

**YAMAHA**

**VMX12 '86**  
2EN-ME1

**SERVICE MANUAL**



---

**VMX12  
SERVICE MANUAL**

**© 1986 by Yamaha Motor Co., Ltd.  
1st Edition, March 1986**

**All rights reserved. Any reprinting or  
unauthorized use without the written  
permission of Yamaha Motor Co., Ltd.  
is expressly prohibited.**

**Printed in Japan**

---

## NOTICE

This manual was written by the Yamaha Motor Company primarily for use by Yamaha dealers and their qualified mechanics. It is not possible to put an entire mechanic's education into one manual, so it is assumed that persons using this book to perform maintenance and repairs on Yamaha motorcycles have a basic understanding of the mechanical concepts and procedures inherent in motorcycle repair technology. Without such knowledge, attempted repairs or service to this model may render it unfit to use and/or unsafe.

Yamaha Motor Company, Ltd. is continually striving to improve all models manufactured by Yamaha. Modifications and significant changes in specifications or procedures will be forwarded to all Authorized Yamaha dealers and will, where applicable, appear in future editions of this manual.

TECHNICAL PUBLICATIONS  
SERVICE DIVISION  
MOTORCYCLES OPERATIONS  
YAMAHA MOTOR CO., LTD.

## HOW TO USE THIS MANUAL

### PARTICULARLY IMPORTANT INFORMATION

This material is distinguished by the following notation.

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

**CAUTION:** A **CAUTION** indicates special procedures that must be followed to avoid damage to the motorcycle.

**WARNING:** A **WARNING** indicates special procedures that must be followed to avoid injury to a motorcycle operator or person inspecting or repairing the motorcycle.

### MANUAL FORMAT

All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy to read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and inspection operations.

In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.,

- Bearings  
Pitting/Damage → Replace.

### EXPLODED DIAGRAM

Each chapter provides exploded diagrams before each disassembly section for ease in identifying correct disassembly and assembly procedures.

|   |                                                                                               |  |   |                                                                                               |  |
|---|-----------------------------------------------------------------------------------------------|--|---|-----------------------------------------------------------------------------------------------|--|
| ① | GEN<br>INFO  |  | ② | INSP<br>ADJ  |  |
| ③ | ENG          |  | ④ | COOL         |  |
| ⑤ | CARB         |  | ⑥ | CHAS         |  |
| ⑦ | ELEC         |  | ⑧ | APPX         |  |
| ⑨ |             |  | ⑩ |             |  |
| ⑪ |            |  | ⑫ |            |  |
| ⑬ |            |  | ⑭ |            |  |
| ⑮ |            |  | ⑯ |            |  |
|   |                                                                                               |  | ⑰ |            |  |
| ⑱ |            |  | ⑲ |            |  |
|   |                                                                                               |  | ⑳ |            |  |
| ㉑ |            |  |   |                                                                                               |  |

## ILLUSTRATED SYMBOLS (Refer to the illustration)

Illustrated symbols ① to ⑧ are designed as thumb tabs to indicate the chapter's number and content.

- ① General information
- ② Periodic inspection and adjustment
- ③ Engine
- ④ Cooling system
- ⑤ Carburetion
- ⑥ Chassis
- ⑦ Electrical
- ⑧ Appendices

Illustrated symbols ⑨ to ⑭ are used to identify the specifications appearing in the text.

- ⑨ Filling fluid
- ⑩ Lubricant
- ⑪ Tightening
- ⑫ Wear limit, clearance
- ⑬ Engine speed
- ⑭  $\Omega$ , V, A

Illustrated symbols ⑮ to ㉑ in the exploded diagram indicate grade of lubricant and location of lubrication point.

- ⑮ Apply engine oil
- ⑯ Apply gear oil
- ⑰ Apply molybdenum disulfide oil
- ⑱ Apply wheel bearing grease
- ⑲ Apply lightweight lithium-soap base grease
- ⑳ Apply molybdenum disulfide grease
- ㉑ Apply locking agent (LOCTITE®)

---

# INDEX

|                                         |                                                                                       |
|-----------------------------------------|---------------------------------------------------------------------------------------|
| GENERAL INFORMATION                     |    |
|                                         | GEN INFO <b>1</b>                                                                     |
| PERIODIC INSPECTIONS<br>AND ADJUSTMENTS |    |
|                                         | INSP ADJ <b>2</b>                                                                     |
| ENGINE OVERHAUL                         |    |
|                                         | ENG <b>3</b>                                                                          |
| COOLING SYSTEM                          |    |
|                                         | COOL <b>4</b>                                                                         |
| CARBURETION                             |  |
|                                         | CARB <b>5</b>                                                                         |
| CHASSIS                                 |  |
|                                         | CHAS <b>6</b>                                                                         |
| ELECTRICAL                              |  |
|                                         | ELEC <b>7</b>                                                                         |
| APPENDICES                              |  |
|                                         | APPX <b>8</b>                                                                         |

# CHAPTER 1. GENERAL INFORMATION

|                                     |      |
|-------------------------------------|------|
| <b>MOTORCYCLE IDENTIFICATION</b>    | 1-1  |
| FRAME SERIAL NUMBER                 | 1-1  |
| ENGINE SERIAL NUMBER                | 1-1  |
| <b>IMPORTANT INFORMATION</b>        | 1-2  |
| ALL REPLACEMENT PARTS               | 1-2  |
| GASKETS, OIL SEALS, AND O-RINGS     | 1-2  |
| LOCK WASHERS/PLATES AND COTTER PINS | 1-2  |
| BEARINGS AND OIL SEALS              | 1-2  |
| CIRCLIPS                            | 1-3  |
| <b>SPECIAL TOOLS</b>                | 1-3  |
| FOR TUNE-UP                         | 1-3  |
| FOR ENGINE SERVICE                  | 1-4  |
| FOR CHASSIS SERVICE                 | 1-8  |
| FOR MIDDLE GEAR SERVICE             | 1-9  |
| FOR ELECTRICAL COMPONENTS           | 1-10 |

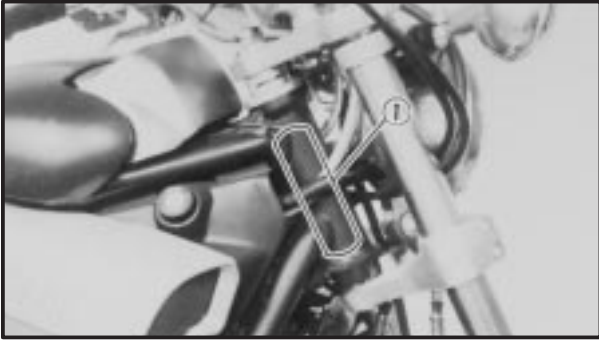




## GENERAL INFORMATION

### MOTORCYCLE IDENTIFICATION FRAME SERIAL NUMBER

The frame serial number ① is stamped into the steering head pipe.



### ENGINE SERIAL NUMBER

The engine serial number ① is stamped into the left side of the engine.

**NOTE:** \_\_\_\_\_

The first three digits of these numbers are for model identifications; the remaining digits are the unit production number.

**Starting Serial Number:**  
**VMX12 ..... 2EN-000101**

**NOTE:** \_\_\_\_\_

Designs and specifications are subject to change without notice.





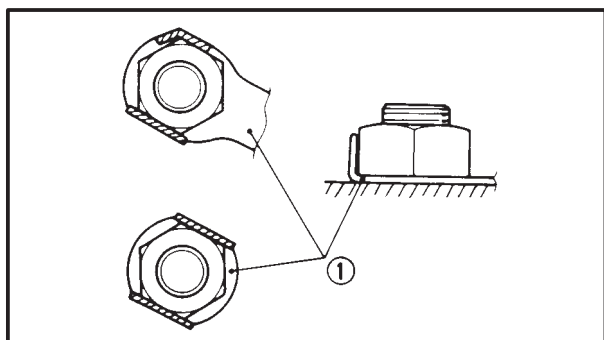
## IMPORTANT INFORMATION

### ALL REPLACEMENT PARTS

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

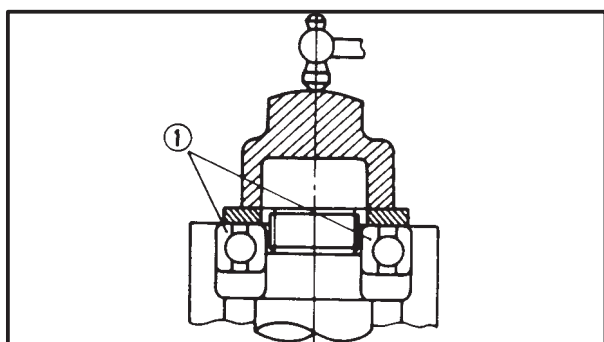
### GASKETS, OIL SEALS, AND O-RINGS

1. All gaskets, seals, and O-rings should be replaced when an engine is overhauled. All gasket 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.



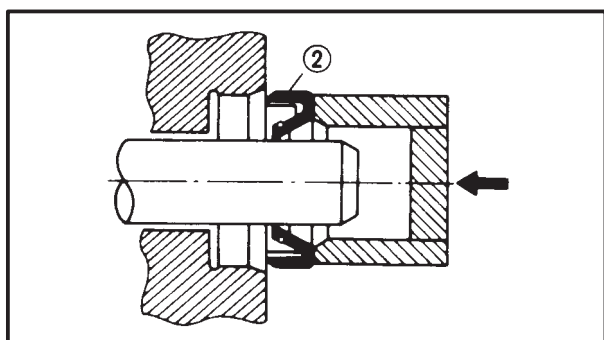
### LOCK WASHERS/PLATES AND COTTER PINS

1. All lock washers/plates ① and cotter pins must be replaced when they are removed. Lock tab(s) should be bent along the bolt or nut flat(s) after the bolt or nut has been properly tightened.



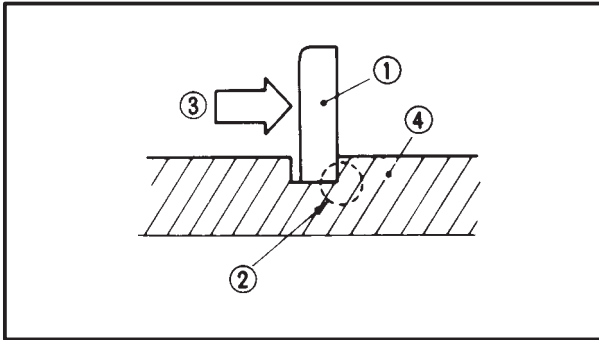
### BEARINGS AND OIL SEALS

1. Install the bearing(s) ① and oil seal(s) ② with their manufacturer'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 light-weight lithium base grease to the seal lip(s). Oil the bearings liberally when installing.



### CAUTION:

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

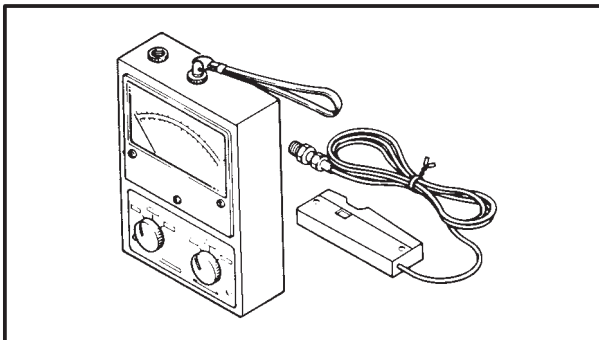
**CIRCLIPS**

1. All circlips should be inspected carefully before reassembly. Always replace piston pin clips after one use. Replace distorted circlips. When installing a circlip ①, make sure that the sharp-edged corner ② is positioned opposite to the thrust ③ it receives. See the sectional view.

④ Shaft

**SPECIAL TOOLS**

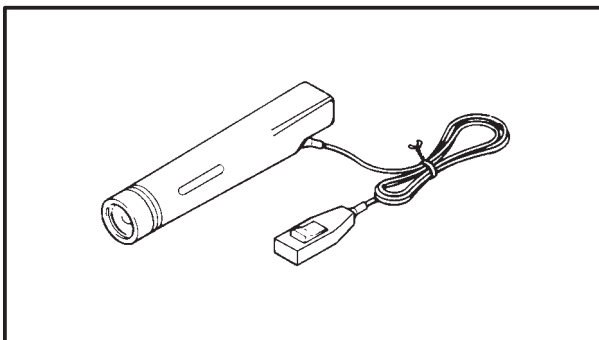
The proper special tools are necessary for complete and accurate tune-up and assembly. Using the correct special tool will help prevent damage caused by the use of improper tools or improvised techniques.

**FOR TUNE UP**

1. Inductive Tachometer

P/N 90890-03113

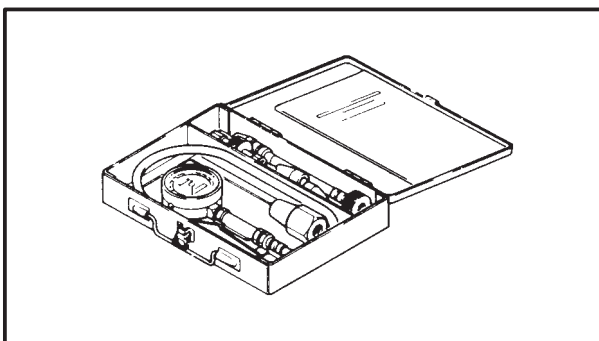
This tool is needed for detecting engine rpm.



2. Inductive Timing Light

P/N 90890-03109

This tool is necessary for checking ignition timing.



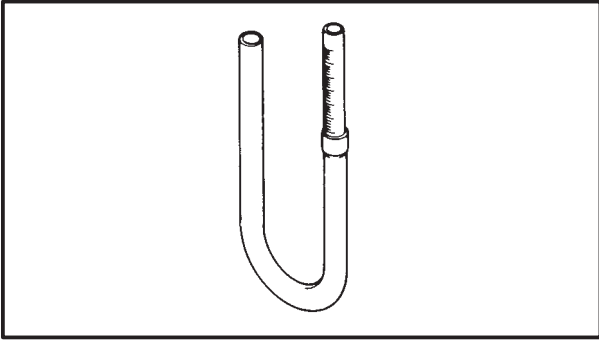
3. Compression Gauge

P/N 90890-03081

This gauge is used to measure the engine compression.

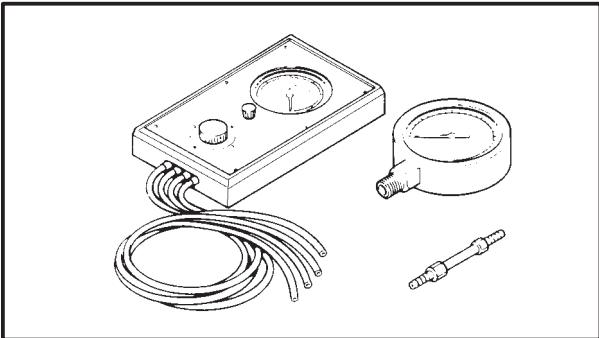
## SPECIAL TOOLS

GEN  
INFO



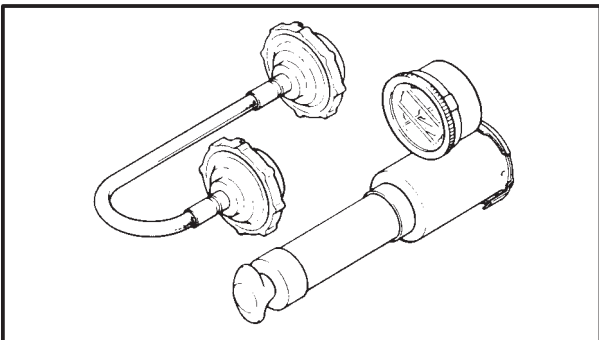
4. Fuel Level Gauge  
P/N 90890-01312

This gauge is used to measure the fuel level in the float chamber.



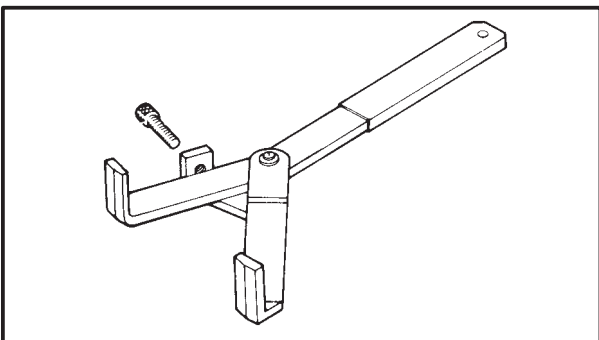
5. Vacuum Gauge  
P/N 90890-03094

This gauge is needed for carburetor synchronization.



6. Radiator Cap Tester  
P/N 90890-01325

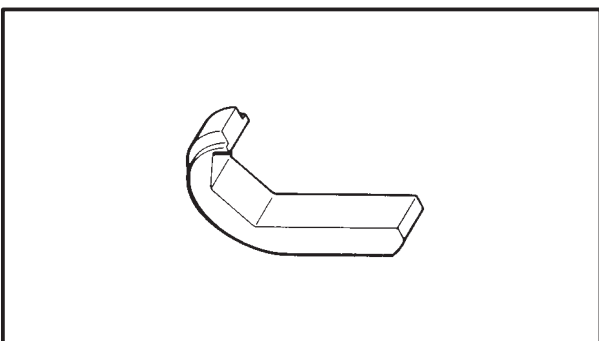
This tester is needed for checking the cooling system.



### FOR ENGINE SERVICE

1. Clutch Holder  
P/N 90890-04086

This tool is used to hold the clutch when removing or installing the clutch boss locknut.

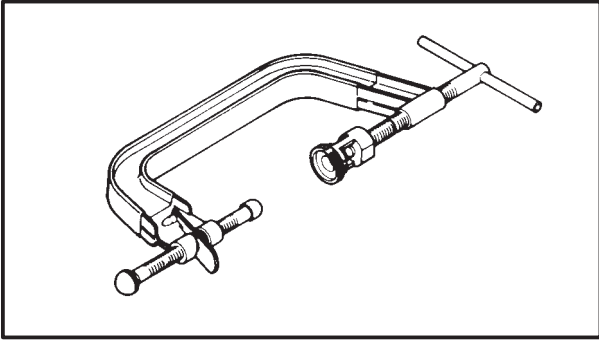


2. Tappet Adjusting Tool  
P/N 90890-04105

This tool is necessary to replace valve adjusting pads.

## SPECIAL TOOLS

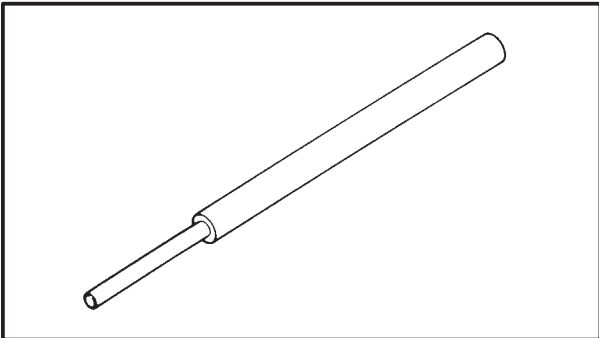
GEN  
INFO



### 3. Valve Spring Compressor

P/N 90890-04019

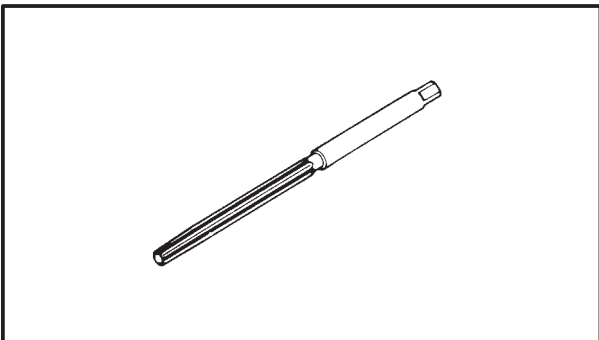
This tool is needed to remove and install the valve assemblies.



### 4. Valve Guide Remover (5.5 mm)

P/N 90890-01122

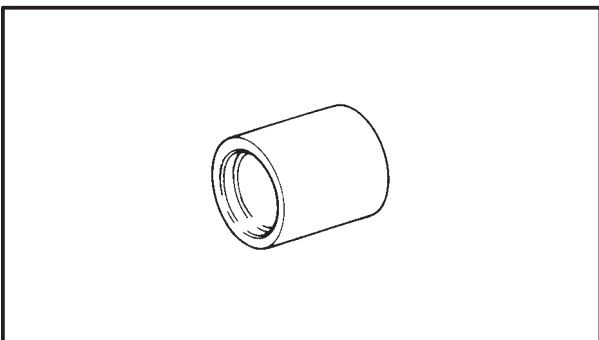
This tool is used to remove the valve guides.



### 5. Valve Guide Reamer (5.5 mm)

P/N 90890-01196

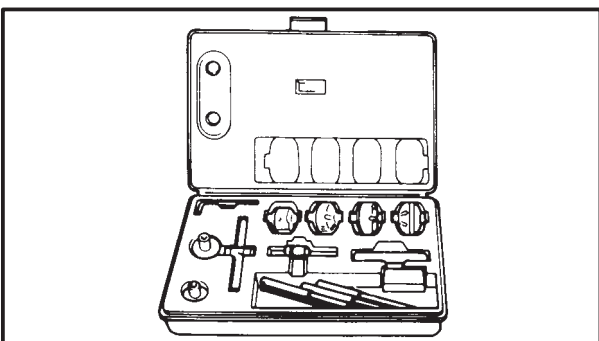
This tool is used to rebores the new valve guide.



### 6. Valve Guide Installer

P/N 90890-04015

This tool is needed to install the valve guides properly.



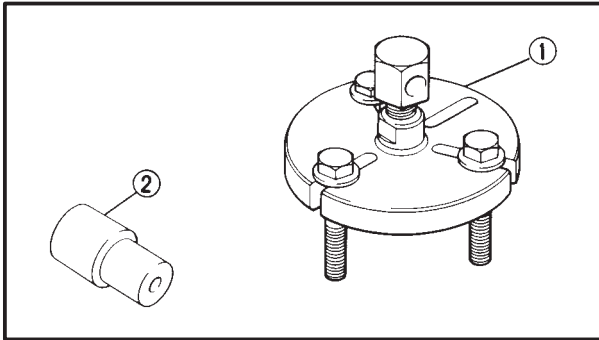
### 7. Valve Seat Cutter Set

P/N YM-91043

This tool is needed to resurface the valve seat.

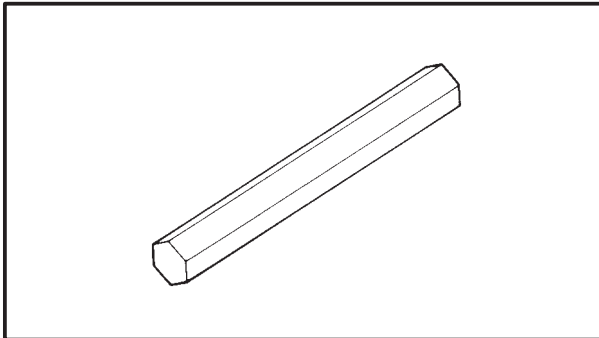
## SPECIAL TOOLS

GEN  
INFO



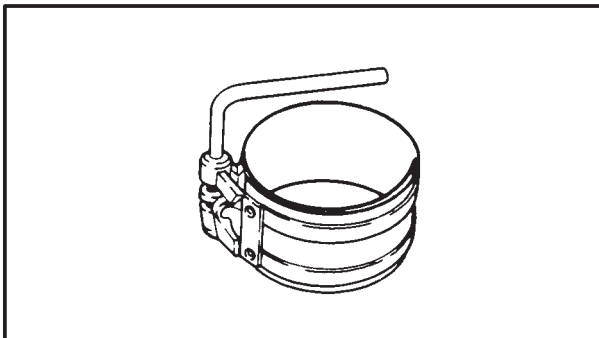
8. Flywheel Puller  
P/N 90890-01362 – ①  
Adapter  
P/N 90890-04089 – ②

These tools are used to remove the flywheel.



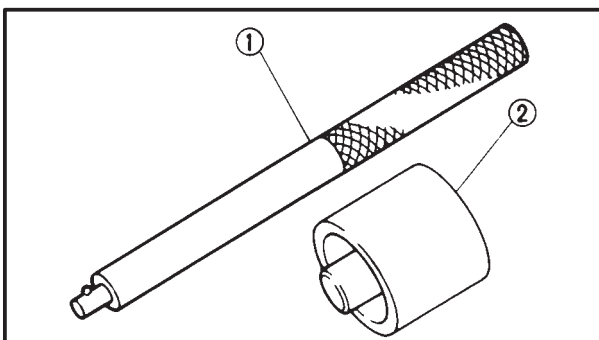
9. 8 mm Wrench Adapter  
P/N 90890-04076

This tool is used to loosen or tighten the cylinder head securing nut.



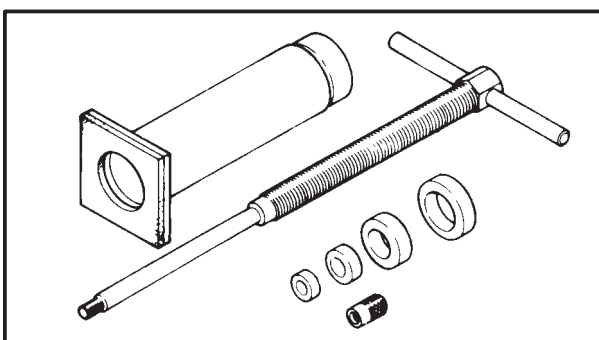
10. Piston Ring Compressor  
P/N 90890-05158

This tool is used when installing the piston into the cylinder.



11. Water Pump Seal Installer  
Handle  
P/N 90890-04058 – ①  
Adapter  
P/N 90890-04078 – ②

This tool is needed for proper installation of the water pump seal.

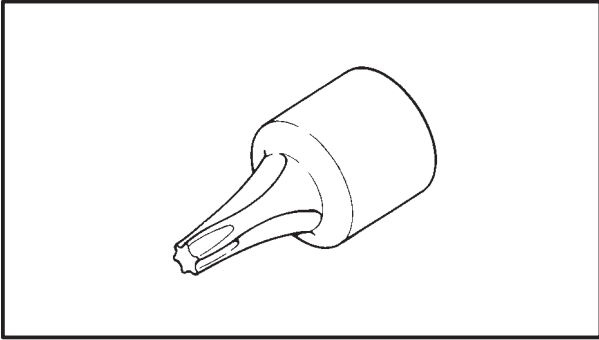


12. Piston Pin Puller  
P/N 90890-01304

This tool is used to remove the piston pin.

## SPECIAL TOOLS

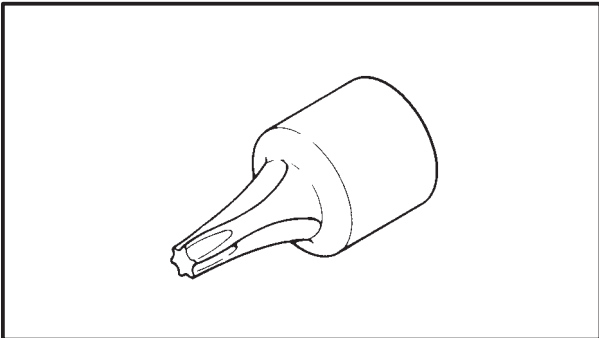
GEN  
INFO



13. #40 Torx Driver

P/N 90890-04049

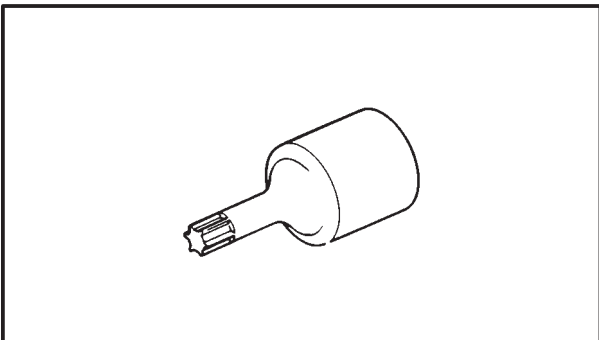
This tool is used to loosen or tighten the middle gear bearing retainer bolt.



14. #30 Torx Driver

P/N YU-29843-6

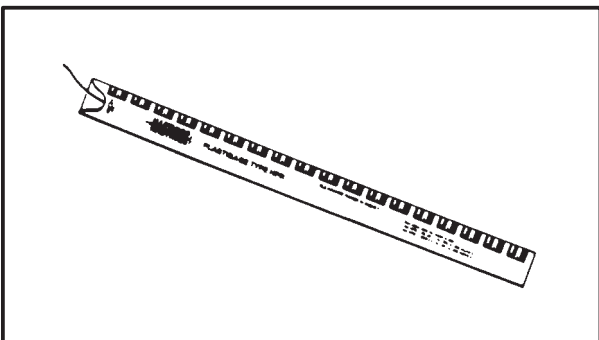
This tool is used to loosen or tighten the drive axle bearing retainer bolt.



15. #25 Torx Driver

P/N YU-29843-4

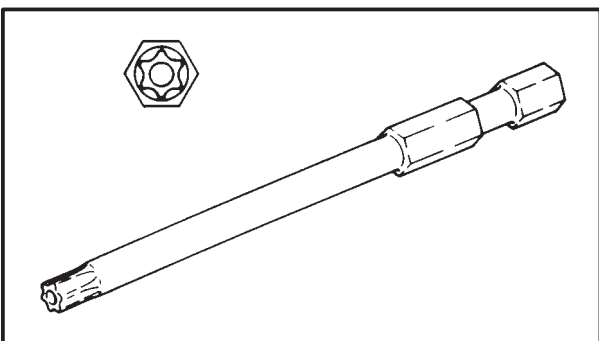
This tool is used to loosen or tighten the shift cam segment securing bolt.



16. Plastigage® Set "Green"

P/N YU-33210

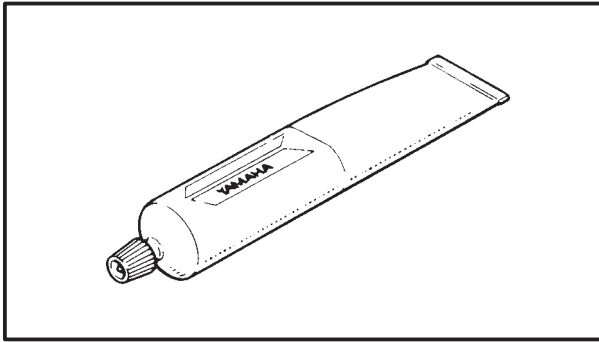
This gauge is needed to measure the clearance for the connecting rod bearing.



17. Special Torx Driver

P/N 90890-05349

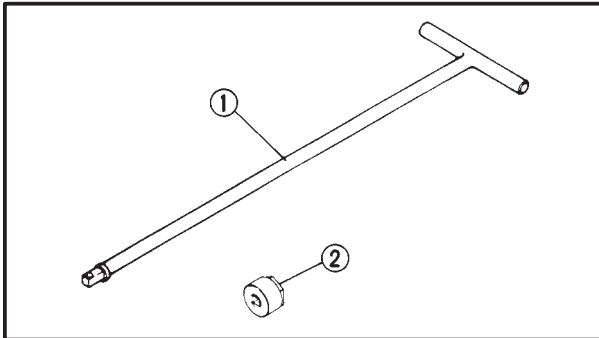
This tool is used when overhauling the carburetors.



### 18. Yamaha Bond No.1215

P/N 90890-85505

This sealant (bond) is used for crankcase mating surfaces, etc.



### FOR CHASSIS SERVICE

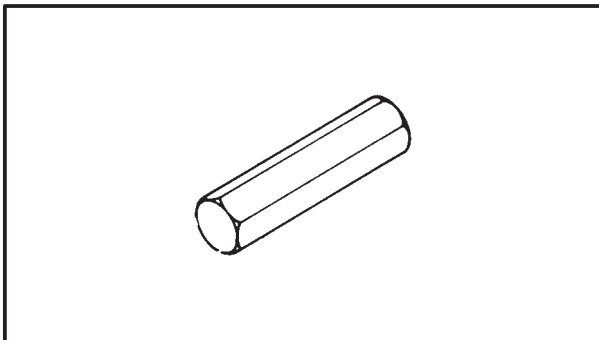
#### 1. T-Handle

P/N 90890-01326 – ①

Damper Rod Holder (24 mm)

P/N 90890-01328 – ②

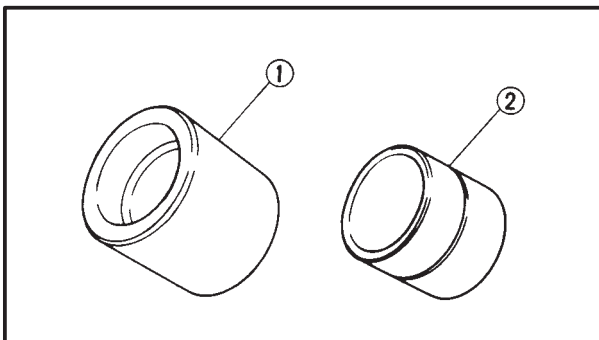
This tool is used to loosen and tighten the front fork cylinder holding bolt.



#### 2. Front Fork Cap Socket (17 mm)

P/N 90890-01104

This tool is needed when loosening and tightening the front fork cap bolt.



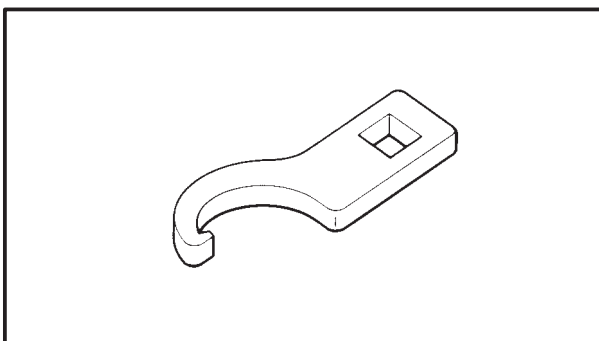
#### 3. Front Fork Seal Driver Weight

P/N 90890-01367 – ①

Adapter (40 mm)

P/N 90890-01373 – ②

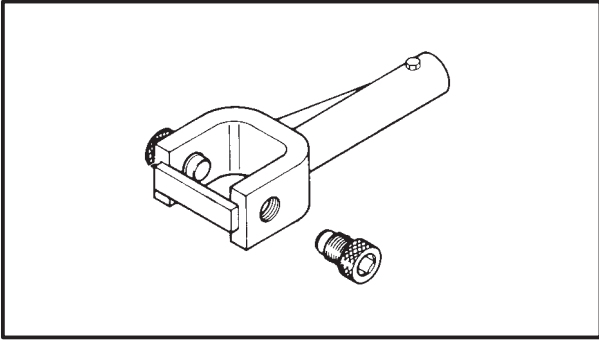
These tools are used when installing the fork seal.



#### 4. Ring Nut Wrench

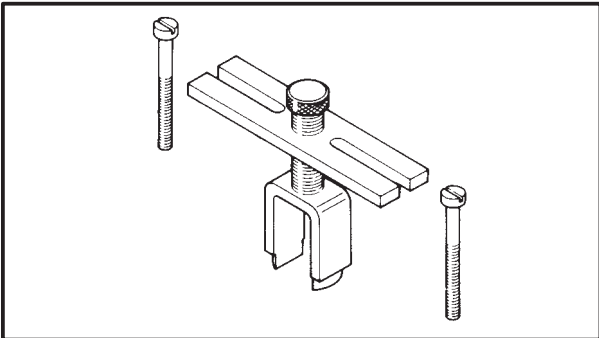
P/N 90890-01403

This tool is used to loosen and tighten the steering ring nut.

**FOR MIDDLE GEAR SERVICE**

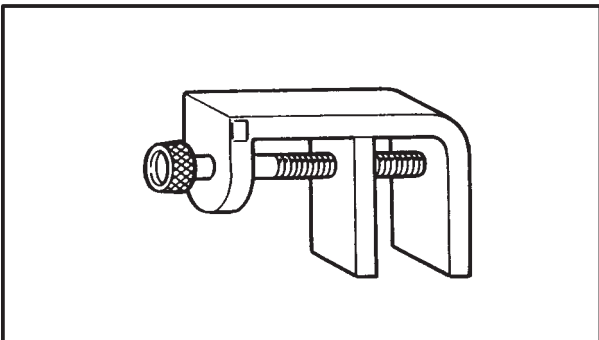
1. Universal Joint Holder  
P/N 90890-04062

This tool is used when adjusting the gear lash in the middle gear.



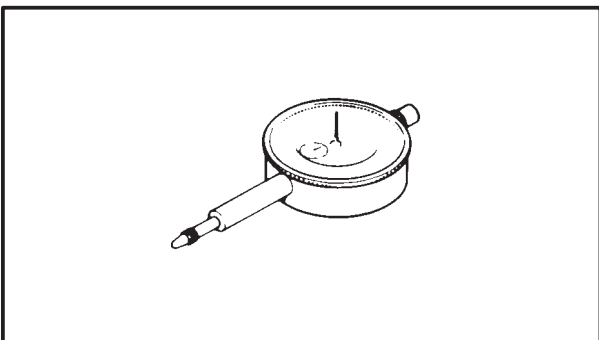
2. Middle Drive Gear Holder  
P/N 90890-04080

This tool is needed when measuring the middle gear lash.



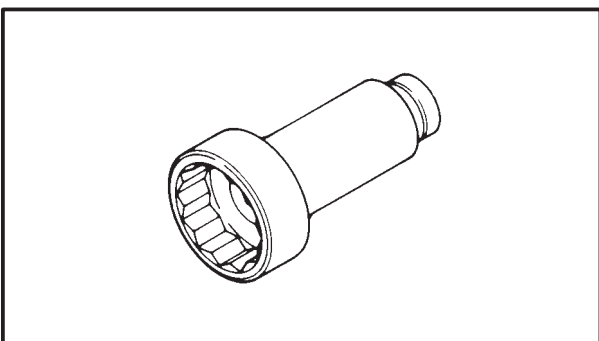
3. Damper Spring Compressor  
P/N 90890-04090

This tool is used to disassemble and reassemble the middle gear damper.



4. Dial Gauge  
P/N 90890-03097

This tool is used to measure the gear lash for the middle gear and final gear.

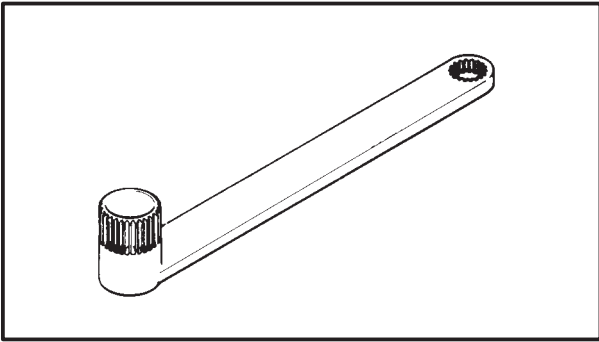


5. 55 mm Offset Wrench  
P/N 90890-04054

This tool is used to loosen and tighten the drive shaft nut.

## SPECIAL TOOLS

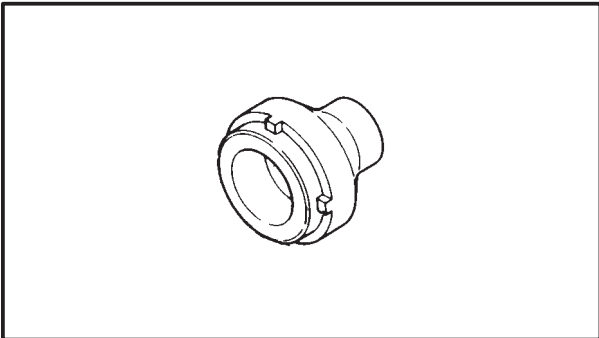
**GEN  
INFO**



### 6. Final Drive Shaft Holder

P/N 90890-01229

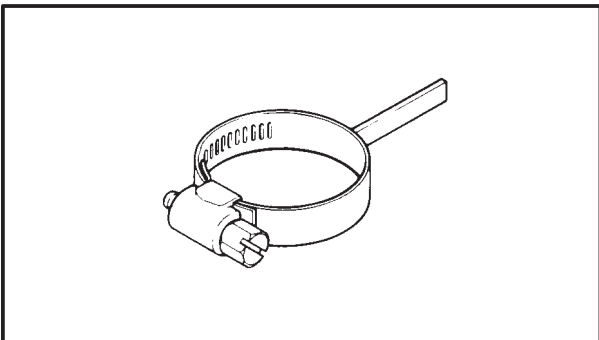
This tool is used when adjusting the gear lash for the final gear.



### 7. Final Drive Shaft Bearing Retainer Wrench

P/N 90890-04050

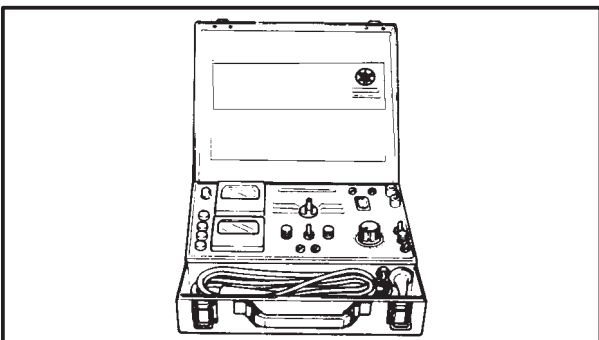
This tool is used to remove and install the bearing retainer.



### 8. Gear Lash Measurement Tool

P/N 90890-01230

This tool is used to measure gear lash.

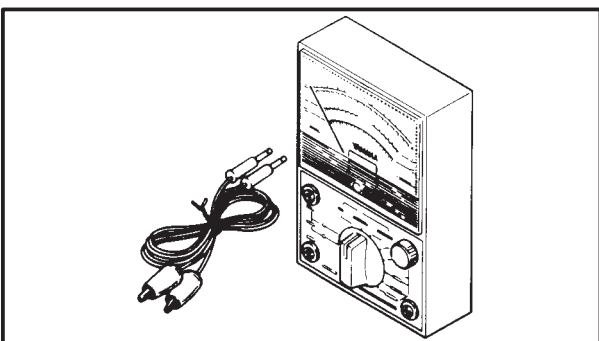


## FOR ELECTRICAL COMPONENTS

### 1. Electro Tester

P/N 90890-03021

This instrument is necessary for checking the ignition system components.



### 2. Pocket Tester

P/N 90890-03112

This instrument is invaluable for checking the electrical system.



## CHAPTER 2. PERIODIC INSPECTIONS AND ADJUSTMENTS

|                                                                                          |      |
|------------------------------------------------------------------------------------------|------|
| <b>INTRODUCTION</b> .....                                                                | 2-1  |
| <b>PERIODIC MAINTENANCE/LUBRICATION INTERVALS</b> .....                                  | 2-1  |
| <b>ENGINE</b> .....                                                                      | 2-3  |
| VALVE CLEARANCE ADJUSTMENT .....                                                         | 2-3  |
| CRANKCASE VENTILATION SYSTEM INSPECTION .....                                            | 2-8  |
| FUEL LINE INSPECTION .....                                                               | 2-8  |
| FUEL FILTER REPLACEMENT .....                                                            | 2-9  |
| INTAKE MANIFOLD INSPECTION .....                                                         | 2-9  |
| EXHAUST SYSTEM INSPECTION .....                                                          | 2-9  |
| CARBURETOR SYNCHRONIZATION .....                                                         | 2-10 |
| IDLING SPEED ADJUSTMENT .....                                                            | 2-12 |
| THROTTLE CABLE ADJUSTMENT .....                                                          | 2-12 |
| ENGINE OIL LEVEL INSPECTION .....                                                        | 2-13 |
| ENGINE OIL REPLACEMENT .....                                                             | 2-13 |
| COOLANT LEVEL INSPECTION .....                                                           | 2-15 |
| COOLING SYSTEM INSPECTION .....                                                          | 2-15 |
| COMPRESSION PRESSURE MEASUREMENT .....                                                   | 2-16 |
| <b>CHASSIS</b> .....                                                                     | 2-17 |
| FINAL GEAR OIL LEVEL INSPECTION .....                                                    | 2-17 |
| FINAL GEAR OIL REPLACEMENT .....                                                         | 2-17 |
| AIR FILTER CLEANING .....                                                                | 2-18 |
| BRAKE FLUID LEVEL INSPECTION .....                                                       | 2-19 |
| FRONT AND REAR BRAKE PAD INSPECTION .....                                                | 2-20 |
| FRONT BRAKE ADJUSTMENT .....                                                             | 2-21 |
| REAR BRAKE ADJUSTMENT .....                                                              | 2-21 |
| CABLE INSPECTION AND LUBRICATION .....                                                   | 2-22 |
| BRAKE AND CHANGE PEDALS/BRAKE AND CLUTCH LEVERS<br>LUBRICATION .....                     | 2-22 |
| CENTERSTAND AND SIDESTAND LUBRICATION .....                                              | 2-22 |
| SWINGARM LUBRICATION .....                                                               | 2-22 |
| FRONT FORK OIL CHANGE .....                                                              | 2-23 |
| FRONT FORK ADJUSTMENT .....                                                              | 2-24 |
| REAR SHOCK ABSORBER ADJUSTMENT .....                                                     | 2-25 |
| RECOMMENDED COMBINATIONS OF THE FRONT FORK<br>AND THE REAR SHOCK ABSORBER SETTINGS ..... | 2-27 |
| STEERING HEAD INSPECTION .....                                                           | 2-27 |
| STEERING HEAD ADJUSTMENT .....                                                           | 2-27 |
| WHEEL BEARINGS CHECK .....                                                               | 2-30 |
| TIRES CHECK .....                                                                        | 2-30 |
| WHEELS CHECK .....                                                                       | 2-33 |

---

|                                     |      |
|-------------------------------------|------|
| <b>ELECTRICAL</b> .....             | 2-33 |
| IGNITION TIMING CHECK .....         | 2-33 |
| BATTERY INSPECTION .....            | 2-34 |
| BRAKE LIGHT SWITCH ADJUSTMENT ..... | 2-36 |
| SPAR PLUG INSPECTION .....          | 2-36 |
| HEADLIGHT BULB REPLACEMENT .....    | 2-37 |
| HEADLIGHT BEAM ADJUSTMENT .....     | 2-38 |
| FUSE INSPECTION .....               | 2-38 |



## PERIODIC INSPECTIONS AND ADJUSTMENTS

### INTRODUCTION

This chapter includes all information necessary to perform recommended inspections and adjustments.

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

### PERIODIC MAINTENANCE/LUBRICATION INTERVALS

Unit: km (miles)

| Item                 | Remarks                                                                                                                 | Break-in<br>1,000 (600) | EVERY                           |                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------|-----------------------------------|
|                      |                                                                                                                         |                         | 6,000<br>(4,000) or<br>6 months | 12,000<br>(8,000) or<br>12 months |
| Valve(s)*            | Check valve clearance. Adjust if necessary.                                                                             | ○                       |                                 | ○                                 |
| Spark plug(s)        | Check condition. Clean or replace if necessary.                                                                         | ○                       | ○                               | ○                                 |
| Air filter           | Clean. Replace if necessary.                                                                                            |                         | ○                               | ○                                 |
| Carburetor*          | Check idle speed/synchronization/starter operation. Adjust if necessary.                                                | ○                       | ○                               | ○                                 |
| Fuel line*           | Check fuel hose (and vacuum pipe) for cracks or damage. Replace if necessary.                                           |                         | ○                               | ○                                 |
| Fuel filter*         | Check condition. Replace if necessary.                                                                                  |                         |                                 | ○                                 |
| Engine oil           | Replace (Warm engine before draining). See NOTE.                                                                        | ○                       |                                 | ○                                 |
| Engine oil filter*   | Replace.                                                                                                                | ○                       |                                 | ○                                 |
| Final gear oil       | Check oil level/oil leakage.<br>Replace every 24,000 (16,000) or 24 months.                                             | Replace                 | ○                               | ○                                 |
| Brake*               | Check operation/fluid leakage/See NOTE.<br>Correct if necessary.                                                        |                         | ○                               | ○                                 |
| Clutch*              | Check operation/fluid leakage/See NOTE.<br>Correct if necessary.                                                        |                         | ○                               | ○                                 |
| Rear arm pivot*      | Check rear arm assembly for looseness.<br>Correct if necessary. Moderately repack every 24,000 (16,000) or 24 months.** |                         |                                 | ○                                 |
| Wheels*              | Check balance/damage/runout.<br>Repair if necessary.                                                                    |                         | ○                               | ○                                 |
| Wheel bearings*      | Check bearings assembly for looseness/damage.<br>Replace if damaged.                                                    |                         | ○                               | ○                                 |
| Steering bearing*    | Check bearings assembly for looseness.<br>Correct if necessary. Moderately repack every 24,000 (16,000) or 24 months.** | ○                       |                                 | ○                                 |
| Front forks*         | Check operation/oil leakage. Repair if necessary.                                                                       |                         | ○                               | ○                                 |
| Rear shock absorber* | Check operation/oil leakage. Repair if necessary.                                                                       |                         | ○                               | ○                                 |
| Cooling system       | Check coolant leakage. Repair if necessary.<br>Replace coolant every 24,000 (16,000) or 24 months.                      |                         | ○                               | ○                                 |

# PERIODIC MAINTENANCE/LUBRICATION INTERVALS

INSP  
ADJ



| Item                  | Remarks                                                                                    | Break-in<br>1,000 (600) | EVERY                           |                                   |
|-----------------------|--------------------------------------------------------------------------------------------|-------------------------|---------------------------------|-----------------------------------|
|                       |                                                                                            |                         | 6,000<br>(4,000) or<br>6 months | 12,000<br>(8,000) or<br>12 months |
| Fittings/Fasteners*   | Check all chassis fittings and fasteners.<br>Correct if necessary.                         | ○                       | ○                               | ○                                 |
| Center and sidestand* | Check operation. Repair if necessary.                                                      | ○                       | ○                               | ○                                 |
| Battery*              | Check specific gravity. Check breather pipe for<br>proper operation. Correct if necessary. |                         | ○                               | ○                                 |

\* : It is recommended that these items be serviced by a Yamaha dealer.

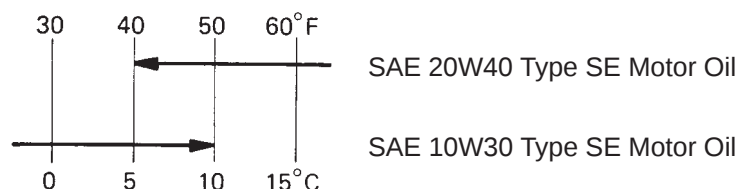
\*\* : Medium weight wheel bearing grease.

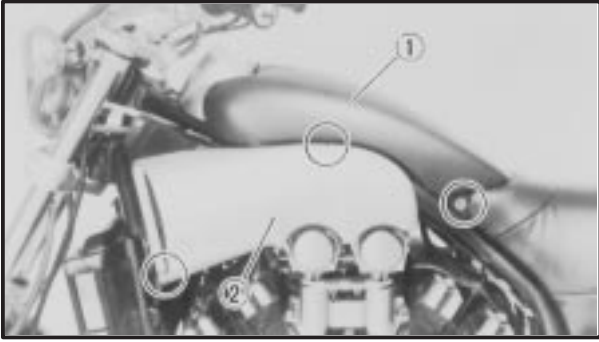
## NOTE:

### • Brake fluid replacement (brake and clutch):

- 1) When disassembling the master cylinder or caliper cylinder, replace the brake fluid. Normally check the brake fluid level and add the fluid as required.
- 2) On the inner parts of the master cylinder and caliper cylinder, replace the oil seals every two years.
- 3) Replace the brake (clutch) hoses every four years, or it cracked or damaged.

### • Engine oil:





## ENGINE

### VALVE CLEARANCE ADJUSTMENT

#### Removal

##### 1. Remove:

- Top cover ①
- Covers (left and right) ②

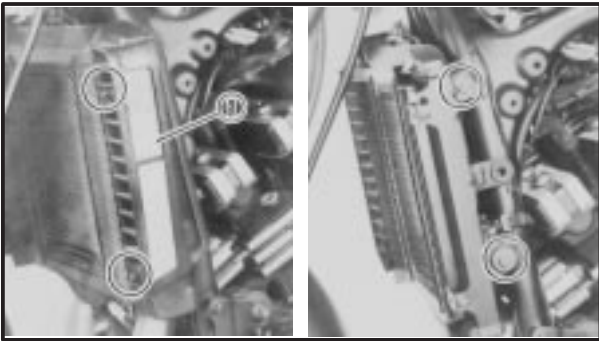


##### 2. Remove:

- Electrical components board ①

##### 3. Disconnect:

- All electrical component leads

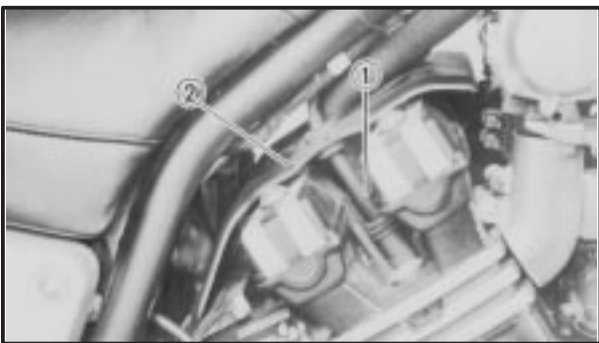


##### 4. Remove:

- Side covers (radiator) ①
- Bolts (radiator)

#### NOTE:

It is not necessary to remove the radiator completely from the motorcycle.



##### 5. Disconnect:

- Spark plug caps ①

##### 6. Remove:

- Air baffle plate (rear) ②



##### 7. Remove:

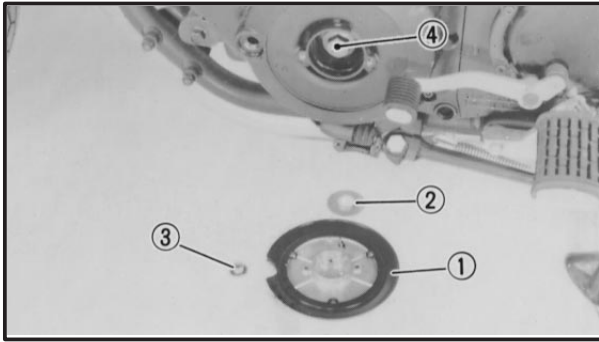
- Cylinder head covers

#### NOTE:

Be sure you do not lose the oil plugs ① on the camshaft caps.

## VALVE CLEARANCE ADJUSTMENT

**INSP  
ADJ**

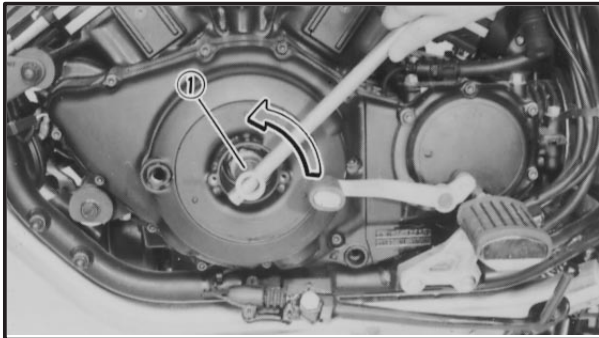


8. Remove:

- Crankcase cover plate ①
- Special washer ②
- Timing plug ③

**NOTE:**

Check for clog of oil passage ④ in the bolt.  
If any, clean the oil passage.



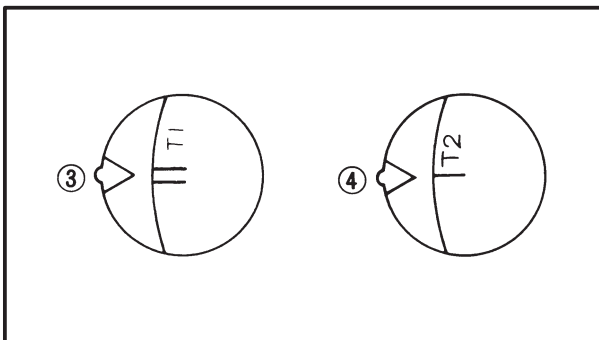
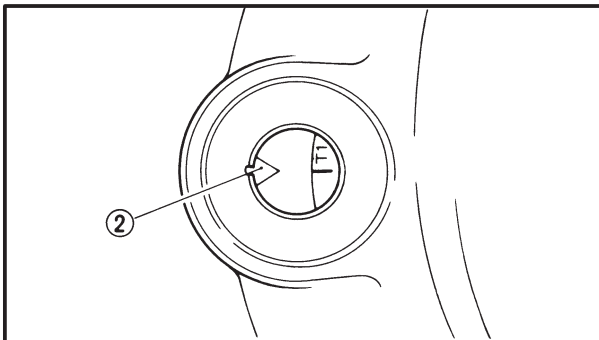
### Inspection and Adjustment

1. Measure:

- Valve clearance

**NOTE:**

Be sure piston is at Top Dead Center (TDC)  
when measuring clearance.



### Valve Clearance measurement steps:

- Turn the crankshaft counterclockwise with a 32 mm (1.26 in) socket wrench ①.

**NOTE:**

Valve clearance must be measured when the  
engine is cool to the touch.

- Align the "T<sub>1</sub>" mark (for the No.1 cylinder) on the flywheel with the stationary pointer ② on the crankcase cover. When the "T<sub>1</sub>" mark is aligned with the stationary pointer ②, the piston is at top dead center TDC.
- Note marks on flywheel to obtain correct valve clearance measurements.

③ TDC for No.1 cylinder

④ TDC for No.2 cylinder

- Measure the valve clearance using a Feeler Gauge ⑤.
- Record the measured amount if the clearance is incorrect.



**Intake Valve (cold):**

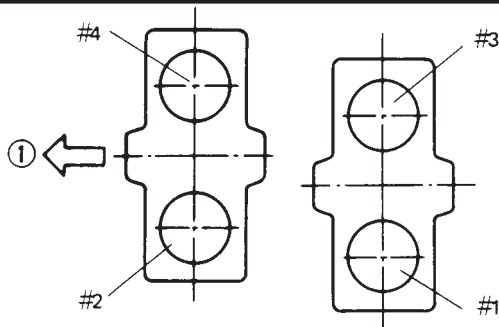
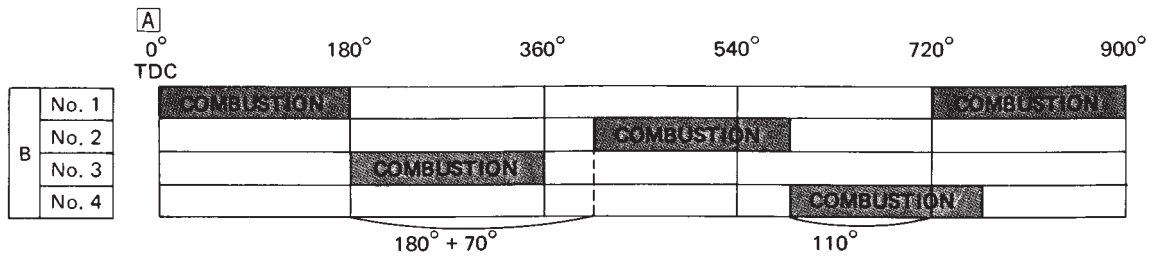
**0.11 ~ 0.15 mm**  
**(0.004 ~ 0.006 in)**

**Exhaust Valve (cold):**

**0.26 ~ 0.30 mm**  
**(0.010 ~ 0.012 in)**

# VALVE CLEARANCE ADJUSTMENT

INSP  
ADJ



A Crankshaft degree

B Cylinder

- Measure the valve clearance, in sequence, for No.3, 4, and No.2 cylinders.
- Out of specification → Adjust clearance.

① Front

**Firing Sequence:**

**1 - 3 - 4 - 2**

2. Adjust:

- Valve clearance

## Valve clearance adjustment steps:

- Position the valve lifter slots (intake and exhaust side) opposite each other.
- Install the Tappet Adjusting Tool ① (90890-04105) onto the camshaft ②.

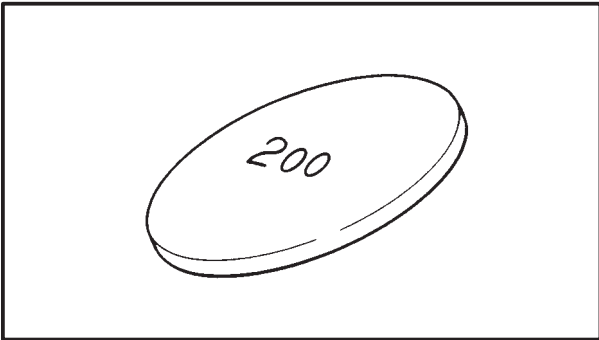
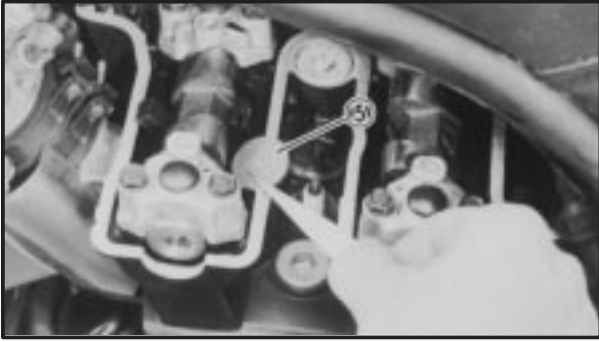
- Turn the crankshaft until the lobe of the tool ① depresses the valve lifters ③.

④ Cylinder head

⑤ Pad

## VALVE CLEARANCE ADJUSTMENT

**INSP**  
**ADJ**



- Remove the pads ⑤ from the lifters. Use a small screwdriver and a magnetic rod for removal.
- Note pad numbers.
- Select the proper valve adjusting pad from the chart below:

| Pad range            |                                                   | Pad Availability:<br>25 increments                  |
|----------------------|---------------------------------------------------|-----------------------------------------------------|
| No. 200 ~<br>No. 320 | 200 mm<br>(0.079 in)<br>~<br>320 mm<br>(0.130 in) | Pads stepped in<br>0.05 mm (0.002 in)<br>increments |

### NOTE:

The thickness of each pads is marked on the pad face that contacts the valve lifter (not the cam).

- Round off the hundredths digit of the original pad number to the nearest 0.05 mm increment.

| Hundredths digit | Rounded valve     |
|------------------|-------------------|
| 0 or 2           | 0                 |
| 5                | (NOT ROUNDED OFF) |
| 8                | 10                |

### EXAMPLE:

Original pad number = 258 (2.58 mm)

Rounded off digit = 260

### NOTE:

Pads can only be selected in 0.05 mm (0.002 in) increments.

- Locate the "Installed Pad Number" on the chart, and then find the measured valve clearance. The point where these coordinates intersect is the new pad number.

### NOTE:

Use the new pad number as a guide only as the number must be verified.

### Pad number verification steps:

- Install the new pad with the number down.
- Remove the adjusting tool.
- Recheck the valve clearance.
- If the clearance is incorrect, repeat all of the clearance adjustment steps until the proper clearance is obtained.

# VALVE CLEARANCE ADJUSTMENT

INSP  
ADJ



## INTAKE

| [B]<br>MEASURED<br>CLEARANCE | [A] INSTALLED PAD NUMBER |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
|------------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|--|--|
|                              | 200                      | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |  |  |  |  |  |
| 0.00 ~ 0.05                  |                          |     | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |  |  |  |  |  |
| 0.06 ~ 0.10                  |                          | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |  |  |  |  |  |
| 0.11 ~ 0.15                  |                          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.16 ~ 0.20                  | 205                      | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |  |  |  |  |  |
| 0.21 ~ 0.25                  | 210                      | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |  |  |  |  |  |
| 0.26 ~ 0.30                  | 215                      | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |  |  |  |  |  |
| 0.31 ~ 0.35                  | 220                      | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |  |  |  |  |  |
| 0.36 ~ 0.40                  | 225                      | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.41 ~ 0.45                  | 230                      | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.46 ~ 0.50                  | 235                      | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.51 ~ 0.55                  | 240                      | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.56 ~ 0.60                  | 245                      | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.61 ~ 0.65                  | 250                      | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.66 ~ 0.70                  | 255                      | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.71 ~ 0.75                  | 260                      | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.76 ~ 0.80                  | 265                      | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.81 ~ 0.85                  | 270                      | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.86 ~ 0.90                  | 275                      | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.91 ~ 0.95                  | 280                      | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 0.96 ~ 1.00                  | 285                      | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 1.10 ~ 1.05                  | 290                      | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 1.06 ~ 1.10                  | 295                      | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 1.11 ~ 1.15                  | 300                      | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 1.16 ~ 1.20                  | 305                      | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 1.21 ~ 1.25                  | 310                      | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 1.26 ~ 1.30                  | 315                      | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |
| 1.31 ~ 1.35                  | 320                      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |

VALVE CLEARANCE (cold):

0.11 ~ 0.15 mm (0.004 ~ 0.006 in)

Example: Installed is 250

Measured clearance is 0.32 mm (0.013 in)

Replace 250 pad with 270 pad

\*Pad number: (example)

Pad No.250 = 2.50 mm (0.098 in)

Pad No.255 = 2.55 mm (0.100 in)

Always install pad with number down.

## EXHAUST

| [B]<br>MEASURED<br>CLEARANCE | [A] INSTALLED PAD NUMBER |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
|------------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|--|
|                              | 200                      | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |  |  |  |  |
| 0.00 ~ 0.05                  |                          |     |     | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |  |  |  |  |
| 0.06 ~ 0.10                  |                          |     | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |  |  |  |  |
| 0.11 ~ 0.15                  |                          | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |  |  |  |  |
| 0.16 ~ 0.20                  |                          |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.21 ~ 0.25                  | 205                      | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |  |  |  |  |
| 0.26 ~ 0.30                  | 210                      | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |  |  |  |  |
| 0.31 ~ 0.35                  | 215                      | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |  |  |  |  |
| 0.36 ~ 0.40                  | 220                      | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |  |  |  |  |
| 0.41 ~ 0.45                  | 225                      | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.46 ~ 0.50                  | 230                      | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.51 ~ 0.55                  | 235                      | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.56 ~ 0.60                  | 240                      | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.61 ~ 0.65                  | 245                      | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.66 ~ 0.70                  | 250                      | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.71 ~ 0.75                  | 255                      | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.76 ~ 0.80                  | 260                      | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.81 ~ 0.85                  | 265                      | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.86 ~ 0.90                  | 270                      | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.91 ~ 0.95                  | 275                      | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 0.96 ~ 1.00                  | 280                      | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.10 ~ 1.05                  | 285                      | 290 | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.06 ~ 1.10                  | 290                      | 295 | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.11 ~ 1.15                  | 295                      | 300 | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.16 ~ 1.20                  | 300                      | 305 | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.21 ~ 1.25                  | 305                      | 310 | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.26 ~ 1.30                  | 310                      | 315 | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.31 ~ 1.35                  | 315                      | 320 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |
| 1.36 ~ 1.40                  | 320                      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |

VALVE CLEARANCE (cold):

0.26 ~ 0.30 mm (0.010 ~ 0.012 in)

Example: Installed is 250

Measured clearance is 0.32 mm (0.013 in)

Replace 250 pad with 265 pad

\*Pad number: (example)

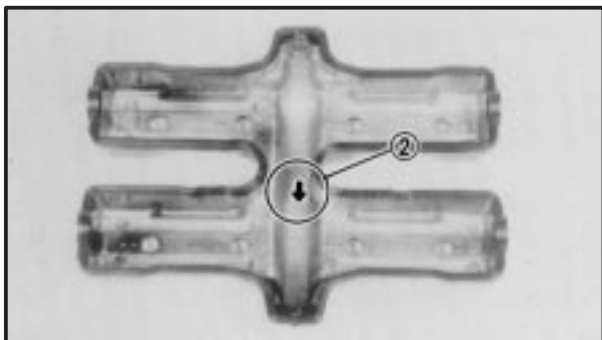
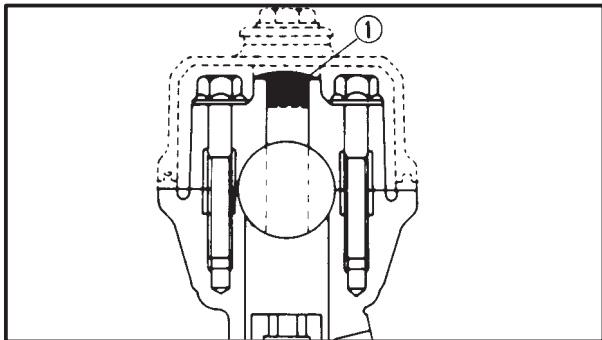
Pad No.250 = 2.50 mm (0.098 in)

Pad No.255 = 2.55 mm (0.100 in)

Always install pad with number down.

## CRANKCASE VENTILATION SYSTEM INSPECTION/ FUEL LINE INSPECTION

**INSP  
ADJ**



### Assembly

When installing the top cover, reverse the removal procedure. Note the following points.

#### 1. Install:

- Cylinder head covers

#### NOTE:

- Be sure all cam caps are covered with oil plug ①.
- Arrow mark ② on the cover should face toward the exhaust side.
- Inspect the head cover gasket and replace it if damaged.

#### 2. Tighten:

- Bolts (cylinder head cover)



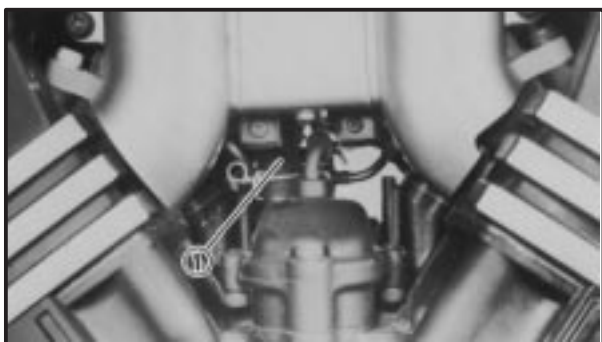
**Bolts (Cylinder Head Cover):**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

#### 3. Tighten:

- Bolts (radiator)



**Bolts (Radiator):**  
7 Nm (0.7 m•kg, 5.1 ft•lb)



## CRANKCASE VENTILATION SYSTEM INSPECTION

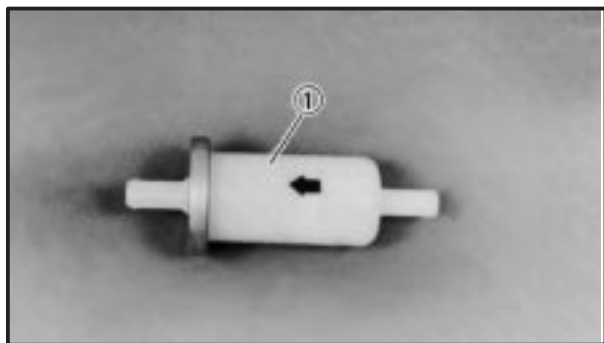
#### 1. Inspect:

- Crankcase ventilation hose ①  
Cracks/Damage → Replace.

## FUEL LINE INSPECTION

#### 1. Inspect:

- Fuel hoses
- Vacuum lines  
Cracks/Damage → Replace.



### FUEL FILTER REPLACEMENT

1. Remove:
  - Seat
  - Bracket
  - Fuel filter ①
2. Inspect:
  - Fuel filter
  - Dirty/Damage → Replace.
3. Install:
  - Components in above list (step “1”)

### INTAKE MANIFOLD INSPECTION

1. Tighten:
  - Carburetor clamps
  - Carburetor joint bolts
  - Carburetor joint nuts
2. Inspect:
  - Carburetor joint
  - Gaskets
  - Cracks/Damage → Replace.

### EXHAUST SYSTEM INSPECTION

1. Inspect:
  - Exhaust pipe
  - Muffler clamp gasket(s)
  - Damage → Replace.
2. Tighten:
  - Exhaust pipe bolts
  - Muffler bolts



**Exhaust Pipe Joint:**  
7 Nm (0.7 m•kg, 5.1 ft•lb)

**Exhaust Pipe Flange:**  
20 Nm (2.0 m•kg, 14 ft•lb)

**Muffler Clamp:**  
20 Nm (2.0 m•kg, 14 ft•lb)

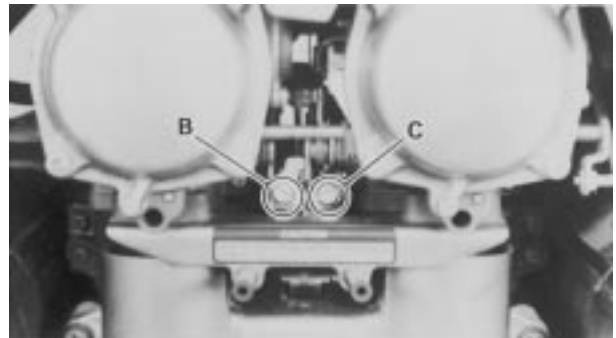
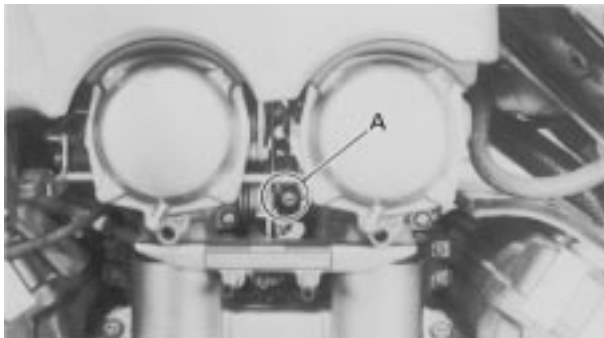
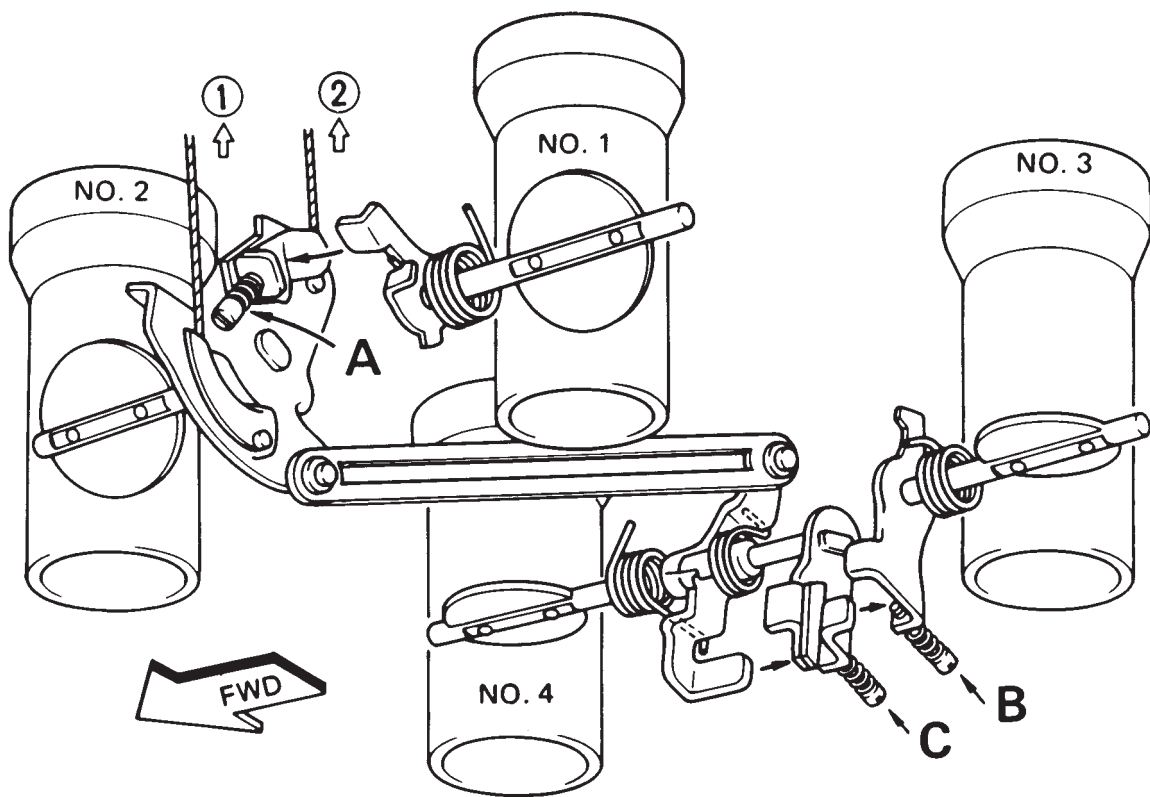


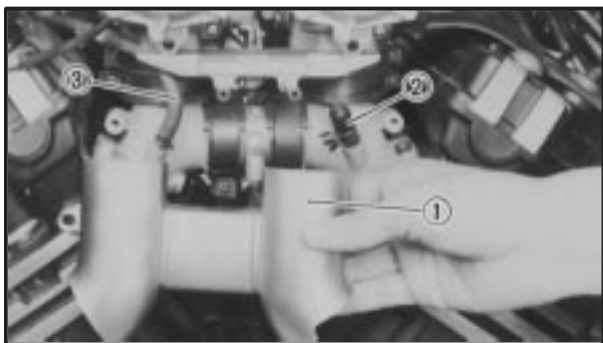
### CARBURETOR SYNCHRONIZATION

**NOTE:**

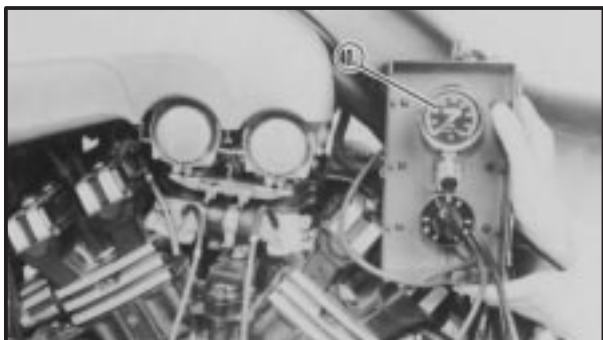
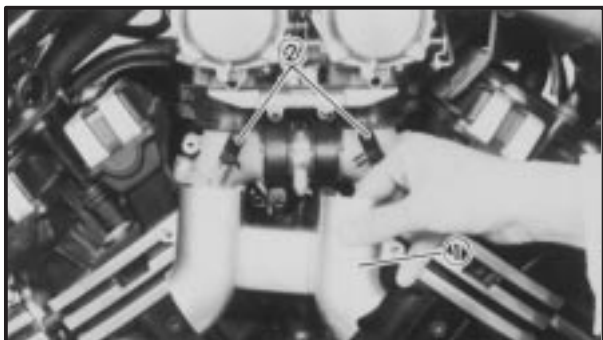
Valve clearance must be set properly before synchronizing the carburetors.

- ① OPEN
- ② CLOSE

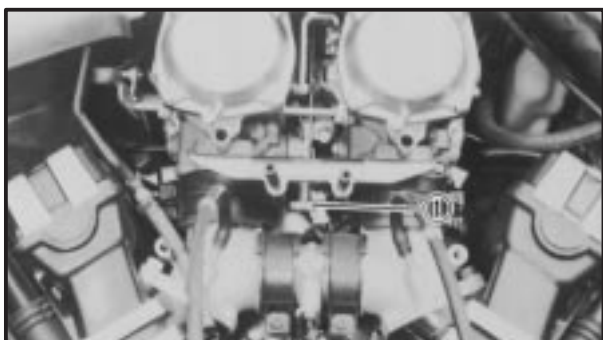




1. Remove:
  - Carburetor joint covers (left and right) ①
  - Vacuum plugs (left and right) ②
  - Vacuum hose ③



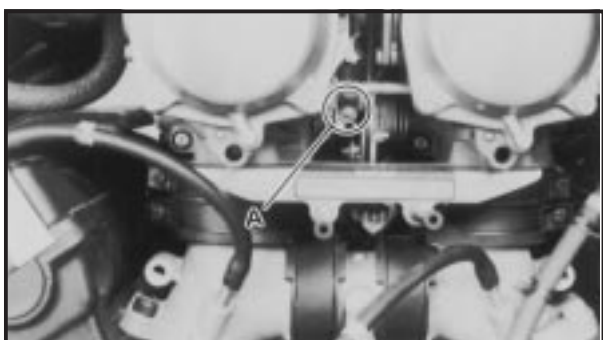
2. Attach:
  - Vacuum Gauge ① (90890-03094)  
To the vacuum plugs.
3. Start the engine and let it warm up.



4. Adjust:
  - Idle speed  
Out of specification →  
Turn the throttle stop screw ① to adjust.



**Idle Speed:**  
950 ~ 1,050 r/min



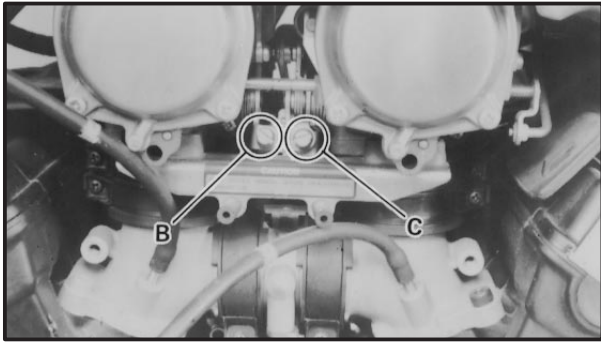
5. Adjust:
  - Carburetor synchronization

## Carburetor synchronization adjustment steps:

- Synchronize carburetor No.1 to carburetor No.2 by turning synchronizing screw "A" until both gauges read the same.
- Rev the engine for a fraction of a second, two or three times, and check the synchronization again.

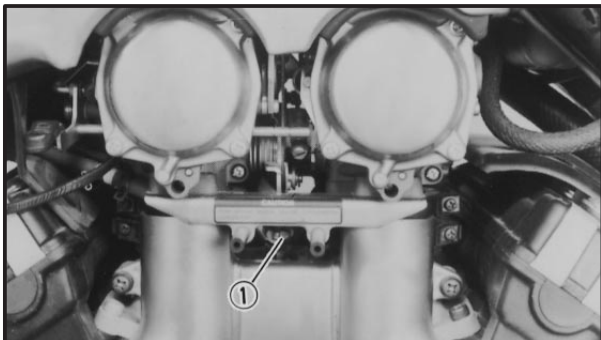
## IDLING SPEED ADJUSTMENT/ THROTTLE CABLE ADJUSTMENT

**INSP  
ADJ**



**Vacuum Pressure at Idle Speed:**  
22.61 kPa (170 mm Hg, 6.69 in Hg)  
**Vacuum Synchronous Difference:**  
2.66 kPa (30 mm Hg, 0.79 in Hg)

- Repeat the above steps to synchronize carburetor No.3 to carburetor No.4 by turning synchronizing screw "B" until both gauges read the same.
- Repeat the same steps to synchronize No.4 carburetor to No.2 carburetor, then turn synchronizing screw "C" until both gauges read the same.



### IDLE SPEED ADJUSTMENT

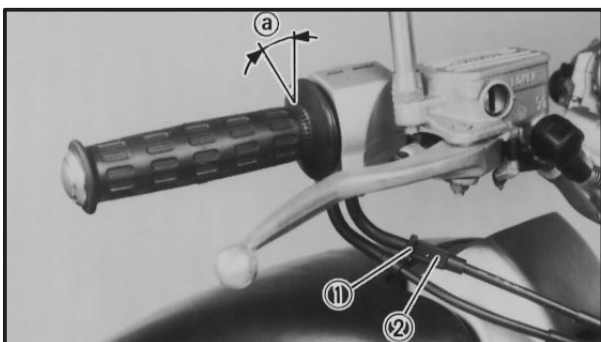
#### 1. Adjust

- Idle speed

Warm up the engine and turn the throttle stop screw ① to adjust.



**Idle Speed:**  
950 ~ 1,050 r/min



### THROTTLE CABLE ADJUSTMENT

#### NOTE:

Before adjusting the throttle cable free play, the engine idling speed should be adjusted.

#### 1. Check:

- Throttle cable free play (a)  
Out of specification → Adjust.



**Throttle Cable Free Play (a):**  
4 ~ 7 mm (0.16 ~ 0.28 in)

#### 2. Adjust:

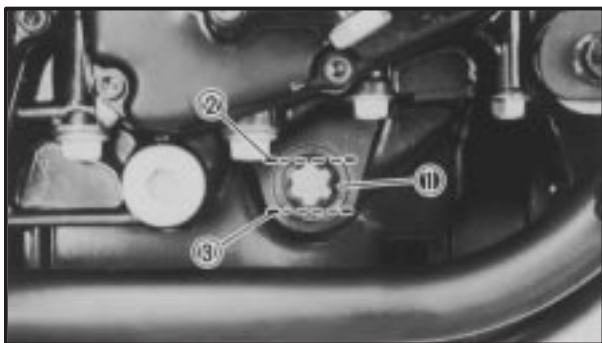
- Throttle cable free play

#### Throttle cable adjustment steps:

- Loosen the locknut ①.
- Turn the adjuster ② clockwise or counter-clockwise until proper free play is attained.
- Tighten the locknut.

## ENGINE OIL LEVEL INSPECTION/ ENGINE OIL REPLACEMENT

**INSP**  
**ADJ**



### ENGINE OIL LEVEL INSPECTION

#### 1. Inspect:

- Oil level

Oil level low → Add sufficient oil.

#### Engine oil level visual inspection steps:

- Place the motorcycle on its centerstand and warm up the engine for several minutes.

#### NOTE:

Position motorcycle straight up when checking oil level, a slight tilt to the side can produce false readings.

- Stop the engine and visually check the oil level through the level window (1).

(2) Maximum

(3) Minimum

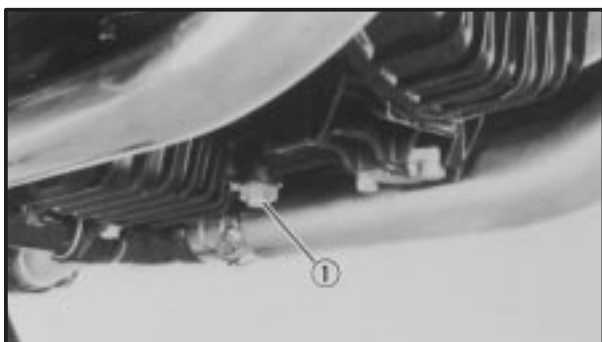
### ENGINE OIL REPLACEMENT

#### Engine Oil Replacement (Without Oil Filter)

1. Warm up the engine for several minutes, then place a receptacle under the engine.

#### 2. Remove:

- Oil filler cap



#### 3. Remove:

- Drain plug (1)

Drain the engine oil.

#### 4. Tighten:

- Drain plug (1)



#### Drain Plug:

43 Nm (4.3 m•kg, 31 ft•lb)

#### 5. Fill:

- Crankcase



#### Recommended Oil:

At 5°C (40°F) or Higher (1):

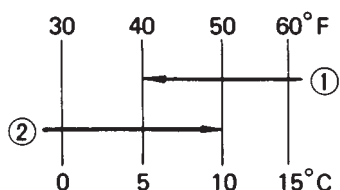
SAE 20W40 Type SE Motor Oil

At 15°C (60°F) or Lower (2):

SAE 10W30 Type SE Motor Oil

#### Periodic Oil Change:

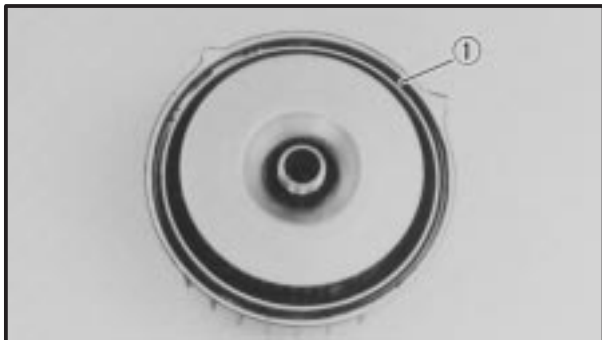
3.5 L (3.1 Imp qt, 3.7 US qt)





## CAUTION:

Do not allow foreign material to enter the crankcase.



6. Install:
  - Filler cap
7. Inspect:
  - Oil leaks
  - Oil level

## Engine Oil Replacement (With Oil Filter)

1. Warm up the engine and place a receptacle under the engine.
2. Remove:
  - Oil filler cap
  - Drain plugDrain the engine oil.
3. Remove:
  - Oil filter cover ①
4. Install:
  - Drain plug



**Drain Plug:**  
43 Nm (4.3 m•kg, 31 ft•lb)

- Oil filter (new)
- O-ring (new)
- Oil filter cover

## NOTE:

Be sure the O-ring ① is positioned properly.

5. Tighten:
  - Bolt (oil filter)

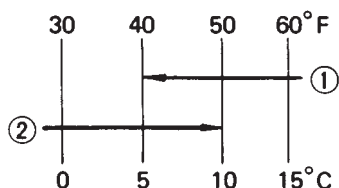


**Bolt (Oil Filter):**  
32 Nm (3.2 m•kg, 23 ft•lb)

6. Fill:
  - Crankcase



**Recommended Oil:**  
At 5°C (40°F) or Higher ①:  
SAE 20W40 Type SE Motor Oil  
At 15°C (60°F) or Lower ②:  
SAE 10W30 Type SE Motor Oil  
With Oil Filter Replacement:  
3.8 L (3.3 Imp qt, 4.0 US qt)



## CAUTION:

Do not allow foreign material to enter the crankcase.



7. Install:
  - Oil filter cap
8. Inspect:
  - Oil leaks
  - Oil level



### COOLANT LEVEL INSPECTION

1. Remove:
  - Top cover
2. Inspect:
  - Coolant level (reservoir tank)  
Level low → Add tap water (soft water).  
Change the Coolant every two years.  
Refer to Chapter 4 "COOLING SYSTEM" for more detail.

- ① "FULL" level
- ② "LOW" level

### WARNING:

Do not remove the radiator cap when the engine is hot.

### CAUTION:

Hard water or salt water is harmful to the engine parts; use boiled or distilled water if you can't get soft water.



#### Total Amount:

3.05 L (2.69 Imp qt, 3.22 US qt)

#### Reservoir Tank Capacity:

0.30 L (0.26 Imp qt, 0.32 US qt)

#### From LOW to FULL Level:

0.20 L (0.18 Imp qt, 0.21 US qt)

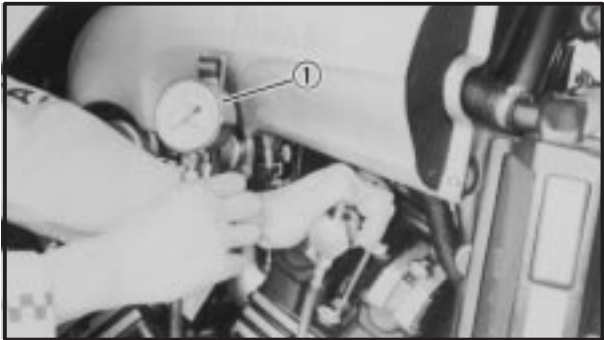
### COOLING SYSTEM INSPECTION

1. Inspect:
  - Hoses  
Cracks/Damage → Replace.

COMPRESSION PRESSURE MEASUREMENT

NOTE: \_\_\_\_\_

Insufficient compression pressure will result in performance loss.



- 1. Measure:
  - Valve clearance  
Out of specification → Adjust.
- 2. Warm up the engine.
- 3. Remove:
  - Spark plugs
- 4. Measure:
  - Compression pressure

Compression pressure measurement steps:

- Install the Compression Gauge ① (90890-03081) using an adapter.
- Crank over the engine with the electric starter (be sure the battery is fully charged) with the throttle wide open until the compression reading on the gauge stabilizes.
- Check readings with specified levels (See chart)

Compression Pressure (at sea level):

- Standard:  
980 kPa (10 kg/cm<sup>2</sup>, 142 psi)
- Minimum:  
882 kPa (9 kg/cm<sup>2</sup>, 128 psi)
- Maximum:  
1,176.8 kPa (12 kg/cm<sup>2</sup>, 171 psi)

WARNING: \_\_\_\_\_

When cranking the engine, ground all of the spark plug leads to prevent sparking.

- Repeat the previous steps for the other cylinders.
- If pressure falls below the minimum level:
  - 1) Squirt a few drops of oil into the affected cylinder.
  - 2) Measure the compression again.

Compression Pressure  
(with oil introduced into cylinder)

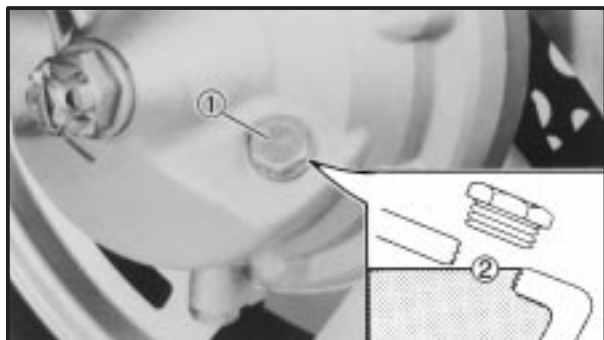
| Reading                 | Diagnosis               |
|-------------------------|-------------------------|
| Higher than without oil | Worn or damaged pistons |

## FINAL GEAR OIL LEVEL INSPECTION FINAL GEAR OIL REPLACEMENT

**INSP**  
**ADJ**



|                                                                                                                                                         |                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Same as without oil                                                                                                                                     | Defective ring(s), valves, cylinder head gasket or piston is possible.      |
| Above maximum level                                                                                                                                     | Inspect cylinder head, valve surfaces, or piston crown for carbon deposits. |
| <b>NOTE:</b> _____<br>The difference between the highest and lowest cylinder compression readings must not vary more than the specified value.<br>_____ |                                                                             |
| <b>Difference Between Each Cylinder:</b><br><b>Less than 98 kPa (1 kg/cm<sup>2</sup>, 14 psi)</b>                                                       |                                                                             |



## CHASSIS

### FINAL GEAR OIL LEVEL INSPECTION

#### 1. Inspect:

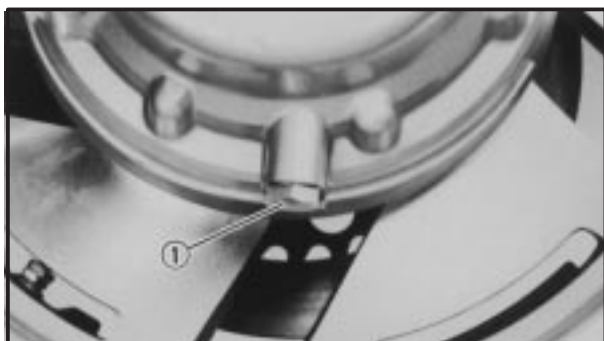
- Final gear oil level  
Oil level low → Add sufficient oil.

#### Final gear oil level visual inspection steps:

- Position the motorcycle on a level area and place on its centerstand.
- Remove the oil filler cap ①.
- Visually check the oil level. Correct oil level ② should be at the brim of the hole.
- If the oil level is low, add sufficient oil.
- Tighten the oil filler cap to specification.



**Oil Filler Cap (Final Gear):**  
**23 Nm (2.3 m•kg, 17 ft•lb)**



### FINAL GEAR OIL REPLACEMENT

1. Place a receptacle under the final gear case.
2. Remove:
  - Oil filler cap
  - Drain plug ①  
Drain the oil.

## AIR FILTER CLEANING

INSP  
ADJ



3. Install:
- Drain plug



**Drain Plug (Final Gear):**  
23 Nm (2.3 m•kg, 17 ft•lb)

4. Fill:
- Final gear case



**Oil Capacity:**  
0.2 L (0.18 Imp qt, 0.21 US qt)  
**Final Gear Oil:**  
SAE 80 API “GL-4” Hypoid  
Gear Oil  
If desired, an SAE 80W90 Hypoid gear oil  
may be used for all conditions.

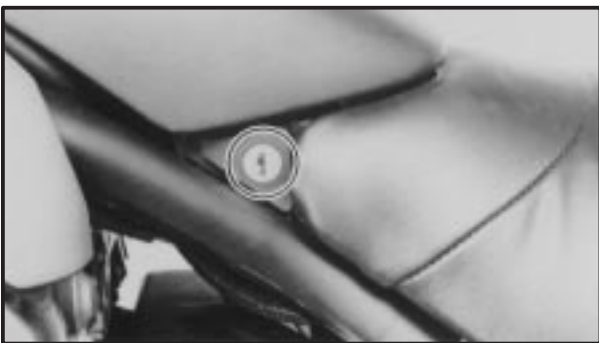
### **WARNING:**

Do not allow the gear oil to contact the tire or wheel.

5. Install:
- Oil filler cap



**Oil Filler Cap (Final Gear):**  
23 Nm (2.3 m•kg, 17 ft•lb)



## AIR FILTER CLEANING

1. Remove:
- Top cover



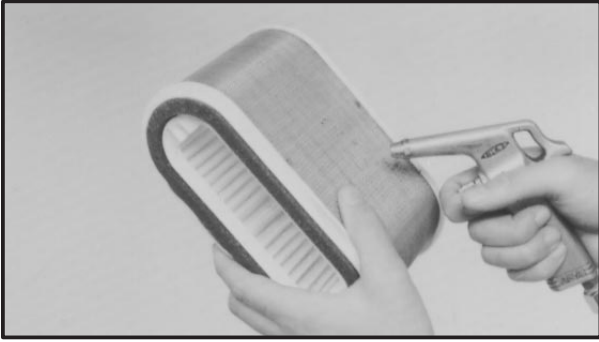
2. Remove:
- Air filter case cover
  - Air filter element

### **CAUTION:**

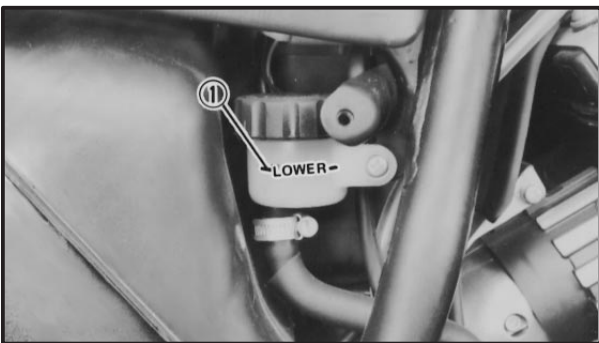
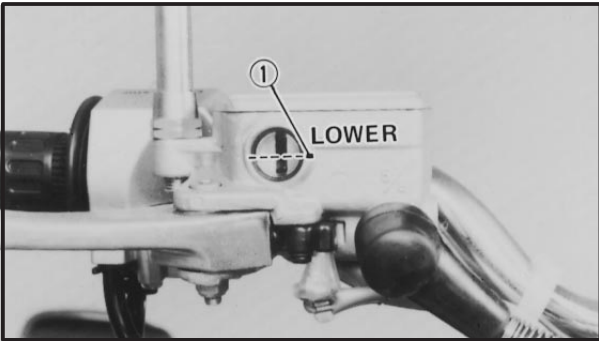
The engine should never be run without the air filter element installed; excessive piston and/or cylinder wear may result.

## BRAKE FLUID LEVEL INSPECTION

INSP  
ADJ



3. Eliminate:
  - Dust  
Use the compressed air.  
Blow out dust in the element from the outer surface.
4. Inspect:
  - Element  
Damage → Replace.
5. Install:
  - Element
  - Air filter case cover
  - Top cover



## BRAKE FLUID LEVEL INSPECTION

### Brake Inspection

1. Inspect:
  - Brake fluid level (brake master cylinder)  
Level low → Replenish fluid.



**Brake Fluid:**  
**DOT #3**

- ① Lower level

### NOTE:

Be sure that:

- Spilled fluid is cleaned up immediately to prevent painted surfaces or plastic parts from eroding.

### WARNING:

- Use only the designated quality brake fluid, otherwise poor brake performance will result.
- Water does not enter the master cylinder when refilling, otherwise poor brake performance.

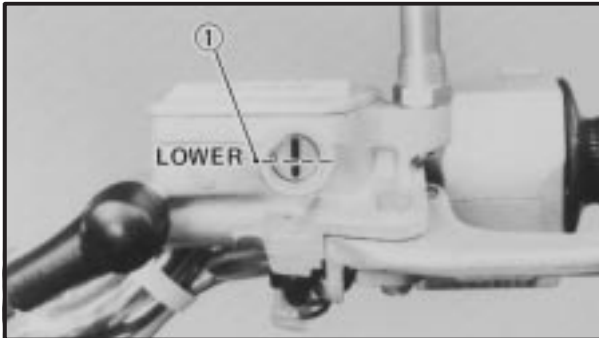


## Clutch Inspection

This motorcycle has a hydraulic clutch. There are no adjustments to perform, but the clutch system must be inspected periodically for fluid level and leakage.

### 1. Inspect:

- Brake fluid level (clutch master cylinder)  
Level low → Replenish fluid.



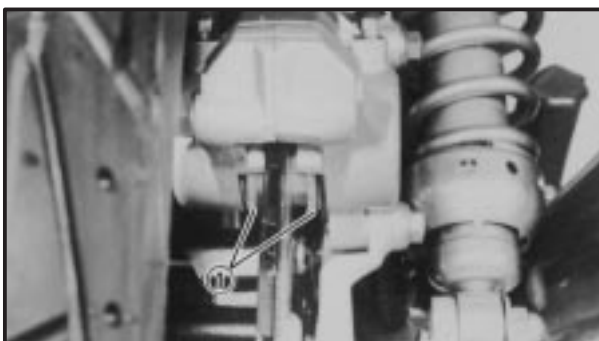
**Brake Fluid:**  
**DOT #3**

### ① Lower level

### NOTE:

Be sure that:

- Use only the designated quality brake fluid.
- Water does not enter the master cylinder when refilling.
- Spilled fluid is cleaned up immediately to prevent painted surfaces or plastic parts from eroding.

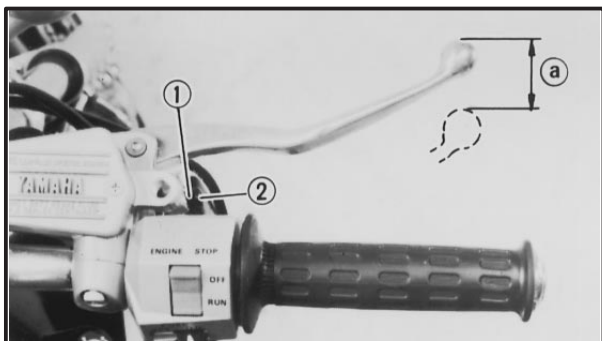


## FRONT AND REAR BRAKE PAD INSPECTION

### 1. Activate the brake lever or brake pedal.

### 2. Inspect:

- Wear indicator ①  
Indicator almost contacts disc → Replace pads.  
Refer to "Chapter 5 CHASSIS" section.



## FRONT BRAKE ADJUSTMENT

1. Loosen:
  - Locknut ①
2. Adjust:
  - Free play ②

Turn the adjuster ② until the free play ② is within the specified limits.



**Free play ②:**  
2 ~ 5 mm (0.08 ~ 0.20 in)

### CAUTION:

Proper lever free play is essential to avoid excessive brake drag.

### WARNING:

A soft or spongy feeling in the brake lever can indicate the presence of air in the brake system. This air must be removed by bleeding the brake system before the motorcycle is operated. Air in the system will cause greatly diminished braking capability and can result in loss of control and an accident. Inspect and bleed the system if necessary.

3. Tighten:
  - Locknut



## REAR BRAKE ADJUSTMENT

1. Loosen:
  - Locknut ①
2. Adjust:
  - Brake pedal height ②

Turn the adjuster ② until the brake pedal position is at the specified height.



**Brake Pedal Height ②:**  
20 mm (0.8 in)  
Below the Top of the Footrest

### WARNING:

After adjusting the brake pedal height, visually check the adjuster end through the hole ③ of the joint holder. The adjuster end must appear within this hole.



## CABLE INSPECTION AND LUBRICATION

### Cable inspection and lubrication steps:

- Remove the screws that secure throttle housing to handlebar.
- Hold cable end high and apply several drops of lubricant to cable.
- Coas metal surface of disassembled throttle twist grip with suitable all-purpose grease to minimize friction.
- Check for damage to cable insulation. Replace any corroded or obstructed cables.
- Lubricate any cables that do not operate smoothly.



SAE 10W30 Motor Oil

## BRAKE AND CHANGE PEDALS/BRAKE AND CLUTCH LEVERS LUBRICATION

Lubricate pivoting parts of each lever and pedal.



SAE 10W30 Motor Oil

## CENTERSTAND AND SIDESTAND LU- BRICATION

Lubricate the centerstand and sidestand at their pivot points.



SAE 10W30 Motor Oil

## SWINGARM LUBRICATION

Lubricate the swingarm bearing.



Medium Weight Wheel  
Bearing Grease



## FRONT FORK OIL CHANGE

### WARNING:

- Fork oil leakage can cause loss of stability and safe handling. Have any problem corrected before operating the motorcycle.
- Securely support the motorcycle so there is no danger of it falling over.



1. Elevate the front wheel by placing a suitable stand under the engine.
2. Remove:
  - Air valve cap (left)
  - Fork caps ①

### NOTE:

Keep the valve open by pressing it for several seconds so that the air can be let out of the inner tube.



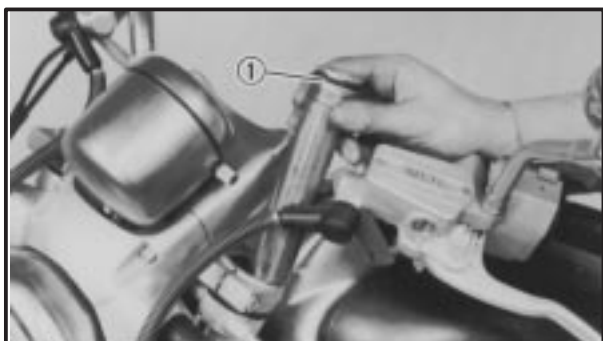
3. Loosen:
  - Pinch bolts (steering crown) ①
4. Remove:
  - Cap bolts ②
  - Use the Front Fork Cap Socket ③ (90890-01104).
  - Collars
5. Place a receptacles under the drain screws.



6. Remove:
  - Drain screws ①
 Drain the fork oil.

### WARNING:

Do not allow any oil to contact the disc brake components. If oil is discovered, be sure to remove it, otherwise diminished braking capacity and damage to the rubber components of the brake assembly will occur.



7. Inspect:
  - O-rings (cap bolt) ①
  - Gaskets (drain screw)
  - Wear/Damage → Replace.



8. Install:
  - Drain screws
  - Collars
9. Fill:
  - Front forks



**Each Fork:**  
**451 cm<sup>3</sup> (15.9 Imp oz, 15.3 US oz)**  
**Fork Oil 10 wt or Equivalent**  
**After filling, pump the forks slowly**  
**up and down to distribute the oil.**

10. Tighten:
  - Cap bolts  
 Use the Front Fork Cap Socket (90890-01104).
  - Pinch bolts (steering crown)



**Cap Bolt:**  
**23 Nm (2.3 m•kg, 17 ft•lb)**  
**Pinch Bolts (Steering Crown):**  
**20 Nm (2.0 m•kg, 14 ft•lb)**

11. Adjust:
  - Front fork air pressure  
 Refer to "FRONT FORK ADJUSTMENT" section.

### FRONT FORK ADJUSTMENT

1. Elevate the front wheel by placing a suitable stand under the engine.

**NOTE:** \_\_\_\_\_

When checking and adjusting the air pressure, there should be no weight on the front end of the motorcycle.

2. Adjust:
  - Air pressure

**NOTE:** \_\_\_\_\_

The air pressure of the front forks can be adjusted to suit rider's preference, weight, and the course condition.

## REAR SHOCK ABSORBER ADJUSTMENT

INSP  
ADJ



### Air pressure adjustment steps:

- Remove the valve cap.
- Using the air check gauge ①, check and adjust the air pressure.

**Stiffer** → Increase the air pressure.  
(Use an air pump or pressurized air supply.)

**Softer** → Decrease the air pressure.  
(Release the air by pushing the valve.)

### Standard Air Pressure:

39.2 kPa (0.4 kg/cm<sup>2</sup>, 5.7 psi)

### Maximum Air Pressure:

98.1 kPa (1.0 kg/cm<sup>2</sup>, 14.2 psi)

### CAUTION:

Never exceed the maximum pressure, or oil seal damage may occur.

- Install the valve cap securely.

## REAR SHOCK ABSORBER ADJUSTMENT

### 1. Adjust:

- Spring preload
- Damping

### NOTE:

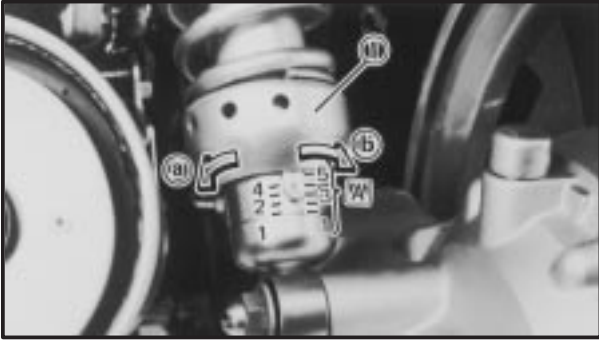
The spring preload and damping of the rear shock absorbers can be adjusted to suit rider's preference, weight, and the course condition.

### WARNING:

Always adjust rear shock absorber preload and damping to the same setting. Uneven adjustment can cause poor handling and loss of stability.

## REAR SHOCK ABSORBER ADJUSTMENT

**INSP  
ADJ**



### Spring preload adjustment steps:

- Using the screwdriver, adjust the spring preload.

**Stiffer (a) → Increase the spring preload. (Turn the spring seat ① clockwise.)**

**Softer (b) → Decrease the spring preload. (Turn the spring seat ① counter-clockwise.)**

**A** Position: 5 (Maximum)  
4  
3  
2  
1 (Minimum/Standard)

**Standard Position (Minimum Position):**  
1

**Maximum Position:**  
5

### CAUTION:

Never attempt to turn the spring seat beyond the maximum or minimum setting.



### Damping adjustment steps:

- Adjust the damping with the damping adjuster ①.

**Stiffer (a) → Increase the damping. (Turn the adjuster ① clockwise.)**

**Softer (b) → Decrease the damping (Turn the adjuster ① counter-clockwise.)**

**Standard Position (Minimum Position):**  
1

**Maximum Position:**  
4

### CAUTION:

Never attempt to turn the adjuster beyond the maximum or minimum setting.

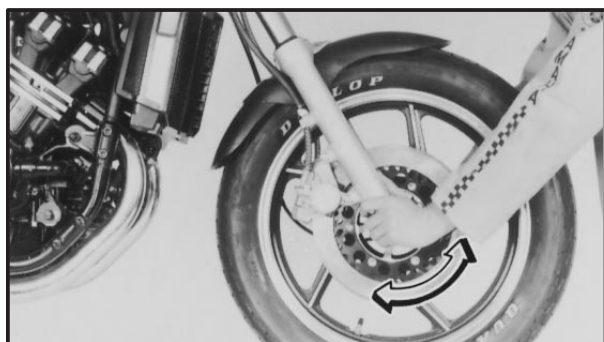
**RECOMMENDED COMBINATIONS OF THE FRONT FORK  
AND THE REAR SHOCK ABSORBER SETTINGS/  
STEERING HEAD INSPECTION/STEERING HEAD ADJUSTMENT**



**RECOMMENDED COMBINATIONS OF THE FRONT FORK AND THE REAR SHOCK ABSORBER SETTINGS**

Use this table as guidance to meet specific riding conditions and motorcycle load.

| A | Front fork                                                            | C           | Rear shock absorber |  | F          | Loading condition |                           |                                         |
|---|-----------------------------------------------------------------------|-------------|---------------------|--|------------|-------------------|---------------------------|-----------------------------------------|
| B |                                                                       | D           | E                   |  | G          | H                 | I                         | J                                       |
|   | Air pressure                                                          | Spring seat | Damping adjuster    |  | Solo rider | With passenger    | With accessory equipments | With accessory equipments and passenger |
|   | 39.2 ~ 58.8 kPa<br>(0.4 ~ 0.6 kg/cm <sup>2</sup> ,<br>5.7 ~ 8.5 psi)  | 1 or 2      | 1 or 2              |  | ○          |                   |                           |                                         |
|   | 39.2 ~ 98.1 kPa<br>(0.4 ~ 1.0 kg/cm <sup>2</sup> ,<br>5.7 ~ 14.2 psi) | 3 ~ 5       | 2 ~ 4               |  |            | ○                 | ○                         |                                         |
|   | 39.2 ~ 98.1 kPa<br>(0.4 ~ 1.0 kg/cm <sup>2</sup> ,<br>5.7 ~ 14.2 psi) | 5           | 4                   |  |            |                   |                           | ○                                       |



**STEERING HEAD INSPECTION**

**WARNING:**

**Securely support the motorcycle so there is no danger of it falling over.**

1. Place the motorcycle on its centerstand, then elevate the front wheel.
2. Check:
  - Steering assembly bearings  
Grasp the bottom of the forks and gently rock the fork assembly back and forth.  
Looseness → Adjust steering head.

**STEERING HEAD ADJUSTMENT**

**WARNING:**

**Securely support the motorcycle so there is no danger of it falling over.**

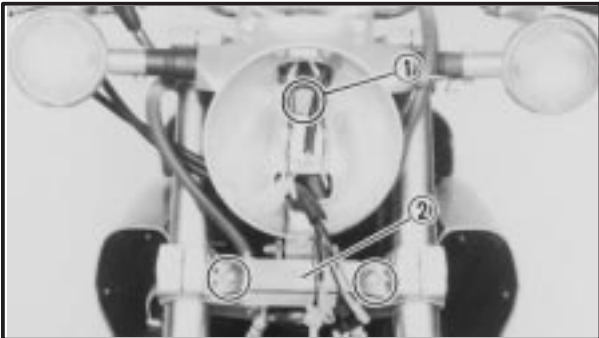
1. Elevate the front wheel by placing a suitable stand under the engine.

## STEERING HEAD ADJUSTMENT

INSP  
ADJ



2. Remove:
  - Headlight lens unit ①
3. Disconnect:
  - All leads (in the headlight body)



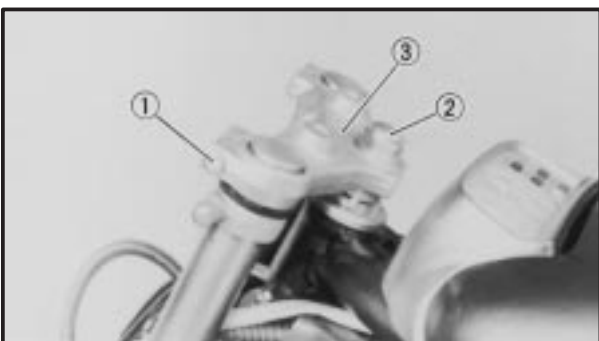
4. Remove:
  - Bolt (headlight body bracket) ①
  - Emblem ②



5. Remove:
  - Flasher light bracket assembly ①



6. Remove:
  - Handlebar holder assembly ①



7. Loosen:
  - Pinch bolts (steering crown) ①
8. Remove:
  - Nut (steering stem) ②
  - Steering crown ③

## STEERING HEAD ADJUSTMENT

**INSP  
ADJ**



9. Remove:

- Lock washer (ring nut) ①
- Ring nut (upper) ②
- Washer ③
- Ring nut (lower) ④

### **WARNING:**

Support the under bracket so that it may not fall down.

10. Tighten:

- Ring nuts (lower and upper)

### **Ring nuts tightening steps:**

#### **NOTE:**

Set the Torque Wrench to the Ring Nut Wrench so that they form a right angle.

- Install the ring nut (lower) ⑥.

#### **NOTE:**

The tapered side of ring nut must face downward.

- Tighten the ring nut ⑥ using the Ring Nut Wrench (90890-01403).



**Ring Nut ⑥ (Initial Tightening):**  
**50 Nm (5.0 m•kg, 36 ft•lb)**

- Loosen the ring nut ⑥ completely and re-tighten it to specification.

### **WARNING:**

Do not over-tightening.



**Ring Nut ⑥ (Final Tightening):**  
**3 Nm (0.3 m•kg, 2.2 ft•lb)**

- Check the steering stem by turning it lock to lock. If there is any binding, remove the steering stem assembly and inspect the steering barings ⑦.

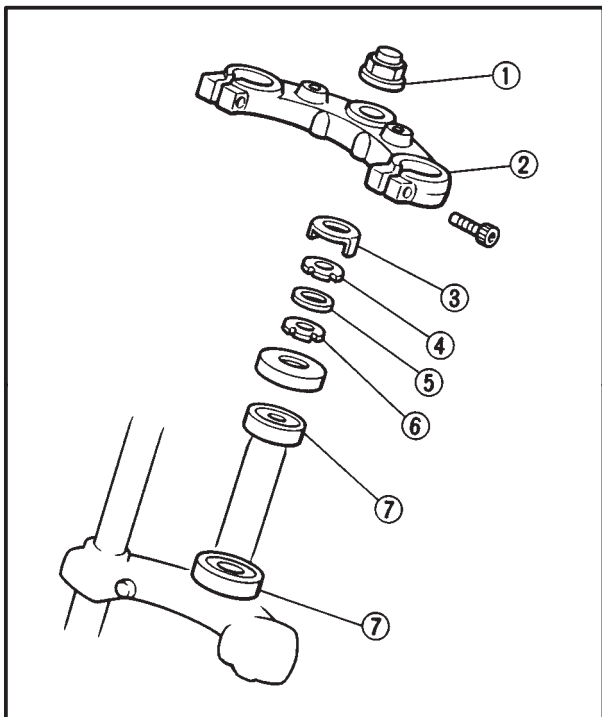
Refer to "CHAPTER 6. STEERING HEAD" for more details.

- Install the washer ⑤.
- Install the ring nut (upper) ④.

#### **NOTE:**

The tapered side of ring nut must face downward.

- Finger tighten the ring nut ④, then align the slots of both ring nuts. If not aligned, hold the lower ring nut ⑥ and tighten the other until they are aligned.



## WHEEL BEARINGS CHECK/TIRES CHECK

INSP  
ADJ



- Install the lock washer ③.

### NOTE:

Make sure the lock washer tab is placed in the slots.

- Install the steering crown ② and tighten the steering stem nut ① to specification.



**Nut (Steering Stem):**  
110 Nm (11.0 m•kg, 80 ft•lb)

- Tighten the pinch bolts to specification.



**Pinch Bolt (Steering Crown):**  
20 Nm (2.0 m•kg, 14 ft•lb)

### 11. Install:

- Components in above list (steps “6 ~ 2”)



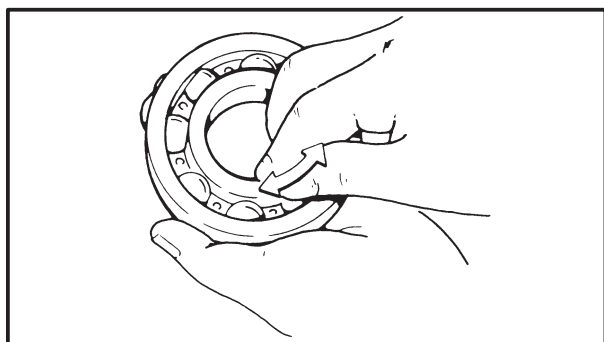
**Handlebar Lower Holder:**  
40 Nm (4.0 m•kg, 29 ft•lb)

## WHEEL BEARINGS CHECK

### Front Wheel

#### 1. Check:

- Front wheel bearings  
Raise the front end of the motorcycle, and spin the wheel by hand. Touch the axle or front fender while spinning the wheel.  
Excessive vibration → Replace bearings.



### Rear Wheel

#### 1. Remove:

- Rear wheel

#### 2. Check:

- Bearing movement  
With the fingers.  
Roughness/Wear → Replace.

## TIRES CHECK

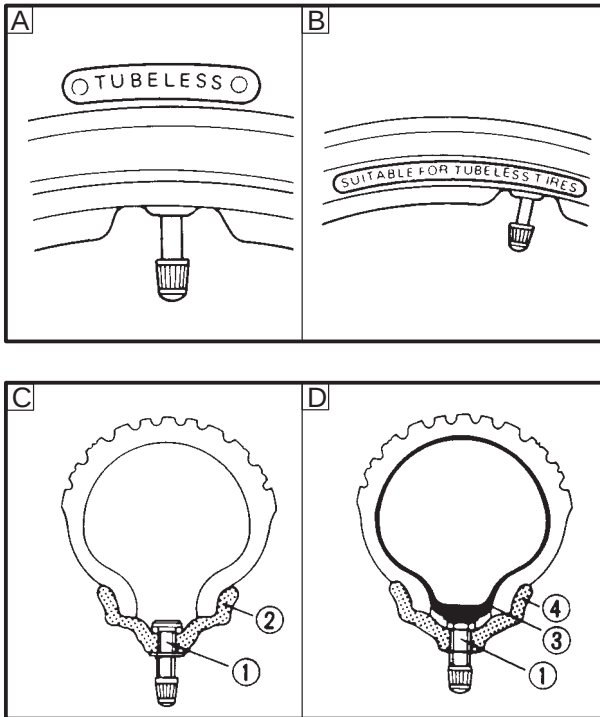
### WARNING:

Do not attempt to use tubeless tires on a wheel designed for tube type tires only. Tire failure and personal injury may result from sudden deflation.

| Wheel     | Tire                  |
|-----------|-----------------------|
| Tube type | Tube type only        |
| Tubeless  | Tube type of tubeless |

## TIRES CHECK

INSP  
ADJ



Be sure to install the correct tube when using tube type tires.

- ☐ A Tire
- ☐ B Wheel
- ☐ C Tubeless tire
- ☐ D Tube type tire
- ① Air valve
- ② Aluminum wheel (tubeless type)
- ③ Tube
- ④ Aluminum wheel (tube type)

### WARNING:

This motorcycle is fitted with “V” range tires (for super high speed running). The following points must be observed in order for you to make fully effective use of these tires.

- Never fail to use “V” range tires in tire replacement. “S” or “H” tires may be in danger of bursting at super high-speeds.
- New tires have a relatively poor adhesion on the road surface so do not allow them to be subjected to high speed load from maximum speed until after a break-in run of approx. 100 km (60 mi).
- Before any high-speed runs, remember to allow a sufficient warm-up time for the tires.
- Always use the correct tire inflation pressure according to the operation conditions.

#### 1. Measure:

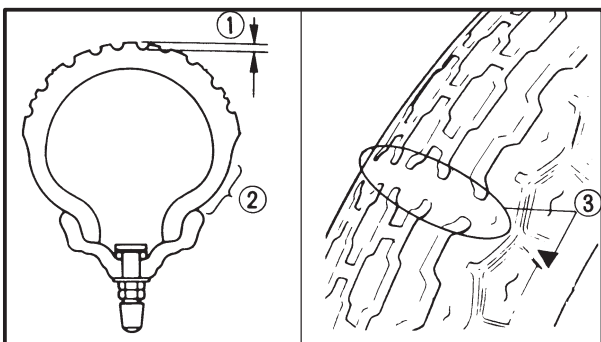
- Tire pressure
- Out of specification → Adjust.

|                                              |                                                 |                                                 |
|----------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Basic weight:<br>With oil and full fuel tank | 281 kg (619 lb)                                 |                                                 |
| Maximum load*                                | 218 kg (481 lb)                                 |                                                 |
| Cold tire pressure                           | Front                                           | Rear                                            |
| Up to 90 kg (198 lb) load*                   | 235 kPa<br>(2.4 kg/cm <sup>2</sup> ,<br>34 psi) | 255 kPa<br>(2.6 kg/cm <sup>2</sup> ,<br>36 psi) |
| 90 kg (198lb) ~<br>Maximum load*             | 235 kPa<br>(2.4 kg/cm <sup>2</sup> ,<br>34 psi) | 275 kPa<br>(2.8 kg/cm <sup>2</sup> ,<br>40 psi) |
| High speed riding                            | 235 kPa<br>(2.4 kg/cm <sup>2</sup> ,<br>34 psi) | 255 kPa<br>(2.6 kg/cm <sup>2</sup> ,<br>36 psi) |

\* Load is the total weight of cargo, rider, passenger, and accessories.

**WARNING:**

- Tire inflation pressure should be checked and adjusted when the temperature of the tire equals the ambient air temperature. Tire inflation pressure must be adjusted according to total weight of cargo, rider, passenger, and accessories (fairing, saddlebags, etc. if approved for this model), and vehicle speed.
- Proper loading of your motorcycle is important for the handling, braking, and other performance and safety characteristics of your motorcycle. Do not carry loosely packed items that can shift. Securely pack your heaviest items close to the center of the motorcycle, and distribute the weight evenly from side to side. Properly adjust the suspension for your load, and check the condition and pressure of your tires. **NEVER OVERLOAD YOUR MOTORCYCLE.** Make sure the total weight of the cargo, rider, passenger, and accessories (fairing, saddlebags, etc. if approved for this model) does not exceed the maximum load of the motorcycle. Operation of an overloaded motorcycle could cause tire damage, an accident, or even injury.



## 2. Inspect:

- Tire surfaces  
Wear/Damage → Replace.



**Minimum Tire Tread Depth: (Front and Rear)**

**1.0 mm (0.04 in)**

- ① Tread depth
- ② Side wall
- ③ Wear indicator

**WARNING:**

- It is dangerous to ride with a wornout tire. When a tire tread begins to show lines, replace the tire immediately.
- Patching a punctured tube is not recommended. If it is absolutely necessary to do so, use great care and replace the tube as soon as possible with a good quality replacement.



## WHEELS CHECK

### 1. Inspect:

- Aluminum wheels  
Damage/Bends → Replace.

### NOTE:

Always balance the wheel when a tire or wheel has been changed or replaced.

### WARNING:

Never attempt even small repairs to the wheel.

### 2. Tighten:

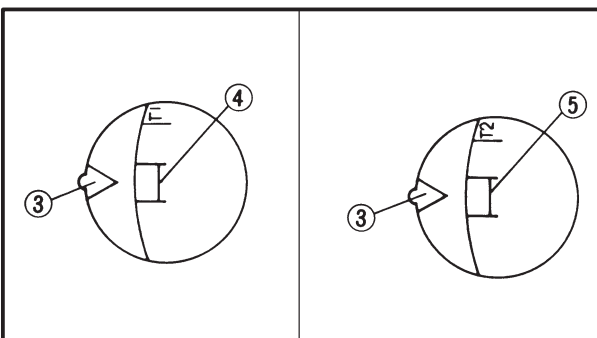
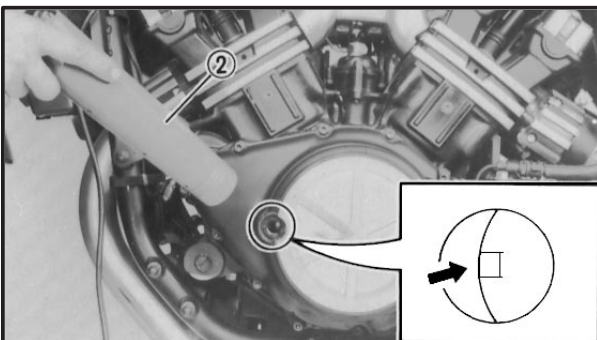
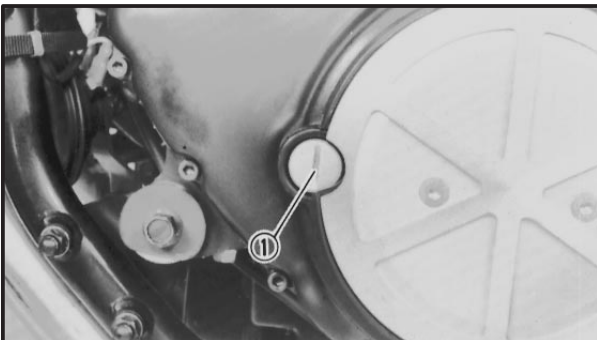
- Valve stem locknut



**Valve Stem Locknut:**  
1.5 Nm (0.15 m•kg, 1.1 ft•lb)

### WARNING:

Ride conservatively after installing a tire to allow it to seat itself properly on the rim.



## ELECTRICAL

### IGNITION TIMING CHECK

#### 1. Check:

- Ignition timing  
By the following steps.

#### Ignition timing check steps:

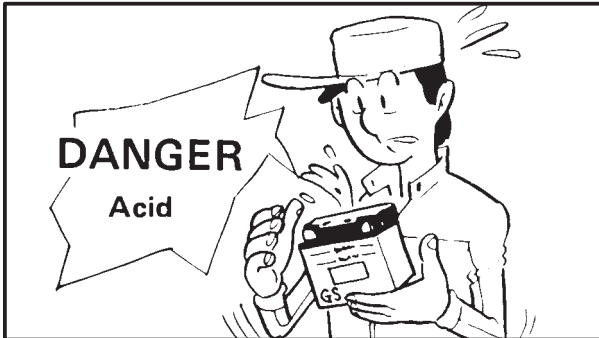
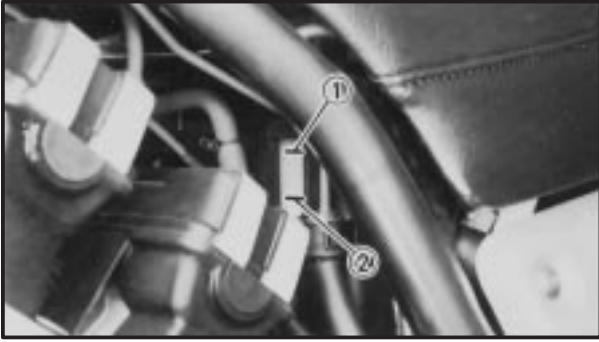
- Remove the timing plug ①.
- Connect the Timing Light ② (90890-03109) to No.1 or No.2 cylinder spark plug lead.
- Warm up the engine and let it idle at the specified idle speed of 1,000 r/min.
- Visually check the stationary pointer ③ in the timing window to verify it is within the required firing range indicated on the flywheel.

Incorrect firing range → Check flywheel and/or pickup assembly (tightness damage).

Refer to "CHAPTER 7, ELECTRICAL" for further information.

④ Firing range for the No.1 cylinder

⑤ Firing range for the No.2 cylinder



### BATTERY INSPECTION

#### 1. Inspect:

- Battery fluid level  
Battery fluid level low → Fill.  
Fluid level should be between upper and lower level marks.

① Upper level

② Lower level

#### **CAUTION:**

Refill with distilled water only; tap water contains minerals harmful to a battery.

#### **WARNING:**

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

Always follow these preventive measures:

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

Antidote (EXTERNAL):

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

Antidote (INTERNAL):

- Drink large quantities of water or milk followed with milk of magnesia beaten egg, or vegetable oil. Get immediate medical attention.

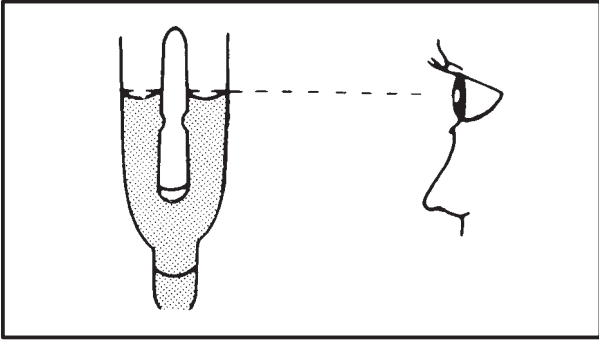
Batteries also generate explosive hydrogen gas, therefore you should always follow these preventive measures:

- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks, or open flames (e.g., welding equipment, lighted cigarettes, etc.)
- DO NOT SMOKE when charging or handling batteries.

**KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.**

## BATTERY INSPECTION

INSP  
ADJ

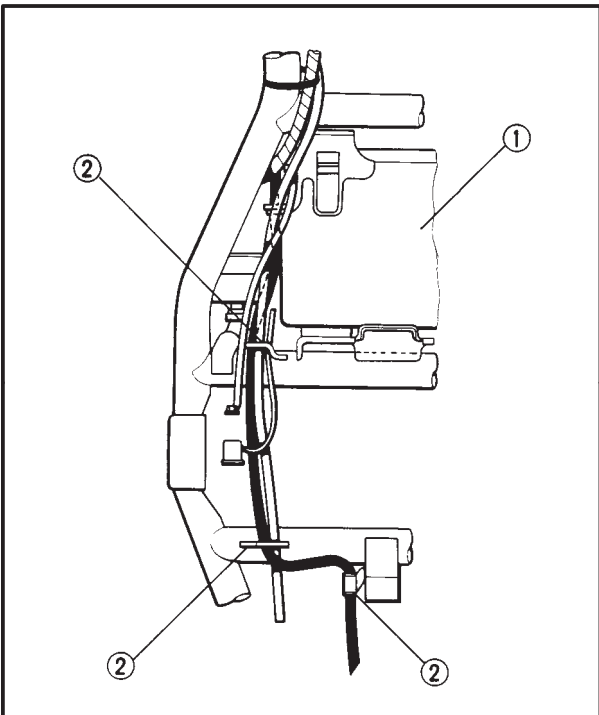


2. Remove:
  - Battery
3. Inspect:
  - Battery fluid specific gravity  
Out of specification → Charge.

### CAUTION:

Always charge a new battery before using it to ensure maximum performance.

Charging Current:  
1.4 amps/10 hrs  
Specific gravity:  
1.280 at 20°C (68°F)



4. Install:
  - Battery
5. Connect:
  - Breather hose  
Be sure the hose is properly attached and routed.

### CAUTION:

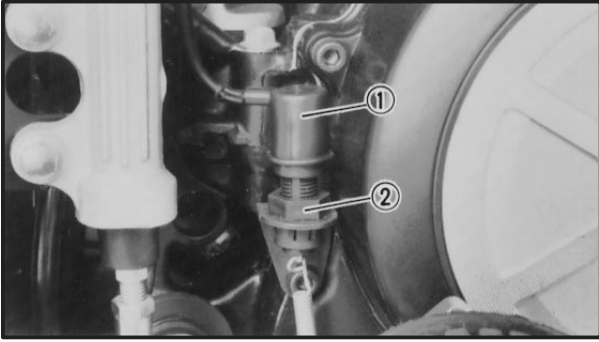
When inspecting the battery, be sure the breather hose is routed correctly. If the breather hose touches the frame or exits in such a way as to cause battery electrolyte or gas to exit onto the frame, structural and cosmetic damage to the motorcycle can occur.

- ① Battery
- ② Pass through guide

6. Inspect:
  - Breather hose  
Obstruction → Remove.  
Damage → Replace.

## BRAKE LIGHT SWITCH ADJUSTMENT/ SPARK PLUG INSPECTION

INSP  
ADJ

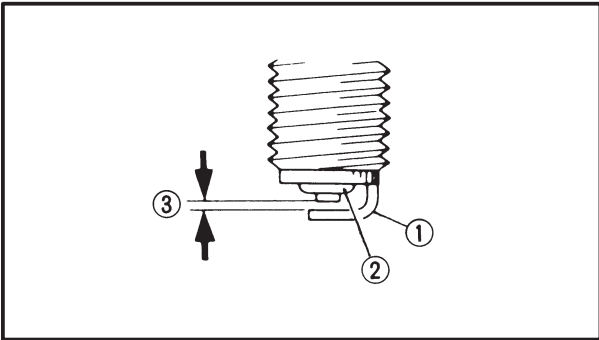


### BRAKE LIGHT SWITCH ADJUSTMENT

#### 1. Adjust:

- Brake light operating timing

Hold the main body ① of the switch with your hand so it does not rotate, and turn the adjuster ② until the operating timing is correct.



### SPARK PLUG INSPECTION

#### 1. Inspect:

- Electrode ①

Wear/Damage → Replace.

- Insulator color ②

Normal condition is a medium to light tan color.

Distinctly different color → Check the engine condition.

#### ③ Spark plug gap

#### 2. Clean:

- Spark plug

Clean the spark plug with a spark plug cleaner or wire brush.

#### 3. Inspect:

- Spark plug type

Incorrect → Replace

#### Standard Spark Plug:

DPR8EA-9 (NGK)

X24EPR-U9 (N.D.)

#### 4. Measure:

- Spark plug gap

Out of specification → Regap.

Use a wire gauge.



#### Spark Plug Gap:

0.8 ~ 0.9 mm (0.031 ~ 0.035 in)

#### 5. Tighten:

- Spark Plug

#### NOTE:

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



#### Spark Plug:

17.5 Nm (1.75 m•kg, 12.5 ft•lb)

**NOTE:**

If a torque wrench is not available when you are installing a spark plug, a good estimate of the correct torque is 1/4 to 1/2 turns part finger tight. Have the spark plug torqued to the correct value as soon as possible with a torque wrench.

**HEADLIGHT BULB REPLACEMENT****1. Remove:**

- Headlight lens unit ①

**2. Disconnect:**

- Headlight lens unit leads

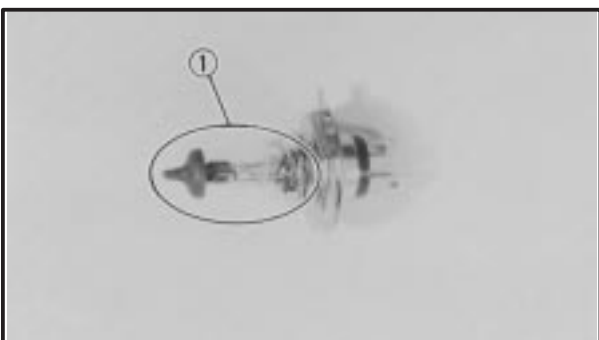
**3. Remove:**

- Bulb

Turn the bulb holder ① counterclockwise to release bulb.

**WARNING:**

**Do not touch headlight bulb when it is on as the bulb generates enormous heat; keep flammable objects away.**

**4. Install:**

- Bulb (new)

Secure the new bulb with the bulb holder.

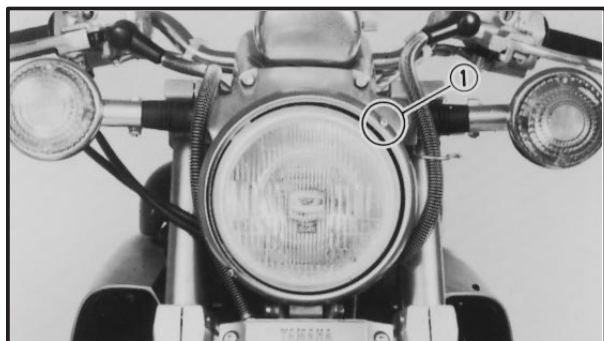
**CAUTION:**

**Avoid touching glass part of bulb. Also keep it free from oil otherwise, transparency of glass, bulb life and illuminous flux will be adversely affected. If oil gets on bulb, clean it with a cloth moistened thoroughly with alcohol or lacquer thinner.**

① Don't touch

**5. Install:**

- Headlight lens unit

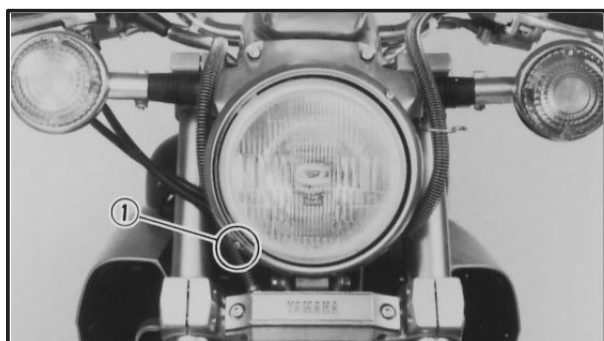


## HEADLIGHT BEAM ADJUSTMENT

### 1. Adjust:

- Headlight beam (horizontally)

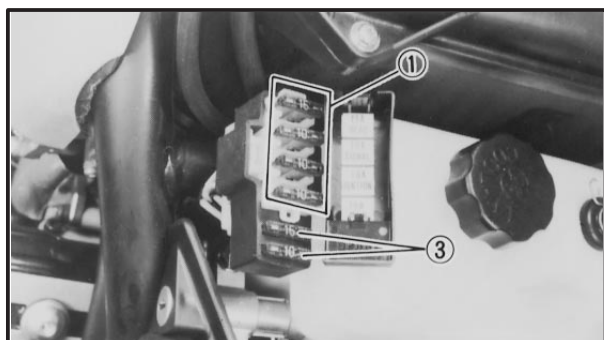
| Horizontal Adjustment |                                         |
|-----------------------|-----------------------------------------|
| Right                 | Turn adjusting screw ① clockwise        |
| Left                  | Turn adjusting screw ① counterclockwise |



### 2. Adjust:

- Headlight beam (vertically)

| Vertical Adjustment |                                              |
|---------------------|----------------------------------------------|
| Higher              | Turn the adjusting screw ① clockwise.        |
| Lower               | Turn the adjusting screw ① counterclockwise. |



## FUSE INSPECTION

The fuse panel is located under the top cover and seat.

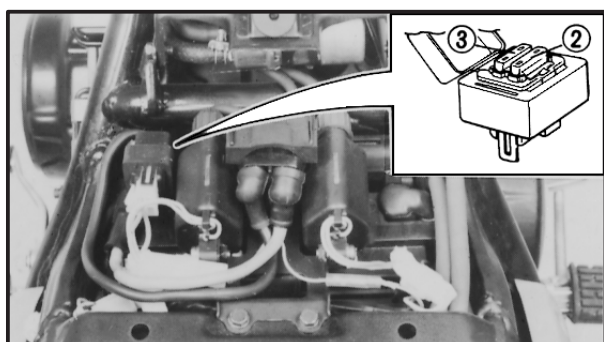
### 1. Inspect:

- Fuses ①
  - Main fuse ②
- Defective → Replace.  
Blown fuse (new) → Inspect circuit.

## CAUTION:

Do not use fuses of higher amperage rating than those recommended.

Substitution of a fuse of improper rating can cause extensive electrical system damage and possible a fire.



### ③ Spare fuses

| Description | Amperage | Quantity |
|-------------|----------|----------|
| Main        | 30 A     | 1        |
| Headlight   | 15 A     | 1        |
| Signal      | 15 A     | 1        |
| Ignition    | 10 A     | 1        |
| Reserve     | 30 A     | 1        |
|             | 15 A     | 1        |
|             | 10 A     | 1        |



## CHAPTER 3. ENGINE OVERHAUL

|                                                   |      |
|---------------------------------------------------|------|
| <b>ENGINE REMOVAL</b> .....                       | 3-1  |
| PREPARATION FOR REMOVAL .....                     | 3-1  |
| CARBURETOR .....                                  | 3-2  |
| RADIATOR .....                                    | 3-3  |
| AIR BAFFLE PLATE .....                            | 3-4  |
| FOOTREST (RIGHT) AND BRAKE PEDAL .....            | 3-4  |
| FOOTREST (LEFT) AND CLUTCH RELEASE CYLINDER ..... | 3-5  |
| EXHAUST PIPE AND MUFFLER .....                    | 3-6  |
| ENGINE REMOVAL .....                              | 3-7  |
| <br><b>ENGINE DISASSEMBLY</b> .....               | 3-8  |
| CYLINDER HEAD AND CAMSHAFT .....                  | 3-8  |
| STARTER IDLE GEARS AND FLYWHEEL .....             | 3-11 |
| CLUTCH AND OIL PUMP DRIVE GEAR .....              | 3-12 |
| WATER PUMP AND THERMOSTATIC VALVE .....           | 3-13 |
| STARTER MOTOR AND BREATHER COVER .....            | 3-14 |
| OIL PAN AND OIL PUMP .....                        | 3-14 |
| CRANKCASE DISASSEMBLY .....                       | 3-15 |
| UPPER CRANKCASE .....                             | 3-16 |
| TRANSMISSION .....                                | 3-17 |
| LOWER CRANKCASE .....                             | 3-17 |
| <br><b>INSPECTION AND REPAIR</b> .....            | 3-19 |
| CYLINDER HEAD .....                               | 3-19 |
| VALVE, VALVE GUIDE, AND VALVE SEAT .....          | 3-20 |
| CAMSHAFT, CAM CHAIN, AND CAM SPROCKET .....       | 3-27 |
| CYLINDER .....                                    | 3-29 |
| PISTON, PISTON RING, AND PISTON PIN .....         | 3-29 |
| STARTER DRIVES .....                              | 3-32 |
| PRIMARY GEARS .....                               | 3-33 |
| CLUTCH .....                                      | 3-33 |
| OIL PUMP .....                                    | 3-35 |
| OIL GALLERY PIPE .....                            | 3-36 |
| CRANKSHAFT .....                                  | 3-36 |
| BLANCER SHAFT .....                               | 3-40 |
| TRANSMISSION .....                                | 3-42 |
| BEARING .....                                     | 3-43 |
| CIRCLIPS AND WASHERS .....                        | 3-43 |
| <br><b>MIDDLE GEAR SERVICE</b> .....              | 3-44 |
| DRIVE AXLE POSITIONING .....                      | 3-46 |
| REMOVAL .....                                     | 3-50 |
| INSPECTION .....                                  | 3-51 |
| ASSEMBLY .....                                    | 3-51 |
| MIDDLE DRIVEN GEAR BEARINGS .....                 | 3-52 |



---

|                                                 |             |
|-------------------------------------------------|-------------|
| <b>ENGINE ASSEMBLY AND ADJUSTMENT .....</b>     | <b>3-55</b> |
| LOWER CRANKCASE .....                           | 3-55        |
| CRANKSHAFT/CONNECTING ROD/PISTON .....          | 3-56        |
| TRANSMISSION .....                              | 3-57        |
| UPPER CRANKCASE .....                           | 3-59        |
| CRANKCASE ASSEMBLY .....                        | 3-61        |
| OIL PUMP AND OIL PAN .....                      | 3-63        |
| BREATHER COVER AND STARTER MOTOR .....          | 3-65        |
| WATER PUMP AND THERMOSTATIC VALVE .....         | 3-65        |
| CLUTCH AND OIL PUMP DRIVE GEAR .....            | 3-66        |
| FLYWHEEL AND STARTER IDLE GEAR .....            | 3-69        |
| CYLINDER HEAD AND CAMSHAFT .....                | 3-71        |
| OIL DELIVERY PIPE AND CYLINDER HEAD COVER ..... | 3-77        |
| REMOUNTING ENGINE .....                         | 3-79        |



## ENGINE OVERHAUL

### ENGINE REMOVAL

**NOTE:**

It is not necessary to remove the engine in order to remove the following components:

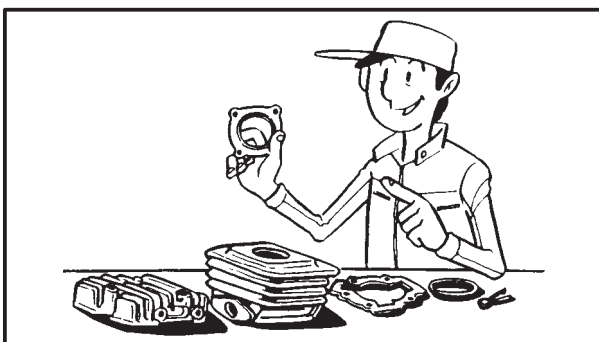
- Clutch
- Carburetor
- Water pump
- AC magneto

**PREPARATION FOR REMOVAL**

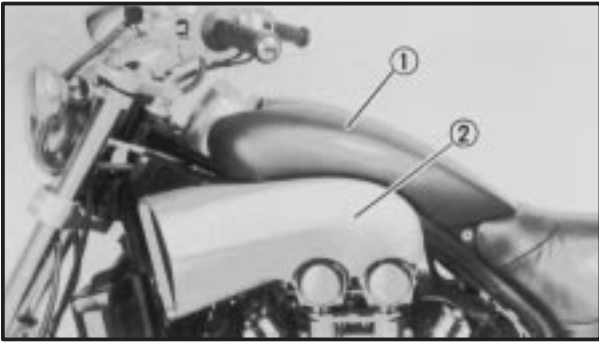
1. Remove all dirt, mud, dust, and foreign material before removal and disassembly.
2. Use proper tools and cleaning equipment.  
Refer to "CHAPTER 1. SPECIAL TOOL" section.

**NOTE:**

When disassembling the engine, keep mated parts together. This includes gears, cylinders, pistons, and other parts that have been "mated" through normal wear. Mated parts must be re-used as an assembly or replaced.



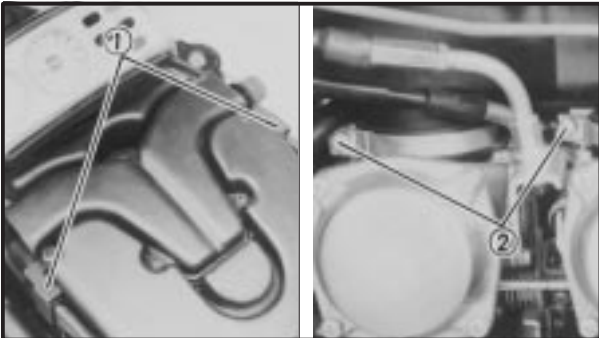
3. During engine disassembly, clean all parts and place them in trays in the order of disassembly. This will speed up assembly time and help assure that all parts are correctly re-installed in the engine.
4. Drain engine oil completely.  
Refer to "CHAPTER 2. ENGINE OIL REPLACEMENT" section.
5. Drain coolant completely.  
Refer to "CHAPTER 4. COOLANT REPLACEMENT" section.



## CARBURETOR

1. Remove:

- Top cover ①
- Covers (left and right) ②



2. Remove:

- Holders (carburetor overflow hose) ①

3. Loosen:

- Screws (air cleaner joint) ②



4. Remove:

- Ventilation hose (crankcase) ①
- Air cleaner assembly ②



5. Disconnect:

- Fuel hose ①



6. Disconnect:

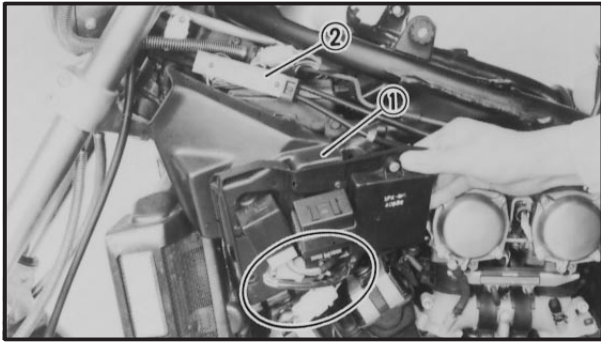
- Vacuum hose (ignition advance) ①

7. Loosen:

- Screws (carburetor joint)

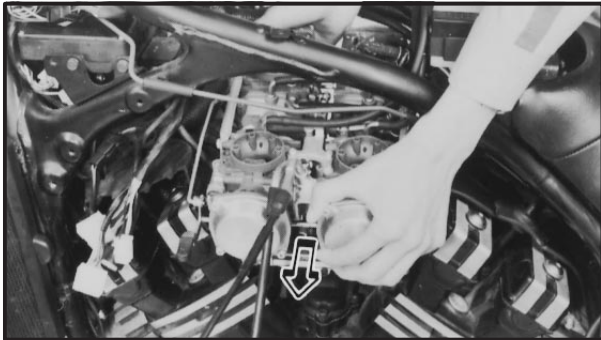
8. Remove:

- Carburetor joint cover (left and right) ②



9. Remove:
  - Electrical components board ①
  - Throttle cable cylinder ②

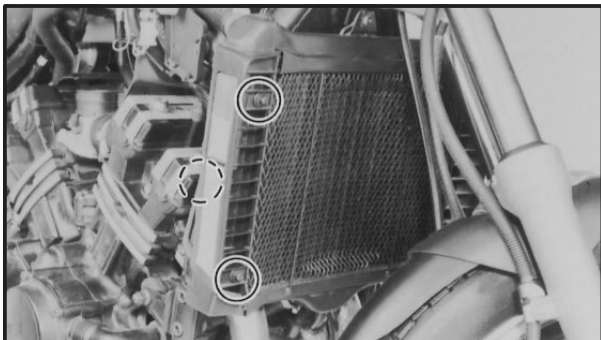
10. Disconnect:
  - All leads and cables



11. Remove:
  - Carburetor assembly

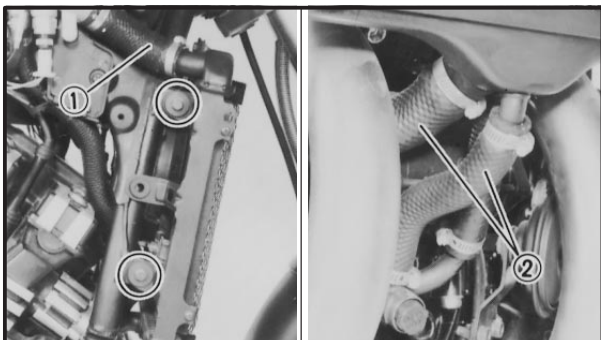
### NOTE:

Cover the carburetor with a clean rag to prevent dirt or foreign matter into the carburetor.



### RADIATOR

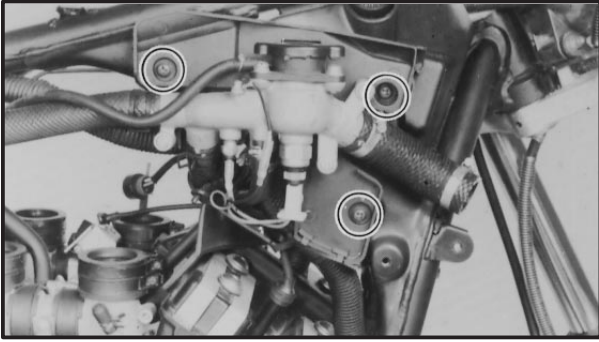
1. Remove:
  - Radiator covers



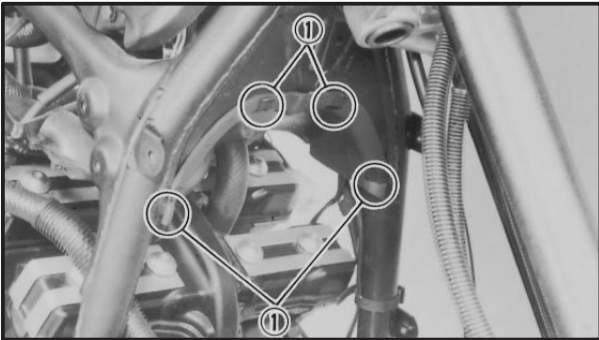
2. Remove:
  - Bolts (radiator)
3. Disconnect:
  - Upper hose ①
  - Lower hoses ②



4. Disconnect:
  - Fan motor coupler
5. Remove:
  - Radiator assembly
  - Horn

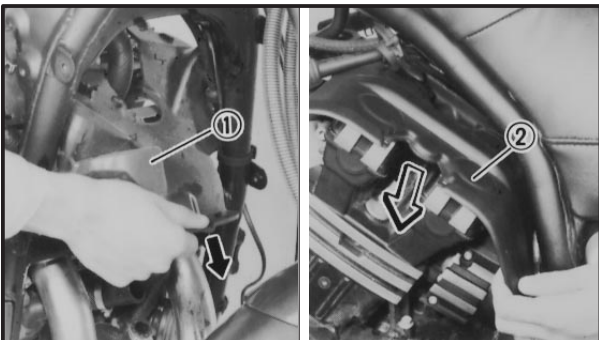


6. Disconnect:
  - All hoses and leads (conduit)
7. Remove:
  - Screws (conduit)

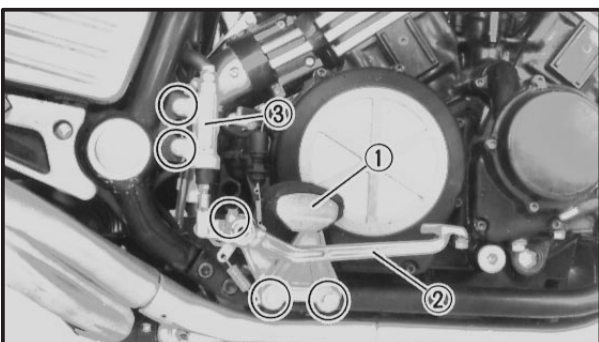


## AIR BAFFLE PLATE

1. Disconnect:
  - Spark plug caps
2. Straighten:
  - Tabs (front baffle plate) ①

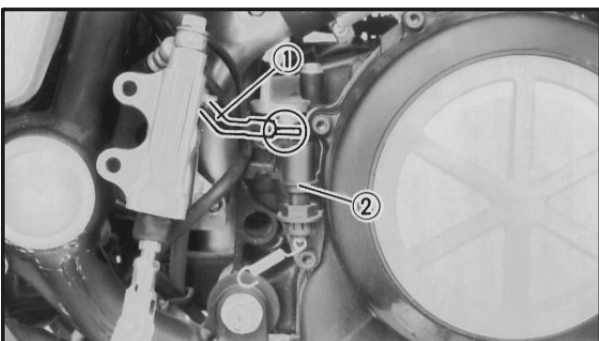


3. Remove:
  - Air baffle plate (front) ①
  - Air baffle plate (rear) ②

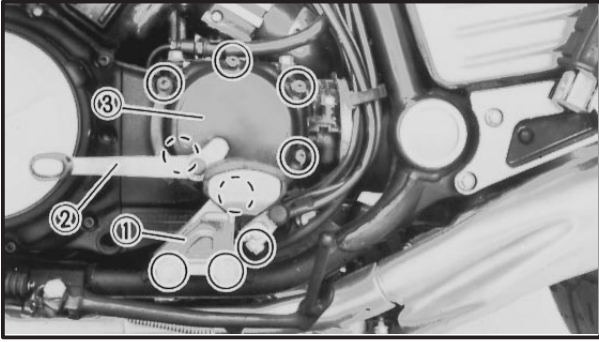


## FOOTREST (RIGHT) AND BRAKE PEDAL

1. Remove:
  - Footrest (right) ①
  - Brake pedal assembly ②
  - Brake master cylinder ③



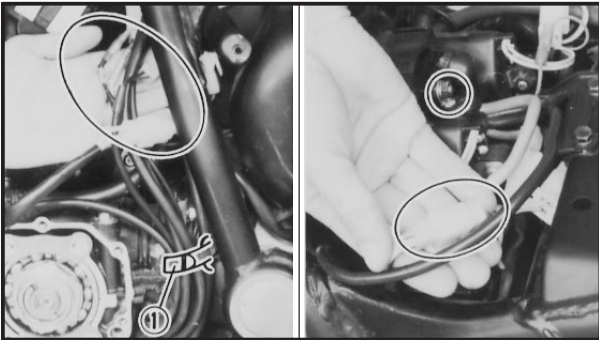
2. Disconnect:
  - Ground lead ①
3. Remove:
  - Rear brake switch ②



## FOOTREST (LEFT) AND CLUTCH RELEASE CYLINDER

### 1. Remove:

- Footrest (left) ①
- Change pedal assembly ②
- Middle gear case cover ③



### 2. Remove:

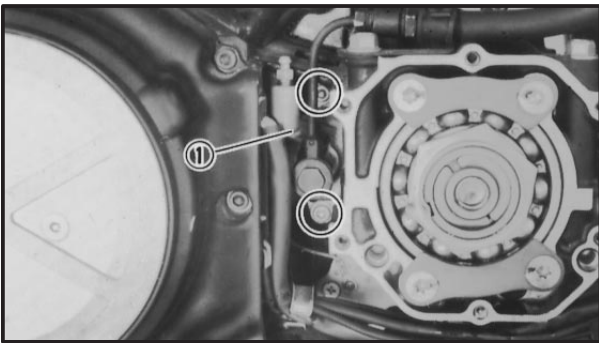
- Seat ①
- Side cover (left) ②

### 3. Disconnect:

- All leads (engine)

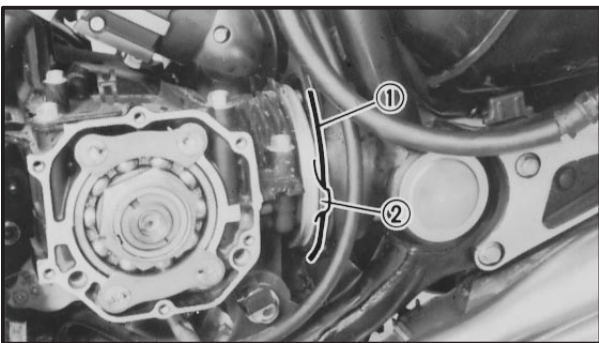
### 4. Remove:

- Band ①



### 5. Remove:

- Clutch release cylinder ①

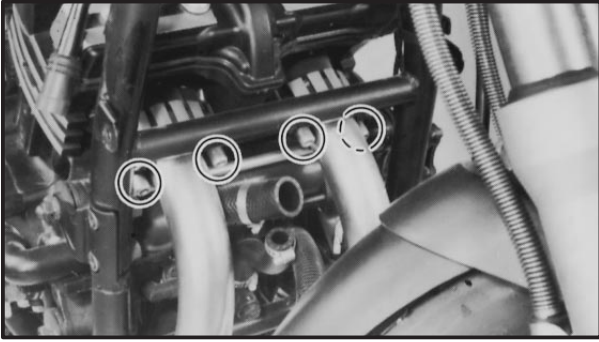


### 6. Remove:

- Spring ①

### 7. Disconnect:

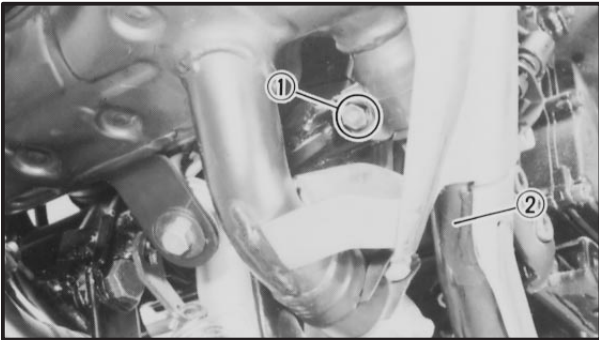
- Rubber boot ②



### EXHAUST PIPE AND MUFFLER

1. Remove:

- Flange bolts (front exhaust pipe)

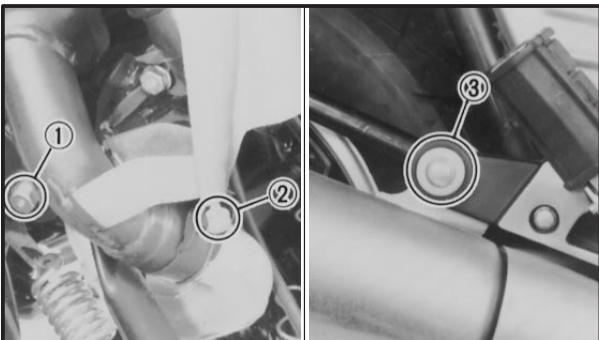


2. Loosen:

- Bolts (front exhaust pipe) ①

3. Remove:

- Front exhaust pipes ②



4. Remove:

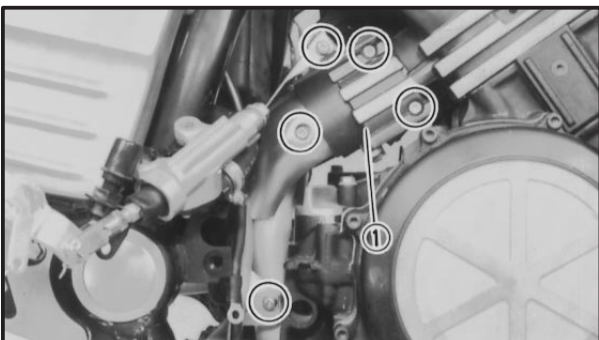
- Bolt (muffler chamber) ①

5. Loosen:

- Bolts (muffler) ②

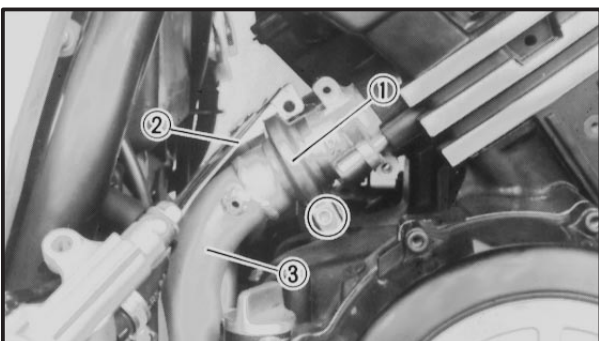
6. Remove:

- Bolts (muffler bracket) ③
- Mufflers



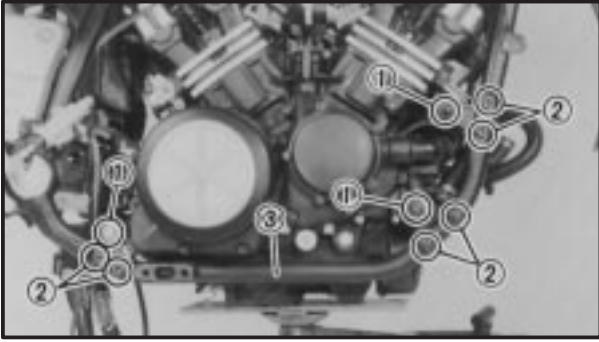
7. Remove:

- Screws (rear exhaust protector)
- Covers (rear exhaust) ①



8. Remove:

- Clamps (rear exhaust pipes) ①
- Protector ②
- Rear exhaust pipes ③

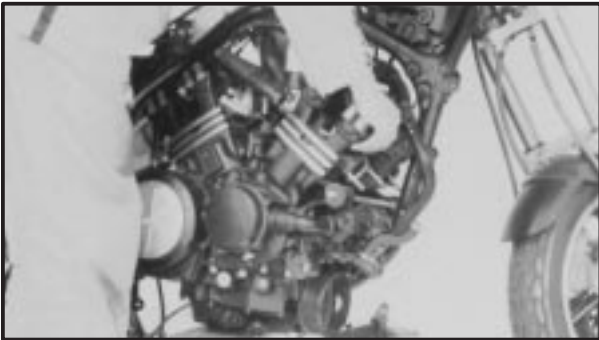


### ENGINE REMOVAL

1. Place a suitable stand under the engine.

2. Remove:

- Bolt (engine) ①
- Bolts (down tube) ②
- Down tube frame (right) ③

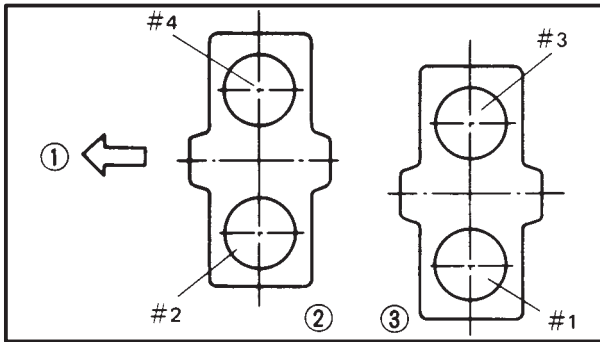


3. Remove:

- Engine assembly  
From right side.

### NOTE:

Remove the rear cylinder head cover if difficulties are encountered with any of the previous steps.



## ENGINE DISASSEMBLY CYLINDER HEAD AND CAMSHAFT Rear Cylinder Head

### 1. Remove:

- Cylinder head covers (rear and front)
- Gaskets
- Spark plugs

### ① Front

### ② Front cylinder

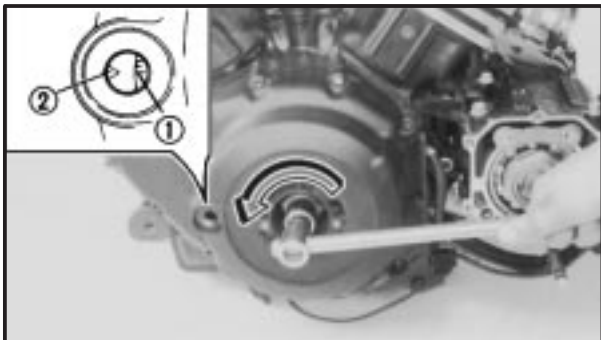
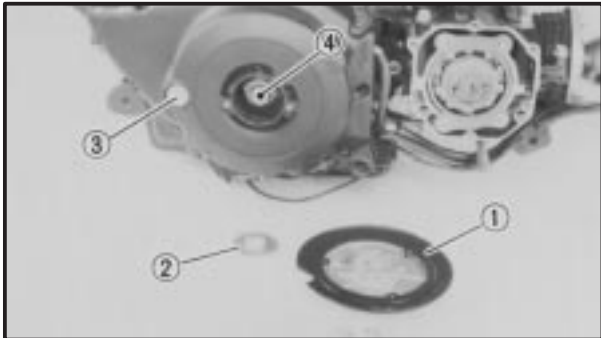
### ③ Rear cylinder

### 2. Remove:

- Crankcase cover plate ①
- Special washer ②
- Timing plug ③

### NOTE:

Check for clog of oil passage ④ in the bolt.  
If any, clean the oil passage.



### 3. Align:

- Flywheel "T-1" mark ① with stationary pointer ② on crankcase cover



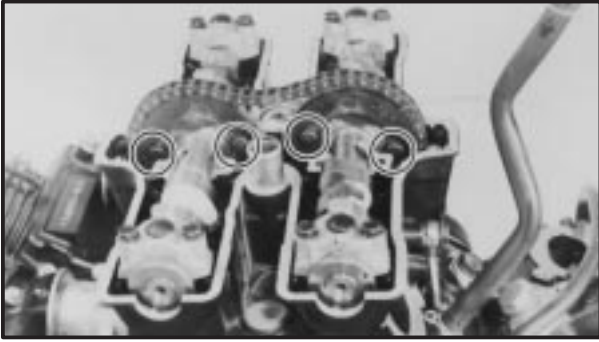
### 4. Remove:

- Cam chain tensioner (rear) ①

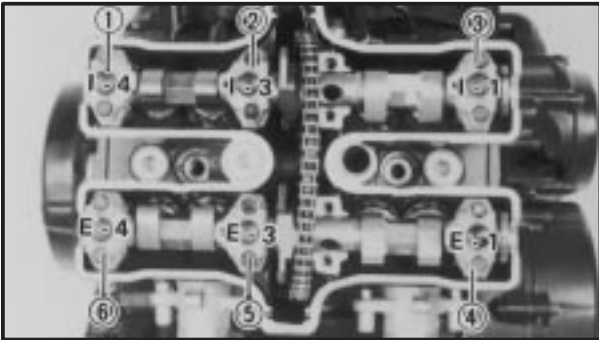


### 5. Remove:

- Chain guides ①, ②
- Camshaft caps ③, ④  
They was marked "I-2" ③ and "E-2" ④.



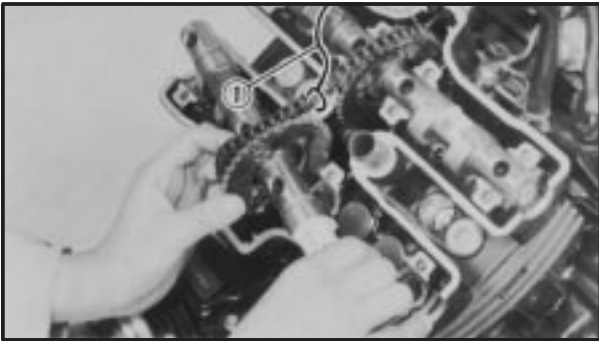
6. Remove:
- Bolts (cam chain sprocket).
- Use 22 mm wrench to hold camshaft.



7. Remove:
- Camshaft caps ①, ②, ③, ④, ⑤, ⑥

**NOTE:**

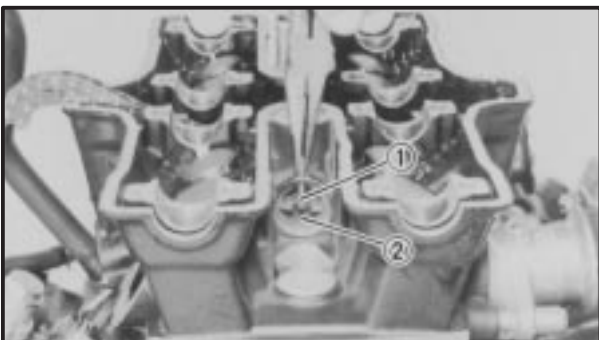
When loosening camshaft cap bolts, be sure camshaft cam lobes do not touching valve lifters.



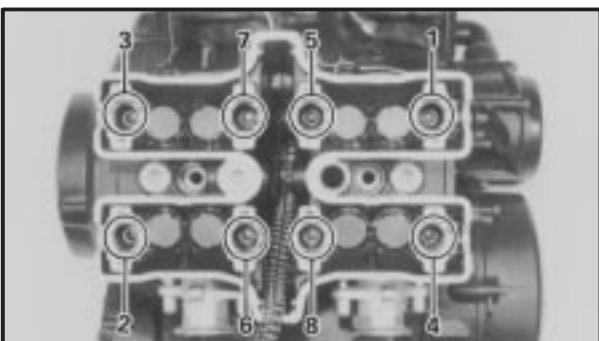
8. Remove:
- Camshafts
  - Sprockets
- Slip the sprockets from mounting boss on camshaft.

**NOTE:**

Fasten a safety wire ① to the cam chain.



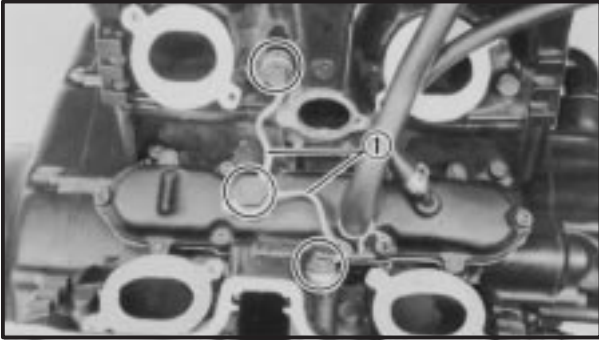
9. Remove:
- Lock pin ①
  - Water jacket joint ②



10. Remove:
- Nuts (cylinder head)
- Use 8 mm Wrench Adapter (90890-04076).

**NOTE:**

Follow numerical order shown in photo. Start by loosening each nut 1/2 turn until all are loose.



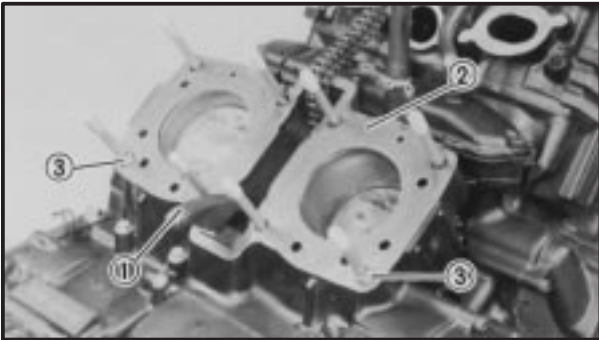
11. Remove:

- Oil delivery pipe ①

**NOTE:**

When removing the pipe, be sure not to lose the washers that may fall out.

- Cylinder head



12. Remove:

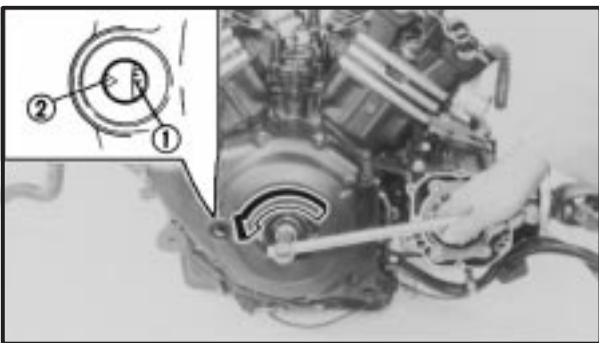
- Cam chain guide (rear) ①
- Gasket ②
- Dowel pins ③

### Front Cylinder Head

When removing the front cylinder head, repeat the rear cylinder head removal procedure. However, note the following points.

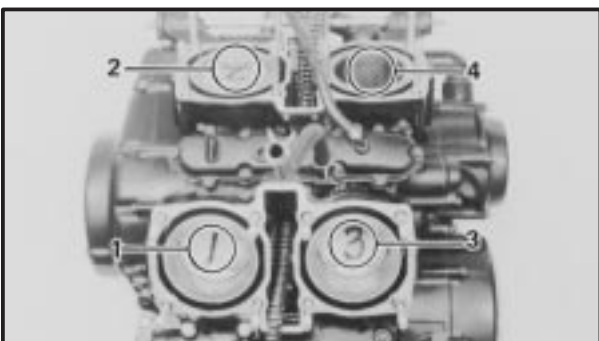
1. Rotate:

- Crankshaft  
Counterclockwise 360° plus an added 70° (430° total) from the "T-1" mark.



2. Align:

- Flywheel "T-2" mark ① with stationary pointer ② on crankcase cover



3. Mark:

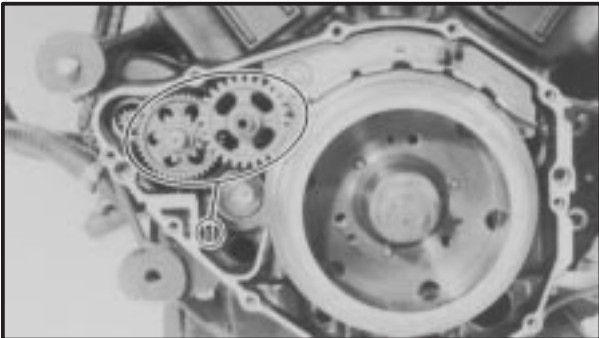
- Pistons  
With piston number designations as shown.



### STARTER IDLE GEARS AND FLYWHEEL

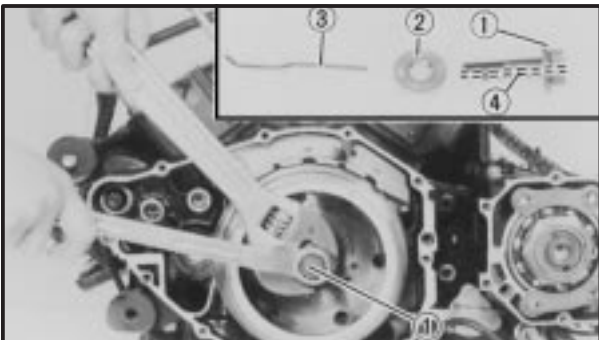
#### 1. Remove:

- Crankcase cover (left) ①
- Gasket
- Dowel pins



#### 2. Remove:

- Starter idle gears ①

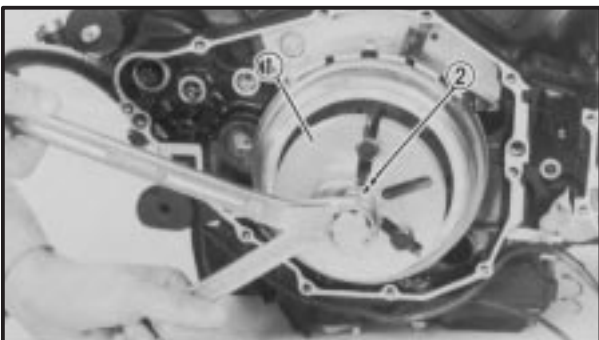


#### 3. Remove:

- Bolt (flywheel) ①
- Plain washer ②
- Pin ③

#### NOTE:

Check for clog of oil passage ④ in the bolt. If any, clean the oil passage.



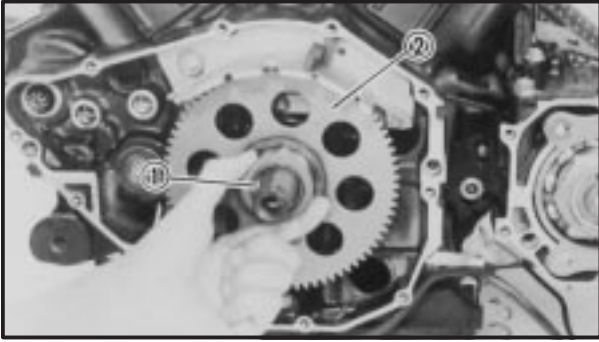
#### 4. Remove:

- Flywheel
- Use the Flywheel Puller (90890-01362) ① with the Puller Adapter (90890-04089) ②.

#### NOTE:

When removing the flywheel, do not allow the oil baffle plate ③ to touch the projections ④ on the flywheel.





5. Remove:
- Woodruff key ①
  - Starter clutch gear ②



6. Remove:
- Oil baffle plate ①



## CLUTCH AND OIL PUMP DRIVE GEAR

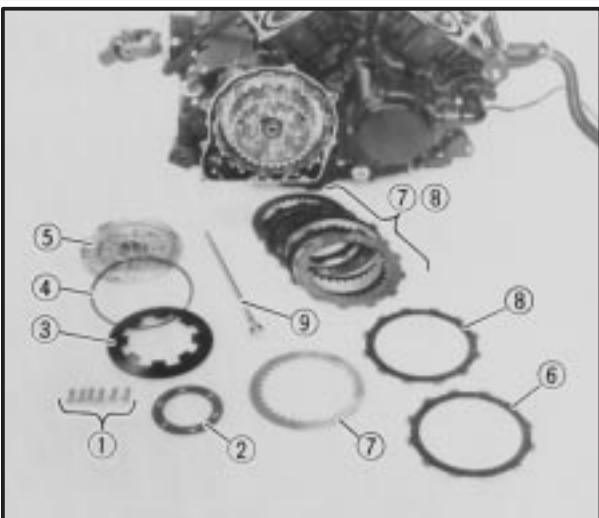
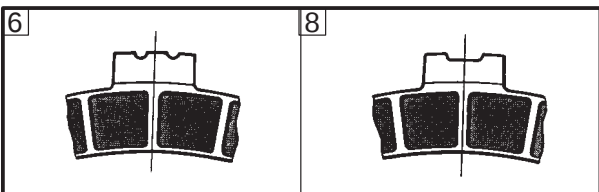
1. Remove:
- Crankcase cover (right) ①

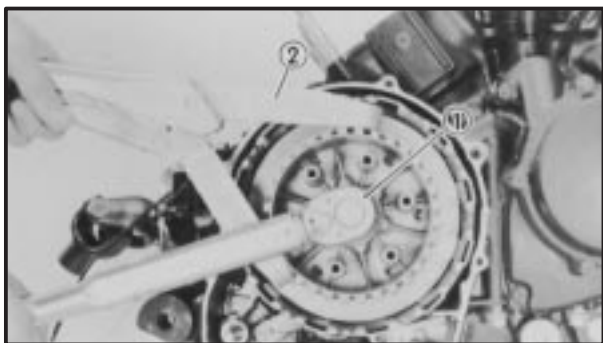
### NOTE:

Working in a crisscross pattern, loosen the bolts 1/4 turn each. Remove them after all are loosened.

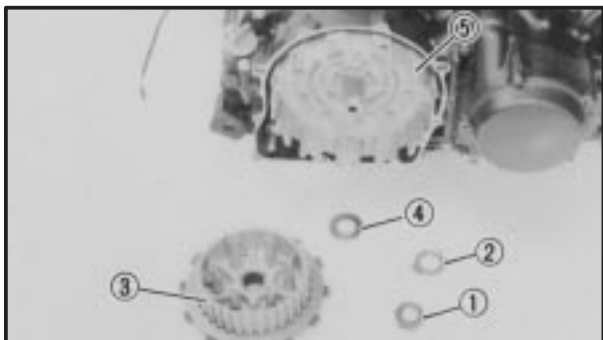
- Gasket
- Dowel pins

2. Remove:
- Bolts (clutch spring) ①
  - Plate washer ②
  - Clutch spring ③
  - Spring seat ④
  - Pressure plate ⑤
  - Friction plate ⑥
  - Clutch plates ⑦
  - Friction plates ⑧
  - Push rod ⑨

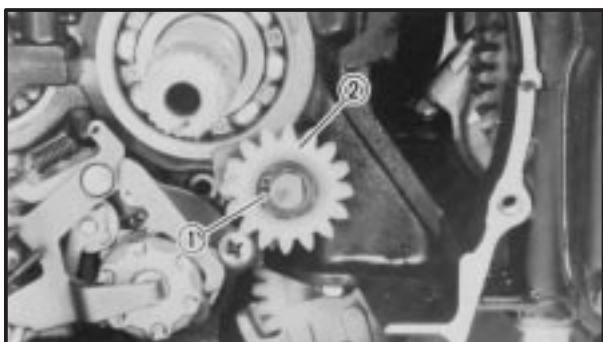




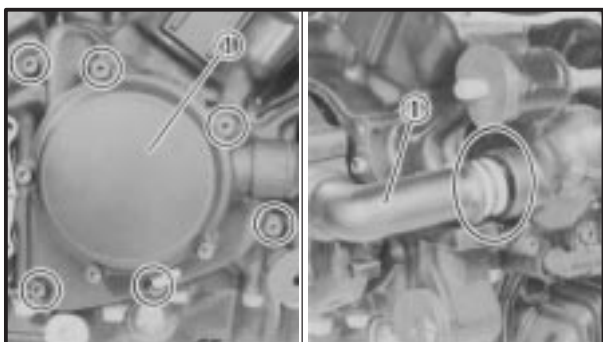
3. Straighten the lock washer tabs.
4. Loosen:
  - Nut (clutch boss) ①
  - Use the Clutch Holder (90890-04086) ② to hold the clutch boss.



5. Remove:
  - Nut (clutch boss) ①
  - Lock washer ②
  - Clutch boss ③
  - Thrust washer ④
  - Clutch housing ⑤

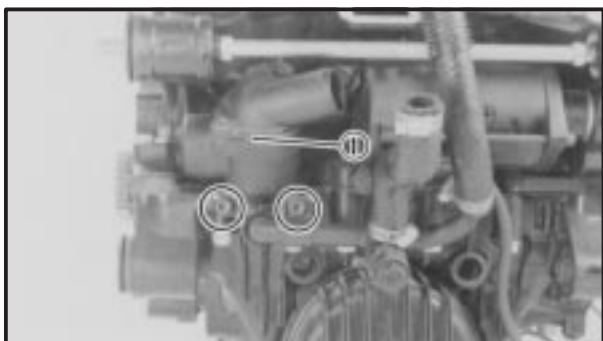


6. Remove:
  - Circlip ①
  - Oil pump drive gear ②

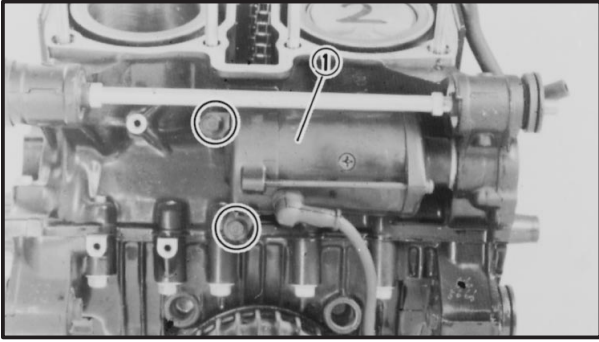


## WATER PUMP AND THERMOSTATIC VALVE

1. Remove:
  - Water pump cover/Water pump cable ①
  - Gasket
  - Dowel pins



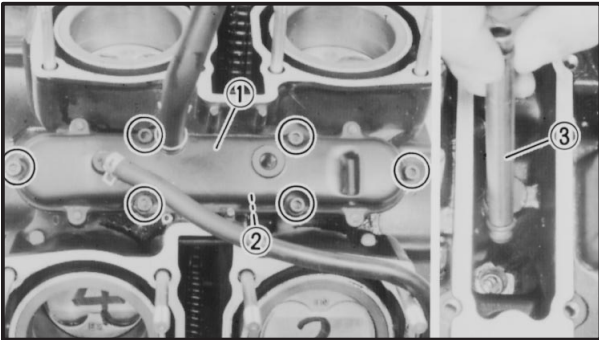
2. Remove:
  - Thermostat assembly ①



## STARTER MOTOR AND BREATHER COVER

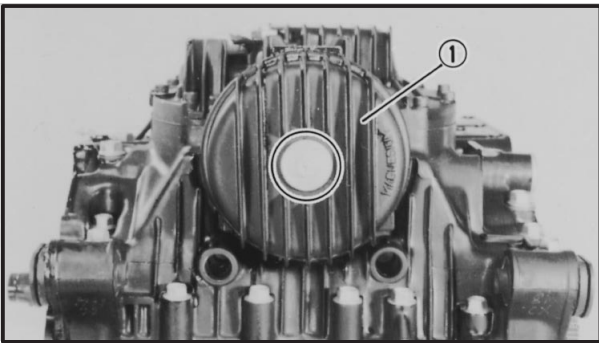
1. Remove:

- Starter motor ①



2. Remove:

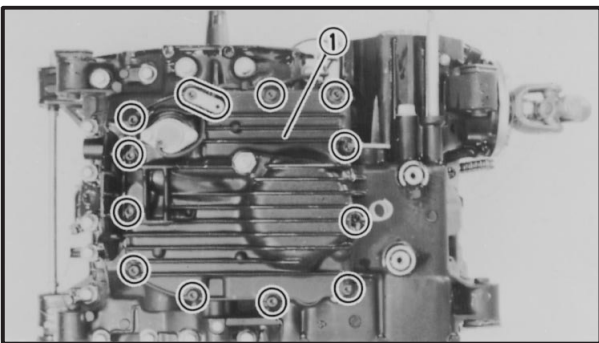
- Breather cover ①
- Breather cover spacer ②
- Oil pipe ③



## OIL PAN AND OIL PUMP

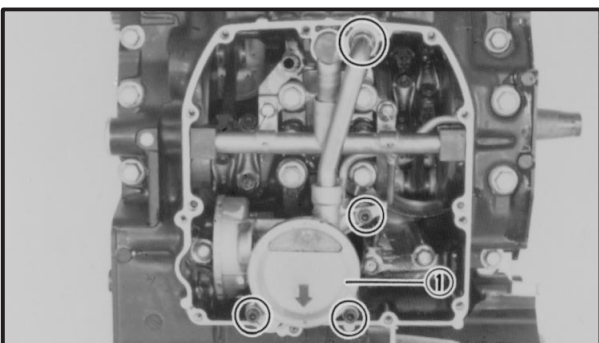
1. Remove:

- Oil filter cover ①



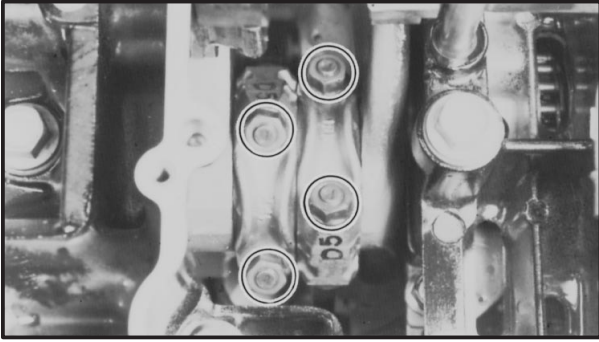
2. Remove:

- Oil pan ①
- Gasket
- Dowel pins



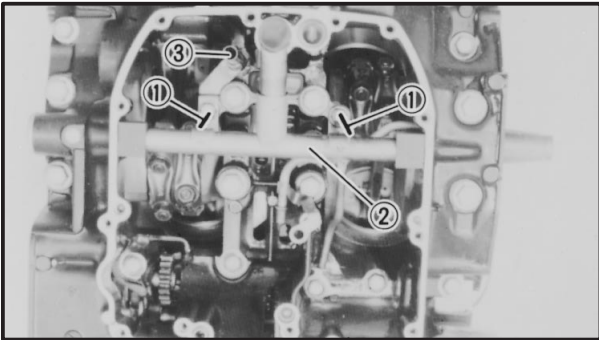
3. Remove:

- Oil pump assembly ①
- Dowel pins



## NOTE:

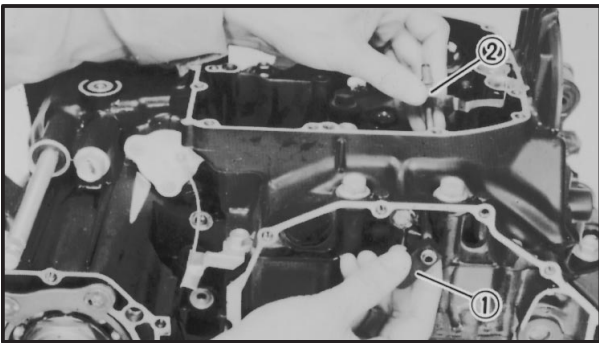
At this stage it is possible to replace the piston, connecting rod, and big-end bearing by simply removing the connecting rod nut. None of the steps below are necessary to replace the above components.



4. Straighten the bracket tabs ①.

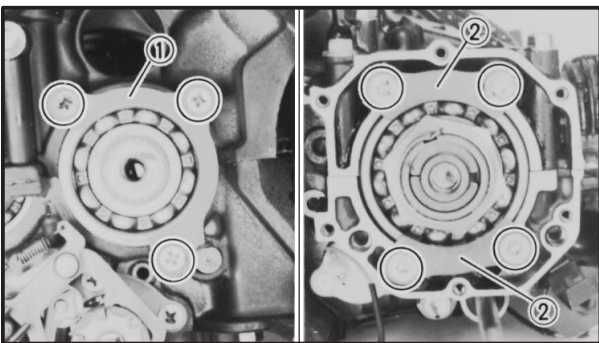
5. Remove:

- Oil pipe ②
- Main oil gallery pipe ③



6. Remove:

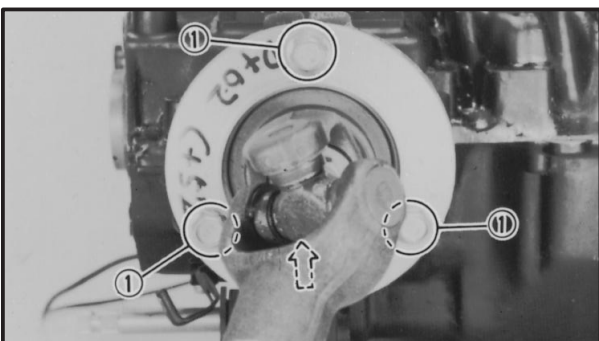
- Damper (oil pump pipe) ①
- Oil pump pipe ②



## CRANKCASE DISASSEMBLY

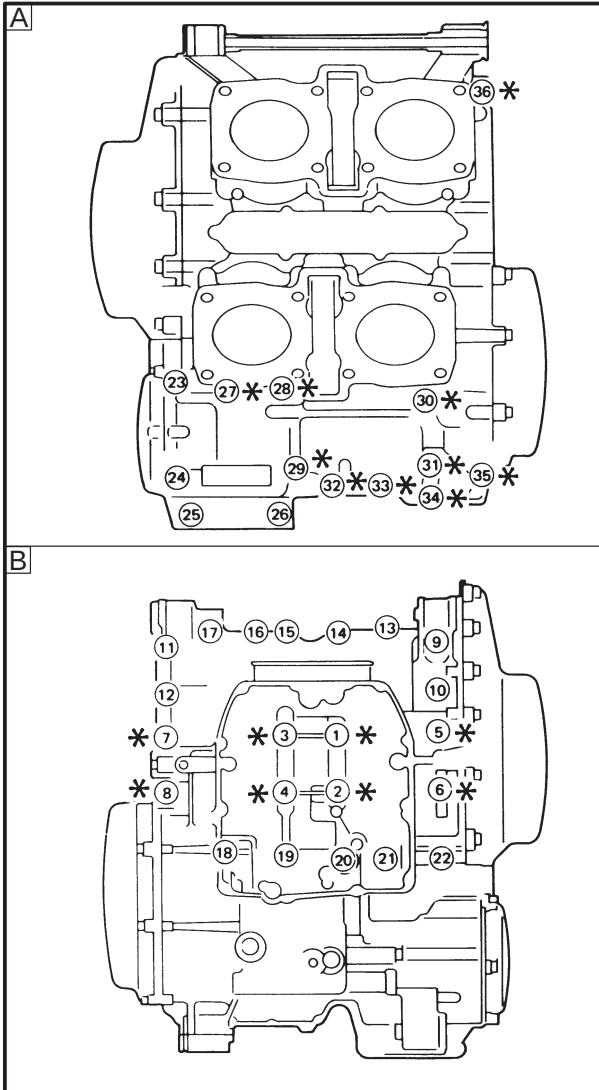
1. Remove:

- Retainer (main axle bearing) ①
  - Retainers (middle gear bearing) ②
- Use the #40 Torx Driver (90890-04049).



2. Remove:

- Bolts (middle driven gear housing) ①



3. Remove:

- Bolts (crankcase)

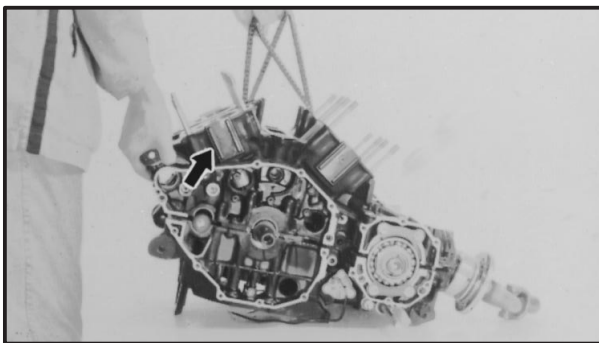
**NOTE:**

- Remove the bolts starting with the highest numbered one.
- The embossed numbers in the crankcase designate the crankcase tightening sequence.

\* With washer

**A** UPPER CASE

**B** LOWER CASE



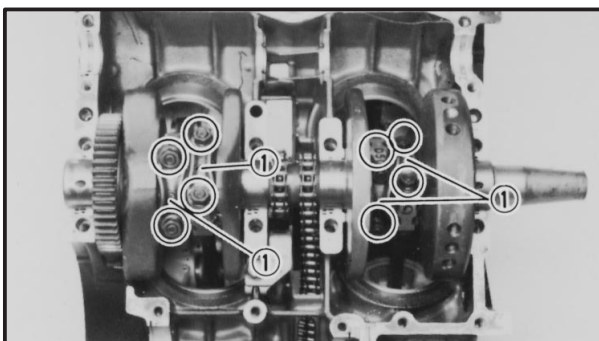
4. Remove:

- Crankcase (upper)  
Use a soft hammer.

**NOTE:**

Pull out the crankcase (upper) while pulling up the cam chain.

- Dowel pins



### UPPER CRANKCASE

1. Remove:

- Connecting rod caps ①
- Connecting rod/Piston assembly

**CAUTION:**

Do not hammer out the connecting bolts to remove the connecting rod assembly.

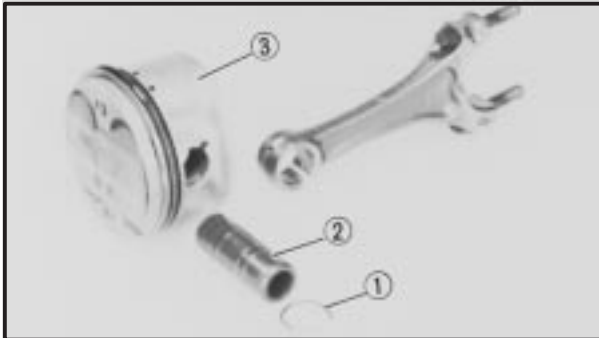


2. Remove:

- Crankshaft
- Plane bearings (crankshaft/connecting rods/balancer shaft)

**NOTE:**

Identify each plane bearing position very carefully so that it can be reinstalled in its original place.



3. Remove:

- Piston pin clip ①
- Piston pin ②
- Piston ③

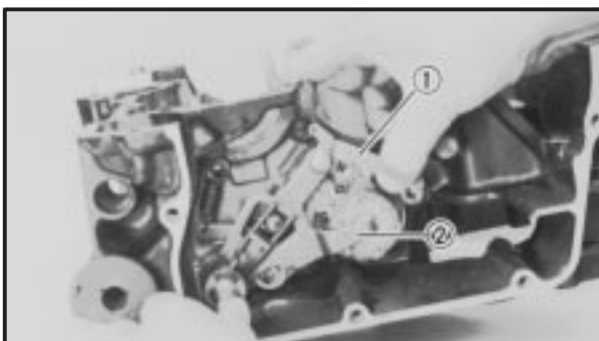
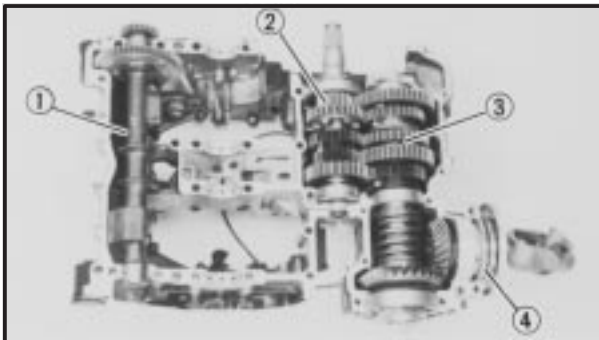
## TRANSMISSION

1. Remove:

- Balancer shaft ①
- Main axle assembly ②
- Drive axle assembly ③
- Middle driven gear assembly ④
- Plane bearings (Crankshaft/balancer shaft)

**NOTE:**

Identify each plane bearing position very carefully so that it can be reinstalled in its original place.



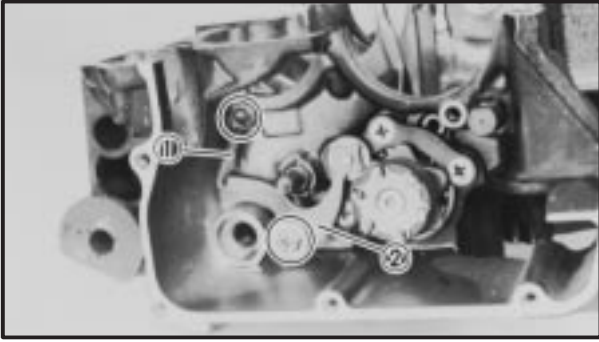
## LOWER CRANKCASE

1. Remove:

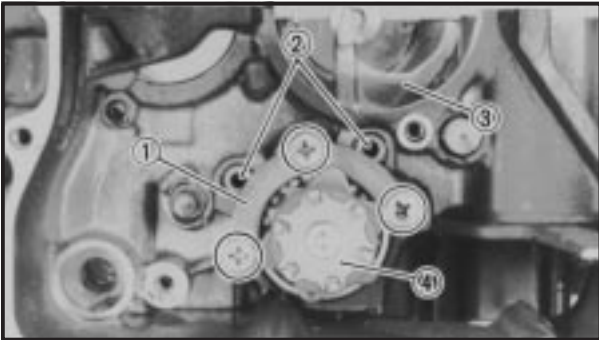
- Shift shaft assembly

① Shift lever 1

② Shift lever 2

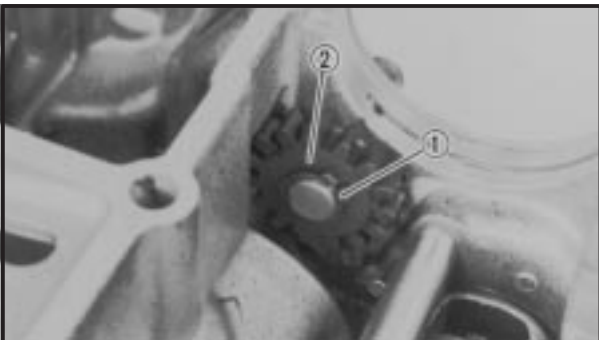


2. Unhook:
  - Tension spring ①
3. Remove:
  - Shift cam stopper lever ②

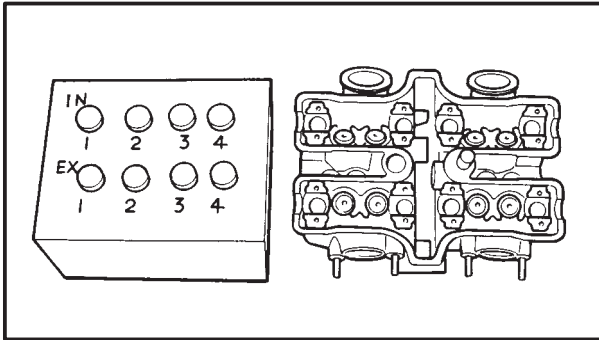


4. Remove:
  - Bearing retainer (shift cam) ①
  - Guide bars ②
  - Shift forks ③
  - Shift cam ④

**NOTE:** \_\_\_\_\_  
 Note the position of each part. Pay particular attention to the location and direction of shift forks.



5. Remove:
  - Circlip ①
  - Oil pump idle gear ②



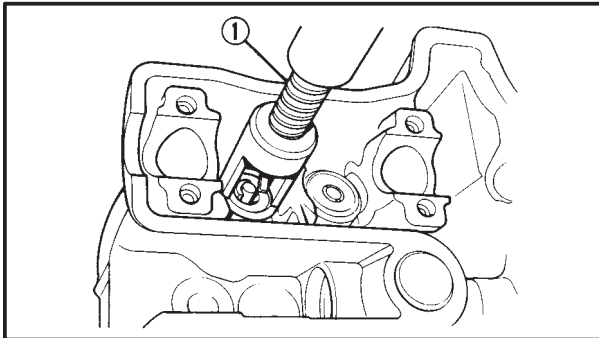
## INSPECTION AND REPAIR CYLINDER HEAD

### 1. Remove:

- Valve pads
- Lifters
- Spark plugs

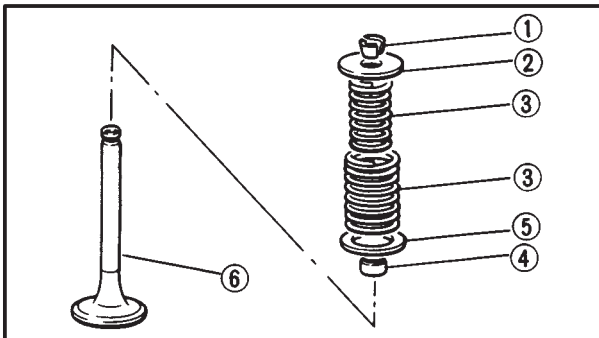
### NOTE:

Identify each lifter and pad position very carefully so that it can be reinstalled in its original place.



### 2. Attach:

- Valve Spring Compressor (90890-04019) ①

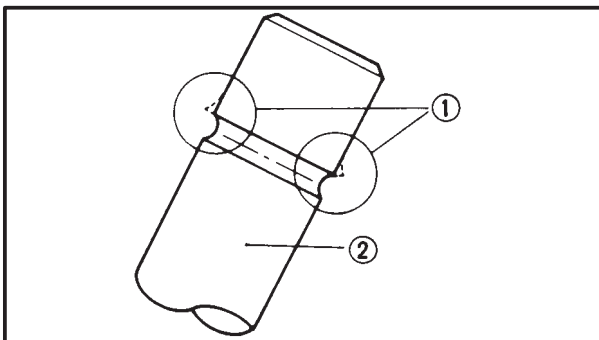


### 3. Remove:

- Valve retainers ①
- Valve spring seat ②
- Valve springs ③
- Oil seal ④
- Valve spring seat ⑤
- Valve ⑥

### NOTE:

Deburr any deformed valve stem end. Use an oil stone to smooth the stem end.



① Deburr

② Valve stem

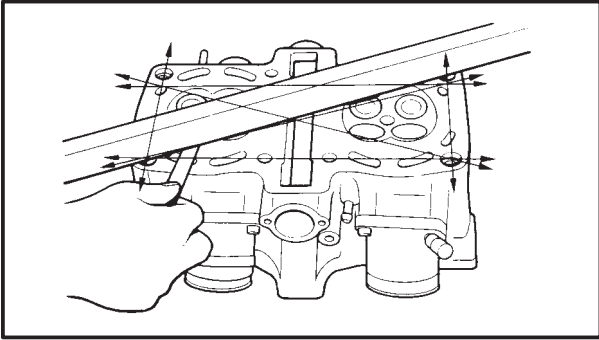
### 4. Eliminate:

- Carbon deposit
- Use rounded scraper.

### NOTE:

Do not use a sharp instrument and avoid damaging or scratching.

- Spark plug threads
- Valve seat
- Cylinder head

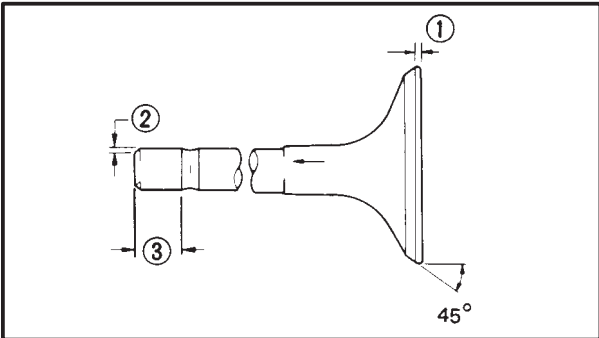


## 5. Measure:

- Cylinder head warpage  
Under specification → Resurface.  
Over specification → Replace.



**Cylinder Head Warp Limit:**  
Less than 0.03 mm (0.0012 in)

**VALVE, VALVE GUIDE, AND VALVE SEAT**  
**Intake and Exhaust Valve**

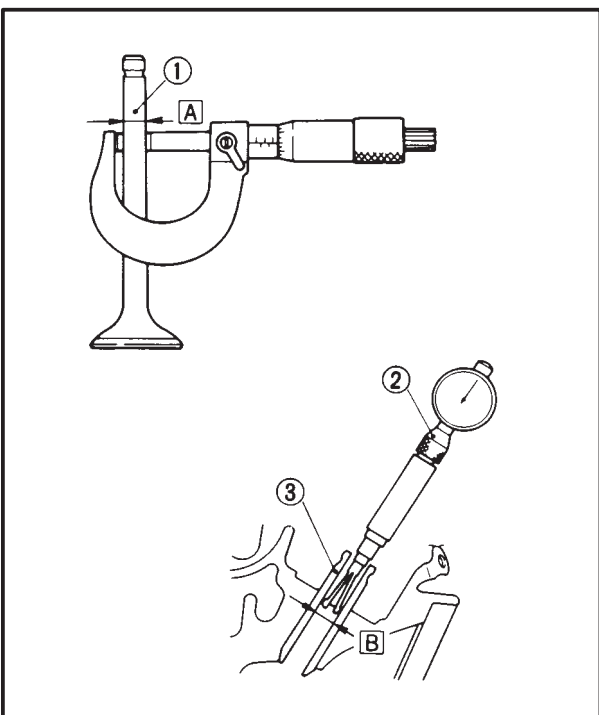
## 1. Inspect:

- Valve face
  - Stem end
- Wear/Pitting/Out of specification → Replace.

**Minimum Thickness (Service limit)**

①: 0.7 mm (0.028 in)

Beveled ②: 0.5 mm (0.020 in)

**Minimum Length (Service limit) ③:**  
4.0 mm (0.16 in)

## 2. Measure:

- Valve stem clearance  
Out of specification → Replace either valve and/or guide.  
Use the Micrometer and Bore Gauge.

|  | Valve Stem Clearance                     | Maximum                |
|-------------------------------------------------------------------------------------|------------------------------------------|------------------------|
| Intake                                                                              | 0.010 ~ 0.037 mm<br>(0.0004 ~ 0.0015 in) | 0.08 mm<br>(0.0031 in) |
| Exhaust                                                                             | 0.025 ~ 0.052 mm<br>(0.0010 ~ 0.0020 in) | 0.10 mm<br>(0.0039 in) |

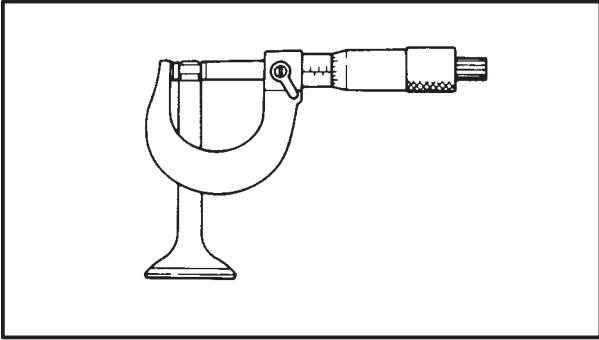
① Valve

② Bore Gauge

③ Valve guide

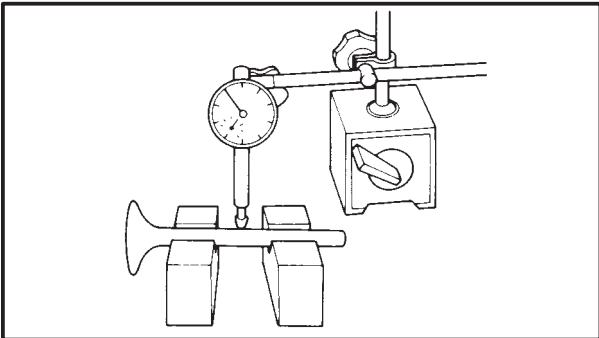
[A] Valve stem outside diameter

[B] Valve guide inside diameter



## 3. Inspect:

- Valve stem end  
Mushroom shape/Larger diameter than rest of stem → Replace valve, valve guide, and oil seal.



## 4. Measure:

- Valve stem runout  
Out of specification → Replace.



**Maximum Runout:**  
**0.01 mm (0.0004 in)**

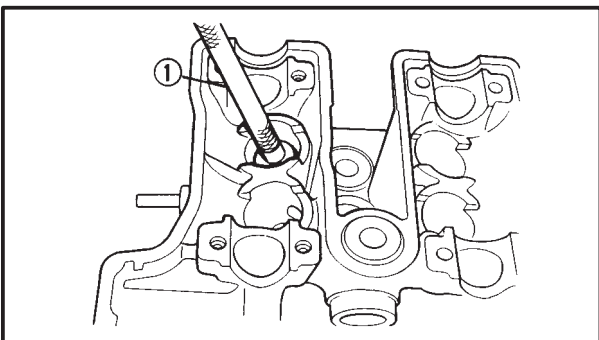
## Valve Guide

**NOTE:**

- Always replace valve guide if valve is replaced.
- Always replace oil seal if valve is removed.

## 1. Inspect:

- Valve guide  
Wear/Oil leakage into cylinder → Replace.

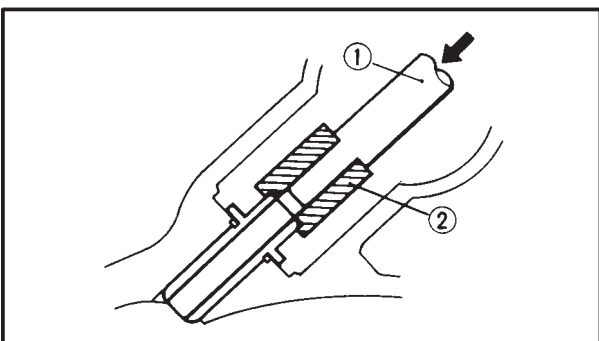


## 2. Remove:

- Valve guide  
Use the Valve Guide Remover (90890-01122) ①.

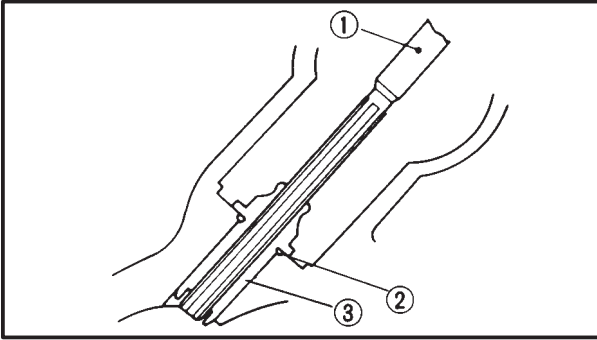
**NOTE:**

Heat the head in an oven to 100°C (212°F) to ease guide removal and installation and to maintain correct interference fit.



## 3. Install:

- Circlip (new)
- Valve guide (Oversize)  
Use the Valve Guide Remover (90890-01122) ① with the Valve Guide Installer (90890-04015) ②.



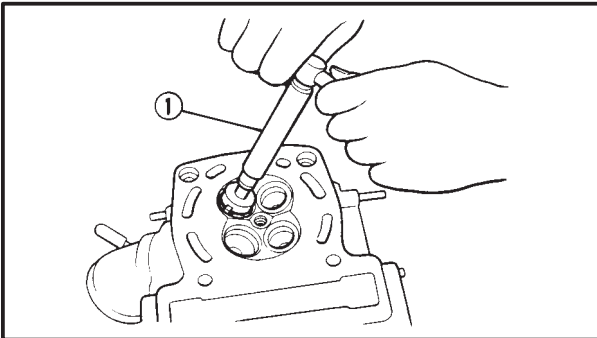
### NOTE:

After installing valve guide:

- Use the 5.5 mm Valve Guide Reamer (90890-01196) ① to obtain proper valve guide/valve stem clearance.
- Recut the valve seat.

② Circlip

③ Valve guide



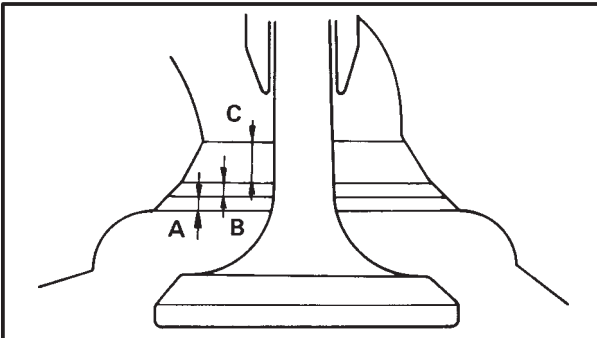
### Valve Seat

1. Inspect:

- Valve seat  
Wear/Pitting/Valve replacement → Resurface seat at 45° angle.

### CAUTION:

Clean valve seat if pitted or worn using a 45° Valve Seat Cutter (YM-91043) ①. When twisting cutter, keep an even downward pressure to prevent chatter marks.



| Cut sections as follows |        |
|-------------------------|--------|
| Section                 | Cutter |
| A                       | 30°    |
| B                       | 45°    |
| C                       | 60°    |

2. Measure:

- Valve seat width

3. Apply:

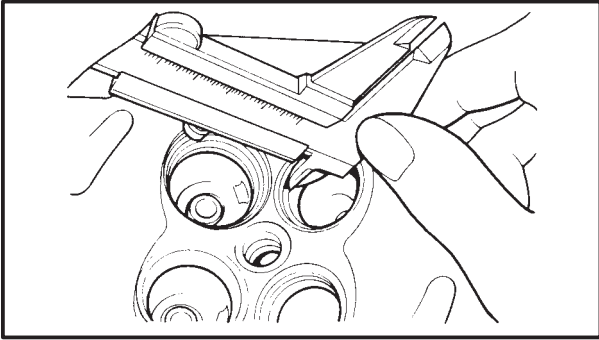
- Mechanics bluing dye (Dykem)  
To valve and seat.
- Fine grinding compound (small amount)  
Ground surface of valve face.

4. Position:

- Valves  
Into cylinder head.  
Spin it rapidly back and forth, then lift valve and clean off all grinding compound.

5. Inspect:

- Valve seat surface  
Wherever valve seat and valve face made contact, bluing will have been removed.



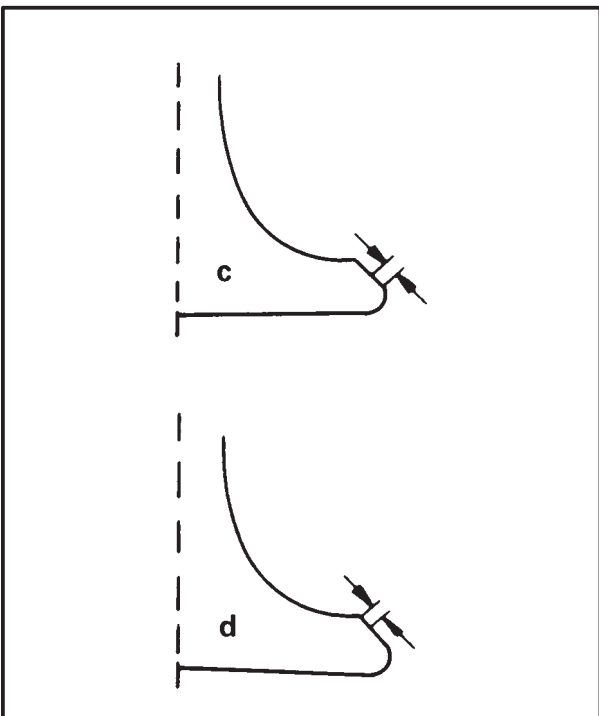
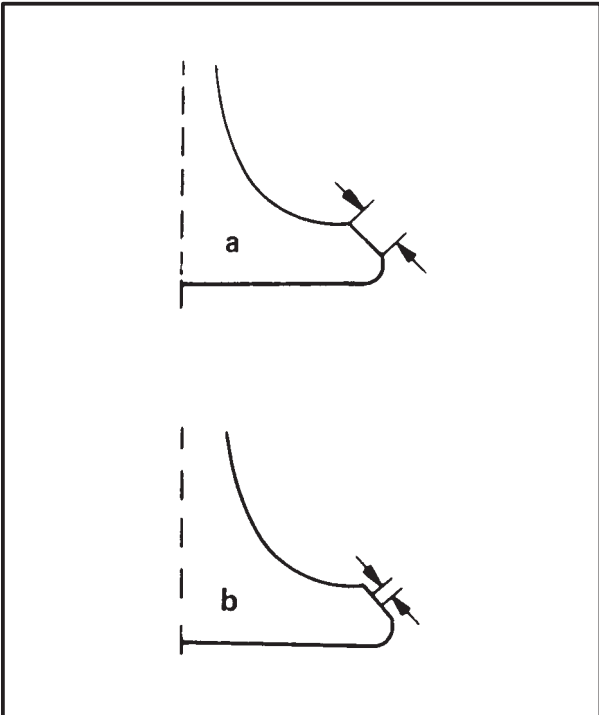
## 6. Measure:

- Valve seat width

Out of specification/Remaining pitting/Variation of valve seat width → Cut valve further.

**CAUTION:**

Remove just enough material to achieve satisfactory seat.

**Seat Width:**

**Standard: 0.9 ~ 1.1 mm**

**(0.035 ~ 0.043 in)**

**Wear limit: 1.4 mm (0.055 in)**

**Valve seat recutting steps are necessary if:**

- Valve seat is uniform around perimeter of valve face but too wide or not centered on valve face.

| Valve Seat Cutter Set |            | Desired Result                            |
|-----------------------|------------|-------------------------------------------|
| Use either            | 30° cutter | To center the seat or to reduce its width |
|                       | 45° cutter |                                           |
|                       | 60° cutter |                                           |

- Valve face indicates that valve seat is centered on valve face but is too wide (see "a" diagram).

| Valve Seat Cutter Set |            | Desired Result                                  |
|-----------------------|------------|-------------------------------------------------|
| Use lightly           | 30° cutter | To reduce valve seat width to 1.0 mm (0.039 in) |
|                       | 60° cutter |                                                 |

- Valve seat is in the middle of the valve face but too narrow (see "b" diagram).

| Valve Seat Cutter Set |            | Desired Result                                             |
|-----------------------|------------|------------------------------------------------------------|
| Use                   | 45° cutter | To achieve a uniform valve seat width of 1.0 mm (0.039 in) |

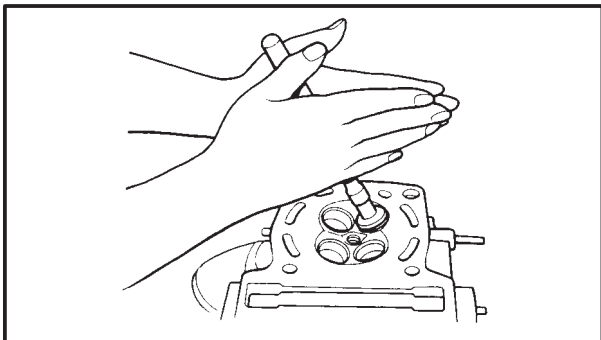
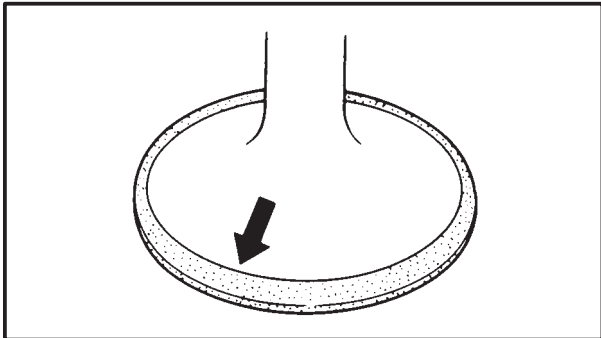
- Valve seat is too narrow and right up near valve margin (see "c" diagram).

| Valve Seat Cutter Set |                   | Desired Result                               |
|-----------------------|-------------------|----------------------------------------------|
| Use                   | 30° cutter, first | To center the seat and to increase its width |
|                       | 45° cutter        |                                              |



- Valve seat is too narrow and is located down near the bottom edge of the valve face (see diagram "d").

| Valve Seat Cutter Set |                   | Desired Result                               |
|-----------------------|-------------------|----------------------------------------------|
| Use                   | 60° cutter, first | To center the seat and to increase its width |
|                       | 45° cutter        |                                              |



### Valve/Valve Seat Assembly Lapping

1. Apply:
  - Coarse lapping compound (small amount)  
To valve face.
  - Molybdenum disulfide oil  
To valve stem.
2. Position:
  - Valves  
In cylinder head.
3. Rotate:
  - Valve  
Turn until valve and valve seat are evenly polished, then clean off all compound.
4. Apply:
  - Fine lapping compound (small amount)  
To valve face.
5. Repeat steps 2 and 3.

#### NOTE:

Be sure to clean off all compound from valve face after every lapping operation.

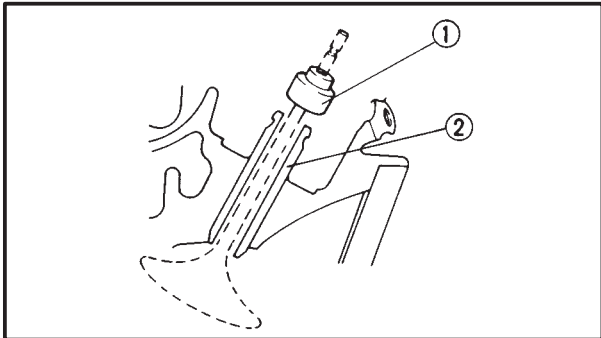
6. Inspect:
  - Valve face  
Not yet uniformly smooth → Repeat procedure from step 1.
7. Apply:
  - Mechanics bluing dye (Dykem)  
To valve face and seat.
8. Rotate:
  - Valve
9. Inspect:
  - Valve face  
Valve must make full seat contact indicated by grey surface all around. The valve face where bluing was removed.  
Faulty contact → Replace.  
(See procedure below)



10. Apply:
- Solvent
- Into each intake and exhaust port.

**NOTE:**

Pour solvent into intake and exhaust ports only after completion of all valve work and assembly of all head parts.

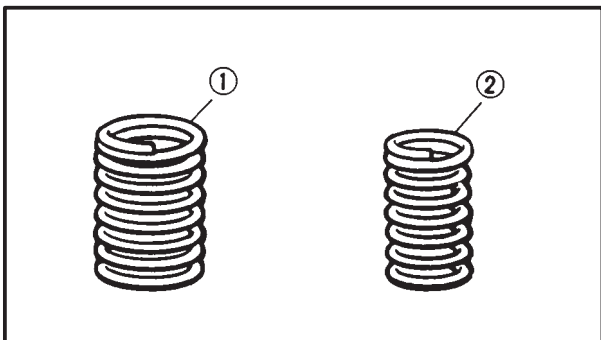


11. Check:
- Valve seals ①
- Leakage past valve seat → Replace valve.  
(See procedure below)

## ② Valve guide

**Relapping steps:**

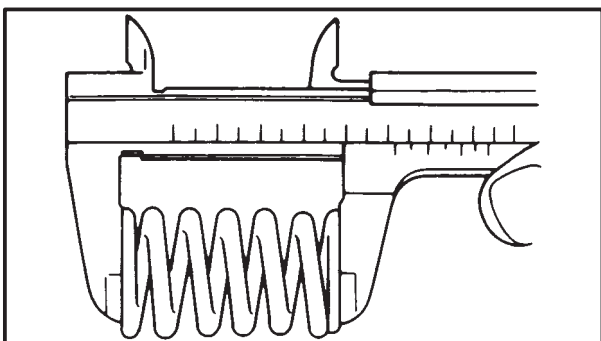
- Disassemble head parts.
- Repeat lapping steps using fine lapping compound.
- Clean all parts thoroughly.
- Reassemble and check for leakage again using solvent.
- Repeat steps as often as necessary to effect a satisfactory seal.

**Valve Spring**

This engine uses two springs of different sizes to prevent valve float or surging. Valve spring specifications show the basic value characteristics.

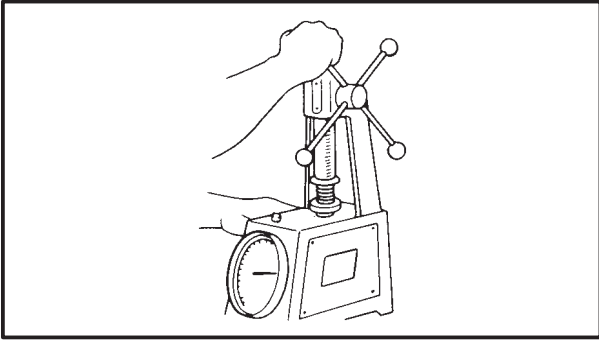
- ① Outer spring  
② Inner spring

1. Measure:
- Spring free length
- Out of specification → Replace.

**Minimum Free Length:**

**Outer: 38.90 mm (1.531 in)**

**Inner: 37.45 mm (1.474 in)**



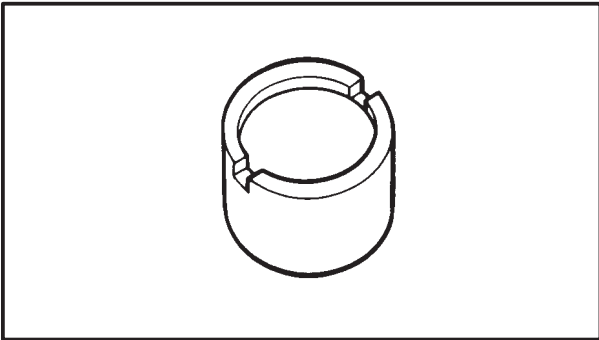
## 2. Measure:

- Spring force (installed length)  
Out of specification → Replace.

**Valve Compressed Force:**

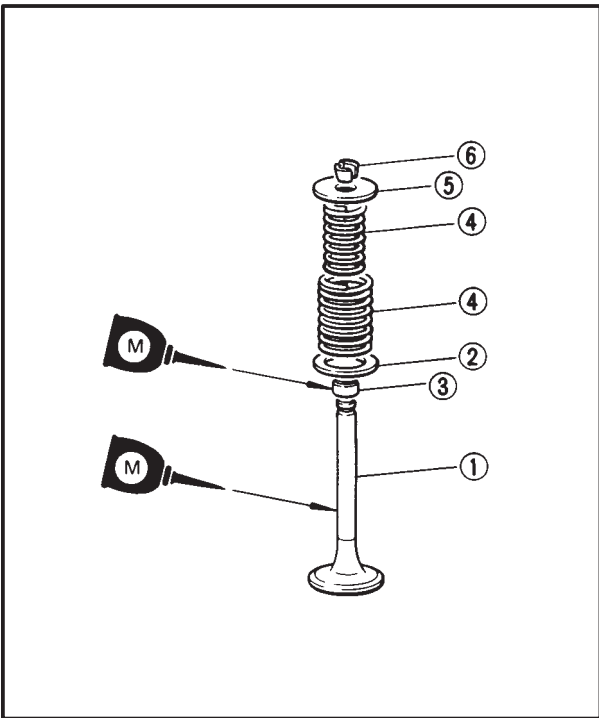
**Outer:** 13.3 ~ 15.7 kg (29.3 ~ 34.6 lb)  
at 33.8 mm (1.331 in)

**Inner:** 6.29 ~ 7.39 kg (13.9 ~ 16.3 lb)  
at 31.8 mm (1.25 in)

**Valve Lifter**

## 1. Inspect:

- Valve lifter wall  
Scratches/Damage → Replace both lifter and cylinder head.

**Valve Installation**

## 1. Lubricate:

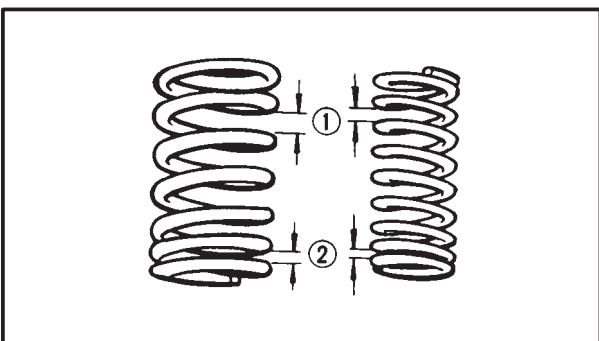
- Valve stem
- Oil seal



**High-Quality Molybdenum Disulfide  
Motor Oil or Molybdenum Disulfide  
Grease**

## 2. Install:

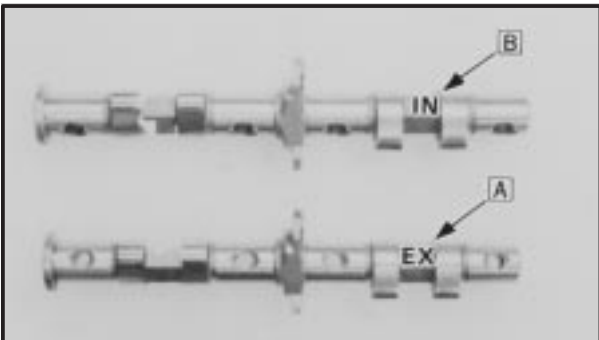
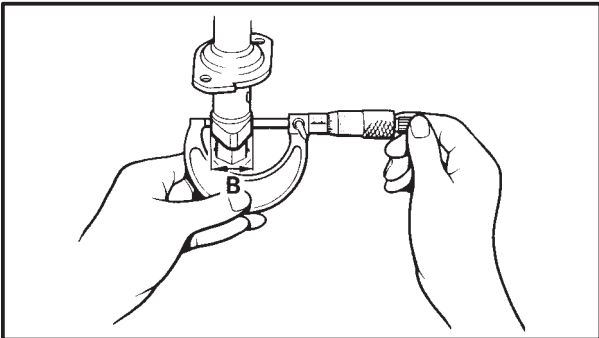
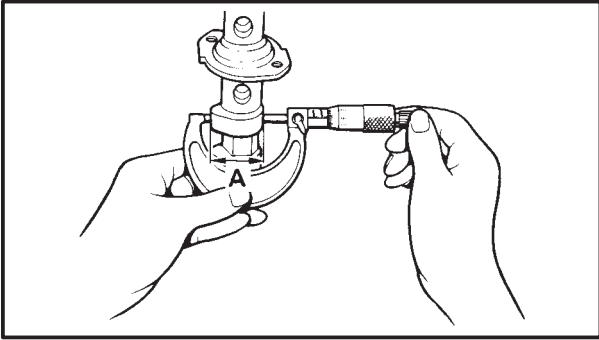
- Valve ①
- Valve spring seat ②
- Oil seal ③
- Valve springs ④
- Valve spring seat ⑤
- Valve retainers ⑥

**NOTE:**

Install springs with wider-gapped coils facing upwards, as shown.

① Larger pitch

② Smaller pitch



## CAMSHAFT, CAM CHAIN, AND CAM SPROCKET

### Camshaft

1. Inspect:
  - Cam lobes  
Pitting/Scratches/Blue discoloration → Replace.
2. Measure:
  - Cam lobes  
Use the Micrometer.  
Out of specification → Replace.

|  | Cam Lobe "A" (Limit)   | Cam Lobe "B" (Limit)   |
|-----------------------------------------------------------------------------------|------------------------|------------------------|
| Intake                                                                            | 35.65 mm<br>(1.404 in) | 26.95 mm<br>(1.061 in) |
| Exhaust                                                                           | 35.65 mm<br>(1.404 in) | 26.95 mm<br>(1.061 in) |

### Camshaft/Cap Clearance Measurement

1. Install:
  - Camshaft
2. Attach:
  - Plastigage® (YU-33210)  
Onto camshaft.

 For Exhaust

 For Intake

3. Attach:
  - Camshaft cap ("1-3" or "E-3")
4. Install:
  - Camshaft caps (others)
5. Tighten:
  - Camshaft cap bolts

### CAUTION:

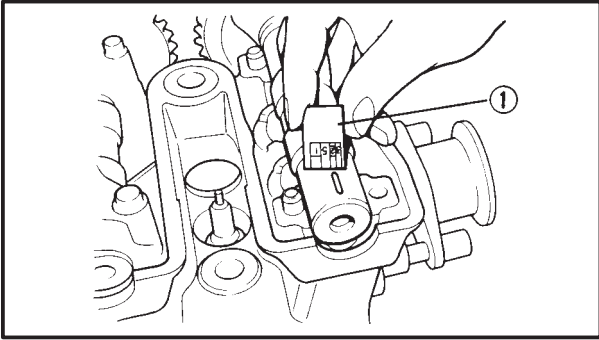
First Tighten the Nos.2, 4, and 1 cap bolts in that order, then the No.3 cap bolts; otherwise, the No.3 caps may be damaged or bent.



**Camshaft Cap:**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

### NOTE:

Do not turn the camshaft when measuring clearance with Plastigage®.



6. Remove:

- Camshaft caps

7. Measure:

- Width of Plastigage® ①

Out of specification → Follow step 8.

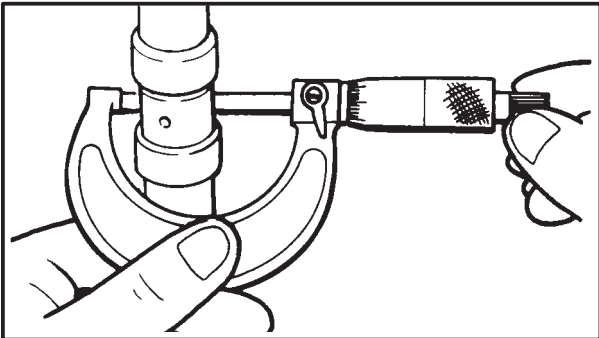


#### Camshaft-to-cap Clearance:

Standard: 0.020 ~ 0.054 mm

(0.0008 ~ 0.0021 in)

Maximum: 0.160 mm (0.006 in)



8. Measure:

- Camshaft outside diameter

Use a micrometer.

Out of specification → Replace camshaft.

Within specification → Replace cylinder head.



#### Camshaft Outside Diameter:

Standard: 24.967 ~ 24.980 mm

(0.9830 ~ 0.9835 in)

#### Cam Cap Inside Diameter:

Standard: 25.000 ~ 25.021 mm

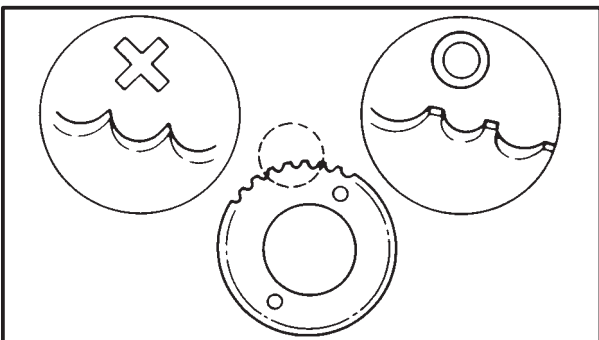
(0.9843 ~ 0.9851 in)

### Cam Chains

1. Inspect:

- Cam chains

Chain stretch/Cracks → Replace.

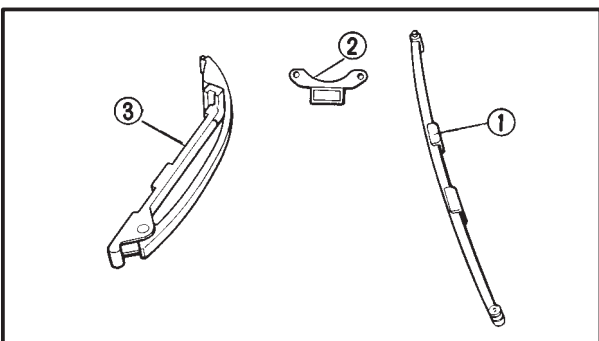


### Cam Sprockets

1. Inspect:

- Cam sprockets

Wear/Damge → Replace.



### Chain Dampers

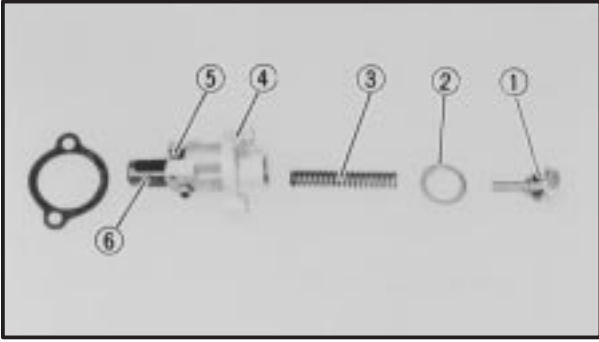
1. Inspect:

- Upper damper ①

- Front damper ②

- Rear damper ③

Wear → Replace.

**Cam Chain Tensioner**

## 1. Check:

- One-way cam operation  
Unsmooth operation → Replace.

## 2. Inspect:

- All parts  
Damage/Wear → Replace.

① End plug

④ Tensioner body

② Washer

⑤ One way cam

③ Spring

⑥ Tensioner rod

**CYLINDER**

## 1. Inspect:

- Cylinder wall  
Wear/Scratches → Rebore or replace.

## 2. Measure:

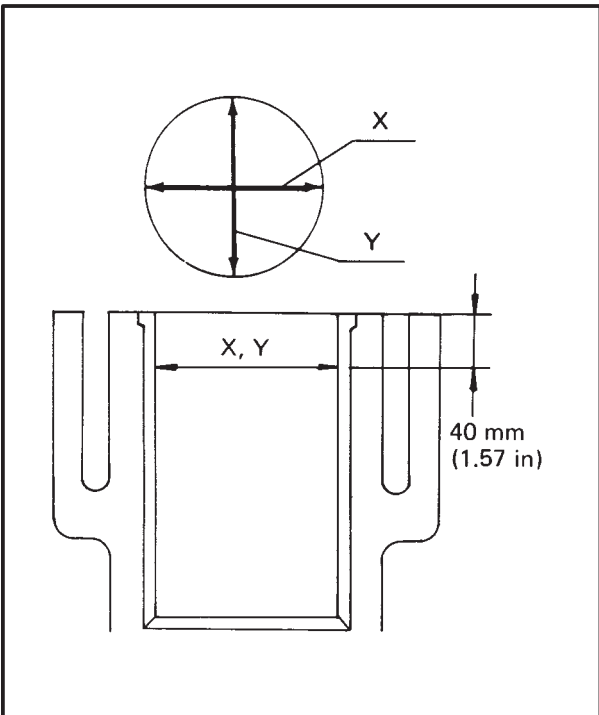
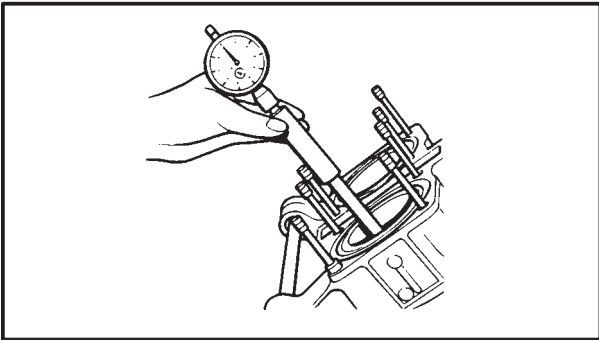
- Cylinder bore "C"

Use the Cylinder Bore Gauge.

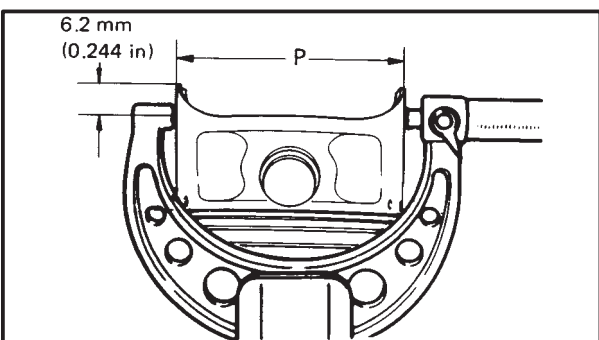
Measure the cylinder bore "C" horizontally and laterally at 40 mm (1.57 in) from cylinder top.

Then, find the coverage of the measurements.

Out of specification → Rebore.



|                       | Standard                                 | Wear Limit            |
|-----------------------|------------------------------------------|-----------------------|
| Cylinder Bore C:      | 75.967 ~ 76.016 mm<br>(2.991 ~ 2.993 in) | 76.1 mm<br>(2.996 in) |
| $C = \frac{X + Y}{2}$ |                                          |                       |

**PISTON, PISTON RING, AND PISTON PIN****Piston**

## 1. Inspect:

- Piston wall  
Wear/Scratches/Damage → Replace.

## 2. Measure:

- Piston outside diameter "P"

Use a Micrometer.

Out of specification → Replace.

**NOTE:**

Measurement should be made at point 6.2 mm (0.244 in) above the bottom edge of the piston.

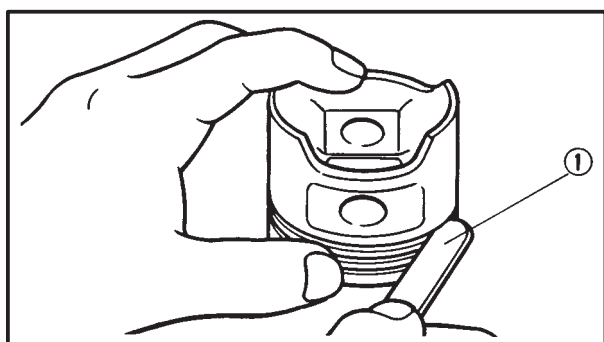
|                                                                                   |                        |                                            |
|-----------------------------------------------------------------------------------|------------------------|--------------------------------------------|
|  |                        | Size "P"                                   |
|                                                                                   | Standard               | 75.905 ~ 75.955 mm<br>(2.9884 ~ 2.9903 in) |
|                                                                                   | Overize 1<br>Overize 2 | 76.25 mm (3.002 in)<br>76.50 mm (3.012 in) |

## 3. Measure:

- Piston clearance

Out of specification → Rebore cylinder or replace piston.

|                                                                                   |                                                                                            |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
|  | <b>Piston Clearance = C – P:</b><br><b>0.055 ~ 0.075 mm</b><br><b>(0.0022 ~ 0.0030 in)</b> |
|                                                                                   | <b>C: Cylinder bore P: Piston outside diameter</b>                                         |

**Piston Ring**

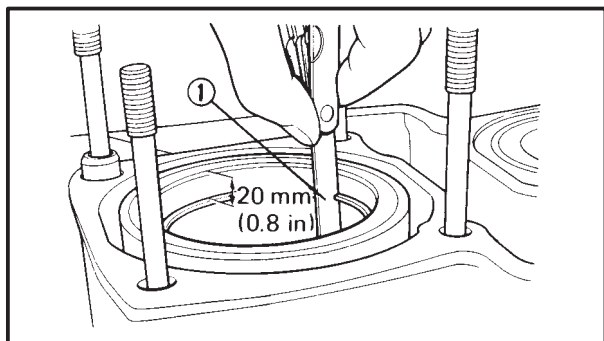
## 1. Measure:

- Side clearance

Use the Feeler Gauge ①.

Out of specification → Replace piston and/or rings.

|  | Side Clearance                         |                        |
|-------------------------------------------------------------------------------------|----------------------------------------|------------------------|
|                                                                                     | Standard                               | Limit                  |
| Top Ring                                                                            | 0.03 ~ 0.07 mm<br>(0.0012 ~ 0.0028 in) | 0.12 mm<br>(0.0047 in) |
| 2nd Ring                                                                            | 0.02 ~ 0.06 mm<br>(0.0008 ~ 0.0024 in) | 0.12 mm<br>(0.0047 in) |



## 2. Position:

- Piston ring  
Into cylinder.  
Push the ring with the piston crown.

## 3. Measure:

- End gap  
Use the Feeler Gauge ①.  
Out of specification → Replace rings as set.

|          | End Gap                                |                        |
|----------|----------------------------------------|------------------------|
|          | Standard                               | Limit                  |
| Top Ring | 0.35 ~ 0.50 mm<br>(0.0138 ~ 0.0197 in) | 0.75 mm<br>(0.0295 in) |
| 2nd Ring | 0.35 ~ 0.50 mm<br>(0.0138 ~ 0.0197 in) | 0.75 mm<br>(0.0295 in) |
| Oil Ring | 0.2 ~ 0.8 mm<br>(0.0080 ~ 0.032 in)    | —                      |

**Oversize Piston Rings**

- The oversize top and middle ring sizes are stamped on top of the ring.

|                   |                            |
|-------------------|----------------------------|
| <b>Oversize 1</b> | <b>0.25 mm (0.0098 in)</b> |
| <b>Oversize 2</b> | <b>0.50 mm (0.0197 in)</b> |

- The expander spacer of the bottom ring (oil control ring) is color-coded to identify sizes. The color mark is painted on the expander spacer.

| Size              | Color             |
|-------------------|-------------------|
| <b>Oversize 1</b> | <b>Blue (Two)</b> |
| <b>Oversize 2</b> | <b>Red (One)</b>  |

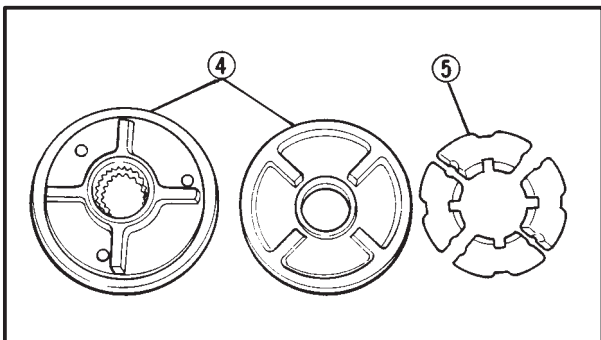
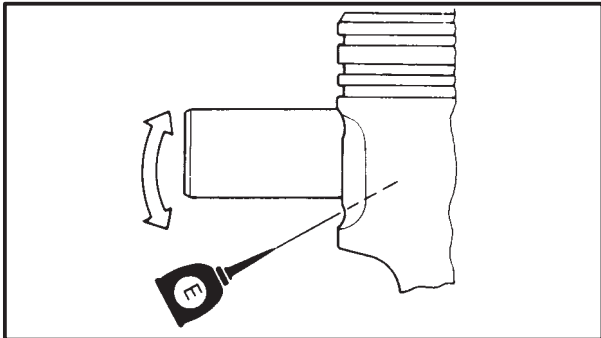
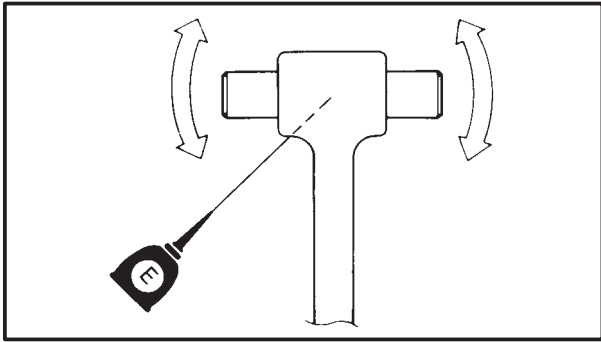
**Piston Pin**

## 1. Lubricate:

- Piston pin (lightly)

## 2. Install:

- Piston pin  
Into small end of connecting rod.



3. Check:
  - Free play
    - Free play → Inspect connecting rod for wear.
    - Wear → Inspect connecting rod and piston pin.
4. Position:
  - Piston pin
    - Into piston.
5. Check:
  - Free play
    - When pin is in place in piston.
    - Free play → Replace piston pin and/or piston.

## STARTER DRIVES

### Electric Starter Clutch

1. Check:
  - Ball ① operation
  - Spring cap ② operation
  - Spring ③ operation
  - Unsmooth operation → Replace one-way clutch.
2. Check:
  - Damper housing ④
  - Rubber dampers ⑤
  - Cracks/Wear/Damage → Replace.
3. Install:
  - Rubber damper
  - Damper housing
  - One-way clutch
4. Tighten:
  - Bolts (one-way clutch)

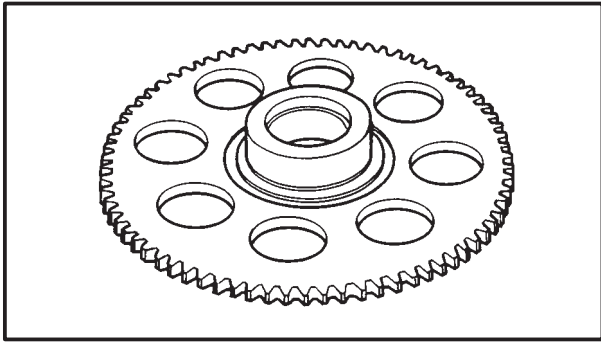


### Bolts (Starter One-way Clutch):

24 Nm (2.4 m•kg, 17 ft•lb)

LOCTITE®

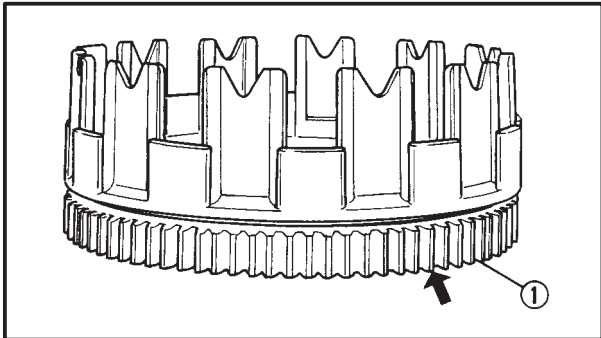
Stake Over the End of the Bolt



## Starter Gears

### 1. Inspect:

- Idle gear surfaces  
Pitting/Wear/Damage → Replace.

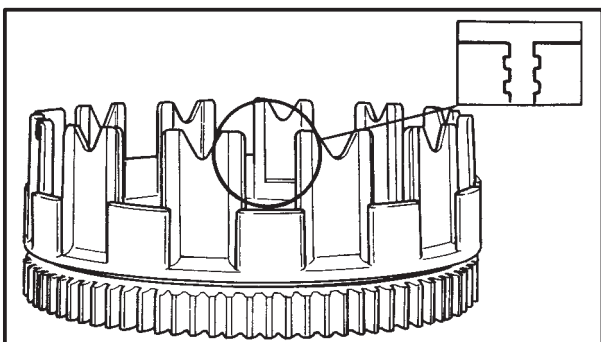


## PRIMARY GEARS

The drive gear is mounted on the crankshaft; the driven gear is mounted on the transmission and is integrated with the clutch assembly.

### 1. Inspect:

- Drive gear  
Scratches/Wear/Damage → Replace crankshaft.
- Driven gear ①  
Scratches/Wear/Damage → Replace clutch housing assembly.

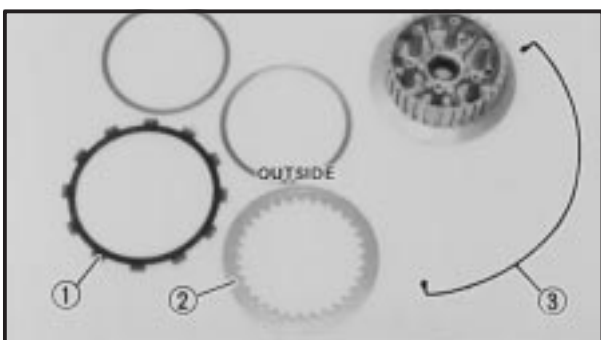


## CLUTCH

### Clutch Housing

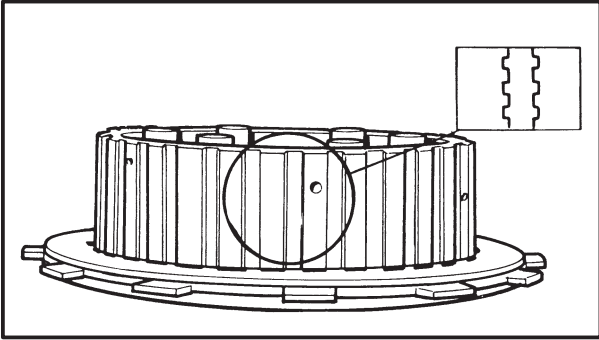
#### 1. Inspect:

- Dogs on the housing  
Cracks/Wear/Damage → Deburr or replace.
- Clutch housing bearing  
Chafing/Wear/Damage → Replace.



## Clutch Boss

The clutch boss contains a built-in damper beneath the friction plate ① and clutch plate ②. It is not necessary to remove the wire circlip ③ and disassemble the built-in damper unless there is serious clutch chattering.



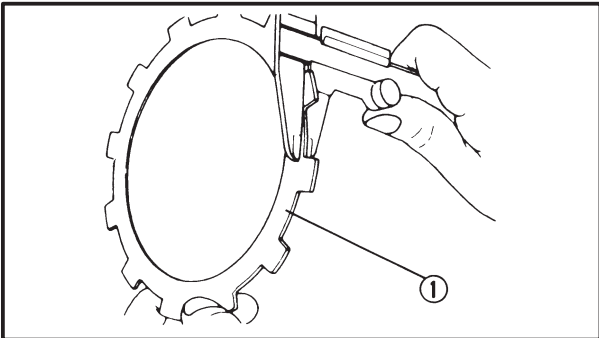
## 1. Inspect:

- Clutch boss splines

Scoring/Wear/Damage → Replace clutch boss assembly.

## NOTE:

Scoring on the clutch plate splines will cause erratic operation.



## Friction Plates

### 1. Inspect:

- Friction plate ①

Damage/Wear → Replace friction plate as a set.

### 2. Measure:

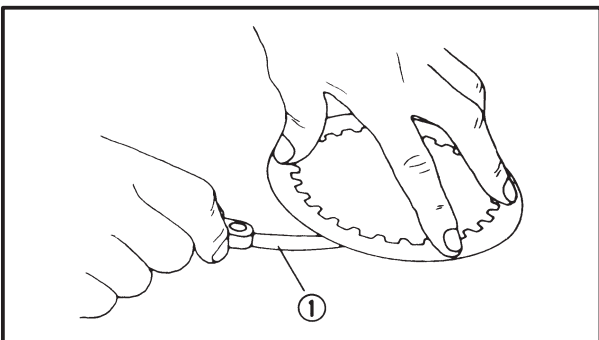
- Friction plate thickness

Measure at all four points.

Out of specification → Replace friction plate as a set.



**Wear Limit:**  
2.8 mm (0.11 in)



## Clutch Plates

### 1. Measure:

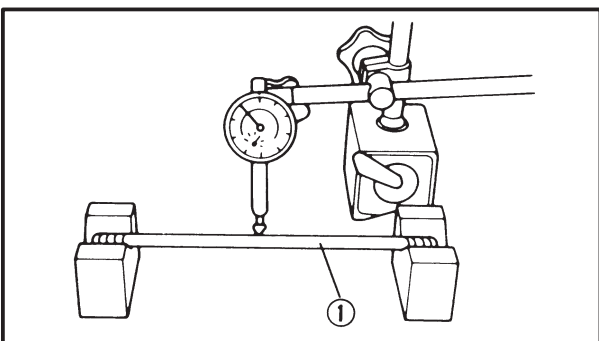
- Clutch plate warpage

Use the surface plate and the Feeler Gauge ①.

Out of specification → Replace.



**Warp Limit:**  
0.2 mm (0.008 in)



## Push Rod

### 1. Measure:

- Push rod runout ①

Use V-Blocks and the Dial Gauge (90890-03097).

Out of specification → Replace.

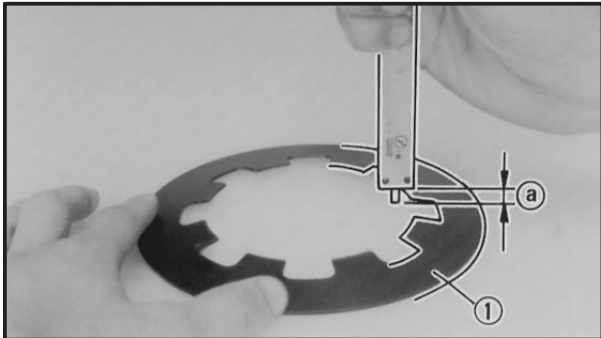


**Bending Limit:**  
0.5 mm (0.02 in)



## Clutch Bearing

1. Inspect:
  - Bearing
 Pitting/Damage → Replace.

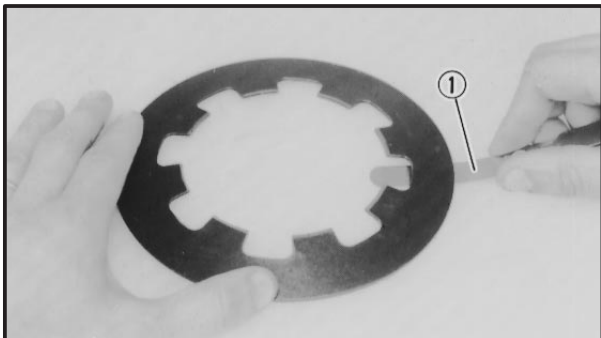


## Clutch Spring

1. Inspect:
  - Clutch spring ①
 Wear/Bends/Cracks → Replace.
2. Measure:
  - Clutch spring free height ②
 Out of specification → Replace.



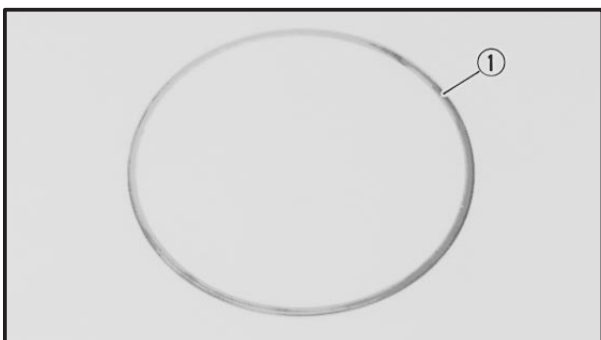
**Clutch Spring Minimum Height:**  
6.5 mm (0.26 in)



3. Measure:
  - Clutch spring warpage
 Use a surface plate and the Feeler Gauge ①  
 Out of specification → Replace.

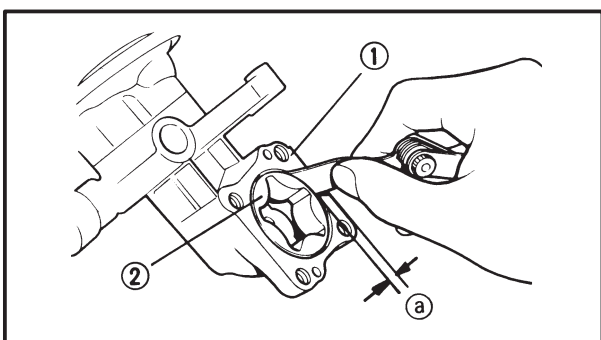


**Warp Limit:**  
0.1 mm (0.004 in)



## Clutch Spring Seat

1. Inspect:
  - Clutch spring seat ①
 Wear/Bends/Damage → Replace.

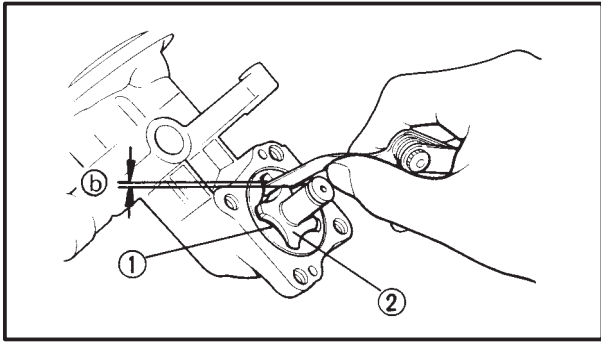


## OIL PUMP

1. Measure:
  - Housing ① / Outer rotor ② clearance ③ Use the Feeler Gauge.
 Out of specification → Replace oil pump assembly.



**Side Clearance Limit:**  
0.08 mm (0.0031 in)

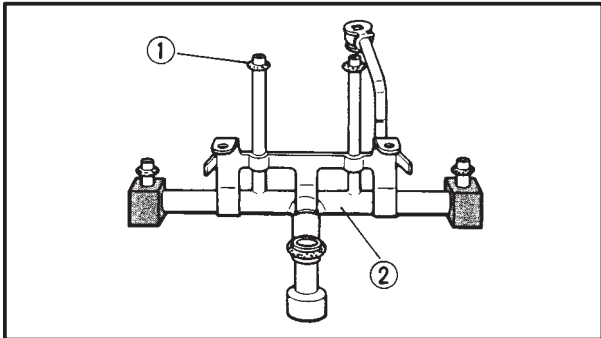


### 2. Measure:

- Outer rotor ① / Inner rotor ② clearance (b)  
Use the Feeler Gauge.  
Out of specification → Replace oil pump assembly.



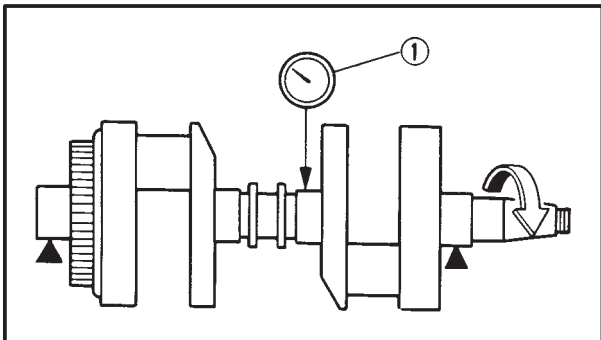
**Tip Clearance Limit:**  
**0.17 mm (0.0067 in)**



### OIL GALLERY PIPE

#### 1. Inspect:

- O-rings ①  
Wear/Cracks/Damage → Replace.
- Gallery pipe ②  
Cracks/Damage → Replace.



### CRANKSHAFT

#### Crankshaft

#### 1. Measure:

- Runout  
Use the V-Blocks and Dial Gauge ① (90890-03097).  
Out of specification → Replace.



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

#### 2. Inspect:

- Crankshaft bearing surfaces  
Wear/Scratches → Replace.

### Crankshaft Main Bearing Clearance Measurement

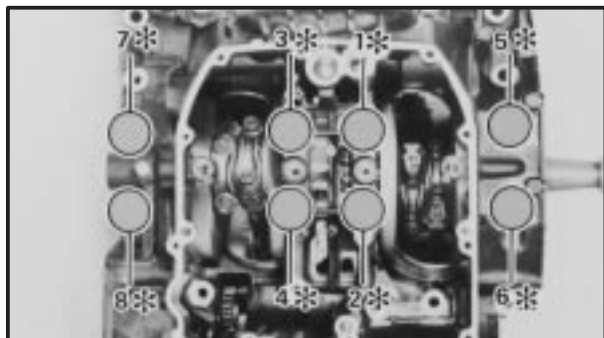
#### 1. Clean all parts.

#### 2. Position:

- Crankcase half (upper)  
Place on a bench in an upside down position.

#### 3. Install:

- Bearings  
Into the upper crankcase.
- Crankshaft



## 4. Attach:

- Plastigage® (YU-33210)  
Onto the crankshaft journal surface.

**NOTE:**

Do not turn the crankshaft until clearance measurement has been completed.

## 5. Install:

- Bearings  
Into lower crankcase.

## 6. Tighten:

- Bolts

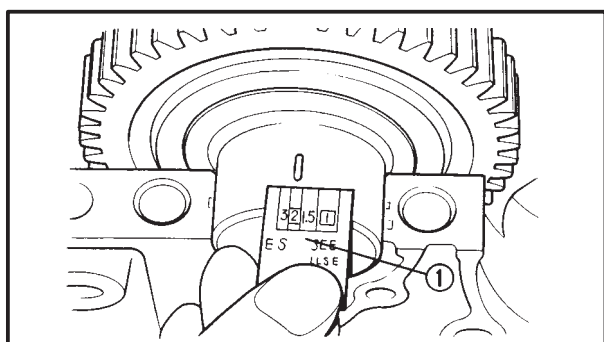
**CAUTION:**

Tighten to full torque in torque sequence as shown.



**10 mm Bolts (Crankcase):**  
**40 Nm (4.0 m•kg, 29 ft•lb)**

\* With a washer



## 7. Remove:

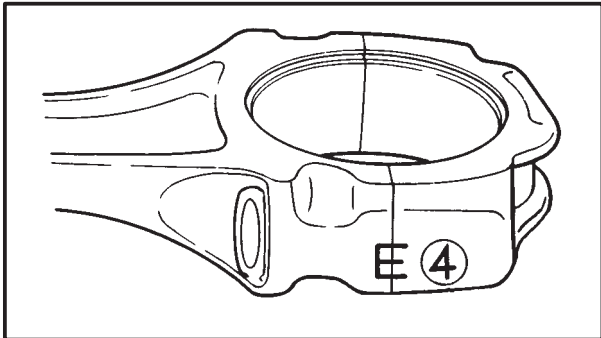
- Bolts  
Reverse assembly order.
- Crankcase (lower)  
Use care in removing.

## 8. Measure:

- Width of Plastigage® ①  
Out of specification → Replace bearings; replace crankshaft if necessary.



**Main Bearing Oil Clearance:**  
**0.020 ~ 0.038 mm**  
**(0.0008 ~ 0.0015 in)**

**Connecting Rod Bearing Clearance Measurement**

1. Clean all parts.
2. Install:
  - Connecting rod bearings  
Into connecting rod and cap.
3. Attach:
  - Plastigage® (YU-33210)  
Onto the crank pin.
4. Install:
  - Connecting rod
  - Connecting rod cap

**NOTE:**

Be sure the letter on both components align to form perfect character.

5. Lubricate:
  - Bolt threads (connecting rod)

**Molybdenum Disulfide Grease**

6. Tighten:
  - Nuts (connecting rod cap)

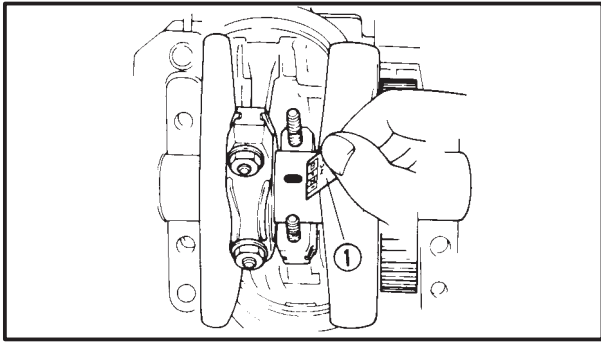
**NOTE:**

Do not turn connecting rod until clearance measurement has been completed.

**CAUTION:**

Tighten to full torque specification without pausing. Apply continuous torque between 3.0 and 3.8 m•kg. Once you reach 3.0 m•kg, **DO NOT STOP TIGHTENING** until final torque is reached. If tightening is interrupted between 3.0 and 3.8 m•kg, loosen nut to less than 3.0 m•kg and start again.

**Connecting Rod Cap:**  
36 Nm (3.6 m•kg, 25 ft•lb)



7. Remove:

- Connecting rod cap  
Use care in removing.

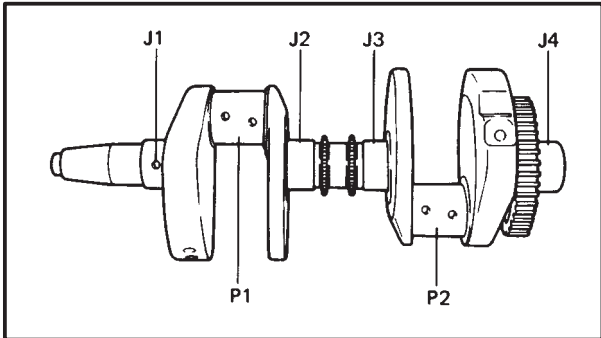
8. Measure:

- Width of Plastigage® ①  
Out of specification → Replace bearings and/or replace crankshaft if necessary.



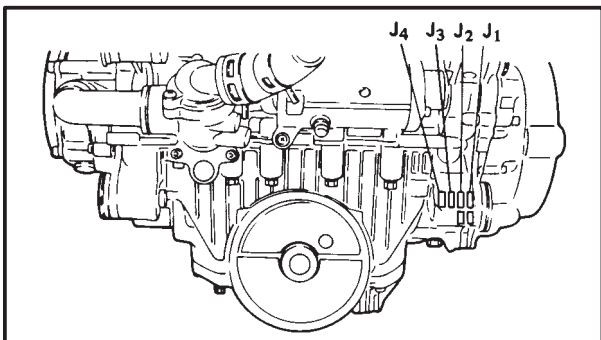
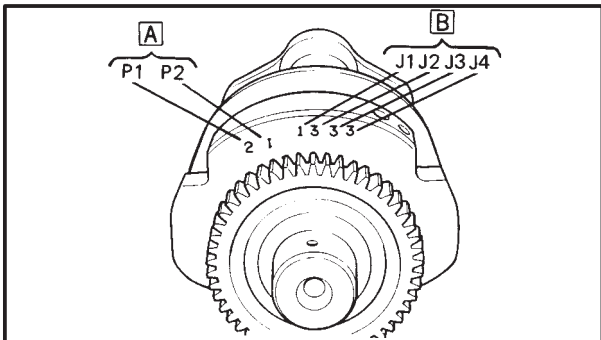
#### Connecting Rod Bearing Clearance:

0.021 ~ 0.039 mm  
(0.0008 ~ 0.0015 in)

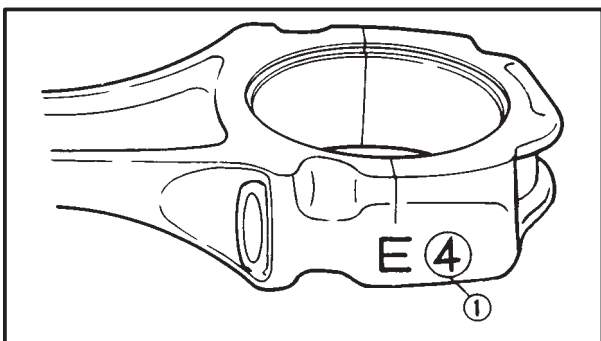


#### Crankshaft Main and Connecting Rod Bearing Selection

- Numbers used to indicate crankshaft journal sizes are stamped on the crankweb. The first two (2) [A] are rod bearing journal numbers, starting with the left journal. The four (4) [B] main bearing journal numbers follow in the same sequence.



- The lower crankcase half is numbered J1, J2, J3, and J4 on the front left boss as shown.



- The numbers ① are stamped in ink on the rod.


**Example 1: Selection of the crankshaft main bearings;**

- If the crankcase J1 and crankshaft J1 sizes are No.4 and No.1, respectively, the bearing size No. is:

**Bearing Size No. =**  
**Crankcase No. – Crankshaft No. =**  
**4 – 1 = 3 (Brown)**

**BEARING COLOR CODE**

|      |        |
|------|--------|
| No.1 | Blue   |
| No.2 | Black  |
| No.3 | Brown  |
| No.4 | Green  |
| No.5 | Yellow |
| No.6 | Pink   |

**Example 2: Selection of the connecting rod bearing;**

- If the connecting rod P1 and crankshaft P1 sizes are No.5 and No.1, respectively, the bearing size No. is:

**Bearing Size No. =**  
**Connecting Rod No. – Crankshaft No. =**  
**5 – 1 = 4 (Green)**

**BEARING COLOR CODE**

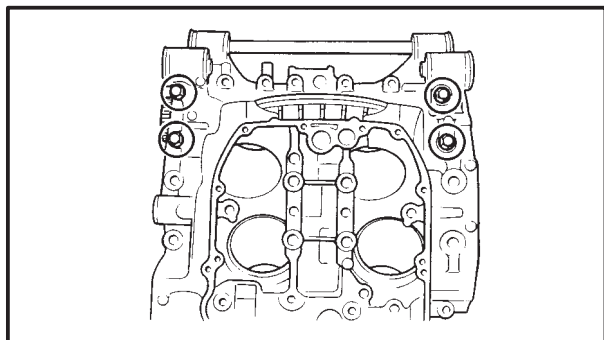
|      |        |
|------|--------|
| No.1 | Blue   |
| No.2 | Black  |
| No.3 | Brown  |
| No.4 | Green  |
| No.5 | Yellow |
| No.6 | Pink   |
| No.7 | Red    |

**BALANCER SHAFT**
**Balancer Shaft Bearing Clearance Measurement**

1. Clean surfaces of balancer shaft and crankcase journal.
2. Position:
  - Crankcase half (upper)  
Place on a bench in an upside down position.



3. Install:
  - Bearings  
Into the upper crankcase.
4. Install:
  - Balancer shaft  
Into the upper crankcase.
5. Attach:
  - Plasticage® (YU-33210)  
Onto the balancer shaft journal surface.

**NOTE:**

Do not move balancer shaft until clearance measurement has been completed.

6. Install:
  - Bearings  
Into lower crankcase.
7. Tighten:
  - Bolts (crankcase)

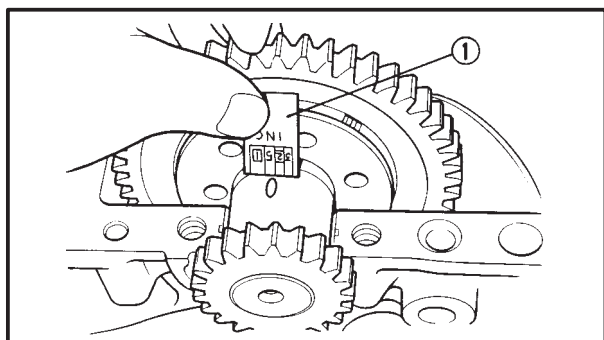
**CAUTION:**

Tighten to full torque in torque sequence cast on the crankcase.



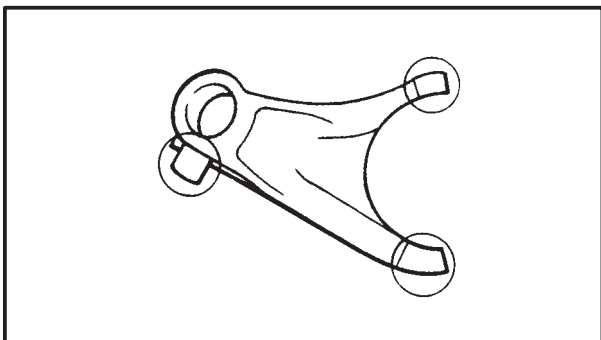
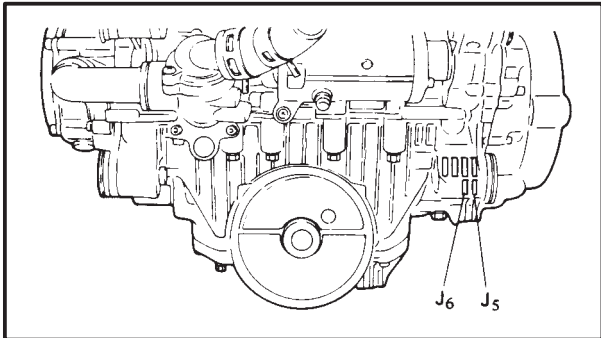
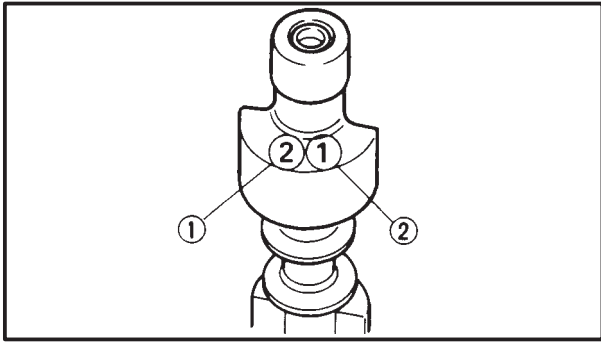
**8 mm Bolt (Crankcase):**  
**24 Nm (2.4 m•kg, 17 ft•lb)**

8. Remove:
  - Bolts  
Reverse assembly order.
  - Crankcase (lower)  
Use care in removing.
9. Measure:
  - Plastigage® width ①  
Out of specification → Replace bearings; replace balancer shaft in necessary.



**Balancer Shaft Bearing Oil Clearance:**

**0.020 ~ 0.048 mm**  
**(0.0008 ~ 0.002 in)**



### Balancer Shaft Bearing Selection

- Numbers used to indicate balancer shaft journal sizes are stamped on the RH balancer web corner, starting with the left journal.

- ① Left balancer shaft journal size number
- ② Right balancer shaft journal size number

- The lower crankcase half is numbered J5, and J6 as shown.

### Example: Selection of the balancer shaft bearings;

- If the crankcase J5 and left balancer shaft sizes are No.4 and No.1, respectively, the left balancer bearing size No. is:

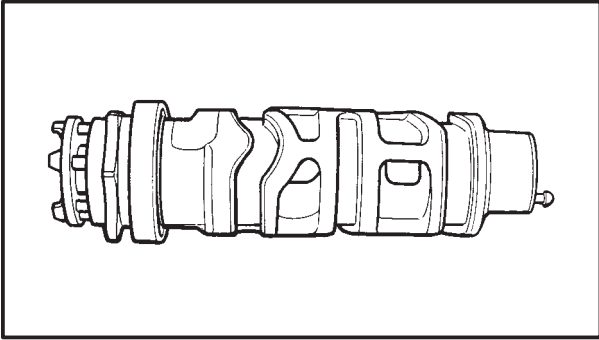
**Bearing Size No. =**  
**Crankcase No. – Balancer Shaft No. =**  
**4 – 1 = 3 (Brown)**

| BEARING COLOR CODE |        |
|--------------------|--------|
| No.1               | Blue   |
| No.2               | Black  |
| No.3               | Brown  |
| No.4               | Green  |
| No.5               | Yellow |
| No.6               | Pink   |

### TRANSMISSION

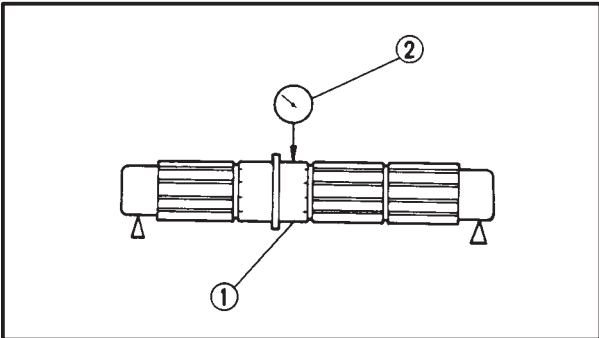
#### Shift Fork

- Inspect:
  - Shift forks
    - On the gear and shift cam contact surfaces.
    - Wear/Chafing/Bends/Damage → Replace.
- Check:
  - Shift fork movement
    - On its guide bar.
    - Unsmooth operation → Replace fork and/or guide bar.

**Shift Cam**

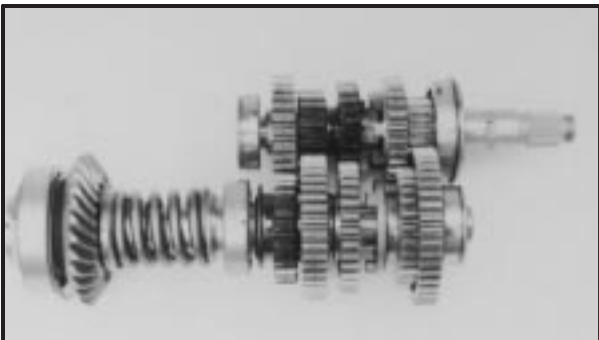
## 1. Inspect:

- Shift cam grooves  
Wear/Damage/Scratches → Replace.
- Shift cam segment  
Damage/Wear → Replace.
- Shift cam bearing  
Pitting/Damage → Replace.

**Main and Drive Axles**

## 1. Measure:

- Axle runout ①  
Use the centering device and Dial Gauge (90890-03097) ②.  
Out of specification → Replace.

**Runout Limit: 0.08 mm (0.0031 in)****Gears**

## 1. Inspect:

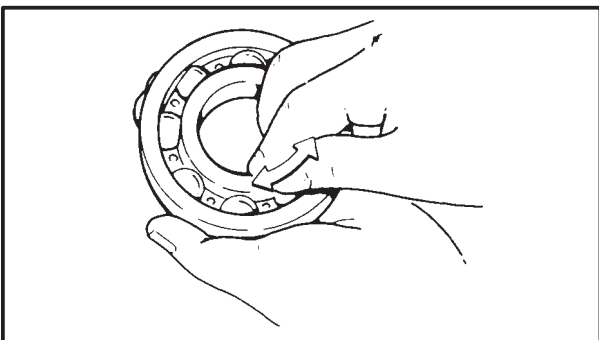
- Gears  
Damage/Wear → Replace.

## 2. Check:

- Gear movement  
Unsmooth operation → Replace.

## 3. Inspect:

- Mating dogs  
Cracks/Wear/Damage → Replace.

**BEARINGS**

## 1. Inspect:

- Axle bearings
- Shift cam bearing  
Pitting/Damage → Replace.

**CIRCLIPS AND WASHERS**

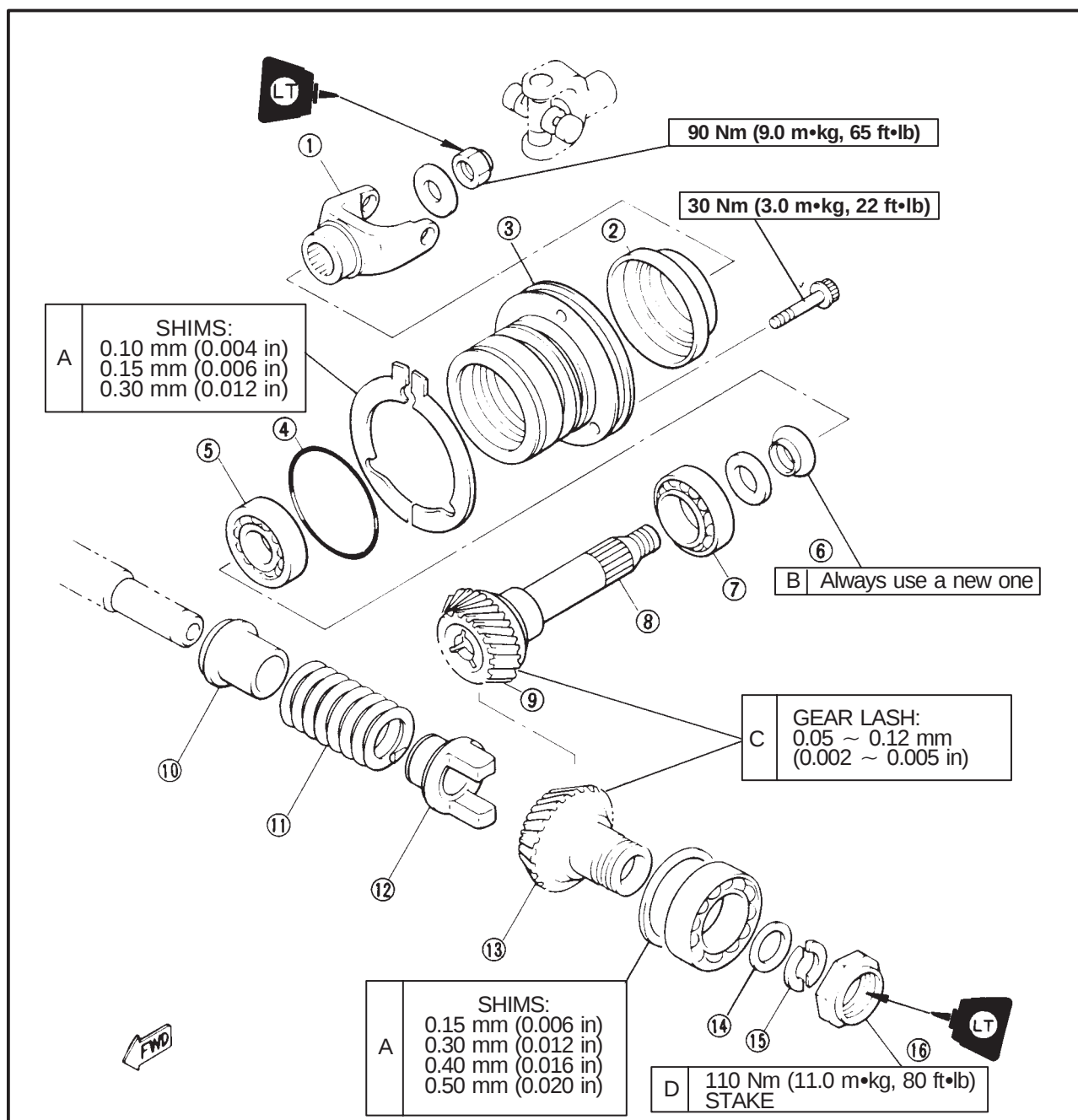
## 1. Inspect:

- Circlips
- Washers  
Damage/Looseness/Bends → Replace.



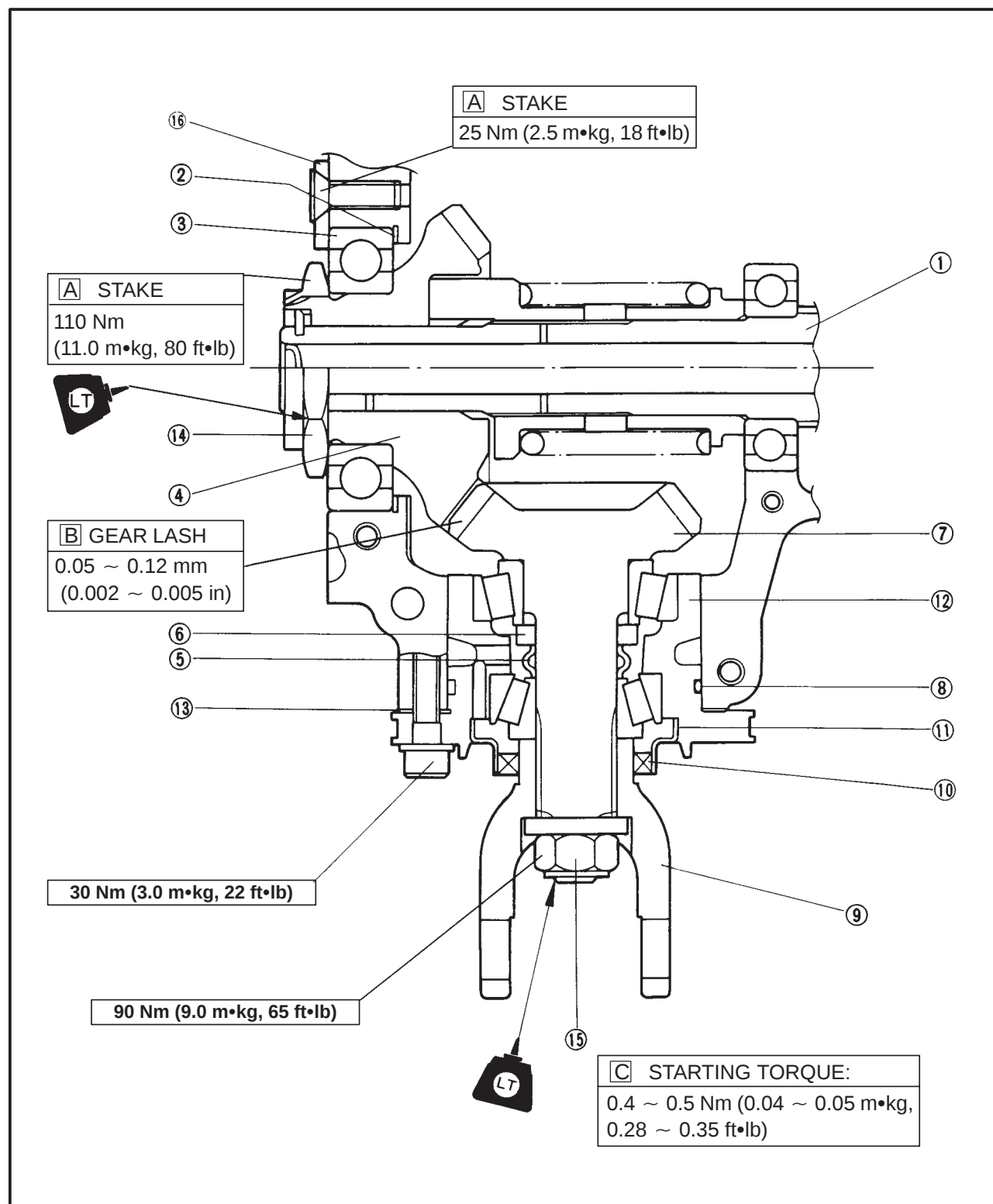
## MIDDLE GEAR SERVICE

- |                             |                            |
|-----------------------------|----------------------------|
| ① Universal joint           | ⑬ Middle drive pinion gear |
| ② Dust seal                 | ⑭ Thrust washer            |
| ③ Housing                   | ⑮ Retainer                 |
| ④ O-ring                    |                            |
| ⑤ Bearing                   |                            |
| ⑥ Collapsible collar        |                            |
| ⑦ Bearing                   |                            |
| ⑧ Middle drive shaft        |                            |
| ⑨ Middle driven pinion gear |                            |
| ⑩ Spring seat               |                            |
| ⑪ Damper spring             |                            |
| ⑫ Damper cam                |                            |





- |                                                |                            |
|------------------------------------------------|----------------------------|
| ① Drive axle                                   | ⑩ Oil seal                 |
| ② Drive pinion gear shim                       | ⑪ Bearing retainer         |
| ③ Bearing                                      | ⑫ Bearing housing          |
| ④ Middle drive pinion gear                     | ⑬ Driven pinion gear shim  |
| ⑤ Collapsible collar<br>(Always use a new one) | ⑭ Nut (drive pinion gear)  |
| ⑥ Spacer                                       | ⑮ Nut (driven pinion gear) |
| ⑦ Middle driven pinion gear                    | ⑯ Bearing stopper          |
| ⑧ O-ring                                       |                            |
| ⑨ Universal joint                              |                            |

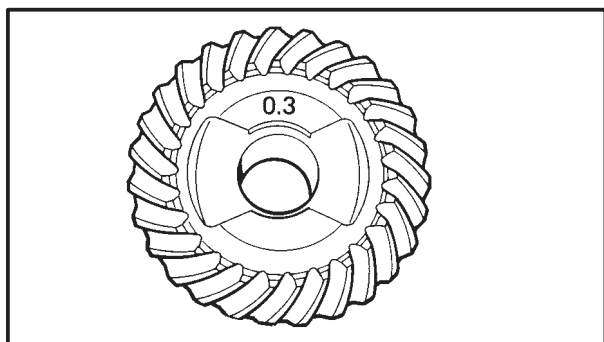
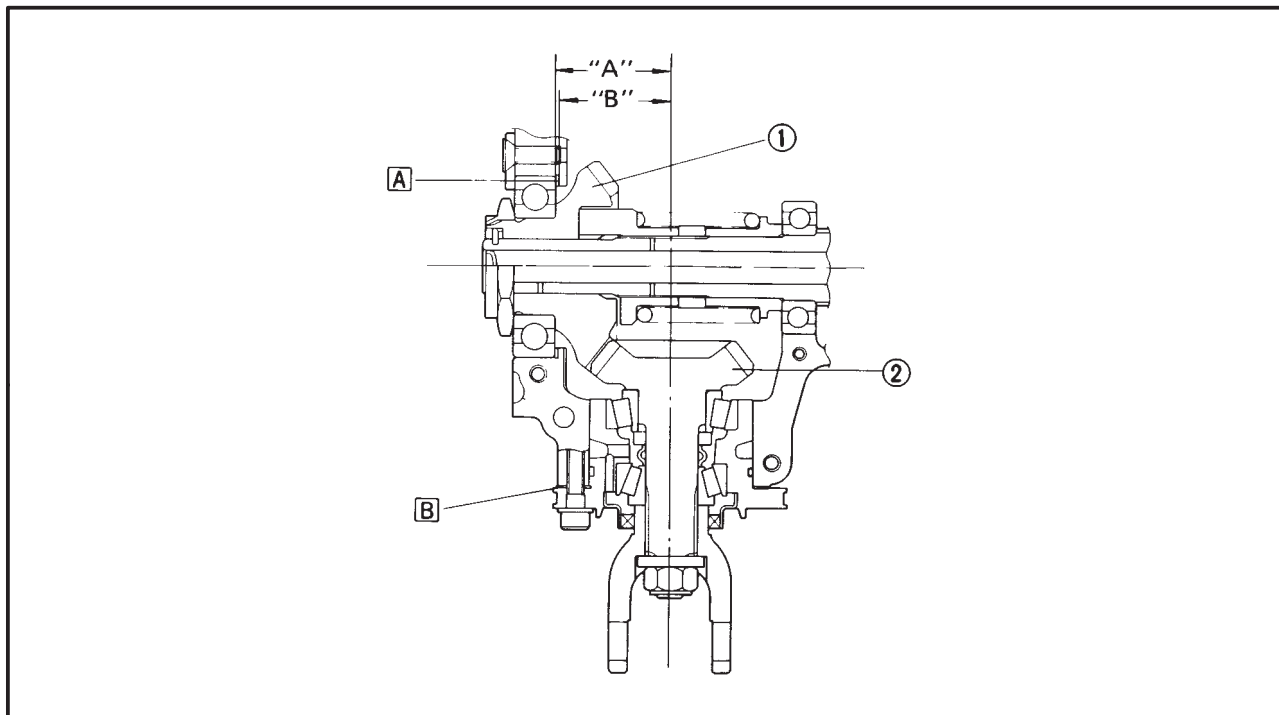


**DRIVE AXLE POSITIONING**

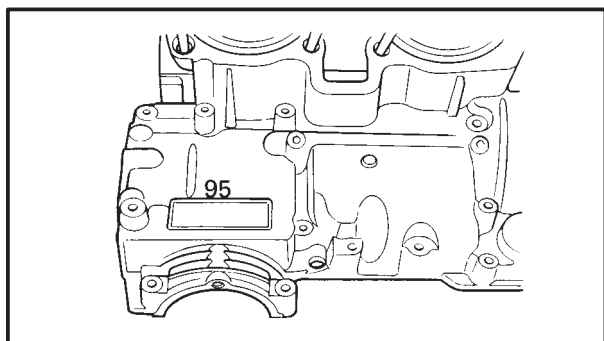
When the crankcase assembly and/or the drive axle are replaced, you must position the drive axle in place.

Refer to "Drive Pinion Gear Shim Selection and Middle Gear Lash Adjustment" section.

- ① Drive pinion gear
- ② Driven pinion gear
- [A] Drive pinion gear shim
- [B] Driven pinion gear shim

**Drive Pinion Gear Shim Selection**

- "A" = 54.5 plus or minus the number stamped on the drive pinion gear.



- "B" = 53 plus the number stamped on the left-side rear of the upper crankcase.



**Example: Selection of the drive pinion gear shim;**

**Shim Thickness =  
Distance "A" – Distance "B"**

- If the drive pinion gear is stamped "03" (plus (+03) is implied here since only the minus (–) designations are stamped alongside the numbers), then:

$$\begin{aligned} \text{"A"} &= 54.5 + 0.03 \\ &= 54.53 \end{aligned}$$

**NOTE:** \_\_\_\_\_

All stamped numbers are in hundredths of a mm.

- If the left-side-rear of the upper crankcase is stamped "95", then:

$$\begin{aligned} \text{"B"} &= 53 + 0.95 \\ &= 53.95 \end{aligned}$$

Therefore:

$$\begin{aligned} T &= A - B \\ &= 54.53 - 53.95 \\ &= 0.58 \text{ mm} \end{aligned}$$

- The calculated shim thickness is 0.58 mm. Because shim can only be selected in 0.05 mm increments, use the following chart to round off the hundredths digit of the calculated thickness and select the appropriate shim.

| Hundredths Digit | Rounded Value |
|------------------|---------------|
| 0, 1, 2          | 0             |
| 3, 4, 5, 6       | 5             |
| 7, 8, 9          | 10            |

- Using the above example, the calculated shim thickness of 0.58 mm is rounded off to 0.60 mm. Therefore, you may choose either 4 – 0.15 mm shims, 2 – 0.30 mm shims, or 1 – 0.30 mm and 2 – 0.15 mm shims as selected from the shim thickness chart below. Shim size are supplied in the following thicknesses:



#### Drive Pinion Gear Shim

| Thickness (mm) | 0.15 0.30<br>0.40 0.50 |
|----------------|------------------------|
|----------------|------------------------|



### Middle Gear Lash Adjustment

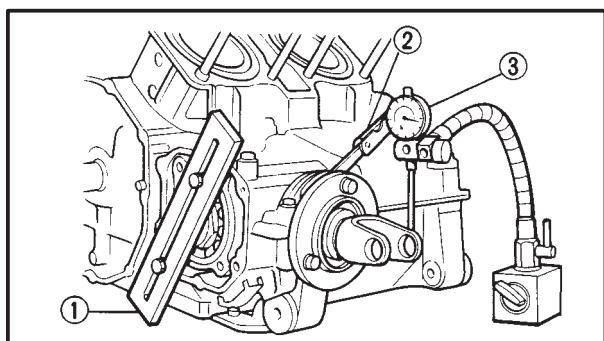
#### 1. Attach:

- Middle Drive Gear Holder ① (90890-04080)

This tool will prevent the drive axle from turning.

#### 2. Install:

- Bolts (three)  
On driven bearing housing.  
Finger-tighten the bolts.



#### NOTE:

Clearance between the crankcase and driven bearing housing should be about 2 mm.  
Measure gap with Feeler Gauge ②.

#### 3. Position:

- Dial Gauge ③ (90890-03097)  
On the outside edge of U-joint.

#### NOTE:

Be sure the gauge is positioned over the center-line of the yoke bearing hole.

#### 4. Rotate:

- U-joint  
Move it gently back and forth.

#### 5. Measure:

- Gear lash  
Over specification → Follow next steps.  
Under or same specification → Incorrect; check for faulty parts and/or reassemble bearing housing.



#### Middle Gear Lash:

0.05 ~ 0.12 mm  
(0.002 ~ 0.005 in)

#### CAUTION:

Do not hammer the U-joint or the collapsible collar of the driven pinion gear may be distorted.

This will result in a change in the standard starting torque, requiring replacement of the collapsible collar and reassembly of the driven gear assembly.

#### NOTE:

Check the gear lash at four positions. Rotate the U-joint 90 degrees each time and repeat the gear lash check.



## 6. Tighten:

- Bolt (Three)

Tighten carefully one-thread turn only. Push in bearing housing and hold in position while tightening bearing housing bolts.

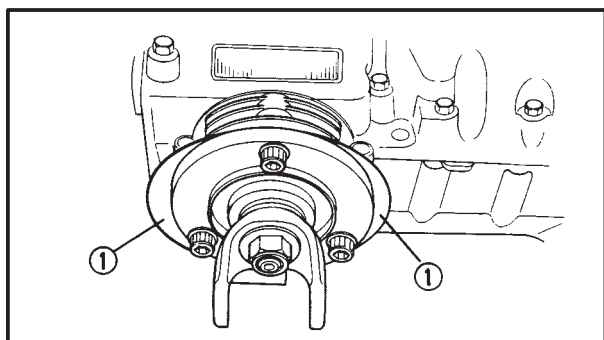
**CAUTION:**

**Do not overtighten bearing housing bolts or you may obtain too little gear lash and cause damage to gears. If over tightened, loosen the 3 bolts so that crankcase/bearing housing clearance is about 2 mm (0.08 in) and repeat all previous steps.**

7. Repeat steps 4 and 5 until correct gear lash is achieved.

**Middle Gear Lash:**

**0.05 ~ 0.12 mm**  
**(0.002 ~ 0.005 in)**



## 8. Measure:

- Crankcase/bearing housing clearance  
Use a Feeler Gauge.

## 9. Select:

- Shim(s) ①

**Example: Selection of the driven pinion gear shim;**

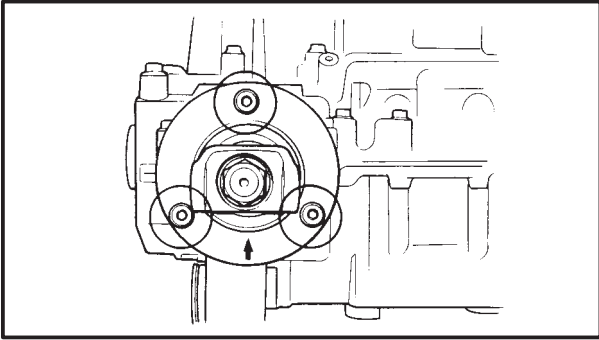
- If the clearance is 0.46 mm.
- The shim can only be selected in 0.05 mm increments, round off hundredths digit and select appropriate shim(s).

| Hundredths | Round Value |
|------------|-------------|
| 0, 1, 2    | 0           |
| 3, 4, 5, 6 | 5           |
| 7, 8, 9    | 10          |

- In the example above, the measured shim thickness is 0.46 mm. The chart instructs you, however, to round off the 6 to 5. Thus you should use 0.15 mm and 0.30 mm shims.
- Shim sizes are supplied in the following thickness.

**Driven Pinion Gear Shim**

| Thickness (mm) | 0.10 | 0.15 | 0.30 | 0.40 | 0.50 | 0.60 |
|----------------|------|------|------|------|------|------|
|----------------|------|------|------|------|------|------|



10. Tighten:
- Bolts (bearing housing)

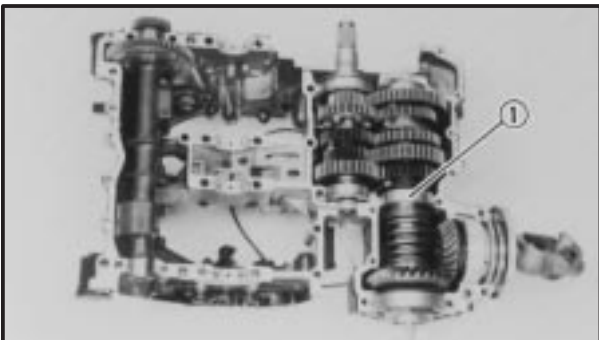


**Bolts (Bearing Housing):**  
30 Nm (3.0 m•kg, 22 ft•lb)

### NOTE:

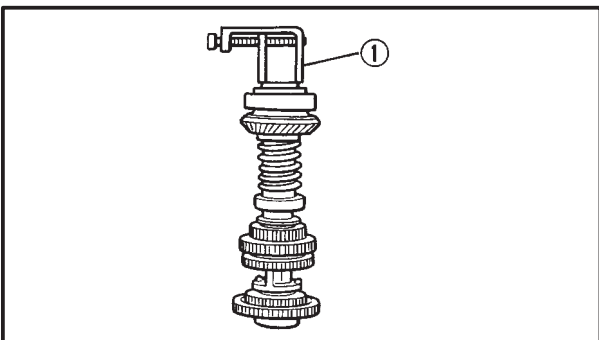
Before tightening the bolts, make sure that the arrow on the bearing housing points to the upper crankcase.

11. Measure:
- Gear lash

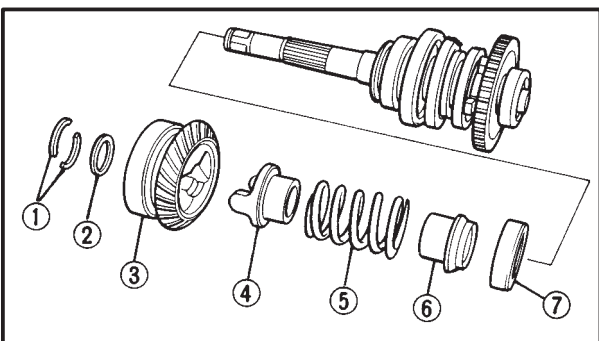


### REMOVAL

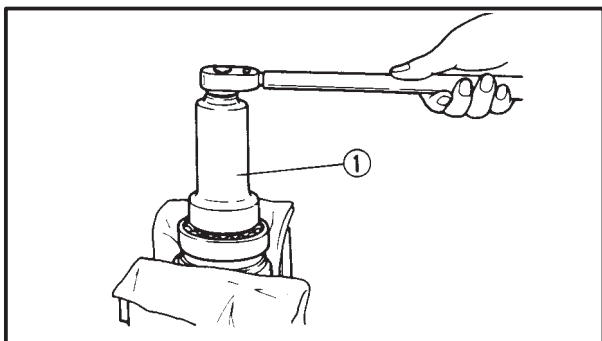
1. Remove:
- Drive axle assembly ①



2. Attach:
- Damper Spring Compressor (90890-04090) ①  
Onto drive pinion.
3. Position:
- Drive axle shaft assembly  
Onto a Hydraulic Press.
4. Compress the damper spring on the drive axle shaft assembly.

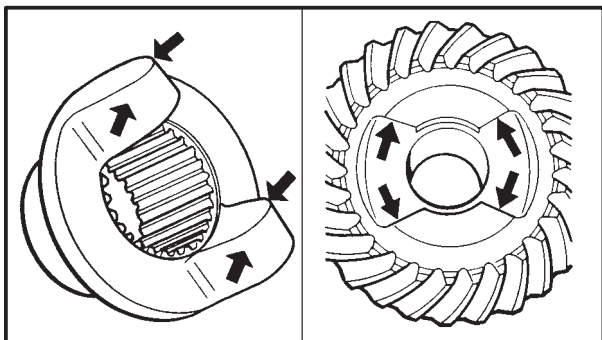


5. Remove:
- Retainers ①
  - Washer ②
  - Drive pinion gear ③
  - Damper cam ④
  - Damper spring ⑤
  - Spring seat ⑥
  - Bearing ⑦



6. Remove:

- Nut (drive gear)  
Use the Offset Wrench ① (90890-04054).
- Bearing
- Shim(s)



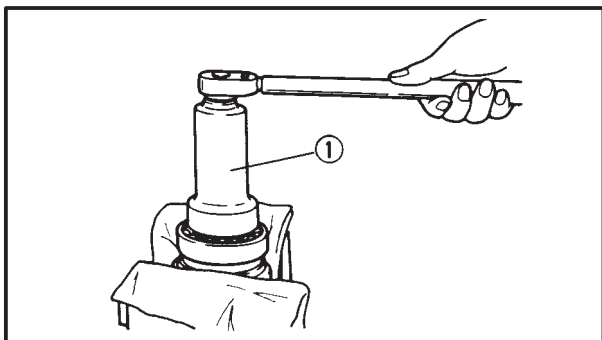
## INSPECTION

1. Inspect:

- Damper cam surfaces  
Wear/Scratches → Replace damper and drive pinion gear as a set.

2. Inspect:

- Damper spring  
Damage/Cracks → Replace.



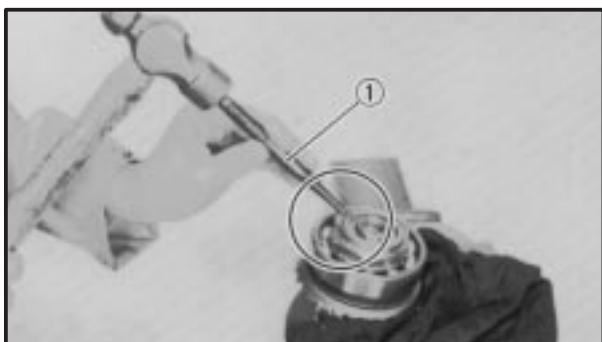
## ASSEMBLY

1. Install:

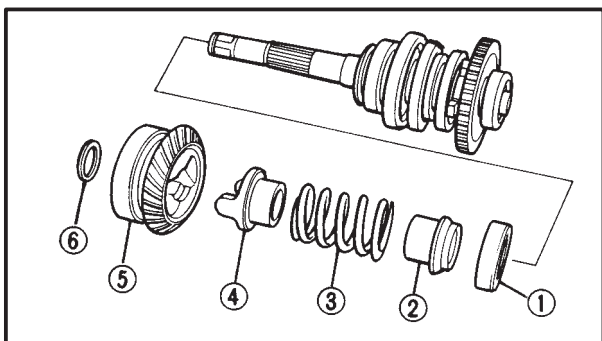
- Shim(s)
- Bearing
- Nut (drive gear)  
Use the Offset Wrench ① (90890-04054).



**Nut (Drive Gear):**  
**110 Nm (11 m•kg, 80 ft•lb)**  
**LOCTITE®**

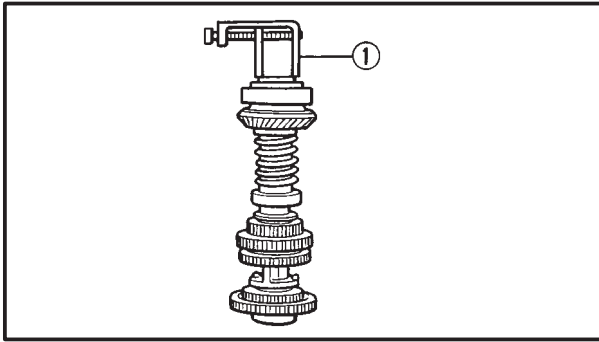


2. Lock the threads with center punch ① as shown.



3. Install:

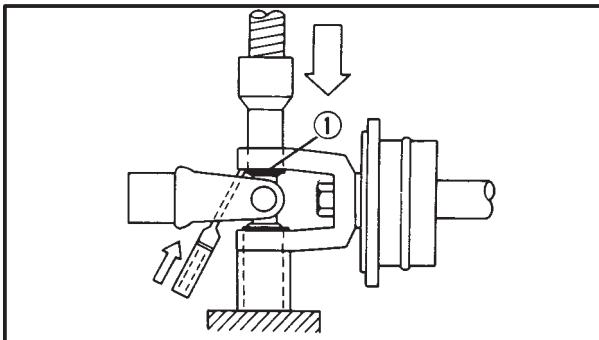
- Bearing ①
- Spring seat ②
- Damper Spring ③
- Damper cam ④
- Drive gear assembly ⑤
- Washer ⑥



4. Attach:
  - Damper Spring Compressor (90890-04090) ①
5. Position:
  - Drive axle shaft assembly  
Onto a Hydraulic Press.
6. Compress the damper spring on the drive axle assembly.
7. Install:
  - Retainers  
Into drive axle shaft groove.
  - Drive axle shaft assembly  
Onto the crankcase.

## MIDDLE DRIVEN GEAR BEARINGS

The following procedures should be performed only if the middle driven gear or middle drive shaft bearing(s) must be replaced.



## Universal Joint Removal

1. Remove:
  - Universal joint

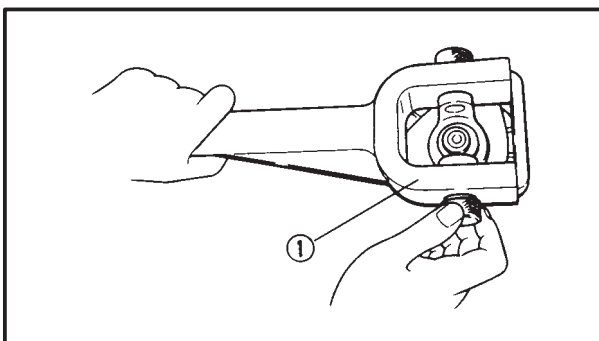
### Universal joint removal steps:

- Remove the circlips ①.
- Place the U-joint in a press.
- With a suitable diameter pipe beneath the yoke, press the bearing into the pipe as shown.

**NOTE:** \_\_\_\_\_  
It may be necessary to lightly tap the yoke with a punch.

- Repeat the steps for the opposite bearing.
- Remove the yoke.

**NOTE:** \_\_\_\_\_  
It may be necessary to lightly tap the yoke with a punch.



2. Attach:
  - Universal Joint Holder ① (90890-04062)  
Onto the universal joint yoke.



## 3. Remove:

- Nut (driven pinion gear)
- Washer
- Yoke
- Bearing
- Bearing housing
- Collapsible collar
- Spacer

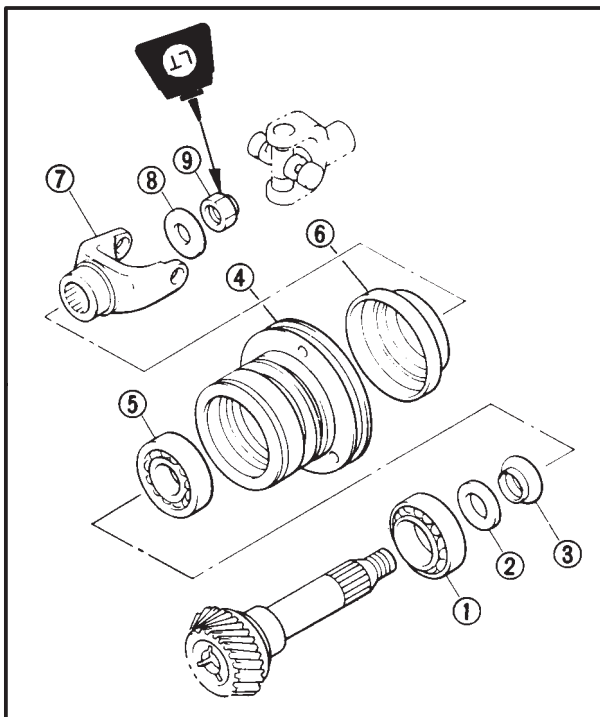
## Inspection

### 1. Inspect:

- Gear teeth  
Pitting/Galling/Wear → Replace middle gear as a set.
- Bearings  
Pitting/Damage → Replace.

### 2. Check:

- U-joint movement  
Roughness → Replace U-joint.



## Assembly

### 1. Install:

- Bearing outer race  
Into the bearing housing.

## CAUTION:

**Do not press the bearing outer race. Always press the inner race with care when installing.**

### 2. Install:

- Inner bearing ①
- Spacer ②
- Collapsible collar ③ (new)
- Bearing housing ④
- Outer bearing ⑤
- Dust seal ⑥
- Yoke ⑦
- Washer ⑧
- Nut (driven pinion gear) ⑨

### 3. Attach:

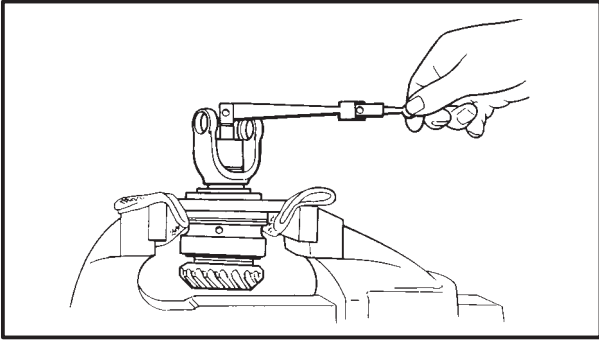
- Universal Joint Holder (90890-04062)  
Onto the universal joint yoke.

### 4. Tighten:

- Nut (driven pinion gear)  
Torque nut carefully, little by little.



**Nut (Driven Pinion Gear):**  
**90 Nm (9.0 m•kg, 65 ft•lb)**  
**LOCTITE®**



### 5. Measure:

- Starting torque (driven pinion gear)  
Under specification → Repeat steps from 4.

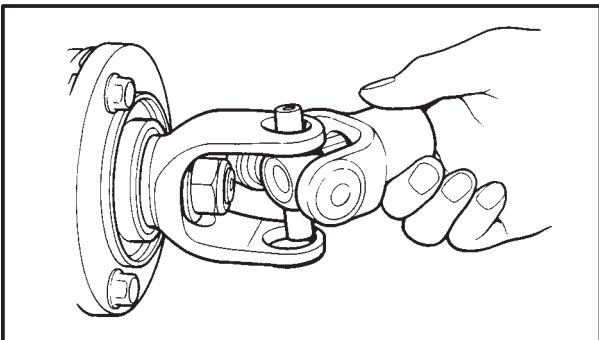


### Starting Torque (Driven Pinion Gear):

0.4 ~ 0.5 Nm (0.04 ~ 0.05 m•kg,  
0.29 ~ 0.36 ft•lb)

### CAUTION:

- Never exceed the standard starting torque.
- Be sure to tighten the driven pinion gear nut slowly, carefully checking measurements each time. Exceeding the standard starting torque may depress the collapsible collar, requiring reassembly.
- To reassemble, you must replace the collapsible collar and repeat the steps in 4 and 5 to obtain the standard starting torque.



### 6. Position:

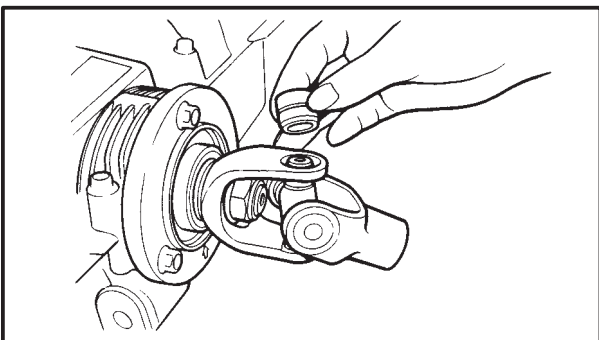
- Yoke  
Into the U-joint.

### 7. Lubricate:

- Bearings



### Wheel Bearing Grease

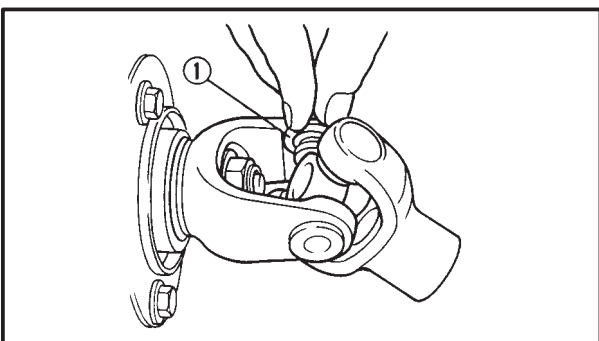


### 8. Install:

- Bearings  
Onto the yoke.

### CAUTION:

Check each bearing. The needles can easily fall out of their races. Slide the yoke back and forth on the bearings; the yoke will not go all the way onto a bearing if a needle is out of place.



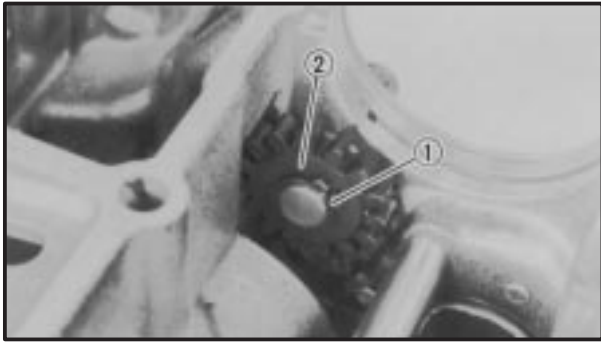
9. Press each bearing into U-joint using a suitable socket.

### NOTE:

Bearing must be inserted far enough into U-joint so that circlip can be installed.

### 10. Install:

- Circlips ①  
Into groove of each bearing.

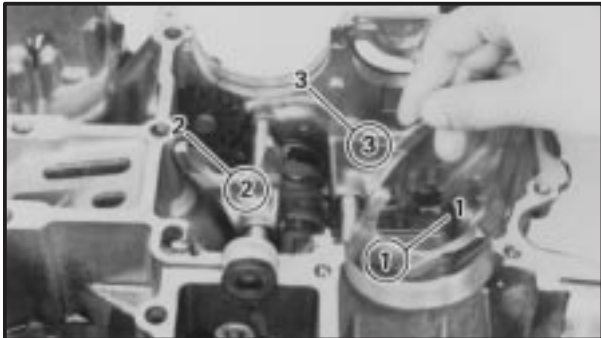


## ENGINE ASSEMBLY AND ADJUSTMENT

### LOWER CRANKCASE

#### 1. Install:

- Oil pump idle gear (2)
- Circlip (1)



#### 2. Install:

- Shift cam
- Shift forks (No.1, 2, 3)
- Guide bars

#### NOTE:

All numbers should face the left side and be in sequence (1, 2, 3), beginning from the left.

#### 3. Install:

- Bearing retainer (shift cam)

#### 4. Tighten:

- Screws (bearing retainer)



**Screws (Bearing Retainer):**  
7 Nm (0.7 m•kg, 5.1 ft•lb)  
LOCTITE®



#### 5. Rotate the shift cam to neutral position.

#### 6. Install:

- Shift cam stopper lever (1)
- tension spring (2)
- Washer (3)
- Bolt (shift cam stopper lever) (4)

#### 7. Tighten:

- Bolt (shift cam stopper lever)



**Bolt (Shift Cam Stopper Lever):**  
8 Nm (0.8 m•kg, 5.8 ft•lb)  
LOCTITE®

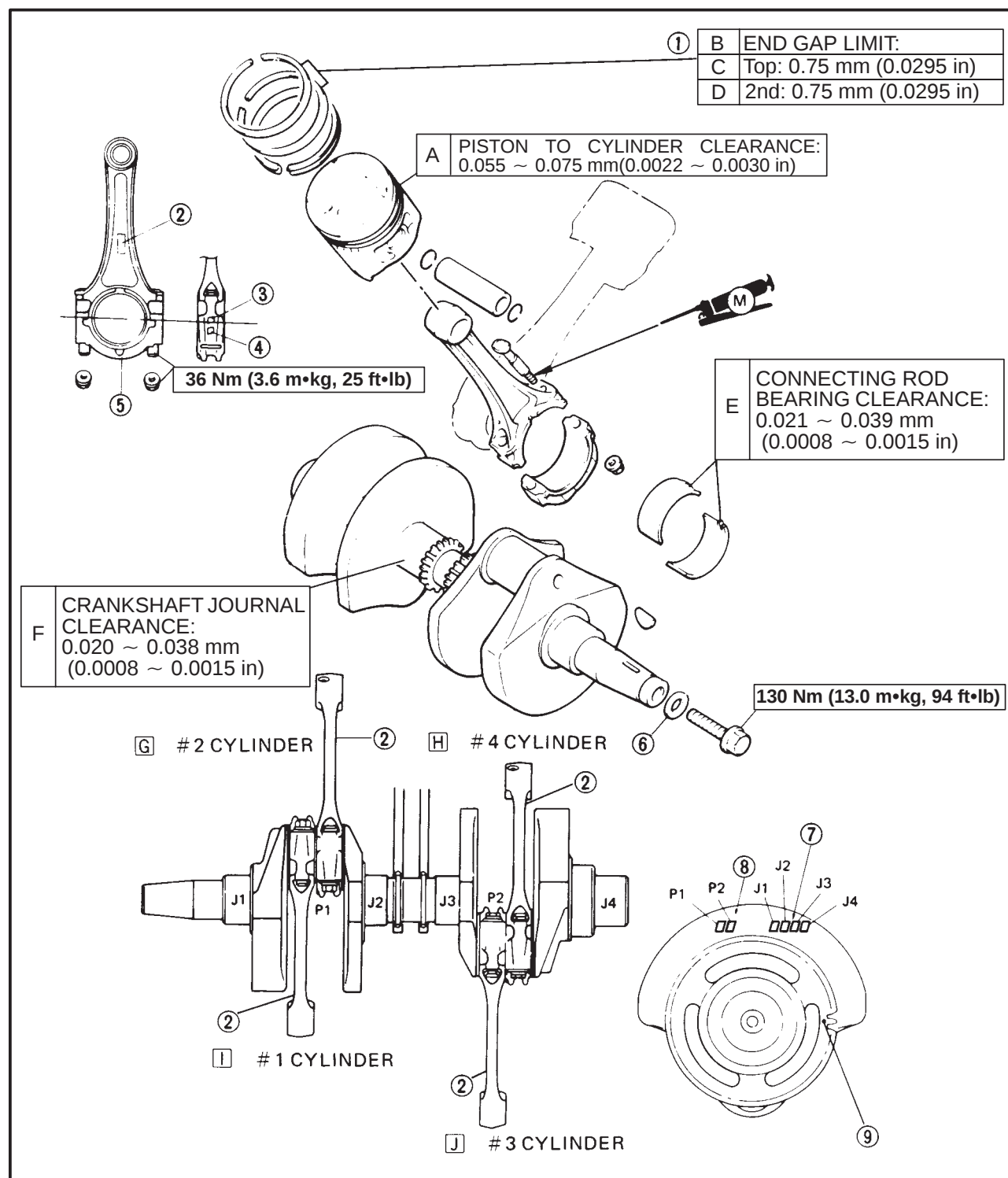
#### NOTE:

Check for smooth operation after tightening the stopper lever.



### CRANKSHAFT/CONNECTING ROD/PISTON

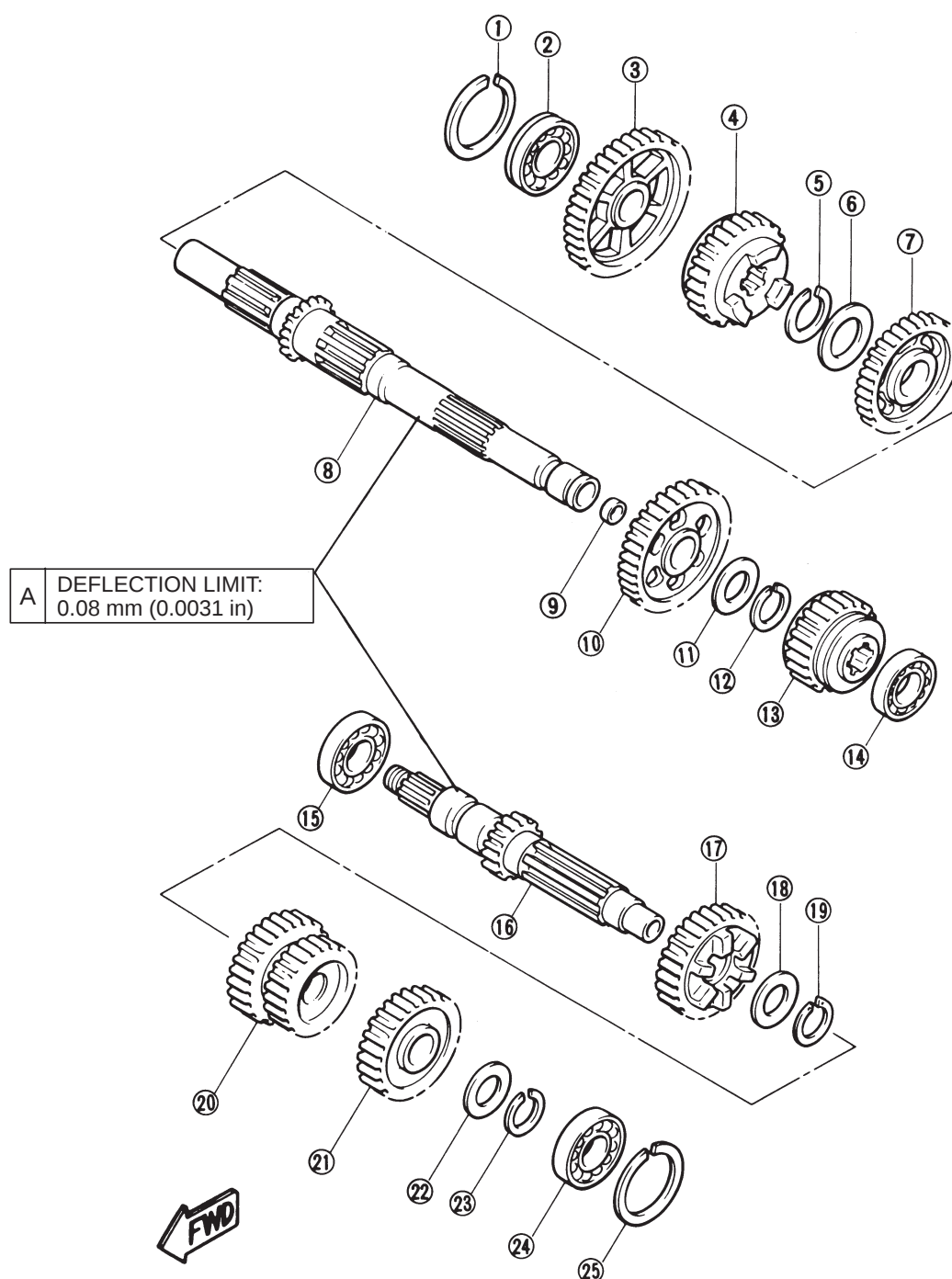
- ① Piston ring
- ② "Y" mark
- ③ Matching mark
- ④ Connecting rod bearing size
- ⑤ Projection
- ⑥ Washer
- ⑦ Journal bearing size
- ⑧ Crank pin size
- ⑨ Balancer matching mark

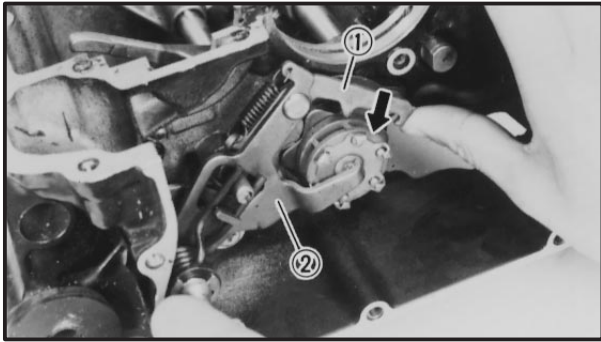




## TRANSMISSION

- |                        |                         |                                 |
|------------------------|-------------------------|---------------------------------|
| ① Circlip              | ⑩ 2nd wheel gear (39T)  | ⑲ Circlip                       |
| ② Bearing              | ⑪ Washer                | ⑳ 2nd, 3rd pinion gear (22/23T) |
| ③ 1st wheel gear (43T) | ⑫ Circlip               | ㉑ 5th pinion gear (28T)         |
| ④ 4th wheel gear (28T) | ⑬ 5th wheel gear (26T)  | ㉒ Washer                        |
| ⑤ Circlip              | ⑭ Bearing               | ㉓ Circlip                       |
| ⑥ Washer               | ⑮ Bearing               | ㉔ Bearing                       |
| ⑦ 3rd wheel gear (31T) | ⑯ Main axle             | ㉕ Circlip                       |
| ⑧ Drive axle           | ⑰ 4th pinion gear (26T) |                                 |
| ⑨ Plug                 | ⑱ Washer                |                                 |





8. Install:
- Shift shaft assembly

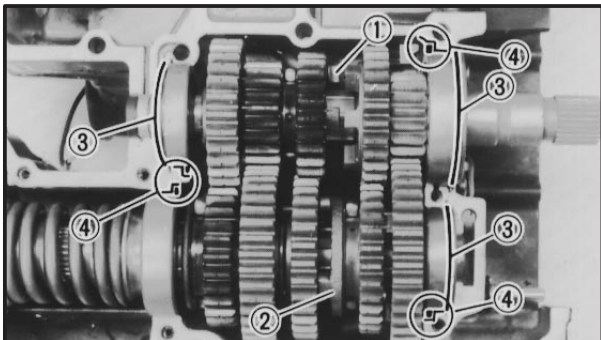
- ① Shift lever 1  
② Shift lever 2

## TRANSMISSION

1. Install:
- Plane bearings (crankshaft/balancer shaft)

**NOTE:** \_\_\_\_\_

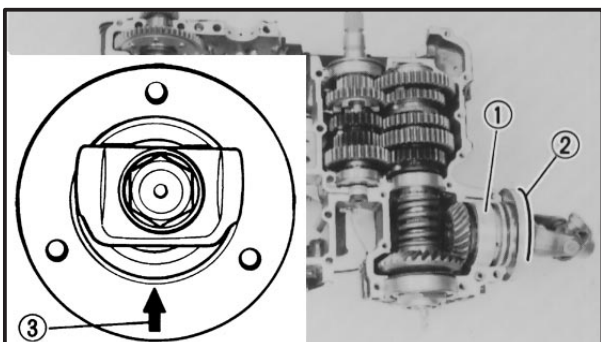
Identify each plane bearing position very carefully so that it can be reinstalled in its original place.



2. Install:
- Main axle assembly ①
  - Drive axle assembly ②

**NOTE:** \_\_\_\_\_

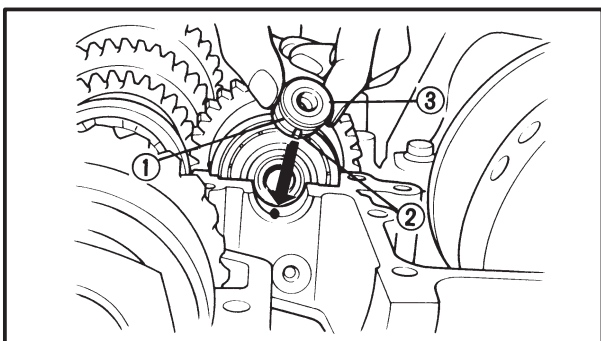
- Insert the bearing circlips ③ completely into lower crankcase positioning grooves.
- Position the bearing pin ④ as shown.



3. Install:
- Middle driven pinion gear assembly ①

**NOTE:** \_\_\_\_\_

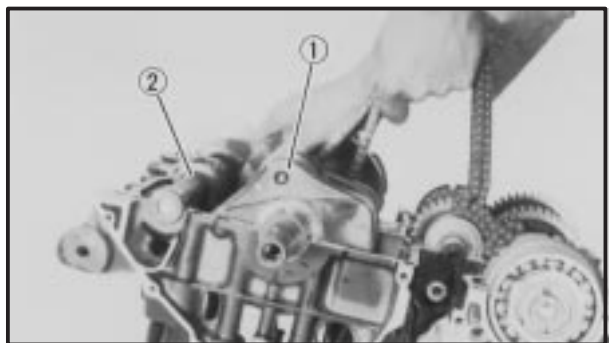
- Be careful not to damage the O-ring ② during installation.
- The arrow mark ③ on the bearing housing points to the upper crankcase.



4. Install:
- Push rod support bearing ①

**NOTE:** \_\_\_\_\_

- Insert the bearing pin ② into the crankcase hole.
- Position the oil seal ③ snugly against the bearing.
- Lightly apply grease to the oil seal lips.



5. Check:

- Transmission and shifter operation  
Unsmooth operation → Repair.

**NOTE:** \_\_\_\_\_

Oil each gear and bearing thoroughly.

6. Install:

- Crankshaft with cam chains ①
- Balancer shaft ②

**NOTE:** \_\_\_\_\_

Align the mark ③ on the balancer shaft gear with the mark ④ on the crankshaft gear.

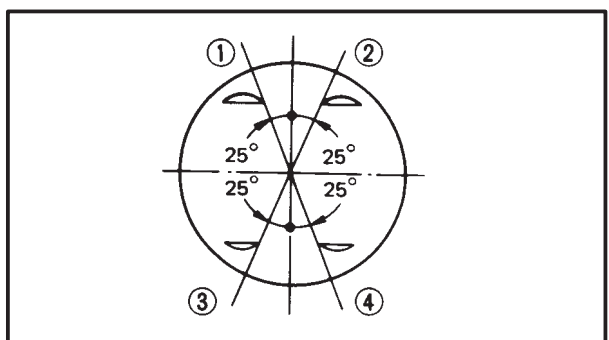
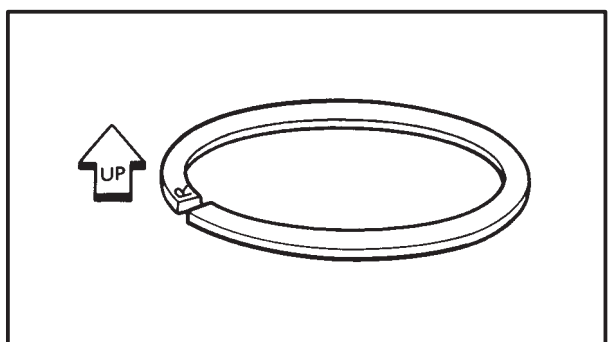
## UPPER CRANKCASE

1. Install:

- Plane bearings (crankshaft/balancer gear)

**NOTE:** \_\_\_\_\_

Identify each plane bearing position very carefully so that it can be reinstalled in its original place.



2. Install:

- Piston rings

**NOTE:** \_\_\_\_\_

Be sure to install rings so that Manufacturer's marks or numbers are located on the top side of the rings.

3. Oil liberally:

- Pistons
- Rings
- Cylinders

4. Set:

- Piston ring ends

**CAUTION:** \_\_\_\_\_

**Make sure the ends of the oil ring expanders do not overlap.**

① TOP    ② OIL RING (LOWER RAIL)

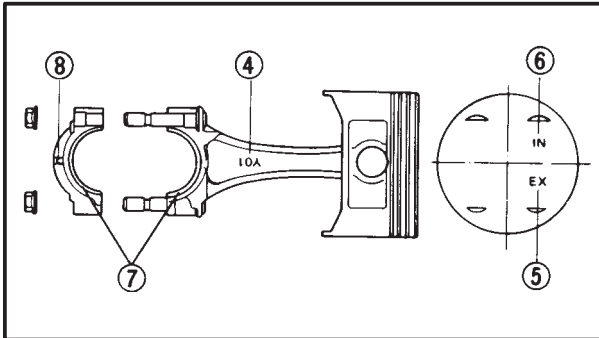
③ OIL RING (UPPER RAIL)    ④ 2ND



5. Install:
- Piston ③
  - Piston pin ②
  - Piston pin clip ①

**NOTE:**

- Be sure the piston is positioned correctly as shown.
- Always install new piston pin clips.



- Plane bearings (connecting rods) ⑦  
Onto the connecting rod and cap.

- ④ "Y" Mark
- ⑤ "EX" Exhaust side
- ⑥ "IN" Intake side
- ⑧ Projection



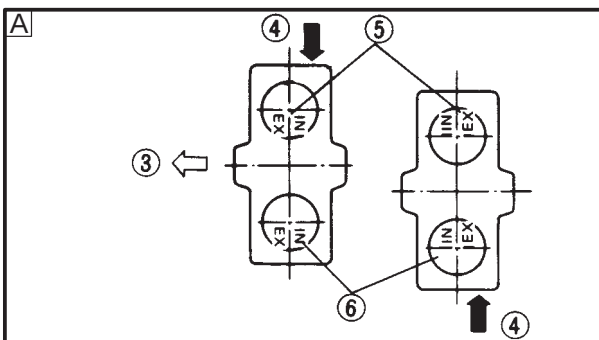
6. Install:
- Piston/Connecting rod assembly (#1 ~ #4)  
Into the upper crankcase.

**Piston/Connecting rod assembly installation steps:**

- Attach the Piston Ring Compressor ① (90890-05158) to the piston.
- Install the piston to the cylinder.

**NOTE:**

- The stamped "Y" mark ② on the No.2 and No.4 connecting rods should face towards the RIGHT side of the crankcase.
- The stamped "Y" mark ② on the No.1 and No.3 connecting rods should face towards the LEFT side of the crankcase.



- Ⓐ Top view
- ③ Front
- ④ "Y"-mark facing direction
- ⑤ Piston exhaust mark
- ⑥ Piston intake mark



### CRANKCASE ASSEMBLY

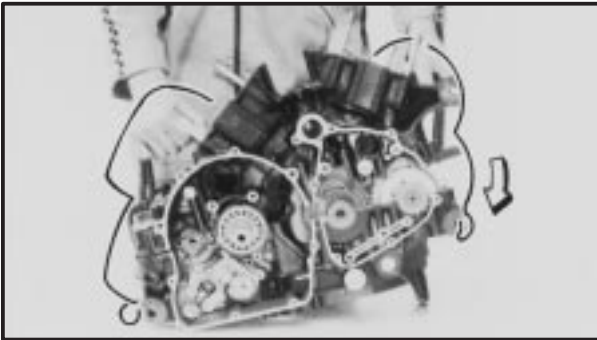
#### 1. Apply:

- Yamaha Bond No.1215  
(90890-85505)

To the mating surfaces of both case halves.

#### NOTE:

DO NOT ALLOW any sealant to come in contact with the oil gallery O-ring, or crankshaft bearings. Do not apply sealant to within 2 ~ 3 mm (0.08 ~ 0.12 in) of the bearings.



#### 2. Set shift cam and transmission gears in NEUTRAL position.

#### 3. Install:

- Upper crankcase
  - Dowel pins
- To the lower crankcase.

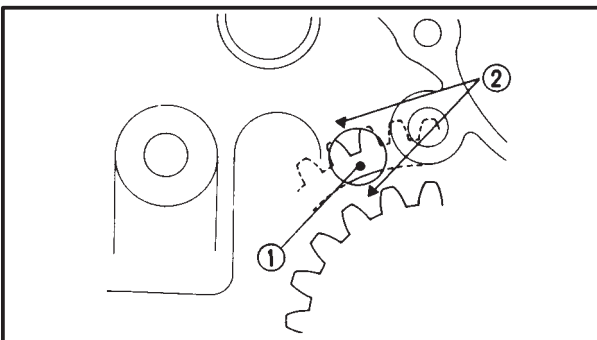
#### NOTE:

Attach wire to each cam chain and place cam chains on timing gear sprockets.

### CAUTION:

Before tightening the crankcase bolts, check the following points:

- Be sure the gear shifts correctly while handturning the shift cam.
- Be sure the balancer shaft gear is aligned so that the dot mark lines up between the triangular timing marks on the upper crankcase when the No.1 piston is at TDC.



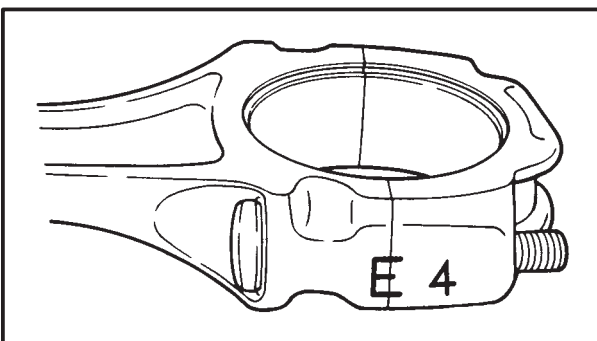
① Balancer shaft mark

② Triangular timing marks

#### 4. Finger-tighten the several crankcase bolts, preferably wide apart. Then, turn the crankcase assembly upside down.

#### NOTE:

Be careful not to let pistons fall out of the cylinders.

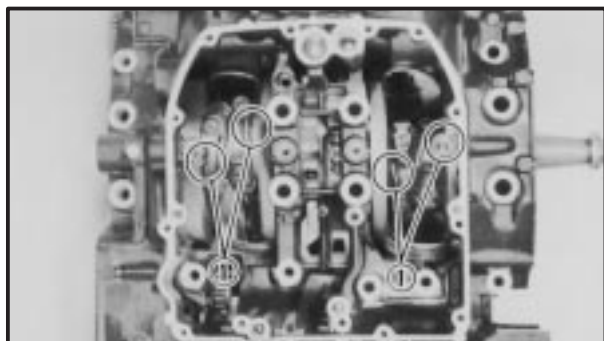


#### 5. Install:

- Rod caps

#### NOTE:

Be sure the letters on both components align to form a perfect character.



### 6. Tighten:

- Nuts (connecting rod cap)



**Nut (Connecting Rod):**  
36 Nm (3.6 m•kg, 25 ft•lb)

### NOTE:

- Apply Molybdenum disulfide grease to the rod cap bolt threads and nut surfaces.
- The projection ① on the connecting rod cap should face the crankshaft web.

### CAUTION:

When tightening the rod cap, apply continuous torque between 3.0 and 3.8 m•kg. Once you reach 3.0 m•kg of torque, **DO NOT STOP TIGHTENING** until final torque is reached. If tightening is interrupted between 3.0 and 3.8 m•kg, loosen the nut to less than 3.0 m•kg, and start again. Tighten to full-torque specification without pausing.

### 7. Tighten:

- Bolts (crankcase)

### NOTE:

Tighten the bolts starting with the lowest numbered one.

\* With washer

**A** LOWER CASE

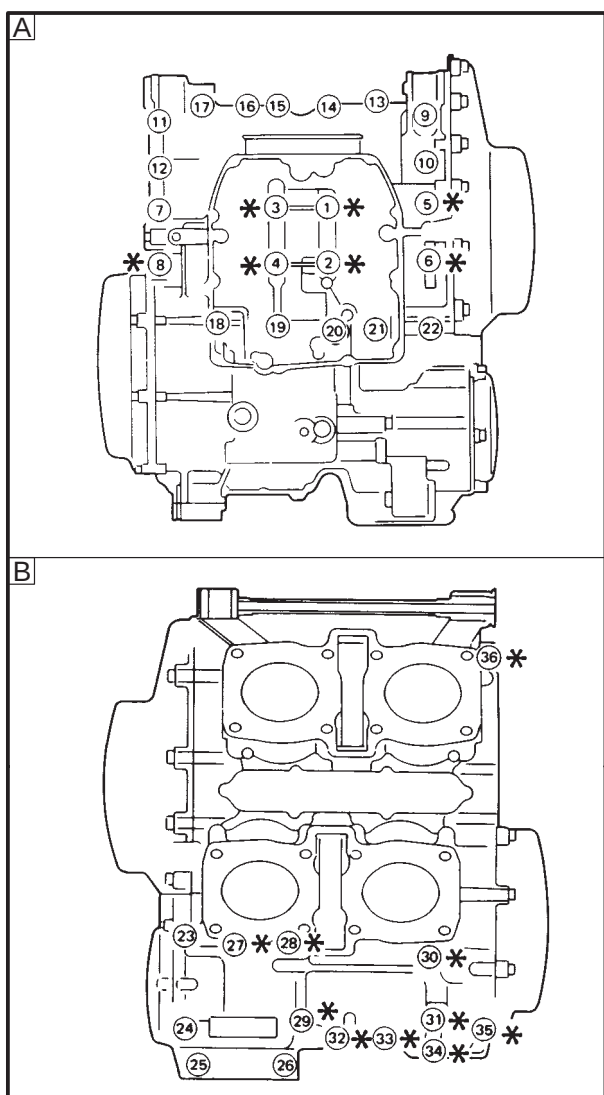
**B** UPPER CASE



**6 mm Bolt:**  
12 Nm (1.2 m•kg, 8.7 ft•lb)  
**8 mm Bolt:**  
24 Nm (2.4 m•kg, 17 ft•lb)  
**10 mm Bolt:**  
40 Nm (4.0 m•kg, 29 ft•lb)

### NOTE:

- Install the oil pipe bracket on Bolt Nos.1 and 3.
- Install the lead wire bracket on Bolt No.22.
- Install the battery ground lead on Bolt No.36.
- Install the copper washers on Bolt Nos.28 and 30.



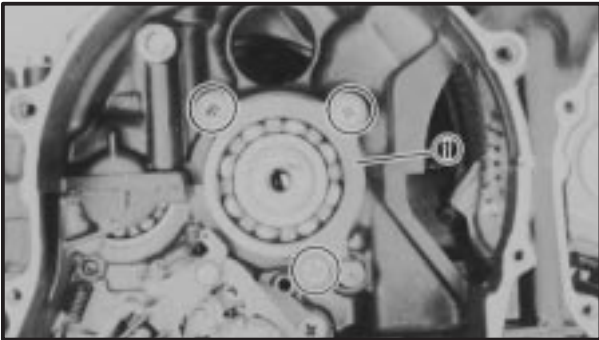


8. Check:
- Crankshaft operation  
Unsmooth operation → Repair.

9. Install:
- Bolts (middle driven gear housing)

**NOTE:**

The arrow mark ① on the bearing housing points to the upper crankcase.



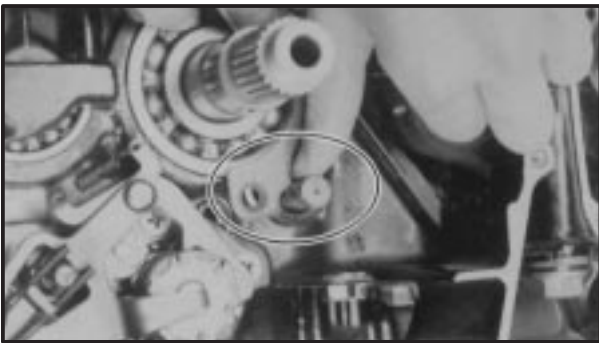
10. Install:
- Retainer (main axle bearing) ①

**NOTE:**

Be sure that the groove in the shaft mesh with the slot in the retainer.



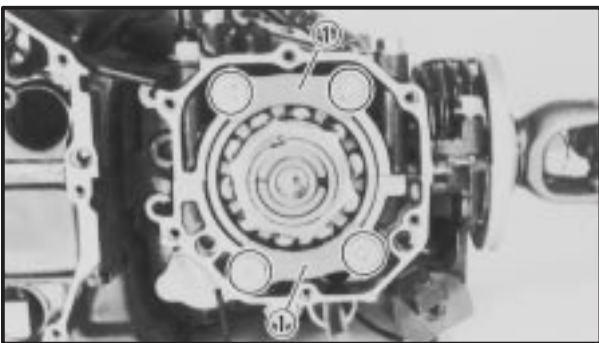
**Retainer (Main Axle Bearing):**  
7 Nm (0.7 m•kg, 5.1 ft•lb)  
**LOCTITE®**



11. Install:
- Retainers (middle gear bearing) ①  
Use the #40 Torx Drive (90890-04049).  
Stake screw head with center punch to lock.



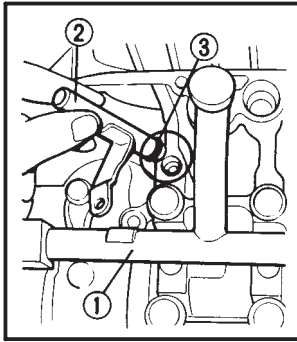
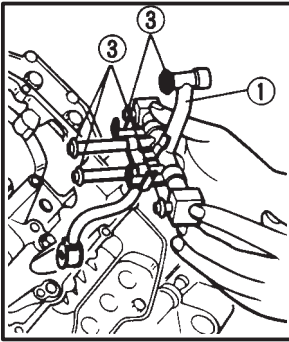
**Retainers (Middle Gear Bearing):**  
25 Nm (2.5 m•kg, 18 ft•lb)



### OIL PUMP AND OIL PAN

1. Install:
- Damper (oil pump pipe) ①
  - Oil pump pipe ②

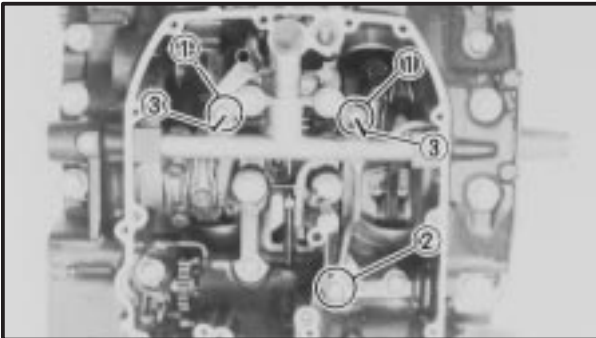




2. Install:
- Main oil gallery pipe ①
  - Oil pipe ②

**NOTE:**

Make sure the correct O-rings ③ are installed on gallery pipe.

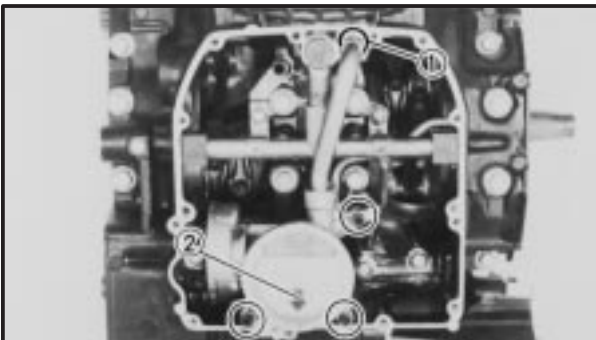


3. Tighten:
- Bolts (main oil gallery pipe) ①, ②



**6 mm Flange Bolt ①:**  
12 Nm (1.2 m•kg, 8.7 ft•lb)  
**8 mm Union Bolt ②:**  
18 Nm (1.8 m•kg, 13 ft•lb)

4. Bend the bracket tabs ③



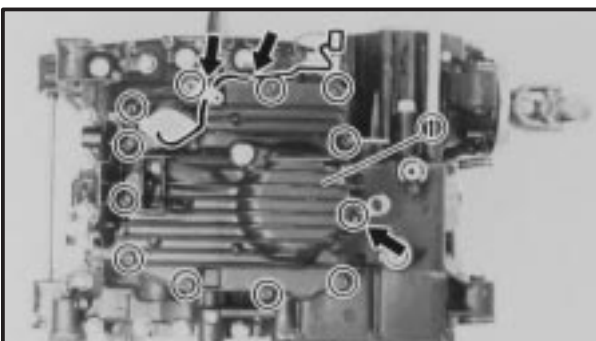
5. Install:
- Dowel pins
  - Oil pump assembly

**NOTE:**

- Make sure the correct O-ring ① is installed on oil pump pipe.
- The arrow mark ② on the oil pump should face toward the rear.



**Oil Pump:**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

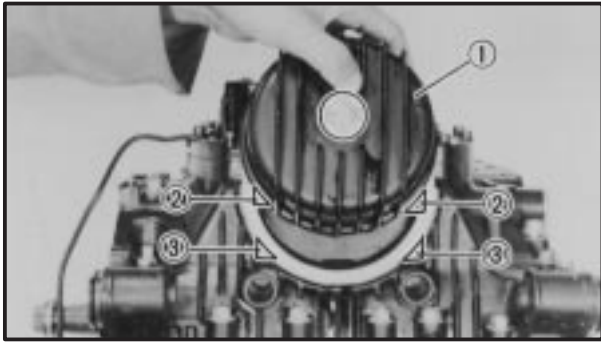


6. Install:
- Gasket
  - dowel pins
  - Oil pan ①



**Oil Pan:**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

7. Clamp the oil level gauge lead.



8. Install:
- Oil filter cover ①

**NOTE:**

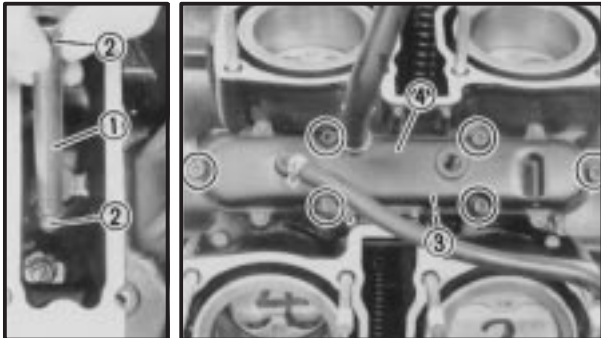
Be sure that the projections ② on the filter cover mesh with the slots ③ on the crankcase.



**Oil Filter Cover:**  
32 Nm (3.2 m•kg, 23 ft•lb)

### BREATHER COVER AND STARTER MOTOR

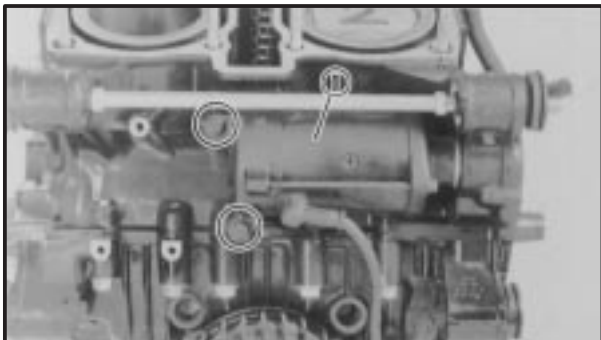
1. Install:
- Oil pipe ①
  - Breather cover spacer ③
  - Breather cover ④



**Bolt (Breather Cover):**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

- ② O-ring

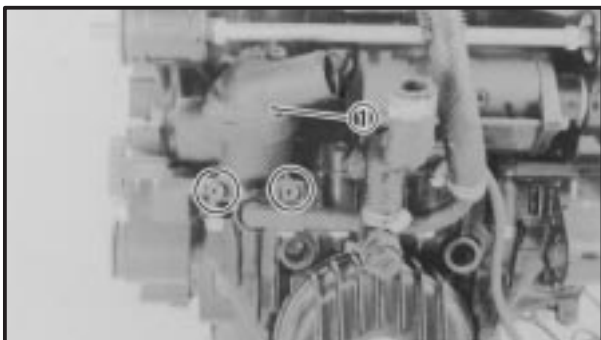
2. Install:
- Starter motor ①



**Bolts (Starter Motor):**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

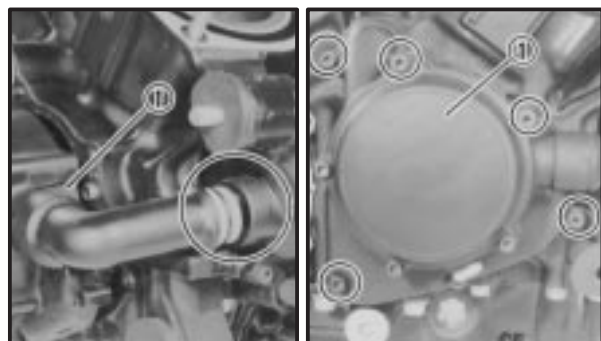
### WATER PUMP AND THERMOSTATIC VALVE

1. Install:
- Thermostat assembly ①

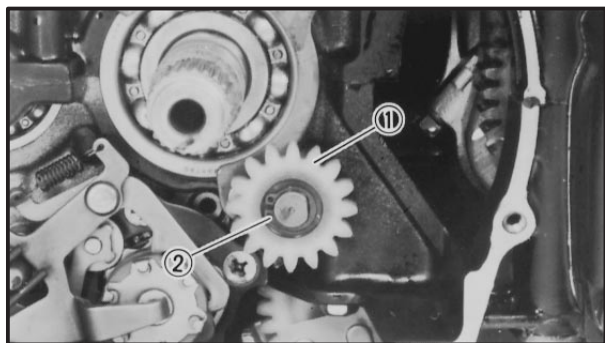


**Thermostatic Valve Housing:**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

2. Install:
- Dowel pins
  - Gasket
  - Water pump case/Water pump cover ①



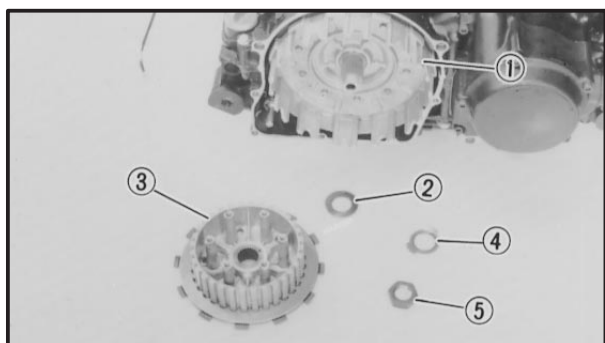
**Water Pump Case and Housing:**  
10 Nm (1.0 m•kg, 7.2 ft•lb)



### CLUTCH AND OIL PUMP DRIVE GEAR

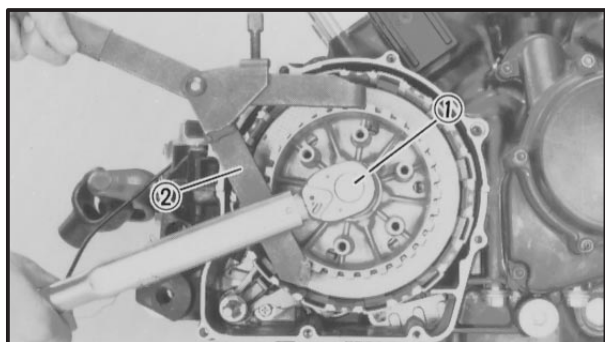
#### 1. Install:

- Oil pump drive gear ①
- Circlip ②



#### 2. Install:

- Clutch housing ①
- Thrust washer ②
- Clutch boss ③
- Lock washer (new) ④
- Nut (clutch boss) ⑤

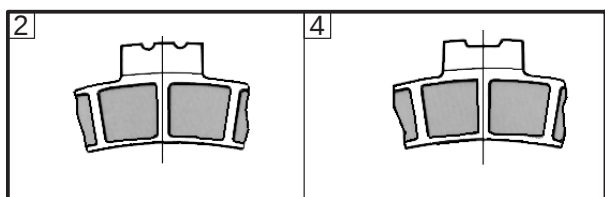


#### 3. Tighten:

- Nut (clutch boss) ①
- Use the Clutch Holder (90890-04086) ② to hold the clutch boss.



**Nut (Clutch Boss):**  
70 Nm (7.0 m•kg, 50 ft•lb)



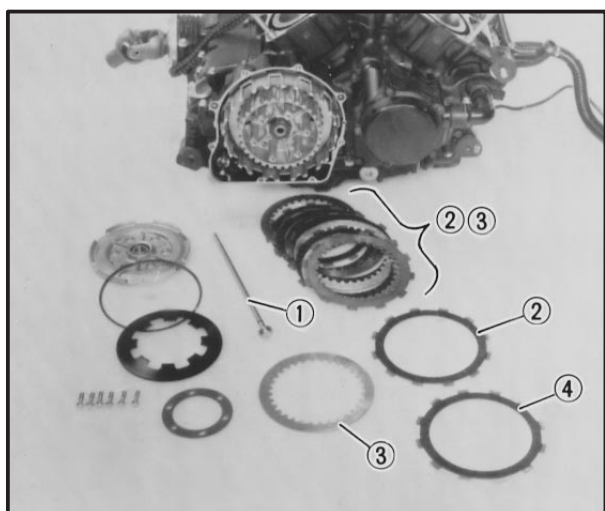
#### 4. Bend the lock washer tabs along the nut flat.

#### 5. Install:

- Push rod ①
- Friction plates ②, ④
- Clutch plates ③

#### NOTE:

Install the friction plates and clutch plates alternately on the clutch boss, starting with a friction plate and ending with a friction plate.

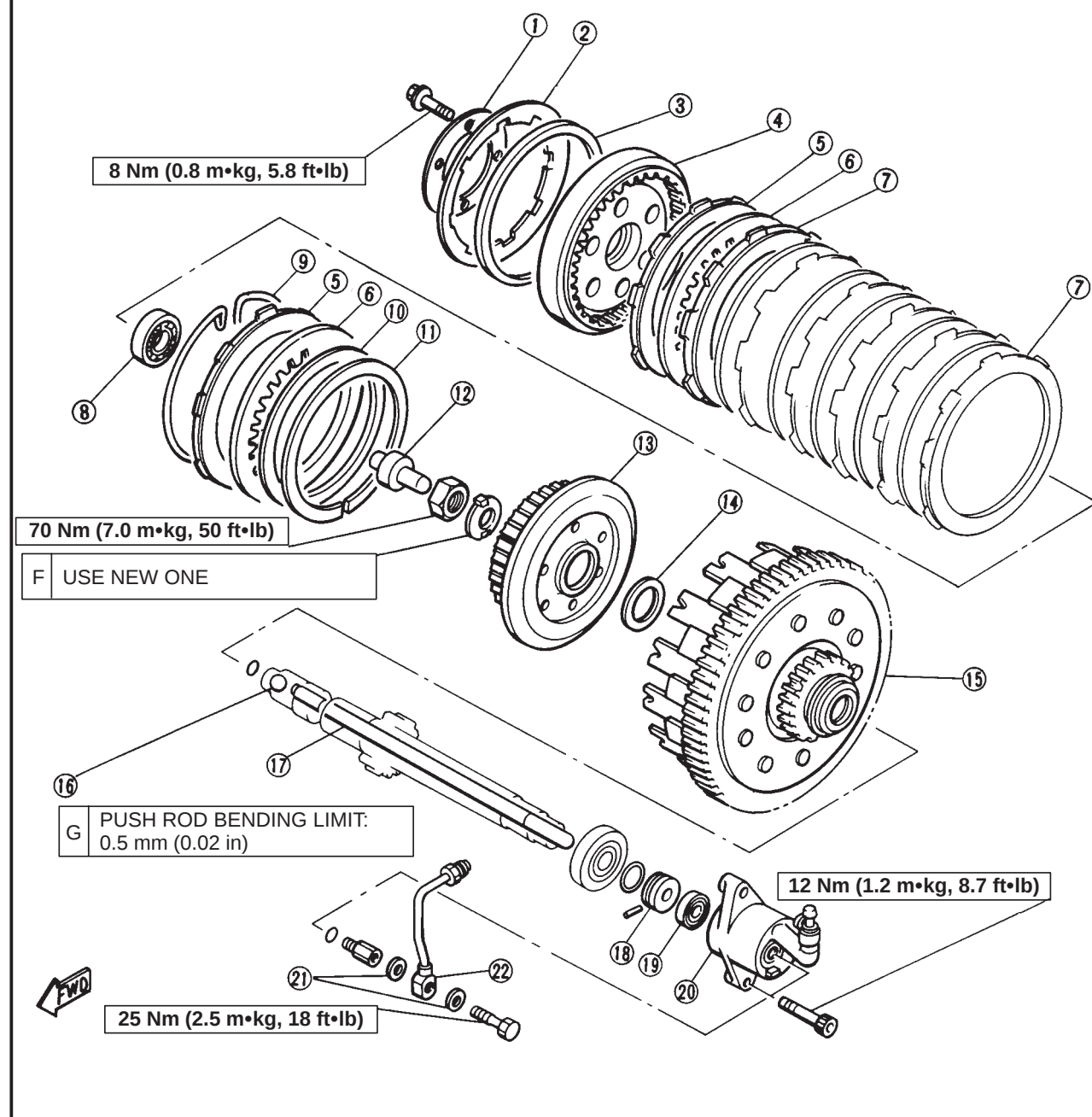


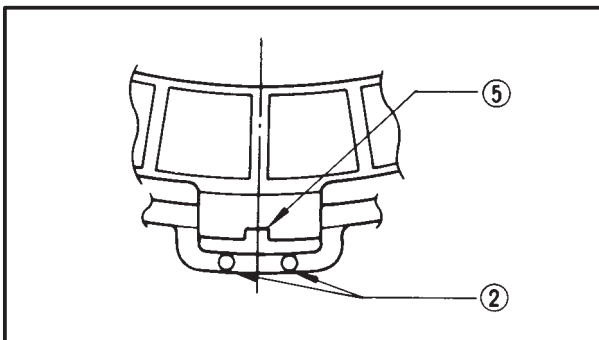
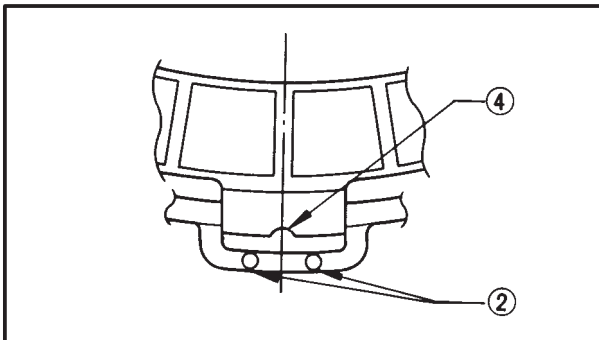
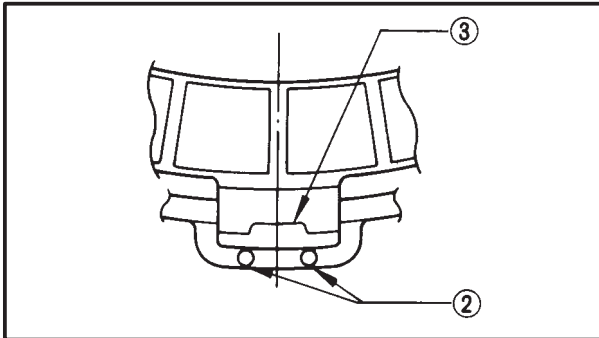
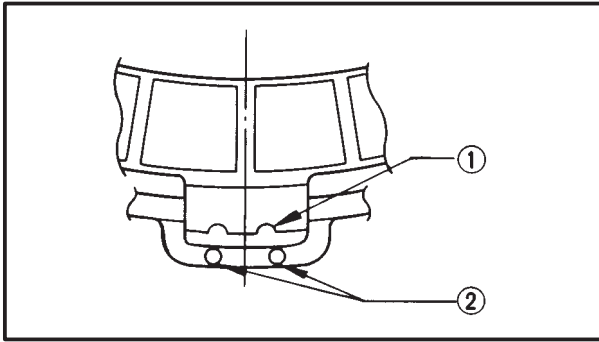


### CLUTCH

- |                          |                   |                            |
|--------------------------|-------------------|----------------------------|
| ① Washer                 | ⑨ Wire circlip    | ⑬ Push rod (No.1)          |
| ② Clutch spring          | ⑩ Washer          | ⑭ Clutch boss              |
| ③ Spring seat            | ⑪ Circuit         | ⑮ Thrust washer            |
| ④ Pressure plate         | ⑫ Push rod (No.2) | ⑯ Clutch housing           |
| ⑤ Friction plate (2 pcs) | ⑬ Clutch boss     | ⑰ Ball                     |
| ⑥ Clutch plate (7 pcs)   | ⑭ Thrust washer   |                            |
| ⑦ Friction plate (6 pcs) | ⑮ Clutch housing  |                            |
| ⑧ Bearing                | ⑯ Clutch housing  |                            |
|                          | ⑰ Ball            |                            |
|                          |                   | ⑱ Push rod (No.2)          |
|                          |                   | ⑲ Push rod support bearing |
|                          |                   | ⑳ Oil seal                 |
|                          |                   | ㉑ Clutch release cylinder  |
|                          |                   | ㉒ Special washer           |
|                          |                   | ㉓ Clutch pipe              |

|   |                                               |   |                                                |
|---|-----------------------------------------------|---|------------------------------------------------|
| A | FRICITION PLATE THICKNESS:                    | D | CLUTCH SPRING MINIMUM HEIGHT:                  |
| B | WEAR LIMIT: 2.8 mm (0.11 in)                  | E | 6.5 mm (0.26 in)                               |
| C | CLUTCH PLATE WARP LIMIT:<br>0.2 mm (0.008 in) |   | CLUTCH SPRING WARP LIMIT:<br>0.1 mm (0.004 in) |





### Friction plates and clutch plates installation steps:

- Install the six friction plates (with the double semi-circular slots) and the six clutch plates.

#### NOTE:

Be sure the double semi-circular slots ① on the friction plate is aligned with the clutch housing embossed match marks ②.

- Install the clutch plate and the friction plate (with the wide square slot).

#### NOTE:

Be sure the wide square slot ③ on the friction plate is aligned with the clutch housing embossed match marks ②.

- If the clutch does not release due to hard meshing between the friction plates and the clutch housing, check to see if any of the friction plates fit too snugly into the clutch housing. Any tight-fitting friction plates must be repositioned as follows.

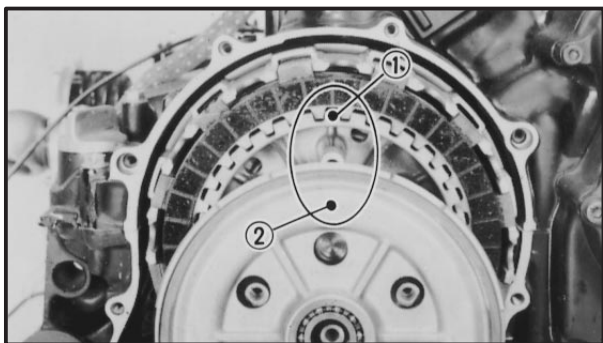
- 1) Remove the friction plates and the clutch plates.
- 2) Install the six friction plate (with the double semi-circular slots) and the six clutch plates.

#### NOTE:

- Invert the friction plates.
- Be sure the single semi-circular slot ④ on the friction plate is aligned with the clutch housing embossed match marks ②.
- 3) Install the clutch plate and the friction plate (with the wide square slot).

#### NOTE:

- Invert the friction plates.
- Be sure the narrow square slot ⑤ on the friction plate is aligned with the clutch housing embossed match marks ②.



6. Install:
- Pressure plate

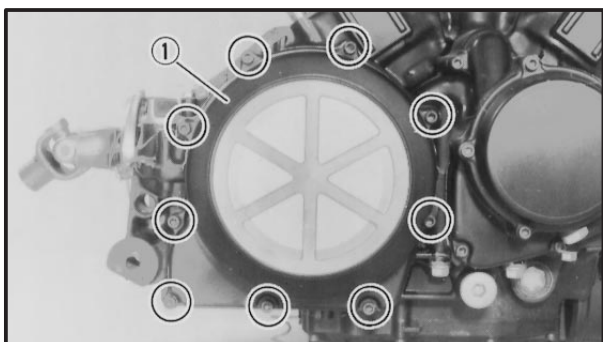
**NOTE:**

Be sure the match mark ① on the clutch boss is aligned with the match mark ② on the pressure plate.

7. Install:
- Spring seat
  - Clutch spring
  - Plate washer
  - Bolts (clutch spring)



**Bolt (Clutch Spring):**  
8 Nm (0.8 m•kg, 5.8 ft•lb)



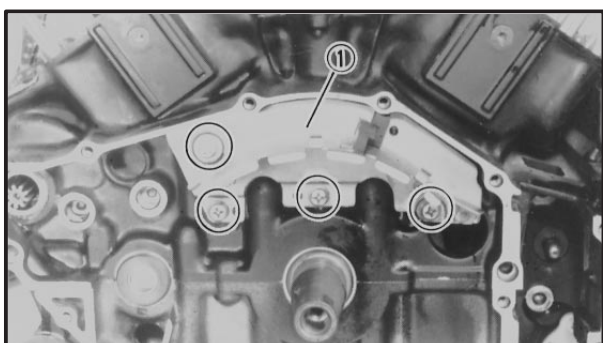
8. Install:
- Dowel pins
  - Gasket
  - Crankcase cover (right) ①

**NOTE:**

Tighten the bolts in a crisscross pattern.



**Crankcase Cover (Right):**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

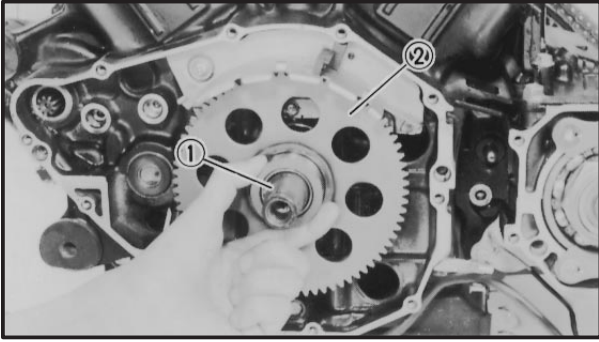


## FLYWHEEL AND STARTER IDLE GEAR

1. Install:
- Oil baffle plate ①



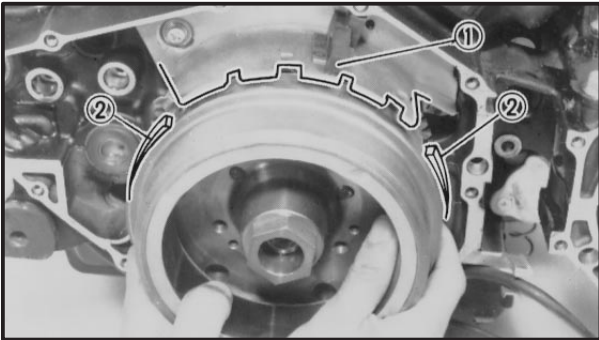
**Oil Baffle Plate:**  
7 Nm (0.7 m•kg, 5.1 ft•lb)



2. Install:
- Starter clutch gear (2)
  - Woodruff key (1)

### CAUTION:

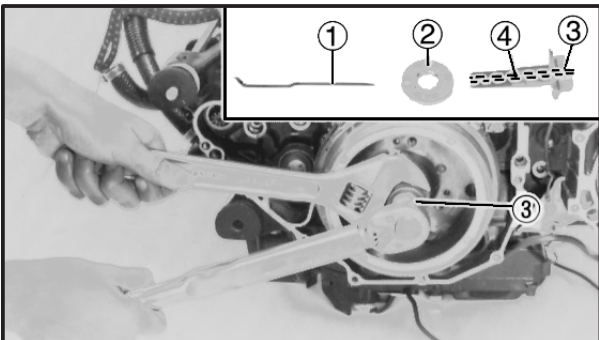
Be sure to remove any oil and or grease from the tapered portion of the crankshaft and rotor with a thinner.



3. Install:
- Flywheel

### NOTE:

When installing the flywheel, do not allow the oil baffle plate (1) to touch the projections (2) on the flywheel.



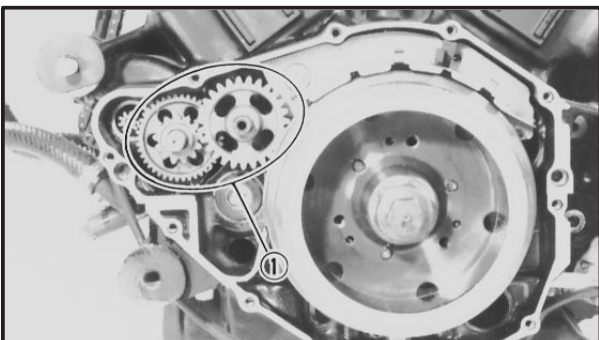
4. Install:
- Pin (1)
  - Plain washer (2)
  - Bolt (flywheel) (3)

### NOTE:

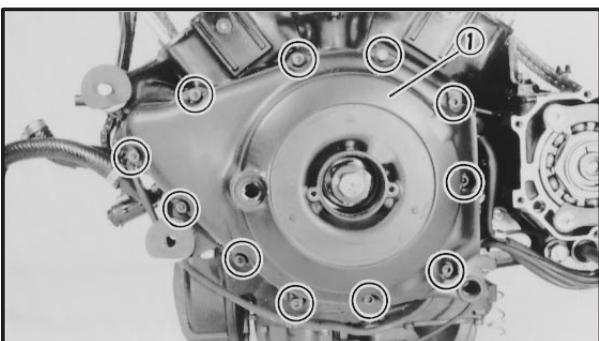
Check for clog of oil passage (4) in the bolt. If any, clean the oil passage.



**Bolt (Flywheel):**  
130 Nm (13.0 m•kg, 94 ft•lb)



5. Install:
- Starter idle gears (1)



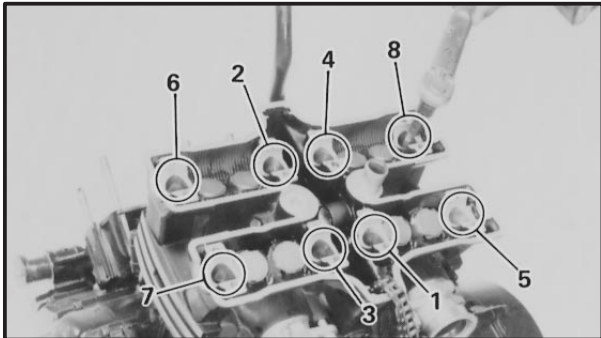
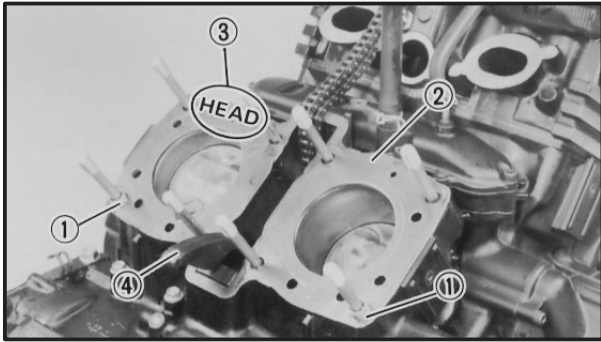
6. Install:
- Dowel pins
  - Gasket
  - Crankcase cover (left) (1)

### NOTE:

Tighten the bolts in a crisscross pattern.



**Crankcase Cover (Left):**  
10 Nm (1.0 m•kg, 7.2 ft•lb)



### CYLINDER HEAD AND CAMSHAFT

#### Rear Cylinder Head

##### 1. Install:

- Dowel pins ①
- Gasket ②
- Rear cam chain guide ④

##### NOTE:

- The gasket "HEAD" mark ③ should be upward.
- The lower end of chain guide must rest in the cam chain guide slot in the crankcase.

- Cylinder head

Pass cam chain through cam chain cavity.

##### 2. Install:

- Nuts (cylinder head)

Use 8 mm Wrench Adapter (90890-04076).

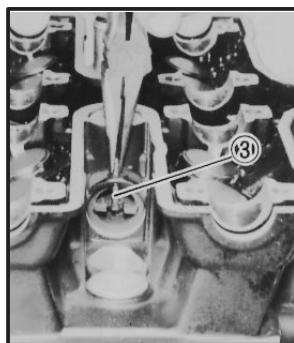
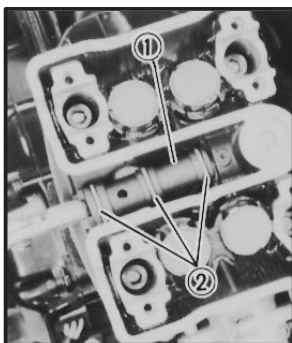
##### NOTE:

- In sequence as shown and torque nuts in two stages.
- Never lubricate the bolt threads with engine oil.



#### Nuts (Cylinder Head):

43 Nm (4.3 m•kg, 31 ft•lb)



##### 3. Install:

- Water jacket joints ①

##### NOTE:

Be sure each joint passes through its corresponding cam chain.

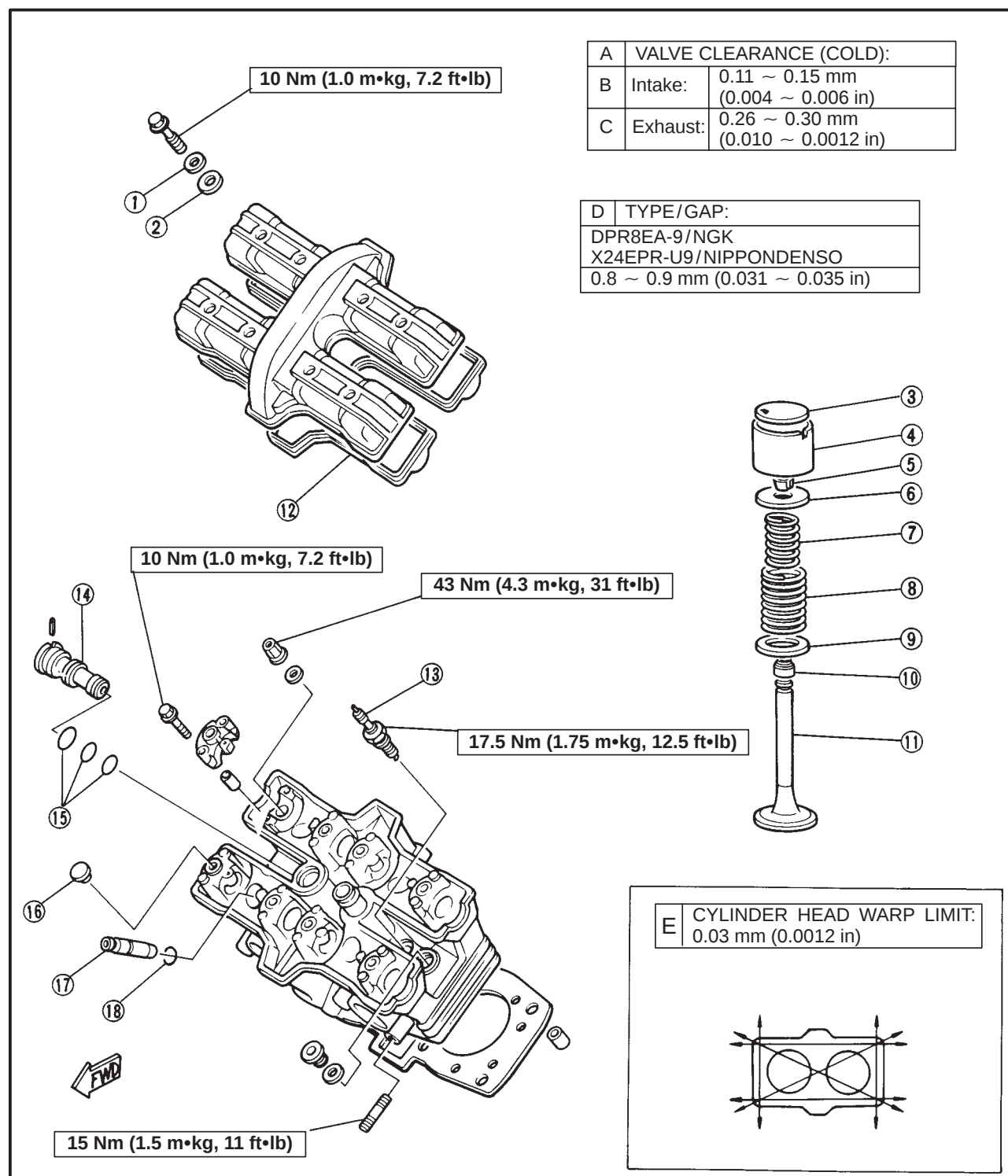
- Lock pin ③

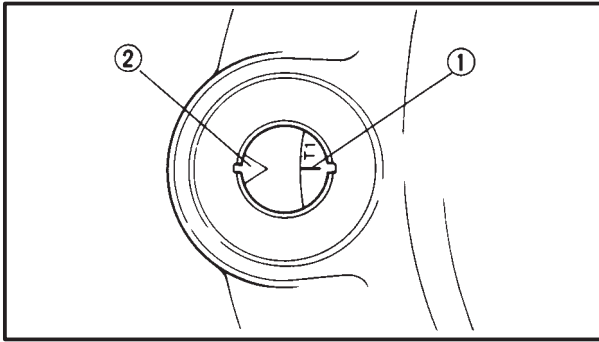
- ② O-ring



### CYLINDER HEAD AND CAMSHAFT

- |                  |               |
|------------------|---------------|
| ① Washer         | ⑩ Oil seal    |
| ② Rubber washer  | ⑪ Valve       |
| ③ Pad            | ⑫ Gasket      |
| ④ Valve lifter   | ⑬ Sprak plug  |
| ⑤ Valve retainer | ⑭ Joint       |
| ⑥ Spring seat    | ⑮ O-ring      |
| ⑦ Inner spring   | ⑯ Oil plug    |
| ⑧ Outer spring   | ⑰ Valve guide |
| ⑨ Spring seat    | ⑱ Circlip     |





### 4. Install:

- Camshafts

#### Camshaft installation steps:

- Align the "T-1" mark (1) on the flywheel with the stationary pointer (2) on the crankcase cover use 32 mm wrench.

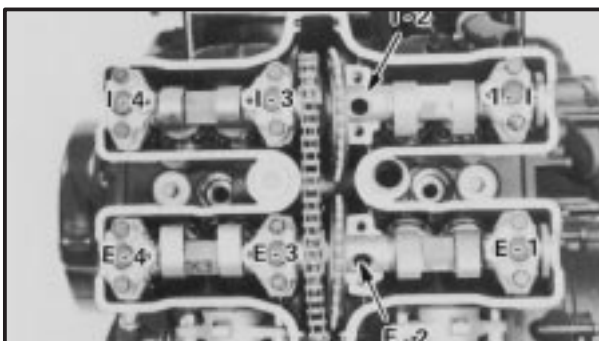
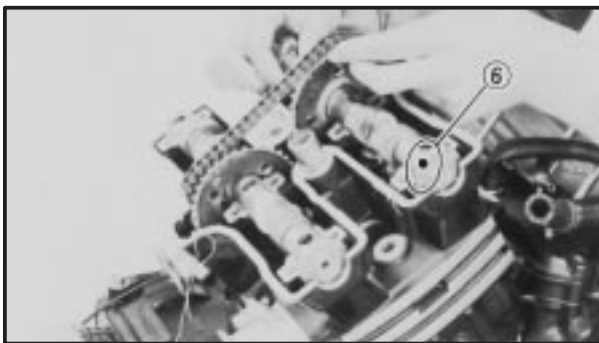
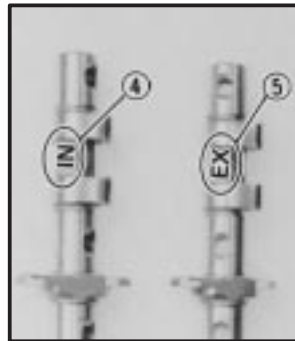
#### CAUTION:

- **Never turn the flywheel installing bolt. Rotating the bolt may loosen it, causing the rotor to fall out.**
- **Do not turn the crankshaft during the camshafts installation.**

- Install the cam chain sprockets onto the camshafts.

#### NOTE:

Make sure the "REAR" mark (3) on the cam chain sprockets face away from the "IN" mark (4) and "EX" mark (5) on the camshafts.



- Apply engine oil to the camshaft bearing surfaces.
- Install the "IN" marked camshaft onto the intake side and "EX" marked camshaft onto the exhaust side.
- Turn the camshafts by hand so that the timing marks (6) (○: small hole) on the camshaft face upward.
- Install the dowel pins into the cam caps.
- Install the cam caps (Nos.3, 1 and 4) onto the camshaft.

#### NOTE:

- Do not install No.2 intake and No.2 exhaust cam caps at this stage.
- The numbers are punched on the camshaft caps in increments from right to left.



- Tighten the cap bolts.

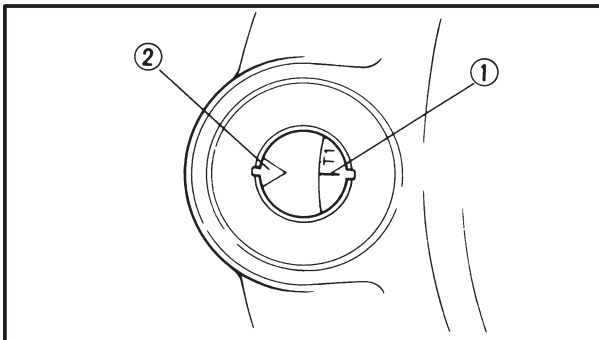
**NOTE:**

First tighten the No.3, 1 and 4 cap bolts in that order, then the No.2 cap bolts.



**Camshaft Cap:**

**10 Nm (1.0 m•kg, 7.2 ft•lb)**



5. Install:

- Cam chain sprockets

**Cam chain sprockets installation steps:**

- Align the “T-1” mark ① on the flywheel with the stationary pointer ② on the crankcase cover use 32 mm wrench.

**CAUTION:**

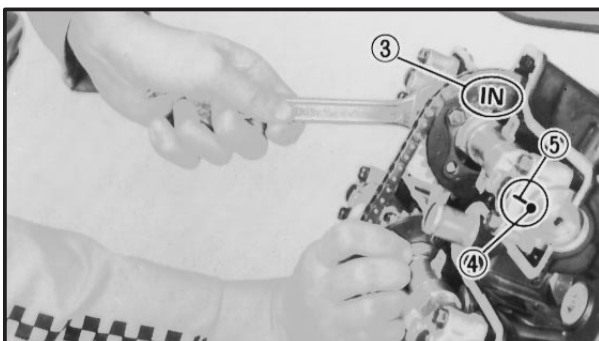
- **Never turn the flywheel installing bolt. Rotating the bolt may loosen it, causing the rotor to fall out.**
- **Do not turn the crankshaft during the sprocket installation.**

- Place the cam chain onto the intake sprocket.
- Install the sprocket with the punched mark “REAR” facing outward and finger-tighten the sprocket bolts.

**NOTE:**

Align the “IN” mark ③ hole on the sprocket with the thread hole on the camshaft.

- Rotate the intake camshaft to align the timing mark ④ (○: small hole) on the camshaft with the embossed match mark ⑤ on the camshaft cap (I-4).



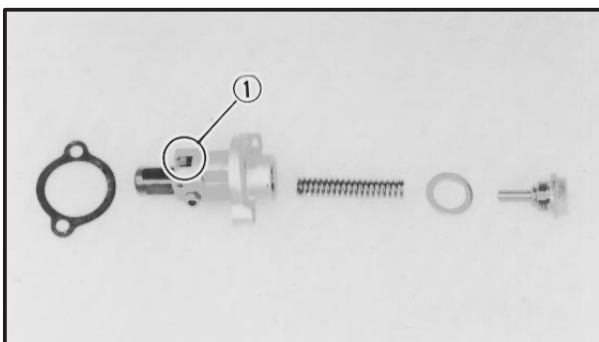


- Force the intake camshaft counterclockwise to remove the cam chain slack.
- Place the cam chain onto the exhaust sprocket.
- Install the sprocket with the punched mark "REAR" facing outward and finger-tighten the sprocket bolt.

### NOTE:

Align the "EX" mark hole on the sprocket with the thread hole on the camshaft.

- Rotate the exhaust camshaft to align the timing mark (○: small hole) on the camshaft with the embossed match mark on the camshaft cap (E-4).
- Force the exhaust camshaft clockwise to remove all the cam chain slack.
- Insert your finger into the cam chain tensioner hole, and push the cam chain guide inward.
- While pushing the cam chain guide, be sure camshaft embossed match marks align with the timing marks on the camshaft.
- If marks do not align, change the meshing position of sprocket and cam chain.



### 6. Install:

- Cam chain tensioner

### Cam chain tensioner installation steps:

- Remove the tensioner end cap bolt and spring.
- Release the cam chain tensioner one-way cam (1).
- Install the tensioner with a new gasket into the cylinder.



**Cam Chain Tensioner Body:**  
12 Nm (1.2 m•kg, 8.7 ft•lb)

- Install the tensioner spring (2), copper washer (3) and end cap bolt (4).



**End Bolt (Cam Chain Tensioner):**  
20 Nm (2.0 m•kg, 14 ft•lb)



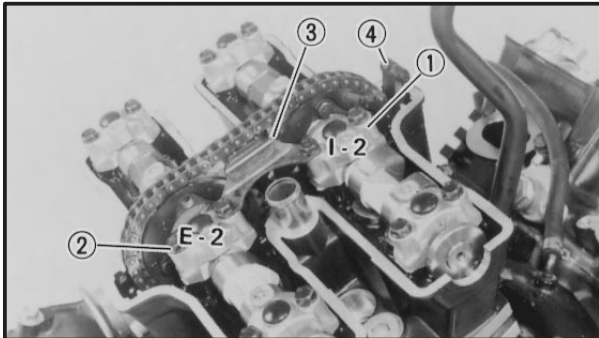
7. Turn the crankshaft and tighten the cam sprocket bolts.



**Camshaft Sprocket:**  
24 Nm (2.4 m•kg, 17 ft•lb)

### CAUTION:

Be sure to attain the specified torque value to avoid the possibility of these bolts coming loose and causing damage to the engine.

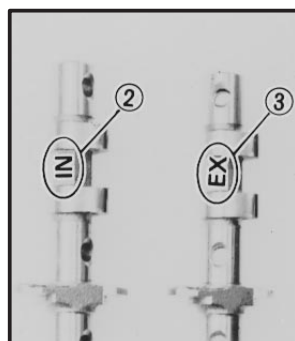
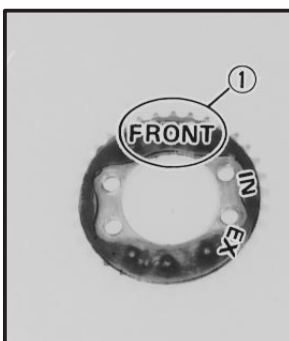
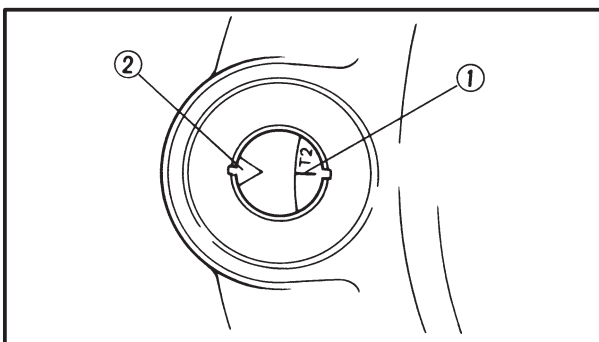


8. Install:
  - Cam caps ("I-2" and "E-2") ①, ②



**Camshaft Cap:**  
10 Nm (1.0 m•kg, 7.2 ft•lb)

- Cam chain guides ③, ④
9. Apply:
    - Engine oil
 To the cam chain, sprockets, camshaft and valves.



### Front Cylinder Head

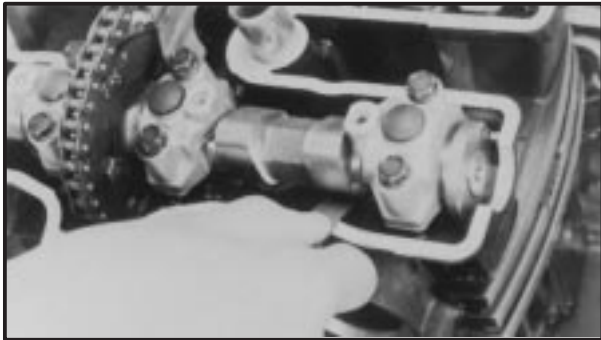
When installing the front cylinder head, repeat the rear cylinder head installation procedure. However, note the following points.

1. Install:
  - Camshafts
  - 1) Rotate the crankshaft counterclockwise 360° plus and added 70° (430° total) from the "T-1" mark.
  - 2) Align the "T-2" ① mark on the flywheel with the stationary pointer ② on the crankcase cover use 32 mm wrench.
  - 3) Install the cam chain sprockets onto the camshafts.

### NOTE:

Make sure the "FRONT" mark ① on the cam chain sprockets face away from the "IN" mark ② and "EX" mark ③ on the camshaft.

- 4) Turn the camshafts by hand so that the timing marks (○: big hole) on the camshaft face upward.



## 2. Install:

- Cam chain sprocket

- 1) Align the "T-2" mark on the flywheel with the stationary pointer on the crankcase cover use 32 mm wrench.
- 2) Install the sprocket with the punched mark "FRONT" facing outward and finger-tighten the sprocket bolts.
- 3) Rotate the intake and exhaust camshafts to align the timing mark (○: big hole) on the camshaft with the embossed match mark on the camshaft caps (I-4 and E-4).

## 3. Measure:

- Valve clearance

Out of specification → Adjust.

Refer to "CHAPTER 2. VALVE CLEARANCE ADJUSTMENT" section.



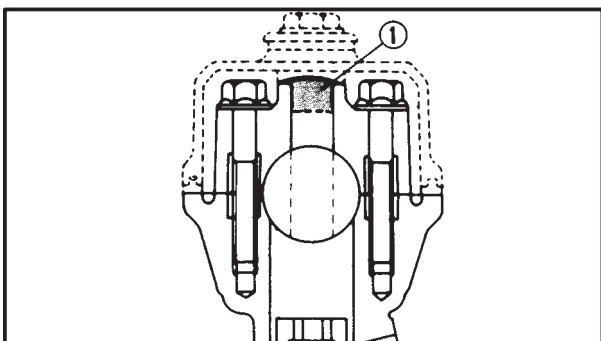
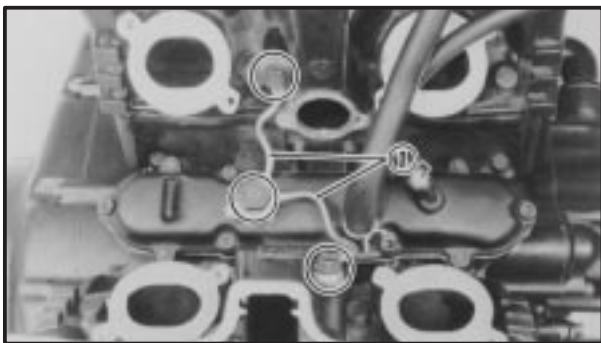
### Valve Clearance (Cold):

Intake: 0.11 ~ 0.15 mm

(0.004 ~ 0.006 in)

Exhaust: 0.26 ~ 0.30 mm

(0.010 ~ 0.012 in)



## OIL DELIVERY PIPE AND CYLINDER HEAD COVER

### 1. Install:

- Oil delivery pipe ①

### NOTE:

Tighten the three unin bolts evenly, then torque them to specification.



### Oil Delivery Pipe:

8 mm Bolt:

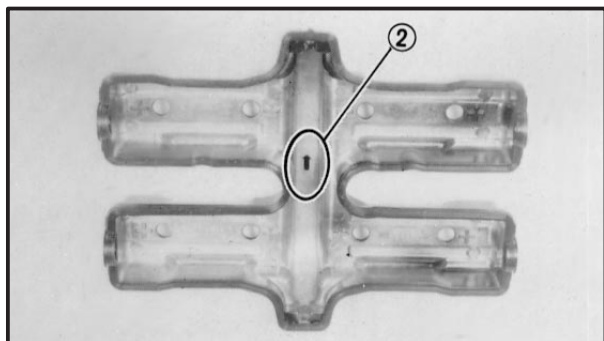
18 Nm (1.8 m•kg, 13 ft•lb)

10 mm Bolt:

20 Nm (2.0 m•kg, 14 ft•lb)

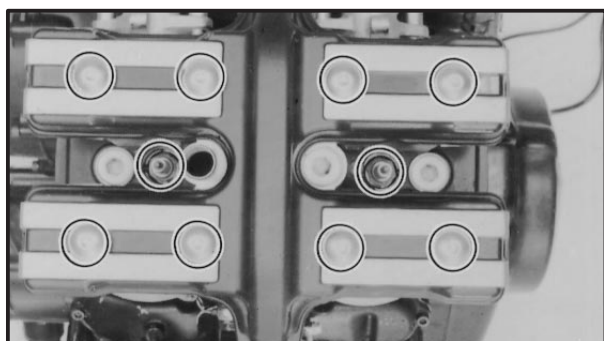
### 2. Install:

- Gasket
- Cylinder head covers (rear and front)



### NOTE:

- Be sure all cam caps are covered with oil plugs ①.
- Arrow mark ② on the cover should face toward the exhaust side.
- Inspect the head cover gasket and replace it if damaged.



### 3. Tighten:

- Bolts (cylinder head cover)
- Spark plugs

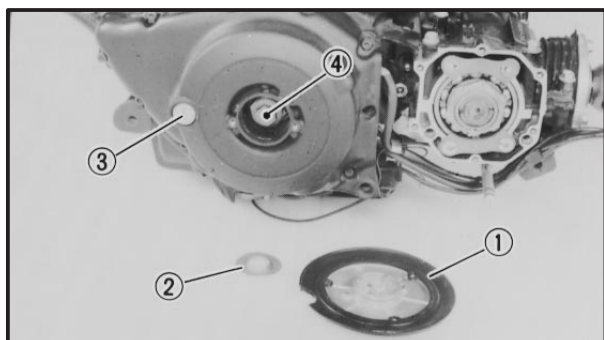


### Cylinder Head Cover:

10 Nm (1.0 m•kg, 7.2 ft•lb)

### Spark Plug:

17.5 Nm (1.75 m•kg, 12.5 ft•lb)



### 4. Install:

- Timing plug ③
- Special washer ②
- Crankcase cover plate ①

### NOTE:

Check for clog of oil passage ④ in the bolt. If any, clean the oil passage.



### REMountING ENGINE

When remounting the engine, reverse the removal procedure. Note the following points.

#### 1. Install:

- Down tube frame (right)
- Bolts (down tube) ①, ②, ③, ④, ⑦, ⑧
- Bolts (engine) ⑤, ⑥, ⑨

#### NOTE:

Tighten the bolts (#1 ~ #9) in that order.



#### Engine Mounting:

**Bolts (Down Tube) ①, ②, ③, ④:**

45 Nm (4.5 m•kg, 32 ft•lb)

**Bolts (Engine) ⑤:**

70 Nm (7.0 m•kg, 50 ft•lb)

**Bolts (Engine) ⑥, ⑨:**

40 Nm (4.0 m•kg, 29 ft•lb)

**Bolts (Down Tube) ⑦, ⑧:**

15 Nm (1.5 m•kg, 11 ft•lb)

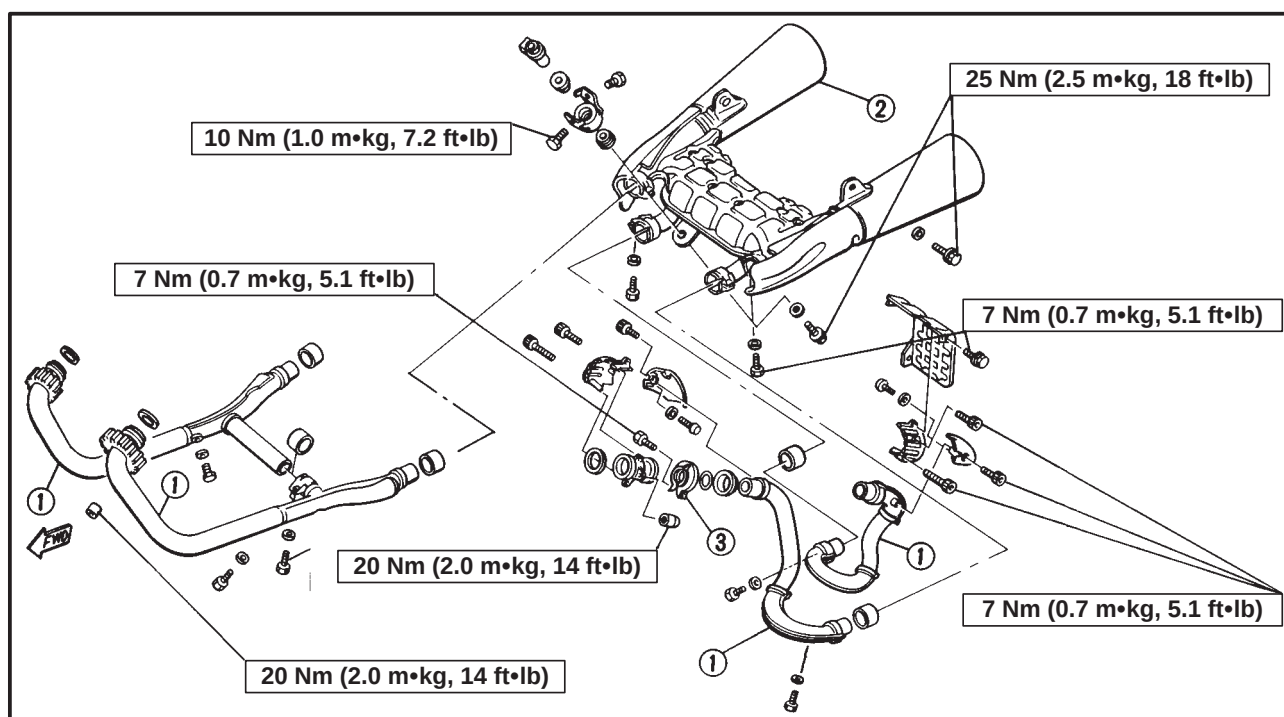
#### 2. Tighten:

- Exhaust pipes
- Muffler

① Exhaust pipe

② Muffler

③ Clamp





### 3. Tighten:

- All nuts or bolts

By the following specification torque.



#### Clutch Release Cylinder:

12 Nm (1.2 m•kg, 8.7 ft•lb)

#### Middle Gear Case Cover:

10 Nm (1.0 m•kg, 7.2 ft•lb)

#### Change Pedal:

10 Nm (1.0 m•kg, 7.2 ft•lb)

#### Footrest (Left):

40 Nm (4.0 m•kg, 29 ft•lb)

#### Footrest (Right):

23 Nm (2.3 m•kg, 17 ft•lb)

#### Rear Brake Master Cylinder:

23 Nm (2.3 m•kg, 17 ft•lb)



### 4. Adjust:

- Rear brake switch

Refer to "CHAPTER 2. REAR BRAKE SWITCH ADJUSTMENT" section.

### 5. Bend the tabs ① on the air baffle plate (front) as shown.

### 6. Tighten:

- All nuts or bolts.

By the following specification torque.



#### Conduit:

7 Nm (0.7 m•kg, 5.1 ft•lb)

#### Radiator:

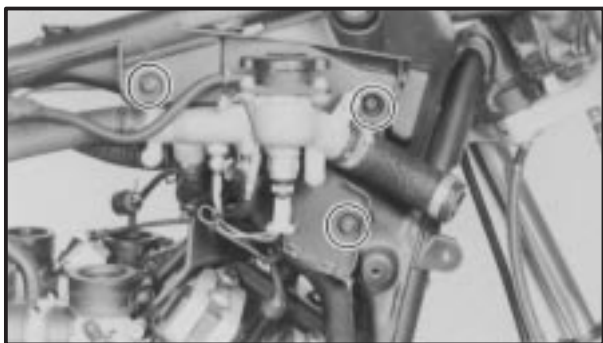
7 Nm (0.7 m•kg, 5.1 ft•lb)

#### Radiator Cover:

4 Nm (0.4 m•kg, 2.9 ft•lb)

#### Carburetor Joint:

10 Nm (1.0m•kg, 7.2 ft•lb)



7. Connect:
  - All hoses and lead (conduit)  
Refer to "CHAPTER 4. COOLING SYSTEM, RADIATOR AND CONDUIT" section.
8. Adjust:
  - Throttle cable free play  
Refer to "CHAPTER 5. CARBURETION, THROTTLE CABLE CYLINDER" section.
9. Add:
  - Engine oil  
Refer to "CHAPTER 2. ENGINE OIL REPLACEMENT" section.
10. Add:
  - Coolant  
Refer to "CHAPTER 4. COOLING SYSTEM COOLANT" section.



## CHAPTER 4. COOLING SYSTEM

|                                               |      |
|-----------------------------------------------|------|
| <b>COOLANT</b> .....                          | 4-1  |
| COOLANT FLOW .....                            | 4-1  |
| COOLANT REPLACEMENT .....                     | 4-2  |
| <b>WATER PUMP</b> .....                       | 4-5  |
| DISASSEMBLY .....                             | 4-5  |
| INSPECTION .....                              | 4-5  |
| BEARING AND SEAL REPLACEMENT .....            | 4-5  |
| ASSEMBLY .....                                | 4-7  |
| <b>THERMOSTATIC VALVE</b> .....               | 4-8  |
| REMOVAL .....                                 | 4-8  |
| INSPECTION AND ASSEMBLY .....                 | 4-8  |
| <b>COOLANT DRAIN VALVE</b> .....              | 4-9  |
| DISASSEMBLY .....                             | 4-9  |
| INSPECTION .....                              | 4-9  |
| ASSEMBLY .....                                | 4-9  |
| <b>CYLINDER HEAD WATER JACKET JOINT</b> ..... | 4-10 |
| REMOVAL .....                                 | 4-10 |
| INSPECTION .....                              | 4-10 |
| ASSEMBLY .....                                | 4-10 |
| <b>RADIATOR AND CONDUIT</b> .....             | 4-10 |
| DISASSEMBLY .....                             | 4-10 |
| INSPECTION .....                              | 4-11 |
| ASSEMBLY .....                                | 4-12 |



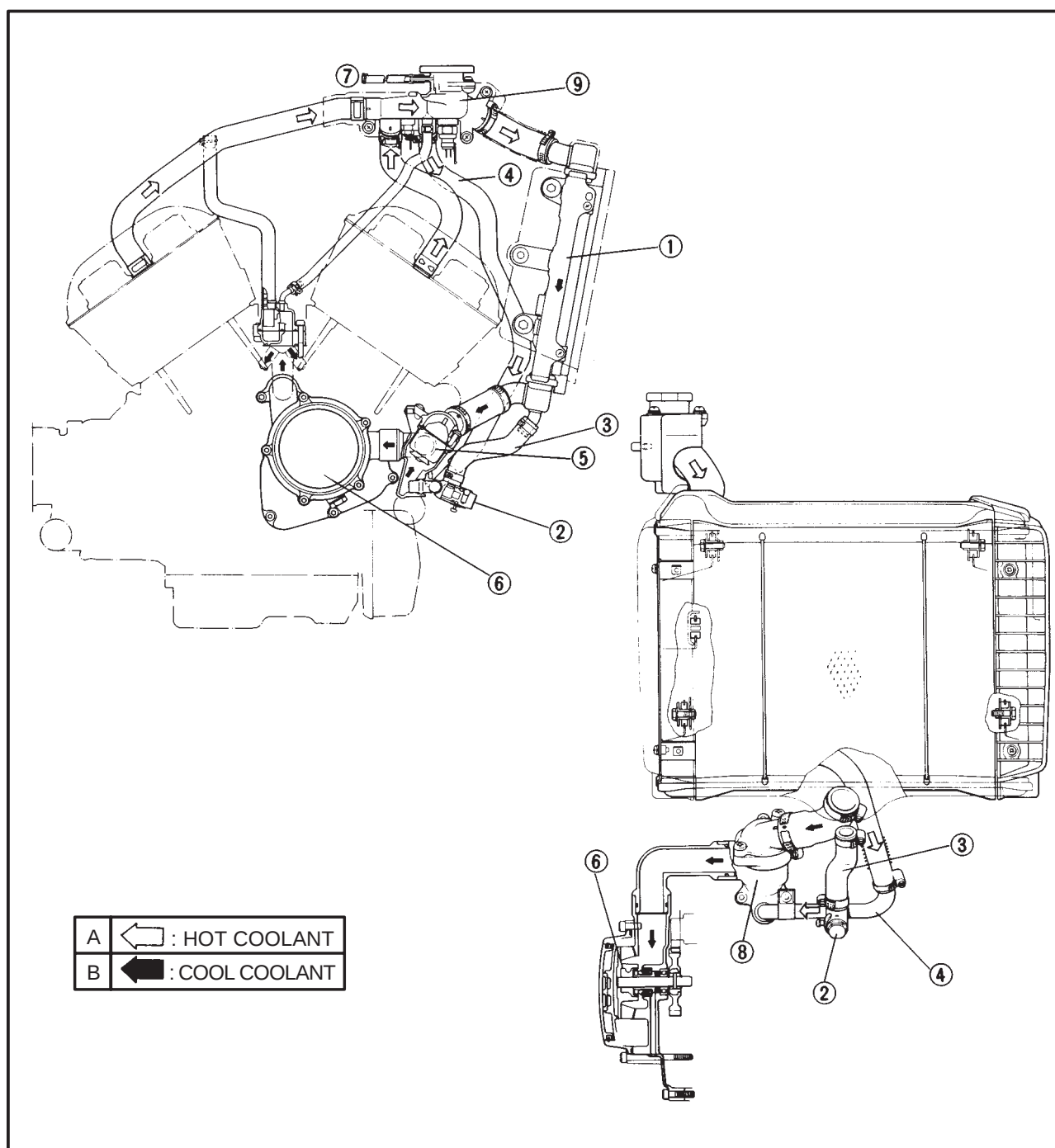


## COOLING SYSTEM

### COOLANT

#### COOLANT FLOW

- ① Radiator
- ② Coolant drain valve
- ③ Bypass pipe to the coolant drain valve
- ④ Bypass pipe to the thermostatic valve
- ⑤ Thermostatic valve
- ⑥ Water pump
- ⑦ To the reservoir tank
- ⑧ Thermostat housing
- ⑨ Conduit





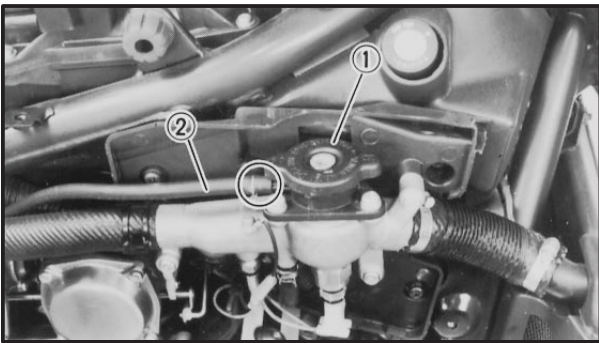
## COOLANT REPLACEMENT

**WARNING:**

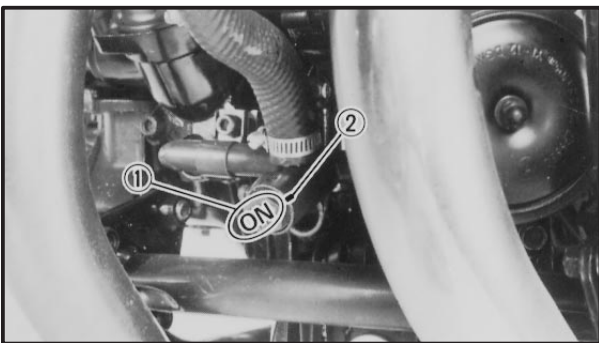
Do not remove the radiator cap when the engine and radiator are hot. Scalding hot fluid and steam may be blown out under pressure, which could cause serious injury. When the engine has cooled, open the radiator cap by the following procedure:

Place a thick rag, like a towel, over the radiator cap, slowly rotate the cap counterclockwise to the detent. This procedure allows any residual pressure to escape. When the hissing sound has stopped, press down on the cap while turning counterclockwise and remove it.

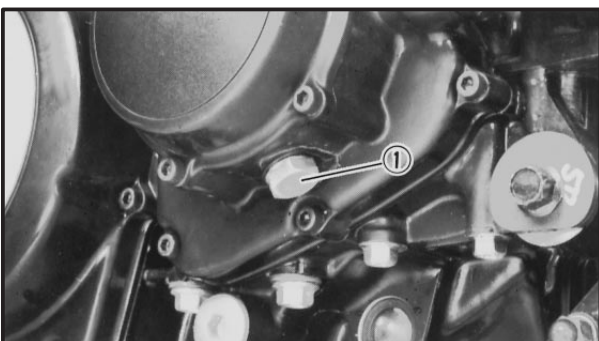
1. Place a receptacle under the coolant drain bolt.



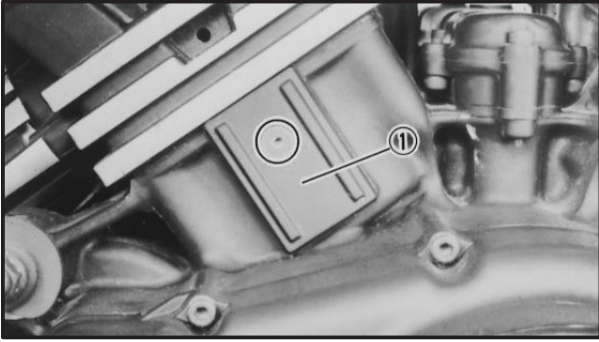
2. Remove:
  - Cover (right)
  - To cover
  - Radiator cap ①
  - Feed hose (reservoir tank) ②



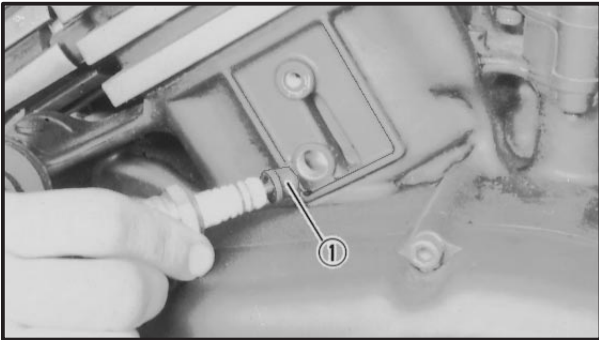
3. Align:
  - Coolant drain valve "ON" ① mark with match mark ② on drain valve housing



4. Remove:
  - Drain bolt ①Drain the coolant.



5. Remove:
- Side covers (cylinder) ⑪



6. Remove:
- Rubber plugs ①
- Drain the coolant.

**NOTE:** \_\_\_\_\_

To facilitate removal of the rubber plug's, screw a spark plug into the threaded hole and hand-pull the spark plug firmly.

\_\_\_\_\_

7. Drain:
- Coolant (completely)

**NOTE:** \_\_\_\_\_

Thoroughly flush the cooling system with clean tap water.

\_\_\_\_\_

8. Inspect:
- Rubber plugs
- Damage → Replace.
9. Tighten:
- Drain bolt



**Drain Bolt:**  
43 Nm (4.3 m•kg, 31 ft•lb)

10. Fill:
- Cooling system



**Recommended Coolant:**  
High Quality Ethylene Glycol  
Anti-Freeze containing Anti-  
Corrosion for Aluminum Engine  
Inhibitors  
**Coolant and Water Mixed Ratio:**  
50%/50%  
**Total Amount:**  
3.05 L (2.69 Imp qt, 3.22 US qt)



Reservoir Tank capacity:  
0.30 L (0.26 Imp qt, 0.32 US qt)  
From "LOW" to "FULL" Level:  
0.20 L (0.18 Imp qt, 0.21 US qt)

**CAUTION:**

- Hard water or salt water is harmful to the engine. You may use distilled water if you can't get soft water.
- Do not mix more than one type of ethlen glycol antifreeze containing corrosion for aluminum engine inhibitors.

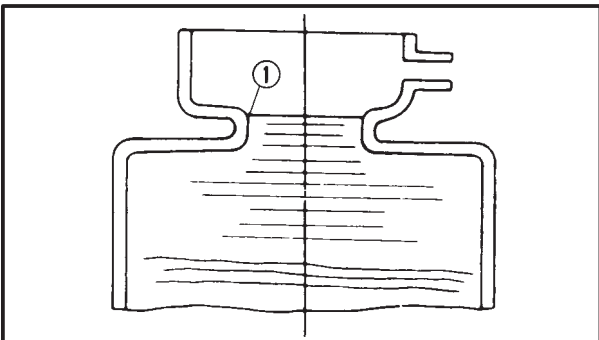
**Coolant filling steps:**

- Fill the coolant into the conduit until the conduit is full.
- Start the engine (coolant level decreases.)

**CAUTION:**

**Always check coolant level, and check for coolant leakage before starting engine.**

- Add the coolant while engine is running.
- Stop the engine when coolant level stabilizes.
- Add the coolant again to specified level ①.
- Install the radiator cap.
- Align the coolant drain valve "OFF" mark ② with the match mark ③ on drain valve housing.



## 11. Connect:

- Feed hose (reservoir tank)

## 12. Fill:

- Reservoir tank

Add the coolant until liquid reaches "FULL" level mark.

① "FULL" level

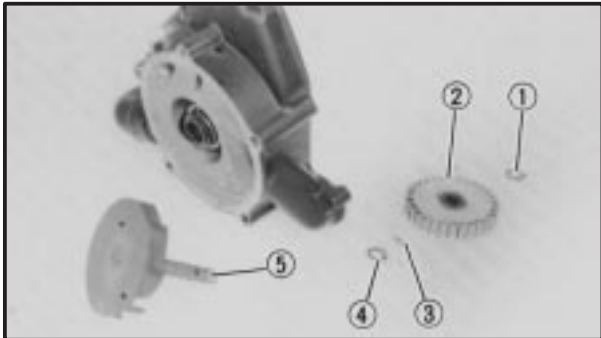
② "LOW" level



### WATER PUMP DISASSEMBLY

#### NOTE:

- Be sure to drain the coolant before disassembly of the cooling system components.
- Refer to Engine Disassembly for water pump disassembly.

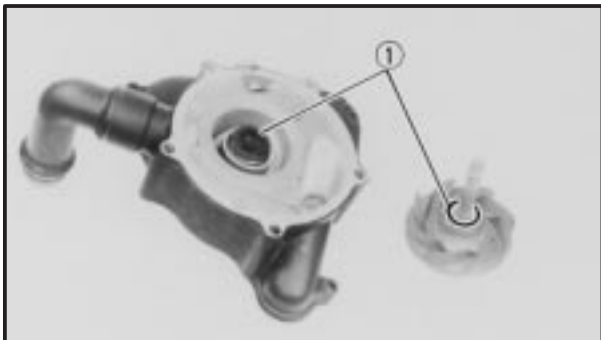


#### 1. Remove:

- Circled clip ①
- Drive gear ②
- Gear stopper pin ③
- Circled clip ④
- Impeller shaft ⑤

#### 2. Eliminate:

- Deposits  
From the impeller and water pump housing.



### INSPECTION

#### 1. Inspect:

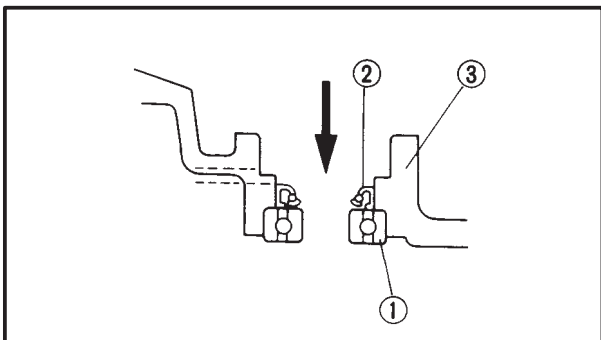
- Bearing  
Wear/Damage → Replace.
- Oil seal  
Wear/Damage → Replace.
- Impeller  
Cracks/Wear/Damage → Replace.
- Water pump seal set ①  
Wear/Damage → Replace.

### BEARING AND SEAL REPLACEMENT

#### 1. Remove:

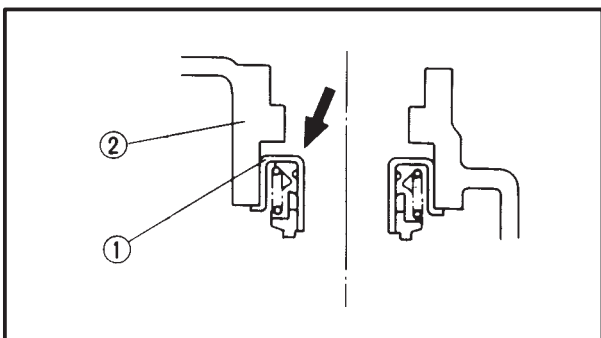
- Bearing ①
- Oil seal ②  
Tap off both components from water pump seal side.

③ Crankcase cover



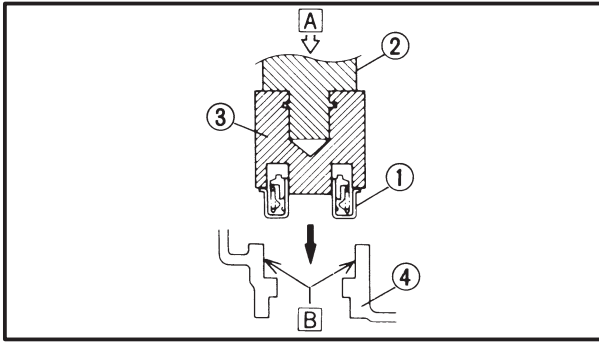
#### 2. Remove:

- Water pump seal (crankcase side) ①  
Tap it off from the cover ②.



## WATER PUMP

COOL

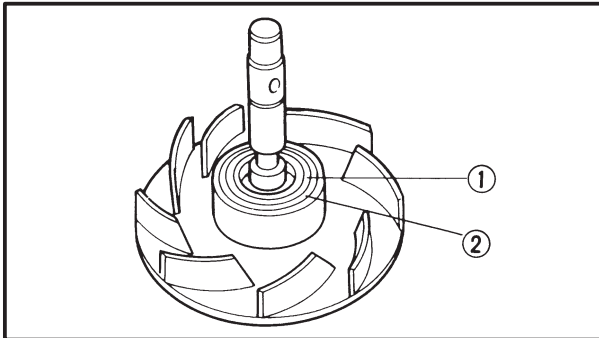


### 3. Install:

- Water pump seal ①  
Use Water Pump Seal Installer (90890-04058 ②, 90890-04078 ③)  
Apply Yamaha Bond No.4 to crankcase cover ④ before installing seal.

**A** PRESS

**B** APPLY YAMAHA BOND No.4



### 4. Remove:

- Seal No.2 ①  
From impeller.  
Pry out with a small screwdriver.

### NOTE:

Be careful not to scratch or bend the impeller shaft.

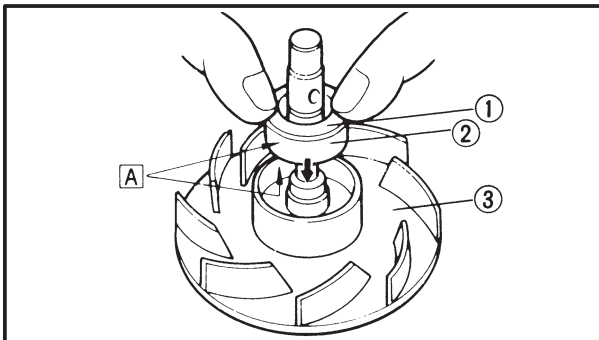
② Damper rubber

### 5. Apply:

- Water or coolant  
To outer surface of damper rubber ② and impeller hub.

### CAUTION:

Never apply oil or grease to water pump seal surfaces.



### 6. Assemble:

- Seal No.2/Damper rubber ②  
To impeller hub.

① Slip ring

③ Impeller

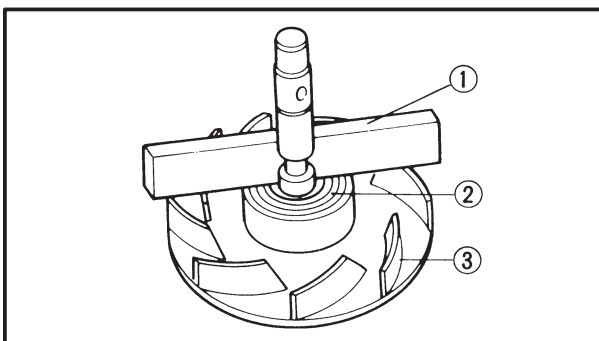
**A** APPLICATION OF WATER OR COOLANT

### 7. Measure:

- Tilt  
Out of specification → Repeat the above steps "4 ~ 6".

### NOTE:

Be sure seal No.2 fits squarely.



**Tilt Limit: 0.15 mm (0.006 in)**

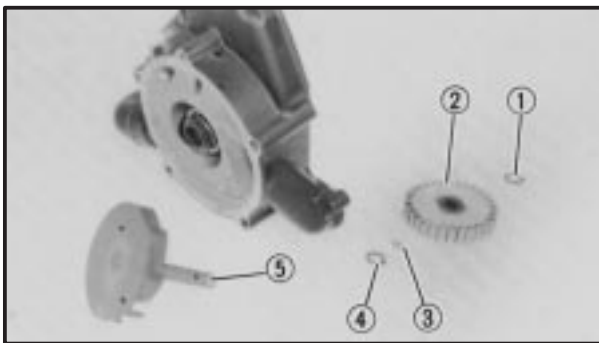
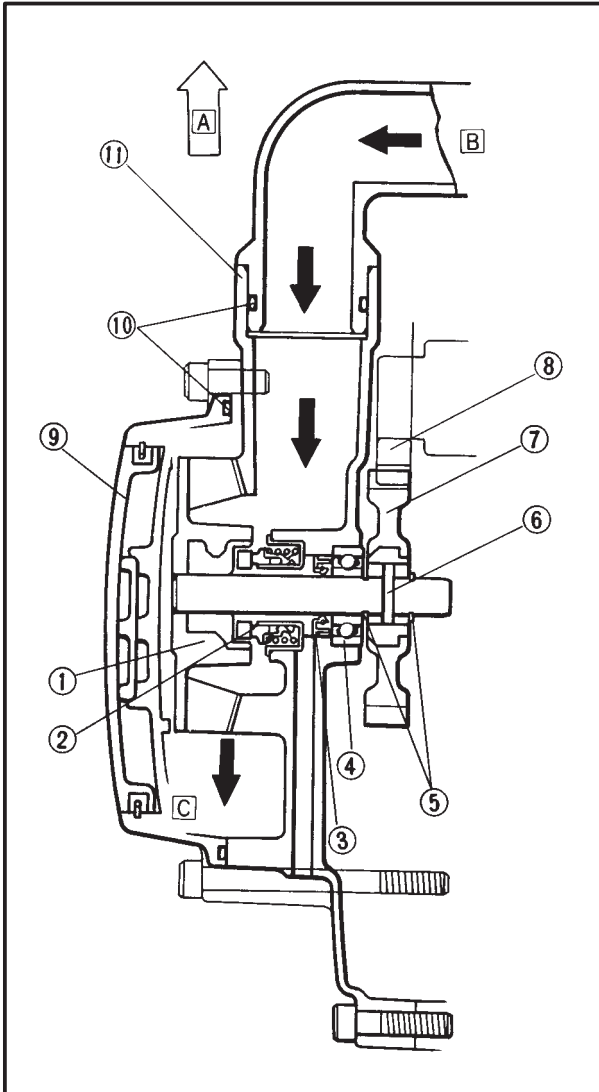
① Straight edge

② Seal No.2

③ Impeller



## ASSEMBLY



- ① Impeller
- ② Mechanical seal
- ③ Oil seal
- ④ Bearing
- ⑤ Circlip
- ⑥ Gear stopper pin
- ⑦ Driven gear
- ⑧ Drive gear
- ⑨ Water pump cover
- ⑩ O-ring
- ⑪ Crankcase cover

A FRONT

B FRONT RADIATOR

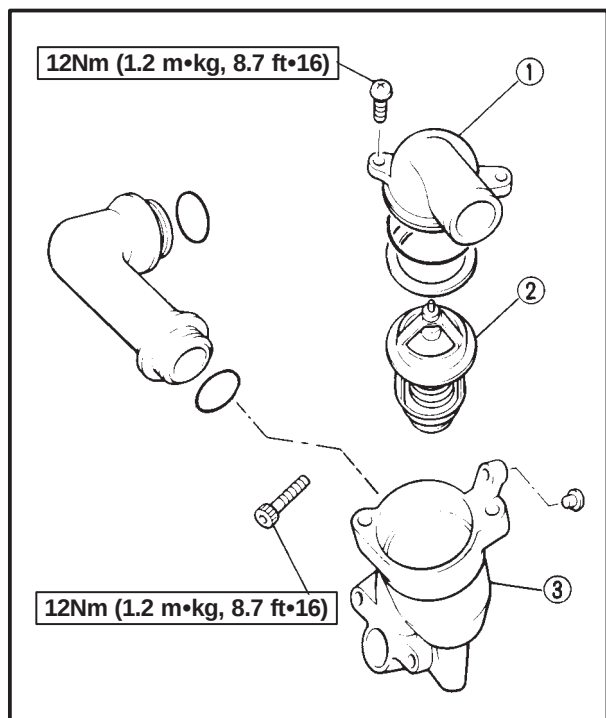
C TO CYLINDER

1. Install:

- Impeller shaft ⑤
- Circlip ④
- Gear stopper pin ③
- Drive gear ②
- Circlip ①

### CAUTION:

- Be sure not to scratch the water pump mechanical seal while installing.
- Replace any scratched seal.

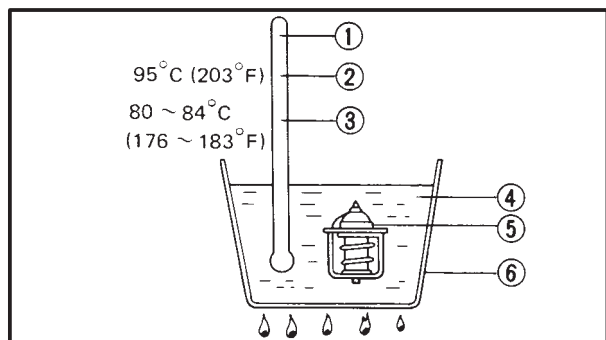


## THERMOSTATIC VALVE REMOVAL

1. Remove:

- Thermostat cover ①
- Thermostatic valve ②

③ Thermostat housing



## INSPECTION AND ASSEMBLY

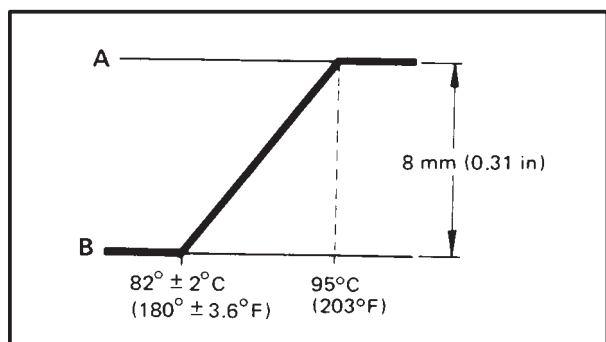
1. Inspect:

- Thermostatic valve

Valve does not open at 80 ~ 84°C (176 ~ 183°F) → Replace.

### Thermostatic valve inspection steps:

- Suspend thermostatic valve in a vessel or water.
- Place reliable thermometer in water.
- Heat water slowly.
- Observe thermometer, while stirring water continually



① Thermometer

④ Water

② Full open

⑤ Thermostatic valve

③ Opening sequence begins

⑥ Vessel

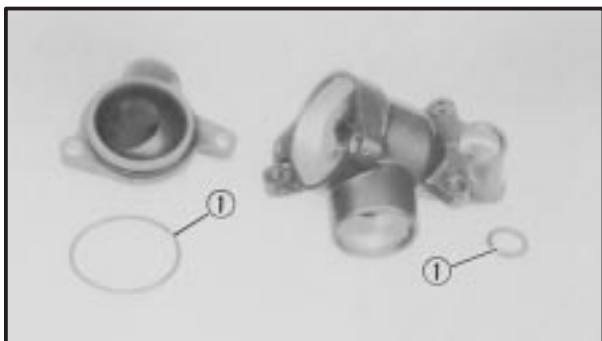
☐ OPEN ☐ CLOSE

### NOTE:

Thermostat is sealed and its setting is specialized work. If its accuracy is in doubt, always replace it. A faulty unit could cause serious overheating or overcooling.

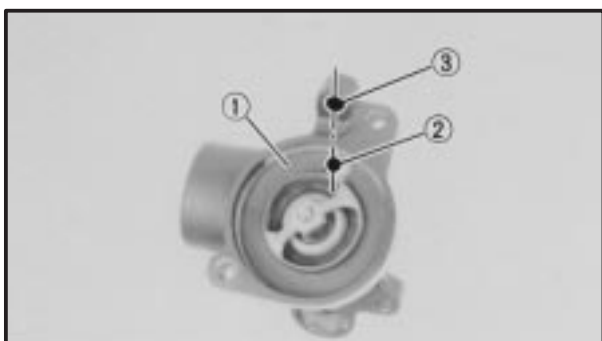
## COOLANT DRAIN VALVE

COOL



2. Inspect:

- O-ring (1)  
Wear/Damage → Replace.



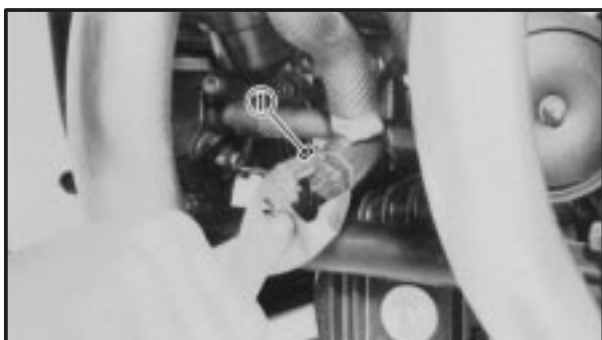
3. Install:

- Thermostatic valve (1)

### NOTE:

Line up the valve breather hole (2) with the housing projection (3).

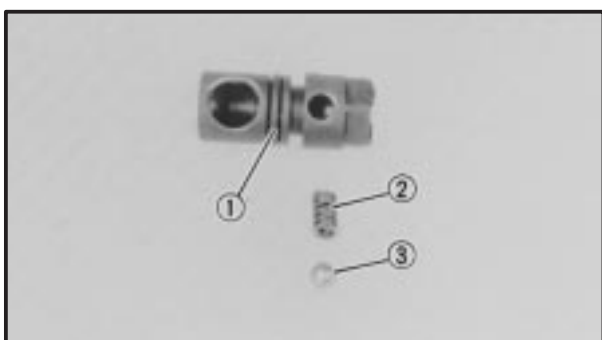
- Thermostat cover
- Thermostat housing



## COOLANT DRAIN VALVE DISASSEMBLY

1. Remove:

- Retaining screw (1)
- Valve assembly



## INSPECTION

1. Inspect:

- O-ring (1)  
Wear/Damage → Replace.
- Spring (2)  
Damage → Replace.
- Stopper ball (3)  
Wear/Damage → Replace.

## ASSEMBLY

1. Install:

- Valve assembly  
Be sure stopper ball falls into body cavity.

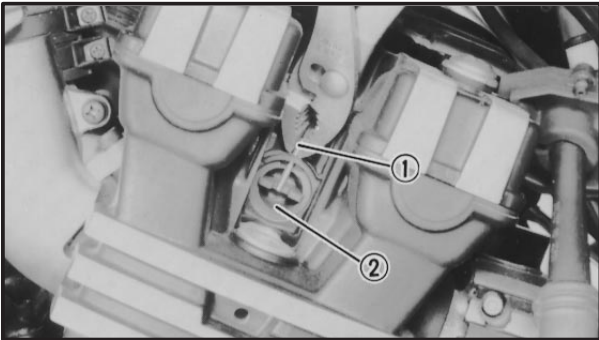
2. Secure valve assembly with retaining screw.



### CYLINDER HEAD WATER JACKET JOINT

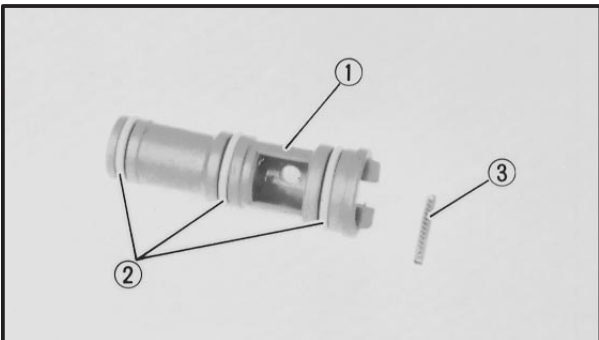
#### CAUTION:

- Be sure to drain the coolant before you disassemble the water jacket joints otherwise the coolant will flow into the crankcase.
- Do not remove the water jacket joints unless absolutely essential; e.g., when overhauling the engine.



#### REMOVAL

1. Remove:
  - Stopper pins ①
  - Water jacket joints ②

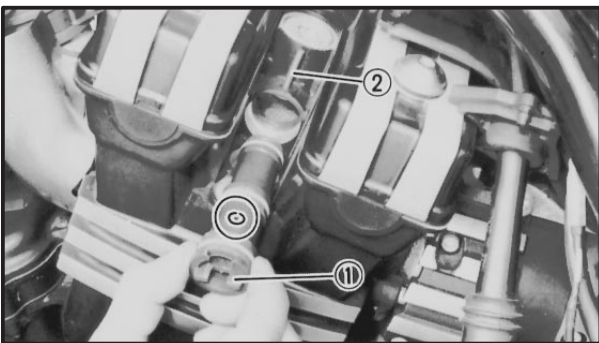


#### INSPECTION

1. Inspect:
  - Water jacket joint ①  
Clogging → Clean.
  - O-rings ②  
Wear/Damage → Replace.
  - Stopper pin ③  
Wear/Bends → Replace.

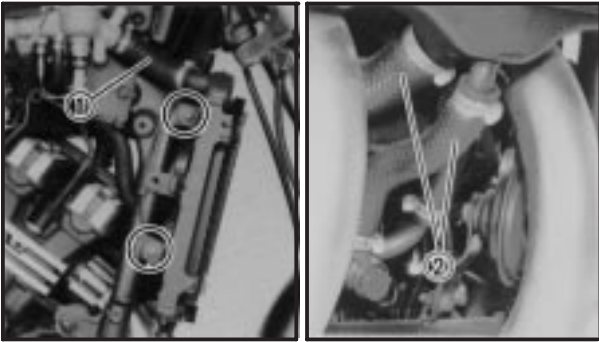
#### ASSEMBLY

1. Install:
  - Water jacket joints ①
  - Stopper pins ②

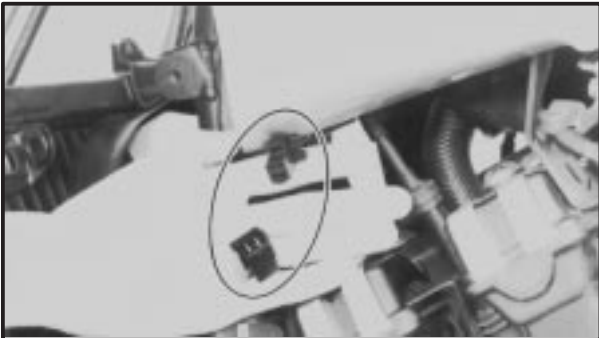


### RADIATOR AND CONDUIT DISASSEMBLY

1. Drain:
  - Coolant (completely)  
Refer to "COOLANT REPLACEMENT" section.



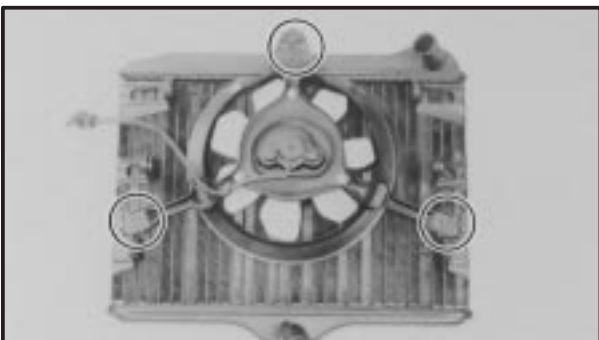
2. Remove:
  - Bolts (radiator)
3. Disconnect:
  - Upper hose ①
  - Lower hoses ②



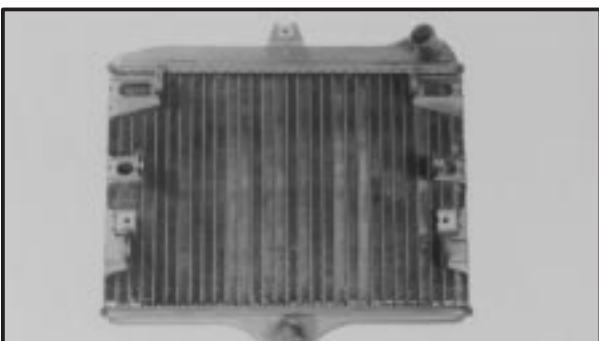
4. Disconnect:
  - Fan motor coupler
5. Remove:
  - Radiator assembly



6. Disconnect:
  - All hoses and leads (conduit)
7. Remove:
  - Screws (conduit)



8. Remove:
  - Fan motor assembly



### INSPECTION

1. Inspect:
  - Radiator
    - Obstruction → Blow out with compressed air through rear of radiator.
    - Flattened fins → Repair.
  - Coolant hoses
    - Cracks/Damage → Replace.



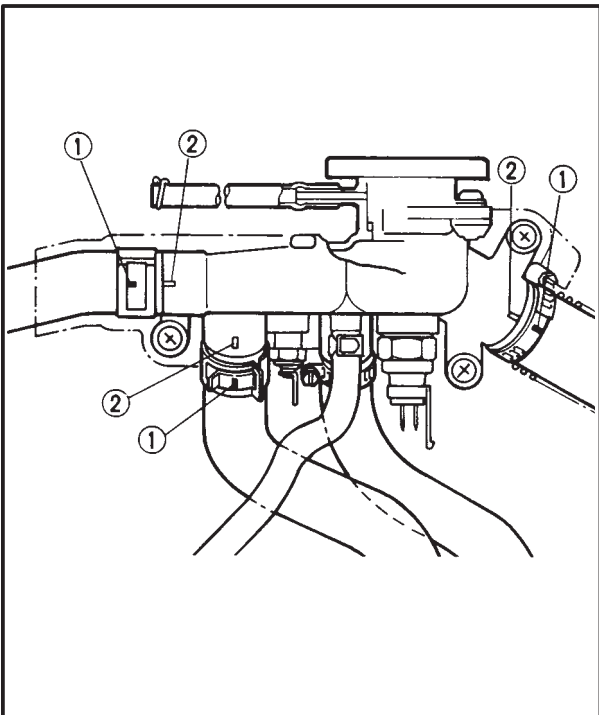
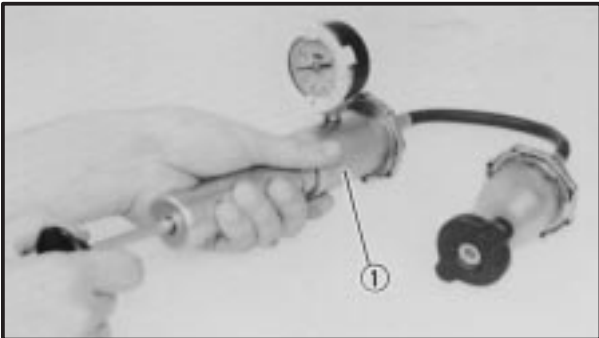
2. Inspect:
  - Vacuum valve spring  
Fatigue → Replace.
  - Vacuum valve seating condition  
Poor condition → Replace.
3. Measure:
  - Valve opening pressure

## Valve opening pressure measurement steps:

- Measure the radiator cap pressure using the Radiator Cap Tester ① (90890-01325). Valve opens at pressure below specified valve or defective → Replace.

## Valve Opening Pressure:

73.6 ~ 103.0 kPa (0.75 ~ 1.05 kg/cm<sup>2</sup>,  
10.7 ~ 14.9 lb/in<sup>2</sup>)



## ASSEMBLY

When installing the radiator and conduit, reverse the removal procedure. Note the following points.

1. Install:
  - Conduit



## Screws (Conduit):

7 Nm (0.7 m•kg, 5.1 ft•lb)

2. Connect:
  - All hoses and leads (conduit)

## NOTE:

Align the hose match marks ① with the match marks ② on the conduit.

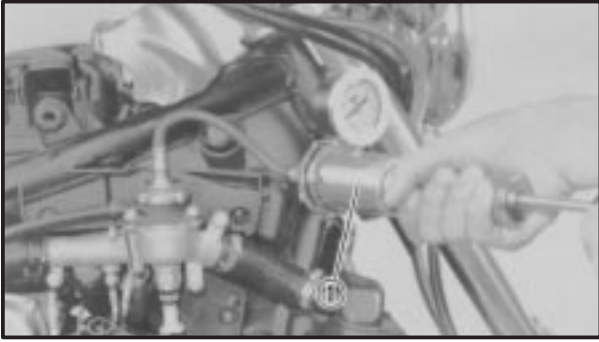
3. Install:
  - Radiator assembly



## Bolts (Radiator):

7 Nm (0.7 m•kg, 5.1 ft•lb)

4. Fill:
  - Cooling system  
Refer to "COOLANT REPLACEMENT" section.



5. Inspect
- Cooling system

**Cooling system inspection steps:**

- Connect Radiator Cap Tester (90890-01325) ①.
  - Apply 98 kPa (1.0 kg/cm<sup>2</sup>, 14 psi) pressure.
  - Measure pressure with gauge.
- Decrease of pressure (leaks) → Repair at required.



---

## CHAPTER 5. CARBURETION

|                                                               |      |
|---------------------------------------------------------------|------|
| <b>CARBURETOR</b> .....                                       | 5-1  |
| SECTION VIEW .....                                            | 5-2  |
| REMOVAL .....                                                 | 5-3  |
| DISASSEMBLY .....                                             | 5-3  |
| INSPECTION .....                                              | 5-6  |
| ASSEMBLY .....                                                | 5-7  |
| INSTALLATION .....                                            | 5-8  |
| ADJUSTMENT .....                                              | 5-9  |
| <br><b>THROTTLE CABLE CYLINDER</b> .....                      | 5-10 |
| ADJUSTMENT .....                                              | 5-10 |
| <br><b>AIR CLEANER AND CRANKCASE VENTILATION SYSTEM</b> ..... | 5-14 |





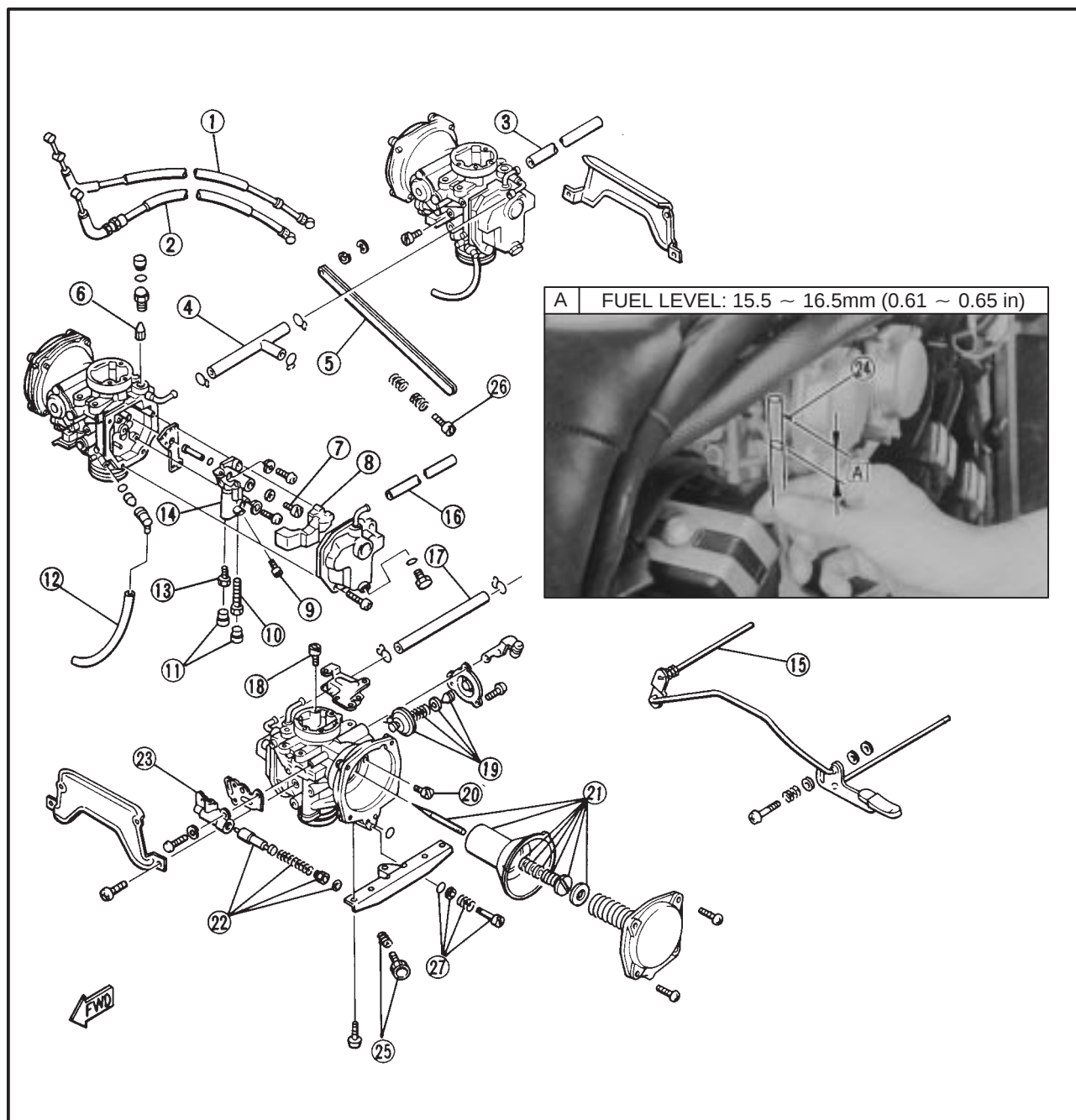
## CARBURETION

### CARBURETOR

- |                               |                                      |
|-------------------------------|--------------------------------------|
| ① Throttle cable (Close side) | ⑮ Starter lever shaft                |
| ② Throttle cable (Open side)  | ⑯ Fuel overflow hose                 |
| ③ Fuel overflow hose          | ⑰ Fuel feed hose                     |
| ④ Fuel feed hose              | ⑱ Pilot air jet No.1                 |
| ⑤ Synchronization rod         | ⑲ Coasting enrichment valve assembly |
| ⑥ Float needle valve          | ⑳ Pilot air jet No.2                 |
| ⑦ Needle jet screw            | ㉑ Piston valve assembly              |
| ⑧ Float                       | ㉒ Starter plunger assembly           |
| ⑨ Main jet                    | ㉓ Starter body                       |
| ⑩ Main bleed pipe             | ㉔ Piston valve center mark           |
| ⑪ Rubber plug                 | ㉕ Throttle stop screw set            |
| ⑫ Fuel drain hose             | ㉖ Synchronization screw              |
| ⑬ Pilot jet                   | ㉗ Pilot screw set                    |
| ⑭ Jet block                   |                                      |

#### SPECIFICATIONS

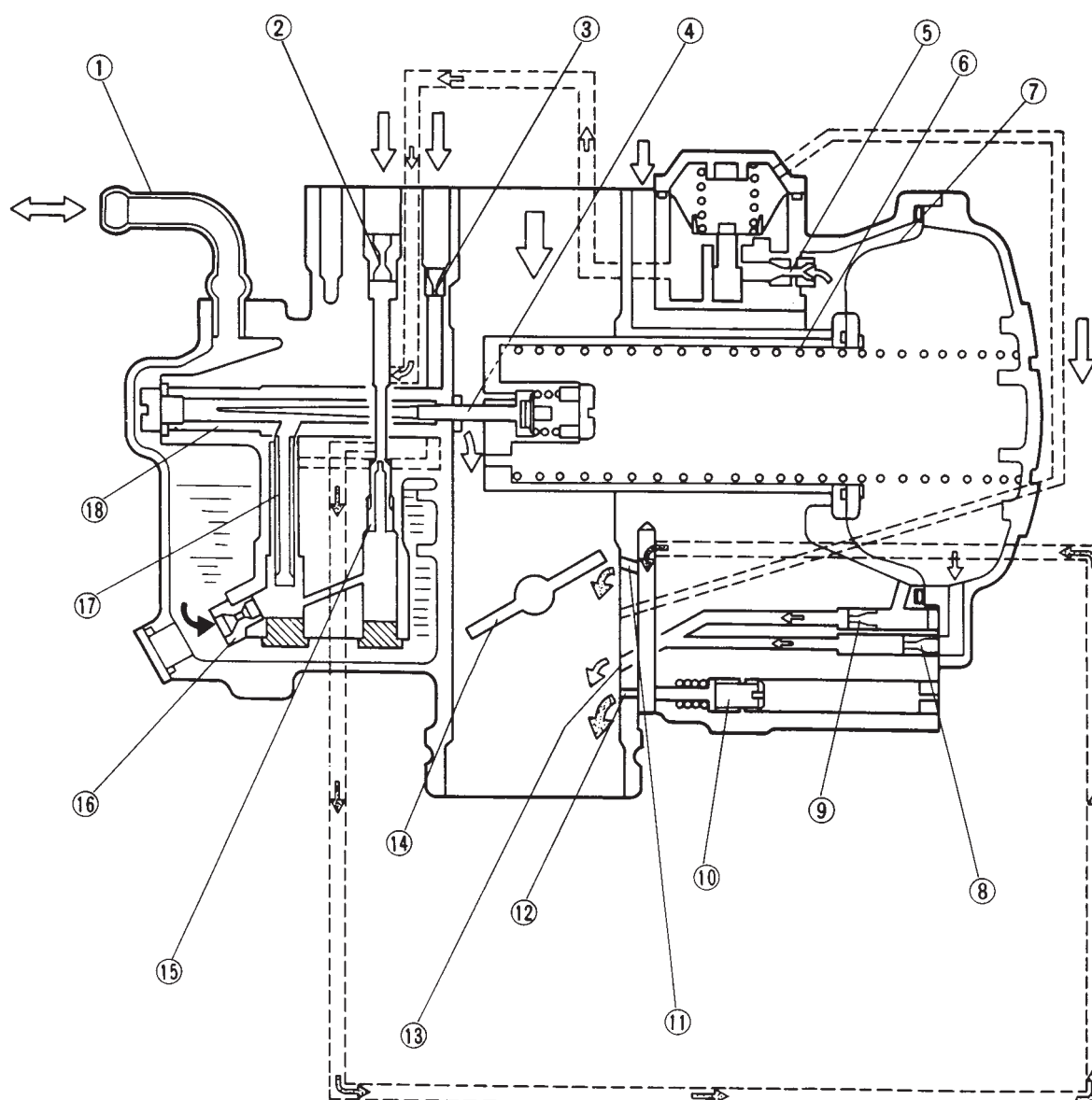
|                   |                                    |
|-------------------|------------------------------------|
| Main jet          | #1& #3:# 152.5<br>#2& #4:# 150     |
| Main air jet      | Ø 2.0                              |
| Jet needle        | 5EZ47-3                            |
| Needle jet        | Y-0                                |
| pilot jet         | #37.5                              |
| Fuel level        | 15.5 ~ 16.5 mm<br>(0.61 ~ 0.65 in) |
| Pilot screw       | 2                                  |
| Float valve seat  | 1.5                                |
| Engine idle speed | 950 ~ 1,050 r/min                  |





### SECTION VIEW

- |                      |                   |
|----------------------|-------------------|
| ① Air vent           | ⑩ Pilot screw     |
| ② Pilot air jet No.1 | ⑪ Bypass hole     |
| ③ Main air jet       | ⑫ Pilot outlet    |
| ④ Jet needle         | ⑬ Purge hole      |
| ⑤ Pilot air jet No.2 | ⑭ Throttle valve  |
| ⑥ Piston valve       | ⑮ Pilot jet       |
| ⑦ Diaphragm          | ⑯ Main jet        |
| ⑧ Purge jet No.2     | ⑰ Main bleed pipe |
| ⑨ Purge jet No.1     | ⑱ Needle jet      |



|   |  |         |
|---|--|---------|
| A |  | AIR     |
| B |  | MIXTURE |
| C |  | FUEL    |



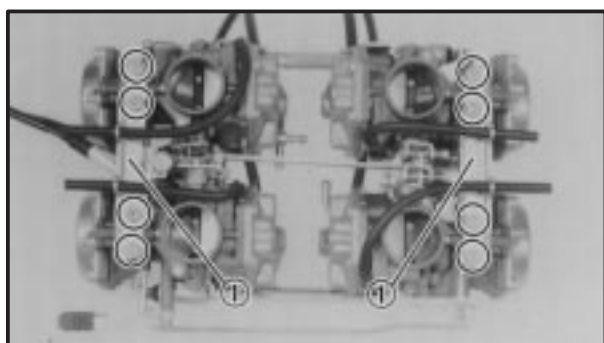
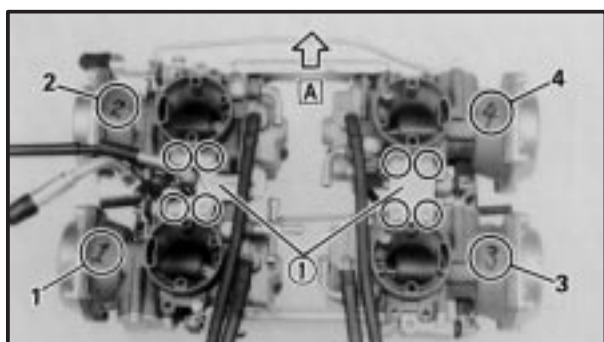
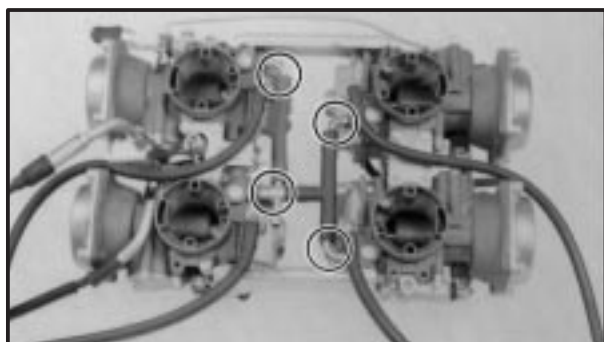
### REMOVAL

1. Remove:
  - Carburetor assembly
 Refer to engine removal section.

### NOTE:

The following parts can be cleaned and inspected without disassembly.

- Piston valve
- Starter plunger
- Coasting enrichment valve



### DISASSEMBLY

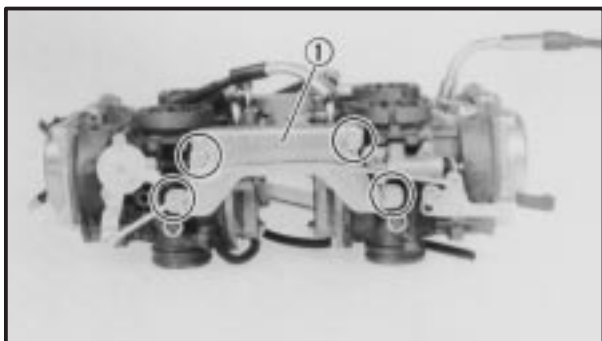
#### CAUTION:

The plastic piston valve is fragile and highly susceptible to damage. Be sure to handle with extreme care. Do not drop the valve or subject it to undue abuse as this can cause cracks that could severely weaken the piston valve.

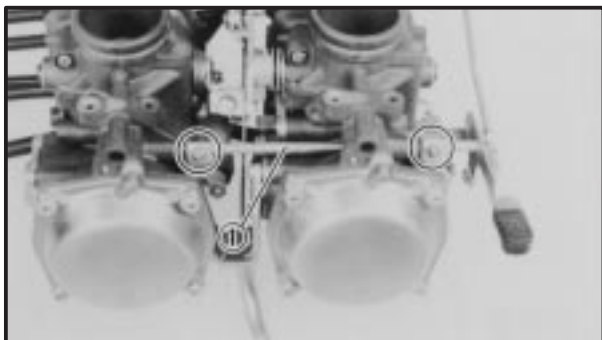
1. Remove:
  - Fuel lines
2. Number each carburetor before removing it from carburetor bracket.
3. Remove:
  - Upper brackets ①

**A** FRONT

4. Remove:
  - Lower brackets ①



5. Remove:
- Side brackets (1)



6. Remove:
- Starter lever shafts (1)



7. Remove:
- Synchronization screws (1)
  - Synchronization rod (2)

**NOTE:**

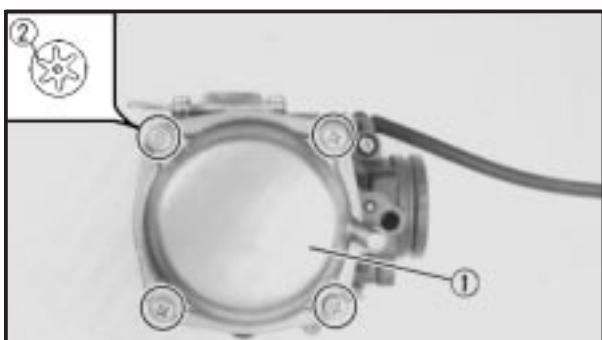
When separating the carburetors be sure not to lose the small spring that may fall out. This spring connects the throttle levers.



8. Remove:
- Starter plunger (1)
  - Starter plunger body (2)

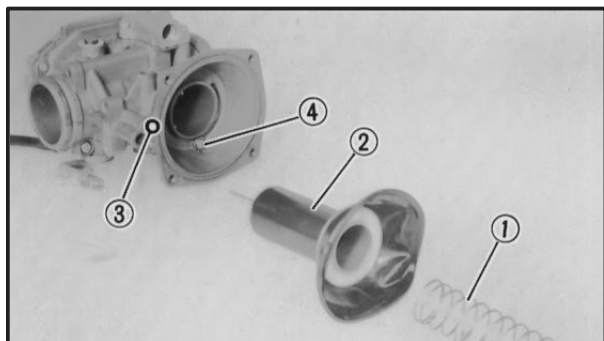
(3) Nut

(4) Spring



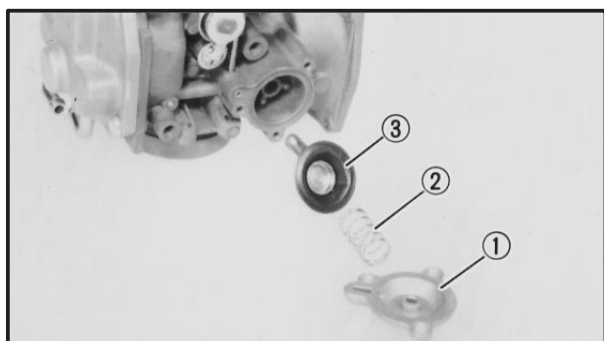
9. Remove:
- Vacuum chamber cover (1)
- Use the special Torx Driver (90890-05349).

(2) Tamperproof screw



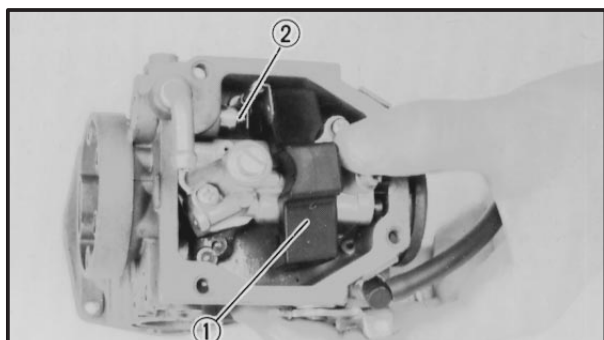
10. Remove:

- Spring ①
- Vacuum piston ②
- O-ring ③
- Pilot air jet No.2 ④



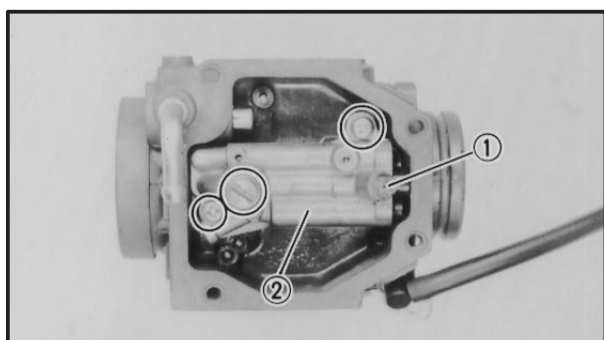
11. Remove:

- Coasting enrichment cover ①
- Spring ②
- Diaphragm ③



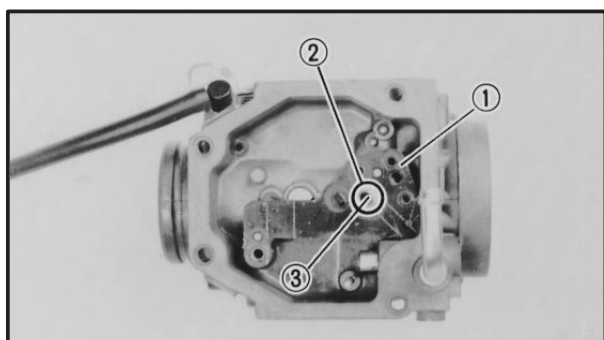
12. Remove:

- Float chamber cover
- Float ①
- Needle valve ②



13. Remove:

- Main jet ①
- Jet block ②

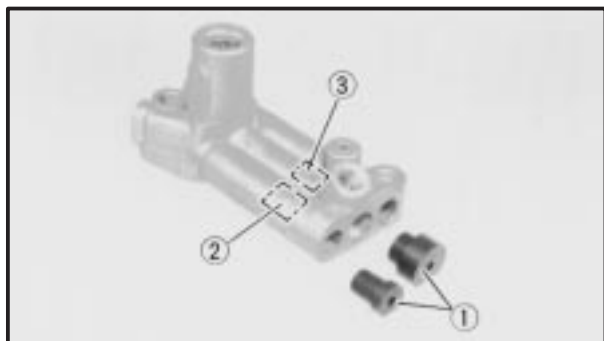


14. Remove:

- Gasket ①
- O-ring ②
- Needle jet ③

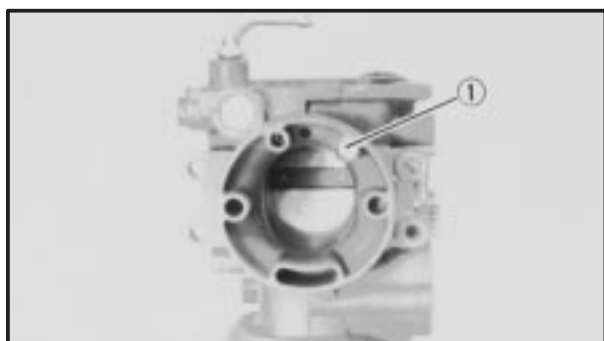
**NOTE:**

Move the needle jet toward the vacuum piston.



15. Remove:

- Rubber caps ①
- Pilot jet ②
- Main bleed pipe ③



16. Remove:

- Pilot air jet No.1 ①

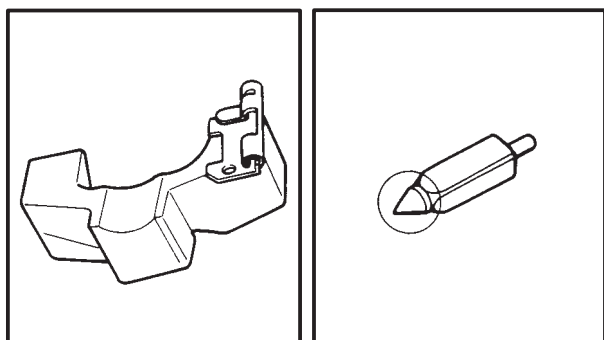
## INSPECTION

1. Inspect:

- Carburetor body  
Contamination → Clean.

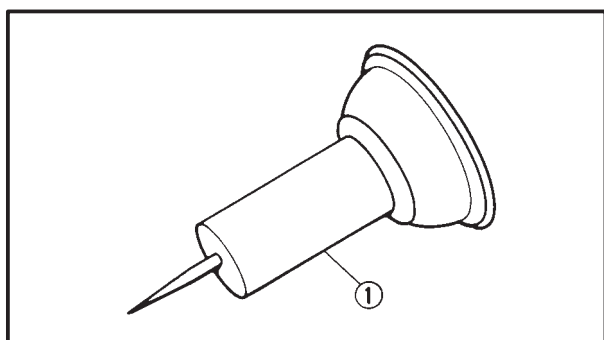
### NOTE:

Use a petroleum based solvent for cleaning.  
Blow out all passages and jets with compressed air.



2. Inspect:

- Float  
Damage → Replace.
- Needle valve  
Wear/Contamination → Replace.

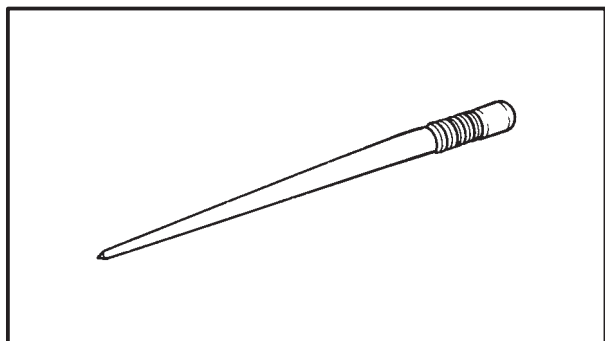


3. Inspect:

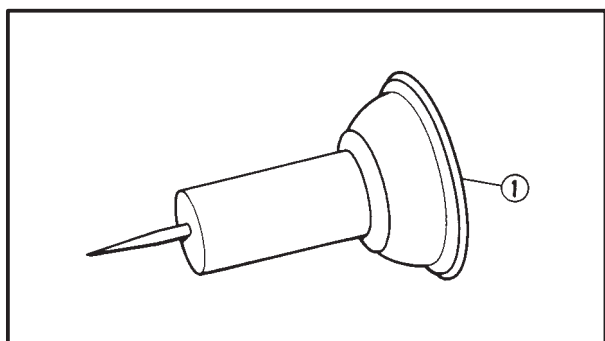
- Vacuum piston ①  
Cracks → Replace.

### NOTE:

If you suspect the piston valve has been damaged, check the component for cracks by pouring gasoline into the valve. If it leaks, replace with a new piston valve.



4. Inspect:
  - Jet needle
  - Bends/Wear → Replace.



5. Inspect:
  - Diaphragm ①
  - Tears → Replace.



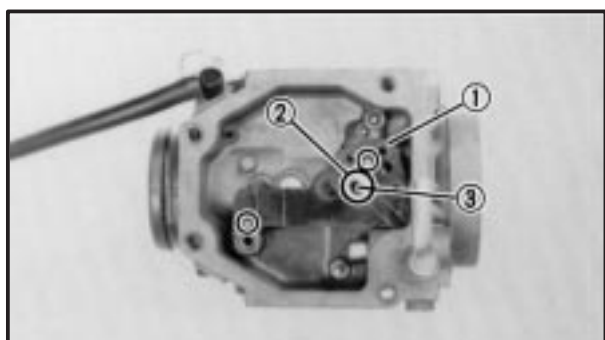
6. Inspect:
  - Starter plunger
  - Damage/Wear → Replace.
7. Inspect
  - O-ring,
  - Gasket
  - Damage → Replace.

### ASSEMBLY

To assemble the carburetors, reverse the disassembly procedures. Note the following points.

#### CAUTION:

- Before reassembling, wash all parts in clean gasoline.
- Always use a new gasket.

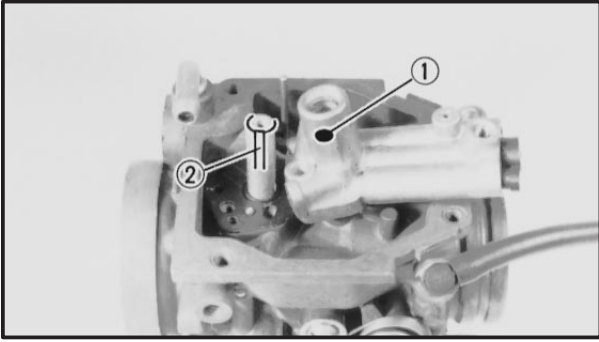


1. Install:
  - Needle jet ③
  - O-ring ②
  - Gasket ①

#### NOTE:

Make sure the projections on the carburetor body are meshed with the holes on the gasket.

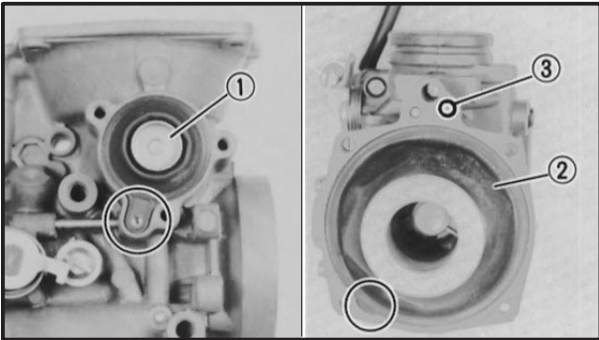
## CARBURETOR

**CARB**

2. Install:
- Jet block

**NOTE:**

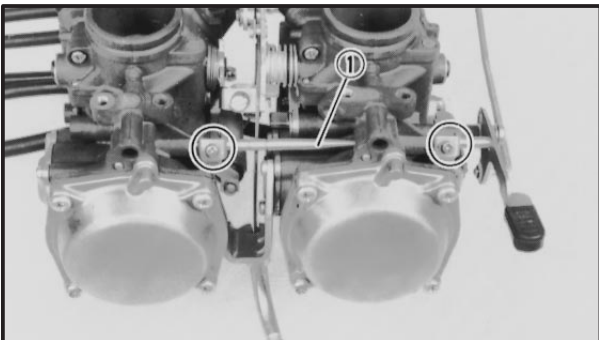
Make sure the projection (1) on the jet block is meshed with the groove (2) on the needle jet.



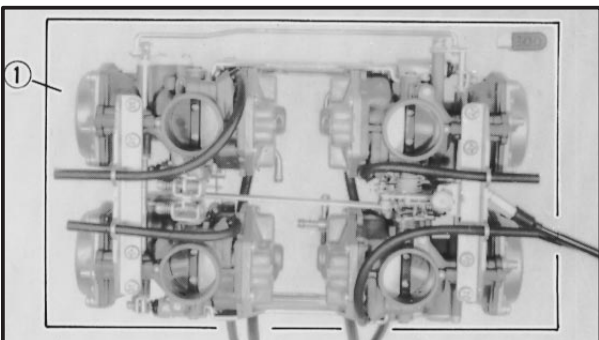
3. Install:
- Coasting enricher (1)
  - Vacuum piston (2)
  - O-ring (3)

**NOTE:**

There is a tab on the rubber diaphragm and a matching recess in the carburetor body to accept the diaphragm tab.



4. Install:
- Starter lever shafts (1)
- Apply LOCTITE® to the starter plunger lever securing screws.



5. Install:
- Mounting brackets
- Apply LOCTITE® to the bracket securing screws.

**NOTE:**

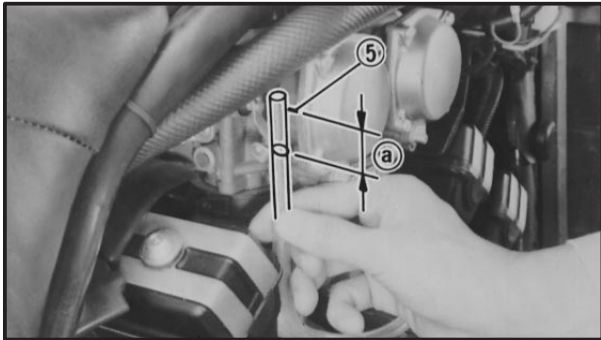
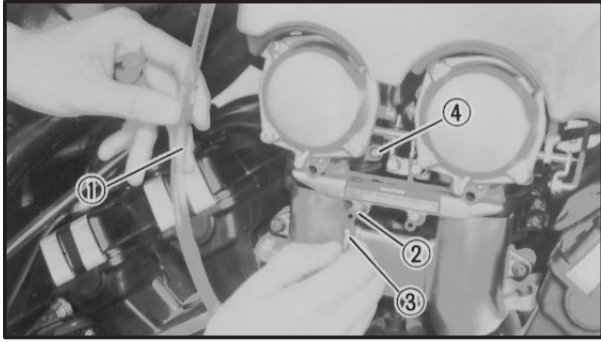
When reassembling, the surface plate (1) should be used for proper carburetor alignment.



**Screws (Mounting Brackets):**  
5 Nm (0.5 m•kg, 3.6 ft•lb)

### INSTALLATION

1. Install:
- Carburetors
- Reverse the removal steps



### ADJUSTMENT

#### 1. Measure:

- Fuel level

Out of specification → Adjust.



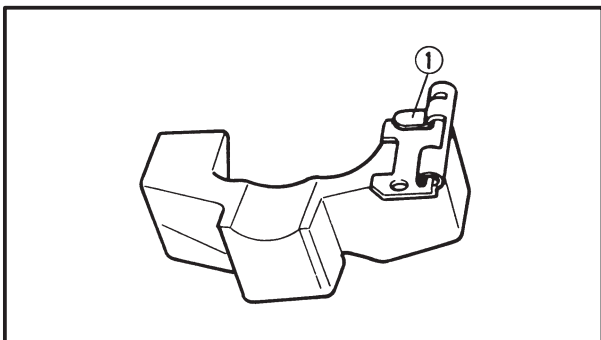
#### Fuel Level:

**15.5 ~ 16.5 mm (0.61 ~ 0.65 in)**

**Below the Carburetor Piston Valve Center**

#### Fuel level measurement steps:

- Place the motorcycle on a level surface.
- Use a garage jack under the engine to ensure that the carburetor is positioned vertically.
- Connect the Fuel Level Gauge ① (90890-01312) to the drain pipe ② using a level gauge adapter ③.
- Loosen the drain screw ④ and warm up the engine for several minutes.
- Measure the fuel level ⑤ with the gauge.
- ⑤ Piston valve center mark
- Repeat the above procedure for other carburetors.
- If the fuel level(s) is incorrect, adjust the fuel level(s).



#### 2. Adjust:

- Fuel level

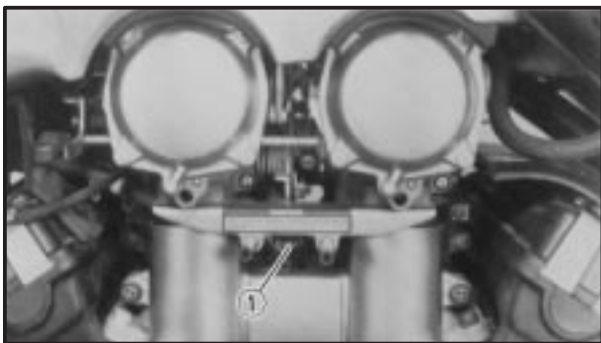
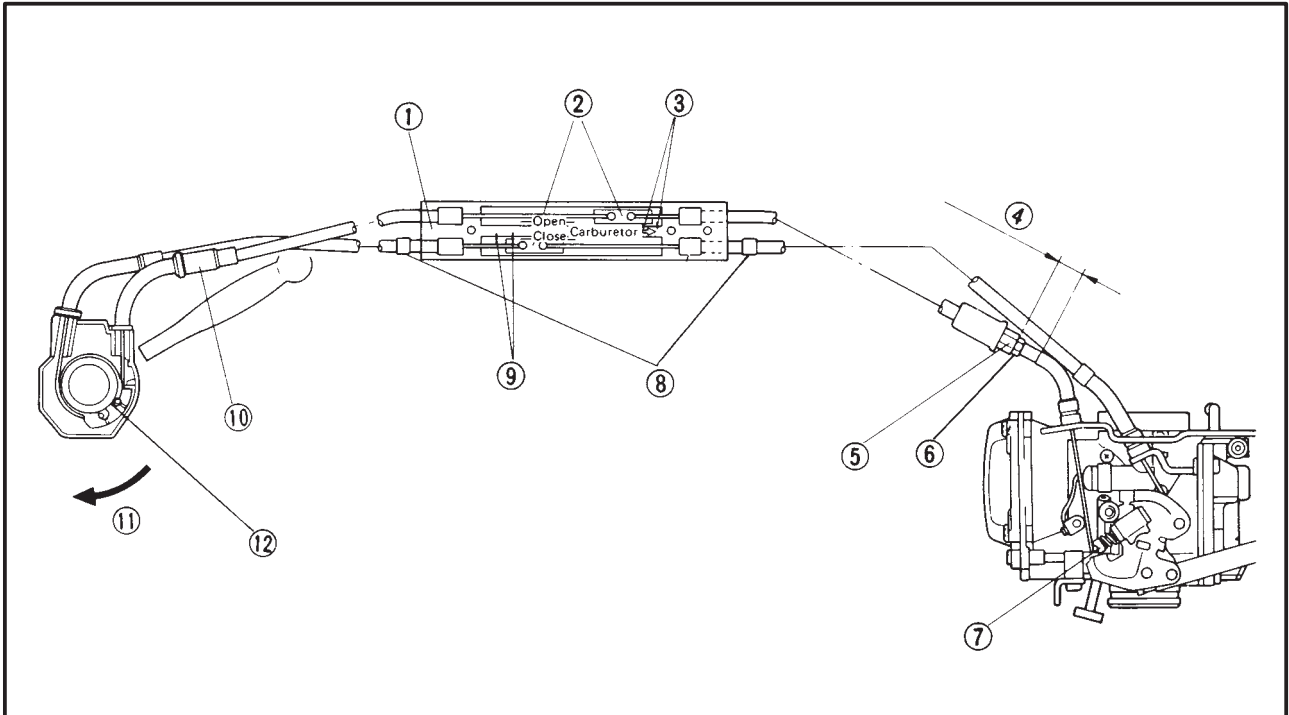
#### Fuel level adjustment steps:

- Remove the carburetors.
- Inspect the needle valve.
- If it is worn, replace it.
- If it is fine, adjust float level by bending the float tang ① slightly.
- Repeat the procedure for the other carburetors.



### THROTTLE CABLE CYLINDER

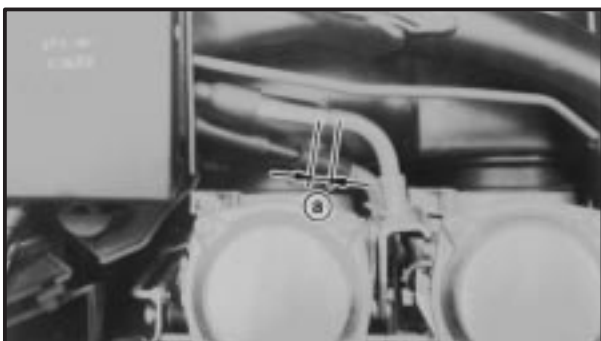
- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| ① Cable cylinder                    | ⑦ Throttle stop screw                 |
| ② Slider                            | ⑧ Silver tape                         |
| ③ Cable adjustment mark (Open side) | ⑨ Cable adjustment mark (Close side)  |
| ④ Standard adjuster distance        | ⑩ Cable adjuster (Throttle grip side) |
| ⑤ Cable adjuster (Carburetor side)  | ⑪ Turning direction                   |
| ⑥ Locknut (Carburetor side)         | ⑫ Free play (Throttle grip)           |



### ADJUSTMENT

#### 1. Loosen:

- Throttle stop screw ①  
To set the throttle valve to full closed.

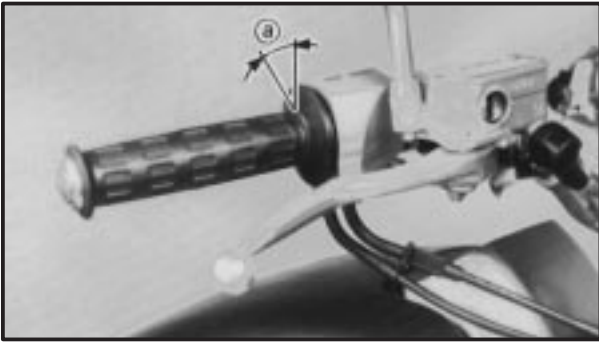


#### 2. Adjust:

- Distance ④  
Between the threaded end of the tubular control cable guide and the adjuster.



**Standard Carburetor Side  
Adjuster Distance:  
15 mm (0.59 in)**

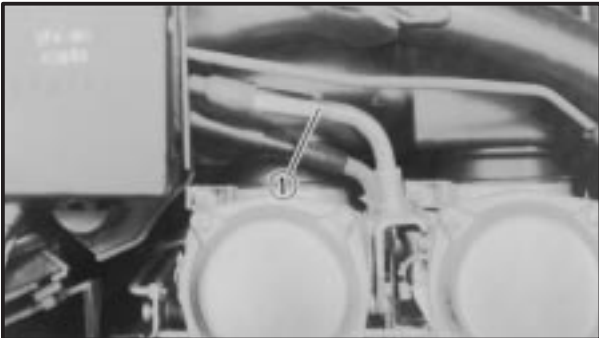


### 3. Measure:

- Free play (throttle grip) ①
- Out of specification → Adjust.



**Throttle Grip Free Play:**  
4 ~ 7 mm (0.16 ~ 0.28 in)



### 4. Check:

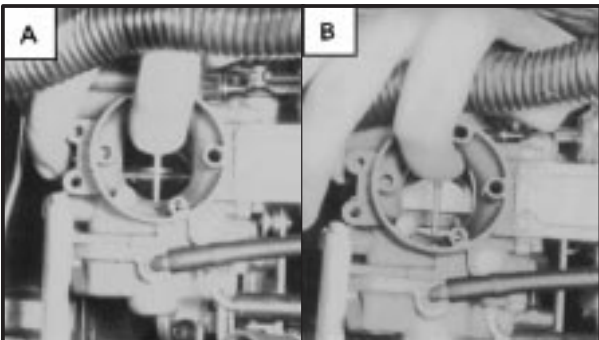
- No.2 carburetor throttle valve operation

#### No.2 carburetor throttle valve operation checking steps:

- Loosen the locknut (carburetor side) ①.
- Turn throttle grip back and forth.
- Check No.2 carburetor to see if the throttle valve operates at full open and full closed. Operation of throttle valve normal → Tighten locknut ①.
- Throttle valve fails to operate at full closed → Adjust.

**A** THROTTLE VALVE FULLY OPEN

**B** THROTTLE VALVE FULLY CLOSED



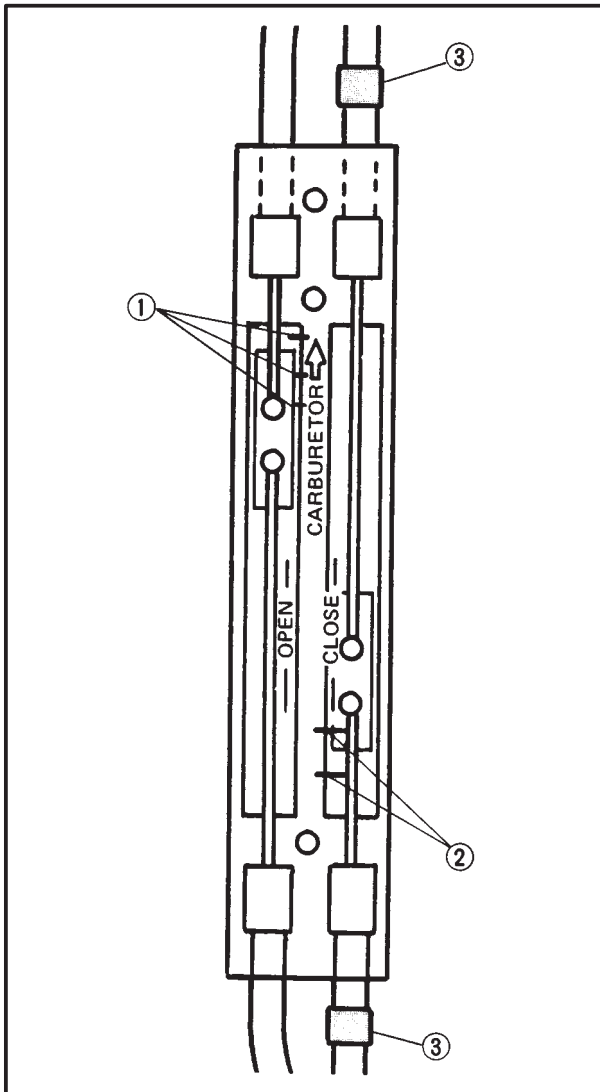
### 5. Adjust:

- No.2 carburetor throttle valve operation

#### No.2 carburetor throttle valve operation adjustment steps:

##### First step:

- Loosen the locknut (carburetor side).
- Turn the adjuster (carburetor side) clockwise a little.
- Turn the adjuster (throttle grip side) counterclockwise and adjust free play (throttle grip) to within 4 ~ 7 mm (0.16 ~ 0.28 in).
- Check to see if throttle valve operates at full closed.  
If not, repeat steps a ~ d.
- Set the throttle valve at full closed and tighten locknut (carburetor side).
- Check to see if throttle valve operates at full open.  
Throttle valve fails to operate at full open → Perform the next step.



### Second step:

- Loosen the locknut (carburetor side).
- Turn the adjuster (carburetor side) counterclockwise a little.
- Turn adjuster (throttle grip side) clockwise so that the free play (throttle grip) is within 4 ~ 7 mm (0.16 ~ 0.28 in).
- Check to see if throttle valve operates at full open.

If not, repeat steps a ~ d.

- Tighten locknut (carburetor side).
- Check to see if throttle valve operates at full open or full closed.

Throttle valve fails to operate at full open or full closed → Perform the next step.

### Third step:

- Check to see if throttle cable installation is correct.

#### NOTE:

Be sure that the silver throttle cable ③ is positioned opposite the adjusters.

- Check the position of the control cable sliders in the throttle cable cylinder.

#### NOTE:

- Be sure the open side slider (silver cable side) falls between the three adjustment marks on the carburetor side.
- Be sure the closed side slider falls between the two adjustment marks on the throttle grip side.

- If the slider(s) fall outside the adjustment marks then the throttle cable(s) must be replace.

① Cable adjustment mark (Open side)

② Cable adjustment mark (Closed side)

## THROTTLE CABLE CYLINDER

---

**CARB**



6. Install:

- Air cleaner

7. Set engine idle speed.



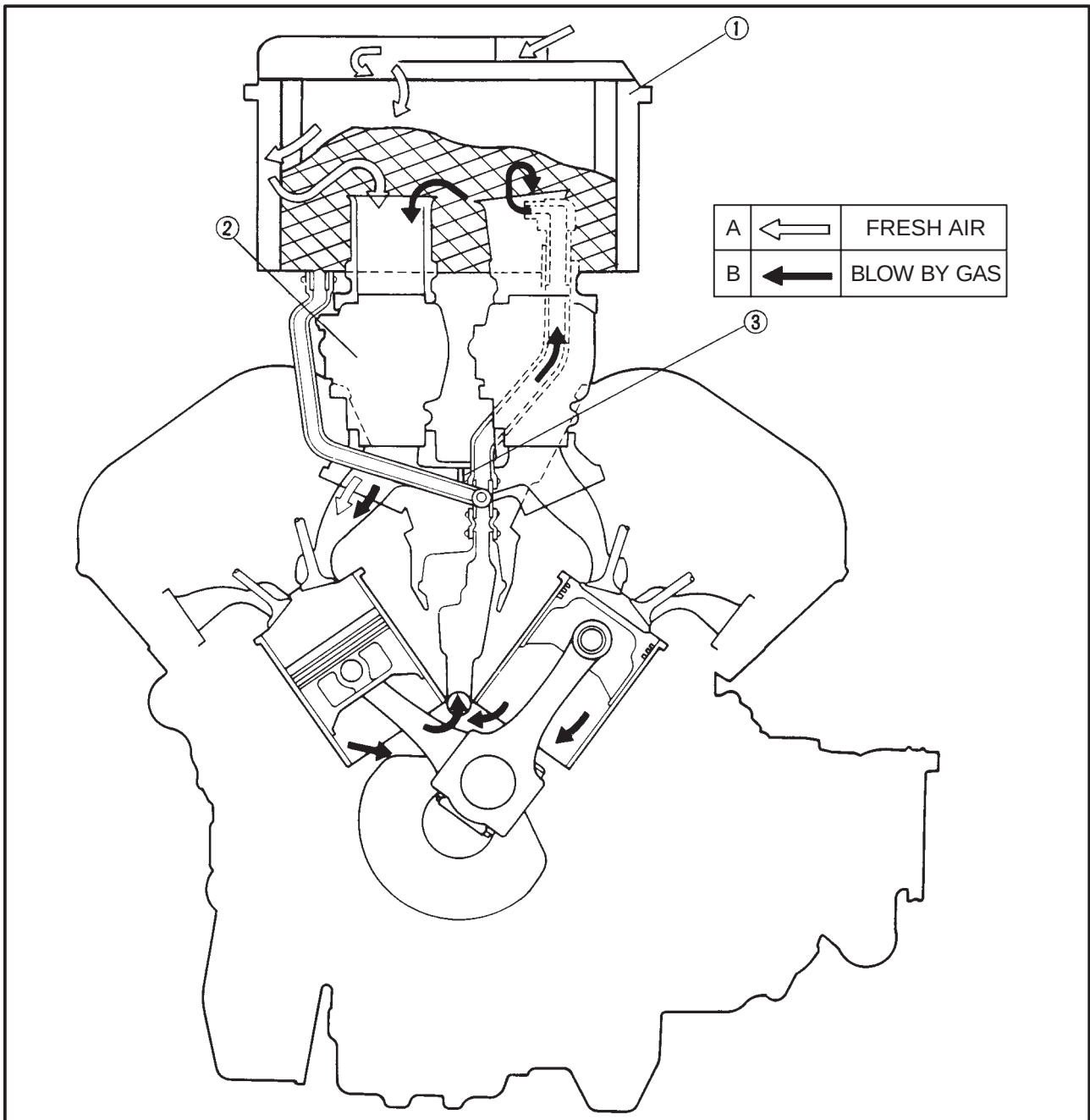
**Idle Speed: 950 ~ 1,050 r/min**



### AIR CLEANER AND CRANKCASE VENTILATION SYSTEM

Refer to "CHAPTER 2" for the air cleaner maintenance.

- ① Air cleaner
- ② Carburetor
- ③ Blind plug





## CHAPTER 6. CHASSIS

|                                    |      |
|------------------------------------|------|
| <b>FRONT WHEEL</b> .....           | 6-1  |
| REMOVAL .....                      | 6-2  |
| INSPECTION .....                   | 6-2  |
| INSTALLATION .....                 | 6-4  |
| <b>REAR WHEEL</b> .....            | 6-6  |
| REMOVAL .....                      | 6-7  |
| INSPECTION .....                   | 6-7  |
| INSTALLATION .....                 | 6-8  |
| <b>FRONT AND REAR BRAKE</b> .....  | 6-9  |
| CALIPER PAD REPLACEMENT .....      | 6-11 |
| CALIPER DISASSEMBLY .....          | 6-12 |
| MASTER CYLINDER DISASSEMBLY .....  | 6-13 |
| BRAKE INSPECTION AND REPAIR .....  | 6-16 |
| BRAKE REASSEMBLY .....             | 6-17 |
| AIR BLEEDING .....                 | 6-19 |
| BRAKE DISC INSTALLATION .....      | 6-20 |
| <b>HYDRAULIC CLUTCH</b> .....      | 6-21 |
| CLUTCH RELEASE DISASSEMBLY .....   | 6-22 |
| MASTER CYLINDER DISASSEMBLY .....  | 6-22 |
| CLUTCH INSPECITON AND REPAIR ..... | 6-23 |
| CLUTCH REASSEMBLY .....            | 6-24 |
| AIR BLEEDING .....                 | 6-25 |
| <b>FRONT FORK</b> .....            | 6-27 |
| REMOVAL .....                      | 6-28 |
| DISASSEMBLY .....                  | 6-29 |
| INSPECTION .....                   | 6-30 |
| ASSEMBLY .....                     | 6-31 |
| INSTALLATION .....                 | 6-33 |
| <b>STEERING HEAD</b> .....         | 6-35 |
| REMOVAL .....                      | 6-36 |
| INSPECTION .....                   | 6-38 |
| INSTALLATION .....                 | 6-38 |
| <b>REAR SHOCK ABSORBER</b> .....   | 6-40 |
| REMOVAL .....                      | 6-41 |
| INSPECTION .....                   | 6-41 |
| INSTALLATION .....                 | 6-41 |



---

|                              |          |
|------------------------------|----------|
| <b>SWINGARM</b> .....        | 6-43     |
| FREE PLAY INSPECTION .....   | 6-44     |
| REMOVAL .....                | 6-44     |
| INSPECTION .....             | 6-45     |
| INSTALLATION .....           | 6-46     |
| <br><b>SHAFT DRIVE</b> ..... | <br>6-47 |
| TROUBLESHOOTING .....        | 6-48     |
| FINAL DRIVE GEAR .....       | 6-52     |
| DRIVE SHAFT .....            | 6-62     |



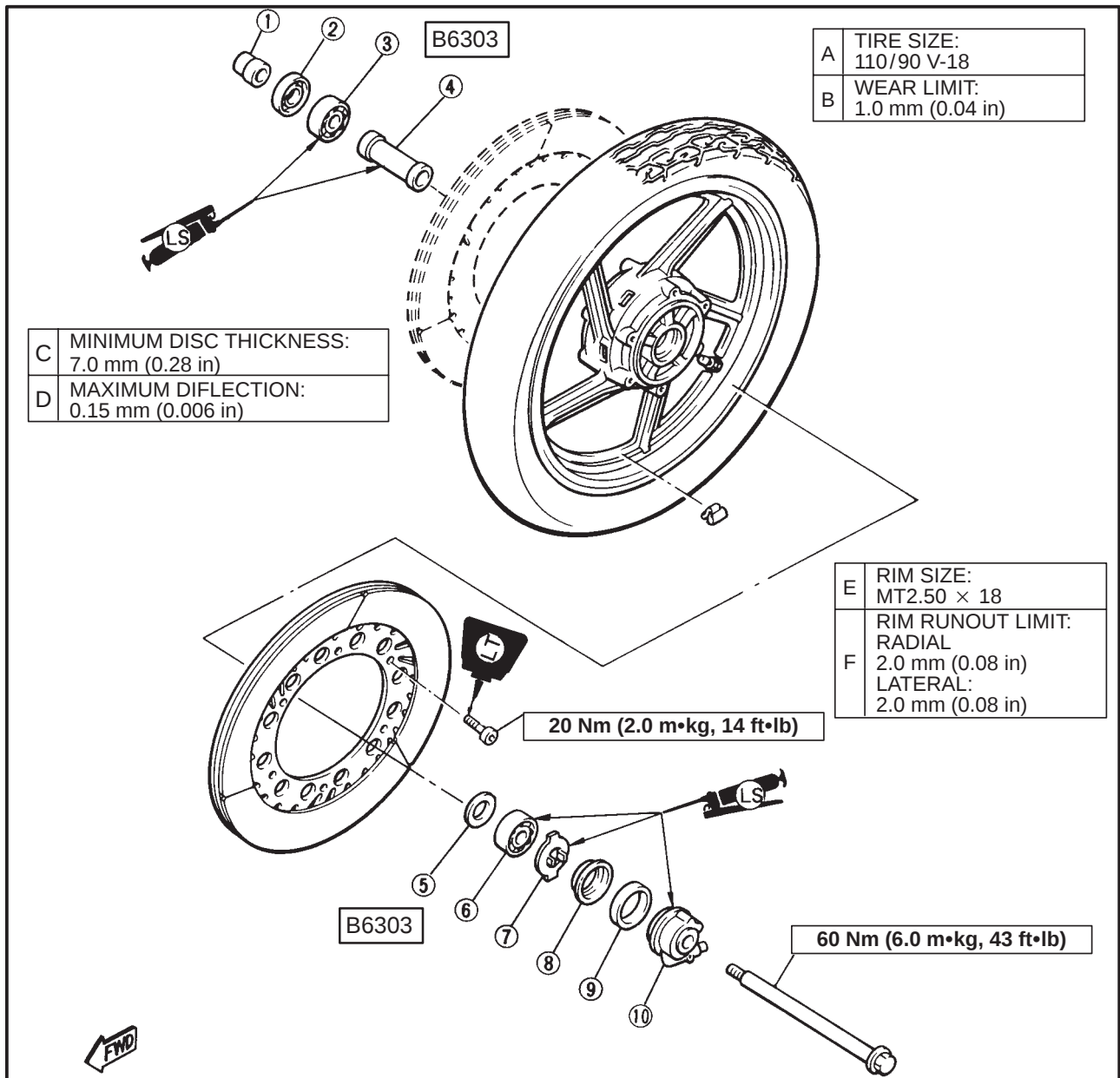
### CHASSIS

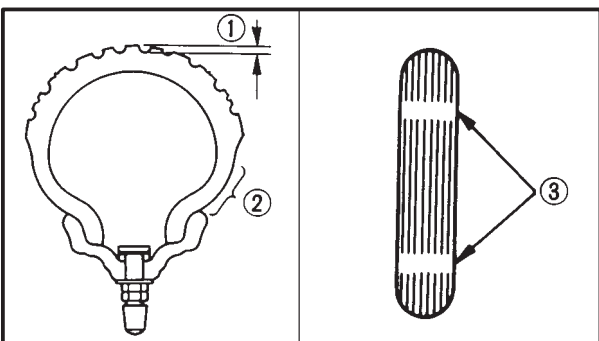
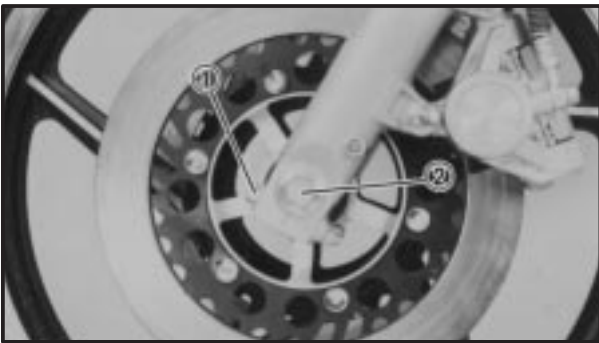
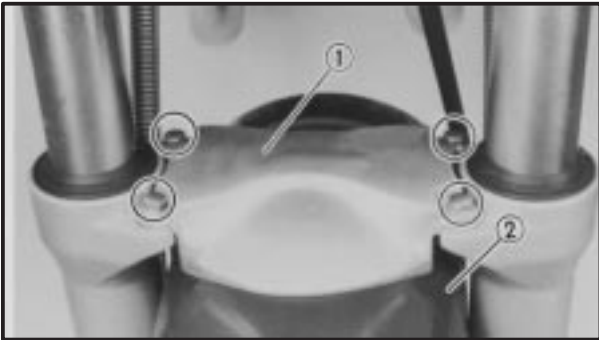
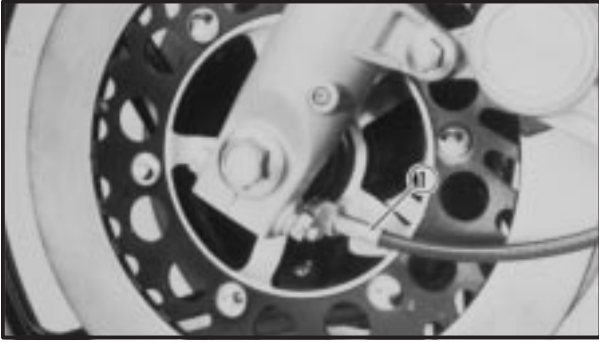
#### FRONT WHEEL

- |                 |                      |
|-----------------|----------------------|
| ① Collar        | ⑥ Sealing            |
| ② Oil seal      | ⑦ Meter clutch       |
| ③ Bearing       | ⑧ Clutch retainer    |
| ④ Spacer        | ⑨ Oil seal           |
| ⑤ Spacer flange | ⑩ Gear unit assembly |

| TIRE PRESSURE (COLD TIRE)                       |                                                 |                                                 |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Basic weight:<br>With Oil and Full<br>Fuel Tank | 281 kg (619 lb)                                 |                                                 |
| Maximum Load*                                   | 218 kg (481 lb)                                 |                                                 |
| Cold Tire Pressure:                             | FRONT                                           | REAR                                            |
| Up to 90 kg (198 lb)<br>Load*                   | 235 kPa<br>(2.4 kg/cm <sup>2</sup> ,<br>34 psi) | 255 kPa<br>(2.6 kg/cm <sup>2</sup> ,<br>36 psi) |
| 90 kg (198 lb)* ~<br>Maximum Load*              | 235 kPa<br>(2.4 kg/cm <sup>2</sup> ,<br>34 psi) | 275 kPa<br>(2.8 kg/cm <sup>2</sup> ,<br>40 psi) |
| High Speed Riding                               | 235 kPa<br>(2.4 kg/cm <sup>2</sup> ,<br>34 psi) | 255 kPa<br>(2.6 kg/cm <sup>2</sup> ,<br>36 psi) |

\* Load is the total weight of cargo, rider, passenger, and accessories.





## REMOVAL

### WARNING:

Securely support the motorcycle so it won't fall over when the front wheel.

1. Place the motorcycle on its centerstand.
2. Remove:
  - Speedometer cable ①
3. Remove:
  - Fork brace ①
  - Front fender ②
4. Loosen:
  - Pinch bolt (front axle) ①
  - Front axle ②
5. Elevate the front wheel by placing a suitable stand under the engine.
6. Remove:
  - Front axle
  - Front wheel

Lower the wheel until the brake discs come off the calipers. Turn the brake calipers outward so they do not obstruct the wheel.

### NOTE:

Do not squeeze the brake lever while the wheel is off the motorcycle.

## INSPECTION

1. Inspect:
  - Tire

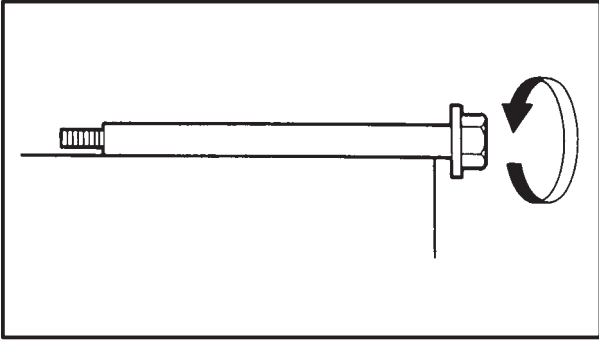
Tire tread shows crosswise lines (minimum tread depth)/Cracks → Replace.



**Minimum Tire Tread Depth:**  
**1.0 mm (0.04 in)**

- ① Tread depth    ② Side wall    ③ Wear indicator

## FRONT WHEEL

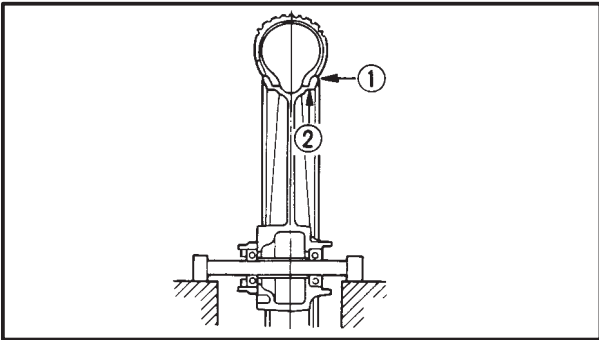
**CHAS**

### 2. Inspect:

- Front axle  
Bends → Replace.  
Roll the axle on a flat surface.

### **WARNING:**

Do not attempt to straighten a dent axle.



### 3. Inspect:

- Wheel  
Cracks/Bends/Warpage → Replace.

### 4. Measure:

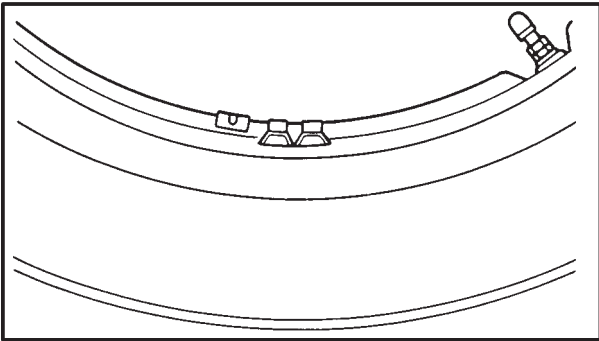
- Wheel runout  
Over specified limit → Replace.



### Rim Runout Limits:

Radial ①: 2.0 mm (0.08 in)

Lateral ②: 2.0 mm (0.08 in)



### 5. Check:

- Wheel balance  
Out of balance → Adjust.

### **NOTE:**

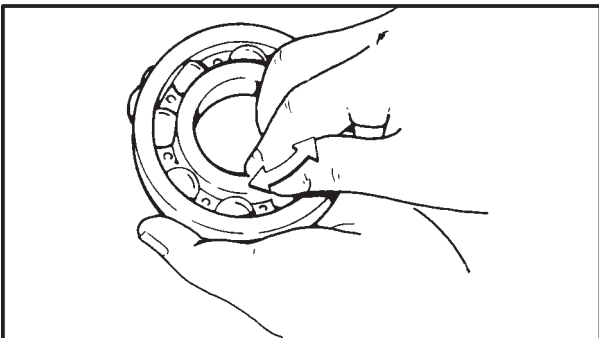
Balance wheels with the brake discs installed.

### **CAUTION:**

Be sure the valve stem locknut is tightened securely after repairing or replacing a tire and/or wheel.

### **WARNING:**

Ride conservatively after installing a tire to allow the tire to seat itself correctly on the rim.



### 6. Inspect:

- Wheel bearings  
Bearings allow play in the wheel hub or wheel turns roughly → Replace.

### **Wheel bearing replacement steps:**

- Clean the outside of the wheel hub.
- Drive out the bearing.



### WARNING:

Eye protection is recommended when using striking tools.

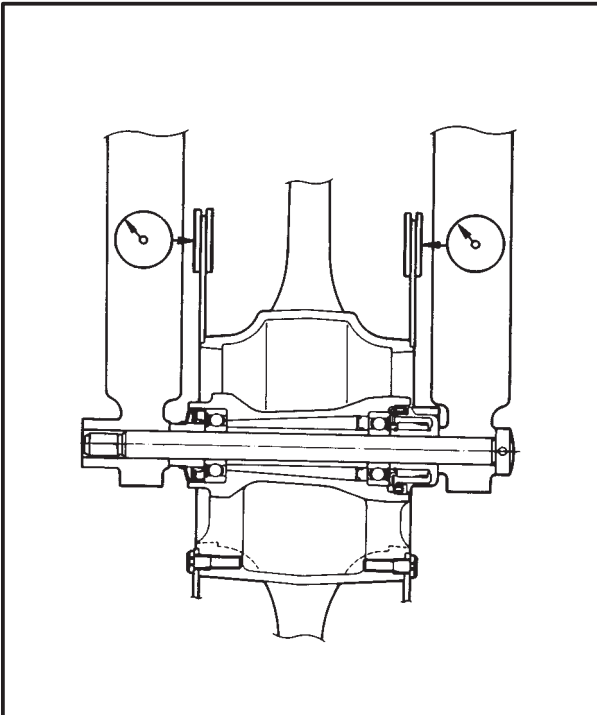
- Install the new bearing by reversing the previous steps.

### NOTE:

Use a socket that matches the outside diameter of the race of the bearing.

### CAUTION:

Do not strike the center race or balls of the bearing. Contact should be made only with the outer race.



### 7. Inspect:

- Brake disc  
Wear/Over specified limit → Replace.

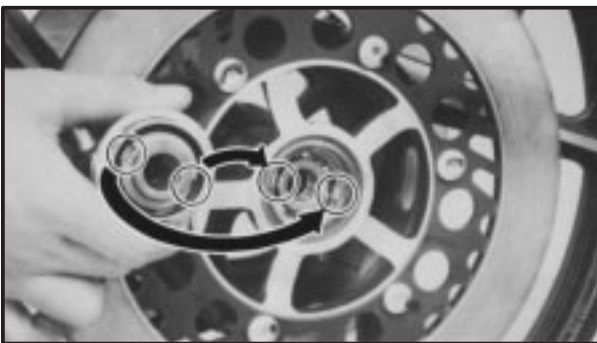


**Maximum Deflection  
(Front and Rear):**

**0.15 mm (0.006 in)**

**Minimum Disc Thickness  
(Front and Rear):**

**7.0 mm (0.28 in)**



### INSTALLATION

When installing the front wheel, reverse the removal procedure. Note the following points.

#### 1. Apply:

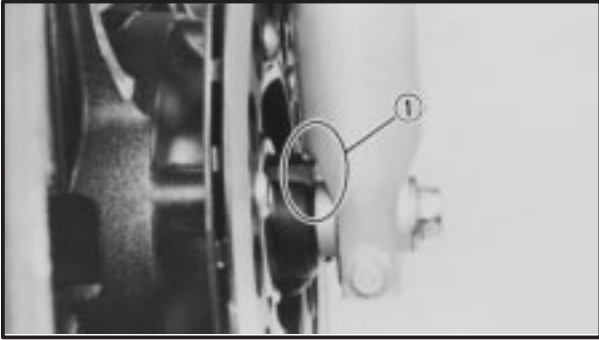
- Lithium base grease  
Lightly grease to the oil seal and gear unit.

#### 2. Install:

- Gear unit assembly

### NOTE:

Be sure that the two projections inside the wheel hub mesh with the two slots in the gear unit assembly.



3. Install:
  - Front wheel

**NOTE:**

Be sure that the projecting portion (torque stopper) ① of the gear unit housing is positioned correctly.

4. Tighten:
  - Front axle



**Front Axle:**  
60 Nm (6.0 m•kg, 43 ft•lb)

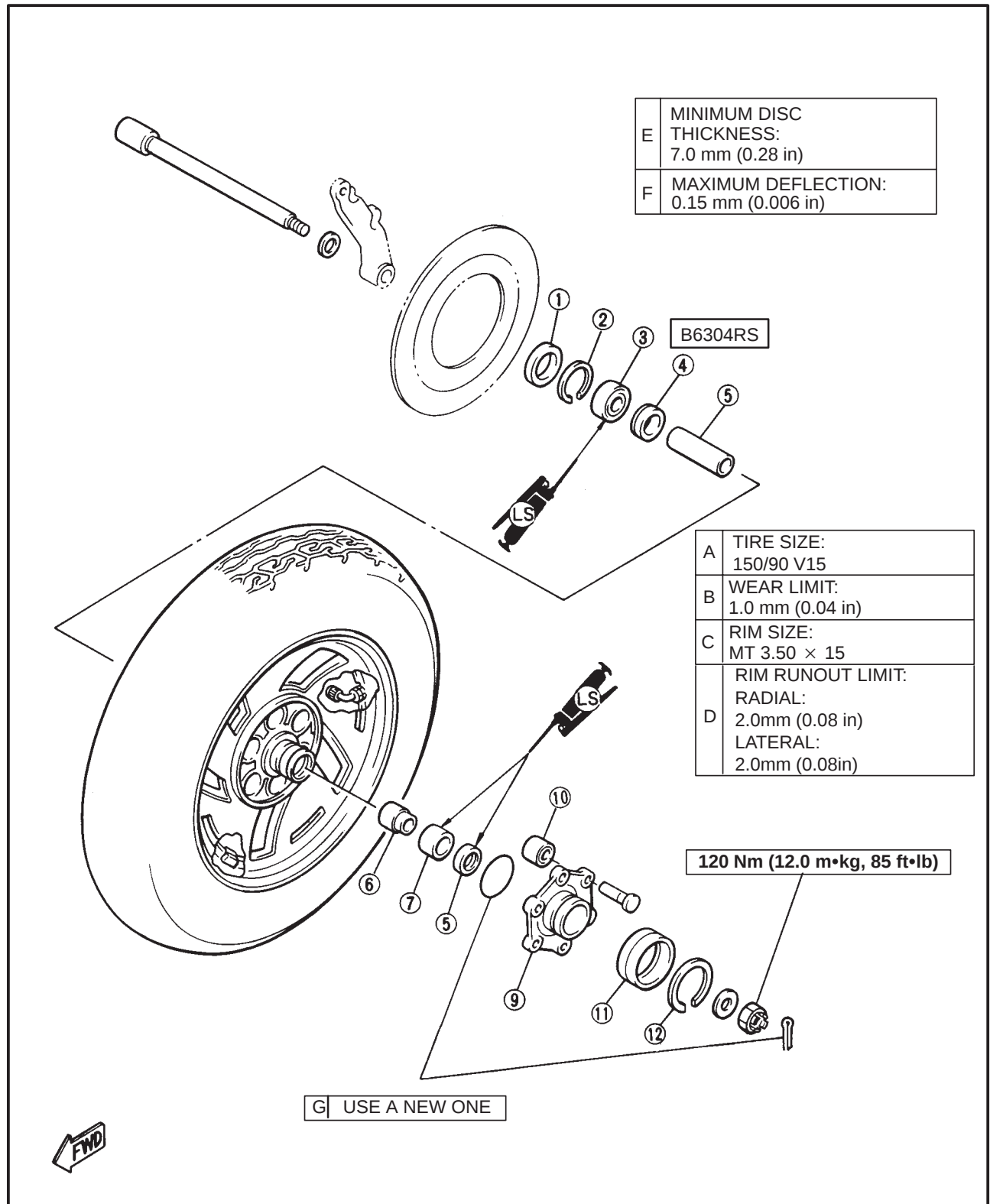
5. Tighten:
  - Pinch bolt (front axle)
  - Fork brace
  - Front fender



**Pinch Bolt (Front Axle):**  
20 Nm (2.0 m•kg, 14 ft•lb)  
**Nuts (Fork Brace):**  
9 Nm (0.9 m•kg, 6.5 ft•lb)

## REAR WHEEL

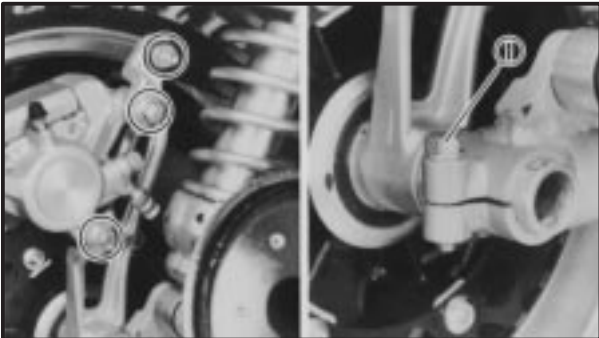
- |                 |                       |
|-----------------|-----------------------|
| ① Oil seal      | ⑦ Cylindrical bearing |
| ② Circlip       | ⑧ Oil seal            |
| ③ Bearing       | ⑨ Clutch hub          |
| ④ Spacer flange | ⑩ Damper              |
| ⑤ Spacer        | ⑪ Hub dust seal       |
| ⑥ Collar        | ⑫ Circlip             |





## REMOVAL

1. Place the motorcycle on its centerstand.
2. Remove:
  - Cotter pin ①
  - Axle nut ②
  - Washer



3. Remove:
  - Rear caliper
  - Tension bar

## NOTE:

Do not depress the brake pedal when the wheel is off the motorcycle as the brake pads will be forced.



4. Loosen:
  - Pinch bolt (rear axle) ①
5. Remove:
  - Rear axle
 

While supporting the brake caliper, pull out the rear axle.
  - Rear wheel
 

Move the wheel to the right side to separate it from the final gear case.

## INSPECTION

1. Inspect:
  - Tire
  - Rear axle
  - Wheel
  - Wheel bearings
  - Brake disc
 

Refer to "FRONT WHEEL – INSPECTION" section.
2. Measure:
  - Wheel runout
 

Refer to "FRONT WHEEL – INSPECTION" section.
3. Check:
  - Wheel balance
 

Refer to "FRONT WHEEL – INSPECTION" section.



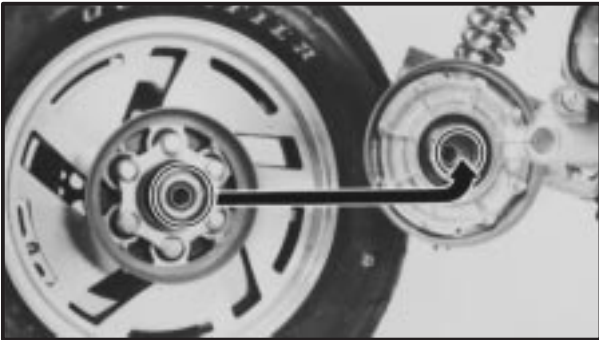
## INSTALLATION

When installing the rear wheel, reverse the removal procedure. Note the following points.

1. Apply:
  - Lithium base grease  
Lightly grease to the final gear case splines.
2. Install:
  - Rear wheel assembly

### NOTE:

Be sure the splines on the wheel hub fit into final gear case.



3. Tighten:
  - Wheel axle



#### Axle Nut:

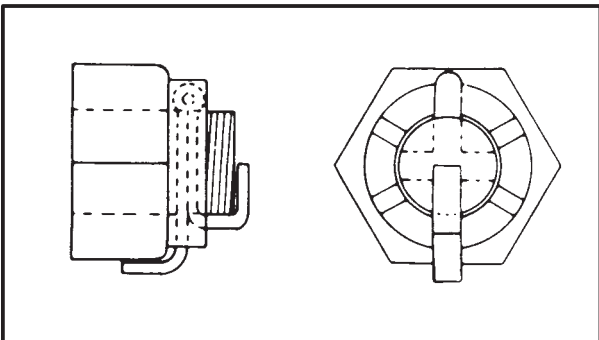
120 Nm (12.0 m•kg, 85 ft•lb)

#### Pinch Bolt (Rear Wheel):

20 Nm (2.0 m•kg, 14 ft•lb)

### CAUTION:

Always use a new cotter pin on the rear axle nut.



4. Tighten:
  - Tension bar
  - Rear caliper



#### Rear Caliper:

45 Nm (4.5 m•kg, 32 ft•lb)

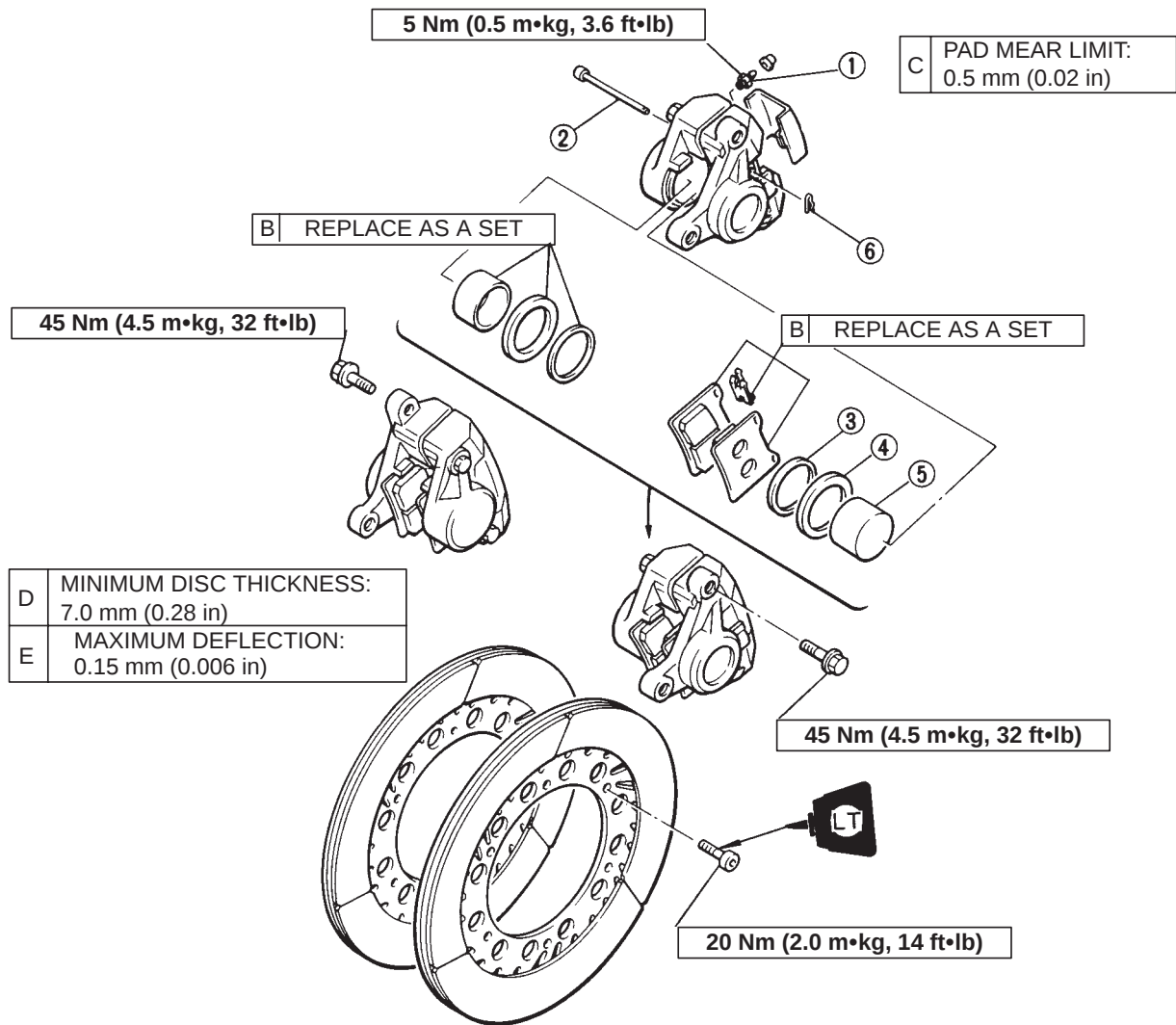


## FRONT AND REAR BRAKE

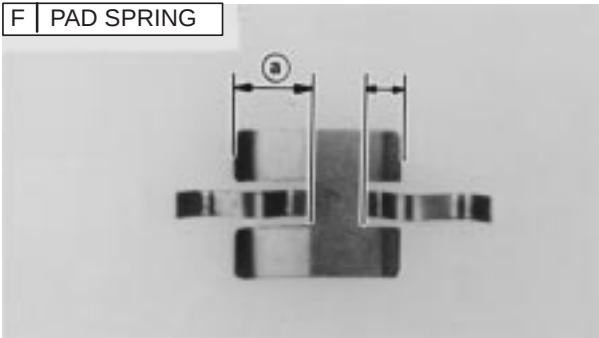
- ① Air bleed screw
- ② Retaining pin
- ③ Dust seal
- ④ Piston seal
- ⑤ Piston
- ⑥ Circlip

F – ①: Install the pad spring with its longer tangs① in the disc rotating direction.

### A FRONT CALIPER



### F PAD SPRING



# FRONT AND REAR BRAKE

CHAS



- ① Air bleed screw
- ② Retaining pin
- ③ Dust seal
- ④ Piston seal
- ⑤ Piston
- ⑥ Clirip
- ⑦ Shim

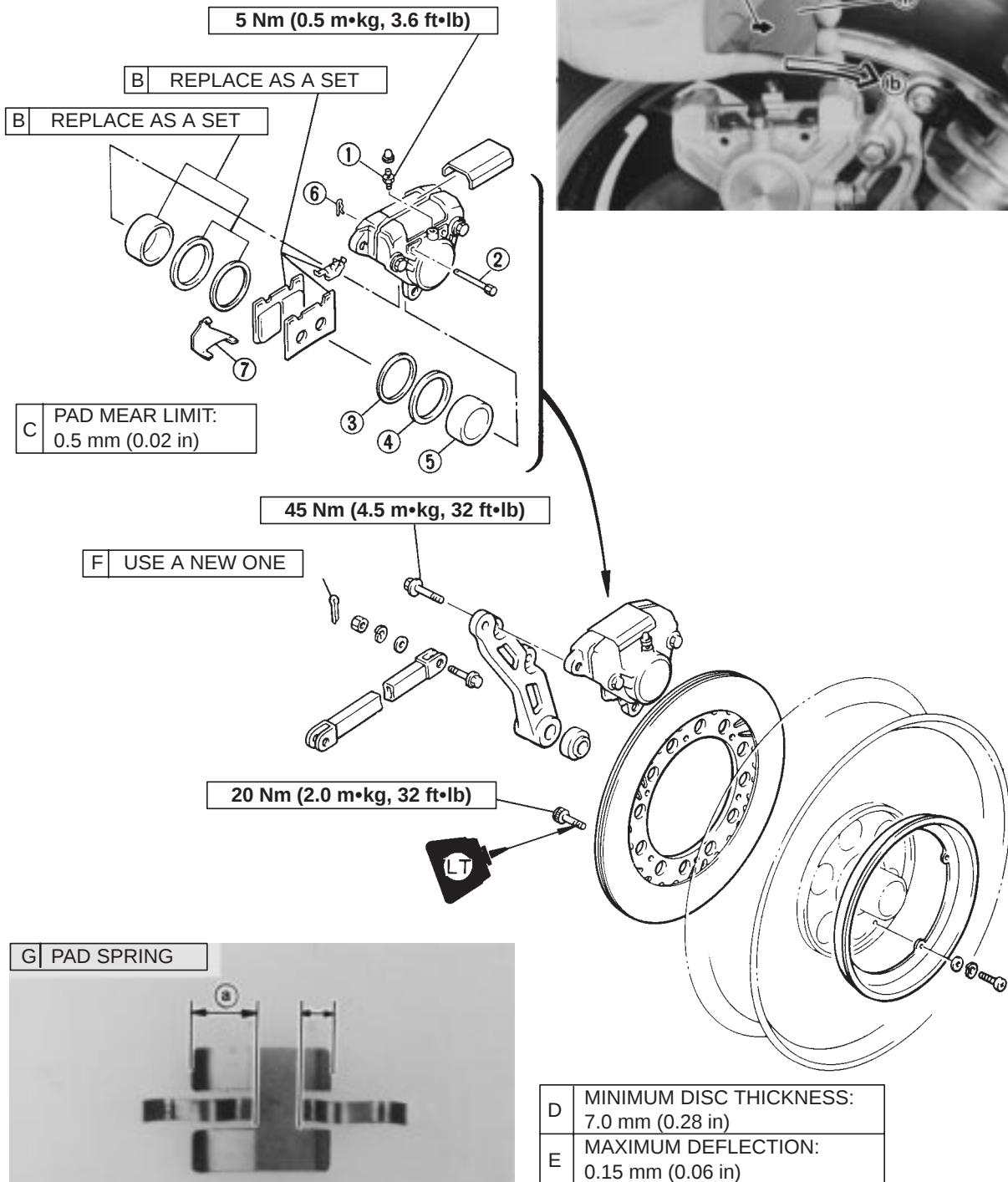
G – ①:

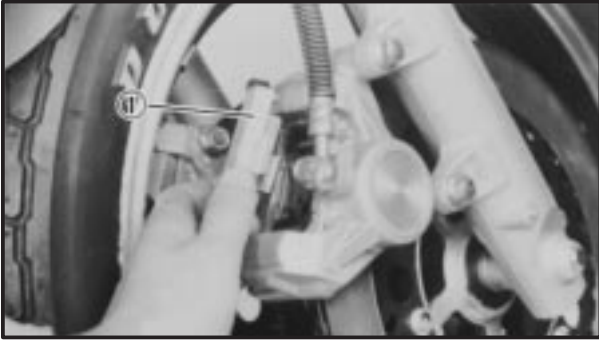
Install the pad spring with its longer tangs ① in the disc rotating direction.

H – ①:

Be sure to position the shim ① so that its arrow mark ① points in the rotating direction ② of the disc plate rotation.

## A FRONT CALIPER



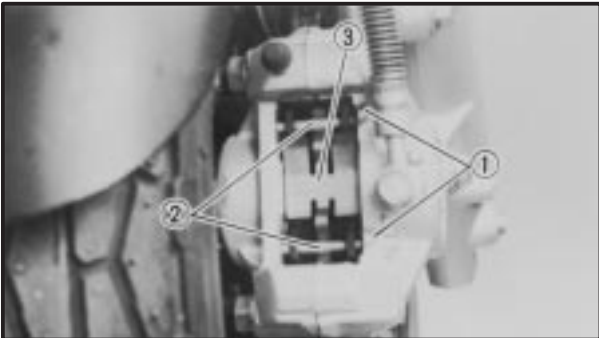


## CALIPER PAD REPLACEMENT

It is not necessary to disassemble the brake caliper and brake hose to replace the brake pads.

1. Remove:

- Cover ①



2. Remove:

- Retaining clips ①
- Retaining pins ②
- Pad spring ③



3. Remove:

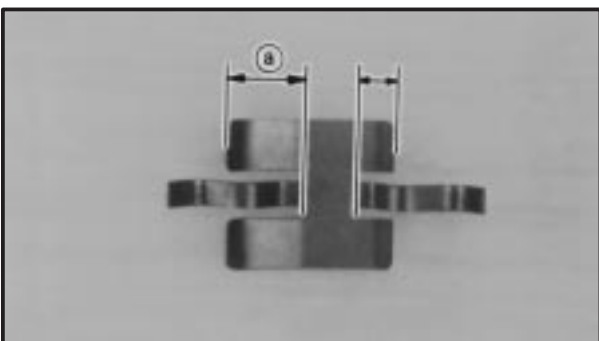
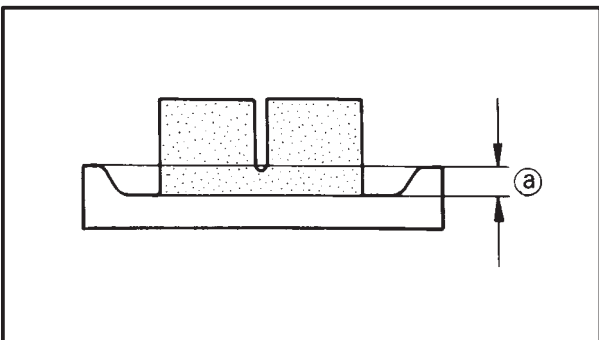
- Pads

### NOTE:

- Replace the pad spring if pad replacement is required.
- Replace the pads as a set if either is found to be worn to the wear limit.



**Wear Limit ①:**  
0.5 mm (0.02 in)



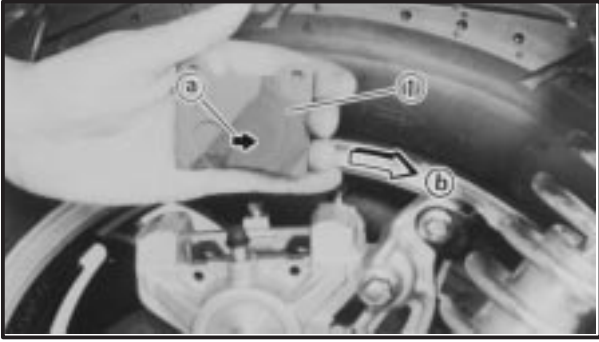
4. Install:

- Components in above list (steps "3 ~ 1")

### NOTE:

• FRONT AND REAR BRAKE:

Install the pad spring with its longer tangs ① facing towards the disc rotating direction.



• REAR BRAKE ONLY:

Be sure to position the shim ① so that its arrow mark (a) points in the rotating direction (b) of the disc plate rotation.



## CALIPER DISASSEMBLY

1. Remove:

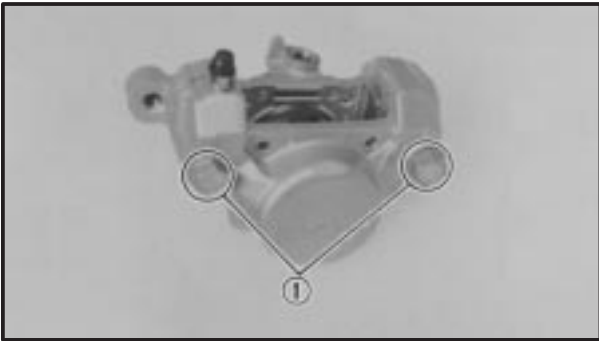
- Pads

Refer to "CALIPER PAD REPLACEMENT" section.

2. Remove:

- Brake hose ①

Place the open hose end into a container and pump the old fluid out carefully.

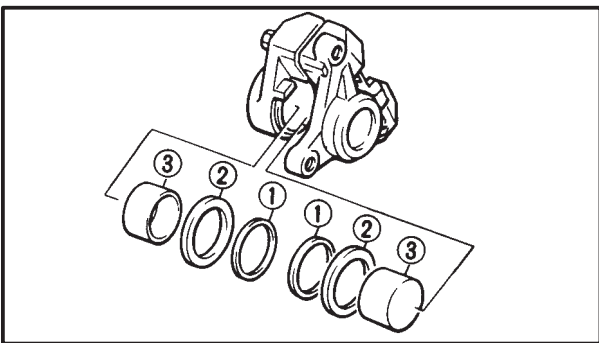


3. Remove:

- Caliper

**CAUTION:**

Never loosen the bridge bolts ① on either side of the caliper.



4. Remove:

- Dust seals ①
- Piston seals ②
- Pistons ③

**Caliper piston removal steps:**

- Insert a piece of wooden board ④ into the caliper to lock the right side piston.
- Blow compressed air into the tube joint opening to force out the left side piston from the caliper body.
- Repeat previous step to force out the right side piston from the caliper body.



- ① Master cylinder cap
- ② Rubber seal
- ③ Master cylinder kit
- ④ Copper washer
- ⑤ Brake joint



## FRONT AND REAR BRAKE

CHAS

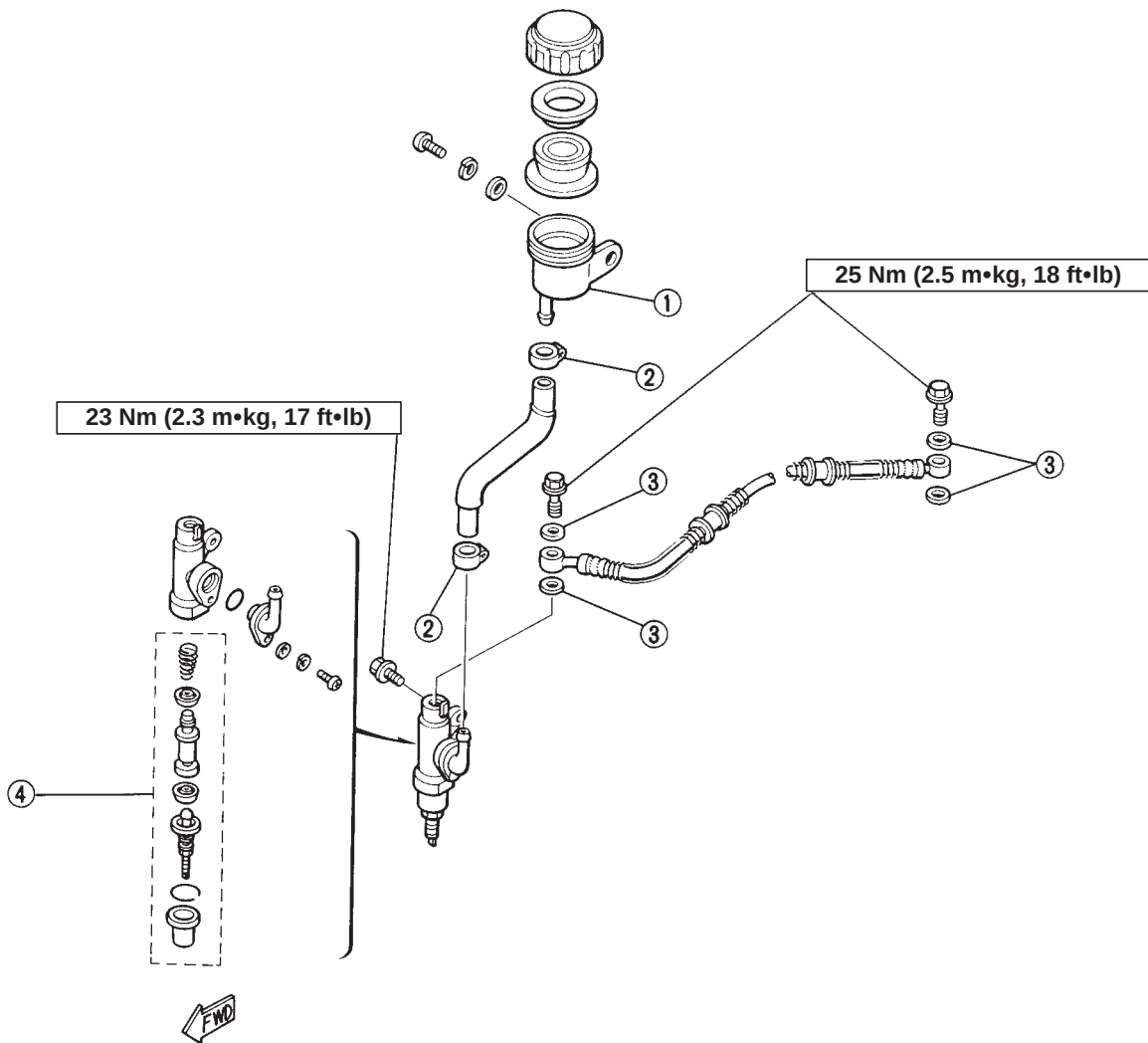


- ① Reservoir tank
- ② Band
- ③ Copper washer
- ④ Master cylinder kit

**D BRAKE HOSE ROUTING:**  
When installing the rear brake hose, align the brake pipe ① with the front projection ② on the master cylinder.

### A REAR MASTER CYLINDER

### B BRAKE FLUID TYPE: DOT #3

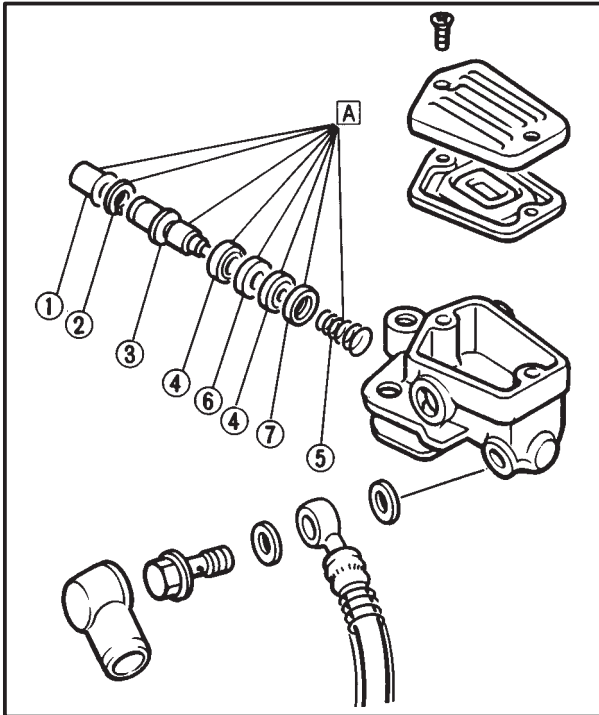


### C BRAKE PEDAL HEIGHT:



### D BRAKE HOSE ROUTING





### Front Brake Master Cylinder Disassembly

#### NOTE:

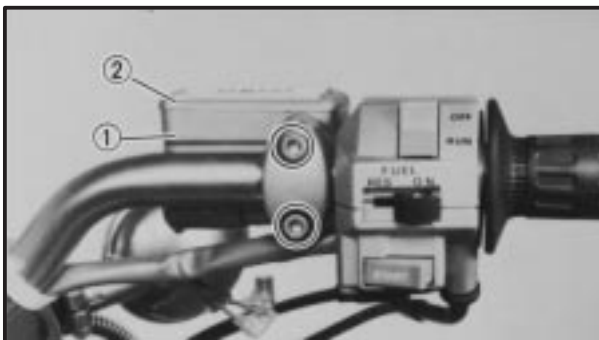
Drain the brake fluid before removing master cylinder.

- ① Dust boot
- ② Circlip
- ③ Piston
- ④ Piston cups
- ⑤ Return spring
- ⑥ Washer
- ⑦ Seat

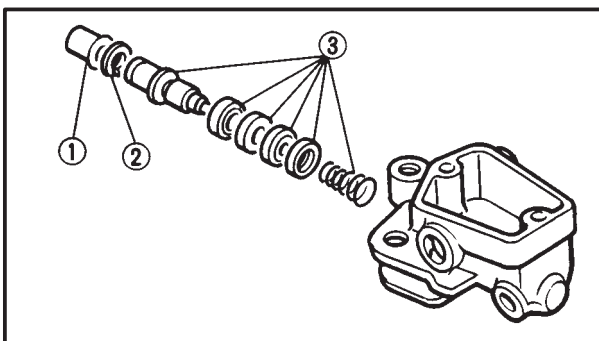
**A** MASTER CYLINDER KIT (Replace as a set)



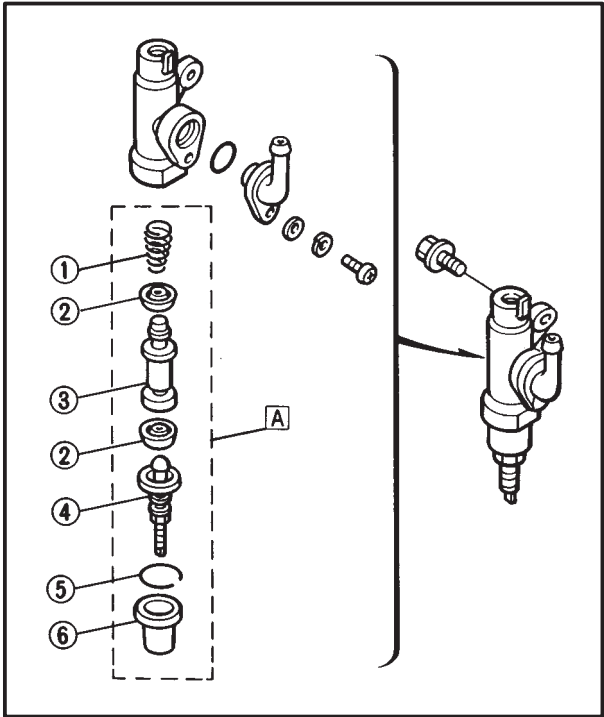
1. Remove:
  - Brake light switch leads ①
  - Brake lever ②
  - Lever spring
2. Disconnect:
  - Brake hose ③
 Drain the fluid.



3. Remove:
  - Master cylinder ①
  - Master cylinder cap ②



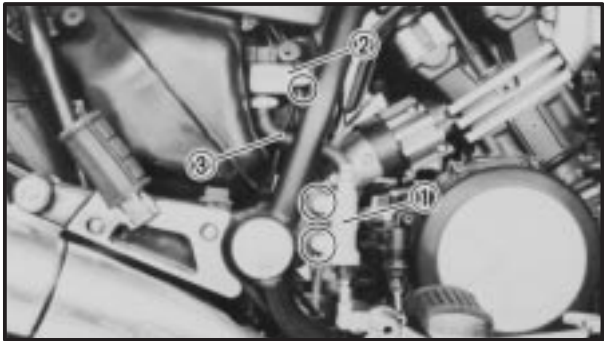
4. Remove:
  - Dust boot ①
  - Circlip ②
  - Master cylinder kit ③



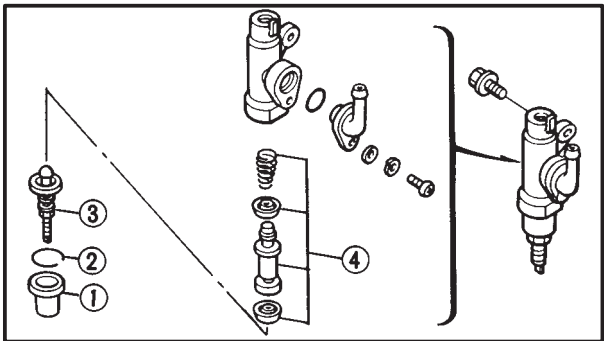
Rear Brake Master Cylinder Disassembly

**NOTE:** \_\_\_\_\_  
Drain the brake fluid before removing master cylinder.

1. Remove:
    - Side cover (right)
  2. Disconnect:
    - Brake hose
- 
- ① Spring
  - ② Piston cup
  - ③ Piston
  - ④ Adjusting rod
  - ⑤ Circlip
  - ⑥ Dust boot
- A** MASTER CYLINDER KIT (Replace as a set)



3. Remove:
  - Master cylinder ①
  - Fluid reservoir tank ②Drain the fluid.
4. Disconnect:
  - Tank hose ③



5. Remove:
  - Dust boot ①
  - Circlip ②
  - Adjusting rod ③
  - Master cylinder kit ④Drain the excess fluid.

BRAKE INSPECTION AND REPAIR

| Recommended Brake Component Replacement Schedule: |                                           |
|---------------------------------------------------|-------------------------------------------|
| Brake pads                                        | As required                               |
| Piston seal, dust seal                            | Every two years                           |
| Brake hoses                                       | Every four years                          |
| Brake fluid                                       | Replace only when brakes are disassembled |



## WARNING:

All internal parts should be cleaned in new brake fluid only. Do not use solvents will cause seals to swell and distort.

### 1. Inspect:

- Brake pads  
Over specified limit → Replace.



**Wear Limit (a):**  
**0.5 mm (0.02 in)**

### 2. Inspect:

- Caliper piston  
Rust/Wear/Damage → Replace.
- Dust seal/Piston seal  
Damage → Replace.

## WARNING:

Replace the piston and dust seals whenever a caliper is disassembled.

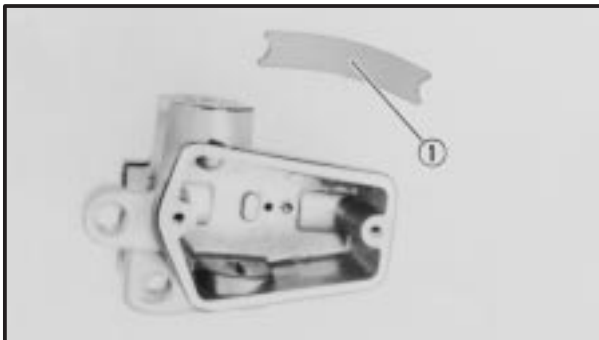
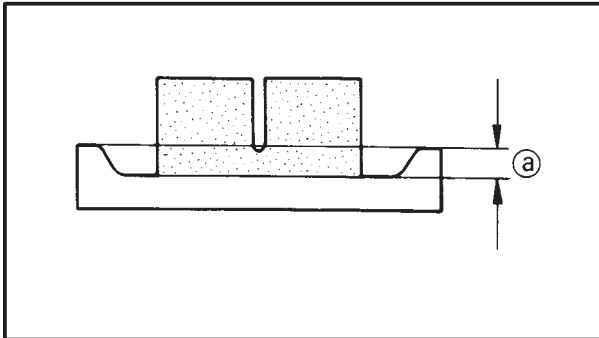
- Master cylinder kit
- Master cylinder body  
Scratches/Wear → Replace.

## NOTE:

Clean all passages with new brake fluid.

### ① Oil baffle plate

- Brake hose  
Cracks/Wear/Damage → Replace.



## BRAKE REASSEMBLY

## WARNING:

- All internal parts should be cleaned in new brake fluid only.
- Internal parts should be lubricated with brake fluid when installed.



**Brake Fluid:**  
**DOT #3**



## Caliper Reassembly

When assembling the caliper, reverse the disassembly procedure. Note the following points.

1. Install:
  - Brake calipers
  - Brake hoses



### Brake Caliper:

45 Nm (4.5 m•kg, 32 ft•lb)

### Brake Hose:

25 Nm (2.5 m•kg, 18 ft•lb)

2. Bleed the air completely from the brake system.

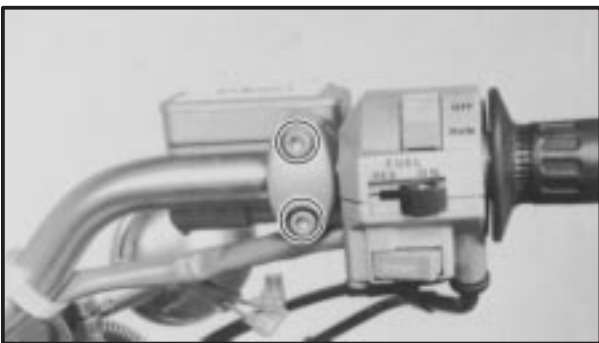
## Master Cylinder Reassembly

When assembling the master cylinder, reverse the disassembly procedure. Note the following points.

1. Install:
  - Master cylinder kit

### WARNING:

Internal parts should be lubricated with brake fluid when installed.



2. Install:
  - Master cylinders (front and rear)
  - Brake hoses



### Front Master Cylinder:

9 Nm (0.9 m•kg, 6.5 ft•lb)

### Rear Master Cylinder:

23 Nm (2.3 m•kg, 17 ft•lb)

### Brake Hose:

25 Nm (2.5 m•kg, 18 ft•lb)

### CAUTION:

When installing the rear brake hose, align the brake pipe ① with the front projection ② on the master cylinder.





3. Fill:
  - Master cylinders



**Brake Fluid:**  
**DOT #3**

4. Bleed the air completely from the brake system.

## AIR BLEEDING

### WARNING:

Bleed the brake system it:

- The system has been disassembled.
- A brake hose has been loosened or removed.
- The brake fluid is very low.
- The brake operation is faulty.

A dangerous loss of braking performance may occur if the brake system is not properly bled.



1. Bleed:
  - Brake fluid

### Air bleeding steps:

- a. Add proper brake fluid to the reservoir.
- b. Install the diaphragm. Be careful not to spill any fluid or allow the reservoir to overflow.
- c. Connect the clear plastic tube ① tightly to the caliper bleed screws.
- d. Place the other end of the tube into a container.
- e. Slowly apply the brake lever or pedal several times.
- f. Pull the lever in or push down on the pedal. Hold the lever or pedal in position.
- g. Loosen the bleed screw and allow the lever or pedal to travel towards its limit.
- h. Tighten the bleed screw when the lever or pedal limit has been reached; then release the lever or pedal.



**Bleed Screw:**  
**6 Nm (0.6 m•kg, 4.3 ft•lb)**

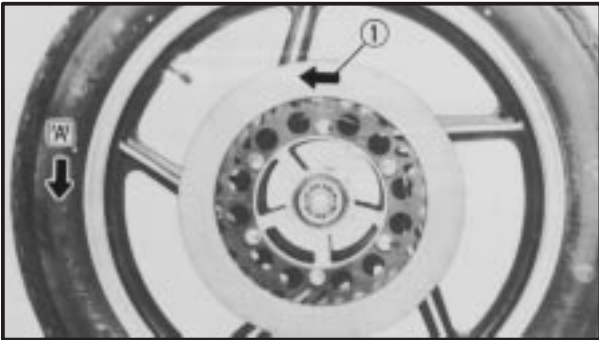
- i Repeat steps (e) to (h) until of the air bubbles have been removed from the system.



## NOTE:

If bleeding is difficult, it may be necessary to let the brake fluid system stabilize for a few hours. Repeat the bleeding procedure when the tiny bubbles in the system have disappeared.

j. Add brake fluid to the level line on the reservoir.



## BRAKE DISC INSTALLATION

### 1. Install:

- Brake disc(s)

### NOTE:

- The brake disc should be installed with the arrow mark ① face outward.
- The arrow mark ① on the disc must point toward the rotating direction **A** of the wheel.

### 2. Tighten:

- Bolts (disc)



### Bolts (Brake Disc):

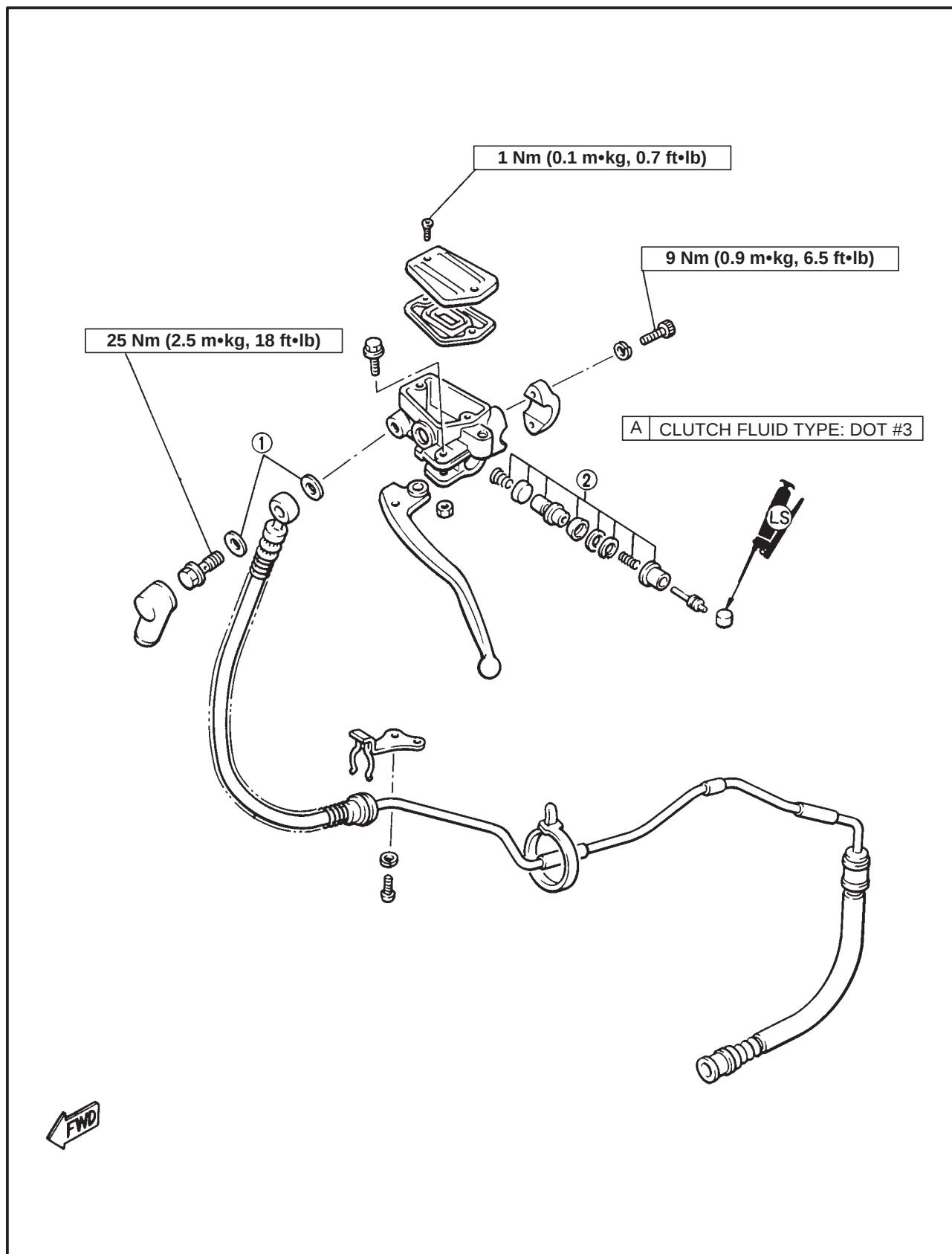
20 Nm (2.0 m•kg, 14 ft•lb)

LOCTITE®



## HYDRAULIC CLUTCH

- ① Copper washer
- ② Master cylinder kit  
(Replace as a set)





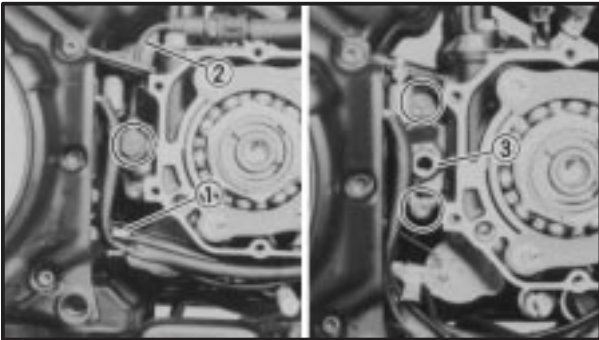
## CLUTCH RELEASE DISASSEMBLY

### 1. Remove:

- Footrest
- Change pedal
- Middle gear case cover

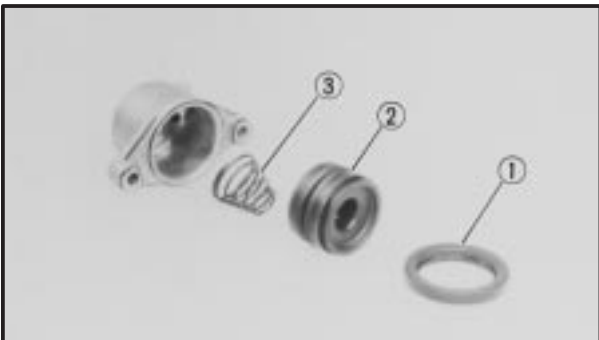
### NOTE:

When removing the middle gear case cover, be sure oil does not leak out of the case.



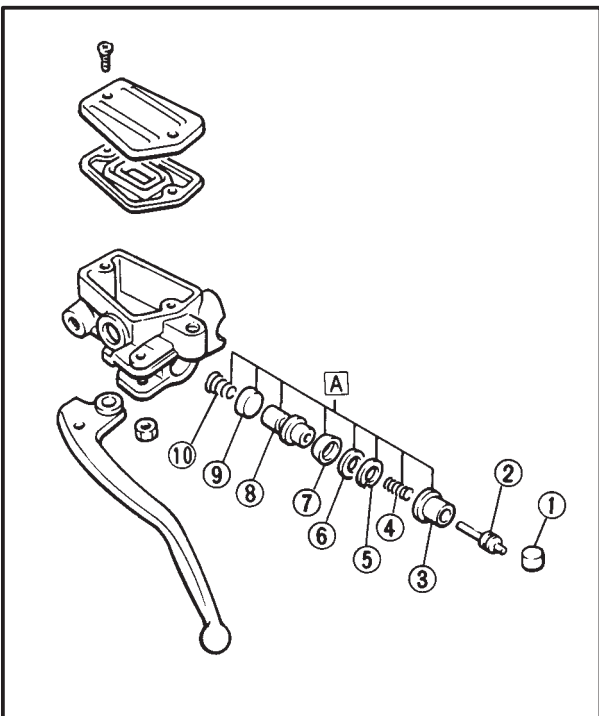
### 2. Remove:

- Clamp ①
- Clutch hose ②
- Drain the fluid.
- Clutch release assembly ③



### 3. Remove:

- Dust seal ①
- Piston assembly ②
- Spring ③

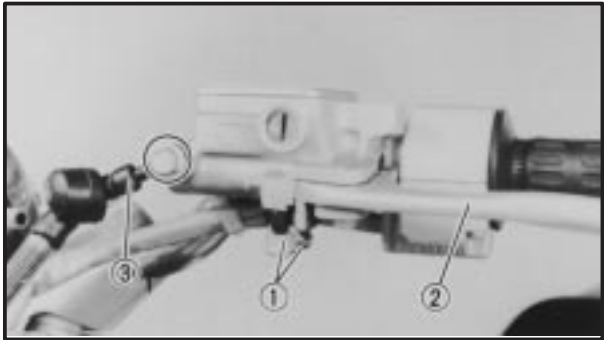


## MASTER CYLINDER DISASSEMBLY

### NOTE:

Drain the clutch fluid before removing master cylinder.

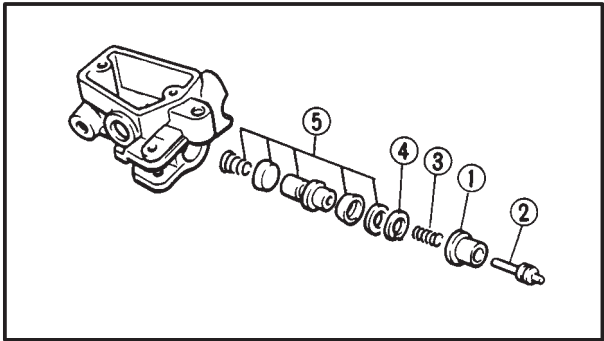
- ① Bush
- ② Push rod
- ③ Dust boot
- ④ Spring
- ⑤ Circlip
- ⑥ Washer
- ⑦ Piston cup
- ⑧ Piston
- ⑨ Seat
- ⑩ Return spring
- [A] Master cylinder kit (Replace as a set)



1. Remove:
- Clutch switch leads ①
  - Clutch lever ②
  - Clutch hose ③
- Drain the fluid.



2. Remove:
- Master cylinder ①
  - Cap ②
- Drain the excess fluid.



3. Remove:
- Dust boot ①
  - Push rod ②
  - Spring ③
  - Circlip ④
  - Master cylinder kit ⑤

CLUTCH INSPECTION AND REPAIR

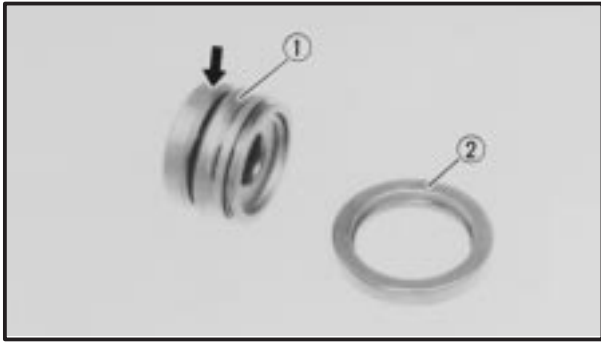
| Recommended Clutch Component Replacement Schedule: |                                          |
|----------------------------------------------------|------------------------------------------|
| Piston seal, dust sel                              | Every two years                          |
| Clutch hoses                                       | Every four years                         |
| Clutch fluid                                       | Replace only when clutch is disassembled |

1. Inspect:
- Cylinder body
- Scratches/Wear → Replace.

**NOTE:** \_\_\_\_\_

Clean all passages with new brake fluid.

- Clutch hoses
- Cracks/Wear/Damage → Replace.



## 2. Inspect:

- Piston ①  
Scratches/Wear → Replace.
- Piston seal ②  
Wear → Replace.

## CLUTCH REASSEMBLY

### WARNING:

- All internal parts should be cleaned in new brake fluid only.
- Internal parts should be lubricated with brake fluid when installed.



**Brake Fluid:**  
DOT #3

### Clutch Release Reassembly

When assembling the clutch release, reverse the disassembly procedure. Note the following points.

#### 1. Install:

- Clutch release assembly
- Clutch hose



**Clutch Release Assembly:**  
12 Nm (1.2 m•kg, 8.7 ft•lb)

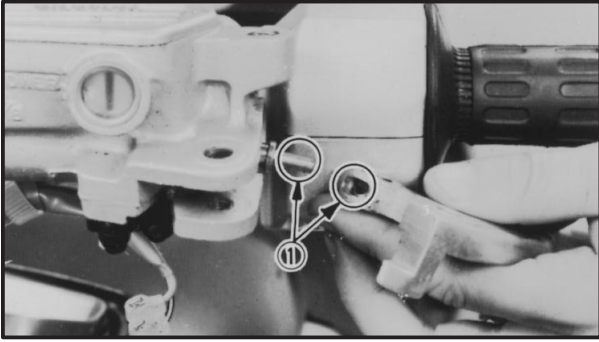
**Clutch Hose:**  
25 Nm (2.5 m•kg, 18 ft•lb)

### Master Cylinder Reassembly

When assembling the master cylinder, reverse the disassembly procedure. Note the following points.

#### 1. Install:

- Master cylinder
- Clutch hose



## Master Cylinder:

9 Nm (0.9 m•kg, 6.5 ft•lb)

## Clutch Hose:

25 Nm (2.5 m•kg, 18 ft•lb)

### 2. Install:

- Push rod
- Lever

### NOTE:

Grease the pivot point ①.

### 3. Fill:

- Master cylinder



## Brake Fluid:

DOT #3

4. Bleed the air completely from the clutch system.

### AIR BLEEDING

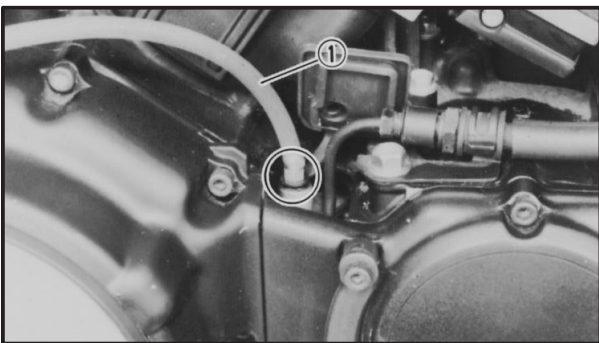
### WARNING:

#### Bleed the clutch system it:

- The system has been disassembled.
- A clutch hose has been loosened or removed.
- The clutch fluid is very low.
- The clutch operation is faulty.

### 1. Bleed:

- Clutch fluid (brake fluid)



#### Air bleeding steps:

- a. Add proper brake fluid to the reservoir.
- b. Install the diaphragm. Be careful not to spill any fluid or allow the reservoir to overflow.
- c. Connect the clear plastic hose ① to the bleed screw.
- d. Place the other end of the tube into a container.
- e. Slowly apply the clutch lever several times.
- f. Pull in the lever and hold it in position.
- g. Loosen the bleed screw and allow the lever to travel slowly toward its limit.
- h. Tighten the bleed screw when the lever has reached its limit, then release the lever.



## Bleed Screw:

6 Nm (0.6 m•kg, 4.3 ft•lb)

## HYDRAULIC CLUTCH

CHAS



- i. Repeat steps (e) to (h) until allow of the air bubbles have been removed from the system.

**NOTE:** \_\_\_\_\_

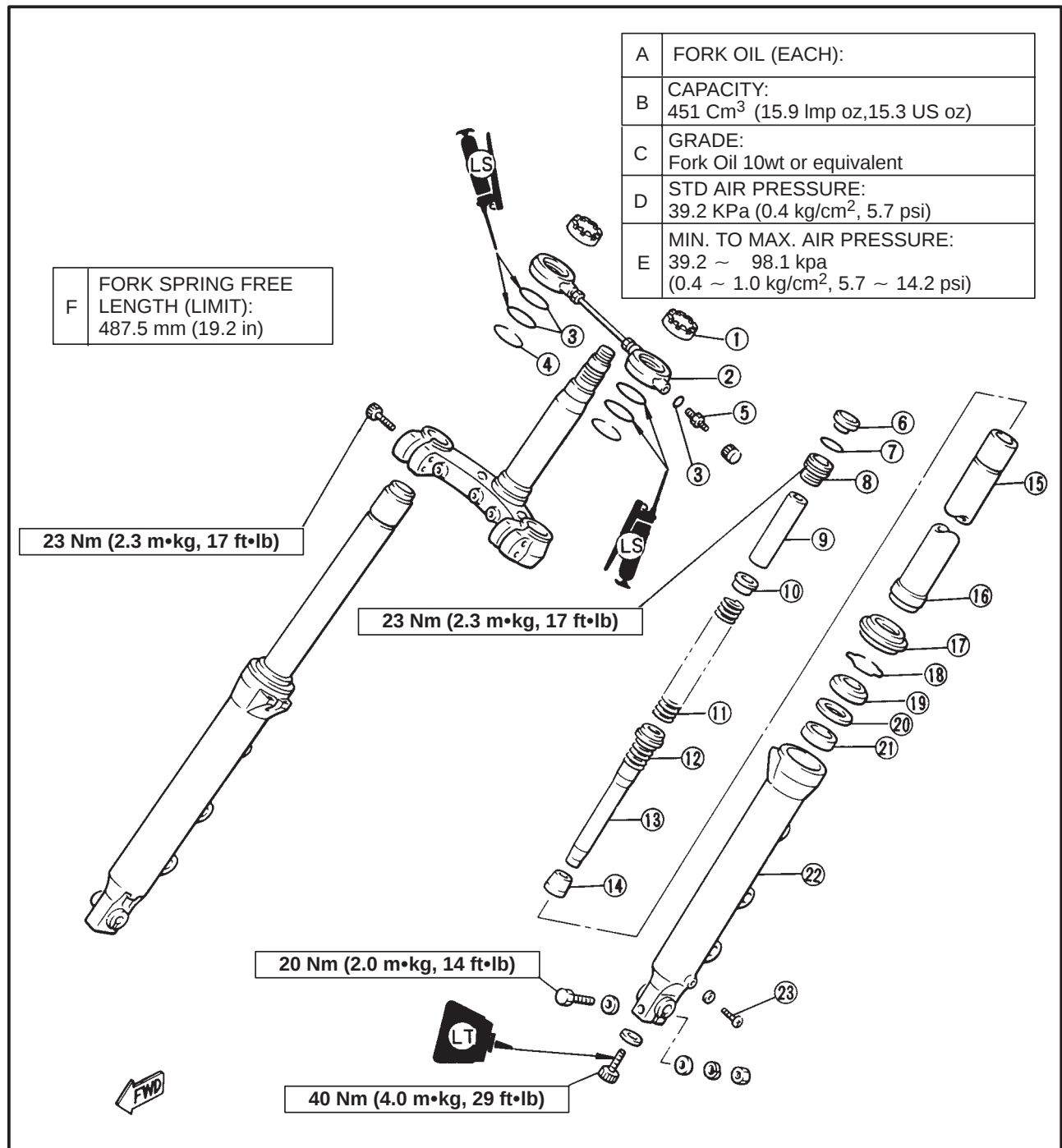
If bleeding is difficult, it may be necessary to let the clutch fluid system stabilize for a few hours. Repeat the bleeding procedure when the tiny bubbles in the system have disappeared.

- j. Add brake fluid to the level line on the reservoir.



### FRONT FORK

- |                  |                     |
|------------------|---------------------|
| ① Damper         | ⑬ Cylinder complete |
| ② Air joint      | ⑭ Oil lock piece    |
| ③ O-ring         | ⑮ Inner fork tube   |
| ④ Circlip        | ⑯ Guide bush        |
| ⑤ Air valve      | ⑰ Dust cover        |
| ⑥ Fork cap       | ⑱ Retaining clip    |
| ⑦ O-ring         | ⑲ Oil seal          |
| ⑧ Cap bolt       | ⑳ Seal spacer       |
| ⑨ Collar         | ㉑ Slide bush        |
| ⑩ Spring seat    | ㉒ Outer fork tube   |
| ⑪ Fork spring    | ㉓ Drain screw       |
| ⑫ Rebound spring |                     |





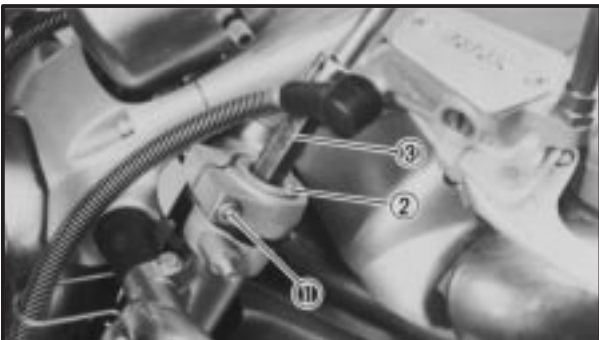
## REMOVAL

### WARNING:

Securely support the motorcycle so it won't fall over when the front wheel and front forks are removed.



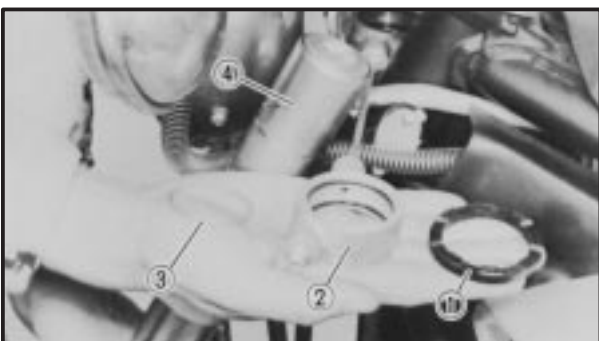
1. Remove:
  - Front wheel  
Refer to "FRONT WHEEL" section.
  - Brake calipers
  - Cable holders
2. Remove:
  - Air valve cap (left)
  - Fork cap ①  
Depress the valve until all of the air has been released.



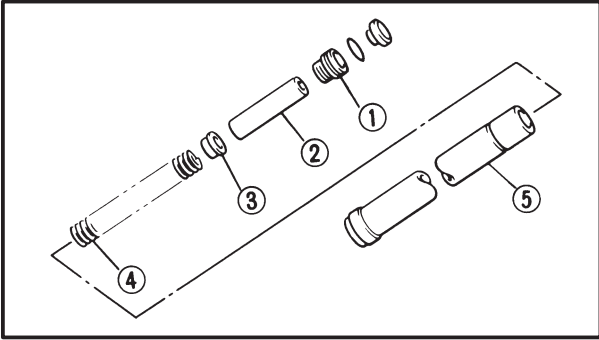
3. Loosen:
  - Pinch bolt (steering crown) ①
  - Cap bolt ②  
Use the Front Fork Cap Socket ③ (90890-01104).



4. Loosen:
  - Pinch bolts (under bracket) ①



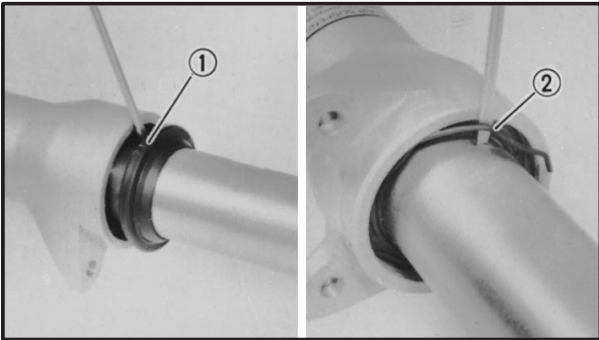
5. Remove:
  - Rubber damper ①
  - Air joint bracket ②
  - Circlip ③
  - Front fork(s) ④



## DISASSEMBLY

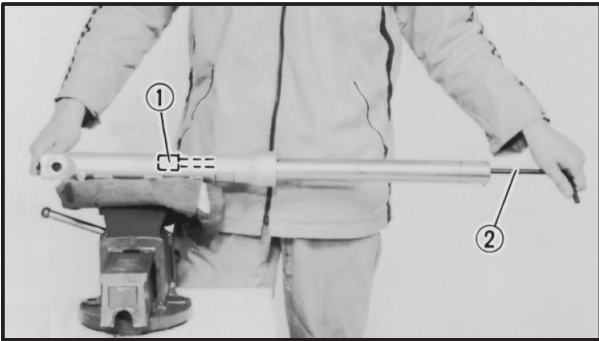
### 1. Remove:

- Cap bolt ①  
Use the Front Fork Cap Socket (90890-01104).
- Collar ②
- Spring seat ③
- Fork spring ④
- ⑤ Inner fork tube



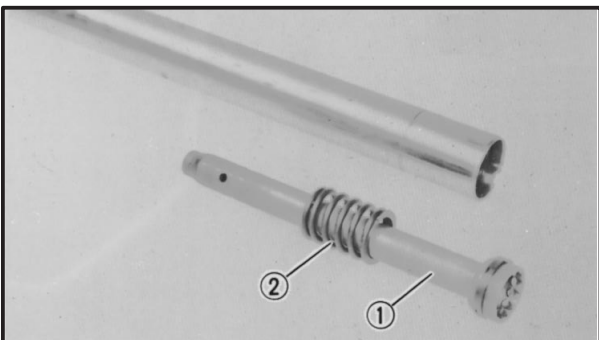
### 2. Remove:

- Dust cover ①
- Retaining clip ②  
Use a thin screwdriver, and be careful not to scratch the inner fork tube.



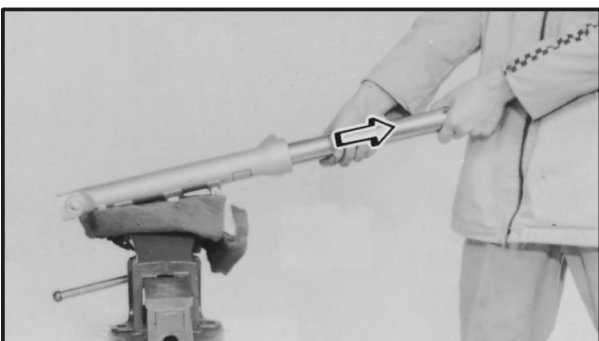
### 3. Remove:

- Bolt (cylinder complete)  
Use the Damper Rod Holder ① (90890-01328) and the T-Handle ② (90890-01326) to lock the damper rod.



### 4. Remove:

- Damper rod (cylinder complete) ①
- Rebound spring ②



### 5. Remove:

- Inner fork tube

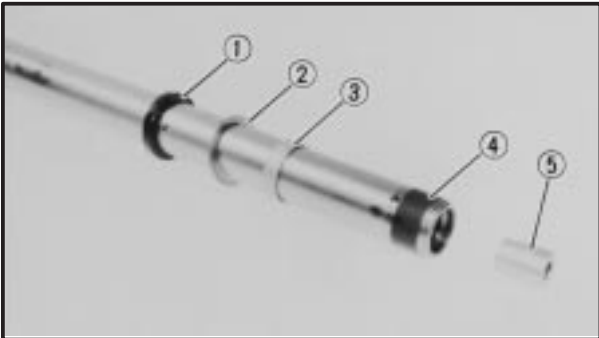
#### Inner fork tube removal steps:

- Hold fork leg horizontally.
- Clamp the caliper mounting boss of the outer tube securely in a vise with soft jaws.
- Pull out the inner fork tube from the outer tube by forcefully, but carefully, with drawing the inner tube.



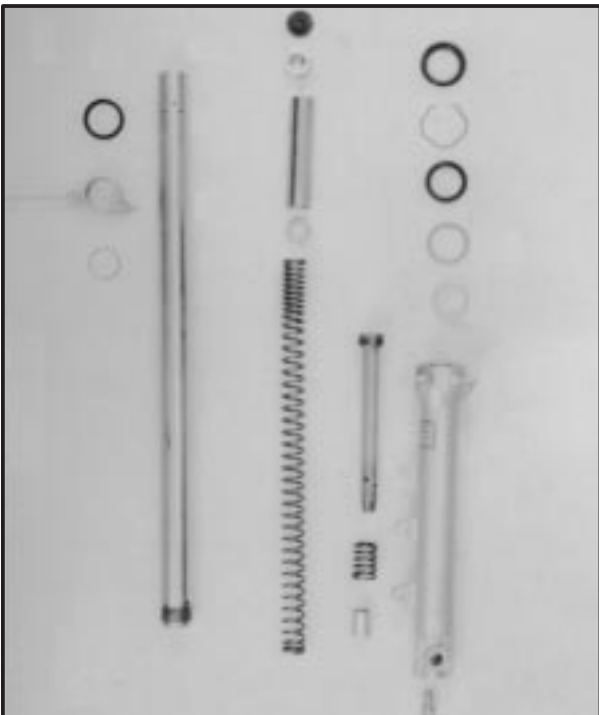
### NOTE:

- Excessive force will damage the oil seal and/or the bushes. Damaged oil seal and bushing must be replaced.
- Avoid bottoming the inner tube in the outer tube during the above procedure, as the oil lock piece will be damaged.



### 6. Remove:

- Oil seal ①
- Seal spacer ②
- Slide bush ③
- Guide bush ④
- Oil lock piece ⑤



### INSPECTION

#### 1. Inspect:

- Inner fork tube  
Scratches/Bends → Replace.

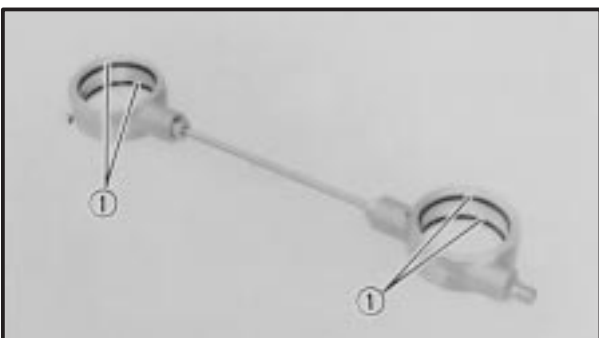
### WARNING:

**Do not attempt to straighten a bent inner fork tube as this may dangerously weaken the tube.**

- Outer fork tube  
Scratches/Bends/Damage → Replace.
- Fork spring  
Over specified limit → Replace.



**Fork Spring Free Length (limit):  
487.5 mm (19.2 in)**



### 2. Inspect:

- Air joint bracket
- Air hose  
Cracks/Damage → Replace.
- O-ring ①  
Damage → Replace.

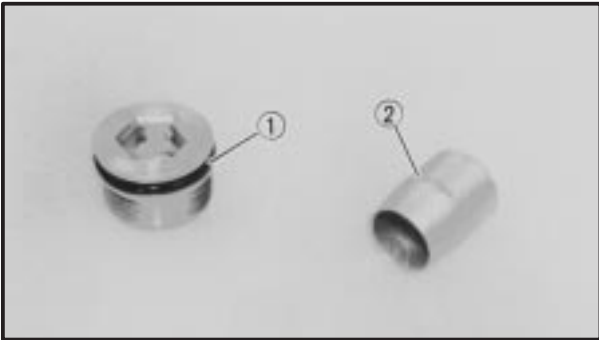


## 3. Inspect:

- Damper rod

Wear/Damage → Replace.

Contamination → Blow out all oil passages with compressed air.



## 4. Inspect:

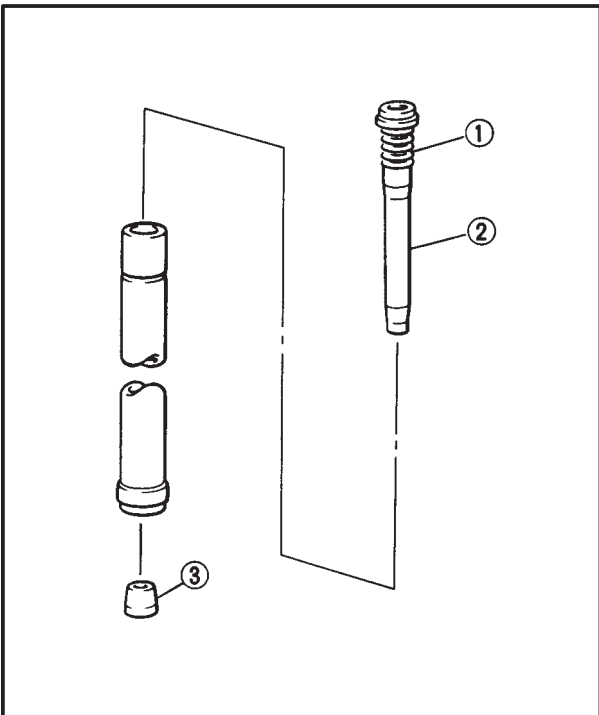
- O-ring (cap bolt) ①

- Oil lock piece ②

Damage → Replace.

- Seals

Wear/Damage → Replace.



## ASSEMBLY

Before assembling, clean and inspect all parts and replace when necessary.

### NOTE:

In front fork assembly, be sure to use following new parts. Do not reuse them.

- Slide bush
- Guide bush
- Oil seal
- Dust seal

## 1. Install:

- Rebound spring ①

- Damper rod ②

Allow the rod to slide slowly down the tube until the it protrudes from the bottom.

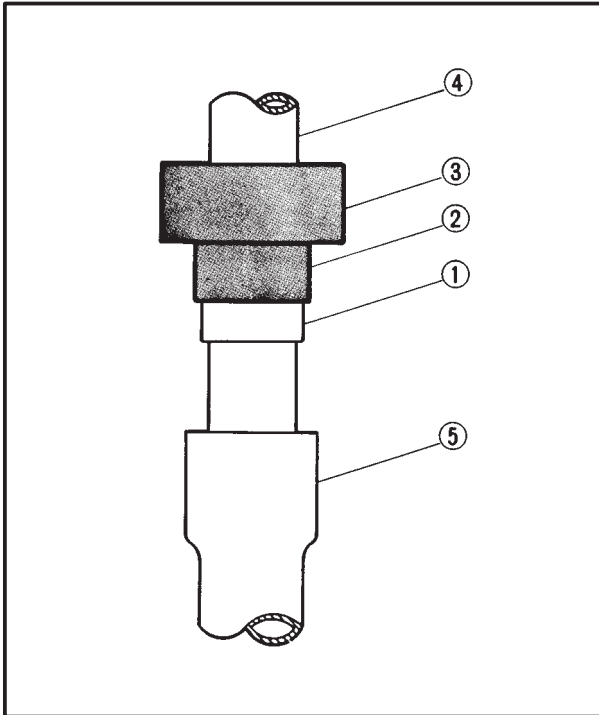
- Oil lock piece ③

Fit oil lock piece over damper rod sticking out of the inner fork tube.

## 2. Install:

- Inner fork tube

Into outer tube.



### 3. Tighten:

- Bolt (cylinder complete)

Use the Damper Rod Holder (90890-01328) and the T-Handle (90890-01326).



### Bolt (Cylinder Complete):

40 Nm (4.0 m•kg, 29 ft•lb)

LOCTITE®

### 4. Install:

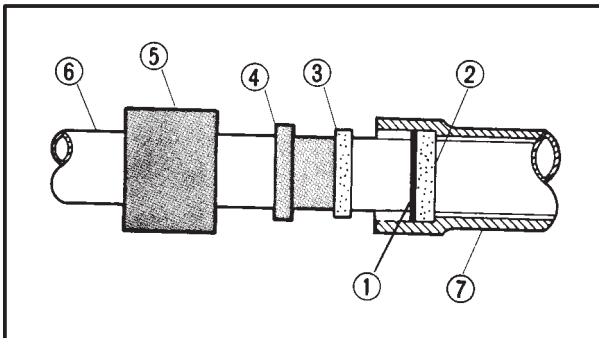
- Slide bush (1)

Into outer tube.

Use the Fork Seal Driver Weight (3) (90890-01367) and the Adapter (2) (90890-01373).

(4) Inner tube

(5) Outer tube



### 5. Install:

- Seal spacer (1)

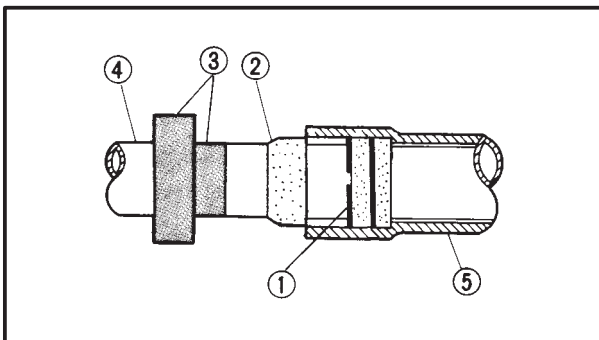
On top of the slide bush (2).

- Oil seal (3)

Use the Fork Seal Driver Weight (5) (90890-01367) and the Adapter (4) (90890-01373), and install with numbered side up.

(6) Inner tube

(7) Outer tube



### 6. Install:

- Retaining clip (1)

- Dust seal (2)

Use the Special Tools (3) (90890-01367, 90890-01373)

(4) Inner tube

(5) Outer tube

### 7. Fill:

- Front fork

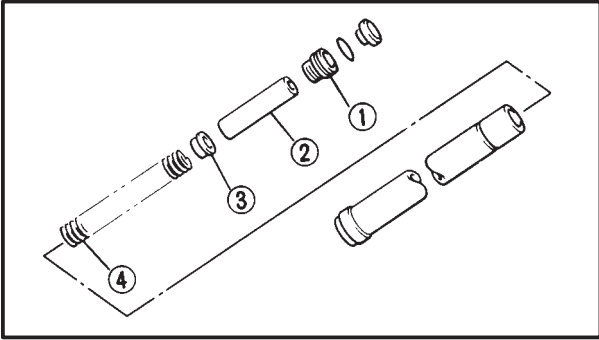


### Each Fork:

451 cm<sup>3</sup> (15.9 Imp oz, 15.3 US oz)

Fork Oil 10 wt or equivalent

After filling, slowly pump the fork up and down to distribute oil.



8. Install:
  - Fork spring ④  
With smaller pitch side up.
  - Spring seat ③
  - Collar ②
  - Cap bolt ①  
Temporarily tighten the cap bolt.

## INSTALLATION

1. Install:
  - Front fork(s)  
Into underbracket.
  - Circlip  
Onto inner tube.  
Apply a light coat of lithium base grease to the O-rings in the air joint bracket.
  - Air joint bracket
  - Rubber damper  
Over inner fork tube.
2. Tighten:
  - Pinch bolts (under bracket)  
Temporarily tighten the pinch bolts.

### NOTE:

Position the inner tube end so that it is flush ① with the top of the steering crown.

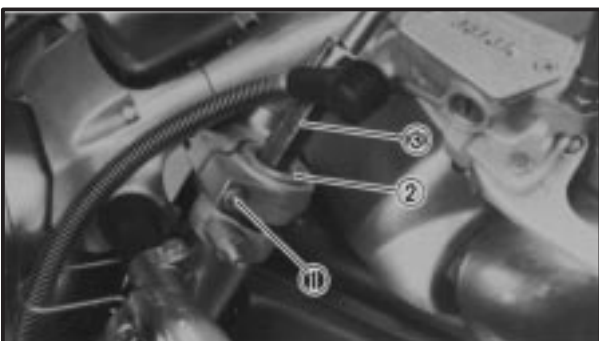
3. Tighten:
  - Pinch bolts (under bracket)



**Pinch Bolts (Under Bracket):**  
23 Nm (2.3 m•kg, 17 ft•lb)

### NOTE:

Do not tighten the pinch bolt (steering crown) in this stage.



4. Tighten:
  - Cap bolt ②  
Use the Front Fork Cap Socket ③ (90890-01104).
  - Pinch bolt (steering crown) ①



**Cap Bolt:**  
23 Nm (2.3 m•kg, 17 ft•lb)  
**Pinch Bolts (Steering Crown):**  
20 Nm (2.0 m•kg, 14 ft•lb)



5. Adjust:

- Front fork air pressure

Refer to "CHAPTER 2. FRONT FORK ADJUSTMENT" section.

6. Install:

- Air valve cap
- Fork cap
- Brake calipers
- Cable holders

Refer to "FRONT AND REAR BRAKE" section.

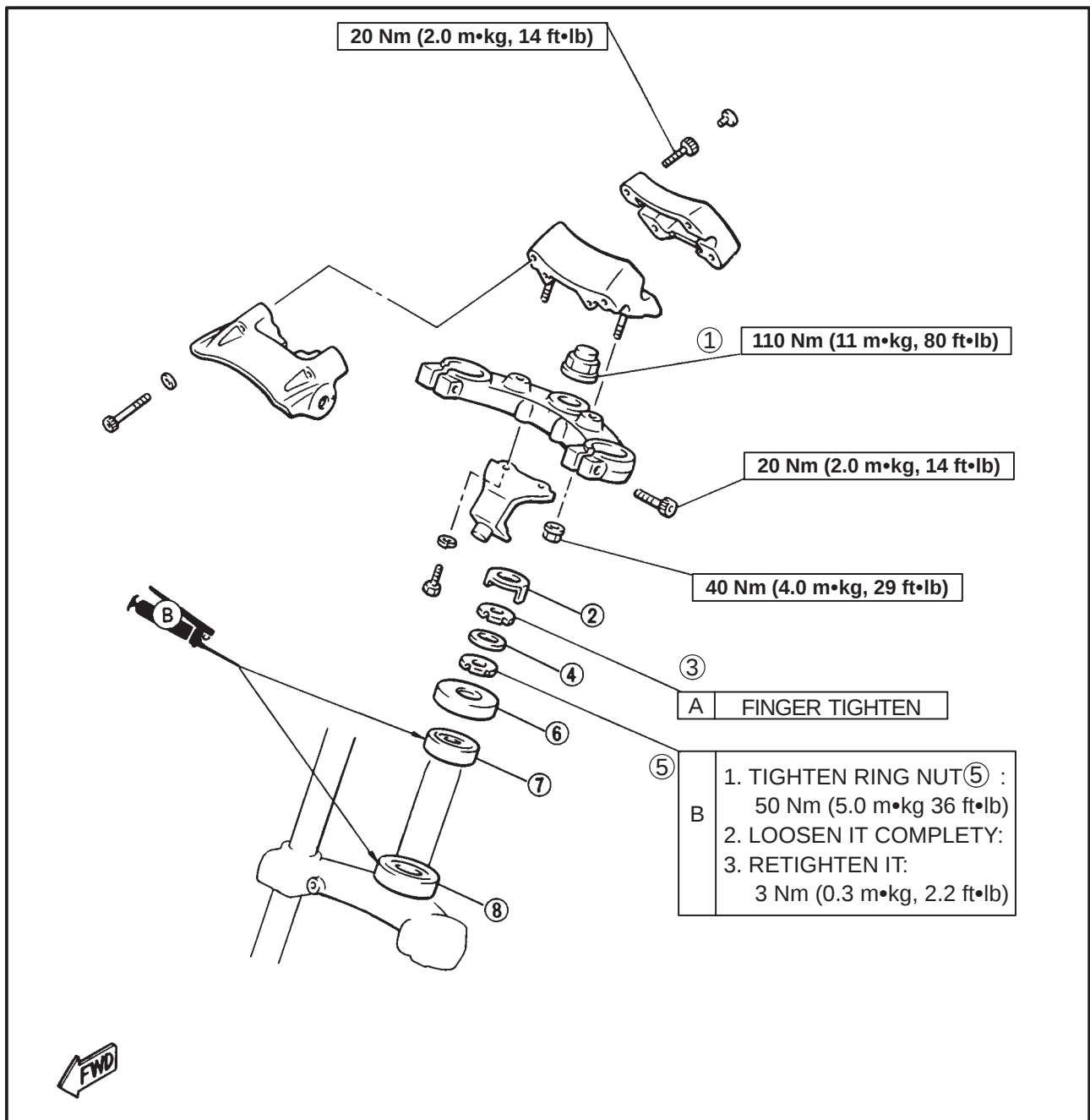
- Front wheel

Refer to "FRONT WHEEL" section.



## STEERING HEAD

- |                     |                    |
|---------------------|--------------------|
| ① Steering stem nut | ⑤ Ring nut (Lower) |
| ② Lock washer       | ⑥ Bearing cover    |
| ③ Ring nut (Upper)  | ⑦ Bearing (Upper)  |
| ④ Washer            | ⑧ Bearing (Lower)  |





## REMOVAL

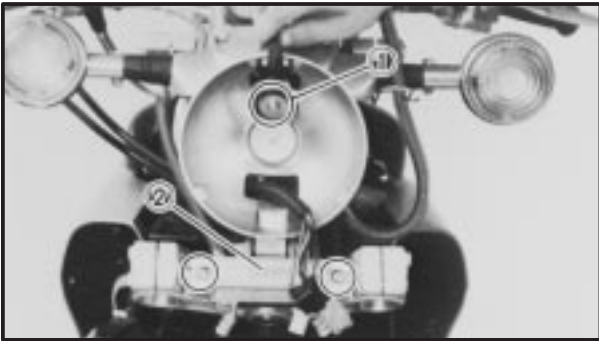
**WARNING:**

Securely support the motorcycle so there is no danger of it falling over.

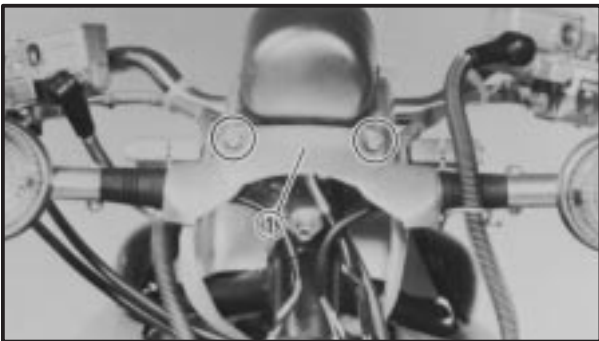
1. Remove:
  - Front wheel
  - Front forks
2. Remove:
  - Headlight lens unit ①
3. Disconnect:
  - All leads (in the headlight body)



4. Remove:
  - Bolt (headlight body bracket) ①
  - Emblem ②

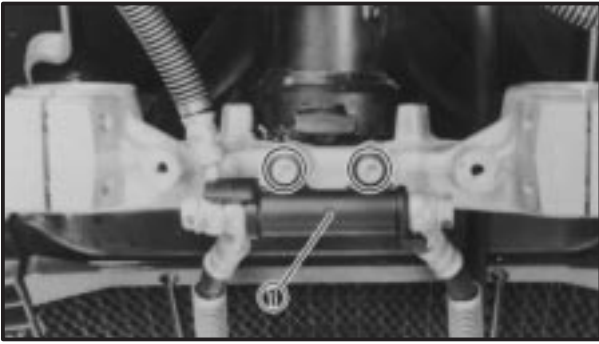


5. Remove:
  - Flasher light bracket assembly ①

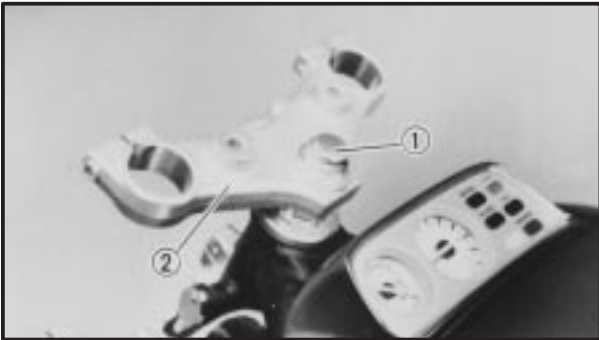


6. Remove:
  - Handlebar holder assembly ①

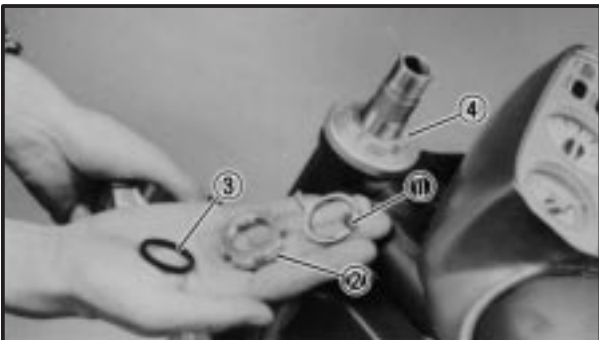




7. Remove:
- Brake hose joint ①



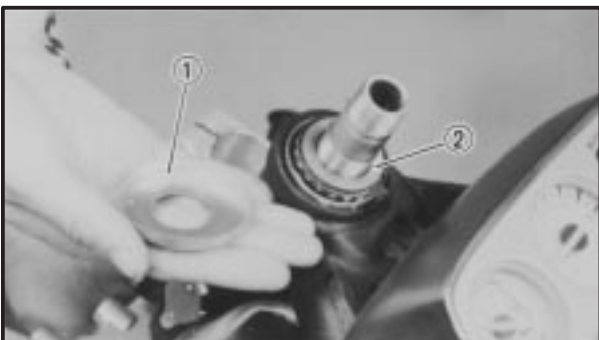
8. Remove:
- Nut (steering crown) ①
  - Steering crown ②



9. Remove:
- Lock washer (ring nut) ①
  - Ring nut (upper) ②
  - Washer ③
  - Ring nut (lower) ④

**WARNING:**

Support the under bracket so that it may not fall down.



10. Remove:
- Steering stem
  - Bearing cover ①
  - Bearing (upper) ②
  - Bearing (lower) ③



**INSPECTION**

1. Wash the bearing in a solvent.
2. Inspect:
  - Bearings
  - Bearing race
  - Pitting/Damage → Replace.

**NOTE:**

Always replace bearing and race as a set.

**INSTALLATION**

1. Lubricate:
  - Bearing and races



**Wheel bearing grease**

2. Install:
  - Bearing (lower) ①
  - Onto steering stem.
  - Steering stem ②

**CAUTION:**

**Hold the steering stem until it is secured.**

- Bearing (upper) ③
  - Ball race cover ④
  - Ring nut (lower) ⑤
3. Tighten:
    - Ring nuts (lower and upper)

**Ring nuts tightening steps:****NOTE:**

Set the Torque Wrench to the Ring Nut Wrench so that they form a right angle.

- Install the ring nut (lower) ⑤.

**NOTE:**

The tapered side of ring nut must face downward.

- Tighten the ring nut ⑤ using the Ring Nut Wrench (90890-01403).



**Ring Nut ⑤ (Initial Tightening):**  
50 Nm (5.0 m•kg, 36 ft•lb)

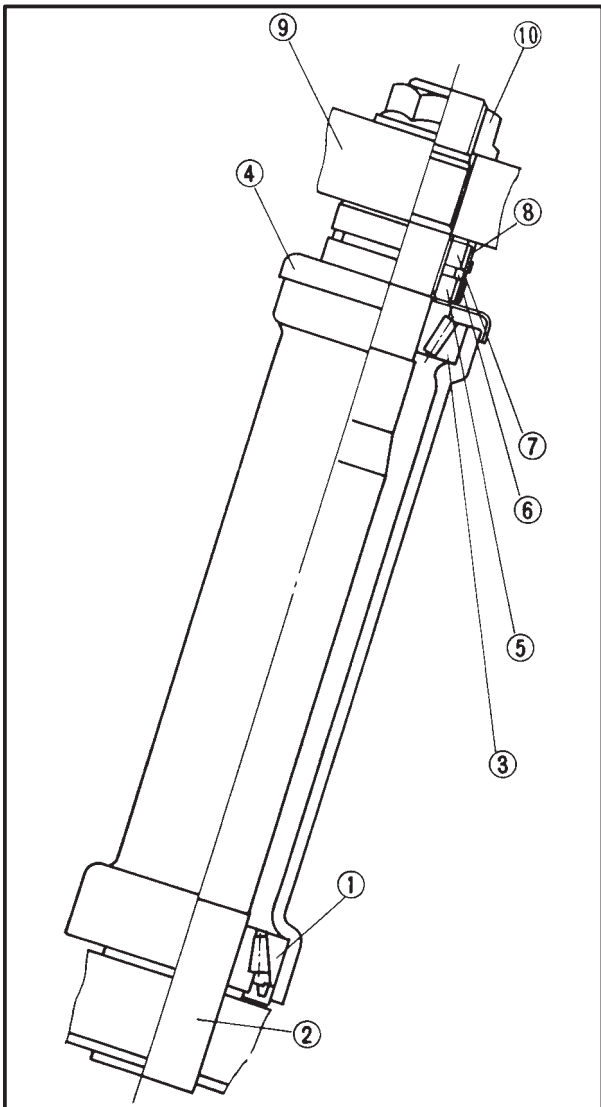
- Loosen the ring nut ⑤ completely and re-tighten it to specification.

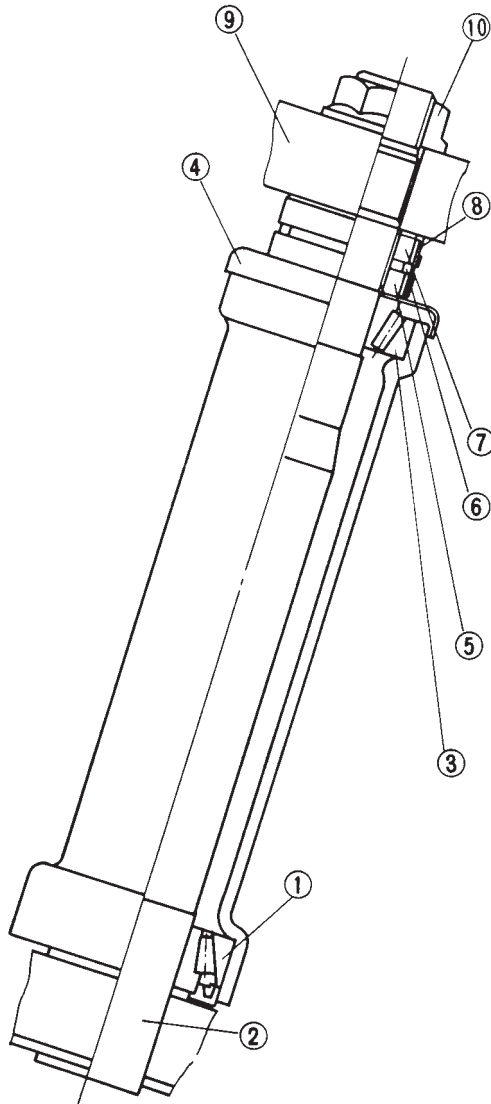
**WARNING:**

**Do not over-tightening.**



**Ring Nut ⑤ (Final Tightening):**  
3 Nm (0.3 m•kg, 2.2 ft•lb)





- Check the steering stem by turning it lock to lock. If there is any binding, remove the steering stem assembly and inspect the steering bearings ①, ③.
- Install the washer ⑥.
- Install the ring nut (upper) ⑦.

**NOTE:**

The tapered side of ring nut must face downward.

- Finger tighten the ring nut ⑦, then align the slots of both ring nuts. If not aligned, hold the lower ring nut ⑤ and tighten the other until they are aligned.
- Install the lock washer ⑧.

**NOTE:**

Make sure the lock washer tab is placed in the slots.

- Install the steering crown ⑨ and tighten the steering stem nut ⑩ to specification.



**Nut (Steering Stem):**  
110 Nm (11.0 m•kg, 80 ft•lb)

- Tighten the pinch bolts to specification.



**Pinch Bolt (Steering Crown):**  
20 Nm (2.0 m•kg, 14 ft•lb)

## 5. Install:

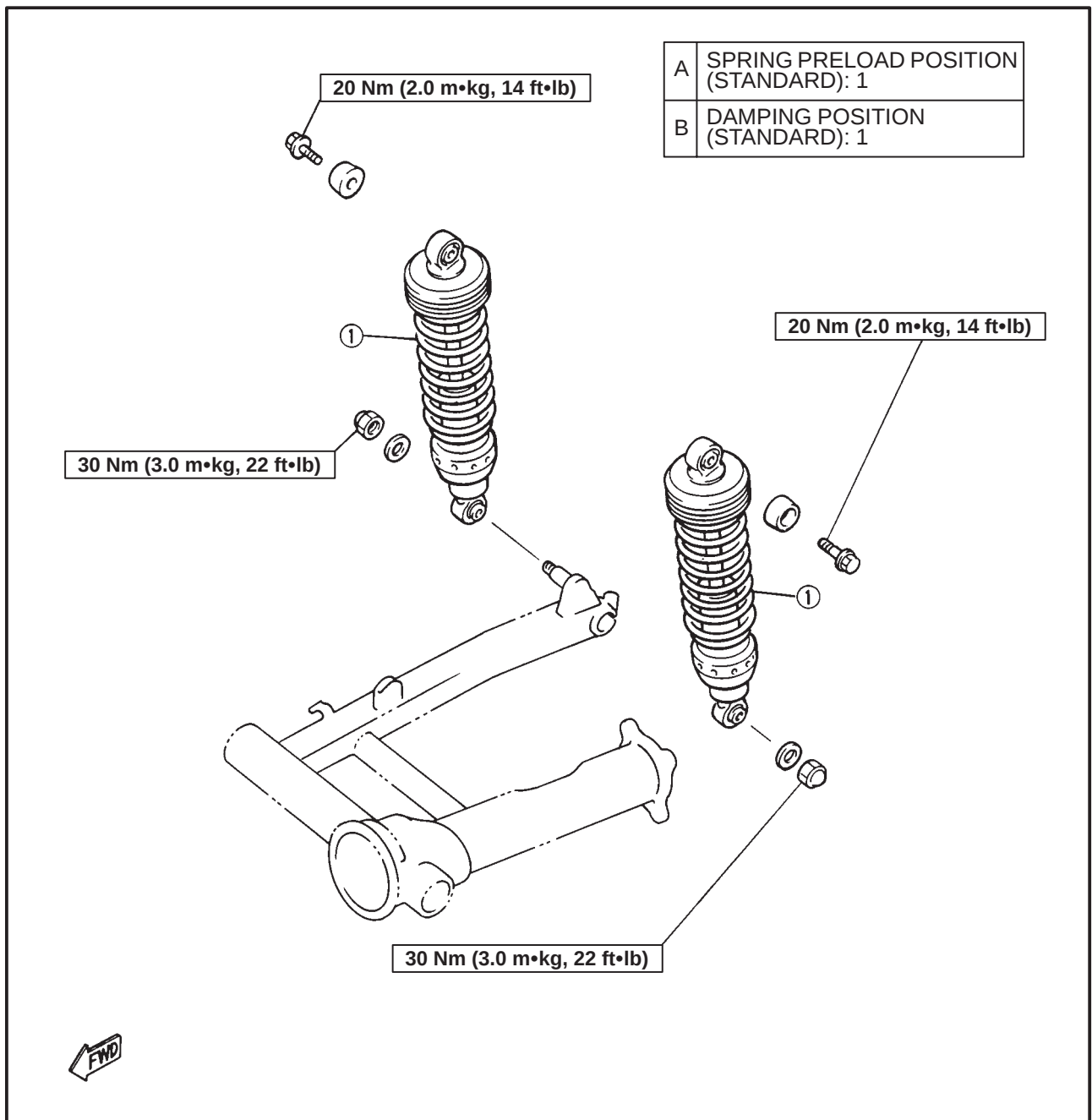
- Components in aforementioned list (steps "7 ~ 1")



**Handlebar Lower Holder:**  
40 Nm (4.0 m•kg, 29 ft•lb)

## REAR SHOCK ABSORBER

① Rear shock absorber assembly





## REMOVAL

### 1. Remove:

- Bolt (shock absorber top) ①
- Special washer ②
- Nut (shock absorber bottom) ③
- Plain washer ④

### 2. Pull out the shock absorber top, and turn the shock absorber clockwise.

### 3. Remove:

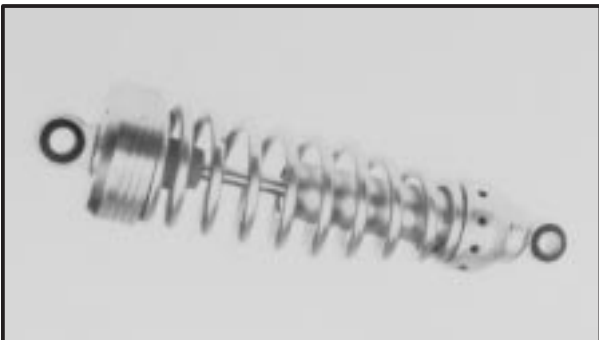
- Rear shock absorber



## INSPECTION

### 1. Inspect:

- Shock absorber rod  
Bends/Damage → Replace the shock absorber assembly.
- Shock absorber  
Oil leaks → Replace the shock absorber assembly.
- Spring  
Fatigue → Replace the shock absorber assembly.  
Move the spring up and down.



## INSTALLATION

When installing the rear shock absorber, reverse the removal procedure. Note the following points.

### 1. Apply:

- Lithium base grease  
To the pivot points.



2. Install:
  - Rear shock absorber

**NOTE:**

The rear shock absorber should be installed so that the damping match mark ① on the shock absorber faces outward ②.

3. Tighten:
  - Bolt (shock absorber top)
  - Nut (shock absorber bottom)



**Bolt (Shock Absorber Top):**  
20 Nm (2.0 m•kg, 14 ft•lb)

**Nut (Shock Absorber Bottom):**  
30 Nm (3.0 m•kg, 22 ft•lb)

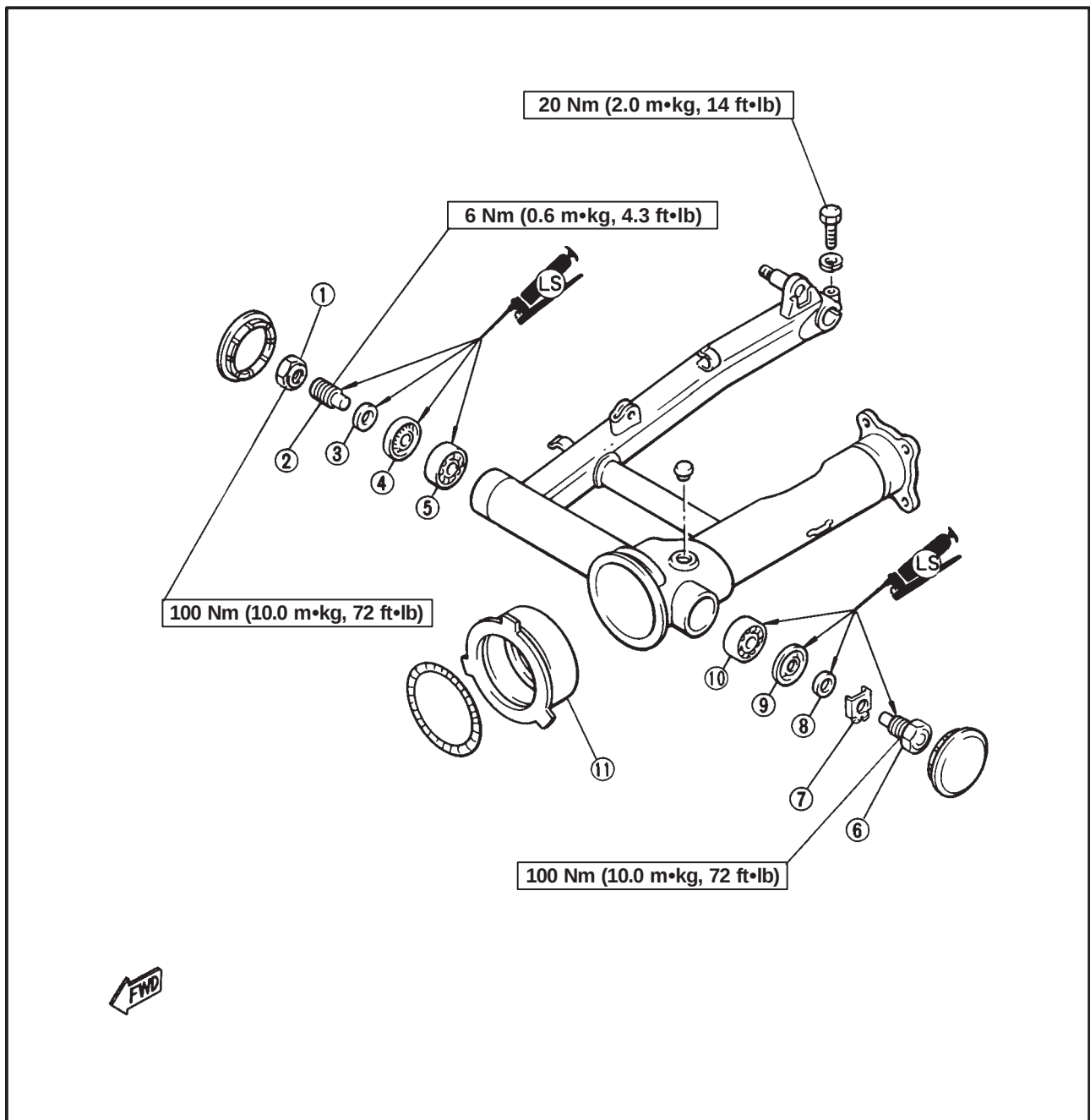
4. Adjust:
  - Spring preload
  - Damping force

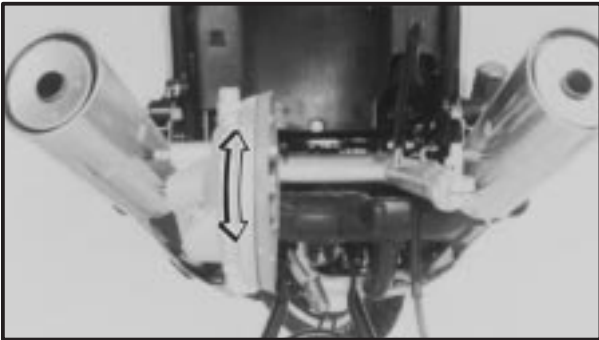
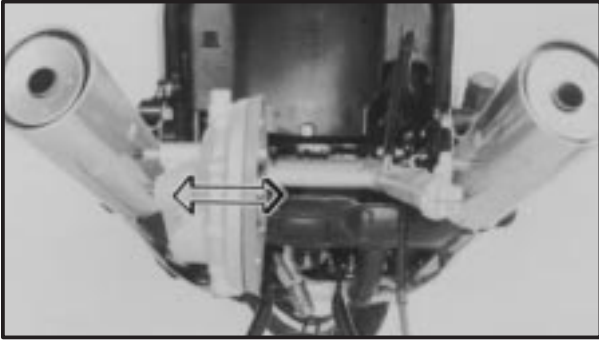
Refer to "CHAPTER 2. REAR SHOCK ABSORBER ADJUSTMENT" section.



## SWINGARM

- ① Locknut
- ② Pivot shaft (right)
- ③ Collar
- ④ Oil seal
- ⑤ Taper roller bearing
- ⑥ Pivot shaft (left)
- ⑦ Lock washer
- ⑧ Collar
- ⑨ Oil seal
- ⑩ Taper roller bearing
- ⑪ Rubber boot



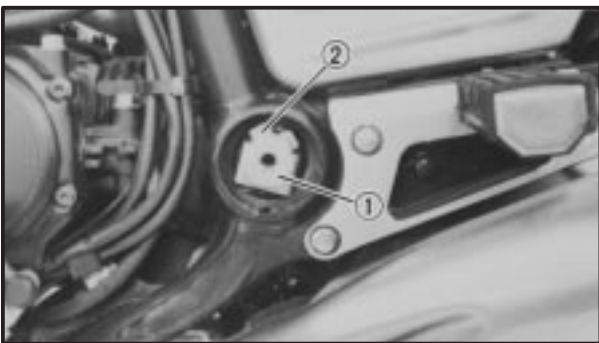


### FREE PLAY INSPECTION

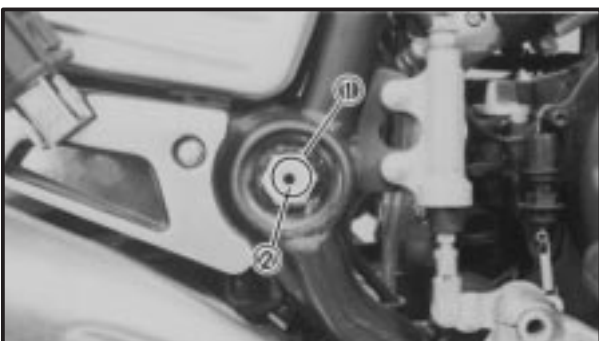
1. Remove:
  - Rear wheel
  - Rear shock absorbers
2. Check:
  - Swingarm (side play)  
Side play → Replace taper roller bearings and collars.  
Move the swingarm from side to side.  
There should be no noticeable side play.
3. Check:
  - Swingarm (vertical movement)  
Tightness/Binding/Rough spots → Replace bearings.  
Move the swingarm up and down.

### REMOVAL

1. Remove:
  - Rear wheel
  - Rear shock absorbers
  - Pivot shaft caps
2. Flatten:
  - Lock washer tab  
Use a blunt chisel.



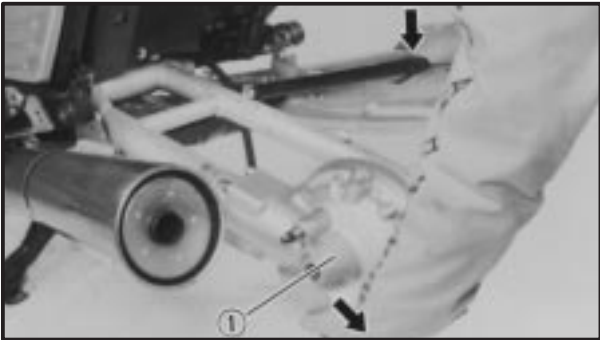
3. Remove:
  - Pivot shaft (left) ①
  - Lock washer ②



4. Remove:
  - Nut ①
  - Pivot shaft (right) ②



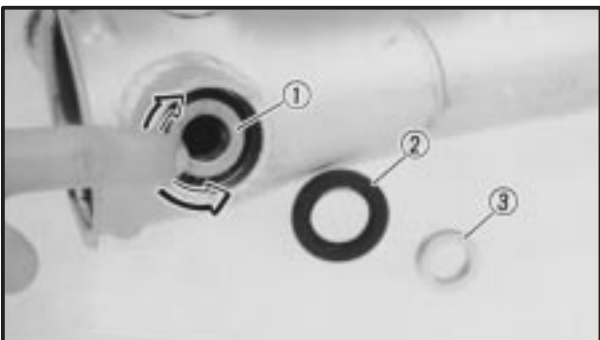
5. Remove:
  - Rubber boot
  - Bolts (muffler) ①



6. Remove:
  - Swingarm ①Push down the muffler.



7. Remove:
  - Final gear assembly



### INSPECTION

1. Wash the bearings in a solvent.
2. Inspect:
  - Bearings (race/rollers) ①  
Pitting/Damage → Replace.
  - Oil seals ②
  - Collars ③  
Damage → Replace.



3. Inspect:
  - Rubber boot  
Damage → Replace.



## INSTALLATION

When installing the swingarm, reverse the removal steps. Note the following points.

### 1. Lubricate:

- Bearing
- Oil seals



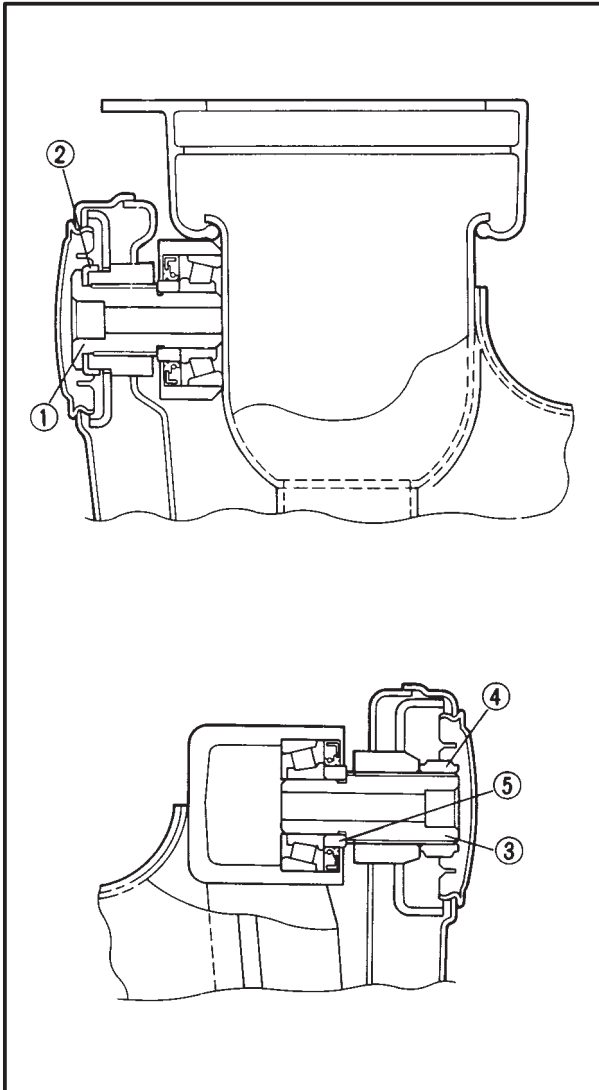
**Lithium Base Waterproof Wheel Bearing Grease**

### 2. Install:

- Swingarm
- Pivot shafts

### 3. Tighten:

- Pivot shafts



### Pivot shaft tightening steps:

- Tighten the pivot shaft (left) ① to specification.



**Pivot Shaft (Left):**  
**100 Nm (10.0 m•kg, 72 ft•lb)**

- Tighten the pivot shaft (right) ③ until it contacts the collar ⑤.



**Pivot Shaft (Right):**  
**6 Nm (0.6 m•kg, 4.3 ft•lb)**

- Tighten nut (right pivot shaft) ④ to specification.



**Nut (Right Pivot Shaft):**  
**100 Nm (10.0 m•kg, 72 ft•lb)**

- Bend the lock washer tab ② along the nut flat.

### 4. Apply:

- Yamaha Bond No.1215 (90890-85505)

To the mating surfaces of both case halves.

### 5. Install:

- Final gear assembly



**Nuts (Final Gear Case):**  
**42 Nm (4.2 m•kg, 30 ft•lb)**

### 6. Check:

- Swingarm (side play)
- Swingarm (vertical movement)

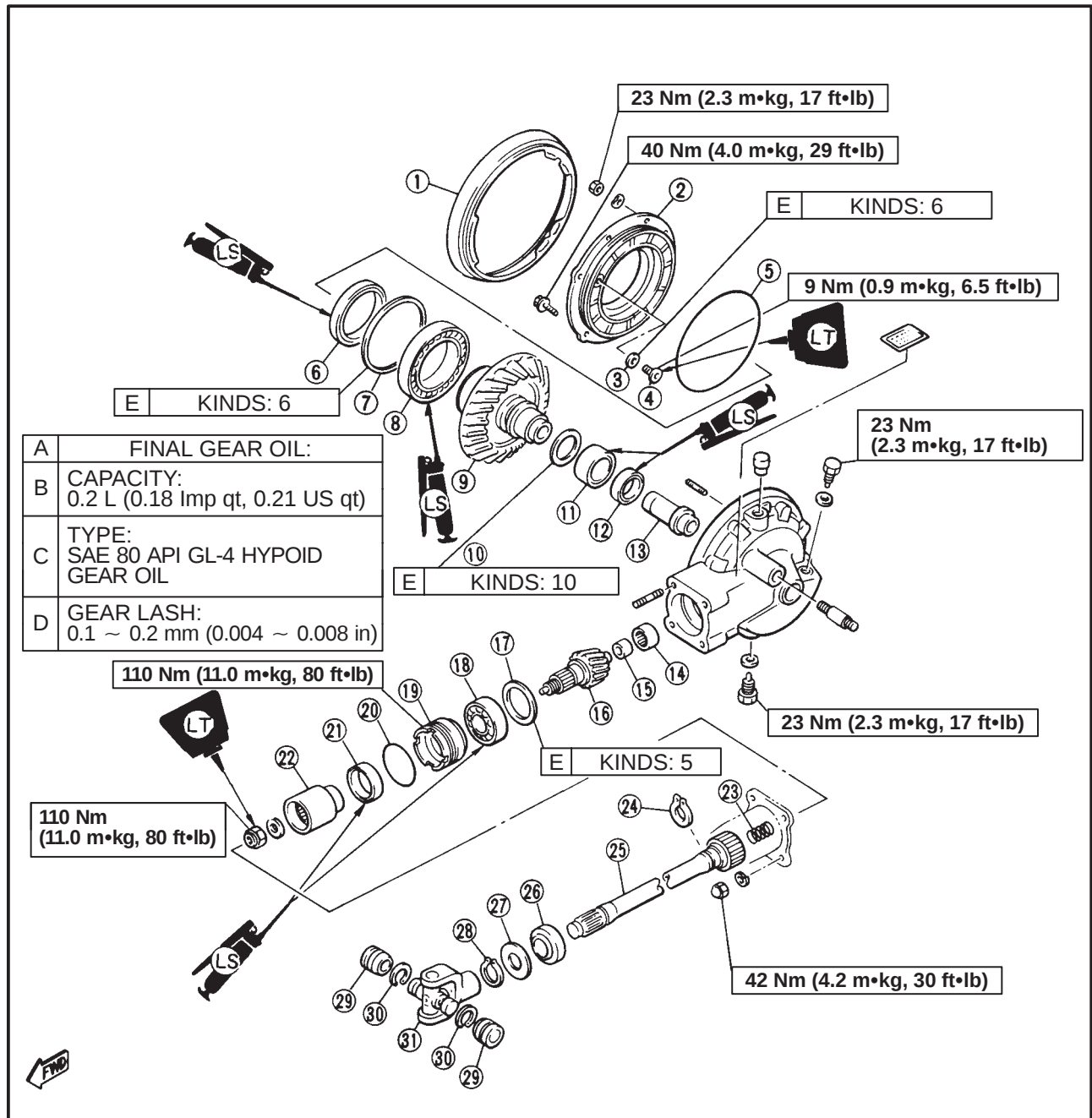
Refer to "FREE PLAY INSPECTION" section.





### SHAFT DRIVE

- |                          |                         |                    |
|--------------------------|-------------------------|--------------------|
| ① Dust cover             | ⑮ Bearing               | ②⑨ Bearing         |
| ② Bearing housing        | ⑯ Drive pinion gear     | ③⑩ Circlip         |
| ③ Ring gear stopper shim | ⑰ Final drive gear shim | ③① Universal joint |
| ④ Ring gear stopper      | ⑱ Bearing               |                    |
| ⑤ O-ring                 | ⑲ Bearing retainer      |                    |
| ⑥ Oil seal               | ⑳ O-ring                |                    |
| ⑦ Ring gear shim         | ㉑ Oil seal              |                    |
| ⑧ Bearing                | ㉒ Coupling gear         |                    |
| ⑨ Ring gear              | ㉓ Spring                |                    |
| ⑩ Thrust washer          | ㉔ Circlip               |                    |
| ⑪ Bearing                | ㉕ Drive shaft           |                    |
| ⑫ Oil seal               | ㉖ Oil seal              |                    |
| ⑬ Collar                 | ㉗ Washer                |                    |
| ⑭ Bearing                | ㉘ Circlip               |                    |



**TROUBLESHOOTING**

The following conditions may indicate damaged shaft drive components:

| A  | Symptoms                                                                                                                                                                            | B  | Possible Causes                                   |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---------------------------------------------------|
| 1. | A pronounced hesitation or “jerky” movement during acceleration, deceleration, or sustained speed. (This must not be confused with engine surging or transmission characteristics.) | A. | Bearing damage.                                   |
| 2. | A “rolling rumble” noticeable at low speed; a high-pitched whine; a “clunk” from a shaft drive component or area.                                                                   | B. | Improper gear lash.                               |
| 3. | A locked-up condition of the shaft drive mechanism; no power transmitted from engine to rear wheel.                                                                                 | C. | Gear tooth damage.                                |
|    |                                                                                                                                                                                     | D. | Broken drive shaft.                               |
|    |                                                                                                                                                                                     | E. | Broken gear teeth.                                |
|    |                                                                                                                                                                                     | F. | Seizure due to lack of lubrication.               |
|    |                                                                                                                                                                                     | G. | Small foreign object lodged between moving parts. |

**NOTE:**

Areas A, B, and C above may be extremely difficult to diagnose. The symptoms are quite subtle and difficult to distinguish from normal motorcycle operating noise. If there is reason to believe these components are damaged, remove the components for specific inspection.

**Inspection Notes**

## 1. Investigate any unusual noises

**The following “Noises” may indicate a mechanical defect:**

a. A “rolling rumble” noise during coasting, acceleration, or deceleration. The noise increases with rear wheel speed, but it does not increase with higher engine or transmission speeds.

Diagnosis: Possible wheel bearing damage.

b. A “whining” noise that varies with acceleration and deceleration.

Diagnosis: Possible incorrect reassembly, too-little gear lash.

**CAUTION:**

**Too-little gear lash is extremely destructive to the gear teeth. If a test ride following reassembly indicates this condition, stop riding immediately to minimize gear damage.**

c. A slight “thunk” evident at low speed operation. This noise must be distinguished from normal motorcycle operation.

Diagnosis: Possible broken gear teeth.

**WARNING:**

**Stop riding immediately if broken gear teeth are suspected. This condition could result in a locking-up of the shaft drive assembly, causing loss of control of the bike and possible injury to the rider.**

## 2. Inspect:

- Drained oil

Drain plug shows large amount of metal.

Particles → Check bearing for seizure.

**NOTE:**

A small amount of metal particles in the oil is normal.



3. Inspect:
- Oil leakage

**Oil leakage inspection steps:**

- Clean the entire motorcycle thoroughly, then dry it.
- Apply a leak-localizing compound or dry powder spray to the shaft drive.
- Road test the motorcycle for the distance necessary to locate the leak.

Leakage →

Inspect component housing, gasket, and/or seal for damage.

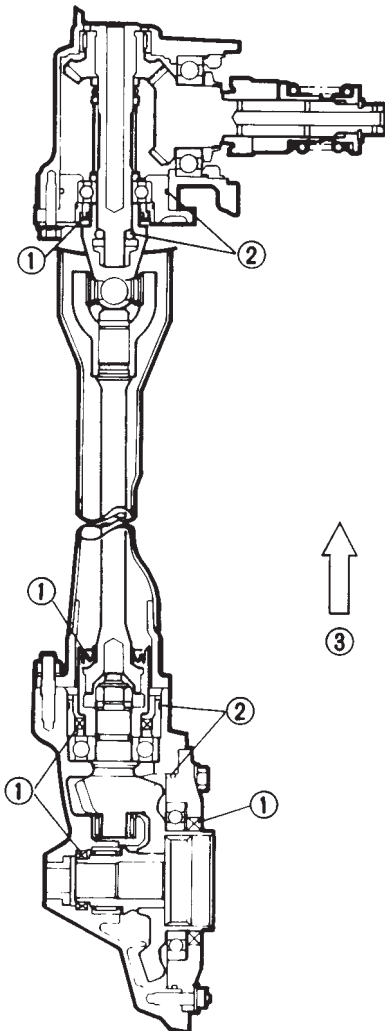
Damage →

Replace component.

- ① Oil seal
- ② O-ring
- ③ Forward

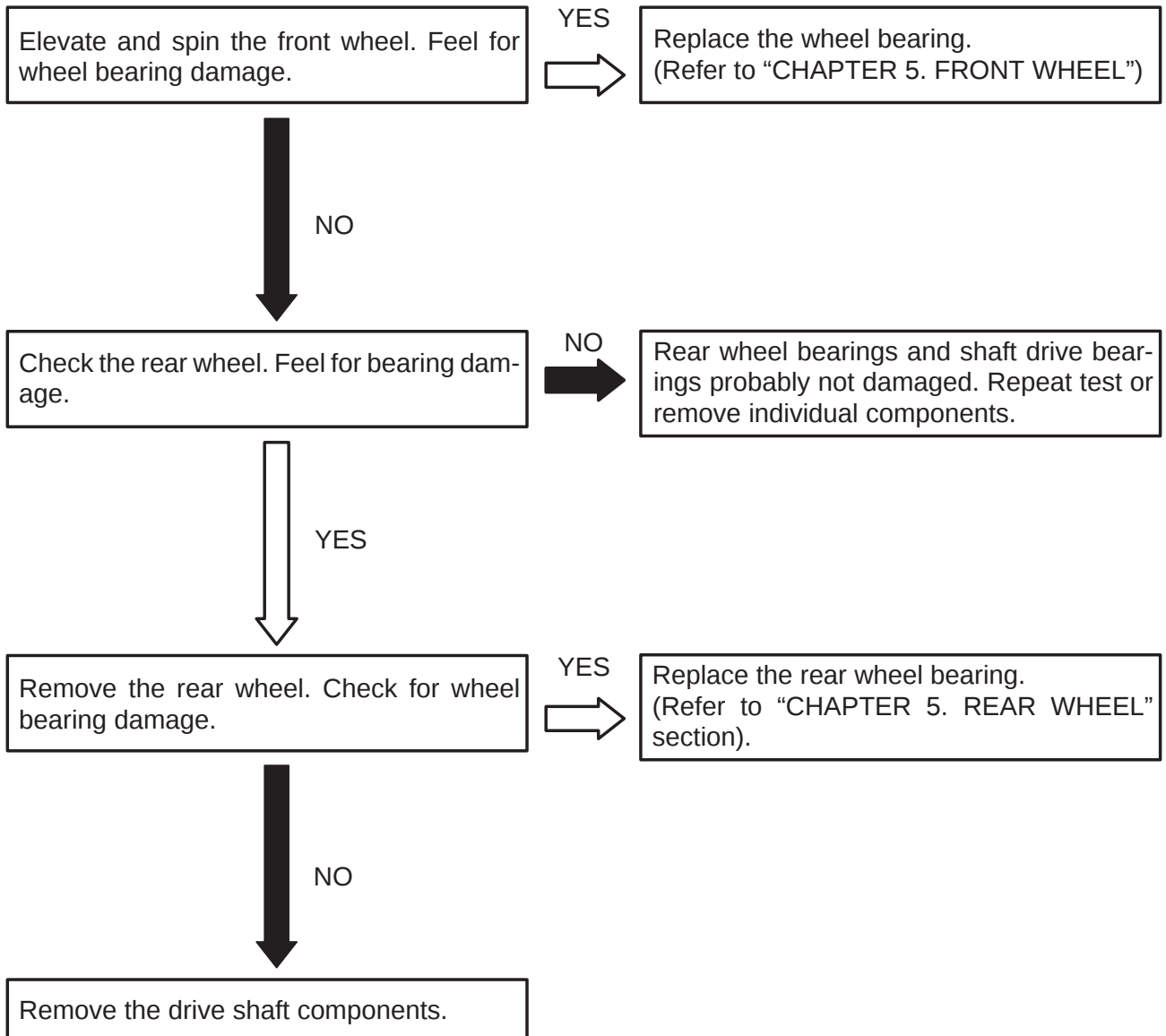
**NOTE:**

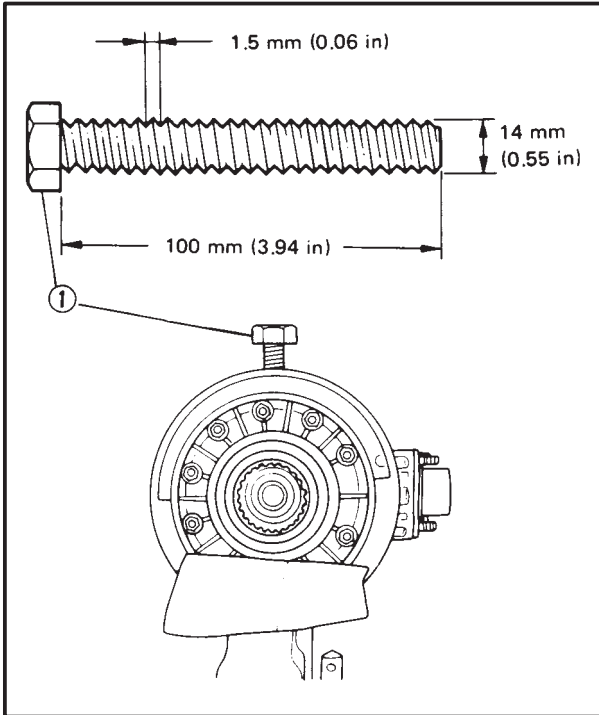
- An apparent oil leak on a new or nearly new motorcycle may be the result of a rest-preventative coating or excessive seal lubrication.
- Always clean the motorcycle and recheck the suspected location of an apparent leakage.



**Troubleshooting Chart**

When basic conditions “a” and “b” above exist, check the following points:





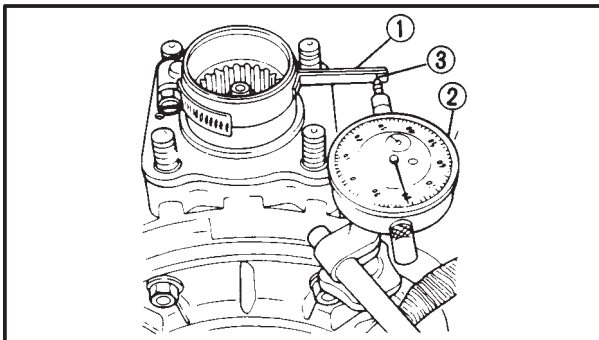
### FINAL DRIVE GEAR

#### Gear Lash Measurement

1. Secure the gear case in a vise or other support.
2. Remove:
  - Drain plug
  - Drain the oil.
3. Install:
  - A bolt of the specified size ①
  - Into the drain plug hole.
4. Finger tighten the bolt until it holds the ring gear.

#### NOTE:

Do not over tighten the bolt; finger-tight is sufficient.



5. Attach:

- Gear Lash Measurement Tool ① (90890-01230)
- Dial Gauge ② (90890-03097)

- ③ Position mark

6. Measure:

- Gear lash
- Gently rotate the gear coupling from engagement to engagement.
- Over specified limit → Adjust.

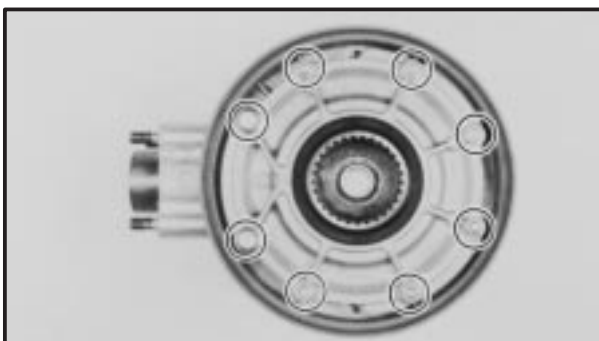


#### Final Gear Lash:

0.10 ~ 0.20 mm  
(0.004 ~ 0.008 in)

#### NOTE:

Measure the gear lash at 4 positions., Rotate the shaft 90° each time.



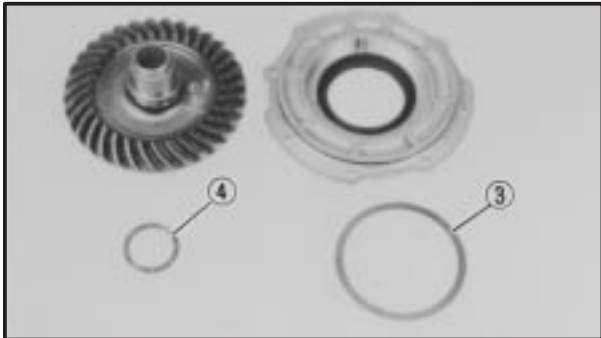
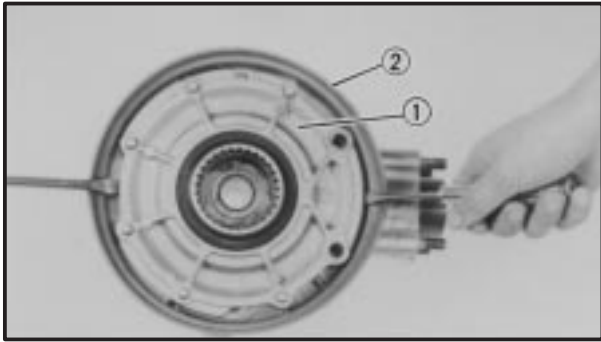
### Gear Lash Adjustment

1. Remove:

- Nuts (bearing housing)
- Bolts (bearing housing)

#### NOTE:

Working in a crisscross pattern, loosen nut 1/4 turn each. Remove them after all are loosened.



## 2. Remove:

- Bearing housing ①
- Dust cover ②
- Ring gear
- Shim(s) ③
- Thrust washer ④

## 3. Adjust:

- Gear lash

**Gear lash adjustment steps:**

- Select the suitable shims and thrust washer by the following chart.

**Too-little gear lash → Reduce shim thickness.**

**Too-large gear lash → Increase shim thickness.**

**To Add or Reduce Ring Gear Shim Thickness**

Increase by more than 0.1 mm (0.004 in)

Reduce by more than 0.1 mm (0.004 in)

Reduce thrust washer thickness by 0.1 mm (0.004 in) for every 0.1 mm of ring gear shim increase.

Reverse procedure

**Ring Gear Shim**

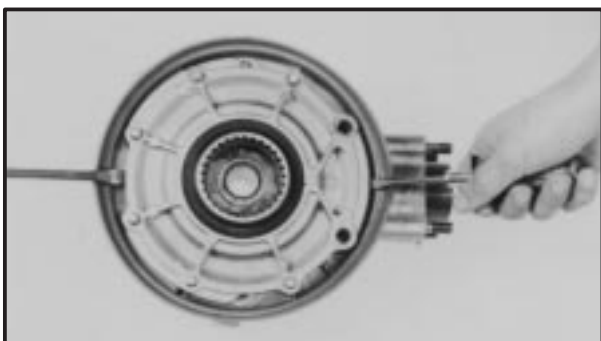
Thickness (mm)

0.25 0.30 0.35  
0.40 0.45 0.50

**Thrust Washer**

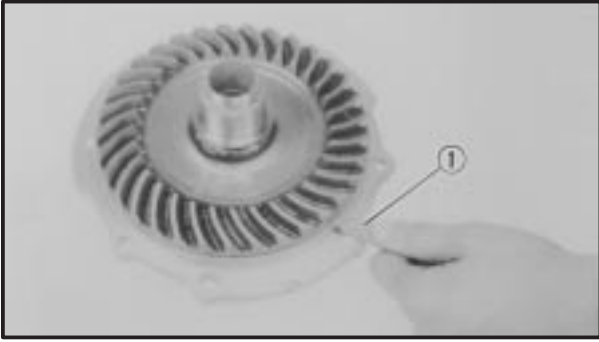
Thickness (mm)

1.4 1.5 1.6  
1.7 1.8 1.9  
2.0 2.1 2.2  
2.3

**Ring Gear Stopper Clearance Measurement**

## 1. Remove:

- Bearing housing with ring gear  
Refer to "Gear Lash Adjustment" section.



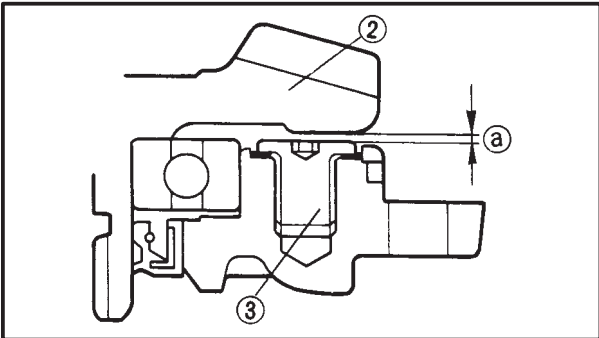
## 2. Measure:

- Ring gear stopper clearance (a)  
Use the Feeler Gauge (1).  
Out of specification → Adjust.

**Ring Gear Stopper Clearance (a):****0.30 ~ 0.60 mm (0.012 ~ 0.024 in)**

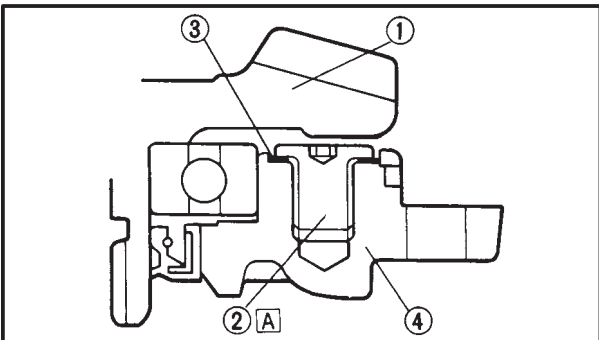
② Ring gear stopper

③ Ring gear



## 3. Install:

- Bearing housing with ring gear

**Ring Gear Stopper Clearance Adjustment**

## 1. Remove:

- Ring gear (1)
- Ring gear stopper (2)
- Shim(s) (3)

④ Bearing housing

[A] Left-hand-threads

## 2. Select:

- Suitable shim(s)  
By the following chart.

**Shim**

| Thickness (mm) | 0.10 | 0.15 |
|----------------|------|------|
|                | 0.20 | 0.30 |
|                | 0.40 | 0.50 |
|                |      |      |

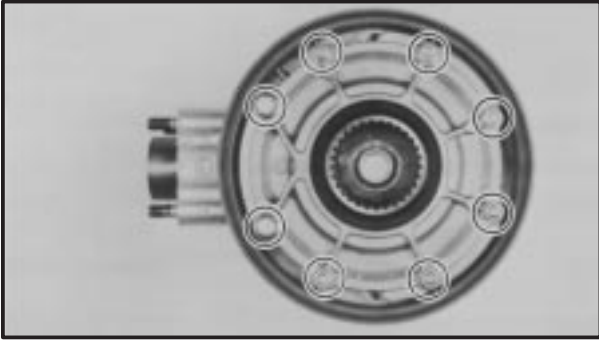
## 3. Install:

- Components in above list (step "1")

**Ring Gear Stopper:****9 Nm (0.9 m•kg, 6.5 ft•lb)****LOCTITE®**

## 4. Measure:

- Ring gear stopper clearance



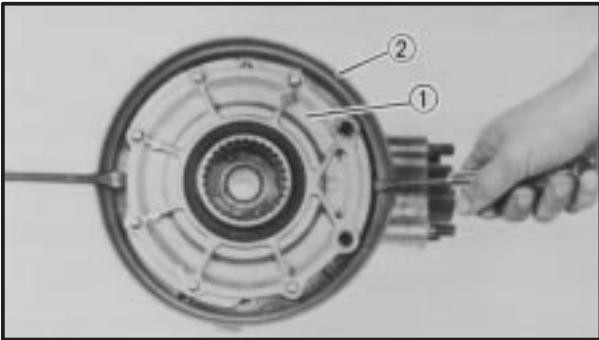
### Final Drive Gear Disassembly

#### 1. Remove:

- Nuts (bearing housing)
- Bolts (bearing housing)

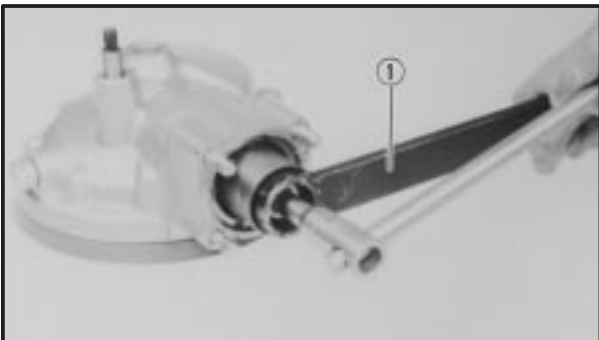
#### NOTE:

Working in a crisscross pattern, loosen nut 1/4 turn each. Remove them after all loosened.



#### 2. Remove:

- Bearing housing ①
- Dust cover ②
- Shim(s)
- Thrust washer



#### 3. Remove:

- Self-locking nut (coupling gear)  
Use a Final Drive Shaft Holder ① (90890-01229).
- Coupling gear



#### 4. Remove:

- Bearing retainer (final drive shaft)  
Use a Final Drive Shaft Bearing Retainer ① (90890-04050).

### CAUTION:

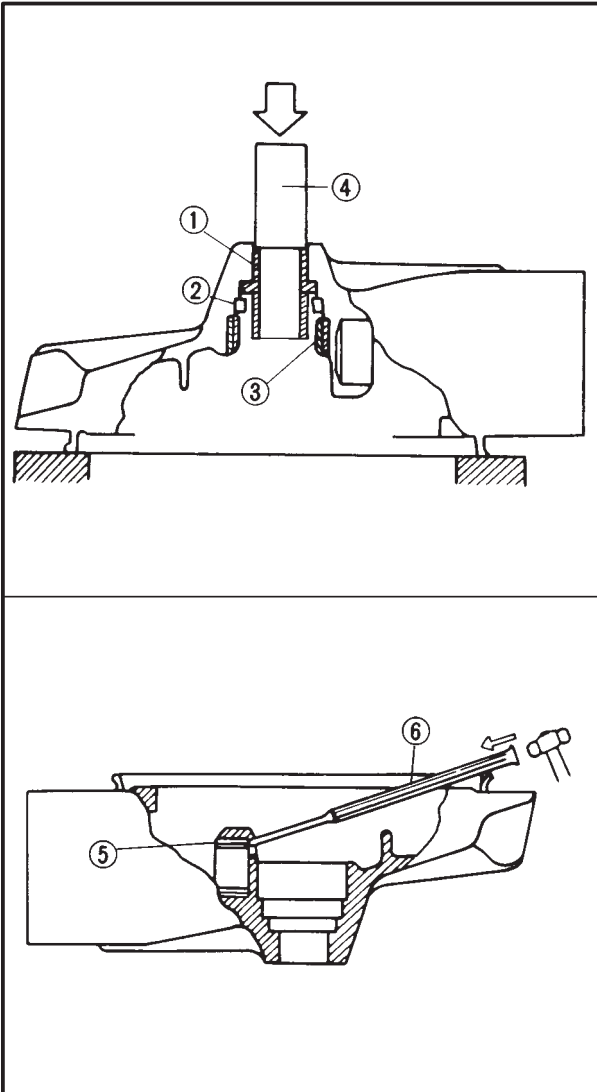
**Final-drive-shaft-bearing-retainer has left-hand threads. Turn retainer clockwise to loosen it.**

- Final drive shaft assembly

Tap lightly on the final drive shaft end with a soft hammer.

### CAUTION:

**Final drive shaft removal should be performed only if gearing replacement is necessary. Do not reuse bearings or races after removal.**



### Bearing Removal and Reassembly

#### 1. Remove:

- Guide collar ①
- Oil seal ②
- Roller bearing ③

Use a suitable press tool ④ and an appropriate support for the main housing.

#### 2. Inspect:

- Roller bearing

Damage → Replace.

#### NOTE:

Reuse of roller bearing OK, but Yamaha recommends installation of new bearing. Do not reuse the oil seal.

#### 3. Remove:

- Final drive shaft roller bearing ⑤

#### Final drive shaft roller bearing removal steps:

- Heat the bare housing to 150°C (302°F)
- Remove the roller bearing outer race with an appropriately shaped punch ⑥.
- Remove the inner race from the final drive shaft.

#### NOTE:

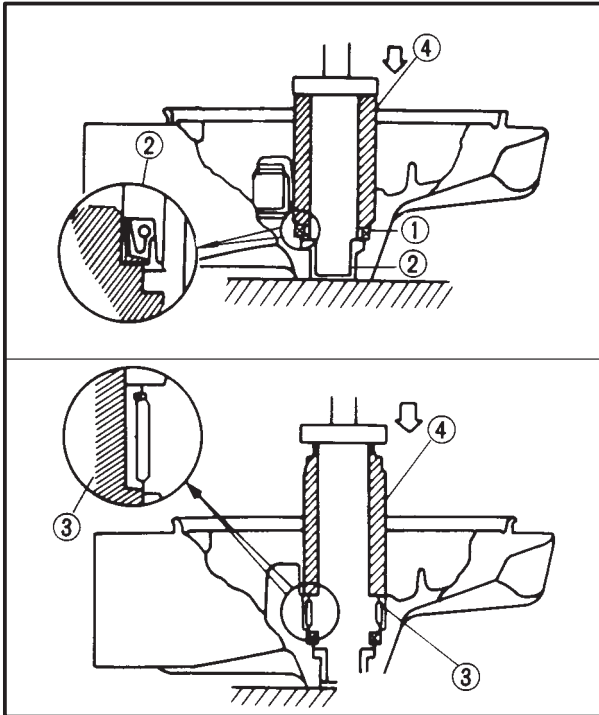
The removal of the final drive shaft roller bearing is difficult and seldom necessary.

#### 4. Install:

- Rear final drive shaft roller bearing (new)

#### Final drive shaft roller bearing installation steps:

- Heat the bare bearing to 150°C (320°F)
- Install the roller bearing outer race using the proper adapted.
- Install the inner race onto the drive shaft.



## 5. Install:

- Guide collar ①
- Oil seal (new) ②
- Roller bearing (outer race) ③

Use a suitable press tool ④ and a press to install the above components into the main housing.

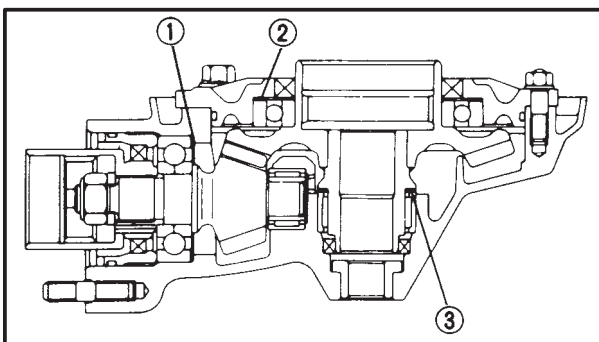
**Final Drive/Ring Gear Positioning****NOTE:**

Gear Positioning is necessary when any of the following parts are replaced:

- Final gear case
- Ring gear bearing housing
- Bearing(s)

## 1. Select:

- Final drive gear shim ①
- Ring gear shim ②

**Final drive/ring gear shim selection steps:**

- Position final drive shaft gear and ring gear by using shims ① and ② with their respective thicknesses calculated from information marked on final gear case and drive gear end.

① Shim thickness "A"

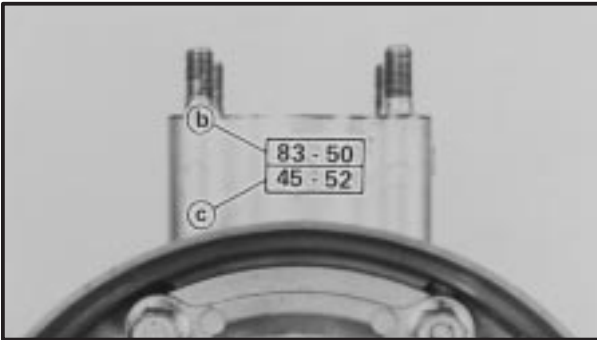
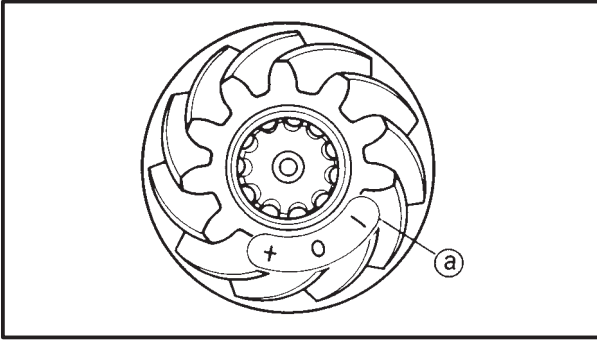
② Shim thickness "B"

③ Thrust washer

- To find shim thickness "A" use following formula:

**Final Drive Gear Shim Thickness:**

$$A = a - b$$



Where:

a = a numeral (usually a decimal number) on the gear is either added to or subtracted from "84".

b = a numeral on the gear case (i.e. 83.50)

Example:

1) If final drive shaft gear is marked "+01" ... "a" is 84.01.

2) If the gear case is marked "83.50" ... "b" is 83.50.

$$A = 84.01 - 83.50$$

$$= 0.51$$

3) Therefore, shim thickness is 0.51 mm.

Shim sizes are supplied in following thicknesses:



#### Final Drive Gear Shim

| Thickness<br>(mm) | 0.15 | 0.30 |
|-------------------|------|------|
|                   | 0.40 | 0.50 |
|                   | 0.60 |      |

Because shims can only be selected in 0.05 mm increments, round off hundredths digit and select appropriate shim(s).

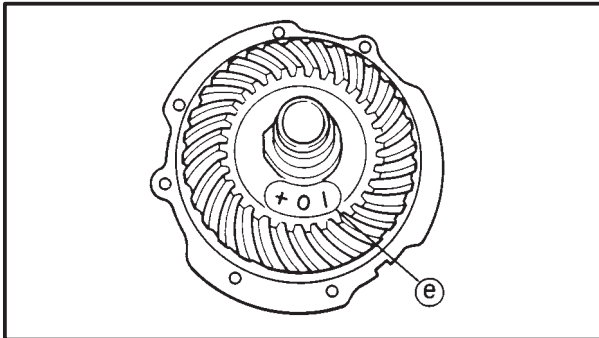
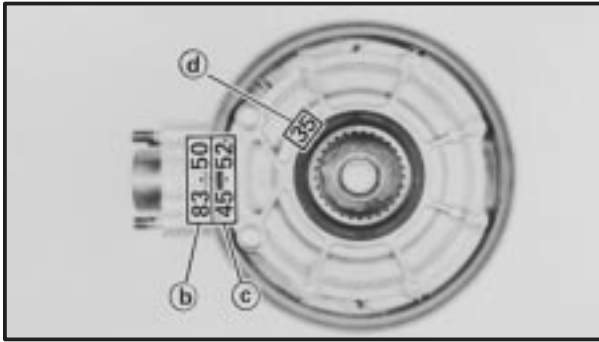
| Hundredths    | Round value |
|---------------|-------------|
| 0, 1, 2       | 0           |
| 3, 4, 5, 6, 7 | 5           |
| 8, 9          | 10          |

In the example above, the calculated shim thickness is 0.51 mm. The chart instructs you, however, to round off the 1 to 0. Thus you should use a 0.50 mm shim.

• To find shim thickness "B", use following formula:

#### Ring Gear Shim Thickness:

$$B = c + d - (e + f)$$



Where:

c = numeral on gear case (i.e. 45.52)

d = numeral (usually a decimal number) on outside of ring gear bearing housing and added to 3.

e = numeral (usually a decimal number) on inside of ring gear either added to or subtracted from 35.40.

f = bearing thickness (considered constant).



**Bearing Thickness "f" = 13.00 mm**

Example:

1) If gear case is marked "45.52" . . . "c" is 45.52.

2) If ring gear bearing housing is marked "35" . . . "d" is  $0.35 + 3 = 3.35$ .

3) If ring gear is marked "+01" . . . "e" is  $35.40 + 0.01 = 35.41$ .

4) "f" is 13.00.

$$\begin{aligned} B &= c + d - (e + f) \\ &= 45.52 + 3.35 - (35.41 + 13.00) = 48.87 \\ &\quad - (48.41) \\ &= 0.46 \end{aligned}$$

5) Therefore, shim thickness is 0.46 mm.

Shim sizes are supplied in following thickness:



### Ring Gear Shim

**Thickness (mm)**

**0.25 0.30 0.35  
0.40 0.45 0.50**

Because shims can only be selected in 0.05 mm increments, round off hundredths digit and select appropriate shim(s).



| Hundredths    | Round value |
|---------------|-------------|
| 0, 1, 2       | 0           |
| 3, 4, 5, 6, 7 | 5           |
| 8, 9          | 10          |

In the example above, the calculated shim thickness is 0.46 mm. The chart instructs you, however, to round off the 6 to 5. Thus you should use a 0.45 mm shims.

2. Install:

- Shims (proper size as calculated)
- Final drive shaft assembly
- Bearing retainer (final drive shaft)  
Use a Final Drive Shaft Bearing Retainer Wrench (90890-04050).

**NOTE:**

The bearing retainer has left-hand threads; turn retainer counterclockwise to tighten it.



**Bearing Retainer:**

**110 Nm (11.0 m•kg, 80 ft•lb)**

3. Install:

- Coupling gear
- Self-locking nut (coupling gear)  
Use a Final Drive Shaft Holder (90890-01229).



**Self-locking Nut (Coupling Gear)**

**110 Nm (11.0 m•kg, 80 ft•lb)**

**LOCTITE®**

4. Install:

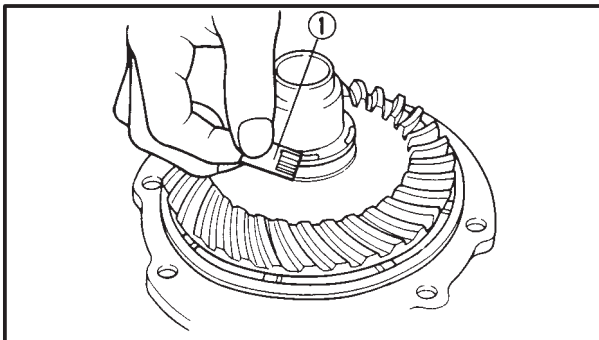
- Ring gear assembly (without thrust washer)

5. Adjust:

- Gear lash  
Refer to “Gear Lash Measurement and Adjustment” section.

6. Measure/Select:

- Ring gear thrust clearance

**Thrust clearance measurement steps:**

- Remove the ring gear assembly.
- Place four pieces of Plastigage<sup>®</sup> between originally fitted thrust washer and ring gear.
- Install the ring gear assembly and tighten the bolts and nuts to specification.

**Bolts (Bearing Housing):**

40 Nm (4.0 m•kg, 29 ft•lb)

**Nuts (Bearing Housing):**

23 Nm (2.3 m•kg, 17 ft•lb)

**NOTE:**

Do not turn the shaft drive and ring gear when measuring clearance with Plastigage<sup>®</sup>.

- Remove the ring gear assembly.
- Measure the thrust clearance. Calculate width of flattened Plastigage<sup>®</sup> ①.

**Ring Gear Thrust Clearance:**

0.1 ~ 0.2 mm (0.004 ~ 0.008 in)

- If the clearance is correct, install the ring gear assembly.
- If the out of specification, select the correct washer.

**Thrust washer selection steps:**

- Select the suitable thrust washer by the following chart.

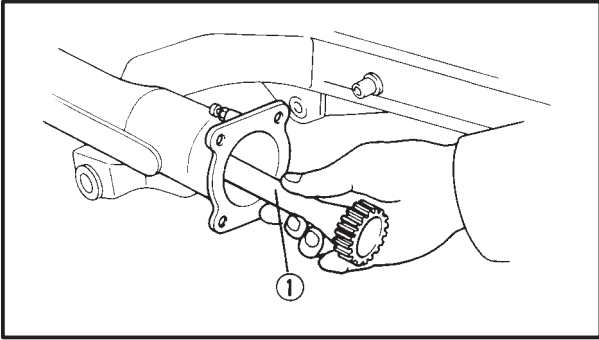
**Thrust Washer**

| Thickness (mm) | 1.4 | 1.5 | 1.6 |
|----------------|-----|-----|-----|
|                | 1.7 | 1.8 | 1.9 |
|                | 2.0 | 2.1 | 2.2 |
|                | 2.3 |     |     |
|                |     |     |     |

- Repeat measurement steps until the ring gear thrust clearance is within the specified limits.

**Ring Gear Thrust Clearance:**

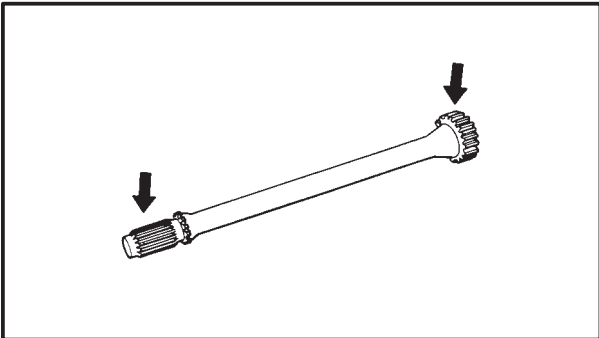
0.1 ~ 0.2 mm (0.004 ~ 0.008 in)



### DRIVE SHAFT

#### Removal

1. Remove:
  - Rear wheel
  - Final gear assembly
  - Drive shaft ①



#### Inspection

1. Inspect:
  - Drive shaft splines
 Wear/Damage → Replace.

#### Installation

When installing the drive shaft, reverse the removal procedure. Note the following points.

1. Lubricate:
  - Shaft splines



**Molybdenum Disulfide Grease**

2. Install:
  - Drive shaft

#### NOTE:

Before installing, first set the universal joint in place on the middle case side.

3. Apply:
  - Yamaha Bond No.1215 (90890-85505)
 To the mating surfaces of both case halves.
4. Tighten:
  - Nuts (final gear case)



**Nuts (Final Gear Case):**  
42 Nm (4.2 m•kg, 30 ft•lb)



## CHAPTER 7. ELECTRICAL

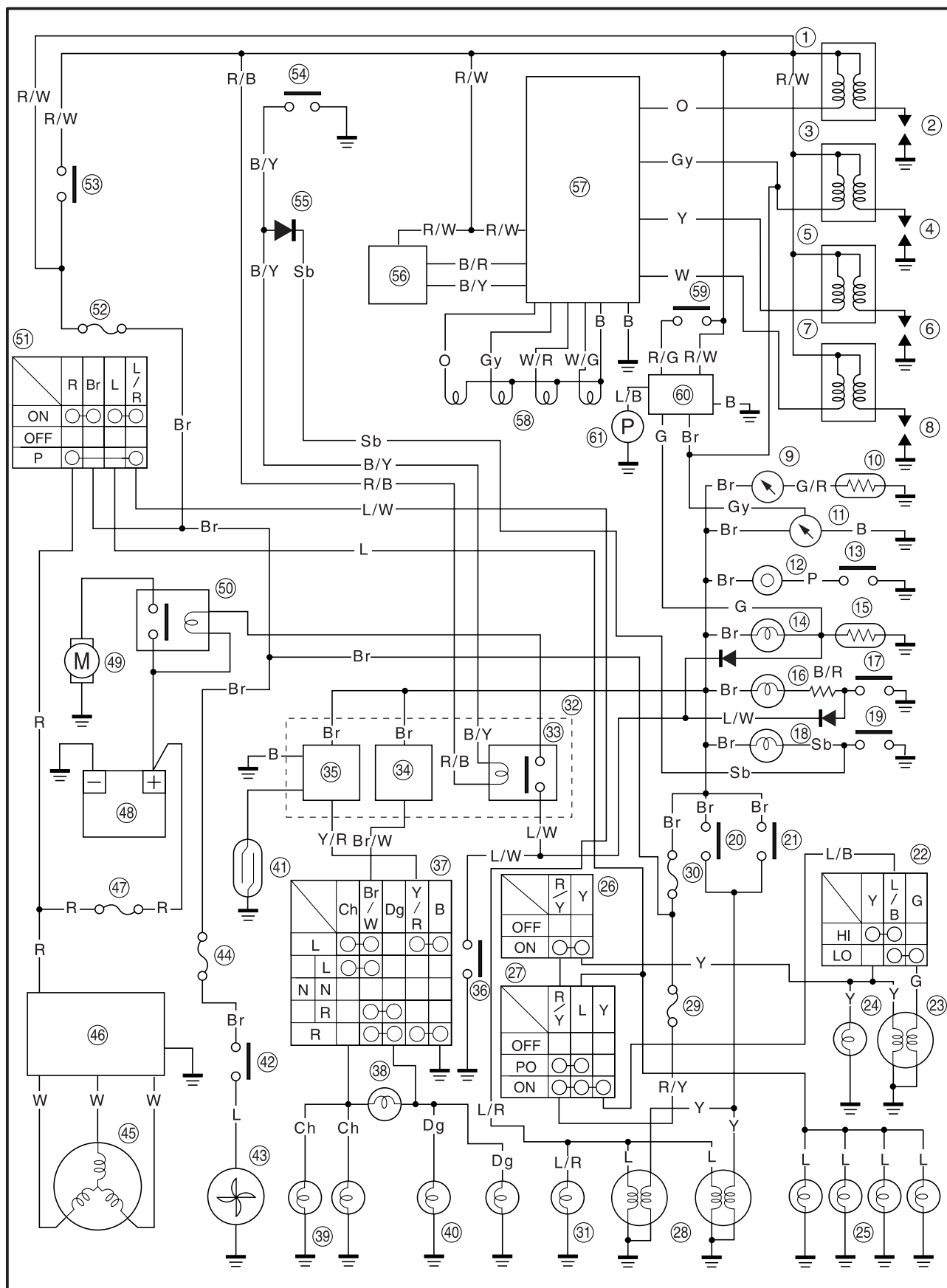
|                                           |      |
|-------------------------------------------|------|
| <b>VMX12 CIRCUIT DIAGRAM</b> .....        | 7-1  |
| <b>ELECTRICAL COMPONENTS</b> .....        | 7-3  |
| <b>ELECTRIC STARTING SYSTEM</b> .....     | 7-5  |
| CIRCUIT DIAGRAM .....                     | 7-5  |
| TROUBLESHOOTING .....                     | 7-7  |
| STARTING CIRCUIT CUT-OFF SYSTEM .....     | 7-9  |
| STARTER MOTOR TEST .....                  | 7-10 |
| BATTERY INSPECTION .....                  | 7-13 |
| STARTER RELAY TEST .....                  | 7-13 |
| STARTING CIRCUIT CUT-OFF RELAY TEST ..... | 7-14 |
| DIODE TEST .....                          | 7-14 |
| NEUTRAL SWITCH TEST .....                 | 7-15 |
| <b>CHARGING SYSTEM</b> .....              | 7-17 |
| CIRCUIT DIAGRAM .....                     | 7-17 |
| TROUBLESHOOTING .....                     | 7-19 |
| CHARGING VOLTAGE TEST .....               | 7-20 |
| BATTERY INSPECTION .....                  | 7-20 |
| STATOR COIL RESISTANCE TEST .....         | 7-20 |
| RECTIFIER TEST .....                      | 7-21 |
| <b>IGNITION SYSTEM</b> .....              | 7-23 |
| CIRCUIT DIAGRAM .....                     | 7-23 |
| TROUBLESHOOTING .....                     | 7-25 |
| DESCRIPTION .....                         | 7-27 |
| OPERATION .....                           | 7-27 |
| IGNITION SPARK GAP TEST .....             | 7-28 |
| IGNITION COIL RESISTANCE TEST .....       | 7-28 |
| PICKUP COIL RESISTANCE TEST .....         | 7-29 |
| SPARK PLUG INSPECTION .....               | 7-29 |
| PRESSURE SENSOR .....                     | 7-29 |
| <b>LIGHTING SYSTEM</b> .....              | 7-31 |
| CIRCUIT DIAGRAM .....                     | 7-31 |
| LIGHTING TESTS AND CHECKS .....           | 7-33 |
| <b>SIGNAL SYSTEM</b> .....                | 7-37 |
| CIRCUIT DIAGRAM .....                     | 7-37 |
| SIGNAL SYSTEM TESTS AND CHECKS .....      | 7-39 |
| OIL LEVEL GAUGE TEST .....                | 7-40 |
| REED SWITCH TEST .....                    | 7-41 |
| SELF-CANCELLING FLASHER SYSTEM TEST ..... | 7-41 |
| SWITCHES TEST .....                       | 7-43 |



---

|                                            |          |
|--------------------------------------------|----------|
| <b>COOLING SYSTEM</b> .....                | 7-45     |
| CIRCUIT DIAGRAM .....                      | 7-45     |
| TROUBLESHOOTING .....                      | 7-47     |
| ELECTRIC FAN AND THERMOSTATIC SWITCH ..... | 7-48     |
| THERMO-UNIT AND THERMOMETER .....          | 7-49     |
| <br><b>FUEL PUMP SYSTEM</b> .....          | <br>7-51 |
| CIRCUIT DIAGRAM .....                      | 7-51     |
| FUEL PUMP CIRCUIT OPERATION .....          | 7-53     |
| TROUBLESHOOTING .....                      | 7-54     |
| “FUEL” (RESERVE) SWITCH TEST .....         | 7-57     |
| FUEL PUMP RELAY TEST .....                 | 7-57     |
| FUEL PUMP TEST .....                       | 7-57     |
| FUEL SENDER UNIT TEST .....                | 7-58     |

## VMX12 CIRCUIT DIAGRAM





- ① Ignition coil #1
- ② Spark plug #1
- ③ Ignition coil #2
- ④ Spark plug #2
- ⑤ Ignition coil #3
- ⑥ Spark plug #3
- ⑦ Ignition coil #4
- ⑧ Spark plug #4
- ⑨ Temperature meter
- ⑩ Thermo-unit
- ⑪ Tachometer
- ⑫ Horn
- ⑬ "HORN" switch
- ⑭ "FUEL" indicator light
- ⑮ Fuel sender unit
- ⑯ "OIL LEVEL" warning indicator light
- ⑰ Oil level gauge
- ⑱ "NEUTRAL" indicator light
- ⑲ Neutral switch
- ⑳ Front brake switch
- ㉑ Rear brake switch
- ㉒ "LIGHTS" (Dimmer) switch
- ㉓ Headlight
- ㉔ "HIGH BEAM" indicator light
- ㉕ Meter light
- ㉖ "PASS" switch
- ㉗ "LIGHTS" switch
- ㉘ Tail/brake light
- ㉙ Fuse (HEAD)
- ㉚ Fuse (SIGNAL)
- ㉛ Auxiliary light

- ㉜ Relay unit
- ㉝ Starting circuit cut-off relay
- ㉞ Flasher relay
- ㉟ Cancelling unit
- ㊱ Starter switch
- ㊲ "TURN" switch
- ㊳ "TURN" indicator light
- ㊴ Flasher light (Left)
- ㊵ Flasher light (Right)
- ㊶ Reed switch
- ㊷ Thermo switch
- ㊸ Electric fan
- ㊹ Fuse
- ㊺ AC Magneto
- ㊻ Rectifier with regulator
- ㊼ Main fuse
- ㊽ Battery
- ㊾ Starter motor
- ㊿ Starter relay
- 1 Main switch
- 2 Fuse (IGNITION)
- 3 "ENGINE STOP" switch
- 4 Clutch switch
- 5 Diode
- 6 Pressure sensor
- 7 Ignitor unit
- 8 Pick-up coil (#1 ~ #4)
- 9 "FUEL" (RESERVE) switch
- 0 Fuel pump relay
- 1 Fuel pump

### COLOR CODE

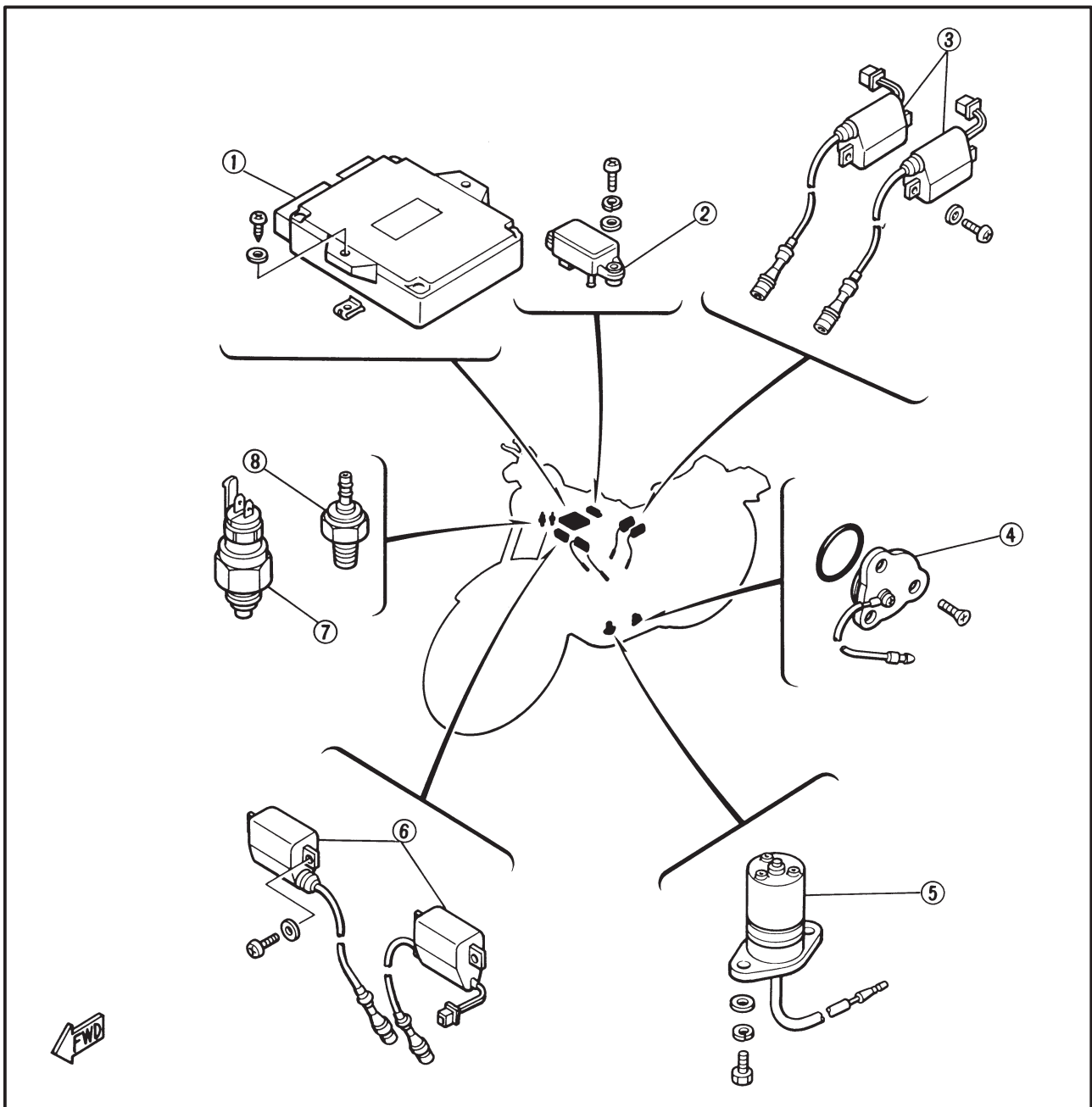
|      |       |              |
|------|-------|--------------|
| B    | ..... | Black        |
| L    | ..... | Blue         |
| O    | ..... | Orange       |
| G    | ..... | Green        |
| R    | ..... | Red          |
| P    | ..... | Pink         |
| Y    | ..... | Yellow       |
| W    | ..... | White        |
| Br   | ..... | Brown        |
| Dg   | ..... | Dark green   |
| Ch   | ..... | Chocolate    |
| Sb   | ..... | Sky blue     |
| Gy   | ..... | Gray         |
| G/R  | ..... | Green/Red    |
| G/Y  | ..... | Green/Yellow |
| B/R  | ..... | Black/Red    |
| B/W  | ..... | Black/White  |
| B/Y  | ..... | Black/Yellow |
| L/Y  | ..... | Blue/Yellow  |
| L/B  | ..... | Blue/Black   |
| L/W  | ..... | Blue/White   |
| R/W  | ..... | Red/White    |
| R/G  | ..... | Red/Green    |
| R/B  | ..... | Red/Black    |
| R/Y  | ..... | Red/Yellow   |
| W/R  | ..... | White/Red    |
| W/G  | ..... | White/Green  |
| W/B  | ..... | White/Black  |
| Y/R  | ..... | Yellow/Red   |
| Y/L  | ..... | Yellow/Blue  |
| Br/W | ..... | Brown/White  |



## ELECTRICAL COMPONENTS (1)

- ① TCI unit
- ② Pressure sensor
- ③ Ignition coil (#1 & #3)
- ④ Neutral switch
- ⑤ Oil level gauge
- ⑥ Ignition coil (#2 & #4)
- ⑦ Thermostatic switch
- ⑧ Thermo-unit

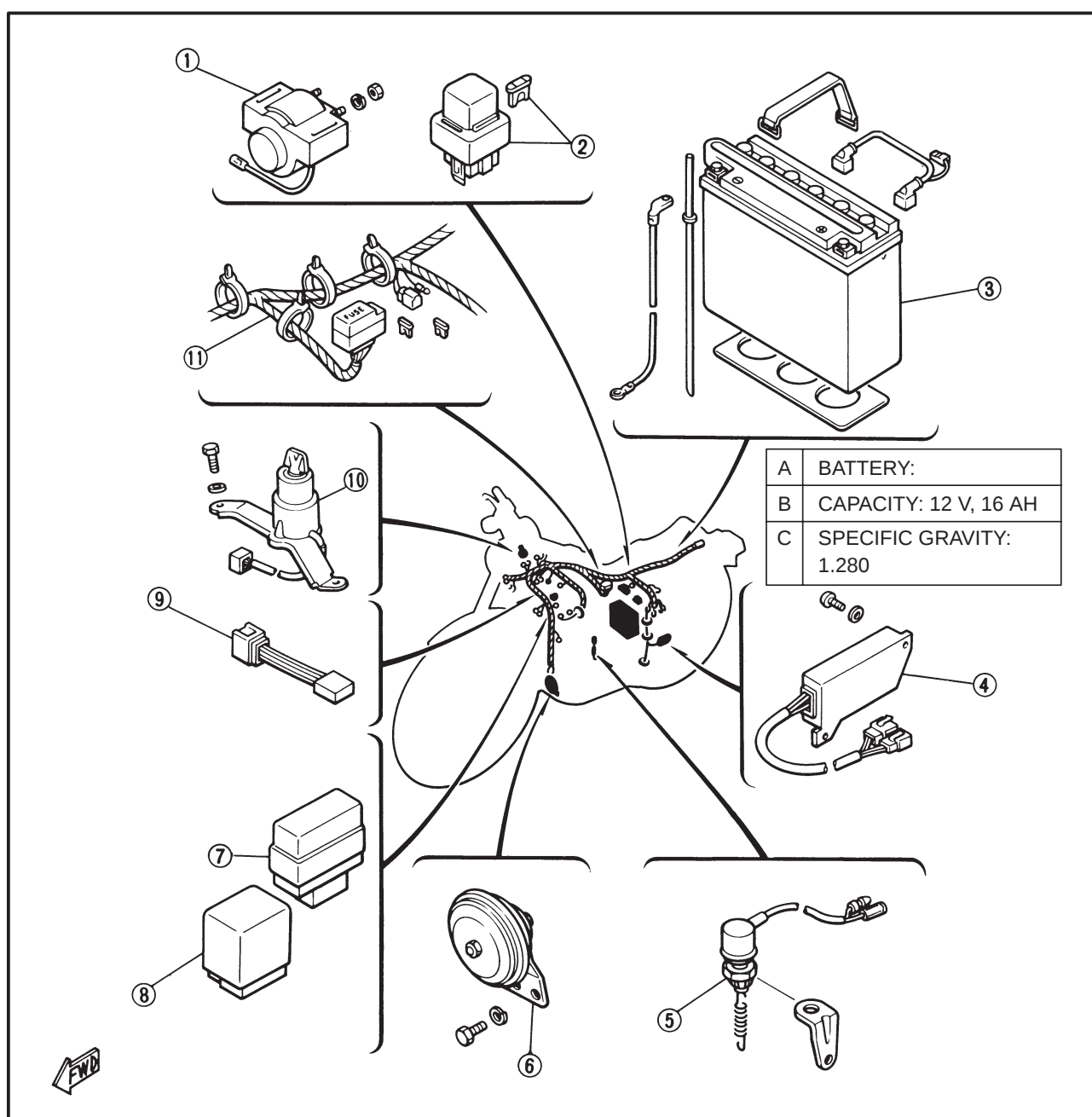
| SPECIFICATIONS            | RESISTANCE             |
|---------------------------|------------------------|
| IGNITION COIL:<br>PRIMARY | 2.4 ~ 3.0 $\Omega$     |
| SECONDARY                 | 10.6 ~ 15.8 k $\Omega$ |
| PICK-UP COIL:             | 93.5 ~ 126.5 $\Omega$  |





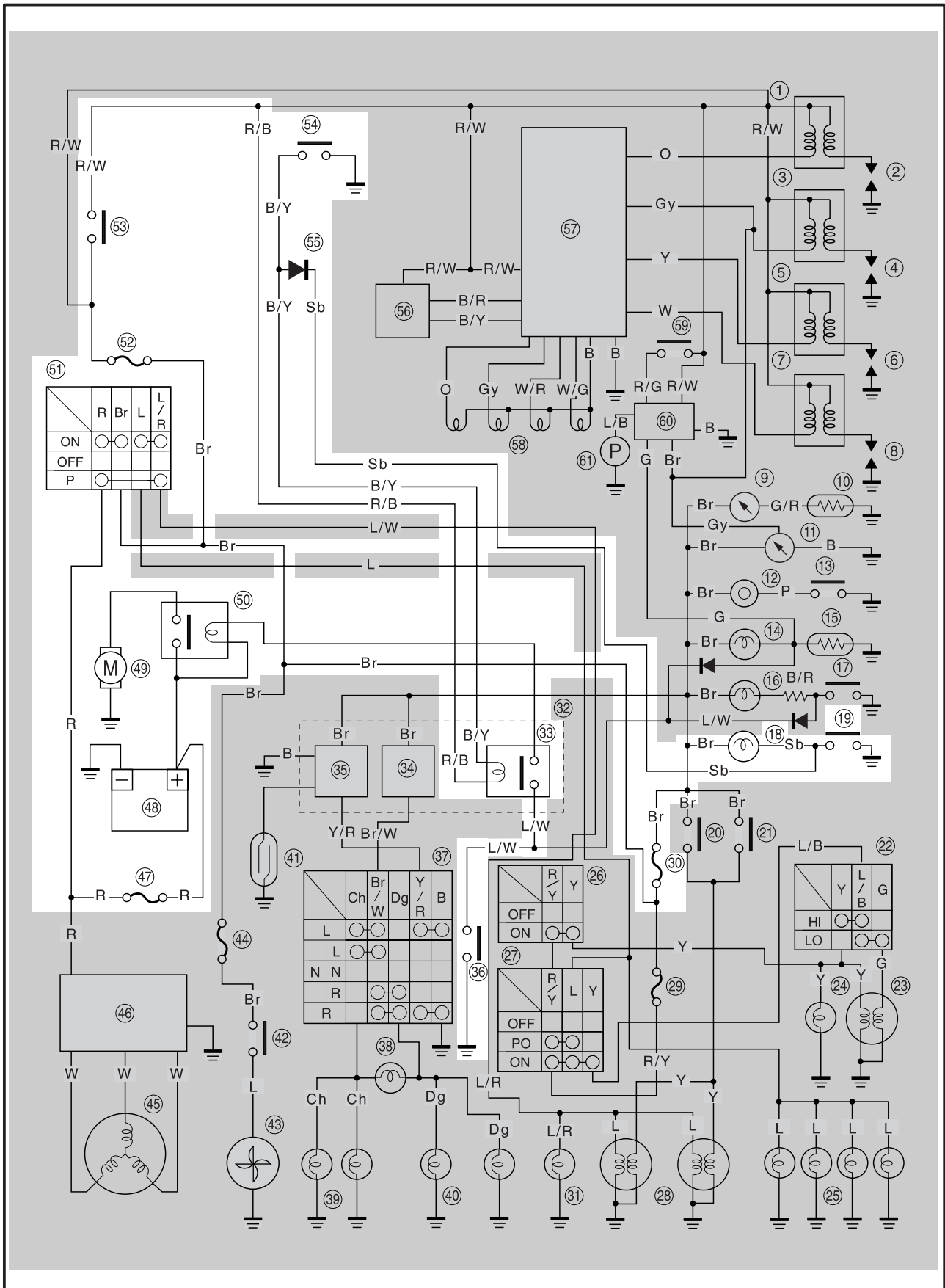
## ELECTRICAL COMPONENTS (2)

- ① Starter relay
- ② Main fuse
- ③ Battery
- ④ Rectifier with regulator
- ⑤ Rear brake switch
- ⑥ Horn
- ⑦ Relay unit
- ⑧ Fuel pump relay
- ⑨ Diode
- ⑩ Main switch
- ⑪ Wire harness





# ELECTRIC STARTING SYSTEM CIRCUIT DIAGRAM



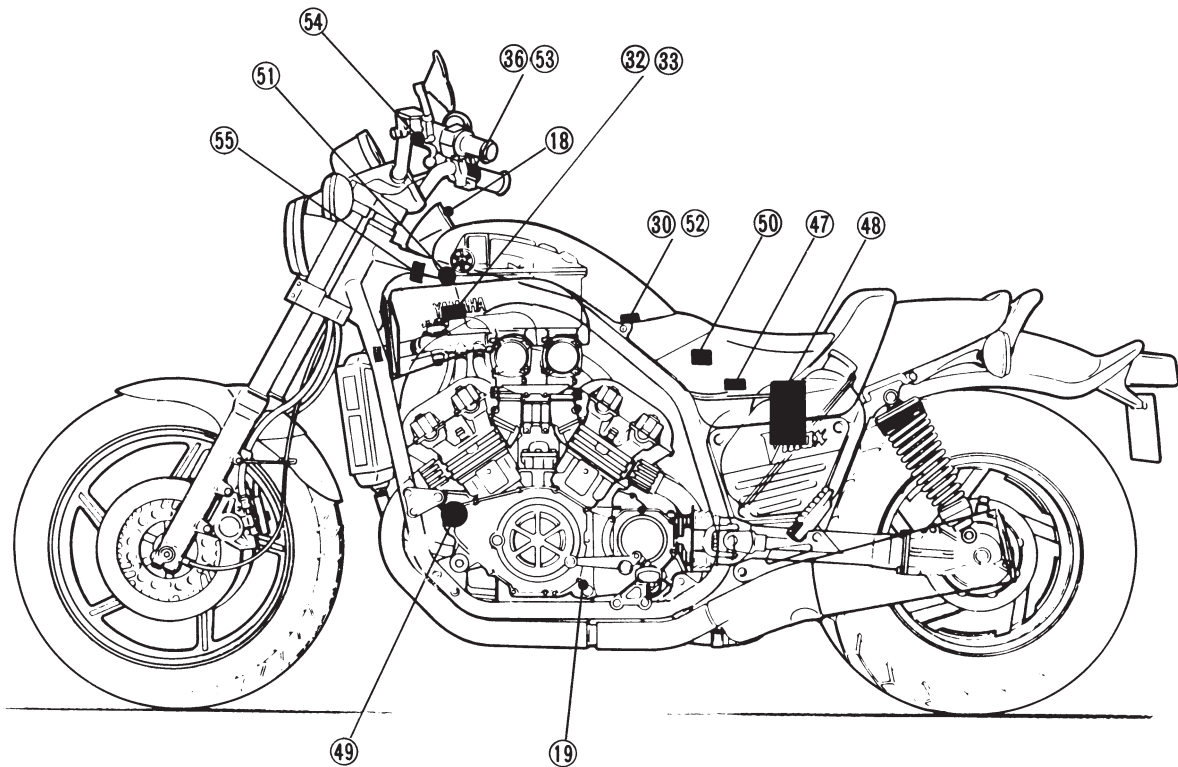


Aforementioned circuit diagram shows electrical starting circuit in wiring diagram.

**NOTE:**

For the encircled numbers and color cords, see page 7-2.

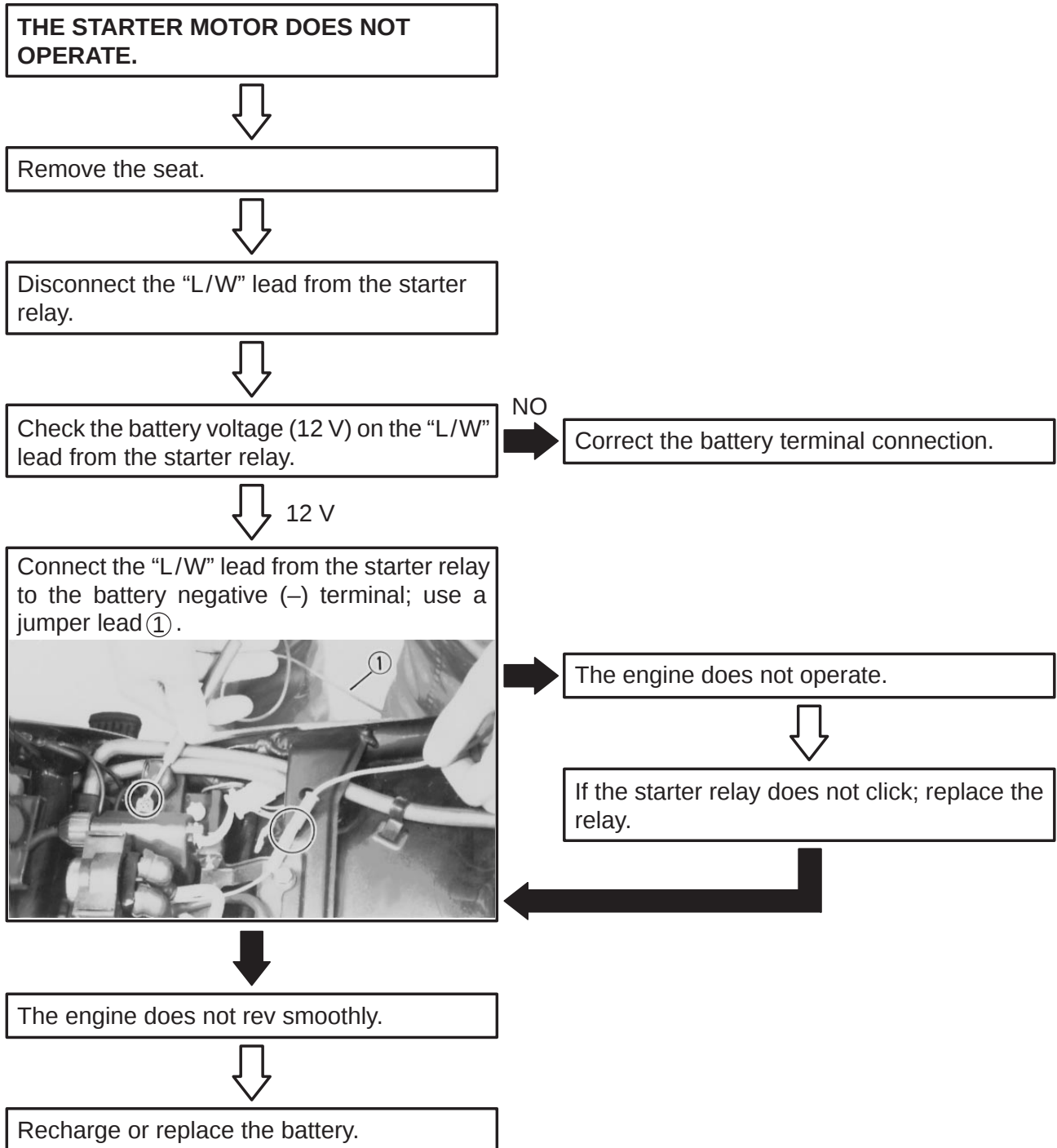
- ①⑧ "NEUTRAL" indicator light
- ①⑨ Neutral switch
- ③⑩ Fuse (SIGNAL)
- ③② Relay unit
- ③③ Starting circuit cut-off relay
- ③⑥ Starter switch
- ④⑦ Main fuse
- ④⑧ Battery
- ④⑨ Starter motor
- ⑤⑩ Starter relay
- ⑤① Main switch
- ⑤② Fuse (IGNITION)
- ⑤③ "ENGINE STOP" switch
- ⑤④ Clutch switch
- ⑤⑤ Diode





## TROUBLESHOOTING

## Troubleshooting Chart (1)





## Troubleshooting Chart (2)

**THE STARTER MOTOR DOES NOT OPERATE.**



Check the starter relay and starter motor; refer to CHART (1).



Remove the cover (left) and disconnect the relay unit connector.



Main and engine stop switches are turned to "ON".

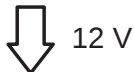


Check the battery voltage (12 V) on the "R/B" lead.

|     |      |                                                                                     |     |     |
|-----|------|-------------------------------------------------------------------------------------|-----|-----|
| Br  | Br/W |  | L/W | L/W |
| W/G | Y/R  | B                                                                                   | B/Y | R/W |

NO

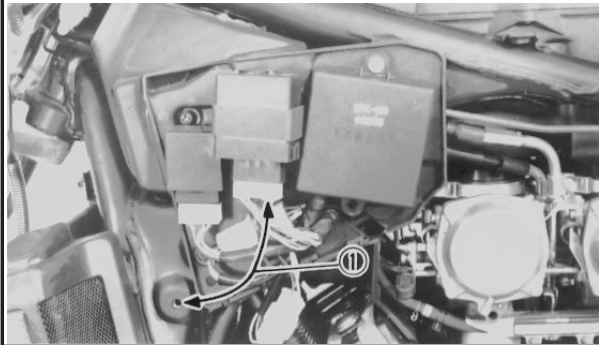
Check for an open or poor connection between the main switch and relay unit.



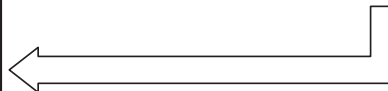
Connect the relay unit connector.



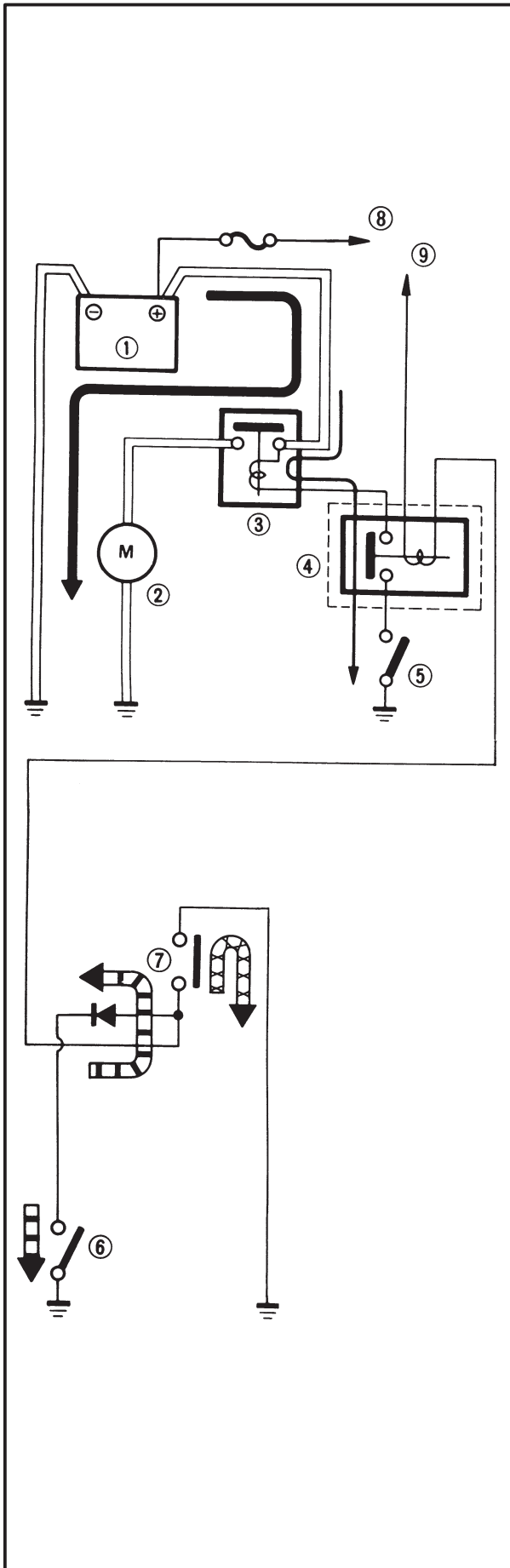
Connect "B/Y" lead to "ground" on the frame; use a jumper lead ①.



If the relay unit does not click, replace the relay unit.



If the relay unit clicks, check the starter, clutch and neutral switches. Replace switch(es) if necessary.



### STARTING CIRCUIT CUT-OFF SYSTEM

A starting circuit cut-off system is employed, and operates as follows:

#### Starting Circuit Operation

The starting circuit on this model consist of the starter motor, starter relay, and the relay unit (starting circuit cut-off relay). If the engine stop switch and the main switch are both on, the starter motor can operate only if:

The transmission is in neutral (the neutral switch is on).

or if

The clutch lever is pulled to the handlebar (the clutch switch is on).

The starting circuit cut-off relay prevents the starter from operating when neither of these conditions has been met. In this instance, the starting circuit cut-off relay is off so current cannot reach the starter motor.

When one of both of the above conditions have been met, however, the starting circuit cut-off relay is on, and the engine can be started by pressing the starter switch.



WHEN THE TRANSMISSION IS IN NEUTRAL



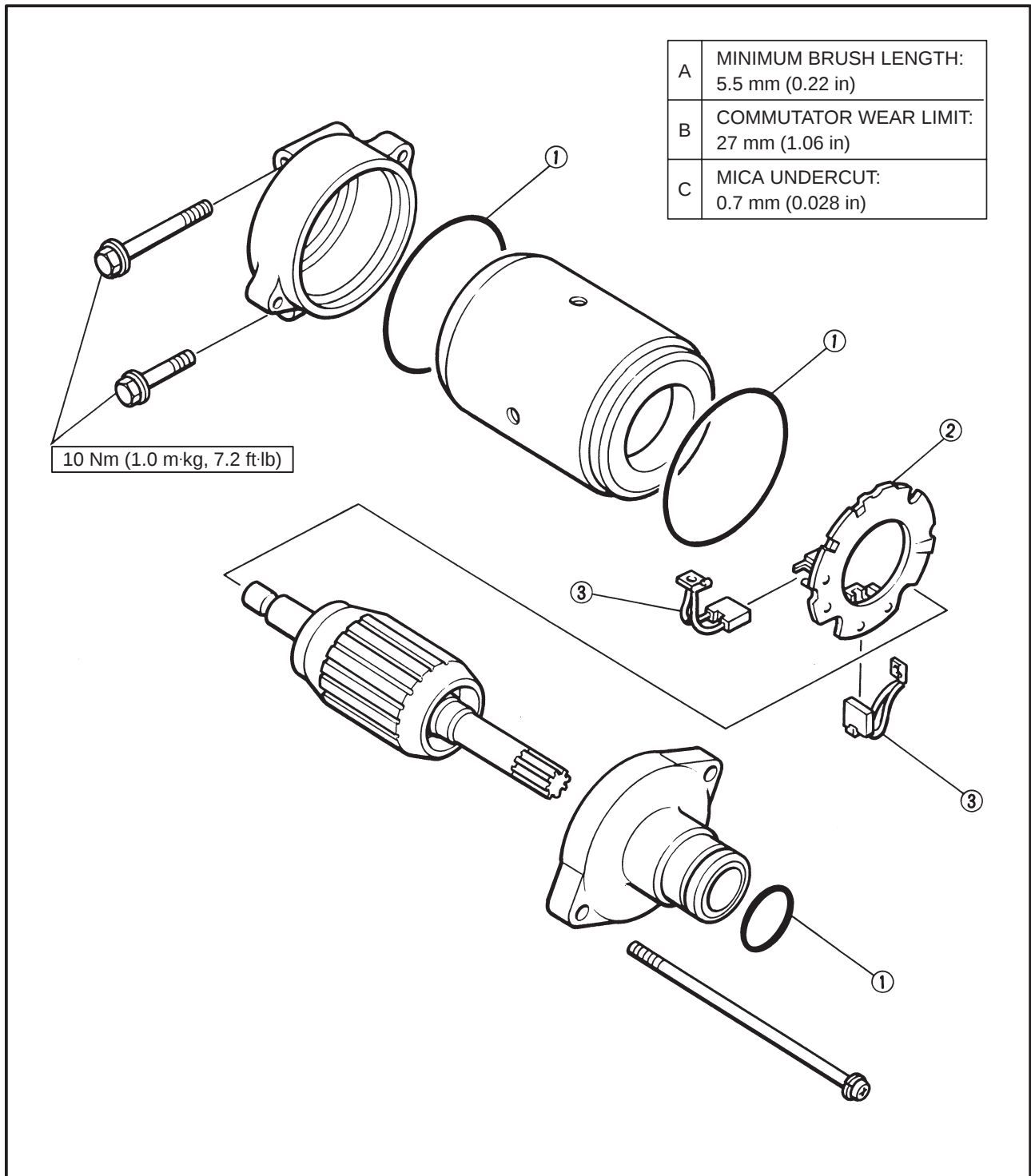
WHEN THE SIDESTAND IS UP AND THE CLUTCH LEVER IS PULLED IN

- ① Battery
- ② Starter motor
- ③ Starter relay
- ④ Starting circuit cut-off relay
- ⑤ Starter switch
- ⑥ Neutral switch
- ⑦ Clutch switch
- ⑧ To main switch
- ⑨ To engine stop switch



## STARTER MOTOR TEST

- ① O-ring
- ② Brush holder assembly
- ③ Brush



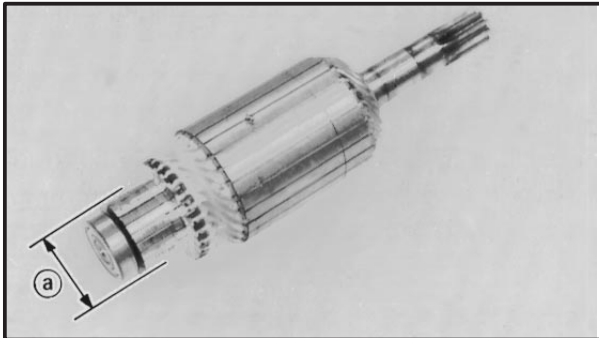


### Removal

#### 1. Remove:

- Starter motor

Refer to "CHAPTER 3. ENGINE DIS-ASSEMBLY" section.



### Inspection and Repair

#### 1. Inspect:

- Commutator

Dirty → Clean with #600 grit sandpaper.

#### 2. Measure:

- Commutator diameter (a)

Out of specification → Replace starter motor.



**Commutator Wear Limit:**  
27 mm (1.06 in)

#### 3. Measure:

- Mica undercut (b)

(between commutator segments)

Out of specification → Scrape mica to proper valve.

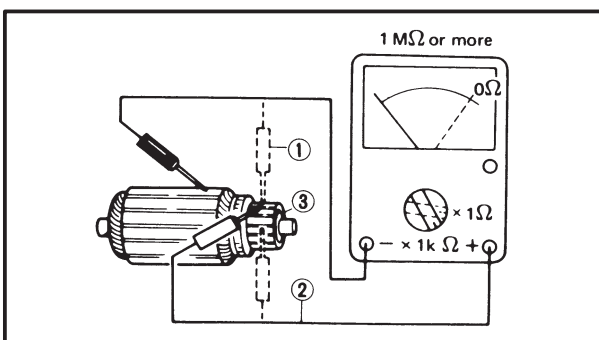
Use a hacksaw blade that is ground to fit.



**Mica Undercut:**  
0.7 mm (0.028 in)

### NOTE:

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



#### 4. Measure:

- Armature coil insulation/continuity

Defect(s) → Replace starter motor.

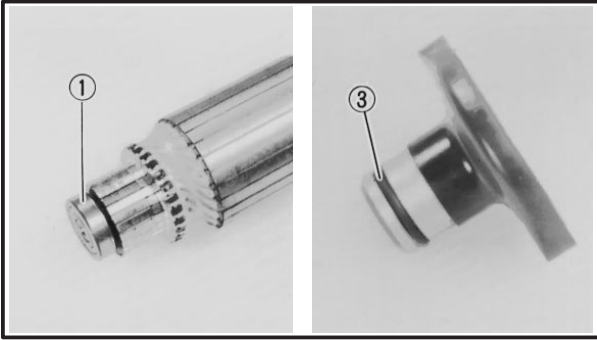


**Insulation Resistance:**  
1 MΩ or more at 20°C (68°F)

① Continuity check

② Insulation check

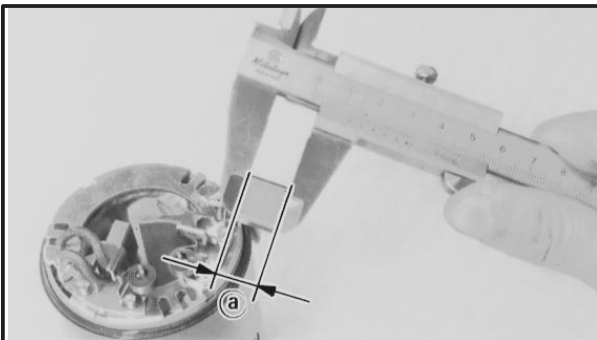
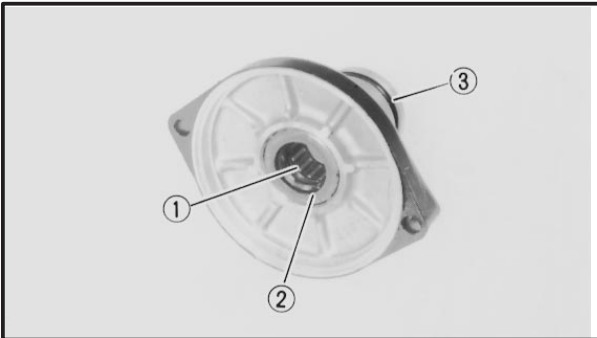
③ Armature coil



5. Inspect:

- Bearings ①
- Oil seal ②
- O-ring ③

Wear/Damage → Replace



6. Inspect:

- Commutator brushes
- Damage → Replace.

7. Measure:

- Brush length ①

Out of specification → Replace.



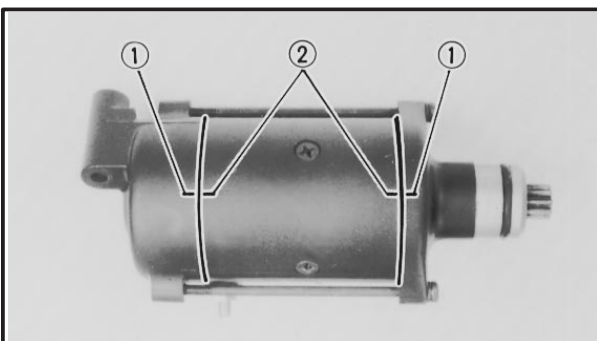
**Minimum Brush Length:**  
**5.5 mm (0.22 in)**

8. Inspect:

- Brush springs

Compare with new spring.

Wear/Damage → Replace.



## Installation

1. Install:

- Starter motor

**NOTE:**

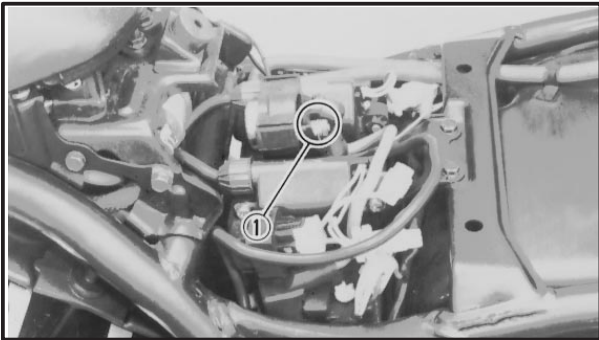
Align the match marks ① on the brackets with the match marks ② on the housing.

**BATTERY INSPECTION**

## 1. Inspect:

- Battery

Refer to "CHAPTER 2. BATTERY INSPECTION" section.

**STARTER RELAY TEST**

## 1. Inspect:

- Starter relay

Poor condition → Replace.

**Starter relay inspection steps:**

- Remove the seat.
- Turn ignition switch to "ON", engine stop switch to "RUN" and shift pedal to "NEUTRAL".
- Disconnect the starter motor lead ① from the starter motor.
- Push the starter switch and check to see if the starter relay clicks.  
Starter relay clicking → Starter relay OK.  
Starter relay not clicking → Measure coil resistance.

## 2. Measure:

- Starter relay resistance

Out of specification → Replace.

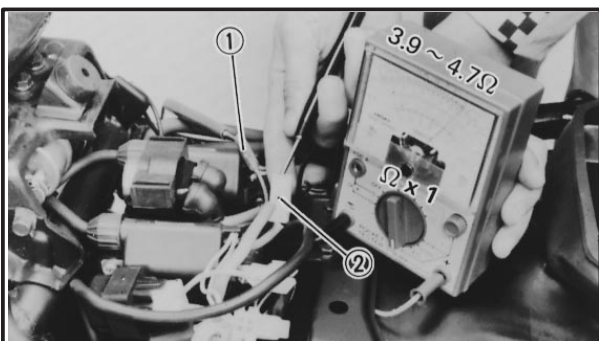
**Starter relay resistance measurement steps:**

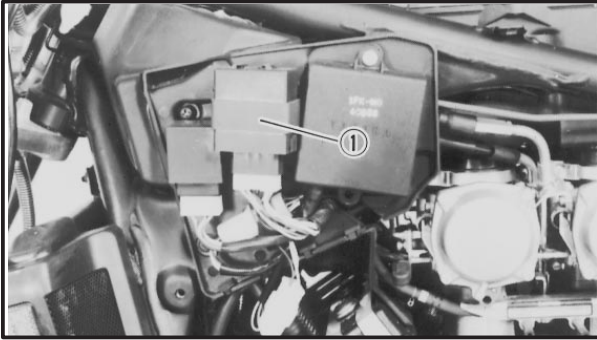
- Disconnect the "L/W" lead and the battery positive lead.
  - Connect the Pocket Tester (90890-03112) leads to the starter relay.
- ① Blue/White  
② Red
- Measure the coil resistance.

**Starter Relay Resistance:**

**3.9 ~ 4.7  $\Omega$  at 20°C (68°F)**

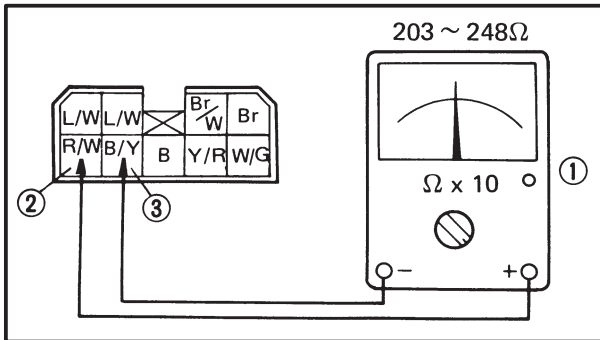
- If the resistance is not within specification, replace the starter relay.





### STARTING CIRCUIT CUT-OFF RELAY TEST

1. Remove:
  - Top cover
  - Cover (left)
  - Relay unit ①
2. Disconnect:
  - Relay unit connector



3. Measure:
  - Starting circuit out-off relay resistance
 Use the Pocket Tester ① (90890-03112).  
 Out of specification → Replace.

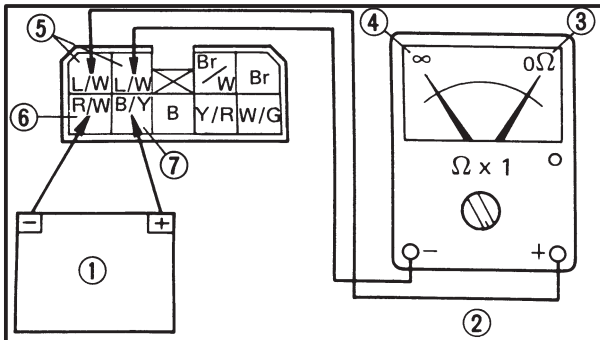


**Starting Circuit Cut-off Relay Resistance:**

**203 ~ 248 Ω at 20°C (68°F)**

- ② Red/White
- ③ Black/Yellow

4. Check:
  - Starting circuit cut-off relay contacts
 Use 12 V battery ① and the Pocket Tester ② (90890-03112).  
 Out of specification → Replace.



**Battery Connected ③: 0 Ω**

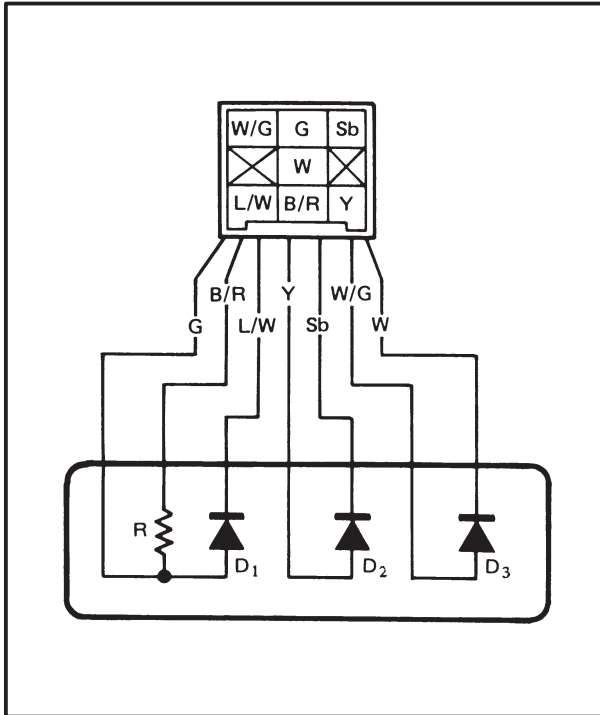
**Battery Disconnected ④: ∞**

- ⑤ Blue/White
- ⑥ Red/White
- ⑦ Black/Yellow



### DIODE TEST

1. Remove:
  - Top cover
  - Meter panel
  - Diode ①



2. Check:

- Diode continuity/discontinuity  
Defective element(s) → Replace diode.

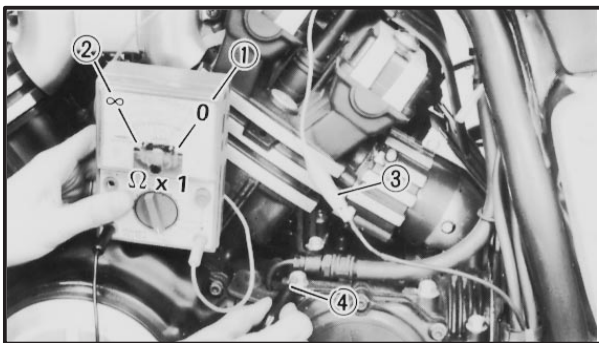
| Checking element | Pocket tester connecting point |             | Good  |
|------------------|--------------------------------|-------------|-------|
|                  | (+) (Red)                      | (-) (Black) |       |
| D <sub>1</sub>   | G                              | L/W         | ○     |
|                  | L/W                            | G           | ×     |
| D <sub>2</sub>   | Y                              | Sb          | ○     |
|                  | Sb                             | Y           | ×     |
| D <sub>3</sub>   | W/G                            | W           | ○     |
|                  | W                              | W/G         | ×     |
| R                | G                              | B/R         | 8.2 Ω |

○: Continuity (0 Ω) (Scale Ω × 1K)

×: Discontinuity (∞) (Scale Ω × 1)

**NOTE:**

The results “○” or “×” should be reversed according to the Pocket Tester polarity.



### NEUTRAL SWITCH TEST

1. Disconnect:

- One lead (Blue)

2. Check:

- Neutral switch contact

Out of specification → Replace switch

|  |                   |
|--|-------------------|
|  | In Neutral ①: 0 Ω |
|  | In Gear ②: ∞      |

③ Blue

④ Ground



— MEMO —

Handwriting practice area with 20 horizontal dashed lines.



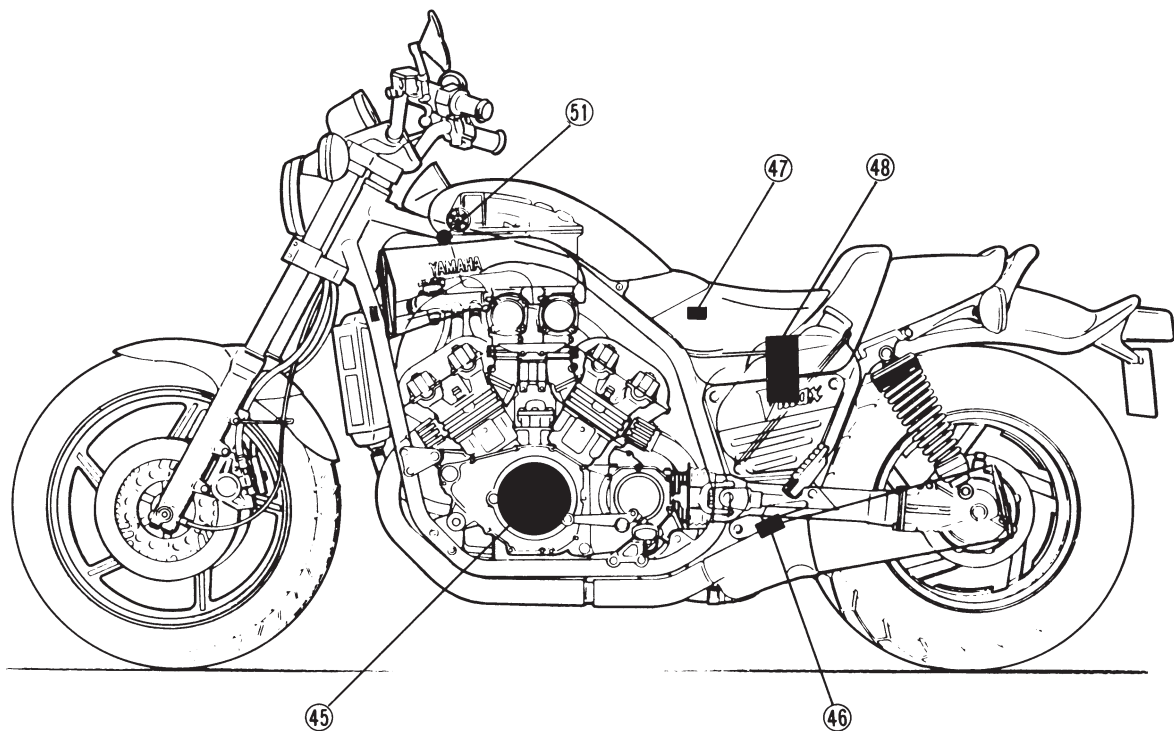


Aforementioned circuit diagram shows charging circuit in wiring diagram.

**NOTE:**

For the encircled numbers and color codes, see page 7-2.

- ④⑤ AC Magneto
- ④⑥ Rectifier with regulator
- ④⑦ Main fuse
- ④⑧ Battery
- ⑤① Main switch





## TROUBLESHOOTING

THE BATTERY IS NOT CHARGED.



Remove the seat.



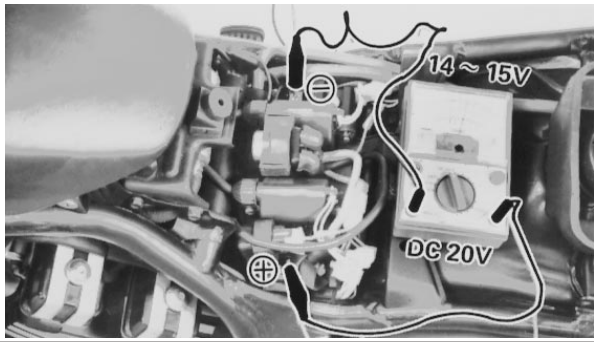
Measure the battery for voltage and specific gravity.  
Battery voltage: More than 12 V  
Specific gravity: 1,280

No.

Recharge the battery.



Connect the Pocket Tester to the battery to measure the generator voltage.



Start the engine and accelerate to about 2,000 r/min or more.



Generator Voltage:  
More than 15 V



Generator Voltage:  
Less than 13 V



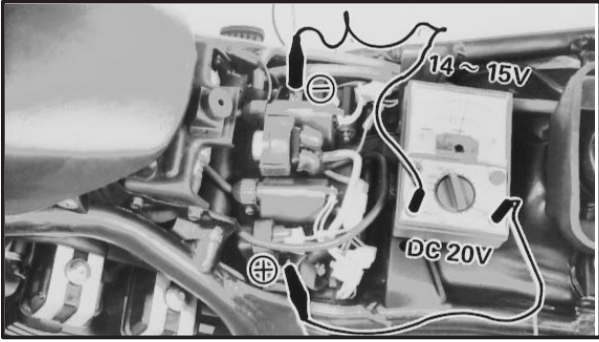
Check the stator coil resistance.  
Stator coil resistance (White – White):  
0.36 ~ 0.48  $\Omega$  at 20°C (68°F)



Replace the stator coil.



Replace rectifier with regulator.



### CHARGING VOLTAGE TEST

1. Remove:
  - Seat
2. Connect:
  - Pocket Tester (90890-03112)  
To battery terminals.
3. Start the engine and accelerate to about 2,000 r/min or more.
4. Measure:
  - Generator voltage  
Out of specification → Check battery, stator coil, and rectifier/regulator.



**Generator Voltage: 14 ~ 15 V**

### CAUTION:

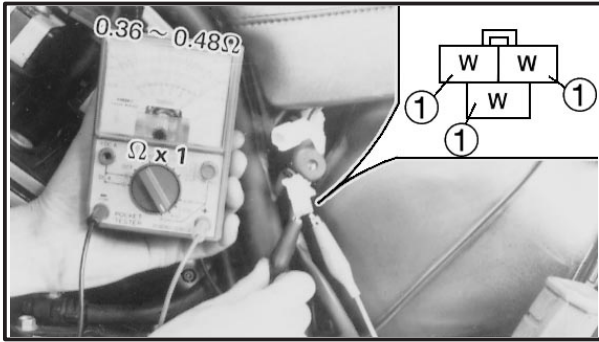
Never disconnect the wires from the battery while the generator is operating, otherwise the voltage across the generator terminals will increase and damage the semiconductors.

### BATTERY INSPECTION

Refer to "CHAPTER 2. BATTERY INSPECTION" section.

### STATOR COIL RESISTANCE TEST

1. Remove:
  - Side cover (left)
2. Disconnect:
  - 3-pin connector (White, White and White)  
From rectifier/regulator.
3. Connect:
  - Pocket Tester (90890-03112)



## 4. Measure:

- Stator coil resistance

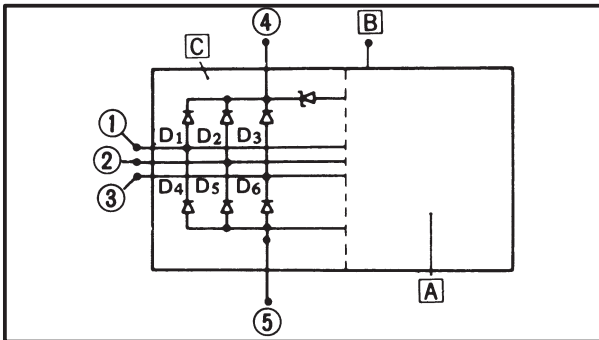
Out of specification → Replace stator coils.

**Stator Coil Resistance:**

**0.36 ~ 0.48 Ω at 20°C (68°F)**

**(White – White)**

① White

**RECTIFIER TEST**

## 1. Check:

- Defective element → Replace rectifier.

① White

② White

③ White

④ Red

⑤ Black

**A** IC Regulator

**B** Brown

**C** Rectifier

| Checking Element | Pocket Tester Connecting Point |             | Good | Replace (Element shorted) | Replace (Element opened) |
|------------------|--------------------------------|-------------|------|---------------------------|--------------------------|
|                  | (+) (Red)                      | (-) (Black) |      |                           |                          |
| D <sub>1</sub>   | d                              | a           | ○    | ○                         | ×                        |
|                  | a                              | d           | ×    | ○                         | ×                        |
| D <sub>2</sub>   | d                              | b           | ○    | ○                         | ×                        |
|                  | b                              | d           | ×    | ○                         | ×                        |
| D <sub>3</sub>   | d                              | c           | ○    | ○                         | ×                        |
|                  | c                              | d           | ×    | ○                         | ×                        |
| D <sub>4</sub>   | a                              | e           | ○    | ○                         | ×                        |
|                  | e                              | a           | ×    | ○                         | ×                        |
| D <sub>5</sub>   | b                              | e           | ○    | ○                         | ×                        |
|                  | e                              | b           | ×    | ○                         | ×                        |
| D <sub>6</sub>   | c                              | e           | ○    | ○                         | ×                        |
|                  | e                              | c           | ×    | ○                         | ×                        |

○: Continuity      ×: Discontinuity (∞)

**NOTE:**

The results “○” or “×” should be reversed according to the Pocket tester polarity.

**CAUTION:**

**Do not overcharge rectifier or damage may result.**

**Avoid:**

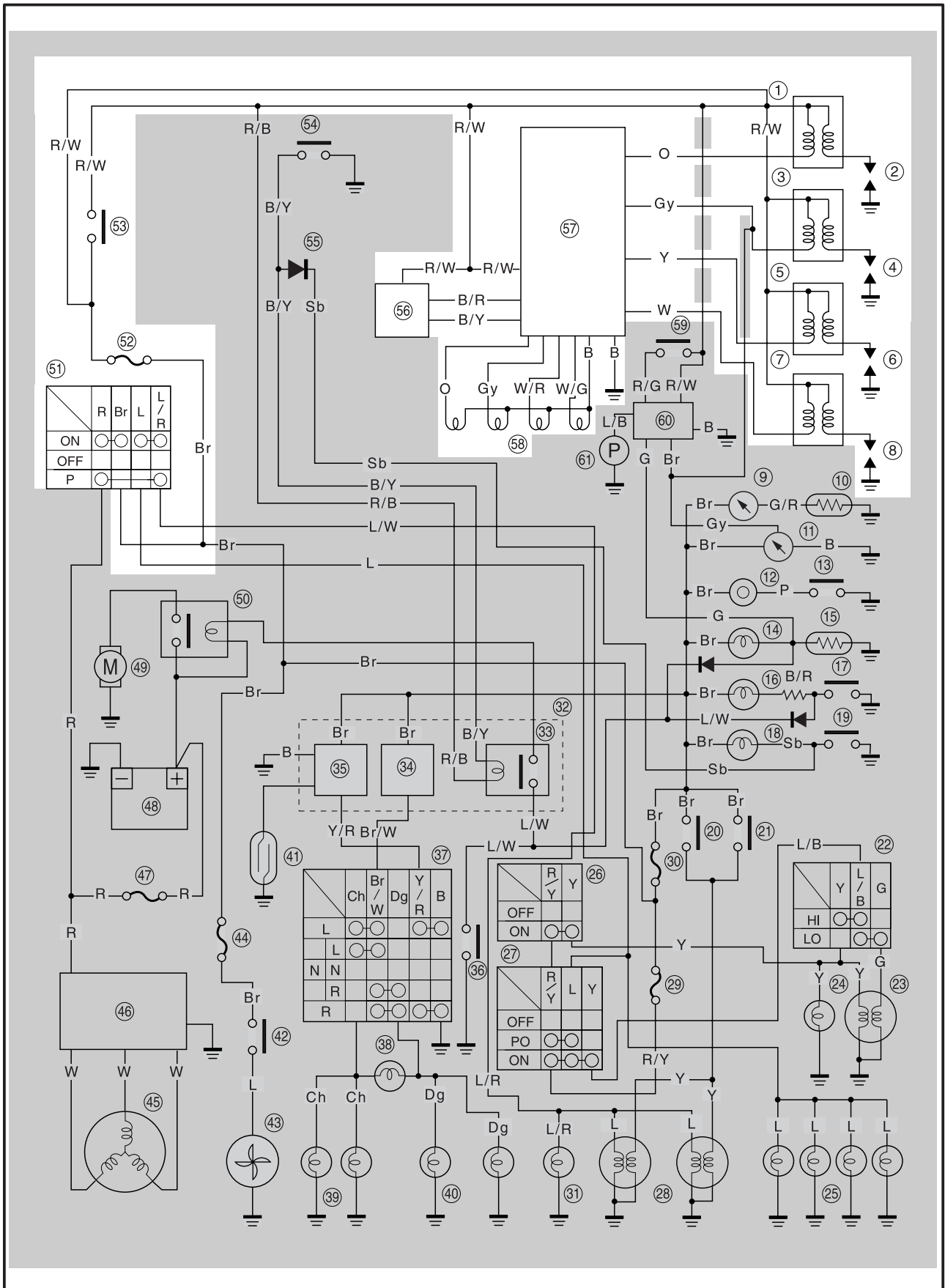
- A short circuit.
- Inverting + and – battery leads.
- Direct connection of rectifier to battery.

— MEMO —

Handwriting practice area with 20 horizontal dashed lines.



### IGNITION SYSTEM CIRCUIT DIAGRAM



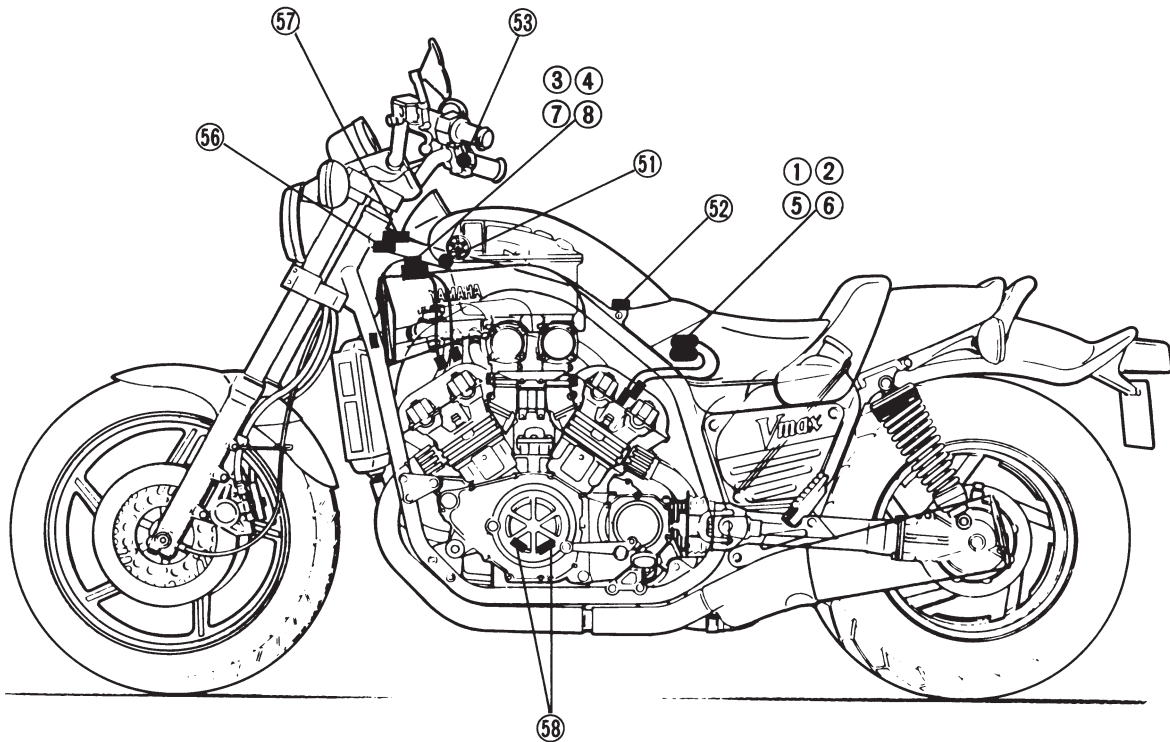


Aforementioned circuit diagram shows ignition circuit in wiring diagram.

**NOTE:**

For the encircled numbers and color codes, see page 7-2.

- |                    |                           |
|--------------------|---------------------------|
| ① Ignition coil #1 | ⑤① Main switch            |
| ② Spark plug #1    | ⑤② Fuse (IGNITION)        |
| ③ Ignition coil #2 | ⑤③ "ENGINE STOP" switch   |
| ④ Spark plug #2    | ⑤⑥ Pressure sensor        |
| ⑤ Ignition coil #3 | ⑤⑦ Ignitor unit           |
| ⑥ Spark plug #3    | ⑤⑧ Pick-up coil (#1 ~ #4) |
| ⑦ Ignition coil #4 |                           |
| ⑧ Spark plug #4    |                           |

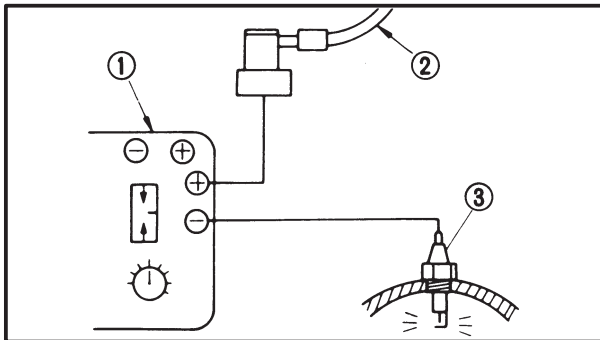




### TROUBLESHOOTING

The entire ignition system can be checked for misfire and weak spark by using the Electro Tester.

1. Warm up the engine so that all of the electrical components are at operating temperature.



2. Connect:
  - Electro Tester (90890-03021) ①
3. Start the engine, and increase the spark gap until misfire occurs. (Test at various r/min between idle and red line.)

② Spark plug lead

③ Spark plug

### CAUTION:

**Do not run the engine in neutral above 6,000 r/min for more than 1 or 2 seconds.**

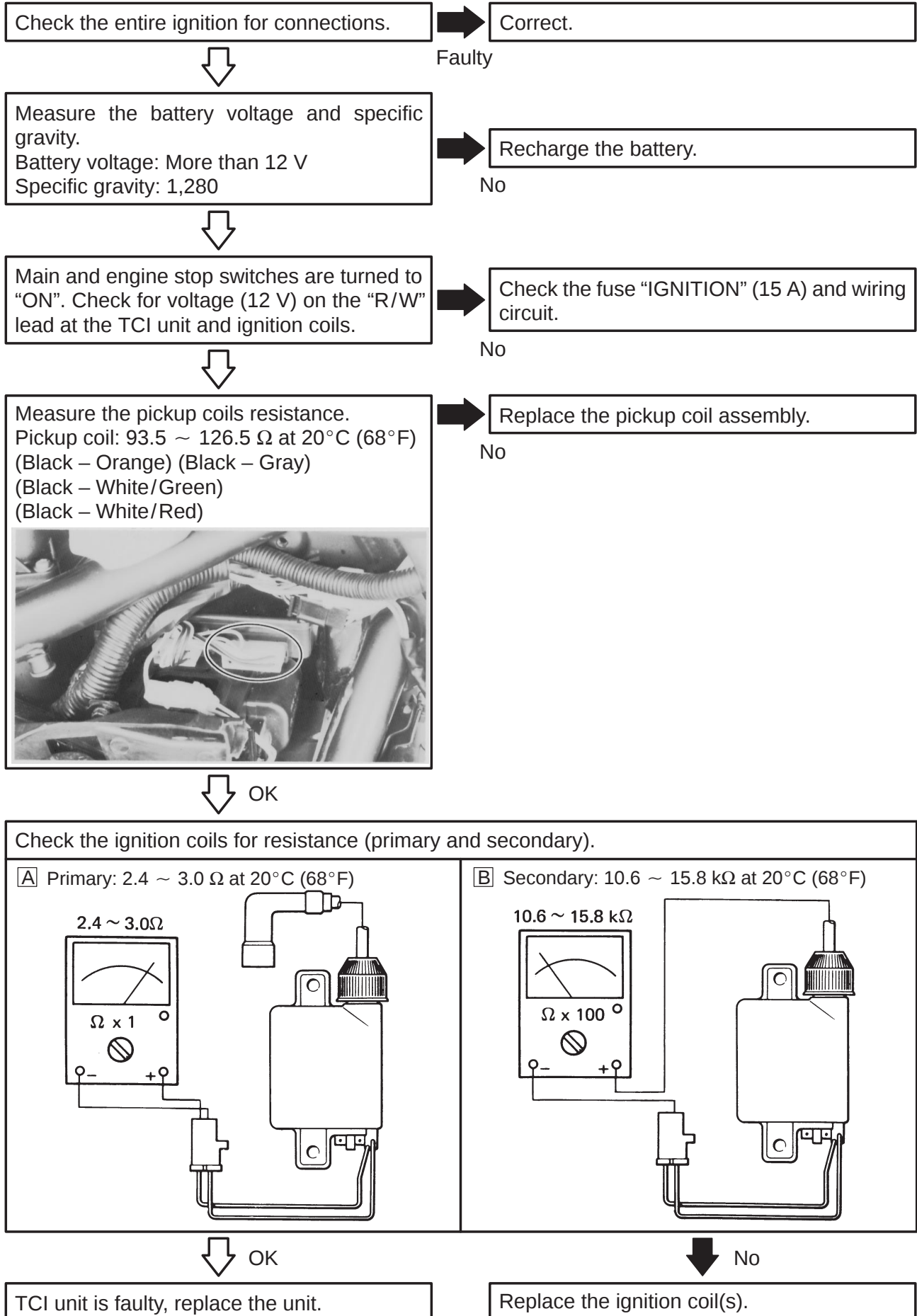


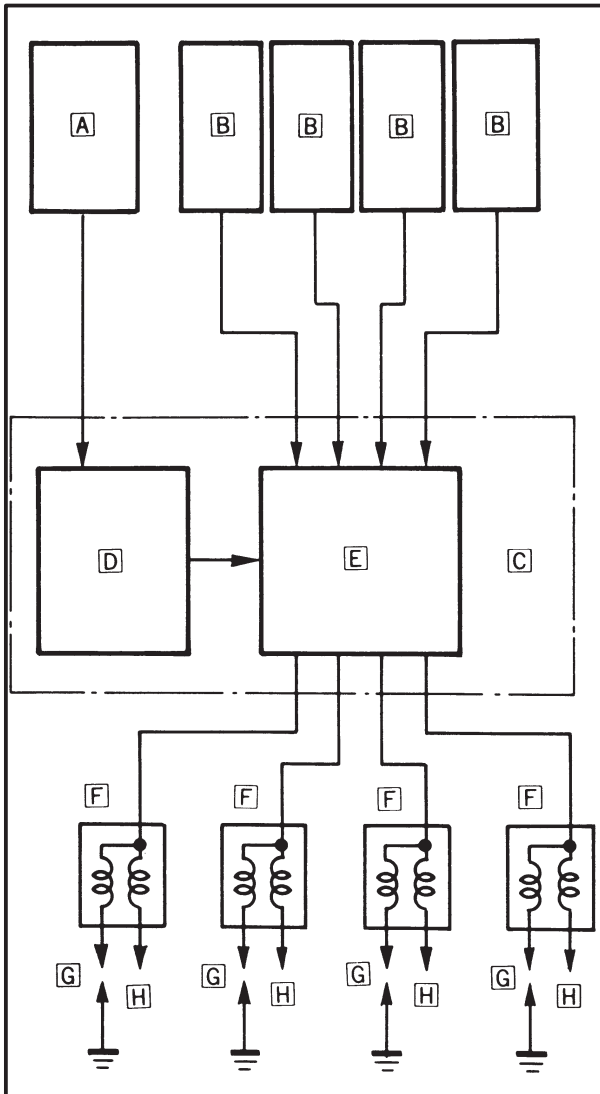
**Minimum Spark Gap:**  
**6 mm (0.24 in)**

Faulty ignition system operation (at the minimum spark gap or smaller) → Follow the troubleshooting chart until the source of the problem is located.



### Troubleshooting Chart

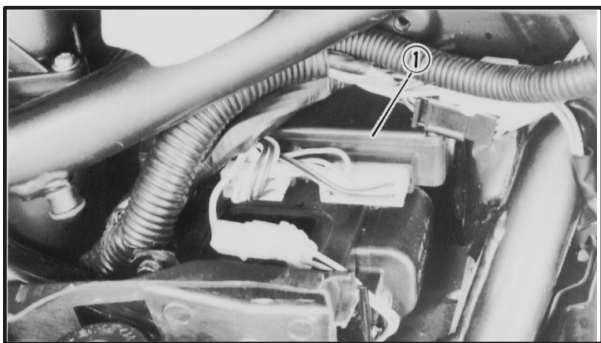




### DESCRIPTION

This model is equipped with a battery operated, fully transistorized, breakerless ignition system. By using magnetic pickup coils, the need for contact breaker points is eliminated. This adds to the dependability of the system by eliminating frequent cleaning and adjustment of points and ignition timing. The TCI (Transistor Control Ignition) unit incorporates an automatic advance circuit controlled by signals generated by the pickup coil. This adds to the dependability of the system by eliminating the mechanical advancer. This TCI system consists of two units; a pickup unit and an ignitor unit.

- [A] Pressure sensor
- [B] Pickup coil
- [C] Ignitor unit
- [D] Advance control
- [E] Electronic advance circuit
- [F] Ignition coil × 4
- [G] Spark plug × 4
- [H] Battery

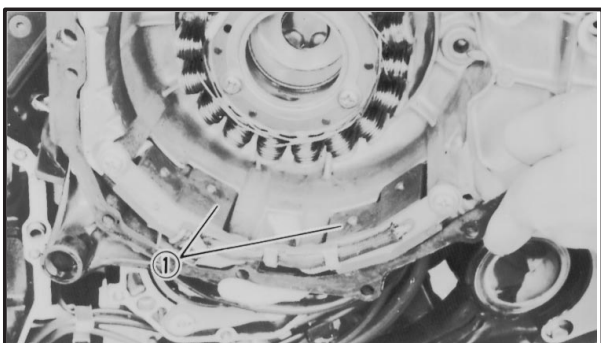


### OPERATION

#### TCI Unit

The TCI functions on the same principle as a conventional DC ignition system with the exception of using magnetic pickup coils and a transistor control box (TCI) in place of contact breaker points.

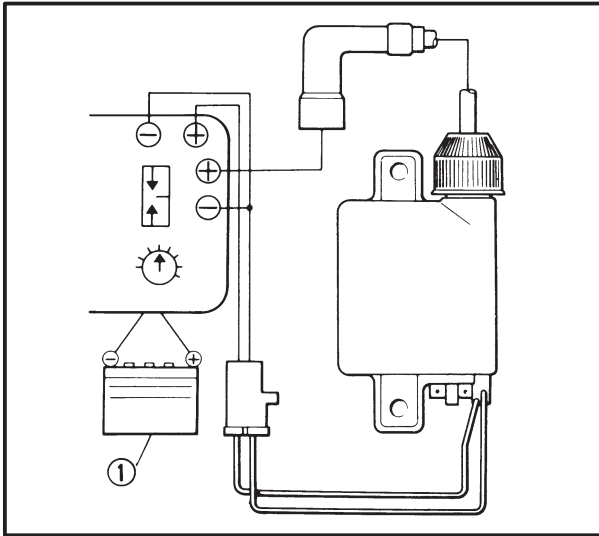
- ① TCI unit



#### Pickup Unit

The pickup unit consists of two pickup coils ① and a flywheel mounted onto the crankshaft. When the projection on the flywheel passes a pickup coil, a signal is generated and transmitted to the ignitor unit. The width of the projection on the flywheel determines the ignition advance.

The pickup coils are located in the right crank-case cover.



### IGNITION SPARK GAP TEST

1. Remove:
  - Top cover
  - Seat
  - Cover (left)
  - Electrical component board
2. Disconnect:
  - Ignition coil leads
  - Spark plug leads
3. Connect:
  - Electro Tester (90890-03021)

#### NOTE:

Be sure to use a fully charge 12 V battery ①.

4. Turn the spark plug gap adjuster and increase the gap to the maximum limit unless misfire occurs first.



**Minimum Spark Gap:**  
6 mm (0.24 in)

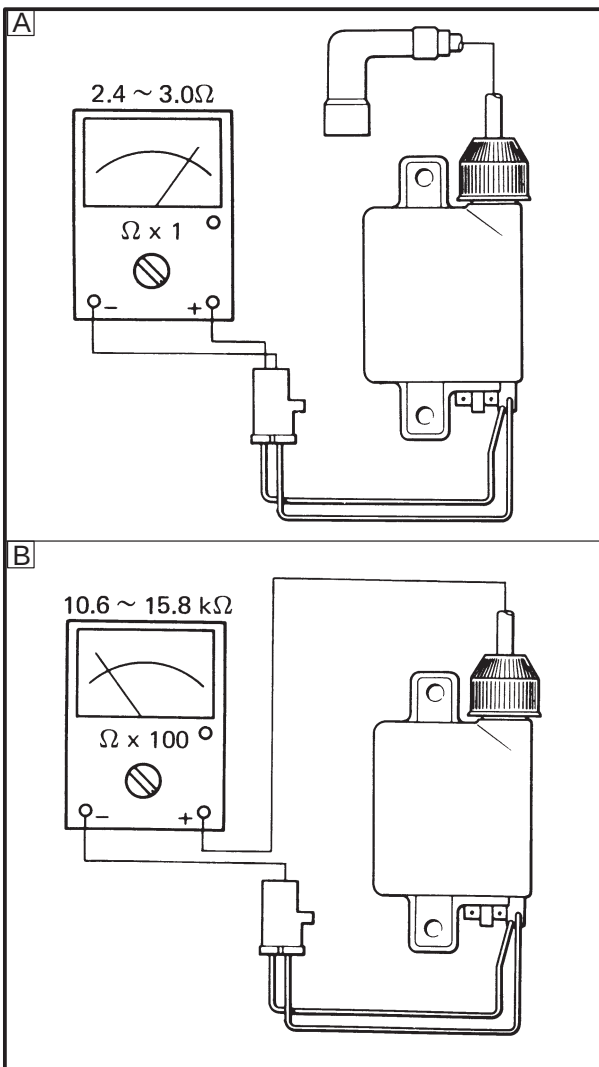
### IGNITION COIL RESISTANCE TEST

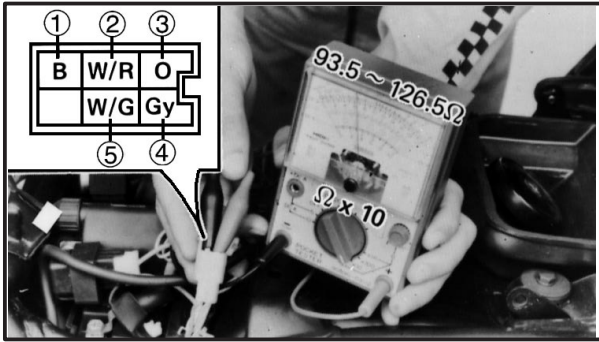
1. Connect:
  - Pocket Tester (90890-03112)
2. Measure:
  - Primary coil resistance **A**
  - Secondary coil resistance **B**

Out of specification → Replace.



**Primary Coil Resistance:**  
2.4 ~ 3.0  $\Omega$  at 20°C (68°F)  
**Secondary Coil Resistance:**  
10.6 ~ 15.8 k $\Omega$  at 20°C (68°F)  
**Spark Plug Cap:**  
9 ~ 11 k $\Omega$





### PICKUP COIL RESISTANCE TEST

1. Remove:
  - Seat
2. Disconnect:
  - 5-pin connector (Black, White/Red, Orange, White/Green and Gray)
3. Measure
  - Pickup coil resistance
 Use a Pocket Tester (90890-03112).  
 Out of specification → Replace.



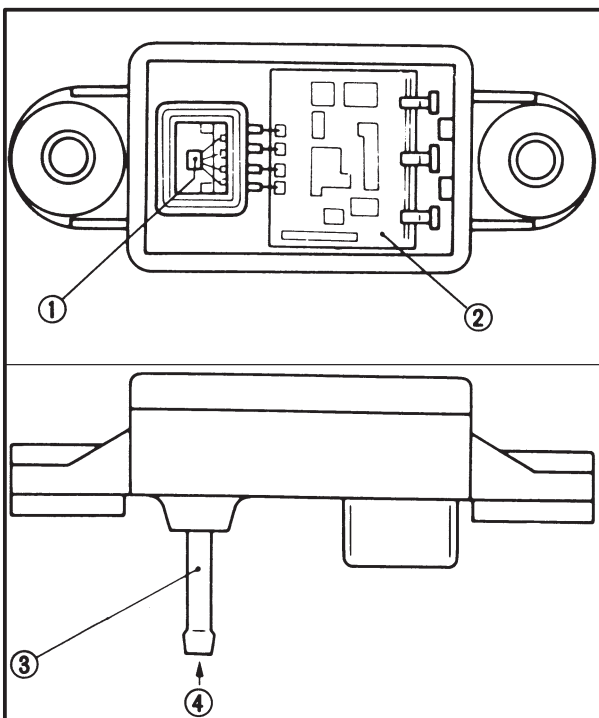
#### Pickup Coil Resistance:

**93.5 ~ 126.5 Ω at 20°C (68°F)**  
**(B – O), (B – Gy),**  
**(B – W/G), (B – W/R)**

- ① Black
- ② White/Red
- ③ Orange
- ④ Gray
- ⑤ White/Green

### SPARK PLUG INSPECTION

Refer to “CHAPTER 2. SPARK PLUG INSPECTION” section.



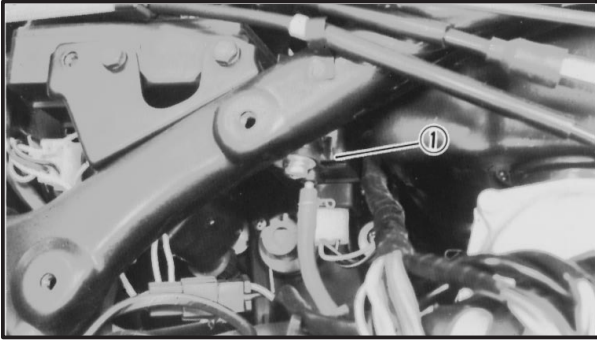
### PRESSURE SENSOR

#### Operation

This pressure sensor unit consists of a semiconductor strain gauge and an amplifying circuit.

Pressure to the carburetor joint (venturi portion) is sensed by the strain gauge and amplified in the circuit connected with this gauge. The amplified pressure signals are then transmitted to the ignition system for the control of ignition timing advance.

- ① Strain gauge
- ② Amplifying circuit
- ③ Pressure intake tube
- ④ From carburetor joint



### Removal

1. Remove:
  - Top cover
  - Cover (left)
  - Electrical component board
2. Disconnect:
  - Sensor connector
  - Vacuum hose
3. Remove:
  - Pressure sensor ①

### Inspection

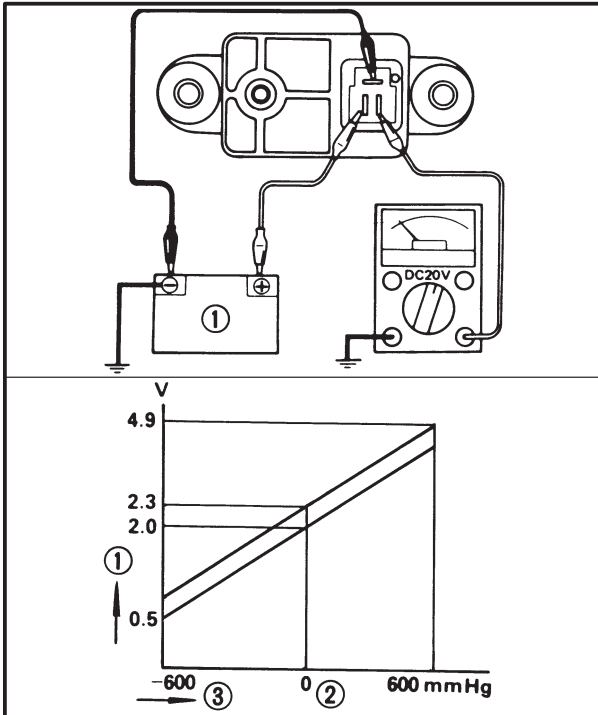
1. Connect:
  - Pocket Tester (90890-03112)
  - Battery (12 V) ①
2. Measure:
  - Output voltage

Out of specification → Replace.



**Output Voltage:**  
**About 2.0 DC Volt**

- ① Output voltage
- ② Atmospheric pressure
- ③ Pressure



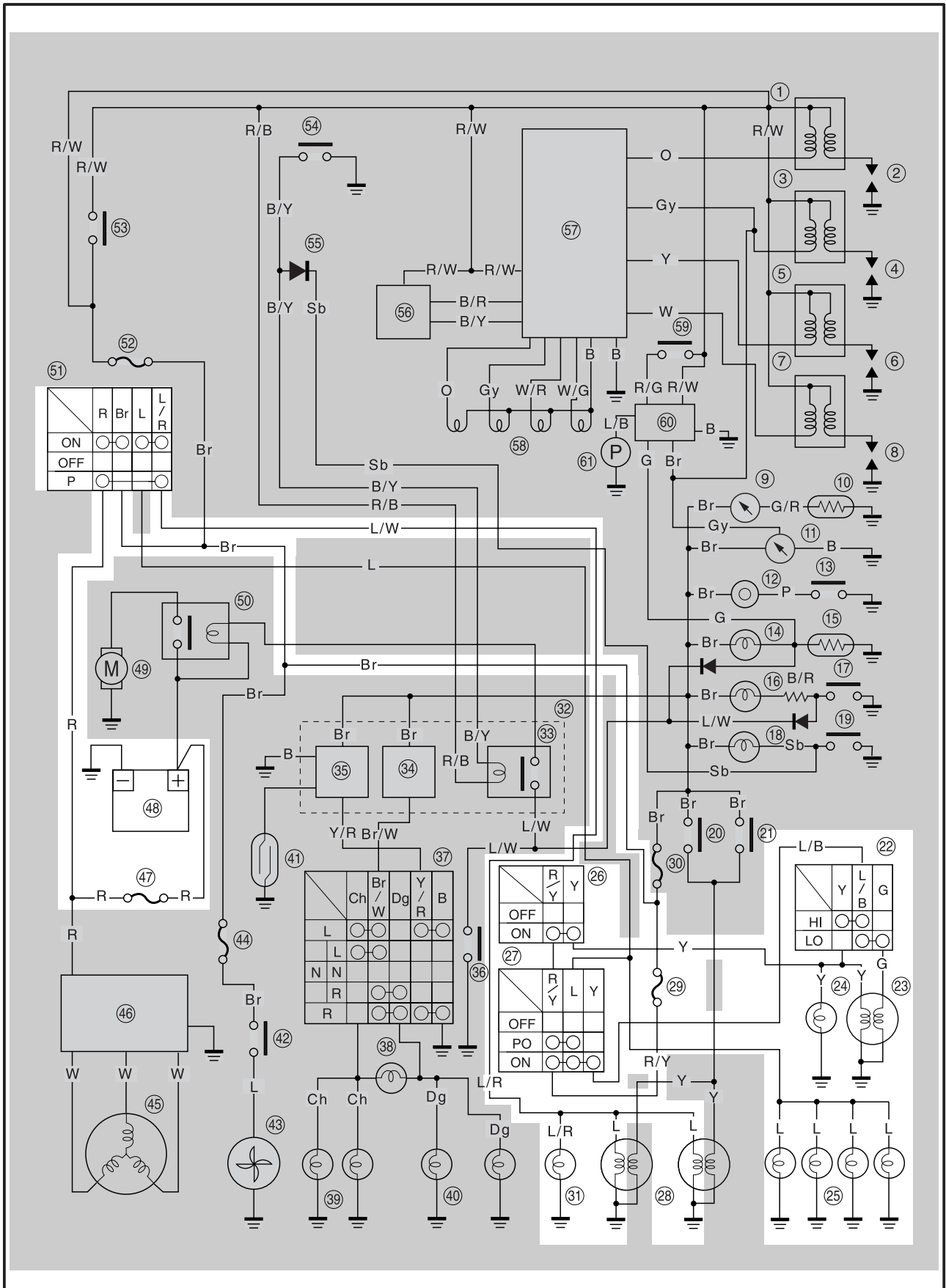
### Installation

1. Install:
  - Pressure sensor

Reverse the removal procedure.



### LIGHTING SYSTEM CIRCUIT DIAGRAM



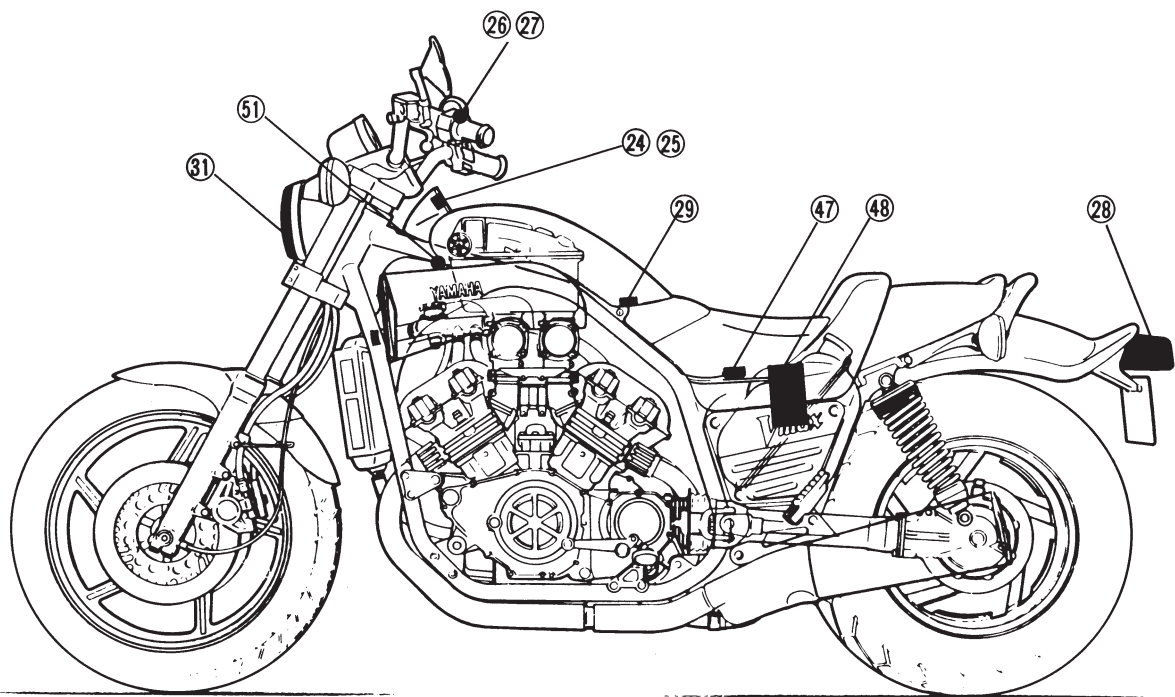


Aforementioned circuit diagram shows lighting circuit in wiring diagram.

**NOTE:**

For the encircled numbers and color codes, see page 7-2.

- ②② "LIGHTS" (Dimmer) switch
- ②③ Headlight
- ②④ "HIGH BEAM" indicator light
- ②⑤ Meter lights
- ②⑥ "PASS" switch
- ②⑦ "LIGHTS" switch
- ②⑧ Tail/brake light
- ②⑨ Fuse (HEAD)
- ③① Auxiliary light
- ④⑦ Main fuse
- ④⑧ Battery
- ⑤① Main switch





### LIGHTING TESTS AND CHECKS

The battery provides power for operation of the headlight, taillight, and meter lights. If none of the above fail to operate proceed further.

Low battery voltage indicates either a faulty battery, low battery fluid level, or a defective charging system.

Also check fuse condition. Replace any "open" fuses. There are individual fuses for various circuits (see complete Circuit Diagram).

**NOTE:** \_\_\_\_\_

Check each bulb first before performing the following check.

\_\_\_\_\_



### Headlight Troubleshooting

**HEADLIGHT DOES NOT COME ON HIGH BEAM DOES NOT OPERATION.**



Check headlight bulb.

Faulty

Replace.



OK

Check fuse (HEAD).

Faulty

Replace.



OK

Measure voltage on Brown lead from main switch ("ON" position).

Faulty

Check main switch, replace if necessary.



12 V

Measure voltage on Blue/Black lead from "LIGHTS" switch ("ON" position).

No voltage

Check "LIGHTS" switch, if necessary.



12 V

Measure voltage at "LIGHTS" (Dimmer) switch terminal.

No voltage

Check "LIGHTS" (Dimmer) switch, replace if necessary.



12 V

Measure voltage at headlight high beam or low beam terminal.

No voltage

An open or poor connection between headlight and "LIGHTS" (Dimmer) switch terminal.

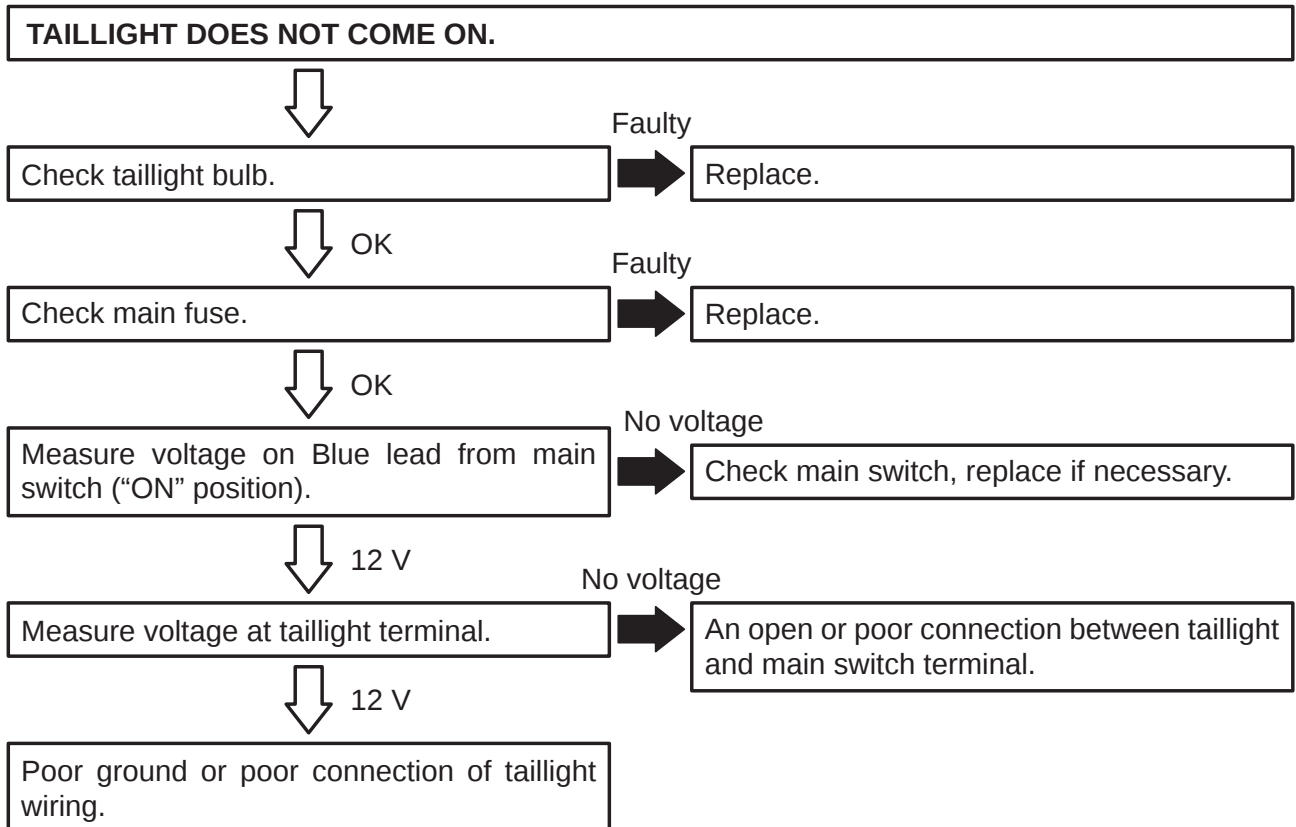


12 V

Poor ground or poor connection of headlight wiring.



### Taillight Troubleshooting



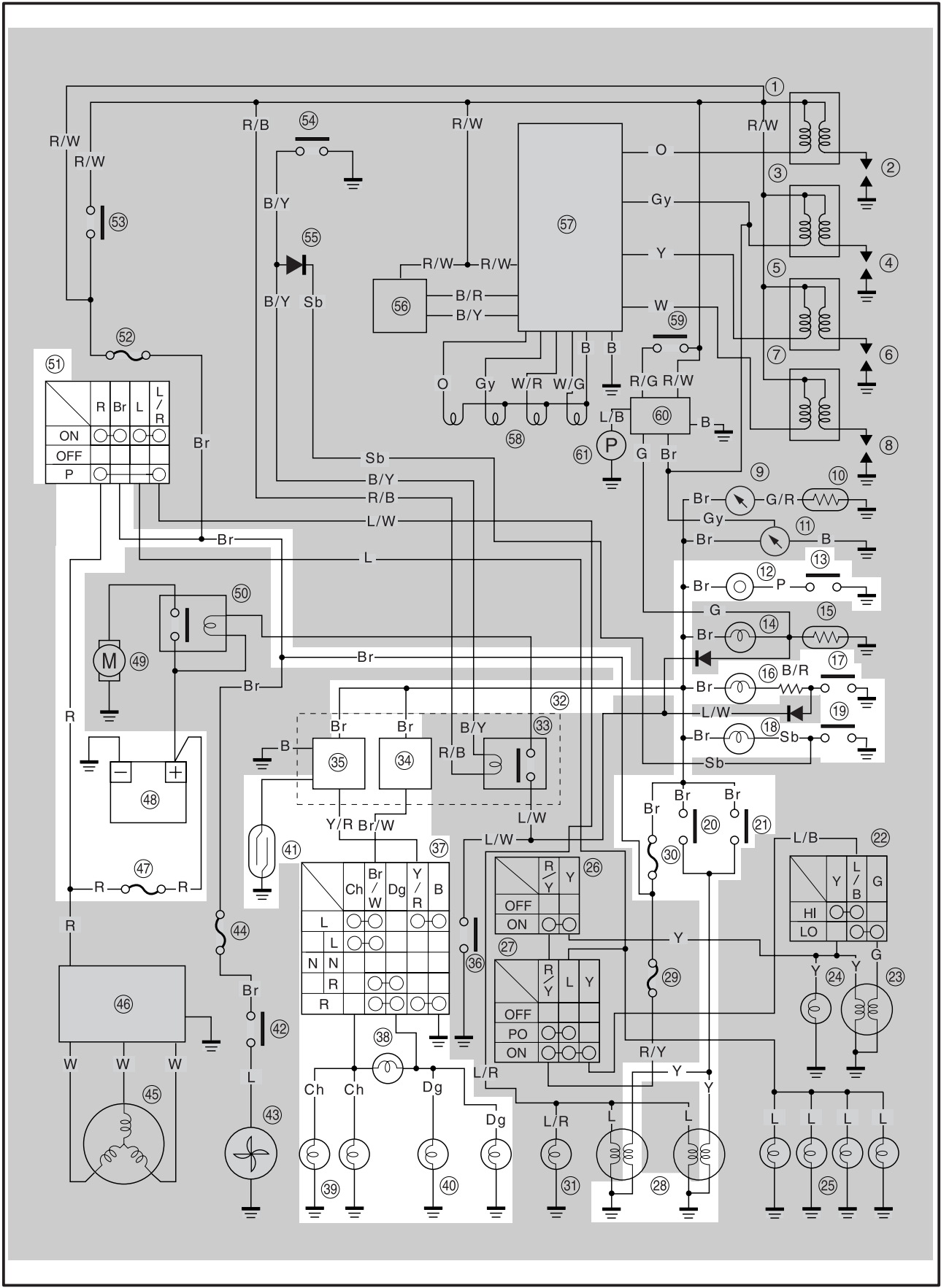


— MEMO —

Area for handwritten notes, consisting of multiple horizontal dashed lines.



SIGNAL SYSTEM  
CIRCUIT DIAGRAM



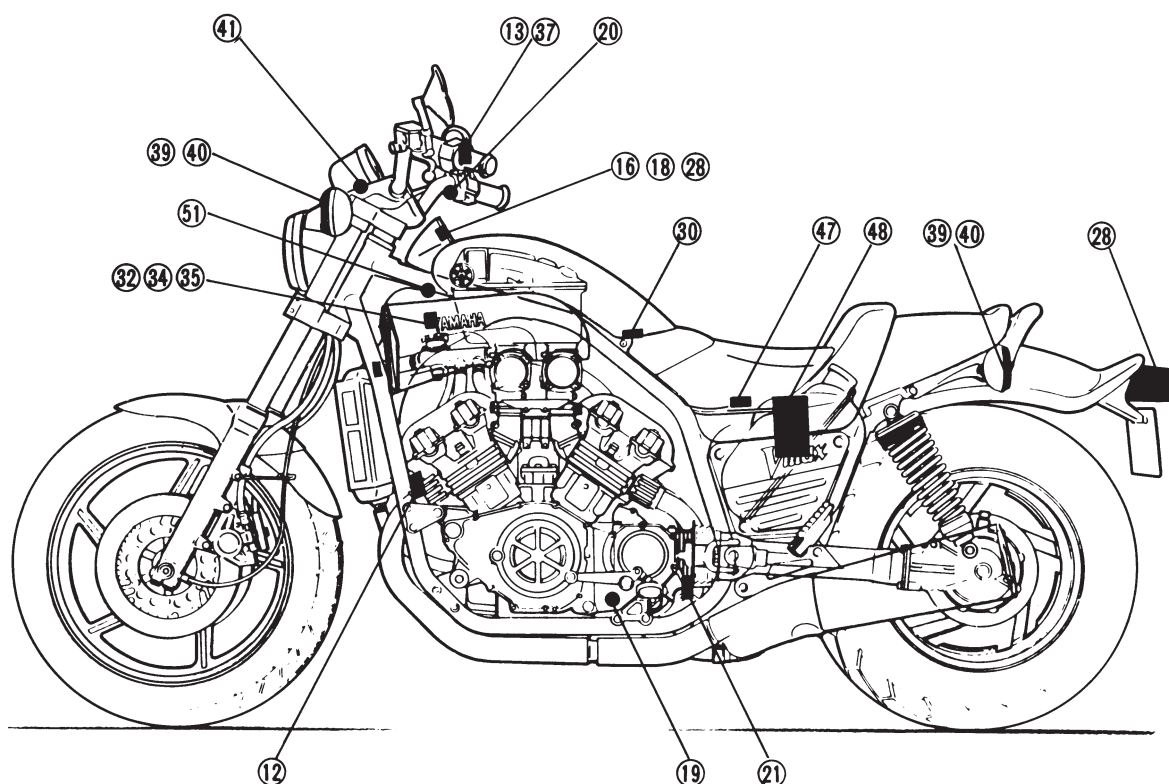


Aforementioned circuit diagram shows signal circuit in wiring diagram.

### NOTE:

For the encircled numbers and color codes, see page 7-2.

- |                                       |                           |
|---------------------------------------|---------------------------|
| ⑫ Horn                                | ③④ Flasher relay          |
| ⑬ "HORN" switch                       | ③⑤ Canelling unit         |
| ⑬ "OIL LEVEL" warning indicator light | ③⑦ "TURN" switch          |
| ⑬ Oil level gauge                     | ③⑧ "TURN" indicator light |
| ⑬ "NEUTRAL" indicator light           | ③⑨ Flasher light (Left)   |
| ⑬ Neutral switch                      | ④① Flasher light (Right)  |
| ⑬ Front brake switch                  | ④① Reed switch            |
| ⑬ Rear brake switch                   | ④⑦ Main fuse              |
| ⑬ Tail/brake light                    | ④⑧ Battery                |
| ⑬ Fuse (SIGNAL)                       | ⑤① Main switch            |
| ⑬ Relay assembly                      |                           |





### SIGNAL SYSTEM TESTS AND CHECKS

The battery provides power for operation of the horn, brakelight, indicator lights and flasher lights. If none of the above operates, always check battery voltage before proceeding further.

#### Battery

1. Check:

- Battery voltage  
Defective components → Replace.

|            |                           |
|------------|---------------------------|
| Check for: | Faulty battery            |
|            | Low battery fluid level   |
|            | Defective charging system |
|            | Faulty fuse(s)            |

#### Horn

1. Check:

- Horn operation  
Defective components → Replace.

|            |                                                                |
|------------|----------------------------------------------------------------|
| Check for: | 12 V on Brown lead to horn                                     |
|            | Good grounding of horn (Pink lead) when horn button is pressed |
|            | Faulty fuse                                                    |

#### Brake Light

1. Check:

- Brake light operation  
Defective components → Replace.

|            |                                                                             |
|------------|-----------------------------------------------------------------------------|
| Check for: | Defective bulb                                                              |
|            | 12 V on Yellow lead to brake light                                          |
|            | 12 V on Brown lead to each brake light switch (Front and rear brake switch) |

#### “NEUTRAL” Indicator Light

1. Check:

- Indicator light operation  
Defective components → Replace.

|            |                                         |
|------------|-----------------------------------------|
| Check for: | Defective bulb                          |
|            | 12 V on Sky Blue lead to neutral switch |
|            | 12 V on Brown lead to indicator light   |



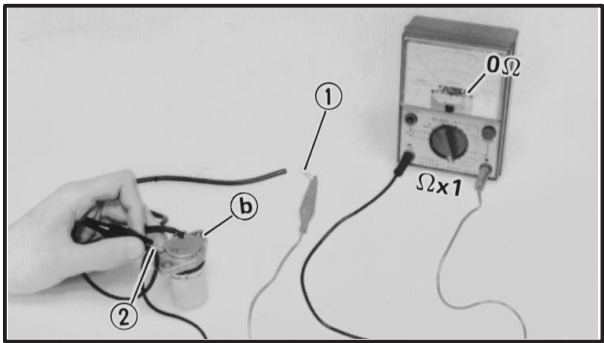
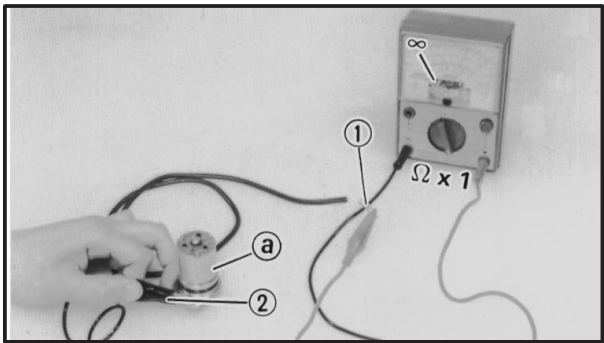
“OIL LEVEL” Warning Indicator Light

1. Check:
- Indicator light operation
- Defective components → Replace.

|            |                                       |
|------------|---------------------------------------|
| Check for: | Defective bulb                        |
|            | Defective oil level gauge             |
|            | 12 V on Brown lead to indicator light |

Flasher Light

1. Check:
- Flasher light operation
- Refer to “SELF-CANCELLING FLASHER SYSTEM” section.



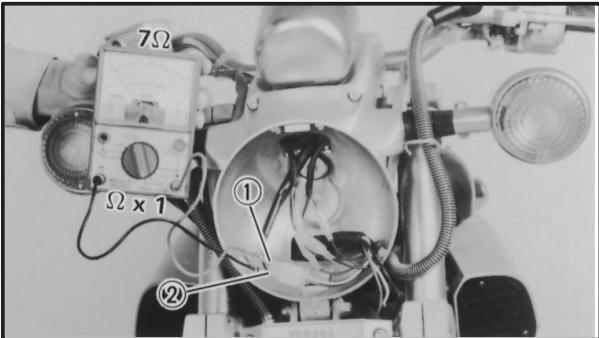
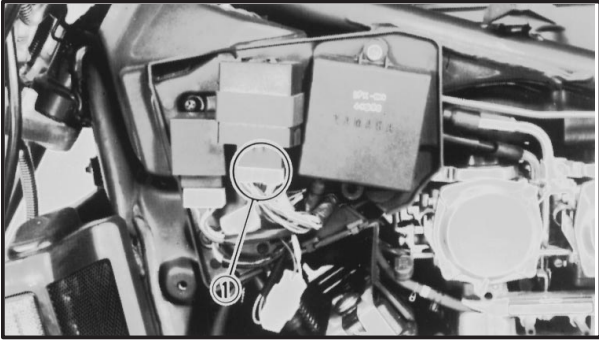
OIL LEVEL GAUGE TEST

1. Drain:
- Engine oil
2. Remove:
- Oil level gauge
3. Measure:
- Oil level gauge resistance
- Use the Pocket Tester (90890-03112).  
Out of specification → Replace.



**Oil Level Gauge Resistance:**  
Float is down (a) → Infinity  
Float is up (b) → Zero ohms

- ① Black/Red  
② Ground
4. Install:
- Oil level gauge
5. Connect:
- Leads
6. Fill:
- Crankcase
- Refer to “CHAPTER 2 ENGINE OIL REPLACEMENT” section.



### REED SWITCH TEST

1. Remove:
  - Headlight lens unit
  - Top cover
  - Cover (left)
2. Disconnect:
  - Relay assembly coupler ①
3. Measure:
  - Reed switch resistance

Use the Pocket Tester (90890-03112).  
 Out of specification → Replace.  
 Lift the front wheel and rotate the wheel by hand.



#### Reed Switch Resistance:

**About 7 Ω**

**Then return back 0 Ω" or ∞ Ω  
when wheel is stopped**

① White/Green

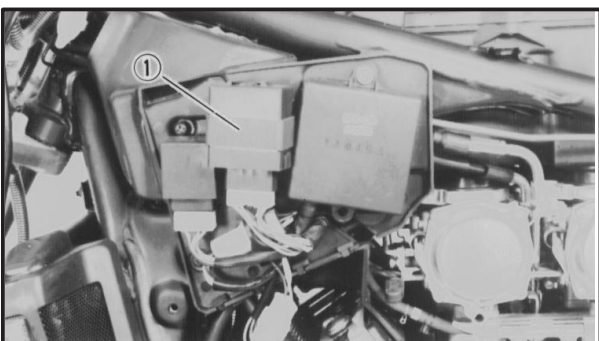
② Black

### SELF-CANCELLING FLASHER SYSTEM TEST

#### Description

The self-cancelling flasher system turns off the turn signal after a period of time or distance involved in turning or changing lanes. Generally, the signal will cancel after either 10 seconds, or 150 meters (490 feet), whichever is greater. At very low speed, the function is determined by distance; at high speed, especially when changing speeds the cancelling determination is a combination of both times and distance. The self-cancelling determination is a commechanism only operates when the motorcycle is moving; thus the signal will not self-cancel while you are stopped at an intersection.

① Cancelling unit



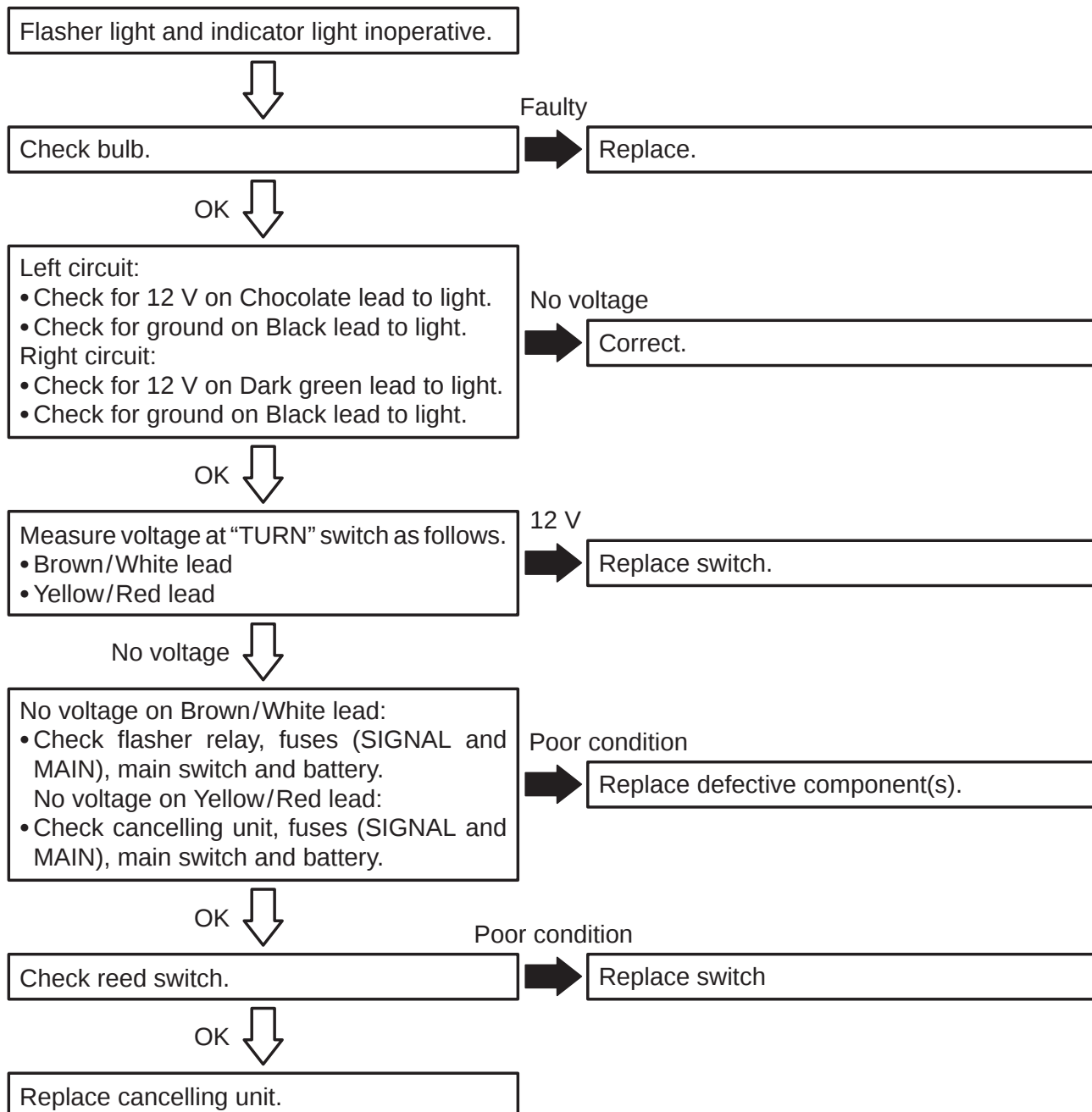


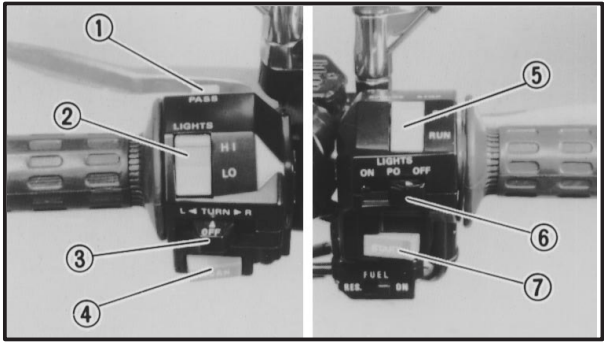
### Operation

The handlebar switch has three positions: L (left), OFF, and R (right). The switch lever will return to the "OFF" position after being pushed to L or R, but the signal will function.

By pushing the lever in, the signal may be cancelled manually. If the flasher self-cancelling system should become inoperative, replace relay unit.

### Troubleshooting





**SWITCHES TEST**

Switches may be checked for continuity with a Pocket Tester (90890-03112) on the “Ohm × 1” position.

- ① “PASS” switch
- ② “LIGHTS” (Dimmer) switch
- ③ “TURN” switch
- ④ “HORN” switch
- ⑤ “ENGINE STOP” switch
- ⑥ “LIGHTS” switch
- ⑦ “START” switch

**Main Switch**

| Switch Position | Lead Color |    |   |     |
|-----------------|------------|----|---|-----|
|                 | R          | Br | L | L/R |
| P               | ○          | —  | — | ○   |
| OFF             |            |    |   |     |
| ON              | ○          | ○  | ○ | ○   |

**“PASS” Switch**

| Switch Position | Lead Color |   |
|-----------------|------------|---|
|                 | R/Y        | Y |
| OFF             |            |   |
| ON              | ○          | ○ |

**“LIGHTS” (Dimmer) Switch**

| Switch Position | Lead Color |     |   |
|-----------------|------------|-----|---|
|                 | Y          | L/B | G |
| HI              | ○          | ○   |   |
| LO              |            | ○   | ○ |

**“TURN” Switch**

| Switch Position |   | Lead Color |      |    |     |   |
|-----------------|---|------------|------|----|-----|---|
|                 |   | Ch         | Br/W | Dg | Y/R | B |
| L               |   | ○          | ○    |    | ○   | ○ |
| N               | L | ○          | ○    |    |     |   |
|                 | N |            |      |    |     |   |
|                 | R |            | ○    | ○  |     |   |
| R               |   |            | ○    | ○  | ○   | ○ |

**“HORN” Switch**

| Switch Position | Lead Color |   |
|-----------------|------------|---|
|                 | P          | B |
| OFF             |            |   |
| ON              | ○          | ○ |

“ENGINE STOP” Switch

| Switch Position | Lead Color                                                                          |                                                                                     |
|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                 | R/W                                                                                 | Br                                                                                  |
| OFF             |                                                                                     |                                                                                     |
| ON              |  |  |

“LIGHTS” Switch

| Switch Position | Lead Color                                                                          |                                                                                     |                                                                                     |
|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                 | R/Y                                                                                 | L                                                                                   | L/B                                                                                 |
| OFF             |                                                                                     |                                                                                     |                                                                                     |
| PO              |  |  |                                                                                     |
| ON              |  |  |  |

“START” Switch

| Switch Position | Lead Color                                                                          |                                                                                     |
|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                 | L/W                                                                                 | B                                                                                   |
| OFF             |                                                                                     |                                                                                     |
| ON              |  |  |

[illegible]

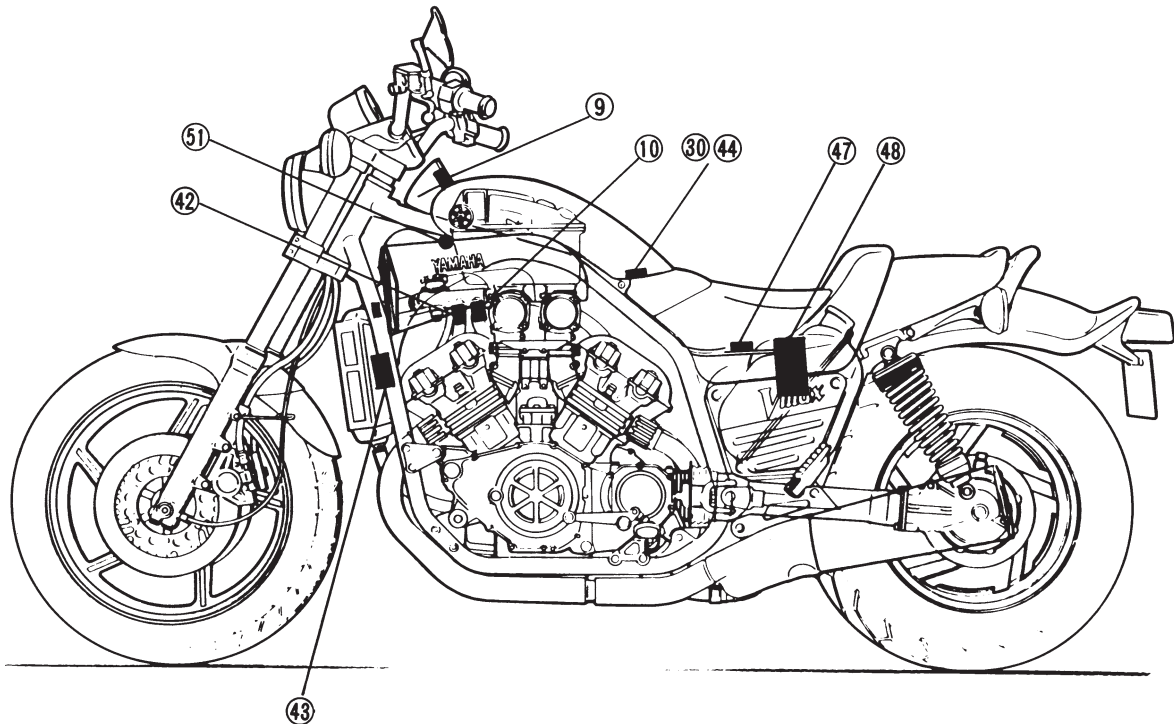


Aforementioned circuit diagram shows cooling circuit in wiring diagram.

**NOTE:**

For the encircled numbers and color codes, see page 7-2.

- ⑨ Temperature meter
- ⑩ Thermo-unit
- ③① Fuse (SIGNAL)
- ④② Thermostatic switch
- ④③ Electric fan
- ④④ Fuse
- ④⑦ Main fuse
- ④⑧ Battery
- ⑤① Main switch





## TROUBLESHOOTING

The electric fan will not turn at coolant temperatures of  $105 \pm 3^{\circ}\text{C}$  ( $221.0 \pm 5.4^{\circ}\text{F}$ ) or more:



Check the connectors.

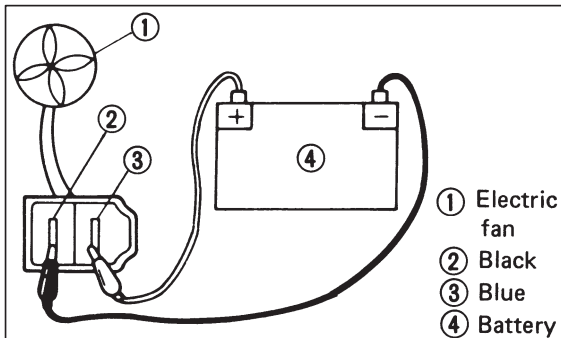
Defective

Correct.



OK

Disconnect fan motor connector and connect battery as shown.



Fan inoperative

Replace fan motor assembly.



Fan operative

No voltage

Check battery voltage on Blue leads.

Check wiring circuit, and correct defective component(s).



12 V

Disconnect the lead of the thermostatic switch and ground it to the motor body.

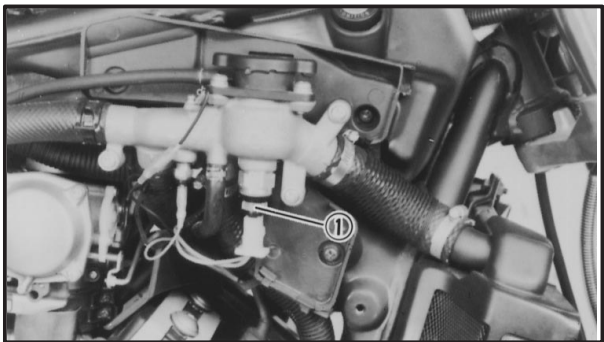
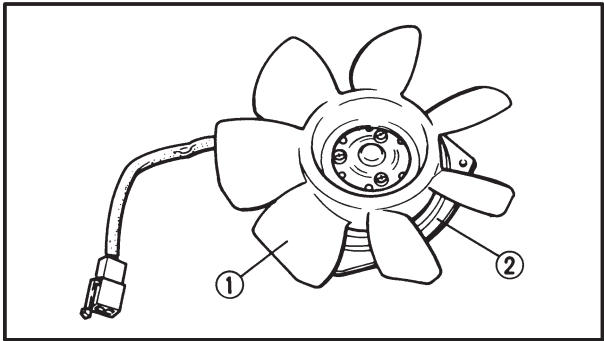
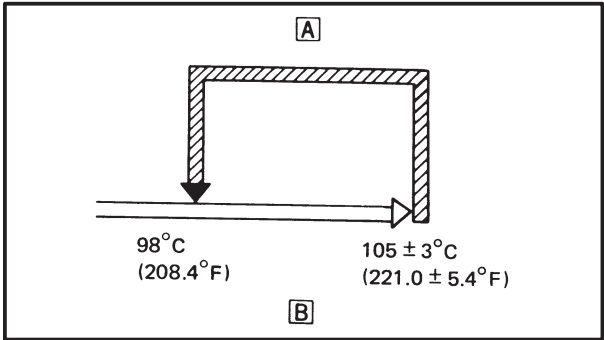
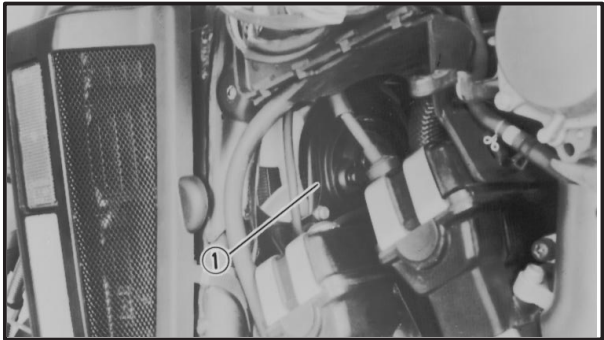
Fan operative

Replace the thermostatic switch.



Fan inoperative

Replace the fan motor assembly.



**ELECTRIC FAN AND THERMOSTATIC SWITCH**  
**Operation**

The electric fan will be switched ON or OFF according to the coolant temperature in the radiator.

① Electric fan

**NOTE:** The electric fan is controlled by the thermostatic switch when the main switch is “ON”. Thus, under certain operating conditions, this fan may continue to run until the engine temperature has cooled down to about 91°C (195.8°F).

- A** THERMOSTATIC SWITCH “ON”  
**B** COOLANT TEMPERATURE

**Electric Fan Inspection**

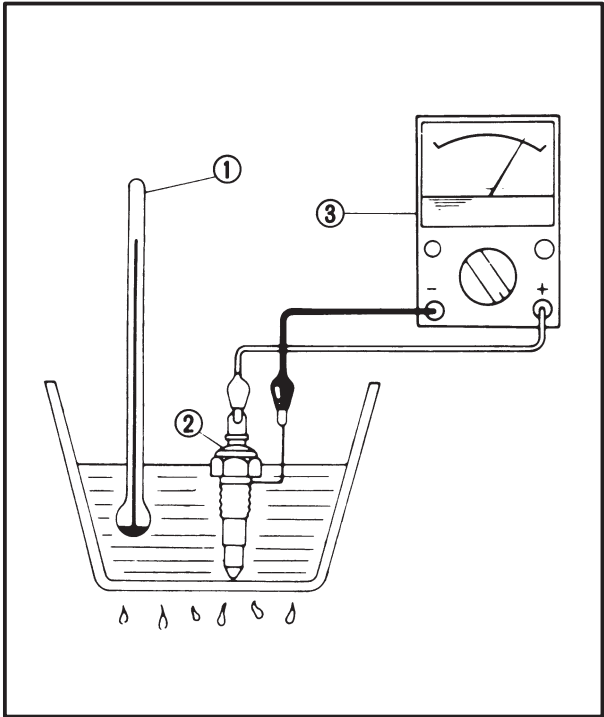
| The following problems may require repair or replacement of components |                     |
|------------------------------------------------------------------------|---------------------|
| Component                                                              | Condition           |
| Fan motor                                                              | Unsmooth operation  |
| Fan motor                                                              | Excessive vibration |
| Fan motor bracket                                                      | Cracks              |
| Fan blades                                                             | Cracks              |
| Securing bolts                                                         | Looseness           |

- ① Fan  
② Electric fan motor

**Thermostatic Switch Inspection**

1. Remove:
- Top cover
  - Cover (right)
  - Thermostatic switch ①

**WARNING:** Handle the thermostatic valve very carefully. Never subject it to strong shock or allow it to be dropped. Should it be dropped, it must be replaced.



2. Inspect:
- Thermostatic switch operation

**Thermostatic switch inspection steps:**

- Immerse thermostatic switch in water.
- ① Thermometer  
② Thermostatic switch  
③ Pocket Tester
- Check continuity as indicated.  
Note temperatures while heating the water.  
Malfunction → Replace switch.

| Test Step                                                  | Water Temperature                      | Pocket Tester ( $\Omega \times 1$ ) |
|------------------------------------------------------------|----------------------------------------|-------------------------------------|
| 1                                                          | 0 ~ 98°C<br>(32 ~ 208.4°F)             | Discontinuity                       |
| 2                                                          | More than 105 ± 3°C<br>(221.0 ± 5.4°F) | Continuity                          |
| 3*                                                         | 105 to 98°C<br>(221.0 to 208.4°F)      | Continuity                          |
| 4*                                                         | Less than 98°C<br>(208.4°F)            | Discontinuity                       |
| Test 1 & 2; Heat-up tests<br>Test 3* & 4*; Cool-down tests |                                        |                                     |

3. Install:
- Thermostatic switch



**Thermostatic Switch:**  
15 Nm (1.5 m•kg, 11 ft•lb)  
Three Bond Sealock® #10

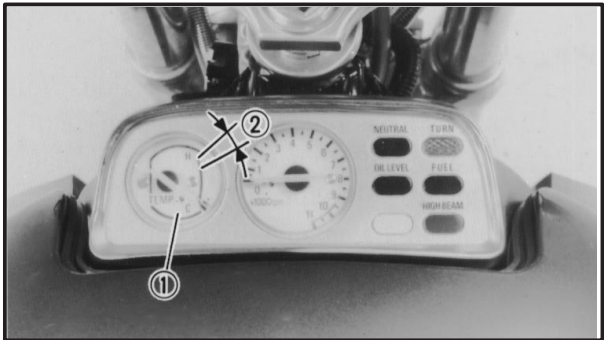
**CAUTION:**

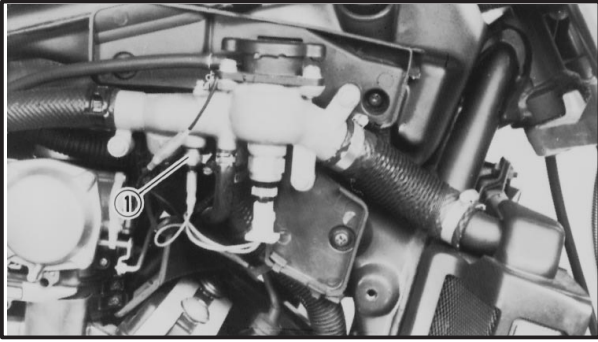
After replacing the thermostatic switch, check the coolant level in the radiator and also check for any leakage.

**THERMO-UNIT AND THERMOMETER Operation**

The thermo unit has less resistance at higher temperatures and thus allows more current to pass through. When more current flows to the coil in the thermometer, the armature to which the needle is attached by the increased magnetic field. In this way, the needle indicates the temperature.

- ① Temperature meter  
② Red zone



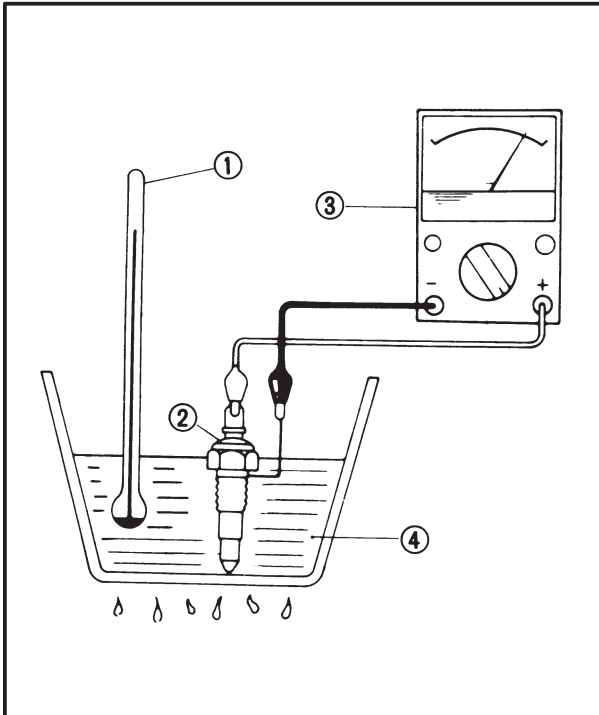


### Thermo-unit Inspection

1. Remove:
  - Top cover
  - Cover (right)
  - Thermo-unit ①

### WARNING:

Handle the thermo-unit with special care. Never subject it to strong shock or allow it to be dropped. Should it be dropped, it must be replaced.



2. Inspect:
  - Thermo-unit operation

### Thermo-unit inspection steps:

- Immerse thermo-unit in water.

- ① Temperature gauge
- ② Thermo-unit
- ③ Pocket Tester
- ④ Water

- Check continuity at indicated  
Note temperatures while heating the water.  
Malfunction → Replace switch

|                   |                 |                  |                  |
|-------------------|-----------------|------------------|------------------|
| Water Temperature | 50°C<br>(122°F) | 80°C<br>(176°F)  | 100°C<br>(212°F) |
| Resistance        | 153.9 Ω         | 47.5 ~<br>56.8 Ω | 26.2 ~<br>29.3 Ω |

3. Install:
  - Thermo-unit



### Thermo-unit:

15 Nm (1.5 m•kg, 11 ft•lb)

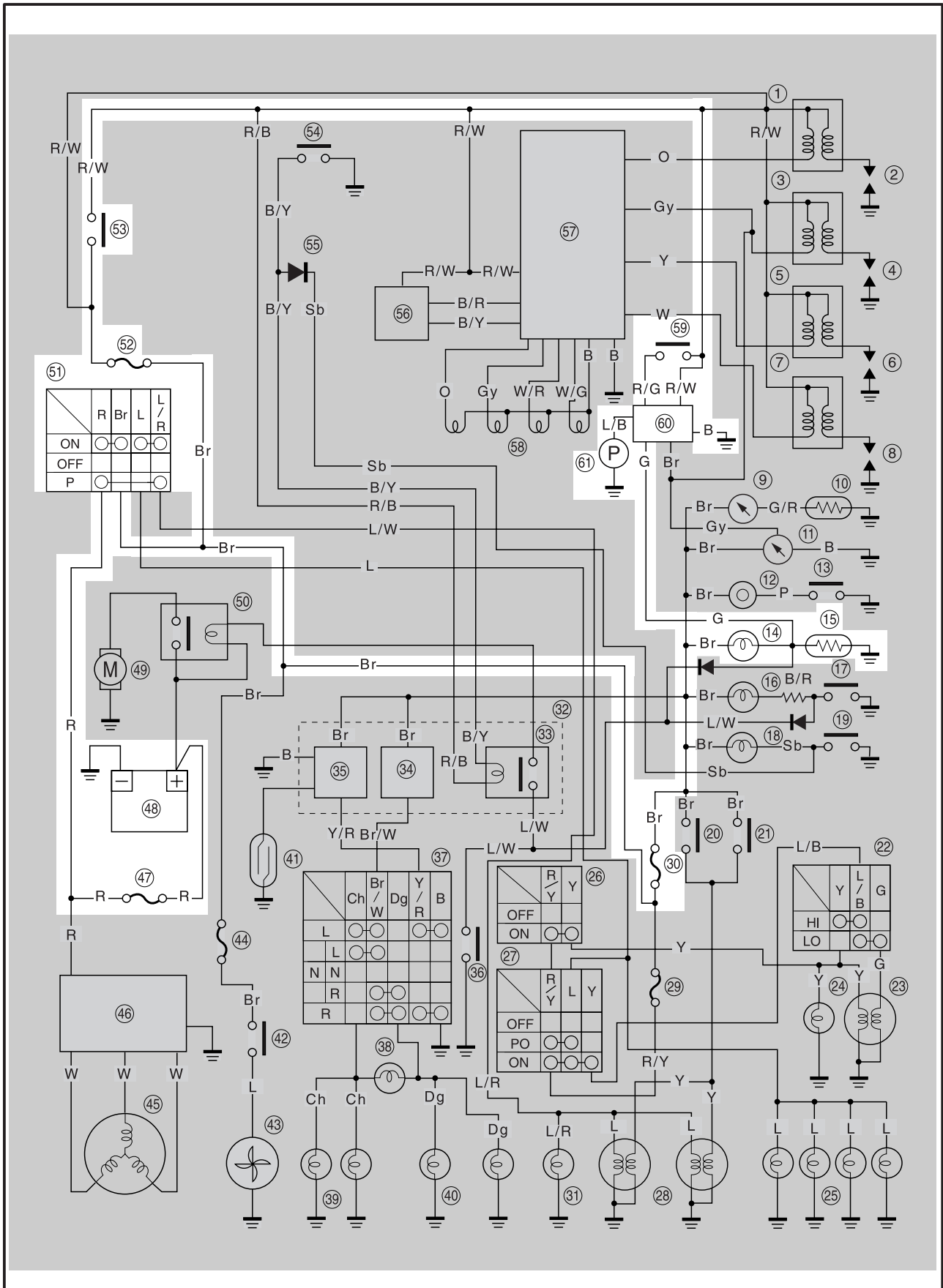
Three Bond Sealock® #10

### CAUTION:

After replacing the thermo-unit, check the coolant level in the radiator and also check for any leakage.



### FUEL PUMP SYSTEM CIRCUIT DIAGRAM



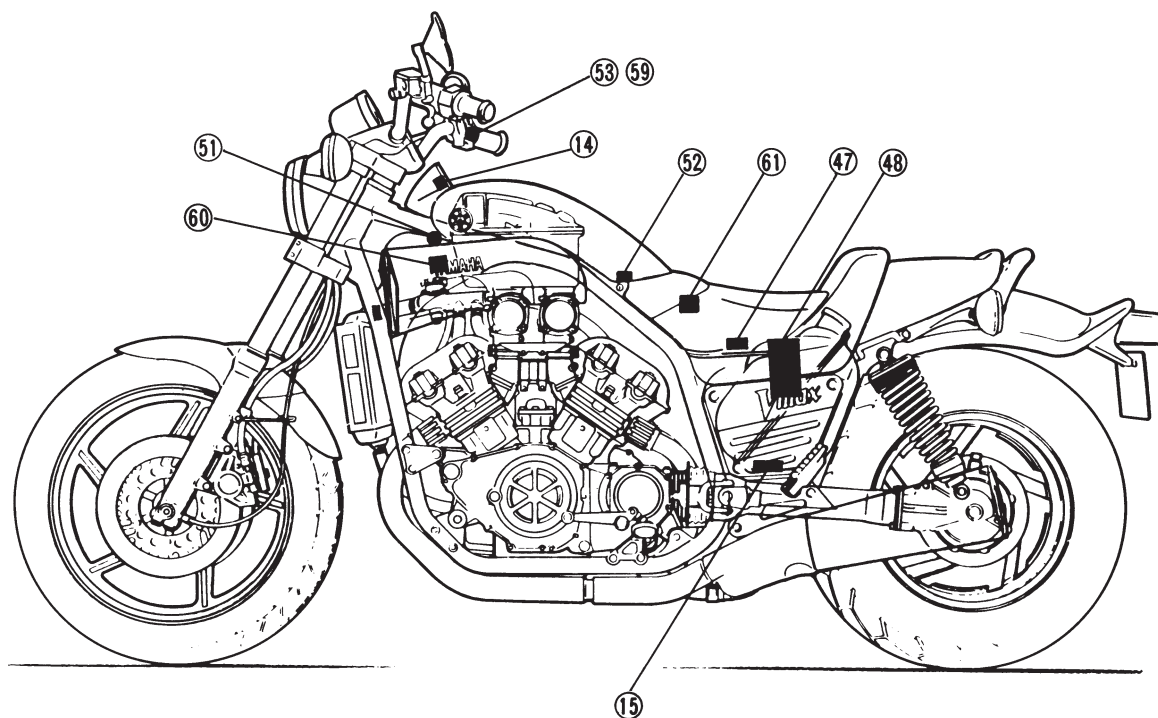


Aforementioned circuit diagram shows fuel pump circuit in wiring diagram.

**NOTE:**

For the encircled numbers and color codes, see page 7-2.

- ⑭ "FUEL" indicator light
- ⑮ Fuel sender unit
- ④⑦ Main fuse
- ④⑧ Battery
- ⑤① Main switch
- ⑤② Fuse (IGNITION)
- ⑤③ "ENGINE STOP" switch
- ⑤⑨ "FUEL" (RESERVE) switch
- ⑥① Fuel pump relay
- ⑥① Fuel pump

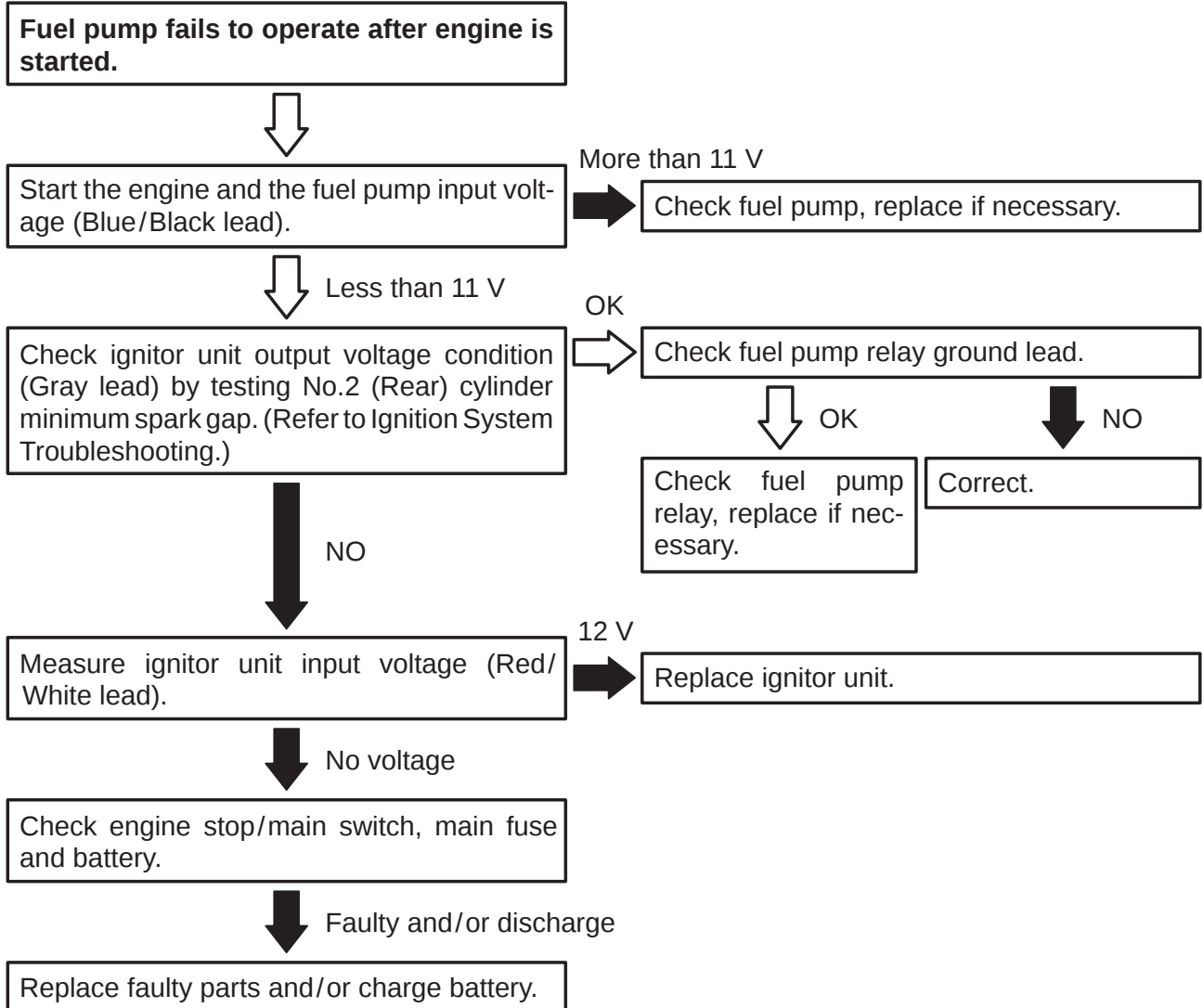






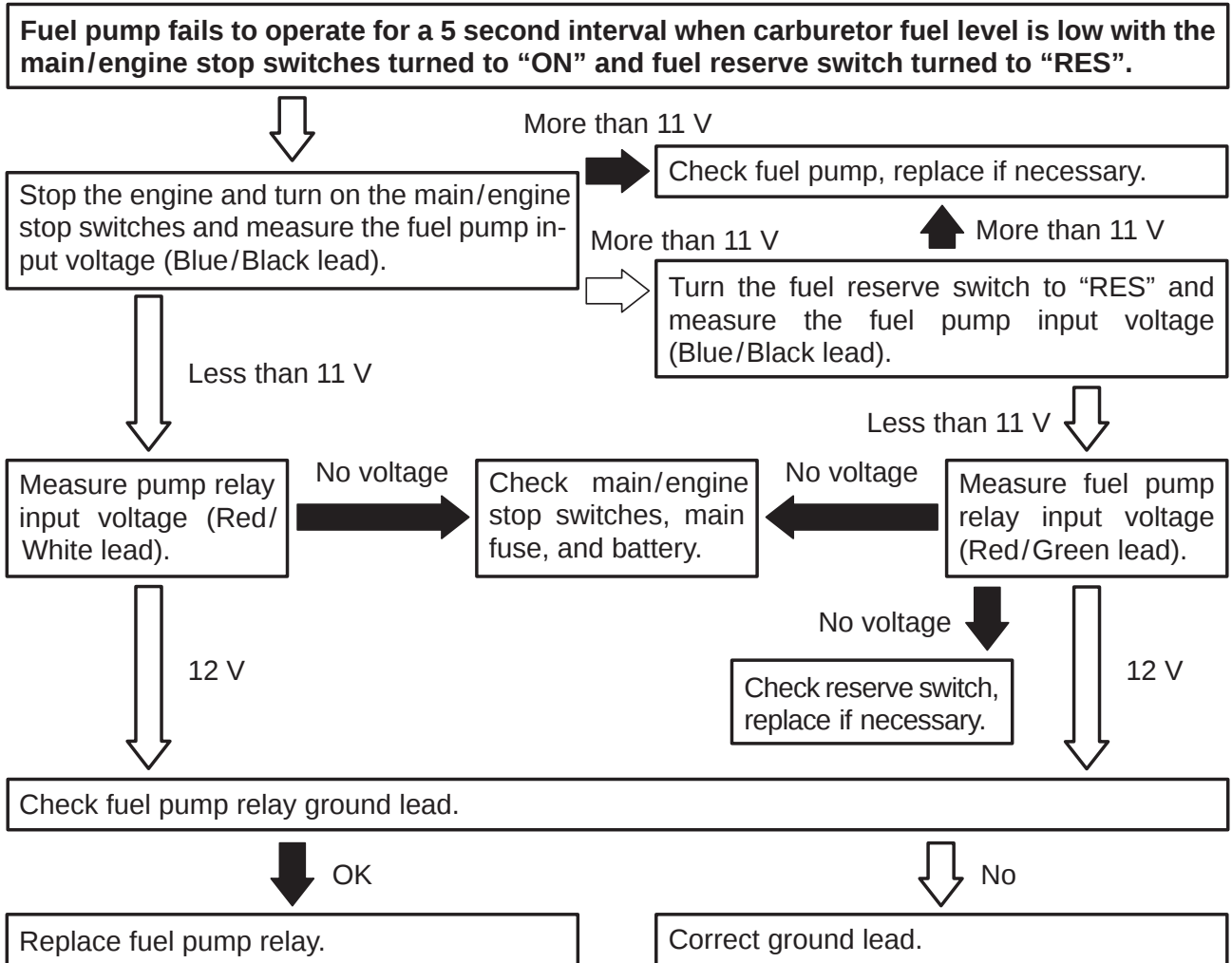
## TROUBLESHOOTING

### Troubleshooting Chart (1)





## Troubleshooting chart (2)





### Troubleshooting Chart (3)

**Fuel pump does not stop after 30 seconds when fuel indicator light comes on while engine is running.**



Start the engine and measure the fuel pump input voltage 30 seconds after fuel sender Green lead is grounded (Blue/Black lead).

No voltage



Check fuel pump connections correct if necessary.



More than 11 V

Check fuel sender unit resistance.  
Fuel sender unit resistance:  
0.7 ~ 1.1 kΩ at 20°C (68°F)

No



Replace.



OK

Check fuel pump relay ground lead.

No

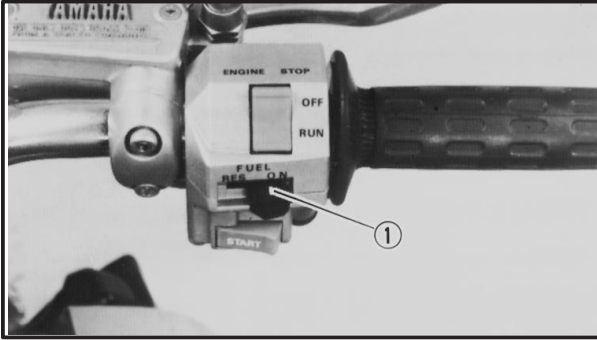


Correct ground lead.



OK

Replace fuel pump relay.



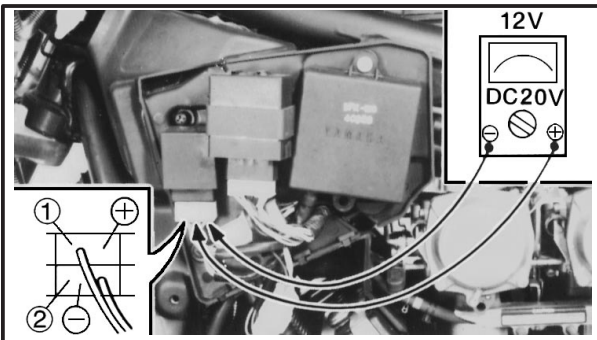
### “FUEL” (RESERVE) SWITCH TEST

Switch ① may be checked for continuity with a Pocket Tester (90890-03112) on the “Ohm × 1” position.

| Switch Position | Lead Color |       |
|-----------------|------------|-------|
|                 | R/W        | B/G   |
| OFF             |            |       |
| ON              | ○ — ○      | ○ — ○ |

### FUEL PUMP RELAY TEST

- Remove:
  - Top cover
  - Cover (left)
- Check:
  - Fuel pump operation  
Refer to “FUEL PUMP TEST” section.
- Measure:
  - Battery voltage  
Use the Pocket Tester (90890-03112).  
Out of specification → Replace relay.  
Main and engine stop switches are “ON” position.



**Fuel Pump Relay Input Voltage:**  
**12 V**

- ① Red/White
- ② Black



### FUEL PUMP TEST

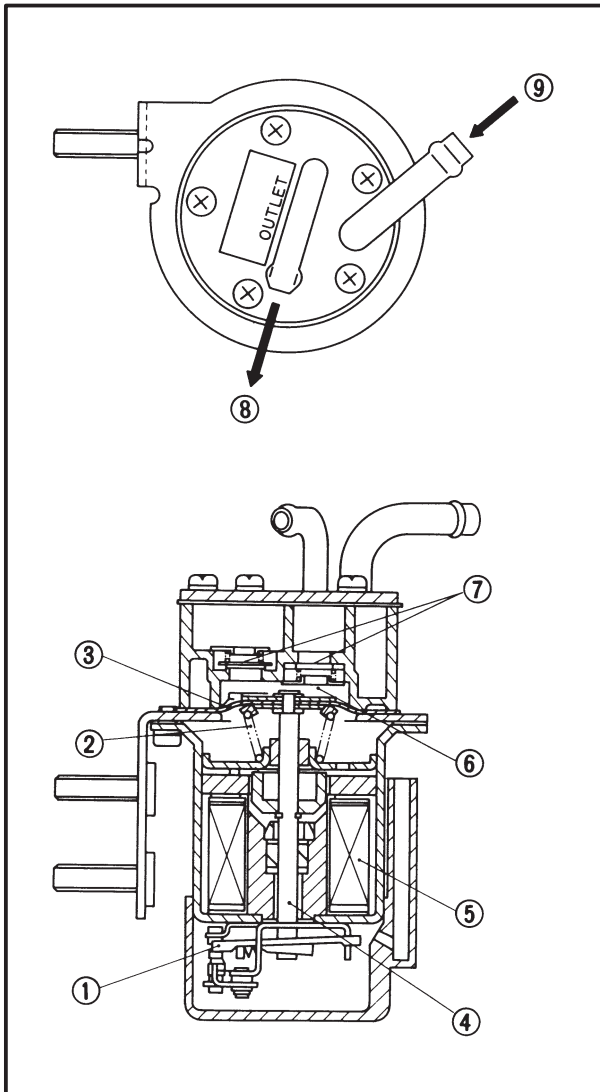
#### Operation

The diaphragm is pulled left by the plunger allowing fuel to be sucked into the fuel chamber. Fuel is pushed out from the pump until carb float chamber is filled with fuel, and then the cut-off switch cuts off the circuit.

When the spring pushes the diaphragm further to the end, the cut-off switch turns on and the solenoid coil pulls the plunger with the diaphragm forcing fuel into the fuel chamber.

#### NOTE:

When the main and engine stop switches are ON, the fuel pump relay is activated for five (5) seconds at which time the fuel pump operates.



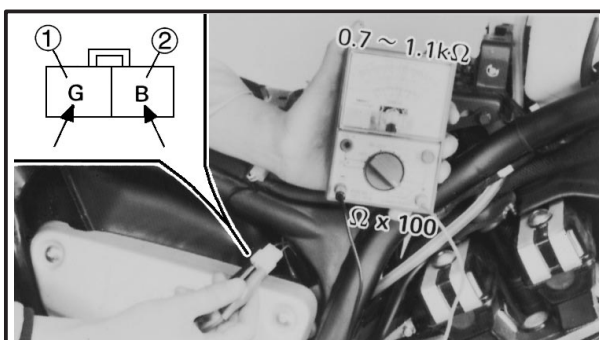
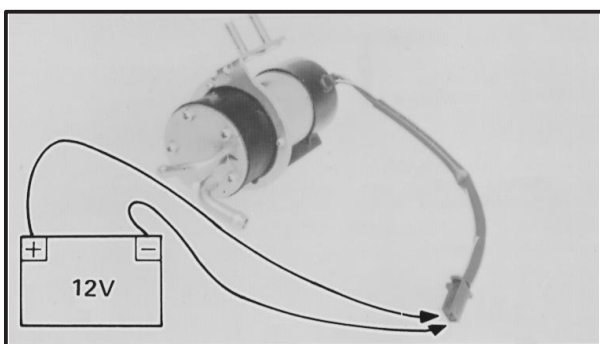
- ① Cut-out switch
- ② Spring
- ③ Diaphragm
- ④ Plunger
- ⑤ Solenoid coil
- ⑥ Fuel chamber
- ⑦ Valve
- ⑧ Outlet
- ⑨ Inlet

### Inspection

1. Connect:
  - Battery (12 V)
2. Check:
  - Fuel pump operation
  - Faulty operation → Replace.
3. Inspect:
  - Fuel pump
  - Cracks/Damage → Replace.

### FUEL SENDER UNIT TEST

1. Remove:
  - Seat
  - Top cover
2. Measure:
  - Fuel sender unit resistance
  - Out of specification → Replace.



**Fuel Sender Unit Resistance:**  
0.7 ~ 1.1 kΩ at 20°C (68°F)

① Green

② Black



---

## CHAPTER 8. APPENDICES

|                                                |      |
|------------------------------------------------|------|
| <b>SPECIFICATIONS</b> .....                    | 8-1  |
| GENERAL SPECIFICATIONS .....                   | 8-1  |
| MAINTENANCE SPECIFICATIONS .....               | 8-3  |
| <br><b>GENERAL TORQUE SPECIFICATIONS</b> ..... | 8-18 |
| <br><b>DEFINITION OF UNITS</b> .....           | 8-18 |
| <br><b>LUBRICATION DIAGRAMS</b> .....          | 8-19 |
| <br><b>CABLE ROUTING</b> .....                 | 8-23 |
| <br><b>WIRING DIAGRAM</b>                      |      |

---



## APPENDICES

## SPECIFICATIONS

## GENERAL SPECIFICATIONS

| Model                         | VMX12                                                                                                                                                             |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model Code Number             | 2EN                                                                                                                                                               |
| Engine Starting Number        | 2EN-000101                                                                                                                                                        |
| Frame Starting Number         | 2EN-000101                                                                                                                                                        |
| Dimensions:                   |                                                                                                                                                                   |
| Overall Length                | 2,300 mm (90.6 in)                                                                                                                                                |
| Overall Width                 | 795 mm (31.3 in)                                                                                                                                                  |
| Overall Height                | 1,160 mm (45.7 in)                                                                                                                                                |
| Seat Height                   | 765 mm (30.1 in)                                                                                                                                                  |
| Wheelbase                     | 1,590 mm (62.6 in)                                                                                                                                                |
| Minimum Ground Clearance      | 145 mm ( 5.7 in)                                                                                                                                                  |
| Basic Weight:                 |                                                                                                                                                                   |
| Weight Oil and Full Fuel Tank | 281 kg (619 lb)                                                                                                                                                   |
| Minimum Turning Radius:       | 2,800 mm (110.2 in)                                                                                                                                               |
| Engine:                       |                                                                                                                                                                   |
| Engine Type                   | Liquid cooled 4-stroke gasoline, DOHC                                                                                                                             |
| Cylinder Arrangement          | V-4 cylinder                                                                                                                                                      |
| Displacement                  | 1,198 cm <sup>3</sup>                                                                                                                                             |
| Bore × Stroke                 | 76 × 66 mm (2.992 × 2.598 in)                                                                                                                                     |
| Compression Ratio             | 10.5 : 1                                                                                                                                                          |
| Compression Pressure          | 1,422 kPa (14.5 kg/cm <sup>2</sup> , 206 psi)                                                                                                                     |
| Starting System               | Electric starter                                                                                                                                                  |
| Lubrication System:           | Wep sump                                                                                                                                                          |
| Oil Type or Grade:            |                                                                                                                                                                   |
| Engine Oil                    |                                                                                                                                                                   |
|                               | SAE 20 W 40 type SE motor oil<br>(If temperature does not go below 5°C (40°F))<br>SAE 10 W 30 type SE motor oil<br>(If temperature does not go above 15°C (60°F)) |
| Final Gear Oil                | SAE 80 API "GL-4" Hypoid gear oil                                                                                                                                 |
| Oil Capacity:                 |                                                                                                                                                                   |
| Engine Oil:                   |                                                                                                                                                                   |
| Periodic Oil Change           | 3.5 L (3.1 Imp qt, 3.7 US qt)                                                                                                                                     |
| With Oil Filter Replacement   | 3.8 L (3.3 Imp qt, 4.0 US qt)                                                                                                                                     |
| Total Amount                  | 4.7 L (4.1 Imp qt, 5.0 US qt)                                                                                                                                     |
| Final Gear Case:              |                                                                                                                                                                   |
| Total Amount                  | 0.2 L (0.18 Imp qt, 0.21 US qt)                                                                                                                                   |
| Radiator Capacity:            |                                                                                                                                                                   |
| (Including All routes)        | 3.05 L (2.69 Imp qt, 3.22 qt)                                                                                                                                     |
| Air Filter:                   | Dry type element                                                                                                                                                  |
| Fuel:                         |                                                                                                                                                                   |
| Type                          | Regular gasoline                                                                                                                                                  |
| Tank Capacity:                |                                                                                                                                                                   |
| Total                         | 15.0 L (3.3 Imp gal, 4.0 US gal)                                                                                                                                  |
| Reserve                       | 3.0 L (0.66 Imp gal, 0.80 US gal)                                                                                                                                 |

# SPECIFICATIONS

APPX



| Model                                                                                                                                                                                                                | VMX12                                                                                                                                                                                                       |                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Carburetor:<br>Type/Manufacturer                                                                                                                                                                                     | BDS35 × 4/MIKUNI                                                                                                                                                                                            |                                              |
| Spark Plug:<br>Type/Manufacturer<br>Gap                                                                                                                                                                              | DPR8EA-9/NGK, X24EPR-U9/NIPPONDENSO<br>0.8 ~ 0.9 mm (0.031 ~ 0.035 in)                                                                                                                                      |                                              |
| Clutch Type:                                                                                                                                                                                                         | Wet, multiple-disc                                                                                                                                                                                          |                                              |
| Transmission:<br>Primary Reduction System<br>Primary Reduction Ratio<br>Secondary Reduction System<br>Secondary Reduction Ratio<br>Transmission Type<br>Operation<br>Gear Ratio:<br>1st<br>2nd<br>3rd<br>4th<br>5th  | Spar gear<br>87/49 (1.775)<br>Shaft drive<br>21/27 × 33/9 (2.851)<br>Constant mesh, 5-speed<br>Left foot operation<br><br>43/17 (2.529)<br>39/22 (1.772)<br>31/23 (1.347)<br>28/26 (1.076)<br>26/28 (0.928) |                                              |
| Chassis:<br>Frame Type<br>Caster Angle<br>Trail                                                                                                                                                                      | Double cradle<br>29°<br>119 mm (4.7 in)                                                                                                                                                                     |                                              |
| Tire:<br>Type<br>Size (F)<br><br>Size (R)<br><br>Wear Limit                                                                                                                                                          | Tubeless<br>110/90 V 18<br>DUNLOP F20<br>150/90 V 15<br>DUNLOP K525<br>1.0 mm (0.04 in)                                                                                                                     |                                              |
| Tire Pressure (Cold Tire):<br>Basic Weight:<br>With Oil and Full Fuel Tank<br>Maximum Load*<br>Cold Tire Pressure:<br><br>Up to 90 kg (198 lb) Load*<br><br>90 kg (198 lb)* ~ Maximum Load*<br><br>High Speed Riding | 281 kg (619 lb)<br>218 kg (481 lb)                                                                                                                                                                          |                                              |
|                                                                                                                                                                                                                      | FRONT                                                                                                                                                                                                       | REAR                                         |
|                                                                                                                                                                                                                      | 235 kPa<br>(2.4 kg/cm <sup>2</sup> , 34 psi)                                                                                                                                                                | 255 kPa<br>(2.6 kg/cm <sup>2</sup> , 36 psi) |
|                                                                                                                                                                                                                      | 235 kPa<br>(2.4 kg/cm <sup>2</sup> , 34 psi)                                                                                                                                                                | 275 kPa<br>(2.8 kg/cm <sup>2</sup> , 40 psi) |
|                                                                                                                                                                                                                      | 235 kPa<br>(2.4 kg/cm <sup>2</sup> , 34 psi)                                                                                                                                                                | 255 kPa<br>(2.6 kg/cm <sup>2</sup> , 36 psi) |
|                                                                                                                                                                                                                      | * Load is the total weight of cargo, rider, passenger, and accessories.                                                                                                                                     |                                              |
| Brake:<br>Front<br>Operation<br>Rear<br>Operation                                                                                                                                                                    | Dual disc brake<br>Right hand operation<br>Single disc brake<br>Right foot operation                                                                                                                        |                                              |
| Suspension:<br>Front Suspension<br>Rear Suspension                                                                                                                                                                   | Telescopic fork<br>Swing arm                                                                                                                                                                                |                                              |

## SPECIFICATIONS

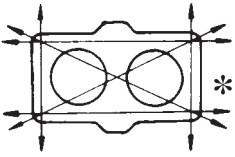
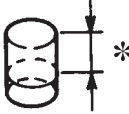
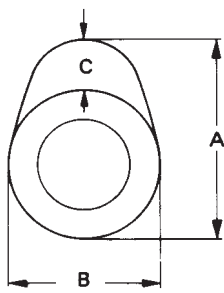
APPX



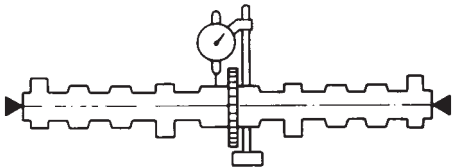
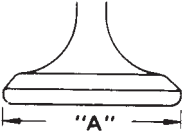
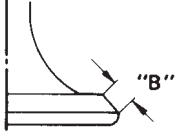
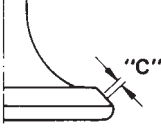
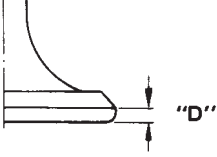
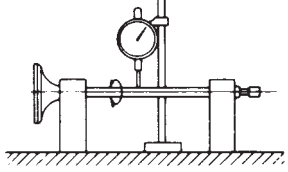
| Model                                                                                                                                                                                           | VMX12                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shock Absorber:<br>Front Shock Absorber<br>Rear Shock Absorber                                                                                                                                  | Air/Coil spring, Oil damper<br>Coil spring, Oil damper                                                                                                                                                  |
| Wheel Travel:<br>Front Wheel Travel<br>Rear Wheel Travel                                                                                                                                        | 140 mm (5.5 in)<br>100 mm (3.9 in)                                                                                                                                                                      |
| Electrical:<br>Ignition System<br>Generator System<br>Battery Type or Model<br>Battery Capacity                                                                                                 | T.C.I.<br>A.C. magneto generator<br>YB16AL-A2<br>12 V 16 AH                                                                                                                                             |
| Headlight Type:                                                                                                                                                                                 | Bulb type (Quartz bulb)                                                                                                                                                                                 |
| Bulb Wattage × Quantity:<br>Headlight<br>Tail/Brake Light<br>Flasher Light<br>Auxiliary Light<br>Indicator Light:<br>“NEUTRAL”<br>“HIGH BEAM”<br>“OIL LEVEL”<br>“TURN”<br>“FUEL”<br>Meter Light | 12 V, 60 W/55 W × 1<br>12 V, 5 W/21 W × 2<br>12 V, 21 W × 4<br>12 V, 4 W × 1<br><br>12 V, 3 W × 1<br>12 V, 3 W × 1<br>12 V, 3 W × 1<br>12 V, 3 W × 1<br>12 V, 3 W × 1<br>12 V, 3 W × 1<br>12 V, 3 W × 4 |

## MAINTENANCE SPECIFICATIONS

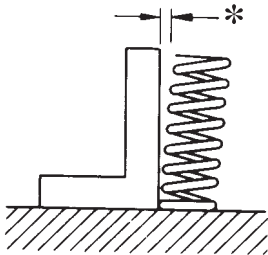
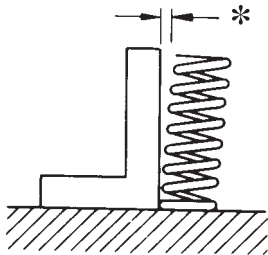
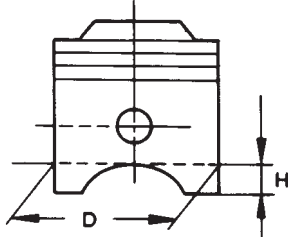
### Engine

| Model                                                                                                                                                                                                                                                                                                              | VMX12                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cylinder Head:<br>Warp Limit*<br>                                                                                                                                                                                               | 0.03 mm (0.0012 in)<br>* Lines indicate straightedge measurement                                                                                                                                                                                                                                                                                                                                                |
| Cylinder:<br>Bore Size/Measuring Point*<br>Out of Round Limit<br>                                                                                                                                                               | 75.967 ~ 76.016 mm (2.991 ~ 2.993 in)/<br>40 mm (1.57 in)<br>0.05 mm (0.002 in)                                                                                                                                                                                                                                                                                                                                 |
| Camshaft:<br>Drive Method<br>Cam Cap Inside Dia.<br>Camshaft Outside Dia.<br>Shaft-to-Cap Clearance<br>Cam Dimensions<br>Intake “A”<br><Limit><br>Intake “B”<br><Limit><br>Exhaust “A”<br><Limit><br>Exhaust “B”<br><Limit><br> | Chain drive (Center)<br>25.000 ~ 25.021 mm (0.9843 ~ 0.9851 in)<br>24.967 ~ 24.980 mm (0.9830 ~ 0.9835 in)<br>0.020 ~ 0.054 mm (0.0008 ~ 0.0021 in)<br><br>35.75 ~ 35.85 mm (1.407 ~ 1.411 in)<br>35.65 mm (1.404 in)<br>27.95 ~ 28.05 mm (1.100 ~ 1.104 in)<br>26.95 mm (1.061 in)<br>35.75 ~ 35.85 mm (1.407 ~ 1.411 in)<br>35.65 mm (1.404 in)<br>27.95 ~ 28.05 mm (1.100 ~ 1.104 in)<br>26.95 mm (1.061 in) |



| Model                                                                                                                                                                                                                                                                                                                                      |  | VMX12                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------|
| Camshaft Runout Limit                                                                                                                                                                                                                                                                                                                      |  | 0.03 mm (0.0012 in)                   |
|                                                                                                                                                                                                                                                           |  |                                       |
| Cam Chain:                                                                                                                                                                                                                                                                                                                                 |  |                                       |
| Cam Chain Type/No. of Links                                                                                                                                                                                                                                                                                                                |  | DID219FTS/118                         |
| Cam Chain Adjustment Method                                                                                                                                                                                                                                                                                                                |  | Automatic                             |
| Valve, Valve Seat, Valve Guide:                                                                                                                                                                                                                                                                                                            |  |                                       |
| Valve Clearance (Cold):                                                                                                                                                                                                                                                                                                                    |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 0.11 ~ 0.15 mm (0.004 ~ 0.006 in)     |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 0.26 ~ 0.30 mm (0.010 ~ 0.012 in)     |
| Valve Dimensions:                                                                                                                                                                                                                                                                                                                          |  |                                       |
|     |  |                                       |
| "A" Head Dia.                                                                                                                                                                                                                                                                                                                              |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 30.4 ~ 30.6 mm (1.197 ~ 1.205 in)     |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 24.9 ~ 25.1 mm (0.980 ~ 0.988 in)     |
| "B" Face Width                                                                                                                                                                                                                                                                                                                             |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 1.6 ~ 3.1 mm (0.063 ~ 0.122 in)       |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 1.3 ~ 2.4 mm (0.051 ~ 0.095 in)       |
| "C" Seat Width                                                                                                                                                                                                                                                                                                                             |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 0.9 ~ 1.1 mm (0.035 ~ 0.043 in)       |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 0.9 ~ 1.1 mm (0.035 ~ 0.043 in)       |
| <Limit>                                                                                                                                                                                                                                                                                                                                    |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 1.4 mm (0.055 in)                     |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 1.4 mm (0.055 in)                     |
| "D" Margin Thickness                                                                                                                                                                                                                                                                                                                       |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 1.1 ~ 1.5 mm (0.043 ~ 0.059 in)       |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 1.1 ~ 1.5 mm (0.043 ~ 0.059 in)       |
| <Limit>                                                                                                                                                                                                                                                                                                                                    |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 0.7 mm (0.028 in)                     |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 0.7 mm (0.028 in)                     |
| Stem Outside Dia.                                                                                                                                                                                                                                                                                                                          |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 5.475 ~ 5.490 mm (0.2156 ~ 0.2161 in) |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 5.460 ~ 5.475 mm (0.2150 ~ 0.2156 in) |
| <Limit>                                                                                                                                                                                                                                                                                                                                    |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 5.445 mm (0.214 in)                   |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 5.420 mm (0.213 in)                   |
| Guide Inside Dia.                                                                                                                                                                                                                                                                                                                          |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in) |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in) |
| <Limit>                                                                                                                                                                                                                                                                                                                                    |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 5.550 mm (0.219 in)                   |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 5.550 mm (0.219 in)                   |
| Stem-to-Guide Clearance                                                                                                                                                                                                                                                                                                                    |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 0.010 ~ 0.037 mm (0.0004 ~ 0.0015 in) |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 0.025 ~ 0.052 mm (0.0010 ~ 0.0020 in) |
| <Limit>                                                                                                                                                                                                                                                                                                                                    |  |                                       |
| IN.                                                                                                                                                                                                                                                                                                                                        |  | 0.08 mm (0.0031 in)                   |
| EX.                                                                                                                                                                                                                                                                                                                                        |  | 0.10 mm (0.0039 in)                   |
| Stem Runout Limit                                                                                                                                                                                                                                                                                                                          |  | 0.01 mm (0.0004 in)                   |
|                                                                                                                                                                                                                                                         |  |                                       |

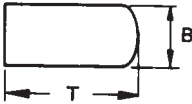
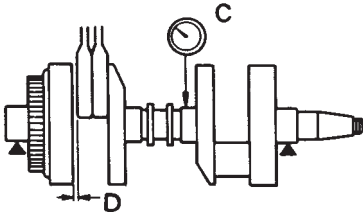


| Model                                                                               |     | VMX12                                   |
|-------------------------------------------------------------------------------------|-----|-----------------------------------------|
| Valve Spring:<br>Inner Spring:                                                      |     |                                         |
| Free Length                                                                         | IN. | 39.65 mm (1.561 in)                     |
|                                                                                     | EX. | 39.65 mm (1.561 in)                     |
| <Limit>                                                                             | IN. | 37.45 mm (1.474 in)                     |
|                                                                                     | EX. | 37.45 mm (1.474 in)                     |
| Set Length (Valve Closed)                                                           | IN. | 31.8 mm (1.25 in)                       |
|                                                                                     | EX. | 31.8 mm (1.25 in)                       |
| Compressed Pressure (Installed)                                                     | IN. | 6.29 ~ 7.39 kg (13.9 ~ 16.3 lb)         |
|                                                                                     | EX. | 6.29 ~ 7.39 kg (13.9 ~ 16.3 lb)         |
| Tilt Limit*                                                                         | IN. | 2.5°/1.7 mm (0.067 in)                  |
|                                                                                     | EX. | 2.5°/1.7 mm (0.067 in)                  |
|    |     |                                         |
| Direction of Winding                                                                | IN. | Counterclockwise                        |
|                                                                                     | EX. | Counterclockwise                        |
| Outer Spring:                                                                       |     |                                         |
| Free Length                                                                         | IN. | 41.10 mm (1.618 in)                     |
|                                                                                     | EX. | 41.10 mm (1.618 in)                     |
| <Limit>                                                                             | IN. | 38.90 mm (1.531 in)                     |
|                                                                                     | EX. | 38.90 mm (1.531 in)                     |
| Set Length (Valve Closed)                                                           | IN. | 33.8 mm (1.331 in)                      |
|                                                                                     | EX. | 33.8 mm (1.331 in)                      |
| Compressed Pressure (Installed)                                                     | IN. | 13.3 ~ 15.7 kg (29.3 ~ 34.6 lb)         |
|                                                                                     | EX. | 13.3 ~ 15.7 kg (29.3 ~ 34.6 lb)         |
| Tilt Limit*                                                                         | IN. | 2.5°/1.8 mm (0.071 in)                  |
|                                                                                     | EX. | 2.5°/1.8 mm (0.071 in)                  |
|  |     |                                         |
| Direction of Winding                                                                | IN. | Clockwise                               |
|                                                                                     | EX. | Clockwise                               |
| Piston:                                                                             |     |                                         |
| Piston Clearance                                                                    |     | 0.055 ~ 0.075 mm (0.0022 ~ 0.0030 in)   |
| <Limit>                                                                             |     | 0.15 mm (0.0059 in)                     |
| Piston Size "D"                                                                     |     | 75.905 ~ 75.955 mm (2.9884 ~ 2.9903 in) |
| Measuring Point "H"                                                                 |     | 6.2 mm (0.244 in)                       |
|  |     |                                         |

# SPECIFICATIONS

APPX



| Model                                                                               |                                                                                   | VMX12                                                          |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------|
| Oversize:                                                                           | 1st<br>2nd                                                                        | 76.25 mm (3.002 in)<br>76.50 mm (3.012 in)                     |
| Piston Ring:                                                                        |                                                                                   |                                                                |
| Top ring:                                                                           |                                                                                   |                                                                |
| Type                                                                                |  | Barrel                                                         |
| Dimensions (B × T)                                                                  |                                                                                   | 3.1 × 1.0 mm (0.122 × 0.040 in)                                |
| End Gap (Installed)                                                                 |                                                                                   | 0.35 ~ 0.50 mm (0.0138 ~ 0.0197 in)                            |
| <Limit>                                                                             |                                                                                   | 0.75 mm (0.0295 in)                                            |
| Side Clearance (Installed)                                                          |                                                                                   | 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in)                            |
| <Limit>                                                                             |                                                                                   | 0.12 mm (0.0047 in)                                            |
| 2nd Ring:                                                                           |                                                                                   |                                                                |
| Type                                                                                |  | Taper                                                          |
| Dimensions (B × T)                                                                  |                                                                                   | 3.1 × 1.2 mm (0.122 × 0.047 in)                                |
| End Gap (Installed)                                                                 |                                                                                   | 0.35 ~ 0.50 mm (0.0138 ~ 0.0197 in)                            |
| <Limit>                                                                             |                                                                                   | 0.75 mm (0.0295 in)                                            |
| Side Clearance                                                                      |                                                                                   | 0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in)                            |
| <Limit>                                                                             |                                                                                   | 0.12 mm (0.0047 in)                                            |
| Oil Ring:                                                                           |                                                                                   |                                                                |
| Dimensions (B × T)                                                                  |  | 3.1 × 2.5 mm (0.122 × 0.098 in)                                |
| End Gap (Installed)                                                                 |                                                                                   | 0.2 ~ 0.8 mm (0.0080 ~ 0.032 in)                               |
| Connecting Rod:                                                                     |                                                                                   |                                                                |
| Oil Clearance                                                                       |                                                                                   | 0.021 ~ 0.039 mm (0.0008 ~ 0.0015 in)                          |
| Bearing Color Code                                                                  |                                                                                   | 1. Blue 2. Black 3. Brown 4. Green<br>5. Yellow 6. Pink        |
| Crankshaft:                                                                         |                                                                                   |                                                                |
|  |                                                                                   |                                                                |
| Runout Limit                                                                        | "C"                                                                               | 0.03 mm (0.0012 in)                                            |
| Big End Side Clearance                                                              | "D"                                                                               | 0.320 ~ 0.924 mm (0.0126 ~ 0.0364 in)                          |
| Journal Oil Clearance                                                               |                                                                                   | 0.020 ~ 0.038 mm (0.0008 ~ 0.0015 in)                          |
| Bearing Color Code                                                                  |                                                                                   | 1. Blue 2. Black 3. Brown 4. Green<br>5. Yellow 6. Pink 7. Red |
| Clutch:                                                                             |                                                                                   |                                                                |
| Friction Plate:                                                                     | Thickness                                                                         | 2.9 ~ 3.1 mm (0.114 ~ 0.122 in)                                |
|                                                                                     | Quantity                                                                          | 8 pcs.                                                         |
|                                                                                     | Wear Limit                                                                        | 2.8 mm (0.11 in)                                               |
| Clutch Plate:                                                                       | Thickness                                                                         | 2.2 ~ 2.4 mm (0.087 ~ 0.095 in)                                |
|                                                                                     | Quantity                                                                          | 7 pcs.                                                         |
|                                                                                     | Warp Limit                                                                        | 0.2 mm (0.008 in)                                              |
| Clutch Spring:                                                                      | Free Height                                                                       | 7.0 mm (0.28 in)                                               |
|                                                                                     | Quantity                                                                          | 1 pc.                                                          |
|                                                                                     | Minimum Height                                                                    | 6.5 mm (0.26 in)                                               |
|                                                                                     | Warp Limit                                                                        | 0.1 mm (0.004 in)                                              |
| Push Rod Bending Limit                                                              |                                                                                   | 0.5 mm (0.02 in)                                               |
| Transmission:                                                                       |                                                                                   |                                                                |
| Main Axle Deflection Limit                                                          |                                                                                   | 0.08 mm (0.0031 in)                                            |
| Drive Axle Deflection Limit                                                         |                                                                                   | 0.08 mm (0.0031 in)                                            |



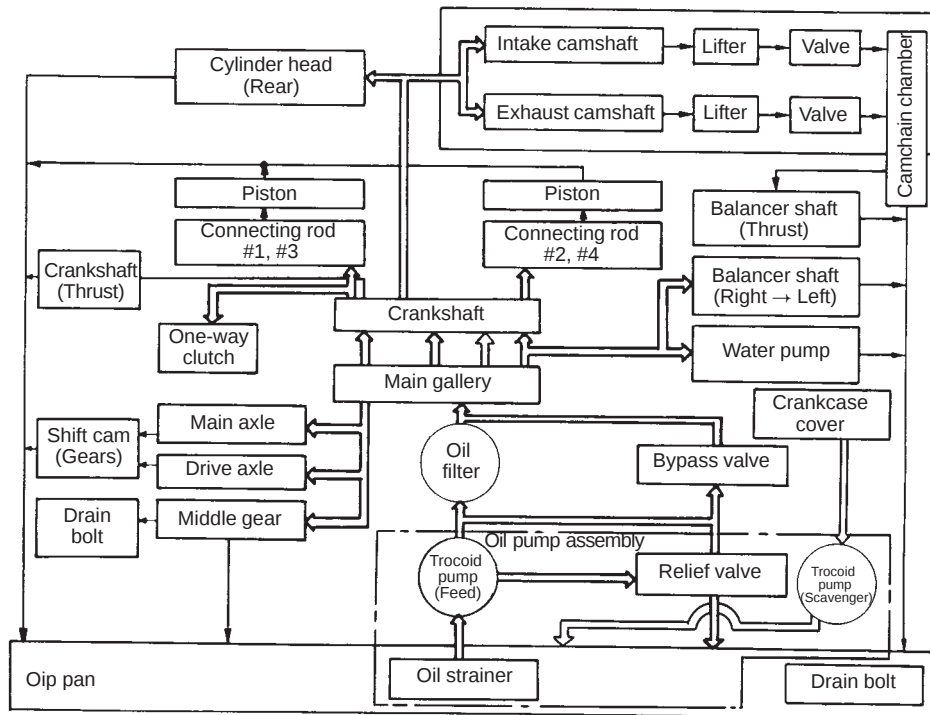
8-7



Model

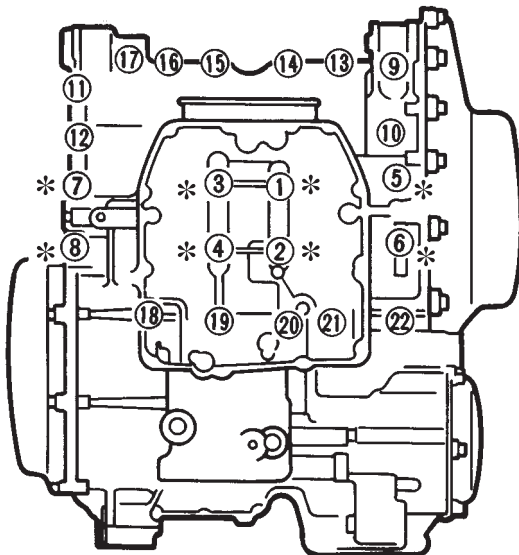
VMX12

Lubrication Chart:

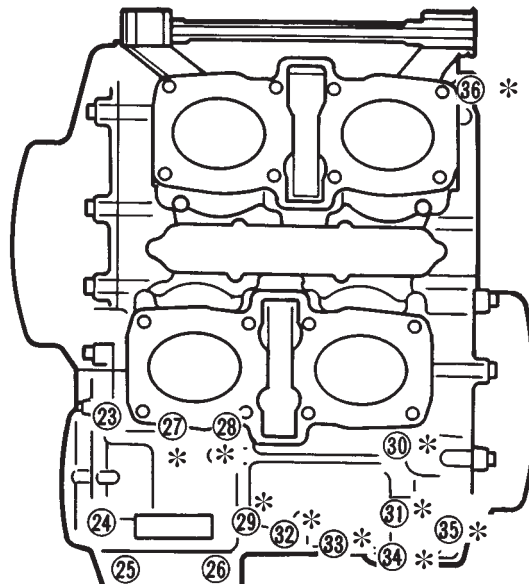


Crankcase Tightening Sequence:

Lower Case



Upper Case



\* : With washer

## SPECIFICATIONS

APPX



| Model                                                                                                                                                                                                                       | VMX12                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling System:<br>Radiator Core Size:                      Width<br>Height<br>Thickness<br>Radiator Cap Opening Pressure<br>Reservoir Tank Capacity<br><Front Low to Full Level><br>Water Pump:<br>Type<br>Reduction Ratio | 363.8 mm (14.3 in)<br>240 mm (9.45 in)<br>16 mm (0.63 in)<br>73.6 ~ 103.0 kPa<br>(0.75 ~ 1.05 kg/cm <sup>2</sup> , 10.7 ~ 14.9 psi)<br>0.3 L (0.26 Imp qt, 0.32 US qt)<br>0.2 L (0.18 Imp qt, 0.21 US qt)<br>Single-suction centrifugal pump<br>31/21 (1.476) |
| Shaft Drive:<br>Middle Gear Backlash<br><Limit><br>Final Gear Backlash<br><Limit><br>Ring Gear Stopper Clearance                                                                                                            | 0.05 ~ 0.12 mm (0.002 ~ 0.005 in)<br>0.3 mm (0.012 in)<br>0.1 ~ 0.2 mm (0.004 ~ 0.008 in)<br>0.3 mm (0.012 in)<br>0.30 ~ 0.60 mm (0.012 ~ 0.024 in)                                                                                                           |



TIGHTENING TORQUE

| Part to be tightened          | Part name         | Thread size | Q'ty | Tightening torque |      |       | Remarks                                                                                                                                                                    |
|-------------------------------|-------------------|-------------|------|-------------------|------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               |                   |             |      | Nm                | m•kg | ft•lb |                                                                                                                                                                            |
| Camshaft Cap                  | Bolt              | M6 × 1.0    | 32   | 10                | 1.0  | 7.2   | <br> |
| Spark Plug                    | —                 | M12 × 1.25  | 4    | 17.5              | 1.75 | 12.5  |                                                                                                                                                                            |
| Cylinder Head                 | Nut               | M10 × 1.25  | 16   | 43                | 4.3  | 31    |                                                                                                                                                                            |
| Cylinder Head Cover           | Bolt              | M6 × 1.0    | 16   | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Connecting Rod                | Bolt              | M8 × 0.75   | 8    | 36                | 3.6  | 25    |                                                                                                                                                                            |
| AC Magneto Rotor              | Bolt              | M12 × 1.25  | 1    | 130               | 13.0 | 94    |                                                                                                                                                                            |
| Cam Sprocket                  | Flange bolt       | M7 × 1.0    | 8    | 24                | 2.4  | 17    |                                                                                                                                                                            |
| Plate (Damper chain)          | Flange bolt       | M8 × 1.25   | 1    | 24                | 2.4  | 17    |                                                                                                                                                                            |
| Tensioner                     | Bolt              | M6 × 1.0    | 4    | 12                | 1.2  | 8.7   |                                                                                                                                                                            |
| Tensioner Stopper Bolt        | Bolt              | M16 × 1.0   | 2    | 20                | 2.0  | 14    |                                                                                                                                                                            |
| Water Pump Cover              | Bolt              | M6 × 1.0    | 6    | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Water Pump Housing            | Bolt              | M6 × 1.0    | 3    | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Coolant Drain Plug            | Bolt              | M14 × 1.5   | 1    | 43                | 4.3  | 31    |                                                                                                                                                                            |
| Thermostatic Valve Housing    | Bolt              | M6 × 1.0    | 2    | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Thermostatic Valve Cover      | Screw             | M6 × 1.0    | 2    | 7                 | 0.7  | 5.1   |                                                                                                                                                                            |
| Electric Fan Motor            | Screw with washer | M5 × 0.8    | 3    | 4                 | 0.4  | 2.9   |                                                                                                                                                                            |
| Electric Fan                  | Nut               | M5 × 0.8    | 1    | 4                 | 0.4  | 2.9   |                                                                                                                                                                            |
| Radiator Assembly             | Bolt with washer  | M6 × 1.0    | 4    | 7                 | 0.7  | 5.1   |                                                                                                                                                                            |
| Breather Cover                | Bolt              | M6 × 1.0    | 10   | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Radiator Cover                | Screw             | M5 × 0.8    | 4    | 4                 | 0.4  | 2.9   |                                                                                                                                                                            |
| Cover (Left and right)        | Screw             | M5 × 0.8    | 4    | 4                 | 0.4  | 2.9   |                                                                                                                                                                            |
| Conduit                       | Screw             | M6 × 1.0    | 6    | 7                 | 0.7  | 5.1   |                                                                                                                                                                            |
| Oil Pump Cover                | Screw             | M6 × 1.0    | 6    | 7                 | 0.7  | 5.1   |                                                                                                                                                                            |
| Oil Strainer Housing          | Screw             | M6 × 1.0    | 3    | 7                 | 0.7  | 5.1   |                                                                                                                                                                            |
| Oil Pump                      | Bolt              | M6 × 1.0    | 3    | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Oil Filter Cover              | Union bolt        | M20 × 1.5   | 1    | 32                | 3.2  | 23    |                                                                                                                                                                            |
| Engine Oil Drain Bolt         | Bolt              | M14 × 1.5   | 1    | 43                | 4.3  | 31    |                                                                                                                                                                            |
| Oil Pan                       | Bolt              | M6 × 1.0    | 12   | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Oil Baffle Plate              | Flange bolt       | M6 × 1.0    | 2    | 12                | 1.2  | 8.7   |                                                                                                                                                                            |
| Oil Delivery Pipe (Lower)     | Union bolt        | M8 × 1.25   | 2    | 18                | 1.8  | 13    |                                                                                                                                                                            |
| Oil Delivery Pipe (Upper)     | Union bolt        | M10 × 1.25  | 1    | 20                | 2.0  | 14    |                                                                                                                                                                            |
| Oil Delivery Pipe (4)         | Flange bolt       | M6 × 1.0    | 2    | 12                | 1.2  | 8.7   |                                                                                                                                                                            |
| Oil Pipe                      | Union bolt        | M8 × 1.25   | 1    | 18                | 1.8  | 13    |                                                                                                                                                                            |
| Stay 1                        | Flange bolt       | M6 × 1.0    | 1    | 12                | 1.2  | 8.7   |                                                                                                                                                                            |
| Carburator Joint              | Bolt              | M6 × 1.0    | 8    | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Fuel Pump                     | Flange bolt       | M6 × 1.0    | 2    | 12                | 1.2  | 8.7   |                                                                                                                                                                            |
| Exhaust Pipe (#1, #3) & Joint | Bolt              | M6 × 1.0    | 2    | 7                 | 0.7  | 5.1   |                                                                                                                                                                            |
| Exhaust Pipe Connection       | Bolt              | M8 × 1.25   | 1    | 20                | 2.0  | 14    |                                                                                                                                                                            |
| Exhaust Pipe Flange           | Nut               | M8 × 1.25   | 8    | 20                | 2.0  | 14    |                                                                                                                                                                            |
|                               | Bolt              | M5 × 0.8    | 6    | 7                 | 0.7  | 5.1   |                                                                                                                                                                            |
| Exhaust Cover                 | Screw             | M5 × 0.8    | 4    | 4                 | 0.4  | 2.9   |                                                                                                                                                                            |
| Muffler Stay                  | Bolt              | M6 × 1.0    | 2    | 10                | 1.0  | 7.2   |                                                                                                                                                                            |
| Muffler                       | Bolt              | M10 × 1.25  | 3    | 25                | 2.5  | 18    |                                                                                                                                                                            |
| Exhaust and Chamber           | Bolt              | M8 × 1.25   | 4    | 20                | 2.0  | 14    |                                                                                                                                                                            |

# SPECIFICATIONS

APPX

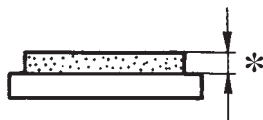


| Part to be tightened               | Part name         | Thread size | Q'ty | Tightening torque |      |       | Remarks         |
|------------------------------------|-------------------|-------------|------|-------------------|------|-------|-----------------|
|                                    |                   |             |      | Nm                | m•kg | ft•lb |                 |
| Crankcase                          | Bolt              | M6 × 1.0    | 10   | 12                | 1.2  | 8.7   | Stake           |
| Crankcase                          | Bolt              | M8 × 1.25   | 19   | 24                | 2.4  | 17    |                 |
| Crankcase                          | Bolt              | M10 × 1.25  | 8    | 40                | 4.0  | 29    |                 |
| Drive Axle Bearing Retainer        | Torx screw        | M8 × 1.25   | 4    | 25                | 2.5  | 18    |                 |
| Main Axle Bearing Retainer         | Screw             | M6 × 1.0    | 3    | 7                 | 0.7  | 5.1   | Use lock washer |
| Crankcase Cover (Left)             | Bolt              | M6 × 1.0    | 11   | 10                | 1.0  | 7.2   |                 |
| Lead Clamp                         | Screw             | M6 × 1.0    | 2    | 7                 | 0.7  | 5.1   |                 |
| Crankcase Cover (Right)            | Bolt              | M6 × 1.0    | 6    | 10                | 1.0  | 7.2   |                 |
| Middle Gear Case Cover             | Bolt              | M6 × 1.0    | 9    | 10                | 1.0  | 7.2   | Stake           |
| Middle Gear Oil Drain Bolt         | Bolt              | M8 × 1.25   | 1    | 38                | 3.8  | 27    |                 |
| Starter One-way Clutch             | Bolt              | M8 × 1.25   | 3    | 24                | 2.4  | 17    |                 |
| Clutch Boss                        | Nut               | M20 × 1.0   | 1    | 70                | 7.0  | 50    |                 |
| Clutch Release Cylinder            | Special           | M6 × 1.0    | 2    | 12                | 1.2  | 8.7   | Stake           |
| Clutch Pressure Plate              | Bolt              | M6 × 1.0    | 6    | 8                 | 0.8  | 5.8   |                 |
| Middle Drive Gear                  | Nut               | M44 × 1.5   | 1    | 110               | 11   | 80    |                 |
| Middle Drive Shaft                 | Self-lock nut     | M14 × 1.5   | 1    | 90                | 9.0  | 65    |                 |
| Middle Drive Shaft Bearing Housing | Bolt              | M8 × 1.25   | 3    | 30                | 3.0  | 22    | Use lock washer |
| Shift Cam Segment                  | Screw             | M6 × 1.0    | 1    | 12                | 1.2  | 8.7   |                 |
| Shift Cam Plate (Neutral)          | Screw             | M5 × 0.8    | 1    | 4                 | 0.4  | 2.9   |                 |
| Shift Cam Bearing Stopper          | Screw             | M6 × 1.0    | 3    | 7                 | 0.7  | 5.1   |                 |
| Change Lever Adjuster              | Screw             | M8 × 1.25   | 1    | 22                | 2.2  | 16    | Apply Sealant   |
| Shift Cam Stopper Lever            | Screw with washer | M6 × 1.0    | 1    | 8                 | 0.8  | 5.8   |                 |
| Change Pedal Adjuster Lock         | Nut               | M6 × 1.0    | 4    | 10                | 1.0  | 7.2   |                 |
| Change Pedal/Linkage Pinch Bolt    | Bolt              | M6 × 1.0    | 3    | 10                | 1.0  | 7.2   |                 |
| Thermostatic Switch                | —                 | —           | 1    | 15                | 1.5  | 11    | Apply Sealant   |
| Thermo-unit                        | —                 | —           | 1    | 15                | 1.5  | 11    |                 |
| Neutral Switch                     | Screw             | M5 × 0.8    | 3    | 4                 | 0.4  | 2.9   |                 |
| Starter Motor                      | Flange bolt       | M6 × 1.0    | 2    | 10                | 1.0  | 7.2   |                 |
| Oil Level Switch                   | Bolt with washer  | M6 × 1.0    | 2    | 10                | 1.0  | 7.2   | Stake           |
| ACM Stator                         | Screw             | M6 × 1.0    | 3    | 7                 | 0.7  | 5.1   |                 |
| Pick-up Coil                       | Screw             | M6 × 1.0    | 4    | 7                 | 0.7  | 5.1   |                 |
| Bearing Housing                    | Nut               | M8 × 1.25   | 6    | 23                | 2.3  | 17    |                 |
| Bearing Retainer                   | Flange-bolt       | M10 × 1.25  | 2    | 40                | 4.0  | 29    | Stake           |
| Bearing Retainer                   | Retainer          | M65 × 1.5   | 1    | 110               | 11.0 | 80    |                 |
| Coupling Gear                      | Nut               | M14 × 1.5   | 1    | 110               | 11.0 | 80    |                 |
| Final Gear Filler Bolt             | Bolt              | M14 × 1.5   | 1    | 23                | 2.3  | 17    |                 |
| Final Gear Drain Bolt              | Bolt              | M14 × 1.5   | 1    | 23                | 2.3  | 17    |                 |



### Chassis

| Model                                                                                                                                                                                                                                                        | VMX12                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Steering System:<br>Steering Bearing Type                                                                                                                                                                                                                    | Taper roller bearing                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Front Suspension:<br>Front Fork Travel<br>Fork Spring Free Length<br><Limit><br>Collar Length<br>Spring Rate: K1<br>K2<br>Stroke: K1<br>K2<br>Optional Spring<br>Oil Capacity<br>Oil Level<br>Oil Grade<br>Enclosed Air Pressure (Standard)<br><Min. ~ Max.> | 140 mm (5.51 in)<br>492.5 mm (19.4 in)<br>487.5 mm (19.2 in)<br>136 mm (5.35 in)<br>3.92 N/mm (0.4 kg/mm, 22.4 lb/in)<br>4.90 N/mm (0.5 kg/mm, 28.0 lb/in)<br>0 ~ 78 mm (0 ~ 3.07 in)<br>78 ~ 140 mm (3.07 ~ 5.51 in)<br>No.<br>451 cm <sup>3</sup> (15.9 Imp oz, 15.3 US oz)<br>139 mm (5.5 in)<br>Fork oil 10 wt or equivalent<br>39.2 kPa (0.4 kg/cm <sup>2</sup> , 5.7 psi)<br>39.2 ~ 98.1 kPa<br>(0.4 ~ 1.0 kg/cm <sup>2</sup> , 5.7 ~ 14.2 psi) |
| Rear Suspension:<br>Shock Absorber Travel<br>Spring Free Length<br><Limit><br>Fitting Length<br>Spring Rate: K1<br>K2<br>Stroke: K1<br>K2<br>Optional Spring                                                                                                 | 85 mm (3.35 in)<br>245.5 mm (9.67 in)<br>240.5 mm (9.47 in)<br>217.5 mm (8.56 in)<br>19.1 N/mm (1.95 kg/mm, 109 lb/in)<br>26.5 N/mm (2.7 kg/mm, 151 lb/in)<br>0 ~ 50 mm (0 ~ 1.97 in)<br>50 ~ 85 mm (1.97 ~ 3.35 in)<br>No.                                                                                                                                                                                                                           |
| Rear Arm:<br>Swingarm Free Play Limit: End<br>Side                                                                                                                                                                                                           | Zero mm (Zero in)<br>Zero mm (Zero in)                                                                                                                                                                                                                                                                                                                                                                                                                |
| Front Wheel:<br>Type<br>Rim Size<br>Rim Material<br>Rim Runout Limit: Vertical<br>Lateral                                                                                                                                                                    | Cast wheel<br>MT2.15 × 18<br>Aluminum<br>2 mm (0.08 in)<br>2 mm (0.08 in)                                                                                                                                                                                                                                                                                                                                                                             |
| Rear Wheel:<br>Type<br>Rim Size<br>Rim Material<br>Rim Runout Limit: Vertical<br>Lateral                                                                                                                                                                     | Cast wheel<br>MT3.50 × 15<br>Aluminum<br>2 mm (0.08 in)<br>2 mm (0.08 in)                                                                                                                                                                                                                                                                                                                                                                             |
| Front Disc Brake:<br>Type<br>Disc Outside Diameter × Thickness<br>Pad Thickness Inner<br><Limit>*<br>Pad Thickness Outer<br><Limit>*                                                                                                                         | Dual<br>282 × 7.5 mm (11.1 × 0.30 in)<br>5.5 mm (0.22 in)<br>0.5 mm (0.02 in)<br>5.5 mm (0.22 in)<br>0.5 mm (0.02 in)                                                                                                                                                                                                                                                                                                                                 |



## SPECIFICATIONS

**APPX**


| Model                                                                                                                                                                         | VMX12                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Master Cylinder Inside Diameter<br>Caliper Cylinder Inside Diameter<br>Brake Fluid Type                                                                                       | 15.87 mm (0.63 in)<br>45.4 mm (1.79 in)<br>DOT #3                                                                       |
| Rear Disc Brake:<br>Type<br>Disc Outside Diameter × Thickness<br>Pad Thickness                      Inner<br><Limit>*<br>Pad Thickness                      Outer<br><Limit>* | Single<br>282 × 7.5 mm (11.1 × 0.30 in)<br>5.5 mm (0.22 in)<br>0.5 mm (0.02 in)<br>5.5 mm (0.22 in)<br>0.5 mm (0.02 in) |
| <br>Master Cylinder Inside Diameter<br>Caliper Cylinder Inside Diameter<br>Brake Fluid Type  | 12.7 mm (0.50 in)<br>42.85 mm (1.69 in)<br>DOT #3                                                                       |
| Clutch:<br>Master Cylinder Inside Diameter<br>Release Cylinder Inside Diameter<br>Brake Fluid Type                                                                            | 15.87 mm (0.63 in)<br>38.1 mm (1.50 in)<br>DOT #3                                                                       |
| Brake Lever and Brake Pedal:<br>Brake Lever Free Play<br>Brake Pedal Position<br>Brake Pedal Free Play                                                                        | 2 ~ 5 mm (0.08 ~ 0.20 in)<br>20 mm (0.8 in)<br>Adjustment not permitted                                                 |

### Recommended combinations of the front fork and the rear shock absorber

Use this table as guidance to meet specific riding conditions and motorcycle load.

| Front Fork                                                            | Rear Shock Absorber |                  | Loading Condition |                |                           |                                         |
|-----------------------------------------------------------------------|---------------------|------------------|-------------------|----------------|---------------------------|-----------------------------------------|
| Air pressure                                                          | Spring seat         | Damping adjuster | Solo rider        | With passenger | With accessory equipments | With accessory equipments and passenger |
| 39.2 ~ 58.8 kPa<br>(0.4 ~ 0.6 kg/cm <sup>2</sup> ,<br>5.7 ~ 8.5 psi)  | 1 or 2              | 1 or 2           | ○                 |                |                           |                                         |
| 39.2 ~ 98.1 kPa<br>(0.4 ~ 1.0 kg/cm <sup>2</sup> ,<br>5.7 ~ 14.2 psi) | 3 ~ 5               | 2 ~ 4            |                   | ○              | ○                         |                                         |
| 39.2 ~ 98.1 kPa<br>(0.4 ~ 1.0 kg/cm <sup>2</sup> ,<br>5.7 ~ 14.2 psi) | 5                   | 4                |                   |                |                           | ○                                       |



## TIGHTENING TORQUE

| Part to be tightened                | Thread size | Tightening torque |      |       | Remarks        |
|-------------------------------------|-------------|-------------------|------|-------|----------------|
|                                     |             | Nm                | m•kg | ft•lb |                |
| Front Wheel Axle                    | M14 × 1.5   | 60                | 6.0  | 43    | Refer to NOTE. |
| Front Axle Pinch Bolt               | M8 × 1.25   | 20                | 2.0  | 14    |                |
| Under Bracket & Inner Tube          | M8 × 1.25   | 23                | 2.3  | 17    |                |
| Steering Crown & Inner Tube         | M8 × 1.25   | 20                | 2.0  | 14    |                |
| Steering Crown & Steering Shaft     | M22 × 1.0   | 110               | 11.0 | 80    |                |
| Steering Shaft Ring Nut (Lower)     | M25 × 1.0   | 50                | 5.0  | 36    |                |
| Steering Shaft Ring Nut (Lower)     | M25 × 1.0   | 3                 | 0.3  | 2.2   |                |
| Steering Shaft Ring Nut (Upper)     | M25 × 1.0   | —                 | —    | —     |                |
| Caliper & Front Fork                | M10 × 1.25  | 45                | 4.5  | 32    | Front          |
| Caliper & Bracket                   | M10 × 1.25  | 45                | 4.5  | 32    | Rear           |
| Caliper & Bleed Screw               | M8 × 1.25   | 5                 | 0.5  | 3.6   | Brake & Clutch |
| Brake Hose Union Bolt               | M10 × 1.25  | 25                | 2.5  | 18    |                |
| Clutch Hose Union Bolt              | M10 × 1.25  | 25                | 2.5  | 18    |                |
| Brake Hose & Brake Pipe             | M10 × 1.0   | 19                | 1.9  | 13    |                |
| Clutch Hose & Clutch Pipe           | M10 × 1.0   | 19                | 1.9  | 13    |                |
| Front Master Cylinder Cap           | M4 × 0.7    | 1                 | 0.1  | 0.7   |                |
| Front Brake Master Cylinder Bracket | M6 × 1.25   | 9                 | 0.9  | 6.5   |                |
| Clutch Master Cylinder Bracket      | M6 × 1.25   | 9                 | 0.9  | 6.5   |                |
| Rear Master Cylinder Union Bolt     | M10 × 1.25  | 25                | 2.5  | 18    |                |
| Rear Master Cylinder & Frame        | M8 × 1.25   | 23                | 2.3  | 17    |                |
| Pivot Shaft (Left) & Frame          | M22 × 1.5   | 100               | 10.0 | 72    |                |
| Pivot Shaft (Right) & Frame         | M25 × 1.5   | 6                 | 0.6  | 4.3   |                |
| Pivot Shaft (Right) & Locknut       | M25 × 1.5   | 100               | 10.0 | 72    |                |
| Front Fender & Fork Brace           | M6 × 1.0    | 9                 | 0.9  | 6.5   |                |
| Handlebar Upper Holder              | M8 × 1.25   | 20                | 2.0  | 14    |                |
| Handlebar Lower Holder              | M10 × 1.25  | 40                | 4.0  | 29    |                |
| Engine Bracket (Front upper)        | M10 × 1.25  | 40                | 4.0  | 29    |                |
| Engine Bracket (Front lower)        | M10 × 1.25  | 40                | 4.0  | 29    |                |
| Engine Bracket (Rear)               | M12 × 1.25  | 70                | 7.0  | 50    |                |
| Engine Stay & Frame                 | M8 × 1.25   | 15                | 1.5  | 11    |                |
| Down Tube & Frame                   | M10 × 1.25  | 45                | 4.5  | 32    |                |
| Frame and Front Cross Frame         | M8 × 1.25   | 20                | 2.0  | 14    |                |
| Muffler Bracket (Left) & Frame      | M8 × 1.25   | 25                | 2.5  | 18    |                |
| Muffler Bracket (Left) & Back Stay  | M8 × 1.25   | 25                | 2.5  | 18    |                |
| Back Stay & Frame                   | M8 × 1.25   | 30                | 3.0  | 22    |                |
| Rear Shock Absorber & Frame         | M8 × 1.25   | 20                | 2.0  | 14    |                |
| Rear Shock Absorber & Swingarm      | M10 × 1.25  | 30                | 3.0  | 22    |                |
| Rear Shock Absorber & Housing Gear  | M10 × 1.25  | 30                | 3.0  | 22    |                |
| Swingarm & Housing Gear             | M10 × 1.25  | 42                | 4.2  | 30    |                |
| Rear Wheel Axle & Nut               | M18 × 1.5   | 120               | 12.0 | 85    |                |
| Footrest Bracket (Left) & Frame     | M10 × 1.25  | 37                | 3.7  | 27    |                |
| Footrest Bracket (Right) & Frame    | M8 × 1.25   | 23                | 2.3  | 17    |                |

## NOTE:

## •Ring nut (lower):

1) First, tighten the ring nut approximately 50 Nm (5.0m•kg, 36 ft•lb) by using the torque wrench, then loosen the ring nut completely.

2) Retighten the ring nut 3 Nm (0.3 m•kg, 2.2 ft•lb).

## •Ring nut (upper):

1) Finger tighten the ring nut.



Electrical

| Model                                                                                                                                                               | VMX12                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Voltage:                                                                                                                                                            | 12 V                                                                                                                 |
| Ignition System:<br>Ignition Timing (B.T.D.C.)<br>Advanced Timing (B.T.D.C.)<br>Advancer Type                                                                       | 3° at 1,000 r/min<br>43° at 9,000 r/min<br>Vacuum and electrical                                                     |
| <p>Ignition timing (B.T.D.C.)</p> <p>Engine speed (<math>\times 10^3</math> r/min)</p> <p>10.6 kPa (80 mm Hg, 3.15 in Hg)</p> <p>5.3 kPa (40 mm Hg, 1.57 in Hg)</p> |                                                                                                                      |
| T.C.I.:<br>Pickup Coil Resistance (Color)                                                                                                                           | 93.5 ~ 126.5 $\Omega$ at 20°C (68°F)<br>(Black – Orange) (Black – Gray)<br>(Black – White/Green) (Black – White/Red) |
| T.C.I. Unit-Model/Manufacturer                                                                                                                                      | TID14-43/HITACHI                                                                                                     |
| Ignition Coil:<br>Model/Manufacturer<br>Primary Winding Resistance<br>Secondary Winding Resistance                                                                  | CM11-61/HITACHI<br>2.4 ~ 3.0 $\Omega$ at 20°C (68°F)<br>10.6 ~ 15.8 k $\Omega$ at 20°C (68°F)                        |
| Charging System/Type:                                                                                                                                               | A.C. magneto generator                                                                                               |
| A.C. Generator:<br>Model/Manufacturer<br>Nominal Output                                                                                                             | FL130-04/HITACHI<br>14 V, 25 A at 5,000 r/min                                                                        |
| <p>Output current (A)</p> <p>Engine speed (<math>\times 10^3</math> r/min)</p>                                                                                      |                                                                                                                      |
| Stator Coil Resistance                                                                                                                                              | 0.36 ~ 0.48 $\Omega$ at 20°C (68°F)                                                                                  |

## SPECIFICATIONS

**APPX**



| Model                                                                                                                                                                                                                                                                                                  | VMX12                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Voltage Regulator:<br>Type<br>Model/Manufacture<br>No Load Regulated Voltage                                                                                                                                                                                                                           | Short control<br>SH569/SHINDENGEN<br>14 ~ 15 V                                                                                                                                                                                                                       |
| Rectifier:<br>Model/Manufacturer<br>Capacity<br>Withstand Voltage                                                                                                                                                                                                                                      | SH569/SHINDENGEN<br>25 A<br>200 V                                                                                                                                                                                                                                    |
| Battery:<br>Capacity<br>Specific Gravity                                                                                                                                                                                                                                                               | 12 V, 16 AH<br>1.280                                                                                                                                                                                                                                                 |
| Electric Starter System:<br>Type<br>Starter Motor:<br>Model/Manufacturer<br>Out put<br>Bush:<br>Overall Length<br><Limit><br>Spring Pressure<br>Commutator:<br>Outside Diameter<br><Wear Limit><br>Mica Undercut<br>Starter Relay:<br>Model/Manufacturer<br>Amperage Rating<br>Coil Winding Resistance | Constant mesh type<br><br>SM-229C/MITSUBA<br>0.6 kW<br><br>12.5 mm (0.49 in)<br>5.5 mm (0.22 in)<br>560 ~ 680 g (19.7 ~ 23.9 oz)<br><br>28 mm (1.1 in)<br>27 mm (1.06 in)<br>0.7 mm (0.028 in)<br><br>A104-128/HITACHI<br>100 A<br>3.9 ~ 4.7 $\Omega$ at 20°C (68°F) |
| Horn:<br>Type/Quantity<br>Model/Manufacturer<br>Maximum Amperage                                                                                                                                                                                                                                       | Plain type $\times$ 1<br>YF-12/NIKKO<br>2.5 A                                                                                                                                                                                                                        |
| Flasher Relay:<br>Type<br>Model/Manufacturer<br>Self Cancelling Device<br>Flasher Frequency<br>Wattage                                                                                                                                                                                                 | Semi transistor type<br>FX257N/NIPPONDENSO<br>Yes.<br>75 ~ 95 cycle/min<br>21 W $\times$ 2 + 3.4 W                                                                                                                                                                   |
| Self Cancelling Unit:<br>Model/Manufacturer                                                                                                                                                                                                                                                            | FX257N/NIPPONDENSO                                                                                                                                                                                                                                                   |
| Oil Level Switch:<br>Model/Manufacturer                                                                                                                                                                                                                                                                | 1FK/NIPPONDENSO                                                                                                                                                                                                                                                      |
| Fuel Gauge:<br>Model/Manufacturer<br>Sender Unit Resistance (Full)                                                                                                                                                                                                                                     | 1FK/NIPPONSEIKI<br>0.7 ~ 1.1 k $\Omega$ at 20°C (68°F)                                                                                                                                                                                                               |

## SPECIFICATIONS

APPX



| Model                                                                                     | VMX12                                                                                                                               |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Starting Circuit Cut-off Relay:<br>Model/Manufacturer<br>Coil Winding Resistance<br>Diode | G4MW-1121T-100-Y10/TATEISHI<br>203 ~ 248 $\Omega$ at 20°C (68°F)<br>Yes.                                                            |
| Fuel Pump Relay:<br>Model/Manufacturer<br>Coil Winding Resistance                         | G8D-04Y/OMRON<br>90 ~ 110 $\Omega$ at 20°C (68°F)                                                                                   |
| Electric Fan:<br>Model/Manufacturer                                                       | 26H/NIPPONDENSO                                                                                                                     |
| Thermostatic Switch:<br>Model/Manufacturer                                                | 47X/NIPPON THERMOSTAT                                                                                                               |
| Thermo-unit:<br>Model/Manufacturer                                                        | 11H/NIPPONSEIKI                                                                                                                     |
| Circuit Breaker:<br>Type<br>Amperage for Individual Circuit × Quantity:                   | Fuse<br><br>Main 30 A × 1<br>Headlight 15 A × 1<br>Signal 10 A × 1<br>Ignition 10 A × 1<br>Reserve 30 A × 1<br>15 A × 1<br>10 A × 1 |

## GENERAL TORQUE SPECIFICATIONS/ DEFINITION OF UNITS

APPX

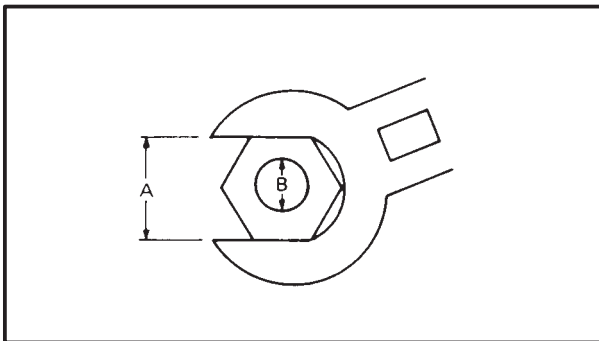


### GENERAL TORQUE SPECIFICATIONS

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 multifastener assemblies in a crisscross fashion, in progressive stages, until full torque is reached.

Unless otherwise specified, torque specifications call for clean, dry threads. Components should be at room temperature.

| A<br>(Nut) | B<br>(Bolt) | General torque specifications |      |       |
|------------|-------------|-------------------------------|------|-------|
|            |             | Nm                            | m•kg | ft•lb |
| 10 mm      | 6 mm        | 6                             | 0.6  | 4.3   |
| 12 mm      | 8 mm        | 15                            | 1.5  | 11    |
| 14 mm      | 10 mm       | 30                            | 3.0  | 22    |
| 17 mm      | 12 mm       | 55                            | 5.5  | 40    |
| 19 mm      | 14 mm       | 85                            | 8.5  | 61    |
| 22 mm      | 16 mm       | 130                           | 13.0 | 94    |



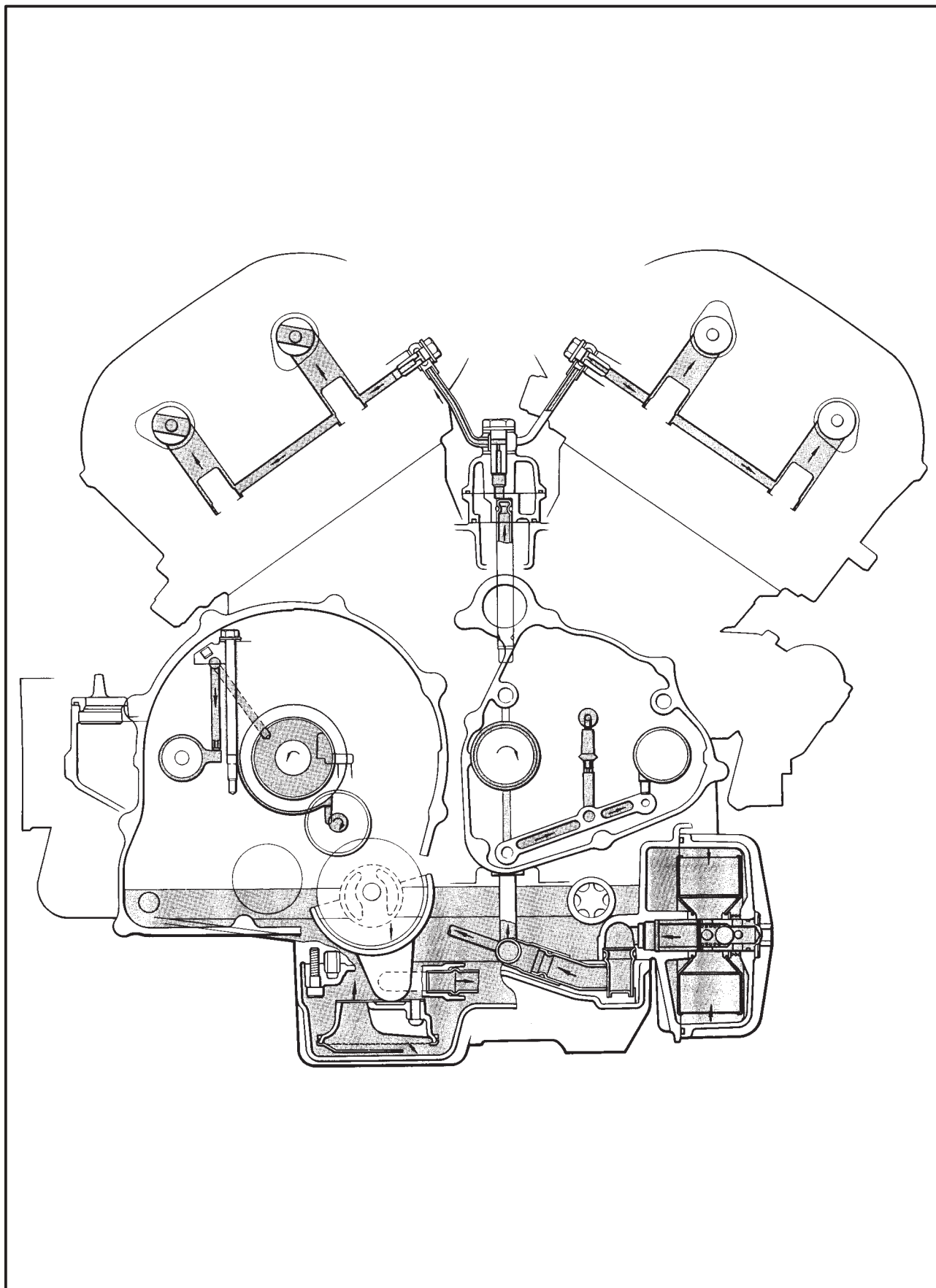
### DEFINITION OF UNITS

| Unit               | Read                            | Definition                                                | Measure                 |
|--------------------|---------------------------------|-----------------------------------------------------------|-------------------------|
| mm<br>cm           | millimeter<br>centimeter        | $10^{-3}$ meter<br>$10^{-2}$ meter                        | Length<br>Length        |
| kg                 | kilogram                        | $10^3$ gram                                               | Weight                  |
| N                  | Newton                          | $1 \text{ kg} \times \text{m/sec}^2$                      | Force                   |
| Nm<br>m•kg         | Newton meter<br>Meter kilogram  | $\text{N} \times \text{m}$<br>$\text{m} \times \text{kg}$ | Torque<br>Torque        |
| Pa<br>N/mm         | Paskal<br>Newton per millimeter | $\text{N/m}^2$<br>N/mm                                    | Pressure<br>Spring rate |
| L<br>$\text{cm}^3$ | Liter<br>Cubic centimeter       | —                                                         | volume or Capacity      |
| r/min              | Rotation per minute             | —                                                         | Engine speed            |



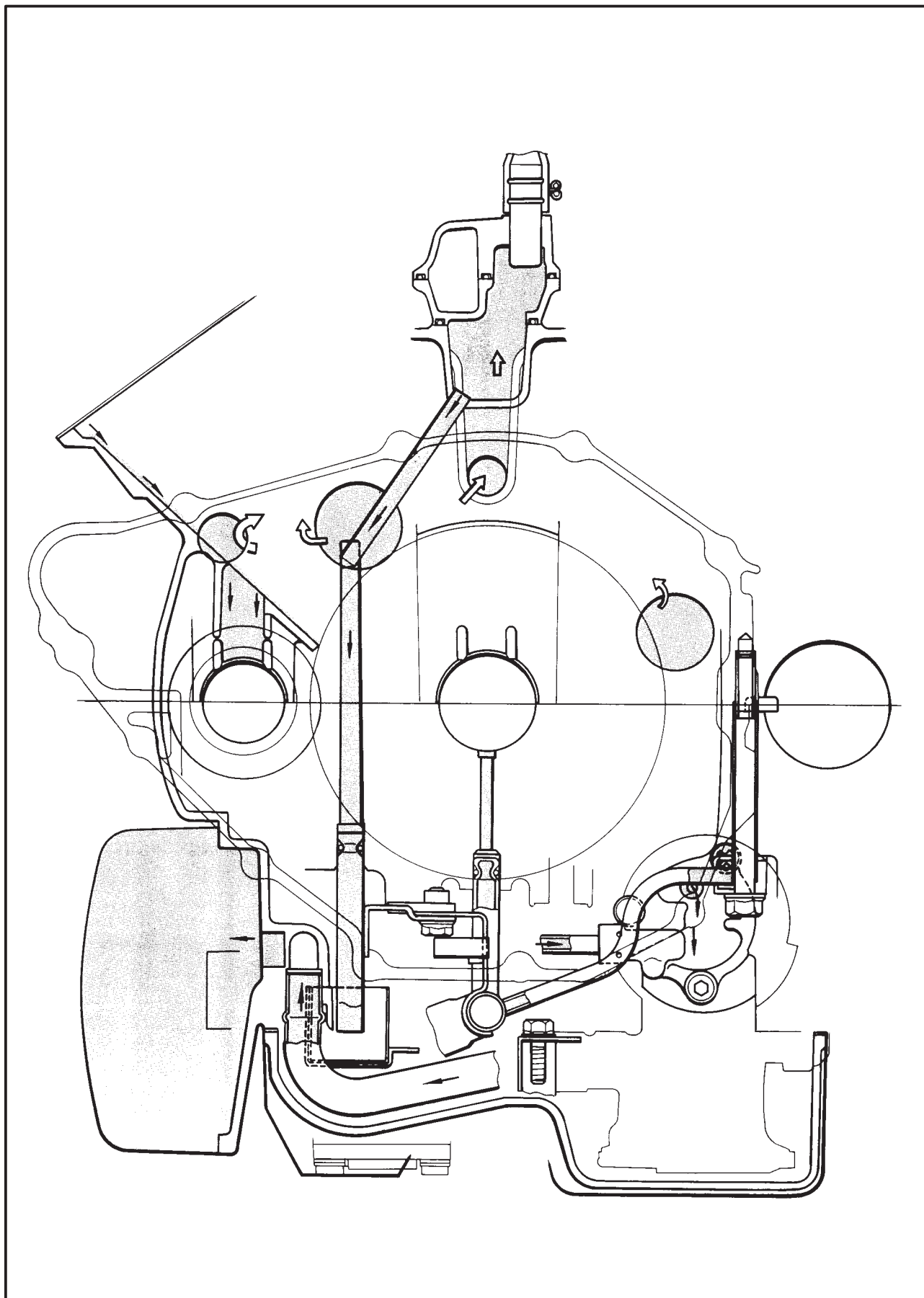
## LUBRICATION DIAGRAMS

## LUBRICATION DIAGRAM (1)



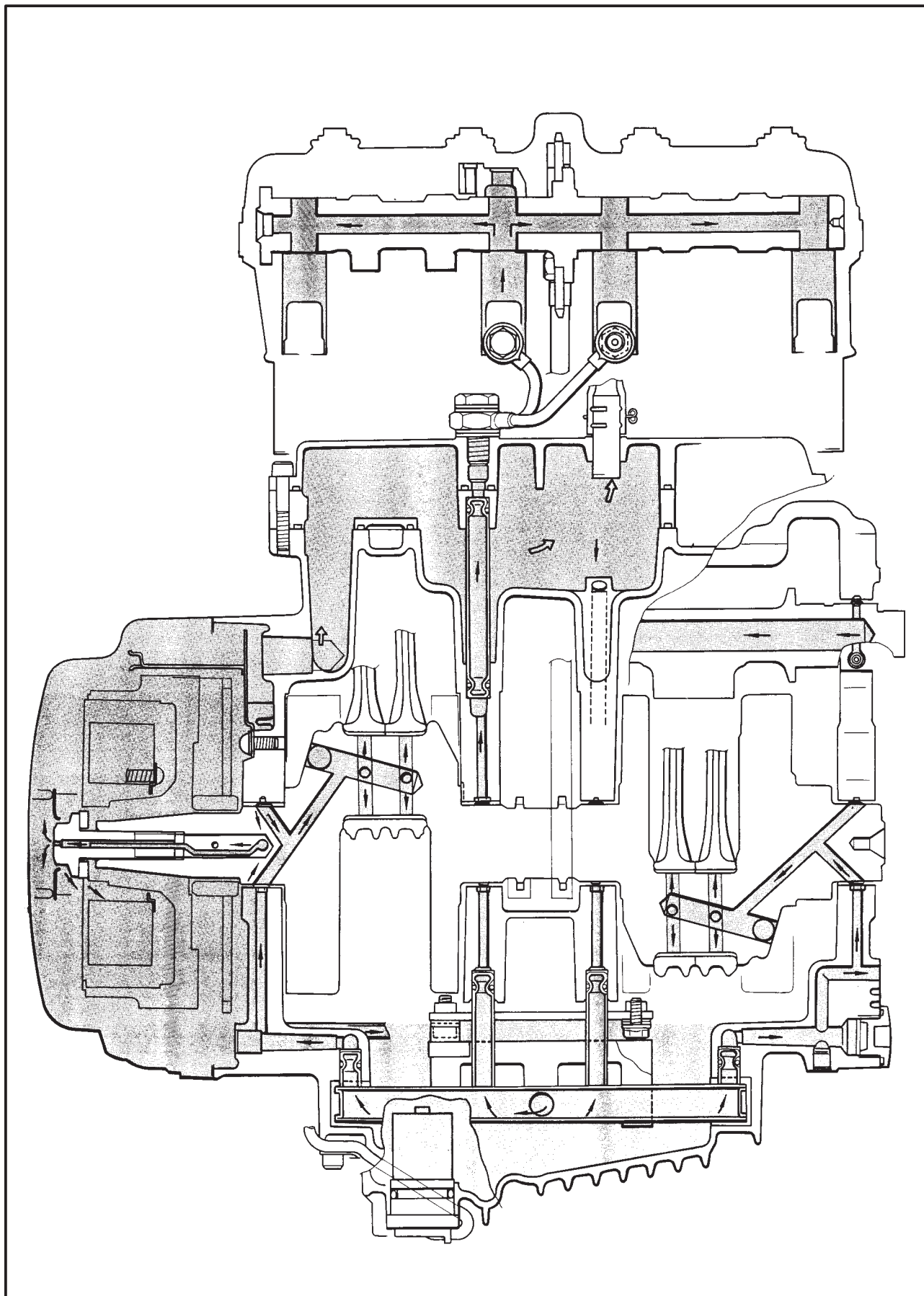


LUBRICATION DIAGRAM (2)



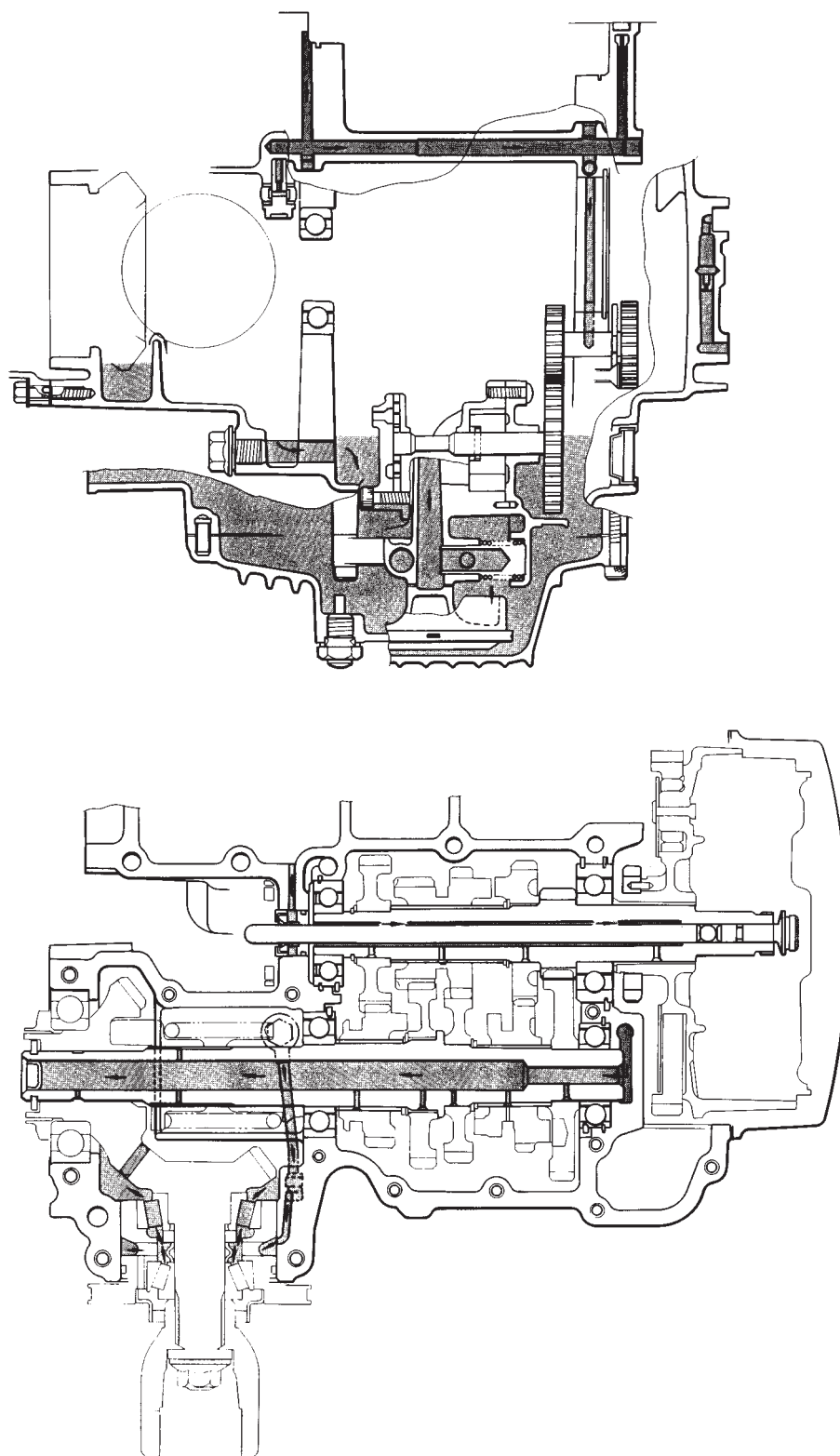


LUBRICATION DIAGRAM (3)



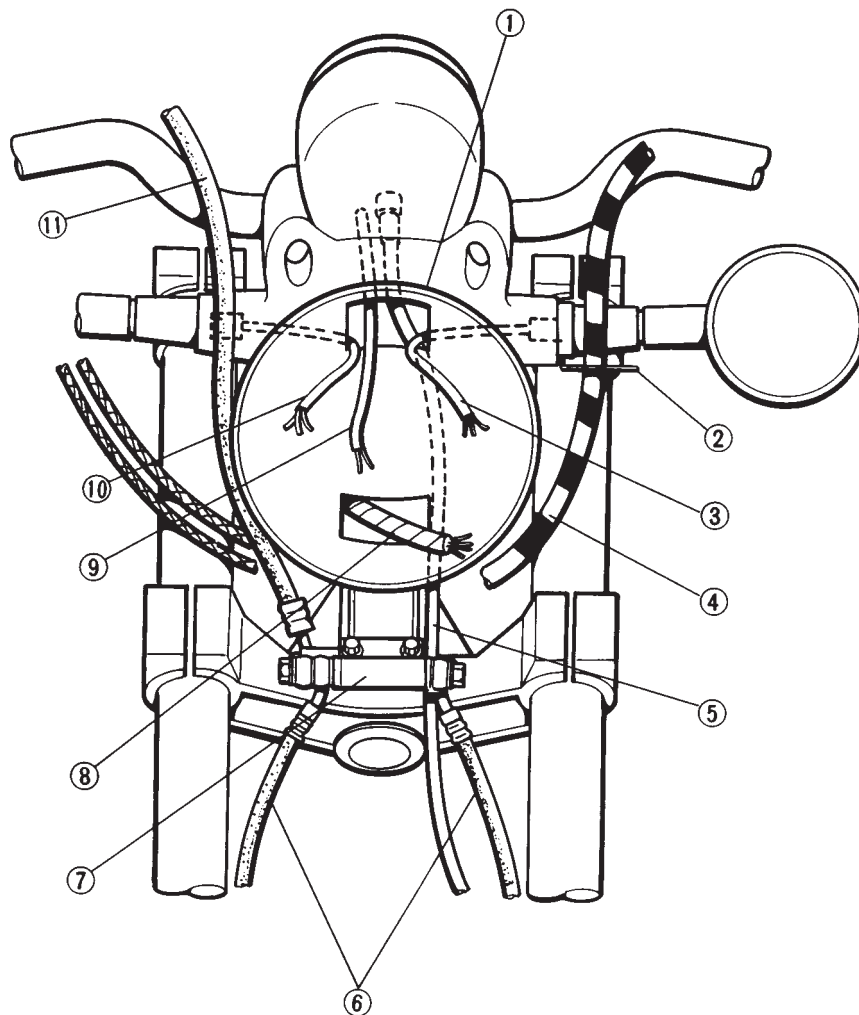


LUBRICATION DIAGRAM (4)



**CABLE ROUTING**

- |                                   |                                    |
|-----------------------------------|------------------------------------|
| ① Headlight body                  | ⑦ Brake joint                      |
| ② Hose guide                      | ⑧ Wireharness                      |
| ③ Front flasher light lead (Left) | ⑨ Speedometer light lead           |
| ④ Clutch hose                     | ⑩ Front flasher light lead (Right) |
| ⑤ Speedometer cable               | ⑪ Front brake hose                 |
| ⑥ Front brake hose                |                                    |



## CABLE ROUTING

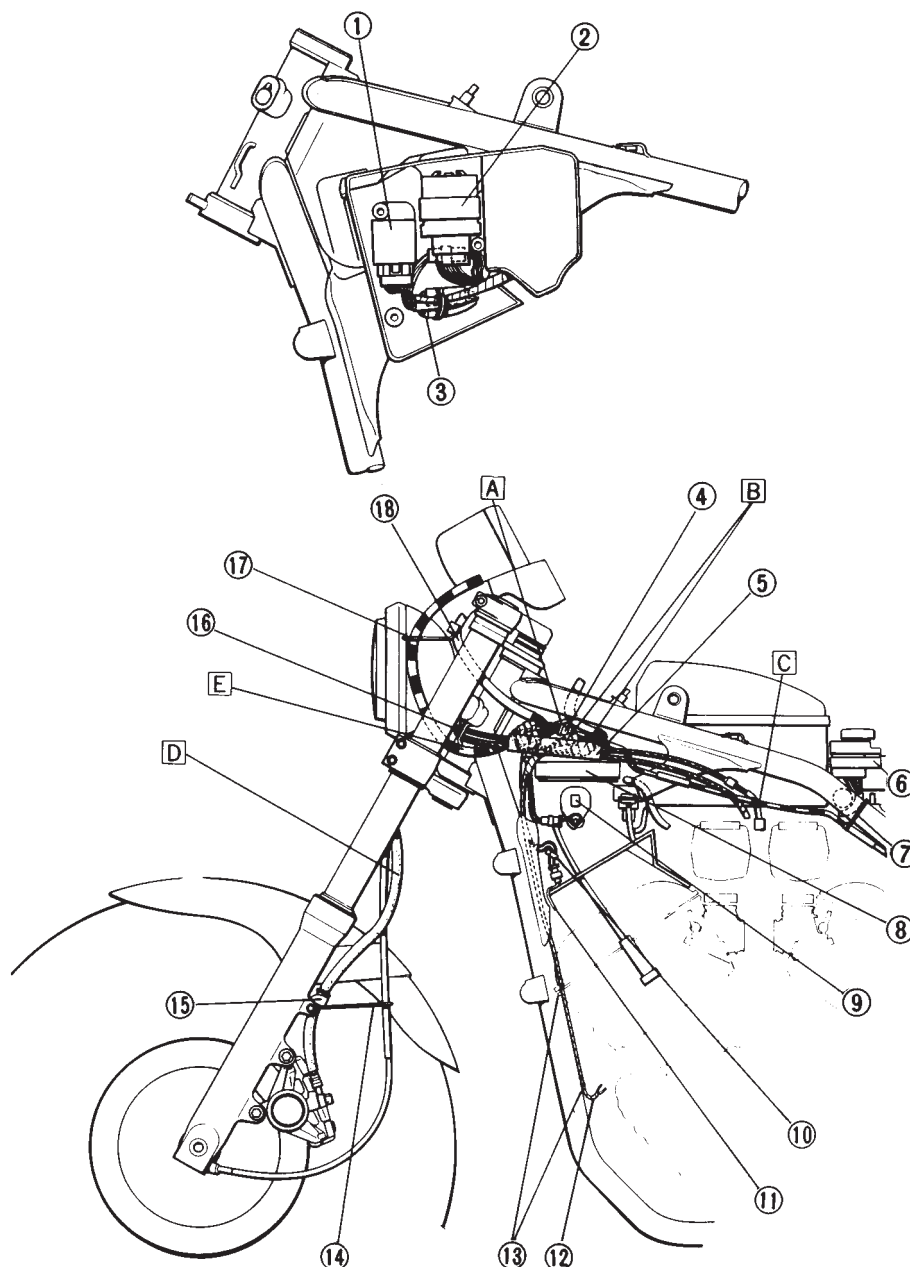
APPX



- ① Fuel pump control unit
- ② Relay unit
- ③ Clamp
- ④ Clutch hose clamp
- ⑤ Throttle cable joint
- ⑥ Fuse box
- ⑦ Band
- ⑧ Ignitor unit
- ⑨ Ignition coil
- ⑩ Clamp
- ⑪ Radiator fan lead

- ⑫ Horn lead
- ⑬ Clamp
- ⑭ Guide (For speedometer cable)
- ⑮ Clamp (For brake hose)
- ⑯ Guide (For throttle cable)
- ⑰ Guide (For clutch hose)
- ⑱ Handlebar switch lead (Left)

- A Pass the handlebar switch lead inside the clutch hose
- B Pass the meter lead outside the clutch hose.
- C Pass the clutch hose outside the throttle cable.
- D Pass the brake hose outside the speedometer cable.
- E Pass the clutch hose under the throttle cable guide.

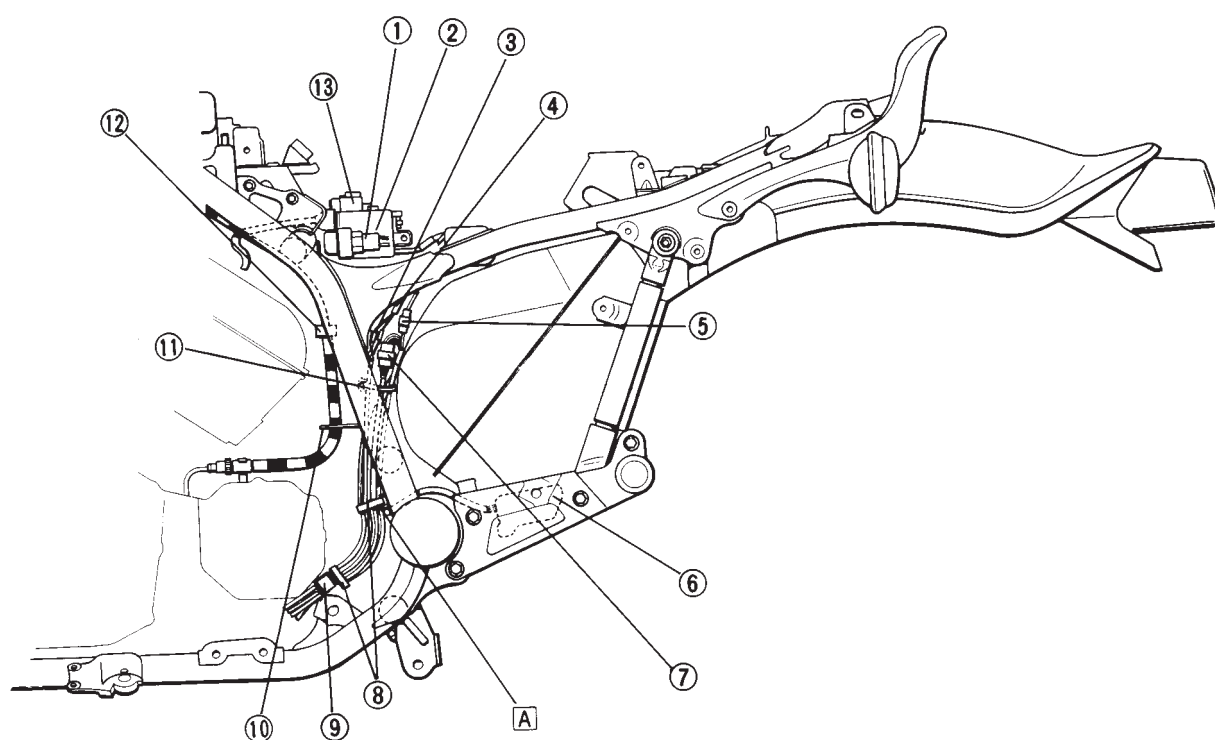


## CABLE ROUTING

APPX



- |                            |                                            |
|----------------------------|--------------------------------------------|
| ① Main fuse                | ⑩ Guide (For clutch hose)                  |
| ② Ignition coil            | ⑪ Clamp                                    |
| ③ Oil level switch lead    | ⑫ Clamp (For clutch hose)                  |
| ④ Neutral switch lead      | ⑬ Starter relay                            |
| ⑤ Regulator lead           | Ⓐ Pass the band through the guide on frame |
| ⑥ Rectifier/Regulator lead | on frame.                                  |
| ⑦ A.C. generator lead      |                                            |
| ⑧ Band                     |                                            |
| ⑨ Clamp                    |                                            |

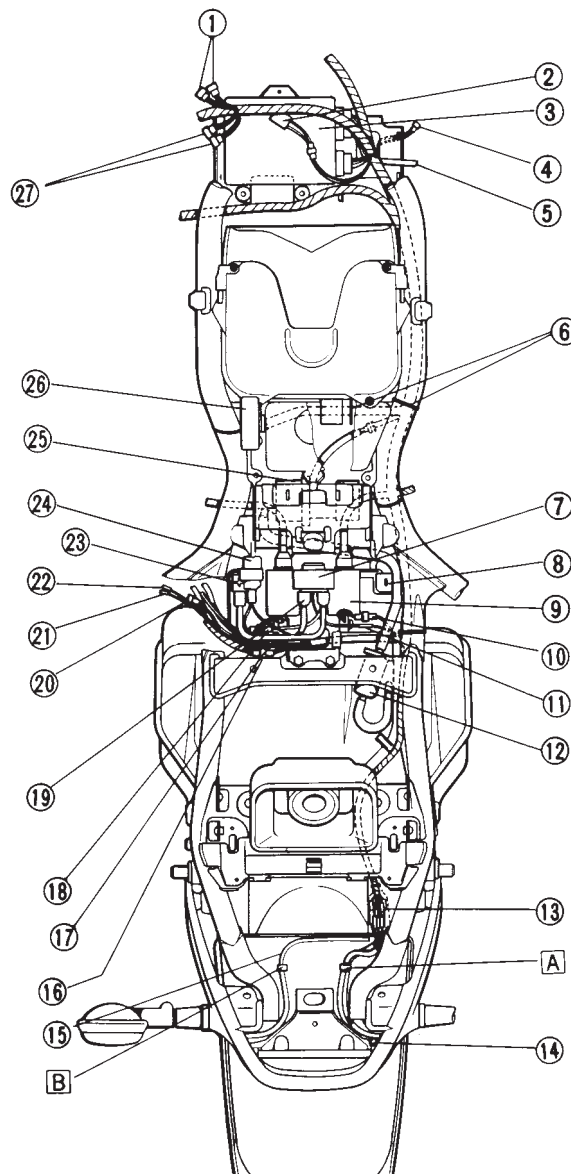


## CABLE ROUTING

APPX



- |                             |                                  |                                                                 |
|-----------------------------|----------------------------------|-----------------------------------------------------------------|
| ① Handlebar switch lead     | ⑬ Boot cover                     | ⑫ Fuel pump                                                     |
| ② Diode                     | ⑭ Taillight lead                 | ⑫ Fuse box                                                      |
| ③ Ignitor unit              | ⑮ Rear flasher light lead (Left) | ⑫ Meter lead                                                    |
| ④ Ignition coil lead        | ⑯ Ignition coil lead             | Ⓐ Clamp the taillight lead and rear flasher light lead (Right). |
| ⑤ Conduit lead              | ⑰ Pick up coil lead              | Ⓑ Clamp the rear flasher light lead (Left).                     |
| ⑥ Band                      | ⑱ Starter relay lead             |                                                                 |
| ⑦ Starter relay             | ⑲ Starter motor lead             |                                                                 |
| ⑧ Battery negative (–) lead | ⑳ Regulator lead                 |                                                                 |
| ⑨ Ignition coil             | ㉑ Oil level switch lead          |                                                                 |
| ⑩ Ignition coil lead        | ㉒ Neutral switch lead            |                                                                 |
| ⑪ Starter relay lead        | ㉓ Battery positive (+) lead      |                                                                 |
| ⑫ Fuel filter               | ㉔ Main fuse                      |                                                                 |



## CABLE ROUTING

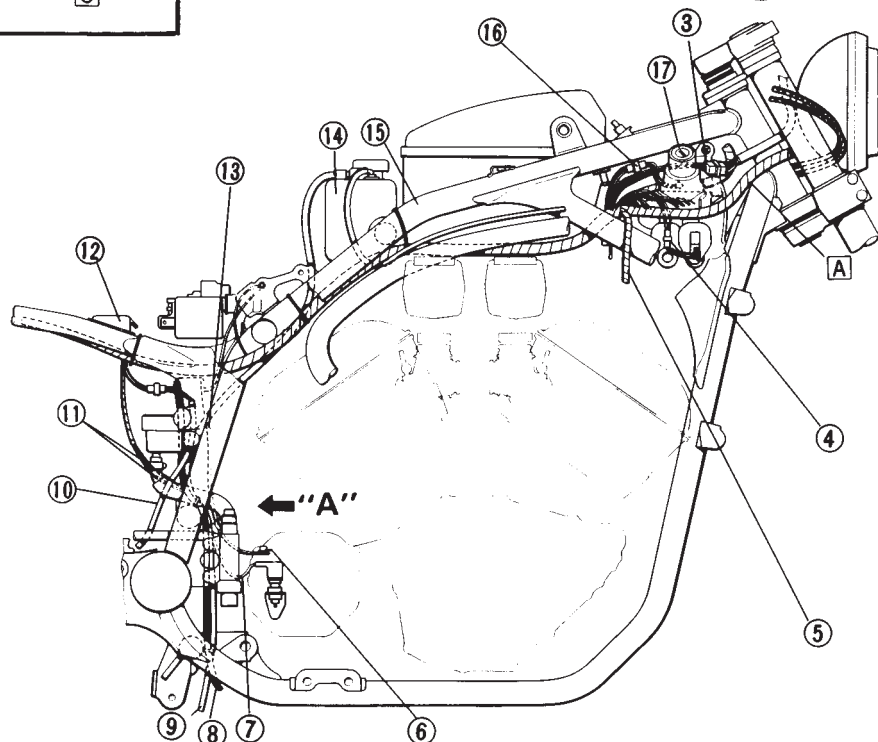
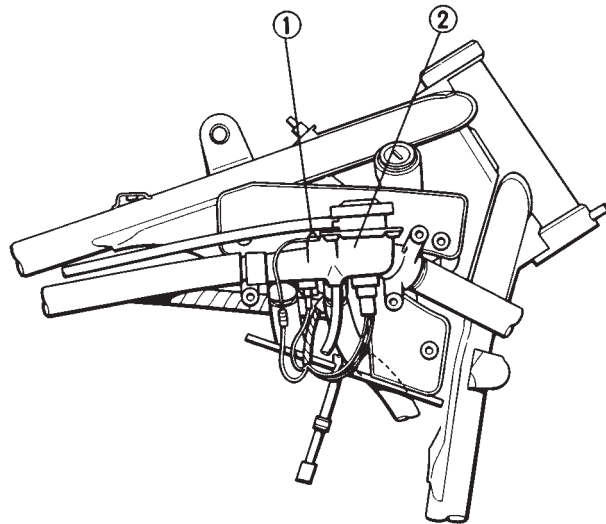
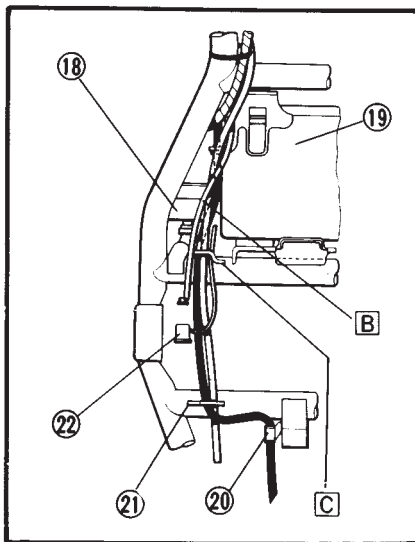
APPX



- ① Earth lead
- ② Conduit
- ③ Handlebar switch lead (Left)
- ④ Ignition coil lead
- ⑤ To conduit
- ⑥ Earth lead
- ⑦ Rear brake switch lead
- ⑧ Battery breather hose
- ⑨ Coolant reservoir tank breather hose
- ⑩ Fuel sender lead
- ⑪ Rear brake switch lead
- ⑫ Band

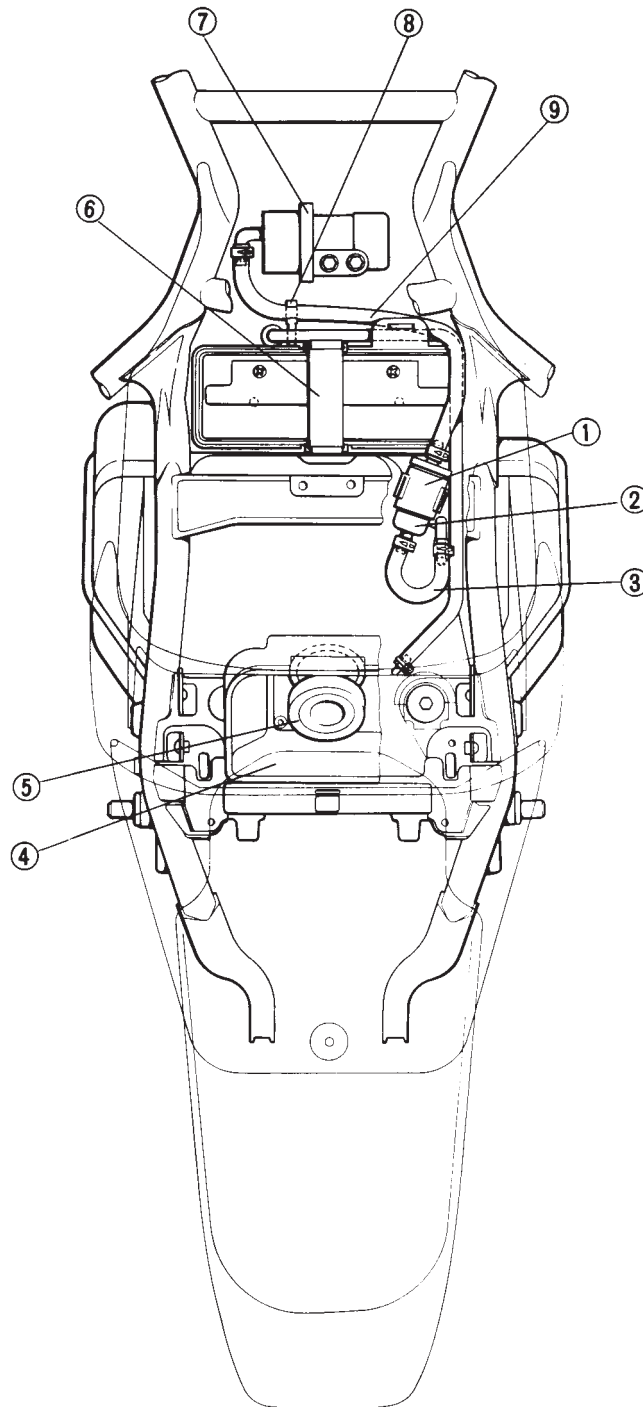
- ⑬ Battery negative (-) lead
- ⑭ Coolant reservoir tank
- ⑮ Band
- ⑯ Main switch lead
- ⑰ Main switch
- ⑱ Rear brake reservoir tank
- ⑲ Battery box
- ⑳ Clamp (For battery breather hose)
- ㉑ Guide (For reservoir tank breather hose and Battery breather hose)
- ㉒ Rear brake switch

- A Pass the wireharness outside the main switch stay.
- B Earth lead:  
Pass the earth lead outside the reservoir tank breather hose.
- C Guide (For battery breather hose, reservoir tank breather hose and rear brake switch lead).



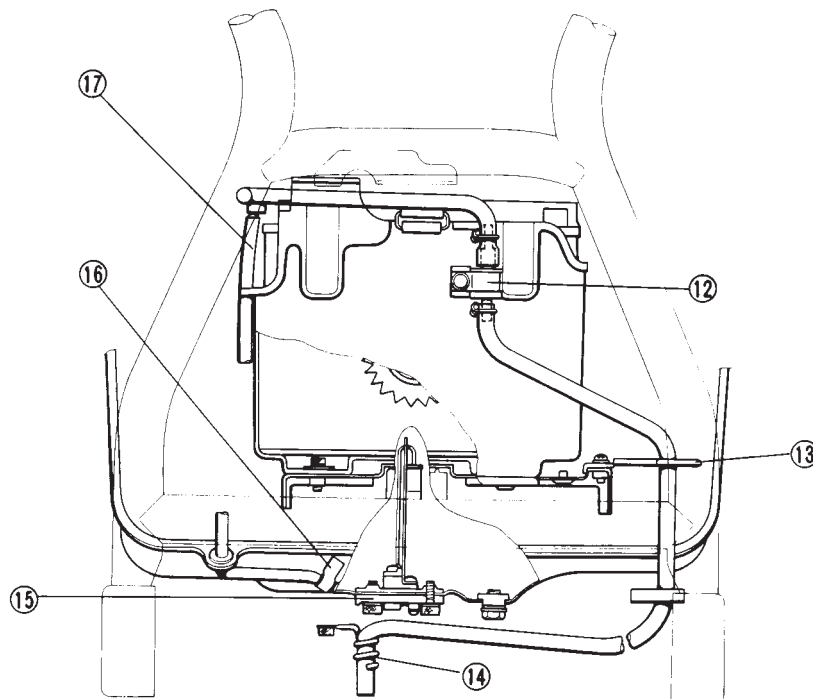
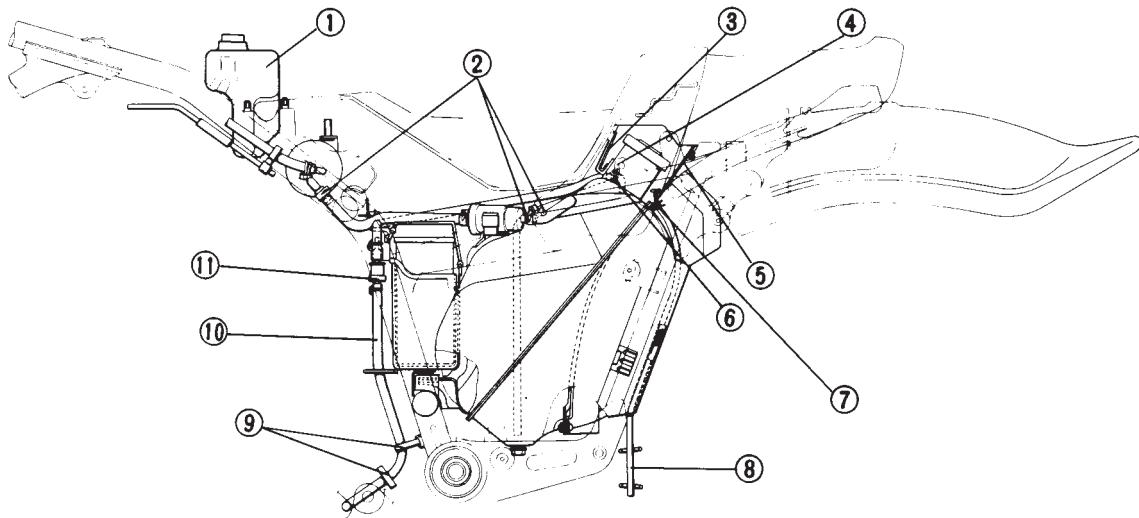


- |                       |                |
|-----------------------|----------------|
| ① Fuel filter bracket | ⑥ Battery band |
| ② Fuel filter         | ⑦ Fuel pump    |
| ③ Fuel pipe           | ⑧ Clamp        |
| ④ Filler cover        | ⑨ Fuel pipe    |
| ⑤ Filler cap          |                |



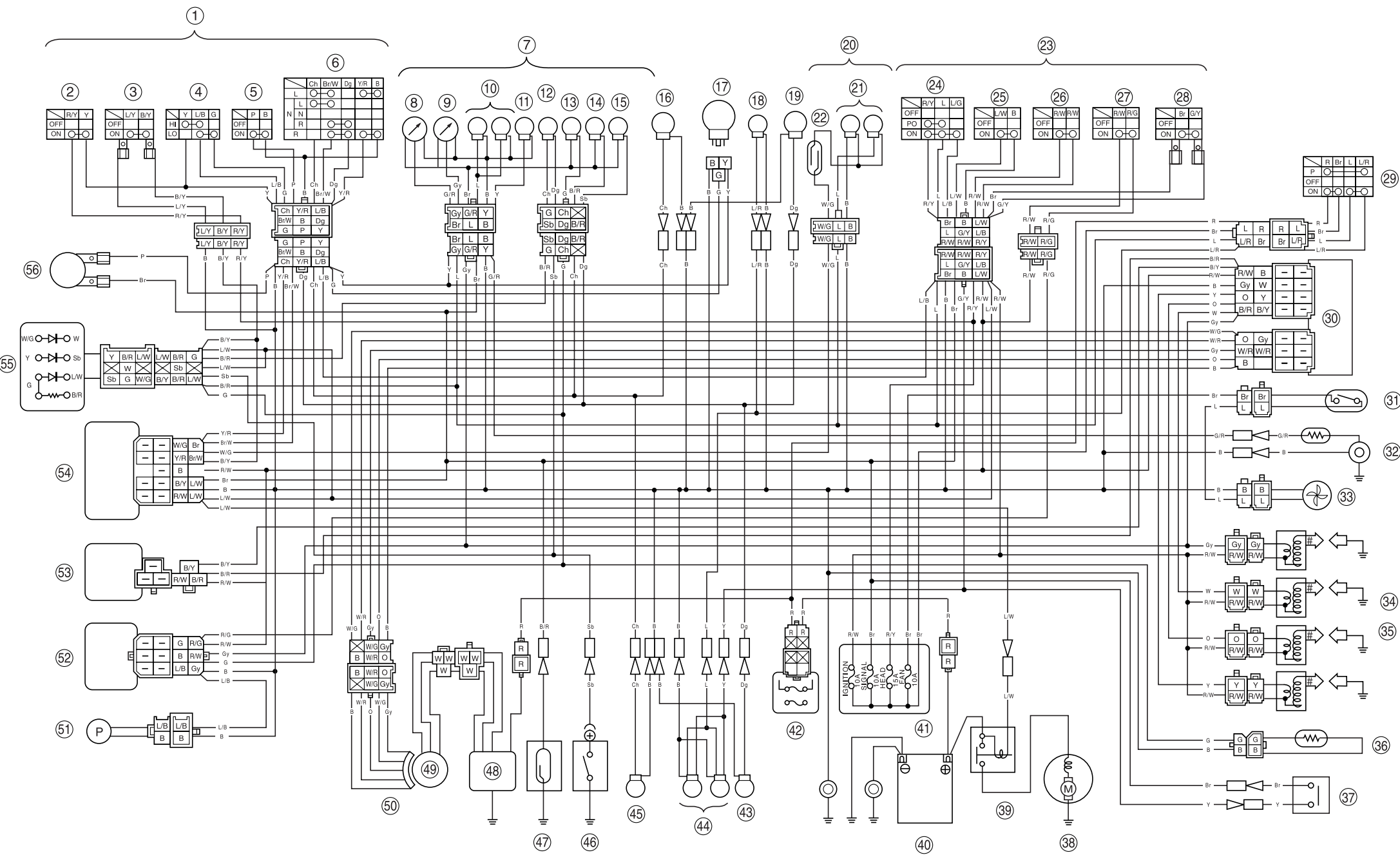


- |                  |                         |
|------------------|-------------------------|
| ① Reservoir tank | ⑩ Over flow hose        |
| ② Clip           | ⑪ Over flow valve       |
| ③ Spring         | ⑫ Clamp                 |
| ④ Clip           | ⑬ Holder                |
| ⑤ Filler cover   | ⑭ Clamp                 |
| ⑥ Pipe joint     | ⑮ Fuel sender           |
| ⑦ Clip           | ⑯ Clamp                 |
| ⑧ Drain hose     | ⑰ Battery breather hose |
| ⑨ Band           |                         |



---

WIRING DIAGRAM



COLOR CODE

|   |        |    |        |    |            |      |              |     |            |     |             |     |              |
|---|--------|----|--------|----|------------|------|--------------|-----|------------|-----|-------------|-----|--------------|
| B | Black  | L  | Blue   | Ch | Chocolate  | L/Y  | Blue/Yellow  | B/R | Black/Red  | L/R | Blue/Red    | G/Y | Green/Yellow |
| P | Pink   | R  | Red    | Br | Brown      | B/Y  | Black/Yellow | G/R | Green/Red  | W/G | White/Green | R/G | Red/Green    |
| Y | Yellow | O  | Orange | Dg | Dark green | R/Y  | Red/Yellow   | Y/R | Yellow/Red | L/W | Blue/White  | W/R | White/Red    |
| G | Green  | Gy | Gray   | Sb | Sky blue   | Br/W | Brown/White  | L/B | Blue/Black | R/W | Red/White   | W   | White        |

- 1. Handlebar switch (Left)
- 2. "PASS" switch
- 3. Clutch switch
- 4. "LIGHTS" (Dimmer) switch
- 5. "HORN" switch
- 6. "TURN" switch
- 7. Meter assembly
- 8. Temperature meter
- 9. Tachometer
- 10. Meter light
- 11. "HIGH BEAM" indicator light
- 12. "TURN" indicator light
- 13. "FUEL" warning light
- 14. "OIL LEVEL" indicator light
- 15. "NEUTRAL" indicator light
- 16. Front flasher light (Left)
- 17. Headlight
- 18. Auxiliary light
- 19. Front flasher light (Right)
- 20. Speedometer
- 21. Meter light
- 22. Reed switch
- 23. Handlebar switch (Right)
- 24. "LIGHTS" switch
- 25. "START" switch
- 26. "ENGINE STOP" switch
- 27. "FUEL" (Reserve) switch
- 28. Front brake switch
- 29. Main switch
- 30. Ignitor unit
- 31. Thermo switch
- 32. Thermo unit
- 33. Fan
- 34. Ignition coil
- 35. Spark plug
- 36. Fuel sender
- 37. Rear brake switch
- 38. Starter motor
- 39. Starter relay
- 40. Battery
- 41. Fuse
- 42. Main fuse
- 43. Rear flasher light (Right)
- 44. Tail/Brake light
- 45. Rear flasher light (Left)
- 46. Neutral switch
- 47. Oil level switch
- 48. Rectifier/Regulator
- 49. A.C. Magneto
- 50. Pick up coil
- 51. Fuel pump
- 52. Fuel pump control unit
- 53. Pressure sensor
- 54. Relay unit
- 55. Diode assembly
- 56. Horn