YAMAHA

# SERVICE MANUAL

# MX775
# MX800
# MX825

LIT-19616-02-37

7UD-F8197-E0

**MX775, MX800, MX825**
**SERVICE MANUAL**

**1st Edition, December 2016**

**LIT-19616-02-37**

## IMPORTANT

This manual was produced by the Yamaha Motor Powered Products Co., Ltd. primarily for use by Yamaha dealers and their qualified mechanics. It is not possible to include all the knowledge of a mechanic in one manual. Therefore, anyone who uses this book to perform maintenance and repairs on Yamaha machines should have a basic understanding of mechanics and the techniques to repair these types of machines. Repair and maintenance work attempted by anyone without this knowledge is likely to render the machine unsafe and unfit for use.
This model has been designed and manufactured to perform within certain specifications in regard to performance and emissions. Proper service with the correct tools is necessary to ensure that the machine will operate as designed. If there is any question about a service procedure, it is imperative that you contact a Yamaha dealer for any service information changes that apply to this model. This policy is intended to provide the customer with the most satisfaction from his machine and to conform to federal environmental quality objectives.
Yamaha Motor Powered Products Co., Ltd. is continually striving to improve all of its models. Modifications and significant changes in specifications or procedures will be forwarded to all authorized Yamaha dealers and will appear in future editions of this manual where applicable.

**TIP**
- This Service Manual contains information regarding periodic maintenance to the emission control system. Please read this material carefully.
- Designs and specifications are subject to change without notice.

## IMPORTANT MANUAL 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.**

**⚠ WARNING**

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

***NOTICE***

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

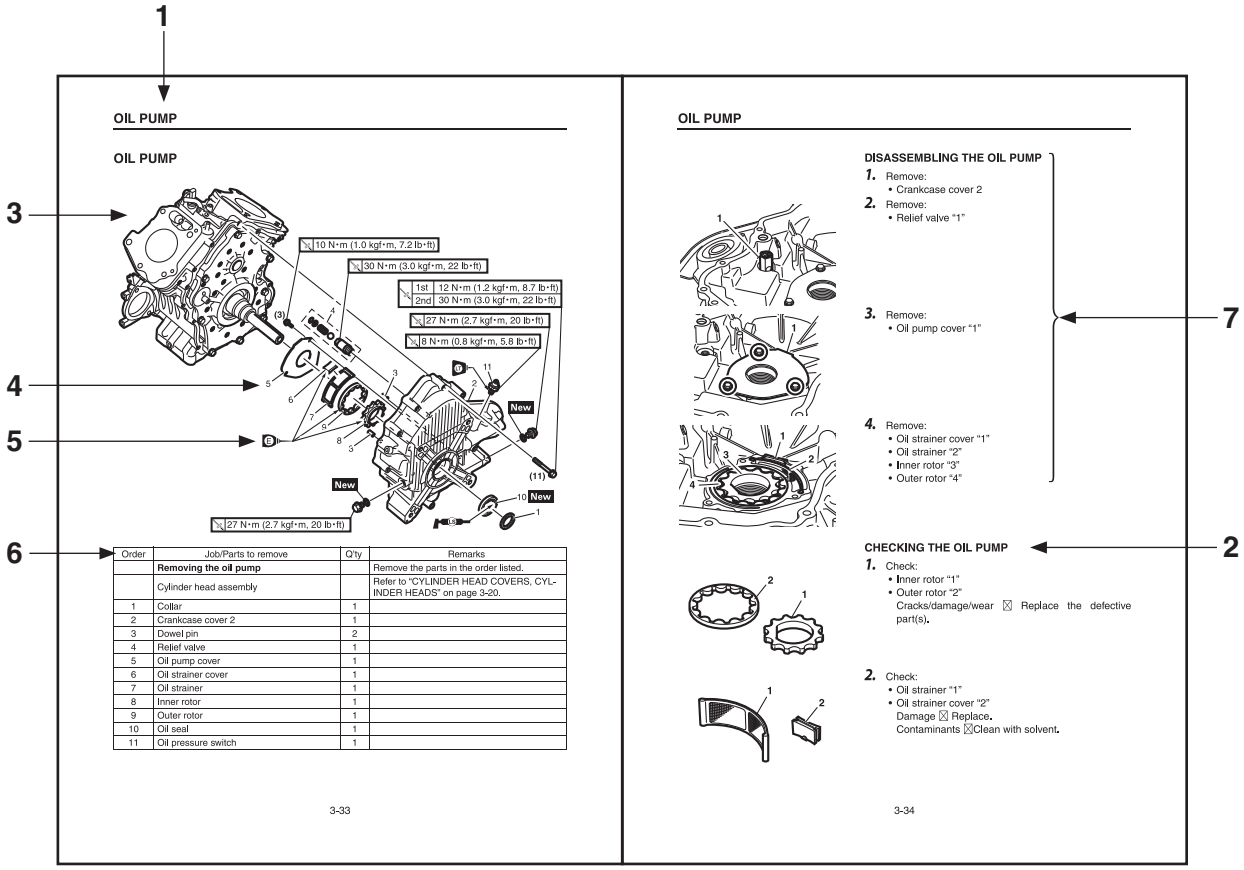
**TIP**

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

# HOW TO USE THIS MANUAL

This manual is intended as a handy, easy-to-read reference book for the mechanic.
Comprehensive explanations of all installation, removal, disassembly, assembly, repair and check procedures are laid out with the individual steps in sequential order.

- The manual is divided into chapters and each chapter is divided into sections. The current section title is shown at the top of each page “1”.
- Sub-section titles appear in smaller print than the section title “2”.
- To help identify parts and clarify procedure steps, there are exploded diagrams at the start of each removal and disassembly section “3”.
- Numbers are given in the order of the jobs in the exploded diagram. A number indicates a disassembly step “4”.
- Symbols indicate parts to be lubricated or replaced “5”.
  Refer to SYMBOLS.
- A job instruction chart accompanies the exploded diagram, providing the order of jobs, names of parts, notes in jobs, etc. “6”. This step explains removal procedure only. For installation, reverse the steps.
- Jobs requiring more information (such as special tools and technical data) are described sequentially “7”.

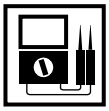


## SYMBOLS

The following symbols are used in this manual for easier understanding.

**TIP**

The following symbols are not relevant to every machine.

| SYMBOL | DEFINITION | SYMBOL | DEFINITION |
|---|---|---|---|
|  | Filling fluid |  | Lubricant |
|  | Special tool |  | Tightening torque |
|  | Wear limit, clearance |  | Engine speed |
|  | Electrical data | New | Replace the part with a new one. |
|  | Lithium-soap base grease |  | Molybdenum disulfide grease |
|  | Engine oil |  | Silicone fluid |
|  | Apply locking agent (LOCTITE®) | | |

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# MEMO

# TABLE OF CONTENTS

## GENERAL INFORMATION



## PERIODIC CHECKS AND ADJUSTMENTS



## ENGINE

## FUEL

## ELECTRICAL

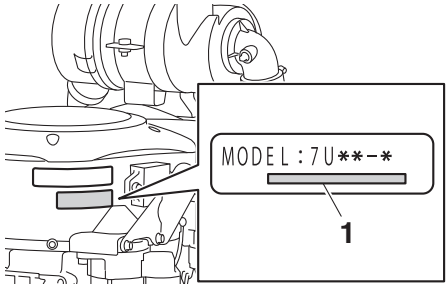


## TROUBLESHOOTING



## SPECIFICATIONS

## MACHINE IDENTIFICATION




### SERIAL NUMBER

The serial number is printed on the label "1" affixed to the position of the multi-purpose engine as shown in the illustration.

**TIP**

- The first four digits identify the model, and the remaining digits indicates the production number.
- Designs and specifications are subject to change without notice.

### STARTING SERIAL NUMBER

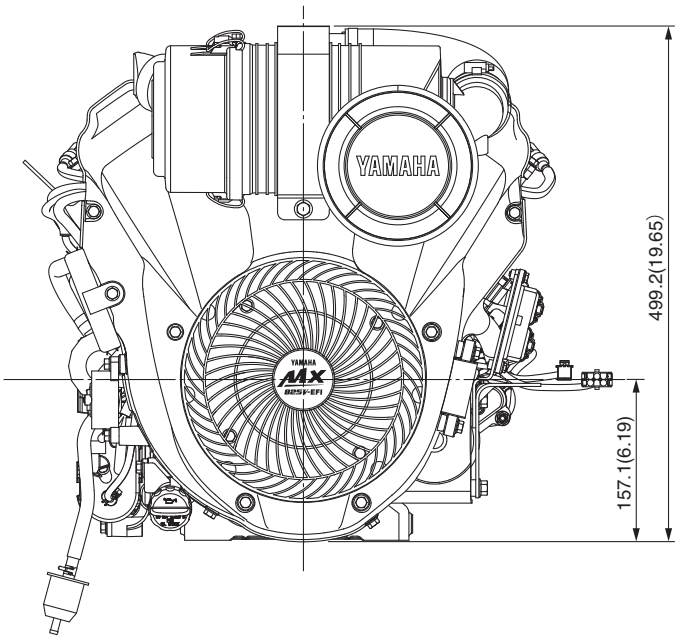
| Model | Code | Starting serial number |
|---|---|---|
| MX775VJ7L6 | 7U2J | 7U2J-1000101- |
| MX775VJ7W6 | | 7U2J-2000101- |
| MX775VJ7X6 | | 7U2J-3000101- |
| MX800VJ7L6 | 7U1J | 7U1J-1000101- |
| MX800VJ7W6 | | 7U1J-2000101- |
| MX800VJ7X6 | | 7U1J-3000101- |
| MX825VJ7L6 | 7UDJ | 7UDJ-1000101- |
| MX825VJ7W6 | | 7UDJ-2000101- |
| MX825VJ7X6 | | 7UDJ-3000101- |

# DIMENSIONS



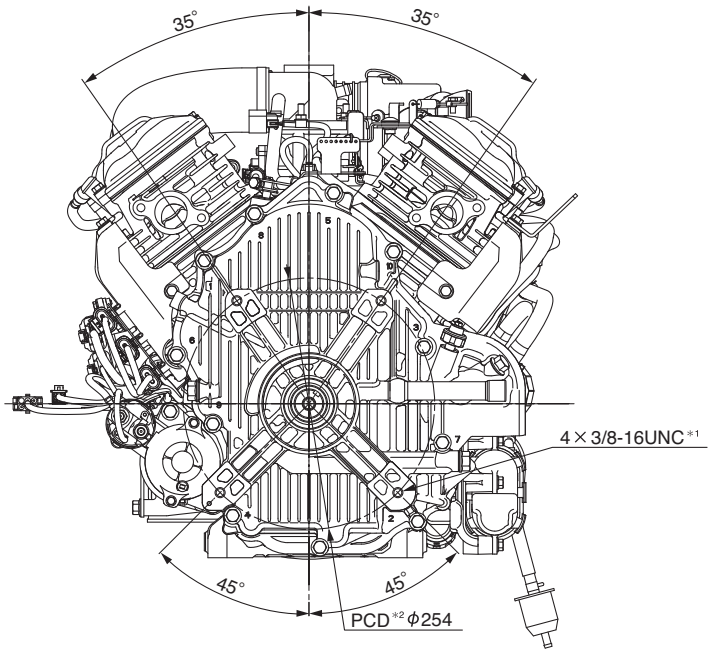
## TOP

mm (in)




## MOUNTING BASE

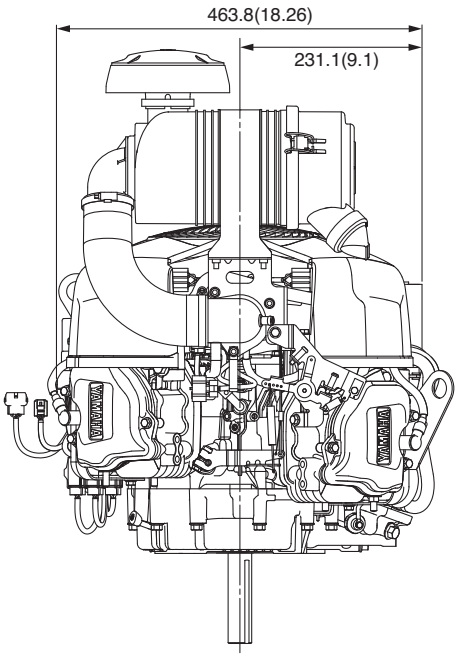
mm (in)




*1: UNC: Unified coarse thread (Unit: in)
*2: PCD: Pitch Circle Diameter

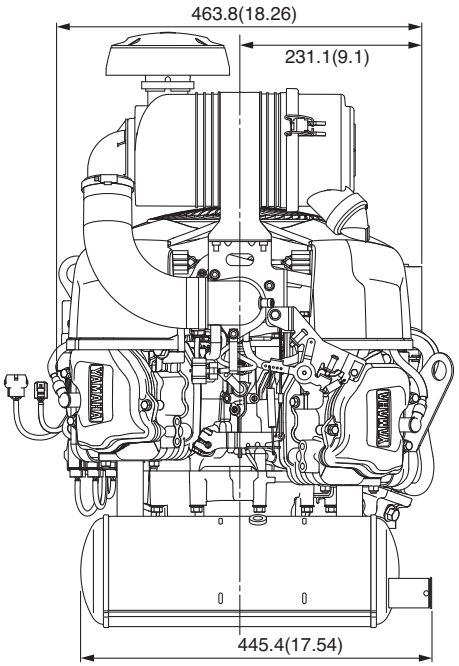
## REAR

mm (in)




## REAR (For models equipped with a muffler)

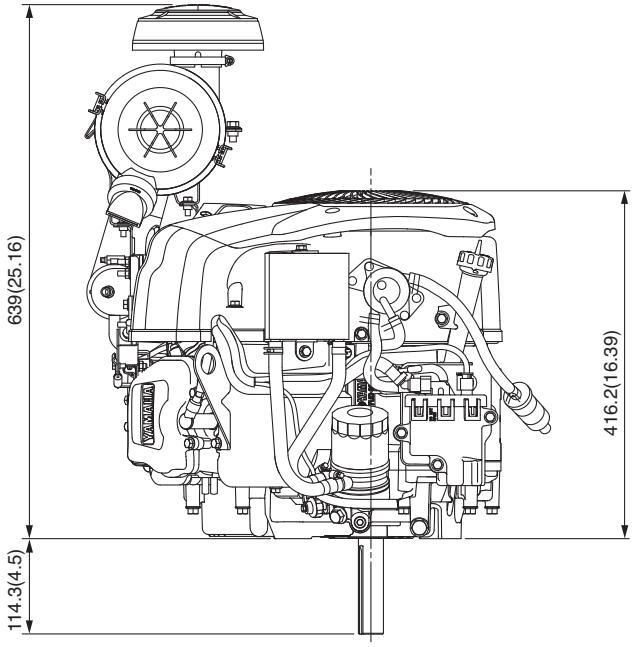
mm (in)



# DIMENSIONS

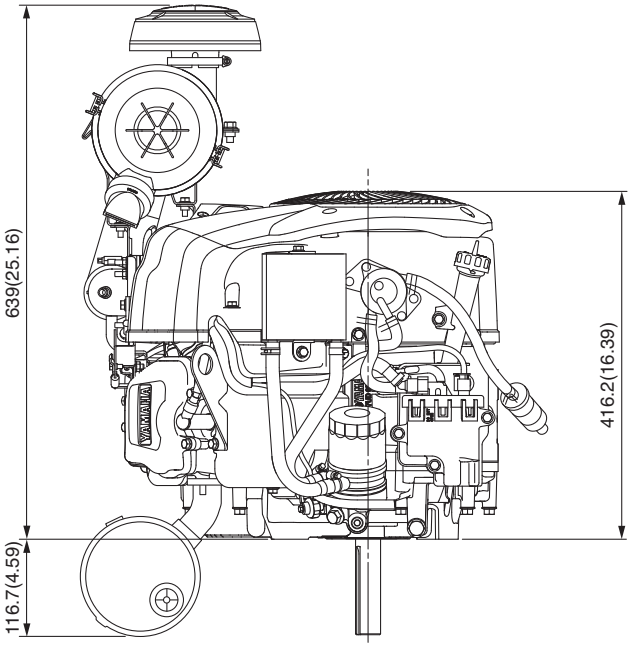
## RIGHT SIDE

mm (in)




## RIGHT SIDE (For models equipped with a muffler)

mm (in)

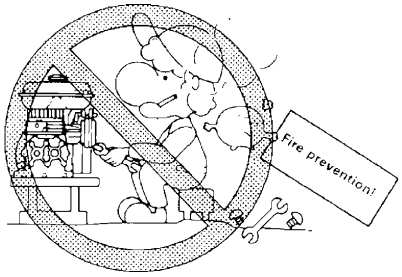


# IMPORTANT INFORMATION

## PREPARATION FOR REMOVAL AND DISASSEMBLY

### CAUTION ON SERVICE

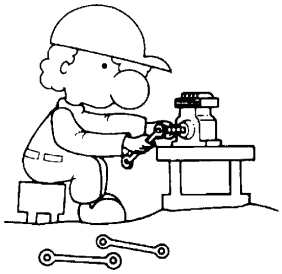
**Fire prevention**




When servicing the engine, always keep the engine and yourself away from fire.

### NOTES ON SERVICE

**Correct tools**

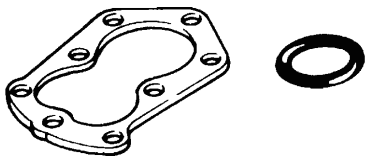


Be sure to use the correct special tool for the job to guard against damage.

**Oil, grease and seals**


Be sure to use genuine Yamaha oils, grease and sealers, or the equivalents.

**Expendable parts**



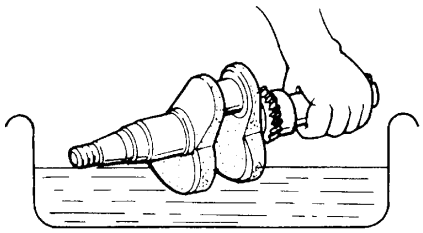
Always replace the gaskets, O-rings, cotter pins and circlips with new parts when servicing engine.

**Tightening torque**

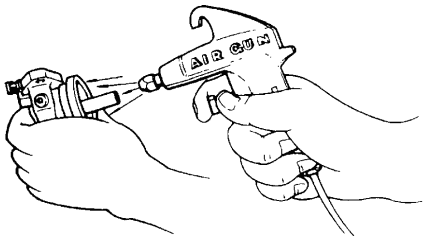
Be sure to follow torque specifications. When tightening bolts, nuts or screws, start with the largest-diameter fastener and work from an inner position to an outer position in a crisscross pattern.

**Notes on disassembly and assembly**

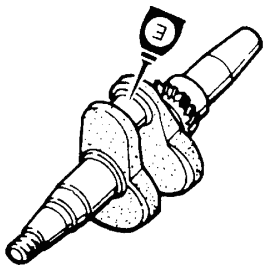
- Parts should be cleaned in solvent and blown dry with compressed air after disassembly.



Solvent




- Contact surfaces of moving parts should be oiled when reassembled.
- Make sure that the parts, move smoothly after each section of the machine is assembled.

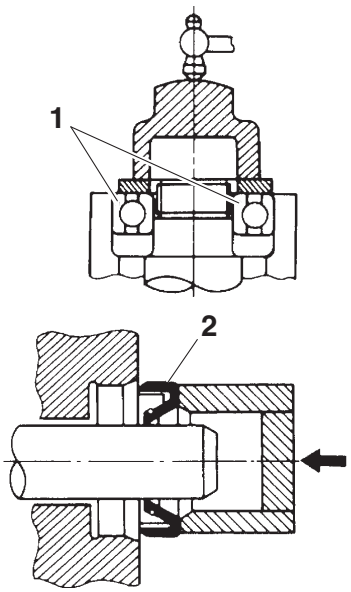


## ALL REPLACEMENT PARTS

We recommend the use of genuine Yamaha parts for all replacements. Use oil and/or grease, recommended by Yamaha, for assembly and adjustment.

## GASKETS, OIL SEALS, AND O-RINGS

1. All gaskets, seals, and O-rings should be replaced when an engine is overhauled. All gaskets surfaces, oil seal lips, and O-rings must be cleaned.
2. Properly oil all mating parts and bearings during reassembly. Apply grease to the oil seal lips.




### BEARINGS AND OIL SEALS

Install the bearing(s) "1" and oil seal(s) "2" with their manufacture's marks or numbers facing outward. (In other words, the stamped letters must be on the side exposed to view.) When installing oil seal(s), apply a light coating of lightweight lithium base grease to the seal lip(s). Oil the bearings liberally when installing.

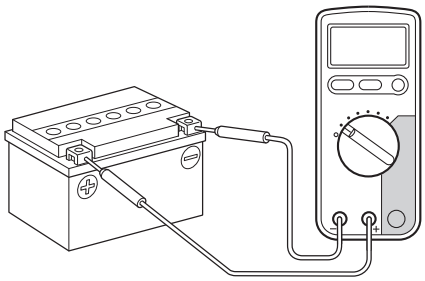
***NOTICE***

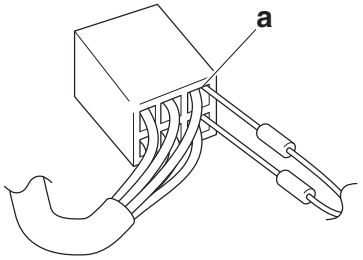
**Do not use compressed air to spin the bearings dry. This causes damage to the bearing surfaces.**

## BASIC SERVICE INFORMATION

### ELECTRICAL SYSTEM

**Checking the electrical system**



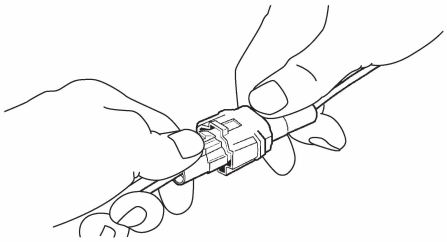



**TIP**

Before checking the electrical system, make sure that the battery voltage is at least 12 V.

***NOTICE***

**Never insert the tester probes into the coupler terminal slots. Always insert the probes from the opposite end "a" of the coupler, taking care not to loosen or damage the leads.**



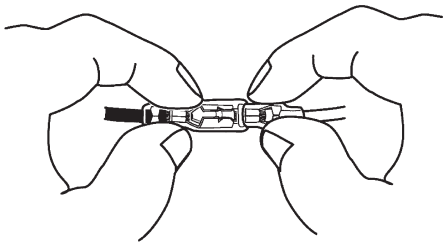
**Checking the connections**

Check the leads, couplers, and connectors for stains, rust, moisture, etc.

***1.*** Disconnect:
- Lead
- Coupler
- Connector

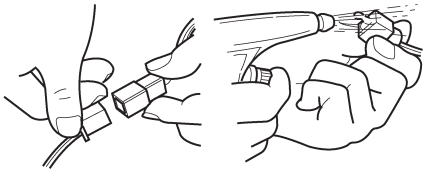
***NOTICE***

- **When disconnecting a coupler, release the coupler lock, hold both sections of the coupler securely, and then disconnect the coupler.**
- **There are many types of coupler locks; therefore, be sure to check the type of coupler lock before disconnecting the coupler.**



***NOTICE***

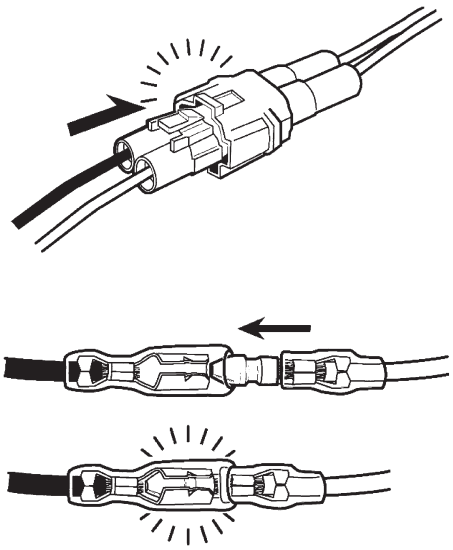
**When disconnecting a connector, do not pull the leads. Hold both sections of the connector securely, and then disconnect the connector.**



***2.*** Check:
- Lead
- Coupler
- Connector

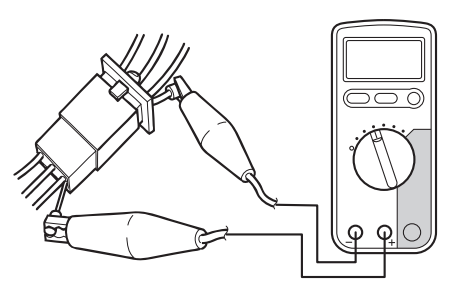
  Moisture → Dry with an air blower.

  Rust/stains → Connect and disconnect several times.

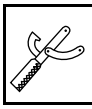


***3.*** Connect:
- Lead
- Coupler
- Connector

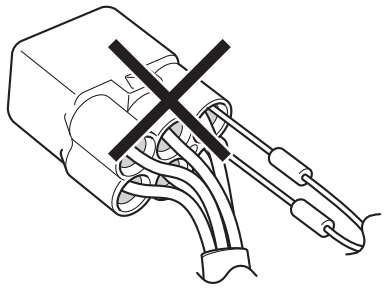
**TIP**
- When connecting a coupler or connector, push both sections of the coupler or connector together until they are connected securely.
- Make sure all connections are tight.



***4.*** Check:
- Continuity
  (with the digital circuit tester)

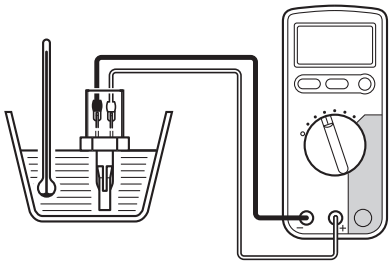
| | |
|---|---|
|  | **Model 88 Multimeter with tachometer: YU-A1927** |

**TIP**
- If there is no continuity, clean the terminals.
- When checking the wire harness, perform steps (1) to (3).
- As a quick remedy, use a contact revitalizer available at most part stores.



***NOTICE***

**For waterproof couplers, never insert the tester leads directly into the coupler. When performing any checks using a waterproof coupler, use the specified test harness or a suitable commercially available test harness.**



***5.*** Check:
- Resistance

| | |
|---|---|
| | **Model 88 Multimeter with tachometer: YU-A1927** |

**TIP**

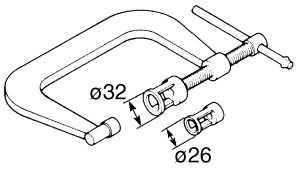
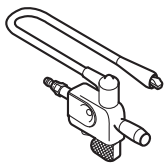
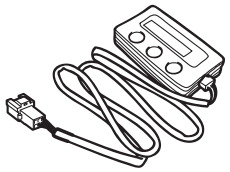
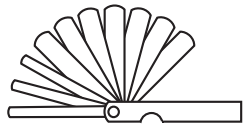
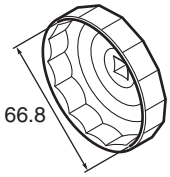
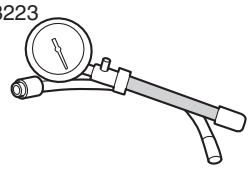
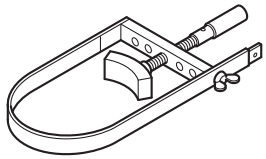
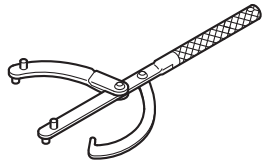
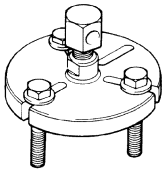
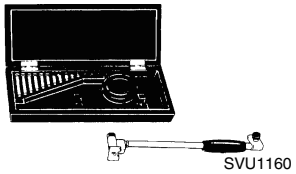
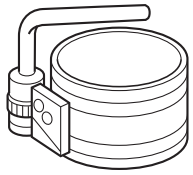
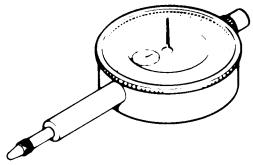
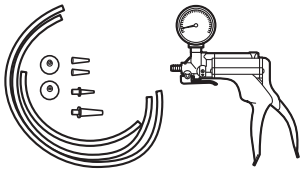
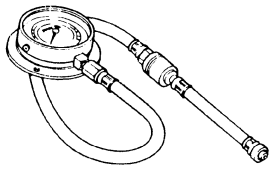
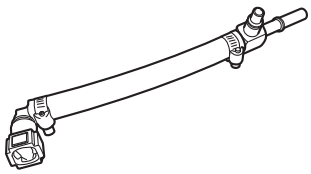
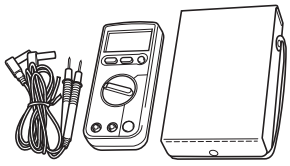
The resistance values shown were obtained at the standard measuring temperature of 20 °C (68 °F). If the measuring temperature is not 20 °C (68 °F), the specified measuring conditions will be shown.

| | |
|---|---|
| | **Engine temperature sensor resistance: 9.0 kΩ–11.0 kΩ at 25 °C (77 °F)** |

## SPECIAL TOOLS AND TESTERS



The proper special tools are necessary for complete and accurate tune-up and assembly. Using the correct special tool will help prevent damage caused by the use of improper tools or improvised techniques.

| | | | |
|---|---|---|---|
| Valve spring compressor<br>90890-01253<br>  | Ignition checker<br>90890-06754<br>  | FI Diagnostic Tool<br>90890-03253<br>  | Feeler gauge set<br>YU-26900-9<br>  |
| Oil filter wrench<br>YM-01469<br>  | Engine compression tester<br>YU-33223<br>YU-33223<br>  | Primary clutch holder<br>YU-01235<br>  | Rotor holding tool<br>90890-01235<br>  |
| Heavy duty puller<br>YU-33270-B<br>  | Cylinder gauge<br>Commercially obtainable<br>  | Piston ring compressor<br>YM-08037<br>  | Dial indicator gauge<br>YU-A8428<br>  |
| Pressure/vacuum tester<br>YB-35956-B<br>  | Fuel pressure gauge<br>YU-03153<br>  | Fuel pressure adapter<br>YM-03186<br>  | Model 88 Multimeter with tachometer<br>YU-A1927<br>  |

## MEMO

# PERIODIC CHECKS AND ADJUSTMENTS



## INTRODUCTION

This chapter includes all information necessary to perform recommended checks and adjustments. These preventive maintenance procedures, if followed, will ensure more reliable machine operation and a longer service life. The need for costly overhaul work will be greatly reduced. This information applies to machines already in service as well as new machines that are being prepared for sale. All service technicians should be familiar with this entire chapter.

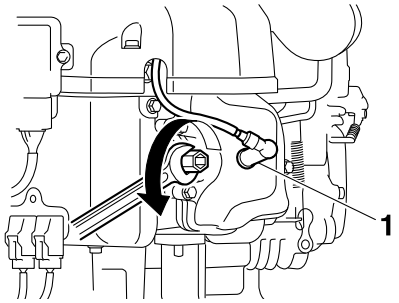
## MAINTENANCE INTERVALS CHART

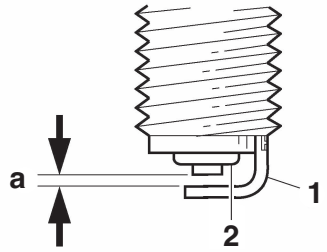
Proper periodic maintenance is important. Especially important are the maintenance services related to emissions control. These controls not only function to ensure air filter but are also vital to proper engine operation and maximum performance.

## PERIODIC MAINTENANCE/LUBRICATION INTERVALS

| | Daily | 50 hrs | 100 hrs | 200 hrs | 250 hrs | 500 hrs | 1000 hrs |
|---|---|---|---|---|---|---|---|
| Check spark plug | | | √ | | | | |
| Check muffler and spark arrester | | | √ (*1) | | | | |
| Check oil level | √ | | | | | | |
| Change engine oil | | | √ | | | | |
| Change oil filter | | | | √ | | | |
| Clean fan case covers and cooling area | | | | √ | | | |
| Check and change fuel filter | | | √ | | | | |
| Check fuel line | √ | | | | | | |
| Clean oil cooler fins | | | | √ | | | |
| Check air filter element | | √ | | | | | |
| Replace air filter element | | | | | √ | | |
| Check air filter inner element | | | | | √ | | |
| Replace air filter inner element | | | | | | √ | |
| Check valve clearance | | | | | | | √ (*2) |
| Clean combustion chamber | | | | | | | √ (*2) |
| Idle speed | | | | | | | √ (*2) |
| Fitting/fastener | | | | | | | √ (*2) |
| Check leaks and anything operator notices such as noises or abnormal operation. | √ | | | | | | |

*1 For models equipped with a Yamaha muffler.
*2 Items marked with an asterisk require special tools, data and technical skills, have a Yamaha dealer perform the service.




## PERIODIC MAINTENANCE

### SPARK PLUGS

**⚠ WARNING**

**Check and adjust the areas around the cylinder head after the engine has cooled down completely.**

**1.** Remove:
- Spark plug caps “1”
- Spark plugs

***NOTICE***

**Before removing the spark plugs, use compressed air to clean the cylinder head covers to prevent dirt from falling into the engine.**

**2.** Check:
- Spark plug type
  Not correct → Replace.

| | |
|---|---|
| | **Spark plug type:**<br>**BPR6ES (NGK)** |

- Electrode “1”
  Wear/damage → Replace.
- Insulator color “2”
  Not normal → Replace.

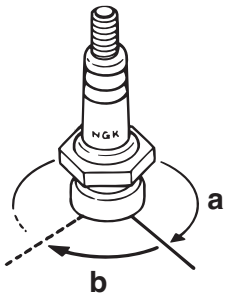
**3.** Measure:
- Spark plug gap “a”
  Use a wire gauge or feeler gauge set.
  Out of specification → Regap.
  If necessary, clean the spark plugs with a spark plug cleaner.

| | |
|---|---|
| | **Feeler gauge set:**<br>**YU-26900-9** |

| | |
|---|---|
| | **Spark plug gap:**<br>**0.7–0.8 mm (0.028–0.031 in)** |

**TIP**

Before installing the spark plugs, clean the gasket surface and plug surface.



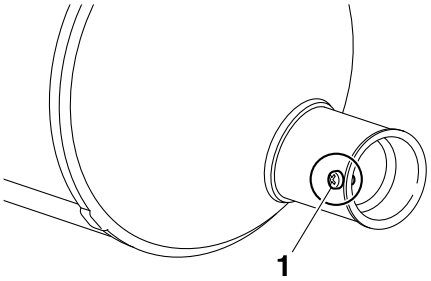

**4.** Install:
- Spark plugs

| | |
|---|---|
| | **Spark plug:**<br>**20 N·m (2.0 kgf·m, 14 lb·ft)** |

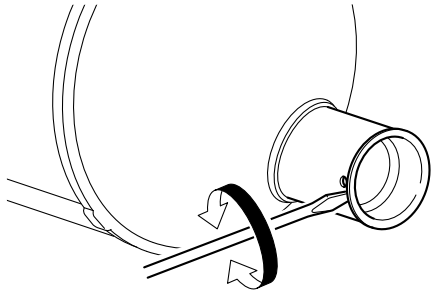
**TIP**
To prevent threads from being damaged, temporally tighten "a" the spark plug before tightening it to the specified torque "b".

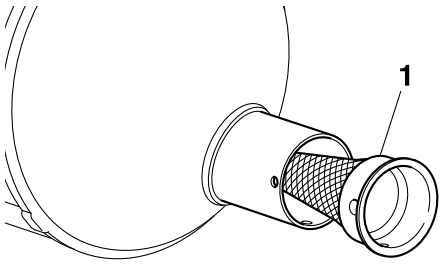
## MUFFLER
## (For models equipped with a muffler)

**⚠ WARNING**
**The engine and muffler will be very hot after the engine has been run.**
**Avoid touching the engine and muffler while they are still hot with any part of your body or clothing during check or repair.**



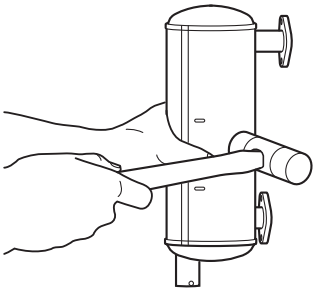

**1.** Remove:
- Spark arrester screw "1"






**2.** Remove:
- Spark arrester "1"

**TIP**
Use a flathead screw driver to pry the spark arrester out from the muffler.

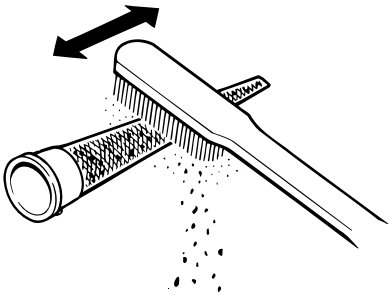


**3.** Remove:
- Muffler
  (Refer to "MUFFLER (For models equipped with a muffler)" on page 3-4)

**4.** Decarbonize:
- Muffler
  Tap on the muffler in the area shown in the illustration to loosen carbon buildup, and then shake it out from the end of the muffler.

***NOTICE***

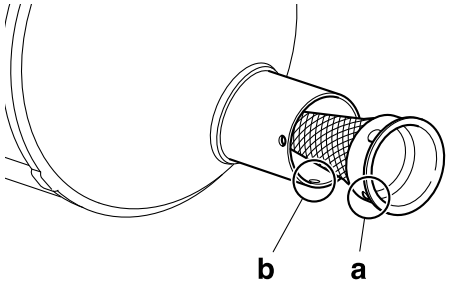
**Do not use a wire brush to clean, otherwise the noise damping material may come out, and the damping effect may be reduced.**



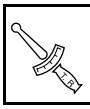
**5.** Decarbonize:
- Spark arrester

***NOTICE***

**When cleaning with a wire brush, use it softly to avoid damage or scratch the spark arrester.**




**6.** Install:
- Muffler
  (Refer to "MUFFLER (For models equipped with a muffler)" on page 3-4)
- Spark arrester
- Spark arrester screw

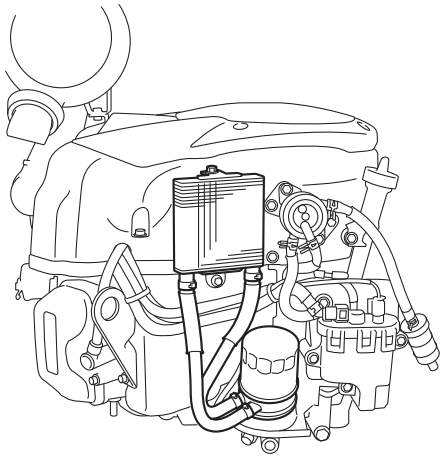
| | |
|---|---|
|  | **Spark arrester screw:**<br>**3.5 N·m (0.35 kgf·m, 2.5 lb·ft)** |

**TIP**

Align the spark arrester lump "a" with the hole "b" in the muffler pipe.

## ENGINE OIL LEAKAGE

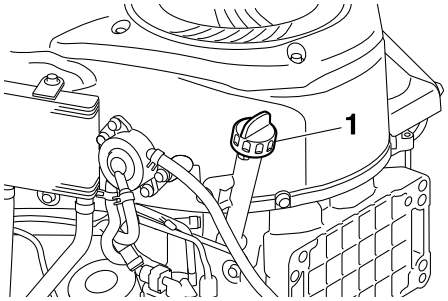
**1.** Place the multi-purpose engine on a level surface.



**2.** Check the areas outside of the engine for oil leakage.
Oil leakage → Replace the gasket, oil seal, or O-ring.

### ENGINE OIL LEVEL

**1.** Remove:
- Oil filler cap "1"




**2.** Check:
- Check that engine oil is at the specified level.

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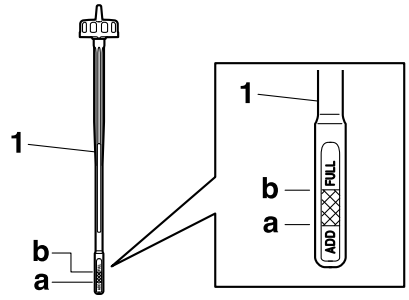
a. Place the multi-purpose engine on a level surface.
b. Warm up the engine for several minutes.
c. Stop the engine.
d. Remove the oil filler cap.
e. Wipe the engine oil dipstick "1" clean, insert it back into the oil filler hole (without screwing it in), and then remove it again to check the oil level.
Add oil if necessary.




**TIP**
The engine oil should be between the minimum "a" and maximum "b" level marks.

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**3.** Install:
- Oil filler cap

**TIP**
Check whether the oil warning light comes on by turning the main switch.

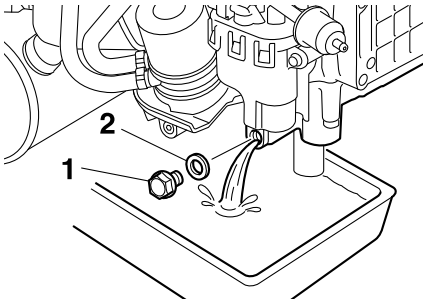
Oil warning light comes on → Add oil.
Oil warning light does not comes on → OK

## REPLACING THE ENGINE OIL

**⚠ WARNING**

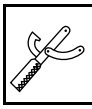
**Avoid draining the engine oil immediately after stopping the engine. The oil is hot and should be handled with care to avoid burns.**

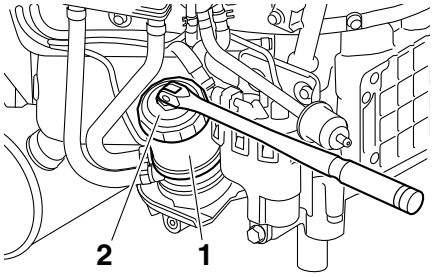
1. Warm up the engine for several minutes, and then stop the engine.
   Place the oil pan under the engine.
2. Remove:
   - Oil filler cap
   - Oil drain bolt "1"
   - Oil drain bolt gasket "2"



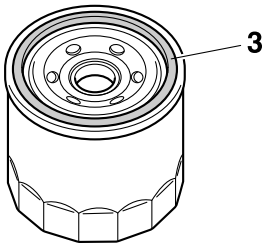

3. Drain:
   - Engine oil
4. If the oil filter is also to be replaced, perform the following procedure.

a. Remove the oil filter "1" with an oil filter wrench "2".

| | |
|---|---|
|  | **Oil filter wrench:**<br>**YM-01469** |

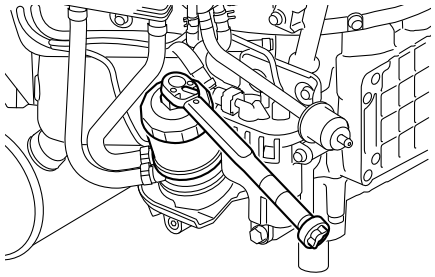



b. Lubricate the O-ring "3" of the new oil filter with a thin coat of engine oil.

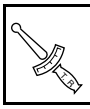



***NOTICE***

**Make sure the O-ring "3" is positioned correctly in the groove of the oil filter.**



c. Tighten the new oil filter to specification with an oil filter wrench.

| | |
|---|---|
|  | **Oil filter:**<br>**14 N·m (1.4 kgf·m, 10 lb·ft)** |

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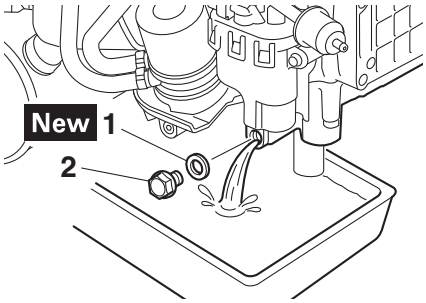
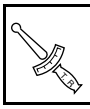
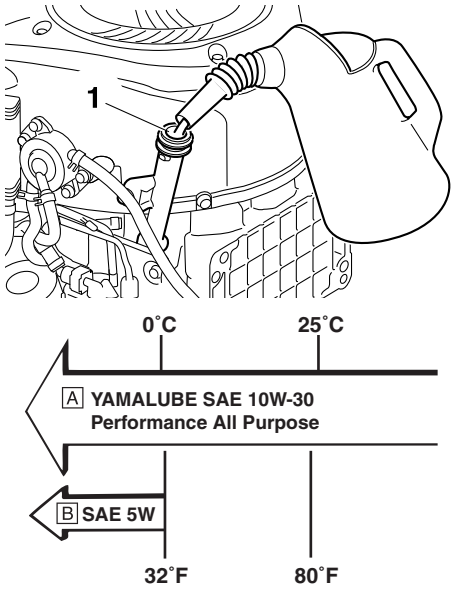



***5.*** Install:
- Oil drain bolt gasket “1” New
- Oil drain bolt “2”

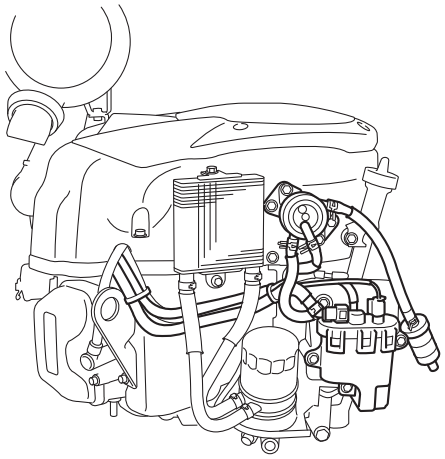
| | |
|---|---|
|  | **Oil drain bolt:**<br>**27 N·m (2.7 kgf·m, 20 lb·ft)** |




***6.*** Fill:
- Engine oil
  Make sure to fill with the recommended engine oil from the oil filler hole “1” in the crankcase.

| | |
|---|---|
|  | **Recommended engine oil:**<br>**A YAMALUBE SAE 10W-30 Performance All Purpose, SAE 10W-30 or 10W-40**<br>**B SAE 5W-30**<br>**Recommended engine oil grade:**<br>**API Service SE type or higher**<br>**Engine oil quantity:**<br>**2.0 L (2.11 US qt, 1.76 Imp.qt)** |

***7.*** Check:
- Engine oil level
  (Refer to “ENGINE OIL LEVEL” on page 2-5)



### FUEL LEAKAGE

1. Check:
   - Leakage
     Check at fuel pump, fuel hose, and throttle body.

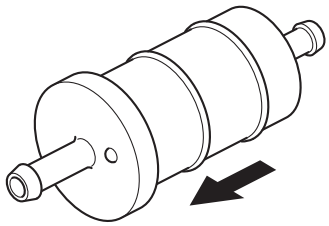
**NOTICE**

**Replace fuel hose every four years.**

### FUEL FILTER

**WARNING**

**Do not smoke, and keep away from open flames, sparks, or any other source of fire when handling or in the vicinity of fuel.**

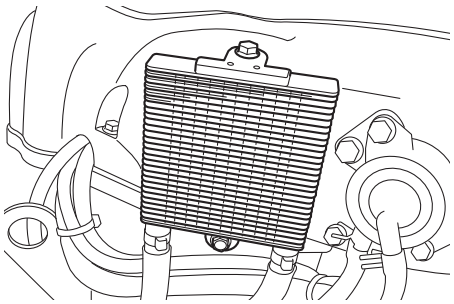


1. Remove:
   - Fuel filter

2. Check:
   - Fuel filter
     Damage → Replace.
     Dirt/clog → Clean.

**TIP**

Clean the fuel filter with clean gasoline, and then dry it thoroughly.



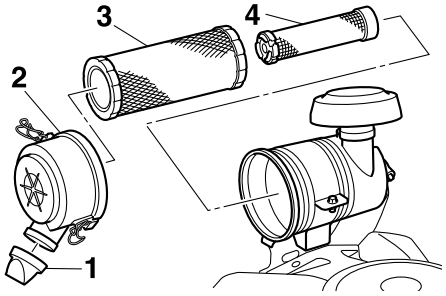
### OIL COOLER

1. Check:
   - Oil cooler
     Damage → Replace.
     Dirt/clog → Clean.

### AIR FILTER ELEMENT

**NOTICE**

**Be sure not to run the engine without air filter element. Otherwise this can result in excessive piston and/or cylinder wear.**



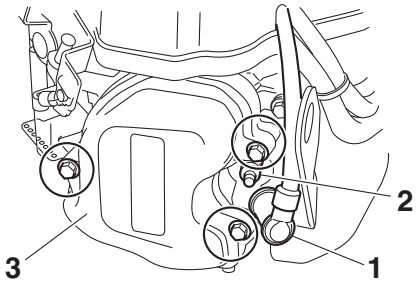

1. Remove:
   - Dust cap “1”
   - Air filter case cover “2”
   - Air filter element “3”
   - Inner element “4”

2. Check:
   - Air filter element
   - Inner element
     Damage/dirty → Replace.

3. Install:
   - Inner element
   - Air filter element
   - Air filter case cover
   - Dust cap

### ADJUSTING THE VALVE CLEARANCE

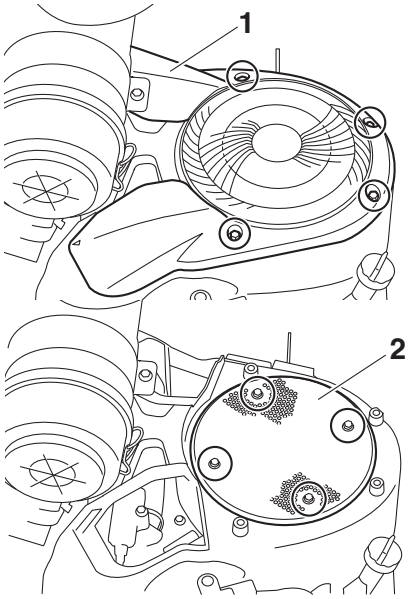
The following procedure applies to all of the valves.




1. Remove:
   - Spark plug cap “1”
   - Spark plug “2”

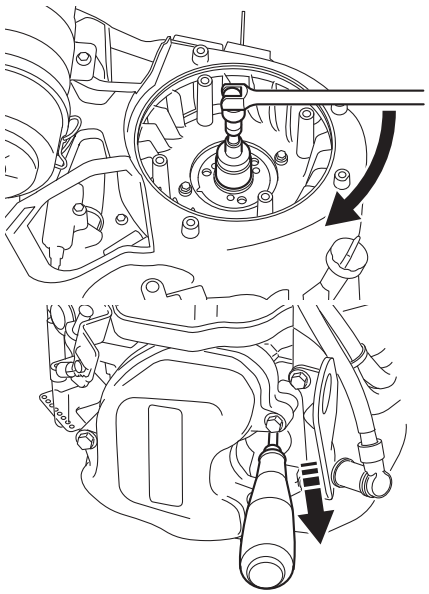
**NOTICE**

**Before removing the spark plug, use compressed air to clean the cylinder head cover to prevent dirt from falling into the engine.**



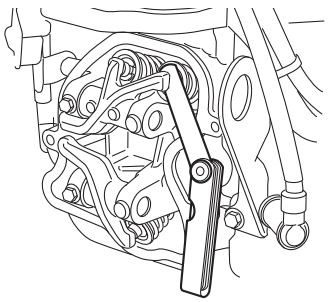

**2.** Remove:
- Cylinder head cover "3"
- Cylinder head cover gasket

**3.** Remove:
- Fan case cover "1"
  (Refer to "CASE AND FAN" on page 3-11)
- Grass screen "2"
  (Refer to "CASE AND FAN" on page 3-11)



**4.** Turn the crankshaft clockwise, and then set the piston at TDC (top-dead-center) on the compression stroke.

**TIP**
Check the piston position by inserting a screw driver into the spark plug hole.

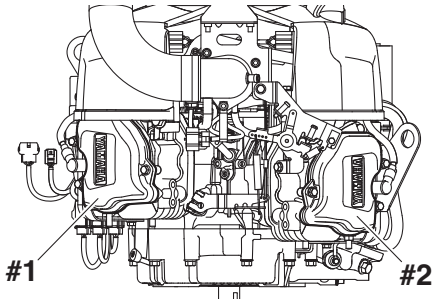


**5.** Measure:
- Valve clearance
  (Between the rocker arm and adjusting pad)
  Out of specification → Adjust to original set value at every 1000 hr.

**TIP**
Valve clearance must be measured when the engine has cooled down enough to be touched.

| | |
|---|---|
|  | **Feeler gauge set:**<br>**YU-26900-9** |

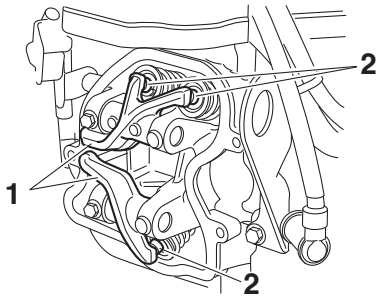
**Valve clearance (cold):**
**Normal ENG operation range (between 1000 hr periodic maintenance):**
**Intake: 0.02–0.2 mm (0.0008–0.01 in)**
**Exhaust: 0.02–0.2 mm (0.0008–0.01 in)**
**Original set value (adjust at 1000 hr periodic maintenance):**
**Intake: 0.07–0.13 mm (0.003–0.005 in)**
**Exhaust: 0.07–0.13 mm (0.003–0.005 in)**




***6.*** Adjust:
- Adjust to original set value

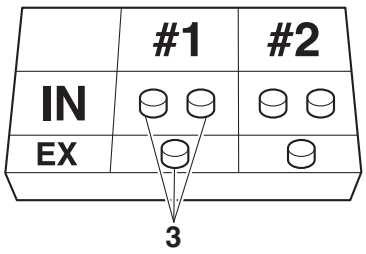
**TIP**
- When adjust valve clearance, record the measured reading of current.
- Measure the valve clearance in the following sequence.

Valve clearance measuring sequence
Cylinder #2 → #1

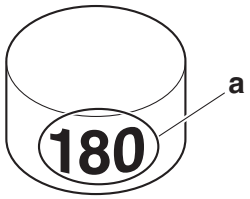



a. Remove the rocker arm "1" and the adjusting pad "2".
(Refer to "CYLINDER HEAD COVERS, CYLINDER HEADS" on page 3-20)

**TIP**
- Pay attention so that the push rod does not fall into the cylinder head.
- Make a note of the position of each adjusting pad "3" so that they can be installed in the correct place.




b. Calculate the difference between the specified valve clearance and the measured valve clearance.
Example:
Specified valve clearance = 0.07–0.13 mm (0.003–0.005 in)
Measured valve clearance = 0.18 mm (0.007 in)
0.18 mm (0.007 in)–0.13 mm (0.005 in) = 0.05 mm (0.002 in)




c. Check the thickness of the current adjusting pad.

**TIP**
The thickness of each adjusting pad is indicated in 1/100 mm units “a” and inscribed on the side.

Example:
If the adjusting pad is marked “180”, the pad thickness is 1.80 mm (0.071 in).

d. Calculate the sum of the values obtained in steps (b) and (c) to determine the required adjusting pad thickness and the adjusting pad number.
Example:
1.80 mm (0.071 in) + 0.05 mm (0.002 in) = 1.85 mm (0.073 in)
The adjusting pad number is 185.

e. Round off the adjusting pad number according to the following table, and then select the suitable adjusting pad.

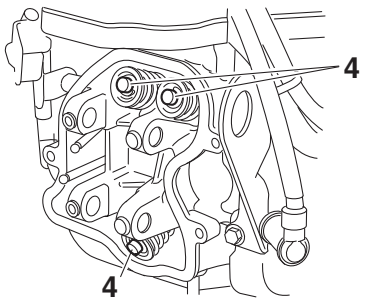
| Last digit | Rounded value |
|---|---|
| 0,2 | 0 |
| 5 | 5 |
| 8 | 10 |

**TIP**
Refer to the following table for the available adjusting pads.

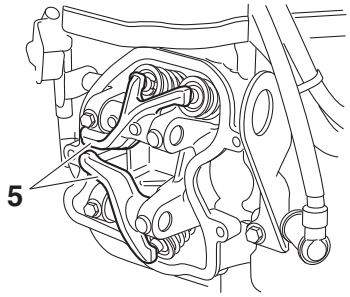
| | |
|---|---|
| Adjusting pad range | Nos. 180–300 |
| Adjusting pad thickness | 1.80–3.00 mm (0.07086–0.11811 in) |
| Available adjusting pads | 0.050 mm (0.002 in) increments |

Example:
Adjusting pad number = 188
Rounded value = 200
New adjusting pad number = 200

f. Install the new adjusting pad “4”.




**TIP**
Lubricate the adjusting pad with engine oil.




g. Install the rocker arm "5".
(Refer to "CYLINDER HEAD COVERS, CYLINDER HEADS" on page 3-20)

| | |
|---|---|
|  | **Rocker arm shaft bolt:**<br>**4.0 N·m (0.40 kgf·m, 2.9 lb·ft)** |

**TIP**
- Lubricate the rocker arm with engine oil.
- Turn the crankshaft clockwise several full turns to seat the parts.

h. Measure the valve clearance again.
i. If the valve clearance is still out of specification, repeat all of the valve clearance adjustment steps until the specified clearance is obtained.

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***7.*** Install:
- Cylinder head cover gasket New
- Cylinder head cover
- Cylinder head cover bolts

| | |
|---|---|
|  | **Cylinder head cover bolt:**<br>**11 N·m (1.1 kgf·m, 8.0 lb·ft)** |

- Spark plug

| | |
|---|---|
|  | **Spark plug:**<br>**20 N·m (2.0 kgf·m, 14 lb·ft)** |

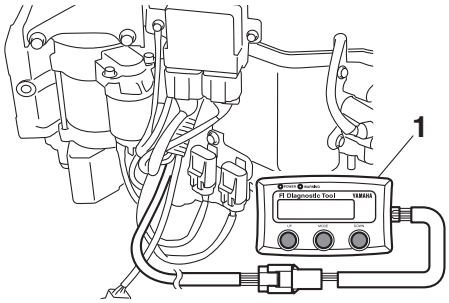
- Spark plug cap

### CYLINDER HEADS DECARBONIZATION

***1.*** Remove:
- Cylinder heads
(Refer to "CYLINDER HEAD COVERS, CYLINDER HEADS" on page 3-20)

***2.*** Eliminate:
- Carbon deposits
(Refer to "CHECKING THE CYLINDER HEADS" on page 3-24)

***3.*** Install:
- Cylinder heads
(Refer to "INSTALLING THE CYLINDER HEAD ASSEMBLY" on page 3-25)




### ENGINE SPEED

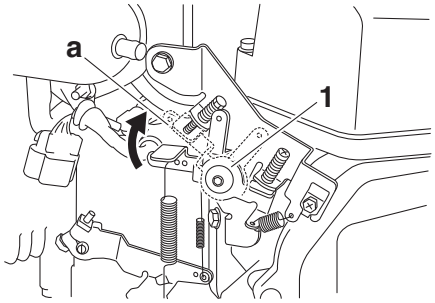
1. Warm up the engine for several minutes.
2. Connect:
   - FI Diagnostic Tool "1"

| | |
|---|---|
| | **FI Diagnostic Tool:**<br>**90890-03253** |

3. Measure:
   - High engine speed (with no load)
     Out of specification → Adjust.

| | |
|---|---|
| | **High engine speed (with no load):**<br>**3550–3600 r/min** |

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼




a. Move the throttle lever "1" to the high engine speed position "a".

b. Check the high engine speed.

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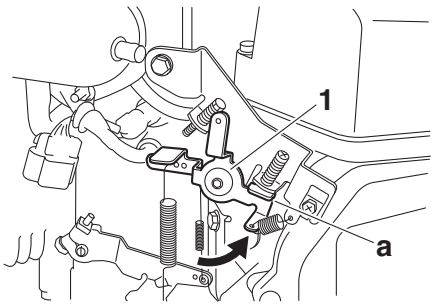
4. Measure:
   - Low engine speed (with no load)
     Out of specification → Adjust.

| | |
|---|---|
| | **Low engine speed (with no load):**<br>**1450–1550 r/min** |

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

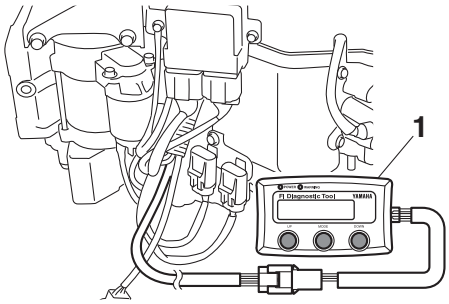



a. Move the throttle lever "1" to the low engine speed position "a".

b. Check the low engine speed.

▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲

### ADJUSTING THE ENGINE SPEED

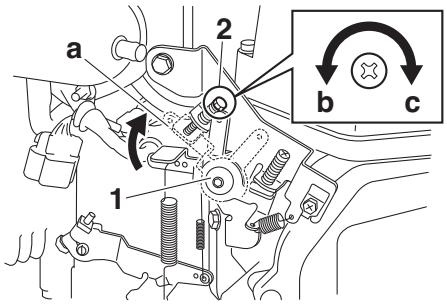



1. Warm up the engine for several minutes.
2. Connect:
   • FI Diagnostic Tool “1”

| | |
|---|---|
| | **FI Diagnostic Tool:**<br>**90890-03253** |

3. Adjust:
   • High engine speed

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼




a. Move the throttle lever “1” to the high engine speed position “a”.

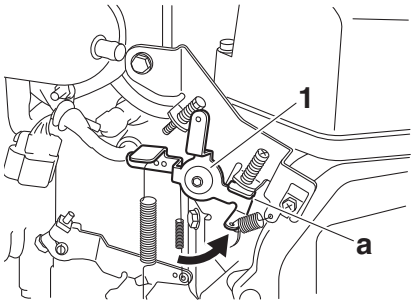
b. Turn the throttle stop screw “2” in direction “b” or “c” until the high engine speed is obtained.

| |
|---|
| Direction “b”<br>High engine speed is increased.<br>Direction “c”<br>High engine speed is decreased. |

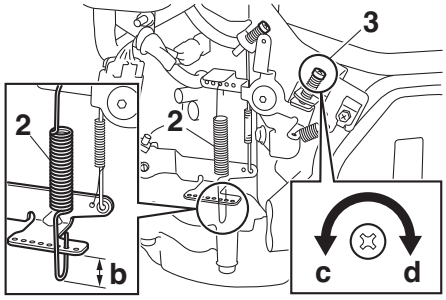
| | |
|---|---|
| | **High engine speed (with no load):**<br>**3550–3600 r/min** |

▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲

4. Adjust:
   • Low engine speed




a. Move the throttle lever "1" to the low engine speed position "a".




b. Turn the screw "3" in direction "c" or "d" until obtain adequet low engine speed.

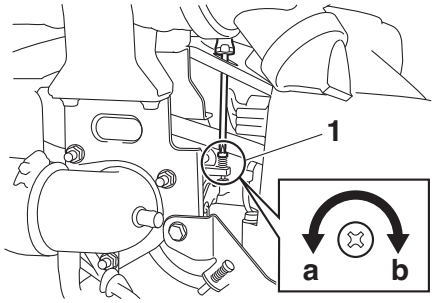
| |
|---|
| Direction "c"<br>Low engine speed is decreased.<br>Direction "d"<br>Low engine speed is increased. |

| | |
|---|---|
| | **Low engine speed (with no load):**<br>**1450–1550 r/min** |

### LOW ENGINE SPEED (Replace the throttle body)

**TIP**

When replace throttle body, follow the procedure below.
Adjust low engine speed with throttle stop screw "1" in direction "a" or "b".




***1.*** Turn the throttle stop screw "1" (throttle body) in direction "a" or "b" until the low engine speed is obtained.

| |
|---|
| Direction "a"<br>Low engine speed is decreased.<br>Direction "b"<br>Low engine speed is increased. |

| | |
|---|---|
| | **Low engine speed (with no load):**<br>**1450–1550 r/min** |

### FITTINGS AND FASTENERS

***1.*** Check:
- All fittings and fasteners
  Looseness → Tighten.
  Rough movement → Replace the defective part(s).
  Damage/pitting → Replace.

## ENGINE INSPECTION

### MEASURING THE COMPRESSION PRESSURE

The following procedure applies to all of the cylinders.

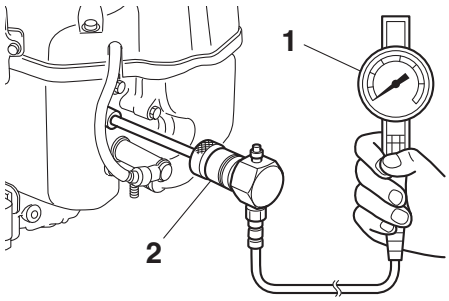
**TIP**

Measure the compression pressure after checking and adjusting the valve clearance.

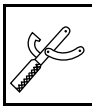
1. Warm up the engine for several minutes.
2. Remove:
   - Spark plug cap
   - Spark plug

***NOTICE***

**Before removing the spark plug, use compressed air to clean the cylinder head cover to prevent dirt from falling into the engine.**




3. Connect:
   - Engine compression tester "1"
   - Extension "2"

| | |
|---|---|
|  | **Engine compression tester:**<br>**YU-33223** |

4. Measure:
   - Compression pressure

   Open the throttle and crank the engine until the needle stop rising on the engine compression tester.

   Out of specification → Refer to steps (a) and (b).

| | |
|---|---|
|  | **Standard compression pressure:**<br>**1.31–1.45 MPa (13.4–14.8 kg/cm², 190–210 psi)**<br>**Limit:**<br>**1.03 MPa (10.3 kg/cm², 150 psi)** |

**⚠ WARNING**

**To prevent sparking the plugs, remove all ignition coil couplers and fuel injector couplers before cranking the engine.**

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

a. If the compression pressure is below the minimum specification, pour a teaspoonful of engine oil into the spark plug hole and measure again. Refer to the following table.

| Reading | Diagnosis |
|---|---|
| Higher than without oil | • Worn cylinder, piston, and piston ring(s) |
| Same as without oil | • Defective piston, piston ring(s), valve(s), and cylinder head gasket<br>• Improper valve timing and valve clearance |

b. If the compression pressure is above the maximum specification, check the cylinder head, valve surfaces and piston crown for carbon deposits.
Carbon deposits → Eliminate.

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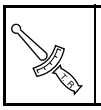
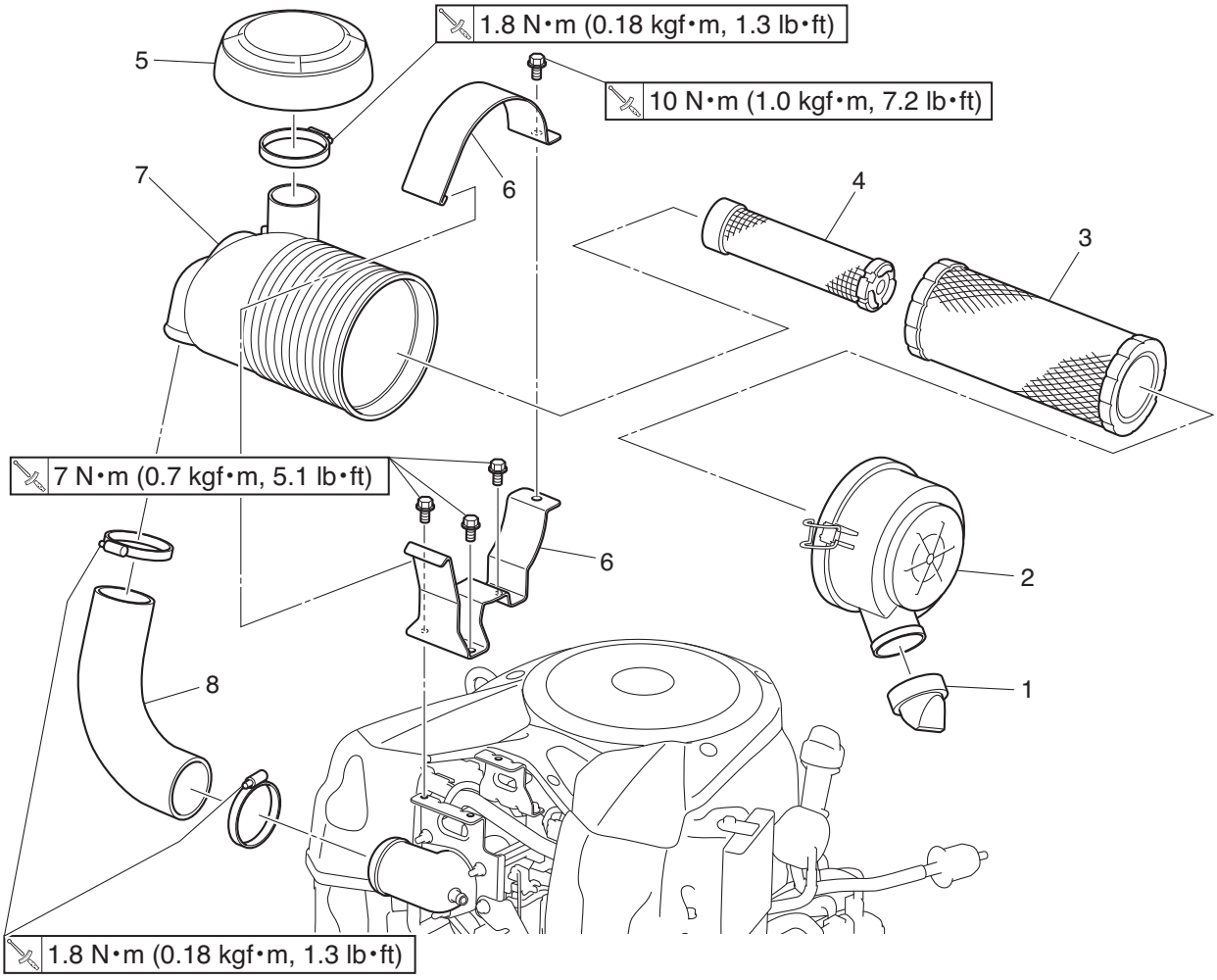
***5.*** Install:
- Spark plug



**Spark plug:**
**20 N·m (2.0 kgf·m, 14 lb·ft)**

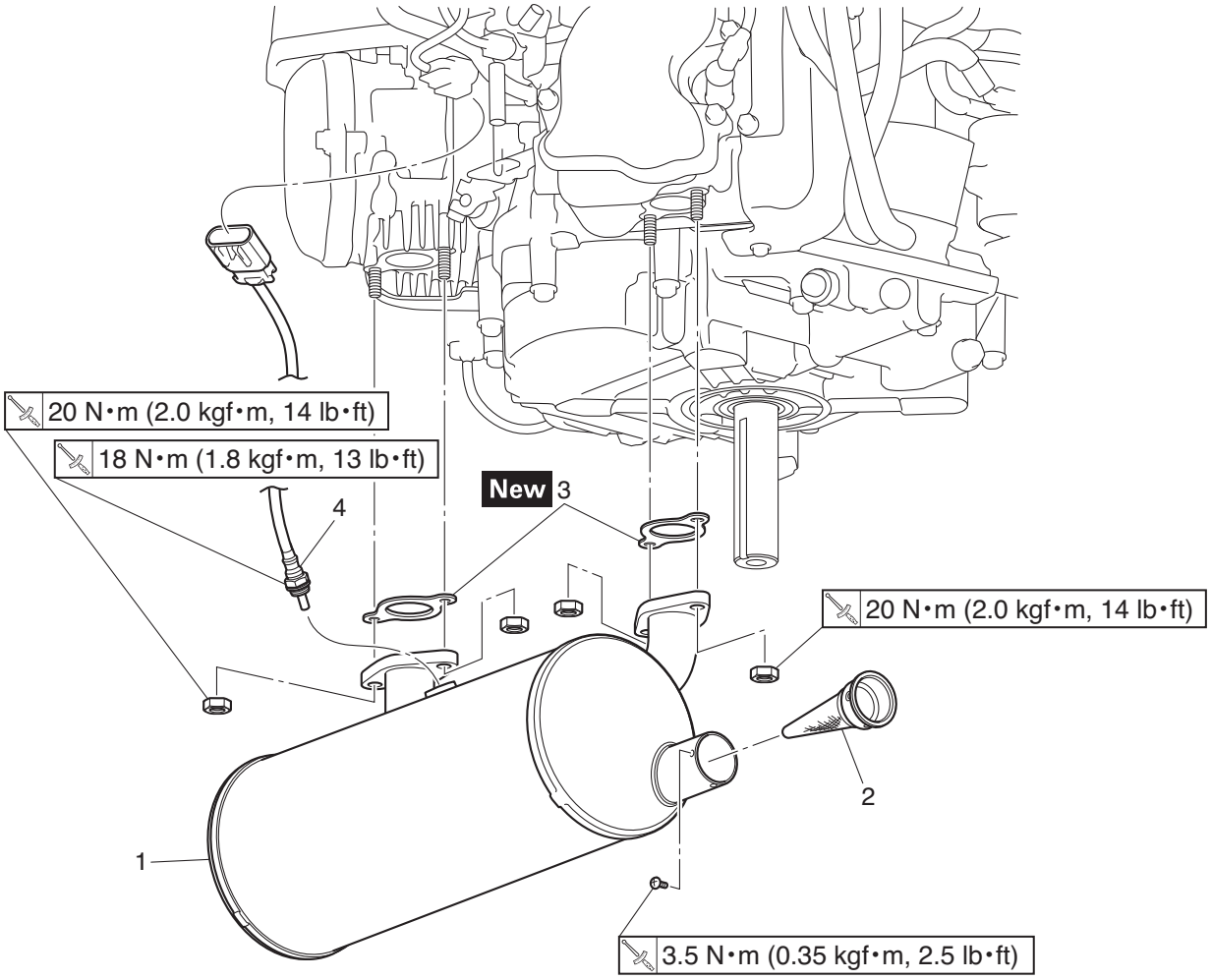
- Spark plug cap

# AIR FILTER



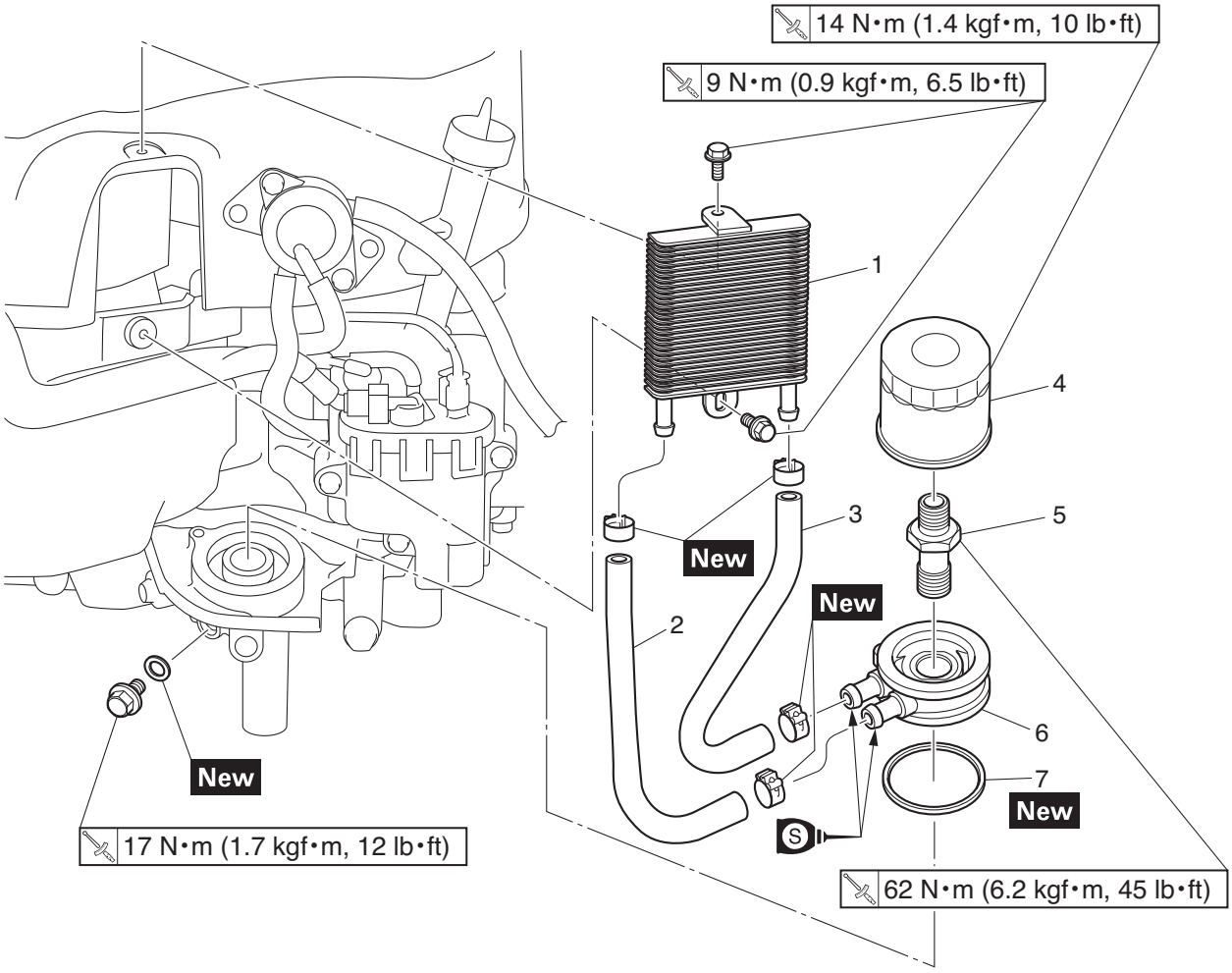

| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the air filter** | | Remove the parts in the order listed. |
| 1 | Dust cap | 1 | |
| 2 | Air filter case cover | 1 | |
| 3 | Air filter element | 1 | |
| 4 | Inner element | 1 | |
| 5 | Air filter cover 1 | 1 | |
| 6 | Air filter case stay | 1 | |
| 7 | Air filter case | 1 | |
| 8 | Joint 2 | 1 | |

## MUFFLER (For models equipped with a muffler)

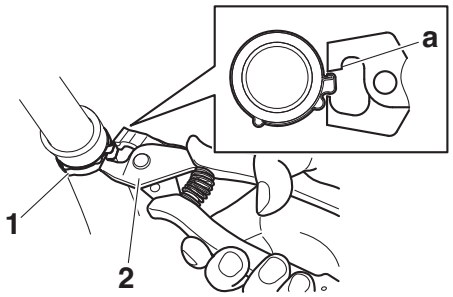



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the muffler** | | Remove the parts in the order listed. |
| 1 | Muffler | 1 | |
| 2 | Spark arrester | 1 | |
| 3 | Gasket | 2 | |
| 4 | $O_2$ sensor | 1 | |

## OIL COOLER




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the oil cooler** | | Remove the parts in the order listed. |
| | Engine oil | | Drain.<br>Refer to "REPLACING THE ENGINE OIL" on page 2-6. |
| 1 | Oil cooler | 1 | |
| 2 | Oil hose 1 | 1 | |
| 3 | Oil hose 2 | 1 | |
| 4 | Oil filter | 1 | |
| 5 | Adapter union bolt | 1 | |
| 6 | Adapter | 1 | |
| 7 | Oil seal | 1 | |

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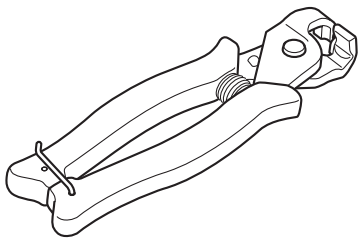


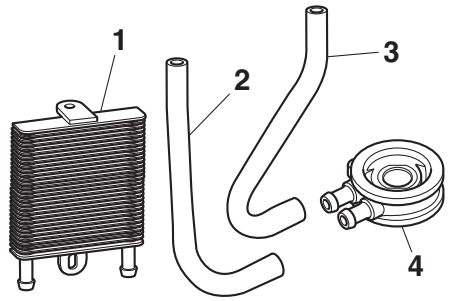
## REMOVING THE OIL COOLER

**1.** Remove:
- Hose clamp (Clic-R) “1”

**TIP**
- Remove the hose clamp using the hose clamp pliers “2”.
- When removing the hose clamp, make sure that the thick tip “a” of the hose clamp pliers is directed as shown in the illustration.

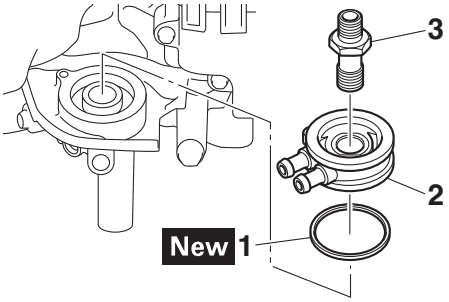
A. Hose clamp pliers

**2.** Remove:
- Oil hose 1
- Oil hose 2
- Oil cooler




## CHECKING THE OIL COOLER

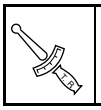
**1.** Check:
- Oil cooler “1”
- Oil hose 1 “2”
- Oil hose 2 “3”
- Adapter “4”
  Damage → Replace.
  Dirt/clog → Clean.

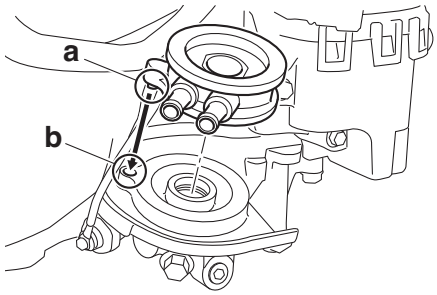



## INSTALLING THE OIL COOLER

**1.** Clean:
- Mating surfaces of the adapter and the crankcase cover 2
  (with a cloth dampened with lacquer thinner)

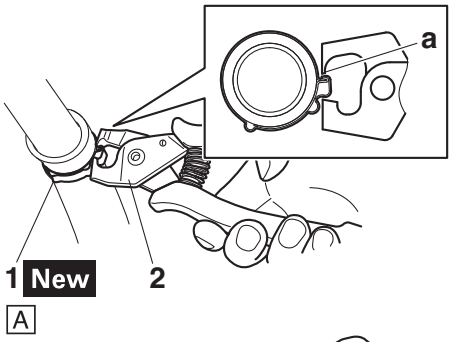
**2.** Install:
- Oil seal “1” New
- Adapter “2”
- Adapter union bolt “3”

| | |
|---|---|
|  | **Adapter union bolt:**<br>**62 N·m (6.2 kgf·m, 45 lb·ft)** |



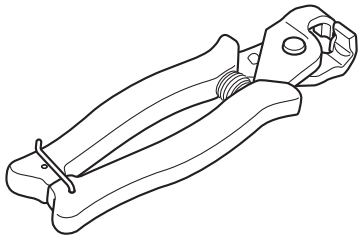

**TIP**
- Make sure the oil seal is positioned properly.
- Align the projection “a” on the adapter with the hole “b” in the crankcase cover 2.





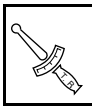

***3.*** Install:
- Oil filter
- Oil hose 2
- Oil hose 1
- Hose clamp (Clic-R) “1” New

**TIP**
- Install the hose clamp using the hose clamp pliers “2”.
- When installing the hose clamp, make sure that the thin tip “a” of the hose clamp pliers is directed as shown in the illustration.

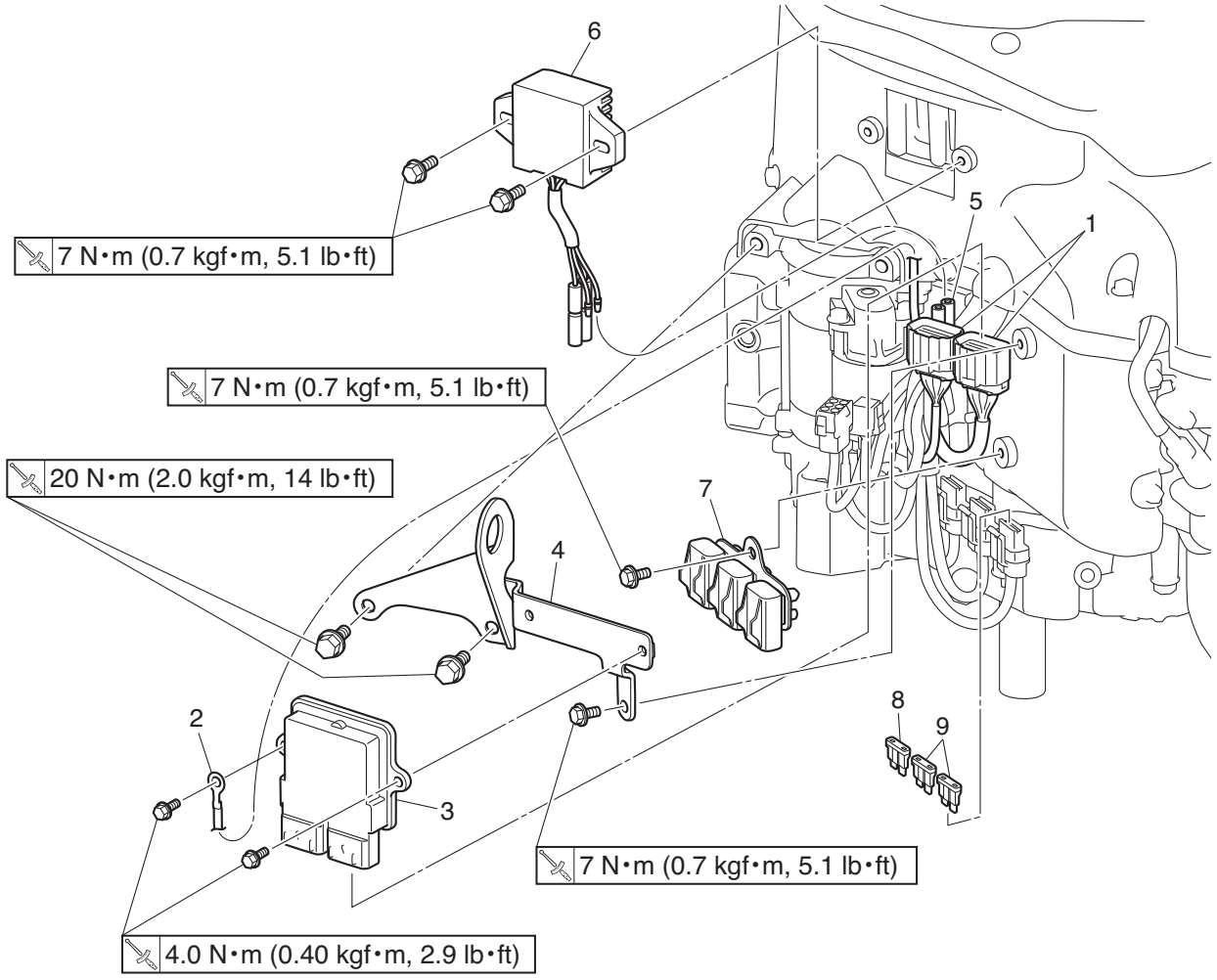


A. Hose clamp pliers

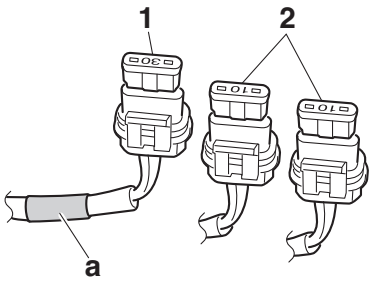
***4.*** Install:
- Oil cooler
- Oil cooler bolts

| | |
|---|---|
|  | **Oil cooler bolt:**<br>**9 N·m (0.9 kgf·m, 6.5 lb·ft)** |

# ECU, RECTIFIER/REGULATOR, AND FUSES




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the ECU, rectifier/regulator, and fuses** | | Remove the parts in the order listed. |
| 1 | ECU coupler | 2 | Disconnect. |
| 2 | Earth terminal | 1 | |
| 3 | ECU | 1 | |
| 4 | Engine hunger | 1 | For maintenance. |
| 5 | Rectifier/regulator lead connector | 4 | Disconnect. |
| 6 | Rectifier/regulator | 1 | |
| 7 | Fuse holder bracket | 1 | |
| 8 | Fuse | 1 | 30 A |
| 9 | Fuse | 2 | 10 A |




### INSTALLING THE FUSES

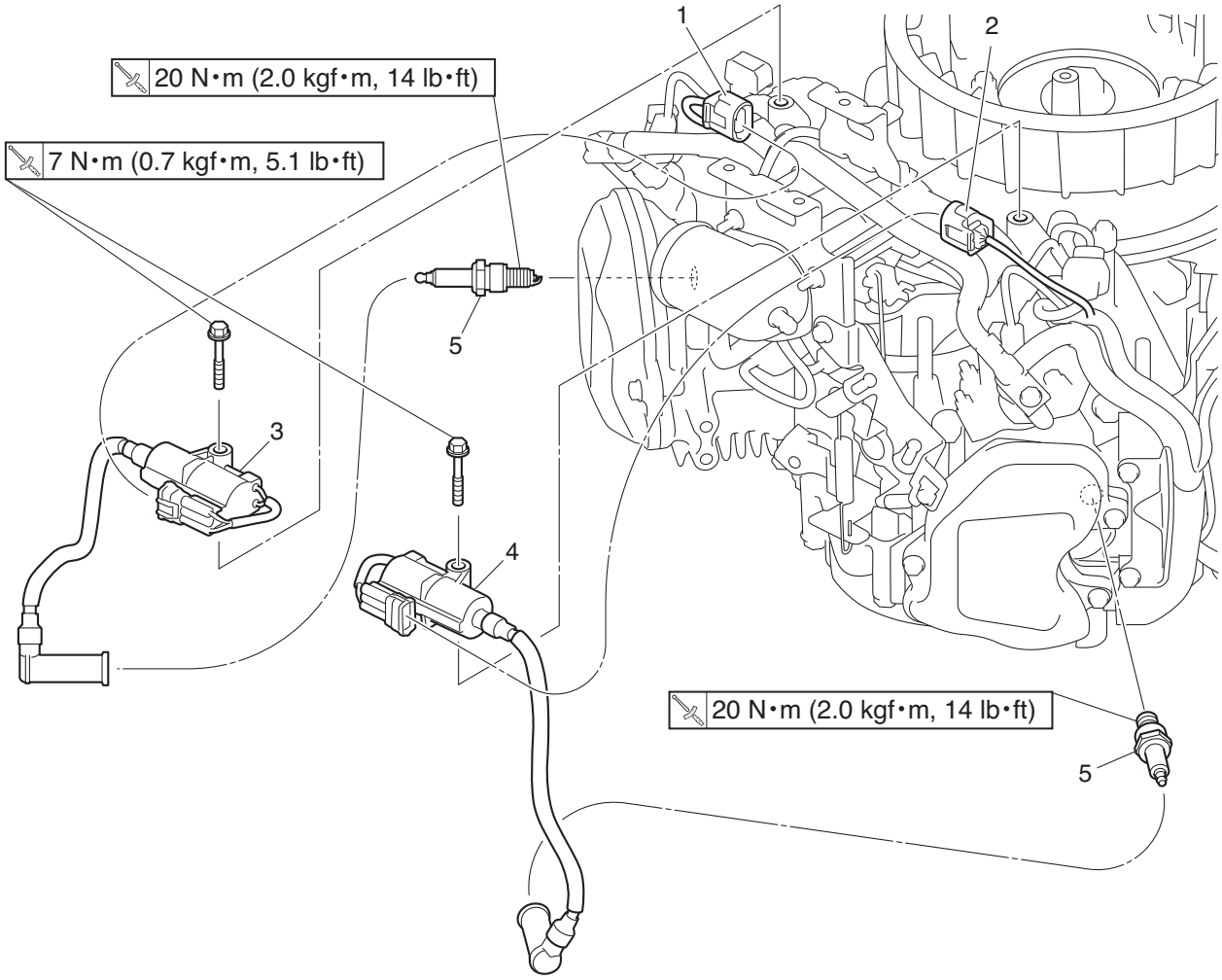
1. Install:
   - 30 A fuse “1”
   - 10 A fuses “2”

**NOTICE**

**For the 30 A fuse “1”, there is identification red tape “a” on the wire harness.**

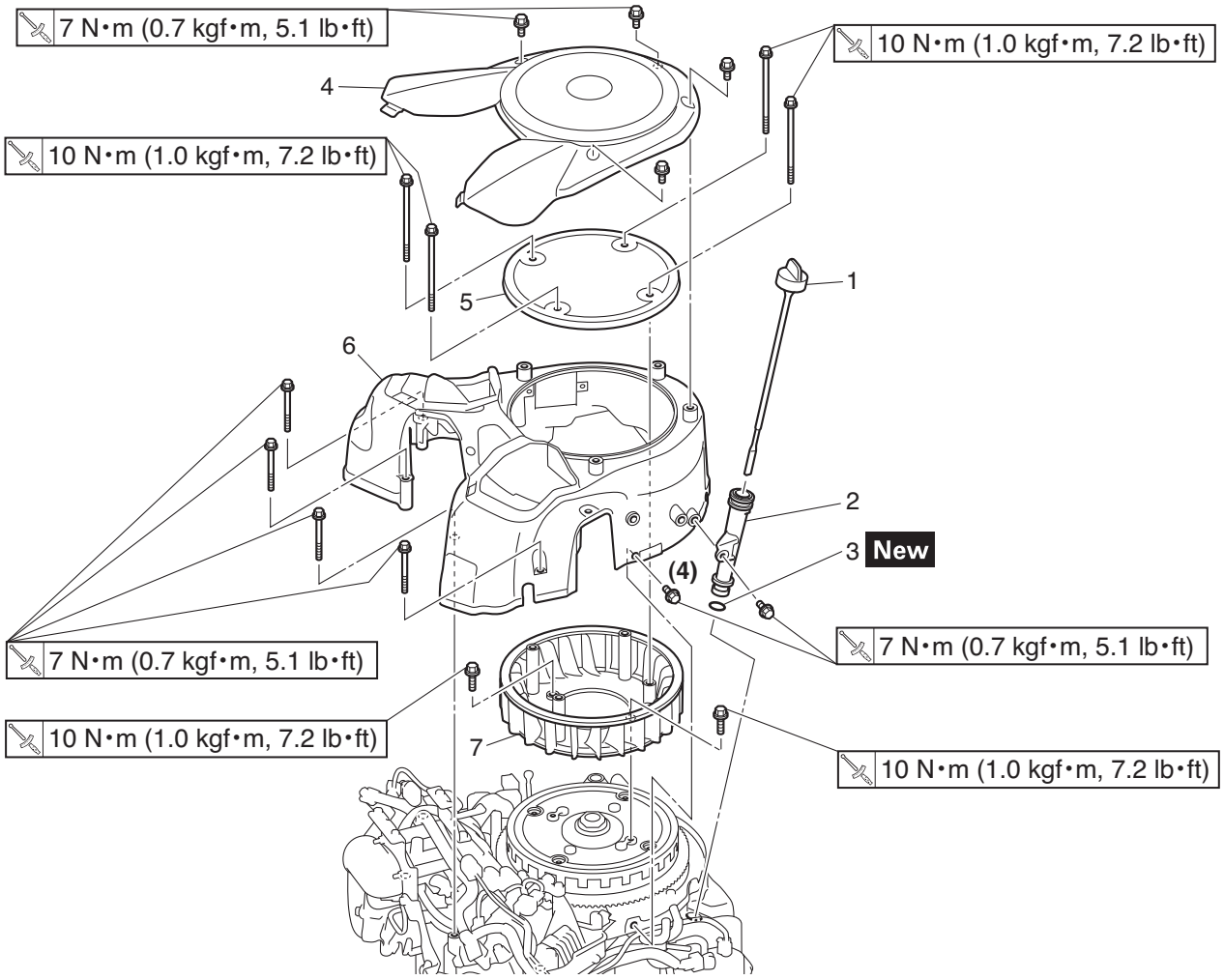
# IGNITION COILS



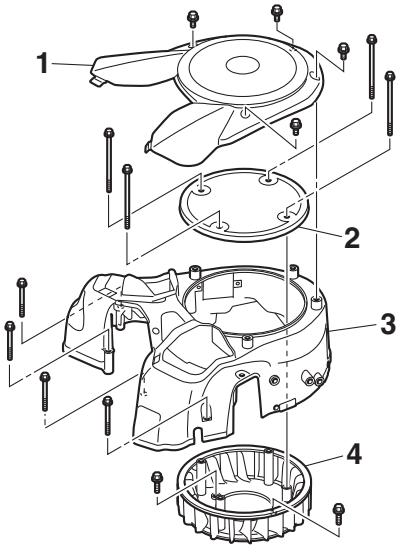



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the ignition coils** | | Remove the parts in the order listed. |
| | Air filter case | | Refer to "AIR FILTER" on page 3-3. |
| | ECU and rectifier/regulator | | Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8. |
| | Low-pressure fuel pump | | Refer to "FUEL PUMPS" on page 4-1. |
| | Oil cooler | | Refer to "OIL COOLER" on page 3-5. |
| | Fan case | | Refer to "CASE AND FAN" on page 3-11. |
| 1 | Ignition coil #1 lead coupler | 1 | Disconnect. |
| 2 | Ignition coil #2 lead coupler | 1 | Disconnect. |
| 3 | Ignition coil #1 | 1 | |
| 4 | Ignition coil #2 | 1 | |
| 5 | Spark plug | 2 | |

## CASE AND FAN




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the case and fan** | | Remove the parts in the order listed. |
| | Air filter case | | Refer to "AIR FILTER" on page 3-3. |
| | ECU and rectifier/regulator | | Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8. |
| | Low-pressure fuel pump | | Refer to "FUEL PUMPS" on page 4-1. |
| | Oil cooler | | Refer to "OIL COOLER" on page 3-5. |
| 1 | Oil filler cap | 1 | |
| 2 | Oil filler pipe | 1 | |
| 3 | O-ring | 1 | |
| 4 | Fan case cover | 1 | |
| 5 | Grass screen | 1 | |
| 6 | Fan case | 1 | |
| 7 | Fan | 1 | |

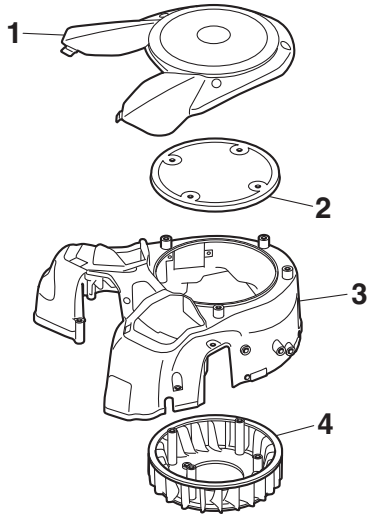



### REMOVING THE CASE AND FAN

1. Remove:
   - Air filter case
     (Refer to “AIR FILTER” on page 3-3)
2. Remove:
   - ECU and rectifier/regulator
     (Refer to “ECU, RECTIFIER/REGULATOR, AND FUSES” on page 3-8)
3. Remove:
   - Low-pressure fuel pump
     (Refer to “FUEL PUMPS” on page 4-1)
4. Remove:
   - Oil cooler
     (Refer to “OIL COOLER” on page 3-5)
5. Remove:
   - Oil filler cap
   - Oil filler pipe
6. Remove:
   - Fan case cover “1”
   - Grass screen “2”
   - Fan case “3”
   - Fan “4”

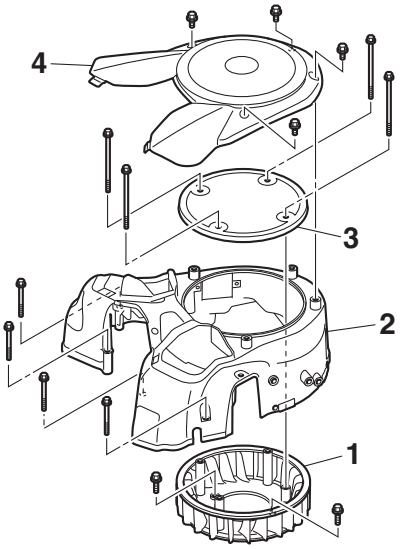
***NOTICE***

**Because there is a risk of damage, remove the grass screen “2” and fan case “3” in this order.**




## CHECKING THE CASE AND FAN

***1.*** Check:
- Fan case cover “1”
- Grass screen “2”
- Fan case “3”
- Fan “4”
  Damage → Replace.
  Dirt/clog → Clean.




## INSTALLING THE CASE AND FAN

***1.*** Install:
- Fan “1”
- Fan bolts

| | |
|---|---|
|  | **Fan bolt:**<br>**10 N·m (1.0 kgf·m, 7.2 lb·ft)** |

- Fan case “2”
- Fan case bolts

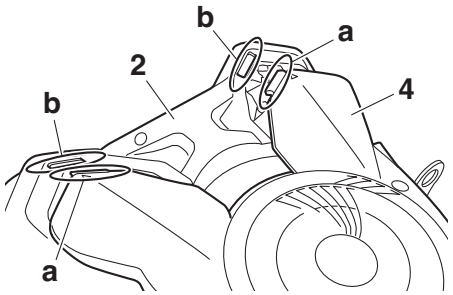
| | |
|---|---|
|  | **Fan case bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

- Grass screen “3”
- Grass screen bolts

| | |
|---|---|
|  | **Grass screen bolt:**<br>**10 N·m (1.0 kgf·m, 7.2 lb·ft)** |

- Fan case cover “4”
- Fan case cover bolts

| | |
|---|---|
|  | **Fan case cover bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |




**TIP**

Insert the tab “a” of the fan case cover “4” into the hole “b” of the fan case “2” first and then install.

***2.*** Install:

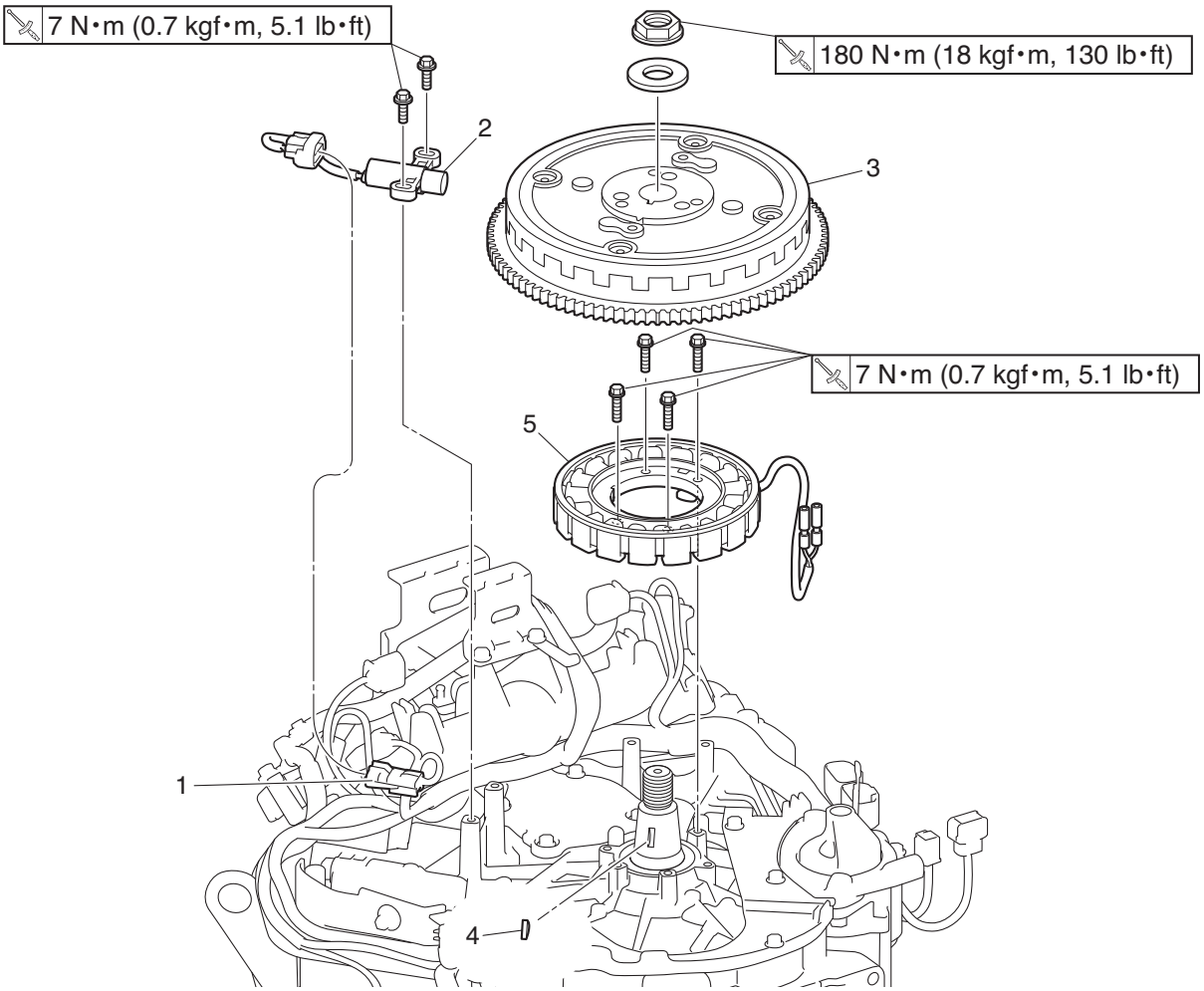
- Oil filler pipe
- Oil filler pipe bolt

| | |
|---|---|
|  | **Oil filler pipe bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

- Oil filler cap

# FLYWHEEL AND STATOR COIL ASSEMBLY

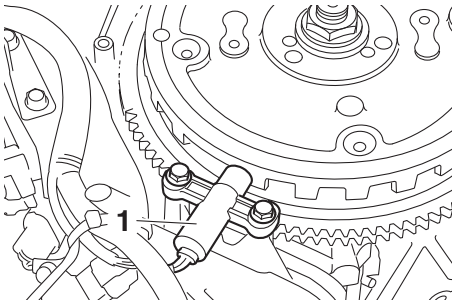




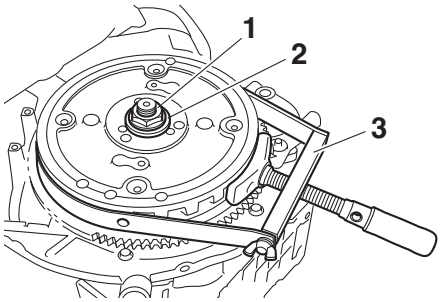

| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the flywheel and stator coil assembly** | | Remove the parts in the order listed. |
| | Air filter case | | Refer to "AIR FILTER" on page 3-3. |
| | ECU and rectifier/regulator | | Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8. |
| | Low-pressure fuel pump | | Refer to "FUEL PUMPS" on page 4-1. |
| | Oil cooler | | Refer to "OIL COOLER" on page 3-5. |
| | Fan case | | Refer to "CASE AND FAN" on page 3-11. |
| 1 | Crankshaft position sensor lead coupler | 1 | Disconnect. |
| 2 | Crankshaft position sensor | 1 | |
| 3 | Flywheel | 1 | |
| 4 | Woodruff key | 1 | |
| 5 | Stator coil assembly | 1 | |

## REMOVING THE FLYWHEEL AND STATOR COIL ASSEMBLY

1. Remove:
   - Air filter case
   (Refer to "AIR FILTER" on page 3-3)
2. Remove:
   - ECU and rectifier/regulator
   (Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8)
3. Remove:
   - Low-pressure fuel pump
   (Refer to "FUEL PUMPS" on page 4-1)
4. Remove:
   - Oil cooler
   (Refer to "OIL COOLER" on page 3-5)
5. Remove:
   - Fan case cover
   - Grass screen
   - Fan case
   - Fan
   (Refer to "CASE AND FAN" on page 3-11)
6. Remove:
   - Crankshaft position sensor "1"



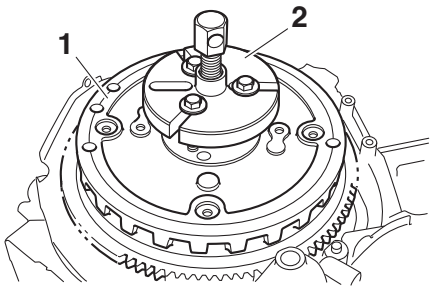

7. Remove:
   - Flywheel nut "1"
   - Washer "2"




**TIP**

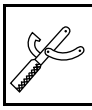
Attach the primary clutch holder "3" to hold the flywheel.

**Primary clutch holder:**
**YU-01235**
**Rotor holding tool:**
**90890-01235**



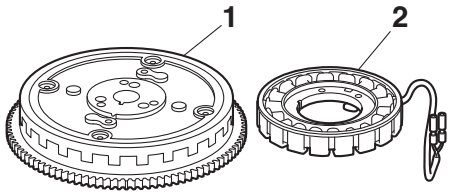

**8.** Remove:
- Flywheel "1"
- Woodruff key

**TIP**
- Remove the flywheel "1" using the heavy duty puller "2".
- Fully tighten the tool holding bolts, making sure the tool body is parallel with the flywheel. If necessary, one bolt may be backed out slightly to level the tool body.

| | |
|---|---|
|  | **Heavy duty puller:**<br>**YU-33270-B** |

**9.** Remove:
- Stator coil assembly

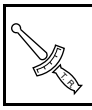
### CHECKING THE FLYWHEEL AND STATOR COIL ASSEMBLY



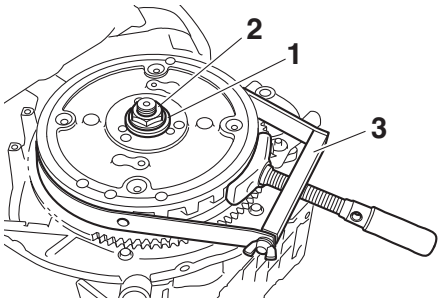

**1.** Check:
- Flywheel "1"
- Stator coil assembly "2"
  Damage → Replace.

### INSTALLING THE FLYWHEEL AND STATOR COIL ASSEMBLY

**1.** Install:
- Stator coil assembly
- Stator coil assembly bolts

| | |
|---|---|
|  | **Stator coil assembly bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

**2.** Install:
- Woodruff key
- Flywheel




***3.*** Install:
- Washer "1"
- Flywheel nut "2"

| | |
|---|---|
| | **Flywheel nut:**<br>**180 N·m (18 kgf·m, 130 lb·ft)** |

**TIP**
Tighten the flywheel nut "2" using the primary clutch holder "3" to hold the flywheel.

| | |
|---|---|
| | **Primary clutch holder:**<br>**YU-01235**<br>**Rotor holding tool:**<br>**90890-01235** |

***4.*** Install:
- Crankshaft position sensor
- Crankshaft position sensor bolts
  (Refer to "INSTALLING THE CRANKSHAFT POSITION SENSOR" on page 3-19)

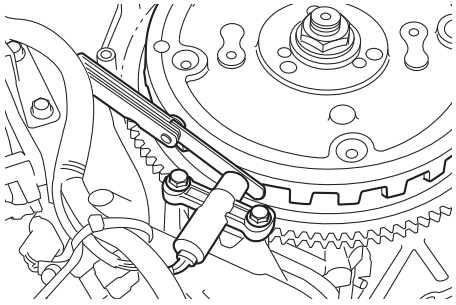
| | |
|---|---|
| | **Crankshaft position sensor bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

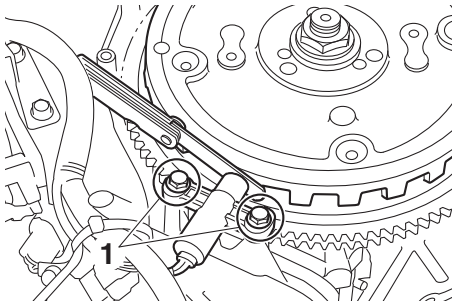
***5.*** Install:
- Fan
- Fan case
- Grass screen
- Fan case cover
  (Refer to "CASE AND FAN" on page 3-11)

***6.*** Install:
- Low-pressure fuel pump
  (Refer to "FUEL PUMPS" on page 4-1)

***7.*** Install:
- ECU and rectifier/regulator
  (Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8)

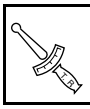
***8.*** Install:
- Air filter case
  (Refer to "AIR FILTER" on page 3-3)



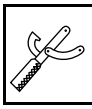



### INSTALLING THE CRANKSHAFT POSITION SENSOR

***1.*** Install:
- Crankshaft position sensor
- Crankshaft position sensor bolts

| | |
|---|---|
|  | **Crankshaft position sensor bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

***2.*** Measure:
- Crankshaft position sensor air gap
  Out of specification → Adjust.

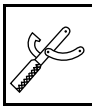
| | |
|---|---|
|  | **Feeler gauge set:**<br>**YU-26900-9** |

| | |
|---|---|
|  | **Crankshaft position sensor air gap:**<br>**0.5–1.5 mm (0.02–0.06 in)** |

***3.*** Adjust:
- Crankshaft position sensor air gap

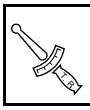
▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

a. Loosen the crankshaft position sensor bolts “1”.
b. Adjust the crankshaft position sensor air gap.

| | |
|---|---|
|  | **Feeler gauge set:**<br>**YU-26900-9** |

| | |
|---|---|
|  | **Crankshaft position sensor air gap:**<br>**0.5–1.5 mm (0.02–0.06 in)** |

c. Tighten the crankshaft position sensor bolts “1”.

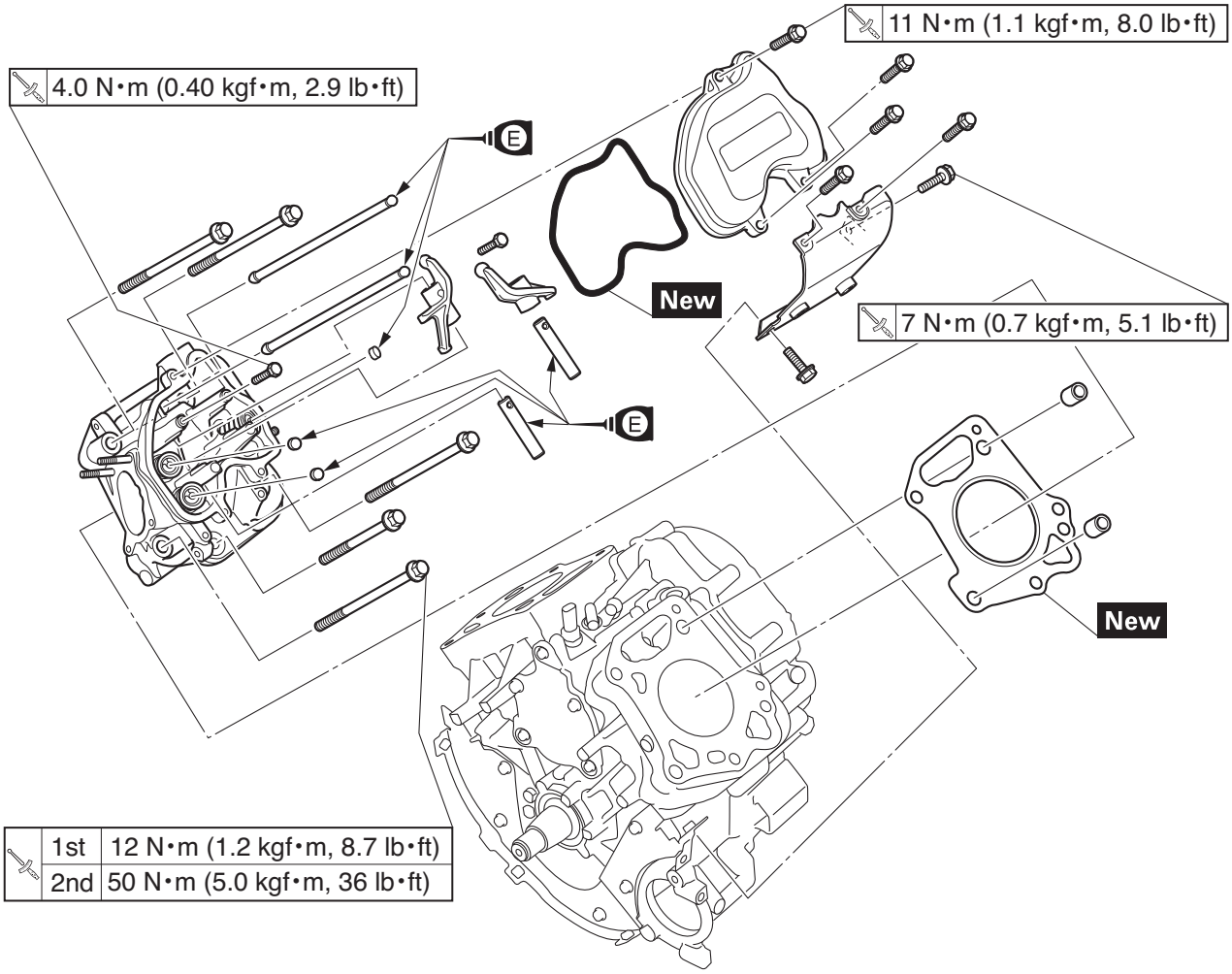
| | |
|---|---|
|  | **Crankshaft position sensor bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲

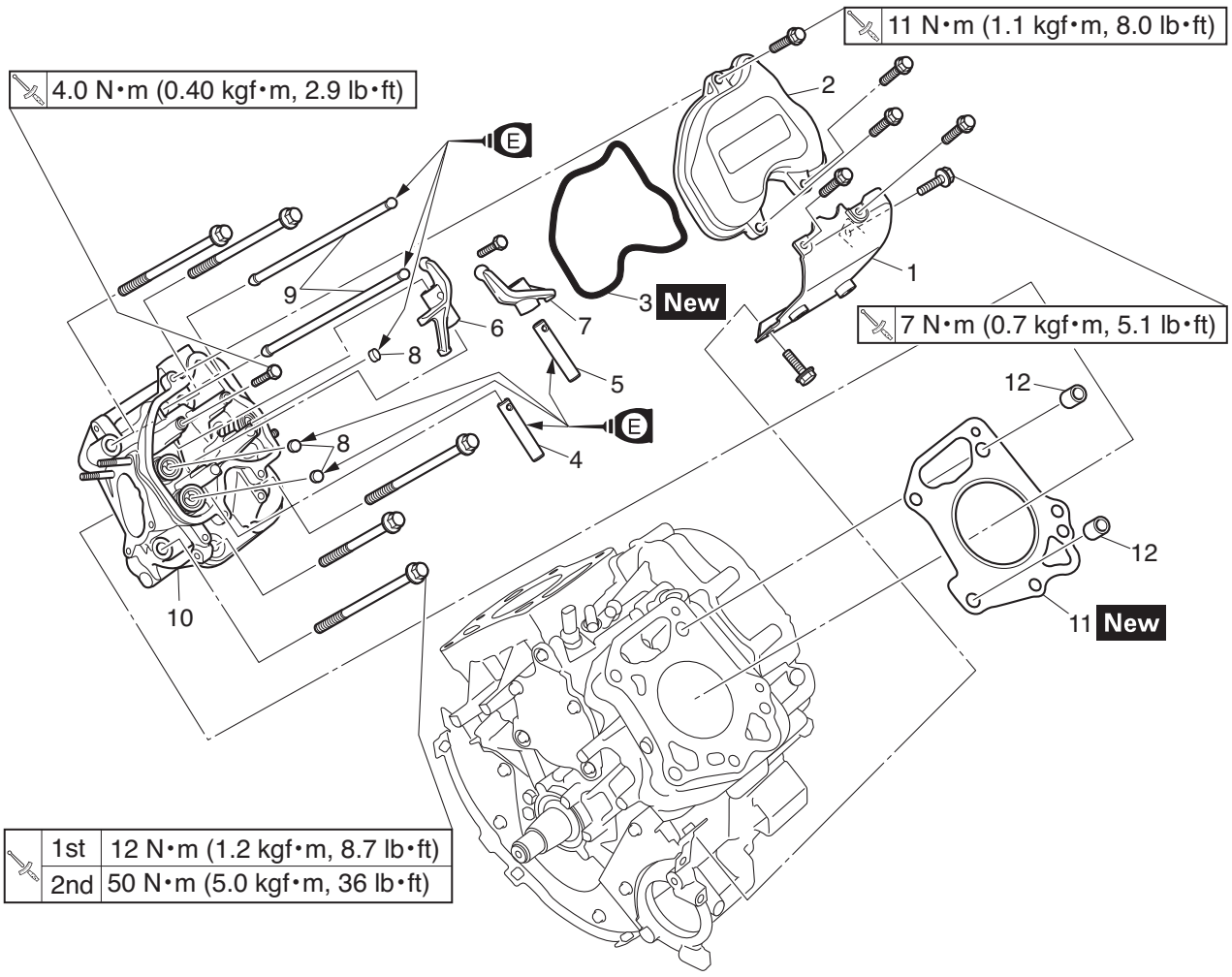
# CYLINDER HEAD COVERS, CYLINDER HEADS

## CYLINDER HEAD #1



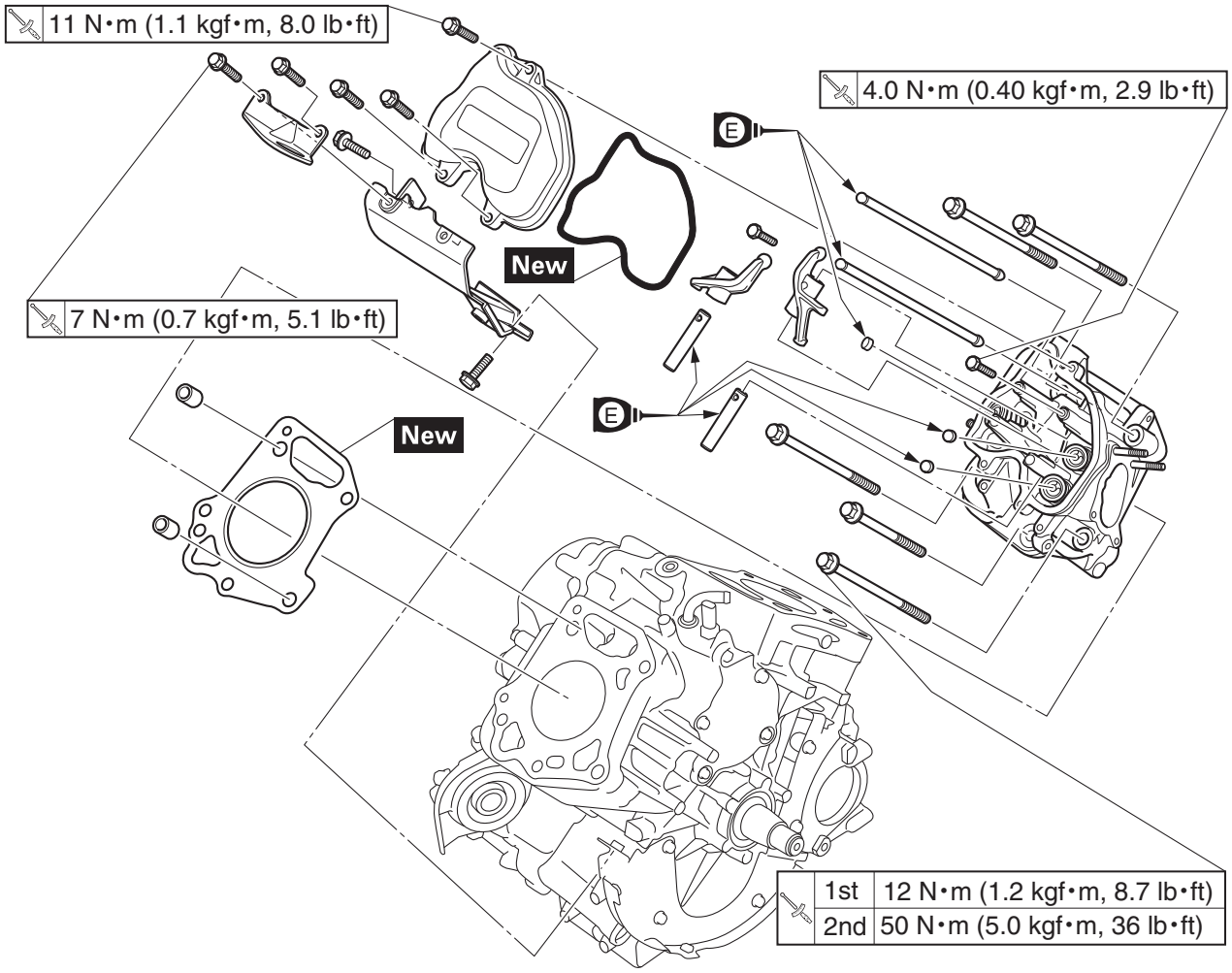



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the cylinder head covers, and cylinder heads** | | Remove the parts in the order listed. |
| | Air filter case | | Refer to "AIR FILTER" on page 3-3. |
| | ECU, rectifier/regulator and fuse | | Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8. |
| | High and low-pressure fuel pump | | Refer to "FUEL PUMPS" on page 4-1. |
| | Oil cooler | | Refer to "OIL COOLER" on page 3-5. |
| | Fan case | | Refer to "CASE AND FAN" on page 3-11. |
| | Flywheel and stator coil assembly | | Refer to "FLYWHEEL AND STATOR COIL ASSEMBLY" on page 3-15. |
| | Throttle body assembly | | Refer to "THROTTLE BODY ASSEMBLY" on page 4-6. |
| | Intake manifold | | Refer to "FUEL INJECTORS AND INTAKE MANIFOLD" on page 4-9. |
| | Starter motor assembly | | Refer to "REMOVING THE STARTER MOTOR" on page 5-37. |

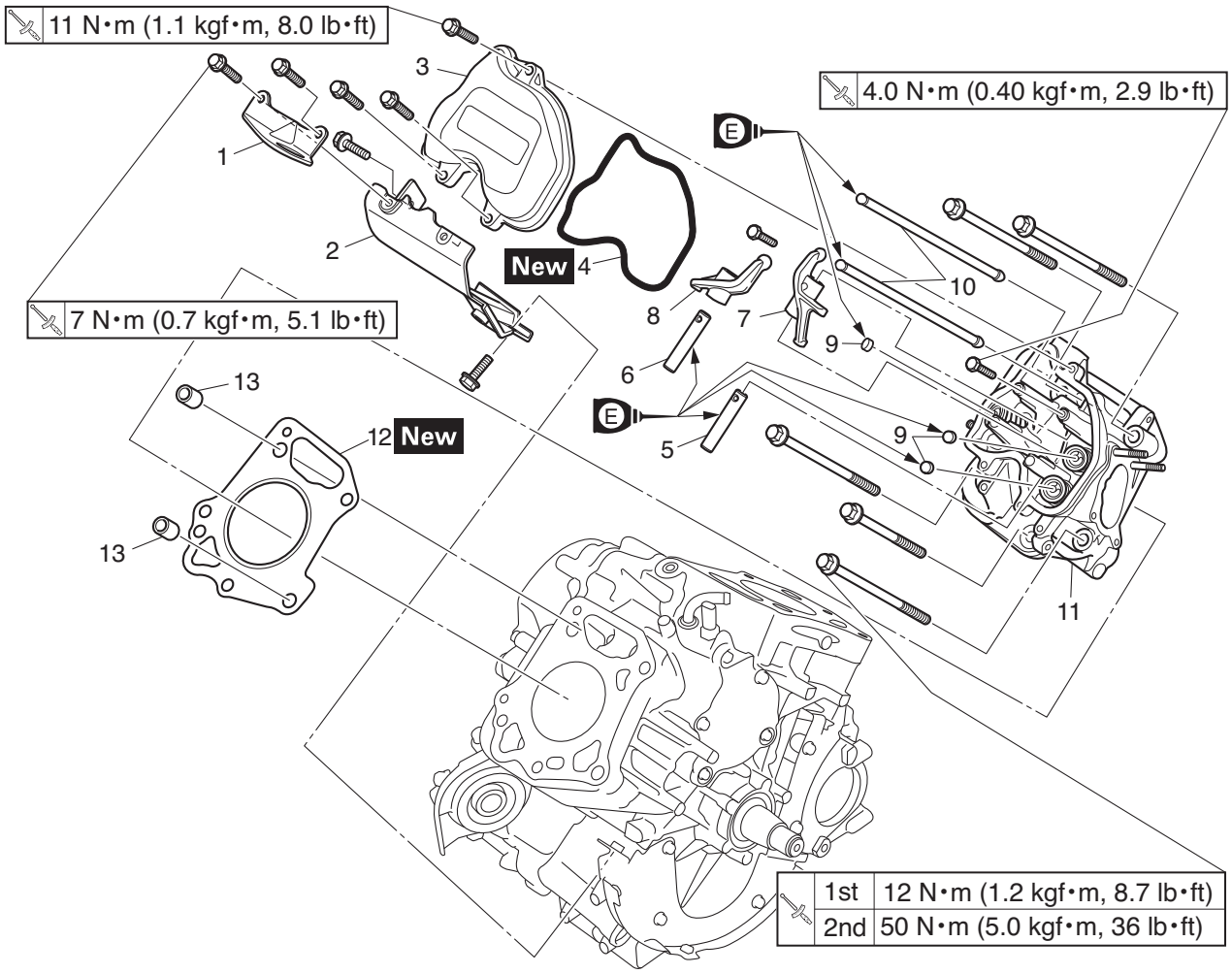



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| 1 | Cylinder air shroud | 1 | |
| 2 | Cylinder head cover | 1 | |
| 3 | Cylinder head cover gasket | 1 | |
| 4 | Rocker arm shaft | 1 | Intake |
| 5 | Rocker arm shaft | 1 | Exhaust |
| 6 | Rocker arm | 1 | Intake |
| 7 | Rocker arm | 1 | Exhaust |
| 8 | Adjusting pad | 3 | |
| 9 | Push rod | 2 | |
| 10 | Cylinder head assembly #1 | 1 | |
| 11 | Cylinder head gasket | 1 | |
| 12 | Dowel pin | 2 | |

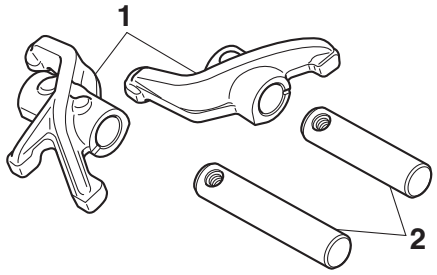
## CYLINDER HEAD #2




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the cylinder head covers, and cylinder heads** | | Remove the parts in the order listed. |
| | Air filter case | | Refer to "AIR FILTER" on page 3-3. |
| | ECU, rectifier/regulator and fuse | | Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8. |
| | High and low-pressure fuel pump | | Refer to "FUEL PUMPS" on page 4-1. |
| | Oil cooler | | Refer to "OIL COOLER" on page 3-5. |
| | Fan case | | Refer to "CASE AND FAN" on page 3-11. |
| | Flywheel and stator coil assembly | | Refer to "FLYWHEEL AND STATOR COIL ASSEMBLY" on page 3-15. |
| | Throttle body assembly | | Refer to "THROTTLE BODY ASSEMBLY" on page 4-6. |
| | Intake manifold | | Refer to "FUEL INJECTORS AND INTAKE MANIFOLD" on page 4-9. |
| | Starter motor assembly | | Refer to "REMOVING THE STARTER MOTOR" on page 5-37. |



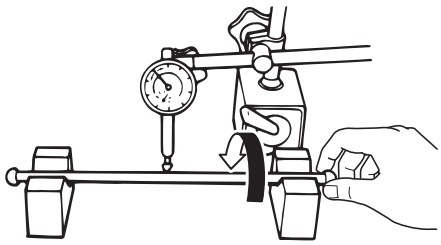

| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| 1 | Engine hunger | 1 | For maintenance. |
| 2 | Cylinder air shroud | 1 | |
| 3 | Cylinder head cover | 1 | |
| 4 | Cylinder head cover gasket | 1 | |
| 5 | Rocker arm shaft | 1 | Intake |
| 6 | Rocker arm shaft | 1 | Exhaust |
| 7 | Rocker arm | 1 | Intake |
| 8 | Rocker arm | 1 | Exhaust |
| 9 | Adjusting pad | 3 | |
| 10 | Push rod | 2 | |
| 11 | Cylinder head assembly #2 | 1 | |
| 12 | Cylinder head gasket | 1 | |
| 13 | Dowel pin | 2 | |




### CHECKING THE ROCKER ARMS AND ROCKER ARM SHAFTS

The following procedure applies to all of the rocker arms and rocker arm shafts.

1. Check:
   - Rocker arm "1"
   - Rocker arm shaft "2"
     Wear/damage/cracks → Replace.



### CHECKING THE PUSH RODS

The following procedure applies to all of the push rods.

1. Check:
   - Push rod runout

| | |
|---|---|
| | **Runout limit:**<br>**0.3 mm (0.0118 in)** |

Out of specifications → Replace.

### REMOVING THE CYLINDER HEADS

The following procedure applies to all of the cylinder heads.

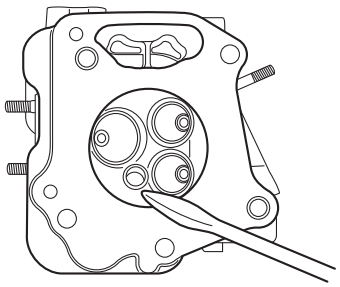
1. Remove:
   - Cylinder head

**TIP**

Set the piston at TDC (top-dead-center) on the compression stroke.
(Refer to "ADJUSTING THE VALVE CLEARANCE" on page 2-9.)

### CHECKING THE CYLINDER HEADS

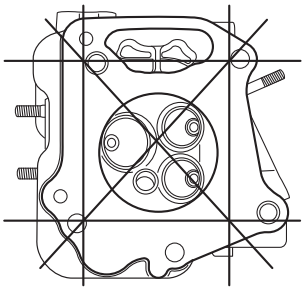
The following procedure applies to all of the cylinder heads.



**1.** Check:
- Cylinder head combustion chamber
  Check the combustion chamber for carbon deposits.
  Any carbon deposits → Eliminate.

**TIP**
Be sure not to damage the sealing surface of the cylinder head.

**2.** Check:
- Cylinder head
  Cracks/damage around the hole of spark plug → Replace.



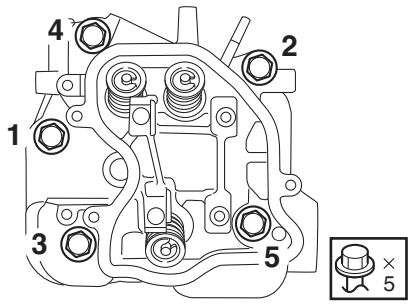
**3.** Measure:
- Cylinder head warpage

**TIP**
Measure the warpage on the contact surface of the cylinder head at six points using the straight edge and feeler gauge set.

| | |
|---|---|
| | **Warpage limit:**<br>**0.05 mm (0.002 in)** |

Out of specifications → Resurface or replace.

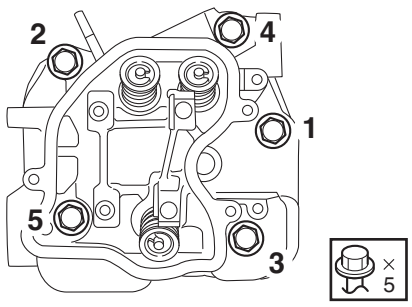
### INSTALLING THE CYLINDER HEAD ASSEMBLY




**1.** Install:
- Cylinder head assembly #1
- Cylinder head bolts “1” to “5”.

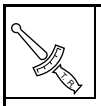
**TIP**
Tighten the bolts to the specified torque in two steps and in order from “1” to “5”.

| | |
|---|---|
| | **Cylinder head bolt:**<br>**1st: 12 N·m (1.2 kgf·m, 8.7 lb·ft)**<br>**2nd: 50 N·m (5.0 kgf·m, 36 lb·ft)** |



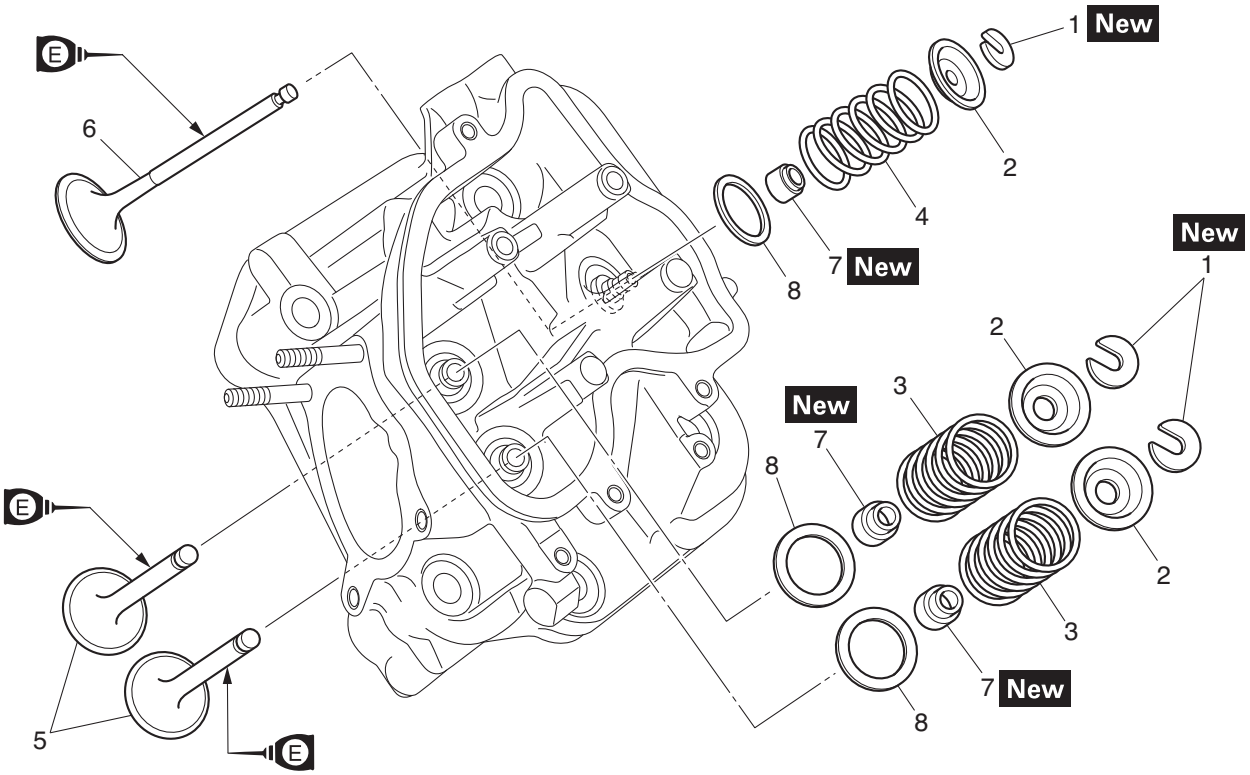

**2.** Install:
- Cylinder head assembly #2
- Cylinder head bolts “1” to “5”.

**TIP**
Tighten the bolts to the specified torque in two steps and in order from “1” to “5”.

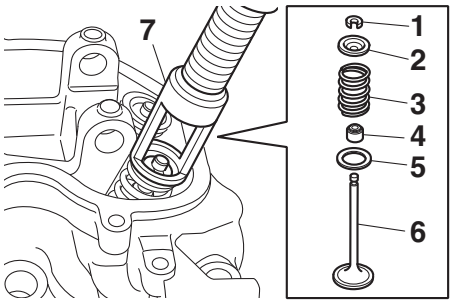


**Cylinder head bolt:**
**1st: 12 N·m (1.2 kgf·m, 8.7 lb·ft)**
**2nd: 50 N·m (5.0 kgf·m, 36 lb·ft)**

# VALVES




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the valves** | | Remove the parts in the order listed.<br>The following procedure applies to both cylinders. |
| | Cylinder head assembly | | Refer to "CYLINDER HEAD COVERS, CYLINDER HEADS" on page 3-20. |
| 1 | Valve cotter | 3 | |
| 2 | Valve spring retainer | 3 | |
| 3 | Intake valve spring | 2 | |
| 4 | Exhaust valve spring | 1 | |
| 5 | Intake valve | 2 | |
| 6 | Exhaust valve | 1 | |
| 7 | Valve stem seal | 3 | |
| 8 | Valve spring seat | 3 | |




## REMOVING THE VALVES AND VALVE SPRINGS

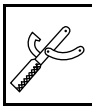
The following procedure applies to all of the valves, valve springs and related components.

1. Remove:
   - Valve cotter “1”
   - Valve spring retainer “2”
   - Valve spring “3”
   - Valve stem seal “4”
   - Valve spring seat “5”
   - Valve “6”

   Remove the parts using the valve spring compressor “7”.

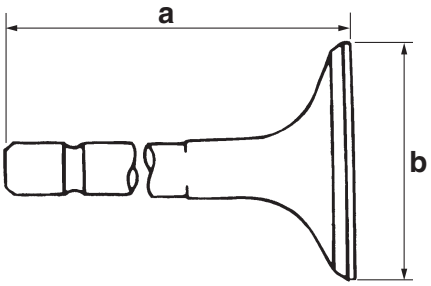
***NOTICE***

**Do not compress the valve spring more than necessary.**

| | |
|---|---|
|  | **Valve spring compressor:**<br>**90890-01253** |

## CHECKING THE VALVES AND VALVE SPRINGS

The following procedure applies to all of the valves, valve springs and related components.



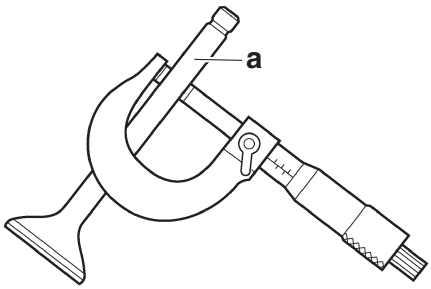

1. Measure:
   - Valve stem length “a”
   - Valve head diameter “b”

**Valve stem length (Intake):**
**88.8 mm (3.4961 in)**
**Valve stem length (Exhaust):**
**89.8 mm (3.5354 in)**
**Valve head diameter (Intake):**
**27.9–28.1 mm (1.0984–1.1063 in)**
**Valve head diameter (Exhaust):**
**34.9–35.1 mm (1.3740–1.3819 in)**

Out of specifications → Replace.

**TIP**

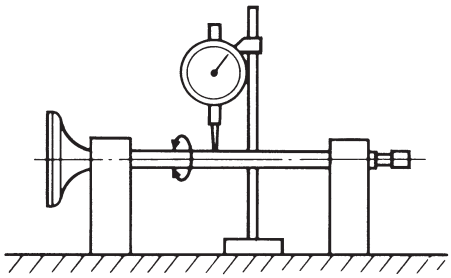
Intake and exhaust springs are different. Do not mix.




**2.** Measure:
- Valve stem diameter “a”

**Valve stem diameter (Intake):**
**5.948–5.963 mm (0.2342–0.2348 in)**
**Valve stem diameter (Exhaust):**
**5.940–5.955 mm (0.2339–0.2344 in)**
**Limit (Intake):**
**5.918 mm (0.2330 in)**
**Limit (Exhaust):**
**5.910 mm (0.2327 in)**

Out of specifications → Replace.

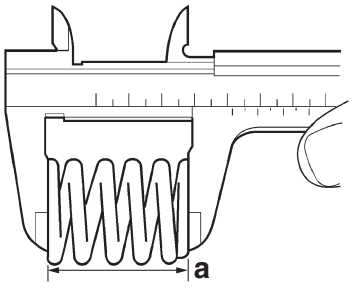


**3.** Measure:
- Valve stem runout

**Valve stem runout limit:**
**0.01 mm (0.0004 in)**

Out of specifications → Replace.

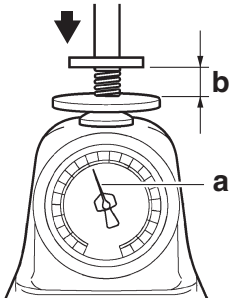
**TIP**
The value is half of that indicated on the dial indicator gauge.




**4.** Measure:
- Valve spring free length “a”

**Valve spring free length (Intake):**
**37.1 mm (1.4606 in)**
**Valve spring free length (Exhaust):**
**35.6 mm (1.4016 in)**
**Limit (Intake):**
**35.25 mm (1.3878 in)**
**Limit (Exhaust):**
**33.82 mm (1.3315 in)**

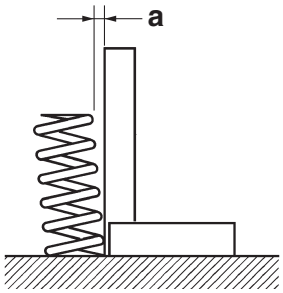
Out of specifications → Replace.




**5.** Measure:
- Compressed valve spring force “a”
  Out of specification → Replace.

b. Installed length

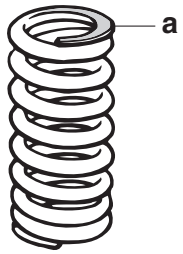
**Installed compression spring force (Intake):**
**67.7 N (6.90 kgf, 15.2 lbf)**
**Installed compression spring force (Exhaust):**
**118.1 N (12.0 kgf, 26.5 lbf)**
**Installed length (Intake):**
**29.3 mm (1.1535 in)**
**Installed length (Exhaust):**
**29.0 mm (1.1417 in)**




***6.*** Measure:
- Valve spring tilt "a"

**Tilt limit:**
**2.0 mm (0.0787 in)**

Out of specifications → Replace.



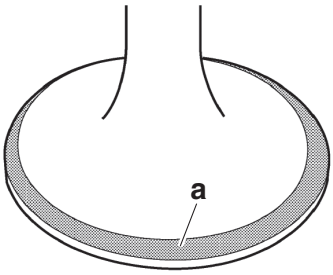

***7.*** Check:
- Valve spring contact surface "a"
  More than 2/3 of the contact surface does not contact → Replace.

## CHECKING THE VALVE SEATS

The following procedure applies to all of the valves and valve seats.

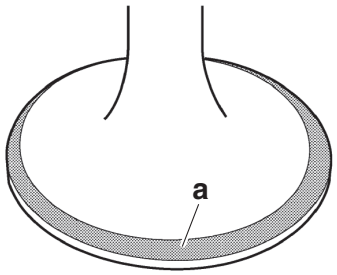
***1.*** Remove carbon deposits from the valve face and valve seat.

***2.*** Apply a small amount of coarse mechanic's blue layout fluid to the valve face "a".




***3.*** Insert the valve into the valve guide and use a valve lapper to contact the valve face with the valve seat.

**TIP**
Do not rotate the valve while the valve face is contacting the valve seat.

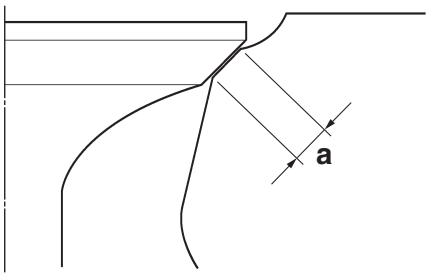



**4.** Measure:
- Valve face contact width "a"

Make sure that the contact width along the entire valve face is within specifications.

**Valve face contact width (Intake):**
**0.9–1.1 mm (0.0354–0.0433 in)**
**Valve face contact width (Exhaust):**
**0.9–1.1 mm (0.0354–0.0433 in)**
**Limit (Intake):**
**1.6 mm (0.063 in)**
**Limit (Exhaust):**
**1.6 mm (0.063 in)**

Out of specification/rough/eccentric wear → Replace.



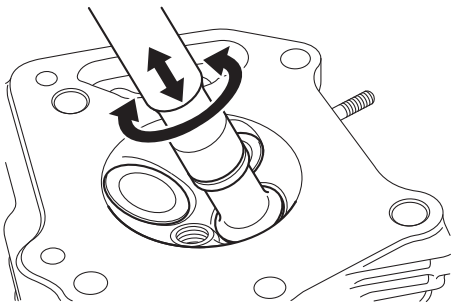

**5.** Measure:
- Valve seat contact width "a"

Make sure that the contact width along the entire valve seat is within specifications.

**Valve seat contact width (Intake):**
**0.9–1.1 mm (0.0354–0.0433 in)**
**Valve seat contact width (Exhaust):**
**0.9–1.1 mm (0.0354–0.0433 in)**
**Limit (Intake):**
**1.6 mm (0.063 in)**
**Limit (Exhaust):**
**1.6 mm (0.063 in)**

Out of specification/rough/eccentric wear → Replace.

## VALVE LAPPING



**1.** Apply a coarse lapping compound evenly on the valve face. Lap the valve by tapping and rotating the valve lapper clockwise and counterclockwise.

**2.** Clean off all of the lapping compound from the valve face and valve seat. Apply fine lapping compound on the valve face and lap the valve as described in step 1.

***3.*** Once the contacting surface of the valve face is polished and becomes shiny, apply mechanic's blue layout fluid to make sure that there are traces of even contact in the center of the valve face.

***NOTICE***

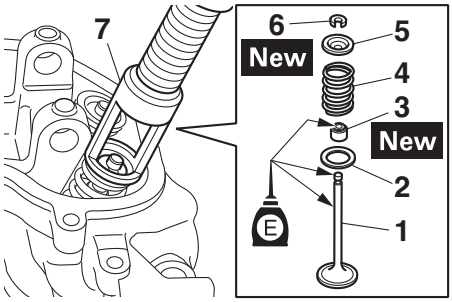
**Do not let the lapping compound enter the gap between the valve stem and the valve guide.**

**TIP**

After every lapping procedure, clean off the compound from the valve face and valve seat.

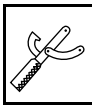
## INSTALLING THE VALVES AND VALVE SPRINGS

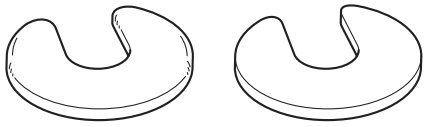
The following procedure applies to all of the valves, valve springs and related components.




***1.*** Install:
- Valve "1"
- Valve spring seat "2"
- Valve stem seal "3" New
- Valve spring "4"
- Valve spring retainer "5"
- Valve cotter "6" New

  Use the valve spring compressor "7" to install the parts.

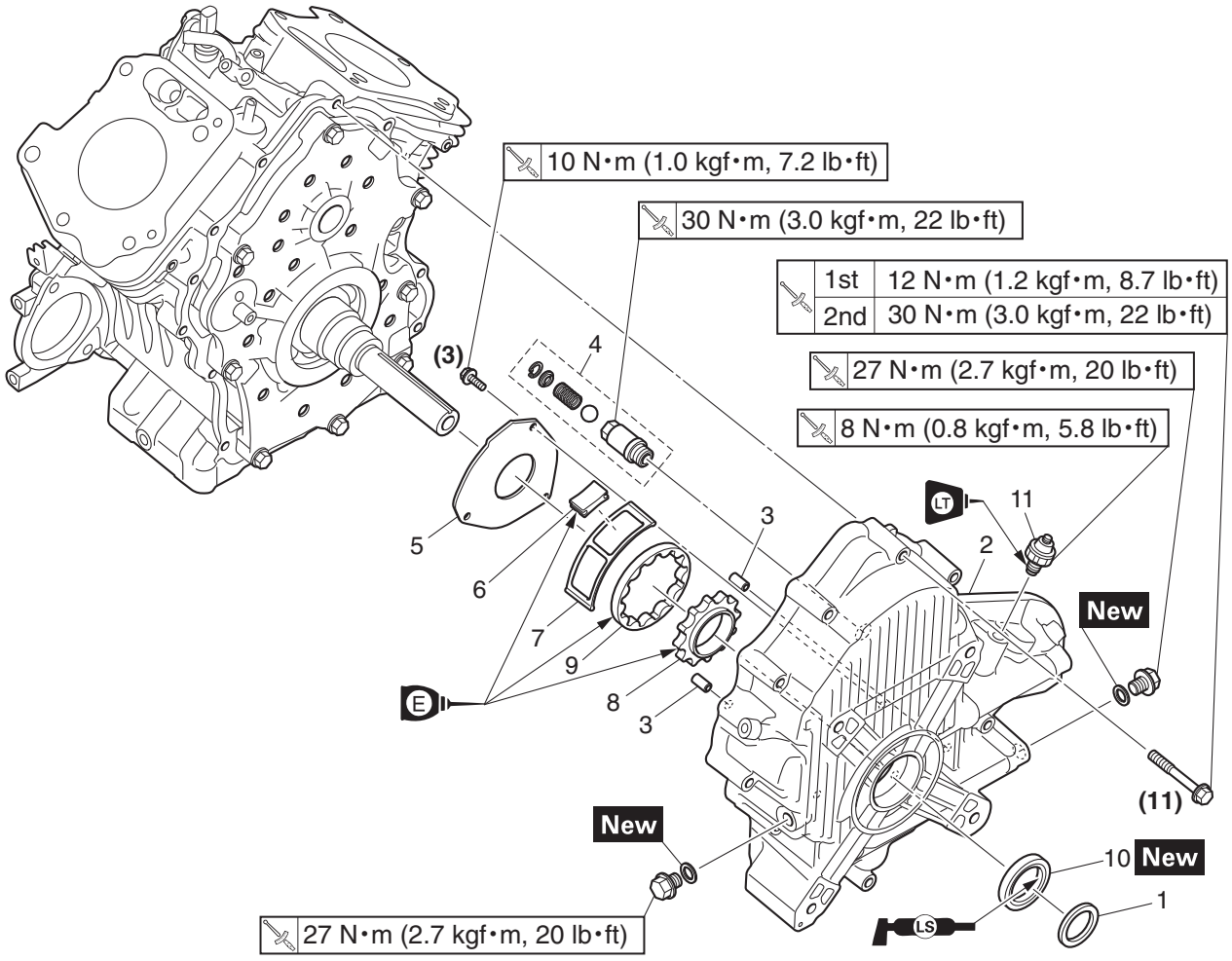
| | |
|---|---|
|  | **Valve spring compressor: 90890-01253** |



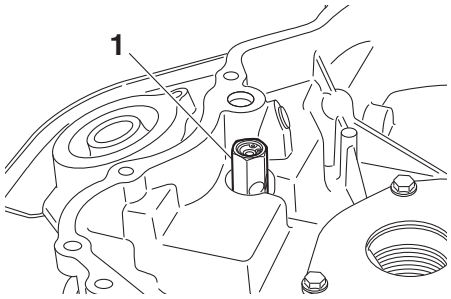

***NOTICE***

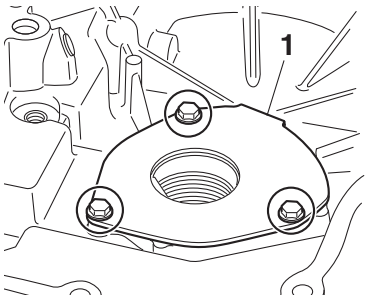
- **Do not compress the spring more than necessary.**
- **Surface "a" with the rounded edges of the valve cotter must face downward (to the valve spring retainer side) when installing it on top of the valve spring retainer. If surface "b" of the opposite side is facing downward when the valve cotter is installed, it could result in the premature wear of the valve cotter.**

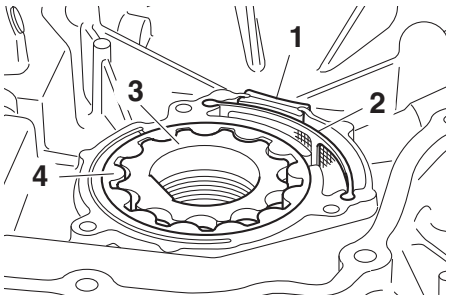
## OIL PUMP




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the oil pump** | | Remove the parts in the order listed. |
| | Cylinder head assembly | | Refer to "CYLINDER HEAD COVERS, CYLINDER HEADS" on page 3-20. |
| 1 | Collar | 1 | |
| 2 | Crankcase cover 2 | 1 | |
| 3 | Dowel pin | 2 | |
| 4 | Relief valve | 1 | |
| 5 | Oil pump cover | 1 | |
| 6 | Oil strainer cover | 1 | |
| 7 | Oil strainer | 1 | |
| 8 | Inner rotor | 1 | |
| 9 | Outer rotor | 1 | |
| 10 | Oil seal | 1 | |
| 11 | Oil pressure switch | 1 | |

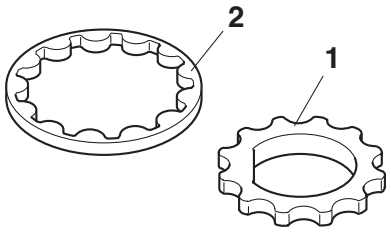


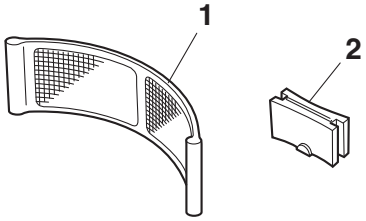




### DISASSEMBLING THE OIL PUMP

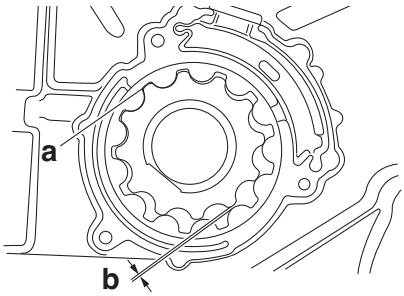
1. Remove:
   - Crankcase cover 2
2. Remove:
   - Relief valve “1”
3. Remove:
   - Oil pump cover “1”
4. Remove:
   - Oil strainer cover “1”
   - Oil strainer “2”
   - Inner rotor “3”
   - Outer rotor “4”




### CHECKING THE OIL PUMP

1. Check:
   - Inner rotor “1”
   - Outer rotor “2”
     Cracks/damage/wear → Replace the defective part(s).
2. Check:
   - Oil strainer “1”
   - Oil strainer cover “2”
     Damage → Replace.
     Contaminants →Clean with solvent.

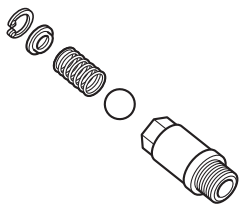



**3.** Measure:
- Inner-rotor-to-outer-rotor-tip clearance “a” and “b”
  Out of specification → Replace the defective part(s).

**Inner-rotor-to-outer-rotor-tip clearance “a”:**
**0.0 mm (0.0 in)**
**Inner-rotor-to-outer-rotor-tip clearance “b”:**
**0.19–0.35 mm (0.008–0.013 in)**

**4.** Check:
- Oil pump operation
  Rough movement → Replace the defective part(s).

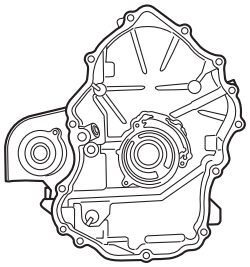
### CHECKING THE RELIEF VALVE



**1.** Check:
- Relief valve
  Damage/wear/seized → Replace.

**Relief valve operating pressure (reference data):**
**342–538 kPa (3.42–5.38 kgf/cm² , 49.59–78.01psi)**

### CHECKING THE CRANKCASE COVER 2

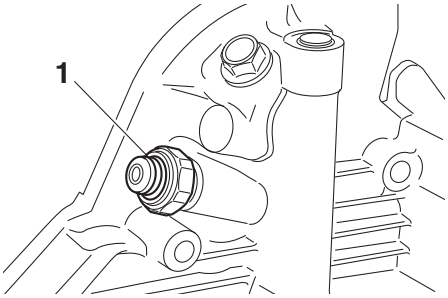


**1.** Check:
- Crankcase cover 2
  Damage → Replace.

### INSTALLING THE OIL PRESSURE SWITCH

**1.** Check:
- Oil pressure switch
  Damage → Replace.

**2.** Install:
- Oil pressure switch “1”




**Oil pressure switch:**
**8 N·m (0.8 kgf·m, 5.8 lb·ft)**

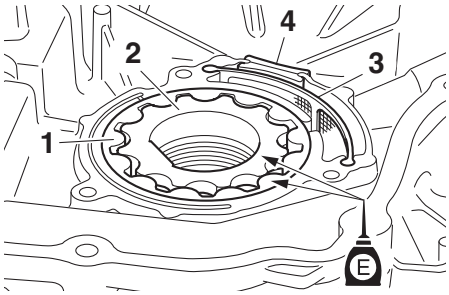
**TIP**
Engage the two threads of the oil pressure switch screw

with the crankcase cover 2, apply LOCTITE®, and tighten to the specified torque.

### ASSEMBLING THE OIL PUMP

***1.*** Lubricate:
- Inner rotor
- Outer rotor

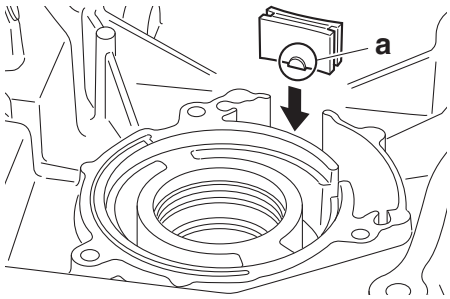
| | |
|---|---|
| | **Recommended lubricant:**<br>**Engine oil** |

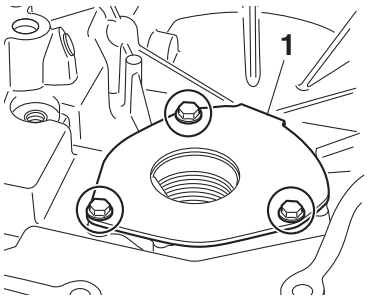



***2.*** Install:
- Outer rotor “1”
- Inner rotor “2”
- Oil strainer “3”
- Oil strainer cover “4”

**TIP**

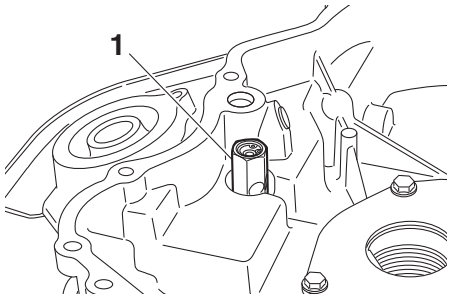
Face portion “a” of the oil strainer cover downward as shown in the illustration, and install it.




***3.*** Install:
- Oil pump cover “1”
- Oil pump cover bolts

| | |
|---|---|
| | **Oil pump cover bolt:**<br>**10 N·m (1.0 kgf·m, 7.2 lb·ft)** |




***4.*** Install:
- Relief valve “1”

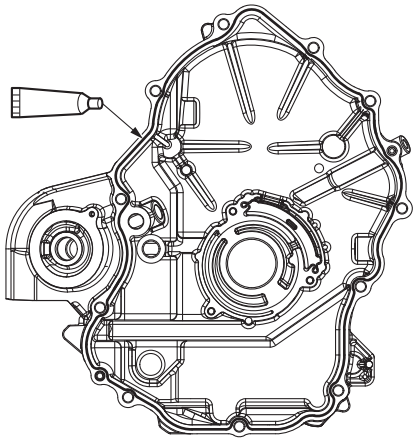
| | |
|---|---|
| | **Relief valve:**<br>**30 N·m (3.0 kgf·m, 22 lb·ft)** |

### INSTALLING THE CRANKCASE COVER 2

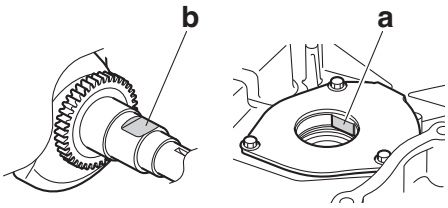
**1.** Clean:
- Mating surfaces of the crankcase and the crankcase cover 2
  (with a cloth dampened with lacquer thinner)

**2.** Apply:
- Sealant
  (onto the crankcase cover 2 mating surfaces)

| | |
|---|---|
| | **Three bond No.1217G®** |

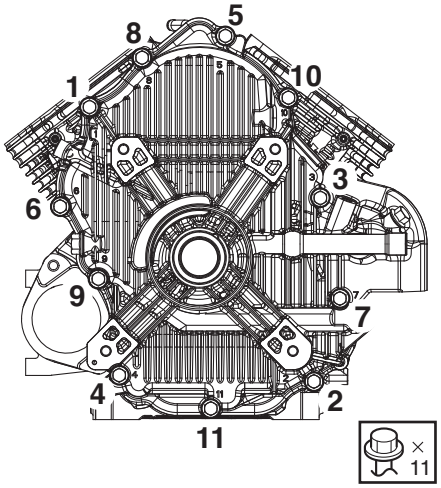


**3.** Install:
- Crankcase cover 2




**TIP**
Align the inner rotor “a” of the oil pump with the flat portion “b” of the crankshaft and install.

**4.** Install:
- Crankcase cover 2 bolts “1” to “11”



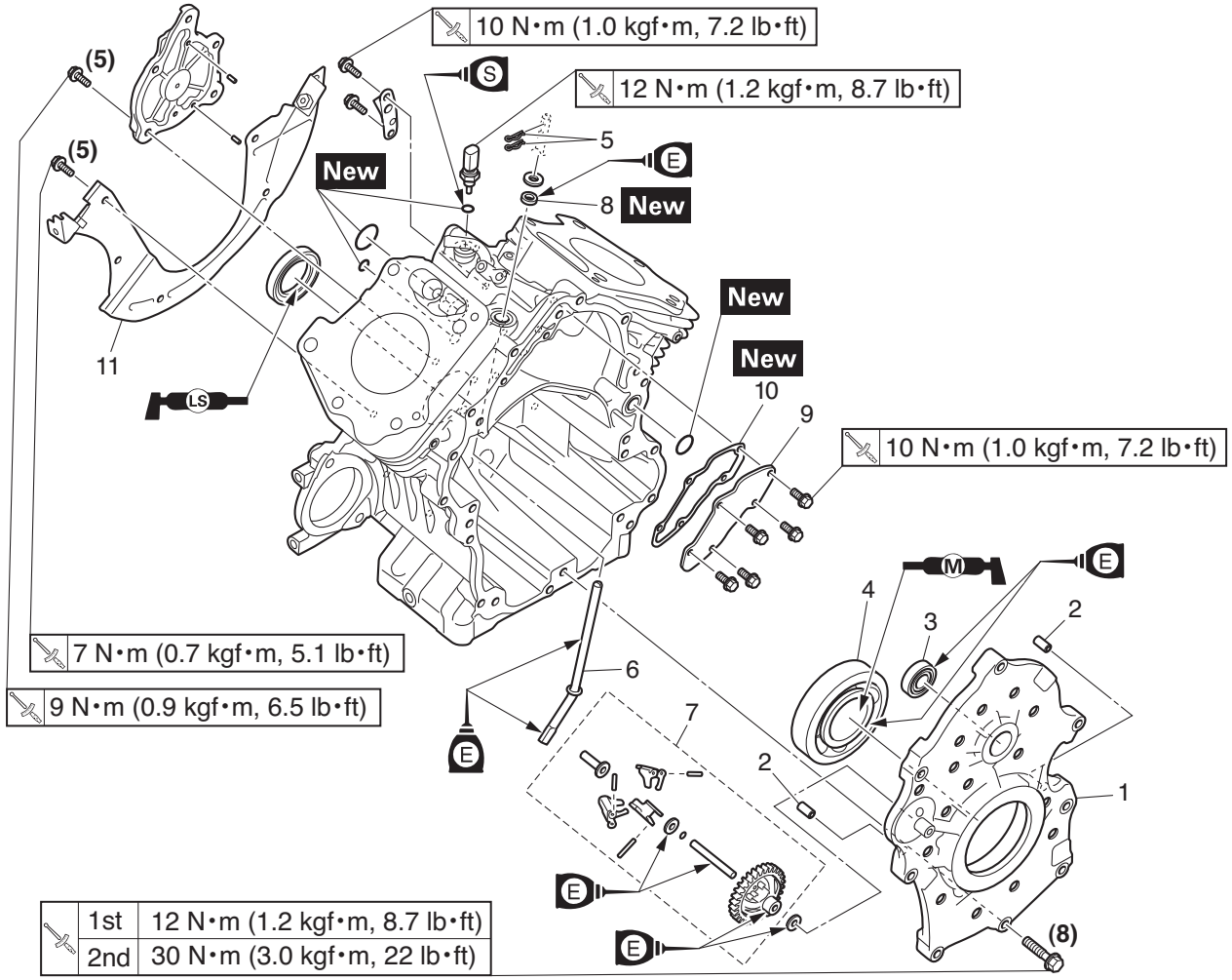

**TIP**
Tighten the bolts to the specified torque in two steps and in order from “1” to “11”.

| | |
|---|---|
| | **Crankcase cover 2 bolt:**<br>**1st: 12 N·m (1.2 kgf·m, 8.7 lb·ft)**<br>**2nd: 30 N·m (3.0 kgf·m, 22 lb·ft)** |

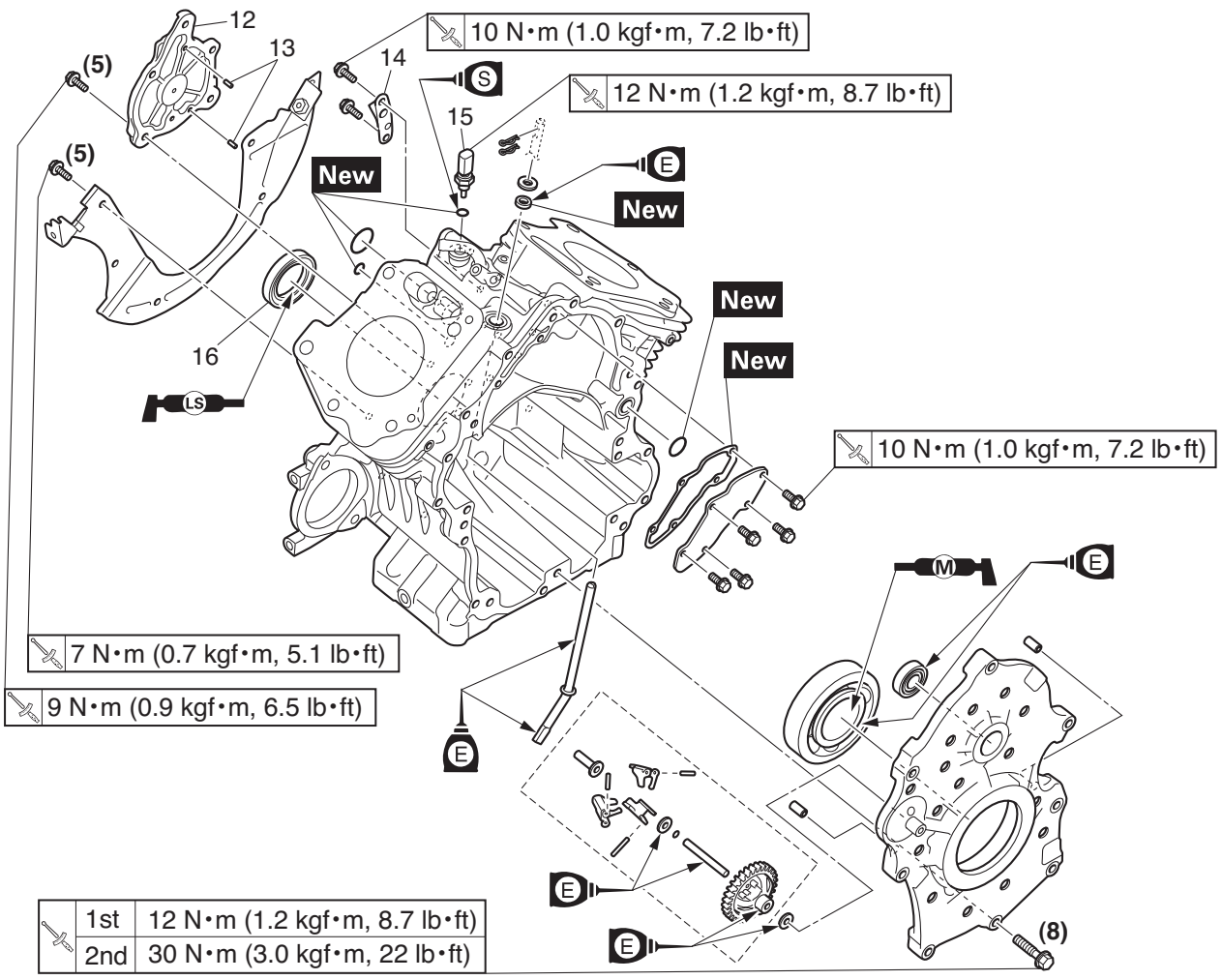
# PISTONS, CAMSHAFT, CRANKCASE, AND CRANKSHAFT

## CRANKCASE



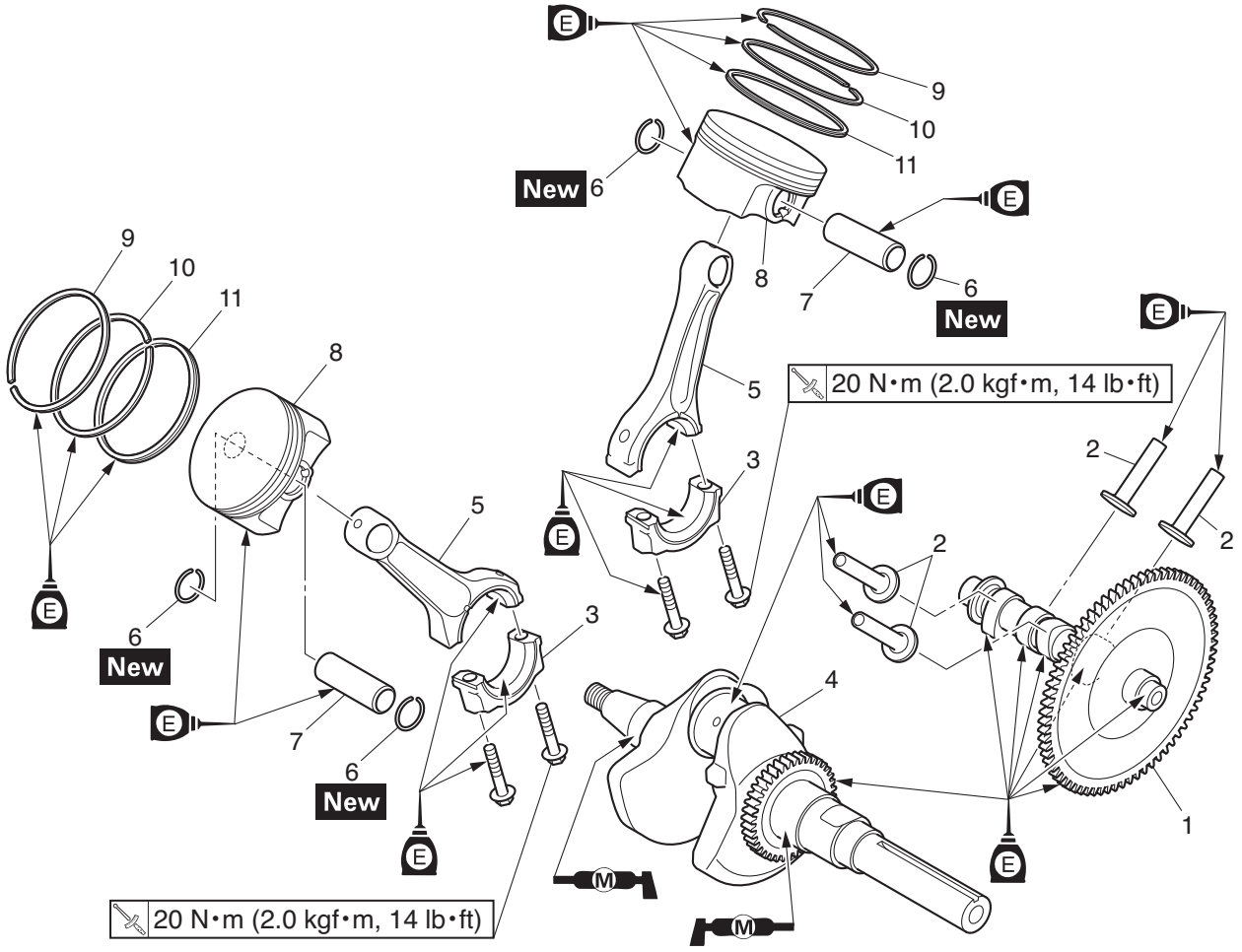



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the crankcase** | | Remove the parts in the order listed. |
| | Cylinder head assembly | | Refer to "CYLINDER HEAD COVERS, CYLINDER HEADS" on page 3-20. |
| 1 | Crankcase cover 1 | 1 | |
| 2 | Dowel pin | 2 | |
| 3 | Bearing | 1 | |
| 4 | Bearing | 1 | |
| 5 | Clip | 2 | |
| 6 | Governor fork | 1 | |
| 7 | Flyweight shaft assembly | 1 | |
| 8 | Oil seal | 1 | |
| 9 | Cover 2 | 1 | |
| 10 | Gasket | 1 | |
| 11 | Scroll air shroud | 1 | |

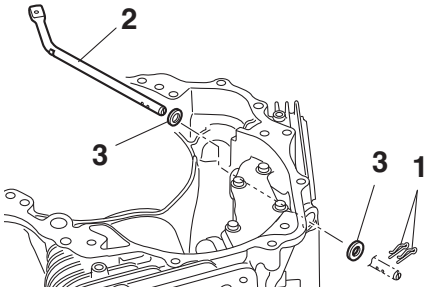


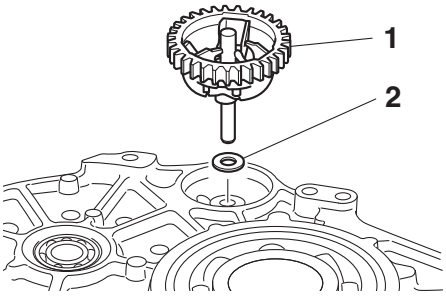

| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| 12 | Cover 1 | 1 | |
| 13 | Dowel pin | 2 | |
| 14 | Reed valve | 1 | |
| 15 | Engine temperature sensor | 1 | |
| 16 | Oil seal | 1 | |

## PISTONS, CAMSHAFT, AND CRANKSHAFT




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the pistons, camshaft, and crankshaft** | | Remove the parts in the order listed. |
| 1 | Camshaft | 1 | |
| 2 | Valve lifter | 4 | |
| 3 | Connecting rod cap | 2 | |
| 4 | Crankshaft | 1 | |
| 5 | Connecting rod | 2 | |
| 6 | Piston pin circlip | 4 | |
| 7 | Piston pin | 2 | |
| 8 | Piston | 2 | |
| 9 | Top ring | 2 | |
| 10 | 2nd ring | 2 | |
| 11 | Oil ring | 2 | |



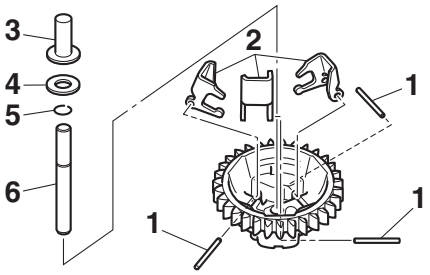




### REMOVING THE FLYWEIGHT SHAFT ASSEMBLY AND GOVERNOR FORK

1. Remove:
   - Crankcase cover 1
   - Governor assembly
2. Remove:
   - Clips “1”
   - Governor fork “2”
   - Washers “3”
3. Remove:
   - Flyweight shaft assembly “1”
   - Washer “2”

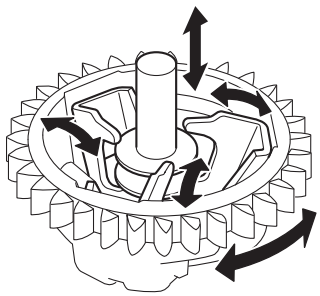
**TIP**

Remove the flyweight shaft assembly by tapping the weight shaft from outside of the crankcase cover 1.



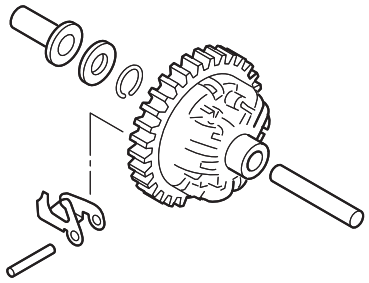

### DISASSEMBLING THE FLYWEIGHT SHAFT ASSEMBLY

1. Remove:
   - Flyweight shafts “1”
   - Weights “2”
   - Collar “3”
   - Washer “4”
   - Circlip “5”
   - Weight shaft “6”



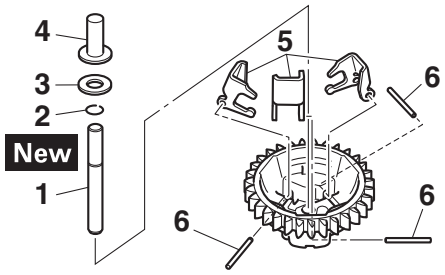
### CHECKING THE FLYWEIGHT SHAFT ASSEMBLY

1. Check:
   - Flyweight shaft assembly move smoothly
     Rough movement → Replace.



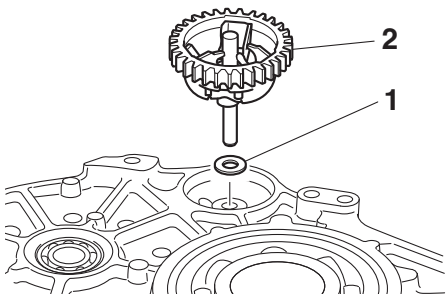
**2.** Check:
- Weight
- Flyweight shaft
- Collar
- Washer
- Weight shaft
  Wear/damage → Replace.

### ASSEMBLING THE FLYWEIGHT SHAFT ASSEMBLY

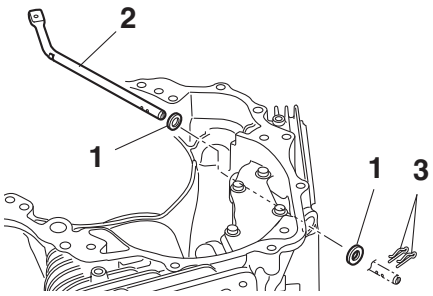



**1.** Install:
- Weight shaft “1”
- Circlip “2” New
- Washer “3”
- Collar “4”
- Weights “5”
- Flyweight shafts “6”

### INSTALLING THE FLYWEIGHT SHAFT ASSEMBLY AND GOVERNOR FORK




**1.** Install:
- Washer “1”
- Flyweight shaft assembly “2”




**2.** Install:
- Washers “1”
- Governor fork “2”
- Clips “3”

**3.** Install:
- Governor assembly
- Crankcase cover 1
  (Refer to “INSTALLING THE CRANKCASE COVER 1” on page 3-47)

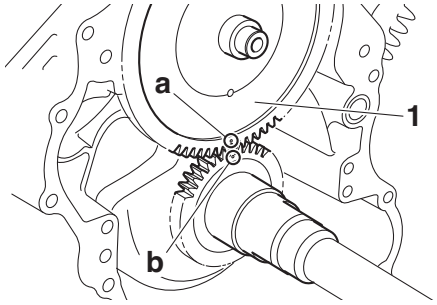
**4.** Adjust:
- Governor

(Refer to "INSTALLING THE THROTTLE BODY ASSEMBLY" on page 4-7)

### REMOVING THE CAMSHAFT AND VALVE LIFTERS

The following procedure applies to all of the camshaft and valve lifters.

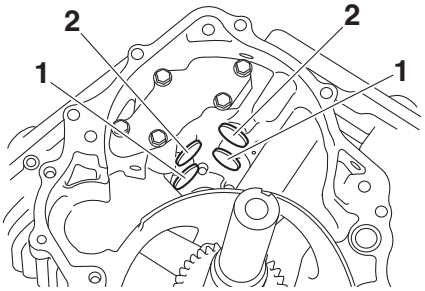





***1.*** Remove:
- Camshaft "1"

**TIP**

Remove the camshaft when the camshaft gear mark "a" and the crankshaft gear mark "b" are aligned.

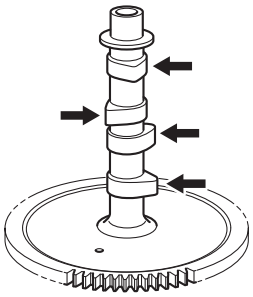



***2.*** Remove:
- Valve lifter "1" (Intake)
- Valve lifter "2" (Exhaust)

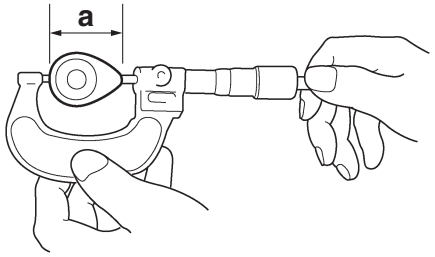
***NOTICE***

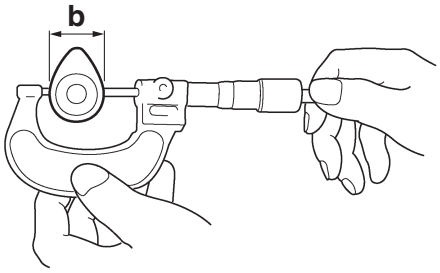
**Mark the valve lifters so as not to confuse them during reassembly.**

### CHECKING THE CAMSHAFT



***1.*** Check:
- Camshaft
  Crack/damage/wear → Replace.

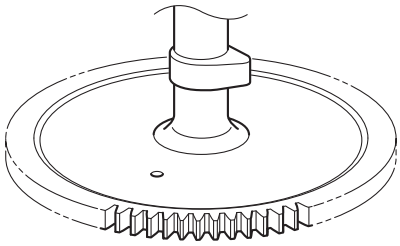


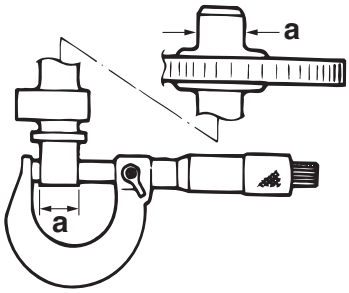

**2.** Check:
- Camshaft lobe dimensions “a” and “b”

**Camshaft lobe dimensions**
**Lobe height “a” (Intake):**
**32.885 mm (1.2947 in)**
**Limit:**
**32.785 mm (1.2907 in)**
**Lobe height “a” (Exhaust):**
**33.957 mm (1.3369 in)**
**Limit:**
**33.857 mm (1.3330 in)**
**Base circle diameter “b” (Intake):**
**26.000 mm (1.0236 in)**
**Limit:**
**25.900 mm (1.0197 in)**
**Base circle diameter “b” (Exhaust):**
**26.000 mm (1.0236 in)**
**Limit:**
**25.900 mm (1.0197 in)**

Out of specification → Replace.



**3.** Check:
- Surface of camshaft gear teeth
  Crack/damage/wear → Replace.



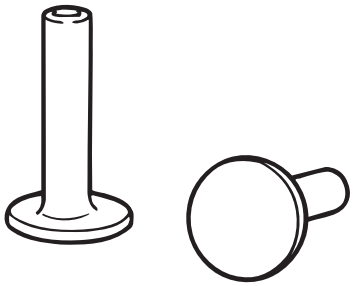

**4.** Check:
- Camshaft journal diameter “a”

**Camshaft journal diameter:**
**16.965–16.990 mm (0.6679–0.6689 in)**
**Limit:**
**16.950 mm (0.6673 in)**

Out of specification → Replace.

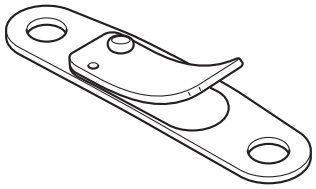
### CHECKING THE VALVE LIFTERS

The following procedure applies to all of the valve lifters.



1. Check:
   - Valve lifter
     Damage → Replace.

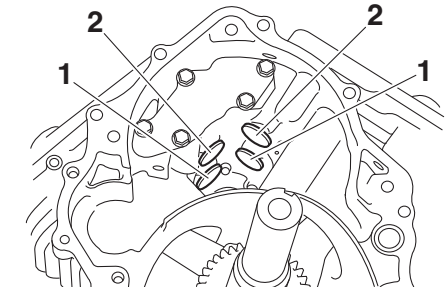
### CHECKING THE REED VALVE



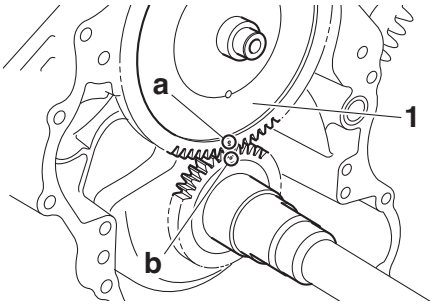
1. Check:
   - Reed valve
     Damage → Replace.

### INSTALLING THE VALVE LIFTERS AND CAMSHAFT

The following procedure applies to all of the camshaft and valve lifters.




1. Install:
   - Valve lifter “1” (Intake)
   - Valve lifter “2” (Exhaust)



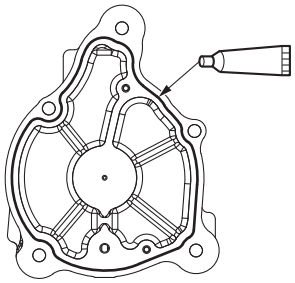

2. Install:
   - Camshaft “1”

***NOTICE***

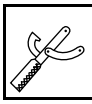
**Be sure to align the camshaft gear mark “a” with the crankshaft gear mark “b”.**

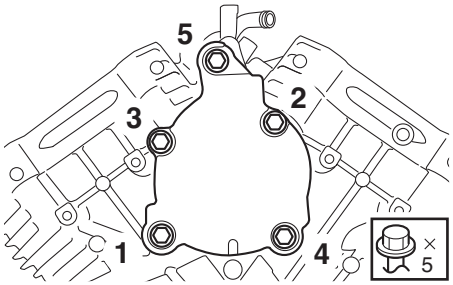
### INSTALLING THE COVER 1

1. Clean:
   - Mating surfaces of the crankcase and the cover 1 (with a cloth dampened with lacquer thinner)



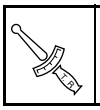
***2.*** Apply:
- Sealant
  (onto the crankcase mating surfaces)

| | |
|---|---|
|  | **Three bond No.1217G®** |

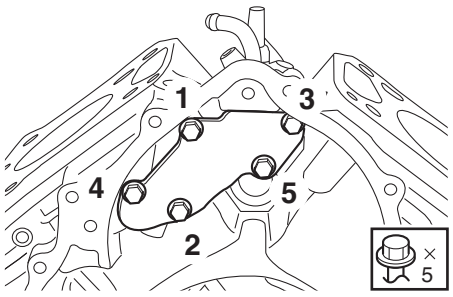



***3.*** Install:
- Cover 1
- Cover 1 bolts “1” to “5”

**TIP**
Tighten the bolts to the specified torque in order from “1” to “5”.

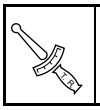
| | |
|---|---|
|  | **Cover 1 bolt:**<br>**9 N·m (0.9 kgf·m, 6.5 lb·ft)** |

### INSTALLING THE COVER 2

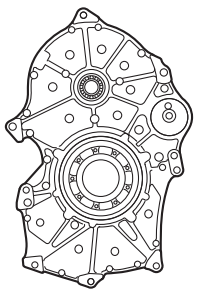



***1.*** Install:
- Gasket New
- Cover 2
- Cover 2 bolts “1” to “5”

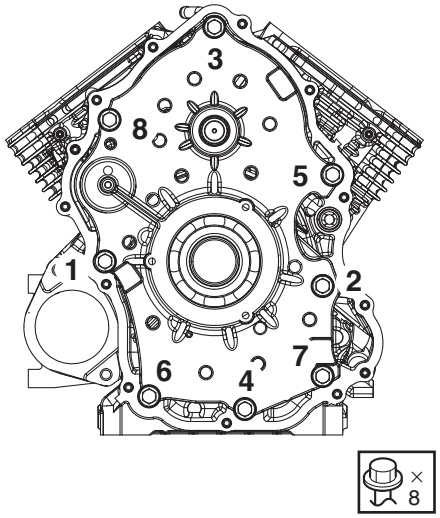
**TIP**
Tighten the bolts to the specified torque in order from “1” to “5”.

| | |
|---|---|
|  | **Cover 2 bolt:**<br>**10 N·m (1.0 kgf·m, 7.2 lb·ft)** |

### CHECKING THE CRANKCASE COVER 1



***1.*** Check:
- Crankcase cover 1
  Damage → Replace.
- Bearing
  Noise/wear/rotational failure → Replace.




### INSTALLING THE CRANKCASE COVER 1

**1.** Install:
- Crankcase cover 1
- Crankcase cover 1 bolts “1” to “8”

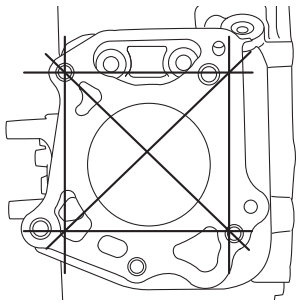
**TIP**
Tighten the bolts to the specified torque in two steps and in order from “1” to “8”.

**Crankcase cover 1 bolt:**
**1st: 12 N·m (1.2 kgf·m, 8.7 lb·ft)**
**2nd: 30 N·m (3.0 kgf·m, 22 lb·ft)**

### CHECKING THE CYLINDERS AND PISTONS

The following procedure applies to all of the pistons and cylinders.

**1.** Check:
- Piston wall
- Cylinder wall
  Vertical scratches → Replace the cylinder, and replace the piston and piston rings as a set.



**2.** Measure:
- Cylinder warpage

**TIP**
Measure the warpage on the contact surface of the cylinder head at six points using a straight edge and feeler gauge set.

**Feeler gauge set:**
**YU-26900-9**

**Warpage limit:**
**0.05 mm (0.002 in)**

Out of specification → Replace the crankcase assembly.

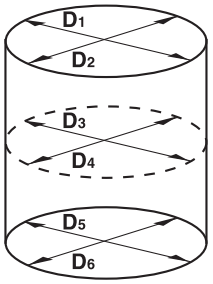
**3.** Measure:
- Piston-to-cylinder clearance

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

a. Measure cylinder bore “C” with the cylinder bore gauge.

**TIP**
Measure cylinder bore "C" by taking side-to-side and front-to-back measurements of the cylinder.

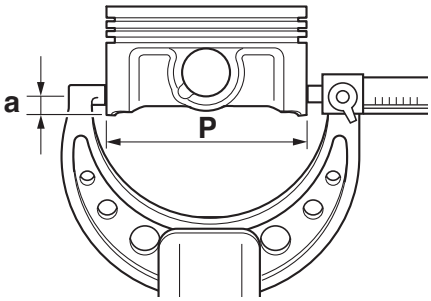
**Bore:**
**80.000–80.020 mm (3.1496–3.1504 in)**
**Warpage limit:**
**80.025 mm (3.1506 in)**




"C" = maximum of $D_1$, $D_2$, $D_3$, $D_4$, $D_5$, $D_6$

b. If out of specification, replace the crankcase assembly, and replace the piston and piston rings as a set.

c. Measure piston skirt diameter "P" with the micrometer.
a = 6.0 mm (0.2362 in) from the piston bottom edge




**Piston diameter:**
**79.959–79.980 mm (3.1480–3.1488 in)**
**Limit:**
**79.900 mm (3.1457 in)**

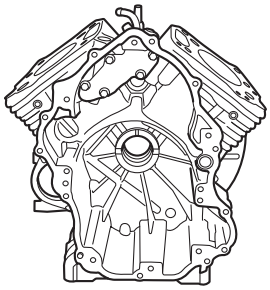
d. If out of specification, replace the piston and piston rings as a set.

e. Calculate the piston-to-cylinder clearance with the following formula.

Piston-to-cylinder clearance = Cylinder bore "C" – Piston skirt diameter "P"

**Piston-to-cylinder clearance:**
**0.033–0.047 mm (0.0013–0.0019 in)**
**Limit:**
**0.15 mm (0.0059 in)**

f. If out of specification, replace the crankcase assembly, and replace the piston and piston rings as a set.



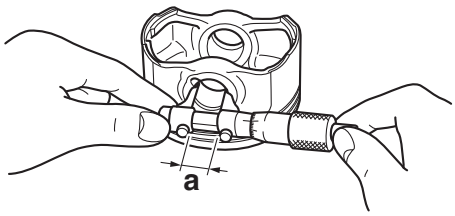
### CHECKING THE CRANKCASE

1. Check:
   - Crankcase
     Damage → Replace.
   - Bearing
     Noise/wear/rotational failure → Replace.

### CHECKING THE PISTON PINS

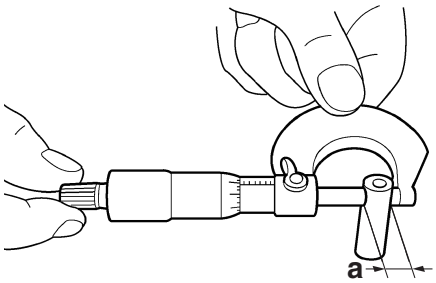
The following procedure applies to all of the piston pins.

1. Check:
   - Piston pin
     Blue discoloration/grooves → Replace the piston pin and then check the lubrication system.
2. Measure:
   - Piston pin hole inside diameter "a"
     Out of specifications → Replace.



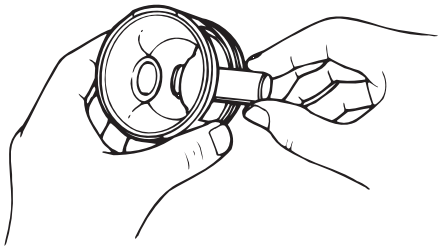

**Piston pin hole inside diameter:**
**19.004–19.015 mm (0.7482–0.7486 in)**
**Limit:**
**19.045 mm (0.7498 in)**

3. Measure:
   - Piston pin diameter "a"
     Out of specification → Replace.




**Piston pin diameter:**
**18.995–19.000 mm (0.7478–0.7480 in)**
**Limit:**
**18.975 mm (0.7470 in)**

4. Check:
   - Check that the piston pin enters smoothly into the piston pin hole.

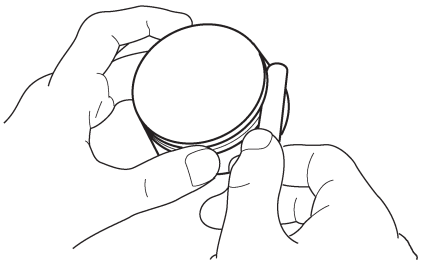


**TIP**

If the piston pin fits too tight into the piston, check the piston pin hole. If there is any protrusion, use a knife or scraper to gently remove it so that piston pin can be pushed in smoothly with your fingers.

### CHECKING THE PISTON RINGS

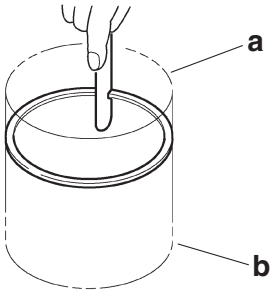
The following procedure applies to all of the piston rings.



**1.** Measure:
- Piston ring side clearance
  Out of specification → Replace the piston and piston rings as a set.

**TIP**
Before measuring the piston ring side clearance, eliminate any carbon deposits from the piston ring grooves and piston rings.

**Piston ring**
**Top ring**
**Side clearance:**
**0.04–0.08 mm (0.0016–0.0031 in)**
**Limit:**
**0.13 mm (0.0051 in)**
**2nd ring**
**Side clearance:**
**0.03–0.07 mm (0.0012–0.0028 in)**
**Limit:**
**0.13 mm (0.0051 in)**




**2.** Install:
- Piston ring
  (into the cylinder)

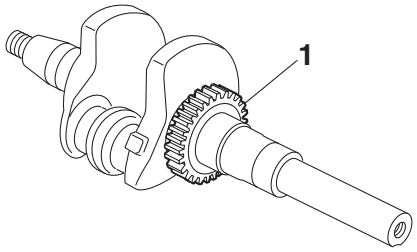
**TIP**
Use the piston crown to level the piston ring near bottom of cylinder “a”, where cylinder wear is lowest.

b. Upper of cylinder

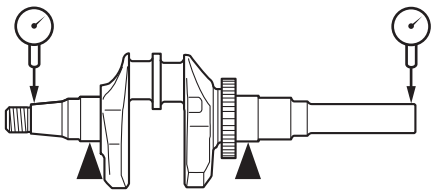
**3.** Measure:
- Piston ring end gap
  Out of specification → Replace the piston rings as a set.

**Top ring**
**End gap (installed):**
**0.20–0.35 mm (0.0079–0.0138 in)**
**Limit:**
**0.60 mm (0.0236 in)**
**2nd ring**
**End gap (installed):**
**0.20–0.35 mm (0.0079–0.0138 in)**
**Limit:**
**0.60 mm (0.0236 in)**
**Oil ring**
**End gap (installed):**
**0.20–0.70 mm (0.0079–0.0276 in)**

## CHECKING THE CRANKSHAFT



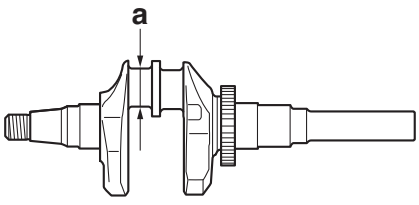

***1.*** Check:
- Crankshaft sprocket "1"
  Damage/wear → Replace the crankshaft.



***2.*** Measure:
- Crankshaft runout limit
  Out of specification → Replace.
  Use a dial indicator gauge.

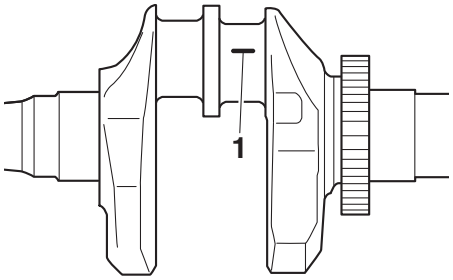
**Dial indicator gauge:**
**YU-A8428**

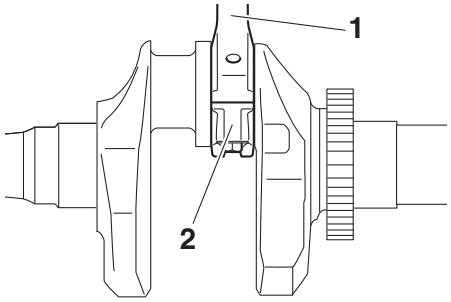
**Runout limit:**
**0.03 mm (0.0012 in)**

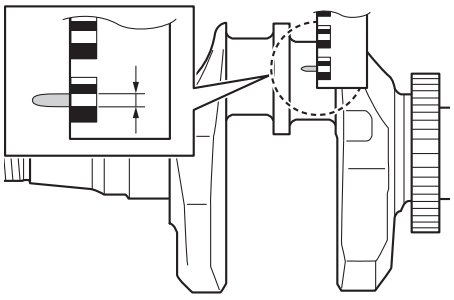



***3.*** Measure:
- Crank pin outside diameter "a"
  Out of specification → Replace.
  Use a micrometer.

**Crank pin outside diameter:**
**40.950–41.050 mm (1.6122–1.6161 in)**



## CHECKING THE CONNECTING RODS OIL CLEARANCE

The following procedure applies to all of the connecting rods.

**TIP**

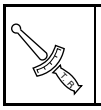
Measure the oil clearance if replacing the crankshaft or connecting rod.

1. Place a piece of Plastigauge® "1" on the crank pin horizontally.

**TIP**

Wipe off oil thoroughly from the crankshaft, connecting rod, and connecting rod cap.

2. Install:
   - Connecting rod "1"
   - Connecting rod cap "2"

| | |
|---|---|
|  | **Connecting rod cap bolt:**<br>**20 N·m (2.0 kgf·m, 14 lb·ft)** |

**TIP**

Tighten the cap bolts so that the crankshaft does not move while the oil clearance is being measured.

3. Remove:
   - Connecting rod cap
   - Connecting rod
4. Measure:
   - Connecting rod big end oil clearance
     Out of specification → Replace crankshaft or connecting rod assembly, and then measure the clearance again.

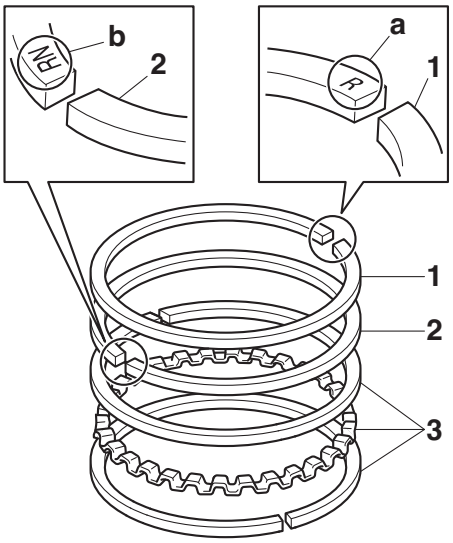
**TIP**

Measure the widest portion of the pressed Plastigauge®.

| | |
|---|---|
|  | **Connecting rod big end oil clearance:**<br>**0.016–0.046 mm (0.0006–0.0018 in)**<br>**Limit:**<br>**0.09 mm (0.0035 in)** |

## INSTALLING THE PISTONS AND PISTON RINGS

The following procedure applies to all of the pistons, piston

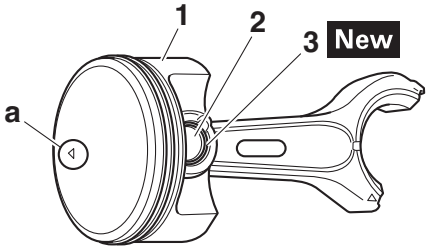



rings and related components.

1. Install:
   - Top ring “1”
   - 2nd ring “2”
   - Oil ring “3”

**TIP**

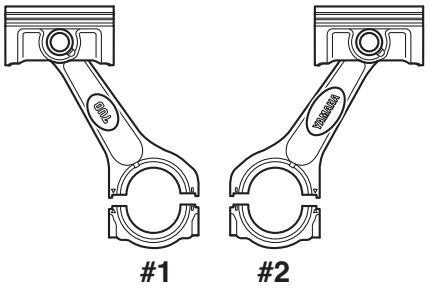
- Be sure to install the top ring so that the “R” mark “a” faces toward the piston head.
- Be sure to install the 2nd ring so that the “RN” mark “b” faces toward the piston head.
- Make sure that the piston rings move smoothly.

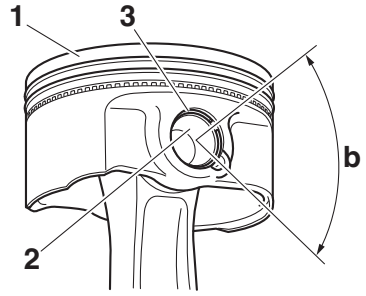


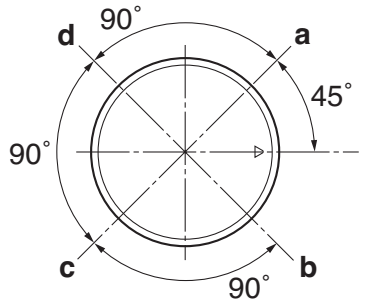

2. Apply the engine oil to the inside of the connecting rod small end.
3. Install:
   - Piston “1”
   - Piston pin “2”
   - Piston pin circlips “3” New

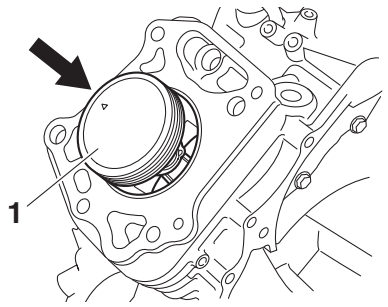
**TIP**

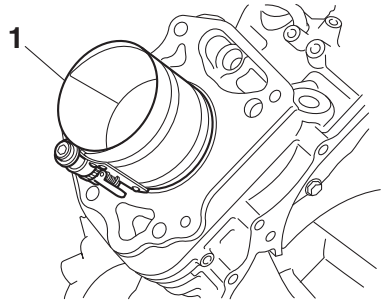
- Make sure that the “▽” mark “a” on the piston head faces toward the flywheel.
- Install the piston pin clips so that the clip ends are 45° “b” or more from the cutout in the piston.

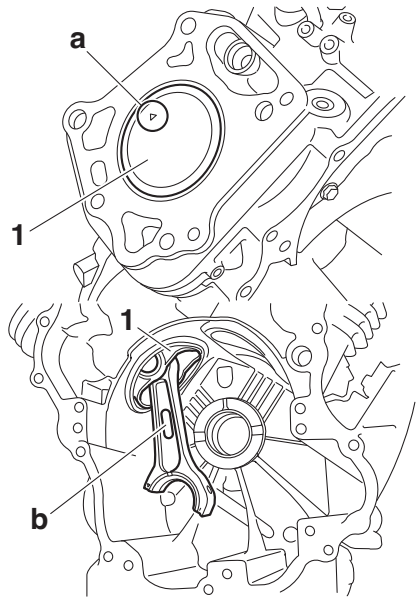




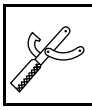

## INSTALLING THE CRANKSHAFT

***1.*** Make sure that the end gap of each piston ring is positioned correctly, as shown in the illustration.

a. Top ring, oil ring expander
b. Lower oil ring rail
c. 2nd ring
d. Upper oil ring rail

***2.*** Install:
- Piston with the connecting rod “1”

***3.*** Attach:
- Piston ring compressor “1”

| | |
|---|---|
|  | **Piston ring compressor:**<br>**YM-08037** |

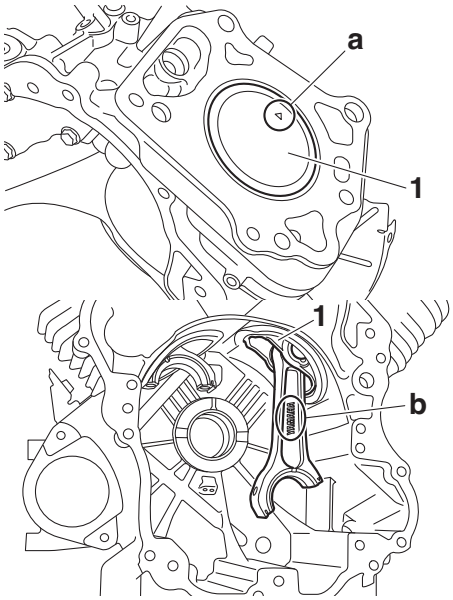
**TIP**

Attach the piston ring compressor to the piston, and then insert the piston into the cylinder.

***4.*** Check:
- Piston #1 with the connecting rod #1 “1” position

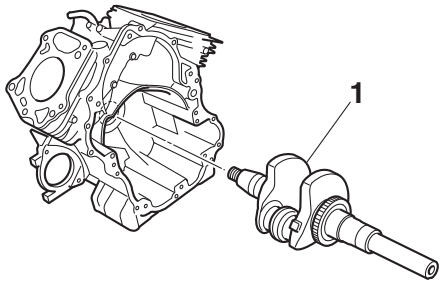
**TIP**

- Make sure that the “▽” mark “a” on the piston #1 head faces toward the flywheel.
- Make sure that the “7UD” mark “b” on the connecting rod #1 faces toward the crankcase cover 1.

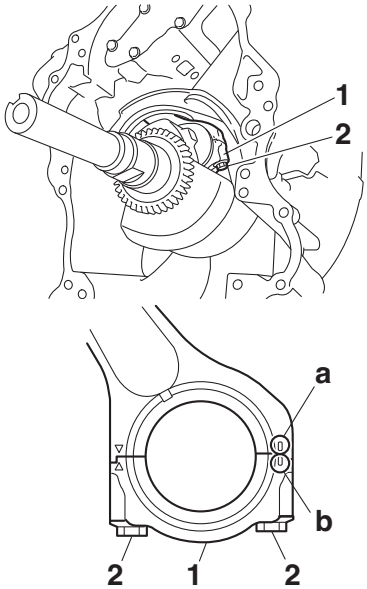



***5.*** Check:
- Piston #2 with the connecting rod #2 "1" position.

**TIP**
- Make sure that the "▽" mark "a" on the piston #2 head faces toward the flywheel.
- Make sure that the "YAMAHA" mark "b" on the connecting rod #2 faces toward the crankcase cover 1.



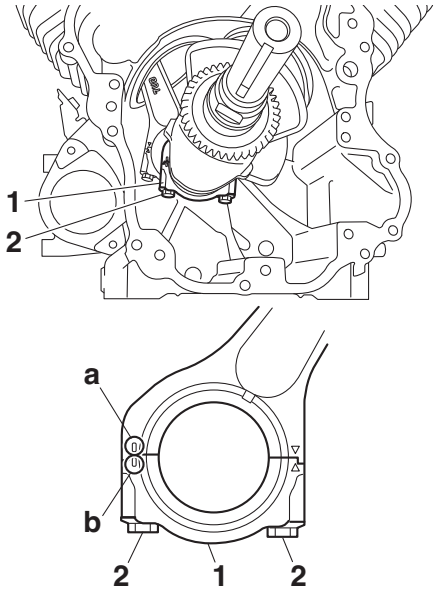

***6.*** Install:
- Crankshaft "1"



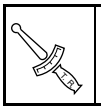

***7.*** Install:
- Connecting rod cap #1 "1"
- Connecting rod cap #1 bolts "2"

| | |
|---|---|
| | **Connecting rod cap bolt:**<br>**20 N·m (2.0 kgf·m, 14 lb·ft)** |

**TIP**
- Make sure that the "▯" mark "a" on the connecting rod #1 is aligned with the "▯" mark "b" on the connecting rod cap #1.
- Tighten the connecting rod cap #1 bolts alternately two to three times.



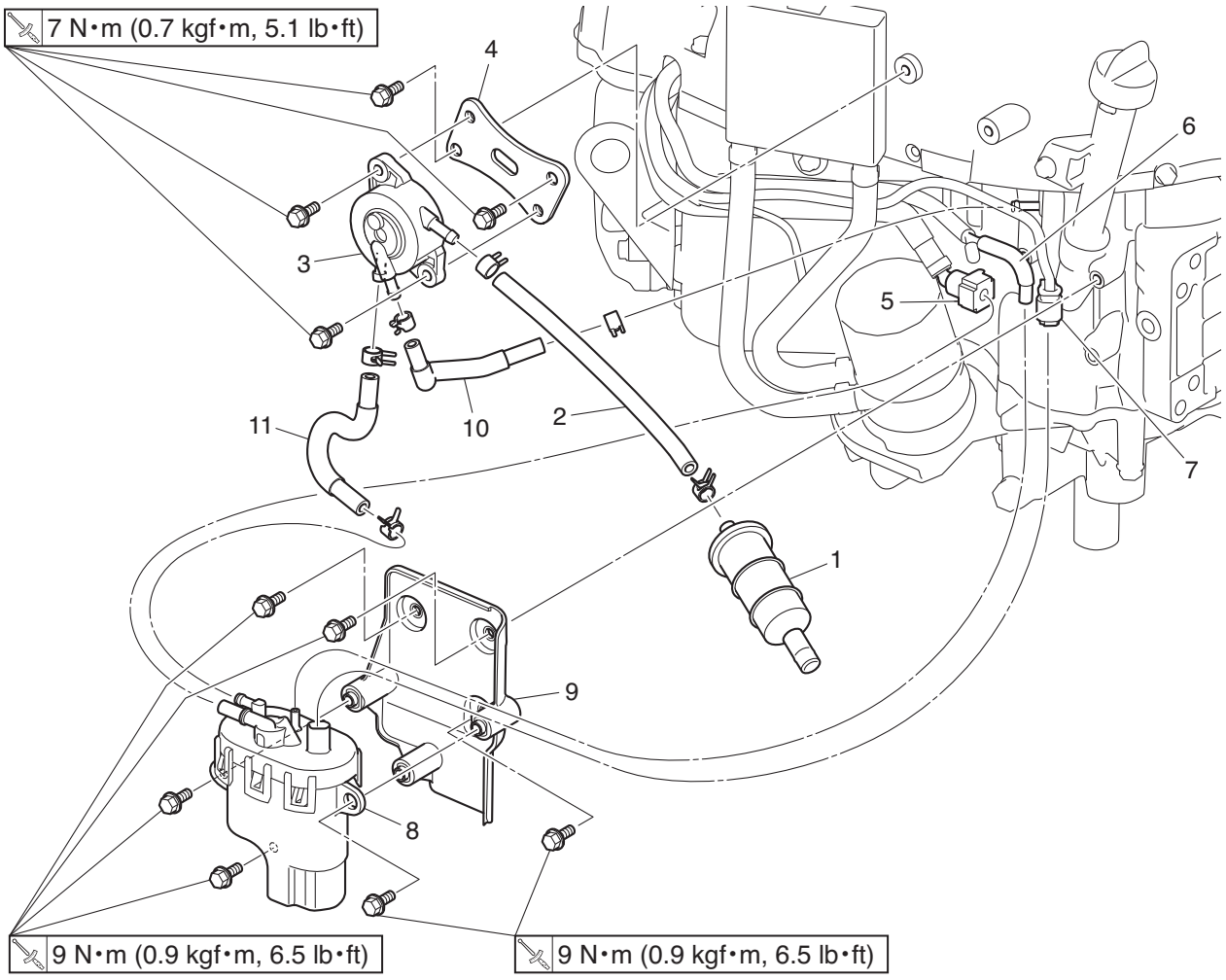

***8.*** Install:
- Connecting rod cap #2 “1”
- Connecting rod cap #2 bolts “2”

| | |
|---|---|
|  | **Connecting rod cap bolt:**<br>**20 N·m (2.0 kgf·m, 14 lb·ft)** |

**TIP**
- Make sure that the “▯” mark “a” on the connecting rod #2 is aligned with the “▯” mark “b” on the connecting rod cap #2.
- Tighten the connecting rod cap #2 bolts alternately two to three times.

***9.*** Install:
- Camshaft
  (Refer to “INSTALLING THE VALVE LIFTERS AND CAMSHAFT” on page 3-45)
- Crankcase cover 1
  (Refer to “INSTALLING THE CRANKCASE COVER 1” on page 3-47)

## FUEL PUMPS

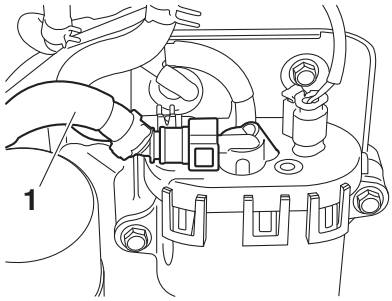



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the fuel pumps** | | Remove the parts in the order listed. |
| 1 | Fuel filter | 1 | |
| 2 | Fuel hose | 1 | |
| 3 | Low-pressure fuel pump | 1 | |
| 4 | Fuel pump bracket | 1 | |
| 5 | Fuel injector pipe 1 | 1 | Disconnect. |
| 6 | Purge hose 2 | 1 | Disconnect. |
| 7 | High-pressure fuel pump lead coupler | 1 | Disconnect. |
| 8 | High-pressure fuel pump | 1 | |
| 9 | Fuel pump bracket | 1 | |
| 10 | Pulsar hose | 1 | |
| 11 | Fuel delivery hose | 1 | |

## REMOVING THE HIGH-PRESSURE FUEL PUMP

**⚠ WARNING**

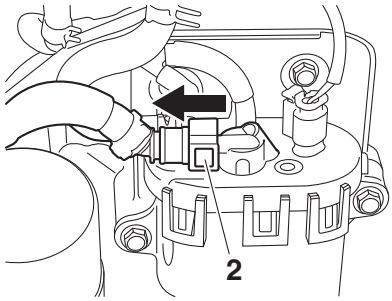
**Cover fuel injector pipe 1 connections with a cloth when disconnecting them. Residual pressure in the fuel lines could cause fuel to spurt out when removing the fuel injector pipe 1.**



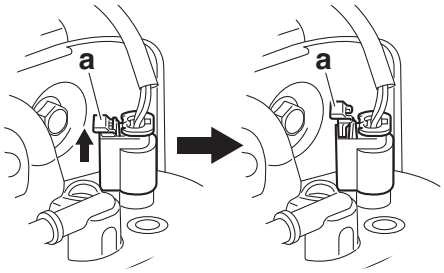

***1.*** Disconnect:
- Fuel injector pipe 1 “1”

***NOTICE***

**Be sure to disconnect the fuel injector pipe 1 “1” by hand. Do not forcefully disconnect the hose with tools.**



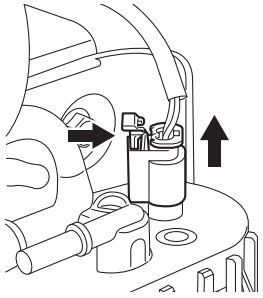

**TIP**
- To remove the fuel injector pipe 1 from the high-pressure fuel pump joint, press the two buttons “2” on the sides of the connector, and then remove the pipe.
- Before removing the pipe, place a few rags in the area under where it will be removed.



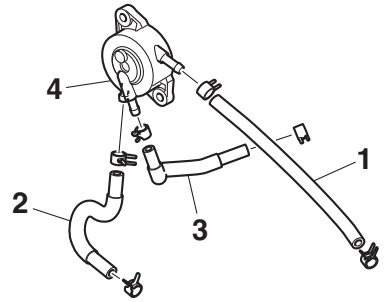

***2.*** Disconnect:
- High-pressure fuel pump lead coupler

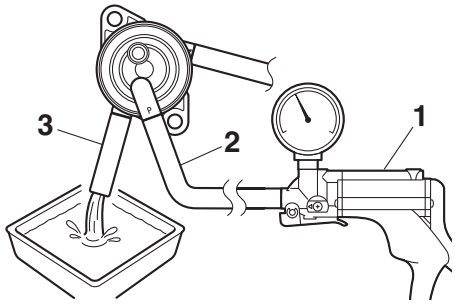
**TIP**

Slide the coupler cover “a” upward as shown in the illustration, and remove the coupler.



***3.*** Remove:
- High-pressure fuel pump




### CHECKING THE LOW-PRESSURE FUEL PUMP

***1.*** Check:
- Fuel hose “1”
- Fuel delivery hose “2”
- Pulsar hose “3”
- Low-pressure fuel pump “4”
  Cracks/damage → Replace.

***2.*** Check:
- Low-pressure fuel pump operation

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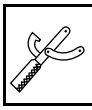
a. Connect the manual vacuum pump (Pressure/vacuum tester) “1” to the pulsar hose “2”.

| | |
|---|---|
|  | **Pressure/vacuum tester:**<br>**YB-35956-B** |

b. Place the container underneath the end of the fuel delivery hose “3”.
c. Operate the manual vacuum pump (Pressure/vacuum tester) “1” and check that gasoline is flowing out of the fuel delivery hose “3”.
d. If not, replace the fuel pump assembly.

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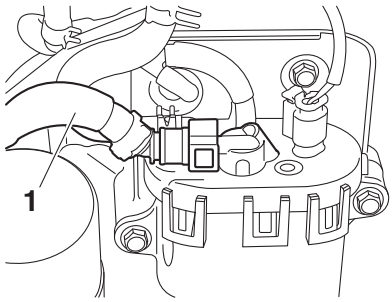
### CHECKING THE HIGH-PRESSURE FUEL PUMP

***1.*** Check:
- High-pressure fuel pump
  Cracks/damage → Replace.

***2.*** Check:
- Fuel pressure

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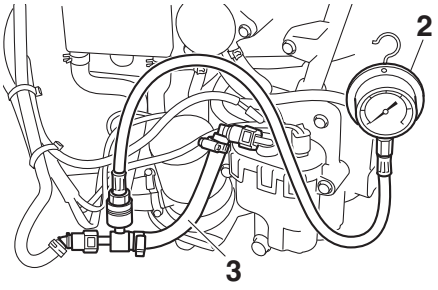
a. Disconnect the fuel injector pipe 1 “1” from the fuel pump.
   Refer to “REMOVING THE HIGH-PRESSURE FUEL PUMP” on page 4-2.

**⚠ WARNING**

**Cover fuel injector pipe 1 connections with a cloth when disconnecting them. Residual pressure in the fuel lines could cause fuel to spurt out when removing the fuel injector pipe 1.**




**NOTICE**

**Be sure to disconnect the fuel injector pipe 1 by hand. Do not forcefully disconnect the hose with tools.**

b. Connect the Fuel pressure gauge "2" and fuel pressure adapter "3" to the fuel injector pipe 1.

**Fuel pressure gauge:**
**YU-03153**
**Fuel pressure adapter:**
**YM-03186**

c. Start the engine.
d. Measure the fuel pressure.
Faulty → Replace the fuel pump.

**Fuel line pressure (at idle):**
**255–285 kPa (2.55–2.85 kgf/cm², 36.98–41.33 psi)**

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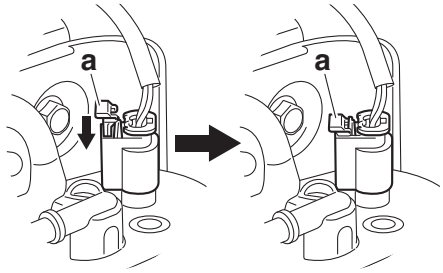
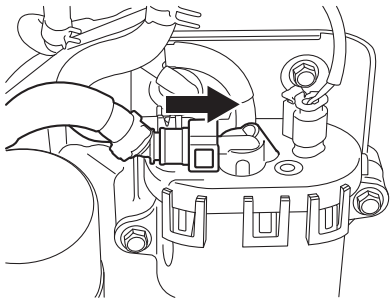
## INSTALLING THE HIGH-PRESSURE FUEL PUMP

1. Install:
   • High-pressure fuel pump
2. Connect:
   • High-pressure fuel pump lead coupler




**TIP**

Insert the coupler securely, slide the coupler cover "a" downward as shown in the illustration, and then lock the coupler.



3. Connect:
   • Fuel injector pipe 1

**NOTICE**

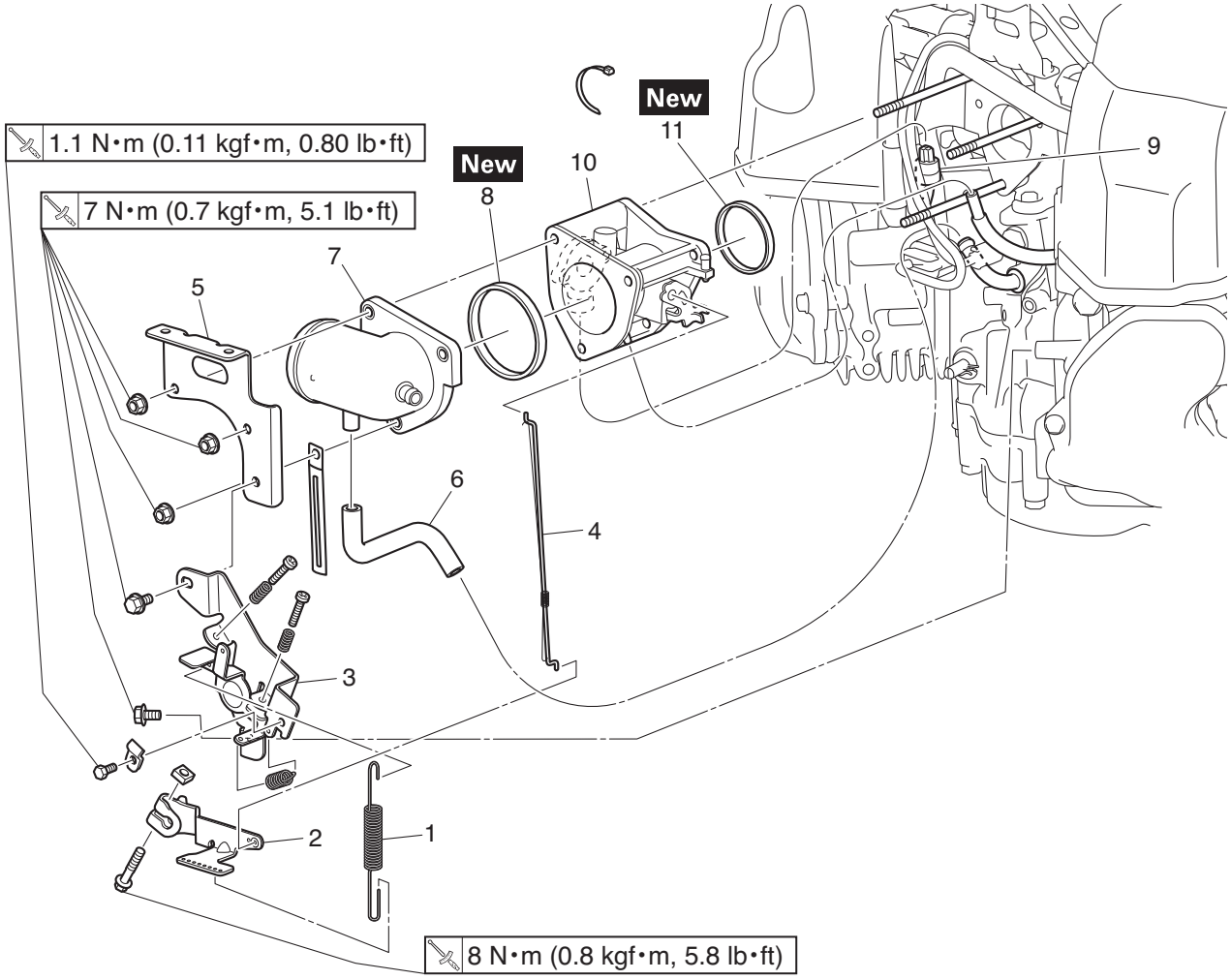
**When connecting the fuel injector pipe 1, make sure that it is securely connected, and that the fuel injector pipe 1 connector on the fuel injector pipe 1 is in the correct position, otherwise the fuel injector pipe 1 will not be properly installed.**

**TIP**

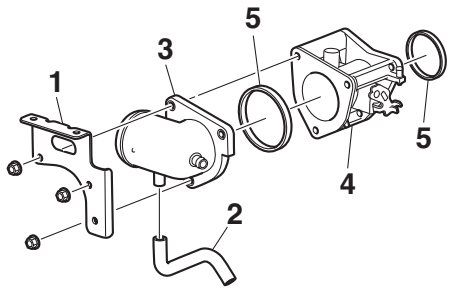
Install the fuel injector pipe 1 securely onto the high-pres-

sure fuel pump joint until a distinct “click” is heard.

## THROTTLE BODY ASSEMBLY




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the throttle body assembly** | | Remove the parts in the order listed. |
| | Air filter case | | Refer to "AIR FILTER" on page 3-3. |
| 1 | Governor spring | 1 | |
| 2 | Governor assembly | 1 | |
| 3 | Throttle lever comp | 1 | |
| 4 | Link rod/spring | 1/1 | |
| 5 | Stay | 1 | |
| 6 | Breather hose | 1 | |
| 7 | Joint 1 | 1 | |
| 8 | Gasket | 1 | |
| 9 | Throttle body assembly lead coupler | 1 | Disconnect. |
| 10 | Throttle body assembly | 1 | |
| 11 | Gasket | 1 | |

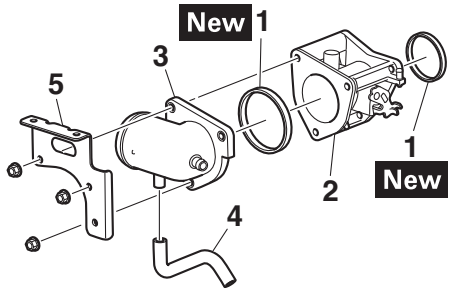



## REMOVING THE THROTTLE BODY ASSEMBLY

1. Remove:
   - Governor spring
   - Governor assembly
   - Throttle lever comp
   - Link rod/spring
2. Remove:
   - Stay "1"
   - Breather hose "2"
   - Joint 1 "3"
   - Throttle body assembly "4"
   - Gaskets "5"

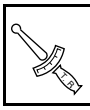
## CHECKING THE THROTTLE BODY ASSEMBLY

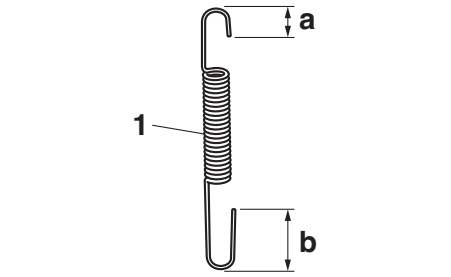
1. Check:
   - Throttle body assembly
     Cracks/damage → Replace.
2. Check:
   - Throttle valve operation
     Throttle valve can not move smoothly → Replace.
   - Engine speed adjustment
     Can not adjust engine high/low engine speed by procedure on page 2-16 → Replace.

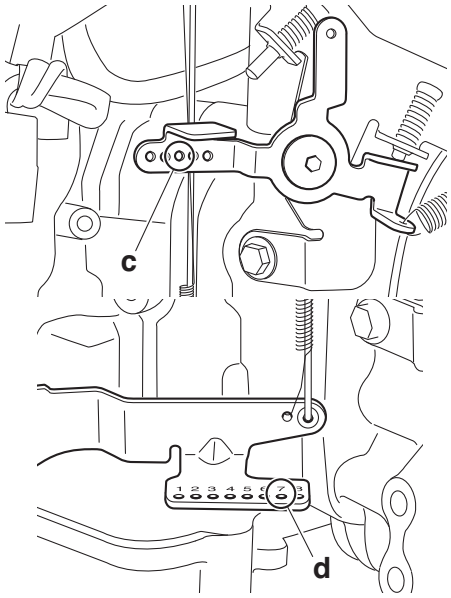


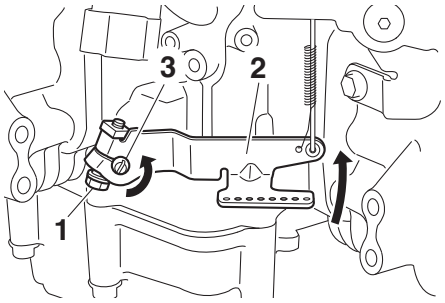

## INSTALLING THE THROTTLE BODY ASSEMBLY

1. Install:
   - Gaskets "1" New
   - Throttle body assembly "2"
   - Joint 1 "3"
   - Breather hose "4"
   - Stay "5"
   - Throttle body assembly nuts

| | |
|---|---|
|  | **Throttle body assembly nut:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |




**2.** Install:
- Link rod/spring
- Throttle lever comp
- Governor assembly
- Governor spring "1"

**TIP**
- Install the bending portion (short) "a" of the governor spring "1" into the hole "c" of the throttle lever comp while installing the bending portion (long) "b" of the governor spring "1" into the hole "d" of the governor assembly.
- Install the governor spring to the throttle lever comp first, and then to the governor assembly.

**3.** Adjust:
- Governor
- Governor assembly

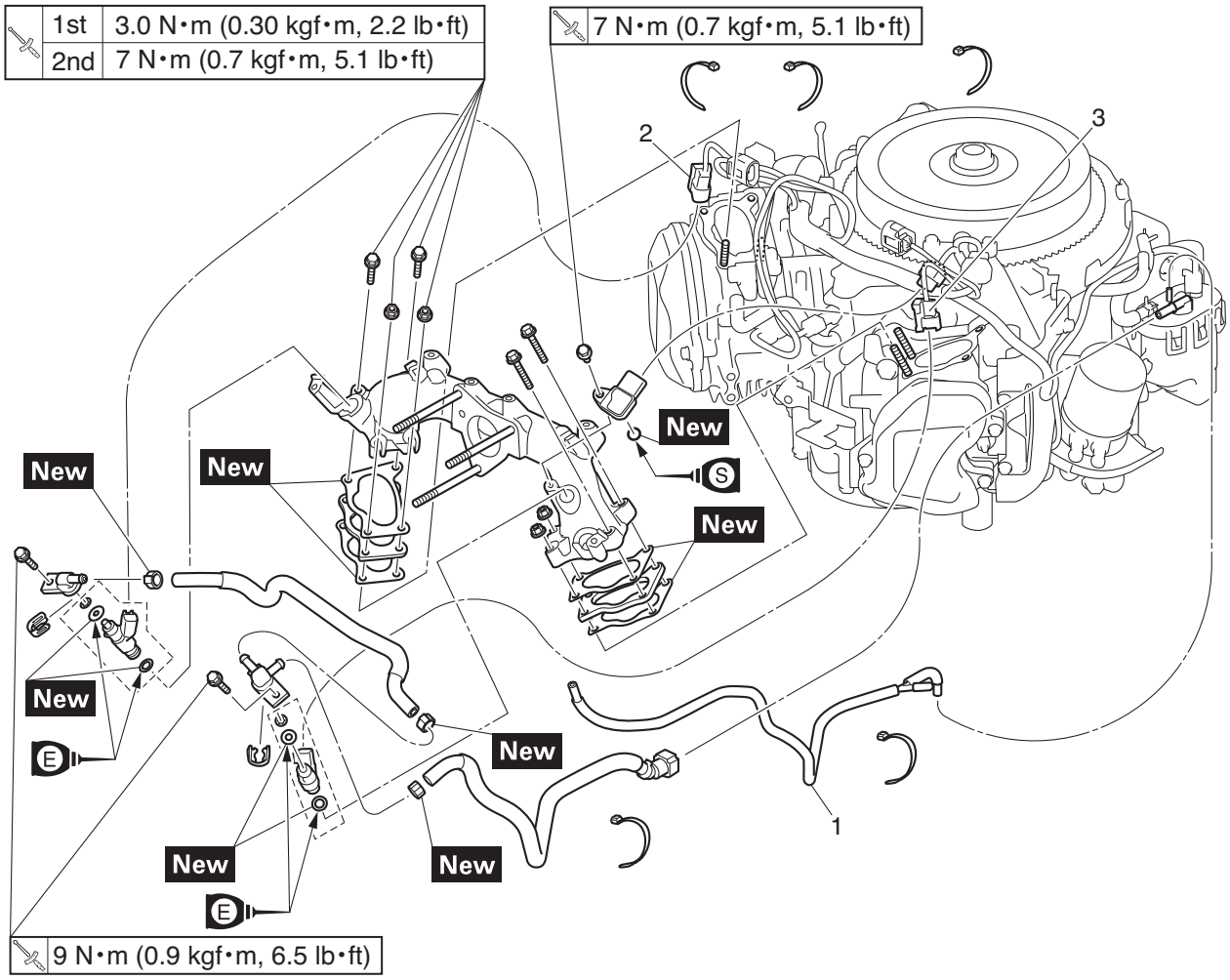
a. Loosen the governor assembly bolt "1".
b. Turn the governor assembly "2" counterclockwise until it stops.
c. Turn the governor fork "3" counterclockwise until it stops.
d. Tighten the governor assembly bolt "1".

| | |
|---|---|
| | **Governor assembly bolt:**<br>**8 N·m (0.8 kgf·m, 5.8 lb·ft)** |

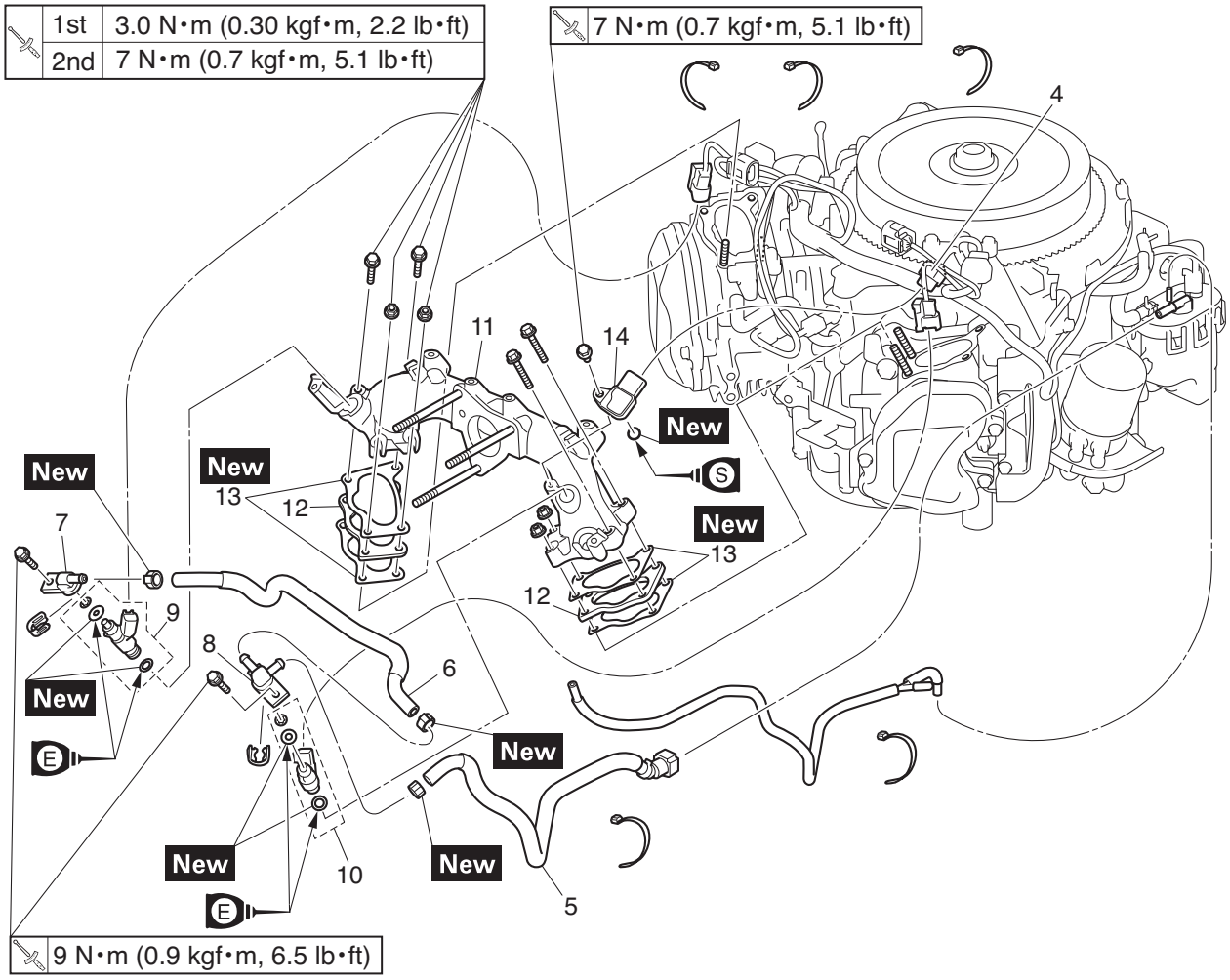
**4.** Check:
- Engine speed
(Refer to "ENGINE SPEED" on page 2-14)

| | |
|---|---|
| | **High engine speed (with no load):**<br>**3550–3600 r/min**<br>**Low engine speed (with no load):**<br>**1450–1550 r/min** |

# FUEL INJECTORS AND INTAKE MANIFOLD




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the fuel injectors and intake manifold** | | Remove the parts in the order listed. |
| | Air filter case | | Refer to "AIR FILTER" on page 3-3. |
| | ECU and rectifier/regulator | | Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8. |
| | Low-pressure fuel pump | | Refer to "FUEL PUMPS" on page 4-1. |
| | Oil cooler | | Refer to "OIL COOLER" on page 3-5. |
| | Fan case and fan | | Refer to "CASE AND FAN" on page 3-11. |
| | Throttle body assembly | | Refer to "THROTTLE BODY ASSEMBLY" on page 4-6. |
| | Ignition coil | | Refer to "IGNITION COILS" on page 3-10. |
| 1 | Purge hose | 1 | |
| 2 | Fuel injector #1 lead coupler | 1 | Disconnect. |
| 3 | Fuel injector #2 lead coupler | 1 | Disconnect. |

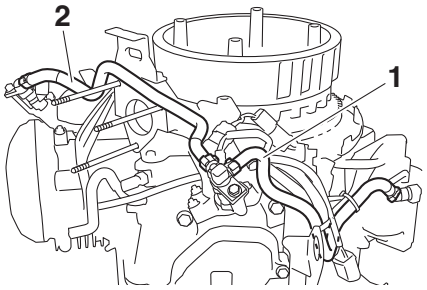



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| 4 | Manifold absolute pressure sensor lead coupler | 1 | Disconnect. |
| 5 | Fuel injector pipe 1 | 1 | |
| 6 | Fuel injector pipe 2 | 1 | |
| 7 | Inlet pipe 1 | 1 | |
| 8 | Inlet pipe 2 | 1 | |
| 9 | Fuel injector #1 | 1 | |
| 10 | Fuel injector #2 | 1 | |
| 11 | Intake manifold | 1 | |
| 12 | Intake manifold joint | 2 | |
| 13 | Gasket | 4 | |
| 14 | Manifold absolute pressure sensor | 1 | |

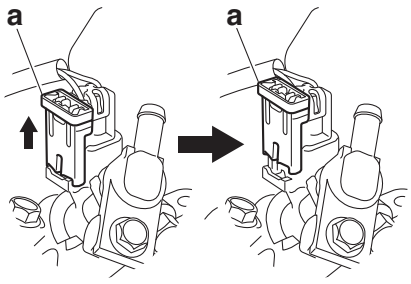
### REMOVING THE FUEL INJECTORS

The following procedure applies to all of the fuel injectors and related components.

1. Remove:
   - Air filter case
     (Refer to "AIR FILTER" on page 3-3)
   - ECU and rectifier/regulator
     (Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8)
   - Low-pressure fuel pump
     (Refer to "FUEL PUMPS" on page 4-1)
   - Oil cooler
     (Refer to "OIL COOLER" on page 3-5)
   - Fan case and fan
     (Refer to "CASE AND FAN" on page 3-11)
   - Throttle body assembly
     (Refer to "THROTTLE BODY ASSEMBLY" on page 4-6)
   - Ignition coil
     (Refer to "IGNITION COILS" on page 3-10)



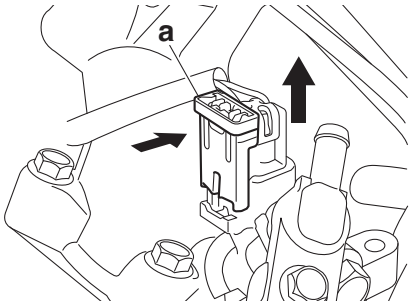

2. Remove:
   - Hose clamp (Clic-R)
     (Refer to "REMOVING THE OIL COOLER" on page 3-6)
   - Fuel injector pipe 1 "1"
   - Fuel injector pipe 2 "2"

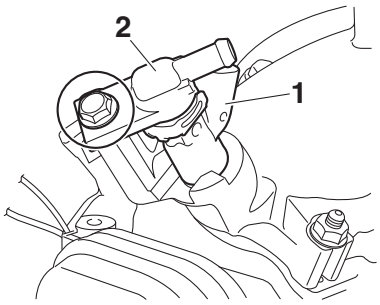



3. Disconnect:
   - Fuel injector lead coupler

**TIP**

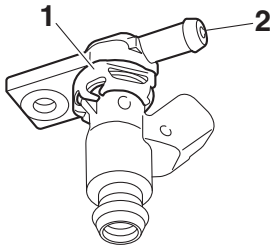
Slide the coupler cover "a" upward as shown in the illustration, and remove the coupler.






**4.** Remove:
- Fuel injector

**TIP**
Remove the fuel injector "1" with the inlet pipe "2" installed.




**5.** Remove:
- Inlet pipe

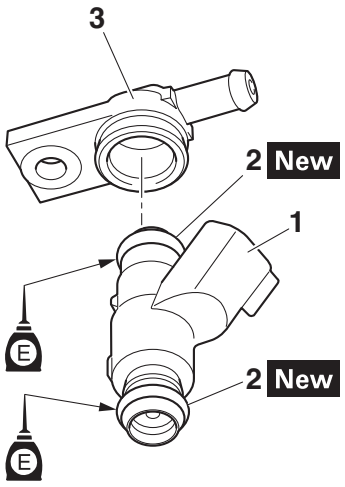
**TIP**
After removing the retainer "1", remove the inlet pipe "2" from the fuel injector.

**6.** Check:
- Fuel injectors
  Obstruction → Replace and check the fuel pump/ fuel supply system.
  Deposit → Replace.
  Damage → Replace.

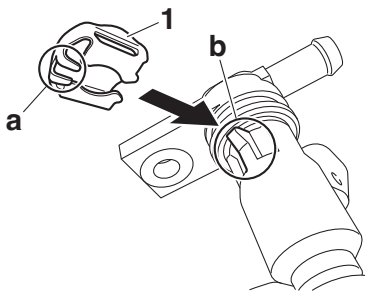
**7.** Check:
- Fuel injector resistance
  (Refer to "CHECKING THE FUEL INJECTORS" on page 5-35)

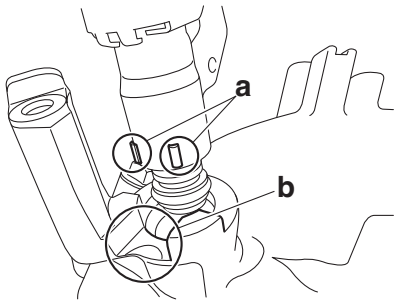
### INSTALLING THE FUEL INJECTORS

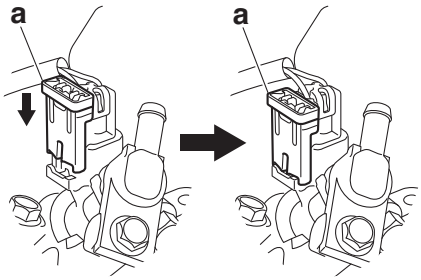
The following procedure applies to all of the fuel injectors and related components.




**1.** Install:
- Fuel injector "1"
- O-ring "2" New
- Inlet pipe "3"




**2.** Install:
- Retainer "1"

**TIP**
Engage the claw "a" of the retainer with the projection "b" on the fuel injector, and install to the fuel injector.

**3.** Install:
- Fuel injector

**TIP**
Engage the projection "a" on the fuel injector with the groove "b" in the intake manifold, and install to the intake manifold.

- Inlet pipe bolts

| | |
|---|---|
| | **Inlet pipe bolt:**<br>**9 N·m (0.9 kgf·m, 6.5 lb·ft)** |

**4.** Connect:
- Fuel injector lead coupler

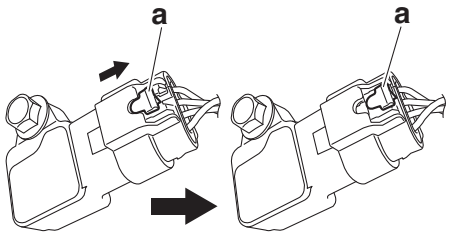
**TIP**
Insert the coupler securely, slide the coupler cover "a" downward as shown in the illustration, and then lock the coupler.

**5.** Install:
- Hose clamp (Clic-R) New
  (Refer to "INSTALLING THE OIL COOLER" on page 3-6)
- Fuel injector pipe 1
- Fuel injector pipe 2

**6.** Install:
- Ignition coil
  (Refer to "IGNITION COILS" on page 3-10)
- Throttle body assembly
  (Refer to "THROTTLE BODY ASSEMBLY" on page 4-6)
- Fan case and fan
  (Refer to "CASE AND FAN" on page 3-11)
- Oil cooler
  (Refer to "OIL COOLER" on page 3-5)
- Low-pressure fuel pump
  (Refer to "FUEL PUMPS" on page 4-1)

- ECU and rectifier/regulator
  (Refer to "ECU, RECTIFIER/REGULATOR, AND FUSES" on page 3-8)
- Air filter case
  (Refer to "AIR FILTER" on page 3-3)

### REMOVING THE MANIFOLD ABSOLUTE PRESSURE SENSOR



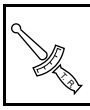

1. Disconnect:
   - Manifold absolute pressure sensor lead coupler

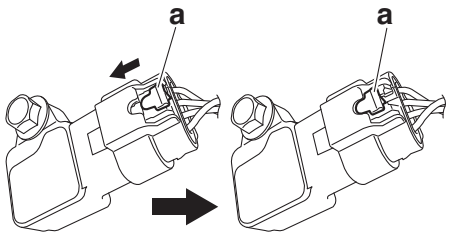
**TIP**
Slide the lock "a" of the coupler as shown in the illustration, and remove the coupler.

2. Remove:
   - Manifold absolute pressure sensor

### INSTALLING THE MANIFOLD ABSOLUTE PRESSURE SENSOR

1. Install:
   - Manifold absolute pressure sensor
   - O-ring New
   - Manifold absolute pressure sensor bolt

| | |
|---|---|
|  | **Manifold absolute pressure sensor bolt:**<br>**7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

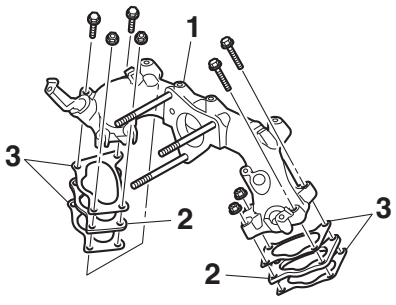



2. Connect:
   - Manifold absolute pressure sensor lead coupler

**TIP**
Insert the coupler securely, slide the lock "a" of the coupler as shown in the illustration, and install the coupler.

### REMOVING THE INTAKE MANIFOLD

1. Remove:
   - Fuel injectors
     (Refer to "REMOVING THE FUEL INJECTORS" on page 4-11)



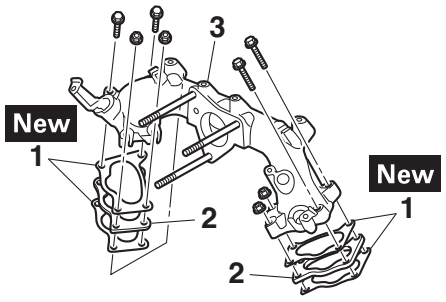

**2.** Remove:
- Intake manifold “1”
- Intake manifold joints “2”
- Gaskets “3”



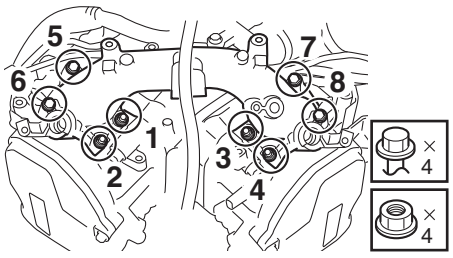
### CHECKING THE INTAKE MANIFOLD

**1.** Check:
- Intake manifold
- Intake manifold joints
  Cracks/damage → Replace.

### INSTALLING THE INTAKE MANIFOLD

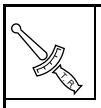



**1.** Install:
- Gaskets “1” New
- Intake manifold joints “2”
- Intake manifold “3”



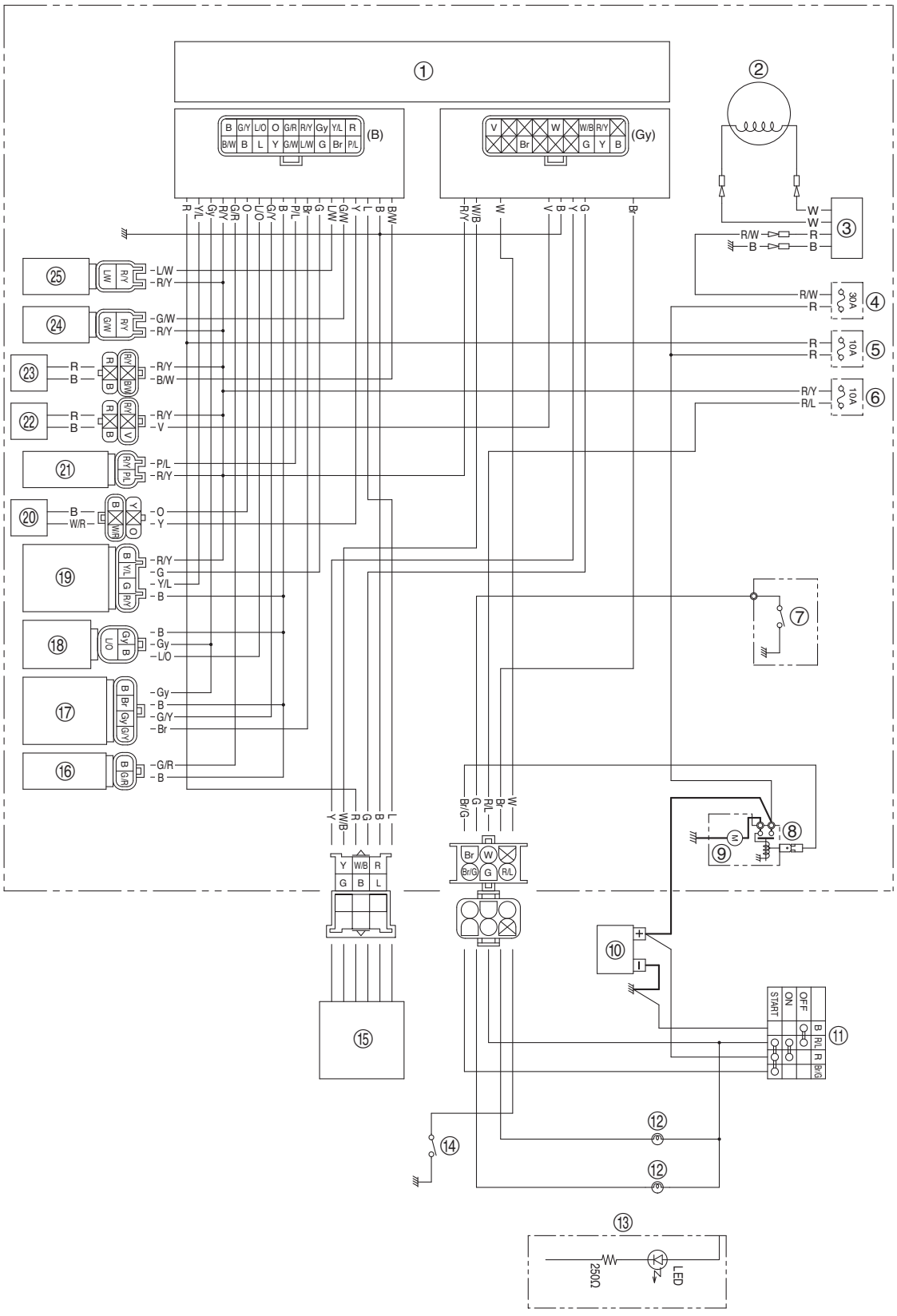

**2.** Install:
- Intake manifold nuts “1”–“4” and bolts “5”–“8”

**TIP**
Tighten the bolts and nuts to the specified torque in two steps and in order from “1” to “8”.

| | |
|---|---|
|  | **Intake manifold nut and bolt:**<br>**1st: 3.0 N·m (0.30 kgf·m, 2.2 lb·ft)**<br>**2nd: 7 N·m (0.7 kgf·m, 5.1 lb·ft)** |

**3.** Install:
- Fuel injectors
  (Refer to “INSTALLING THE FUEL INJECTORS” on page 4-12)

## CIRCUIT DIAGRAM



1. ECU (Engine Control Unit)
2. Stator coil assembly
3. Rectifier/regulator
4. Fuse (30 A)
5. Fuse (10 A)
6. Fuse (10 A)
7. Oil pressure switch
8. Starter relay
9. Starter motor
10. Battery
11. Main switch
12. Mil light
13. Oil warning light
14. Rollover switch
15. FI diagnostic tool coupler
16. Engine temperature sensor
17. Manifold absolute pressure sensor
18. Throttle position sensor
19. $O_2$ sensor
20. Crankshaft position sensor
21. High-pressure fuel pump
22. Ignition coil #2
23. Ignition coil #1
24. Fuel injector #1
25. Fuel injector #2



### Color code

| | | | |
|---|---|---|---|
| B | Black | G/R | Green/Red |
| Br | Brown | G/W | Green/White |
| G | Green | G/Y | Green/Yellow |
| Gy | Gray | L/O | Blue/Orange |
| L | Blue | L/W | Blue/White |
| O | Orange | P/L | Pink/Blue |
| R | Red | R/L | Red/Blue |
| V | Violet | R/W | Red/White |
| W | White | R/Y | Red/Yellow |
| Y | Yellow | W/B | White/Black |
| B/W | Black/White | W/R | White/Red |
| Br/G | Brown/Green | Y/L | Yellow/Blue |

# FUEL INJECTION SYSTEM

## FI DIAG TOOL INSTRUCTIONS

### Purpose

This FI Diagnostic Tool is to diagnose electronic fuel injection system used on Yamaha MX825V-EFI, MX800V-EFI and MX775V-EFI engines.

### Functions

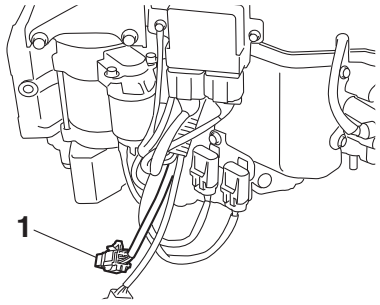
There are 5 Modes in this diag tool.

- "CURRENT"
  Displays current error codes.
- "DIAG"
  Displays sensor output.
- "HISTORY"
  Displays history error codes.
  (Diag tool display 1 history error code, if the same error happened in the past.)
- "CLEAR"
  Deletes history error codes.
- "PROPERTY"
  Display ECU property. (Not needed for usual maintenance)

### Operation

- CONNECTING AND DISCONNECTING

1. Turn the main switch "OFF".
2. Connect the FI Diagnostic Tool to the engine coupler "1".
3. Turn the main switch "ON".



**BUTTONs AND LEDs**

**The “UP” button “1”/“DOWN” button “2”**

1. The “UP”/“DOWN” buttons are used to scroll each MODE.
2. The “UP”/“DOWN” buttons are used to decide “YES” or “NO” to delete history error code in “CLEAR” mode.
3. Reboot FI Diagnostic Tool to push “UP”/“DOWN” buttons simultaneously for more than 3 seconds.

**“MODE” button “3”**

The “MODE” button is used to move to MODE select function, and decide the operating MODE.

**“POWER” LED (Green) “4”**

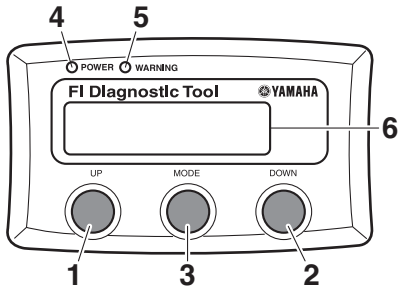
The LED comes on when power (Main Switch Voltage) is supplied to the FI Diagnostic Tool.

**“WARNING” LED (Orange) “5”**

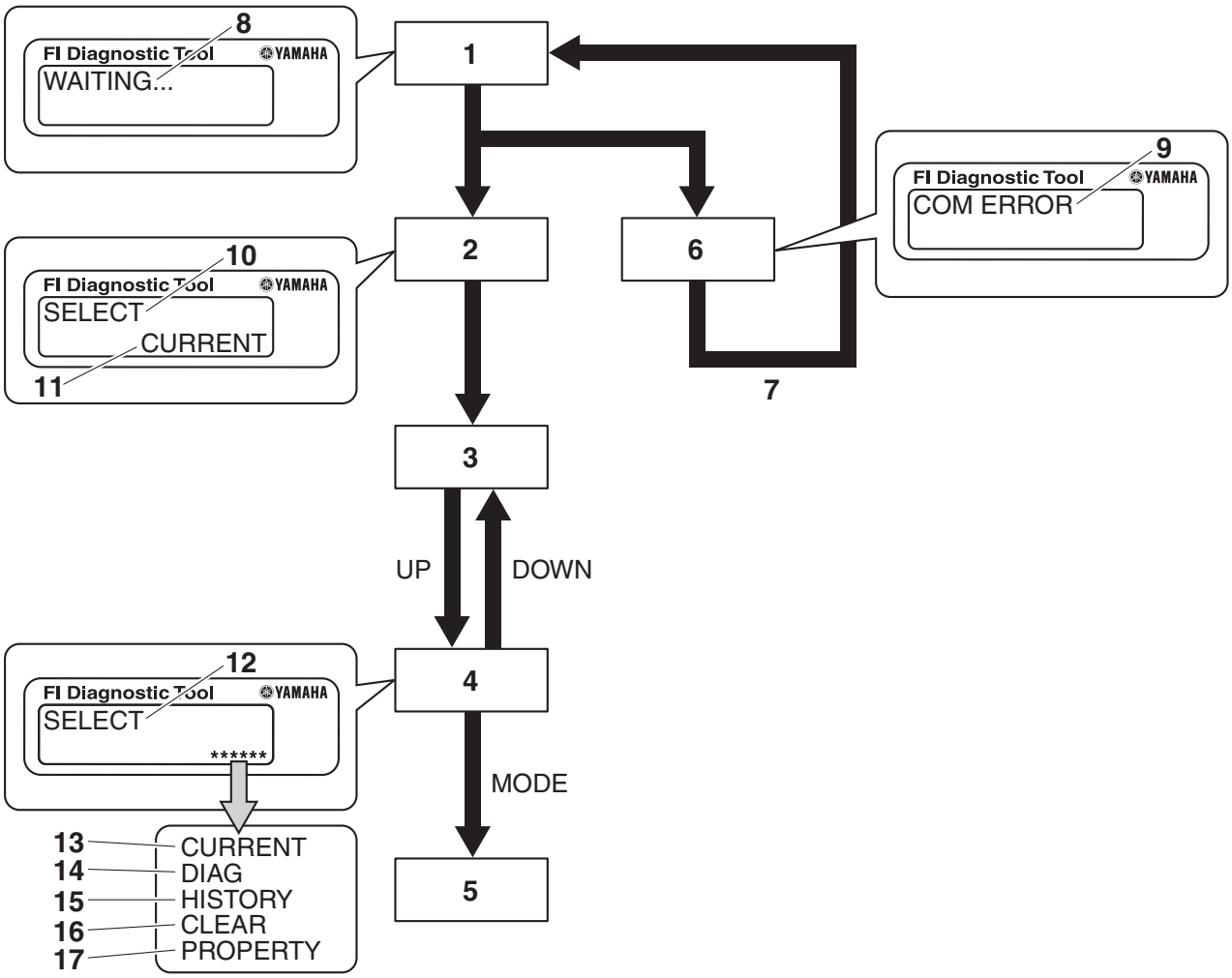
The LED comes on when error code is detected in “CURRENT” MODE.

**LCD Display “6”**

This LCD display indicates error codes, sensor outputs, engine run hours, currently selected MODE or function.



### Operation (BUTTONs and LEDs)

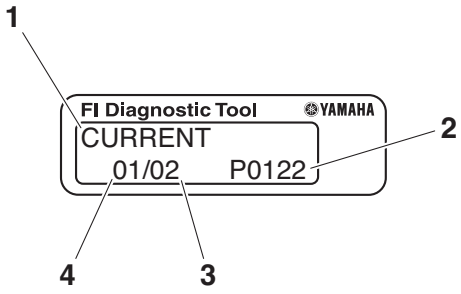



1. CONNECT
2. CONNECTED
3. CHANGE MODE
4. (EACH) MODE
5. DETERMINE MODE
6. FAILED
7. Reboot (UP+DOWN) (Simultaneously more than 3 seconds)
8. WAITING
9. COM ERROR
10. SELECT
11. CURRENT
12. SELECT
13. CURRENT
14. DIAG
15. HISTORY
16. CLEAR
17. PROPERTY

**Details**

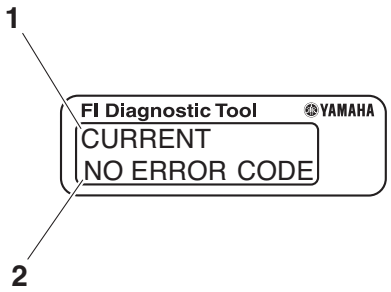
• “CURRENT” MODE

Display when there is error




1. Selected Mode
2. Error Code
3. Total number of Error Code
4. Current page number on display

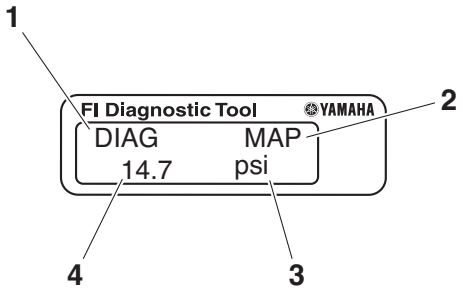
Display when there is no error




1. Selected Mode
2. Message

• “DIAG” MODE

| Diag Code | Item | What to display | Unit |
|---|---|---|---|
| MAP | Manifold Absolute Pressure Sensor | Manifold Absolute Pressure | psi |
| IAT | Intake Air Temperature Sensor | Intake Air Temperature | °F |
| ET | Engine Temperature Sensor | Engine Temperature | °F |
| TPS | Throttle Position Sensor | Throttle Valve position | % |
| $O_2$ | $O_2$ sensor | Oxygen density | V |
| RPM | Engine rpm | Engine rpm | rpm |
| HOUR | Engine run hour | Engine run hour | hr |

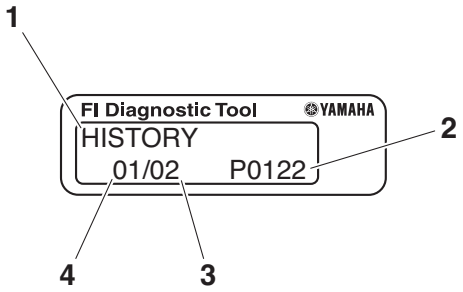



1. Selected Mode
2. Selected Diag Code
3. Unit
4. Sensor output



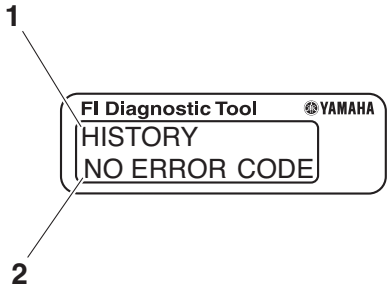
• "HISTORY" MODE

Display when there is error code in the past



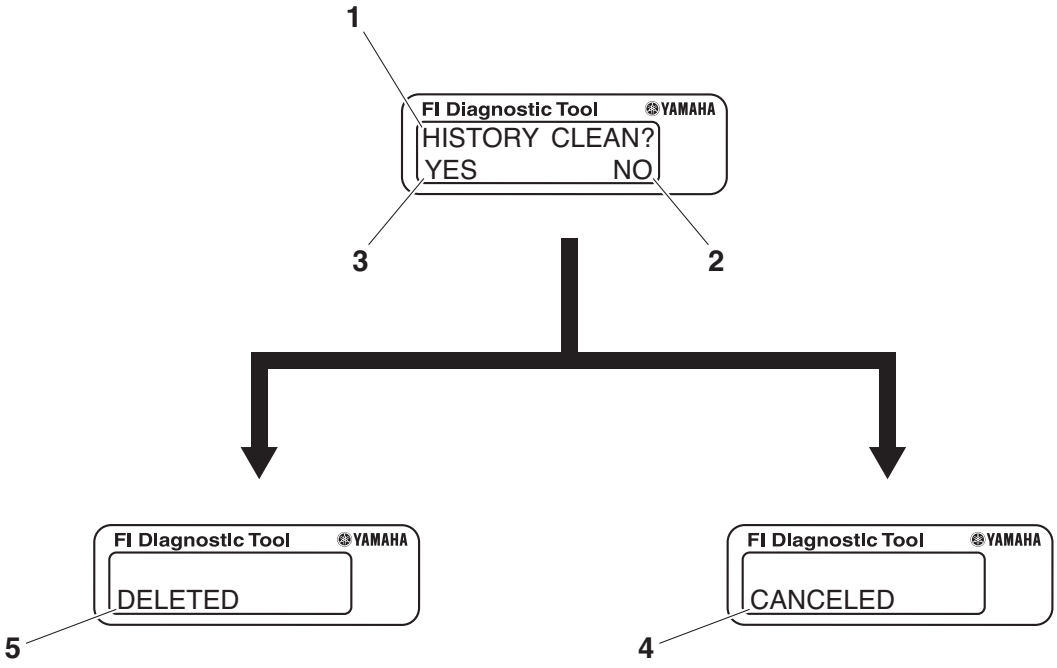

1. Selected Mode
2. Error Code
3. Total number of Error Code
4. Current page number on display

Display there is no error code in the past




1. Selected Mode
2. Message

• “CLEAR” MODE

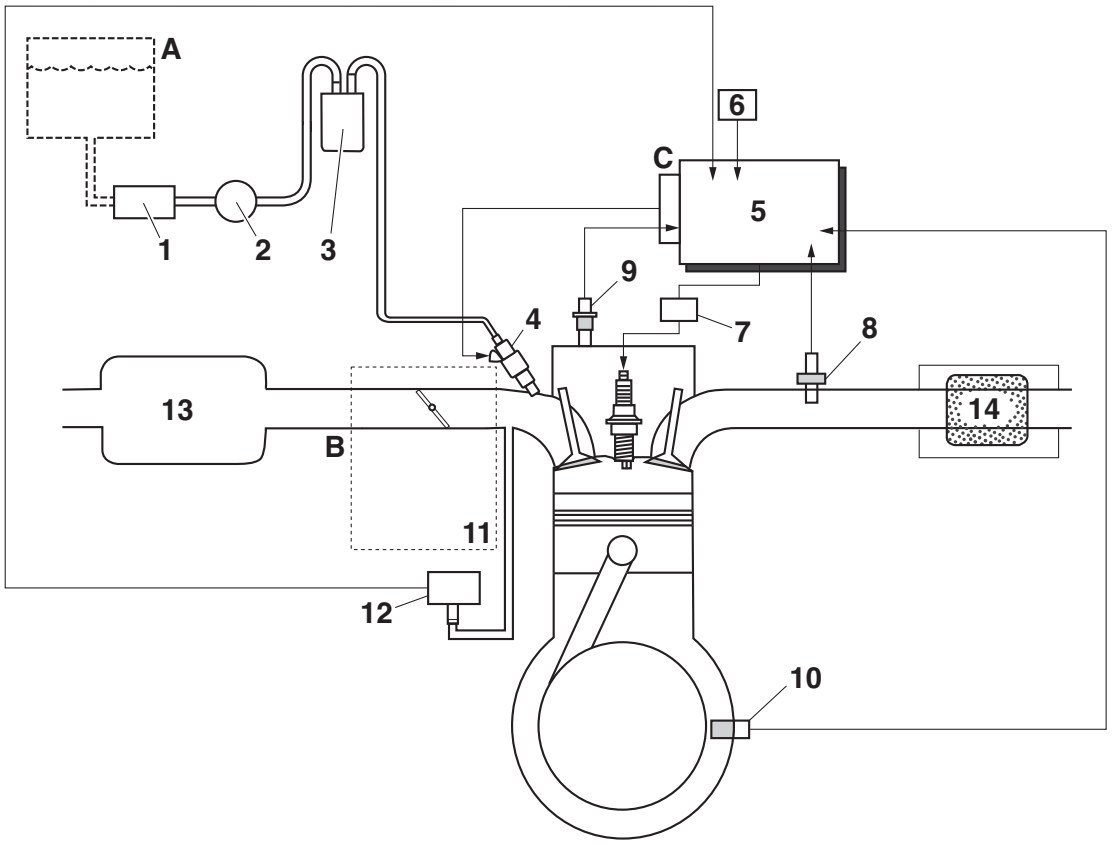



1. Question: Delete?
2. “DOWN” button: NO
3. “UP” button: YES
4. CANCELED
5. DELETED

• “PROPERTY” MODE

This MODE is not needed for usual maintenance.

## FUEL INJECTION DIAGRAM




1. Fuel filter
2. Fuel pump (low pressure)
3. Fuel pump (high pressure)
4. Fuel injector
5. ECU (Engine Control Unit)
6. Throttle position sensor
7. Ignition coil
8. $O_2$ sensor
9. Engine temperature sensor
10. Crankshaft position sensor
11. Throttle body
12. Manifold absolute pressure sensor
13. Air filter case
14. Muffler

A. Fuel system
B. Air system
C. Control system

## ERROR CODE LIST

| Error Code | System or Component | Detail |
|---|---|---|
| P0107 | Manifold Absolute Pressure Sensor (MAP) | MAP Circuit Low Voltage or Open |
| P0108 | Manifold Absolute Pressure Sensor (MAP) | MAP Circuit High Voltage |
| P0112 | Intake Air Temperature Sensor (IAT) | IAT Circuit Low Voltage |
| P0113 | Intake Air Temperature Sensor (IAT) | IAT Circuit High Voltage or Open |
| P0117 | Engine Temperature Sensor (ET) | Engine Temperature Sensor Circuit Low Voltage |
| P0118 | Engine Temperature Sensor (ET) | Engine Temperature Sensor Circuit High Voltage or Open |
| P0122 | Throttle Position Sensor (TPS) | TPS Circuit Low Voltage or Open |
| P0123 | Throttle Position Sensor (TPS) | TPS Circuit High Voltage |
| P0131 | Oxygen Sensor ($O_2$) | Circuit Low Voltage |
| P0132 | Oxygen Sensor ($O_2$) | Circuit High Voltage |
| P0032 | Oxygen Sensor Heater | Heater Circuit High Voltage |
| P0031 | Oxygen Sensor Heater | Heater Circuit Low Voltage |
| P0201 | Fuel Injector | Injector #1 Circuit Malfunction |
| P0202 | Fuel Injector | Injector #2 Circuit Malfunction |
| P0230 | Fuel Pump Relay (FPR) | FPR Coil Circuit Low Voltage or Open |
| P0232 | Fuel Pump Relay (FPR) | FPR Coil Circuit High Voltage |
| P0336 | Crankshaft Position Sensor (CPS) | CPS Sensor Noisy Signal |
| P0337 | Crankshaft Position Sensor (CPS) | CPS Sensor No Signal |
| P0351 | Ignition Coil | Cylinder #1 Ignition Coil Malfunction |
| P0352 | Ignition Coil | Cylinder #2 Ignition Coil Malfunction |
| P0562 | System Voltage | System Voltage Low |
| P0563 | System Voltage | System Voltage High |
| P0650 | MIL | MIL Circuit Malfunction |
| P0171 | BLM MaxAdapt | Correction amount of injection fuel is beyond upper limit |
| P0172 | BLM MinAdapt | Correction amount of injection fuel is beyond lower limit |
| P0174 | PE system Lean | Lean fuel ratio |

## DIAG CODE LIST

| DIAG Tool Mode | Diag Code | Item | What to display | Unit | How to diagnosis |
|---|---|---|---|---|---|
| DIAG | MAP | Manifold Absolute Pressure sensor | Manifold Absolute Pressure | psi | • Compare the sensor output value with atmospheric absolute pressure (Example: 14.7 psi) with engine stopped.<br>• Confirm the sensor output value on display changes while engine cranking. (Manifold Absolute pressure changes during cranking.) |
| | IAT | Intake Air Temperature Sensor | Intake Air Temperature | °F | • Compare the sensor output value with ambient air temperature. (with engine cold)<br>• Confirm the sensor output value on display changes with heating or cooling sensor alone. |
| | ET | Engine Temperature Sensor | Engine Temperature | °F | • Compare the sensor output value with ambient air temperature. (with engine cold)<br>• Confirm the sensor output value on display changes with heating or cooling sensor alone.<br>• Sensor resistance: 9.0–11.0 kΩ (25 °C) |
| | TPS | Throttle Position Sensor | Throttle Valve position | % | • Confirm throttle position on FI diagnositc tool display when throttle valve is fully opened.<br>MX825V: 95–100 %<br>MX800V: 67–77 %<br>MX775V: 54–64 %<br>• Confirm throttle position on FI diagnositc tool display when throttle valve is fully closed.<br>MX825/800/775V: 0–5 %<br>• Confirm throttle position on display changes smoothly with throttle valve open and close. |
| | $O_2$ | $O_2$ sensor | Oxygen density | V | — |
| | RPM | Engine rpm | Engine rpm | rpm | — |
| | HOUR | Engine run hour | Engine run hour | hr | — |

## FUEL INJECTION SYSTEM TROUBLESHOOTING

### Error Code No. P0107, P0108

| | |
|---|---|
| Error Code | P0107 |
| System or Component | Manifold Absolute Pressure Sensor (MAP) |
| Detail of Error | MAP Circuit Low Voltage or Open |
| Engine Symptoms | • Poor engine start<br>• Poor driveability<br>• Deteriorated exhaust |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “MAP” |
| Diagnosing | • Compare the sensor output value with atmospheric absolute pressure (Example: 14.7 psi) with engine stopped.<br>• Confirm the sensor output value on display changes while engine cranking.<br>(Manifold Absolute pressure changes during cranking.) |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Open or low voltage in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU<br>• Vacuum leak from intake manifold |

| | |
|---|---|
| Error Code | P0108 |
| System or Component | Manifold Absolute Pressure Sensor (MAP) |
| Detail of Error | MAP Circuit High Voltage |
| Engine Symptoms | • Poor engine start (There is possibility it can’t start)<br>• Poor driveability<br>• Deteriorated exhaust |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “MAP” |
| Diagnosing | • Compare the sensor output value with atmospheric absolute pressure (Example: 14.7 psi) with engine stopped.<br>• Confirm the sensor output value on display changes while engine cranking.<br>(Manifold Absolute pressure changes during cranking.) |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• High Voltage in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU<br>• Vacuum leak from intake manifold |

### Error Code No. P0112, P0113

| | |
|---|---|
| Error Code | P0112 |
| System or Component | Intake Air Temperature Sensor (IAT) |
| Detail of Error | IAT Circuit Low Voltage |
| Engine Symptoms | • Poor engine start<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “IAT” |
| Diagnosing | • Compare the sensor output value with ambient air temperature. (with engine cold)<br>• Confirm the sensor output value on display changes with heating or cooling sensor alone. |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Low voltage in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0113 |
| System or Component | Intake Air Temperature Sensor (IAT) |
| Detail of Error | IAT Circuit High Voltage or Open |
| Engine Symptoms | • Poor engine start<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “IAT” |
| Diagnosing | • Compare the sensor output value with ambient air temperature. (with engine cold)<br>• Confirm the sensor output value on display changes with heating or cooling sensor alone. |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• High voltage or open in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

### Error Code No. P0117, P0118

| | |
|---|---|
| Error Code | P0117 |
| System or Component | Engine Temperature Sensor (ET) |
| Detail of Error | Engine Temperature Sensor Circuit Low Voltage |
| Engine Symptoms | • Poor engine start<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “ET” |
| Diagnosing | • Compare the sensor output value with ambient air temperature. (with engine cold)<br>• Confirm the sensor output value on display changes with heating or cooling sensor alone.<br>• Sensor resistance: 9.0–11.0 kΩ at 25 °C (77 °F) |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Low voltage in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0118 |
| System or Component | Engine Temperature Sensor (ET) |
| Detail of Error | Engine Temperature Sensor Circuit High Voltage or Open |
| Engine Symptoms | • Poor engine start<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “ET” |
| Diagnosing | • Compare the sensor output value with ambient air temperature. (with engine cold)<br>• Confirm the sensor output value on display changes with heating or cooling sensor alone.<br>• Sensor resistance: 9.0–11.0 kΩ at 25 °C (77 °F) |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• High voltage or open in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

### Error Code No. P0122, P0123

| | |
|---|---|
| Error Code | P0122 |
| System or Component | Throttle Position Sensor (TPS) |
| Detail of Error | TPS Circuit Low Voltage or Open |
| Engine Symptoms | • Poor engine start (There is possibility it can't start)<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling (Different idling engine rpm)<br>• Limited engine performance |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode "DIAG", Code "TPS" |
| Diagnosing | • Confirm throttle position on FI diagnostic tool display when throttle valve is fully opened.<br>MX825V: 95–100 %<br>MX800V: 67–77 %<br>MX775V: 54–64 %<br>• Confirm throttle position on FI diagnostic tool display when throttle valve is fully closed.<br>MX825/800/775V: 0–5 %<br>• Confirm throttle position on display changes smoothly with throttle valve open and close. |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Low voltage or open in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0123 |
| System or Component | Throttle Position Sensor (TPS) |
| Detail of Error | TPS Circuit High Voltage |
| Engine Symptoms | • Poor engine start (There is possibility it can't start)<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling (Different idling engine rpm)<br>• Limited engine performance |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode "DIAG", Code "TPS" |
| Diagnosing | • Confirm throttle position on FI diagnostic tool display when throttle valve is fully opened.<br>MX825V: 95–100 %<br>MX800V: 67–77 %<br>MX775V: 54–64 %<br>• Confirm throttle position on FI diagnostic tool display when throttle valve is fully closed.<br>MX825/800/775V: 0–5 %<br>• Confirm throttle position on display changes smoothly with throttle valve open and close. |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Low voltage or open in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

### Error Code No. P0131, P0132

| | |
|---|---|
| Error Code | P0131 |
| System or Component | Oxygen Sensor |
| Detail of Error | Circuit Low Voltage |
| Engine Symptoms | Deteriorated exhaust |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “$O_2$” |
| Diagnosing | — |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Low voltage in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0132 |
| System or Component | Oxygen Sensor |
| Detail of Error | Circuit High Voltage |
| Engine Symptoms | Deteriorated exhaust |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | Mode “DIAG”, Code “$O_2$” |
| Diagnosing | — |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• High voltage in wire harness between sensor and ECU<br>• Malfunction in sensor unit<br>• Malfunction in ECU |

### Error Code No. P0032, P0031

| | |
|---|---|
| Error Code | P0032 |
| System or Component | Oxygen Sensor Heater |
| Detail of Error | Heater Circuit High Voltage |
| Engine Symptoms | Deteriorated exhaust (until exhaust gas heated after engine starts) |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | — |
| Diagnosing | — |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• High voltage in wire harness between sensor and ECU<br>• Malfunction in sensor (heater) unit<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0031 |
| System or Component | Oxygen Sensor Heater |
| Detail of Error | Heater Circuit Low Voltage |
| Engine Symptoms | Deteriorated exhaust (until exhaust gas heated after engine starts) |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | — |
| Diagnosing | — |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Low voltage in wire harness between sensor and ECU<br>• Malfunction in sensor (heater) unit<br>• Malfunction in ECU |

### Error Code No. P0201, P0202

| | |
|---|---|
| Error Code | P0201 |
| System or Component | Fuel Injector |
| Detail of Error | Injector #1 Circuit Malfunction |
| Engine Symptoms | Cylinder #1 stops |
| Engine Running availability | Able to run with Cylinder #2 alone |
| DIAG Tool Code | — |
| Diagnosing | Fuel injector resistance<br>11.4–12.6 Ω |
| Probable Cause | • Malfunction in wire harness and coupler between injector and ECU<br>• Shorted or open in wire harness between sensor and ECU<br>• Malfunction in injector<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0202 |
| System or Component | Fuel Injector |
| Detail of Error | Injector #2 Circuit Malfunction |
| Engine Symptoms | Cylinder #2 stops |
| Engine Running availability | Able to run with Cylinder #1 alone |
| DIAG Tool Code | — |
| Diagnosing | Fuel injector resistance<br>11.4–12.6 Ω |
| Probable Cause | • Malfunction in wire harness and coupler between injector and ECU<br>• Shorted or open in wire harness between sensor and ECU<br>• Malfunction in injector<br>• Malfunction in ECU |

### Error Code No. P0230, P0232

| | |
|---|---|
| Error Code | P0230 |
| System or Component | Fuel Pump Relay (FPR) |
| Detail of Error | FPR Coil Circuit Low Voltage or Open |
| Engine Symptoms | • Engine stop<br>• Unable to start engine |
| Engine Running availability | Unable to run engine |
| DIAG Tool Code | — |
| Diagnosing | — |
| Probable Cause | • Malfunction in wire harness and coupler between pump and ECU<br>• Low voltage or open in wire harness between pump and ECU<br>• Malfunction in pump<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0232 |
| System or Component | Fuel Pump Relay (FPR) |
| Detail of Error | FPR Coil Circuit High Voltage |
| Engine Symptoms | • Engine stop<br>• Unable to start engine |
| Engine Running availability | Unable to run engine |
| DIAG Tool Code | — |
| Diagnosing | — |
| Probable Cause | • Malfunction in wire harness and coupler between pump and ECU<br>• High voltage in wire harness between pump and ECU<br>• Malfunction in pump<br>• Malfunction in ECU |

### Error Code No. P0336, P0337

| | |
|---|---|
| Error Code | P0336 |
| System or Component | Crankshaft Position Sensor (CPS) |
| Detail of Error | CPS Sensor Noisy Signal |
| Engine Symptoms | • Poor engine start (There is possibility it can't start)<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling |
| Engine Running availability | Depends on the case |
| DIAG Tool Code | — |
| Diagnosing | Crankshaft position sensor resistance<br>3.0–7.0 kΩ |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Malfunction in sensor installing (loose sensor, dirty sensor, air gap)<br>• Malfunction in sensor unit<br>• Malfunction in ECU<br>• Malfunction in rotor (damaged, deformed) |

| | |
|---|---|
| Error Code | P0337 |
| System or Component | Crankshaft Position Sensor (CPS) |
| Detail of Error | CPS Sensor No Signal |
| Engine Symptoms | • Poor engine start (There is possibility it can't start)<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling |
| Engine Running availability | Depends on the case |
| DIAG Tool Code | — |
| Diagnosing | Crankshaft position sensor resistance<br>3.0–7.0 kΩ |
| Probable Cause | • Malfunction in wire harness and coupler between sensor and ECU<br>• Shorted or open in wire harness between sensor and ECU<br>• Malfunction in sensor installing (loose sensor, dirty sensor, air gap)<br>• Malfunction in sensor unit<br>• Malfunction in ECU<br>• Malfunction in rotor (damaged, deformed) |

### Error Code No. P0351, P0352

| | |
|---|---|
| Error Code | P0351 |
| System or Component | Ignition Coil |
| Detail of Error | Cylinder #1 Ignition Coil Malfunction |
| Engine Symptoms | Cylinder #1 stops operating (Injector also stops operating.) |
| Engine Running availability | Able to run with Cylinder #2 alone |
| DIAG Tool Code | — |
| Diagnosing | • Primary coil resistance<br>0.44–0.66 Ω<br>• Secondary coil resistance<br>5.6–8.4 Ω |
| Probable Cause | • Malfunction in wire harness and coupler between coil and ECU<br>• Shorted or open in wire harness between coil and ECU<br>• Malfunction in coil<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0352 |
| System or Component | Ignition Coil |
| Detail of Error | Cylinder #2 Ignition Coil Malfunction |
| Engine Symptoms | Cylinder #2 stops operating (Injector also stops operating) |
| Engine Running availability | Able to run with Cylinder #1 alone |
| DIAG Tool Code | — |
| Diagnosing | • Primary coil resistance<br>0.44–0.66 Ω<br>• Secondary coil resistance<br>5.6–8.4 Ω |
| Probable Cause | • Malfunction in wire harness and coupler between coil and ECU<br>• Shorted or open in wire harness between coil and ECU<br>• Malfunction in coil<br>• Malfunction in ECU |

### Error Code No. P0562, P0563

| | |
|---|---|
| Error Code | P0562 |
| System or Component | System Voltage |
| Detail of Error | System Voltage Low |
| Engine Symptoms | • Engine stop<br>• Unable to start engine |
| Engine Running availability | Depends on the case |
| DIAG Tool Code | — |
| Diagnosing | Confirm battery voltage |
| Probable Cause | • Malfunction in wire harness and coupler between battery and ECU<br>• Shorted or open in wire harness between battery and ECU<br>• Malfunction in battery<br>• Malfunction in charging system<br>• Malfunction in ECU |

| | |
|---|---|
| Error Code | P0563 |
| System or Component | System Voltage |
| Detail of Error | System Voltage High |
| Engine Symptoms | • Engine stop<br>• Unable to start engine |
| Engine Running availability | Depends on the case |
| DIAG Tool Code | — |
| Diagnosing | Confirm battery voltage |
| Probable Cause | • Malfunction in wire harness and coupler between battery and ECU<br>• Shorted or open in wire harness between battery and ECU<br>• Malfunction in battery<br>• Malfunction in charging system<br>• Malfunction in ECU |

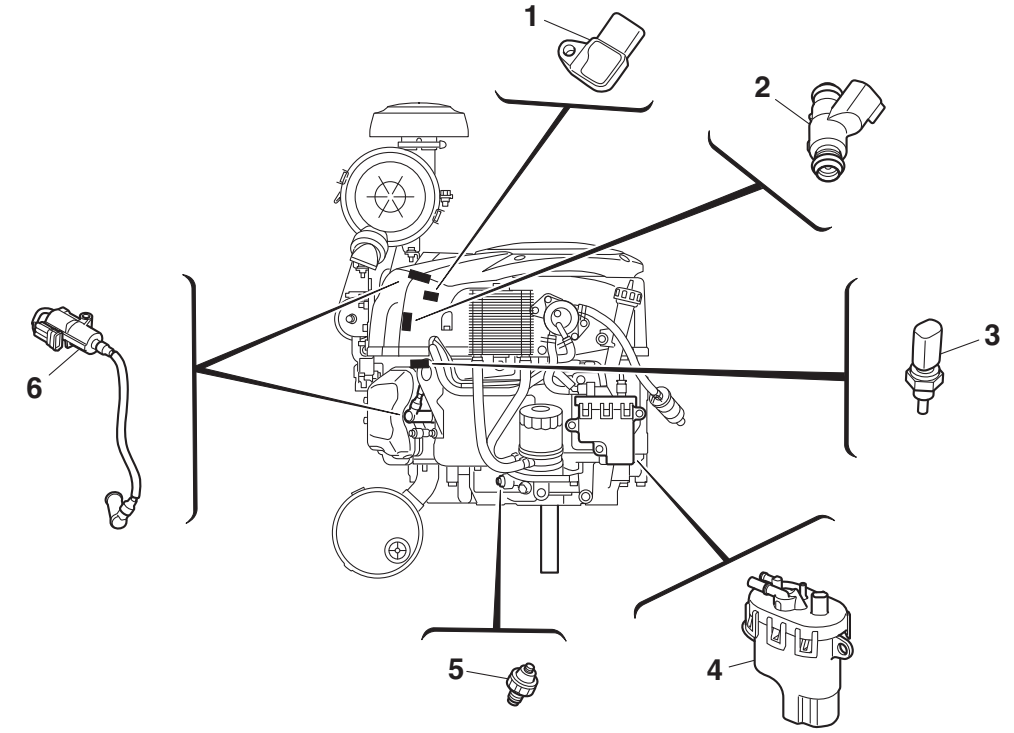
### Error Code No. P0171, P0172, P0174

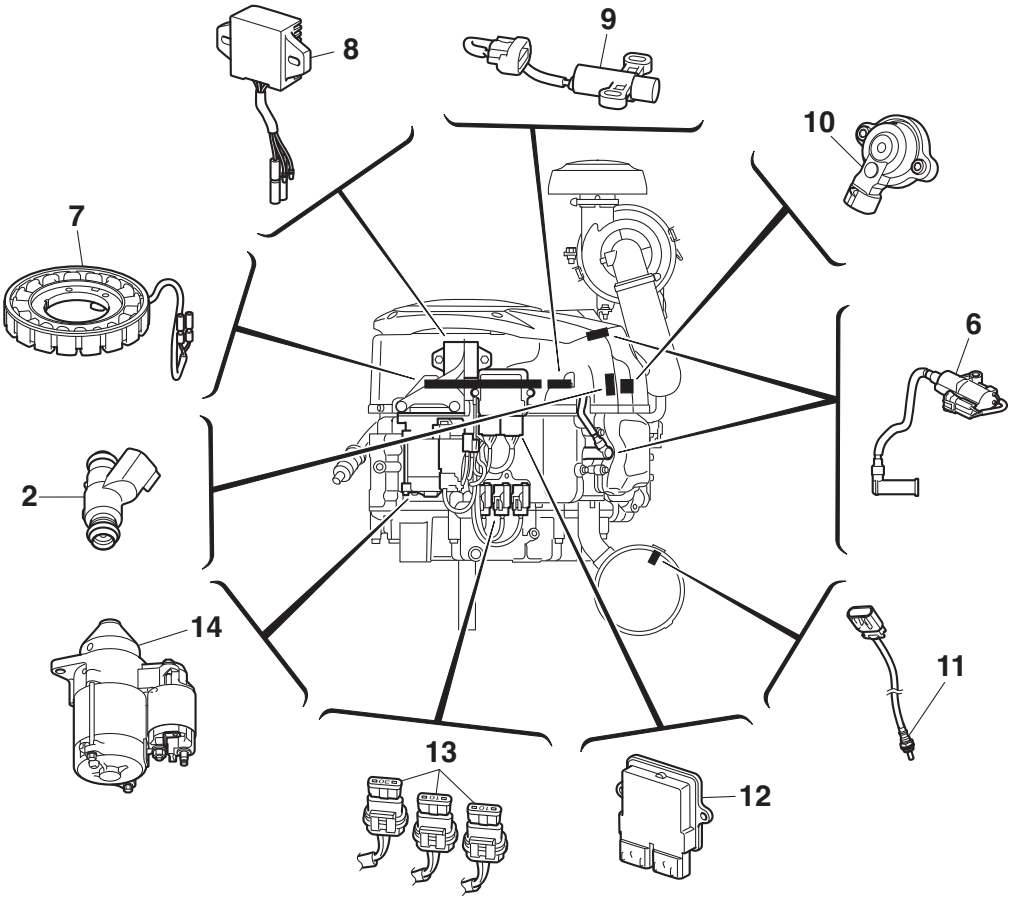
| | |
|---|---|
| Error Code | P0171 |
| System or Component | BLM MaxAdapt |
| Detail of Error | Correction amount of injection fuel is beyond upper limit |
| Engine Symptoms | • Poor engine start (There is possibility it can't start)<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling (Different idling engine rpm) |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | — |
| Diagnosing | — |
| Probable Cause | • Fuel system malfunction (Clogged fuel filter/line, fuel injector, fuel pump)<br>• Malfunction in $O_2$ sensor<br>• Malfunction in manifold absolute pressure sensor<br>• Difference of actual intake air volume (Intake air leak, clogged manifold, dirty/restricted air filter)<br>• Malfunction in ECU<br>• Malfunction in wiring harness |

| | |
|---|---|
| Error Code | P0172 |
| System or Component | BLM MinAdapt |
| Detail of Error | Correction amount of injection fuel is beyond lower limit |
| Engine Symptoms | • Poor engine start (There is possibility it can't start)<br>• Poor driveability<br>• Deteriorated exhaust<br>• Unstable engine idling (Different idling engine rpm)<br>• Overheat<br>• Engine knock sound |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | — |
| Diagnosing | — |
| Probable Cause | • Fuel system malfunction (Clogged fuel filter/line, fuel injector, fuel pump)<br>• Malfunction in $O_2$ sensor<br>• Malfunction in manifold absolute pressure sensor<br>• Difference of actual intake air volume (Intake air leak, clogged manifold, dirty/restricted air filter)<br>• Malfunction in ECU<br>• Malfunction in wiring harness |

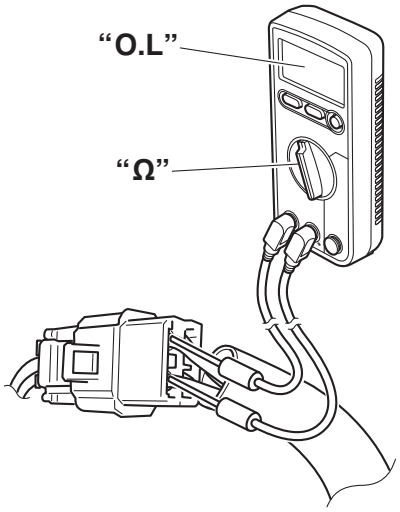
| | |
|---|---|
| Error Code | P0174 |
| System or Component | PE system Lean |
| Detail of Error | Lean fuel ratio |
| Engine Symptomes | • Poor drivability<br>• Deteriorated exhaust<br>• Unstable engine idling (Different idling engine rpm)<br>• Overheat<br>• Engine knock sound |
| Engine Running availability | Able to run engine |
| DIAG Tool Code | — |
| How to Diagnosis | — |
| Probable Cause | • Fuel system malfunction (Clogged fuel filter/line, fuel injector, fuel pump)<br>• Malfunction in $O_2$ sensor<br>• Malfunction in manifold absolute pressure sensor<br>• Difference of actual intake air volume (Intake air leak/clogged manifold)<br>• Running out fuel |

# ELECTRICAL COMPONENTS



1. Manifold absolute pressure sensor
2. Fuel injector
3. Engine temperature sensor
4. High-pressure fuel pump
5. Oil pressure switch
6. Ignition coil/spark plug cap
7. Stator coil assembly
8. Rectifier/regulator
9. Crankshaft position sensor
10. Throttle position sensor
11. $O_2$ sensor
12. ECU (Engine Control Unit)
13. Fuse
14. Starter motor




### CHECKING THE SWITCH CONTINUITY

Check each switch for continuity with the tester. If the continuity reading is incorrect, check the wiring connections and if necessary, replace the switch.

***NOTICE***

**Never insert the tester probes into the coupler terminal slots. Always insert the probes from the opposite end of the coupler, taking care not to loosen or damage the leads.**

| | |
|---|---|
| | **Model 88 Multimeter with tachometer: YU-A1927** |

**TIP**

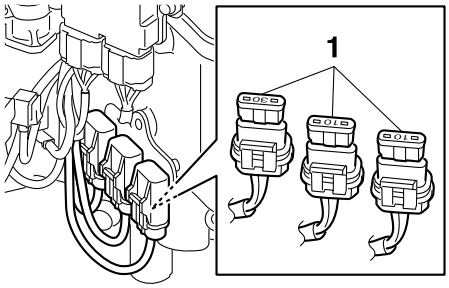
- Before checking for continuity, set the digital circuit tester to the "Ω" range.
- When checking for continuity, switch back and forth between the switch positions a few times.

### CHECKING THE FUSES

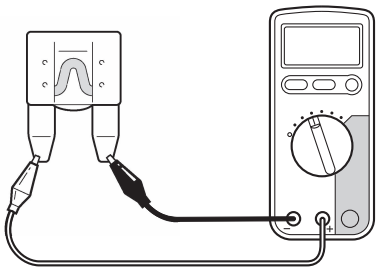
The following procedure applies to all of the fuses.

***NOTICE***

**To avoid a short circuit, always set the main switch to "OFF" when checking or replacing a fuse.**




***1.*** Remove:
- Fuse "1"



***2.*** Check:
- Fuse

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a. Connect the digital circuit tester to the fuse and check the continuity.

**TIP**
Set the digital circuit tester selector to "Ω".

| | |
|---|---|
| | **Model 88 Multimeter with tachometer: YU-A1927** |

b. If the digital circuit tester indicates "O.L", replace the fuse.

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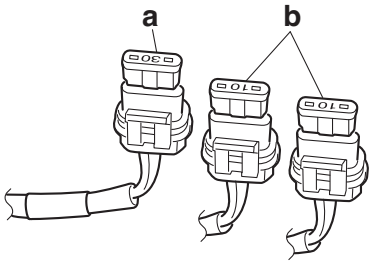
***3.*** Replace:
- Blown fuse

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

a. Set the main switch to "OFF".
b. Install a new fuse of the correct amperage.
c. Set the main switch to "ON" and verify if the electrical circuit is operational.
d. If the fuse immediately blows again, check the electrical circuit.




| | |
|---|---|
| | **Fuse amperage "a":**<br>**30 A × 1**<br>**Fuse amperage "b":**<br>**10 A × 2** |

**⚠ WARNING**

**Never use a fuse with an amperage other than that specified. Improvising or using a fuse with the wrong amperage rating may cause extensive damage to the electrical system and could possibly cause a fire.**

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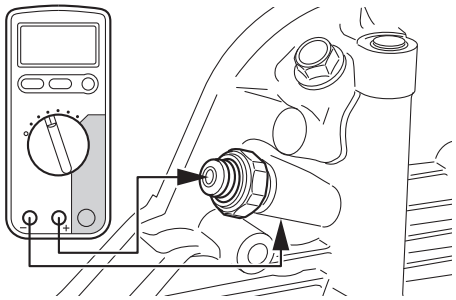
***4.*** Install:
- Fuse

### CHECKING THE OIL PRESSURE SWITCH

***1.*** Drain:
- Engine oil

***2.*** Disconnect:
- Oil pressure switch lead

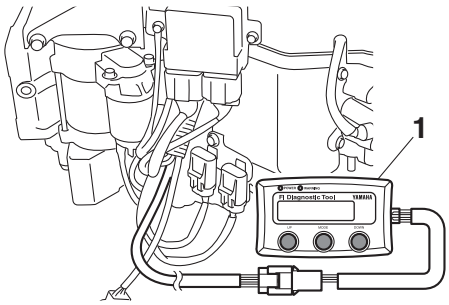


**3.** Connect:
- Digital circuit tester
  (between the engine ground and oil pressure switch terminal)

| | |
|---|---|
| | **Model 88 Multimeter with tachometer: YU-A1927** |

**4.** Check:
- Oil pressure switch continuity
  No continuity → Replace the oil pressure switch.

### CHECKING MANIFOLD ABSOLUTE PRESSURE SENSOR




**1.** Connect:
- FI Diagnostic Tool "1"

| | |
|---|---|
| | **FI Diagnostic Tool: 90890-03253** |

**2.** Select Mode:
- Select "DIAG" Mode and "MAP" Diag Code.

**3.** Check:
- Compare "MAP" value with atomosphere pressure

| | |
|---|---|
| | **Atomosphere pressure (Reference): 14–15 Psi** |

Does not much → Replace the manifold absolute.

### CHECKING THE THROTTLE POSITION SENSOR

**1.** Remove:
- Throttle body assembly
  (Refer to "THROTTLE BODY ASSEMBLY" on page 4-6)

***NOTICE***

- **Handle the throttle body assembly with special care.**
- **Never subject the throttle body assembly to strong shocks. If the throttle body assembly is dropped, replace it.**

**2.** Check:
- Throttle position sensor maximum resistance
  Out of specification → Replace the throttle position sensor.

**Resistance:**
**3.0–7.0 kΩ**

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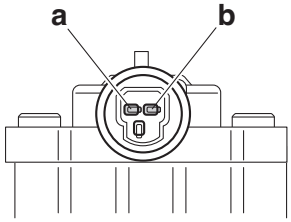
a. Connect the digital circuit tester (Ω) to the throttle position sensor terminals as shown.

**Model 88 Multimeter with tachometer:**
**YU-A1927**




- Positive tester probe → Terminal “a”
- Negative tester probe → Terminal “b”

b. Measure the throttle position sensor maximum resistance.

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***3.*** Install:
- Throttle body assembly

## CHECKING THE CRANKSHAFT POSITION SENSOR

***1.*** Remove:
- Fan case cover
- Grass screen
- Fan case
(Refer to “CASE AND FAN” on page 3-11)

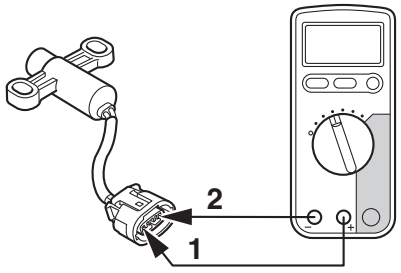
***2.*** Check:
- Crankshaft position sensor resistance
Out of specification → Replace the crankshaft position sensor.

**Crankshaft position sensor resistance:**
**3.0–7.0 kΩ**

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

a. Connect the digital circuit tester (Ω) to the crankshaft position sensor coupler as shown.

**Model 88 Multimeter with tachometer:**
**YU-A1927**




- Positive tester probe → White/Red "1" (wire harness color)
- Negative tester probe → Black "2" (wire harness color)

b. Measure the crankshaft position sensor resistance.

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### CHECKING THE ENGINE TEMPERATURE SENSOR

***1.*** Remove:
- Engine temperature sensor

**⚠ WARNING**

- **Handle the engine temperature sensor with special care.**
- **Never subject the engine temperature sensor to strong shocks. If the engine temperature sensor is dropped, replace it.**

***NOTICE***

**Use inch tool "5/8" or 16 mm for engine temperature sensor.**

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

**Engine temperature sensor resistance:**
**9.0–11.0 kΩ at 25 °C (77 °F)**

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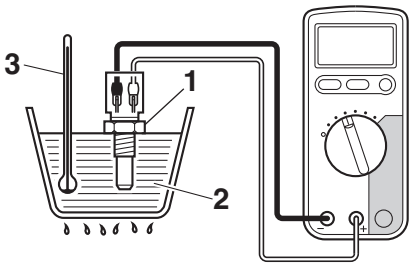
a. Connect the digital circuit tester (Ω) to the engine temperature sensor as shown.




**Model 88 Multimeter with tachometer:**
**YU-A1927**

b. Immerse the engine temperature sensor "1" in a container filled with water "2".

**TIP**

Make sure the engine temperature sensor terminals do not get wet.

c. Place a thermometer "3" in the water.
d. Slowly heat the water, then let it cool down to the specified temperature.

e. Measure the engine temperature sensor resistance.

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**3.** Install:
- Engine temperature sensor

### CHECKING THE IGNITION COILS

The following procedure applies to all of the ignition coils.

**1.** Check:
- Primary coil resistance
  Out of specification → Replace.

| | |
|---|---|
| | **Primary coil resistance:**<br>**0.44–0.66 Ω** |

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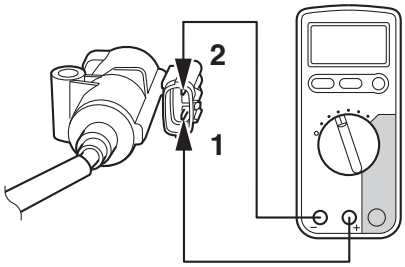
a. Remove the ignition coil from the spark plug.
b. Connect the digital circuit tester (Ω) to the ignition coil as shown.




| | |
|---|---|
| | **Model 88 Multimeter with tachometer:**<br>**YU-A1927** |

- Positive tester probe →
  Red "1" (wire harness color)
- Negative tester probe →
  Black "2" (wire harness color)

c. Measure the primary coil resistance.

▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲

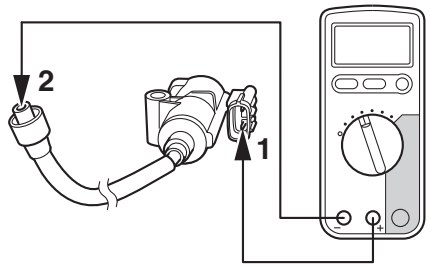
**2.** Check:
- Secondary coil resistance
  Out of specification → Replace.

| | |
|---|---|
| | **Secondary coil resistance:**<br>**5.6–8.4 kΩ** |

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

a. Connect the digital circuit tester (Ω) to the ignition coil as shown.

| | |
|---|---|
| | **Model 88 Multimeter with tachometer:**<br>**YU-A1927** |




- Positive tester probe → Red "1" (wire harness color)
- Negative tester probe → High-tension cord "2"

b. Measure the secondary coil resistance.

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## CHECKING THE IGNITION SPARK GAP

The following procedure applies to all of the ignition coils.

**1.** Check:
- Ignition spark gap
  Out of specification → Perform the ignition system troubleshooting, starting with step 5.
  (Refer to "IGNITION SYSTEM" on page 6-1)

| | |
|---|---|
| | **Minimum ignition spark gap:**<br>**6.0 mm (0.236 in)** |

**TIP**

If the ignition spark gap is within specification, the ignition system circuit is operating normally.

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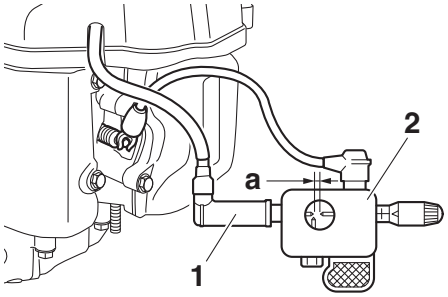


a. Disconnect the spark plug cap "1" from the spark plug.
b. Connect the ignition checker "2" as shown.

| | |
|---|---|
| | **Ignition checker:**<br>**90890-06754** |

c. Turn the main switch to "START".
d. Measure the ignition spark gap "a".

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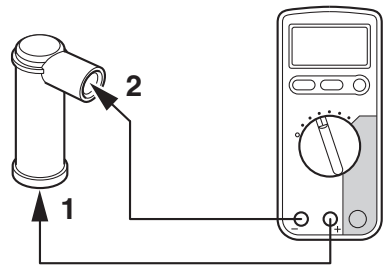
## CHECKING THE SPARK PLUG CAPS

The following procedure applies to all of the spark plug caps.

**1.** Remove:
- Spark plug cap

**2.** Check:
- Spark plug cap resistance
  Out of specification → Replace the spark plug cap.

| | |
|---|---|
| | **Spark plug cap resistance:**<br>**3.75–6.25 kΩ** |




a. Remove the spark plug cap from the high tension cord.
b. Connect the digital circuit tester (Ω) to the spark plug cap as shown.

**Model 88 Multimeter with tachometer:**
**YU-A1927**

- Positive tester probe → Spark plug side "1"
- Negative tester probe → High tension cord side "2"

c. Measure the spark plug cap resistance.

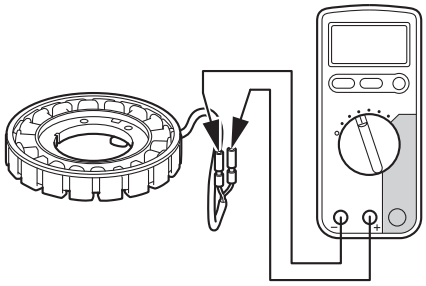
## CHECKING THE STATOR COIL ASSEMBLY

1. Disconnect:
   - Stator coil connector (from the wire harness)
2. Check:
   - Stator coil resistance
     Out of specification → Replace the stator coil assembly.

**Stator coil resistance:**
**18 A: 0.16–0.24 Ω at 23 °C (73.4 °F)**
**20 A: 0.112–0.168 Ω at 23 °C (73.4 °F)**
**25 A: 0.096–0.144 Ω at 23 °C (73.4 °F)**

a. Connect the digital circuit tester to the stator coil connector as shown.

**Model 88 Multimeter with tachometer:**
**YU-A1927**

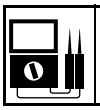


- Positive tester probe → White
- Negative tester probe → White

b. Measure the stator coil resistance.

## CHECKING THE RECTIFIER/REGULATOR

1. Check:
   - Rectifier/regulator output voltage
     Out of specification → Replace the rectifier/regulator.



**Regulated voltage:**
**14–15 V**

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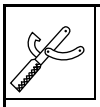
a. Connect FI Diagnostic Tool.
b. Connect the digital circuit tester (DC) to the rectifier/regulator harness.



**FI Diagnostic Tool:**
**90890-03253**
**Model 88 Multimeter with tachometer:**
**YU-A1927**

- Positive tester probe →
  Red (wire harness color)
- Negative tester probe →
  Black (wire harness color)

c. Start the engine.
d. Measure the regulated voltage.

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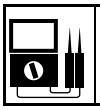
## CHECKING THE FUEL INJECTORS

The following procedure applies to all of the fuel injectors.

1. Remove:
   - Fuel injector
     (Refer to "FUEL INJECTORS AND INTAKE MANIFOLD" on page 4-9)
2. Check:
   - Fuel injector resistance
     Out of specification → Replace the fuel injector.



**Resistance:**
**11.4–12.6 Ω**

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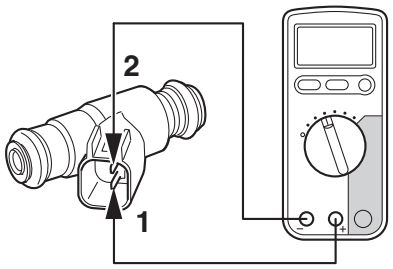
a. Disconnect the fuel injector coupler from the fuel injector.
b. Connect the digital circuit tester (Ω) to the fuel injector coupler as shown.




**Model 88 Multimeter with tachometer:**
**YU-A1927**

- Positive tester probe →
  Injector terminal "1"
- Negative tester probe →
  Injector terminal "2"

c. Measure the fuel injector resistance.

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## CHECKING THE STARTER MOTOR OPERATION

***1.*** Check:
- Starter motor operation
  Does not operate → Perform the electric starting system troubleshooting, starting with step 4.
  (Refer to "ELECTRIC STARTING SYSTEM" on page 6-2)

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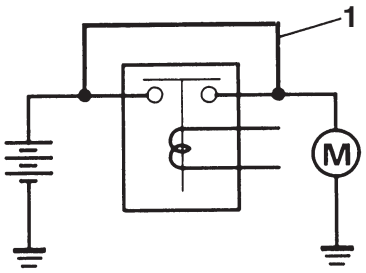
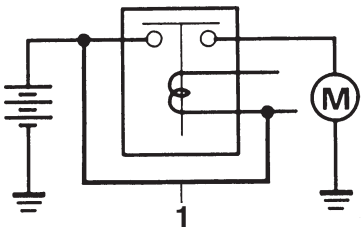
a. Connect the jumper lead "1" to the starter relay terminals on the battery side and the starter motor side.




**⚠ WARNING**

- **A wire that is used as a jumper lead must have at least the same capacity of the battery lead, otherwise the jumper lead may burn.**
- **This check is likely to produce sparks, therefore, make sure no flammable gas or fluid is in the vicinity.**

b. Check the starter motor operation.
c. Disconnect the main switch coupler.
d. Connect the jumper lead "1" to the starter relay coupler.
e. Check the starter motor operation.

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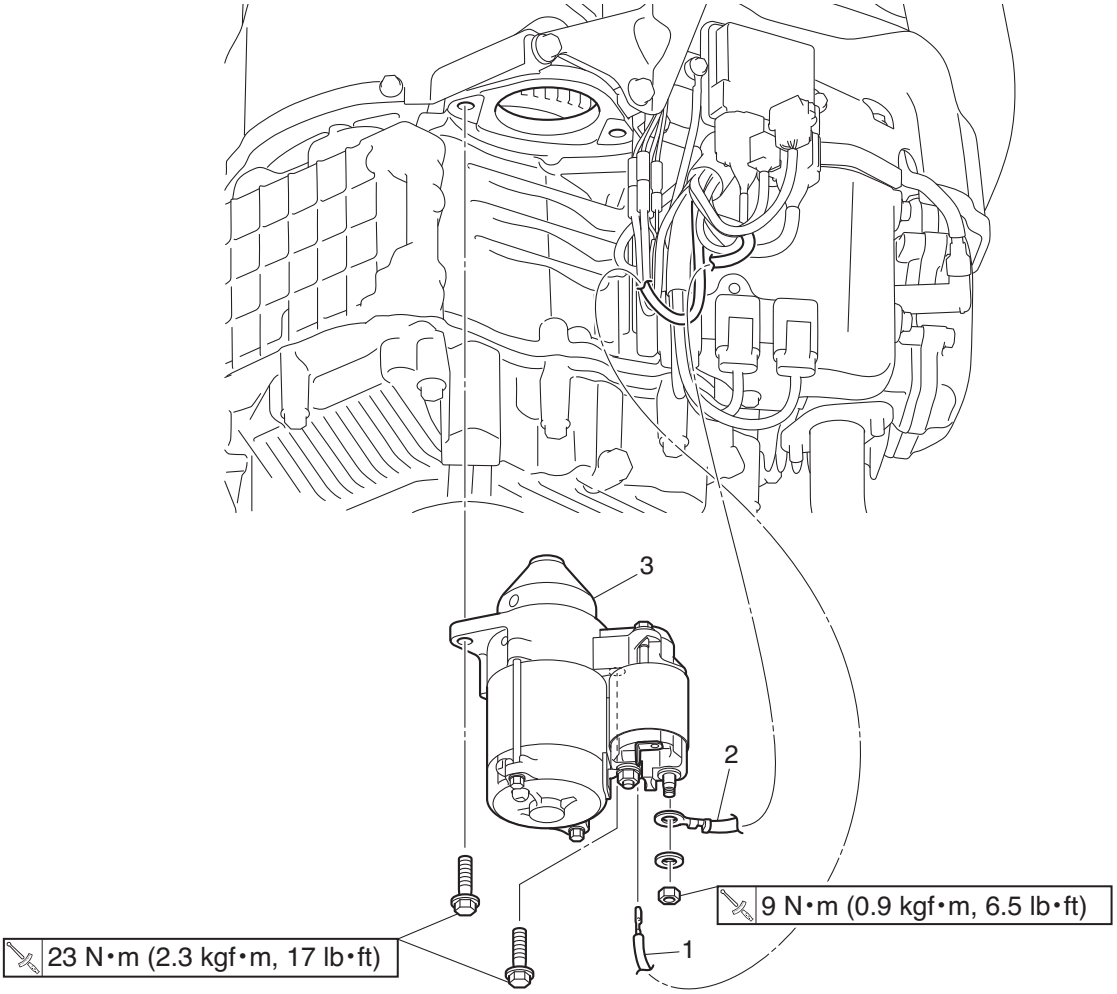
# ELECTRIC STARTING SYSTEM

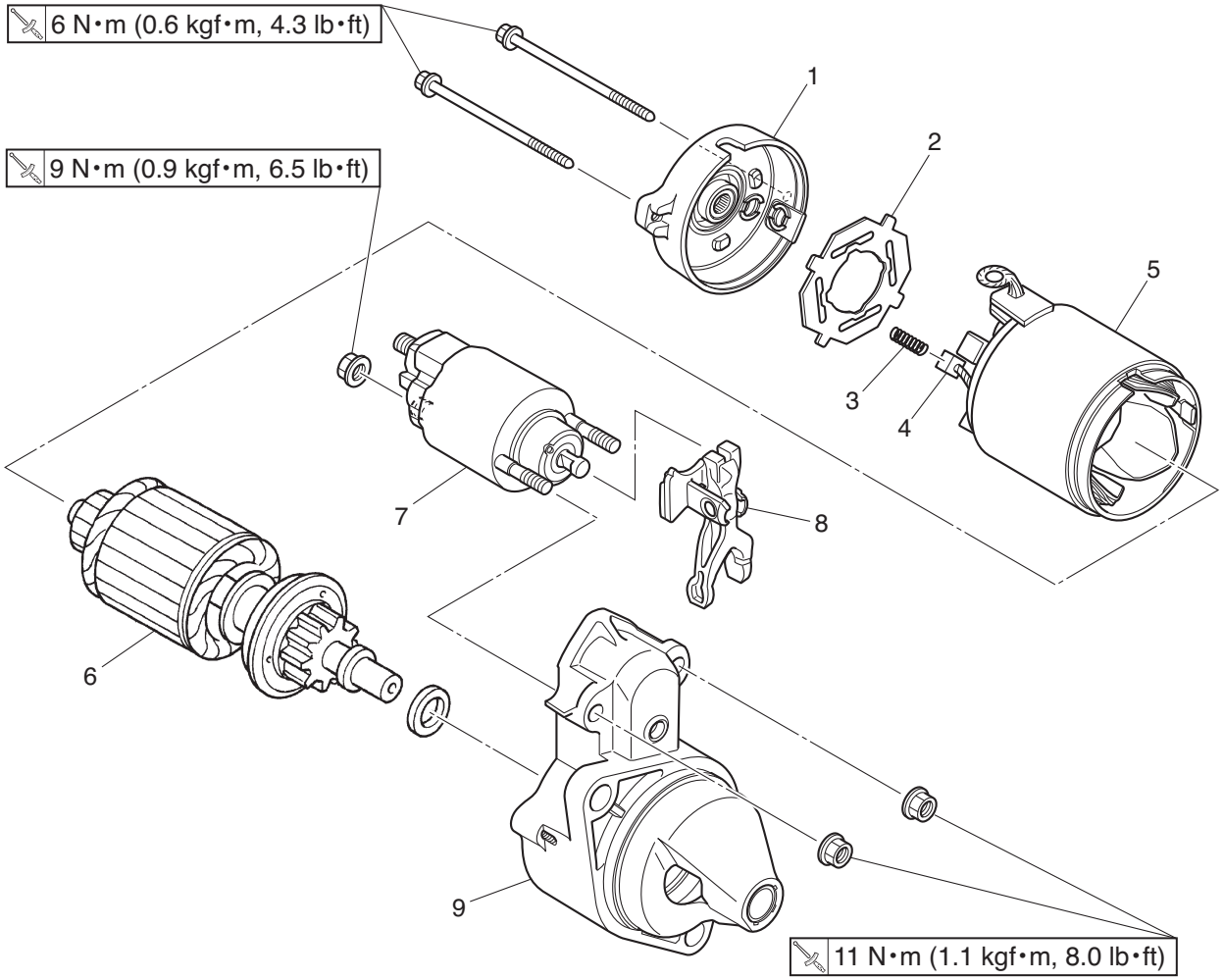
## REMOVING THE STARTER MOTOR



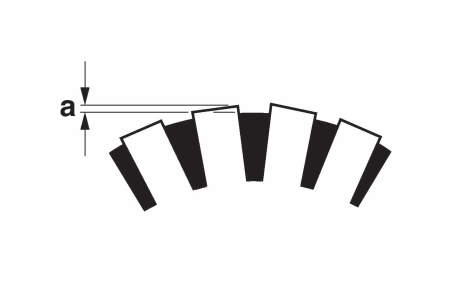



| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Removing the starter motor** | | Remove the parts in the order listed. |
| 1 | Starter relay terminals | 1 | Disconnect. |
| 2 | Earth terminal | 1 | Disconnect. |
| 3 | Starter motor assembly | 1 | |

## DISASSEMBLING THE STARTER MOTOR




| Order | Job/Parts to remove | Q'ty | Remarks |
|---|---|---|---|
| | **Disassembling the starter motor** | | Disassemble the parts in the order listed. |
| 1 | Rear bracket | 1 | |
| 2 | Insulator | 1 | |
| 3 | Brush spring | 4 | |
| 4 | Brush | 4 | |
| 5 | Yoke | 1 | |
| 6 | Armature | 1 | |
| 7 | Starter relay | 1 | |
| 8 | Starter drive lever | 1 | |
| 9 | Starter case | 1 | |




## CHECKING THE ARMATURE COIL

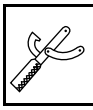
1. Check:
   - Commutator (outer surface)
     Dirty → Clean it with #600 grit sandpaper.
2. Measure:
   - Mica (insulation depth between the commutator segments)
     Out of specification → Scrape the mica to the proper measurement using a hacksaw blade which has been grounded to fit the commutator.

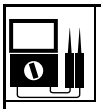
| | |
|---|---|
|  | **Depth of insulator "a":**<br>**2.0 mm (0.79 in)** |

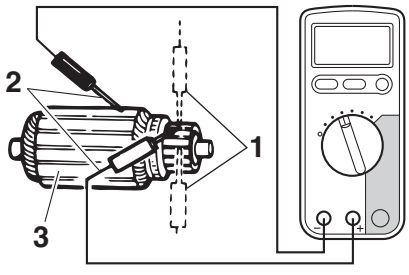
**TIP**

The mica insulation of the commutator must be undercut to ensure proper operation of the commutator.

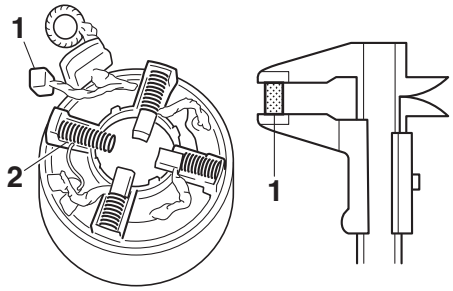
3. Measure:
   - Armature coil (insulation/continuity)
     Defects → Replace the starter motor.
     Connect the digital circuit tester to the armature coil.

| | |
|---|---|
|  | **Model 88 Multimeter with tachometer:**<br>**YU-A1927** |

| | |
|---|---|
|  | **Commutator continuity:**<br>**Continuity**<br>**Insulation resistance:**<br>**More than 1.0 MΩ** |




1. Continuity check
2. Insulation check
3. Armature coil




### CHECKING THE BRUSH

**1.** Measure:
- Brush length (of each brush) "1"
  Out of specification → Replace.

| | |
|---|---|
| | **Brush wear limit length:**<br>**6.0 mm (0.2362 in)** |

**2.** Check:
- Brush spring "2"
  Fatigue/damage → Replace.

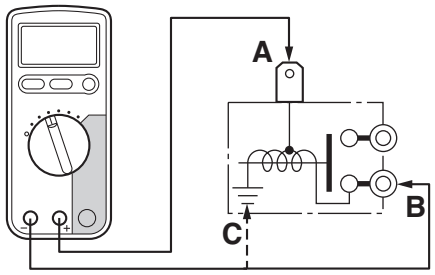


### CHECKING THE STARTER RELAY

**1.** Measure:
- Magnetic switch coil resistance
  Connect the digital circuit tester (Ω) to the magnetic switch.

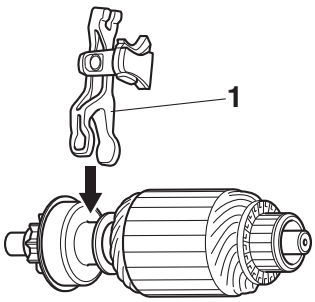
| | |
|---|---|
| | **Model 88 Multimeter with tachometer:**<br>**YU-A1927** |

Out of specification → Replace.

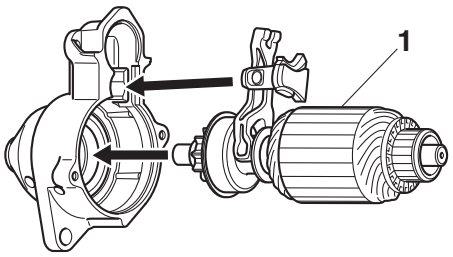



| | |
|---|---|
| | **Holding coil resistance A–B:**<br>**0.88–1.32 Ω**<br>**Pull-in coil resistance A–C:**<br>**0.4–0.6 Ω** |

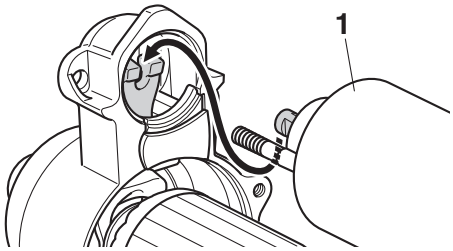
### ASSEMBLING THE STARTER MOTOR



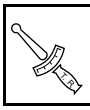

**1.** Install:
- Starter drive lever "1"




**2.** Install:
- Armature and starter drive lever “1”




**3.** Install:
- Starter relay “1”

| | |
|---|---|
|  | **Starter relay nut:**<br>**11 N·m (1.1 kgf·m, 8.0 lb·ft)** |

# TROUBLESHOOTING

## ENGINE DOES NOT START

### IGNITION SYSTEM

The ignition system fails to operate (no spark or intermittent spark).

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the fuses.<br>(Refer to “CHECKING THE FUSES” on page 5-27) | Replace the fuse(s). |
| 2 | Check the battery. | • Clean the battery terminals.<br>• Recharge or replace the battery. |
| 3 | Check the spark plugs.<br>(Refer to “SPARK PLUGS” on page 2-2). | Re-gap or replace the spark plugs. |
| 4 | Check the ignition spark gap.<br>(Refer to “CHECKING THE IGNITION SPARK GAP” on page 5-33) | If the ignition spark gap is OK, the ignition system is OK. |
| 5 | Check the ignition coils.<br>(Refer to “CHECKING THE IGNITION COILS” on page 5-32) | Replace the ignition coils. |
| 6 | Check the spark plug cap resistance.<br>(Refer to “CHECKING THE SPARK PLUG CAPS” on page 5-33). | Replace the spark plug cap. |
| 7 | Check the crankshaft position sensor.<br>(Refer to “CHECKING THE CRANKSHAFT POSITION SENSOR” on page 5-30) | Replace the crankshaft position sensor. |
| 8 | Check the main switch. | Replace the main switch. |
| 9 | Check the entire ignition system’s wiring.<br>(Refer to “CIRCUIT DIAGRAM” on page 5-1) | Properly connect or repair the ignition system’s wiring. |
| 10 | Replace the ECU. | — |

## ELECTRIC STARTING SYSTEM

The starter motor fails to turn.

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the fuses.<br>(Refer to “CHECKING THE FUSES” on page 5-27) | Replace the fuse(s). |
| 2 | Check the battery. | • Clean the battery terminals.<br>• Recharge or replace the battery. |
| 3 | Check the starter motor operation.<br>(Refer to “CHECKING THE STARTER MOTOR OPERATION” on page 5-36) | If the starter motor operates normally, the starter motor is OK. |
| 4 | Check the starter motor.<br>(Refer to “ELECTRIC STARTING SYSTEM” on page 5-37) | Repair or replace the starter motor. |
| 5 | Check the main switch. | Replace the main switch. |
| 6 | Check the entire starting system’s wiring.<br>(Refer to “CIRCUIT DIAGRAM” on page 5-1) | Properly connect or repair the starting system’s wiring. |
| 7 | The starting system circuit is OK. | — |

## FUEL INJECTION SYSTEM

(Refer to “FUEL INJECTION SYSTEM” on page 5-3)

## FUEL PUMP SYSTEM

If the high-pressure fuel pump fails to operate.

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the fuses.<br>(Refer to “CHECKING THE FUSES” on page 5-27) | Replace the fuse(s). |
| 2 | Check the battery. | • Clean the battery terminals.<br>• Recharge or replace the battery. |
| 3 | Check the main switch. | Replace the main switch. |
| 4 | Check the fuel pumps.<br>(Refer to “FUEL PUMPS” on page 4-1) | Replace the fuel pumps. |
| 5 | Check the entire high-pressure fuel pump system’s wiring.<br>(Refer to “CIRCUIT DIAGRAM” on page 5-1) | Properly connect or repair the high-pressure fuel pump system’s wiring. |
| 6 | Replace the ECU. | — |

# OTHER TROUBLES

## ENGINE STARTS BUT STALLS

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the fuel level. | Add the fuel if it is insufficient. |
| 2 | Check if the fuel filter is clogged. | Clean or replace. |
| 3 | Check if the fuel hoses is clogged. | Clean. |
| 4 | Check if there is air suction from the throttle body assembly joint, gasket, or throttle shaft. | • Tighten the throttle body assembly nuts securely.<br>• Replace the throttle body assembly joint or gasket with a new one. |
| 5 | Check the fuel pumps.<br>(Refer to “FUEL PUMPS” on page 4-1) | Replace the fuel pumps. |
| 6 | Check the low engine speed.<br>(Refer to “ENGINE SPEED” on page 2-14) | Adjust the low engine speed. |
| 7 | Measure the valve clearance.<br>(Refer to “ADJUSTING THE VALVE CLEARANCE” on page 2-9) | Adjust the valve clearance. |
| 8 | Check the compression pressure.<br>(Refer to “MEASURING THE COMPRESSION PRESSURE” on page 3-1) | Too high:<br>Decarbonize the combustion chamber if there is carbon deposits.<br>Too low:<br>Next checking steps. |
| 9 | Check if there is seizure, wear, or damage on the piston, piston ring, or cylinder.<br>(Refer to “PISTONS, CAMSHAFT, CRANKCASE, AND CRANKSHAFT” on page 3-38) | Rebore or replace. |
| 10 | Check the crankshaft position sensor air gap.<br>(Refer to “INSTALLING THE CRANKSHAFT POSITION SENSOR” on page 3-19) | Adjust. |

## ENGINE SPEED DOES NOT INCREASE

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the spark plugs for dirt and check the spark plug gap. | Clean, adjust, or replace the spark plugs. |
| 2 | Check the air filter element for dirt. | Replace the air filter element. |
| 3 | Check spark arrester, muffler and air filter. | Clean or replace spark arrester, muffler and air filter. |
| 4 | Check the valve clearance.<br>(Refer to “ADJUSTING THE VALVE CLEARANCE” on page 2-9) | Adjust the valve clearance. |
| 5 | Check the compression pressure.<br>(Refer to “MEASURING THE COMPRESSION PRESSURE” on page 3-1) | Too high:<br>Decarbonize the combustion chamber if there is carbon deposits.<br>Too low:<br>Next checking steps. |
| 6 | Check governor setting.<br>(Refer to “INSTALLING THE THROTTLE BODY ASSEMBLY” on page 4-7) | Adjust the governor. |
| 7 | Check the valve face and valve seat for wear.<br>(Refer to “VALVES” on page 3-27) | Resurface or replace the valve face and valve seat. |
| 8 | Check if the marks on the crankshaft and camshaft are aligned.<br>(Refer to “INSTALLING THE VALVE LIFTERS AND CAMSHAFT” on page 3-45) | Correct. |
| 9 | Check if there is seizure, wear, or damage on the piston, piston ring, or cylinder.<br>(Refer to “PISTONS, CAMSHAFT, CRANKCASE, AND CRANKSHAFT” on page 3-38) | Rebore or replace. |
| 10 | Check if the main passages, such as the throttle body assembly, are clogged. | Clean the parts. |
| 11 | Check if there is air suction from the throttle body assembly joint, gasket, or throttle shaft. | • Tighten the throttle body assembly nuts securely.<br>• Replace the throttle body assembly joint or gasket with a new one. |

## ENGINE SPEED IS UNEVEN

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the fuel level. | Add the fuel if it is insufficient. |
| 2 | Check if fuel has deteriorated. | Replace the fuel. |
| 3 | Check the spark plugs for dirt and check the spark plug gap. | Clean, adjust, or replace the spark plugs. |
| 4 | Check if there is air suction from the throttle body assembly joint, gasket, or throttle shaft. | • Tighten the throttle body assembly nuts securely.<br>• Replace the throttle body assembly joint or gasket with a new one. |
| 5 | Check if the main passages, such as the throttle body assembly, are clogged. | Clean the parts. |
| 6 | Check the valve clearance.<br>(Refer to “ADJUSTING THE VALVE CLEARANCE” on page 2-9) | Adjust the valve clearance. |
| 7 | Check the valve face and valve seat for wear.<br>(Refer to “VALVES” on page 3-27) | Resurface or replace the valve face and valve seat. |
| 8 | Check if there is seizure, wear, or damage on the piston, piston ring, or cylinder.<br>(Refer to “PISTONS, CAMSHAFT, CRANKCASE, AND CRANKSHAFT” on page 3-38) | Rebore or replace the piston, piston ring or cylinder. |

## THE BATTERY IS NOT CHARGED

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the fuses.<br>(Refer to “CHECKING THE FUSES” on page 5-27) | Replace the fuse(s). |
| 2 | Check the battery. | • Clean the battery terminals.<br>• Recharge or replace the battery. |
| 3 | Check the stator coil.<br>(Refer to “CHECKING THE STATOR COIL ASSEMBLY” on page 5-34) | Replace the stator coil assembly. |
| 4 | Check the rectifier/regulator.<br>(Refer to “CHECKING THE RECTIFIER/REGULATOR” on page 5-35) | Replace the rectifier/regulator. |
| 5 | Check the entire charging system’s wiring.<br>(Refer to “CIRCUIT DIAGRAM” on page 5-1) | Properly connect or repair the charging system’s wiring. |
| 6 | The charging system circuit is OK. | — |

### GOVERNOR OPERATION

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check that the governor link operate smoothly. | Adjust or replace. |
| 2 | Check that the governor spring is stretched. | Replace. |
| 3 | Check the governor adjustment.<br>(Refer to “INSTALLING THE THROTTLE BODY ASSEMBLY” on page 4-7) | Adjust. |
| 4 | Check the governor weight and governor bushing function.<br>(Refer to “CHECKING THE FLYWEIGHT SHAFT ASSEMBLY” on page 3-41) | Adjust or replace. |



## OIL PRESSURE SYSTEM

If the oil pressure switch fails to operate.

| No. | Checking steps | Possible remedy |
|---|---|---|
| 1 | Check the fuses.<br>(Refer to “CHECKING THE FUSES” on page 5-27) | Replace the fuse(s). |
| 2 | Check the battery. | • Clean the battery terminals.<br>• Recharge or replace the battery. |
| 3 | Check the main switch. | Replace the main switch. |
| 4 | Check the engine oil level. | Add the oil if it is insufficient. |
| 5 | Check the oil filter. | Replace the oil filter. |
| 6 | Check the oil pressure switch.<br>(Refer to “CHECKING THE OIL PRESSURE SWITCH” on page 5-28) | Replace the oil pressure switch. |
| 7 | Check the entire oil pressure system’s wiring.<br>(Refer to “CIRCUIT DIAGRAM” on page 5-1) | Properly connect or repair the oil pressure system’s wiring. |
| 8 | Check the oil pump.<br>(Refer to “CHECKING THE OIL PUMP” on page 3-34) | Replace the oil pump. |
| 9 | Check the relief valve.<br>(Refer to “CHECKING THE RELIEF VALVE” on page 3-35) | Replace the relief valve. |
| 10 | Replace the ECU. | — |

# SPECIFICATIONS

## GENERAL SPECIFICATIONS

| | |
|---|---|
| **Model:** | |
| | MX775 (7U2J)<br>MX800 (7U1J)<br>MX825 (7UDJ) |
| **Dimensions:** | |
| Overall length | 499 mm (19.65 in) |
| Overall width | 463 mm (18.23 in) |
| Overall height | 639 mm (25.16 in) |
| Dry weight | 60 kg (132 lb) |
| **Engine:** | |
| Engine type | Air cooled 4-stroke gasoline OHV |
| Cylinder arrangement | V-type 2-cylinder |
| Displacement | 0.824 L (824 $cm^3$) |
| Bore × Stroke | 80.0 × 82.0 mm (3.15 × 3.23 in) |
| Compression ratio | 9.1 |
| Standard compression pressure | 1.31–1.45 MPa (13.4–14.8 $kg/cm^2$, 190–210 psi) |
| Limit | 150 psi |
| Fuel | Unleaded gasoline (Gasohol [E10] acceptable)* |
| Engine oil quantity | 2.0 L (2.11 US qt, 1.76 Imp.qt) |
| Recommended engine oil | YAMALUBE SAE 10W-30 Performance All Purpose, SAE 10W-30 or 10W-40 |
| Recommended engine oil grade | API Service SE type or higher |
| Oil filter type | Cartridge |
| Lubrication system | Full pressure with filter |
| Air filter system | Dry |
| Cooling system | Air cooled |
| Starting system | Electric starter |
| Stopping system | Misfire |
| Rotating direction | Counterclockwise (From PTO shaft) |
| Governor type | Centrifugal weight system |
| Maximum angle of operation | 30° (Low oil level) |
| **Electrical:** | |
| Ignition system | ECU control battery ignition |
| Ignition timing | BTDC 30°/ 3750 r/min |
| Spark plug type | BPR6ES (NGK) |
| Spark plug gap | 0.7–0.8 mm (0.028–0.031 in) |
| Fuse amperage | 30 A × 1<br>10 A × 2 |

* Yamaha engine has been designed to use regular unleaded gasoline with a pump octane number ((R+M)/2) of 86 or higher, or research octane number of 91 or higher.
Gasohol containing ethanol can be used if the ethanol content does not exceed 10 % (E10).

***NOTICE***

**Use only unleaded gasoline. The use of leaded gasoline will cause severe damage to internal engine parts.**

# MAINTENANCE SPECIFICATIONS

## ENGINE

| | |
|---|---|
| **Piston:** | |
| Piston-to-cylinder clearance | 0.033–0.047 mm (0.0013–0.0019 in) |
| Limit | 0.15 mm (0.0059 in) |
| Piston diameter | 79.959–79.980 mm (3.1480–3.1488 in) |
| Limit | 79.900 mm (3.1457 in) |
| Measuring point (from piston skirt bottom) | 6.0 mm (0.2362 in) |
| Oversize 1st | 80.25 mm (3.1594 in) |
| 2nd | 80.50 mm (3.1693 in) |
| Piston pin hole inside diameter | 19.004–19.015 mm (0.7482–0.7486 in) |
| Limit | 19.045 mm (0.7498 in) |
| **Piston pin:** | |
| Piston pin diameter | 18.995–19.000 mm (0.7478–0.7480 in) |
| Limit | 18.975 mm (0.7470 in) |
| **Piston ring:** | |
| Top ring | |
| Type | Barrel |
| Dimensions | 1.2 × 2.9 mm (0.0472 × 0.1142 in) |
| End gap (installed) | 0.20–0.35 mm (0.0079–0.0138 in) |
| Limit | 0.60 mm (0.0236 in) |
| Side clearance | 0.04–0.08 mm (0.0016–0.0031 in) |
| Limit | 0.13 mm (0.0051 in) |
| 2nd ring | |
| Type | Taper |
| Dimensions | 1.0 × 2.5 mm (0.0394 × 0.0984 in) |
| End gap (installed) | 0.20–0.35 mm (0.0079–0.0138 in) |
| Limit | 0.60 mm (0.0236 in) |
| Side clearance | 0.03–0.07 mm (0.0012–0.0028 in) |
| Limit | 0.13 mm (0.0051 in) |
| Oil ring | |
| Type | 3-piece type |
| Dimensions | 2.0 × 2.5 mm (0.0787 × 0.0984 in) |
| End gap (installed) | 0.20–0.70 mm (0.0079–0.0276 in) |
| **Cylinder head:** | |
| Warpage limit | 0.05 mm (0.002 in) |
| **Cylinder:** | |
| Bore | 80.000–80.020 mm (3.1496–3.1504 in) |
| Warpage limit | 80.025 mm (3.1506 in) |

| | |
|---|---|
| **Crankshaft:** | |
| Big end side clearance | 0.20–0.65 mm (0.0079–0.0256 in) |
| Runout limit | 0.03 mm (0.0012 in) |
| Crank pin outside diameter | 40.950–41.050 mm (1.6122–1.6161 in) |
| **Connecting rod:** | |
| Small end diameter | 19.006–19.020 mm (0.7483–0.7488 in) |
| Oil clearance | 0.006–0.025 mm (0.0002–0.0010 in) |
| Big end diameter | 40.005–40.020 mm (1.5750–1.5756 in) |
| Oil clearance | 0.016–0.046 mm (0.0006–0.0018 in) |
| Limit | 0.09 mm (0.0035 in) |
| **Camshaft:** | |
| Camshaft lobe dimensions | |
| Lobe height (Intake) | 32.885 mm (1.2947 in) |
| Limit | 32.785 mm (1.2907 in) |
| Lobe height (Exhaust) | 33.957 mm (1.3369 in) |
| Limit | 33.857 mm (1.3330 in) |
| Base circle diameter (Intake) | 26.000 mm (1.0236 in) |
| Limit | 25.900 mm (1.0197 in) |
| Base circle diameter (Exhaust) | 26.000 mm (1.0236 in) |
| Limit | 25.900 mm (1.0197 in) |
| Camshaft journal diameter | 16.965–16.990 mm (0.6679–0.6689 in) |
| Limit | 16.950 mm (0.6673 in) |
| **Valve:** | |
| Valve dimensions | |
| Valve head diameter (Intake) | 27.9–28.1 mm (1.0984–1.1063 in) |
| Valve head diameter (Exhaust) | 34.9–35.1 mm (1.3740–1.3819 in) |
| Valve stem diameter (Intake) | 5.948–5.963 mm (0.2342–0.2348 in) |
| Valve stem diameter (Exhaust) | 5.940–5.955 mm (0.2339–0.2344 in) |
| Limit (Intake) | 5.918 mm (0.2330 in) |
| Limit (Exhaust) | 5.910 mm (0.2327 in) |
| Valve stem length (Intake) | 88.8 mm (3.4961 in) |
| Valve stem length (Exhaust) | 89.8 mm (3.5354 in) |
| Valve face contact width (Intake) | 0.9–1.1 mm (0.0354–0.0433 in) |
| Valve face contact width (Exhaust) | 0.9–1.1 mm (0.0354–0.0433 in) |
| Limit (Intake) | 1.6 mm (0.063 in) |
| Limit (Exhaust) | 1.6 mm (0.063 in) |
| Valve seat contact width (Intake) | 0.9–1.1 mm (0.0354–0.0433 in) |
| Valve seat contact width (Exhaust) | 0.9–1.1 mm (0.0354–0.0433 in) |

| | |
|---|---|
| Limit (Intake) | 1.6 mm (0.063 in) |
| Limit (Exhaust) | 1.6 mm (0.063 in) |
| Valve stem runout limit | 0.01 mm (0.0004 in) |
| **Valve guide** | |
| Guide inside diameter (Intake) | 6.000–6.012 mm (0.2362–0.2367 in) |
| Guide inside diameter (Exhaust) | 6.000–6.012 mm (0.2362–0.2367 in) |
| Stem to guide clearance (Intake) | 0.08 mm (0.0031 in) |
| Stem to guide clearance (Exhaust) | 0.10 mm (0.0039 in) |
| Valve clearance (cold) | |
| Intake | 0.02–0.2 mm (0.0008–0.01 in) |
| Exhaust | 0.02–0.2 mm (0.0008–0.01 in) |
| **Push rod:** | |
| Runout limit | 0.3 mm (0.0118 in) |
| **Rocker arm:** | |
| Rocker arm shaft hole inside diameter (Intake) | 12.000–12.018 mm (0.4724–0.4731 in) |
| Rocker arm shaft hole inside diameter (Exhaust) | 12.000–12.018 mm (0.4724–0.4731 in) |
| Rocker arm shaft diameter (Intake) | 11.981–11.991 mm (0.4717–0.4721 in) |
| Rocker arm shaft diameter (Exhaust) | 11.981–11.991 mm (0.4717–0.4721 in) |
| Oil clearance | 0.08 mm (0.0031 in) |
| **Valve spring:** | |
| Valve spring free length (Intake) | 37.1 mm (1.4606 in) |
| Valve spring free length (Exhaust) | 35.6 mm (1.4016 in) |
| Limit (Intake) | 35.25 mm (1.3878 in) |
| Limit (Exhaust) | 33.82 mm (1.3315 in) |
| Installed length (Intake) | 29.3 mm (1.1535 in) |
| Installed length (Exhaust) | 29.0 mm (1.1417 in) |
| Installed compression spring force (Intake) | 67.7 N (6.90 kgf, 15.2 lbf) |
| Installed compression spring force (Exhaust) | 118.1 N (12.0 kgf, 26.5 lbf) |
| Tilt limit | 2.0 mm (0.0787 in) |
| **Fuel pump:** | |
| Pump type (Lo) | Mechanical |
| Pump type (Hi) | Electrical |

| | |
|---|---|
| Fuel line pressure (at idle) | 255–285 kPa (2.55–2.85 kgf/cm², 36.98–41.33 psi) |
| **Fuel injector:** | |
| Resistance | 11.4–12.6 Ω |
| **Oil pump:** | |
| Inner-rotor-to-outer-rotor-tip clearance | 0.19–0.35 mm (0.008–0.013 in) |
| Relief valve operating pressure | 342–538 kPa (3.42–5.38 kgf/cm², 49.59–78.01 psi) |
| **Throttle body:** | |
| ID mark | E-3750-2 (MX775)<br>E-3750-1 (MX800)<br>E-3750-0 (MX825) |
| **Throttle position sensor:** | |
| Output voltage (at idle) | 0.95–4.5 V |
| Resistance | 3.0–7.0 kΩ |
| **Governor assembly:** | |
| Tension spring attach hole | 7 |
| **Engine speed:** | |
| High engine speed (with no load) | 3550–3600 r/min |
| Low engine speed (with no load) | 1450–1550 r/min |

## ELECTRICAL

| | |
|---|---|
| **Ignition coil:** | |
| Primary coil resistance | 0.44–0.66 Ω |
| Secondary coil resistance | 5.6–8.4 kΩ |
| Spark plug cap resistance | 3.75–6.25 kΩ |
| Crankshaft position sensor air gap | 0.5–1.5 mm (0.02–0.06 in) |
| Minimum ignition spark gap | 6.0 mm (0.236 in) |
| **Charging system:** | |
| Standard output at 3600 r/min | 18 A: More than 18 A<br>20 A: More than 20 A<br>25 A: More than 25 A |
| Stator coil resistance | 18 A: 0.16–0.24 Ω at 23 °C (73.4 °F)<br>20 A: 0.112–0.168 Ω at 23 °C (73.4 °F)<br>25 A: 0.096–0.144 Ω at 23 °C (73.4 °F) |
| **Rectifier/regulator:** | |
| Regulator type | Single-phase full-wave rectification |
| Regulated voltage | 14–15 V |
| Rectifier capacity | 25 A |
| **Fuel injection sensor:** | |
| Crankshaft position sensor resistance | 3.0–7.0 kΩ |
| Manifold absolute pressure sensor air pressure | 14–15 psi |
| Engine temperature sensor resistance | 9.0–11.0 kΩ at 25 °C (77 °F) |
| **Electric starting system:** | |
| Depth of insulator | 2.0 mm (0.79 in) |
| Insulation resistance | More than 1.0 MΩ |
| Brush spring pressure | 11.73–15.35 N (1.196–1.565 kgf, 2.637–3.451 lbf) |
| Brush wear limit length | 6.0 mm (0.2362 in) |
| Holding coil resistance | 0.88–1.32 Ω |
| Pull-in coil resistance | 0.4–0.6 Ω |

# TIGHTENING TORQUES

| Item | Thread size | Tightening torque |
|---|---|---|
| Spark plug | M14S × 1.25 | 20 N·m (2.0 kgf·m, 14 lb·ft) |
| Spark arrester screw | — | 3.5 N·m (0.35 kgf·m, 2.5 lb·ft) |
| Oil filter | — | 14 N·m (1.4 kgf·m, 10 lb·ft) |
| Oil drain bolt | M12 × 1.5 | 27 N·m (2.7 kgf·m, 20 lb·ft) |
| Air filter case stay bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Air filter case stay bolt | M8 × 1.25 | 10 N·m (1.0 kgf·m, 7.2 lb·ft) |
| Joint 2 clamp bolt | — | 1.8 N·m (0.18 kgf·m, 1.3 lb·ft) |
| ECU bolt | M5 × 0.8 | 4.0 N·m (0.40 kgf·m, 2.9 lb·ft) |
| Rectifier/regulator bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Engine hunger bolt | M8 × 1.25 | 20 N·m (2.0 kgf·m, 14 lb·ft) |
| Engine hunger bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Fuse holder bracket bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Ignition coil bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| $O_2$ sensor | M12 × 1.25 | 18 N·m (1.8 kgf·m, 13 lb·ft) |
| Muffler nut | — | 20 N·m (2.0 kgf·m, 14 lb·ft) |
| Adapter union bolt | M20 × 1.5 | 62 N·m (6.2 kgf·m, 45 lb·ft) |
| Oil cooler bolt | M6 × 1.0 | 9 N·m (0.9 kgf·m, 6.5 lb·ft) |
| Fan bolt | M6 × 1.0 | 10 N·m (1.0 kgf·m, 7.2 lb·ft) |
| Fan case bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Grass screen bolt | M6 × 1.0 | 10 N·m (1.0 kgf·m, 7.2 lb·ft) |
| Fan case cover bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Oil filler pipe bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Stator coil assembly bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Flywheel nut | M22 × 1.5 | 180 N·m (18 kgf·m, 130 lb·ft) |
| Crankshaft position sensor bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Cylinder air shroud bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Cylinder head cover bolt | M6 × 1.0 | 11 N·m (1.1 kgf·m, 8.0 lb·ft) |
| Rocker arm shaft bolt | M5 × 1.0 | 4.0 N·m (0.40 kgf·m, 2.9 lb·ft) |
| Cylinder head bolt | M10 × 1.25 | 1st: 12 N·m (1.2 kgf·m, 8.7 lb·ft)<br>2nd: 50 N·m (5.0 kgf·m, 36 lb·ft) |
| Oil pressure switch | M4 × 0.7 | 8 N·m (0.8 kgf·m, 5.8 lb·ft) |
| Oil pump cover bolt | M6 × 1.0 | 10 N·m (1.0 kgf·m, 7.2 lb·ft) |
| Relief valve | M12 × 1.25 | 30 N·m (3.0 kgf·m, 22 lb·ft) |
| Crankcase cover 2 bolt | M8 × 1.25 | 1st: 12 N·m (1.2 kgf·m, 8.7 lb·ft)<br>2nd: 30 N·m (3.0 kgf·m, 22 lb·ft) |
| Cover 1 bolt | M6 × 1.0 | 9 N·m (0.9 kgf·m, 6.5 lb·ft) |
| Cover 2 bolt | M6 × 1.0 | 10 N·m (1.0 kgf·m, 7.2 lb·ft) |
| Crankcase cover 1 bolt | M8 × 1.25 | 1st: 12 N·m (1.2 kgf·m, 8.7 lb·ft)<br>2nd: 30 N·m (3.0 kgf·m, 22 lb·ft) |
| Connecting rod cap bolt | M8 × 1.25 | 20 N·m (2.0 kgf·m, 14 lb·ft) |

# TIGHTENING TORQUES

| Item | Thread size | Tightening torque |
|---|---|---|
| Engine temperature sensor | M10 × 1.5 | 12 N·m (1.2 kgf·m, 8.7 lb·ft) |
| Reed valve | M6 × 1.0 | 10 N·m (1.0 kgf·m, 7.2 lb·ft) |
| Scroll air shroud bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Low-pressure fuel pump bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| High-pressure fuel pump bolt | M6 × 1.0 | 9 N·m (0.9 kgf·m, 6.5 lb·ft) |
| Fuel pump bracket | M6 × 1.0 | 9 N·m (0.9 kgf·m, 6.5 lb·ft) |
| Throttle body assembly nut | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Governor assembly bolt | M6 × 1.0 | 8 N·m (0.8 kgf·m, 5.8 lb·ft) |
| Inlet pipe bolt | M6 × 1.0 | 9 N·m (0.9 kgf·m, 6.5 lb·ft) |
| Manifold absolute pressure sensor bolt | M6 × 1.0 | 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Intake manifold nut and bolt | M6 × 1.0 | 1st: 3.0 N·m (0.30 kgf·m, 2.2 lb·ft)<br>2nd: 7 N·m (0.7 kgf·m, 5.1 lb·ft) |
| Starter motor assembly bolt | M8 × 1.25 | 23 N·m (2.3 kgf·m, 17 lb·ft) |
| Earth terminal nut | M8 × 1.25 | 9 N·m (0.9 kgf·m, 6.5 lb·ft) |
| Starter motor rear bracket bolt | M6 × 0.8 | 6 N·m (0.6 kgf·m, 4.3 lb·ft) |
| Starter relay nut | M6 × 1.0 | 11 N·m (1.1 kgf·m, 8.0 lb·ft) |

## GENERAL TORQUE SPECIFICATIONS

This chart specifies torque for standard fasteners with standard I.S.O. pitch threads. Torque specifications for special components or assemblies are included in the applicable sections of this book. To avoid warpage, tighten multi fastener assemblies in a crisscross fashion, in progressive stages, until full torque is reached. Unless otherwise specifications call for clean, dry threads. Components should be at room temperature.

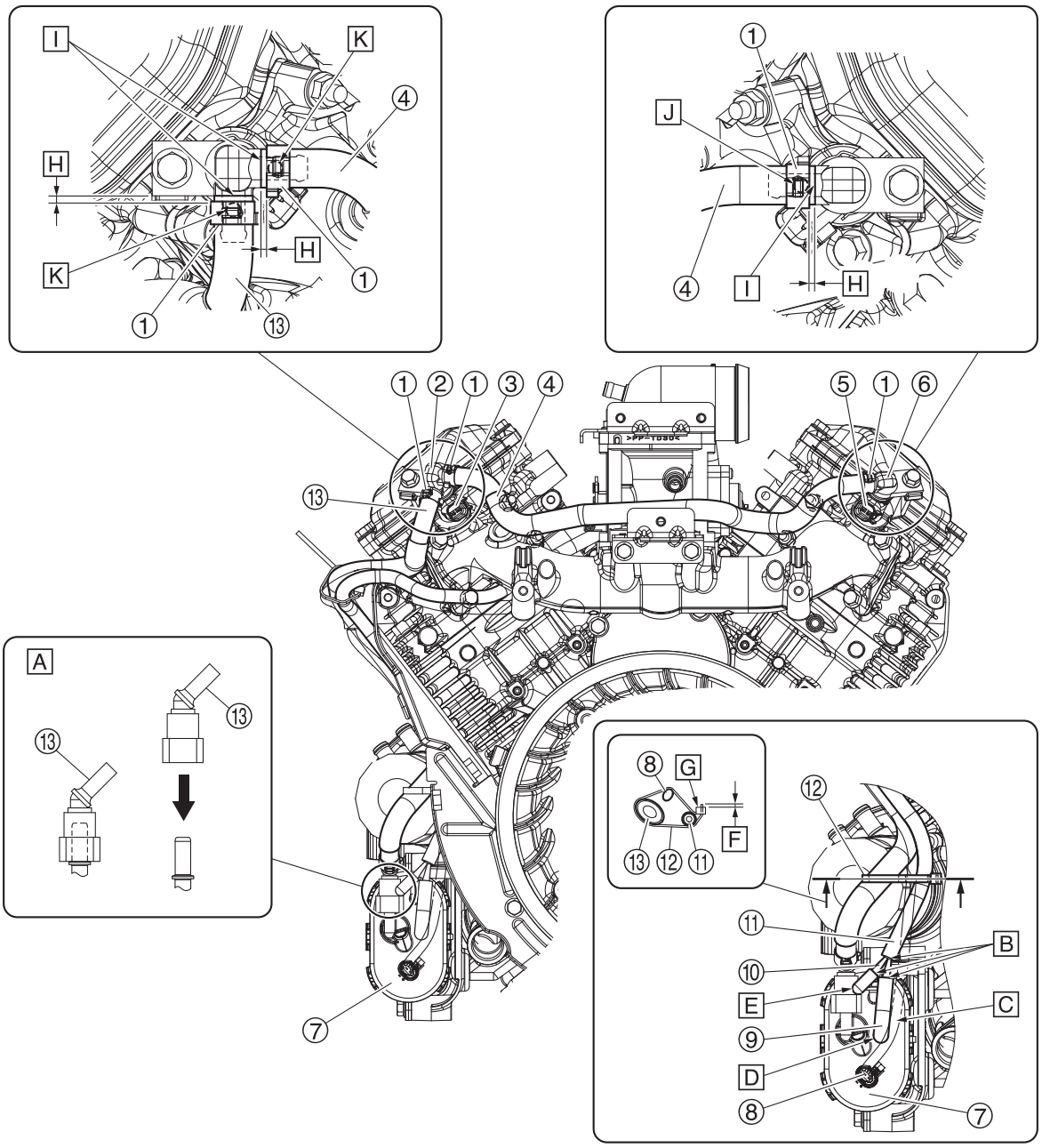
| Thread size | Tightening torque | | |
|---|---|---|---|
| | N·m | kgf·m | lb·ft |
| M4 | 2 | 0.2 | 1.5 |
| M5 | 3 | 0.3 | 2.2 |
| M6 | 7 | 0.7 | 5.2 |
| M7 | 10 | 1.0 | 7.4 |
| M8 | 15 | 1.5 | 11.1 |
| M10 | 30 | 3.0 | 22.1 |
| M12 | 60 | 6.0 | 44.3 |

# LUBRICATION POINTS AND TYPE OF LUBRICANTS

| Part name | Type of lubricant |
|---|---|
| Oil seal lip | LS |
| Oil hose 1, 2 | S |
| Governor fork oil seal lip | E |
| Bearing | E |
| Connecting rod big end | E |
| Crank pin | E |
| Crankshaft journal | M |
| Connecting rod cap bolt | E |
| Piston pin | E |
| Piston | E |
| Valve stem | E |
| Valve stem end | E |
| Valve rocker arm shaft | E |
| Valve push rod end | E |
| Valve lifter stem | E |
| Camshaft lobe | E |
| Camshaft gear teeth | E |
| Camshaft journal | E |
| Adjusting pad | E |
| Inner rotor | E |
| Outer rotor | E |
| Fuel injector O-ring | E |
| Governor collar internal surface | E |
| Governor fork meet surface | E |
| Governor weight moving point | E |
| Oil pressure switch | LG |
| Crankcase cover 2 | Three bond No. 1217G® |
| Cover 1 | Three bond No. 1217G® |

# WIRE ROUTING DIAGRAM

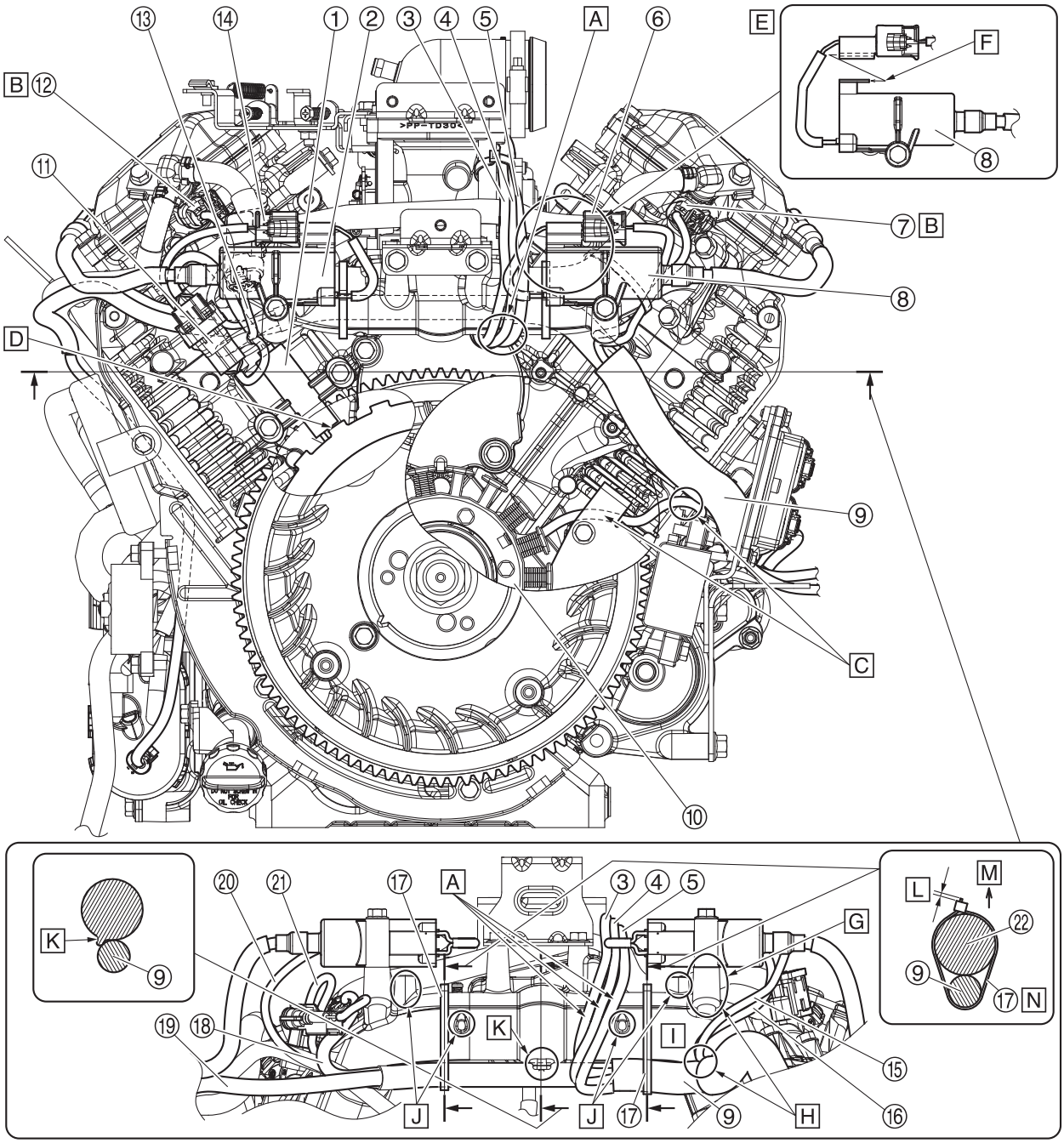
## UPPER SIDE VIEW



1. Hose clamp
2. Inlet pipe 2
3. Fuel injector #2
4. Fuel injector pipe 2
5. Fuel injector #1
6. Inlet pipe 1
7. High-pressure fuel pump
8. Wire harness
9. Purge hose 2
10. 3 WAY joint
11. Purge hose 1
12. Plastic locking tie
13. Fuel injector pipe 1

A. Fuel injector pipe 1 connector installation details
   - Insert the fuel injector pipe 1 connector until a click is heard, and then make sure that the connector is not disconnected.
   - When inserting the fuel injector pipe 1 connector, pay attention not to prize.

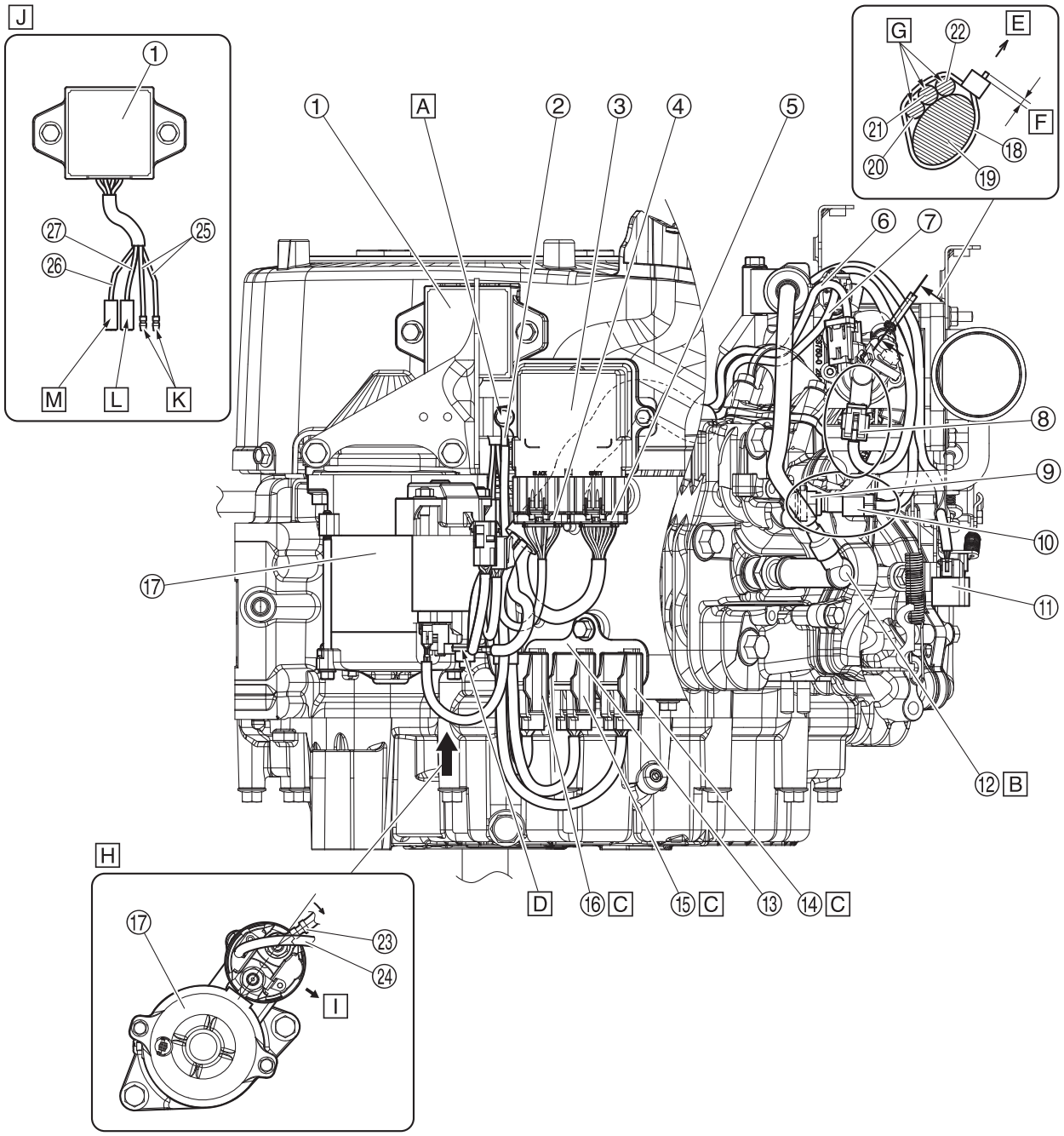
B. Insert the purge hose 1, purge hose 2, cap all the way into the 3 WAY joint.
C. Make sure that there is no looseness or tension of the lead.
D. Insert the protector side of the purge hose 2 all the way into the pipe of the fuel pump.
E. Install the cap in the direction shown in the illustration.
F. Keep the length shown in the illustration to 0–2.0 mm (0–0.08 in) and cut off the end of the plastic locking tie.
G. The binding area of the plastic locking tie should be on the outside of the engine.
H. 2.0–4.0 mm (0.08–0.16 in)
I. Insert the fuel injector pipes until it contacts the inlet pipes.
J. Install the yellow painted portion in the direction shown in the illustration.
K. Install the white painted portion in the direction shown in the illustration.


⑬ ⑭ ① ② ③ ④ ⑤ A ⑥ E F
B ⑫ ⑧
⑪ ⑦ B
⑧
D
⑨
C
⑩
K ⑨
⑳ ㉑ ⑰ A ③ ④ ⑤ G
L M ㉒ ⑨ ⑰ N
⑲ ⑱ K I ⑮
J J ⑰ ⑨ H ⑯

1. Crankshaft position sensor
2. Ignition coil #2
3. Throttle position sensor lead
4. Engine temperature sensor lead
5. $O_2$ sensor lead
6. Ignition coil #1 coupler
7. Fuel injector #1 coupler
8. Ignition coil #1
9. Wire harness
10. Stator
11. Crankshaft position sensor coupler
12. Fuel injector #2 coupler
13. Manifold absolute pressure sensor lead
14. Ignition coil #2 coupler
15. Fuel injector #1 lead
16. Ignition coil #1 lead
17. Plastic locking tie
18. Fuel injector #2 and crankshaft position sensor lead
19. High-pressure fuel pump lead and oil pressure switch lead
20. Ignition coil #2 lead
21. Fuel injector #2 lead
22. Intake manifold

A. Install the leads so that they overlap each other.
B. Lock the fuel injector coupler after installation.
C. Install the lead as shown in the illustration.
D. Gap between crankshaft position sensor and rotor should be 0.5–1.5 mm (0.02–0.06 in).
E. Installation details of ignition coil and coupler
F. After installing the coupler, insert it until it is locked.
G. Boss
H. Align the wire harness with the boss of the intake manifold.
I. Branch
J. Position the plastic locking tie between the projections as shown in the illustration.
K. Projection
L. Allowance 2.0 mm (0.08 in) or less
M. Direction of upper surface of the engine
N. Install the lock of the plastic locking tie as shown in the illustration.

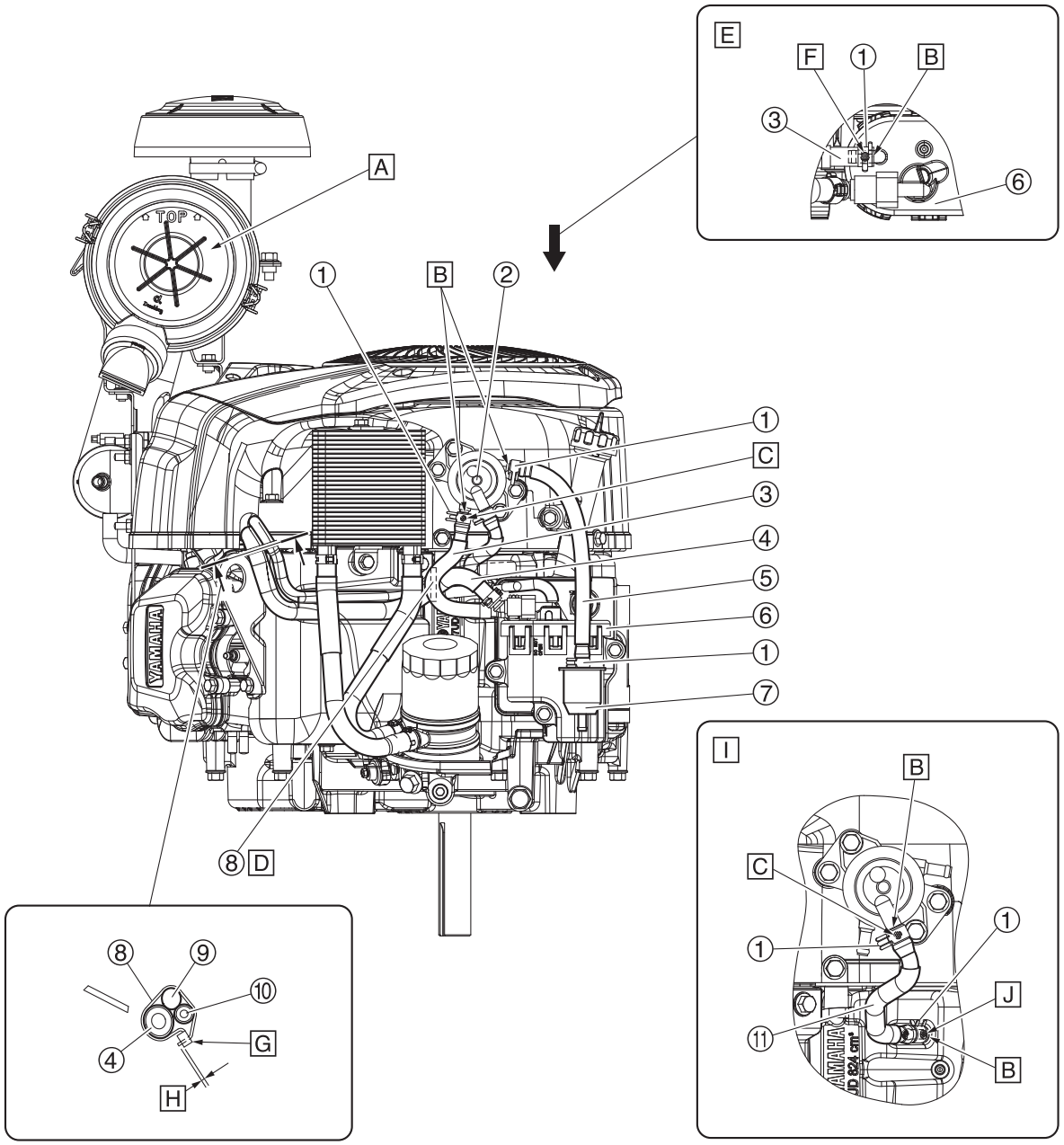
## LEFT SIDE VIEW



1. Rectifier/regulator
2. Earth terminal
3. ECU
4. ECU coupler (black)
5. ECU coupler (gray)
6. Fuel injector #1 lead
7. Ignition coil #1 lead
8. Throttle position sensor coupler
9. Engine temperature sensor
10. Engine temperature sensor coupler
11. $O_2$ sensor coupler
12. Spark plug cap
13. Stay
14. Fuse (10 A) coupler
15. Fuse (10 A) coupler
16. Fuse (30 A) coupler
17. Starter motor
18. Plastic locking tie
19. Throttle body
20. Throttle position sensor lead
21. Engine temperature sensor lead
22. $O_2$ sensor lead
23. Starter motor lead
24. Starter relay lead
25. Rectifier/regulator lead (white)
26. Rectifier/regulator lead (red)
27. Rectifier/regulator lead (black)

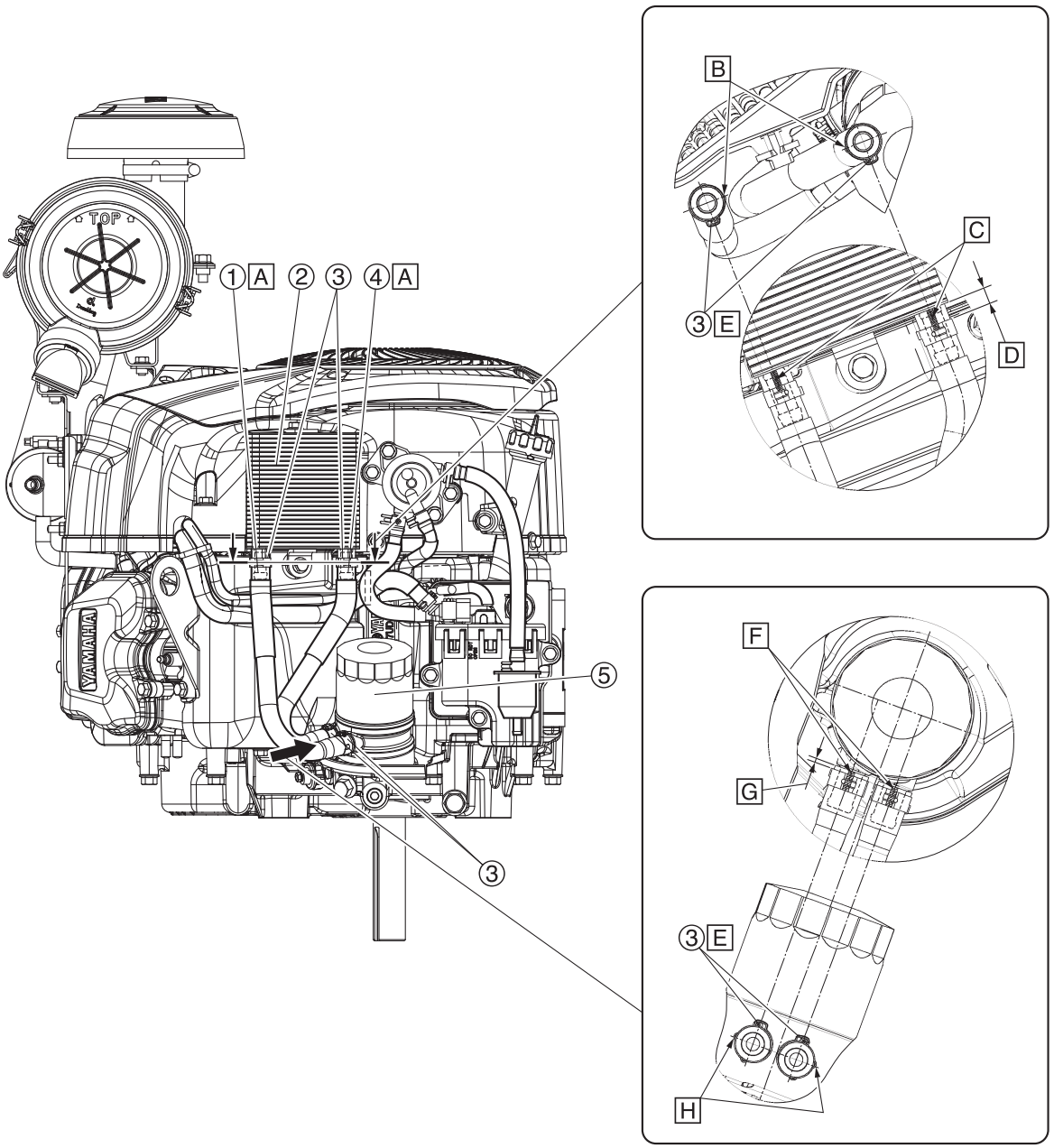
A. Tighten the earth terminal together with the mounting bolt in the direction shown in the illustration.
B. Install the spark plug cap in the direction shown in the illustration.
C. Install in the stay.
D. Tighten together with the vehicle battery positive terminal.
E. Direction of upper surface of the engine
F. Allowance 2.0 mm (0.08 in) or less
G. Install the leads so that they do not overlap each other.
H. Starter motor lead installation details
I. Engine side
J. Rectifier/regulator lead installation details
K. Connect with the stator lead connector (female). (Polarity does not matter)
L. Connect with the wire harness connector (male/black).
M. Connect with the wire harness connector (male/red).

## RIGHT SIDE VIEW



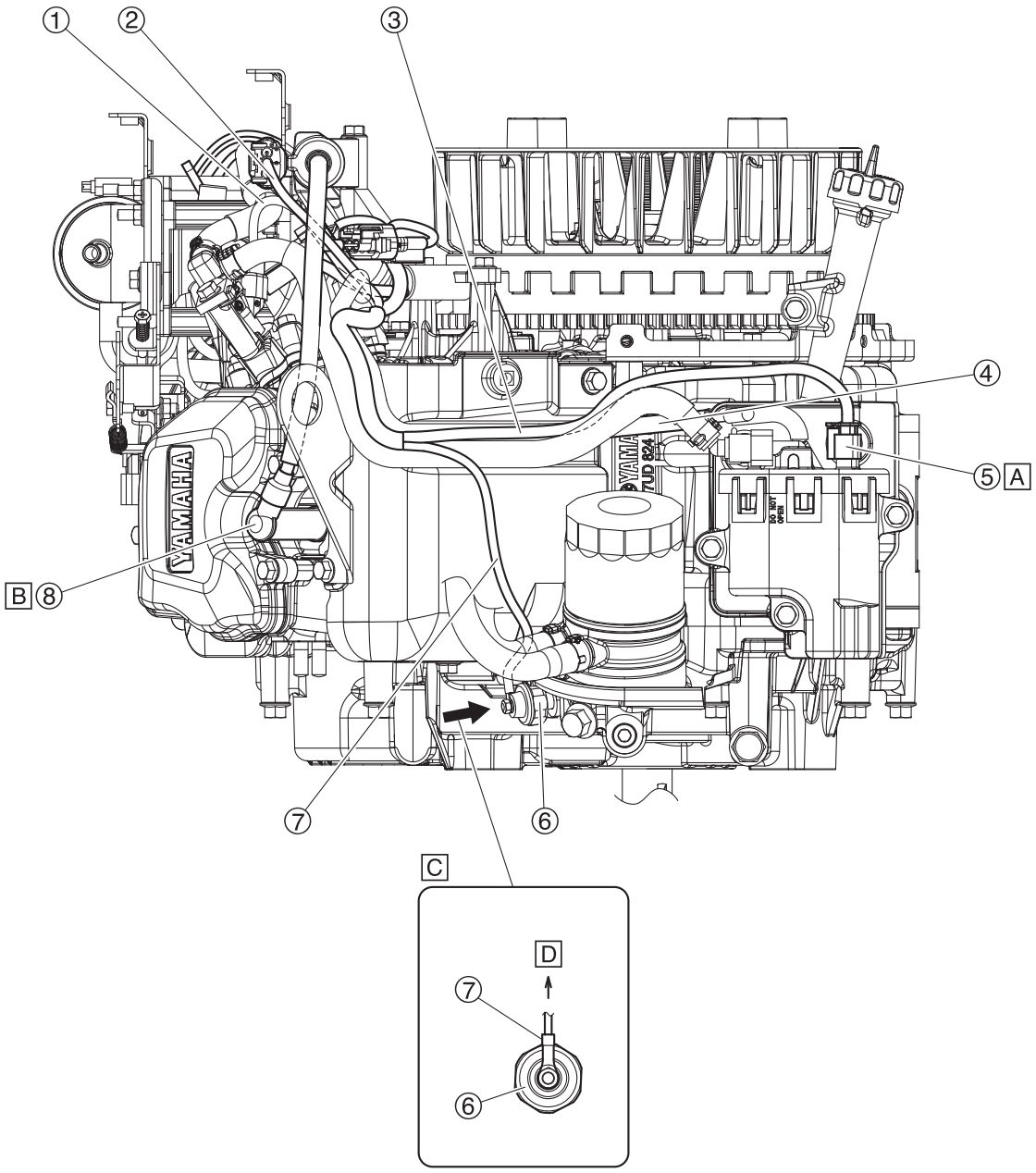
1. Hose clamp
2. Low-pressure fuel pump
3. Fuel delivery hose
4. Fuel injector pipe 1
5. Fuel hose
6. High-pressure fuel pump
7. Fuel filter
8. Plastic locking tie
9. Lead 1
10. Purge hose 1
11. Pulsar hose

A. • Install the air filter case cover as shown in the illustration.
   • The locking claw should be fixed securely to the groove of the case.
B. Insert the hose until it reaches the end as shown in the illustration.
C. Install white painted portion in the direction shown in the illustration.
D. Install the plastic locking tie at the position shown in the illustration.
E. Fuel delivery hose installation details
F. Install with the yellow painted portion on top.
G. The position of the binding area of the plastic locking tie should be on the engine side.
H. Keep the length shown in the illustration to 0–2.0 mm (0–0.08 in) and cut off the end of the plastic locking tie.
I. Pulsar hose installation details
J. Install the yellow painted portion in the direction shown in the illustration.




1. Oil hose 1
2. Oil cooler
3. Hose clamp
4. Oil hose 2
5. Oil filter

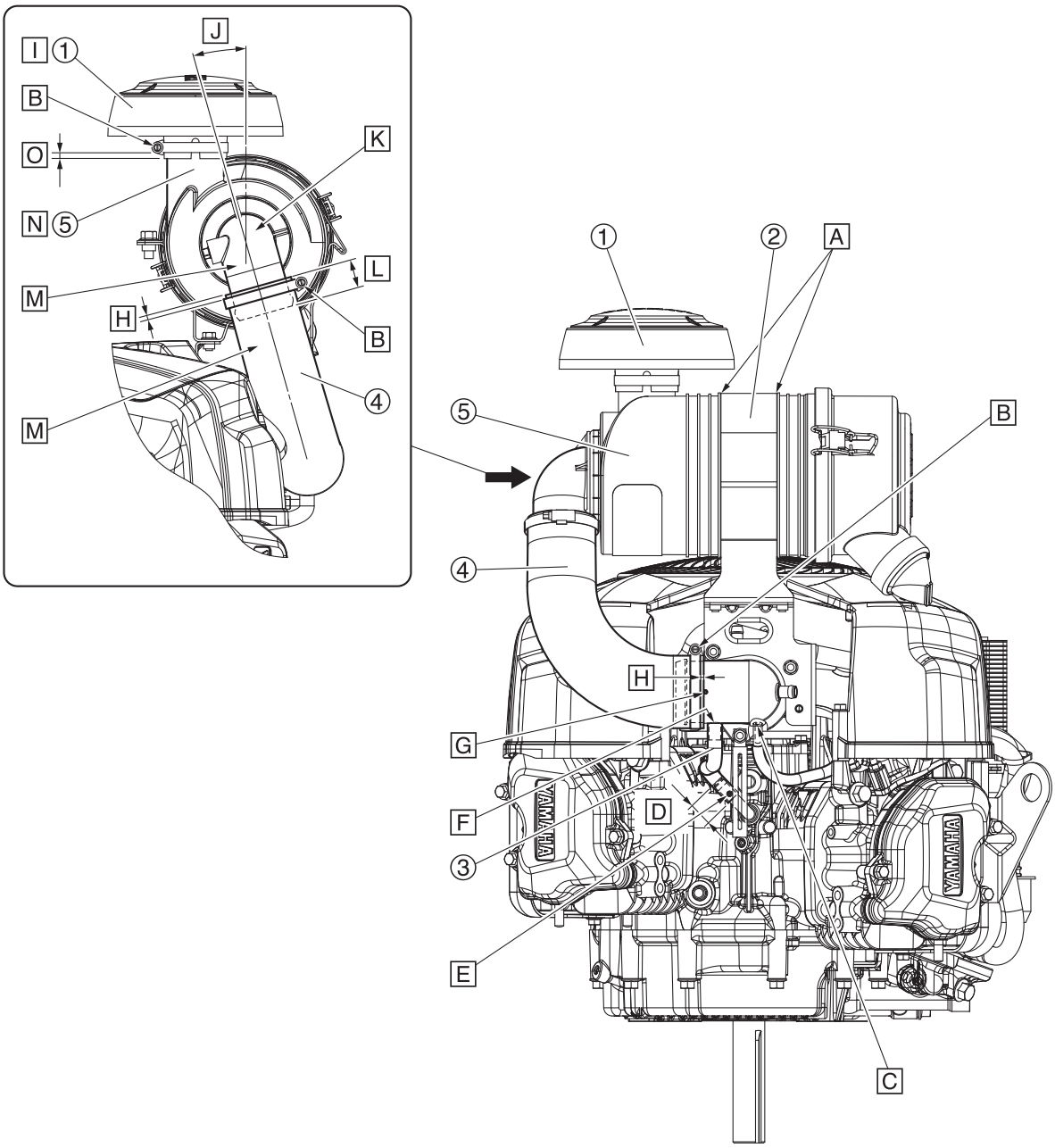
A. Insert the oil hose all the way into the oil cooler.
B. Face the projection inward.
C. Install the white painted portion in the direction shown in the illustration.
D. 8–12 mm (0.31–0.47 in)
E. Install the hose clamp in the direction shown in the illustration.
F. Install the yellow painted portion in the direction shown in the illustration.
G. 2.0–4.0 mm (0.08–0.16 in)
H. Face the projection outward.




1. Fuel injector #2 lead
2. Ignition coil #2 lead
3. High-pressure fuel pump lead
4. Purge hose
5. High-pressure fuel pump coupler
6. Oil pressure switch
7. Oil pressure switch lead
8. Spark plug cap

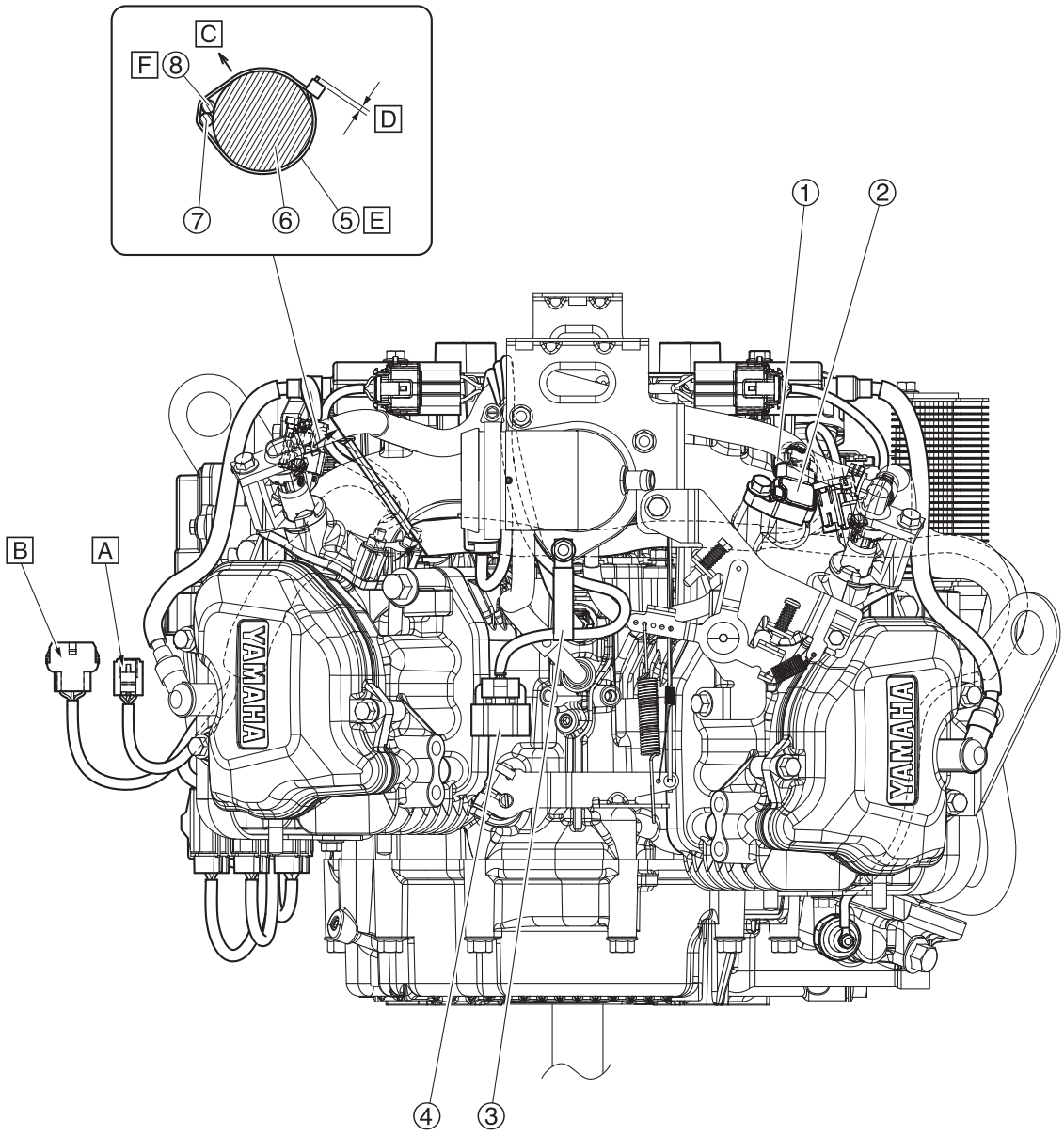
A. The high-pressure fuel pump coupler should be laid along the purge hose.
B. Install the spark plug cap in the direction shown in the illustration.
C. Oil pressure switch lead routing direction
D. Direction of upper surface of the engine

## REAR SIDE VIEW



1. Air filter cover 1
2. Air filter case stay
3. Breather hose
4. Joint 2
5. Air filter case

A. Install the air filter case stay into the groove in the air filter case.
B. Install the screw in the direction shown in the illustration.
C. Insert the protector side of the purge hose 1 all the way into the pipe of the throttle body.
D. 19–21 mm (0.75–0.83 in)
E. Install the white painted portion in the direction shown in the illustration.
F. Insert the breather hose all the way into the pipe of the joint 1.
G. Insert the joint 2 until it contacts the projection on the joint 1.
H. 2.0–4.0 mm (0.08–0.16 in)
I. Insert the air filter cover 1 until it contacts the air filter case.
J. Installation angle of joint 2 15.75° (reference value)
K. Install the joint 2 in the direction shown in the illustration.
L. Insert from 22 mm (0.87 in) until contact is made as shown in the illustration.
M. The air filter case and joint 2 should not be bent or detached due to unreasonable installation.
N. Install the air filter case in the direction shown in the illustration.
O. 5–7 mm (0.20–0.28 in)



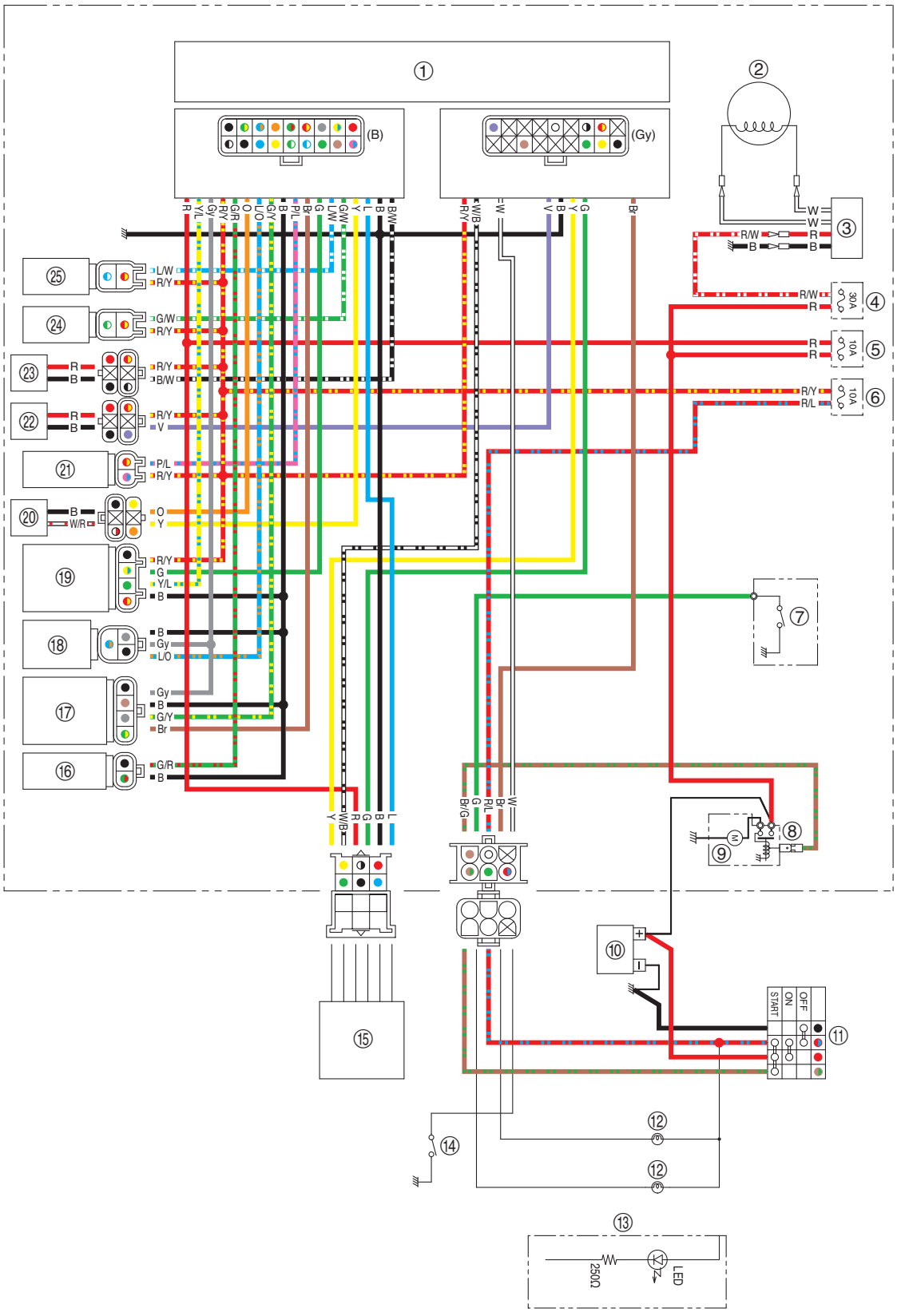

1. Manifold absolute pressure sensor coupler
2. Manifold absolute pressure sensor
3. Clamp
4. $O_2$ sensor coupler
5. Plastic locking tie
6. Inlet manifold
7. Ignition coil #1 lead
8. Fuel injector #1 lead

A. FI diagnostic tool coupler
B. Main switch coupler
C. Direction of upper surface of the engine
D. Allowance 2.0 mm (0.08 in) or less
E. Install the plastic locking tie as shown in the illustration.
F. • Install the leads so that they do not overlap each other.
   • The leads should not interfere with the side of the fan case.

## MEMO

# APPENDIX

## CIRCUIT DIAGRAM



1. ECU (Engine Control Unit)
2. Stator coil assembly
3. Rectifier/regulator
4. Fuse (30 A)
5. Fuse (10 A)
6. Fuse (10 A)
7. Oil pressure switch
8. Starter relay
9. Starter motor
10. Battery
11. Main switch
12. Mil light
13. Oil warning light
14. Rollover switch
15. FI diagnostic tool coupler
16. Engine temperature sensor
17. Manifold absolute pressure sensor
18. Throttle position sensor
19. $O_2$ sensor
20. Crankshaft position sensor
21. High-pressure fuel pump
22. Ignition coil #2
23. Ignition coil #1
24. Fuel injector #1
25. Fuel injector #2

**Color code**

| | | | |
|---|---|---|---|
| B | Black | G/R | Green/Red |
| Br | Brown | G/W | Green/White |
| G | Green | G/Y | Green/Yellow |
| Gy | Gray | L/O | Blue/Orange |
| L | Blue | L/W | Blue/White |
| O | Orange | P/L | Pink/Blue |
| R | Red | R/L | Red/Blue |
| V | Violet | R/W | Red/White |
| W | White | R/Y | Red/Yellow |
| Y | Yellow | W/B | White/Black |
| B/W | Black/White | W/R | White/Red |
| Br/G | Brown/Green | Y/L | Yellow/Blue |

# MEMO

2016.12×1