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CLYMER

YAMAHA

XV535-1100 VIRAGO • 1981-2003

SERVICE • REPAIR • MAINTENANCE

A PRIMEDIA Publication

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Section One:XV700-1100 Virago • 1981-1999
Section Two: XV535 Virago • 1987-2003

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Section Two: XV535 Virago • 1987-2003

TheXV700-1100 Virago 1981-1997 models are covered in Section One of this book.

CONTENTS— Section Two

XV535 Virago • 1987-2003

QUICK REFERENCE DATA

XV535

TIRE INFLATION PRESSURE (COLD}

Load	psi (kg/cm^2)
Up to 198 1b. (90 kg)	
Front	28 (2.0)
Rear	32 (2.3)
198-max. Ib. (90-max kg)*	
Front	28 (2.0)
Rear	36 (2.5)
High-speed riding	
Front	28 (2.0)
Rear	36 (2.5)

* Maximum load: 49-state 507 Ib. (230 kg.), Calif. 505 Ib. (229 kg.), U.K. 501 Ib. (227 kg.).

RECOMMENDED LUBRICANTS

Item	Type
Engine oil	
40° F (5° C) and above	Yamalube 4 or SAE 20W/40
60° F (15° C) and below	Yamalube 4 or SAE 10W/30
Brake fluid	**DOT** 3
Battery refilling	Distilled water
Fork oil	SAE10W
Control cables and pivot points	SAE 10W/30 motor oil
Final drive unit	Hypoid gear oil SAE 80 GL-4 or SAE 80W/90

APPROXIMATE REFILL CAPACITIES

Item	Quantity
Engine oil	
With filter change	3.0 U.S. qt. (2.8 L, 2.5 Imp. qt.)
Without filter change	2.7 U.S. qt. (2.6 L, 2.3 Imp. qt.)
Engine rebuild	3.4 U.S. qt. (3.2 L, 2.8 Imp. qt.)
Front fork	7.71 U.S. oz. (228 cc, 8.03 Imp. oz.)
Final gear case	0.20 U.S. qt. (0.19 L, 0.17 Imp. qt.)

TUNE-UP SPECIFICATIONS

Ignition timing	Fixed
Valve clearance (cold)	
Intake	0.003-0.005 in. (0.07-0.12 mm)
Exhaust	0.005-0.007 in. (0.12-0.17 mm)
Spark plug	
Type	
U.S.	NGK BP7ES, ND W22EP-U
U.K.	NGK BPR7ES, ND W22EPR-U
Gap	0.028-0.031 in. (0.7-0.8 mm)
Idle speed	1,150-1,250 rpm
Compression pressure (cold at sea level)	
Standard	156 psi (11 kg/cm^2,1,100 kPa)
Minimum	142 psi (10 kg/cm^2,1,000 kPa)
Maximum	171 psi (12 kg/cm^2,1,200 kPa)

REPLACEMENT BULBS

Item	Voltage/Wattage
Headlight	12V 60W/55W
Tall/brakelight	
U.S.	12V 8W/27W
U.K.	12V5W/21W
Front running light (U.S.)	12V8W/27W
Auxiliary light (U.K.)	12V 4W
Front flasher	
U.S.	12V 8W/27W
U.K.	12V 21W
Rear flasher	
U.S.	12V 27W
U.K.	12V 21W
Meter light	12V 3.4W
Indicator lights	
High beam	12V1.7W
All others	12V 3.4W

FUSES

	Amperage
Main	20A
Headlight	10A
Signal	**10A**
Ignition	**10A**
Spare	20A&10A

INTRODUCTION

This portion of this detailed and comprehensive manual covers the U.S. and the U.K. models of the Yamaha XV535 V-twins from 1987-on.

The expert text gives complete information on maintenance, tune-up, repair and overhaul. Hundreds of photos and drawings guide you through every step. The book includes all you will need to know to keep your Yamaha running right.

A shop manual is a reference. You want to be able to find information fast. As in all Clymer books, this one is designed with you in mind. All chapters are thumb tabbed. Important items are extensively indexed at the rear of the book. All procedures, tables, photos, etc., in this manual are for the reader who may be working on the bike for the first time or using this manual for the first time. All the most frequently used specifications and capacities are summarized in the *Quick Reference Data* pages at the front of the manual.

Keep the book handy in your tool box. It will help you better understand how your bike runs, lower repair costs and generally improve your satisfaction with the Yamaha.

CHAPTER ONE

GENERAL INFORMATION

This detailed, comprehensive manual covers the U.S. and the U.K. models of the Yamaha XV535 Virago V-twins from 1987-on. **Table 1** lists engine, chassis and primary identification numbers for models covered in this manual and **Table 2** lists the general specifications.

Table 1 and **Table 2** are found at the end of the chapter.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter One at the front of this manual for service procedures.

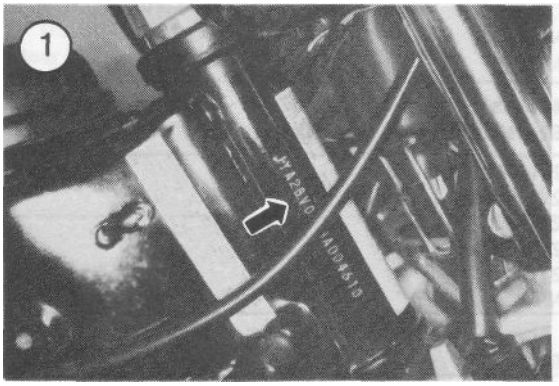
PARTS REPLACEMENT

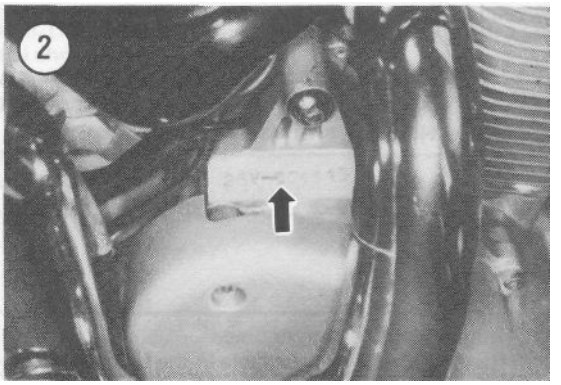
Yamaha makes frequent changes during a model year, some minor, some relatively major. When you order parts from the dealer or other parts distributors, always order by frame and engine numbers. The frame serial number and vehicle identification number (VIN) is stamped on the right-hand side of the steering stem **(Figure 1).** The engine number is stamped on a raised pad on the right-hand side of the crankcase **(Figure 2)** by the rear cylinder. The carburetor number is on the left-hand side of the NO. 1 carburetor body just below the top cover.

Write the numbers down and carry them with you. Compare new parts to old before purchasing them. If they are not alike, have the parts manager explain the difference to you. **Table 1** lists engine and frame serial numbers for the models covered in this manual.

NOTE

If your Yamaha was purchased second-hand and you are not sure of its model





year, use the bike's engine serial number and vehicle identification number (VIN) and the information in ***Table 1.*** *Read your bike's engine serial number. Then compare the number with the engine and serial numbers listed in* ***Table 1.*** *If your bike's serial number is listed in* ***Table 1,*** *cross-reference the number with the adjacent model number and year.*

Table 1 ENGINE SERIAL NUMBER

Model Numbers and Year	Starting Engine Number
U.S. Models	
1987	
XV535T	2GV-000101
XV535TC	2JU-000101
1988	
XV535U	2GV-038101
XV535UC	3BG-000101
1989	
XC535W	2UJ-020101
XC535WC	3BG-002101
1990**	
XV535A	3JC-007101
XV535AC	3JC-002101
1993	
XV535E	3JC-014101
XV535EC	3JC-020101
1994	
XV535F	3JC-021101
XV535FC	3JC-025101
XV535SF	3JC-028101
XV535SFC	3JC-033101
1995	
XV535G	3JC-036101
XV535GC	3JC-039101
XV535SG	3JC-041101
XV535SGC	3JC-047101
1996	
XV535H 3JCS (except California)	3JC-050101
XV535HC 3JCT (California)	3JC-053101
XV535SH 3JCN (except California)	3JC-055101
XV535SHC 3JCP (California)	3JC-060101
1997	N/A
1998	
XV535K	3JC-065097*
XV535KC	3JC-065689*
1999	
XV535L	3JC-065951*
XV535LC	3JC-066007*
2000	
XV535M	N/A
XV535MC	N/A
U.K. Models	
Models Number and Year	**Starting Engine Number**
1988	2YL-003101
1989	2YL-005101
1990	2YL-0022101
1991	2YL-0022101
1992-1997	2YL-
1998-2003	N/A

'Primary identification nubtner.
"The XV535 was not available in the U.S. in 1991 and 1992.

Table 2 GENERAL SPECIFICATIONS

Engine type	Air-cooled, 4-stroke, SOHC, V-twin
Bore and stroke	2.992 x 2.323 in. (76 x 59 mm)
Displacement	32.64 cu. in. (535 cc)
Compression ratio	9:1
Ignition	Transistor control ignition (TCI)
Carburetion	2 Mikuni carburetors
Air filter	Dry type element
Fuel type	Gasoline: regular unleaded
Fuel tank capacity	
1987-1989 U.S. models and 1988 U. K. models	
Total	2.3 U.S. gal. (8.6 L, 1.9 Imp. gal.)
Reserve	0.5 U.S. gal. (2.0 L, 0.4 Imp. gal.)
1990-on U.S. models and 1989-on U. K. models	
Total	3.6 U.S. gal. (13.5 L, 3.0 Imp. gal.)
Reserve	0.7 U.S. gal. (2.5 L, 0.5 Imp. gal.)
Clutch	Wet, multi-plate
Transmission	5 speeds, constant mesh
Transmission ratios	
1st	2.714
2nd	1.900
3rd	1.458
4th	1.166
5th	0.966
Final reduction ratio	3.071
Starting system	Electric starter only
Battery	12 volt/12 amp hour
Charging system	AC alternator
Chassis dimensions	
Overall length	87.0 in. (2,210 mm)
Overall width	32.1 in. (815 mm)
Overall height	43.3 in. (1,100 mm)
Seat height	27.6 in. (700 mm)
Wheelbase	59.5 in. (1,511 mm)
Ground clearance	5.7 in. (145 mm)
Basic weight	
U.S. models	
1987-1989	
49-State	408 lb. (185 kg)
California	4101b. (186 kg)
1990-on	
49-state	430 lb. (195 kg)
California	432 lb. (196 kg)
U.K. models	4151b. (188 kg)
Steering head angle	31°
Trail	4.8 in. (122 mm)
Front suspension	
Telescopic fork	
Travel	5.9 in. (150 mm)
Rear suspension	Dual shock
Travel	3.3 in. (85 mm)
Front tire	3.00S-19 4PR
Rear tire	
1987-1989	140/90-15 70S
1990-on	140/90-15M/C 70S

CHAPTER TWO

TROUBLESHOOTING

Diagnosing mechanical problems is relatively simple if you use orderly procedures and keep a few basic principles in mind. The first step in any troubleshooting procedure is to define the symptoms as closely as possible and then localize the problem. Subsequent steps involve testing and analyzing those areas which could cause the symptoms. A haphazard approach may eventually solve the problem, but it can be very costly in terms of wasted time and unnecessary parts replacement.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Two at the front of this manual for service procedures.

EMERGENCY TROUBLESHOOTING

When the vehicle is difficult to start, or won't start at all, it does not help to wear down the battery and overheat the starter. Check for obvious problems even before getting out your tools. Go down the following list step-by-step. Do each one. If the vehicle still will not start, refer to the appropriate troubleshooting procedures which follow in this chapter.

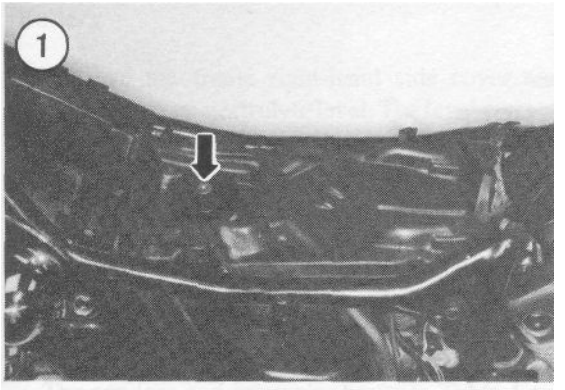
1. Is there fuel in the tank? On models without a sub-fuel tank, raise the seat and open the main fuel tank filler cap **(Figure 1).** On models with a sub-fuel tank, open the sub-fuel tank filler cap **(Figure 2)** and rock the bike from side to side. Listen for fuel sloshing around.

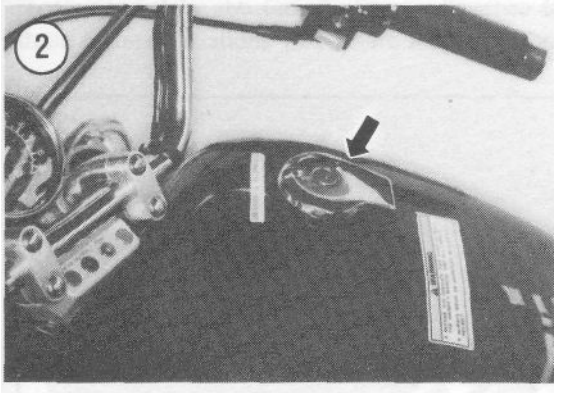
WARNING

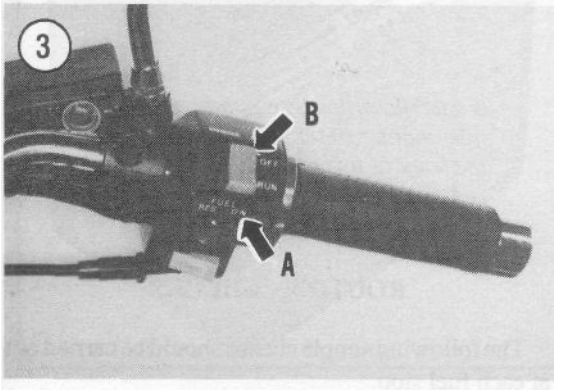
Do not use an openflame to check in the tank. A serious explosion is certain to result.

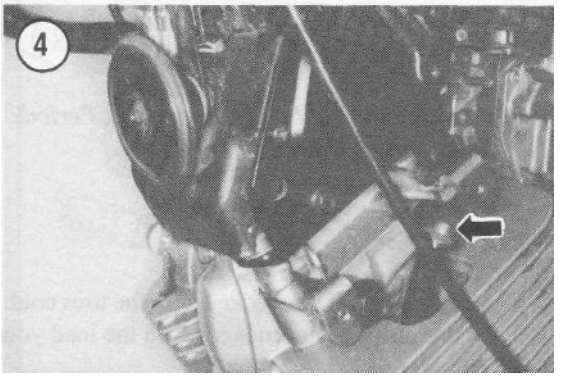
2. On models so equipped, is the fuel shutoff valve in the ON position?

3. Make sure the fuel reserve switch (A, **Figure 3)** is in the RES position. If there is any doubt about the









fuel pump operation, refer to Chapter Seven in this section of the manual.

4. Make sure the engine kill switch (B, **Figure 3)** is not stuck in the OFF position or that the wire is not broken and shorting out.

5. Are the spark plug wires **(Figure 4)** on tight? Remove the engine covers and push both on and slightly rotate them to clean the electrical connection between the plugs and the connectors.

6. Is the choke lever **(Figure 5)** in the correct position? Push the lever down for a cold engine and up for a warm engine.

ENGINE STARTING

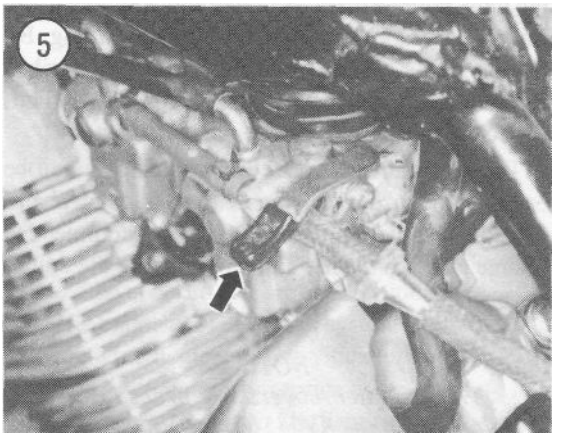
Follow the *Engine Starting* procedure in Chapter Two in front of this manual noting that the XV535 is equipped with an Ignitor Unit and not a CDI unit.

ENGINE PERFORMANCE

Follow the *Engine Performance* procedure in Chapter Two in front of this manual noting that the XV535 is equipped with a fuel fitter.

IGNITION SYSTEM

All XV535 models are equipped with the Transistor Control Ignition system. This system consists of both a pickup unit and an ignitor unit and uses no breaker points or other moving parts. It is non-adjustable, and if any problems arise that you believe to be related to the ignition system, refer to Chapter Seven for ignition system troubleshooting procedures.



CHAPTER THREE

PERIODIC LUBRICATION, MAINTENANCE AND TUNE-UP

Your bike can be cared for by two methods: preventive and corrective maintenance. Because a motorcycle is subjected to tremendous heat, stress and vibration—even in normal use—preventive maintenance prevents costly and unexpected corrective maintenance. When neglected, any bike becomes unreliable and actually dangerous to ride. When properly maintained, the Yamaha XV535 is one of the most reliable bikes available and will give many miles and years of dependable and safe riding. By maintaining a routine service schedule as described in this chapter, costly mechanical problems and unexpected breakdowns can be prevented.

The procedures presented in this chapter can be easily performed by anyone with average mechanical skills. **Table 1** presents a factory recommended maintenance schedule. **Tables 1-5** are at the end of the chapter.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Three at the front of this manual for service procedures.

ROUTINE CHECKS

The following simple checks should be carried out at each fuel stop.

Engine Oil Level

Refer to *Engine Oil Level Check* under *Periodic Lubrication* in this chapter.

Tire Pressure

Tire pressure must be checked with the tires cold. Correct tire pressure depends a lot on the load you are carrying. See **Table 2.**

Battery

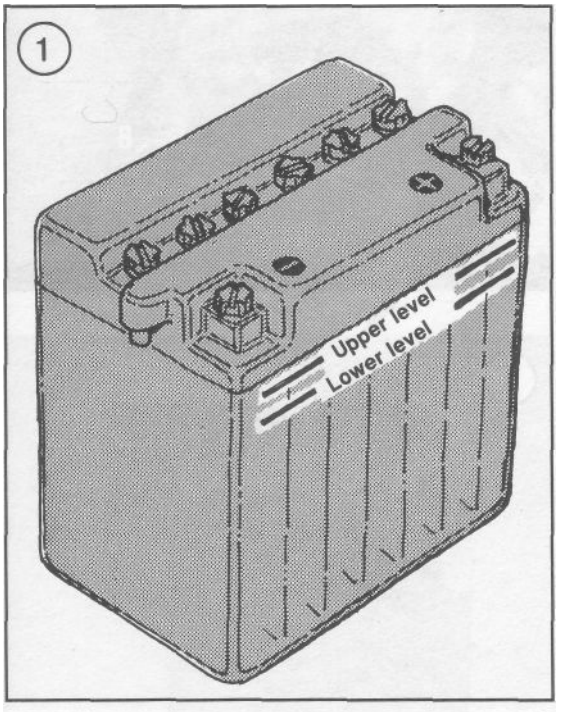
Remove the frame right-hand side cover and check the battery electrolyte level. The level must be between the upper and lower level marks on the case **(Figure 1).**

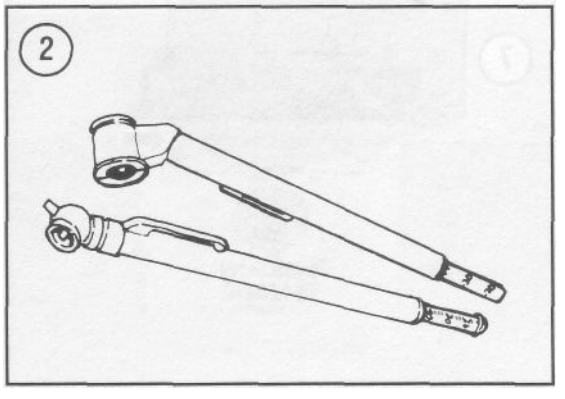
For complete details see *Battery Removal/Installation and Electrolyte Level Check* in this chapter.

MAINTENANCE INTERVALS

The services and intervals shown in **Table 1** are recommended by the factory. Strict adherence to these recommendations will insure long life from your Yamaha. If the bike is run in an area of high humidity, the lubrication services must be done more frequently to prevent possible rust damage.

For convenient maintenance of your motorcycle, most of the services shown in **Table 1** are described in this chapter. Those procedures which require more than minor disassembly or adjustment are covered elsewhere in the appropriate chapter. The *Contents* and *Index* can help you locate a particular service procedure.





TIRES AND WHEELS

Tire Pressure

Tire pressure should be checked and adjusted to accommodate rider and luggage weight. A simple, accurate gauge **(Figure 2)** can be purchased for a few dollars and should be carried in your motorcycle tool kit. The appropriate tire pressures are shown in **Table 2.**

NOTE

After checking and adjusting the air pressure, make sure to reinstall the air valve cap. The cap prevents small pebbles and/or dirt from collecting in the valve stem that could allow air leakage or result in incorrect tire pressure readings.

BATTERY

CAUTION

If it becomes necessary to remove the battery breather tube from the frame when performing any of the following procedures, make sure to route the tube correctly during installation to prevent acid from spilling on parts.

Removal/Installation and Electrolyte Level Check

The battery is the heart of the electrical system. It should be checked and serviced as indicated **(Table 1).** The majority of electrical system troubles can be attributed to neglect of this vital component.

In order to correctly service the electrolyte level it is necessary to remove the battery from the frame.

The electrolyte level should be maintained between the two marks on the battery case. If the electrolyte level is low, it's a good idea to completely remove the battery so that it can be thoroughly cleaned, serviced, and checked.

1. Remove the seat(s).
2. On 1990-on U.S. models and 1989-on U.K. models, perform the following:
   a. Unhook both fuel lines (A, **Figure 3)** from the clamps on top of the battery cover.
   b. Remove the battery cover (B, **Figure** 3).
3. Unhook the battery strap (A, **Figure 4).**
4. Disconnect the battery vent tube (B, **Figure** 4).
5. Pull the battery part way up out of the battery box to gain access to the battery cable attachment screws.
6. Disconnect the negative (-) battery cable (A, **Figure** 5) from the battery.
7. Disconnect the positive (+) battery cable (B, **Figure 5).**

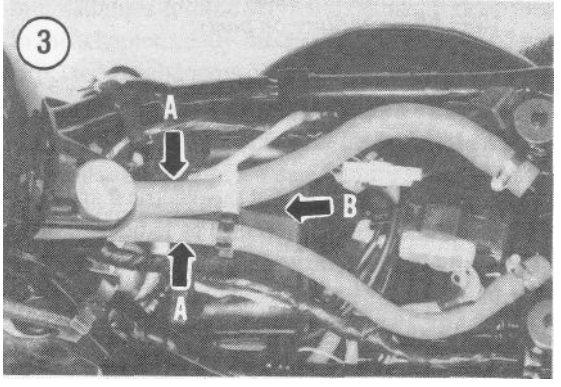
WARNING

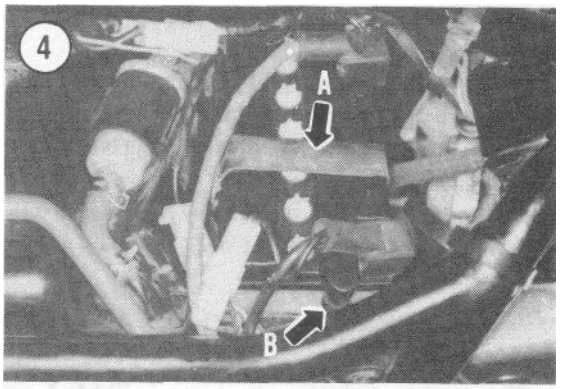
Protect your eyes, skin and clothing. If electrolyte gets into your eyes, flush your eyes thoroughly with clean water and get prompt medical attention.

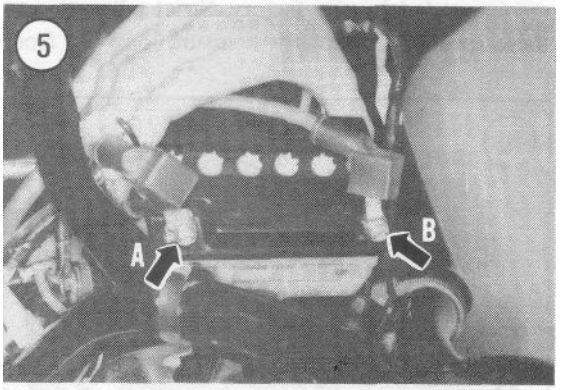
CAUTION

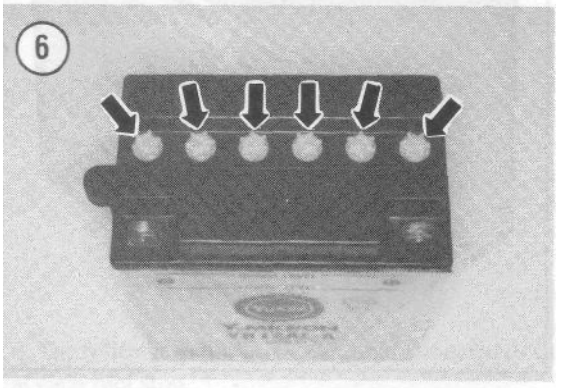
Be careful not to spill battery electrolyte on painted or polished surfaces. The liquid is highly corrosive and will damage the finish. If it is spilled, wash it off immediately with soapy water and thoroughly rinse with clean water.

8. Lift the battery out of the battery box and remove it.
9. Rinse the battery off with clean water and wipe dry.









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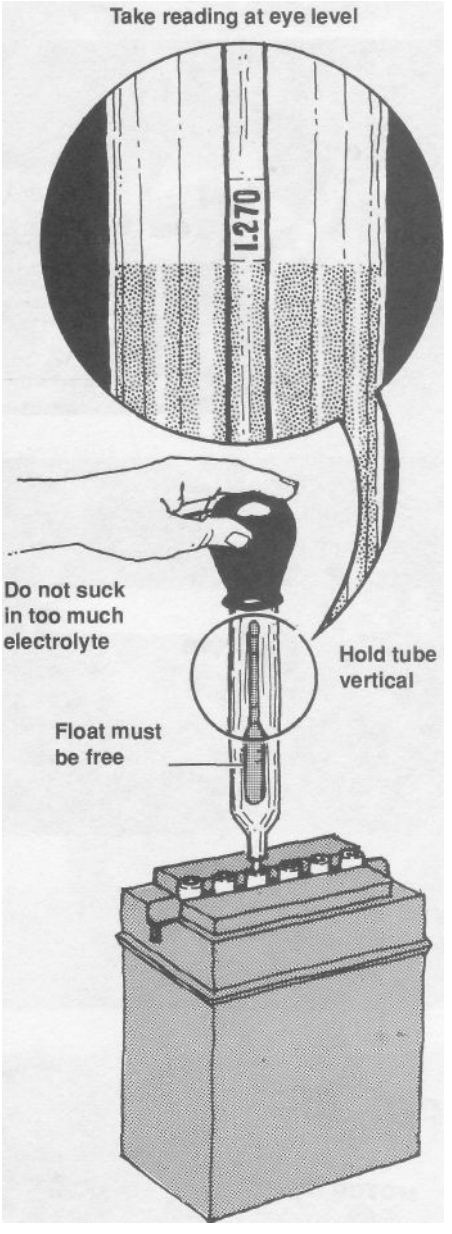


10. Remove the caps **(Figure 6)** from the battery cells and add distilled water. Never add electrolyte (acid) to correct the level. Fill only to the upper battery level mark **(Figure 7).**

11. After the level has been corrected and the battery allowed to stand for a few minutes, check the specific gravity of the electrolyte in each cell with a hydrometer **(Figure 8).** Follow the manufacturer's instructions for reading the instrument. See *Battery Testing* in Chapter Three in the front section of this manual.

CAUTION

If distilled water has been added to a battery in freezing or near freezing weather, add it to the battery, dress warmly and then ride the bike for a ***minimum of 30 minutes.*** *This will help mix the water thoroughly into the electrolyte in the battery. Distilled water is lighter than electrolyte and will float on top of the electrolyte if it is not mixed in properly. If the water stays on the top, it may freeze and fracture the battery case, ruining the battery.*

12. After the battery has been refilled, recharged or replaced, install it by reversing these removal steps while noting the following:

a. Position the battery in the case with the negative (-) terminal on the right-hand side of the bike.
b. Coat the battery terminals with a thin layer of dielectric grease to retard corrosion and decomposition of the terminals.
c. Attach the positive (+) cable first then the negative (-) cable.

CAUTION

Make sure to reconnect the battery breather tube ***(B, Figure 4)*** *to the battery. If the tube was removed with the battery, make sure to route it in its correct position through the frame.*

NEW BATTERY INSTALLATION

When replacing the old battery with a new one, be sure to charge it completely (specific gravity, 1.260-1.280) before installing it in the bike. Failure to do so, or using the battery with a low electrolyte level will permanently damage the battery. When pur-

chasing a new battery, the correct battery capacity for models covered in this manual is 12 volts/12 amp hours.

NOTE

Recycle your old battery. *When you replace the old battery, be sure to turn in the old battery at that time. The lead plates and the plastic case can be recycled Most motorcycle dealers will accept your old battery in trade when you purchase a new one, but if they will not, many automotive supply stores certainly will.* ***Never*** *place an old battery in your household trash since it is illegal, in most states, to place any acid or lead (heavy metal) contents in landfills. There is also the danger of the battery being crushed in the trash truck and spraying acid on the truck operator.*

PERIODIC LUBRICATION

Engine Oil Level Check

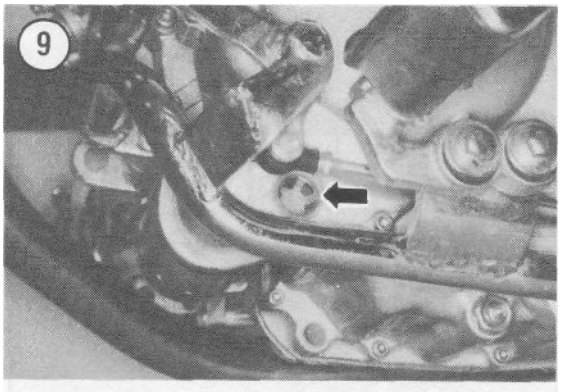
Engine oil level is checked through the inspection window located at the bottom of the crankcase cover on the right-hand side **(Figure 9).**

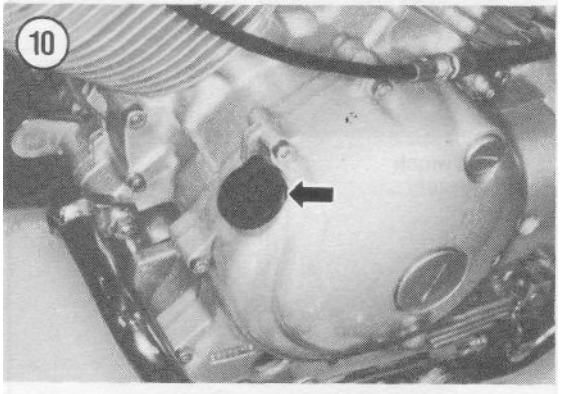
1. Place the bike on level ground on the sidestand. Start the engine and let it reach normal operating temperature.
2. Stop the engine and allow the oil to settle.
3. Hold the bike level in the upright position.
4. The oil level should be between the maximum and minimum window marks **(Figure 9).** If necessary, remove the oil fill cap **(Figure 10)** and add the recommended oil listed in **Table 3** to raise the oil to the proper level. Do not overfill.

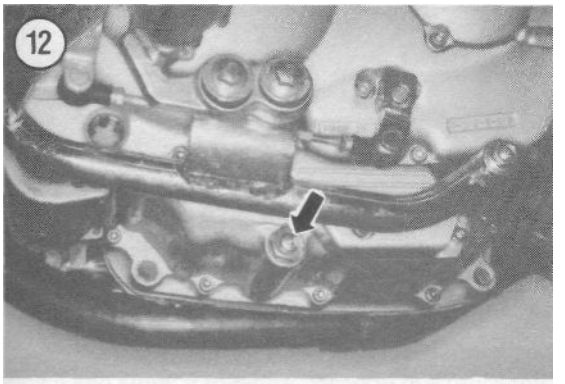
Engine Oil and Filter Change

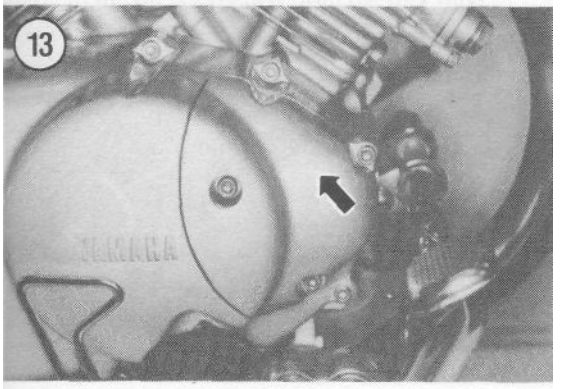
The factory-recommended oil and filter change interval is specified in **Table 1.** This assumes that the motorcycle is operated in moderate climates. The time interval is more important than the mileage interval because combustion acids, formed by gasoline and water vapor, will contaminate the oil even if the motorcycle is not run for several months. If a motorcycle is operated under dusty conditions, the oil will get dirty more quickly and should be changed more frequently than recommended.

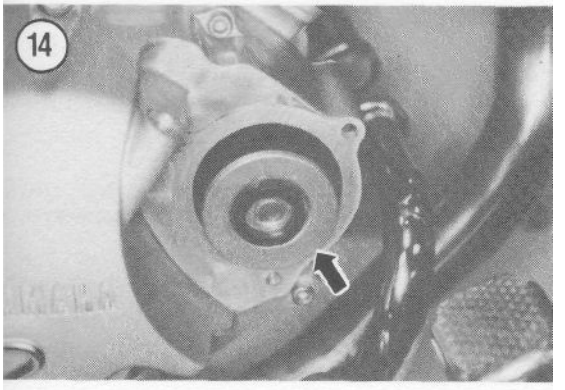
Use only a detergent oil with an API rating of SE or SF. The quality rating is on the label of the bottle **(Figure 11).** Try always to use the same brand of oil. Use of oil additives is not recommended. Refer to **Table 3** for correct weight of oil to use under different temperatures.

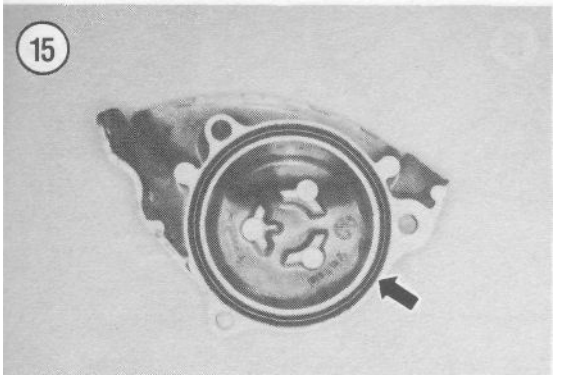












To change the engine oil and filter you will need the following:

a. Drain pan.
b. Funnel.
c. Wrench or socket to remove drain plug.
d. 3 quarts of oil.
e. Oil filter element.

NOTE

Never dispose of motor oil in the trash, on the ground, or down a storm drain. Many service stations accept used motor oil and waste haulers provide curbside used motor oil collection. Do not combine other fluids with motor oil to be recycled. To locate a recycler, contact the American Petroleum Institute (API) at www.recycleoU.org.

There are a number of ways to discard the used oil safely. The easiest way is to pour it from the drain pan into a gallon plastic bleach, juice or milk container for recycling or disposal. Do not discard oil in your household trash or pour it onto the ground.

1. Place the motorcycle on the sidestand.
2. Start the engine and run it until it is at normal operating temperature, then turn it off.
3. Place a drip pan under the crankcase and remove the drain plug **(Figure 12).**
4. Remove the oil filler cap **(Figure 10);** this will speed up the flow of oil.
5. Allow the oil to drain for at least 15-20 minutes.

NOTE

Before removing the oil filter cover, thoroughly clean off all dirt and oil around it.

6. Remove the bolts securing the filter cover **(Figure 13)** to the crankcase.
7. Remove the cover and the filter **(Figure** 14). Discard the oil filter and clean out the cover and filter housing with cleaning solvent. Dry parts thoroughly.
8. Inspect the O-ring in the end of the cover **(Figure 15)** and replace if necessary.

NOTE

Prior to installing the cover, clean off the mating surface of the crankcase—do not allow any dirt to enter the oil system.

9. Position the new oil filter with the shoulder end **(Figure 16)** going in first and install the filter.
10. Reinstall the filter cover to the crankcase and tighten the bolts to 7.2 ft.-lb. (10 N.m).
11. Install the drain plug and gasket and tighten to 31 ft.-lb. (43 N.m).

12. Fill the crankcase with the correct weight **(Table 3)** and quantity of oil **(Table 4).**
13. Screw the oil filler cap on securely.
14. Start the engine and allow it to idle. Check for leaks.
15. Turn the engine off and allow the oil to settle. Check for correct oil level **(Figure 9);** adjust if necessary.

Front Fork Oil Change

1. Place the bike on the sidestand.

CAUTION

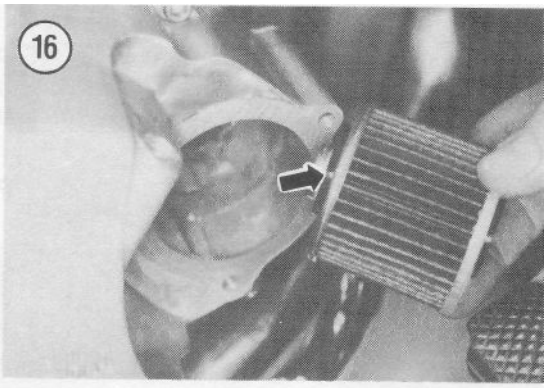
If the bike has been subjected to frequent rain or moisture or if the bike has been in storage for any period of time, moisture may have passed by the trim cap causing rust. Any rust must be removed prior to removing any upper fork parts during this procedure. If any rust particles drop down into the fork assembly the fork must be removed, disassembled and thoroughly cleaned prior to refilling with fresh fork oil. After removing the trim cap, if rust is present, scrape it clean, blow the rust residue out with compressed air and apply WD-40, or equivalent, then remove the stopper ring and spring seat.

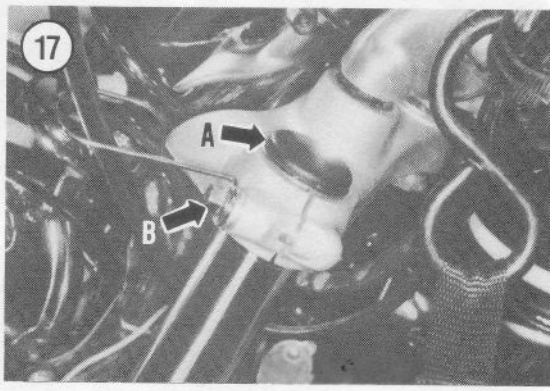
2. Remove the fork trim cap (A, **Figure** 17).
3. Loosen the top fork tube pinch bolt (B, **Figure 17).**

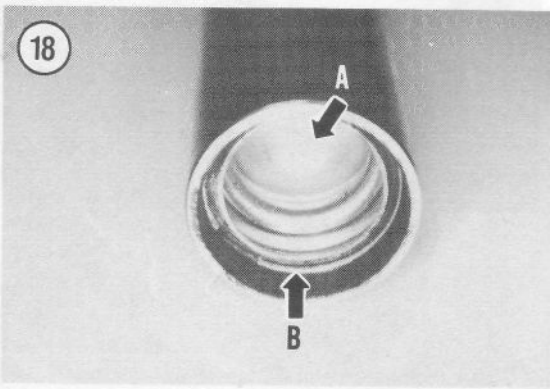
NOTE

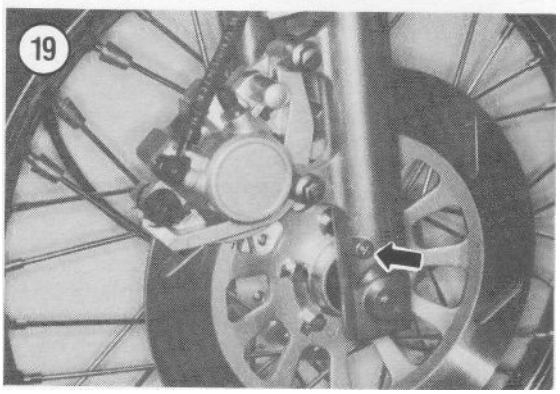
***Figure 18** is shown with the fork assembly removed for clarity. It is not necessary to remove the fork assembly for this procedure.*

4. The spring seat and spring are held in position by a stopper ring. To remove the stopper ring, have an assistant depress the spring seat (A, **Figure** 18) using a suitable size drift.
5. Remove the stopper ring (B, **Figure 18)** from its groove in the fork with a small screwdriver. Discard the stopper ring as a new one must be installed.
6. When the stopper ring is removed, release tension from the spring seat and remove it.
7. Place a drip pan under the fork and remove the drain screw and washer **(Figure 19).** Allow the oil to drain for at least 5 minutes.









WARNING

Do not allow the fork oil to come in contact with any of the brake components.

8. Place a shop cloth around the top of the fork tube, the handlebar and the upper fork bridge to catch remaining fork oil while the fork spring is removed. Withdraw the fork spring from the fork tube.

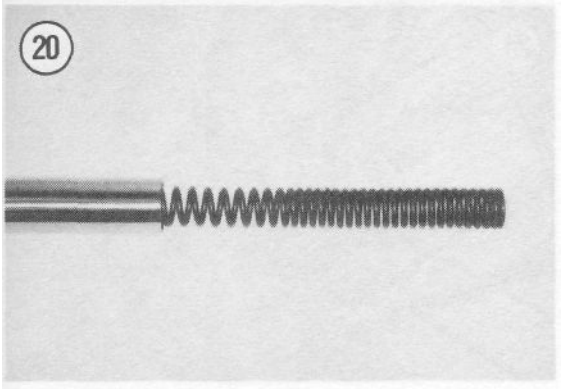
9. With both of the bike's wheels on the ground, have an assistant steady the bike. Then push the front end down and allow it to return. Perform this procedure until all the oil is expelled from the fork tube.

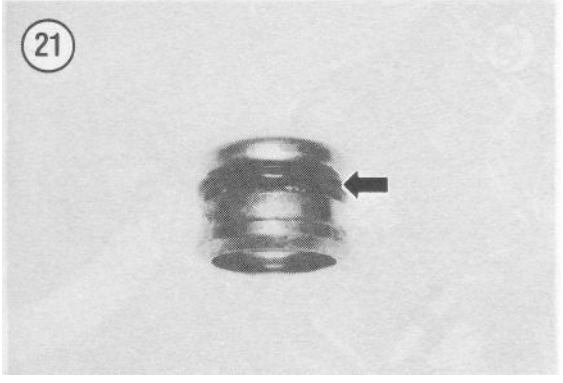
10. Install the drain screw and washer **(Figure 19)** and tighten securely.

11. Fill the fork tube with the correct amount **(Table 4)** and weight **(Table 3)** of fork oil.

NOTE

In order to measure the correct amount offluid, use a baby bottle. These bottles have measurements influid ounces (oz.) and cubic centimeters (cc) imprinted on the side.





NOTE

***Figure 20** is shown with the fork assembly removed for clarity. It is not necessary to remove the fork assembly for this procedure.*

12. Position the fork spring with the narrow pitch coils toward the top and install the fork spring **(Figure 20).**

13. Inspect the O-ring seal **(Figure 21)** on the spring seat; replace if necessary.

CAUTION

Always install a new stopper ring during assembly. This is necessary in order to hold the spring seat securely in place.

14. Install the spring seat. Have an assistant compress the spring seat and install a *new* stopper ring. Make sure the stopper ring seats fully in the groove in the fork tube before releasing the spring seat.

15. Install the trim cap.

16. Repeat Steps 2-15 for the opposite side.

17. Road test the bike and check for oil leaks.

PERIODIC MAINTENANCE

Front Disc Brake

The hydraulic brake fluid in the disc brake master cylinder should be checked every month. The disc brake pads should be checked at the intervals specified in **Table 1.** Replacement is described in Chapter Ten.

Disc Brake Fluid Level

The brake fluid on these models is visually monitored by observing the fluid level in the reservoir **(Figure 22).** The level is corrected by adding fresh brake fluid.

1. The fluid level in the reservoir should be maintained above the lower level line **(Figure 22).** If necessary, correct the level by adding fresh brake fluid. Remove the cover screws and cover **(Figure 23)** and lift the diaphragm out of the housing.

WARNING

Use brake fluid from a sealed container and clearly marked DOT 3 only (specified for disc brakes). Others may vaporize and cause brake failure. Do not

intermix different brands or types of brake fluid as they may not be compatible Do not intermix a sihcone based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure

CAUTION

Be careful not to spill brake fluid on painted or plated surfaces as it will destroy the surface Wash immediately with soapy water and thoroughly rinse it off

2 Reinstall all parts and tighten the cover screws securely

NOTE

If the brake fluid was so low as to allow air in the hydraulic system, the brakes will have to be bled Refer to Chapter Ten in the front section of this manual

Disc Brake Pad Wear

Inspect the brake pads for excessive or uneven wear, scoring, and oil or grease on the friction surface

If any of these conditions exist, replace the pads as described under *Brake Pad Replacement* in Chapter Ten, in this section of this manual

To inspect, remove the plug **(Figure 24)** on top of the cahper and observe the thickness on each pad If the pads are worn to a thickness of 0 03 in (0 8 mm) or less, they must be replaced

Front Brake Lever Adjustment

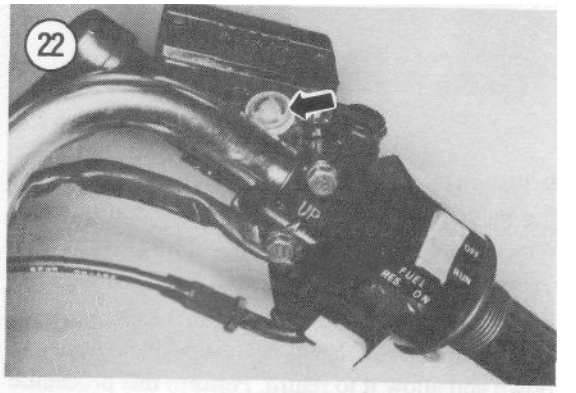
An adjuster is provided to maintain the front brake lever free play

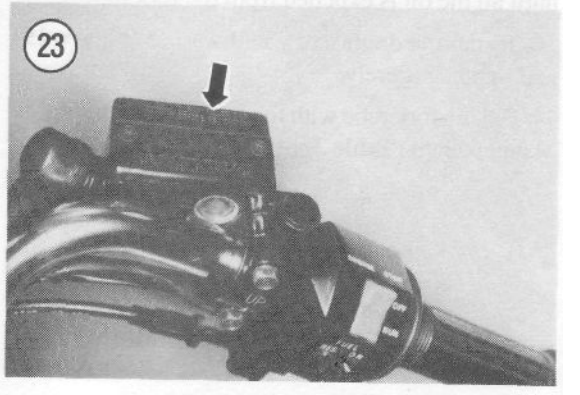
1 Loosen the adjuster locknut (A, **Figure 25)** and turn the adjuster (B, **Figure 25)** to obtain a free play measurement of 0 08-0 20 in (2-5 mm) Tighten the locknut securely

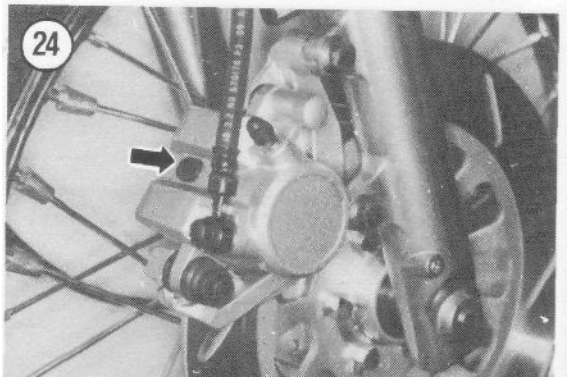
NOTE

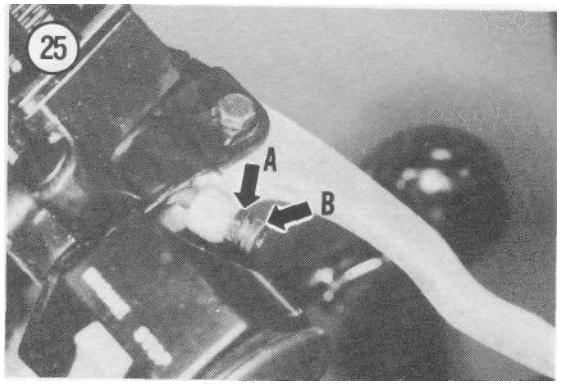
Free play is the distance the lever travels from the at-rest position to the applied position when the master cylinder is depressed by the lever adjuster

2 Rotate the front wheel and check for brake drag Also operate the brake lever several times to make







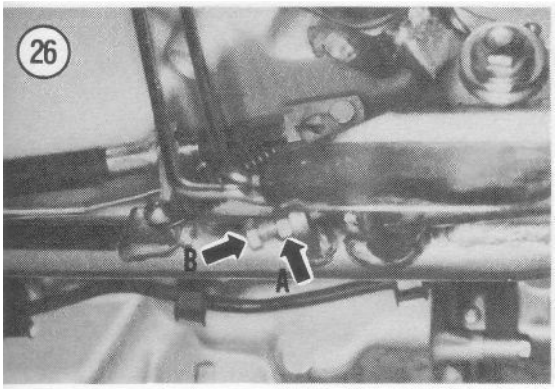


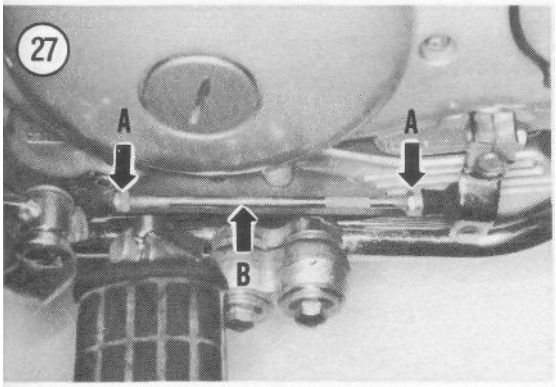
sure it returns to the at-rest position immediately after release.

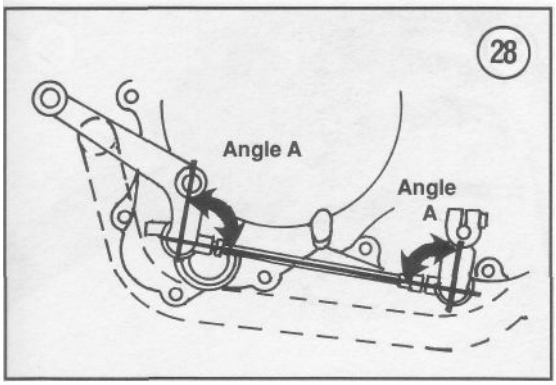
Rear Brake Pedal Height Adjustment

The rear brake pedal height should be adjusted at the intervals specified in **Table 1** or anytime the brake shoes are replaced.

1. Place the motorcycle on the sidestand.
2. Check to be sure the brake pedal is in the at-rest position.







3. The correct height position above the top of the foot peg is 3/4-1 1/4 in. (20-30 mm). To adjust, proceed to Step 4.
4. Loosen the locknut (A, **Figure 26)** and turn the adjusting bolt (B, **Figure 26)** to achieve the correct height. Tighten the locknut securely and adjust the free play, described in Chapter Three in the front section of the manual, and brake light, described in Chapter Seven in this section of the manual.

Gearshift Pedal Adjustment

NOTE

The adjuster rod front locknut has left-hand threads.

1. Loosen the front and rear locknuts (A, **Figure 27)** on the adjuster rod.
2. Turn the adjuster rod (B, **Figure 27)** in either direction until the top of the gearshift pedal is 2.0-2.4 in. (50-60 mm) above the top surface of the footpeg.
3. After the correct height is achieved, check the angle of the change pedal arms. They must be at a 90° angle to the adjuster rod as shown in **Figure 28.** Readjust if necessary to achieve this alignment.
4. Tighten both locknuts securely.

Clutch Adjustment

The clutch cable free play should be adjusted to obtain a free play of 3/32-1/8 in. (2-3 mm) at the intervals specified in **Table 1.**

NOTE

If you are unable to achieve the correct amount of free play adjustment using this adjustment procedure, there is an additional adjustment procedure within the clutch mechanism. Refer to Chapter Five in this section of this manual.

1. At the hand lever, slide back the clutch lever shield **(Figure 29).**
2. Loosen the locknut (A, **Figure 30)** and rotate the adjuster (B, **Figure 30)** for free play adjustment **(Figure 31).**

NOTE

If sufficient free play cannot be obtained at the hand lever, additional adjustment can be made at the lower adjuster on the crankcase.

3. Completely loosen the clutch cable at the handlebar.

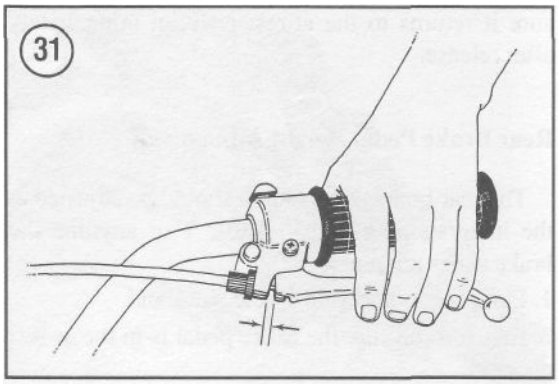
4. At the clutch cable lower adjuster, loosen the locknuts (A, **Figure 32)** and rotate the adjuster **(B, Figure 32)** until the correct amount of free play is achieved. For fine adjustment, repeat Step 2 if necessary.

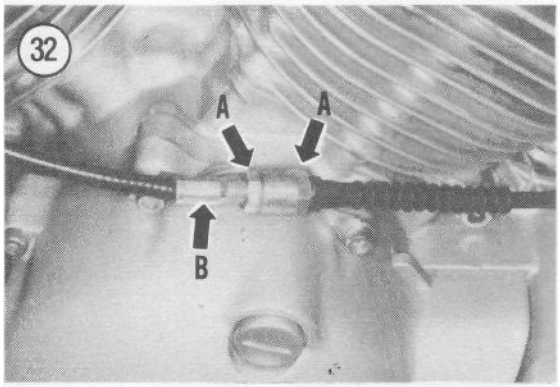
Throttle Operation/Adjustment

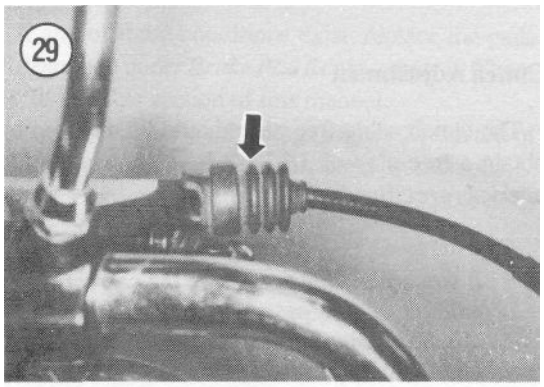
The throttle grip should have 1/8 to 1/4 in. (3-5 mm) of rotational play **(Figure 33).** Make sure there is free play in the cable so the carburetors will be able to close completely when the throttle is let off. If adjustment is necessary, loosen the cable locknut (A, **Figure 34)** and turn the adjuster **(B, Figure 34)** in or out to achieve the proper play. Tighten the locknut securely.

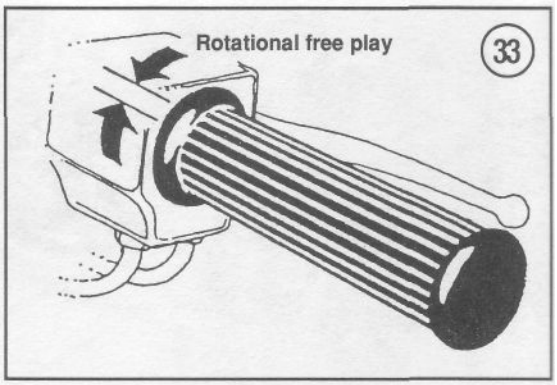
Check the throttle cable from gnp to carburetors. Make sure it is not kinked or chafed. Replace it if necessary.

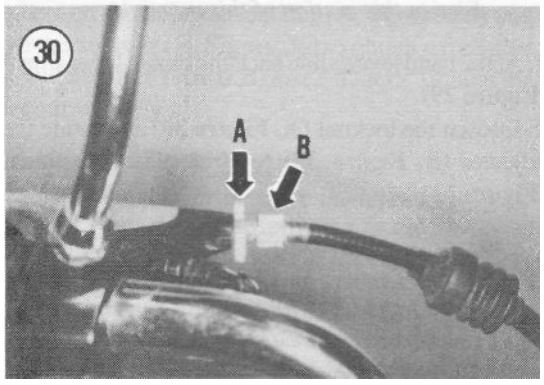
Make sure that the throttle grip rotates smoothly from fully closed to fully open. Check at center, full left and full right position of steering.

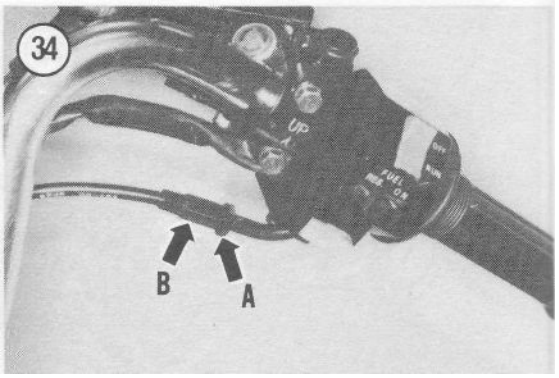


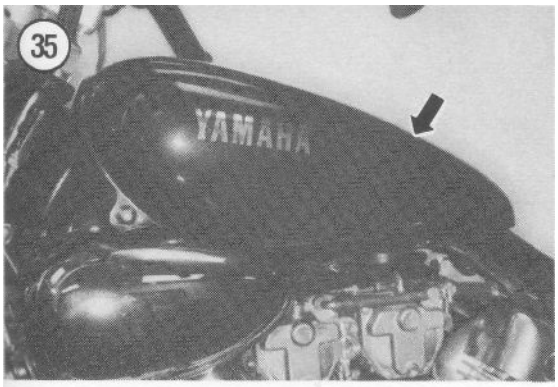


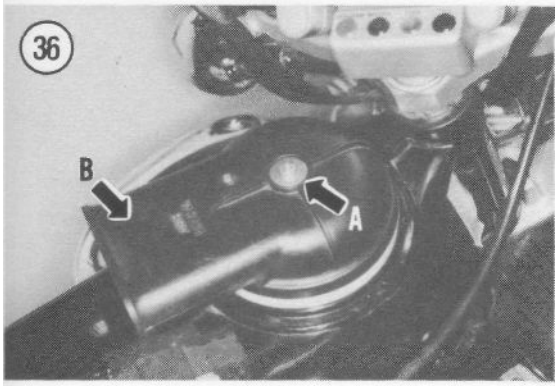


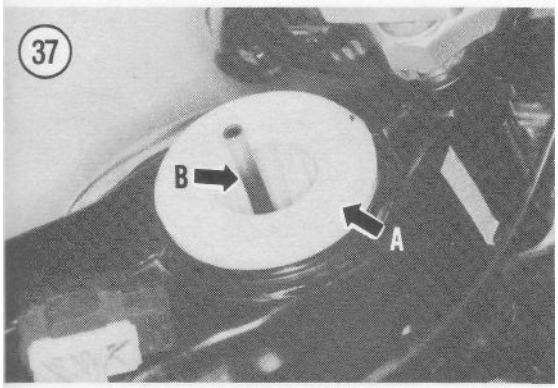


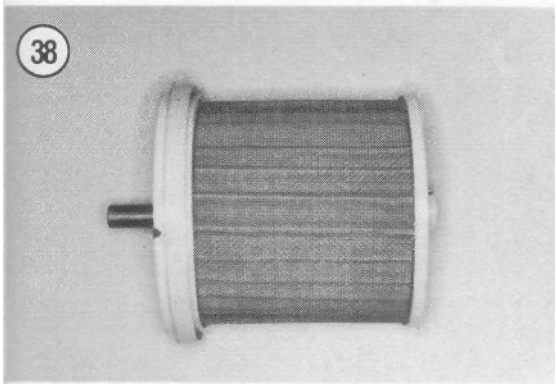












Air Cleaner Removal/Installation

A clogged air cleaner can decrease the efficiency and life of the engine. Never run the bike without the air cleaner installed; even minute particles of dust can cause severe internal engine wear.

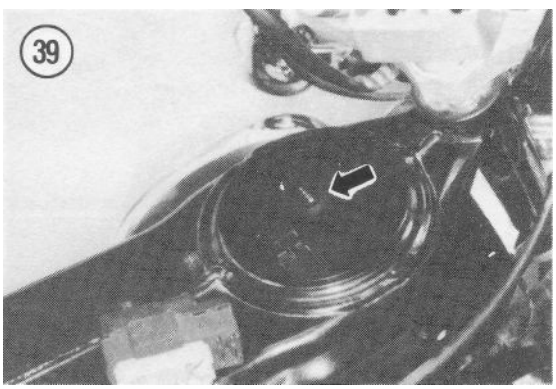
The service intervals specified in **Table 1** should be followed with general use. However, the air cleaner should be serviced more often if the bike is ridden in dusty areas.

1. Place the bike on the sidestand.
2. Remove the seat(s).

3A. On 1987-1989 U.S. models and 1988 U.K. models, remove the rear bolt and front bolt on each side, securing the frame top cover and remove the cover **(Figure 35).**

3B. On 1990-on U.S. models and 1989-on U.K. models, remove the sub-fuel tank as described in Chapter Six in this section of the manual.

4. Unscrew the long bolt and remove the bolt and washer (A, **Figure 36)** securing the air cleaner cover.
5. Remove the air cleaner cover **(B, Figure 36).**
6. Remove the air cleaner element (A, **Figure 37)** and long metal tube.
7. Tap the element lightly to remove most of the dirt and dust; then apply compressed air to the *outside* surface of the element.
8. Inspect the element **(Figure 38)** and make sure it is in good condition. Replace if necessary.
9. Clean out the inside of the air box **(Figure 39)** with a shop rag and cleaning solvent. Remove any foreign matter that may have passed through a broken cleaner element.
10. When installing the air cleaner element make sure that the rubber O-nng gasket **(Figure 40)** seats against the air box properly. Also align the hole in the filter with the threaded hole in the lower mount-



ing bracket and install the long metal tube (B, Figure 37).
11. Install the cover and position it so the intake lip touches the projection on the frame **(Figure** 41).
12. Install the long bolt and washer and tighten the bolt securely.
13. Install the frame top cover, or sub-fuel tank and the seat(s).

Front Suspension Check

1. Apply the front brake and pump the fork up and down as vigorously as possible. Check for smooth operation and check for any oil leaks.
2. Make sure the upper (A, **Figure 42)** and lower (B, **Figure** 42) fork bridge bolts are tight.
3. Remove the trim caps and check the tightness of the 4 Allen bolts securing the handlebar upper holders **(Figure** 43) and handlebar.
4. Check that the front axle pinch bolt (A, **Figure 44)** and the front axle (B, **Figure** 44) are tight.

CAUTION

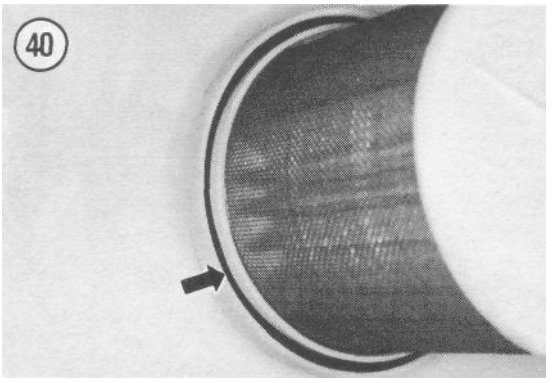
If any of the previously mentioned bolts and nuts are loose, refer to Chapter Eight, in this section of the manual, for correct procedures and torque specifications.

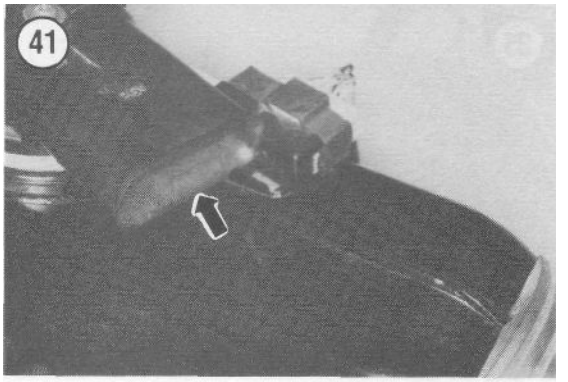
Rear Suspension Check

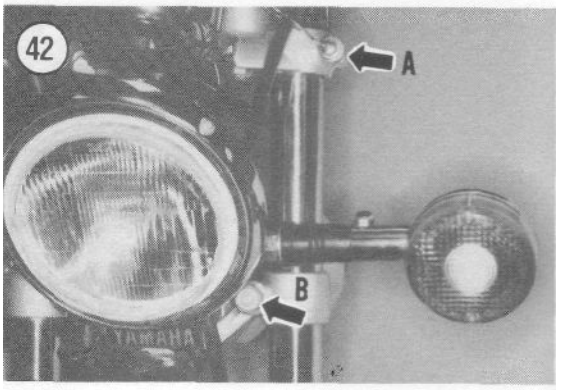
1. Place the bike on the sidestand.
2. Push hard on the rear wheel sideways to check for side play in the rear swing arm bushings or bearings.

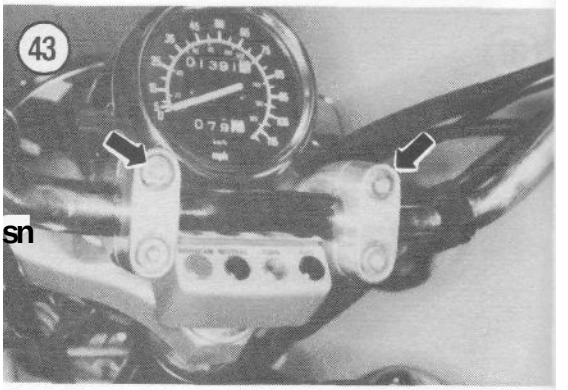
NOTE

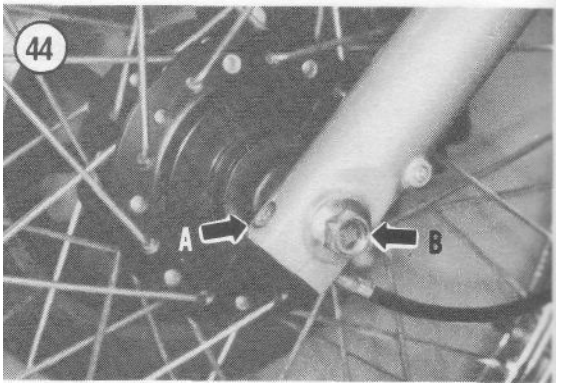
Figure 45 and Figure 46 are shown with the rear wheel removed for clarity.

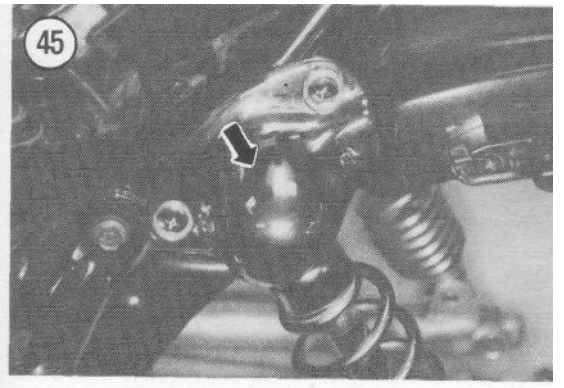


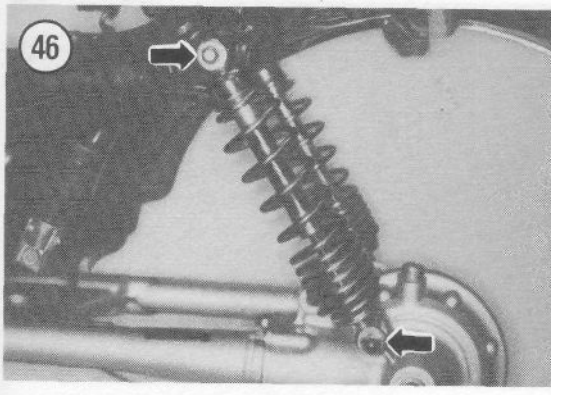


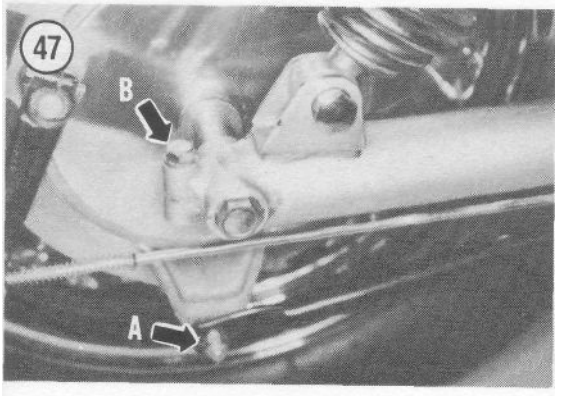


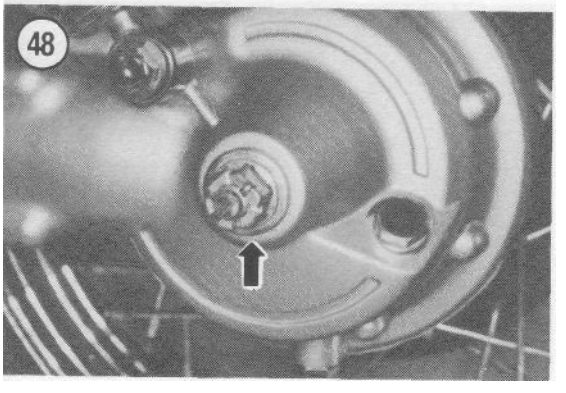












3 Remove the top cover **(Figure 45)** and check the tightness of the upper and lower shock absorber mounting nuts and bolts **(Figure 46)**

4 Check the tightness of the rear brake torque arm bolts (A, **Figure 47)**

5 Make sure the rear axle nut is tight and the cotter pin is still m place **(Figure 48)**

6 Make sure the rear axle pmch bolt (B, **Figure 47)** is tight

7 Check the tightness of the swing arm pivot bolt **(Figure 49)** and that the tab on teh lockwasher is up against one flat of the bolt head

CAUTION

If any of the previously mentioned nuts or bolts are loose, refer to Chapter Nine in this section of the manual, for correct procedures and torque specifications

TUNE-UP

A complete tune-up restores performance and power that is lost due to normal wear deterioration of engine parts Because engine wear occurs over a combined period of time and mileage, the engine tune-up should be performed at the intervals specified in **Table 1** More frequent tune-ups may be requred if the bike is ridden primarily m stop-and-go traffic

Table 5 summarizes tune-up specifications/

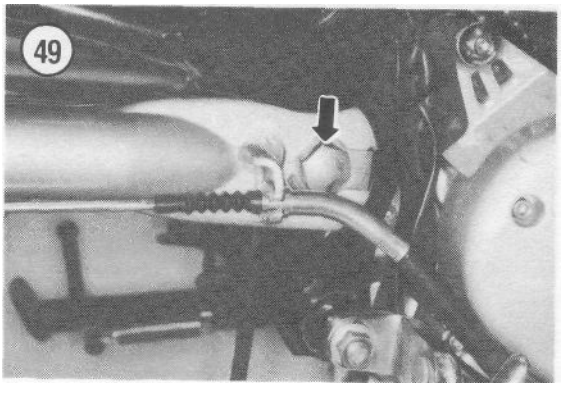
Before starting a tune-up procedure, make sure to first have all new parts on hand

Refer to the XV700-1100 section of this manual for typical air cleaner procedures, compression testing and spark plug information

Because different systems in an engine interact, the procedures should be done in the following order

a Clean or replace the air cleaner element

b Adjust valve clearances



c. Check engine compression.
d. Check or replace the spark plugs.
e. Check the ignition timing.
f. Synchronize carburetors and set idle speed.

Tools

To perform a tune-up on your Yamaha, you will need the following tools:

a. Spark plug wrench.
b. Socket wrench and assorted sockets.
c. Flat feeler gauge.
d. Compression gauge.
e. Spark plug wire feeler gauge and gapper tool.
f. Ignition timing light.
g. Carburetor synchronization tool—to measure manifold vacuum.

Air Cleaner Element

The air cleaner element should be cleaned or replaced prior to doing other tune-up procedures, as described in this chapter.

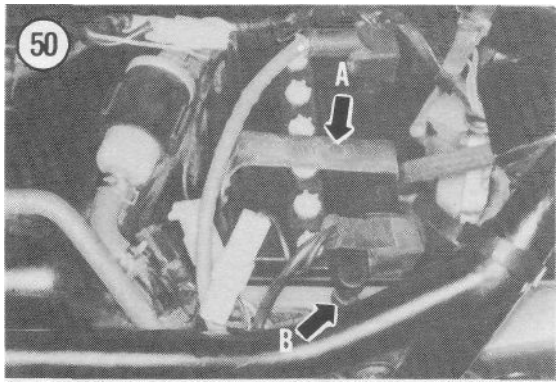
Valve Adjustment

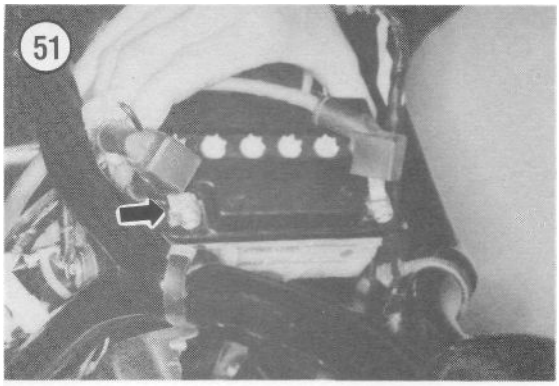
Valve clearance measurement must be made with the engine cool, at room temperature.

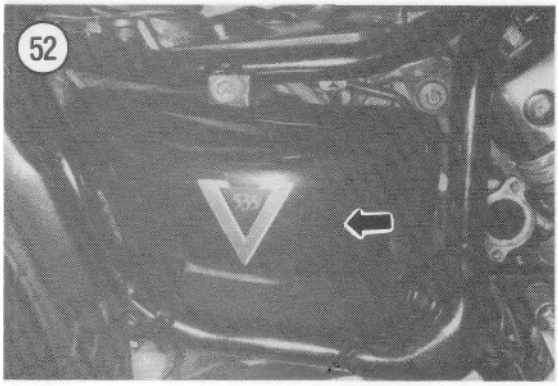
1. Remove the seat.

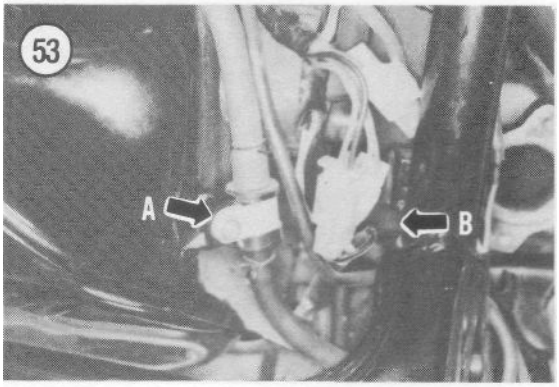
2A. On 1987-1989 U.S. models and 1988 U.K. models, remove the rear bolt and front bolt on each side securing the frame top cover and remove the cover **(Figure 35).**

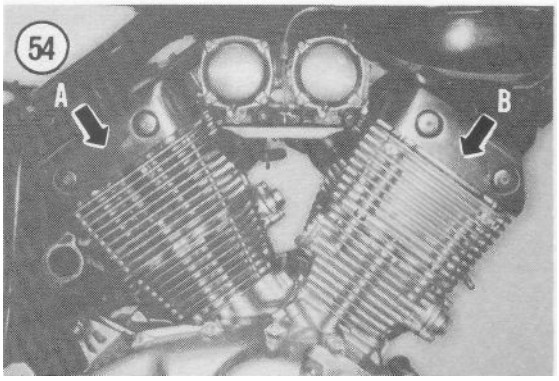
2B. On 1990-on U.S. models and 1989-on U.K. models, remove the sub-fuel tank as described in Chapter Six in this section of the manual.

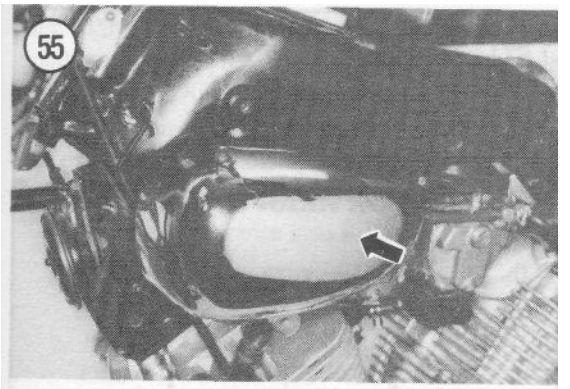


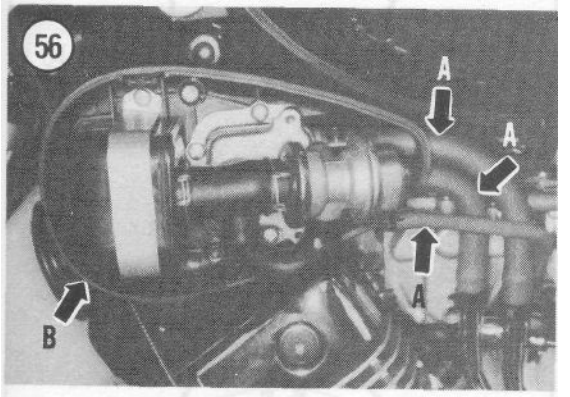


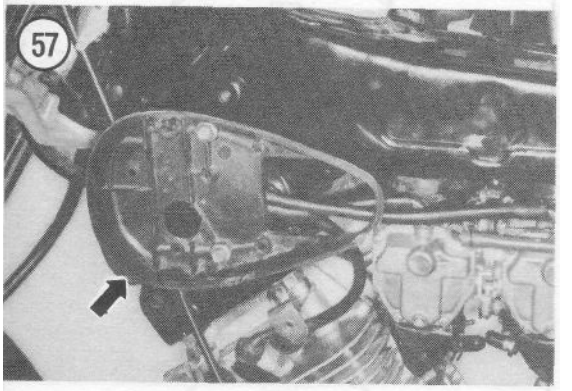


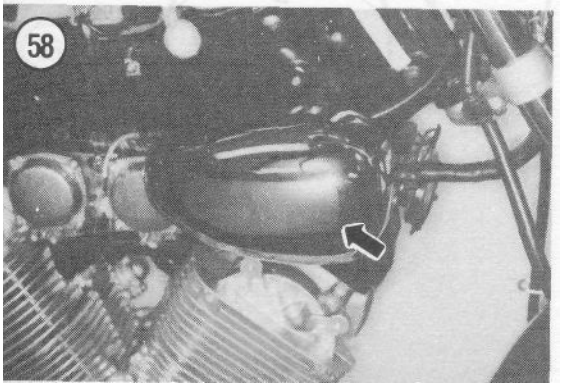




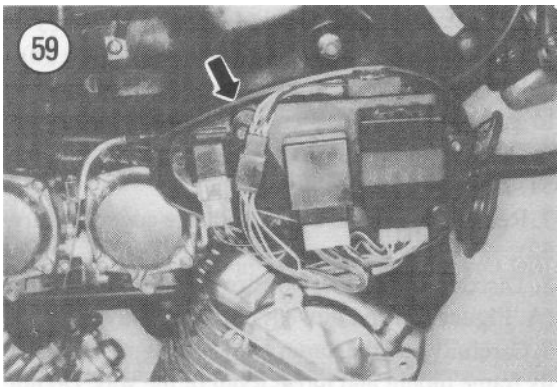


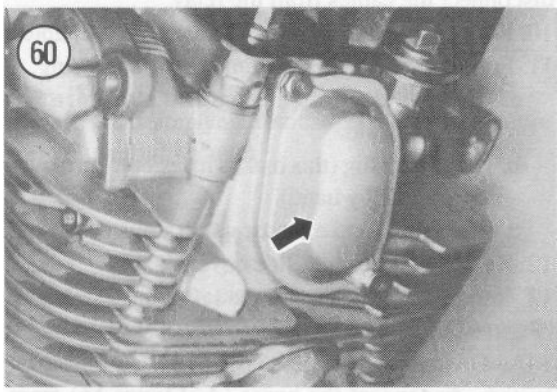


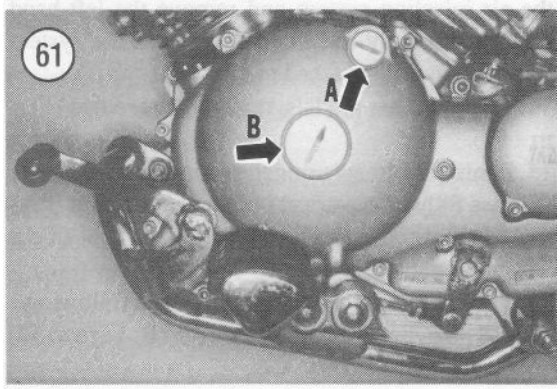


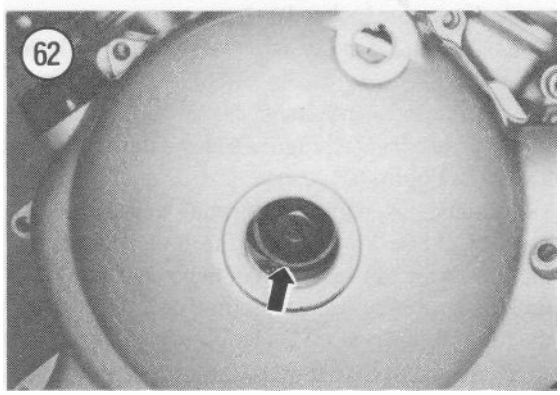


3. Unhook the battery strap (A, **Figure 50).**
4. Disconnect the battery vent tube (B, **Figure** 50).
5. Pull the battery part way up out of the battery box to gain access to the battery cable attachment points.
6. Disconnect the negative (-) battery cable **(Figure 51)** from the battery.
7. Remove the frame right-hand side cover **(Figure 52).**
8. Disconnect the fuel hose from the frame clamp (A, **Figure 53)** and move it out of the way.
9. Carefully pull the starter relay (B, **Figure 53)** from its frame mount and move it out of the way. Do not disconnect the cables from the relay.
10. Remove the battery as described in this chapter.
11. From the rear cylinder, remove the following:
    a. The cylinder head side cover (A, **Figure 54)** from each side.
    b. The spark plug (this makes it easier to turn over the engine by hand).
    c. The intake and exhaust valve adjuster covers.
12. Remove both frame side covers.
13. Remove bolts securing the left-hand side cover **(Figure 55)** and remove the cover.
14A. On models equipped with the air injection system, disconnect the hoses (A, **Figure 56)** from the air injection system and remove the left-hand bracket assembly **(B, Figure 56)** with the system components still attached to it.
14B. On all other models, remove the bracket **(Figure 57).**
15. Remove bolts securing the right-hand side cover **(Figure** 58) and electrical component bracket **(Figure 59)** and move the bracket assembly out of the way.
16. From the front cylinder, remove the following:
    a. The cylinder head side cover (B, **Figure** 54) from each side.
    b. The spark plug (this makes it easier to turn over the engine by hand).
    c. The intake and exhaust valve covers **(Figure 60).**
17. On the left-hand crankcase cover, remove the timing hole cover (A, **Figure 61)** and the crankshaft cover **(B, Figure 61).**
18. Rotate the engine by turning the crankshaft *clockwise.* Use a socket on the bolt **(Figure 62)** located on the left-hand end of the crankshaft. Continue to rotate the crankshaft until the "T" mark on the rotor for the *rear cylinder* **(Figure 63)** is aligned with the crankcase cover stationary pointer as









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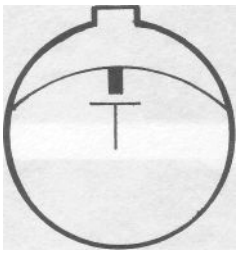
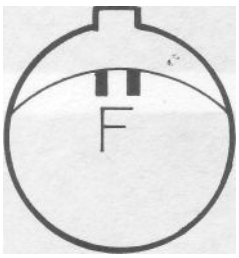
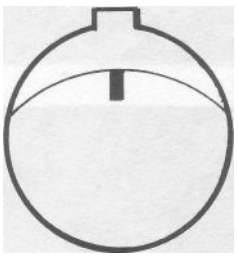
TDC FOR REAR CYLINDER



FIRING RANGE FOR REAR CYLINDER



TDC FOR FRONT CYLINDER



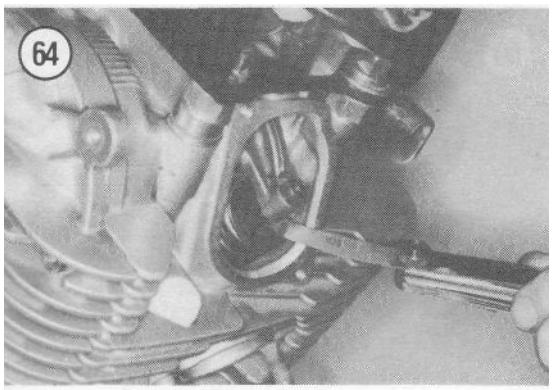
viewed through the timing window in the left-hand crankcase cover. The *rear cylinder* is now at top dead center (TDC) on the compression stroke.

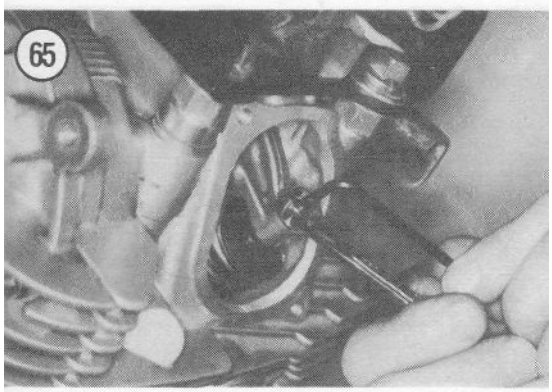
19. Check that there is free play in both the intake and exhaust valve for the *rear cylinder.* If not, rotate the crankshaft an additional 360° *clockwise.*

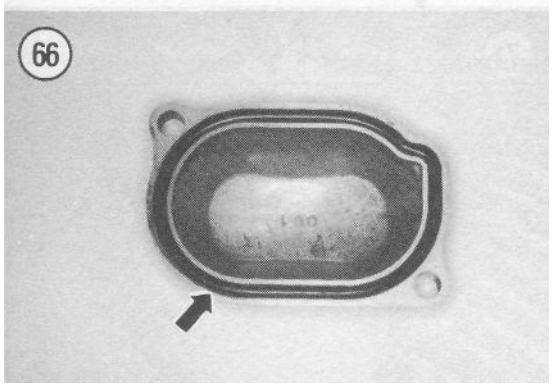
20. The correct clearance is as follows:

a. Exhaust valves: 0.005-0.007 in. (0.12-0.17 mm).

b. Intake valves: 0.003-0.005 in. (0.07-0.12 mm).







NOTE

The exhaust valves are located next to the exhaust pipes and the intake valves are located next to the carburetor assembly.

21. Insert a feeler gauge between exhaust valve rocker arm adjuster screw and valve stem **(Figure 64).** The clearance is correct when there is a slight drag on the feeler gauge when it is inserted and withdrawn. Repeat for the intake valve.

22. To correct the clearance, perform the following:

a. Loosen the valve adjuster locknut **(Figure 65).**

b. Turn the adjuster in or out to obtain the correct clearance.

c. When the correct clearance is obtained, tighten the locknut securely and recheck the clearance.

d. Repeat for the opposite valve.

23. Rotate the engine by turning the crankshaft *clockwise.* Use a socket on the nut located on the left-hand end of the crankshaft. Continue to rotate the crankshaft until the slit in the rotor for *the, front cylinder* **(Figure 63)** is aligned with the crankcase cover stationary pointer as viewed through the timing window in the left-hand crankcase cover. The *front cylinder* is now at top dead center (TDC) on the compression stroke.

24. Repeat Steps 18-22 to adjust the front cylinder's intake and exhaust valves.

25. Install all items removed in the reverse order of removal. Make sure the O-ring seal **(Figure 66)** is in place in the valve adjuster cover. Replace if necessary.

Correct Spark Plug Heat Range

Spark plugs are available in various heat ranges that are hotter or colder than the spark plugs originally installed at the factory.

Select plugs in a heat range designed for the loads and temperature conditions under which the engine will operate. Using incorrect heat ranges, however, can cause piston seizure, scored cylinder walls or damaged piston crowns.

The standard heat range spark plugs are found in **Table 5.**

Ignition Timing

Timing is set on all models and is not adjustable. The following procedure is used to check ignition timing only.

It is only necessary to check the timing on the rear cylinder. If it is found correct, the front cylinder will automatically be correct.

NOTE

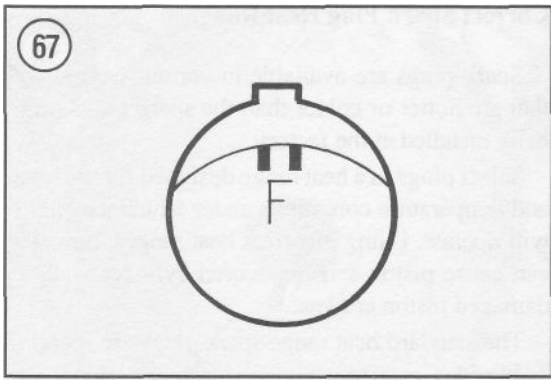
Before starting this procedure, check all electrical connections related to the ignition system. Make sure all connections are tight and free of corrosion and that all ground connections are tight.

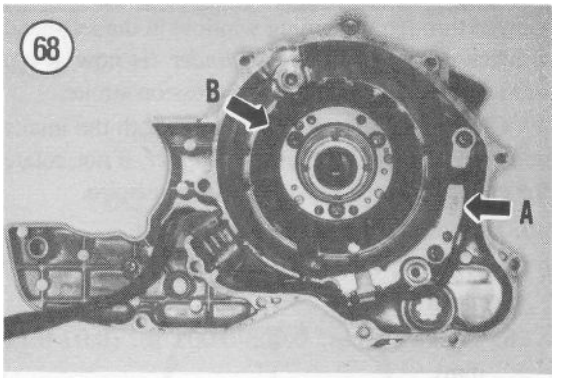
1. Place the bike on the sidestand.
2. Remove the timing cover (A, **Figure 61)** on the left-hand crankcase cover.
3. Connect a portable tachometer following the manufacturer's instructions.
4. Connect a timing light to the rear cylinder following the manufacturer's instructions.

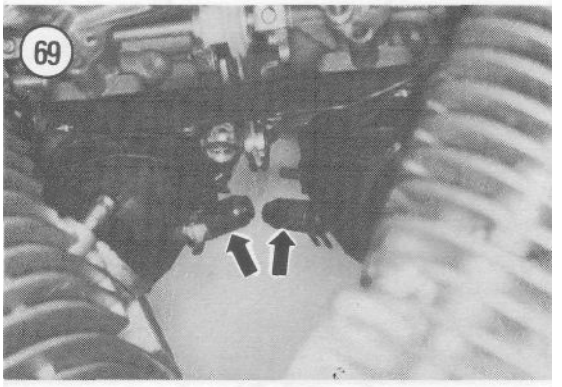
CAUTION

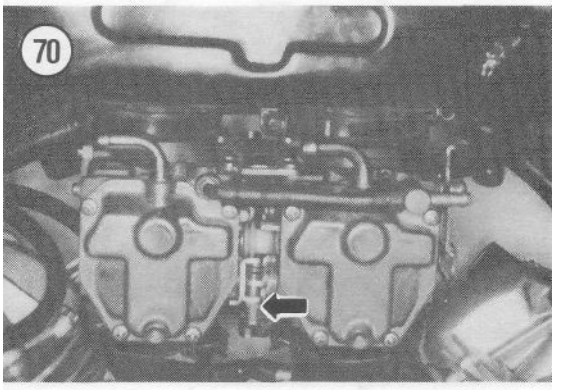
When attaching the timing light to the spark plug wire, do not puncture the wire or cap with the timing light probe. This would cause excessive wire resistance from the separation of the wire conductor and/or high-voltage leakage to ground due to damage of the plug wire insulation. In either case, engine miss-firing would result

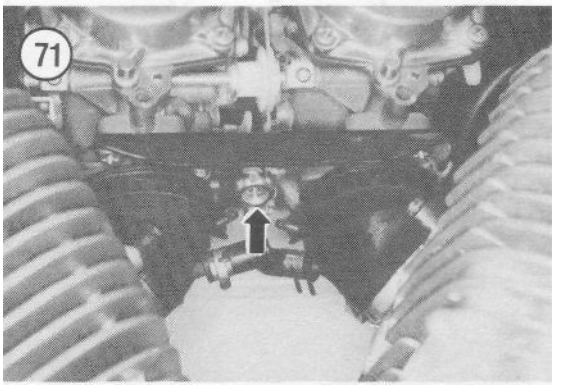
5. Start the engine and let it warm up to normal operating temperature. Bring the engine speed to 1,200 rpm and aim the timing light toward the timing marks on the timing plate.











6. The stationary pointer should align with the "F" mark on the timing plate **(Figure 67).** If not, remove the alternator cover as described in Chapter Seven, in this section of the manual, and check the pick-up (A, **Figure 68)** and stator (B, **Figure 68)** assembly screws for tightness. If these are tight, refer to Chapter Seven, in this section of the manual, for ignition system troubleshooting. Ignition timing cannot be adjusted on these models.

Carburetor Synchronization

A vacuum gauge (Chapter One) must be used to synchronize the carburetors.

NOTE

Prior to synchronizing the carburetors, the ignition timing must be checked and the valve clearance properly adjusted.

1. Place the bike on the sidestand.
2. Start the engine and let it reach normal operating temperature. Then turn it off.
3. Disconnect the small vacuum plug cap from each carburetor joint **(Figure 69).**
4. Connect the vacuum gauge to both carburetor vacuum port joints following the manufacturer's instructions.
5. Start the engine and allow it to idle at 1,140-1,250 rpm.
6. The carburetors are synchronized if they have the same gauge readings. If not, turn the synchronizing screw **(Figure 70)** and balance the rear carburetor to the front carburetor until the gauge readings are the same.
7. Rev the engine several times to make sure the readings remain the same.
8. Turn the engine off and disconnect the vacuum gauge from the carburetors.
9. Install the small vacuum plug cap onto each carburetor joint **(Figure 69)** and make sure it is secured in place.

Carburetor Idle Speed Adjustment

Before making this adjustment, the air cleaner must be clean, the carburetors must be synchronized and the engine must have adequate compression. Otherwise this procedure cannot be done properly.

1. Attach a portable tachometer following the manufacturer's instructions.
2. Start the engine and let it warm up to normal operating temperature.
3. Settheidle speed by turning the carburetor throttle stop screw **(Figure 71)** *in to increase* or *out to decrease* idle speed.
4. The correct idle speed is listed in **Table 5.**

Table 1 MAINTENANCE SCHEDULE*

Initial 600 miles (1,000 km) or 1 month	Change engine oil and oil filter Inspect valve clearance, adjust if necessary Check front and rear brake lever and pedal free play; adjust if required Check front brake pads and rear brake shoe thickness; replace as required Adjust clutch lever free play Lubricate speedometer and control cables Change final gear oil Check sidestand switch operation

(continued)

Table 1 MAINTENANCE SCHEDULE (continued)*

Every 4,400 miles (7,000 km) or 7 months	**Inspect valve clearance; adjust if necessary** **Check, clean and regap spark plugs** **Change engine oil and oil filter** **Check crankcase breather hose for tightness and damage** **Inspect fuel lines for deterioration, chafed, cracked or swollen ends; replace if necessary** **Inspect the exhaust system for leaks; tighten bolts and nuts if necessary** **Synchronize the carburetors** **Check idle speed; adjust if necessary** **Check front brake pads and rear brake shoe thickness; replace as required** **Adjust clutch lever free play** **Check oil level in final drive unit** **Lubricate speedometer and control cables** **Clean and inspect air filter element with compressed air, replace if necessary** **Lubricate rear brake pedal, shift lever and sidestand** **Check front fork oil seal for leakage** **Check steering stem for looseness** **Check tire and wheel condition** **Check wheel bearings for smooth operation** **Check battery fluid level and specific gravity; add water if necessary** **Check brake fluid level in master cylinder; add fluid if necessary**
Every 8,200 miles (13,000 km) or 13 months	**Replace the spark plugs** **Check fluid level in final drive unit; add'fluid if necessary**
Every 15,800 miles (25,000 km) or 25 months	**Lubricate steering stem bearings** **Lubricate swing arm bearings**

*** This Yamaha factory maintenance schedule should be considered as a guide to general maintenance and lubrication intervals. Harder than normal use and exposure to mud, water, sand, high humidity, etc. will naturally dictate more frequent attention to most maintenance items.**

Table 2 TIRE INFLATION PRESSURE (COLD)

Load	psi (kg/cm^2)
Up to 1981b. (90 kg)	
Front	28 (2.0)
Rear	32 (2.3)
198-max. Ib. (90-max kg)*	
Front	28 (2.0)
Rear	36 (2.5)
High-speed riding	
Front	28 (2.0)
Rear	36 (2.5)

* Maximum load: 49-state 507 Ib. (230 kg.), Calif. 505 Ib. (229 kg.), U.K. 501 Ib. (227 kg.)

Table 3 RECOMMENDED LUBRICANTS

Item	Oil Type
Engine oil	
40° F (5° C) and above	Yamalube 4 or SAE 20W/40
60°F(15°C)andbelow	Yamalube 4 or SAE 10W/30
Brake fluid	DOT 3
Battery refilling	Distilled water

(continued)

Table 3 RECOMMENDED LUBRICANTS (continued)

Item	Oil Type
Fork oil	SAE 10W
Control cables and pivot points	SAE10W/30 motor oil
Final drive unit	Hypoid gear oil SAE 80 GL-4 or SAE 80W/90

Table 4 APPROXIMATE REFILL CAPACITIES

Item	Quantity
Engine oil	
With filter change	**3.0 U.S. qt. (2.8 L, 2.5** Imp. **qt.)**
Without filter change	2.7 **U.S. qt. (2.6 L, 2.3** Imp. **qt.)**
Engine rebuild	**3.4 U.S. qt. (3.2 L, 2.8** Imp. **qt.)**
Front forks	7.71 **U.S. oz.** (228 cc, 8.03 Imp. **oz.)**
Final gear case	0.20 **U.S. qt.** (0.19 **L,** 0.17 Imp. **qt.)**

Table 5 TUNE UP SPECIFICATIONS

Ignition timing	Fixed
Valve clearance (cold)	
Intake	0.003-0.005 in. (0.07-0.12 mm)
Exhaust	0.005-0.007 in. (0.12-0.17 mm)
Spark plug	
Type	
U.S.	NGK BP7ES, ND W22EP-U
U.K.	NGK BPR7ES, ND W22EPR-U
Gap	0.028-0.031 in. (0.7-0.8 mm)
Idle speed	1,150-1,250 rpm
Compression pressure (cold at sea level)	
Standard	156 psi (11 kg/cm^2,1,100 kPa)
Minimum	142 psi (10 kg/cm^2,1,000 kPa)
Maximum	171 psi (12 kg/cm^2,1,200 kPa)

CHAPTER FOUR

ENGINE

The engine is a V-twin air-cooled, 4-stroke design. The cylinders are offset (to improve rear cylinder cooling) and set at a 75° angle; the cylinders fire on alternate crankshaft rotations. Each cylinder is equipped with a single camshaft and 2 valves. The crankshaft is supported by 2 main bearings in a vertically split crankcase.

Both engine and transmission share a common case and the same wet sump oil supply. The clutch is a wet-type located inside the right crankcase cover. Refer to Chapter Five in this section of the manual for clutch and transmission service procedures.

This chapter provides complete procedures and information for removal, inspection, service and reassembly of the engine.

Table 1 provides complete specifications for the engine and **Table 2** lists all of the engine torque specifications. **Table 1** and **Table 2** are located at the end of this chapter.

Before beginning work, re-read Chapter One in the front section of this book. You will do a better job with this information fresh in your mind.

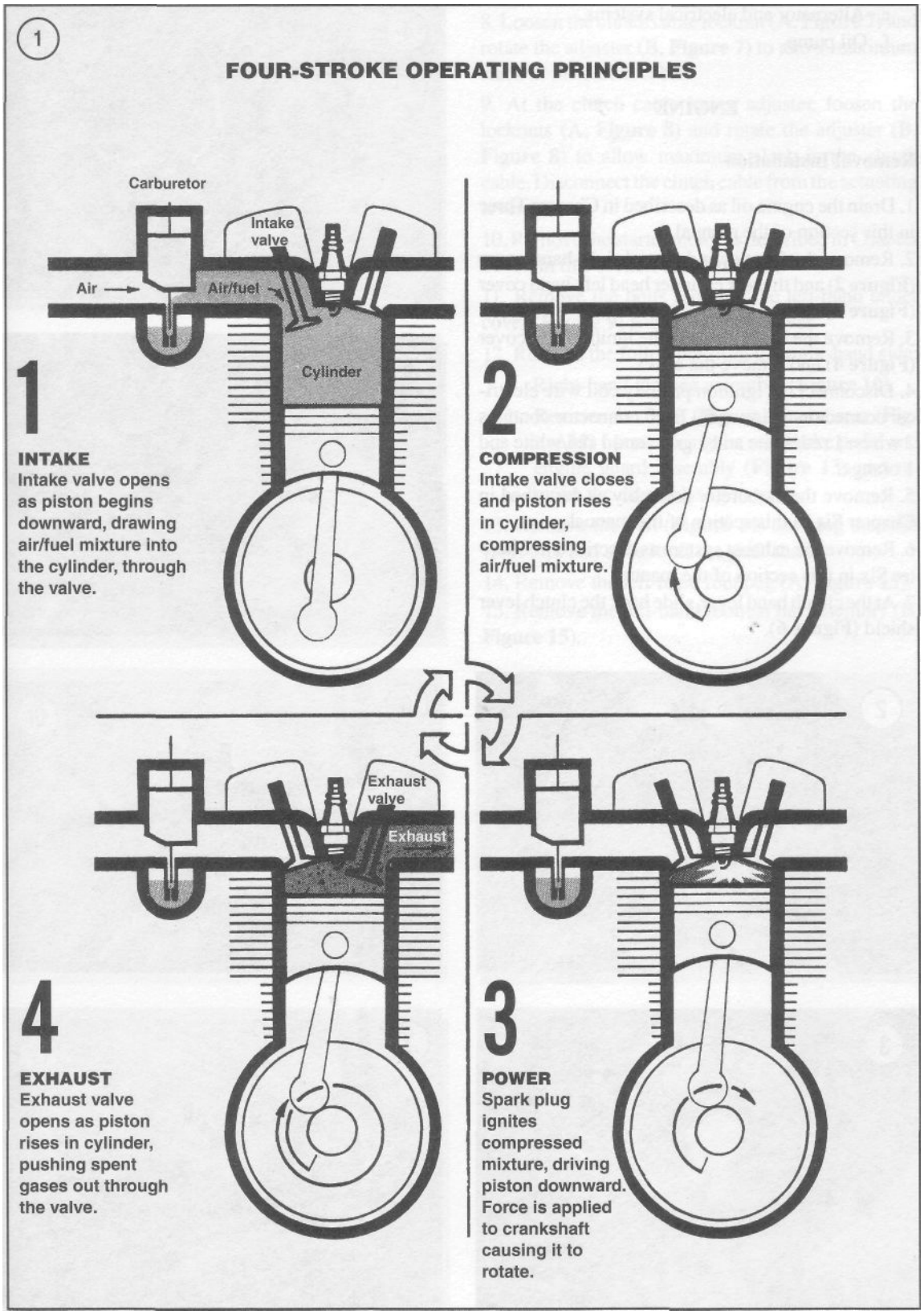
ENGINE PRINCIPLES

Figure 1 explains how the engine works. This will be helpful when troubleshooting or repairing the engine.

SERVICING ENGINE IN FRAME

The following components can be serviced while the engine is mounted in the frame (the bike's frame is a great holding fixture for breaking loose stubborn bolts and nuts):

a. Gearshift mechanism.
b. Clutch.
c. Carburetors.
d. Starter motor and gears.

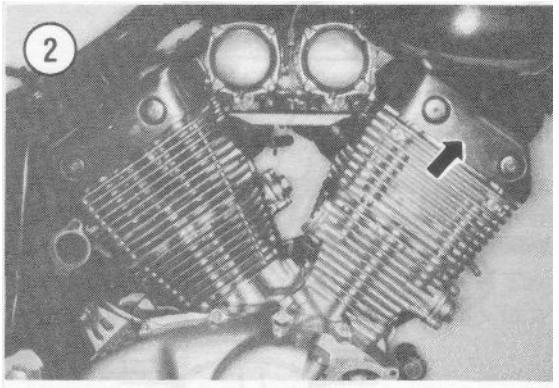

1
FOUR-STROKE OPERATING PRINCIPLES
Carburetor
Intake valve
Air
Air/fuel
Cylinder
1
INTAKE
Intake valve opens as piston begins downward, drawing air/fuel mixture into the cylinder, through the valve.
2
COMPRESSION
Intake valve closes and piston rises in cylinder, compressing air/fuel mixture.
Exhaust valve
Exhaust
4
EXHAUST
Exhaust valve opens as piston rises in cylinder, pushing spent gases out through the valve.
3
POWER
Spark plug ignites compressed mixture, driving piston downward. Force is applied to crankshaft causing it to rotate.

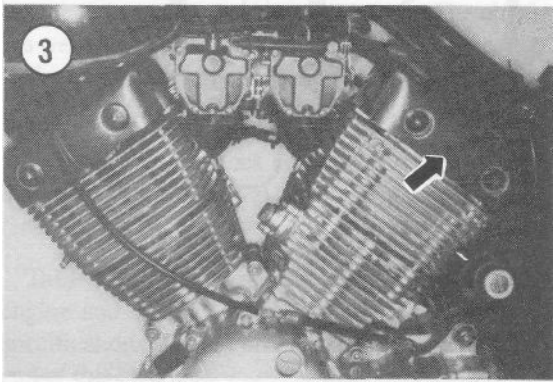
e Alternator and electrical systems
f Oil pump

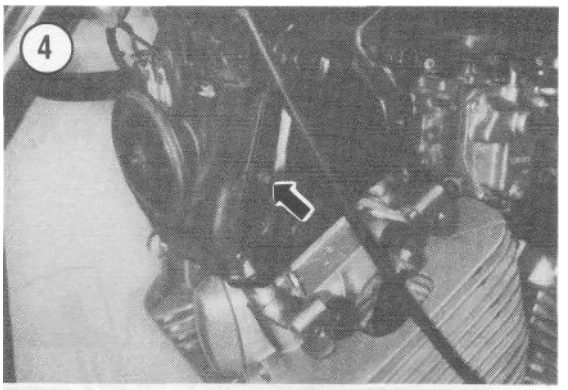
ENGINE

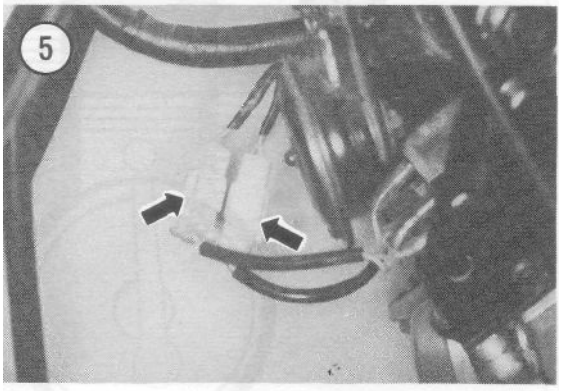
Removal/Installation

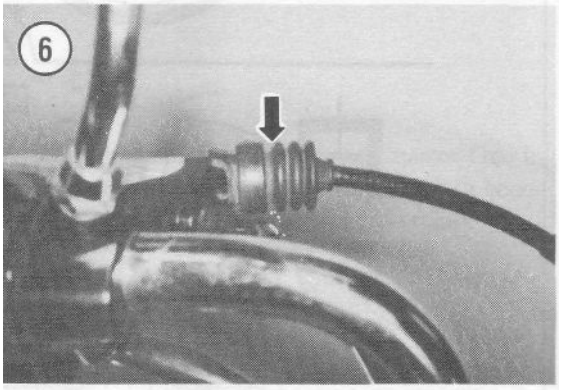
1 Drain the engine oil as described in Chapter Three in this section of the manual
2 Remove the front cylinder head right-hand cover **(Figure 2)** and the rear cylinder head left-hand cover **(Figure 3)**
3 Remove the bolts securing the ignition coil cover **(Figure 4)** and remove the cover
4 Disconnect the ignition primary coil wire electrical connectors **(Figure 5)** Each connector contains 2 wires 1 red/white and 1 gray, and 1 red/white and 1 orange
5 Remove the carburetor assembly as described in Chapter Six in this section of the manual
6 Remove the exhaust system as described in Chapter Six in this section of the manual
7 At the clutch hand lever, slide back the clutch lever shield **(Figure 6)**

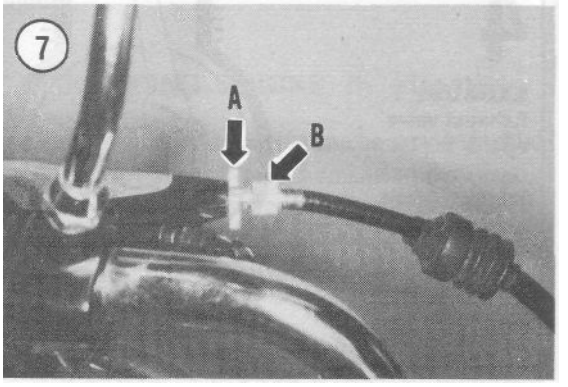


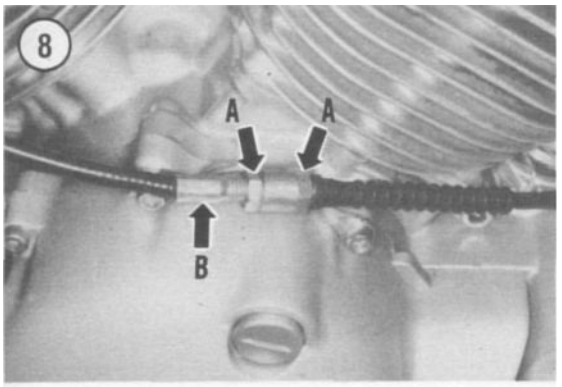


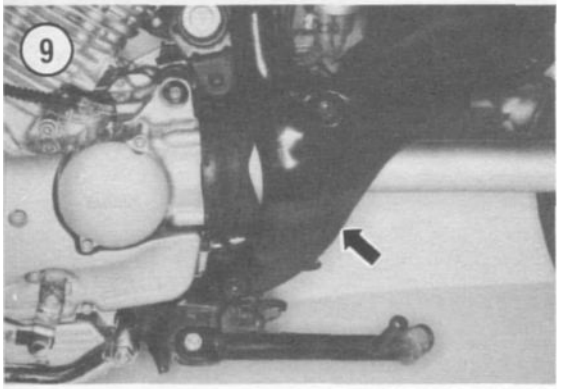












8. Loosen the clutch cable locknut (A, **Figure** 7) and rotate the adjuster **(B, Figure 7)** to allow maximum slack in the clutch cable.

9. At the clutch cable lower adjuster, loosen the locknuts (A, **Figure 8)** and rotate the adjuster (B, **Figure** 8) to allow maximum slack in the clutch cable. Disconnect the clutch cable from the actuating lever.

10. Remove the starter motor as described in Chapter Seven in this section of the manual.

11. Remove the bolts securing the left-hand under cover **(Figure 9)** and remove the cover.

12. Remove the following from the right-hand side:

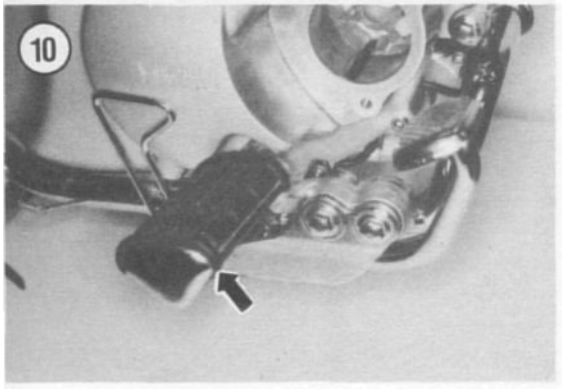
a. Right-hand footpeg assembly **(Figure 10).**

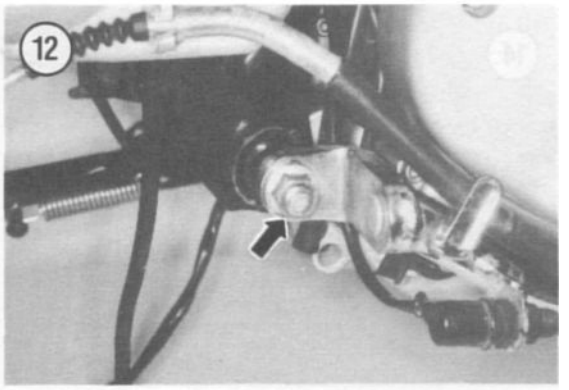
b. Remove the front **(Figure 11)** and rear **(Figure 12)** nuts securing the rear brake pedal and engine guard assembly **(Figure 13)** and remove the assembly.

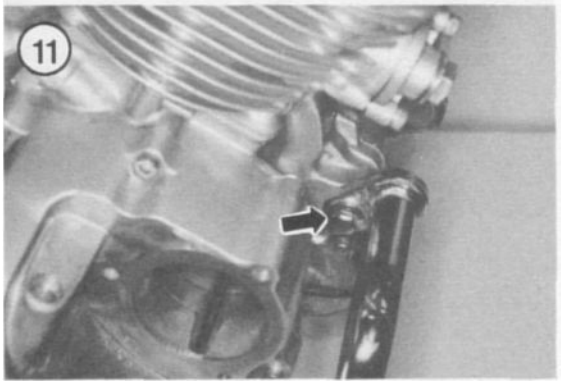
13. Remove the bolt **(Figure 14)** securing the shift lever arm and slide it off the shift shaft.

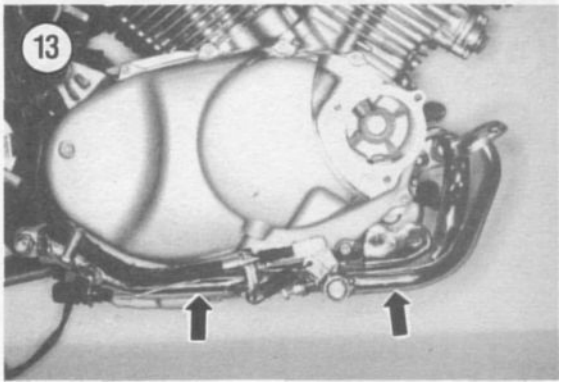
14. Remove the left-hand foot peg (A, **Figure IS).**

15. Remove the left-hand footrest bar assembly **(B, Figure 15).**









16 Place wood block(s) and a small hydraulic jack under the engine to support it securely

17 Disconnect the sidestand switch electrical connector.

18 Remove the nuts **(Figure 16)** securing the sidestand and remove the sidestand assembly.

19 Disconnect the spark plug lead (A, **Figure 17)** from each spark plug

20 Move the drive shaft rubber boot **(Figure 18)** back away from the engine and onto the swing arm.

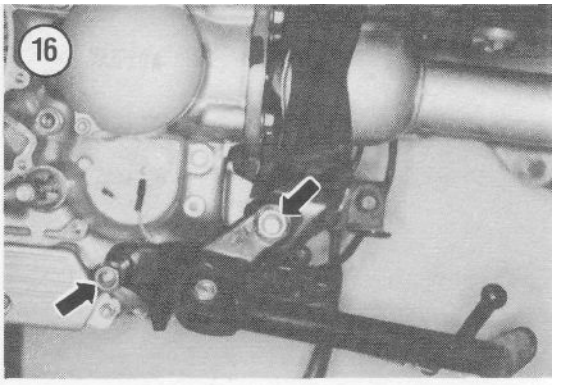
21 Remove the bolt securing the engine ground cable and disconnect the cable.

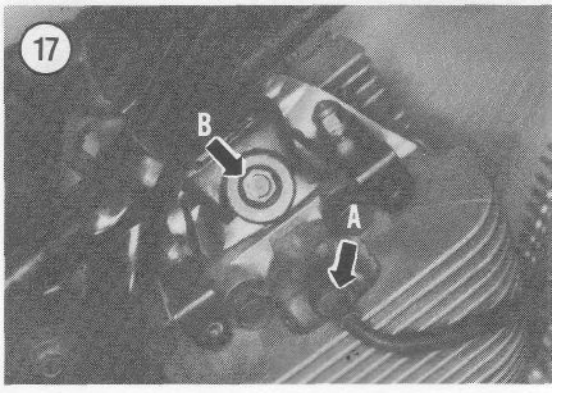
22. Carefully pull the stator wire harness from the frame and remove the wires from the frame Note the path of the wire harness during removal, it must be routed the same during installation

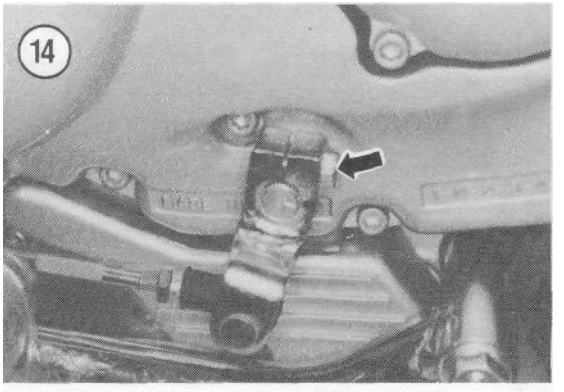
23 Using a crisscross pattern, loosen then remove the Allen screws securing the left-hand crankcase cover **(Figure 19)** Remove the cover and gasket.

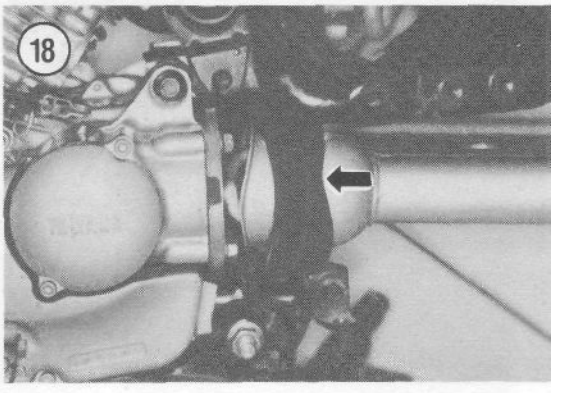
24. Disconnect the neutral switch electrical lead (A, **Figure 20)**

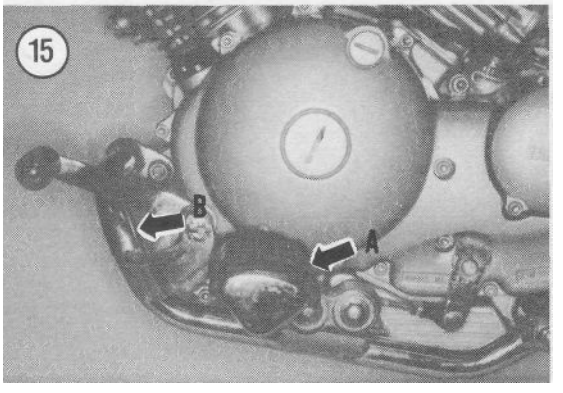
25 Remove the right-hand crankcase lower bolts and remove the starter motor electrical cable and

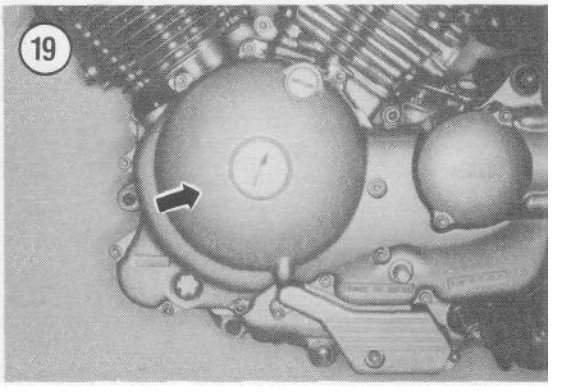


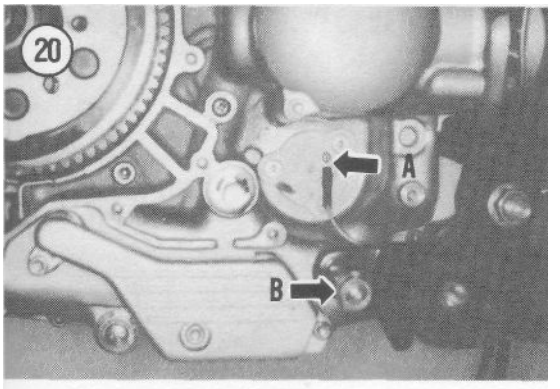


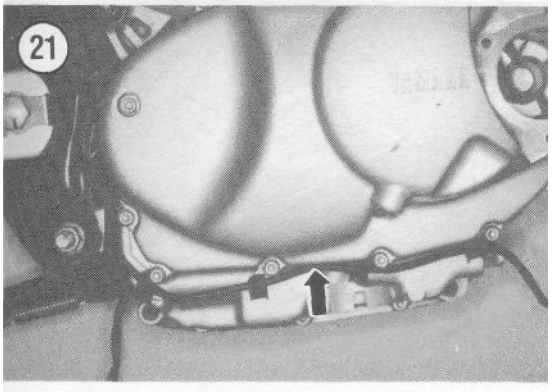


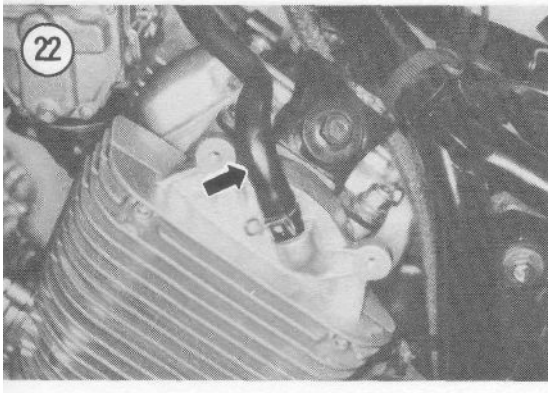


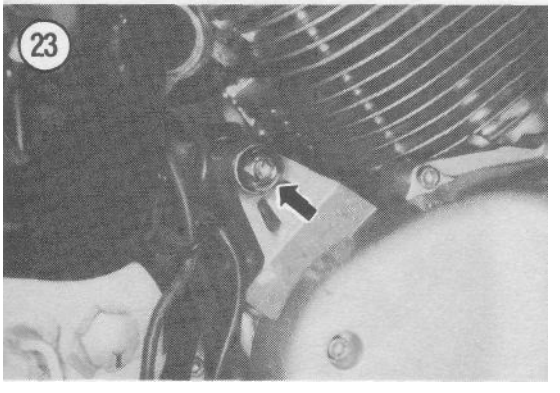












holding straps. Remove the electrical cable **(Figure 21)** from the engine.

26. Disconnect the alternator and the pulse generator electrical connectors.

27. Disconnect the crankcase breather hose **(Figure 22)** from the rear cylinder head.

28. Take a final look all over the engine to make sure everything has been disconnected.

29. Place a stand under the swing arm or tie the bike down to secure it in a vertical position after the engine is removed.

CAUTION

The following steps require the aid of a helper to safely remove the engine assembly from the frame.

30. Make sure the hydraulic jack is still in place and supporting the engine securely.

31. Loosen, but do not remove, all engine mounting bolts and nuts.

32. Remove the rear lower through bolt (B, **Figure 20).**

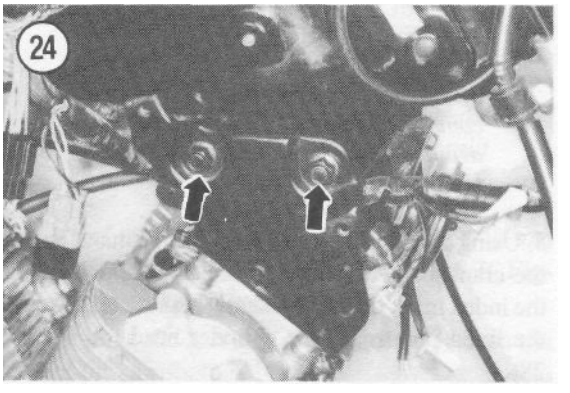
33. Remove the rear upper bolt **(Figure 23)** on each side.

34. Remove the front upper bolts, washers and nuts **(Figure 24)** securing the front cylinder head to the frame.

35. Remove the rear upper bolts and washers **(B, Figure 17)** securing the rear cylinder head to the frame.

36. Slowly lower the engine and move it forward, then remove the engine from the frame. Using a screwdriver, disengage the drive shaft's universal joint from the output shaft.

37. Take the engine to a workbench for further disassembly.



38. Install by reversing these removal steps, while noting the following:

a. Apply a light coat of molybdenum disulfide grease to the splines of the output shaft and the universal joint prior to engaging these 2 parts.
b. Tighten the engine mounting bolts to the torque specifications in **Table 2.**
c. Fill the engine with the recommended type and quantity of oil as described in Chapter Three in this section of the manual.
d. Adjust the clutch as described in Chapter Three in this section of the manual.
e. Start the engine and check for leaks.

CYLINDER HEADS AND CAMSHAFTS

This section describes removal, inspection and installation procedures for the cylinder head and camshaft components. Valves and valve components are described under a separate heading.

Removal

NOTE

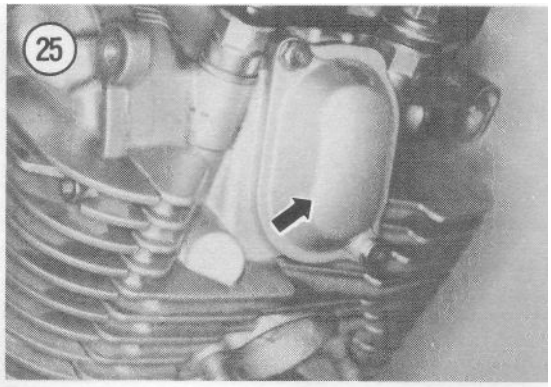
This procedure is for the rear cylinder. Removal of the front cylinder is identical, except for differences noted in Step 29

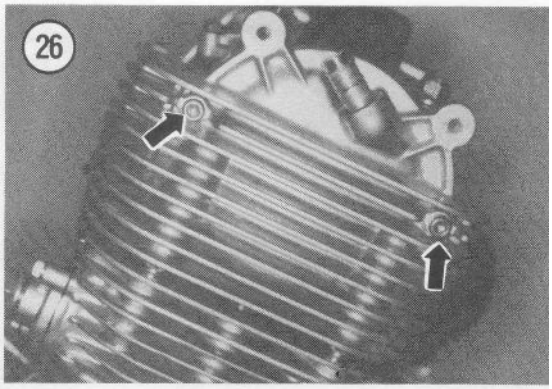
1. Remove the engine from the frame as described in this chapter.
2. Remove the exhaust valve adjuster cover **(Figure 25).**
3. Remove the bolts **(Figure 26)** securing the *rear cylinder* side cover and remove the cover.
4. Remove the intake valve adjuster cover.

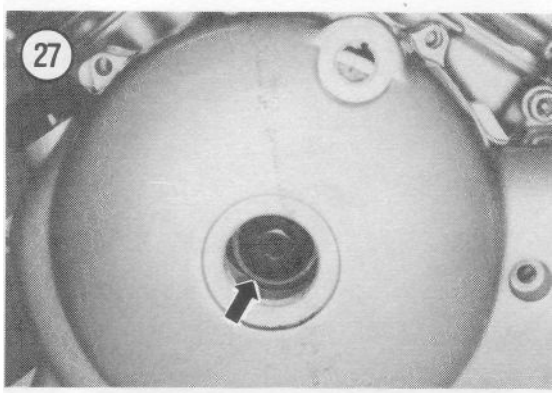
CAUTION

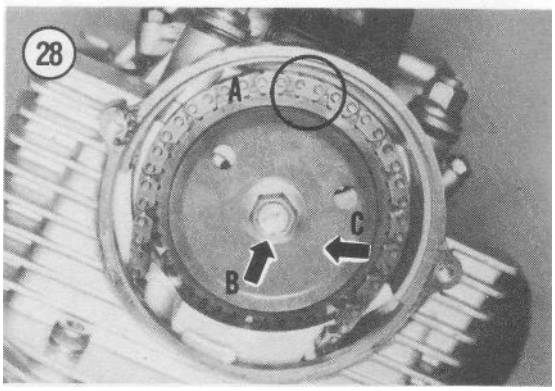
The next steps will position the rear cylinder at top dead center (TDC) on the compression stroke. This is necessary to avoid damage to the camshaft and related parts

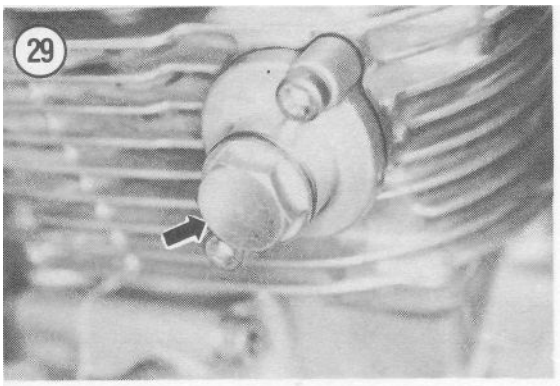
5. Using the bolt **(Figure 27)** on the left-hand end of the crankshaft, turn the crankshaft *clockwise* until the index mark on the camshaft sprocket aligns with the fixed pointer on the cylinder head (A, **Figure 28).**

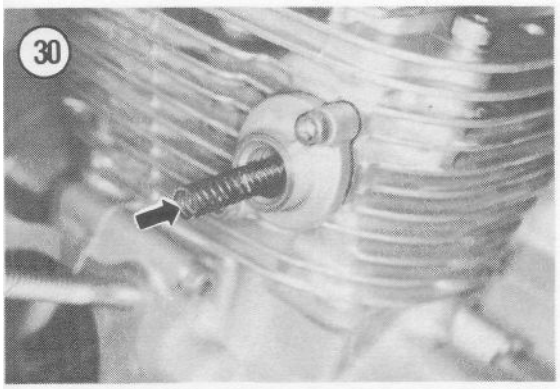


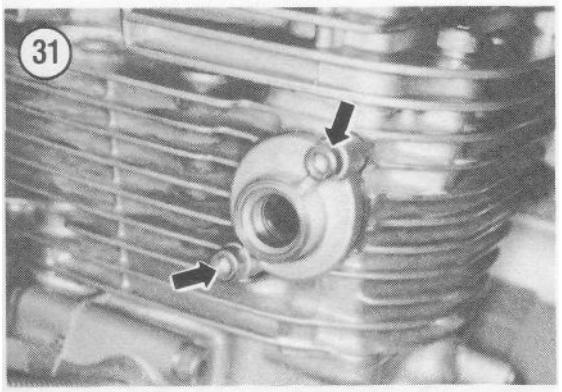


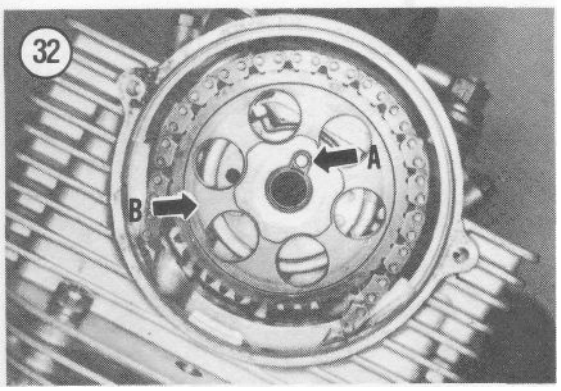












6. Also check that the "T" timing mark on the edge of the alternator rotor is aligned with the centerline of the rear cylinder (pointing straight up toward the timing mark on the camshaft). If the "T" mark is not properly aligned, rotate the crankshaft an additional 360° rotation until alignment is correct.

NOTE

A cylinder at TDC of its compression stroke will have free play in both of its rocker arms, indicating that both the intake and exhaust valves are closed.

7. The rear cylinder piston must be at top dead center (TDC) on the compression stroke.

8. With the crankshaft timing mark on the "T," move both rocker arms to make sure they are loose and have free play. If both rocker arms are not loose; rotate the engine an additional 360° until both rocker arms have free play.

9. Remove the camshaft chain tensioner center bolt **(Figure 29)** and spring **(Figure 30).** Remove the bolts securing the camshaft chain tensioner lifter **(Figure 31)** and remove the tensioner lifter and gasket.

10. Remove both spark plugs. This will make it easier to rotate the engine.

11. Place a wrench on the bolt **(Figure 27)** on the left-hand end of the crankshaft to prevent it from turning, then loosen the camshaft sprocket mounting bolt (B, **Figure 28).**

12. Remove the bolt and the oil baffle plate (C, **Figure 28)** from the sprocket.

NOTE

*If the crankcase is **not** going to be disassembled take note of this possible problem. There is a small locating pin (A, **Figure 32)** that correctly positions the camshaft sprocket to the camshaft. When removing the camshaft sprocket be careful the pin does not work loose as it will fall into the crankcase. If the pin does fall, the crankcase must be split to retrieve the pin.*

13. Carefully slide the camshaft sprocket off the camshaft shoulder and remove the sprocket (B, **Figure 32)** from the drive chain.

14. Remove the locating pin **(Figure 33)** from the end of the camshaft.

15. Tie a piece of wire to the camshaft chain and tie it to an external portion of the engine to prevent the camshaft chain from falling down into the crankcase.

CAUTION

If the crankshaft must be rotated with the camshaft removed, pull up on the camshaft chain and keep it taut, make certain that the camshaft chain is properly meshed onto the crankshaft timing sprocket then rotate the crankshaft. If this step is not followed, the chain may become kinked and cause damage to the crankcases, the camshaft chain and the timing sprocket on the crankshaft.

16. Remove the left-hand bolts **(Figure** 34) securing the cylinder head.

17. Using a crisscross pattern, loosen then remove the nuts and washers securing the engine hanger plates and the cylinder head **(Figure** 35). Don't forget the one nut and washer **(Figure** 36) in the recess on the spark plug side of the cylinder head.

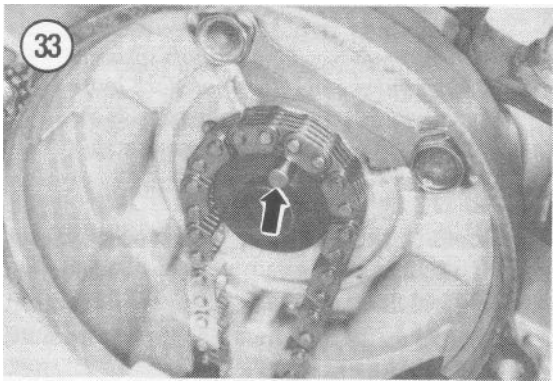
18. Remove the engine hanger plates.

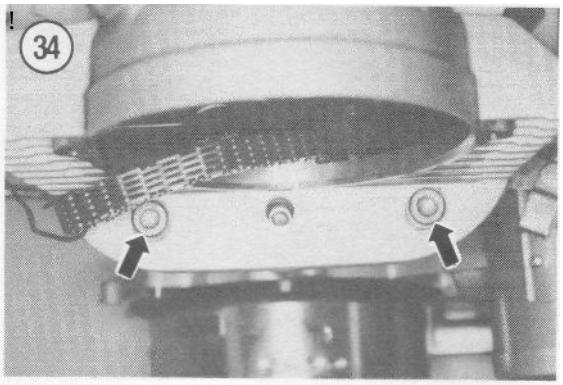
19. Loosen the cylinder head by tapping around the perimeter with a rubber or soft faced mallet. If necessary, *gently* pry the head loose with a broad-tipped screwdriver.

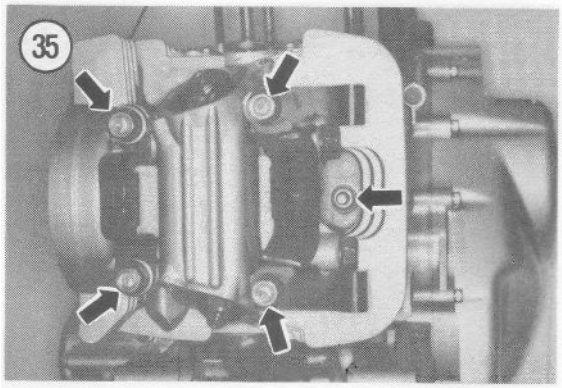
CAUTION

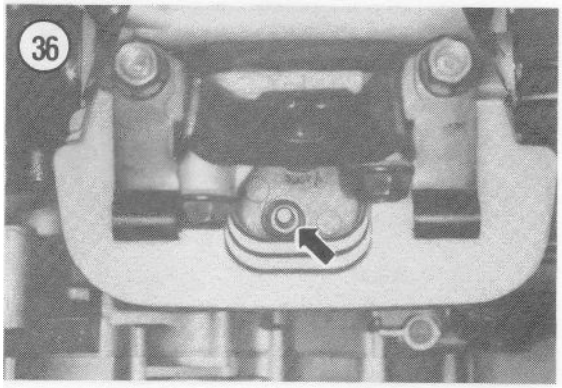
Remember the cooling fins are fragile and may be damaged if tapped or pried on too hard. Never use a metal hammer.

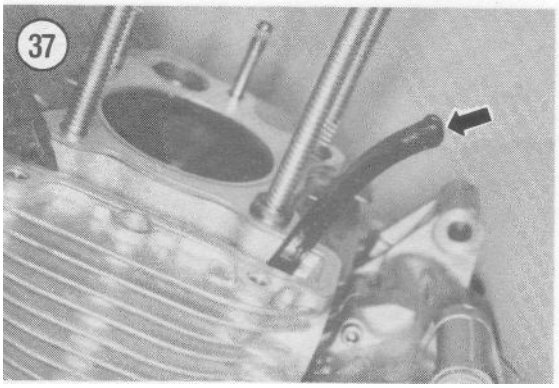
20. Untie the wire securini! the catnshalt chain to the exterior of the engine and hold onto the end of the wire.

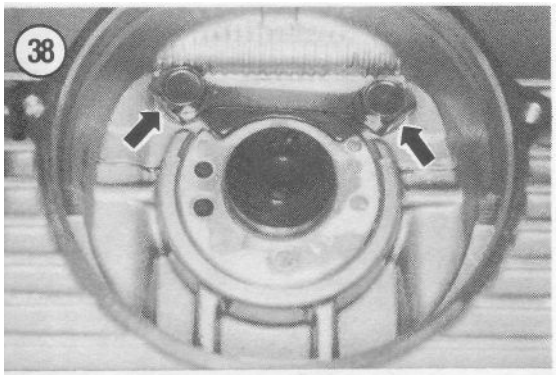


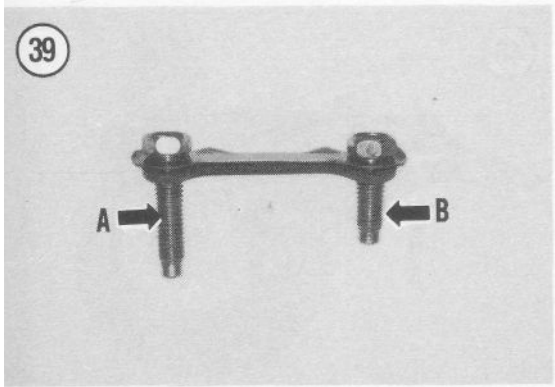


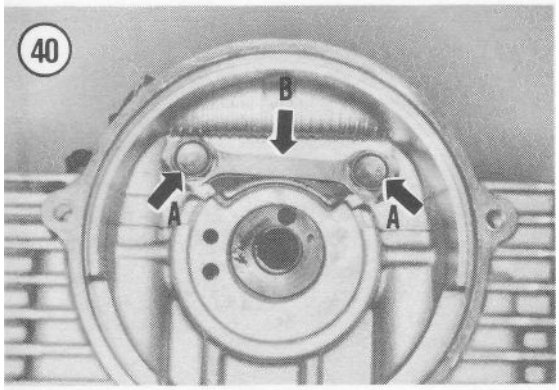


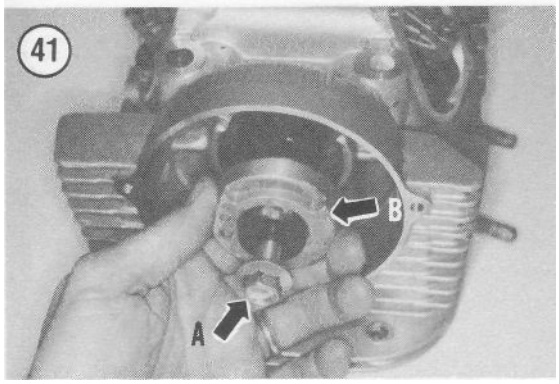












21 Lift the cylinder head straight up and off the crankcase studs Guide the cam chain through the opening in the cylinder head and retie the wire to the exterior of the engine This will prevent the drive chain from falling down into the crankcase

22 Remove the cylinder head gasket and discard it Don't lose the locating dowels

23 Remove the camshaft chain slipper on the exhaust side **(Figure 37)**

24 Place a clean shop cloth into the cam chain opening in the cylinder to prevent the entry of foreign matter

25 Unstake the locking tabs **(Figure 38)** on the camshaft bushing lockwasher

NOTE

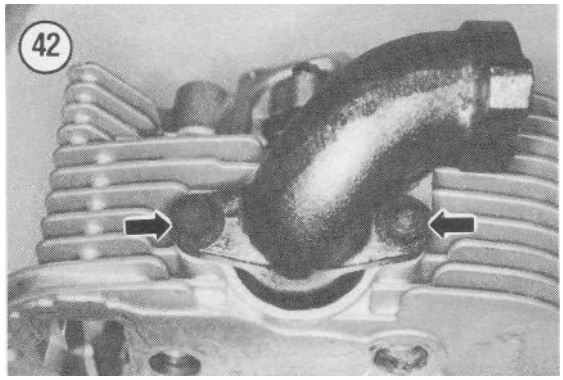
*The camshaft bushing bolts are of two different lengths The long bolt (A, **Figure** 39) is used on the exhaust side and short bolt (B, **Figure** 39) is used on the intake side The bolts must be installed in this location during installation*

26 Remove the bolts (A, **Figure** 40) securing the bushing lockwasher **(B, Figure 40)** and remove the lockwasher

27 Screw a 10 mm bolt (A, **Figure 41)** into the end of the camshaft and withdraw the camshaft and camshaft bushing (B, **Figure 41)**

28 If necessary, remove the self-locking nuts **(Figure** 42) securing the rear exhaust joint to the cylinder head Remove the exhaust joint and discard the nuts as they cannot be reused

29 Repeat Steps 2-27 for the front cylinder head, noting the following that are unique to the front cylinder



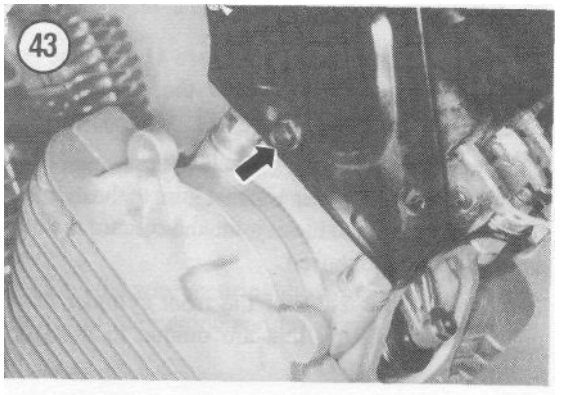
a. Remove the bolt **(Figure 43)** on each side securing the ignition coil assembly to the front cylinder head and remove the coil assembly.

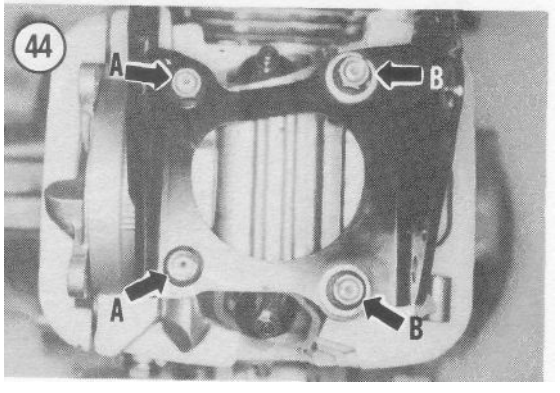
b. Remove the nuts (A, **Figure 44)** and the nuts and washers (B, **Figure 44)** securing the front engine hanger plate to the cylinder head and remove the hanger plate. Note the location of the washers as they must be reinstalled on the same crankcase studs during installation.

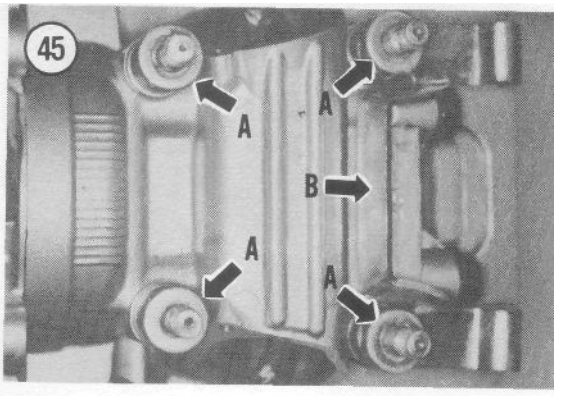
c. While observing Step 5, rotate the crankshaft until the slit in the alternator rotor is aligned with the crankcase cover stationary pointer. See **Figure 63** m Chapter Three. The alternator rotor "T" mark is for the rear cylinder.

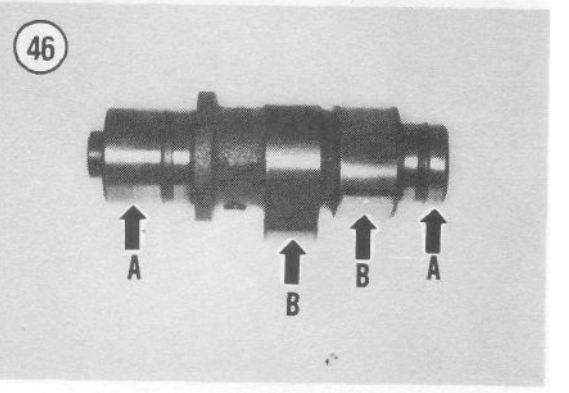
d. Remove the special long nuts (A, **Figure 45)** and washers securing the cylinder head and the cylinder head cover mounting bracket (B, **Figure 45).** Remove the mounting bracket.

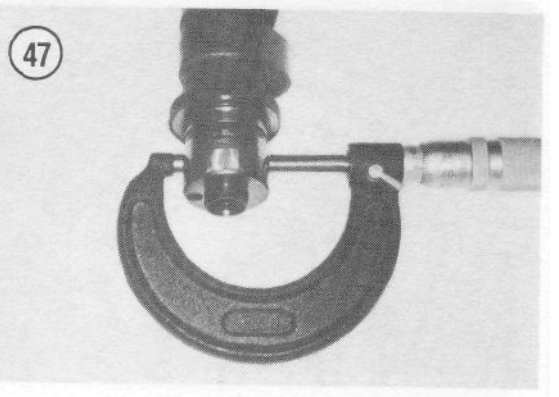
e. The front cylinder camshaft sprocket is not equipped with an oil baffle plate like the one used on the rear cylinder.

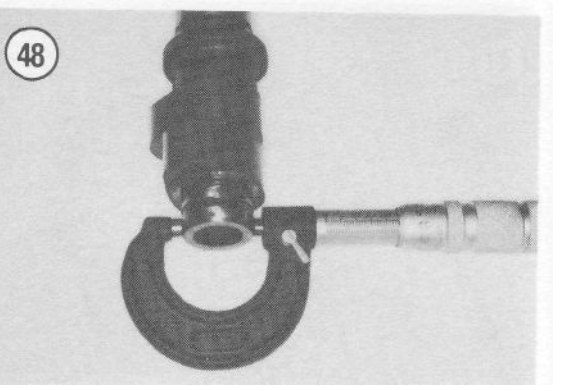


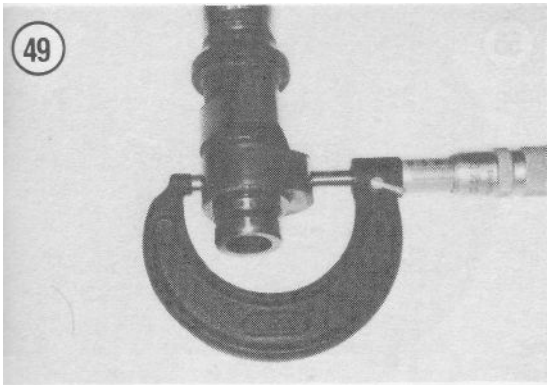


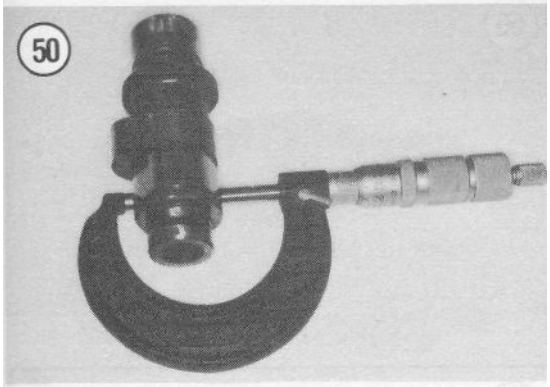


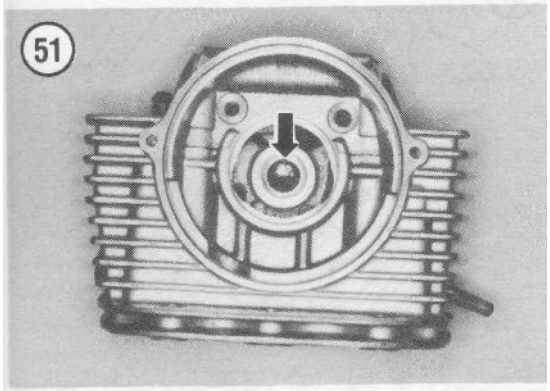


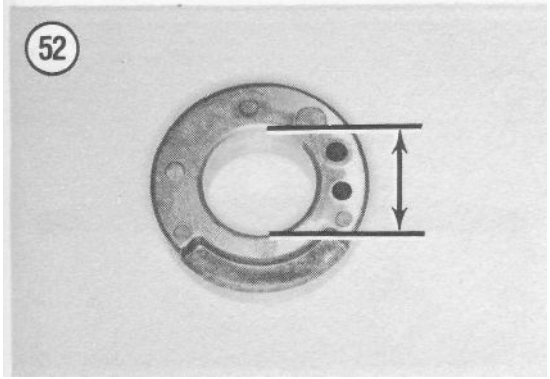












Camshaft Inspection

1. Check the camshaft bearing journals (A, **Figure** 46) for wear or scoring.

2. Using a micrometer, measure the sprocket end of the bearing journal **(Figure** 47) and the opposite journal **(Figure 48).** Compare to dimensions listed in **Table 1.** If any dimension is worn to the service limit dimension or less the camshaft must be replaced. !

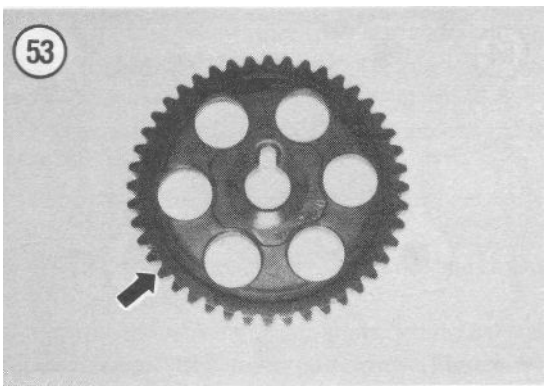
3. Check the camshaft lobes (B, **Figure 46)** for wear or scoring. The lobes should show no signs of wear or scoring and the edges should be square. Slight damage may be removed with a silicone carbide oilstone. Use No. 100-120 grit stone initially, then polish with a No. 280-320 grit stone.

4. Even though the lobe surface appears to be satisfactory, with no visible signs of wear, each camshaft lobe must be measured as shown in **Figure** 49. Compare to dimensions listed in **Table 1.** If either dimension is worn to the service limit dimension or less the camshaft must be replaced.

5. Also measure the cam lobe width **(Figure 50)** with a micrometer. Compare to dimensions listed in **Table 1.** If either dimension is worn to the service limit dimension or less the camshaft must be replaced.

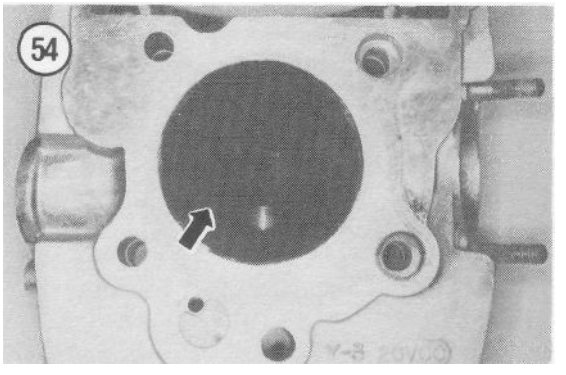
6. Measure the cam bearing surface inside diameter in the cylinder head **(Figure 51)** and camshaft bushing **(Figure 52).** The bearing surfaces should not be scored or excessively worn. Compare to dimensions listed in **Table 1.** If either dimension is worn to the service limit dimension or less either the cylinder head or the bushing must be replaced.

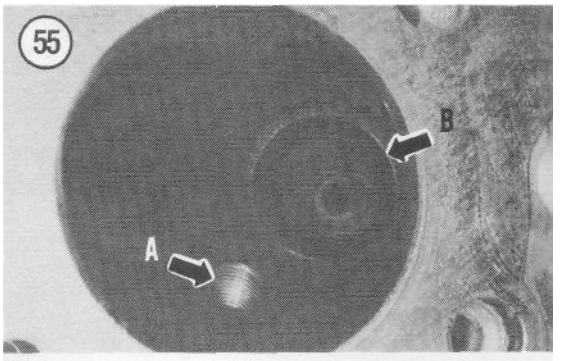
7. Inspect the camshaft sprocket **(Figure** 53) for wear; replace if necessary.

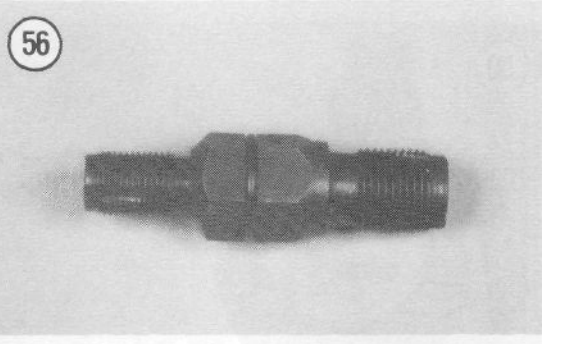


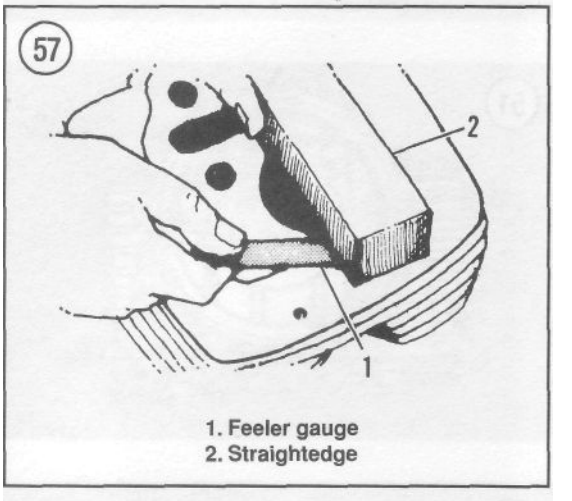
Cylinder Head Inspection

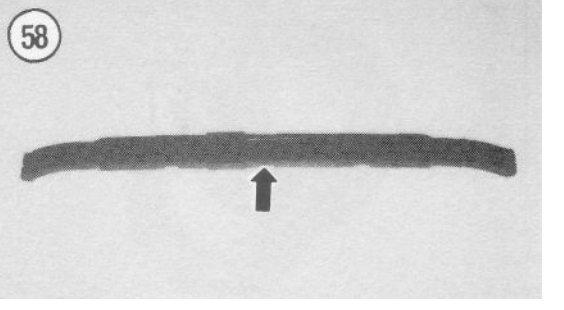
1. Remove all traces of gasket material from the cylinder head and cylinder mating surfaces. Do not scratch the gasket surface.
2. *Without removing the valves,* remove all carbon deposits from the combustion chamber **(Figure 54)** and valve ports with a wire brush. A blunt screwdriver or chisel may be used if care is taken not to damage the head, valves and spark plug threads.
3. Examine the spark plug threads (A, **Figure 55)** in the cylinder head for damage. If damage is minor or if the threads are dirty or clogged with carbon, use a spark plug thread tap **(Figure 56)** to clean the threads following the manufacturer's instructions. If thread damage is severe, refer further service to a dealer or competent machine shop.
4. After the carbon is removed from the combustion chamber and the valve ports (B, **Figure** 55)and the spark plug thread hole is repaired, clean the entire head in cleaning solvent. Blow dry with compressed air.
5. Clean away all carbon from the piston crown. Do not remove the carbon ridge at the top of the piston.
6. Check for cracks in the combustion chamber and exhaust ports. A cracked head must be replaced.
7. Inspect the camshaft bushing seating area **(B, Figure 41)** in the cylinder head for damage, wear or burrs. Clean up if damage is minimal; replace cylinder head if necessary.
8. After the head has been thoroughly cleaned, place a straightedge across the cylinder head/cylinder gasket surface **(Figure 57)** at several points. Measure the warp by inserting a flat feeler gauge between the straightedge and the cylinder head at each location. Maximum allowable warpage is 0.010 in. (0.25 mm). If warpage exceeds this limit, the cylinder head must be replaced.





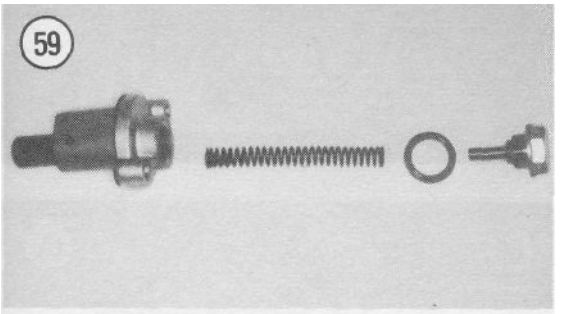


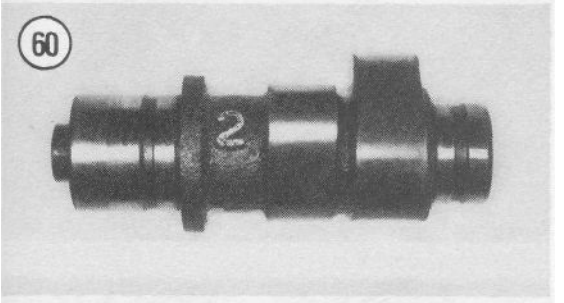


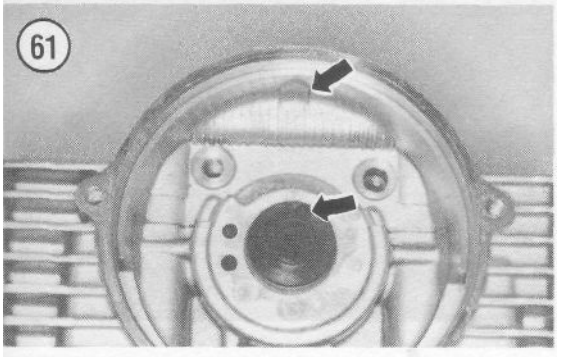


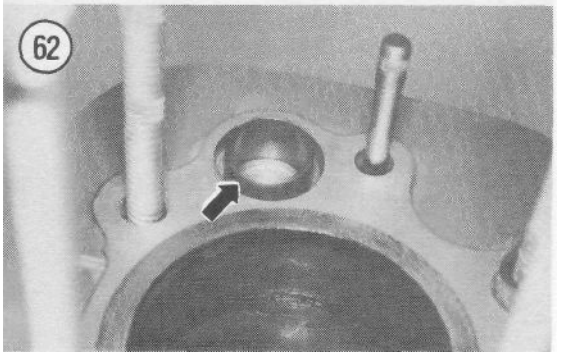
9. Inspect the valve and valve guides as described in this chapter,

10. Inspect the exhaust side camshaft chain guide **(Figure 58)** for excessive wear or separation. Replace if necessary.









11. Inspect the camshaft chain tensioner assembly **(Figure 59)** for wear or damage. If any part is damaged, replace the assembly.

Installation

NOTE

This procedure is for the rear cylinder. Installation of the front cylinder is identical, except for differences noted in Step 27. If both cylinder heads have been removed; install the rear cylinder assembly first, then the front cylinder.

1. Lubricate the camshaft bearing journals and bearing surfaces in the cylinder head and camshaft bushing with molybdenum disulfide grease or assembly oil.

NOTE

*If both cylinder heads have been disassembled, be sure to install the correct camshaft into the correct cylinder head. The front camshaft is marked with a "2" **(Figure 60)** and the rear camshaft is marked with a "I."*

2. Position the camshaft with the locating dowel hole facing up toward the timing mark in the cylinder head. Install the camshaft and camshaft bushing (B, **Figure 41)** into the cylinder head. After installation, check this basic alignment **(Figure 61)** and realign if necessary.

NOTE

*The bolts have different lengths. The long bolt (A, **Figure 39)** is used on the exhaust side and short bolt (B, **Figure 39)** is used on the intake side. The bolts must be installed in this location during installation.*

3. Install a new lockwasher (B, **Figure 40)** and the bolts (A, **Figure 40)** in their correct location. Tighten the bolts to the torque specifications in **Table 2.**

4. Stake the locking tabs **(Figure** 38) onto the flat of each bolt.

5. Remove the shop cloth from the cam chain opening in the cylinder.

6. Install the large dowel pin **(Figure 62)** and O-ring seal **(Figure** 63).

7. Position the camshaft chain slipper on the exhaust side with the "UP" mark and arrow **(Figure 64)**

facing up and install the slipper **(Figure 37).** Make sure it is correctly seated in the locator at the lower end.

8. If removed, install the 2 small locating dowels (A, **Figure 65)** and a new cylinder head gasket **(B, Figure 65).**

9. Install the cylinder head onto the crankcase studs. With your fingers, carefully insert the cam chain into the cam chain cavity on the side of the cylinder head while pushing the cylinder head down into position **(Figure 66).**

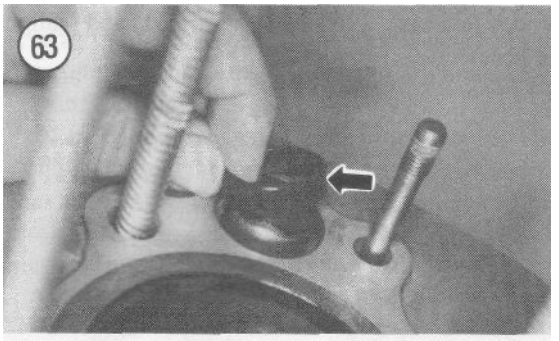
10. Make sure the upper portion of the exhaust side chain slipper is indexed into the cavity in the cylinder head **(Figure 67).**

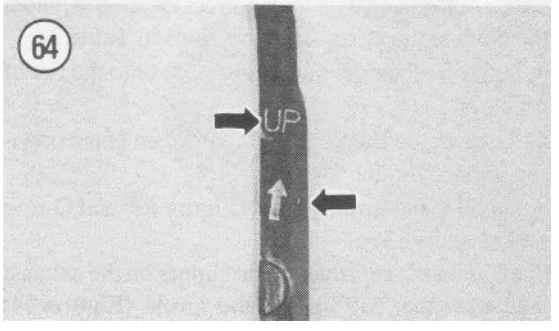
11. Tie the wire attached to the cam chain to the exterior of the engine.

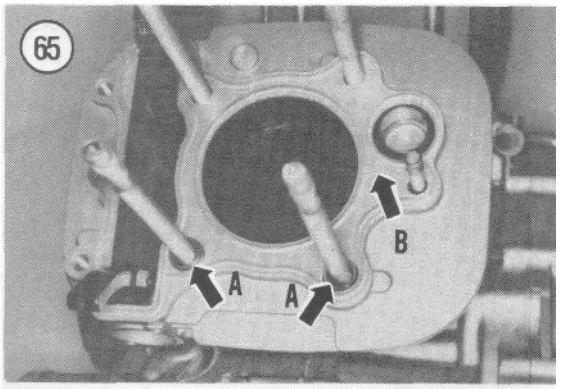
NOTE

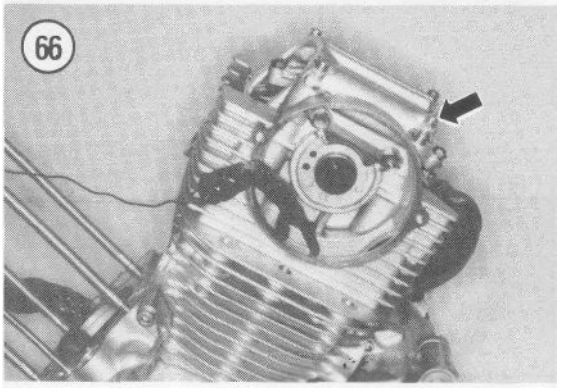
*If both cylinder heads have been disassembled, be sure to install the correct cylinder head nuts. The front cylinder head uses the larger or longer special nuts **(Figure** 68) while the rear cylinder uses the normal type of nuts.*

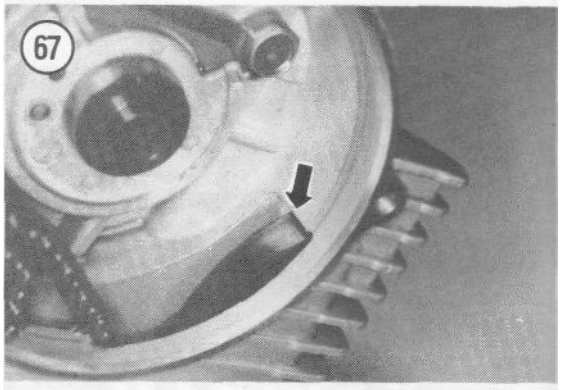
12. Install the engine hanger plates (A, **Figure 69)** onto the crankcase studs and install the washers and nuts **(B, Figure 69).** Don't forget to install the one

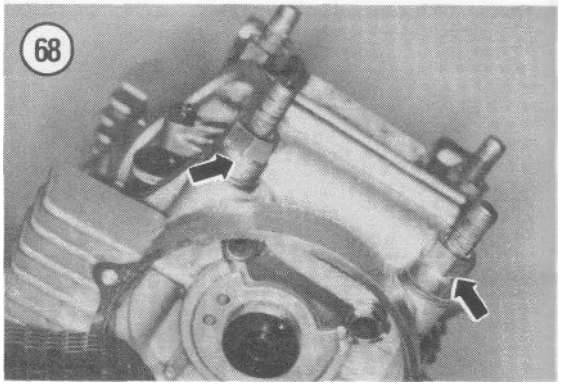


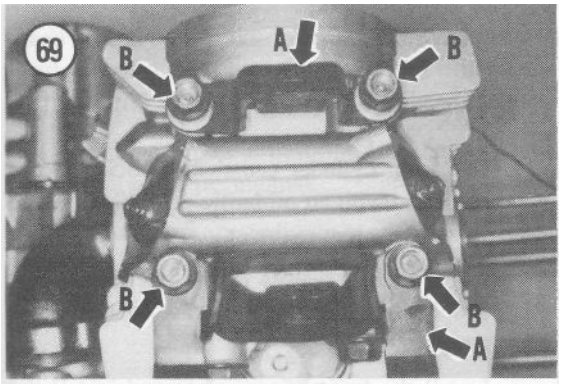


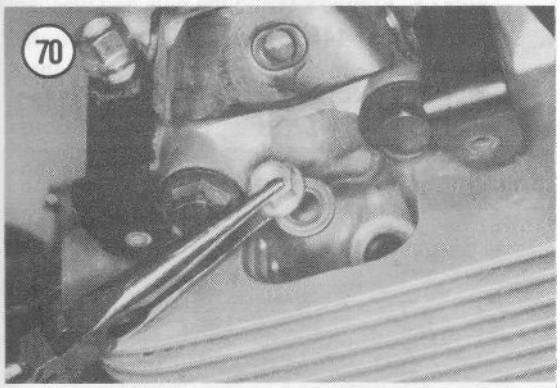


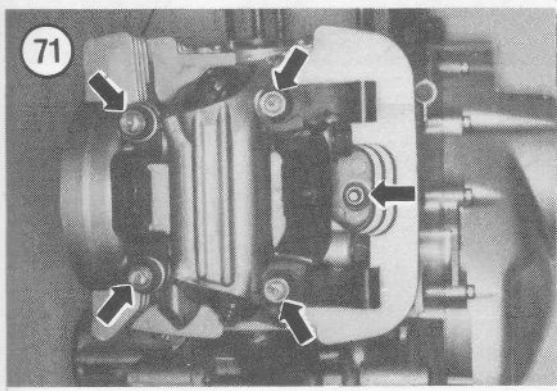


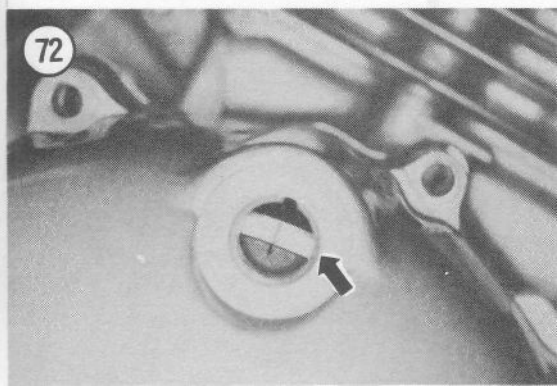












nut and washer **(Figure 70)** in the recess on the spark plug side of the cylinder head.

13. Using a crisscross pattern, tighten the nuts securing the engine hanger plates and the cylinder head **(Figure 71).** Tighten the bolts to the torque specifications in **Table 2.**

14. Install the left-hand bolts **(Figure 34)** securing the cylinder head. Tighten the bolts to the torque specifications in **Table 2.**

15. Make sure the timing mark on the alternator rotor is still aligned correctly to ensure proper valve timing. Perform the following:

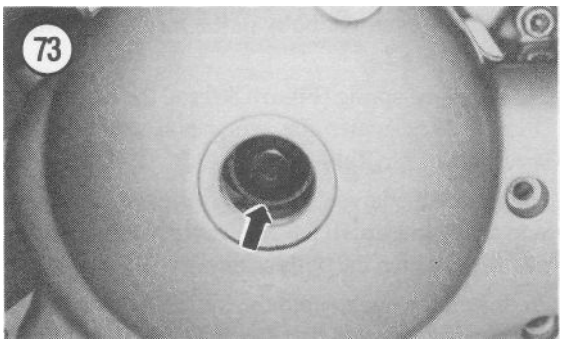
a. Temporarily install the left-hand crankcase cover and hold it in place with several screws.

b. Remove the timing hole cover and the crankshaft cover.

c. Observe that the "T" timing mark on the edge of the alternator rotor is aligned with the fixed pointer on the crankcase **(Figure 72).** If alignment is incorrect, use the bolt **(Figure 73)** on the left-hand end of the crankshaft and turn the crankshaft *clockwise* until the "T" timing mark on the edge of the alternator rotor is aligned with the fixed pointer on the crankcase **(Figure 72).**

NOTE

In the following step, the locating pin may want to partially back out of the blind hole in the camshaft due to residual cleaning solvent or engine oil remaining in this receptacle. To help remedy this problem, spray the blind hole in the camshaft with an aerosol electrical contact cleaner, then me compressed air to blow out this blind hole. This will allow the pin to go in the desired amount although it may still stick outfarther than necessary at first.



16. Install the locating pin **(Figure 33)** into the end of the camshaft and push it in as far as it will go.

17. Pull the drive chain off the camshaft shoulder.

18. Position the camshaft sprocket with the timing mark facing out and straight up for alignment with the fixed pointer on the top inside surface of the cylinder head.

19. Correctly mesh the sprocket with the drive chain so the index mark on the camshaft sprocket aligns with the fixed pointer on the cylinder head **(Figure 74)** and install the sprocket **(B, Figure 32)** onto the camshaft shoulder while aligning the locating dowel with the sprocket notch (A, **Figure 32).**

CAUTION

Very expensive damage could result from improper camshaft and camshaft chain alignment. Recheck your work several times to make sure alignment is correct.

20. Insert your finger into the camshaft drive chain tensioner hole in the cylinder and press on the drive chain damper. This will take up the slack in the drive chain; make sure the sprocket timing mark is still aligned. If alignment is incorrect, adjust it at this time by repositioning the drive chain on the sprocket, in either direction, until correct alignment is obtained.

21. On the rear cylinder only, install the oil baffle plate (C, **Figure 28)** and bolt (B, **Figure 28)** securing the sprocket.

22. Place a wrench on the bolt **(Figure 73)** on the left-hand end of the crankshaft to prevent it from turning, then tighten the camshaft sprocket mounting bolt to the torque specifications in **Table 2.**

23. Push the tensioner lifter **(Figure 75)** all the way into the tensioner body, then install the tensioner lifter, new gasket and the bolts **(Figure 31)** into the cylinder. Tighten the bolts to the torque specifications in **Table 2.**

24. Install the spring **(Figure 30)** and the center bolt **(Figure 29).** Tighten the center bolt to the torque specifications in **Table 2.**

25. Inspect the large O-ring seal **(Figure 76)** on the side cover and install the side cover and bolts **(Figure 26).** Tighten the bolts securely.

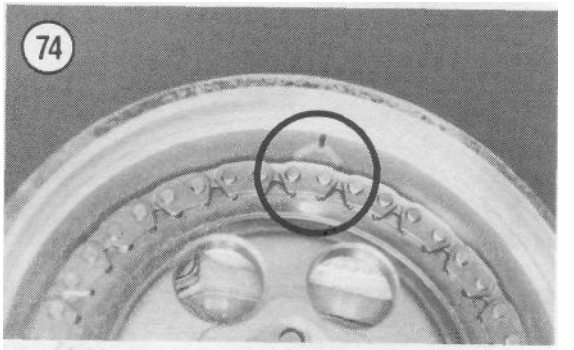
26. Install the engine into the frame as described in this chapter.

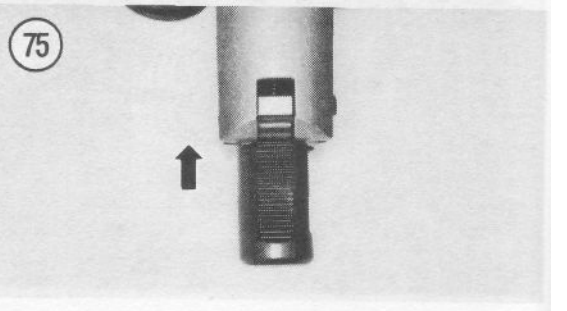
27. Repeat Steps 2-26 for the front cylinder head, noting the following that are unique to the front cylinder head:

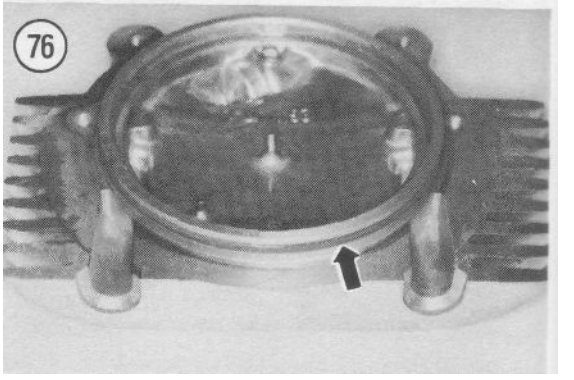
a. The front cylinder camshaft sprocket is not equipped with an oil baffle plate like the one used on the rear cylinder.

b. In Step 15c, the slit in the alternator rotor should align with the crankcase cover stationary pointer.

c. Install the front hanger plate and install the nuts (A, **Figure 44)** and the nuts and washers **(B, Figure 44)** securing the front engine hanger plate to the cylinder head and tighten the nuts to the torque specification in **Table 2.**



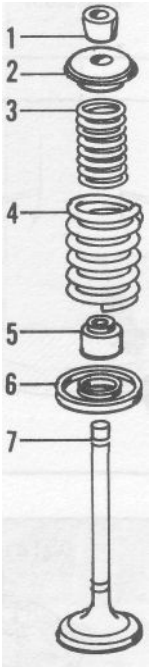




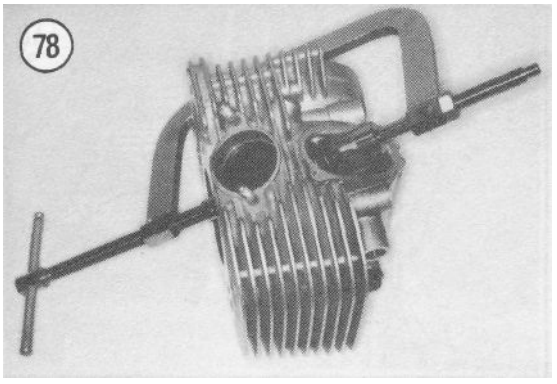
d. Install the ignition coil assembly and the bolt **(Figure 43)** on each side. Tighten the bolts securely.

28. Adjust the valves as described in Chapter Three in this section of the manual.

VALVE ASSEMBLY



1. Keepers
2. Spring seat
3. Inner spring
4. Outer spring
5. Oil seal
6. Valve spring seat
7. Valve



VALVES AND VALVE COMPONENTS

Removal

Refer to **Figure 77** for this procedure.

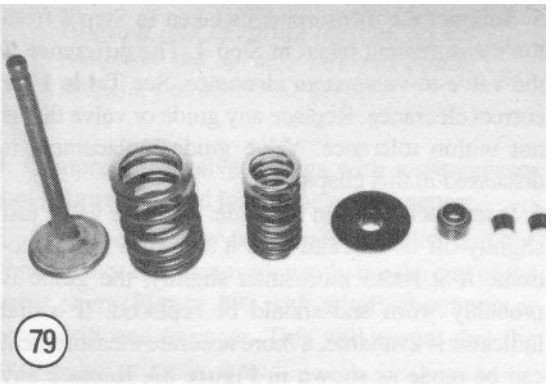
1. Remove the cylinder head as described in this chapter.

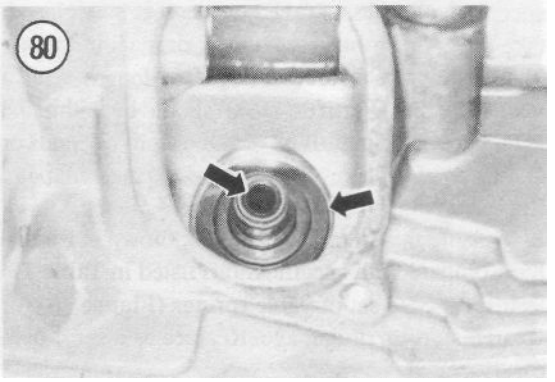
CAUTION
To avoid loss of spring tension, do not compress the springs any more than necessary to remove the keepers.

2. Compress the valve springs with a valve compressor tool **(Figure 78).** Remove the valve keepers and release the compression. Remove the valve compressor tool.

3. Remove the valve spring retainer and valve springs **(Figure 79).**

NOTE
The valve spring seat and valve stem seal will stay in the cylinder head ***(Figure 80).***





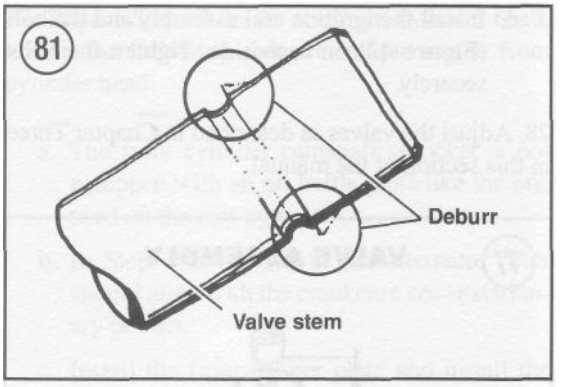
4. Prior to removing the valve, remove any burrs from the valve stem **(Figure** 81). Otherwise the valve guide will be damaged.
5. Mark all parts as they are disassembled so that they will be installed in their same locations.

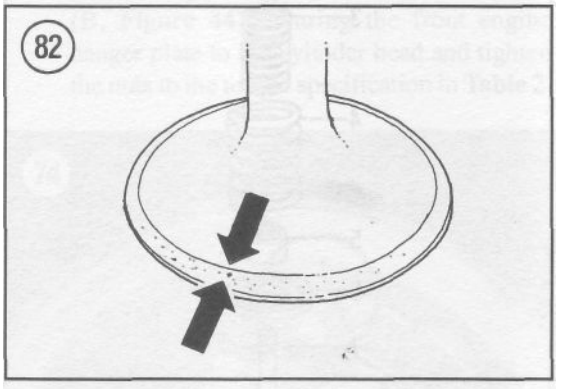
Inspection

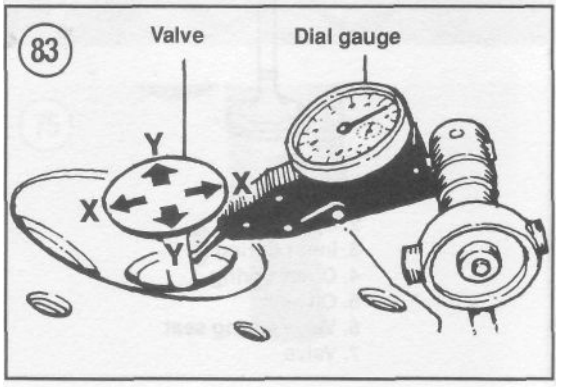
1. Clean valves with a wire brush and solvent.

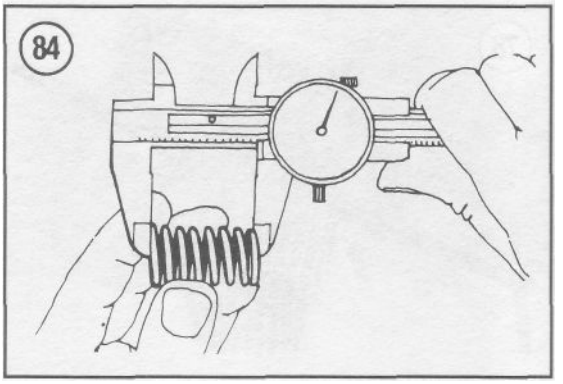
NOTE
The valve contact surface cannot be ground as it has a special coating. If defective, the valve(s) must be replaced.

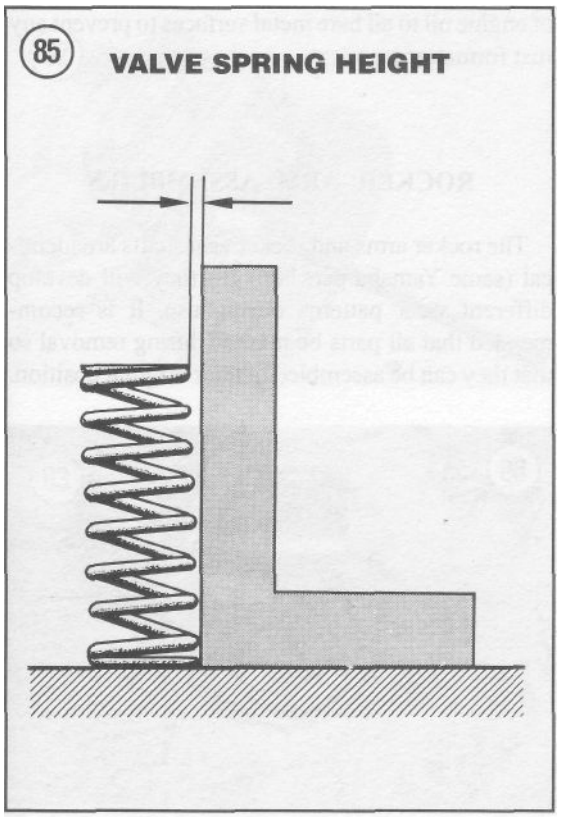
2. Inspect the contact surface of each valve for burning or pitting **(Figure 82).** Unevenness of the contact surface is an indication that the valve is not serviceable.
3. Measure the valve stem for wear. Compare with specifications given in **Table 1.**
4. Remove all carbon and varnish from the valve guide with a stiff spiral wire brush. Measure each valve guide at top, middle and bottom with a small hole gauge. Compare with specifications given in **Table 1.**
5. Subtract the measurements taken in Step 3 from the measurement taken in Step 4. The difference is the valve-to-valve stem clearance. See **Table 1** for correct clearance. Replace any guide or valve that is not within tolerance. Valve guide replacement is discussed in this chapter.
6. Insert each valve in its guide. Hold the valve just slightly off its seat and rock it sideways in 2 directions. If it rocks more than slightly, the guide is probably worn and should be replaced. If a dial indicator is available, a more accurate measurement can be made as shown in **Figure 83.** Replace any guides that exceed the valve stem-to-guide clearance specified in **Table 1.** If the guides must be replaced, take the cylinder head to a dealer or machine shop.
7. Measure each valve spring free length with a vernier caliper **(Figure** 84). All should be within the length specified in **Table 1** with no signs of bends or distortion. Replace all defective springs in pairs (inner and outer).
8. Measure the tilt of all springs as shown in **Figure 85.** Compare with specifications listed in **Table 1.**
9. Inspect each set of valve springs **(Figure 79)** for wear, distortion or damage. Replace as a set if necessary.











10 Check the valve spring retainer and valve keepers If they are in good condition they may be reused, replace as necessary

11 Inspect valve seats (B, **Figure 55)** If worn or burned, they must be reconditioned This should be performed by your dealer or a qualified machine shop Seats and valves in near-perfect condition can be reconditioned by lapping with a fine carborundum paste Lapping, however, is always inferior to precision grinding

Installation

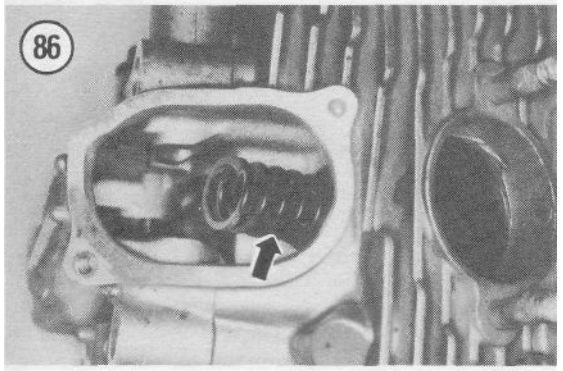
1 Coat the valve stems with molybdenum disulfide grease To avoid damage to the valve stem seal, turn the valve slowly while inserting the valve into the cylinder head

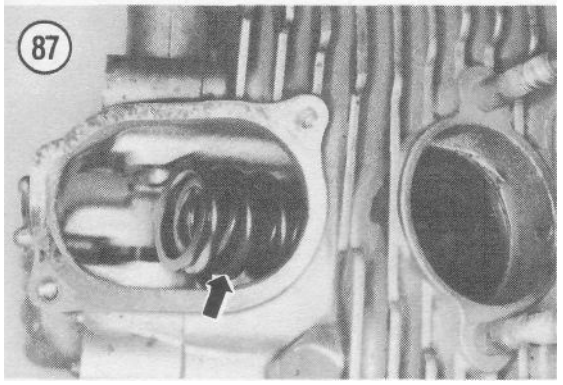
2 Install the valve springs with their closer wound coils facing the cylinder head First install the inner spring **(Figure 86)** and then the outer spring **(Figure 87)**

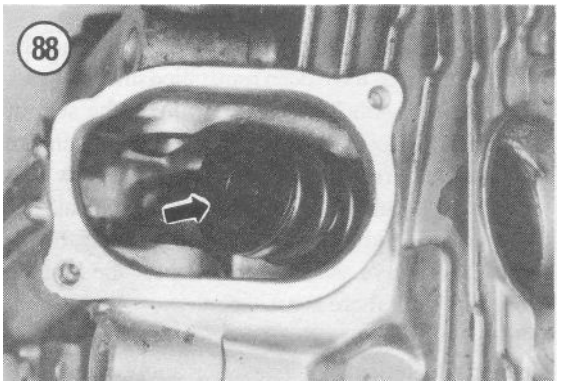
3 Install the valve spring retainer **(Figure 88)**

CAUTION
To avoid loss of spring tension, do not compress the springs any more than necessary to install the keepers

4. Compress the valve springs with a compressor tool **(Figure 78)** and install the valve keepers
5 After the keepers have been installed and the compresssor tool removed, gently tap the end of the valve stem **(Figure 89)** with a soft aluminum or brass drift and hammer This will ensure that the keepers are properly seated







Valve Guide Replacement

When valve guides are worn so that there is excessive valve stem-to-guide clearance or valve tipping, the guides must be replaced. This job should only be done by a dealer as special tools are required as well as considerable expertise. If the valve guide is replaced; also replace the respective valve.

Valve Seat Reconditioning

Special valve cutter tools and considerable expertise are required to properly recondition the valve seats in the cylinder head. You can save considerable money by removing the cylinder head(s) and taking just the cylinder head(s) to a dealer or machine shop and have the valve seats ground.

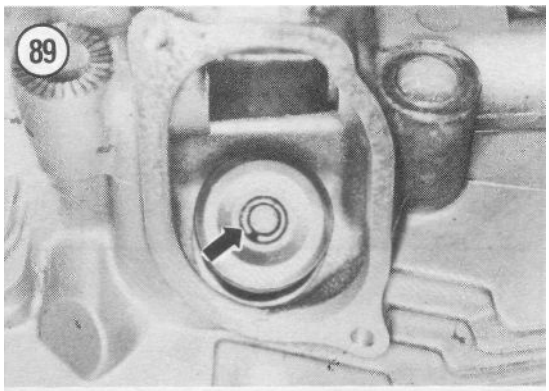
Valve Lapping

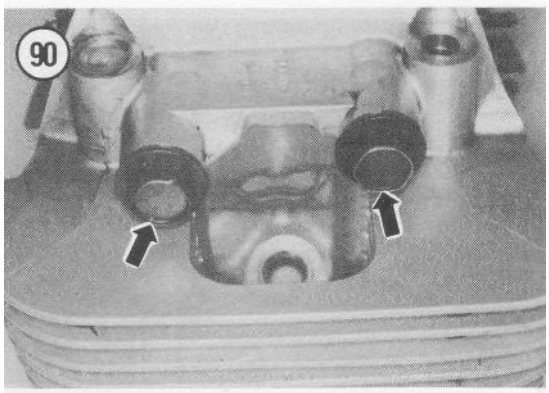
Valve lapping is a simple operation which can restore the valve seal without machining if the amount of wear or distortion is not too great.

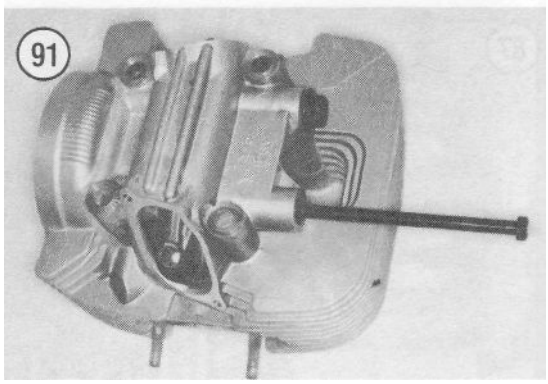
1. Coat the valve seating area in the head with a lapping compound such as Carborundum or Clover Brand.
2. Insert the valve into the cylinder head.
3. Wet the suction cup of the lapping stick and stick it onto the head of the valve. Lap the valve to the seat by rotating the lapping stick in both directions. Every 5 to 10 seconds, rotate the valve 180° in the valve seat; continue lapping until the contact surfaces of the valve and the valve seat are a uniform grey. Stop as soon as they are, to avoid removing too much material.
4. Thoroughly clean the cylinder head and all valve components in solvent or detergent and hot water to remove all grinding compound. Any compound left on the valves or the cylinder head will end up in the engine and will cause damage.
5. After the lapping has been completed and the valve assemblies have been reinstalled into the head, the valve seal should be tested. Check the seal of each valve by pouring solvent into each of the intake and exhaust ports. The solvent should not flow past the valve seat and the valve head. Perform on all sets of valves. If fluid leaks past any of the seats, disassemble that valve assembly and repeat the lapping procedure until there is no leakage.
6. If the cylinder head and valve components were cleaned in detergent and hot water, apply a light coat of engine oil to all bare metal surfaces to prevent any rust formations.

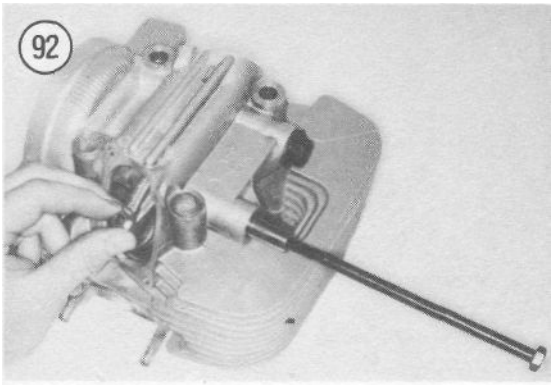
ROCKER ARM ASSEMBLIES

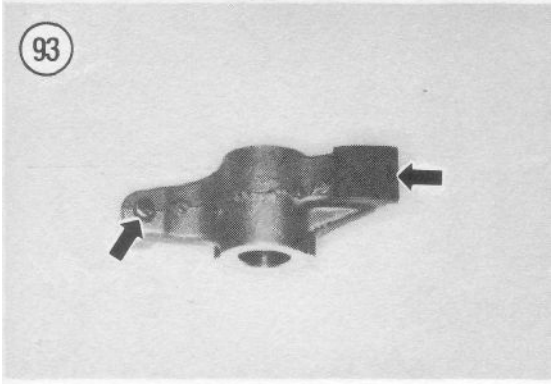
The rocker arms and rocker arm shafts are identical (same Yamaha part No.) but they will develop different wear patterns during use. It is recommended that all parts be marked during removal so that they can be assembled in their original position.

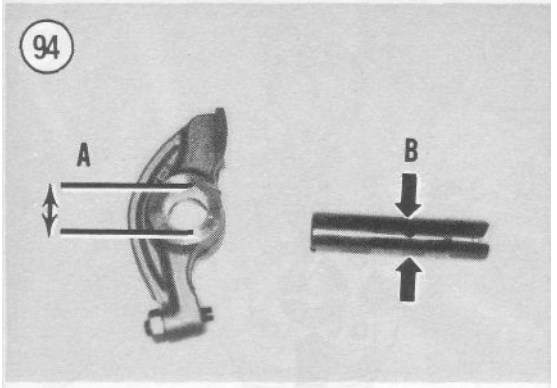


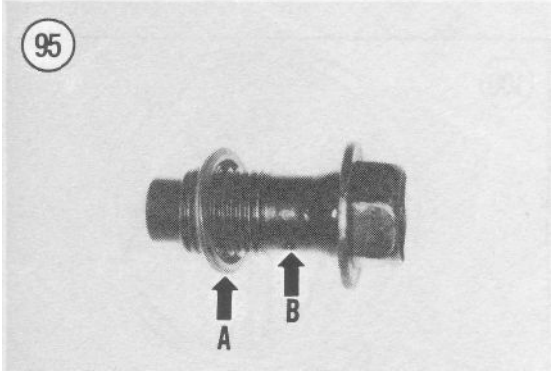






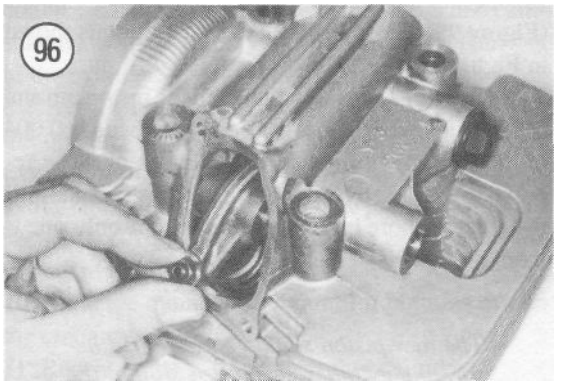






Removal/Inspection/Installation

1. Remove the cylinder head(s) as described in this chapter.
2. Remove the rocker arm shaft bolts and washers **(Figure 90).**
3. Install one of the 10 mm crankcase bolts into the end of the rocker arm shaft **(Figure** 91).
4. Hold onto the rocker arm and withdraw the rocker arm shaft with the bolt **(Figure** 92).
5. Wash all parts in cleaning solvent and thoroughly dry.
6. Inspect the rocker arm pad where it rides on the camshaft lobe and where the adjuster rides on the valve stem **(Figure** 93). If the pad is scratched or unevenly worn, inspect the camshaft lobe for scoring, chipping or flat spots. Replace the rocker arm if defective.
7. Measure the inside diameter of the rocker arm bore (A, **Figure** 94) with an inside micrometer and check against the dimension listed in **Table 1.** Replace if worn to the service limit or greater.
8. Inspect the rocker arm shaft for signs of wear or scoring. Measure the shaft outside diameter (B, **Figure** 94) with a micrometer and check against the dimension listed in **Table** 1. Replace if worn to the service limit or less.
9. Inspect the rocker arm shaft bolt sealing washer (A, **Figure** 95) for damage and replace if necessary.
10. Make sure the rocker arm shaft bolt oil hole (B, **Figure** 95) is clear, clean out if necessary with a piece of wire and compressed air. This hole must be free and clear for proper upper end lubrication.
11. Coat the rocker arm shaft and rocker arm bore with assembly oil or fresh engine oil.
12. Correctly position the rocker arm **(Figure** 96) in the cylinder head and install the rocker arm shaft.



13. Push the rocker arm shaft all the way through the rocker arm until it bottoms out in the cylinder head.
14. Install a sealing washer **(Figure 97)** on the rocker arm shaft bolt and install the bolt.
15. Repeat Steps 3-14 for the other rocker arm assembly.

CYLINDER

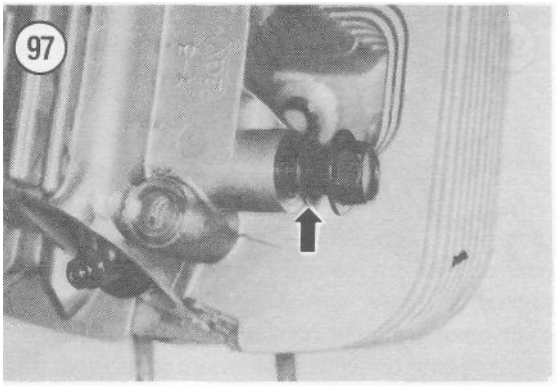
Removal

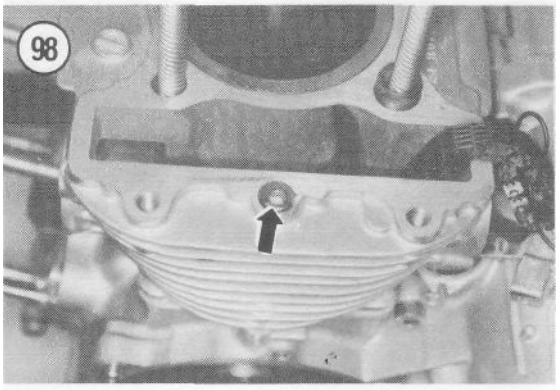
1. Remove the cylinder head as described in this chapter.
2. Remove the bolt **(Figure 98)** on the camshaft chain side of the cylinder.
3. Loosen the cylinder by tapping around the perimeter with a rubber or plastic mallet. If necessary, *gently* pry the cylinder loose with a broad-tipped screwdriver.
4. Pull the cylinder straight up and off of the crankcase studs. Work the cam chain wire through the opening in the cylinder and retie the wire to the crankcase so the chain will not fall into the crankcase.
5. Remove the cylinder base gasket and discard it. Remove the small dowel pins from the crankcase studs and the one large dowel pin and O-ring seal.
6. Stuff clean shop cloths into the crankcase opening to prevent objects from falling into the crankcase.
7. Repeat Steps 2-6 for the other cylinder.

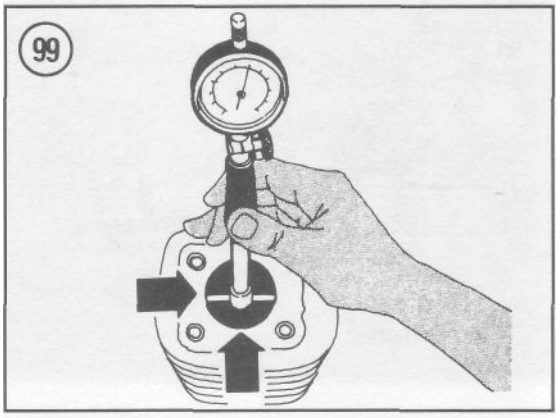
Inspection

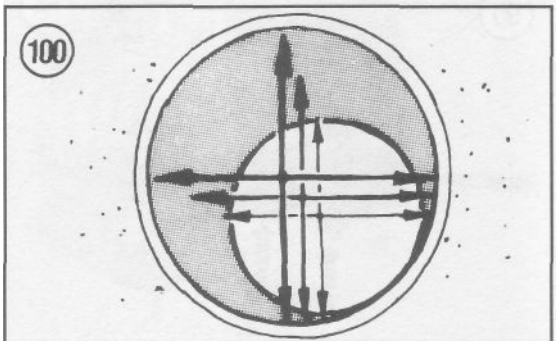
1. Soak with solvent any old cylinder head gasket material on the cylinder. Use a broad-tipped *dull* chisel and gently scrape off all gasket residue. Do not gouge the sealing surface as oil and air leaks will result.
2. Measure the cylinder bore with a cylinder gauge **(Figure 99)** or inside micrometer at the points shown in **Figure 100.**
3. Measure in 2 axes—in line with the piston pin and at 90° to the pin. If the taper or out-of-round is 0.004 in. (0.10 mm) or greater, the cylinder must be rebored to the next oversize and a new piston and rings installed. Rebore both cylinders even if only one is worn.

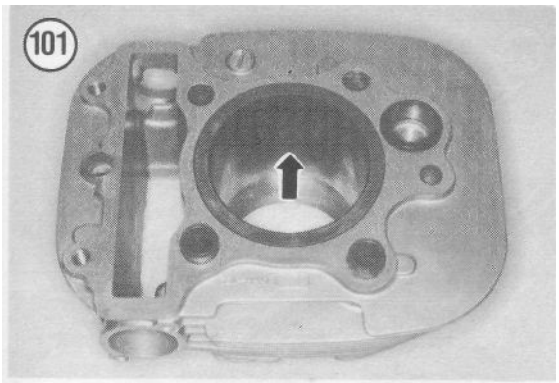
NOTE
The new piston should be obtained before the cylinder is rebored so that the

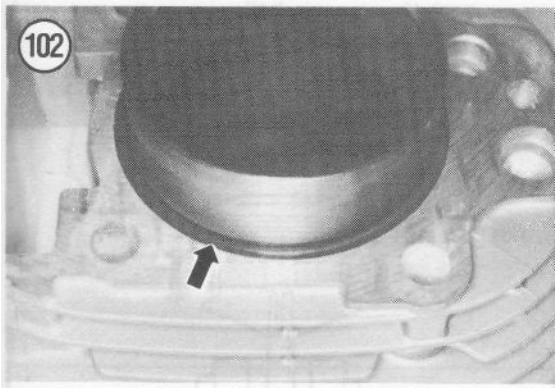


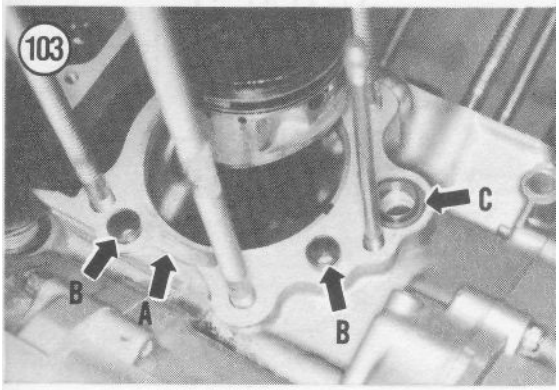


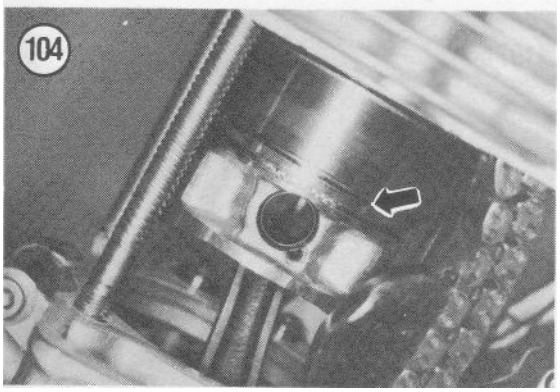












*piston can be measured; slight manufacturing tolerances must be taken into account to determine the actual size and working clearance. Piston-to-cylinder wear limit is listed in **Table 1**.*

4. Check the cylinder wall **(Figure 101)** for scratches; if evident, the cylinder should be rebored.

NOTE

*The maximum wear limit on the cylinder is listed in **Table 1.** If the cylinder is worn to this limit, it must be replaced. Never rebore a cylinder if the finished rebore diameter will be this dimension or greater.*

5. Check the cylinder base O-ring **(Figure 102).** Replace if worn or damaged.

Installation

1. Check that the top surface of the crankcase and the bottom surface of the cylinder are clean prior to installing a new base gasket.
2. Install a new cylinder base 'gasket (A, **Figure 103).**
3. Install the 2 small dowel pins **(B, Figure 103)** and the large dowel pin and O-ring seal (C, **Figure 103).**
4. Make sure the end gaps of the piston rings are *not* lined up with each other—they must be staggered. Lubricate the piston rings and the inside of the cylinder bore with assembly oil or fresh engine oil.
5. Carefully install the cylinder and slide it down onto the crankcase studs. Guide the camshaft chain and camshaft tensioner assembly into the camshaft chain slot in the cylinder.
6. Carefully feed the cam chain and wire up through the opening in the cylinder and tie it to the engine.
7. Install the cylinder and slide it down onto the crankcase studs. Guide the camshaft chain and camshaft tensioner assembly into the camshaft chain slot in the cylinder.
8. Carefully feed the camshaft chain wire up through the opening in the cylinder and tie the wire to the exterior of the engine.
9. Start the cylinder down over the piston. Compress each piston ring with your fingers as it enters the cylinder **(Figure 104).**
10. Slide the cylinder down until it bottoms out on the crankcase **(Figure 105).**
11. Repeat Steps 1-10 for the other cylinder.

12. Install the cylinder head as described in this chapter.

PISTONS AND PISTON RINGS

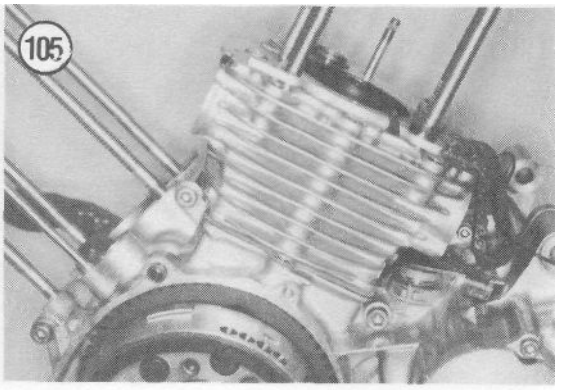
Piston
Removal/Installation

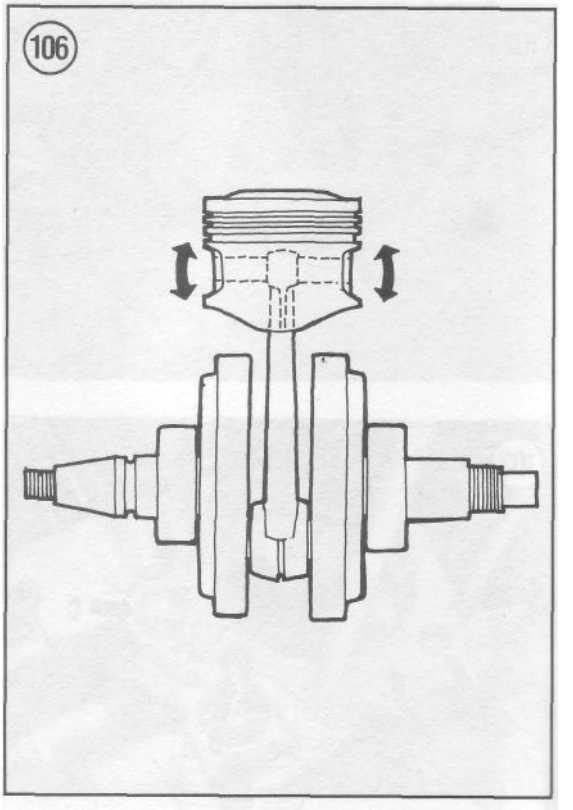
1. Remove the cylinder head(s) and cylinder(s) as described in this chapter.
2. Stuff clean shop cloths into the crankcase opening to prevent objects from falling into the crankcase.
3. Lightly mark the top of the pistons with an "F" (front) or "R" (rear) so they will be installed into the correct cylinder.
4. Remove the piston rings as described in this chapter.
5. Before removing the piston, hold the rod tightly and rock the piston as shown in **Figure 106.** Any rocking motion (do not confuse with the normal sliding motion) indicates wear on the piston pin, piston pin bore or connecting rod small-end bore (more likely a combination of these). Mark the piston and pin so that they will be reassembled into the same set.
6. Remove the clips from each side of the piston pin bore (A, **Figure 107)** with a small screwdriver or scribe. Hold your thumb over one edge of the clip when removing it to prevent the clip from springing out.
7. Use a proper size wooden dowel or socket extension and push out the piston pin.

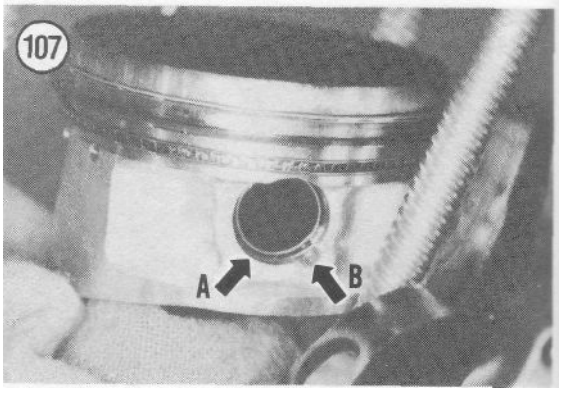
CAUTION

Be careful when removing the pin to avoid damaging the connecting rod. If it is necessary to gently tap the pin to remove it, be sure that the piston is properly supported so that lateral shock is not transmitted to the lower connecting rod bearing.

8. If the piston pin is difficult to remove, heat the piston and pin with a butane torch. The pin will probably push right out. Heat the piston to only about 140° F (60° C), i.e., until it is too warm to touch, but not excessively hot. If the pin is still difficult to push out, use a homemade tool as shown in **Figure 108.**
9. Lift the piston off the connecting rod and inspect it as described in this chapter.



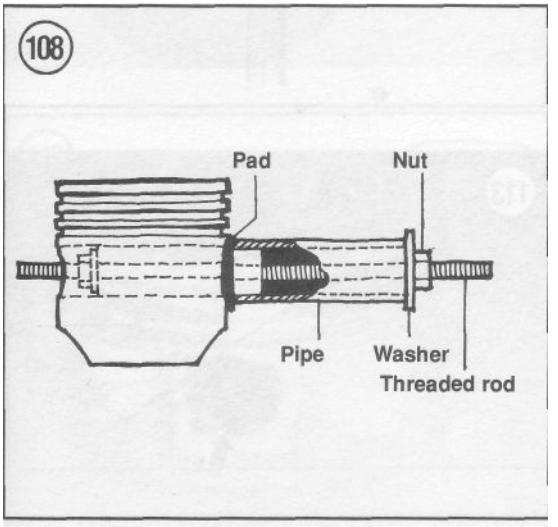


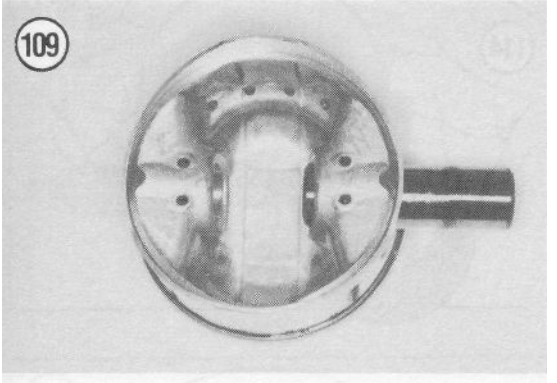


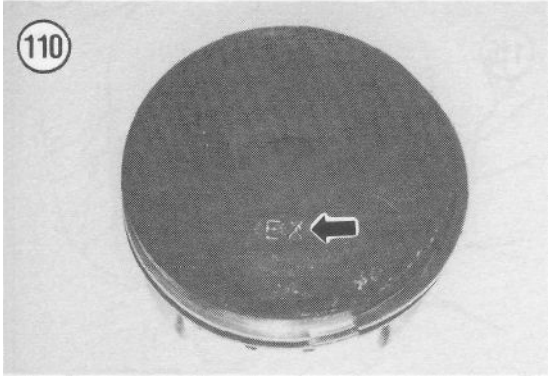
10. If the piston is going to be left off for some time, place a piece of foam insulation tube over the end of the rod to protect it.

11. Apply molybdenum disulfide grease to the inside surface of the connecting rod.

12. Oil the piston pin with assembly oil or fresh engine oil and install it in the piston until its end extends slightly beyond the inside of the boss **(Figure 109).**







13. Place the piston over the connecting rod with the "EX" mark **(Figure 110)** on the front piston crown directed toward the front of the engine and the "EX" on the rear piston should face toward the rear of the engine.

14. Line up the piston pin with the hole in the connecting rod. Push the piston pin through the connecting rod and into the other side of the piston until it is even with the piston pin clip grooves.

CAUTION

If it is necessary to tap the piston pin into the connecting rod, do so gently with a block of wood or a soft-faced hammer. Make sure you support the piston to prevent the lateral shock from being transmitted to the connecting rod bearing.

NOTE

In the next step, install the clips with the gap away from the cutout in the piston ***(B, Figure 107).***

15. Install *new* piston pin clips in both ends of the pin boss. Make sure they are seated in the grooves in the piston.

16. Check the installation by rocking the piston back and forth around the pin axis and from side to side along the axis. It should rotate freely back and forth but not from side to side.

17. Install the piston rings as described in this chapter.

18. Repeat Steps 1-17 for the other piston.

Piston Inspection

1. Carefully clean the carbon from the piston crown **(Figure 111)** with a chemical remover or with a soft scraper. Do not remove or damage the carbon ridge around the circumference of the piston above the top ring. If the piston, rings and cylinder are found to be dimensionaly correct and can be reused, removal of the carbon ring from the top of the piston or the carbon ridge from the top of the cylinder will promote excessive oil consumption.

CAUTION

Do not wire brush the piston skirts.

2. Examine each ring groove for burrs, dented edges and wide wear. Pay particular attention to the top compression ring groove as it usually wears more than the other grooves.

3. If damage or wear indicates piston replacement, select a new piston as described under *Piston Clearance Measurement* in this chapter.

4. Oil the piston pin and install it in the connecting rod. Slowly rotate the piston pin and check for radial and axial play **(Figure 112).** If any play exists, the piston pin should be replaced, providing the rod bore is in good condition.

5. Measure the inside diameter of the piston pin bore with a snap gauge **(Figure 113)** and measure the outside diameter of the piston pin with a micrometer **(Figure 114).** Compare with dimensions given in **Table 1.** Replace the piston and piston pin as a set if either or both are worn.

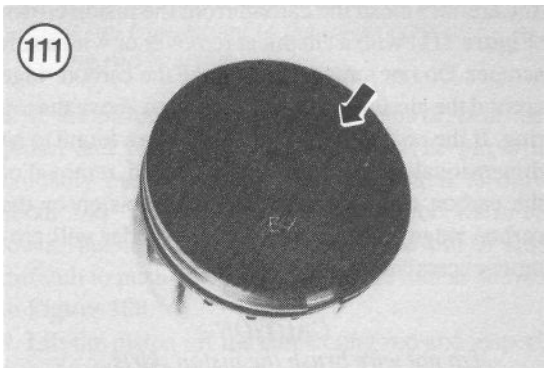
6. Check the oil control holes **(Figure 115)** in the piston for carbon or oil sludge buildup. Clean the holes with a small diameter drill bit and blow out with compressed air.

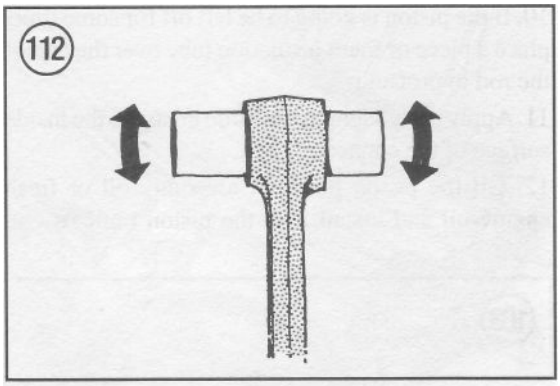
7. Check the piston skirt for galling and abrasion which may have been caused by piston seizure. If light galling is present, smooth the affected area with No. 400 emery paper and oil or a fine oilstone. However, if galling is severe or if the piston is deeply scored, replace it.

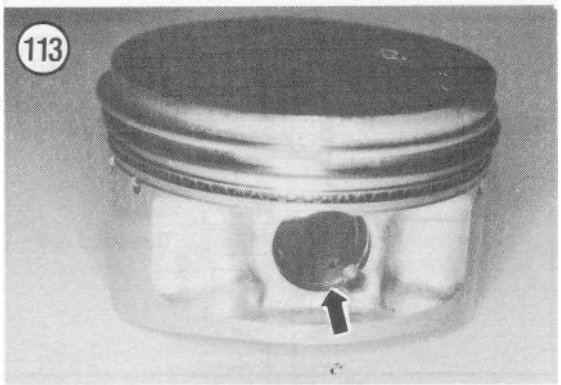
8. If damage or wear indicate piston replacement, select anew piston as described under *Piston Clearance Measurement* in this chapter.

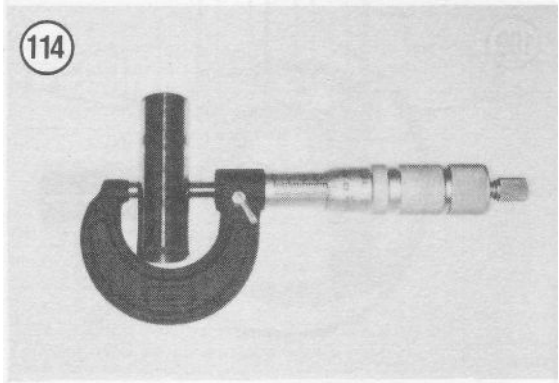
Piston Clearance Measurement

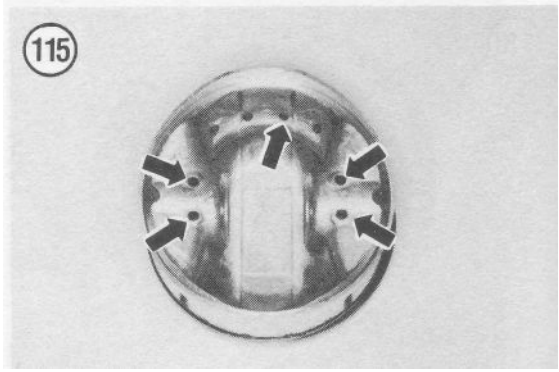
1. Make sure the piston and cylinder walls are clean and dry.

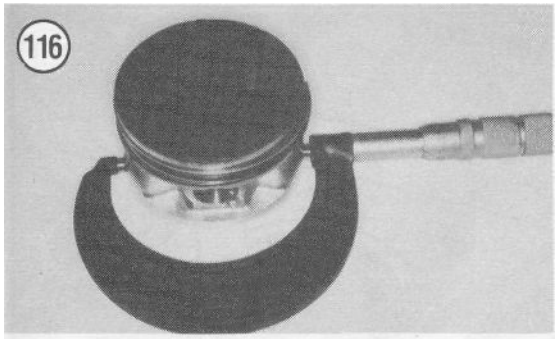


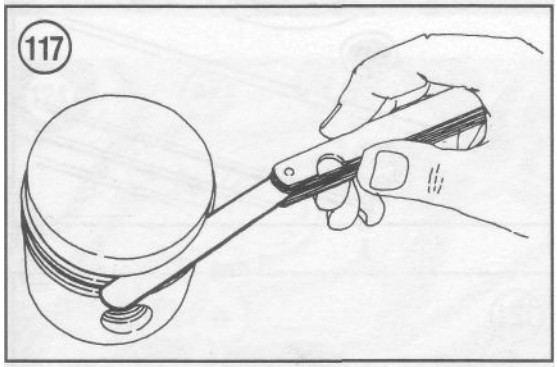


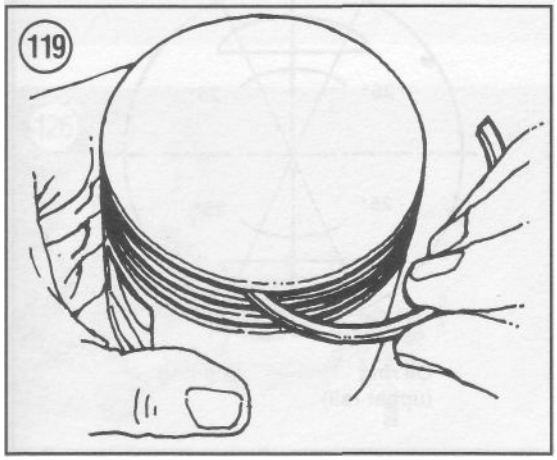












2. Measure the inside diameter of the cylinder bore at a point 1/2 in. (13 mm) from the upper edge with a bore gauge.

3. Measure the outside diameter of the piston across the skirt **(Figure 116)** at right angles to the piston pin. Measure at a distance 0.40 in. (10 mm) up from the bottom of the piston skirt.

4. Subtract the dimension of the piston from the cylinder dimension and compare to the dimension listed in **Table 1.** If clearance is excessive, the piston should be replaced and the cylinder should be re-bored to the next oversize. Purchase the new pistons first; measure its diameter and add the specified clearance to determine the proper cylinder bore diameter.

Piston Ring Removal/Installation

WARNING

The edges of all piston rings are very sharp. Be careful when handling them to avoid cutting fingers.

1. Measure the side clearance of each ring in its groove with a flat feeler gauge **(Figure 117)** and compare to dimensions given in **Table 1.** If the clearance is greater than specified, the rings must be replaced. If the clearance is still excessive with the new rings, the piston must also be replaced.

2. Remove the old rings with a ring expander tool or by spreading the ends with your thumbs just enough to slide the ring up over the piston **(Figure 118).** Repeat for the remaining rings.

3. Carefully remove all carbon buildup from the ring grooves with a broken piston ring **(Figure 119).**

4. Inspect the grooves carefully for burrs, nicks or broken and cracked lands. Recondition or replace the piston if necessary.

5. Check the end gap of each ring. To check the ring, insert the ring, one at a time, into the bottom of the cylinder bore and push it in about 5/8 in. (16 mm) with the crown of the piston to ensure that the ring is square in the cylinder bore. Measure the gap with a flat feeler gauge **(Figure 120)** and compare to dimensions in **Table 1.** If the gap is greater than specified, the rings should be replaced. When installing new rings, measure their end gap in the same manner as for old ones. If the gap is less than specified, carefully file the ends with a fine-cut file until the gap is correct.

NOTE

The oil control ring expander spacer is unmeasurable. If the oil control ring rails show wear, all 3 parts of the oil control ring should be replaced as a set.

6. Roll each ring around its piston groove as shown in Figure **121** to check for binding. Minor binding may be cleaned up with a fine-cut file.

NOTE

Install the compression rings with their markings facing up.

1. Install the piston rings—first, the bottom, then the middle, then the top ring—by carefully spreading the ends with your thumbs and slipping the rings over the top of the piston. Remember that the piston rings must be installed with the manufacturer's marks on them toward the top of the piston or there is the possibility of oil pumping past the rings.

8. Make sure the rings are seated completely in their grooves all the way around the piston and that the ends are distributed around the piston as shown in Figure **122.** The important thing is that the ring gaps are not aligned with each other when installed to prevent compression pressure from escaping.

9. If installing oversize compression rings, check the number to make sure the correct rings are being installed. The ring numbers should be the same as the piston oversize number.

10. If new rings were installed, measure the side clearance of each ring in its groove with a flat feeler gauge (Figure **117)** and compare to dimensions given in **Table 1.**

OIL PUMP

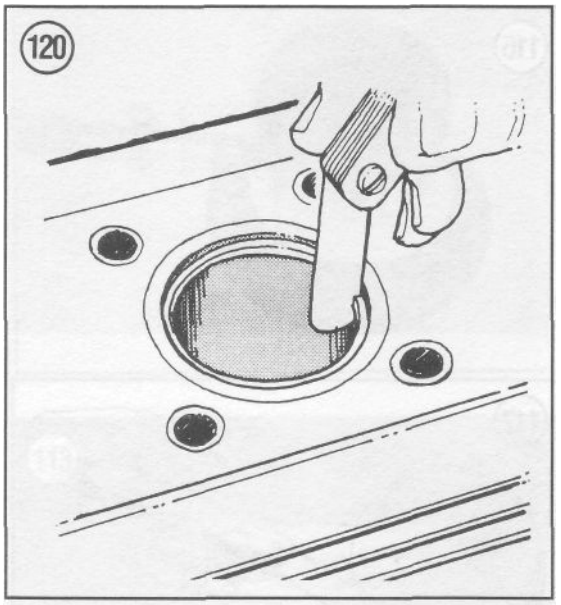
Removal/Installation

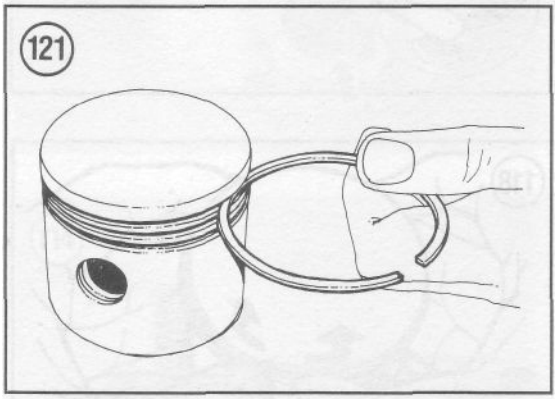
The oil pump can be removed with the engine mounted in the frame; this procedure is shown with the engine removed for clarity.

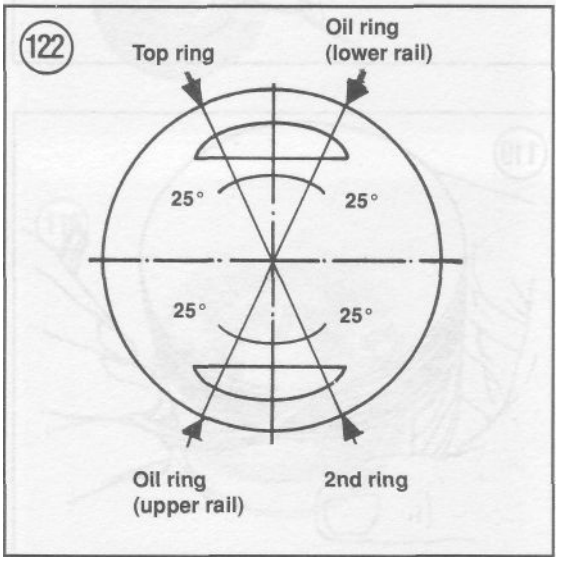
1. Remove the clutch assembly as described in Chapter Five in this section of the manual.

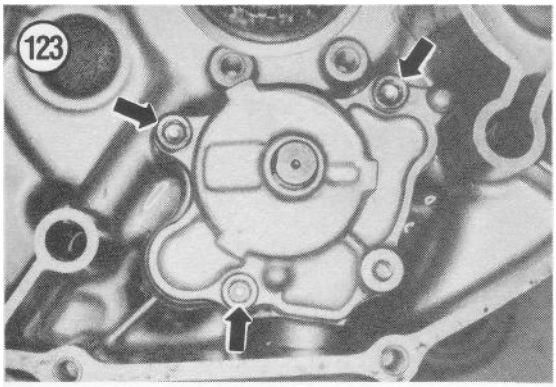
2. Remove the bolts (Figure 123) securing the oil pump to the crankcase and remove the oil pump assembly.

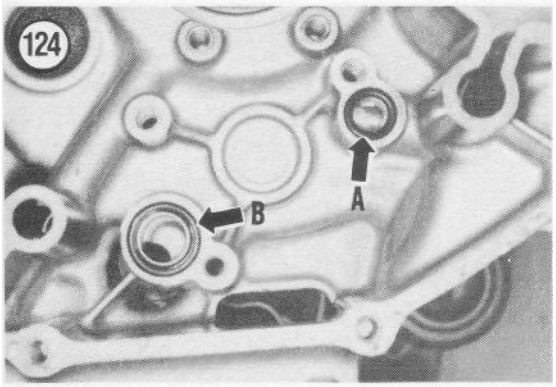
3. Remove the small O-ring (A, Figure 124) and the large locating dowel and O-ring (B, Figure **124)** from the crankcase.

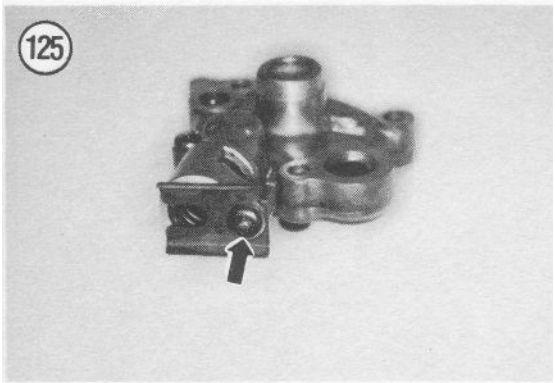


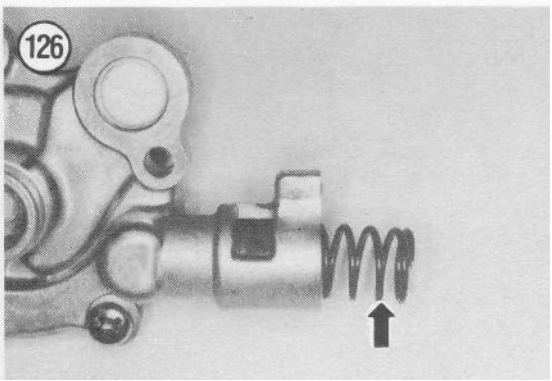












4. Install by reversing these removal steps while noting the following:

a. Install new O-nng seals.

b. Install the oil pump mounting bolts and tighten to the torque specification in **Table 2.**

Disassembly/Inspection/Assembly

There are no replacement parts for the oil pump except for the driven gear. If any part(s) is faulty or out of specification, replace the oil pump assembly.

1. Remove the screw and plate **(Figure** 125) securing the oil relief valve in place.

2. Remove the spring **(Figure 126)** and plunger from the oil pump assembly.

3. Remove the Phillips head screw **(Figure 127)** securing the pump cover to the body and remove the cover.

4. Remove the inner and outer rotors and the rotor shaft and dowel pin.

5. Clean all parts in solvent and thoroughly dry.

6. Inspect both rotors **(Figure 128)** for wear and abrasions. If worn or damaged, replace the oil pump assembly.

7. Inspect the oil pump body and cover for cracks **(Figure** 129). If worn or damaged, replace the oil pump assembly.

8. Inspect the teeth on the driven gear **(Figure 130).** Replace the driven gear if the teeth are damaged or any are missing.

9. Coat all parts with fresh engine oil prior to assembly.

10. Install the outer rotor into the oil pump body.

11. Using a flat feeler gauge measure the clearance between the outer rotor and the oil pump body **(Figure 131).** Compare to specifications listed in

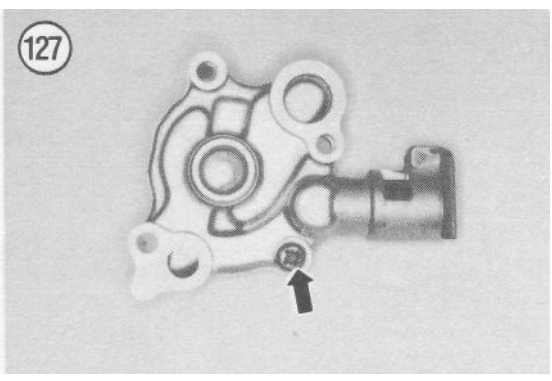


Table 1. If the clearance is worn to the service limit dimension or greater, replace the oil pump assembly.

12. Install the inner rotor into the outer rotor in oil pump body.

13. Using a flat feeler gauge measure the clearance between the inner rotor tip and the outer rotor **(Figure** 132). Compare to specifications listed in **Table 1.** If the clearance is worn to the service limit dimension or greater, replace the oil pump assembly.

14. Install the rotor shaft and dowel pin **(Figure 133)** into the cover.

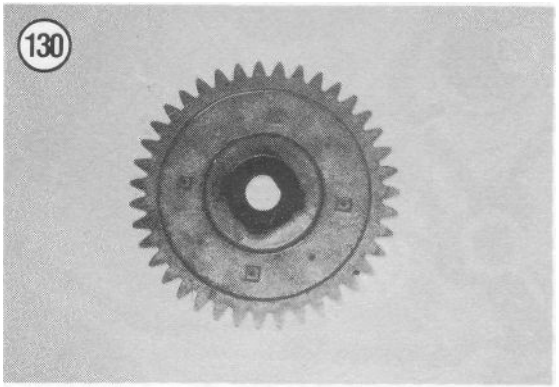
15. Position the inner rotor with the dowel pin groove facing down and install the inner rotor onto the dowel pin and cover **(Figure 134).**

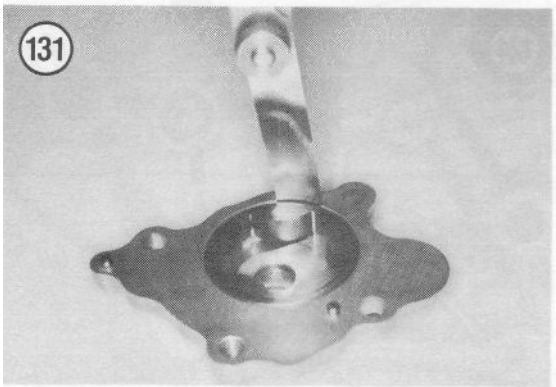
16. Install the outer rotor onto the inner rotor and align it onto the cover so the body can be installed.

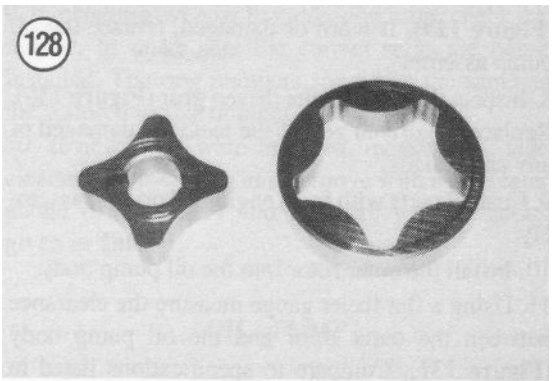
17. Install the body onto the cover and rotor assembly. Align the locating dimple and the recess **(Figure 135)** of the 2 parts and press them together.

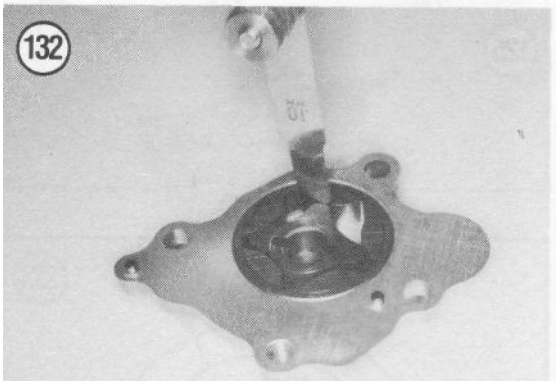
18. Install the Phillips head screw **(Figure 127)** securing the pump cover to the body and tighten securely.

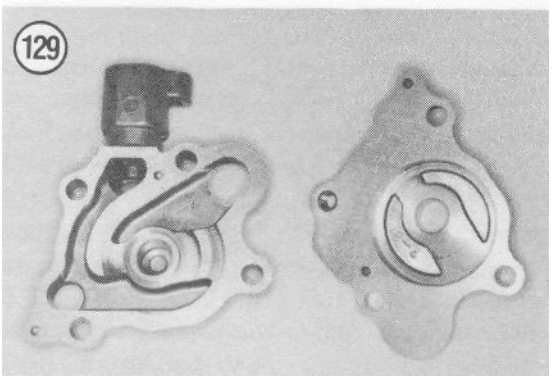
19. Install the plunger and the spring **(Figure 126)** into the oil pump assembly.

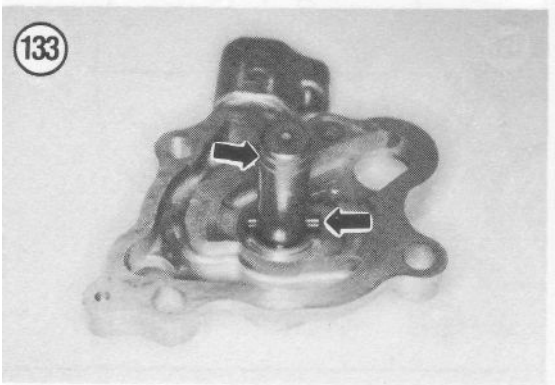


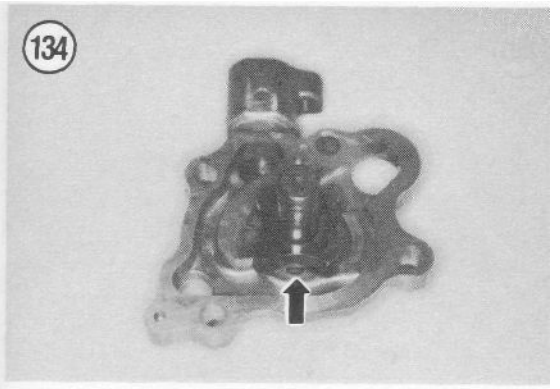


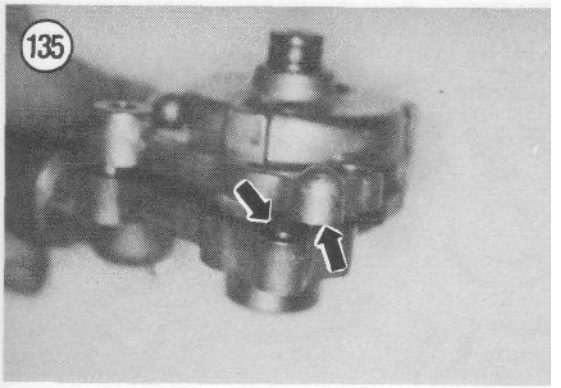


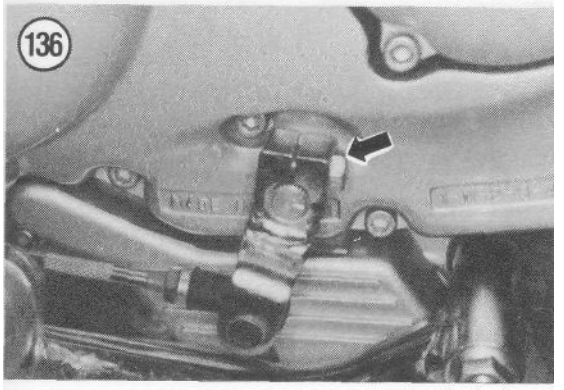


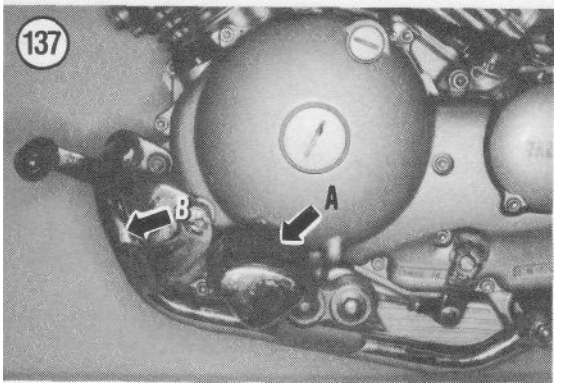












20. Install the plate and screw **(Figure 125)** securing the oil relief valve in place Tighten the screw securely.

OIL STRAINER

Removal/Inspection/Installation

The oil strainer can be removed with the engine mounted in the frame; this procedure is shown with the engine removed for clarity

1 Remove the bolt **(Figure 136)** securing the shift lever arm and slide it off the shift shaft

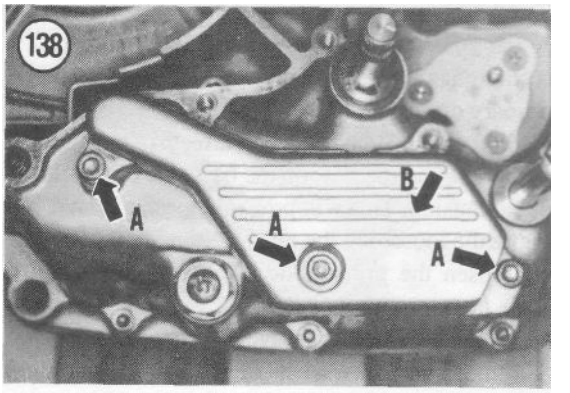
2. Remove the left-hand foot peg (A, **Figure 137)**

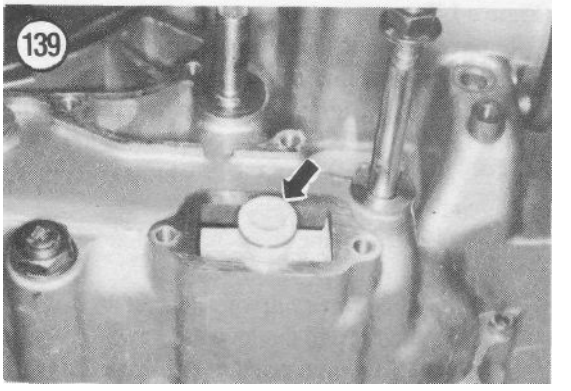
3. Remove the left-hand footrest bar assembly **(B, Figure 137)**

4 Remove the bolt (A, **Figure 138)** securing the oil strainer cover and remove the cover (B, **Figure 138).**

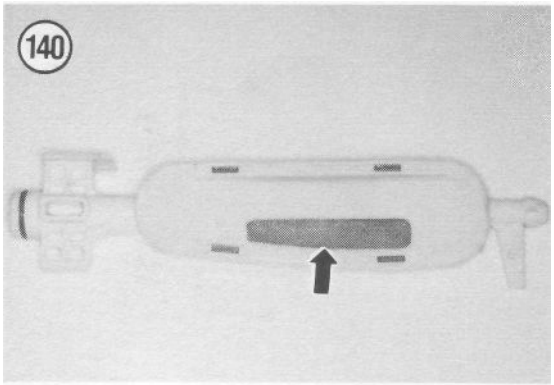
5 Withdraw the oil strainer **(Figure 139)** from the crankcase.

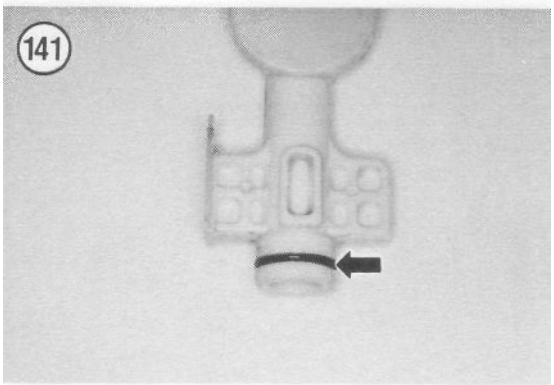
6. Clean the oil strainer and cover in solvent and dry with compressed air

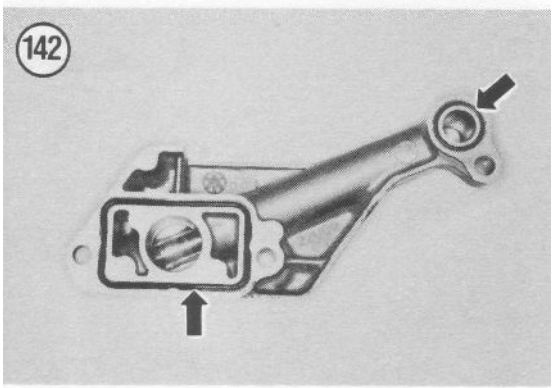


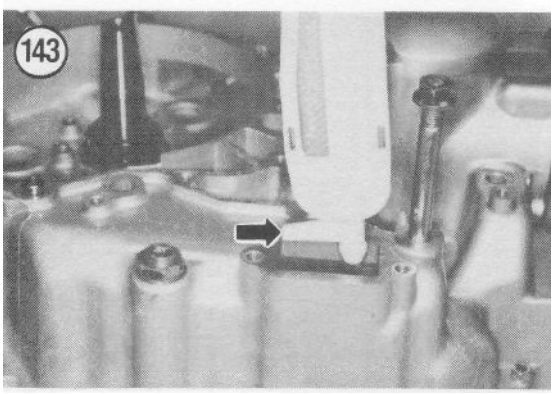


7. Inspect the screen **(Figure 140)** for any broken areas or small holes or damage. If the screen is damaged in any area, replace the strainer.
8. Inspect the O-ring seal **(Figure 141)** on the strainer for deterioration or damage. Replace if necessary.
9. Inspect the O-ring seals **(Figure 142)** on the strainer cover for deterioration or damage. Replace if necessary.
10. Install by reversing these removal steps, while noting the following:
   a. Position the oil strainer with the wing **(Figure 143)** pointing toward the front of the engine and install the strainer.
   b. Make sure all O-ring seals are in place and install the strainer cover. Install the bolts and tighten securely.





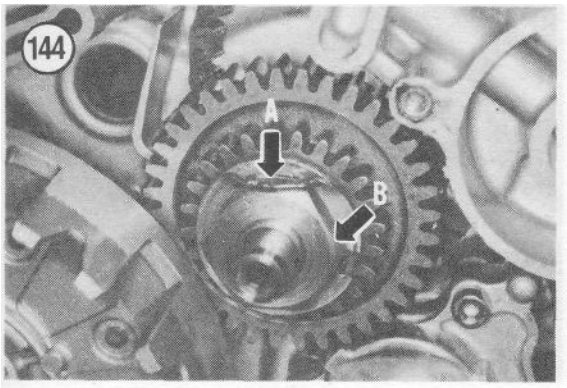




PRIMARY DRIVE GEAR

Removal/Installation

1. Remove the engine from the frame as described in this chapter.
2. Remove the clutch assembly as described in Chapter Five in this section of the manual.
3. Temporarily reinstall the clutch outer housing.
4. Straighten the locking tab (A, **Figure 144)** on the primary drive gear lockwasher.
5. Place a shop cloth between the teeth of the primary drive gear and the gear on the backside of the clutch outer housing. This will prevent the gear from rotating while loosening the nut.
6. Loosen the primary drive gear nut **(B, Figure 144),** then remove it.
7. Remove the primary drive gear nut.
8. Remove the lockwasher **(Figure** 145), the holding plate **(Figure 146)** and the oil pump dnve gear **(Figure 147).**
9. Remove the clutch outer housing **(Figure 148).**
10. Remove the primary drive gear **(Figure 149)** and the locating key **(Figure 150)** from the crankshaft.
11. Inspect the gears and holding plate **(Figure 151)** for wear or damage. If the gear teeth are worn or damaged they must be replaced.
12. Install by reversing these removal steps while noting the following:
   a. Install the primary drive gear first (A, **Figure 152),** then install the locating key (B, **Figure 152).** This eliminates the problem of the key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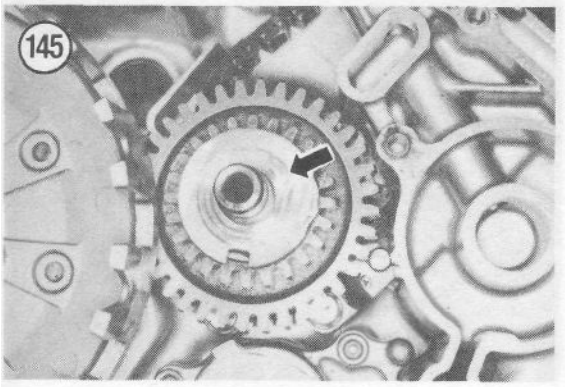
A
B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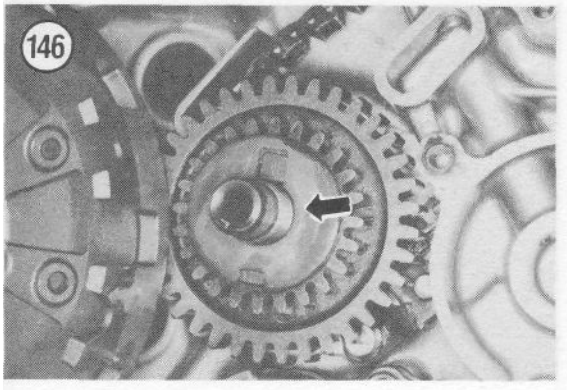
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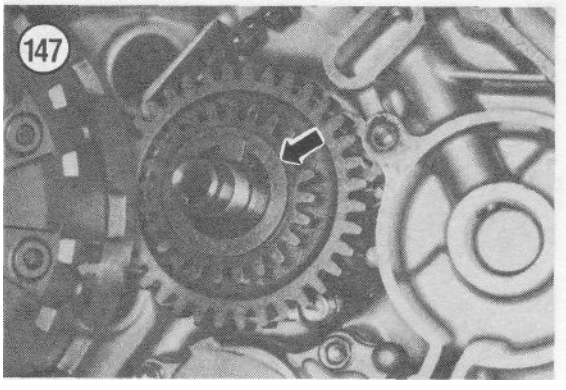
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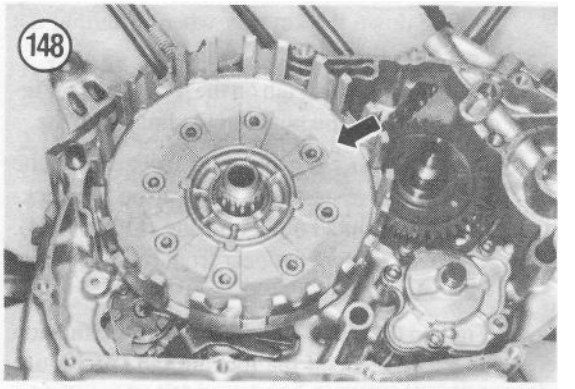
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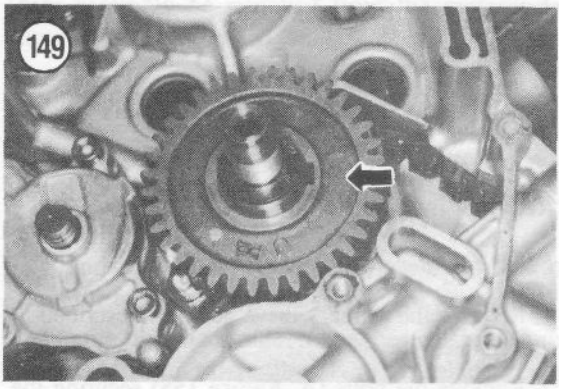
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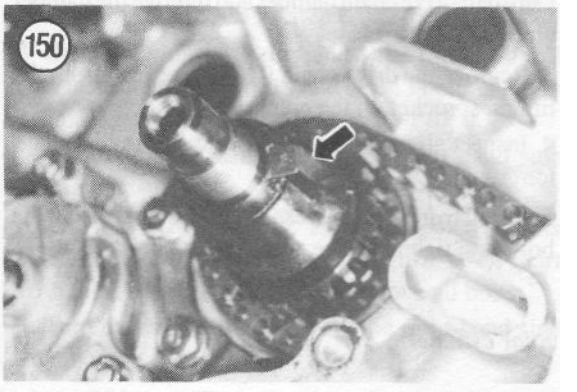
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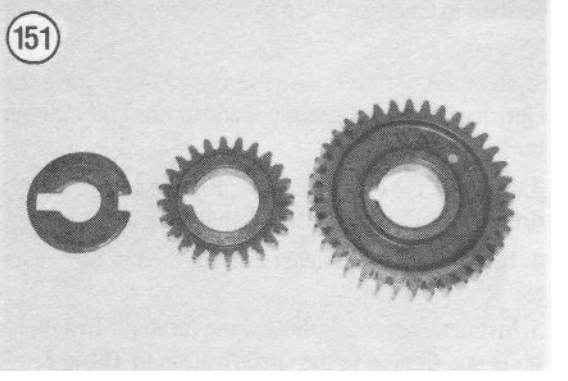

151

sliding down the keyway when installing the gear onto the shaft.

b. Install the locating tab on the lockwasher **(Figure 153)** into the notch in the holding plate.

c. Place a shop cloth between the teeth of the primary drive gear and the gear on the backside of the clutch outer housing **(Figure 154).** This will prevent the gear from rotatmg while loosening the nut.

d. Tighten the locknut to the torque specification in **Table 2.** Bend the locking tab (A, **Figure 144)** down against one of the flats on the primary drive gear.

CAMSHAFT DRIVE CHAIN AND DAMPER

Removal/Installation

***Front** cylinder*

1. Remove the primary drive gears as described in this chapter.

2. Remove the bolts (A, **Figure 155)** securing the camshaft drive chain damper and remove the damper unit (B, **Figure 155).**

3. Remove the drive chain (C, **Figure 155)** from the timing sprocket on the crankshaft.

4. Inspect all components as described in this chapter.

5. Install by reversing these removal steps. Install the bolts and tighten to the specification in **Table 2.**

Rear cylinder

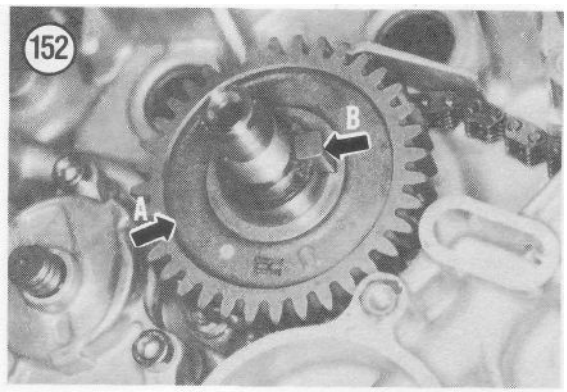
1. Remove the alternator rotor **(Figure 156)** as described in Chapter Seven in this section of the manual.

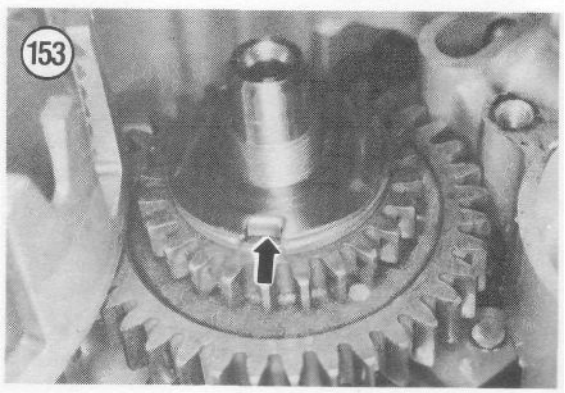
2 Remove the bolts (A, **Figure 157)** securing the camshaft drive chain damper and remove the damper unit (B, **Figure 157).**

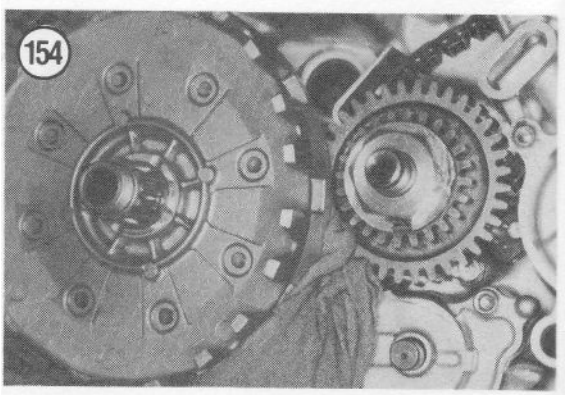
3. Remove the drive chain (C, **Figure 157)** from the timing sprocket on the crankshaft

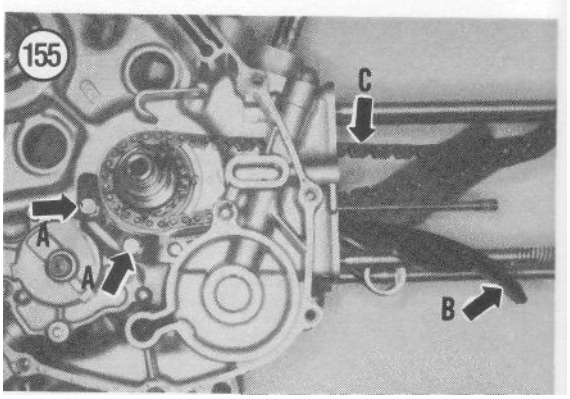
4 Inspect all components as described in this chapter.

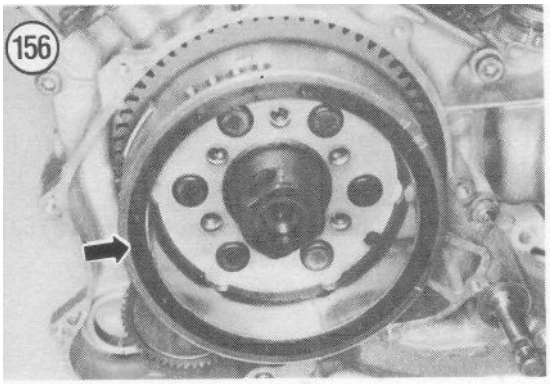
5. Install by reversing these removal steps. Install the bolts and tighten to the specification in **Table 2.**

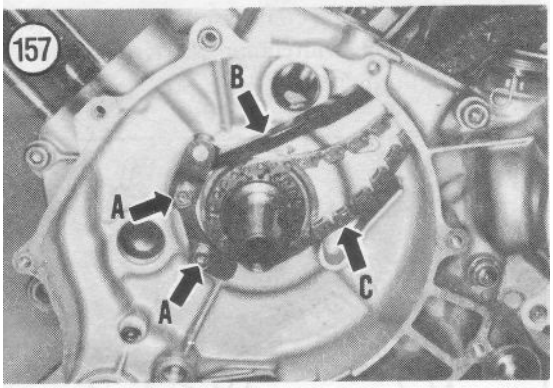


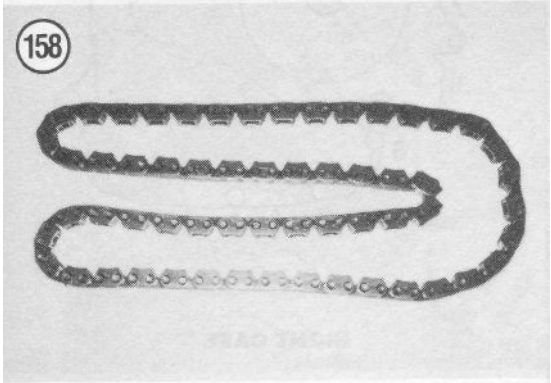


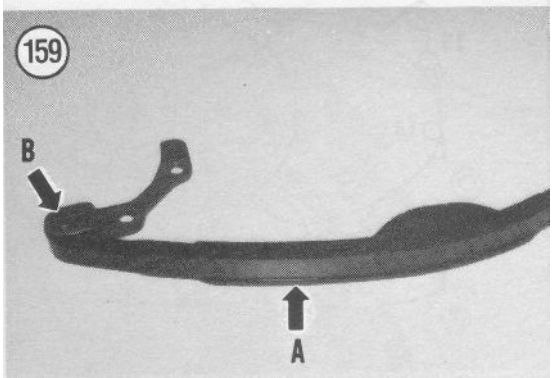












Inspection

1. Inspect the drive chain **(Figure 158)** for wear, stretching or link damage. Replace if necessary.

2. Inspect the damper unit sliding surface (A, **Figure 159)** for excessive wear or damage. Make sure the pivot point **(B, Figure 159)** moves freely. Replace if necessary.

CRANKCASE

Service to the lower end requires that the crankcase assembly be removed from the motorcycle frame and disassembled (split).

Disassembly

1. Remove the engine as described in this chapter. Remove all exterior assemblies from the crankcase. Set the engine on the workbench.

2. Remove the neutral indictor switch **(Figure 160)** from the exterior of the left-hand crankcase half.

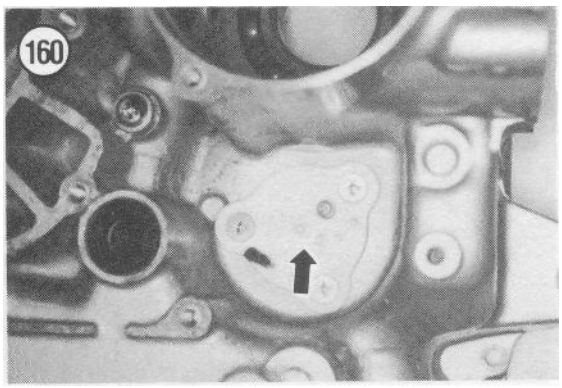
3. On the right-hand side, rotate the gearshift drum so the shift cam ramps align with the reliefs in the crankcase. This is necessary so the drum can pass through the crankcase in Step 8.

4. Starting with the right-hand side, loosen in 1/2 turn increments the No. 14 and No. 13 bolts **(Figure 161).** Remove the bolts.

5. Turn the crankcase over with the left-hand side facing up.

6. On the left-hand side, loosen numbered bolts (1-12) in 1/2 turn increments **(Figure 162).** Start with the highest number first. Remove all bolts.

7. Turn the crankcase over with the right-hand side facing up.



8. Carefully tap around the perimeter of the crankcase with a plastic mallet (do not use a metal hammer) to help separate the 2 case halves. Separate the case halves by pulling the right-hand crankcase up and off the left-hand case half.

9. After separating the crankcase halves, the transmission and crankshaft assemblies should stay with the left-hand crankcase. Check the right-hand crankcase to make sure no transmission shims are stuck to the bearings. If found, reinstall them immediately in their original positions.

10. Remove the 2 small dowel pins and the large O-ring and dowel pin from case halves.

11. Remove the transmission, shift forks and shift drum assemblies from the left-hand crankcase half as described in Chapter Five in this section of the manual.

12. Remove the crankshaft assembly as described in this chapter.

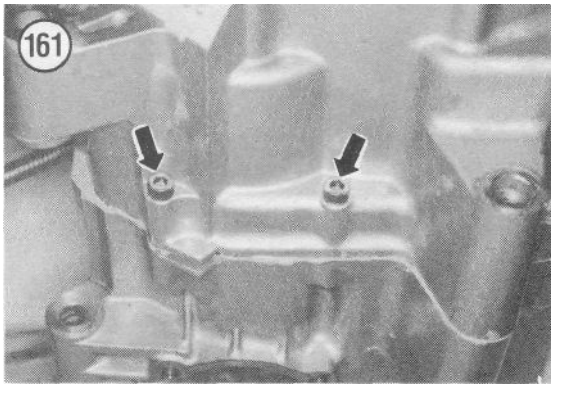
Inspection

1. Remove the screws **(Figure 163)** and remove the oil baffle plate from the right-hand case half.

2. Thoroughly clean the inside and outside of both crankcase halves with cleaning solvent. Dry with compressed air. Make sure there is no solvent residue left in the cases as it will contaminate the engine oil. Lubricate the bearings with oil to prevent rust formation.

3. Make sure all oil passages are clean; blow them out with compressed air.

4. Check the crankcases for cracks or other damage. Inspect the mating surfaces of both halves. They must be free of gouges, burrs or any damage that could cause an oil leak.



5. Make sure the crankcase studs are not bent and the threads are in good condition. Make sure they are screwed into the crankcase tightly.

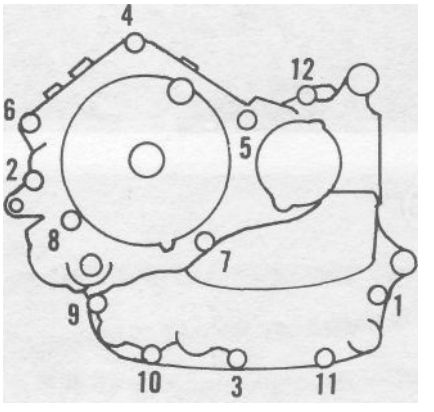
6. Inspect the crankcase bearings as described in this chapter.

7. Install the oil baffle and the screws **(Figure 163).** Tighten the screws securely.

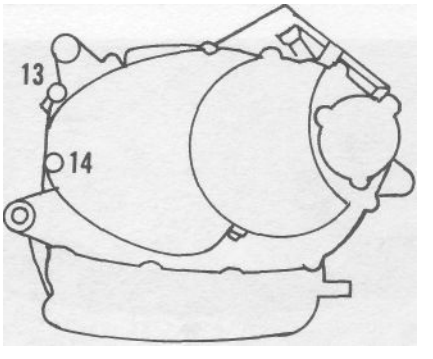
Crankcase Bearings Inspection/Replacement

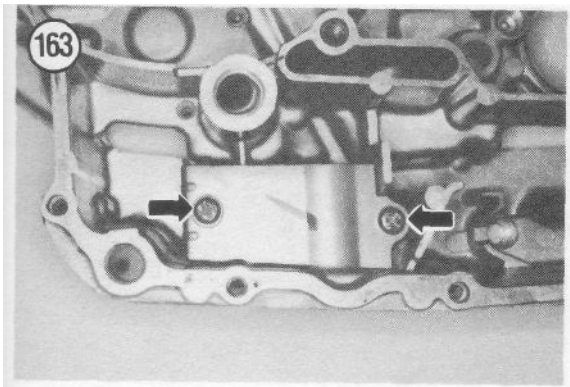
1. After cleaning the crankcase halves in cleaning solvent and drying with compressed air, lubricate the bearings with engine oil.

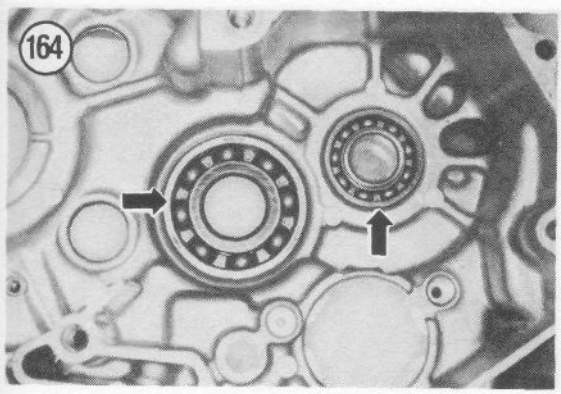
LEFT CASE

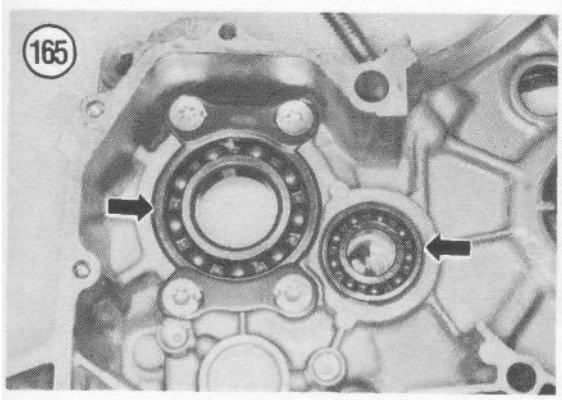


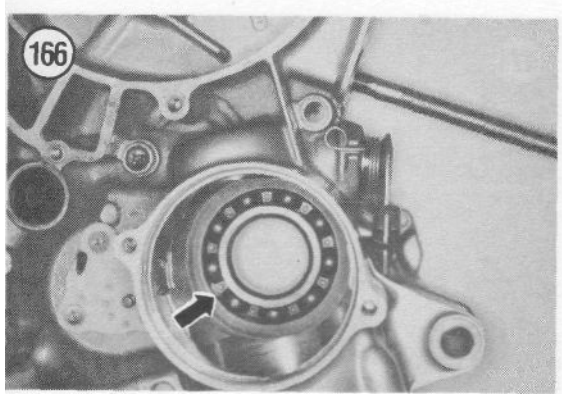
RIGHT CASE











2. Rotate the transmission and bearing inner race and check for play or roughness. Refer to **Figure 164** and **Figure 165.** Replace the bearing if it is noisy or if it does not spin smoothly.

3. Rotate the middle gear shaft bearing inner race **(Figure 166)** and check for play or roughness. Replace the bearing if it is noisy or if it does not spin smoothly.

4. To remove crankcase bearings, perform the following:

a. Heat the crankcase to approximately 205-257° F (95-125° C) in an oven or on a hot plate. Do not attempt bearing removal by heating the crankcases with a torch as this type of localized heating may warp the cases.

b. Wearing a pair of work gloves for protection, remove the case from the oven and place it on wood blocks for support. Drive out the bearing with a suitable size drift placed on the outside bearing race. A large socket works well for bearing removal.

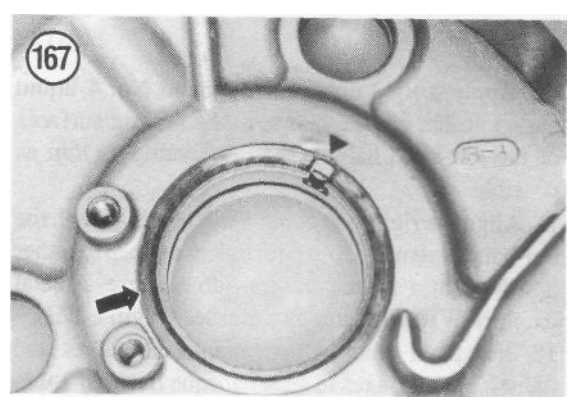
NOTE

*The main bearings are installed in a steel sleeve that is part ofthe crankcase **(Figure 167).** Special tools are required to remove and install these bearing and should be entrusted to a Yamaha dealer*

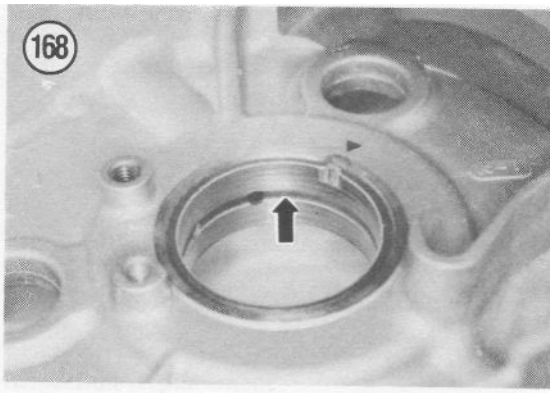
5. Inspect the crankshaft main bearings **(Figure 168)** for wear (bluish tint) or damage. Replace if necessary.

6. Before installing new bearings, clean the bearing housing and oil passages with solvent. Dry thoroughly with compressed air.

7. Install new crankcase bearings by reversing the removal steps, while noting the following:

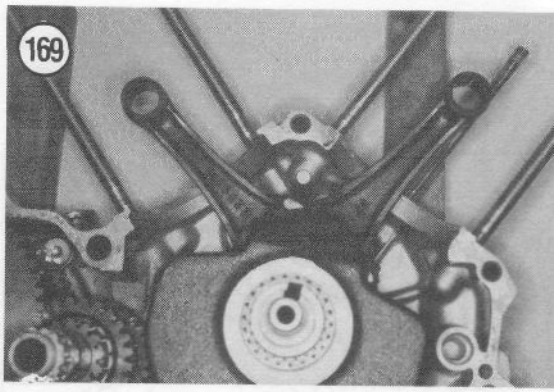


a. Installation of the bearings is made easier by first placing the bearings in a freezer for approximately 30 minutes. Then reheat the crankcase half and install the bearing by driving it squarely into position. If the bearing cocks in its bore, remove it and reinstall. It may be necessary to refreeze the bearing and reheat the case half.
b. Lubricate the bearing races with clean engine oil after installation.



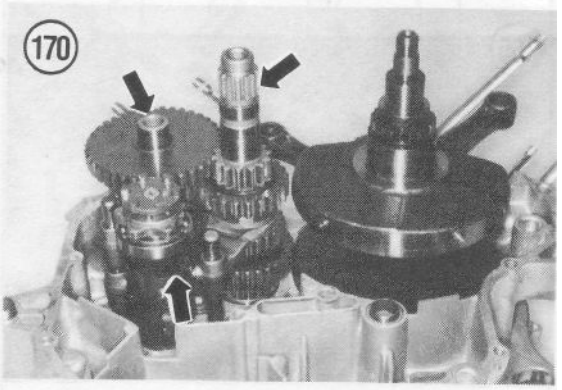
Assembly

1. Prior to installation of all parts, coat all parts with assembly oil or engine oil.
2. Install the crankshaft as described in this chapter. Make sure the connecting rods are positioned correctly within the piston opening **(Figure 169).**
3. Place the left-hand crankcase on wood blocks.
4. Install the shift drum, shift forks and transmission assemblies **(Figure 170)** as described in Chapter Five in this section of the manual.
5. Correctly align the gearshift drum so the shift cam ramps align with the reliefs in the right-hand crankcase. This is necessary so the drum can pass through the crankcase in Step 11.
6. Install the large O-ring and dowel pin **(Figure 171)** and the 2 small dowel pins **(Figure 172)** into the left-hand case half.
7. Apply oil to the transmission shafts and crankshaft bearing surfaces.
8. Clean the crankcase mating surfaces of both halves with aerosol electrical contact cleaner.
9. Make sure the case half sealing surfaces are perfectly clean and dry.

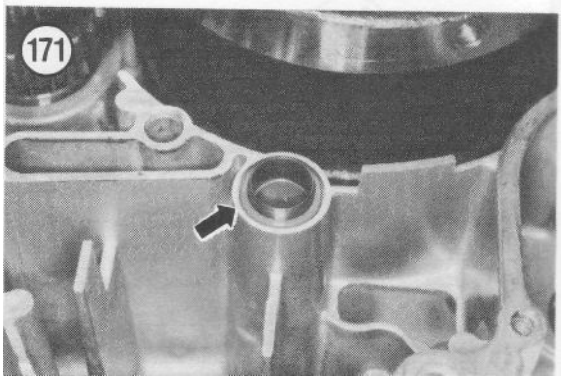


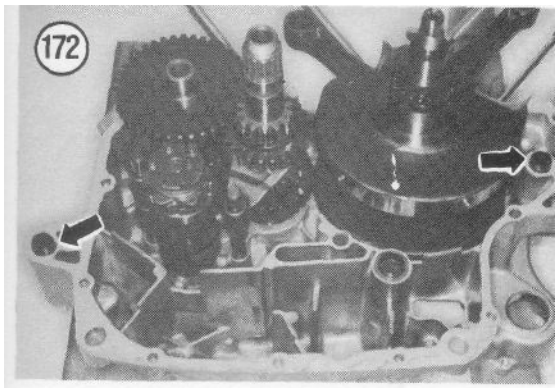
NOTE

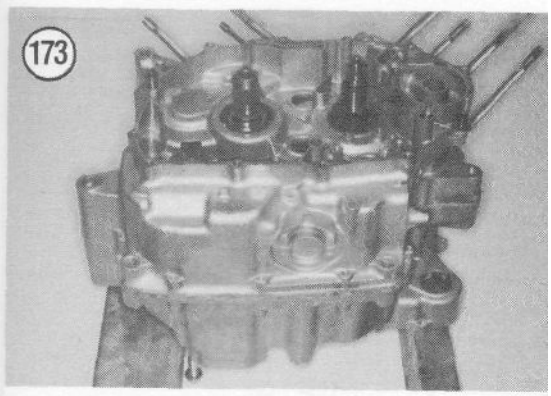
Always use the correct type of gasket sealer—avoid thick and hard-setting materials.

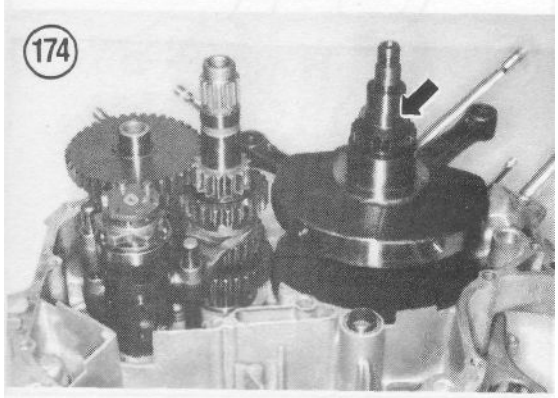


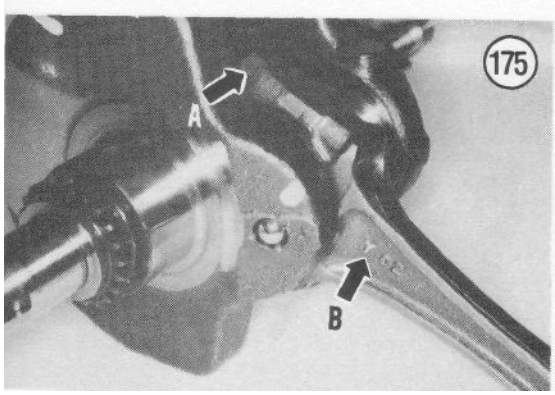
10. Apply a light coat of Yamabond No. 4 liquid gasket sealer, or equivalent, to the sealing surfaces of the left-hand half. Make the coating as thin as possible.
11. Align the right-hand crankcase bearings with the left-hand assembly. Join both halves and tap together lightly with a plastic mallet—do not use a metal hammer as it will damage the cases **(Figure 173).**
12. Install all bolts in both crankcase halves and tighten in two stages to a final torque listed in **Table**











2 Tighten bolts in the correct sequence starting with the lowest number first **(Figure 162)**

13 Install all engine assemblies that were removed

14 Install the engine as described in this chapter

CRANKSHAFT AND CONNECTING RODS

Removal/Installation

1 Split the crankcase as described in this chapter

2 Remove the crankshaft assembly **(Figure 174)** from the left-hand crankcase half

3 Remove the connecting rod cap bolt nuts (A, **Figure 175)** and separate the rods from the crankshaft

4 Mark each rod and cap **(Figure 176)** as a set Also mark them with a "F" (front) and "R" (rear) to indicate from what cylinder they were removed

5 Mark each rod cap and bearing insert so that they can be reinstalled in their original position

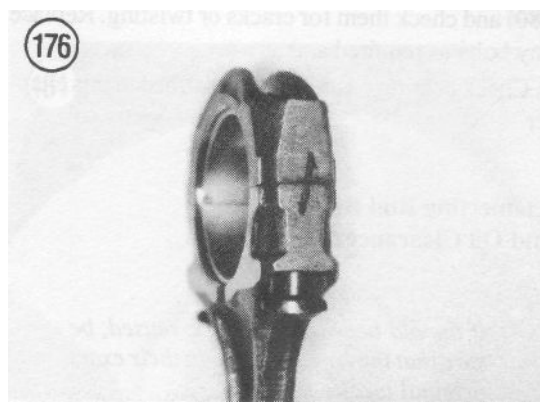
6 Install by reversing these removal steps while noting the following

a Install the bearing inserts into each connecting rod and cap Make sure they are locked in place correctly

CAUTION

If the old bearings are reused, be sure they are installed in their exact original positions

b Lubricate the bearings and crankpins with assembly oil and install the rods so that the letter **"Y" (B, Figure 175)** on each rod faces the tapered end of the crankshaft Apply molybdenum disulfide grease to the threads of the

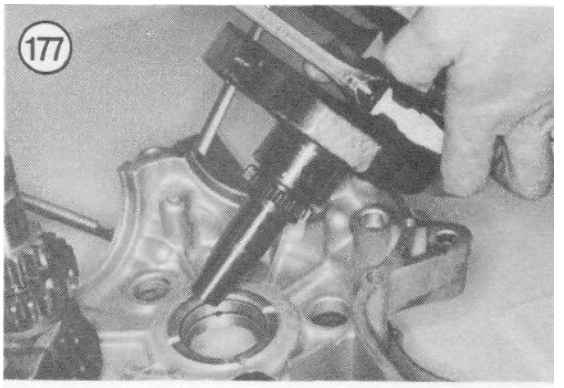


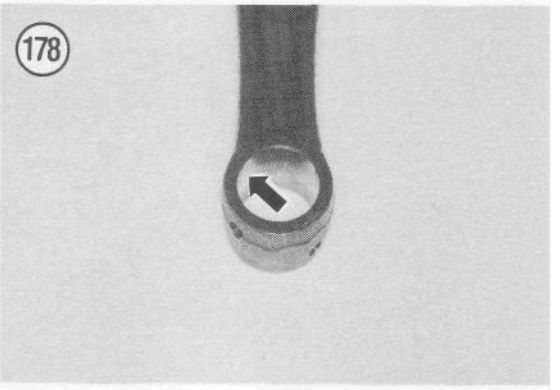
connecting rod bolts. Install the caps and tighten the cap nuts evenly, in a couple of steps, to the torque specification listed in **Table 2.**

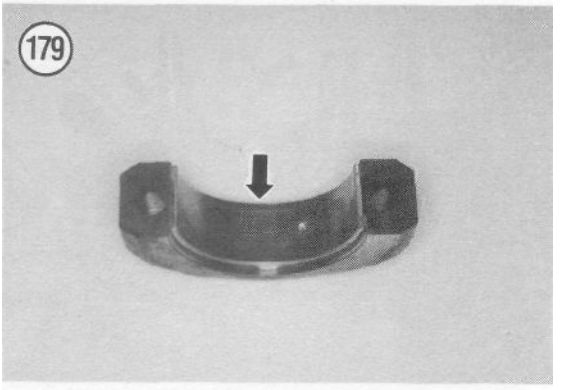
CAUTION

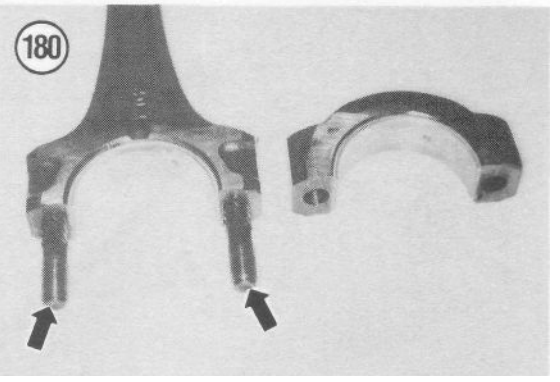
On the final tightening sequence, if a torque of 22 ft.-Ib. (32 N>m) is reached, do not stop tightening until the final torque value is achieved. If the tightening is interrupted between 22-25 ft.-Ib. (32-36 N.m), loosen the nut to less than 22 ft.-lb. (32 N.m) and tighten to the final torque value in one step.

1. Position the crankshaft with the tapered end going into the left-hand crankcase **(Figure 177)** and install the crankshaft in the left-hand crankcase bearing. When installing the crankshaft, align the front and rear connecting rods with their respective cylinder position **(Figure 169).** Continue to check this alignment until the crankshaft is completely installed.









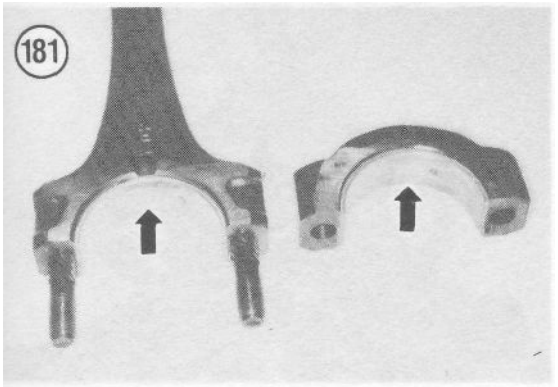
Connecting Rod Inspection

1. Check each rod for obvious damage such as cracks and burns.
2. Check the piston pin bushing **(Figure 178)** for wear or scoring.
3. Take the rods to a machine shop and have them checked for twisting and bending.
4. Examine the bearing inserts **(Figure 179)** for wear, scoring or burning. They are reusable if in good condition. Make a note of the bearing size (if any) stamped on the back of the insert if the bearing is to be discarded; a previous owner may have used undersize bearings.
5. Remove the connecting rod bearing bolts **(Figure 180)** and check them for cracks or twisting. Replace any bolts as required and as a set.
6. Check bearing clearance as described in this chapter.

Connecting Rod Bearing and Oil Clearance Measurement

CAUTION

If the old bearings are to be reused, be sure that they are installed in their exact original locations.

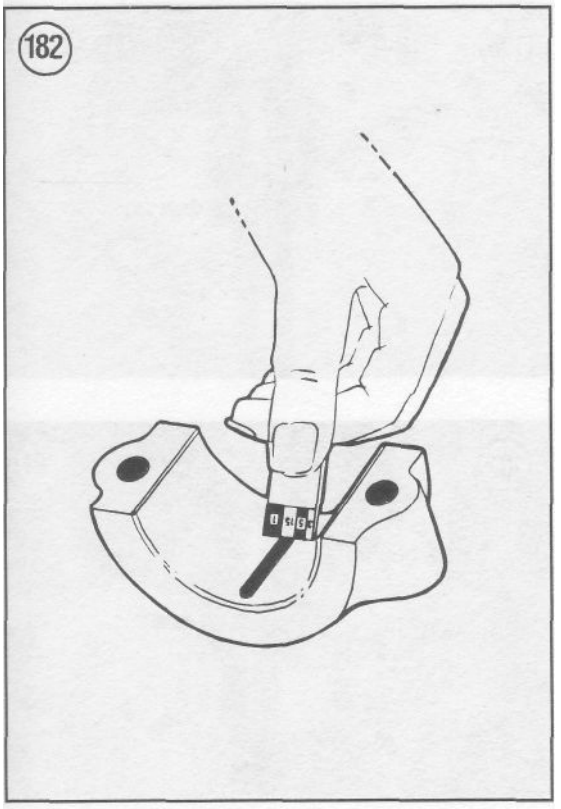


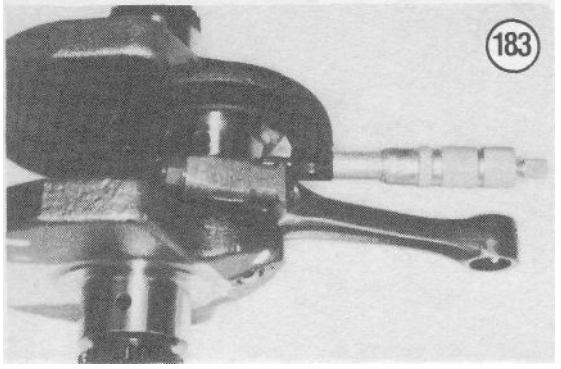
1. Wipe bearing inserts and crankpins clean. Install bearing inserts in rod and cap **(Figure 181).**
2. Place a piece of Plastigage on one crankpin parallel to the crankshaft.
3. Install rod, cap and nuts, then tighten the nuts to 25 ft.-lb. (36 N.m).

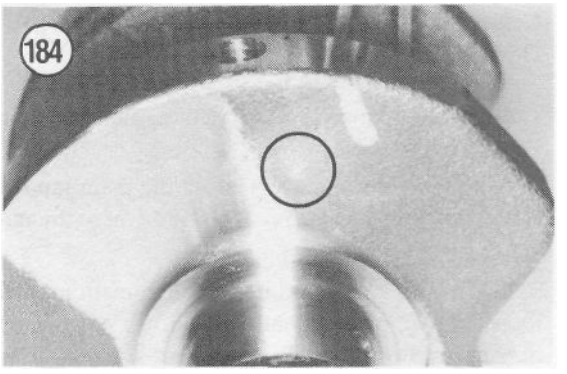
CAUTION

Do not rotate crankshaft while Plastigage is in place.

4. Remove nuts and the rod cap.
5. Measure width of flattened Plastigage according to the manufacturer's instructions **(Figure 182).** Measure at both ends of the strip. A difference of 0.001 in. (0.025 mm) or more indicates a tapered crankpin; the crankshaft must be reground or replaced. Use a micrometer and measure the crankpin OD **(Figure 183)** to get an exact journal dimension.
6. If the crankpin taper is within tolerance, measure the bearing clearance with the same strip of Plastigage. Correct bearing clearance is specified in **Table 1.** Remove Plastigage strips.
7. If the bearing clearance is greater than specified, use the following steps for new bearing selection.
8. The connecting rods and caps are marked with a No. 4 or No. 5.
9. The crankshaft is marked on the left-hand counterbalancer with a set of 2 numbers **(Figure 184).** The numbers relate to the crankshaft connecting rod journals, reading from left to right.
10. To select the proper bearing insert number, subtract the crankshaft connecting rod journal number (Step 9) from the connecting rod and cap number (Step 8). For example, if the connecting rod and cap number is 4 and the crankshaft connecting rod journal is 2,4 - 2 = 2. The new bearing insert should be coded 2.







11. After new bearings have been installed, recheck clearance with Plastigage. If the clearance is out of specifications, either the connecting rod or the crankshaft is worn beyond the service limit. Refer the engine to a dealer or qualified specialist.

Connecting Rod Side Clearance Measurement

1. With both connecting rods attached to the crankshaft, insert a flat feeler gauge between the counterweight and the connecting rod big end **(Figure 185).**

2. The specified side clearance is listed in **Table 1.**

3. If the clearance is out of specification, either the connecting rod or the crankshaft is worn beyond the service limit. Refer the engine to a dealer or qualified specialist.

Crankshaft Inspection

1. Clean crankshaft thoroughly with solvent. Clean oil holes with rifle cleaning brushes; flush thoroughly and dry with compressed air. Lightly oil all oil journal surfaces immediately to prevent rust.

2. If the surface on all journals is satisfactory, take the crankshaft to your dealer or local machine shop. They can check out-of-roundness, taper and wear on the journals. They can also check crankshaft alignment and inspect for cracks. Check against measurements given in **Table 1.**

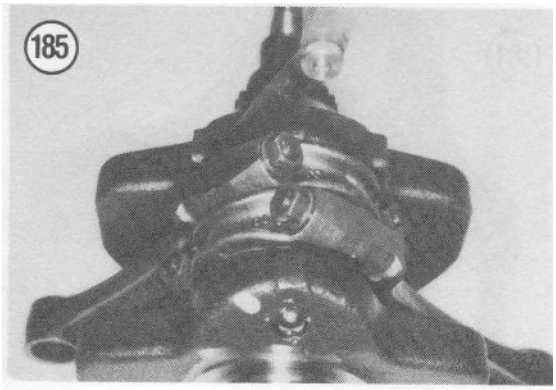
3. Inspect the cam chain sprockets at each end. Refer to **Figure 186** and **Figure 187.** If they are worn or damaged, the crankshaft will have to be replaced. Also inspect the condition of both chains; replace if necessary.

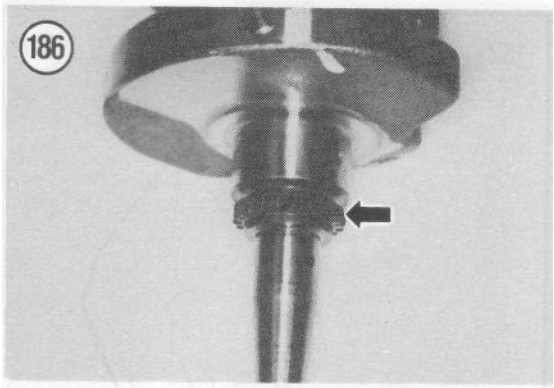
Crankshaft Bearing and Oil Clearance Measurement

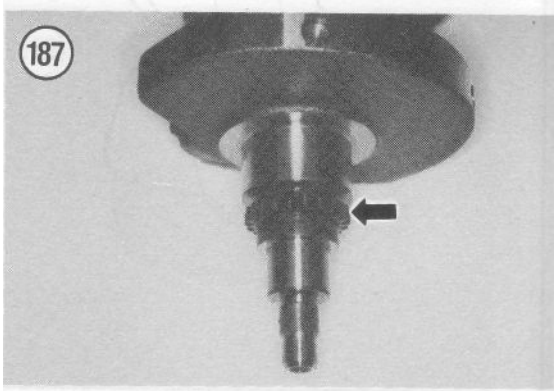
1. Wipe bearing inserts in the crankcase and the main bearing journals clean.

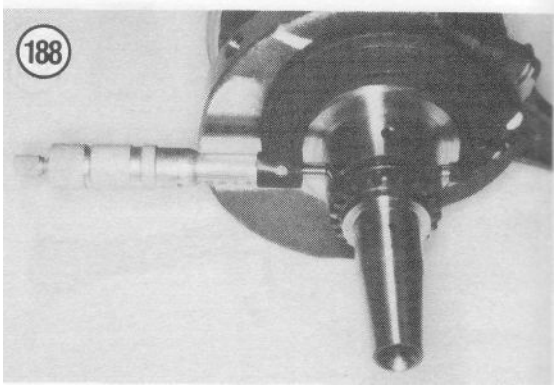
2. Use a micrometer and measure the main journal **OD (Figure 188)** at two places. Write these dimensions down.

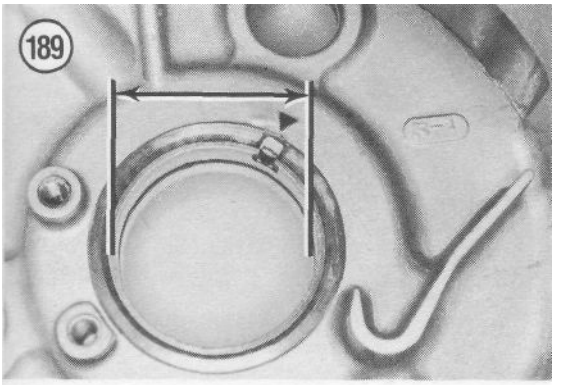
3. Use a bore gauge and measure the main journal insert **ID (Figure 189)** at two places. Write these dimensions down.

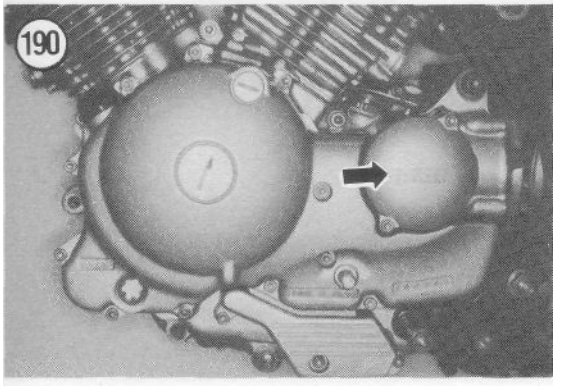


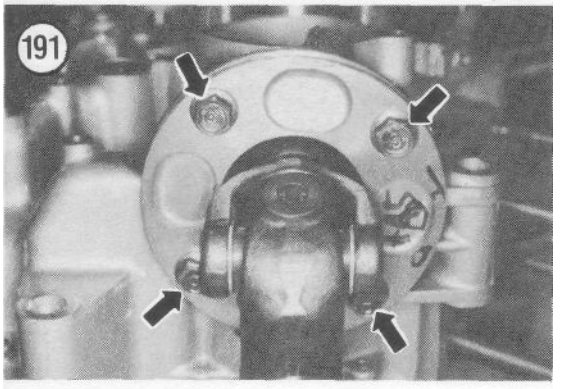


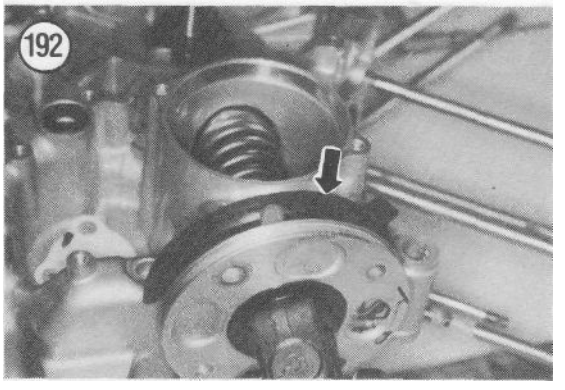












4. To select the proper bearing insert number, subtract the crankshaft OD (Step 2) from the main journal insert ID (Step 3).

5. The oil clearance specification is listed in **Table 1.** If the clearance is out of specifications, either the crankshaft or the bearing insert is worn beyond the service limit. Refer the engine to a dealer or qualified specialist.

MIDDLE DRIVE GEAR

Removal/Installation

1. Remove the bolts securing the middle drive gear cover **(Figure 190)** and remove the cover and O-ring gasket.

2. Remove the engine from the frame as described in this chapter.

3. Remove the bolts **(Figure 191)** securing the middle driven gear bearing housing.

4. Remove the bearing housing and shims from the crankcase. Note the location and number of shims **(Figure 192).** They must be reinstalled in the same location.

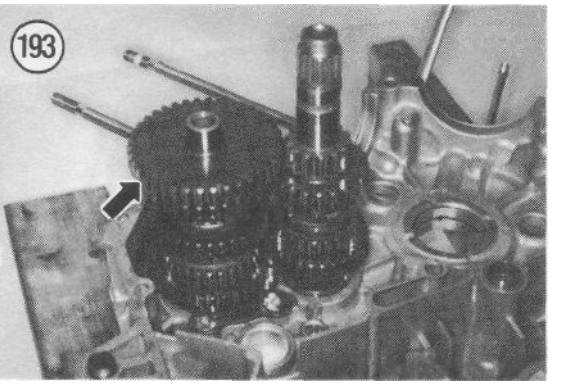
5. Separate the crankcase as described in this chapter. Do not remove the transmission shaft assemblies.

6. Unstake the nut securing the middle drive gear.

7. Remove the first gear **(Figure 193)** from the transmission drive shaft.

8. Install the "Grabbit," or equivalent onto the transmission drive shaft forth gear **(Figure 194)** this will keep the transmission shaft from rotating while loosening the middle drive gear nut.

9. Loosen, then remove the middle drive gear nut (A, **Figure 195).**



10. Remove the middle drive gear (B, **Figure 195)** and if necessary, remove the transmission drive shaft as described in Chapter Five.

11. Inspect the components as described in this chapter.

12. Install by reversing these removal steps while noting the following:

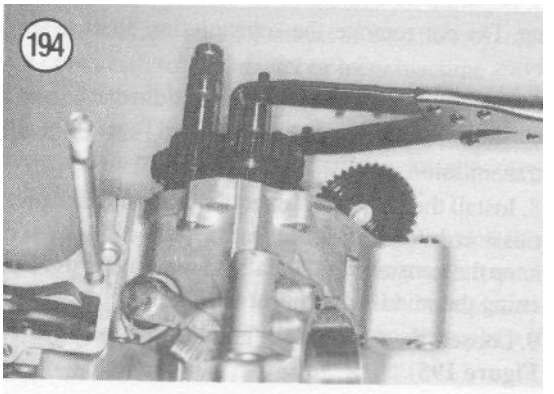
a. Be sure to install the same number of shims and in the same location **(Figure 192)** as noted during removal.

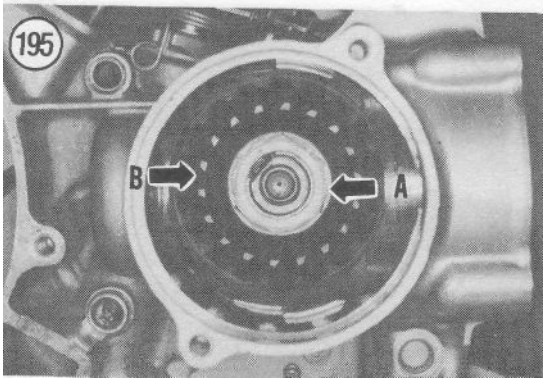
b. Use the same tool set-up used during removal **(Figure 196)** to keep the transmission shaft from rotating while tightening the middle drive gear nut. Tighten the drive gear nut to the torque specification in **Table 2.**

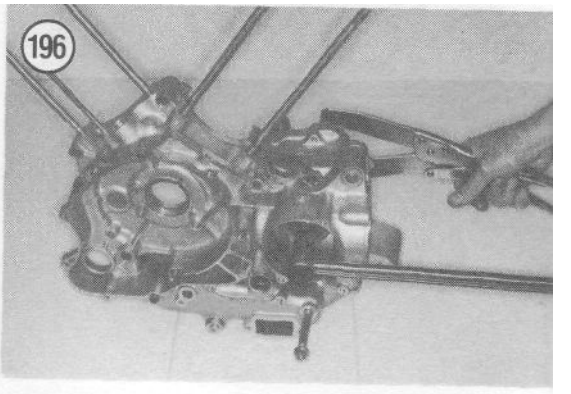
c. Stake the nut securing the middle drive gear.

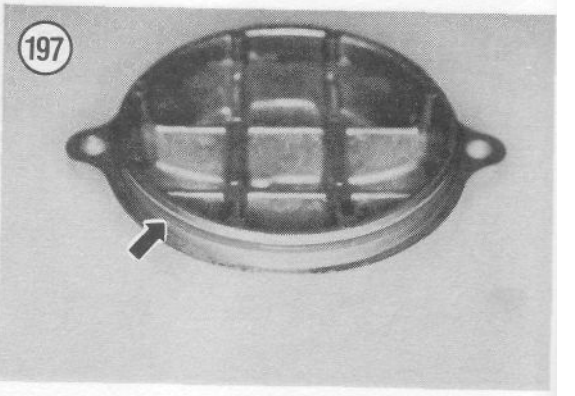
d. Tighten the middle driven gear bearing housing bolts to the torque specification in **Table 2.**

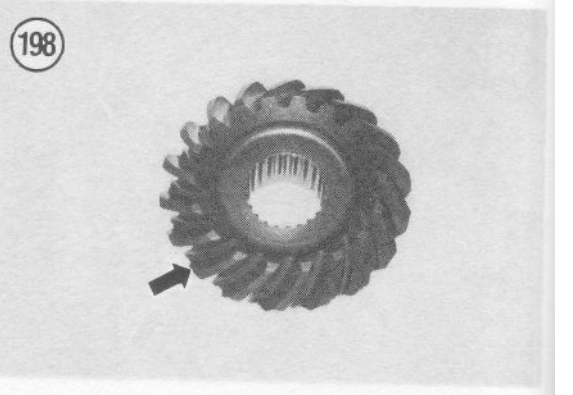
e. Make sure the O-ring seal **(Figure 197)** is in place on the middle drive gear cover. Install the cover and tighten the screws securely.

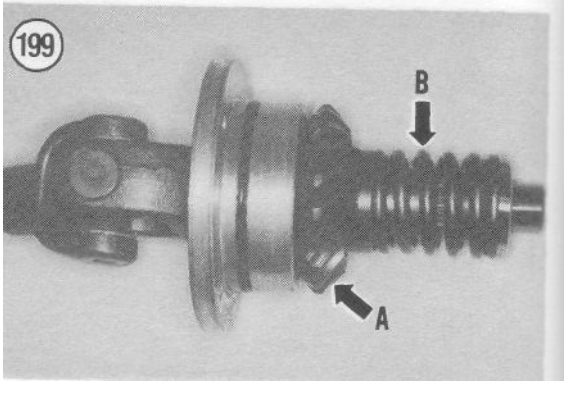


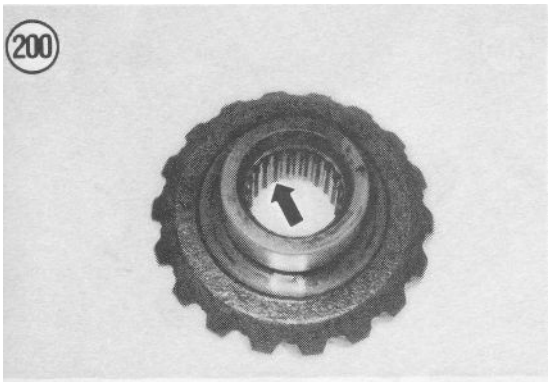


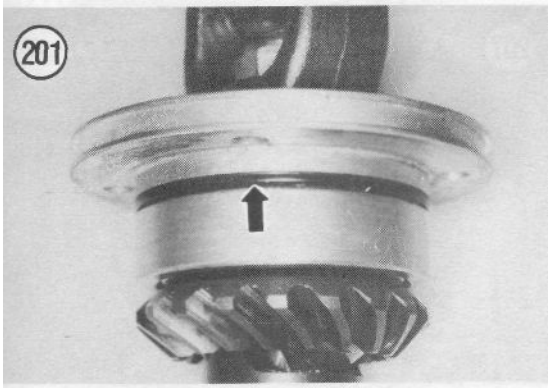


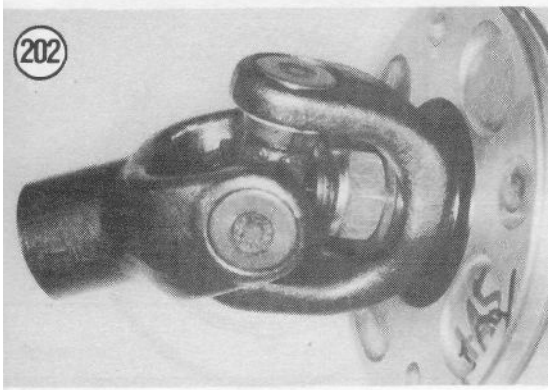


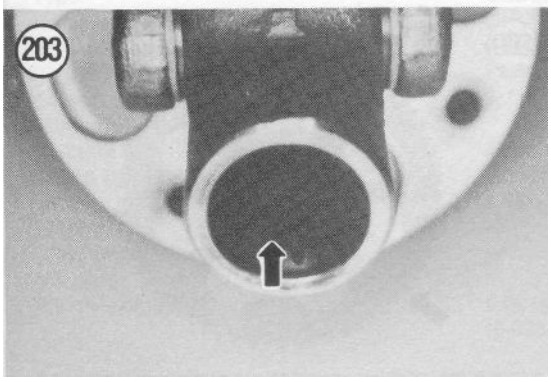












Inspection

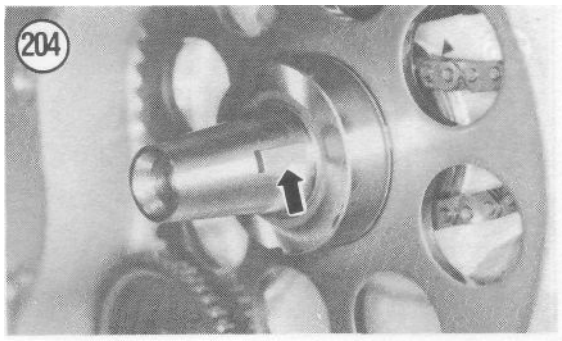
Special tools are required to disassemble the driven shaft assembly. Refer this type of work to a Yamaha dealer or competent machine shop.

1. Inspect for chipped or missing teeth on the middle drive **(Figure 198)** and the driven gear (A, **Figure 199).** If either gear is damaged, both the drive and driven gears must be replaced as a set.
2. Inspect the drive gear inner splines **(Figure 200)** for wear or damage. If damaged, both the drive and driven gears must be replaced as a set.
3. Inspect the spring (B, **Figure 199)** for wear, cracks or damage and replace if necessary.
4. Inspect the O-ring seal **(Figure 201)** for deterioration or hardness. Replace if necessary.
5. Move the universal joint **(Figure** 202) back and forth and pull in and out on it. Check for looseness or stiffness, replace if necessary.
6. Inspect the universal joint inner splines **(Figure 203)** for wear or damage. If the splines are damaged, also check the outer splines on the drive shaft for damage. Replace the universal joint if necessary.

STARTER CLUTCH AND REDUCTION GEARS

Removal/Installation

1. Remove the alternator rotor **(Figure** 156) as described in Chapter Seven in this section of the manual.
2. Remove the Woodruff key **(Figure** 204) from the crankshaft.
3. Remove the starter idler gear No. 1 **(Figure** 205) and shaft **(Figure** 206).
4. Slide the idler gear No. 2 **(Figure** 207) from the crankshaft.



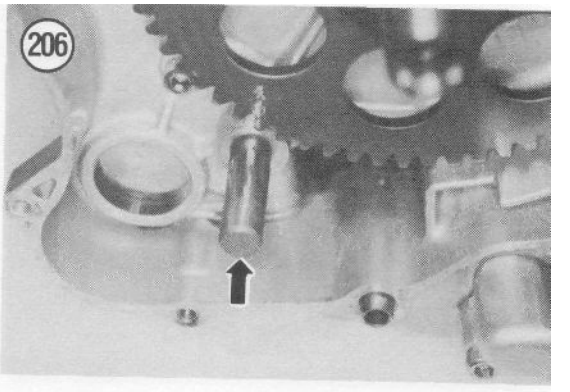
5. If necessary, remove the Allen bolts **(Figure 208)** securmg the starter clutch assembly to the backside of the alternator rotor and remove the assembly.

6. Inspect the components as described in this chapter.

7. Install by reversing these removal steps while noting the following:.

a. If removed, apply red Loctite (No. 271) to the bolts prior to installation.

b. Install the bolts and tighten to the specification in **Table 2.**



Inspection

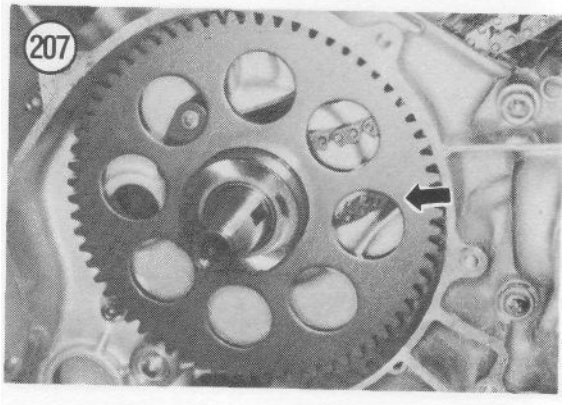
1. Inspect for chipped or missing teeth on the starter idler gear No. 2 **(Figure 209)** and on the starter idler gear No. 1 (A, **Figure 210).** Replace either gear if necessary.

2. Inspect the starter idler No. 1 shaft **(B, Figure 210)** for wear or cvmage. Replace if necessary.

3. Inspect thr area **(Figure 211)** in the idler gear No. 2 where it rides on the crankshaft for wear or galling. Replace the gear if any damage is evident.

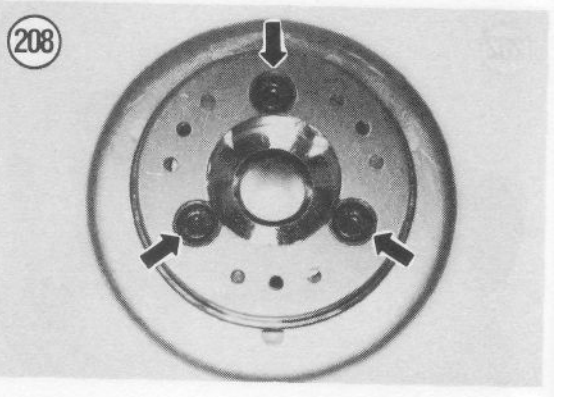
4. Inspect the roller riding surface of the starter idler gear No. 2 for wear or abrasion. Replace the gear if any damage is evident.

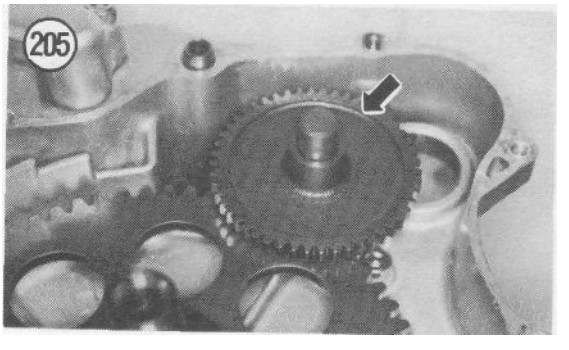
5. Check the rollers **(Figure 212)** in the starter clutch for uneven or excessive wear. Replace as a set if any are bad. If damaged, remove the rollers, springs and plungers.

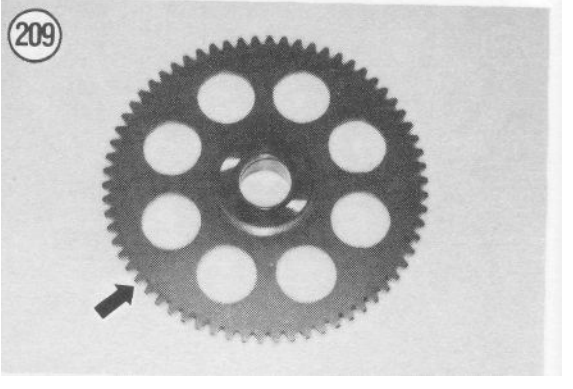


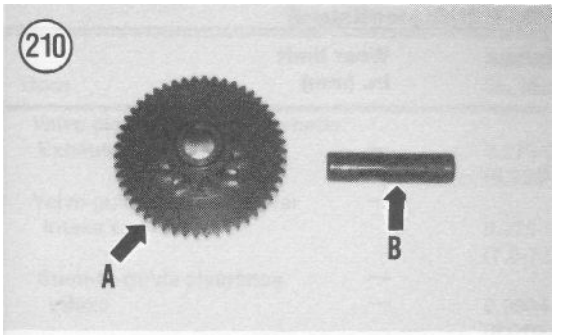
BREAK-IN

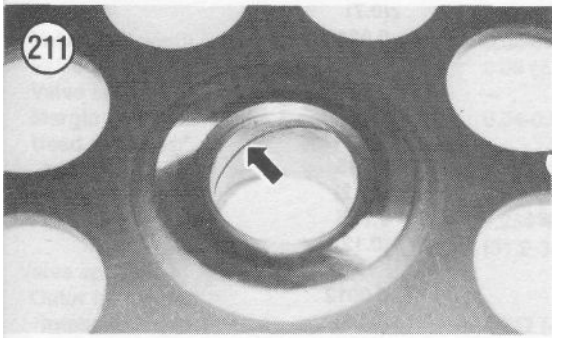
Following cylinder servicing (boring, honing, new rings, etc.) and major lower end work, the engine should be broken in just as if it were new. The performance and service life of the engine depends greatly on a careful and sensible break-in. For the first 500 miles, no more than one-third throttle

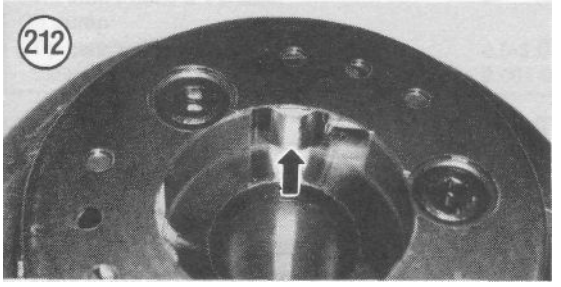












should be used and speed should be varied as much as possible within the one-third throttle limit. Prolonged, steady running at one speed, no matter how moderate, is to be avoided, as is hard acceleration.

Following the 500-mile service, increasingly more throttle can be used but full throttle should not be used until the motorcycle has covered at least 1,000 miles and then it should be limited to short bursts until 1,500 miles have been logged.

The mono-grade oils recommended for break-in and normal use provide a superior bedding pattern for rings and cylinders than do multi-grade oils. As a result, piston ring and cylinder bore life are greatly increased. During this period, oil consumption will be higher than normal. It is therefore important to frequently check and correct the oil level. At no time, during break-in or later, should the oil level be allowed to drop below the bottom line on the inspection window; if the oil level is low, the oil will become overheated resulting in insufficient lubrication and increased wear.

500-Mile Service

It is essential that the oil and filter be changed after the first 500 miles. In addition, it is a good idea to change the oil and filter at the completion of break-in (about 1,500 miles) to ensure that all of the particles produced during break-in are removed from the lubrication system. The small added expense may be considered a smart investment that will pay off in increased engine life.

Table 1 ENGINE SPECIFICATIONS

Item	Specifications in. (mm)	Wear limit in. (mm)
General		
Type	4-stroke, air-cooled, V-twin	
Number of cylinders	2	
Bore and stroke	2.992 x 2.323 in. (76 >< 59 mm)	
Displacement	32.64 cu. in. (535 cc)	
Compression ratio	9:1	
Cylinders		
Cylinder liner	Aluminum alloy with cast iron liners	
Warp limit	0.0012 (0.03)	
Bore	2.991-2.993(75.98-76.02)	
Taper	—	0.002 (0.05)
Out-of-round	—	0.002 (0.05)
Cylinders		
Piston/cylinder clearance	0.0014-0.0022 (0.035-0.055)	0.004 in. (0.1)

(continued)

Table 1 ENGINE SPECIFICATIONS (continued)

Item	Specifications in. (mm)	Wear limit in. (mm)
Pistons		
Diameter	2.989-2.991 (75.92-75.97)	—
Measuring point	0.14(3.5)	—
Piston rings		
Number per piston		
Compression	**2**	—
Oil control	1	—
Ring end gap		
Top	0.012-0.018 (0.30-0.45)	0.028 (0.7)
Top and second	0.012-0.018 (0.30-0.45)	0.031 (0.8)
Oil (side rail)	0.008-0.031 (0.2-0.8)	—
Ring side clearance		
Top	0.001-0.003 (0.03-0.07)	0.005 (0.12)
Second	0.0008-0.0024 (0.02-0.06)	0.005 (0.12)
Crankshaft		
Runout	—	0.0012 (0.03)
Oil clearance	0.0008-0.0020 (0.020-0.052)	—
Connecting rod		
Side clearance	0.011-0.017 (0.27-0.42)	—
Oil clearance	0.001-0.002 (0.026-0.050)	—
Camshaft		
Runout	—	0.0012(0.03)
Oil clearance	0.0008-0.0024 (0.020-0.061)	—
Lobe height		
Intake	1.564(39.73)	1.560 (39.63)
Exhaust	1.566(39.77)	1.562 (39.67)
Lobe width		
Intake	1.269(32.22)	1.229 (31.22)
Exhaust	1.272(32.30)	1.232 (31.30)
Cam cap inside diameter	1.102-1.103 (28.00-28.02)	—
Camshaft outside diameter	1.100-1.102 (27.96-27.98)	—
Rocker arms and shafts		
Shaft clearance	0.0004-0.0015 (0.009-0.038)	0.0032 (0.08)
Rocker arm inside diameter	0.5512-0.5519 (14.000-14.018)	0.5543 (14.078)
Rocker arm shaft diameter	0.5504-0.5508 (13.980-13.991)	0.5492 (13.950)
Valves		
Valve stem outer diameter		
Intake	0.274-0.275 (6.960-6.990)	0.273 (6.930)

(continued)

Table 1 ENGINE SPECIFICATIONS (continued)

Item	Specifications in. (mm)	Wear limit in. (mm)
Valve clearance outer diameter		
Exhaust	0.273-0.274 (6.930-6.960)	0.272 (6.910)
Valve guide inner diameter		
Intake and exhaust	0.275-0.276 (7.0-7.012)	0.278 (7.05)
Stem-to-guide clearance		
Intake	0.0004-0.0015 (0.010-0.037)	0.0031 (0.08)
Exhaust	0.0010-0.0020 (0.025-0.052)	0.0039 (0.10)
Valve seat width intake & exhaust	0.04-0.05(1.0-1.2)	0.055(1.4)
Valve face width intake & exhaust	0.09 (2.3)	—
Valve stem runout maximum	—	0.0012(0.03)
Margin thickness intake & exhaust	0.04-0.06(1.0-1.4)	0.028 (0.7)
Head diameter		
Intake	1.453-1.461 (36.9-37.1)	—
Exhaust	1.256-1.264 (31.9-32.1)	—
Valve springs		
Outer free length		
Intake & exhaust	1.717(43.6)	—
Inner free length intake & exhaust	1.571 (39.9)	—
Tilt limit intake & exhaust	—	2.5°/0.067(1.7)
Oil pump		
Tip clearance	0.0-0.005(0.0-0.12)	0.007(0.17)
Side clearance	0.001-0.003(0.03-0.08)	0.003 (0.08)

Table 2 ENGINE TIGHTENING TORQUES

Item	ft.-lb.	N*m
Engine mounting hardware		
Rear upper bolt	40	**55**
Front upper bolts	40	**55**
Rear lower through bolt	40	**55**
Bracket-to-front cylinder head	40	**55**
Camshaft bushing holder bolts	**14**	**20**
Cylinder head bolts and nuts		
Side bolt	14	**20**
8 mm nut	14	**20**
10 mm nut	25	**35**
Cylinder bolt	7.2	**10**
Camshaft sprocket bolt	40	**55**
Camshaft chain tensioner		
Mounting bolts	**8.7**	**12**
Center bolt	14	**20**
Camshaft drive chain damper		
mounting bolts	7.2	**10**
Oil pump mounting bolts	5.1	**7**
Primary drive gear		
Locknut	50	**70**
Bearing housing bolts	**18**	**25**
Middle drive gear nut	**85**	**120**
Starter clutch bearing bolts	14	**20**
Crankcase bolts		
6 mm	7.2	**10**
8 mm	17	**24**
Connecting rod nuts	**25**	**36**

CHAPTER FIVE

CLUTCH AND TRANSMISSION

CLUTCH

The clutch on the Yamaha XV535 is a wet multiplate type which operates immersed in the engine oil.

All clutch parts can be removed with the engine in the frame. Refer to **Table 1** for all clutch specifications and **Table 2** for all tightening torques. **Tables 1** and **2** are found at the end of the chapter.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Five in the front of this manual for service procedures.

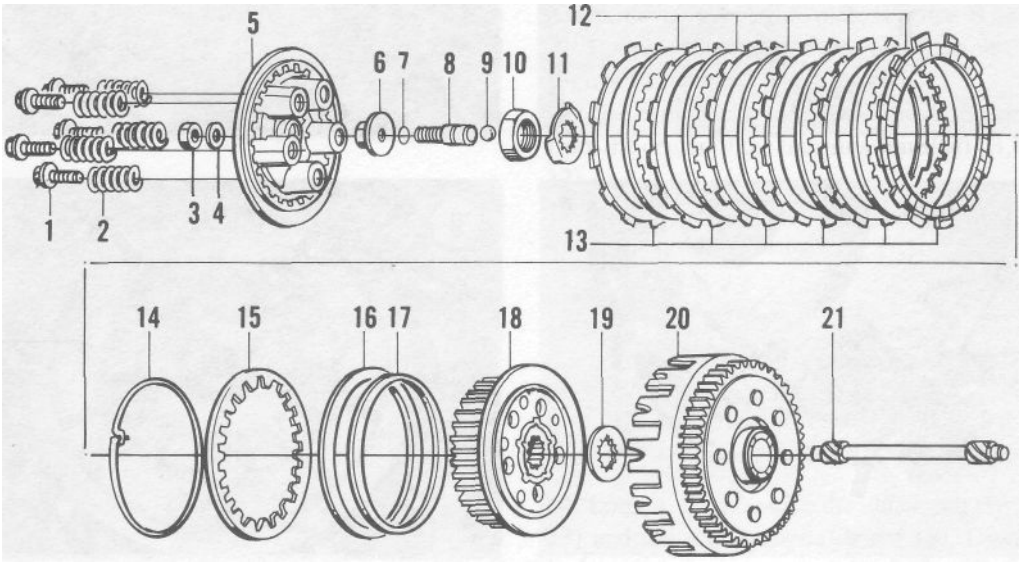
Removal

Refer to **Figure 1** for this procedure.

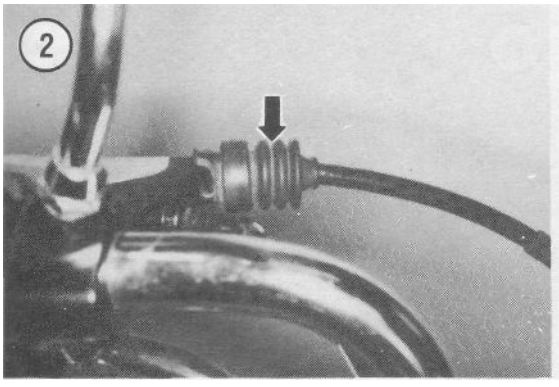
Portions of this procedure are shown with the engine remove and partially disassembled. It is not necessary to do so for clutch removal.

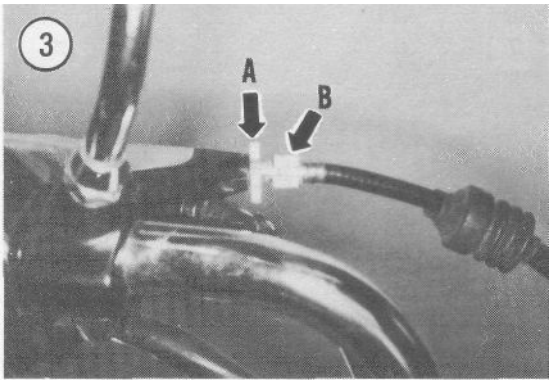
1. Place the bike on the sidestand.
2. Drain the engine oil as described in Chapter Three in this section of the manual.
3. At the hand lever, slide back the clutch lever shield **(Figure 2).**
4. Loosen the clutch cable locknut (A, **Figure 3)** and rotate the adjuster (B, **Figure 3)** to allow maximum slack in the cable.
5. At the clutch cable lower adjuster, loosen the locknuts (A, **Figure 4)** and rotate the adjuster (B, **Figure 4)** to allow maximum slack in the cable. Disconnect the clutch cable from the actuating lever.
6. Remove the following from the right-hand side.
   a. Right-hand footpeg assembly **(Figure 5).**
   b. Rear brake pedal and engine guard assembly **(Figure 6).**

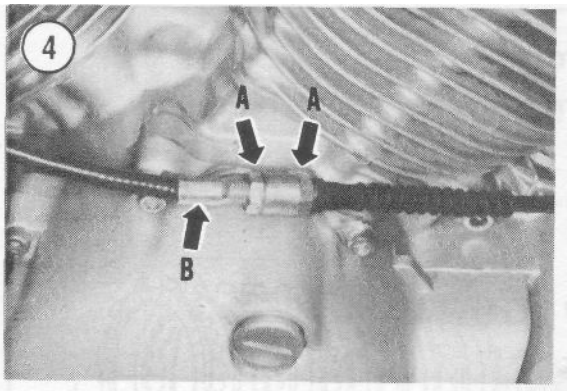
1 CLUTCH



1. Bolt
2. Spring
3. Locknut
4. Washer
5. Pressure plate
6. Push plate
7. O-ring
8. Pushrod No. 1
9. Steel ball
10. Clutch nut
11. Lockwasher
12. Clutch disc
13. Friction disc
14. Clutch boss ring
15. Clutch plate No. 1
16. Spring
17. Spring seat
18. Clutch boss
19. Splined thrust washer
20. Clutch housing
21. Pushrod No. 2



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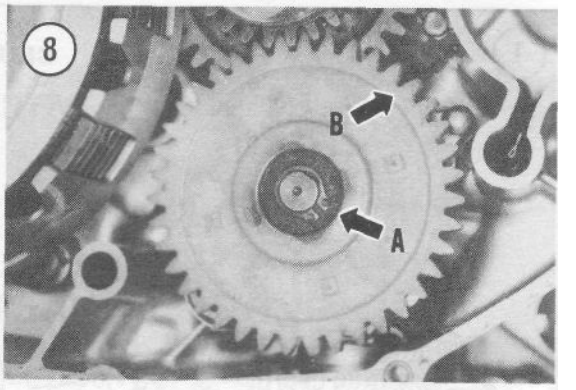
A
A
B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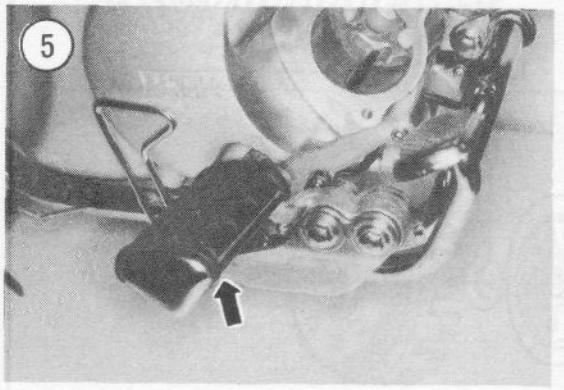
B
A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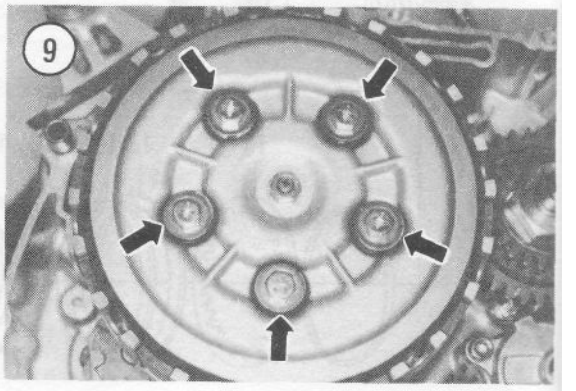
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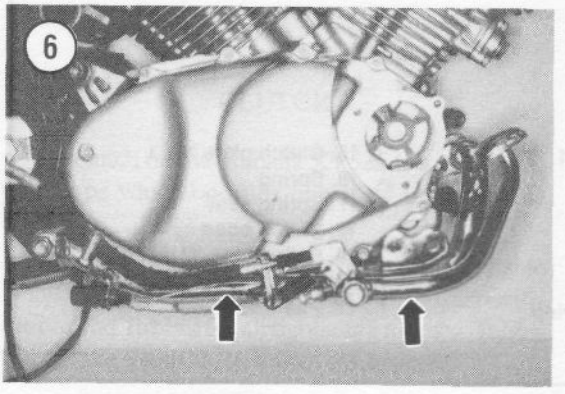
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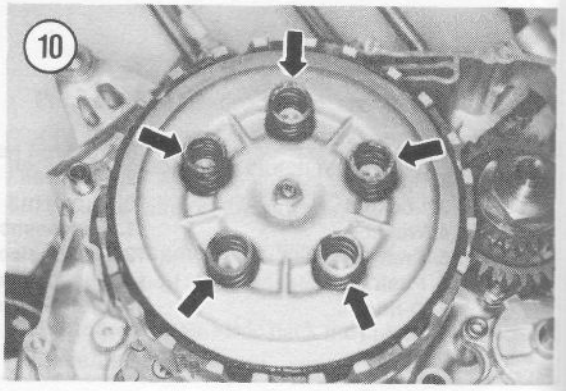
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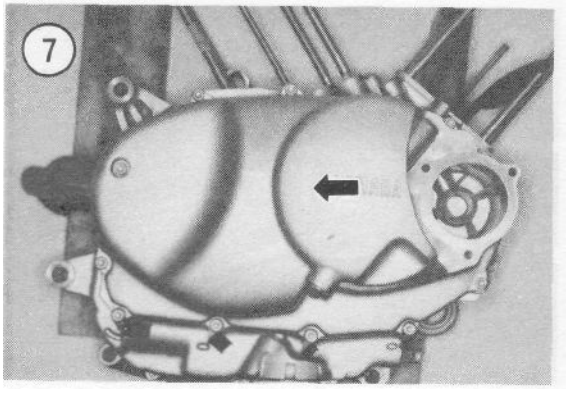
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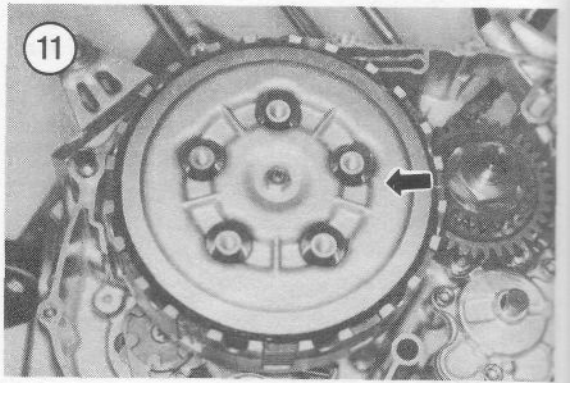
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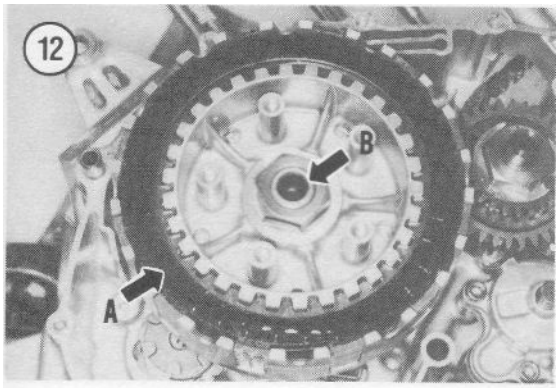
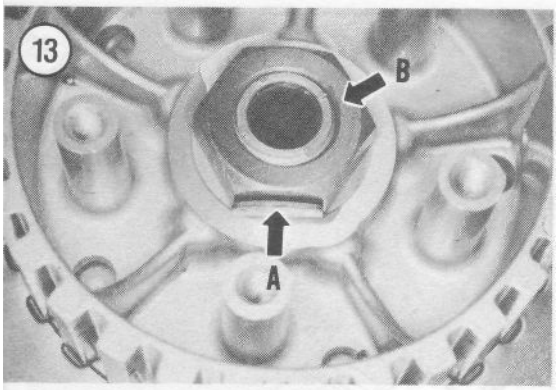
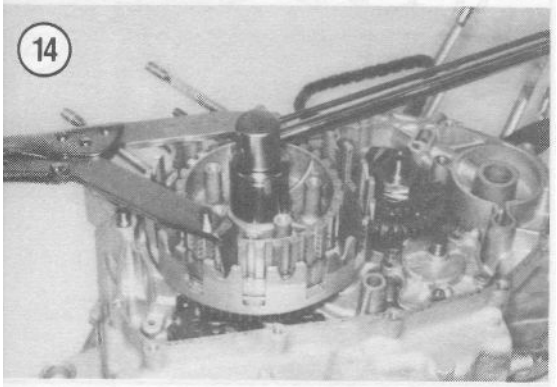
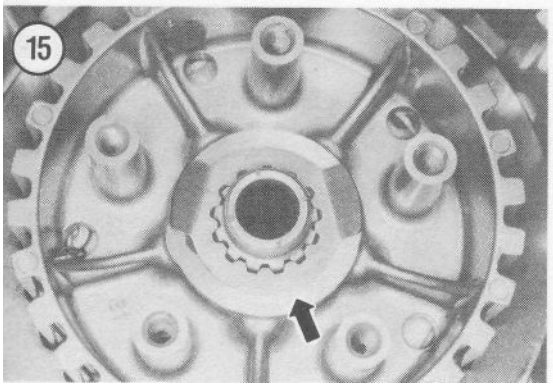








7. Remove the bolts securing the right-hand crankcase cover **(Figure** 7) and remove the cover and gasket. Don't lose the dowel pins.

8. Remove the circlip (A, **Figure** 8) and remove the oil pump drive gear (B, **Figure** 8).

9. Remove the 5 pressure plate screws **(Figure** 9) and springs **(Figure** 10).

10. Remove the pressure plate **(Figure 11).**

11. Remove the clutch plates and friction disc (A, **Figure** 12) and keep them in order.

12. Use a magnetic tool and remove the steel ball from the center of the transmission shaft (B, **Figure 12).**

13. Straighten out the locking tab (A, **Figure 13)** on the clutch nut lockwasher.

NOTE

To keep the clutch housing from turning, use the "Grabbit" or Yamaha Universal Clutch Holder special tool (part No YM-91042) on the clutch boss See Figure 14

14. Loosen, then remove the clutch nut (B, **Figure** 13) and the lockwasher **(Figure** 15). Discard the lockwasher as a new one must be installed during assembly.

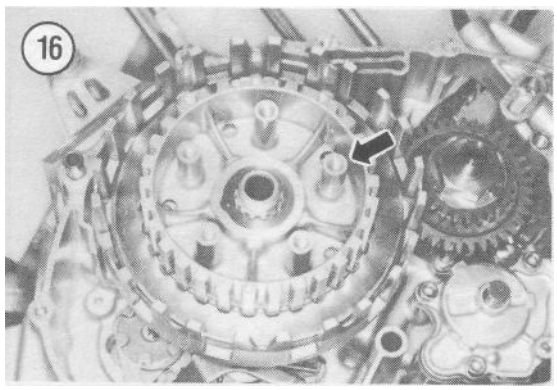
15. Remove the clutch boss **(Figure** 16).

16 Remove the thrust plate **(Figure** 17) and clutch housing **(Figure** 18).

17. Remove the long push rod No. 2 from the center of the transmission shaft.

Inspection

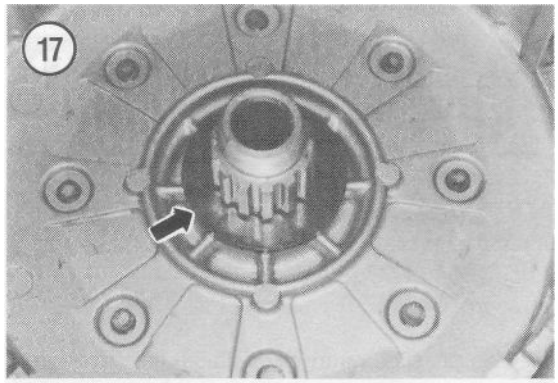
1. Clean all clutch parts in a petroleum-based solvent such as kerosene and thoroughly dry with compressed an"

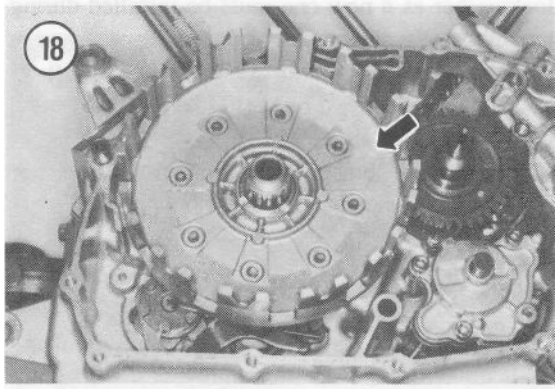


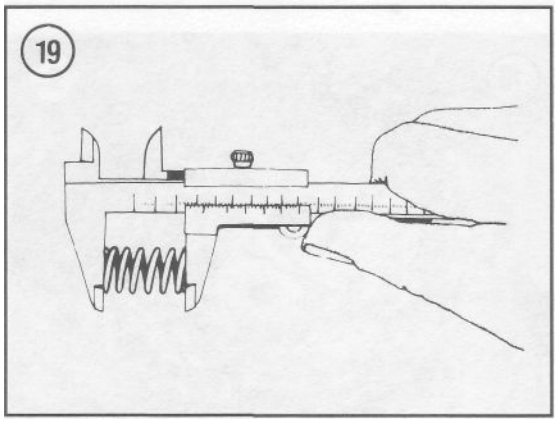
2. Measure the free length of each clutch spring as shown in **Figure 19**. Replace any springs that are too short **(Table 1).**

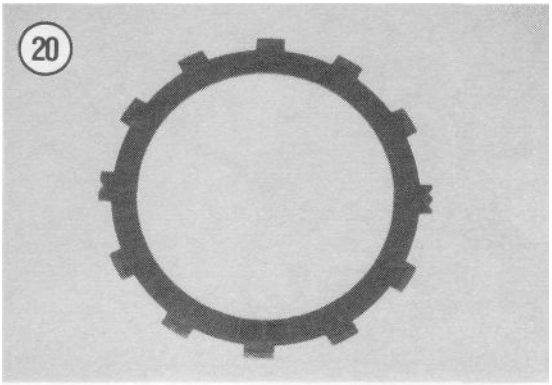
3. Measure the thickness of each friction disc **(Figure 20)** at several places around the disc as shown in **Figure 21.** See **Table 1** for specifications. Replace all friction discs if any one is found too thin. Do not replace only 1 or 2 discs.

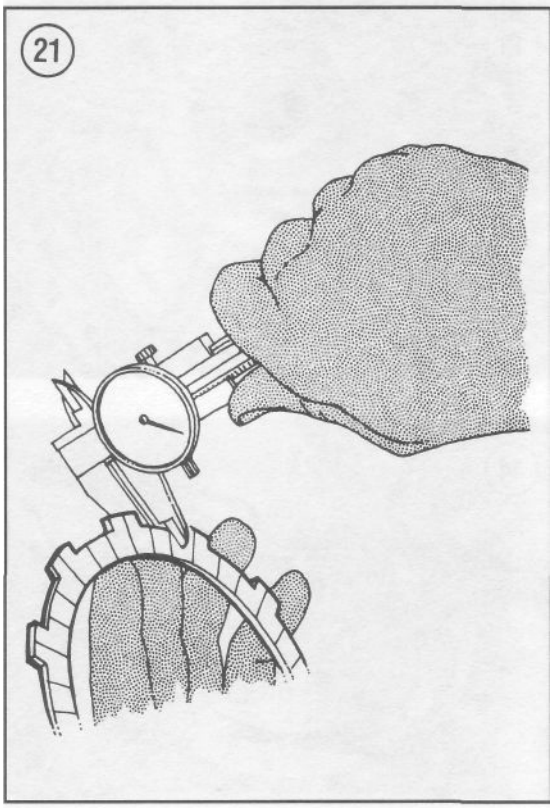
4. Check the clutch metal plates for warpage as shown in **Figure 22.** If any plate is warped more than

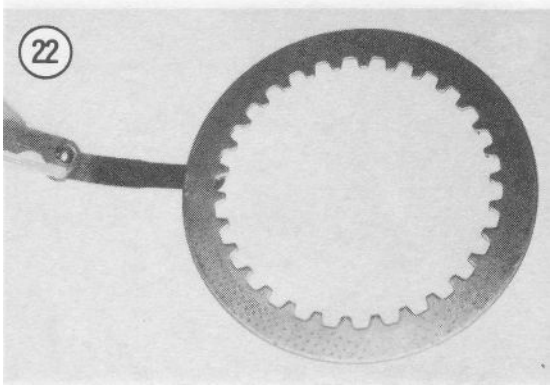


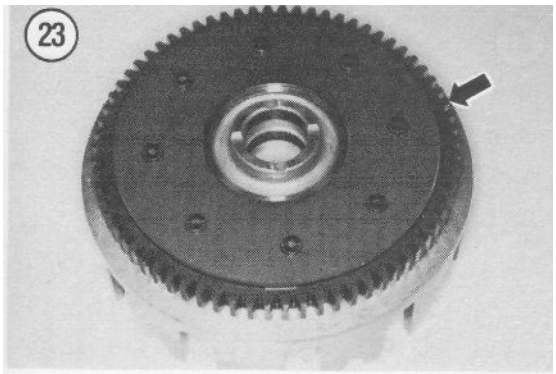


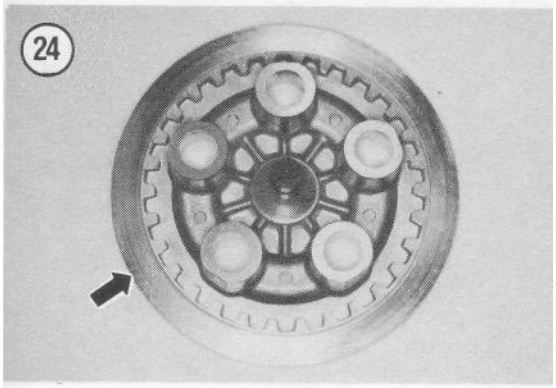


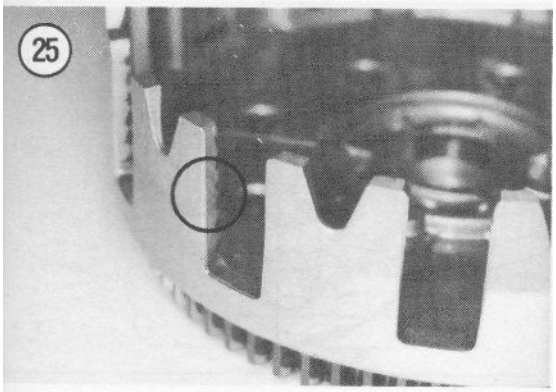


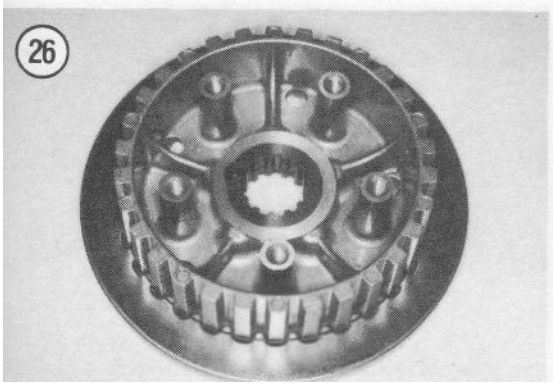












specified **(Table 1),** replace the entire set of plates. Do not replace only 1 or 2 plates.

5. Check the gear teeth on the clutch housing **(Figure 23).** Replace if necessary.

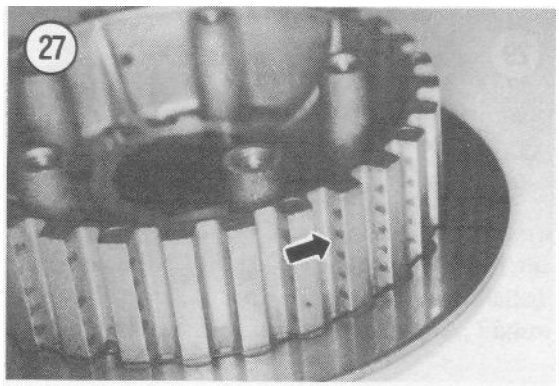
6. Inspect the pressure plate **(Figure 24)** for signs of wear or damage; replace if necessary.

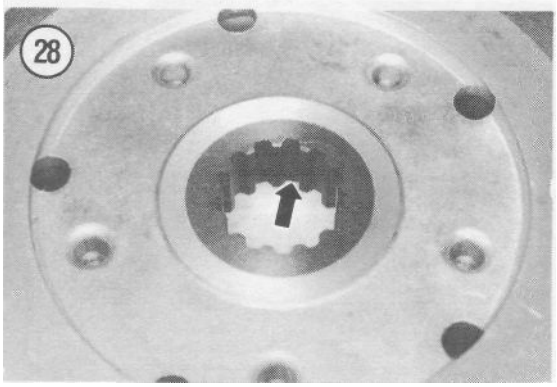
7. Inspect the fingers on the clutch housing **(Figure 25)** and the clutch boss **(Figure 26)** for cracks or galling in the grooves where the clutch friction disc tabs slide **(Figure 27).** They must be smooth for chatter-free clutch operation.

8. Inspect the inner splines **(Figure 28)** in the clutch boss assembly. If damage is only a slight amount, remove any small burrs with a fine cut file; if damage is severe, replace the clutch boss.

NOTE

The clutch boss is a sub-assembly with a built-in damper located inside the first clutch plate A large wire clip ***(Figure*** *29) holds the assembly together. Do not disassemble this unit unless there was severe clutch chatter prior to disassembly.*



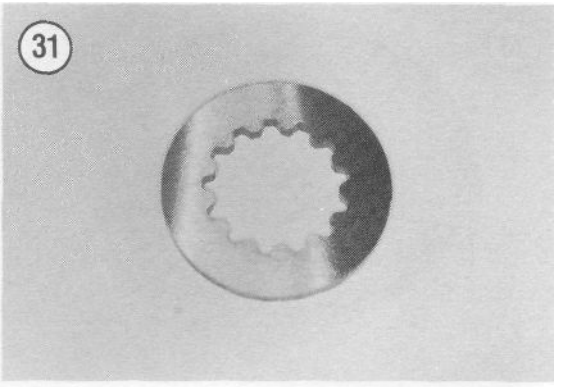


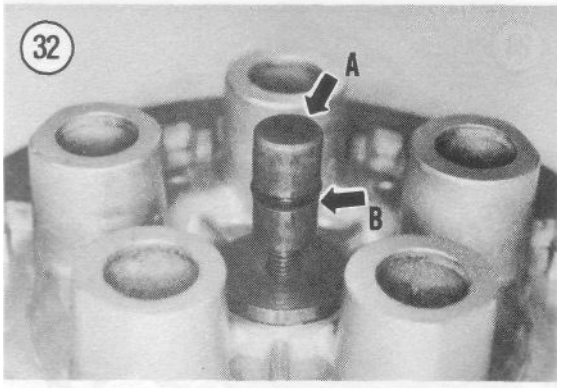
9. Inspect the long push rod No. 2 **(Figure** 30) by rolling it on a flat surface, such as a piece of glass. Any clicking noise detected indicates that the rod is bent and should be replaced.
10. Inspect the clutch nut and sphned thrust washer **(Figure 31)** for wear or damage. Replace as necessary.
11. Inspect the end of the pushrod No. 1 (A, **Figure 32)** for wear or damage. If damaged, perform the following:

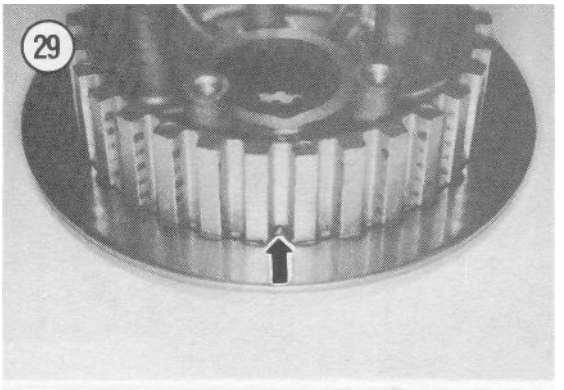
a. Remove the nut and washer **(Figure 33)** and remove the pushrod No. 1 and the push plate from the pressure plate.
b. Inspect the O-ring seal (B, **Figure 32)** on the No. 1 pushrod and replace if necessary.
c. Reinstall the pushrod No. 1 and push plate into the backside of the pressure plate.
d. Install the washer and nut. Do not tighten the nut at this time as it must be adjusted after the clutch assembly is installed in the crankcase.

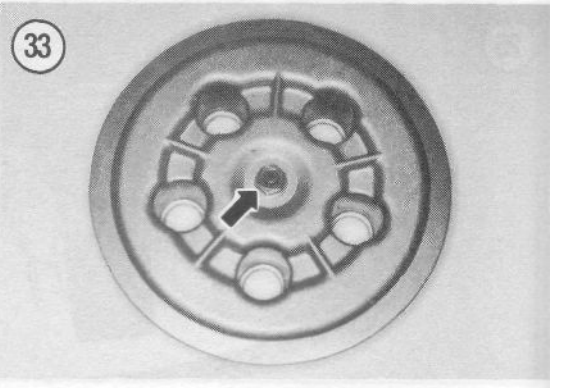
Installation

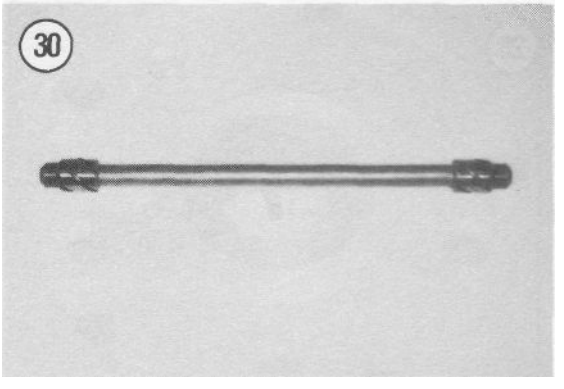
1. Coat all parts with clean engine oil.

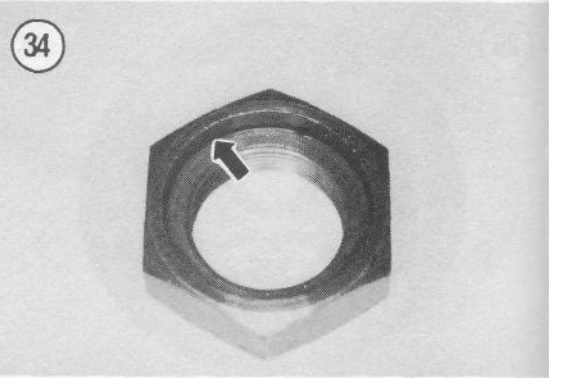


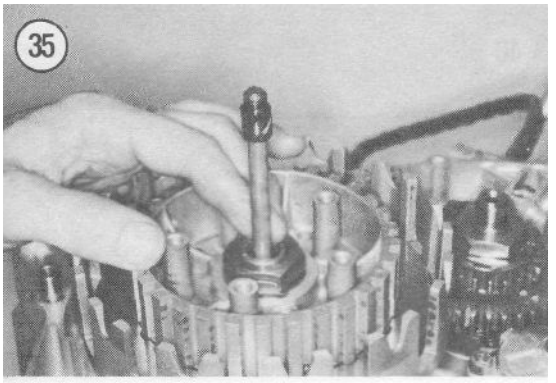


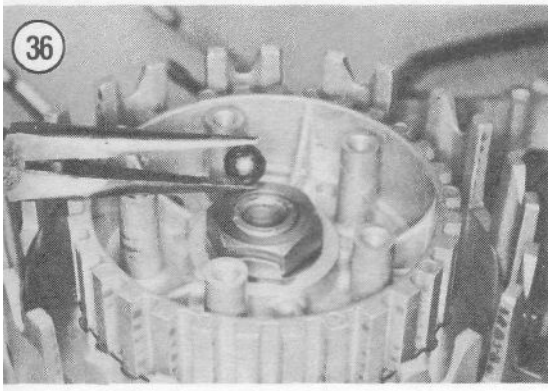


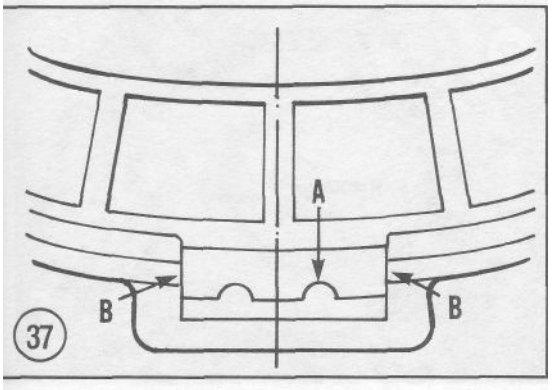


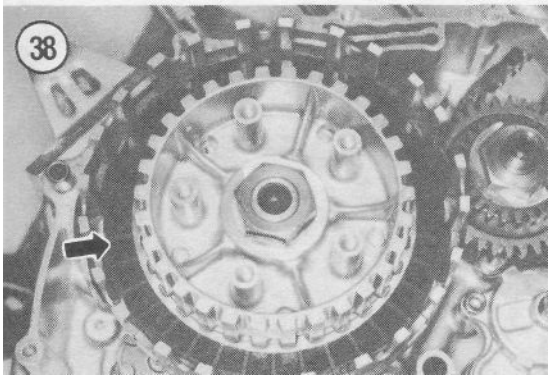












NOTE

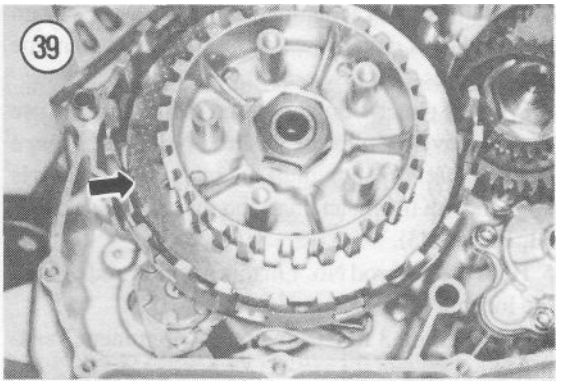
While installing the clutch housing, slightly rotate it back and forth until the gears mesh properly. Push it on until it bottoms out.

2. Install the clutch housing **(Figure 18).** Make sure it meshes properly with the primary drive gear.
3. Install the splined thrust washer **(Figure 17).**
4. Install the clutch boss **(Figure** 16).
5. Install the *new* lockwasher **(Figure 15).** Make sure the locking tabs on the lockwasher are inserted into the slots in the pressure plate.
6. Position the clutch nut with the recessed side **(Figure 34)** going on first. Install the clutch nut (B, **Figure** 13) and tighten to specification **(Table 2)** using a torque wrench and holding tool to keep the clutch hub from turning. See **Figure 14.** Bend up the lockwasher (A, **Figure 13)** against one side of the nut.
7. Install the long push rod **(Figure 35)** into the center of the transmission shaft.
8. Install the steel ball **(Figure 36)** into the center of the transmission shaft.

NOTE

*On models so equipped, position the friction discs so the double notches (A, **Figure 37)** align with the embossed marks on the clutch housing **(B, Figure 37).** If the clutch housing is not marked, align all friction disc double notches.*

9. First install a friction disc **(Figure 38)** and then a clutch plate **(Figure 39).** Continue to install the friction discs and clutch plates until all are installed. The last item installed is a friction disc (A, **Figure** 12).



10 Make sure all friction discs are aligned as shown in **Figure 40**

11 Install the pressure plate **(Figure 11)**

12 Install the springs **(Figure 10)** and bolts **(Figure 9)** and tighten in a criss-cross pattern to specifications **(Table 2)**

NOTE

The clutch mechanism free play must be adjusted after the clutch assembly has been disassembled even if the No 1 push rod assembly was not disassembled

13 Adjust the clutch mechanism free play as described in this chapter

14 Make sure the clutch cover dowel pins (A, **Figure 41)** are in place and mstall a new clutch cover gasket **(B, Figure 41)**

15 Install the clutch cover **(Figure 7)** and tighten the cover screws securely

16 Install the following onto the right-hand side

a Rear brake pedal and engine guard assembly **(Figure 6)**

b Right-hand footpeg assembly **(Figure 5)**

17 Adjust the clutch as described in Chapter Three in this section of the manual

18 Refill the crankcase with the recommended type and quantity of engine oil, refer to Chapter Three in this section of the manual

Clutch Mechanism Free Play Adjustment

This adjustment is necessary if there is insufficient freeplay in the clutch cable or if the clutch assembly has been disassembled

1 If the clutch has *not* been disassembled, perform Steps 1-7 *Clutch Removal* in this chapter

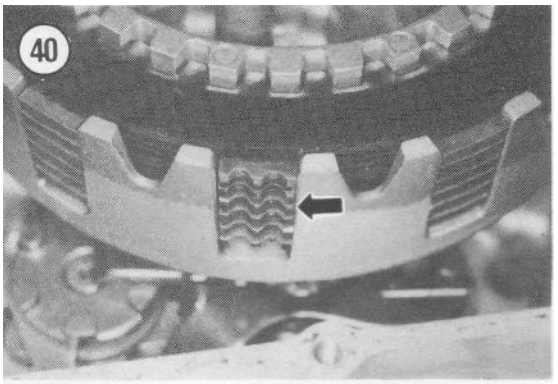
2 Loosen the pushrod No 1 locknut (A, **Figure 42)**

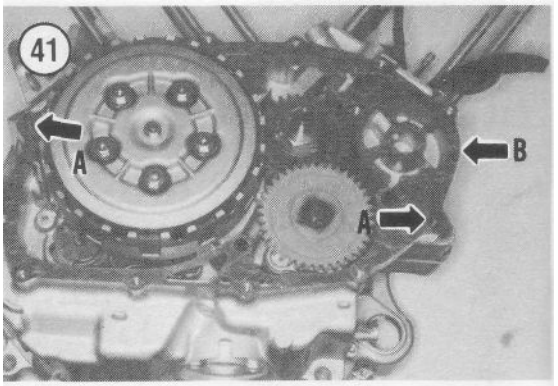
3 Push the clutch actuating lever (A, **Figure 43)** on the crankcase cover toward the front of the engine until it stops

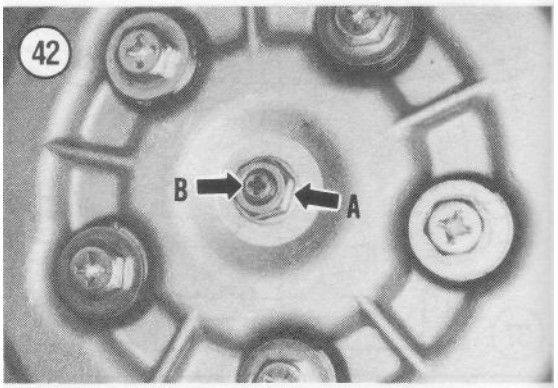
4 With the clutch actuating lever in this position, use a screwdriver to turn the pushrod No 1 (B, **Figure 42)** in either direction until the mark on the lever is aligned with the match mark on the crankcase cover (B, **Figure 43)**

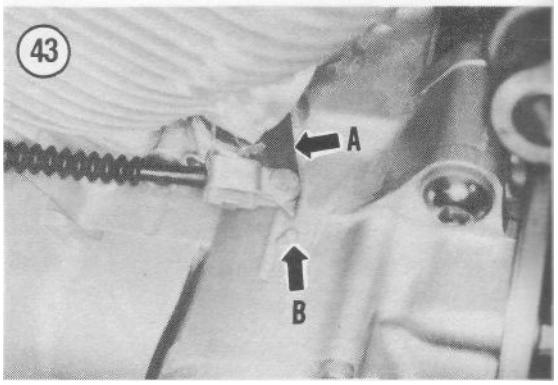
5 Hold the pushrod No 1 in this position and tighten the locknut securely

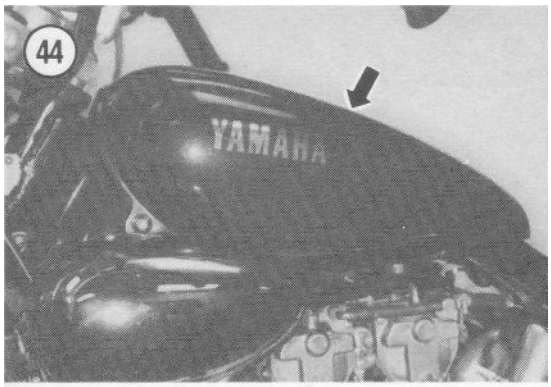
6 Repeat Step 3 to ensure correct alignment, readjust if necessary

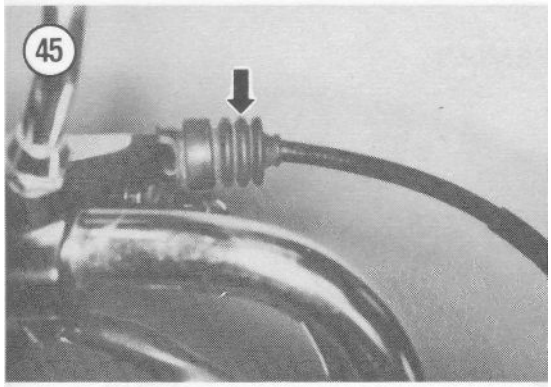


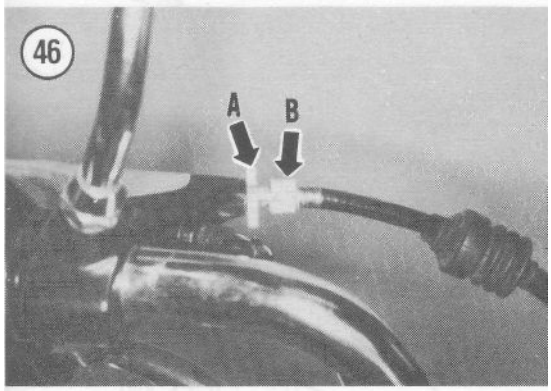


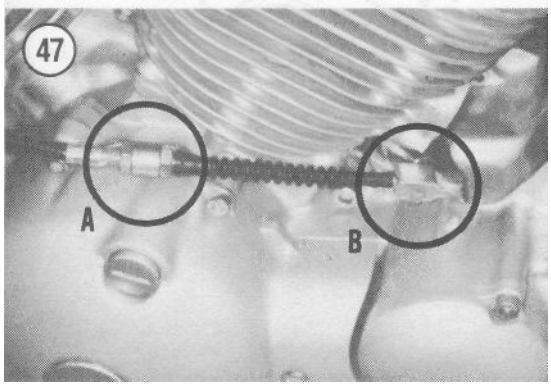












7 Install all items removed

8. Adjust the clutch as described in Chapter Three in this section of the manual.

CLUTCH CABLE

Replacement

In time, the cable will stretch to the point where it is no longer useful and will have to be replaced

1 Place the bike on the sidestand.

2 Remove the seat(s)

3A On 1987-1989 US models and 1988 UK models, remove the rear bolt and front bolt on each side securing the frame top cover and remove the cover **(Figure 44)**

3B On 1990-on US models and 1989-on UK models, remove the sub-fuel tank as described in Chapter Six in this section of the manual

4. At the hand lever, slide back the clutch lever shield **(Figure 45)**

5 Loosen the clutch cable locknut (A, **Figure 46)** and rotate the adjuster (B, **Figure 46)** to allow maximum slack m the cable.

6 At the clutch cable lower adjuster, loosen the locknuts and rotate the adjuster (A, **Figure** 47) to allow maximum slack in the cable

7 Disconnect the clutch cable from the clutch actuating lever (B, **Figure 47)** Then pull the cable out of the lever.

NOTE

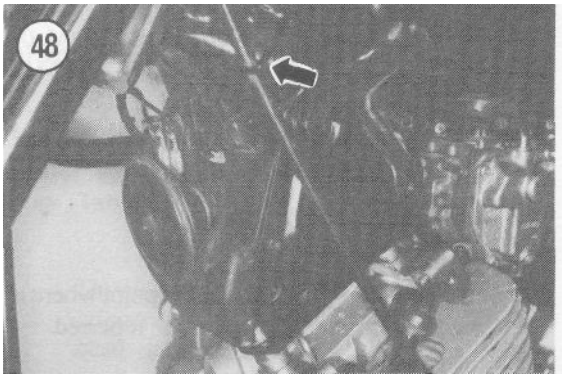
Prior to removing the cable, make a drawing of the cable routing through the frame It is very easy to forget how it was, once it has been removed Replace it exactly as it was, avoiding any sharp turns

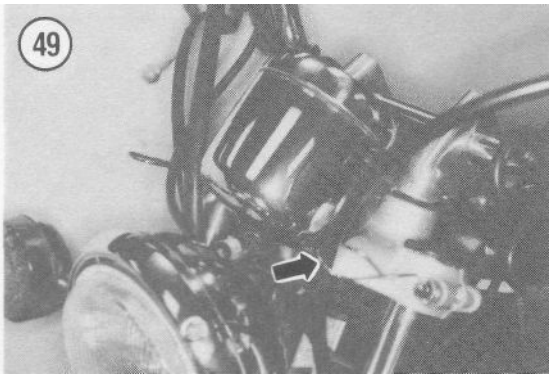
8. Carefully remove the cable from the frame clamps and replace with a new one. Make sure the cable fits into the cable clamp on the left-hand side of the frame **(Figure 48)** and upper fork bridge **(Figure** 49)

9. Adjust the clutch as described in Chapter Three in this section of the manual.

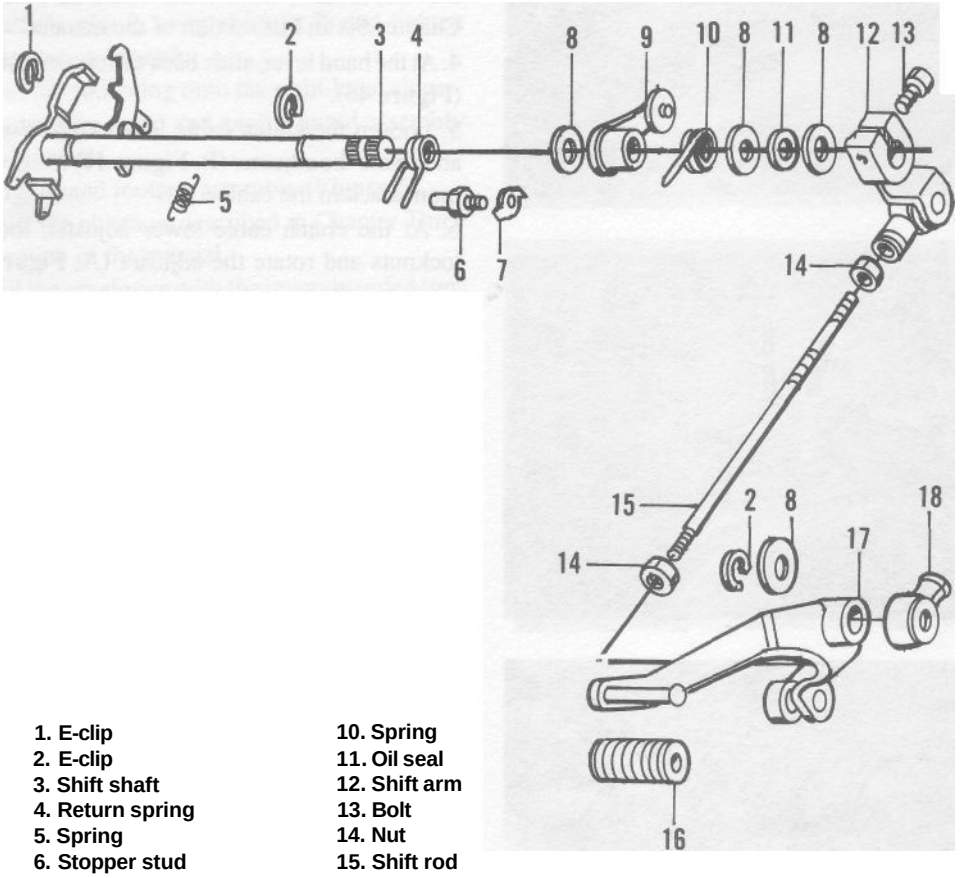
SHIFT MECHANISM

Refer to **Figure 50** for this procedure.

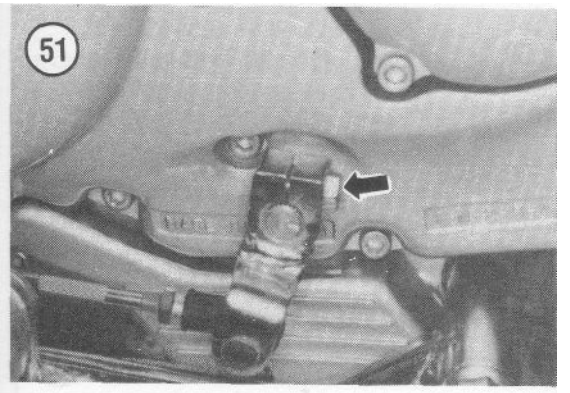


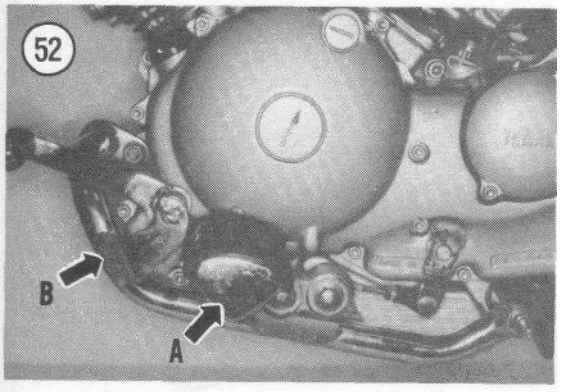


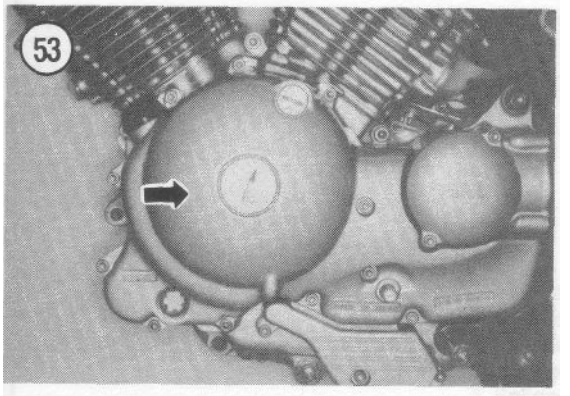
SHIFTER ASSEMBLY

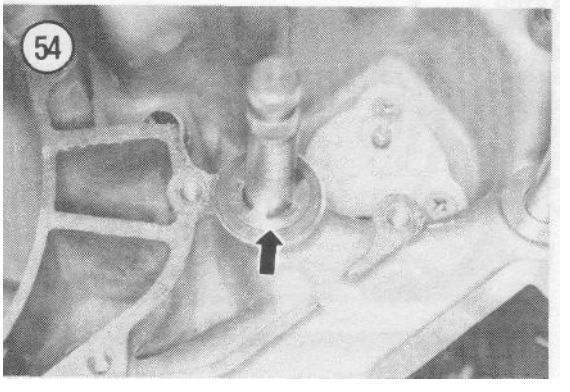


1. E-clip
2. E-clip
3. Shift shaft
4. Return spring
5. Spring
6. Stopper stud
7. Lockwasher
8. Washer
9. Stopper lever
10. Spring
11. Oil seal
12. Shift arm
13. Bolt
14. Nut
15. Shift rod
16. Cover
17. Shift pedal
18. Dust cover









Removal/Inspection/Installation

Portions of this procedure are shown with the engine remove and partially disassembled. It is not necessary to do so for shift mechanism removal and installation.

1. Drain the engine oil as described in Chapter Three in this section of the manual.

2. Remove the bolt **(Figure 51)** securing the shift lever arm and slide it off the shift shaft.

3. Remove the left-hand foot peg (A, **Figure** 52).

4. Remove the left-hand footrest bar (B, **Figure 52).**

5. At the hand lever, slide back the clutch lever shield **(Figure 45).**

6. Loosen the locknut (A, **Figure 46)** and rotate the adjuster (B, **Figure** 46) to allow maximum slack in the cable.

7. At the clutch cable lower adjuster, loosen the locknuts and rotate the adjuster (A, **Figure 47)** to allow maximum slack in the cable.

8. Disconnect the clutch cable from the clutch actuating lever (B, **Figure** 47). Then pull the cable out of the lever.

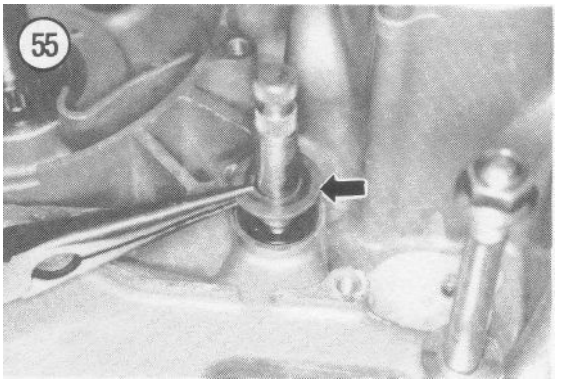
9. Drain the engine oil as described in Chapter Three in this section of the manual.

10. Remove the bolts securing the left-hand crankcase cover **(Figure** 53) and remove the cover and gasket. Don't lose the dowel pins.

11. Remove the clutch assembly as described in this chapter.

12. On the left-hand side, remove the E-clip **(Figure 54)** and washer **(Figure** 55) from the shift shaft assembly.

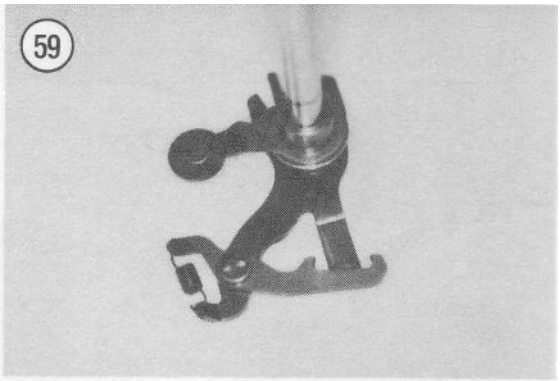
13. On the right-hand side, disengage the shift lever **(Figure 56)** I'mm ilk[1] sliili ilium and remove ihc shilt shall asscmblv I nun Ihc cmnkciiM[1]1 **Figure 57).**

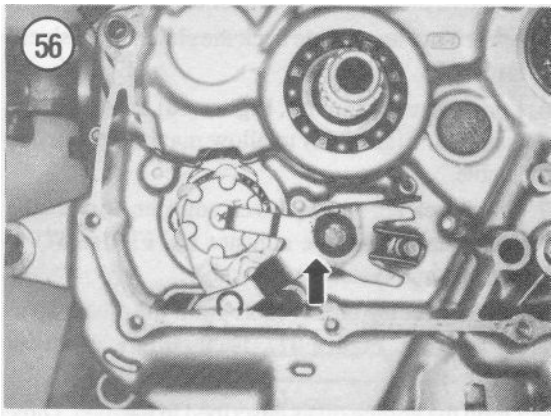


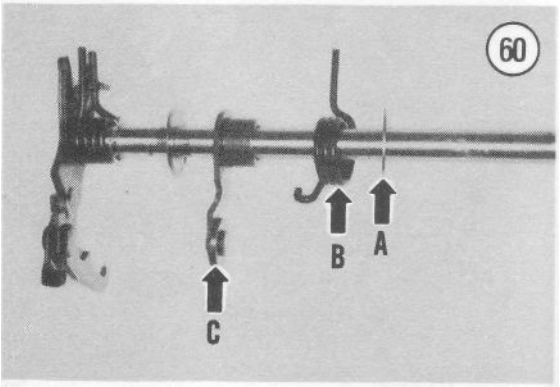
14 Examine the shift shaft spindle assembly for damage Refer to **Figure 58** and **Figure 59** If the shaft is bent or damaged in any way, it must be replaced

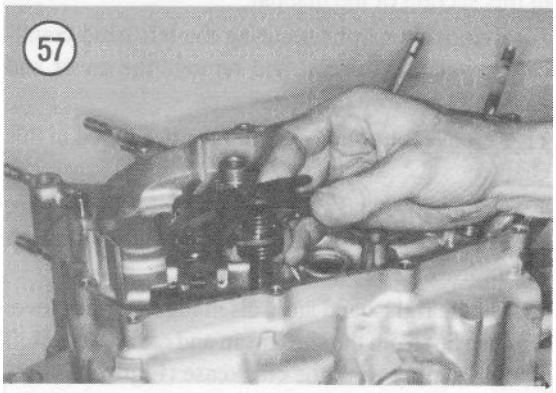
15 If necessary, remove the washer (A, **Figure 60),** spring (B, **Figure 60)** and slide the stopper lever assembly (C, **Figure 60)** off the shaft

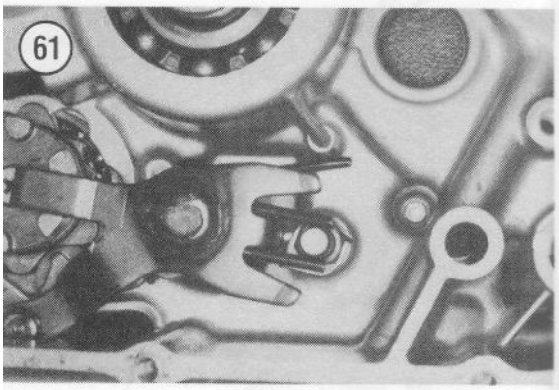
16 On the left-hand side, insert the end of the shift shaft spindle into the engine crankcase opening

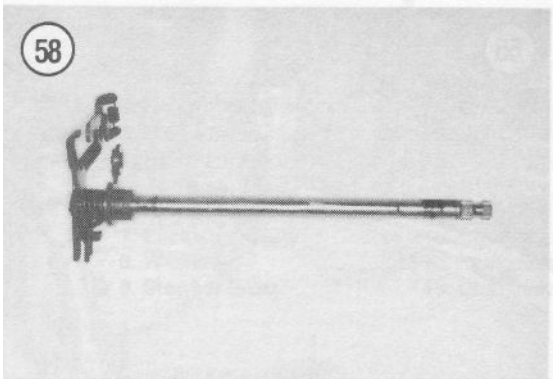


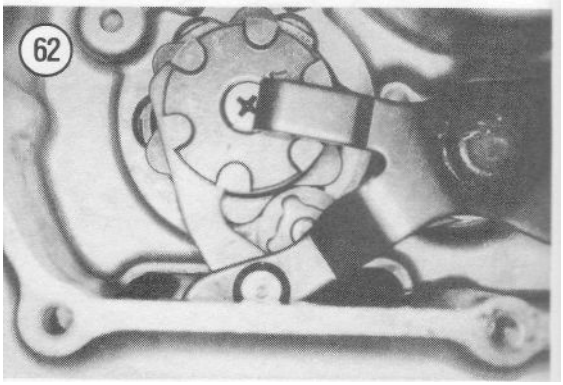












17. Push the shift arm down and install the shift mechanism all the way. **Figure 61** and **Figure 62** shows the installed assembly.

18. Reverse Steps 2-12 to complete installation. Refill the engine with the correct type and quantity of oil as described in Chapter Three in this section of the manual.

TRANSMISSION

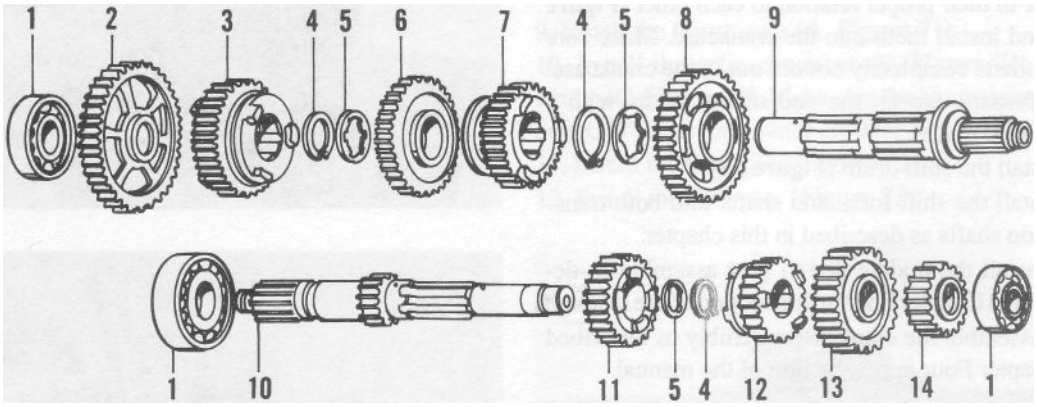
The crankcase must be disassembled to gain access to the transmission components.

Removal/Installation

Refer to **Figure 63** for this procedure.

63

TRANSMISSION

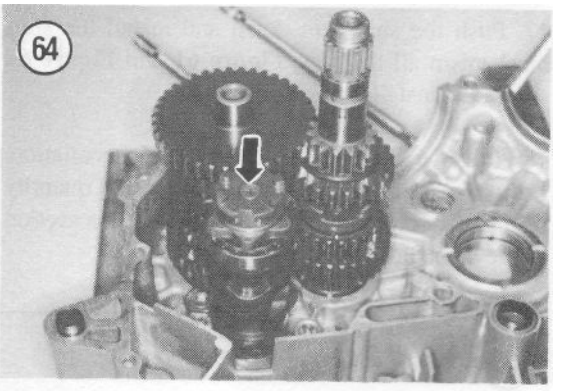


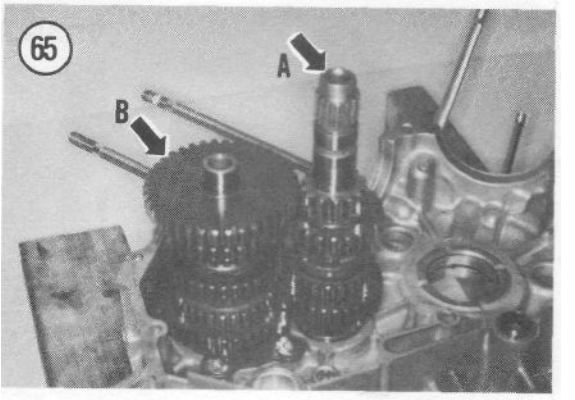
1. Ball bearing
2. Drive axle 1st gear
3. Drive axle 4th gear
4. Circlip
5. Splined washer
6. Drive axle 3rd gear
7. Drive axle 5th gear
8. Drive axle 2nd gear
9. Drive axle
10. Main shaft/1 st gear
11. Main shaft 4th gear
12. Main shaft 3rd gear
13. Main shaft 5th gear
14. Main shaft 2nd gear

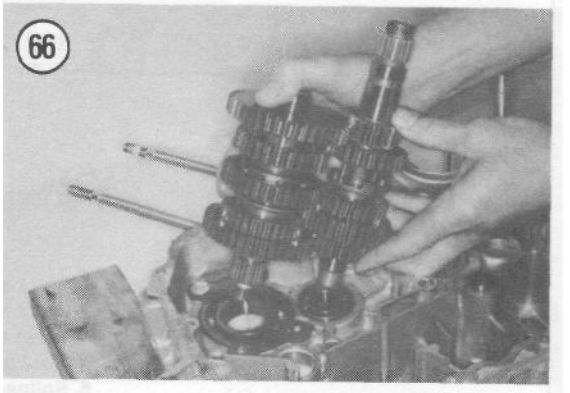
1. Separate the crankcase as described in Chapter Four in this section of this manual.
2. Remove the middle driven gear assembly as described in Chapter Four.
3. Withdraw the shift fork shafts and shift forks from both transmission shafts as described in this chapter.
4. Remove the shift drum **(Figure 64).**
5. Remove the main shaft (A, **Figure 65)** and drive axle (B, **Figure 65)** assemblies from the crankcase as an assembly.
6. Inspect the transmission assembly as described in this chapter.

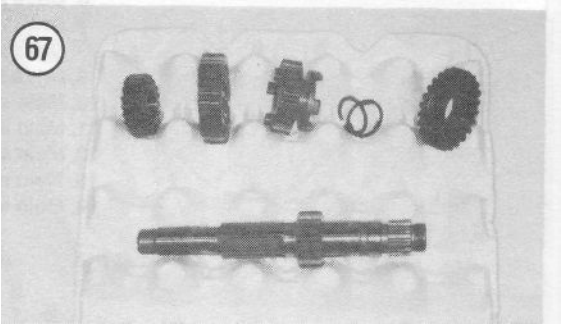
NOTE
Prior to installing any components, coat all bearing surfaces with assembly oil.

7. Properly mesh both transmission assemblies together in their proper relation to each other **(Figure 66)** and install them into the crankcase. Make sure both shafts completely bottom out in the crankcase. If necessary, tap on the end of the shafts with a soft-faced mallet.
8. Install the shift drum **(Figure 64).**
9. Install the shift forks and shafts into both transmission shafts as described in this chapter.
10. Install the middle driven gear assembly as described in Chapter Four in this section of the manual.
11. Assemble the crankcase assembly as described in Chapter Four in this section of the manual.









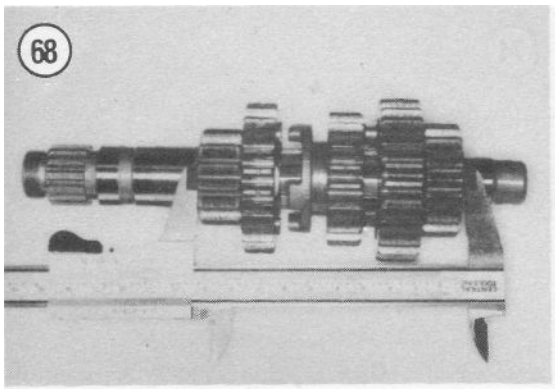
Main Shaft Disassembly/Assembly

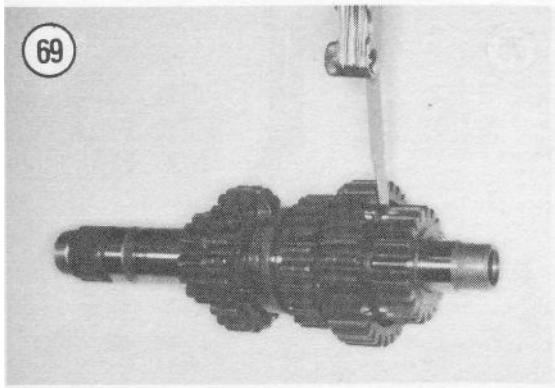
Disassembly and assembly of the main shaft requires the use of a hydraulic press and an insert.

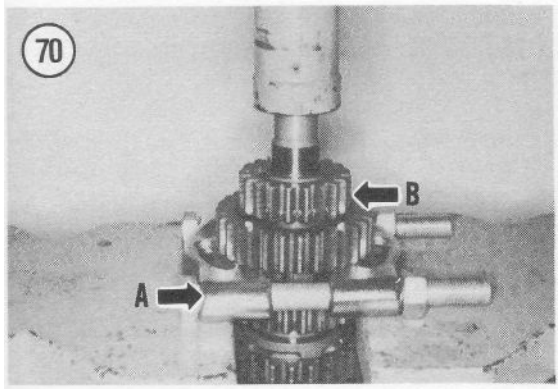
Refer to **Figure 63** for this procedure.

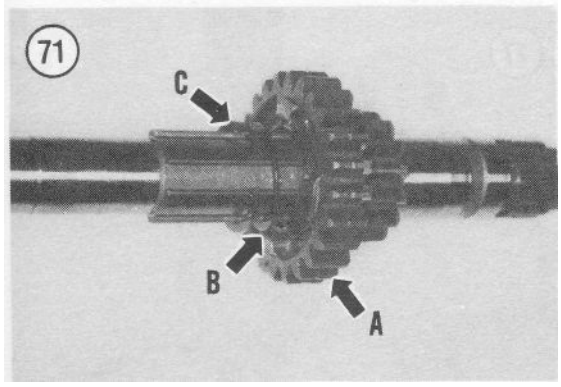
NOTE
When disassembling the main shaft assembly, place all parts in a container, such as an egg carton (Figure 67), to prevent mixing up the gear alignment

1. Prior to disassembling the main shaft, use a Vernier caliper and measure the overall length of the gear set **(Figure 68)** and write this number down. Also measure the clearance between the second and fifth gears **(Figure 69)** and write this number down. These numbers are to be used during assembly to make sure the shaft is assembled to the correct clearance and overall length.







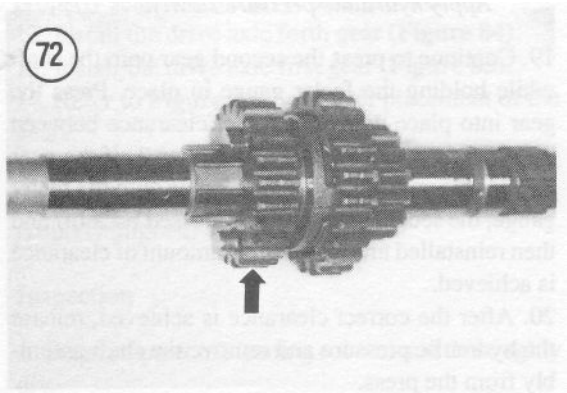


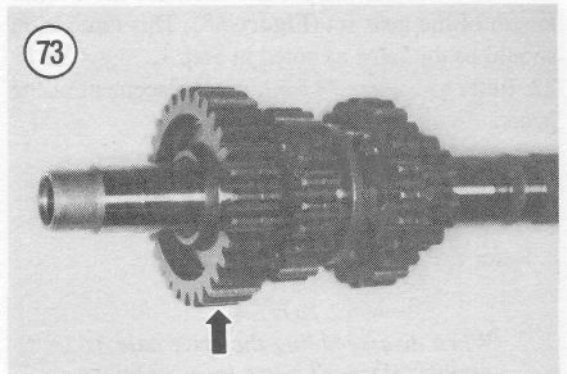
2. Install an insert (A, **Figure 70)** below the fifth gear and install the main shaft assembly in the hydraulic press.
3. While holding onto the main shaft assembly, press the second gear (B, **Figure 70)** off the shaft.
4. Release hydraulic pressure and remove the shaft and insert assembly from the press.
5. Remove the second gear, fifth gear and the insert.
6. Remove the third gear.
7. Remove the circlip, splined washer and slide off the fourth gear.
8. Inspect the main shaft assembly as described in this section.

NOTE

Prior to installing any components, coat all bearing surfaces with assembly oil.

9. Install the fourth gear (A, **Figure 71).**
10. Install the splined washer **(B, Figure 71)** and circlip (C, **Figure 71).** Make sure the circlip is seated correctly in the main shaft groove.
11. Install the third gear **(Figure 72).**
12. Install the fifth gear **(Figure 73).**



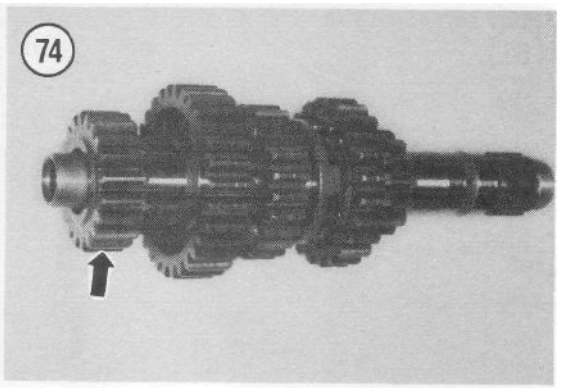


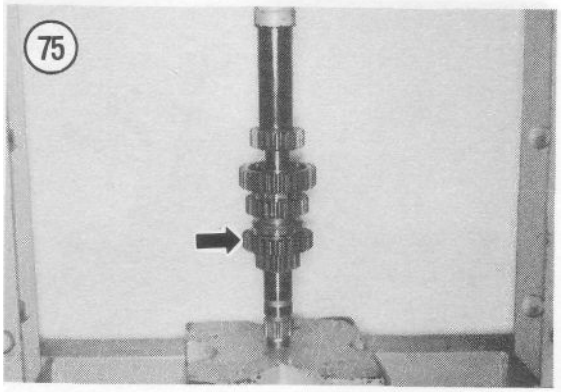
13. Apply a light coat of molybdenum disulfide grease to the main shaft and to the inner surface of the second gear. This will aid in pressing the second gear onto the shaft.
14. Install the second gear **(Figure 74)** onto the end of the shaft as far as it will go.
15. Install the main shaft assembly in the hydraulic press **(Figure 75).**
16. Install a piece of pipe or socket on top of the second gear **(Figure 76).** The inner diameter of the pipe or socket must be large enough for the end of the main shaft to pass into it without touching.
17. While holding onto the main shaft assembly, start pressing the second gear onto the shaft.
18. Refer to the clearance measured in Step 1 and place the correct thickness flat feeler gauge between the second and fifth gears **(Figure 77).**

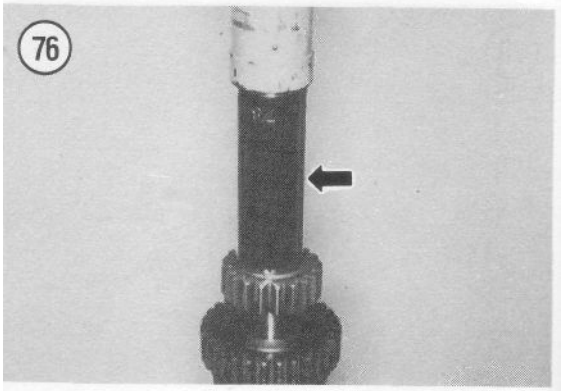
NOTE

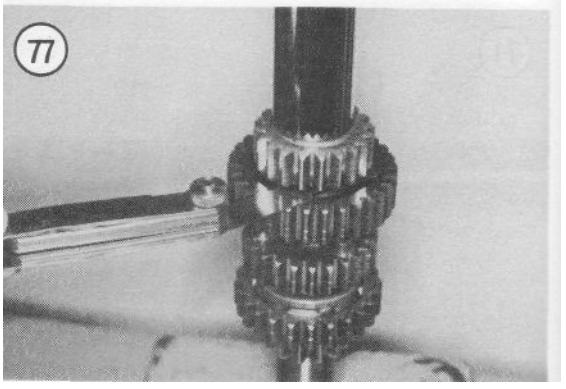
At the beginning the second gear will press smoothly onto the main shaft and then will usually "jump" several times making a loud cracking noise. This is normal, but when the gear does jump it moves rapidly and will close the clearance between the 2 gears very rapidly. Apply hydraulic pressure slowly.

19. Continue to press the second gear onto the shaft while holding the feeler gauge in place. Press the gear into place until the correct clearance between the gears is achieved as noted in Step 1. If the gear jumps during installation and clamps onto the feeler gauge, the second gear must be pressed back off and then reinstalled until the correct amount of clearance is achieved.
20. After the correct clearance is achieved, release the hydraulic pressure and remove the shaft assembly from the press.
21. Use a Vernier caliper and measure the overall length of the gear set **(Figure 68).** This dimension should be the same as noted in Step 1.
22. Refer to **Figure 78** for correct placement of the gears.







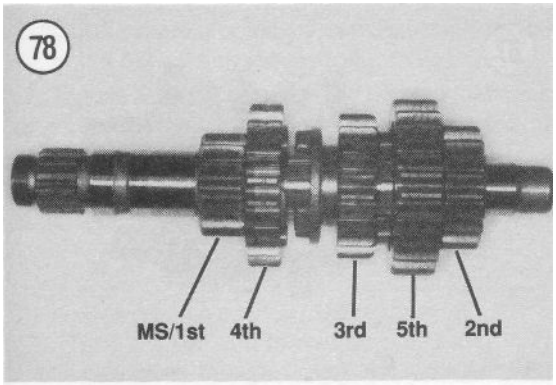


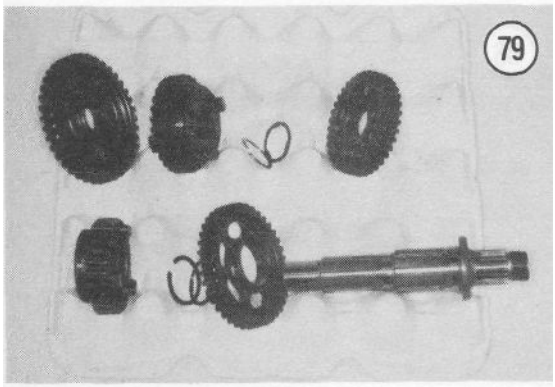
Drive Axle Disassembly/Assembly

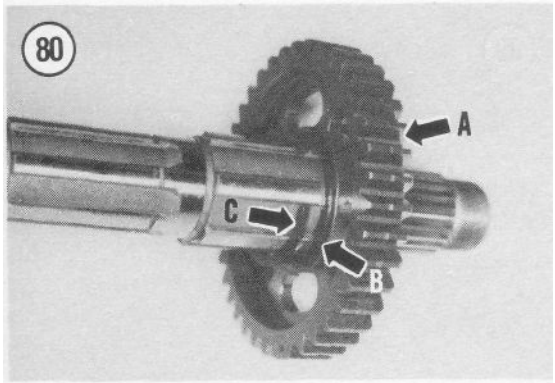
Refer to **Figure 63** for this procedure.

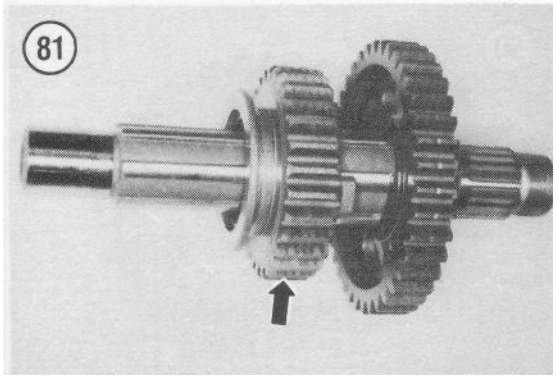
NOTE

When disassembling the drive axle assembly, place all parts in a container,









such as an egg carton (Figure 79), to prevent mixing up the gear alignment.

1. Remove the drive axle first gear and forth gear.
2. Remove the circlip and splined washer.
3. Remove the drive axle third gear and fifth gear.
4. Remove the circlip and splined washer.
5. Remove the drive axle second gear.
6. Inspect the drive axle assembly as described in this chapter.

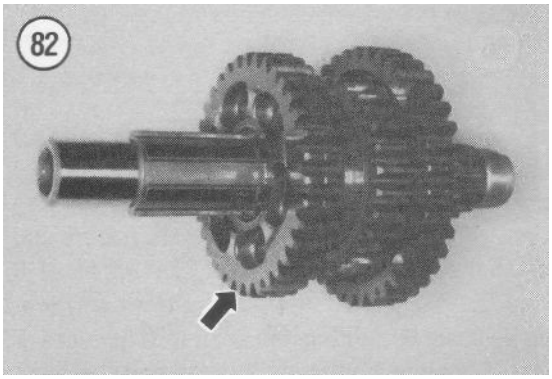
NOTE

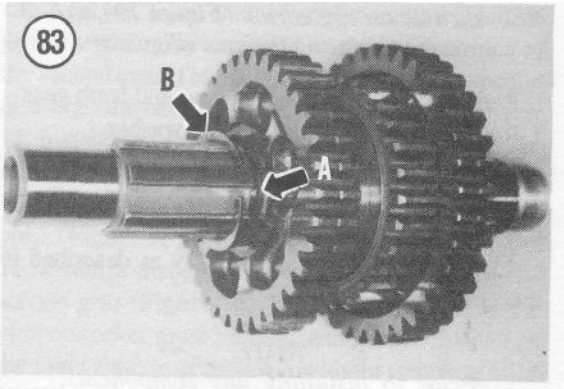
Prior to installing any components, coat all bearing surfaces with assembly oil.

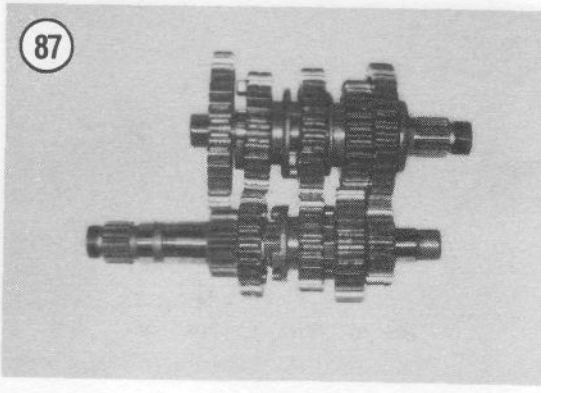
7. Install the drive axle second gear (A, **Figure** 80).
8. Install the splined washer (B, **Figure** 80) and circlip (C, **Figure** 80). Make sure the circlip is properly seated in the drive axle groove.
9. Install the drive axle fifth gear **(Figure** 81).
10. Position the drive axle third gear with the dog receptacle side going on last and install the drive axle third gear **(Figure 82).**
11. Install the splined washer (A, **Figure 83)** and circlip (B, **Figure** 83). Make sure the circlip is properly seated in the drive axle groove.
12. Install the drive axle forth gear **(Figure** 84).
13. Install the drive axle first gear **(Figure 85).**
14. Refer to **Figure** 86 for correct placement of the gears.
15. Properly mesh both transmission assemblies together **(Figure** 87) to make sure all mating gears are properly aligned.

Inspection

1. Clean all parts in cleaning solvent and thoroughly dry.




83
B
A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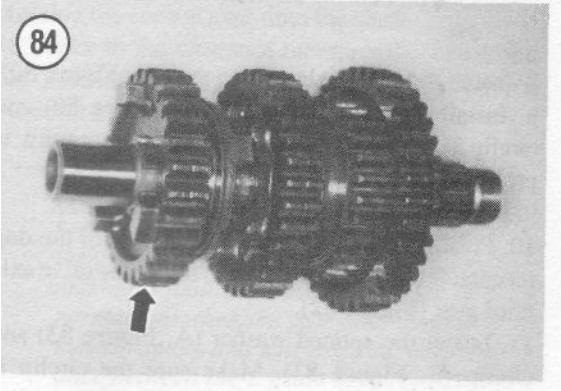
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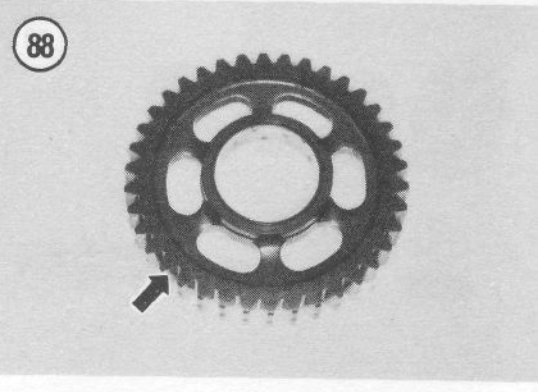
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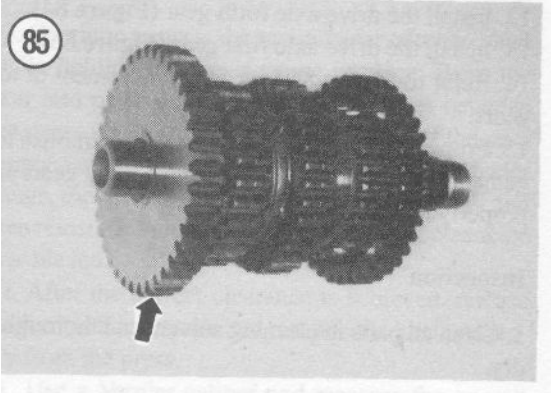
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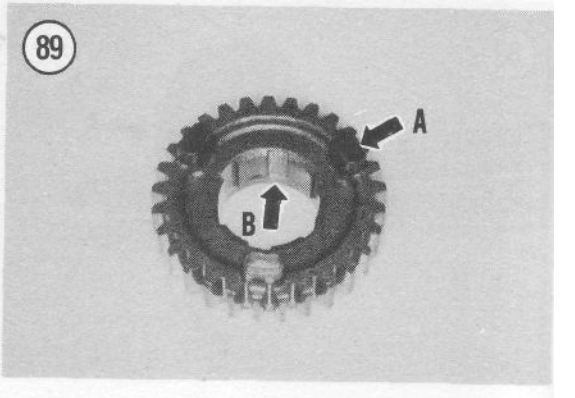
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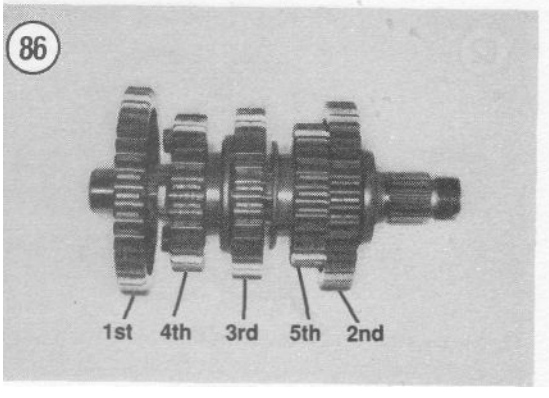
A
B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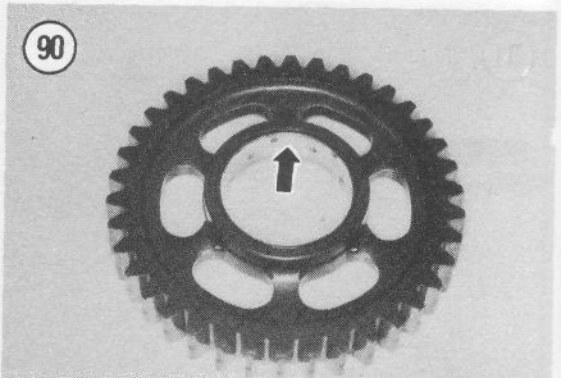
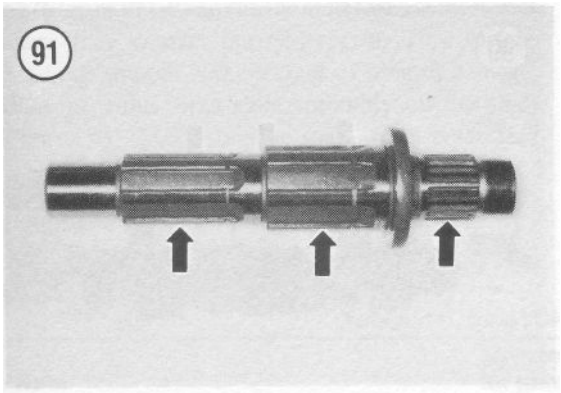
1st
4th
3rd
5th
2nd

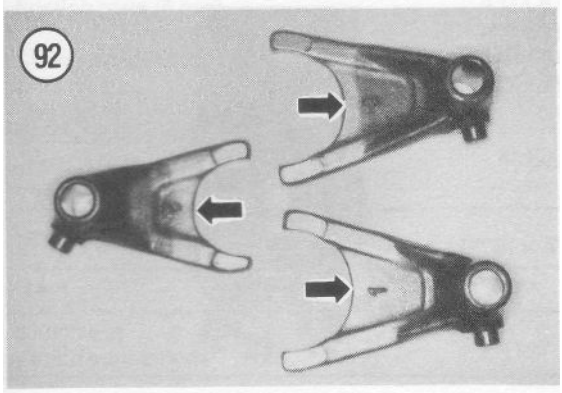

90

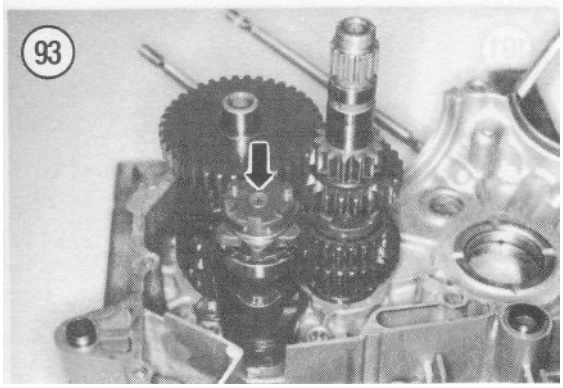
2. Inspect the gears visually for cracks, chips, broken teeth and burnt teeth (Figure 88). Check the dogs (A, **Figure** 89) on the ends of the gears to make sure they are not rounded off. If the lugs are rounded off, check the shift forks as described later in this chapter. More than likely, one or more of the shift forks is bent.

NOTE

Defective gears should be replaced, and it is a good idea to replace the mating gear even though it may not show as much wear or damage. Remember that accelerated wear to new parts is normally caused by contact from worn parts.







3. Inspect all free wheeling gear bearing surfaces **(Figure 90)** for wear, discoloration and galling. Inspect the mating shaft bearing surface also. If there is any metal flaking or visual damage, replace both parts.

4. Inspect the splines **(Figure 91)** on both shafts for wear or discoloration. Check the mating gear internal splines also (B, **Figure 89).** If no visual damage is apparent, install each sliding gear on its respective shaft and work the gear back and forth to make sure gear operates smoothly.

5. Check all circlips and washers. Replace any circlips that may have been damaged during operation or removal as well as any washers that show wear.

6. If some of the transmission components were damaged, make sure to inspect the shift drum and shift forks as described in this chapter.

SHIFT DRUM AND FORKS

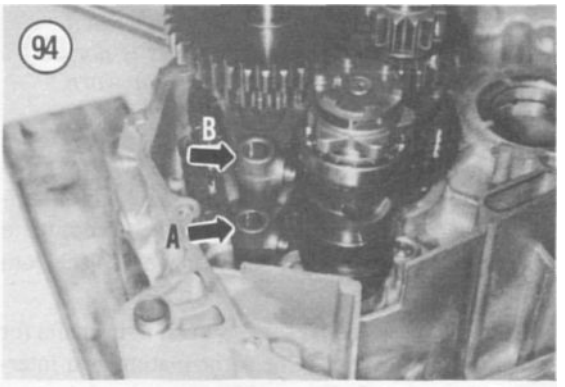
Removal/Installation

1. Separate the crankcase as described in Chapter Four in this section of the manual.
2. Withdraw the rear long shift fork shaft.
3. Withdraw the front short shift fork shaft.
4. Remove all 3 shift forks from both transmission shafts.
5. Remove the shift drum from the left-hand side crankcase.

NOTE

*When installing the shift forks, the number on each shift fork **(Figure** 92) must face toward the left-hand side crankcase.*

6. Install the shift drum **(Figure 93).**
7. Insert the No. 1 shift fork into the drive axle fifth gear (A, **Figure 94)** then insert the No. 3 shift fork into the drive axle forth gear (B, **Figure 94).**
8. Insert the No. 2 shift fork into the main shaft third gear **(Figure 95).**
9. Move all shift forks into position so that their pin seats in their respective shift drum groove.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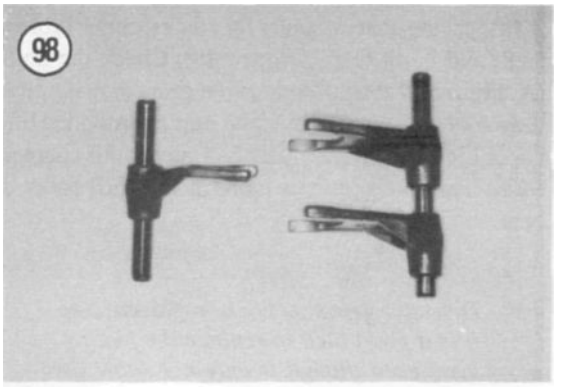
B
A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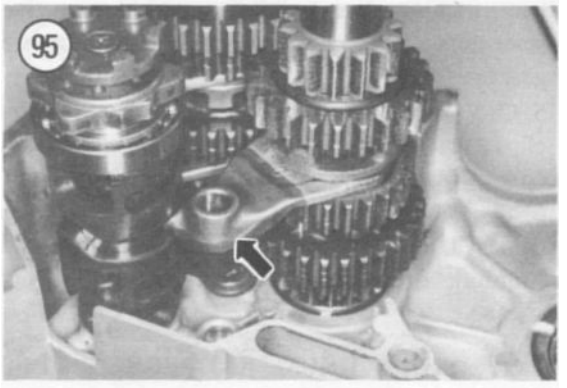
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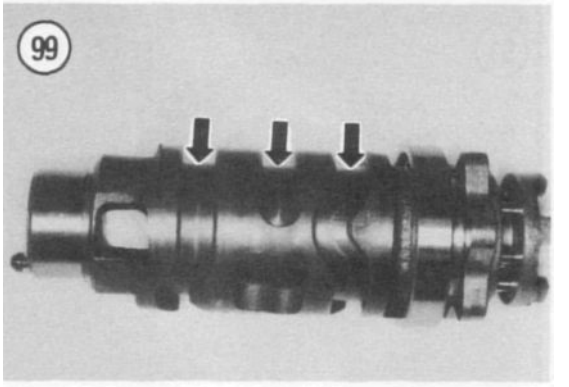
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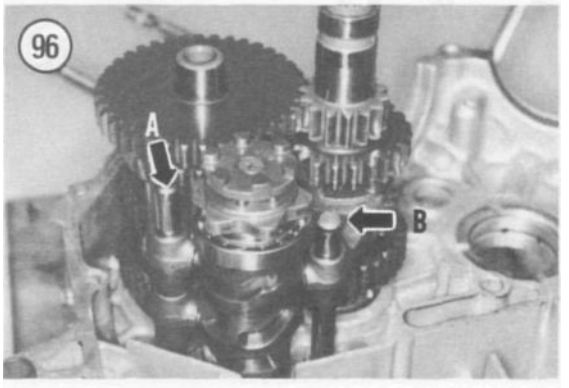
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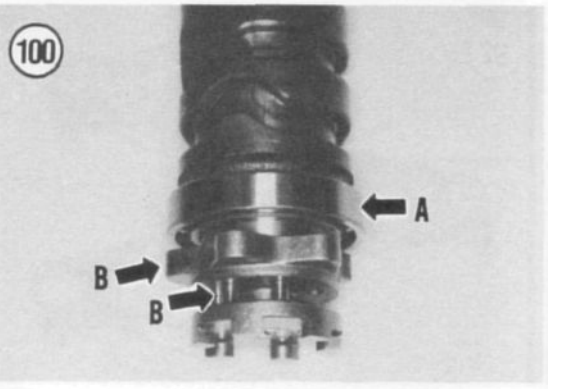
A
B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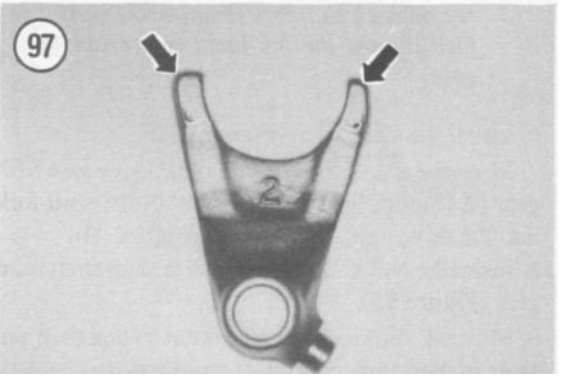
A
B
B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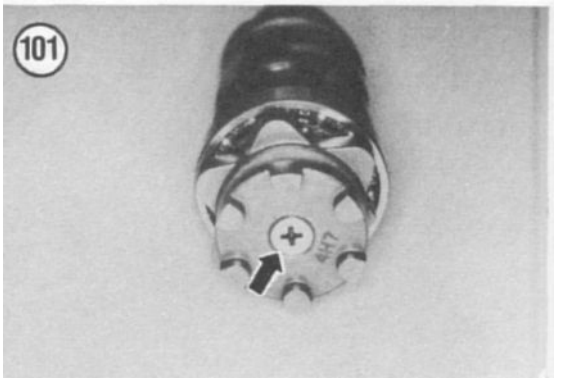
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10. Insert the rear long shift fork shaft through the No. 1 and No. 3 shift forks (A, **Figure 96).** Make sure the shaft bottoms out in the crankcase.
11. Insert the front short shift fork shaft into the No. 2 shift fork **(B, Figure 96).** Make sure the shaft bottoms out in the crankcase.
12. Assemble the crankcase assembly as described in Chapter Four.

Inspection

1. Inspect each shift fork for signs of wear or cracking **(Figure 97).** Examine the shift forks at the points where they contact the slider gear. This surface should be smooth with no signs of wear or damage. Make sure the forks slide smoothly on the shaft **(Figure 98).** Make sure the shaft is not bent. This can be checked by removing the shift forks from the shaft and rolling the shaft on a piece of glass. Any clicking noise detected indicates that the shaft is bent.

2. Check grooves in the shift drum **(Figure 99)** for wear or roughness.

3. Check the shift drum bearing (A, **Figure 100).** Make sure it operates smoothly with no signs of wear or damage.

4. Check the ramps and pin in the segment **(B, Figure 100)** for wear or damage, replace if necessary by removing the screw **(Figure 101)** on the end.

5. Check the cam pin followers in each shift fork. They should fit snugly but not too tightly. Check the end that rides in the shift drum for wear or burrs. Replace as necessary.

Table 1 CLUTCH SPECIFICATIONS

Item	Standard in. (mm)	Minimum in. (mm)
Friction plate (6 pcs)	0.114-0.122 (2.9-3.1)	0.102 (2.6)
Clutch plate (5 pcs)	0.060-0.067 (1.1-1.7)	—
Warp limit	—	0.008 (0.2)
Clutch spring (5)		
Free length	1.56(39.5)	1.52 (38.5)
Pushrod No. 2 bend limit	—	0.02 (0.5)

Table 2 CLUTCH TIGHTENING TORQUES

Item	ft.-lb.	N*m
Clutch nut	50	70
Clutch spring bolts	5.8	8

CHAPTER SIX

FUEL, EMISSION CONTROL AND EXHAUST SYSTEMS

This chapter describes complete procedures for servicing the fuel, emission control and exhaust systems. Carburetor specifications are listed in **Table 1. Table 1** is at the end of the chapter.

NOTE

Where differences occur relating to the United Kingdom (U.K.) models they are identified. If there is no (U.K.) designation relating to a procedure, photo or illustration it is identical to the United States (U.S.) models.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Six in the front section of this manual for service procedures.

CARBURETOR

Removal/Installation

Remove both carburetors as an assembled unit.

1. Place the motorcycle securely on the sidestand.
2. Remove the seat(s).

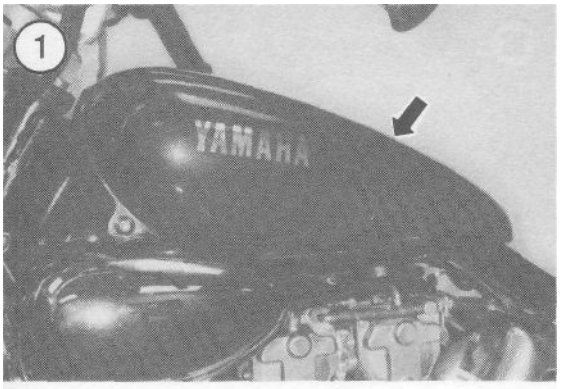
3A. On 1987-1989 U.S. models and 1988 U.K. models, remove the rear bolt and front bolt on each side securing the frame top cover and remove the cover **(Figure** 1).

3B. On 1990-on U.S. models and 1989-on U.K. models, remove the sub-fuel tank as described in this chapter.

4. Unhook the battery strap (A, **Figure** 2).
5. Disconnect the battery vent tube (B, **Figure** 2).
6. Pull the battery part way up out of the battery box to gain access to the battery cable attachment screws.
7. Disconnect the negative (-) battery cable **(Figure** 3) from the battery.
8. Remove the right-and left-hand frame and engine side covers.

9A. On models equipped with the air injection system, disconnect the hoses (A, **Figure 4)** from the air injection system and remove the left-hand bracket assembly (B, **Figure 4)** with the system components still attached to it.

9B. On all other models, remove bolts securing the left-hand side cover **(Figure 5)** and remove the bracket (A, **Figure** 6).

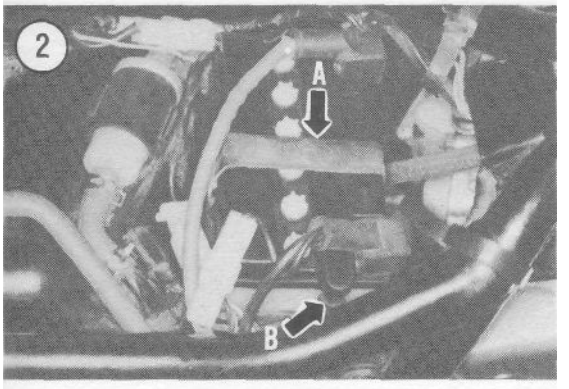


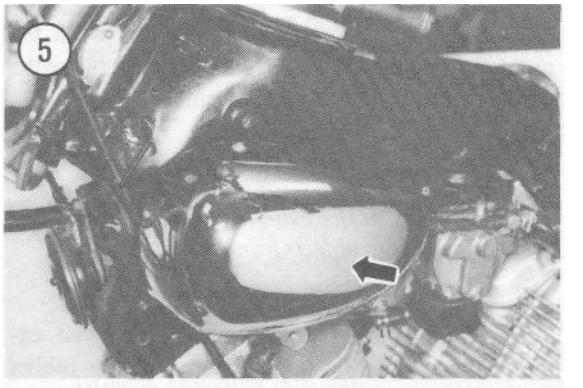
10. Disconnect the vent hose **(B, Figure 6)** from each carburetor.

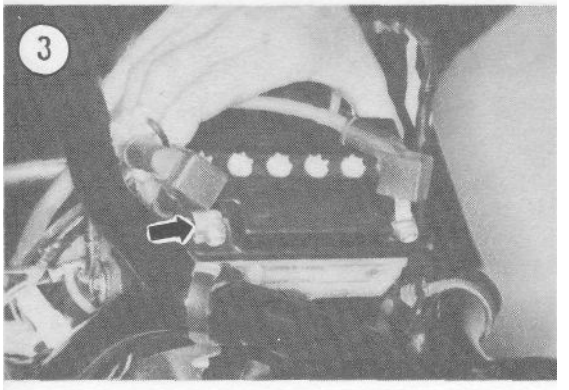
11. Remove bolts securing the right-hand side cover **(Figure 7)** and electrical component bracket **(Figure 8)** and move the bracket assembly out of the way.

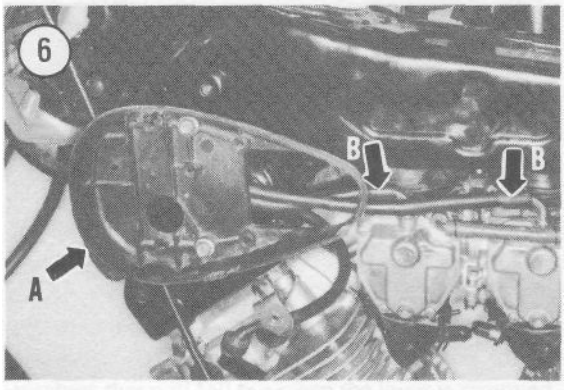
12. Remove the bolts securing the rubber intake tube to each cylinder head **(Figure 9).**

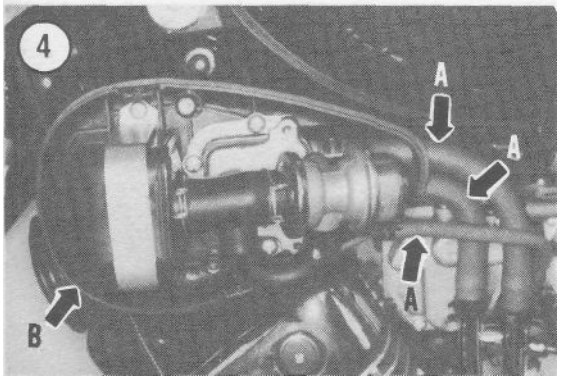
13. At the throttle lever, loosen the cable locknut (A, **Figure 10)** and loosen the adjuster (B, **Figure 10)** to allow maximum amount of slack in the throttle cable.

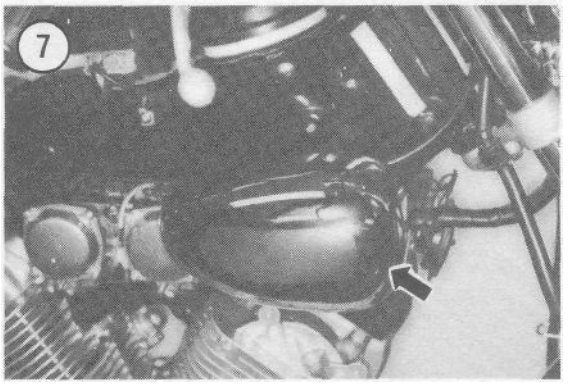












14 Loosen the locknut on the throttle cable (A, **Figure 11)**

15 Open the throttle wheel with your finger and disconnect the throttle cable from the carburetor throttle wheel (B, **Figure 11)**

16 Loosen the hose clamp and disconnect the fuel hose **(Figure 12)** from the carburetor assembly Insert a golf tee to prevent the dribbling of fuel

17 Remove the hose clamp screws **(Figure 13)** securing the air filter housing joints to both carburetors Remove both hose clamps

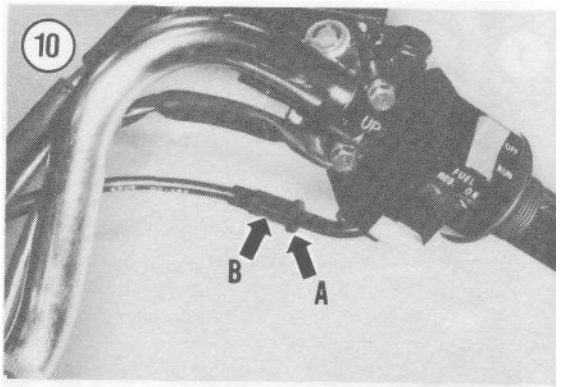
18 Push the air filter housing joints up into the air box

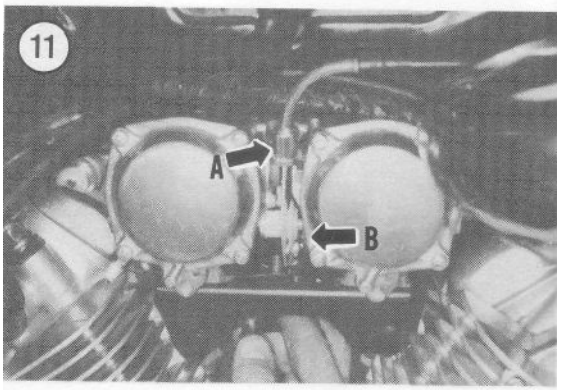
19 Grasp the carburetor assembly and work the assembly out toward the left-hand side Remove the carburetor assembly from the frame

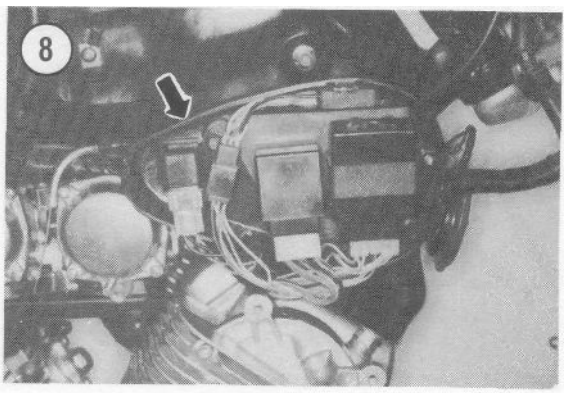
CAUTION

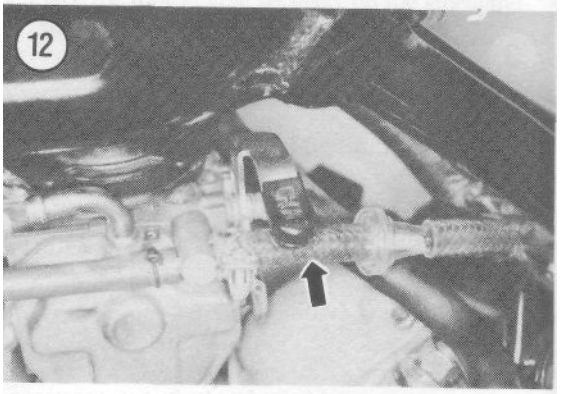
Stuff clean shops rags into the intake openings in the cylinder heads to prevent foreign objects from falling into the cylinder heads

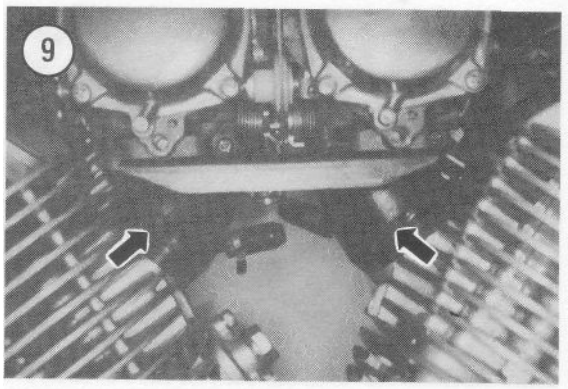
20 While the carburetor assembly is removed, examine the cylinder head intake tubes and the rubber

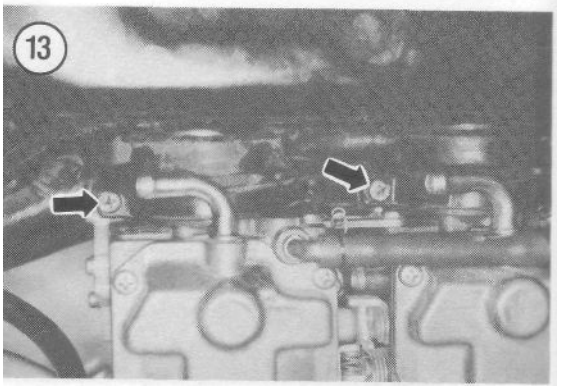


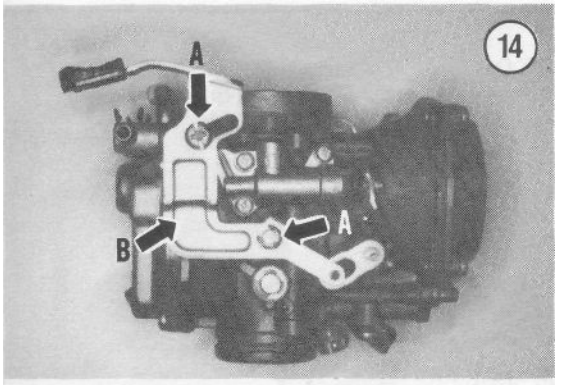


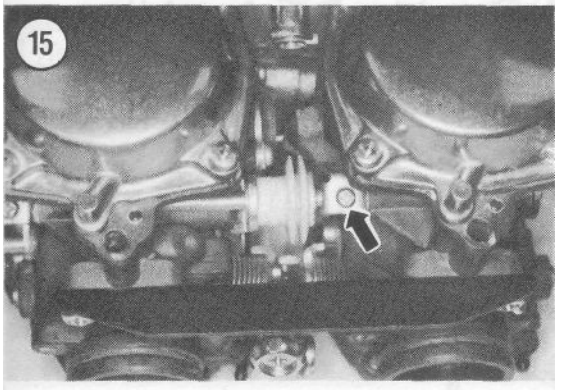


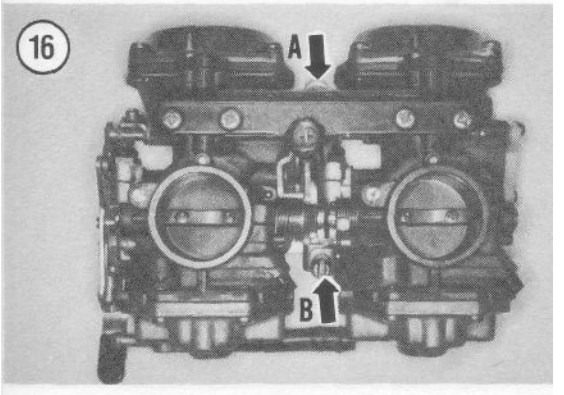


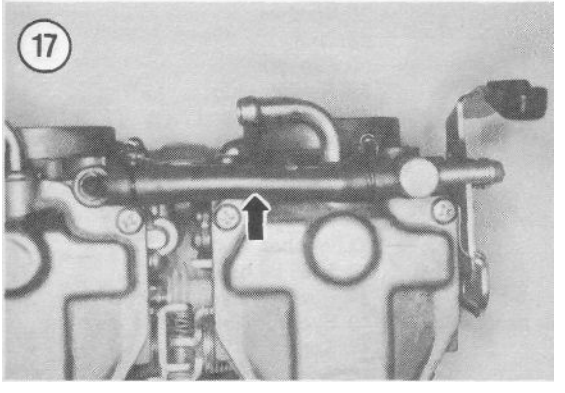












outlet boots on the air filter box for any cracks or damage that would allow unfiltered air to enter the engine. Replace any damaged parts.

21. Install by reverse these removal steps while noting the following:

a. Make sure the O-ring seal is in place in the rubber intake tube prior to installation. During installation of the carburetor assembly, do not snag the O-ring on the cylinder head surface as the O-ring will either be damaged or may be moved out of position resulting in a vacuum leak.

b. Make sure the carburetors are fully seated forward in the filter housing joints on both carburetors. Also make sure the joints are correctly seated in the air filter air box.

CAUTION

Make sure the carburetor intake tubes are air tight. Air leaks can cause severe engine damage because of a lean mixture or the intake of dirt and moisture.

c. Check the throttle cable for correct routing after installation. The cable must not be twisted, kinked or pinched.

d. Adjust the throttle cable as described in Chapter Three in this section of the manual.

Carburetor Assembly Separation/Reassembly

The carburetors can be cleaned without separating the individual body assemblies but if necessary, they can be separated as follows.

1. Remove the screw and E-clip (A, **Figure** 14) securing the choke lever and remove the choke lever assembly (B, **Figure 14).** Don't lose the plastic washers that will fall out when the lever is removed.

2. Loosen the screws on the choke lever link **(Figure 15).**

3. Remove the E-clip, spring and remove the choke lever from the assembly.

4. Remove the screws securing the upper bracket and remove the bracket.

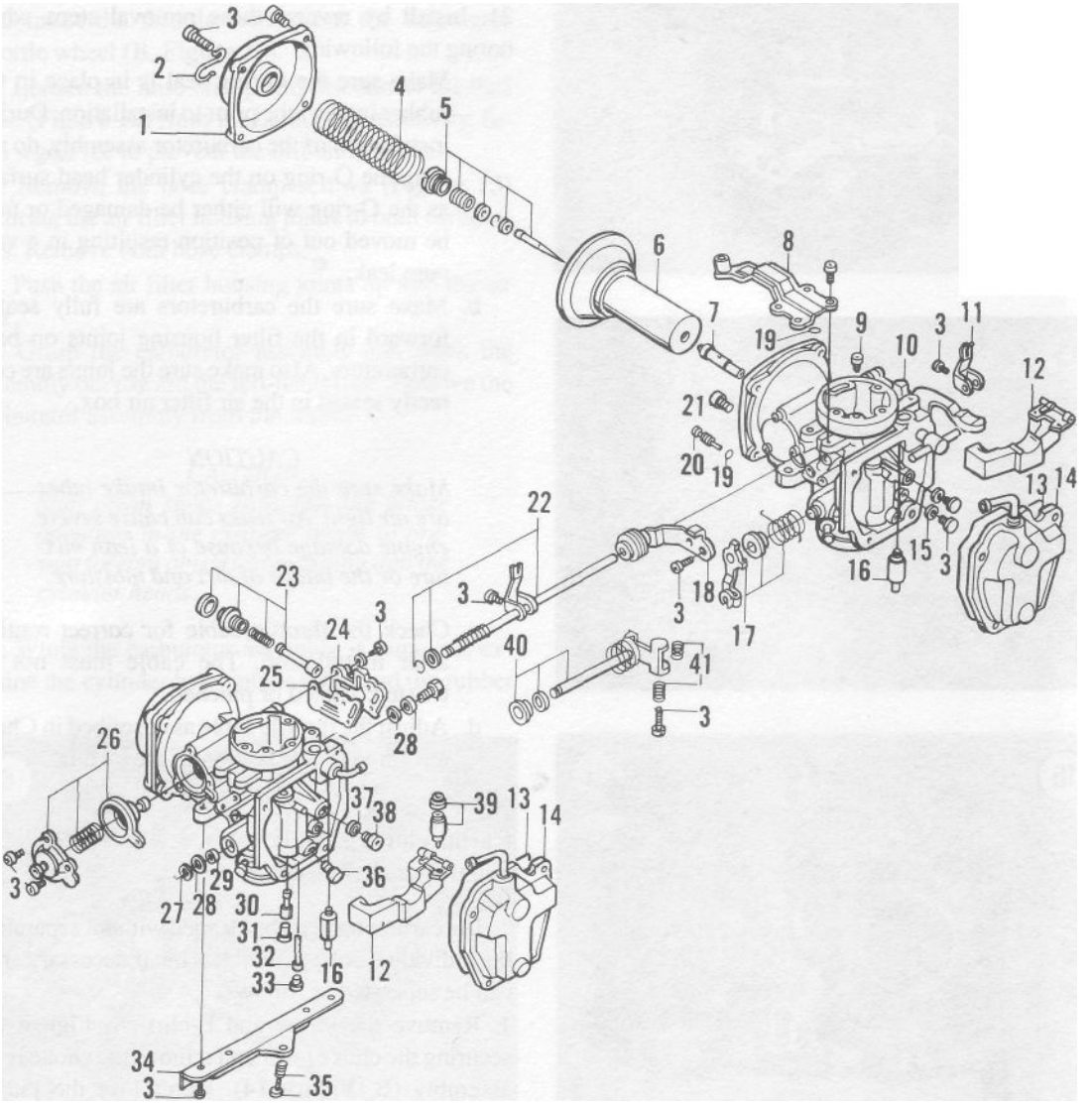
5. Remove the screws securing the lower bracket (A, **Figure** 16) and remove the bracket.

6. Move the hose clamps on the fuel line assembly **(Figure** 17) away from both carburetor bodies.

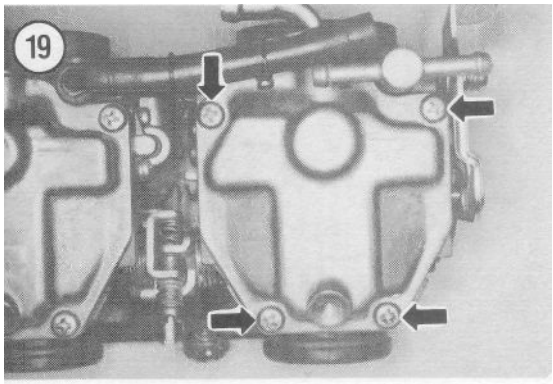
7. Place the carburetor assembly on a piece of plate glass with the vacuum chamber covers facing down.

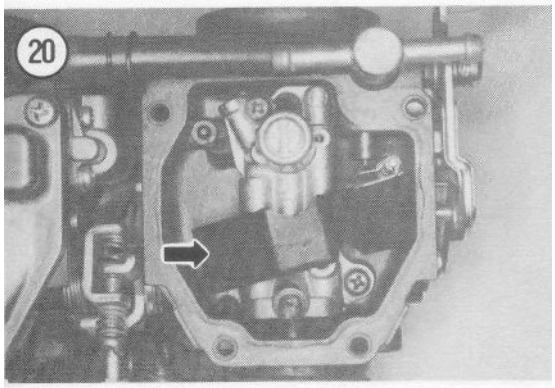
(18)

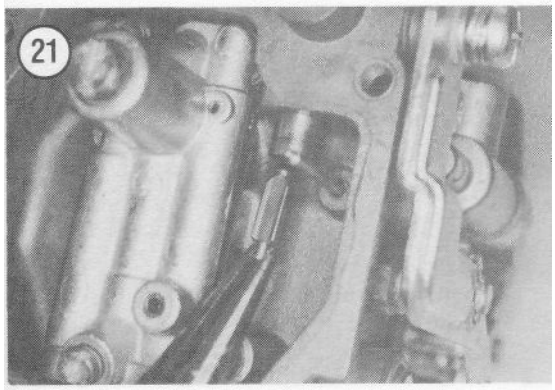
CARBURETOR

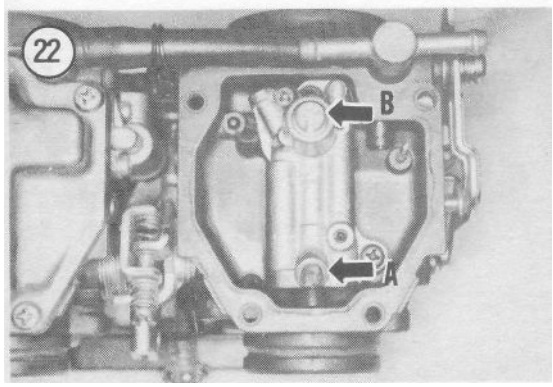


1. Cover
2. Guide
3. Screw
4. Spring
5. Jet needle assembly
6. Diaphragm/slide
7. Main jet nozzle
8. Upper bracket
9. Pilot air Jet No. 1
10. Carburetor body
11. Float hanger
12. Float
13. O-ring gasket
14. Float chamber
15. Lockwasher
16. Needle valve
17. Throttle lever and return spring
18. Choke lever
19. O-ring
20. Drain screw
21. Screw
22. Choke lever assembly
23. Choke assembly
24. Choke plate
25. Gasket
26. Coasting enrichener assembly
27. E-clip
28. Washer
29. Seal
30. Pilot jet
31. Rubber plug
32. Main jet bleed pipe
33. Rubber plug
34. Lower bracket
35. Throttle adjust knob and spring
36. Main jet
37. Washer
38. Main jet holder
39. Needle valve and seat
40. Sychronizing lever assembly
41. Springs









8. Carefully separate the carburetor bodies from each other. Don't lose the small synchronizing screw (B, **Figure 16)** that will usually fall out.
9. Reassemble by reversing these separation steps while noting the following:
   a. Place the carburetor assembly on a piece of plate glass with the inlet side facing down.
   b. Tighten the upper and lower bracket screws securely while pressing down on both carburetors to maintain proper alignment between the 2 carburetors.
   c. Connect the rubber fuel line onto each carburetor body and reposition the hose clamps. Make sure the clamps are positioned correctly to avoid a fuel leak.

Individual Carburetor Disassembly/Assembly

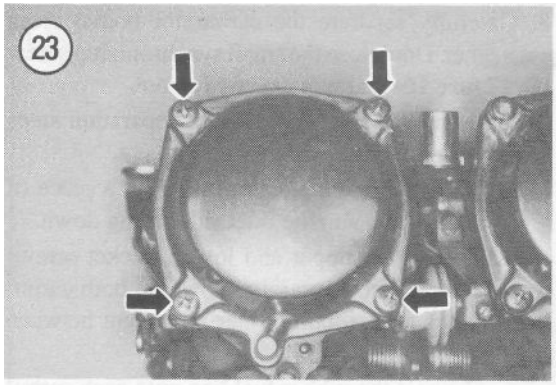
Refer to **Figure 18** for this procedure. It is recommended to disassemble only one carburetor at a time to prevent accidental interchange of parts.

1. Move the hose clamps on the fuel line assembly **(Figure 17)** away from the carburetor to be disassembled.
2. Remove the screws **(Figure 19)** securing the float bowl and remove the float bowl and gasket.
3. Remove the float **(Figure 20)** and the needle valve **(Figure 21).**
4. Remove the main jet (A, **Figure 22).**
5. Remove the main jet nozzle holder screw (B, **Figure** 22) and the washer under it.

NOTE

One of the vacuum cover screws is a Torx head type (size T-27) and a special tool is required to remove it. Use Yamaha special tool U.S. part No. YU-05258, U.K. part No. 90890-05349, or equivalent.

6. Remove the screws **(Figure 23)** and the vacuum chamber cover.
7. Remove the diaphragm spring **(Figure 24)** from the diaphragm.
8. Lift the diaphragm assembly (A, **Figure 25)** out of the carburetor.
9. Unscrew the pilot air jet No. 2 **(Figure 26).**
10. Remove the screws securing the choke chamber and remove the chamber assembly.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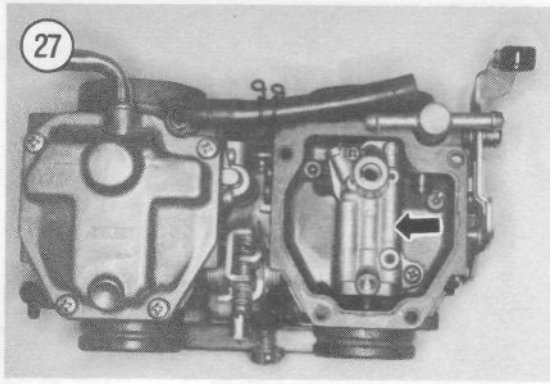
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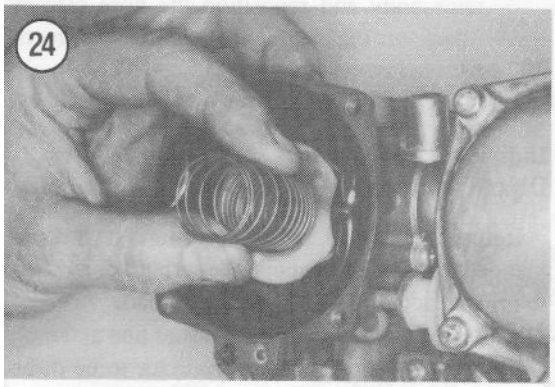
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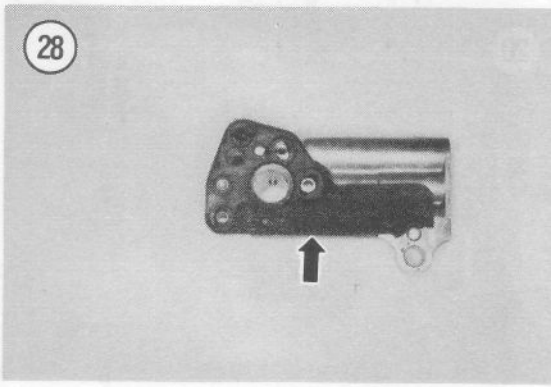
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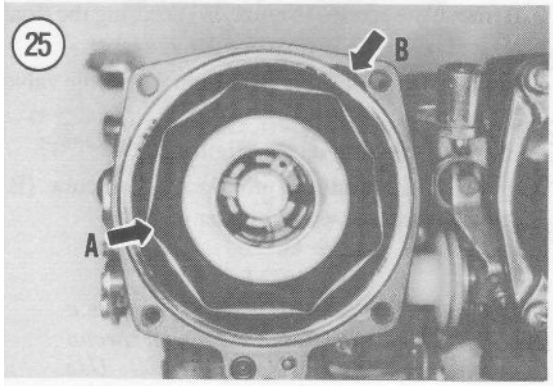
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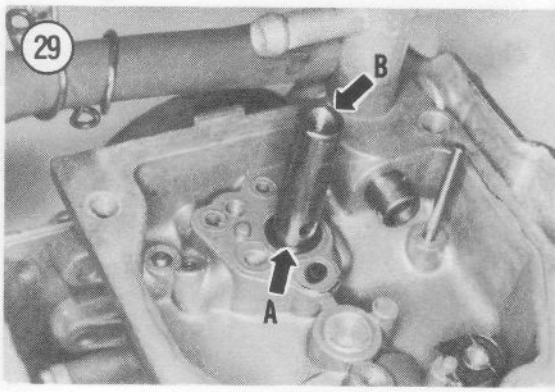
B
A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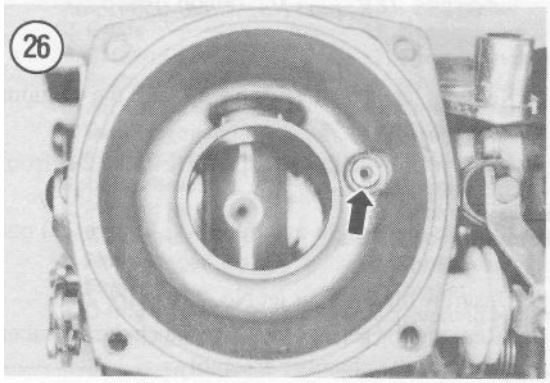
A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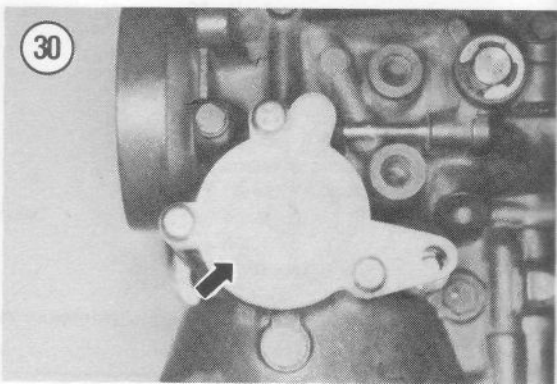
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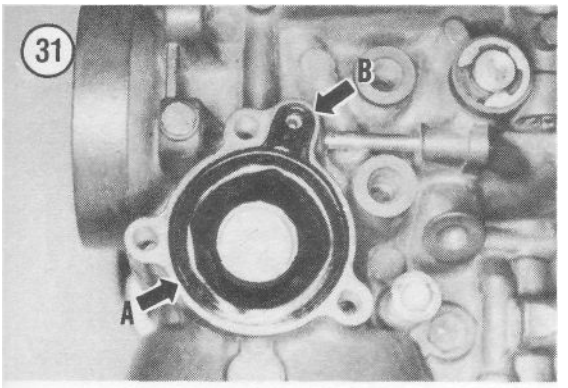
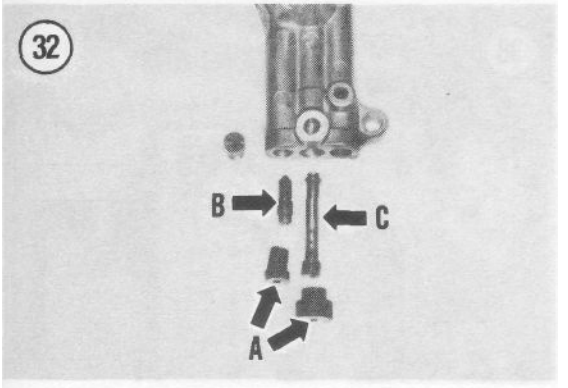
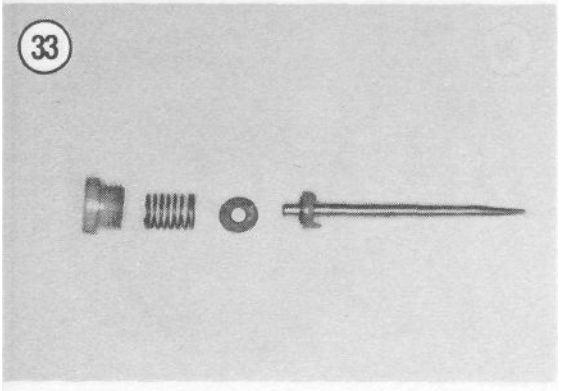
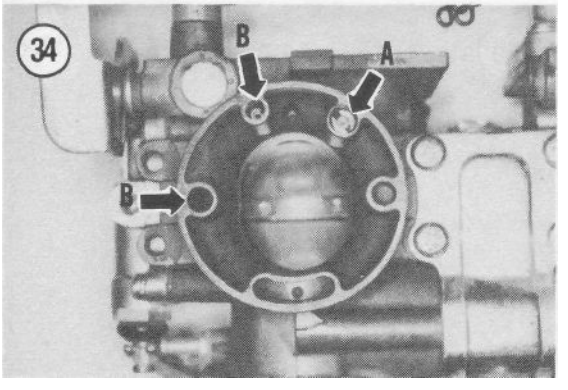








11. Remove the screws securing the jet block assembly **(Figure 27)** and remove it. Remove the gasket **(Figure 28)** and O-ring (A, **Figure 29).**

12. Turn the carburetor over and tap it with your hand. Remove the main jet nozzle (B, **Figure 29).**

13. Remove the screws securing the coasting enricher cover **(Figure 30)** and remove the spring and diaphragm (A, **Figure 31).**

14. Remove the rubber plugs (A, **Figure 32)** from the jet holder assembly.

15. Unscrew the pilot jet (B, **Figure 32)** and the main bleed pipe (C, **Figure 32).**

16. If necessary, remove the screws securing the throttle cable bracket and remove it.

17. Remove the needle valve assembly **(Figure 33).** Don't lose the O-ring seal.

18. Unscrew the pilot air jet No. 1 (A, **Figure 34).**

19. Clean and inspect that carburetor as described in this chapter.

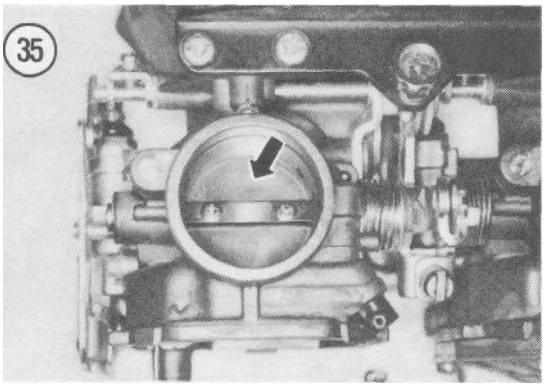
20. Installation is the reverse of these steps while noting the following.

a. Check the throttle shaft and throttle plate **(Figure 35)** for excessive play or damage. Check the throttle plate screws for looseness. If the throttle shaft and/or plate is damaged, that carburetor body must be replaced as an assembly.

b. Make sure the O-ring seal is in place on the needle valve assembly prior to installation.

c. Align the projection **(Figure 36)** on the jet block with the groove **(Figure 37)** on the jet needle and install the jet block. Check to make sure the alignment is correct as shown in **Figure 38.** Tighten the screws securely.

d. Replace the float bowl seal **(Figure 39)** if deformed or starting to deteriorate or if the bowl has leaked.



e. Align the locating tab on the vacuum diaphragm (B, **Figure 25)** with the relief in the carburetor body. Insert your index finger into the venturi and hold the slide up to almost the full open position. This will help eliminate pinching the diaphragm when the top cover is installed.

f. Install the cover and tighten the cover screws securely.

g. Align the locating tab on the coasting enricher diaphragm (B, **Figure 31)** with the relief in the carburetor body. Install the spring and cover and tighten the screws securely.

h. If removed, apply blue Loctite (No. 242) to the throttle cable bracket screws prior to installation. Tighten the screws securely.

21. Repeat Steps 1-17 for the other carburetor. Do not interchange parts—keep them separate.

22. After the carburetors have been disassembled the idle speed should be adjusted and the carburetors synchronized as described in Chapter Three in this section of the manual.

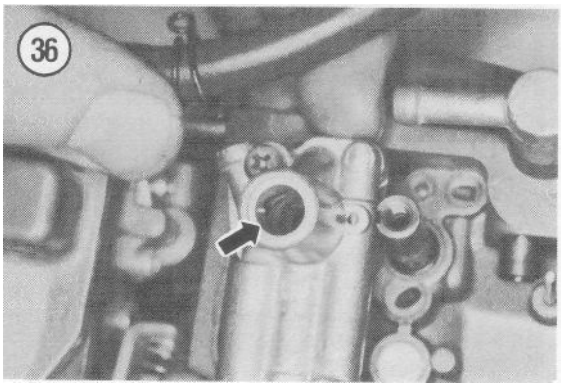
Cleaning and Inspection

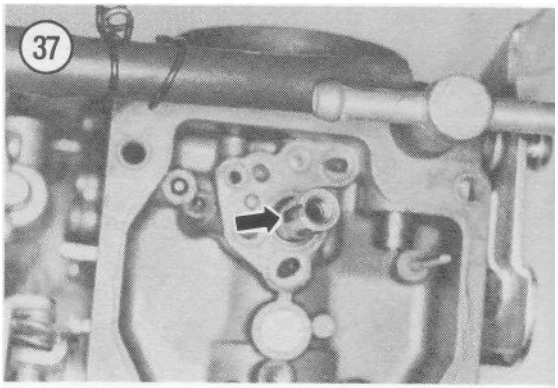
1. Thoroughly clean and dry all parts. Yamaha does not recommend the use of a caustic carburetor cleaning solvent. Instead, clean carburetor parts in a petroleum based solvent. Then rinse in clean water.

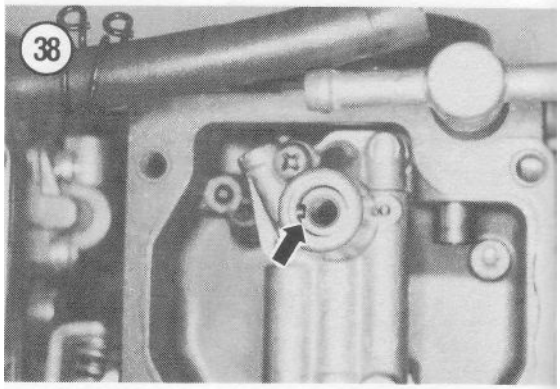
2. Allow the carburetor to dry thoroughly before assembly and blow dry with compressed air. Blow out the jets and needle jet holder with compressed air.

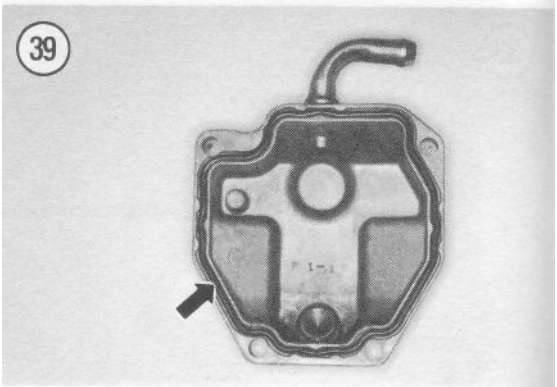
CAUTION

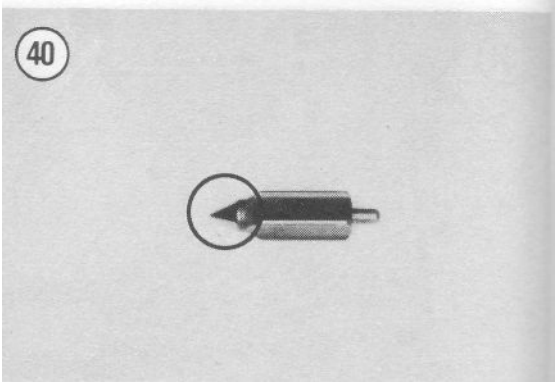
If compressed air is not available, allow the parts to air dry or use a clean lint-

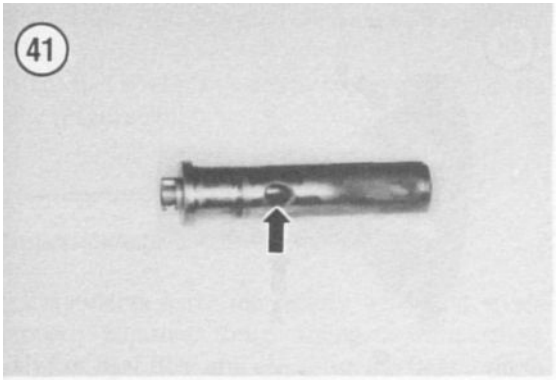


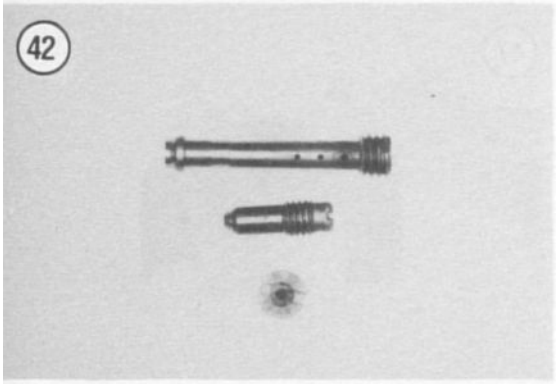


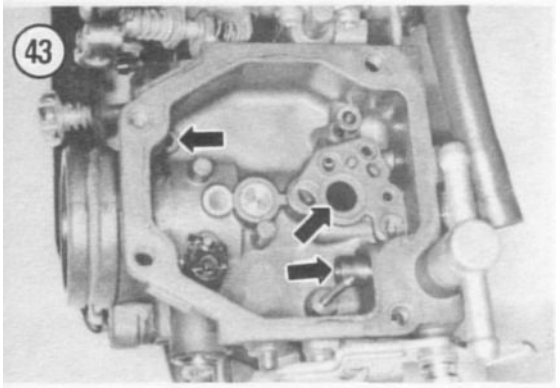


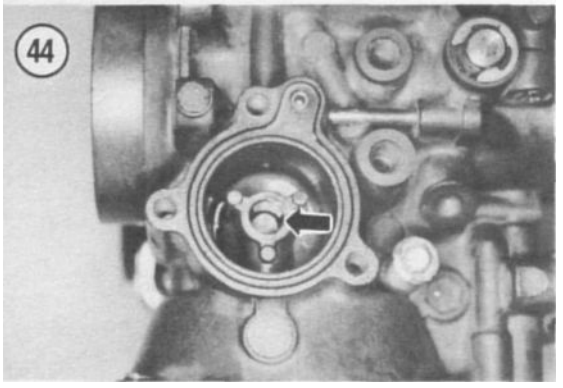












*free cloth. Do **not** use a paper towel to dry carburetor parts, as small paper particles may plug openings in the carburetor body or jets.*

CAUTION

*Do **not** use a piece of wire to clean the jets as minor gouges in the jet can alter flow rate and upset the fuel/air mixture.*

3. Inspect the end of the float valve needle (Figure 40) for wear or damage. Also check the inside of the needle valve in the needle valve body. If either part is damaged, replace as a set. A damaged needle valve or a particle of dirt or grit in the needle valve assembly will cause the carburetor to flood and overflow fuel.

4. Inspect all O-ring seals on the needle valve assembly prior to installation. O-ring seals tend to become hardened after prolonged use and heat and therefore lose their ability to seal properly. Replace if necessary.

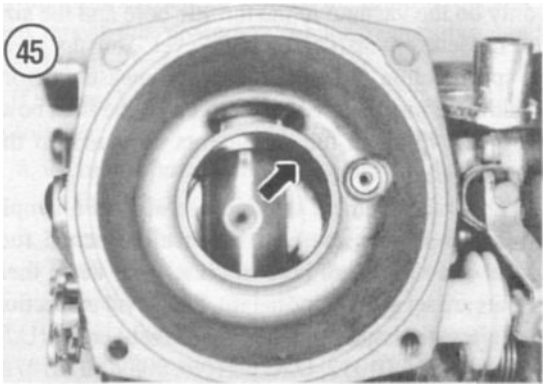
5. Make sure the holes in the main jet nozzle **(Figure 41)** and all jets are clear **(Figure 42).** Clean out if they are plugged in any way. Replace the main jet nozzle if you cannot unplug the holes.

6. Make sure all openings in the carburetor body are clear. Refer to **Figure 43, Figure 44** and **B, Figure 34.** Clean out if they are plugged in any way.

7. Inspect the slide area **(Figure 45)** in the carburetor body. Make sure it is clean and free of any burrs or obstructions that may cause the diaphragm assembly to hang up on during normal operation.

8. Inspect the diaphragm slide (A, **Figure 46) for** scoring and wear. Replace if necessary.

9. Inspect the diaphragm (B, **Figure** 46) for tears, cracks or other damage. Replace the throttle slide assembly if the diaphragm is damaged.



10. Inspect the float **(Figure 47)** for deterioration or damage. If the float is suspected of leakage, place it in a container of non-caustic solution and push it down. If the float sinks or if bubbles appear (indicating a leak), the float must be replaced.

CARBURETOR ADJUSTMENTS

Idle Speed, Idle Mixture Adjustment and *Carburetor Synchronization* are covered in Chapter Three in this section of the manual.

COASTING ENRICHENER SYSTEM

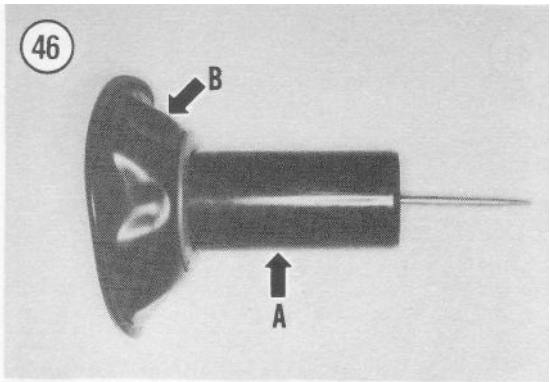
The carburetors on these models are equipped with a coasting enrichener system. When the throttle is opened, air is forced to the pilot air jet through two passageways in the carburetor body. When the throttle is off, vacuum at the carburetor joint increases and actuates the enrichener diaphragm which shuts off the air through one of the passages. This action increases the fuel mixture at the pilot jet outlet and reduces afterburning.

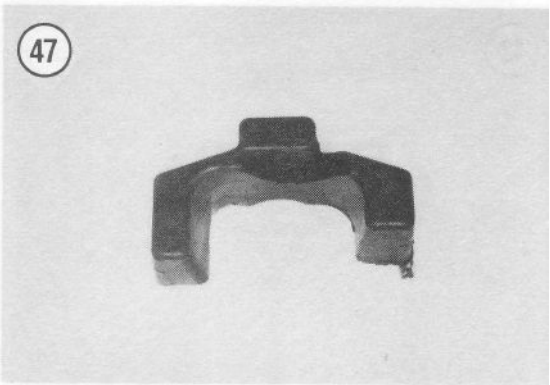
1. Remove the carburetor assembly as described in this chapter.
2. Remove the screws securing the coasting enrichener cover and remove the spring and diaphragm **(Figure 48).**
3. Inspect the enrichener diaphragm for tears or other damage. Replace the diaphragm if necessary.
4. Install by reversing these removal steps.

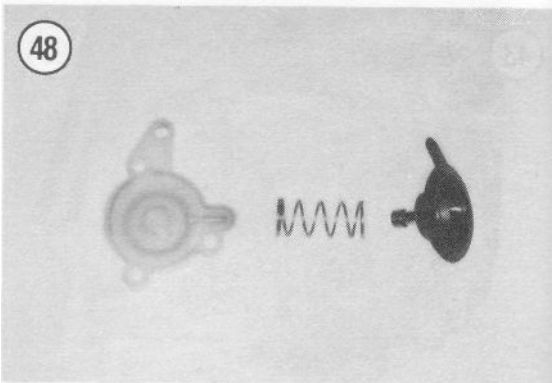
FUEL LEVEL MEASUREMENT

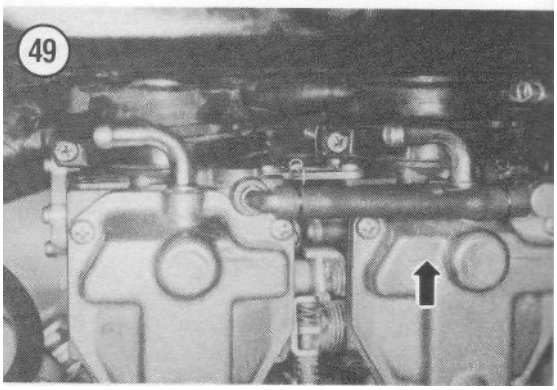
The fuel level in the carburetor float bowls is critical to proper performance. The fuel flow rate from the bowl up to the carburetor bore depends not only on the vacuum in the throttle bore and the size of the jets, but also on the fuel level. Yamaha gives a specification of actual fuel level, measured from below the piston valve center mark on the float bowl **(Figure 49)** with the carburetors mounted on the motorcycle.

This measurement is more useful than a simple float height measurement because the actual fuel level can vary from bike to bike, even when their floats are set at the same height. Fuel level inspection requires a special Yamaha Fuel Level Gauge (U.S. part No. YM-01312, U.K. partNo. 90890-01312) or







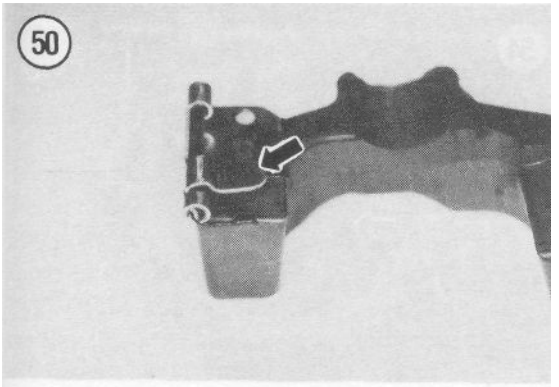


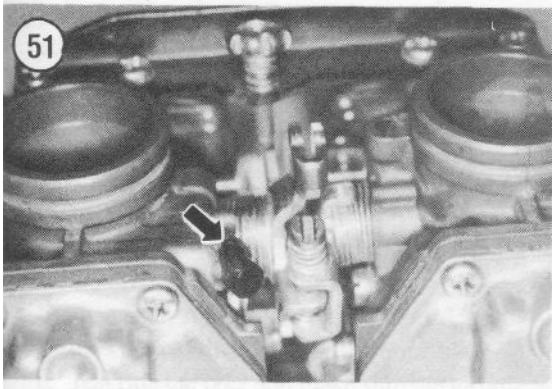
a vinyl tube with an inside diameter of 6 mm (0.24 in.).

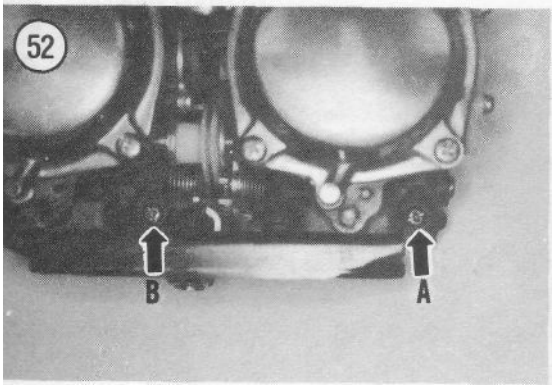
The fuel level is adjusted by bending the float arm tang **(Figure 50).**

Inspection/adjustment

Carburetors leave the factory with float levels properly adjusted. Rough riding, a worn needle valve or bent float arm can cause the float level to change. To adjust the float level on these carburetors, perform the following.







WARNING

Some gasoline will drain from the carburetors during this procedure. Work in a well-ventilated area, at least 50 feet from any open flame. Do not allow anyone to smoke. Wipe up spills immediately.

1. Place the motorcycle securely on the sidestand. Make sure the bike and carburetor assembly are in a true vertical position. If necessary, place shims under the sidestand to achieve a true vertical position for the carburetor assembly.

NOTE

Figure 51 *and* ***Figure 52*** *are shown with the carburetor assembly removed for clarity. Do not remove the assembly for this procedure.*

2. Connect the fuel level gauge (U.S. part No. YM-01312, U.K. part No. 90890-01312) or a vinyl tube (with a 0.24 in./6 mm inner diameter) to the drain nozzle on the float chamber **(Figure 51)** on the front carburetor. Secure the gauge so that it is vertical against the float bowl.

3. Loosen the carburetor drain screw. Refer to A, **Figure 52** for the front cylinder or B, **Figure 52** for the rear cylinder.

4. Start the engine and allow it to idle for a few minutes. Turn the engine off.

5. Wait until the fuel in the gauge settles.

6. The fuel level should be 0.53-0.57 in. (13.5-14.5 mm) below the piston valve center mark on the float bowl. Note the reading for the front carburetor.

7. If the fuel level is incorrect, note the dimension for the front carburetor, tighten the drain screw and then repeat this procedure for the rear carburetor. Note the fuel level in the rear carburetor.

8. If the fuel level is incorrect, adjust the float height as follows:

a. Remove the carburetor assembly as described in this chapter.

b. Remove the screws **(Figure 53)** securing the float bowl and remove the float bowl and gasket.

c. Remove the float **(Figure 54)** and the needle valve.

d. Carefully adjust the tang **(Figure 50)** on the float. Bending the float upward very slightly to lower the fuel level; bend the tang downward to raise the fuel level. If the fuel level is set too high, the result with be a rich air-fuel mixture. If it is set too low, the mixture will be too lean.

e. Install the needle valve, float and float bowl.

9. Install the carburetor assembly and repeat this procedure until both fuel levels are correct.

CAUTION

The floats on both carburetors must be adjusted to the correct position to maintain the same air-fuel mixture to each cylinder.

THROTTLE CABLE REPLACEMENT

1. Place the bike securely on the sidestand.
2. Remove the seat.

3A. On 1987-1989 U.S. models and 1988 U.K. models, remove the rear bolt and front bolt on each side securing the frame top cover and remove the cover.

3B. On 1990-on U.S. models and 1989-on U.K. models, remove the sub-fuel tank as described in this chapter.

4. At the throttle lever, loosen the cable locknut (A, **Figure** 55) and loosen the adjuster **(B, Figure 55)** to allow maximum amount of slack in the throttle cable.

5. Remove the screws securing the right-hand switch/throttle housing halves together (C, **Figure 55).**

6. Remove the housing from the handlebar and disengage the throttle cable (D, **Figure 55)** from the throttle grip.

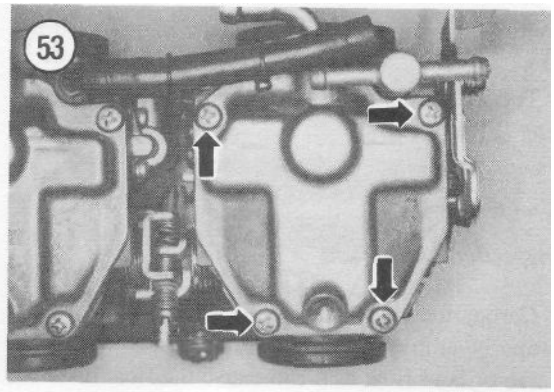
7. Loosen the locknut on the throttle cable (A, **Figure 56)** at the carburetor assembly.

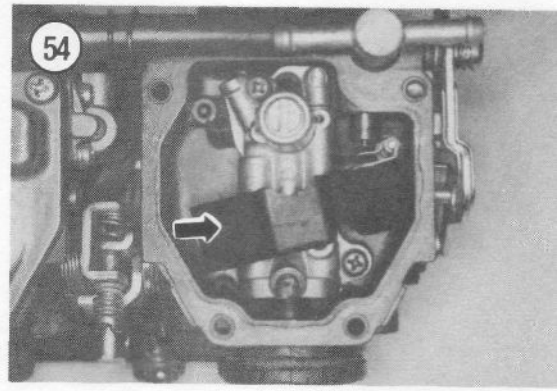
8. Open the throttle wheel with your finger and disconnect the throttle cable from the carburetor throttle wheel (B, **Figure 56).**

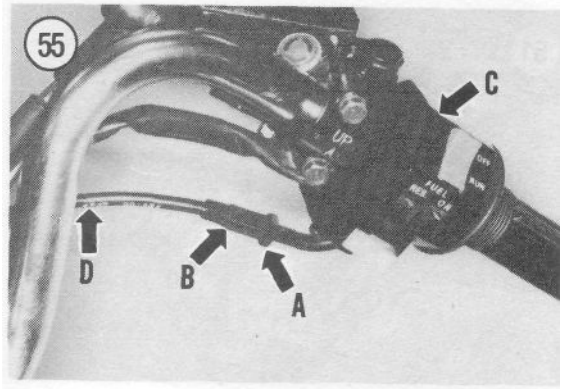
9. Disconnect the throttle cable from any clips holding the cable to the frame.

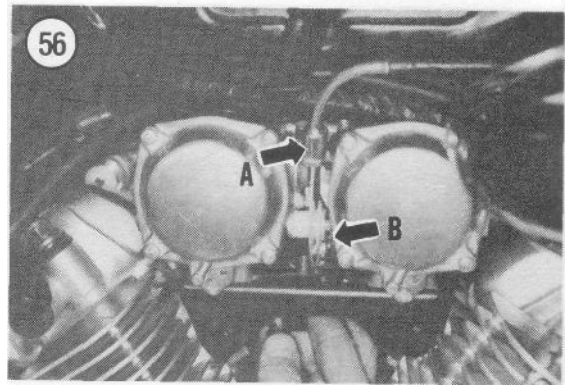
NOTE

The piece of string attached in the next step will be used to pull the new throttle cable back through the frame so it will









be routed in the exact same position as the old one.

10. Tie a piece of heavy string or cord (approximately 7 ft./2 m) to the carburetor end of the throttle cable. Wrap this end with masking or duct tape. Do not use an excessive amount of tape as it will be pulled through the frame. Tie the other end of the string to the frame.
11. At the throttle lever end of the cable, carefully pull the cable (and attached string) out through the frame. Make sure the attached string follows the same path of the cable through the frame.
12. Remove the tape and untie the string from the old cable.

Installation

1. Lubricate the new cable as described in Chapter Three in the front section of the manual.
2. Tie the string (used during removal) to the new throttle cable assembly and wrap it with tape.
3. Carefully pull the string back through the frame routing the new cable through the same path as the old cable.
4. Remove the tape and untie the string from the cable and the frame.
5. Reverse Steps 1-9 *of Removal,* while noting the following:
   a. Operate the throttle grip and make sure the carburetor throttle linkage is operating correctly and with no binding. If operation is incorrect or there is binding, carefully check that the cable is attached correctly and there are no tight bends in the cable.
   b. Adjust the throttle cable as described in Chapter Three in this section of the manual.
   c. Test ride the bike and make sure the throttle is operating correctly.

FUEL SHUTOFF VALVE (1990-ON U.S. MODELS, 1989-ON U.K. MODELS)

Troubleshooting

1. Remove the main fuel tank as described in this chapter.
2. Connect a suitable size piece of tubing to the fuel port.
3. Turn the lever to the ON position.
4. Blow through the tubing and observe the following:
   a. The air goes through the tubing and valve—the valve is operating correctly.
   b. The air *does not* go through the tubing and valve—the valve is faulty and must be replaced.
5. Leave the hose attached and attach a 12 volt battery to the solenoid's electrical connector as follows:
   a. Battery positive (+) to the yellow/blue terminal.
   b. Battery negative (-) to the blue terminal.
6. Blow through the tubing and observe the following:
   a. The air goes through the tubing and valve—the valve is faulty and must be replaced.
   b. The air *does not* go through the tubing and valve—the valve is operating correctly.

Removal/Installation

Refer to **Figure 57** for this procedure.

NOTE

On prior models the main fuel tank was not equipped with a fuel shutoff valve.

WARNING

Some fuel may spill in the following procedure. Work in a well-ventilated area at least 50 feet from any sparks or flames, including gas appliance pilot lights. Do not allow anyone to smoke in the area. Keep a B:C rated fire extinguisher handy.

1. Remove the fuel tank as described in this chapter.
2. If still attached, disconnect the fuel line and vacuum line from shutoff valve.
3. Remove the bolts and washers (A, **Figure 58)** securing the shutoff valve to the fuel tank and remove the valve (B, **Figure 58).**
4. Inspect the shutoff valve mounting O-ring; replace if necessary.
5. Install by reversing these removal steps. Pour a small amount of gasoline in the tank after installing the valve and check for leaks. If a leak is present, solve the problem prior to installing the fuel tank.

FUEL FILTER

All models are equipped with a separate fuel filter that cannot be cleaned. If dirty or clogged, a new filter must be installed. The filter must be periodically replaced (no replacement intervals are specified by Yamaha).

Removal/Installation

1. Remove the seat.
2. Disconnect the inlet (A, Figure 59) and outlet (B, Figure 59) fuel lines from the fuel filter. Plug the end of the fuel line with golf tees.
3. Remove the fuel filter from the rubber mount and remove the filter (C, Figure 59).
4. Install by reversing these removal steps while noting the following:
   a. Install the fuel filter so that the flange end and arrow mark (D, Figure 59) face toward the fuel pump.
   b. Check the fuel line clamps for damage; replace if necessary.
   c. After installation is complete, thoroughly check for leaks.

FUEL PUMP

Removal/Installation

1. Remove the seat.
2. Disconnect the battery negative cable.

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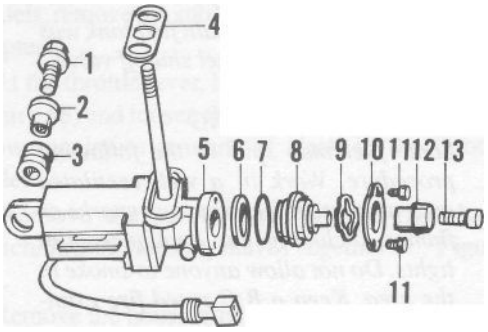
SHUTOFFVALVE (1990-ON U.S. 1989-ON U.K.)



1. Bolt
2. Collar
3. Rubber bushing
4. Gasket
5. Valve body
6. Valve disc
7. O-ring
8. Valve
9. Spring
10. Plate
11. Screw
12. Knob
13. Screw

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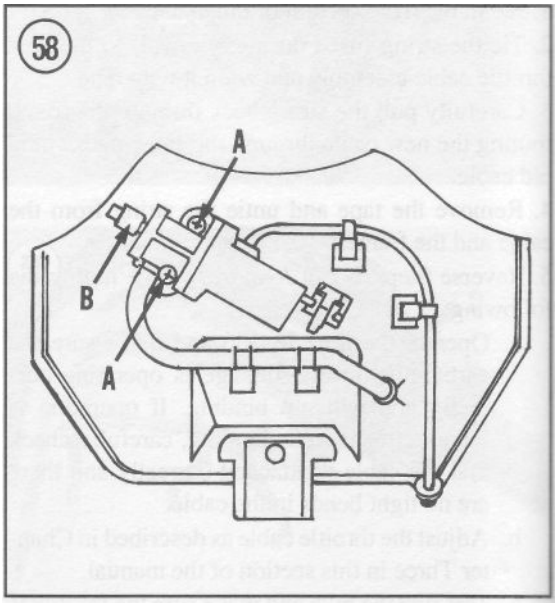

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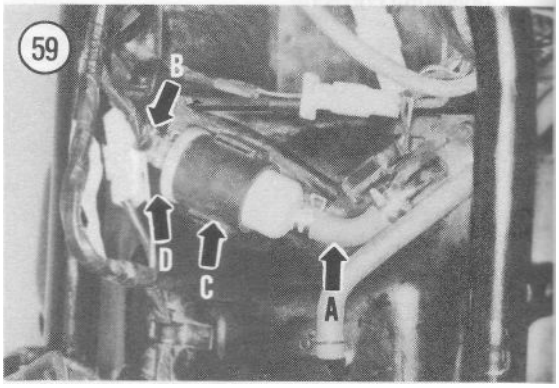
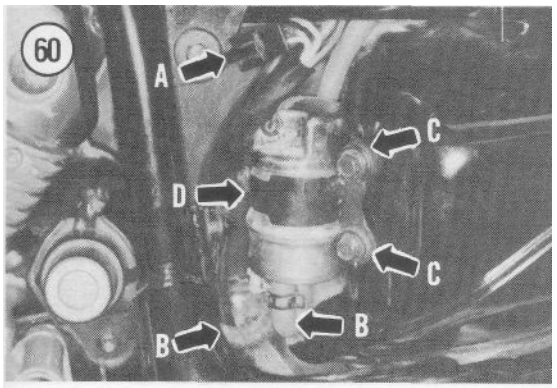


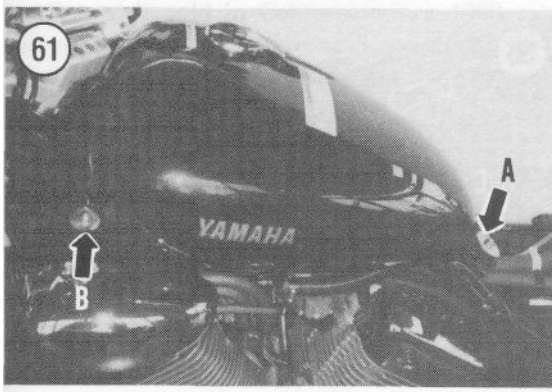
3. Disconnect the fuel pump electrical connector (A, **Figure 60)**

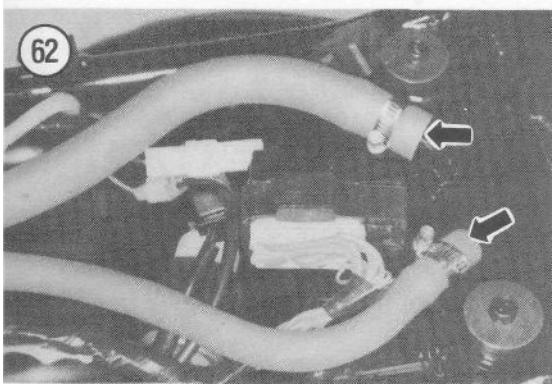
4. Disconnect the fuel inlet and outlet (B, **Figure 60)** lines from the fuel pump. Plug the end of the fuel lines with a golf tee to prevent fuel leakage.

5. Remove the clamping bolts (C, **Figure 60)** securing the fuel pump to the mounting bracket on the fuel tank.

6. Carefully pull the fuel pump (D, **Figure 60)** from the mounting bracket.







7. Install by reversing these removal steps while noting the following.
   a. Check the fuel line clamps for damage; replace if necessary.
   b. After installation is complete, thoroughly check for fuel leaks.

FUEL TANK(S)

On 1987-1989 U.S. models and 1988 U.K. models, there is one main fuel tank that is mounted within the frame assembly beneath the seat and behind the battery. On 1990-on U.S. models and 1989-on U.K. models, there are two fuel tanks, the main fuel tank that is the same as on prior models as well as an additional sub-fuel tank that is mounted on top of the frame in place of the top cover used on prior years.

WARNING

Some fuel may spill in the following procedures. Work in a well-ventilated area at least 50 feet from any sparks or flames, including gas appliance pilot lights. Do not allow anyone to smoke in the area. Keep a B:C rated fire extinguisher handy.

Sub-Fuel Tank (1990-on U.S. Models and 1989-on U.K. Models)

1. Place the bike securely on the sidestand.
2. Remove the seat.
3. Disconnect the battery negative cable.
4. Remove the rear bolt, washer and rubber cushion (A, **Figure 61)** and front bolt and washer (B, **Figure 61)** on each side securing the sub-tank to the frame. Don't lose the metal collar within the rubber cushions on the front mounting areas.

NOTE

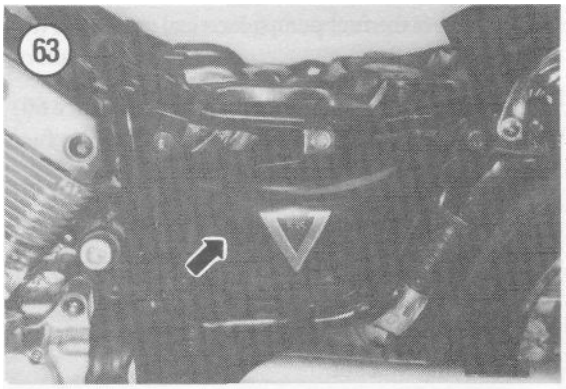
In the following step, leave the fuel lines attached to the sub-fuel tank.

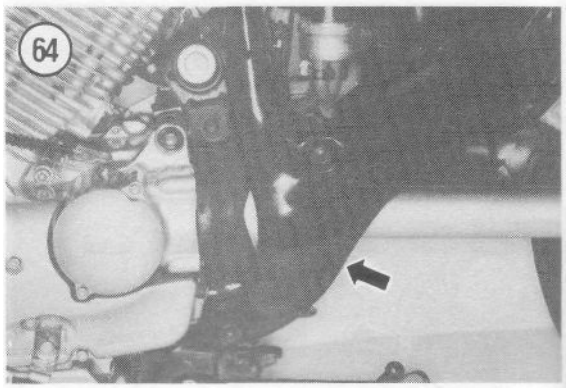
5. Disconnect both fuel lines **(Figure 62)** from the main fuel tank. Plug the end of both fuel lines with a golf tee to prevent the entry of foreign matter and the loss of fuel.
6. Unhook both fuel lines from the clamps on top of the battery cover.
7. Check to make sure everything is disconnected from the fuel tank and remove it from the frame.

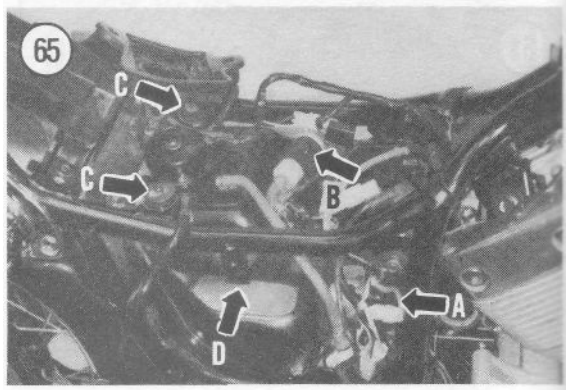
8. If necessary, pour the fuel out of the fuel tank into a container approved for gasoline storage.
9. Check the rubber dampers for wear and damage; replace if necessary.

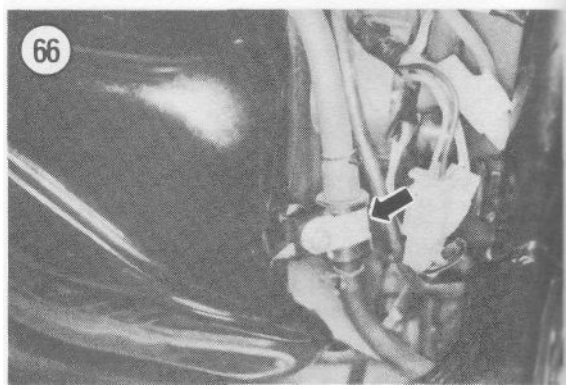
Main Fuel Tank
Removal/Installation

1. Place the bike securely on the sidestand.
2. Remove both seats(s).
3. Disconnect the battery negative cable.
4. Remove both frame side covers **(Figure 63).**
5. Remove the bolts securing the left-hand rear side cover **(Figure** 64) and remove the cover.
6. On the left-hand side, remove the bolts securing the rear bracket and remove the bracket.
7. On 1990-on U.S. models and 1989-on U.K. models, perform the following:
   a. Disconnect both fuel lines **(Figure 62)** from the main fuel tank. Plug the end of both fuel lines with a golf tee to prevent the entry of foreign matter and the loss of fuel.
   b. Unhook both fuel lines from the clamps on top of the battery cover.
8. Unhook the starter relay (A, **Figure** 65) from the frame mounting bracket and move the relay out of the way.
9. On models so equipped, remove the battery cover.
10. Remove the battery as described in Chapter Three in this section of the manual.
11. Remove the bolts, washers and lockwashers securing the battery box and remove the box from the frame.
12. Disconnect the electrical connectors from the fuse panel and remove the panel.
13. Remove the fuel pump and fuel filter **(B, Figure 65)** from the top and side of the fuel tank as described in this chapter.
14. Remove the bolts securing the fuel tank front mounting bracket and remove the bracket.
15. Remove the bolts, washers and lockwashers (C, **Figure 65)** securing the rear of the fuel tank to the frame.
16. Check to make sure everything is disconnected from the fuel tank and that all mounting bolts are removed.
17A. On 1987-1989 U.S. models and 1988 U.K. models, remove the fuel tank and filler cover (D, **Figure 65).**









17B. On all other models, remove the fuel tank from the frame.

18. Install by reversing these removal steps while noting the following:

a. Don't pinch any electrical wires during installation.

b. Reconnect all hoses and connectors. Make sure all hose clamps are in place and are on tight.

CRANKCASE BREATHER SYSTEM

To comply with air pollution standards, all models are equipped with a closed crankcase breather system. The system routes the engine combustion gases into the air filter air box where they are burned in the engine.

Make sure the hose clamps at each end of the hose are tight. Check the hose for deterioration and replace as necessary.

EVAPORATIVE EMISSION CONTROL (1990-ON CALIFORNIA MODELS)

All models sold in California since 1990 are equipped with an evaporative emission control system to reduce the amount of fuel vapors released into the atmosphere. The system consists of a charcoal canister, a roll-over valve, assorted vacuum lines and modified carburetors and fuel tank.

During engine operation, fuel vapors formed in the fuel tank exit the tank though a roll-over valve and enter the charcoal canister through a connecting hose. The vapors are stored in the charcoal canisters until the bike is ridden at high speed, when the vapors are then passed through a hose to the carburetor and mixed and burned with the incoming fresh air. During low-speed engine operation or when the bike is parked, the fuel vapors are stored in the charcoal canister.

The roll-over valve **(Figure 66)** is installed in line with the fuel tank and charcoal canister. Air and fuel vapor passing through the valve is controlled by an internal weight. During normal riding (or when the fuel tank is properly positioned), the weight is at the bottom of the valve. In this position, the breather passage is open to allow the fuel vapors to flow to the charcoal canister. When the bike is rolled or turned over, the weight moves to block off the passage. In this position it is impossible for stored fuel vapors to flow to the charcoal canister.

Service to the emission control system is limited to replacement of damaged parts. No attempt should be made to modify or remove the emission control system.

Parts Replacement

When purchasing replacement parts (carburetor and fuel tank), be sure to specify that the parts are for a 1990-on California emission control bike. Parts sold for non-emission control bikes are not compatible with this emission control system.

Inspection/Replacement

Maintenance to the evaporative emission control system consists of periodic inspection of the hoses for proper routing and a check of the canister mounting bracket. Refer to **Figure 67.**

WARNING

Because the evaporative emission control system stores fuel vapors, make sure the work area is free of all flame or sparks before working on the emission system.

1. Whenever servicing the evaporative emission control system, make sure the ignition switch is turned OFF.

2. Make sure all hoses are attached and that they are not damaged or pinched.

3. Replace any worn or damaged parts immediately.

4. The canister is capable of working through the motorcycle's life without maintenance, provided that it is not damaged or contaminated.

Roll-Over Valve Replacement

1. Remove the seat and the frame right-hand side cover.

2. Remove the bolt and washer securing the roll-over valve to the side of the main fuel tank **(Figure** 66).

3. Disconnect the vacuum lines from each end of the roll-over valve and remove the valve.

4. Install by reversing these removal steps. Make sure the roll-over valve is tight.

Canister and Hose Replacement

1. Label the hoses and fittings prior to disconnecting them.
2. Move the hose clamps off the hoses, then disconnect the hoses from the canister.
3. Remove the bolt, lockwasher and washer securing the canister to the frame.
4. Remove the canister from the frame.
5. To remove the hoses, perform the following:
   a. Remove the tie wraps securing the hoses to the frame and throttle cables.
   b. Disconnect the hoses from the carburetor assembly, fuel tank and canister.
6. Install by reversing these removal steps while noting the following:
   a. Make sure all hoses are connected to the correct fitting.
   b. Make sure the hose clamps and bolts are tight.

AIR INJECTION SYSTEM (1990-ON U.S. AND 1989-ON U.K. MODELS)

All 1990-on U.S. and 1989-on U.K. models are equipped with an air injection emission control system to reduce the amount of hydrocarbons released into the atmosphere. The system consists of an air cut valve, a reed valve assembly and air and vacuum hoses **(Figure 68).** This system does not pressurize air, but uses the momentary pressure differentials generated by the exhaust gas pulses to introduce fresh air into the exhaust ports. Make sure all air and vacuum hoses are correctly routed and attached as shown in **Figure 69.** Inspect the hoses and replace any if necessary.

Removal/Installation

Refer to **Figure 68, Figure 69** and **Figure 70** for this procedure.

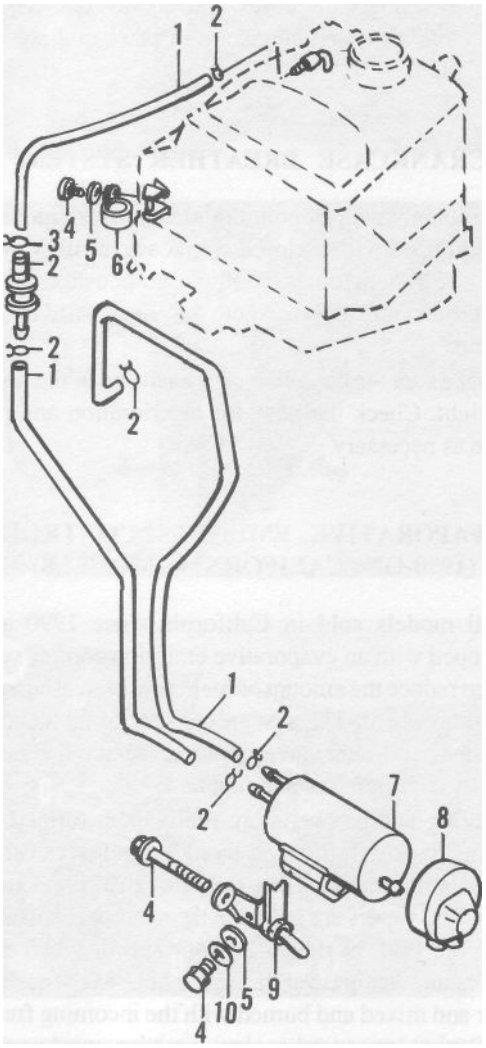
NOTE

Prior to removing any hoses, mark the hose and the fitting with a piece of masking tape and identify where the hose goes during installation.

1. Place the bike securely on the sidestand.
2. Remove the seat.

(67)

EVAPORATIVE EMISSION CONTROL (1990-ON CALIFORNIA MODELS)



1. Hose
2. Hose clamp
3. Rollover valve
4. Bolt
5. Washer
6. Clamp
7. Canister
8. Cover
9. Bracket
10. Lockwasher

3. Remove the left-hand cover **(Figure 71).**
4. To remove the air cleaner **(Figure 72),** perform the following:
   a. Remove the bracket screws and remove the bracket and cover.
   b. Disconnect hose No. 2 from the air cleaner and remove the air cleaner.
5. To remove the air cut valve **(Figure 73),** perform the following:
   a. Disconnect hose No. 2 and No. 3 from the air cut valve.
   b. Disconnect the vacuum hose from the air cut valve.
   c. Remove the air cut valve.
6. To remove the reed valve assembly **(Figure 74),** perform the following:
   a. Disconnect hose No. 3, No. 4 and No. 5 from the reed valve assembly.
   b. Remove the mounting screws and remove the reed valve assembly.
7. To remove air pipe No. 1 and No. 2, perform the following:
   a. Disconnect the air pipes from hose No. 4 and No. 5 **(Figure 75).**
   b. Remove the bolt securing the air pipe No. 5 to the rear cylinder **(Figure 76).**
   c. Remove the bolts securing the air pipes to the right-hand crankcase cover **(Figure 77).**

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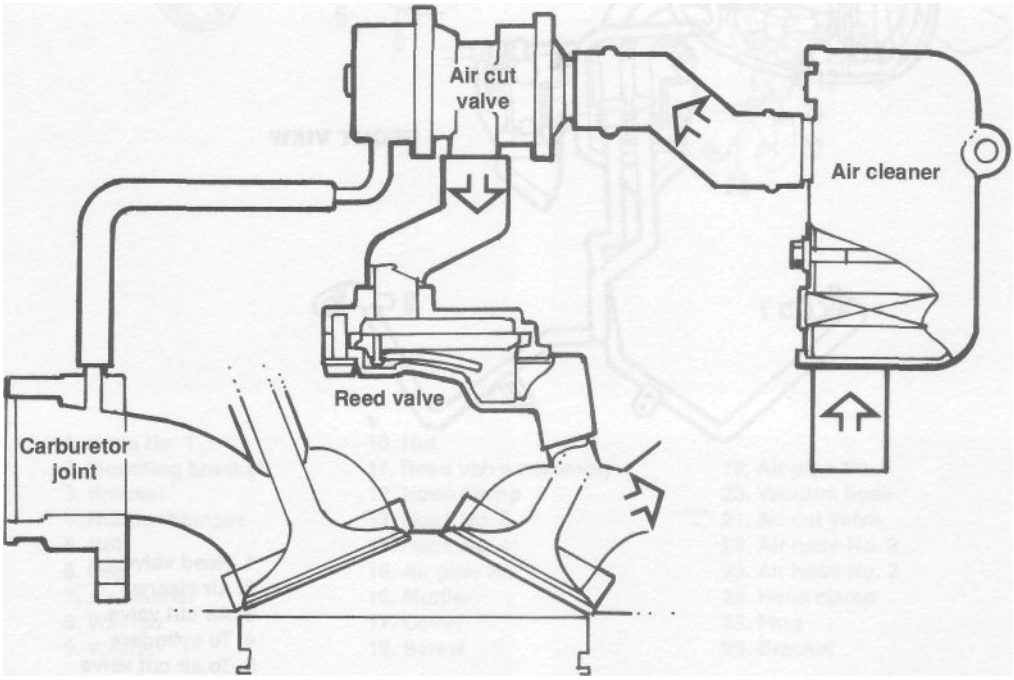
AIR INJECTION SYSTEM (1990-ON U.S. AND 1989-ON U.K. MODELS)



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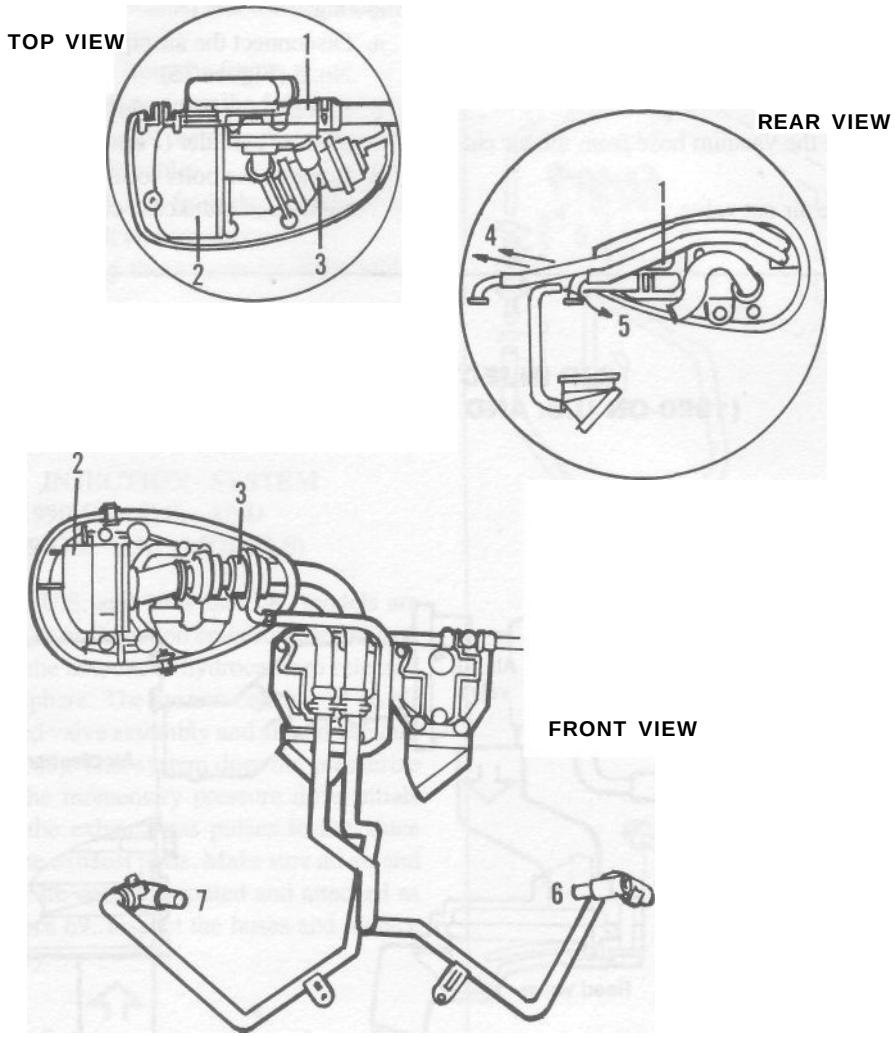
AIR INJECTION SYSTEM LAYOUT (1990-ON U.S. AND 1989-ON U.K. MODELS)



1. Reed valve
2. Air cleaner
3. Air cut valve
4. To cylinders
5. To air cut valve
6. To front cylinder
7. To rear cylinder

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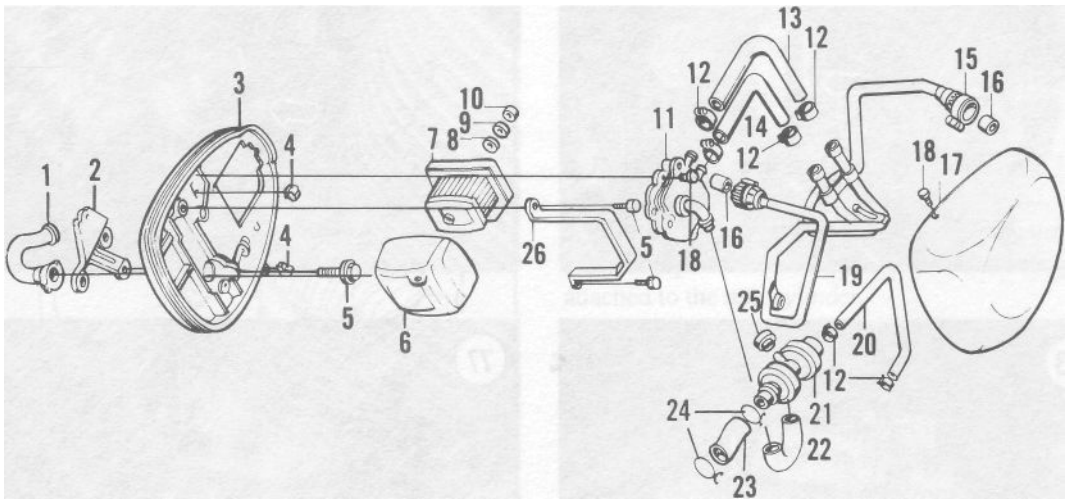
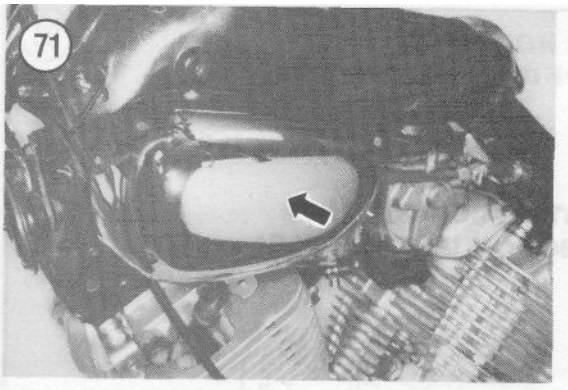
AIR INJECTION SYSTEM COMPONENTS (1990-ON U.S. AND 1989-ON U.K. MODELS)



1. Hose No. 1
2. Mounting bracket
3. Bracket
4. Rubber bumper
5. Bolt
6. Cap
7. Air cleaner
8. Washer
9. Washer
10. Nut
11. Reed valve assembly
12. Hose clamp
13. Hose No. 5
14. Hose No. 4
15. Air pipe No. 1
16. Muffler
17. Cover
18. Screw
19. Air pipe No. 2
20. Vacuum hose
21. Air cut valve
22. Air hose No. 3
23. Air hose No. 2
24. Hose clamp
25. Plug
26. Bracket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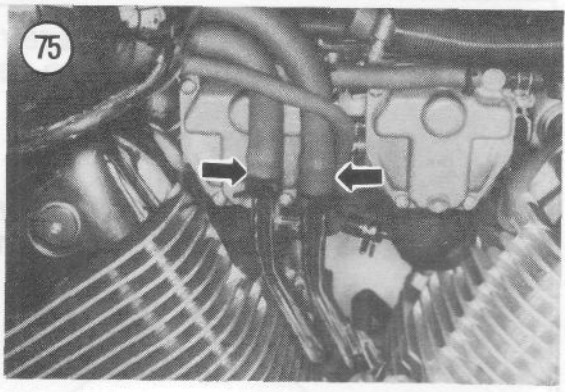
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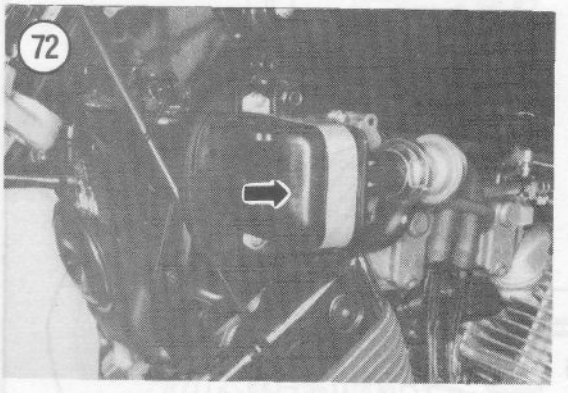
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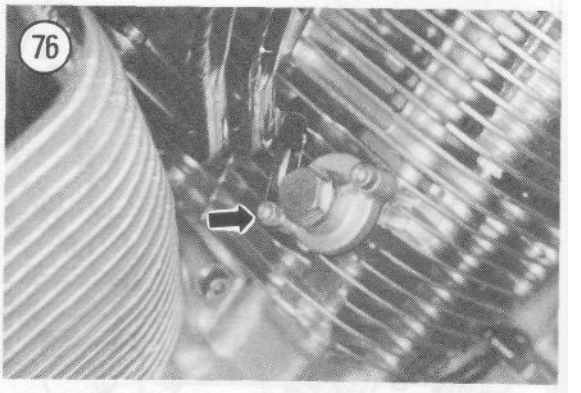
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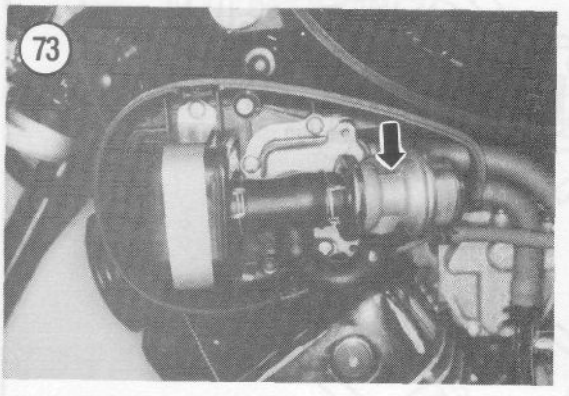
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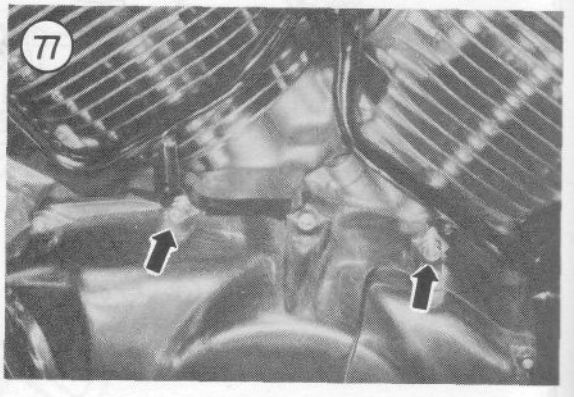
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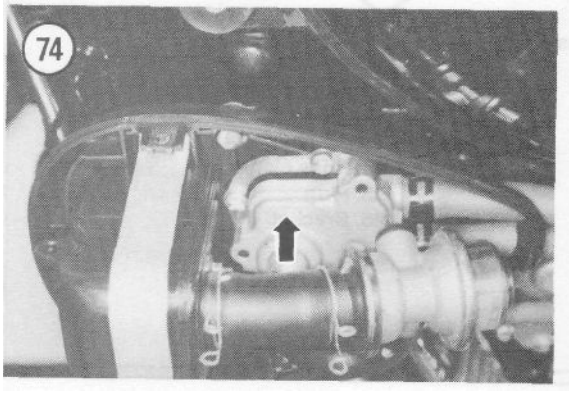
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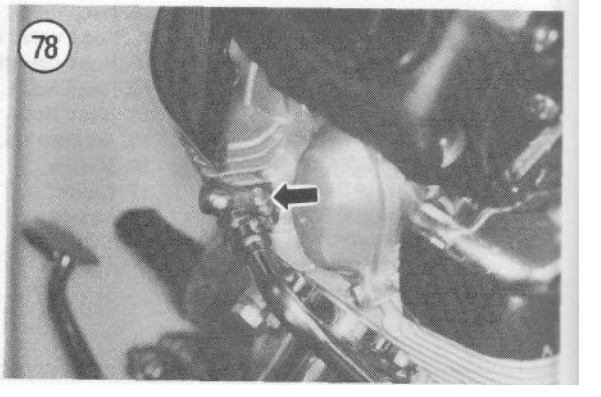
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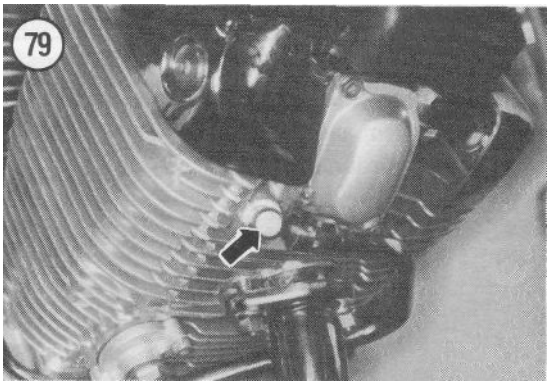

NOTE
***Figure** 78 and **Figure** 79 are shown on the front cylinder Air pipe attachment to the rear cylinder is identical*

d. Remove the bolts securing the air pipes to the cylinders Refer to **Figure 78** and **Figure 79**
e Disconnect the air pipes from the cylinders and remove both air pipes from the engine Don't lose the small muffler in the fitting where they attach to the cylinders

8 Install by reversing these removal steps Be sure to install each hose and pipe onto the correct fitting and tighten the bolts securely

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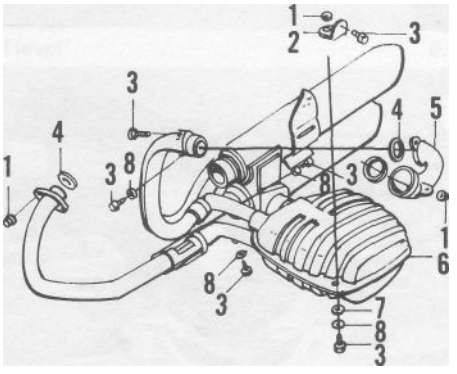
EXHAUST SYSTEM

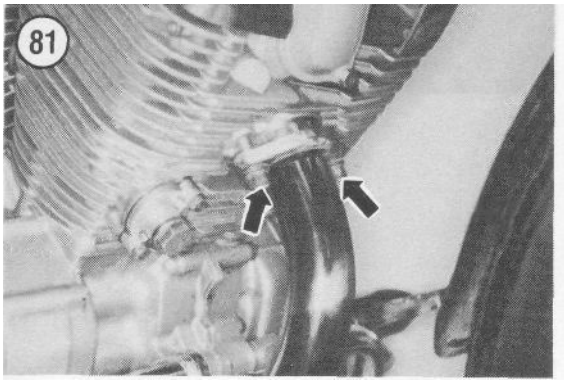


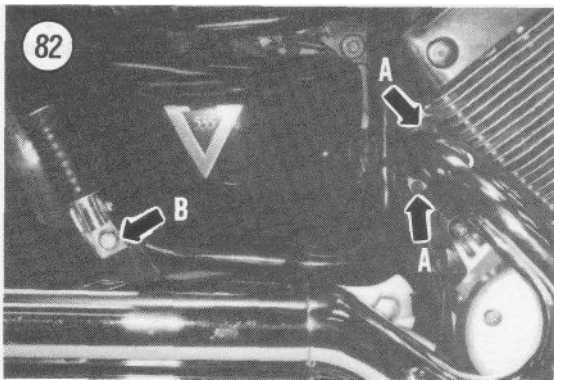
I.Nut
2. Mounting bracket
3 Bolt
4 Gasket
5 Rear joint
6 Exhaust system
7 Washer
8 Lockwasher

EXHAUST SYSTEM

Removal/Installation

Refer to **Figure 80** for this procedure
1 Place the bike on the sidestand
2 Remove the nuts **(Figure 81)** securing the front exhaust pipe flange to the front cylinder head
3 Remove the bolts (A, **Figure 82)** securing the rear exhaust pipe to the rear joint Leave the rear joint attached to the rear cylinder
4 Remove the bolt (B, **Figure 82)** secunng the right-hand foot peg and muffler to the frame
5 Remove the bolt, lockwasher and washer **(Figure 83)** secunng the muffler chamber to the frame
6 Carefully move the exhaust system forward to clear the threaded studs on the front cylinder head exhaust port Pull the exhaust system out of the right-hand side of the frame and remove it from the frame and engine
7 If replacement of the rear joint is necessary, the rear cylinder head must be removed as described in Chapter Four in this section of the manual After the





cylinder head is removed, remove the self-locking nuts **(Figure 84)** and remove the rear joint. Install new self-locking nuts and tighten securely.

NOTE

Don't lose the gasket at the front exhaust port and at the rear joint when the exhaust pipe is removed from the engine.

8. Inspect the system as described in this chapter.
9. Be sure to install a new gasket in the front exhaust port in the cylinder head and at the rear joint **(Figure 85).**
10. Install all of the exhaust system components and tighten the fasteners only finger-tight at this time. Make sure the exhaust pipe inlets are correctly seated in the cylinder head exhaust port and at the rear joint.
11. Securely tighten the bolts and nuts securing the front exhaust pipe flange to the cylinder head and to the rear joint, then tighten the bolts and nuts securing the muffler to the frame. This will minimize exhaust leakage at the cylinder head.
12. After installation is complete, start the engine and make sure there are no exhaust leaks. Correct any leak prior to riding the bike.

Inspection

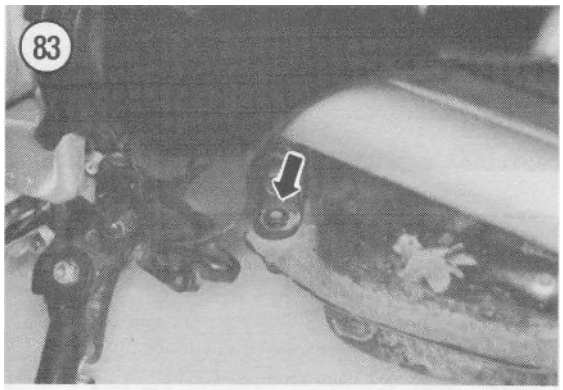
1. Check for leakage where the exhaust pipes attach to the muffler chamber.
2. Inspect the muffler chamber mounting bracket for wear or damage. Replace if necessary.

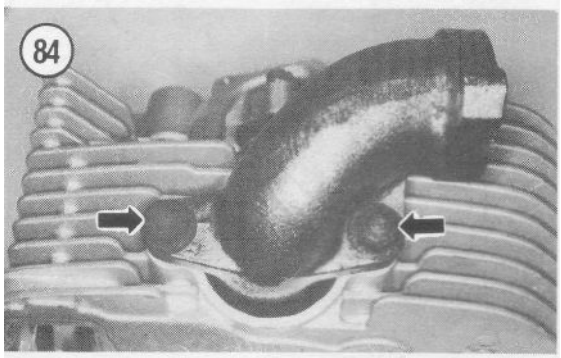
Maintenance

The exhaust system is a vital key to the motorcycles operation and performance, You should periodically inspect, clean and polish (if required) the exhaust system. Special chemical cleaners and preservatives compounded for exhaust systems are available at most motorcycle shops.

Severe dents which cause flow restrictions require replacement of the damaged part.

To prevent internal rust buildup, periodically remove the system and turn it upside down to drain any trapped moisture.





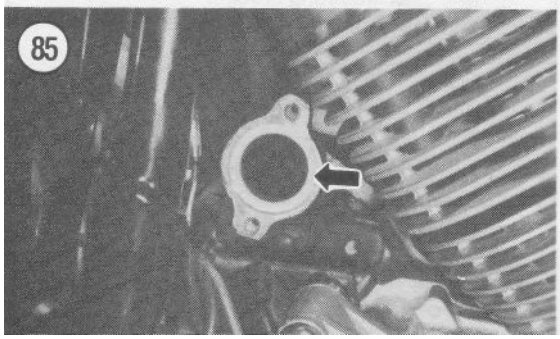


Table 1 CARBURETOR SPECIFICATIONS

Item	1987-1989 U.S.	1990-on U.S.
Manufacturer	Mikuni	Mikuni
Model	BDS34	BDS34
I.D. mark		
49-state	2GV00	3JC10
California	2JU00	3JC00
Main jet		
Both	137.5	—
Front	—	137.5
Rear	—	135
Main air jet	140	140
Jet needle		
Both	—	Y-0
Cylinder 1	5DZ7-1	—
Cylinder 2	5DZ8-1	—
Pilot jet	32.5	35
Pilot air jet		
No. 1	60	70
No. 2	160	170
Pilot screw	Preset	Preset
Starter jet	40	40
Fuel level	0.53-0.57 in. (13.5-14.5 mm)	0.53-0.57 in. (13.5-14.5 mm)
Idle speed	1,150-1,250 rpm	1,150-1,250 rpm

Item	1988 U.K.	1989-on U.K.
Manufacturer	Mikuni	Mikuni
Model	BDS34	BDS34
I.D. mark	2JV00	3BT00
Main jet	135	135
Main air jet	140	140
Jet needle		
Cylinder 1	5DZ10-3	5DZ10-3
Cylinder 2	5DZ9-3	5DZ9-3
Pilot jet	35	35
Pilot air jet		
No. 1	70	70
No. 2	170	170
Pilot screw	2 turns out	2 turns out
Starter jet	40	40
Fuel level	0.53-0.57 in. (13.5-14.5 mm)	0.53-0.57 in. (13.5-14.5 mm)
Idle speed	1,150-1,250 rpm	1,150-1,250 rpm

CHAPTER SEVEN

ELECTRICAL SYSTEM

The electrical systems consists of the following systems:

a. Charging system.
b. Ignition system.
c. Starting system.
d. Lighting system.
e. Directional signal system.
f. Horn.

This chapter discusses each system in detail. Refer to Chapter Three for routine ignition system maintenance. Electrical system specifications are found in **Table 1. Tables 1-4** are found at the end of the chapter.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Seven at the front of this manual for service procedures.

CHARGING SYSTEM

The charging system consists of the battery, alternator and a solid state rectifier/voltage regulator **(Figure 1).**

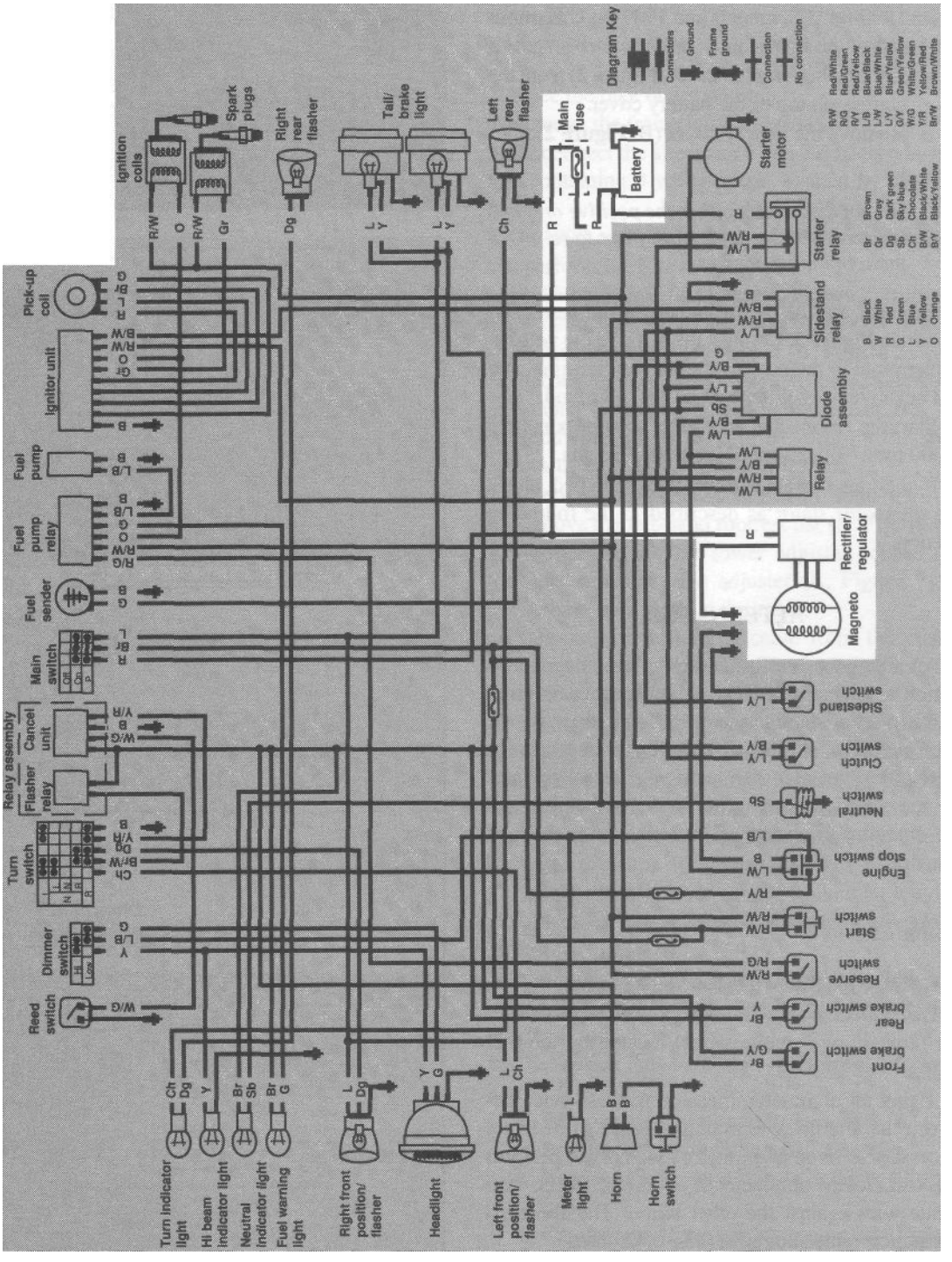
The alternator generates an alternating current (AC) which the rectifier converts to direct current (DC). The regulator maintains the voltage to the battery and load (lights, ignition, etc.) at a constant voltage regardless of variations in engine speed and load.

Testing Charging System

Whenever the charging system is suspected of trouble, make sure the battery is fully charged before going any further. Clean and test the battery as described in Chapter Three in this section of the manual. If the battery is in good condition, test the charging system as follows.

①

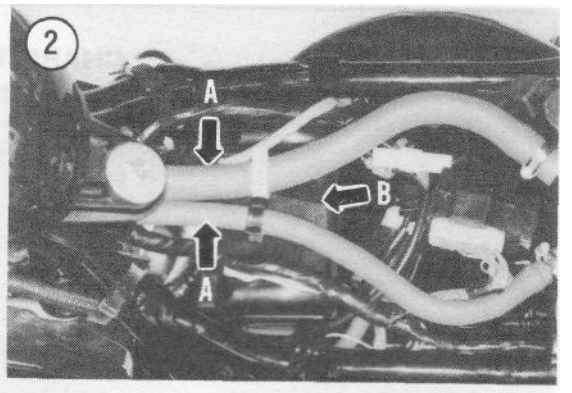
CHARGING SYSTEM

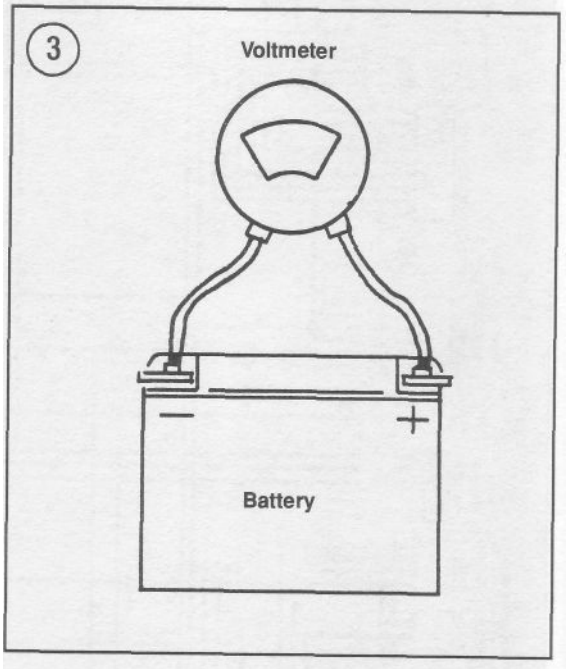


1. Place the bike securely on the sidestand.
2. Remove the seat.
3. Check the fuses as described in this chapter. Replace any blown fuses.
4. On 1990-on U.S. models and 1989-on U.K. models, perform the following:
   a. Unhook both fuel lines (A, **Figure 2)** from the clamps on top of the battery cover.
   b. Remove the battery cover **(B, Figure 2).**

NOTE
Do not disconnect either the positive or negative battery cables; they are to remain in the circuit as is.

5. Connect a 0-20 DC voltmeter to the battery as shown in **Figure 3.** Connect the positive (+) voltmeter terminal to the positive (+) battery terminal and the negative (-) voltmeter terminal to ground.
6. Start the engine and accelerate to approximately 5,000 rpm. Voltage should read 14-15 volts.
7. If charging current is lower than specified, check the alternator stator as described in the following section.



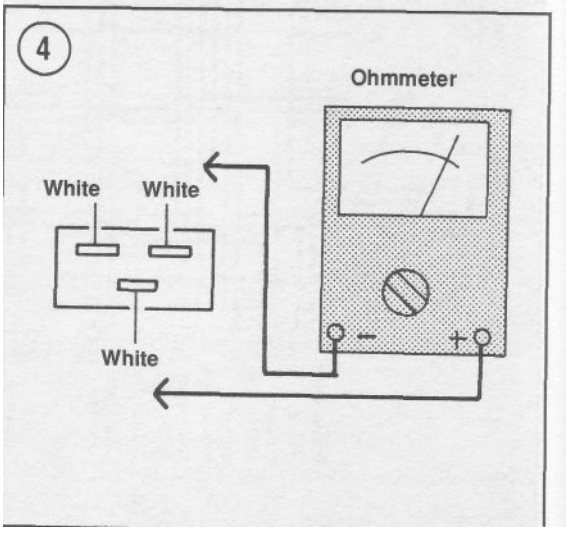


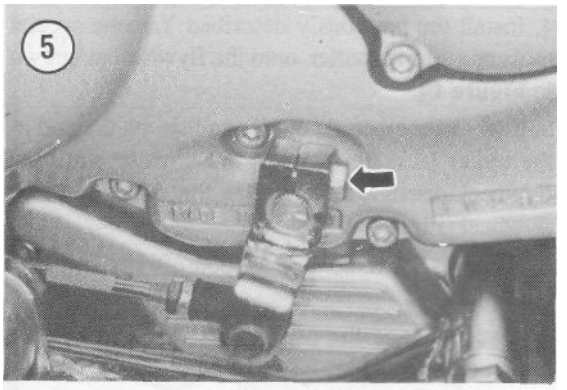
ALTERNATOR

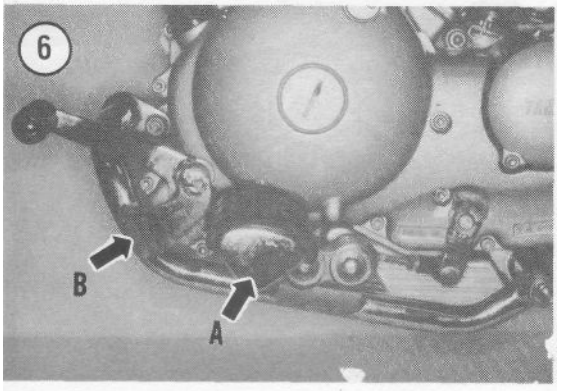
An alternator is a form of electrical generator in which a magnetized field called a rotor revolves within a set of stationary coils called a stator. As the rotor revolves, alternating current is induced in the stator. The current is then rectified and used to operate the electrical accessories on the motorcycle and for charging the battery. The rotor is a permanent magnet.

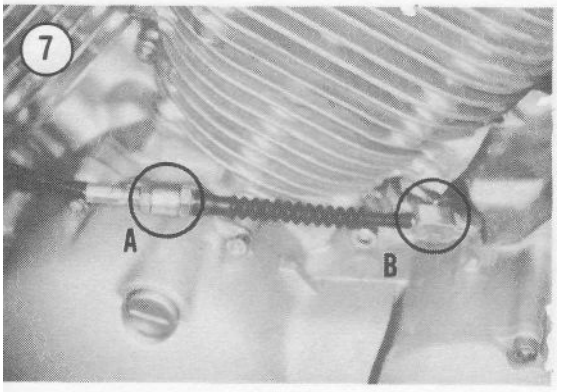
Stator Checks

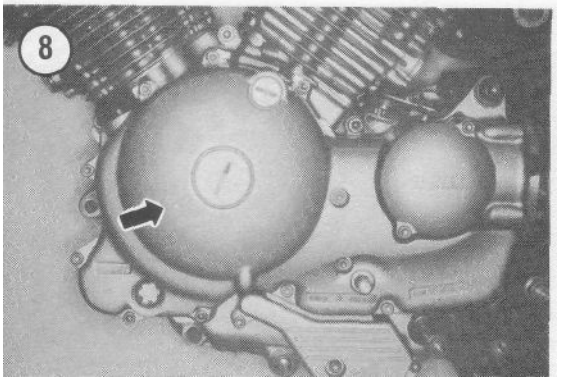
1. Remove the frame left-hand side cover.
2. Disconnect the alternator 3-pin electrical connector (containing 3 white wires) located by the fuel pump.
3. Using an ohmmeter, measure the resistance between the alternator terminals **(Figure 4).** It is not necessary to remove the stator assembly to perform this test. Set the ohmmeter to ohms x 1. Check each white wire against the other white. The specified resistance value should be 0.34-0.42 ohms.
4. If the values are not within the specified range, check the electrical wires to and within the connector











terminals. If they are okay, then there is an open circuit or short in the stator coils and the stator must be replaced as described in this chapter.

Stator
Removal/Installation

1. Place the bike on its sidestand.
2. Remove the frame left-hand side cover.
3. Disconnect the alternator 3-pin electrical connector (containing 3 white wires) located by the fuel pump.
4. On 1990-on U.S. models and 1989-onU.K. models, perform the following:
   a. Unhook both fuel lines (A, **Figure 2)** from the clamps on top of the battery cover.
   b. Remove the battery cover (B, **Figure 2).**
5. Disconnect the negative battery cable as described in Chapter Three in this section of the manual.
6. Remove the bolt **(Figure 5)** securing the shift lever arm and slide it off the shift shaft.
7. Remove the left-hand foot peg (A, **Figure 6).**
8. Remove the left-hand footrest bar (B, **Figure 6).**
9. At the clutch cable lower adjuster, loosen the locknuts and rotate the adjuster (A, **Figure 7)** to allow maximum slack in the cable.
10. Disconnect the clutch cable from the clutch actuating lever (B, **Figure 7)**. Then pull the cable out of the lever and move it out of the way.
11. Remove the bolt securing the engine ground cable and disconnect the cable.
12. Carefully pull the stator wire harness from the frame and remove the wires from the frame. Note the path of the wire harness during removal; it must be routed the same during installation.
13. Using a crisscross pattern, loosen then remove the Allen screws securing the alternator cover/coil assembly **(Figure 8).**
14. Remove the alternator cover/coil assembly, gasket and electrical cable. Don't lose the locating dowels.
15. To replace the stator coils, perform the following:
   a. Remove the screws and lockwashers (A, **Figure 9)** securing the stator coil assembly.
   b. Remove the screw and metal retainer (B, **Figure 9).**
   c. Carefully pull the rubber grommets **(Figure 10)** and wiring harness from the cover. Remove the stator coil assembly from the cover.

d. Separate the stator wiring harness from the pickup coil harness and remove the stator wiring.

16. Install by reversing these removal steps. Note the following:

a. Make sure the locating dowels (A, **Figure 11)** are in place and install a new gasket **(B**, **Figure 11).**
b. Make sure the electrical wire harness is routed through the frame exactly as before.
c. Clean all wire connectors with electrical contact cleaner.

Inspection

1. Inspect the alternator cover/coil assembly for wear or cracking.
2. Check the electrical wires on the stator for any opens or poor connectors. Also check the stator's insulating material for cracking. If the stator appears damaged in any way, test the assembly as described under *Stator Testing* in this chapter.

Flywheel (Rotor)
Removal/Installation

The following Yamaha special tools are required for flywheel removal:

a. Flywheel puller set (U.S. part No. YU-33270) or (U.K. part No. 90890-01362).
b. Adapter (U.S. part No. YU-33282) or (U.K. part No. 90890-04089).

NOTE

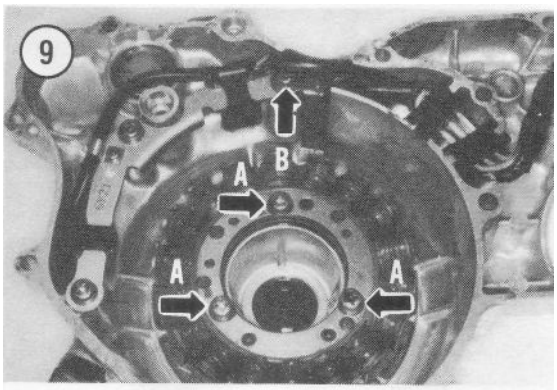
This procedure is shown with the engine removed and partially disassembled/or clarity. It is not necessary to remove the engine for this procedure.

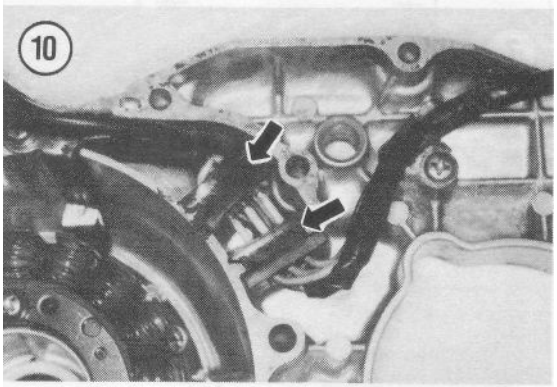
1. Remove the alternator stator as described in this chapter.
2. Use a strap wrench **(Figure 12)** on the flywheel to keep it from turning.
3. Remove the flywheel bolt and washer **(Figure 13)** securing the flywheel.

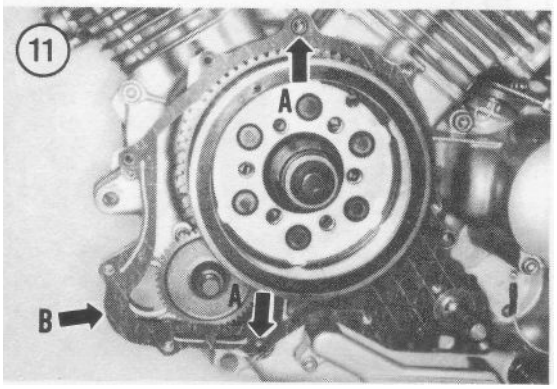
CAUTION

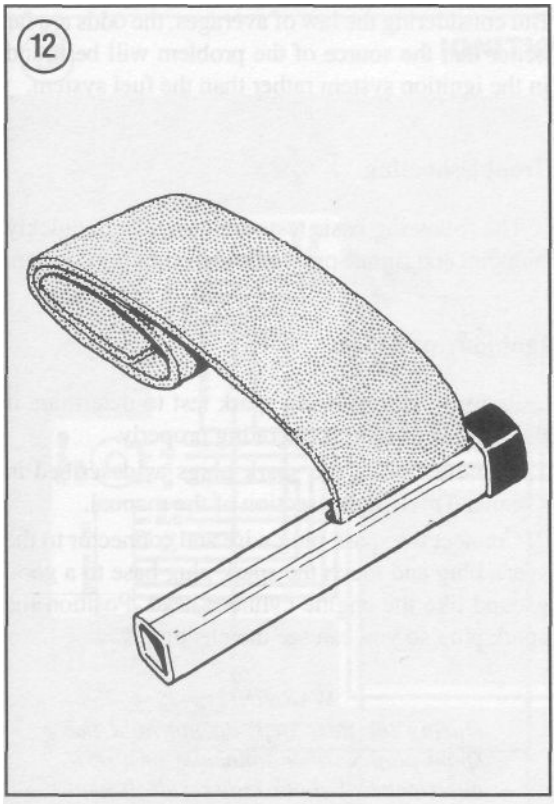
Make sure to thread the special tool bolts completely into the flywheel threads to avoid damage to the flywheel as well as the special tool.

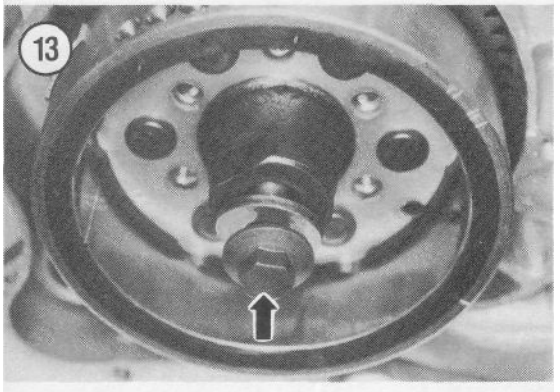
4. Install the previously described Yamaha special tools or a similar puller, onto the flywheel as shown in **Figure** 14.
5. Use a wrench on the puller and tap on the end of the puller jackscrew with a brass mallet until the flywheel disengages. Remove the puller and the flywheel **(Figure** 15).
6. If necessary, remove the Woodruff key from the crankshaft.
7. Installation is the reverse of these steps while noting the following:

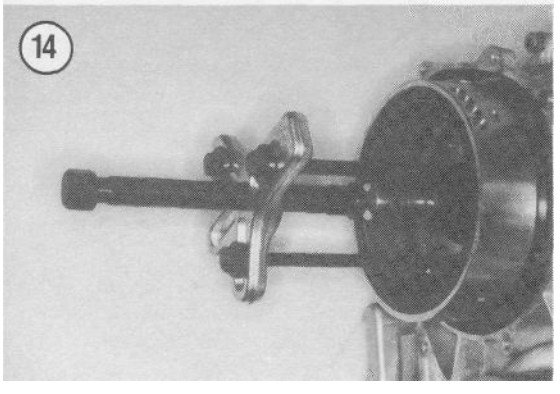








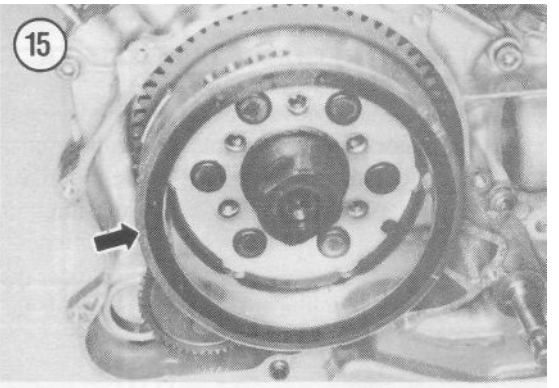


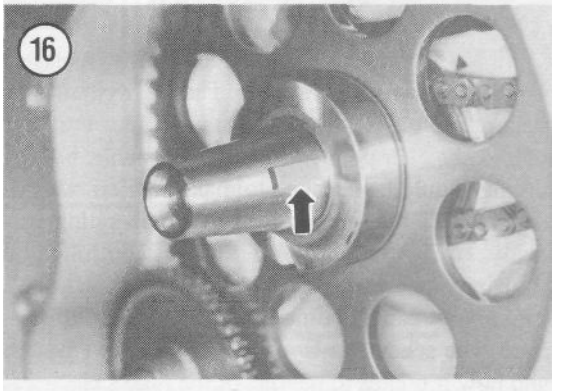


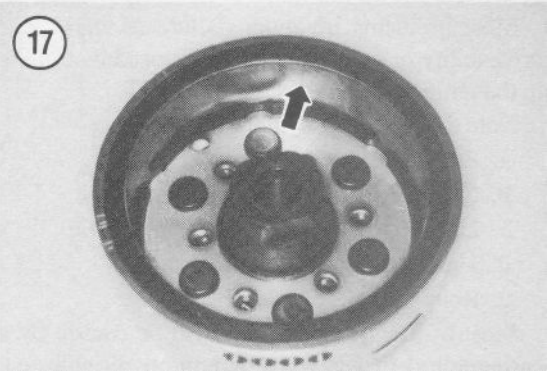
a If removed, install the Woodruff key **(Figure 16)** in the crankshaft

CAUTION

*Carefully inspect the inside of the flywheel **(Figure 17)** for small bolts, washers or other metal "trash" that may have been picked up by the magnets These small metal bits can cause severe damage to the alternator stator assembly*







b. Install the flywheel washer and bolt. Lock the flywheel as in Step 2 during removal. Tighten the flywheel bolt to 58 ft.-lb. (80 N.m).

Flywheel (Rotor) Testing

The flywheel (rotor) is permanently magnetized and cannot be tested except by replacement with a flywheel known to be good. A flywheel can lose magnetism from old age or a sharp blow. If defective, the flywheel must be replaced; it cannot be re-magnetized.

VOLTAGE REGULATOR/RECTIFIER

Varying engine speeds and electrical system loads affect alternator output. The voltage regulator controls alternator output by varying its field current. Yamaha does not provide any test procedures or specifications for the voltage regulator/rectifier.

The voltage regulator is mounted either under the frame behind the engine **(Figure 18)** or under the left-hand trim panel **(Figure 19).**

IGNITION SYSTEM

All XV535 models are equipped with a Transistor Control Ignition (TCI) system. The TCI system consists of both a pickup unit and an ignitor unit and uses no breaker points. It is non-adjustable, but the timing should be checked to make sure all components within the ignition system are operating correctly. The ignition advance circuit is controlled by signals generated by the pickup coils and the advance curve cannot be modified to improve performance. The schematic layout of this ignition system and how it relates to the rest of the bike's electrical systems is shown in **Figure 20.**

Most problems involving failure to start, poor driveability or rough running are caused by trouble in the ignition system:

Note the following symptoms:

a. Engine misses.
b. Stumbles on acceleration (misfiring).
c. Loss of power at high speed (misfiring).
d. Hard starting (or failure to start).
e. Rough idle.

Most of the symptoms can also be caused by a carburetor(s) that is worn or improperly adjusted. But considering the law of averages, the odds are far better that the source of the problem will be found in the ignition system rather than the fuel system.

Troubleshooting

The following basic tests are designed to quickly pinpoint and isolate problems in the ignition system.

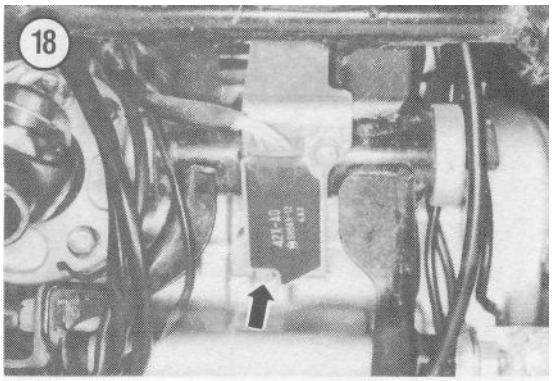
Ignition Spark Test

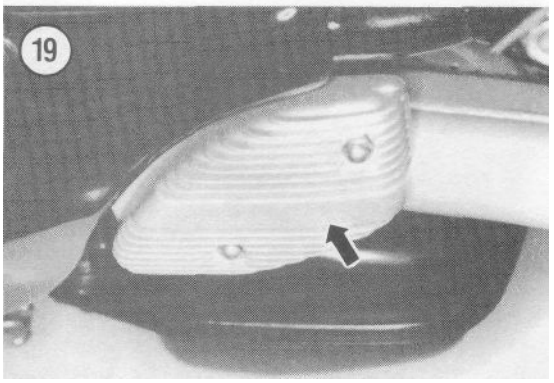
Perform the following spark test to determine if the ignition system is operating properly.

1. Remove one of the spark plugs as described in Chapter Three in this section of the manual.
2. Connect the spark plug wire and connector to the spark plug and touch the spark plug base to a good ground like the engine cylinder head. Position the spark plug so you can see the electrodes.

WARNING

During the next step, do not hold the sparkplug, wire or connector or a serious electrical shock may result. If nee-





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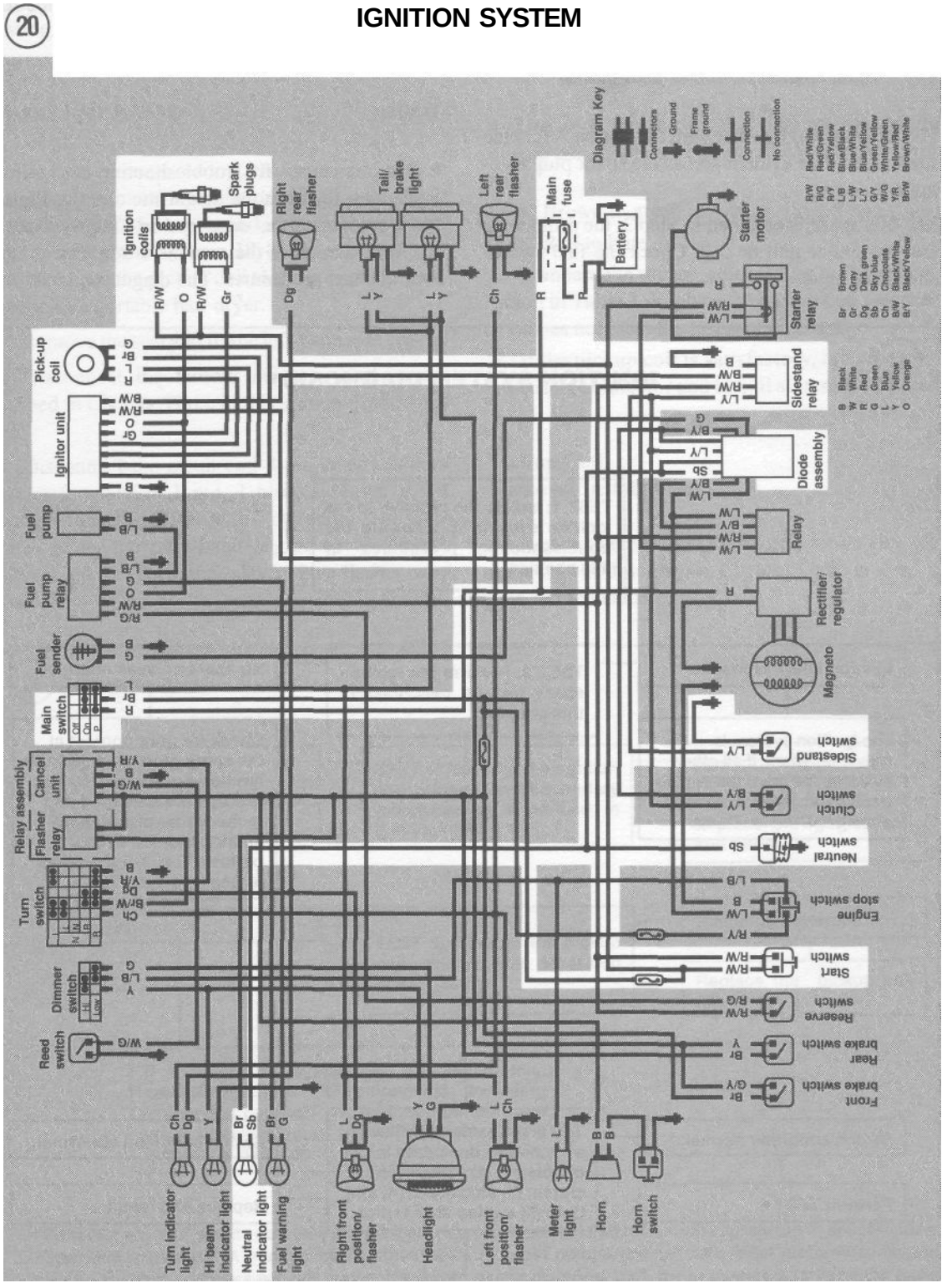
IGNITION SYSTEM



essary, use a pair of insualted pliers to hold the spark plug or wire. The high voltage generated by the ignition system could produce serious or fatal shocks.

3. Crank the engine over with the starter. A fat blue spark should be evident across the spark plug electrodes.

4A. If a spark is obtained in Step 3, the problem is not the ignitor unit or coil. Check the fuel system and spark plugs.

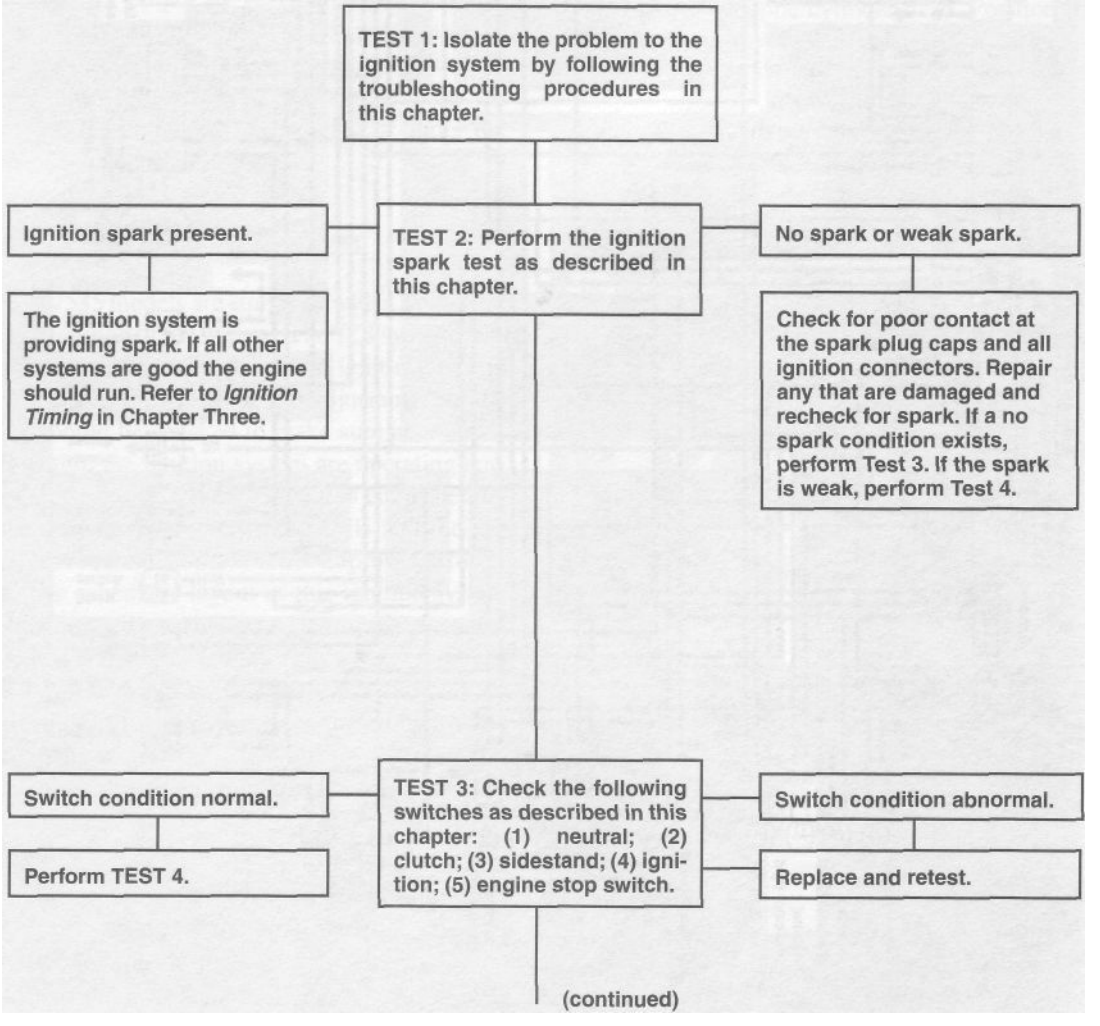
4B. If no spark is obtained, proceed with the following tests.

Testing

Test procedures for troubleshooting the ignition system are found in the diagnostic chart in **Figure 21.** A multimeter, as described in Chapter One, in the front section of the manual, is required to perform the test procedures. The diagnostic chart will

21

IGNITION SYSTEM DIAGNOSIS*



refer you to a certain procedure in this chapter for testing.

Pickup Coil Testing

To get an accurate reading, the ignition coils must be warm (minimum temperature is 20° C [68° F]). If necessary, start the engine and let it warm up to normal operating temperature. If you are unable to start the bike, heat the pickup coil to the proper temperature with a portable hair dryer.

1. Remove the seat and frame left-hand side cover.
2. Disconnect the battery negative lead as described in Chapter Three in this section of the manual.
3. Disconnect the picup coil 4-pin electrical connector (containing 1 red, 1 blue, 1 brown and 1 green) from the ignitor unit. The ignitor unit is located under the right-hand engine cover **(Figure 22)** behind the fuel pump relay and the flasher relay assembly.

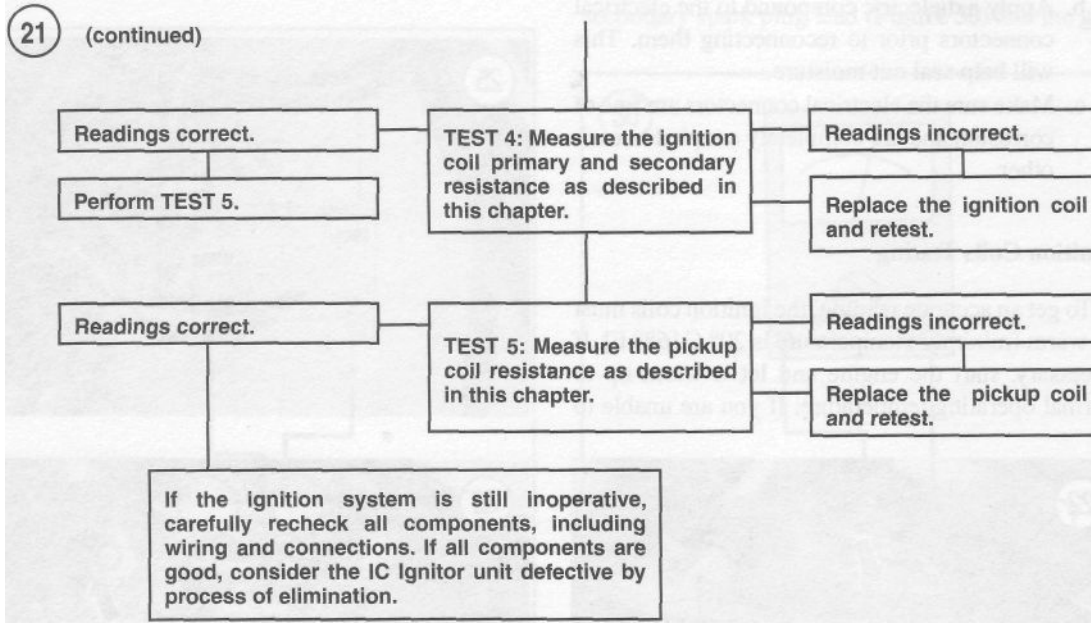
NOTE

Connect the ohmmeter to the electrical connector attached to the wiring harness leading to the pickup coil.

4. Use an ohmmeter on R x 100 to measure the pickup coil resistance between the following terminals:
   a. Brown to green.
   b. Red to blue.
5. Compare the pickup coil reading to the specification in **Table 1.** Replace the pickup coil assembly if it does not meet the test specifications.
6. If the pickup coil is satisfactory, reconnect the electrical connector and install all removed parts.

Pickup Coil Removal/Installation

1. Remove the seat and disconnect the battery negative lead as described in Chapter Three in this section of the manual.



'Consider any test results carefully before replacing a component that tests only *slightly out* of specification, especially resistance. A number of variables can affect test results dramatically. Most motorcycle dealerships and parts suppliers will not accept the return of any electrical part. If you cannot determine the *exact* cause of any electrical system malfunction, have a Yamaha dealership retest that specific system to verify test results.

2. Remove the alternator stator assembly as described in this chapter.

3. Remove the screws and lockwashers (A, **Figure 23)** securing the pickup coil assembly.

4. Remove the screw and metal retainer (B **Figure 23).**

5. Carefully pull the rubber grommets **(Figure 10)** and wiring harness from the cover. Remove the pickup coil assembly from the cover.

6. Separate the pickup coil wiring harness from the stator coil harness and remove the pickup coil wiring.

7. Follow the pickup coil electrical harness from the coil assembly to the electrical connector on the frame and loosen or remove any clamps or tie wraps securing the harness to the frame.

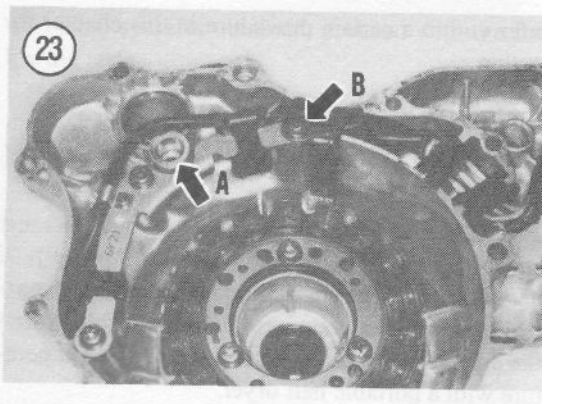
8. Disconnect the electrical connector from the lgmtor unit and remove the pickup coil assembly from the frame.

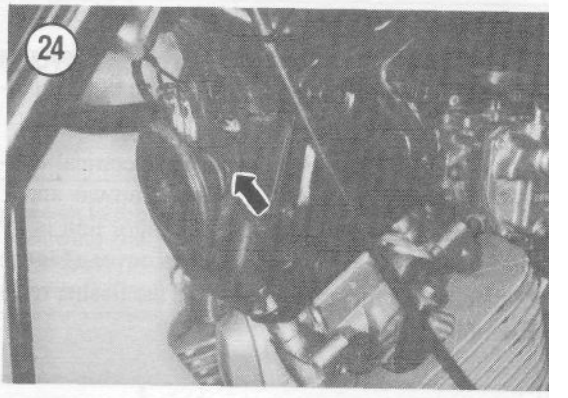
9. Install by reversing these removal steps while noting the following:

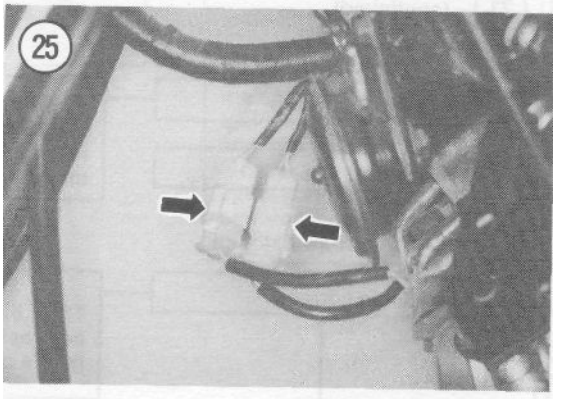
a. Make sure the rubber grommets are properly seated in the crankcase groove to prevent the entry of moisture.

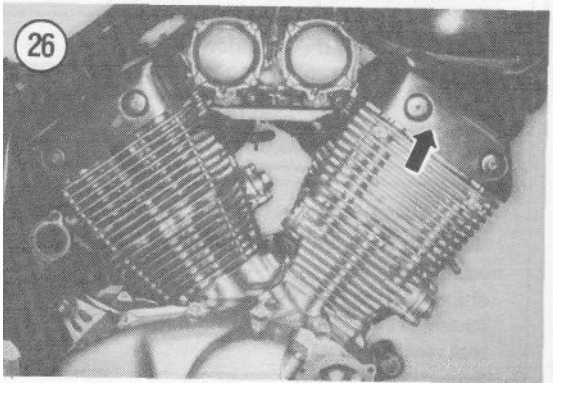
b. Apply a dielectric compound to the electrical connectors prior to reconnecting them. This will help seal out moisture.

c. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.



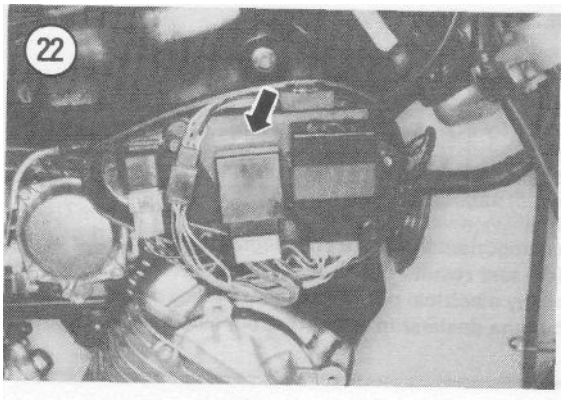


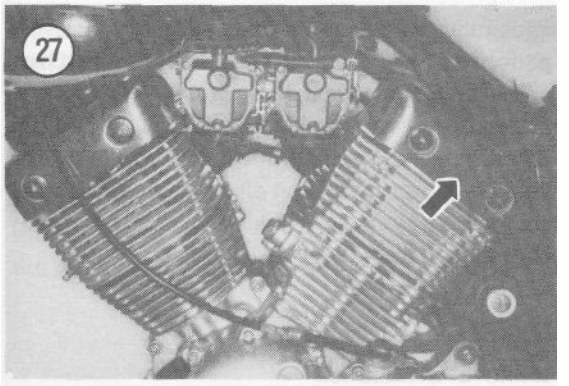


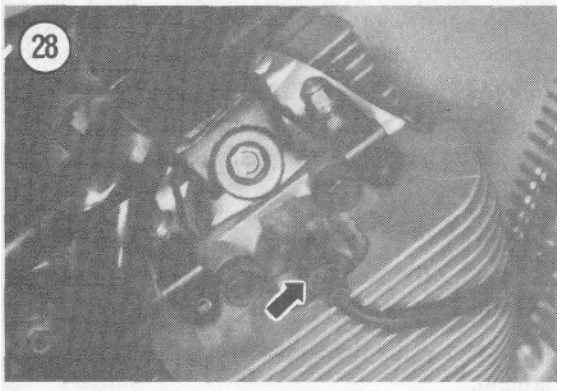


Ignition Coils Testing

To get an accurate reading, the ignition coils must be warm (minimum temperature is 20° C [68° F]. If necessary, start the engine and let it warm up to normal operating temperature. If you are unable to







start the bike, heat the coils to the proper temperature with a portable hair dryer.

1. Place the motorcycle on the sidestand. Turn the front wheel to either side to gain access to the cover.

2. Remove the bolts securing the ignition coil cover **(Figure 24)** and remove the cover.

3. Disconnect the ignition primary coil wire electrical connectors **(Figure 25).** Each connector contains 2 wires; (1 red/white and 1 gray) and (1 red/white and 1 orange).

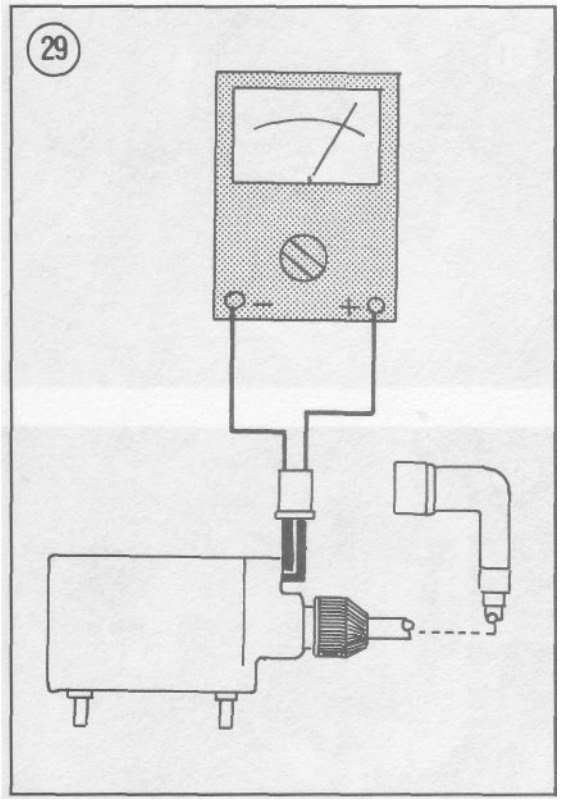
4. Remove the front cylinder head right-hand cover **(Figure 26)** and the rear cylinder head left-hand cover **(Figure 27)**

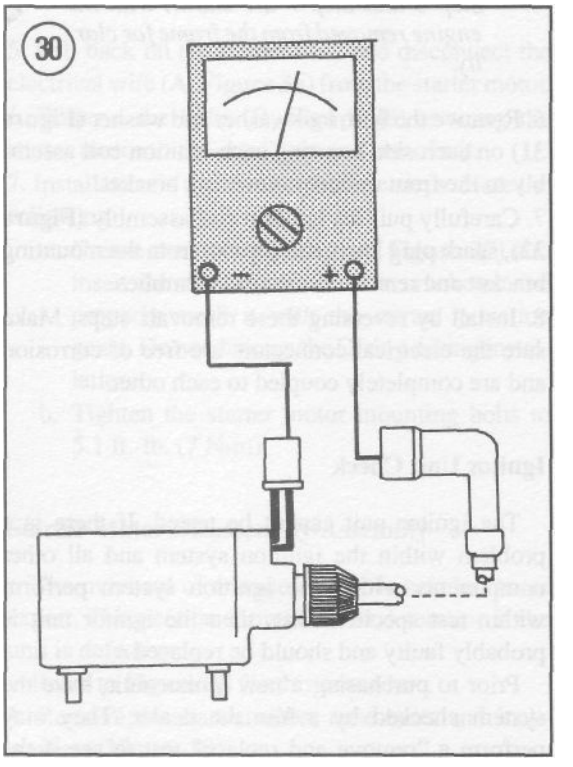
5. Disconnect the spark plug lead **(Figure 28)** from each spark plug.

6. At each electrical connector, measure the coil primary resistance using an ohmmeter set at R x 1. Connect the ohmmeter test leads to the ignition coil connector as shown in **Figure 29.** The correct primary resistance is listed in **Table 1.**

7. Carefully remove the spark plug cap from each spark plug lead.

8. Measure the secondary resistance using an ohmmeter set at R x 1,000. Measure between the coil's secondary spark plug lead **(Figure 30)** and the gray





or orange lead. The correct secondary resistance is listed in **Table 1.**

9. Replace the ignition coil(s) if it doesn't test within the specifications in Step 6 and/or Step 8.

10. Reconnect all electrical connections. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.

11. Install all items removed.

Ignition Coil Removal/Installation

1. Place the motorcycle on the sidestand.

2. Remove the bolts securing the ignition coil cover **(Figure 24)** and remove the cover.

3. Disconnect the ignition primary coil wire electrical connectors **(Figure** 25). Each connector contains 2 wires: 1 red/white and 1 gray; and 1 red/white and 1 orange.

4. Remove the front cylinder head right-hand cover **(Figure 26)** and the rear cylinder head left-hand cover **(Figure** 27).

5. Disconnect the spark plug lead **(Figure 28)** from each spark plug.

NOTE

Step 6 and Step 7 are shown with the engine removed from the frame for clarity.

6. Remove the bolt, lockwasher and washer **(Figure 31)** on each side securing each ignition coil assembly to the front cylinder mounting bracket.

7. Carefully pull the ignition coil assembly **(Figure 32),** spark plug leads and cap out from the mounting bracket and remove both coil assemblies.

8. Install by reversing these removals steps. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.

Ignitor Unit Check

The ignitor unit cannot be tested. If there is a problem within the ignition system and all other components within the ignition system perform within test specifications, then the ignitor unit is probably faulty and should be replaced.

Prior to purchasing a new ignitor unit, have the system checked by a Yamaha dealer. They may perform a "remove and replace" test to see if the igniter unit is faulty. This type of test is expensive if performed by yourself. Remember if you purchase a new ignitor unit and it does *not* solve your particular ignition system problem, you cannot return the ignitor unit for a refund. Most motorcycle dealers will *not* accept returns on electrical and electronic components since they could be damaged internally even though they look okay externally.

Ignitor Unit Removal/Installation

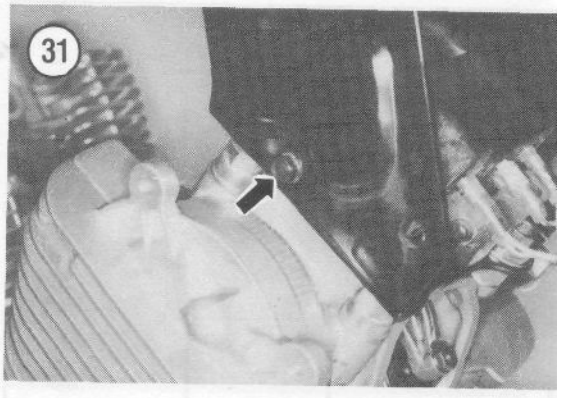
The ignitor unit is located under the right-hand engine cover behind the fuel pump relay and the flasher relay assembly.

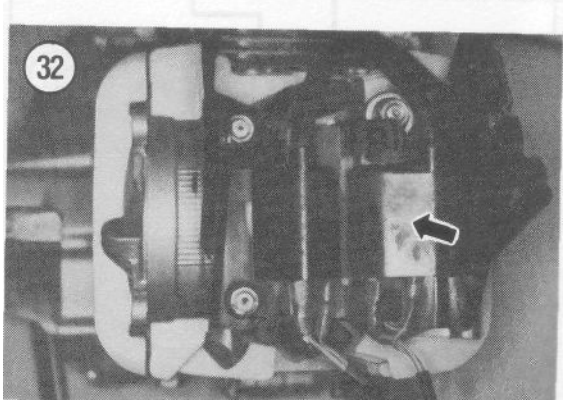
1. Remove the seat and disconnect the battery negative lead as described in Chapter Three in this section of the manual.

2. Remove the right-hand engine cover **(Figure 33).**

3. Remove the bolts securing the electrical panel to the mounting bracket **(Figure** 34).

4. Carefully pull the electrical panel out and turn it around.





5. Remove the bolts and washers securing the ignitor unit to the electrical panel.
6. Disconnect the electrical wire connectors at the ignitor unit and remove it.
7. Install by reversing these removal steps. Before connecting the electrical wire connectors at the ignitor unit, make sure the connectors are clean of any dirt or moisture.

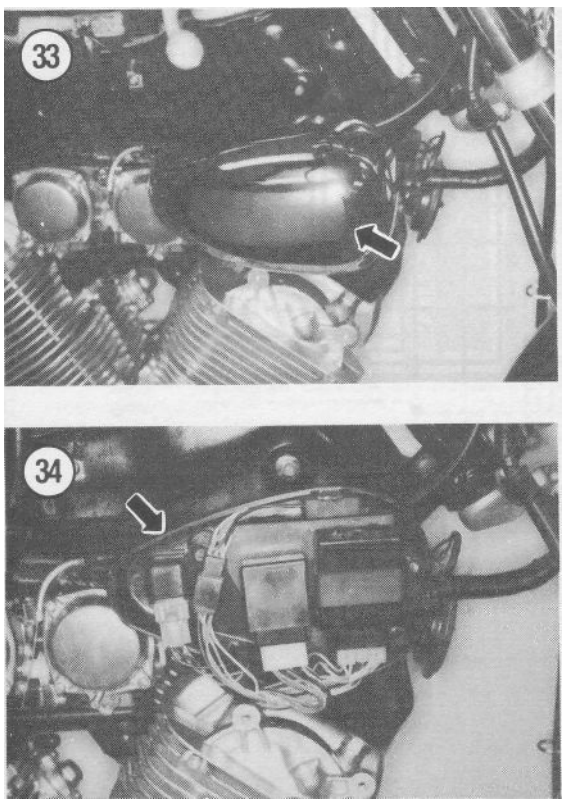
STARTING SYSTEM

The starting system consists of the starter motor, starter solenoid, starter circuit cutoff relay and the starter switch.

The starting system is shown in **Figure 35.** When the starter button is pressed, it engages the solenoid switch that closes the circuit. The electricity flows from the battery to the starter motor.

CAUTION

Do not operate the starter for more than five seconds at a time. Let it rest approximately ten seconds, then use it again.



When the engine stop switch and the main switch are turned to ON, the engine can only be started if:

a. The transmission is in NEUTRAL.
b. The clutch lever is pulled in (transmission in gear) and the sidestand is up.

If the above conditions are not met, the starting circuit cut-off relay will prevent the starter from operating.

The starter gears are covered in Chapter Four in this section of the manual.

Table 2, at the end of the chapter, lists possible starter problems, probable causes and the most common remedies.

Starter Motor Removal/Installation

1. Place the bike on the sidestand.
2. Remove the exhaust system as described in Chapter Six in this section of the manual.
3. Make sure the ignition switch is in the OFF position.
4. Disconnect the negative lead from the battery.

NOTE

Figure 36 is shown with the engine partially disassembled for clarity.

5. Pull back on the rubber boot and disconnect the electrical wire (A, **Figure 36)** from the starter motor.
6. Remove the bolts **(B, Figure 36)** securing the starter motor to the crankcase and remove it.
7. Installation is the reverse of these steps. Note the following:
   a. Grease the starter O-ring (A, **Figure 37)** and insert the starter motor into the crankcase and properly mesh it with the starter reduction gears. Do not damage the O-ring during installation.
   b. Tighten the starter motor mounting bolts to 5.1ft.-lb.(7N.m).

Starter Motor Disassembly/Assembly

The overhaul of a starter motor is best left to an expert. This section shows how to determine if the unit is defective.

Refer to **Figure 38** for this procedure.

1. Remove the starter motor case bolts and lockwashers **(Figure 39).**

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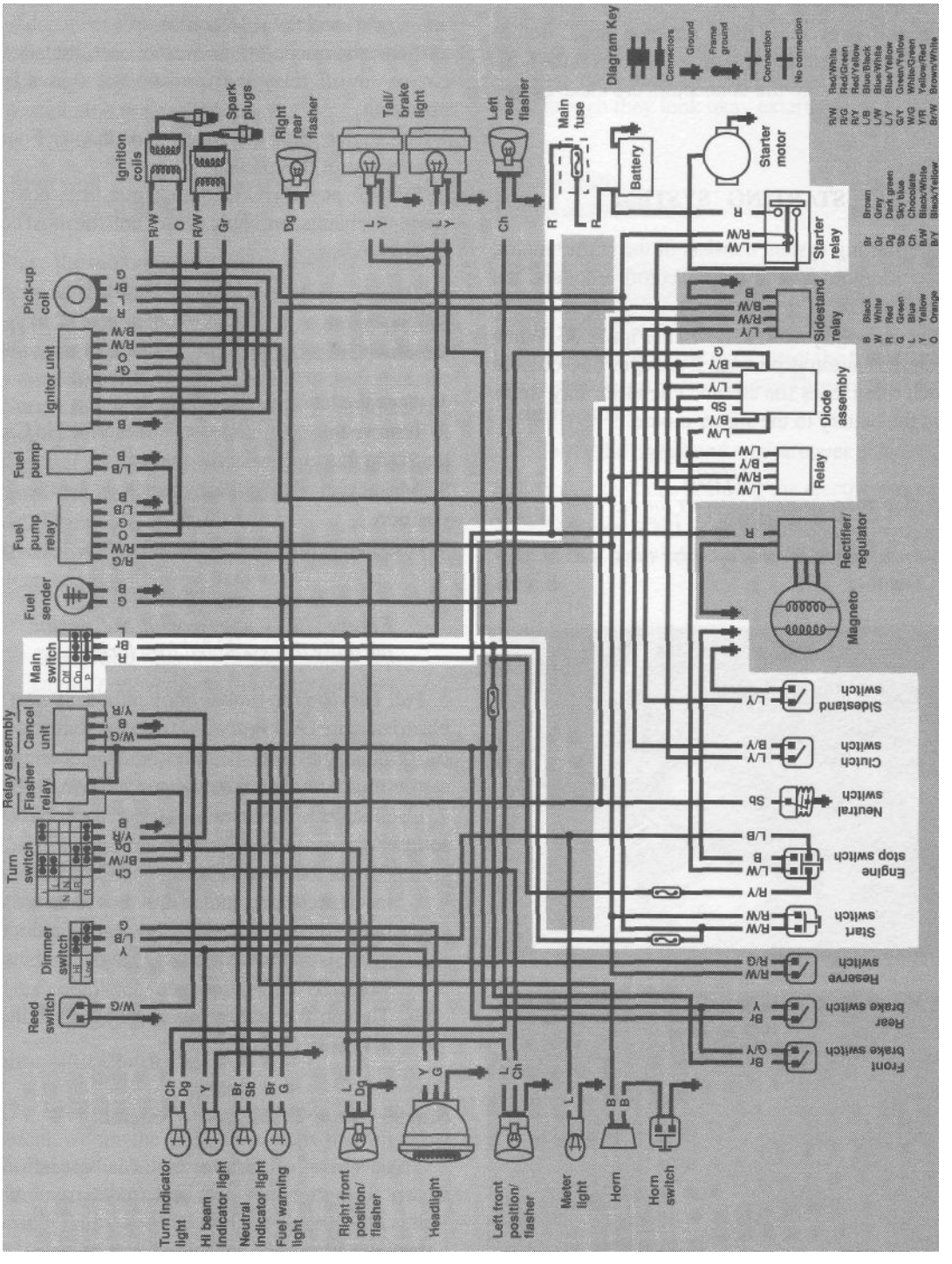
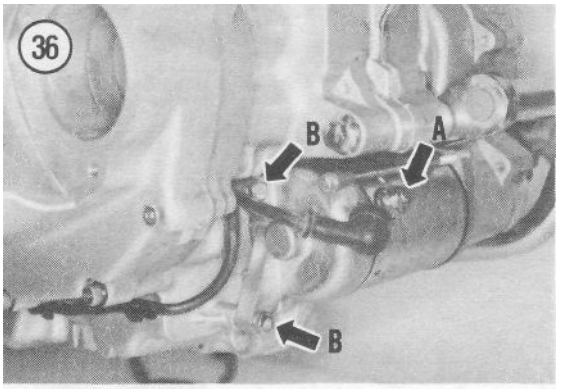
STARTING SYSTEM

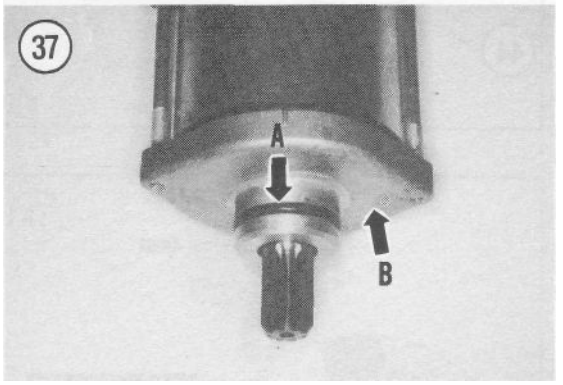


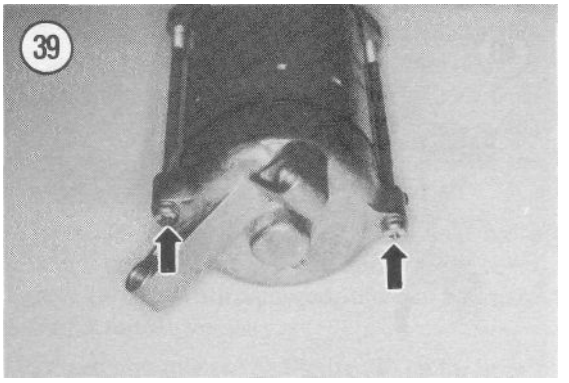


2. Slide off the front cover **(B, Figure 37).**
3. Slide off the rear cover **(Figure 40)** and shims **(Figure 41).** Record the number of shims as the same number must be installed during assembly.
4. Withdraw the armature from the case **(Figure 42).**
5. Clean all grease, dirt, and carbon dust from the armature, case and end covers

CAUTION

Do not immerse brushes or the wire windings in solvent or the insulation might be damaged Wipe the windings





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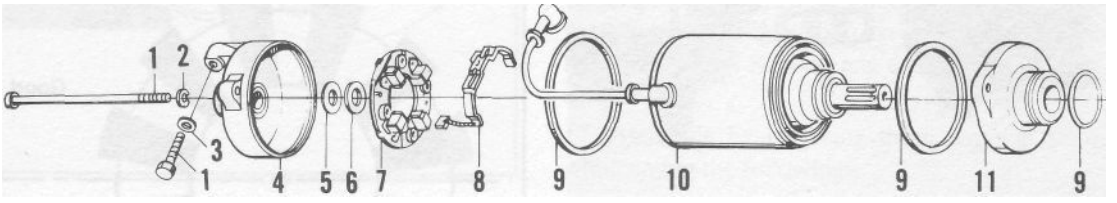
STARTER MOTOR



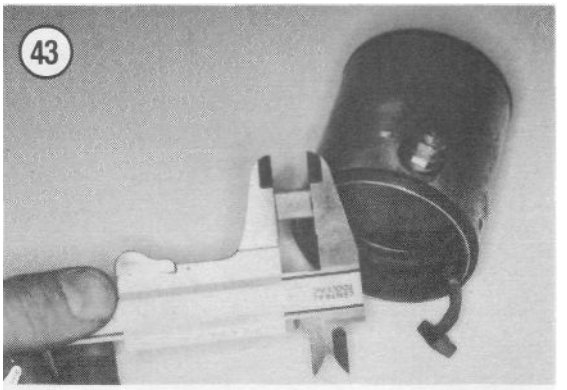
1. Bolt
2. Lockwasher
3. Washer
4. Rear cover
5. Shim
6. Shim
7. Brush holder (negative)
8. Brush holder (positive)
9. O-ring
10. Case and armature
11. Front cover

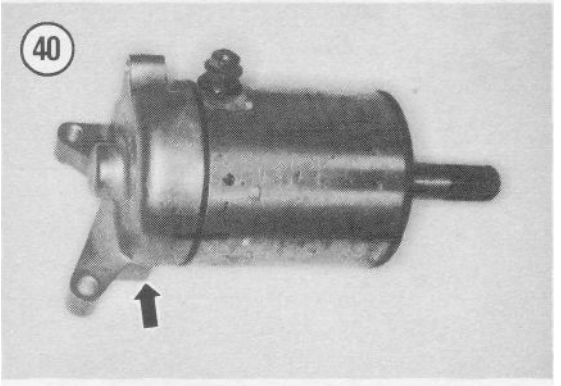
with a cloth slightly moistened with solvent and dry thoroughly.

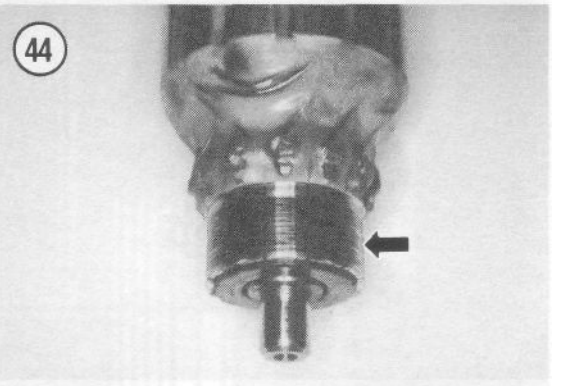
6. Pull back the spring from behind the brashes and remove the brashes from their guides. Measure the length of each brash with a vernier caliper **(Figure 43).** If they are worn to 0.20 in. (5.0 mm) or less, replace them.

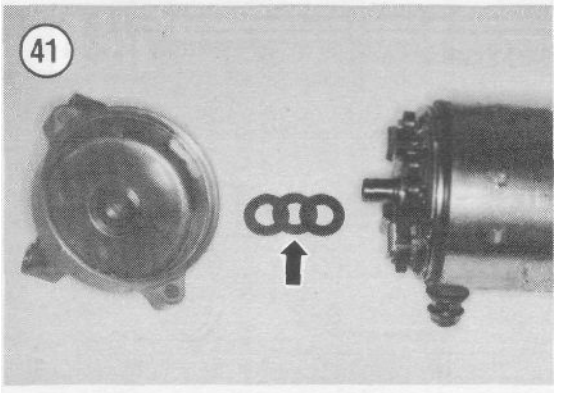
7. Check the spring tension by comparing to a new set of springs. Replace if necessary.

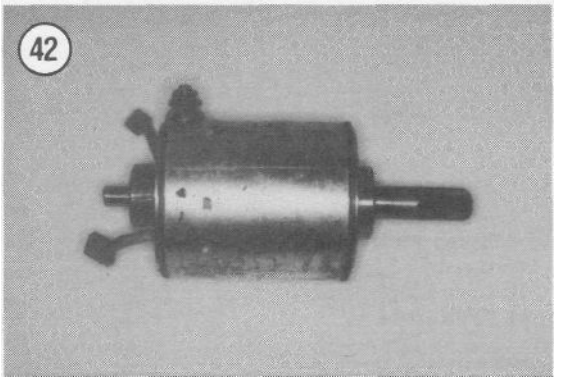
8. Inspect the condition of the commutator **(Figure 44).** The mica in a good commutator is below the

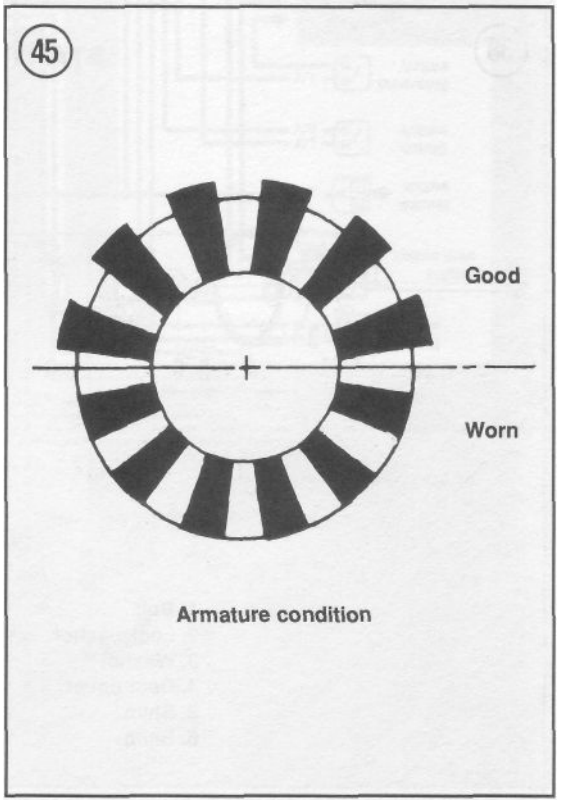


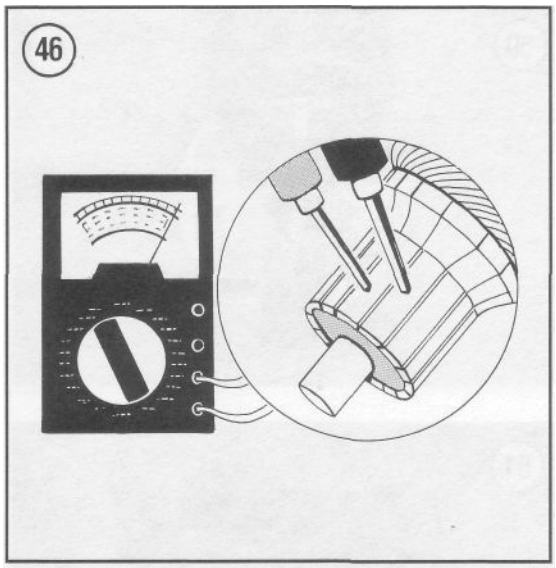


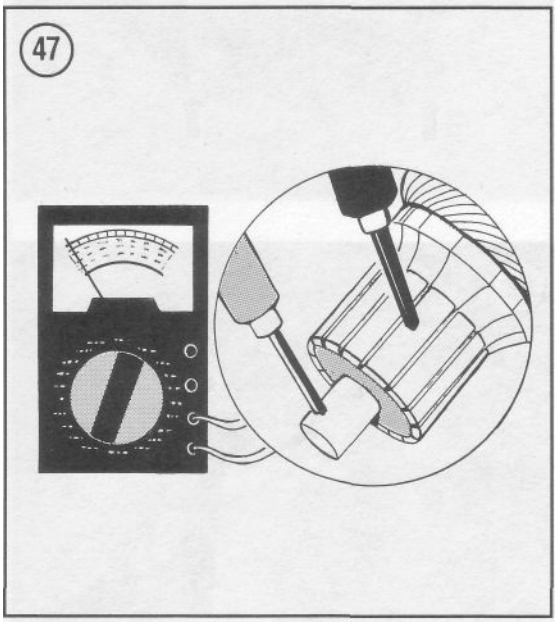












surface of the copper bars **(Figure** 45). A worn commutator is indicated by the copper and mica being level with each other. A worn commutator can be undercut, but it requires a specialist. Take the job to your Yamaha dealer or an electrical repair shop.

9. Inspect the commutator bars for discoloration. If a pair of bars are discolored, that indicates grounded armature coils.

10. Use an ohmmeter and check the electrical continuity between pairs of commutator bars **(Figure** 46) and between the commutator bars and the shaft mounting **(Figure 47).** If there is a short, the armature should be replaced.

11. Inspect the field coil by checking continuity from the cable terminal to the motor case with an ohmmeter; there should be no continuity. Also check from the cable terminal to each brush wire; there should be continuity. If the unit fails either of these tests, the case/field coil assembly must be replaced.

12. Check the bushing in the front end cover **(Figure** 48) and the oil seal and bushing in the rear end cover **(Figure 49)**. If worn or damaged, refer it to a Yamaha dealer for further service.

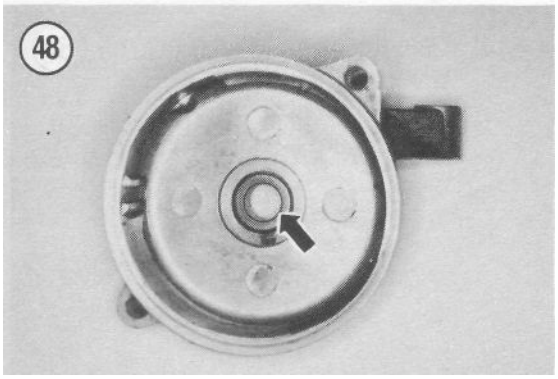
13. Inspect the splines (A, **Figure 50)** on the armature shaft where it meshes with the starter gears. Check for worn or chipped splines.

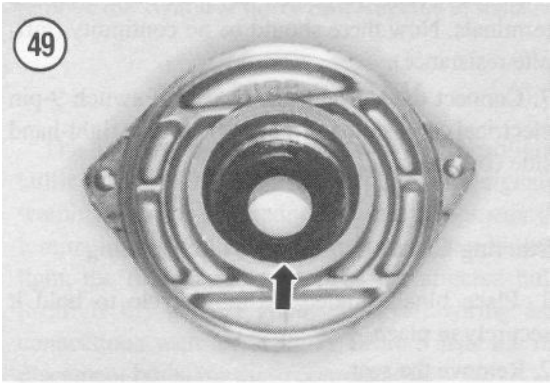
14. Check the bearing (B, **Figure** 50) on the armature shaft for wear or damage.

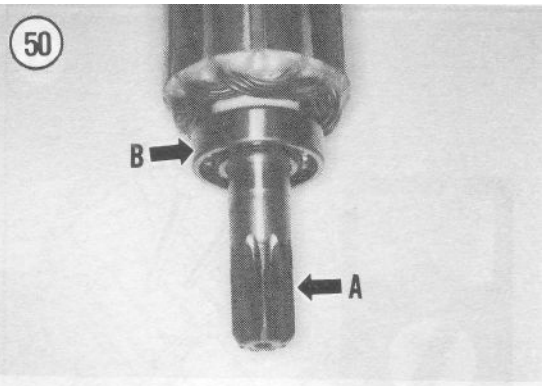
15. Inspect the case O-rings **(Figure 51)** for wear, deterioration or damage; replace if necessary.

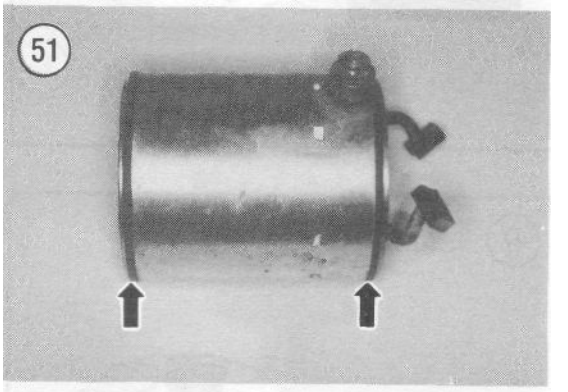
16. Inspect the stack-up of nuts, washer and insulated washers **(Figure 52)** on the positive brush holder assembly. Replace any damaged part if necessary.

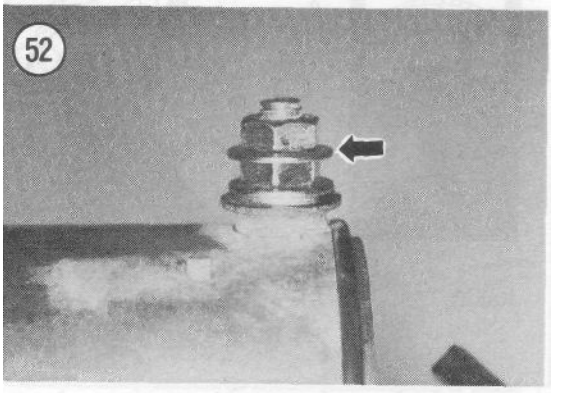
17. Assemble by reversing these removal steps, while noting the following:

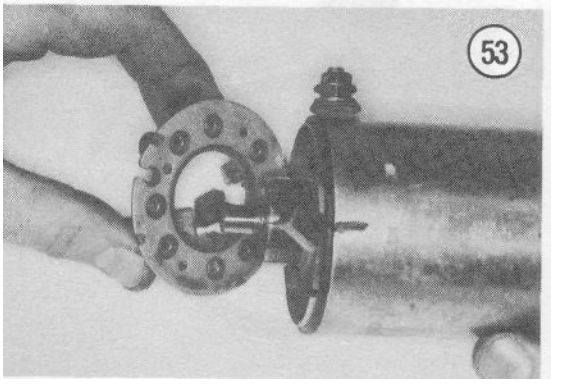








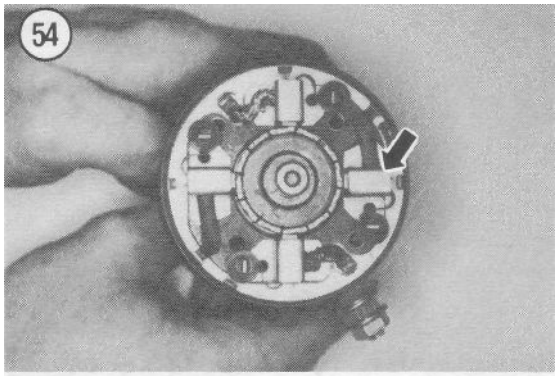


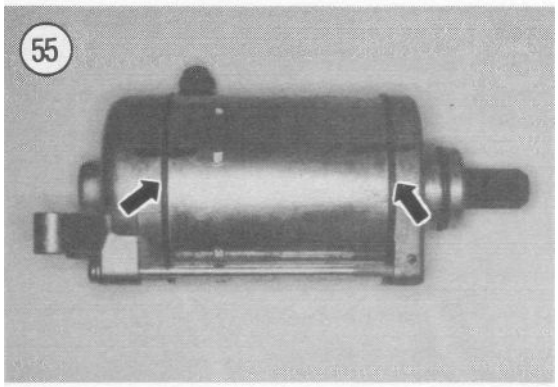


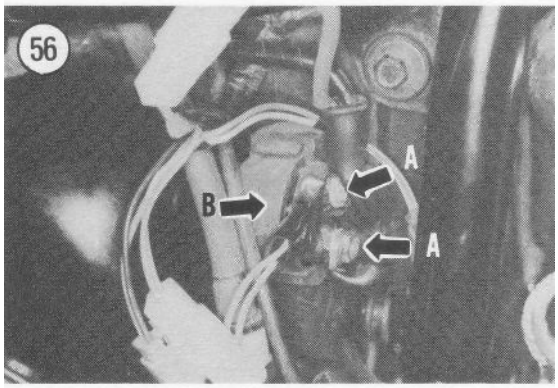
Starting Circuit Sidestand Switch Testing

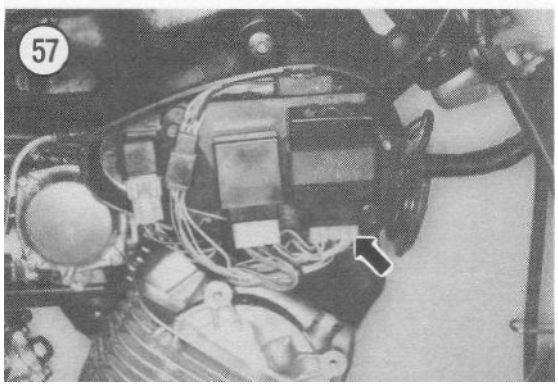
1 Place blocks under the motorcycle to hold it securely m place.

2. Remove the seat.









3. Disconnect the starting circuit sidestand relay 2-pin electrical connector located next to the battery. It contains 2 wires (1 black and 1 blue/yellow).
4. Set the ohmmeter scale to read ohms x 1. Connect the ohmmeter test leads to the black and blue/yellow terminals.
5. Raise the sidestand, there should be continuity (low resistance).
6. Lower the sidestand, there should be no continuity (infinite resistance).
7. If the switch tests okay, reconnect the 2-pin electrical connector.
8. To replace the sidestand switch, disconnect the electrical connector. Remove the mounting screws and remove the switch. Reverse to install.

Starting Circuit Neutral Switch Testing

1. Place the motorcycle on the sidestand.
2. Disconnect the starting circuit neutral switch single sky blue electrical connector, located on the left-hand side next to the battery.
3. Set the ohmmeter scale to read ohms x 1. Connect the ohmmeter positive (+) test lead to the sky blue terminal leading to the neutral switch.
4. Ground the ohmmeter negative (-) test lead to the engine.
5. Shift the transmission into NEUTRAL, there should be continuity (low resistance).
6. Shift the transmission into any gear, there should be no continuity (infinite resistance).
7. If the switch tests okay, reconnect the single sky blue electrical connector.
8. To replace the sidestand switch, remove the left-hand crankcase cover as described in Chapter Four in this section of the manual. Disconnect the electrical connector, then remove the mounting screws and remove the switch **(Figure 58).** Reverse to install.

LIGHTING SYSTEM

The lighting system consists of the headlight, taillight/brakehght combination, directional signals, warning lights and speedometer and tachometer illumination lights. In the event of trouble with any light, the first thmg to check is the affected bulb itself. If the bulb is good, check all wiring and connections with a test light. **Table 3** lists the replacement bulbs for these components.

Headlight Replacement

WARNING
If the headlight bulb has just burned out or turned off it will be hot! Don't touch the bulb until it cools off

1. Remove the mounting screws (A, **Figure 59)** on each side of the headlight housing.
2. Pull the tnm bezel and headlight unit (B, **Figure 59)** out and disconnect the electrical connector (A, **Figure 60)** from the bulb
3 Remove the bulb cover **(B, Figure 60)**

CAUTION
Do not touch the bulb glass with your fingers because traces of oil on the bulb will drastically reduce the life of the bulb Clean any traces of oil from the bulb with a cloth moistened in alcohol or lacquer thinner

4 Turn the bulb holder counterclockwise and remove the bulb
5 Install by reversing these steps. Be sure to install the bulb cover with the TOP mark (C, **Figure 60)** facing up
6 Adjust the headlight as described under *Headlight Adjustment* in this chapter.

Headlight Adjustment

Adjust the headlight horizontally and vertically according to the Department of Motor Vehicles regulations in your area

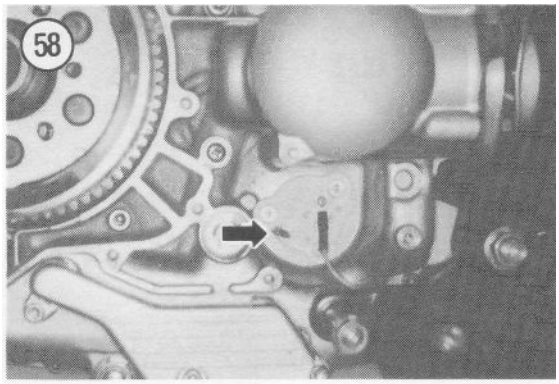
There are 2 adjustments horizontal and vertical To adjust, proceed as follows

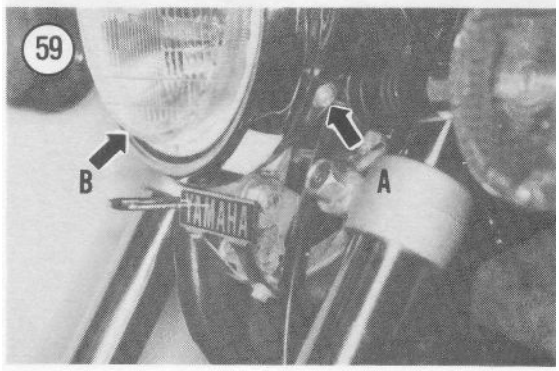
Horizontal adjustment—Turn the top screw (A, **Figure 61)** clockwise to move the beam to the right and counterclockwise to move the beam to the left

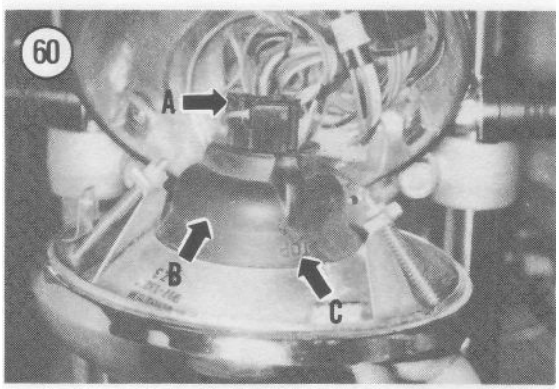
Vertical adjustment—Turn the lower screw **(B, Figure 61)** clockwise to move the beam up and counterclockwise to move the beam down.

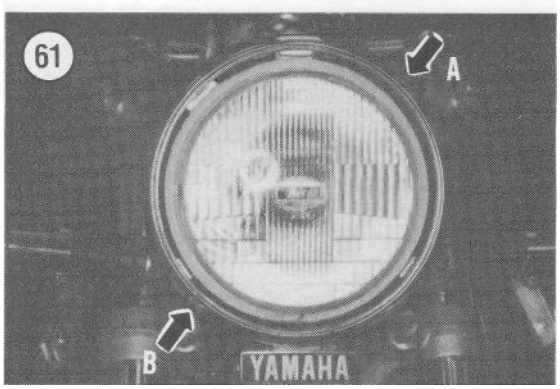
Speedometer Illumination Bulb Replacement

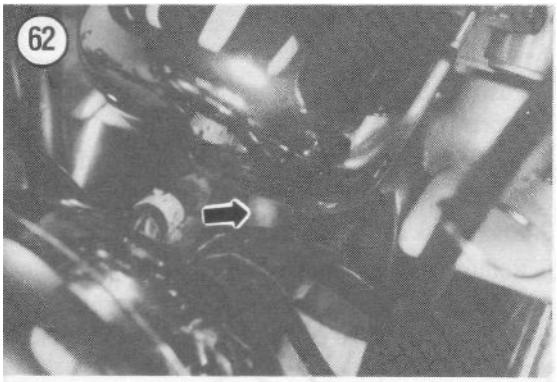
1. Disconnect the speedometer cable **(Figure 62).**
2 Remove the bolts securing the speedometer base and pull it away from the steennq head.

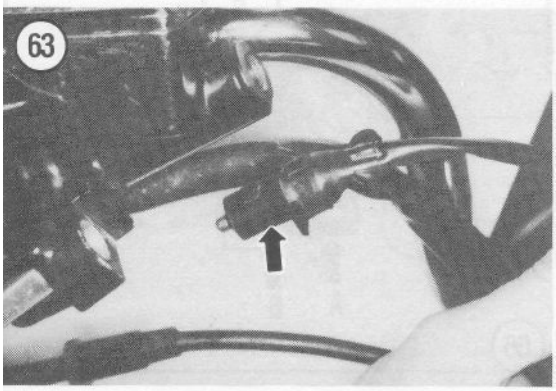


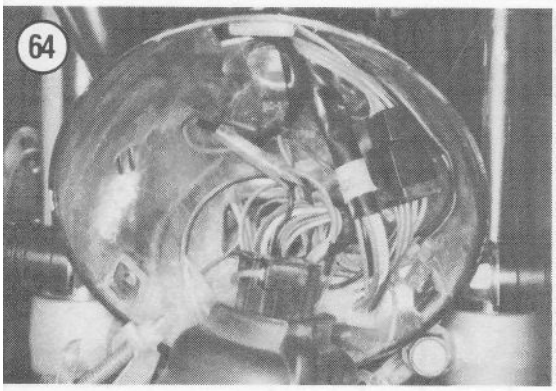


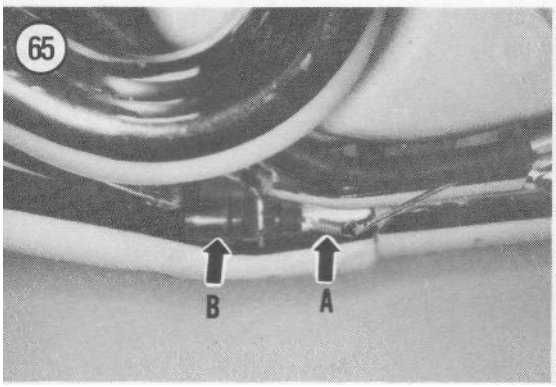












3. Remove the outside cover (as necessary) to gain access to the blown bulb.
4. Remove the bulb from the connector and install a new one.
5. Installation is the reverse of these steps.

SWITCHES

Front Brake Light Switch Replacement

1. Using a small screwdriver or drift, push up in the hole in the base of the master cylinder switch receptacle and withdraw the switch and electrical harness from the master cylinder **(Figure 63).**
2. Remove the headlight and follow the switch's electrical harness into the headlight case **(Figure 64)** and disconnect it.
3. Install the new switch and connect the wires.

Rear Brake Light Switch Replacement

1. Remove the frame right-hand side cover.
2. Unhook the spring (A, **Figure** 65) from the brake arm.
3. Unscrew the switch housing and locknut (B, **Figure 65)** from the mounting bracket.
4. Disconnect the electrical wires.
5. Replace the switch; reinstall and adjust as described in this chapter.

Rear Brake Light Switch Adjustment

1. Turn the ignition switch to the ON position.
2. Depress the brake pedal. Brake light should come on just as the brake begins to work.
3. To make the light come on earlier, hold the switch body (A, **Figure 66)** and turn the adjusting nut **(B, Figure 66)** as required.

Sidestand Switch Replacement

NOTE

This procedure is shown with the sidestand assembly removed for clarity. It is not necessary to remove the assembly in order to remove the switch.

1. Place the bike securely on the sidestand.
2. Remove the sidestand switch screws **(Figure 67).**

3. Disconnect the switch electrical connector and remove the switch.
4. Install the new switch and connect the connector.

Flasher Relay Replacement

1. Remove the right-hand side cover **(Figure 33).**
2. Disconnect the 9-pin electrical connector and remove the flasher relay **(Figure 68)** and replace it with a new unit.

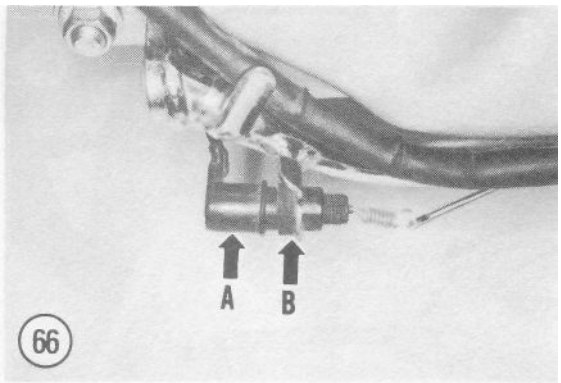
FUEL PUMP TESTING

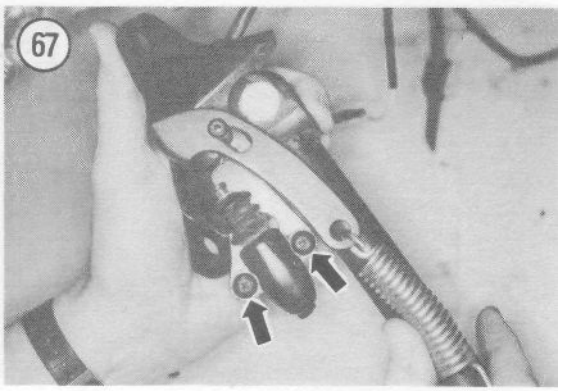
The fuel pump system consists of a fuel pump, fuel pump controller and fuel reserve switch. Refer to **Figure 69** for 1987-1989 models or **Figure 70** for 1990-1993 models. Fuel pump removal and installation is described in Chapter Six in this section of the manual. Observe the following conditions when troubleshooting the fuel pump system.

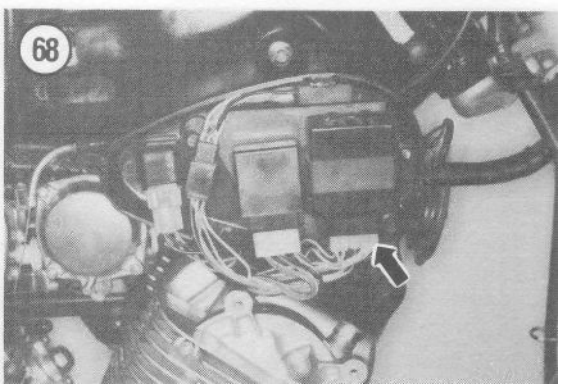
1. Check all connections to make sure they are tight and free of corrosion.
2. Check the battery to make sure it is fully charged.
3. Fuel pump troubleshooting is divided into 4 separate test procedures, each dependent upon the problem experienced.
   a. Test 1: Fuel pump fails to operate after engine is started.
   b. Test 2: Fuel pump fails to operate for a 5 second interval when the carburetor fuel level is low and the fuel level indicator does not come on.
   c. Test 3: Fuel pump fails to operate for 5 second intervals when the carburetor fuel level is low and the fuel level indicator comes on.
   d. Test 4: Fuel pump does not stop after 30 seconds when fuel indicator comes on while engine is turned on.

Testl

1. Remove the right-hand cover **(Figure 33).**
2. Shift the transmission into neutral.
3. Disconnect the fuel pump relay 6-pin electrical connector **(Figure** 71).
4. Connect a 0-20 V DC voltmeter to the wiring harness side of the connector. Connect the positive (+) test lead to the red/white terminals and the negative (-) test lead to ground.
5. Turn the main switch ON and the engine stop switch to RUN.
6. Push the START button and measure the voltage. Interpret results as follows:
   a. Less than 12 volts: check the main switch.
   b. More than 12 volts: proceed to Step 7.
7. Reconnect the 6-pin electrical connector.
8. Remove the headlight as described in this chapter.
9. Within the headlight housing, disconnect the right-hand handlebar switch 9-pin electrical connector.







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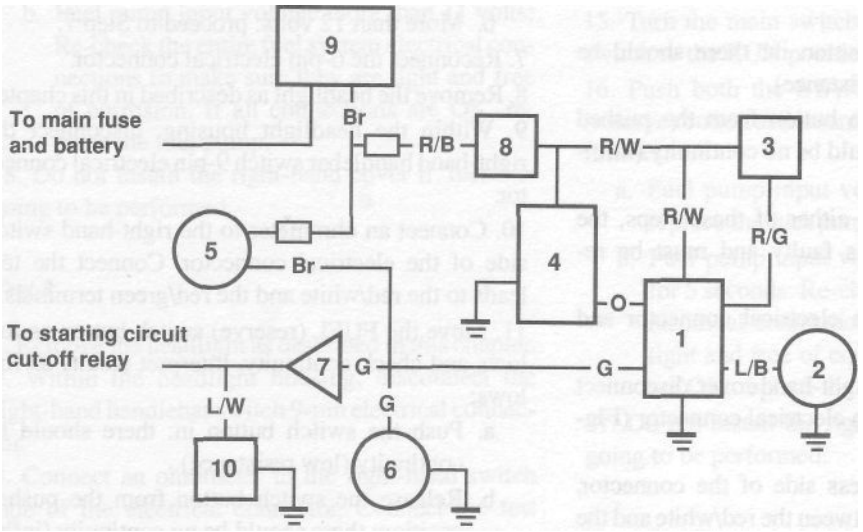
FUEL PUMP CIRCUIT (1987-1989)



1. Fuel pump relay
2. Fuel pump
3. Reserve switch
4. Ignitor unit
5. Fuel indicator light
6. Fuel sender
7. Diode
8. Engine stop switch
9. Main switch
10. Start switch

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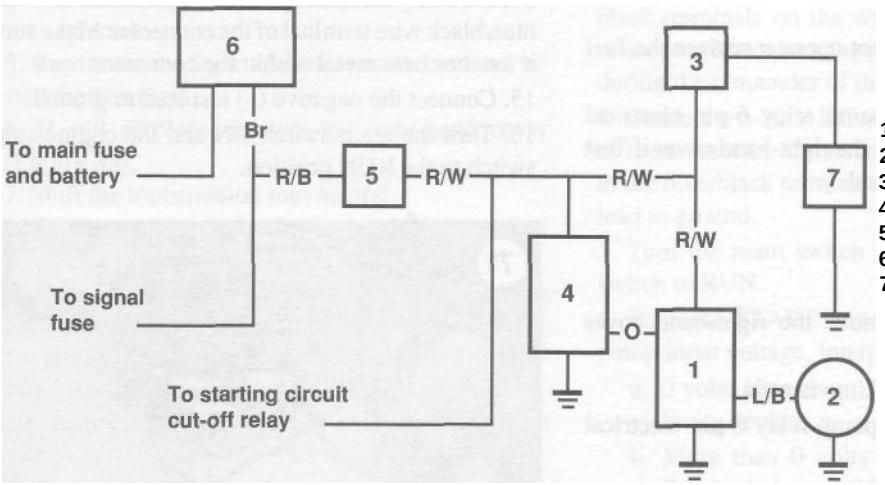
FUEL PUMP CIRCUIT (1990-1993)



1. Fuel pump relay
2. Fuel pump
3. Reserve switch
4. Ignitor unit
5. Engine stop switch
6. Main switch
7. Solenoid valve

10. Connect an ohmmeter to the right-hand switch side of the electrical connector. Connect the test leads to the red/white and the red/green terminals.

11. Move the FUEL (reserve) switch button as follows and check continuity. Interpret results as follows:

a. Push the switch button in: there should be continuity (low resistance).
b. Release the switch button from the pushed position: there should be no continuity (infinity).
c. If the switch fails either of these steps, the switch assembly is faulty and must be replaced.

12. Reconnect the 9-pin electrical connector and install the headlight.

13. In the area under the right-hand cover, disconnect the fuel pump relay 6-pin electrical connector **(Figure 71).**

14. On the wiring harness side of the connector, connect a jumper wire between the red/white and the blue/black terminals.

15. Turn the main switch ON and the engine stop switch to the RUN position.

16. Push both the START button and the FUEL (reserve) button at the same time. Interpret results as follows:

a. Fuel pump operates: Re-check the entire fuel system electrical connections to make sure they are tight and free of corrosion. If all connections are OK, replace the fuel pump relay.
b. Fuel pump does not operate: replace the fuel pump.

17. Connect the fuel pump relay 6-pin electrical connector. Do not install the right-hand cover if Test 2 is going to be performed.

Test 2

1. If still in place, remove the right-hand cover **(Figure 33).**

2. Shift the transmission into neutral.

3. Disconnect the fuel pump relay 6-pin electrical connector **(Figure 71).**

4. Connect a 0-20 V DC voltmeter to the wiring harness side of the connector. Connect the positive (+) test lead to the red/white terminals and the negative (-) test lead to ground.

5. Turn the main switch ON and the engine stop switch to RUN.

6. Push the START button and measure the voltage. Interpret results as follows:

a. Less than 12 volts: check the main switch.
b. More than 12 volts: proceed to Step 7.

7. Reconnect the 6-pin electrical connector.

8. Remove the headlight as described in this chapter.

9. Within the headlight housing, disconnect the right-hand handlebar switch 9-pin electrical connector.

10. Connect an ohmmeter to the right-hand switch side of the electrical connector. Connect the test leads to the red/white and the red/green terminals.

11. Move the FUEL (reserve) switch button as follows and check continuity. Interpret results as follows:

a. Push the switch button in: there should be continuity (low resistance).
b. Release the switch button from the pushed position: there should be no continuity (infinity).
c. If the switch fails either of these steps, the switch assembly is faulty and must be replaced.

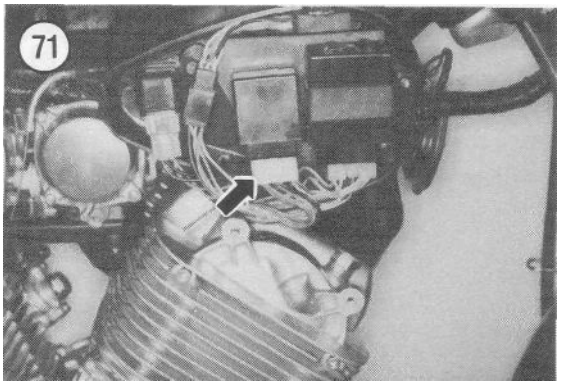
12. Reconnect the 9-pin electrical connector and install the headlight.

13. In the area under the right-hand cover, locate the fuel pump relay 6-pin electrical connector **(Figure 71).** Do NOT disconnect it.

14. Carefully insert the positive (+) test lead into the blue/black wire terminal of the connector. Make sure it touches bare metal within the connector.

15. Connect the negative (-) test lead to ground.

16. Turn the main switch ON and the engine stop switch to the RUN position.



17. Push both the START button and the FUEL (reserve) button at the same time. Interpret results as follows:
   a. Fuel pump input voltage less than 11 volts: replace the fuel pump relay.
   b. Fuel pump input voltage more than 11 volts: Re-check the entire fuel system electrical connections to make sure they are tight and free of corrosion. If all connections are OK, replace the fuel pump.
18. Do not install the right-hand cover if Test 3 is going to be performed.

Test 3

1. Remove the headlight as described in this chapter.
2. Within the headlight housing, disconnect the right-hand handlebar switch 9-pin electrical connector.
3. Connect an ohmmeter to the right-hand switch side of the electrical connector. Connect the test leads to the red/white and the red/green terminals.
4. Move the FUEL (reserve) switch button as follows and check continuity. Interpret results as follows:
   a. Push the switch button in: there should be continuity (low resistance).
   b. Release the switch button from the pushed position: there should be no continuity (infinity).
   c. If the switch fails either of these tests, the switch assembly is faulty and must be replaced.
5. Reconnect the 9-pin electrical connector and install the headlight.
6. If still in place, remove the right-hand cover **(Figure 33).**
7. Shift the transmission into neutral.
8. Disconnect the fuel pump relay 6-pin electrical connector **(Figure 71).**
9. Connect a 0-20 V DC voltmeter to the wiring harness side of the connector. Connect the positive (+) test lead to the red/green terminals and the negative (-) test lead to ground.
10. Turn the main switch ON and the engine stop switch to RUN.
11. Push the START button and measure the voltage. Interpret results as follows:
   a. Less than 12 volts: check the main switch.
   b. More than 12 volts: proceed to Step 12.
12. Reconnect the 6-pin electrical connector.
13. Carefully insert the positive (+) test lead into the blue/black wire terminal of the connector. Make sure it touches bare metal within the connector.
14. Connect the negative (-) test lead to ground.
15. Turn the main switch ON and the engine stop switch to the RUN position.
16. Push both the START button and the FUEL (reserve) button at the same time. Interpret results as follows:
   a. Fuel pump input voltage less than 11 volts: replace the fuel pump relay.
   b. Fuel pump input voltage more than 11 volts for 5 seconds: Re-check the entire fuel system electrical connections to make sure they are tight and free of corrosion. If all connections are OK, replace the fuel pump.
17. Do not install the right-hand cover if Test 4 is going to be performed.

Test 4 (1987-1989 models only)

NOTE
1990 and later models are not equipped with afuel sender, therefor this test cannot be performed on these models.

1. Remove the seat.
2. Disconnect the fuel sender 2-pin electrical connector (1 green and 1 black wire).
3. Connect a jumper wire between the green and black terminals on the wiring harness side of the connector. Make sure the jumper wire stays in place during the remainder of this test.
4. Connect a 0-20 V DC voltmeter to the other side of the connector. Connect the positive (+) test lead to the blue/black terminals and the negative (-) test lead to ground.
5. Turn the main switch ON and the engine stop switch to RUN.
6. Push the START button and measure the fuel pump input voltage. Interpret results as follows:
   a. 0 volts after about 30 seconds: fuel sender is faulty, replace it.
   b. More than 0 volts after about 30 seconds: Re-check the entire fuel system electrical connections to make sure they are tight and free of corrosion. If all connections are OK, replace the fuel pump relay.

7. Reconnect the fuel sender 2-pin electrical connector. Install the right-hand cover.

Fuel Pump Testing

Remove the fuel pump as described in Chapter Six in this section of the manual. Connect a 12-volt battery to the fuel pump as shown in **Figure 72.** If the fuel pump is good, it will vibrate slightly. If not, replace it.

Fuel Reserve Switch

1. Remove the headlight as described in this chapter.
2. Disconnect the fuel reserve switch electrical connector containing 2 wires: red/white and red/green.
3. Connect an ohmmeter's (set on R x 1) red lead to the red/white wire and the black lead to the red/green wire.
4. Interpret results as follows:
   a. With the fuel reserve switch turned to RES, the reading should be 0 ohms.
   b. With the fuel reserve switch turned to ON, the reading should be infinite resistance.
5. If the fuel reserve switch failed either of the tests in Step 4, the right-hand switch assembly should be replaced.

HORN

Removal/Installation

1. Disconnect the horn electrical connector **(Figure 73).**
2. Remove the bolts securing the horn.
3. Installation is the reverse of these steps.

Testing

1. Disconnect horn wires from harness.
2. Connect horn wires to 12-volt battery. If it is good, it will sound.

FUSES

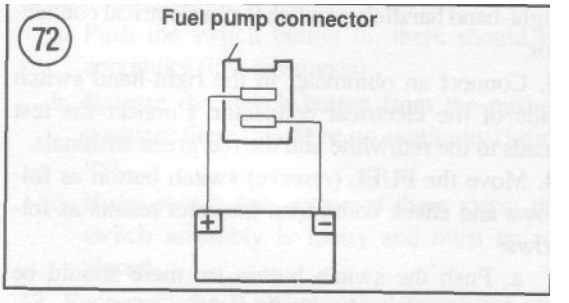
Whenever a fuse blows, find out the reason for the failure before replacing the fuse. Usually, the trouble is a short circuit in the wiring. This may be caused by worn-through insulation or a disconnected wire shorting to ground. Fuse ratings are listed in **Table 4.**

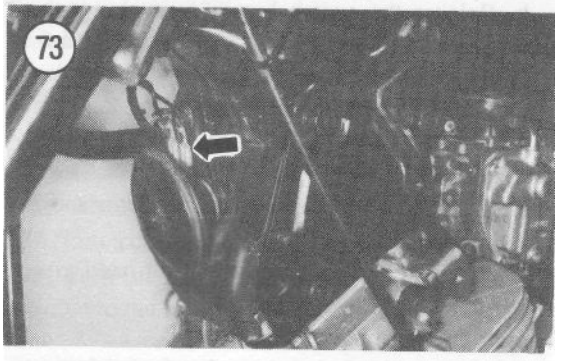
CAUTION

Never substitute aluminum foil or wire for a fuse. Never use a higher amperage fuse than specified. An overload could result in fire and complete loss of the bike.

There are 4 fuses used on the XV535 models. The fuse panel is located underneath the seat.

If the main fuse blows, raise the seat and separate the rubber fuse holder **(Figure 74).** Remove the fuse and replace it with one of the same amperage.





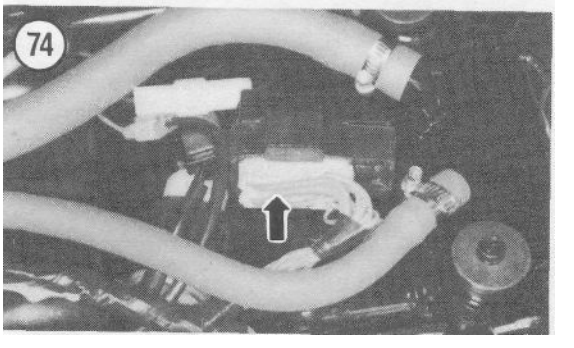


Table 1 ELECTRICAL SPECIFICATIONS

System voltage	12 volts
Pickup coil resistance	140-170 ohms*
Ignition coil resistance	
Secondary	10.6-15.8 K ohms*
Primary	3.8-4.6 ohms*
Charging voltage	14 volts at 5,000 rpm
Armature coil resistance	0.34-0.42 ohms*
Starter brush wear limit	0.20 in. (5.0 mm)

*Test performed to unit at a temperature of 68° F (20° C).

Table 2 STARTER TROUBLESHOOTING

Symptom	Probable cause	Remedy
Starter does not operate	Low battery	Recharge battery
	Worn brushes	Replace brushes
	Defective relay	Repair or replace
	Defective switch	Repair or replace switch
	Defective wiring connection	Repair wire or repair connection
	Internal short circuit	Repair or replace defective component
Starter action is weak	Low battery	Recharge battery
	Pitted relay contacts	Clean or replace
	Worn brushes	Replace brushes
	Defective connection	Clean and tighten
	Short circuit in commutator	Replace armature
Starter runs continuously	Stuck relay	Replace relay
Starter turns; does not turn engine	Defective starter clutch	Replace starter clutch

Table 3 REPLACEMENT BULBS

Item	Voltage/Wattage
Headlight	12V 60W/55W
Tail/brakelight	
U.S.	12V 8W/27W
U.K.	12V5W/21W
Front running light (U.S.)	12V8W/27W
Auxiliary light (U.K. only)	12V 4W
Front flasher	
U.S.	12V 8W/27W
U.K.	12V 21W
Rear flasher	
U.S.	12V 27W
U.K.	12V 21W
Meter light	12V3.4W
Indicator lights	
High beam	12V1.7W
All others	12V 3.4W

Table 4 FUSES

	Amperage
Main	20
Headlight	10
Signal	10
Ignition	**10**
Spare	20&10

CHAPTER EIGHT

FRONT SUSPENSION AND STEERING

This chapter discusses service operations on suspension components, steering, wheels and related items. Specifications **(Table 1)** and tightening torques **(Table 2)** are found at the end of the chapter.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Eight at the front of this manual for service procedures.

FRONT WHEEL

Removal/Installation

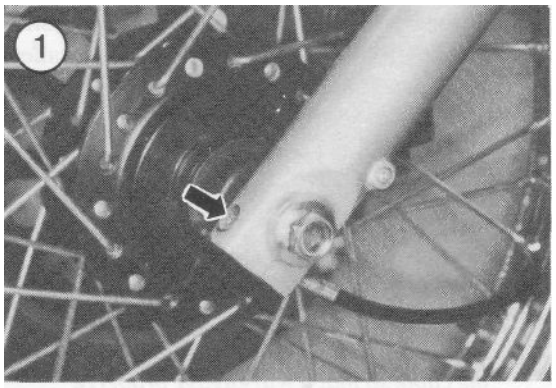
NOTE

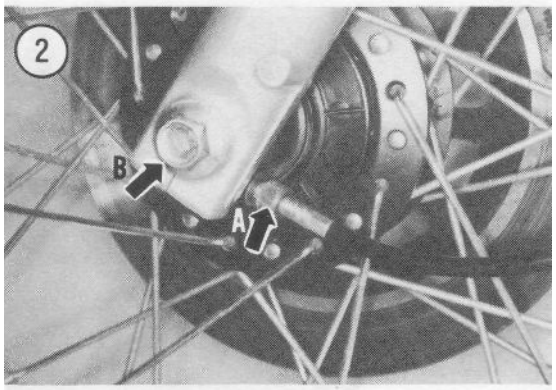
It is not necessary to completely remove the axle pinch bolt.

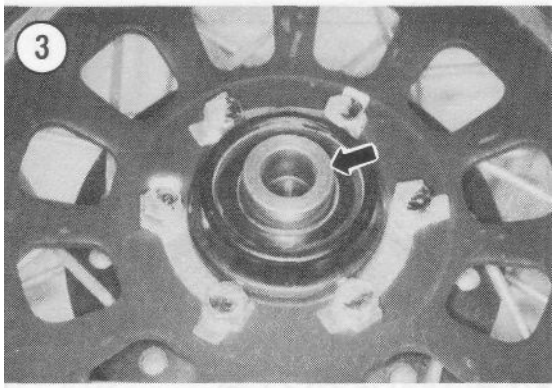
1. Loosen the axle pinch bolt (Figure 1).
2. Disconnect the speedometer cable (A, Figure 2) at the front wheel.
3. Loosen the front axle.
4. Place a wooden block under the crankcase to lift the front of the bike off the ground.
5. Unscrew the axle (B, Figure 2) from the right-hand fork leg and remove it.
6. Pull the wheel forward to disengage the brake disc from the caliper.
7. Remove the wheel.

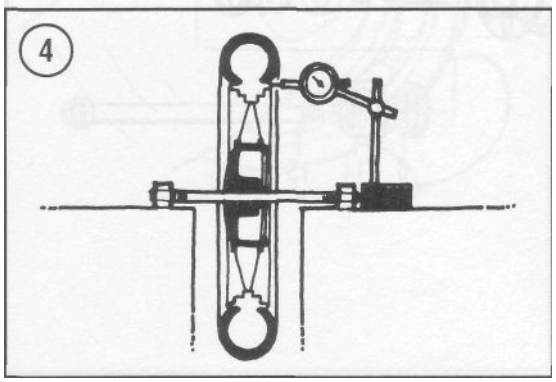
CAUTION

Do not set the wheel down on the disc surface as it may be scratched or warped. Either lean the wheel against a wall or place it on a couple of wood blocks.









NOTE

Insert a piece of wood in the cahper in place of the disc. That way, if the brake lever is inadvertently squeezed, the piston will not be forced out of the cylinder. If this does happen, the caliper might have to be disassembled to reseat the piston and the system will have to be bled. By using the wood, bleeding the brake is not necessary when installing the wheel.

8. Remove the spacer **(Figure** 3) from the seal in the right-hand side of the wheel.

9. Remove the speedometer drive from the seal in the left-hand side of the wheel.

Inspection

1. Remove any corrosion on the front axle with a piece of fine emery cloth.

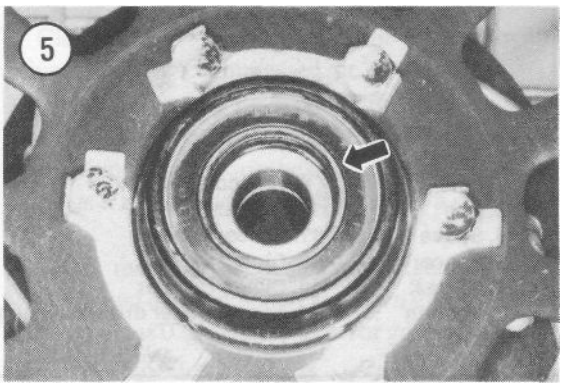
2. Measure the radial runout of the wheel rim with a dial indicator as shown in **Figure** 4. If runout exceeds 0.08 in. (2.0 mm), check the wheel bearings. Refer to *Wheels* in Chapter Eight in the front section of this manual for information on spoke tightening and wheel truing.

3. Check the rims for cracks or damage as described under *Rims* in Chapter Eight in the front section of this manual.

Installation

1. Lightly grease the lips of both front wheel seals **(Figure 5)** and the seal in the speedometer gear case.

2. Insert the spacer in the right-hand side seal **(Figure 3).**



3. Insert the speedometer gear case into the wheel. Make sure to align the notches in the gear case (A, **Figure 6)** with the speedometer drive dogs (B, **Figure 6).**

4. Install the front wheel and *carefully* insert the disc between the pads when installing the wheel.

5. Make sure the locating slot in the speedometer gear case is aligned with the boss on the fork tube. Also make sure the spacer **(Figure 7)** is still in place.

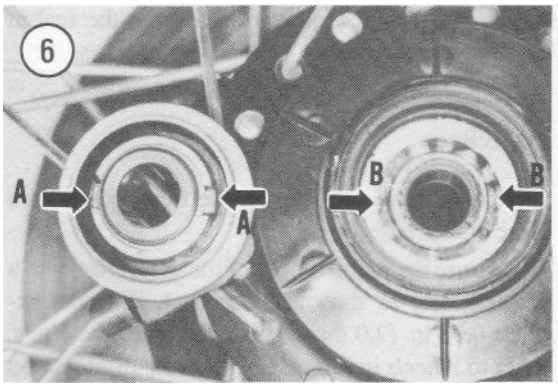
6. Insert the axle and screw it into the right-hand fork leg. Tighten the axle to specifications **(Table 2).**

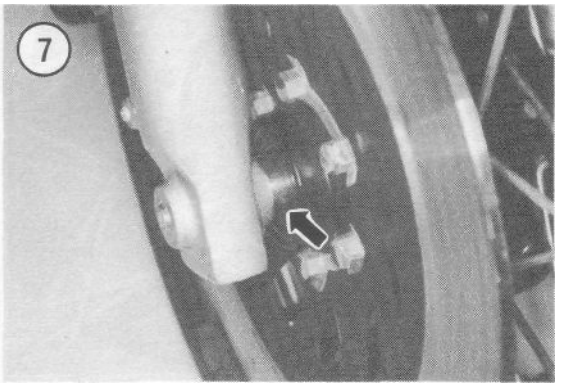
7. Apply the front brake and compress the front forks several times to make sure the axle is installed correctly without binding the forks. Then tighten the axle pinch bolt to specification **(Table 2).**

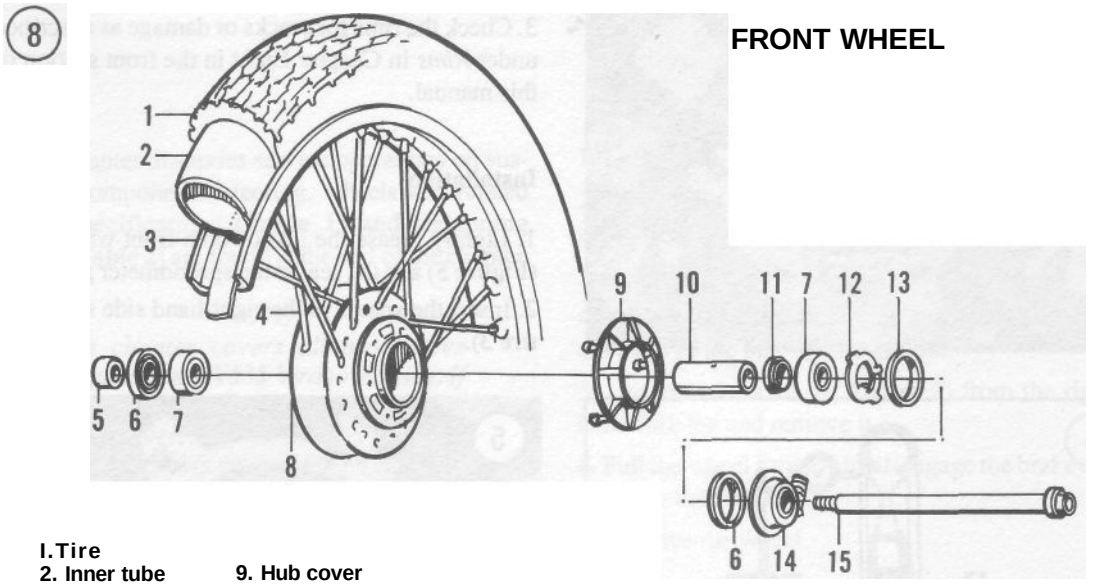
8. After the wheel is installed, completely rotate it and apply the brake several times to make sure it rotates freely.

9. Install the speedometer cable.

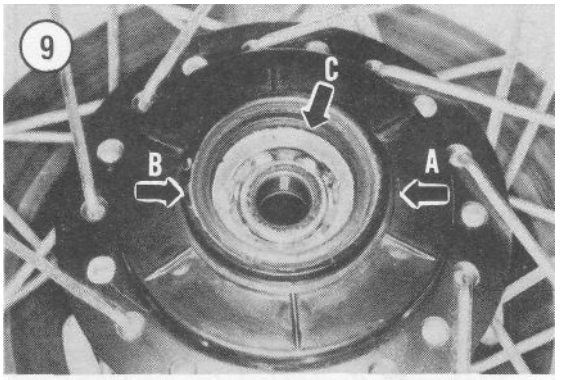
NOTE
Rotate the wheel slowly when inserting the cable so that it will engage properly

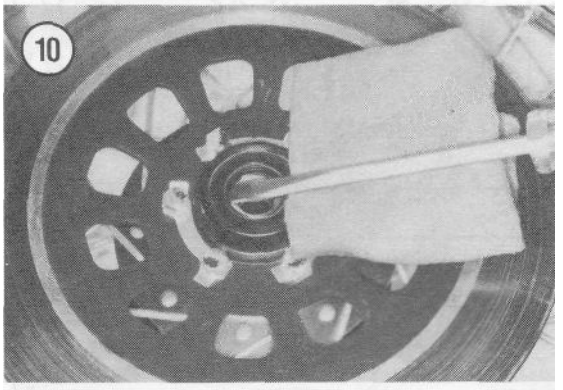


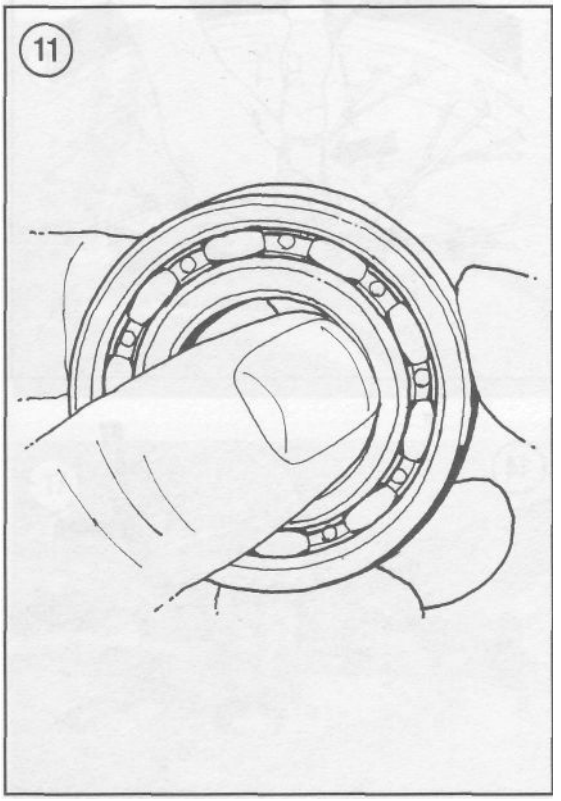




1. Tire
2. Inner tube
3. Rim
4. Spoke
5. Spacer
6. Oil seal
7. Bearing
8. Hub
9. Hub cover
10. Spacer
11. Spacer flange
12. Clutch meter
13. Clutch retainer
14. Speedometer drive assembly
15. Front axle







FRONT HUB

Refer to **Figure 8** for this procedure.

Disassembly

1. Remove the front wheel as described in this chapter.
2. If not already removed, remove the spacer **(Figure 3)** from the seal in the right-hand side of the wheel.
3. If not already removed, remove the speedometer drive from the seal in the left-hand side of the wheel.
4. Remove the hub cover (A, **Figure 9).**
5. Remove the right- **(Figure 10)** and left-hand (B, **Figure 9)** oil seals.
6. Remove the speedometer clutch retainer and clutch (C, **Figure 9).**
7. Remove the wheel bearings, spacer and spacer flange. Tap the bearing out with a soft aluminum or brass drift.

CAUTION

Tap only on the outer bearing race. The bearing will be damaged if struck on the inner race.

Inspection

1. Clean bearings thoroughly in solvent and dry with compressed air.

WARNING

Do not spin the bearing with the air jet while drying. Instead hold the inner race with your hand. Because the air jet can spin the bearing race at higher speeds than which it was designed, the bearing may disintegrate and possibly cause severe eye injuries.

2. Clean the inside and outside of the hub with solvent. Dry with compressed air.
3. Turn each bearing by hand **(Figure 11),** making sure it turns smoothly. Check balls for evidence of wear, pitting or excessive heat (bluish tint). Replace bearings if necessary; always replace as a complete set.
4. Check the axle for wear and straightness. Use V-blocks and a dial indicator as shown in **Figure 12.** If the runout is 0.008 in. (0.2 mm) or greater, the axle must be replaced.

Assembly

NOTE

If installing sealed bearings, it is not necessary to grease the bearings as described in Step 1. Instead, proceed to Step 2.

1. Pack the bearings thoroughly with multipurpose grease. Work the grease between the balls thoroughly.
2. Pack the wheel hub and axle spacer with multipurpose grease.

NOTE

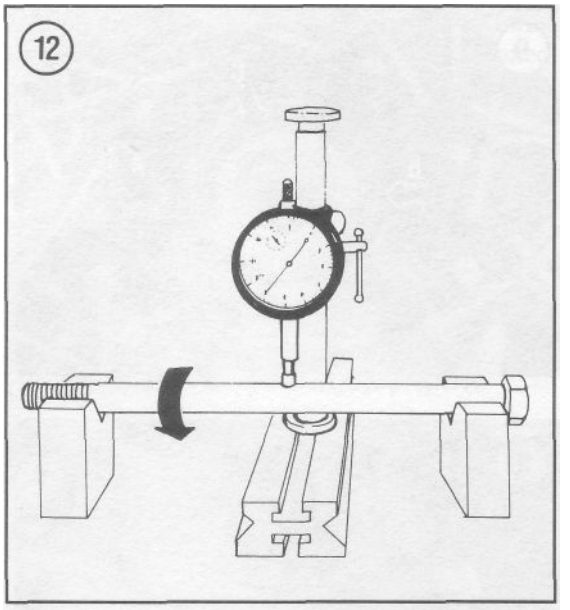
Install the wheel bearings with the sealed side facing outward.

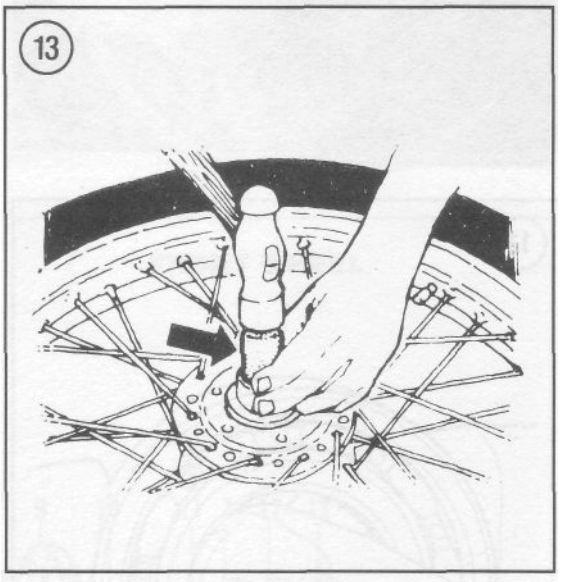
3. Install the right-hand wheel bearing and the spacer. Install the spacer flange and install the left-hand bearing.

CAUTION

Tap the bearings squarely into place and tap on the outer race only. Use a socket ***(Figure 13)*** *that matches the outer race diameter. Do not tap on the inner race or the bearing might be damaged. Be sure that the bearings are completely seated.*

4. Install the right-hand oil seal.
5. Install the speedometer clutch housing, retainer and oil seal in the hub.
6. Lubricate the oil seal lips with grease.
7. Disassemble the speedometer gear case and lubricate the gears and sliding faces with a lightweight lithium soap base grease. Reassemble it.
8. Install the front wheel as described in this chapter.





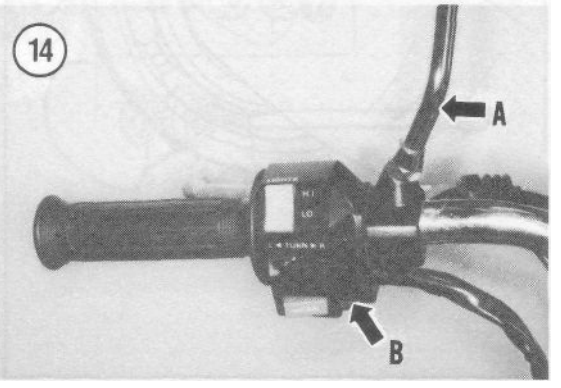
HANDLEBAR

Removal/Installation

1. Place the bike on the sidestand.
2. Remove the rear view mirror(s) (A, **Figure 14).**
3. Disconnect the brake light switch electrical connection.

CAUTION

Cover the fuel tank with a heavy cloth or plastic tarp to protect it from accidental spilling of brake fluid. Wash any spilled brake fluid off any painted or

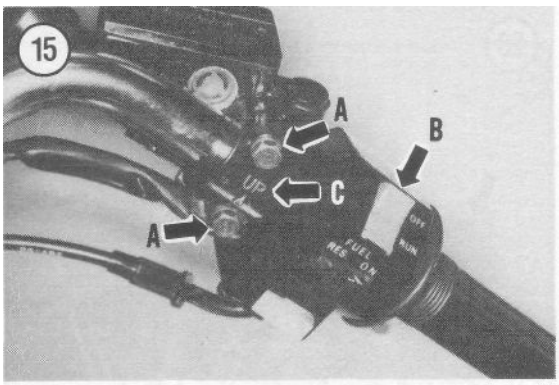


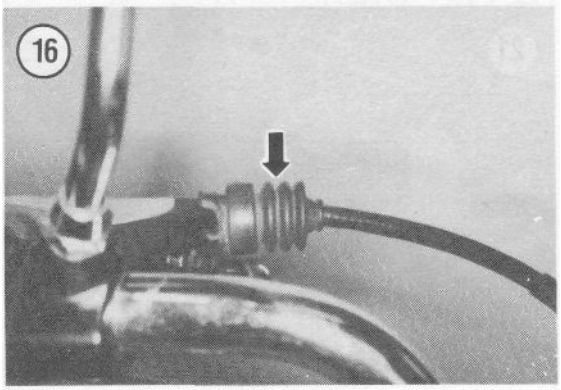
plated surface immediately, as it will destroy the finish. Use soapy water and rinse thoroughly.

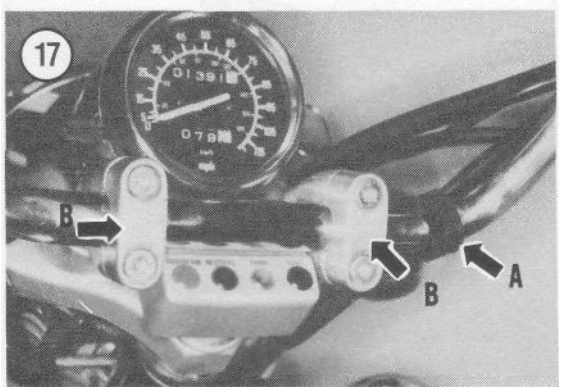
4. Remove the 2 bolts (A, **Figure 15)** securing the master cylinder and lay it on the fuel tank. It is not necessary to disconnect the hydraulic brake line.

5. Slide back the clutch cable adjuster cover **(Figure 16).** Then slacken the clutch cable and disconnect it at the hand lever.

6. Remove the screws and separate the 2 halves of the left-hand switch assembly **(B, Figure 14).**







7. Remove the screws and separate the 2 halves of the right-hand switch assembly (B, **Figure** 15). Disconnect the throttle cable from the throttle grip.

8. Remove the bolt covers.

9. Remove the clamps (A, **Figure 17)** securing electrical cables to the handlebar.

10. Remove the 4 handlebar clamp Allen bolts and remove the handlebar upper holders **(B, Figure 17).**

11. Install by reversing these steps. Note the following:

a. Tighten all fasteners to the specifications in **Table 2.**

b. Make sure the UP mark on the master cylinder clamp (C, **Figure 15)** is facing up.

STEERING HEAD

Refer to **Figure 18** for this procedure.

Disassembly

I. Place the bike on the sidestand.

2A. On 1987-1989 U.S. models and 1988 U.K. models, remove the rear bolt and front bolt on each side securing the frame top cover and remove the cover.

2B. On 1990-on U.S. models and 1989-on U.K. models, remove the sub-fuel tank as described in Chapter Six in this section of the manual.

3. Remove the front wheel as described in this chapter.

4. Disconnect the speedometer cable **(Figure 19).**

5. Disconnect and remove the horn.

6. Remove the headlight, the front turn indicators and the headlight shell **(Figure 20).**

7. Remove the handlebar (A, **Figure 21)** as described in this chapter.

8. Remove the speedometer unit (B, **Figure 21)** and indicator light assembly (C, **Figure 21).**

9. Remove the front forks as described in this chapter.

10. Remove the steering stem bolt and remove the upper fork bridge (D, **Figure 21)**

II. Remove the ring nut (E, **Figure 21)** with a spanner wrench **(Figure 22)** or use an easily improvised unit **(Figure 23).**

12. Remove the upper bearing cover.

13. Pull the steering stem out of the frame **(Figure 24).** On these models, upper and lower bearings are disassembled ball bearings so be ready to catch them

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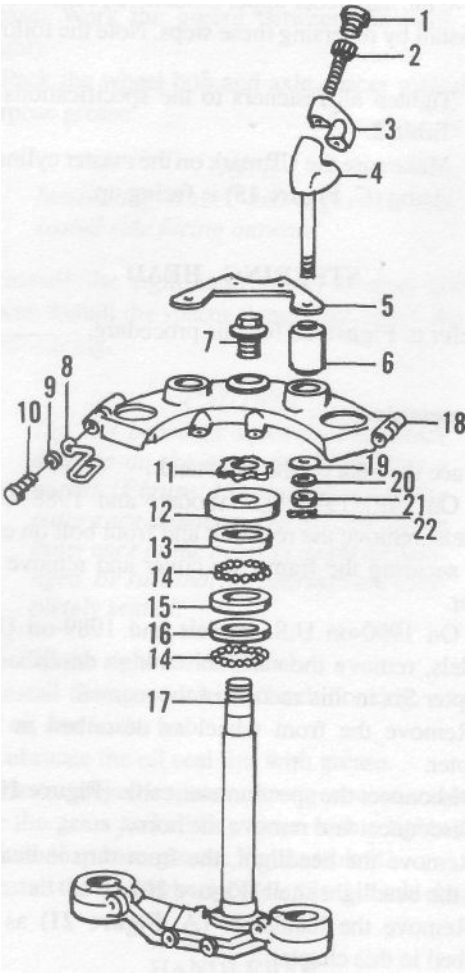
STEERING STEM



1. Cover
2. Allen bolt
3. Upper holder
4. Lower holder
5. Bracket
6. Damper
7. Steering bolt
8. Cable guide
9. Washer
10. Bolt
11. Ring nut
12. Bearing cover
13. Outer race
14. Steel balls
15. Race
16. Race
17. Steering stem
18. Upper fork bridge
19. Washer
20. Lockwasher
21. Nut
22. Clip

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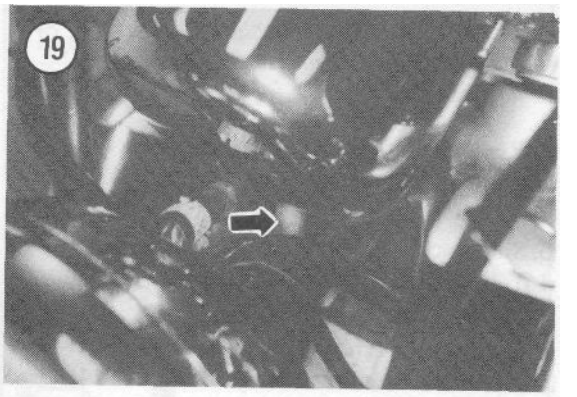

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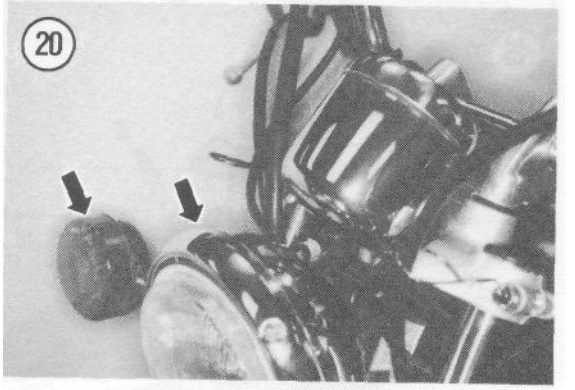

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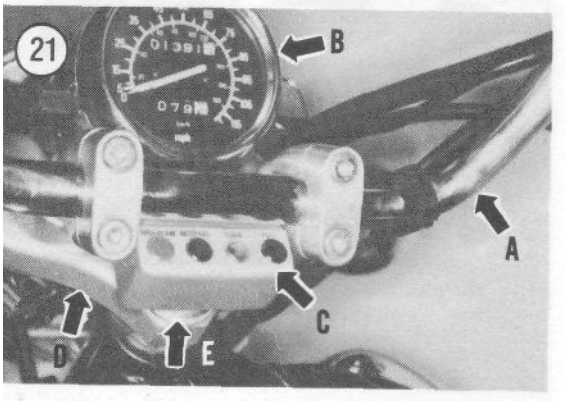

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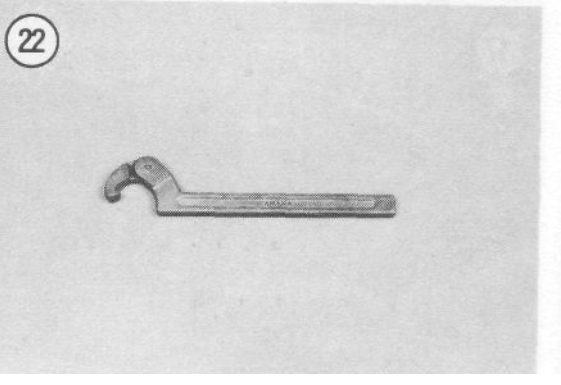
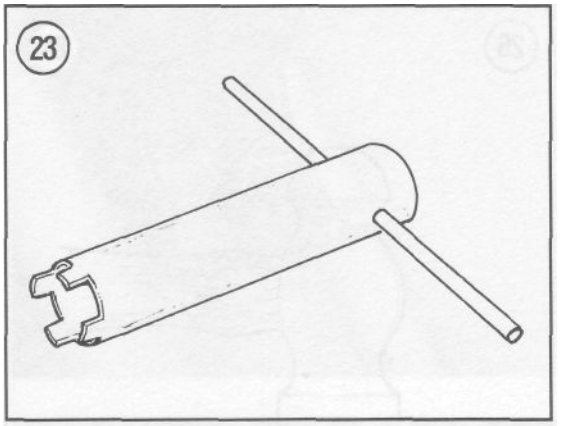
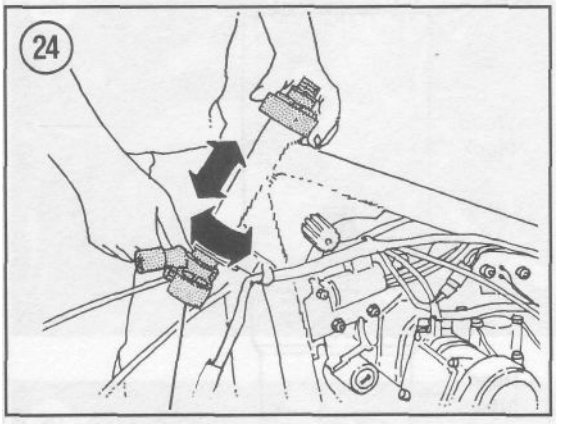
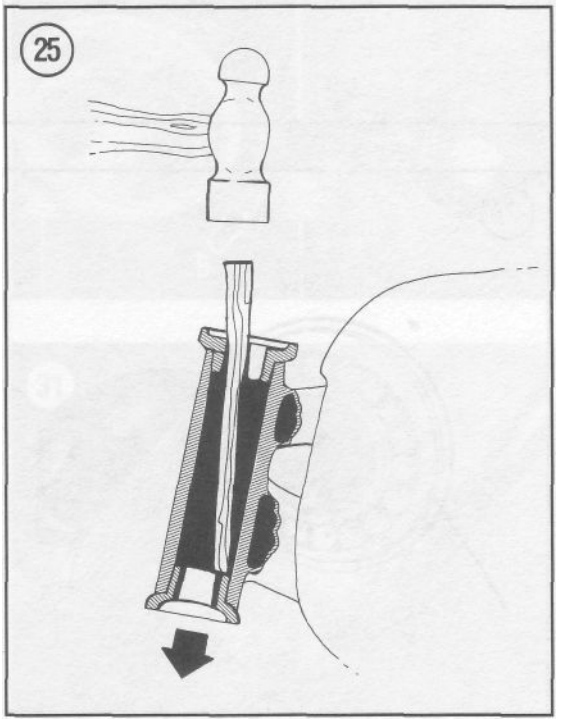








as they fall out. Remove all bearings that are held in the steering head by grease.

NOTE

There is a total number of 38 ball bearings used—19 in the top and 19 in the bottom. The bearings should not be intermixed because if worn or damaged, they must be replaced in sets. However, balls in both sets are the same size.

Inspection

1. Clean the bearing races in the steering head and all bearings with solvent.
2. Check for broken welds on the frame around the steering head. If any are found, have them repaired by a competent frame shop or welding service familiar with motorcycle frame repair.
3. Check the balls for pitting, scratches, or discoloration indicating wear or corrosion. Replace them in sets if any are bad.
4. Check the upper and lower races in the steering head for pitting, galling and corrosion. If any of these conditions exist, replace the races as described in this chapter.
5. Check steering stem for cracks and check its race for damage or wear. Replace if necessary.

Bearing Race Replacement

The headset and steering stem bearing races are pressed mto place. Because they are easily bent, do not remove them unless they are worn and require replacement. Take old races to the dealer to ensure exact replacement.

To remove a headset race, insert a hardwood stick into the head tube and carefully tap the race out from the inside **(Figure 25).** Tap all around the race so that neither the race nor the head tube are bent. To install a race, fit it into the end of the head tube. Tap it slowly and squarely with a block of wood **(Figure 26).**

Assembly

Refer to **Figure 18** for this procedure.

1. Make sure the steering head bearing races are properly seated.

2. Apply a coat of wheel bearing grease to the lower bearing race cone on the steering stem and fit 19 ball bearings around it.
3. Apply a coat of wheel bearing grease to the upper bearing race cone and fit 19 ball bearings around it **(Figure 27).**
4. Insert the steering stem into the head tube. Hold it firmly in place.
5. Install the upper bearing race and upper bearing cover.
6. Position the ring nut with the taper side facing downward.
7. Install the ring nut and tighten it to approximately 27 ft.-lb. (38 N.m).
8. Loosen it completely. Then retighten it to 7.2 ft.-lb. (10 N.m).
9. Continue assembly by reversing *Disassembly* Steps 1-10. Tightening torques are found in **Table 2.**
10. After the total assembly is completed, check the stem for looseness or binding—readjust if necessary.

Steering Stem Adjustment

If play develops in the steering system, it may only require adjustment. However, don't take a chance on it. Disassemble the stem as described under *Steering Head* in this chapter.

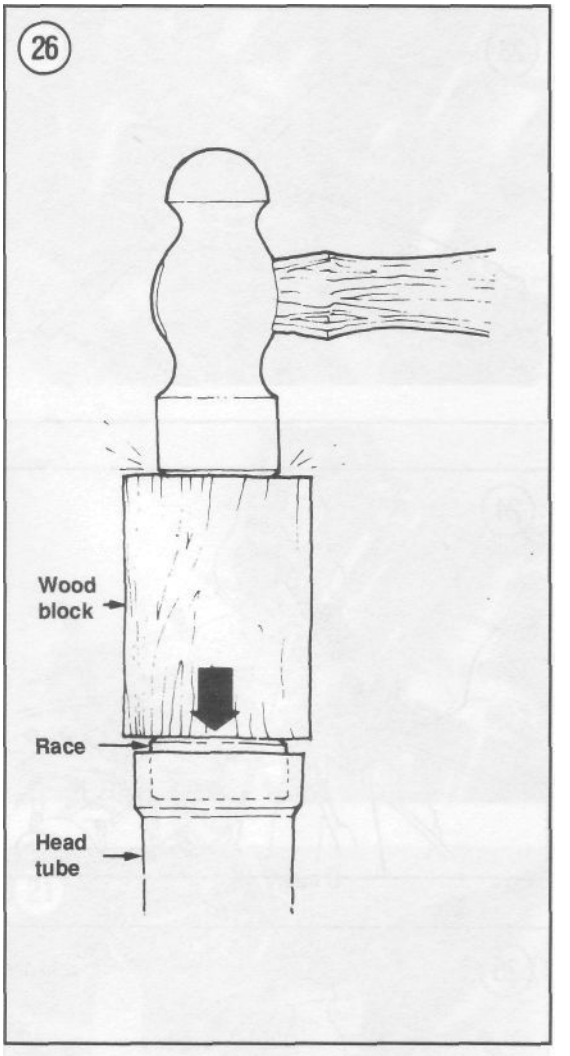
FRONT FORK

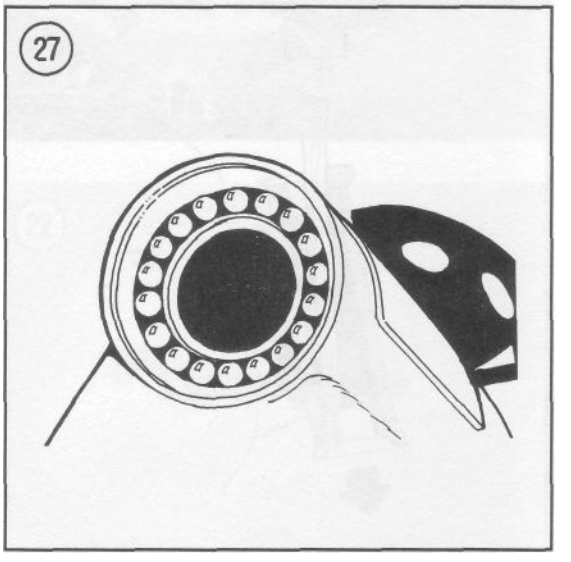
The Yamaha front suspension consists of a spring-controlled, hydraulically dampened telescopic fork. Before suspecting major trouble, drain the front fork oil and refill with the proper type and quantity; refer to Chapter Three in this portion of the manual. If you still have trouble, such as poor damping, a tendency to bottom or top out or leakage around the rubber seals, follow the service procedures in this section.

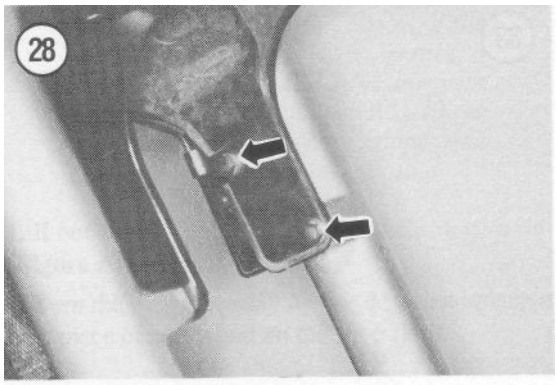
To simplify fork service and to prevent the mixing of parts, the legs should be removed, serviced and installed individually.

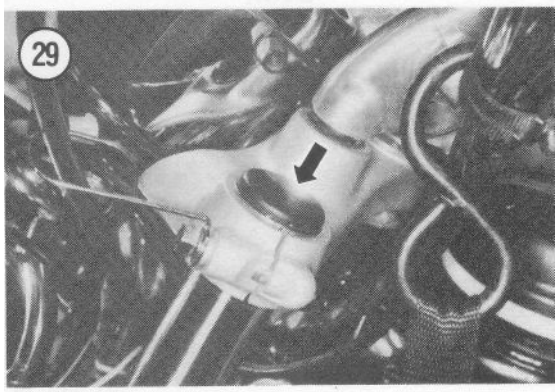
Removal/Installation

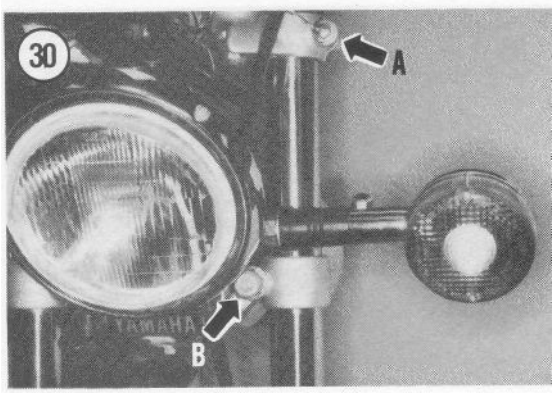
1. Place the motorcycle on the sidestand.
2. Remove the front wheel as described in this chapter.
3. Remove the bolts securing the front fender **(Figure** 28) and remove the fender assembly.

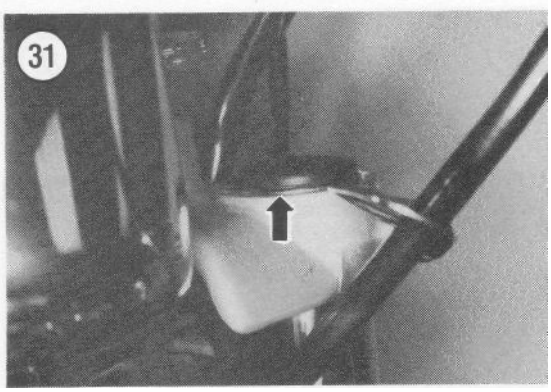












4. Remove the brake caliper as described in Chapter Ten in this portion of the manual.

NOTE

Insert a piece of wood in the caliper in place of the disc. That way, if the brake lever is inadvertently squeezed, the piston will not be forced out of the caliper. If it does happen, the caliper might have to be disassembled to reseat the piston. By using the wood, bleeding the brake is not necessary when installing the wheel.

5. Remove the top trim cap **(Figure 29).**
6. Loosen the upper (A, **Figure 30)** and lower **(B, Figure 30)** fork bridge bolts.
7. Remove the fork tube. It may be necessary to slightly rotate the tube while removing it.
8. Repeat for the opposite side.
9. Install by reversing these removal steps. Note the following:
   a. Push the fork tube up until it is flush with the top surface of the upper fork bridge **(Figure 31).**
   b. Tighten the lower fork bridge bolts only sufficiently to hold the fork assemblies in place.
   c. Install the front axle and tighten it securely. This will hold the fork legs in their correct relation to each other prior to tightening the bridge bolts.
   d. Torque the bolts to specifications in **Table 2.**
   e. Remove the front axle.

Disassembly

Refer to **Figure 32** for this procedure.

NOTE

This procedure is best performed with the aid of a helper.

CAUTION

If the bike has been subjected to frequent rain or moisture or if the bike has been in storage for any period of time, moisture may have passed the trim cap causing rust. Any rust must be removed prior to removing any upper fork parts during this procedure. If any rust particles drop down into the fork assembly the fork must be removed, disassembled and thoroughly cleaned prior to refilling

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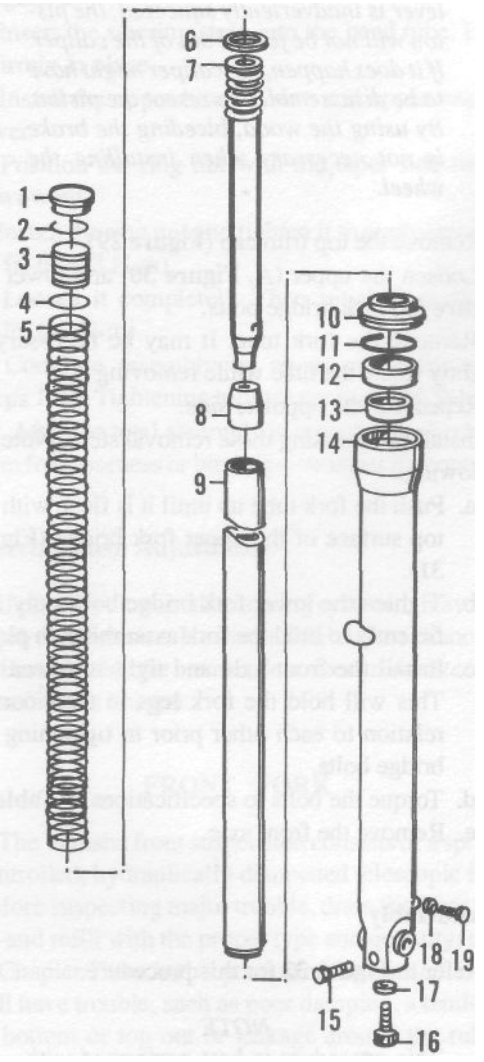
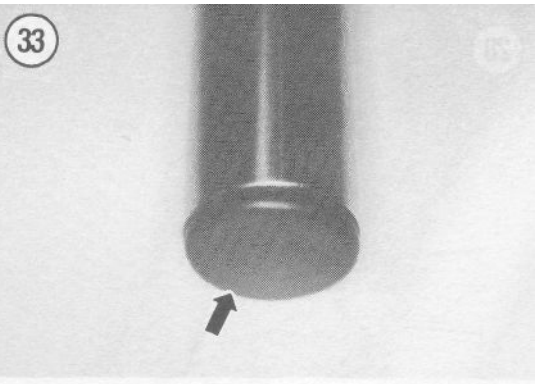
FRONT FORK



1. Trim cap
2. Stopper ring
3. Spring seat
4. O-ring
5. Spring
6. Piston ring
7. Damper rod/ rebound spring
8. Oil lockpiece
9. Fork tube
10. Dust seal
11. Clip
12. Oil seal
13. Slider bushing guide
14. Slider
15. Clamp bolt
16. Allen bolt
17. Washer
18. Gasket
19. Drain screw

33



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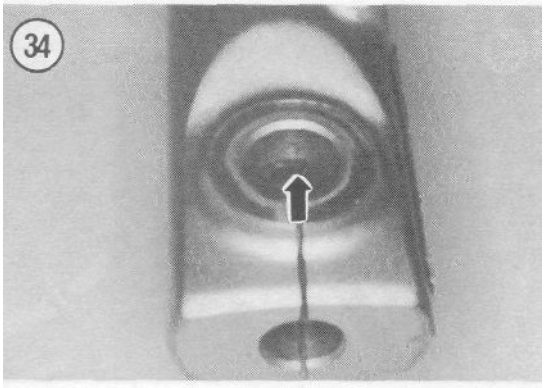

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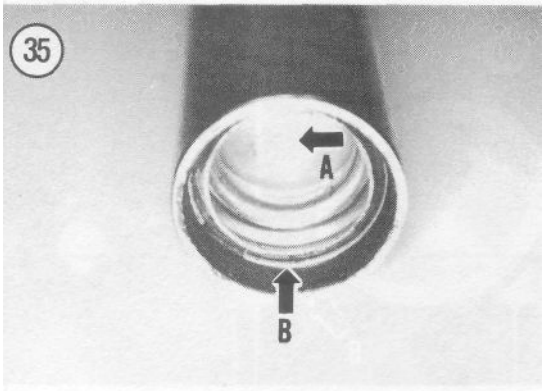

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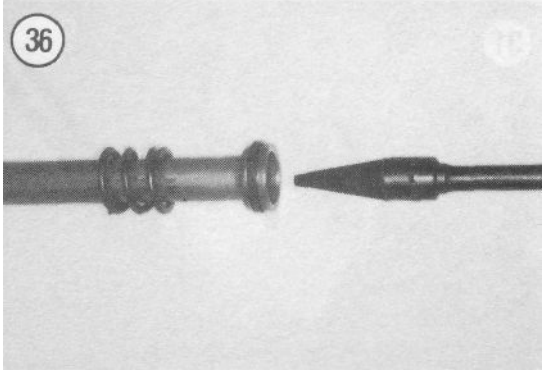
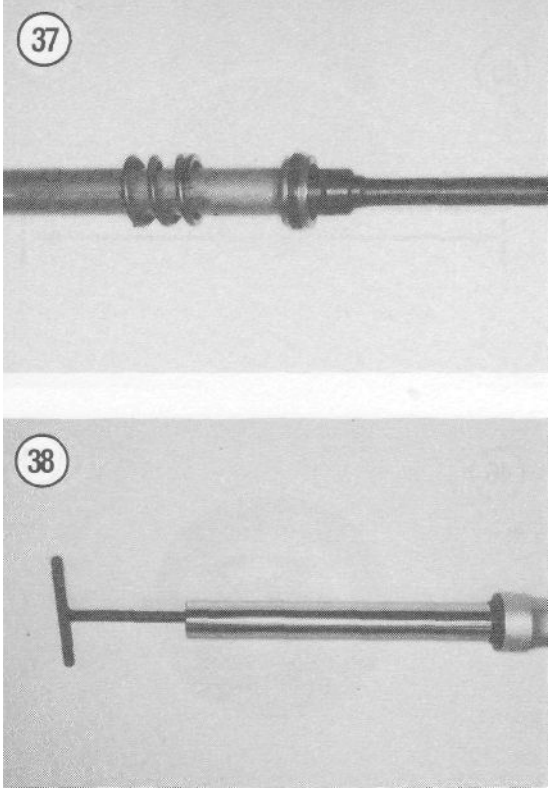


with fresh fork oil. After removing the trim cap, if rust is present, scrape it clean, blow the rust residue out with compressed air and apply WD-40, or equivalent, then remove the stopper ring and spring seat.

1. If not already removed, remove the fork trim cap (Figure 33).
2. Turn the fork assembly upside down and place it on a piece of soft wood on the shop floor.

NOTE
The lower Allen bolt had a locking agent applied to the threads during assembly and is usually very difficult to loosen.

3. Have a helper compress the fork slider to exert spring pressure onto the damper rod to prevent it from rotating in Step 4.
4. Loosen the lower Allen bolt (Figure 34) with an air driver or impact driver if possible. Remove the Allen bolt and sealing washer. If you are unable to loosen the Allen bolt at this time, it will be loosened in Step 10.



5. The spring seat and spring are held in position by a stopper ring. To remove the stopper ring, have an assistant depress the spring seat (A, Figure 35) using a suitable size drift.
6. Remove the stopper ring (B, Figure 35) from its groove in the fork with a small screwdriver. Discard the stopper ring as a new one must be installed.
7. When the stopper ring is removed, release tension from the spring seat and remove it.
8. Remove the fork spring and if the Allen bolt was removed, also remove the damper rod.
9. Turn the fork upside down and pour the oil out and discard it. Pump the fork several times by hand to expel most of the remaining oil.

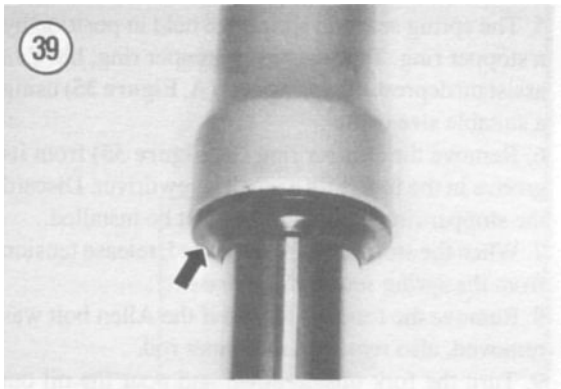
NOTE
The following step requires the use of Yamaha special tools.

10. If you were unable to loosen the lower Allen bolt in Step 4, perform the following:
    a. Install Yamaha special tool Damper Rod Holder (U.S. part No. YM-01300-1, U.K. part No. 90890-01294) onto the T-handle (U.S. part No. YM-01326-1, U.K. part No. 90890-01326).

NOTE
Figure 36 *and* ***Figure 37*** *are shown with the damper rod removed from the fork slider for clarity.*

    b. Insert the special tools into the fork tube (Figure 38) and carefully drive the holder (Figure 36) into the top recess in the damper rod (Figure 37). This will hold the damper rod in place while loosening the Allen bolt.
    c. Hold the special tool in place and loosen the Allen bolt (Figure 34). Remove the Allen bolt and sealing washer.
    d. Remove the special tool.
11. Remove the dust seal (Figure 39) from the slider.
12. Remove the snap ring (Figure 40) from the groove in the slider.
13. Pull the fork tube out of the slider.

CAUTION
The oil seal is very stiff and is difficult to remove. Use an oil seal puller if removal is difficult. If necessary, take the fork slider to a Yamaha dealer and have the seal removed to prevent damage to the slider.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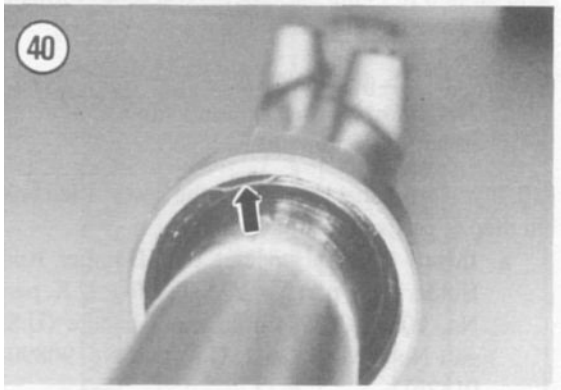
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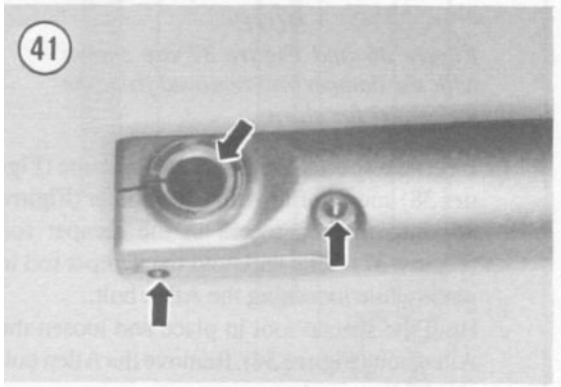
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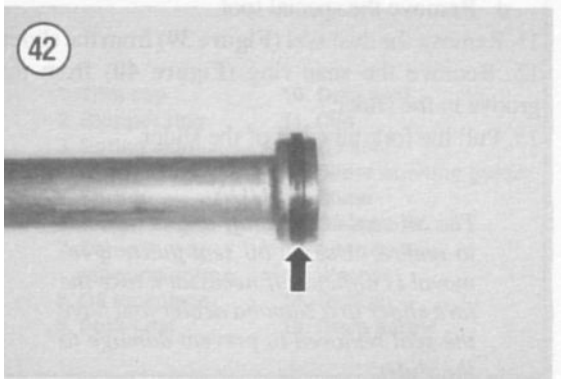
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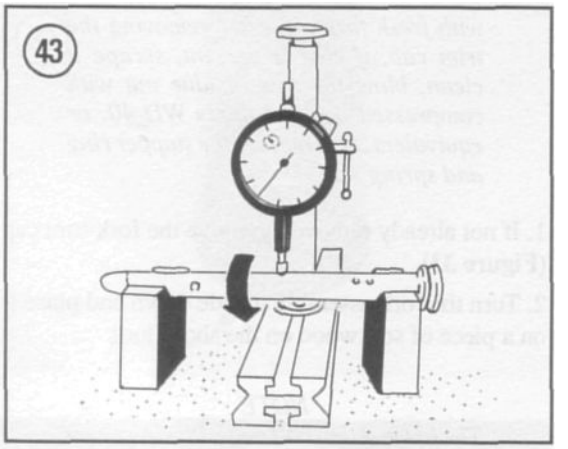
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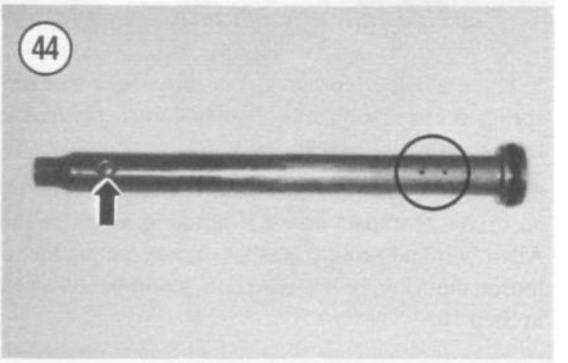
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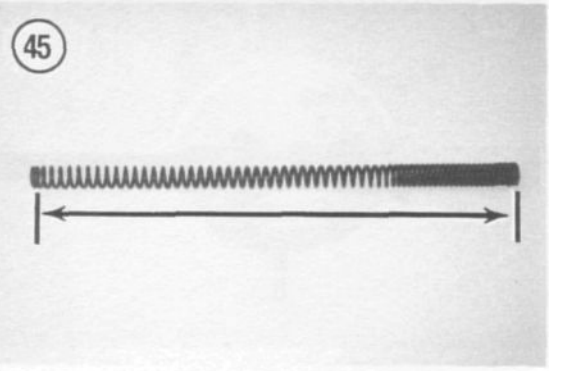
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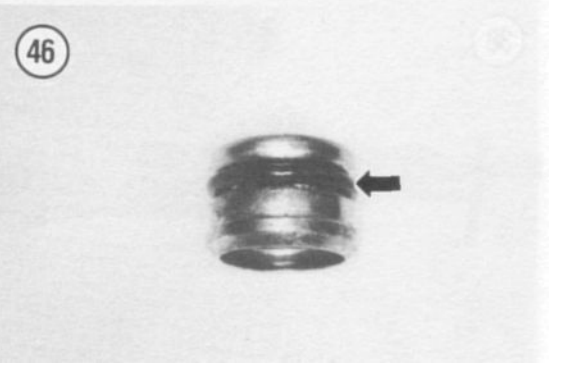
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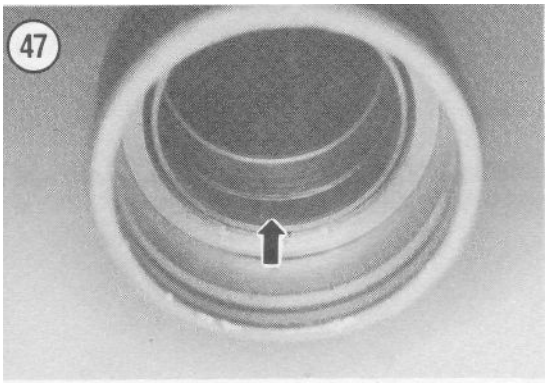
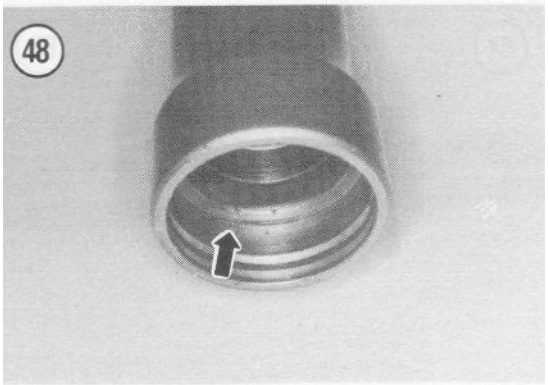
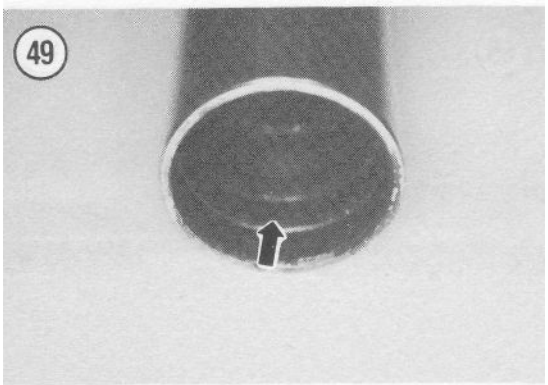
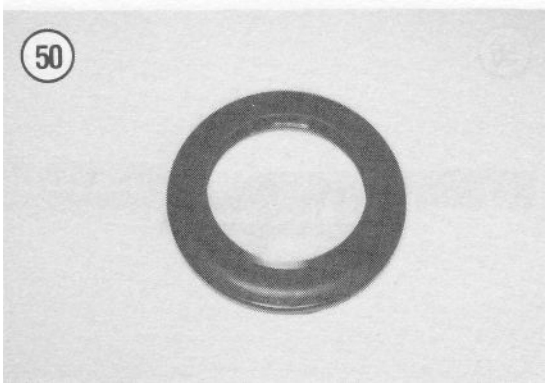








14. Remove the oil seal by prying it out with a flat-tipped screwdriver. Remove the oil seal slowly to prevent damage to the fork slider.

Inspection

1. Thoroughly clean all parts in solvent and dry them.
2. Check upper fork tube exterior for scratches and straightness. If bent or scratched, it should be replaced.
3. Check the fork slider for dents or exterior damage that may cause the upper fork tube to hang up during riding conditions. Replace if necessary.
4. Check the axle bearing surface and the threaded holes in the slider **(Figure 41)** for wear or damage. Replace if necessary.
5. Carefully check the damper rod piston ring **(Figure 42)** for wear or damage.
6. Check the damper rod for straightness. **Figure** 43 shows one method. The rod should be replaced if the runout is 0.008 in. (0.2 mm) or greater.
7. Make sure the oil holes in the damper rod are clear **(Figure 44).** Clean out if necessary.
8. Measure the uncompressed length of the fork spring **(Figure 45).** Replace the spring if it is too short. See **Table 1** for specifications.
9. Check the condition of the O-ring **(Figure 46)** on the fork cap. Replace if worn, damaged or starting to deteriorate.
10. Inspect the slider bushing guide **(Figure 47)** for wear or damage. Replace if necessary.
11. Check the oil seal surface **(Figure 48)** of the slider for wear or damage. Clean out if necessary.
12. Thoroughly clean out any rust that may have formed in the top of the fork tube **(Figure 49).** After removing the rust, thoroughly clean the fork tube in solvent to remove all residue that could contaminate the fork oil.
13. Make sure the dust seal **(Figure 50)** is still flexible and the sealing lip is not damaged, replace if necessary.
14. Any parts that are worn or damaged should be replaced. Simply cleaning and reinstalling unserviceable components will not improve performance of the front suspension.

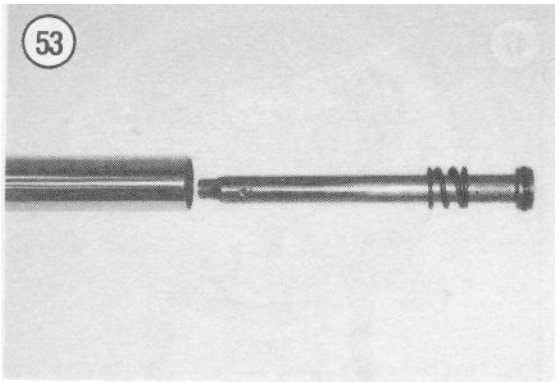
Assembly

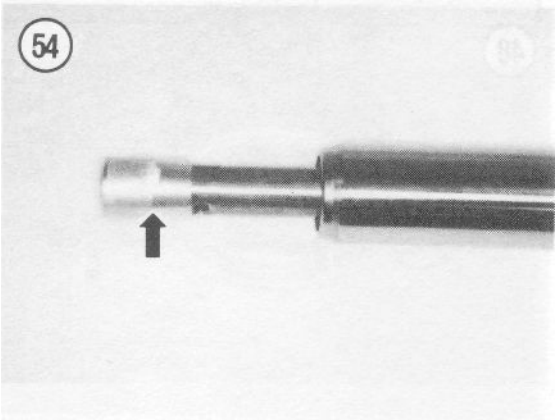
Refer to **Figure 32** for this procedure.

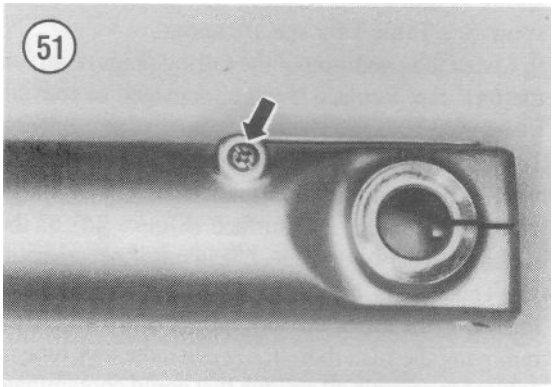
1. If removed, install the drain screw and washer **(Figure** 51).
2. Apply fork oil to all parts prior to assembly.
3. Install the rebound spring onto the damper rod **(Figure** 52).
4. Insert the damper rod into the fork tube **(Figure** 53) and install the oil lock piece **(Figure** 54).
5. Apply a light coat of oil to the outside of the fork tube and install it into the slider **(Figure** 55). Push it in until it stops.
6. Make sure the sealing washer **(Figure** 56) is in place on the Allen bolt.
7. Apply red Loctite (No. 271) to the threads of the Allen bolt and install it **(Figure** 34).
8. Use the same tool set-up used during removal to keep the damper rod from turning and tighten the Allen bolt to the torque found in **Table 2.**
9. Position the oil seal with the open end facing up **(Figure** 57) and install the oil seal onto the fork tube **(Figure 58).**

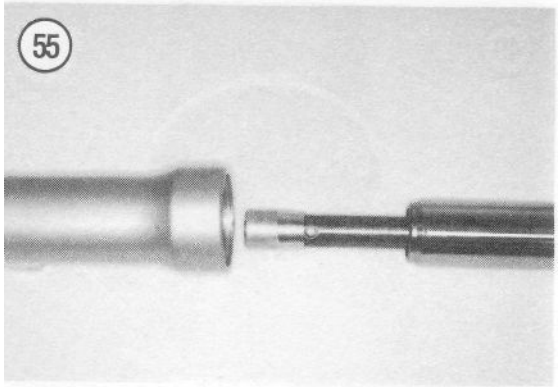
NOTE

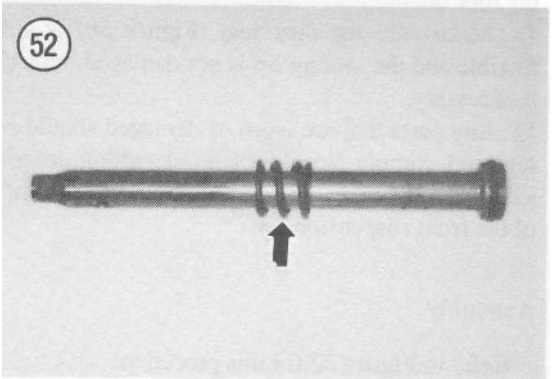
Some type of fork seal driver is required to install the oil seal. Yamaha sells a fork seal driver set (U.S. part No. YM-

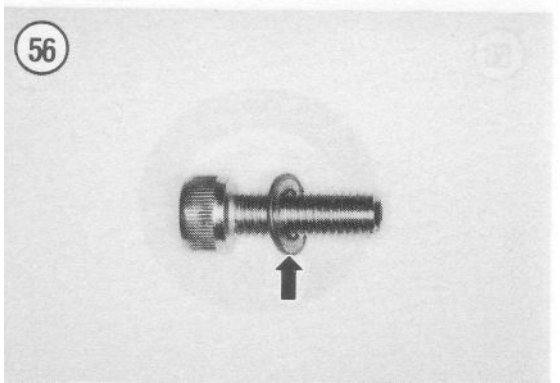


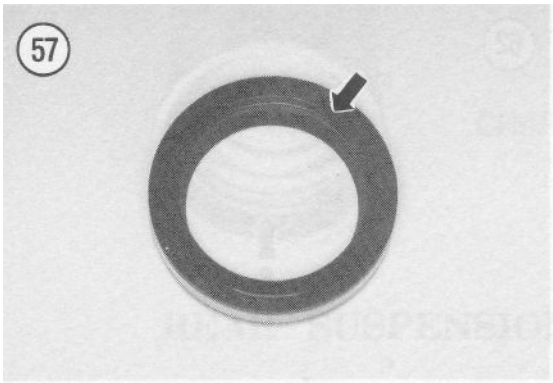


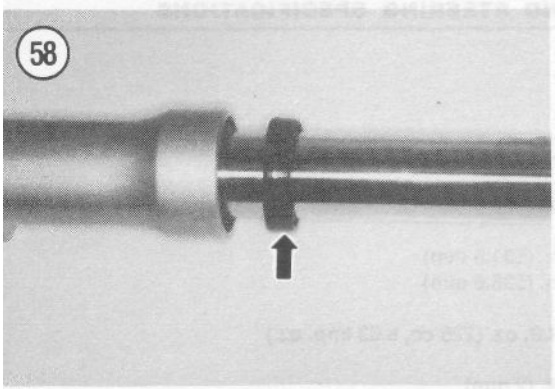


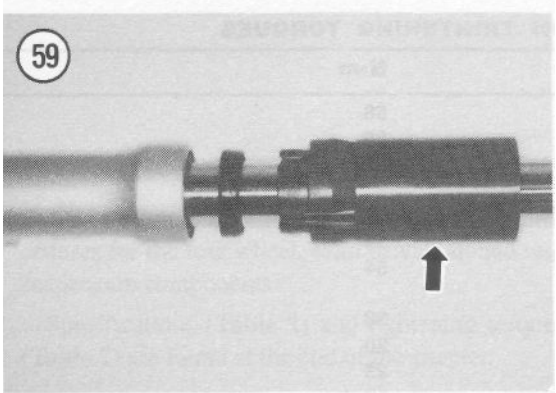


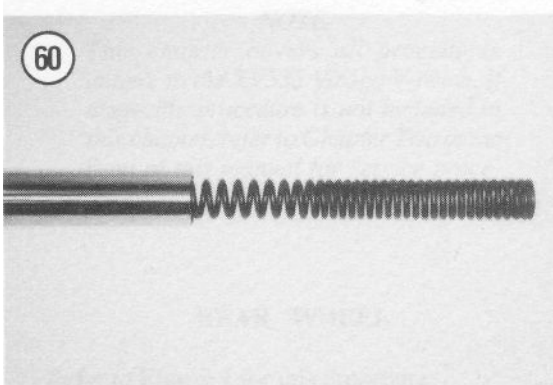












01367 and YM-8010 or U.K. part No. 90890-01367 and 90890-01370). The adjustable fork seal driver shown in ***Figure 59*** *is made by Suzuki, is universal, and can be used on almost all Japanese fork assembles (including Japanese "Showa" forks equipped on some late model Harleys).*

NOTE

Make sure the seal seats squarely and fully in the bore of the slider.

NOTE

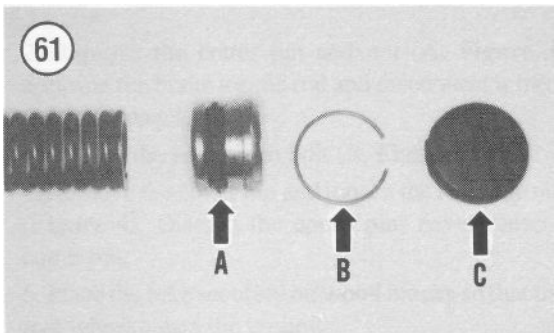
In some cases it may be necessary to drive the oil seal in the final way with a broad tipped flat-bladed screwdriver and hammer being careful not to damage the oil seal.

10. Using a fork seal driver **(Figure 59),** tap the seal into the slider until the clip groove can be seen above the seal.
11. Install the clip **(Figure 40)** and make sure it seats correctly in the slider groove.
12. Install the dust seal and push it down until it completely seats in the slider **(Figure 39).**

NOTE

In order to measure the correct amount of fluid, use a plastic baby bottle. These have measurements in fluid ounces (oz.) and cubic centimeters (cc) on the side.

13. Fill fork tube with fresh fork oil. Carefully fill each fork tube with the type and quantity listed in **Table 1.**
14. Position the fork spring with the closer wound coils going in last **(Figure 60).**
15. Position the spring seat with the O-ring end going in first (A, **Figure 61)** on top of the fork spring.



16. Have an assistant depress the spring seat (A, **Figure 62)** using a suitable size drift and install a *new* stopper ring (B, **Figure 62).** Make sure the stopper ring (B, **Figure 61)** is properly seated in the fork tube groove.

17. After the stopper ring is installed, release tension from the spring seat and remove it.

18. Install the trim cap (C, **Figure 61).**

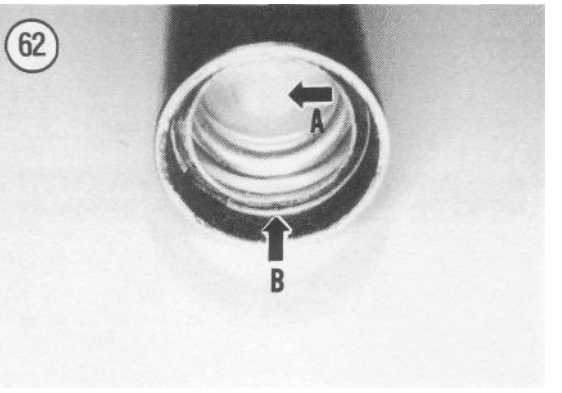


Table 1 FRONT SUSPENSION AND STEERING SPECIFICATIONS

Steering head	
Number of balls in steering head	
Upper	19
Lower	19
Size of steering balls	1/4 in.
Front fork	
Front fork travel	5.91 in. (150 mm)
Spring free length	
Standard	20.9 in. (531.6 mm)
Wear limit	20.7 in. (526.6 mm)
Oil weight	10
Oil capacity	7.71 U.S. oz. (228 cc, 8.03 Imp. oz.)
Front wheel runout	
Vertical and lateral	0.08 in. (2 mm)

Table 2 FRONT SUSPENSION TIGHTENING TORQUES

Item	ft.-lb.	N*m
Front axle	42	58
Front axle pinch bolt	14	20
Handlebar Allen bolts	14	20
Steering stem ring nut		
Initial tightening	27	38
Final tightening	7.2	10
Steering stem bolt	39	54
Front fork		
Upper bridge bolt	27	38
Lower bridge bolt	14	20
Allen bolts	17	23
Front fender bolts	7.2	10

CHAPTER NINE

REAR SUSPENSION AND FINAL DRIVE

This chapter includes repair and replacement procedures for the rear wheel, shaft drive unit and rear suspension components.

Specifications **(Table 1)** and tightening torques **(Table 2)** are found at the end of the chapter.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Two at the front of this manual for service procedures.

REAR WHEEL

Refer to **Figure 1** for this procedure.

Removal/Installation

1. Unscrew the rear brake adjusting nut **(Figure 2)** and disconnect the brake rod from the brake lever.

NOTE

Install the spring, nut and cotter pin back onto the brake rod to prevent their loss.

2. Remove the cotter pin and nut (A, **Figure 3)** securing the brake torque rod and disconnect it from the brake panel.

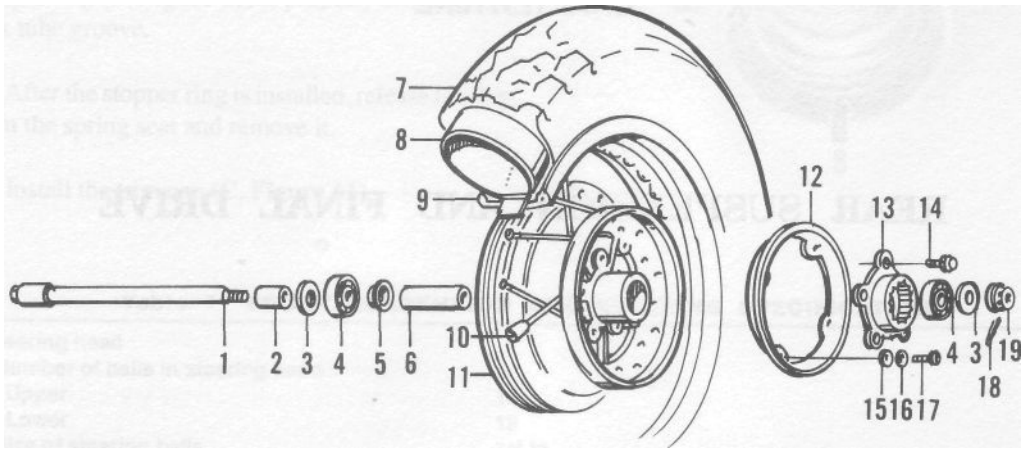
3. Loosen the axle pinch bolt (B, **Figure 3).**

4. Remove the cotter pin and loosen the rear axle nut **(Figure 4).** Discard the cotter pin; never reuse a cotter pin.

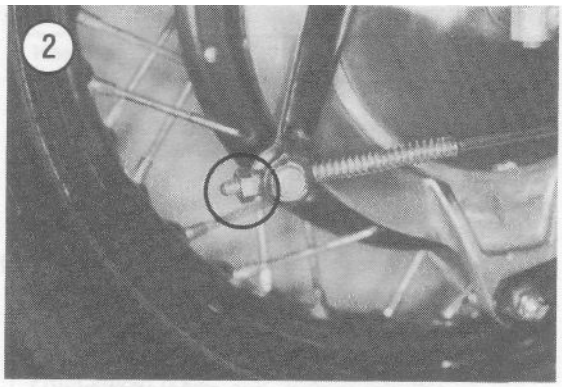
5. Place the bike securely on wood blocks so that the rear wheel clears the ground.

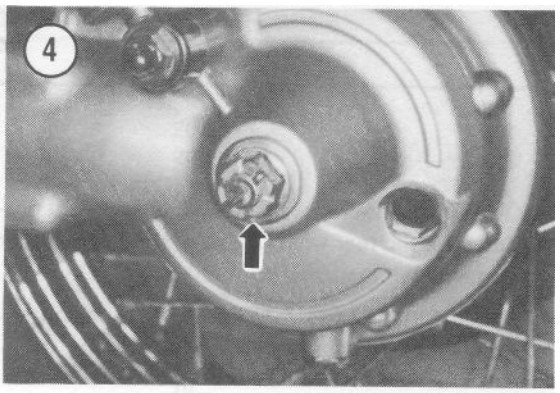
1

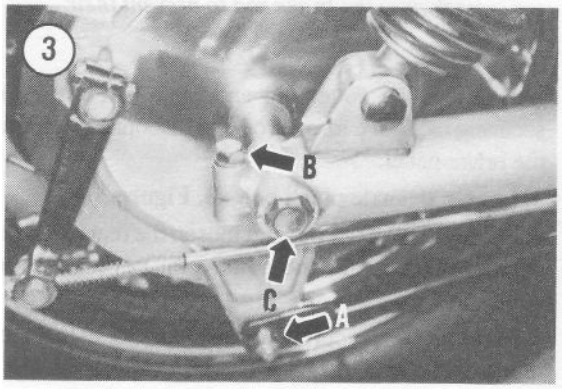
REAR WHEEL

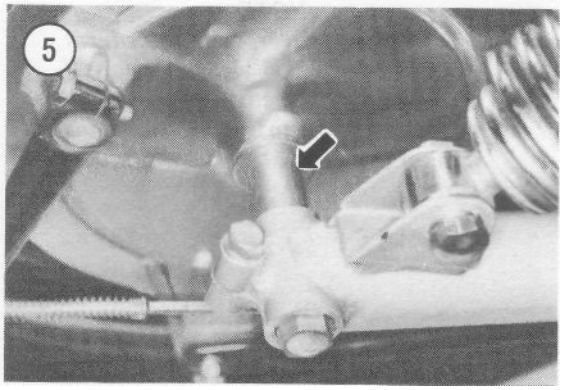


1. Rear axle
2. Spacer
3. Washer
4. Bearing
5. Spacer flange
6. Spacer
7. Tire
8. Inner tube
9. Rim
10. Spoke and weight
11. Hub
12. Hub dust seal
13. Clutch hub
14. Bolt
15. Washer
16. Lockwasher
17. Bolt
18. Cotter pin
19. Axle nut





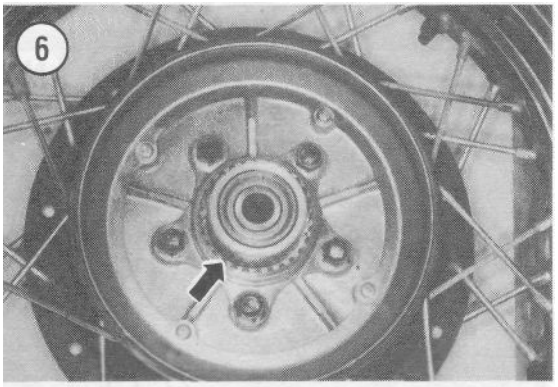


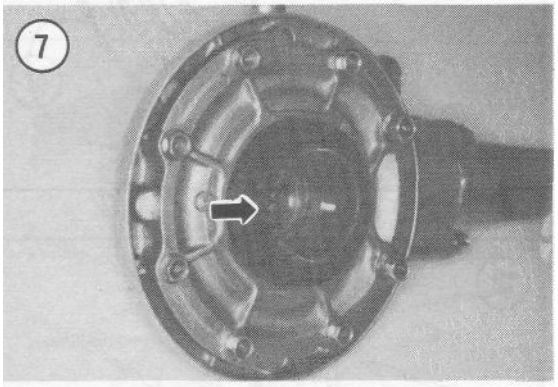


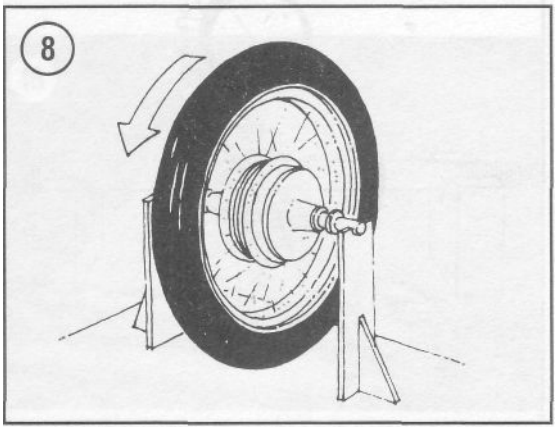
6. Withdraw the axle (C, **Figure 3)** from the right-hand side. Don't lose the spacer **(Figure 5)** between the brake hub and swing arm.

7. Slide the wheel to the right to disengage it from the hub drive splines and remove the wheel.

8. If the wheel is going to be off for any length of time, or if it is to be taken to a shop for repair, install the axle spacer on the axle along with the axle nut to prevent losing any parts.







9. Install by reversing these removal steps. Note the following:

a. Make sure that the wheel hub splines **(Figure 6)** engage with the final drive **(Figure 7).** Apply molybdenum disulfide grease to both splines prior to installation.

b. Prior to tightening the axle nut, install the brake torque link (A, **Figure 3)** and tighten the nut to specifications in **Table 2.**

c. Tighten the pinch bolt to specifications in **Table 2.**

d. Tighten the axle nut to specifications in **Table 2.** Install a new axle nut cotter pin and bend the ends over completely.

e. Adjust the rear brake as described under *Rear Brake Pedal Free Play* in Chapter Three in the front section of the manual.

f. Rotate the wheel several times to make sure it rotates freely and that the brake works properly.

Inspection

Measure the axial and radial runout of the wheel with a dial indicator as shown in **Figure 8.** The maximum allowable axial and radial runout is 0.08 in. (2.0 mm). If the runout exceeds this dimension, check the wheel bearing condition. If the wheel bearings are in good condition and no other cause can be found, refer to the wheel and spoke information in Chapter Eight in the front section of the manual.

Inspect the wheel for signs of cracks, fractures, dents or bends. If it is damaged in any way, it must be replaced.

WARNING

Do not try to repair any damage to the rear wheel as it will result in an unsafe riding condition.

Check axial runout as described under *Rear Hub Inspection* in this chapter.

REAR HUB

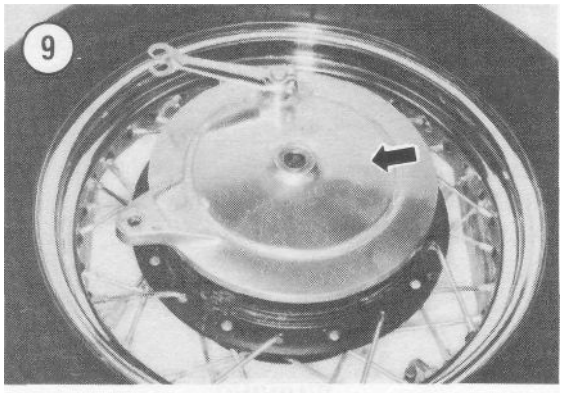
Disassembly

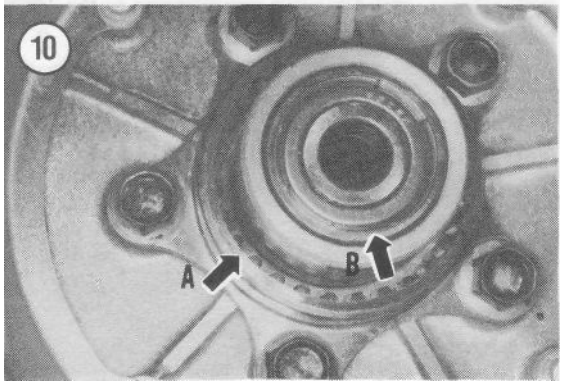
Refer to **Figure 1** for this procedure.

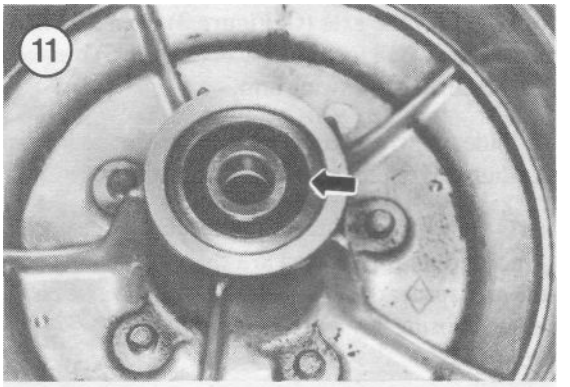
1. Remove the rear wheel as described in this chapter.
2. Pull the brake assembly straight out of the wheel **(Figure 9).**
3. Remove the bolts securing the clutch hub (A, **Figure 10)** to the wheel and remove it.
4. To remove the right-hand bearing **(Figure 11).** Insert a soft aluminum or brass drift into the left-hand side of the hub and place the end of the drift on the outer bearing race. Tap the bearing out of the hub with a hammer working around the perimeter of the bearing.
5. Remove the spacer flange and spacer. Then remove the left-hand bearing (B, **Figure 10)** using the same method described in Step 4.

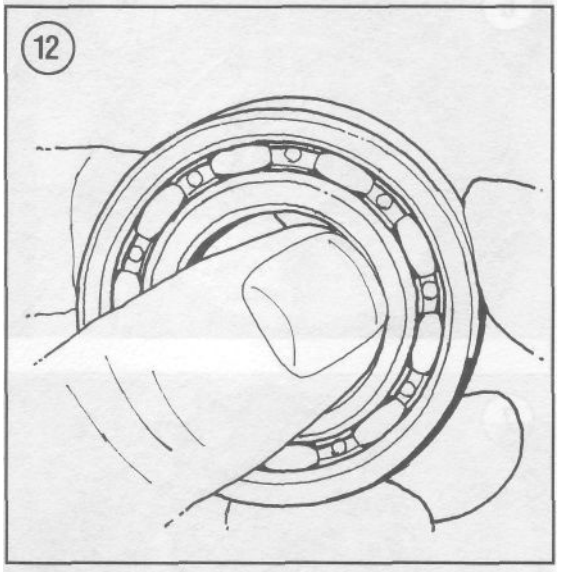
Inspection

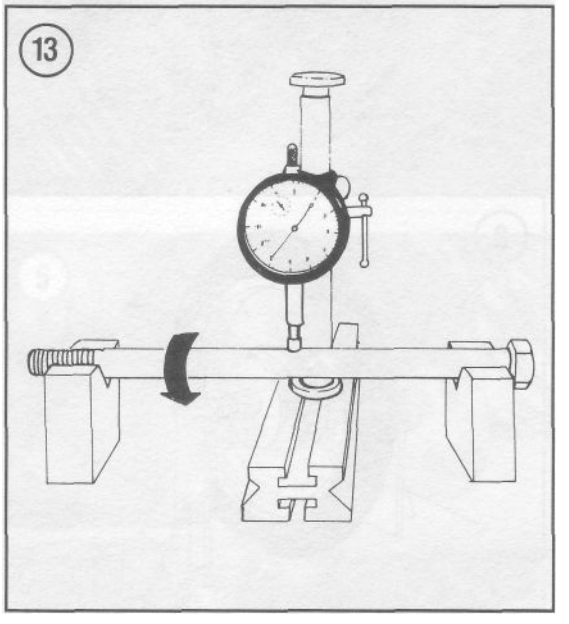
1. Donotclean sealed bearings. Non-sealed bearings can be cleaned in solvent and thoroughly dried with compressed air. *Do not* spin the bearing with the air jet while drying.
2. Clean the inside and outside of the hub with solvent. Dry with compressed air.





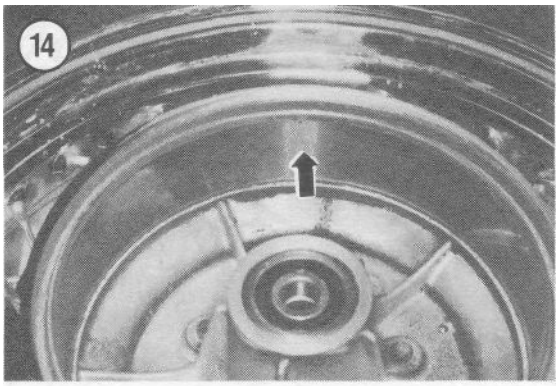


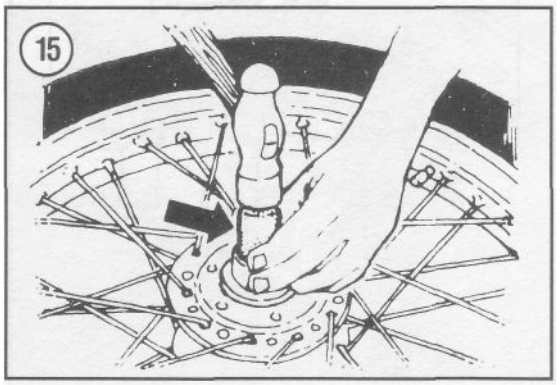


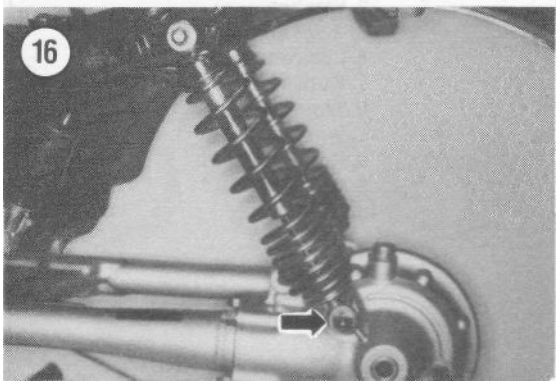


3. Turn each bearing by hand **(Figure 12).** Make sure bearings turn smoothly. On non-sealed bearings, check the balls for evidence of wear, pitting or excessive heat (bluish tint). Replace bearings if necessary; always replace as a complete set. When replacing the bearings, be sure to take your old bearings along to ensure a perfect matchup.

4. Check the axle for wear and straightness. Use V-blocks and a dial indicator as shown in **Figure 13.** If the runout is 0.008 in. (0.2 mm) or greater, the axle should be replaced.







5. Check the brake hub **(Figure 14)** for any scoring or damage. If damage is apparent, refer to Chapter Ten, in the front section of the manual, for further inspection and service.

Assembly

1. Blow any dirt or foreign matter out of the hub prior to installing the clutch hub and right-hand side bearing.
2. Replace the clutch hub O-ring if worn or damaged.
3. Pack the hub with multipurpose grease.

NOTE

*When performing Step 4, refer to **(Figure 1)** for correct bearing and spacer alignment.*

CAUTION

*Tap the bearings squarely into place and tap only on the outer race. Use a socket **(Figure 15)** that matches the outer race diameter. Do not tap on the inner race or the bearings will be damaged. Be sure to tap the bearings until they seat completely.*

NOTE

Install the right-hand side bearing with the sealed side facing outward.

4. Install the right-hand bearing **(Figure 11),** spacer flange and the spacer.
5. Install the left-hand bearing **(B, Figure 10)** into the hub.
6. Install clutch hub (A, **Figure 10)** and tighten the bolts securely.
7. Install the brake assembly into the wheel **(Figure 9).**
8. Install the rear wheel as described in this chapter.

SHAFT DRIVE

Removal/Installation

1. Remove the rear wheel as described in this chapter.
2. Loosen the left-hand lower shock absorber upper nut and remove the lower cap nut **(Figure 16).** Move the shock absorber up and out of the way.

3. Remove the 4 nuts and washers **(Figure** 17) securing the shaft drive unit to the swing arm.

4. Pull the shaft drive unit straight back until it is free.

5. Wipe the grease from the splines on the end of the shaft drive and final drive unit.

6. Check the splines **(Figure 7)** of both units carefully for signs of wear.

7. Pack the splines with multipurpose molybdenum disulfide grease.

8. Install the shaft drive unit onto the swing arm. Make sure that the splines of the shaft drive engage properly with the final drive unit.

9. Install the 4 nuts and washers and tighten to specifications in **Table 2.**

10. Install the rear wheel as described in this chapter.

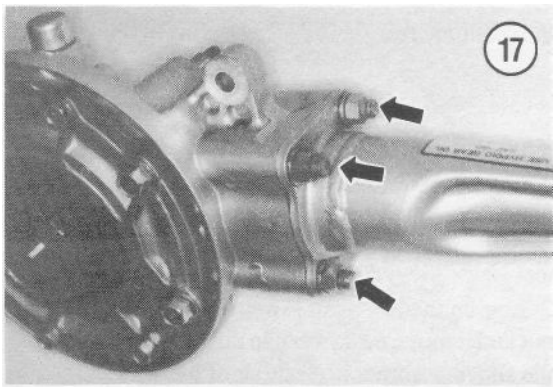
Disassembly/Inspection/Troubleshooting

Although it may be practical for you to disassemble the final drive for inspection, you cannot replace the bearings or seals (which require bearing removal) without special tools. If there is trouble in the shaft drive unit, it is best to remove the unit and take it to your Yamaha dealer and let them overhaul it. They are also better equipped to check and adjust gear lash.

Inspect the exterior of the unit for signs of wear, cracks, damage, or oil leakage. If any damage is present or there are signs of leakage, take the unit to your Yamaha dealer for service.

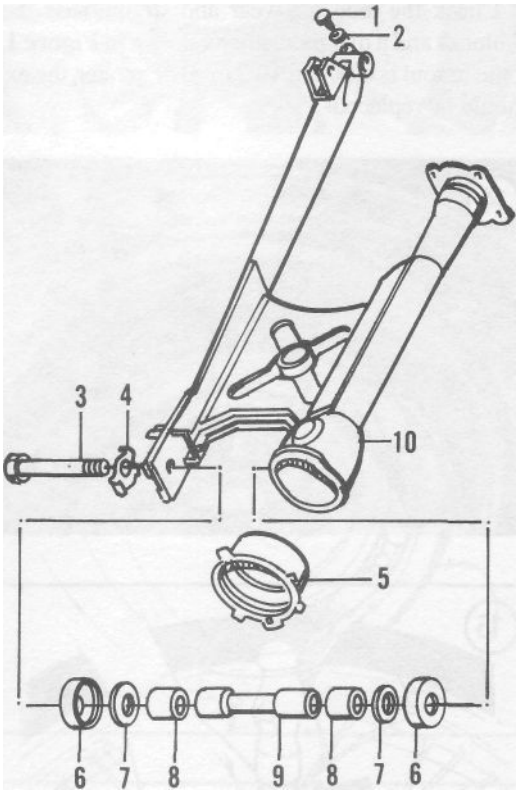
REAR SWING ARM

Refer to **Figure** 18 for this procedure.

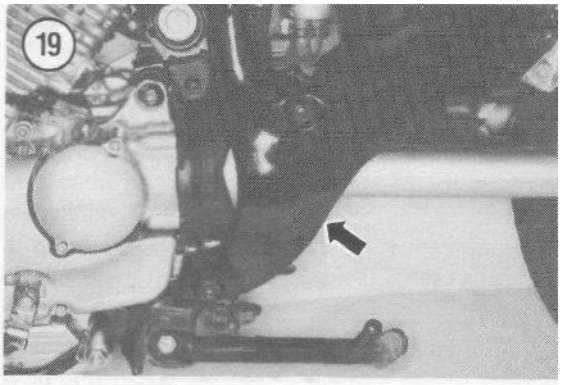


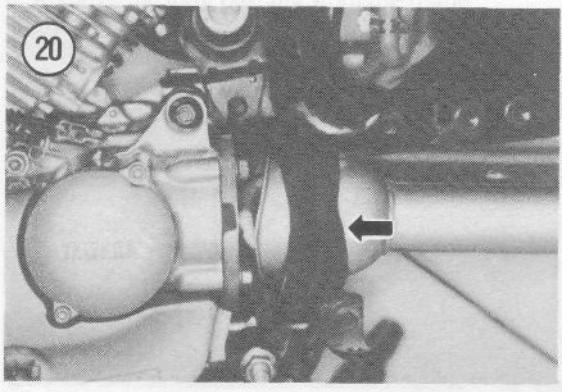
18

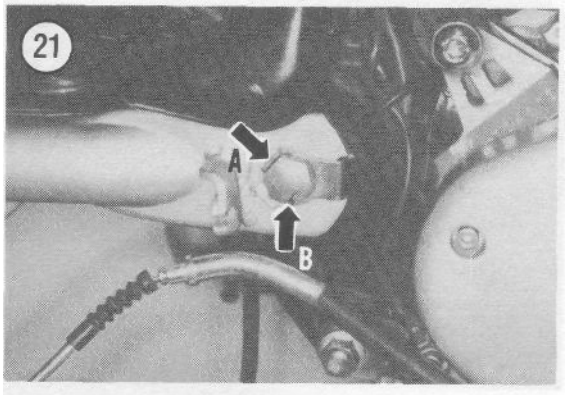
SWING ARM

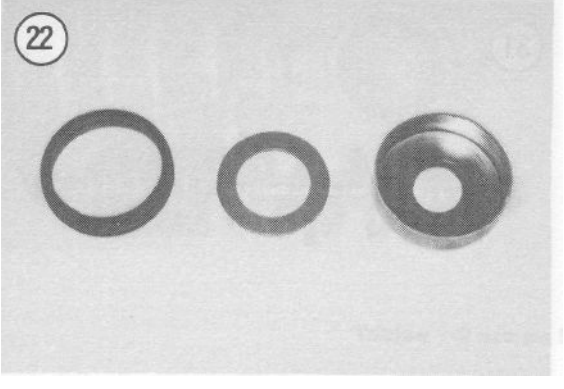


1. Clamp bolt
2. Washer
3. Pivot shaft
4. Lockwasher
5. Rubber boot
6. Thrust cover
7. Washer
8. Roller bearing
9. Bushing
10. Swing arm







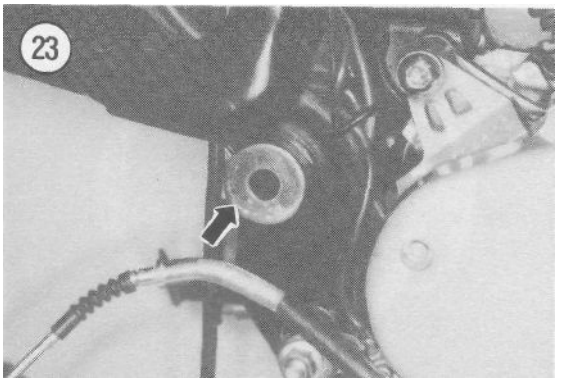


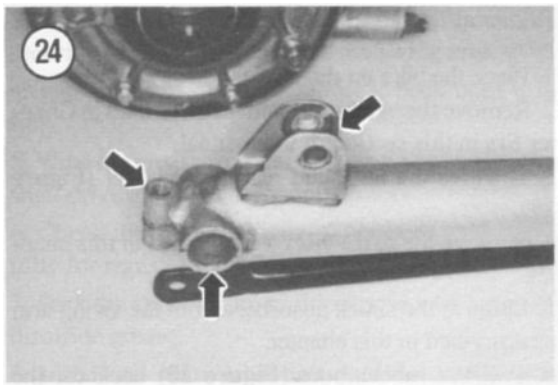
Removal/Installation

1. Place the bike on the sidestand.
2. Remove the exhaust system as described in Chapter Six in this section of the manual.
3. Remove the left-hand rear under cover **(Figure 19).**
4. Remove the rear wheel as described in this chapter.
5. Remove the shock absorbers from the swing arm as described in this chapter.
6. Pull the rubber boot **(Figure 20)** back off the middle driven gear and onto the swing arm.
7. Straighten the locking tab (A, **Figure 21)** on the pivot shaft lockwasher.
8. Loosen, then remove the pivot shaft (B, **Figure 21).**
9. Pull the swing arm straight back and remove it from the frame.
10. Installation is the reverse of these steps. Note the following:
    a. Make sure the washer, oil seal and thrust cover **(Figure 22)** are in place on each side of the pivot area of the frame **(Figure 23).**
    b. Install a new pivot shaft lockwasher and tighten the swing arm pivot shaft to the specifications in **Table 2.**
    c. Bend over the tab on the lockwasher to lock the pivot shaft.
    d. After the swing arm is installed, check free play as described in this chapter.

Inspection

1. Remove the rubber boot from the swing arm and inspect it for tears or deterioration; replace if necessary.

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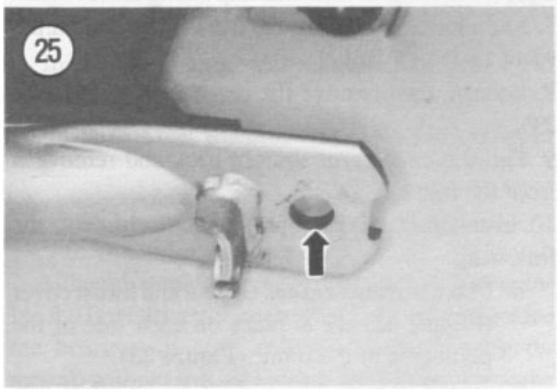
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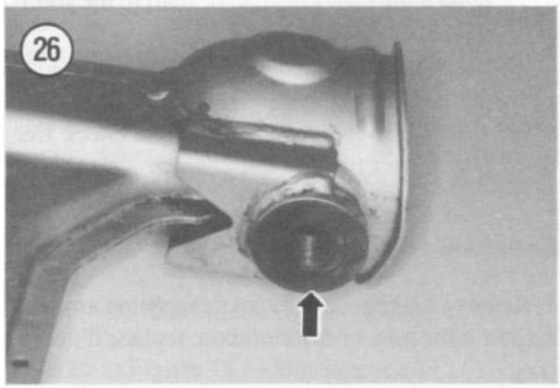
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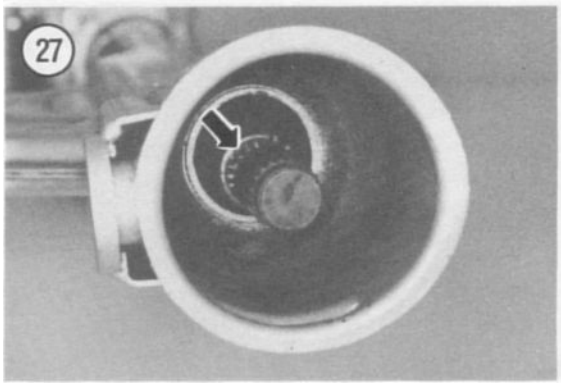
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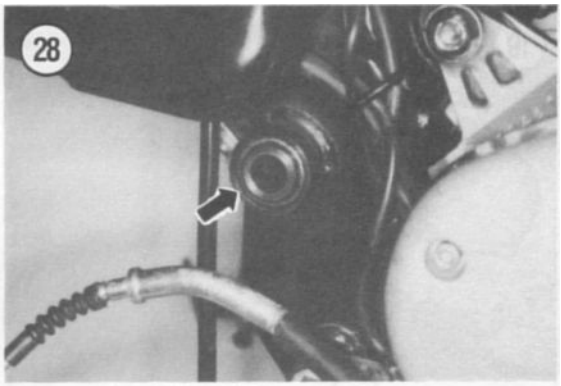
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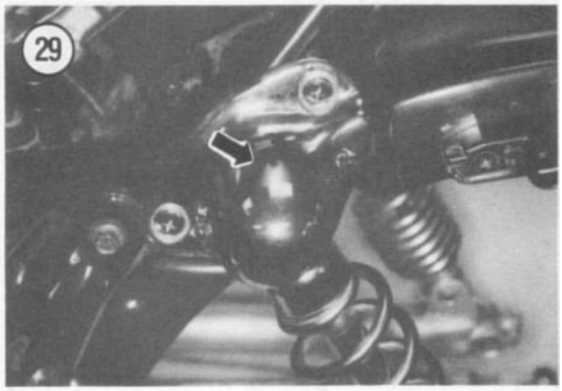
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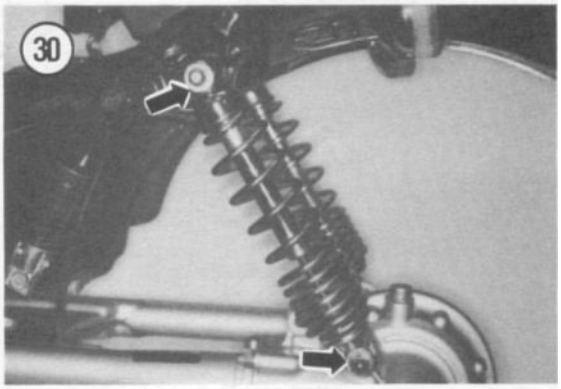
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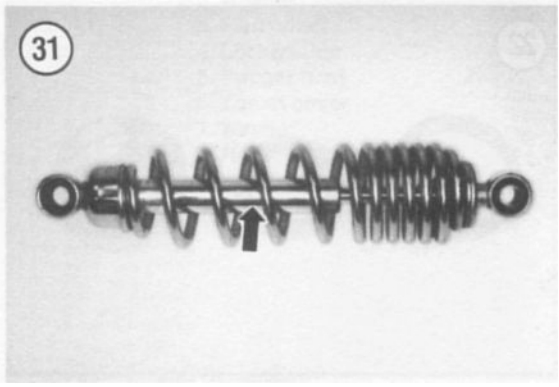
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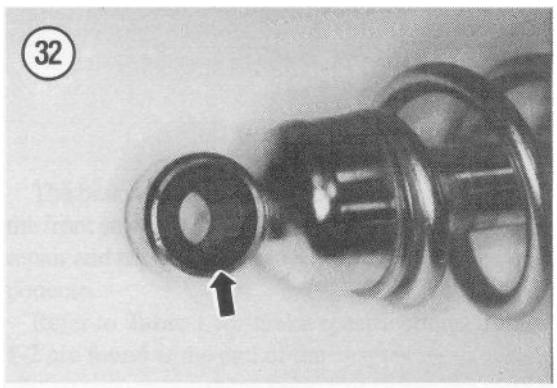
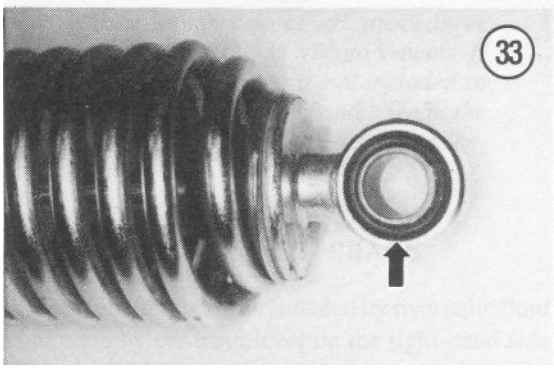
2. On the rear right-hand side of the swing arm, inspect the shock mount, rear axle pinch bolt threads and the rear axle mounting area **(Figure 24)** for wear or damage.
3. On the front right-hand side of the swing arm, inspect the pivot shaft hole **(Figure 25)** for wear or elongation.
4. On the front left-hand side of the swing arm, inspect the pivot shaft threaded hole **(Figure 26)** for wear or damage.
5. Inspect the drive shaft splines **(Figure 27)** for wear or damage.
6. Remove the long bushing from the frame.
7. Remove the oil seals and bearings **(Figure 28)** from the pivot area of the frame.
8. Thoroughly clean the bearings in solvent and dry with compressed air.
9. Turn each bearing by hand. Make sure bearings turn smoothly. Check the balls for evidence of wear or pitting. Replace if necessary. Always replace both bearings at the same time.





10. If bearings have been replaced, the grease seals should be replaced also.
11. Pack the bearings with a lithium base, waterproof wheel bearing grease.
12. Install the bearings into the swing arm.

CAUTION

Tap the bearings squarely into place and tap on the outer race only. Do not tap on the inner race or the bearings might be damaged. Be sure that the bearings are completely seated.

SHOCK ABSORBERS

The rear shocks are spring controlled and hydraulically dampened.

Removal/Inspection/Installation

Removal and installation of the rear shocks is easier if they are done separately. The remaining unit will support the rear of the bike and maintain the correct relationship between the top and bottom mounts. If both shock absorbers must be removed at the same time, cut a piece of wood the same length as the shock absorber. Then drill two holes in the wood the same distance apart as the mounting bolt holes. Install the wood support after one shock absorber is removed. This will allow the bike to be easily moved around until the shock absorbers are reinstalled or replaced.

1. Place the bike on the sidestand.
2. Remove the bolts and the upper trim cover **(Figure 29).**
3. Remove the upper and lower nuts and bolts **(Figure 30).**
4. Pull the shock off.
5. Inspect the shock as follows:
   a. Check the shock absorber body **(Figure 31)** for any signs of oil leakage. Replace the shock if necessary.
   b. Inspect the upper **(Figure 32)** and lower **(Figure 33)** mounts for wear or damage. Replace the shock if necessary.
6. Install by reversing these removal steps. Torque the fasteners to specifications in **Table 2.**

Tables 1-2 are on the following page.

Table 1 REAR SUSPENSION SPECIFICATIONS

Shock absorber	
Spring free length	
Standard	10.5 in. (266 mm)
Wear limit	10.3 in. (261 mm)
Swing arm side play	0.04 in. (1 mm)
Rear wheel runout	
Vertical and lateral	0.08 in. (2 mm)

Table 2 REAR SUSPENSION TIGHTENING TORQUES

Item	ft.-lb.	N.m
Rear axle		
Nut	75	105
Pinch bolt	11	**16**
Shaft drive unit nuts	30	**42**
Swing arm pivot shaft	54	**70**
Shock absorber bolt		
Top bolt	14	**20**
Right-hand bottom bolt	**22**	**30**
Left-hand bottom nut	**22**	**30**

CHAPTER TEN

BRAKES

The brake system consists of a single disc unit on the front and drum on the rear. This chapter describes repair and replacement procedure for all brake components.

Refer to **Table 1** for brake specifications. **Tables 1-2** are found at the end of the chapter.

NOTE

This chapter covers all procedures unique to the XV535 Virago V-twins. If a specific procedure is not included in this chapter, refer to Chapter Ten at the front of this manual for service procedures.

FRONT DISC BRAKE

The front disc brake is actuated by hydraulic fluid controlled by the hand lever on the right-hand side of the handlebar. As the brake pads wear, the brake fluid level drops in the master cylinder reservoir and automatically adjusts for pad wear. However, brake lever free play must be maintained. Refer to *Front Brake Lever Adjustment* in Chapter Three in this section of the manual.

When working on a hydraulic brake system, it is necessary that the work area and all tools be absolutely clean. Any tiny particles of foreign matter or grit on the caliper assembly or the master cylinder can damage the components. Also, sharp tools must not be used inside the caliper or on the caliper piston. If there is any doubt about your ability to correctly and safely carry out major service on the brake components, take the job to a Yamaha dealer or brake specialist.

When adding brake fluid use only a type clearly marked DOT 3 and use it from a sealed container. Brake fluid will draw moisture which greatly reduces its ability to perform correctly, so it is a good idea to purchase brake fluid in small containers and discard what is not used.

Whenever *any* component has been removed from the brake system the system is considered "opened" and must be bled to remove air bubbles. Also, if the brake feels "spongy," this usually means there are

air bubbles in the system and it must be bled. For safe brake operation, refer to *Bleeding the System* in Chapter Ten, in the front section of the manual, for complete details.

CAUTION

Disc brake components rarely require disassembly, so do not disassemble unless absolutely necessary. Do not use solvents of any kind on the brake systems internal components. Solvents will cause the seals to swell and distort. When disassembling and cleaning brake components (except brake pads) use new brake fluid.

MASTER CYLINDER

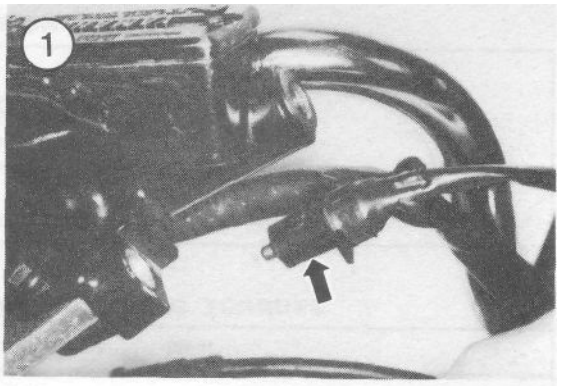
Removal/Installation

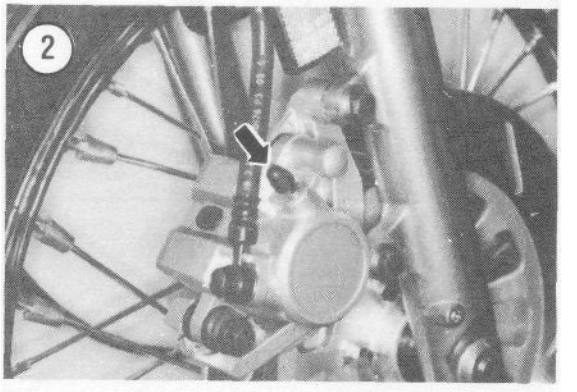
1. On models so equipped, loosen the nut securing the mirror to the master cylinder and remove the mirror.

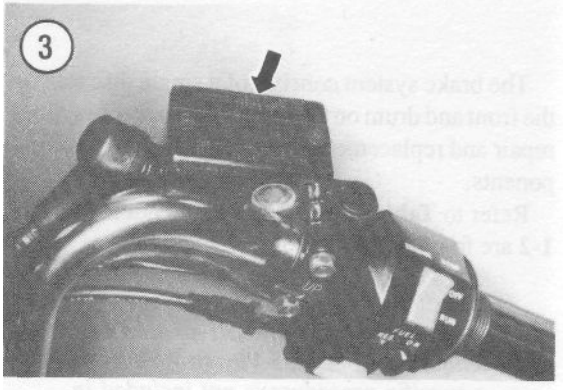
CAUTION

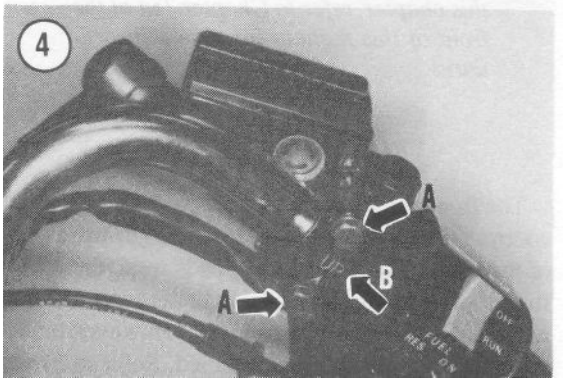
Cover the top cover, or fuel tank, front fender and speedometer with a heavy cloth or plastic tarp to protect them from accidental spilling of brake fluid. Wash any spilled brake fluid off any painted or plated surfaces immediately, as it will destroy the finish. Use soapy water and rinse completely.

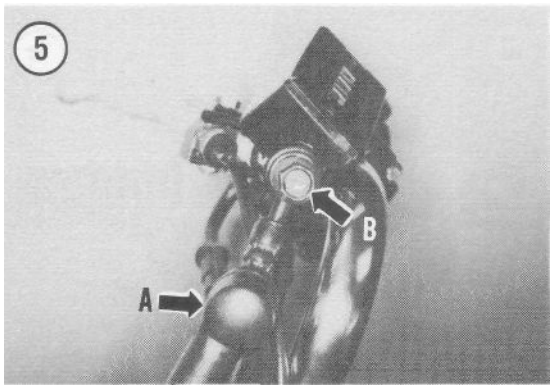
2. Using a small screwdriver or drift, push up in the hole in the base of the switch and withdraw the switch and electrical harness from the master cylinder (Figure 1).
3. Drain the master cylinder as follows:
   a. Attach a hose to the brake caliper bleed screw (Figure 2).
   b. Place the end of the hose in a clean container.
   c. Open the bleed screw and operate the brake lever to drain all brake fluid from the master cylinder reservoir.
   d. Close the bleed screw and disconnect the hose.
   e. Discard the brake fluid.
4. Loosen the screws securing the master cylinder top cover (Figure 3). Do not remove the cover at this time.











5. Loosen the 2 clamping bolts (A, **Figure 4)** securing the master cylinder to the handlebar.

6. Slide back the rubber boot (A, **Figure 5)** and loosen the union bolt (B, **Figure 5)** securing the brake hose to the master cylinder.

7. Remove the union bolt, brake hose and both copper sealing washers. Cover the end of the hose to prevent the entry of foreign matter and moisture. Tie the hose end up to the handlebar to prevent the loss of brake fluid.

8. Remove the 2 clamping bolts (A, **Figure 4)** and clamp securing the master cylinder to the handlebar and remove the master cylinder.

9. Install by reversing these removal steps. Note the following:

a. Install the master cylinder clamp with the arrow facing upward (B, **Figure 4).**

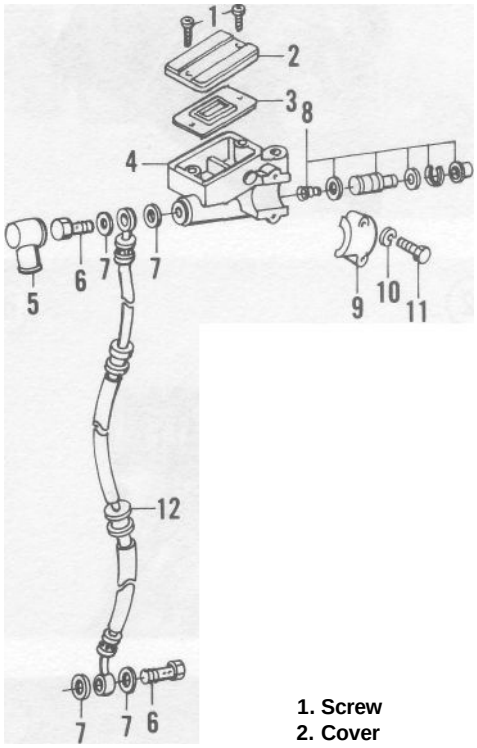
b. Tighten the upper clamp bolt first, then the lower bolt.

c. Install the brake hose onto the master cylinder. Be sure to place a copper sealing washer on each side of the hose fitting and install the union bolt and tighten **(Table 2).**

d. Bleed the brake system as described in Chapter Ten in the front section of this manual.

6

MASTER CYLINDER



1. Screw
2. Cover
3. Diaphragm
4. Body
5. Rubber boot
6. Union bolt
7. Sealing washer
8. Piston assembly
9. Clamp
10. Washer
11. Bolt
12. Brake hose

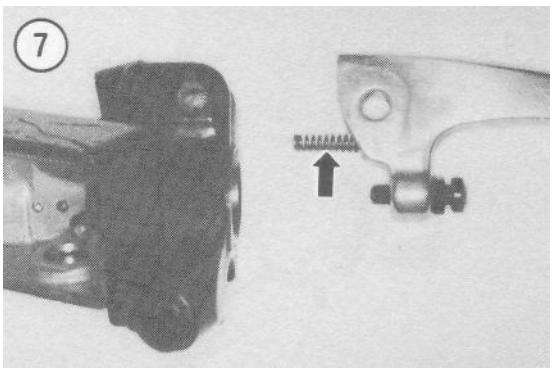
Disassembly

Refer to **Figure 6** for this procedure.

1. Remove the master cylinder as described in this chapter.

2. Remove the bolt securing the hand lever and remove the lever. Don't lose the small spring **(Figure 7)** within the lever.

3. Remove the screws securing the reservoir cover and diaphragm and remove both of them. Pour out



the remaining brake fluid and discard it. Never reuse brake fluid.

4. Remove the rubber boot **(Figure 8)** from the area where the hand lever actuates the internal piston.

5. Using snap ring pliers remove the internal snap ring **(Figure 9)** from the cylinder in the master cylinder body.

6. Remove the piston, return valve, spring cup and return spring **(Figure 10).**

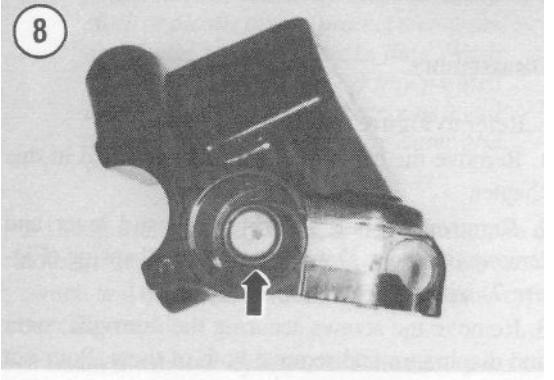
Inspection

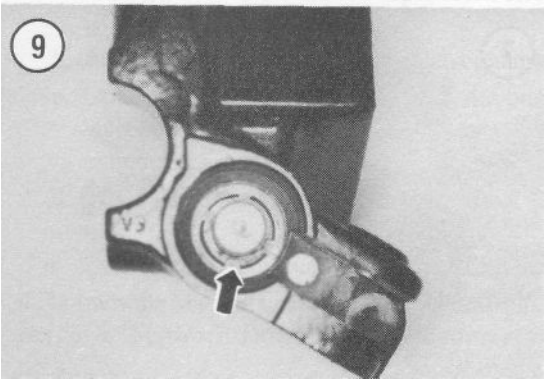
1. Clean all parts in fresh brake fluid. Inspect the cylinder bore **(Figure 11)** and piston contact surfaces **(Figure 12)** for signs of wear or damage. If either part is less than perfect, replace it.

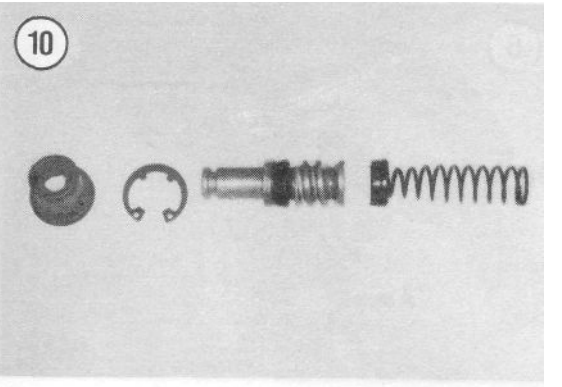
2. Check the end of the piston **(Figure 13)** for wear caused by the hand lever. Replace the entire piston assembly if any portion of it requires replacement.

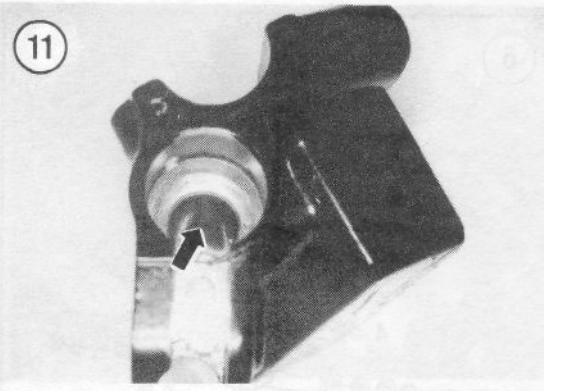
3. Inspect the pivot hole in the hand lever and master cylinder body **(Figure 14).** If worn, either part must be replaced.

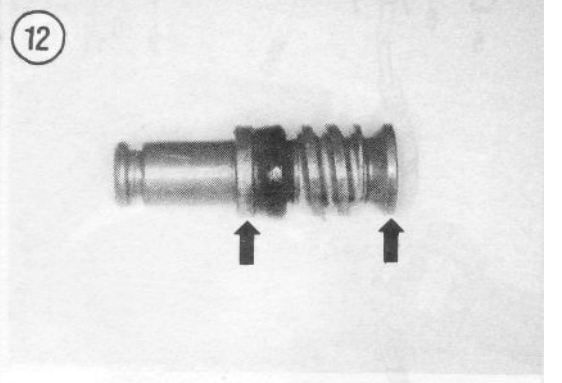
4. Make sure the passages **(Figure 15)** in the bottom of the brake fluid reservoir are clear. Check the

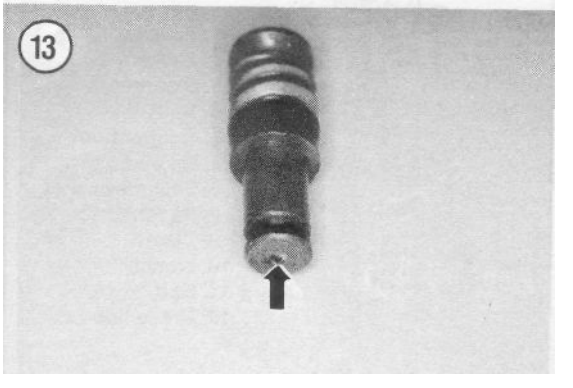


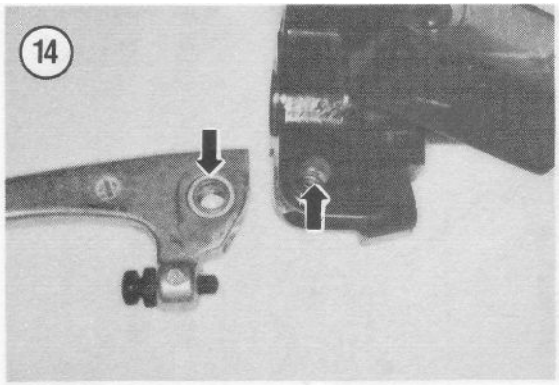


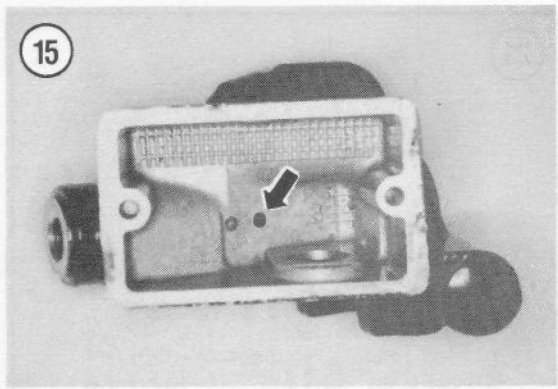


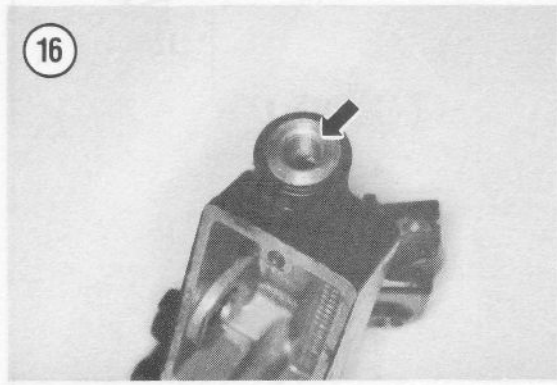


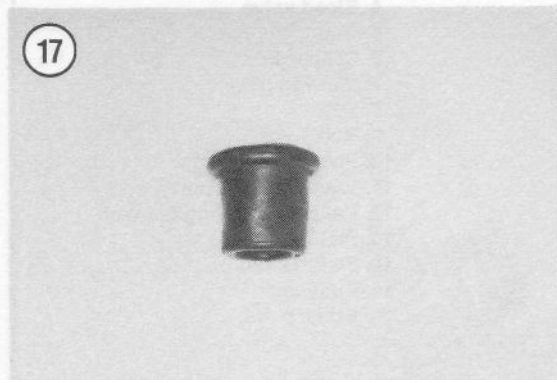












reservoir cap and diaphragm for damage and deterioiation. Replace if necessary.

5. Inspect the condition of the threads **(Figure 16)** in the master cylinder body where the brake hose union bolt screws in. If the threads are damaged or partially stripped, replace the master cylinder body.

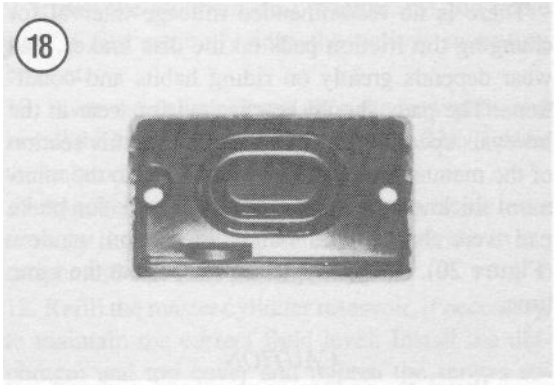
6. Inspect the dust boot **(Figure 17)** for damage or deterioration. Replace if necessary.

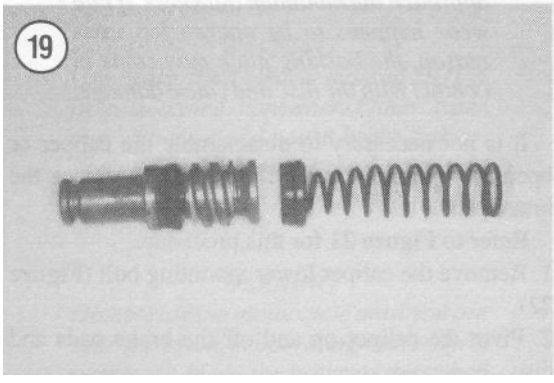
7. Inspect the diaphragm **(Figure 18)** for damage or deterioration. Replace if necessary.

NOTE
*Yamaha recommends replacing the piston assembly **(Figure** 19) whenever the master cylinder is disassembled.*

Assembly

1. Soak the new cups in fresh brake fluid for at least 15 minutes to make them pliable. Coat the inside of the cylinder with fresh brake fluid prior to assembling the parts.





CAUTION

When installing the piston assembly, do not allow the cups to turn inside out as they will be damaged and allow brake fluid to leak within the cylinder bore.

2. Position the spring with the tapered end facing toward the primary cup **(Figure 19).** Position the primary cup so the open end will go in first (toward the spring). Install the spring, primary cup and piston assembly into the cylinder **(Figure 10).**
3. Push down on the piston assembly and install the snap ring **(Figure 9).** Make sure the snap ring is firmly seated in the groove in the cylinder.
4. Slide on the rubber boot **(Figure 8).**
5. Install the diaphragm and cover. Do not tighten the screws at this time as fluid will have to be added later.
6. Install the brake lever and spring **(Figure 7)** onto the master cylinder body and tighten the bolt securely.
7. Install the master cylinder as described in this chapter.

FRONT BRAKE PAD REPLACEMENT

There is no recommended mileage interval for changing the friction pads on the disc brakes. Pad wear depends greatly on riding habits and conditions. The pads should be checked for wear at the intervals specified in Chapter Three in this section of the manual and replaced when worn to the minimum thickness listed in **Table 1.** Check for brake pad wear through the caliper inspection window **(Figure 20).** Always replace both pads at the same time.

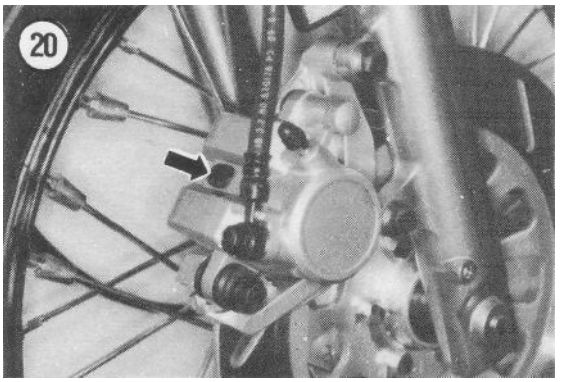
CAUTION

Watch the pads more closely when they approach the minimum thickness. If pad wear happens to be uneven for some reason, the backing plate may come in contact with the disc and cause damage.

It is not necessary to disassemble the caliper or open the hydraulic brake fluid lines to replace the brake pads.

Refer to **Figure 21** for this procedure.

1. Remove the caliper lower mounting bolt **(Figure 22).**
2. Pivot the caliper up and off the brake pads and disc.



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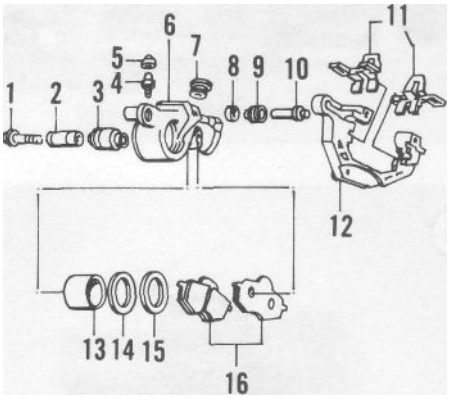
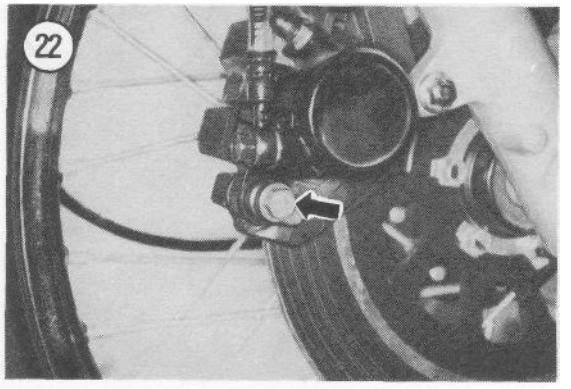
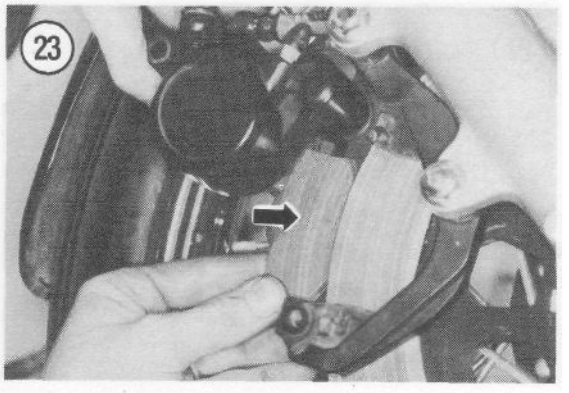
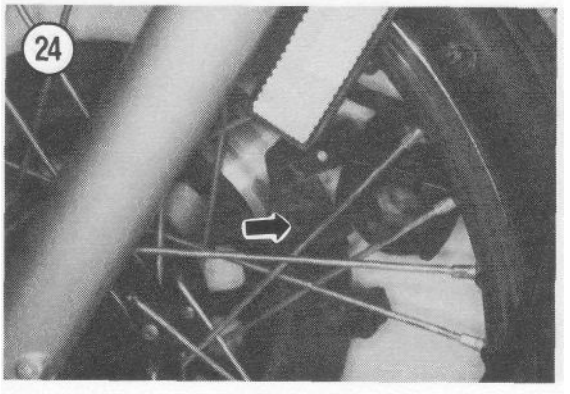
BRAKE CALIPER

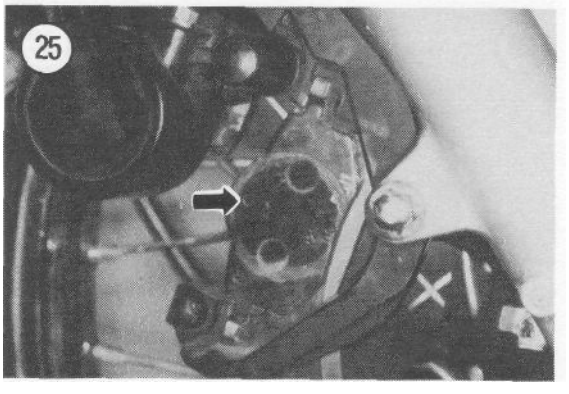


1. Bolt
2. Bushing
3. Boot
4. Bleed valve
5. Cap
6. Caliper body
7. Viewing plug
8. Seal
9. Boot
10. Pivot pin
11. Brake pad support
12. Caliper mounting bracket
13. Piston
14. Piston seal
15. Dust seal
16. Brake pads









3. Remove both brake pads.

4. Clean the pad recess and the end of the piston with a soft brash. Do not use solvent, a wire brash or any hard tool which would damage the cylinder or piston.

5. Lightly coat the end of the piston with disc brake lubricant.

6. When new pads are installed in the caliper, the master cylinder brake fluid level will rise as the caliper piston is repositioned. Clean the top of the master cylinder of all dirt and foreign matter. Remove the screws, cover and diaphragm **(Figure 3).** Slowly push the caliper piston into the caliper. Constantly check the reservoir to make sure brake fluid does not overflow. Remove fluid, if necessary, prior to it overflowing. The piston should move freely. If it does not, and there is evidence of it sticking in the cylinder, the caliper should be removed and serviced as described under *Caliper Rebuilding* in this chapter.

7. Push the piston back in to allow room for the new pads.

8. Install the inboard disc **(Figure** 23) and make sure it fits correctly into the caliper mounting bracket **(Figure 24).**

9. Install the outboard disc **(Figure 25)** and make sure it fits correctly into the caliper mounting bracket.

10. Pivot the caliper down onto the new pads and install the lower mounting bolt **(Figure 22).** Tighten the bolt to specification in **Table 2.**

11. Spin the front wheel and activate the brake lever as many times as it takes to refill the cylinder in the caliper and correctly position the pads.

12. Refill the master cylinder reservoir, if necessary, to maintain the correct fluid level. Install the diaphragm and top cover and tighten the screws securely.

WARNING

Use brake fluid clearly marked DOT 3 from a sealed container. Other types may vaporize and cause brake failure. Always use the same brand name; do not intermix brake fluids, many brands are not compatible.

WARNING

Do not ride the motorcycle until you are sure the brake is operating correctly. If necessary, bleed the brake as described

under Bleeding the System in Chapter Ten in the front section of the manual.

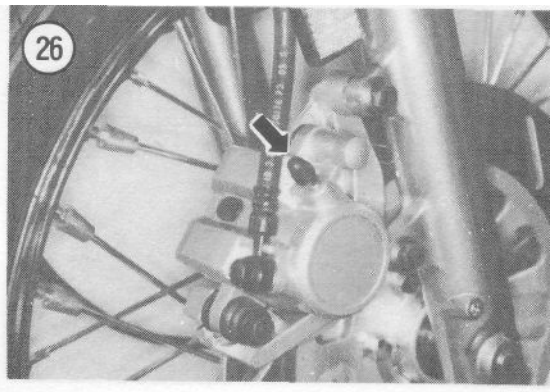
13. Bed the pads in gradually for the first 50 miles by using only light pressure as much as possible. Immediate hard application will glaze the new friction pads and greatly reduce the effectiveness of the brake.

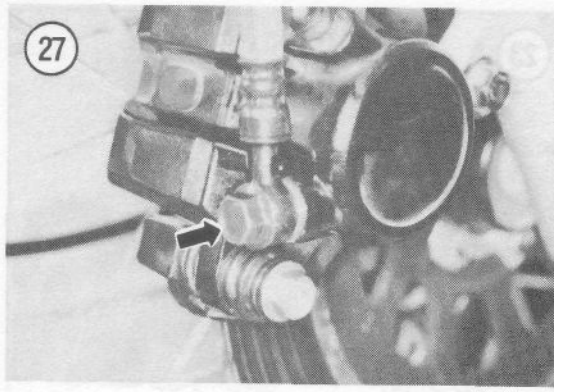
FRONT CALIPER

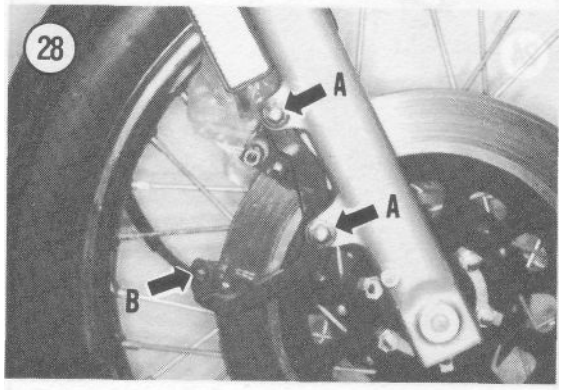
Removal/Installation

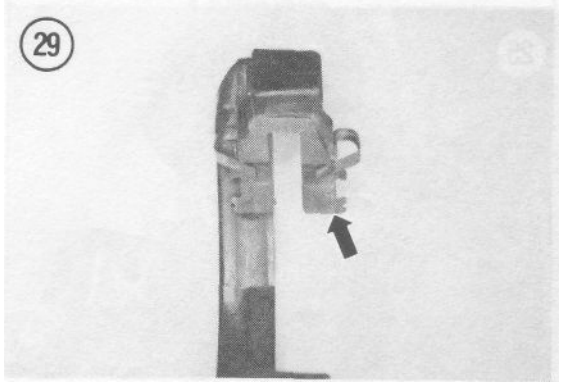
Refer to **Figure 21** for this procedure.

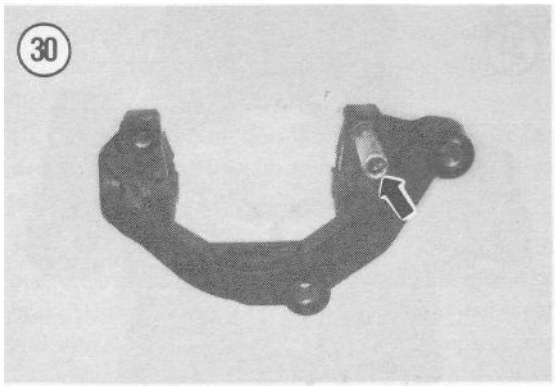
1. Drain the master cylinder and caliper as follows:
   a. Attach a hose to the brake caliper bleed screw **(Figure** 26).
   b. Place the end of the hose in a clean container.
   c. Open the bleed screw and operate the brake lever to drain all brake fluid from the master cylinder reservoir.
   d. Close the bleed screw and disconnect the hose.
   e. Discard the brake fluid.
2. Remove the union bolt **(Figure** 27) and copper sealing washers attaching the brake hose to the caliper. To prevent the entry of moisture and foreign matter, cap the end of the brake hose and tie it up to the fender.
3. Remove the bolt **(Figure 22)** securing the caliper assembly to the caliper mounting bracket.
4. Pivot the caliper up and off the brake pads. Pull the caliper off the pivot post on the mounting bracket and remove the caliper.
5. To remove the caliper bracket, perform the following:
   a. Remove the mounting bolts (A, **Figure** 28) and remove the bracket (B, **Figure 28)** from the fork slider.
   b. Inspect the brake pad supports **(Figure 29)** for damage or cracks; replace if necessary.
   c. Inspect the pivot pin **(Figure 30)** for wear or damage.
6. Install by reversing these removal steps. Note the following:
   a. Install the brake hose onto the caliper. Be sure to place a copper sealing washer on each side of the hose fitting **(Figure** 31) and install the union bolt and tighten **(Table 2).**
   b. Tighten the bolts to specifications in **Table 2.**

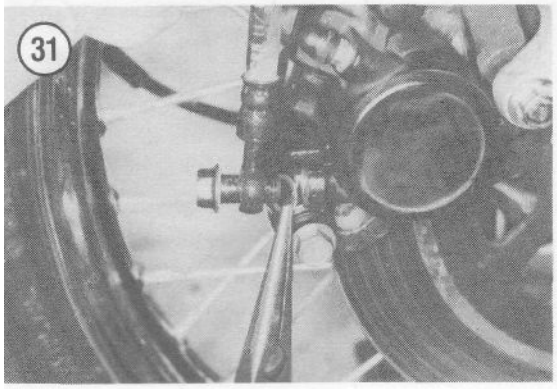


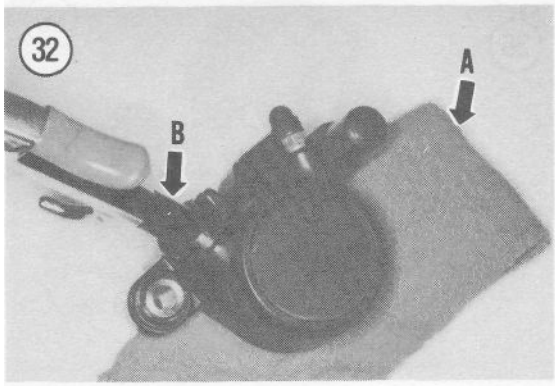


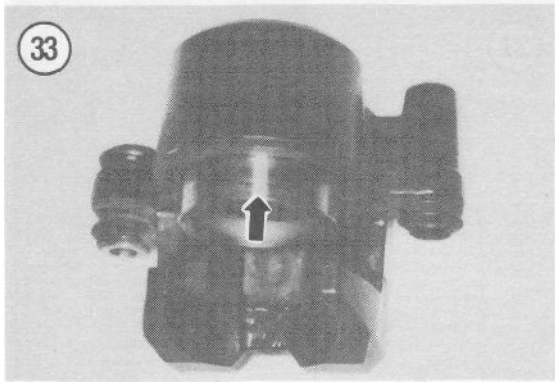












c. Bleed the brake system as described in Chapter Ten in the front section of the manual.

WARNING

Do not ride the motorcycle until you are sure that the brakes are operating properly.

Caliper Rebuilding

If the caliper leaks, the caliper should be rebuilt. If the piston sticks in the cylinder, indicating severe wear or galling, the entire unit should be replaced. Rebuilding a leaky caliper requires special tools and experience.

The factory recommends that the internal seals of the caliper be replaced every two years.

Refer to **Figure 21** for this procedure.

1. Remove the brake caliper as described in this chapter.

WARNING

In the next step, the piston may shoot out of the caliper body like a bullet. Keep your fingers out of the way. Wear shop gloves and apply air pressure gradually. Do ***not*** *use high pressure air or place the air hose nozzle directly against the hydraulic line fitting inlet in the caliper body. Hold the air nozzle away from the inlet allowing some of the air to escape.*

2. Pad the piston with shop rags or wood blocks as shown in A, **Figure 32.** Block the exposed housing fluid port holes on the back of the caliper housing. Then apply compressed air through the caliper hose joint (B, **Figure 32)** and blow the piston **(Figure 33)** out of the caliper.

CAUTION

In the following step, do not use a sharp tool to remove the dust and piston seals from the caliper cylinder. Do not damage the cylinder surface.

3. Use a piece of plastic or wood and carefully push the dust seal and the piston seal in toward the caliper cylinder and out of their grooves. Remove the dust and piston seals from the cylinder and discard both seals.

4. Clean all caliper parts and inspect them as described in this chapter.

NOTE
Never reuse the old dust seals or piston seals. Very minor damage or age deterioration can make the seals useless.

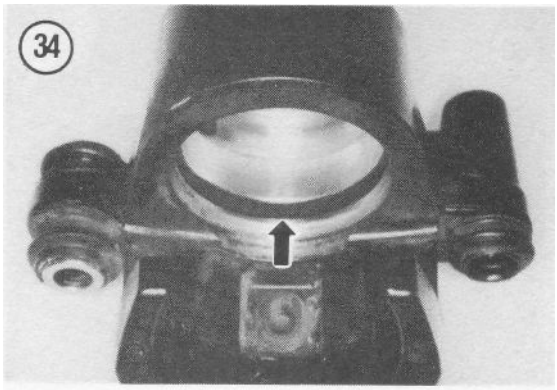
5. Coat the new dust seal and piston seal with fresh DOT 3 brake fluid.

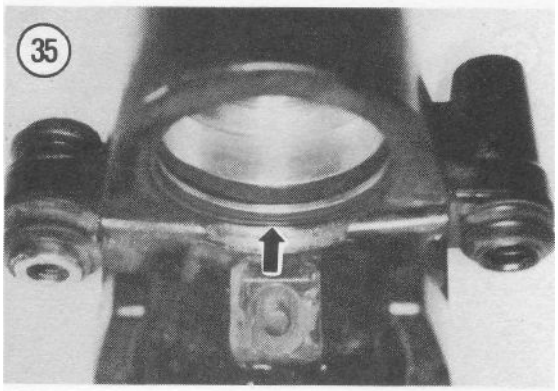
6. Carefully install the new piston seal **(Figure 34)** and dust seal **(Figure 35)** in the grooves in the caliper cylinder. Make sure the seals are properly seated in their respective grooves.

7. Coat the piston and caliper cylinder with fresh DOT 3 brake fluid.

8. Position the piston with the open end facing out toward the brake pads and install the piston **(Figure 33)** into the caliper cylinder. Push the piston in until it bottoms out.

9. Install the caliper and brake pads as described in this chapter.





Caliper Inspection

1. Clean all parts (except brake pads) with rubbing alcohol and rinse with clean DOT 3 brake fluid. Place the cleaned parts on a lint-free cloth while performing the following inspection procedures.

2. Inspect the seal grooves (A, **Figure 36)** in the caliper body for damage. If damaged or corroded, replace the caliper assembly.

3. Inspect the cylinder walls **(B, Figure 36)** for scratches, scoring or other damage. If rusty or corroded, replace the caliper assembly.

4. Measure the cylinder bore inside diameter with a bore gauge. Replace the brake caliper if the inside diameter is worn. Refer to the standard dimension listed in **Table 1.**

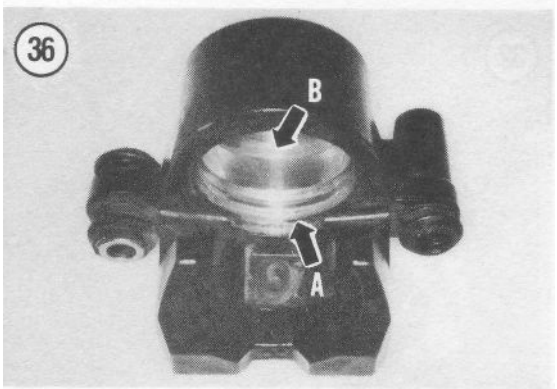
5. Inspect the piston **(Figure 37)** for scratches, scoring or other damage. If rusty or corroded, replace the pistons.

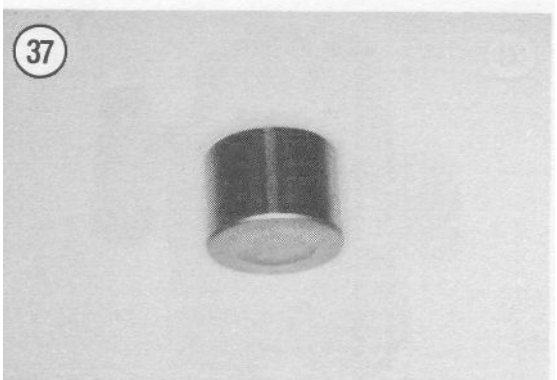
6. Inspect both caliper bodies for damage, replace the caliper body if necessary **(Figure 38).**

7. Inspect the caliper mounting bolt holes on the caliper body. If worn or damaged, replace the caliper assembly.

8. Remove the bleed screw and make sure it is clean and open. Apply compressed air to the opening and make sure it is clear. Clean out if necessary with fresh brake fluid.

9. Inspect the fluid opening **(Figure 39)** in the base of the cylinder bore and make sure it is clean and



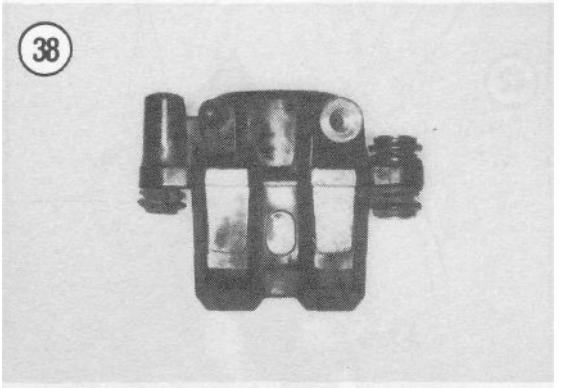


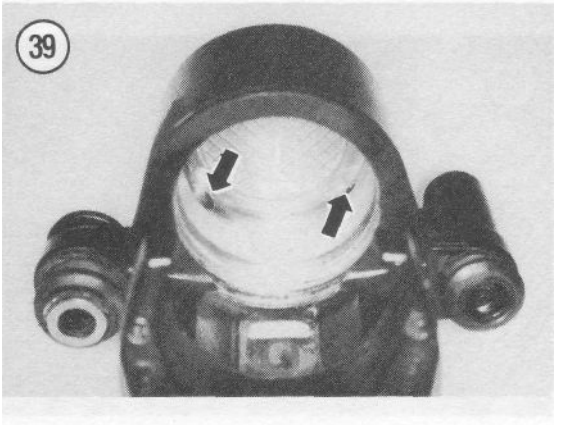
open. Apply compressed air to the opening and make sure it is clear. Clean out if necessary with fresh brake fluid.

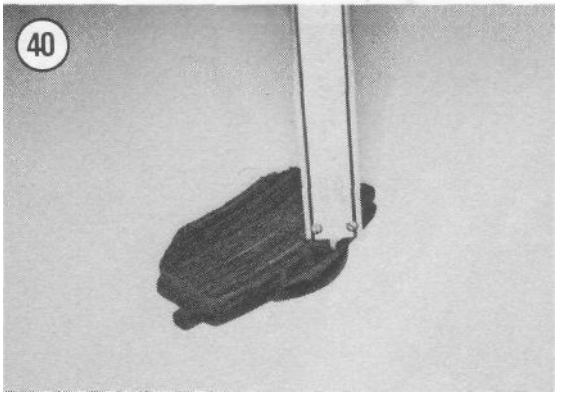
10. Inspect the union bolt threads in the caliper for wear or damage. Clean up any minor thread damage or replace the caliper assembly if necessary.

11. The piston seal maintains correct brake pad to disc clearance. If the seal is worn or damaged, the brake pads will drag and cause excessive pad wear and elevate brake fluid temperatures. Replace the piston and dust seals if the following conditions exist:

a. Brake fluid leaks around the brake pad.
b. The piston seal is stuck in the caliper groove.
c. There is a large difference in inner and outer brake pad wear.
d. Measure the brake pad friction thickness material with a vernier caliper **(Figure 40).** Replace both brake pads if any one pad is worn to the service limit dimension listed in **Table 1** or less.







FRONT BRAKE HOSE REPLACEMENT

The factory-recommended brake hose replacement interval is every 4 years, but it is a good idea to replace brake hoses whenever signs of cracking, leakage or damage are apparent.

CAUTION

Cover the front wheel, fender and top cover or fuel tank with a heavy cloth or plastic tarp to protect it from the accidental spilling of brake fluid. Wash any spilled brake fluid off of any painted or plated surface immediately, as it will destroy the finish. Use soapy water and rinse completely.

1. Drain the master cylinder and caliper as follows:
   a. Attach a hose to the brake caliper bleed screw **(Figure 26).**
   b. Place the end of the hose in a clean container.
   c. Open the bleed screw and operate the brake lever to drain all brake fluid from the master cylinder reservoir.
   d. Close the bleed screw and disconnect the hose.
   e. Discard the brake fluid.
2. Remove the union bolt **(Figure 27)** and copper sealing washers attaching the brake hose to the caliper.
3. Disconnect the hose from the clamp on the fork **(Figure 41).**
4. Slide back the rubber boot (A, **Figure 42)** and remove the union bolt **(B, Figure 42)** securing the hose to the master cylinder.
5. Remove the brake hose.
6. Install new brake hose, copper sealing washers and union bolts in the reverse order of removal. Be sure to install the new sealing washers in their cor-

rect positions. Tighten all union bolts to specifications in **Table 2.**

7. Refill the master cylinder with fresh brake fluid clearly marked DOT 3. Bleed the brake as described in Chapter Ten in the front section of the manual.

WARNING

Do not ride the motorcycle until you are sure that the brakes are operating properly.

FRONT BRAKE DISC

Removal/Installation

1. Remove the front wheel as described in this chapter.

NOTE

Place a piece of wood in the caliper in place of the disc. This way, if the brake lever is inadvertently squeezed, the piston will not be forced out of the cylinder. If this does happen, the caliper might have to be disassembled to reseat the piston and the system will have to be bled. By using the wood, bleeding the system is not necessary when installing the wheel.

2. Straighten the lock tabs on the washers **(Figure** 43) and remove the bolts securing the disc to the wheel.

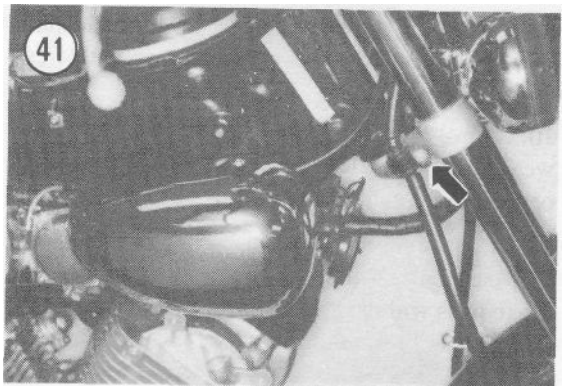
3. Remove the disc from the hub.

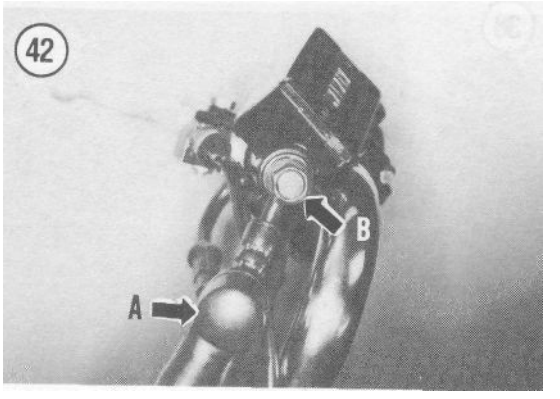
4. Install by reversing these removal steps. Install the bolts and tighten to specifications in **Table 2.** Install new lockwashers and bend over the lock tabs after the bolts are tightened.

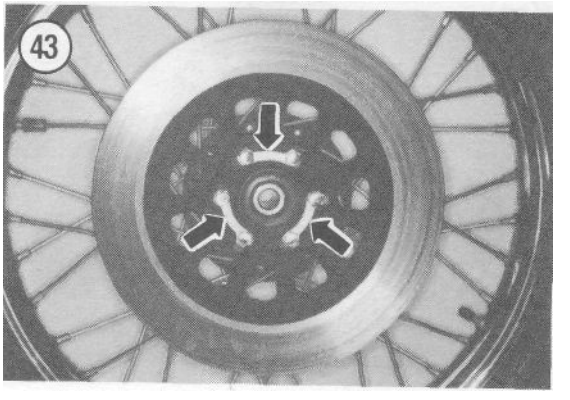
Inspection

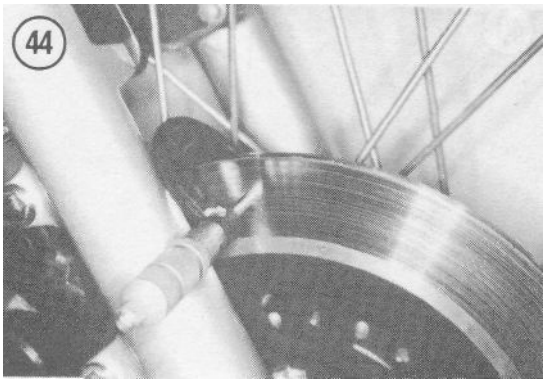
It is not necessary to remove the disc from the wheel to inspect it. Small marks on the disc are not important, but deep radial scratches, deep enough to snag a fingernail, reduce braking effectiveness and increase brake pad wear. If these grooves are found, the disc should be resurfaced or replaced.

1. Measure the thickness around the disc at several locations with Vernier calipers or a micrometer (Figure 44). The disc must be replaced if the thickness at any point is less than specified in **Table 1.**

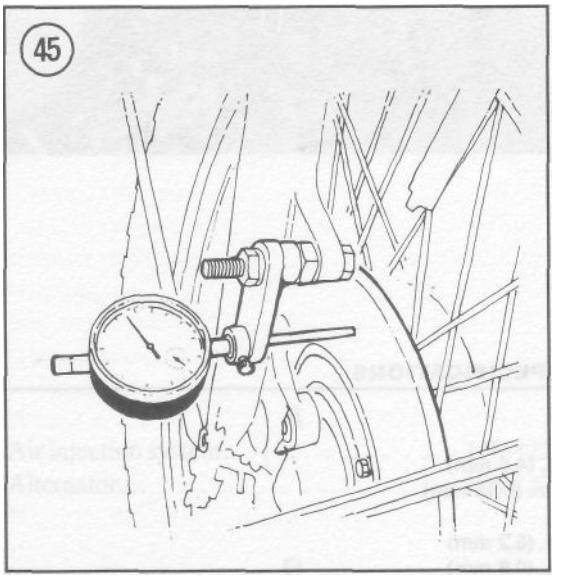








2. Make sure the disc bolts are tight prior to performing this check. Check the disc runout with a dial indicator as shown in **Figure 45.** Slowly rotate the wheel and watch the dial indicator. If the runout is 0.006 in. (0.15 mm) or greater, the disc must be replaced.



3. Clean the disc of any rust or corrosion and wipe clean with lacquer thinner. Never use an oil based solvent that may leave an oil residue on the disc.

REAR BRAKE PEDAL ASSEMBLY

Removal/Installation

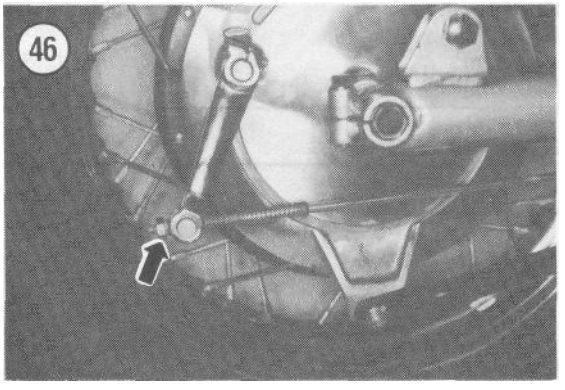
1. Place the motorcycle on its sidestand.

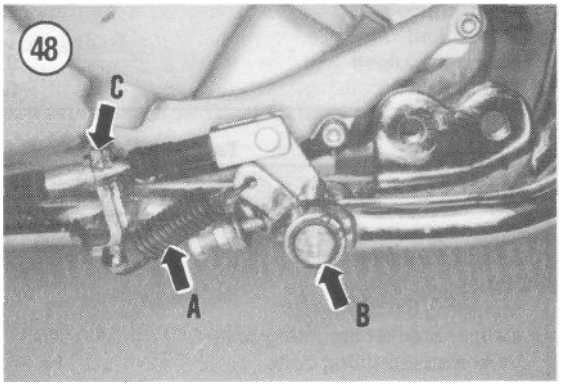
2. Completely unscrew the brake rod adjustment nut **(Figure 46)** and disconnect the rod from the brake arm. Reinstall the adjustment nut, pivot pin and spring on the rod to avoid losing them.

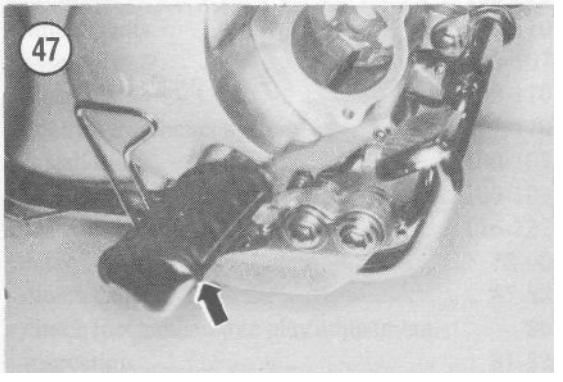
3. Remove the bolts securing the right-hand footpeg and guard assembly **(Figure 47)** to the footpeg bar assembly. Remove the footpeg and guard assembly.

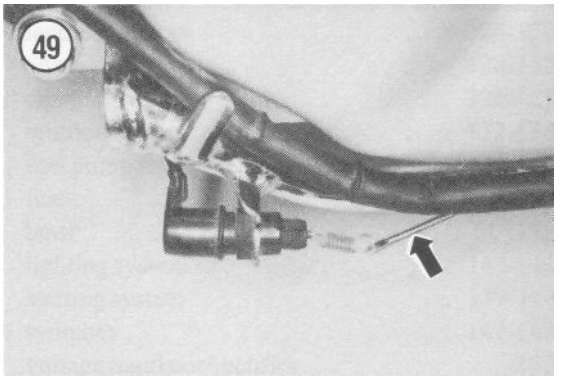
4. Unhook the pedal return spring (A, **Figure 48)** and disconnect the brake light spring or rod **(Figure 49).**

5. Remove the circlip and washer securing the brake pedal to the footpeg bar assembly and remove the pedal (B, **Figure 48)** from the pivot post.









6. Unhook the brake cable from the front bracket (C, **Figure 48)** and rear bracket **(Figure 50)** on the swing arm.
7. Remove the brake pedal and cable/rod assembly from the frame.
8. Install by reversing these removal steps, while noting the following:
   a. Apply grease to the brake pivot post prior to installing the assembly into the frame.
   b. Adjust the rear brake pedal as descnbed in Chapter Three in the front section and in this section of the manual.

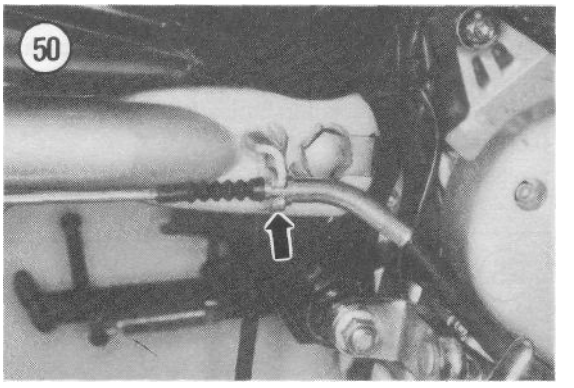


Table 1 BRAKE SPECIFICATIONS

Brake fluid type	DOT 3
Front borake	
Disc thickness (limit)	0.18 in. (4.5 mm)
Disc deflection (limit)	0.006 in. (0.15 mm)
Pad thickness	
New	0.26 in. (6.2 mm)
Wear limit	0.03 in. (0.8 mm)
Rear brake	
Drum diameter	7.87 in. (200 mm)
Wear limit	7.91 in. (201 mm)
Lining thickness	0.16 in. (4 mm)
Wear limit	0.08 in. (2 mm)

Table 2 BRAKE TIGHTENING TORQUES

Item	ft.-lb.	Nun
Master cylinder clamping bolts	6.5	9
Brake hose union bolt	19	26
Caliper		
Mounting bolts	13	18
Caliper bracket mounting bolts	25	35
Brake disc mounting bolts	14	20

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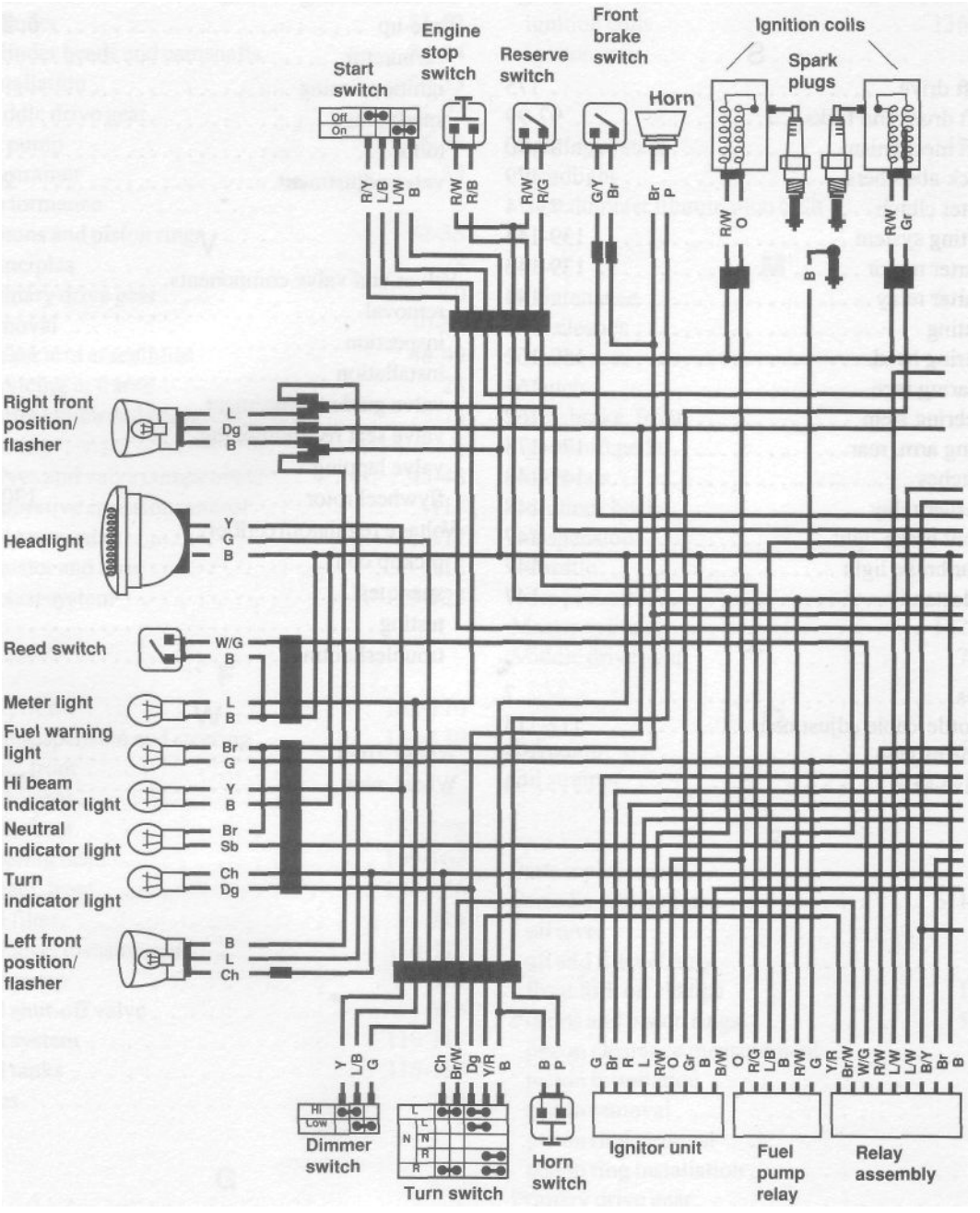

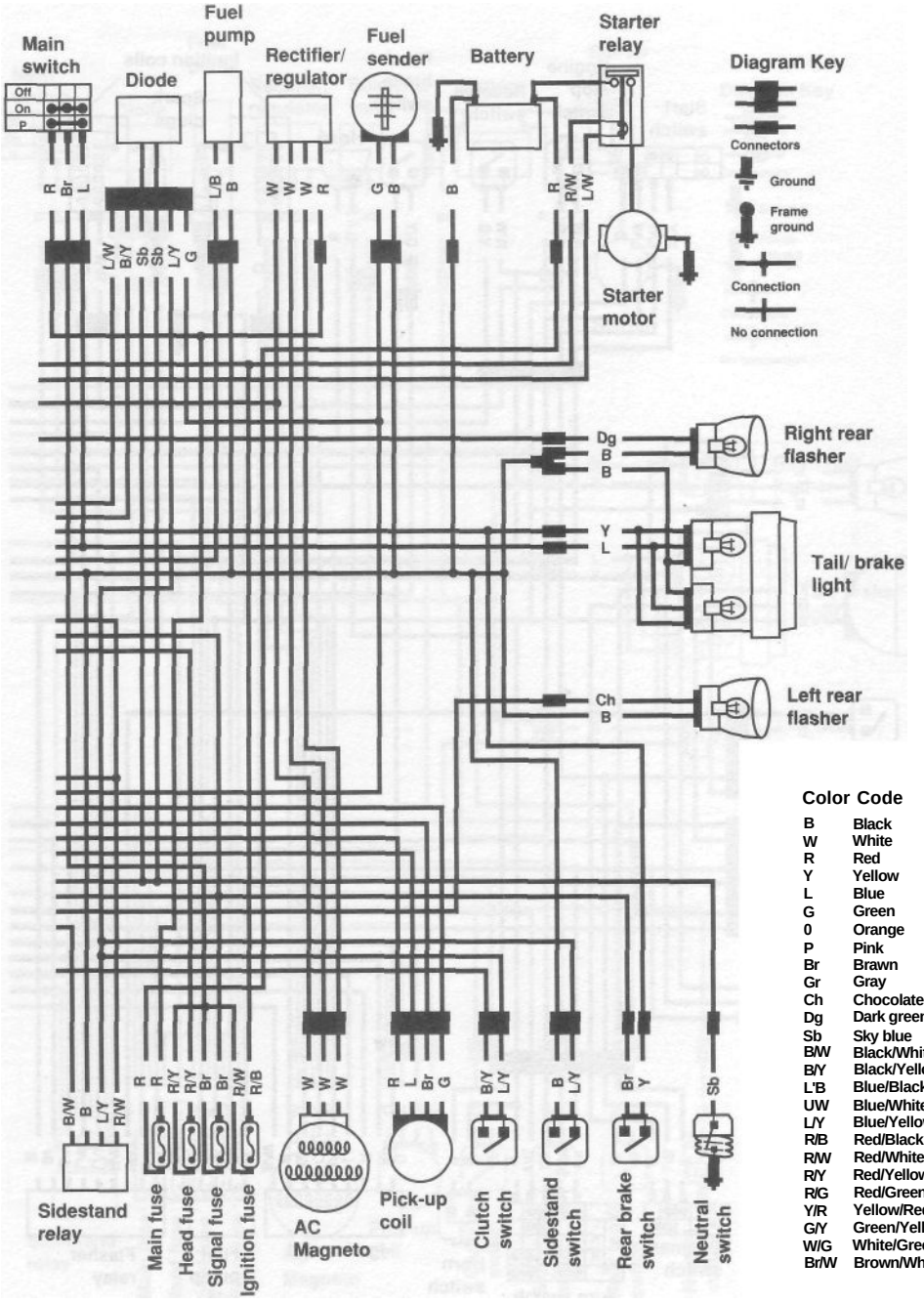

Color Code

B	Black
W	White
R	Red
Y	Yellow
L	Blue
G	Green
0	Orange
P	Pink
Br	Brawn
Gr	Gray
Ch	Chocolate
Dg	Dark green
Sb	Sky blue
B/W	Black/White
B/Y	Black/Yellow
L'B	Blue/Black
UW	Blue/White
L/Y	Blue/Yellow
R/B	Red/Black
R/W	Red/White
R/Y	Red/Yellow
R/G	Red/Green
Y/R	Yellow/Red
G/Y	Green/Yellow
W/G	White/Green
Br/W	Brown/White

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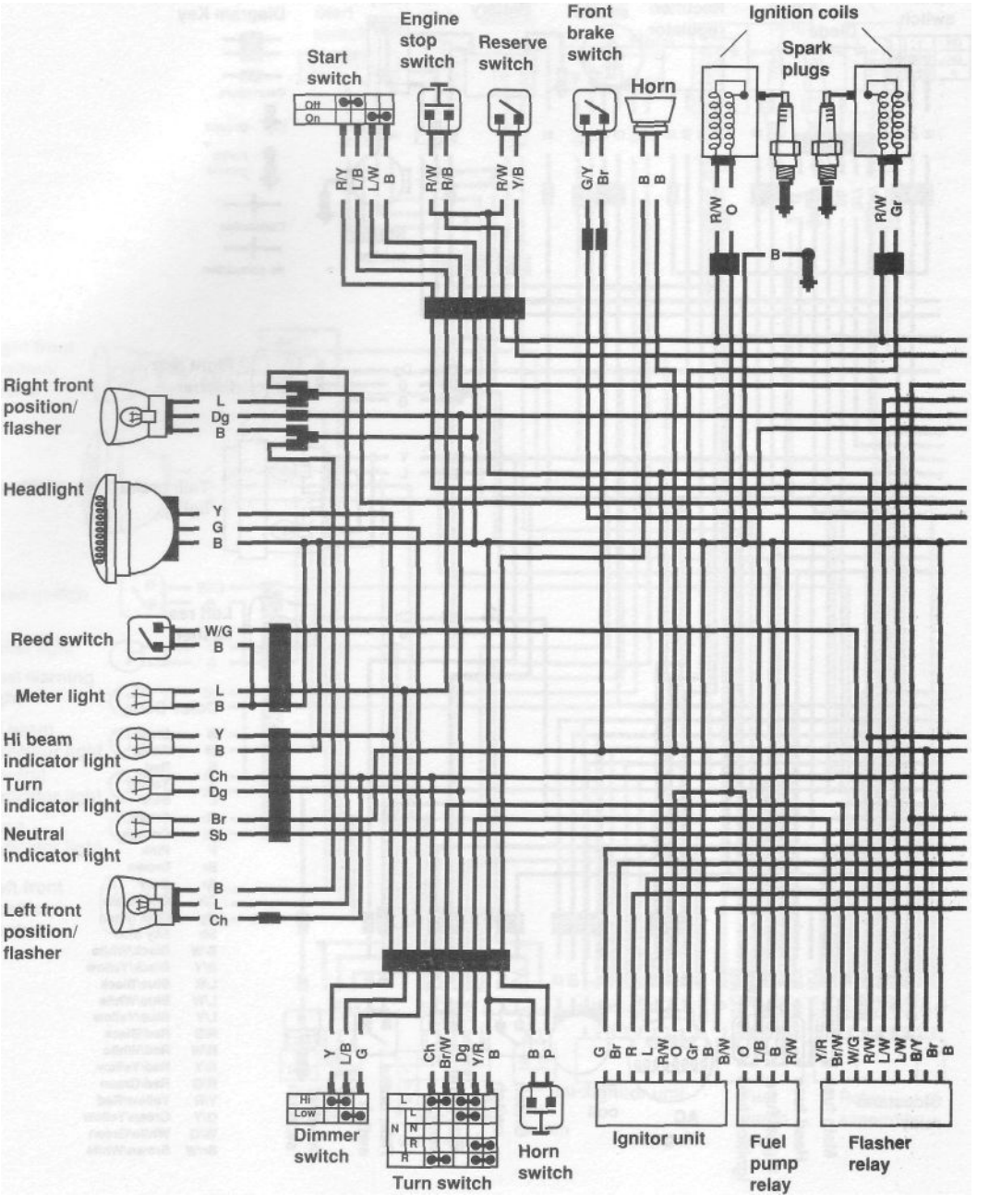
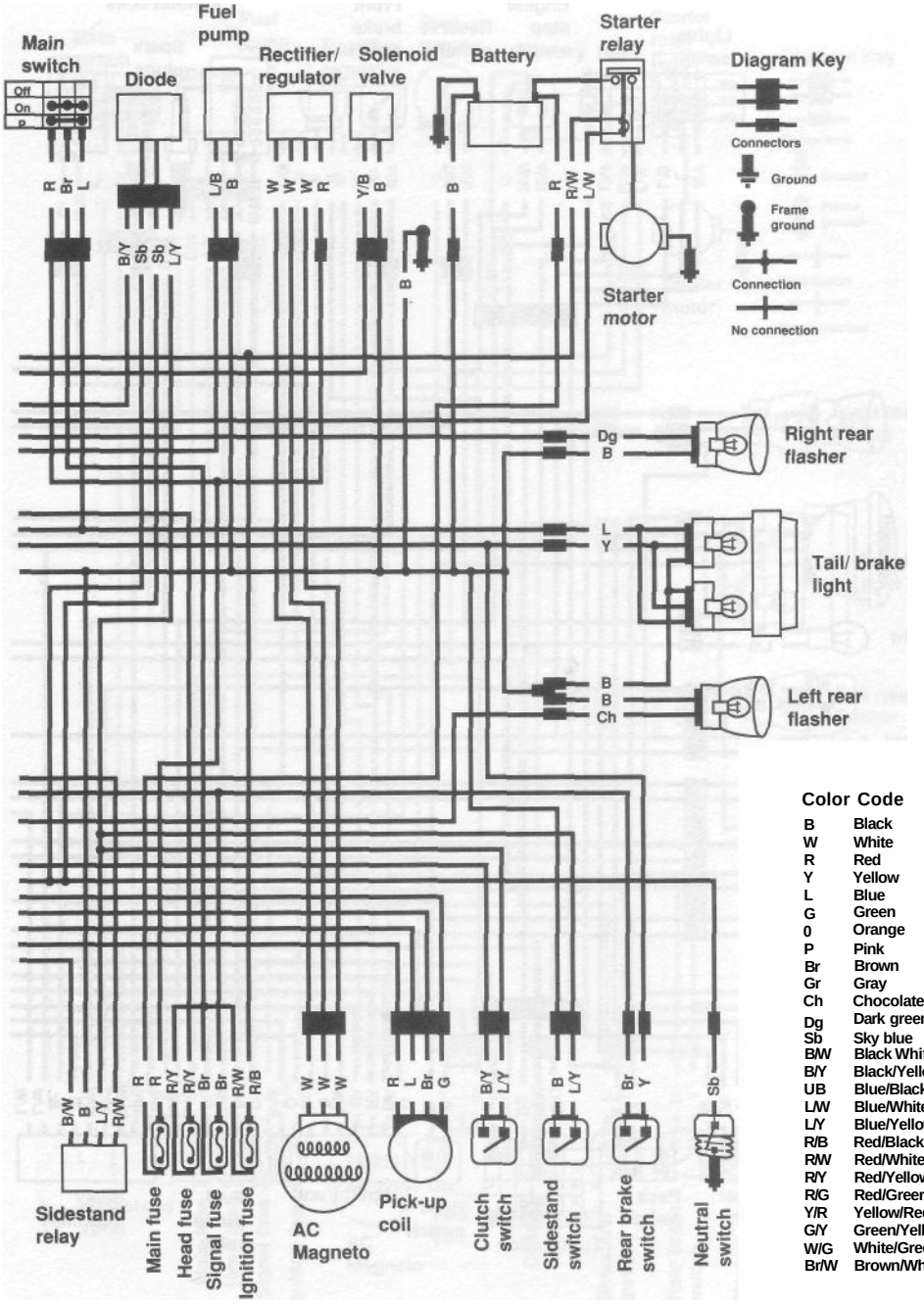
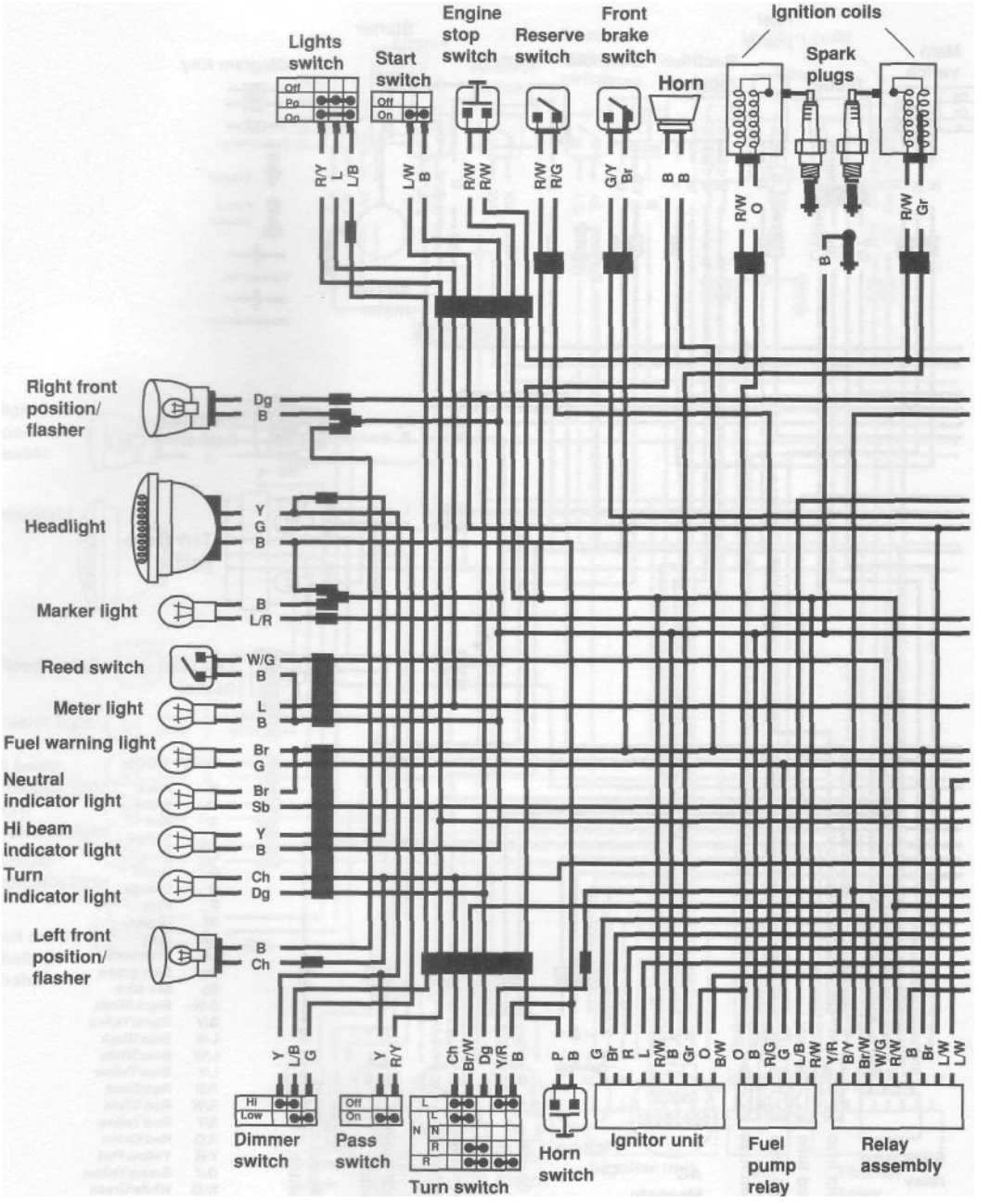


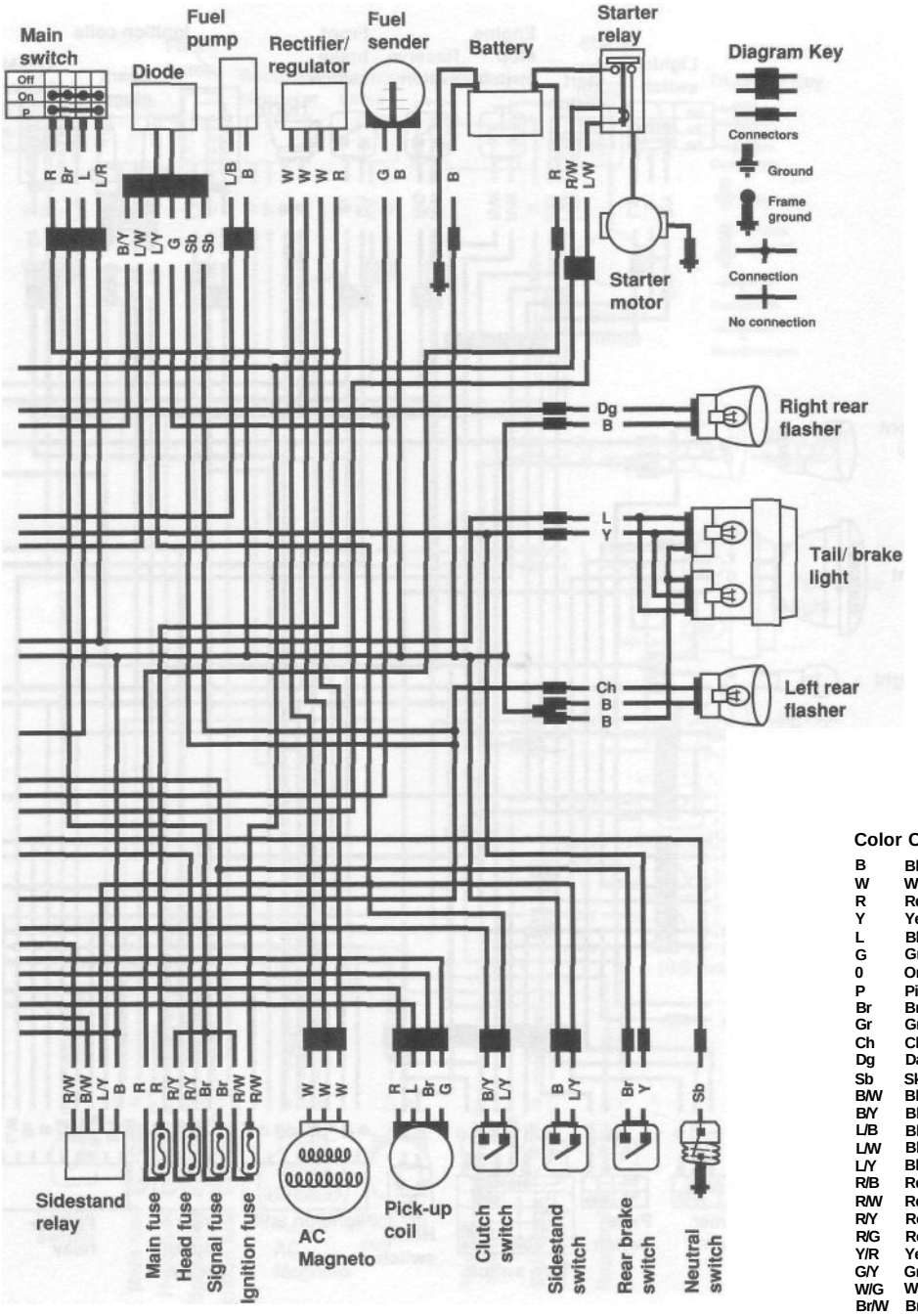


Color Code

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

XV535 (1988-1991 U.K.)

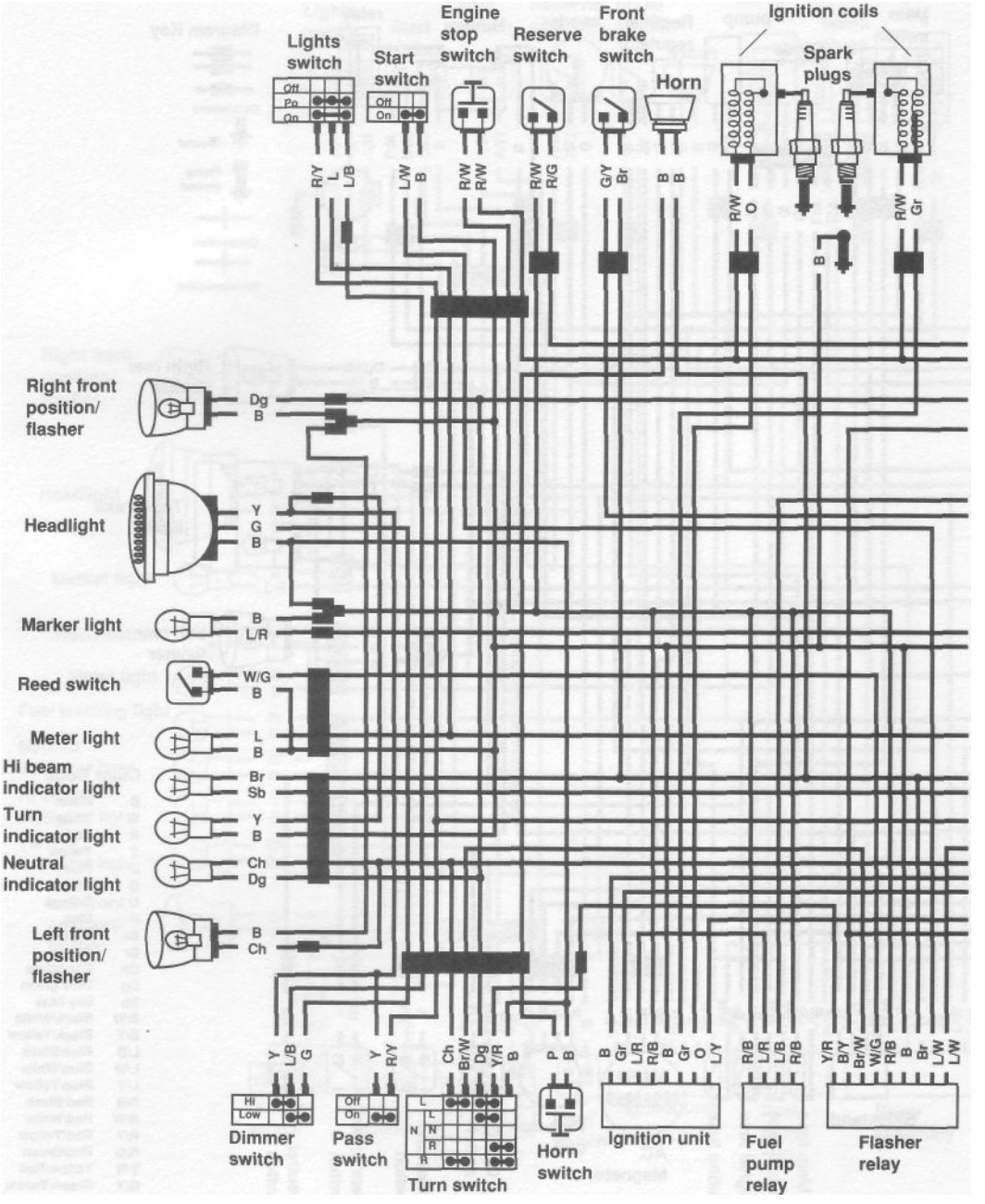


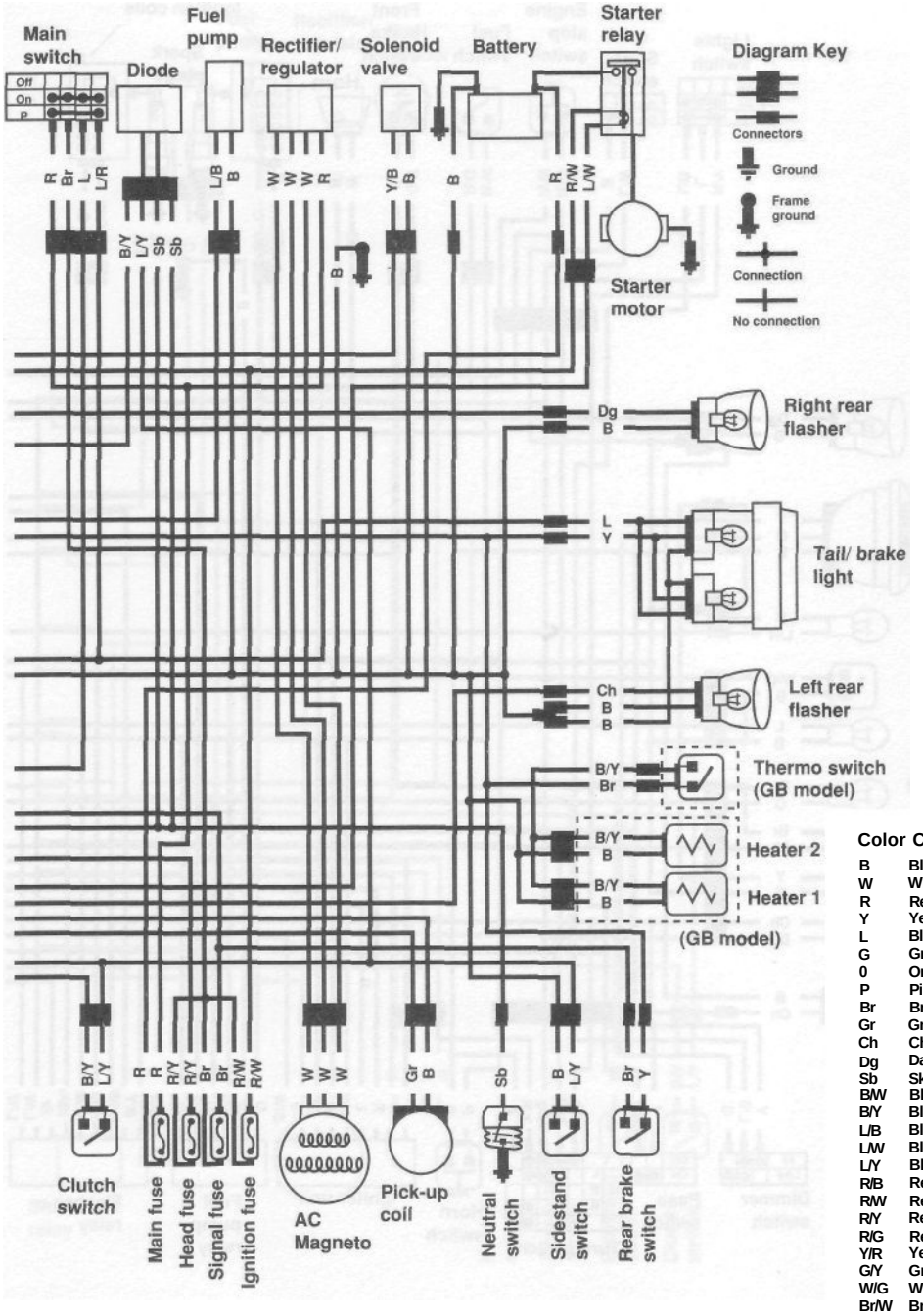


Color Code

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

XV535(1992-ONU.K.)

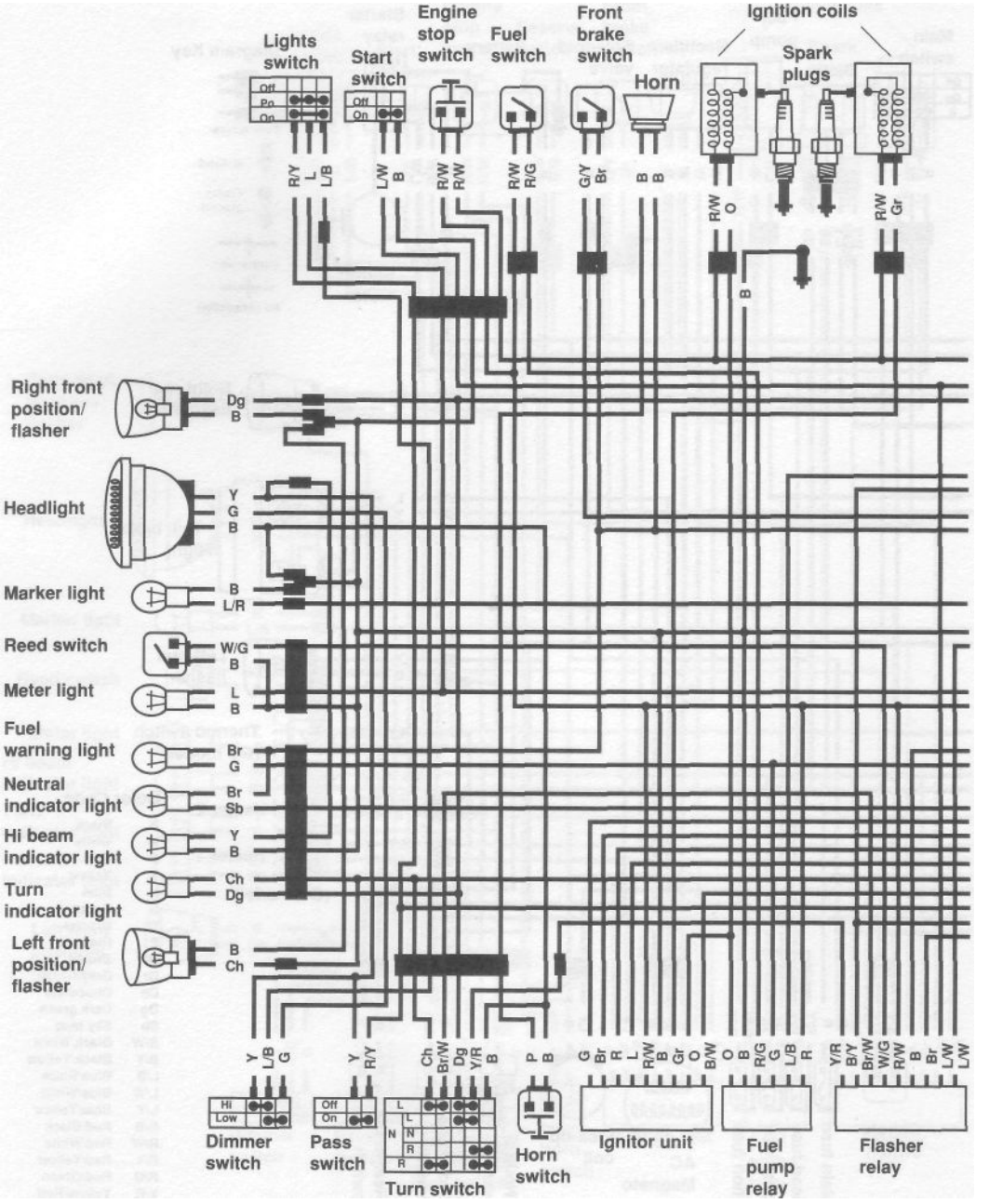


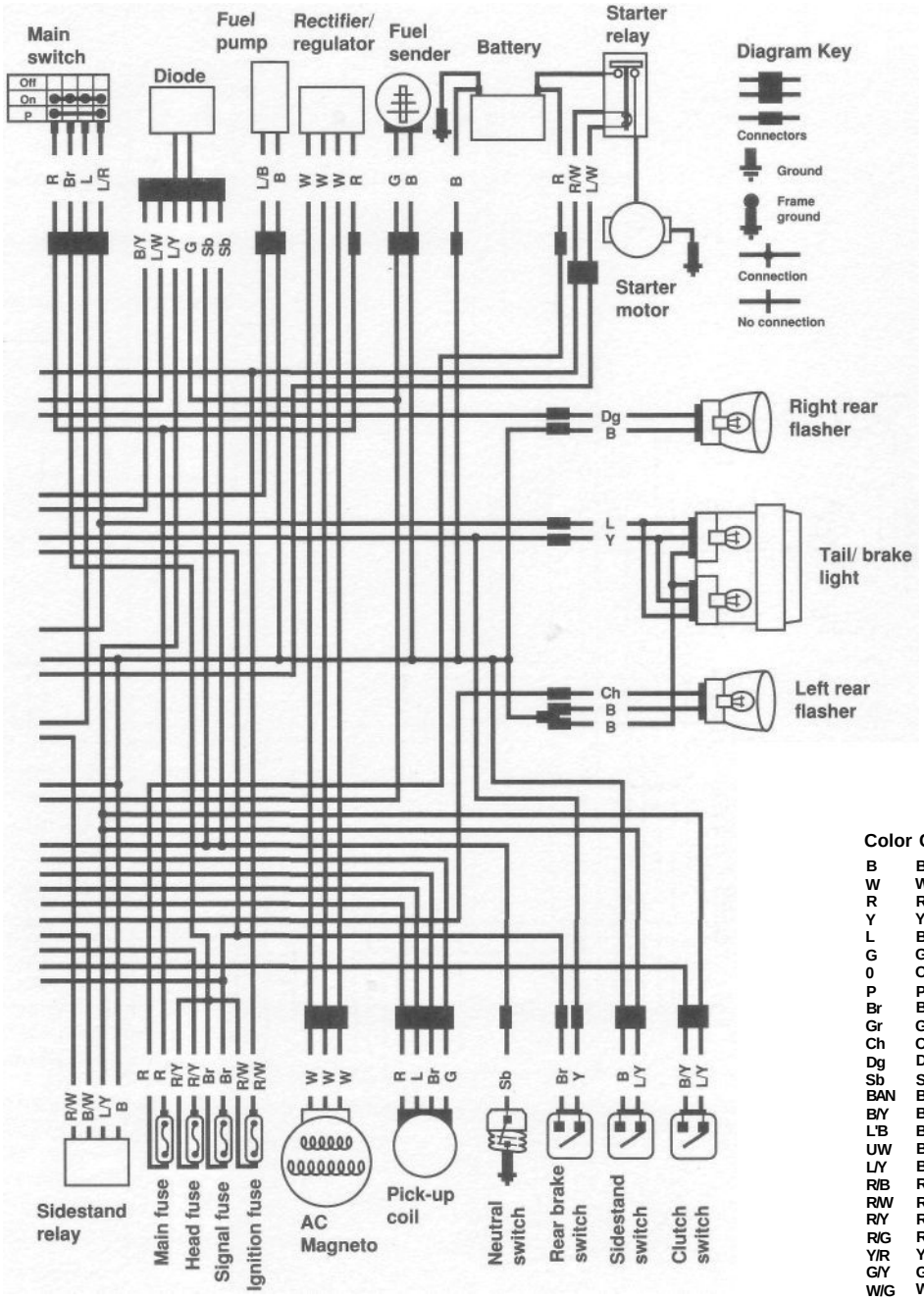


Color Code

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

XV535 (French & German)





Color Code

B	Black
W	White
R	Red
Y	Yellow
L	Blue
G	Green
0	Orange
P	Pink
Br	Brown
Gr	Gray
Ch	Chocolate
Dg	Dark green
Sb	Sky blue
BAN	Black/White
B/Y	Black/Yellow
L'B	Blue/Black
UW	Blue/White
L/Y	Blue/Yellow
R/B	Red/Black
R/W	Red/White
R/Y	Red/Yellow
R/G	Red/Green
Y/R	Yellow/Red
G/Y	Green/Yellow
W/G	White/Green
Br/W	Brown/White

NOTES

MAINTENANCE LOG

Date	Miles	Type of Service

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BMW

M308 500 & 600 CC Twins, 55-69
M309 F650,1994-2000
M500-3 BMW K-Senes, 85-97
M502-3 BMWR50/5-R100GSPD, 70-96
M503 R850 & R1100,93-98

HARLEYDAVIDSON

M419 Sportsters, 59-85
M428 Sportster Evolution, 86-90
M429^| Sportster Evolution, 91-03
M418 Panheads, 48-65
M420 Shovelheads,66-84
M421-3 FLS/FXS Evolution,84-99
M423 FLS/FXS Twin Cam 88B 2000-2003
M422 FLH/FLT/FXR Evolution, 84-94
M430-2FLH/FLTTwinCam88, 1999-2003
M424-2FXD Evolution, 91-98
M425 Dyna Glide Twin Cam, 99-01

HONDA

ATVs

M316 Odyssey FL250,77-84
M311 ATC, TRX & Fourtrax 70-125,70-87
M433 Fourtrax 90 ATV, 93-00
M326 ATC185 & 200,80-86
M347 ATC200X & Fourtrax 200SX,86-88
M455 ATC250& Fourtrax 200/ 250,84-87
M342 ATC250R, 81-84
M348 TRX250R/Fourtrax 250R & ATC250R,85-89
M456-2 TRX250X 87-92, TRX300EX 93-03
M446 TRX250 Recon 97-02
M346-3TRX300/Fourtrax300& TRX300FW/Fourtrax4x4 88-00
M200 TRX350 Rancher, 00-03
M459-2 Fourtrax Foreman 95-01
M454-2 TRX400EX 99-03

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M310-13 50-110cc OHC Singles, 65-99
M319 XR50R-XR70R, 97-03
M315 100-350cc OHC, 69-82
M317 Elsmore, 125-250cc, 73-80
M442 CR60-125R Pro-Link, 81-88
M431-2 CR80R, 89-95, CR125R, 89-91
M435 CR80,96-02
M457-2 CR125R&CR250R 92-97
M464 CR125R, 1998-2002
M443 CR250R-500R Pro-Link, 81-87
M432-3 CR250R, 88-91 & CR500R,88-01
M437 CR250R 97-01
M312-13 XL/XR75-100 75-03
M318-4XL/XR/TLR125-200 79-03
M328-4 XL/XR250, 78-00, XL/XR350R 83-85, XR200R, 34-85 XR250L, 91-96
M320 XR400R, 96-00
M339-7XL/XR 500-650,79-03

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M322 250-350cc 64-74
M323 250-360cc Twins, 74-77
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M334 400-450CC, 78-87
M333 450 & 500cc, 65-76
M335 CX & GL500/650 Twins 78-83
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M313 VT700 & 750,83-87
M440 Shadow 1100cc, 85-96
M460-2 VT1100C2ACE Shadow, 95-99

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M332 CB350-550cc, SOHC, 71-78
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M341 CB750 SOHC, 69-78
M337 CB750 DOHC, 79-82
M436 CB750 Nighthawk, 91-93 & 95-99
M325 CB900,1000 & 1100,80-83
M439 Hurricane 600,87-90
M441-2 CBR600,91-98
M445 CBR600F4,99-03
M434 CBR900RR Fireblade, 93-98
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M438 HondaVFR800,98-00
M349 700-1000 Interceptor, 83-85
M458-2 VFR700F-750F, 86-97
M327 700-1100ccV-Fours, 82-88
M340 GL1000 & 1100,75-83
M504 GL1200,84-87
M508 ST1100/PAN European 90-02

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M506-2GL1500 Gold Wing, 93-00
M462-2GL1500C Valkyrie, 97-03

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M465-2 KLF220 & KLF250 Bayou, 88-03
M466-2KLF300 Bayou, 86-98
M467 KLF400 Bayou, 93-99
M470 KEF300 Lakota, 95-99
M385 KSF250 Mojave, 87-00

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M448 KX80/85/100,89-03
M351 KDX200,83-88
M447-2 KX125 & KX250,82-91 KX500,83-02
M472-2 KX125,92-00
M473-2 KX250 92-00
M474 KLR650,87-03

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M355 KZ400, KZ/Z440, EN450 & EN500,74-95
M360-3 EX500, GPZ500S NmjaR, 87-02
M356-3 700-750 Vulcan, 85-02
M354-2 VN800 Vulcan 95-04
M357-2 VN1500 Vulcan 87-99
M471-2 VN1500 Vulcan Classic, 96-04

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M450 KZ, Z & ZX750,80-85
M358 KZ650,77-83
M359-3 900-1 OOOcc Fours, 73-81
M451-3 1000 &1100cc Fours, 81-02
M452-3 ZX500 & 600 Ninja, 85-97
M453-3 Ninja ZX900-1100 84-01
M468 ZX6 Ninja, 90-97
M469 ZX7 Ninja 91-98
M453-3 900-1100 Ninja, 84-01
M409 Concours, 86-04

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M496 Polaris ATV 85-95
M362 Polaris Magnum ATV, 96-98
M363 Scrambler 500,4X4 97-00
M365-2 Sportsman/Xplorer 96-03

SUZUKI

ATVs

M381 ALT/LT125 & 185,83-87
M475 LT230 & LT250,85-90
M380 LT250R Quad Racer 85-88
M343 LTF500F Quadrunner, 98-00
M483-2 Suzuki King Quad/ Quad Runner 250 87-98

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M369 125-400CC64-81
M379 RM125-500 Single Shock, 81-88
M476 DR250-350 90-94
M384-2LS650 Savage 86-03
M386 RM80-250,89-95
M400 RM125,96-00
M401 RM250,96-02

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M481-3 VS700-800 Intruder, 85-02
M482-2 VS1400 Intruder 87-01
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M331 GSX-R600,97-00
M478-2 GSX-R750,88-92 GSX750F Katana, 89-96
M485 GSX-R750,96-99
M338 GSF600 Bandit, 95-00
M353 GSF1200 Bandit 96-03

YAMAHA

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M394 YTM/YFM200& 225,83-86
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M489-2 Timberwolf 89-00
M487-4 Warrior, 87-03
M486-4 Banshee, 87-02
M490-2 YFM350 MotD-4 & Big Bear, 87-98
M493 YFM400FW Kodiak, 93-98
M280 Raptor 660R, 01-03

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M413 YZ100-490 Monoshock, 76-84
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M498 YZ250,94-98 and WR250Z 94-97
M406 YZ250F & WR250F, 01-03
M491 YZ400F YZ426F & WR400F, 98-00
M417 XT125-250 80-84
M480-3 XT/TT 350,85-00
M405 XT500 & TT500,76-81
M416 XT/TT 600,83-89

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M395-9 XV535-1100 Virago 81-99
M495-2 V-Star 650,98-03
M281 V-Star 1100,99-04

Triple

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Fours

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M494 XJ600 Seca II 92-98
M388 YX600 Radlan &FZ600,86-90
M396 FZR600 89-93
M392 FZ700-750 & Fazer 85-87
M411 XS1100 Fours, 78-81
M397 FJ1100 & 1200,84-93
M375 V-Max, 85-03
M374 Royal Star, 96-03

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YAMAHA

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XV920 (1982-1983)
XV1000 (1984-1985)
XV1100 (1986-1999)

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