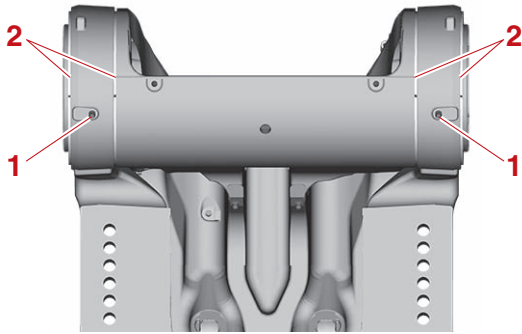
	Grease nipple
	3.0 N·m (0.30 kgf·m, 2.2 lb·ft)



2. Inject:
  - Grease

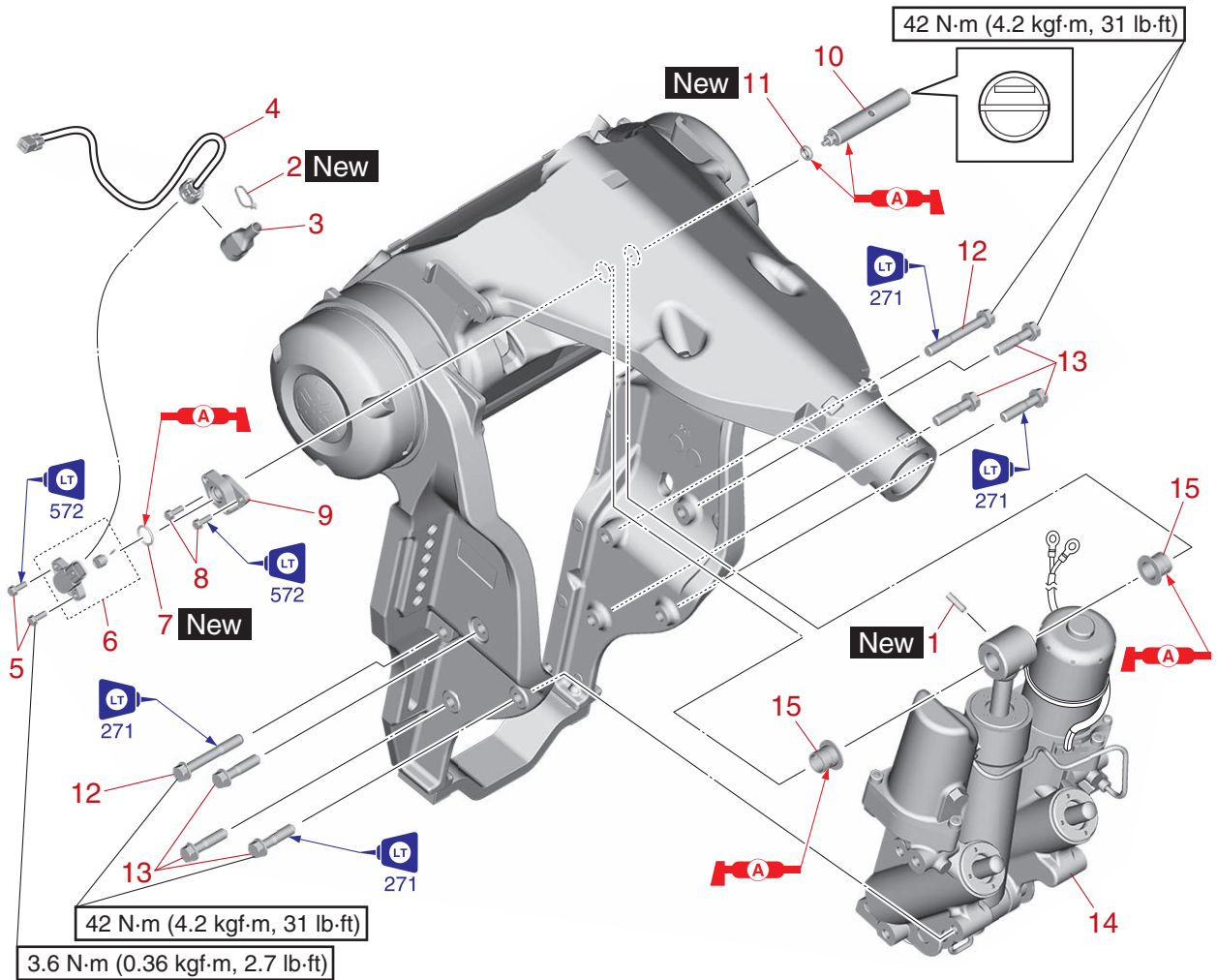
**TIP:** \_\_\_\_\_  
Inject grease into the grease nipples “1” until grease comes out from both the port and starboard bushings “2”.

---



3. Install:
  - PTT unitSee “Installing the PTT unit” (9-33).

PTT unit



∩∩	Part name	Q'ty	Remarks
1	Pin	1	
2	Plastic tie	1	
3	Cover	1	
4	Lead	1	
5	Bolt M5 × 15 mm	2	
6	Sensor	1	PTT
7	O-ring	1	
8	Bolt M5 × 15 mm	2	
9	Adapter	1	
10	Shaft	1	
11	O-ring	1	
12	Bolt M10 × 75 mm	2	
13	Bolt M10 × 45 mm	6	
14	PTT unit	1	
15	Bushing	2	

## Removing the PTT unit

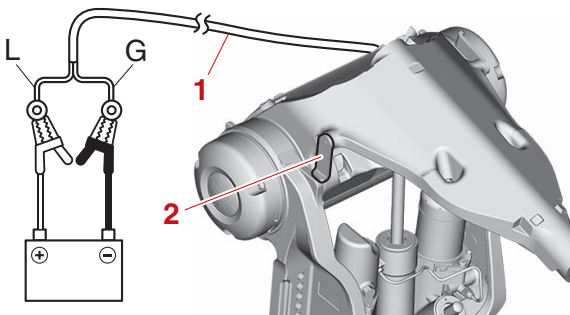
### ⚠ WARNING

When removing or installing the PTT unit with the power unit or upper case assembly installed, make sure to suspend the out-board motor.

1. Remove:

- PTT unit

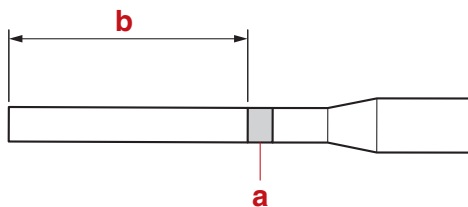
- a. Connect the battery jumper leads to the PTT motor lead “1” to fully tilt the swivel bracket up, and then support it using the tilt support lever “2”.



Ram	PTT motor lead	Battery
Extend	Blue (L)	(+)
	Green (G)	(-)

- b. Remove the sensor (PTT) and adapter.

- c. Put a mark “a” on the specified length “b” on the pin-extraction tool.

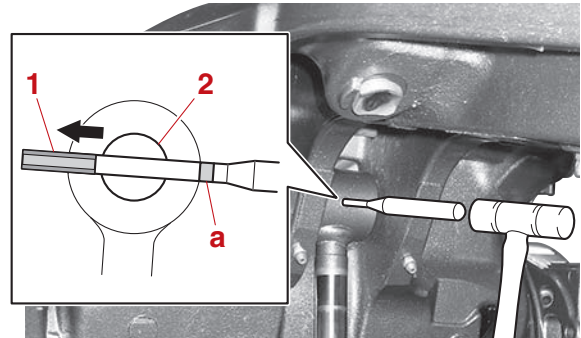


	Length “b” 31 mm (1.22 in)
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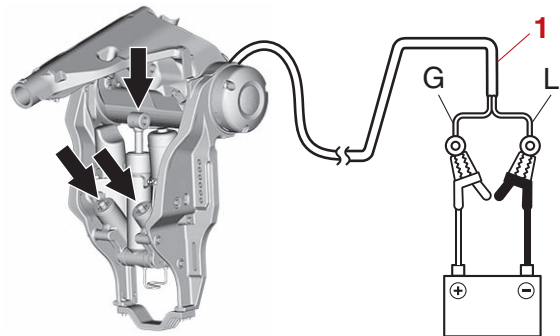
- d. Push in the pin “1” to the mark “a” position on the pin-extraction tool, and then remove the shaft “2”.

### TIP:

Be careful not to push the pin in too much, because the pin might fall into the swivel bracket requiring subsequent removal from the front side of the swivel bracket.



- e. Connect the battery jumper leads to the PTT motor lead “1” to fully retract the PTT rams.



Ram	PTT motor lead	Battery
Retract	Green (G)	(+)
	Blue (L)	(-)

- f. Remove the pin left at the edge of the rod.

- g. Remove the PTT unit.

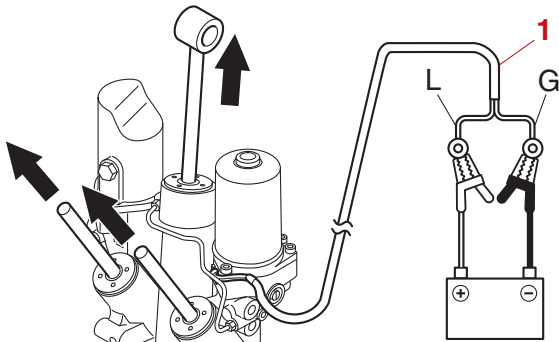
### NOTICE

When removing or installing the PTT unit, do not hold the PTT unit using the tilt cylinder. Otherwise, the pipe could break, causing PTT fluid to leak.

### Checking the hydraulic pressure

1. Check:

- PTT fluid level
  - a. Place the PTT unit in an upright position.
  - b. Connect the battery jumper leads to the PTT motor lead "1" to fully extend the PTT rams.



Ram	PTT motor lead	Battery
Extend	Blue (L)	(+)
	Green (G)	(-)

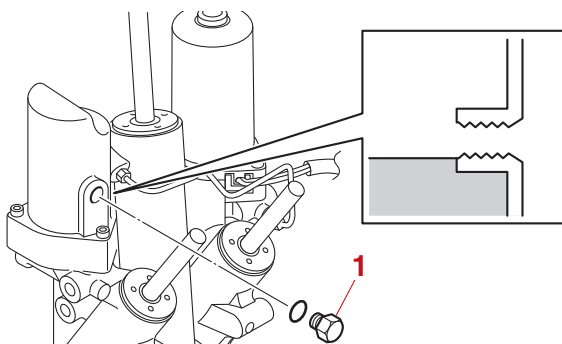
- c. Remove the reservoir cap "1", and then check the fluid level in the reservoir.

**⚠ WARNING**


Before removing the reservoir cap "1", make sure that the PTT rams are fully extended. Otherwise, fluid could be expelled forcefully from the PTT unit due to internal pressure.

**TIP:**

If the fluid is at the proper level, a small amount of fluid should flow out of the filler hole.

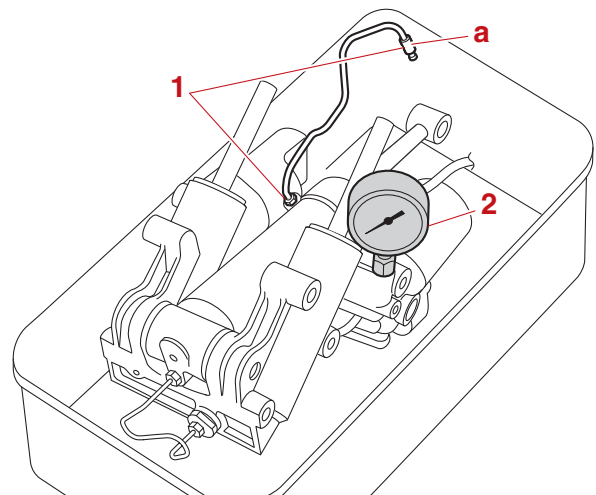



- d. If the fluid is below the proper level, add the recommended fluid.
- e. Install the reservoir cap, and then tighten it to the specified torque.

	Reservoir cap 7 N·m (0.7 kgf·m, 5.2 lb·ft)
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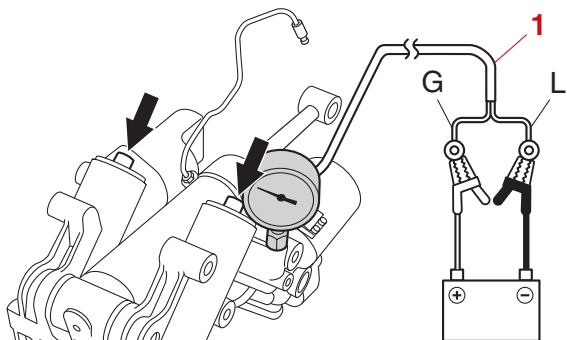
2. Check:


- Hydraulic pressure  
Out of specification → Check the internal parts.
  - a. Place the PTT unit in the drain pan.
  - b. Loosen the pipe joints "1", and then remove the pipe joint at the end "a".
  - c. Install the special service tool "2".



	PTT oil pressure gauge assembly "2" 90890-06580 PTT pressure gauge "2" YB-06580
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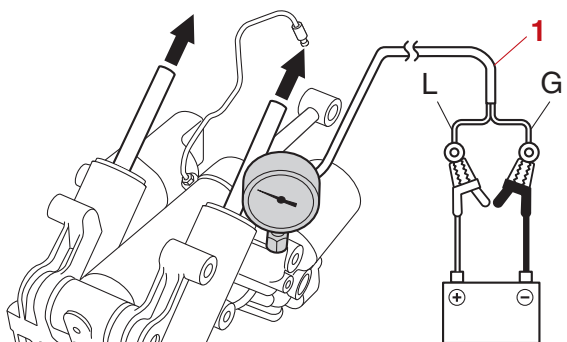
- d. Connect the battery jumper leads to the PTT motor lead “1” to fully retract the trim rams, and then measure the hydraulic pressure when the reading on the pressure gauge stabilizes.



	Hydraulic pressure Down 7.70 Mpa (77.0 kgf/cm <sup>2</sup> , 1116.5 psi)
---	--

Ram	PTT motor lead	Battery
Retract	Green (G)	(+)
	Blue (L)	(-)

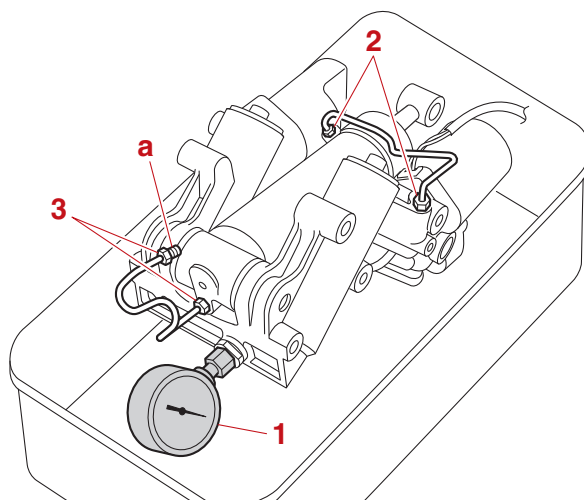
- e. Reverse the connection between battery jumper leads and the PTT motor lead “1” to fully extend the trim rams.





Ram	PTT motor lead	Battery
Extend	Blue (L)	(+)
	Green (G)	(-)

- f. Remove the special service tool “1”.
- g. Install the pipe joints “2”, and then tighten them to the specified torque.

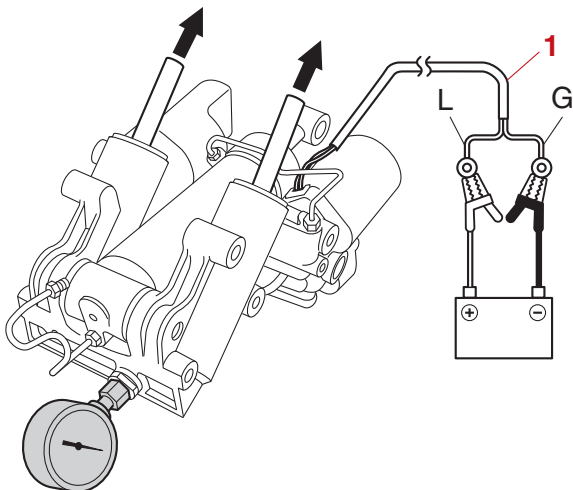
- h. Connect the battery jumper leads to the PTT motor lead to fully retract the PTT rams.
- i. Loosen the pipe joints “3”, and then remove the pipe joint at the end “a”.
- j. Install the special service tool “1”.



	PTT oil pressure gauge assembly “1” 90890-06580 PTT pressure gauge “1” YB-06580
---	---

	Pipe joint “2” 15 N·m (1.5 kgf·m, 11 lb·ft)
---	--

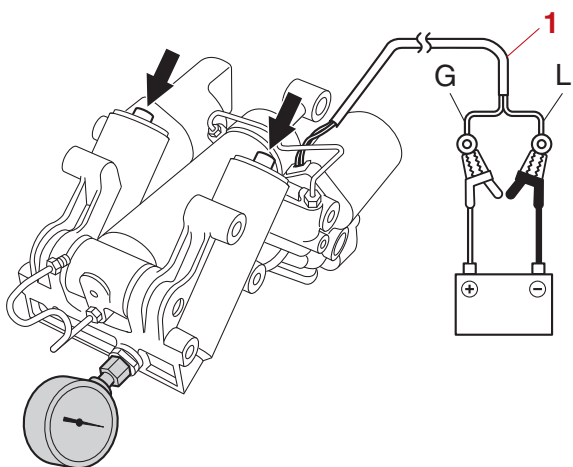
- k. Connect the battery jumper leads to the PTT motor lead “1” to fully extend the trim rams, and then measure the hydraulic pressure when the reading on the pressure gauge stabilizes.



	Hydraulic pressure Up 14.00 Mpa (140.0 kgf/cm <sup>2</sup> , 2030.0 psi)
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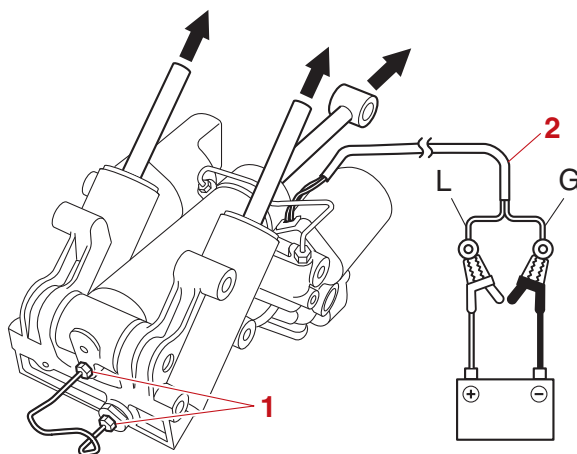
Ram	PTT motor lead	Battery
Extend	Blue (L)	(+)
	Green (G)	(-)

- l. Reverse the connection between battery jumper leads and the PTT motor lead “1” to fully retract the trim rams.



Ram	PTT motor lead	Battery
Retract	Green (G)	(+)
	Blue (L)	(-)

- m. Remove the special service tool.  
n. Install the pipe joints “1”, and then tighten them to the specified torque.  
o. After measuring the hydraulic pressure, connect the battery jumper leads to the PTT motor lead “2” to fully extend the PTT rams.



	Pipe joint “1” 15 N·m (1.5 kgf·m, 11 lb·ft)
--	--

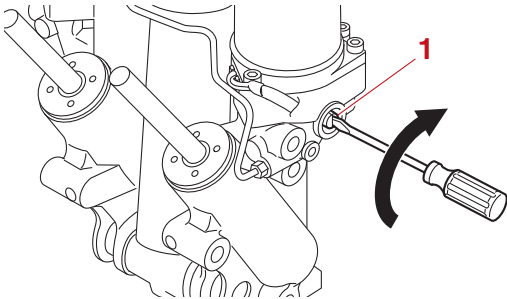
Ram	PTT motor lead	Battery
Extend	Blue (L)	(+)
	Green (G)	(-)


- p. Place the PTT unit in an upright position.  
q. Repeat step (1) to check the PTT fluid level.

### Bleeding the PTT unit

1. Bleed:
- PTT unit
    - a. Place the PTT unit in an upright position.

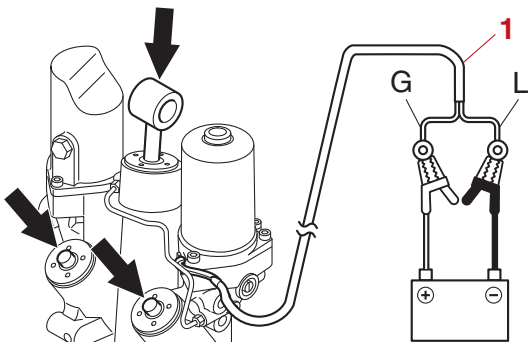
- b. Turn the manual valve "1" clockwise to close it.



	Manual valve "1" 2.0 N·m (0.20 kgf·m, 1.5 lb·ft)
---	---

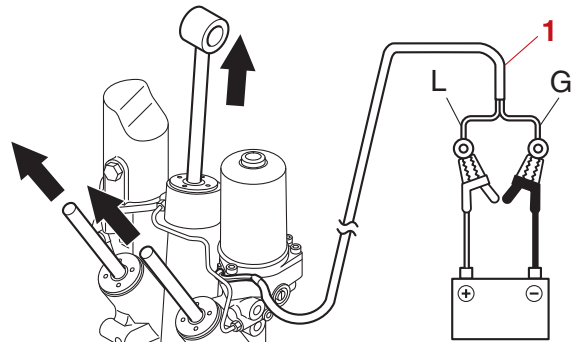
- c. Check the fluid level. See step (1) in "Checking the hydraulic pressure" (9-29).
- d. Connect the battery jumper leads to the PTT motor lead "1" to fully retract the PTT rams.

**TIP:** \_\_\_\_\_  
If the PTT rams do not move down easily, push on the PTT rams to assist operation.



Ram	PTT motor lead	Battery
Retract	Green (G)	(+)
	Blue (L)	(-)

- e. Reverse the connection between battery jumper leads and the PTT motor lead "1" to fully extend the PTT rams.




Ram	PTT motor lead	Battery
Extend	Blue (L)	(+)
	Green (G)	(-)

- f. Repeat steps (d) and (e) to fully extend and retract the PTT rams 4 or 5 times.
- g. Fully extend the PTT ram.
- h. Remove the reservoir cap, and then check the fluid level in the reservoir.

**WARNING** \_\_\_\_\_  
**Before removing the reservoir cap, make sure that the PTT rams are fully extended. Otherwise, fluid could be expelled forcefully from the PTT unit due to internal pressure.**

**TIP:** \_\_\_\_\_  
If the fluid is below the proper level, add the recommended PTT fluid. Repeat steps (c)–(g) until the fluid remains at the proper level.

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

	Reservoir cap 7 N·m (0.7 kgf·m, 5.2 lb·ft)
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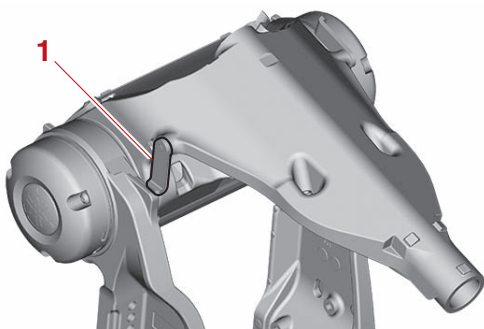


## Installing the PTT unit

### **WARNING**

When removing or installing the PTT unit with the power unit or upper case assembly installed, make sure to suspend the out-board motor.

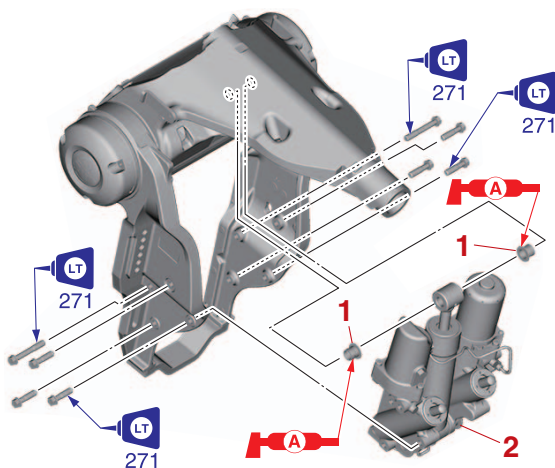
1. Install:
  - Bushing (into the swivel bracket)
  - PTT unit
    - a. Fully tilt the swivel bracket up, and then support it using the tilt support lever "1".



- b. Install the bushings "1" and PTT unit "2".

### **NOTICE**

When removing or installing the PTT unit, do not hold the PTT unit using the tilt cylinder. Otherwise, the pipe could break, causing PTT fluid to leak.

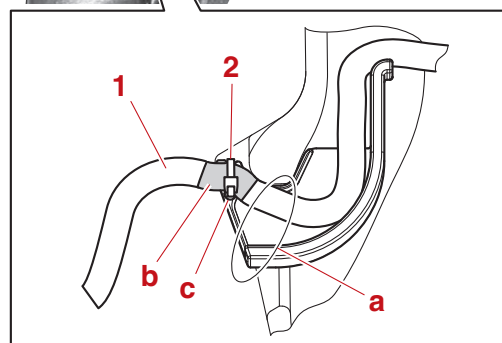
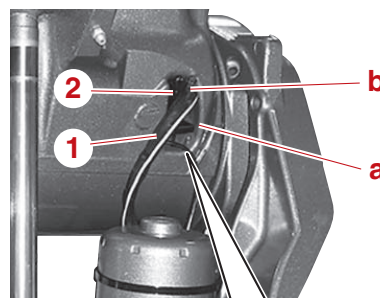


PTT unit mounting bolt  
42 N·m (4.2 kgf·m, 31 lb·ft)

- c. Route the PTT motor lead "1" through the hole "a" in the swivel bracket, and then fasten it at the gray tape position "b" using the plastic tie "2".

### **TIP:**

Route the plastic tie "2" through the hole "c", and then fasten it.

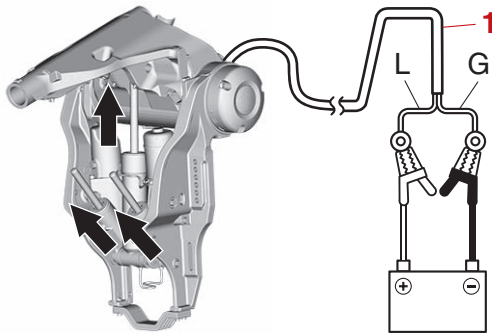


2. Install:
  - O-ring **New**
  - Adapter
  - Upper mounting shaft
  - PTT sensor
  - Pin **New**
  - PTT sensor lead
  - Plate

### **NOTICE**

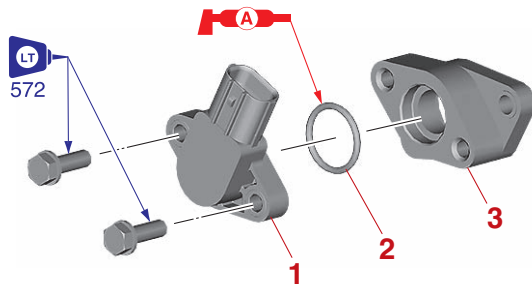
Do not install the PTT sensor to the upper mounting shaft while the sensor is installed to the adapter. Otherwise, the PTT sensor could be damaged.


- a. Connect the battery jumper leads to the PTT motor lead “1” to extend the PTT rams until the end of the tilt ram is aligned with the mounting position hole.



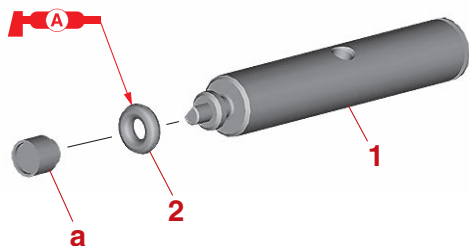
Ram	PTT motor lead	Battery
Extend	Blue (L)	(+)
	Green (G)	(-)

- b. Assemble the PTT sensor “1”, a new O-ring “2”, and the adapter “3”.



	<p>PTT sensor bolt 3.6 N·m (0.36 kgf·m, 2.7 lb·ft)</p>
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- c. Assemble the upper mount shaft “1”, a new O-ring “2”, and the magnet “a”.



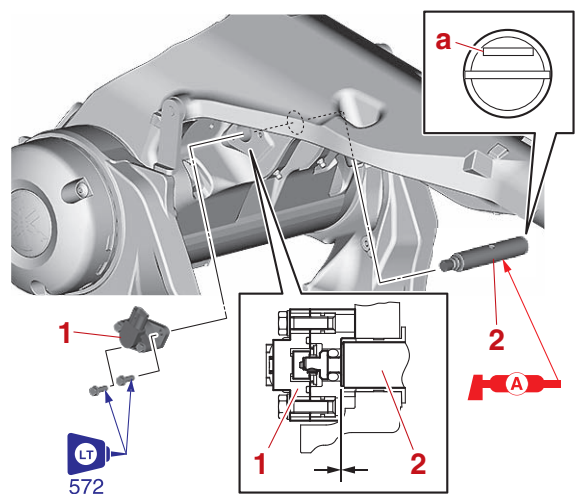
- d. Assemble the PTT sensor assembly “1” and upper mount shaft assembly “2” to the swivel bracket.

**NOTICE**

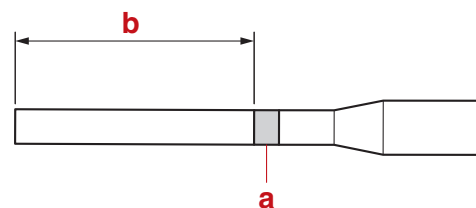
Do not strike or tap the upper mounting shaft to install it. Otherwise, the bushing could be damaged.


**TIP:**

Install the upper mount shaft assembly “2” into the swivel bracket so that the groove “a” in the shaft is facing in the direction shown.

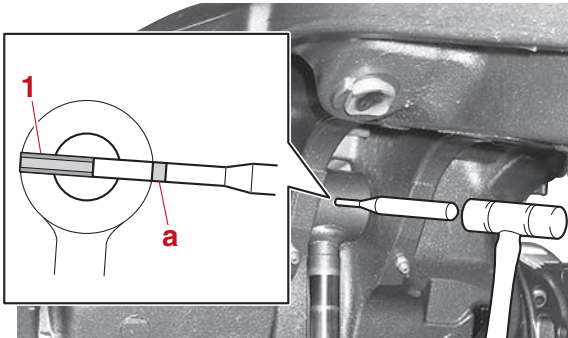


- e. Put a mark “a” on the specified length “b” on the pin-extraction tool.



	<p>Length “b” 18 mm (0.71 in)</p>
---	---------------------------------------

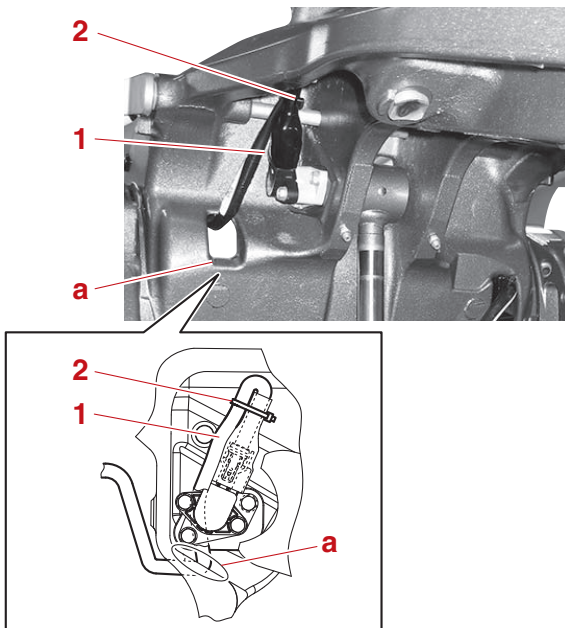
- f. Push in the pin “1” to the mark “a” position on the pin-extraction tool.



**TIP:**

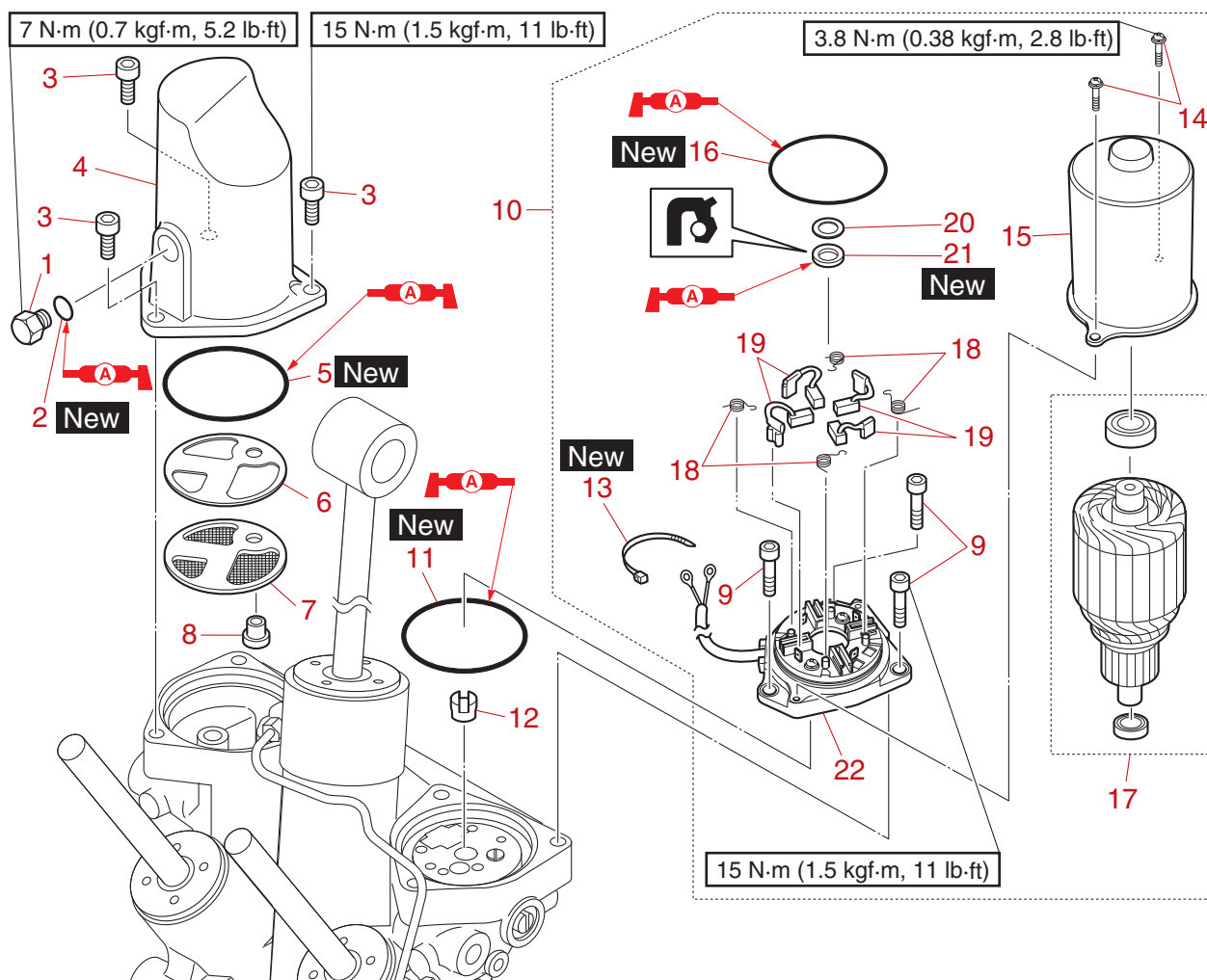
By pushing it to the mark “a” position on the pin-extraction tool, the pin “1” will then be installed in the correct position.

- g. Fasten the PTT sensor lead “1” using the plastic tie “2” as shown, and then route it through the hole “a” in the swivel bracket.



- h. Fully tilt the swivel bracket down.

PTT motor



↑↓	Part name	Q'ty	Remarks
1	Reservoir cap M12 × 10 mm	1	
2	O-ring	1	
3	Bolt M8 × 20 mm	3	
4	Reservoir	1	
5	O-ring	1	
6	Sheet	1	
7	Filter	1	
8	Spacer	1	
9	Bolt M8 × 20 mm	3	
10	PTT motor assembly	1	
11	O-ring	1	

↑↓	Part name	Q'ty	Remarks
12	Joint	1	
13	Plastic tie	1	*1
14	Screw M5 × 12 mm	2	
15	Stator	1	
16	O-ring	1	
17	Armature assembly	1	
18	Spring	4	
19	Brush	4	
20	Washer	1	
21	Oil seal	1	
22	Motor base assembly	1	

\*1. When the plastic tie securing the PTT motor lead is removed, fasten the PTT motor lead using the 2 plastic ties when installing it.

## Removing the reservoir

### ⚠ WARNING

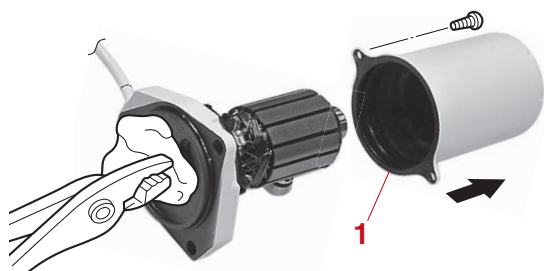
Before removing the reservoir, make sure that the PTT rams are fully extended. Otherwise, fluid could be expelled forcefully from the PTT unit due to internal pressure.

## Disassembling the PTT motor

- Remove:
  - Stator "1"

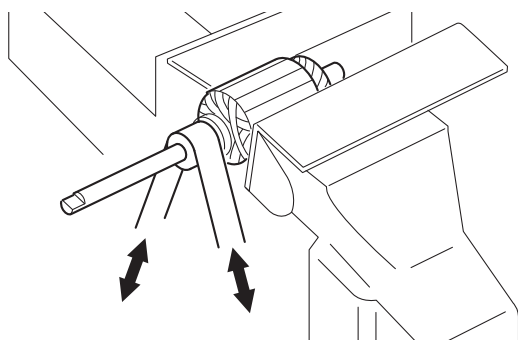
### NOTICE

When removing or installing the armature along with the motor base assembly, secure the end of the armature shaft using a pair of pliers. Otherwise, the armature could separate from the motor base assembly due to the magnetic force of the stator and damage the brushes.

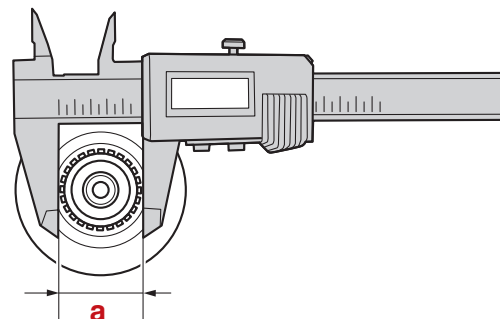



## Checking the PTT motor

- Check:
  - Commutator
    - Dirty → Clean using 600-grit sandpaper and compressed air.

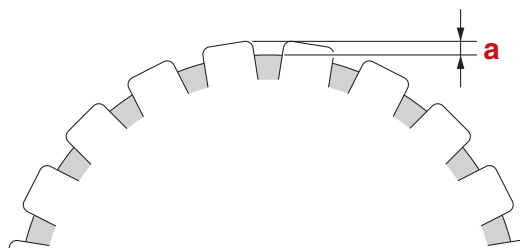



- Measure:
  - Commutator diameter "a"
    - Out of specification → Replace the armature.



	Standard commutator diameter
	23.00 mm (0.9055 in)
	Wear limit
	22.00 mm (0.8661 in)

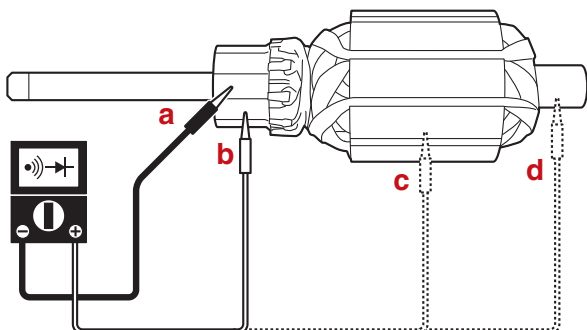
- Measure:
  - Commutator undercut "a"
    - Out of specification → Replace the armature.



	Standard commutator undercut
	1.50 mm (0.0591 in)
	Wear limit
	1.00 mm (0.0394 in)

4. Check:

- Armature continuity  
Out of specification → Replace the armature assembly.

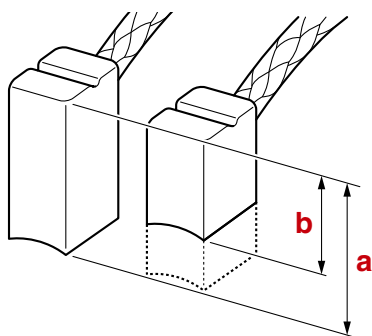


Armature continuity			
"a"	"b"	"c"	"d"
○ — ○			

**Checking the brush**

1. Measure:

- Brush length  
Below specification → Replace the brush.

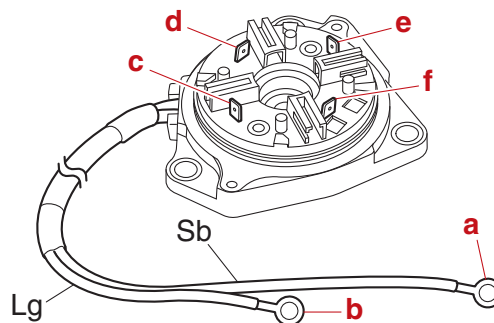


- a. Standard brush length
- b. Wear limit

	Standard brush length
	11.50 mm (0.4528 in)
	Wear limit
	6.5 mm (0.26 in)

2. Check:

- Motor base assembly continuity  
No continuity → Replace.



Motor base assembly continuity					
"a"	"b"	"c"	"d"	"e"	"f"
○ — ○					
○ — ○				○ — ○	
	○ — ○		○ — ○		
○ — ○		○ — ○			
○ — ○		○ — ○			
			○ — ○		

3. Check:

- PTT motor base assembly  
Cracked/damaged → Replace the PTT motor assembly.

**Checking the reservoir**

1. Check:

- Reservoir  
Cracked/damaged → Replace.

**Checking the filter**

1. Check:

- Filter  
Dirt/residue → Clean.  
Clogged/damaged → Replace.

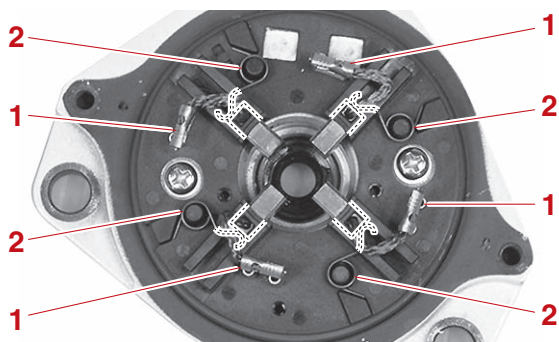
**Assembling the PTT motor**

**NOTICE**

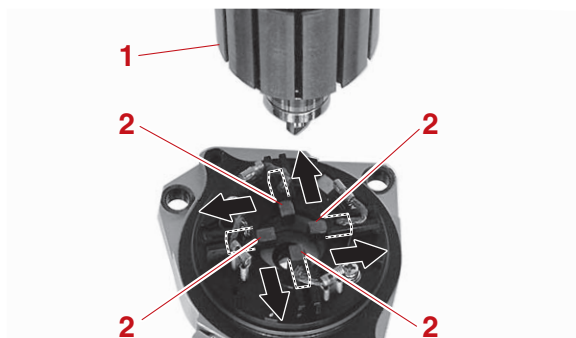
**Do not apply grease or oil to the commutator of the armature.**



1. Assemble:
  - Motor base assembly
  - Oil seal **New**
  - Washer
  - Circuit breaker "1"
  - Spring "2"



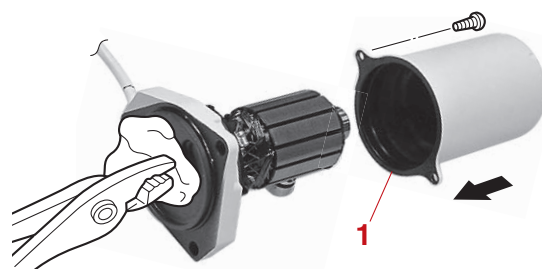
2. Install:
  - Armature "1"
    - a. Push the brushes "2" into the holders, and then install the armature "1".




3. Install:
  - O-ring **New**
  - Stator "1"

**NOTICE**


When removing or installing the armature along with the motor base assembly, secure the end of the armature shaft using a pair of pliers. Otherwise, the armature could separate from the motor base assembly due to the magnetic force of the stator and damage the brushes.



	Stator screw 3.8 N·m (0.38 kgf·m, 2.8 lb·ft)
---	---

**Installing the reservoir**

1. Install:
  - Spacer
  - Filter
  - Sheet
  - O-ring **New**
  - Reservoir
  - Reservoir cap

	Reservoir mounting bolt 15 N·m (1.5 kgf·m, 11 lb·ft)
	Reservoir cap 7 N·m (0.7 kgf·m, 5.2 lb·ft)

**Installing the PTT motor**

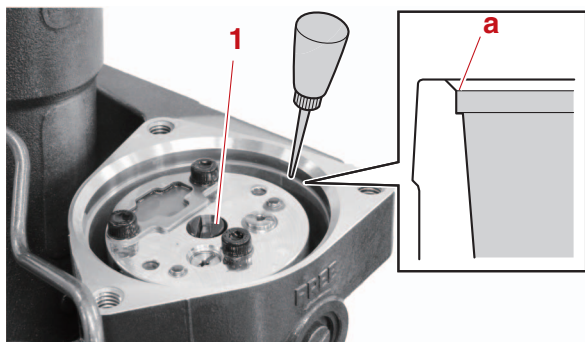
**NOTICE**

When assembling the PTT unit, do not use a rag. Otherwise, dust and particles could get on the PTT unit components, causing poor performance.

1. Install:
  - Joint
2. Fill:
  - PTT fluid
    - a. Fill the gear pump housing with the recommended fluid up to the proper level "a".



- b. Turn the joint “1” using a screwdriver to remove any air between the pump gear teeth.



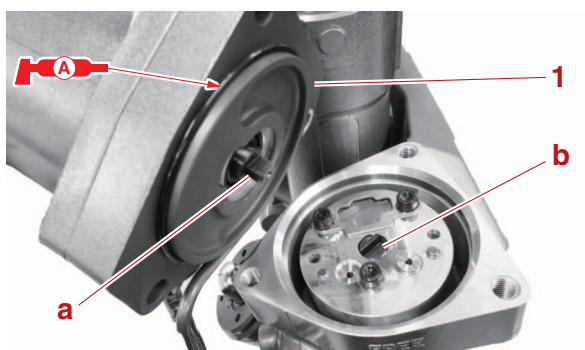
- c. Remove all of the air bubbles using a syringe or suitable tool.

3. Install:

- O-ring **New**
- PTT motor assembly “1”

**TIP:**

Align the protrusion “a” on the armature shaft with the slot “b” in the joint.



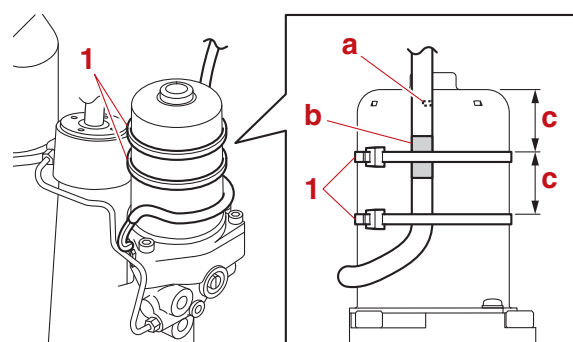
	<p>PTT motor mounting bolt 15 N·m (1.5 kgf·m, 11 lb-ft)</p>
--	---

4. Fasten:

- PTT motor lead

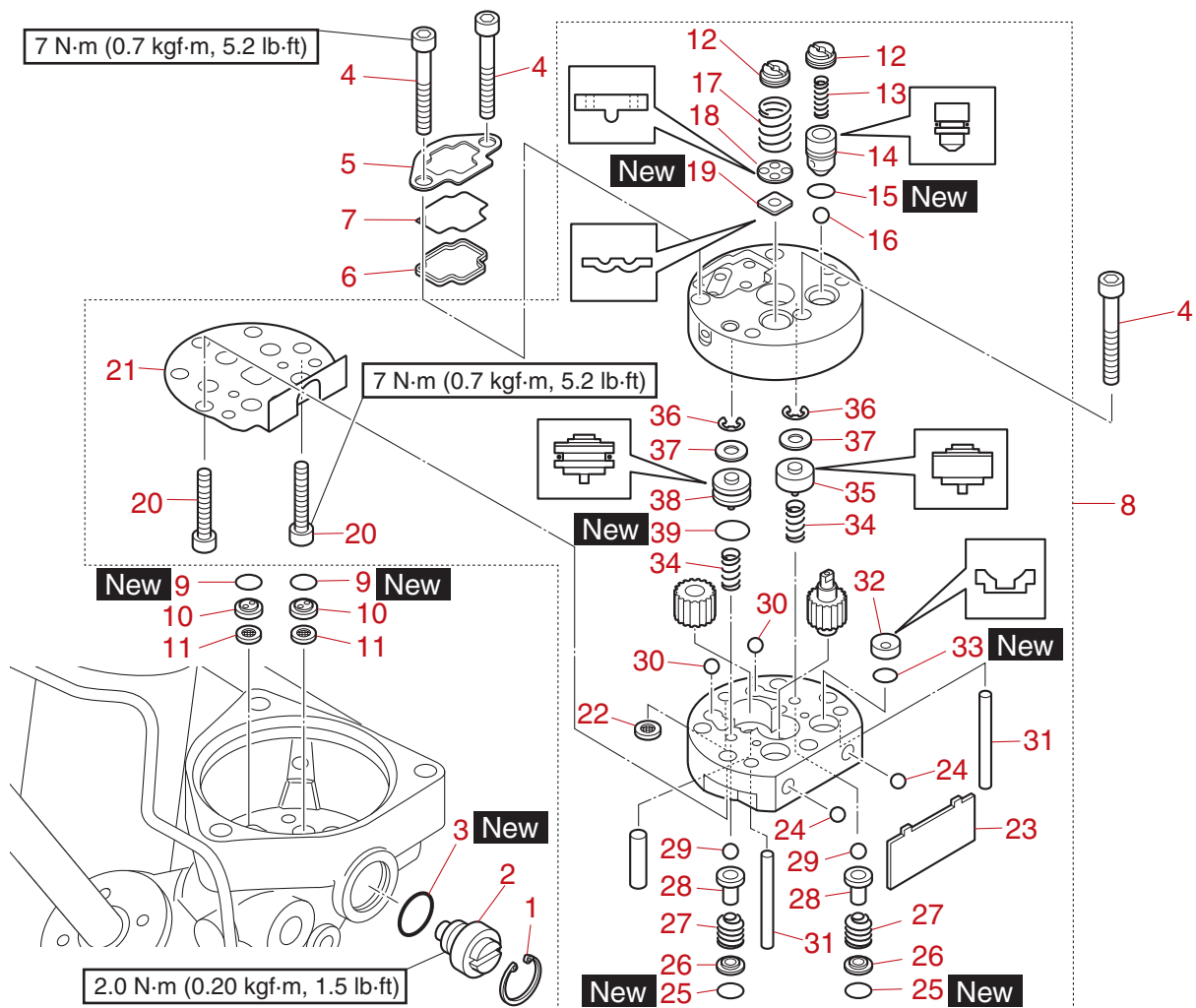
**TIP:**

- When the plastic tie securing the PTT motor lead is removed, fasten the PTT motor lead using the 2 plastic ties “1” when installing it.
- Wind the PTT motor lead toward the outside as shown, align it with the hollow position “a”, and then place it.
- Secure the upper plastic tie “1” at the gray tape position “b” of the PTT motor lead.
- Secure the gray tape position “b” using the upper plastic tie “1” so that it does not move vertically or horizontally.



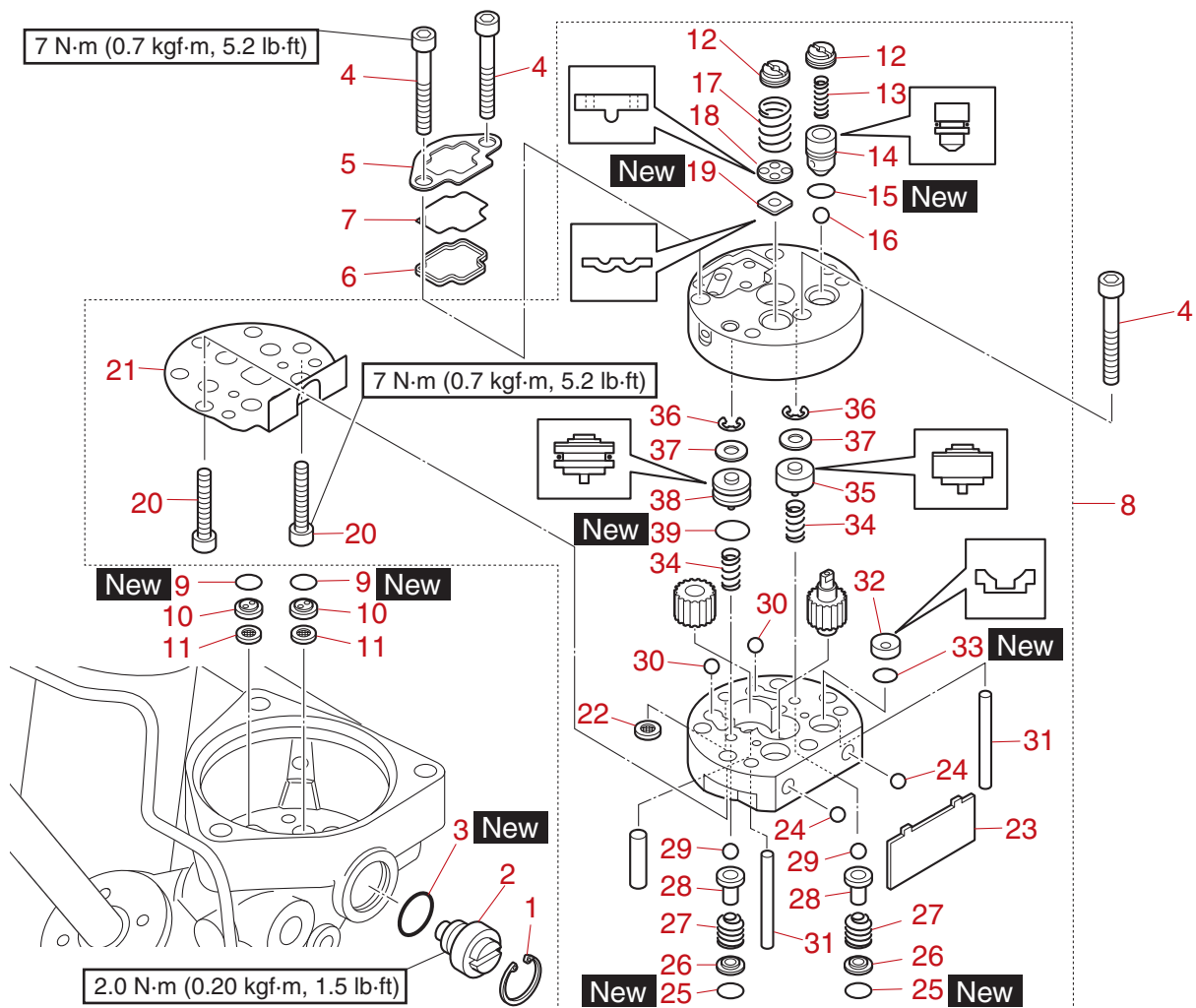
	<p>Installation height “c” 30 mm (1.18 in)</p>
--	--

# PTT gear pump



↑↓	Part name	Q'ty	Remarks
1	Circlip	1	
2	Manual valve	1	
3	O-ring	1	
4	Bolt M5 × 40 mm	3	
5	Plate	1	
6	Seal	1	
7	Filter	1	
8	Gear pump assembly	1	
9	O-ring	2	
10	Spacer	2	
11	Filter	2	
12	Valve lock screw	2	
13	Spring	1	
14	Valve support pin	1	
15	O-ring	1	
16	Ball 3.18 mm (0.13 in) (reference data)	1	
17	Spring	1	

↑↓	Part name	Q'ty	Remarks
18	Valve pin	1	
19	Valve seal	1	
20	Bolt M5 × 25 mm	2	
21	Bracket	1	
22	Filter	1	
23	Manual release plate	1	
24	Ball 3.97 mm (0.16 in) (reference data)	2	
25	O-ring	2	
26	Spacer	2	
27	Spring	2	
28	Valve pin	2	
29	Ball 3.97 mm (0.16 in) (reference data)	2	
30	Ball 4.76 mm (0.19 in) (reference data)	2	
31	Pin	2	
32	Relief valve seat	1	



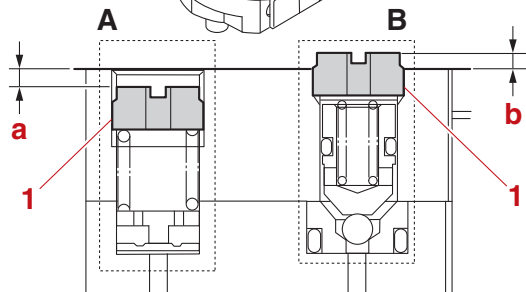
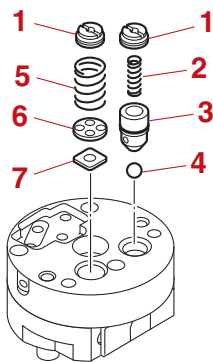
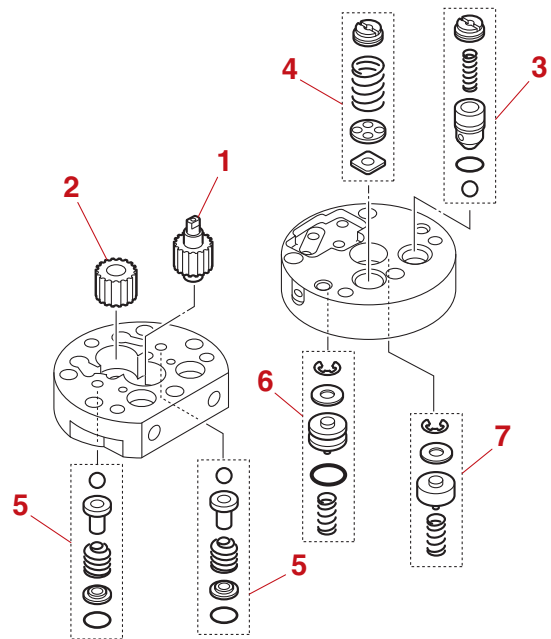
↑↓	Part name	Q'ty	Remarks
33	O-ring	1	
34	Spring	2	
35	Up-main valve	1	
36	E-clip	2	
37	Main valve seal	2	
38	Down-main valve	1	
39	O-ring	1	

## Disassembling the gear pump assembly

1. Remove:
  - Valve lock screw "1"
  - Spring "2"
  - Valve support pin "3"
  - Ball "4"
  - Spring "5"
  - Valve pin "6"
  - Valve seal "7"

### TIP:

Before removing the valve lock screws "1", measure and write down the screw depth "a" and screw height "b".



- A. Down-relief valve  
B. Up-relief valve

## Checking the gear pump

1. Check:
  - Drive gear "1"
  - Driven gear "2"
  - Damaged/worn → Replace the gear pump assembly.
  - Up-relief valve "3"
  - Down-relief valve "4"
  - Main valve "5", "6", "7"
  - Dirt/residue → Clean.

## Checking the gear pump housing

1. Check:
  - Gear pump housing
  - Corroded/cracked → Replace the gear pump assembly.

## Checking the filter

1. Check:
  - Filter
  - Dirt/residue → Clean.

## Assembling the gear pump assembly

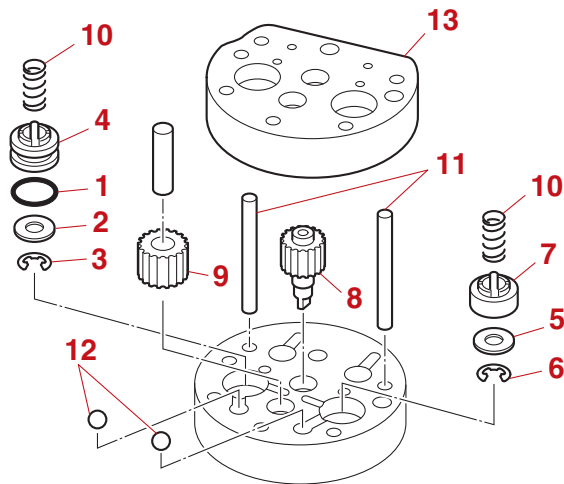
Lubricate the parts using recommended fluid during assembly.

### NOTICE

When assembling the PTT unit, do not use a rag. Otherwise, dust and particles could get on the PTT unit components, causing poor performance.

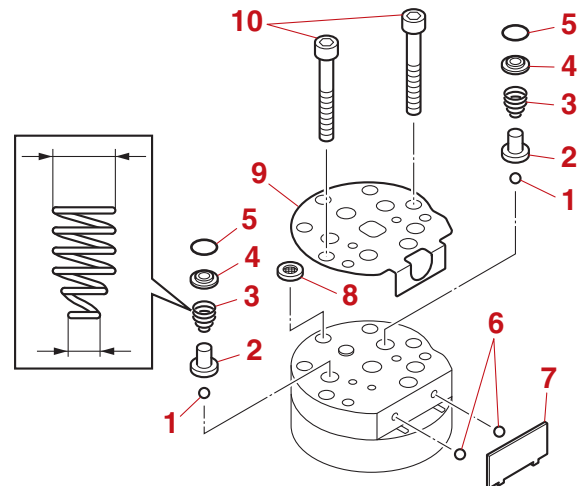
1. Install:

- O-ring "1" **New** (to down-main valve "4")
- Main valve seal "2" (to down-main valve "4")
- E-clip "3" (to down-main valve "4")
- Down-main valve "4"
- Main valve seal "5" (to up-main valve "7")
- E-clip "6" (to up-main valve "7")
- Up-main valve "7"
- Drive gear "8"
- Driven gear "9"
- Spring "10"
- Pin "11"
- Ball "12"
- Gear housing "13"



2. Install:

- Ball "1"
- Valve pin "2"
- Spring "3"
- Spacer "4"
- O-ring "5" **New**
- Ball "6"
- Manual release plate "7"
- Filter "8"
- Bracket "9"
- Pump bracket bolt "10" (temporarily tighten)




3. Check:

- Gear pump movement  
Not smooth → Repeat from step (1).

4. Tighten:

- Pump bracket bolt

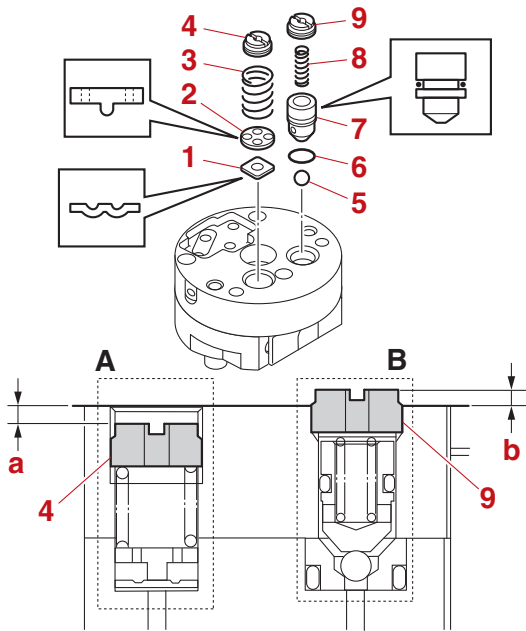
	<p>Pump bracket bolt 7 N·m (0.7 kgf·m, 5.2 lb·ft)</p>
---	---

5. Install:

- Valve seal "1" **New**
- Valve pin "2"
- Spring "3"
- Valve lock screw "4"
- Ball "5"
- O-ring "6" **New** (to valve support pin "7")
- Valve support pin "7"
- Spring "8"
- Valve lock screw "9"

**TIP:** \_\_\_\_\_

- Install the valve lock screw “4” and valve lock screw “9” to the depth “a” and height “b” that were measured before removing them.
- When installing new parts, install them according to the preceding reference data.

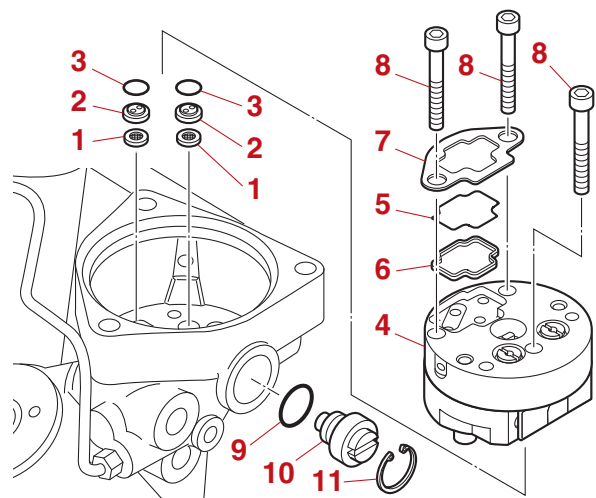


A. Down-relief valve  
B. Up-relief valve

	Installation depth “a” (reference data)
	1.46–2.90 mm (0.0575–0.1142 in)
	Installation height “b” (reference data)
	1.24–1.55 mm (0.0488–0.0610 in)

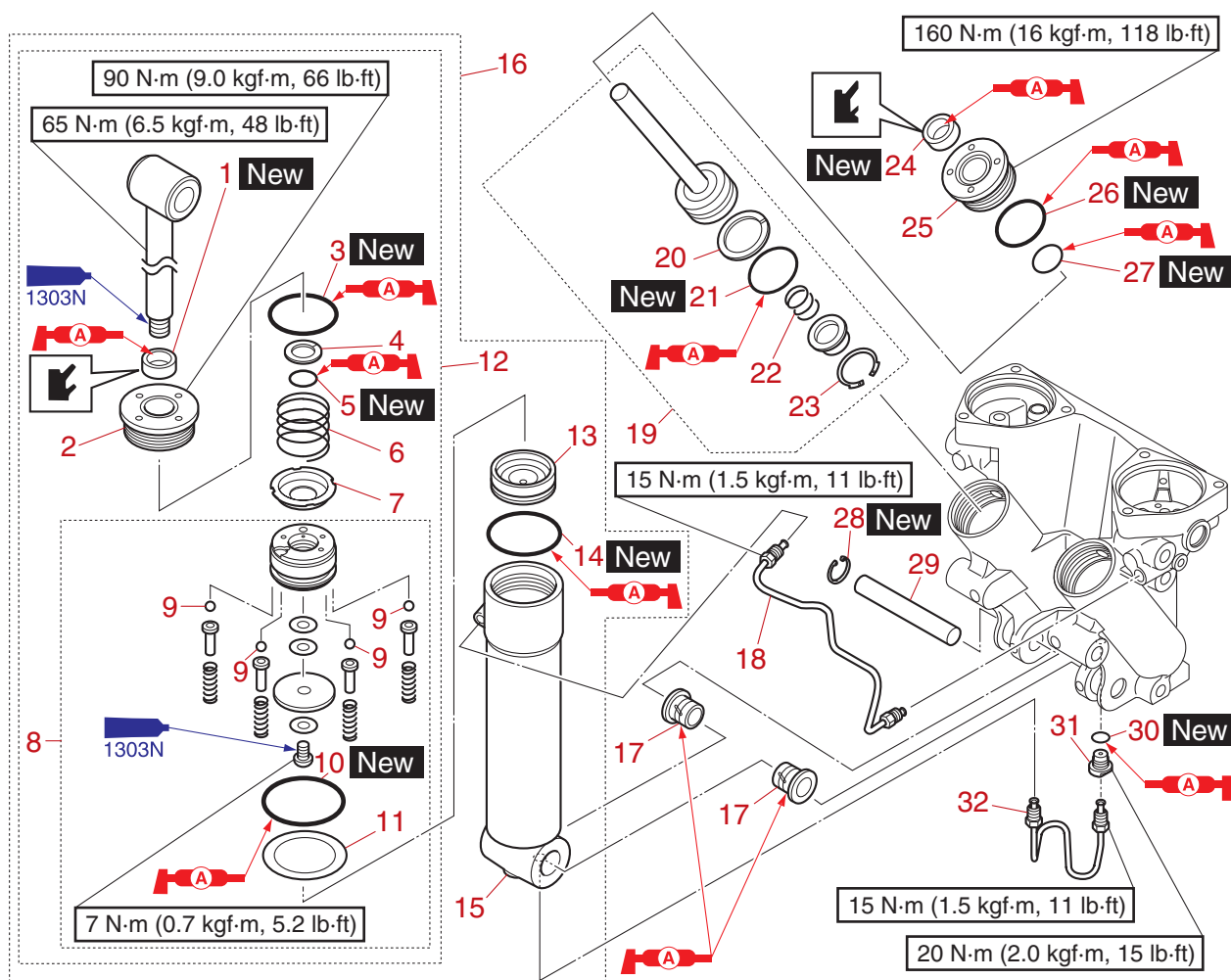
**Installing the gear pump assembly**

1. Install:
  - Filter “1”
  - Spacer “2”
  - O-ring “3” **New**
  - Gear pump assembly “4”
  - Filter “5” (to the seal “6”)
  - Seal “6”
  - Plate “7”
  - Gear pump bolt “8”
  - O-ring “9” **New**
  - Manual valve “10”
  - Circlip “11”



	Gear pump bolt “8”
	7 N·m (0.7 kgf·m, 5.2 lb·ft)
	Manual valve “10”
	2.0 N·m (0.20 kgf·m, 1.5 lb·ft)

PTT cylinder



↑↓	Part name	Q'ty	Remarks
1	Dust seal	1	
2	Tilt cylinder end screw	1	
3	O-ring	1	
4	Backup ring	1	
5	O-ring	1	
6	Spring	1	
7	Adapter	1	
8	Tilt piston assembly	1	
9	Ball 3.97 mm (0.16 in) (reference data)	4	
10	O-ring	1	
11	Backup ring	1	
12	Tilt ram assembly	1	
13	Free piston	1	
14	O-ring	1	
15	Tilt cylinder	1	
16	Tilt cylinder assembly	1	
17	Bushing	2	

↑↓	Part name	Q'ty	Remarks
18	Pipe	1	
19	Tilt ram assembly	2	
20	Backup ring	2	
21	O-ring	2	
22	Spring	2	
23	Circlip	2	
24	Dust seal	2	
25	Trim cylinder end screw	2	
26	O-ring	2	
27	O-ring	2	
28	Circlip	1	
29	Shaft	1	
30	O-ring	1	
31	Pipe joint adapter	1	
32	Pipe	1	

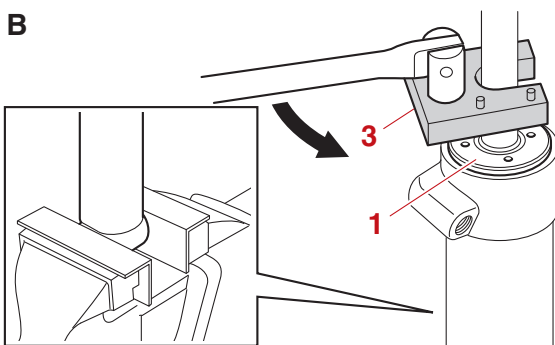
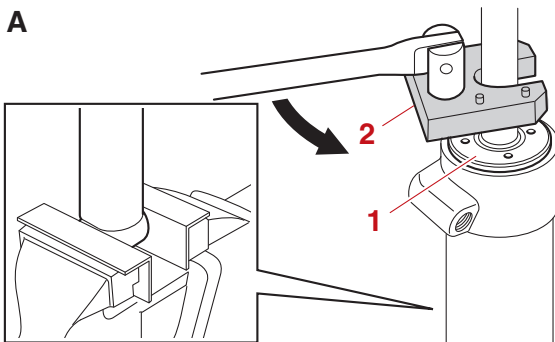


## Removing the tilt ram


### **⚠ WARNING**

Before removing the tilt cylinder end screw, make sure that the PTT rams are fully extended. Otherwise, fluid could be expelled forcefully from the PTT unit due to internal pressure.

1. Remove:
  - Pipe
  - Pipe joint adapter
  - Circlip
  - Shaft
  - Tilt cylinder assembly
2. Loosen:
  - Tilt cylinder end screw "1"



- A. Worldwide  
B. USA and Canada

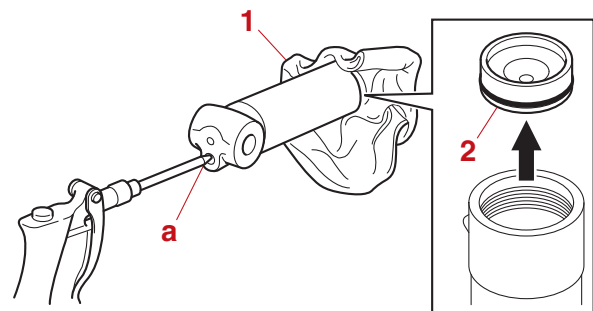
	Cylinder end screw wrench "2" 90890-06591
	Trim cylinder wrench "3" YB-06175-2B

3. Drain:
  - PTT fluid

4. Remove:
  - Free piston
    - a. Cover the tilt cylinder using a rag "1", and then blow compressed air through the hole "a" to remove the free piston "2".

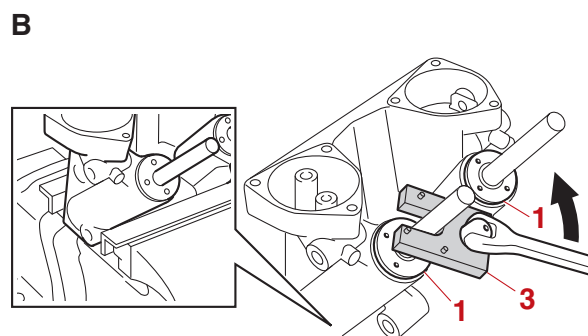
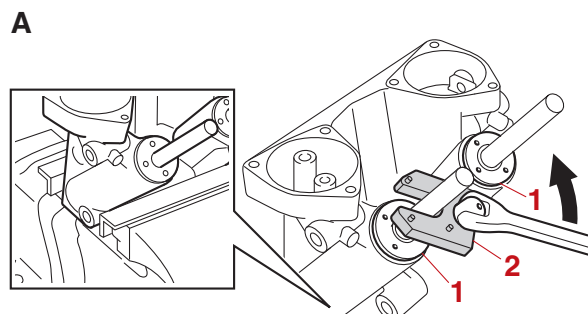
### **⚠ WARNING**

When removing the free piston, never look into the tilt cylinder opening because the free piston and PTT fluid could be expelled forcefully.

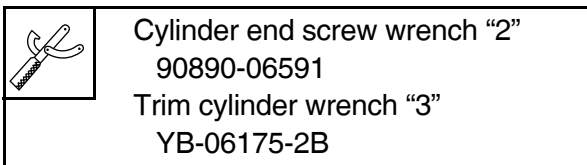


## Removing the trim ram

1. Loosen:
  - Tilt cylinder end screw "1"



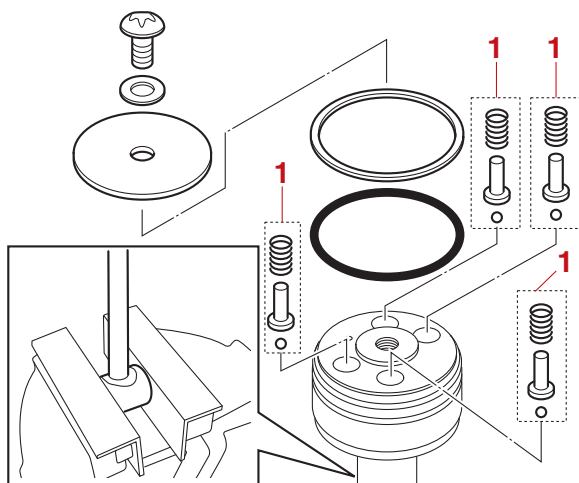
- A. Worldwide  
B. USA and Canada



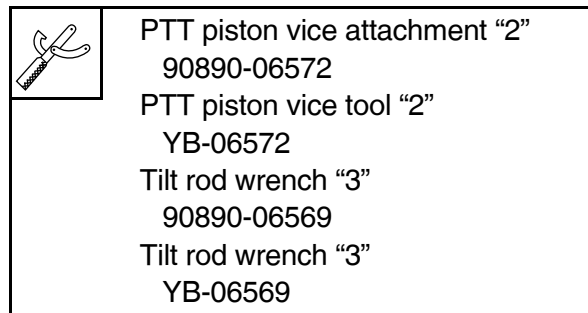
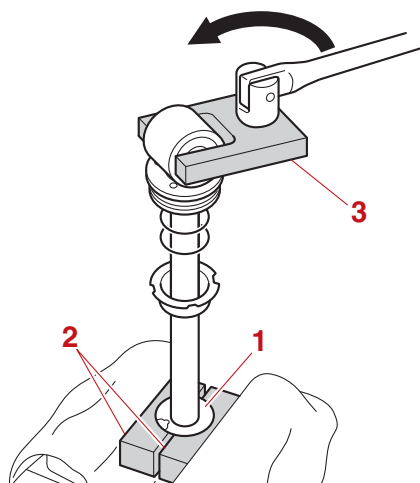
2. Drain:
  - PTT fluid

### Disassembling the tilt ram

1. Remove:
  - Tilt piston absorber valve "1"



2. Remove:
  - Tilt piston "1"



### Checking the tilt cylinder and trim cylinder

1. Check:
  - PTT body
  - Tilt cylinder
  - Corroded/cracked → Replace.
2. Check:
  - Inner surface of the PTT body
  - Inner surface of the tilt cylinder
  - Scratched → Replace.
3. Check:
  - Outer surfaces of the tilt piston
  - Outer surfaces of the trim piston
  - Outer surfaces of the free piston
  - Scratched → Replace.
4. Check:
  - Backup ring
  - Damaged/worn → Replace.
5. Check:
  - Trim ram
  - Tilt ram
  - Rust → Clean using 400–600-grit sandpaper.
  - Bent/corroded → Replace.
6. Check:
  - Pipe
  - Corroded/cracked → Replace.

### Checking the absorber valve

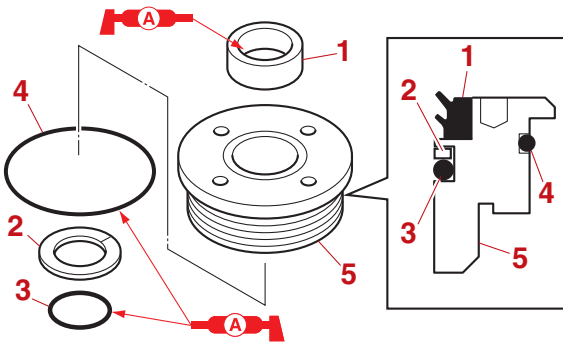
1. Check:
  - Tilt piston absorber valve
  - Dirt/residue → Clean.

## Assembling the tilt ram

### NOTICE

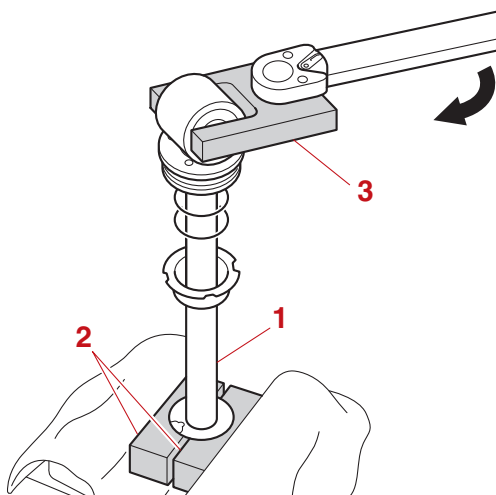
When assembling the PTT unit, do not use a rag. Otherwise, dust and particles could get on the PTT unit components, causing poor performance.

1. Install:
  - Dust seal "1" **New** (to tilt cylinder end screw "5")
  - Backup ring "2" (to tilt cylinder end screw "5")
  - O-ring "3", "4" **New** (to tilt cylinder end screw "5")
  - Tilt cylinder end screw "5"



2. Install:
  - Tilt cylinder end screw
  - Spring
  - Adapter
  - Tilt piston

3. Tighten:
  - Tilt ram "1"



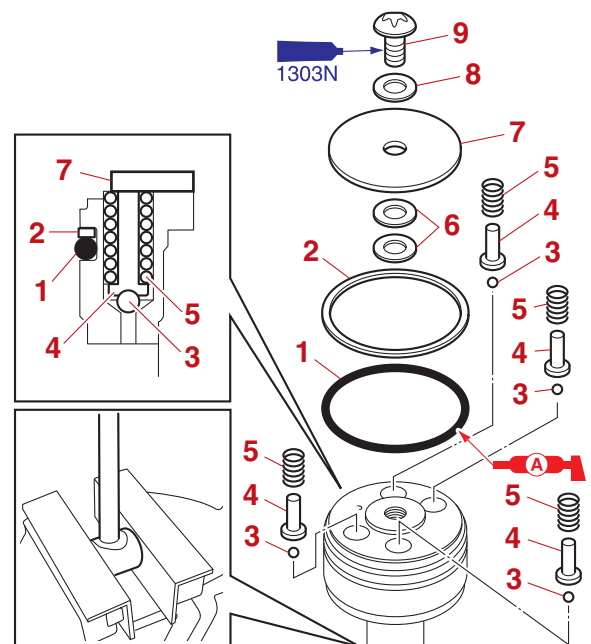
	PTT piston vice attachment "2"
	90890-06572
	PTT piston vice tool "2"
	YB-06572
	Tilt rod wrench "3"
90890-06569	
Tilt rod wrench "3"	
YB-06569	

	Tilt ram "1"
	65 N·m (6.5 kgf·m, 48 lb·ft)

4. Install:
  - O-ring "1" **New**
  - Backup ring "2"
  - Ball "3"
  - Absorber valve pin "4"
  - Spring "5"
  - Washer "6"
  - Plate "7"
  - Washer "8"
  - Tilt piston screw "9"

### TIP:

Washer(s) of "6" may not be installed.



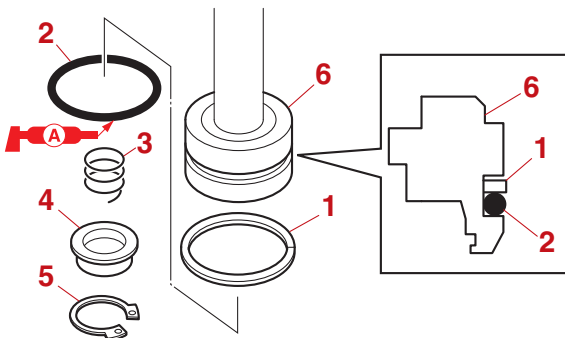
	Tilt piston screw "9"
	7 N·m (0.7 kgf·m, 5.2 lb·ft)

## Assembling the trim ram

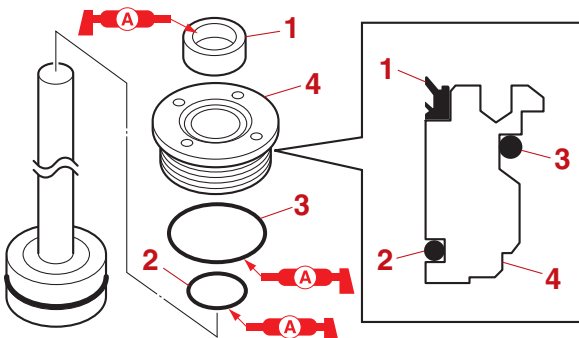
### NOTICE

When assembling the PTT unit, do not use a rag. Otherwise, dust and particles could get on the PTT unit components, causing poor performance.

1. Install:
  - Backup ring "1" (to piston "6")
  - O-ring "2" **New** (to piston "6")
  - Spring "3" (to piston "6")
  - Adapter "4" (to piston "6")
  - Circlip "5" (to piston "6")
  - Piston "6"



2. Install:
  - Dust seal "1" **New** (to trim cylinder end screw "4")
  - O-ring "2" **New** (to trim cylinder end screw "4")
  - O-ring "3" **New** (to trim cylinder end screw "4")
  - Trim cylinder end screw "4"

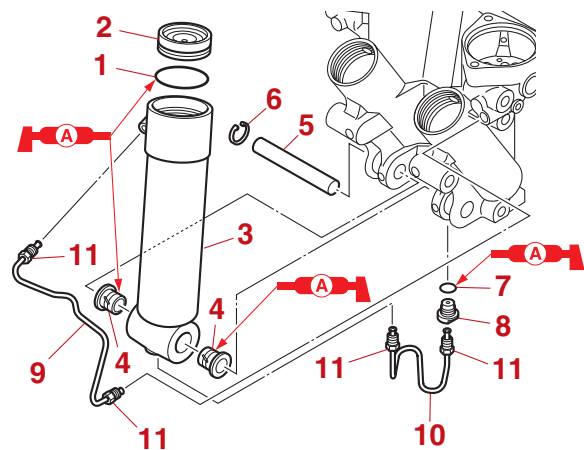



## Installing the tilt cylinder

### NOTICE

When assembling the PTT unit, do not use a rag. Otherwise, dust and particles could get on the PTT unit components, causing poor performance.

1. Install:
  - O-ring "1" **New**
  - Free piston "2"
  - Tilt cylinder "3"
  - Bushing "4"
  - Shaft "5"
  - Circlip "6" **New**
  - O-ring "7" **New**
  - Pipe joint adapter "8"
  - Pipe "9", "10"
  - Pipe joint "11"



	Pipe joint adapter "8" 20 N·m (2.0 kgf·m, 15 lb·ft)
	Pipe joint "11" 15 N·m (1.5 kgf·m, 11 lb·ft)

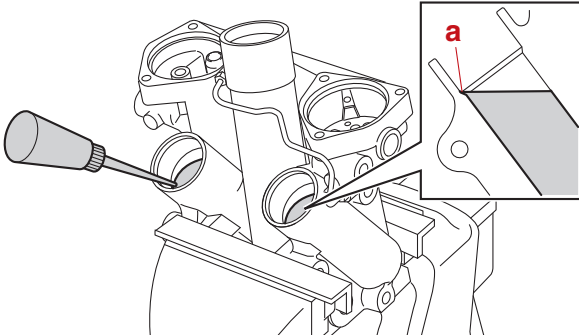
## Installing the trim ram

### NOTICE

When assembling the PTT unit, do not use a rag. Otherwise, dust and particles could get on the PTT unit components, causing poor performance.

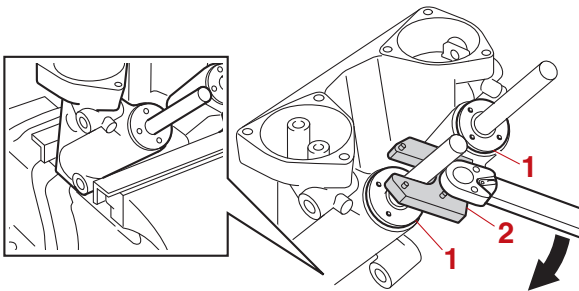
1. Fill:
  - PTT fluid

**TIP:** \_\_\_\_\_  
 Fill the trim cylinders with the recommended fluid up to the proper level “a”.

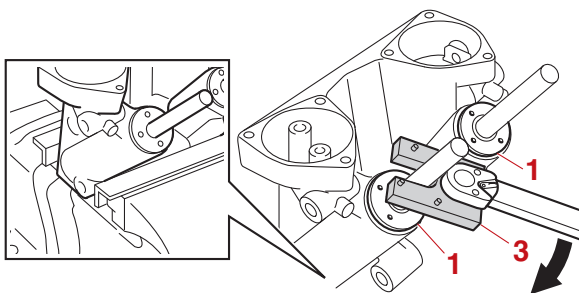


2. Install:
- Trim ram assembly
  - Trim cylinder end screw “1”

**A**



**B**



A. Worldwide  
 B. USA and Canada

	Cylinder end screw wrench “2” 90890-06591
	Trim cylinder wrench “3” YB-06175-2B

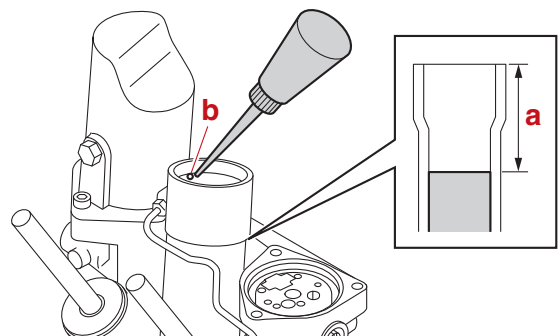
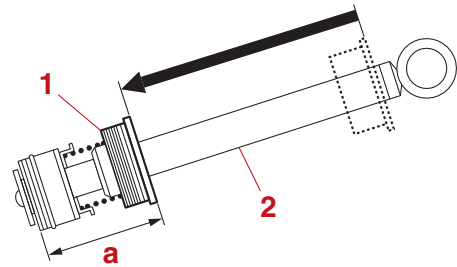
	Trim cylinder end screw “1” 160 N·m (16 kgf·m, 118 lb·ft)
--	--

### Installing the tilt ram

**NOTICE** \_\_\_\_\_

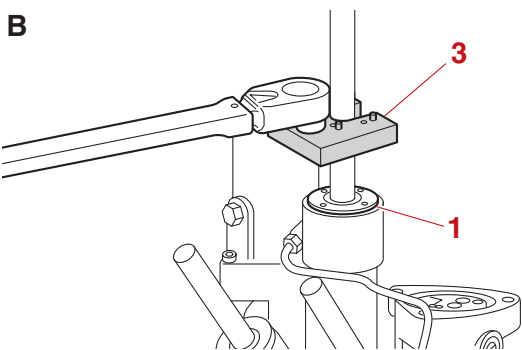
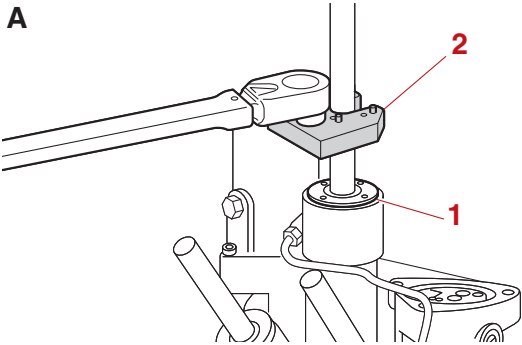
When assembling the PTT unit, do not use a rag. Otherwise, dust and particles could get on the PTT unit components, causing poor performance.

1. Install:
  - Gear pump assembly  
See “Assembling the gear pump assembly” (9-43).
2. Install:
  - Reservoir  
See “Installing the reservoir” (9-39).
    - a. Place the tilt cylinder end screw “1” at the bottom of the tilt ram “2”.
    - b. Fill the tilt cylinder and PTT body with the recommended fluid up to the proper level “a”.
    - c. Add a small amount of the recommended fluid through the PTT body hole “b”.





3. Install:

- Tilt ram assembly
- Tilt cylinder end screw "1"



- A. Worldwide
- B. USA and Canada

	Cylinder end screw wrench "2" 90890-06591
	Trim cylinder wrench "3" YB-06175-2B

	Tilt cylinder end screw "1" 90 N·m (9.0 kgf·m, 66 lb·ft)
---	---

4. Install:

- PTT motor  
See "Installing the PTT motor" (9-39).

---

## Maintenance

<b>Outline</b> .....	<b>10-1</b>
Maintenance interval chart 1 .....	10-1
Maintenance interval chart 2 .....	10-3
<b>Predelivery check</b> .....	<b>10-4</b>
Checking the engine oil level.....	10-7
Checking the battery .....	10-7
Checking the cooling water pilot hole .....	10-8
Checking the gear oil level .....	10-8
Checking the power trim and tilt unit .....	10-9
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Checking the cooling water inlet.....	10-13
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## Outline

- To obtain long product life, Yamaha strongly recommends that the specified periodic checks and maintenance be performed according to the maintenance interval charts.
- 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 interval charts 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 3000–4000 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 is based on 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 1

The “●” symbol indicates the check-ups which the owners or operators may carry out themselves.  
The “○” symbol indicates work to be carried out by a Yamaha dealer.

Item	Actions	Initial	Every		
		20 hours (3 months)	100 hours (1 year)	300 hours (3 years)	500 hours (5 years)
Anode(s) (external)	Inspection or replacement as necessary		●/○		
Anode(s) (internal) *1	Inspection or replacement as necessary		○		
Anode(s) (internal) *2	Replacement				○
Battery (electrolyte level, terminal)	Inspection	●/○	●/○		
Battery (electrolyte level, terminal)	Fill, charging or replacing as necessary		○		
Cooling water leakage	Inspection or replacement as necessary	○	○		
Cowling lock lever	Inspection		●/○		
Engine starting condition/noise	Inspection	●/○	●/○		
Engine idle speed/noise	Inspection	●/○	●/○		

Outline

Item	Actions	Initial	Every		
		20 hours (3 months)	100 hours (1 year)	300 hours (3 years)	500 hours (5 years)
Engine oil	Replacement	●/○	●/○		
Engine oil filter (cartridge)	Replacement		●/○		
Fuel filter (can be disassembled)	Inspection or replacement as necessary	●/○	●/○		
Fuel line (High pressure)	Inspection	●	●		
Fuel line (High pressure)	Inspection or replacement as necessary	○	○		
Fuel line (Low pressure)	Inspection	●	●		
Fuel line (Low pressure)	Inspection or replacement as necessary	○	○		
Fuel pump	Inspection or replacement as necessary			○	
Fuel/engine oil leakage	Inspection	○	○		
Gear oil	Replacement	●/○	●/○		
Greasing points	Greasing	●/○	●/○		
Clamp bracket bolt (through tube)	Inspection and greasing		○		
Impeller/water pump housing	Inspection or replacement as necessary		○		
Impeller/water pump housing	Replacement			○	
OCV (Oil Control Valve) filter	Replacement				○
Power trim and tilt unit	Inspection	●/○	●/○		
Propeller/propeller nut/cotter pin	Inspection or replacement as necessary	●/○	●/○		
Spark plug(s)	Inspection or replacement as necessary		●/○		
Ignition coils/ignition coil leads	Inspection or replacement as necessary	○	○		
Shift Dampener System (SDS) propeller damper	Inspection or replacement		○		
Water from the cooling water pilot hole	Inspection	●/○	●/○		

## Outline

Item	Actions	Initial	Every			
		20 hours (3 months)	100 hours (1 year)	300 hours (3 years)	500 hours (5 years)	
Thermostat	Inspection or replacement as necessary		○			
Timing belt	Inspection or replacement as necessary		○			
Valve clearance	Inspection and adjustment				○	
Cooling water inlet	Inspection	●/○	●/○			
Main switch/stop switch	Inspection or replacement as necessary	○	○			
Wire harness connections/wire coupler connections	Inspection or replacement as necessary	○	○			
Connector connections/lead connections	Inspection or replacement as necessary	○	○			
(Yamaha) Meter/gauge	Inspection	○	○			
SBW (Steer-by-wire)	Inspection or replacement as necessary	○	○	○	○	

\*1 cylinder head exhaust passage

\*2 cylinder head, cylinder block, cylinder block thermostat portion, oil cooler cover, exhaust guide

### Maintenance interval chart 2

Item	Actions	Every
		1000 hours
Exhaust guide/exhaust manifold	Inspection or replacement as necessary	○
Timing belt	Replacement	○
SBW (Steer-by-wire)	Inspection or replacement as necessary	○

## Predelivery check

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

Item	Procedures	See
Engine oil level	Check the oil level using the dipstick. Oil is not at the proper level → Add or extract engine oil.	10-7
Battery	Check the battery electrolyte level. Below the minimum level mark → Add distilled water.	10-7
	Check the specific gravity of the electrolyte. Below specification → Fully charge the battery.	
Cooling water pilot hole	Start the engine.	—
	Check that the cooling water is discharged from the cooling water pilot hole. Not discharged → Check the cooling passage for clog.	10-8 2-26
Communication between the engine and the Digital Electronic Control	Check that the Digital Electronic Control-active indicator light comes on in blue. Light does not come on in blue → Check the wire harness for proper connections, the main wire harness (16 pins) for continuity, and the Digital Electronic Control circuit.	5-49
Engine start switch (Single application)	Check that the engine starts when the engine start switch is turned to START. Out of specification → Check the engine start switch.	5-42
	Check that the engine stops when the engine start switch is turned to OFF. Out of specification → Check the engine start switch.	5-42
Main switch Engine start/stop button	Turn the main switch to ON, and then push the engine start/stop button. Check that the engine starts. Out of specification → Check the main switch or engine start/stop button.	5-43
	Start the engine. Check that the engine stops when the main switch is turned to OFF. Out of specification → Check the main switch.	5-43
	Start the engine. Check that the engine stops when the engine start/stop button is pushed. Out of specification → Check the engine start/stop button.	5-43
Engine shut-off switch	Check that the engine stops when the clip is removed from the engine shut-off switch. Out of specification → Check the engine shut-off switch.	5-41
Fuel line	Check the fuel line connection. Disconnect → Connect.	2-21
	Check all the fuel lines for leakage. Leaking → Check the related parts.	
Gear oil	Check the gear oil level. Below the proper level → Add the recommended gear oil.	10-8

**Predelivery check**

Item	Procedures	See
Shift and throttle operation	Check that the gear shift operates properly when the remote control lever is moved from the N position to the F or R position. Not properly → Check the shift actuator and related parts.	8-10 8-15 8-47 9-1
	Check that the throttle operates properly when the remote control lever is moved from the F or R position to the fully open position. Not properly → Check the ETV and/or LPS.	6-14
Outboard motor mounting height	Check the outboard motor mounting height. Improper → Adjust.	10-9
PTT unit	Check the PTT unit operation. Not smooth → Check the PTT fluid level and PTT motor electric current when the relief valve operate.	10-20
	Check that there is no abnormal noise produced when the outboard motor is tilted up or down. Abnormal noise → Overhaul PTT unit.	9-27 9-36 9-41 9-46
	Steer the tilted-up outboard motor. Interference → Check the hose and wire harness routing, or mounting of the outboard motor.	3-8 5-1 1-1
Steering system	Check that the steering operates smoothly. Not smooth → Check the steering arm, swivel bracket, steering actuator, helm unit or related parts.	9-17 9-24
	Check that there is no interference with hose or leads when the outboard motor is steered. Interference → Check the hose and wire harness routing.	3-8 5-1
Test run	Start the engine, and then check that the gear shift operates properly.	—
	Warm up the engine, and then check the engine idle speed. Out of specification → Perform the troubleshooting procedures.	10-13 4-21
	Operate the boat at trolling speed.	—
	Operate the outboard motor according to the break-in procedure.	—
	Check that the outboard motor does not tilt up when reverse operation. Tilt up → Check the PTT unit.	9-27

**Predelivery check**

Item	Procedures	See
Break-in	Operate the engine under load (in gear with a propeller installed) for 10 hours.	—
	For the first hour of operation: Operate the engine at varying speeds up to 2000 r/min or approximately 1/2 throttle.	—
	For the second hour of operation: Increase the engine speed until the boat is on plane (but do not fully open the throttle), and then back off on the throttle while keeping the boat at a planing speed.	—
	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.	—
	After the first 10 hours of operation: Operate the engine normally.	—
After test run	Check for water in the gear oil. Oil is milky → Check the lower case for airtightness and oil seal.	8-6
	Check all the fuel lines for leakage. Leaking → Check the connection or replace affected parts.	2-21
	Flush the cooling water passages using fresh water. When using the equipped flashing device, flush the cooling water passages without starting the engine.	—

## Checking the engine oil level

### NOTICE

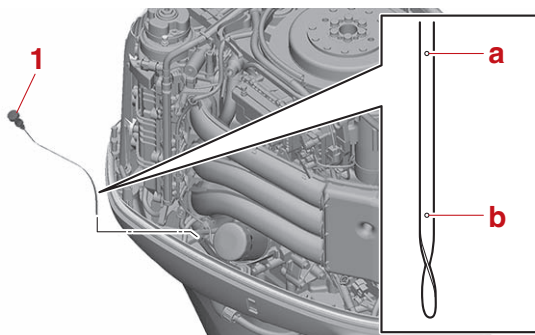
Make sure that the engine is filled with engine oil before operating the outboard motor for the first time. Otherwise, the engine could be damaged severely.

1. Check:
  - Engine oil level  
Not at the proper level → Add or extract the engine oil.
    - a. 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 correct.

- b. Start the engine and warm it up for 5–10 minutes.
- c. Stop the engine and leave it off for 5–10 minutes.
- d. Remove the top cowling.
- e. Remove the dipstick “1” and wipe it clean.
- f. Insert the dipstick “1” completely for a correct measurement and remove it again.
- g. Check that the oil level indicated on the dipstick “1” is between the upper mark “a” and the lower mark “b”. If the engine oil is not at the proper level, add or extract engine oil.



## Checking the battery

### 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):

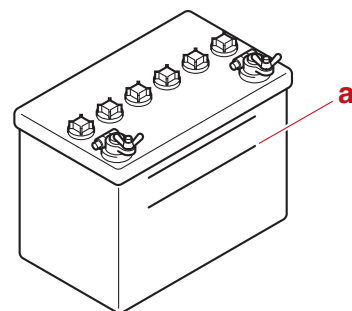
- Drink large quantities of water or milk followed with milk of magnesia, beaten egg, or vegetable oil. Get immediate medical attention.

Batteries generate 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:
  - Battery electrolyte level  
Below the minimum level mark “a” → Add distilled water until the level is between the maximum and minimum level marks.





2. Check:
  - Specific gravity of the electrolyte  
Below specification → Fully charge the battery.

**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 disconnect the positive battery cable.



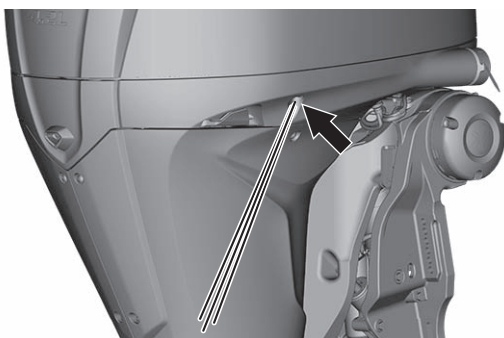
Recommended battery capacity

Battery rating

- 680–1150 A (CCA/SAE)
- 770–1370 A (MCA/ABYC)
- 160 minutes (RC/SAE)
- 640–1080 A (CCA/EN)
- 80 Ah (20 HR/IEC)

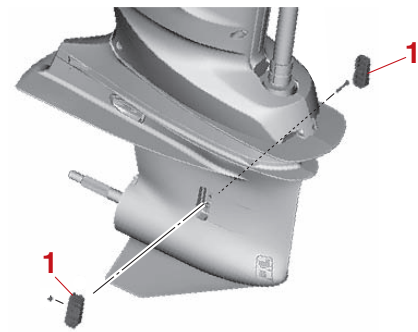
**Checking the cooling water pilot hole**

1. Place the lower unit in water, and then start the engine.
2. Check:
  - Cooling water is discharged from the cooling water pilot hole.  
Not discharged → Check the cooling passages for clog.



**Checking the gear oil level**

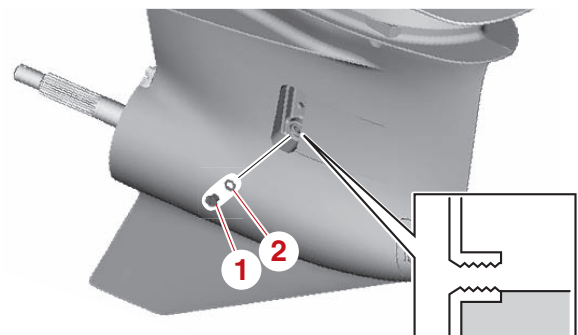
1. Remove:
  - Water inlet cover “1”



2. Check:
  - Gear oil level  
Below the proper level → Add the recommended gear oil.
    - a. Place the outboard motor in an upright position.
    - b. Remove the oil level plug “1”, and O-ring “2”, and then check the gear oil level.

**TIP:** \_\_\_\_\_

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



3. Install:
  - O-ring **New**
  - Oil level plug
  - Water inlet cover

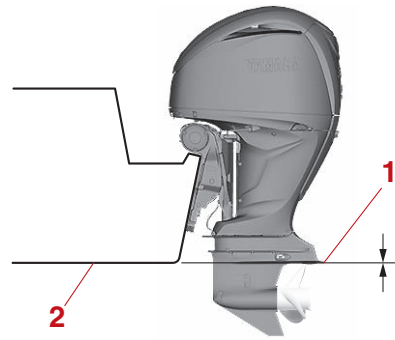


- Oil level plug  
7 N·m (0.7 kgf·m, 5.2 lb·ft)
- Water inlet cover screw  
2.0 N·m (0.20 kgf·m, 1.5 lb·ft)

## Checking the power trim and tilt unit

1. Check:

- Power trim and tilt unit  
Abnormal noise → Check the PTT unit.  
Interference → Check the hose and wire harness routing, or mounting of the outboard motor.  
Does not display → Adjust the manual valve. See “Bleeding the PTT unit” (9-31).
- a. Check that there is no abnormal noise produced when the outboard motor is tilted up or down.
- b. Check that there is no interference with cables, hoses, leads, or the boat when the tilted-up outboard motor is steered.
- c. Check that the trim meter, on the boat’s gauge, displays full down when the outboard motor is in the full-down position.



2. Check:

- Mount bolt  
Loosen → Tighten.

## Checking the outboard motor mounting height

1. Check:

- Outboard motor mounting height  
Improper → Adjust.
- a. Check that the anti-cavitation plate “1” is aligned with the bottom of the boat “2”.

**TIP:** \_\_\_\_\_

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

**General periodic maintenance**

Item	Procedures	See
Anodes	Check the anodes. Eroded (1/2 or more worn out) → Replace. Adhered grease, oil, paint, or scales → Clean.	7-62 7-57 7-87 8-5 9-25
Battery	Check the battery electrolyte level. Below the minimum level mark → Add distilled water.	10-7
	Check the specific gravity of the electrolyte. Below specification → Fully charge the battery.	
Cooling water inlet	Check the cooling water inlet. Clogged → Clean.	2-26
Cooling water pilot hole	Start the engine.	—
	Check that the cooling water is discharged from the cooling water pilot hole. Not discharged → Check the cooling system.	2-26
Engine idle speed	Check the engine idle speed.	10-13
Engine oil	Check the oil level using the dipstick. Not at the proper level → Add or extract the engine oil.	10-7
	Check the engine oil. Replacement interval has been exceeded/deterioration → Change. Milky → Overhaul the outboard motor.	10-13 10-14
Oil filter	Replace the oil filter.	10-16
Engine start switch (Single application)	Check that the engine starts when the engine start switch is turned to START. Out of specification → Check the engine start switch.	5-42
	Check that the engine stops when the engine start switch is turned to OFF. Out of specification → Check the engine start switch.	5-42
Main switch Engine start/stop button	Turn the main switch to ON, and then push the engine start/stop button. Check that the engine starts. Out of specification → Check the main switch or engine start/stop button.	5-43
	Start the engine. Check that the engine stops when the main switch is turned to OFF. Out of specification → Check the main switch.	5-42
	Start the engine. Check that the engine stops when the engine start/stop button is pushed. Out of specification → Check the engine start/stop button.	5-43
Engine shut-off switch	Check that the engine stops when the clip is removed from the engine shut-off switch. Out of specification → Check the engine shut-off switch.	5-41

## General periodic maintenance

Item	Procedures	See
Exhaust guide Exhaust manifold	Check the exhaust joint and exhaust guide. Corroded/cracked/damaged → Replace.	9-15
Fuel filter	Check the fuel filter element. Dirt/residue → Replace. Water accumulated → Drain.	6-7
	Checking the fuel cup assembly. Foreign material → Clean. Cracked → Replace.	
	Checking the fuel inlet or fuel outlet holding pressure. Out of specification → Replace the O-ring, fuel cup assembly, or fuel filter assembly.	
Fuel pump	Check the operation of the fuel pump using the YDIS “Stationary test” and check the operating sound. Abnormal sound → Check the fuel pump internal parts.	5-31
Fuel leakage	Check the fuel line. Leaking → Check the related parts.	2-21
Engine oil leakage	Check the engine oil line. Leaking → Check the related parts.	2-24
Gear oil	Check the gear oil level. Below the proper level → Add the recommended gear oil.	10-8
	Check the gear oil. Replacement interval has been exceeded/deterioration → Change. Milky → Overhaul the lower unit.	10-17 8-4
OCV filter	Replace the OCV gasket.	7-49
Greasing	Apply lubricants.	10-19
Propeller Propeller nut Cotter pin	Check the propeller blade and damper rubber spline. Cracked/damaged/worn → Replace.	8-2
	Check the installed condition of propeller nut and cotter pin. Improperly installed → Reinstall.	8-1
PTT fluid level	Check that a small amount of fluid flows out of the filler hole. Below the proper level → Add the recommended fluid.	10-20
PTT unit operation	Check the PTT unit operation. PTT operation is not smoothly → Check the PTT fluid level.	10-20
	Check the tilt stop lever. Tilt stop lever locks in place not properly → Check the related parts.	10-20 9-24
	Check the PTT fluid leakage. Leaking → Check the related parts.	10-20 9-36 9-46

## General periodic maintenance

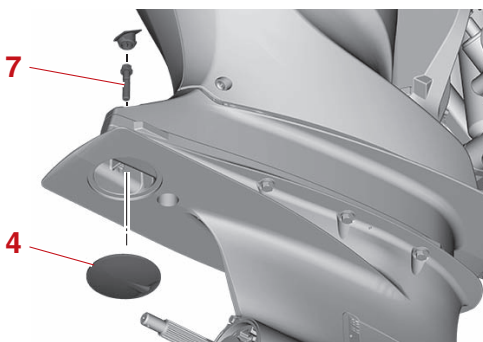
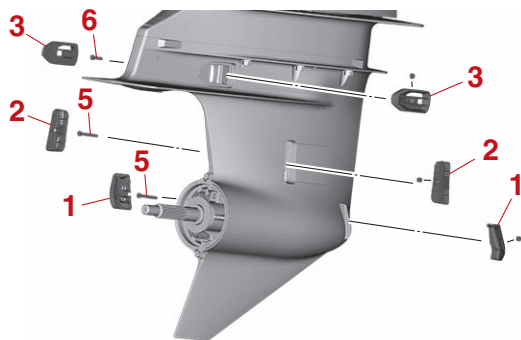
Item	Procedures	See
Spark plug	Clean the electrodes using a spark plug cleaner.	—
	Check the spark plug. Electrodes are damaged/worn or insulator is abnormal color → Replace.	7-30
	Check the spark plug gap. Out of specification → Replace.	
Ignition coil	Check the ignition spark. Out of specification → Replace.	5-36
Timing belt	Check the timing belt. Cracked/damaged/worn → Replace.	7-35
Thermostat	Measure the thermostat valve opening. Out of specification → Replace.	7-69
Cowling lock lever	Check the fitting by pushing the top cowling. Looseness/rattling → Adjust or replace the top cowling stopper.	10-20
Valve clearance	Check the valve clearance. Out of specification → Adjust.	7-2
Water pump	Check the upper water pump housing. Deformed → Replace.	8-11
	Check the impeller, insert cartridge, and outer plate cartridge. Cracked/worn → Replace.	
	Check the impeller key and keyway in the drive shaft. Deformed/worn → Replace.	
Wire harness	Check the wire harness coupler and lead connector connections.	—
(Yamaha) Meter/gauge	Check the meter/gauge display.	—
SBW (Steer-by-wire)	Check that the steering operates smoothly. Not smooth → Check the steering arm, swivel bracket, steering actuator, helm unit, or related parts.	9-17 9-24
	Check whether the steering responds immediately when the steering wheel is turned. Slow response → Check the steering control system components for tightness, looseness, and wear.	9-17 9-24
	Check the steering control system components. Looseness → Tighten. Worn/corroded → Replace.	9-17 9-24
	Check the trouble code using the YDIS. Trouble code is detected → Perform the troubleshooting procedures.	4-7
	Check the wire harness coupler and lead coupler.	—


### Checking the cooling water inlet

1. Check:
  - Cooling water inlet  
Clogged → Clean.
    - a. Remove the water inlet covers “1”, “2”, outlet cover “3” and anode “4”.
    - b. Check the water inlet covers and water inlets.
    - c. Install the water inlet covers “1”, “2”, outlet cover “3” and anode “4”, and then tighten the water inlet cover screws “5”, water outlet cover screw “6” and anode bolt “7” to the specified torque.

**TIP:**


After installing the water inlet covers “1”, “2” and outlet cover “3” make sure that there is no rattling.



	Water inlet cover screw “5”
	2.0 N·m (0.20 kgf·m, 1.5 lb·ft)
	Water outlet cover screw “6”
	2.0 N·m (0.20 kgf·m, 1.5 lb·ft)
	Anode bolt “7”
	42 N·m (4.2 kgf·m, 31 lb·ft)

### Checking the engine idle speed

1. Check:
  - Engine idling speed  
Out of specification → Perform the troubleshooting procedures. See “Troubleshooting procedure” (4-4).
    - a. Check the engine idle speed using the YDIS. See the YDIS (Ver. 2.49 or later) instruction manual.

	Idle speed (in neutral) 650–750 r/min
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### Changing the engine oil 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. Warm up:
  - Engine
    - a. Place the outboard motor in an upright position.

**NOTICE**

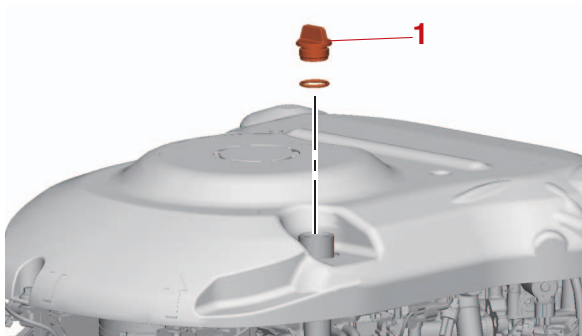
If the outboard motor is not level, the oil level indicated on the dipstick may not be correct.

- b. Start the engine and warm it up for 5–10 minutes.
  - c. Stop the engine and leave it off for 5–10 minutes.
2. Remove:
  - Top cowling

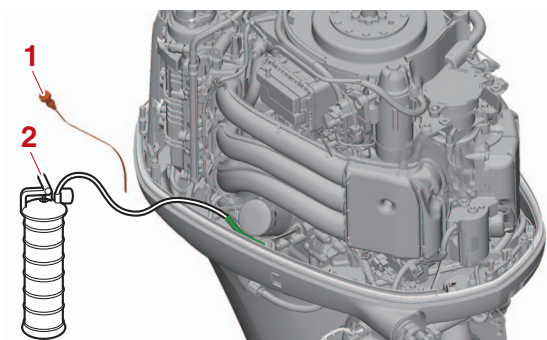
## General periodic maintenance

### 3. Drain:

- Engine oil
  - a. Remove the oil filler cap “1”.



- b. Remove the dipstick “1” and extract the engine oil using the oil changer “2”.



### 4. Fill:

- Engine oil
  - a. Fill the engine with the specified amount of the recommended engine oil through the oil filler hole. Install the oil filler cap and dipstick.

#### **NOTICE**

Do not overfill the engine with engine oil. Otherwise, the engine could be damaged or oil could leak. If the engine oil is above the upper level, extract the excess engine oil until the oil is at the proper level.

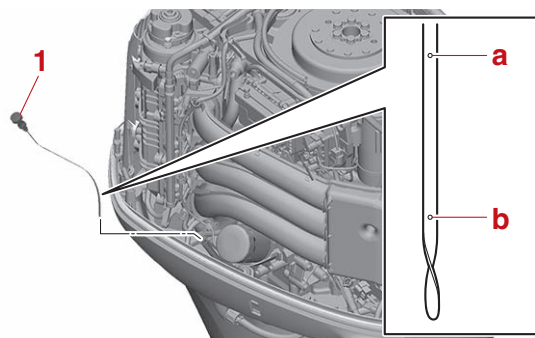


Engine oil quantity (without oil filter replacement)  
6.0 L (6.34 US qt, 5.28 Imp.qt)

- b. Leave the outboard motor off for 5–10 minutes.
  - c. Remove the dipstick “1” and wipe it clean.

- d. Insert the dipstick “1” completely for a correct measurement and remove it again.

- e. Check that the oil level indicated on the dipstick “1” is between the upper mark “a” and the lower mark “b”.



- f. Start the engine and check that the oil pressure alert indicator does not come on. Also, check that there is no oil leakage.

#### **NOTICE**

If the oil pressure alert indicator comes on or if there is oil leakage, stop the engine and find the cause. Continued operation with a problem could cause severe engine damage.

### Changing the engine oil by removing the drain bolt

#### **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.

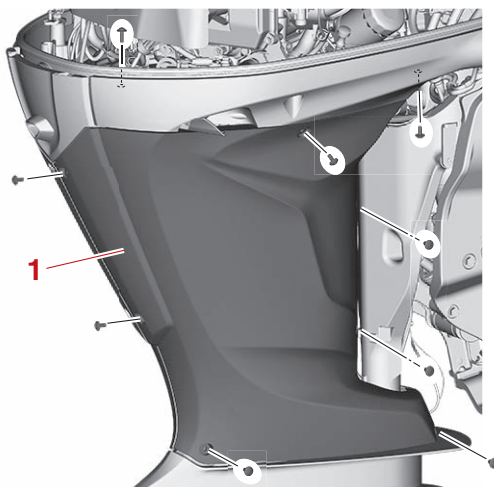
#### 1. Warm up:

- Engine
  - See step (1) in “Changing the engine oil using an oil changer” (10-13).

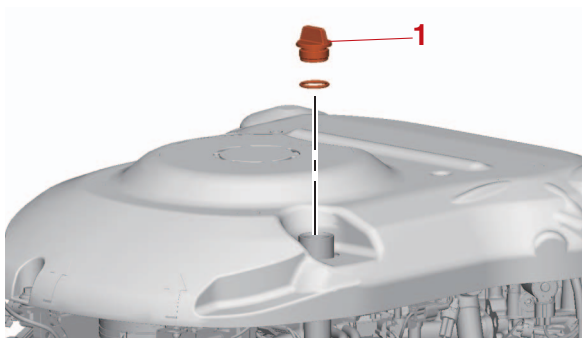


## General periodic maintenance

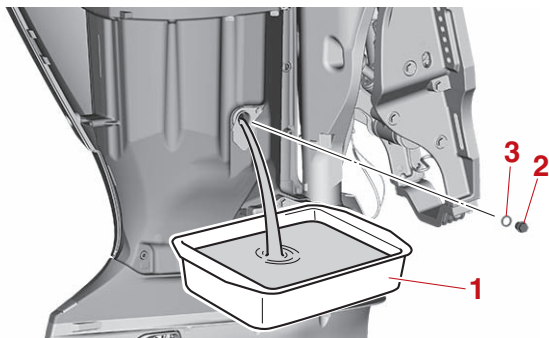
2. Remove:
  - Top cowling
  - Apron "1"



3. Drain:
  - Engine oil
    - a. Remove the oil filler cap "1".

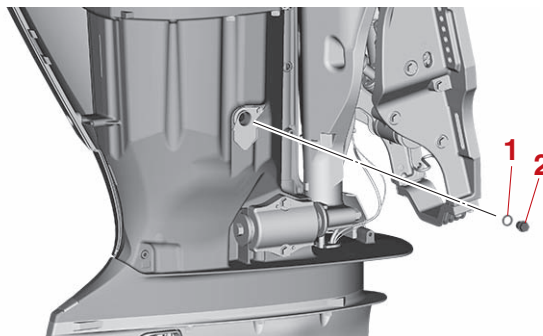


- b. Place a drain pan "1" under the engine oil drain hole.
  - c. Remove the drain bolt "2" and gasket "3", and let the oil drain completely.



4. Install:
  - Gasket "1" **New**
  - Drain bolt "2"

- a. Install a new gasket "1" and then tighten the drain bolt "2" with specified torque.



Drain bolt "2"  
27 N·m (2.7 kgf·m, 20 lb·ft)

5. Fill:
  - Recommended engine oil
    - a. Fill the engine with the specified amount of the recommended engine oil through the oil filler hole. Install the oil filler cap.

### NOTICE

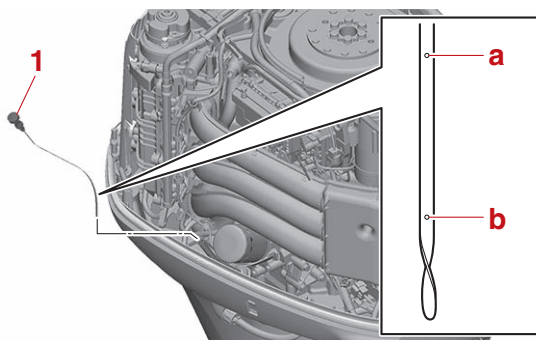
**Do not overfill the engine with engine oil. Otherwise, the engine could be damaged or oil could leak. If the engine oil is above the upper level, extract the excess engine oil until the oil is at the proper level.**



Engine oil quantity (without oil filter replacement)  
6.0 L (6.34 US qt, 5.28 Imp.qt)

- b. Leave the outboard motor off for 5–10 minutes.
  - c. Remove the dipstick "1" and wipe it clean.
  - d. Insert the dipstick "1" completely for a correct measurement and remove it again.

- e. Check that the oil level indicated on the dipstick "1" is between the upper mark "a" and the lower mark "b".

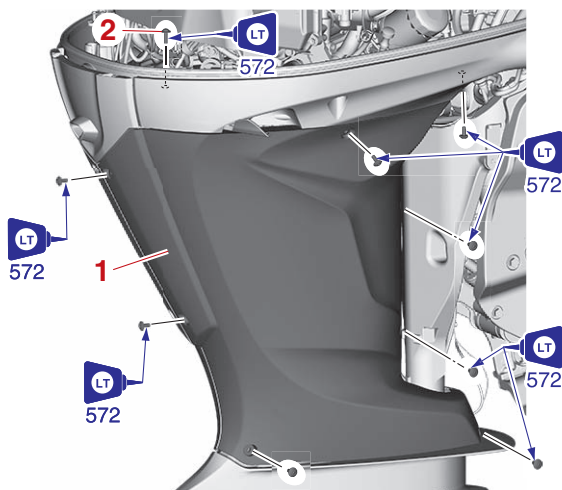



- f. Start the engine and check that the oil pressure alert indicator does not come on. Also, check that there is no oil leakage.

**NOTICE**

If the oil pressure alert indicator comes on or if there is oil leakage, stop the engine and find the cause. Continued operation with a problem could cause severe engine damage.

6. Install:
- Apron "1"
  - Top cowling



	Apron screw "2" 3.0 N·m (0.30 kgf·m, 2.2 lb·ft)
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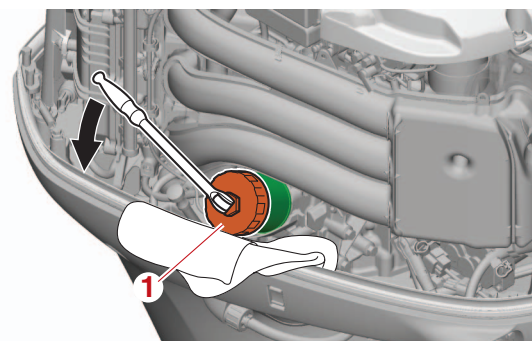
**Replacing the oil filter**


1. Warm up:
  - Engine  
See step (1) in "Changing the engine oil using an oil changer" (10-13).
2. Remove:
  - Top cowling
3. Drain:
  - Engine oil  
See step (3) in "Changing the engine oil using an oil changer" (10-13) or step (3) in "Changing the engine oil by removing the drain bolt" (10-14).

**TIP:**  
If the engine oil was changed by removing the drain bolt, install the drain bolt. See step (4) in "Changing the engine oil by removing the drain bolt" (10-14).

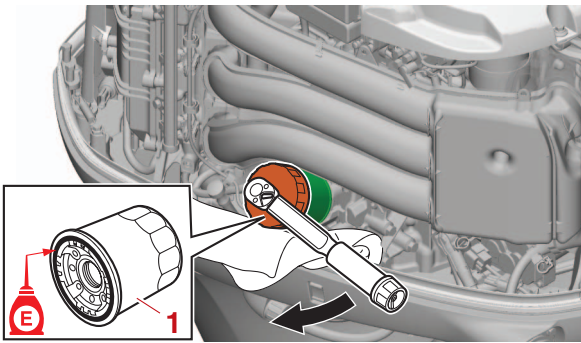
4. Replace:
  - Oil filter  
a. Place a rag under the oil filter, and then remove the oil filter.


**TIP:**  
Make sure to clean up any oil spills.



	Oil filter wrench "1" 90890-06874
	Oil filter wrench "1" YB-06874

- b. Install a new oil filter “1”.




	<p>Oil filter “1” 18 N·m (1.8 kgf·m, 13 lb·ft)</p>
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5. Fill:
- Recommended engine oil
    - a. Fill the engine with the specified amount of the recommended engine oil through the oil filler hole. Install the oil filler cap.

**NOTICE**

**Do not overfill the engine with engine oil. Otherwise, the engine could be damaged or oil could leak. If the engine oil is above the upper level, extract the excess engine oil until the oil is at the proper level.**

	<p>Engine oil quantity (with oil filter replacement) 6.3 L (6.66 US qt, 5.54 Imp.qt)</p>
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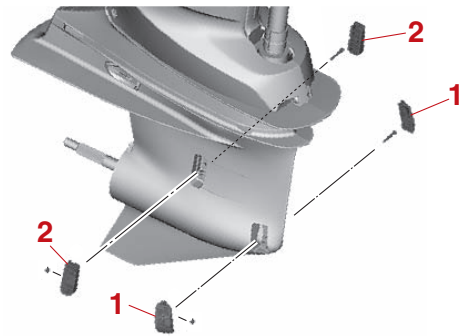
- b. Install the oil filler cap and dipstick, and then start the engine and warm it up for 5–10 minutes.
  - c. Stop the engine, and then leave it off for 5–10 minutes.
  - d. Check the oil level.
6. Install:
- Top cowling

**Changing the gear oil**

**WARNING**

**Never get under the lower unit while it is tilted.**

1. Remove:
- Water inlet cover “1”, “2”



2. Drain:
- Gear oil
    - a. Tilt the outboard motor so that the drain screw is at the lowest point.
    - b. Place a drain pan “1” under the gear oil drain hole.
    - c. Remove the drain screw “2” and gasket “3”.

**NOTICE**

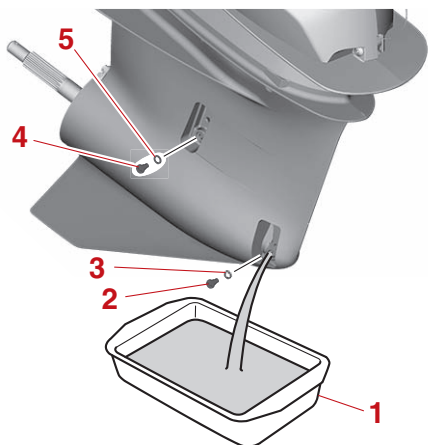
**If there is a significant amount of metal particles on the magnetic drain screw, the lower unit may have a problem.**

- d. Remove the oil level plug “4” and gasket “5” and let the oil drain completely.

**NOTICE**

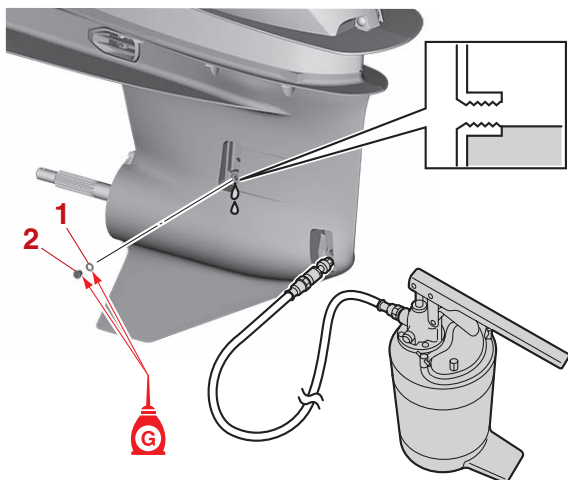
**After the gear oil has been drained, check the used oil. If the oil is milky, water is getting into the lower case, which can cause gear damage.**


- e. After the gear oil has been drained, check the used oil. Pressure test the lower case and inspect the oil seal for damage if the oil is milky. See “Bleeding the PTT unit” (9-31).




3. Fill:

- Gear oil
  - a. Place the outboard motor in an upright position.
  - b. Insert the gear oil pump into the drain hole, and then fill the lower unit slowly with gear oil until oil flows out of the check hole and no air bubbles are visible.
  - c. Install a new gasket “1” and the oil level plug “2”.



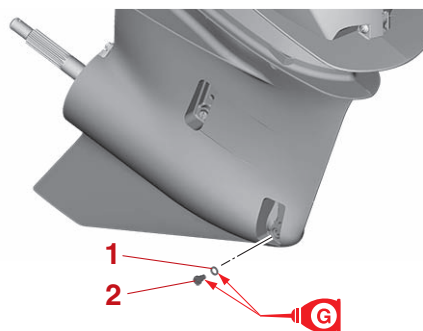
	<p><b>Gear oil quantity</b>                  0.885 L (0.935 US qt, 0.779 Imp.qt) (FL250NST, FL300FST, LF250SB, LF300SB)                  0.925 L (0.978 US qt, 0.814 Imp.qt) (F250NST, F250SB, F300FST, F300SB)</p>
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	<p><b>Oil level plug “2”</b>                  7 N·m (0.7 kgf·m, 5.2 lb·ft)</p>
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- d. Remove the gear oil pump, and then install a new gasket “1” and the drain screw “2”.

**TIP:**

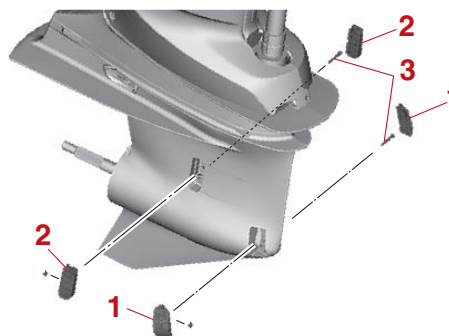
Before installing the magnetic drain screw, make sure to remove all metal particles.




	<p><b>Drain screw “2”</b>                  7 N·m (0.7 kgf·m, 5.2 lb·ft)</p>
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4. Install:

- Water inlet cover “1”, “2”

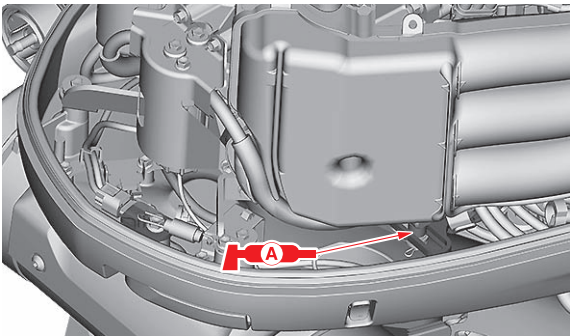
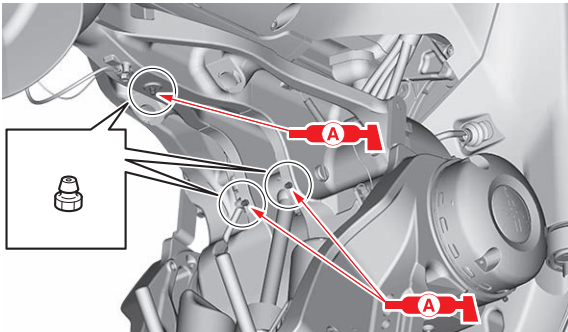
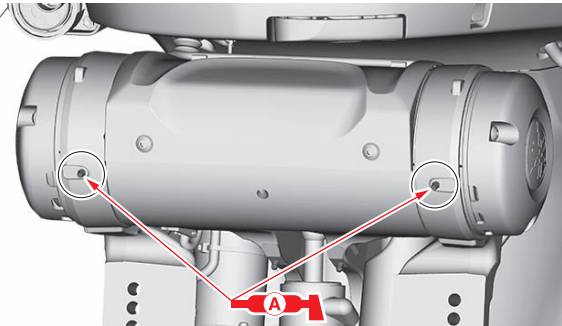
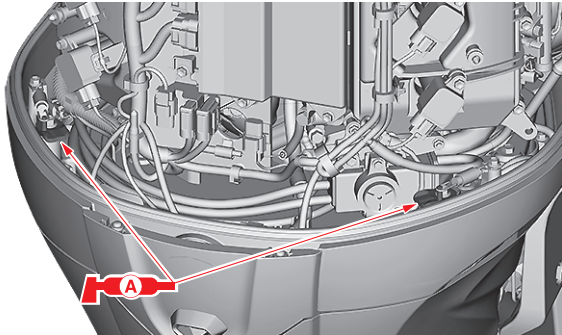
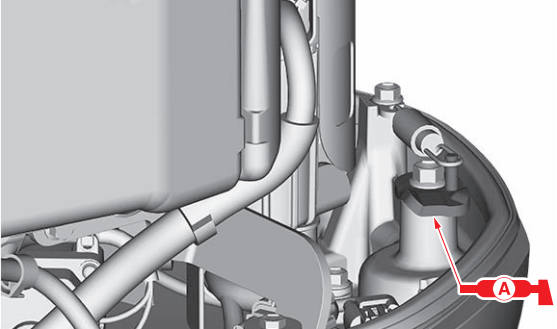


	<p><b>Water inlet cover screw “3”</b>                  2.0 N·m (0.20 kgf·m, 1.5 lb·ft)</p>
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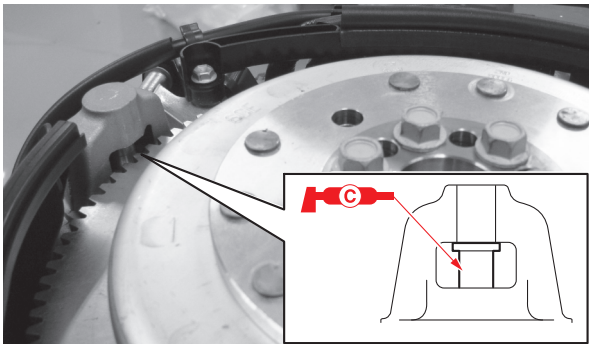


**Greasing points**

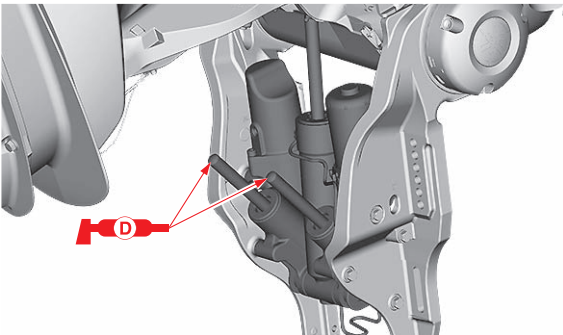
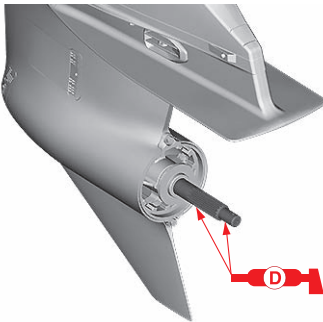
- 1. Apply:
  - Specified lubrication points
    - a. Apply water resistant grease to the specified lubrication points.



- b. Apply low temperature resistant grease to the specified lubrication point.



- c. Apply corrosion resistant grease to the specified lubrication point.

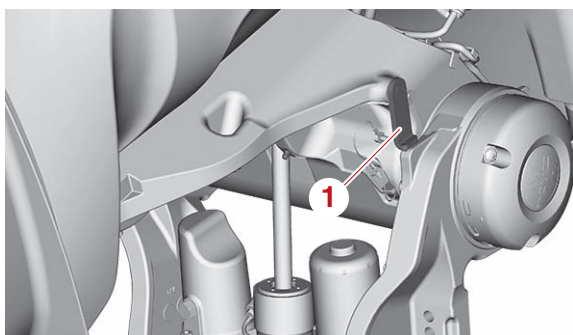


## Checking the PTT fluid level

### ⚠ WARNING

Never get under the outboard motor while it is tilted.

1. Check:
  - PTT fluid level  
Below the proper level → Add the recommended fluid.
  - a. Fully tilt the outboard motor up, and then support it using the tilt stop lever "1".



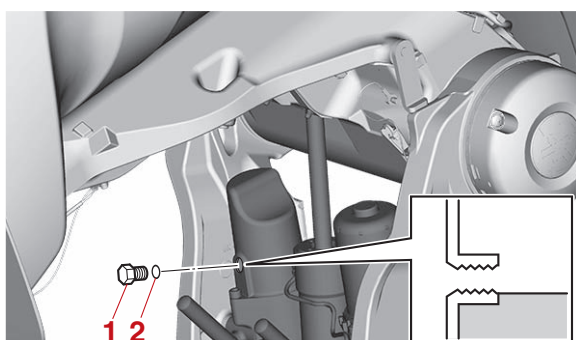
- b. Remove the reservoir cap "1" and O-ring "2", and then check the fluid level in the reservoir.

### ⚠ WARNING


Before removing the reservoir cap, make sure that the PTT ram is fully extended. Otherwise, fluid could be expelled forcefully from the unit due to internal pressure.

### TIP:

- If the fluid is at the proper level, a small amount of fluid should flow out of the filler hole when the reservoir cap is removed.
- If the fluid is below the proper level, add the recommended fluid.



2. Install:
  - O-ring **New**
  - Reservoir cap

	Reservoir cap 7 N·m (0.7 kgf·m, 5.2 lb·ft)
---	---

## Checking the cowling lock lever

1. Check:
  - Top cowling fitting  
Looseness/rattling → Adjust or replace the top cowling stopper.

### TIP:

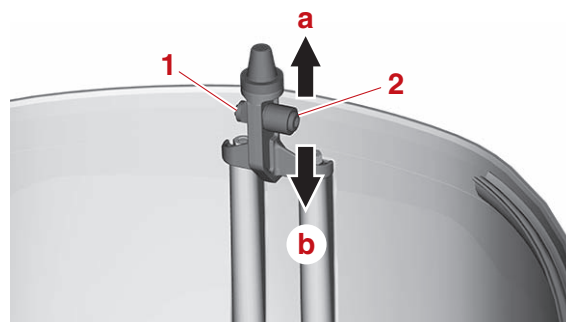
Check the fitting by pushing the top cowling. Adjust if there is looseness or rattling.



2. Adjust:
  - Top cowling fitting
    - a. Loosen the cowling stopper nut "1".
    - b. Move the stopper "2" up or down slightly to adjust its position.

### TIP:

- To loosen the fitting, move the stopper in direction "a".
- To tighten the fitting, move the stopper in direction "b".



- c. Tighten the cowling stopper nut.

- d. Recheck the fitting. Replace the rubber seal if looseness or rattling cannot be adjusted.



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## Specification

### Model data

#### Dimension and weight

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
Overall length	1026 mm (40.4 in)			
Overall width	634 mm (25.0 in)			
Overall height X	1964 mm (77.3 in)			
Overall height U	2091 mm (82.3 in)			
Overall height E	2218 mm (87.3 in)			
Motor transom height X	640 mm (25.2 in)			
Motor transom height U	767 mm (30.2 in)			
Motor transom height E	894 mm (35.2 in)			
Dry weight (SUS) X	288 kg (635 lb)			
Dry weight (SUS) U	294 kg (648 lb)			
Dry weight (SUS) E	299 kg (659 lb)			

\* Dry weight: With SUS (stainless steel) propeller

#### Performance

Rated power	183.8 kW (250 HP) (F250NST, F250SB)	183.8 kW (250 HP) (FL250NST, LF250SB)	183.8 kW (250 HP) (F250SB)	183.8 kW (250 HP) (LF250SB)
	220.6 kW (300 HP) (F300FST, F300SB)	220.6 kW (300 HP) (FL300FST, LF300SB)	220.6 kW (300 HP) (F300SB)	220.6 kW (300 HP) (LF300SB)
	Full throttle operating range			
5000–6000 r/min				

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
Maximum fuel consumption (reference data)	83.9 L/h at 5500 r/min (22.1 US gal/h at 5500 r/min, 18.5 Imp.gal/h at 5500 r/min) (F250NST, F250SB) 96.6 L/h at 5500 r/min (25.5 US gal/h at 5500 r/min, 21.3 Imp.gal/h at 5500 r/min) (F300FST, F300SB)	83.9 L/h at 5500 r/min (22.1 US gal/h at 5500 r/min, 18.5 Imp.gal/h at 5500 r/min) (FL250NST, LF250SB) 96.6 L/h at 5500 r/min (25.5 US gal/h at 5500 r/min, 21.3 Imp.gal/h at 5500 r/min) (FL300FST, LF300SB)	83.9 L/h at 5500 r/min (22.1 US gal/h at 5500 r/min, 18.5 Imp.gal/h at 5500 r/min) (F250SB) 96.6 L/h at 5500 r/min (25.5 US gal/h at 5500 r/min, 21.3 Imp.gal/h at 5500 r/min) (F300SB)	83.9 L/h at 5500 r/min (22.1 US gal/h at 5500 r/min, 18.5 Imp.gal/h at 5500 r/min) (LF250SB) 96.6 L/h at 5500 r/min (25.5 US gal/h at 5500 r/min, 21.3 Imp.gal/h at 5500 r/min) (LF300SB)
Idle speed (in neutral)	650–750 r/min			

#### Power unit

Type	4-stroke DOHC V6 24 valves
Total displacement	4169 cm <sup>3</sup> (254.4 c.i.)
Bore × stroke	96.0 × 96.0 mm (3.78 × 3.78 in)
Compression ratio	10.3 : 1
Throttle & shift control system	Remote control
Starting system	Electric starter
Fuel system	Fuel injection
Starting carburetion system	Fuel injection
Ignition system	TCI
Advance type	Microcomputer
Maximum generator output	70 A
Maximum charging capacity	48 A
Spark plug (NGK)	LFR6A-11
Firing order	1-2-3-4-5-6
Steering system	Remote steering
Cooling system	Water

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
Exhaust system	Through propeller boss			
Lubrication system	Wet sump			

#### Lower unit

Gear shift positions	Forward-neutral-reverse			
Gear ratio	1.75 (21/12)			
Gear type	Spiral bevel gear			
Clutch type	Dog clutch			
Propeller fitting mechanism	Spline			
Propeller direction (rear view)	Clockwise	Counterclockwise	Clockwise	Counterclockwise
Propeller mark	M/T	ML/TL	M/T	ML/TL

#### Bracket unit

Trim angle	-3 ~ +16°			
Full Tilt-up angle	69°			
Tilt support angle	67°			
Steering angle	32+32°			
Trim and tilt system	Power trim and tilt			

#### Fuel and oil

Recommended fuel	Premium unleaded gasoline (F300FST, F300SB) Regular unleaded gasoline (F250NST, F250SB)	Premium unleaded gasoline (FL300FST, LF300SB) Regular unleaded gasoline (FL250NST, LF250SB)	Mid-grade unleaded gasoline (For North America), Premium unleaded gasoline (F300SB) Regular unleaded gasoline (F250SB)	Mid-grade unleaded gasoline (For North America), Premium unleaded gasoline (LF300SB) Regular unleaded gasoline (LF250SB)
Min. research octane number (RON)	90 (F250SB) 94 (F300FST_CRB/NME, F300SB)	90 (LF250SB) 94 (FL300FST_CRB/NME, LF300SB)	90 (F250SB) 94 (F300SB)	90 (LF250SB) 94 (LF300SB)

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
Min. pump octane number (PON)	89 (F300FST_CRB)	89 (FL300FST_CRB)	86 (F250SB) 89 (F300SB)	86 (LF250SB) 89 (LF300SB)
Recommended engine oil	YAMALUBE 4 or 4-stroke outboard motor oil		YAMALUBE 4M FC-W or 4-stroke outboard motor oil	
Recommended engine oil grade 1	SAE 10W-30/10W-40/5W-30 API SG/SH/SJ/SL			
Recommended engine oil grade 2	SAE 15W-40/20W-40/20W-50 API SH/SJ/SL			
Engine oil quantity (total amount)	7.1 L (7.50 US qt, 6.25 Imp.qt)			
Engine oil quantity (without oil filter replacement)	6.0 L (6.34 US qt, 5.28 Imp.qt)			
Engine oil quantity (with oil filter replacement)	6.3 L (6.66 US qt, 5.54 Imp.qt)			
Recommended gear oil	YAMALUBE outboard gear oil or Hypoid gear oil		Yamalube Marine Gearcase Lube HD or Hypoid gear oil	
Recommended gear oil grade	SAE 80W API GL-5 / SAE 90 API GL-5			
Gear oil quantity	0.925 L (0.978 US qt, 0.814 Imp.qt)	0.885 L (0.935 US qt, 0.779 Imp.qt)	0.925 L (0.978 US qt, 0.814 Imp.qt)	0.885 L (0.935 US qt, 0.779 Imp.qt)

\* Recommended engine oil and gear oil grade: Meeting both API and SAE requirements.

#### Battery requirement

Battery rating (CCA/SAE)	680–1150 A (F300FST_CRB)	680–1150 A (FL300FST_CRB)	680–1150 A	
Battery rating (MCA/ABYC)	770–1370 A (F300FST_CRB)	770–1370 A (FL300FST_CRB)	770–1370 A	
Battery rating (RC/SAE)	160 minutes (F300FST_CRB)	160 minutes (FL300FST_CRB)	160 minutes	
Battery rating (CCA/EN)	640–1080 A (F250SB, F300FST_CRB/NME, F300SB)	640–1080 A (FL300FST_CRB/NME, LF250SB, LF300SB)	640–1080 A	

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
Battery rating (20HR/IEC)	80 Ah (F250SB, F300FST_ CRB/NME, F300SB)	80 Ah (FL300FST_ CRB/NME, LF250SB, LF300SB)	80 Ah	
Battery rating (JIS)	105D31– 195G51 (F250NST, F300FST_ JPN)	105D31– 195G51 (FL250NST, FL300FST_ JPN)	—	
Battery cable length	3.50 m (11.5 ft)			
Battery cable conductor cross sectional area	30 mm <sup>2</sup> (AWG 2)			

#### PTT system

Recommended fluid	ATF Dexron II	Yamalube Marine Power Trim and Tilt fluid or ATF Dexron II
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### Electrical system technical data

#### Ignition timing control system

<b>Spark plug</b>	
Spark plug gap	1.0–1.1 mm (0.039–0.043 in)
<b>Ignition coil</b>	
Input voltage	12 V
<b>Cam position sensor</b>	
Input voltage (R/Y–B)	12 V
Input voltage (STBD IN: W/B–B, PORT IN: W/G–B, PORT EX: W/L–B)	5 V
<b>Pulsar coil</b>	
Air gap	0.36–1.14 mm (0.014–0.045 in)
Output peak voltage at cranking (unloaded) (reference data)	7.6 V
Output peak voltage at cranking (loaded) (reference data)	6.9 V

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
Output peak voltage at 1500 r/min (loaded) (reference data)	23.9 V			
Output peak voltage at 3500 r/min (loaded) (reference data)	25.1 V			
<b>Intake air pressure sensor</b>				
Input voltage	5 V			
Output voltage at -20.0 kPa (-0.20 kgf/cm <sup>2</sup> , -2.9 psi)	3.21 V			
Output voltage at -46.7 kPa (-0.467 kgf/cm <sup>2</sup> , -6.8 psi)	2.16 V			
<b>Intake air temperature sensor</b>				
Input voltage	5 V			
Resistance at 20 °C (68 °F)	2.200–2.700 kΩ			
Resistance at 80 °C (176 °F)	0.322 kΩ			
<b>Engine temperature sensor</b>				
Input voltage	5 V			
Resistance at 5 °C (41 °F) (reference data)	4.55 kΩ			
Resistance at 25 °C (77 °F) (reference data)	1.90–2.10 kΩ			
Resistance at 100 °C (212 °F) (reference data)	0.16–0.20 kΩ			
<b>Thermo switch</b>				
Input voltage	5 V			
Switch ON temperature	84–90 °C (183–194 °F)			
Switch OFF temperature	68–82 °C (154–180 °F)			
<b>Knock sensor</b>				
Resistance	504–616 kΩ			

### Fuel injection control system

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Water detection switch</b>				
Input voltage	5 V			
<b>Fuel injector</b>				
Input voltage	12 V			
Resistance (reference data)	11.50–13.00 Ω			
<b>Low-pressure fuel pump</b>				
Input voltage	12 V			
Resistance (reference data)	0.5–4.0 Ω			
<b>High-pressure fuel pump</b>				
Input voltage	12 V			
Resistance (reference data)	0.2–3.0 Ω			
<b>Vapor shut-off valve</b>				
Input voltage	12 V			
Resistance	30.0–34.0 Ω			

### Engine speed control system

<b>TPS</b>	
TPS 1 output voltage at throttle valve fully closed (reference data)	0.760 V
TPS 2 output voltage at throttle valve fully closed (reference data)	2.750 V
TPS 1 output voltage at throttle valve fully open (reference data)	4.350 V
TPS 2 output voltage at throttle valve fully open (reference data)	4.640 V
Throttle valve opening angle at throttle valve fully closed (reference data)	4.9°
Input voltage	5 V

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>SPS</b>				
Output voltage at gear shift in the F position (reference data)	0.47–1.68 V			
Output voltage at gear shift in the N position (reference data)	2.30–2.67 V			
Output voltage at gear shift in the R position (reference data)	3.21–4.39 V			
Input voltage	5 V			
<b>Oil pressure sensor</b>				
Input voltage	5 V			
Output voltage at 392 kPa (3.92 kgf/cm <sup>2</sup> , 56.8 psi)	2.5 V			
Output voltage at 784 kPa (7.84 kgf/cm <sup>2</sup> , 113.7 psi)	4.5 V			

### VCT system

<b>OCV</b>	
Input voltage	12 V
Resistance	6.7–7.7 Ω

### Shift system

<b>Shift actuator</b>	
Rod stroke at gear shift in the F position (reference data)	80.0 mm (3.15 in)
Rod stroke at gear shift in the N position (reference data)	61.5 mm (2.42 in)
Rod stroke at gear shift in the R position (reference data)	39.5 mm (1.56 in)
Motor resistance (reference data)	1.7 Ω

### PTT system

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>PTT sensor</b>				
Output voltage at full tilt-up position	4.23 V			
Output voltage at full trim-down position	0.90 V			
Input voltage	5 V			

### Charging system

<b>Lighting coil</b>	
Output peak voltage at cranking (unloaded) (reference data)	6.9 V
Output peak voltage at 1500 r/min (unloaded) (reference data)	38.0 V
Output peak voltage at 3500 r/min (unloaded) (reference data)	83.2 V
Resistance (reference data)	0.1056–0.1584 Ω
Output voltage at 1500 r/min (loaded) (reference data)	13 V
Output voltage at 3500 r/min (loaded) (reference data)	13 V

### Starting system

<b>Starter motor</b>	
Type	Sliding gear
Output	1.70 kW
Cranking time limit	30 sec
Standard brush length	15.5 mm (0.61 in)
Wear limit	9.5 mm (0.37 in)
Standard commutator diameter	29.0 mm (1.14 in)
Wear limit	28.0 mm (1.10 in)

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
Standard commutator undercut	0.8 mm (0.03 in)			
Wear limit	0.2 mm (0.01 in)			

### Y-COP

<b>Receiver</b>	
Input voltage	12 V
<b>Buzzer</b>	
Input voltage	12 V
<b>Button cell battery - CR2016</b>	
Battery voltage (reference data)	3 V

### Gauge/sensor

<b>Water pressure sensor</b>	
Input voltage	5 V
Output voltage at 392 kPa (3.92 kgf/cm <sup>2</sup> , 56.8 psi) (reference data)	2.5 V
Output voltage at 784 kPa (7.84 kgf/cm <sup>2</sup> , 113.7 psi) (reference data)	4.5 V
<b>Speed sensor</b>	
Input voltage	5 V
Output voltage at 392 kPa (3.92 kgf/cm <sup>2</sup> , 56.8 psi) (reference data)	2.5 V
Output voltage at 784 kPa (7.84 kgf/cm <sup>2</sup> , 113.7 psi) (reference data)	4.5 V



## Fuel system technical data

### Fuel system

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Fuel line</b>				
Fuel pressure at engine start switch to "ON" within 5 seconds	315 kPa (3.2 kgf/cm <sup>2</sup> , 45.7 psi)			
Fuel pressure at idle speed	260 kPa (2.6 kgf/cm <sup>2</sup> , 37.7 psi)			
<b>Primer pump</b>				
Positive pressure	166.7 kPa (1.67 kgf/cm <sup>2</sup> , 24.2 psi)			
<b>Fuel filter assembly</b>				
Fuel inlet holding pressure (positive pressure)	200.0 kPa (2.00 kgf/cm <sup>2</sup> , 29.0 psi)			
Fuel outlet holding pressure (negative pressure)	80.0 kPa (0.80 kgf/cm <sup>2</sup> , 11.6 psi)			
<b>Vapor separator tank</b>				
Float height	65.0–70.0 mm (2.56–2.76 in)			
<b>Canister</b>				
Holding pressure (positive pressure)	19.6 kPa (0.20 kgf/cm <sup>2</sup> , 2.8 psi)			

## Power unit technical data

### Power unit

<b>Compression pressure</b>	
Minimum (reference data)	694.2 kPa (6.94 kgf/cm <sup>2</sup> , 100.7 psi)
<b>Engine oil</b>	
Engine oil pressure at idle speed (reference data)	412.0 kPa (4.12 kgf/cm <sup>2</sup> , 59.7 psi)
Engine oil pressure at 3000 r/min (reference data)	688.0 kPa (6.88 kgf/cm <sup>2</sup> , 99.8 psi)

\* For the checking method, see "Checking the oil pressure" (7-1). The figures are for reference only.

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Thermostat</b>				
Valve opening temperature	50–54 °C (122–129 °F)			
Fully open temperature	62 °C (144 °F)			
Fully open stroke	4.3 mm (0.17 in)			
<b>Timing belt</b>				
Installation height	2.5 mm (0.10 in)			

### Cylinder head assembly

<b>Cylinder head</b>	
Warpage limit	0.10 mm (0.0039 in)
Journal inside diameter	25.000–25.021 mm (0.9843–0.9851 in)
Camshaft journal oil clearance	0.020–0.061 mm (0.0008–0.0024 in)
Limit	0.080 mm (0.0032 in)
<b>Camshaft</b>	
Cam lobe height IN	46.661–46.761 mm (1.8370–1.8410 in)
Limit	46.611 mm (1.8351 in)
Cam lobe height EX	46.960–47.060 mm (1.8488–1.8528 in)
Limit	46.910 mm (1.8468 in)
Journal diameter	24.960–24.980 mm (0.9827–0.9835 in)
Runout	0.030 mm (0.0012 in)
<b>Valve clearance</b>	
Valve clearance IN (cold engine)	0.17–0.24 mm (0.0067–0.0094 in)
Valve clearance EX (cold engine)	0.31–0.38 mm (0.0122–0.0150 in)
<b>Valve</b>	
Margin thickness IN	0.75–1.15 mm (0.0295–0.0453 in)
Margin thickness EX	0.90–1.30 mm (0.0354–0.0512 in)
Seat contact width IN	1.10–1.40 mm (0.0433–0.0551 in)
Limit	1.850 mm (0.0728 in)
Seat contact width EX	1.40–1.70 mm (0.0551–0.0669 in)
Limit	2.150 mm (0.0846 in)



Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Valve lifter</b>				
Outside diameter	30.970–30.980 mm (1.2193–1.2197 in)			
Clearance IN (reference data)	0.020–0.055 mm (0.0008–0.0022 in)			
Clearance EX (reference data)	0.020–0.055 mm (0.0008–0.0022 in)			
<b>Valve stem</b>				
Diameter IN	5.477–5.492 mm (0.2156–0.2162 in)			
Limit	5.447 mm (0.2144 in)			
Diameter EX	5.464–5.479 mm (0.2151–0.2157 in)			
Limit	5.434 mm (0.2139 in)			
Runout limit IN	0.01 mm (0.0004 in)			
Runout limit EX	0.01 mm (0.0004 in)			
<b>Valve guide</b>				
Inside diameter IN	5.504–5.522 mm (0.2167–0.2174 in)			
Clearance IN	0.012–0.045 mm (0.0005–0.0018 in)			
Limit	0.070 mm (0.0028 in)			
Inside diameter EX	5.504–5.522 mm (0.2167–0.2174 in)			
Clearance EX	0.025–0.058 mm (0.0010–0.0023 in)			
Limit	0.080 mm (0.0032 in)			
Installation height	11.30–11.70 mm (0.4449–0.4606 in)			
<b>Valve spring</b>				
Free length IN	48.08 mm (1.89 in)			
Limit	45.67 mm (1.80 in)			
Tilt limit IN	1.7 mm (0.07 in)			
Free length EX	48.08 mm (1.89 in)			
Limit	45.67 mm (1.80 in)			
Tilt limit EX	1.7 mm (0.07 in)			

### Crankcase assembly

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Cylinder</b>				
Bore	96.000–96.012 mm (3.7795–3.7800 in)			
Limit	96.072 mm (3.7824 in)			
<b>Piston</b>				
Diameter	95.945–95.960 mm (3.7774–3.7779 in)			
Limit	95.905 mm (3.7758 in)			
Measuring point	13.5 mm (0.53 in)			
Piston clearance	0.040–0.067 mm (0.0016–0.0026 in)			
Limit	0.167 mm (0.0066 in)			
Ring groove (Top)	1.22–1.25 mm (0.0480–0.0492 in)			
Ring groove (2nd)	1.22–1.24 mm (0.0480–0.0488 in)			
Ring groove (Oil)	2.51–2.53 mm (0.0988–0.0996 in)			
Pin boss inside diameter	22.011–22.018 mm (0.8666–0.8668 in)			
Limit	22.038 mm (0.8676 in)			
Pin outside diameter	21.996–22.005 mm (0.8660–0.8663 in)			
Limit	21.986 mm (0.8656 in)			
<b>Piston ring (Top)</b>				
Type	Barrel			
Height (B)	1.170–1.185 mm (0.0461–0.0467 in)			
Width (T)	2.800–3.000 mm (0.1102–0.1181 in)			
End gap	0.20–0.30 mm (0.0079–0.0118 in)			
Limit	0.470 mm (0.0185 in)			
End gap measuring point	20.0 mm (0.79 in)			
Side clearance	0.04–0.08 mm (0.0016–0.0032 in)			
Limit	0.130 mm (0.0051 in)			
<b>Piston ring (2nd)</b>				
Type	Taper			
Height (B)	1.170–1.190 mm (0.0461–0.0469 in)			
Width (T)	3.800–4.000 mm (0.1496–0.1575 in)			
End gap	0.60–0.75 mm (0.0236–0.0295 in)			
Limit	0.900 mm (0.0354 in)			
Side clearance	0.03–0.07 mm (0.0012–0.0028 in)			
Limit	0.110 mm (0.0043 in)			

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Piston ring (Oil)</b>				
Height (B)	2.400–2.470 mm (0.0945–0.0972 in)			
Width (T)	2.350–2.750 mm (0.0925–0.1083 in)			
End gap	0.15–0.60 mm (0.0059–0.0236 in)			
Side clearance	0.04–0.13 mm (0.0016–0.0051 in)			
<b>Connecting rod</b>				
Small end inside diameter	22.010–22.024 mm (0.8665–0.8671 in)			
Big end inside diameter	55.990–56.010 mm (2.2043–2.2051 in)			
Big end side clearance	0.140–0.310 mm (0.0055–0.0122 in)			
Limit	0.36 mm (0.0142 in)			
Big end oil clearance	0.025–0.050 mm (0.0010–0.0020 in)			
Limit	0.080 mm (0.0032 in)			
<b>Crankshaft</b>				
Journal diameter	72.976–72.996 mm (2.8731–2.8739 in)			
Crankshaft pin diameter	52.980–53.000 mm (2.0858–2.0866 in)			
Runout	0.03 mm (0.0012 in)			
Limit	0.04 mm (0.0016 in)			
Crankshaft pin width	21.00–21.10 mm (0.8268–0.8307 in)			
Journal oil clearance	0.029–0.045 mm (0.0011–0.0018 in)			
Limit	0.065 mm (0.0026 in)			

## Lower unit technical data

### Lower unit assembly (regular rotation model)

<b>Lower unit</b>				
Holding pressure	68.6 kPa (0.69 kgf/cm <sup>2</sup> , 9.9 psi)	—	68.6 kPa (0.69 kgf/cm <sup>2</sup> , 9.9 psi)	—
<b>Gear backlash</b>				
Forward gear backlash	0.27–0.80 mm (0.0106–0.0315 in)	—	0.27–0.80 mm (0.0106–0.0315 in)	—
Reverse gear backlash	0.45–1.04 mm (0.0177–0.0409 in)	—	0.45–1.04 mm (0.0177–0.0409 in)	—

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Available shim thicknesses</b>				
Pinion shims	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm	—
Forward shims	2.00/2.03/2.06/ 2.09/2.12/2.15 mm	—	2.00/2.03/2.06/ 2.09/2.12/2.15 mm	—
Reverse shims	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm	—
Propeller shaft shims	0.7/0.8/0.9/1.0/ 1.1/1.2 mm	—	0.7/0.8/0.9/1.0/ 1.1/1.2 mm	—
<b>Standard shim thicknesses</b>				
Forward shim	2.06 mm (0.0811 in)	—	2.06 mm (0.0811 in)	—
Reverse shim	0.75 mm (0.0295 in)	—	0.75 mm (0.0295 in)	—
<b>Propeller shaft</b>				
Motive torque	0.4–1.3 N·m (0.04–0.13 kgf·m, 0.3–1.0 lb·ft)	—	0.4–1.3 N·m (0.04–0.13 kgf·m, 0.3–1.0 lb·ft)	—
Runout	0.02 mm (0.0008 in)	—	0.02 mm (0.0008 in)	—
<b>Drive shaft</b>				
Motive torque	0.05–2.60 N·m (0.01–0.27 kgf·m, 0.04– 1.92 lb·ft)	—	0.05–2.60 N·m (0.01–0.27 kgf·m, 0.04– 1.92 lb·ft)	—
Runout	0.3 mm (0.012 in)	—	0.3 mm (0.012 in)	—
<b>Intermediate drive shaft</b>				
Runout	0.25 mm (0.010 in)	—	0.25 mm (0.010 in)	—

\* Figures obtained using the special service tools.

### Lower unit assembly (counter rotation model)

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Lower unit</b>				
Holding pressure	—	68.6 kPa (0.69 kgf/cm <sup>2</sup> , 9.9 psi)	—	68.6 kPa (0.69 kgf/cm <sup>2</sup> , 9.9 psi)
<b>Gear backlash</b>				
Forward gear backlash	—	0.43–0.97 mm (0.0169–0.0382 in)	—	0.43–0.97 mm (0.0169–0.0382 in)
Reverse gear backlash	—	0.48–1.05 mm (0.0189–0.0413 in)	—	0.48–1.05 mm (0.0189–0.0413 in)
<b>Available shim thicknesses</b>				
Pinion shims	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm
Forward shims	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm
Reverse shims	—	2.00/2.03/2.06/ 2.09/2.12/2.15 mm	—	2.00/2.03/2.06/ 2.09/2.12/2.15 mm
Propeller shaft shims	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm	—	0.10/0.12/0.15/ 0.18/0.30/0.40/ 0.50 mm
<b>Standard shim thicknesses</b>				
Forward shim	—	0.58 mm (0.0228 in)	—	0.58 mm (0.0228 in)
Reverse shim	—	2.06 mm (0.0811 in)	—	2.06 mm (0.0811 in)
<b>Propeller shaft</b>				
Free play	—	0.25–0.35 mm (0.0098–0.0138 in)	—	0.25–0.35 mm (0.0098–0.0138 in)
Runout	—	0.02 mm (0.0008 in)	—	0.02 mm (0.0008 in)

Model	F250N, F300F, F250B_EUR, F300B_EUR	FL250N, FL300F, LF250B_EUR, LF300B_EUR	F250B, F300B	LF250B, LF300B
<b>Drive shaft</b>				
Motive torque	—	0.05–2.60 N·m (0.01–0.27 kgf·m, 0.04–1.92 lb·ft)	—	0.05–2.60 N·m (0.01–0.27 kgf·m, 0.04–1.92 lb·ft)
Runout	—	0.3 mm (0.012 in)	—	0.3 mm (0.012 in)
<b>Intermediate drive shaft</b>				
Runout	—	0.25 mm (0.010 in)	—	0.25 mm (0.010 in)

\* Figures obtained using the special service tools.

### Bracket unit technical data

#### PTT system

<b>Hydraulic pressure</b>	
Up	14.00 Mpa (140.0 kgf/cm <sup>2</sup> , 2030.0 psi)
Down	7.70 Mpa (77.0 kgf/cm <sup>2</sup> , 1116.5 psi)
<b>Motor</b>	
Standard commutator diameter	23.00 mm (0.9055 in)
Wear limit	22.00 mm (0.8661 in)
Standard commutator undercut	1.50 mm (0.0591 in)
Wear limit	1.00 mm (0.0394 in)
Standard brush length	11.50 mm (0.4528 in)
Wear limit	6.5 mm (0.26 in)







## Wiring diagram

### How to use the wiring diagram

#### Composition of the wiring diagrams

The wiring diagram consists of five categories: “Engine control unit”, “Fuel unit”, “Ignition unit”, “Charging unit and starting unit”, and “PTT unit”.

#### Legend symbols in the wiring diagrams

1		2		3	
4		5		6	

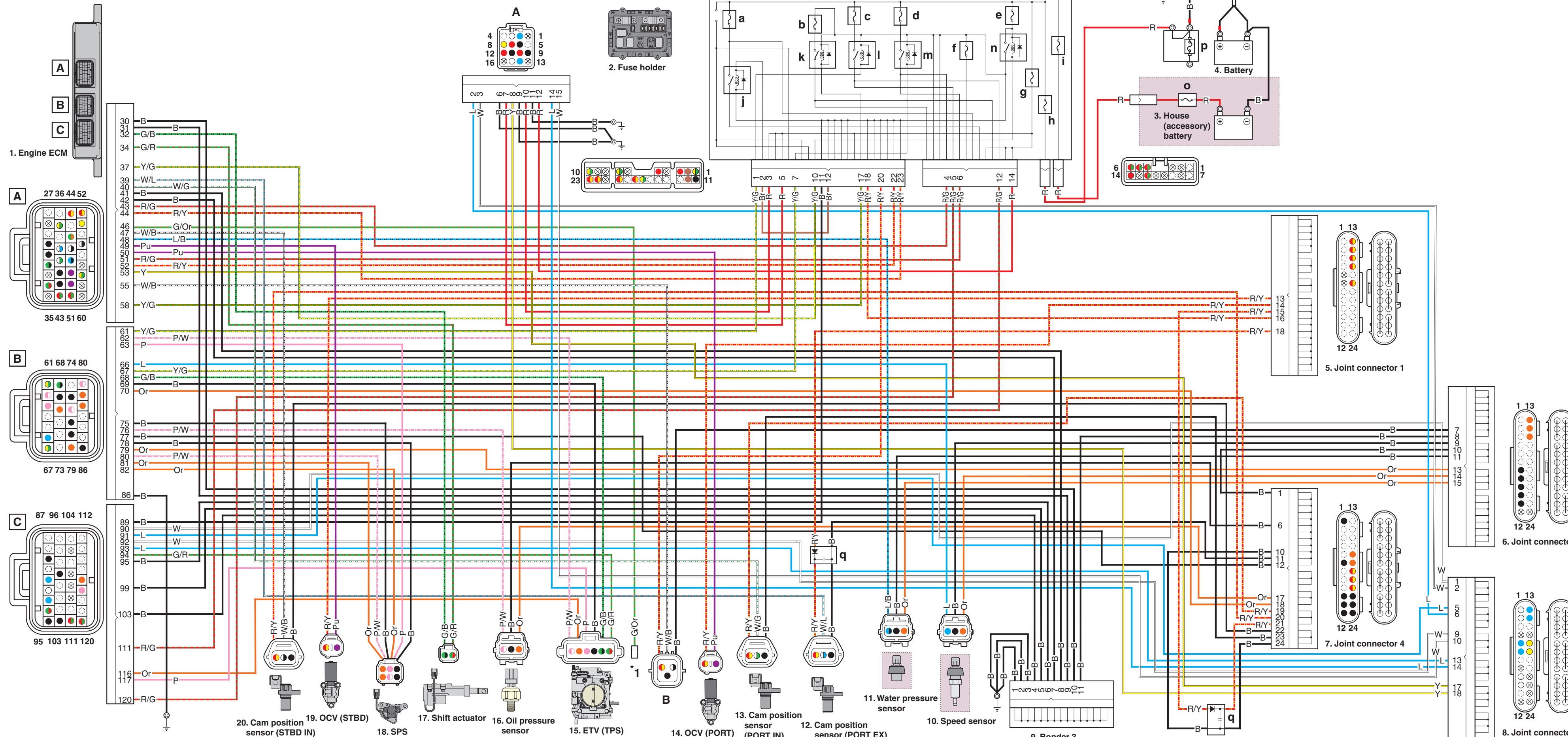
1. Double-colored wire
2. Not used (vacant)
3. A wire is not included in the selected wiring unit
4. PTT buzzer
5. Optional parts
6. Continuity

#### Terminal numbers

- Terminal numbers are indicated for cases where terminal locations of wires are unclear.
- In the coupler illustrations, only the rightmost and leftmost terminal numbers are indicated, and terminal numbers between them are omitted.



**Engine control unit**



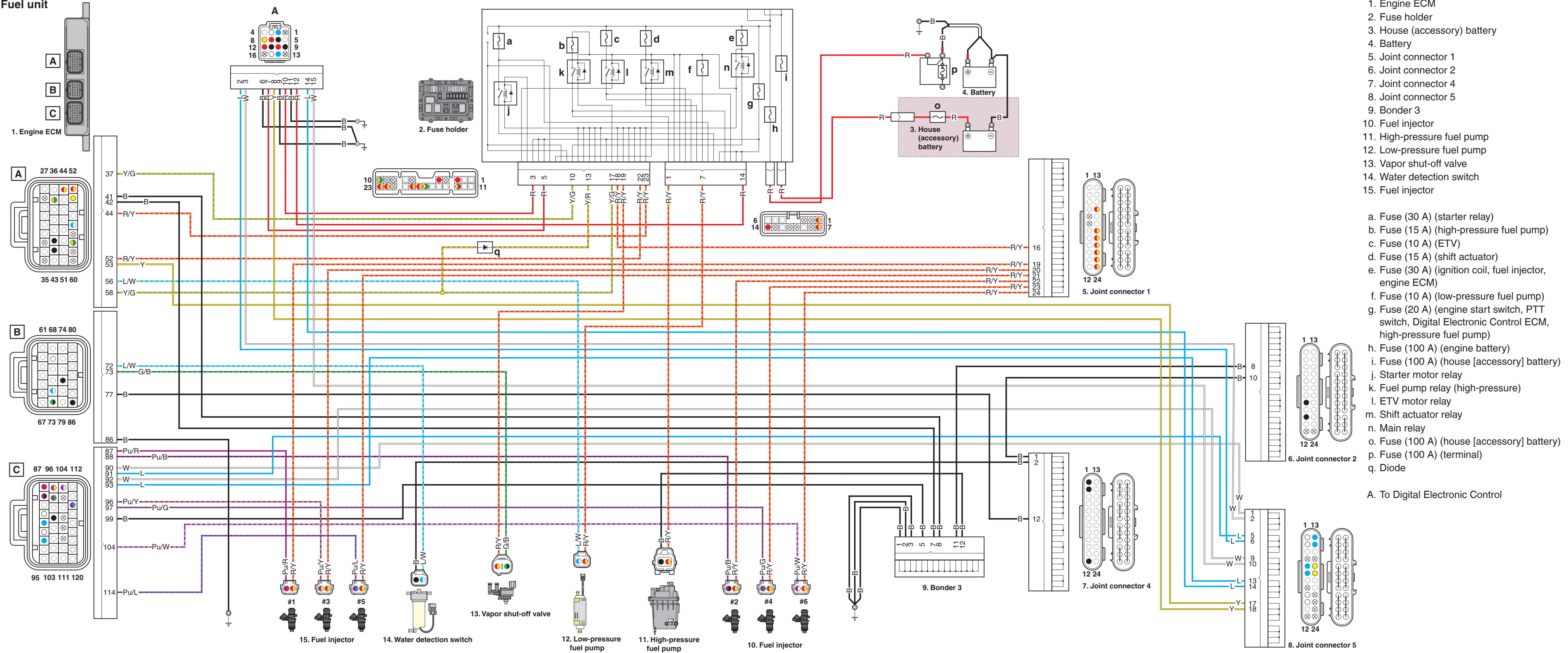
- 1. Engine ECM
- 2. Fuse holder
- 3. House (accessory) battery
- 4. Battery
- 5. Joint connector 1
- 6. Joint connector 2
- 7. Joint connector 4
- 8. Joint connector 5
- 9. Bonder 3
- 10. Speed sensor
- 11. Water pressure sensor
- 12. Cam position sensor (PORT EX)
- 13. Cam position sensor (PORT IN)
- 14. OCV (PORT)
- 15. ETV (TPS)
- 16. Oil pressure sensor
- 17. Shift actuator
- 18. SPS
- 19. OCV (STBD)
- 20. Cam position sensor (STBD IN)

- a. Fuse (30 A) (starter relay)
- b. Fuse (15 A) (high-pressure fuel pump)
- c. Fuse (10 A) (ETV)
- d. Fuse (15 A) (shift actuator)
- e. Fuse (30 A) (ignition coil, fuel injector, engine ECM)
- f. Fuse (10 A) (low-pressure fuel pump)
- g. Fuse (20 A) (engine start switch, PTT switch, Digital Electronic Control ECM, high-pressure fuel pump)
- h. Fuse (100 A) (engine battery)
- i. Fuse (100 A) (house [accessory] battery)
- j. Starter motor relay
- k. Fuel pump relay (high-pressure)
- l. ETV motor relay
- m. Shift actuator relay
- n. Main relay
- o. Fuse (10 A) (house [accessory] battery)
- p. Fuse (100 A) (terminal)
- q. Condenser (connect to the intake air pressure sensor)

- A. To Digital Electronic Control
- B. To YDIS
- \*1. Exclusive connector for reprogramming



Fuel unit

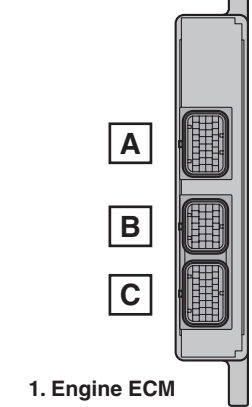


- 1. Engine ECM
- 2. Fuse holder
- 3. House (accessory) battery
- 4. Battery
- 5. Joint connector 1
- 6. Joint connector 2
- 7. Joint connector 4
- 8. Joint connector 5
- 9. Bonder 3
- 10. Fuel injector
- 11. High-pressure fuel pump
- 12. Low-pressure fuel pump
- 13. Vapor shut-off valve
- 14. Water detection switch
- 15. Fuel injector

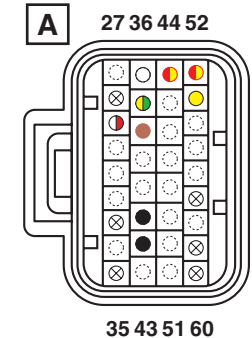
- a. Fuse (30 A) (starter relay)
- b. Fuse (15 A) (high-pressure fuel pump)
- c. Fuse (10 A) (ETV)
- d. Fuse (15 A) (shift actuator)
- e. Fuse (30 A) (ignition coil, fuel injector, engine ECM)
- f. Fuse (10 A) (low-pressure fuel pump)
- g. Fuse (20 A) (engine start switch, PTT switch, Digital Electronic Control ECM, high-pressure fuel pump)
- h. Fuse (100 A) (engine battery)
- i. Fuse (100 A) (house [accessory] battery)
- j. Starter motor relay
- k. Fuel pump relay (high-pressure)
- l. ETV motor relay
- m. Shift actuator relay
- n. Main relay
- o. Fuse (100 A) (house [accessory] battery)
- p. Fuse (100 A) (terminal)
- q. Diode

A. To Digital Electronic Control

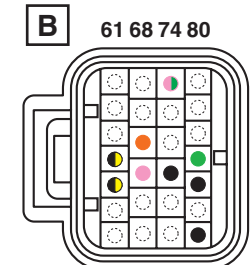
**Ignition unit**



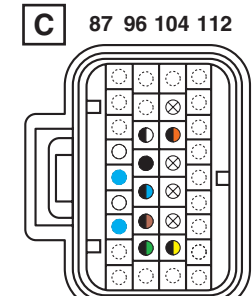
1. Engine ECM



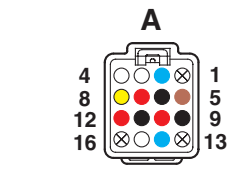
35 43 51 60



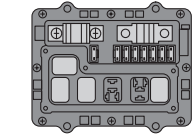
67 73 79 86



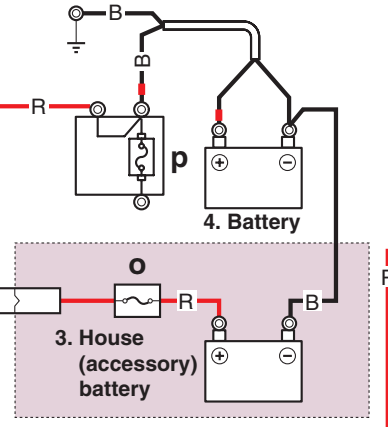
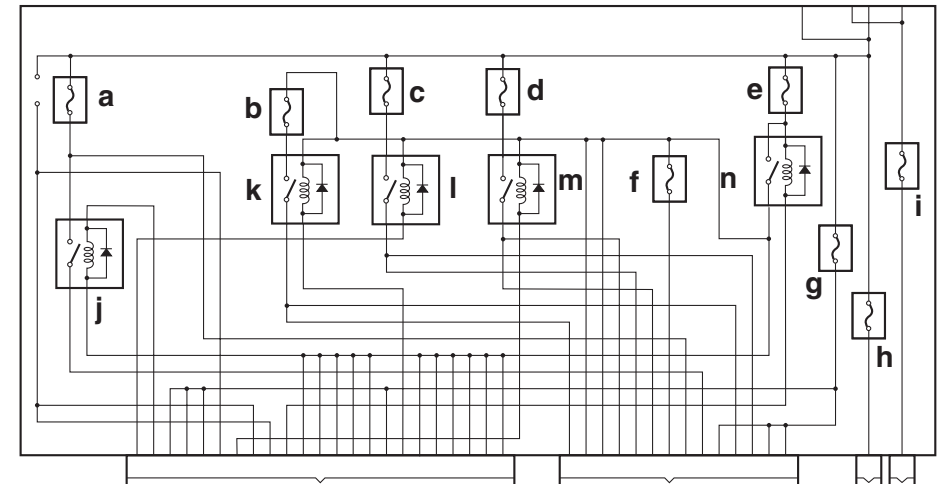
95 103 111 120



A

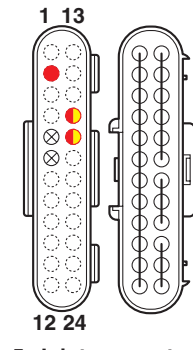


2. Fuse holder

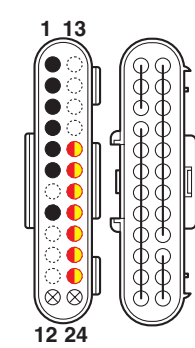


4. Battery

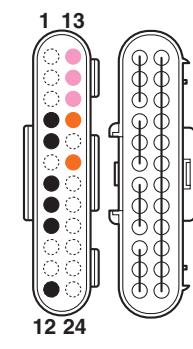
3. House (accessory) battery



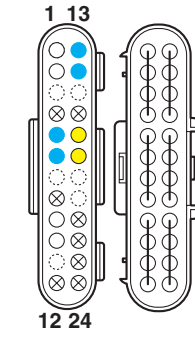
5. Joint connector 1



6. Joint connector 2



7. Joint connector 4



8. Joint connector 5

1. Engine ECM
2. Fuse holder
3. House (accessory) battery
4. Battery
5. Joint connector 1
6. Joint connector 2
7. Joint connector 4
8. Joint connector 5
9. Bonder 3
10. Thermo switch (PORT)
11. Knock sensor
12. Ignition coil
13. Thermo switch (STBD)
14. Ignition coil
15. Engine temperature sensor
16. Intake air temperature sensor
17. Intake air pressure sensor
18. Pulser coil

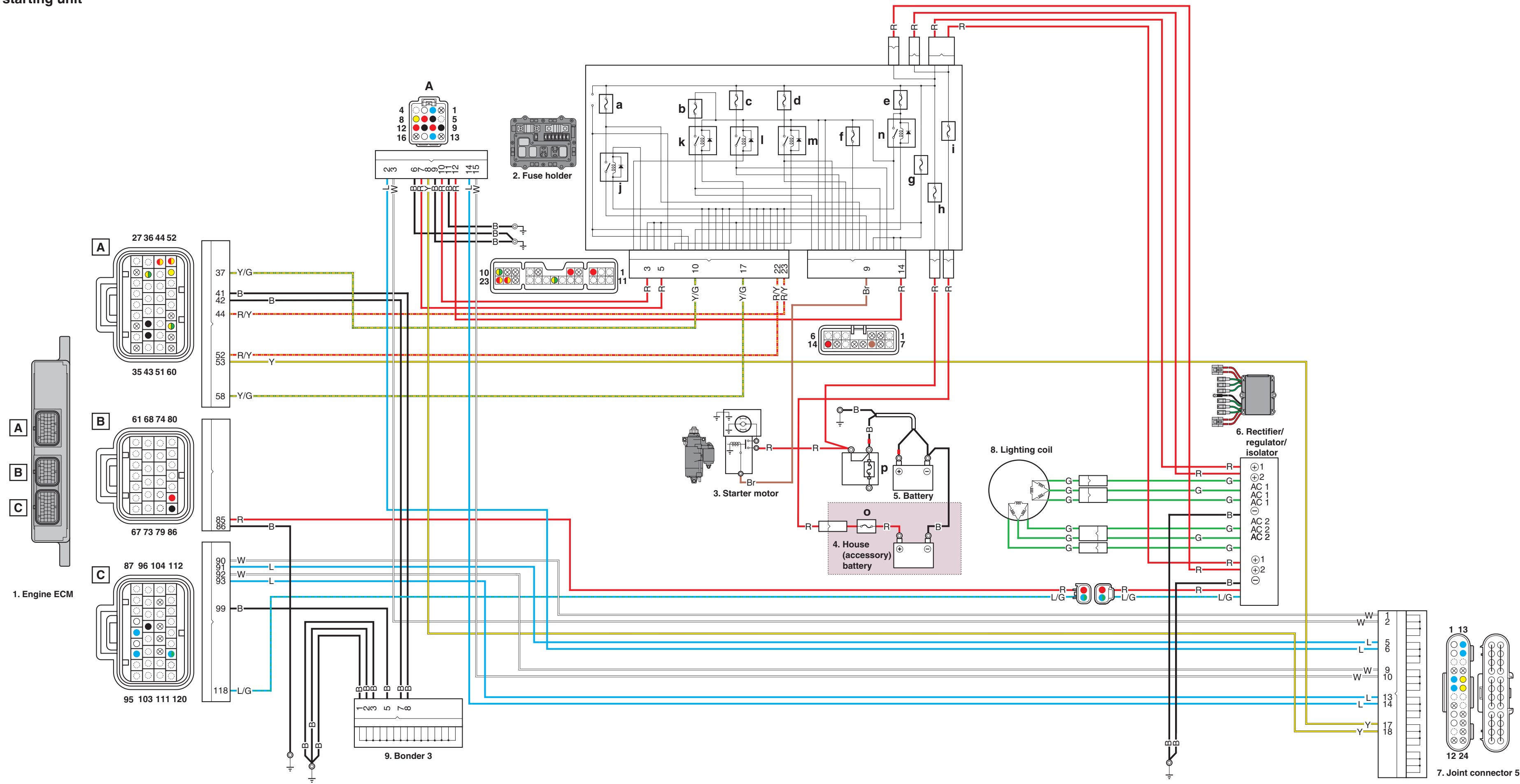
- a. Fuse (30 A) (starter relay)
- b. Fuse (15 A) (high-pressure fuel pump)
- c. Fuse (10 A) (ETV)
- d. Fuse (15 A) (shift actuator)
- e. Fuse (30 A) (ignition coil, fuel injector, engine ECM)
- f. Fuse (10 A) (low-pressure fuel pump)
- g. Fuse (20 A) (engine start switch, PTT switch, Digital Electronic Control ECM, high-pressure fuel pump)
- h. Fuse (100 A) (engine battery)
- i. Fuse (100 A) (house [accessory] battery)
- j. Starter motor relay
- k. Fuel pump relay (high-pressure)
- l. ETV motor relay
- m. Shift actuator relay
- n. Main relay
- o. Fuse (100 A) (house [accessory] battery)
- p. Fuse (100 A) (terminal)

A. To Digital Electronic Control

18. Pulser coil
17. Intake air pressure sensor
16. Intake air temperature sensor
15. Engine temperature sensor
14. Ignition coil
13. Thermo switch (STBD)
12. Ignition coil
11. Knock sensor
10. Thermo switch (PORT)



# Charging unit and starting unit

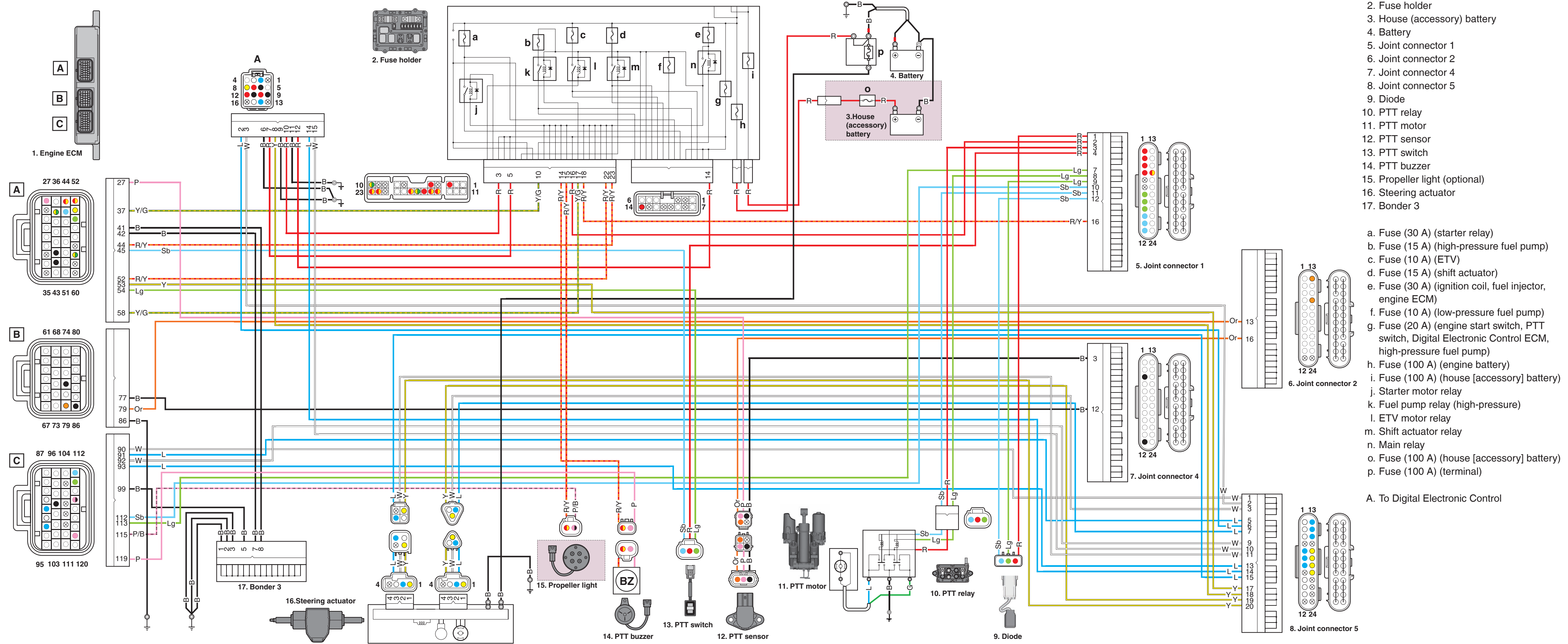


- 1. Engine ECM
- 2. Fuse holder
- 3. Starter motor
- 4. House (accessory) battery
- 5. Battery
- 6. Rectifier/regulator/isolator
- 7. Joint connector 5
- 8. Lighting coil
- 9. Bonder 3

- a. Fuse (30 A) (starter relay)
- b. Fuse (15 A) (high-pressure fuel pump)
- c. Fuse (10 A) (ETV)
- d. Fuse (15 A) (shift actuator)
- e. Fuse (30 A) (ignition coil, fuel injector, engine ECM)
- f. Fuse (10 A) (low-pressure fuel pump)
- g. Fuse (20 A) (engine start switch, PTT switch, Digital Electronic Control ECM, high-pressure fuel pump)
- h. Fuse (100 A) (engine battery)
- i. Fuse (100 A) (house [accessory] battery)
- j. Starter motor relay
- k. Fuel pump relay (high-pressure)
- l. ETV motor relay
- m. Shift actuator relay
- n. Main relay
- o. Fuse (100 A) (house [accessory] battery)
- p. Fuse (100 A) (terminal)

A. To Digital Electronic Control

PTT unit

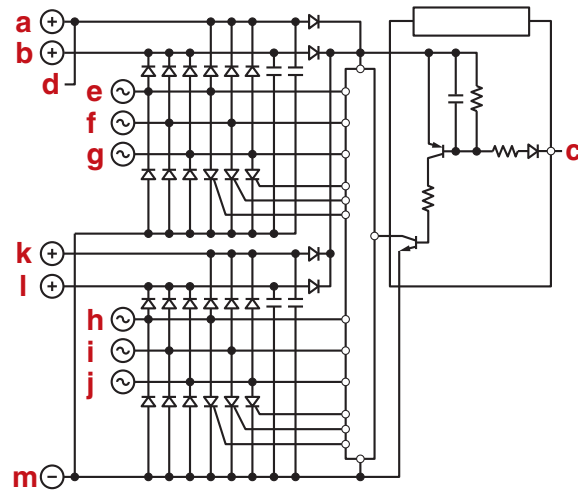
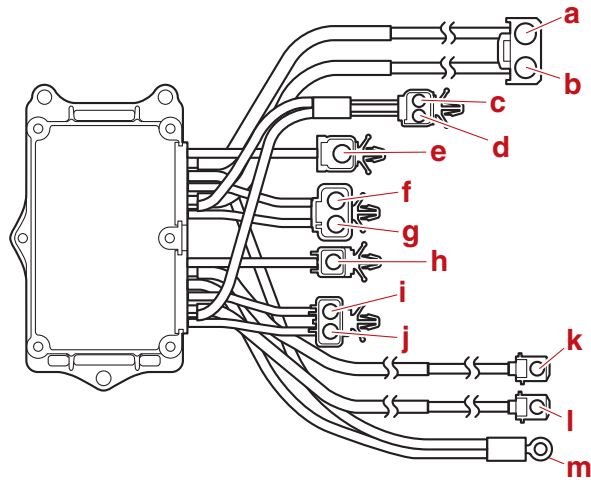


- 1. Engine ECM
- 2. Fuse holder
- 3. House (accessory) battery
- 4. Battery
- 5. Joint connector 1
- 6. Joint connector 2
- 7. Joint connector 4
- 8. Joint connector 5
- 9. Diode
- 10. PTT relay
- 11. PTT motor
- 12. PTT sensor
- 13. PTT switch
- 14. PTT buzzer
- 15. Propeller light (optional)
- 16. Steering actuator
- 17. Bonder 3

- a. Fuse (30 A) (starter relay)
- b. Fuse (15 A) (high-pressure fuel pump)
- c. Fuse (10 A) (ETV)
- d. Fuse (15 A) (shift actuator)
- e. Fuse (30 A) (ignition coil, fuel injector, engine ECM)
- f. Fuse (10 A) (low-pressure fuel pump)
- g. Fuse (20 A) (engine start switch, PTT switch, Digital Electronic Control ECM, high-pressure fuel pump)
- h. Fuse (100 A) (engine battery)
- i. Fuse (100 A) (house [accessory] battery)
- j. Starter motor relay
- k. Fuel pump relay (high-pressure)
- l. ETV motor relay
- m. Shift actuator relay
- n. Main relay
- o. Fuse (100 A) (house [accessory] battery)
- p. Fuse (100 A) (terminal)

A. To Digital Electronic Control

Rectifier/regulator/isolator continuity table



**Rectifier/regulator/isolator continuity table**

OL: Indicates an overload

Rectifier/regulator/isolator for continuity		
Tester probe		Display value (reference data)
(+)	(-)	
"a"	"d"	0 V
	Except for "d"	OL
"b"	All terminals	OL
"c"	All terminals	OL
"d"	"a"	0 V
	Except for "a"	OL
"e"	"a", "b" and "c"	0.4–0.5 V
	Except for "a", "b" and "c"	OL
"f"	"a", "b" and "c"	0.4–0.5 V
	Except for "a", "b" and "c"	OL
"g"	"a", "b" and "c"	0.4–0.5 V
	Except for "a", "b" and "c"	OL
"h"	"k" and "l"	0.4–0.5 V
	Except for "k" and "l"	OL
"i"	"k" and "l"	0.4–0.5 V
	Except for "k" and "l"	OL
"j"	"k" and "l"	0.4–0.5 V
	Except for "k" and "l"	OL
"k"	All terminals	OL
"l"	All terminals	OL
"m"	"a", "b", "c", "k", and "l"	0.7–0.9 V
	"d", "e", "f", "g", "h", "i", and "j"	0.4–0.5 V

**Shim selection table and chart (regular rotation model)**  
**Calculated value (B) table**

(mm)

		A																				
		-010	-009	-008	-007	-006	-005	-004	-003	-002	-001	000	+001	+002	+003	+004	+005	+006	+007	+008	+009	+010
B	000	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84	0.85
	005	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84	0.85
	010	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84
	015	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84
	020	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83
	025	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83
	030	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82
	035	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82
	040	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81
	045	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81
	050	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80
	055	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80
	060	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79
	065	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79
	070	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78
	075	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78
	080	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77
	085	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77
	090	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76
	095	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76
100	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	

- A. Mark (P)
- B. Mark (H)







### Shim selection table and chart (counter rotation model)

#### Calculated value (B) table

See "Calculated value (B) table" (A-18).

#### Pinion shim (T3) selection table

See "Pinion shim (T3) selection table" (A-19).

#### Propeller shaft shim (T4) selection table

(mm)

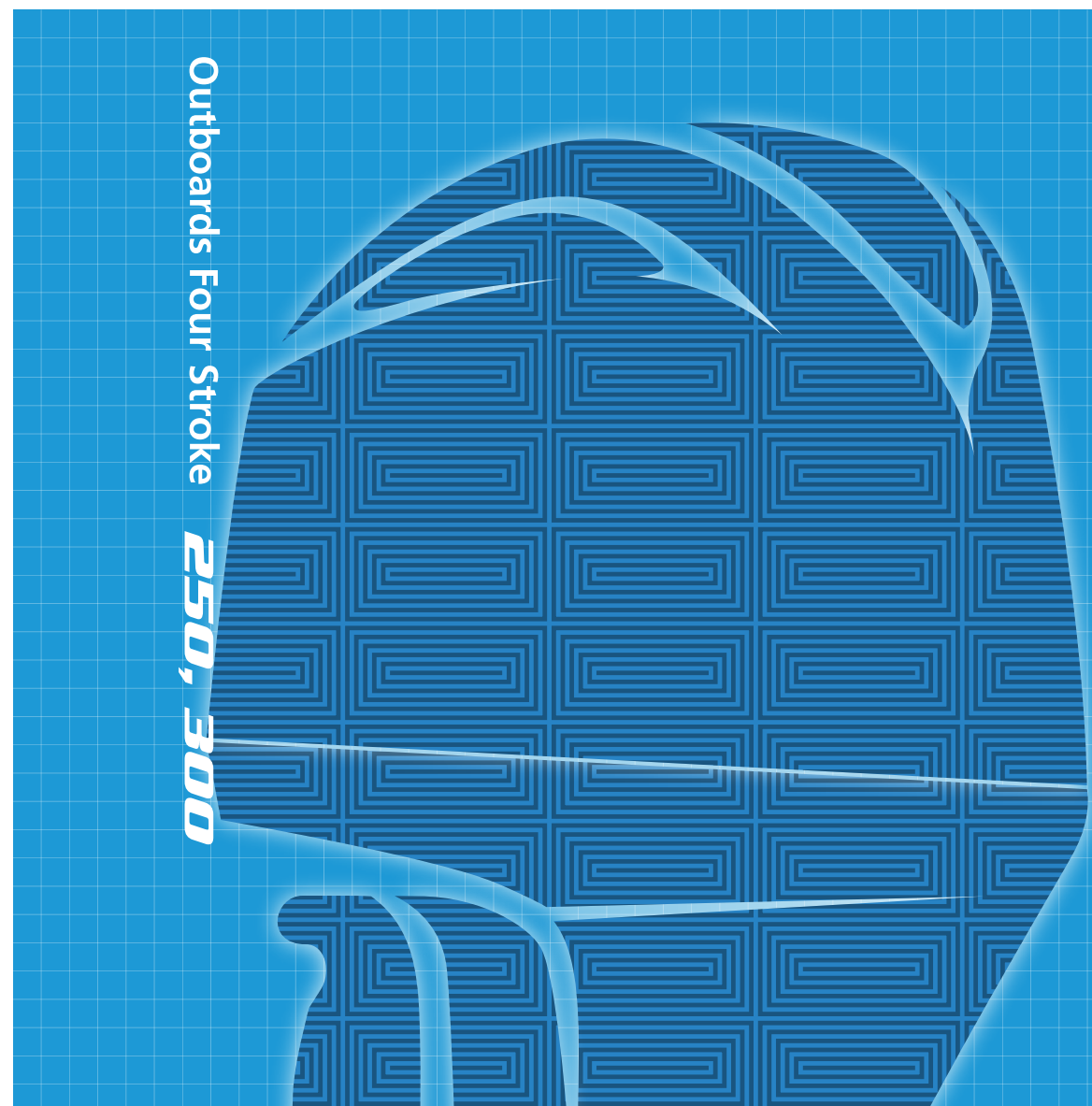
<b>A</b>	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
<b>B</b>	-0.3	-0.2	-0.1		+0.1	+0.2	+0.3	+0.4	+0.5	+0.6	+0.7	+0.8	+0.9	+1.0	+1.1	+1.2	+1.3	+1.4	+1.5	+1.6	+1.7	+1.8	+1.9	+2.0	+2.1	+2.2	+2.3	+2.4	+2.5	+2.6

A. Free play measurement

B. Shim thickness adjustment



SERVICE  
MANUAL



Worldwide:

**F250N** <sup>(6KD)</sup>

**FL250N** <sup>(6KE)</sup>

**F300F** <sup>(6KA)</sup>

**FL300F** <sup>(6KB)</sup>

USA, CAN, EUR, AUS and NZL:

**F250B** <sup>(6KD)</sup>

**LF250B** <sup>(6KE)</sup>

**F300B** <sup>(6KA)</sup>

**LF300B** <sup>(6KB)</sup>

6KA-28197-Z3-11 ●  
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