YAMAHA

GTS1000AE
GTS1000AEC

SERVICE MANUAL
—NEW FEATURES—

LIT-11616-09-22

4HH-28197-21

The service information for this motorcycle has been split into two manuals.
For service information on the following components, please refer to the "SERVICE MANUAL - NEW FEATURES":

- EFI (Electronic Fuel Injection) system
- Single-sided swingarm front suspension
- ABS (Anti-lock Brake System)

GTS1000AE/GTS1000AEC
SERVICE MANUAL
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1st Edition, November 1993
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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 pepairs 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.

for USA, California
This model has been designed and manufactured to perform within certain specifications in regard to performance and emissions. proper service with correct tools in necessary to ensure that the motorcycle will operate as designed. If there is any question about a service procedure, it is imperative that you contact a Yamaha dealer for any service information changes that apply to this model. This policy is intended to provide the customer with the most satisfaction from his motorcycle and to conform with federal environmental qual objectives.

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.

NOTE:
For USA, California:
This Service Manual contains information regarding peroodic maintenance to the emission control system. Please read this material carefully.

PARTICULARY IMPORTANT INFORMATION

This material is distinguished by the following notation.

⚠ The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING Failure to follow WARNING instructions could result in severe injury or death to the motorcycle operator, a bystander, or a person inspecting or repairing the motorcycle.

CAUTION: A CAUTION indicates special precautions that must be taken to avoid damage to the motorcycle.

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

HOW TO USE THIS MANUAL

CONSTRACTION OF THIS MANUAL

This manual consists of chapters for the main categories of subjects. (See "Illustrated symbols")

1st title ①: This is a chapter with its symbol on the upper right of each page.

2nd title ②: This title appears on the upper of each page on the left of the chapter symbol. (For the chapter "Periodic inspection and adjustment" the 3rd title appears.)

3rd title ③: This is a final title.

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 inspectio

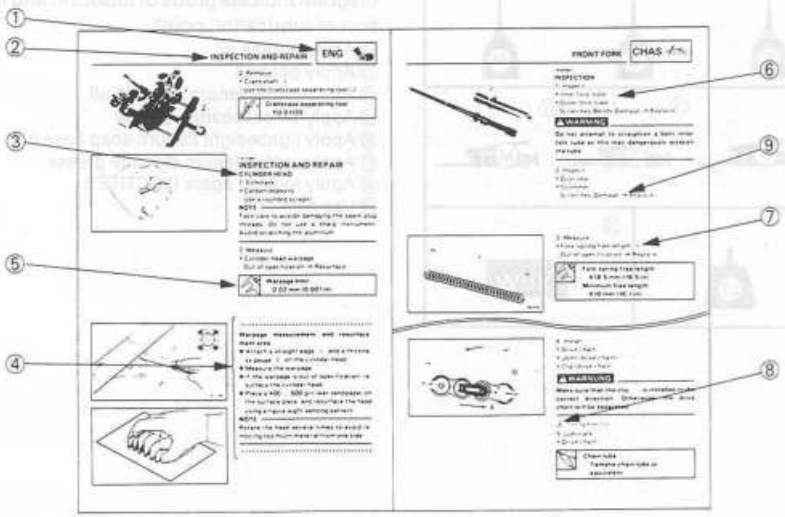
A set of particularly important procedure ④ is placed between a line of asterisks "✱"with each procedure preceded by "●".

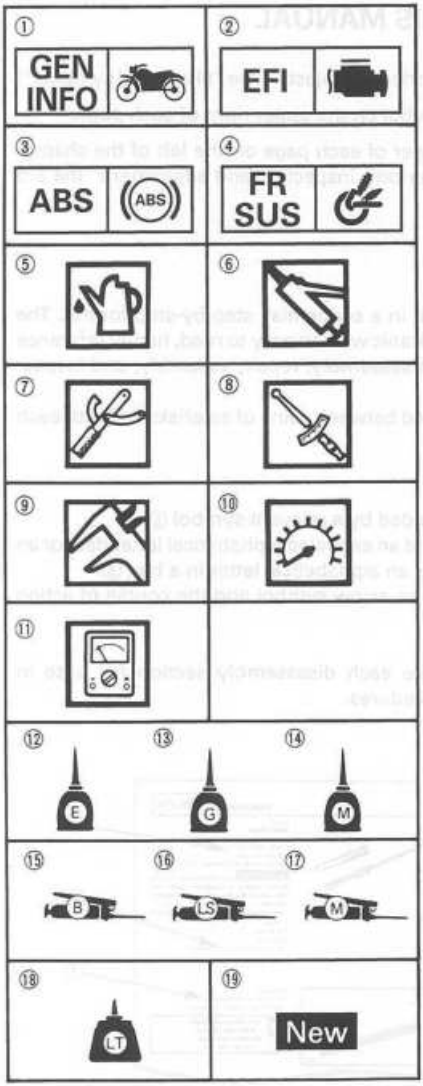
IMPORTANT FEATURES

- Data and a special tool are framed in a box preceded by a relevant symbol ⑤.
- An encircled numeral ⑥ indicates a part name, and an encircled alphabetical letter data or an alignment mark ⑦, the others being indicated by an alphabetical letter in a box ⑧.
- A condition of a faulty component will precede an arrow symbol and the course of action required the symbol ⑨.

EXPLODED DIAGRAM

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





ILLUSTRATED SYMBOLS (REFER TO THE ILLUSTRATION)

Illustrated symbols ① to ④ are designed as thumb tabs to indicate the chapter's number and content.

① General information
② Electronic Fuel Injection (EFI)
③ Anti-Lock Brake System (ABS)
④ Single-sided swingarm front suspension

Illustrated symbols ⑤ to ⑪ are used to identify the specifications appearing in the text.

⑤ Filling fluid
⑥ Lubricant
⑦ Special tool
⑧ Tightening
⑨ Wear limit, clearance
⑩ Engine speed
⑪ Ω, V, A

Illustrated symbols ⑫ to ⑱ in the exploded diagram indicate grade of lubricant and location of lubrication point.

⑫ Apply engine oil
⑬ Apply gear oil
⑭ Apply molibdenum disufide oil
⑮ Apply wheel bearing grease
⑯ Apply lightweight lithium-soap base grease
⑰ Apply molybdenum disufide grease
⑱ Apply locking agent (LOCTITE®)
⑲ Use new one

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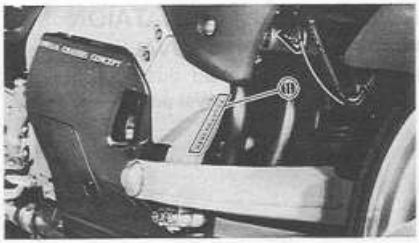
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GEN INFO



GENERAL INFORMATION

MOTORCYCLE IDENTIFICATION

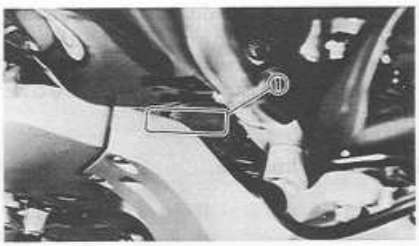
VEHICLE IDENTIFICATION NUMBER (For E)

The vehicle identification number ① is stamped into the frame.

Starting serial number:
JYA4HHEO * PA000101 (USA)
JYA4HHCO * PA001101 (California)
JYA4HHNO * PA002101 (CDN)
JYA4HJTO * PA000101 (AUS, NZ)

NOTE:

The vehicle identification number is used to identify your motorcycle and may be used to register your motorcycle with the licensing authority in your state.



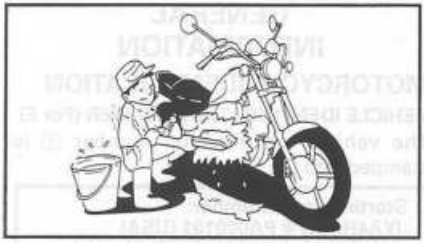
ENGINE SERIAL NUMBER

The engine serial number ① is stamped into crankcase.

Starting serial number:
4HH-000101 (USA)
4HH-001101 (California)
4HH-002101 (CDN)
4HJ-000101 (AUS, NZ)

NOTE:

- The first three digits of these numbers are for model identification; the remaining digits are the unit production number.
- Designs and specifications are subject to change without notice.





IMPORTANT INFORMATAION

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 "SPECIAL TOOL".
3. When disassembling the machine keep mated parts together. This includes gears, cylinders, pistons, and other mated ts that have been +mated+ through normal wear. Mated parts must be reused as an assembly or replaced.
4. During the machine 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 reinstalled.
5. Keep away from fire.

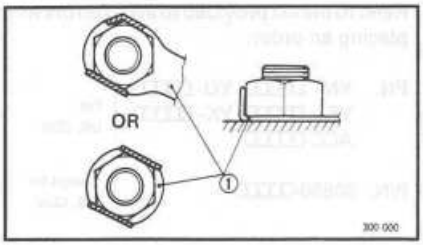


ALL REPLACEMENT PARTS

1. Use only genuine Yamaha parts for al placements. Use oil and/or grease recommended by Yamaha for assembly and adjustment. Other brands may be similar in function and appearance, but inferior in quality.

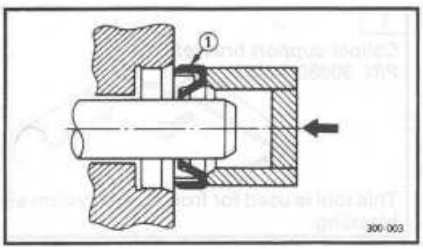
GASKETS, OIL SEALS, AND O-RINGS

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



LOCK WASHERS/PLATES AND COTTERPINS

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.



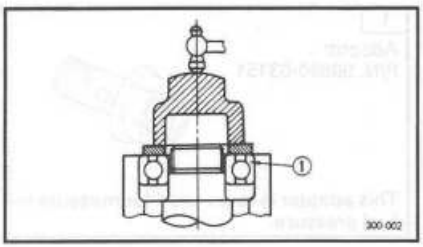
BEARINGS AND OIL SEALS

1. Install the bearing(s) and oil seal(s) 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.

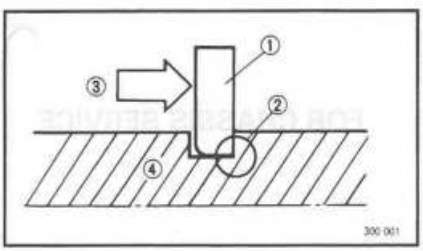
① Oil seal

CAUTION:

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



① Bearing



CIRCLIPS

1. All circlips should be inspected carefully before reassembly. Always replace piston pin clips after one use. Replace distorted circlips. When installing a circlips 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.
The shape and part number used for the special tool differ by country, so two types are provided.

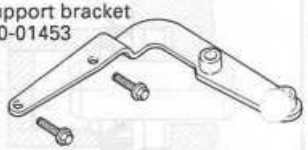
Refer to the list provided to avoid errors when placing an order.

PN. YM- □□□□□, YU- □□□□□
YS- □□□□□, YK- □□□□□ } For US, CDN
ACC-□□□□□

P/N. 90890-□□□□□ Except for US, CDN

FOR TUNE UP

1
Caliper support bracket
P/N. 90890-01453



This tool is used for front brake system air bleeding.

1
Adapter
P/N. 90890-03151



This adapter is to be used for measure the fuel pressure.

FOR ENGINE SERVICE

2
Pressure gauge
P/N. 90890-03153



This measuring equipments to measure the fuel pressure.

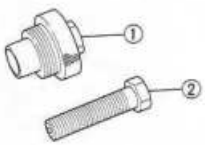
FOR CHASSIS SERVICE

1
Ring nut wrench
P/N. YU-01268
90890-01268
P/N. YU-33975
90890-01403



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

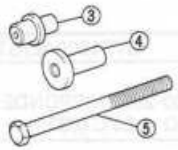
2-A
Bearing puller kit
P/N. 90890-04127
Bearing puller - ①
Bolt - ②



This bearing puller kit is to remove and install the front wheel bearing.

2-B

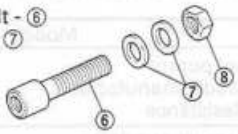
Spacer - ③
Bearing spacer - ④
Puller bolt - ⑤



This bearing puller kit is to remove and install the front wheel bearing.

2-C

Connecting bolt - ⑥
Plane washer - ⑦
Nut - ⑧



This bearing puller kit is to remove and install the front wheel bearing.

3

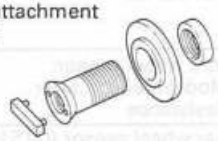
Cap wrench
P/N. 90890-01451



This tool is to remove and install the hub cap nut.

4

Wheel balancer attachment
P/N. 90890-01452



This attachment is to be used to fix the front wheel to the wheel balance.

FOR ELECTRICAL COMPONENTS

1

Test coupler adapter
P/N. YM-3149
90890-03149

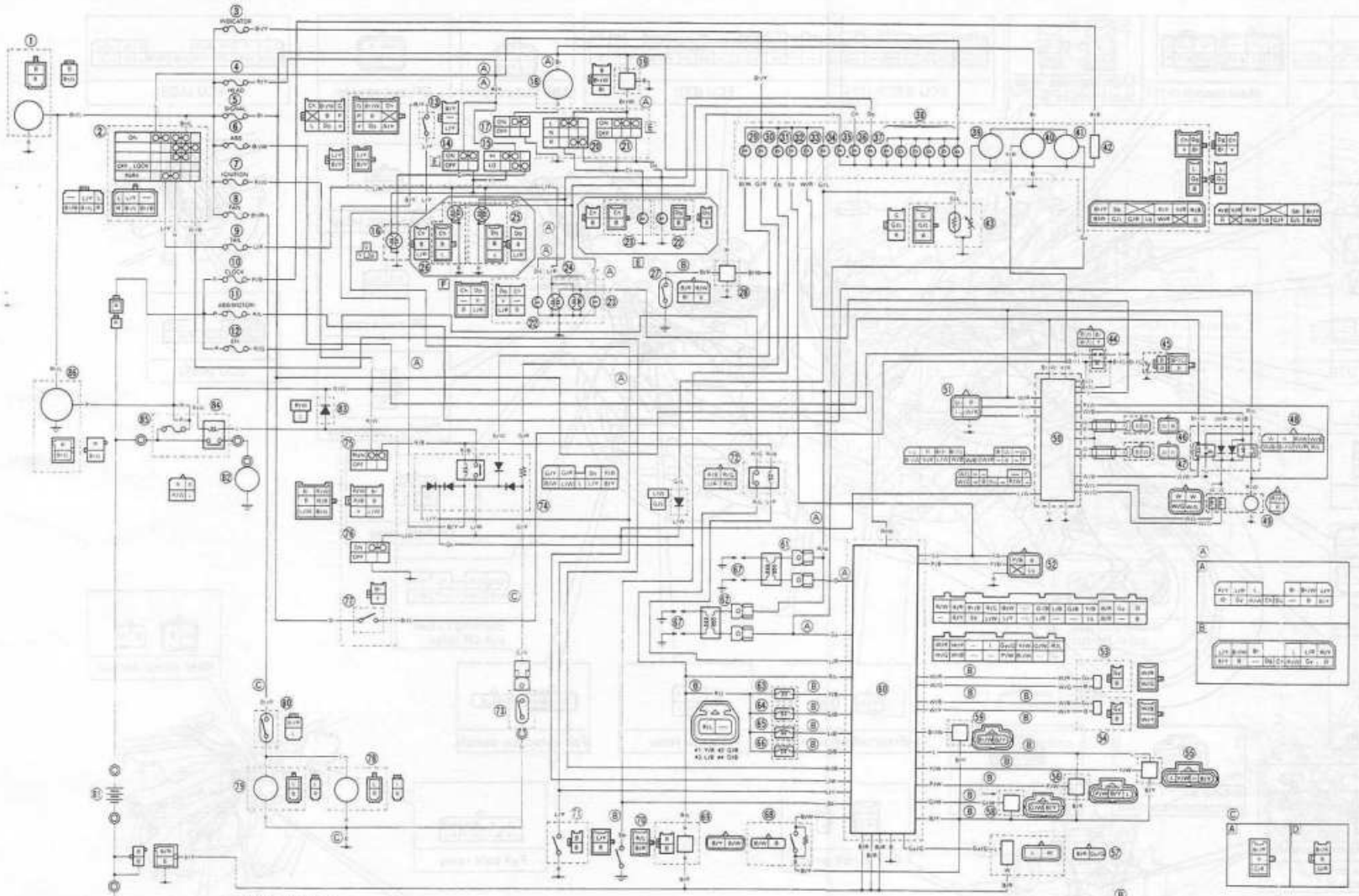


This instrument is necessary for self diagnosis of the EFI and ABS system.

MAINTENANCE SPECIFICATIONS

Model	GTS1000AE/GTS1000AEC
Fuel pump:	
Model/manufacturer	196100-2220/NIPPONDENSO
Resistance	2 ~ 4 Ω at 20°C (68°F)
Pressure regulator:	
Model/manufacturer	195300-2380/NIPPONDENSO
Control pressure	255 kPa (2.55 kg/cm², 36.3 psi)
Throttle sensor:	
Model/manufacturer	198500-3070/NIPPONDENSO
Resistance	
Full open	2.62 ~ 3.94 Ω at 20°C (68°F)
Full close	0.39 ~ 0.59 Ω at 20°C (68°F)
Front wheel sensor:	
Model/manufacturer	OELAAB/SUMITOMO
Resistance	1.19 ~ 2.21 kΩ at 20°C (68°F)
Rear wheel sensor (GTS1000A):	
Model/manufacturer	OELAAJ/SUMITOMO
Resistance	1.19 ~ 2.21 kΩ at 20°C (68°F)
Injector:	
Model/manufacturer	195500-2680/NIPPONDENSO
Resistance	11 ~ 17 Ω at 20°C (68°F)
Camshaft sensor:	
Model/manufacturer	PU200-11F/HITACHI
Resistance	120 ~ 180 Ω at 20°C (68°F)
Crankshaft sensor:	
Model/manufacturer	PU200-11F/HITACHI
Resistance	120 ~ 180 Ω at 20°C (68°F)
Water temperature sensor:	
Model/manufacturer	179700-0110/NIPPONDENSO
Resistance	1.96 ~ 2.94 kΩ at 20°C (68°F)
Intake temperature sensor:	
Model/manufacturer	179700-0110/NIPPONDENSO
Resistance	1.96 ~ 2.94kΩ at 20°C (68°F)
Intake pressure sensor:	
Model/manufacturer	079800-2880/NIPPONDENSO
Output voltage	3.8 V at 760 mmHg

ELECTRIC SYSTEM CIRCUIT DIAGRAM



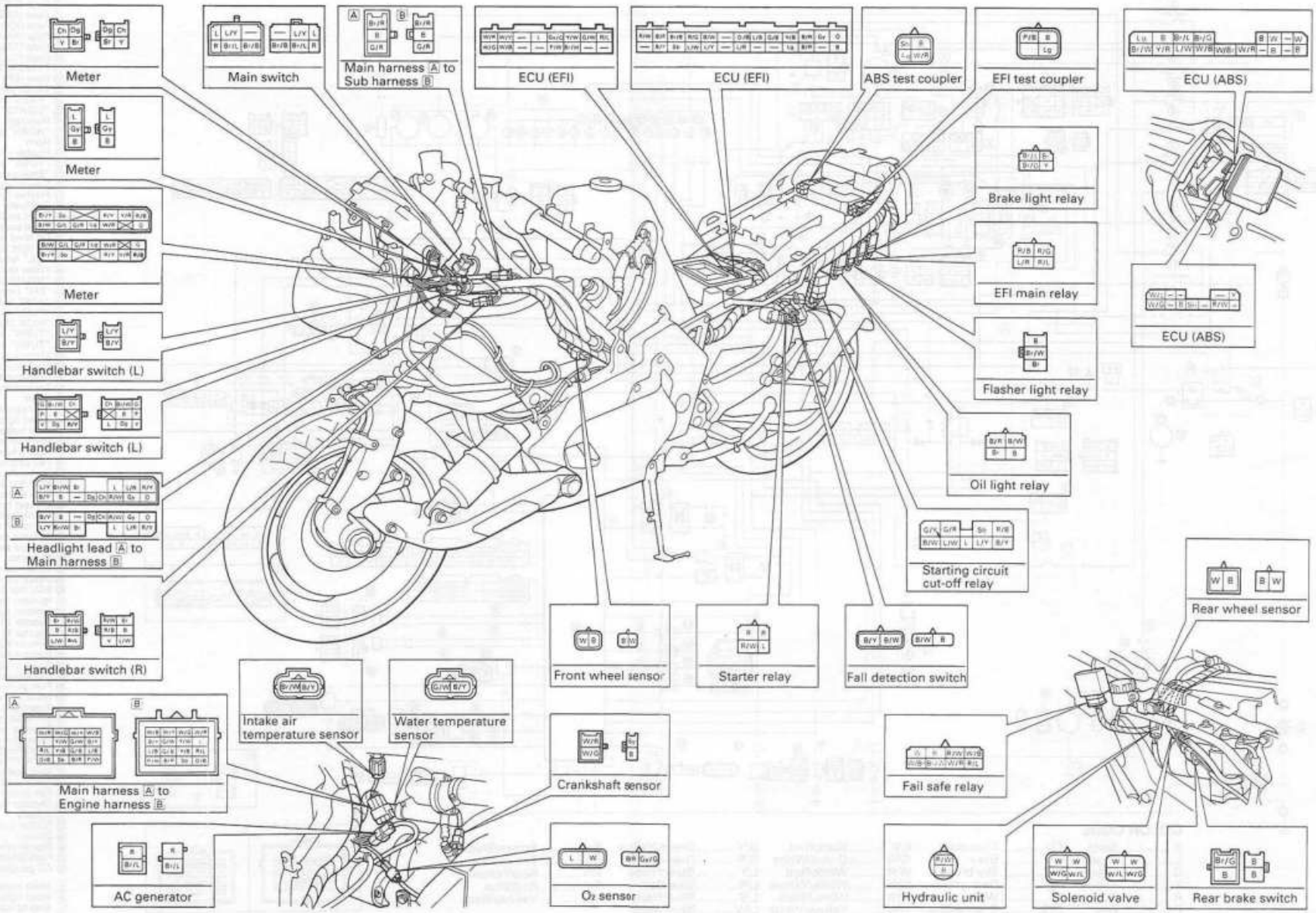
COLOR CODE

B	Black	Ch	Chocolate	B/R	Black/Red	G/Y	Green/Yellow	Br/L	Brown/Blue
L	Blue	Gy	Gray	G/W	Green/White	G/R	Green/Red	Br/R	Brown/Red
G	Green	Sb	Sky blue	W/R	White/Red	L/Y	Blue/Yellow	R/Y	Red/Yellow
Y	Yellow	Dg	Dark green	W/Y	White/Yellow	L/R	Blue/Red	R/L	Red/Blue
R	Red	W	White	W/B	White/Black	L/B	Blue/Black	Y/B	Yellow/Black
P	Pink	O/B	Orange/Black	Y/W	Yellow/White	L/W	Blue/White		
O	Orange	B/Y	Black/Yellow	P/W	Pink/White	R/W	Red/White		
Br	Brown	B/W	Black/White	G/B	Green/Black	Br/W	Brown/White		

① Condensor
② Main switch
③ Fuse (INDICATOR)
④ Fuse (HEAD)
⑤ Fuse (SIGNAL)
⑥ Fuse (ABS)
⑦ Fuse (IGNITION)
⑧ Fuse (FAN)
⑨ Fuse (TAIL)
⑩ Fuse (CLOCK)
⑪ Fuse (ABS PUMP)
⑫ Fuse (EFI)
⑬ Clutch switch
⑭ "PASS" switch
⑮ "LIGHTS" (dimmer) switch
⑯ Headlight
⑰ "HORN" switch
⑱ Horn
⑲ Flasher relay
⑳ "TURN" switch
㉑ "Emergency" switch
㉒ Flasher light (right)
㉓ Flasher light (left)
㉔ Tail/brake light
㉕ Front position light (right)
㉖ Front position light (left)
㉗ Oil level switch
㉘ Oil light relay
㉙ "OIL" level indicator light
㉚ Water temperature indicator light
㉛ "NEUTRAL" indicator light
㉜ "EFI" indicator light
㉝ "ABS" indicator light
㉞ "FUEL" level indicator light
㉟ "HIGH BEAM" indicator light
㊱ "TURN" indicator light (left)
㊲ "TURN" indicator light (right)
㊳ Meter light
㊴ Fuel gauge
㊵ Speedometer
㊶ Tachometer
㊷ Clock
㊸ Fuel sender
㊹ Brake light relay
㊺ Rear brake switch
㊻ Front wheel sensor
㊼ Rear wheel sensor
㊽ Fail safe relay
㊾ Hydraulic unit
㊿ ECU (for ABS)
(51) ABS test coupler
(52) EFI test coupler
(53) Crankshaft sensor
(54) Camshaft sensor
(55) Throttle sensor
(56) Presure sensor
(57) O_2 sensor
(58) Water temperature sensor
(59) Intake air temperature sensor
(60) ECU (for EFI)
(61) Ignition coil #1
(62) Ignition coil #2
(63) Injector #1
(64) Injector #2
(65) Injector #3
(66) Injector #4
(67) Spark plug
(68) Fall detection switch
(69) Fuel pump
(70) Neutral switch
(71) Sidestand switch
(72) EFI main relay
(73) Thermo unit
(74) Starting circuit cut-off relay
(75) "ENGINE STOP" switch
(76) "START" switch
(77) Font brake switch
(78) Fan motor #2
(79) Fan motor #1
(80) Thermo switch
(81) Battery
(82) Starter motor
(83) Diode
(84) Starter relay
(85) Fuse (MAIN)
(86) AC genelator

A Main harness
B Head light lead
C Engine harness
D Sub lead
E For AUS and NZ
F For US and CDN

COUPLER LAYOUT DRAWING

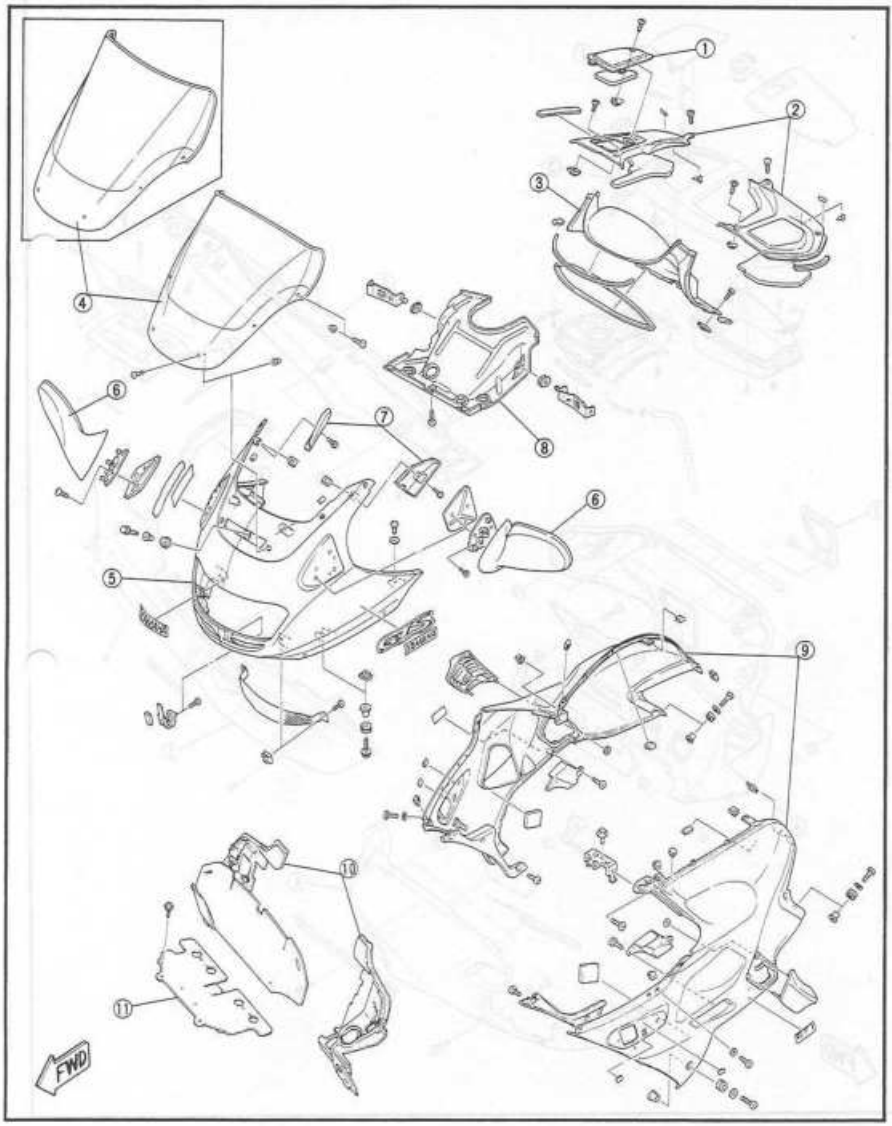


COUPLER LAYOUT DRAWING
GEN INFO

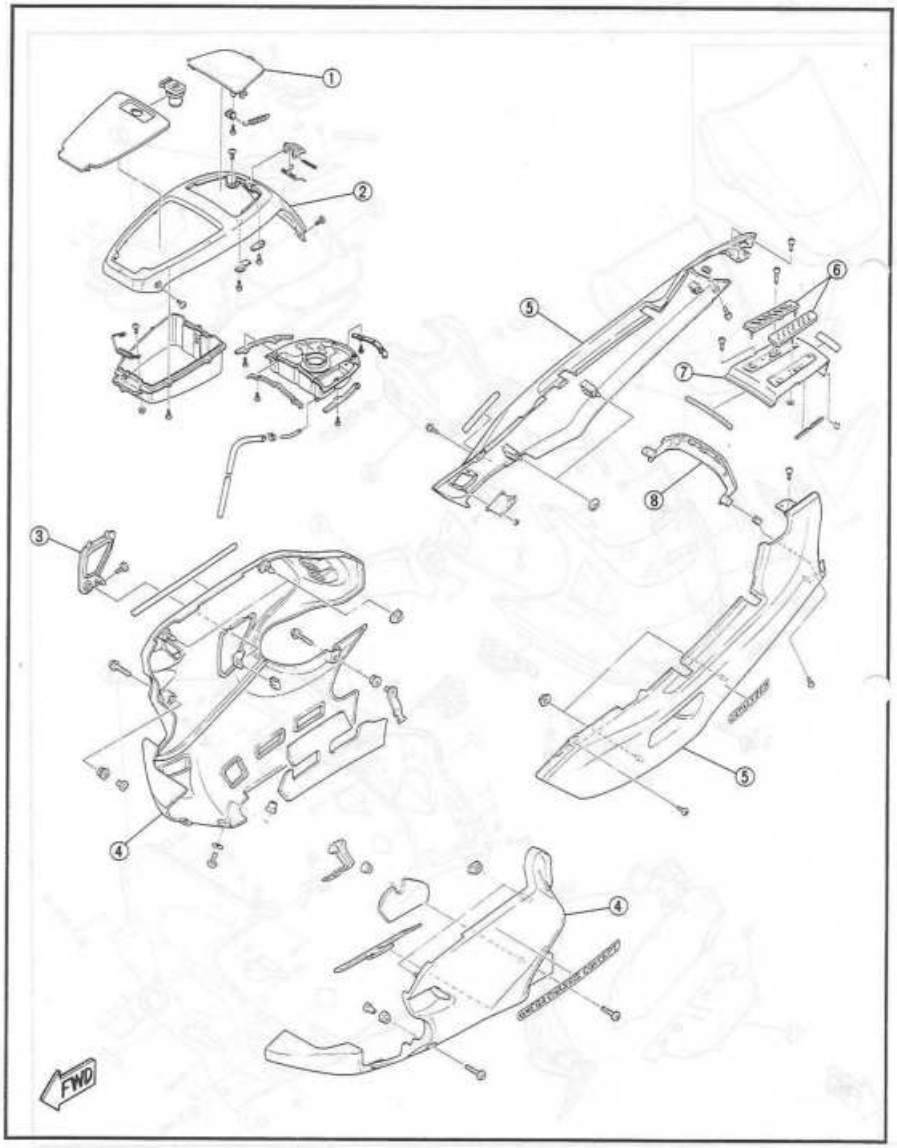
PERIODIC INSPECTION AND ADJUSTMENT

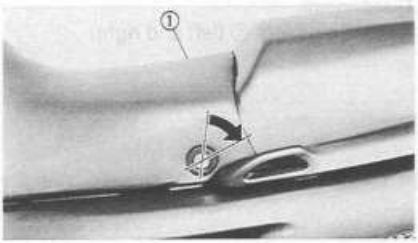
COWLING

① Reservoir tank lid
② Inner panel
③ Meter cover
④ Windshield
⑤ Front cowling
⑥ Rear view mirror
⑦ Meter cover extension
⑧ Bottom cover
⑨ Side cowling
⑩ Rubber baffles (side)
⑪ Rubber baffles (lower)



① Fuel filler lid
② Top cover
③ Filler cap cover
④ Lower cowling
⑤ Side cover
⑥ Tail cover protector
⑦ Tail cover
⑧ Side cover bridge





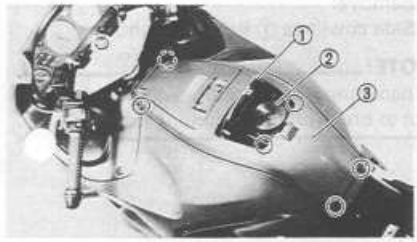
COWLING REMOVAL AND INSTALLATION

Removal

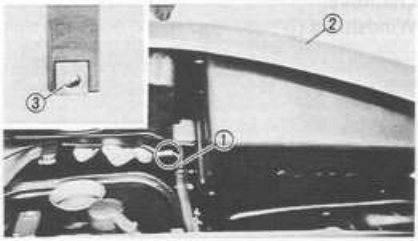
Top cover and cowling

1. Remove:
   - Seat ①

NOTE:
Insert the key into the seat lock and turn it clockwise to release the seat lock.



2. Open:
   - Fuel filler lid ①
3. Remove:
   - Fuel tank cap ②
   - Screws (top cover ③)

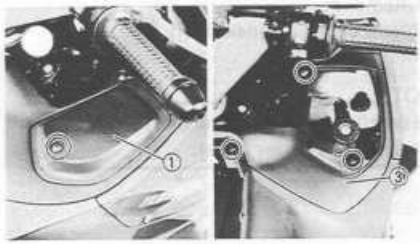


4. Disconnect:
   - Drain hose ① (over flow plate)

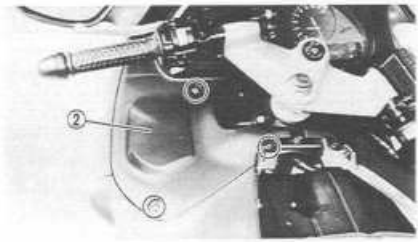
NOTE:
Pull up the top cover ② and disconnect the drain hose.

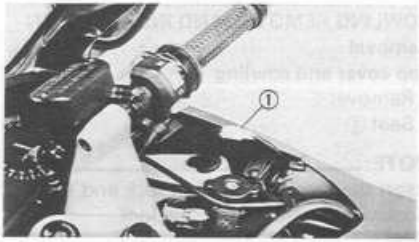
5. Remove:
   - Top cover ②

NOTE:
Be careful not to loose the spring nuts ③.

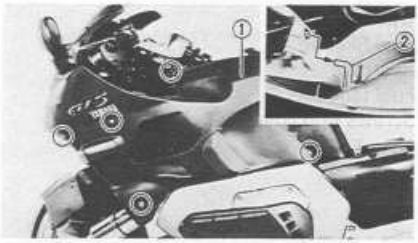


6. Install:
   - Fuel tank cap
7. Remove:
   - Reservoir tank lid ①
   - Inner panel (left ② and right ③)



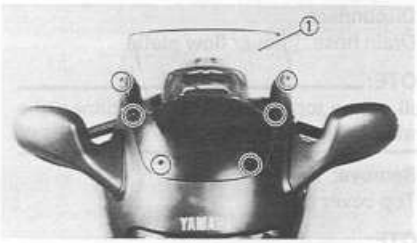


8. Disconnect:
• Flasher couplers ① (left and right)

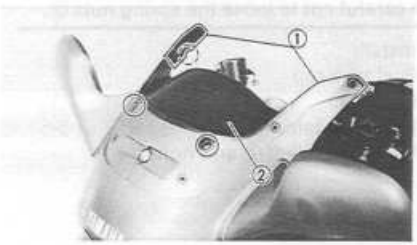


9. Remove:
• Side cowlings ① (left and right)

NOTE:
When removing the side cowlings, be careful not to break off the mounting hook ②.

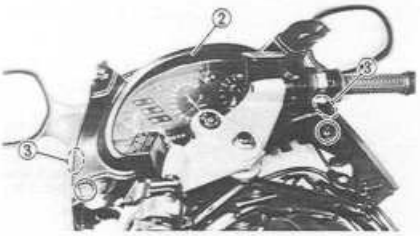


10. Remove:
• Windshield ①



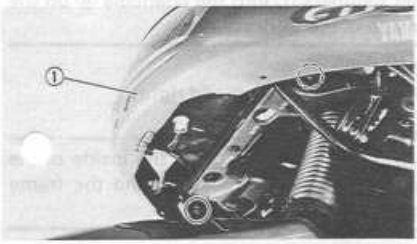
11. Remove:
• Meter cover extensions ①
• Meter cover ②

NOTE:
Be careful not to loose the two rubber dampers ③ on the meter cover.





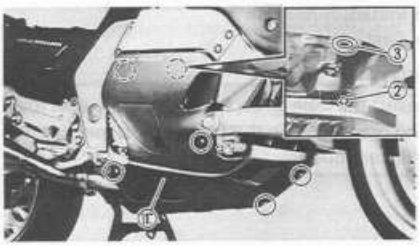
12. Remove:
- Front cowling ①

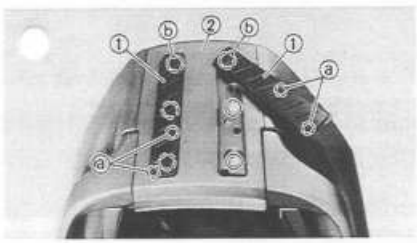


Side cover and lower cowling

1. Remove:
- Lower cowlings ① (left and right)

NOTE:
Unhook the projections ② on the inside of the lower cowling from the grommets ③ on the frame.

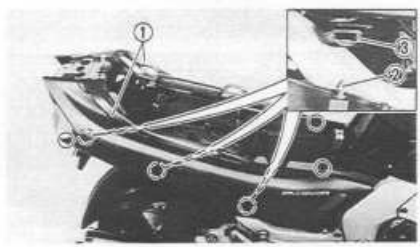




2. Remove:
- Tail cover protectors ①
- Tail cover ②

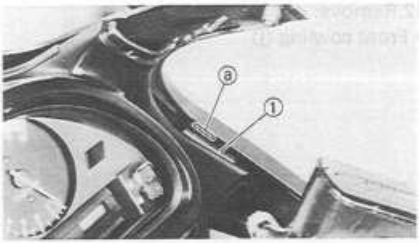
NOTE:
Disconnect knobs ⓐ and turn the tail cover protectors ①.

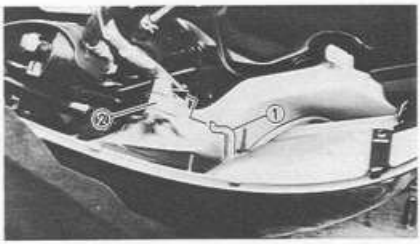
CAUTION:
This knob (rear end) ⓑ can not disconnect.

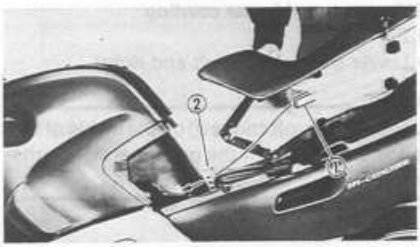


3. Remove:
- Side cover ① (left and right)

NOTE:
Unhook the projections ② on the inside of the side cover from the grommets ③ on the frame.







Installation
Reverse the "Removal" procedure.
Note the following points.

Top cover and cowling
1. Install:
- Meter cover

NOTE:
When installing the meter cover, fit the rubber dampers ① into the channels ⓐ on the inside of the front cowling.

2. Install:
- Side cowlings (left and right)

NOTE:
Make sure the hook ① on the inside of the side cover sits correctly behind the frame bracket ②.

3. Install:
- Seat

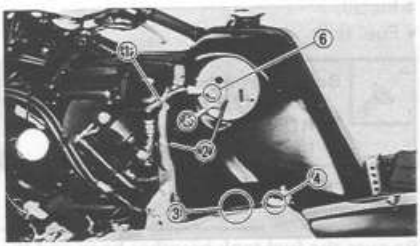
NOTE:
Insert the lobe ① on the front of the seat into the bracket ② on the frame, then push down the seat end.

FUEL TANK REMOVAL AND INSTALLATION

Removal

1. Place the motorcycle on the centerstand.
2. Remove:
   - Seat
   - Top cover
   - Inner panels
   - Side cowlings

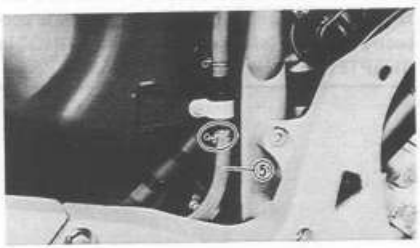
   Refer to "COWLING REMOVAL AND INSTALLATION".



3. Disconnect:
   - Fuel delivery hose ①
   - Fuel return hose ②
   - Fuel sender coupler ③
   - Fuel pump coupler ④
   - Fuel breather hose ⑤

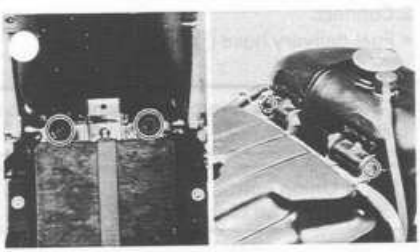
⚠ WARNING

Gasoline is highly flammable.
Avoid spilling fuel on the hot engine.



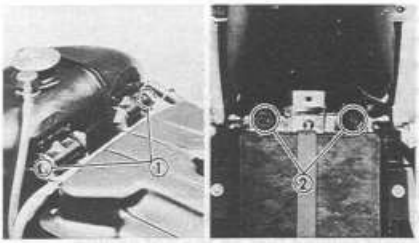
NOTE:

Place a rag under the return hose ② and the union bolt ⑧ of the fuel delivery hose to avoid spilling fuel.



4. Remove:
   - Fuel tank

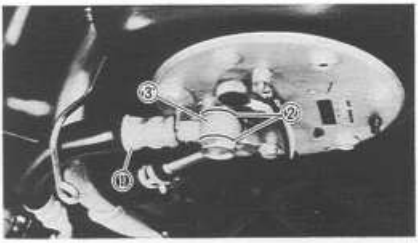
Installation
Reverse the "Removal" procedure.
Note the following points.



1. Install:
• Fuel tank

	Bolt ① (front): **23 Nm (2.3 m • kg, 17 ft • lb)** **Bolt ② (rear):** **16 Nm (1.6 m • kg, 11 ft • lb)**

CAUTION:
Be sure the fuel tank breather hose and the tank cap compartment drain hose are correctly routed. Refer to "CABLE ROUTING" in CHAPTER 2.



2. Connect:
• Fuel delivery hose ①

NOTE:
Be sure to place one copper washer ② on each side of the hose fitting ③.

	Union bolt: **30 Nm (3.0 m • kg, 2.2 ft• lb)**

⚠ WARNING
Always use new copper washers.

3. Check:
• Fuel leakage
Leak → Repair.

NOTE:
Tarn the main switch "ON" to operate the fuel pump and check for fuel leakage.

INTAKE AIR PRESSURE SYNCHRONIZATION

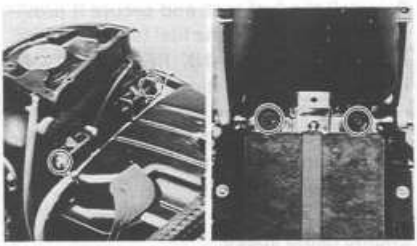
The air screws must be adjusted to provide uniform air pressure in all air intake ducts.

NOTE:

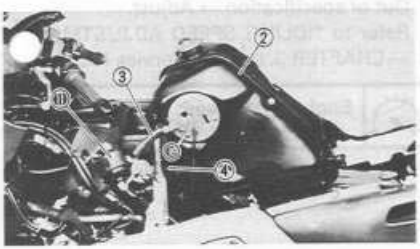
Valve clearance should be adjusted properly before synchronizing the intake air pressure.

1. Place the motorcycle on its centerstand.
2. Remove:
   - Seat
   - Top cover
   - Side cowlings (left and right)

   Refer to "COWLING REMOVAL AND INSTALLATION".



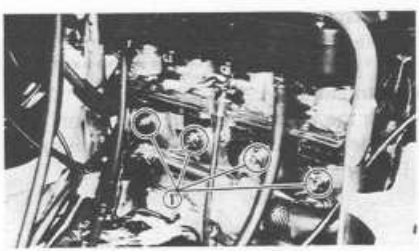
3. Remove:
   - Fuel tank mounting bolts



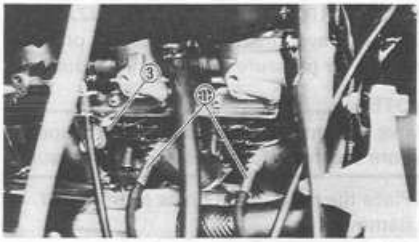
4. Detach the fuel filter ① from the frame, then lift the fuel tank ② up and place it on the left side of the frame without disconnecting the delivery ③ and fuel return hose ④.

CAUTION:

Be careful not to push down the fuel tank while connecting the vacuum gauge.



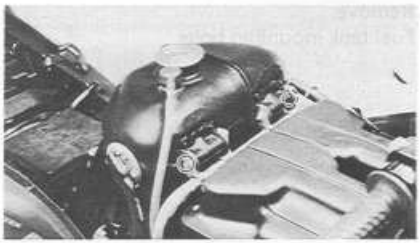
5. Remove:
   - Vacuum check bolts ① (with gasket)





6. Attach:
- Inductive tachometer (to #1 spark plug lead)
- Adapters ①
- Vacuum gauge ②

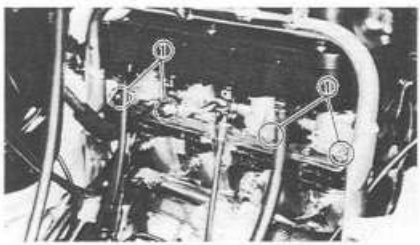
Inductive tachometer:
YU-08036-A/90890-03113
Adapter:
YM-03060/90890-03060
Vacuum gauge:
YU-08030-A/90890-03094



7. Reinstall the fuel tank and secure it provisionally with one of the fuel tank stay bolts. Refer to "FUEL TANK REMOVAL AND INSTALLATION" section.

8. Start the engine and let it warm up for several minutes until the fast idling system ③ cuts out.
9. Check:
- Engine idling speed
  Out of specification → Adjust.
  Refer to "IDLING SPEED ADJUSTMENT" — CHAPTER 3. in Main Service Manual.

Engine idle speed:
950 ~ 1,050 r/min



10. Adjust:
- Intake air pressure synchronization

****

Adjustment steps:
- Turn the air screws ① in or out until the gauge shows the specified vacuum reading for all four intake ducts.

- Race the engine for less than a second, two or three times, and check the synchronization again.

Vacuum pressure at idle speed:
26.32 ~ 32.90 kPa
(200 ~ 250 mm Hg, 7.87 ~ 9.84 in Hg)

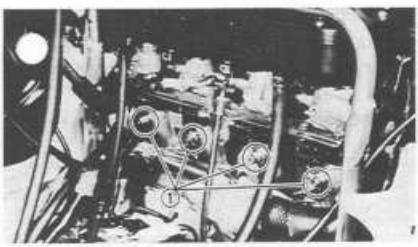
NOTE:
The difference between the highest and lowest simultaneous reading should not exceed 1.33 kPa (10 mm.Hg, 0.4 in Hg).

****

11. Check:
- Engine idling speed
  Out of specification → Adjust.
  Refer to "ENGINE IDLING SPEED ADJUSTMENT" in CHAPTER 3.

12. Stop the engine and remove the measuring equipment.
13. Adjust:
- Throttle cable free play
  Refer to "THROTTLE CABLE FREE PLAY ADJUSTMENT" in CHAPTER 3.

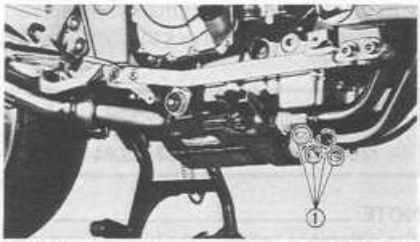
Throttle cable free play:
3 ~ 5 mm (0.1 ~ 0.2 in)

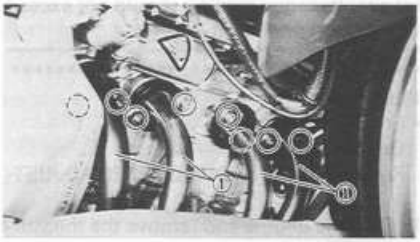


14. Install:
- Vacuum check bolts ①
  (with gasket)

CAUTION:
Always use new gaskets.

15. Install:
- Fuel tank
  Refer to "FUEL TANK REMOVAL AND INSTALLATION".
- Side cowlings
- Top cover
  Refer to "COWLING REMOVAL AND INSTALLATION".

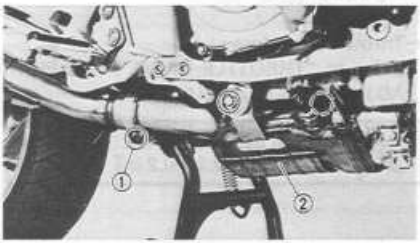




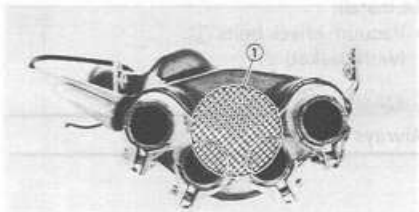
CATALYZER CONVERTOR UNIT INSPECTION

1. Remove:
   - Lower cowlings
     Refer to "COWLING REMOVAL AND INSTALLATION".
2. Disconnect:
   - Coupler (O_2 sensor)
3. Loosen:
   - Bolt ① (exhaust pipe-exhaust chamber)
4. Remove:
   - Exhaust pipes ①

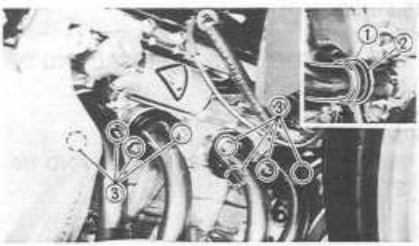
NOTE:
Put marks on the exhaust pipes so that they can be reinstalled in their original place.



5. Loosen:
   - Bolt ① (exhaust chamber-muffler)
6. Remove:
   - Exhaust chamber ②

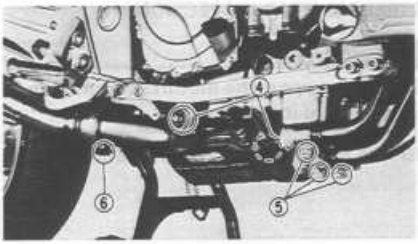


7. Inspect:
   - Visually check the condition of the catalyzer convertor unit ① from the exhaust pipe side.
     Dense carbon deposit / melted cells → Replace.



8. Install:
   - Exhaust chamber (temporarily)
9. Install:
   - Exhaust pipes

NOTE:
Insert the exhaust pipe into the exhaust chamber until the exhaust pipe flange ① touches the gasket ②.



Nut ③ (exhaust pipe):
20 Nm (2.0 m • kg, 14 ft • lb)
Bolt ④ (exhaust chamber):
18 Nm (1.8 m • kg, 13 ft • lb)
Bolt ⑤
(exhaust pipe – exhaust chamber):
20 Nm (2.0 m • kg, 14 ft • lb)
Bolt ⑥
(exhaust chamber-muffler):
20 Nm (2.0 m • kg, 14 ft • lb)

10. Connect:
- Copler (O_2 sensor)

11. Install:
- Lower cowlings

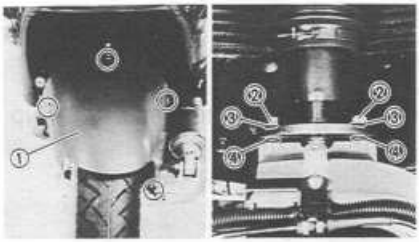
  Refer to "COWLING REMOVAL AND INSTALLATION".

STEERING HEAD INSPECTION

⚠ WARNING

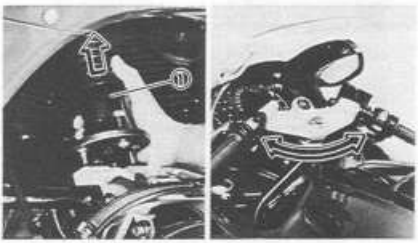
Securely support the motorcycle so there is no danger of it falling over.

1. Place the motorcycle on the centerstand.



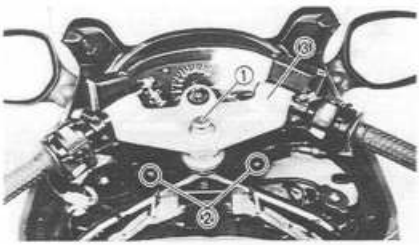
2. Remove:
- Front fender ①

3. Remove:
- Nuts ② (steering tube)
- Special washers ③
- Plain washers ④



4. Check:
- Steering assembly bearings
  Lift the steering tube ① up and while holding it, turn the handlebar from side to side. Rock up and down on the handlebar.
  Looseness/Free play → Adjust the steering head.

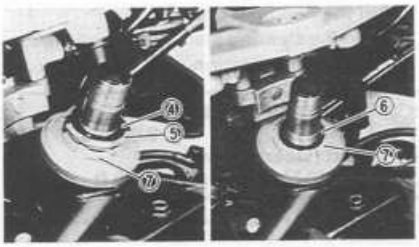
5. Remove:
- Seat
- Top cover
- Inner panels
  Refer to "COWLING REMOVAL AND INSTALLATION".

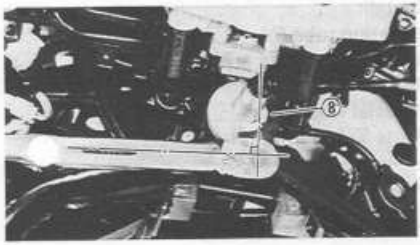


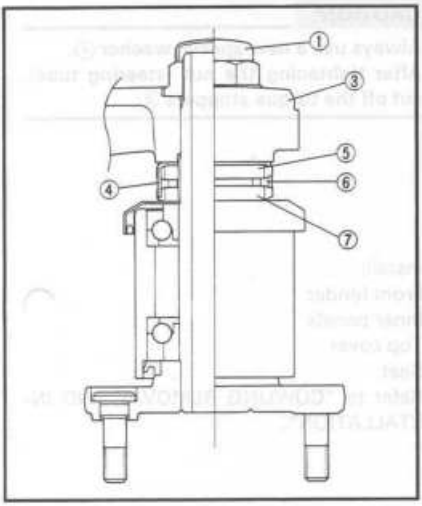
6. Adjust:
- Steering head

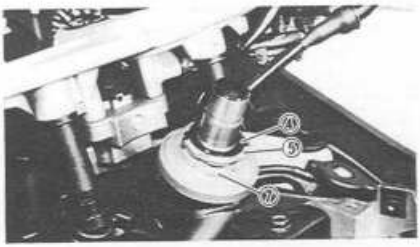
****

Adjustment steps:
- Remove the steering stem nut ① and the pinch bolts ②.
- Remove the handle crown ③.









- Remove the lock washer ④, ring nut ⑤ (upper), and rubber washer ⑥.
- Loosen the ring nut ⑦ (lower).
- Tighten the ring nut (lower) using the ring nut wrench ⑧.

NOTE:
Set the torque wrench to the ring nut wrench so that they form a right angle.

Ring nut wrench:
YU-33975/90890-01403

Ring nut (lower):
(initial tightening)
47 Nm (4.7 m • kg, 34 ft • lb)

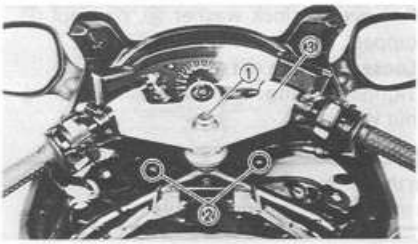
- Loosen the ring nut ⑦ (lower) completely, then retighten it to specification.

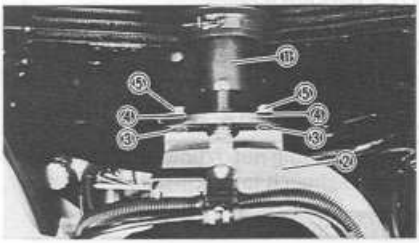
⚠ WARNING
Do not overtighten.

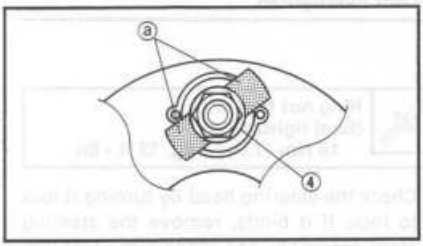
Ring nut (lower):
(final tightening):
18 Nm (1.8 m • kg, 13 ft • lb)

- Check the steering head by turning it lock to lock. If it binds, remove the steering stem assembly and inspect the steering bearings.
  Refer to "STEERING HEAD AND HANDLEBAR" in CHAPTER IV.
- Install the rubber washer ⑥.
- Install the ring nut ⑤ (upper).
- Finger tighten the ring nut ⑤ (upper), then align the slots of both ring nuts. If necessary, hold the ring nut ⑦ (lower) and tighten the ring nut (upper) until their slots are aligned.
- Install the lock washer ④.

NOTE:
Make sure the lock washer tabs sit correctly in the slots.







- Install the handle crown ③.
- Tighten the steering stem nut ① and pinch bolts ② to specification.

	Pinch bolt (handle crown): 11 Nm (1.1 m • kg, 8.0 ft • lb) **Nut (steering stem): 110 Nm (11.0 m • kg, 80 ft • lb)**

****

7. Install:
- Steering tube ①
  (onto the knuckle arm ②)
- Plain washers ③
- Special washers ④
- Nuts ⑤ (steering tube)

	Nut (steering tube): 23 Nm (2.3 m • kg, 17 ft • lb)

CAUTION:
- **Always use a new special washer ④.**
- **After tightening the nut (steering tube), cut off the torque stoppers ⓐ.**

8. Install:
- Front fender
- Inner panels
- Top cover
- Seat

  Refer to "COWLING REMOVAL AND INSTALLATION".

STEERING TUBE INSPECTION

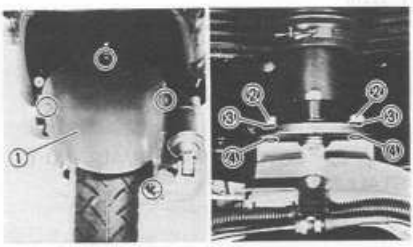
⚠ WARNING

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

1. Place the motorcycle on the centerstand.

2. Remove:
- Seat
- Top cover
- Inner panels

Refer to "COWLING REMOVAL AND INSTALLATION".



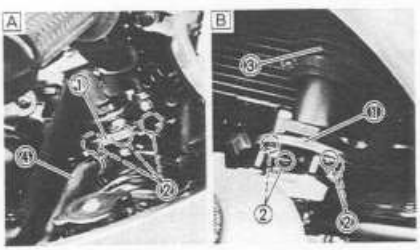
3. Remove:
- Front fender ①

4. Remove:
- Nuts ② (steering tube)
- Special washers ③
- Plain washers ④



5. Inspect:
- Steering tube ①

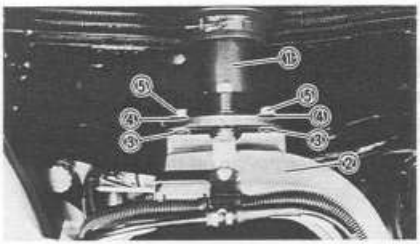
Pump several times on the steering tube.
Looseness/Binding → Replace.
Refer to "STEERING TUBE AND KNUCKLE ARM" in CHAPTER IV.

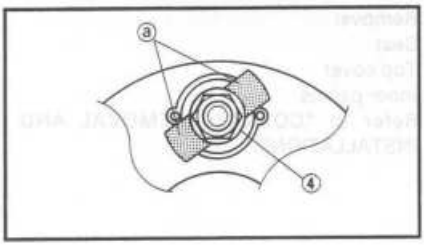


6. Inspect:
- Steering tube joint ring ① and ball joints ②
- Rubber boot ③
- Breather hose ④

Damage → Replace the steering tube assembly.

A Upper
B Lower





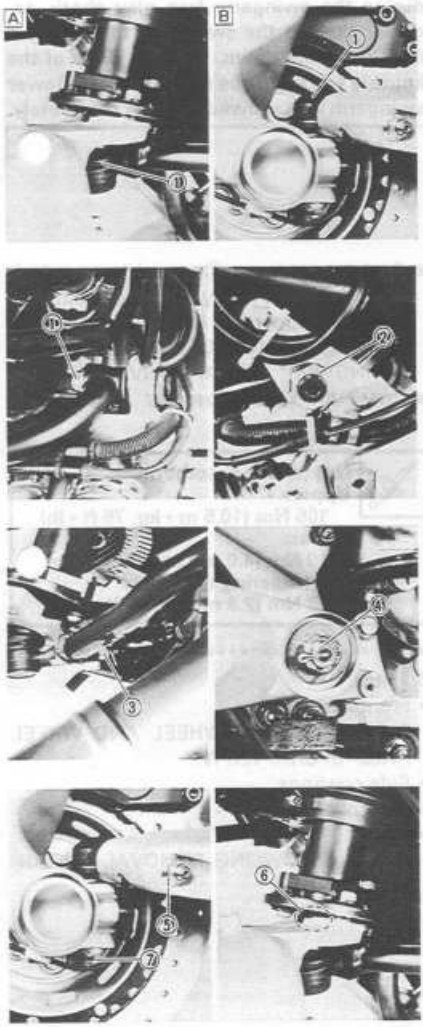
7. Install:
- Steering tube ①
  (onto the knuckle arm ②)
- Plain washers ③
- Special washers ④
- Nut ⑤ (steering tube)

	Nut (steering tube): 23 Nm (2.3 m • kg, 17 ft • lb)

CAUTION:
- **Always use a new special washer ④.**
- **After tightening the nut (steering tube), cut off the torque stoppers ⓐ.**

8. Install:
- Front fender
- Lower cowlings
- Inner panels
- Top cover
- Seat

  Refer to "COWLING REMOVAL AND INSTALLATION".



FRONT SWINGARM INSPECTION

⚠ WARNING

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

1. Place the motorcycle on the centerstand.
2. Remove:
- Seat
- Tap cover
- Side cowlings
  Refer to "COWLING REMOVAL AND INSTALLATION".
- Front wheel
  Refer to "FRONT WHEEL AND WHEEL AXLE" in CHAPTER IV.
3. Check:
- Rubber boots ① (ball joint)
  Cracks/Damage → Replace.
  Refer to "STEERING TUBE AND KNUCKLE ARM" in CHAPTER IV.

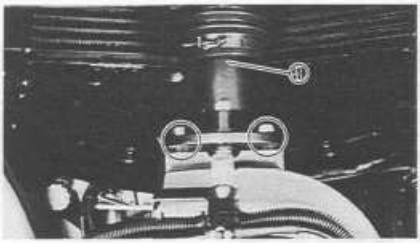
Ⓐ Upper
Ⓑ Lower

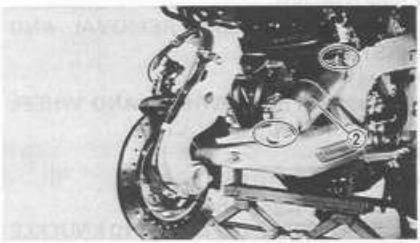
4. Check:
- Bolts and nuts (front swingarm)
  If necessary, tighten to specification.

Nut ① (upper arm - frame):
40 Nm (4.0 m • kg, 29 ft • lb)
Lock nut ② (camber adjuster):
23 Nm (2.3 m • kg, 17 ft • lb)
Nut ③ (upper arm - ball joint):
40 Nm (4.0 m • kg, 29 ft • lb)
Nut ④ (lower arm - frame):
Left:
105 Nm (10.5 m • kg, 75 ft • lb)
Right:
105 Nm (10.5 m • kg, 75 ft • lb)
Nut ⑤ (lower arm - ball joint):
78 Nm (7.8 m • kg, 56 ft • lb)
Nut ⑥
(knuckle arm - upper ball joint):
53 Nm (5.3 m • kg, 38 ft • lb)
Nut ⑦
(knuckle arm - lower ball joint):
78 Nm (7.8 m • kg, 56 ft • lb)

CAUTION:

Always use a new cotter pin.







5. Check:
• Front swingarm free play.

****

Checking steps:
- Remove the steering tube ① from the knuckle arm.
- Remove the front shock absorber ②.

CAUTION:

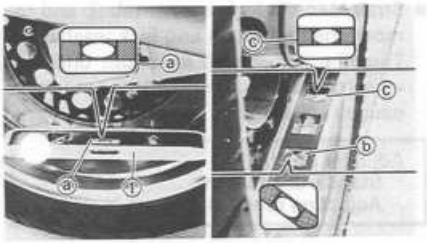
When removing the shock absorber ② and during the swingarm free play check, securely support the swingarm to prevent it from dropping down. The ball joints of the knuckle arm would be damaged, if the lower swingarm was allowed to lower completely.

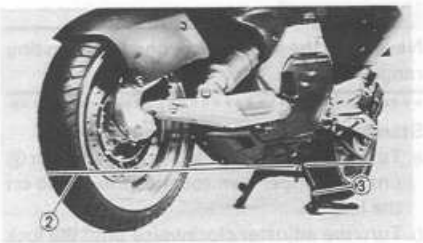
- Rock the swingarm ③ up and down and left to right. If there is any free play or binding, check the upper and lower arm bearings. Refer to "FRONT SHOCK ABSORBER AND SWINGARM" in CHAPTER IV.
- Install the shock absorber and steering tube.

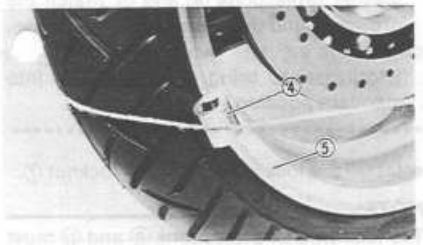
Nut (shock absorber):
Upper:
105 Nm (10.5 m • kg, 75 ft • lb)
Lower:
40 Nm (4.0 m • kg, 29 ft • lb)
Nut (Steering tube):
23 Nm (2.3 m • kg, 17 ft • lb)

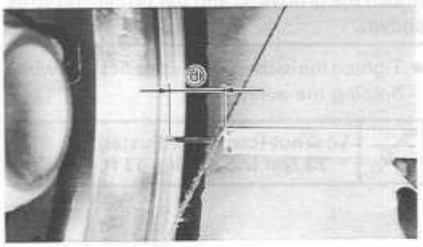
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6. Install:
• Front wheel
Refer to "FRONT WHEEL AND WHEEL AXLE" in CHAPTER IV.
• Side cowlings
• Top cover
• Seat
Refer to "COWLING REMOVAL AND INSTALLATION".









FRONT WHEEL ALIGNMENT

1. Place the motorcycle on the centerstand.

CAUTION:

Be sure to place the motorcycle on an even surface.

2. Check:
- Font wheel alignment
  Out of alignment → Adjust.

****

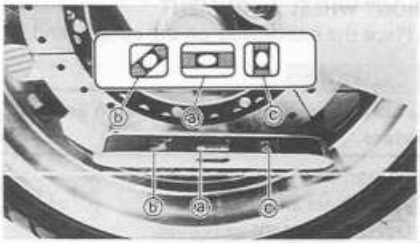
Checking and adjustment steps:

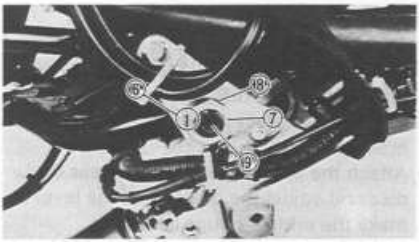
- Check the drive chain slack.
  Refer to "DRIVE CHAIN SLACK ADJUSTMENT" in CHAPTER 3.
- Clean the surface of the front and rear brake discs.
- Attach the spirit level ① to the rear brake disc and adjust the position of the level to make the middle gauge ⓐ level.
- Make the other two gauges ⓑ and ⓒ level by placing suitable shims under the centerstand.
- Attach a string ② around the rear and the front wheel at about 180 mm (7.1 in) from the ground as shown. Pass the string through the centerstand ③ on the left side.
- Place two identical spacers ④ (collar, tube, or similar) between the rim ⑤ and the string on the front side of the front wheel.

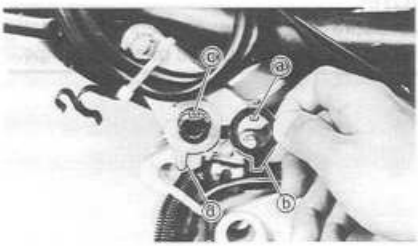
NOTE:

Make sure the string touches only the wheels, not the frame, centerstand or exhaust pipe.

- Measure with vernier calipers the distance d between the string and the rim edge on the rear side of the front wheel.
- Turn the handlebar until the distance to the rim is identical on both sides (i.e. the front wheel is pointing exactly straight ahead).







- Attach the spirit level to the front brake disc and make the middle gauge ⓐ level.
- If the other two gauges ⓑ, ⓒ have not become level too, the front wheel is out of alignment and the wheel camber needs adjustment.
- Remove the seat, top cover, inner panels and left side cowling.
  Refer to "COWLING REMOVAL AND INSTALLATION".
- Straighten the lock washer tab ⑥ and remove the locknut ⑦ and lock washer ⑧. Turn the adjuster ⑨ in or out until the wheel camber is correct and the spirit level gauges are all level.

Adjuster position:
Standard: 2 turn in
Adjusting range: 0 ~ 4 turn in

CAUTION:

Never turn the adjuster beyond the adjusting range.

****

Standard position setting steps:

a. Turn out (counterclockwise) the adjuster ⑨ until the upper arm touches the frame on the left.
b. Turn the adjuster clockwaise until the lock washer projections ⓐ and ⓑ match the groove ⓒ and the projection ⓓ as shown.
c. Turn the adjuster two complete turn. ı (clockwise) to bring the upper arm into standard position.

****

- Install the lock washer ⑧ and locknut ⑦.

NOTE:

The lock washer projections ⓐ and ⓑ must match the groove ⓒ and the projection ⓓ as shown.

- Tighten the locknut ⑦ to specification while holding the adjuster ⑨.

Locknut (camber adjuster):
23 Nm (2.3 m · kg, 17 ft · lb)

- Check the alignment again. If all the spirit level gauges are not level, repeat the adjustment steps.
- Bend the lock washer tab against the flat side of the nut.

CAUTION:

Always use a new lock washer.

- Install the left side cowling, inner panels, top cover and seat.
  Refer to "COWLING REMOVAL AND INSTALLATION".

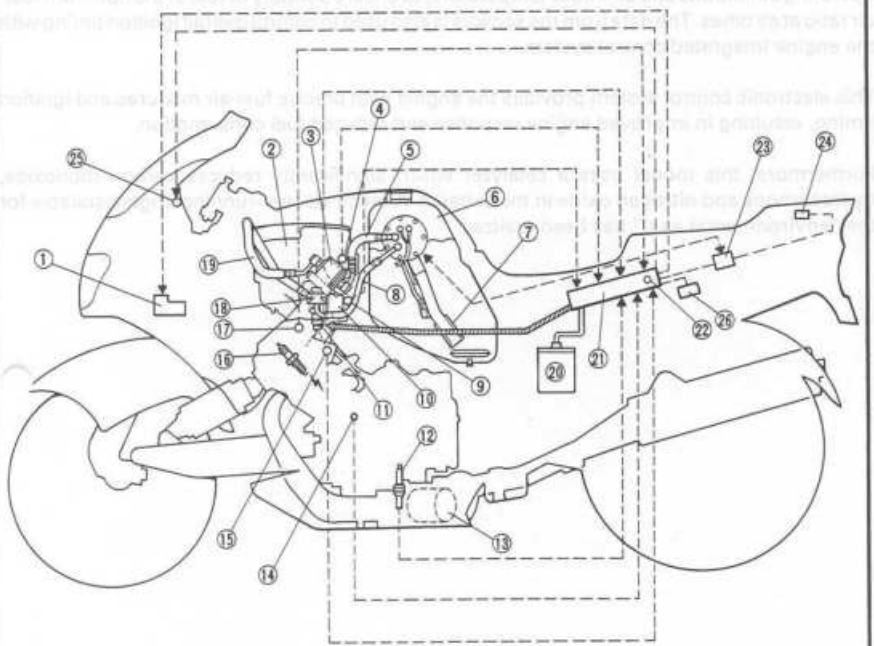
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EFI

ELECTRONIC FUEL INJECTION (EFI)

NAMES OF COMPONENTS AND LAYOUT

① Ignition coil
② Air cleaner case
③ Fuel filter
④ Intake air temperature sensor
⑤ Fuel delivery hose #1
⑥ Fuel tank
⑦ Fuel pump
⑧ Fuel return hose
⑨ Intake pressure sensor
⑩ Throttle sensor
⑪ Fuel injector
⑫ O_2 sensor
⑬ Catalytic converter
⑭ Crankshaft sensor
⑮ Water temperature sensor
⑯ Spark plug
⑰ Camshaft sensor
⑱ Pressure regulator
⑲ Fuel delivery hose #2
⑳ Battery
㉑ Electronic Control Unit (ECU)
㉒ Atmospheric pressure sensor
㉓ EFI main relay
㉔ EFI test coupler
㉕ EFI warning light
㉖ Fall detection switch



OUTLINE

The main function of a fuel delivery system, either carburetor or fuel injection, is to supply fuel to the combustion chamber at the optimum fuel-air ratio to suit engine operating conditions and atmospheric temperature.

In conventional carburetor systems, the fuel-air ratio of the mixture is supplied to the combustion chamber depending upon the metering and the balance between the intake air quantity and the size of the needle valve (jet) at the fuel outlet.

The quantity of fuel required, however, varies depending upon engine operating conditions such as acceleration or deceleration, although the air intake quantity may be the same. Various auxiliary devices have been used to cope with this problem, but there is a limit to the supply of fuel at the optimum fuel-air ratio to suit the operating conditions of the engine at all times.

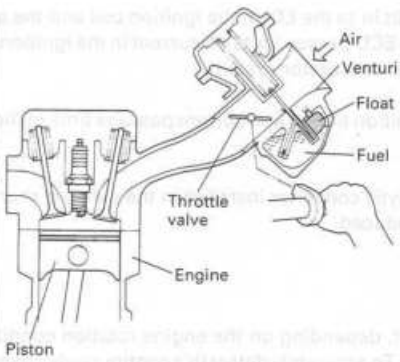
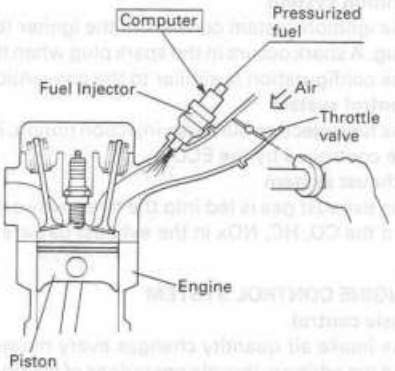
To solve the problem, this model uses electronic fuel injection (EFI) with a microcomputer. The injection quantity is controlled, based on information from various sensors which detect engine operating conditions and air intake temperature, to ensure a supply of fuel at the optimum fuel-air ratio at all times. The data from the sensors is also used to control overall ignition timing with the engine integrated control system.

This electronic control system provides the engine with precise fuel-air mixtures and ignition timing, resulting in improved engine response and reduced fuel consumption.

Furthermore, this model uses a catalyzer which significantly reduces carbon monoxide, hydrocarbons and nitrogen oxide in the exhaust. A much cleaner-running engine suitable for the "environmental age," has been realized.

TYPES OF FUEL DELIVERY EQUIPMENT

The fuel supply equipment, which plays a major role in the operation of the engine, can be broadly classified into the two types given below.
There are differences in the configuration and the construction, but the functions are the same.

	Fuel supply equipment	
	Carburetor	Electronic Fuel Injection (EFI)
Configuration		
Fuel supply method	The fuel is sucked into the intake circuit upstream of the throttle by the negative pressure of the Venturi section that develops due to the air flow created when the piston descends in the cylinder.	The injector injects an appropriate quantity of fuel in the intake circuit when the computer transmits an electric signal to the injector.
Fuel supply quantity control method	The fuel supply quantity is mechanically controlled by balancing the intake negative pressure by opening or closing the throttle valve, and by the size of needle valve in the fuel outlet.	The intake air quantity opening or closing the throttle valve is analyzed in the computer and the fuel supply quantity to be injected is controlled by the computer.

ENGINE INTEGRATED CONTROL SYSTEM (OUTLINE)

OPERATION SYSTEM

Fuel system

Fuel is supplied by the fuel pump to the fuel injector, through the fuel filter. The fuel pressure on the injector is maintained at a pressure that is 2.55 kg/cm² higher than the internal pressure of intake duct by the pressure regulator. Therefore, when the fuel path of the injector opens on a signal from the ECU, a quantity of fuel proportional to the opening time is injected into the intake duct.

Ignition system

The ignition system consists of the igniter (built in to the ECU), the ignition coil and the spark plug. A spark occurs in the spark plug when the ECU passes / cuts off current in the ignition coil. The configuration is similar to the conventional carburetor system.

Control system

The fuel injection duration, injection timing, ignition timing and current passage time in the coil are controlled by the ECU.

Exhaust system

The exhaust gas is led into the three-way catalytic converter installed in the exhaust chamber and the CO, HC, NOx in the exhaust gas are reduced.

ENGINE CONTROL SYSTEM

Basic control

The intake air quantity changes every moment, depending on the engine rotation conditions and the arbitrary throttle operations of the rider. To accurately detect this continuously changing intake air quantity and to inject the optimum quantity of fuel in the engine at all times, engine rotation sensors, intake air pressure sensor and throttle sensor are provided in the engine control system in this model.

Auxiliary control

The engine is capable of different operations with basic controls only, but for more accurate injection under various environmental conditions, temperature sensors, an atmospheric pressure sensor (built in to ECU), and an O_2 sensor have been provided in the engine control system.

INTAKE AIR METERING SYSTEM

Speed density system + throttle speed system

The basic function of air-fuel ratio control performed by the computer is the accurate detection of air intake quantity in the engine.

In this model, two intake air metering systems have been adopted. These are the compact speed density system (engine speed/air density) and the throttle speed system (throttle opening/engine speed). A high accuracy air intake metering system has been achieved by combining the advantages of both these systems.

FUEL INJECTION SYSTEM

Injector system

The function of the injector is to inject the fuel accurately, based on the instructions from the ECU.

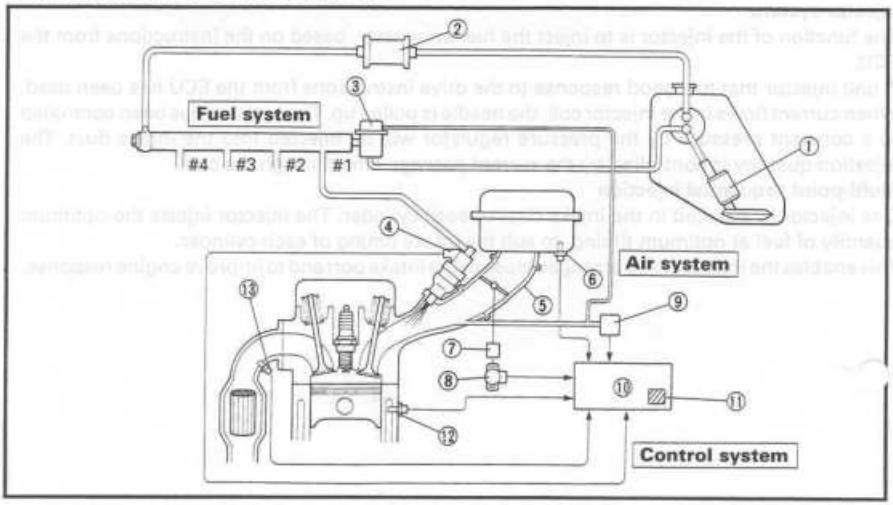
A unit injector that has good response to the drive instructions from the ECU has been used. When current flows in the injector coil, the needle is pulled up. The fuel that has been controlled to a constant pressure by the pressure regulator will be injected into the intake duct. The injection quantity is controlled by the current passage time through the coil.

Multi-point sequential injection

One injector is installed in the intake duct of each cylinder. The injector injects the optimum quantity of fuel at optimum timing, to suit the intake timing of each cylinder.

This enables the injector to be arranged close to the intake port and to improve engine response.

FUNCTION OF COMPONENTS



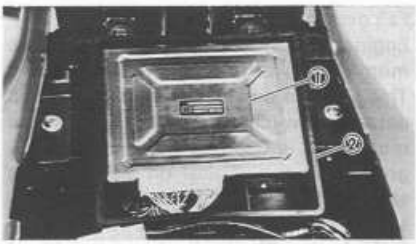
① Fuel pump
② Fuel filter
③ Pressure regulator
④ Fuel injector
⑤ Throttle body
⑥ Intake air temperature sensor
⑦ Fast idling system
⑧ Throttle sensor
⑨ Intake pressure sensor
⑩ ECU (Electronic Control Unit)
⑪ Atmospheric pressure sensor
⑫ Water temperature sensor
⑬ O_2 sensor

THE FUEL CONTROL SYSTEM

Consists of the following components.

	Components	Function
Control system	ECU	Overall system control
	Throttle body	Air quantity adjustments
	Pressure regulator	Fuel pressure regulation
Sensor system	Intake pressure sensor	Intake air pressure detection
	Atmospheric pressure sensor	Atmospheric pressure detection
	Water temperature sensor	Water temperature detection
	Intake air temperature sensor	Intake air temperature detection
	Throttle sensor	Degree of throttle opening detection
	O_2 sensor	Exhaust gas oxygen concentration detection
	Camshaft sensor	Reference position detection
	Crankshaft sensor	Engine rpm detection
Actuator system	Fuel injector	Fuel injection
	Fuel pump	Fuel supply
Others	Fuel filter	Removal of foreign matter in fuel

Also, there are other components, such as the EFI warning light in the meter panel and the EFI test coupler inside the tail cowl.





CONTROL SYSTEM

ECU (Electronic Control Unit)

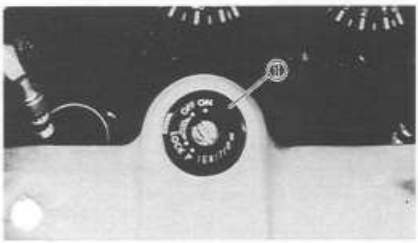
The ECU ① is fitted beneath the seat and above the battery. To protect the ECU from water, it is covered by a plastic case ② and a rubber cover ③.

The main functions of the ECU are the self diagnosis function for testing the normal operation of the system and control of fuel injection and ignition. The controls are performed according to the procedure given below.

Function of ECU

- **Main function**

1. All the sensor signals input in the ECU pass through the input interface circuit and are input in the CPU (Central Processing Unit).
2. The CPU checks the correctness of the signal, processes it and outputs the control commands.
3. The output interface circuit drives various actuators, based on the output commands from the CPU.

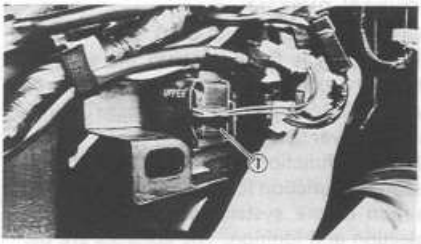


- **Auxiliary functions**

1. Theft prevention function
   The main switch ① outputs specific pulse signals (hereafter called AT signals) when it is turned ON from the OFF position. The ECU checks that the correct AT signal is input when the power is turned ON, then starts the control operations for injection and ignition.
   Therefore, the engine will not start if the main switch bypassed.
   Also, to ensure correct transmission of the AT signals, the main switch must be turned ON from the OFF position correctly.



2. Side stand fuel cut-off function
   This function operates with the side stand switch ①, the clutch switch ②, and the neutral switch ③, in addition to the ECU. Depending on the position of these switches, fuel injection may be interrupted, which in turn stops the engine.

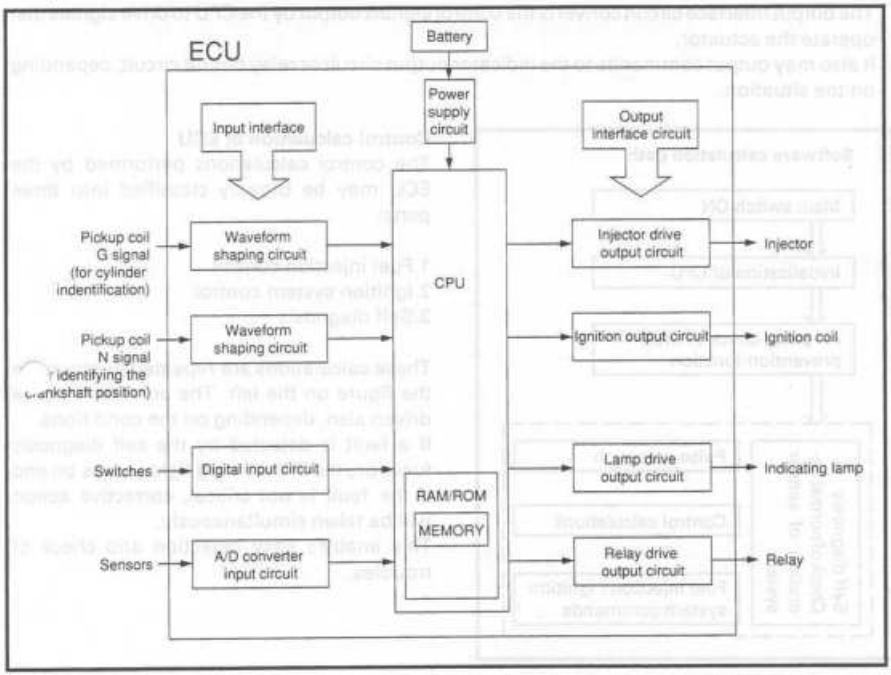


3. Fall detection switch

Engine stop function operates when the motorcycle overturns or is tilted too far.

This function operates with use of the fall detection switch ① and the ECU. If the motorcycle is tilted by more than 45 degrees from the vertical on either side, a signal is transmitted by the fall detection switch to the ECU and the ECU stops the fuel injection. The engine however will not stop while the motorcycle is operated at cornering.

Components in the ECU and functions



The main components in the ECU unit may be broadly divided into 4 blocks. These are the power supply circuit that supplies power to the ECU, the CPU (central processing unit) that controls and processes all the systems, input / output interface circuits that send and receive various signals.

1. Power supply circuit
The power supply circuit generates and supplies the power (5 V) required for ECU operation from the battery power supply (12 V).

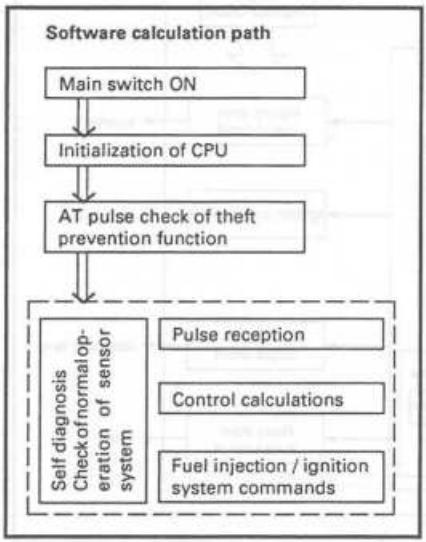
2. Interface circuit
The input interface circuit converts all the sensor output signals to digital signals (that can be processed by the CPU) and then inputs these signals to the CPU.

3. CPU (Central Processing Unit)
The CPU first judges whether the operation of the sensor system is normal, based on the level of the signals output from the various sensors.
Next, the CPU calculates the fuel injection period, the injection timing, and the ignition timing based on the data of various sensor signals temporarily stored in the CPU RAM and the basic processing program in the ROM. It then transmits the control commands to various output interface circuits.

4. Output interface circuit

The output interface circuit converts the control signals output by the CPU to drive signals that operate the actuator.

It also may output commands to the indicator output circuit or relay output circuit, depending on the situation.



Control calculation of ECU

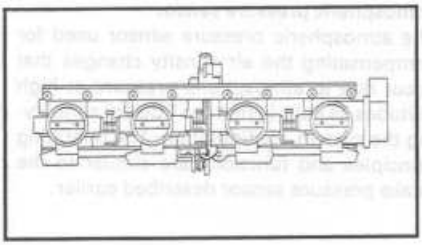
The control calculations performed by the ECU may be broadly classified into three parts:

1. Fuel injection control
2. Ignition system control
3. Self diagnosis

These calculations are repeated as shown in the figure on the left. The actuator may be driven also, depending on the conditions.

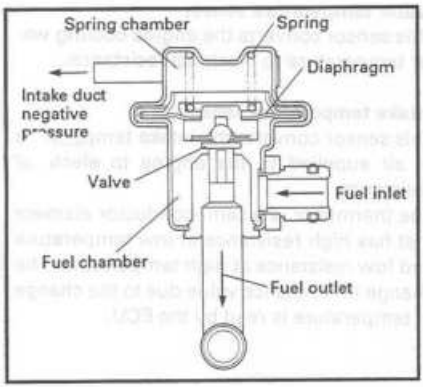
If a fault is detected by the self diagnosis function, the EFI warning light comes on and if the fault is not critical, corrective action will be taken simultaneously.

This enables easy detection and check of troubles.



Throttle body

A throttle valve is fitted on the throttle body. The throttle valve control system is a mechanicaly controled by the throttle cable used by the rider, similar to the conventional carburetors. It varies the intake air quantity and adjusts the engine output.



Pressure regulator

The fuel is supplied by the fuel pump. The pressure regulator adjusts and regulates the fuel pressure in the injector, installed in each intake duct. It maintains a constant pressure difference with the intake duct.

The fuel supplied by the fuel pump fills up the fuel chamber through the fuel inlet and exerts pressure on the diaphragm. The intake duct pressure is transmitted to the spring chamber through the pipe. Therefore, if the fuel pressure exceeds the sum of this pressure and the spring force, the valve that is integrated with the diaphragm, opens. The fuel is returned to the fuel tank through the fuel outlet and the fuel return hose.

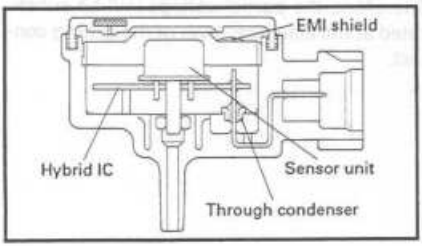
The result is that even if the consumed fuel quantity (injected quantity) in the injector varies compared to the constant supply of fuel from the pump, the fuel pressure (difference of pressure in the intake duct) will be maintained at the preset value because of the increase in return fuel quantity from the pressure regulator.

SENSOR SYSTEM

Intake pressure sensor

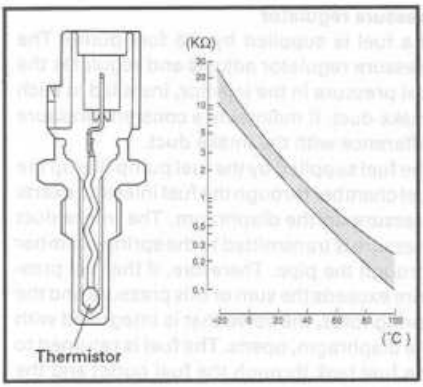
This sensor converts the intake duct pressure to electrical signals.

The sensor unit installed in the vacuum chamber on the side of the silicon diaphragm converts the pressure to electric signals. These signals are amplified, adjusted and compensated for temperature by circuits consisting of hybrid ICs. Electric signals that are proportional to the pressure, are generated.



Atmospheric pressure sensor

The atmospheric pressure sensor used for compensating the air density changes that occur due to atmospheric pressure at high altitudes, is built-in into the ECU for simplifying the system configuration. The operating principles and functions are similar to the intake pressure sensor described earlier.



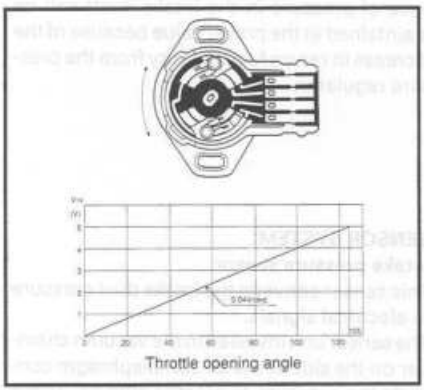
Water temperature sensor

This sensor converts the engine cooling water temperature to electrical resistance.

Intake temperature sensor

This sensor converts the intake temperature of air supplied to the engine to electrical resistance.

The thermistor is a semi-conductor element that has high resistance at low temperature and low resistance at high temperature. The change in resistance value due to the change in temperature is read by the ECU.

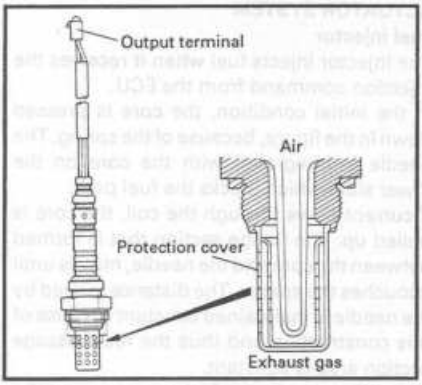


Throttle sensor

This sensor converts the mechanical angles of the throttle valve to electrical signals.

The sensor converts the angles to proportional voltages by the positional relationship between the sliding contact that operates jointly with the throttle shaft and the resistor substrate.

In actual, a constant voltage (5 V) is supplied at either end of the resistor from the ECU. Therefore, the partial voltage will be substituted at the electrical level of the sliding contact.

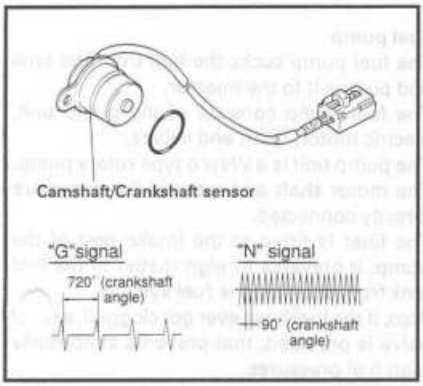


O_2 Sensor

This sensor converts the concentration of oxygen in the exhaust gas to electrical signals.

For the detection of oxygen concentration, the property of oxygen ion conductivity of stable solidified zirconium electrolyte is used. In practice, platinum electrodes are installed on both sides of the zirconium test tube shaped element. Air is introduced in the zirconium and the arrangement is such that the exhaust gas surrounds this test tube shaped element, thus obtaining a kind of oxygen concentrated battery.

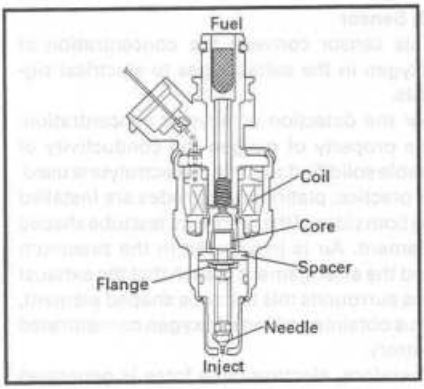
Therefore, electromotive force is generated because of the difference in oxygen concentrations in the exhaust gas and the atmosphere. This voltage is read by the ECU.



Camshaft sensor ("G" signal)/ Crankshaft sensor ("N" signal)

One electromagnetic pickup is installed in the cylinder head cover for cylinder identification and one pickup in the crankcase for detecting the crankshaft rotation angle.

There is a hole set in the cam lobe and in the crankweb. When the unit rotates, the gap in the pickup coil, changes. When it passes by the pickup coil the magnetic flux changes, generating electromotive force in the coil. The crank angle position and its reference position are detected by the changes in voltage.



ACTUATOR SYSTEM

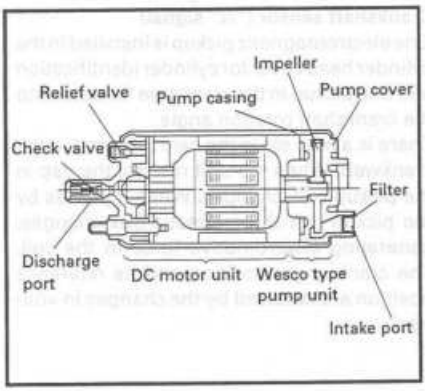
Fuel injector

The injector injects fuel when it receives the injection command from the ECU.

In the initial condition, the core is pressed down in the figure, because of the spring. The needle is integrated with the core on the lower side, which blocks the fuel path.

If current flows through the coil, the core is pulled up. The flange section that is formed between the core and the needle, moves until it touches the spacer. The distance moved by the needle is maintained constant because of this construction and thus the fuel passage section area is constant.

The difference in the fuel pressure and the intake duct pressure is maintained at a constant value by the pressure regulator. Therefore the injected fuel quantity is directly proportional to the time the current is passed.



Fuel pump

The fuel pump sucks the fuel from the tank and pumps it to the injector.

The fuel pump consists of the pump unit, electric motor, filter, and valves.

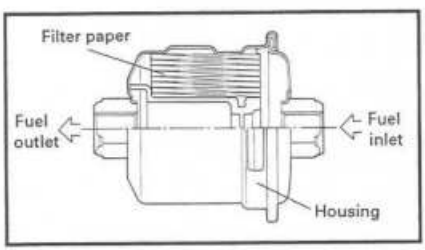
The pump unit is a Wesco type rotary pump.

The motor shaft and rotor of the pump are directly connected.

The filter is fitted at the intake port of the pump. It prevents foreign matter in the fuel tank from entering the fuel system.

Also, if the fuel hose ever got clogged, a relief valve is provided, that prevents abnormally high fuel pressures.

The check valve is provided for preventing back flow of fuel.



OTHERS

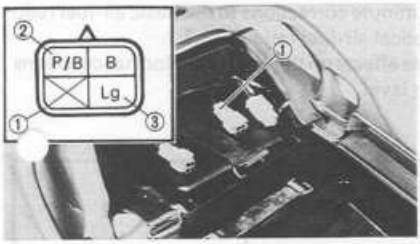
Fuel filter

The fuel filter removes foreign matter mixed up in the gasoline. It prevents wear and deterioration of the injector and fuel pump.

The foreign matter in the fuel is removed when the fuel pumped by the pump, passes through the filter paper in the housing.



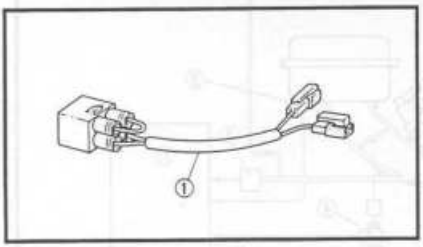
EFI warning light
The EFI warning light ① is installed in the meter panel. It indicates the status of the EFI system and reports the self diagnosis results.



EFI test coupler
A three-pole coupler is inside the tail cowl. This is the EFI test coupler ①.

• **Functions of terminals of the test coupler**
If you ground the T terminal ② (pink/black), then the ECU will be set in the dealer mode. (Connect the test coupler adapter to the EFI test coupler to ground the T terminal.)
The fault codes (rise or drop in voltage) generated in the dealer mode are output by the ECU from the W/L terminal ③ (light green).

Test coupler adapter
If you connect the test coupler adapter (90890-03149) ① to the EFI test coupler, the ECU will be set in the dealer mode. The fault codes recorded in the ECU are indicated by the flashing of the warning light or by the pocket tester.



NOTE:
Be sure to remove the test coupler adapter and reinstall the protection cap on the test coupler before starting out.

Diag tester
If you connect the optional diag tester ① to the test coupler, the ECU will be set in the dealer mode. The fault codes recorded in the ECU are indicated by the flashing by the diag tester.



NOTE:
Be sure to remove the test coupler adapter and fit the protection cap on the test coupler before running.

ELECTRONIC CONTROL THREE-WAY CATALYTIC CONVERSION SYSTEM

OUTLINE

This system is a high efficiency exhaust gas cleanup system. It decrease substances such as CO, HC, and NO_x from the exhaust gas by total control of fuel-air ratio, in association with the EFI system, the O_2 sensor and the three-way catalytic conversion system.

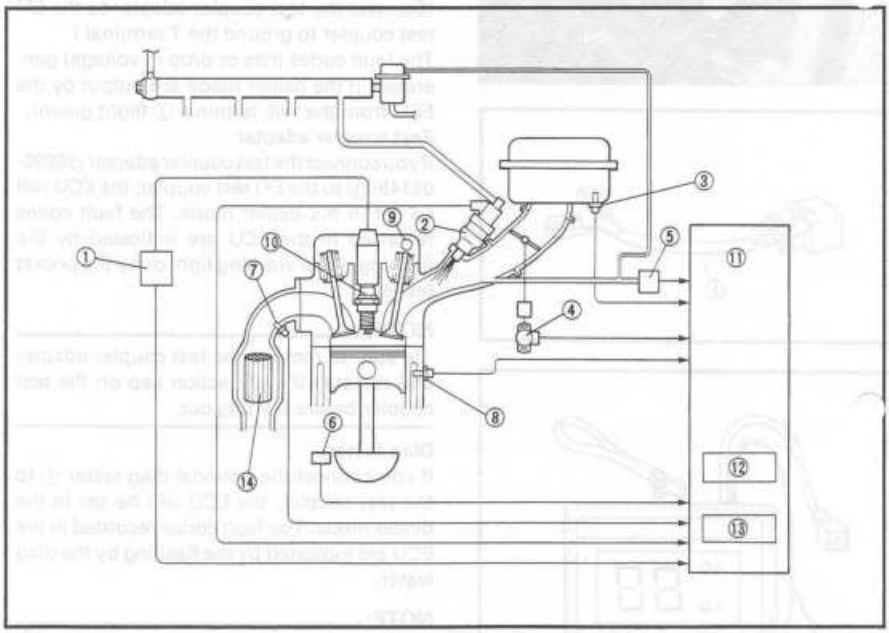
Optimum combustion is realized by matching air-fuel ratio (basic air-fuel ratio) with the operating condition of the engine, using the EFI system. Furthermore, maximum performance of the three-way catalytic converter is attained. With the aim of cleaning up the exhaust gas at high efficiency, an O_2 sensor is installed in the exhaust chamber.

This sensor detects the residual oxygen in the exhaust gas.

Based on the data from the sensor, the ECU makes minute corrections to the basic air-fuel ratio and always maintains this ratio close to the theoretical air-fuel ratio of 14.7:1.

These control systems, while not having any adverse effects on the engine performance, cleans up the exhaust gas at high efficiency and to a high level.

SYSTEM DIAGRAM

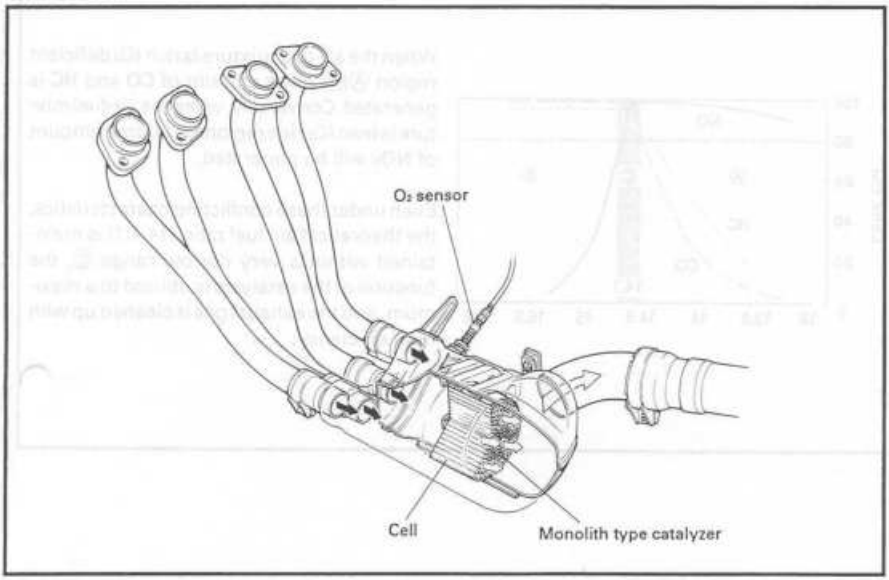


① Ignition coil
② Injector
③ Intake temperature sensor
④ Throttle sensor
⑤ Intake pressure sensor
⑥ Crankshaft sensor
⑦ O_2 sensor
⑧ Water temperature sensor
⑨ Camshaft sensor
⑩ Spark plug
⑪ ECU
⑫ Igniter
⑬ Atmospheric pressure sensor
⑭ Catalytic converter

FUNCTION OF COMPONENTS

	Device	Function	Main components
Electronic control three-way catalytic conversion system	Catalyzer (Monolith type)	Simultaneous reduction of CO, HC, NOx	• Catalytic converter • Case for catalyst
	Fuel-air ratio correcting device	Reduction of CO, HC, NOx The catalyst functions mainly to cleanup the exhaust gas. It maintains the theoretical fuel-air ratio.	• O_2 sensor • ECU
	Fuel cut-off device	Reduction of CO and HC, improved fuel consumption. Cuts off fuel during deceleration.	• Throttle position sensor • ECU

CATALYZER



The toxic components CO, HC and the generating conditions of NO_x in the exhaust gas have conflicting characteristics. Therefore, there is a limit to reducing the concentrations of all these components simultaneously in the combustion stage.

The role of the catalyzer is to purge the CO, HC, and NO_x toxic substances and clean up the exhaust gas at high efficiency in the exhaust stage.

The catalyst used in this model is a metallic monolith type (honeycomb construction) catalyst with large surface area (for high purification efficiency) and low exhaust resistance.

Platinum or rhodium, which are catalysts, adhere to the walls of the honeycomb cells. The honeycomb structure is installed in the exhaust chamber. When the exhaust gas comes in contact with the catalytic substance, chemical reactions, such as oxidation and reduction take place and the exhaust gas is cleaned up.

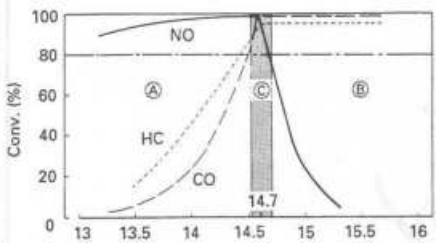
- CO and HC are oxidized by platinum and converted to non-toxic carbon dioxide gas (CO_2) and water (H_2O), and thus the exhaust gas is cleaned up.

$$CO + 1/2\ O_2 \longrightarrow CO_2$$
$$HC + O_2 \longrightarrow CO_2 + H_2O$$

- NOx is reduced by rhodium and converted to non-toxic nitrogen (N_2) and oxygen (O_2), and thus the exhaust gas is cleaned up.

$$NOx \longrightarrow N_2 + O_2$$

To attain the maximum performance of the catalyst and to cleanup the exhaust gas with high efficiency, the air-fuel mixture must always be controlled and maintained close to the theoretical air-fuel ratio (14.7:1).
The O_2 feedback compensation method is adopted in this system for maintaining the theoretical air-fuel ratio, using an O_2 sensor. This method is explained in the following section.



When the air-fuel mixture is rich (O_2 deficient region Ⓐ), a large amount of CO and HC is generated. Conversely, when the air-fuel mixture is lean (O_2 rich region Ⓑ), a large amount of NOx will be generated.

Even under these conflicting characteristics, the theoretical air-fuel ratio (14.7:1) is maintained within a very narrow range Ⓒ, the function of the catalysts is utilized to a maximum, and the exhaust gas is cleaned up with high efficiency.

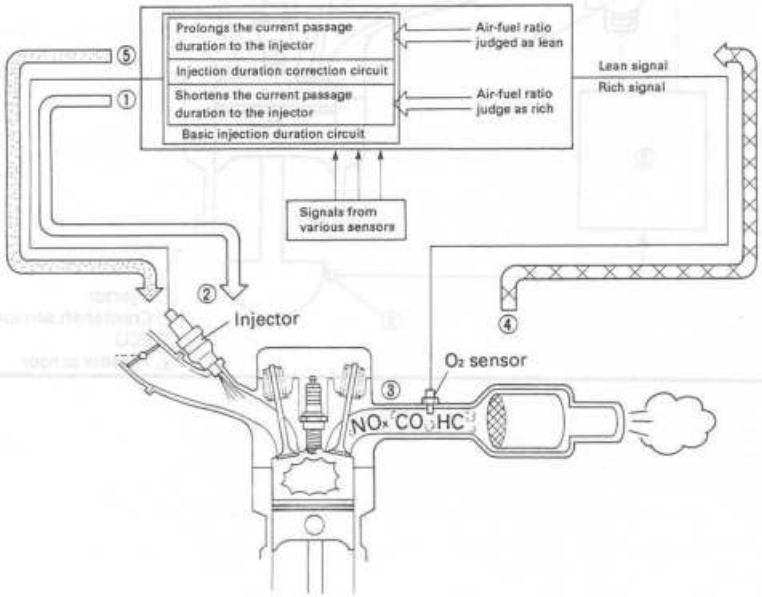
AIR-FUEL RATIO CORRECTING DEVICE

An O_2 sensor is installed in front of the catalyzer in the exhaust chamber for using the catalyzer at high efficiency.

This O_2 sensor detects the residual O_2 concentration in the exhaust gas. If the concentration of residual O_2 is rich, the air-fuel ratio of the fuel-air mixture is lean. This is detected by the O_2 sensor, which inputs a lean signal to the ECU.

Conversely, if the residual O_2 concentration is lean, the sensor inputs a rich signal to the ECU. The ECU system is designed so that it adds fine compensation to the injector injection quantity (current passage duration) to approach close to the theoretical air-fuel ratio and to maximize the cleanup function of the catalyst.

FEEDBACK CORRECTION CIRCUIT

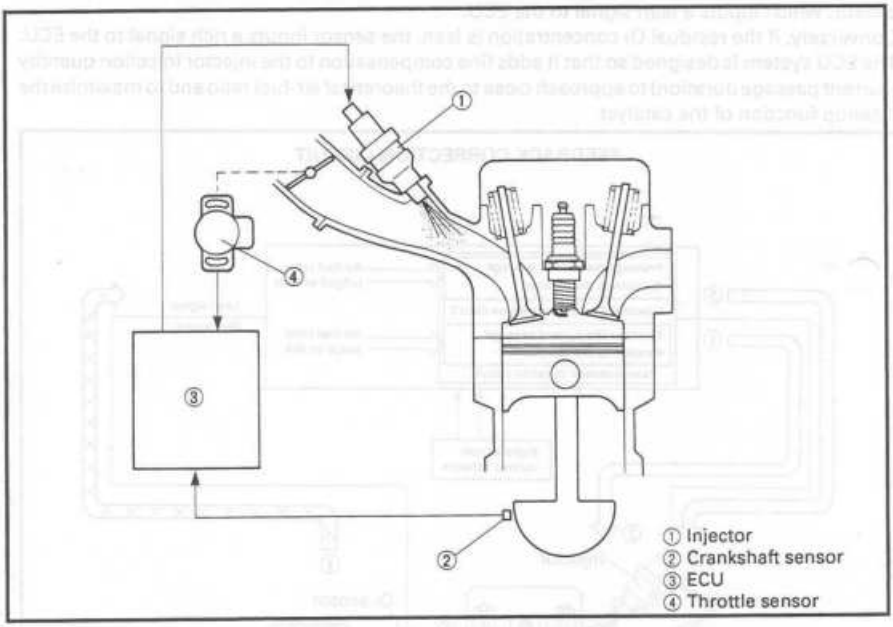


①The ECU decides the basic injection quantity, based on the input signals from various sensors and gives instructions for current passage duration to the injector.
②Current passes through the injector. The injector injects fuel accordingly.
③Combustion/exhaust takes place.
④The O_2 sensor detects the residual oxygen concentration in the exhaust gas. It sends the lean signal/rich signal for the fuel-air ratio based on this data.
⑤The ECU adds fine compensation to the basic injection timing, based on the signals received. It decides the injection quantity for the next stroke and gives instructions to the injector.

By repeating the operations described above, the theoretical air-fuel ratio is maintained.

FUEL CUT-OFF DEVICE (DURING DECELERATION)

When the engine rpm is high and the throttle valve is close (during engine brake), this device stops fuel injection. This action prevents generation of large quantity of CO and HC as only air is drawn into the combustion chamber. This device also prevents overheating of the catalyst and helps in reducing fuel consumption.



ENGINE INTEGRATED CONTROL SYSTEM (DETAIL)

The fuel injection period, injection timing, ignition timing and current duration through the coil are controlled by the ECU.

The ECU first calculates the intake air quantity from the signals received from the intake pressure sensor, the throttle sensor, the camshaft sensor and the crankshaft sensors. It then decides the basic injection timing.

Then, it adds the compensation value calculated from the acceleration conditions and the various compensation values calculated from the signals of sensors, such as the water temperature sensor, the intake temperature sensor, the atmospheric pressure sensor and the oxygen concentration sensor in the exhaust gas and decides the final injection timing.

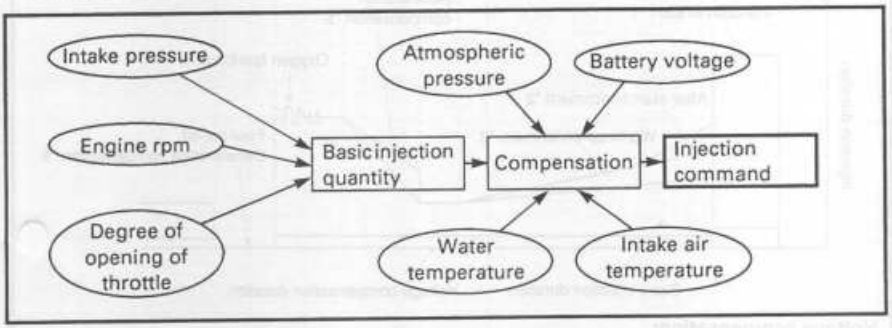
Simultaneously, it estimates the crank angle from the signals sent by the camshaft sensor and the crankshaft sensor and sends the injection command to the injector when the injection time is reached.

Also, it calculates the ignition timing and current passage time, based on the signals received from the various sensors and controls the current passage through the ignition coil.

DE..DING THE BASIC INJECTION DURATION

To operate the engine at the optimum conditions, it is necessary to supply fuel at the optimum fuel-air ratio according to the intake air quantity that changes from moment to moment and to ignite the fuel at the correct timing.

To supply fuel at the optimum fuel-air ratio, the intake air quantity must be accurately metered. The basic injection duration is controlled by the ECU based on the data of the intake air quantity and the engine rpm.



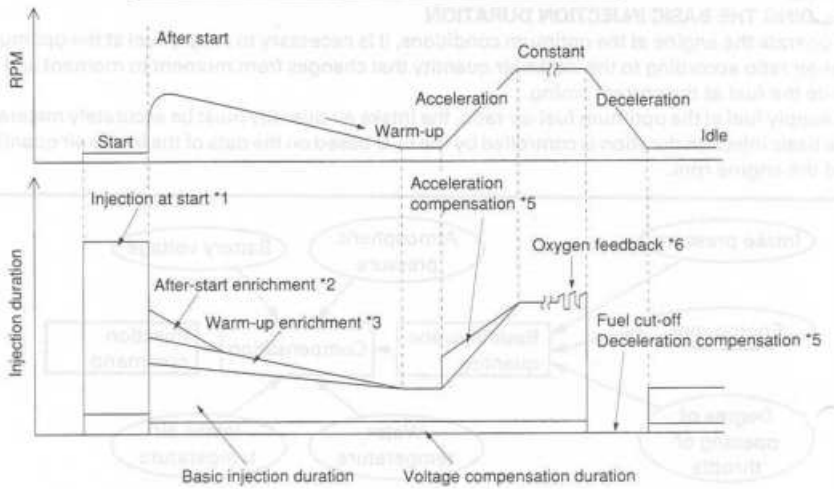
DETECTION OF INTAKE AIR QUANTITY

This model is provided with two metering systems - the compact speed density system and the throttle speed system. This has enabled the metering of intake air quantity at high accuracy at various operating conditions, because the advantages of both these systems have been combined.

DECIDING THE FINAL INJECTION DURATION

The basic injection duration is decided by the intake air quantity.
However, even if the intake air quantity is the same, the fuel quantity required during acceleration or deceleration varies depending on the engine operating conditions or the weather conditions.
In this system, these conditions are checked in detail using various sensors. Compensation data is added to the basic injection duration and the final injection duration is decided according to the engine operating conditions.
Furthermore, in addition to the fuel injection (synchronous injection) during normal running, the system also increases the fuel quantity by asynchronous injection, regardless of the crank rotation during situations such as the sudden opening of the throttle.
Also, conversely, when conditions require that fuel is no longer required, the system cuts off the fuel to stop fuel injection.

Configuration of final injection duration



Voltage compensation:

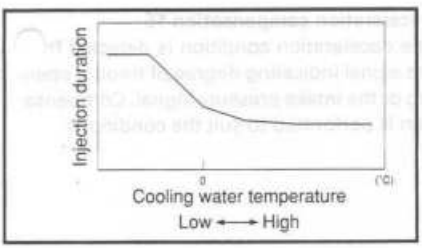
An operation delay occurs in the interval after the ECU outputs the fuel injection signal to the injector until the valve actually opens. Therefore, the ECU accounts for this operation delay time beforehand and sends the operation signal to the injector.
This voltage compensation depends on the battery voltage.

- If the voltage is high → Compensation duration is short
- If the voltage is low → Compensation duration is long

Fuel injection compensation

Table of fuel injection compensations

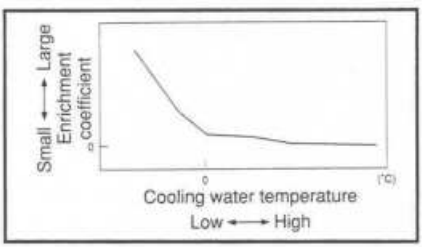
item	Check items	Sensors used
Injection at starting *1	Cooling water temperature	Water temperature sensor
Injection after starting:		
After-start enrichment *2	Cooling water temperature	Water temperature sensor
Warm-up enrichiment *3	Cooling water temperature	Water temperature sensor
Intake temperature compensation *4	Intake air temperature	Intake air temperature sensor
Acceleration/deceleration compensation *5	Intake pressure	Intake pressure sensor
	Degree of opening of throttle	Throttle sensor
	Cooling water temperature	Water temperature sensor
Air-fuel ratio feedback compensation*6	Exhaust gas residual oxygen concentration	O_2 sensor



Injection at starting *1

The system decides the injection timing from the cooling water temperature at engine starting. Therefore, the starting ability is improved.

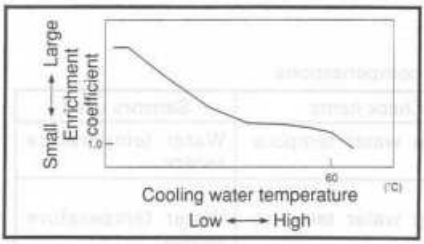
Injection timing at start = Basic injection duration × injection compensation coefficient



Injection after starting the engine
After-start enrichment *2

The fuel injection is increased at engine starting and the engine rpm is stabilized after the start. The increase is maximum immediately after starting the engine, later it decreases gradually.

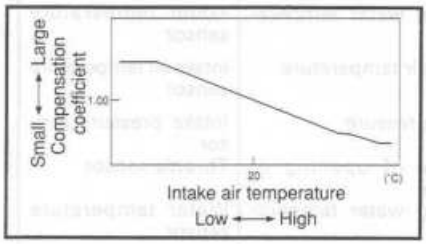
Enrichment after starting = Coefficient decided according to the cooling water temperature



Warm-up enrichment *3

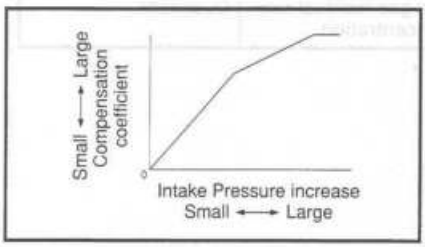
Fuel injection is increased in response to the signals received from the water temperature sensor, to improve the operation of the engine when the cooling water temperature is low.

Warm-up enrichment= Coefficient decided according to the cooling water temperature



Intake temperature compensation *4

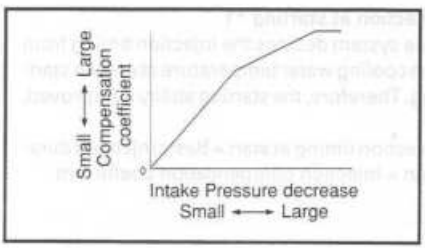
The deviation in air-fuel ratio generated by differences in the intake air density, which is due to the intake air temperature, is compensated based on the signals received from the intake air temperature sensor.



Acceleration compensation *5

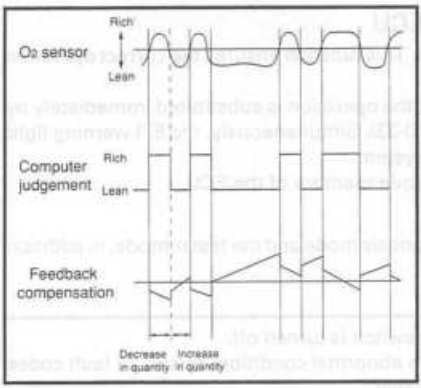
The acceleration condition is detected from the intake pressure signal and the signal for degree of opening of the throttle. Fuel consumption is increased according to the conditions.

Also, when the cooling water temperature is low, the increase will be large.



Deceleration compensation *5

The deceleration condition is detected fr
the signal indicating degree of throttle opening or the intake pressure signal. Compensation is performed to suit the conditions.



Air-fuel ratio feedback compensation *6
The fuel injection quantity is increased or decreased according to the O_2 sensor signals and compensated so that the air-fuel ratio is maintained close to the theoretical ratio of 14.7:1 at all times.

Asynchronous injection
To improve starting and response during acceleration a fixed quantity of fuel is injected into all cylinders simutaneously immediately after sensors input the corresponding signals. This injection is called asynchronous injection, as opposed to the normal fuel injection (synchronous injection).

Injection during starting
One single a synchronous injection takes place during starting.

Injection during acceleration
Asynchronous injection takes place after a change greater than a given value in the degree of o ning of the throttle valve.

Fuel cut-off
Fuel cut-off during deceleration
When the throttle valve is fully closed and the engine rpm is greater than the specified value (at engine brake), the fuel injection is stopped, generation of large quantities of CO and HC and heating of the catalytic converter is prevented and fuel consumption is improved.
When the engine rpm drops below the specified rpm, fuel injection starts automatically, preventing engine stop.

Over revolutions fuel cut-off
When the engine speed exceeds the specified value of engine speed fuel injection stops.
When the engine speed falls below the specified value, the fuel injection starts automatically.

SELF DIAGNOSIS FUNCTION OF THE ECU

The ECU is provided with a self diagnosis function. This function ensures the correct operation of the engine integrated control system.
If a fault in the system is detected by this function, the operation is substituted immediately by suitable characteristics (See "Fault code table", P II-33). Simultaneously, the EFI warning light comes ON and informs the rider of a fault in the system.
Every detected fault will be recorded in the fault code memory of the ECU.

ECU MODE FUNCTIONS

The ECU is provided with the dealer mode, the diagnosis mode and the tester mode, in addition to the user mode for normal operation.

NOTE:

All fault codes detected will be erased if the main switch is turned off.
When fault codes needs to be checked to repair an abnormal condition, record all fault codes on a piece of paper before turning off the main switch.
If the engine must be stopped after detecting a fault code, use the engine stop switch to stop the engine but leave the main switch on.

User mode

- To check the blow-out of bulb filament of the EFI warning light, the EFI warning light is turned ON for 1.4 seconds after main switch is turned ON and while the "START" switch is being pushed.
- To inform the rider that the fuel injection stop function has been activated, the EFI warning light blinks when the engine starts during the "START" switch is pushed.
- When a fault is detected by the self diagnosis function, the operation is substituted by suitable characteristics. Simultaneously, the EFI warning light comes ON and informs the rider of the fault.

Dealer mode

- When a fault is detected by the self diagnosis function, the fault code can be confirmed by the blinking pattern of the EFI warning light or by using a pocket tester.
- When no fault is defected, the blinking pattern of the EFI warning light is used to adjust the throttle sensor position.

Diagnosis mode

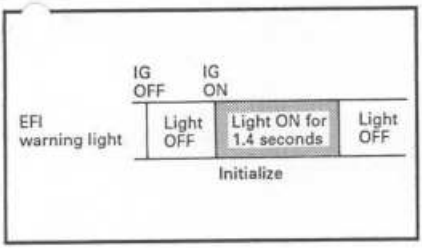
- In this mode, the diagnosis code is input in the ECU by the number of operations of the "START" switch.
- The ECU displays the values read from the sensor according to the diagnosis mode and drives the actuator.
- The judgement on normal operation is done by the you after checking the EFI warning light display or the actuator drive status.

Tester mode

The function is similar to the diagnosis mode. However, by using the diagnosis tester, the sensor readings can be directly read on the digital display. Therefore, the ease of service is enhanced.

EFI WARNING LIGHT DISPLAY AND EFI SYSTEM OPERATING STATUS (DURING USER MODE)

Display status of EFI warning light	Operating status of ECU	EFI operating status	Start and run
ON and OFF *1	Self diagnosis function in operation	EFI function in operation	Possible
Blinking *2	Fuel injection stop function	Operation stop	Not possible
Continuously ON	Fault being detected	Gives instructions for operation by substituting other characteristics, according to the fault.	
Not ON *3	EFI warning light bulb filament burn out. Possibility of a fault in the electrical system or in the ECU unit	———	



*1:
The EFI warning light lights up for 1.4 seconds each time the main switch is turned ON. The ECU performs the self diagnosis during this period. The EFI warning light goes off after the self diagnosis. When the AT pulse is not input correctly, however, the warning light will not come on for 1.4 seconds.
At this stage, if you crank the engine or continue pushing the "START" switch, the warning light will blink and the engine will not start.
Turn OFF the switch, then switch it ON again.

*2:
The EFI warning light blinks when the engine is being cranked, under the following conditions:

- AT signal is not input correctly to the ECU
- Side stand switch is defective
- The overturn switch is defective.

The warning light blinks when the engine is not being cranked, under the following conditions:

- ECU is set in the dealer mode
- Pinching of the T terminal wire.



*3:
EFI warning light bulb filament burn out check function.
After the main switch is turned ON, for an interval of 1.4 seconds and while the "START" switch is being pressed, the EFI warning light ① and the OIL LEVEL indicator light ② come on.
If the warning light does not come on, then the fault may be due to a bulb filament burn-out.
Refer to "TROUBLESHOOTING" and correct the fault.

MOTORCYCLE MAINTENANCE BY USING THE DEALER MODE

If there is a fault warning in one of the systems indicated by the EFI warning light during the user mode, you can set the ECU in the dealer mode and check the fault code.
This enables the fault location to be judged accurately and enables speedy vehicle maintenance.
Also, when no fault is detected in the system, the installation position of the throttle sensor can be checked by the blinking pattern of the EFI warning light.

Checking the fault code and troubleshooting

NOTE:

All fault codes detected will be erased if the main switch is turned off.
When fault codes needs to be checked to repair an abnormal condition, record all fault codes on a piece of paper before turning off the main switch.
If the engine must be stopped after detecting a fault code, use the engine stop switch to stop the engine but leave the main switch on.

Fault occurrence warning by the EFI warning light

⇩

1. Set the ECU in the dealer mode

⇩

2. Check the fault code using the EFI warning light method or the pocket tester method.

⇩

3. Judge the fault locations after referring to the "Fault code table" (P II-33).

⇩

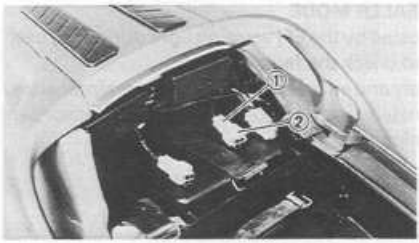
Turn off the main switch.

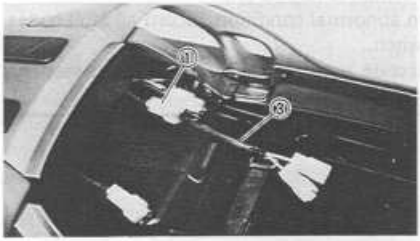
⇩

5. Restore the fault location correctly.
   Refer to "TROUBLESHOOTING" (P II-49)

⇩

6. Turn on the main switch and check that no fault code is output.





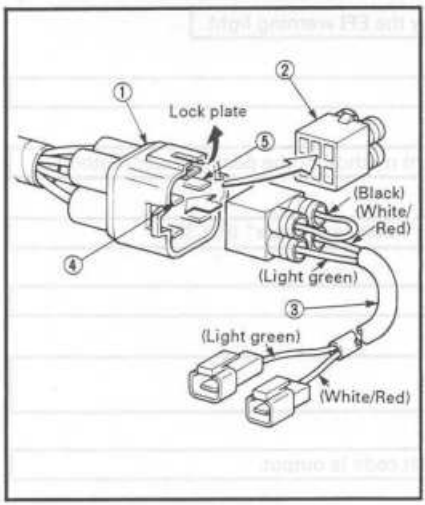
1. Method of setting the dealer mode in the ECU

NOTE:
When checking the fault code after setting the ECU in the dealer mode, make sure that you use a fully charged battery.

1) Remove the seat. Remove the protection cap ② from the EFI test coupler ① in the tail cowl.

2) Connect the test coupler adapter ③ (or diag tester) to the EFI test coupler ①.
This connection grounds the T terminal ④ (Pink / Black).
After one second, the ECU will be set in the dealer mode.

⑤ Ground (black) terminal



2. How to check the fault code

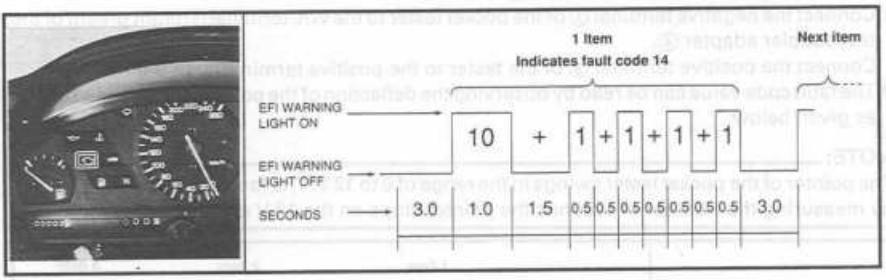
There are three methods of checking the fault code - by using the EFI warning light, by using the pocket tester or by using the diag tester.
The details of the methods are given below.

NOTE:

Record all the fault codes displayed. Perform all the checks and restoration work for each fault item.

1) Method of checking the fault code by the EFI warning light
   a. Set the ECU in the dealer mode.
      (Refer to "Method of setting the dealer mode" (P II-30))
   b. The EFI warning light may blink according to the two patterns described below.

EFI warning light blinks every 0.5 (or 0.15, 1.0) seconds (output of normal code)	No fault in the system currently.
[warning light blinks irregularly	ECU is sending the fault code signal therefore, read these signals by the procedure given below.

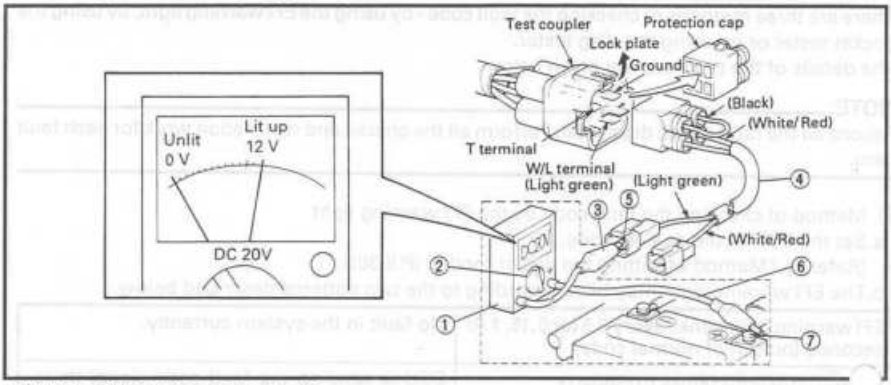


- EFI warning light comes on for 1 second ➡ Indicates the value 10
- EFI warning light comes on for 0.5 seconds ➡ Indicates the value 1
- The sum of 10 and 1 is the number of the fault code.

NOTE:

- There is no need to count the number of seconds the light goes off. However, if the light is OFF for 3 seconds continuously, and then blinks again, it indicates that the output of the fault code of the next item has started.
- Fault code will be output repeatedly. If there are several fault codes, the output will be in the descending numeric order.

2)Checking the fault code by pocket tester



a. Set the ECU in the dealer mode.
(Refer to the "Method of setting the dealer mode" (P II-30)).

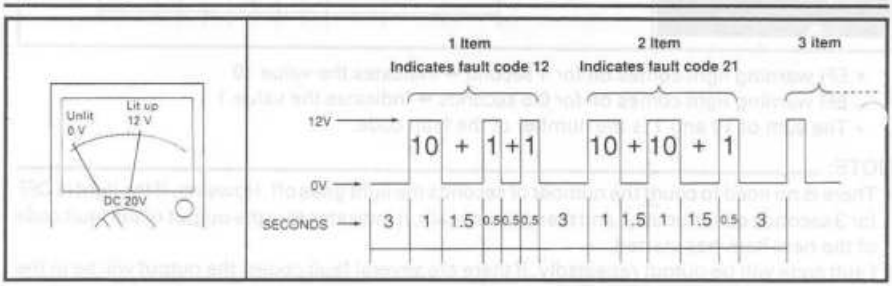
b. Set the range ② of the pocket tester ① at DC 20 V.

c. Connect the negative terminal ③ of the pocket tester to the W/L terminal ⑤ (light green) of the test coupler adapter ④.
Connect the positive terminal ⑥ of the tester to the positive terminal ⑥ of the battery.

d. The fault code value can be read by observing the deflection of the pointer of the pocket tester, as given below.

NOTE:

The pointer of the pocket tester swings in the range of 0 to 12 V. The fault code value can be read by measuring the number of seconds the pointer stops on the 12 V position.



- The pointer of the pocket tester stops on the 12 V position for 1 second ➡ Indicates the value 10.
- The pointer of the pocket tester stops on the 12 V position for 0.5 seconds ➡ Indicates the value 1.
- The sum of the values 10 and 1 gives the value of the fault code.

NOTE:

- Counting is not necessary at the 0 V position. However, if the pointer remains at the 0 V position for 3 seconds and then swings to the 12 V position again, it indicates that the output for the next item of the fault code has started.
- Fault code will be output repeatedly. If there are several fault codes, the output will be in the descending numeric order.

3. Judging the fault location

The possibility of a fault in the system can be judged by using the fault code table given below. Read the fault code corresponding to the fault code value, obtained by using the EFI warning light or the pocket tester (or diag tester).

Use this table in combination with "TROUBLESHOOTING" (P II-49). Check each item that may be considered a cause, find the real cause of the fault and restore it correctly.

NOTE:

Record all the fault codes that are displayed. Check all the relevant check items.

Fault code table

Fault code	Phenomenon	Check description	Reference
11	The input of camshaft sensor signal (G signal) is not correct.	• Mounting of camshaft sensor • Connection of camshaft sensor, engine harness, main harness and ECU coupler • Check the sensor unit • Continuity of engine harness and main harness	Fault code 11 (P II-55)
12	The input of crankshaft sensor signal (N signal) is not correct.	• Mounting of crankshaft sensor • Connection of crankshaft sensor, engine harness, main harness and ECU coupler • Check the sensor unit • Continuity of engine harness and main harness	Fault code 12 (P II-56)
13	Discontinuity or shorting of intake pressure sensor detected	• Connection of intake pressure sensor, engine harness, main harness and ECU coupler • Check sensor unit • Continuity of engine harness and main harness	Fault code 13 (P II-56)
14	The intake pressure sensor hose is disconnected, atmospheric pressure is acting all the time or the hose is clogged	• Disconnect, holes, biting or bend in the intake pressure sensor hose.	Fault code 14 (P II-56)
15	Discontinuity or shorting of the throttle sensor is detected.	• Mounting of throttle sensor • Connection of throttle sensor, engine harness, main harness and ECU coupler. • Check the sensor • Continuity of engine harness and main harness.	Fault code 15 (P II-57)
16	Fixed throttle sensor output.	• Mounting of throttle sensor. • Check the sensor	Fault code 16 (P II-57)

Fault code	Phenomenon	Check description	Reference
21	Discontinuity or shorting of the water temperature sensor is detected.	• Connection of water temperature sensor ,engine harness, main harness and ECU coupler. • Check the sensor • Continuity of engine harness and main harness • Mounting of water temperature sensor	Fault code 21 (P II-57)
22	Discontinuity or shorting of the intake temperature sensor is detected.	• Connection of intake temperature sensor, main harness and ECU coupler. • Check the fuel pressure • Continuity of main harness • Mounting of intake temperature sensor	Fault code 22 (P II-58)
23	Discontinuity or shorting of atmospheric pressure sensor is detected (built into ECU)	• Replace the ECU.	—
24	Discontinuity of the O_2 sensor is detected.	• Mounting of O_2 sensor • Connection of O_2 sensor and main harness coupler. • Check the fuel pressure. • Continuity of main harness	Fault code 24 (P II-58)
31	When the air fuel ratio feedback compensation continuously remains close to the upper limit value (basic air fuel ratio is too lean)	• Check the fuel pressure • Check injector	Fault code 31/32 (P II-59)
32	When the air fuel ratio feedback compensation continuously remains close to the lower limit value (basic air fuel ratio is too rich)		
33	Discontinuity on the primary side of the ignition coil (#1, 4) is detected.	• Connection of the ignition coil, cord headlight, main harness and ECU coupler. • Check ignition coil unit. • Continuity of cord headlight and main harness.	Fault code 33/34 (P II-59)
34	Discontinuity on the primary side of the ignition coil (#2, 3) is detected.		
41	Discontinuity in the fall detection switch is detected	• Connection of fall detection switch, main harness and ECU coupler • Check the switch • Discontinuity of main harness	Fault code 41 (P II-60)

NOTE:
If you start the engine with the starter motor when the battery voltage has dropped, fault code 41 will be output. If this occurs, charge the battery.

4. Work for restoring the fault locations
Refer to the relevant item of "TROUBLESHOOTING" (P II-49) and check all the locations that may be the cause of the fault. Perform the repair or restoration work correctly.

5. Method of deleting the fault code
1. Turn off the main switch.
2. Disconnect the EFI test coupler adapter from the EFI test coupler. Fit the protection cap on the EFI test coupler.
   The procedure for erasing the fault codes is now completed.

NOTE:
Make sure you fit the protection cap firmly on the EFI test coupler.



Method of checking the installed position of the throttle sensor

CAUTION:

As long as there is no fault in the driving ability, even if the adjustment signal indicates HI/LO, do not adjust.

When the throttle valve is in the fully close condition, an appropriate output voltage must be ensured for the throttle sensor ①.
This enables the correct detection of the throttle valve opening angle.

Working procedure

1)Make the following checks
- Throttle cable free play
- Intake air pressure synchronization
- Idle speed adjustment
  Refer to "CHAPTER 3".

Throttle cable free play:
3 ~ 5 mm (0.1 ~ 0.2 in)
Engine idle speed
950 ~ 1,050 r/min
Vacuum pressure at idle speed:
26.32 ~ 32.90 k (200 ~ 250 mmHg, 7.87 ~ 9.84 inHg)

2)Warm-up operation
Start the engine and let it warm up until the fast idle system cuts out. Then stop the engine.
Confirm that the engine stabilizes at 950 ~1,050 r/min. rpm.

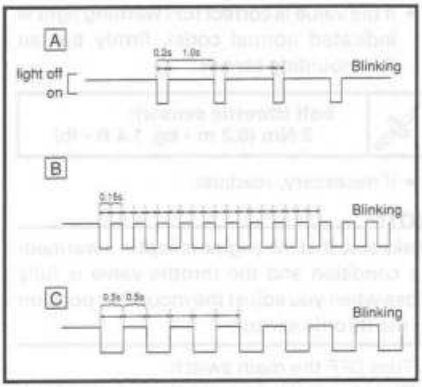
NOTE:

An auto choke for fast idling is fitted on the throttle body. Therefore, always warm up the engine and confirm that the throttle valve is in the fully closed condition.

3)Set the ECU in the dealer mode.

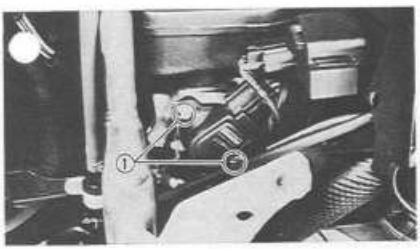
NOTE:

- Confirm that the ECU does not output the fault code by checking the EFI warning light.
- If there is a fault code output, repair all the fault locations.
- If the warning light blinks at 0.5 second intervals, it indicates that the system and the throttle sensor mounting position are normal.



4)Check the blinking status of the EFI warning light.
[A] Output voltage is low.
Blinking of the light at 1.0 second intervals.
[B] Output voltage is high.
Blinking of the light at 0.15 second intervals.
[C] Output voltage is normal (normal code).
Blinking of the light at 0.5 second intervals.

5)If the EFI warning light blinks at intervals other than the normal code, adjust the mounting position of the throttle sensor by the procedure given below and adjust the output voltage at the correct value (normal code output).
a. Turn OFF the main switch.
b. Remove the following parts.
- Seat
- Top cover
- Side cowling (right)
Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.



c. Loosen the two throttle sensor mounting bolts ①.
d. Rotate the throttle sensor by approximately 1 degree and adjust the output voltage so that you obtain the correct value.

Direction of rotation of sensor	Output voltage value
Clockwise	Output voltage decrease
Counterclockwise	Output voltage increases

e. Temporarily tighten the mounting bolts of the throttle sensor.
Repeat steps c and d and check whether the output voltage is set at the correct value.

- If the value is correct (EFI warning light is indicated normal code), firmly tighten the mounting screws.

	Bolt (throttle sensor): 2 Nm (0.2 m • kg, 1.4 ft • lb)

- If necessary, readjust.

NOTE:

Make sure that the engine is kept in a warmed-up condition and the throttle valve is fully close when you adjust the mounting position of the throttle sensor.

6. Turn OFF the main switch.
7. Disconnect the test coupler adapter from the EFI test coupler. Fit the protection cap on the test coupler.

NOTE:

Make sure you fit the protection cap on the test coupler firmly.

MOTORCYCLE MAINTENANCE BY USING THE DIAGNOSIS MODE AND THE TESTER MODE

The diagnosis mode and the tester mode are used for checking the input / output sequentially. Complex faults, difficult to detect in the dealer mode, can be accurately detected and checked in these modes.

Working procedure

0. Inspect the battery and the fuses.

⇩

1. Set the ECU in the diagnosis mode.

⇩

2. Set the ECU in the tester mode. (when using the diagnosis tester)

⇩

3. Check the normal operation of the sensors and the actuators.
Input the diagnosis code corresponding to the check item and check the results.
(Refer to "Diagnosis code table")

⇩

4. Turn OFF the main switch.

⇩

5. Repair and restore the fault locations correctly.
(Referring to the reference items in the "Diagnosis code table")

⇩

6. Turn OFF the main switch.

⇩

7. Fit the protection cap on the test coupler. This finishes the operation.

1. Method of setting the diagnosis mode in ECU

NOTE:

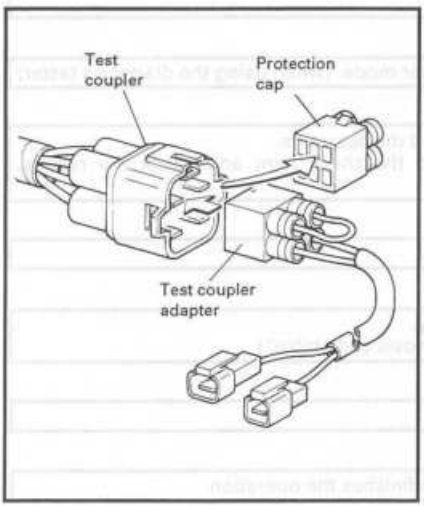
Be sure to use a fully charged battery before you set the ECU in the diagnosis mode for motorcycle maintenance.

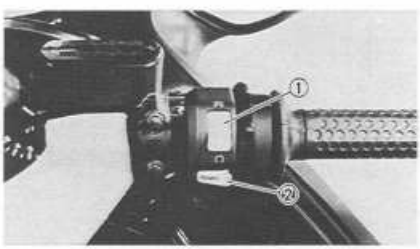
1. Remove the following parts.
   - Seat
   - Top cover
   - Side cowling (left)

   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
2. Disconnect the fuel pump coupler.
   (If the "ENGINE STOP" switch is ON during the diagnosis mode, the fuel pump continue to operate, resulting in a waste of battery power. Therefore, the coupler must be removed.)
3. Set the ECU in the dealer mode.
   Refer to "Method of setting the dealer mode" (P II-30).

NOTE:

- Make sure the engine is stopped.
- Never press the "START" button.





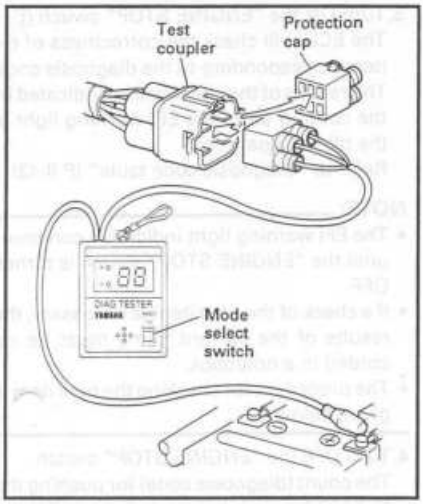
4. Set the "ENGINE STOP" switch ① at OFF.
5. Push the "START" switch ② ten times within 4 seconds.
   Confirm that the EFI warning light comes on for 1.4 seconds and then goes out.
6. The setting of the diagnosis mode is now complete.

2. Method of setting the tester mode in ECU

NOTE:

Be sure to use a fully charged battery before you set the ECU in the tester mode for motorcycle maintenance.

1. Disconnect the fuel pump coupler.
   (If the "ENGINE STOP" switch is ON during the tester mode, the fuel pump continue to operate, resulting in a waste of battery power. Therefore, the coupler must be removed.)



2. Set the ECU in the diagnosis mode.
   Refer to "Method of Setting the Diagnosis Mode"
3. Connect the positive lead of the diag tester to the positive terminal of the battery.
4. Push the "START" switch for more than one second.
5. With this operation, the setting of the tester mode and the diag tester is complete.

Method of checking in the diagnosis mode

After setting the ECU in the diagnosis mode (or tester mode), input the diagnosis codes sequentially starting from DIAGNOSIS CODE 1 in the ECU by pushing the "START" switch. Refer to the "Diagnosis code table" (P II-43) for the check items and the corresponding diagnosis codes.

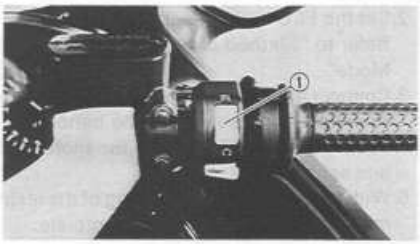


Procedure for input of diagnosis codes

1. Set the ECU in the "diagnosis mode" or the "tester mode".
   Refer to "Method of Setting the Diagnosis Mode/Tester Mode."
2. Push the "START" switch ① one time.
   The blinking pattern of the EFI warning light, depending on the number of times (diagnosis code) you have pushed the starter switch, will be visible.

NOTE:

The EFI warning light will come on during the interval the starter switch is pressed. The time for pushing the starter switch should be less than one second per push. If you push the switch for more than one second, the count will be reset.



3. Turn ON the "ENGINE STOP" switch ①.
   The ECU will check the correctness of the item corresponding to the diagnosis code. The results of the check will be indicated by the coming on of the EFI warning light or the blinking pattern.
   Refer to "Diagnosis code table" (P II-43)

NOTE:
- The EFI warning light indication continues until the "ENGINE STOP" switch is turned OFF.
- If a check of the next item is necessary, the results of the current items must be recorded in a notebook.
- The procedure for checking the next item is given below.

4. Turn OFF the "ENGINE STOP" switch.
   The count (diagnosis code) for pushing the "START" switch before switching ON the "ENGINE STOP" switch will be indicated by the blinking pattern of the EFI warning light.
5. Repeat steps 2. to 4. until all the checks are completed.
6. After completing all the checks, turn OFF the main switch.
7. Connect the fuel pump coupler.
8. Disconnect the test coupler adapter from the EFI test coupler. Fit the protection cap on the test coupler.
   The ECU is set to the user mode.

NOTE:
Make sure you fit the protection cap firmly on the EFI test coupler.

Diagnosis code table

Diagnosis code	Check item	Display of results	Reference item
0	Make the EFI warning light come on for 1.4 seconds.		
1	Camshaft sensor (G signal) Crankshaft sensor (N signal)	• Output of normal code • Output of fault code G signal - 11 N signal - 12	Diagnosis code 1 (P II-60)
2	Atmospheric pressure sensor	Diagnosis code output → Judge the result by the output table • If there is a fault in the atmospheric pressure sensor system	Diagnosis code 2 (P II-61)
3	Intake pressure sensor	Diagnosis code output → Judge the result from the output table • If there is a fault in the intake air pressure sensor system	Diagnosis code 3 (P II-61)
4	Throttle sensor	Diagnosis code output → Judge the result from the output table • If there is a fault in the throttle sensor system	Diagnosis code 4 (P II-61)
5	Throttle sensor (Low opening angle range: Fully closed ~ 1/4) Wax type throttle opener (fast idle system)	Diagnosis code output → Judge the result from the output table • If there is a fault in the throttle sensor system	Diagnosis code 5 (P II-61)
6	Intake air temperature sensor	Diagnosis code output → Judge the result from the output table • If there is a fault in the intake air temperature sensor system	Diagnosis code 6 (P II-62)
7	Water temperature sensor	Diagnosis code output → Judge the result from the output table • If there is a fault in the water temperature sensor system	Diagnosis code 7 (P II-62)
8	Fall detection switch	Up light position → EFI warning light comes on 90 degree position → EFI warning light does not come on • If there is an indication other than mentioned above, there is a fault in the overturn switch.	Diagnosis code 8 (P II-62)

Diagnosis code	Check item	Display of results	Reference item
9	Side stand switch Inspect after you shift the gear at a position other than the neutral position.	Switch ON → EFI warning light does not come on Switch OFF → EFI warning light come on • If the display is other than mentioned above, there is a fault in the side stand switch system.	Diagnosis code 9 (P II-62)
10	Neutral switch	Switch ON → EFI warning light does not come on Switch OFF → EFI warning light come on • If the display is other than mentioned above, there is a fault in the neutral switch system.	Diagnosis code 10 (P II-63)
11	Fuel pump relay Connect the fuel pump connector before starting this inspection (when the "ENGINE STOP" switch is OFF. Disconnect the connector after completing the inspection.	The fuel pump relay operates for 0.6 seconds, stops for 0.6 seconds and then operates continuously. **NOTE:** The EFI warning light comes on when the relay is not operating. • If the display is other than mentioned above, there is a fault in the fuel pump relay system.	Diagnosis code 11 (P II-63)
12	Ignition coil (#1.4)	The ignition coil (#1.4) operates for 0.01 second every second. Simultaneously, the EFI warning light comes on for 0.5 seconds five times and then stops. Pull out the plug cap and check the spark using the ignition checker. • If the display is other than mentioned above, there is a fault in the ignition coil (#1.4).	Diagnosis code 12/13 (P II-63)

Diagnosis code	Check item	Display of results	Reference item
13	Ignition coil (#2.3)	Same as ignition coil (#1, 4)	Diagnosis code 12/13 (P II-63)
14	#1 cylinder injector **CAUTION:** **If you repeat this inspection with the fuel pump coupler connected, a large amount of fuel enters the manifold. This may occurred to a fuel lock.**	The injector (#1) operates for 0.01 seconds every second. Simultaneously, the EFI warning light comes on for 0.5 seconds five times and then stops. Check the operating sound using a sound scope. Remove the injector and check metering/leakage of injected quantity. • There is a fault in the injector (#1) system.	Diagnosis code 14/15/16/17 (P II-64)
15	#2 cylinder injector	Same as injector (# 1)	Diagnosis code 14/15/16/17 (P II-64)
16	#3 cylinder injector	Same as injector (# 1)	Diagnosis code 14/15/16/17 (P II-64)
17	#4 cylinder injector	Same as injector (# 1)	Diagnosis code 14/15/16/17 (P II-64)
18~30	Same as diagnosis code 0		
31	ROM specifications Version no.	Diagnosis code output	

Diagnosis code output conversion table

Method of using the conversion table

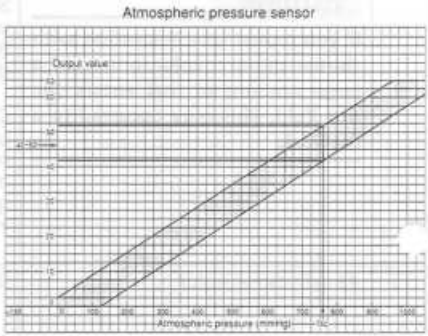
The values of output of each sensor read by the ECU are taken on the vertical axis of the table. The values of external conditions each sensor is subjected to, are taken on the horizontal axis. The relationship between these two quantities is proportional. This relation ship is indicated by the inclined line at the center of the graph.

For instance:

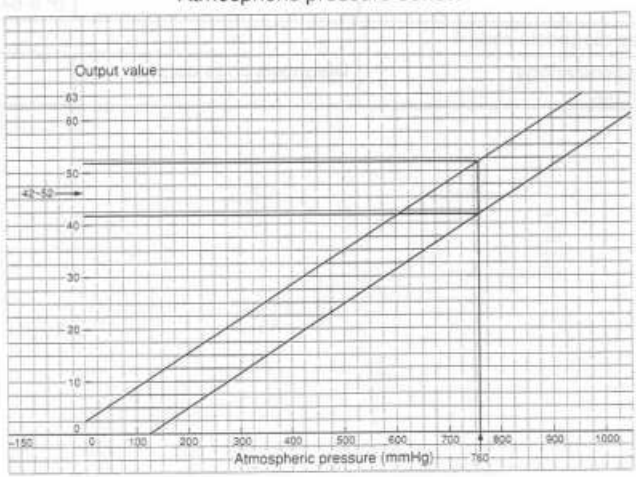
To check the normal operation of the atmospheric pressure sensor, let us assume that the measured value of atmospheric pressure is 760 mm Hg. If you plot this value on the graph, the value on the vertical axis is approximately 42 to 52.

If the output code from the ECU is approximately 42 to 52, then the atmospheric pressure sensor is judged to operate correctly.

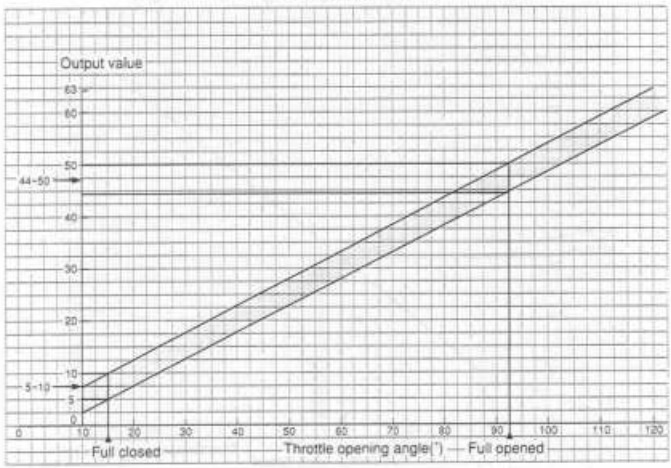
If the output code from the ECU exceeds this value, you must refer to the reference items of the diagnosis code table, check the fault location and repair or restore it correctly.



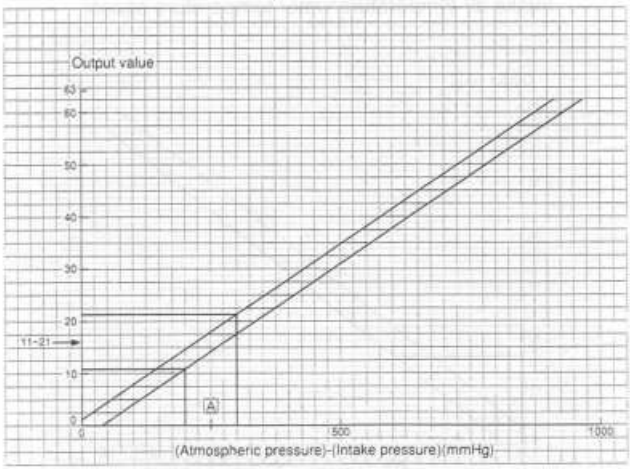
Atmospheric pressure sensor



Throttle sensor

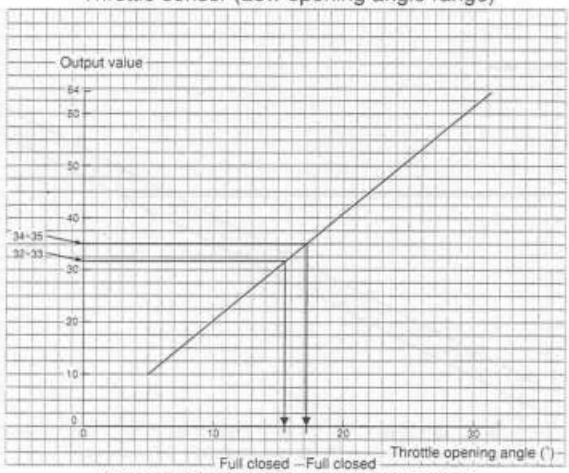


Intake pressure sensor

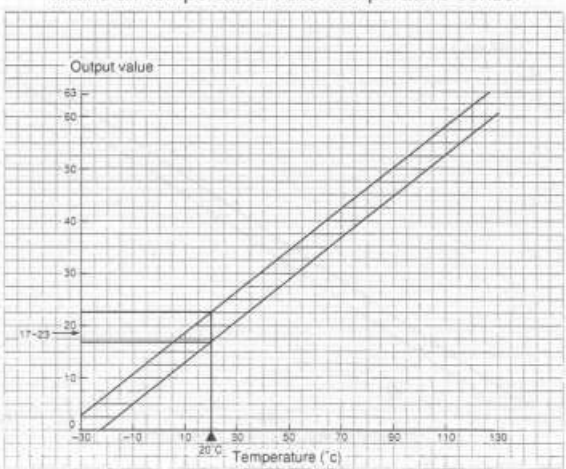


A : 200~300mm Hg (Throttle fully close,at iding engine speed (950~1,050r/min)

Throttle sensor (Low opening angle range)

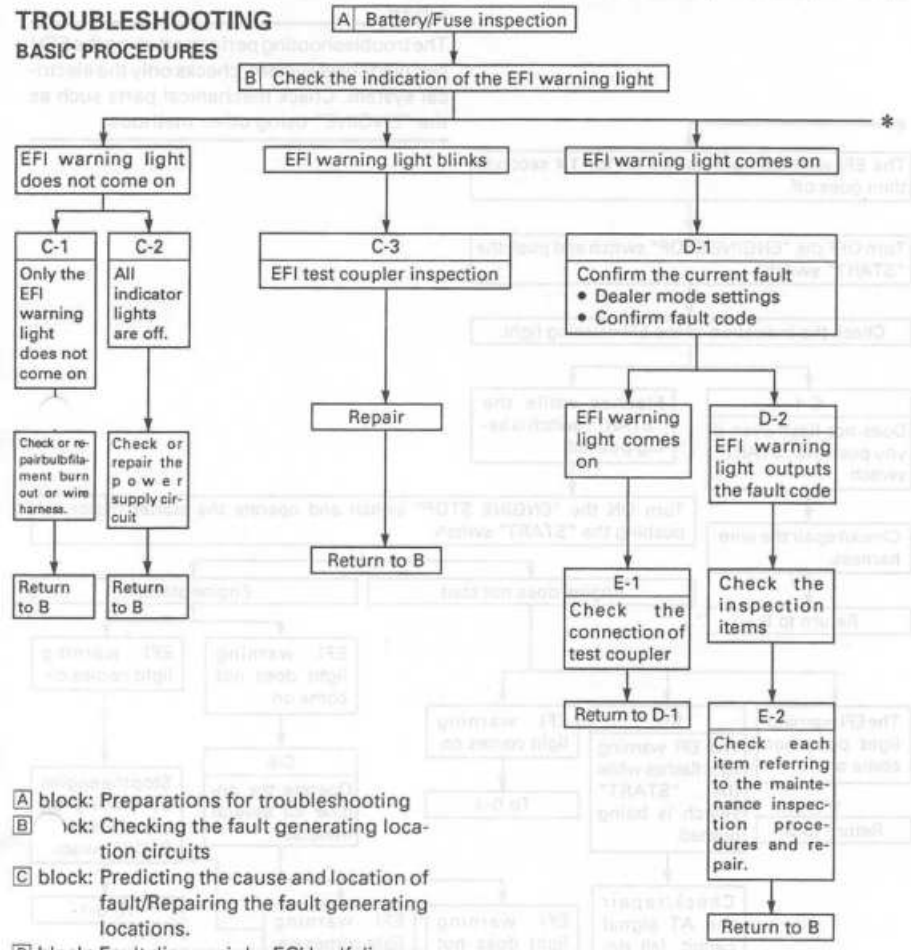


Intake air temperature/water temperature sensor



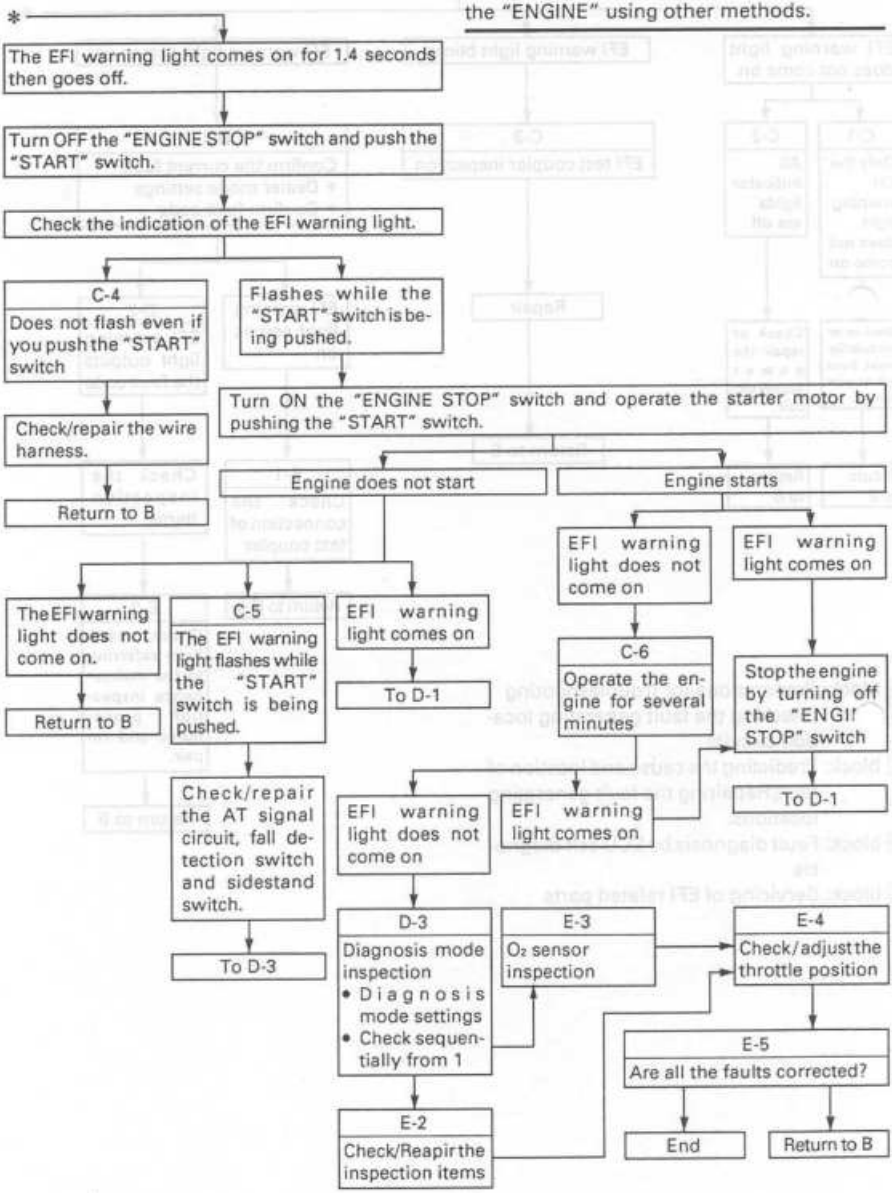
TROUBLESHOOTING

BASIC PROCEDURES



A block: Preparations for troubleshooting
B block: Checking the fault generating location circuits
C block: Predicting the cause and location of fault/Repairing the fault generating locations.
D block: Fault diagnosis by ECU self diagnosis
E block: Servicing of EFI related parts

NOTE:
The troubleshooting performed using the ECU self diagnosis system, checks only the electrical system. Check mechanical parts such as the "ENGINE" using other methods.



DETAILED PROCEDURES

A block TROUBLESHOOTING PREPARATIONS

A	BATTERY/FUSE INSPECTION	
Inspection item	Countermeasure	Reference items
Measurement of battery terminal voltage	• Clean the battery terminals. • Measure the voltage using a digital voltmeter. If the voltage is less than 12.8 V, charge the battery or replace it.	"BATTERY INSPECTION" (P 3-76)
Checking the fuse	• Check the fuse as follows. If this fuse is defective, replace it. • "MAIN" • "EFI" • "IGNITION" • "INDICATOR"	"FUSE INSPECTION" (P 3-82)

B block CHECKING THE FAULT GENERATING LOCATION CIRCUIT

B	CHECK THE INDICATION OF THE EFI WARNING LIGHT.
Preparatory work	• Remove the seat. • Turn ON the main switch.
Symptoms	
• EFI warning light does not comes on. • EFI warning light flashes. • EFI warning light comes on. • EFI warning light lights up for 1.4 seconds, then goes off.	

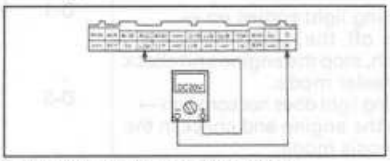
C block REPAIRING THE FAULT GENERATING LOCATIONS (OTHER THAN EFI RELATED ITEMS)

C-1	ONLY THE EFI WARNING LIGHT DOES NOT COME ON.	
Inspection item	Countermeasure	Reference items
Check the power supply at the test coupler terminals. • Turn OFF the main switch. • Remove two couplers from the ECU. **CAUTION:** **Make sure you remove two couplers from the ECU. If you remove only one coupler and inspect, it will occurred to a fault in the ECU circuit.** • Turn ON the main switch. • Connect/disconnect the test couplers of Black and Light green.	B-LG: Connection → EFI warning light: Comes on B-LG: Disconnection → EFI warning light: Goes off ⇩ CORRECT • Check/repair the Light green continuity between the ECU coupler and the test coupler. • If there is continuity → replace the ECU. ⇩ INCORRECT Check/repair the Light green lead continuity between the test coupler and the meter coupler.	"COUPLER LAYOUT DRAWING" (P I-9)

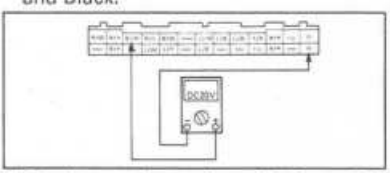
C-2	ALL INDICATOR LIGHTS ARE NOT COME ON		
	Inspection item	Countermeasure	Reference items
	Continuity check of power supply system • Check continuity of Brown/Yellow lead between the meter coupler and the fuse. • Check continuity of Brown/Blue lead between the fuse and the main switch coupler. • Check continuity of Red lead between the main switch coupler and the start relay coupler. • Check the continuity of Red lead between start relay and battery.	• There is continuity in all the parts checked → Check/repair the main switch. • There is no continuity → Check/repair individual leads.	"IGNITION SYSTEM" (P 7-12)

C-3	EFI TEST COUPLER INSPECTION		
	Inspection item	Countermeasure	Reference items
	Is the T terminal (Pink/Black-Black) of the EFI test coupler connected? • Connected	• Remove the test coupler adapter from the EFI test coupler. Insert the protection cap on the test coupler.	
	• Not connected • Check continuity in the test coupler a. Turn OFF the main switch b. Remove the couplers at two locations from the ECU.	• There is a bend or contact between the terminals → Repair/replace.	"CHECKING OF CONNECTIONS" (P 7-11)
	CAUTION: **Make sure you remove two couplers from the ECU. If you remove only one coupler and inspect, it will occurred to a fault in the ECU circuit.**	• Shorting between test coupler and ECU coupler → Check/repair the Pink/Black lead. • Open circuit between the test coupler and ECU coupler → Normal.	"COUPLER LAYOUT DRAWING" (P I-9)
	c. Check continuity between Pink/Black and Black of the EFI test coupler.		

C-4 EFI WARNING LAMP DOES NOT COME ON IF YOU PUSH THE STARTER SWITCH

Inspection item	Countermeasure	Reference items
Check power supply to the starter system. • Turn OFF the main switch. • Remove the two couplers from the ECU. **CAUTION:** **Make sure you remove two couplers from the ECU. If you remove only one coupler and inspect, it will occurred to a fault in the ECU circuit.** • Turn ON the main switch. • Connect Blue/White and Black of the coupler to the pocket tester and check the voltage.  • Starter switch to ON and OFF.	Starter switch / Battery voltage ON — 0 V OFF — 12.8 V CORRECT → Normal INCORRECT → Check/replace the starter switch. Check/repair the continuity of Blue/White between the handlebar switch (right) and the ECU coupler.	"BATTERY INSPECTION" (P 3-76) "ELECTRIC STARTING SYSTEM" (P 7-19) "COUPLER LAYOUT DRAWING" (P I-9)

C-5 EFI WARNING LIGHT FLASHES WHILE THE STARTER SWITCH IS BEING PUSHED

Inspection item	Countermeasure	Reference items
Check the AT signal • Preparatory work Turn OFF the main switch and turn it ON again. a. Turn OFF the main switch. b. Remove the two couplers from the ECU. **CAUTION:** **Make sure you remove two couplers from the ECU. If you remove only one coupler and inspect, it will occurred to a fault in the ECU circuit.** c. Connect the pocket tester to the coupler. Check the voltage of Brown/Black and Black.  d. Slowly turn the main switch from OFF to ON.	• Same phenomenon occurs → AT signal is defective. Check according to the procedure a. to d. Main switch / Voltage OFF — 0 V Intermediate position — 12 V ON — 0 V CORRECT: Fault is probably in the sidestand or fall detection switch. Check using the diagnosis code 8 or 9. INCORRECT: Check/repair the continuity of Brown/Black lead between the main switch coupler and the ECU coupler. Refer to "COUPLER LAYOUT DRAWING"	

C-6	OPERATE THE ENGINE FOR SEVERAL MINUTES	
Inspection item	Countermeasure	Reference items
Overall diagnosis of the engine • Operate the engine for several minutes. Does the idling speeds reduce and become steady?	• Idling speed remains high → Adjust using the throttle stop screw. Auto choke defective. • Idling speed is excessively low and engine stops → Check/adjust the intake air pressure synchronization. Adjust using the throttle stop screw. • Idling speeds remains steady → Adjust the idling speed.	"IDLE SPEED ADJUSTMENT" (P 3-26) Diagnosis code 5 (P II-61) "INTAKE AIR PRESSURE SYNCHRONIZATION" (P 3-23) "IDLE SPEED ADJUSTMENT" (P 3-26)
• Race the engine for 5 to 6 times and inspect the engine response. • Check the indication of the EFI warning light.	EFI warning light comes on → Turn off the "ENGINE STOP" switch, stop the engine and check the dealer mode. EFI warning light does not come on → Stop the engine and check in the diagnosis mode.	D-1 D-3

D block FAULT DIAGNOSIS BY ECU SELF DIAGNOSIS

D-1	THE FAULT IS CURRENTLY BEING DETECTED IN THE SYSTEM.
Execution item	Reference items
Set the ECU in the dealer mode. • If the engine is operating, stop it by turning OFF the "ENGINE STOP" switch. • Confirm the fault code. Judge the fault locations from the fault code table.	"DEALER MODE SETTING METHOD" (P II-30) "Fault code table" (P II-33)

D-2	EFI WARNING LIGHT OUTPUTS THE FAULT CODE		
Fault code 11	THE SIGNAL FROM THE CAMSHAFT SENSOR (G SIGNAL) IS INCORRECT.		
	Inspection item	Countermeasure	Reference items
	Mounting status of the camshaft sensor	Check for looseness/foreign matter in the mounted unit.	E-2-1
	Check for faults in the camshaft sensor unit.	Replace if there is a fault.	E-2-2
	Connection status of the connector • Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Camshaft sensor — Engine harness coupler • Engine harness — Main harness coupler • Main harness — ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
	Check for continuity/shorting of the lead.	Repair or replace the leads if there is a discontinuity or shorting of the lead. • Engine harness (Gy — W/B, B — W/Y) • Main harness (W/B — W/B, W/Y — W/Y)	"COUPLER LAYOUT DRAWING" (P I-9)

Fault code 12	THE CRANKSHAFT SENSOR SIGNAL (N SIGNAL) IS INCORRECT.	
Inspection item	Countermeasure	Reference items
Mounting status of crankshaft sensor	Check for looseness/foreign matter in the mounted unit.	E-2-3
Check for faults in the crankshaft sensor unit.	Replace if there is a fault.	E-2-4
Connection status of the connector • Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Crankshaft sensor — Engine harness coupler • Engine harness — Main harness coupler • Main harness - ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of the lead.	Repair or replace the leads if there is a discontinuity or shorting of the lead. • Engine harness (Gy — W/R, B — W/G) • Main harness (W/R — W/R, W/G — W/G)	"COUPLER LAYOUT DRAWING" (P I-9)

Fault code 13	DISCONNECTION OR SHORTING OF THE INTAKE PRESSURE SENSOR DETECTED	
Inspection item	Countermeasure	Reference items
Check for faults in the intake pressure sensor.	Replace if there is a fault.	E-2-5
Check the connection status of connector. Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Intake pressure sensor — Engine harness coupler • Engine harness — main harness coupler • Main harness — ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of the lead .	Repair or replace the leads if there is a discontinuity or shorting of the lead. • Engine harness (B/Y — B/Y, P/W — P/W, L — L) • Main harness (B/Y — B/Y, P/W — P/W, L — L)	"COUPLER LAYOUT DRAWING" (P I-9)

Fault code 14	INTAKE PRESSURE SENSOR HOSE IS DISCONNECTED OR HOSE CLOGGING HAS BEEN DETECTED.	
Inspection item	Countermeasure	Reference items
Check for disconnection, cuts (holes), pinch and bending of the intake pressure sensor hose.	• Repair or replace the intake pressure sensor hose. • Connect correctly. • If there is no fault, check the intake pressure sensor.	E-2-6 E-2-5

Fault code 15	DISCONNECTION OR SHORTING OF THROTTLE SENSOR DETECTED	
Inspection item	Countermeasure	Reference items
Mounting status of throttle sensor	Install certainly.	"Throttle sensor" (P II-36)
Check for faults in the throttle sensor unit.	Replace if there is a fault.	"Throttle sensor" (P II-36)
Connection status of connector • Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Throttle sensor — Engine harness coupler • Engine harness — main harness coupler • Main harness — ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of the lead wire.	Repair or replace the leads if there is a discontinuity or shorting. • Engine harness (B/Y — B/Y, Y/W — Y/W, L — L) • Main harness (B/Y — B/Y, Y/W — Y/W, L — L)	"COUPLER LAYOUT DRAWING" (P I-9)

Fault code 16	THROTTLE SENSOR DOES NOT OPERATE.	
Inspection item	Countermeasure	Reference items
Mounting status of throttle sensor	Mount correctly.	"Throttle sensor" (P II-93)

Fault code 21	DISCONNECTION OR SHORTING OF WATER TEMPERATURE SENSOR DETECTED.	
Inspection item	Countermeasure	Reference items
Check for faults in the water temperature sensor.	Replace if there is a fault.	E-2-7
Connection status of connector • Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Water temperature sensor — Engine harness coupler • Engine harness — main harness coupler • Main harness — ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of the lead.	Repair or replace the leads if there is a discontinuity or shorting. • Engine harness (B/Y — B/Y, G/W — G/W) • Main harness (B/Y — B/Y, G/W — G/W)	"COUPLER LAYOUT DRAWING" (P I-9)

Fault code 22	DISCONNECTION OR SHORTING OF INTAKE TEMPERATURE SENSOR DETECTED.	
Inspection item	Countermeasure	Reference items
Check for faults in the intake temperature sensor.	Replace if there is a fault.	E-2-8
Connection status of connector • Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Intake temperature sensor — Engine harness coupler • Main harness — ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of the lead.	Repair or replace the leads if there is a discontinuity or shorting. Main harness (B/Y — B/Y, Br/W — Br/W)	"COUPLER LAYOUT DRAWING" (P I-9)

Fault code 23	DISCONNECTION OR SHORTING OF ATMOSPHERIC PRESSURE SENSOR DETECTED.	
Inspection item	Countermeasure	Reference items
The atmospheric pressure sensor is built-in in the ECU.	Replace the ECU.	—

Fault code 24	DISCONNECTION OR SHORTING OF O_2 SENSOR DETECTED.	
Inspection item	Countermeasure	Reference items
O_2 sensor mounting	Mount correctly.	O_2 sensor
Connection of connector • Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • O_2 sensor — main harness coupler • Main harness — ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of the lead.	Repair or replace the leads if there is a discontinuity or shorting. • Main harness (W — B/R, L — Gy/G)	"COUPLER LAYOUT DRAWING" (P I-9)
Check the fuel pressure.	For the inspection method, refer to Fault Code 31/32.	—

Fault code 31/32	WHEN THE CORRECTION OF THE O_2 FEED BACK SENSOR CONTINUOUSLY REACHES THE UPPER LIMIT VALUE OR THE LOWER LIMIT VALUE	
Inspection item	Countermeasure	Reference items
Check the fuel pressure	Compare the fuel pressures at idling and when the throttle is opened. Similar level → Correct Low → Fuel pump has deteriorated. Fuel filter/Pump filter is clogged. Damage/Pinch of the fuel delivery hose. Fault in the pressure regulator. Throttle sensor adjustment fault Sealing defect in the intake system High → Fault in the pressure regulator Disconnection, cuts (holes), pinch and binding in the hose of the pressure regulator. Damage/Pinch of the fuel return hose. Throttle sensor adjustment fault	"PRESSURE REGULATOR" (P II-90) "FUEL PUMP SYSTEM" (P 7-70) "CABLE ROUTING" "PRESSURE REGULATOR" (P II-90) E-4 "PRESSURE REGULATOR" (P II-90) "CABLE ROUTING" E-4
Check the injector.	Replace the injector if there is a fault.	Diagnosis Code 14 –17. (PII-64)

Fault code 33/34	DISCONNECTION ON THE PRIMARY SIDE OF THE IGNITION COIL (#1, #4/ #2, #3) DETECTED.	
Inspection item	Countermeasure	Reference items
Check the ignition coil unit. (Continuity check of primary and secondary coils.)	Replace the ignition coil if there is a break or disconnection.	"IGNITION SYSTEM" (P 7-12)
Connection status of the connector. • Check for loose pin in the coupler. • Make sure that the connector is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Primary side connector of ignition coil • Cord headlight — Main harness coupler • Main harness — ECU coupler	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of lead.	Repair or replace the leads if there is a discontinuity or shorting. • Cord headlight (Primary side terminal — Gy, Secondary side terminal — O, Primary side terminal — R/W) • Main harness (O — O, Gy — Gy)	"COUPLER LAYOUT DRAWING" (P I-9)

Fault code 41	DISCONNECTION OF FALL DETECTION SWITCH DETECTED.	
Inspection item	Countermeasure	Reference items
Check for faults in the fall detection switch.	Replace the switch if there is a fault.	Diagnosis code 8
Connection status of the connector. • Check for loose pin in the coupler. • Make sure that the locking is correct.	Repair or connect firmly. Confirm the connection by a distinct 'click' sound. • Fall detection switch — Main harness coupler • Main harness — ECU coupler.	"COUPLER LAYOUT DRAWING" (P I-9)
Check for continuity/shorting of the lead.	Repair or replace the leads if there is a discontinuity or shorting. • Main harness (B/Y — B/Y, B/W — B/W)	"COUPLER LAYOUT DRAWING" (P I-9)

D-3	INSPECTION BY THE DIAGNOSIS MODE	
Execution item		Reference items
Set the ECU in the diagnosis mode. • If the engine is operating, stop the engine. • Remove the fuel pump connector.		"Diagnosis mode setting" (P II-40)
• Start inspection sequentially from Diagnosis code 1 after setting the ECU in the diagnosis mode.		"Diagnosis Code table" (P II-43)

Diagnosis code 1	INSPECTION OF CAMSHAFT SENSOR/CRANKSHAFT SENSOR	
Inspection item	Countermeasure	Reference items
Inspection method **NOTE:** The detecting sensitivity of the inspection by this diagnosis code has been set at a higher value than for other inspection codes (user mode / dealer mode).		
• Turn on the "ENGINE STOP" switch. • Crank by pushing the starter switch.	• Output of normal code → Normal	"Normal code" (P II-37)
CAUTION: **Crank the engine for about 3 seconds.**	• Output of abnormal code 11 → D-2 fault code 11 12 → D-2 fault code 12	"How to check the fault code" (P II-31)
• Check the indication of the EFI warning light.		

Diagnosis code 2 INSPECTION OF ATMOSPHERIC PRESSURE SENSOR

Inspection item	Countermeasure	Reference items
Inspection method • Measure the atmospheric pressure using the atmospheric pressure gauge. • Read the output code Ⓐ in the "Diagnosis code output conversion table". Example: 760 mm Hg → 42 to 52 • Turn ON the ENGINE STOP stop switch. • Check the indication of the EFI warning light Ⓐ'.	Ⓐ is similar to Ⓐ' → Normal Clear difference in Ⓐ and Ⓐ' → Replace ECU.	"Conversion table" (P II-46) "How to check the fault code" (P II-31)

Diagnosis code 3 INSPECTION OF INTAKE AIR PRESSURE SENSOR

Inspection item	Countermeasure	Reference items
Inspection method • Connect the fuel pump connector. • Turn on the "ENGINE STOP" switch. • Start the engine and let it warm up for several minutes until the fast idling system cut out. (950 ~ 1,050 r/min) • Check the indication of the EFI warning light. • Turn off the "ENGINE STOP" switch. • Disconnect the fuel pump connector.	Output code (Throttle Fully close): 11 ~ 12 → Normal Other code → Check intake air pressure sensor/hose	"Conversion table" (P II-46) E-2-5

Diagnosis code 4 INSPECTION OF THROTTLE SENSOR

Inspection item	Countermeasure	Reference items
• Turn ON the "ENGINE STOP" switch. • Fully close the throttle. • Check the indication of the EFI warning light.	Output code: 5 to 10 → Normal Output code: Other than 5 to 10 → Adjust the mounting position using diagnosis code 5.	"Conversion table" (P II-46) "How to check the fault code" (P II-31)
fully open the throttle. • Check the indication of the EFI warning light.	Output code: 44 to 50 → Normal Output code does not change (full close to open) → Check throttle sensor. Output code: other than 44 to 50 → Check throttle sensor.	"Throttle sensor" (P II-36) "Throttle sensor" (P II-36)

Diagnosis code 5 INSPECTION OF FAST IDLE UNIT POSITION

Inspection item	Countermeasure	Reference items
NOTE: Adjust the throttle sensor position correctly before making this adjustment. Work when the engine is cold (when the fast idle unit is operating). • Turn ON the "ENGINE STOP" switch. • Fully close the throttle. • Check the indication of the "EFI" warning light. • Check when the engine is cold and when it is warm.	Out put code: 34 ~ 35 → Normal Out put code: Other than 34 ~ 35 → Check fast idle unit	"Fast idle unit" (P II-79)

Diagnosis code 6 INSPECTION OF INTAKE TEMPERATURE SENSOR

Inspection item	Countermeasure	Reference items
• Measure the temperature in the air cleaner. • Read the output code in the "Diagnosis code output conversion table" → Ⓐ Example 20°C → 17 to 23 • Turn on the "ENGINE STOP" switch. • Check the indication on the EFI warning light. → Ⓐ′	Ⓐ is similar equal to Ⓐ′ → Normal Clear difference between Ⓐ and Ⓐ′ → E-2-8 (P II-68) **NOTE:** Measure the temperature at the sensor location. Measure the temperature at varying temperature conditions several times and judge.	"Conversion table" (P II-46) "How to check the fault code" (P II-31)

Diagnosis code 7 INSPECTION OF WATER TEMPERATURE SENSOR

Inspection item	Countermeasure	Reference items
• Measure the temperature of the cooling water. • Read the output code in the "Diagnosis code output conversion table" → Ⓐ Example 20°C → 17 to 23 • Turn on the "ENGINE STOP" switch. • Check the indication on the EFI warning light. → Ⓐ′	Ⓐ is similar to Ⓐ′ → Normal Clear difference between Ⓐ and Ⓐ′ → E-2-7 (P II-68) **NOTE:** Measure the temperature at the sensor location. Measure the temperature at varying temperature conditions several times and judge.	"Conversion table" (P II-46) "How to check the fault code" (P II-31)

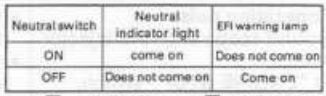
Diagnosis code 8 INSPECTION OF FALL DETECTION SWITCH

Inspection item	Countermeasure	Reference items
• Remove the fall detection switch from the motorcycle body. • Turn ON the "ENGINE STOP" switch. • Set the fall detection switch up light or at 90 degrees. • Check the indication of the EFI warning light.	Fall detection switch / EFI warning light Up light / Comes on 90 degrees / Does not comes on CORRECT → Normal INCORRECT → Replace	—

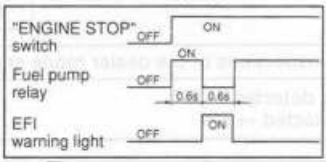
Diagnosis code 9 INSPECTION OF SIDESTAND SWITCH

Inspection item	Countermeasure	Reference items
• Shift the transmission gear other than the neutral position. • Turn ON the "ENGINE STOP" switch. • Turn ON, then turn OFF the side stand switch. • Check the indication on the EFI warning light.	Sidestand switch / EFI warning light ON / Does not come on OFF / Come on CORRECT → Normal INCORRECT → Refer to "IGNITION SYSTEM" (P 7-12)	—

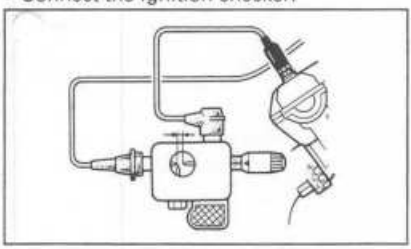
Diagnosis code 10 INSPECTION OF NEUTRAL SWITCH

Inspection item	Countermeasure	Reference items
• Turn ON the "ENGINE STOP" switch. • Turn ON and then turn OFF the neutral switch. (Shift the gear at neutral or other gear.) • Check the indication of the EFI warning light and the neutral indicator light.	 ⇩ CORRECT → Normal ⇩ INCORRECT → Refer to "IGNITION SYSTEM" (P7-12)	—

Diagnosis code 11 INSPECTION OF FUEL PUMP RELAY

Inspection item	Countermeasure	Reference items
• Connect the fuel pump coupler. • Turn ON the "ENGINE STOP" switch. • Check the operating sound of the fuel pump and the indication of the EFI warning light. • After checking, turn off the "ENGINE STOP" switch and disconnect the fuel pump coupler.	Check the cycles of the fuel pump and the EFI warning light.  ⇩ CORRECT → NORMAL ⇩ INCORRECT → Refer to "FUEL PUMP SYSTEM" (P 7-70)	—

Diagnosis code 12/13 INSPECTION OF IGNITION COIL (#1, #4/#2, #3)

Inspection item	Countermeasure	Reference items
Visual inspection of spark • Remove the spark plug cap (#1, #2, #3 and #4). • Connect the ignition checker.  • Turn ON the "ENGINE STOP" switch. • Inspect the spark.	• Satisfactory sparks obtained five times → Normal. • No spark → Refer to "IGNITION SYSTEM" (P 7-12). **NOTE:** • For the first time, the spark occurs simultaneously with switching ON of the "ENGINE STOP" switch. • The EFI warning light comes on for 0.5 seconds simultaneously with the occurrence of the spark. This is repeated five times.	—

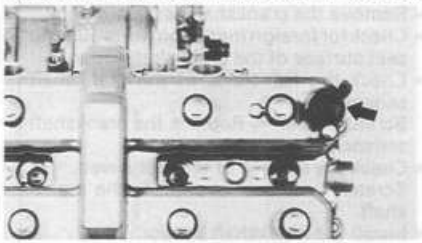
Diagnosis code 14/15/16/17	INSPECTION OF INJECTOR (#1/#2/#3/#4)	
Inspection item	Countermeasure	Reference items
Inspection of operating noise • Attach the sound scope with the injector (#1/#2/#3/#4). • Turn ON the "ENGINE STOP" switch. • Check the operating sound.	• Operating sound could be confirmed five times → Normal. • Operating sound could not be confirmed → E-2-9. (P II-69) **NOTE:** • For the first time, the operating sound can be heard simultaneously with the switching on of the "ENGINE STOP" switch. • The EFI warning light comes on for 0.5 seconds simultaneously with the operation of the injector. This is repeated five times.	—
With this, all inspections of the dealer mode and diagnosis mode are completed.		
• If no fault is detected → E-3 • If fault is detected → E-4		

E block SERVICING OF EFI RELATED PARTS

E-1	INSPECTION OF TEST COUPLER GROUND	
Inspection item	Countermeasure	Reference items
Check the T terminal (P/B-B) of the EFI test coupler is normal. • Connection is incorrect.	• Mount the test coupler adapter on the test coupler. • Connect the T terminal (P/B — B) ground correctly.	"Dealer mode setting" (P II-30)
• Connection is correct. • Shorting of the Light green lead may be the cause. a. Turn OFF the main switch. b. Remove the two couplers from the ECU. **CAUTION:** **Make sure you remove two couplers from the ECU. If you remove only one coupler and inspect, it will occurred to a fault in the ECU circuit.**		
c. Remove the meter couplers. d. Check the continuity between Light green — Black of the test coupler.	Repair or replace the lead if there is a continuity. • Test coupler (Lg) — ECU coupler (Lg) • Test coupler (Lg) — Meter coupler (Lg) • Test coupler (B) — Ground	"COUPLER LAYOUT DRAWING" (P I-9)

E-2-1 INSPECTION FOR LOOSENESS IN THE MOUNTING OF CAMSHAFT SENSOR/ PINCH OF FOREIGN MATTER

Inspect for looseness in the mounting of camshaft sensor and pinch of foreign material.

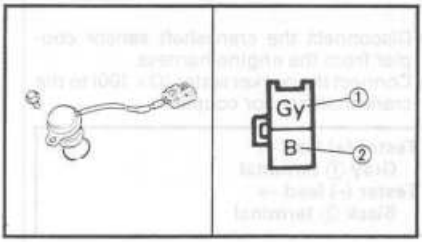


- Remove the camshaft sensor.
- Check for foreign matter on the mounting seat surface of the camshaft sensor.
- Check the front end of the camshaft sensor.
  Scratch, wear → Replace the camshaft sensor.
- Check the surface of the cam.
  Scratch → Replace the camshaft.
- Install the camshaft sensor.

Bolt (camshaft sensor)
10 Nm (1.0 m • kg, 7.2 ft • lb)

E-2-2 INSPECTION OF THE CAMSHAFT SENSOR UNIT

Measure the resistance of the camshaft sensor.



- Disconnect the camshaft sensor coupler from the engine harness.
- Connect the pocket tester (Ω × 100) to the camshaft sensor coupler.

Tester (+) lead →
Gray ① terminal
Tester (–) lead →
Black ② terminal

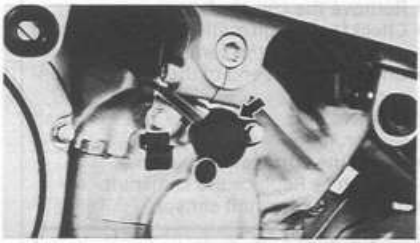
Check the camshaft sensor for specification resistance.

Camshaft sensor resistance:
120 ~ 180 Ω at 20°C (68°F)
(Gray – Black)

MEETS SPECIFICATION → CORRECT
OUT OF SPECIFICATION → Replace camshaft sensor.

E-2-3 INSPECTION FOR LOOSENESS IN THE MOUNTING OF CRANKSHAFT SENSOR/ PINCH OF FOREIGN MATTER

Inspect for looseness in the mounting of crankshaft sensor and pinch of foreign material.

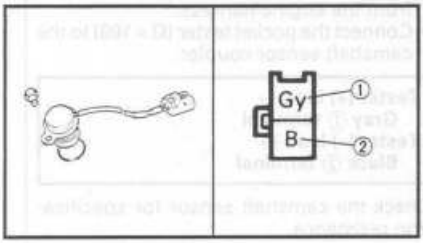


- Remove the crankshaft sensor.
- Check for foreign matter on the mounting seat surface of the crankshaft sensor.
- Check the front end of the crankshaft sensor.
  Scratch, wear → Replace the crankshaft sensor.
- Check the surface of the crank web.
  Scratch → Repair or replace the crankshaft.
- Install the crankshaft sensor.

Bolt (crankshaft sensor)
10 Nm (1.0 m · kg, 7.2 ft · lb)

E-2-4 INSPECTION OF THE CRANKSHAFT SENSOR UNIT

Measure the resistance of the crankshaft sensor.



- Disconnect the crankshaft sensor coupler from the engine harness.
- Connect the pocket tester (Ω × 100) to the crankshaft sensor coupler.

Tester (+) lead →
Gray ① terminal
Tester (–) lead →
Black ② terminal

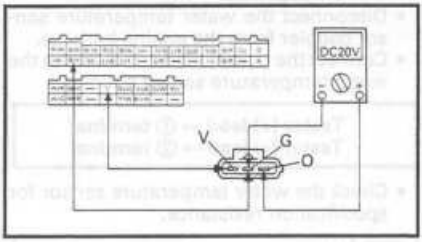
- Check the crankshaft sensor for specification resistance.

Crankshaft sensor resistance:
120 ~ 180 Ω at 20°C (68°F)
(Gray - Black)

MEETS SPECIFICATION → CORRECT
OUT OF SPECIFICATION → Replace crankshaft sensor.

E-2-5 INSPECTION OF INTAKE PRESSURE SENSOR UNIT

Measure the voltage of the intake pressure sensor.

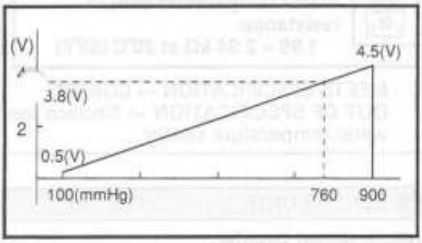


- Disconnect the intake pressure sensor coupler from the engine harness.
- Connect the ECU coupler and the intake pressure sensor.

ECU coupler:	Intake pressure sensor:
"Blue" terminal →	V terminal
"Black/Yellow" terminal →	G terminal

- Connect the pocket tester (DC 20V) to the intake pressure sensor.

Tester (+) lead → O terminal
Tester (–) lead → G terminal



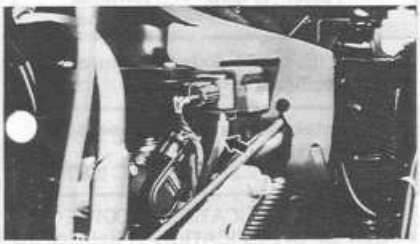
- Check the intake pressure sensor for specification voltage.

Example:
760 mmHg → Approximately 3.8 V

MEETS SPECIFICATIONS → CORRECT
OUT OF SPECIFICATION → Replace the intake pressure sensor.

E-2-6 INTAKE PRESSURE SENSOR HOSE

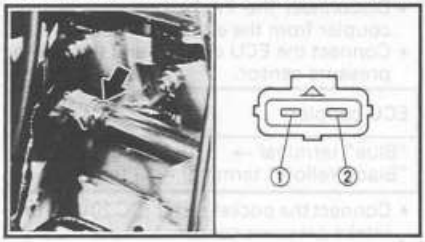
Check the intake pressure sensor hose.



- Check.
  Disconnect, pinch bending or clip position → Repair.
  Cut or holes → Replace.

E-2-7 INSPECTION OF WATER TEMPERATURE SENSOR UNIT.

Measure the resistance of the water temperature sensor coupler.



- Disconnect the water temperature sensor coupler from the engine harness.
- Connect the pocket tester (Ω × 100) to the water temperature sensor coupler.

Tester (+) lead → ① terminal
Tester (–) lead → ② terminal

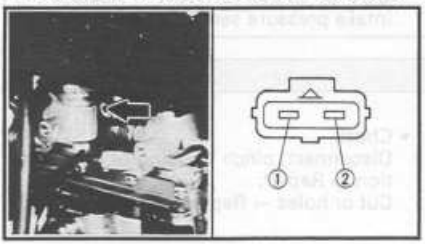
- Check the water temperature sensor for specification resistance.

Water temperature sensor resistance:
1.96 ~ 2.94 kΩ at 20°C (68°F)

MEETS SPECIFICATION → CORREC
OUT OF SPECIFICATION → Replace the water temperature sensor.

E-2-8 INSPECTION OF INTAKE TEMPERATURE SENSOR UNIT.

Measure the resistance of the intake air temperature sensor coupler.



- Disconnect the intake air temperature sensor coupler from the main harness.
- Connect the pocket tester (Ω × 100) to the intake air temperature sensor coupler.

Tester (+) lead → ① terminal
Tester (–) lead → ② terminal

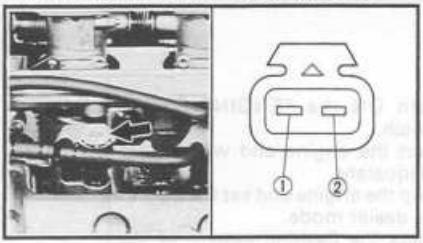
- Check the intake air temperature sensor for specification resistance.

Intake air temperature sensor resistance:
1.96 ~ 2.94 kΩ at 20°C (68°F)

MEETS SPECIFICATION → CORRECT.
OUT OF SPECIFICATION → Replace the intake air temperature sensor.

E-2-9	INSPECTION OF INJECTOR UNIT

Measure the resistance of the injector.



- Disconnect the injector coupler from the engine harness.
- Connect the pocket tester (Ω × 1) to the injector coupler.

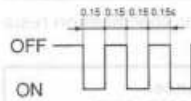
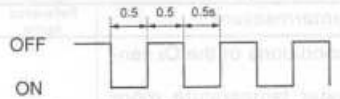
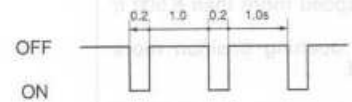
Tester (+) lead → ① terminal
Tester (–) lead → ② terminal

- Check the injector for specification resistance.

Injector resistance:
11 ~ 17 Ω at 20°C (68°F)

MEETS SPECIFICATION → CORRECT.
OUT OF SPECIFICATION → Replace the injector.

E-3	INSPECTION OF O_2 SENSOR	
Inspection item	Countermeasure	Reference items
Inspection of O_2 sensor • Fault in the O_2 sensor may be considered. Operate the engine under the conditions for the O_2 sensor failure detection. **NOTE:** In the actual running, the O_2 feedback compensation is applied in the high speed running and the O_2 sensor fault will be detected. All the conditions given on the ht must be satisfied during high speed running, such as on a highway. Therefore, if you turn the main switch ON, and start the engine, the O_2 sensor fault will not be detected in the idling condition.	Operating conditions of the O_2 sensor: • Engine water temperature more than 80°C. • Engine speed more than 6,500 r/min. • Throttle opening position more than half. **NOTE:** Keep the engine running in the state described above for more than 64 seconds. **CAUTION:** **Do not running the engine in no load condition. Apply a load with the cam drum, cool adequately (using air) and inspection.**	
	EFI warning light comes on → Turn OFF the "ENGINE STOP" switch and check in the dealer mode. EFI warning light does not come on → O_2 sensor is normal.	Fault code 24 or 31/32 (P II-58, 59)

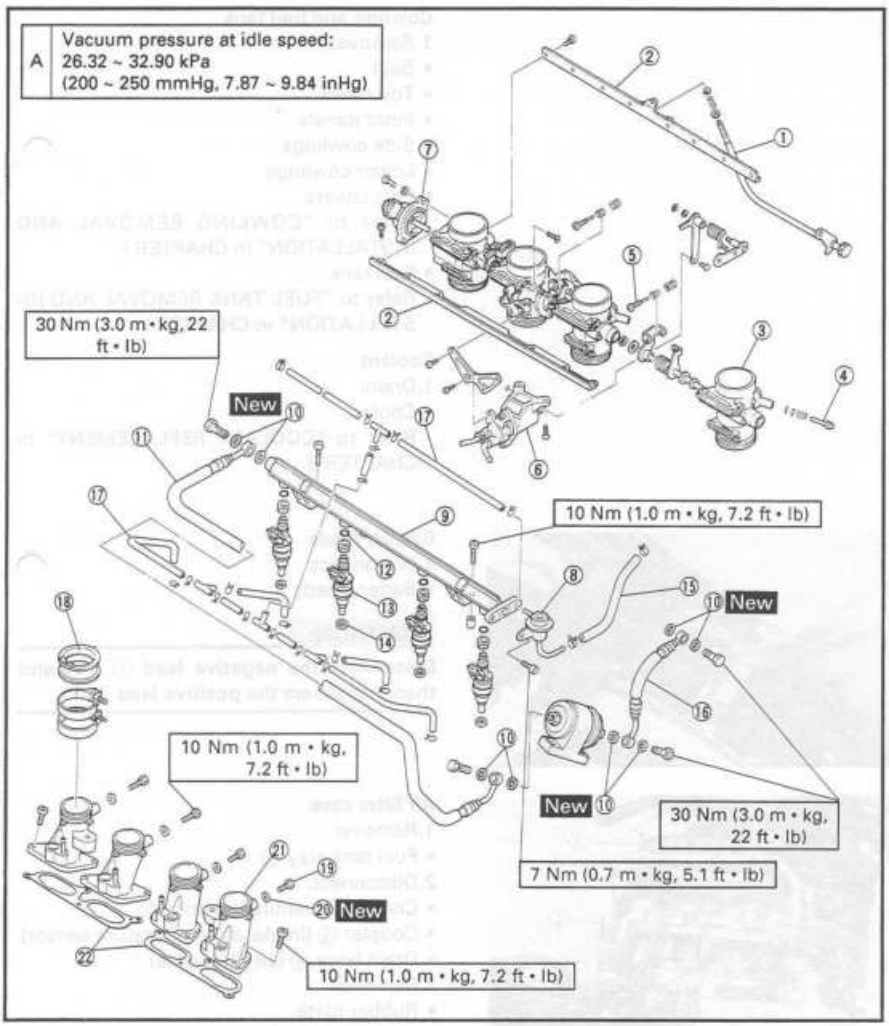
E-4	INSPECTION/ADJUSTMENT OF THROTTLE POSITION	
Inspection item	Countermeasure	Reference items
Set the ECU in the dealer mode when the engine is cold. • Check the flashing pattern of the EFI warning light. HI code is being output.  **NOTE:** Throttle sensor is operating normally.	• Turn ON the "ENGINE STOP" switch. • Start the engine and warm it up adequately. • Stop the engine and set the ECU in the dealer mode. • Check the flashing pattern of the EFI warning light. Normal code output → Throttle position is correct. HI or LO code output → Loosen the screw of the throttle sensor and adjust it so that normal code is output.	"Throttle sensor (P II-36)
• Normal code is being output  • Or LO code is being output.  **NOTE:** Throttle sensor is abnormal or the throttle position has shifted.	• Turn ON the "ENGINE STOP" switch. • Start the engine and warm it up adequately. • Stop the engine and set the ECU in the dealer mode. • Check the flashing pattern of the "EFI" warning light. a. Normal code output → Throttle position is correct. Check the mounting condition of the throttle sensor in the diagnosis mode. b. Output of HI or LO code → Loosen the bolts of the throttle sensor and adjust it so that normal code output. Check the mounting condition of the throttle sensor in the diagnosis mode.	Diagnosis code 5 (P II-61) "Throttle sensor" (P II-36) Diagnosis code 5 (P II-61)

E-5	HAVE ALL THE FAULTS CONDITION BEEN CORRECTED?
• All faults have been corrected →	• Pull out the test coupler adapter from the test coupler or disconnect the T terminal (P/B - B). • End.
• Faults remain →	• Return to B block and inspect according to the flow chart.

SERVICE OF COMPONENTS

FUEL INJECTOR

① Idle speed adjusting cable
② Connecting plates
③ Throttle body
④ Air screw
⑤ Adjusting screw
⑥ Fast idle unit
⑦ Throttle sensor
⑧ Pressure regulator
⑨ Fuel distributor
⑩ Aluminium washer
⑪ Fuel delivery hose #2
⑫ O-ring
⑬ Fuel injector
⑭ Seal
⑮ Fuel return hose
⑯ Fuel delivery hose #1
⑰ Pulser hose
⑱ Air intake joints
⑲ Vacuum check bolt
⑳ Gasket
㉑ Intake ducts
㉒ Gasket



Removal

⚠ WARNING

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

1. Place the motorcycle on the centerstand.

Cowling and fuel tank

1. Remove:
- Seat
- Top cover
- Inner panels
- Side cowlings
- Lower cowlings
- Side covers

Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.

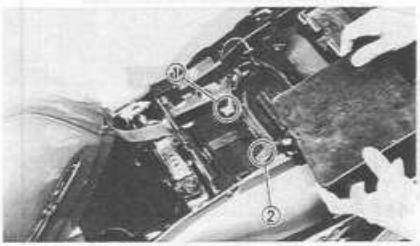
- Fuel tank

Refer to "FUEL TANK REMOVAL AND INSTALLATION" in CHAPTER I.

Coolant

1. Drain:
- Coolant

Refer to "COOLANT REPLACEMENT" in CHAPTER 3.

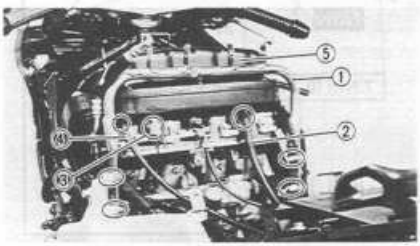


Battery leads

1. Disconnect:
- Battery leads

CAUTION:

Disconnect the negative lead ① first and then disconnect the positive lead ②.



Air filter case

1. Remove:
- Fuel tank stay ①

2. Disconnect:
- Crankcase ventilation hose ②
- Coupler ③ (intake air temperature sensor)
- Drain hose ④ (air filter case)

3. Remove:
- Rubber plate
- Air filter case ⑤



Rubber baffle

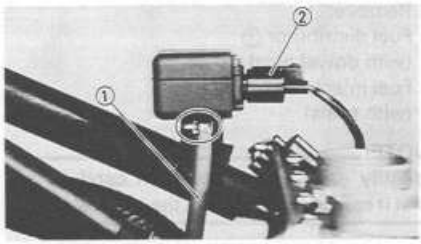
1. Remove:
- Rubber baffle ① (left and right)





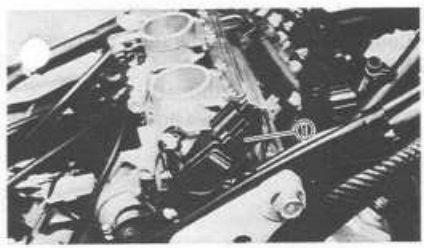
Cable and hoses

1. Disconnect:
- Idle speed adjuster cable ①
- Throttle cables ②

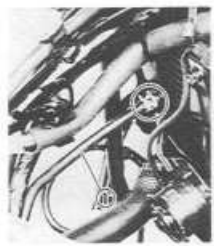


2. Disconnect:
- Pulser hose ① (pressure sensor)
- Coupler ② (pressure sensor)

3. Remove:
- Pressure sensor



4. Disconnect:
- Coupler ① (throttle sensor)





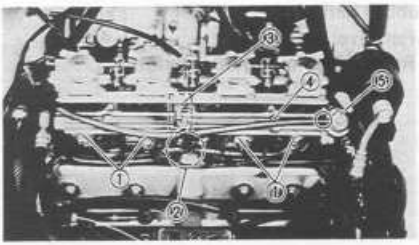
5. Disconnect:
- Hose ① (from fast idle unit)
- Fuel delivery hose ② (from fuel distributor) (with gaskets)

⚠ WARNING

Gasoline is highly flammable.
Avoid spilling fuel on the hot engine.

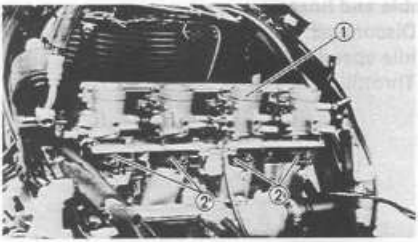
NOTE:

Place a rag under the fuel delivery hose ② to avoid spilling fuel.

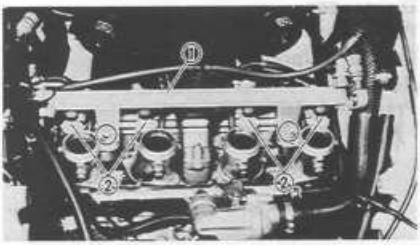


Injector assembly

1. Disconnect:
   - Couplers ① (injector)
   - Hoses ②
     (from fast idle unit ③)
   - Pulser hose ④
     (from pressure regulator ⑤)

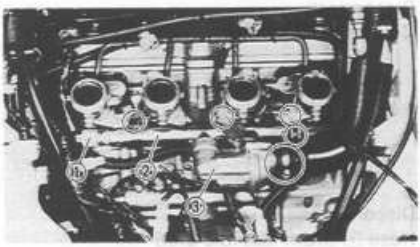


2. Remove:
   - Throttle body assembly ①
   - Air intake joints ②

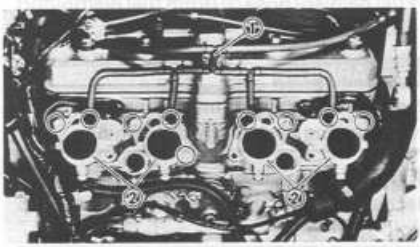


3. Remove:
   - Fuel distributor ①
     (with dowel pins)
   - Fuel injectors ②
     (with seals)

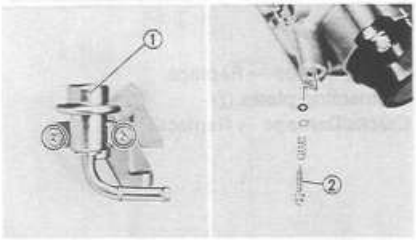
NOTE:
Identify each injector position carefully so that it can be reinstalled in the original place.



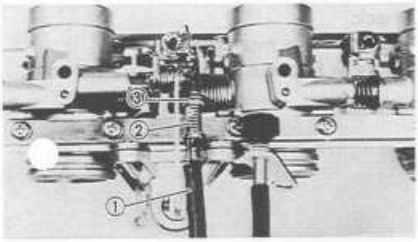
4. Disconnect:
   - Coupler ① (water temperature sensor)
5. Remove:
   - Coolant collector ② (outlet)
     (with thermostatic valve housing ③ and O-rings)



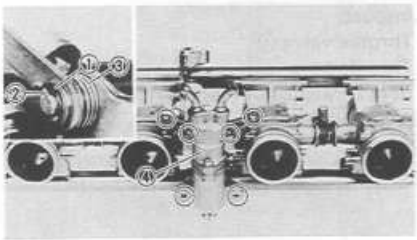
6. Disconnect:
   - Pulser hoses ① (from intake ducts)
7. Remove:
   - Intake ducts ②
   - Gaskets (intake duct)



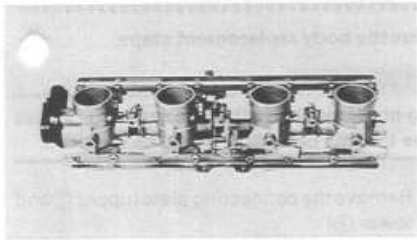
8. Remove:
- Pressure regulator ①
  (with O-ring)
- Air screws ②
  (with O-ring, washer and spring)



9. Remove:
- Idle speed adjusting cable ①
- Spring ②
- Washer ③



10. Remove:
- Circlip ①
- Washer ②
- Spring ③
- Fast idle unit ④



Inspection

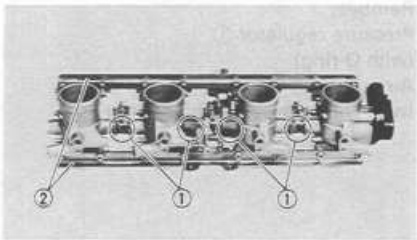
Throttle body assembly

1. Inspect:
- Throttle body
  Cracks/Damage → Replace complete throttle body
- Air passage
  Contamination → Clean as indicated.

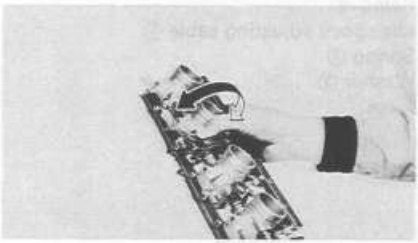
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Cleaning steps:
- Wash throttle body in petroleum based solvent. (Do not use any caustic carburetor cleaning solution.)
- Blow out all passages and air screws with compressed air.

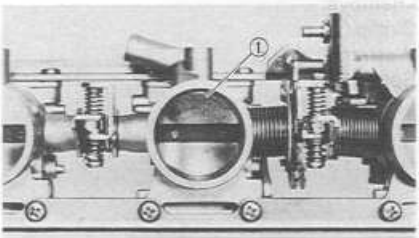
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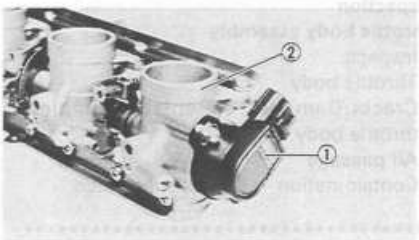
2. Inspect:
- Springs ①
  Wear/Damage → Replace.
- Connecting plates ②
  Cracks/Damage → Replace.



3. Check:
- Throttle valve movement
  Sticky → Replace complete throttle body.



4. Inspect:
- Throttle valve ①
- Throttle bore
  Bent/Scratches/Damage → Replace complete throttle body.



****

Throttle body replacement steps:

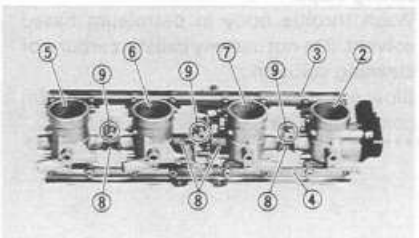
CAUTION:

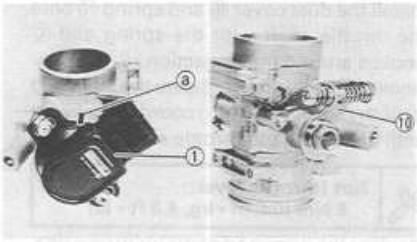
Do not remove the throttle sensor ① unless the throttle body #4 ② must be replaced.

- Remove the connecting plate (upper ③ and lower ④)
- Separate the throttle body (#1 ⑤, #2 ⑥, #3 ⑦ and #4 ②) and remove the springs ⑧.

NOTE:

Be careful not to loose the springs ⑨.





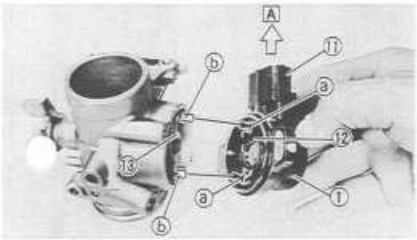
Throttle body #4 replacement steps:

a. Remove the throttle sensor ① and throttle lever ⑩.

b. Put marks ⓐ on the throttle sensor body and throttle body before removing so that the throttle sensor can be reinstalled in the original position.

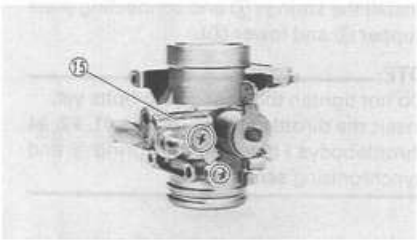
c. Install the throttle lever ⑩ onto the new throttle body.

	Throttle lever: **6 Nm (0.6 m • kg, 4.3 ft • lb)**



d. Close the throttle valve completely and install the throttle sensor ①, coupler ⑪ facing the front A and flat sides ⓐ of the sensor lever ⑫ against the projections ⓑ on the throttle shaft ⑬.

e. Temporary tighten the throttle sensor bolts.



Throttle body #2 replacement steps:

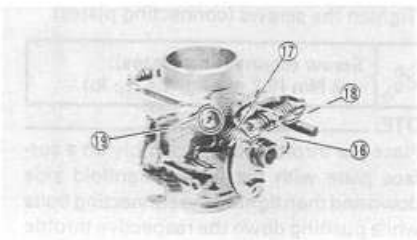
a. Remove the throttle lever ⑭, fast idle lever bracket ⑮.

b. Install the fast idle lever bracket ⑮ onto new throttle body.

	Screw (fast idle lever bracket): **3.5 Nm (0.35 m • kg, 2.5 ft • lb)** **LOCTITE®**

c. Install the throttle lever ⑭ onto new throttle body.



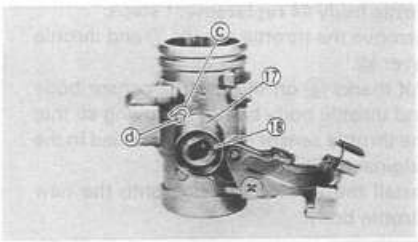


Throttle body #3 replacement steps:

a. Remove the throttle lever ⑯, spring ⑰, dust cover ⑱ and throttle cable bracket ⑲.

b. Install the throttle cable bracket ⑲ onto new throttle body.

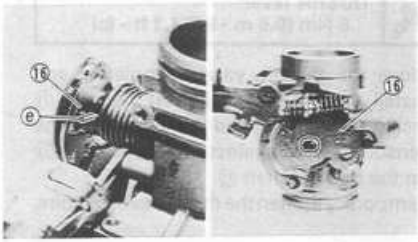
	Screw (throttle cable bracket): **3.5 Nm (0.35 m • kg, 2.5 ft • lb)** **LOCTITE®**

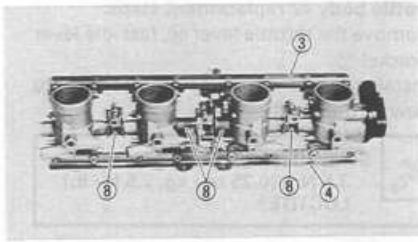


c. Install the dust cover ⑱ and spring ⑰ onto the throttle shaft with the spring end ⓒ hooked around the projection ⓓ.
d. Hook the throttle lever ⑯ onto the other end ⓔ of the spring and turn counterclockwise until it fits onto the throttle shaft.

	Nut (throttle lever): 6 Nm (0.6 m • kg, 4.3 ft • lb)

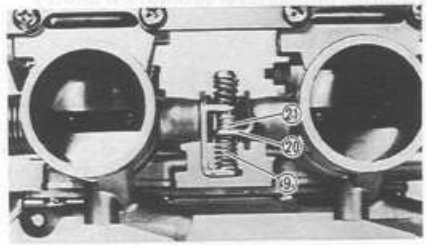
- Replace the damaged part(s) with new one.

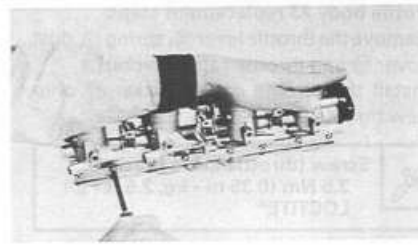




- Install the springs ⑧ and connecting plate (upper ③ and lower ④).

NOTE:
- Do not tighten the connecting bolts yet.
- Insert the throttle arm ㉑ (on the #1, #2, #4 throttlebodys.) between the spring ⑨ and synchronizing screw ㉑.

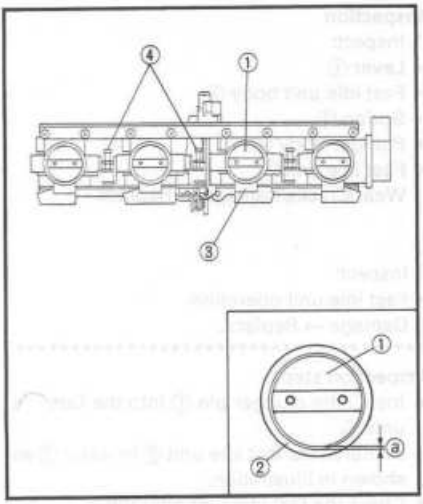




- Tighten the screws (connecting plates).

	Screw (connecting plates): 2 Nm (0.2 m • kg, 1.4 ft • lb)

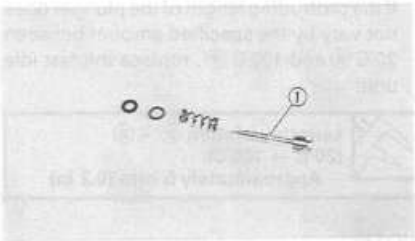
NOTE:
- Place the throttle body assembly on a surface plate with the intake manifold side down and then tighten the connecting bolts while pushing down the respective throttle body with an even force.



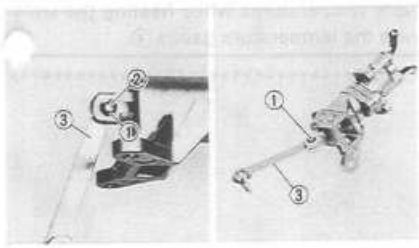
- After tightening, check the throttle lever for smooth action.

- Compare the clearance ⓐ between throttle valve ① and throttle body ② using throttle body #3 ③ as reference.
- Adjust the position of the three throttle valves at the adjusting screw ④ until their clearance matches that of throttle body #3 ③.

Turning in	**→Closes the throttle valve.**
Turning out	**→Opens the throttle valve.**

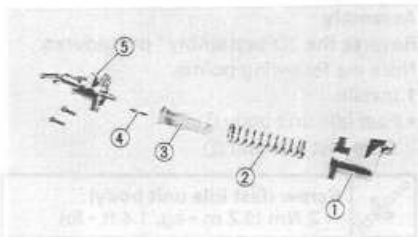


5. Inspect:
- Air screw ①
  Scratches/Wear/Damage → Replace.



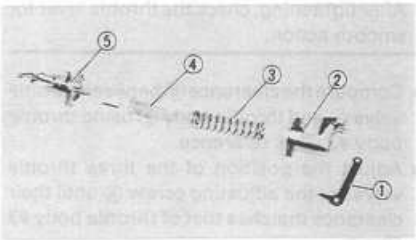
Fast idle unit

NOTE:
If diagnosis code 5 is output, disassembly and inspection of the fast idle unit, is required as follows



Disassembly
1. Remove:
- Circlip ①
- Pin ②
- Lever ③

2. Remove:
- Fast idle unit body ①
- Spring ②
- Plunger body ③
- Plunger pin ④
- Fast idle unit ⑤



Inspection

1. Inspect:
- Lever ①
- Fast idle unit body ②
- Spring ③
- Plunger body ④
- Fast idle unit ⑤

Wear/Cracks/Damage → Replace.

2. Inspect:
- Fast idle unit operation

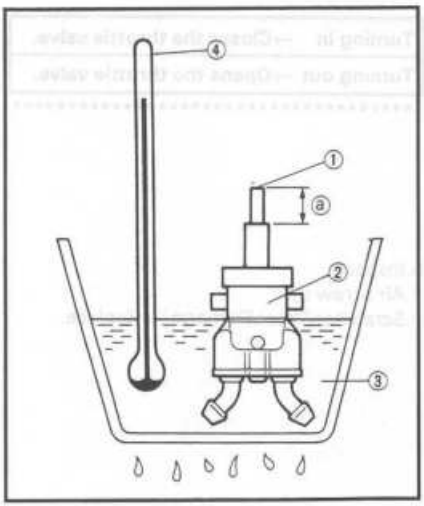
Damage → Replace.

****

Inspection steps:

- Install the plunger pin ① into the fast idle unit ②.
- Immerse the fast idle unit ② in water ③ as shown in illustration.
- Check the fast idle unit operation.

If the protruding length of the plunger does not vary by the specified amount between 20°C ⓐ and 100°C ⓐ', replace the fast idle unit.

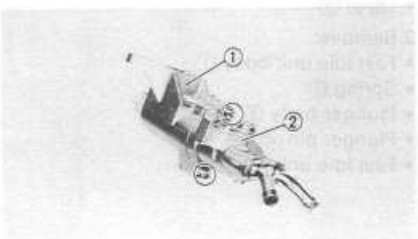


Length variation ⓐ' – ⓐ (20°C → 100°C): Approximately 5 mm (0.2 in)

NOTE:

Note temperatures while heating the water with the temperature gauge ④.

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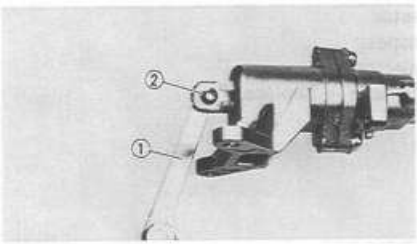
Assembly

Reverse the "Disassembly" procedures.
Note the following points.

1. Install:
- Fast idle unit body ①

Onto fast idle unit ②

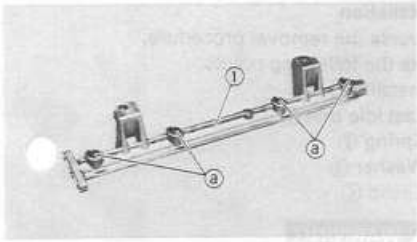
Screw (fast idle unit body): 2 Nm (0.2 m • kg, 1.4 ft • lb)



2. Install:
- Lever ①
- Circlips ②

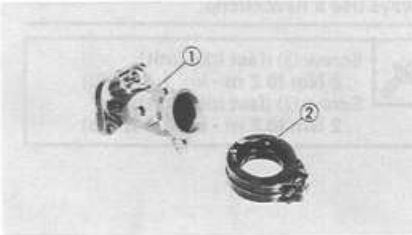
⚠ WARNING

Always use a new circlips.



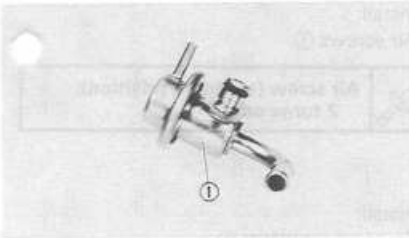
Fuel distributor

1. Inspect:
- Fuel distributor ①
  Cracks/Damage → Replace.
  Contamination → Clean with mild solvent.
- Injector seat ⓐ
  Scratches/Wear/Damage → Replace.



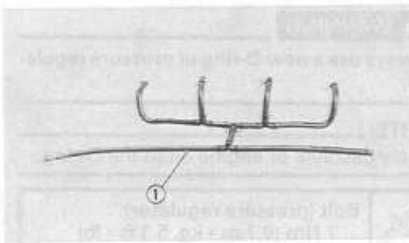
Intake duct and air intake joint

1. Inspect:
- Intake duct ①
  Cracks/Damage → Replace.
- Air intake joint ②
  Wear/Cracks/Damage → Replace.

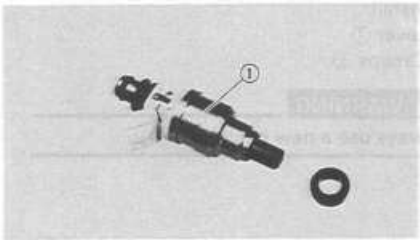


Pressure regulator and pulser hose

1. Inspect:
- Pressure regulator ①
  Damage → Replace:
  Refer to "PRESSURE REGULATOR" (P II-90)

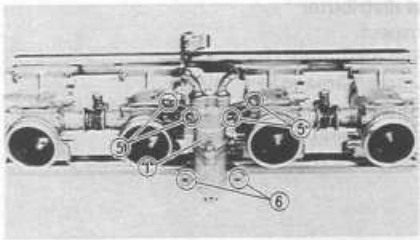


2. Inspect:
- Pulser hose ①
  Wear/Cracks/Damage → Replace.



Injector

1. Inspect:
- Injector ①
  Damage → Replace.



Installation

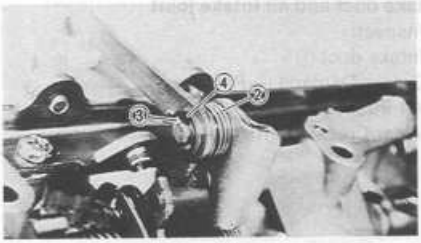
Reverse the removal procedure.
Note the following points.

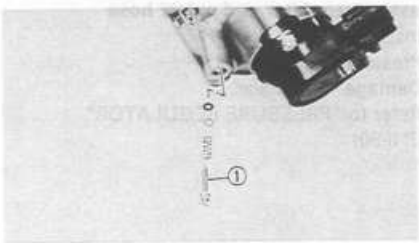
1. Install:
- Fast idle unit ①
- Spring ②
- Washer ③
- Circlip ④

⚠ WARNING

Always use a new circlip.

	Screw ⑤ (fast idle unit): 2 Nm (0.2 m • kg, 1.4 ft • lb) **Screw ⑥ (fast idle unit): 2 Nm (0.2 m • kg, 1.4 ft • lb)**

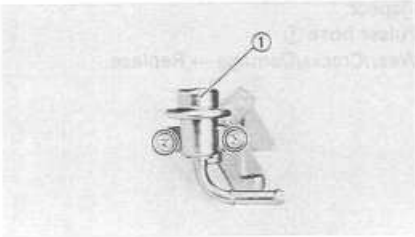




2. Install:
- Air screws ①

	Air screw (standard position): 2 turns out

3. Install:
- Pressure regulator ①



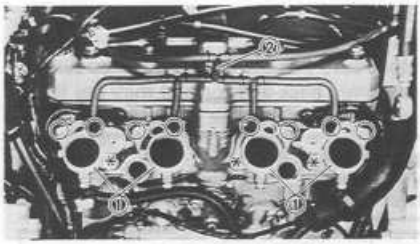
⚠ WARNING

Always use a new O-ring of pressure regulator.

NOTE:

Apply gasoline or engine oil to the O-ring.

	Bolt (pressure regulator): 7 Nm (0.7 m • kg, 5.1 ft • lb)



4. Install:
- Gaskets (intake duct)
- Dowel pins
- Intake ducts ①

⚠ WARNING

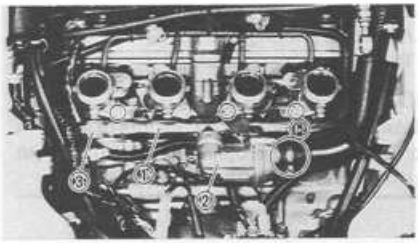
Always use new gaskets (intake duct).

NOTE:

Do not install the bolts at places marked "*" in this stage.

	Bolt (intake duct): 10 Nm (1.0 m • kg, 7.2 ft • lb)

5. Connect:
- Pulser hoses ②
(to intake ducts)



6. Install:
- Coolant collector ① (outlet)
(with O-rings and thermostat housing ②)

NOTE:

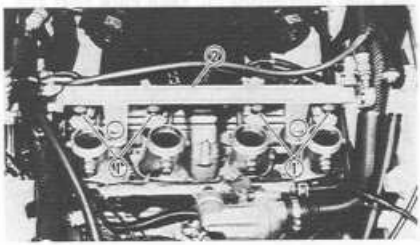
Apply engine oil to the O-rings of the coolant collector.

⚠ WARNING

Always use a new O-ring.

	Bolt (coolant collector): 10 Nm (1.0 m • kg, 7.2 ft • lb)

7. Connect:
- Coupler ③ (water temperature sensor)



8. Install:
- Fuel injectors ①
(with seal and O-ring)
- Fuel distributor ②
(with dowel pins)

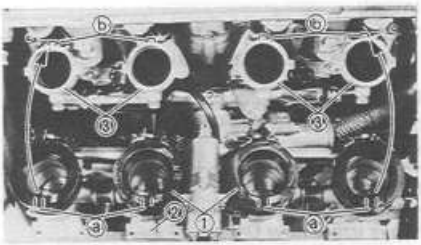
NOTE:
- Apply gasoline or engine oil to the O-ring and injector seals.

- Be sure to reinstall each injector in the original place.
- Make sure that the injectors can be turned smoothly back and forth. If they are tight, check the seal and the injector position.

⚠ WARNING

Always use new seal and O-ring.

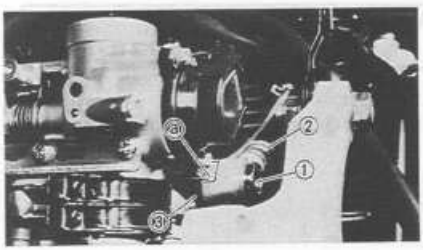
	Bolt (fuel distributor): 10 Nm (1.0 m • kg, 7.2 ft • lb)



9. Install:
- Air intake joints ①
- Throttle body assembly ②

NOTE:

Make sure the slots ⓐ on the intake joints fit correctly over the projections ⓑ on the intake ducts ③ and on the throttle body ②.

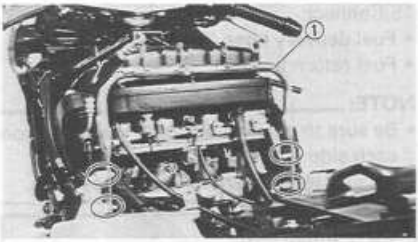


10. Tighten:
- Union bolt ①
  (with copper washer)

	Union bolt: 30 Nm (3.0 m • kg, 22 ft • lb)

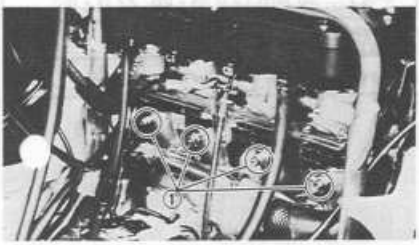
⚠ WARNING

- **Always use a new copper washer.**
- **When installing the fuel delivery hose ② on the fuel distributor ③, take care that the pipe touches the projection ⓐ as shown.**

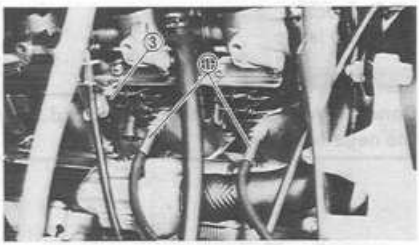


11. Install:
- Fuel tank stay ①

	Bolt/Nut (fuel tank stay): 20 Nm (2.0 m • kg, 14 ft • lb)



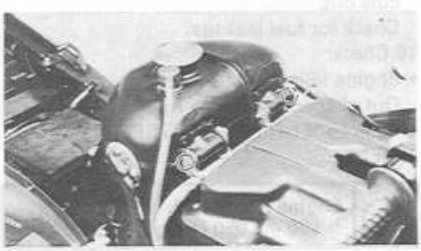
12. Remove:
- Vacuum check bolts ① (with gasket)



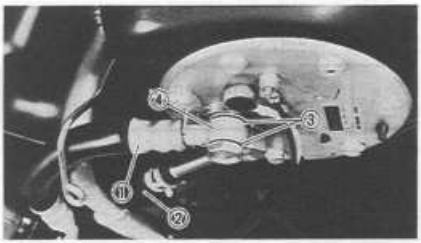
13. Attach:
- Inductive tachometer (to #1 spark plug lead)
- Adapters ①
- Vacuum gauge ②

	Inductive tachometer: YU-08036-A/90890-03113 **Adapter: YM-03060/90890-03060** **Vacuum gauge: YU-08030-A/90890-03094**





14. Install the fuel tank and secure it provisionally with one of the fuel tank stay bolts.



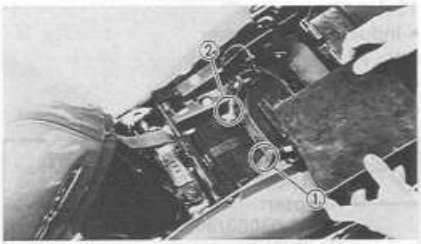
15. Connect:
- Fuel delivery hose ①
- Fuel return hose ②

NOTE:
- Be sure to place one copper washers ③ on each side of the hose fitting ④.
- Be sure to reinstall the return hose clip.

	Union bolt: 30 Nm (3.0 m • kg, 22 ft • lb)

⚠ WARNING

Always use new copper washers.



16. Connect:
- Battery leads

CAUTION:

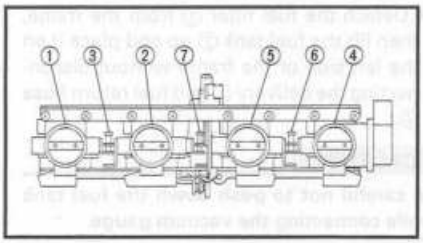
Connect the positive lead ① first and then the negative lead ②.

17. Fill:
- Cooling system
  Refer to "COOLANT LEVEL INSPECTION" in CHAPTER 3.

	Total amount: 2.3 L (2.0 Imp qt, 2.4 US qt)

18. Start the engine and let it warm up for several minutes until the fast idling system cuts out.
    Check for fuel leakage.
19. Check:
- Engine idling speed
  Out of specification → Adjust.
  Refer to "ENGINE IDLING SPEED ADJUSTMENT".

	Engine idle speed: 950 ~ 1,050 r/min



20. Adjust
- Throttle body synchronization.

****

Adjustment steps:

NOTE:
- Valve clearance should be adjusted properly before synchronizing.
- Synchronization is only required if the throttle body has been disassembled

- Synchronize throttle body #1 ① to throttle body #2 ② by turning adjusting screw ③ until both gauges read the same.
- Race the engine for less than a second, two or three times and check the synchronization again.
- Repeat the above steps to synchronize throttle body #4 ④ to throttle body #3 ⑤ by turning adjusting screw ⑥ until both gauges read the same.
- Repeat the same steps to synchronize throttle body #2 ② to carburetor #3 ⑤ by turning adjusting screw ⑦ until both gauges read the same.

Vacuum pressure at idle speed:
26.32 ~ 32.90 kPa
(200 ~ 250 mm Hg, 7.89 ~ 9.84 in Hg)

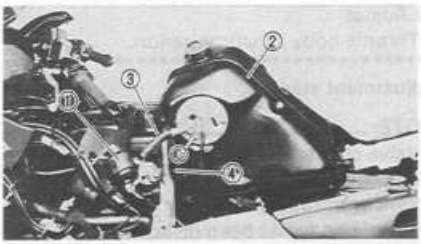
NOTE:
The difference between both throttle bodys should be 1.33 kPa (10 mm Hg, 0.4 in Hg) or less.

****

21. Check:
- Engine idling speed
  Out of specification → Adjust.
  Refer to "IDLE SPEED ADJUSTMENT" in CHAPTER 3.

Idle speed:
950 ~ 1,050 r/min

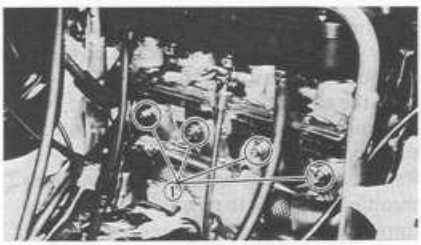
22. Stop the engine and detach the measuring equipment.
23. Remove:
- Fuel tank mounting bolts



24. Detach the fuel filter ① from the frame, then lift the fuel tank ② up and place it on the left side of the frame without disconnecting the delivery ③ and fuel return hose ④.

CAUTION:

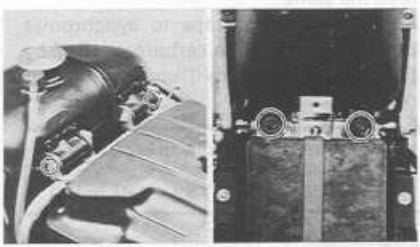
Be careful not to push down the fuel tank while connecting the vacuum gauge.



25. Install:
- Vacuum check bolts ①
  (with gasket)

CAUTION:

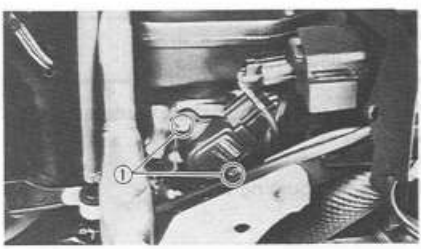
Always use new gaskets.



26. Install:
- Fuel tank
  Refer to "FUEL TANK REMOVAL AND INSTALLATION" in CHAPTER I.

	Bolt ① (front): **23 Nm (2.3 m • kg, 17 ft • lb)** **Bolt ② (rear):** **16 Nm (1.6 m • kg, 11 ft • lb)**

27. Adjust:
- Throttle sensor position
  Refer to "Method of checking the installed position of the throttle sensor". (P II-36)



28. Tighten:
- Bolts ① (throttle sensor)

	Bolts (throttle sensor): **2 Nm (0.2 m • kg, 1.4 ft • lb)**

29. Install:
- Side covers
- Lower cowlings
- Side cowlings
- Inner panels
- Top cover
- Seat

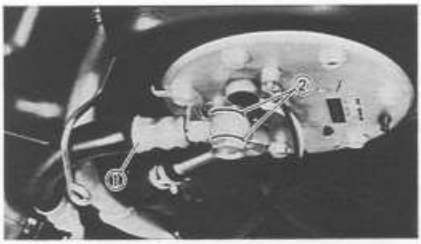
Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.

PRESSURE REGULATOR

Inspection

1. Place the motorcycle on the centerstand.
2. Remove:
   - Seat
   - Top cover
   - Inner panels
   - Side cowlings

   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
3. Inspect:
   - Fuel pump
     Damage → Replace.
   - Fuel filter
     Refer to "FUEL PUMP SYSTEM" in CHAPTER 7.
   - Fuel return hose
     Clogged/Damage → Replace.
   - Pulser hose
   - Fuel delivery hose
   - Fuel distributor
     Cracks/Wear/Damage → Replace.
     Loose connect → correct.
     Refer to "Fuel distributor".
   - Injector seals
     Wear/Damage → Replace.
     Refer to "Injector assembly".



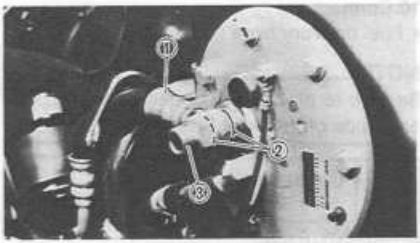
4. Disconnect:
   - Fuel delivery hose ①
     (with copper washers ②)

⚠ WARNING

Gasoline is highly flammable.
Avoid spilling fuel on the hot engine.

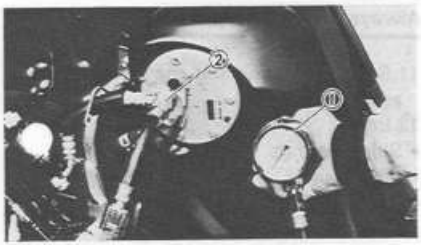
NOTE:

Place rag under the fuel delivery hose to avoid spilling fuel.



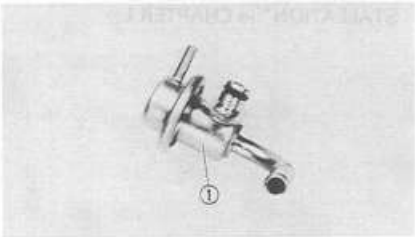
5. Connect:
- Fuel delivery hose ①
(with copper washers ② and adapter ③)

	Adapter: 90890-03151
	Adapter: 30 Nm (3.0 m • kg, 22 ft • lb)



6. Attach:
- Pressure gauge ①
(to adapter ②)

	Pressure gauge: 90890-03153

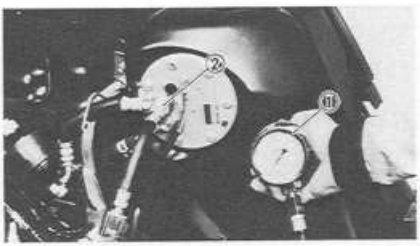


7. Start the engine and let it warm up until the fast idle system cuts out. Let the engine run at the specified speed.

	Engine speed: 950 ~ 1,050 r/min

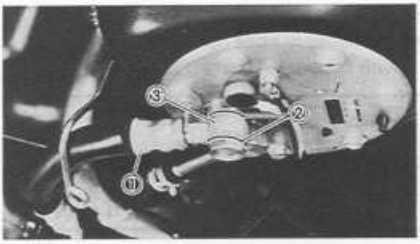
8. Read the gauge at the compression gauge stabilizes.
If pressure falls bellow the specified pressure → Replace pressure regulator ①.

Fuel pressure (at sea level): 220 kPa (2.2 kg/cm², 31.3 psi)



9. Remove:
- Pressure gauge ①
- Adapter ②

NOTE:
Place rag under the fuel delivery hose to avoid spilling fuel.



10. Connect:
- Fuel delivery hose ①

NOTE:
Be sure to place one copper washers ② on each side of the hose fitting ③.

Union bolt:
30 Nm (3.0 m • kg, 22 ft • lb)

⚠ WARNING
Always use new copper washers.

11. Start the engine and check the fuel leakage.
12. Install:
- Side cowlings
- Inner panels
- Top cover
- Seat

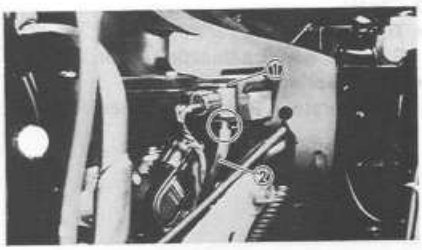
Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.

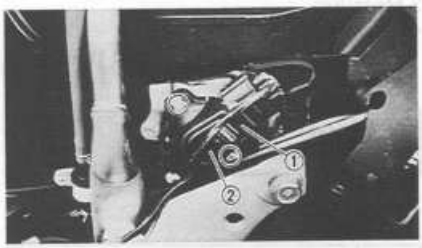
THROTTLE SENSOR

Removal

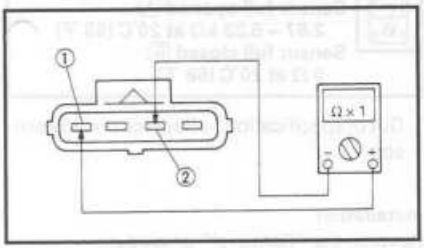
1. Place the motorcycle on the centerstand.
2. Remove:
   - Seat
   - Top cover
   - Inner panel (left)
   - Side cowling (left)

   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
3. Disconnect:
   - Pressure sensor ①
     (from bracket)
   - Pulser hose ②
     (from pressure sensor)





4. Disconnect:
   - Coupler ① (throttle sensor ②)

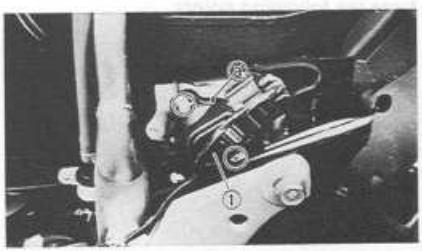


5. Measure:
   - Throttle sensor resistance.

   Connect the pocket tester (Ω × 100) to the sensor terminals.

Tester (+) lead → ① terminal Tester (–) lead → ② terminal
Sensor full opened: **2.62 ~ 3.94 kΩ at 20°C (68°F)** **Sensor full closed:** **0.39 ~ 0.59 kΩ 20°C (68°F)**

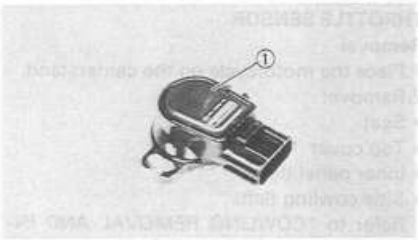
Out of specification → Replace throttle sensor.



6. Remove:
   - Throttle sensor ①

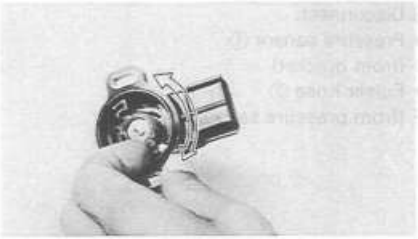
NOTE:

Put marks ⓐ on the throttle sensor body and throttle body before removing so that the throttle sensor can be reinstalled in the original position.

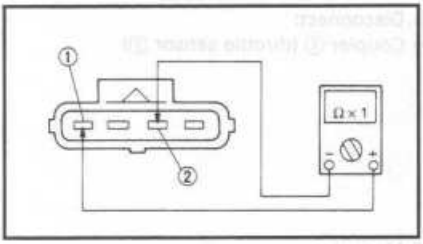


Inspection

1. Inspect:
- Throttle sensor ①
  Cracks/Damage → Replace.

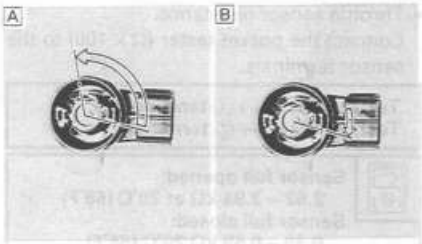


2. Check:
- Throttle sensor lever mivement
  Sticky → Replace throttle sensor.
- Return spring operation
  Not operate → Repair or replace.



3. Measure:
- Throttle sensor resistance.
  Connect the pocket tester (Ω × 100) to the sensor terminals.

Tester (+) lead → ① Terminal
Tester (–) lead → ② Terminal



Sensor full opened A:
2.87 ~ 5.33 kΩ at 20°C (68 °F)
Sensor full closed B:
0 Ω at 20°C (68 °F)

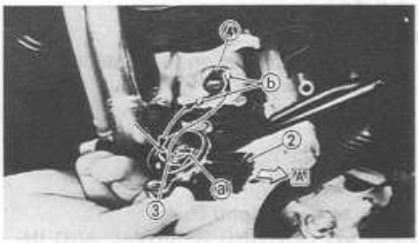
Out of specification → Replace throttle sensor



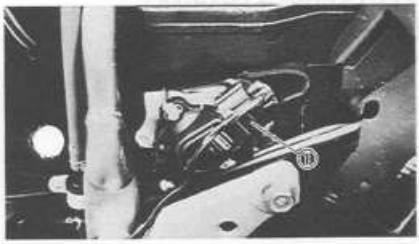
Installation

Reverse the "Removal" procedure.
Note the following points.

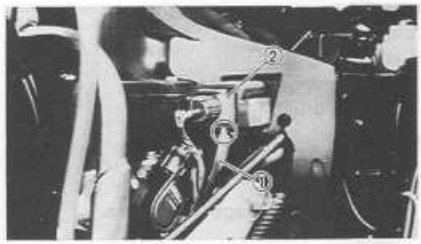
1. Instal:
- Throttle sensor ①



NOTE:
- Close the throttle valve completely and install the throttle sensor ①, coupler ② facing the front A and flat sides ⓐ of the sensor lever ③ against the projections ⓑ on the throttle shaft ④.
- Temporary tighten the throttle sensor bolts.

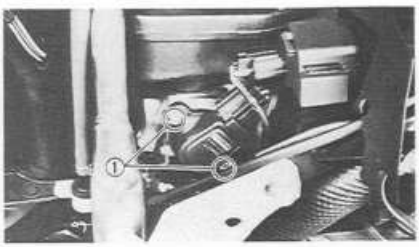


2. Connect:
- Coupler ① (throttle sensor)



3. Connect
- Pulser hose ①
  (to pressure sensor)
- Pressure sensor ②
  (to bracket)

4. Adjust:
- Throttle sensor position
  Refer to "Method of checking the Installed Position of the throttle sensor" (P II-36).



5. Tighten
- Bolts ① (throttle sensor)

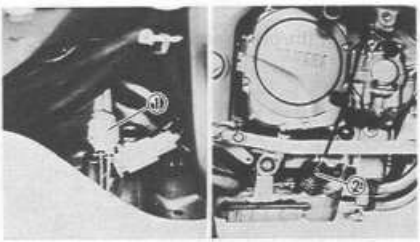
	Bolt (throttle sensor): **2 Nm (0.2 m • kg, 1.4 ft • lb)**

O_2 SENSOR

Removal

1. Place the motorcycle on the centerstand.
2. Remove:
   - Seat
   - Top cover
   - Inner panels
   - Side cowling (right)
   - Lower cowling (right)

   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
3. Disconnect:
   - Coupler ① (O_2 sensor)
4. Remove:
   - O_2 sensor ②

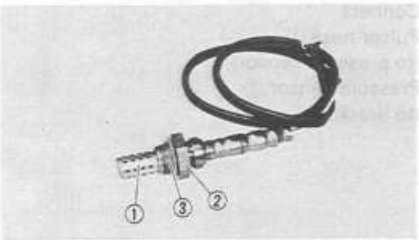


Inspection

1. Eliminate:
   - Carbon deposit (from sensor protector ①)

   Use wire brush
2. Inspect:
   - O_2 sensor ②
   - Gasket ③

   Cracks/Wear/Damage → Replace.



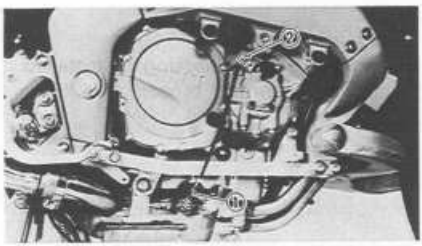
Installation

Reverse the removal procedure.
Note the following points.

1. Install
   - O_2 sensor ①

	O_2 sensor: 40 Nm (4 m • kg, 29 ft • lb)

2. Hold the O_2 sensor lead with the clamp ②.



ABS

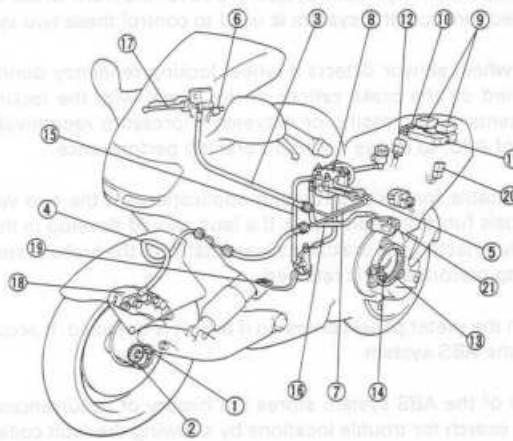
ANTI-LOCK BRAKE SYSTEM (ABS)

NAMES OF COMPONENTS AND LAYOUT

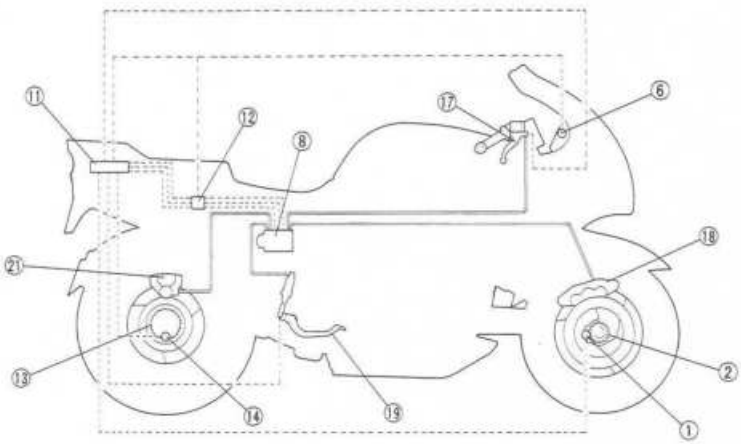
① Front wheel sensor
② Front sensor rotor
③ Brake hose #1
④ Brake hose #2
⑤ Brake pipe #1
⑥ ABS warning light
⑦ Brake pipe #2
⑧ Hydraulic unit (HU)
⑨ Fuse
⑩ ABS test coupler
⑪ Electronic control unit (ECU)
⑫ Fail safe relay
⑬ Rear sensor rotor
⑭ Rear wheel sensor
⑮ Brake hose #3
⑯ Brake hose #4
⑰ Front brake lever
⑱ Front brake caliper
⑲ Rear brake pedal
⑳ Brake light relay
㉑ Rear brake caliper
Ⓐ Parts layout diagram
Ⓑ Circuit diagrams

=: Brake oil circuit
–: Electric circuit

Ⓐ



Ⓑ



OUTLINE OF ABS

The friction between the tire and road surface reduces abruptly when the wheel locks due to hard braking. If the front wheel locks, the steering ability decreases. If the rear wheel locks, the directional stability of the motorcycle decreases.

The YAMAHA Anti-lock Brake System (ABS) detects and controls the wheel locking tendency during the braking of the motorcycle under various road and weather conditions.

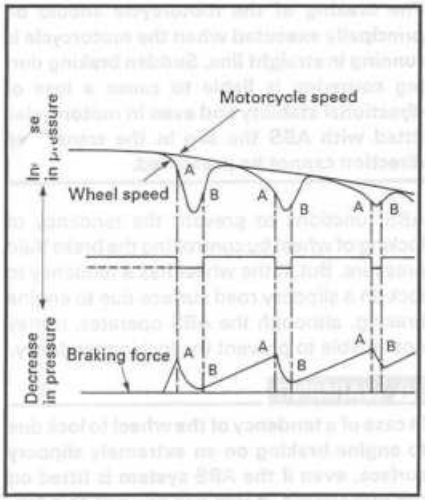
The braking operation is identical to that of a conventional motorcycle. The brake lever is used for applying the brake on the front wheel, and the brake pedal for applying the brake on the rear wheel. There are two independent hydraulic systems, one for the front wheel and one for the rear wheel. The latest electronic control system is used to control these two systems.

When the front or rear wheel sensor detects a wheel locking tendency during braking, the hydraulic pressure applied on the brake caliper of the wheel with the locking tendency is controlled (fine adjustments by increasing or decreasing pressure repetitively) by the ECU (electronic control unit) of ABS, to derive optimum braking performance.

The control system is suitable for various running applications of the two wheeler. Also, a sophisticated self diagnosis function is provided. If a fault should develop in the ABS system, the fault status is correctly detected, the braking characteristics of the brake system are restored to normal and the braking performance is retained.

The ABS warning light in the meter panel comes on if a fault is detected. It accurately informs the rider about faults in the ABS system.

The memory in the ECU of the ABS system stores the history of occurrences of faults. It is designed to assist in the search for trouble locations by showing the fault codes.



WHEEL SLIP AND HYDRAULIC PRESSURE CONTROL

The ABS computer calculates the different wheel speeds based on the rotation signals received from the front and rear wheel sensors. The computer calculates the motorcycle running speed, and deceleration rate of the wheel based on the wheel speed.

The difference between the calculated running speed and wheel speed of each wheel corresponds to the slip of the wheel.

When the wheel tends to lock, the deceleration rate of the wheel is increased rapidly.

When the magnitude of slip and the wheel deceleration rate exceed the decided value, the ABS computer judges that the wheel has a tendency to lock and controls the brake.

If the slip is large, and the wheel tends to lock (Point A in figure), the ABS computer reduces the brake fluid pressure. When the locking tendency (Point B in figure) is eliminated, it increases the brake fluid pressure.

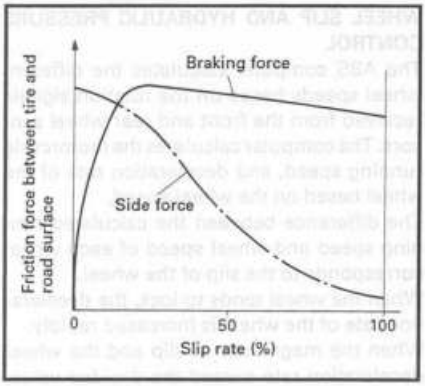
By repeating these fine adjustments in pressure control, a highly efficient braking force can be attained.

ABS OPERATION AND MOTORCYCLE CONTROL

If the ABS starts operating, it means that there is a tendency of the wheel to lock, and indicates that the motorcycle is approaching the limit of control. To make the rider aware of this condition, the ABS has been designed to generate a reaction force in the brake lever and brake pedal.

NOTE:

The reaction force generated in the brake lever and brake pedal when the ABS operates, is not an abnormal condition. It is merely a warning given to the rider.



In motorcycles equipped with ABS, as well as those equipped with conventional brake systems, the side force is reduced during braking. Therefore, sudden braking while cornering is not recommended. Otherwise, the direction stability will be lost.
Furthermore, the ABS cannot prevent slip in the transverse direction.

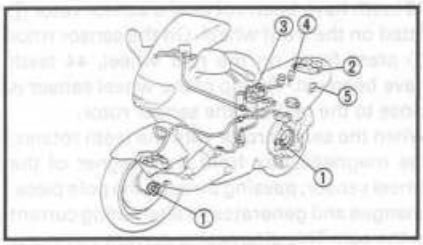
⚠ WARNING

The braking of the motorcycle should be principally executed when the motorcycle is running in straight line. Sudden braking during cornering is liable to cause a loss of directional stability and even in motorcycles fitted with ABS the slip in the transverse direction cannot be prevented.

ABS functions to prevent the tendency of locking of wheel by controlling the brake fluid pressure. But, if the wheel has a tendency to lock on a slippery road surface due to engine braking, although the ABS operates, it may not be able to prevent the locking tendency.

⚠ WARNING

In case of a tendency of the wheel to lock due to engine braking on an extremely slippery surface, even if the ABS system is fitted on the motorcycle, it will not prevent this tendency of locking.



FUNCTIONS OF ABS COMPONENTS

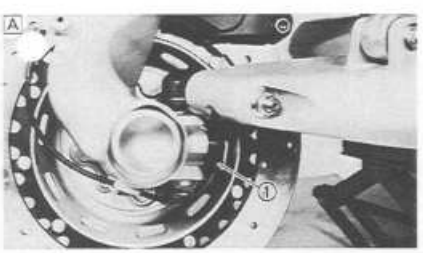
ABS consists of the main components given below. Wheel sensor and sensor rotor are mounted on the front wheel and rear wheel.

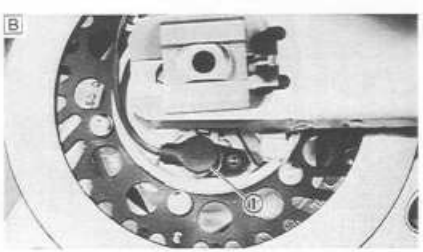
- Wheel sensor and sensor rotor ①
- Electronic Control Unit (ECU) ②
- Hydraulic Unit (HU) ③
- Fail safe relay ④
- Brake light relay ⑤

In addition to these, there are other related components, such as ABS test coupler inside the tail cowl cover and "ABS" warning light in the meter panel.

CAUTION:

- **The ABS components have been precisely adjusted, therefore take extreme care and precautions to avoid impact or dirt on these components.**
- **Within the ABS components, ECU, HU, wheel sensor, brake light relay and fail safe relay cannot be disassembled. Even if you feel that a minor fault has occurred in one of these components, do not try to disassemble the component and repair it. Please replace it with a new part.**

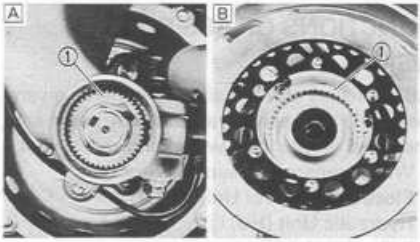


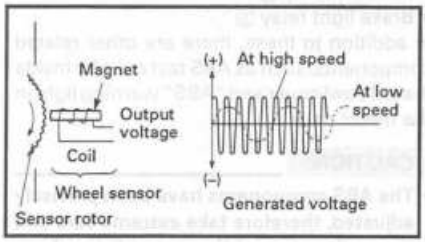


WHEEL SENSOR AND SENSOR ROTOR

The alternative current is generated in the wheel sensor ① when the wheel rotates and the current is transmitted to the ECU. The sensor consists of permanent magnet and coils. One wheel sensor ① is mounted on the rear wheel housing and one on the front wheel housing.

A Front
B Rear

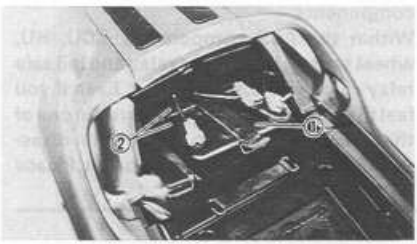


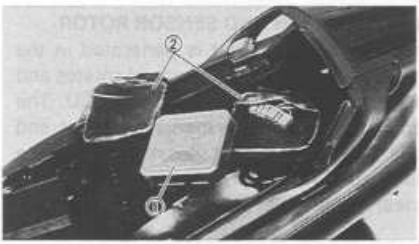


43 teeth have been cut on the sensor rotor ① fitted on the front wheel. On the sensor rotor ① press-fitted on the rear wheel, 44 teeth have been cut. The tip of the wheel sensor is close to the teeth of the sensor rotor.
When the sensor rotor with the teeth rotates, the magnetic flux from the magnet of the wheel sensor, passing through the pole piece, changes and generates an alternating current in the coil. This alternating current voltage is proportional to the wheel rotating speed and its frequency changes according to the speed.

The alternative current is supplied to the ECU as rotation signal.

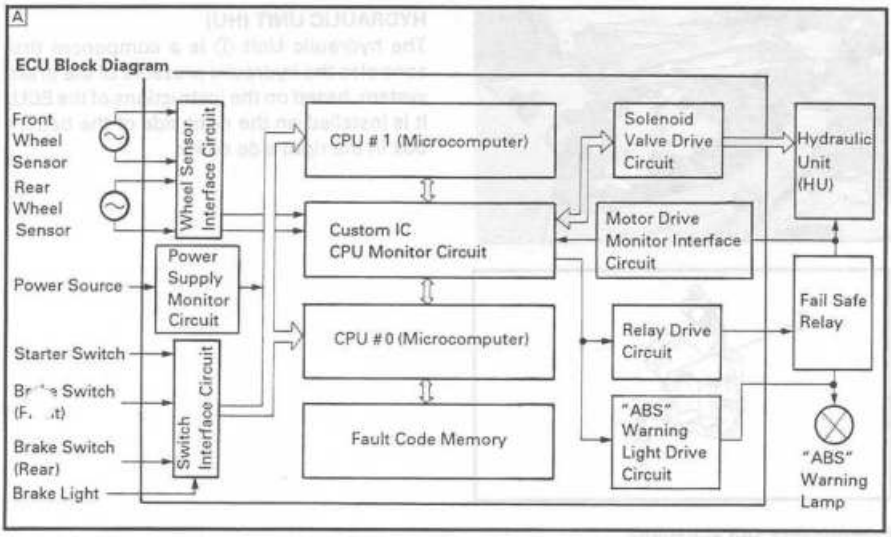
A Front
B Rear





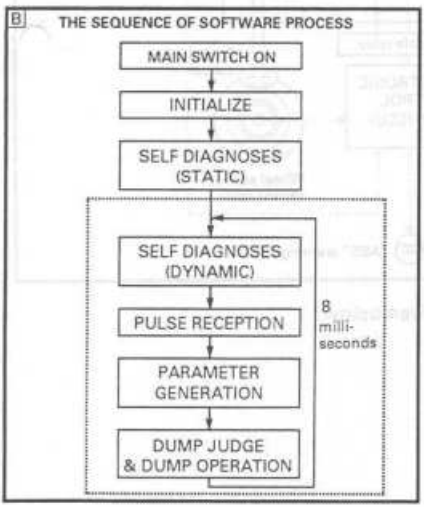
ELECTRONIC CONTROL UNIT (ECU)
The Electronic Control Unit ① (ECU) controls the ABS and is mounted inside the tail cowl. The ECU is covered by a rubber covers ② for protection against water.

A



As shown in the ECU block diagram of Fig. A, the ECU captures signals from the front and rear wheel sensors and also the monitor circuit signals.
Two microcomputers are provided in the ECU and each of these operates independently to process the ABS control logic. These processed results are checked and compared by the CPU monitor circuit. Based on these results, control signals are supplied to the hydraulic unit, the fail safe relay and the "ABS" warning light.

B



ABS control

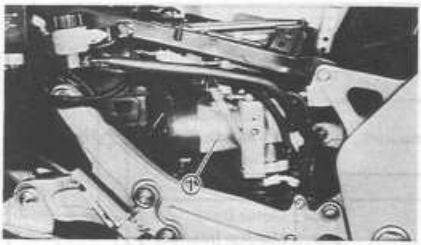
The ABS control performed by ECU consists of two main parts given below:

1. Hydraulic control
2. Self diagnosis

The control processes, as explained in Fig. B, are repeated once every 8 microseconds. Also, the descriptions of faults are stored in the fault code memory for fault detection and inspection at a later stage.

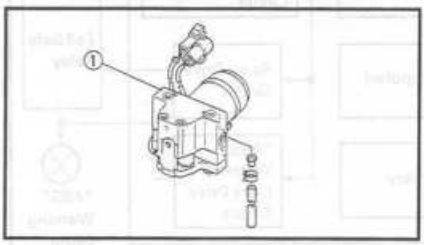
NOTE:

Some types of faults are not saved in memory. (Example: Drop in power source voltage)

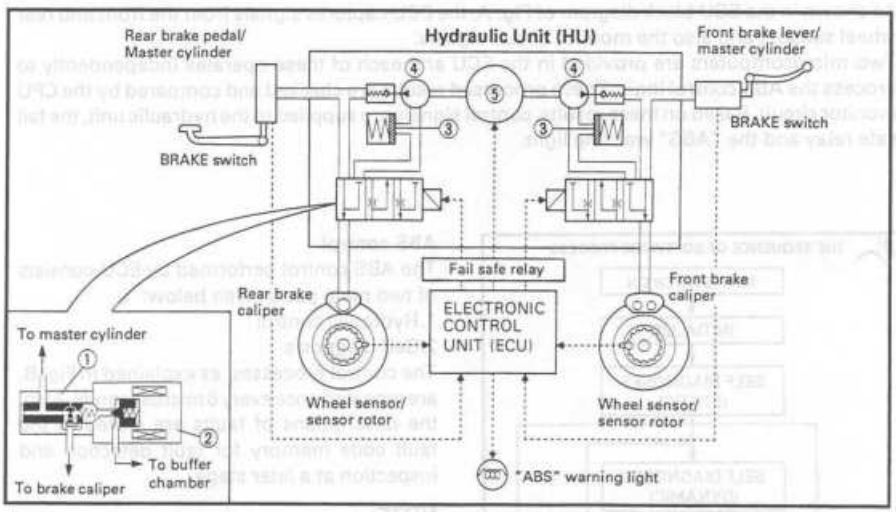


HYDRAULIC UNIT (HU)

The hydraulic Unit ① is a component that controles the hydraulic pressure of the brake system, based on the instructions of the ECU. It is installed on the right side of the battery box in the right side cover.



Components and Functions



Hydraulic unit consists of the main components given below.

- Flow control valve ①
- Solenoid valve ②
- Buffer chamber ③
- Pump ④
- Motor ⑤

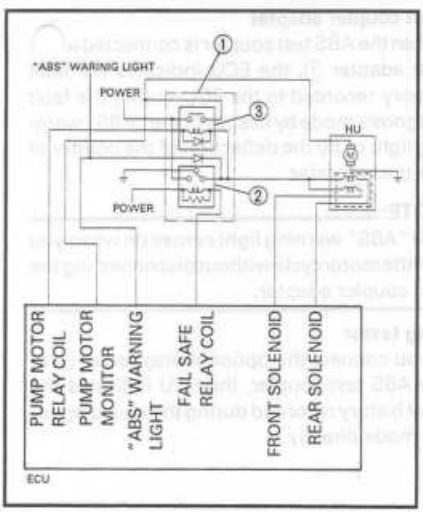
The HU adjusts the brake fluid pressure of the front and rear wheel based on the signals from the ECU to give the optimum braking force to the motorcycle.

The flow control valve maintains a constant brake fluid flow rate during the ABS operation. It works in combination with the solenoid valve in increasing and decreasing the brake fluid pressure.

The buffer chamber has the function of temporarily storing the brake fluid which is by-passed to reduce brake fluid pressure during the ABS operation.

The pump is driven by the electric motor. Its function is to return the brake fluid stored in the buffer chamber to the master cylinder.





FAIL SAFE RELAY

Fail safe relay ① controls the power supply to HU and is installed inside the right side cover.

Components and Functions

The fail safe relay consists of the solenoid relay ② and the motor relay ③. The solenoid relay is switched ON by the ECU command, when the ECU activates the ABS system. In this condition, the solenoid valve can operate if the ECU's dump command is given.

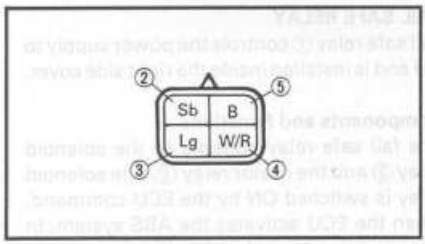
At the same time as ECU's dump command, the motor relay is also switched "ON" by the ECU. That is, the pump motor can be operated simultaneously with the start of hydraulic pressure reduction of ABS.

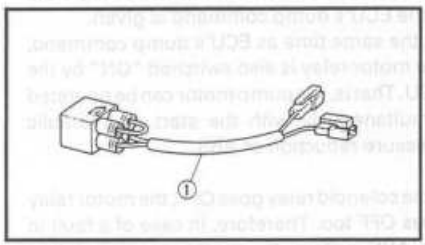
If the solenoid relay goes OFF, the motor relay goes OFF too. Therefore, in case of a fault in the ABS system, the motor stops operating and the circuit reverts to the conventional brake circuit.

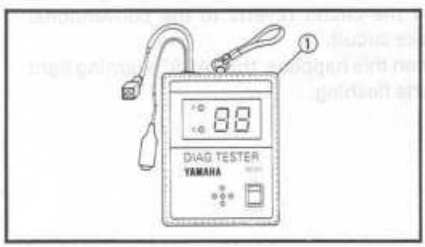
When this happens, the "ABS" warning light starts flashing.











OTHER ABS COMPONENTS

"ABS" warning light

The "ABS" warning light ① informs the rider of the ABS self diagnosis results. It is installed in the meter panel.

NOTE:

If the ABS warning light remains on, check to make sure the test coupler was not left in place.

ABS test coupler

You can see a 4-pole coupler installed inside the tail cowl. This is the ABS test coupler ①.

Functions of each terminal of the test coupler

- If you ground the T/C terminal ② (Sky b), the ECU reverts to the fault diagnosis mode. (To ground the T/C terminal, connect the test coupler adapter to the ABS test coupler.)
- The fault codes (voltage rise or drop) generated in the fault diagnosis mode of the ECU are output from T/F terminal ③ (Light green).
- ABS warning light terminal ④ (White / red) is used when checking the "ABS" warning light circuit.
- Ground ⑤ terminal

Test coupler adapter

When the ABS test coupler is connected to test adapter ①, the ECU indicates the fault history recorded in the ECU during the fault diagnosis mode by flashes of the "ABS" warning light or by the deflection of the pointer of the pocket tester.

NOTE:

The "ABS" warning light comes on when you run the motorcycle without disconnecting the test coupler adapter.

Diag tester

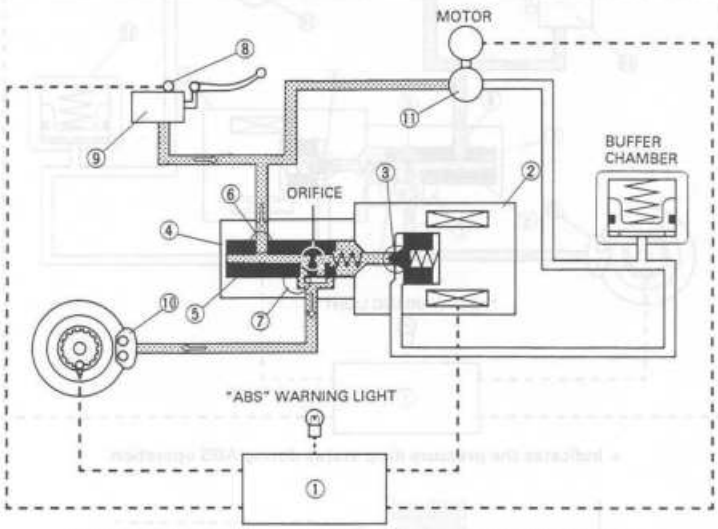
If you connect the optional diag tester ① to the ABS test coupler, the ECU indicates the fault history recorded during the fault diagnosis mode directly.

ABS OPERATION AND HYDRAULIC CIRCUIT

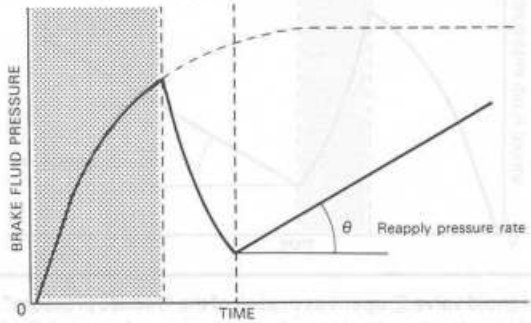
The hydraulic circuits in the ABS system consist of 2 independent circuits, one for the front wheel and one for the rear wheel. The front wheel system is explained here.

DURING OPERATION OF CONVENTIONAL BRAKE SYSTEM (ABS NOT WORKING)

During normal braking operation, the master cylinder pressurizes the brake caliper directly.



• **Indicates the pressure application in the conventional brake circuit.**



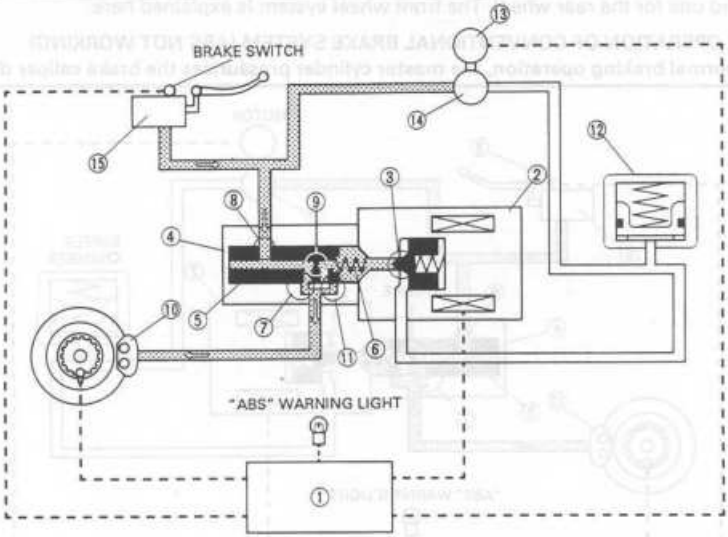
Since the control signal from ECU ① will not be input, the port ③ of the solenoid valve ② remains closed. Also, the ports ⑥ and ⑦ of the spool ⑤ of the flow control valve ④ are open. Therefore, when the hydraulic pressure of the master cylinder ⑨ rises when the brake lever ⑧ is pulled, the brake fluid is sent to port ⑥, port ⑦ and to the brake caliper ⑩.

At this stage, the return of the brake fluid is prevented by the check valves in the inlet and outlet on the pump ⑪ side.

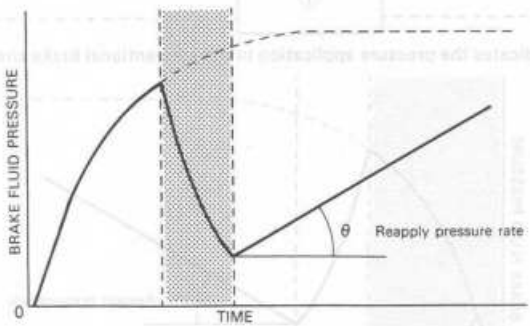
Next, if the brake lever is released, the brake fluid is returned from the brake caliper to the master cylinder through the port ⑦ circuit of the brake caliper and port ⑥ master cylinder circuit.

DURING EMERGENCY BRAKING (DURING ABS OPERATION)

Pressure reduction status



• **Indicates the pressure drop status during ABS operation.**

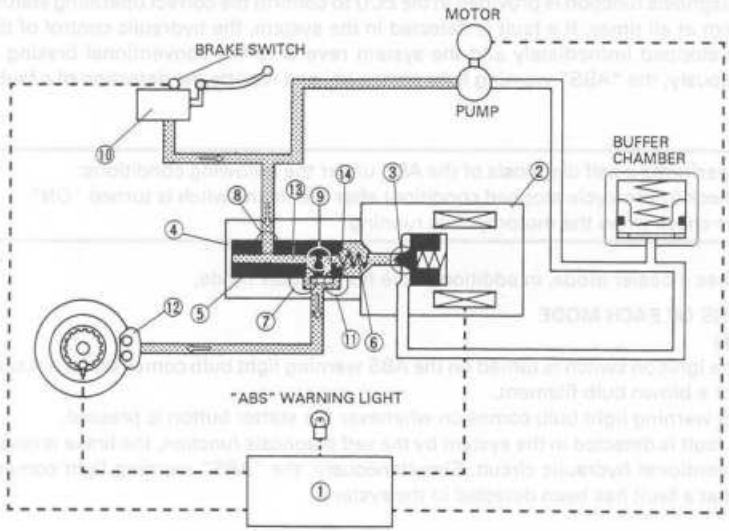


The port ③ of the solenoid valve ② opens as a result of the "reduce pressure" signal from ECU① when there is a tendency for the wheel to lock. At this stage, the spool ⑤ of flow control valve ④ compresses the return spring ⑥ and port ⑦ closes.

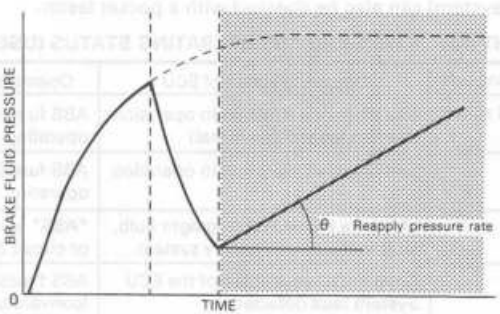
Also, the brake fluid that has entered through port ⑧ is metered by the orifice. Therefore, the brake fluid of brake caliper ⑩ is sent to the buffer chamber ⑫ through the ports ⑪ and port ③. In this way, the brake caliper fluid pressure is reduced.

Furthermore, the ECU outputs an activating signal to the motor ⑬, so that the brake fluid collected in the buffer chamber is pumped by the electric pump ⑭ and returned to the master cylinder ⑮.

Pressure increase status



• Indicates the repressurized status during ABS operation.



The port ③ of the solenoid valve ② closes as a result of the "increase pressure" signal from ECU①. Also, the spool ⑤ of the flow control valve ④ compresses the return spring ⑥, therefore the port ⑦ closes.

The brake fluid that has entered through port ⑧ will be further metered by the orifice. Therefore, the brake fluid of master cylinder ⑩ is sent to the brake caliper ⑫ through port ⑧ and ⑪. However, at this stage, the metering of port ⑧ changes to ensure a constant pressure difference in chamber ⑬ and chamber ⑭ of the flow control valve. Therefore, the brake is pressurized at a constant speed, regardless of the brake oil pressure level.

SELF DIAGNOSIS FUNCTION OF ECU

The self diagnosis function is provided in the ECU to confirm the correct operating status of the ABS system at all times. If a fault is detected in the system, the hydraulic control of the ABS system is stopped immediately and the system reverts to the conventional braking circuit. Simultaneously, the "ABS" warning light comes on, and reports the detection of a fault in the system.

NOTE:

The ECU performs a self diagnosis of the ABS under the following conditions:

- Static check (motorcycle stopped condition) after the main switch is turned "ON"
- Dynamic check when the motorcycle is running

The ECU has a dealer mode, in addition to the normal user mode.

FUNCTIONS OF EACH MODE

User mode

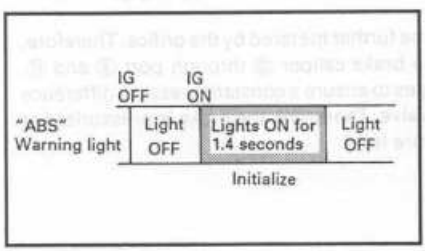
- When the ignition switch is turned on the ABS warning light bulb comes on for 1.4 seco. . to check for a blown bulb filament.
- The ABS warning light bulb comes on whenever the starter button is pressed.
- When a fault is detected in the system by the self diagnosis function, the brake is reverted to the conventional hydraulic circuit. Simultaneously, the "ABS" warning light comes on to report that a fault has been detected in the system.

Dealer mode

- When a fault is detected in the system by the self diagnosis function, the warning light flashes. The fault code (fault system) can also be checked with a pocket tester.

"ABS" WARNING LIGHT INDICATION AND ABS OPERATING STATUS (USER MODE)

Indication of "ABS" warning light	Operating status of ECU	Operating status of ABS
OFF after becoming ON at the start *1	Self diagnosis function in operation (system judged as normal)	ABS function normally operating
Flashes *2	Self diagnosis function in operation	ABS function normally operating
Not ON at start *3	May be a blown warning light bulb, fault in the power supply system.	"ABS" warning light bulb or circuit defect
Continuously ON	Couplers disconnected of the ECU System fault detected	ABS function not operating (conventional braking operation)



*1:
Each time you turn on the main switch, the "ABS" warning light comes on for 1.4 seconds. During this period, the ECU makes the self diagnosis test. The light goes off after the self diagnosis.

*2:
There are four main cases.
1. Fault in brake switch (coupler disconnected, etc.)
2. Rear wheel spin or rear wheel running idle after the main stand etc. is raised.
3. ABS continuous operation for more than 20 seconds and less than 36 seconds.
4. Diagnostic coupler is being used.



*3:
"ABS" warning light bulb filament blow-out check function
After the main switch is turned on, for an interval of 1.4 seconds and while the start switch is being pressed, the "ABS" warning light ① and the "OIL LEVEL" indicator light ② come on.
If the "ABS" warning light does not come on, then the fault may be due to a bulb filament blow-out or bad connection in the circuit.
Refer to "TROUBLESHOOTING" and correct the fault.

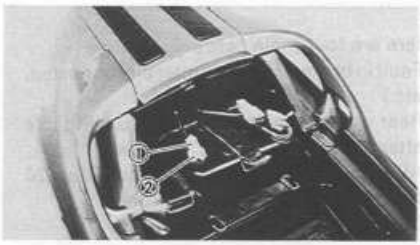
MOTORCYCLE MAINTENANCE BY USING THE DEALER MODE

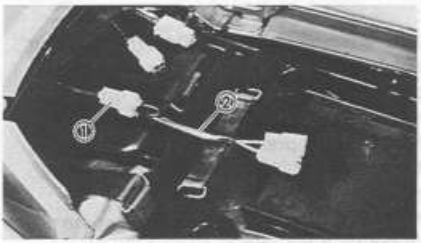
During the user mode, if there is an indication of a fault in one of the systems indicated by the "ABS" warning light, or if the fault history needs to be checked, set the ECU in the dealer mode and check the fault code. This enables you to judge the fault location correctly and to carry out motorcycle maintenance quickly.
However, there are cases when the fault codes are not registered in the ECU.
- ABS warning light flashes
- Comes on because of a drop in the power supply voltage

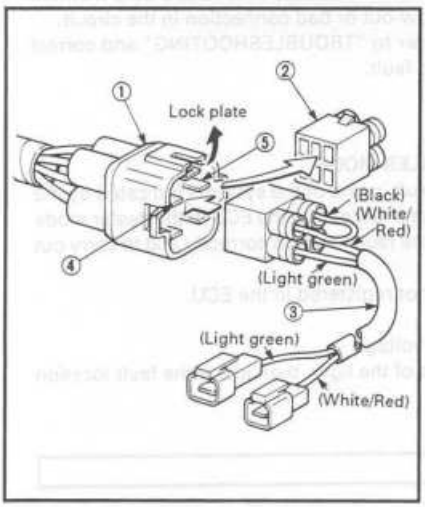
Correctly check the flashing or steady lighting status of the light, then judge the fault location and repair.

Usage Procedure

1. Set the ECU in the dealer mode.
⇩
2. Check the fault code using either the "ABS" warning light method or the pocket tester method.
⇩
3. Judge the fault location referring to the fault code table (P III-19)
⇩
4. Repair the fault location correctly.
(Refer to the relevant section in "TROUBLESHOOTING" on P III-22)
⇩
5. Erase the fault code.







1. METHOD OF SETTING THE DEALER MODE IN ECU

1)Remove the seat. Remove the protection cap ② from the ABS test coupler ① in the tail cowl.

2)Connect the test coupler adapter ③ (or diag tester) to the ABS test coupler ①. The T/C terminal ④ (Sky blue) will be grounded and the ECU will be set in the dealer mode.

NOTE:

When checking the fault code after setting the ECU in the dealer mode, make sure that you use a fully charged battery.

⑤ Ground (Black) terminal

2. PROCEDURE FOR CHECKING THE FAULT CODE

There are two methods for checking the fault code, depending on the status of the fault - using the "ABS" warning light or using a pocket tester.
The details of these methods are given below.

- **When a current fault is detected (method of checking the fault code detected currently):**

a. Check the fault code using the pocket tester.
Since the "ABS" warning light is on currently, you cannot check the fault code using the "ABS" warning light.

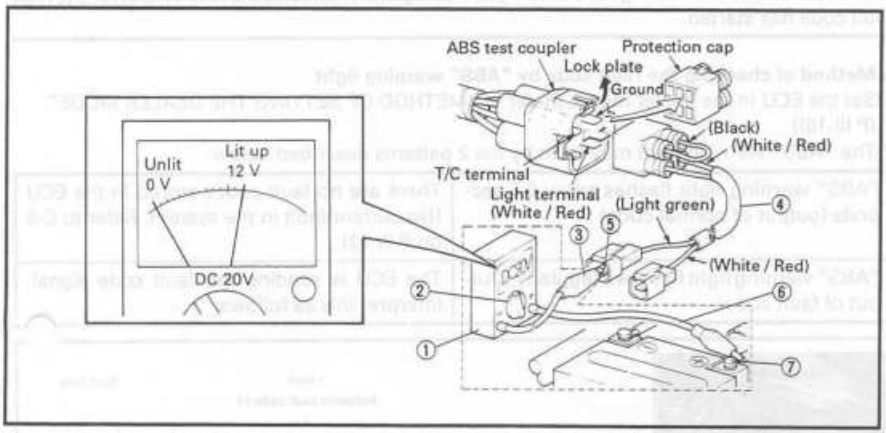
- **When a current fault is not detected (method of checking the fault code detected in the past):**

a. Use the pocket tester.
b. Use the "ABS" warning light.
You can check by either of the two methods.

NOTE:
Record all the displayed faults and check all the check items for each fault.

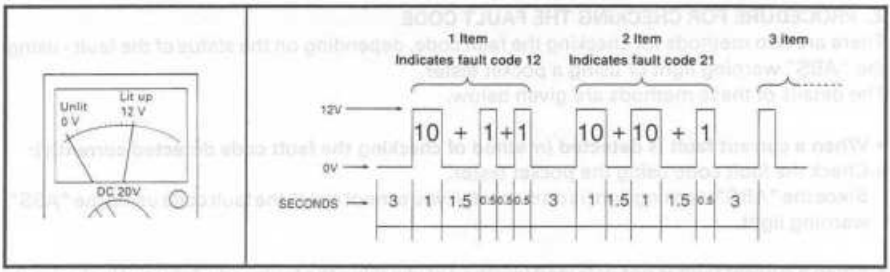
III

a. Method of checking the fault code by pocket tester



1) Set the ECU in the dealer mode. (Refer to "METHOD OF SETTING DEALER MODE" (P III-16).
2) Set the range ② of the pocket tester ① at DC 20 V.
3) Connect the negative terminal ③ of the pocket tester to the T/F terminal ⑤ (light green) of the test adapter ④. Connect the positive terminal ⑥ of the tester to the positive terminal ⑦ of the battery.
4) Read the fault code from the deflection of the pocket tester by the method described below.

NOTE:
The pointer of the pocket tester swings in the range of 0 to 12 V. The fault code value can be read by measuring the number of seconds the pointer stops on the 12 V position.



- The pointer of the pocket tester stops on the 12 V position for 1 second ➡ Indicates the value 10.
- The pointer of the pocket tester stops on the 12 V position for 0.5 seconds ➡ Indicates the value 1.
- The sum of the values obtained above, indicates the fault code number.

NOTE:

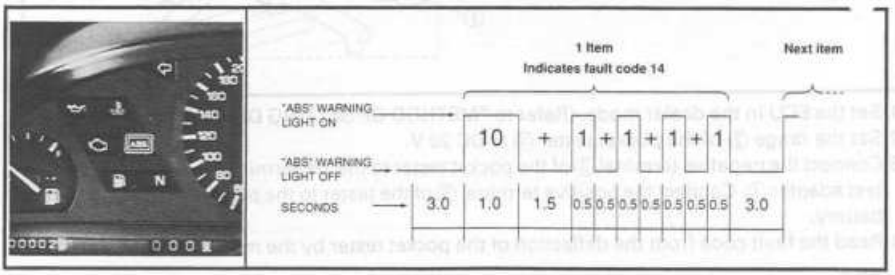
Counting is not necessarily at the 0 V position. However, if the pointer remains at the 0 V position for 3 seconds and then swings to the 12 V position again, it indicates that the output for the next fault code has started.

b.Method of checking the fault code by "ABS" warning light

1)Set the ECU in the dealer mode. (Refer to "METHOD OF SETTING THE DEALER MODE" (P III-16))

2)The "ABS" warning light may flash by the 2 patterns described below.

"ABS" warning light flashes every 0.5 seconds (output of normal code)	There are no fault codes stored in the ECU (No current fault in the system. Refer to C-6 on P III-22)
"ABS" warning light flashes irregularly (Output of fault code)	The ECU is sending the fault code signal. Interpret this as follows:



- "ABS" warning light comes on for 1 second ➡ Indicates the value 10.
- "ABS" warning light comes on for 0.5 seconds ➡ Indicates the value 1.
- The sum of the values obtained above indicates the fault code number.

NOTE:

There is no need to count the number of seconds the light is OFF. However, if the light is OFF continuously for 3 seconds and then flashes again, it indicates that the output for the next fault code has started.

3. JUDGING THE FAULT LOCATION

The possibility of a fault in the system can be judged by using the fault code table given below. Read the fault code corresponding to the fault code value, obtained by using the "ABS" warning light or the pocket tester.

Use this table in combination with "TROUBLESHOOTING" (P III-22). Check each item that may be considered a cause, find the real cause of the fault and restore it correctly.

NOTE:

Record all the fault codes that are displayed. Check all the relevant check items.

Fault code table

Fault code	Phenomenon	Check	Reference
11 (*1)	Front sensor signals are not received properly.	• Front sensor mount • Front sensor lead wire, coupler • ABS harness circuit • Front sensor housing	C-5-1 and Electrical
12	Rear sensor signals are not received properly.	• Rear sensor mount • Rear sensor lead wire, coupler • ABS harness circuit • Front sensor housing	C-5-2 and Electrical
13/14	Abnormal signals have been detected from the front (13) or rear (14) sensor.	• Sensor mounts • Sensor housing • Sensor rotor	C-5-3
15 (*2)	Discontinuity in the sensor circuit has been detected.	• Sensor continuity • ABS harness circuit • Coupler connections of sensor	C-5-4
21	Discontinuity or short circuit in the solenoid circuits has been detected.	• ABS harness circuits • Coupler of solenoid • Solenoid	C-5-5 and Electrical
31	Discontinuity has been detected in the wiring system between the fail safe relay and solenoids.	• ABS harness circuit • Fail safe relay circuit • Coupler of solenoid	C-5-6
32	Abnormal response of fail safe relay has been detected.	• Fail safe relay • ABS harness circuit	C-5-7 and Electrical
33	Abnormal motor operation has been detected. (Motor does not rotate)	• ABS harness circuit • Coupler of motor • Fail safe relay • HU motor circuit	C-5-8 and Electrical
34	Abnormal motor operation has been detected. (Motor continues to rotate without stopping)	• Fail safe relay • ABS harness circuit • HU motor circuit	C-5-9 and Electrical
41	One of the wheels does not recover from the wheel locking tendency in spite of continuous transmission of commands by the ECU to release hydraulic pressure.	• Forced dragging of a wheel • HU operation test (Refer to "D-7-3") • Brake hydraulic piping	C-5-10

Fault code	Phenomenon	Check	Reference
51	Power supply switched on to activate ABS when the battery voltage was low but it could not be activated because of the drop in voltage.	• Battery voltage • Power supply line connections (Fuse, main switch, ECU)	C-5-11
Current fault (C-4) (Tester always indicates 12 V)	There may be a fault in the ECU.	• ABS harness circuit (Test coupler circuit) • ECU (replacement)	D-1 and Electrical

NOTE:

*1:
Fault code "11" is displayed even when the front wheel has stopped and the rear wheel rotates for more than 20 seconds.

*2:
Fault code "15" is displayed when there is a connection fault in either the front or rear sensor or the sensor is shorted, and the motorcycle is not running.

III

4. RESTORING FAULT LOCATIONS

Check all the locations that may be faulty after referring to the relevant item in the "TROUBLE-SHOOTING" (P III-22) and correct the fault properly.

5. METHOD OF DELETING THE FAULT CODE



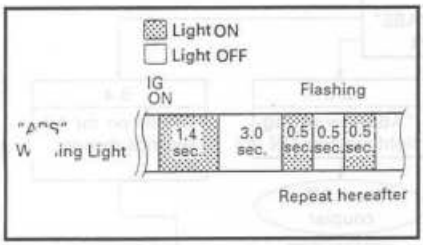


1. Connect the test coupler adapter ① to the ABS test coupler ②.
   Refer to "METHOD OF SETTING THE DEALER MODE" (P III-16).
2. Turn ON the main switch.
   The fault codes recorded previously are indicated by the "ABS" warning light.
3. Turn OFF the "ENGINE STOP" switch ③.

CAUTION:

If you push the starter switch without turning off the engine stop switch, the engine will start. Therefore, be sure to turn the engine stop switch off before pushing the starter switch.

4. Push the "START" switch ④ at least 10 times within 4 seconds.



NOTE:
The OIL LEVEL indicator light comes on when you push the starter switch. Note that this is not a fault.

5. Confirm that the "ABS" warning light comes on continuously for more than 2 seconds.
6. Turn OFF the main switch.
7. Turn ON the main switch again. Confirm that the "ABS" warning light lights up for 1.4 seconds, becomes OFF for 3 seconds and then starts flashing at 0.5 second intervals.
8. Turn OFF the main switch.
9. Disconnect the test coupler adapter from the ABS test coupler. Fit the protection cap on the ABS test coupler. With this operation, the fault code deletion work is completed.

NOTE:
Make sure you fit the protection cap correctly on the ABS test coupler.

NOTE:
The fault code remains in the memory of the ECU. To prevent duplication of past fault codes, make sure you delete the fault code after finishing the maintenance work.

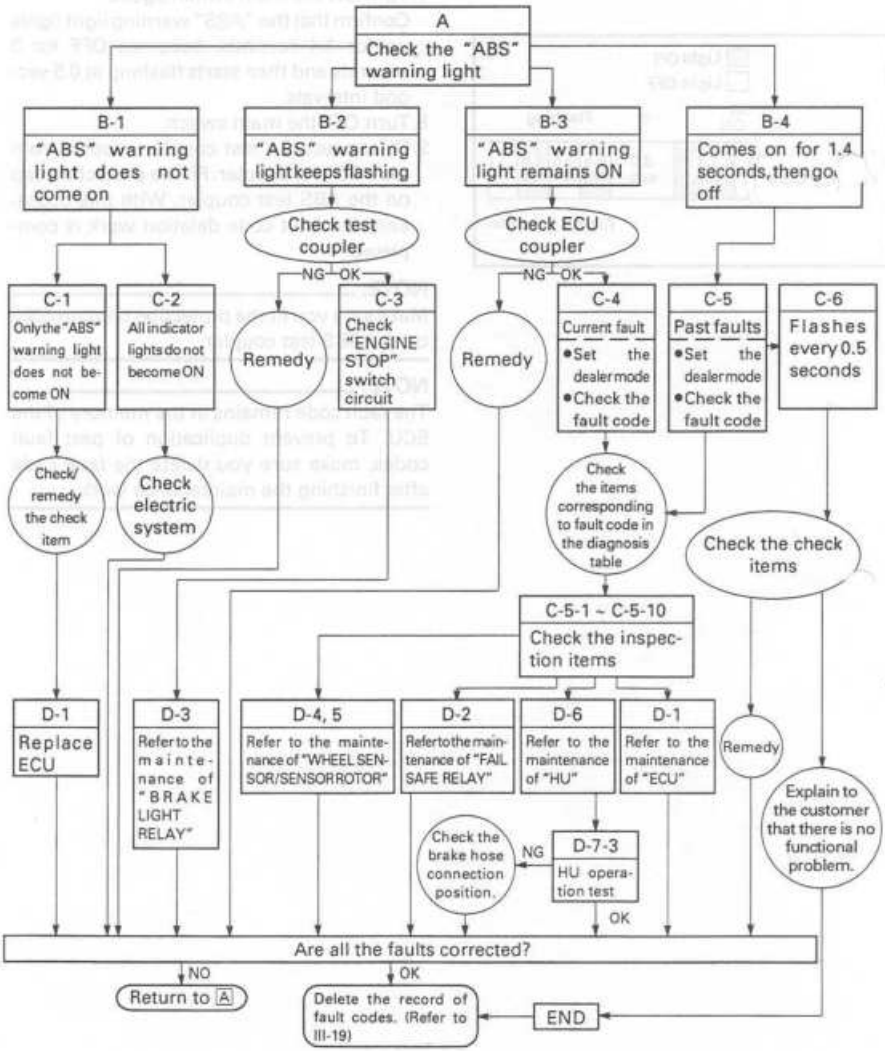
TROUBLESHOOTING

BASIC PROCEDURES

Proceed with troubleshooting by following the flow chart given below and working through the basic procedures from A to D.

For detailed checks and repair work, refer to "DETAILED PROCEDURES" (P III-24) and perform the work correctly.

Troubleshooting flow chart



A block:	Check the indication of "ABS" warning light.	C block:	Detect the causes and position of faults / correct the fault locations (other than faults related to ABS)
B block:	Check the system related to the fault occurrence.	D block:	Servicing of ABS related faults

Precautions during troubleshooting

- Follow the basic procedures for troubleshooting given in the flow chart "TROUBLESHOOTING (P III-22)". Check the items sequentially from blocks A → B → C → D and remedy the fault. Take care because if you omit or make a mistake in the procedure, your diagnosis will be wrong.
- When there are more than 2 fault codes, the smaller fault code number will come first. Also, be sure to record all the displayed fault codes, check all the items and then start the repair work.
- Do not delete the fault codes during the troubleshooting work. Make sure you delete them after all the checks and repair work are completed.
- For inspection and servicing of ABS related items, always carry out the "FINAL INSPECTION (D-7)" of the motorcycle.

Precautions during maintenance of motorcycle fitted with ABS

- The ABS components have been accurately adjusted. Therefore, take adequate care to handle these components carefully and avoid damage to these components through impact or tension.
- ECU, HU, sensors and relay box cannot be disassembled. Therefore, do not try to disassemble them.
- All the faults (fault codes) detected by the ECU once, will be recorded in the memory of the ECU. Therefore, after servicing is completed, make sure you delete the fault codes. (This is a measure to avoid duplication of past faults, if a fault recurs.)

DETAILED PROCEDURES

A block CHECKING OF FAULT BY "ABS" WARNING LIGHT

Preparation	Turn ON the main switch. (Do not start the engine.)

Symptoms	Reference items
1) "ABS" warning light does not come on.	B-1
2) "ABS" warning light keeps flashing	B-2
3) "ABS" warning light remains on.	B-3
4) "ABS" warning light comes on for 1.4 seconds, then goes off.	B-4

B block CHECK THE SYSTEM RELATED TO THE FAULT OCCURRENCE

B-1 "ABS" WARNING LIGHT DOES NOT COME ON

Symptoms	Reference items
1) Only the "ABS" warning light does not come on	C-1
2) The "ABS" warning light and all other indicator lights do not come on	C-2

B-2 "ABS" WARNING LIGHT KEEPS FLASHING

Inspection items	Countermeasures	Reference items
Is the T/C terminal of the ABS test coupler grounded? 1) Grounded (NG)	• Disconnect the test adapter from the ABS test coupler. Insert the protection cap in the test coupler.	"SETTING THE DEALER MODE" (P III-16)
NOTE: If the test adapter is connected to the test coupler, then the T/C terminal will be grounded.		
2) Not grounded (OK)		C-3
NOTE: Before starting the checks, make sure that the battery is completely charged.		

B-3 "ABS" WARNING LIGHT REMAINS ON

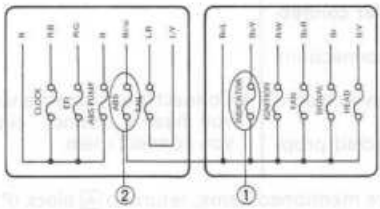
Inspection items	Countermeasures	Reference items
Are both couplers properly connected to the ECU? 1) Connected (OK) 2) Not connected (NG)	• Connect the coupler to the ECU so that you hear a distinct "click". This ensures that the connection is proper.	"COUPLER LAYOUT DRAWING" (P I-9) C-4

B-4 "ABS" WARNING LIGHT COMES ON FOR 1.4 SECONDS, THEN GOES OFF

Status	Reference items
No fault is detected in the system currently but the normal operation of the system and the fault history of the past can be checked.	C-5

C block DETECTING THE CAUSES AND POSITION OF FAULT / RESTORING FAULT LOCATIONS (OTHER THAN ABS RELATED FAULTS)

C-1 ONLY THE "ABS" WARNING LIGHT DOES NOT COME ON WHEN THE MAIN SWITCH IS TURNED ON.

Inspection items	Countermeasures	Reference items
		
Check visually 1) Check the fuses of INDICATOR①/ABS②. Is a fuse blown?	• If the fuse is blown, check the cause and correct it. Then replace with a new fuse.	"FUSE INSPECTION" (P 3-82)
2) Are both couplers properly connected to the ECU?	• Connect the coupler to the ECU so that you hear a distinct "click". This ensures that the connection is proper.	"COUPLER LAYOUT DRAWING" (P I-9)
Check using the test coupler adapter. (connect the ABS test coupler and the test coupler adapter.) 1) Connect the "ABS" warning light terminal "White/Red" of the test adapter to the ground (or negative terminal of e battery). a. "ABS" warning light comes on: • There may be a discontinuity in the wiring in the wire harness. Perform the continuity test.	• If the wire harness is defective, replace with a new wire harness.	"CIRCUIT DIAGRAM"
b. "ABS" warning light does not come ON: • There may be bulb filament blow-out or disconnection of the "ABS" warning light.	• Replace the bulb or set the bulb correctly.	"CIRCUIT DIAGRAM"
2) Disconnect the ECU couplers and check the continuity of the "White/Red" lead. a. There is continuity. • ECU is defective.	• Replace with a new one.	D-1
b. Discontinuity • There is a fault in the wire harness warning light circuit.	• Repair or replace the harness.	"CIRCUIT DIAGRAM"

C-2	NEITHER THE "ABS" WARNING LIGHT NOR OTHER INDICATORS COME ON	
Inspection items	Countermeasures	Reference items
Check the electric power system 1) Is the battery connected correctly?	• Make sure that the connections are firm and proper.	"BATTERY INSPECTION" (P 3-76)
2) Is the battery voltage correct?	• Re-charge or replace	
3) Is the main fuse blown?	• Investigate the causes, repair and replace the fuse	"FUSE INSPECTION" (P 3-82)
Check the harness and coupler connections. 1) Is the main fuse coupler connections proper?		"COUPLER LAYOUT DRAWING" (P I-9)
2) Is the coupler for the main switch connected properly?	• Connect the couplers ensuring that you hear a distinct "click" when you connect them.	
3) Is the meter coupler connected properly?		
• After you check all the above mentioned items, return to [A] block (P III-22).		

C-3	"ABS" WARNING LIGHT KEEPS FLASHING	
Inspection items	Countermeasures	Reference items
Check the coupler connection. 1) Are the couplers for stop light / switch systems properly connected?	• Connect the couplers ensuring that you hear a distinct "click" when you connect them.	"COUPLER LAYOUT DRAWING" (P I-9)
2) Are the couplers of ABS and main harness properly connected?		
Check the status of the brake switches (front and rear) without starting the engine. Does the brake light come on when you apply the front or rear brake independently?		
1. The brake light comes on normally during braking operation • Check for discontinuity in the leads	• Repair or replace as necessary. (Between "Brown/Blue" of ECU coupler and "Brown/Blue" of brake light relay coupler) (Between "Brown/Green" of ECU coupler and "Brown/Green" of brake light relay coupler) (Between "Yellow" of ECU coupler and "Yellow" of tail light coupler)	"CIRCUIT DIAGRA
2. The brake light comes on regardless of braking operation	• Check stop light relay operation. • Repair or replace as necessary (Between "Brown/Blue" of the brake light relay coupler and "Brown/Blue" of front brake switch) (Between "Brown/Green" of brake light relay coupler and "Brown/Green" of rear brake switch)	"CIRCUIT DIAGRAM" D-3
(1) Brake light relay		
(2) Brake light relay operation circuit		

Inspection items	Countermeasures	Reference items
3. The brake light stays off regardless of braking operation (1) Light filament blown out	• Inspection and replacement of brake light	"COUPLER LAYOUT DRAWING" (P I-9)
(2) Light connector disconnected	• Inspection of brake light connector	
(3) Brake light defective	• Inspection and replacement of brake light	D-3
(4) Brake light disconnected	• Inspection of brake light connector	
4. Brake lights goes "OFF" when either the front brake or the rear brake is applied, or when both brakes are applied. Comes "ON" when both brakes are released. (1) The relay type is not correct.	Inspection of brake light relay 4U8 → Correct	D-3

C-4	CURRENT FAULT DETECTED IN SYSTEM	
	Execution items	Reference items
Set the ECU in the dealer mode. • Check the fault code using the test coupler adapter and pocket tester. Judge the fault location from the fault code table.		"SETTING THE DEALER MODE" (P III-16) "Fault code table" (P III-19)

C-5	CHECK FOR NORMAL OPERATION OF SYSTEM	
	Execution items	Reference items
Set the ECU in the dealer mode. 1) Warning light flashes every 0.5 seconds. (output of normal code) 2) Warning light flashes irregularly (output of fault codes recorded in the past) • Check the fault codes and judge the fault locations from the fault code table.		"SETTING THE DEALER MODE" (P III-16) "Fault code table" (P III-19)

C-5-1		Fault code 11	
Preparation	TURN OFF THE MAIN SWITCH ONCE, THEN SWITCH IT ON AGAIN.		
Symptoms	Fault check locations	Inspection items	Reference items
"ABS" warning light remains ON.	1)Defective connection in the front wheel sensor circuit	• Disconnection of wheel sensor connector • Discontinuity of wheel sensor lead wire or coil • Discontinuity of sensor circuit of wire harness • Disconnection of ECU connector terminal	D-4 D-4 "CIRCUIT DIAGRAM" D-1
"ABS" warning light comes on for 1.4 seconds, then goes off.	1)Rear wheel has been rotated for more than 20 seconds while the front wheel was stopped.	• Not a fault	
	2)No signal is output from the front wheel sensor. 3)Shorting of front wheel sensor circuit	• Disconnection of wheel sensor • Sensor rotor fault • Shorting of wheel sensor or lead • Shorting of sensor circuit of wire harness	D-4 D-4 D-4 "CIRCUIT DIAGRAM"
	4)Drop in output of front wheel sensor	• NOTE 1	D-4

NOTE 1:
The sensor signal output may drop because of a fault in the bearing of the front wheel, wheel axle, wheel, or sensor housing. Check for clearance, distortion, bending in these components and repair if necessary.

C-5-2		Fault code 12	
Preparation	TURN OFF THE MAIN SWITCH ONCE, THEN TURN IT ON AGAIN.		
Symptoms	Check locations	Inspection items	Reference items
"ABS" warning light remains ON	1)Defective connection in the rear wheel sensor circuit	• Disconnection of wheel sensor connector	D-5
		• Discontinuity in wheel sensor lead wire or coil	D-5
		• Discontinuity in wire harness sensor circuit	"CIRCUIT DIAGRAM"
		• Disconnection of ECU connector terminal of wire harness	D-1
"ABS" warning light comes on for 1.4 seconds, then goes off.	1)The front wheel has been rotated at a speed greater than 11 km/h with the rear wheel at a standstill.	• Not a fault	—
	2)No signal is output from the rear wheel sensor.	• Wheel sensor disconnected	D-5
		• Fault in sensor rotor	D-5
	3)Shorting of rear wheel sensor circuit.	• Shorting of wheel sensor or lead	D-5
		• Shorting of sensor circuit of wire harness	"CIRCUIT DIAGRAM"
	4)Drop in output of the rear wheel sensor.	• NOTE 2	D-5

NOTE 2:
The sensor signal output may drop because of a fault in the bearing of the rear wheel, wheel axle, wheel, or sensor housing. Check for clearance, distortion, bending in these components and repair if necessary.

NOTE:

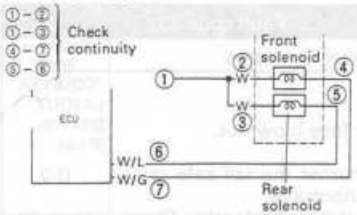
The "ABS" warning light may flash when running over extremely bumpy or uneven roads. If you continue to run the motorcycle further, while the warning light flashes, the fault code "11" or "12" may record this fault, depending on the status at that time.

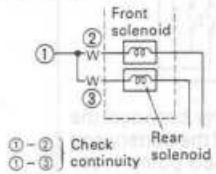
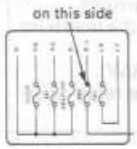
C-5-3	Fault code 13	
Fault location	Inspection items	Reference items
Mounting of the wheel sensor is not correct	• Mounting status of wheel sensor with respect to sensor housing	D-4, 5
	• Mounting status of sensor housing with respect to wheel	D-4, 5
Mounting of the sensor rotor is not correct	• Press-fitting status of rotor with respect to wheel	D-4, 5
	• Check for foreign matter in the area where the rotor is attached.	D-4, 5
Fault in the teeth of the sensor rotor	• Flaws, cracks or dents on the rotor teeth surface	D-4, 5
	• Foreign matter sticking on the rotor teeth surface	D-4, 5
Drop in sensor output	• NOTE 3	D-4, 5

NOTE 3:
The front or rear sensor signal output may drop because of a fault in the bearing of the wheel, wheel axle, wheel, or sensor housing. Check for clearance, distortion, bending in these components and repair if necessary.

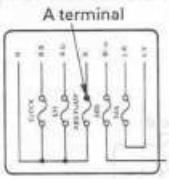
C-5-4	Fault code 15	
Fault location	Inspection items	Reference items
Discontinuity in the front / rear wheel sensor circuit	• Disconnection of front / rear wheel sensor connector	D-4, 5
	• Discontinuity in front / rear wheel sensor lead or coil	D-4, 5
	• Discontinuity in sensor circuit of wire harness	"CIRCUIT DIAGRAM"
	• Disconnection of ECU connector terminal of wire harness	D-1

NOTE:
- Check for disconnection of sensor lead connectors in both the front wheel and the rear wheel.
- If you run the motorcycle when fault code "15" is indicated and if a fault in the front wheel or the rear wheel is specified, the fault code will change from "15" to "11" or "12".

C-5-5	Fault code 21	
Fault location	Inspection items	Reference items
Discontinuity or shorting in the solenoid circuit.		
1)Solenoid coupler:	• Disconnection of terminal of solenoid coupler	D-2
2)HU solenoid:	• Check continuity of front/rear solenoid	D-2
	• Check insulation status of negative terminal of battery and all terminals of solenoid	D-2
3)Wire harness:	• Check continuity of solenoid circuit	
	• Check the insulation status between the solenoid circuit and negative terminal of battery	

C-5-6	Fault code 31	
Fault location	Inspection items	Reference items
Discontinuity between the fail safe relay and the solenoid		
1)ABS pump fuse:	• Check for fuse blow-out	"COUPLER LAYOUT DRAWING" (P I-9)
2)Solenoid coupler:		
3)Wire harness	• Disconnection of solenoid coupler	
	• Check continuity of the "White/Brown" wires between ECU and fail safe relay	D-1
	• Disconnection of ECU connector	
	• Check continuity of white lead in the solenoid circuit	
4)Fail safe relay	• Check whether the operation of the fail safe relay is normal.	D-2
	• Check continuity between the terminal of fail safe relay coupler and positive terminal of battery.	
	• Remove the ABS fuse and check for continuity between the "Brown/White" wires of fail safe relay and the ECU.	

C-5-7	Fault code 32	
Fault location	Inspection items	Reference items
Fault in the fail safe relay. 1) Fail safe relay: 2) Wire harness:	• Check for normal operation of the fail safe relay. • Check the insulation status between the "White" and "Red" terminals of coupler for fail safe relay. (After disconnecting the ECU and the wire harness and the fail safe relay)	D-2 "COUPLER LAYOUT DRAWING" (P I-9)

C-5-8	Fault code 33	
Fault location	Inspection items	Reference items
Fault in motor operation. (Motor stops and does not rotate.) 1)ABS pump fuse:	• Check for fuse blow-out.	"COUPLER LAYOUT DRAWIN_ (P I-9)
2)Fail safe relay:	• Check whether the fail safe relay operates normally.	D-2
3)Wire harness:	• Disconnect the fail safe relay. Check for continuity between the red terminal of the ABS harness connector and A terminal (wire harness side) of the ABS pump fuse in the fuse box.  • Check the continuity between the positive terminal of the battery and B terminal of the ABS pump fuse. • Disconnect the ECU and fail safe relay from the wire harness. Check for continuity in the lead wire harness. (W/B — W/B, R/W — R/W).	"COUPLER LAYOUT DRAWING" (P I-9)
4)Fail safe relay	• Check that the fail safe relay operates normally	

C-5-9	Fault code 34	
Fault location	Inspection items	Reference items
Fault in the motor operation. (Motor does not rotate)		"COUPLER LAYOUT DRAWING" (P I-9)
1)HU pump motor:	• Disconnection of coupler of HU pump motor • Check continuity of pump motor	D-2
2)Wire harness:	• Check the continuity between the "Black" terminal in the pump motor coupler of the wire harness and the negative terminal of the battery (with the HU pump motor disconnected from the coupler) • Check the continuity between the "Red/White" terminal of ECU coupler and "Red/White" terminal of coupler for pump motor. (with the ECU coupler of wire harness disconnected) • Check the insulation between the "Red/White" terminal of the pump motor coupler of wire harness and the positive terminal of the battery. (with the fail safe relay disconnected)	
3)Fail safe relay:	• Check that the fail safe relay operates normally.	D-2

III

C-5-10	Fault code 41	
Fault location	Inspection items	Reference items
The locking tendency of the wheel cannot be eliminated.		
1)Wheel rotation:	• Check that the front and rear wheels rotate smoothly without drag. (dirt and rust on the caliper piston, deformation, rust and dirt on the brake pad) • Make sure there is no free play in the front wheel bearing, no bending of wheel axle and no deflection of the brake disk.	Service Manual CHAPTER 6
2)Master cylinder and caliper	• When the brake lever or the brake pedal is operated, the force must be correctly transmitted. When the brake lever or the brake pedal is released, the force must be correctly released.	
3)Brake fluid:	• Check the quantity of brake fluid in the reservoir tank visually (water, foreign matter contamination, solids and dirt).	Service Manual CHAPTER 3
4)Brake piping	• Make sure there is no air in the brake system. • Make sure there is no bending or deformation of the brake piping. (Between HU pump — front and rear caliper) • Make sure that there is no error in connection of the brake hose piping of the HU and master cylinder, caliper side.	D-6
5)Solenoid coupler terminal: 6)HU	• Make sure the front and rear solenoid coupler connections have not been accidentally reversed.	"COUPLER LAYOUT DRAWIN (P I-9)
7)No problems in all the items mentioned above.	• Replace the HU with a new one. Connect the piping and wiring correctly and test the HU operation.	D-6 D-7-3

	Color of terminal	
	Solenoid side	ECU side
Front	White	White / Blue
Rear	White	White / Green

NOTE:

- If connections have been reversed or made incorrectly, when the HU operation test described in D-7 is carried out, a phenomenon can be observed in which the lever or pedal encounters resistance and does not extend for its full stroke, but is slowly pressed back into position without any pulsating motion.
- If the front and rear connections have been made incorrectly, and if you perform the operation test of HU described in D-7, the sequence of HU operations for the front and rear will be reversed.

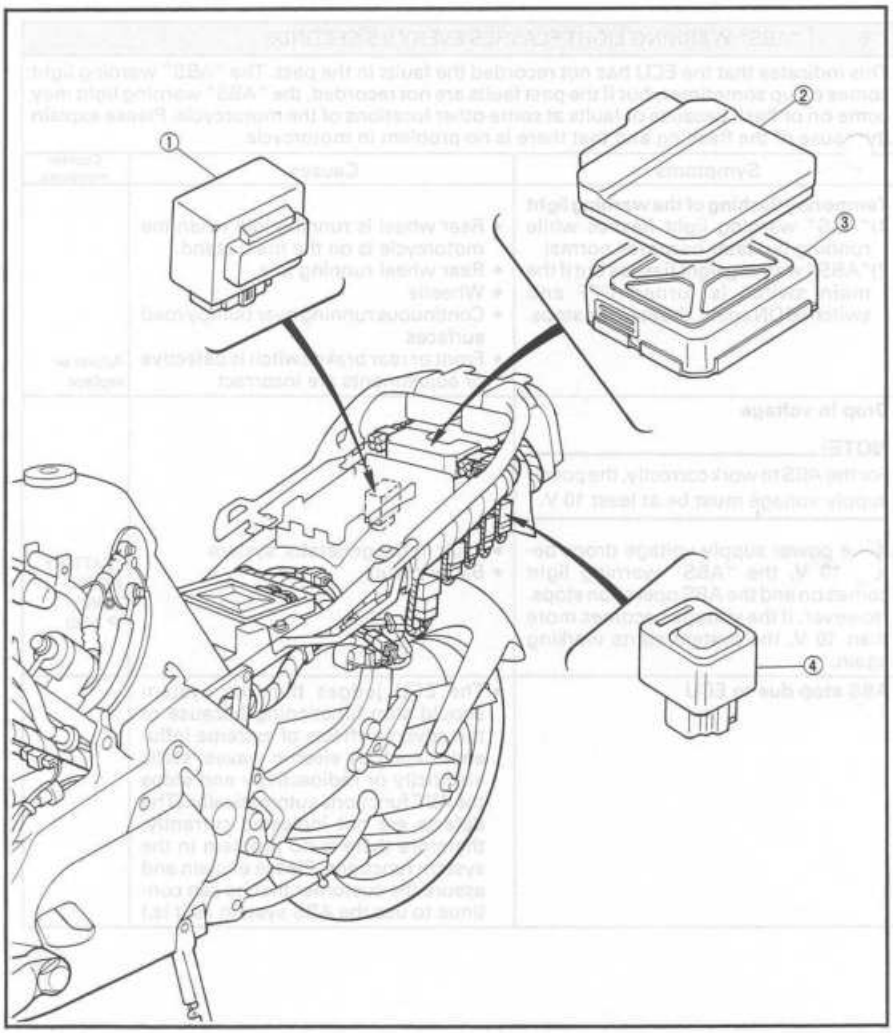
C-5-11	Fault code 51	
Fault location	Inspection items	Reference items
Drop in battery voltage	• Check the battery voltage. Charge the battery or replace it.	"BATTERY INSPECTION" (P 3-76)
Fault in power supply line	• Check the continuity of the power supply line. Battery → Starter relay (Main fuse) → Wire harness → Main switch → Fuse box → ECU	"CIRCUIT DIAGRAM"

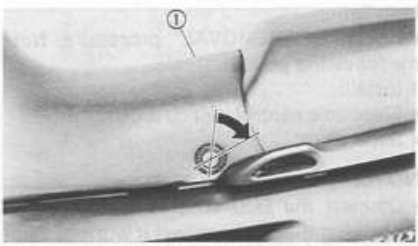
C-6	"ABS" WARNING LIGHT FLASHES EVERY 0.5 SECONDS	
This indicates that the ECU has not recorded the faults in the past. The "ABS" warning light comes on up sometimes, but if the past faults are not recorded, the "ABS" warning light may come on or flash because of faults at some other locations of the motorcycle. Please explain the cause of the flashing and that there is no problem in motorcycle.		
Symptoms	Causes	Counter measures
Temporary flashing of the warning light 1) "ABS" warning light flashes while running but later becomes normal 2) "ABS" warning light flashes but if the main switch is turned OFF and switched ON again, the flashing stops.	• Rear wheel is running idle when the motorcycle is on the main stand. • Rear wheel running idle • Wheelie • Continuous running over bumpy road surfaces • Front or rear brake switch is defective or adjustments are incorrect	Adjust or replace
Drop in voltage **NOTE:** For the ABS to work correctly, the power supply voltage must be at least 10 V. If the power supply voltage drops below 10 V, the "ABS" warning light comes on and the ABS operation stops. However, if the voltage becomes more than 10 V, the system starts working again.	• Fault in the generator system • Battery fault	"BATTERY INSPECTION" (P 3-76)
ABS stop due to ECU	• The ECU judges that the system should stop functioning because of the adverse effects of extreme influences such as electric waves, static electricity or radioactivity and stops the ABS functions automatically. (The defects are not indicated currently, therefore there is no problem in the system functions. Please explain and assure the customer that he can continue to use the ABS system as it is.)	

SERVICE OF COMPONENTS

D-1 ECU D-2 FAIL SAFE RELAY D-3 BRAKE LIGHT RELAY

① Fail safe relay
② ECU cover
③ Electronic control unit (ECU)
④ Brake light relay



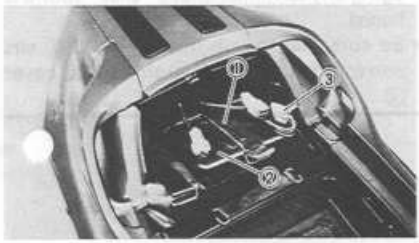


D-1 ECU

Removal

1. Place the motorcycle on a level place on its centerstand.
2. Remove:
   - Seat ①

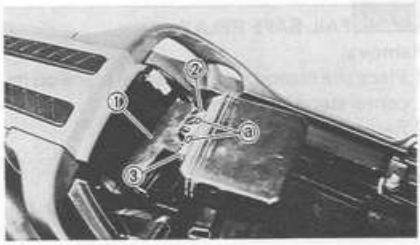
   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.



3. Remove:
   - Band ①
   - Electronic control unit ② (ECU)

NOTE:

When removing the ECU, carefully pull the ECU lead ③ so as not to cause damage to the ECU coupler unit.



4. Pull back the lid cover ①
5. Disconnect:
   - ECU coupler ②
   - ECU coupler ③

CAUTION:

Do not pull the ECU leads to remove the ECU coupler. Remove each terminal carefully while pressing the lock ⓐ.



Inspection

1. Inspect:
   - ECU terminals ①

     Cracks/Damage → Replace.
   - ECU coupler ② terminals

     Disconnected/Dirty → Repair.

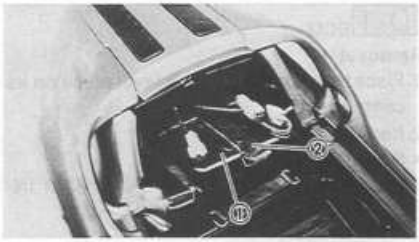
NOTE:

If the coupler is clogged with mud or dust, blow it off with compressed air.



2. Inspect:
   - ECU cover ①
   - Lid cover ②

     Wear/Damage → Replace





Installation

Reverse the "REMOVAL" procedure. Note the following points.

1. Install:
   - Electronic control unit ① (ECU)
   - Band ②

NOTE:

- Connect the ECU coupler unit properly, ensuring that you connect it without damaging any terminal, until a "click" sound is heard.
- Be sure that the rib inside the lid ③ sits correctly in the groove ⓐ on the ECU cover ④.

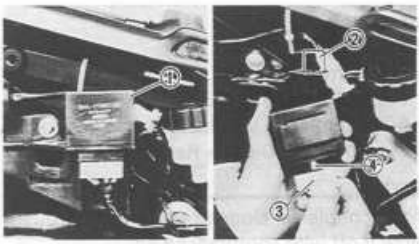
D-2 FAIL SAFE RELAY

Removal

1. Place the motorcycle on a level place on its centerstand.
2. Remove:
   - Seat
   - Side cover (right)

   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
3. Remove:
   - Fail safe relay ①

   from bracket ②
4. Disconnect:
   - Coupler ③ (fail safe relay)



CAUTION:

Do not pull the fail safe relay leads to remove the fail safe relay coupler.
Remove each terminal carefully while pressing the lock ④.

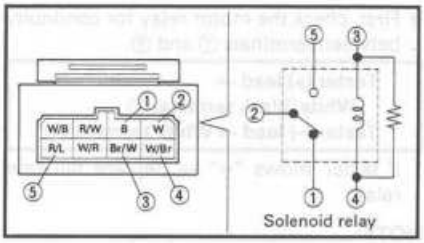
Inspection

1. Check:
   - Continuity of solenoid relay.

****

Checking steps:

- Connect the pocket tester (Ω × 1) to the following terminals.



Solenoid relay standard value

Terminal number	①	②	⑤	③	④
Normal condition	○	○		○	○
When battery power supply connected between ③ and ④.		○	○		

- First, check the solenoid relay for continuity between terminals ① and ②.

Tester (+) lead → Black terminal ①
Tester (–) lead → White terminal ②

If the tester shows "∞" → Replace fail safe relay.

- Second, check the solenoid relay for the continuity between terminals ③ and ④.

Tester (+) lead →
Brown/White terminal ③
Tester (–) lead →
White/Brown terminal ④

If the tester shows "∞" → Replace fail safe relay.

- Third, connect the battery positive (+) terminal to "Brown/White" terminal ③, and the battery negative (–) terminal to "White/Brown" terminal ④.
  Check the solenoid relay for the continuity between terminals ② and ⑤.

Tester (+) lead → White terminal ②
Tester (–) lead → Red/Blue terminal ⑤

If the tester shows "∞" → Replace fail safe relay.

CAUTION:

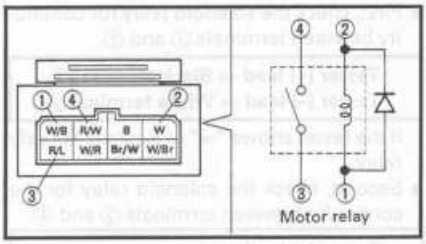
Take care to avoid shorting between the positive and negative terminals of the battery when connecting the relay terminal and battery.

****

2. Check:
- Continuity of motor relay.

****

Checking steps:
- Connect the pocket tester (Ω × 1) to the motor relay terminal.



Motor relay standard value

Terminal number	①	③	④	②
Normal condition	○			○
When battery power supply connected between ② and ①.		○	○	

- First, check the motor relay for continuity between terminals ① and ②.

Tester (+) lead → White/Black terminal ①
Tester (–) lead → White terminal ②

If tester shows "∞" → Replace fail safe relay.

NOTE:

Make sure you do not reverse the connections of test lead because you will not be able to detect the fault.

- Second, measure the motor relay for resistance between terminal ② and ①.

Tester (+) lead → White terminal ②
Tester (–) lead → White/Black terminal ①

Motor relay resistance:
80 ~ 120 Ω at 20°C (68°F)

Out of specification → Replace fail safe relay.

- Third, connect the battery positive (+) terminal to "White" terminal ②, and connect the battery negative (–) terminal to "White/Blue" terminal ①.

Check the motor relay component for the continuity between terminals ③ and ④.

Tester (+) lead → Red/Blue terminal ③
Tester (–) lead → Red/White terminal ④

If the tester shows "∞" → Replace fail safe relay.

CAUTION:

- **Take care not to reverse the battery connections because the diode will be damaged.**
- **Take care to avoid shorting the positive and negative terminals when connecting the battery and relay.**

****

3. Check the HU operation
Refer to D-7-3
"ABS" warning light comes on again → Inspect wire harness continuity and replace the ECU.



Installation

Reverse the "Removal" procedure.
Note the following points.

1. Install:
   - Fail safe relay ①

NOTE:

Connect the fail safe relay coupler properly, ensuring that you connect it without damaging any terminal, until a "click" sound is heard.

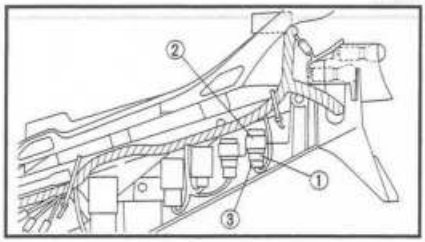
D-3 BRAKE LIGHT RELAY

Removal

1. Place the motorcycle on a level place on its centerstand.
2. Remove
   - Seat
   - Side cover (left)

   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
3. Remove:
   - Brake light relay ①

   from bracket ②
4. Disconnect
   - Coupler ③ (brake light relay)



NOTE:

Do not pull the brake light relay leads to remove the brake light relay coupler.
Remove each terminal carefully while pressing the lock ④.

Inspection

1. Check:
   - Continuity of brake light relay

****

Checking steps:

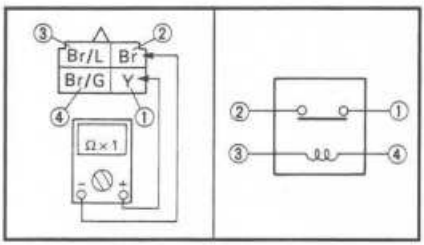
- Connect the pocket tester (Ω × 1) to the following terminals.
- First, check the brake light relay for continuity between terminal ① and ②.

Tester (+) lead → Yellow terminal ①
Tester (–) lead → Brown terminal ②

If the tester shows "∞" → Replace brake light relay.

- Second, connect the battery positive (+) terminal to "Brown/Blue" terminal ③, and the battery negative (–) terminal to "Brown/Green" terminal ④.

  Check the brake light relay for continuity between terminals ① and ②.



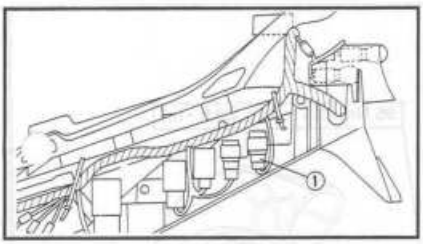
Tester (+) lead → Yellow terminal ①
Tester (–) lead → Brown terminal ②

If the tester shows "0" → Replace brake light relay.

CAUTION:

Take care to avoid shorting the positive and negative terminals when connecting the battery and relay.

****



Installation

Reverese the "Removal" procedure.

Note the following points.

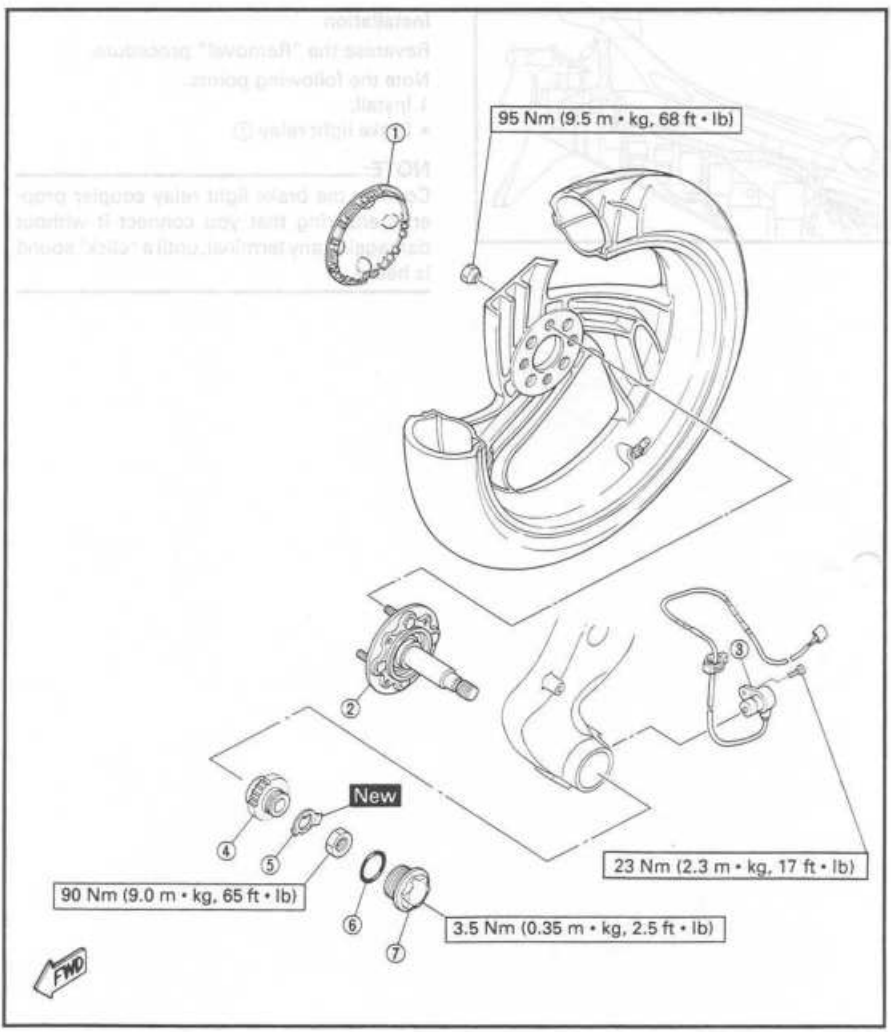
1. Install:
   - Brake light relay ①

NOTE:

Connect the brake light relay coupler properly, ensuring that you connect it without damageing any terminal, until a "click" sound is heard.

D-4 FRONT WHEEL SENSOR AND SENSOR ROTOR

① Wheel cap
② Wheel axle
③ Front wheel sensor
④ Sensor rotor
⑤ Lock washer
⑥ O-ring
⑦ Hub cap



ABS wheel sensor and sensor rotor

CAUTION:

- **ABS components have been adjusted and set with precision. Therefore handle these components carefully and avoid impact or dirt on these components.**
- **The ABS wheel sensor cannot be disassembled. Even if you feel that the fault is minor, do not try to disassemble and repair it. Replace the part.**

Removal

⚠ WARNING

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

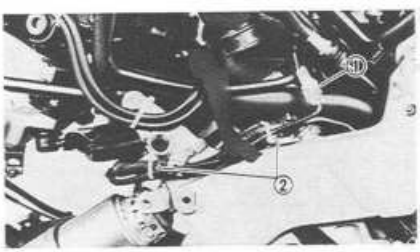
1. Place the motorcycle on a level place on its centerstand.

2. Remove:
- Seat
- Top cover
- Inner panel (left)
- Side cowling (left)

Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.

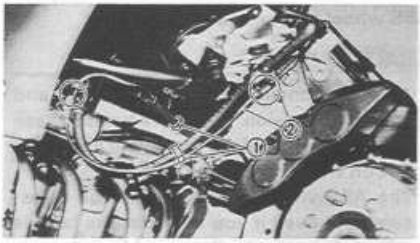
3. Remove:
- Front wheel

Refer to "FRONT WHEEL AND WHEEL AXLE" in CHAPTER IV.



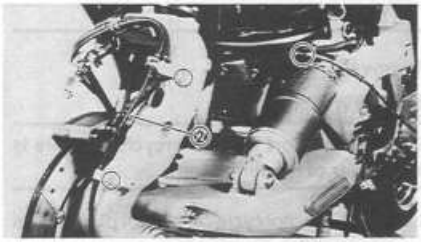
4. Disconnect:
- Coupler ① (wheel sensor)

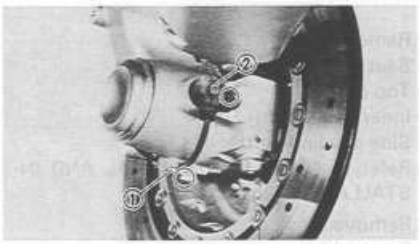
5. Remove:
- Bands ②



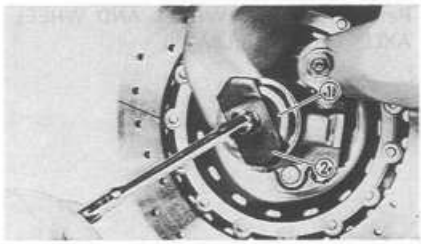
6. Remove:
- Clamps ①

7. Disconnect:
- Wheel sensor lead ②
  from lead holders





8. Remove:
- Lead holder ①
- Wheel sensor ②



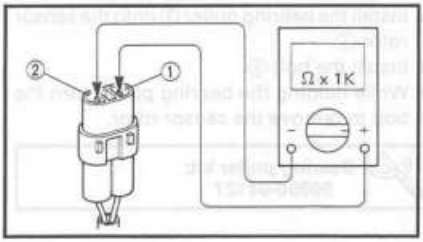
9. Remove:
- Hub cap ①
  Using the cap wrench ②.

	Cap wrench: **90890-01451**



Inspection

1. Inspect:
- Front wheel sensor ①
  Cracks/Bends/Damage → Replace.



2. Check:
- Front wheel sensor resistance.
  Connect the pocket tester (Ω × 1k) to the front wheel sensor coupler terminal.

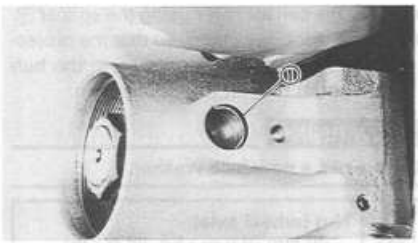
Tester (+) lead → White terminal ①
Tester (–) lead → Brake terminal ②

CAUTION:

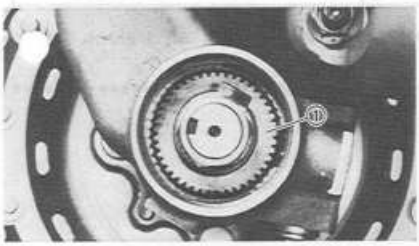
While checking, do not force the pocket tester probes into the coupler terminals. The terminal gap may widen resulting in poor connection.

Front wheel sensor resistance:
1.19 ~ 2.21 kΩ at 20 °C (68 °F)

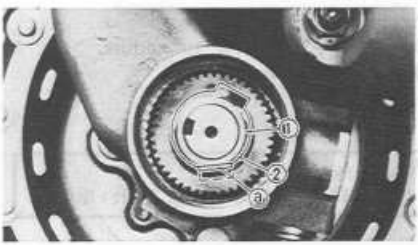
Out of specification → Replace.



3. Inspect:
- O-ring ①
  Wear/Damage → Replace.

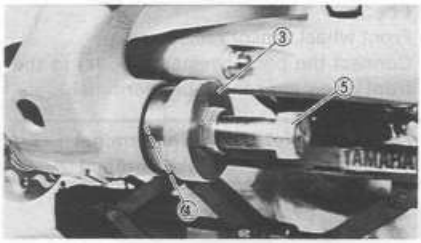


4. Inspect:
- Sensor rotor ①
  Cracks/Damage → Replace.
  Contamination → Clean.



****

Replacement steps:
- Straighten the lock washer tab ⓐ.
- Remove the nut ① and lock washer ②.

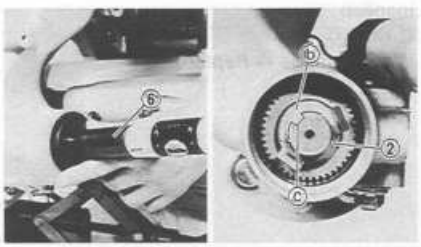


- Install the bearing puller ③ onto the sensor rotor ④.
- Install the bolt ⑤.
- While holding the bearing puller, turn the bolt to remove the sensor rotor.

	Bearing puller kit: 90890-04127



- Clean the installation area of the sensor rotor using a cloth dampened with solvent.

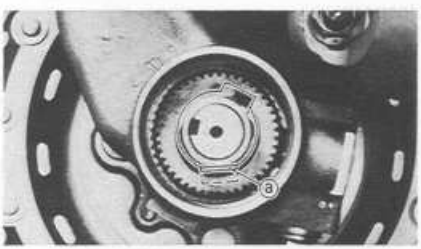


- Install the sensor rotor using the spacer ⑥.
- Install the lockwasher ② so that the projection ⓑ matches the groove ⓒ in the hub and tighten the nut to specification.

⚠ WARNING

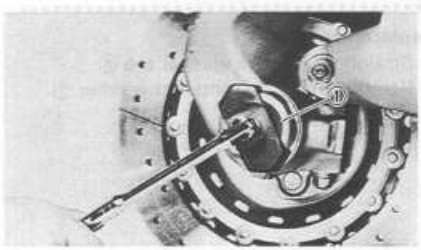
Always use a new lock washer.

	Nut (wheel axle): 90 Nm (9.0 m • kg, 65 ft • lb)



- Bend the lock washer tab ⓐ along the nut flat.

****

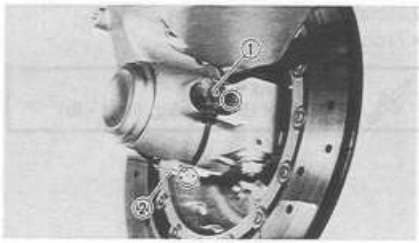


Installation

Reverse the "Removal" procedure.
Note the following points.

1. Install:
   - Hub cap ①

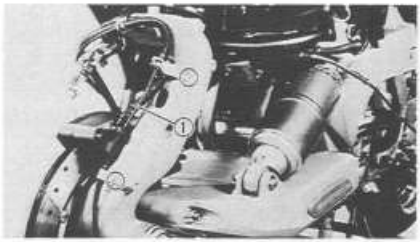
	Hub cap: 3.5 Nm (0.35 m• kg, 2.5 ft • lb)



2. Install:
- Wheel sensor ①
- Lead holder ②

	Screw (wheel sensor): **23 Nm (2.3 m · kg, 17 ft · lb)** **Bolt (lead holder):** **8 Nm (0.8 m · kg, 5.8 ft · lb)**

NOTE:
Apply a grease to the O-ring of the wheel sensor.

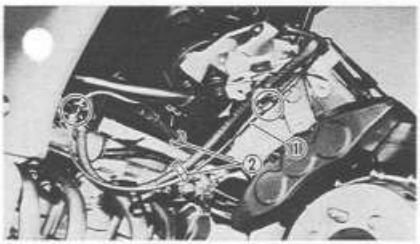


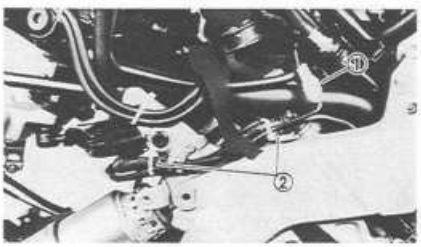
3. Connect:
- Wheel sensor lead ①
  to lead holders

	Screw (lead holder) **6.5 Nm (0.65 m · kg, 4.7 ft · lb)**

4. Install:
- Clamps ②

⚠ WARNING
Make sure that the brake hose and wheel sensor lead are routed properly.

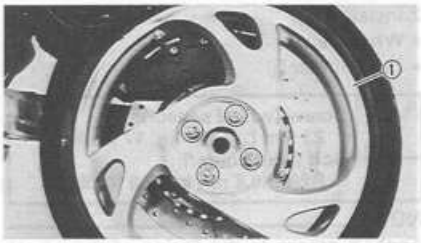




5. Connect:
- Coupler ① (wheel sensor)

6. Install:
- Bands ②

NOTE:
Always use a new band.



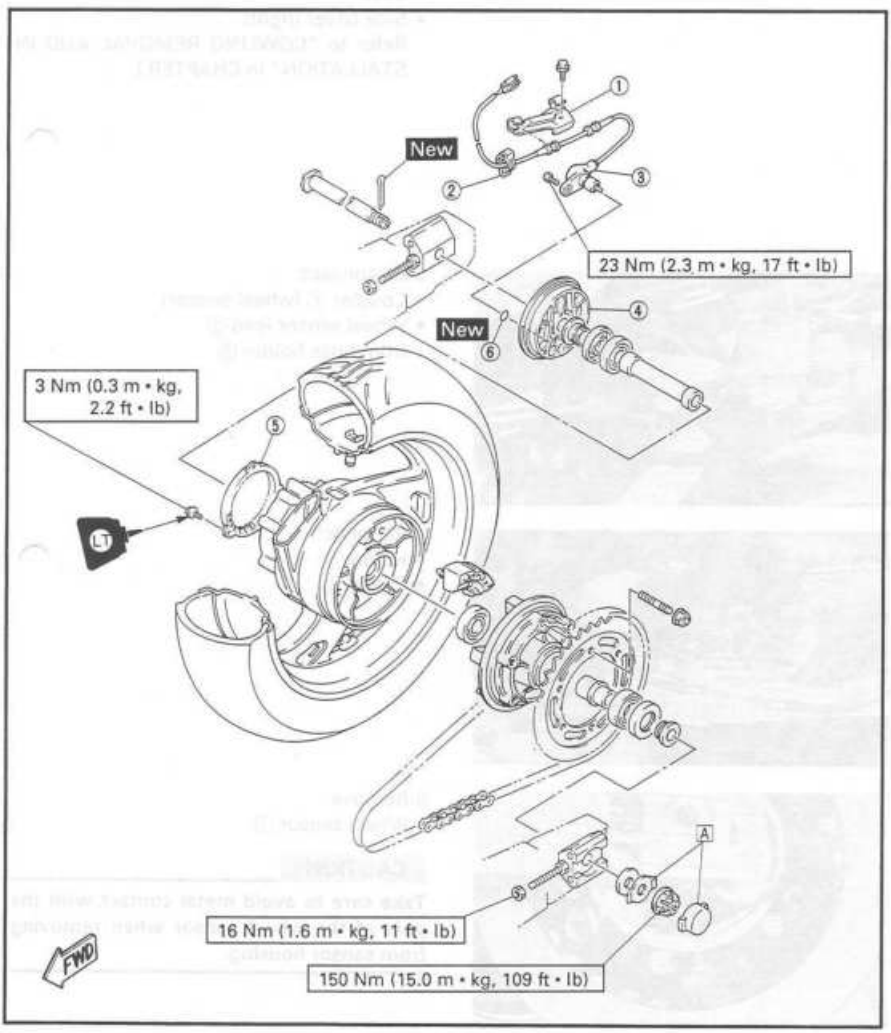
7. Install:
• Front wheel ①

	Nut (front wheel): 95 Nm (9.5 m • kg, 68 ft • lb)

III

D-5 REAR WHEEL SENSOR AND SENSOR ROTOR

① Holder (sensor lead)
② Clamp
③ Rear wheel sensor
④ Sensor housing
⑤ Sensor rotor
⑥ O-ring
A For D only



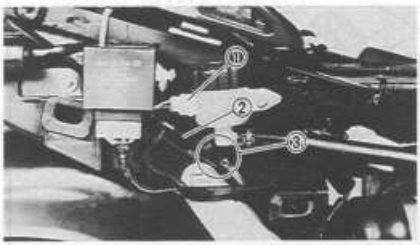
Removal

⚠ WARNING

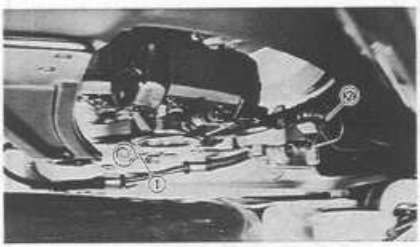
Securely support the motorcycle so there is no danger of it falling over.

1. Place the motorcycle on a level place and on its centerstand.
2. Remove:
   - Seat
   - Side cover (right)

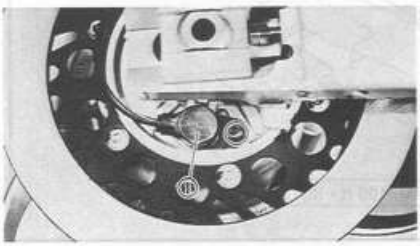
   Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.



3. Disconnect:
   - Coupler ① (wheel sensor)
   - Wheel sensor lead ② from hose holder ③



4. Remove:
   - Holder ①
   - Clamp ②



5. Remove:
   - Wheel sensor ①

CAUTION:

Take care to avoid metal contact with the pole of the wheel sensor when removing from sensor housing.



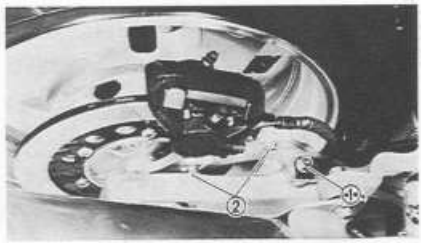
6. Remove:
- Rear fender ①
  (with chain guard ②)

NOTE:
Take care not to lose the collars ③.

A Left side
B Right side



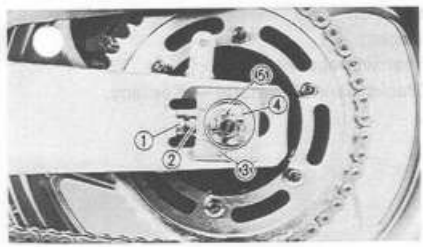
III



7. Loosen:
- Bolt ① (brake caliper bracket)

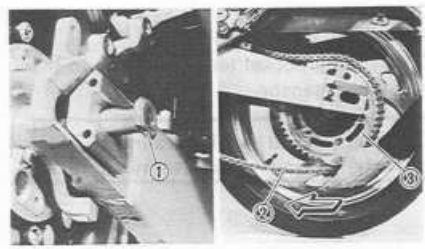
8. Remove:
- Bolts ② (brake caliper)

NOTE:
Do not depress the brake pedal while the caliper is removed.



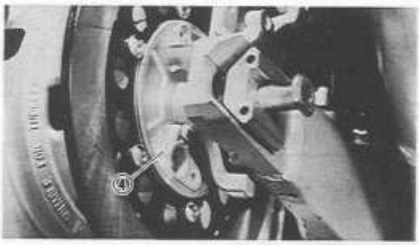
9. Loosen:
- Locknut ①
- Adjuster ②

10. Remove:
- Cotter pin ③
- Axle nut ④
- Washer ⑤



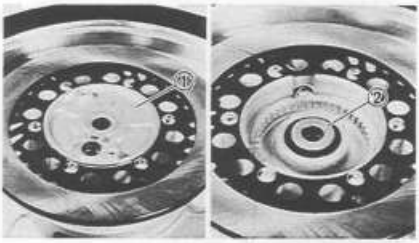
11. Remove:
- Rear wheel axle ①
- Rear wheel

NOTE:
Push the rear wheel forward and disconnect the drive chain ② from the rear sprocket wheel ③.

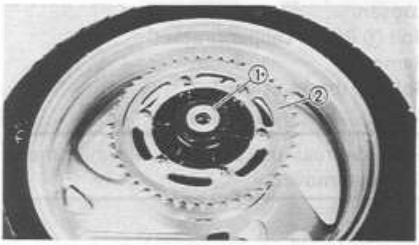


CAUTION:

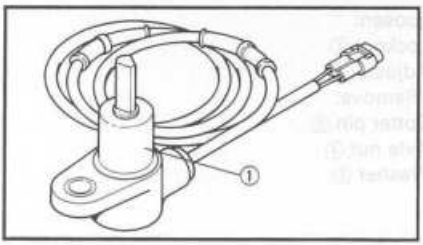
To prevent damage to the sensor rotor, the sensor housing ④ should not be removed before rear wheel is removed.



12. Remove:
- Sensor housing ①
- Collar ②

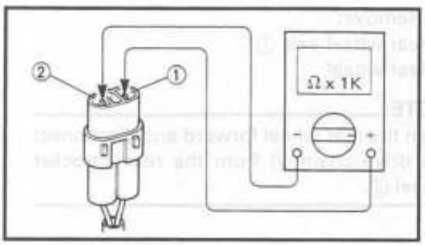


13. Remove:
- Collar ①
- Sprocket wheel ②



Inspection

1. Inspect:
- Rear wheel sensor ①
  Cracks/Bends/Damage → Replace.



2. Check:
- Rear wheel sensor resistance.
  Connect the pocket tester (Ω x 1K) to the rear wheel sensor.

Tester (+) lead → White terminal ①
Tester (–) lead → Black terminal ②

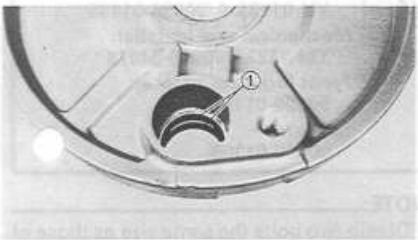
NOTE:
While checking, do not force the pocket tester probes into the coupler terminals. The terminal clearance may widen resulting in poor connection.

Rear wheel sensor resistance:
1.19 ~ 2.21 kΩ at 20°C (68°F)

Out of specification → Replace.

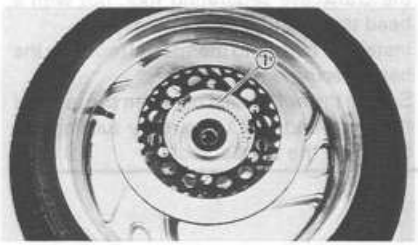
3. Inspect:
- O-rings ①

Wear/Damage → Replace.



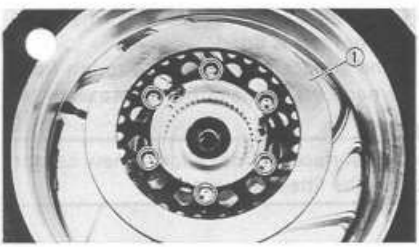
4. Inspect:
- Sensor rotor ①

Cracks/Damage → Replace.
Contamination → Clean.

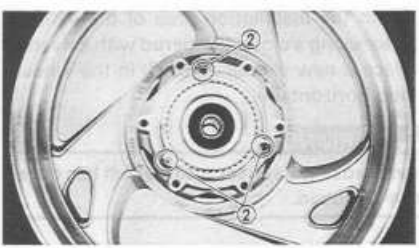


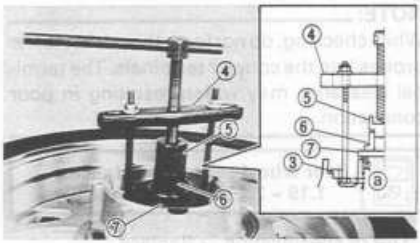
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Replacement steps:
- Remove the brake disc ①.



- Remove the bolts ② (rear sensor rotor).



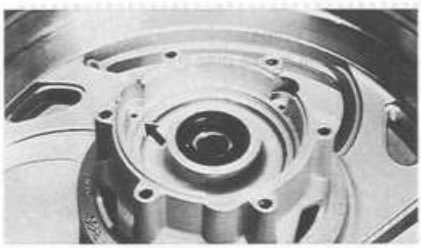


- Remove the rear sensor rotor ③ by using the crankcase separating tool ④, the mechanical seal installer ⑤, the front fork seal adapter ⑥ and the spacer ⑦.

NOTE:
Be careful not to allow the inner race of the bearing to be directly.

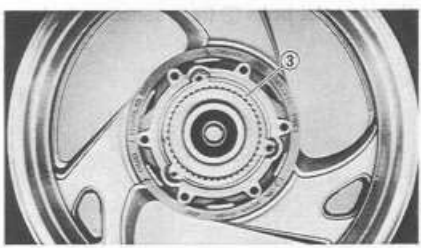
Crankcase separating tool:
YU-01135-A/90890-01135
Mechanical seal installer:
YM-33221/90890-04078
Front fork seal adapter:
90890-01186
Spacer:
90890-01309

NOTE:
- Obtain two bolts the same size as those of the crankcase separating tool, but with a head thin enough to fit into gap ⓐ.
- Install the bolts into the special tool with the heads facing downward.
- Secure the bolt heads between the teeth of the rotor and pull upward by turning the handle of the special tool.



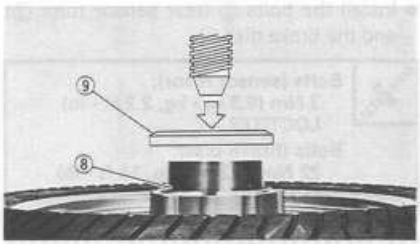
- Check the surface of the hub where the sensor rotor is fitted.
  If the surface is found to be rough from damage, etc., replace the wheel assembly.

NOTE:
Rough surface will not allow a new sensor rotor to be fitted horizontally.



- Clean the installation area of the sensor rotor using a cloth dampered with solvent.
- Place a new sensor rotor ③ in the wheel hub horizontally.

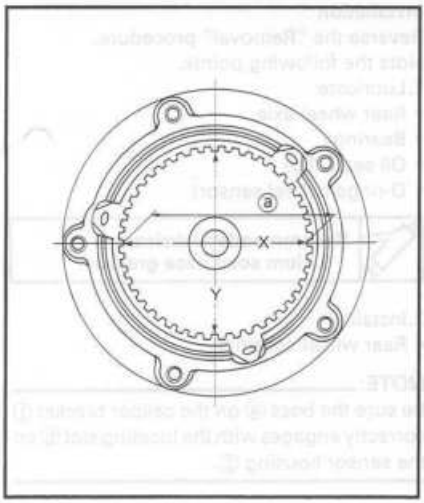
⚠ WARNING
Never reuse the sensor rotor which has once been removed.



- Place the sensor rotor installation pot ⑧ on the new sensor rotor ③, and put on appropriate support plate ⑨ on the pot ⑧ horizontally.
  Then fully fit the sensor rotor vertically in the hub while applying force on the center of the plate with a hydraulic press.

	Sensor rotor installation pot: 90890-04124

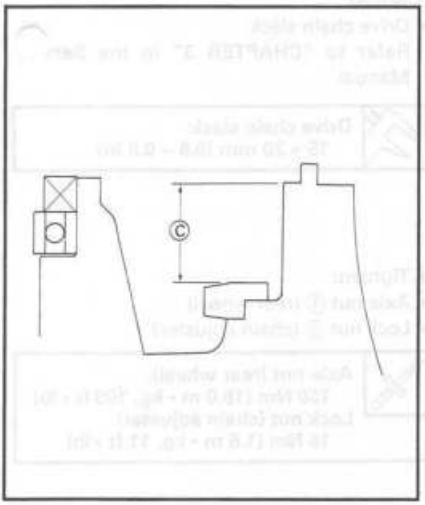
CAUTION:
Do not strike the sensor rotor.



- Measure the inside diameters of the installed sensor rotor with vernier calipers.

NOTE:
Measure the inside diameters of the installed sensor rotor at four equally divided points of its circumference, at right angles to the wheel axle.
Then, find the average of the measurements.

	Sensor rotor inside diameter ⓐ: 99.90 ~ 100.15 mm (3.933 ~ 3.943 in) **Allowance ⓑ: Less than 0.1 mm (0.004 in)**
	$ⓐ = \frac{X+Y}{2}$ $ⓑ = X-Y$



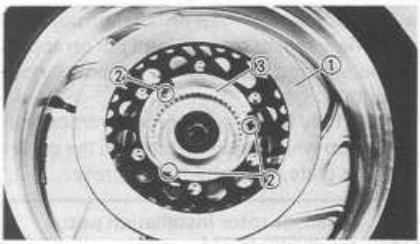
If the measurement is not within the above ⓐ and ⓑ, replace the wheel assembly.

- Measure the distance between the surface of the wheel hub and the outer circumference of the sensor rotor with a vernier calipers.

NOTE:
Measure the distance at six equally divided points of the sensor rotor in parallel to the wheel axle. Then, find the average of the measurements.

	Distance ⓒ: 18.15 ~ 18.85 mm (0.715 ~ 0.742 in)

If out of specification, replace the wheel assembly.



- Install the bolts ② (rear sensor rotor ③) and the brake disk ①.

Bolts (sensor rotor):
3 Nm (0.3 m · kg, 2.2 ft · lb)
LOCTITE®
Bolts (brake disc):
22 Nm (2.2 m · kg, 16 ft · lb)
LOCTITE®

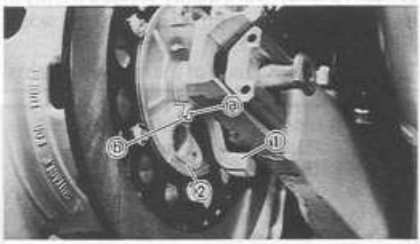
****

Installation

Reverse the "Removal" procedure.
Note the following points.

1. Lubricate:
- Rear wheel axle
- Bearings
- Oil seals (lip)
- O-rings (wheel sensor)

Recommended lubricant:
Litium soap base grease



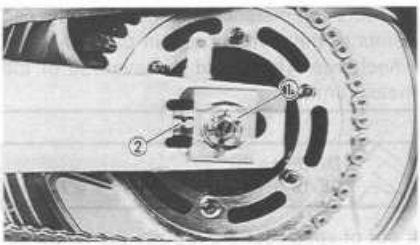
2. Install:
- Rear wheel assembly

NOTE:

Be sure the boss ⓐ on the caliper bracket ① correctly engages with the locating slot ⓑ on the sensor housing ②.

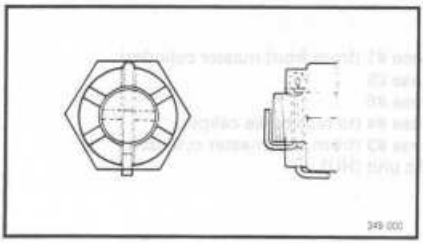
3. Adjust:
- Drive chain slack
  Refer to "CHAPTER 3" in the Service Manual.

Drive chain slack:
15 ~ 20 mm (0.6 ~ 0.8 in)



4. Tighten:
- Axle nut ① (rear wheel)
- Lock nut ② (chain adjuster)

Axle nut (rear wheel):
150 Nm (15.0 m · kg, 109 ft · lb)
Lock nut (chain adjuster):
16 Nm (1.6 m · kg, 11 ft · lb)

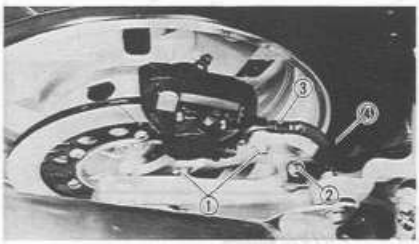


NOTE:
- Do not loosen the axle nut after torque tightening .
- If the axle nut groove is not aligned with the wheel axle cotter pin hole, align the groove to the hole by tightening up on the axle nut.

5. Install:
- Cotter pin

⚠ WARNING

Always use a new cotter pin on the axle nut.

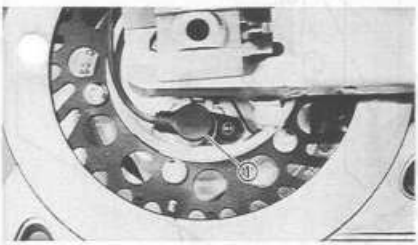


6. Tighten:
- Bolts ① (brake caliper)
- Bolt ② (caliper bracket)

	Bolt (brake caliper) **35 Nm (3.5 m • kg, 25 ft • lb)** **Bolt (caliper bracket)** **49 Nm (4.9 m • kg, 35 ft • lb)**

⚠ WARNING

Make sure that brake hose is routed properly.



③ Brake hose
④ Brake hose guides

7. Install:
- Wheel sensor ①
- Clamp ②
- Holder ③

NOTE:

When mounting the wheel sensor, make sure that there is no twist in the wheel sensor lead and no foreign matter sticking to the pole.

CAUTION:

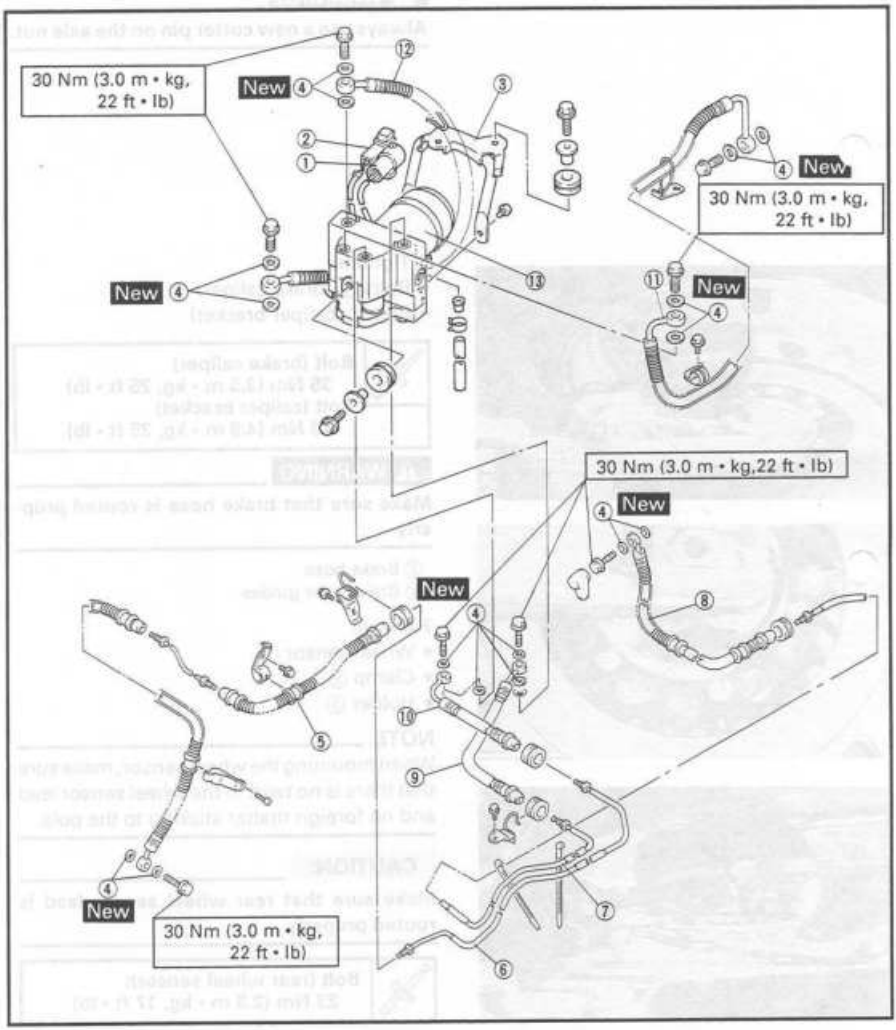
Make sure that rear wheel sensor lead is routed properly.

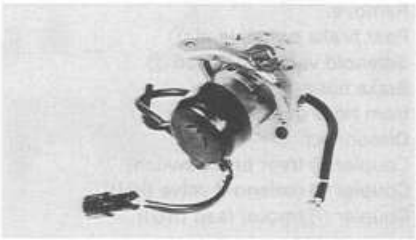


	Bolt (rear wheel sensor): **23 Nm (2.3 m • kg, 17 ft • lb)**

D-6 HYDRAULIC UNIT (HU)

① Motor lead (HU)
② Solenoid valve lead (HU)
③ Hydraulic unit stay
④ Copper washer
⑤ Brake hose #2 (to front brake caliper)
⑥ Brake pipe #2
⑦ Brake pipe #1
⑧ Brake hose #1 (from front master cylinder)
⑨ Brake hose #5
⑩ Brake hose #6
⑪ Brake hose #4 (to rear brake caliper)
⑫ Brake hose #3 (from rear master cylinder)
⑬ Hydraulic unit (HU)





NOTE:
When checking this unit for the solenoid and motor resistance, do not remove it. Refer to the "Inspection" section of this chapter.

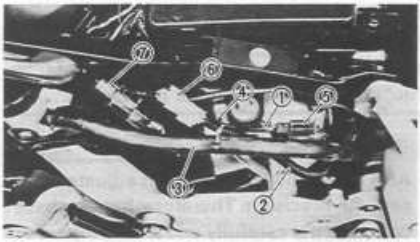
CAUTION:
- **ABS components have been adjusted and set with precision. Therefore, handle these components carefully and avoid impact or dirt on these components.**
- **The ABS Hydraulic Unit cannot be disassembled. Even if you feel that the fault is minor, do not try to disassemble and repair it. Replace the part.**
- **Be careful that no dirt, dust, or other foreign material enter the HU unit.**

Hydraulic unit components rarely require disassembly.
DO NOT:
- **Disassemble components unless absolutely necessary.**
- **Use solvents on internal brake component.**
- **Use contaminated brake fluid for cleaning.**
- **Allow brake fluid to come in contact with the eyes, otherwise eye injury may occur.**
- **Allow brake fluid to contact painted surfaces or plastic parts, otherwise damage may occur.**
- **Disconnect any hydraulic connections, otherwise the entire system must be disassembled, drained, cleaned, and then properly filled and bled after reassembly.**

Removal

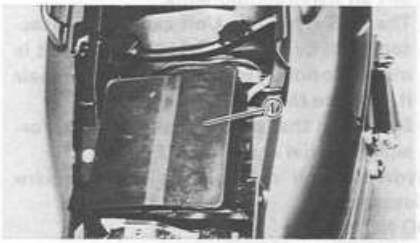
⚠ WARNING
Securely support the motorcycle so there is no danger of it falling over.

1. Place the motorcycle on a level place and on its centerstand.
2. Remove:
- Seat
- Side cover (right)
Refer to the "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.

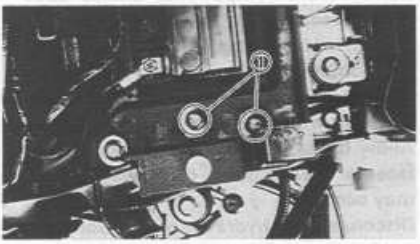


3. Remove:
- Rear brake switch lead ①
- Solenoid valve (HU) lead ②
- Brake hose ③
  from hose guide ④

4. Disconnect:
- Coupler ⑤ (rear brake switch)
- Coupler ⑥ (solenoid valve (HU))
- Coupler ⑦ (motor lead (HU))



5. Remove:
- ECU ①



6. Loosen:
- Union bolts ①

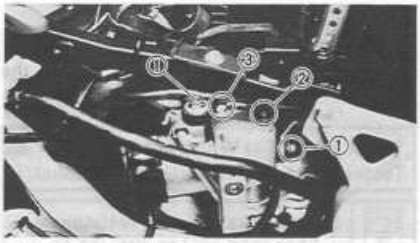
NOTE:
Do not operate the front brake lever and the rear brake pedal. The brake fluid may leak out and air may enter the hose.

CAUTION:
- **Spread out a waste cloth around the hydraulic unit before removing the brake hose so that the brake fluid does not leak on other parts.**
- **Brake fluid may erode painted surfaces or plastic parts. Always clean up spilled fluid immediately.**



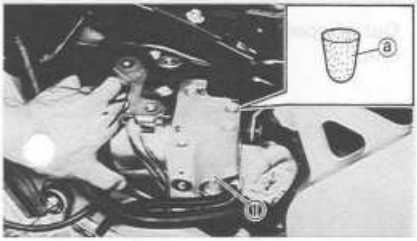
7. Disconnect:
- Brake hose #4 ①
- Brake hose #3 ②
  (with copper washers)

CAUTION:
Dirt around the hydraulic unit could contaminate the brake fluid in the hose during removal. Therefore clean off any dirt throughly before removing the brake hose.



8. Remove:
- Bolts ① (hydraulic unit)

9. Disconnect:
- Brake hose #6 ②
- Brake hose #5 ③
  (with copper washers)



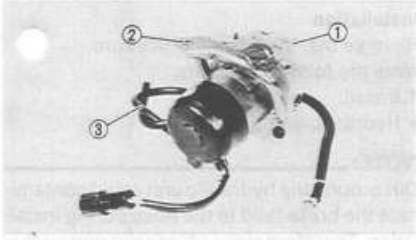
10. Remove:
- Hydraulic unit ①

NOTE:

When removing the hydraulic unit, install an appropriate rubber plug ⓐ so as to prevent brake fluid leakage and entering of foreign matter.

CAUTION:

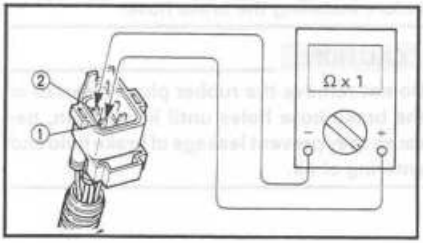
Spread out a waste cloth around the hydraulic unit before removing the brake hose so that the brake fluid does not leak on other parts.



Inspection

1. Inspect:
- Hydraulic unit ①
- Hydraulic unit stay ②
- Breather hose ③
  Cracks/Damage → Replace.

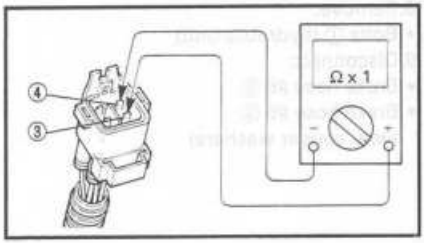
2. Check:
- Solenoid valve (front) resistance.
  Connect the pocket tester (Ω x 1) to the solenoid valve (front) terminals.



Tester (+) lead → White terminal ①
Tester (–) lead → White/Blue terminal ②

Solenoid valve (front) resistance: Less than 10Ω at 20°C (68°F)

Out of specification → Replace hydraulic unit.

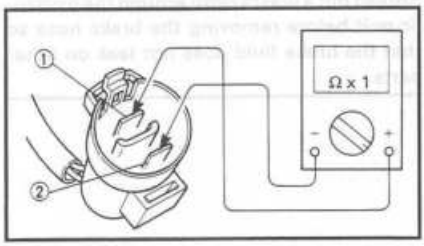


3. Check:
- Solenoid valve (rear) resistance.
  Connect the pocket tester (Ω x 1) to the solenoid valve (rear) terminals.

Tester (+) lead → White terminal ③
Tester (–) lead → White/Green terminal ④

Solenoid valve (rear) resistance: Less than 10Ω at 20°C (68°F)

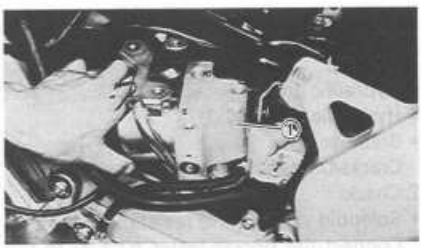
Out of specification → Replace hydraulic unit.



4. Check:
- Continuity of motor (HU)
  Connect the pocket tester (Ω x 1) to the motor coupler terminals.

Tester (+) lead → Red/White terminal ①
Tester (–) lead → Black terminal ②

If the tester shows "∞" → Replace hydraulic unit.



Installation

Reverse the "Removal" procedure.
Note the following points.

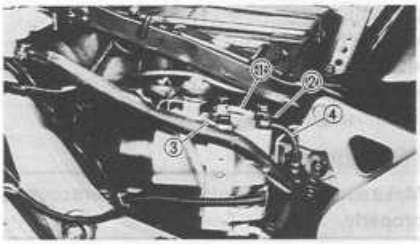
1. Install:
- Hydraulic unit ①

NOTE:

Dirt around the hydraulic unit could contaminate the brake fluid in the hose during installation. Therefore clean off any dirt thoroughly before installing the brake hose.

CAUTION:

Do not remove the rubber plugs inserted in the brake hose holes until installation, because they prevent leakage of brake fluid and entering of air.



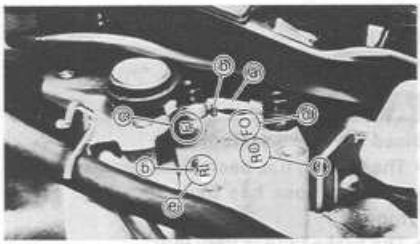
2. Remove:
- Rubber plugs

3. Install:
- Brake hose #5 ①
  (from front master cylinder)
- Brake hose #6 ②
  (to front brake caliper)
- Brake hose #3 ③
  (from rear master cylinder)
- Brake hose #4 ④ (to rear brake caliper)
  (with copper washers)

	Union bolt: **30 Nm (3.0 m • kg, 22 ft • lb)**

NOTE:

The inlet pipe ends of the front and rear brake hoses are white plated, and the outlet ends black plated.



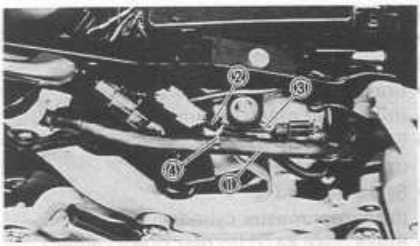
CAUTION:

- **When installing the brake hose, position it so that portion of pipe ⓐ is touching projection ⓑ on the hydraulic unit.**
- **Make sure that the brake hoses are not twisted and are connected and routed properly.**

⚠ WARNING

- **Always use new copper washers.**
- **On the upper surface of the hydraulic unit, marks (F.I), (F.O), (R.I), (R.O) are provided to indicate the position of installation of each hose. Install the hoses after carefully confirming the correct position of each hose. Incorrect installation of brake hose will result in locking of wheel.**

F.I ⓒ (Front Inlet) – Brake hose #5 of from front master cylinder
F.O ⓓ (Front Outlet) – Brake hose #6 of to front brake caliper
R.I ⓔ (Rear Inlet) – Brake hose #3 of from rear master cylinder
R.O ⓕ (Rear Outlet) – Brake hose #4 of to rear brake caliper



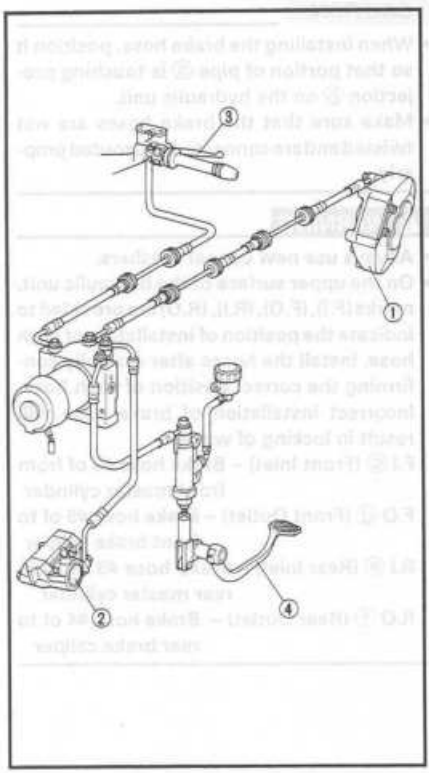
3. Install:
- Brake hose ①
- Solenoid valve (HU) lead ②
- Rear brake switch lead ③ to hose guide ④

CAUTION:

Make sure that the leads and hoses are routed properly.

4. Fill:
- Brake system

Recommended brake fluid:
Front:
DOT #4
Rear:
DOT#4



Brake system air bleeding

1. Air bleed:
- Brake system

⚠ WARNING

Bleed the brake system if:
- **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 loss of braking performance may occ if the brake system is not properly bled.

****

Air bleeding steps:

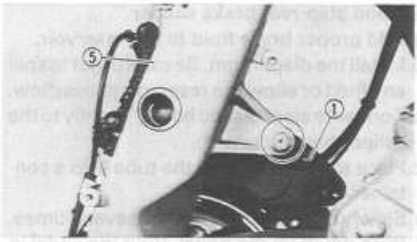
NOTE:

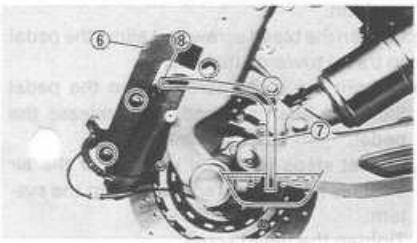
Bleed the brake system in the following order.
I First step-Front brake caliper ①
II Second step-Rear brake caliper ②

③ Brake lever
④ Brake pedal

First step-front brake caliper

a. Remove the front wheel.
Refer to "FRONT WHEEL AND WHEEL AXLE" in CHAPTER IV.





b. Remove the front brake caliper assembly ① from the knuckle arm ⑤.
c. Install the caliper support bracket ⑥, then install the caliper assembly on the caliper support bracket.

	Caliper support bracket 90890-01453

d. Add proper brake fluid to the reservoir.
e. Install the diaphragm. Be careful not to spill any fluid or allow the reservoir to overflow.
f. Connect a clear plastic hose ⑦ tightly to the caliper bleed screw ⑧.
g. Place the other end of the tube into a container.
h. Slowly apply the brake lever several times.
i. Pull the lever in. Hold the lever in position.
j. Loosen the bleed screw and allow the lever to travel towards its limit.
k. Tighten the bleed screw when the lever limit has been reached, then release the lever.
l. Repeat steps (h) to (k) until all air bubbles have disappeared from the fluid.
m. Tighten the bleed screw.

	Bleed screw: 6 Nm (0.6 m • kg, 4.3 ft • lb)

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.

A



B

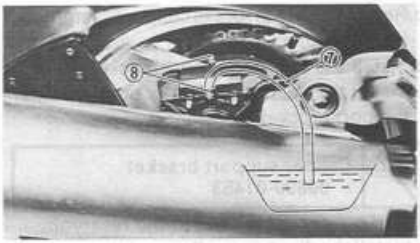


n. Add brake fluid to proper level.
Refer to "[D-7-1] Brake Fluid Inspection".
A Front B Rear
o. Remove the front brake caliper and caliper support bracket, then install the caliper assembly to the knuckle arm.

	Bolt (front brake caliper): 67 Nm (6.7 m • kg, 48 ft • lb)

p. Install the front wheel.
Refer to "FRONT WHEEL AND WHEEL AXLE" in CHAPTER IV.

⚠ WARNING
Check the operation of the brake after bleeding the brake system.



Second step-rear brake caliper

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 a clear plastic hose ⑦ tightly to the caliper bleed screw ⑧.
d. Place the other end of the tube into a container.
e. Slowly apply the brake pedal several times.
f. Push down on the pedal. Hold the pedal in position.
g. Loosen the bleed screw and allow the pedal to travel towards its limit.
h. Tighten the bleed screw when the pedal limit has been reached; then release the pedal.
i. Repeat steps (e) to (h) until all of the air bubbles have been removed from the system.
j. Tighten the bleed screw.

	Bleed screw: 6 Nm (0.6 m • kg, 4.3 ft • lb)

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.

k. Add brake fluid to proper level.
Refer to "[D-7-1] Brake Fluid Inspection".

⚠ WARNING

Check the operation of the brake after bleeding the brake system.

****

Hydraulic unit pressure drop operation check
Refer to "[D-7-3] HU Operation Check".
Test run
Refer to "[D-7-4] Test Run".

D-7 FINAL INSPECTION BEFORE RE-DELIVERY OF THE SERVICE MOTORCYCLE

Inspection procedure:
1. Brake fluid inspection
2. Re-confirmation of wheel sensor installation
3. HU operation test
4. Erasing the fault-code(s)
5. Test run

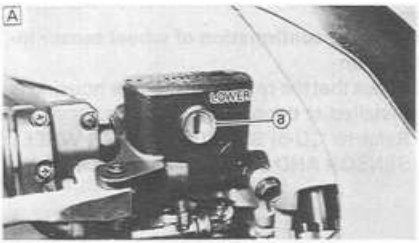
D-7-1 Brake fluid inspection

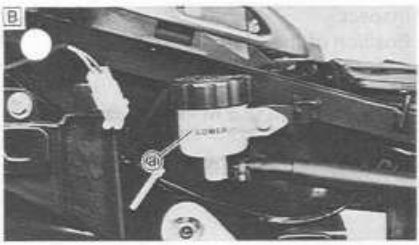
1. Place the motorcycle on a level place.

NOTE:
- Position the motorcycle straight up when inspecting the brake fluid level.
- When inspecting the front brake fluid level, make sure the master cylinder top is horizontal by turning the handlebars.

2. Inspect:
- Brake fluid level
  Fluid level is under "LOWER" level line ⓐ
  → Fill up.

Recommended brake fluid
Front:
DOT #4
Rear:
DOT #4

A


B


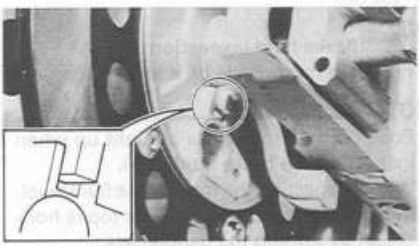
A Front
B Rear

CAUTION:
Brake fluid may erode painted surfaces or plastic parts. Always clean up spilled fluid immediately.

⚠ WARNING

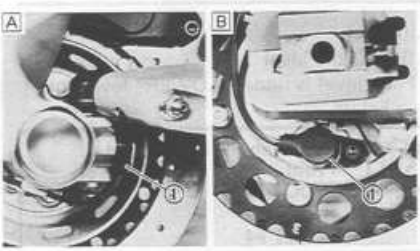
- **Use only the designated quality brake fluid: otherwise, the rubber seals may deteriorate, causing leakage and poor brake performance.**
- **Refill with the same type of brake fluid; mixing fluids may result in a harmful chemical reaction and lead to poor performance.**
- **Be careful that water does not enter the master cylinder when refilling. Water will significantly lower the boiling point of the fluid and may result in vapor lock.**

III



D-7-2 Re-confirmation of wheel sensor installation

1. Check that the rear wheel sensor housing is installed at the correct positions.
   Refer to "[D-5] SERVICE OF REAR WHEEL SENSOR AND SENSOR ROTOR".



2. Inspect:
   - Position of the wheel sensors ①

	Bolt (wheel sensor): 23 Nm (2.3 m • kg, 17 ft • lb)

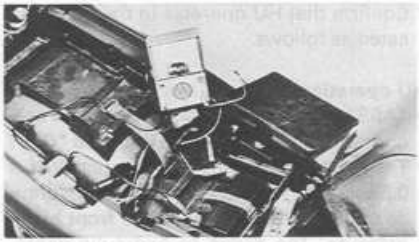
- Wheel sensors lead routing
  A Front
  B Rear

D-7-3 HU operation test

⚠ WARNING

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

1. Place the motorcycle on a level place and on its centerstand.



2. Remove:
- Seat

3. Check:
- Battery voltage

	Battery voltage: **12.8 V or higher at 20°C (68°F)**

Refer to "BATTERY INSPECTION" in CHAPTER 3.

NOTE:
- If the source voltage is lower than 12.8 V, it is recommended to carry out the test after fully charging the battery.
- If the source voltage is lower than 10V, the "ABS" warning light will come on and the ECU will stop ABS operation.



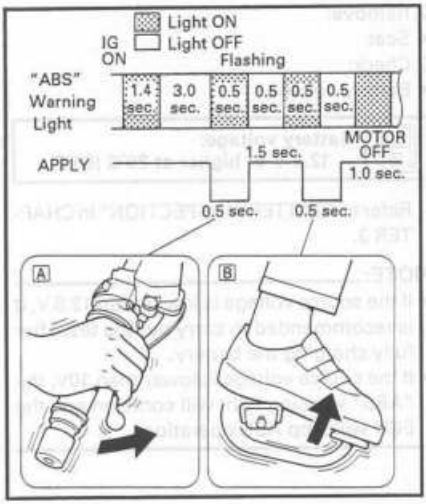
4. Insert the test adapter ① into the ABS test coupler ②.
Refer to the "[C-5]".



5. Apply both the front brake lever and the rear brake pedal at the same time.

6. Turn the main switch to ON.

NOTE:
This test will not start if BOTH brake lever and pedal are not applied at the moment when the main switch is turned to ON.



7. Confirm that HU operates in the way indicated as follows.

HU operation:

- "ABS" warning light comes on for 1.4 seconds after the main switch is turned "ON".
- The HU dumps the front brake pressure for 0.5 seconds. At the same time, the hydraulic pump starts reapplying the front brake pressure. The series of hydraulic operations feels like a "Drop-in" and then a pulsing "Return" of the lever.
- After the movement of the front brake, the HU dumps the rear brake pressure for 0.5 seconds.
  The same hydraulic operation as that of the front brake lever is felt at the rear brake pedal.

NOTE:

- The order of the pressure dumping (first at front and then at rear) is very essential. If this order is different, the hydraulic circuit should be checked again.
- If you do not feel a pulsing "Return", but rather a smooth "Return", it can be assumed that the hydraulic circuit's inlet and outlet are inversed.
- If all HU operations are correct, erase the fault cords.

⚠ WARNING

Inverse connections of brake hose to brake pipe/brake pipe to HU will cause the instantaneous lock of the caliper to the brake disc and could cause a very serious accident.

8. Erasing the fault-code(s)
   Refer to "MACHINE MAINTENANCE USING THE DEALER MODE-5."
   Erasing the fault-code(s).

D-7-5 **Test run**

If everything is correct after all the checking, test run the motorcycle at a low and safe speed of more than 10 km/h (6.2 m.p.h.).

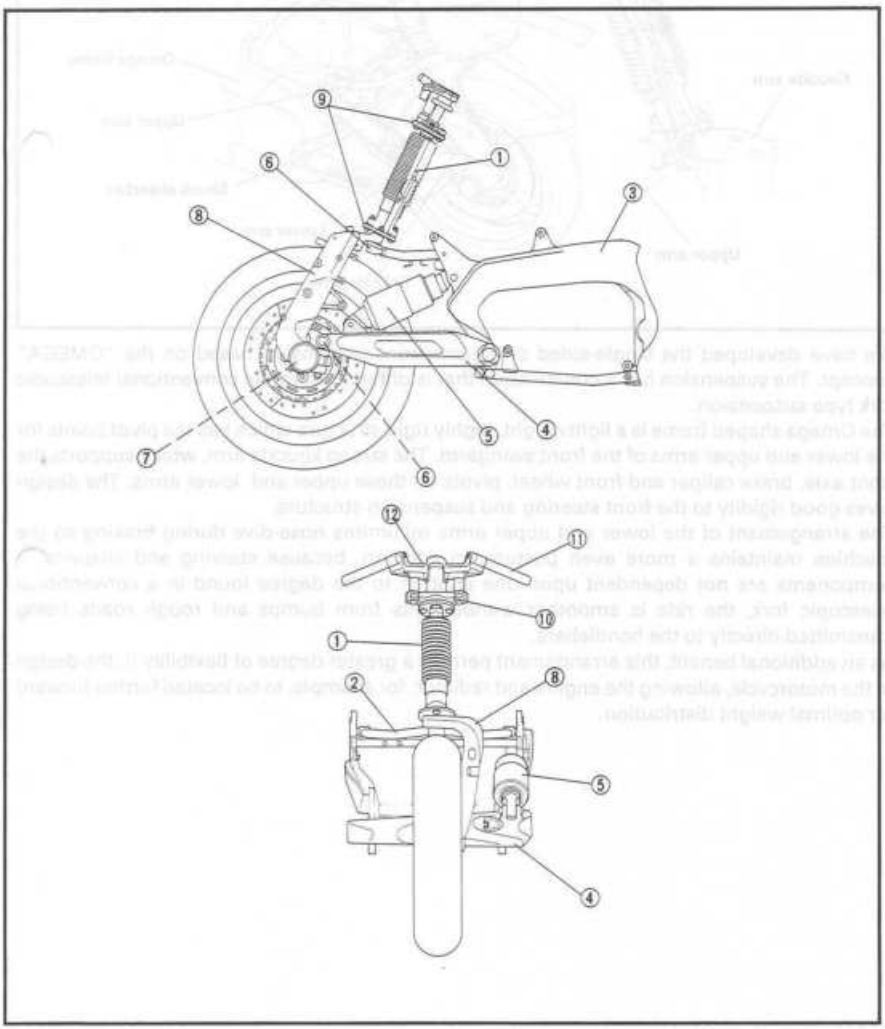
This completes the "FINAL INSPECTION BEFORE RE-DELIVERY OF THE SERVICE MOTORCYCLE".
The motorcycle may now be returned to its owner.

FR
SUS

SINGLE-SIDED SWINGARM FRONT SUSPENSION

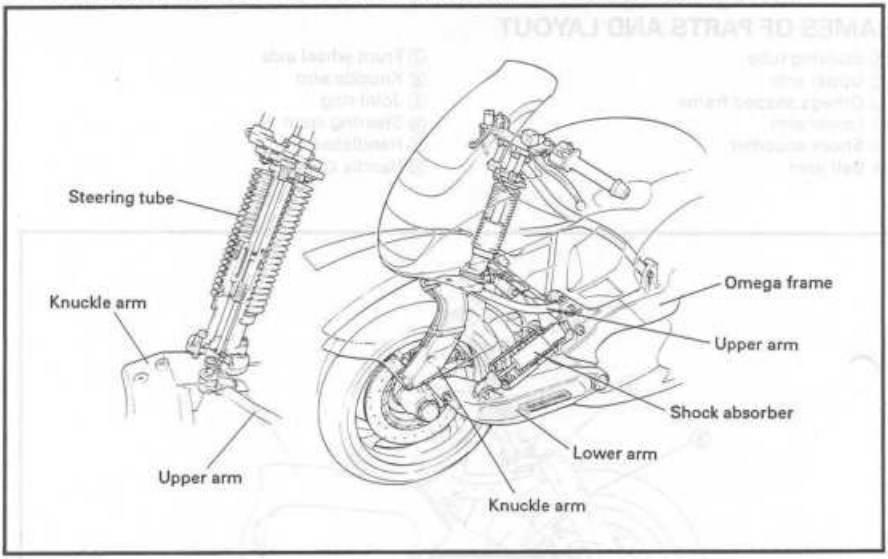
NAMES OF PARTS AND LAYOUT

① Steering tube
② Upper arm
③ Omega shaped frame
④ Lower arm
⑤ Shock absorber
⑥ Ball joint
⑦ Front wheel axle
⑧ Knuckle arm
⑨ Joint ring
⑩ Steering stem
⑪ Handlebar
⑫ Handle crown



IV

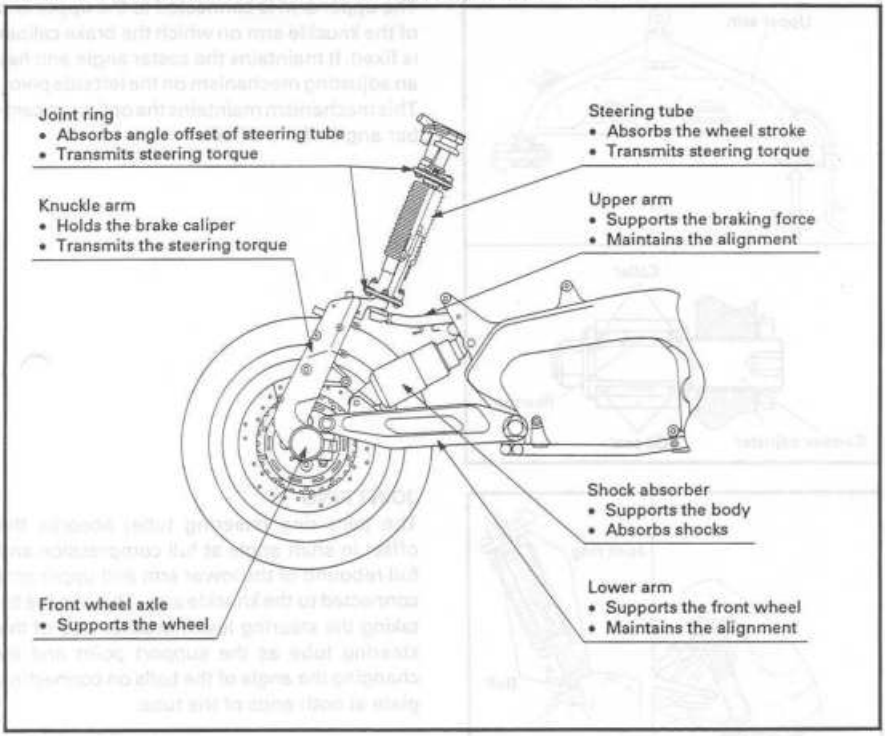
FEATURES OF SINGLE-SIDED SWINGARM FRONT SUSPENSION

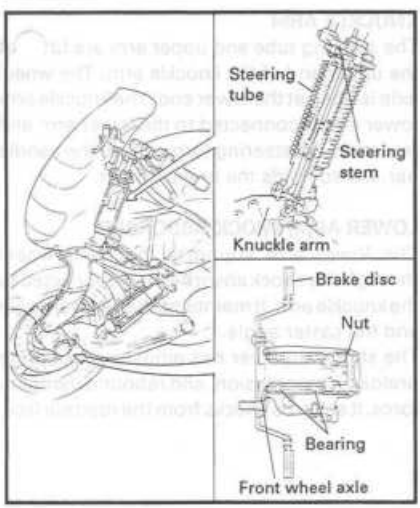


IV

We have developed the single-sided swingarm front suspension based on the "OMEGA" concept. The suspension has a construction that is different from the conventional telescopic fork type suspension.
The Omega shaped frame is a lightweight, highly rigid structure which has the pivot points for the lower and upper arms of the front swingarm. The strong knuckle arm, which supports the front axle, brake caliper and front wheel, pivots on these upper and lower arms. The design gives good rigidity to the front steering and suspension structure.
The arrangement of the lower and upper arms minimizes nose-dive during braking so the machine maintains a more even posture. In addition, because steering and suspens' components are not dependent upon one another to the degree found in a conventional telescopic fork, the ride is smoother without jolts from bumps and rough roads being transmitted directly to the handlebars.
As an additional benefit, this arrangement permits a greater degree of flexibility in the design of the motorcycle, allowing the engine and radiator, for example, to be located further forward for optimal weight distribution.

FUNCTIONS AND ROLES OF COMPONENTS





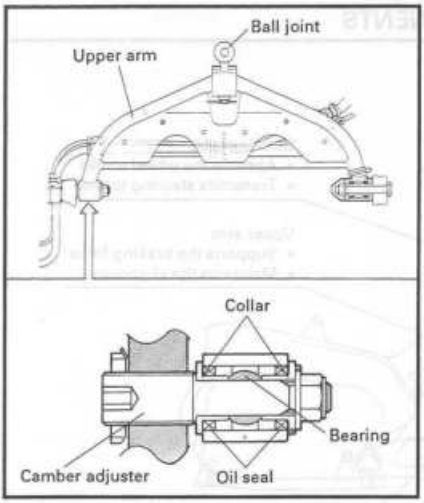
STEERING TUBE

The steering tube is connected to the steering stem at the upper end and the knuckle arm at the lower end. It transmits the steering torque from the handlebar or the front wheel and takes up the vertical stroke.

FRONT WHEEL AXLE

It is supported by the nut through built-in bearings in the knuckle arm. The brake disc and the front wheel are fixed on the front wheel axle.

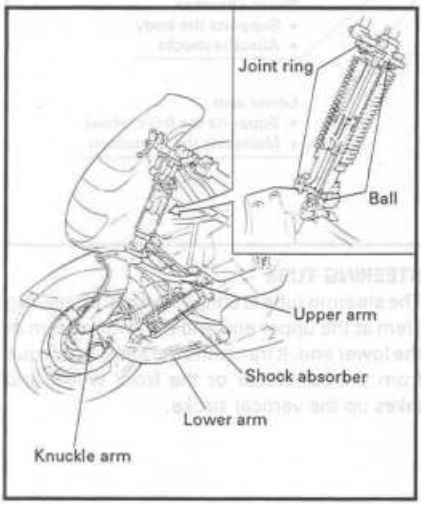
IV



UPPER ARM

The upper arm is connected to the upper end of the knuckle arm on which the brake caliper is fixed. It maintains the caster angle and has an adjusting mechanism on the left side pivot. This mechanism maintains the optimum camber angle of the wheel.

IV



JOINT RING

The joint ring (steering tube) absorbs the offset in shaft angle at full compression and full rebound of the lower arm and upper arm connected to the knuckle arm. This is done by taking the steering lower bracket side of the steering tube as the support point and by changing the angle of the balls on connecting plate at both ends of the tube.

KNUCKLE ARM

The steering tube and upper arm are fitt at the upper end of the knuckle arm. The wheel axle is fitted at the lower end. The knuckle arm lower end is connected to the lower arm and transmits the steering torque from the handle bar. It also holds the brake caliper.

LOWER ARM/SHOCK ABSORBER

The lower arm supports the front wheel through the shock absorber. It is connected to the knuckle arm. It maintains the camber angle and the caster angle.

The shock absorber has adjusters for spring preload, compression, and rebound damping force. It absorbs shocks from the road surface.

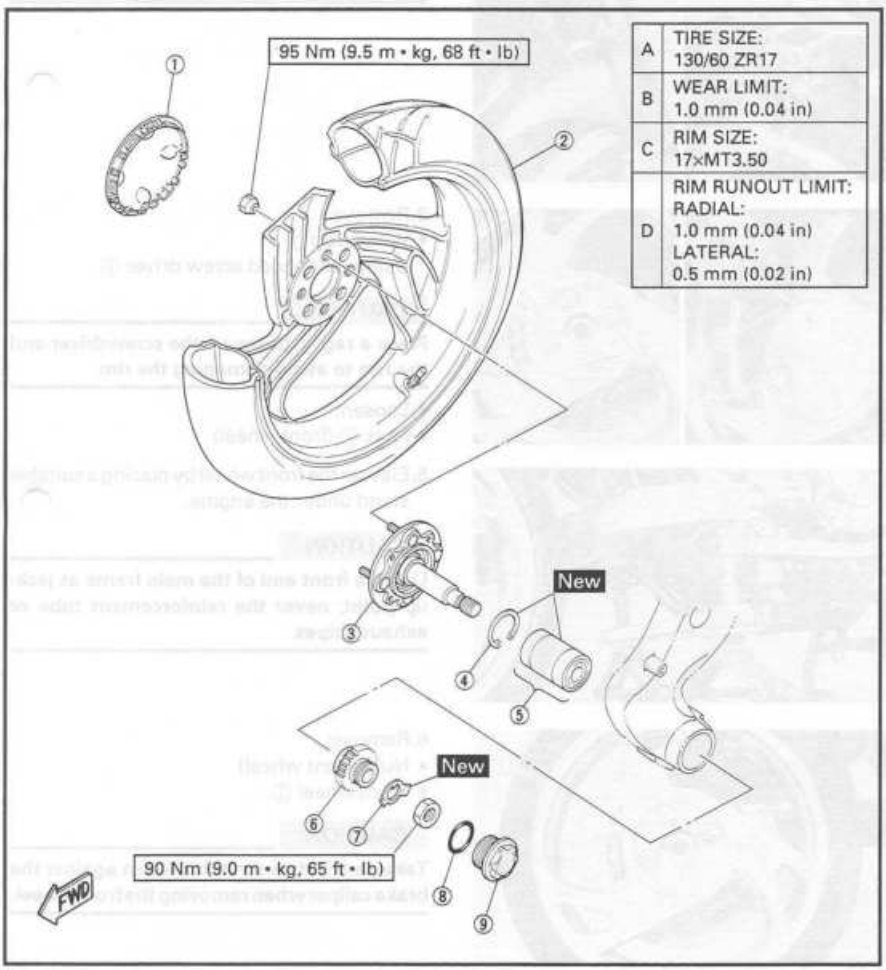
SERVICE OF COMPONENTS

FRONT WHEEL AND WHEEL AXLE

① Wheel cap
② Front wheel
③ Wheel axle
④ Circlip
⑤ Bearing kit
⑥ Sensor rotor
⑦ Lock washer
⑧ O-ring
⑨ Hub cap

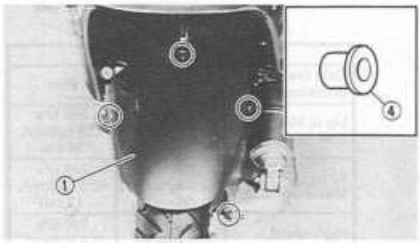
TIRE AIR PRESSURE (COLD)		
Cold tire pressure:	Front	Rear
Up to 90 kg (198 lbs) load*	250 kPa (2.5 kgf/cm², 36 psi)	250 kPa (2.5 kgf/cm², 36 psi)
90 kg (198 lbs) ~ Maximum load*	250 kPa (2.5 kgf/cm², 36 psi)	290 kPa (2.9 kgf/cm², 42 psi)
High speed riding	250 kPa (2.5 kgf/cm², 36 psi)	290 kPa (2.9 kgf/cm², 42 psi)

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



A	TIRE SIZE: 130/60 ZR17
B	WEAR LIMIT: 1.0 mm (0.04 in)
C	RIM SIZE: 17×MT3.50
D	RIM RUNOUT LIMIT: RADIAL: 1.0 mm (0.04 in) LATERAL: 0.5 mm (0.02 in)

IV



Removal

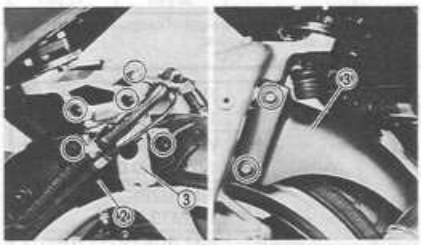
⚠ WARNING

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

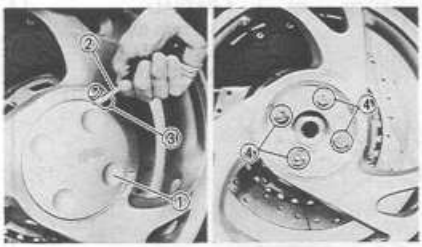
1. Place the motorcycle on the centerstand.
2. Remove:
   - Front fenders (upper ① and lower ②)
   - Fender bracket ③

NOTE:

Take care not to lose the collars ④.



IV

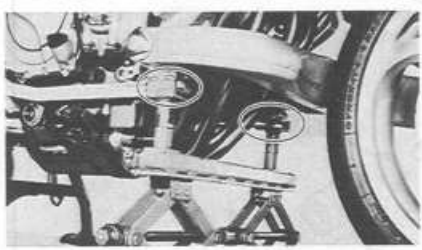


3. Remove:
   - Wheel cap ①
     Using a flat-head screw driver ②

CAUTION:

Place a rag ③ between the screwdriver and the rim to avoid damaging the rim.

4. Loosen:
   - Nuts ④ (front wheel)



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

CAUTION:

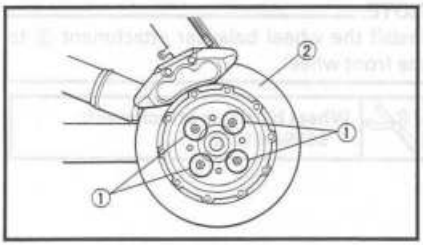
Use the front end of the main frame as jack-up point, never the reinforcement tube or exhaust pipes.



6. Remove:
   - Nuts (front wheel)
   - Front wheel ①

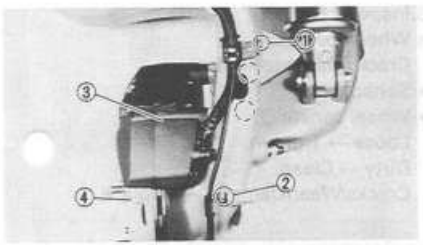
CAUTION:

Take care not to scratch the rim against the brake caliper when removing the front wheel.



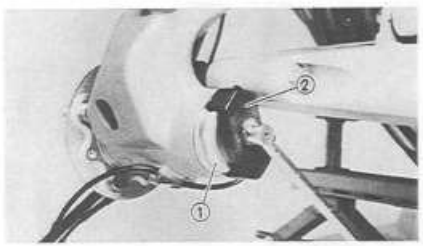
7. Loosen:
- Bolts ① (brake disc ②)

NOTE:
When loosening the bolts (brake disc), apply the front brake to hold the brake disc.



8. Remove:
- Screw ① (brake hose holder)
- Screw ② (wheel sensor lead)
- Brake caliper ③
- Brake disc ④

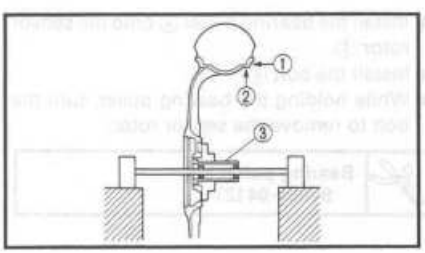
NOTE:
Do not depress the front brake lever while the caliper is removed, otherwise the brake pads will be forced shut.



9. Remove:
- Hub cap ①
  Using the cap wrench ②.

Cap wrench:
90890-01451

Inspection
1. Inspect:
- Tire
  Wear/Damage → Replace.
  Refer to "TIRE INSPECTION" in CHAPTER 3 of SERVICE MANUAL.
- Wheel
  Refer to "WHEEL INSPECTION" in CHAPTER 3 of SERVICE MANUAL.

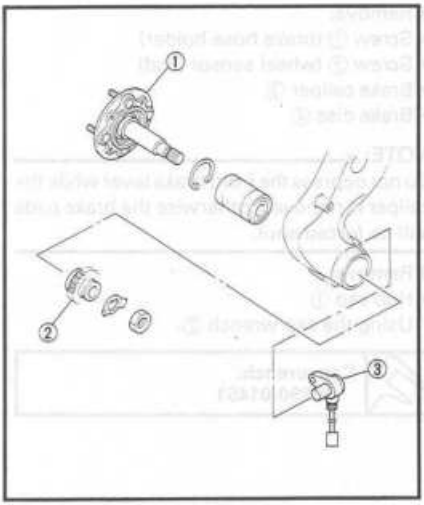


2. Measure:
- Wheel runout
  Over specified limit → Replace.

Rim runout limits:
Radial ①:0.7 mm (0.03 in)
Lateral ②: 0.5 mm (0.02 in)

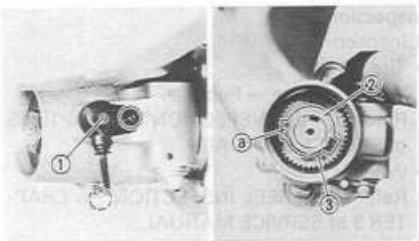
NOTE:
Install the wheel balancer attachment ③ to the front wheel.

	Wheel balancer attachment: 90890-01452



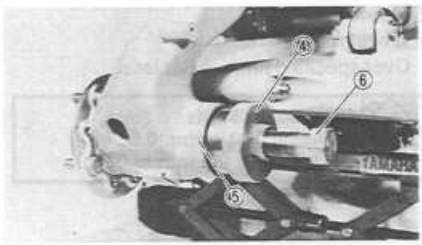
3. Inspect:
- Wheel axle ①
  Cracks/Damage → Replace.
- Sensor rotor ②
- Wheel sensor ③
  Loose → Tighten.
  Dirty → Clean.
  Cracks/Wear/Damage → Replace.

IV



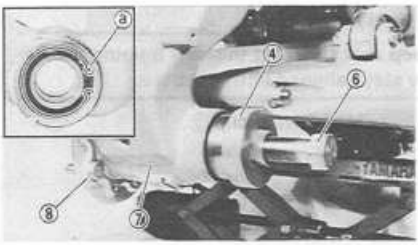
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Wheel axle, bearing and sensor rotor replacement steps:
- Remove the wheel sensor ①.
- Straighten the lock washer tab ⓐ.
- Remove the nut ② and lock washer ③.

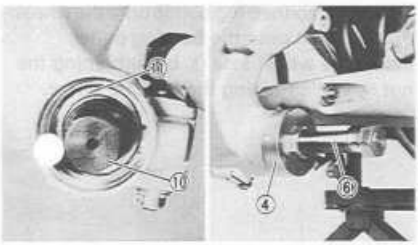


- Install the bearing puller ④ onto the sensor rotor ⑤.
- Install the bolt ⑥.
- While holding the bearing puller, turn the bolt to remove the sensor rotor.

	Bearing puller kit: 90890-04127



- Install the bearing puller ④ with bolt ⑥ onto the knuckle arm ⑦.
- While holding the bearing puller, turn in the bolt to press out the wheel axle ⑧.
- Remove the circlip ⑨.



- Install the spacer ⑩ onto the bearing assembly ⑪.
- Install the bearing puller with bolt onto the knuckle arm.
- While holding the bearing puller ④, turn in the bolt ⑥ to press out the bearing assembly ⑪.

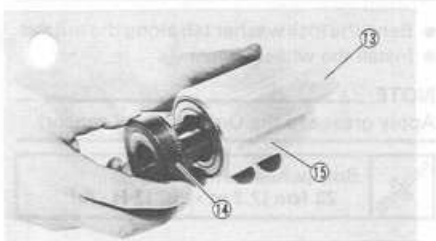


- Remove the dust seal ⑫.
- Replace the wheel axle, dust seal and/or sensor rotor, if worn or damaged.

⚠ WARNING

Always replace the bearing assembly.

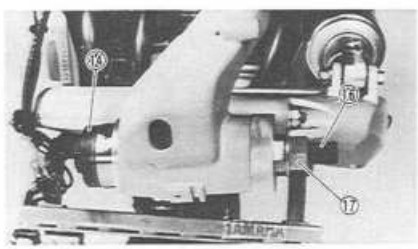
- Install the new dust seal ⑫.



- Replace the plastic core ⑬ from the new bearing assembly with the bearing spacer ⑭. Remove the outer cover ⑮ (new bearing).

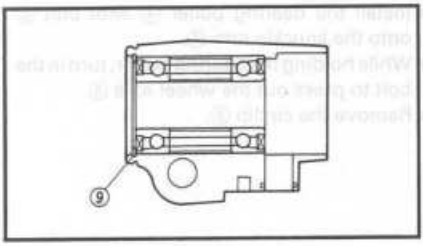
CAUTION:

Keep all parts of the new bearing exactly in the order in which they are packed.



- Install the bearing puller onto the knuckle arm.
- Pass the puller bolt ⑯ through the bearing spacer ⑭ and attach it to the bearing puller as shown.
- Install the new bearing assembly by tightening the nut ⑰ while holding the bearing puller.

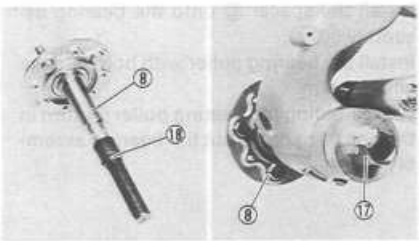
IV



CAUTION:

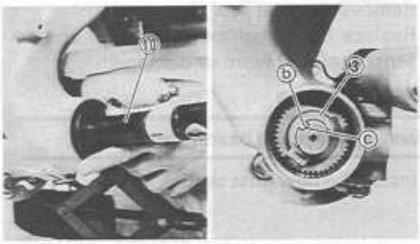
Keep checking that the new bearing assembly stays aligned with the bore.

- Install the new circlip ⑨.



- Attach the connecting bolt ⑱ onto the wheel axle ⑧, then onto the bearing puller.
- Install the wheel axle ⑧ by tightening the nut ⑰ while holding the bearing puller.

IV

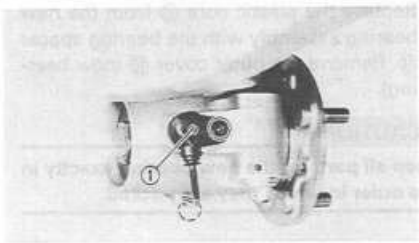


- Install the sensor rotor using the spacer ⑩.
- Install the lockwasher ③ so that the projection ⓑ matches the groove ⓒ in the wheel axle and tighten the nut to specification.

⚠ WARNING

Always use a new lock washer.

	Nut (wheel axle): 90 Nm (9.0 m • kg, 65 ft • lb)



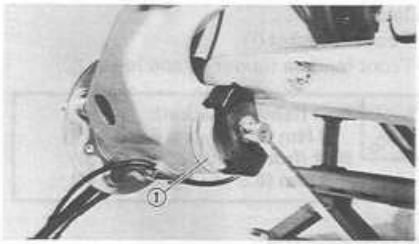
- Bend the lock washer tab along the nut flat.
- Install the wheel sensor ①.

NOTE:

Apply grease to the O-ring (wheel sensor).

	Bolt (wheel sensor): 23 Nm (2.3 m • kg, 17 ft • lb)

****

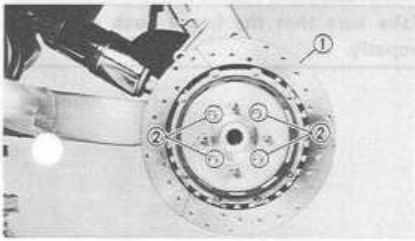


Installation

Reverse the "Removal" procedure.
Note the following points.

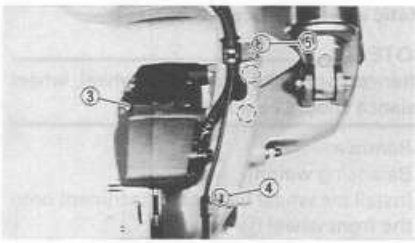
1. Install:
   - Hub cap ①

	Hub cap: **3.5 Nm (0.35 m • kg, 2.5 ft • lb)**



2. Install:
   - Brake disc ①
   - Bolts ② (brake disc)
   - Brake caliper ③
   - Screw ④ (wheel sensor lead holder)
   - Screw ⑤ (brake hose holder)

	Bolt (brake caliper): **67 Nm (6.7 m • kg, 48 ft • lb)** **Screw:** **6.5 Nm (0.65 m • kg, 4.7 ft • lb)**



3. Tighten:
   - Bolts ② (brake disc)

	Bolt (brake disc): **22 Nm (2.2 m • kg, 16 ft • lb)** **LOCTITE®**

NOTE:

When tightening the bolts (brake disc), apply the front brake to hold the brake disc.

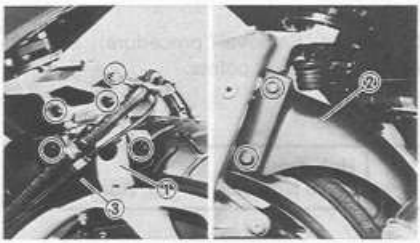
CAUTION:

After installing the front brake, check the maximum defection of the front brake disc. Refer to "FRONT AND REAR BRAKE" in CHAPTER 6.



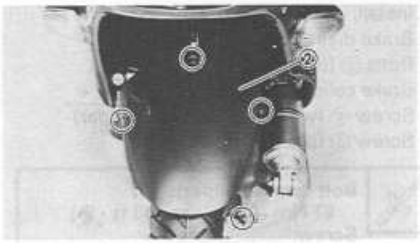
4. Install:
   - Front wheel ①

	Nut (front wheel): **95 Nm (9.5 m • kg, 68 ft • lb)**



5. Install:
- Fender bracket ①
- Front fenders (upper ② and lower ③)

Bolt (fender bracket):
8 Nm (0.8 m · kg, 5.8 ft · lb)
Bolt (front fender):
6 Nm (0.6 m · kg, 4.3 ft · lb)



⚠ WARNING

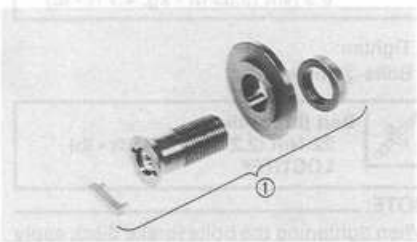
Make sure that the brake hose is routed properly.

IV

Static wheel balance adjustment

NOTE:

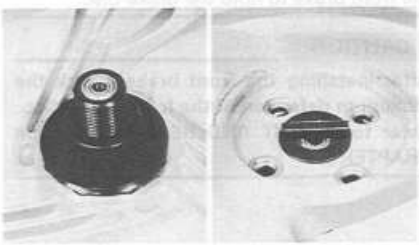
After replacing the tire and/or wheel, wheel balance should be adjusted.



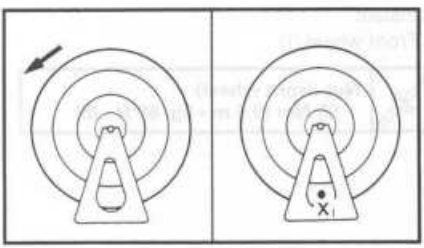
1. Remove:
- Balancing weight

2. Install the wheel balancer attachment onto the front wheel ①.

Wheel balancer attachment:
90890-01452



- Set the wheel on a suitable stand

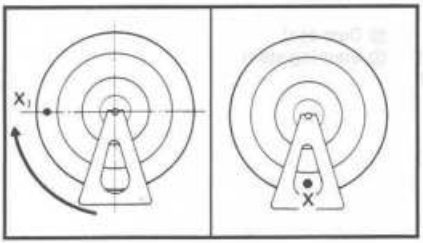


3. Find:
- Heavy spot

****

Procedure:

a. Spin the wheel and wait for it to rest.
b. Put an "X_1" mark on the wheel bottom spot.
c. Turn the wheel so that the "X_1" mark is 90° up.



d. Let the wheel fall and wait for it to rest. Put an "X_2" mark on the wheel bottom spot.
e. Repeat the above b., c., and d. several times until these marks come to the same spot.
f. This spot is the heavy spot "X".

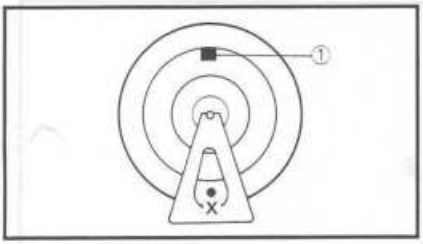
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4. Adjust:
• Wheel balance

****

Adjusting steps:

- Install a balancing weight ① on the rim exactly opposite to the heavy spot "X".

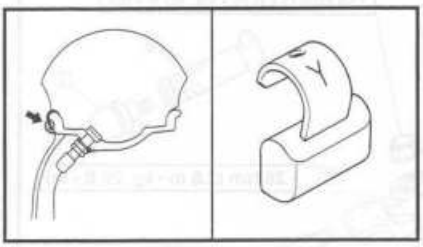


NOTE:

Start with the smallest weight.

CAUTION:

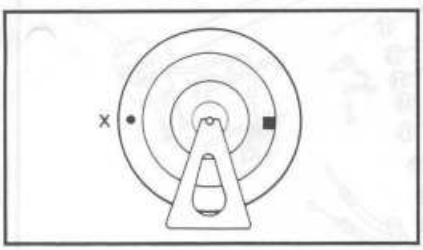
- **Attach the balancing weight on the spoke side of the rim.**
- **Use only genuine Yamaha parts. Genuine Yamaha balancing weights are marked with a punched-in "Y".**



⚠ WARNING

Use Yamaha Genuine Balancer Weights only. Install weights on the right side of the wheel only. Otherwise, handling could be adversely affected.

Balancer weight parts number	Weight
4BH-25398-30	5 g (0.18 oz)
4BH-25398-40	10 g (0.35 oz)
4BH-25398-50	15 g (0.53 oz)
4BH-25398-60	20 g (0.71 oz)
4BH-25398-70	25 g (0.88 oz)
4BH-25398-80	30 g (1.06 oz)



- Turn the wheel so that the heavy spot is 90° up.
- Check that the heavy spot is at rest there. If not, try another weight until the wheel is balanced.

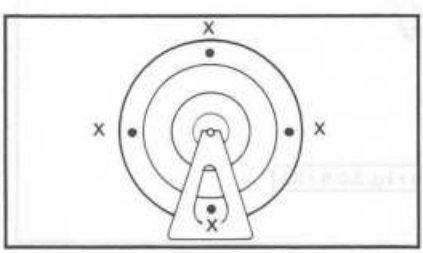
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5. Check:
• Wheel balance

****

Checking steps:

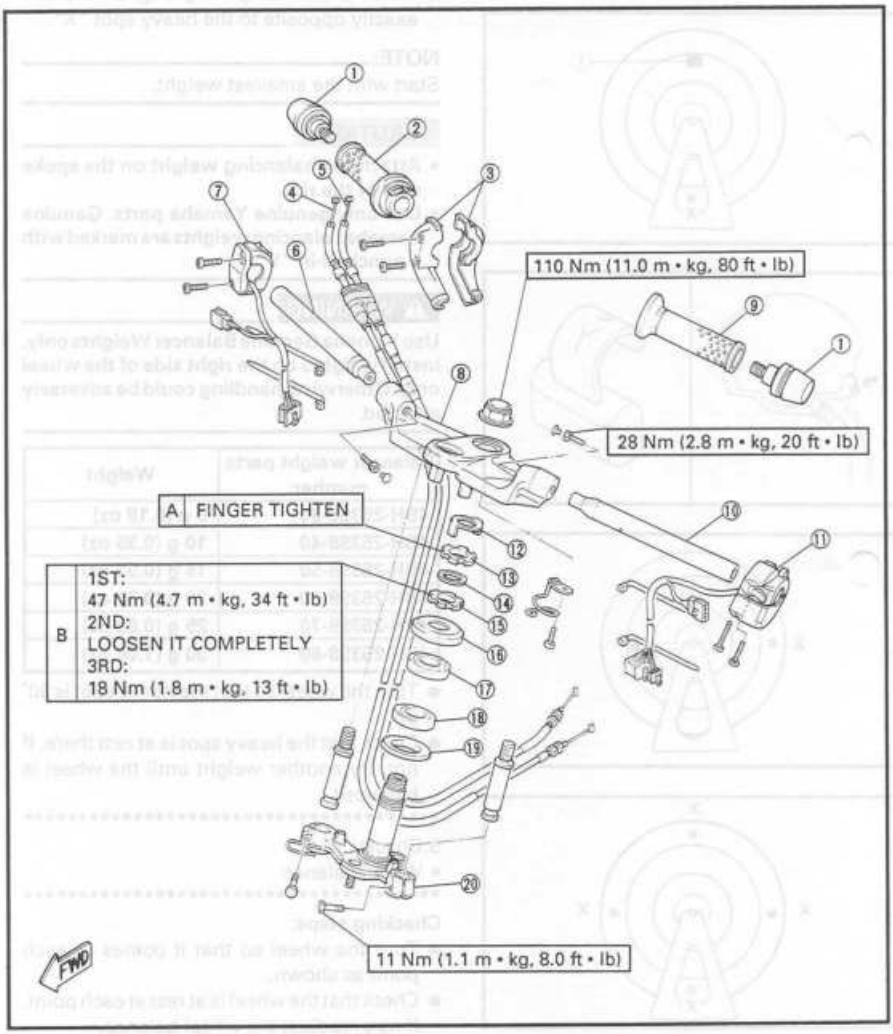
- Turn the wheel so that it comes to each point as shown.
- Check that the wheel is at rest at each point. If not, readjust the wheel balance.



****

STEERING HEAD AND HANDLEBAR

① Handlebar grip end
② Throttle grip
③ Throttle cable housing
④ Throttle cable #1
⑤ Throttle cable #2
⑥ Handlebar (right)
⑦ Handlebar switch (right)
⑧ Handle crown
⑨ Grip rubber
⑩ Handlebar (left)
⑪ Handlebar switch (left)
⑫ Lock washer (ring nut)
⑬ Ring nut (upper)
⑭ Rubber washer
⑮ Ring nut (lower)
⑯ Bearing cover
⑰ Bearing (upper)
⑱ Bearing (lower)
⑲ Dust seal
⑳ Steering stem

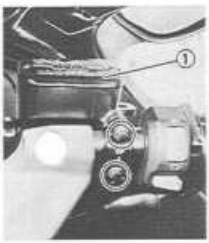
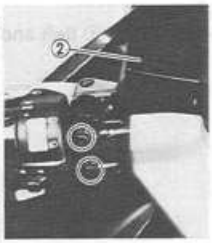


Removal

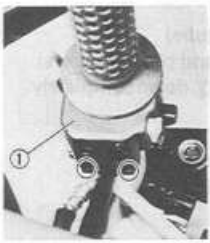
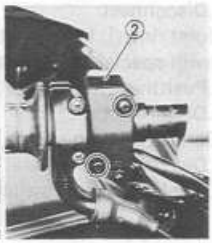
⚠ WARNING

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

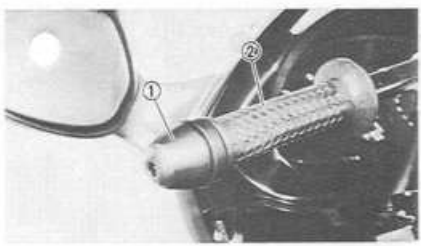
1. Place the motorcycle on the centerstand.
2. Remove:
- Seat
- Top cover
- Inner panels
  Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
3. Remove:
- Master cylinders
  (front brake ① and clutch ②)

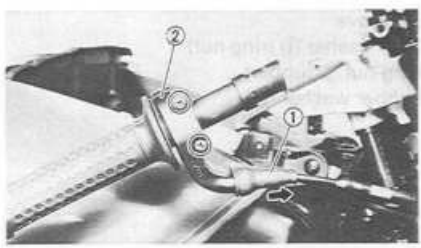
4. Remove:
- Handlebar switches (left ① and right ②)

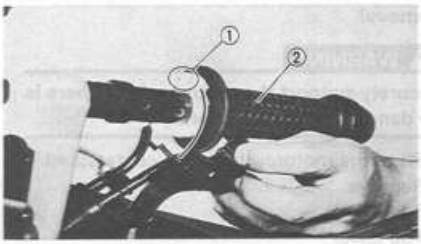



5. Remove:
- Grip ends ① (left and right)
- Grip (left) ②



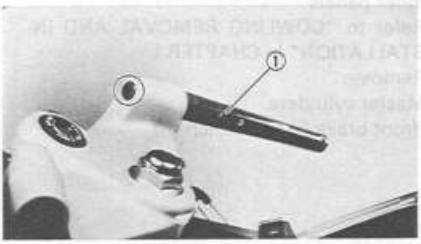
6. Push back the rubber cover ①.
7. Remove:
- Throttle cable housing ②





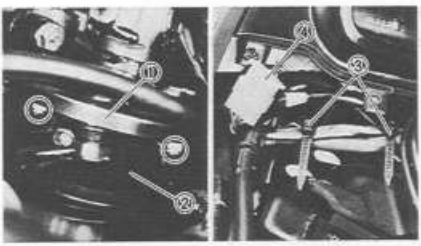
8. Disconnect:
- Throttle cables ①

9. Remove:
- Throttle grip ②



10. Remove:
- Handlebars ① (left and right)

IV

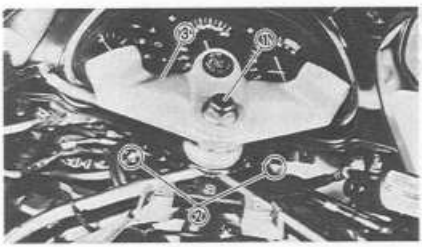


11. Disconnect:
- Joint ring ① (steering tube)
  (with special washers and plain washers)

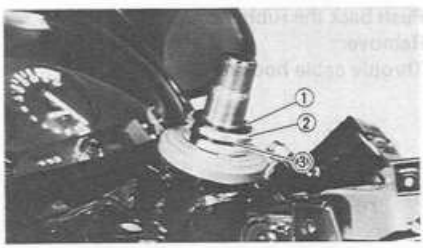
12. Push the steering tube ② down completely.

13. Disconnect:
- Bands ③ (main switch lead)

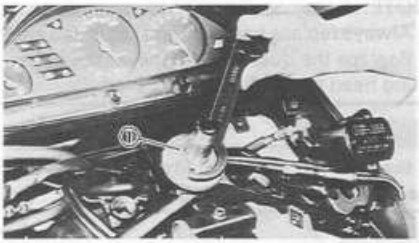
14. Disconnect:
- Coupler ④ (main switch)



15. Remove:
- Steering stem nut ①
- Pinch bolts ②
- Handle crown ③



16. Remove:
- Lock washer ① (ring nut)
- Ring nut ② (upper)
- Rubber washer ③

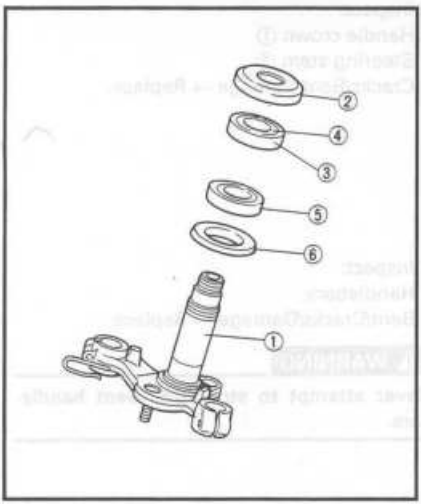


17. Remove:
- Ring nut ① (lower)
  Using the ring nut wrench.

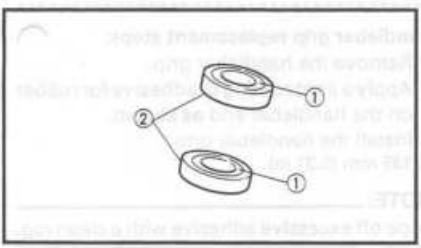
	Ring nut wrench: YU-01268/90890-01268

⚠ WARNING

Support the steering stem so that it will not fall down.

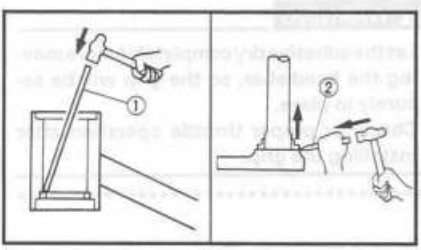


18. Remove:
- Steering stem ①
- Bearing cover ②
- Bearing race ③ (upper)
- Bearing ④ (upper)
- Bearing ⑤ (lower)
- Dust seal ⑥



Inspection

1. Wash the bearings and bearing races in solvent.
2. Inspect:
- Bearings ①
- Bearing races ②
  Pitting/Damage → Replace.



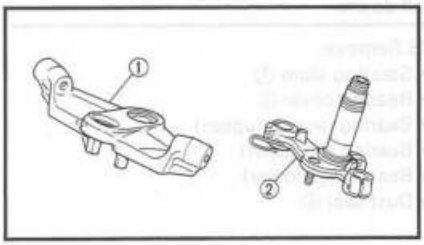
****

Bearing race replacement steps:
- Remove the bearing races on the head pipe using a long rod ① and hammer as shown.
- Remove the bearing race on the lower bracket (steering stem) using a floor chisel ② and hammer as shown.
- Install new bearing races.

****

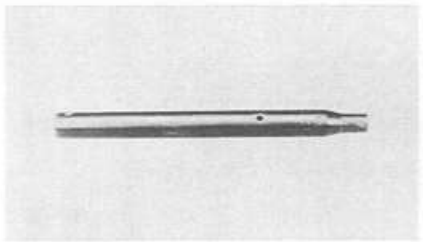
NOTE:
- Always replace bearings and races as a set.
- Replace the dust seal whenever the steering head has been disassembled.

CAUTION:
If the bearing race is not fitted squarely, the head pipe could be damaged.



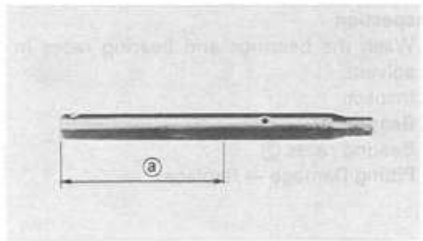
3. Inspect:
- Handle crown ①
- Steering stem ②
  Cracks/Bent/Damage → Replace.

IV



4. Inspect:
- Handlebars
  Bent/Cracks/Damage → Replace.

⚠ WARNING
Never attempt to straighten bent handlebars.



****

Handlebar grip replacement steps:
- Remove the handlebar grip.
- Apply a light coating of adhesive for rubber on the handlebar end as shown.
- Install the handlebar grip.

ⓐ 135 mm (5.31 in)

NOTE:
Wipe off excessive adhesive with a clean rag.

⚠ WARNING
- **Let the adhesive dry completely before moving the handlebar, so the grip will be securely in place.**
- **Check for proper throttle operation after installing the grip.**

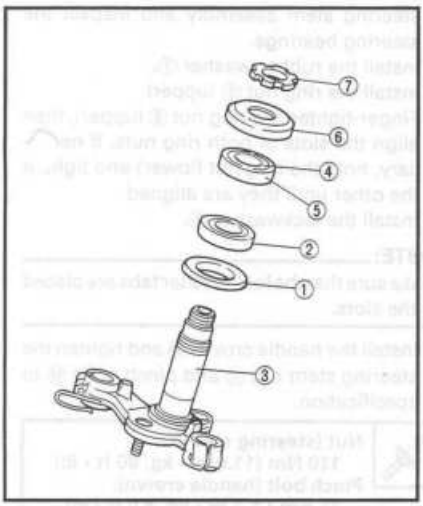
****

Installation

Reverse the "Removal" procedure.
Note the following points.

1. Lubricate:
- Bearings (upper and lower)
- Bearing races

	Recommended lubricant: Wheel bearing grease



2. Install:
- Dust seal ①
- Bearing ② (lower) (onto steering stem)
- Steering stem ③
- Bearing ④ (upper)
- Bearing race ⑤ (upper)
- Bearing cover ⑥
- Ring nut ⑦ (lower)

CAUTION:

Hold the steering stem until it is secured.

IV



3. Tighten:
- Ring nuts (lower and upper)

****

Tightening steps:

NOTE:

Set the torque wrench to the ring nut wrench so that they form a right angle.

- Tighten the ring nut ⑥ (lower) using the ring nut wrench.

	Ring nut wrench: YU-33975/90890-01403
	Ring nut (initial tightening): 47 Nm (4.7 m • kg, 34 ft • lb)

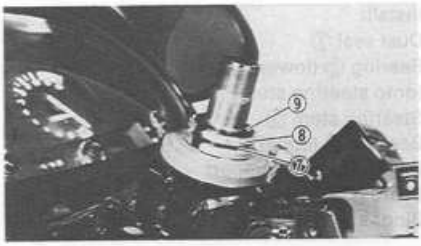
- Lossen the ring nut ⑥ (lower) completely and retighten it to specification.

⚠ WARNING

Do not over-tighten.

	Ring nut (final tightening): 18 Nm (1.8 m • kg, 13 ft • lb)

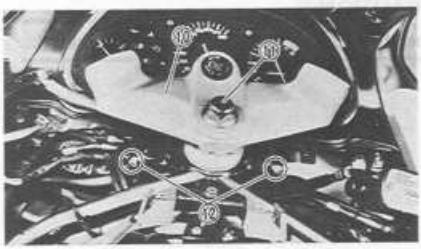
- Check the steering stem by turning it lock to lock. If there is any binding, remove the steering stem assembly and inspect the steering bearings.
- Install the rubber washer ⑦.
- Install the ring nut ⑧ (upper)
- Finger-tighten the ring nut ⑧ (upper), then align the slots of both ring nuts. If necessary, hold the ring nut (lower) and tighten the other until they are aligned.
- Install the lockwasher ⑨.



NOTE:

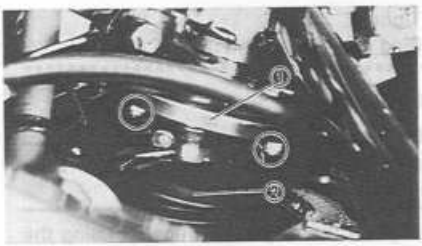
Make sure that the lock washer tabs are placed in the slots.

- Install the handle crown ⑩ and tighten the steering stem nut ⑪ and pinch bolts ⑫ to specification.



	Nut (steering stem): 110 Nm (11.0 m • kg, 80 ft • lb) **Pinch bolt (handle crown): 11 Nm (1.1 m • kg, 8.0 ft • lb)**

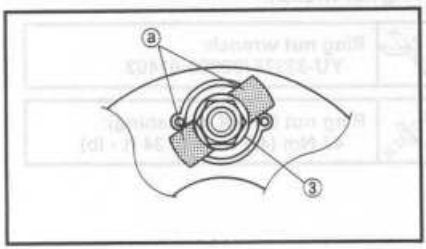
4. Connect:
- Joint ring ① (steering tube ②) (with plain washers and special washers)

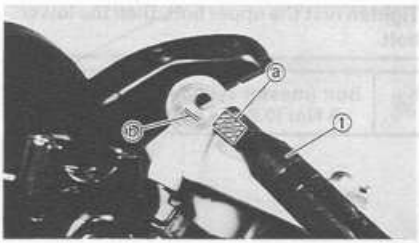


	Nut (joint ring): 23 Nm (2.3 m • kg, 17 ft • lb)

CAUTION:

- **Always use a new special washer ③.**
- **After tightening the nut (steering tube), cut off torque stoppers ⓐ.**

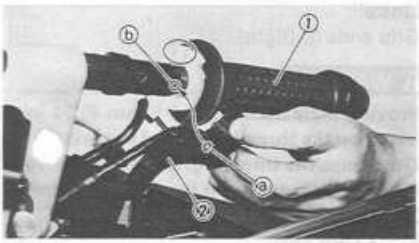




5. Install:
- Handlebars ① (left and right)

NOTE:
The flat side ⓐ of the handlebar must be aligned with the pin ⓑ inside the handle crown.

	Bolt (handlebar): 28 Nm (2.8 m • kg, 20 ft • lb)



6. Install:
- Throttle grip ①

NOTE:
Before installing the throttle grip, apply a light coat of lithium soap base grease onto the surface where the handlebar and the throttle grip make contact.

7. Connect:
- Throttle cables

8. Install:
- Throttle cable housings ②

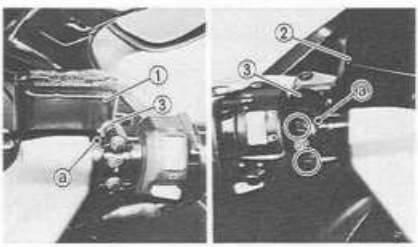
NOTE:
Align the projection ⓐ on the throttle cable housing with the hole ⓑ on the handlebar.

IV



9. Install:
- Handlebar switches ① (left and right)

NOTE:
Align the projection ⓐ on the handlebar switch with the hole ⓑ on the handlebar.

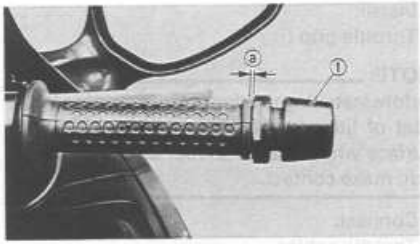


10. Install:
- Master cylinders (front brake ① and clutch ②)

CAUTION:
- **Install the master cylinder holder with the "UP" mark facing upward.**
- **Align the end of the holder ③ with the punch mark ⓐ on the handlebar.**

- **Tighten first the upper bolt, then the lower bolt.**

	Bolt (master cylinder holder): 9 Nm (0.9 m • kg, 6.5 ft • lb)



11. Install:
- Grip ends ① (right)

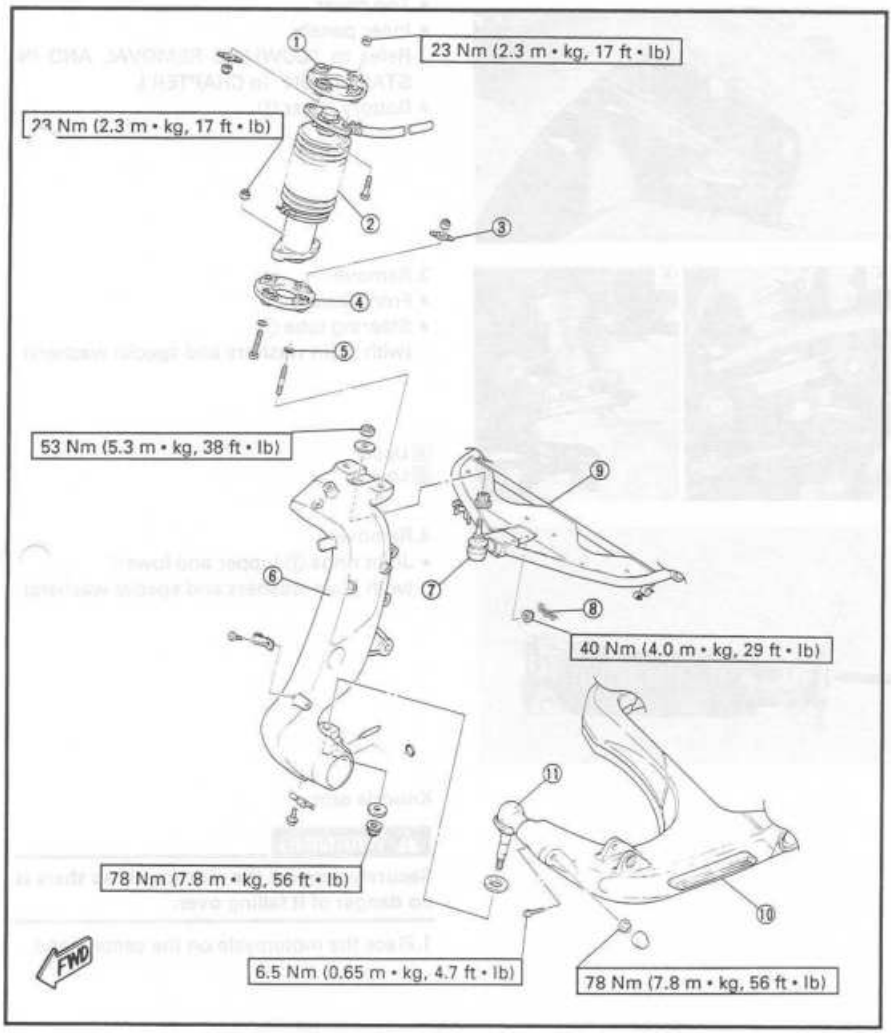
⚠ WARNING

- **Provide a clearance ⓐ of 1 mm (0,04 in) between the throttle grip and the grip ①. Otherwise the throttle grip may not move.**
- **Check the throttle grip for smooth action.**

	Grip end: 25 Nm (2.5 m • kg, 18 ft • lb)

STEERING TUBE AND KNUCKLE ARM

① Joint ring (upper)
② Steering tube
③ Special washer
④ Joint ring (lower)
⑤ Plain washer
⑥ Knuckle arm
⑦ Ball joint (upper)
⑧ Cotter pin
⑨ Upper arm
⑩ Lower arm
⑪ Ball joint (lower)

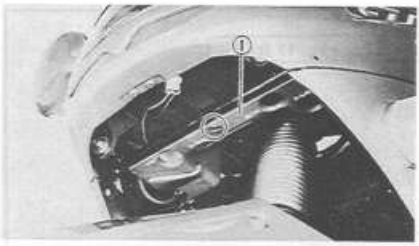


Removal
Steering tube

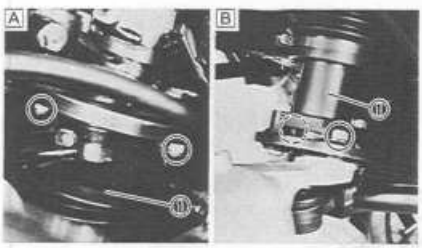
⚠ WARNING

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

1. Place the motorcycle on the centerstand
2. Remove:
- Seat
- Top cover
- Inner panels
  Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.
- Bottom cover ①

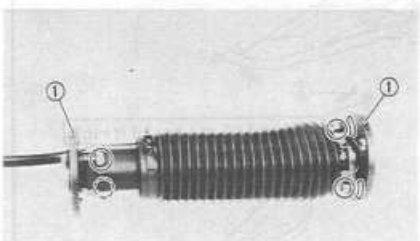


IV



3. Remove:
- Front fender
- Steering tube ①
  (with plain washers and special washers)

Ⓐ Upper
Ⓑ Lower



4. Remove:
- Joint rings ① (upper and lower)
  (with plain washers and special washers)

Knuckle arm

⚠ WARNING

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

1. Place the motorcycle on the centerstand

2. Remove:
- Front wheel
- Front brake caliper
- Front brake disc

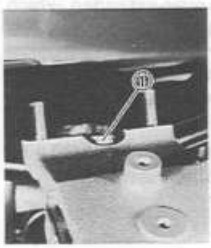
Refer to "FRONT WHEEL AND WHEEL AXLE".

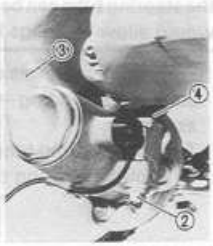


3. Disconnect:
- Joint ring ①

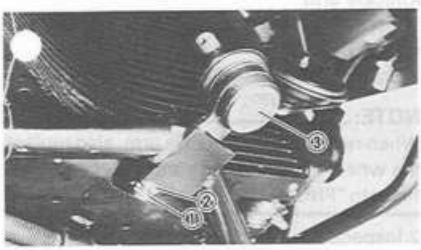
(with plain washers and special washers)

NOTE:
Attach the steering tube to the frame with a string or piece of wire.

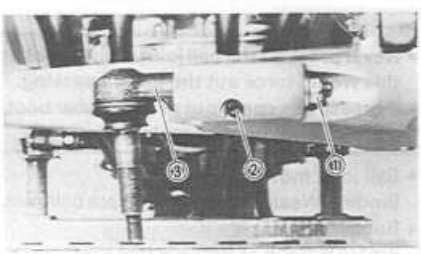




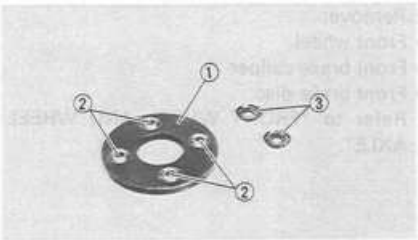
4. Remove:
- Nut ① (upper)
(with washer)
- Nut ② (lower)
(with washer)
- Knuckle arm ③
- Washer ④ (lower ball joint)



5. Remove:
- Cotter pin ①
- Nut ②
- Ball joint ③ (upper)



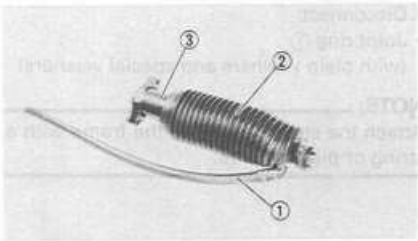
6. Remove:
- Nut ①
- Bolt ② (stopper)
- Ball joint ③ (lower)



Inspection

Steering tube

1. Inspect:
- Joint ring ①
  Cracks/Bent/Damage → Replace.
- Ball/Rubber washer ② (joint ring)
  Binding/Wear/Damage → Replace the joint ring.



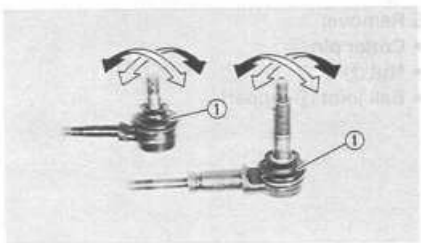
2. Inspect:
- Breather hose ①
- Rubber boot ②
  Wear/Damage → Replace steering tube assembly.
- Steering tube ③ → Replace steering tube assembly.

CAUTION:

Do not remove the boot. Without the boot, the steering tube can be over-extended, which would allow bearings in the tube to fall out.



Pump several times on the steering tube
Looseness/Binding → Replace steering tube assembly.
Turn the steering tube lock to lock Free play → Replace steering tube assembly.



Knuckle arm

1. Inspect:
- Knuckle arm ①
  Cracks/Damage → Replace.

NOTE:

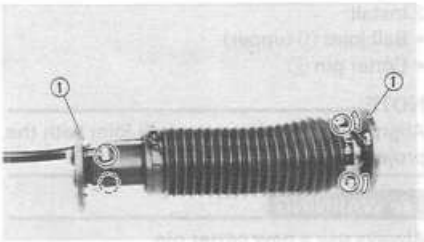
When replacing the knuckle arm, also replace the wheel axle, bearings and sensor rotor. Refer to "FRONT WHEEL AND WHEEL AXLE".

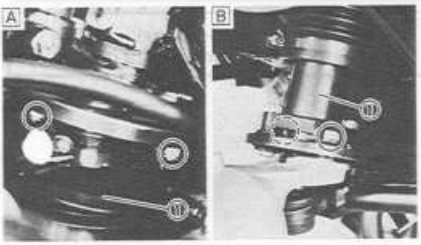
2. Inspect:

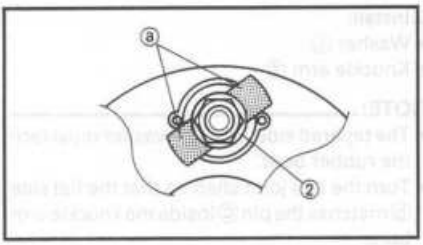
CAUTION:

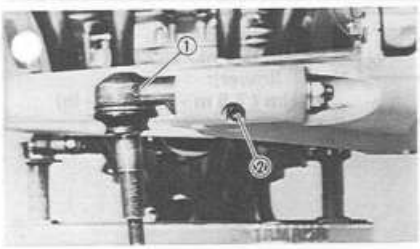
- **Never press on the ball joint rubber boot as this would force out the grease packing.**
- **If grease has come out of the rubber boot, the ball joint must be replaced.**

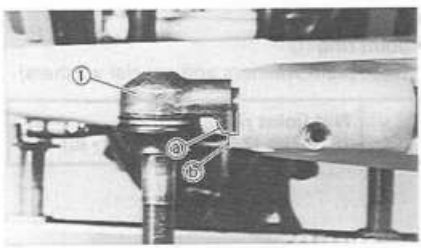
- Ball joint movement
  Binding/Wear/Damage → Replace ball joint.
- Rubber boot ①
  Wear/Damage → Replace ball joint.











Installation

Steering tube

Reverse the "Removal" procedure.

Note the following points

1. Install:
   - Joint ring ① (upper and lower) (with rubber washers)

	Nut (joint ring): 23 Nm (2.3 m • kg, 17 ft • lb)

2. Install:
   - Steering tube ① (with plain washers and special washers)

	Nut (steering tube): 23 Nm (2.3 m • kg, 17 ft • lb)

A Upper
B Lower

CAUTION:

- **Always use a new special washer ②.**
- **After tightening the nut (steering tube), cut off the torque stoppers ⓐ.**

Knuckle arm

Reverse the removal procedure.

Note the following points

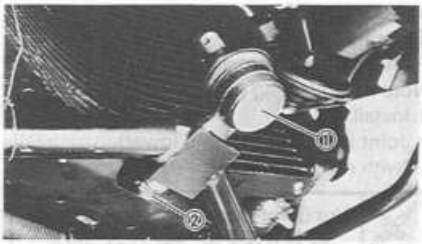
1. Install:
   - Ball joint ① (lower)
   - Bolt ② (stopper)

NOTE:

Align the indent ⓐ on the ball joint with the projection ⓑ on the lower arm.

	Nut (ball joint - lower): 78 Nm (7.8 m • kg, 56 ft • lb) **Bolt (Stopper): 6.5 Nm (0.65 m • kg, 4.7 ft • lb)**

IV



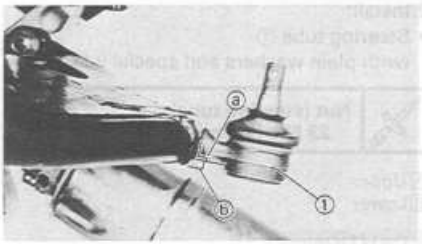
2. Install:
- Ball joint ① (upper)
- Cotter pin ②

NOTE:
Align the indent ⓐ on the ball joint with the projection ⓑ on the upper arm.

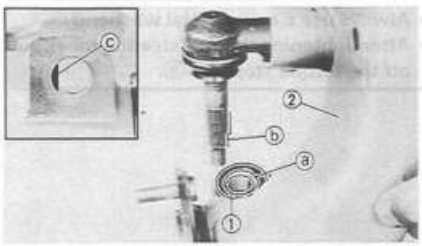
⚠ WARNING

Always use a new cotter pin.

	Nut (ball joint - upper): 40 Nm (4.0 m • kg, 29 ft • lb)



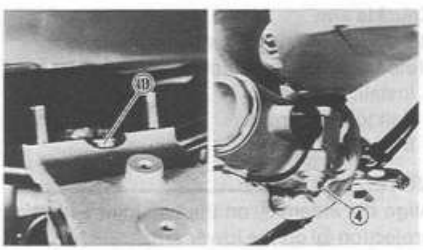
IV



3. Install:
- Washer ①
- Knuckle arm ②

NOTE:
- The tapered side ⓐ of the washer must face the rubber boot.
- Turn the ball joint shaft so that the flat side ⓑ matches the pin ⓒ inside the knuckle arm bore.

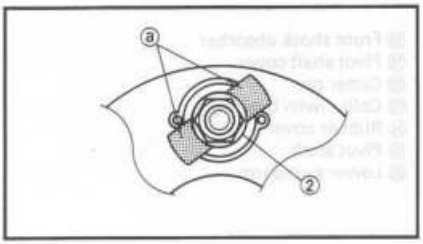
	Nut ③ (upper): 53 Nm (5.3 m • kg, 38 ft • lb) **Nut ④ (lower): 78 Nm (7.8 m • kg, 56 ft • lb)**





4. Connect:
- Joint ring ①
(with plain washers and special washers)

	Nut (joint ring): 23 Nm (2.3 m • kg, 17 ft • lb)



CAUTION:

- **Always use a new special washer ②.**
- **After tightening the nut (steering tube), cut off the torque stoppers ⓐ.**

5. Install:
- Front brake disc
- Front brake caliper
- Front wheel

Bolt (front brake disc):
20 Nm (2.0 m • kg, 14 ft • lb)
Bolt (front brake caliper):
67 Nm (6.7 m • kg, 48 ft • lb)
Nut (front wheel):
95 Nm (9.5 m • kg, 68 ft • lb)

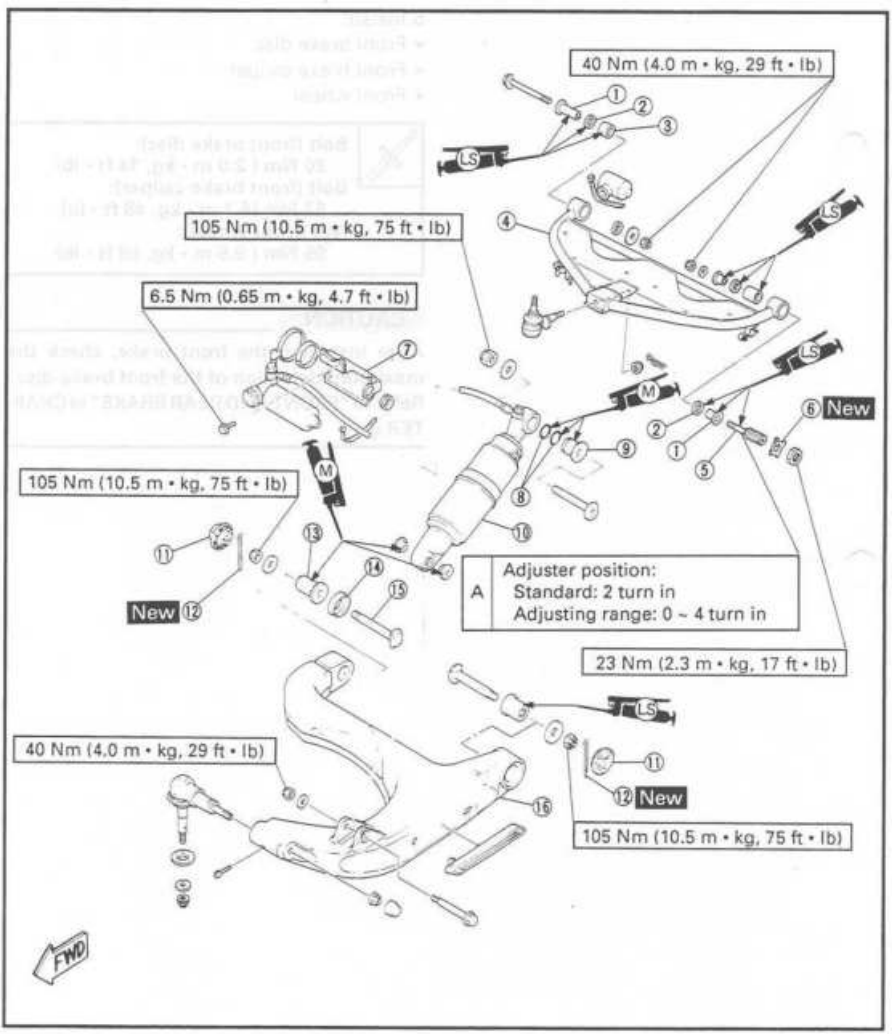
CAUTION:

After installing the front brake, check the maximum defection of the front brake disc. Refer ro "FRONT AND REAR BRAKE" in CHAPTER 6.

IV

FRONT SHOCK ABSORBER AND SWINGARM

① Collar
② Oil seal
③ Bearing
④ Upper arm
⑤ Camber adjuster
⑥ Lock washer
⑦ Gas chamber holder
⑧ O-ring
⑨ Collar
⑩ Front shock absorber
⑪ Pivot shaft cover
⑫ Cotter pin
⑬ Collar (with bearing)
⑭ Rubber cover
⑮ Pivot shaft
⑯ Lower swingarm



Handling Notes

⚠ WARNING

This shock absorber contains highly compressed nitrogen gas. Read and understand the following information before handling the shock absorber. The manufacturer cannot be held responsible for property damage or personal injury that may result from improper handling.

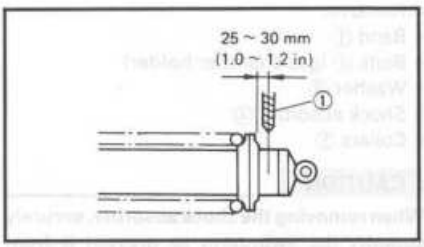
1. **Do not tamper or attempt to open the cylinder assembly.**
2. **Do not subject shock absorber to an open flame or other high heat. This may cause the unit to explode due to excessive gas pressure.**
3. **Do not deform or damage the cylinder in any way. Cylinder damage will result in poor damping performance.**

Notes on disposal

****

Shock absorber disposal steps:

Gas pressure must be released before disposing of the shock absorber. To do so, drill a 2 ~ 3 mm (0.08 ~ 0.12 in) hole at a point 25 ~ 30 mm (1.0 ~ 1.2 in) from the end of the gas chamber.



⚠ WARNING

Wear eye protection to prevent eye damage from escaping gas and/or metal chips.

****

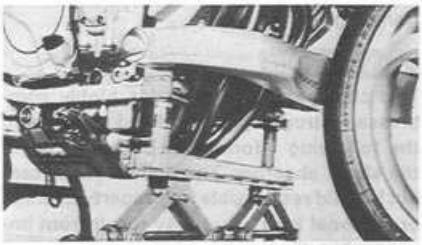
Removal

Front shock absorber

⚠ WARNING

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

1. Place the motorcycle on the centerstand.



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

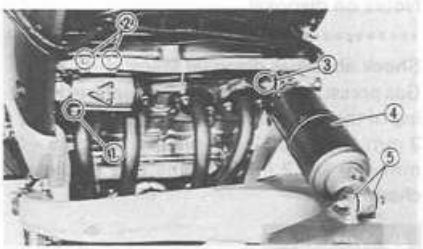
CAUTION:

Use the front end of the main frame as jack-up point, never the reinforcement tube or the exhaust pipes.

3. Remove:
- Seat
- Top cover
- Inner panels
- Side cowlings

Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.

IV



4. Remove:
- Band ①
- Bolts ② (gas chamber holder)
- Washer ③
- Shock absorber ④
- Collars ⑤

CAUTION:

When removing the shock absorber, securely support the swingarm to prevent it from dropping down. The ball joints of the knuckle arm could be damaged, if the lower swingarm was allowed to lower completely.

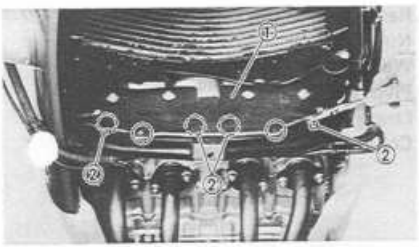
Swingarm

1. Remove:
- Seat
- Top cover
- Inner panels
- Side cowlings

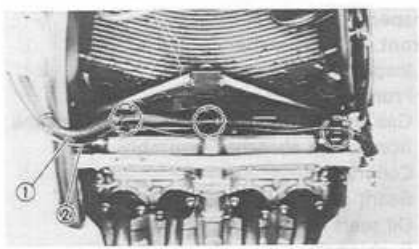
Refer to "COWLING REMOVAL AND INSTALLATION" in CHAPTER I.

2. Remove:
- Front wheel
- Front brake caliper
- Front brake disc
  Refer to "FRONT WHEEL AND WHEEL AXLE".
- Knuckle arm
  Refer to "STEERING TUBE AND KNUCKLE ARM".
- Front shock absorber
  Refer to "FRONT SHOCK ABSORBER AND SWINGARM".

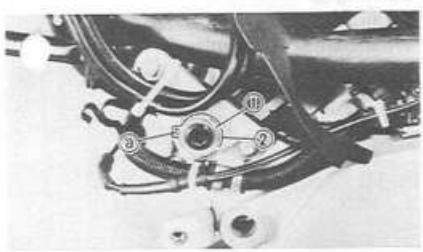
3. Remove:
- Rubber baffle ① (lower)



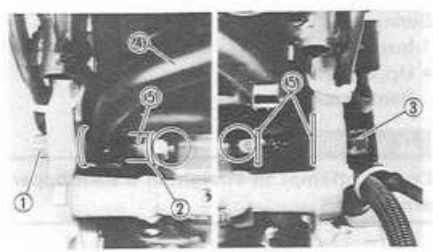
NOTE:
Carefully pull out the retainers ② with long nose pliers.



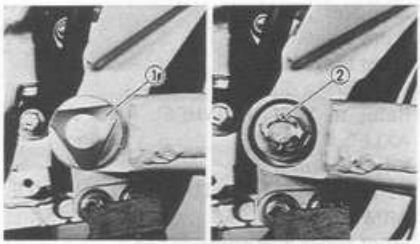
4. Disconnect:
- Brake hose ①
- Wheel sensor lead ②
  (from upper arm)



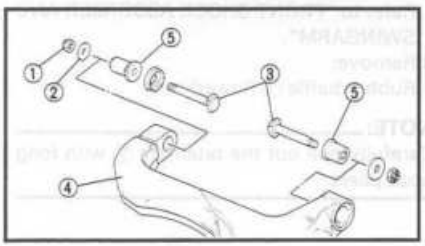
5. Straighten the lock washer tab ⓐ.
6. Remove:
- Locknut ① (camber adjuster)
- Lock washer ②



7. Remove:
- Bolt ① (right)
- Washer ②
- Camber adjuster ③
- Upper arm ④
- Collars ⑤

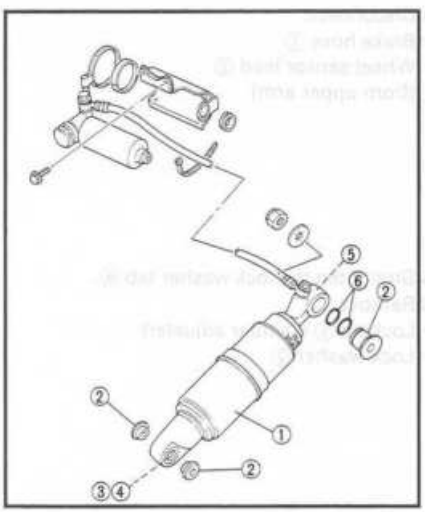


8. Remove:
- Pivot shaft cover ① (left and right)
- Cotter pin ② (left and right)



9. Remove:
- Nut ①
- Washer ②
- Pivot shaft ③
- Lower swingarm ④
- Collar ⑤ (with bearing)

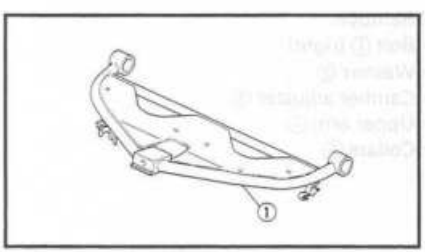
IV



Inspection

Front shock absorber

1. Inspect:
- Front shock absorber ①
  Gas leaks/Oil leaks/Damage → Replace the front shock absorber assembly.
- Collars ②
- Bearing ③
- Oil seals ④
- Bushing ⑤
- O-rings ⑥
  Wear/Damage → Replace.

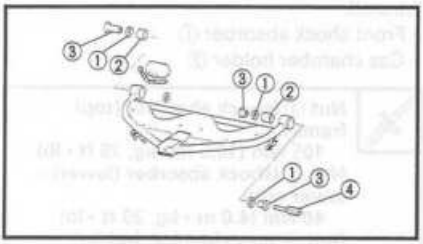


Swingarm

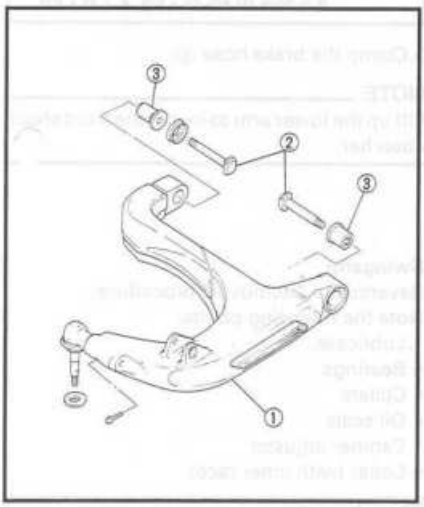
1. Inspect:
- Upper arm ①
  Bent/Cracks/Damage → Replace.

⚠ WARNING

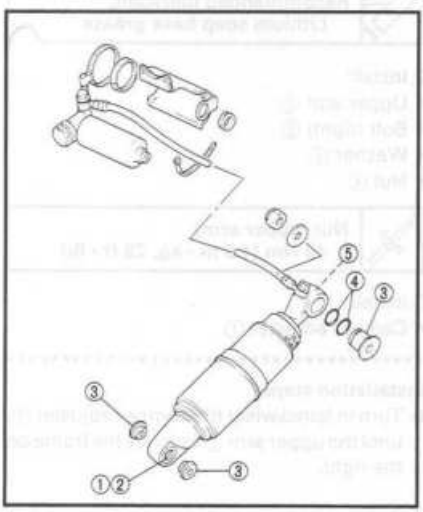
Do not attempt to straighten a bent upper arm.



2. Inspect:
- Oil seals ①
  Wear/Damage → Replace.
- Bearings ②
  Pitting/Damage → Replace.
- Collars ③
- Camber adjuster ④
  Scratches/Wear/Damage → Replace.



3. Inspect:
- Lower swingarm ①
  Cracks/Damage → Replace.
- Pivot shaft ②
  Bent/Damage → Replace.
- Collar ③ (with bearing)
  Pitting/Wear/Damage → Replace.



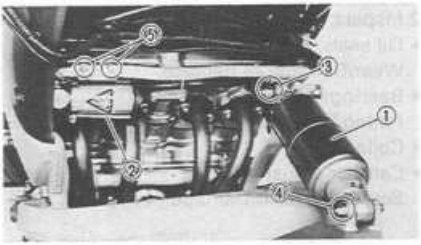
Installation

Front shock absorber

Reverse the "Removal" procedure.
Note the following points.

1. Lubricate:
- Bearing ①
- Oil seals ②
- Collars ③
- O-ring ④
- Bushings ⑤

Recommended lubricant:
Molybdenum disufide grease



2. Install:
- Front shock absorber ①
- Gas chamber holder ②

Nut ③ (shock absorber (top) - frame)
105 Nm (10.5 m • kg, 75 ft • lb)
Nut ④ (shock absorber (lower) - lower arm)
40 Nm (4.0 m • kg, 29 ft • lb)
Bolt ⑤ (gas chamber holder)
6.5 Nm (0.65 m • kg, 4.7 ft • lb)

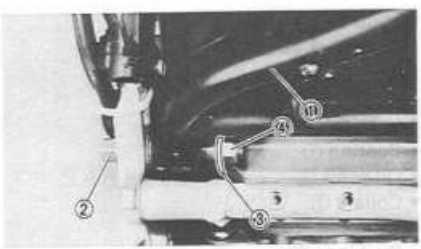
3. Clamp the brake hose ⑥.

NOTE:
Lift up the lower arm to install the front shock absorber.

IV

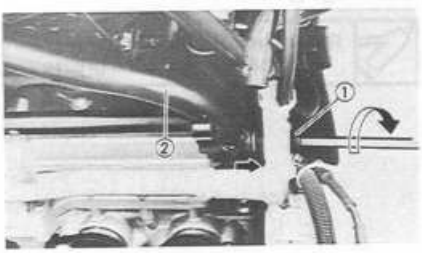
Swingarm
Reverse the "Removal" procedure.
Note the following points.
1. Lubricate:
- Bearings
- Collars
- Oil seals
- Camber adjuster
- Collar (with inner race)

Recommended lubricant:
Lithium soap base grease



2. Install:
- Upper arm ①
- Bolt (right) ②
- Washer ③
- Nut ④

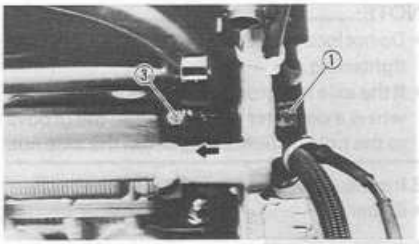
Nut (upper arm):
40 Nm (4.0 m • kg, 29 ft • lb)



3. Install:
- Camber adjuster ①

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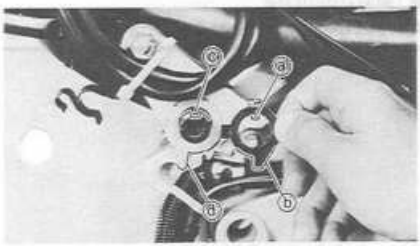
Installation steps:
- Turn in (clockwise) the camber adjuster ①, until the upper arm ② touches the frame on the right.

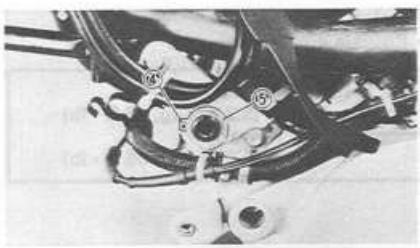


- Install the nut ③ onto the camber adjuster bolt.

	Nut (camber adjuster): 40 Nm (4.0 m • kg, 29 ft • lb)

- Turn out (counterclockwise) the camber adjuster ① until the upper arm touches the frame on the left.
- Turn the adjuster clockwise until the lock washer projections ⓐ and ⓑ match the groove ⓒ and the projection ⓓ as shown.
- Turn the camber adjuster two complete turns in (clockwise) to bring the upper arm into standard position.



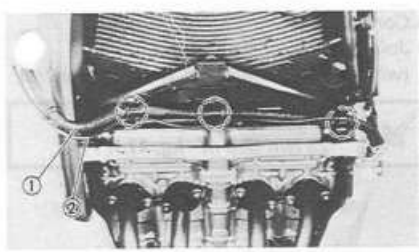


- Install the lock washer ④ and the locknut ⑤ temporarily.

⚠ WARNING

Always use a new lock washer.

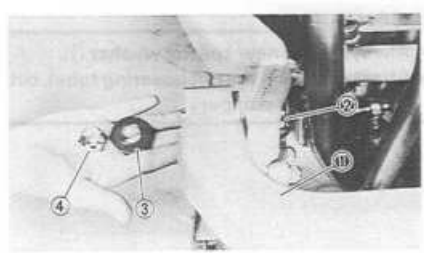
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4. Connect:
- Brake hose ①
- Wheel sensor lead ②

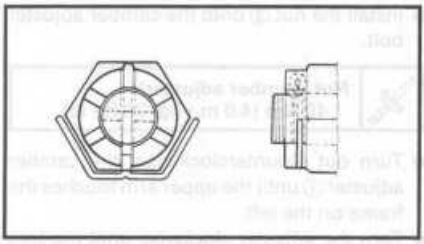
CAUTION:

Proper hose and lead routing is essential to insure safe motorcycle operation. Refer to "CABLE ROUTING".



5. Install:
- Lower arm ①
- Collars (with bearing)
- Pivot shafts ②
- Washers ③
- Nuts ④

	Nut (pivot shaft): 105 Nm (10.5 m • kg, 75 ft • lb)



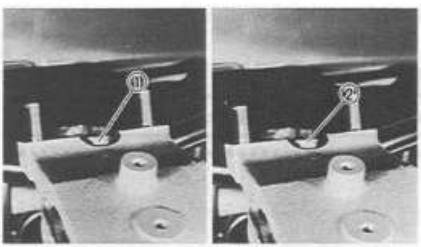
NOTE:
- Do not loosen the pivot shaft nut after torque tightening.
- If the axle nut groove is not aligned with the wheel axle cotter pin hole, align the groove to the hole by tightening up on the axle nut.

6. Install:
- Cotter pin

⚠ WARNING

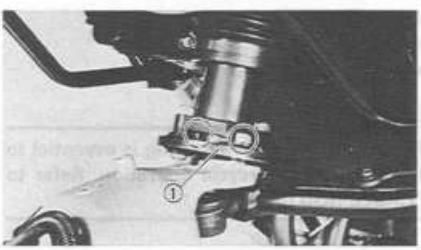
Always use a new cotter pin on the axle nut.

IV



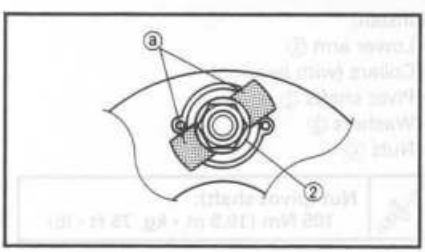
7. Install:
- Knuckle arm

Nut ① (upper):
53 Nm (5.3 m • kg, 38 ft • lb)
Nut ② (lower):
78 Nm (7.8 m • kg, 56 ft • lb)



8. Connect:
- Joint ring ① (steering tube)
(with plain washers and special washers)

Nut (joint ring):
23 Nm (2.3 m • kg, 17 ft • lb)



CAUTION:
- **Always use a new special washer ②.**
- **After tightening the nut (steering tube), cut off the torque stoppers ⓐ.**

9. Install:
- Front brake disc
- Front brake caliper
- Front wheel

	**Bolt (front brake disc):** **20 Nm (2.0 m • kg, 14 ft • lb)** **Bolt (front brake caliper):** **67 Nm (6.7 m • kg, 48 ft • lb)** **Nut (front wheel):** **95 Nm (9.5 m • kg, 68 ft • lb)**

CAUTION:

After installing the front brake, check the maximum defection of the front brake disc. Refer to "FRONT AND REAR BRAKE" in CHAPTER 6.

10. Adjust:
- Front wheel camber
  Refer to "FRONT WHEEL ALIGNEMENT" in CHAPTER 3.

	**Locknut (camber adjuster):** **23 Nm (2.3 m • kg, 17 ft • lb)**

IV


YAMAHA
GENUINE
Parts & Accessories
03/07/96
1 PC.
LIT116160922
Yamaha Motor Corp., USA
Cypress, California
made in